Ministry of Water Resources and Irrigation/ Government of Southern Sudan
Southern Sudan Urban Water Corporation
The Republic of Sudan

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR THE IMPROVEMENT OF WATER SUPPLY SYSTEM OF JUBA
IN
SOUTHERN SUDAN

March 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO ENGINEERING CONSULTANTS CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on the Project for the Improvement of Water Supply System of Juba in Southern Sudan, and organized a survey team headed by Mr. Naoto Tohda of Tokyo Engineering Consultants Co., Ltd. between June, 2010 to August, 2010.

The Survey team held a series of discussions with the officials concerned of the Government of Sudan, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Sudan for their close cooperation extended to the survey team.

March, 2011

Shinya Ejima
Director General,
Global Environment Department
Japan International Cooperation Agency

SUMMARY

1. Country Profile

The Republic of Sudan is located in north-east of the African continent. The area of the country is approximately 2.5 million km^2, which is the largest in Africa. Total population of Sudan is 39.15 million (2008, census). Northern part of the country experiences desert dry climate while the southern part has humid tropical climate. After conflict between the north and south of Sudan for more than 20 years, Comprehensive Peace Agreement (CPA) was concluded in 2005. Southern Sudan, being composed of ten states, was granted administrative autonomy. As a result of the referendum took place in January 2011 for independence of Southern Sudan, 98.8% of voters supported for independence. Southern Sudan is expected to become an independent country in July 2011. Juba became the capital of Southern Sudan. Juba is located approximately 1,200 km south of Khartoum and about 130 km north of border with Uganda. Bahr el-Jebel River which is a tributary of River Nile flows through Juba from south to north. Juba is situated at the altitude ranging 450 – 550m above mean sea level. The topography gently slopes toward east. Climate of Juba is warm throughout the year. It has dry and rainy season. Annual rainfall is approximately 1,000mm.

GNI (Gross National Income) per capita is US$1,220 (2009, World Bank). Composition of industrial structure is; primary: 25.8%, secondary: 34.1%, and tertiary: 40.1% (2008, World Bank). Agriculture remains major industry, as Sudan is one of the leading countries producing cotton and sesame. Recently, the national economy recorded high growth rate supported by oil export. However, due to huge foreign debts, the national economy is facing difficult situation. While economic recovery is urgently needed, stabilization of economy is also required by developing non-oil industry, since current industrial structure depends entirely on oil sector that accounts for more than 90% of total exports. Poverty rate is estimated to be 40% (2004 est., World Bank). Therefore, diversifying industrial structure as well as increasing income of agricultural sector, in which most labor population are engaged, is essential. For this purpose, converting subsistence crop into cash crop and improvement of transport infrastructure in order to reduce logistics cost is essentially required.

2. Background of the Project

Of the total population of Juba, that is estimated to be 400 thousand, population that have access to piped water supply either by house connection or public tap stands are estimated to be only about 34 thousand (2009 est.). The rest of Juba residents mostly depend on water from public or private wells, and private water vendors who withdraw river water and transport to sell to people. However, the water from existing wells mostly has high salinity. River water is not treated and the quality is not suitable for drinking. Consequently, most people in Juba don’t

have access to safe water. In addition, monthly expenditure for purchasing water is SDG 178(2010, socio-economic survey) which accounts for approximately 10% of household income. This is a significant burden particularly in case of poor people. Also, frequent occurrence of waterborne diseases such as diarrhea and typhoid is reported, which requires medical expenditures. In the Project area, water fetching is borne by women and children in 92% cases. Whereas average time spent on water fetching is 40 minutes in case of people who use public tap stands, water fetching consumes about 1.9 hours in non piped-water served area, which corresponds to approximately 3 times (2010, Socio-economic survey).

The existing water supply facility consists of the water treatment plant that was rehabilitated by Multi Donor Trust Fund (MDTF) and started operation in May 2009, and old pipelines that were constructed from 1972 to 1980 and are mostly deteriorated. Although water quality has been improved by rehabilitation of the water treatment plant, the production capacity is 7,200 m^3/day which meets 22% of total water demand of Juba, whereas water demand of entire Juba is estimated as 32,000 m^3/day (referred to the Development Study, current population served with house connection: 31,300 persons (90L/c/d), current population served with public tap stands and population in non-served area: 368,700 persons (40L/c/d), Non-domestic water consumption: 37% of total consumption, leakage: 15%). There is significant gap between water demand and production capacity of the existing system. The existing distribution networks (total length: approx. 60km) are mostly of asbestos cement pipe, which causes leakage so frequently and as a result leakage rate is estimated to be 40%. Consequently, the occurrence of water supply suspension and shortage of water is quite common.

Operation and maintenance of urban water supply in Southern Sudan is carried out by Southern Sudan Urban Water Corporation (SSUWC). Water supply of Juba is managed by SSUWC Juba Station, that operates the water supply facilities and collects water charge. Capacity of waterworks in general is insufficient. Currently, practice is limited to minimum level, such as daily operation of treatment plant and pump station, repair of pipe burst accidents, etc. which can be done within limited budget and capacity. Due to absence of operational record or maintenance plan, lack of chemicals necessary for water treatment, consumables, or repair equipment occurs so frequently that operation and maintenance is not done appropriately.

As mentioned above, water supply situation in Juba is serious because population that has access to treated safe water in Juba are very small and sustainability of waterworks management is weak because of insufficient management capacity.

Under the circumstances, the Government of Republic of Sudan requested the Government of Japan to implement the grant aid project, titled as “Improvement of Water Supply System of Juba”, which aims to expand the water treatment plant, construct distribution facilities, and replace the existing distribution pipelines, based on the urgent project which was proposed in

the Water Supply Master Plan prepared under the development study, “Juba Urban Water Supply and Capacity Development Study, 2009”, carried out by Japan International Cooperation Agency (JICA).

3. Summary of the Survey Results and Contents of the Project

(1) Commencement of the Preparatory Survey

JICA carried out the First Preparatory survey in February 2010, in order to confirm the contents of the request and examine the components of the Grant Aid. As a result, it was confirmed that increasing number of population need to have access to safe water urgently while the ratio of population served by the piped water is currently estimated to be only about 8%. Therefore, a basic policy was agreed to prioritize wide range of beneficiaries to be supplied with safe treated water by means of public tap stands and water tanker. Necessity and priority of each component of the requested item was also confirmed.

Based on the requested items confirmed in the First Preparatory Survey, JICA dispatched the Second Preparatory Survey Team to Sudan from 23 June to 7 August 2010. After the field survey and analysis in Japan, the appropriate scope of work as the Grant Aid Project was examined and outline design and cost estimation was also prepared. In December 2010, a mission to explain the contents of Draft Preparatory Survey Report was dispatched by JICA. As a result of discussion with the Ministry of Water Resources and Irrigation/Government of Southern Sudan (MWRI/GOSS) as the responsible ministry as well as SSUWC as the implementing agency, contents of the Project were agreed and accepted in principle. This final report is prepared based upon the above mentioned results of survey, analysis, and discussion.

(2) Overall Goal and Project Objective

The Government of Southern Sudan formulated “Water Policy, 2007” as the national supreme plan in water sector in which the primary objective is to provide safe, affordable and reliable urban water and sanitation services to the urban population on an equitable basis, including poor and vulnerable groups. This Project is requested based on the water supply master plan which was formulated through the technical assistance by the Japanese Government. The target of the master plan is to provide safe and clean water supply to all Juba citizens by year 2025.

The overall goal of the Project is to improve living environment of the Project area through improvement of water supply services in Juba. Therefore, implementation of this Project contributes to promotion of the supreme plan of “Water Policy”. The objective of the Project is to enable residents of Juba access to treated water, who still do not have access to safe water, through public tap stands and water tankers, by means of increasing drinking water supply

capacity.

(3) Basic Policy

Priority under this Project is given to provision of treated safe water to wider areas in order to contribute to water supply facility development plan by GOSS, which aims to improve water supply situation of Juba. Given this, the basic policy of the Project is set to maximize the number of beneficiaries by means of public tap stands and water tankers instead of individual house connection.

Based on field survey and results of discussion, contents of the requests are examined. As a result, the project components as shown in the following Table are agreed to be implemented under the Japan's Grant Aid.

Components of the Japan's Grant Aid Confirmed in the Preparatory Survey

Pri-ority	Requested items verified by the First Preparatory Survey (M/D dated March 05, 2010)	Requested items verified by the Second Preparatory Survey (M/D dated December 10, 2010)	Items changed
1	Expansion of the existing water treatment plant (WTP) with capacity of 14,400m^3/day.	Expansion of the existing water treatment plant with capacity of 10,800m^3/day.	Water treatment capacity
2	Construction of 5,000m^3 reservoir near the Parliament. Transmission pump station and transmission main from WTP to the reservoir	Construction of a reservoir and elevated tank with total capacity of 5,000m^3. Transmission pump station and transmission main from WTP to the reservoir	Additional construction of elevated tank
3	Construction of distribution mains	Construction of distribution mains	No change (pipeline routes are reviewed according to change in number of water tanker filling stations)
4	Water tanker feeding stations (6 locations) Water kiosk in low income community (38+6 at the locations of water tanker filling stations)	Eight (8) water tanker filling stations One hundred twenty (120) public tap stands	Number of water tanker filling stations and public tap stands
5	Replacement of old distribution pipes (in Atala Bara, Nimara Talata, Hai Cinema, Buluk, Hai Sora residential areas)	Not to be implemented	Not to be implemented. Reconnection work of the service pipes to be done by GOSS. However, technical viability seems to be low. In addition, under budget constraint, priority is given to maximize beneficiary by constructing new public tap stands and tanker filling stations.
6	Water quality testing laboratory	No procurement in the Project	Not to be procured in the Project. This will be considered in the Technical Cooperation Project.
7	Water tankers for low income people in remote areas	No procurement in the Project	Not to be procured in the Project. Currently a lot of private water venders are engaged. Necessity of operating tankers by SSUWC seems low.
8	Workshop for repairs	No procurement in the Project	Not to be procured in the Project. To be examined in the Technical Cooperation Project.

(4) The Entire Plan

1) Water Service Area

The urbanized area of Juba, including whole areas of Juba town-Payam, Kator-Payam and Munuki-Payam and a part (Gurai) of Northern Bari-Payam and two parts (Lologo and Gumbo) of Rejaf-Payam where future urbanization is expected.

2) Target Year: 2015

3) Population Served: 355,400 persons

4) Unit Water Consumption

(i) Domestic Water (Daily Life Water): 26 L/c/day

(ii) Non-Domestic Water: Not to be included in the Scope of the Project

(The priority is given to increase the ratio of population having access to safe water and the objective of the Project is to supply domestic water through public tap stands and water tankers.)

(5) Summary of Facility Plan

Facility	Description	Qty
Water Treatment Plant	1) Intake facility: Float type intake facility, Intake pipe Dia. 250mm x 3 nos. (including 1 standby) 2) Intake pump house: Single suction volute pump, 4.1m^3/min x 21m x 3 units (including 1 standby), switching board, control panel 3) Receiving well, Chemical mixing tank, Flocculation basin, Sedimentation tank: Receiving well:83.7m^3 (retention time 10min) x 1 tank, chemical mixing tank: 1 tank, Flocculation basin: Horizontal baffled channel x 2 nos., Sedimentation tank: Upflow, 11.9x11.9xH5.7m (surface load 29.1min/min) x 2 tanks 4) Rapid sand filtration: Open gravity type: 3.7m x 5.2m x 6 basin (including 1 standby) , Filtration rate: 123m/day, Backwash: Air + Backwashing 5) Chemical dosing facility: Coagulant (Aluminum Sulfate), Dissolving tank and dosing equipment: 3 units (including 1 standby), Disinfectant (Calcium hypochlorite), dissolving tank and dosing equipment: 3 units (including 1 standby), Chemical storage room: 30days of average consumption 6) Clear water reservoir: Reinforced Concrete, Rectangular, Capacity: 4.5x24x2.8mHx2 tanks = 604.8m^3(1.34hours) 7) Transmission pump room: Single suction volute pump, 2.5m^3/min x 76m (55kW) x 4 units (including 1 standby), Switching board, Control panel	Lump Sum Lump Sum Lump Sum Lump Sum Lump Sum Lump Sum

Facility	Description	Qty
	8) Sludge treatment facility: Solid-liquid separation of sludge from sedimentation tank, 5.0 x 19.0 x H0.5m x 2 basin (Surface load:200mm/min) 9) Generator: Capacity:500KVA, Fuel tank: 5000 L	Lump Sum Lump Sum
Service Reservoir	1) Service reservoir: Ground level reservoir, Reinforced Concrete, Rectangular, Capacity: 20 x 32 x H4.0m x 2 tanks (5000m^3) 2) Lifting pump: Single suction volute pump, 6.0m^3/min×21m (37kW) x 4 units (including 1 standby), switching board, control panel 3) Elevated tank: Reinforced Concrete, Capacity:540m^3×1 tank (Retention time: 30min) 4) Generator: Capacity: 200KVA, Fuel tank: 2000 L	1 tank Lump Sum 1tank Lump Sum
Clear water transmission pipeline	Ductile Iron Pipe , φ400mm (From transmission pump house –to service reservoir)	4.9km
Distribution pipeline	1) Distribution main: Ductile iron pipe: Dia.250 - 500mm 2) Distribution secondary main: High density polyethylene pipe: Dia.50 - 125mm (Nominal dia.) 3) Water pipe bridge: Dia.400mm x L 10m, Pipe beam type (Steel pipe) 4) Water pipe bridge: Dia.350mm x L 15m, Pipe beam type (Steel pipe) 5) Water pipe bridge: Dia.100mm x L 15m, Truss support 6) Connecting pipe with the existing pipes: Dia. 400mm 7) Fittings, valves: Stop valve, air valve, washout valve, thrust anchor block, etc.	20.3km 32.5km 1 no. 1 no. 1 no. Lump Sum Lump Sum
Water tanker filling station	1) Station No.1: 6 taps, 3 tool booths, pavement within site 2) Station No.2: 6 taps, 3 tool booths, pavement within site 3) Station No.3: 4 taps, 2 tool booths, pavement within site 4) Station No.4: 4 taps, 2 tool booths, pavement within site 5) Station No.5: 4 taps, 2 tool booths, pavement within site 6) Station No.6: 4 taps, 2 tool booths, pavement within site 7) Station No.7: 6 taps, 3 tool booths, pavement within site 8) Station No.8: 6 taps, 3 tool booths, pavement within site	Lump Sum Lump Sum Lump Sum Lump Sum Lump Sum Lump Sum Lump Sum Lump Sum
Public tap stands	Block : W2m x L2.5m Service pipes: 4 taps Concrete apron: W2m x L2m	120 nos.

4. Implementation Schedule and Project Cost

For project implementation, eight months for preparation of detailed design and tendering, and 25 months for construction works are required. The project cost to be borne by the Southern Sudan side is estimated to be SDG 377,815 (equivalent to JPY 13.7 million).

5. Project Evaluation

(1) Relevance

1) Beneficiaries and Population

Whereas the total population of Juba is estimated to be 400 thousand people (2009 estimate), population served by the piped water system is estimated to be only 34 thousand people (2009). Consequently, most of the people of Juba have no access to safe water.

Objective of the Project is that residents including poor people in the target areas, where the existing water supply system does not provide services, will have access to safe water. The population to be served by the Project is 355,300 persons. The ratio of population served in the target year of 2015 is 52% while total population of the project area is estimated to be 679,600 (estimation by Development Study).

2) Project Objectives and Basic Human Needs (BHN)

Most of the Juba residents currently rely on water tankers that withdraw and distribute river water without treatment or groundwater from public wells that are not suitable for drinking in many cases. People are suffering from high risk of waterborne disease as well as high expenses on buying water for domestic uses.

The Project aims to improve living environment of residents by supplying clean treated water, which complies with Basic Human Needs of residents.

3) Operation and Maintenance Technique

The treatment process adopted in case of the proposed water treatment plant is same as the process of the existing plant. Operation method is also designed based on manual operation at site. In addition, the Technical Cooperation Project is undergoing along with this Project implementation. Taking into account that capacity of staff-members in terms of operation and maintenance and waterworks management will be developed on completion of the Grant Aid Project, the current staff would be able to take care of proper operation and maintenance of the project facilities.

4) Mid-Long Term Plan

In the “Expenditure Priorities & Funding Needs (2008-2011)” prepared by GOSS, expenditures priorities are identified based on priority issues of Southern Sudan as well as

estimated costs, and development of water supply infrastructure is identified as the priority issue. Therefore, the Project complies with the development policy of GOSS.

5) Profitability

As the beneficiaries of the Project are large number of population including poor people, profitability is not an objective of the Project. As a result of affordability analysis by assuming that operation and maintenance expenditures are to be covered by water revenue and calculating unit cost and average price of water per cubic meter, it was concluded that expenses on water can be significantly reduced compared to the current expenditure.

6) Social and Environmental Considerations

As a result of the environmental scoping carried out in this Preparatory Survey, serious negative impact is not expected through the Project implementation (see Appendix-6). As necessary measures to be taken to mitigate/minimize possible negative impacts caused by the Project have been identified, with condition that these measures are to be taken, Environmental Approval was issued by the Ministry of Environment/GOSS in February 2011.

7) Feasibility under the Japan's Grant Aid Scheme

On condition that security situation will not deteriorate significantly, the Project is feasible without particular difficulties.

(2) Effectiveness

1) Quantitative Evaluation

Indicator	Baseline (year 2010)	Target (year 2015)
Average daily water production capacity	7,200 m^3/day	18,000 m^3/day
Number of population having access to safe treated water	34,000 persons	389,300 persons
Ratio of population having access to safe water	8 %	57 %
Consumption of treated water per person in the project area	0 L/c/day	26 L/c/day

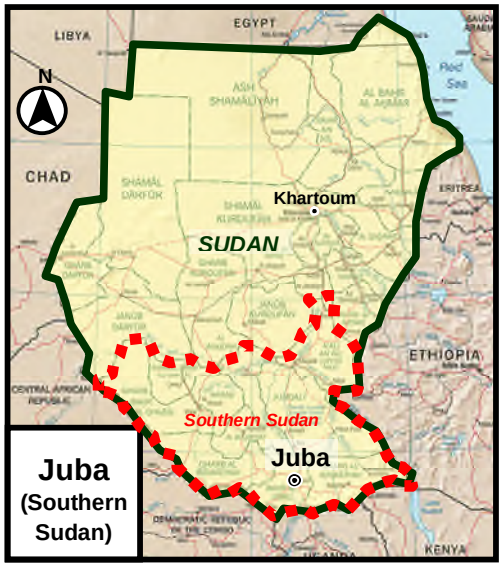
2) Qualitative Evaluation

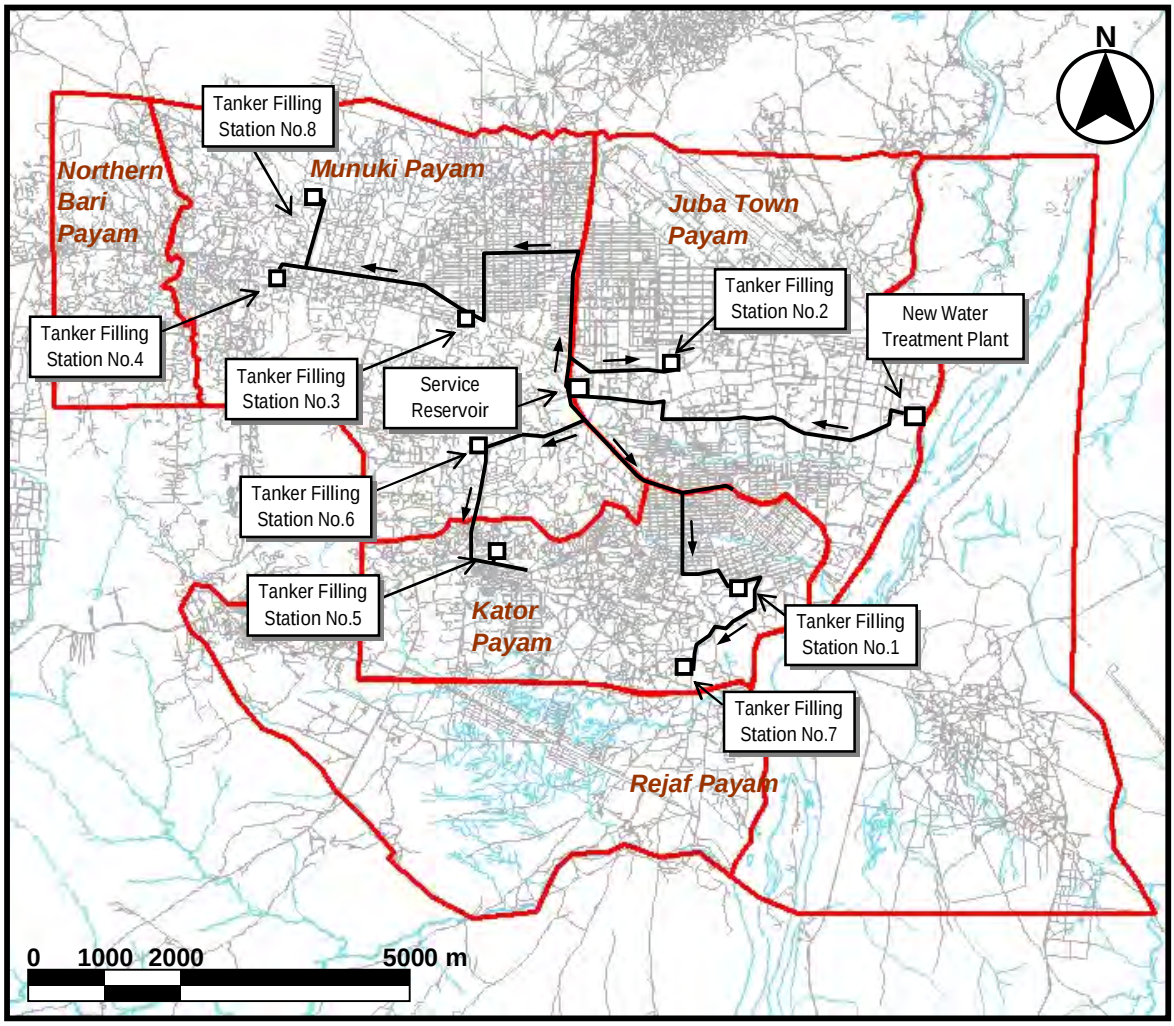
(a) Whereas 56% of residents in non-served area of piped water experiences waterborne diseases, such as diarrhea and typhoid (2010, Socio-economic survey), decrease in rate of water borne disease is expected as a result of improving public health by use of safe and stable water supply.

(b) Currently 92% of water fetching is borne by women and children. Time spend for water fetching is 1.9 hours in average in the current non-served area, while that in current served area with public tap stands is 40 minutes in average (2010, Socio-economic survey). As a result of mitigating the hardship in water fetching, empowerment and job creation for women as well as increased opportunity for children to study are expected.

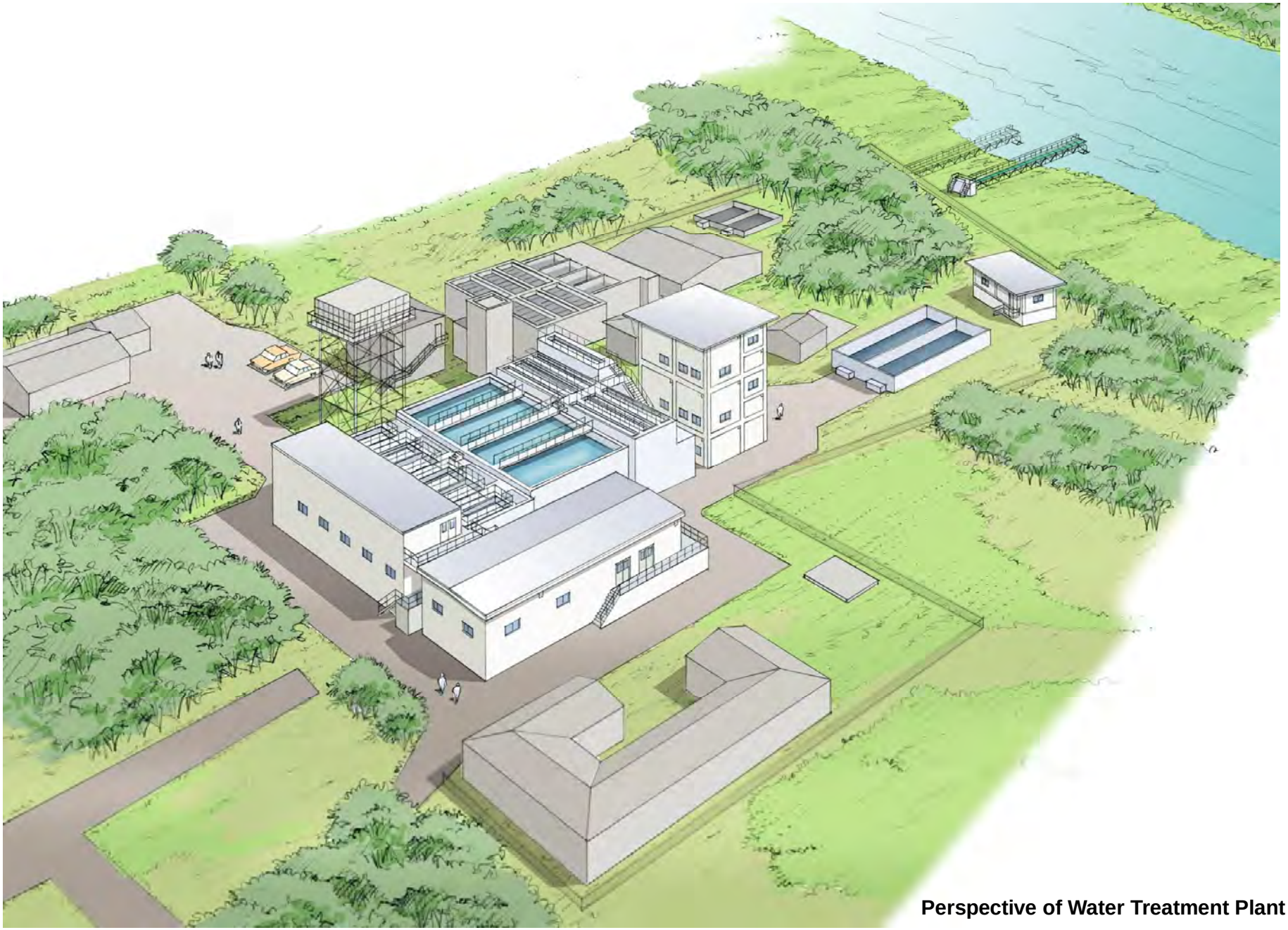
(c) Since emergency connecting pipes shall be provided between the new and existing facilities in order to supplement water supply in the existing system in accidental cases, occurrence of water supply interruption can be mitigated. Consequently, it is expected to improve reliability of the water supply services by the existing system, which serves the current population of approx. 34,000.

As aforementioned, the Project will contribute to improve living environment of approx. 355 thousand people of Juba including poor residents. As positive effects are also expected, the Project is evaluated to be relevant and effective to be implemented under the Japan's Grant Aid.





Location Map of the Project Site



Perspective of Water Treatment Plant

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C o n t e n t s

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Abbreviations

CES	Central Equatoria State
GOSS	Government of Southern Sudan
GTZ	German Technical Cooperation
IDP	Internal Disturbed Population
IEE	Initial Environmental Examination
MDTF	Multi-Donor Trust Fund
MOPI	Ministry of Physical Infrastructure
MWRI	Ministry of Water Resources and Irrigation
SDG	Sudanese Pond
SSUWC	Southern Sudan Urban Water Corporation
USAID	United States Agency for International Development

CHAPTER 1 BACKGROUND OF THE PROJECT

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1-1 Background

The Republic of Sudan is located in north-east of the African continent. The area of the country is approximately 2.5 million km2, which is the largest in Africa. Total population of Sudan is 39.15 million (2008, census). Northern part of the country experiences desert dry climate while the southern part has humid tropical climate. After conflict between the north and south of Sudan for more than 20 years, Comprehensive Peace Agreement (CPA) was concluded in 2005. Southern Sudan, being composed of ten states, was granted administrative autonomy. As a result of the referendum took place in January 2011 for independence of Southern Sudan, 98.8% of voters supported for independence. Southern Sudan is expected to become an independent country in July 2011. Juba became the capital of Southern Sudan. Juba is located approximately 1,200 km south of Khartoum and about 130 km north of border with Uganda. Bahr el-Jebel River which is a tributary of River Nile flows through Juba from south to north. Juba is situated at the altitude ranging 450 – 550m above mean sea level. The topography gently slopes toward east. Climate of Juba is warm throughout the year. It has dry and rainy season. Annual rainfall is approximately 1,000mm.

Based upon the Water Supply Master Plan which was prepared in the development study, "Juba Urban Water Supply and Capacity Development Study, 2009" (hereinafter referred to as "Development Study"), carried out by Japan International Cooperation Agency (JICA), the Government of Republic of Sudan requested the Government of Japan to implement the grant aid project, titled as "Improvement of Water Supply System of Juba", which aims to expand the water treatment plant, construct distribution facilities, and replace the existing distribution pipelines as the urgent project.

In response to the request, the First Preparatory survey was carried out in February 2010, in order to confirm the contents of the request and examine the components of the grant aid, by collecting information such as, situation of water supply, capacity of the Southern Sudan Urban Water Corporation (SSUWC) that is in charge of waterworks management, conditions of procurement of materials and equipment, security conditions, etc. As a result, it was confirmed that increasing number of population need to have access to safe water urgently to great extent, while the rate of population served by the piped water is currently estimated to be only approx. 8%. And therefore, a basic policy was agreed to prioritize wide range of beneficiaries to be supplied with safe treated water by means of public tap stands and water tanker. Necessity and priority of each component of the requested item was also confirmed.

Based on the requested items confirmed in the First Preparatory Survey, the Second Preparatory Survey was carried out from June 2010 in order to examine the appropriate scope of

work as the grant aid project, to prepare outline design and cost estimation. After examination of appropriateness of the project component as the Japan's grant aid project in terms of project scale, project effect, etc., the contents of Draft Preparatory Survey Report was presented to and discussed with the Ministry of Water Resources and Irrigation / Government of Southern Sudan (MWRI/GOSS) as the responsible ministry as well as SSUWC as the implementing agency. As a result, the project components as shown in Table 1-1 was finally agreed to be the scope of the Japanese Grant Aid.

Table1-1 Requested Items

Priority	Requested items verified by the First Preparatory Survey (M/D dated March 05, 2010)	Requested items verified by the Second Preparatory Survey (M/D dated December 10, 2010)
1	Expansion of the existing water treatment plant (WTP) with capacity of 14,400m^3/day.	Expansion of the existing water treatment plant with capacity of 10,800m^3/day.
2	Construction of 5,000m^3 reservoir near the Parliament. Transmission pump station and transmission main from WTP to the reservoir	Construction of a reservoir and elevated tank with total capacity of 5,000m^3. Transmission pump station and transmission main from WTP to the reservoir
3	Construction of distribution mains	Construction of distribution mains
4	Water tanker feeding stations (6 locations) Water kiosk in low income community (38 + 6 at the locations of water tanker filling stations)	Eight (8) water tanker filling stations One hundred twenty (120) public tap stands
5	Replacement of old distribution pipes (in Atala Bara, Nimara Talata, Hai Cinema, Buluk, Hai Sora residential areas)	Not to be implemented by the Project
6	Water quality testing laboratory	No procurement in the Project
7	Water tankers for low income people in remote areas	No procurement in the Project
8	Workshop for repairs	No procurement in the Project

1-2 Natural Conditions

1-2-1 Project Site

The project site is located in the Juba County of the Central Equatoria State in Southern Sudan and consists of Juba Town, Kator and Munuki Payam that are currently urbanized and Rejaf and a part of Northern Bari Payams that are prospected to be urbanized. The total area of the project site is to be approx. 40km^2. Juba has been developed on the west bank of the Bahr el-Jebel River as the stopover to Kenya, Uganda and Congo Republic. Juba became the capital of Southern Sudan when CPA was concluded in 2005. Whereas the population of the project area was 250,000 in 2005, the population in 2009 is estimated as approx. 400,000 (Development Study) due to significant population growth caused by return of refugees and internally displaced persons.

