Appendix A-8

Drawings and Photos of Urgent Development Project

(Water Supply Sector)

Composition of Appendix A-8

1. Technical Specification

Technical Specification
for
Procurement of
Construction of Small-scale Water Supply System
in Malakal Town

Table of Clauses

LIST OF TERMS PAGE

1. Work Objectives

The objective of the Construction is to construct unit type treatment plant, Elevated Tank, distribution tank and Public Tap, which may provide potable water to beneficiaries in South and East Zone in Malakal town.

The construction-sites of the main facility of Project including Unit Type Treatment Plant, Elevated Tanks, distribution tank ,Public Taps and the sites of other related facilities are shown in Appendix 'Drawing No.1 of 12'.

2. Scope of Urgent Small-Scale Water Supply Development Project

The Contractor's works to be rendered under this Contract shall consist of the following items in the Contract Documents;

Scheme 1: Service by Water Truck

Pure-water treated by Unit Type Treatment Plant shall be transported by water trucks to small scale Elevated Tanks which will be located nearby new Public Taps and supplied to it in gravity. Dwellers will receive safe and stable water from Pubic Taps.

Capacity of Unit Type Treatment Plant is 150 cubic meters per day, which covers water demand for scheme 1 and scheme 2.

Scheme 2: Service through Pipe System

Water shall be supplied to dwellers through piped scheme in the particular service area where road is inaccessible during rainy season. Pure-water treated by unit type plant is lifted to Elevated Tank and supplied to each tap in gravity.

In addition, Project includes the procurement service for urgent support project of water supply as Scheme 0.

Inscription plates, approximately 100mm x 200mm, shall be furnished and monumentalized at Unit Type Treatment Plant, Elevated Tank, Kiosk and every Public Taps in accordance with the direction by the Employer. The material may be stainless steel or other material approved by Project Manager and the design, wording and style shall be directed by Employer. No separate payment will be made for the inscription plates, the relevant cost being included in the rates of the Bill of Quantities for each other works.

Basic Condition of each scheme is shown in Table -1.

Table- 1 Basic Condition of Each Scheme

	Scheme 1	Scheme 2
Approximate Population(potential beneficiaries)	3,000	3,000
Assumed Water Consumption per capita a day (Litter)	20	20
Assumed total water	60	60

demand a day (m3)		
Source of treated water	New Unit Type Treatment Plant	New Unit Type Treatment Plant

The scope of work for each scheme is shown in Table -2.

Table - 2 Scope of Work of Each Scheme

	Items	Outline
Procurement Works		
Scheme 0	<Scheme 0-1> Materials for Soft Components	1. Token (Coins) 10 plastic coins per bag × 2000 bags 2. Coin box with lock ×66 sets
	<Scheme 0-2> Laboratory Materials for Unit Type Treatment Plant	Details refer to Section 7 Bill of Quantities Scheme 0-2 Laboratory Material for Unit Treatment Plant
	<Scheme 0-3> Chemicals, Fuel and Material for Urgent Supply Taps	1. Aluminum Sulfate (Al_2O_3 approx.14wt%) 1,500kg 2. Soda Ash (Na2CO3 approx. 98wt%) 350kg 3. Calcium Hypochlorite (Available Chlorine approx.70%) 150kg 4. Fuel for engine pumps and generator (Diesel Oil) 20m^3 5. Fuel for water truck (Diesel Oil) 8.5m^3 etc. Details shall refer to Section 6 Annex 2
Construction Works		
Scheme 1	<Scheme 1-1> Unit Type Treatment Plant	Capacity : 150m3/day×1 set Operating Time : 12 hours Water Source : Nile River Process : Floating Intake + Coagulation and Sedimentation + Sand Filtration + Activated Carbon Filtration + Chlorine Disinfection Design water quality : <Raw water > Turbidity; At High Condition Max.500NTU, Max.24hours At Normal Condition Normal. 100NTU or less <Treated water> Turbidity 5NTU or less Color 15TCU or less
	<Scheme 1-2> Small Scale Elevated Tank+ Public Taps	5m3 (Height 3m)×12 sets 4 faucet typed Public Taps ×12 sets (including service pipe)

Scheme 2	Distribution Pipes (Approx. 5km) + Elevated Tank (1 set)+ Public Taps (10 sets)	1.Distribution Pipes Total length 5,019m Dia.40mm ×369m Material: PE (PN10) Dia.50mm ×1,380m Material: PE (PN10) Dia. 75mm×2,112m Material: PE (PN10) Dia. 100mm×708m Material: PE (PN10) Dia. 150mm×450m Material: PE (PN10) ※Including pipe culvert(L=25m) for Dia.150mm 2.Elevated Tank 5m3 ×4 tanks (Height 7m) 1set 3.Public Taps Faucet typed Public Taps ×10 sets 4.Piping Works

The scope of the Work may be amended and modified pursuant to mutual agreement in writing under the Contract.

3. Contract Price

1) All prices shall be quoted in USD without exception. Contract prices shall be firm and final except Scheme 2.
2) Contract prices shall include all necessary scope of Urgent Small-Scale Water Supply Development Project
3) Type of work for each scheme is as follows;

Type of work for Each Scheme

Procurement Works	
Scheme 0-1	Materials for Soft Component
Scheme 0-2	Laboratory Material for Unit Type Treatment Plant
Scheme 0-3	Chemicals, Fuel and Materials for Urgent Supply Project
Construction Works	
Scheme 1-1	Unit Type Treatment Plant
Scheme 1-2	Small Scale Elevated Tank + Public Taps
Scheme 2	Distribution Pipe + Elevated Tank + Public Taps

4) Regarding procurement works, the contract price shall include manufactured, equipped, shipped, transported and insurance etc. completed in accordance with the provision of Contract Documents
The final quantities of the Works may be revised subject to final on-site inspection during the Construction and/or requirement by the end user. In such a case, it is considered that contract price is changed based on the unit price at the time of the contract.
Breakdown cost described in Form of bidding shall be applied to evaluation of bidding price and cost quotation in case quantities of work are revised in Project.

5) Regarding construction works, the contract price shall include site survey, land preparation, design and supply for temporary works, permanent installation materials, performance test, transportation, insurance and all other things required in and for Project implementation in due conformity with the Contract Documents.

Contract price shall include all the necessary Works, not only described in the contract document but also which the Contractor may find any doubts on specifications, drawings and any inappropriateness for the site.
The final quantities of the Works may be revised subject to final on-siteon-site inspection during the Construction and/or requirement by the end user. In such a case,, it is considered that contract price is changed based on the unit price at the time of the contract. (The article is applied to pipe installation work etc.)
Breakdown cost described in CONTRACT PRICE SCHEDULE (BQ) shall be applied to cost quotation in case quantities of work are revised in Project.

6) Regarding especially in mechanical works, electrical works and piping works of Unit Type Treatment Plant (Scheme 1-1), draft of flow sheet, general layout and draft of design calculation paper for Unit Type Treatment Plant, which Project Manager is supposed to adopt in Project, are attached in Section 8 ' Drawings'Appendix Drwing No.2 of 12'.
In addition to article 5), contract lump sum prices in the BQ price of mechanical works, electrical work and piping work of Unit Type Treatment Plant (Scheme 1-1) shall include all the necessary Works, not only described in the contract document but also which the Contractor may find any doubts on specifications, drawings and any inappropriateness for the site including any necessary valves and /or drains which the Contractor needs but are not described in (draft of) flow sheet and/or general layout attached in the bidding documents. The Contractor shall prepare and submit the flow sheet and general layout at the bid submission, which the Contractor is supposed to deliver for Project.
Breakdown cost described in CONTRACT PRICE SCHEDULE (BQ) shall be applied to cost quotation, should the quantities of work or Project scope be revised in Project.

4. Specifications

4.0 General Requirements

The Contractor shall comply with the following general requirements. Items described in 4.0 General Requirements shall be allied to all the Construction Works in Project.

4.0.1 Temporary Works

(1) Mobilization and Demobilization

1) Description

This work shall consist of moving, transportation, fabrication and, equipment to Project and performing all works necessary before the commencement of the work at Project Site and removing of the same upon completion of the Work.

2) Construction Method

Before commencement of the work, the Contractor shall submit the schedule of construction plans and equipment to Project Manager in accordance with the requirements of the Contract.
During the period of the Contract, the Contractor shall maintain, at the site, equipment in accordance with the schedule by replacing alternatives or additional items approved by Project Manager.
Where this Specification prescribes specific type of equipment to be used or specific procedure to be followed, the Contractor may submit alternative proposals to Project Manager for approval. If when it is demonstrated that equal results are obtained by the use of such alternatives, Project Manager may approve them.

(2) Establishment

1) Description

This work shall consist of furnishing, installing, maintaining, removing establishments and site reconnaissance and shall include clean up the site on completing.

2) Construction Method

a. Contractor's Office

The Contractor shall provide and maintain such facilities as are necessary for the accommodation and messing of his employees. The Contractor shall make his own arrangements for the area required to construct accommodation and messing facilities for his employees. The location and area of such land

shall be appropriate to the intended use and shall be subject to the approval of Project Manager. Such work shall not be commenced without prior approval of Project Manager.
The Contractor shall bear cost of water supply and electric utility to the office and works areas and provide reticulation systems to office and work sites.
The Contractor shall pay attention to keep clean condition surrounding construction-site and office.
Upon completion of the work or direction of Project Manager, the Contractor's Office, constructed or erected by the Contractor shall be dismantled and removed from the Site or otherwise disposed of, all services disconnected, all pits and other excavation shall be neatly filled in, all overhead lines shall be removed and office left in a clean and tidy condition to the satisfaction of Project Manager.

b. Work sites for Contractor's Construction Facilities and Services, Borrow Areas, Disposal Area

The Contractor shall make his own arrangements for required works areas to be used. The location of areas to be used as works areas shall be subject to the approval of Project Manager.
Unless otherwise approved or directed by Project Manager, the Contractor shall confine all workshops, storage and similar facilities to the area approved for use as a works area.
Upon completion of the permanent work or direction of the Consultant, the Contractor's Construction Facilities and Services, Borrow Areas, Disposal Area utilized, constructed or erected by the Contractor shall be dismantled and removed from the Site or otherwise disposed of, all pits and other excavation shall be neatly filled in, cut off, trimmed, graded and left in a clean and tidy condition to the satisfaction of the Consultant.

c. Site Reconnaissance

The Contractor shall join in site reconnaissance prior to commencement of construction and during construction in accordance with the requirements of the Contract.
The Contractor shall submit implementation schedule and specifications of the work proposed to Project Manager for approval.

d. Notice Board

The Contractor may erect six construction project notice boards on the Site provided they are constructed of durable materials. The number, wording, style and location of the notice boards and method of support and fixing shall be as approved by the Consultant.

e. Safety Measures

In the performance of the works, the Contractor shall exercise every reasonable precaution to protect from injury to persons or property. The Contractor shall erect and maintain all necessary temporary fencing, barricades, barriers, signs and lights and provide fire extinguishers at locations as required. The Contractor shall adopt and enforce such rules and regulations as may be necessary, desirable or proper to safeguard the public, all persons engaged in the work and its supervision with helmets, barricade, etc. The Contractor shall appoint a safety officer and hold regular safety meetings with the Consultant and with his own supervisors.

f. Temporary Fencing

The Contractor shall erect, maintain and remove suitable and temporary fencing to enclose such areas of the work and all areas of land occupied by the Contractor within the site as may be necessary to implement his obligations under the Contract, to the satisfaction of Project Manager.

g. Traffic Control Devices

All traffic control devices necessary for the safety shall be properly placed and in operation before any construction is allowed to start. When work of a progressive nature is involved, such as resurfacing a road under traffic, the necessary signs shall be moved concurrently with advancing operation.

h. Permits and Licenses

The Contractor shall procure all permits and licenses, pay all charges, fees incidental to the due and lawful prosecution of the work.

4.0.2 Pipe Laying Works

(1) Pipe laying

1) Description

This work shall define distribution pipe laying in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

2) Material

Polyethylene pipes, tees, caps and reducers and their fittings shall be used for pipe laying. Nominal pressure is PN10 in public road. Nominal pressure is PN10 as well expect the pipe which is used in the site of the until plant treatment plant. In addition, in case of the road crossing of pipelines, polyethylene pipes shall also be used with concrete pipe culvert which will protect the pipelines from the live-load. On the other hand the galvanized pipes (GS) should be used for pipelines to be exposed in the site.

3) Construction Method

The proposed pipelines are laid at position of 80cm in covering depth as shown in the drawing. Location of tees, reducers and plug caps shall be directed by Project Manager. Connection point to the existing pipelines should be confirmed under observation of SSUWC-Malakal and Project Manager.

(2) Excavation

1) Description

This work shall define excavation for pipe laying in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

2) Construction Method

Basically, trench for pipe laying shall be made by using machinery, but in case of that excavator cannot accessible to the site, the trench shall be made by manual.
Prior to starting the work, any standing water shall be dewatered.
Excavation depth depends on pipe diameter in the covering depth of 80cm. Trench for laying pipes shall be excavated in width of 60cm
During construction, the Contractor shall maintain the work area in such way that they will be free draining.
Undesirable materials such as stone, roots, refuse, weeds, stumps, stones and other unsuitable debris should be removed from the trench to be excavated.

3) Back-filling

a. Description

This work shall define the back-filling of sand and soil in the trench for pipe laying in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

b. Construction Method

In order to protect pipeline, sand shall be back-filled in thickness of 5cm from the bottom of the trench and 15cm from the top of the pipes. After back-filling sand, excavated soil shall be back-filled in principle. However, if excavated soil cannot be applied for back-filling due to soft and damp soil, fine quality soil should be back-filled into the trench of pipelines. In order to clarify pipe position, it is recommended that marker sheets are buried in 30cm from the top of pipes.

4) Compaction

a. Description

This work shall define the compaction for the back-filled soil in the trench for pipe laying in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

b. Construction Method

After back-filling sand and soil, back-filled soil shall be compacted by using compactor sufficiently so as to avoid ground subsidence. Compaction should be done in thickness of every 30cm.

5) Disposal

a. Description

This work shall define the disposal of soft, damp and dispensable soil which will be excavated for pipe laying and installation of the Unit Type Treatment Plant and other facilities in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

b. Construction Method

Regarding the trench for pipe laying, soil to be replaced with sand, soft and damp soil shall be disposed in the appropriate dump site which is authorized by Upper Nile State Government.
Meanwhile, the soil to be excavated at the site for the Unit Type Treatment Plant and other facilities shall be utilized for back-filling in principle. However, soft, damp and dispensable soil should be disposed as well.

6) Dewatering

a. Description

This work shall define the dewatering in the trench for pipe laying in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

b. Construction Method

In case of that groundwater is observed in the trench after excavation, it should be dewatered by using engine pumps, etc. definitely prior to the back-filling of sand and soil.

7) Maker Sheet

a. Description

This work shall define the maker sheet installed with distribution pipe lying in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

b. Method

The Contractor shall install maker sheet, the size of which is approx. Width 150mm as indicated in Appendix ' Drawing No.10 of 12'.

8) Water Pressure Test

This work shall define the water pressure test of the pipelines to be laid in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

a. Method

The Contractor shall conduct the water pressure test for 2-3 hours in the morning, afternoon and evening respectively after completion of pipes lying. Water pressure gauge shall be equipped with drain pipe. Measures of the water pressure test are as follows:

a. 0.75Mpa shall be pressurized in the pipelines.
b. Five minutes after pressurizing as per 'A', water in the pipes shall be pressurized to 0.75Mpa again.
c. Water pressure shall be reduced to 0.5Mpa on pressurizing as per 'B' and measured for an hour.
d. If water pressure is kept being at least 0.4Mpa, result of the water pressure is acceptable.
e. While, if it is kept being less than 0.4Mpa, water pressure shall be measure for 24hours in principle.
f. After 24hour-measure, if the water pressure is at least 0.3Mpa, it is acceptable. If it is less than 0.3Mpa, the result is not acceptable.

4.0.3 Installation of valve and flow meter

(1) Installation of valve and flow meter

1) Description

This work shall define installation of the control valves, wash-out valves and flow meters in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

2) Materials

The bronze and PVC made, etc. are preferable as material of valves. FC made, etc. as material of flow meter.

The ready-made chambers of valve and flow meter will be on the market in Malakal, Juba and Nairobi and so on. If there is no the ready-made chamber, the Contractor will discuss the use of mass concrete in situ with Project Manager.

3) Construction Method

Sluice valves, wash-out valves and flow meters with their chambers shall be installed in specified location in the public road and at the Elevated Tank for maintenance purpose. Location of sluice valves to be installed is as shown in the drawings, and that of wash-out valve shall be directed by Project Manager.

(2) Earth Work for installation of valve and flow meter

1) Description

This work shall define earth work such as excavation, back-filling compaction and disposal on the installation of the chambers of valves and flow meters in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

2) Construction Method

In order to install valve & flow meter chambers, the designated site shall be excavated by using machinery and / or in manual.

After installation of chamber, some parts of the land shall be back-filled with fine quality soil properly.

When back-filled, all surface objects and all trees, stumps and other protruding obstructions, not to be designated to remain, shall be cleared and/or grubbed, including mowing, as required, except undisturbed stumps and non-perishable solid objects.

After back-filling soil, back-filled soil shall be compacted by using compactor sufficiently so as to avoid ground subsidence.

The soil to be excavated at the site for the chamber installation shall be utilized for back-filling in principle. However, soft, damp and dispensable soil should be disposed as well.

4.0.4 Construction of Public Tap

1) Description

This work shall define installation of Public Tap, water meter & gate valve with their chamber to be installed around the tap in the designated sites in accordance with the requirement of the Contract, and as directed by Project Manager.

2) Material

Concrete used for construction should be referred to the General Specification and the drawings.

