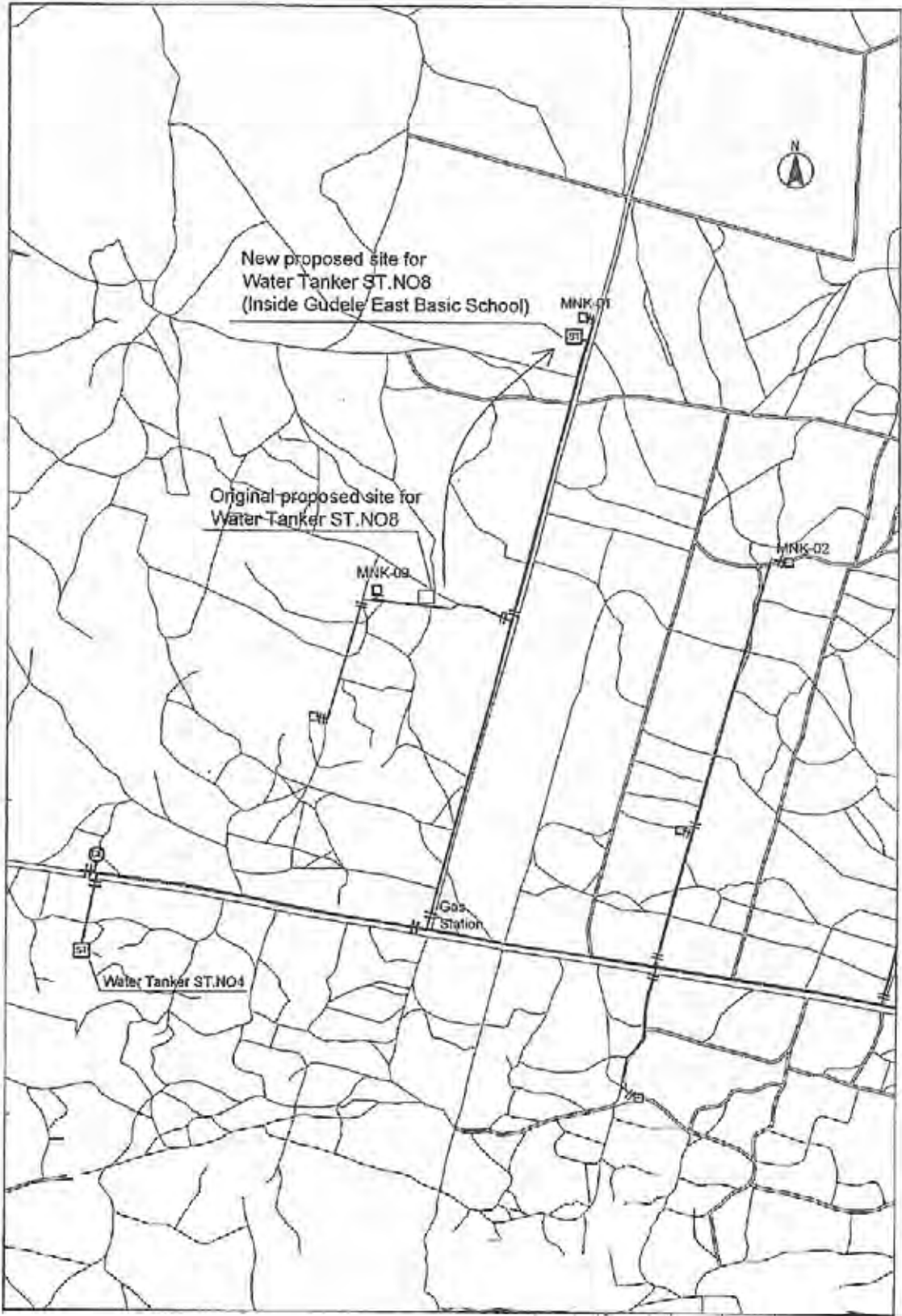


Annex 1

Modified location of water tanker filling station No.8



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Annex 2

Components of the Project

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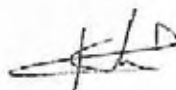

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Table 1-B: Cost borne by the Government of the Southern Sudan

(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 <sup>2</sup> , Temporary yard in Juba: 10,000m <sup>2</sup> , 3 years)	156,000	5.0 SDG/m <sup>2</sup> (assumption) x 10,400m <sup>2</sup> 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 <sup>3</sup> (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.

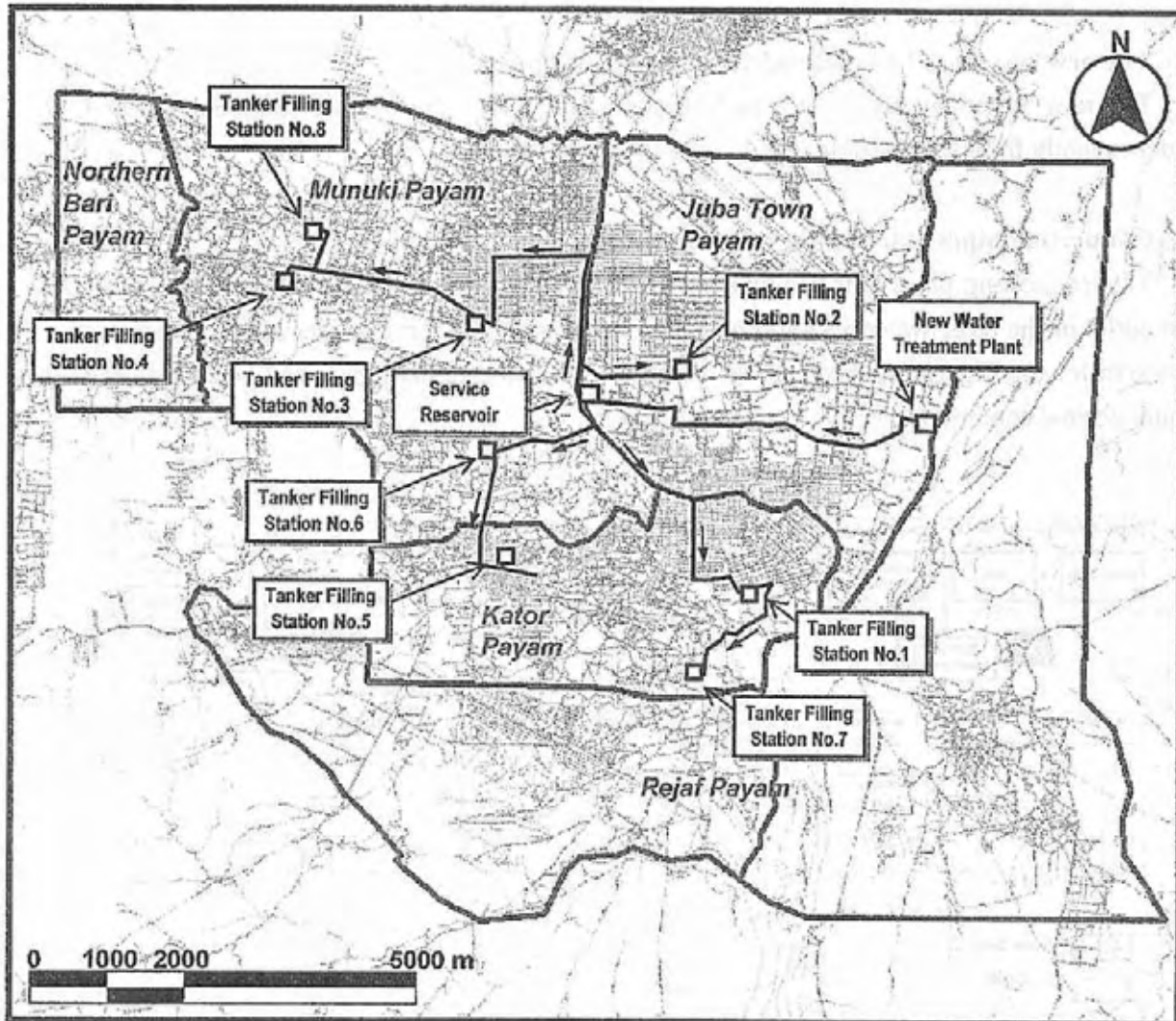
## Annex 3

## 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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### 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.

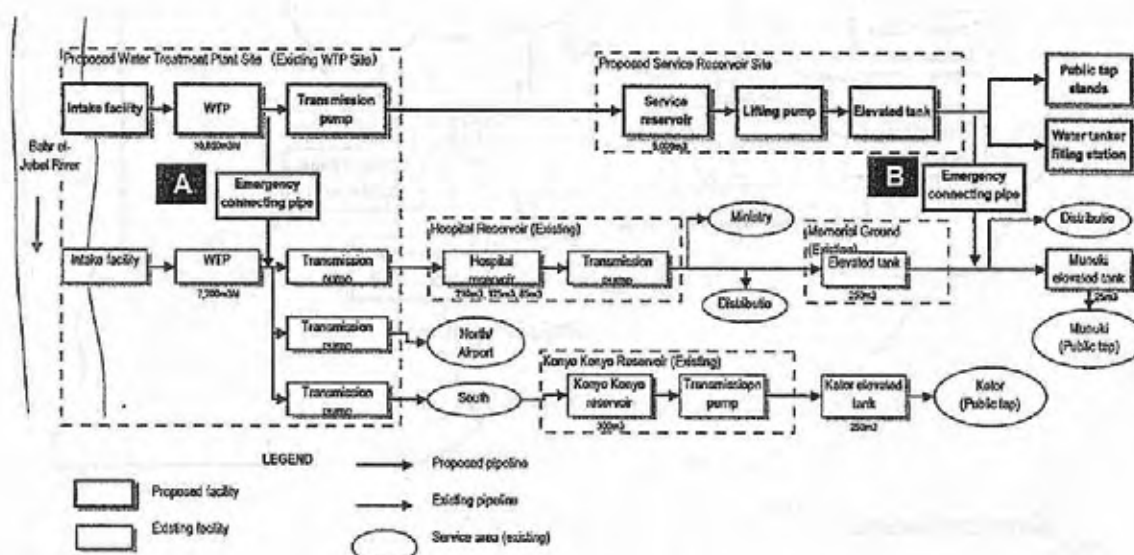


Figure The New and Existing Water Supply System and Connecting Pipes

#### (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 pipes 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<sup>2</sup> nearby the water treatment plant for stockyard and approx. 10,000 m<sup>2</sup> 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.

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TECHNICAL NOTES  
ON  
THE SECOND PREPARATORY SURVEY  
FOR  
THE PROJECT FOR THE IMPROVEMENT OF WATER SUPPLY SYSTEM OF JUBA  
IN SOUTHERN SUDAN

Based on the Minutes of Discussions (hereinafter referred to as "M/D") on the Second Preparatory Survey for the Project for the Improvement of Water Supply System of Juba in Southern Sudan (hereinafter referred to as "the Project") signed on 30 June 2010 between the Second Preparatory Survey Team (hereinafter referred to as "the Team") of Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Government of Southern Sudan, the consultant members of the Team had a series of discussions and conducted field surveys from 23 June to 5 August 2010.

As a result of the discussions and the surveys, both sides confirmed the technical conditions described as per the attached.

Juba, 4th August 2010

任田直人

Naoto Tohda  
Chief Consultant,  
JICA Second Preparatory Survey for the  
Project for the Improvement of Water  
Supply System of Juba in Southern Sudan



Isaac Liabwel G. Yot  
Under Secretary  
Ministry of Water Resources and Irrigation  
Government of Southern Sudan  
Juba



Chanyek Chung Wirtour  
General Manager  
Southern Sudan Urban Water Corporation  
Juba

## ATTACHMENT

Both parties agreed upon and confirmed the following items.

### 1. Selection of the sites for Public Tap Stands

120 public tap sites were identified one at each site as shown in Figure-1 in presence of a relevant Payam engineer, a water counselor member of each interested area and Team members. It was confirmed that all the sites identified were considered to be consented as a public tap site by all the concerned parties.

However, the Team expressed their concerns about appropriateness of some sites as follows:

- i) Since some sites were identified based on future road plans which do not have any concrete evidence, public tap stands and pipeline to the stands may be obstacle to future road alignment.
- ii) Some public tap stands require service pipe to be buried in land presently occupied by buildings and so on either illegal or legal basis.
- iii) Some public tap stands require long service pipe from distribution pipe.

The Team proposed that they would re-evaluate appropriateness of each identified public tap stand sites in their further study in Japan and Southern Sudan side accepted it.