1-2-2 Meteorology

Juba experiences the tropical climate, and it is warm throughout the year and has wet and dry seasons. According to record of rainfall data from 2005 to 2007, the mean annual precipitation is about 1,000 mm. Monthly precipitation in the rainy season, from May till September, is 120mm to 180mm. In dry season, lasting from December to March, there is little rainfall. During the rainy season, rainfall occurs for short duration of about two hours only, and does not continue throughout the day.

Table1-2 Monthly Rainfall (Year 2005- 2007)

(mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2007	Nil	1.0	11.8	117.4	178.8	129.8	194.1	125.5	172.0	74.5	55.5	TR	1,060.4
2006	TR	5.5	130.0	40.8	188.0	82.1	60.5	265.0	145.0	80.0	35.5	21.5	1,053.0
2005	0	TR	22.8	103.7	173.0	129.8	189.0	34.5	56.9	90.6	15.2	0	815.0

(Note) TR=Rainfall less than 0.1(mm)

(Source) Sudan Meteorological Authority

Table1-3 Monthly Average Maximum / Minimum Temperature (2006)

(Degrees Celsius)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
Max	38.9	39.5	35.8	35.5	31.3	31.9	31.6	30.5	31.8	33.5	33.5	34.3	34.0
Min.	21.9	23.6	23.6	23.9	22.1	21.5	21.1	20.4	20.5	20.8	20.8	18.9	21.6

(Source) Sudan Meteorological Authority

1-2-3 Hydrology

Water body around the project site consists of Bahr el-Jebel River and small rivers flowing into Bahr el-Jebel. The width of Bahr el-Jebel River ranges about 250m - 600m and the river flows from south to north. Several tributaries join this river downstream of Juba and it finally merges with the Blue Nile River in Khartoum city.

Small rivers in the project area, namely Luri River, Khorbou River, Lobulyet River, Wallan Creek and Kor Ramula River (from north to south) flow from west to east toward Bahr el-Jebel River. The project area is divided into five major watersheds by these five small streams. In these small rivers, water flows only during the rainy season, and these rivers dry up during the dry season, so-called Wadi, and the bed rock is exposed.

River flow of the Bahr el-Jebel River has been monitored since January 2008 by Sudanese

Dam Implementation Unit. The location of flow measurement in river is right upstream of the Juba Bridge. Based on the 45 monitored data at this location from January to September 2008, the maximum and minimum flow in the same period are 1,125 m^3/s (97.2 million m^3/day) and 1,742 m^3/s (150.5 million m^3/day) respectively.

A water level measuring gauge is also installed near the raw water intake point of the existing water treatment plant. Based on the data record of this location, the annual highest water level, and annual lowest level during 2006 and 2009 are shown in Table 1-4, together with estimated 5% annual exceedence probability by assuming a normal distribution of risk factor.

Table 1-4 Water Level of Bahr el-Jebel River at Water Treatment Plant

Year	Highest Water Level(m)	Lowest Water Level(m)
2006	11.92	11.14
2007	12.90	11.00
2008	12.80	11.22
2009	11.62	10.91
Water level of 5% risks	13.03	10.87

(Note) Water level can be read as elevation above sea level by adding 439.607m to adjust with the elevation system used under the Project.

According to the above table, the difference between the highest and lowest water levels at 5% annual exceedence probability is 2.16m. As the highest water level in the elevation system adopted in the Project is 452.637m, these water levels shall be taken into account in designing the water intake facilities.

1-2-4 Groundwater

From the hydrogeological point of view, Juba in general, except areas along Bahr el-Jebel River, has very low potential of groundwater development. Since Juba is situated in the rocky area, groundwater capacity is so small that groundwater is not suitable as the water source for urban water supply.

In the Development Study, 89 wells out of about 400 public wells in Juba were surveyed for water quality measurement by using field test kits. As a result approximately 40% of samples turned out to exceed in salinity compared to the drinking water quality standard values. And it was concluded that there are many wells that are unsuitable as drinking water source. However, although not suitable as source of potable water, they can be utilized as technical water other than potable use. Therefore, it is expected that the existing public wells will continue to be used by people since they do not need to pay for getting water from these wells in many cases.

1-2-5 Topography and Geology

Topography of Juba gently slopes from Kujur mountain (Jebel Körök: Mountain, altitude: 744 m) in the west toward Bahr el-Jebel River in the east (altitude: 450 m). The project area is situated in alluvium formations of Bahr el-Jebel where gneiss outcrops are unevenly distributed. There are five small streams that have water flow only during rainy season. Some areas along Bahr el-Jebel River often get flooded during rainy season. The water supply area of the Project is situated in the ground elevation range of 455m - 510m.

In the north of Juba, sedimentary gneiss is distributed covering Proterozoic gneisses. Proterozoic gneisses are distributed around Juba. Also, Alluvium is found in narrow areas along Bahr el-Jebel. Juba has hilly terrain and bedrocks are exposed at many places in the city. The thickness of the alluvium of sand layer is confirmed to be approx. 8m in the old riverbed. And terrace deposits are distributed in the area north of the airport.

In the Development Study (2009), mechanical boring survey was carried out by drilling two boreholes at the proposed site for expansion of water treatment plant. From the survey, stratum composition, geological analysis, groundwater level etc. has been identified. However, information on relationship of supporting soil (N value of weathered gneiss = 79-300) is insufficient in order to decide the structure and dimension of the proposed facility. Therefore, mechanical boring along with plane survey has been conducted in this Study, in order to confirm positions of the weathered gneiss at the construction site. The geological profile at the WTP site is as shown in Fig. 1-1. The depth of the supporting bedrock was confirmed to be 4 – 6 m from the ground level. Based on the existing geological formations, two types of foundation structures are considered, either footing foundation by excavating 0.5-1.0m below surface of the weathered gneiss, or pile foundation by penetrating the pile bottom 0.5-1.0m below the weathered gneiss. In selecting the foundation structure, other conditions should be taken into account, such as, high groundwater level (2.3m below the ground level) and constraint of available land.

In case of the reservoir site, the supporting layer (weathered gneiss) is situated 2.5m below the ground level. Spread foundation is proposed for foundation structure. Taking into account that wide area of approx. 1,000m^2 is required for the service reservoir (5,000 m^3), test pit excavation survey was carried out in order to identify position, distribution and slope of the supporting layer prior to deciding design layout and height of the reservoir. As a result, it was observed that bedrock is situated at relatively shallow level of 1.0-1.7m below the ground level.

1-2-6 Flora Fauna and Ecosystem

According to the vegetation maps of entire Sudan prepared by FAO, the original vegetation

of the project site was composed of savanna grassland and woodland. However, vegetation has been significantly damaged during civil war. Although this area had relatively rich forest until just 10 years ago, a lot of big trees have been cut down for military and fuel wood purposes. As a result, the forest has been destroyed. Accordingly, wildlife including many small birds has been lost. Currently, forest vegetation exists only in small stretches along the river bank. Nevertheless, fruit trees, such as mango and papaya, and useful trees such as neem trees are found throughout the city. In addition, in Bahr el-Jebel River, there are several species of aquatic life such as, fish, alligators, waterfowl, etc.

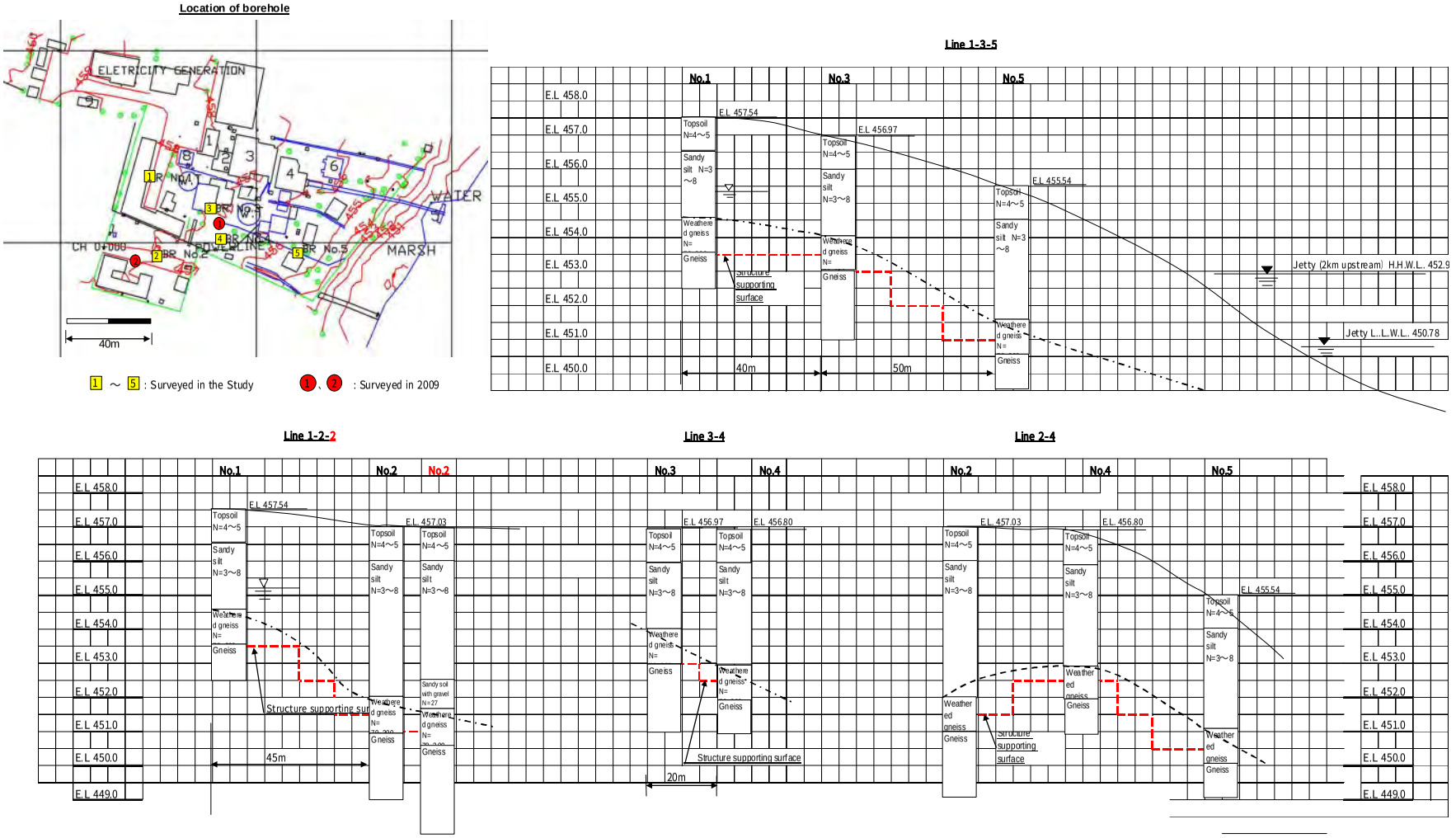


Figure 1-1 Geological Profile of the Proposed Site for Water Treatment Plant

1-3 Environmental and Social Considerations

Since little possibility of land acquisition and involuntary resettlement is expected in implementation of the Project, the Project is categorized as the Category B according to the JICA Guidelines for Environmental and Social Considerations. Expected negative impacts due to Project activities during and after construction period from viewpoints of Environmental and Social considerations are shown in Tables 1-5 and 1-6 together with their mitigation measures to be taken by the Project.

Table 1-5 Expected adverse impacts of the Project during construction stage and proposed mitigation measures

Items	Impacts	Mitigation Measures
<Landscape>	No significant impact expected	- Installation of information desk to collect complaints from residents and neighborhoods.
<Air Pollution>	Generation of particulates and exhaust gases	- Dust control through water sprinkling at construction site - Preventive maintenance of construction machineries and vehicles - Attentive operation and speed restrictions of construction vehicles and equipment - Arrangement of information desk and deployment of responsible person - Monitoring of air pollution parameter (dust) before and after project on necessity
<Noise and Vibration>	Generation of noise and vibration from heavy vehicles and equipments	- Announcement of construction schedule and contents at site - Attentive operation and speed restrictions of construction vehicles and equipment - Monitoring of noise
<Flora and Fauna>	Few trees might be required to cut in the proposed location of the WTP or along the alignment of the pipes	- Cutting of trees should be avoided as much as possible - In unavoidable cases, new trees should be planted after construction completes.
<Traffic/ Public Facilities> <Air Pollution> <Noise and Vibration>	Carrying in and out of materials/construction waste can result into possible adverse impacts on health, air pollution level, and noise and vibration along access road	- Announcement and public notification concerning construction contents and its schedule - Assigning of watchman or traffic control staff - Education on traffic rules for construction workers, drivers of water tankers and inhabitants - Water sprinkling - Covering the loading platform - Arrangement of information desk and deployment of responsible person - Attentive operation and speed restrictions of vehicles - Preventive maintenance of construction

Items	Impacts	Mitigation Measures
		machineries and vehicles
<Solid Waste>	Disposal of construction waste and soil	- Promotion of reuse - Disposal at appropriate location such as landfill site, etc.

Table 1-6 Expected adverse impacts of the Project during operation stage and proposed mitigation measures

Items	Impacts	Mitigation Measures
<Noise and Vibration>	Noise from blower, pumps, and generators is expected	- Facilities shall be installed inside buildings to reduce noise level significantly - Monitoring of noise
<Water Pollution> <Public Health Condition>	Water uses pattern being same, very little increase in wastewater discharge is expected within few years.	- In long run, planning is required towards appropriate handling and disposal of wastewater.
<Sludge Disposal>	Generated sludge will be from sedimentation tanks and not hazardous in nature	- Sludge removed from sedimentation tank shall be thickened using new sludge tanks at WTP. - Thick sludge can be removed through vacuum switch pump to sewage truck and should be disposed off at appropriate landfill site.
<Loss of jobs in case of pump operators>	Due to operation of water tanker filling station, several pump operators might lose present job.	- Affected pump operators should be informed of project activities during implementation. - When bidding is announced for O&M of these stations, pump operators should be informed as well.
<Water logging near water tanker filling station and Public tap stands>	Operation of water tanker filling station and public tap stands might result into water logging in its surroundings.	- Appropriate drainage facilities should be considered during design. - Operation should be carried out appropriately to avoid water logging in its neighborhoods. - Monitoring of surrounding situation of the stations and public tap stands

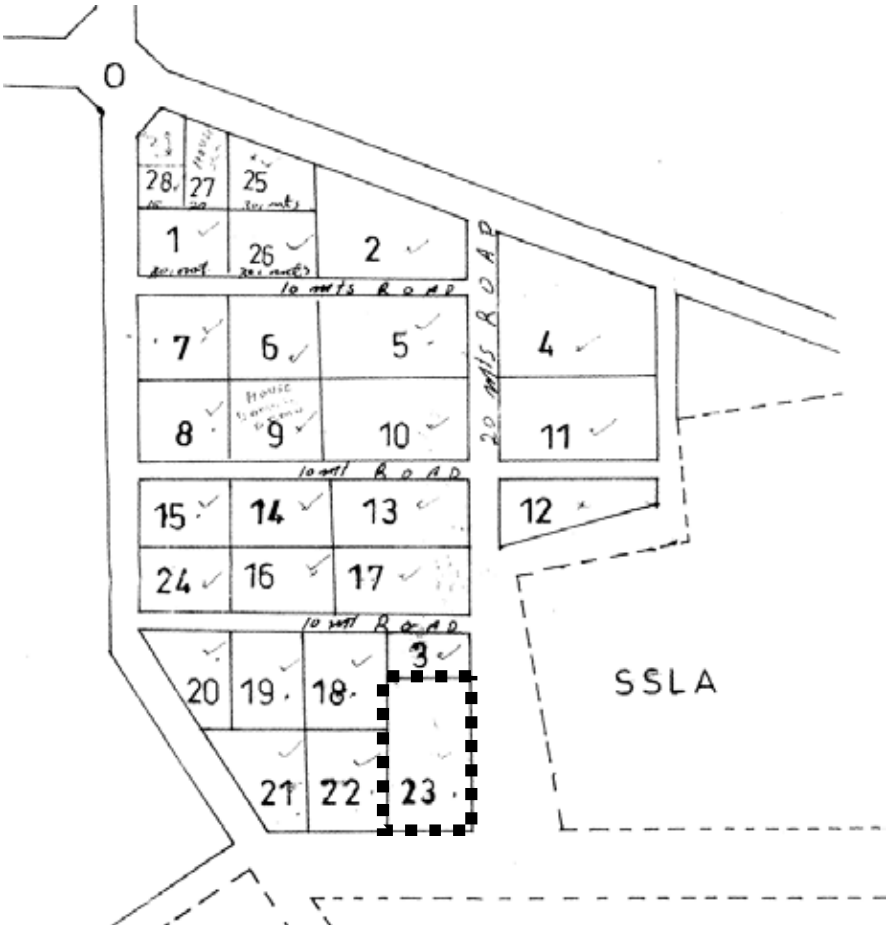
Environmental Protection law, applicable in Southern Sudan, is in draft stage and has not been enacted. Detail procedures are not described in this law. According to the Ministry of Environment (MoE) of the Government of Southern Sudan, this Project shall accord to the draft Environmental law. For this purpose, the project brief, which outlines the contents of the Project, shall be examined by MoE for the Environmental approval to be issued by MoE. The Project brief was submitted by the Ministry of Water Resources and Irrigation (MWRI) to MoE on 29th July 2010. MoE issued the Environmental Approval in February 2010, with condition that mitigation measures will be taken against the adverse impacts which might be caused by the Project implementation.

On 28th July 2010, Stakeholders Meeting was organized under the co-sponsorship of MWRI

and SSUWC. In the meeting, the following items were discussed and as a result, basic consensus related to the project implementation has been reached among the Stakeholders.

- Basic concept and outline of the Project
- Predicted positive and adverse impacts caused by implementation of the Project
- Mitigation measures to be taken against the adverse impacts
- Confirmation on land use situation and ownership of the proposed sites for the Project facilities

The proposed site for service reservoir is owned by the Central Equatoria State (CES). The Ministry of Physical Infrastructure (MOPI) of CES has prepared a plot plan to allocate the land to the Ministries concerned. MWRI requested MOPI for land use permission of a part of the plot plan. In December 2010, land use permission was granted by MOPI to use the plot No. 23 as shown in the figure below which has an area of 4,500 m^2 (50 x 90m).



(Source) Letter of Land Use Permission by MOPI/CES, December 2010

Figure 1-2 Location Map of the Land Use Permission (Plot No.23)

CHAPTER 2 CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Outline of the Project

(1) Overall Goal and Project Objective

The Government of Southern Sudan formulated “Water Policy, 2007” as the national supreme plan in water sector in which the primary objective is to provide safe, affordable and reliable urban water and sanitation services to the urban population on an equitable basis, including poor and vulnerable groups. This Project is requested based on the water supply master plan which was formulated through the technical assistance by the Japanese Government. The target of the master plan is to provide safe and clean water supply to all Juba citizens by year 2025.

The overall goal of the Project is to improve living environment of the Project area through improvement of water supply service of Juba. And therefore, implementation of this Project contributes to promotion of the supreme plan of “Water Policy”. The project objective is to enable residents of Juba who have no access to safe water to access to treated water through public tap stands and water tankers, by means of increasing drinking water supply capacity.

2-1-2 Outline of the Project

In order to achieve the project objective, water supply facilities will be constructed. As the outputs of the project activities, the water production capacity will be augmented and water transmission and distribution facilities will be constructed. The facilities to be constructed under the Japan’s Grant Aid include water treatment plant, service reservoir, transmission/ distribution facilities, public tap stands and water tanker filling stations. The outline of the Project is summarized in the Project Design Matrix as shown in Table 2-1.

Table 2-1 Outline of the Project

Target Area: Juba, Southern Sudan

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Water-supply services will be improved and living environment of the people in the target area will be improved.	- Water purchase costs of the people in the served areas. - Morbidity due to waterborne diseases - Infant mortality rate	Questionnaires survey Statistics of Ministry of Health/GOSS Annual Report of SSUWC	There will be no alteration in the Sudan's policy related to water supply services.
Project Purpose Residents of Juba who have no access to safe water are enabled to access to treated water through public tap stands and water tankers, by means of increasing drinking water supply capacity.	- Water-served population will increase from 34,000 persons (year 2010) to 389,300 persons (year 2015) - Consumption of safe water, which the people of the target area can use, will increase to 26L/c/day from the current zero-L/c/day. - Water quality, which is supplied from public tap stands /tanker filling stations, will meet the water-quality standards.	Annual Report of SSUWC Questionnaires survey	Operation/ maintenance of the constructed facilities will be continuously carried out.
Outputs - The water treatment plant will be expanded. - Water transition capacity will be augmented. - Water storage capacity will be augmented. - Water distribution capacity will be augmented. - Water supply system at pipe-ends will be improved.	- Treated-water production-volume will increase from the current 7,200m^3/day (the year 2010) to18, 000m^3/day. - Total length of transmission pipe will increase from the current 4.5 km (one line) to 9.4 km (2 lines). - Reservoir capacity will increase from the current 1,245m^3 to 6,245m^3. - Total length of distribution pipe will increase from the current 60 km to 112.8 km. - In the target water-served areas, newly 120 units of public tap stand will be placed. - In the target water-served areas, newly 8 units of water tanker filling station will be placed.(total 40 stations)	Operation records of the facilities (the water treatment plant) Records in user's ledgers Operation records of the facilities (the water tanker filling stations)	Necessary expenses for operation/ maintenance will be secured.
Activities - Expansion of the existing water treatment plant. - Construction of transmission pipelines. - Construction of a water service reservoir/ elevated tank. - Construction of distribution pipelines. - Installation of public tap stands. - Installation of water tanker filling stations.	**Inputs**		Budget of the Sudanese side will be secured.
	The Japanese side* Finance for construction/ renovation of the facilities Engineers of design/ construction (consultant, contractor)	The Sudanese side** Finance to be borne by the Sudan side (procurement of lands, administration/ operation/ maintenance and such) Engineers of design/ construction Engineers in the counterpart, the executing agency)	**Prerequisite conditions** Expenses for the Sudan's undertakings will be prepared. Selection of the construction-planned lands will finish and permission for land-use will be obtained.

(Remark) *: in the scope of the Japanese grant aid **: in the scope of the Sudan's undertakings

2-2 Outline Design of the Japanese Assistance

2-2-3 Design Policy

(1) Basic Policy

Priority of the Project is given to provide treated safe water to wider areas in order to contribute to water supply facility development plan by GOSS, which aims to improve water supply situation of Juba. Given this, the basic policy of the Project is set to maximize the number of beneficiaries by means of public tap stands and water tankers instead of individual house connection. In the Project, only domestic water demand is considered but non-domestic water demand is not included.

The population served of the Project is set to be 355,300 as planned in the Water Supply Master Plan formulated in the JICA Development Study (2009), in which the number of population having access to clean water through public tap stands and water tankers in year 2015 are estimated.

Based on field survey and results of discussion, contents of the requests are examined. As a result, the project components as shown in Table 2-2 are agreed to be implemented under the Japan's Grant Aid.

Table 2-2 Requested Items

Pri-ority	Requested items verified by the First Preparatory Survey (M/D dated March 05, 2010)	Requested items verified by the Second Preparatory Survey (M/D dated December 10, 2010)	Items changed
1	Expansion of the existing water treatment plant (WTP) with capacity of 14,400m^3/day.	Expansion of the existing water treatment plant with capacity of 10,800m^3/day.	Water treatment capacity
2	Construction of 5,000m^3 reservoir near the Parliament. Transmission pump station and transmission main from WTP to the reservoir	Construction of a reservoir and elevated tank with total capacity of 5,000m^3. Transmission pump station and transmission main from WTP to the reservoir	Additional construction of elevated tank
3	Construction of distribution mains	Construction of distribution mains	No change (pipeline routes are reviewed according to change in number of water tanker filling stations)
4	Water tanker feeding stations (6 locations) Water kiosk in low income community (38+6 at the locations of water tanker filling stations)	Eight (8) water tanker filling stations One hundred twenty (120) public tap stands	Number of water tanker filling stations and public tap stands
5	Replacement of old distribution pipes (in Atala Bara, Nimara Talata, Hai Cinema, Buluk, Hai Sora residential areas)	Not to be implemented	Not to be implemented. Reconnection work of the service pipes to be done by GOSS. However, technical viability seems to be low. In addition, under budget constraint, priority is given

Pri-ority	Requested items verified by the First Preparatory Survey (M/D dated March 05, 2010)	Requested items verified by the Second Preparatory Survey (M/D dated December 10, 2010)	Items changed
			to maximize beneficiary by constructing new public tap stands and tanker filling stations.
6	Water quality testing laboratory	No procurement in the Project	Not to be procured in the Project. This will be considered in the Technical Cooperation Project.
7	Water tankers for low income people in remote areas	No procurement in the Project	Not to be procured in the Project. Currently a lot of private water venders are engaged. Necessity of operating tankers by SSUWC seems low.
8	Workshop for repairs	No procurement in the Project	Not to be procured in the Project. To be examined in the Technical Cooperation Project.

(2) Policy to Natural Environmental Conditions

- Juba is located in the area belonging to tropical zone, and has a mild climate all the year around and comprises both rainy season and dry season. The rainfall lasts usually for 2 hours. Due to heavy rainfall over a short period of time, there is fear that excavated areas for pipe laying work are quickly flooded and, therefore, backfilled materials are washed away or floating up of pipe materials may occur. Therefore, pipe laying work should be planned such that after excavation, both piping work as well as backfilling work could finish within the day.
- Monthly temperature of 2006 shows that the yearly average highest temperature is 34°C and a yearly average lowest temperature is 21.6°C. Temperature difference is caused by high temperature in the daytime and low temperature at night. In consideration of high temperature, especially, concrete-casting/ concrete-curing work in hot weather should be carefully controlled. Aggregates should be stocked so as to hold concrete's temperature as low as possible at the time of concrete mixing.
- The target service area of water supply is situated at the altitude ranging +455m to +510m and in a terrain sloping gently in the direction of east-west. Water distribution can be feasible to those areas as one whole water-served-area, by a flow method of natural gravity from elevated water-tanks which will be constructed in the proposed reservoir site (altitude +509m).
- In the northern part of Juba, sedimentary rocks are located over the Proterozoic. In the neighborhood of Juba also, gneiss of the Proterozoic are located. In the narrow zone along Bahr el-Jebel River, an alluvium exists. The target areas are located on a hilly terrain. At some places in the city, bedrocks are cropping out. In pipe-laying work, in particular, cost reduction should be considered by decreasing volume of rock-excavation work with shallow depth of pipeline trenches.
- At the site of the proposed water treatment plant, an alluvium layer occurs, and weathered gneiss exists at a depth of 4m - 6m underground, which will become a supporting layer.

Taking this situation into consideration, pile foundation structure is employed.

- Soundness of the ground at the service reservoir site is confirmed. Therefore, spread foundation is employed.

(3) Policy to Socio-Economic Conditions

- Although security situation after CPA seems stable and referendum for independence was peacefully completed in January 2011, the unrest situation will continue since some conflicts reportedly still happens after February 2011 near border with North and internal disturbance, etc. Special attention should be paid to security.
- In the midst of reconstruction after the conflict, in which a lot of projects such as infrastructure construction projects are being developed, the current social situations are very changeable. Careful consideration should be given to other construction projects that are related to the facilities of this Project. Attention should be paid, in particular, to "Urban Roads Rehabilitation Project in Juba" now under implementation. Almost all distribution main pipelines will be laid alongside the roads planned in the above-mentioned project. The pipeline route should be designed on assumption that the road-construction projects would have been already completed.
- It has been already verified that the sites, which are proposed for public tap stands in this Project, will be located in the lands of Payam's administration along public roads. In many cases, distribution secondary pipelines (pipelines running from diverging points on the distribution main pipeline to public tap stands) will be laid mostly along unleveled and unpaved roads. Therefore, there is a possibility that the line/shape of the present roads would be reviewed in accordance with the road construction scheme in future. In such a case, there is the possibility also that the distribution secondary pipelines, which are planned in this Project, would deviate from the roads in the future. In this Project, at the time of detail design, the road construction scheme of Payam should be examined and re-verified at Payam level. To overcome this issue, high density polyethylene pipes (HDPE), which are flexible and adaptable to probable changes in circumstance at the time of pipeline-construction, will be adopted in case of the distribution secondary pipelines.

(4) Policy to Construction Situation/Procurement Situation

- In Southern Sudan, most industrial products such as constructional materials are imported from the neighboring countries, Kenya and Uganda. BS (British Standard) is commonly applied to most of the industrial standards for industrial products. In this Project too, constructional materials are assumed to be procured from these neighboring countries. In consideration of ease in quality-control as well as construction-work, BS should be primarily considered. In cases when any product made under another international standard is used, its compatibility with BS should be considered.

- Construction materials procurable at the job-site, are aggregate/ sand/ timber/ gasoline and so on. All other construction materials (cement/iron bar/steel frame/ plywood/ pipe etc.) need to be imported from foreign countries. In order to minimize transportation cost and shorten procurement period, these materials shall be procured from neighboring countries of Kenya or Uganda. The final decision shall be made after checking the quality and price.
- As most materials are to be imported, the transportation-cost will account for a large part in procurement-cost. In addition, the procurement period will affect construction period. For these reasons, method/route/period of transportation should be incorporated accurately into construction schedule.

(5) Policy to Utilization of Local Contractor (Construction Company and Consultant)

- In Southern Sudan, infrastructure-construction projects, which are assisted mainly by international donors, are being implemented. The contractors of those projects are construction companies of Kenya/ Uganda/ the Sudan (i.e. united nation). In most of the companies working on these projects, engineers and workers of foreign countries (including the unified Sudan) are used. People of Southern Sudan are engaged in simple works. In this Project also, the local people are planned to carry out simple works under the supervision of foremen and technicians from other countries.
- In Southern Sudan, there is no contractor who has experience and capability in civil engineering and architectural engineering works including waterworks. It could be possible that a Japanese contractor would utilize such construction companies having employees of foreign nationality, as its sub-contractors that have experiences and expertise of construction works in the local conditions similar to Southern Sudan.

(6) Policy to Management/Maintenance

- Management/maintenance of waterworks will be carried out by SSUWC. As SSUWC's competence for operational management/financial management is generally low, in addition to this Project's implementation, Technical Cooperation Project by JICA is under implementation. It is expected that on completion of the Technical Cooperation Project, there would not be problems in maintenance of the facilities, because under the said Project SSUWC will be supported for reinforcing its capability of operation and its water-charge collection system, and will be supported for establishing an organization to manage the public tap stands/water tanker filling stations, by the time of completion of this Project's facilities.
- At public tap stands, caretakers need to be always stationed to collect water charges. Both for the sake of sun-shade/rain-shelter for the managers and for the purpose of preventing illegal use when the caretaker is away, a shed-like house (kiosk) should be designed, which can store water-meters, water-valves and record-books of water charges.

- At the water tanker filling stations too, a shed-like house should be constructed similarly as in the case of the public tap stands, because caretakers will be stationed at all times to collect water charges.

(7) Policy to Grade of Facilities and Equipment

- Since there is no design standard related to water supply facility in Sudan, those of donor countries are applied in the past aid projects. “Design Guideline for Water Supply Facility of Japan (2000)” is applied in facility design in the Project.
- For water quality standards, the Draft Drinking Water Quality Standard to be adopted in Southern Sudan is applied.
- The water treatment plant, which will be constructed in this Project, will adopt the same treatment method, in principle, as in the existing one. In operational process, there should be consistency in maintenance technologies with the existing one.
- Control of pumps and machines should be by on-site operation only, similarly as in case of the existing facilities. Operation of valves also should be by manual method, similar to the existing facilities.
- As electricity-supply is very unstable, an emergency electricity-generator should be installed at the water treatment plant and the service reservoir, respectively.
- In consideration of the policy that pipeline laying work should be of shallow laying method, and in consideration of the situation that many pipelines would be laid in unpaved roads, the ductile iron pipes (diameter 250mm or more) which have higher durability and ductility and high density polyethylene pipes (diameter 200mm or less) which have greater flexibility should be adopted.