The ready-made chambers of valve & water meter will be on the market in Malakal, Juba and Nairobi and so on. If there is no the ready-made chamber, the Contractor will discuss the use of mass concrete in situ with Project Manager.

Pipelines and their fittings which are put in the Public Tap and its surrounding should be GS.

3) Construction Method

Four (4) faucets with drain shall be constructed in the designated compound of public facilities. Reference structure of Public Taps is shown in the drawing. The location of Public Taps may slightly be changed in accordance with site situation. After construction of the Public Taps, logo marks of SSUWC & JICA and surface plate shall be painted on the Public Taps.

Public Taps are composed of two (2) sides of two (2) faucets positioned on the one-sided. Tap diameters shall be proposed in 25mm.

Drain with gravel shall be constructed surrounding Public Taps. In addition, water meters and gate valves of 40mm and their chambers shall be installed at the inlet of Public Taps.

Flag of South Sudan

Logo mark of SSUWC

4.1 Scheme 0

4.1.1 Scheme 0-1 Materials for Soft Component

Materials for Soft component is consist of the following items;

1) Token (Coins)
   10 plastic coins (dia: 35mm x thick: 2.5mm) per bag and 2,000bags made of cloth will be procured by the Contractor. They will be utilized for water tariff collection. Please refer to the picture below;
2) Mobile coin box with lock
   Steel materials (e.g. 30mm x 200mm x 150mm) will be utilized for water tariff collection. Please refer to the picture below;

Token made of plastic
(Dia. 35mmx thickness:

Not Actual Size

Cloth-bag

Not Actual Size

Token box

The Contractor shall submit specification and quantities for delivery of each material to Project Manager for approval before commencement of the work.

4.1.2 Scheme 0-2 Laboratory Material for Unit Type Treatment Plant

Laboratory material procurement works are consisted of procurement works of laboratory material for Unit Type Treatment Plant describe in Annex 1.

The Contractor shall submit specification and quantities for delivery of each material described in Annex 1 to Project Manager for final approval before commencement of the work.

4.1.3 Scheme 0-3 Chemicals, Fuel and Materials for Urgent Supply Project

Chemicals procurement works are consisted of procurement works of chemicals and fuel for unit type treatment, engine pump for transmission of water and fuel for water truck described in Annex 2.

The Contractor shall submit specification and quantities for delivery of each material described in Annex 2 to Project Manager for approval before commencement of the work.

4.2 Scheme 1

4.2.1 Scheme 1-1 Unit Type Treatment Plant

(1) General Requirements

Unit Type Treatment Plant is consisted of civil and buildings works, mechanical works, electrical works and piping works described in (2) Specification.

Considering strict condition of construction-site, the Contractor shall adopt the water treatment plants which it is easy to install at site.

Project Manager supposes that unit treatment plant which sustain for approximate 5 years is applied in this project.

(Draft of)Flow sheet, general layout and draft of design calculation paper regarding Unit Type Treatment Plant for the project, which Project Manager is supposed to adopt and the basic concept of design for unit typed treatment plant is approved by Project Manager, are attached in Section 8 'Drawings' in bidding documents.

All materials, plant, equipment and testing apparatus and methods to be furnished by the Contractor in this Contract shall conform to the requirements of ISO (International Standardization Organization) or other equivalent standard approved by Project Manager

As reference, water quality of raw water which is conducted by Project Manager is attached in Section 8 'Drawings' in bidding documents. Project Manager supposes that main target items for water treatment are turbidity and fecal bacteria; therefore they can be treated by sedimentation with coagulant, sand filtration and disinfection.

The Contractor shall check/ verify all specification and drawing described in the Bidding Document. The Contractor shall revise all necessary specification, design and design to be attached in the Bidding Document

(2) Specifications

(2)-1 Civil and Buildings Works

Civil and building works are consisted of all related works including site preparation, excavation, embankment dewatering, backfilling , disposal of surplus materials, procurement, installation, joint cutting etc. of reinforced concrete and acceptance test regarding the following items;

1) Land Preparation Work
2) Base concrete on the site of intake pump and Unit Type Treatment Plant (Except for Back Washing Water Tank Approx. Total 745m2, t=0.2m, Back Washing Tank Approx. Total 56m2, t=1.2m) + Drain Pit
3) House for intake pump (Approx. 5m ×3m)
   ※ At least it is required that rain and wind can be blocked but heat never be accumulated.
4) House for electrical room (Approx. 8m ×5m)
   ※ At least it is required that rain and wind can be blocked but heat never be accumulated.
5) House for laboratory (Approx. 8m ×5m)
   ※ At least the house requires electrical light, socket for electricity （240V）, ventilation, and window such as unit house.
6) Sink (Approx. 1m ×0.5m)
   ※ The sink for washing muddy boots using cleaning water
7) Fence (Approx. 166m)
   ※ Fence + barbed wire shall be installed around the project site (Refer to Section 8 'Drawings' Appendix 'Drawing No.3 of 12')

The Contractor shall submit shop drawing of each work mentioned above to Project Manager for approval before commencement of the work.

Note:

Regarding specification of civil and building works, items to be required are shown below;

1) The land preparation works includes demolishment and mobilization of vinyl bladder with dram cans, a stand pipe (Public Taps) and poly-tank for chemical dosing on the construction-site.
   In addition, the work includes banking and land grading with soil of good quality on coastal side of Nile river in the construction-site, the area of which is 20mL×50mW, layer thickness of which is t= 0.0-2.0m.
2) It is supposed that the thickness of base concrete (Except for the site of back washing tank) is approx. 200mm and approx. ϕ 6mm iron bar of approx. 3kg per 1 m2 is installed in the concrete base. Base concrete for back washing tank refer to Section 8 'Drawings' Appendix 'Drawing No.4 of 12'.

(2)-2 Mechanical Works

Mechanical works are consisted of all related works including procurement, installation, commissioning test, and acceptance test of the following items. Each items for the works shall include necessary steps, mount, handrail and support etc.

Details of specification and quantities which is supposed to be applied by Project Manager shall refer to Section 8 'Drawings' Appendix 'Drawing No.2 of 12'.
Necessary instruments such as pressure gage, flow meter shall be proposed and installed by the Contractor.
Basically it is supposed that not with automatic operation but with manual operation is applied to all the machines, electrical products, valves and instruments etc. to escape the breakdown of them.

The Contractor shall submit shop drawing of each equipment and materials etc. to Project Manager for approval before commencement of the work.

1) Intake Device

2) Intake Pump
3) Settling Tank
4) Aluminum Sulfate Solution Tank
5) Soda Ash Solution Tank
6) Raw Water Pump for Sand Filter
7) Sand Filter Unit
8) Activated Carbon Filter
9) Receiving Tank for Backwashing (Refer to Section 8 'Drawings' Appendix' Drawing No.4 of 12')
10) High Lift Pump for Backwashing Water
11) Backwashing Water Tank
12) Clean Water Tank
13) Calcium Hypochlorite Solution Tank
14) Receiving Tank for Cleaning Water
15) Transmission Pump for Clean Water Tank
16) Cleaning Water Tank
17) Submergible Pump for Cleaning Water
18) Transmission Pump

Note:

Regarding specification of mechanical works, items to be required are shown below;

1) Regarding 1)Intake Device, reference drawing of intake device which is supposed to be applied by Project Manager in the project is attached in Annex 3 Table 1.
2) 6) Raw Water Pump for Sand filter, 10) High Lift Pump for Backwashing Water and 18) Transmission Pump shall include one stand-by pump against each pump (stored in warehouse).
3) Pump and agitator shall include the consumable parts for one year.
4) 2) Inlet of intake pump,6) raw water pump for filter and 18)Transmission Pump shall install pressure gage (Bourdon type) .
5) 3) Settling tank shall take anti-corrosion for steeled tank, for example plastic sheet is attached inside tank.
6) Regarding 7) Sand Filter Unit, the following specification shall be applied;

① Capacity 150m3/day at 12 hours operation
② Number of unit 1 unit
③ Planned Water Quality

	Turbidity (NTU)
Inlet of Sand Filter	Average 5
Outlet of Sand Filter	5 or less

※Supernatant after coagulation and sedimentation is filtrated by sand filter.
Please refer to attached flow sheet (Draft) in Section 8 'Drawings'.

④ Recovery rate as treated water 80% or more

※Recovery rate by both sand filter and activated carbon filter

⑤ Type Vertical type or horizontal type
⑥ Filtration velocity 120m/day or less
⑦ Kind of Media Anthracite + Silica Sand + Gravel (for support)
⑧ Effective Dia.: Anthracite 0.9～1.4mm, Silica Sand 0.45～0.6mm
⑨ Uniformity Coefficient:
Anthracite 1.5 or less, Silica Sand 1.5 or less
⑩ Thickness: Anthracite 200～500mm, Silica Sand 300～500mm
⑪ Backwash Velocity: 0.6～0.9m3/min・m2
⑫ Operation Mode, Methods for backwashing
Filtration is manually operated using raw water pump.
Flow rate is controlled with manual butterfly value etc.
Backwashing is manually operated approximate once per 12 hours using backwashing pump.
⑬ Material
Main vessel Steel with paint for anti-corrosion or more

※Each standard material against anti-corrosion at the part of inner tank, external tank, internal pipe and external pipe shall be proposed .

⑭ Accessory
Pressure gage to measure pressure drop of media
⑮ Note
Price shall include necessary media such as anthracite and silica sand etc. In addition 1m3 of each media installed in the filter shall be provided for spare.

7) Regarding 8) Activated Carbon Filter Unit, the following specification shall be applied.
① Capacity 150m3/day at 12 hours operation
② Number of unit 1 unit
③ Planned Water Quality

	Color (TCU)
Inlet of Activated Carbon Filter	Average 50
Outlet of Activated Carbon Filter	15 or less

※Filtrated water after coagulation and sedimentation by sand filter is filtrated by activated carbon filter.
④ Recovery rate as treated water 80% or more
※Recovery rate by both sand filter and activated carbon filter

⑤ Type Vertical type or horizontal type
⑥ Filtration velocity 120m/day or less
⑦ Kind of Media Granular activated carbon
⑧ Effective Dia.: 1.0～1.2mm
⑨ Uniformity Coefficient:1.3 or less
⑩ Thickness: 700mm or more
⑪ Backwash Velocity: 0.6～0.9m3/min・m2
⑫ Operation Mode, Methods for backwashing
Filtration is manually operated using raw water pump. Flow rate is controlled with manual butterfly value etc. Backwashing is manually operated approximate once per 12 hours using backwashing pump.
⑬ Material
Main vessel Steel with paint for anti-corrosion or more
※Each standard material against anti-corrosion at the parts of inner tank, external tank, internal pipe and external pipe shall be proposed.
⑭ Accessory
Pressure gage to measure pressure drop of media
⑮ Note
Price shall include necessary media such as granular activated carbon. In addition 1m3 of each media installed in the filter shall be provided for spare.

8) 18) Transmission Pump shall adopt the following specification,
① Type Diesel Engine Pump
② Capacity 0.19m3/min×15mH
③ Qty. 2 units (Including 1 stand-by)
※The house to prevent the rain shall be installed.

(2)-3 Electrical Works
Electrical works are consisted of all related works including procurement, installation, commissioning test, trial operation and acceptance test of the following products.
The Contractor shall submit shop drawing of each work mentioned above to Project Manager for approval before commencement of the work.

① Diesel Generator (25kVA or more, Power voltage 415-240V)
② Power receiving and distribution Panel
③ Machine switch box for raw water pump etc.
④ Cabling works
⑤ Earthing works

Note;

1) Regarding 1) Diesel generator, the following specification shall be applied.

① Type : Diesel Engine, 3-phase AC power generator
② Capacity : 25kVA
③ Quantity : 1 set
④ Power system : 415-240V 3 ϕ , 4 lines, 50Hz
⑤ Incidental Equipment: Consumable parts for one year

2) Regarding 2) Power receiving and distribution panel is the panel which receive the electrical power (415V) from the generator and distribute raw water pump for filter, high lift pump for backwashing water, the other pumps, agitator, electricity for laboratory house including light etc.

Following specification for the panel shall be applied.

① Receiving Method : 415V 3 ϕ , 4 lines, 50Hz
② Distributing Method : 415-240V 3 ϕ , 4 lines, 50Hz
③ Quantity : 1 set

All the necessary mold case circuit breaker (MCCB), earth leakage circuit breaker (ELCB), protector for motor etc. shall be installed. 1 sets of MCCB (3P,30AF) for spare shall be installed.

3) Regarding 4) Cabling work, cables and wires shall be laid in conduit pipes, cable pit, cable trays and racks. The Contractor shall design and adopt the appropriate cable specification, cable route including conduit pipe and/or racks etc. installation which secure the movement line. Shop drawing and specification shall be approved by Project Manager before commencement of the work.

4) Regarding 5) Earthing works, earthing system shall be designed based on the soil respectively to be measured at the Contractor. Applied limitations shall be as follows;
-For power supply (415V) less than 10 ohm
-For instrument less than 10 ohm

(2)-4 Piping Works

Piping works are consisted of all related works including procurement, installation of pipes and valves, pipe support and instruments etc. regarding the following items;

1) Piping Works 1set
2) Kiosk for Water Truck (1 set) and Gantry for Water Truck (2 sets)
3) Instruments

Note:

1) Regarding 1) Piping Works, the works shall be laid on the appropriate pipe support.

The Contractor shall design and adopt the appropriate pipe specification, pipe route including pipe support installations which secure the movement line based on Section 8 'Drawings' Appendix 'Drawing No.2 of 12' and Appendix 'Drawing No.3 of 12'. Shop drawing and specification shall be approved by Project Manager before commencement of the work.

2) Regarding 2) Kiosk for water truck (1 set) and Gantry for Water Truck (2 sets), the work are consisted of all related works including site preparation, excavation, embankment, dewatering, backfilling, disposal of surplus materials, procurement and installation etc. The work shall comply with the following general items;

a) Kiosk for water truck

<Material>

Water kiosk is composed of the concrete block with mortar, batholith and roof slab made of reinforced concrete, and the colgate steel sheet for roof as shown in Section 8 'Drawings' Appendix 'Drawing No.6 of 12'.

Door of the water kiosk is made of steel with lock.

<Construction Method>

Water kiosk (1 set) of approx. 2.5m x 2.5m x 3.3m in an internal size shall be built as shown in Section 8 'Drawings' Appendix 'Drawing No.6 of 12'. It should be located in approximately 3m far from the very point where a pier of water gantry shall be constructed.
In order to measure water flow and control supply of water, a flow meter of 75mm and two gate valves of 75mm should horizontally be installed inside of the water kiosk.

b) Gantry for water truck

<Material>

Pier of the gantry and support concrete shall be made of the reinforced concrete. Pipe to be wrapped with the concrete pier should be galvanized pipe. In order to avoid water splash, it is proposed that wavy pipe which is made of jute, etc. shall be connected to the galvanized pipe.

<Construction Method>

Water gantry shall be constructed as shown in Section 8 'Drawings' Appendix 'Drawing No.6 of 12'. It should be located in approximately 3m far from the very point where a pier of water gantry shall be constructed.

3) Regarding Instruments Works, the following instruments shall be installed at least;

①	Flow meter for intake volume	1 set
②	Flow meter for transmission pump	1 set
③	Flow meter for gantry	1 set
④	Flow indicator for inlet of filter	1 set
⑤	Flow indicator for backwashing of filter	1 set

4.2.2 Scheme 1-2 Small Scale Elevated Tank+ Public Taps

(1) Scope of work

Scheme 1-2 is consisted of all related works including site preparation, excavation, embankment, dewatering, backfill, disposal of surplus material, procurement, installation and construction work regarding the following items;

1)	Small Scale Elevated Tank	5m3×Approx. 3mH 12 sets
2)	Public Taps	4 faucets typed, 12 sets
3)	Piping Works (Service Pipe)	1 set

Location of 1) Small Scale Elevated Tank (12set) and 2) Public Taps (12 sets) is shown in Appendix 'Drawing No.1 of 12'.

(2) Specification

1) Small Scale Elevated Tank

Reference drawing of small scale Elevated Tank (12 sets) refers to Section 8 'Drawings' Appendix 'Drawing No.5 of 12'

2) Public Taps

Reference drawing of Public Taps (12 sets) is Section 8 'Drawings' Appendix ' Drawing No.11 of 12'.

3) Piping Works (Service Pipe)

The work are consisted of all related works including site preparation, excavation, embankment, dewatering, backfilling, disposal of surplus materials, procurement and installation etc regarding pipe installation (GS 40mm, approx..10m) between Elevated Tank (12 sets) and Public Taps (12 sets) including required drain, water meter, valve and fittings.

4.3 Scheme 2

4.3.1 Scheme 2 Distribution Pipe+ Elevated Tank + Public Taps

(1) Scope of Work

Scheme 2 is consisted of all related works including site preparation, excavation, embankment, dewatering, backfill, disposal of surplus material, procurement, installation and construction work regarding the following items;

1) Distribution Pipes Total length Approx.5,019m Material: HDPE Pressure Resistance: PN10
Dia. 40mm×Approx.369m、Dia. 50mm×Approx.1,380m、
Dia.75mm×Approx.2,112m、Dia. 100mm×Approx.708m、
Dia. 150mm×Approx.450m

2) Elevated Tank 20m3 (5m3×4tanks)×7.7mH 1 set
3) Public Taps 4 faucet typed Public Taps ×10 sets
4) Piping Works
Schematic drawing which shows the location and compositions of 1)Distribution Pipes, 2) Elevated Tank (1set), 3) Public Taps (10 sets) and 3) Public Taps are Section 8 'Drawings' Appendix 'Drawing No.7 of 12'.

(2) Specification
1) Distribution Pipes
Piping route and specification refer to Section 8 'Drawings' Appendix 'Drawing No.7 of 12'.
Standard drawing of distribution piping works refer to Section 8 'Drawings' Appendix ' Drawing No.10 of 12'.