### 2. Filling Station sites

8 sites of the filling station were identified one at each site as shown in Figure-1 in presence of a relevant Payam engineer, a water counselor member of each interested area and Team members.

At the earlier stage of this study the Southern Sudan side requested one of eight sites to be located in Northern Bari, considering the on going town expansion westward. The Team agreed to it and a Payam engineer together with the Team members tried to identify an available site in the target area. Since the land rearrangement works are undergoing there, the Payam engineer needed negotiation with persons of relevant communities. However, negotiation failed to reach agreement among the relevant persons at the time of the end of the consultant's field survey. Therefore, the filling station in Northern Bari was not fixed and instead an additional filling station was identified in western part of Munuki Payam (indicated as alternative FS in Figure-1), which is intended to be a base of tanker water delivery to Northern Bari.

The Southern Sudan side agreed to obtain written approval/consent to use the sites as a filling station by relevant authorities or organizations by 1st November 2010.

### 3. Acquisition of land for Service Reservoir site

In accordance with the agreement in the M/D, the Minister of Water Resources and Irrigation informed the Team of their decision to fix the site in one of the lots in the land next to the premises of Parliament building, which is currently owned by the Government of Central Equatoria State (for the location, refer to Figure 2). The Southern Sudan side and the Team agreed that the Team finalizes the facility plan based on this site and consequently carries out facility design works.

In addition, it was confirmed that the Southern Sudan side shall complete all the



land acquisition procedures and report it to JICA Southern Sudan Field Office in Juba by 1 November 2010 accompanying at least following documents so that JICA can proceed to the next step for realization of the Project:<sup>1</sup>

- Drawings which show exact dimensions of the said land and its configuration to the present permanent structures in the vicinity. (ordnance maps are preferable)
- Official certificate which shows owner or authority managing the said land
- Official certificate by the owner or managing authority which shows approval for the land to be used as the reservoir/elevated tank site

As per the said documents above, a copy of the certificate for the allocation of the plot by MOPI may be effective.

It was also confirmed that the Southern Sudan side is responsible to keep the site vacant until the commencement of the project after acquisition of the land.

#### 4. EIA

The Team had a meeting with Ministry of Environment to discuss required procedures to fulfill the Southern Sudanese environmental law system. Mr. Gabriel Modi Remijo, Senior Inspector for Environment, Ministry of Environment, instructed to submit Project Brief which covers the project profiles, expected environmental and social impacts by the project and mitigation measures against the expected adverse impacts to be taken to the Director General, Ministry of Environment and suggested that Director General would submit the environmental approval for the implementation of the project, which means the completion of the environmental procedure for the project implementation, after reviewing the Project Brief.

Accordingly, MWRI prepared the Project Brief and submitted it to Director General of Ministry of Environment for approval on 29 July 2010. MWRI was requested to obtain the environment approval and send its copy to JICA Southern Sudan Field Office by 1<sup>st</sup> November 2010.

#### 5. Facility plan

The Team presented outlines of facility plan of WTP, Service Reservoir, filling stations and public tap stands as shown in ANNEX 1.

The Southern Sudan side accepted the plan in general.

#### 6. Site for WTP expansion

The Team presented a provisional layout plan of WTP expansion focusing on facilities, structures and trees to be removed. Most of the structures and facilities to be removed are abandoned ones except a building (Building-1 in Figure 3) located at the west end of the WTP premises parts of which are presently used as contractor office.

The Southern Sudan Side agreed to the facility layout plan including removal of identified structures in general, but requested to rebuild this building in the Project to

<sup>1</sup> Mr. Emmanuel Matayo Wani, Director General, Ministry of Physical Infrastructure (MOPI), CES, confirmed and assured to the Team on 26 July 2010 that MOPI can submit a certificate which provides evidence that the plot is allocated to the MWRI for the use of Service Reservoir site.




accommodate the present functions of the building. The Team agreed to convey this request to JICA.

7. Provision for costs to be borne by the Southern Sudan Side

The Team reminded major costs to be borne by the Southern Sudan Side for the implementation of the Project as follows and requested to take budgetary steps at appropriate time:

- Installation of electric power line to the facility sites, i.e. WTP site, Service Reservoir site and filling station sites.
- Securing of sites for the contractor office with minimum material stock yard (approx. 400m<sup>2</sup>) nearby the WTP and a contractor camp site with material stock yard (approx. 10,000m<sup>2</sup>) at a proper location in Juba.
- Acquisition of lands for the reservoir/elevated tank, the filling stations and the public tap stand, if necessary.
- Costs for the reconnection work for the improvement of the existing distribution pipe.
- Bank Commissions

The Team will inform more detailed requirements and preliminary cost estimates at the time of Draft Report Explanation for Southern Sudan Side's convenience.

The Southern Sudan Side expressed understanding of it.

8. Rehabilitation of the existing distribution pipeline

The Team reported that they were conducting the topographical survey work to acquire necessary technical data for designing of the rehabilitation of the existing pipe in Japan in accordance with the agreement in M/D (refer to (4) of 7.2) and explained that they would discuss the conditionality of the said agreement in Japan.

In addition, the Team suggested that even though the appropriateness and necessity of the rehabilitation is confirmed in some extent, the Japanese Government may not approve the rehabilitation as the project components, if there are budget constraints or any other reasons.

9. Tax exemption

The Team reported that it was confirmed by the Ministry of Finance and Economic Planning<sup>2</sup> that all taxes, duties and levies applicable to goods and services to be rendered in relation with the project are exempted and there would be neither alternate tax payment by the responsible/implementing organizations nor the temporary payment by the contractor followed by refunding.

10. Pipe laying

The Team explained that, in principle, pipe laying would be positioned under the utility zone. However, the Team observed that in many sections the utility zone is either occupied by roadside trees, absent, too narrow, or functioning as drainage channel.

<sup>2</sup> Meeting with Mr. Gabriel Garang Deng, Director of Taxation, Ministry of Finance and Economic Planning, GoSS on 27 July 2010.



In this regard, the Team had meetings with MOPI<sup>3</sup>, Ministry of Housing and Physical Planning, GoSS<sup>4</sup>, and Ministry of Transport and Roads, GoSS<sup>5</sup>, to discuss the possibility of cutting trees down (with recovering by replanting) and pipe laying under pavement. The Team reported outcomes of the meeting as follows:

MOPI suggested removing obstacles occupying the utility zone since they are mostly illegal. However, the Team did not accept such removal because it had been agreed between the Southern Sudan Side and the Japanese side that any land which was presently occupied by dwellers, stores agriculture or so on were excluded from the land for the project to avoid dispute and compensation ((3), 7.3 of M/D). As conclusion, MOPI expressed their positive response to permit the pipe laying under the pavement in case where no other options exist.

Ministry of Housing and Physical Planning and Ministry of Transport and Roads also expressed positive opinion to the pipe laying under the pavement on conditions that no other options exist.

As such since the pipe laying under road pavement is considered unavoidable in the project and MOPI and Ministry of Housing and Physical Planning seem positive to this issue, the Team requested the MWRI to organize an inter-ministerial discussion to obtain permission for this issue at a proper time. MWRI agreed to it.

#### 11. Operation records of WTP

With reference to the Request for the Information to MWRI dated 8 July 2010 (Ref No: 52-0300-011), the Team requested MWRI to make necessary arrangements to obtain the following data which are presently under custody of the Contractor who is not in position to open the data to the Team due to contractual obligation to Ministry of Housing and Physical Planning (MHPP). MWRI confirmed that they would take actions to obtain the data from the Contractor through MHPP and send them to JICA Southern Sudan Field Office by 31 August 2010.

- O&M Manuals provided by the Contractor
- Daily operation records since May 2009 to date, which shall include,
  - ✓ Raw water quality data, treated water quality data
  - ✓ Daily river water level
  - ✓ Water flow data

#### 12. Supports to Topographic Survey Works

The Team is leaving Juba before the sub-contractor completing all the survey work. By kind instrumentality of the Southern Sudan side, it is believed that all the approvals/permissions necessary for the work have been obtained, hence the subcontractor will not have major difficulties in their work. However, in case the subcontractor encounters unexpected problems, the Team requested the Southern Sudan side to provide supports to them so as to be able to complete the all the work that are essential for the basic design work.

#### 13. Interconnection between the existing and new systems

The Team explained that as agreed in M/D they would install an interconnection valve

<sup>3</sup> Meeting with Mr. Emmanuel Matayo Wani, Director General, Ministry of Physical Infrastructure (MOPI) on 26 July 2010.

<sup>4</sup> Meeting with Mr. Silvas Clark Amozay, Director General for Housing and Urban Development, Ministry of Housing and Physical Planning, GoSS on 27 July 2010.

<sup>5</sup> Meeting with Mr. Otim Bong, Deputy Director, Urban Roads, Ministry of Transport and Roads, GoSS on 29 July 2010.

in the new system so that the Project can benefit the users of the existing system even if slightly by reducing a risk of water cut due to the existing system shut down.

However, the operation of the interconnection must be strictly limited in emergency case in order the new system exerts its planned benefits. While Southern Sudan concerned personnel were too busy to discuss this regard, the Team will prepare a draft of an operation policy of the interconnection valve in Japan and discuss it at the time of Draft Basic Design Explanation due in December 2010.





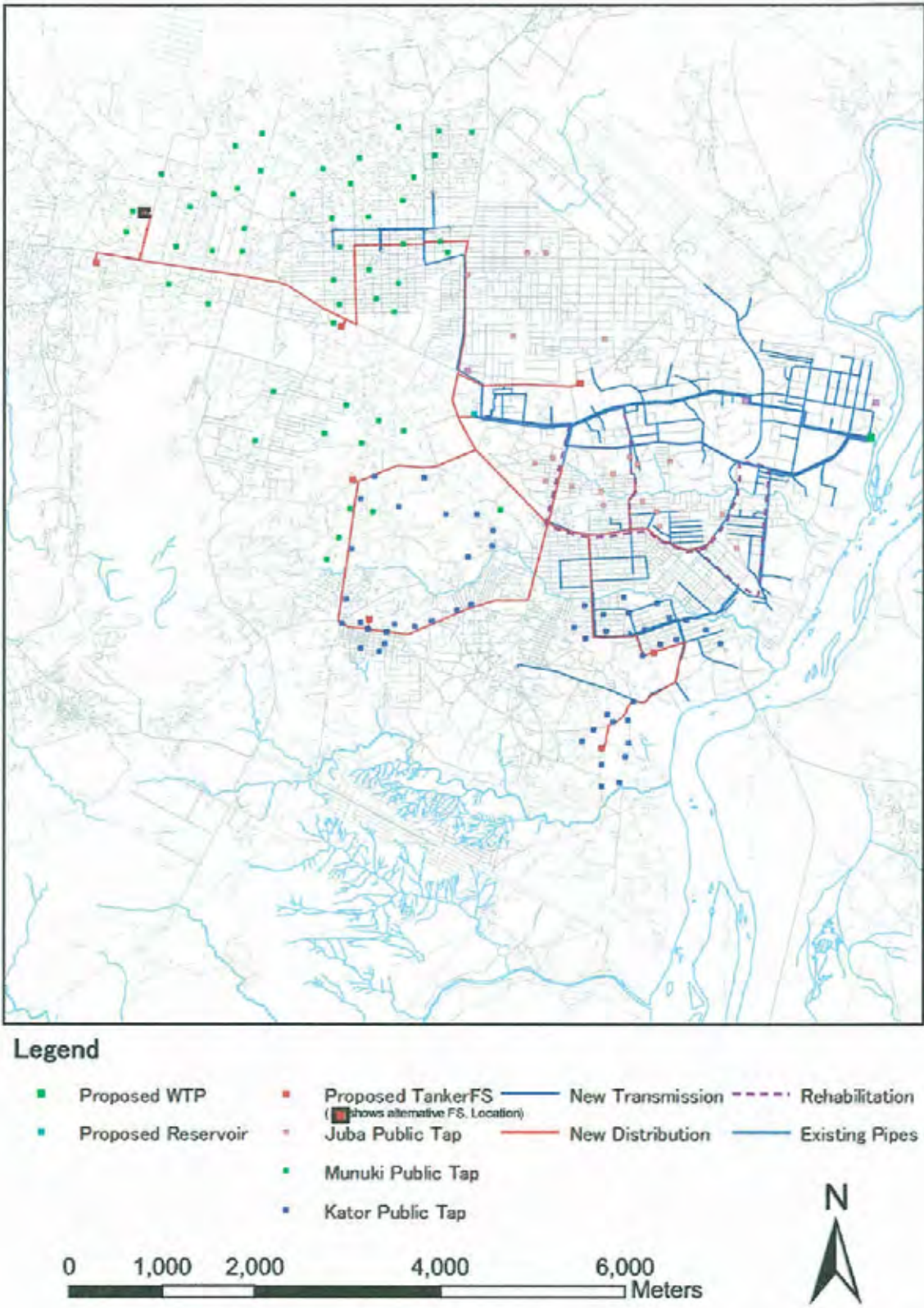


Figure 1 Location of Water Supply Facilities Identified



Figure 2 Location of Service Reservoir Site

Note: Delineated by the Team on the Google image based on the plot allocation plan of the land west of the Parliament premises by MOPI which was given by MWRI on 13 July 2010. Securing of the preferable plots for the Service Reservoir site was confirmed by the Minister of MWRI on 20 July 2010.