(8) Policy to Construction Method/Procurement Method and Construction Period

- The implementation schedule of this Project depends on the assumption that the Government’s Bond of Japan Type-B will be applied. Approximately, a period of 33 months are expected from Detail Design to the Project’s completion (Detail Design: 8 months, Construction: 25 months).
- For the facilities in the water treatment plant (sedimentation tank, filtration basin, clear water reservoir), the service reservoir and the elevated tank and others, strictly water-tight concrete structure is required. For this reason, construction management and quality-control should be carefully scheduled in each process of concrete-work from compounding, mixing, conveying, casting to curing.
- In planning construction processes, the procurement-period of construction machines and materials should be taken into account. Main construction works includes treatment plant, service reservoir and pipelines. Eight squads for construction of pipelines are planned in order to harmonize with the work progress of the water treatment plant as well as service

reservoir.

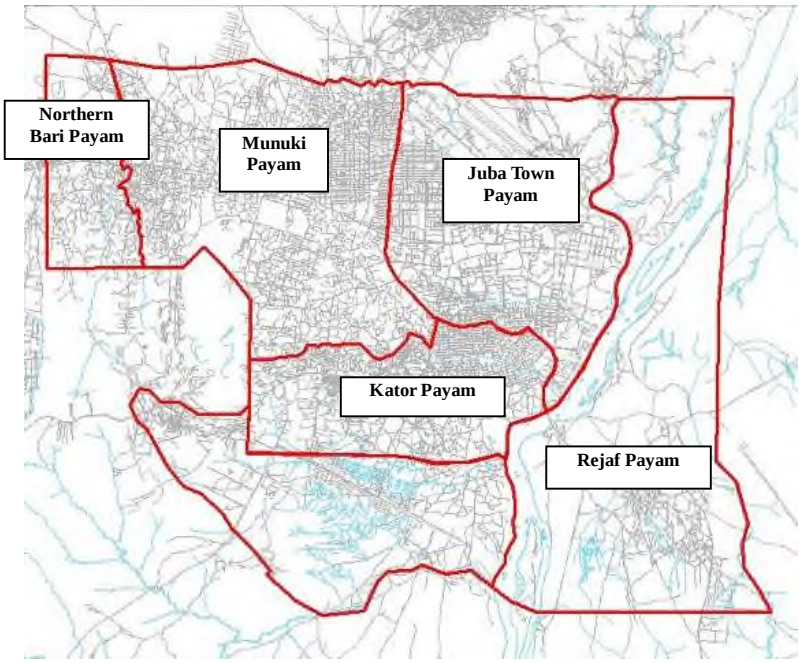
- The pipeline construction work will be carried out mainly on or alongside public roads. Its construction-schedule should be so studied that both inconvenience and discomfort, which pipeline construction work would cause to general traffics, passers-by and the neighboring people, could be maintained as low as possible.

2-2-4 Basic Plan (Construction Plan)

(1) The Entire Plan

1) Water Service Area

The target service area of water supply is the same area as the Master Plan, namely the major urbanized area of Juba, including whole areas of Juba town-Payam, Kator-Payam and Munuki-Payam and a part (Gurai) of Northern Bari-Payam and two parts (Lologo and Gumbo) of Rejaf-Payam where future urbanization is expected.



(N.B.) In this Survey, the administrative demarcation between Munuki Payam and Northern Bari Payam was checked. It was verified that Gudele area, which had been targeted in the Development Study, belongs to Munuki Payam, and that the west of Gudele, which is called Gurai area, belongs to Northern Bari Payam. Therefore, the administrative boundary between Munuki Payam and Northern Bari Payam in the target areas of the Project should be modified. However, there will not occur any change in this water supply Project, such as population forecast since there is no change as the entire service area.

Figure 2-1 Target Service Area of Water Supply

2) Target Year

Target year of the Project is to be 2015, which will fall on the target horizon in the Master Plan. Incidentally, this target year conforms to the Millennium Development Goal (MDG) of Southern Sudan which aims at halving down the population having no access to clean water by 2015.

3) Population Forecast and Population Served

Adopting the result of the population forecast by the Development Study (2009), the population to be served under this Project is 355,300, which was proposed as a population who can access to public tap stands and water tankers, in the water supply plan of the Master Plan.

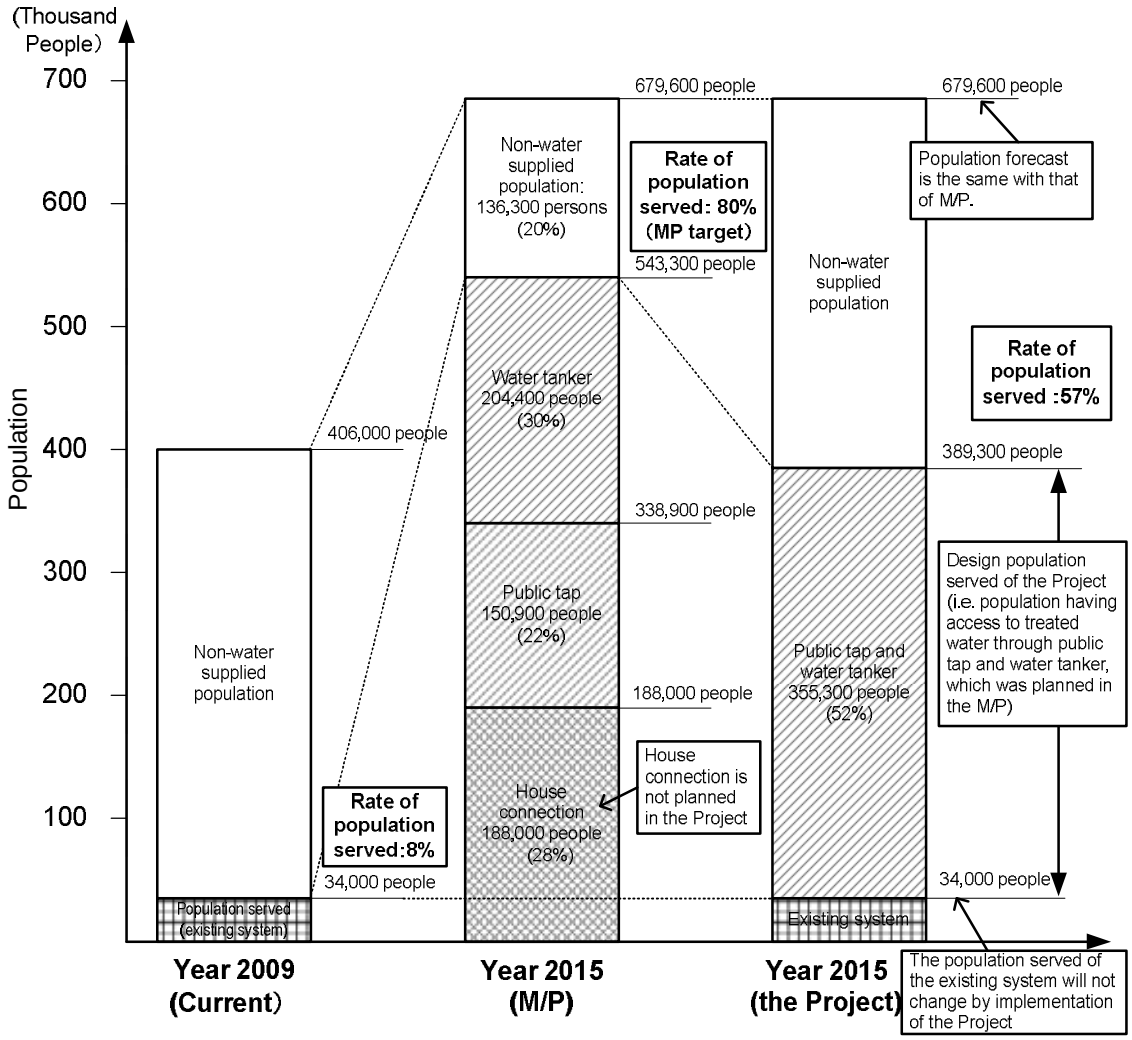


Figure 2-2 Population Forecast and Population Served Planned in M/P and the Project

4) Unit Water Consumption

(i) Domestic Water (Daily Life Water)

In the Development Study, the target value of design domestic water consumption per capita per day in 2015 is set at 90L/c/day in case of house connection and 40L/c/day in case of public tap stands/water tankers, respectively. In case that public tap stands/water tankers are used, on assumption that the charge-free wells are continuously used, the public wells are assumed to contribute 30% (12L/c/day) in the water consumption of 40L/c/day. Therefore, per capita water consumption of the piped water supply is scheduled at 28L/c/day (= 40L- 12L). With reference to the social survey carried out in this Survey, a test calculation was carried out to estimate consumption of water from public wells. The result of the calculation showed that water-consumption per capita per day from public wells was 11.2L/c/day in a household which has no access to tap water-service. In addition, the value of 11.2L/c/day is thought to be reasonable, because the value lies in the range of 10~15L/c/day (12L/c/day on average) which is generally regarded as water-consumption per capita per day from public taps in developing countries.[#]

Table 2-3 Per Capita Water Consumption from Public Wells in Non -Served Areas (presumed from the Socio-economic Survey)

	Item	Survey Result /Presumed Value	Remarks
[A]	Number of households out of access to tap water	166 households	100%
[B]	Number of households using public well	99 households	[B] / [A] = 60%
[C]	Number of households using public well as main source (Cooking, drinking and other use)	45 households	[C] / [A] = 27%
[D]	Number of households using public well for cooking and drinking purpose, and using other sources for auxiliary purpose	55 households	([B] - [C]) / [A] = 33%
[E]	Water-consumption per capita (on average)	29.4L/c/day	From the result of questionnaire
[F]	Water-consumption per capita from public well in [C] household using public well as main source	29.4L/c/day	Same as [E]
[G]	Water-consumption per capita from public well in [D] household using public well and other sources as auxiliary source	9.8L/c/day	1/3 of [E] is presumed.
[H]	Average water-consumption per capita in all households out of tap water	12.8L/c/day	([F] x 38%) + ([G] x 40%)

[#] Small Community Water Supplies: Technology of Small Water Supply Systems in Developing Countries, Technical Paper Series 18, p40, International Water and Sanitation Center, 1983.

The results of the social survey on water-consumption carried out in this Survey are presented in Table 2-4. In the social survey, domestic water consumption by use in both rainy season and dry season is examined. The result indicates that 6.8 - 8.9L/c/day (The range is from rainy season to dry season.) is used as drinking/cooking water, and 19.4 - 21.5L/c/day is used for other purposes. Hence, 26.2 - 30.4L/c/day is used in total.

Furthermore, approximately 22% of the respondents point out the water-shortage as a problem in the current situation of water use. The result also shows that, if the situation of water supply service would improve, the people would wish to use much more water than the present, that is to say, +22L/c/day in case of the charge remaining unchanged and +23.6L/c/day in case of the charge going down. Assuming that 22% of the population needs +23L/c/day to make up the shortage, the entire volume of water shortage is calculated as +23L/c/day x 22% = +5.1L/c/day. When compared with approximate 30L/c/day of the current water-consumption, 35L/c/day is calculated out as appropriate water-consumption. Considering additional about 10% of water-consumption for planning purpose, the water-consumption of 40L/c/day, proposed in the Master Plan as the water consumption target, is thought to be a reasonable value.

Table 2-4 Summary of Results of Social Survey in the Preparatory Survey (the Result about Water-Consumption)

Time of Survey	July 2010	
Number of households interviewed	200 households	
Number of average household members	7.2 persons/household	
Water consumption	Dry season	Rainy season
Drinking/cooking water	64L/household/day (8.9L/c/day) ….. 29% of consumption per day	49L/household/day (6.8L/c/day) ….. 26% of consumption per day
Other daily life water	155L/household/day (21.5L/c/day) ….. 71% of consumption per day	140L/household/day (19.4L/c/day) ….. 74% of consumption per day
Total	219L/household/day (30.4L/c/day)	189L/household/day (26.2L/c/day)
Kind of drinking water source (plural answers)	Tap water ·House connection: 15 households (7.5%) ·Public tap: 20 households (10%)	Other than tap water ·Public well: 102 households (51%) ·Bottled water: 26 households (13%) ·Water tanker: 112 households (56%) ·Water vendor: 9 households (4.5%) ·Rain water: 20 households (10%)
Kind of general service water source (plural answers)	Tap water ·House connection: 12 households (6%) ·Public tap: 19 households (9.5%)	Other than tap water ·Public well: 49 households (24.5%) ·Bottled water: 2 households (1%) ·Water tanker: 137 households (68.5%) ·Water vendor: 8 households (4%) ·Rain water: 57 households (28.5%)
Water volume to be used more than the present, when water	In case the water charge remains unchanged,	In case the water charge goes down,

service improves	+159L/household/day (+22L/c/day)	+170L/household/day (+23.6L/c/day)

Hereupon, the production capacity of the water treatment plant, which will be constructed in this Project, is to be 10,800m^3/day as stated later. According to the calculation shown in Table 2-5, the possible water supply volume per capita per day is to be 26L/c/day.

Table 2-5 Water Supply Volume Per Capita Per Day in this Project

	Item	Design Value	Abstract
[A]	Treatment Capacity of Treatment Plant	10,800m^3/day	To study in the below-mentioned
[B]	Seasonal fluctuation (daily maximum coefficient)	1.0	Coefficient 1.2 is proposed in the Master Plan. In order to fairly supply water to many people under dimensional restrictions of the water treatment plant, loading rate of 100% (= daily average water supply volume ÷ daily maximum water supply volume) is adopted.
[C]	Ineffective water ratio (water leakage ratio)	15%	Water leakage ratio 20% is proposed in the Master Plan. In this Project, however, a house connection, which is a major cause of water leakage, is not included. It is reasonable that a rate of leakage from distribution pipelines is thought to be 10% or so. However, a rate of 15% is proposed, in consideration that water leakage would occur when poly-tanks and water tankers take turns in water-filling work at public tap stands and water tank filling stations.
[D]	Water consumption other than household	Nil	Refer to the next item (ii).
[E]	Possible water supply volume per capita per day	26 L/c/day	[A] x (100% - [C]) ÷ 355,300 persons = 26L/c/day

A comparison on unit water demand between the Master Plan and this Project is shown in Table 2-6. The tap water consumption in this Project runs short by 2L/c/day, as compared to the value of the Master Plan. However, considering that the priority is given to both the rate of population served as the basic policy of the Project and that the Project is urgently needed, such shortage is thought to be acceptable. Furthermore, the unit domestic water consumption of 40L/c/day, which is a target value in the Master Plan, is thought to be achievable, because more than 400 public wells can be used as the alternative water sources other than tap water in the target areas and because the supplemental water sources of some 14L/c/day can be used for the purposes other than drinking use.

Table 2-6 Comparison on Unit Water Demand between the Master Plan and the Project

	Master Plan	The Project
Tap water (mainly for drinking /cooking use)	28L/c/day	26L/c/day
Public well and other water (general service water)	12L/c/day	14L/c/day
Water consumption per capita	40L/c/day	40L/c/day

(ii) Non-Domestic Water

In the Master Plan, in addition to domestic water, 61% of the domestic water consumption is taken into account as non-domestic water consumption including water uses by public institutions and commercial users, etc. On the other hand, as the Project's policy, non-domestic water is not taken into account, because the priority is given to increase the population having access to safe water and the objective of the Project is to supply domestic water through public tap stands and water tankers.

Incidentally, it is recommended, in the Preparatory Survey, to study water supply both to the airports and to important public facilities including schools, hospitals and so on. However, those water users are not included in the target of water supply, because it is very difficult to incorporate such a water demand into this Project's design, considering the constraint of the scale of water treatment plant. Therefore, water supply to these public facilities, other than households, to which water should be supplied from either the existing facilities or private wells, will not be included in the scope of the Project. In connection with airport-use water, it seems reasonable that private wells should be constructed by the Southern Sudan side for general service and fire extinguishing works since the airport needs massive water volume in case of occurrence of fire.

5) Study on the Scale of Facilities

In the Project, as the prime objective is to increase population having access to safe water, water supply volume should be planned as much as possible. As a result of the examination in terms of the following items, the treatment capacity of the water treatment plant of 10,800m^3/day is determined as appropriate.

Table 2-7 Comparison on Alternatives of Water Treatment Plant Capacity

Alternatives (Refer to (i) mentioned below)	7,200mm^3/day (the original request)	10,800m^3/day	14,400m^3/day
Consistency with MP target	**B**(fair) The population served (or water consumption per capita) is small.	**A**(good) The population served/water consumption targeted in MP is almost attainable.	**A**$^+$(very good) The population served/water consumption targeted in MP is almost attainable.
Examination on public tap stands and water tankers (Refer to (ii) mentioned below)	**A**(good) The number of public tap stands and water tanker filling station to be constructed is reasonable.	**A**(good) The number of public tap stands and water tanker filling station to be constructed is reasonable.	**B**(fair) A considerably large number of public tap stands and water tanker filling stations are required.
Examination on land Constraint (Refer to (iii) mentioned below)	**A**(good) Construction is feasible, after removing the unused old facilities.	**A**(good) Construction is feasible, after removing the unused old facilities.	**C**(not good) If the same treatment process as in the existing facility would be used, land needed for construction will run

Alternatives (Refer to (i) mentioned below)	7,200mm^3/day (the original request)	10,800m^3/day	14,400m^3/day
			short.
Overall Judgment	**B**(fair) An impact to the target is inferior.	**A**(good) The scale is appropriate.	**C**(not good) Infeasible due to land constraint

MP: Master Plan

(i) Capacity per One Train of the Water Treatment Plant

The existing water treatment plant consists of 2 trains of system capable of treating 3,600m^3/day per train. As there is a policy of adopting the same operational system to the augmented facility as in case of the existing facility, it is reasonable that the treatment capacity per one train is fixed at the same 3,600m^3/day as in the existing facility. Considering this, the capacity of expanded facility will be selected from among 7,200m^3/day (2 trains), 10,800m^3/day (3 trains) and 14,400m^3/day (4 trains).

(ii) Examination from the Number of Public Tap Stand and Water Tanker Filling Station

A test calculation for the necessary number of public tap stands and water tanker filling stations is shown in the following Table 2-8, in the cases of 10,800m^3/day and 14,400m^3/day as water treatment plant capacity. According to the result, 210 public tap stands and 10 water tanker filling stations will be required, in the case of production capacity of 14,400m^3/day. Whereas available lands are quite limited due to rapid increase of returnees, further land acquisition is very difficult other than the eight sites that have been secured already. As the number of water tanker filling stations will increase, the number of water tankers will be additionally required. However, capacities of these tanker operators are unclear. The social impact is also concerned that heavy traffic jams in the city would become worse in case the number of water tankers would increase.

Table 2-8 Calculation on Number of Public Tap Stands and Water Tanker Filling Stations

Scale of Water Treatment Plant	10,800m^3/day	14,400m^3/day
[A] Public Tap Stands	Number: 120 locations	Number: 210 locations (assumption)
	Providing tap water consumption per capita at 26L/c/day, distribution water volume: 1,560m^3/day (26L/c/day x 500 persons/location x 120 locations)	Providing tap water consumption per capita at 26L/c/day, distribution water volume: 2,730m^3/day (26L/c/day x 500 persons/location x 210 locations)
[B] Water Tanker Filling Station	Number: 8 locations	Number: 10 locations
	·From [A] and [C], 10,800m^3/day-1,560m^3/day (public tap stand)-1,620m^3/day (ineffective water volume) = 7,620m^3/day ·Providing water service volume per tap at 192m^3/day,	·From [A] and [C], 14,400m^3/day-2,730m^3/day (public tap stand)-2,160m^3/day (ineffective water volume) = 9,510m^3/day ·Providing water service volume per tap at 192m^3/day,

	7,620m^3/day / 192m^3/day = 39.6 taps…40 taps (Refer to the calculation mentioned in the following item) ·Providing 5 taps on average per one station, the number of 8 stations is calculated out. (40 taps / 5 taps/ station= 8 stations)	9,510m^3/day / 192m^3/day = 49.5 taps … 50 taps ·Providing 5 taps on average per one station, the number of 10 stations is calculated out. (50 taps / 5 taps/ station = 10 stations
[C] Ineffective Water Volume (15%)	1,620m^3/day (=10,800m^3/day x 15%)	2,160m^3/day (=14,400m^3/day x 15%)
Total [A]+[B]+[C]	10,780m^3/day	14,390m^3/day

(iii) Examination from the Constraint of Land at the Existing Water Treatment Plant

In this Survey, in the premises of existing water treatment plant, check and verification was carried out for those facilities that are still in use and those which are no more in use and could be removed in order to plan the facility layout. It turned out that the land that could be used for the facility expansion is smaller than initially expected, because several facilities that are still in-use are spotted and there also exist distribution pipelines that are in use as shown in Figure 2-3. As minimizing the space for passage ways is required even in the case of WTP with capacity of 10,800 m^3/day, it is not practical to construct the plant of 14,400 m^3/day due to this land constraints because special space-saving design such as double-deck filtration basin, etc. would be required if the plant of 14,400 m^3/day is designed to fit within the available space.

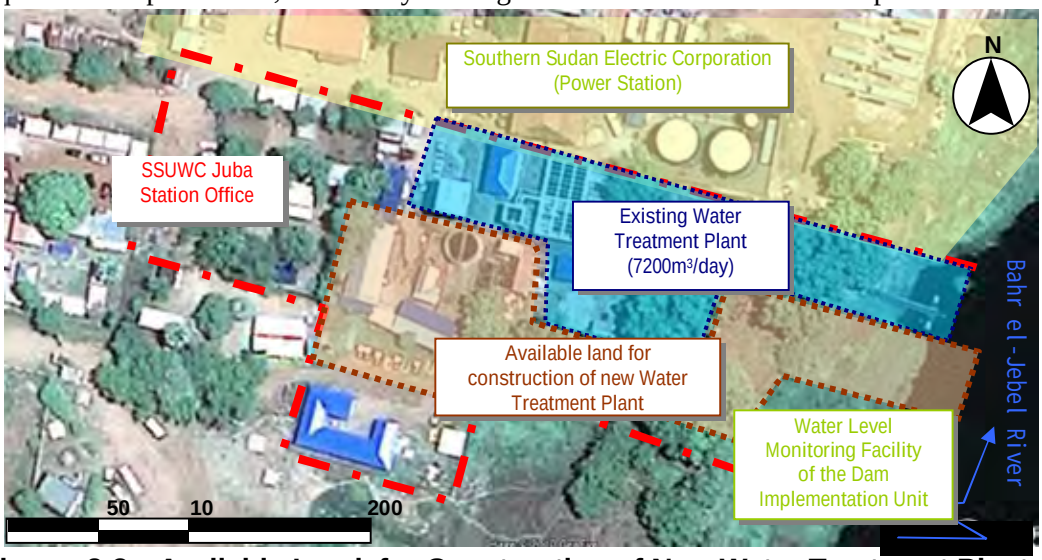
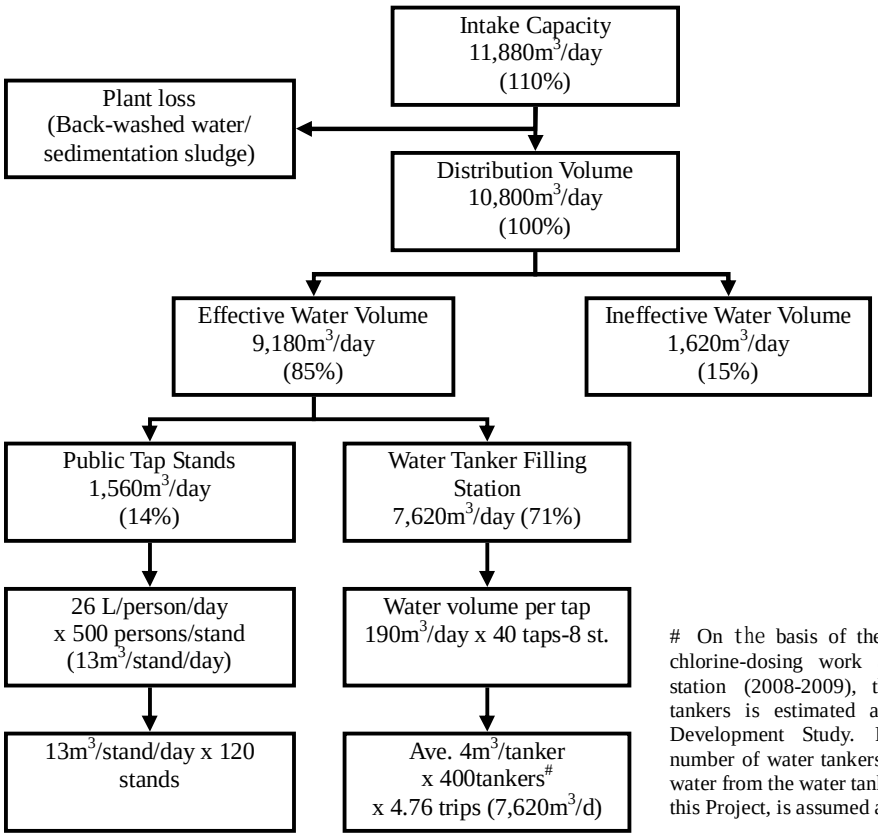


Figure 2-3 Available Land for Construction of New Water Treatment Plant

6) Water Balance of the Water Supply System

Water balance of the water supply system is illustrated as Figure 2-4. Calculation basis for water supply volume for the one public tap stand and one water tanker filling station are shown in Table 2-9 and 2-10, respectively.



On the basis of the operation records of chlorine-dosing work at river-water supply station (2008-2009), the number of water tankers is estimated at 400 - 600 in the Development Study. For this reason, the number of water tankers, which will distribute water from the water tanker filling stations after this Project, is assumed at 400 on average.

Figure 2-4 Water Balance of the Water Supply System in the Project

Table 2-9 Calculation on Water Supply Volume per Public Tap Stand and the Number of Taps

	Item	Design (Calculation) Value	Remarks
[A]	Water consumption per capita per day	26 L/c/day	
[B]	Water-served population by one public tap stand	500 persons/stand	[Design] Providing 300m for an average distance in between public taps and 35m in between houses, the number of 500 persons is calculated out. (300m / 35m) ^2 x 7 persons/ household = 514 persons…500persons
[C]	Water supply volume per one public tap stand	13 m^3/stand	[Calculation] [A: 26L/c/day] x [B: 500 persons/stand]
[D]	Water flow per one tap	0.25 L/second	[Design] Bases on Japanese Standard (Dia. 13mm, 0.28L/sec.)
[E]	Water filling time to jerry can (polyethylene tank, 20L)	1.4 minutes	[Calculation] 20L / [D:0.25L/sec] / 60 = 1.33 minutes
[F]	Cycle time including tank change time	2.0 minutes	[Design] Presumed lead-time and loss-time of 30 seconds per one cycle is added to [E: 1.4 minutes].

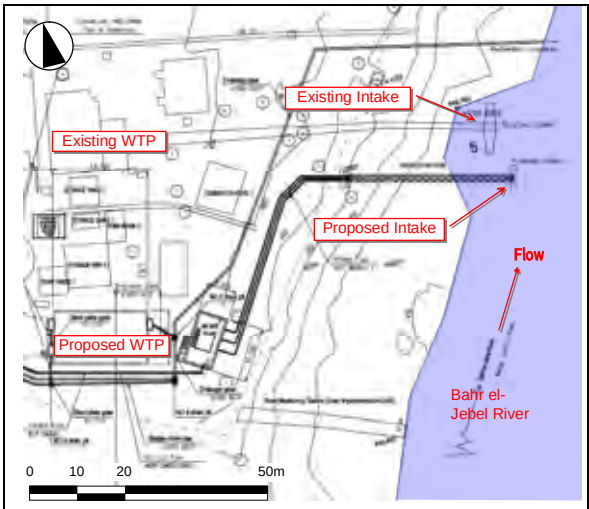
	Item	Design (Calculation) Value	Remarks
[G]	Water filling time of water tap	6.0 hours	[Design] 3 hours in the morning and 3 hours in the evening based on the result of the social survey
[H]	Water supply volume per one tap	3,600 L/day-tap	[Calculation] 20L x (60 min./hour / [F: 2 min.]) x [G: 6 hours] = 3,600 L/day
[I]	Number of taps per one public tap stand	4 taps/stand	[Calculation] [C: 13m^3/stand] / [H: 3.6m^3/tap] = 3.6 … 4 taps

Table 2-10 Calculation on Water Supply Volume per Tap in Water Tanker Filling Station and the Necessary Number of Taps

	Item	Design (Calculation) Value	Remarks
[A]	Gross distribution-water volume from water tanker filling station	7,620 m^3/day	[Calculation] [gross distribution-water volume] – [ineffective water volume] – [distribution-water volume from public tap stands]
[B]	Operation time at water tanker filling station	8 hours	[Design] Out of 8:00 - 17:00 (9 hours), 8 hours is presumed as actual working hours.
[C]	Water filling cycle per one water tanker (4m^3)	10 minutes	[Design] Based on the result of observation (about 7 min./ tanker) at trial operation at USAID water supply system
[D]	Water filling volume per one tap	192 m^3/day-tap	[Calculation] 4m^3 (average capacity per one tanker) x (60min./hour / [C:10 min.]) x [G: 8 hours] = 192m^3/day
[E]	Number of necessary taps	40 taps	[Calculation] [A:7,620m^3/day] / [D: 192m^3/day] = 39.6 taps…40 taps
[F]	Number of necessary filling stations	8 stations	[Presumption/Design] The usable lands are restricted. Providing 4-6 taps per one station, 5 taps per one station can be presumed. 40 taps / 5 taps/station = 8 stations

(2) Water Source Plan

As reported in the Development Study, Bahr el-Jebel River, which is a tributary of the White Nile flowing through Juba from south to north, is designated to be the water source for the urban water supply of Juba. The Bahr el-Jebel River, having sufficient water flow, has good raw water quality which can be treated to drinkable water through conventional water treatment. Therefore, this river is selected as the water source for the Project. The water intake point for new treatment plant is designed to be at the upstream of the existing water intake facility.



Water intake point in the Bahr el-Jebel River

Photo of the existing water intake facility

A 5% annual exceedance (20-year flood) water level, which is supposed on basis of both the observation data (January - September 2008) of river flow rate recorded at the upstream point of Juba and the observation data (2006 - 2009) of water levels recorded at the upstream point of the water intake point in the water treatment plant by Sudan Dam Implementation Unit, is as shown in Table 2-11.

The water intake volume of the entire water supply system after the Project, is expected to be 19,800m^3/day (with a 10% loss being added to the production capacity). The volume is equivalent to approximately 0.02% of the minimum river flow, being a negligibly small water-volume, and therefore, can be stably taken-in as raw water to the urban water supply of the object areas without affecting the river flow. In addition, a water level difference at the 5% annual exceedance probability (20 year probability) is 2.16m, which is reflected in the design of water intake facility. The 5% annual exceedance probability is, being equivalent to a 20 year probability, somewhat small as a design probability for a river structure. It is sufficient, however, to consider a fluctuation of 5% annual exceedance probability, because the watershed of the main river is very vast, the occurrence of rainfall at the same time all over the entire watershed is very rare, and also because the river flow is controlled using a dam upstream.

Table 2-11 River Flow/Water Level Observation and Design Water Intake Volume

Item	Design Criteria	Remarks
River flow rate	Maximum: 1,742m^3/sec (150.5 million-m^3/day) Minimum: 1,125m^3/sec (97.2 million-m^3/day)	
River level	Highest level (5% exceedance probability): +452.637m Lowest level (5% exceedance probability): +450.477m	Level difference: 2.16m
Design Water Intake Volume	19,800m3/day (A 10% plant loss is added to both 7,200m3/day of the existing facility and 10,800m3/day of the new facility respectively.)	Equivalent to 0.02% of minimum river flow rate

The raw water quality exceeds the values of the water quality standard (the draft drinking water quality standard in Southern Sudan) in the parameters of turbidity, iron, aluminum and general bacteria. It was verified, according to the analyses of the treated water quality in the existing water treatment plant in operation at present that these substances can be treated to level under the standard value through application of the conventional water treatment methods of flocculation, sedimentation and rapid filtration. The Development Study concludes that there is no problem, although antimony was detected at a level somewhat exceeding the standard value. Based on the re-examination by an authorized laboratory in Japan in the Survey, it was verified that the river water is non-problematic as water source, since antimony value proved to be below the detectable limit (0.002mg/L) in both the raw water and the treated water.