Note:
1) Marker sheet shall be procured and installed as indicated general requirements.

2) Elevated Tank
Reference drawing of Elevated Tank (1 set) is Section 8 'Drawings' Appendix 'Drawing No.8 of 12'.

3) Public Taps
Reference drawing of Public Taps (12 sets) is Section 8 'Drawings' Appendix ' Drawing No.11 of 12'

4) Piping Works
Piping works are consisted of pipe installation between Elevated Tank (1 set) and Public Taps (12 sets) including required water meter, valve and fittings.

Note:
1) Following fitting, which is not described in Section 8 'Drawings' Appendix 'Drawing No.7 of 12', shall be procured and equipped with the pipeline for the future expansion. Location of the above items shall be directed by SSUWC and/or Project Manager.

a)	Tee and Caps (PE , 50mm×50mm)	2sets
b)	Tee and Caps (PE , 75mm×75mm)	2sets
c)	Tee and Caps (PE , 150mm×150mm)	1sets
d)	Wash out valves +Chamber (Dia. 50mm, bronze)	5sets

2) Structural material standard

a) Compression strength of reinforced concrete is 24 Mpa.
b) Reinforcing bar for concrete shall conform to the requirements of AASHTO M31 (ASTM A615) Grade 40 or equivalent.

5. Documents to be submitted
Following documents shall be attached in the Contact document (at the time of Contract)
-Construction Schedule

-Organization Chart (List of sub-contractor)
-Curriculum vitae for each work including resident representative
-Catalogue etc. of sand filter and activated carbon (which the Contractor intends to adopt in the Project)
-Flow sheet of Unit Type Treatment Plant submitted by the Contractor
-General Layout of Unit Type Treatment Plant submitted by the Contractor
-Design Calculation Sheet of Unit Type Treatment Plant submitted by the Contractor
-Additional minute.

Necessary documents shall be submitted to Project Manager at the following stage. Unless otherwise specified, 2 sets of copies (including original) for Project Manager and the Client shall be submitted;

(1) Before commencement of work and shall be approved by Project Manager
-Shop drawing and specification for all the works
-Construction plan of each work

(2) During the construction
-Monthly progress report with photograph
-Necessary photograph for inspection
-Operation and maintenance manual (30 days before commencement of commissioning test)

(3) At the completion of work
-Factory test report
-On-site inspection report
-Commissioning test report
-Acceptance test report
-As built drawing

6. Test and Inspection

(1) Factory test
Factory test means inspection and test to guarantee the quality of construction material, products such as pumps, generator etc., which shall be done by before the site delivery at factory and /or other appropriate place.
All the materials and chemicals shall be guaranteed not to contain toxic substance and to apply as drinking water.

(2) Commissioning test
The purpose of commissioning test is to check if equipment complies with the requirement described in shop drawing and specification approved by Project Manager.
Visual inspection, rotating direction check, vibration check, noise check, over heating check etc. shall be conducted as commissioning test regarding the following equipment;
-Intake pump
-Generator
-Sand filter
-Activated carbon filter
-The other pumps etc.

(3) Acceptance test
Following acceptance test shall be conducted by the Contractor regarding the following items in the presence of Project Manager and the Client.
-Over all operation from intake to treated water supply through the setting tank, sand filter, activated carbon filter and disinfection for not less than 48 hours.
-Pressure test for distribution pipe

7. Handing Over Procedure

Works shall be handed over to JICA when the works have been completed in accordance with the Contract and a Handing-Over Certificate for the Works has been issued by Project Manager

8. Warrantee

The Contractor shall warranty the quality of the facility for twelve (12) months from the date of handing over.

Annex-1

Table -3 List of laboratory material for Unit Type Treatment Plant

	Items	Specification	Qty.
1)	Jar tester	① Type : Desk-top type ② Number of Position : 6 nos. ③ Speed setting rpm : from 10 to 300 rpm ④ Power Supply : 220-240V ⑤ Accessories :Manual in English	1
2)	Scale	① Type :Even balance (not electrical balance) ② Sensitivity : 50mg ③ Accessories :Weight 1 set	1
3)	pH meter	① Type :Handy type ② Measuring Range : pH2～12 ③ Sensibility : 0.1pH or less ④ Power : Battery type ⑤ Accessories :Calibration Solution set, Manual in English	1
4)	Electro Conductivity meter	① Type :Handy type ② Measuring Range : 0～19.9mS/cm ③ Power : Battery type ④ Accessories :Calibration Solution set, Manual in English	1
5)	Turbidity meter	① Type :Potable type ② Measuring Range : 0～Approx.1,000NTU ③ Sensibility : 0.01NTU or less ④ Power : Battery type ⑤ Accessories :Calibration Solution set, Manual in English	1
6)	Color meter	① Type :Potable type ② Measuring Range : 0～Approx.50TCU ③ Sensibility : 0.1NTU or less ④ Power : Battery type ⑤ Accessories :Calibration Solution set, Manual in English	1
7)	Turbidity/Color Comparator Set	① Type : Potable Colorimetric type ② Measuring Range : Turbidity 0.5, 1, 2, 3, 5, 10, 15 degree Color 2, 4, 5, 6, 10, 20 degree ③ Accessories :Standard turbidity/color plate	1
8)	Thermometer	① Type : Alcohol thermometers ② Measuring Range :0～50℃ ③ Minimum scale : 1℃	3

9)	Residual Chlorine meter	① Type :Handy type, colorimetric determination method, DPD method (Not electrical type) ② Measuring Range : 0.05mg/L～2.0mg/L ③ Accessories :DPD regent for 500 times	1
10)	Detection Paper for E.Coli	① Quantity :500 papers ② Accessories :Exclusive UV light	1
11)	Detection Paper for pH	① Measuring Range :pH5.5～9.0 ② Quantity :5m	2
12)	Magnetic Stirrer	① Type :Des- top type ② Number of Position :6 nos.(For max.2L) ③ Speed setting rpm :from 100 to 1500 rpm ④ Power Supply :220-240V	1
13)	Table	① Approx. 2m ×0.5m	2
14)	Chair		4
15)	Sodium Dihydrogen Phosphate Dihydrate	500g (For laboratory) as Chemicals for pH 7 buffer solution	1
16)	Disodium Hydrogenphosphate	500g (For laboratory) as Chemicals for pH 7 buffer solution	1
17)	Citric Acid	500g (For laboratory) as Chemicals for pH 4 buffer solution	1
18)	Trisodium Citrate Dihydrate	500g (For laboratory) as Chemicals for pH 4 buffer solution	1
19)	Formazine standard solution 1000NTU	500ml (For laboratory) as Chemicals for turbidity standard solution	1
20)	Color standard solution 1000NTU	500ml (For laboratory) as Chemicals for color standard solution	1
21)	Hygrometer		1
22)	Pipette	5ml, Glass made	3
23)	Pipette	3ml, Glass made	3
24)	Pipette	1ml, Glass made	3
25)	Spoits	For 5ml pipette	2
26)	Spoits	For 3ml pipette	2
27)	Spoits	For 1ml pipette	2
28)	Volumetric Flask	Volume 500ml, plastic made	3
29)	Volumetric Flask	Volume 100ml, plastic made	3
30)	Mas Cylinder	Volume 1,000ml, plastic made	3
31)	Mas Cylinder	Volume 100ml, plastic made	3
32)	Spoon	For chemicals, stainless made	3
33)	Brush	Approx. 710×120 ϕ	1
34)	Brush	Approx. 470×70 ϕ	1
35)	PE tank with tap	For storage of water, approx. 20L	1

36)	Beaker	1000ml, Polypropylene made	6
37)	Beaker	500ml, Polypropylene made	12
38)	Beaker	100ml, Polypropylene made	6
39)	Stirrer Bar	50mm (For item 12)	6
40)	Stirrer Bar	35mm (For item 12)	6
41)	Stirrer Bar	20mm (For item 12)	6
42)	Wash Bottles	500ml	2

[Reference photo]

8) Thermometer

13) Table

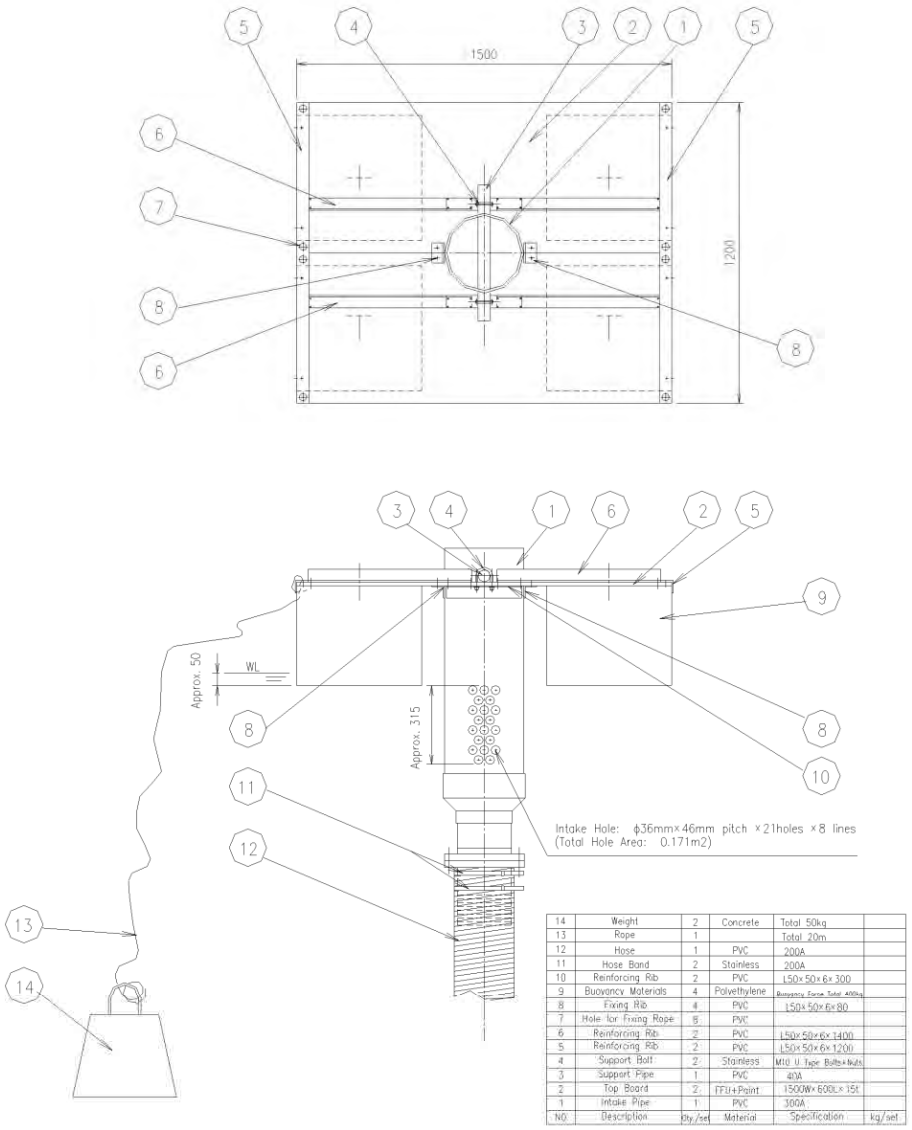
42) Wash Bottle

Annex 2

Table -4 List of Chemical and Fuel for Urgent Water Supply Project

	Items	Specification	Qty.
1)	Aluminum Sulfate	Solid Typed, Al2O3 Conc. approx.14wt%	1,500kg
2)	Soda Ash	Solid Typed, Na2CO3 Conc. approx. 98wt%	350kg
3)	Calcium Hypochlorite	Solid Typed, Available Chlorine Conc. Approx.70%	150kg
4)	Fuel for engine pumps and generator	Diesel oil with dram-can	20m3
5)	Fuel for 3 water trucks	Diesel oil with dram-can	8.5m3
6)	Hose	Approx. ϕ 1 in (For transporting cleaning water using submergible) Material : PVC or equivalent	50m
7)	Hose Band	For 6) hose Material: SUS 304 or more	2 sets

Annex 3



NO	Description	Qty./set	Material	Specification	kg/set
14	Weight	2	Concrete	Total 50kg	
13	Rope	1		Total 20m	
12	Hose	1	PVC	200A	
11	Hose Band	2	Stainless	200A	
10	Reinforcing Rib	2	PVC	L50×50×6×300	
9	Buoyancy Materials	4	Polyethylene	Buoyancy Force Total 400kg	
8	Fixing Rib	4	PVC	L50×50×6×80	
7	Hole for Fixing Rope	8	PVC		
6	Reinforcing Rib	2	PVC	L50×50×6×1400	
5	Reinforcing Rib	2	PVC	L50×50×6×1200	
4	Support Bolt	2	Stainless	M10 U Type Bolts+Nuts	
3	Support Pipe	1	PVC	40A	
2	Top Board	2	FRU+Paint	1500W×600L×15t	
1	Intake Pipe	1	PVC	300A	

Figure 1 Reference Drawing of Intake Device

2. Transport Route of Materials

Transport Routes for Procurement of Materials

All of the materials are to be procured outside of Malakal Town due to lack of industries for construction materials in Malakal. Transport of materials from outside of Malakal depends on the weather condition and reliable routes for transport are limited.

Major procurement sources and possible transport routes are shown in Tables 1.1 and 1.2.

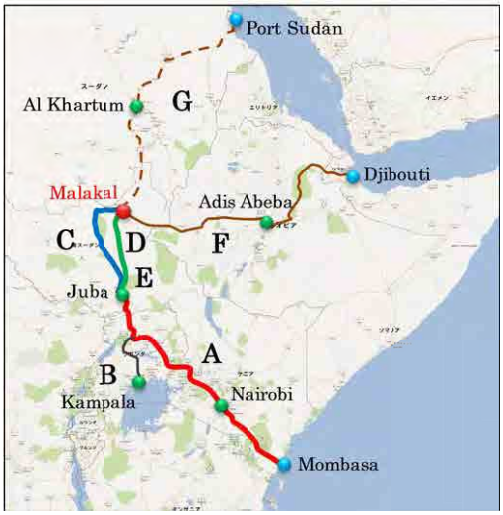


Figure 1.1 Possible Routes of Material Transport to Malakal

Table 1.1 Possible Routes of Material Transport to Malakal

Transport Routes		Length	Transport Condition	Evaluation
A	Mombasa Port～Nairobi～Juba (Land Transport)	about 1,650km	・No problem is observed through the year round because of fair road condition. ・Stable transport is performed.	◎
B	Kampala～Juba (Land Transport)	about 530km	・No problem is observed through the year round because of fair road condition same as route A.	○
C	Juba～Malakal (River Transport)	about 700km	・This route is used for the large volume of goods though the year round. ・Berge is the main transport mode. Motorboat is used for transportation of small volume of goods.	◎
D	Juba～Malakal (Land Transport)	about 550km	・This route is only passable in dry season. In rainy season (from June to October) it becomes impassable. ・This route is mainly for small volume of goods and required transportation time is rather short.	○
E	Juba～Malakal (Air Transport)	about 520km	・This route is mainly for small volume of goods and required transportation time is short. ・This route cannot accommodate large volume of goods.	△
F	Djibouti Port～Addis Ababa～Malakal (Land Transport)	about 1,900km	・This route is passable during dry season due to the poor road condition in South Sudan. In rainy season (from June to October) it is likely impassable. ・Stable transport is in question now.	△
G	Port Sudan～Khartoum～Malakal (Land and River Transport)	about 1,900km	・Formerly this route was the main transport route, however not available at present due to political situation. ・This still can be a likely route if situation allow.	△

Table 1.2 Major Procurement Source and Possible Transport Means

Major Materials	Procurement Source	Transport Means
Cement and Iron Bar	Juba	Berge
Sand and Crushed Stone	North of UNS	Land Transport
Water Quality Test Equipment for Laboratory	Japan	Air
Coagulant and Chlorine Agent	Nairobi	Berge and Land Transport
Settling Tank	Netherland	Ship up to Mombasa, then Land or Air and Berge
Filter	Italy	Ship up to Mombasa, then Land or Air and Berge
Generator and Pump	Nairobi	Berge and Land Transport
PP Tank (Elevated Tank/Small Water Tank)	Nairobi	Berge and Land Transport
Construction Machine	Nairobi	Berge and Land Transport

3. Design Calculation

Design Calculation Paper
for
Procurement of
Construction of Small-scale Water Supply System
in Malakal Town

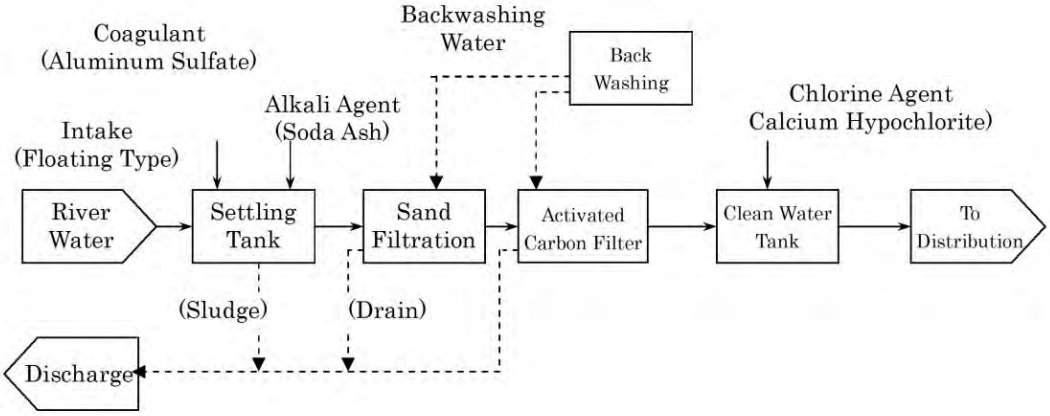
<Reference>

Contents

1. Overview of Facility

Items	Specification
(1)Type of Raw Water	River Water
(2)Water Quality of Raw Water	<Turbidity> At High Turbidity : Maximum 500NTU、Max.24hours At Normal : 100NTU or less
(3)Target Water Quality of Treated Water	<Turbidity> 5 NTU or less <Color> 15TCU or less ※WHO Guideline Level
(4) Treatment Flow	150m³/day Intake Facility (Floating Type) → Sedimentation (Batch Typed Operation, 113m³,φ9,000×1,800H×2 Tanks) →Sand Filter (φ2,000×2,200H×1 Tower) →Activated Carbon Filter (φ2,000×2,200H×1 Tower) →Clean Water Tank (38m³、φ5,200×1,800H×1 Tank)
(5) Production Rate	150m³/day
(6) Intake Rate	225m³/day (Production Rate ×150%)
(7) Operation Hour	12 Hours Operation per Day
(8) Drainage Volume	※Mainly discharged from sedimentation tank, sand filter and activated carbon filter At Normal : 31m³/day At High Turbidity: 40m³/day
(9)Type of Drain Treatment	Direct discharge

2. Overview of Water Treatment



※1 Intake, sedimentation, supplying water and discharging sludge are operated with repeated batch in setting tank.