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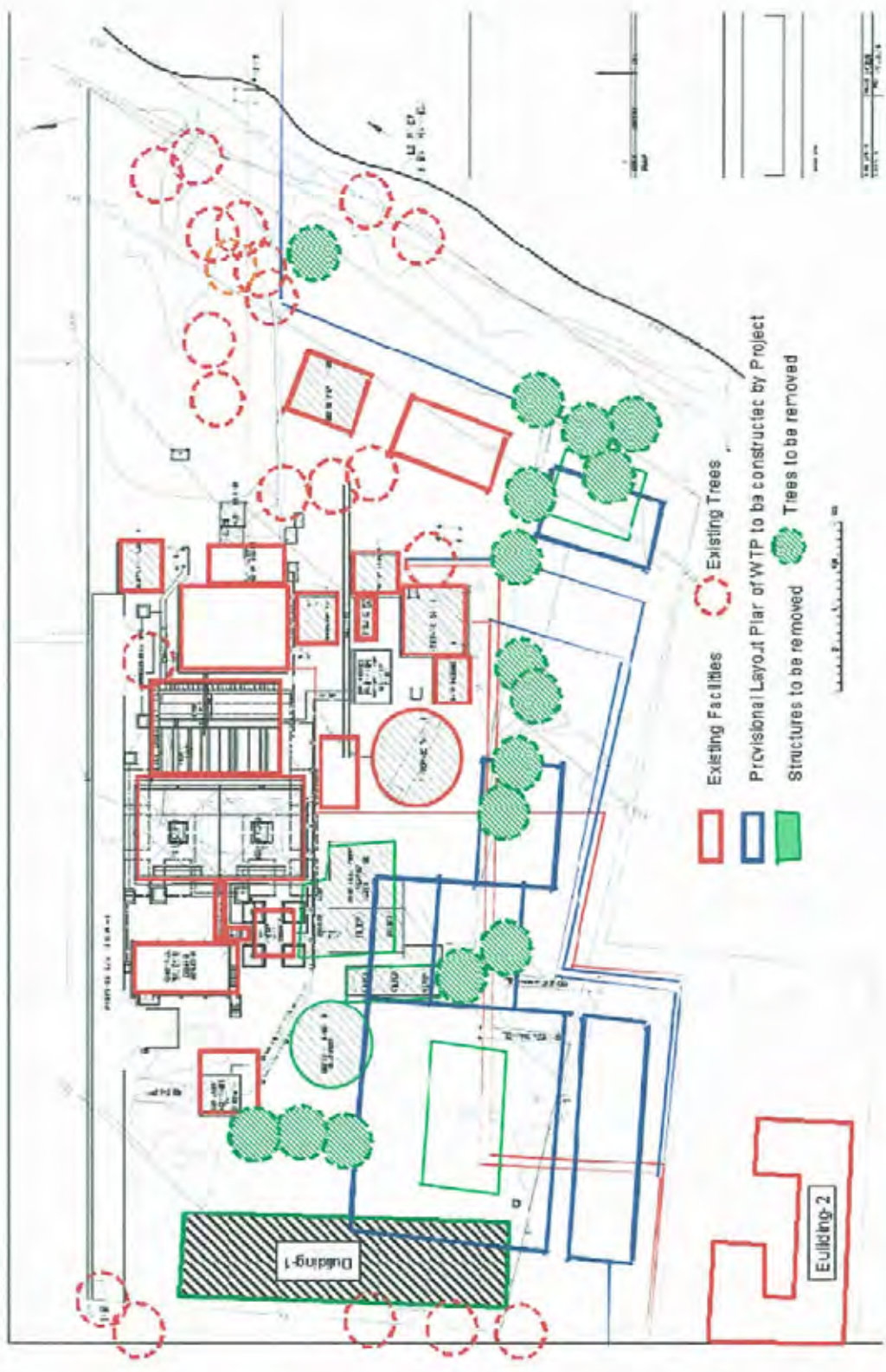


Figure 3 Provisional Layout Plan of WTP

## ANNEX-1

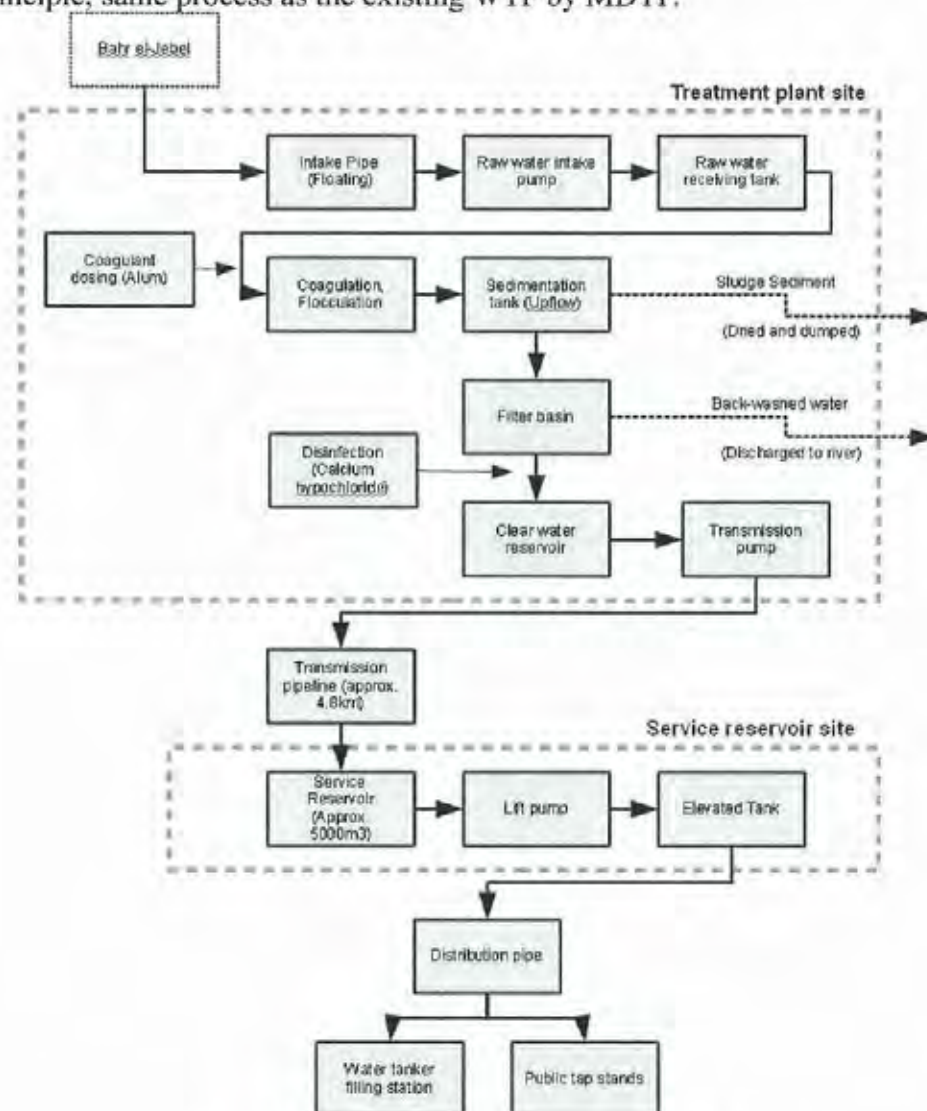
### THE SECOND PREPARATORY SURVEY FOR THE PROJECT FOR THE IMPROVEMENT OF WATER SUPPLY SYSTEM OF JUBA IN SOUTHERN SUDAN

#### 1. Layout Plan of New Water Treatment Plant

- Demolishing the old plant facilities that are not in use.
- Current SPENCON office needs to be moved.
- Old pipes for Kator and Juba town need to be replaced since they exist under location of the proposed clear water reservoir.
- Intake facility
  - Float type (same type as the existing) is proposed
  - Approx. 15m upstream of the existing intake

#### 2. Treatment Process

- In principle, same process as the existing WTP by MDTF.



Flowchart of Proposed Water Supply System



## ANNEX-1

### 3. Design of Service Reservoir and Elevated Tank

- A service reservoir (above ground type, approx. 5000 m<sup>3</sup>), lift pumps and an elevated tank (approx. 16m in height, LWL: GL+12.5m) is tentatively proposed.
- Proposed site immediately to the west of the Parliament and in front of the Memorial Ground.

### 4. Water Tanker Filling Station (Gurai in Northern Bari Payam)

- 8 locations have been identified.

### 5. Public Tap Stands

- 120 locations for tap stands have been confirmed.
- Locations are to be verified from the following viewpoints:
  - Elevation of the land
  - Distance from the main pipeline
  - Pipeline route from the main pipe to the tap should be demarcated and cleared.
- In consideration of the above, the Team may propose alternative sites for some taps in December 2010 when Draft Final Report will be presented.
- Design of public tap stands; type of public tap stands shall be examined either of Munuki which was constructed by JICA, Kator by USAID, or water Kiosk which is common in Kenya.

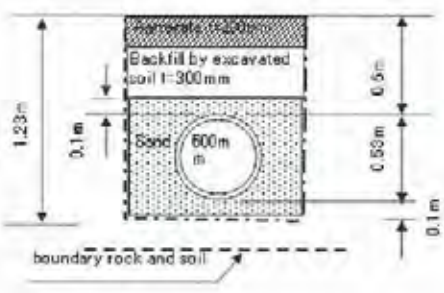
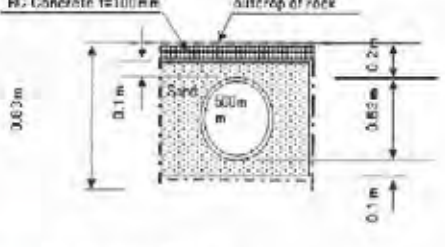
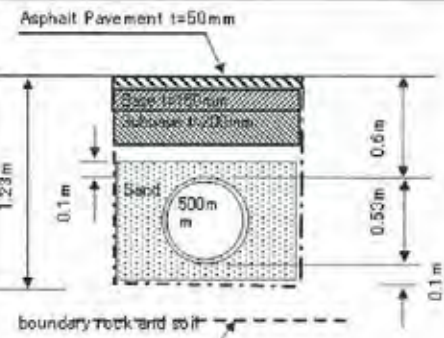
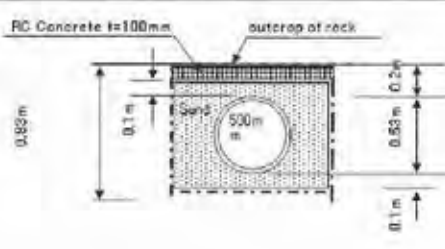
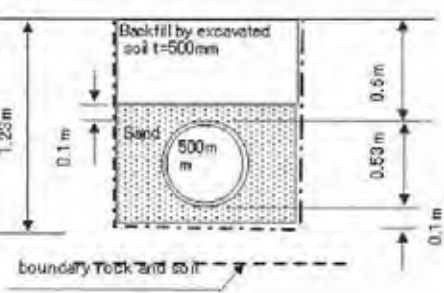
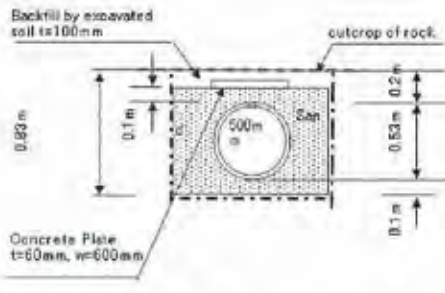
### 6. Existing Distribution Pipes to be Replaced

- Information provided by SSUWC CES Juba seems insufficient. Further information and clarification is requested by the Team.
- Interview survey is carried out by the Team
- Diameters of the existing service pipe are reportedly of 15mm - 25mm. More information shall be collected from SSUWC CES Juba.