(3) Facility Plan

1) The Entire System

As the water service area of this Project is the currently non-served areas, all the facilities which are to be expanded in this Project will be newly constructed. On the other hand, among the existing water supply system, the main facilities such as treatment plant, transmission/distribution facilities are now in service since they were rehabilitated by MDTF in 2009. However, most distribution pipelines include the asbestos cement pipes laid in 1970's which have never been replaced since they were laid. For this reason, a large ratio of leakage as much as about 40% is estimated from the aged and decrepit pipelines. In addition, the water service is very inefficient, because there is a large waste of water owing to a flat-rate tariff system, and because it is forecasted that there is the non-revenue water ratio of approximately 60% (assumed by the Development Study) including non-payment. As the current water supply volume is lacking in capacity compared to the water demand, in case that the newly constructed facilities are connected with the existing system, the distribution water volume to the people in non-water-served coverage areas, who are the object in this Project, will diminish. For this reason, the expanded facilities in this Project are, in principle, to be independent from the existing system. Consequently, the facilities are to be newly constructed under the Project, except some facilities in the existing water treatment plant. Water flow system and each facility of this Project are outlined in Table 2-12 and Figure 2-5. The general layout plan is shown in the following page.

Table 2-12 Outline of Water Supply Facility

Kind of Facility	Outline of Facility
Water Intake Facility	New construction in the existing water treatment plant site (at a point approximately 10m upstream from the existing intake facility)
Water Treatment Facility	New construction in the existing water treatment plant site (The existing old facility will be removed)
Water Transmission Facility	Clear water transmission pumps will be installed in the water treatment plant, which will transmit clear water from the water treatment plant to the service reservoir through a transmission pipeline.
Service reservoir	A ground type water reservoir tank will be constructed in the land adjacent to the National Assembly towards west. (Ground elevation: +509m) Elevated water tank will be constructed for distributing the treated water to water service areas by gravity flow and a pumping station will be constructed for lifting pumps which will lift water from the reservoir to the elevated tanks.
Distribution Pipelines	Distribution pipelines consisting of both distribution main pipelines from the reservoir (the elevated water tank) to water tanker filling stations and distribution secondary pipelines from the main pipelines to public tap stands. Distribution pipelines will be laid alongside or under public roads. Aqueducts will be constructed for crossing small rivers/canals.
Water Tanker Filling Station	8 locations were selected in the Project areas. (Munuki: 4 locations, Juba Town: 1 location, Kator: 3 locations) All of those locations are owned by Payam.
Public Tap Stands	120 locations were selected in the areas currently non-served. Locations of these public tap stands are beside public roads and in Payam-owned lands.

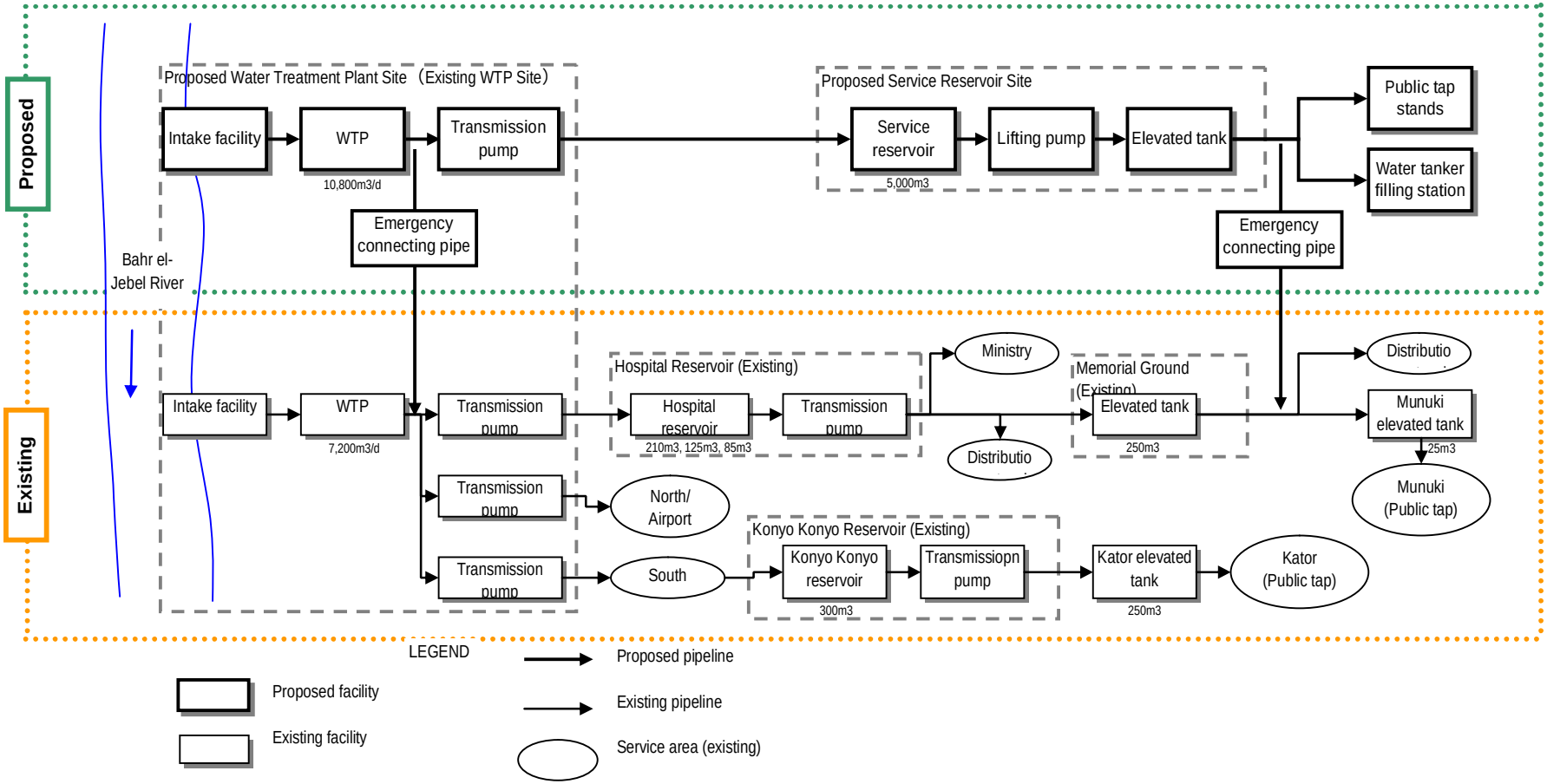


Figure 2-5 Water Supply System of the Project

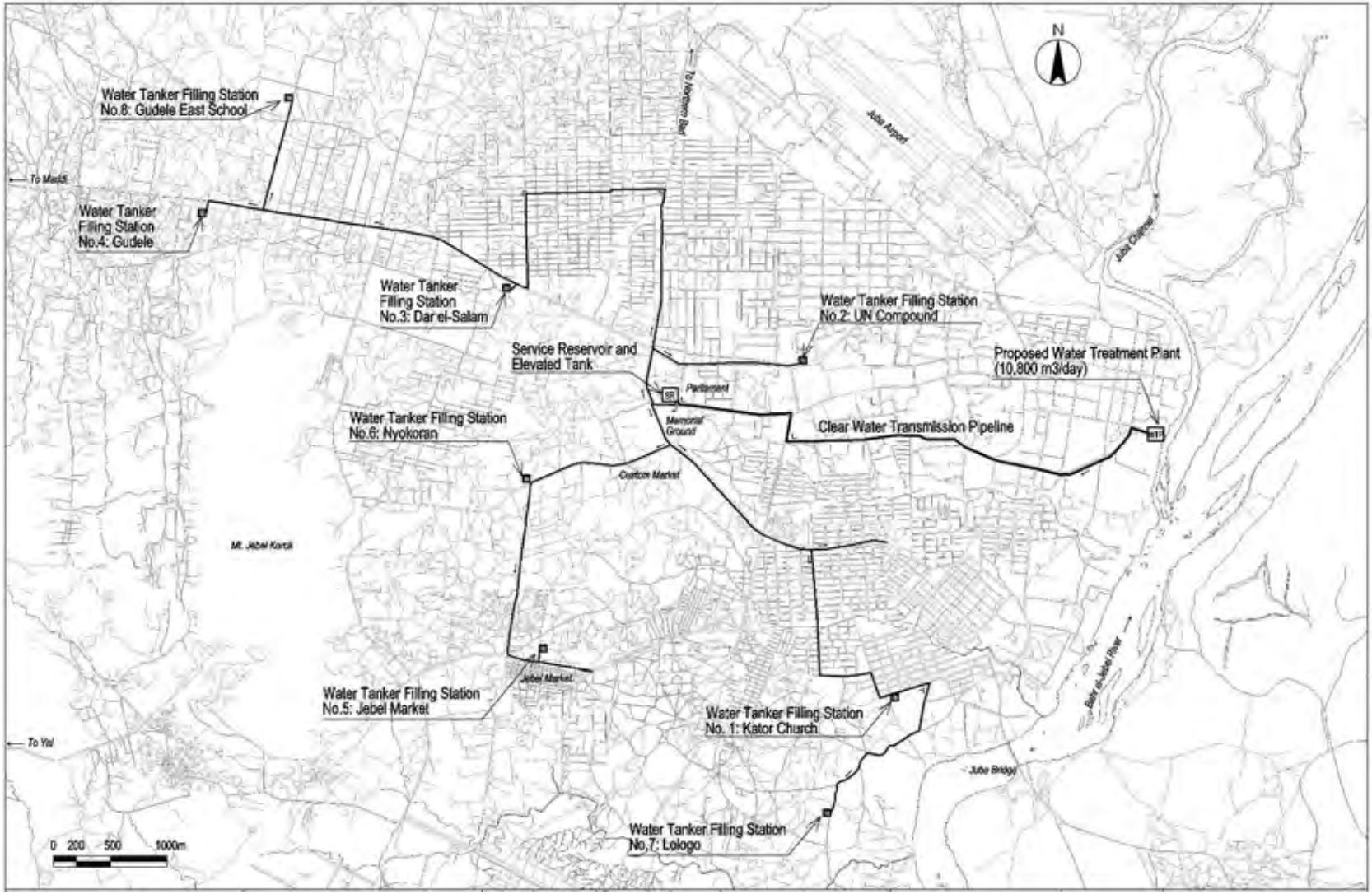


Figure 2-6 General Layout Plan

2) Water Intake Facility

(i) Policy to Utilization of the Existing Facility

The capacity of the existing water intake facility was designed on basis of WTP capacity of 7,200m^3/day. The diameter of the pipes in the existing water intake facility is not enough for carrying new intake capacity. For this reason, a new intake facility will be constructed instead of utilization of the existing facility.

(ii) Examination on Intake Point

There is a need to select an intake point within the land territory of the existing water treatment plant (approximately 90m in the direction to the river). For the following reasons, a new water intake site should be located at a point approximately 10m upstream of the existing water intake facility:

- On the downstream side of the existing water intake facility, a water intake point is not suitable, because sludge from the existing sedimentation tank is being discharged.
- On the nearest upstream side of the existing water intake facility, construction of a facility is very difficult, because there stands a river-level observation facility.
- In the site on the 15m~80m upstream side of the existing water intake facility, there is thick river sediment. A longer intake-bridge and a longer pipeline, if not constructed nearby the existing water intake facility, will become un-economical.

(iii) Examination on Intake Method/Intake Structure

Intake method is examined through comparison between (A) float method (same as the existing facility) and (B) fixed pier method. From the results of the natural condition investigation, the (B) fixed pier method is thought to be advantageous with the view-point of operational management, because the fluctuation in river-level is as small as 2.2m. However, it is apprehended that a new water intake point would be fixed on the upstream side of the existing water intake facility, and an excavation work would heavily affect the existing water intake facility downstream, and therefore, massive temporary work would be required. Under this circumstance, the fixed pier method was judged as economically poor option. Consequently, the (A) float method should be adopted, because this method, being economically advantageous, will hardly affect the existing water intake facility at the time of the new construction. As water intake pump, the ground type pump (horizontal centrifugal pump), being easy in maintenance, should be adopted. In order to keep water on suction-side at the time of pump-stop, a foot-valve should be installed at the mouth on suction side of the water intake pipe. Furthermore, in the existing water intake facility, operators stop the pump and dive into water, in order to manually clear the foot-valve of wooden debris and rubbish. For this reason, in this Project, the water intake pipe should be provided with circular steel-made screen in order to prevent rubbish from sticking on the pipe.

In addition, it is apprehended that due to increase of river transport activities as river ports improve, oil-leakage might occur upstream of the intake facilities. . In the float-type water intake facility, the float moves up and down, according to changes in river water-level, to make intake of water possible at a constant depth from water surface all the time. Oil is thought to be harmless to water-intake, since oil, being lighter than water in specific gravity and being insoluble in water, floats and flows over water surface. It could be supposed that emulsified oil-drops get suspended and mixed in water. Even in such a case, however, the float method, which intakes water at a certain depth underwater, can prevent inflow of oil-mixed water more effectively than an oil-fence which can prevent solely inflows of oil. For this reason, in the design of water intake facility, any special equipment such as an oil-fence, is not taken into consideration.

(iv) Main Design Specifications

Table 2-13 Design Specifications for Water Intake Facilities

Item	Specifications	Remark
Water Intake Volume	10,800m^3/day x 1.10 (margin rate of water source) = 11,880m^3/day = 8.26m^3/min = 0.138m^3/sec	
Water Intake Structure	Float-type intake tower	similar to the existing facility
Water Intake Pipe	Dia. 250mm x 3 pipes (one standby) V = 1.43m/sec, I = 11.1‰; Foot-valves and a screen will be installed.	-
Water Intake Pump	4.13m^3/sec x 21m x 3 units (one standby), Self-supply type	-
Water Intake Pump Room	Outer dimensions: 9.0m x 5.0m	-

3) Water Treatment Plant

(i) Water Treatment Process

From the result of analysis of raw water qualities, it is indicated that during treatment, the prime constituent to remove is medium-grade turbidity substance (turbidity less than 100 degree fluctuation in raw water). Applicable water treatment process is both (A) coagulating sedimentation/rapid filtration method and (B) membrane filtration. In consideration of the technical capabilities on the actual site, the operational consistency with the existing machines, the restrictions of land availability and the economic conditions, the (A) coagulating sedimentation/ rapid filtration method, same as in the case of existing facility, will be adopted.

(ii) Issues of the Existing Facility and Design Policy

As stated above, the treatment process, which is same as in the existing facility, will be adopted. Based on the result of investigations of the existing facility, reviewing a part of the design specifications will be considered, as shown in Table 2-14.

Table 2-14 Design Policy Based on the Issues in the Existing Facility

	Issues in the Existing Facility	Design Policy
Receiving Tank	Retention time of the existing facility is 12 minutes (more than 1.5 minutes of the Japanese Waterworks Standard), being excessively long, which results into more sediments.	The design capacity shall be adopted to have a retention time of 10 minutes.
Chemical Mixing Tank	In the existing facility, cascade-type aeration is carried out, which is supposed to make dissolved-oxygen excessively larger, causing generation of scum. Dosing point of coagulant is located at the end of inlet channel which results in ineffectiveness of mixing.	Similar to the existing facility, mechanical equipment is not used (considering easy maintenance). An overflow weir will be constructed, which can stir coagulant into overflowing water. From water quality data, aeration is thought to be unnecessary, therefore, a water-level difference downward from Receiving Tank will not be provided.
Flocculation Tank	Horizontal baffled channel type, one train As the existing facility is provided with only one train, there is a need to stop the whole water flow at the time of cleaning/repairing. Also, the velocity of water is very rapid in the existing facility, and flocks are not formed in sufficiently large size.	Horizontal baffled channel type, 2 trains (considering internal cleanings) Facility will be designed considering retention time of 20 minutes.
Sedimentation Tank	Solid contact sedimentation tank: 2 tanks Surface load: 25 mm/min In actual operation, it is used as the vertical flow sedimentation tank without settling in the sludge-blanket zone. Once in 2 or 3 weeks, one train is stopped for whole day, and operators clean the inside of tank manually to discharge sludge.	Vertical flow sedimentation tank: 2 tanks Surface load: 29.1 mm/min There is a need to think out a way, after reviewing the water-level design, that sludge-discharge work may become practicable in relatively shorter time.
Filtration Tank	Filtering rate: 120m/day Filtration area: 63m^2 (15.75m^2 x 4 tanks) Depth above filter media is approx. 10cm which results in unequal water flow.	Filtering rate: 123 m/day Filtration area: 115.4m^2 (19.24m^2 x 6 tanks) Filtration area per one basin will be almost the same as in case of the existing facility, for 6 basins. Water level of outlet channel is designed so as to ensure the water level above filter media appropriately.
Filter backwashing method	Backwashing is carried out using both backwash-water from backwash -water tank (steel-made elevated tank, 150m^3) and air from an air- blower. Backwash-water is lifted to the backwash-water tank through a branch installed on the outlet of a clean water transmission pump. In the backwash-water tank, a ball tap valve is installed, which stops inflow of backwash-water, when the tank becomes full.	As a backwashing method, similar to the existing facility, a combination of both backwash-water and air scouring will be adopted. If the existing backwash-water tank would be successively used, it is judged that, in actual operation, a linkage of operation timing between the new facility and the old facility will become complicated and, therefore, proper operation would become difficult. A new backwash–water tank will be constructed, instead of using the existing backwash-water tank.

	Issues in the Existing Facility	Design Policy
Clear Water Reservoir	4 tanks, Total capacity: approximately 370m^3	A new tank of about 600 m^3 will be constructed to store treated water equivalent to 1 hour treatment. . A branch pipe, which runs from the outlet of new clear water reservoir to the existing clear water reservoir, will be installed. (for backup in emergency)
Chemical Dosing Equipment	As coagulant, solid aluminum sulfate dissolved in dissolving tank is used at certain dosing rate. For the purpose of adjusting pH when turbidity is high, a soda ash dosing equipment is installed, however, it has never been used.	As coagulant, aluminum sulfate will be used. From the operation record, the use of soda ash equipment is judged as unnecessary. Therefore, soda ash equipment will not be installed.
Disinfection Equipment	Calcium hypochlorite (powder) dissolved in dissolving tank is used at certain dosing rate.	In consideration of safety in transport/handling, as a disinfectant, calcium hypochlorite will be adopted, the same as in case of the existing facility. A dosing point is only after the outlet of the filtration tank (post-chlorination). Control method shall be manual at certain dosing rate.
Sludge treatment	Lagoon for sludge thickening is used.	Lagoon for solid-liquid separation is designed, by retaining the sludge from sedimentation tank. Effluent will be discharged to river and dry sludge will be taken away for disposal.
Electrical, Mechanical Equipment	Water intake pump, clear water transmission pumps, air blower, switch board and control panel are installed. As power failure happens so frequently, emergency electric generators are installed.	Water intake pump, clear water transmission pumps, water lifting pump for backwash-water tank, air blower, switch board and control panel will be installed. An emergency electric generator is required in the new water treatment plant too.
Instrumentation	On site manual operation only Communication with the transmitting destination, i.e. the reservoir, is done by telephone. At the outlet of a clear water transmission pump (one train in 3 trains), a flow-meter is installed, however, being submerged in water, is not being used.	·As same as in the existing facility, operations shall be manually carried out on-site, in principle, and communication between the water treatment plant and the reservoir will be done by telephone. As a safety device for pumps, an interlock (automatic cutoff) will be installed. At the outlet side of both clear water transmission pumps and elevated tank (reservoir), a flow-meter will be installed respectively.
Administration House	Some of the houses in use need to be removed.	As a new water treatment plant will be constructed, a room for operators will be provided

(iii) Major Design Specifications

Table 2-15 Design Specifications for Water Treatment Facilities

Item	Specifications	Remark
Treatment Volume	10,800m^3/day = 7.50m^3/day/min. = 0.125m^3/sec.	
Receiving Tank	Number: one tank B2.5m x L9.85m x H3.4m = 83.7m^3 …10.1 minutes … OK	Retention time: more than 1.5 minutes (Water Supply Facility Design Guideline)
Rapid Mixing Tank	Number: one tank B2.5m x L2.5m x H1.5m = 9.4m^3 … 1.10 minutes … OK Head (H): 1.2m G value: 347/sec… OK	Retention time: 1 - 5 minutes G-value: more than150/sec. (Water Supply Facility Design Guideline)
Flocculation Tank	Number: 2 tanks Method: Horizontal baffled channel type Number of channel: 4 channels B1.2m x L9.95m x H1.9m x 2 tanks x 4 channels = 181.5m^3…Retention time 22.0 minutes….OK GT value: 88,000 … OK	Retention time: 20 - 40 minutes (Water Supply Facility Design Guideline) GT-value: 23,000 - 210,000
Sedimentation Tank	Number: 2 tanks B11.9m x L11.9m x effective depth 5.3m x 2 tanks… 1,501m^3 …Retention time 181.9 minutes…OK Surface load: 29.1mm/minute… OK	Surface load: 20 - 30mm/minute Retention time: 1.0 - 3.0 hours
Rapid Filtration Tank	Type: open gravity type Number: 6 tanks (one standby) B3.7m x L5.2m = 19.24m^2/tank Filtering rate: 123m/day Backwash Method: air scouring plus backwashing	Filtering rate: 120-150 m/day (Water Supply Facility Design Guideline)
Clear Water Reservoir	Number: 2 tanks B4.5m x L24.0m x H2.8m x 2 tanks = 604.8m^3 …. 1.34 hours	Storing time: more than 1 hour (Water Supply Facility Design Guideline)
Chemical Dosing Equipment	Solid aluminum sulfate (3 units including 1 stanby) Calcium hypochlorite (3 units including 1 standby)	
Sludge thickening lagoon	Number: 2 basins B5.0m x L19.0m x H0.5 x 2 basins	
Clear water transmission pump	2.75m^3/min. x 80m x 4 units (one for standby) Self supply type Clear water transmission pump room: Outer dimension 8.8m x 12.6m	

4) Service Reservoir

In the original request of the Project, location of the service reservoir was planned to be at a site next to the existing elevated tank within the premises of the Memorial Ground near the Assembly. However, the Memorial Ground area has been fenced. Therefore, possibility of approval on land acquisition appeared to be very low. Considering this, the Southern Sudan Government proposed an alternative site adjacent to the Assembly towards west. The Preparatory Survey Team confirmed that the location, available area, and elevation of proposed site is appropriate for service reservoir construction. The Team also confirmed that the proposed site is currently vacant and not used for any purpose. The land is owned by the Central

Equatoria State. Land use permission was issued by the Ministry of Physical Infrastructure of CES in December 2010.

A reservoir (capacity: 5,000m^3) is to be of ground type, and constructed of reinforced-concrete (RC). From the view-point of effective use of land, the elevated water tank is to be constructed on the reservoir as one integral structure. In addition to the elevated tank, an attached pumping station, a generator room and a fuel tank room will be required.

Table 2-16 Design Specifications for Service Reservoir

Item	Specifications	Remark
Reservoir	Capacity: 5,000m^3 (11.1 hours) Number: 2 tanks	Capacity: 12 hours (Water Supply Facility Design Guideline)
Distribution Pump	Type: self-supply type 5.5m^3/sec x 25m x 4 units (one for standby)	
Elevated Tank	Capacity: 540m^3	Capacity: 30 minutes at hourly maximum distribution water volume (Water Facility Design Guideline)

5) Transmission/Distribution Pipelines

(i) Design Policy

- In the original request, the transmission pipeline route was planned to follow the same route as the existing transmission pipeline. As a result of discussions with the Ministry of Transport and Roads and SSUWC in the first preparatory survey, the route of the original request is judged to be difficult for pipe laying in consideration of traffic load, road width and the existing underground installations. Consequently, alternative route was proposed by the first preparatory survey team, which was confirmed through the site reconnaissance carried out in the second preparatory survey. The outline design has been prepared based on the alternative route.
- In consideration of environmental conditions at the pipeline-laying sites, and workability of construction, both ductile iron pipes (bore diameter 250mm or more) and high density polyethylene pipes (bore diameter 200mm or less) will be adopted.
- Pipeline construction is based on pipe-laying work, in principle, in the utility zones alongside roads. In case when suitable location is not available, the pipeline should be embedded in road. In such cases, if the road is paved one, the pavement should be restored.
- As countermeasure of water-hammer that possibly occurs in the transmission pipeline, seven air valves will be installed.
- At many locations proposed for alignment of distribution main pipelines, a road improvement project is in progress. The pipeline design has been prepared based on the assumption that the road project would already be completed when this Project is at the

implementation stage. Given this, conditions for pipe embedding are reflected in cost estimation, on assuming the space for pipe laying, existence of drain channels and street trees, etc.

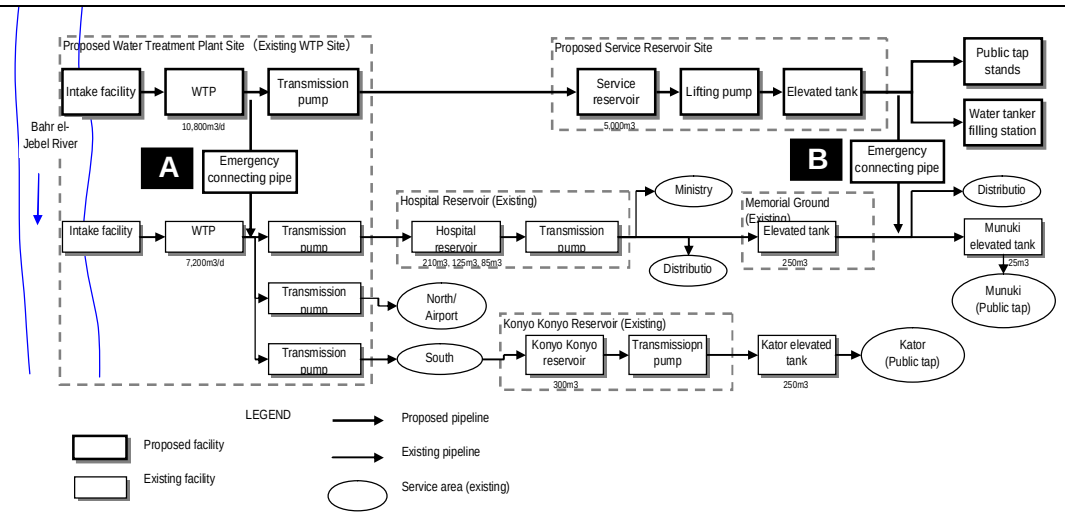
- In the entire target areas, rocks are present in geological formations. In order to cut down excavation costs, a standard earth-covering is so designed as to be 60cm thick. At locations where rocks are outcropping, the minimum design earth-covering of 20cm shall be provided and shall be appropriately protected with concrete covering against weight and erosion by rainfalls.
- A section crossing over a canal and a small river should be so structured as to be an aqua-bridge/aqueduct.
- In Southern Sudan, the regulation relevant to installation of fire hydrant is not available. In the rehabilitation project implemented by MDTF, fire hydrants are installed (underground type) along distribution pipelines. In this Project, policy of not installing a fire hydrant on the pipeline route is adopted, because a fire hydrant would cause water leakage and dishonest use of water. However, ground-type fire-hydrants will be so designed that fire-tucks may be supplied with fire-fighting water, in compliance with the request of the Southern Sudan side calling for a consideration for some fire-prevention measures under the circumstance that local houses are made of flammable materials such as bamboos and straws.
- For use in case of emergency, connection pipelines with the existing pipelines will be constructed in the new system. In ordinary operations, stop valves shall remain closed. A guideline for opening the connecting valve is described below. The guideline has been agreed by the Southern Sudan side.

(1) The new system to be independent from the existing system

The new water supply system to be constructed under the Project shall be operated independently from the existing system.

(2) Connecting pipes between the new and existing systems

Two connecting pipes with the existing system are to be constructed at the points of (A) the outlet of the clear water reservoir and (B) the outlet of the service reservoir as illustrated in the following Figure. The stop valves installed at the connecting pipes shall be kept closed under normal conditions.



(3) Responsibility lies with the area manager of SSUWC Juba station

Judgments, instructions, records and whatsoever related to opening the stop valves of the connecting pies shall be made under responsibility of the area manager of the Juba Station of SSUWC.

(4) Supplemental water supply to be allowed when over 24 hours water suspension is expected unavoidable and to be of a provisional measure in emergency

In case accidents and failures happens in the existing system, by which suspension of water supply for more than 24 hours is expected unavoidable, treated water can be supplemented from the new system by opening the connecting stop valve. However, this supplemental operation shall be of a provisional measure that is limited to the emergency case. Adverse impacts to the new water supply systems shall be always minimized.

(5) Cases to open stop valve (A) outlet of clear water reservoir

Supplemental water supply by opening stop valve (A) at the outlet of the clear water reservoir is allowed when operation of the existing water treatment plant (WTP) stops for unavoidable reasons. Unavoidable reasons are deemed to be the cases of failure of the intake pump and such. But the cases of suspension of operation which happens commonly and temporally, such as a power failure, are not regarded as unavoidable.

Supplemental water supply is also allowed when major maintenance works by which full stop of plant operation is required for more than 3 days. Major maintenance works are deemed to be the cases of repair work of tank structure and replacement of mechanical equipment, such as pipes, valves and pumps. But the cases of suspension of operation which is done regularly, such as cleaning of sedimentation tank, etc., are not regarded as major maintenance.

Whenever supplemental water supply is done, water level of the clear water reservoir shall be confirmed and recorded. The water level shall be kept more than 1 m above the low water level.

(6) Cases to open stop valve (B) outlet of service reservoir

Supplemental water supply by opening stop valve (B) at the outlet of the service reservoir is allowed when the existing elevated tank can not be filled up for unavoidable reasons. Unavoidable reasons are deemed to be the cases of pipe burst of the existing transmission pipeline, failure of

the transmission pump. But the cases of stop of operation which happens commonly and temporally, such as a power failure, are not regarded as unavoidable.

Whenever supplemental water supply is done, water level of the service reservoir shall be confirmed and recorded. The water level shall be kept more than 1 m above the low water level.

(7) Water tanker filling stations and public tap stands shall be informed by SSUWC

In case that adverse impacts to the new water supply facilities are expected as a result of the supplemental supply, SSUWC shall inform the management organizations of water tanker filling stations and public tap stands.

(8) SSUWC to keep all necessary records

Since the Project is commenced under the Japan's Grant Aid, the Project effects shall be confirmed by the verifiable manner. Therefore, SSUWC ensures the all necessary records related to the supplemental water supply, including cause, date and time, water level, water flow, etc., as well as the operation records of the water treatment facilities.

(ii) Major Design Specifications

Table 2-17 Design Specifications for Pipelines

Item	Specifications	Remark
Transmission Pipeline	Pipe material: ductile iron pipe Diameter :φ400mm (V = 1.0m/s, I = 3.3‰) Length: 4.9km Standard earth-covering: 60cm thick (Minimum earth-covering: 20cm thick)	
Distribution Main Pipeline	Pipe material: ductile iron pipe Diameter :φ250~500mm Length: 20.3km Standard earth-covering: 60cm thick (Minimum earth-covering: 20cm thick) Aqueduct: Pipe beam aqueduct of steel pipe (Dia. 400mm x 10.7m-span, Dia.350mm x 15.7m-span)	
Distribution Secondary Pipeline	Pipe material: high density polyethylene pipe Diameter :φ50~200mm (nominal diameter) Length: 32.5km Standard earth-covering: 60cm thick (Minimum earth-covering: 20cm thick) Aqueduct: Pipe on truss support (Dia. 100mm x 15.8m-span)	

6) Water Tanker Filling Stations

(i) Design Policy

- Eight sites for water tanker filling stations were identified as shown in Figure 2-7. All sites are under Payam and land use permission is also obtained.
- It has been reported that the existing water tanker filling stations are located very near to the public roads, and the people nearby the existing filling-stations are complaining that the tankers are causing traffic jams, and in addition, water stagnation and puddle formation

occur owing to the overflowing water from the top of tanker at the time of filling. In this Project, the water filling will be practiced within filling sites, not on roads.