3. Specification

Facility	Equipment Name	Design Condition	Main Specification	Nos. (No. of Stand-by)
Intake Facility	Intake Device		1,200×1,500, Floating Type (PVC), Screen Hole 36mm	1 set
	Intake Pump		Diesel Engine Pump (Centrifugal Type) 1.88m3/min×5mAq	2 units (1)
Sedimentation Facility	Settling Tank	1 day or more volume against required treatment volume	Circular Panel Typed Steeled Tank Volume : 113m3 φ9,000×1,800H (Effective Water Depth)	2 tanks
	Aluminum Sulfate Solution Tank	1 day or more volume against required volume	Circular PE Tank (With Agitator) Volume : 500L	2 tanks
	Soda Ash Solution Tank	1 day or more volume against required volume	Circular PE Tank (With Agitator) Volume : 500L	2 tanks

Sand Filter /Activated Carbon Filter Facility	Raw Water Pump for Filter		Centrifugal Pump 0.26m3/min×15mAq ×2.2kw	2 units (1)
	Sand Filter	LV=120m/day or less	Pressured Typed (Steeled) Capacity : 150m³/day φ2,000×2,200H	1 unit
	Activated Carbon Filter	LV=120m/day or less	Pressured Typed (Steeled) Capacity : 150m³/day φ2,000×2,200H	1 unit
	Receiving Tank for Backwashing		Circular PE Tank Volume : 1,000L	1 tank
	High Lift Pump for Backwashing Water		Submergible Pump 0.07m³/min×20mAq×0 .75kw	2units (1)
	Backwashing Water Tank (Elevated Tank)	1 time or more volume against required backwashing volume	Circular PE Tank Volume :20m3 5m3×4tanks,Height approx.8m	1 set
Clean Water Tank Facility	Clean Water Tank	6 hours or more volume against required clean water volume	Circular Panel Typed Steeled Tank Volume : 38m³ Φ5,200×1,800H (Effective Water Depth)	1 tank
	Calcium Hypochlorite Solution Tank	1 day or more volume against required volume	Circular PE Tank (With Agitator) Volume : 100L	2 tanks (1)
Cleaning Water Facility	Receiving Tank for Cleaning Water		Circular PE Tank Volume : 200L	1 tank
	Transmission Pump for Clean Water Tank		Submergible Pump 0.15m³/min×6.5mAq× 0.4kw	1 unit
	Cleaning Water Tank		Circular PE Tank Volume : 5 m³	1 tank
	Submergible Pump for Cleaning Water Tank		Submergible Pump 0.15m³/min×6.5mAq× 0.4kw	1 unit

Power Generation Facility	Generator		Diesel Engine Type Capacity : 25kVA	1 unit

4. Concept of Design

As shown in 2. Overview of Water Treatment, raw water taken from river is purified by sedimentation facility and sand filter / activated carbon filter facility, the capacity of which is 150m^3/day. The treated water is stored in clean water tank.

Basic concept of design is as follows;

- Operation time of treatment plant is from 8 AM to 20 PM for 12 hours operation.
- All valves are basically operated with manual.
- Regarding raw water pump for sand filter and highlift pump for backwashing water, one stand-by pump for each pump is stored in the warehouse.
- Two solution tanks for calcium hypochlorite are installed to keep it injected continuously into clean water tank. While injection of calcium hypochlorite is conducted with one tank, dissolving calcium hypochlorite is conducted with another tank.

5. Design Calculation

(1) Intake Facility

Intake facility is the facility for removing relatively big debris in the water source(Nile river) and transporting raw water to treatment facility.

Intake facility is composed of screen and intake pump.

① Intake Device

Specification	Type	Floating Type (PVC)
	Specificaton	Capacity 1.88m³/min
	Dimension	Top Board:1,200W×1,500H
		Intake Pipe: φ 300, Screen Hole φ 36mm
	Qty.	1 set

② Intake Pump

225m³/day is set as intake volume from river, which is equivalent to 150% of planned production rate, 150m³/day.

225m³/day covers the volume of discharging sludge, drain of backwashing from sand filter and activated carbon filter etc.

Capacity is deciced by the volume transporting required raw water to settling tank for 1 hour.

Requried intake volume;

150m³/day×1.5×24/1÷1,440÷1unit÷2tanks＝1.88m³/min

Specification	Type	Diesel Engine Pump (Centrifugal Pump)
	Material	FC
	Capacity	1.88m³/min×5mAq
	Qty.	Total 1 units

(2) Sedimentation Facility

Sedimentation facility is the facility for reducing turbidity in the raw water by coagulation and sedimentation.

Sedimentation facility is composed of 2 sets of settling tank, aluminum sulfate solution tank and soda ash solution tank.

Planned water quality for inlet and outlet of sedimentation facility are as follows;

<Planned Water Quality>

	Turbidity (NTU)
Inlet	At Normal:100NTU At High :Turbidity 500NTU (Maximum 24 hours)
Outlet	10 NTU or less

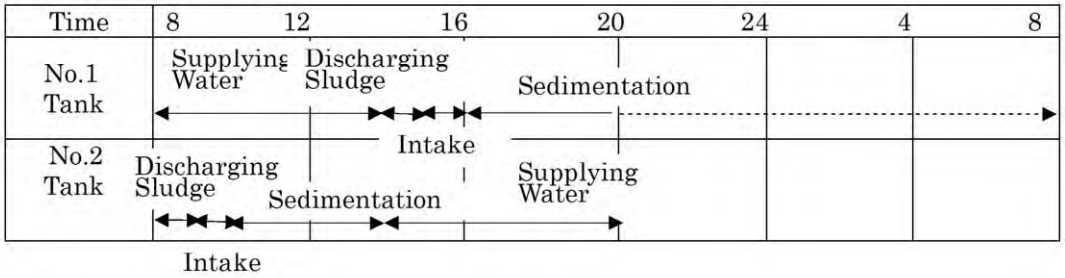
① Settling Tank

By intake, sedimentation, supplying water and discharging sludge being operated with repeated batch using 2 setting tanks in alternate shift, turbidity in the raw water is coagulated with coagulant and sedimentation.

Water is supplied to sand filter / activated carbon filter continuously without intermission from 8 AM to 20 PM for 12 hours using 2 settling tanks, which are operated for 6 hours against each tank. And whole operation including intake, sedimentation, supplying water and discharging sludge is completed within 12 hours from 8 AM to 20 PM

Coagulant is mixed with water using hydraulic power by fall of water from inlet.

＜Operation Chart＞



※Operation time for each operation is as follows;

Intake: 1hour, Sedimentation: 4hours, Supplying water: 6hours,

Discharging sludge: 1hour

Design condition of settling tank is as follows;

Items	Design Condition
Volume	1 day or more volume against required treatment volume
Height of tank	Sedimentation and thickening are completed within 4 hours. Therefore the height of settling tank is decided on the basis of length which sludge is settled to the bottom for 1 hour as the sedimentation velocity 30mm/min.
Storage volume of sludge	2 times or more against sludge volume generated at the time of high turbidity.

Required Volume:

$150m^3/day \times 1.5 \times 1日 \div 2tanks = 112.5\ m^3 < 113m^3$

Required height:

30mm/min×60min =1800mm

Sludge volume generated at the high turbidity

<Suspended Solid from Raw Water>

500NTU×1mg/L/NTU×150m³/日×1.5÷10,000mg/L÷2tanks=5.63m³

<Sludge generated from Coagulant>

150m³/day×1.5×50mg-Al_2O_3/L×1.53÷10,000 mg/L÷2tanks =0.86 m³

<Total Sludge Generated>

5.63m³+0.86 m³=6.49m³

Required tank volume

6.49m³×2=13.0m³<113m³

Specification	Type	Circular Panel Type
	Material	Steel
	Volume	113m³
	Dimension	φ9,000×1,800H (Effective Water Depth)
	Qty.	Total 2 tanks

② Aluminum Sulfate Solution Tank

Aluminum sulfate (solid type, Al_2O_3 conc. 14%wt or more) is adopted as coagulant and aluminum sulfate is dissolved on site.

Design condition of dosing rate of coagulant is as follows;

	Dosing rate of coagulant
At Normal (Turbidity 100NTU)	10 mg-Al_2O_3/L
At High Turbidity (Turbidity 500NTU)	50 mg-Al_2O_3/L

Dosing rate of coagulant at normal condition;

150m³/day×1.5×10mg-Al_2O_3/L×10^{-3} ÷0.14= 16.1 kg /day

Dosing rate of coagulant (Conc. 100kg/m³)

16.1 kg /day÷2tanks= 8.04kg/day

8.04 kg /day÷ 100kg/m³= 0.09m³/day

Dosing rate of coagulant at high turbidity condition;

$150m^3/day \times 1.5 \times 50mg\text{-}Al_2O_3/L \times 10^{-3} \div 0.14 = 80.4kg/day$

Dosing rate of coagulant (Conc. 100kg/m^3)

$80.4kg/day \div 2tanks = 40.2kg/day$

$40.2kg/day \div 100kg/m^3 = 0.41m^3/day$

Tank volume is decided on the basis of the volume of coagulant required for 1 day (1 batch) at high turbidity condition.

Specification	Type	Circular Type (Agitator installed)
	Material	PE
	Volume	500L
	Qty.	Total 2 tanks

③ Soda Ash Solution Tank

Soda ash is adopted as alkali agent and soda ash (Conc. 99% or more) is dissolved on site.

Soda ash is injected when alkalinity of raw water is low and agreeability is worsening. Tank volume is decided on the basis of the alkalinity consumed by dosing coagulant at the high turbidity condition

Dosing rate of soda ash at normal condition

$150m^3/day \times 1.5 \times 10mg\text{-}Al_2O_3/L \times 10^{-3} \times 3mg/L \times 1.07mg/L = 7.3kg/day$

Dosing rate of soda ash (Conc. 50kg/m^3)

$7.3kg/day \div 2 tanks = 3.7 kg/day$

$3.7kg/day \div 50kg/m^3 = 0.08m^3/day$

Dosing rate of soda ash at high turbidity condition

$150m^3/day \times 1.5 \times 50mg\text{-}Al_2O_3/L \times 10^{-3} \times 3mg/L \times 1.07mg/L = 36.2kg/day$

Dosing rate of soda ash (Conc. 50kg/m^3)

$36.2kg/day \div 2 tanks = 18.1kg/day$

$18.1kg/day \div 50kg/m^3 = 0.37m^3/day$

Tank volume is decided on the basis of the volume of soda ash required for 1 day (1 batch) or more at high turbidity condition.

Specification	Type	Circular Type (Agitator installed)
	Material	PE
	Volume	500L

tec. spec.an

Qty. Total 2 tanks

(3) Sand Filter / Activated Carbon Filter Facility

Sand filter / activated carbon filter facility is the facility for reducing turbidity in the settled water by being filtrated with sand filter.

Sand filter / activated carbon filter facility is composed of raw water pump for filter, sand filter, activated carbon filter, receiving tank for backwashing, high lift pump for backwashing water and backwashing tank.

In case filtration rate of sand filter or activated carbon filter decreases, backwashing is executed using backwashing water from backwashing tank (elevated tank) to recover filtration rate.

Recovery rate as treated water (against intake water volume) sets 80% or more.

Planned water quality for inlet and outlet of sand filter / activated carbon filter are as follows;

<Planned Water Quality>

	Turbidity (NTU)	Color (TCU)
Inlet	Average 5	Average 50
Outlet	5 or less	15 or less

① Raw Water Pump for Filter

Pump capacity is deciced on the basis of the required treatment volume transported to sand filter and/or activated carbon filter for 12 hours.

Required volume;

$150m^3/day \times 100/80 \times 24/12 \div 1,440 \div 1 \text{ unit} = 0.26m^3/min$

Specification	Type	Centrifugal Pump
	Material	FC
	Capacity	$0.26m^3/min \times 15mAq \times 2.2kw$
	Qty.	Total 2 units (Inculding 1 stand-by)

② Sand Filter

Capacity is decided on the basis of the required treatment volume for 12 hours.

Design condition of sand filter is as follows;

Items	Design Condition
Filtration Velocity	120m/day or less
Media	Kind of Media : Anthracite + Silica Sand

	Effective Dia. : Anthracite 0.9～1.4mm, Silica Sand 0.45～0.6mm Uniformity Coefficient: Anthracite 1.5 or less, Silica Sand 1.5 or less Thickness : Anthracite 200～500mm, Silica Sand 300～500mm
Backwash	Backwashing Velocity : 0.6～0.9m^3/min・m^2

Required Filtration Area;

150m^3/day×100/80×24/12÷120m/day÷1unit＝3.13m^2<3.14m^2

Filtration velocity for sand filter of φ2,000

150m^3/day×100/80×24/12÷1unit÷3.14m^2=118m/day < 120m/day

Specification

Type Pressure typed multilayer sand filter

Material Steel

Capacity 150m^3/day

Specification of media

Kind of Media : Anthracite + Silica Sand＋Gravel

Effective Dia. : Anthracite 1.4mm, Silica Sand 0.6mm

Thickness :

Anthracite 250mm, Silica Sand 450mm, Gravel 200mm

Dimension φ2,000×2,200H

Qty. Total 1 unit

③ Activated Carbon Filter

Capacity is decided on the basis of the required treatment volume for 12 hours.

Design condition of activated carbon filter is as follows;

Items	Design Condition
Filtration Velocity	120m/day or less
Activated Carbon	Effective Dia. : 1.0～1.2mm Uniformity Coefficient : 1.3 or less Thickness : 700mm or more
Backwash	Backwashing Velocity : 0.6～0.9m^3/min・m^2

Required Filtration Area;

150m^3/day×100/80×24/12÷120m/day÷1unit＝3.13m^2<3.14m^2

Filtration velocity for activated carbon filter of φ2,000

150m^3/day×100/80×24/12÷1unit÷3.14m^2=118m/day<120m/day

Specification

Type	Pressure typed multilayer sand filter
Material	Steel
Capacity	150m³/day
Specification of media	
Kind of Media	: Activated Carbon＋Gravel
Effective Dia.	: Activated Carbon 1.2mm
Thickness	: Activated Carbon 700mm, Gravel 200mm
Dimension	φ2,000×2,200H
Qty.	Total 1 unit

④ Receiving Tank for Backwashing

Receiving tank for backwashing is the facility for temporary storing backwashing water and transporting the water to backwashing water tank (elevated tank) using submergible pump.

Specification	Type	Circular Type
	Material	PE
	Volume	1,000L
	Qty.	Total 1 tank

⑤ High Lift Pump for Backwashing Water

High lift pump for backwashing water is the pump which transport backwashing water for sand filter and activated carbon filter to backwashing water tank within 10 hours.

Flow rate of pump

38m3 ÷ 10 hours ÷ 60 min = 0.07 m³/min

Specification	Type	Submergible Pump (With level switch)
	Capacity	0.07m³/min×20mAq×0.75kw
	Qty.	Total 2 units（Inculding 1 stand-by）

⑥ Backwashing Tank

Tank volume is decided on the volume of 1 time or more against required volume for backwashing.

Required volume for backwashing:

$3.14m^2 \times 0.6m^3/m^2 \cdot min$ (Average volume for backwashing) $\times 10min = 18.9m^3$

Specification	Type	Circular PE Tank
	Total Volume	$20m^3$
		$5m^3 \times 4$tanks, Approx. 8m height
	Qty.	Total 1 set

(4) Clean Water Tank Facility

Clean water tank facility is the facility for disinfecting filtrated water and storing clean water.

Clean water tank facility is composed of clean water tank and calcium hypochlorite solution tank.

① Clean Water Tank

Tank volume is decided on the basis of 6 hours or more volume against required volume for water supply.

$150m^3/day \times 6/24 = 38m^3 < 38.2\ m^3$

Specification	Type	Circular Panel Type
	Material	Steel
	Volume	$38m^3$
	Dimension	φ5,200×1,800H (Effective Water Depth)
	Qty.	Total 1 tank

② Calcium Hypochlorite Solution Tank

Calcium hypochlorite is adopted as chlorine agent. Powdered calcium hypochlorite (Conc. 70% available chlorine or more) is dissolved on site.

Design condition of dosing rate of calcium hypochlorite is as follows;

	Dosing rate of calcium hypochlorite
At Normal	5 mg-Cl_2/L
At Maximum	10 mg-Cl_2/L

Dosing rate of calcium hypochlorite at normal condition;

$150m^3/day \times 5mg\text{-}Cl_2/L \times 10^{-3} \div 0.7 = 1.08kg/day$

Dosing rate of calcium hypochlorite (Conc. 30kg/m^3)

1.08kg/day÷30kg/m^3= 0.04m^3/day

Dosing rate of calcium hypochlorite at maximum condition;

150m^3/day×10mg-Cl_2/L×10^{-3}÷0.7= 2.15kg/day

Dosing rate of calcium hypochlorite (Conc. 30kg/m^3)

2.15kg/day÷30kg/m^3= 0.08m^3/日

Tank volume is decided on the basis of the volume of calcium hypochlorite required for 1 day at maximum condition.