### 7. Design of New Pipeline

- Pipeline routes are proposed as Figure 1 of Attachment.
- Position of pipe installation:
  - To be designed in consideration of space for pipe installation (Utility zone).
  - Some part of the distribution mains are to be installed under the pavement, according to observation by the Team.
- Covering depth of pipe (Depth of covering soil above the pipe crown)
  - The team propose covering depth of 60cm in consideration of existence of hard rock in Juba.
  - In case of rocky terrain, min. covering depth of 20 cm is proposed. Appropriate pipe protection shall be considered, e.g. RC concrete plate.

# ANNEX-1

	Normal soil	Rocky terrain
Non-paved road	 <p>Covering depth: 60 cm Aggregate</p>	 <p>Covering depth: min. 20 cm RC concrete (t=100mm)</p>
Paved road	 <p>Covering depth: 60 cm Asphalt pavement</p>	 <p>Covering depth: min. 20 cm RC concrete (t=100mm)</p>
Outside of road (Side walk, utility zone)	 <p>Covering depth: 60 cm Backfill by excavated soil</p>	 <p>Covering depth: min. 20 cm Backfill: excavated soil Concrete plate (t=60mm): 10 cm above pipe crown</p>

- Hydraulic design criteria:
  - Dynamic water pressure:
    - Minimum 1 bar (10m head) at water tanker filling station
    - Minimum 0.5 bar (5m head) at public tap stands
  - Hydrostatic pressure:
    - Maximum 7.5 bar (75m head) at the points of lowest elevation



## ANNEX-1

### 8. Control System (pump facility)

- Manual on/off, inter-lock (auto-stop) by water level (LWL, HWL)
- Control between WTP and Service reservoir (approx. 4.8km) shall be done by telephone communication between operators

### 9. Engine Generator

- Back-up for power failure
- Oil tank capacity
  - New WTP: For 3 days (same as the existing WTP)
  - Service Reservoir: For approx. 5 days (more than WTP, considering possibility of infrequent tank filling)

### 10. Water flow meter

- One at outlet of WTP (Transmission Pump) and one at outlet of Elevated Tank
- Type of flow meter is to be mechanical turbine type (i.e. neither ultrasonic nor electromagnetic flowmeter that are difficult for maintenance)

### 11. Valves and fittings

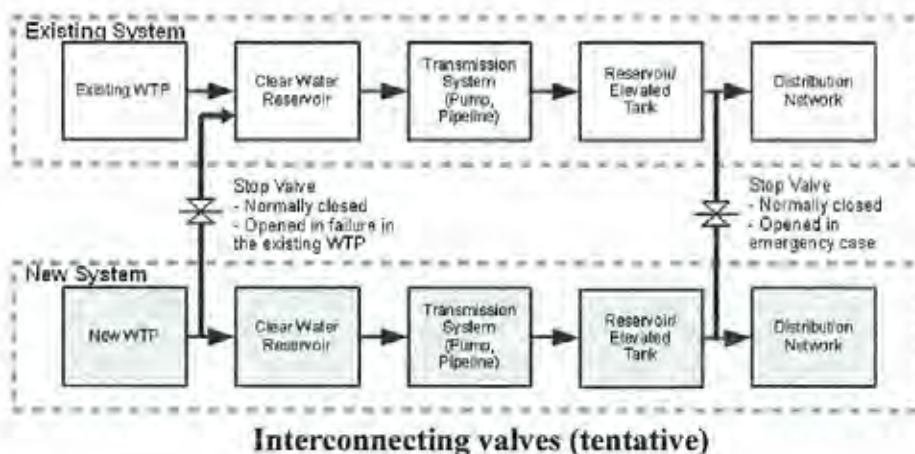
- Stop valve, washout valve, air valve
  - Design of valve chamber is to be modified so as to level with the road surface.
- Fire hydrant is not proposed in the pipeline route considering expensive cost, possibility of leakage and illegal use.
- One hydrant in each tanker filling station is proposed for fire-fighting purpose.

### 12. Design Criteria, Standard

- Water Quality Standard (Draft Southern Sudan Guideline)
- Technical Standard to be commonly applied is British Standard. Other international well known standards, etc. shall be employed as appropriate.

### 13. Interconnection between the existing and New Systems

- Interconnection between the existing and new system shall be considered as the back-up in emergency case in either system. For this purpose, connecting pipes and valves will be installed at the hydraulically appropriate points.





## 添付資料－5 社会条件調査結果





## RESULTS OF SOCIO-ECONOMIC SURVEY

### 1. OBJECTIVES AND METHODOLOGY

The objective of the socio-economic survey was to investigate the social and economic living conditions of the people in the target areas (Payams) of Juba city. Along with this the study set out to examine the water use and supply patterns as well as the hygiene and sanitation conditions in homes and other premises.

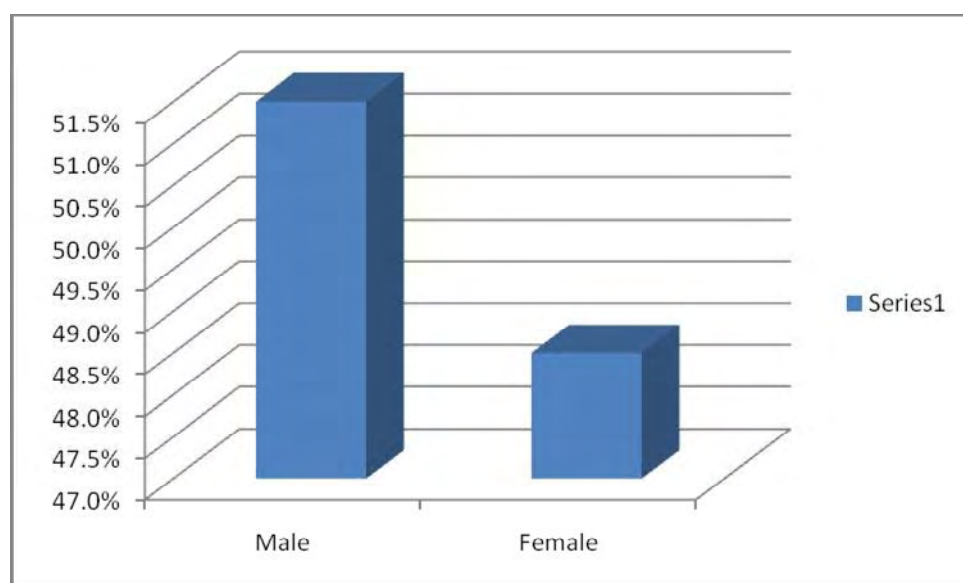
A random sample of residents was selected in the Payams of Juba, Kator and Munuki to serve as respondents in the study with care being taken to include in the sample household in the low, middle and high income/social strata categories. Data was collected by interviewers using a questionnaire developed by the study team. The interviewers were selected on the strength of their local knowledge including their being conversant with both English and the local languages spoken in the survey areas. A total of two hundred (200) respondents were interviewed.

An excel spreadsheet was developed by the study team for the entry and analysis of the data. Data was entered by a data entry clerk and cleaned by members of the study team before analysis.

The field interviews started on 14<sup>th</sup> July and ended on the 19<sup>th</sup> of July 2010.

### 2. DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Out of the 200 respondents, 51.5% were male while 48.5% were female.



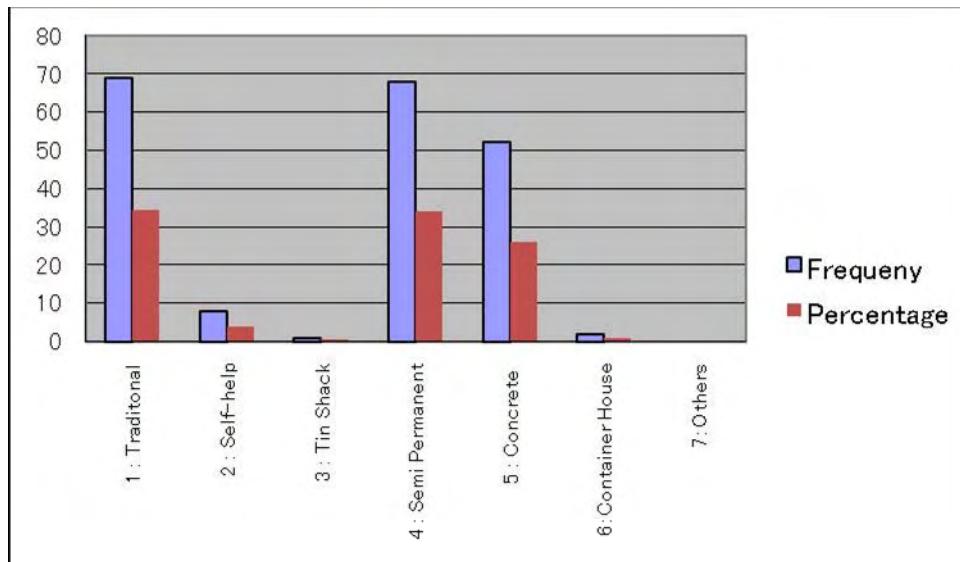
**Figure 2.1: Gender of Respondents**

The average age of the respondents was 35.9. The range was from 17 to 81 years.

### 3. SOCIO-ECONOMY

#### TYPE OF HOUSING

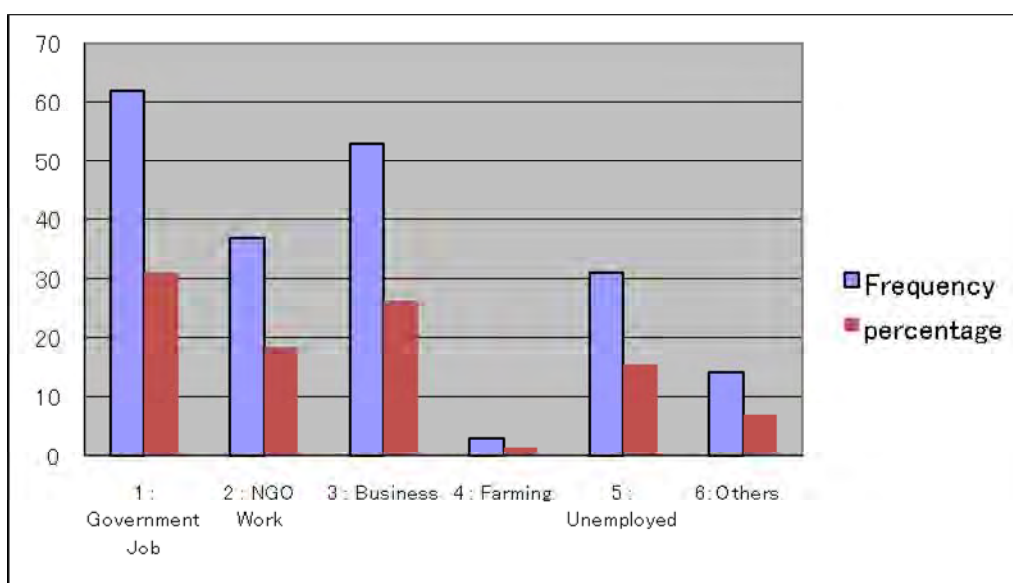
On the type of housing of the respondents, 34.5% of the respondents lived in traditional type of housing, 34% in semi permanent and 26% in concrete. Smaller percentages lived in 'self help', tin shack, and container type of housing.