- The tanker filling station site will be covered by the asphalt pavement (4cm-thick), having approx. 2% slope in order to drain the overflowing water. The drained water is to be infiltrated into the ground around the site. Examination on volume of overflow and infiltration is described as below:
  - Overflow water volume per one tank filling work: 20 L/cycle (assumption)
  - Average cycle time for filling: 10 minutes/truck (design)
  - Overflow water volume per one water tap per hour: 20L/cycle x (60min. / 10min./truck) = 120 L/tap/hour
  - Total overflow water volume of station with six taps: 120L/tap/hour x 6 taps = 720 L/hour… (A)
  - Permeability coefficient of the ground: 1.0 x 10^{-3} cm/sec. (assumption)
  - Surface area of the ground around the station: 50m (average length of two peripheral sides) x 50 cm-width = 25 m^2
  - Permeable water volume by the ground: 1.0 x 10^{-3} cm/sec. x 25m^2 = 900L/hour > (A)
- In order to reduce traffic jams, there is a need to make the filling-work time as short as possible and to consider such a device that water tankers my run into one way at the sites where sufficient spaces of land can be secured.

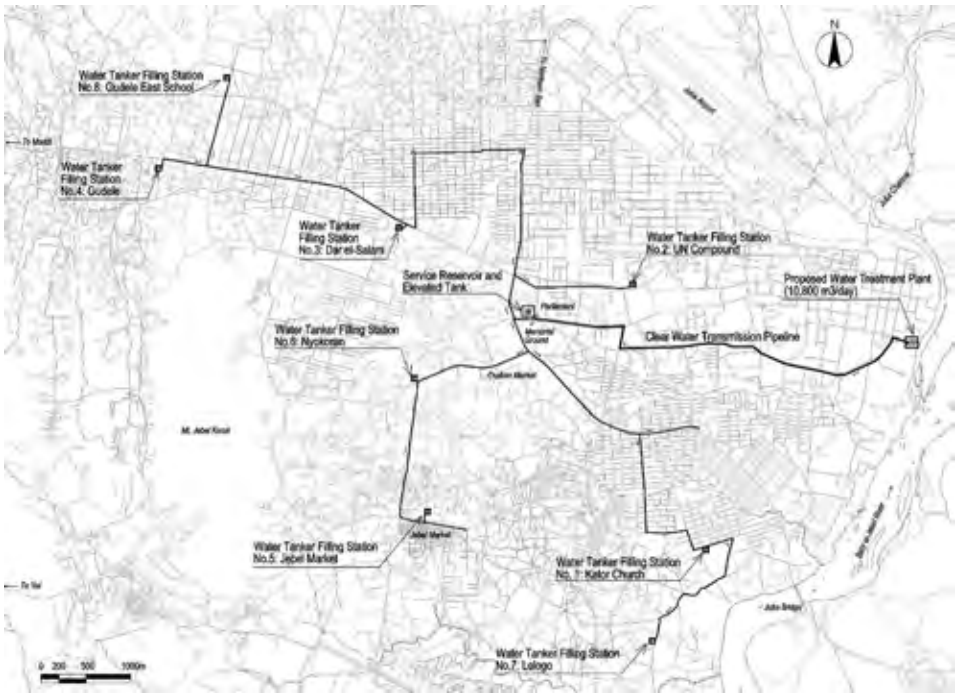


Figure 2-7 Locations of Sites for Water Tanker Filling Station

(ii) Major Design Specifications

Table 2-18 Design Specifications for Water Tanker Filling Station

Item	Specifications	Remark
Number of stations	Total 8 stations (Juba Town Payam: 1 station, Kator Payam: 3 stations, Munuki Payam: 4 stations)	
Number of taps	Total 40 taps (station with 4 taps x 4 stations: No.3, No. 4, No.5, No.6, station with 6 taps x 4 stations: No. 1, No.2, No.7, No.8)	
Operation house	Total 20 houses (1 house per 2 taps, Concrete block made: 2m-width x 3m-length, with valve and water meter)	
Exterior work	Asphalt pavement (4cm-thickness, inside of the site)	Lighting, drainage gutters, pavement for access road are not included as the scope of the Project

7) Public Tap Stands

(i) Design Policy

- In presence of representatives of SSUWC, relevant Payam and residents living in the vicinity, 120 sites for public tap stands were identified.
- Public tap stands will be constructed on the sites extending over an area of about 5m x 2m (owned by Payam) beside public roads. Taps will be located at a distance of 50cm from boundaries of private lands, and at a distance of 5m from corner lots, since the corner lot up to 5m is permitted for commercial use.
- For public tap stands, any caretakers who are from people's organizations or private sectors need to reside near the tap and collect water charges. In this Project, shed-like houses in size of about 2m x 3.0m will be constructed, to be used as a sunshade/rain shelter for the caretakers and for the purpose of preventing illegal use when they are away. It seems appropriate that those houses, which will accommodate the caretakers and will store water-valves, are of water-kiosk type. It is reported that a kiosk type is prevailing in the neighboring countries of Kenya and Uganda. In the pilot project which GTZ is implementing at present, water-kiosk type is adopted for water tap stand, and at such kiosks, the managers are authorized to sell not only water but also health related goods such as soaps.

(ii) Relocation of Tap Stand

- After study in Japan, four locations in Munuki are proposed to be relocated from the originally proposed locations since they are at high elevation and it would be difficult to supply water by gravity flow to these locations. The proposed relocation plan is shown in Figure 2-8.

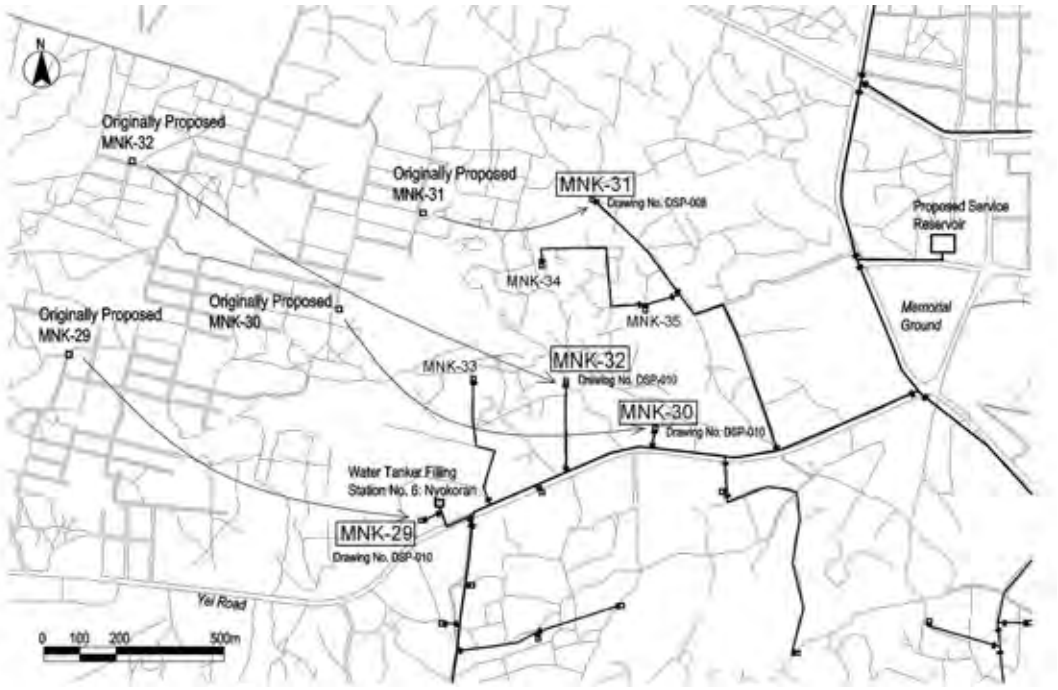


Figure 2-8 Relocation of Tap Stand

(iii) Major Design Specifications

Table 2-19 Design Specifications for Public Tap Stands

Item	Specifications	Remark
Number of public tap stands	Total 120 stands (Juba Town Payam: 20 station, Kator Payam: 50 stations, Munuki Payam: 50 stations)	
Number of taps	4 taps at each public tap stands	
Operation house	Total 120 houses (Concrete block made: 2m-width x 3m-length, with valve and water meter, Concrete apron: 2m x 2m, soak pit)	

2-2-5 Outline Design Drawing

The list of outline design drawings is shown in Table 2-20. The design drawings are attached as Appendix-7.

Table 2-20 List of Outline Design Drawings

	Drawing No.	Facility	Title
1	GEN-001	General	General Arrangement Plan
2	WTP-001	Water Treatment Plant	Layout Plan
3	WTP-002	Water Treatment Plant	Process Flow Diagram
4	WTP-003	Water Treatment Plant	Water Level Profile
5	WTP-004	Water Treatment Plant	Intake Facility
6	WTP-005	Water Treatment Plant	Intake Pump House (1/2)
7	WTP-006	Water Treatment Plant	Intake Pump House (2/2)
8	WTP-007	Water Treatment Plant	Flocculation/ Sedimentation/ Filtration -1

	Drawing No.	Facility	Title
9	WTP-008	Water Treatment Plant	Flocculation/ Sedimentation/ Filtration -2
10	WTP-009	Water Treatment Plant	Flocculation/ Sedimentation/ Filtration -3
11	WTP-010	Water Treatment Plant	Flocculation/ Sedimentation/ Filtration -4
12	WTP-011	Water Treatment Plant	Clear Water Reservoir (1/2)
13	WTP-012	Water Treatment Plant	Clear Water Reservoir (2/2)
14	WTP-013	Water Treatment Plant	Chemical Building (1/4)
15	WTP-014	Water Treatment Plant	Chemical Building (2/4)
16	WTP-015	Water Treatment Plant	Chemical Building (3/4)
17	WTP-016	Water Treatment Plant	Chemical Building (4/4)
18	WTP-017	Water Treatment Plant	Sludge Basin
19	WTP-018	Water Treatment Plant	Site Electrical System
20	WTP-019	Water Treatment Plant	Generator Plan
21	WTP-020	Water Treatment Plant	Single Line Diagram
22	RES-001	Service Reservoir	Layout Plan
23	RES-002	Service Reservoir	Plan A-A (Pump Room)
24	RES-003	Service Reservoir	Plan B-B, C-C (1st, 2nd Floors)
25	RES-004	Service Reservoir	Section 1-1
26	RES-005	Service Reservoir	Section 2-2
27	RES-006	Service Reservoir	Electrical System
28	RES-007	Service Reservoir	Single Line Diagram
29	WFS-001	Water Tanker Filling Station	Station No.1: Kator Church
30	WFS-002	Water Tanker Filling Station	Station No.2: UN Compound
31	WFS-003	Water Tanker Filling Station	Station No.3: Dar el-Salam
32	WFS-004	Water Tanker Filling Station	Station No.4: Gudele
33	WFS-005	Water Tanker Filling Station	Station No.5: Jebel Market
34	WFS-006	Water Tanker Filling Station	Station No.6: Nyokoran
35	WFS-007	Water Tanker Filling Station	Station No.7: Lologo
36	WFS-008	Water Tanker Filling Station	Station No.8: Gudele East Basic School
37	WFS-009	Water Tanker Filling Station	Toll Booth
38	PTS-001	Public Tap Stands	Water Kiosk
39	TRP-001	Transmission Pipeline	Key Plan
40	TRP-002	Transmission Pipeline	Plan and Profile (1/10)
41	TRP-003	Transmission Pipeline	Plan and Profile (2/10)
42	TRP-004	Transmission Pipeline	Plan and Profile (3/10)
43	TRP-005	Transmission Pipeline	Plan and Profile (4/10)
44	TRP-006	Transmission Pipeline	Plan and Profile (5/10)
45	TRP-007	Transmission Pipeline	Plan and Profile (6/10)
46	TRP-008	Transmission Pipeline	Plan and Profile (7/10)
47	TRP-009	Transmission Pipeline	Plan and Profile (8/10)
48	TRP-010	Transmission Pipeline	Plan and Profile (9/10)
49	TRP-011	Transmission Pipeline	Plan and Profile (10/10)
50	TRP-012	Transmission Pipeline	Details of Transmission Pipe
51	DSP-001	Distribution Pipeline	Distribution Main and Secondary Pipelines -1
52	DSP-002	Distribution Pipeline	Distribution Main and Secondary Pipelines -2
53	DSP-003	Distribution Pipeline	Distribution Main and Secondary Pipelines -3
54	DSP-004	Distribution Pipeline	Distribution Main and Secondary Pipelines -4
55	DSP-005	Distribution Pipeline	Distribution Main and Secondary Pipelines -5
56	DSP-006	Distribution Pipeline	Distribution Main and Secondary Pipelines -6
57	DSP-007	Distribution Pipeline	Distribution Main and Secondary Pipelines -7
58	DSP-008	Distribution Pipeline	Distribution Main and Secondary Pipelines -8
59	DSP-009	Distribution Pipeline	Distribution Main and Secondary Pipelines -9
60	DSP-010	Distribution Pipeline	Distribution Main and Secondary Pipelines -10
61	DSP-011	Distribution Pipeline	Distribution Main and Secondary Pipelines -11
62	DSP-012	Distribution Pipeline	Distribution Main and Secondary Pipelines -12

	Drawing No.	Facility	Title
63	DSP-013	Distribution Pipeline	Distribution Main and Secondary Pipelines -13
64	DSP-014	Distribution Pipeline	Distribution Main and Secondary Pipelines -14
65	DSP-015	Distribution Pipeline	Distribution Main and Secondary Pipelines -15
66	DSP-016	Distribution Pipeline	Distribution Main and Secondary Pipelines -16
67	DSP-017	Distribution Pipeline	Water Pipe Bridge
68	DSP-018	Transmission/ Distribution Pipe	Typical Section
69	DSP-019	Transmission/ Distribution Pipe	Thrust Anchor Block
70	DSP-020	Distribution Pipe	Details of Distribution Pipe (1)
71	DSP-021	Distribution Pipe	Details of Distribution Pipe (2)
72	DSP-022	Distribution Pipe	Details of Distribution Pipe (3)

2-2-6 Implementation Plan

2-2-6-1 Implementation Policy

In recent years, only one contractor of Kenya has constructed a full-scale water treatment plant in the neighborhood of Juba City. In the local site, neither contractor nor engineers are available who can work on the construction of the facilities under this Project. Therefore, in the construction works of this Project too, sub-contractors, engineers and skilled-workers employed from Kenya and Uganda will be utilized. As a lot of engineers and workers, who have different knowledge and experience, will gather from many countries and will work in Team, the construction methods should be so selected as to become as clear and easy as possible for smooth construction-management and quality-control.

Also, the procurable goods in the local site are limited, and therefore materials and equipment will be imported from the third countries. In order to save transport-costs as much as possible, the possibility of importing materials and equipment from the neighboring countries such as Kenya and Uganda, should be studied, after examining qualities and purchase-costs. On such materials and equipment that cannot be procured from Kenya and Uganda, the countries should be decided, after examining not only qualities, specifications and purchasing costs but also transport-costs.

2-2-6-2 Implementation Conditions

- Construction Plan considering Rainy Season

The annual rainfall of Juba is approx. 1,000mm. Monthly rainfall during the rainy season from May to September ranges from 120mm to 180mm, while almost no rainfall is observed during dry season from December to March. Considering monthly rainfall is below 200mm even in rainy season, significant effects are not expected in construction of water treatment plant facilities. However, interruption of pipe laying work is expected by water flowing into the excavated trench in rainy season. Therefore, trench work in rainy season shall be carried out with care and consideration shall be given to include drainage equipment and drainage method.

The difference in water level of Bahr el-Jebel river (water source in this Project) is around

2m between dry and rainy seasons. In constructing water intake facility, due care shall be taken to this water level change. In addition, Construction work in and along the river shall be avoided in construction plan during the season of high water level in River from June to November.

- Concrete Work

The supplier of raw concrete is not available in the local site, therefore a batcher plant should be constructed for the constructor's own use. For the construction of the batcher plant, the location should be selected such that it is easily accessible from the construction location of the water treatment plant as well as reservoir. The treatment plant and reservoir being main destinations of concrete for construction, proper selection of location for batcher plant will facilitate easy transport of concrete within short time.

Cement should be procured from either Kenya or Uganda or the third countries, and the aggregates from the local site. In either case, before actual use, their brands should be decided, after examinations on qualities. As the actual site belongs to tropical zone, with a daily average temperature of more than 25°C and a daily maximum temperature of about 35°C, the concrete works that is suitable for hot weather, should be considered.

- Pipe Laying Work

Pipe laying work of transmission pipelines and distribution pipelines will be carried out mainly on or alongside public roads. A construction plan should be so scheduled as to control inconvenience and discomfort (traffic jams, noise, dust and others) as low as possible. In order to advance the construction work smoothly, careful attention should be paid to such arrangements, as explanations on the construction to the neighboring people as well as applications for permission from the governmental authorities to the construction, and these activities should be finished up before the construction starts.

As piping materials, which will be imported from the third countries, are voluminous, they should be procured on divided lot basis, in consideration of available storage space at site. These piping materials should be so appropriately ordered that there is no trouble in obtaining storage sites and there would be no interruption in construction work owing to materials-shortage, under constant checking up of both progress of construction and volume of stocks.

Along the roads in Juba City, pavement work, its incidental sidewalk construction work and drainpipe laying work are in progress. In regard to locations for laying transmission pipelines and distribution pipelines in this Project, there is a need to check up on existing situations of the construction sites and on the existing data, when the construction starts, and to re-verify the locations by trial excavation, as the need arises.

2-2-6-3 Scope of Works

The scope of works to be undertaken by the Japanese Government and the Southern Sudan Government in implementation of the Project are as shown in the following Table 2-21.

Table 2-21 Scope of Works by the Both Governments

	Item	Japanese side	Sudanese side
1	Lands for temporary yards (Stock yard near WTP: 400m^2, Temporary yard in Juba: 10,000m^2, 3 years)		✔
2	Lands for the facilities (water treatment plant, reservoir, elevated tank, public tap stand, water tank filling station, transmission/distribution pipeline)		✔
3	Information collection from the authorities concerned, local bodies		✔
4	Cooperation at the time of connection between the existing pipelines and new ones (to witness the connection work and to publicize water-cutoff)		✔
5	Supply of water for flushing and water-pressure test		✔
6	Trial excavation to verify ground quality and underground utility	✔	
7	Main construction work (design, schedule, procurement of materials and machines, and construction itself)	✔ #1	
8	Flushing of the new transmission and distribution pipelines, pressure tests and chlorine disinfection	✔	
9	Removal of the existing structures in the water treatment plant and in the land planned for construction of reservoir, and cleaning of those land	✔ #2	
10	Connection of cables for power and light to the water treatment plant, reservoir, public tap stands and water tanker filling stations		✔

#1 The Scope of Work by the Japanese side doesn't include: fence, gate, planting, in-site pavement, outdoor light, in-site gutter of the water treatment plant, the reservoir and the water tanker filling stations.

#2 Regarding the demarcation of both sides on site preparation for the proposed water treatment plant, both sides confirmed that the Southern Sudan side is responsible for acquiring necessary permissions and bearing costs required for cutting trees, such as "tree-cutting fee" etc., prior to hand-over of the construction site, while the Japanese side is responsible for demolition and removal of existing buildings and levelling.

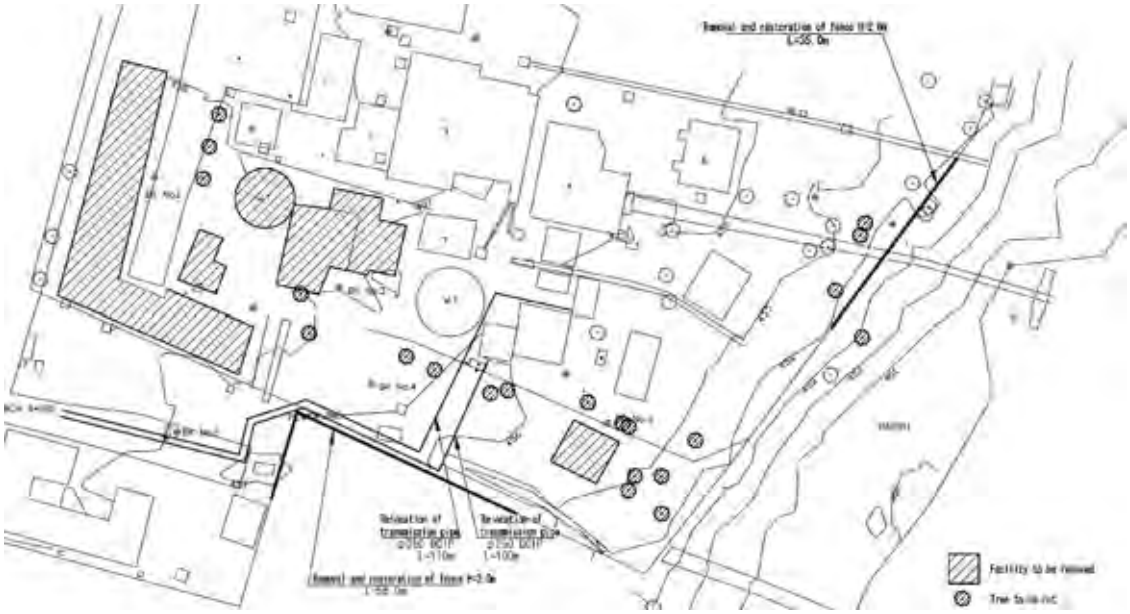


Figure 2-9 Facilities to be removed and trees to be cut for the Project

2-2-6-4 Consultant Supervision

This Project will be implemented by the system of the Japanese cooperation of grant aid. The Consultant will carry out preparation of design and construction management for implementation of the Project.

- Detail Design

Detail designs, after adding necessary modifications to the outline designs on basis of the latest information, will be prepared for distribution as a tender document.

- Tender

The Consultant will assist Southern Sudan Government so that a tender-bidding may be carried out fairly and smoothly.

- Construction Supervision

The Consultant will carry out, assisting SSUWC, such works as instructions/supervisions of contractors, focusing on progress-control and quality-control through staff-meetings before the start of construction, factory-inspections of materials/machines, witnessing of transportation at the local site, inspections of construction works as well as equipment installations when they are installed, trial operations, completion inspections and so on. The Consultant will share the responsibility for completing the construction of the facilities complying with the required qualities and specifications within the construction schedule prescribed in E/N.

2-2-6-5 Quality Control Plan

1) Quality Control on Concrete

Measurement of slump, measurement of air-volume, measurement of temperature and production of test pieces for compression tests will be carried out by contractor at the local site. Compression tests will be carried out by a reliable public testing organization.

2) Verification on Water-tightness of the Structures

Water-tightness of such structures as tank portions in the treatment facilities, reservoir and the elevated water tanks will be verified by water-leakage detection tests.

3) Verification on Water-Tightness of Transmission/Distribution Pipelines

Whether there is leakage or not in transmission pipelines and distribution pipelines will be verified by water-pressure tests.

2-2-6-6 Procurement Plan

In this Project, materials and machines will be procured either at the local site or from Japan or the third countries. The option for third countries should be studied, focusing on the neighboring countries, Kenya and Uganda, in order to save transport-costs. Supplier countries of each material and machine are listed in the following Table 2-22.

Table 2-22 Supplier Countries

No.	Item	Japan	Southern Sudan	Third Country
1	Cement			✔
2	Iron bar			✔
3	Steel frame			✔
4	Plywood			✔
5	Timber for construction		✔	
6	Gasoline, light oil		✔	
7	Gravel, sand		✔	
8	Brick, block		✔	
9	Asphalt mixture		✔	
10	Fixtures			✔
11	Polyethylene pipe			✔
12	Ductile iron pipe			✔
13	Pump, valve, electrical equipment	✔		✔

The materials and machines, which will be procured from Japan or the third countries, will be discharged at Mombasa Port of Kenya and then will be transported using overland route running to Juba City through Nairobi, the capital of Kenya and Kampala, the capital of Uganda. The distance from Mombasa Port to Juba City is 1,760km. In case containers are to be transported from Japan or the third countries, 5 days for custom clearance at Mombasa and 9 days for inland transportation and custom clearance at the two borders crossing from Mombasa to Juba, which

implies that approx. 2 weeks in total is required.

On the other hand, the transportation route from the port in Port Sudan in the north of Sudan is to be: Port Sudan – Tabat – Juba. Total distance of this route is approx. 3,000km. Days required for transportation in this case are: 5 days at Port Sudan for custom clearance, 4 days for inland transportation from Port Sudan to Tabat, and 12 days for river transportation from Tabat to Juba, hence, approximately 3 weeks are required in total. Overland transportation from Tabat to Juba is possible, but road condition is so bad that it takes approximately 3 weeks similar to the case of river transportation. Hence, the transportation from Port Sudan requires longer period and is approximately 50% more expensive than the case of route via Mombasa. Therefore, the transportation route from Japan and the third countries is planned to be via Mombasa of Kenya.

2-2-6-7 Operational Guidance Plan

Both initial operation instructions and operation guidance regarding, in principle, all of the construction facilities will be provided by contractor. Such operation guidance will be carried out using English-language manuals that will be provided when the facilities are handed over. Contents of the guidance (plan) for each facility are summed up in Table 2-23.

Table 2-23 Outline of Operational Guidance by the Contractor

No.	Facility	Content of Guidance	Number of days
1	Water Treatment Plant		
1-1	Water intake facilities (screen, float, foot valve and others)	·Explanation on names of each part, specifications and function ·Method of maintenance for screen and foot valve (cleaning, checkup) ·Method of maintenance for ductile iron pipe (checkup, replacement)	5
1-2	Water intake pump	·Explanation on names of each part, specifications and function ·Operation of water intake pump (when normal, when abnormal) ·Method of maintenance for mechanical and electrical equipment (checkup, upkeep, repair)	5
1-3	Water treatment facilities	·Explanation on names of each part, specifications and function ·Control of water quality, water flow volume and operation of water treatment facility ·Judgment and countermeasures when operation is shutdown and checkup- items when operation is restored. ·Method of checkup and cleaning of the structures of the facilities (tanks and others) ·Operation of chemical dosing facility	30

No.	Facility	Content of Guidance	Number of days
		(safekeeping, conveying, dissolving and dosing of chemicals) ·Operation of backwash-water pump and air blower (when normal, abnormal) ·Method of maintenance for mechanical and electrical equipment (checkup, upkeep, repair) ·Method for operation and maintenance of emergency power supply source	
1-4	Water transmission facilities	·Explanation on names of each part, specifications and function ·Method for recording water levels, for communicating with the reservoir and for controlling water flow volume ·Operation of clear water transmission pump (when normal, when abnormal) ·Method of maintenance for mechanical and electrical equipment (checkup, upkeep, repair)	15
2	Reservoir		
2-1	Reservoir	·Explanation on names of each part, specifications and function ·Method for recording water levels, for controlling water flow volume, and for communicating with transmission pump house ·Method for checkups and cleaning of the structures of the facilities (tanks and such) ·Operation of the attached pumps (when normal, when abnormal) ·Method of maintenance for mechanical and electrical equipment (checkup, upkeep, repair) ·Method for operation and maintenance of emergency power supply source	15
3	Water tanker filling station and public tap stand	·Explanation on names of each part, specifications and function ·,Method of operation and checkup of the facilities ·Countermeasures at the time of emergency and accident	10
4	Pipeline facility and ancillary facilities	·Explanation on pipe-route, pipe-type, specifications and quantities ·Method of maintenance for valves (gate valve, air-release valve, drain valve) (checkup, upkeep and repair)	10

2-2-6-8 Soft Component (Technical Assistance) Plan

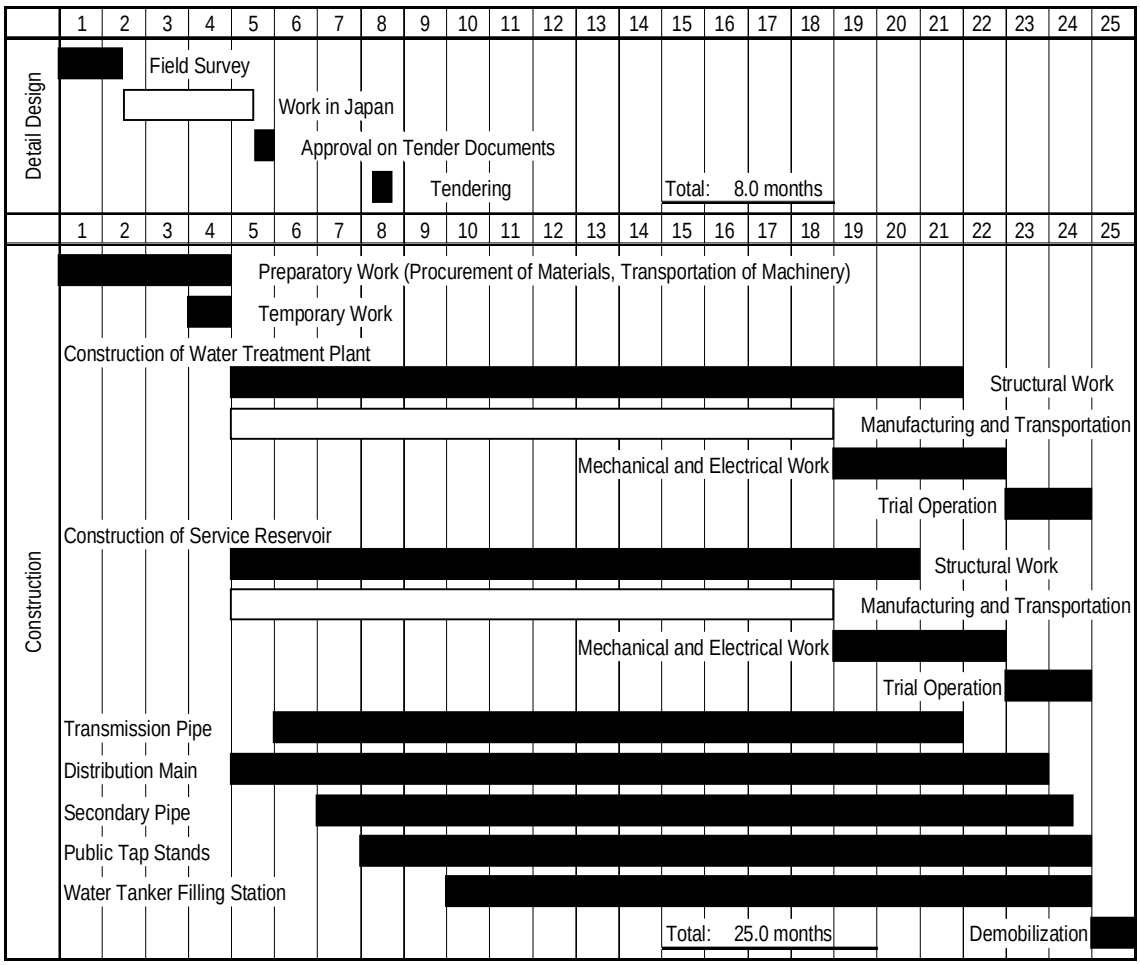
In association with the implementation of the Project, Technical Cooperation Project, "The Project for Management Capacity Enhancement of Southern Sudan Urban Water Corporation" is being carried out from October 2010 to September 2013 in which reinforcement of capacity of operational maintenance of the water treatment plant, examination on water-charge collection

system, and technical assistance on management organization of the public tap stands and water tanker filling stations will be carried out. Consequently, the capacity required for operation and maintenance of the facilities will be enhanced. For this reason, a soft component will not be implemented in this Project.

2-2-6-9 Implementation Schedule

The Project is to be implemented under Government's Bond of Japan Type-B. Its implementation schedule is as shown in Table 2-24.