Specification	Type	Circular Type (Agitator installed)
	Material	PE
	Volume	100L
	Qty.	Total 2 tanks (Including 1 stand-by)

③ Transmission Pump

Pump capacity is decided on the basis of the required capacity to transport treaed water of 130m^3/day to the elevated tank (H= approx.8m) ,which is approx. 150m away from the transmission pump for 12 hours

Required Volume;

130m3/day×24/12÷1,440÷1unit=0.181m^3/min

Specification	Type	Diesel Engine Pump
	Material	FC
	Capacity	0.19m^3/min×15mAq
	Qty.	Total 2 units (Including 1 stand-by)

(5) Cleaning Water Facility

① Receiving Tank for Cleaning Water

Receiving tank for cleaning water is the facility for temporary storing supernatant from settling tank and transporting the water to cleaning water tank using submergible pump.

Specification	Type	Circular Type
	Material	PE
	Volume	200L

	Qty.	Total 1 tank

② Transmission pump for cleaning water tank

Specification	Type	Submergible Pump（With level switch）
	Material	Stainless
	Capacity	0.15m^3/min×6.5mAq×0.4kw
	Qty.	Total 1 unit

③ Cleaning Water Tank

Specification	Type	Circular Type
	Material	PE
	Volume	5m^3
	Qty.	Total 1 tank

④ Submergible Pump for Cleaning Water

Specification	Type	Submergible Pump（With level switch）
	Material	Sustainless
	Capacity	0.15m^3/min×6.5mAq×0.4kw
	Qty.	Total 1 unit

(6) Electrical Facility

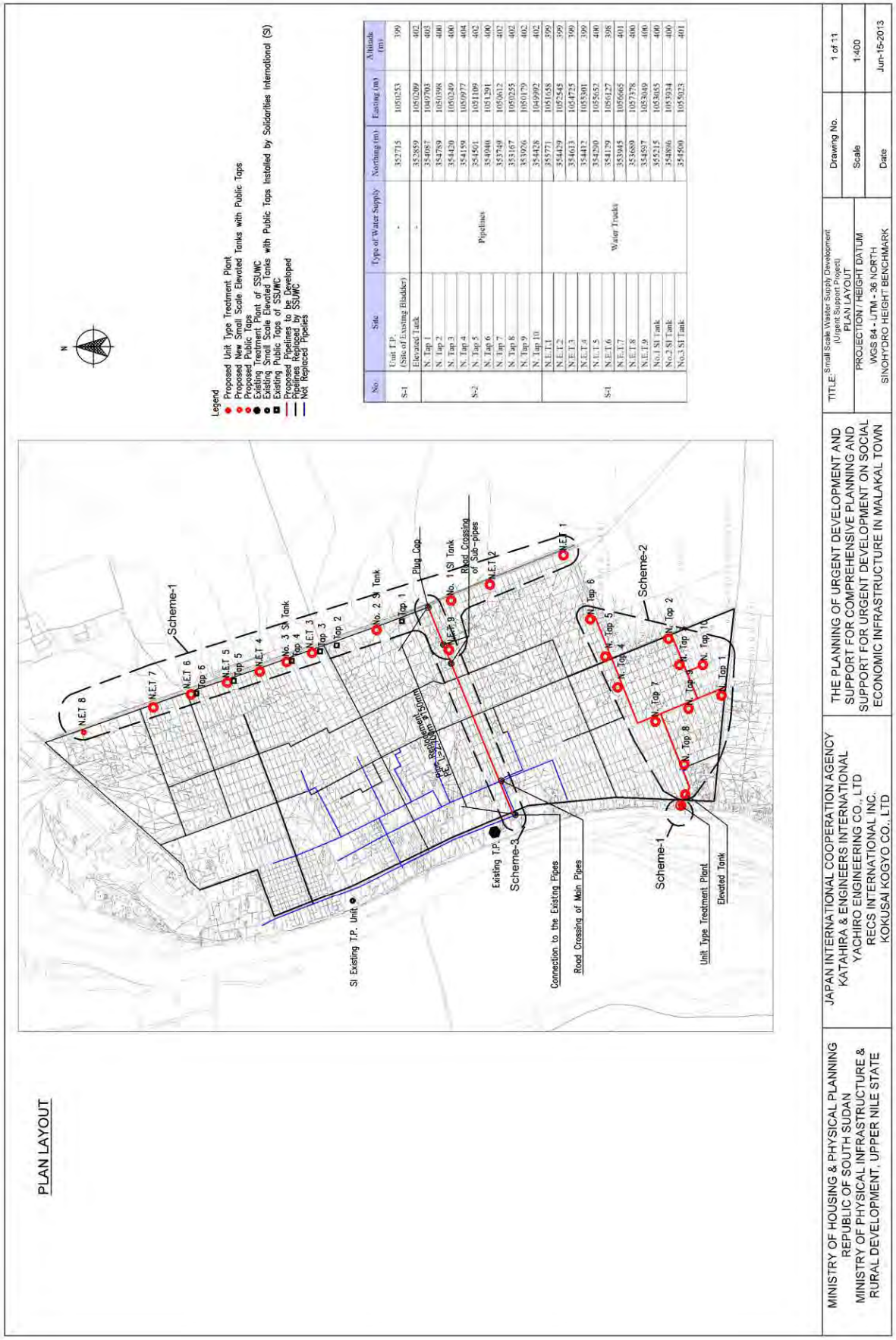
① Generator

Generator supplies electricity for raw water pump for filter and backwashing pump etc.

Specification	Type	Diesel Engine Type
	Capacity	25kVA
	Qty.	Total 1 unit

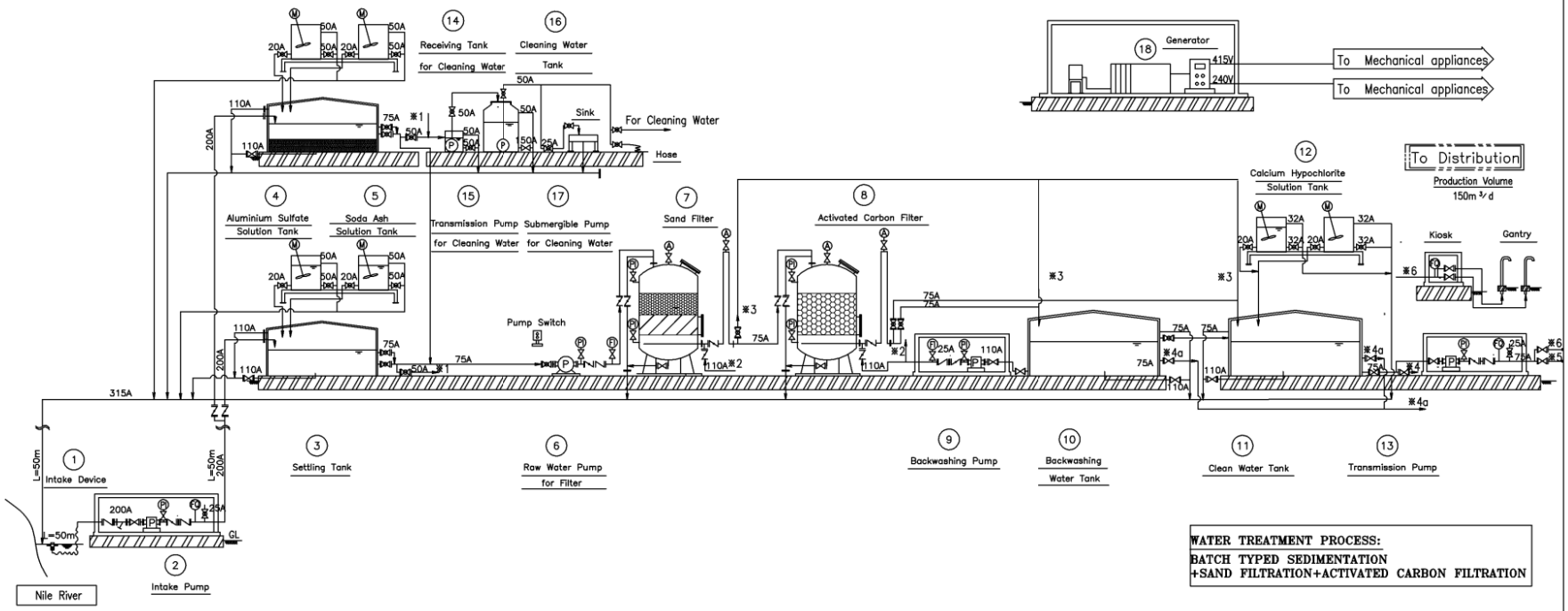
End

4. Drawings



No.	Site	Type of Water Supply	Northing (m)	Easting (m)	Altitude (m)
S-1	Unit T.P. (Site of Existing Bladder)	-	352715	1050253	399
	Elevated Tank	-	352859	1050209	402
S-2	N. Tap 1	Pipelines	354087	1049703	403
	N. Tap 2		354789	1050398	400
	N. Tap 3		354420	1050249	400
	N. Tap 4		354159	1050977	404
	N. Tap 5		354501	1051109	402
	N. Tap 6		354946	1051291	400
	N. Tap 7		353748	1050612	402
	N. Tap 8		353167	1050255	402
	N. Tap 9		353926	1050179	402
	N. Tap 10		354428	1049992	402
S-1	N.E.T.1	Water Trucks	355771	1051658	399
	N.E.T.2		354429	1052545	399
	N.E.T.3		354613	1054725	399
	N.E.T.4		354412	1055301	399
	N.E.T.5		354290	1055652	400
	N.E.T.6		354179	1056127	398
	N.E.T.7		353945	1056665	401
	N.E.T.8		353669	1057378	400
	N.E.T.9		354597	1058049	400
	No.1 SI Tank		355215	1058055	400
	No.2 SI Tank		354896	1053934	400
	No.3 SI Tank		354500	1055023	401

FLOW SHEET OF WATER TREATMENT PLANT



WATER TREATMENT PROCESS:
BATCH TYPED SEDIMENTATION +SAND FILTRATION+ACTIVATED CARBON FILTRATION

※1 Cleaning Water Line
※2 Backwashing Line
※3 Filtranted Water of Sand Filter Line
※4 For Jerry Tank, Drum Can
※5 To Distributin (Elevated Tank)
※6 Line for Kiosk

EQUIPMENT No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨
NAME	Intake Device	Intake Pump	Settling Tank	Aluminium Sulfate Solution Tank	Soda Ash Solution Tank	Raw Water Pump for Sand Filter	Sand Filter	Activated Carbon Filter	Backwashing Pump
TYPE / MATERIALS	Floting Type/PVC	Diesel Engine Pump/FC	Circle/Galvanized Steel	Circle/PE	Circle/PE	Centrifugal Pump/FC	Pressure Type/SS	Pressure Type/SS	Diesel Engine Pump/FC
SPECIFICATION	1.88m3/min	1.88m3/min× 25mAq	115m³ / each	500L	500L	0.26m3/min× 40mAq× 5.5kw	150m3/day	150m3/day	1.30m3/min× 20mAq
QUANTITY(INCLUDING STANDBY)	1	1	2	2	2	2(1)	1	1	1
NOTE				Agitator 1φ× 0.18kw× 240V	Agitator 1φ× 0.18kw× 240V	3φ× 415V			

EQUIPMENT No.	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱
NAME	Backwashing Water Tank	Clean Water Tank	Calcium Hypochlorite solution tank	Transmission Pump	Receiving Tank for Cleaning Water	Transmission Pump for Clean Water Tank	Cleaning Water Tank	Submergible Pump for Cleaning Water	Generator
TYPE / MATERIALS	Circle/Galvanized Steel	Circle/Galvanized Steel	Circle/PE	Diesel Engine Pump/FC	Circle/PE	Submergible Pump	Circle/PE	Submergible Pump	Diesel Type
SPECIFICATION	33m³ / each	33m³ / each	200L	0.19m3/min× 15mAq	500L	0.25m3/min× 6.5mAq× 1.0kw	5m³	0.25m3/min× 6.5mAq× 1.0kw	70kVA
QUANTITY(INCLUDING STANDBY)	1	1	2	2(1)	1	1	1	1	1
NOTE			Agitator 1φ× 0.18kw× 240V			Level Switch inst		Level Switch inst	

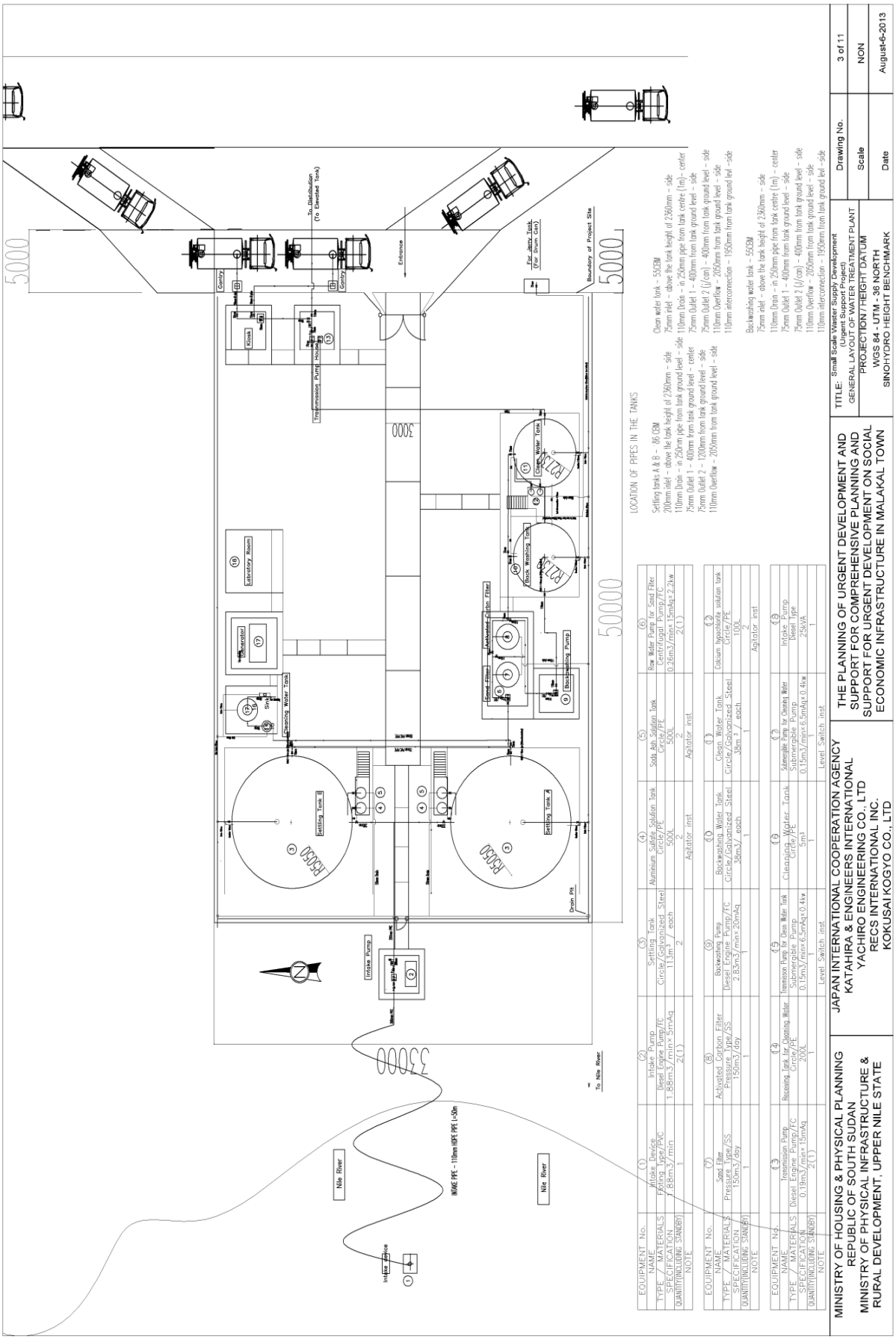
EQUIPMENT No.									
NAME									
TYPE / MATERIALS									
SPECIFICATION									
QUANTITY(INCLUDING STANDBY)									
NOTE									

LEGEND

SYMBOL	NAME
	Manual sluice valve
	Check valve
	Butterfly valve
	Manual ball valve
	Y-shape strainer
Ⓐ	Air Valve
Ⓕ	Flow Totalizer
Ⓕ	Flow indicator
Ⓟ	Pressure Indicator