**Figure 3.1: Type of Housing**

#### OCCUPATION

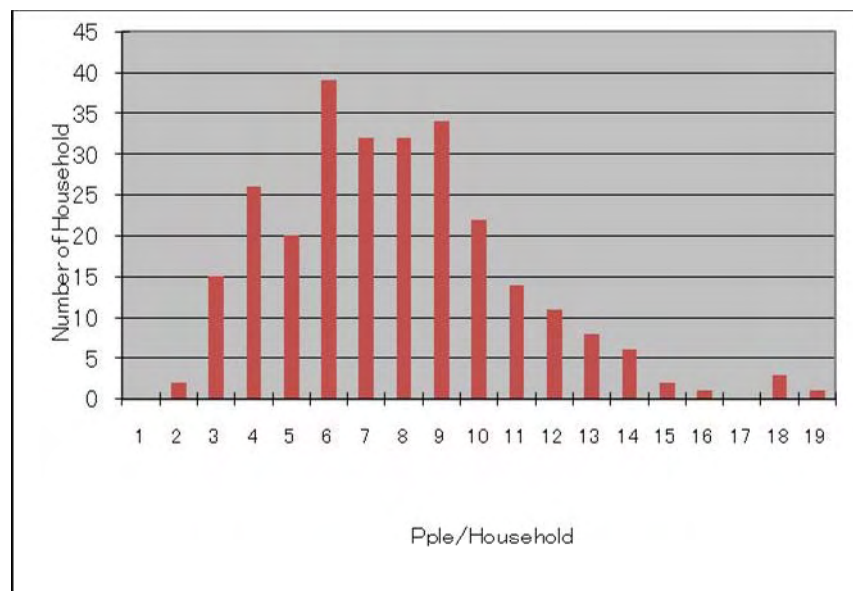
On occupation, most of the heads of the households in the sample were either in a government job, NGO work or in business. Some 31% were in government job, 26% in business and 18.5% in NGO work. About 15% were unemployed. Because of the urban nature of the survey area, only 1.5% were engaged in farming.



**Figure 3. 2: Occupation of HH Head**

### FAMILY STRUCTURE

The average family size in the interviewed household is 7.2 persons/household; the range is from 1 person to 33 persons per household), and a large proportion of interviewed households has a family size of 6 persons.



**Figure 3.3: Family Size of the Interviewed Household**

The average number of adult family members with income was 1.6 while the average number of children was 2.8. Many families also had adults without income.

### MAJOR PROBLEMS OF HOUSEHOLD

Respondents were also asked to name and rank the major problems they face in the household with a view to establishing whether water and water related problems were among the most pressing. Table 1 below shows the results of the responses. Among the problems named the one ranked the highest is the one on water supply (Dirty, scarcity, distance to water, etc) with 154 people out of 200 naming it as 1<sup>st</sup>, 2<sup>nd</sup> or 3<sup>rd</sup> problem. Of the people who named it as a major problem, 57.1% named it as problem number one, 27.9% as problem number 2 and 14.9% as problem number three. Other major problems named in order of priority were, No Development (Poor Roads / Electronics, No transport etc), Famine (Little Food / Food Security etc), lack of health facilities and health related problems, unemployment and lack of educational facilities.

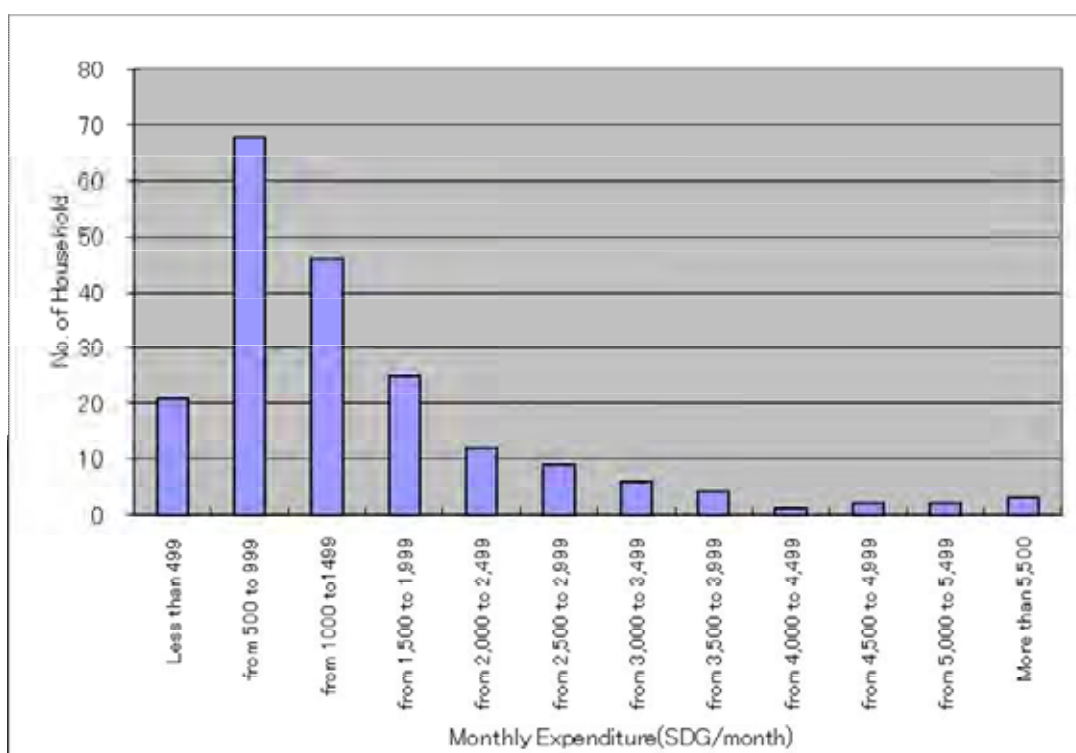
**Table 1 Major problems of household**

<i>Major problems of household</i>	<i>1st</i>	<i>2nd</i>	<i>3rd</i>	<i>Total (No.)</i>
<i>Water supply (Dirty, scarcity, distance to water ,etc)</i>	57.1%	27.9%	14.9%	154
<i>No Development (Poor Roads / Electronics, No transport etc)</i>	23.7%	40.3%	36.0%	139
<i>Famine (Little Food / Food Security etc)</i>	38.5%	46.2%	15.4%	52
<i>Lack of Health Treatment, Medical care, Health Facilities, Diseases, Sickness / Health Problem</i>	23.5%	43.1%	33.3%	51

<i>No Employment / Low Profits in Business</i>	53.6%	25.0%	21.4%	28
<i>No Serious Education (No school / No technical training / School fees etc)</i>	17.4%	26.1%	56.5%	23

#### EXPENDITURE OF HOUSEHOLD

Owing to the suspicions associated with collecting income figures, this survey sought instead to establish household financial status from the household expenditure. Average monthly expenditure of household is 1,515 SDG/month/household and the minimum and maximum monthly expenditures in the sample was 90 SDG/month and 6,100 SDG/month, respectively. Two thirds of all households fall in the range between 500 SDG/month and 1,749 SDG/month.



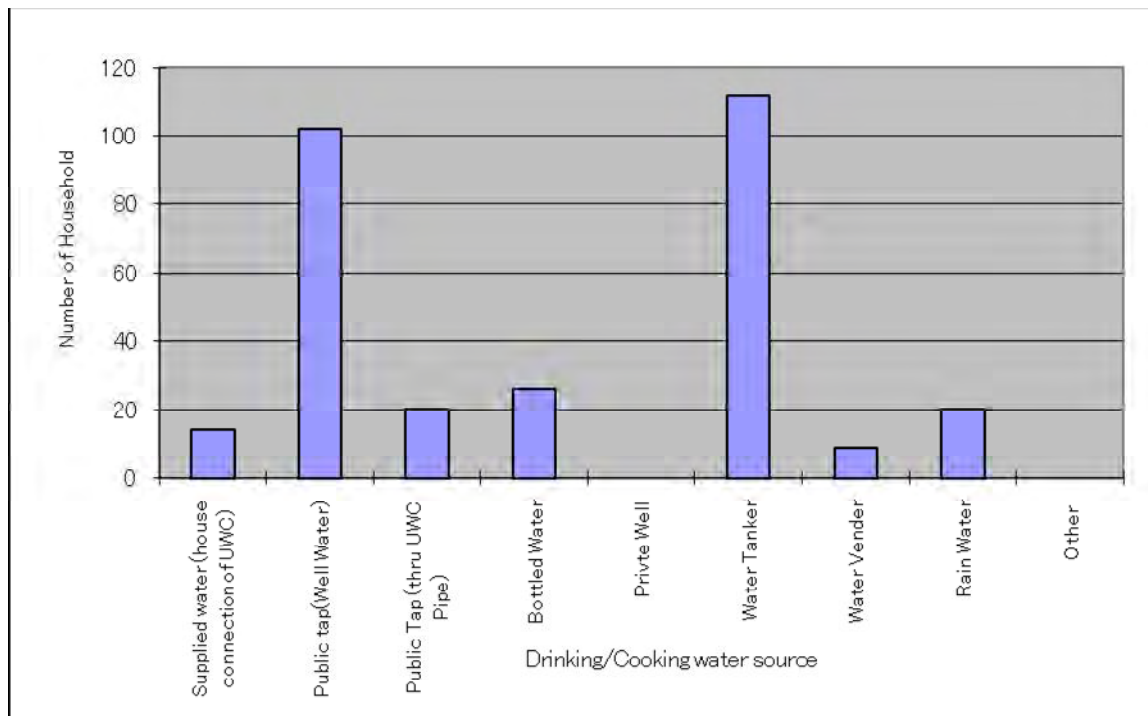
**Figure 3. 4: Monthly expenditure of Household**

## 4. CONDITION OF WATER SUPPLY AND USAGE

### SOURCE OF DRINKING AND COOKING WATER

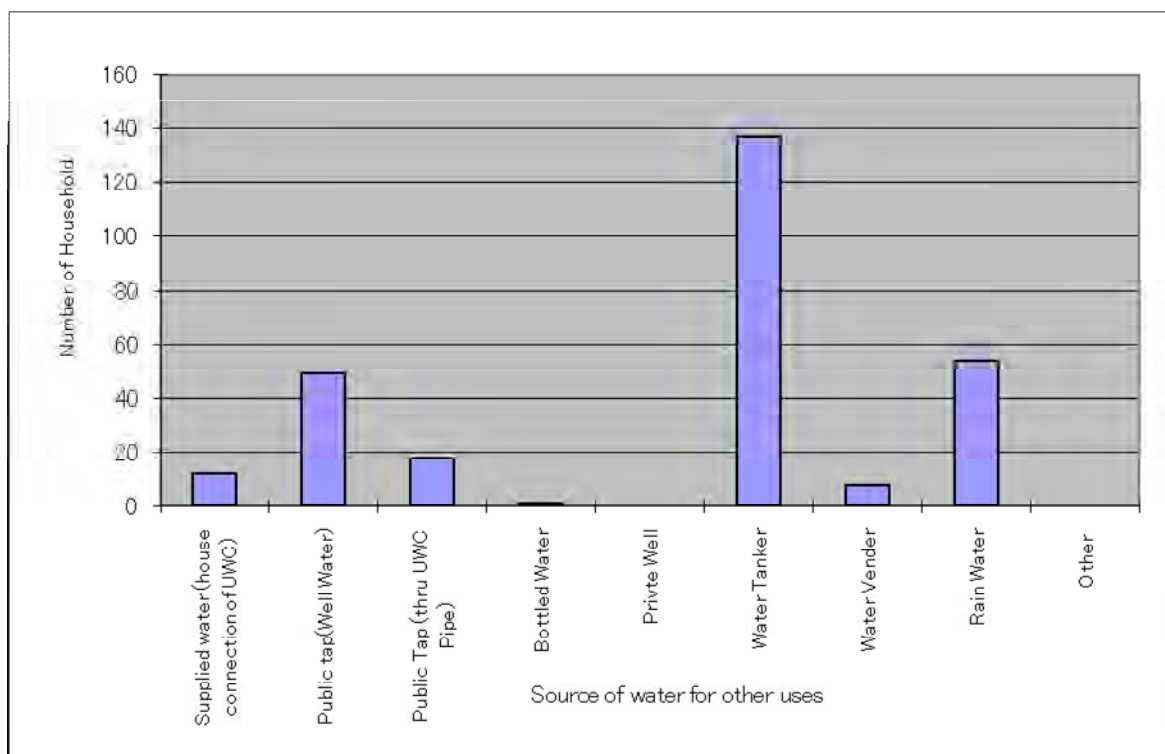
The largest number of respondents indicated that their source of drinking and cooking water is the water tanker(112hh) and the public tap or well (102hh). Some household indicated that they use both sources for their drinking water.





**Figure 4.1: Source of Drinking/Cooking Water**

#### SOURCE OF WATER FOR OTHER USES



**Figure 4.2: Source of Water for Other Uses**

Regarding water for other uses, most of the people said that the source is the water tanker (137) followed by rain water (54) and public tap (49). Some homes use more than one source.