Table 2-24 Project Implementation Schedule



2-3 Obligations of the Recipient Country

In the implementation of the Project, MWRI is responsible for facilitating the undertakings below to be smoothly secured, collaborating with the signatory of the Grant Agreement and the authorities concerned of the recipient side upon necessity:

(1) To secure the lands (including construction sites and access roads), clear the sites (service reservoir/ elevated tank, water tanker filling stations and public tap stands)
(2) To provide temporary yard for construction to the Japanese Contractor (approx. 400 m2 nearby the water treatment plant for stockyard and approx. 10,000 m2 at an appropriate location in Juba for stockyard and temporary works of the Contractor)
(3) To exempt taxes which may be imposed on the goods imported to the recipient country, to ensure prompt customs clearance of the products and to assist the internal transportation of the products in the recipient country.
(4) To ensure that custom duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the goods and the services be exempted.
(5) To accord Japanese nationals whose services may be required in connection with the supply of the goods and the services or such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.
(6) To ensure that the facilities be maintained and used properly and effectively for the implementation of the Project.
(7) To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project.
(8) To bear commissions paid to the Japanese bank for banking services based upon Banking Arrangement (B/A); such as advising commission of Authorization to Pay (A/P) and payment commission.
(9) To give due environmental and social considerations in the implementation of the Project.
(10) To provide power connection to the proposed facilities (water treatment plant: 500KVA, service reservoir: 200KVA and water tanker filling stations)
(11) To provide information on underground utilities and to witness trial excavations at site, where available
(12) To provide water free of charge for leakage testing of the tank structure, pressure testing and flushing of transmission and distribution pipelines
(13) To assign counterpart staff necessary for the Project implementation, including members from MWRI, SSUWC Headquarters, SSUWC Juba Station and duty-officers of Payams.
(14) To acquire necessary permissions and bear costs required for cutting trees on the construction site of the water treatment plant.

2-4 Project Operation Plan

(1) Operation/Maintenance Management System

It is expected that, of the facilities to be constructed in this Project, the water intake facilities, the water treatment facilities and the transmission/ distribution facilities will be operated and managed by SSUWC. As for the public tap stands and the water tanker filling stations, they are currently entrusted to third parties such as private administrators or residential groups. The management system for them will be examined in the Technical Cooperation Project which aims to develop the capacity of waterworks management of SSUWC Juba station. A conceptual diagram of the key managerial bodies for this Project's facilities is shown in Figure 2-10.

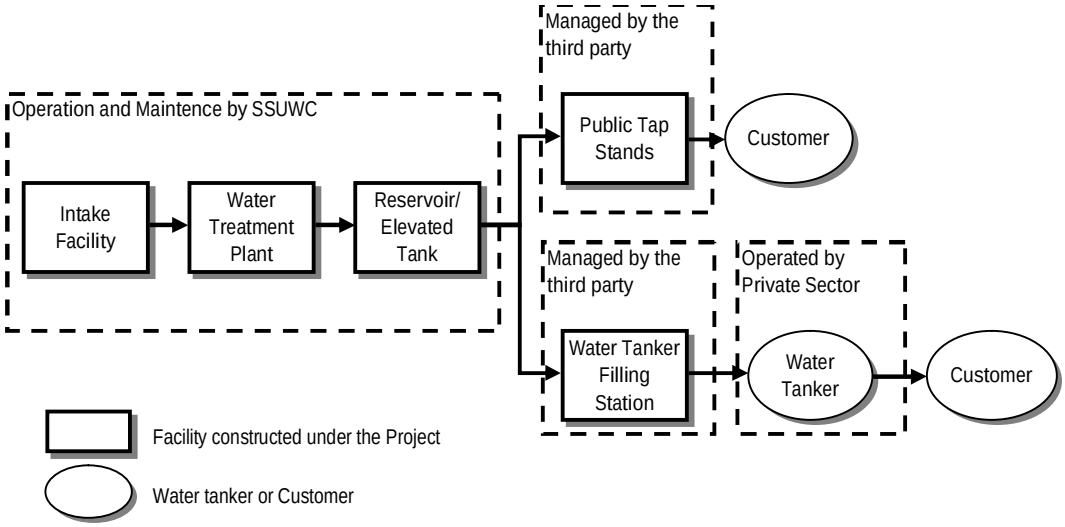


Figure 2-10 Management Entity of the Facilities Constructed in the Project

(2) Management of Water Supply Facilities

It is thought to be feasible to operate and manage the new facilities without any significant increase in the present number of officers, because design policy has been followed so that operational methods for this Project's facilities are almost the same as the ones in the existing facilities, and also it is expected that operational technical capability of present staff-members will improve by the Technical Cooperation Project which will be carried out in parallel with this Project. Personnel formation required after the Project's implementation is shown in Table 2-25. Total staff number is estimated to be 173 persons, which requires additional 9 staff to the current 164 staff.

Table 2-25 Personnel Formation (example) by division in Juba Station after the Project's Implementation

Division	Major Functions	Present Situation	After this Project implemented
Area Manager	Manager responsible for managing the water supply project of Juba Station	1 person	1 person
Deputy Area Manager	To deputize for Area Manager	1 person (concurrent)	1 person (concurrent)
Water Treatment Division	Operation management of water treatment plant and pump houses	64 persons (one concurrent)	69 persons (+ 5 persons)
Water Distribution Division	Maintenance management of transmission/ distribution pipelines	54 persons	57 persons (+ 3 persons)
Finance Division	Accounting, collection of water charges	23 persons	23 persons
General Affairs Division	General affairs, general office work	19 persons	19 persons
Human Resources Development Division	Attendance-time management	4 persons	4 persons
Total		164 persons	173 persons (+ 9 persons)

(3) Operation and Management of Water Tanker Filling Station

In this Project, 8 locations (40 taps in total) of water tanker filling station will be established. In the existing system, water tanker filling station have been constructed at 3 locations through the support of USAID, being now in trial operation as of August 2010. As a management system of these 3 filling stations, operation and management by a private sector is being carried out on trial basis.

As a management system for the facilities which will be constructed in this Project, either direct management by SSUWC or a management-commission method to a third party is under study. The management system will be studied in the course of the Technical Cooperation Project. In this Project, assumption is made that the management system commissioned to a third party will be carried out on the model similar to the case of the preceding USAID Project. In such case, the scopes of responsibility of both SSUWC and third party-undertakers are mostly as follows:

Table 2-26 Responsibility of SSUWC and Third Party Undertakers (sample)

SSUWC	Commissioned Undertaker
Supply of safe water up to the end of water taps with a given water pressure	Assignment of operation managers who will work during defined business hours and operation of water-service facilities
Selection of commissioned undertakers and providing permission for the exclusive use of facilities under contracts	Daily checkups and upkeeps of water-service facilities
Readings of water meters and billings/collecting of water charges	Payment of water charges to SSUWC

SSUWC	Commissioned Undertaker
Suspension of water supply and termination of contracts against those commissioned undertakers who violate the rules in terms of delay in payment, etc.	Answering to complaints involved in operation at water filling stations
Periodical checkups and repairs of the facilities	Payment of wages to tap-management officers and payment of expenses for repairing the facilities

It is understood that, for the operation-management of water filling stations, there is no need to master special techniques, and that those who have knowledge of secondary level education could come to know specifications of the facilities and could master the operation methods by practice-type trainings in several days.

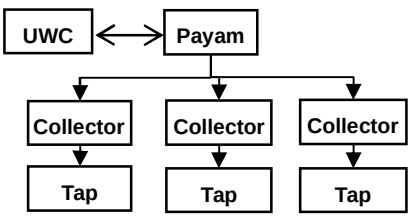
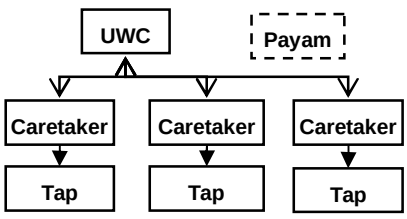
(4) Management of Public Tap Stands

In this Project, 120 locations of public tap stands are designed for construction. Their operation-management will be carried out by either Payam, groups of residents, or private contractors.

Currently, in the existing water supply system, the public tap stands supported by both JICA and USAID are in operation in Munuki and Kator, respectively. As the management system for these public tap stands, there are 2 cases of contractual relationship with SSUWC; in one case the contractor is Payam and in the other case the contractor is people's organization. These cases have both advantages and issues respectively as shown in Table 2-27.

As a result of hearings with SSUWC and the observations by the Survey Team, the method of a tap unit contract proved to be advantageous to the SSUWC's side, and, therefore, is also expected to guarantee longer sustainability of this Project. For this reason, the said method is supposed to be adopted as a management system after this Project's implementation.

Table 2-27 Comparison on Management Systems for Public Tap Stands

Management System	Integrated Management (Munuki model) Payam will become a contractor with SSUWC, manage water taps under its control and oversee charge-collections.	Management by Tap Unit (Kator model) Tap caretakers will become contractors with SSUWC, manage water taps and collect water charges.
		

Advantage	Organization is easy to establish, since Payam will take responsibility. Coordination by Payam can be utilized in negotiation with people. Financial balance can be held within the whole Payam, since Payam carries out blanket management over plural taps.	Scope of responsibility is clear and a changeover to a metered-volume method will become easy, due to tap-by-tap contract. Distance between UWC and water-consumers is short, since direct influence of Payam is minor. A manager of high capability can be expected, since manager can be selected from anywhere, private sectors or people's representatives.
Issue	Countermeasures such as suspension of water supply are difficult, since a contract is not on tap-by-tap basis. There is a possibility that waste-use of water and dishonesty such as under-reporting could occur, since charge-collectors would weaken in workmanship. There is a possibility that decision-making of the water supply utility would be delayed, since Payam's power is too strong.	Reinforcement of UWC's management capability is required, since both meter-reading work and charge-collecting work increase as contracts increase. To uphold such charges unified fairly to water consumers is a problematic issue, in situation that every tap varies in selling water volume and in cost (water-receiving charge, labor costs and such). In case that there would occur a water-supply- shutdown due to any failure (dishonesty, nonpayment and such to UWC) by tap-management officers, water-consumers would be affected for a certain period.

The method of selection, selection standard, and the rules on wage for tap-management officers, etc., will be studied in detail in the course of the Technical Cooperation Project. It is understood that the scope of responsibility of both SSUWC and tap-management officers will become almost the same as in the above-mentioned case of water tanker filling station.

In case if care takers for public tap stands will be from people's groups consisting of the nearby residents, according to the information obtained at the time of assistance, which were carried out in the Development Study, in establishing the water management associations in Munuki area, those people who can join managerial organizations are mainly poor-experienced housewife-classes, and therefore, the level of their technical knowledge is low. For this reason, it is understood that there is a need of providing training on operations of equipment and training for elementary corporate-accounting. Furthermore, it is understood also that, in order to keep a certain technical level, there is a need to periodically monitor their technical levels and to provide with upkeep services to the equipment.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Project Cost Estimation to be Borne by the Southern Sudan Side

The Project cost to be borne by the Southern Sudan side is estimated as shown in Table 2-28. Value added tax, import tax, etc., to be imposed as per the taxation system in Sudan on the materials and equipment to be procured under the Japanese Grant Aid, will be exempted.

Table 2-28 Summary Table of the Southern Sudan Side's Apportionment Expenditures

(Unit: SDG)

Expense Item	Estimated Expenditure (SDG)	Remark
1) Lands for the facilities to be constructed	16,875	Land use permission to use the proposed service reservoir site. This expenditure has been spent.
2) Fencing to secure lands for facilities	55,440	Service reservoir: 272m, Water tanker filling station: 652m SDG60/m x 924m
3) Lease of lands for temporary yards (Stock yard near WTP: 400m^2, Temporary yard in Juba: 10,000m^2, 3 years)	156,000	5.0 SDG/m^2 (assumption) x 10,400m^2 x 3 years
3) Installation of primary power supply	70,000	Water treatment plant (500kVA), reservoir (200kVA), water filling stations 100SDG/kVA x 700kVA
4) Provision of water for pressure tests and flushing	10,500	3,000m^3 (assumption) x 3.5SDG (assumption)
5) Bank Commission	29,000	
Total	337,815	

Notes:
The cost estimation is provisionally prepared by the Team with available data obtained through the field survey and assumption by the Team. Therefore, it might be reviewed and modified by the Southern Sudan Side.

(2) Conditions for Cost Estimation

1) Time of Estimation : August 2010
2) Exchange Rate : US$1 = 91.76 Japanese Yen
: SDG1 = 40.60 Japanese Yen
3) Construction Period : Period for detailed design and construction is shown in the construction schedule.
4) Others : Cost estimation is prepared in conformity with the Grant Aid System by the Japanese Government

2-5-2 Operation and Maintenance Cost

(1) Maintenance Cost

Operation and maintenance costs in this Project, as shown in Table 2-29, will amount to SDG 2.68 million approximately (Yen 108.9 million approximately) per year, which is calculated as SDG 0.85/m^3 (Yen 34.5/m^3) per unit of water volume (accounted-for water volume).

Table 2-29 Operation and Maintenance Cost of the Proposed Facility

	Item	Maintenance Cost	Remarks
[A]	Water production volume	10,800m^3/day	Design capacity for this Project's facilities
[B]	Accounted-for ratio	80%	Ineffective water ratio: 15%, Water charge collection ratio: 95% (assumed)
[C]	Annual accounted-for water volume	3,153,600m^3/year	[A]/(daily maximum coefficient:1.0) x [B] x 365 days
	Maintenance Cost		
[D]	Personnel cost	SDG 1,199,160/year	
[E]	Electric power cost	SDG 755,638/year	
[F]	Chemical cost	SDG 485,713/year	
[G]	Spare parts cost	SDG 56,297/year	
[H]	Staff training cost	SDG 59,958/year	[D] x 5% (assumed)
[I]	Others	SDG 127,838/year	([D]+ [E] +[F]+[G]+[H]) x 5% (assumed)
[J]	Total of maintenance cost	SDG 2,684,604/year (Yen108,999,714/year)	[D]+[E]+[F]+[G]+[H]+[I]x 5% (assumed)
[K]	Maintenance cost per unit accounted-for water volume	SDG 0.85/m^3 (Yen 34.5/m^3)	[J]/[C]

(Notes)
- These estimated costs are at time of estimation in July 2010.
- The labor cost is calculated out proportionally to the produced-water-volume from the existing waterworks facilities, on basis of assumption that government's subsidy is not available. (Currently, all of the labor cost is covered by government's subsidy.)
- For the 5% rates in the above-mentioned items [H] and [I], the values assumed in the Development Study were reviewed in consideration of the balance among the cost items.

(2) Water Revenue Forecast

The present water tariff system is based on fixed rate method, not on metered- water-volume method, to which a water rate per cubic meter is not applied. In order to manage the waterworks in sustainable manner, it is indispensable to secure the financial soundness by revising the present water tariff system to a new one based on metering system. Under the Technical Cooperation Project, several activities related to finance and management are being carried out, such as, improvement of customer ledger, examination on water tariff system, and examination on management models of public tap stands and water tanker filling stations through pilot

operation. In the end, appropriate tariff system and management model will be set up before completion of this Project. Therefore, it is supposed that the metering system will be adapted to the water billing after the Project completes. While the labor cost is dependent, at present, on government's subsidy, this water revenue forecast is carried out on assumption that the water charge system will get changed to a self-support accounting system, in which a subsidy related to maintenance cost is not provided, after the Project.

In this sub-section, an unit-price, on which 15% is tacked on as both the administration expenses in SSUWC Headquarters in addition to the above-mentioned maintenance cost and the retained-earnings for capital investments in future, is fixed as an average water charge in this revenue-prospect. However, the average water charge means a contract-price between SSUWC and the management entities stationed in public tap stands as well as water tanker filling stations, being different from the charges paid by water-consumers, i.e., general people.

Distribution system to be constructed under the Project is new and independent from the existing system. Water meters are also installed to the public tap stands and water tanker filling stations. Therefore, leakage rate of the distribution system can be reduced from the current estimated approx. 40% to 15% or less, which enables to distribute water effectively. Furthermore, the number of management organizations of water tanker filling station and public tap stands are limited to 140. In this case, water charge billing and collection is easier for SSUWC. And water charge collection from water users are ensured depending on water volume sold since the management organizations of public tap stands and such is supposed to collect water charge upon water selling to customer.

Results of the revenue forecast are shown in Table 2-30. It is noteworthy that maintenance cost can be covered by such water revenue that remains on self-support accounting basis and free from subsidy. In other words, profitability of waterworks will be improved by increasing rate of accounting-for water as well as water charge collection rate after the Project. It is expected in the end that sustainability of operation and maintenance will be ensured through self financing.

Table 2-30 Water Revenue Forecast

	Item	Revenue	Remarks
[P]	Maintenance cost per accounted-for water volume	SDG 0.85/m^3	Refer to [K] in the previous sub-section.
[Q]	Headquarters' expenses and retained capital	SDG 0.13/m^3	[P] x 15%
[R]	Average water charge	SDG 0.98/m^3	[P] + [Q]
[S]	Annual accounted-for water volume	3,153,600m^3/year	Refer to [C] in the previous sub-section.
[T]	Annual water revenue	SDG 3,090,527/year	[R] x [S]
[U]	Annual maintenance cost	SDG2,684,604/year	Refer to [J] in the previous sub-section
[V]	Operating income	SDG 405,924/year	[T] – [U]

(3) Examination on Retail Price

Retail price, at which the tap-management officers sell water, was studied on basis of the results from the studies made in the previous articles. As shown by an example setting of retail price in [GG] box of Table 2-31, the calculation has reached such a result that retail price can be lowered by 50-70% from the present one.

Table 2-31 Examination on Retail Price

		Public Tap Stands	Water Tanker Filling Station
[AA]	Average water charge (Water charge paid by tap management officers)	SDG0.98/m^3 (Refer to [R] in the previous article.)	SDG0.98/m^3 (Refer to [R] in the previous sub-section)
[BB]	Average selling water volume per day	13m^3/day (26L/capita/day x average population served: 50 persons/tap)	384m^3/day Water service volume per one tap: 192m^3/day) (One tap-management officer controls 2 taps)
[CC]	Water purchase cost per month	SDG382/month ([AA] x [BB] x 30days)	SDG11,290/month ([AA] x [BB] x 30days)
[DD]	Labor cost per month (fixed cost)	SDG1,800/month (assumed as SDG600/month for labor cost per person in 3 shift system)	SDG3,600/month (assumed as SDG600/month for labor cost per person in 6 shift system)
[EE]	Maintenance cost per month	SDG 2,182/month ([CC] + [DD])	SDG 14,890/month ([CC] + [DD])
[FF]	Retail price at break-even point	SDG 5.60/m^3 ([EE]/[BB]/30) …8.9 jerry cans per SDG1.0	SDG 1.29/m^3 ([EE]/[BB]/30) …SDG 5.16 per one water tanker of 4m^3
[GG]	Example Setting of retail price	SDG1.0 per 8 jerry cans of 20 liters(…SDG6.25/m^3) (Reference: Currently price is SDG 1.0 by 4 cans)	SDG6.0 per one tanker of 4m^3(…SDG1.50/m^3) (Reference: Current price is SDG20.0 by 4m^3…SDG5.0/m^3)
[HH]	Monthly revenue	SDG2,437/month ([BB] x [GG] x 30days)	SDG17,280/month ([BB] x [GG] x 30days)
[II]	Monthly income	SDG 255 /month [HH] – [EE]	SDG2,390 /month [HH] – [EE]

(4) Affordability Analysis

According to the social survey carried out in the Project area, the monthly expenditure on purchasing of water is SDG178 /household, which makes up 11.4% of the average monthly household expenditure of SDG 1,567 /household.

The result of the trial calculation on possible water expenditure after the Project by using the above discussed retail price is shown in Table-32. It implies that the water expenditures can be significantly reduced compared to the current expenditure. As shown in the row [LL], the ratios of water expenditures among the average household expenditure are 2.2% in case of public tap stands customers and 5.3% in case of water tanker customers. Affordability levels related to

water and sanitation services are generally recognized to be 3-5% of the average household expenditure. Given this, expenditure of water tanker customers slightly exceeds the affordability level. However, a noticeable result is obtained in the social survey related to medical expenditures. That is, average medical expenditures of households having and not having access to tap water are SDG73 /person/year and SDG267 /person/year, respectively. This implies that medical expenditures can also be reduced as a result of improvement in living environment by using tap water. Considering the above, the above calculated expenditures can be acceptable.

Table 2-32 Trial Calculation on Expenditures on Water Purchasing

		Purchasing from Public Tap Stands	Purchasing from Water Tanker
[JJ]	Average water purchasing volume	26L/person/day x 7.2 persons/household x 30 days = 5.6 m^3/household/month	26L/person/day x 7.2 persons/household x 30 days = 5.6 m^3/household/month
[KK]	Water price	SDG 6.25 /m^3 ([GG] of the previous subsection)	SDG 15.0 /m^3 (Retail price from water tanker is assumed to be SDG 3.0 per 200 L drum, considering a whole selling price of SDG 1.50 /m^3 set in [GG] of the previous subsection)
[LL]	Monthly water expenditure	SDG35 /month ([JJ] x [KK])	SDG84 /month ([JJ] x [KK])
[MM]	Water expenditure ratio to the average household expenditure	2.2% ([LL] / SDG1,567)	5.3% ([LL] / SDG1,567)

(5) Verification on Budget Arrangement and Appropriateness

As aforementioned, operation and maintenance costs required for the Project facility can be covered by water revenue without subsidies by the Government. Possibility of lower water price to the customers compared to the current price is verified through the trial calculation. In addition, household expenditures on water purchasing (SDG 178/month in average) can be reduced significantly and that is regarded as acceptable. In conclusion, the operation and maintenance cost and budgetary arrangement is considered to be appropriate and feasible.

However, the contents verified in this chapter targets only new waterworks system as cooperation object, and does not include a study on the existing waterworks system (7,200m^3/day). There is a need of improving profitability of the existing system by both revising water-charge collection method and reducing the unaccounted-for water ratio, because, in the existing system, the profitability is very low owing to its high unaccounted-for water ratio caused by massive water-leakage, waste-use of water and delayed payments of water charges.

2-6 Other Relevant Issues

As a result of referendum, independence of the Southern Sudan was decided. Since this Project is scheduled to be implemented during the transitional period of independence, special attention shall be paid to political and security situations.

Taking into account the possibility that the signatory of the recipient country would be the new government, the official procedures and undertakings required for smooth implementation of the Project by the government shall be facilitated by assisting the relevant authorities of the new country where legislation and implementing organization may not be well established in the initial stage of the Project.

CHAPTER 3 PROJECT EVALUATION

Chapter 3 Project Evaluation

3-1 Recommendations

3-1-1 Prerequisite conditions for Implementation of the Project

(1) Land Acquisition and Securing the Site

All proposed construction sites have been confirmed to be public land and permitted to use for construction of the facility. Since these sites are currently not secured by fence, it is requested to protect the sites from any occupations or constructions other than facilities under this Project. It is therefore recommended to stake out the lots to indicate government ownership and conduct regular monitoring of the sites to prevent any physical occupation.

Provision of land for stockyard and temporary facilities (total area: approx. 10,400 m^2) are also requested to the Southern Sudan side. It shall be secured prior to implementation of the Project.

(2) Undertakings of the Recipient Side

Budget arrangement shall be ensured to carry out the undertakings by the Southern Sudan side appropriately and in timely manner.

(3) Security Situation

Since Southern Sudan is planned to be independent in July 2011 as a result of the referendum in January 2011, instability of security situation is expected in that period. Therefore, security situation is one of preconditions and it should not worsen significantly to implement the Project smoothly.

3-1-2 Important Assumptions for Achievement of the Overall Goal

(1) Effective Use of Developed Capacity through the Technical Cooperation Project

Since capacity of SSUWC who carries out waterworks management, there is a necessity to develop capacity of operation and maintenance of the water supply facility to be constructed under the Project. For this purpose, " The Project for Management Capacity Enhancement of Southern Sudan Urban Water Corporation in Southern Sudan" (hereinafter referred to as the "Technical Cooperation Project", is carried out by JICA along with this Project from October 2010 to September 2013. The Technical Cooperation Project aims to enhance capacity of

operation and maintenance of water supply facilities, water quality management and understanding of financial condition of SSUWC Juba station, and to develop capacity of SSUWC Headquarters to support SSUWC Juba station. In order to perform proper operation and maintenance of the facilities to be constructed under the Project, these organization and staff are required to continue participating in the operation and maintenance of the new water supply facilities, upon completion of the knowledge transfer.

(2) Independent Operation from the Existing Water Supply System

The Project aims to supply clean treated water to new service areas which is not yet covered by the existing water distribution system. Therefore, it is necessary to operate the new distribution system independently from the existing one in order to achieve the Project effect as planned. Even though connecting valves will be installed between the existing and new distribution network, it will be strictly closed except at emergency. The valves are to be opened by judgment, instruction and record be made appropriately according to the guideline on the emergency operations as stated in sub-section 2-2-2.

(3) Financial Soundness

In order to ensure sustainability of waterworks management, enhancement of financial status of SSUWC is essential. It is recommended to take measures for applying new water tariff system based on water metering and bad debt management. In order to seek finance source for future investment, provision of financial statements according to International Accounting Standards and financial soundness of SSUWC is also required. In this regard, technical assistance to prepare water ledgers and basic financial statements is carried out in the undergoing Technical Cooperation Project.

3-2 Project Evaluation

3-2-1 Relevance

(1) Beneficiaries and Population

Whereas the total population of Juba is estimated to be 400 thousand people (2009 estimate), population served by the piped water system is estimated to be only 34 thousand people (2009). Consequently, most of the people of Juba have no access to safe water.

Objective of the Project is that residents including poor people in the target areas, where the existing water supply system does not provide services, will have access to safe water. The

population to be served by the Project is 355,300 persons. The ratio of population served in the target year of 2015 is 52% while total population of the project area is estimated to be 679,600 (estimation by Development Study).

(2) Project Objectives and Basic Human Needs (BHN)

Most of the Juba residents currently rely on water tankers that withdraw and distribute river water without treatment or groundwater from public wells that are not suitable for drinking in many cases. People are suffering from high risk of waterborne disease as well as high expenses on buying water for domestic uses.

The Project aims to improve living environment of residents by supplying clean treated water, which complies with Basic Human Needs of residents.

(3) Operation and Maintenance Technique

The treatment process adopted in case of the proposed water treatment plant is same as the process of the existing plant. Operation method is also designed based on manual operation at site. In addition, the Technical Cooperation Project is undergoing along with this Project implementation. Taking into account that capacity of staff-members in terms of operation and maintenance and waterworks management will be developed on completion of the Grant Aid Project, the current staff would be able to take care of proper operation and maintenance of the project facilities.

(4) Mid-Long Term Plan

In the “Expenditure Priorities & Funding Needs (2008-2011)” prepared by GOSS, expenditures priorities are identified based on priority issues of Southern Sudan as well as estimated costs, and development of water supply infrastructure is identified as the priority issue. Therefore, the Project complies with the development policy of GOSS.

(5) Profitability

As the beneficiaries of the Project are large number of population including poor people, profitability is not an objective of the Project. As a result of affordability analysis by assuming that operation and maintenance expenditures are to be covered by water revenue and calculating unit cost and average price of water per cubic meter, it was concluded that expenses on water can be significantly reduced compared to the current expenditure.

(6) Social and Environmental Considerations

As a result of the environmental scoping carried out in this Preparatory Survey, serious negative impact is not expected through the Project implementation (see Appendix-6). As necessary measures to be taken to mitigate/minimize possible negative impacts caused by the Project have been identified, with condition that these measures are to be taken, Environmental Approval was issued by the Ministry of Environment/GOSS in February 2011.

(7) Feasibility under the Japan's Grant Aid Scheme

On condition that security situation will not deteriorate significantly, the Project is feasible without particular difficulties.

3-2-2 Effectiveness

(1) Quantitative Evaluation

Indicator	Baseline (year 2010)	Target (year 2015)
Average daily water production capacity	7,200 m^3/day	18,000 m^3/day
Number of population having access to safe treated water	34,000 persons	389,300 persons
Ratio of population having access to safe water	8 %	57 %
Consumption of treated water per person in the project area	0 L/c/day	26 L/c/day

(2) Qualitative Evaluation

(a) Whereas 56% of residents in non-served area of piped water experiences waterborne diseases, such as diarrhea and typhoid (2010, Socio-economic survey), decrease in rate of water borne disease is expected as a result of improving public health by use of safe and stable water supply.

(b) Currently 92% of water fetching is borne by women and children. Time spend for water fetching is 1.9 hours in average in the current non-served area, while that in current served area with public tap stands is 40 minutes in average (2010, Socio-economic survey). As a result of mitigating the hardship in water fetching, empowerment and job creation for women as well as increased opportunity for children to study are expected.

(c) Since emergency connecting pipes shall be provided between the new and existing facilities in order to supplement water supply in the existing system in accidental cases,

occurrence of water supply interruption can be mitigated. Consequently, it is expected to improve reliability of the water supply services by the existing system, which serves the current population of approx. 34,000.

As aforementioned, the Project will contribute to improve living environment of approx. 355 thousand people of Juba including poor residents. As positive effects are also expected, the Project is evaluated to be relevant and effective to be implemented under the Japan's Grant Aid.

Appendix-1 Member List

Appendix-2 Study Schedule

Appendix-3 List of Parties Concerned

Member List of the Study Team

1. The Second Preparatory Survey (22 June – 8 August, 2010)

Name	Assignment	Organization
Mr. Sadanobu Sawara	Team Leader	Senior Advisor, JICA
Mr. Kiyofumi Takashima	Project Coordinator	Program Officer, Water Resources Management Division II, Water Resources and Disaster Management Group, Global Environment Department, JICA
Mr. Naoto Tohda	Chief Consultant/Operation & Maintenance Planning	Tokyo Engineering Consultants Co., LTD.
Mr. Akira Takechi	Deputy Chief Consultant/ Water Supply Planning	Tokyo Engineering Consultants Co., LTD.
Mr. Zenyomon Hayashi	Water Treatment Plant Facility/ Mechanical and Electrical Facilities	Tokyo Engineering Consultants Co., LTD.
Mr. Koichi Iwamoto	Pipe Facility Design/ Transmission and Distribution Facility Design	Tokyo Engineering Consultants Co., LTD.
Mr. Alok Kumar	Environmental and Social Consideration (1)	Tokyo Engineering Consultants Co., LTD.
Mr. Hiroshi Kobayashi	Construction and Procurement Planning / Cost Estimation	Tokyo Engineering Consultants Co., LTD.
Mr. Steven Mukibi	Environmental and Social Consideration (2)	Tokyo Engineering Consultants Co., LTD.

2. The Third Preparatory Survey (3 - 13 December, 2010)

Name	Assignment	Organization
Mr. Yoshiki Omura	Team Leader	Senior Advisor, JICA
Mr. Kiyofumi Takashima	Project Coordinator	Program Officer, Water Resources Management Division II, Water Resources and Disaster Management Group, Global Environment Department, JICA
Mr. Naoto Tohda	Chief Consultant/Operation & Maintenance Planning	Tokyo Engineering Consultants Co., LTD.
Mr. Hiroshi Kobayashi	Construction and Procurement Planning / Cost Estimation	Tokyo Engineering Consultants Co., LTD.