As of August 6, 2013

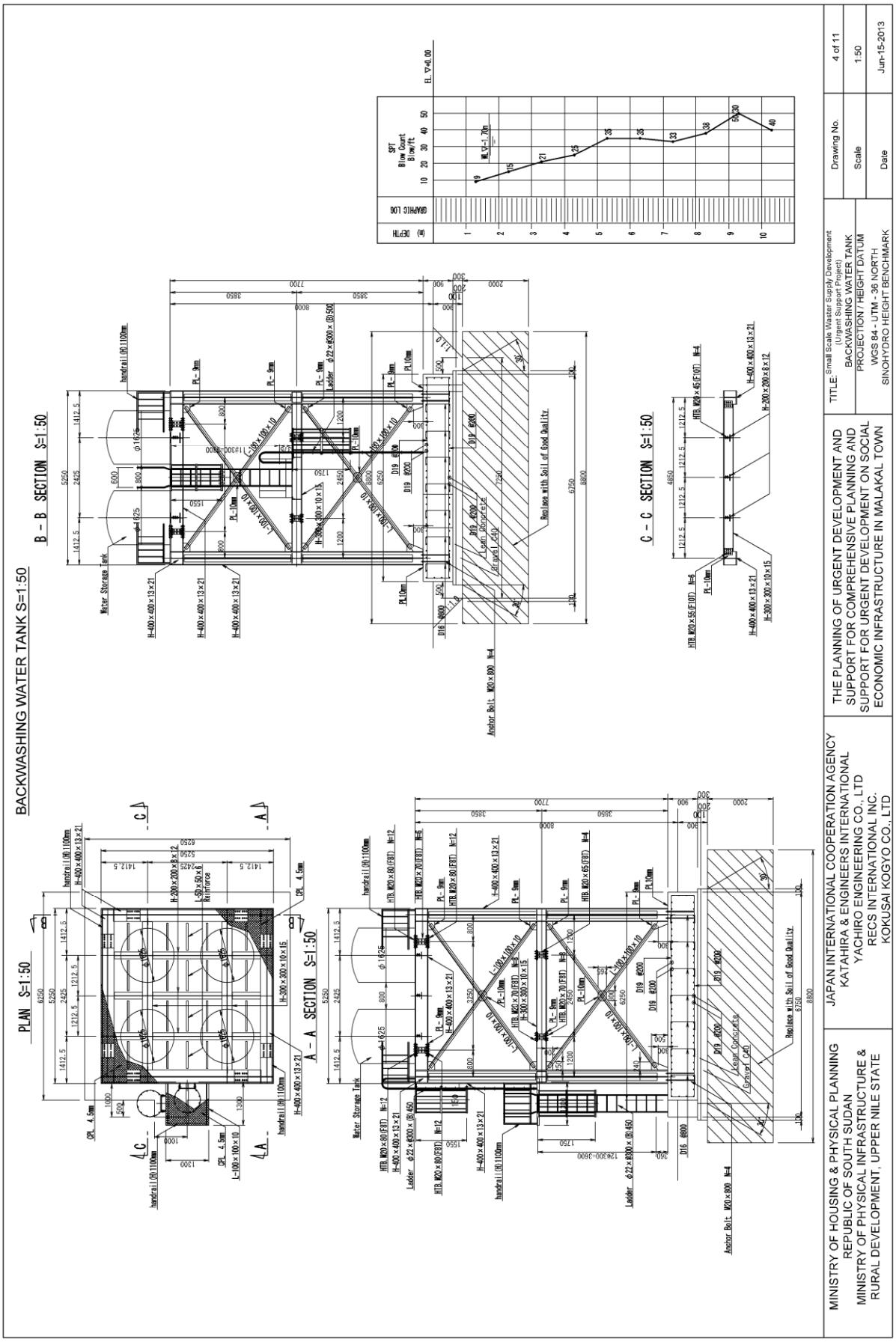
MINISTRY OF HOUSING & PHYSICAL PLANNING REPUBLIC OF SOUTH SUDAN MINISTRY OF PHYSICAL INFRASTRUCTURE & RURAL DEVELOPMENT, UPPER NILE STATE	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL YACHIRO ENGINEERING CO., LTD RECS INTERNATIONAL INC. KOKUSAI KOGYO CO., LTD	THE PLANNING OF URGENT DEVELOPMENT AND SUPPORT FOR COMPREHENSIVE PLANNING AND SUPPORT FOR URGENT DEVELOPMENT ON SOCIAL ECONOMIC INFRASTRUCTURE IN MALAKAL TOWN	TITLE: Small Scale Waster Supply Development (Urgent Support Project) FLOW SHEET OF WATER TREATMENT PLANT PROJECTION / HEIGHT DATUM WGS 84 - UTM - 36 NORTH SINOHYDRO HEIGHT BENCHMARK
			Drawing No. 2 of 11 Scale NON Date August-6-2013



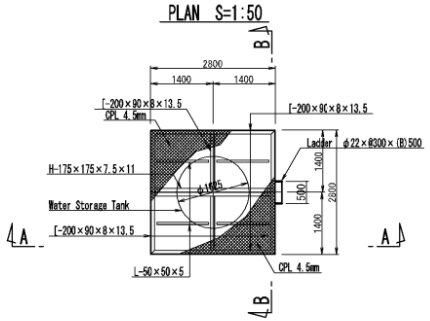
EQUIPMENT No.	(1)	(2)	(3)	(4)	(5)	(6)
NAME	Intake Device	Intake Pump	Setting Tank	Aluminium Sulfate Solution Tank	Soda Ash Solution Tank	Raw Water Pump for Sand Filter
TYPE / MATERIALS	FRP/Mesh Steel/PVC	Diesel Engine Pump/FC	Circle/Galvanized Steel	Circle/PE	Circle/PE	Centrifugal Pump/FC
SPECIFICATION	1.88m3/min×5mAq	1.88m3/min×5mAq	113m3 / each	500L	500L	0.26m3/min×15mAq×2.2kw
QUANTITY(INCLUDING STANDBY)	1	2(1)	2	2	2	2(1)
NOTE				Agitator inst	Agitator inst	

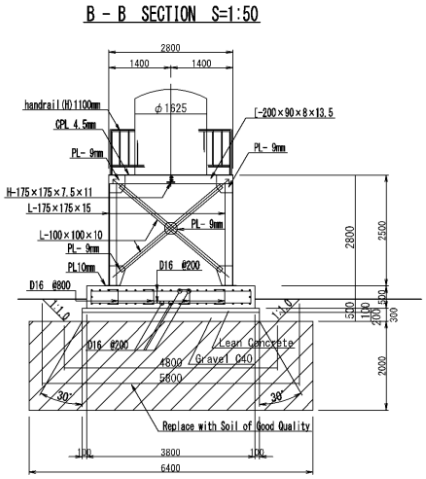
EQUIPMENT No.	(7)	(8)	(9)	(10)	(11)	(12)
NAME	Sand Filter	Activated Carbon Filter	Backwashing Pump	Backwashing Water Tank	Clean Water Tank	Calcium hypochlorite solution tank
TYPE / MATERIALS	Pressure Type/SS	Pressure Type/SS	Diesel Engine Pump/FC	Circle/Galvanized Steel	Circle/Galvanized Steel	Circle/PE
SPECIFICATION	150m3/day	150m3/day	2.83m3/min×20mAq	38m3/ each	38m3 / each	100L
QUANTITY(INCLUDING STANDBY)	1	1	1	1	1	2
NOTE						Agitator inst

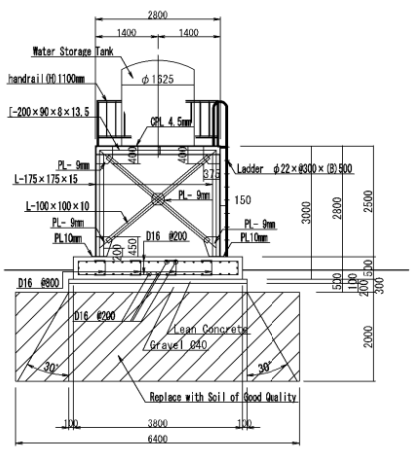
EQUIPMENT No.	(13)	(14)	(15)	(16)	(17)	(18)
NAME	Transmission Pump	Receiving Tank for Cleaning Water	Transmission Pump for Clean Water tank	Cleaning Water Tank	Submergible Pump for Cleaning Water	Intake Pump
TYPE / MATERIALS	Diesel Engine Pump/FC	Circle/PE	Submergible Pump	Circle/PE	Submergible Pump	Diesel Type
SPECIFICATION	0.19m3/min×15mAq	200L	0.15m3/min×6.5mAq×0.4kw	5m3	0.15m3/min×6.5mAq×0.4kw	25KVA
QUANTITY(INCLUDING STANDBY)	2(1)	1	Level Switch inst	1	Level Switch inst	1
NOTE						

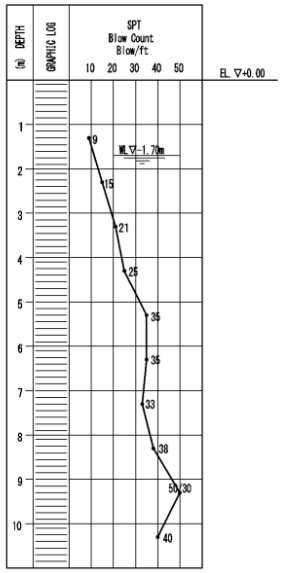

BACKWASHING WATER TANK S=1:50
PLAN S=1:50
B - B SECTION S=1:50
C - C SECTION S=1:50
A - A SECTION S=1:50
Water Storage Tank
Anchor Bolt M20×800 N=4
Replace with Soil of Good Quality
Lean Concrete
Compact Soil
MINISTRY OF HOUSING & PHYSICAL PLANNING
REPUBLIC OF SOUTH SUDAN
MINISTRY OF PHYSICAL INFRASTRUCTURE & RURAL DEVELOPMENT, UPPER NILE STATE
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
YACHIRO ENGINEERING CO., LTD
RECS INTERNATIONAL INC.
KOKUSAI KOGYO CO., LTD
THE PLANNING OF URGENT DEVELOPMENT AND SUPPORT FOR COMPREHENSIVE PLANNING AND SUPPORT FOR URGENT DEVELOPMENT ON SOCIAL ECONOMIC INFRASTRUCTURE IN MALAKAL TOWN
TITLE: Small Scale Master Supply Development (Urgent Support Project)
BACKWASHING WATER TANK
PROJECTION / HEIGHT DATUM
WGS 84 - UTM - 36 NORTH
SINOHYDRO HEIGHT BENCHMARK
Drawing No. 4 of 11
Scale 1:50
Date Jun-15-2013

WATER STORAGE TANK STRUCTURE S=1:50

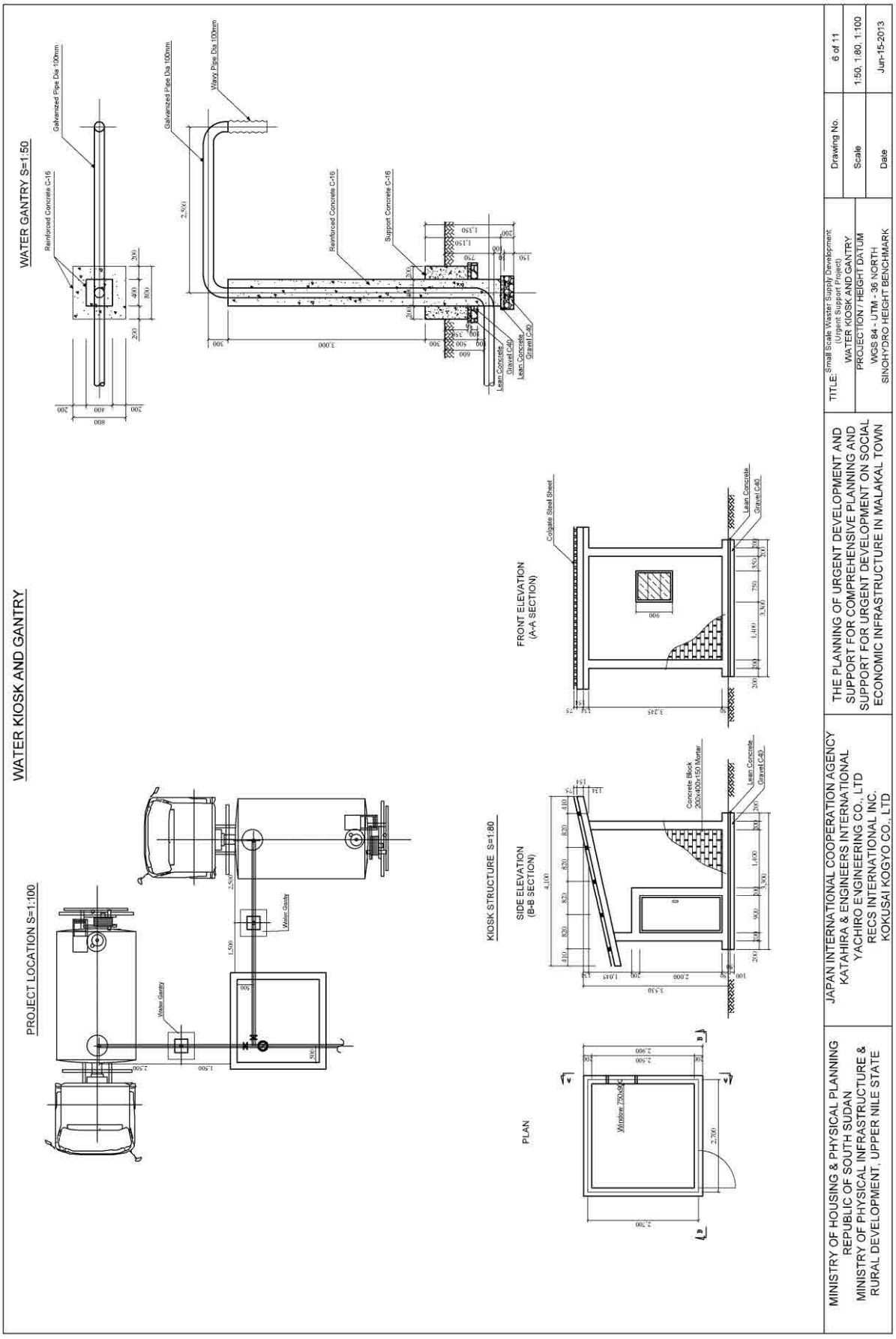








MINISTRY OF HOUSING & PHYSICAL PLANNING REPUBLIC OF SOUTH SUDAN MINISTRY OF PHYSICAL INFRASTRUCTURE & RURAL DEVELOPMENT, UPPER NILE STATE	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL YACHIRO ENGINEERING CO., LTD RECS INTERNATIONAL INC. KOKUSAI KOGYO CO., LTD	THE PLANNING OF URGENT DEVELOPMENT AND SUPPORT FOR COMPREHENSIVE PLANNING AND SUPPORT FOR URGENT DEVELOPMENT ON SOCIAL ECONOMIC INFRASTRUCTURE IN MALAKAL TOWN	TITLE: Small Scale Waster Supply Development (Urgent Support Project) WATER STORAGE TANK STRUCTURE PROJECTION / HEIGHT DATUM WGS 84 - UTM - 36 NORTH SINOHYDRO HEIGHT BENCHMARK	Drawing No. Scale Date	5 of 11 1:50 Jun-15-2013