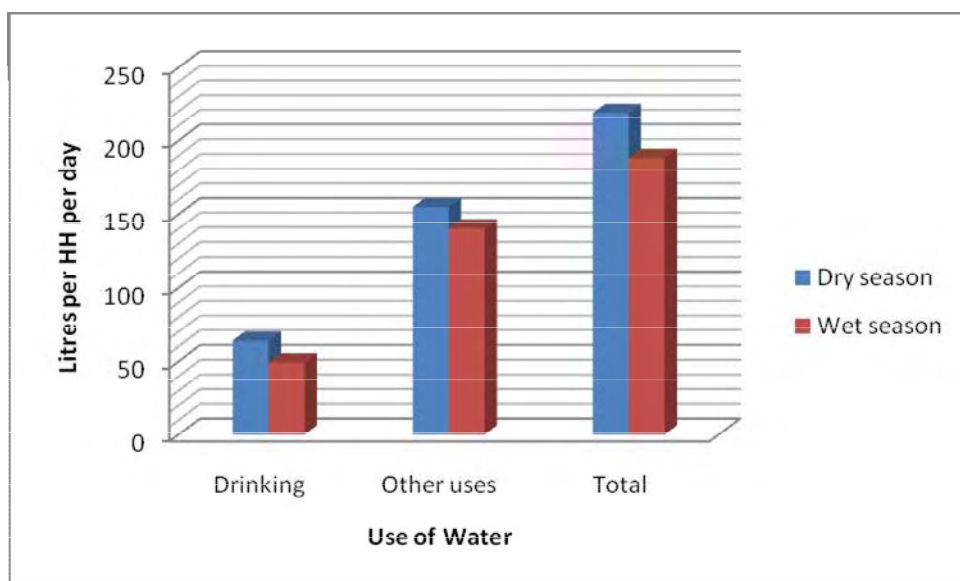
A comparison of the source of both drinking/cooking water and water for other uses shows that the main sources for both are the water tanker and the public tap. While water from the public taps comes from the Urban Water Corporation and it is treated, most water tankers get raw untreated water directly from the river. This underlines the need for the increasing of the points at which water tankers can get treated water. Also by implication, the greatest impact in terms of sanitation and access to clean water will be achieved first by increasing access and quality with respect to both public taps and water tankers.

#### SATISFACTION WITH DRINKING/COOKING WATER QUALITY

On the quality of drinking water, the greatest majority of the respondents at 52.3% reported that they are not satisfied with the quality of their drinking water. Some 17.6% of all respondents reported that they are satisfied with the quality of drinking water. Some 26% said that the quality of drinking water is acceptable. A casual tally shows that most of those that are satisfied either use piped water or bottled water. The problem most frequently reported in connection with drinking water is that it is not safe.

#### HOUSEHOLD WATER USAGE

According to the data from the survey, households use more water during the dry season as compared to the wet season. In the dry season, the average water use for drinking and cooking is 64 liters per day while the amount of water used for other purposes is 155 litres. In the wet season an average of 49 liters per day is used per household for drinking and cooking while 140 liters is used for other purposes. The average water usage per household for both seasons is 203.5 liters



**Figure 5.4: Household Water Usage**

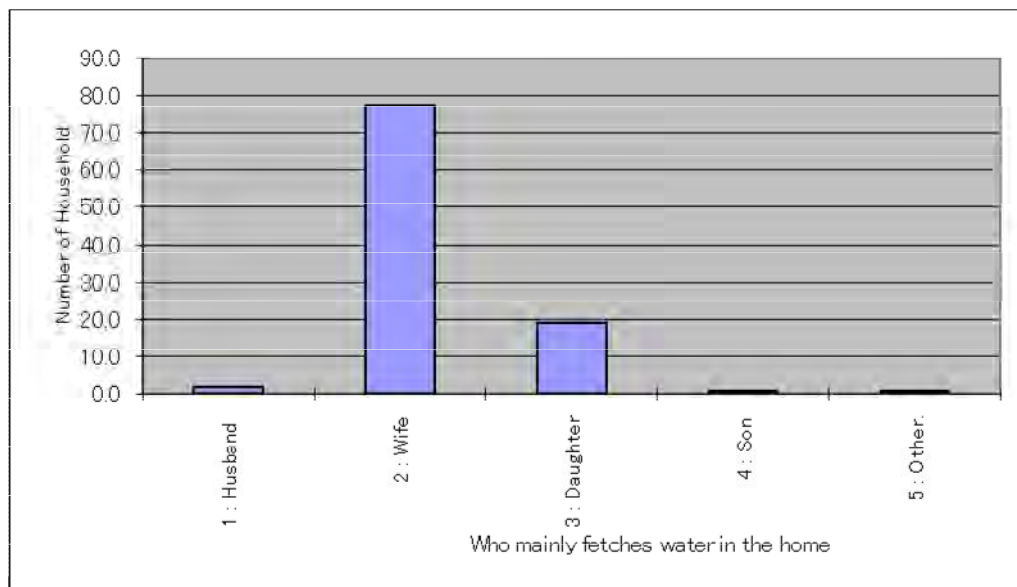
#### UWC SUPPLY TIME

Regarding the number of hours of water supply by the Urban Water Corporation, the response indicate that the average number of hour of daily supply is 6 while the range was from 1 to 12 hours. Respondents reported that although the water is supposed to come daily at the regular times, in reality it often does not come for

days. For that reason even these hours of supply are just indicative but in reality the supply is for fewer hours every week.

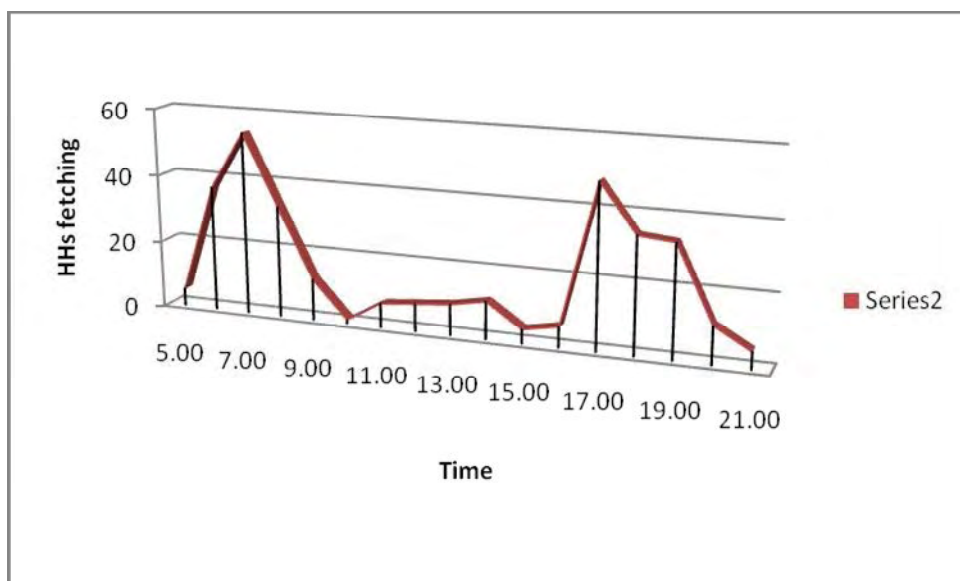
#### DISTANCE TO WATER SOURCE FOR USERS OF PUBLIC WATER TAPS AND BOREHOLES

The average distance to a public tap or borehole was reported at 163 meters but some indicated that they have to travel as long as 1,000 meters (1 km ) and some only had to travel just 2 meters. For those who have to travel long distances this means time spent away from domestic responsibilities like child care and energy spent in the process. The average time taken to fetch water from these points was reported at 2 hours per household every day. This is a huge amount of time to be spent only in getting water and it is likely to influence decisions on hygiene and sanitation negatively.



**Figure 5.5: Who Mainly Fetches Water in the Home**

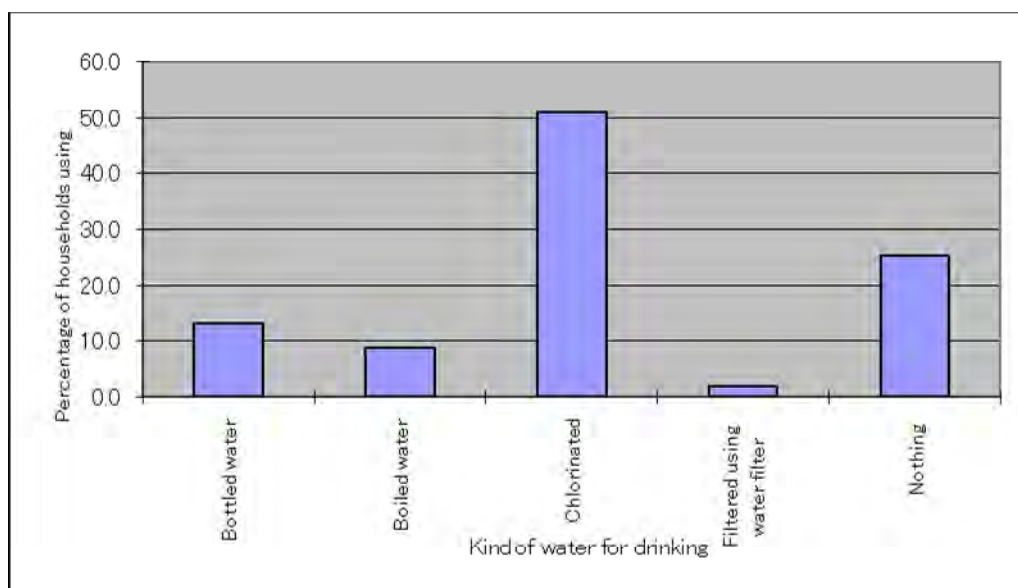
Regarding who fetches water in the home the responses indicate that it is mainly the wife as figure 5.5 above shows. Households that responded to this question were 111. Of these, over 70% indicated the person mainly responsible for fetching water in the home is the wife. Households reported fetching water at all times in the course of the day with two clear peaks at 7.00 and again at 17.00 hrs.



**Figure 5.6: Times for Fetching Water**

#### KIND OF WATER USED FOR DRINKING

On the water used for drinking, there are various options for making it safe. Most of the people reported that they treat it with chlorine to make it safe. 51% of the people who responded to this question said that they use chlorine. About 25% of the respondents indicated that they do not do anything to make the water safer. However this should not be alarming as this number includes those who use piped water from the UWC who stand at 8% of the people interviewed. Some people also use a combination of methods for instance they may use boiled water as well as bottled water. For those who use chlorination, the average number of chlorine tablets used a week was put at 17 tablets.

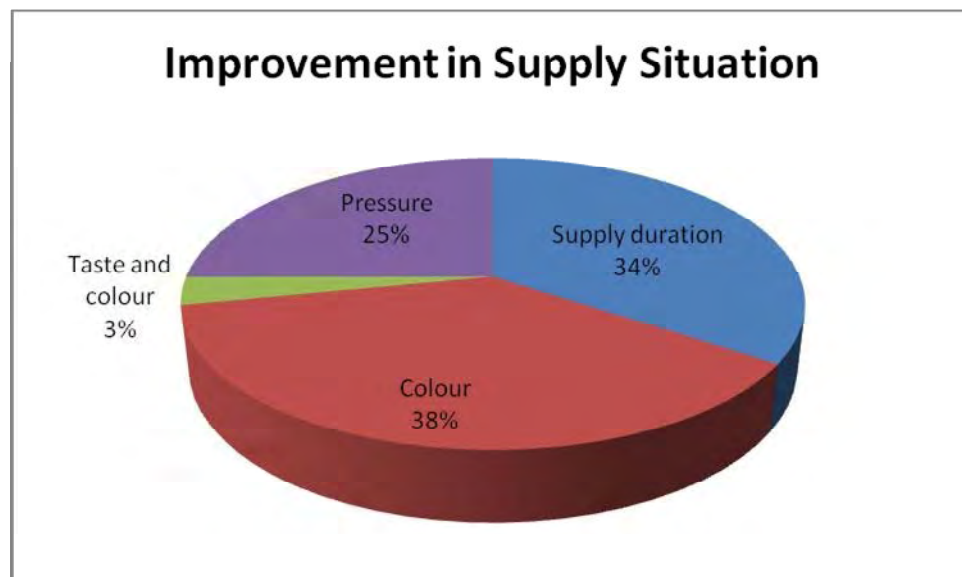


**Figure 5.7: Kind of Drinking Water Used**



### IMPROVEMENT IN PIPED WATER SUPPLY SITUATION SINCE MAY 2009

Out of the two hundred respondents, only 16 or 8% were connected to the UWC mains. Of these, 11 (69%) reported improvement in the duration of the supply, 12 (75%) reported an improvement in the color of the water while 1 (6%) reported an improvement in both the colour and the taste. 8 (50%) reported an improvement in the pressure.