Study Schedule

1. The Second Preparatory Survey

Study period: 22 June – 8 August 2010

Date		JICA	Consultant	Accommodation
6/22	Tue	Travel (Haneda - Kansai - Dubai)	Travel (Haneda - Kansai - Dubai)	Aircraft
6/23	Wed	Travel (Dubai - Khartoum)	Travel (Dubai - Nairobi)	Khartoum/Nairobi
6/24	Thu	Courtesy call to Embassy of Japan (JICA Sudan Office)	Travel (Nairobi - Juba)	Khartoum/Juba
6/25	Fri	Travel (Khartoum - Juba) MWRI, SSUWC (IC/R Explanation, discussion)	MWRI, SSUWC (IC/R Explanation, discussion)	Juba
6/26	Sat	Site visit (Public tap stands, Water tanker filling stations)	Site visit (Public tap stands, Water tanker filling stations)	Juba
6/27	Sun	Site visit (Service reservoir) Data collection	Site visit (Service reservoir) Data collection	Juba
6/28	Mon	Courtesy call to Juba County Internal meeting, Preparation of draft M/D	Field survey	Juba
6/29	Tue	Courtesy call to MRC/GOSS, Explanation of the Project MWRI, SSUWC to discuss on M/D Courtesy call to Ministry of Economic Planning/GOSS, Explanation of the Project	Field survey	Juba
6/30	Wed	Signing on M/D Travel (Juba-Khartoum)	Field survey	Khartoum/Juba
7/1	Thu	Report to Embassy of Japan Report to JICA Sudan Office Travel (Khartoum-Dubai)	Field survey	Aircraft/Juba
7/2	Fri	Travel (Dubai – Kansai - Haneda)	Field survey	Juba
~			Field survey	Juba
8/4	Wed		Signing Technical Notes Travel (Juba - Khartoum)	Khartoum /Nairobi
8/5	Thu		Travel (Khartoum - Dubai)	Aircraft/Nairobi
8/6	Fri		Travel (Dubai - Narita)	Nairobi
8/7	Sat		Travel (Cost estimator, Nairobi - Dubai)	Aircraft
8/8	Sun		Travel (Cost estimator, Dubai - Narita)	

2. The Third Preparatory Survey

Study Period: 3 – 13 December 2010

Date		JICA	Consultant	Accommodation
12/3	Fri	Travel (Narita-Dubai)	Travel (Narita-Dubai)	Aircraft
12/4	Sat	Travel (Dubai - Khartoum)	Travel (Dubai - Nairobi)	Khartoum/Nairobi
12/5	Sun	JICA Sudan Office Courtesy call to Embassy of Japan Courtesy call to MIC	Travel (Nairobi - Juba)	Khartoum/Juba
12/6	Mon	Travel (Khartoum - Juba)		Juba
		MWRI, SSUWC (Draft Report explanation and discussion)		
12/7	Tue	Courtesy call to MWRI Minister MWRI, SSUWC discussion on Draft Report Site visit		Juba
12/8	Wed	Courtesy call to MRC/GOSS, explanation of the Project Courtesy call to MOPI/CES, explanation of the Project MWRI (Discussion on M/D)		Juba
12/9	Thu	Courtesy call to GTZ	Site visit (Munuki Payam, alternative site for Water Tanker Filling Station No.8)	Juba
		MWRI (Discussion on M/D)		
12/10	Fri	Signing on M/D		Juba
		Discussion with Expert Team of Technical Cooperation on Capacity Development of SSUWC		
12/11	Sat	Travel (Juba - Khartoum)		Khartoum
12/12	Sun	Report to Embassy of Japan Travel (Khartoum - Dubai)		Aircraft
12/13	Mon	Travel (Dubai - Narita)		

List of Parties Concerned in the Recipient Country

Ministry of Water Resources and Irrigation : MWRI/ GOSS

H.E. Hon. Paul Mayom Akec	Minister
Eng. Isaac Liabwel C. Yol	Undersecretary
Mr. Laurence Muludyang	Director of Urban Water Supply Project Department
Mr. Zacharia Joseph Pitia	Urban Water Supply Project Department
Ms. Nyasigin Deng Bar	Water Resources Management Department
Mr. Simon Otowny Awijak	Water Resources Management Department
Mr. Peter Jalyath Saver	Water Quality Laboratory

Ministry of Economic Planning/ GOSS

Mr. Aggrey Tisa Sabuni	Undersecretary
Mr. Gabriel Garang Deng	Director of Taxation Department

Ministry of Regional Cooperation / GOSS

Mr. George Justin Achor	Undersecretary
Dr. Salwa Gabriel Berberi	Undersecretary
Ms. Beatrice Khamisa Wani	Director General of Multilateral Cooperation

Ministry of Housing and Physical Planning / GOSS

Mr. Moris Lomodong	Director General of Urban Sanitation
Mr. Silvas Clark Amozay	Director General of Housing Development

Ministry of Transport and Roads/ GOSS

Mr. Otim Bong	Deputy Director of Urban Roads

Southern Sudan Urban Water Cooperation : SSUWC

Mr. Chamjok Chung Wiitour	General Manager
Mr. Khor Guang Loa	Acting General Manager
Mr. Santurino Tongun	Director of Water Supply Department, SSUWC Headquarter
Mr. Peter Toburu	Engineer of Water Supply Department, SSUWC Headquarter
Mr. Samuel Taban Longa	Area Manager of SSUWC Juba Station
Mr. Hassan Aggery Yousif	Deputy Area Manager of SSUWC Juba Station
Mr. Joseph Ebere Amosa	Former Acting General Manager

Ministry of Physical Infrastructure/ Central Equatoria States : MOPI/CES

H.E. John Lado Tombe	Minister
Mr. Louis Gore George	1st Director General
Mr. Emmanuel Matayo Wani	Director General
Mr. Martin	

Juba Town Payam

Mr. Mathew Ladu	Payam Director
Mr. Dominic Pitia	Payam Engineer

Kator Payam

Mr. Daniel Ali	Payam Engineer

Munuki Payam

Mr. Alison Samuel	Payam Engineer

Northern Bari Payam

Mr. Martin	Deputy Payam Director
Mr. Isaac Kenyi Scopas	Payam Officer

International Donors

Mr. Norbert Hagen	GTZ expert
Mr. Josef Ehrmann	GTZ expert
Mr. Kola Farakode	Louis Berger Group (USAID SISP Water and Sanitation Project)

Embassy of Japan in Sudan

Mr. Yoichi Nakashima	Counselor
Mr. Murakami	Secretary

JICA Sudan Office (Khartoum)

Mr. Kenichi Shishido	Resident Representative
Mr. Hideaki Matsuoka	Project Formulation Advisor

JICA Southern Sudan Field Office

Mr. Yasuhiko Wada	Deputy Resident Representative
Mr. Kiyotaka Tamari	Project Formulation Advisor
Mr. Kensuke Oshima	Project Formulation Advisor
Mr. Jun Iijima	Assistant Program Officer

Appendix-4 Minutes of Discussion(M/D)

(1) Inception Report (30 June 2010)

(2) Explanation on Draft Report (10 December 2010)

(3) Technical Notes (4 August 2010)

Minutes of Discussions
on the Second Preparatory Survey for the Project
for the Improvement of Water Supply System of Juba
in Southern Sudan

In response to a request from the Government of the Republic of Sudan (hereinafter referred to as "Sudan"), for the Project for Improvement of Water Supply System of Juba (hereinafter referred to as "the Project"), the Japan International Cooperation Agency (hereinafter referred to as "JICA") conducted the first Preparatory Survey on the Project in February 2010.

Following the previous survey, JICA sent to Sudan the Second Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Mr. Sadanobu Sawara, JICA senior advisor, and is scheduled to stay in the country from June 23rd 2010 to August 5th, 2010.

The Team held series of discussions with the officials concerned of the Government of Southern Sudan and conducted a field survey in the project area. In the course of discussions and field survey, both sides have confirmed the main items described in the attached sheets. The Team will proceed to further work and prepare the Preparatory Survey Report.

Juba, June 30th, 2010

Signed : Japanese side

Mr. Sadanobu Sawara
Leader
Second Preparatory Survey Team
Japan International Cooperation Agency

Signed: Government of Southern Sudan

Mr. Aggrey Tisa Sabuni
Undersecretary of Economic Planning

Mr. George Justin Achor
Undersecretary of Regional Cooperation

Eng. Isaac Liabwel C. Yol
Undersecretary of Water Resources and Irrigation

Eng. Joseph Ebere Amosa
Acting General Manager
Southern Sudan Urban Water Corporation

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the water supply conditions in Juba, Southern Sudan by expanding and rehabilitating the facilities related to water supply services.

2. Project Sites

The project site, according to the current request, is Juba, as shown in Annex-1.

3. Responsible and Implementing Organization

3-1 The Responsible Organization is the Ministry of Water Resources and Irrigation (hereinafter referred to as "MWRI"), the Government of Southern Sudan.

3-2 The Implementing Organization is the Southern Sudan Urban Water Corporation (hereinafter referred to as "SSUWC"), the Government of Southern Sudan. SSUWC is in charge of operation and maintenance of the facilities to be constructed under the Project.

3-3 The organization charts of the responsible and implementing organizations are shown in Annex-2A and 2B.

4. Items requested by the Southern Sudan side

After discussions with the Team, the items described in Annex-3 were finally requested by the Government of Southern Sudan.

JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

5-1 The Southern Sudan side reconfirmed the Japan's Grant Aid Scheme explained by the Team, as described in Annex-4 and 5.

5-2 The Southern Sudan side will take the necessary measures, as described in Annex-6 for smooth implementation of the Project, as the condition of the Japan's Grant Aid to be implemented.

5-3 JICA will report to the Southern Sudan side if there are any other specific undertakings based on the result of this Survey.

6. Schedule of the Study

6-1 The Consultant of the Team will proceed to undertake further surveys in Southern Sudan until August 5th, 2010

6-2 JICA will prepare the draft final report of the Survey in English and dispatch a mission to Southern Sudan in order to explain its contents around the middle of December, 2010.

6-3 In case the contents of the draft final report are accepted in principle by the Southern Sudan

side, JICA will complete the final report and send it to the National Government in March 2011.

6-4 The Team explained that implementation of the Preparatory Surveys is not a commitment of the approval of the Project, as the first preparatory survey team explained.

7. Other Relevant Issues

7-1 Basic framework for design works

Both sides confirmed the basic framework for design works conducted by the Consultant of the Team as followings:

1) Target year: Year 2015
2) Service area of water supply system: the area proposed by the Master Plan developed in JICA Development Study Project named "Juba Urban Water Supply and Capacity Development Study in the Southern Sudan" conducted in year 2009 (hereinafter referred to as "the Master Plan")
3) Target population: 356,000, defined as population in year 2015 that will have water supply through public tap stands or water tankers in the Master Plan
4) Unit amount of water supply (liter/person/day): 90L for house connection and 30L for users of public tap stands and water tankers as agreed in the Minutes of Discussions signed on March 5th, 2010, to be reviewed in detail through the Second Preparatory Survey

7-2 The details of the facilities requested

(1) Capacity of water treatment plant

In the first preparatory survey, the Southern Sudan side requested the water treatment plant (WTP) to be constructed in the Project with capacity of 14,400m^3 per day. Reviewing this request, however, Japanese side counter-proposed appropriate size of the water treatment plant to be constructed in the Project as 10,800m^3 per day. It is because, in the absence of adequate distribution network, bigger amount of treated water might cause rapid and drastic increase in number of water tankers to maximize the beneficiaries, which might cause socially and environmentally negative impacts such as traffic jams and loud noise in Juba. The Southern Sudan side understood the points and agreed with the counterproposal raised by the Japanese side.

(2) Location of and land acquisition for reservoir

As a result of discussions, both sides agreed that a reservoir and an elevated tank will be constructed on the land located either inside or in the vicinity of the "Memorial Ground" as shown in Annex-7. The Southern Sudan side will inform the Consultant of the Team the final outcome of its selection of the site by July 7th, 2010. The Southern Sudan side will secure necessary land for the construction of the facilities with proper land use permission or land acquisition, and report its completion to JICA Southern Sudan Field Office in Juba by November 1st, 2010 in writing.

(3) Location of and land acquisition for public tap stands and water taker filling stations

Considering the capacity of WTP (10,800m^3 per day) as mentioned in 7-2 (1), the Japanese side explained its estimation that approximately one hundred twenty (120) public tap stands and eight (8) water tanker filling stations are necessary to distribute treated water properly.

The Japanese side requested the Southern Sudan side to identify exact locations of the sites for the public tap stands by the beginning of July, 2010, by marking with pegs provided by the Team. The Southern Sudan side confirmed that MWRI and SSUWC will carry out this task in coordination with Munuki, Kator and Juba Town payams. The Consultant of the Team will review the details of the proposed sites and finalize the location before they leave Southern Sudan in August 2010.

Regarding the locations of water tanker filling stations, both sides confirmed the locations of five (5) stations out of eight (8) stations as shown in Annex-7. The locations of the remaining three (3) stations will be decided through discussions between MWRI, SSUWC, and the Consultant of the Team by the beginning of July, 2010, considering easiness of land acquisition.

Both sides confirmed that the sites should be on public land in principle, in order to avoid dispute and compensation. The Southern Sudan side is responsible for securing necessary land with consensus of neighboring communities, and reporting its completion to JICA Southern Sudan Field Office in Juba by November 1st, 2010 in writing.

(4) Replacement of existing distribution pipes

Reviewing the request in the first preparatory survey, both sides agreed that some parts of the existing distribution pipes will be replaced on condition that technical appropriateness and necessity of the pipe replacement component are confirmed through the second preparatory survey and approved by the Japanese Government. Both sides confirmed the priority sites for the replacement as shown in Annex-8.

The Southern Sudan side confirmed that MWRI and SSUWC are responsible for reconnection of service pipes at own expense whenever it becomes necessary as a result of the pipe replacement.

The Consultant of the Team will assess the capacity and budget for reconnection works and report it to the Japanese Government.

(5) Other facilities requested in the first Preparatory Survey

The Japanese side explained that the items such as water quality testing laboratory, water tankers, and workshops for repairs requested in the first preparatory survey shall not be provided in the Project, and the Southern Sudan side understood it.

(6) Independent operation from the existing water supply system

Both sides agreed that water distribution through the existing water supply system is not so efficient due to leakages in distribution pipes, and therefore water treated by new facilities should be distributed only through new distribution pipes, in order to maximize project effectiveness. Both sides also agreed that the existing and new systems will be connected, but the valves between two

systems will be strictly closed except at emergency. In the second Preparatory Survey, SSUWC and the Consultant of the Team will have discussions to define the emergency cases in which the valves are to be opened.

7-3 Undertakings by the Southern Sudan Side

Both sides reconfirmed that the Southern Sudan side carries out all undertakings mentioned in 7-4 of the Minutes of Discussion signed by both sides on March 5th 2010, such as land acquisition and proper land preparation including clearing and leveling, tax exemption and custom clearance, upon necessity. The following items were especially discussed in the second Preparatory Survey:

(1) It is confirmed that MWRI is responsible for the provision of privileges of tax exemption to the Japanese side as agreed in the abovementioned Minutes of Discussion, through coordination with the Ministry of Finance and the authorities concerned.

(2) All land necessary for the construction of the facilities should be secured by MWRI/SSUWC with proper land use permission or land acquisition and consensus of neighboring communities.

(3) Both sides agreed that the land in which there are dwellers, stores, or agricultural fields shall be excluded from the candidate sites in principle, even though the land belongs to the government and they are illegal occupants, in order to avoid dispute and compensation, which causes delay, modification, and at worst cancellation of the construction works.

(4) The Southern Sudan side shall prepare enough and proper spaces necessary to store the procured materials for the construction. If there are any existing facilities on the storage space, the Southern Sudan side shall remove them before the Project is commenced at own expense.

7-4 Water right

The Southern Sudan side (MWRI) explained that being part and parcel of Sudan, it is implied that the Government of Southern Sudan has water right jurisdiction over Bahr el-Jebel River, which is the main source of the water supply system to be constructed under the Project. MWRI further explained that Sudan currently utilizes only 60% of the quota allocated under the 1959 Water Accord between Sudan and Egypt.

7-5 Environmental and Social Considerations

The Team explained to the Southern Sudan side about the JICA Guidelines for Environmental and Social Considerations (hereinafter referred to as "JICA Guidelines"). The Southern Sudan side understood the contents of JICA Guidelines, and that the Project should comply with JICA Guidelines, as well as laws and regulations applicable in the Southern Sudan related to environmental and social considerations. In addition, the Southern Sudan side assured to take necessary measures, if necessary, for environmental impact assessment (EIA) in relation with the

Project and to obtain the formal approval from relevant authorities according to the Southern Sudan laws and regulations.

7-6 Capacity development for operation and maintenance of the facilities

Japanese side emphasized that capacity of SSUWC, which is the main user of the facilities to be constructed in the Project, should be enhanced for proper, efficient, and effective operation and maintenance of the facilities, and therefore, the requested JICA Technical Cooperation Project "the Project for Capacity Enhancement of Southern Sudan Urban Water Corporation" (hereinafter referred to as "the TCP") is very indispensable for the implementation of this grant aid project. The Southern Sudan side recognized the importance of implementation of the TCP and promised to take every effort for the earliest commencement of the TCP.

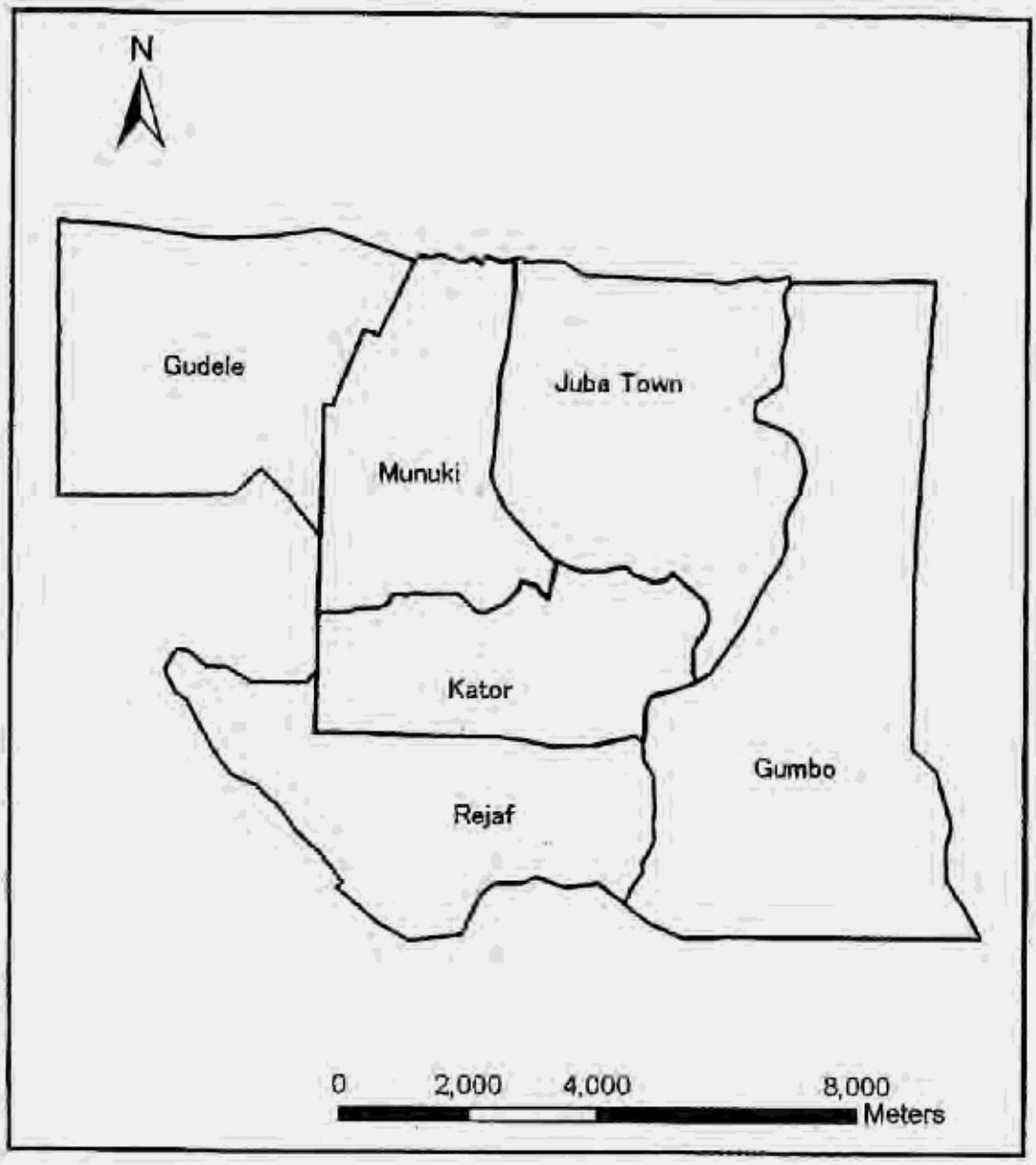
(END)

Annex:

Annex-1 Proposed project site
Annex-2 Organization chart of the responsible and implementing organizations
Annex-3 Items requested by the Southern Sudan side
Annex-4 Japan's Grant Aid Scheme
Annex-5 Flow chart of Japan's Grant Aid procedures
Annex-6 Major undertakings to be taken by each government
Annex-7 Location map for reservoir and water tanker filling stations
Annex-8 Location map for the priority site for the replacement of existing distribution pipes

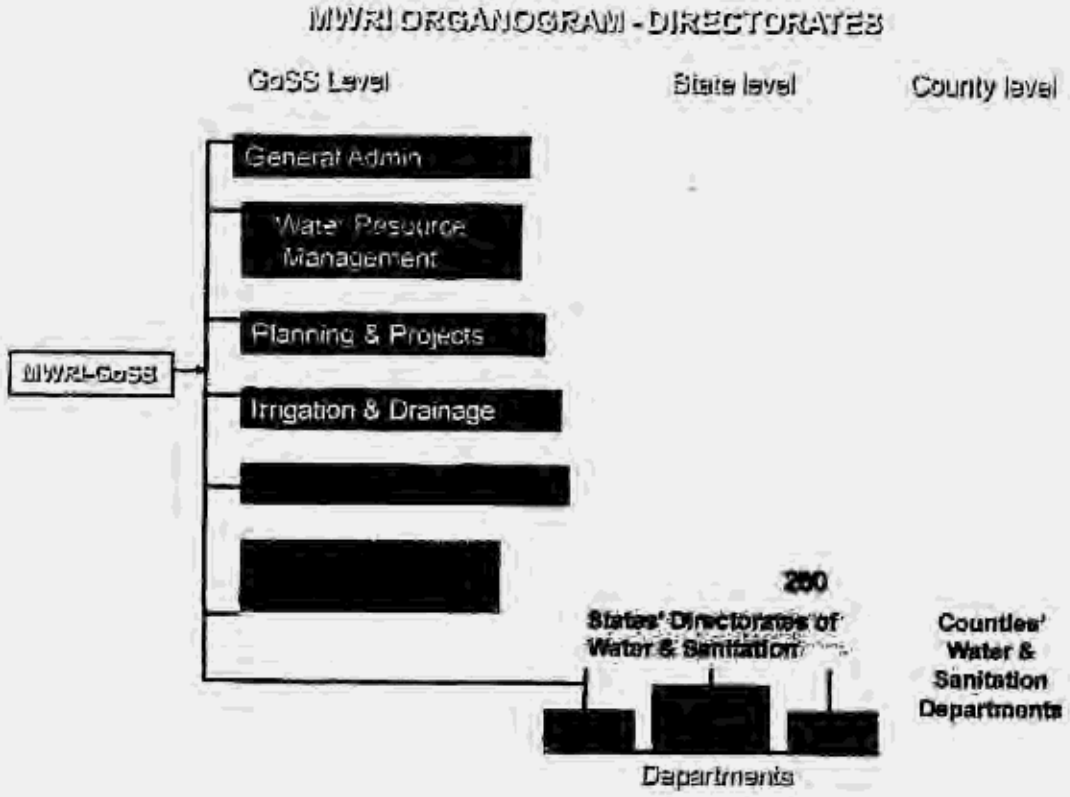
Annex-1

Proposed Project Site



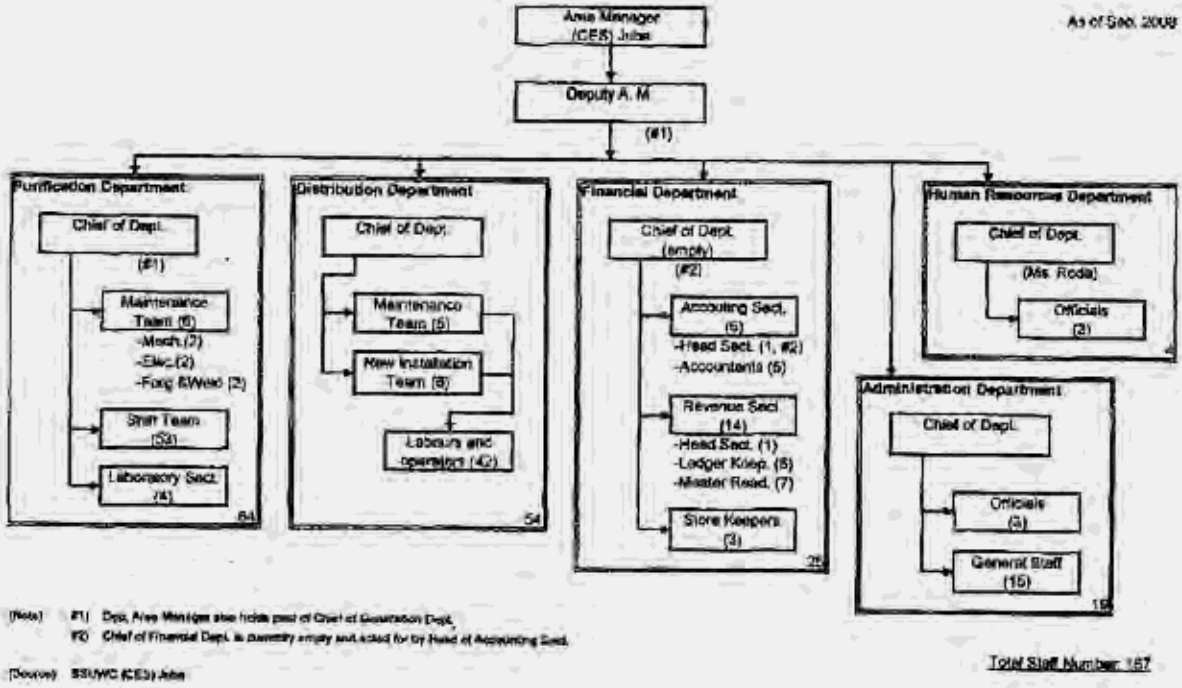
Annex-2A

Organization Chart of the Responsible Organization
(Ministry of Water Resources and Irrigation)



Annex-2B

Organization Chart of the Implementing Organization (Southern Sudan Urban Water Corporation: SSUWC)



Annex-3

Items requested by the Southern Sudan side

<Priority 1>

- Expansion of the existing water treatment plant (WTP) with capacity of 10,800 m^3/day

<Priority 2>

- Construction of reservoir and elevated tank with total capacity of 5,000 m^3
- Transmission pump station and transmission main from WTP to the reservoir

<Priority 3>

- Construction of distribution mains

<Priority 4>

- Eight (8) water tanker filling stations
- One hundred twenty (120) public tap stands

<Priority 5>

- Replacement of some part of old distribution pipes (priority sites are indicated in Annex-8)

(End)

Annex-4

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of Official Development Assistance (ODA) operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures:

- Preparatory Survey
  - The Survey conducted by JICA
- Appraisal &Approval
  - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
  - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - Agreement concluded between JICA and a recipient country
- Implementation
  - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the

Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants
JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

(3) Result of the Survey
JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme
(1) The E/N and the G/A
After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions

(2) Selection of Consultants
In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country
Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"
The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country
In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex.

(6) "Proper Use"
The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"
The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

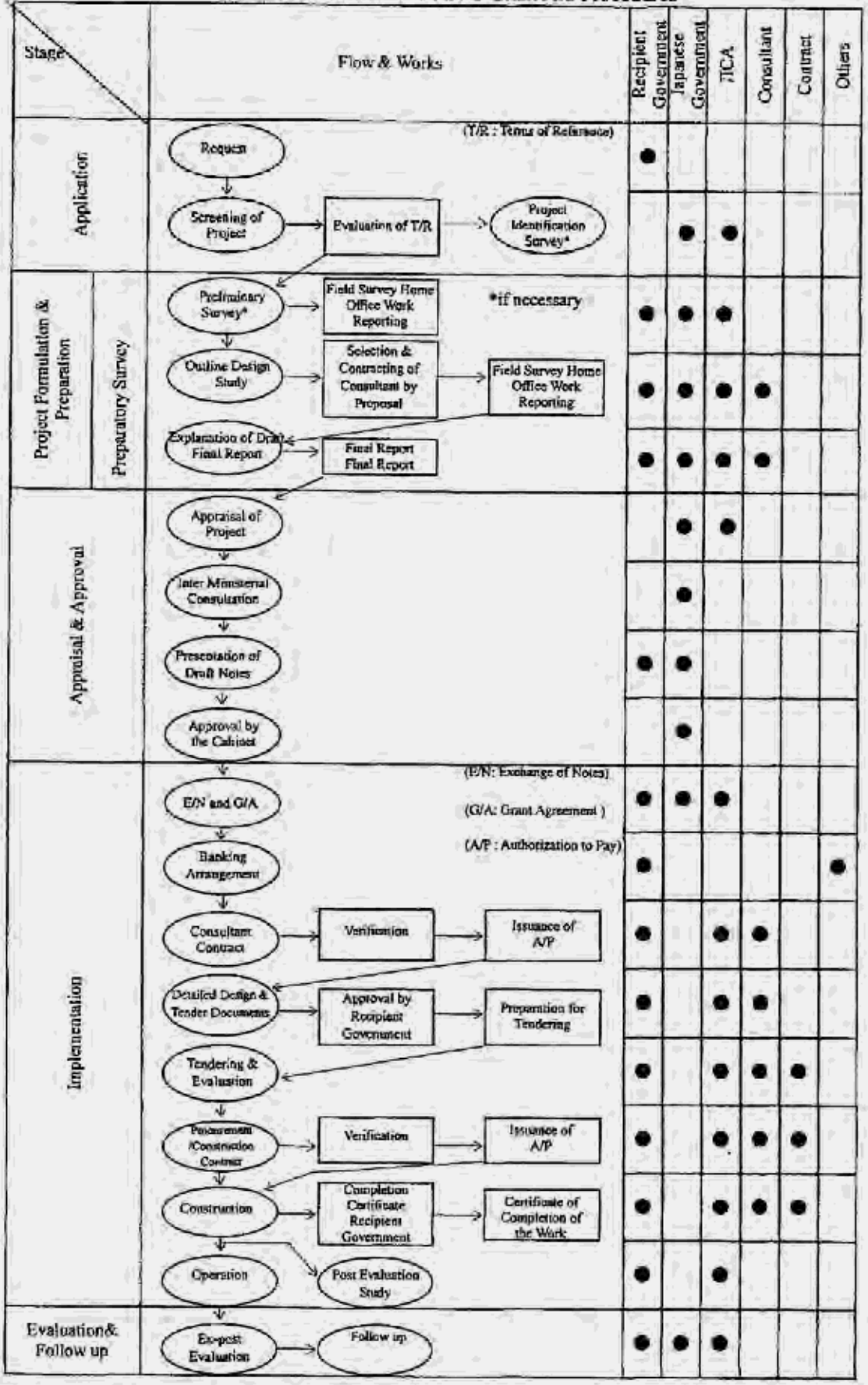
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

Annex-5

Flow Chart of JAPAN'S Grant Aid Procedures



Annex-6

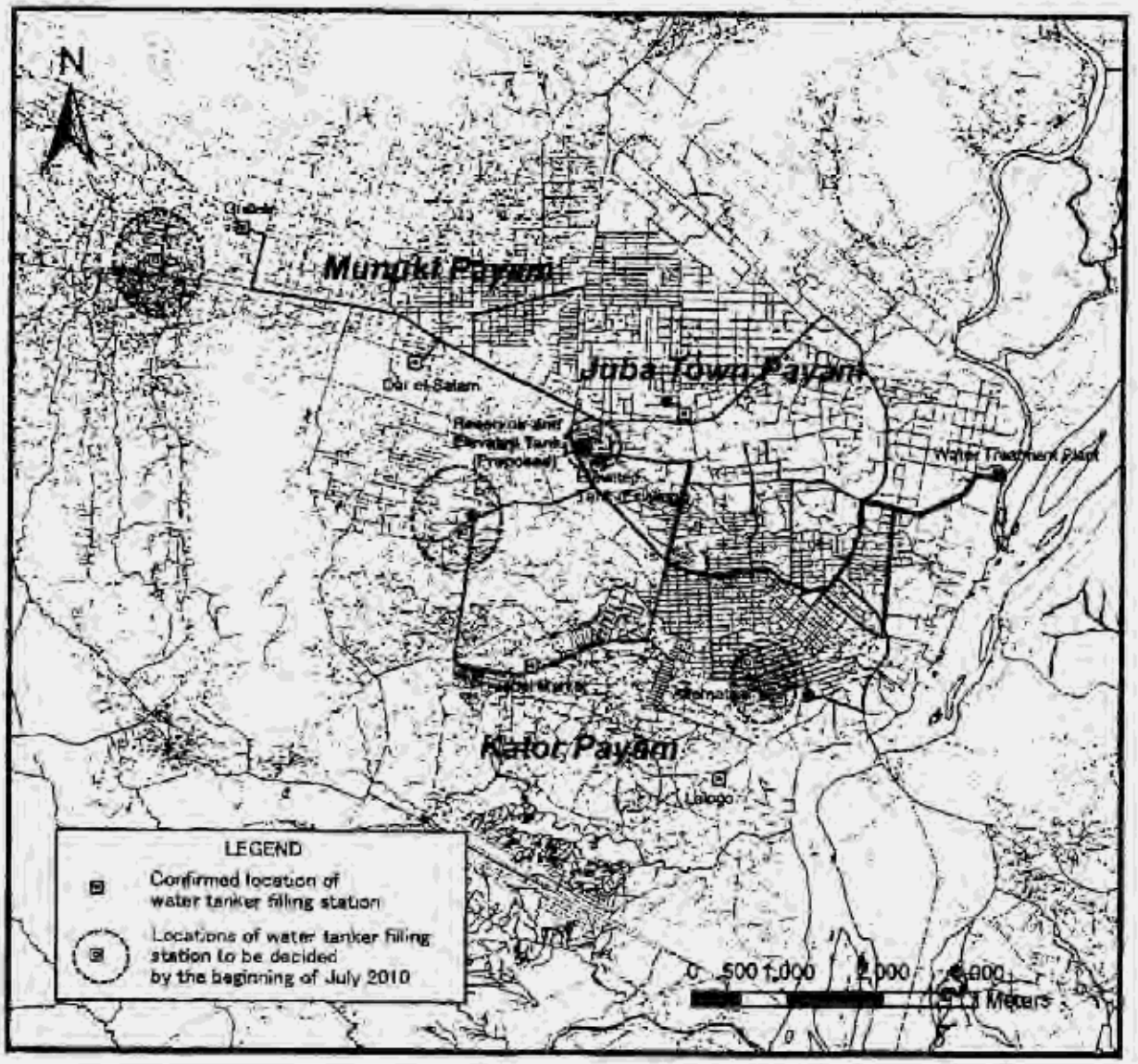
Major Undertakings to be taken by Each Government (Construction)