WATER GANTRY S=1:50
WATER KIOSK AND GANTRY
PROJECT LOCATION S=1:100
KIOSK STRUCTURE S=1:80
FRONT ELEVATION (A-A SECTION)
SIDE ELEVATION (B-B SECTION)
PLAN
Galvanized Pipe Dia 100mm
Reinforced Concrete C-16
Support Concrete C-16
Vinyl Pipe Dia 100mm
Water Gantry
Coligate Steel Sheet
Lean Concrete
Gravel C40
Concrete Block 200x400x150 Mortar
Window 750x900
MINISTRY OF HOUSING & PHYSICAL PLANNING
REPUBLIC OF SOUTH SUDAN
MINISTRY OF PHYSICAL INFRASTRUCTURE & RURAL DEVELOPMENT, UPPER NILE STATE
JAPAN INTERNATIONAL COOPERATION AGENCY
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YACHIYO ENGINEERING CO., LTD
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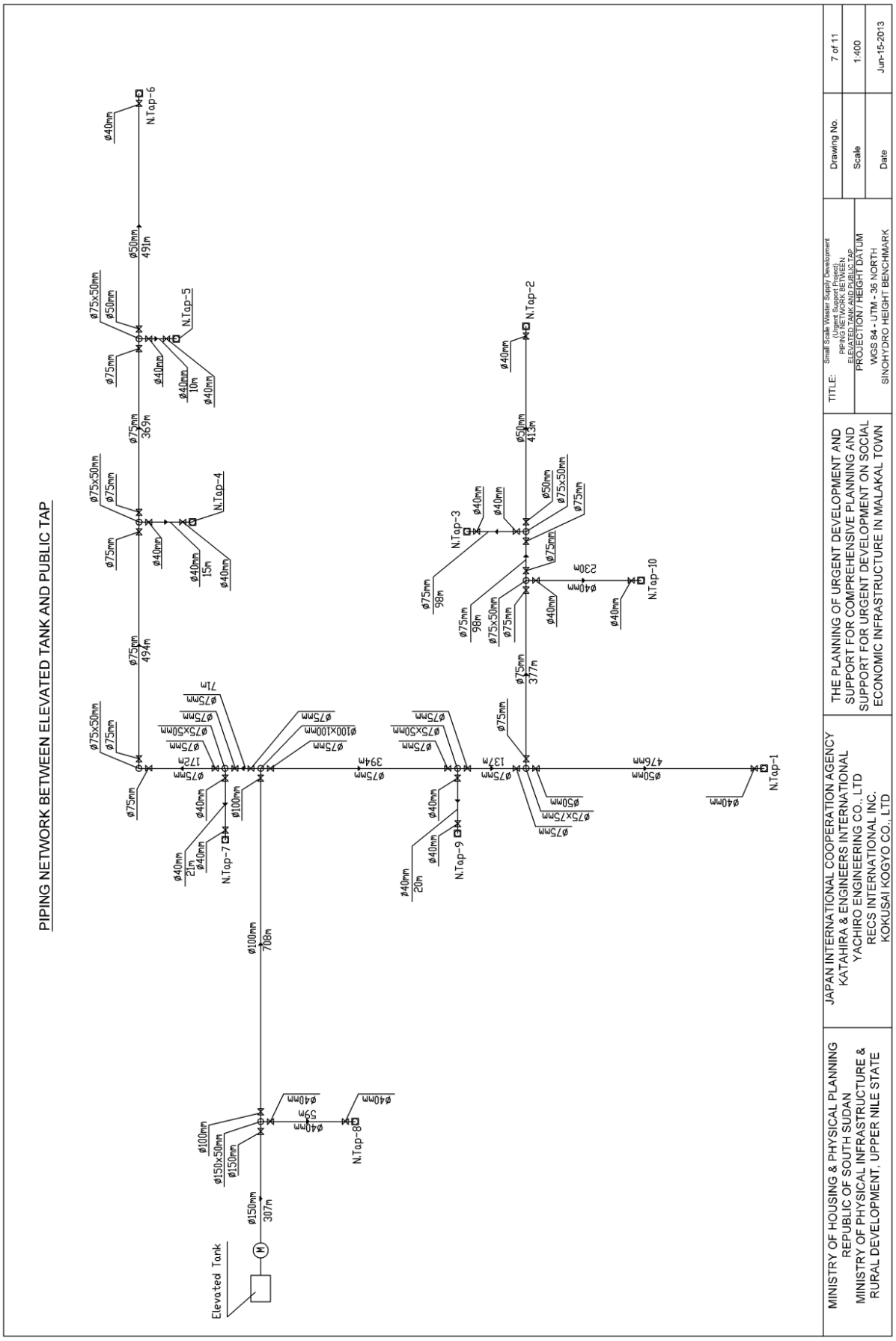
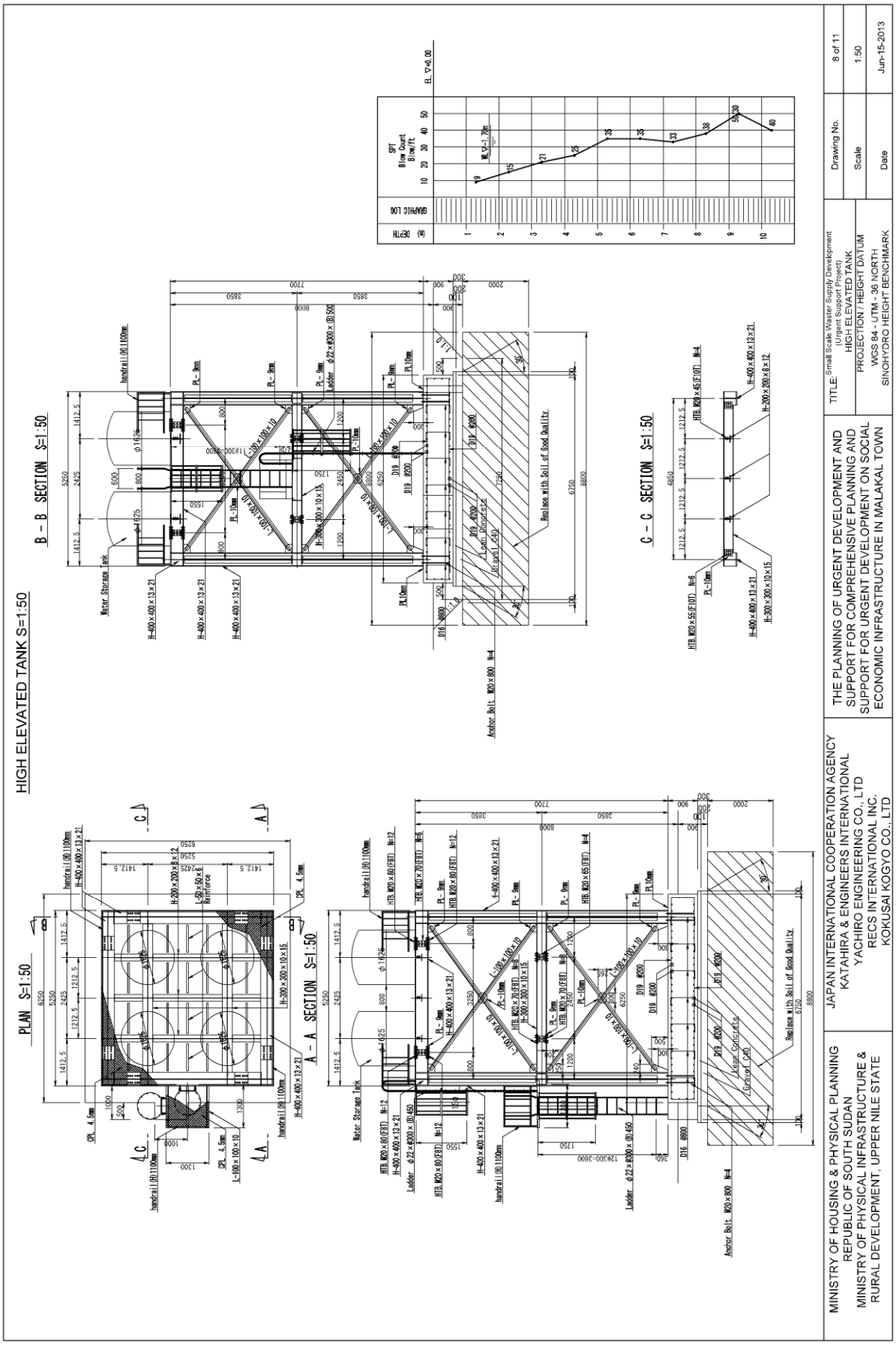
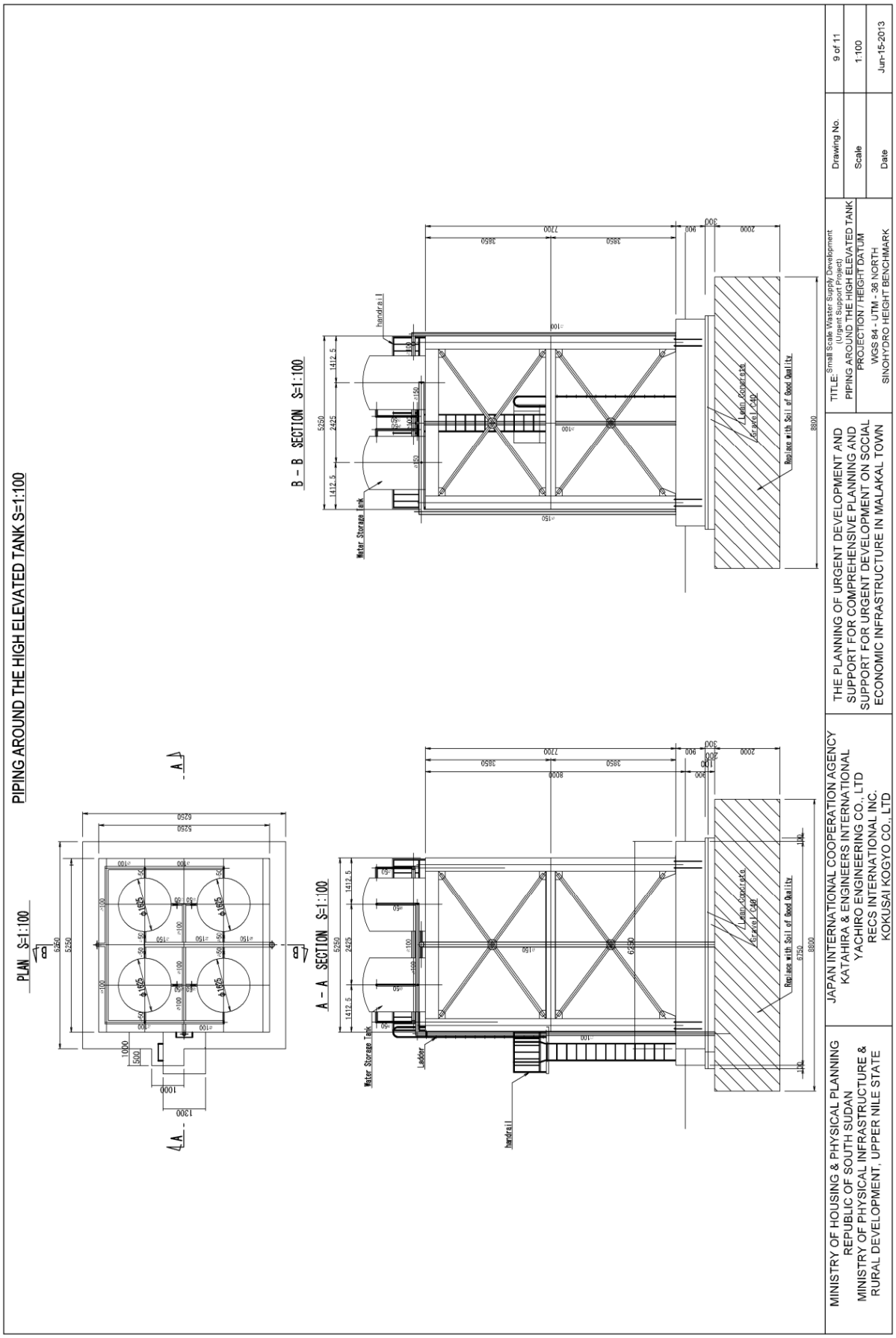
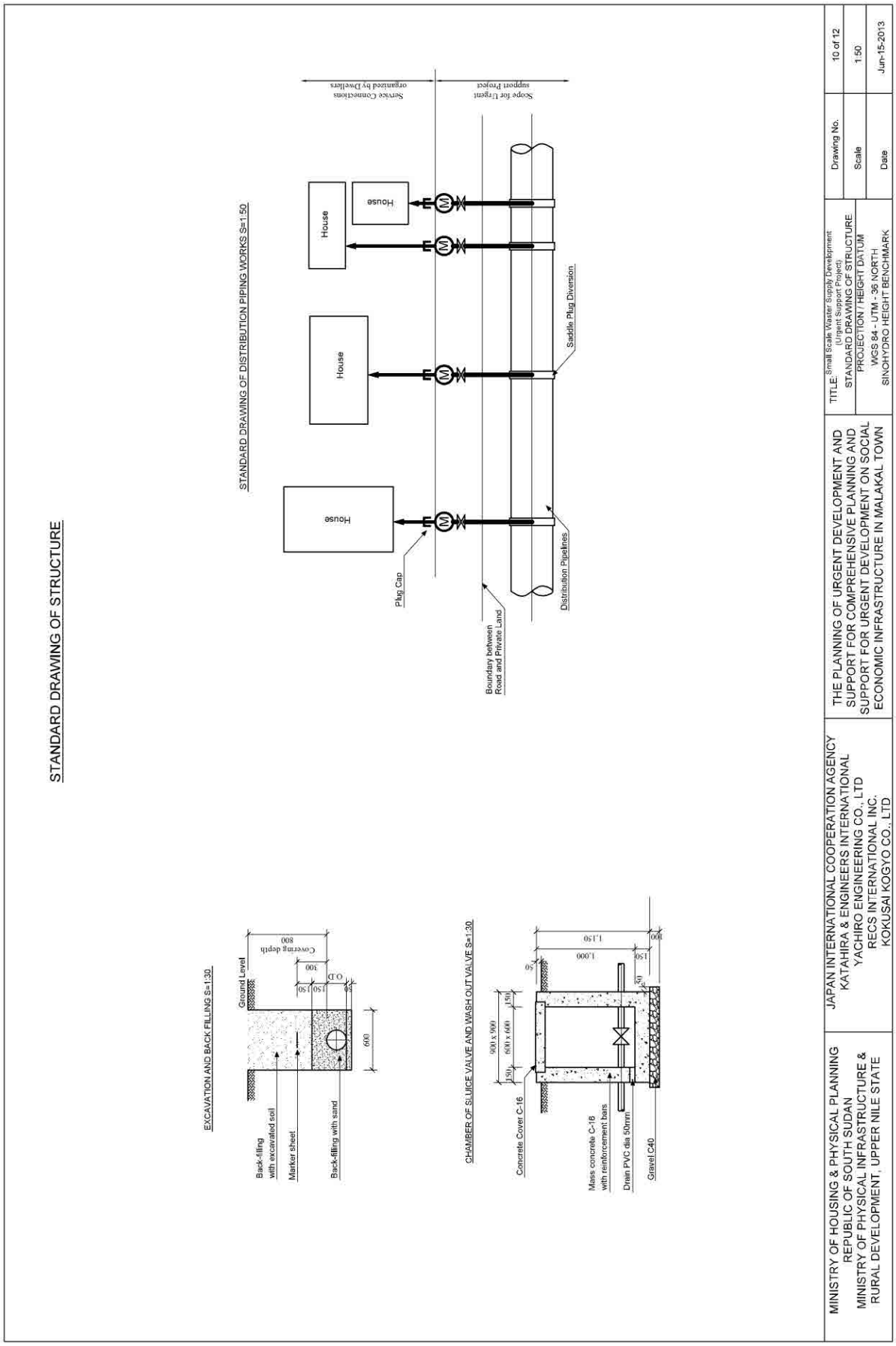
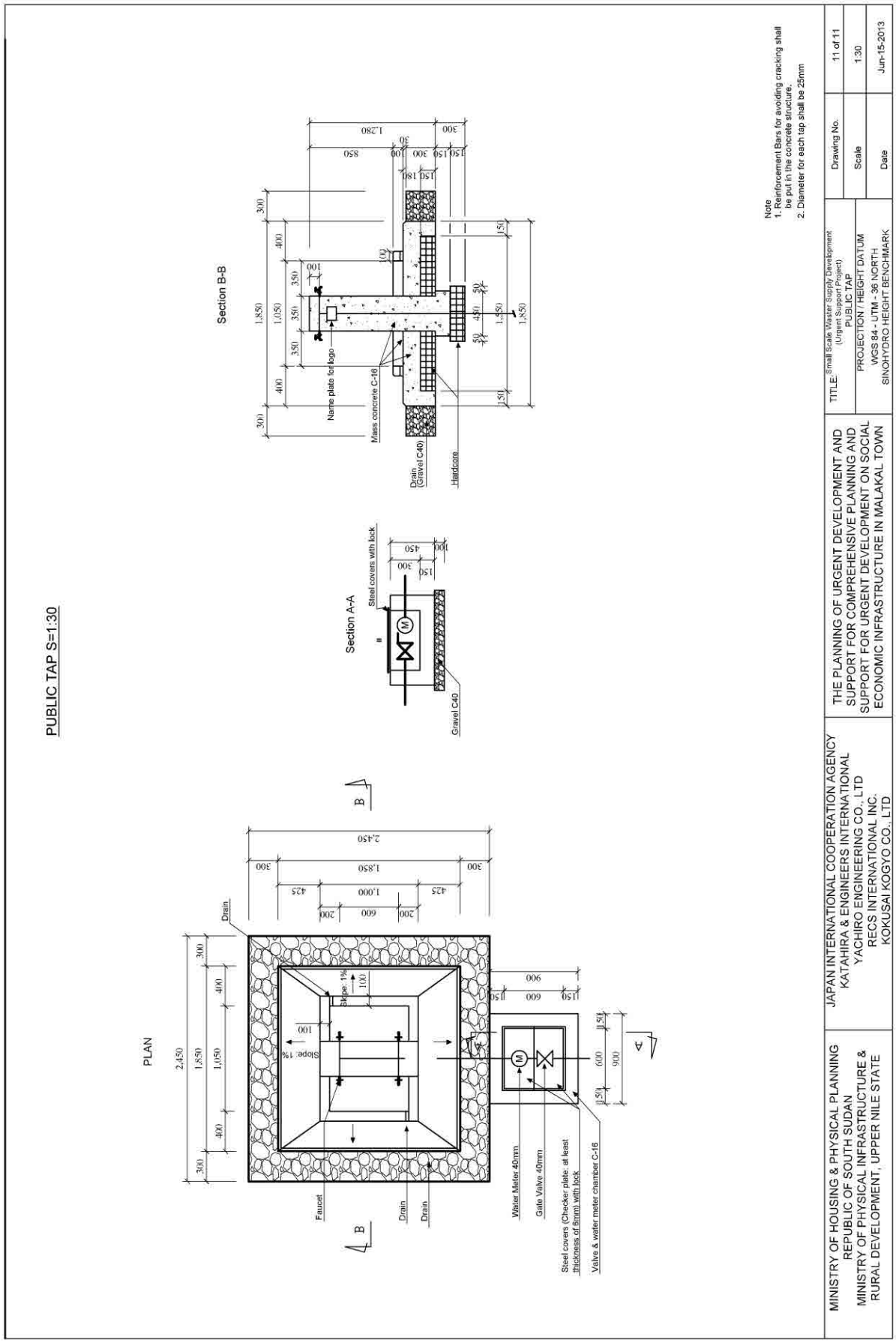
THE PLANNING OF URGENT DEVELOPMENT AND SUPPORT FOR COMPREHENSIVE PLANNING AND SUPPORT FOR URGENT DEVELOPMENT ON SOCIAL ECONOMIC INFRASTRUCTURE IN MALAKAL TOWN
TITLE: Small Scale Water Supply Development (Urgent Support Project)
WATER KIOSK AND GANTRY
PROJECTION / HEIGHT DATUM
WGS 84 - UTM - 36 NORTH
SINOHYDRO HEIGHT BENCHMARK
Drawing No. 6 of 11
Scale 1:50, 1:80, 1:100
Date Jun-15-2013


PIPING NETWORK BETWEEN ELEVATED TANK AND PUBLIC TAP
Elevated Tank
N.Tap-1
N.Tap-2
N.Tap-3
N.Tap-4
N.Tap-5
N.Tap-6
N.Tap-7
N.Tap-8
N.Tap-9
N.Tap-10
MINISTRY OF HOUSING & PHYSICAL PLANNING
REPUBLIC OF SOUTH SUDAN
MINISTRY OF PHYSICAL INFRASTRUCTURE & RURAL DEVELOPMENT, UPPER NILE STATE
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
YACHIRO ENGINEERING CO., LTD
RECS INTERNATIONAL INC.
KOKUSAI KOGYO CO., LTD
THE PLANNING OF URGENT DEVELOPMENT AND SUPPORT FOR COMPREHENSIVE PLANNING AND SUPPORT FOR URGENT DEVELOPMENT ON SOCIAL ECONOMIC INFRASTRUCTURE IN MALAKAL TOWN
TITLE:
Small Scale Water Supply Development (Urgent Support Project)
PIPING NETWORK BETWEEN ELEVATED TANK AND PUBLIC TAP
PROJECTION / HEIGHT DATUM
WGS 84 - UTM - 36 NORTH
SINOHYDRO HEIGHT BENCHMARK
Drawing No.
7 of 11
Scale
1:400
Date
Jun-15-2013