**Figure 5.8: Improvement in Supply Situation Since May 2009**

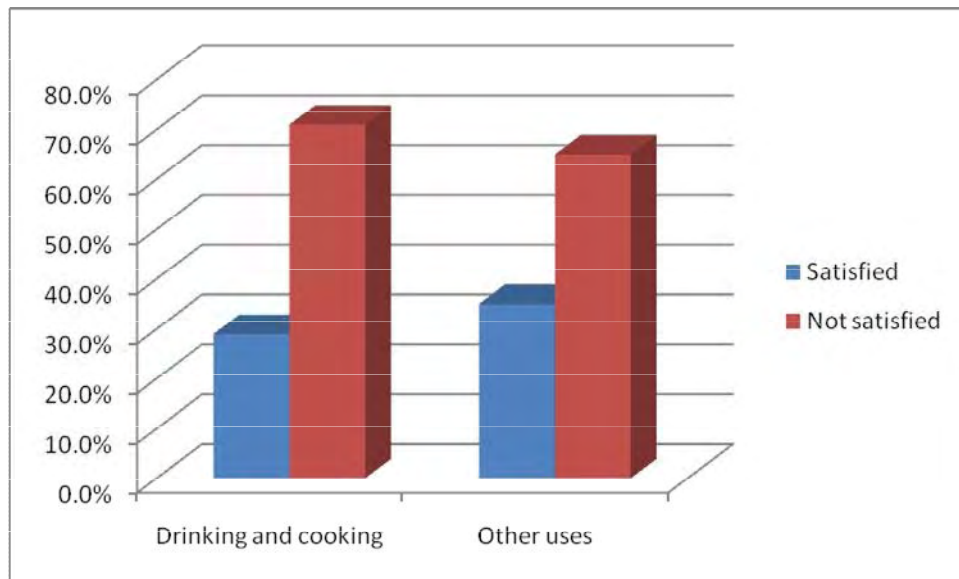
### IMPROVEMENT OF WATER SUPPLY SERVICES FOR USERS OF PUBLIC STANDS IN KATOR AND MUNUKI

Nine people reported to be getting water from the new public taps in Munuki and Kator. Of these, 1 indicated that supply duration had improved by some two hours. The rest indicated that there had not been any improvement in the supply duration. Eight out of the nine people indicated that there had been improvement in the color and odor of the water. On the price compared to before the projects in those areas, 5 out of the nine people felt that it was high while 2 felt that it was appropriate. One felt that it was too high and one felt that it is too low. In all instances the price was reported at 25 cents for a 20 litre jerry can. In general it appears that the projects in Munuki and Kator have not improved supply conditions except for making the water points nearer. However it should be noted (as our study of the public tap systems showed) that supply conditions including the supply duration and the color and odor of the water are really determined by the UWC.

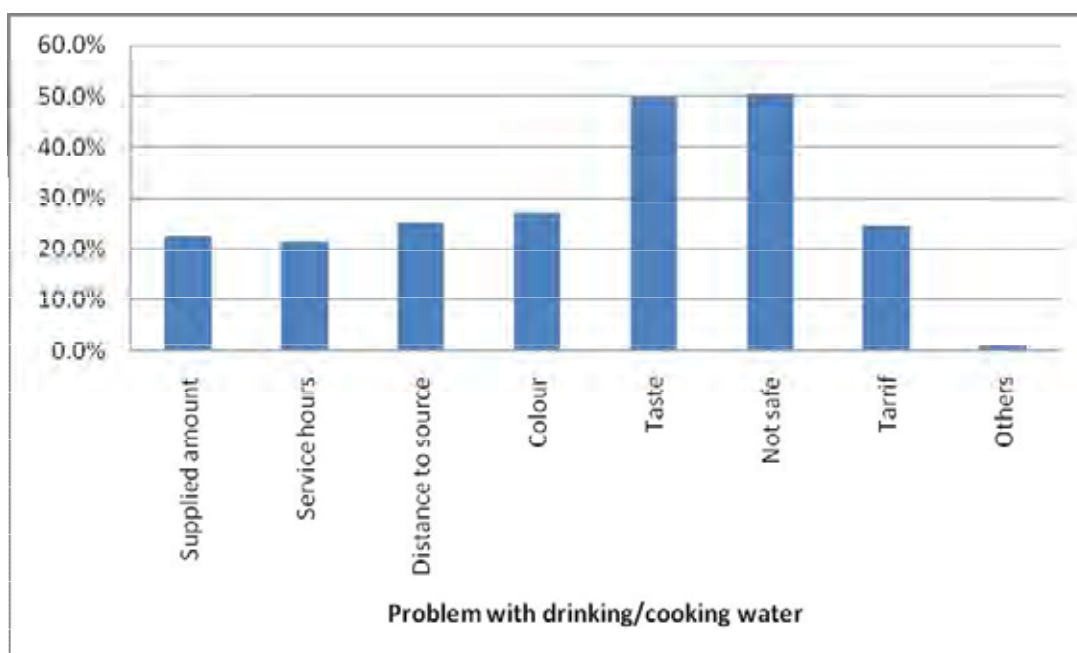
## 5: AWARENESS OF PEOPLE ABOUT WATER SUPPLY SERVICES

### SATISFACTION WITH DRINKING WATER

When respondents were asked if they are satisfied with the existing water both for drinking and cooking majority indicated that they are not satisfied. With respect to drinking water 71% said that they are not satisfied. The biggest problem with drinking water is that it is not safe. However a large proportion of the respondents also said that there is also a problem with the taste.



**Figure 5.1. Satisfaction with drinking cooking and water for other uses.**

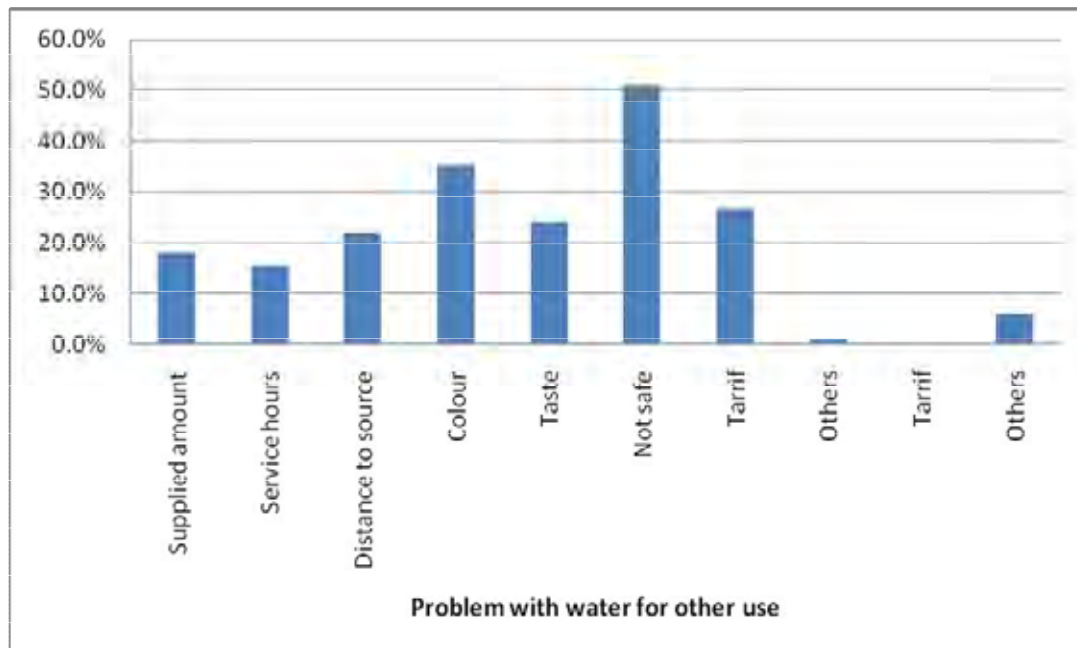


**Figure 5.2: Problem With Drinking Water**

#### SATISFACTION WITH QUALITY OF WATER FOR OTHER USES

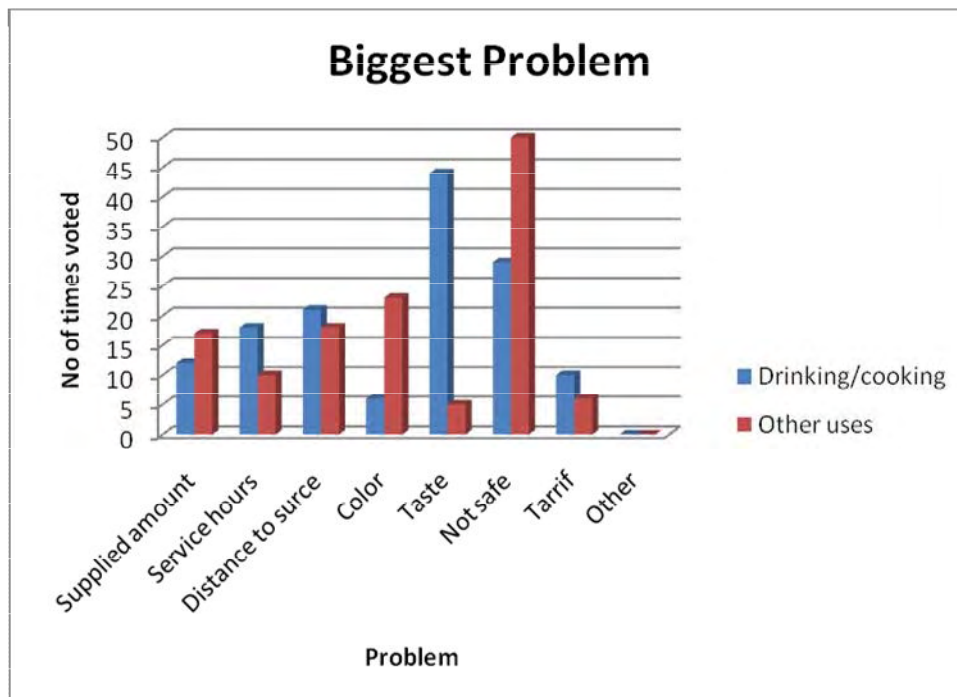
Regarding water for other uses, only 35% of the respondents said that they are satisfied with the quality. For those who are not satisfied, the problem reported most frequently is that the water is not safe at 51%. This tallies closely with the problem reported in connection with drinking water with the major concern being the safety of the water. However unlike with the drinking/cooking water the where the second most frequently

reported problem is the taste, with water for other uses, the second most frequently reported problem here is the color. The tariff and the distance to the source are third and fourth most frequently mentioned problems.



**Figure 5.3: Problem With Water for Other Uses**

But respondents were also asked to rank the problems to indicate the one they felt was the most pressing. The outcome of this ranking was as follows.



**Figure 5.4. Problem with Water for Drinking/Cooking and Other Uses**

The analysis shows that the problem voted as the biggest problem most frequently with respect to drinking water was taste. This is closely followed by the problem of 'not safe'. With respect to water for 'other uses' the problem which is most pressing is 'not safe' while the second most pressing is 'color'.