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure lots of land necessary for the implementation of the Project and to clear the sites;		•
2	To ensure prompt customs clearance of the products and to assist internal transportation of the products in the recipient country		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the Products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site	(•)	(•)
3	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted		•
4	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
5	To ensure that the Facilities be maintained and used properly and effectively for the implementation of the Project		•
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		•
7	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
8	To give due environmental and social consideration in the implementation of the Project.		•

(B/A: Banking Arrangement, A/P: Authorization to pay)

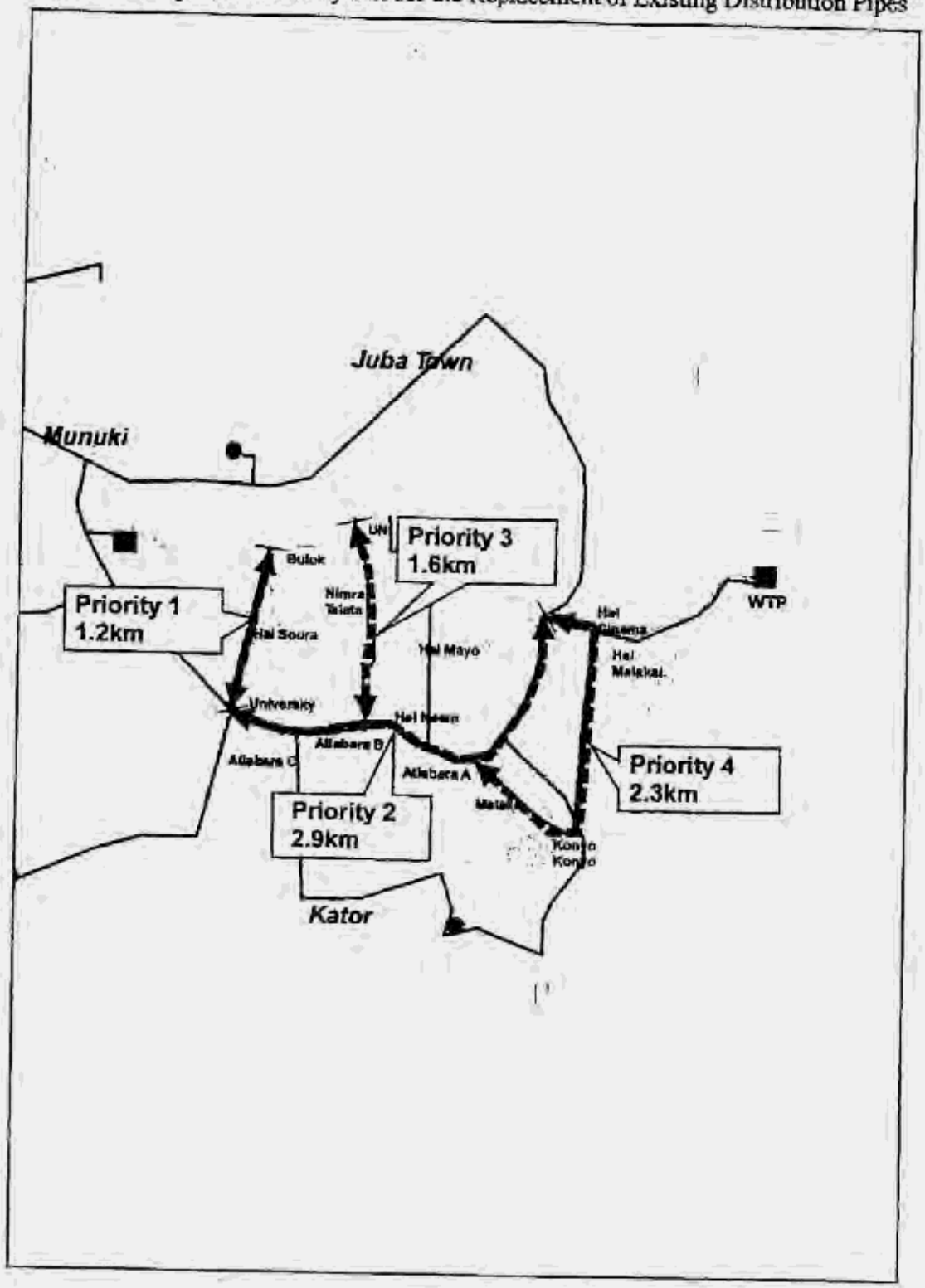
Annex-7

Location Map for Reservoir and Water Tanker Filling Stations



Annex-8

Location Map for the Priority Site for the Replacement of Existing Distribution Pipes



Minutes of Discussions

on the 3rd Preparatory Survey for the Project for the Improvement of Water Supply System of Juba in Southern Sudan (Explanation on Draft Report)

In June 2010, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Preparatory Survey Team on the Project for the Improvement of Water Supply System of Juba in Southern Sudan (hereinafter referred to as "the Project") to the Southern of Sudan of the Republic of Sudan (hereinafter referred to as "Southern Sudan") and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the study.

In order to explain and to consult the Southern Sudanese authorities concerned on the components of the draft report, JICA dispatched to the Southern Sudan the Draft Report Explanation Team (hereinafter referred to as "the Team"), which was headed by Mr. Yoshiki Omura, Senior Advisor of JICA, from December 5th, 2010.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Juba, December 10th, 2010

Signed : Japanese side

Mr. Yoshiki Omura
Leader
3rd Preparatory Survey Team
Japan International Cooperation Agency

Signed: Government of Southern Sudan

Mr. Aggrey Tisa Sabuni
Undersecretary
Ministry of Finance and Economic Planning

Dr. Salwa Gabriel Berberi
Undersecretary
Ministry of Regional Cooperation

Eng. Isaac Liabwel C. Yol
Undersecretary
Ministry of Water Resources and Irrigation

Mr. Khor Guang Loa
Acting General Manager
Southern Sudan Urban Water Corporation

ATTACHMENT

1. Components of the Draft Report

The Southern Sudan side agreed and accepted in principle the components of the draft outline design explained by the Team.

2. Japan's Grant Aid scheme

The Southern Sudan side understood the scheme of Japan's Grant Aid and would take the necessary measures and allocate necessary budget properly for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented. The Grant Aid Scheme and necessary measures were described in the Annex 4, 5 and 6 of the Minutes of Discussions signed by both sides on June 30th, 2010 (hereinafter referred to as "the previous minute").

3. Responsible and Implementing Agencies

Both sides reconfirmed the responsible and implementing agencies as follows:

- The responsible agency: the Ministry of Water Resources and Irrigation, of the Government of the Southern Sudan (hereinafter referred to as "MWRI")
- The implementing agency: Southern Sudan Urban Water Corporation (hereinafter referred to as "SSUWC")

4. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the National Government by the end of March, 2011.

5. Other Relevant Issues

(1) Project Components

With regard to requested items confirmed in the article 4 of the previous minute, the Japanese side proposed that the following components should be included in the project scope, and the Southern Sudan side agreed to the proposal:

- Expansion of the existing water treatment plant (WTP) with capacity of 10,800 m^3/day
- Construction of a reservoir and an elevated tank with total capacity of 5,540 m^3
- Transmission pump station and transmission main from WTP to the reservoir
- Construction of distribution mains
- One hundred twenty (120) public tap stands
- Eight (8) water tanker filling stations

Both sides confirmed the other requested items as follows:

1) Water tanker filling stations

Japanese side proposed to construct eight (8) water tanker filling stations as requested in the previous minute. However, the candidate construction site for No.8 tanker filling station

in Gudele area of Munuki Payam was found already demarcated for private property and not available, despite that both sides agreed to its location in the technical note signed by the chief consultant of JICA, the Undersecretary of MWRI, and the General Manager of SSUWC on August 4th, 2010.

The Southern Sudan side submitted an official letter requesting the Japanese side to construct the station No.8 on the alternative site 500 meter away to the north from original site, as shown in **Annex-1**. In response to the request, the Japanese side agreed to relocate the site as requested with the condition that the Southern Sudan side obtains proper land use permission issued by the Ministry of Physical Infrastructure of Central Equatoria State. The Southern Sudan side understood and expressed its appreciation to the Japanese side on the acceptance of the abovementioned modification.

2) Replacement of the existing distribution pipes

In the pervious minute, replacement of the existing distribution pipes (total length approx. 11km) was also requested. However, despite the necessity, the Japanese side proposed to exclude this component from the project scope, due to the following reason, and the Southern Sudan side agreed to the proposal:

<Reason>

Under budget ceiling, the components shall be prioritized from the view point of maximizing cost/benefit efficiency. The components of new public tap stands and water tanker filling stations will generate new and large benefits among the people who currently have no access to safe water, while replacement of the existing pipelines will improve service situation of the current beneficiaries who have already enjoyed safe water through individual connections. Scaling-down of the components on the public tap stands and water tanker filling station would definitely decrease the number of new beneficiaries.

(2) Project Cost Estimate and Budgetary Arrangement

The Japanese side explained to the Southern Sudan side the project cost estimate as attached in **Annex 2**. Both sides confirmed that the cost estimate is provisional since it has to be reviewed in order to reflect the modification of the location of the water tanker filling station No.8 mentioned in 5-(1)-1 above. Both sides also agreed that it would be examined further by the Government of Japan for its final approval.

Furthermore, both sides confirmed that this project cost estimate is confidential, and should never be duplicated in any forms or released to any other parties until the relevant contracts are awarded by the authority concerned of the recipient country, in order to secure fairness of tendering procedure.

(3) Budgetary arrangement for operation and maintenance of the water supply facilities

The Japanese side explained the estimated cost for management, operation, and maintenance of water supply facilities as described in **Annex 3**, and the Southern Sudan side

promised to allocate necessary budget.

(4) Service Area of the Project

Both sides reconfirmed the service areas, the locations of principal facilities, and the routes of transmission and distribution pipelines as shown in **Annex 4.**

(5) Independent operation from the existing water supply system

Both sides reconfirmed, as agreed in the previous minute, that clean water supplied by the proposed facilities shall be distributed only through new distribution pipes to new service areas. Even though connecting valves will be installed between the existing and new distribution network, it is strictly closed except at emergency. The Japanese side proposed a guideline on the emergency operation in which the valve(s) is (are) to be opened, as shown in **Annex 5.** The Southern Sudan side agreed to it and expressed its willingness to observe it.

(6) Other undertakings of the Southern Sudan side

The Japanese side explained to the Southern Sudan side its undertakings as listed in **Annex 6** and the Southern Sudan side understood and promised to execute them, collaborating with the signatory of the Grant Agreement and the authorities concerned of the recipient side.

The following items are to be emphasized:

1) Exemption of financial duties

Both sides reconfirmed MWRI shall take necessary measures to facilitate project implementation, such as exemption of Value Added Tax, customs duties, and any other taxes and fiscal levy charges in the Southern Sudan arisen from the Project activities, collaborating with the signatory of the Grant Agreement and the authorities concerned of the recipient side.

2) Provision of land for stockyard and temporary facilities

The Japanese side explained that the large amount of construction materials for the Project such as piping materials and reinforcing bars might be delivered to Juba and they must be properly stored during the construction. Also temporary facilities for construction such as office, camp, and concrete plant will be constructed. Therefore the Southern Sudan side is requested to provide land for stockyard and temporary facilities (approx. 10,400m^2 in total) in Juba before the Project commences. The Southern Sudan side understood and expressed its intention to inform JICA Southern Sudan Field Office of the location of the stockyard by February 28th, 2011 in writing. The Japanese side requested that the yard should be flat for easy access of construction vehicles, and the Southern Sudan side took note.

3) Installation of electricity facilities

The Japanese side explained that the proposed water treatment plant is so designed to receive required electricity from the grid of the Southern Sudan Electricity Corporation. The Southern Sudan side promised to construct permanent electric power receiving facilities for the water treatment plant required for stable operation.

4) Site preparation for the construction site of water treatment plant

Regarding the demarcation of both sides on site preparation for the proposed water treatment plant, both sides confirmed that the Southern Sudan side is responsible for acquiring necessary permissions and bearing costs required for cutting trees, such as "tree-cutting fee" etc., prior to hand-over of the construction site, while the Japanese side is responsible for demolition and removal of existing buildings and levelling.

(7) Environmental and social considerations

The Southern Sudan side explained that, MWRI submitted an environmental approval request to the Ministry of Environment (MoE), following the necessary procedures required in the environment law system of the Southern Sudan. Japanese side requested MWRI to submit a copy of the environmental certificate to JICA Southern Sudan Field Office by December 17th, 2010, to verify the official decision of MoE.

(8) Land use permission

Both sides recognized that no formal land use permissions have been issued by the Southern Sudanese authorities yet. The Japanese side explained that proper land acquisition is an absolute requirement for the project approval by the Government of Japan and requested MWRI to complete the land acquisition process, including one for the water tanker filling station No.8. The Southern Sudan promised to inform JICA of the completion with an official letter by December 17th, 2010.

The Japanese side requested the Southern Sudan side to protect the construction sites for the reservoir and eight (8) water tanker filling stations from any constructions, occupations, and illegal occupants other than the implementation of the Project by proper fencing. However, the Southern Sudan side explained it is impossible to make fence, since the necessary budget cannot be secured until the Project is officially approved by both Governments.

At the end of the discussions, both sides agreed that the Southern Sudan side requests each Payam to stake out a lot to indicate government property, has regular monitoring on the sites and takes every effort to prevent any physical occupations of the sites. Japanese side also explained the principle of the Government of Japan that forced removal of structure and involuntary relocation of occupants, whether legal or illegal, should be avoided, and therefore, also explained that the construction might be cancelled in the case that any physical occupation(s) is/are found at the sites. The Southern Sudan side understood it.

(9) Tentative Schedule

Japanese side explained the tentative schedule as shown in the following table:

December 2010	In principle acceptance on the outline design
April 2011	A cabinet approval by the Government of Japan of the Project.
(In the case that the Project is officially approved by the cabinet)	

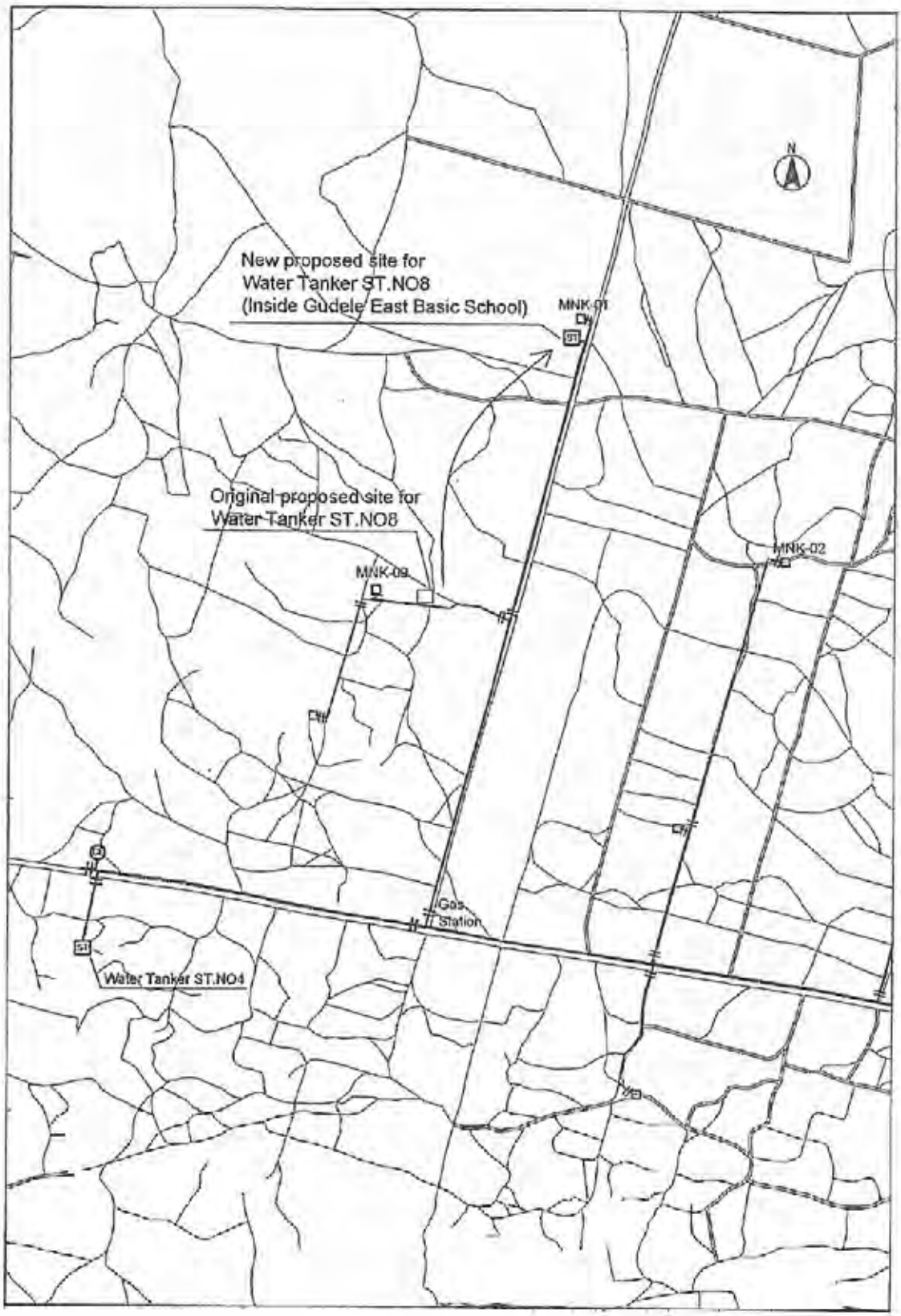
May 2011	Signing of the agreements on the project implementation: - Exchange of Note: Agreement between both Governments - Grant Agreement: Agreement between JICA and the authority concerned of the recipient side.
May 2011	Service contract between the authority of the recipient side and Japanese consultant firm, referring to the recommendation by JICA
June 2011	Detailed design work by the Consultant
January 2012	Tendering & Contracting between the authority of the recipient side and a Japanese construction firm
February 2012	Commencement of construction work
January 2014	Completion of the construction work

End

5

Annex 1

Modified location of water tanker filling station No.8



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Confidential

Annex 2

Components of the Project

This page is closed due to the confidentiality.

Table 1-B: Cost borne by the Government of the Southern Sudan

(Unit: SDG)

Expense Item	Estimated Expenditure (SDG)	Remark
1) Lands for the facilities to be constructed	16,875	Land use permission to use the proposed service reservoir site. This expenditure has been spent.
2) Fencing to secure lands for facilities	55,440	Service reservoir: 272m, Water tanker filling station: 652m SDG60/m x 924m
3) Lease of lands for temporary yards (Stock yard near WTP: 400m^2, Temporary yard in Juba: 10,000m^2, 3 years)	156,000	5.0 SDG/m^2 (assumption) x 10,400m^2 x 3 years
4) Installation of primary power supply	70,000	Water treatment plant (500kVA), reservoir (200kVA), water filling stations, 100SDG/kVA x 700kVA
5) Provision of water for pressure tests and flushing	10,500	3,000m^3 (assumption) x 3.5SDG (assumption)
6) Bank Commission	29,000	
Total	337,815	

Notes:

1. The cost estimation is provisionally prepared by the Team with available data obtained through the field survey and assumptions by the Team. Therefore, it might be reviewed and modified by the Southern Sudan Side.

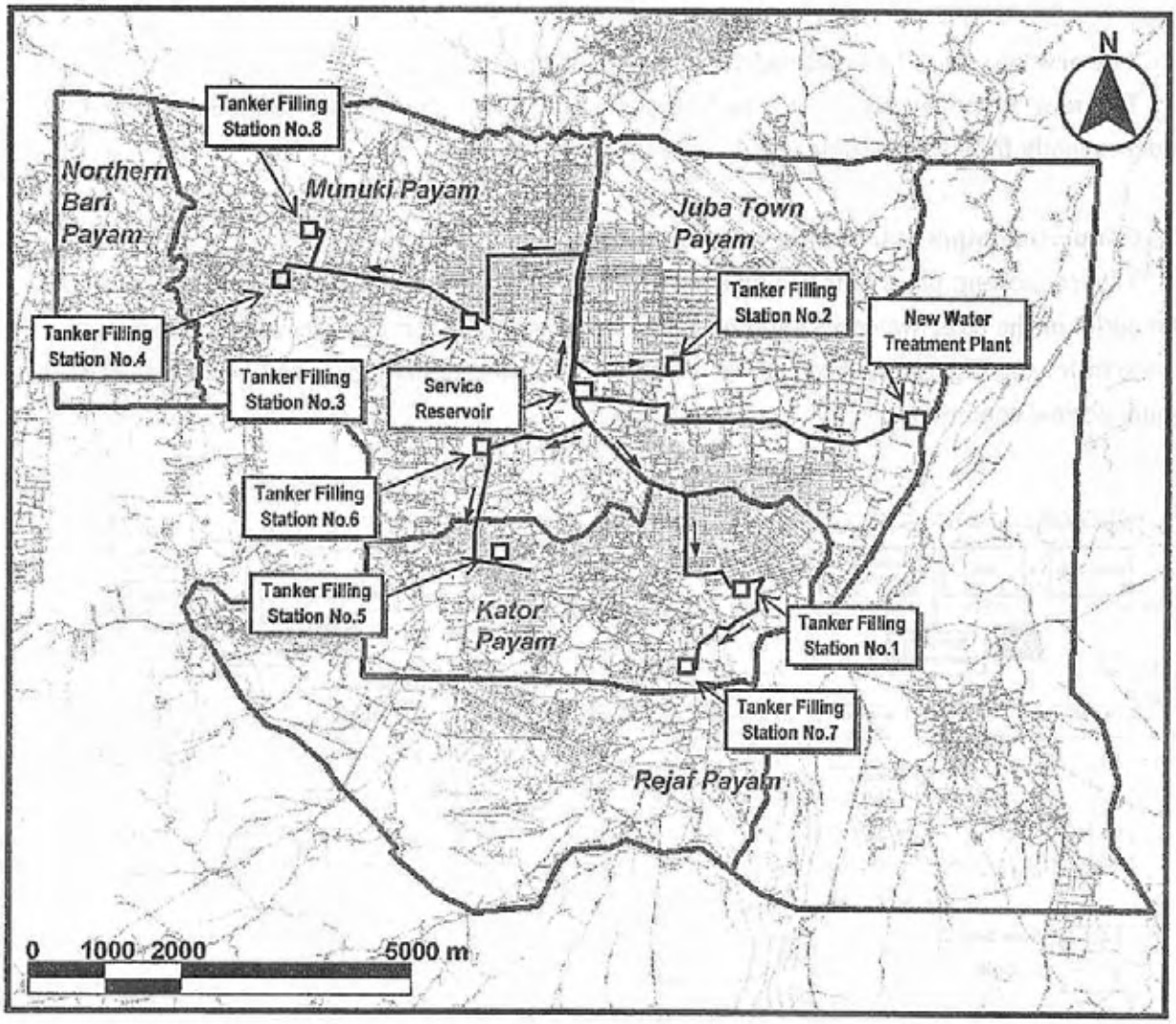
Annex 3

Annual operation and maintenance cost in 2015

Items	Cost (Thousand SDG)	Cost (Thousand JPY)	Remarks
1. Personnel Cost	1,199.2	48,687.5	
2. Electricity Cost	755.6	30,677.4	
3. Chemical Cost	485.7	19,719.4	
4. Spare Parts Cost	56.3	2,285.8	
5. Staff Training Cost	60.0	2,436.0	5% of 1
6. Other Cost	127.8	5,188.7	5% of (1-5)
Total	2,684.6	108,994.8	

Annex 4

Service area and layout map



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Annex 5

Guideline for Emergency Use

(1) The new system to be independent from the existing system

The new water supply system to be constructed under the Project shall be operated independently from the existing system.

(2) Connecting pipes between the new and existing systems

Two connecting pipes with the existing system are to be constructed at the points of (A) the outlet of the clear water reservoir and (B) the outlet of the service reservoir as illustrated in the following Figure. The stop valves installed at the connecting pipes shall be kept closed under normal conditions.

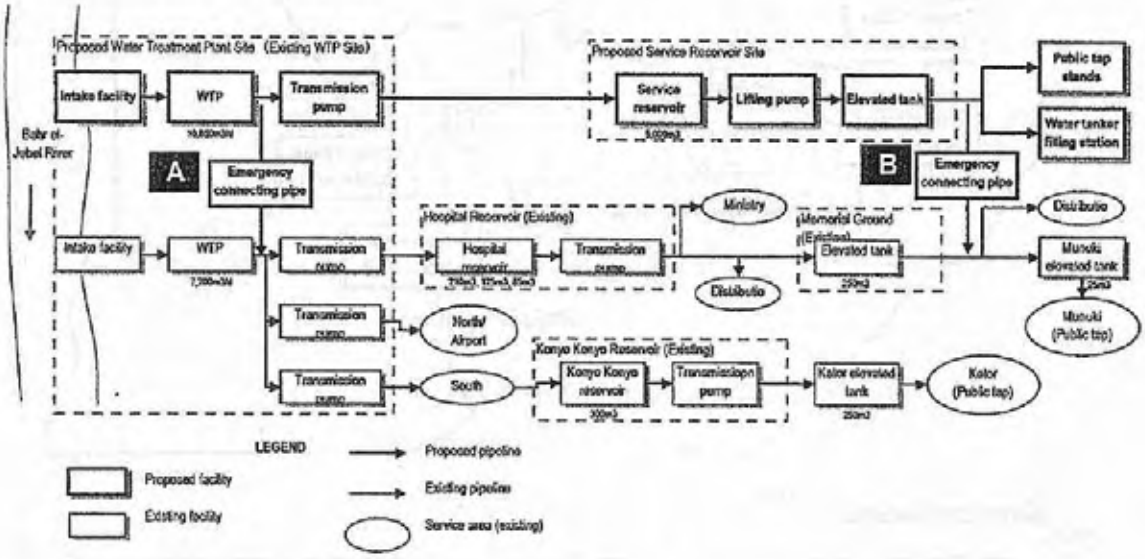

Figure The New and Existing Water Supply System and Connecting Pipes

(3) Responsibility lies with the area manager of SSUWC Juba station

Judgements, instructions, records and whatsoever related to opening the stop valves of the connecting pies shall be made under responsibility of the area manager of the Juba Station of SSUWC.

(4) Supplemental water supply to be allowed when over 24 hours water suspension is expected unavoidable and to be of a provisional measure in emergency

In case accidents and failures happens in the existing system, by which suspension of water supply for more than 24 hours is expected unavoidable, treated water can be supplemented from the new system by opening the connecting stop valve. However, this supplemental operation shall be of a provisional measure that is limited to the emergency case.

Adverse impacts to the new water supply systems shall be always minimized.

(5) Cases to open stop valve (A) outlet of clear water reservoir

Supplemental water supply by opening stop valve (A) at the outlet of the clear water reservoir is allowed when operation of the existing water treatment plant (WTP) discontinues for failure of the intake pump and major maintenance works by which full suspension of plant operation is required for more than 3 days. But the cases of suspension of operation which happens commonly and temporally, such as a power failure, are not regarded as unavoidable.

Major maintenance works are deemed to be the cases of repair work of tank structure and replacement of mechanical equipment, such as pipes, valves and pumps. But the cases of suspension of operation which is done regularly, such as cleaning of sedimentation tank, etc., are not regarded as major maintenance.

Whenever supplemental water supply is done, water level of the clear water reservoir shall be confirmed and recorded. The water level shall be kept more than 1 m above the low water level.

(6) Cases to open stop valve (B) outlet of service reservoir

Supplemental water supply by opening stop valve (B) at the outlet of the service reservoir is allowed when the existing elevated tank can not be filled up because of pipe burst of the existing transmission pipeline or failure of the transmission pump. But the suspension of operation which happens rather frequently, such as a power failure, are not regarded as unavoidable.

Whenever supplemental water supply is done, water level of the service reservoir shall be confirmed and recorded. As a guide of water availability, the water level of the service reservoir shall be more than 1 m above the low water level.

(7) Water tanker filling stations and public tap stands shall be informed by SSUWC

In case that adverse impacts to the new water supply facilities are expected as a result of the supplemental supply, SSUWC shall inform possible reduction of water pressure and flow to the management organizations of water tanker filling stations and public tap stands.

(8) SSUWC to keep all necessary records

Since the Project is commenced under the Japan's Grant Aid, the Project effects shall be confirmed by the verifiable manner. Therefore, SSUWC ensures the all necessary records related to the supplemental water supply, including cause, date and time, water level, water flow, etc., as well as the operation records of the water treatment facilities.

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Annex 6

Undertakings of the Southern Sudan side

In the implementation of the Project, MWRI is responsible for facilitating the undertakings below to be smoothly secured, collaborating with the signatory of the Grant Agreement and the authorities concerned of the recipient side upon necessity:

1) To secure the lands (including construction sites and access roads), clear the sites (service reservoir/ elevated tank, water tanker filling stations and public tap stands), and be responsible for acquiring necessary permissions and bearing costs required for cutting trees in the water treatment plant site
2) To provide temporary yard for construction to the Japanese Contractor (approx. 400 m^2 nearby the water treatment plant for stockyard and approx. 10,000 m^2 at an appropriate location in Juba for stockyard and temporary works of the Contractor)
3) To exempt taxes which may be imposed on the goods imported to the recipient country, to ensure prompt customs clearance of the products and to assist the internal transportation of the products in the recipient country.
4) To ensure that custom duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the goods and the services be exempted.
5) To accord Japanese nationals whose services may be required in connection with the supply of the goods and the services or such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.
6) To ensure that the facilities be maintained and used properly and effectively for the implementation of the Project.
7) To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project.
8) To bear commissions paid to the Japanese bank for banking services based upon Banking Arrangement (B/A); such as advising commission of Authorization to Pay (A/P) and payment commission.
9) To give due environmental and social considerations in the implementation of the Project.
10) To provide power connection to the proposed facilities (water treatment plant: 500KVA, service reservoir: 200KVA and water tanker filling stations)
11) To provide information on underground utilities and to witness trial excavations at site, where available
12) To provide water free of charge for leakage testing of the tank structure, pressure testing and flushing of transmission and distribution pipelines
13) To assign counterpart staff necessary for the Project implementation, including members from MWRI, SSUWC Headquarters, SSUWC Juba Station and duty-officers of Payams.

14) To acquire necessary permissions and bear costs required for cutting trees on the construction site of the water treatment plant.

SB

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