HIGH ELEVATED TANK S=1:50
PLAN S=1:50
A - A SECTION S=1:50
B - B SECTION S=1:50
C - C SECTION S=1:50
DEPTH (m)
GRAPHIC LOG
SPT Blow Count Blow/ft
EL. V=40.00
W.L V=1.70m
Water Storage Tank
Anchor Bolt M20×800 N=4
Replace with Soil of Good Quality
Lean Concrete
Cement Cath
MINISTRY OF HOUSING & PHYSICAL PLANNING
REPUBLIC OF SOUTH SUDAN
MINISTRY OF PHYSICAL INFRASTRUCTURE & RURAL DEVELOPMENT, UPPER NILE STATE
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
YACHIRO ENGINEERING CO., LTD
RECS INTERNATIONAL INC.
KOKUSAI KOGYO CO., LTD
THE PLANNING OF URGENT DEVELOPMENT AND SUPPORT FOR COMPREHENSIVE PLANNING AND SUPPORT FOR URGENT DEVELOPMENT ON SOCIAL ECONOMIC INFRASTRUCTURE IN MALAKAL TOWN
TITLE: Small Scale Master Supply Development (Urgent Support Project)
HIGH ELEVATED TANK
PROJECTION / HEIGHT DATUM
WGS 84 - UTM - 36 NORTH
SINOHYDRO HEIGHT BENCHMARK
Drawing No. 8 of 11
Scale 1:50
Date Jun-15-2013


PIPING AROUND THE HIGH ELEVATED TANK S=1:100
PLAN S=1:100
A - A SECTION S=1:100
B - B SECTION S=1:100
Water Storage Tank
Ladder
handrail
Lawn concrete
Gravel Cap
Replace with Soil of Good Quality
MINISTRY OF HOUSING & PHYSICAL PLANNING
REPUBLIC OF SOUTH SUDAN
MINISTRY OF PHYSICAL INFRASTRUCTURE & RURAL DEVELOPMENT, UPPER NILE STATE
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
YACHIRO ENGINEERING CO., LTD
RECS INTERNATIONAL INC.
KOKUSAI KOGYO CO., LTD
THE PLANNING OF URGENT DEVELOPMENT AND SUPPORT FOR COMPREHENSIVE PLANNING AND SUPPORT FOR URGENT DEVELOPMENT ON SOCIAL ECONOMIC INFRASTRUCTURE IN MALAKAL TOWN
TITLE: Small Scale Waster Supply Development (Urgent Support Project)
PIPING AROUND THE HIGH ELEVATED TANK
PROJECTION / HEIGHT DATUM
WGS 84 - UTM - 36 NORTH
SINOHYDRO HEIGHT BENCHMARK
Drawing No. 9 of 11
Scale 1:100
Date Jun-15-2013


STANDARD DRAWING OF STRUCTURE
STANDARD DRAWING OF DISTRIBUTION PIPING WORKS S=1:50
Service Connections organized by Dwellers
Scope for Urgent support Project
House
House
House
House
Saddle Plug Diversion
Plug Cap
Distribution Pipelines
Boundary between Road and Private Land
EXCAVATION AND BACK FILLING S=1:30
Ground Level
Covering depth 800
100
O.D
150
150
50
600
Back-filling with excavated soil
Marker sheet
Back-filling with sand
CHAMBER OF SLUICE VALVE AND WASH OUT VALVE S=1:30
900 x 900
600 x 600
150
150
1,150
1,000
150
50
50
100
Concrete Cover C-16
Mass concrete C-18 with reinforcement bars
Drain PVC dia 50mm
Gravel C40
MINISTRY OF HOUSING & PHYSICAL PLANNING
REPUBLIC OF SOUTH SUDAN
MINISTRY OF PHYSICAL INFRASTRUCTURE & RURAL DEVELOPMENT, UPPER NILE STATE
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
YACHIRO ENGINEERING CO., LTD
RECS INTERNATIONAL INC.
KOKUSAI KOGYO CO., LTD
THE PLANNING OF URGENT DEVELOPMENT AND SUPPORT FOR COMPREHENSIVE PLANNING AND SUPPORT FOR URGENT DEVELOPMENT ON SOCIAL ECONOMIC INFRASTRUCTURE IN MALAKAL TOWN
TITLE: Small Scale Water Supply Development (Urgent Support Project)
STANDARD DRAWING OF STRUCTURE
PROJECTION / HEIGHT DATUM
WGS 84 - UTM - 36 NORTH
SINOHYDRO HEIGHT BENCHMARK
Drawing No. 10 of 12
Scale 1:50
Date Jun-15-2013


PUBLIC TAP S=1:30
PLAN
Section B-B
Section A-A
Name plate for logo
Mass concrete C-16
Drain (Gravel C40)
Hardcore
Steel covers with lock
Gravel C40
Drain
Slope: 1%
Faucet
Water Meter 40mm
Gate Valve 40mm
Steel covers (Checker plate, at least thickness of 8mm) with lock
Valve & water meter chamber C-16
Note
1. Reinforcement Bars for avoiding cracking shall be put in the concrete structure.
2. Diameter for each tap shall be 25mm
MINISTRY OF HOUSING & PHYSICAL PLANNING
REPUBLIC OF SOUTH SUDAN
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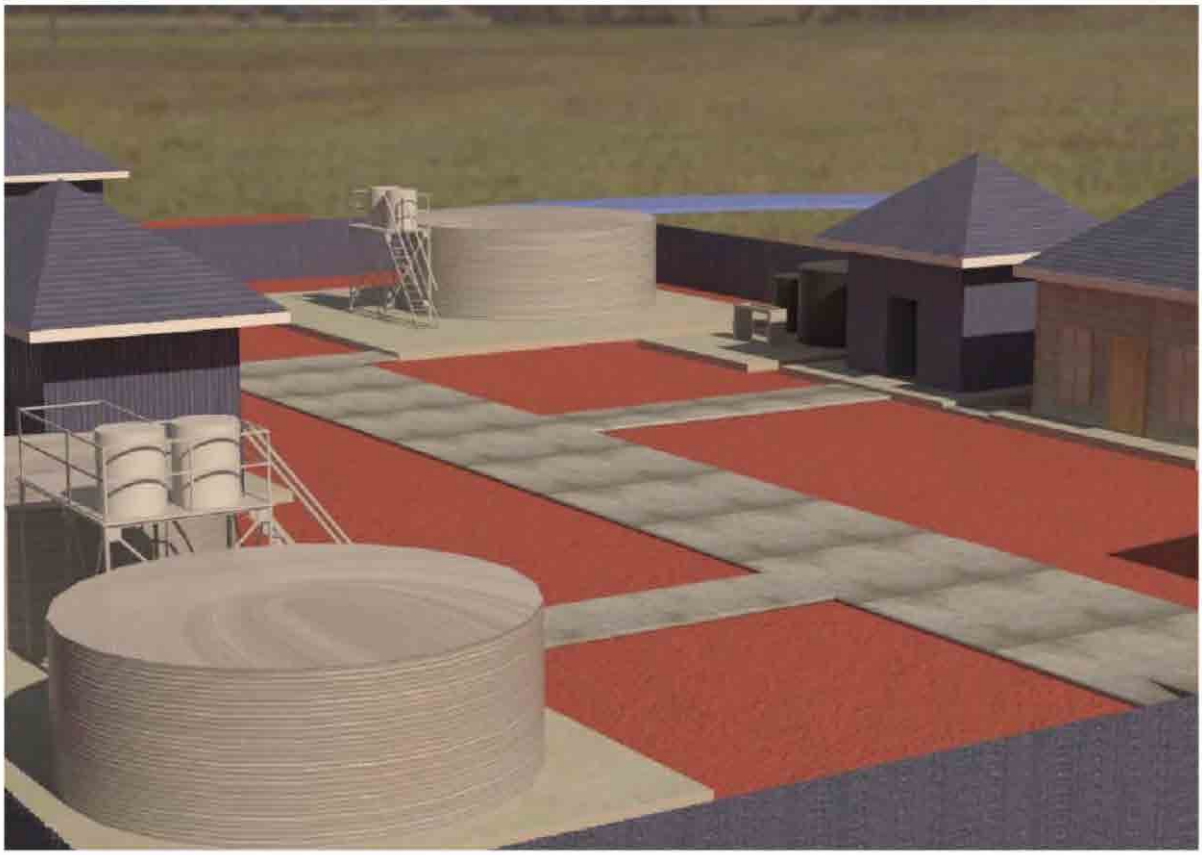
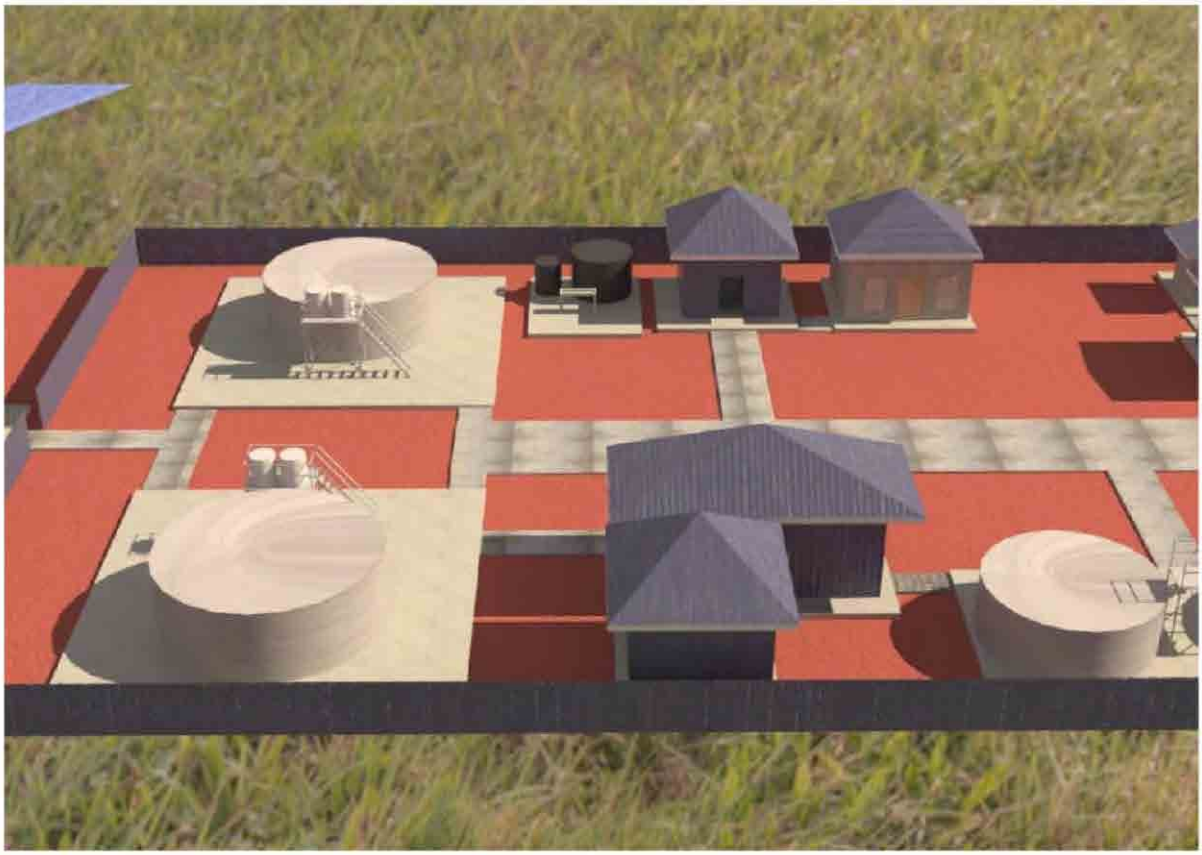
THE PLANNING OF URGENT DEVELOPMENT AND SUPPORT FOR COMPREHENSIVE PLANNING AND SUPPORT FOR URGENT DEVELOPMENT ON SOCIAL ECONOMIC INFRASTRUCTURE IN MALAKAL TOWN
TITLE: Small Scale Water Supply Development (Urgent Support Project)
PUBLIC TAP
PROJECTION / HEIGHT DATUM
WGS 84 - UTM - 36 NORTH
SINOHYDRO HEIGHT BENCHMARK
Drawing No. 11 of 11
Scale 1:30
Date Jun-15-2013





3D Drawings of Water Treatment Plant

5. Photographs

Procurement of Construction of Small-Scale Water Supply System in Malakal Town (Bid No. JICA/MAL2012/WS01)

The photograph of construction supervision

1. Prior checking of the Site
2. Handing over the Site of the Water Supply System
3. Relocation of UNICEF facilities etc.
4. The Land Preparation Work of the Water Treatment Plant
5. Construction and Supervision
6. The inspection for the material of the 1st Batch
7. Suspension of Construction

1. Prior checking of the Site

	No.1 10-May-13 ・Unit Type Treatment Plant
	No.2 10-May-13 ・Unit Type Treatment Plant
	No.3 10-May-13 ・Unit Type Treatment Plant
	No.4 10-May-13 ・Intake
	No.5 10-May-13 ・Elevated Tank
	No.6 10-May-13 ・Elevated Tank

	No.7 10-May-13 Elevated Tank→N.tap-8
	No.8 10-May-13 Elevated Tank→N.tap-8
	No.9 10-May-13 N.tap-8
	No.10 10-May-13 N.tap-8→Main Pipe

	No.75 11-May-13
	No.76 11-May-13 House Connection-1 residential area
	No.77 11-May-13 House Connection-2 commercial area
	No.78 11-May-13 House Connection-2 commercial area

2. Handing over the Site of the Water Supply System

No.1 21-Jun-13

Small-scale Water Supply System in Malakal Town

・Handing over the Site

No.2 21-Jun-13

Small-scale Water Supply System in Malakal Town

・Handing over the Site

No.3 21-Jun-13

Small-scale Water Supply System in Malakal Town

・Handing over the Site

No.4 21-Jun-13

Small-scale Water Supply System in Malakal Town

・Handing over the Site

3. Relocation of UNICEF facilities etc.

No.1 18-Jul-13

Small-scale Water Supply System in Malakal Town

・Relocation of UNICEF facilities etc.
・Implement all manually.

No.2 18-Jul-13

Small-scale Water Supply System in Malakal Town

・Relocation of UNICEF facilities etc.
・Implement all manually.

No.3 18-Jul-13

Small-scale Water Supply System in Malakal Town

・Relocation of UNICEF facilities etc.
・Implement all manually.

No.4 18-Jul-13

Small-scale Water Supply System in Malakal Town

・Relocation of UNICEF facilities etc.

No.23 19-Jul-13

Small-scale Water Supply System in Malakal Town

・Installation of Signboard.

4. The Land Preparation Work of the Water Treatment Plant

No.1 21-Jul-13

Small-scale Water Supply System in Malakal Town

・The Land Preparation Work of the Water Treatment Plant.

No.3 21-Jul-13

Small-scale Water Supply System in Malakal Town

・The Land Preparation Work of the Water Treatment Plant.

No.4 21-Jul-13

Small-scale Water Supply System in Malakal Town

・The Land Preparation Work of the Water Treatment Plant.

No.5 21-Jul-13

Small-scale Water Supply System in Malakal Town

・The Land Preparation Work of the Water Treatment Plant.

5. Construction and Supervision

Date	10-Dec-2013	No.1	
Work Items	Transportation of the construction material		
Remarks	・ The 1st batch arrives in Malakal.		

Date	11-Dec-2013	No.2	
Work Items	Transportation of the construction material		
Remarks	・Discharge of the construction material.		

Date	11-Dec-2013	No.3	
Work Items	Transportation of the construction material		
Remarks	・Discharge of the construction material.		

Date	12-Dec-2013	No.4	
Work Items	Transportation of the construction material		
Remarks	・Discharge of the construction material.		

Date	12-Dec-2013	No.5	
Work Items	Transportation of the construction material		
Remarks	・Two containers arrive in Malakal.		

Date	12-Dec-2013	No.6	
Work Items	Transportation of the construction material		
Remarks	・ Transportation to SITE from the Malakal port.		

6. The inspection for the material of the 1st Batch

Date	17-Dec-2013	No.1
Work Items	The inspection of material.	
Remarks	Site Office and Accomadation	

Date	17-Dec-2013	No.2
Work Items	The inspection of material.	
Remarks	Installing solar power at site office	

Date	17-Dec-2013	No.3
Work Items	The inspection of material.	
Remarks	Steel 2"x1.5mm, 150mm Drain pipe & 200mm Wast Pipe	

Date	17-Dec-2013	No.4
Work Items	The inspection of material.	
Remarks	Steel 2"x1.5mm, 150mm Drain pipe & 200mm Wast Pipe	

Date	17-Dec-2013	No.5
Work Items	The inspection of material.	
Remarks	Combined Power generator and Welding Machine	

Date	17-Dec-2013	No.6
Work Items	The inspection of material.	
Remarks	Tool box set	

7. Suspension of Construction

Date	20-Dec-2013	No.1
Work Items	Unit Type Treatment Plant site.	
Remarks	・The final check of suspension of construction.	

Date	20-Dec-2013	No.2
Work Items	Unit Type Treatment Plant site.	
Remarks	・The final check of suspension of construction.	

Date	20-Dec-2013	No.3
Work Items	Unit Type Treatment Plant site.	
Remarks	・The final check of suspension of construction.	