#### WILLINGNESS TO USE MORE WATER IF SERVICE IS IMPROVED AND THE PRICE REMAINS THE SAME

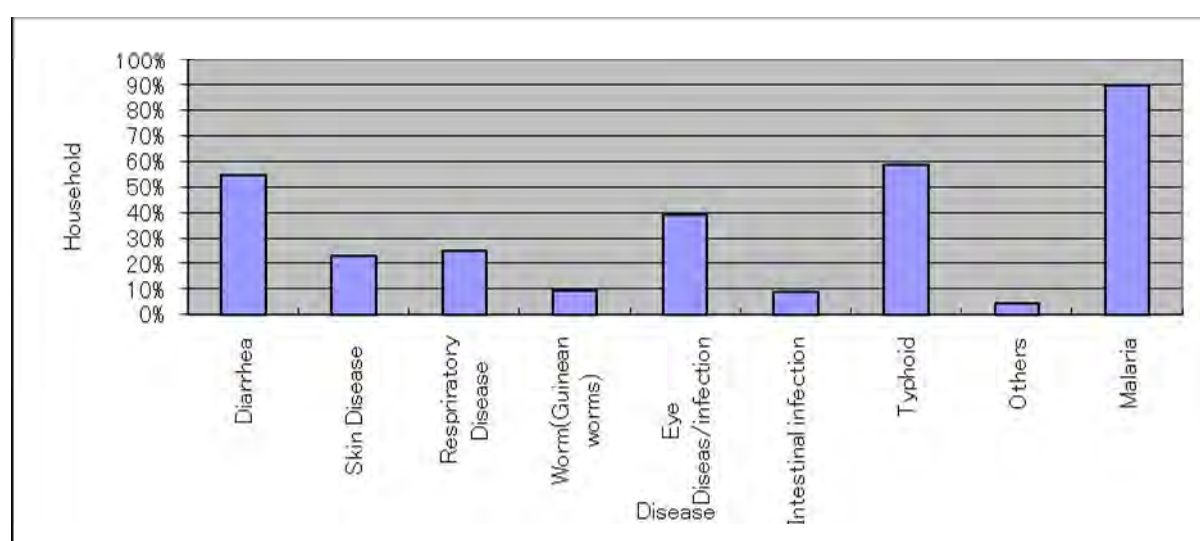
On willingness to use more water if the service is improved without raising the price, 41% of the respondents said that they would be willing to use more water. Some 59% said that they would not be willing to use more water even if the service is increased and the price remains the same. For those who are willing to use more water, the average amount they expect to use beyond what they are using at present is 159 liters per day. This is an increase of 78% percent given that the average current daily usage stands at 203 litres.

#### WILLINGNESS TO USE MORE WATER IF SERVICE IS IMPROVED AND THE PRICE LOWERED

The situation changes slightly when respondents are asked if they will be willing to use more water if the service is improved and price lowered. In this case, 52% of the respondents expressed readiness to use more water. The average increase in usage was indicated to be 170 liters per day which is a 83% increase given that the average current daily use is 203 litres. The conclusion from both the two questions above is that there is significant potential demand for water provided the quality and the price are right. Both the price and the quality of the water are significant factors in the amount demanded and improvement in both the quality and price of the water will lead to more than 50% increase in demand.

## 6. HEALTH AND HYGIENE AND SANITATION CONDITIONS

Regarding infection with water borne or water related disease in the previous year, 97% of the households reported that that one or more members had contracted one or more of the diseases. Only 3% indicated that none of the family members had contracted any of the diseases. Figure 6.1 below shows the percentage of households that reported one or more of their members to have contracted each of the diseases indicated. 90% of the households reported that at least one member got infected with malaria, 59% reported infection with typhoid while 55% reported infection with diarrhea.



**Figure 6.1: Diseases in Households**



The average total number of people affected by water borne disease and malaria in each household is 3.9 consisting of an average of 2 adults and 1.9 children. The average cost of treatment for these diseases for a household was 1,574 SDG per year.

TABLE 1.0 FAMILY DISEASES IN 2009

	Ave. Adult	Ave. Children	Ave. Total
How many persons contacted disease in this year (person/hh)	2.0	1.9	3.9

TABLE 1.3 TREATMENT COST OF FAMILY DISEASE

	Hospital	Medicine	Transportation (to Hospital)	Total
Treatment cost of disease (SDG/year)	250	985	339	1,574

## 7. WATER TANKS SERVICES

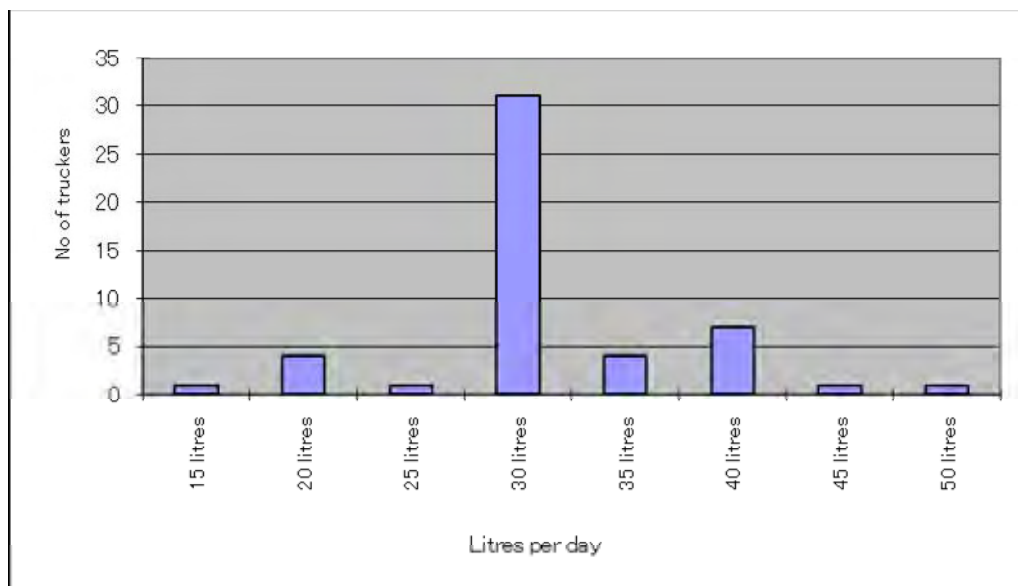
### DEMOGRAPHICS

All the operators of the water tanks interviewed were men. The average age for the respondents was 36.6 years.

### NUMBER OF WATER TANKERS SOLD A DAY

The number of tankers sold in a day varied from 2 to 6 but the average is 2.6. The capacity of the tanks also varied from 2,000 liters up to 8,000 liters with the average capacity being 3,794 litres.

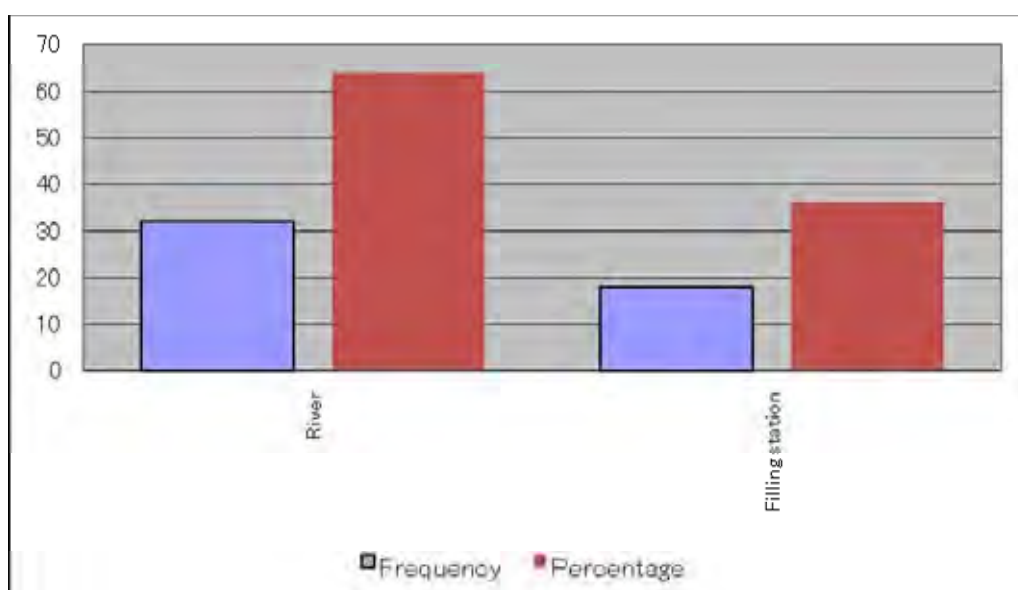
The amount of fuel used by each tanker operator also varied from 15 liters a day to 50 litres a day with most of the operators using 30 litres a day. The price of a litre of diesel was quoted by all truckers at 2.5 SDG meaning that most truckers spent around 75 SDG a day on fuel.



**Figure 7.1: Fuel Used Per Day**

#### PURCHASE AND SALE PRICE FOR WATER.

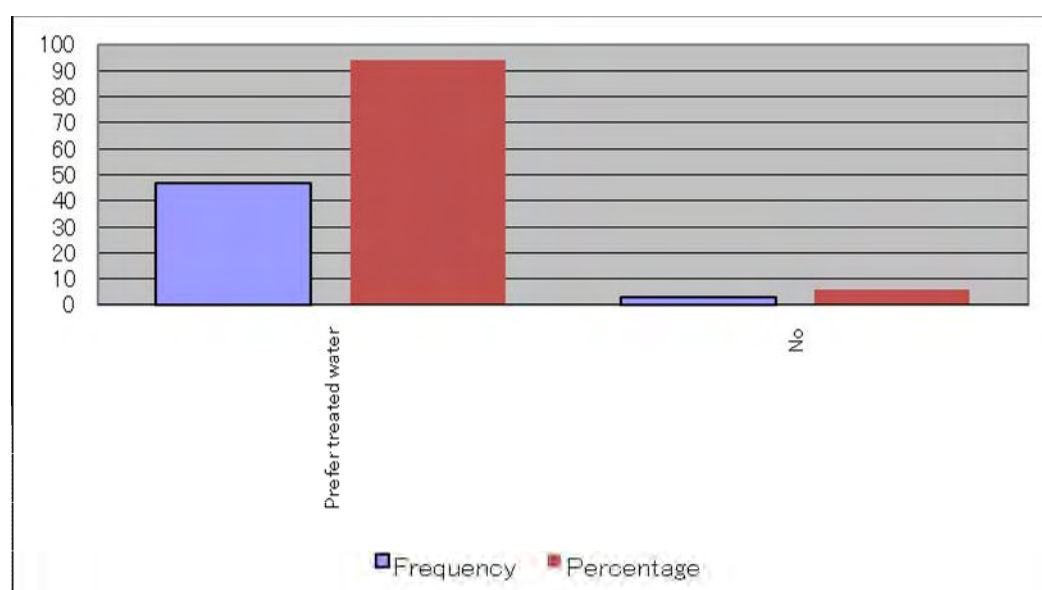
Tanker operators reported purchasing a full tank of water at between 5SDG for a 2,000 litre tank up to SDG 20 for an 8,000 litre tanker. The when tallied with the capacity of the tanker, the price varied depending on whether the water is raw water from the river or treated water from a filling station. On average the price of raw water from the river is 400 litres for one SDG while the price of treated water from a filling station is 200 litres for 1 SDG meaning that raw untreated water is approximately half the price of treated water. The number of truckers getting water from the river at 64% is however higher than those getting water from the filling stations at 36%. One of the reasons for this is the intermittent supply of water at the filling stations. The study team visited a sample of these stations and was confronted with long lines of trucks waiting for water without any certainty as to when it would come. When some of these truckers get tired of waiting they go the river and fetch the water from there.



**Figure 7.2: Source of water**

The sale price for water was reported at between SDG 4 and 5 per 200 litre drum for raw river water and SDG 6 per 200 litre drum for treated water. The average price of water when all factors are combined is SDG 4.8 per 200 litre drum. One of the factors affecting the sale price of water is the distance that the tanker has to travel to the point of sale. Truckers reported travelling between 8 Km and 180 Km for their daily sale. The average distance is 99.6 Kms.

While at present most of the truckers get their water from the river, when they were asked whether they would prefer to take treated water, the great majority at 94% said that they would prefer to take treated water as opposed to 6% who were indifferent. Surprisingly when asked if they are willing to pay a better price for treated water and a better service, only 24% answered in the affirmative. 34 % said that they are willing to pay the price they are paying now while some 42% said that they would rather pay a lower price.



**Figure 7.3: Willingness to Take Treated Water**

On whether they are willing to reduce the price if the services are improved with new filling stations and easier access to water 74% said that they are willing to reduce the price while 26% said that they are not willing to reduce the price even if services are improved. The new price was put at an average of 4.2 SDG per 200 litre drum. This is lower by only .6 of an SDG.

#### CONCLUSION ON THE WATER TANKS

Both the tanker operators and their customers are aware about the need to use treated water as evidenced by the higher price that both are willing to pay to get it. It is therefore reasonable to conclude that if more filling stations are provided it will enable more people to access treated water leading to better health and sanitation as well as reduction in the cost of treating water for domestic use. Most truckers also indicated that they would prefer to take treated water and in conversations with some of the reasons given for not doing so are the long lines at the filling stations. From the relative price of a tanker of water and the selling price of a 200 litre drum of water it is clear that the tanker business would still continue to be profitable even if the price went up a little. There is therefore the need and the effective demand for the use of any new filling stations in the near future.

