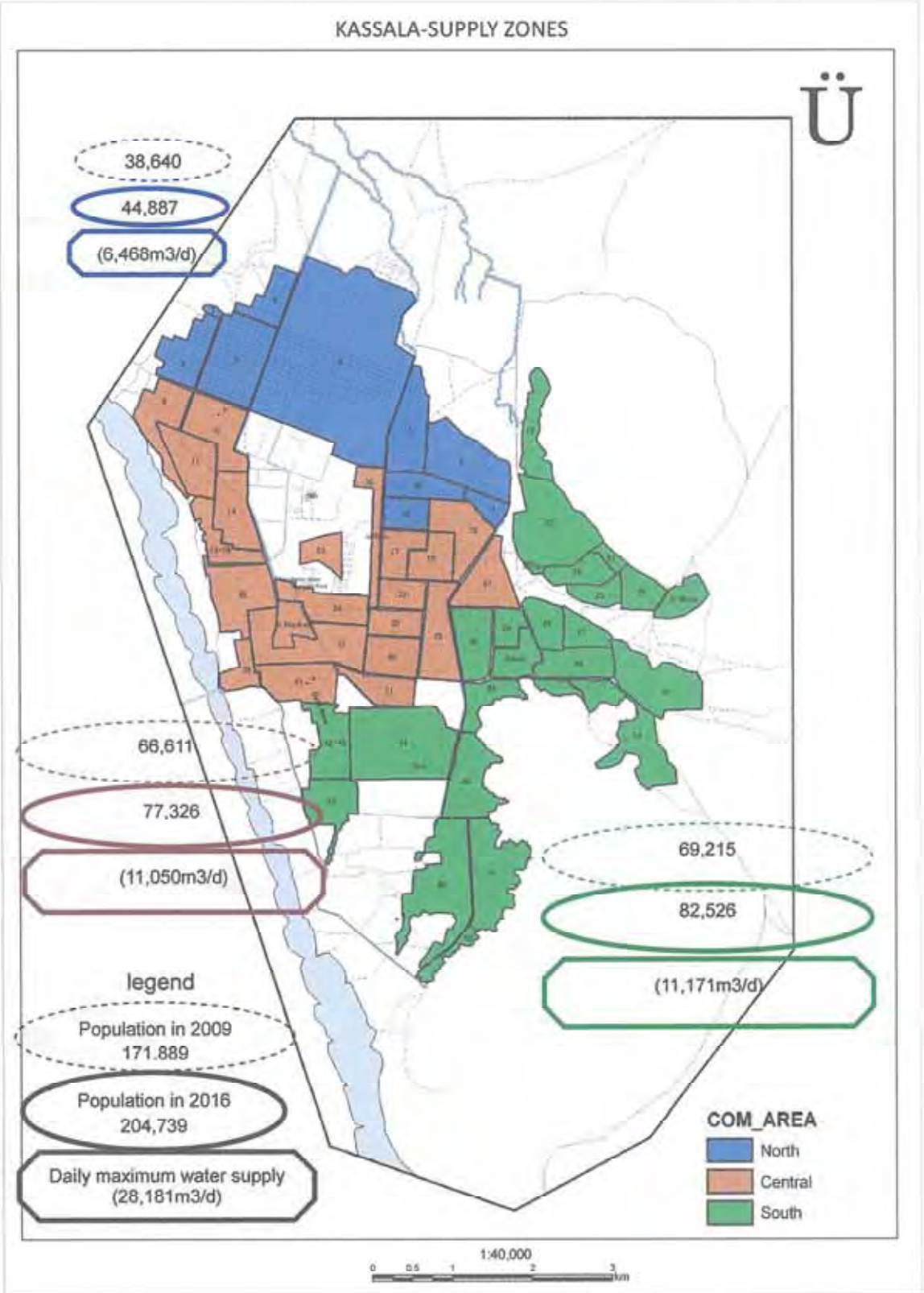
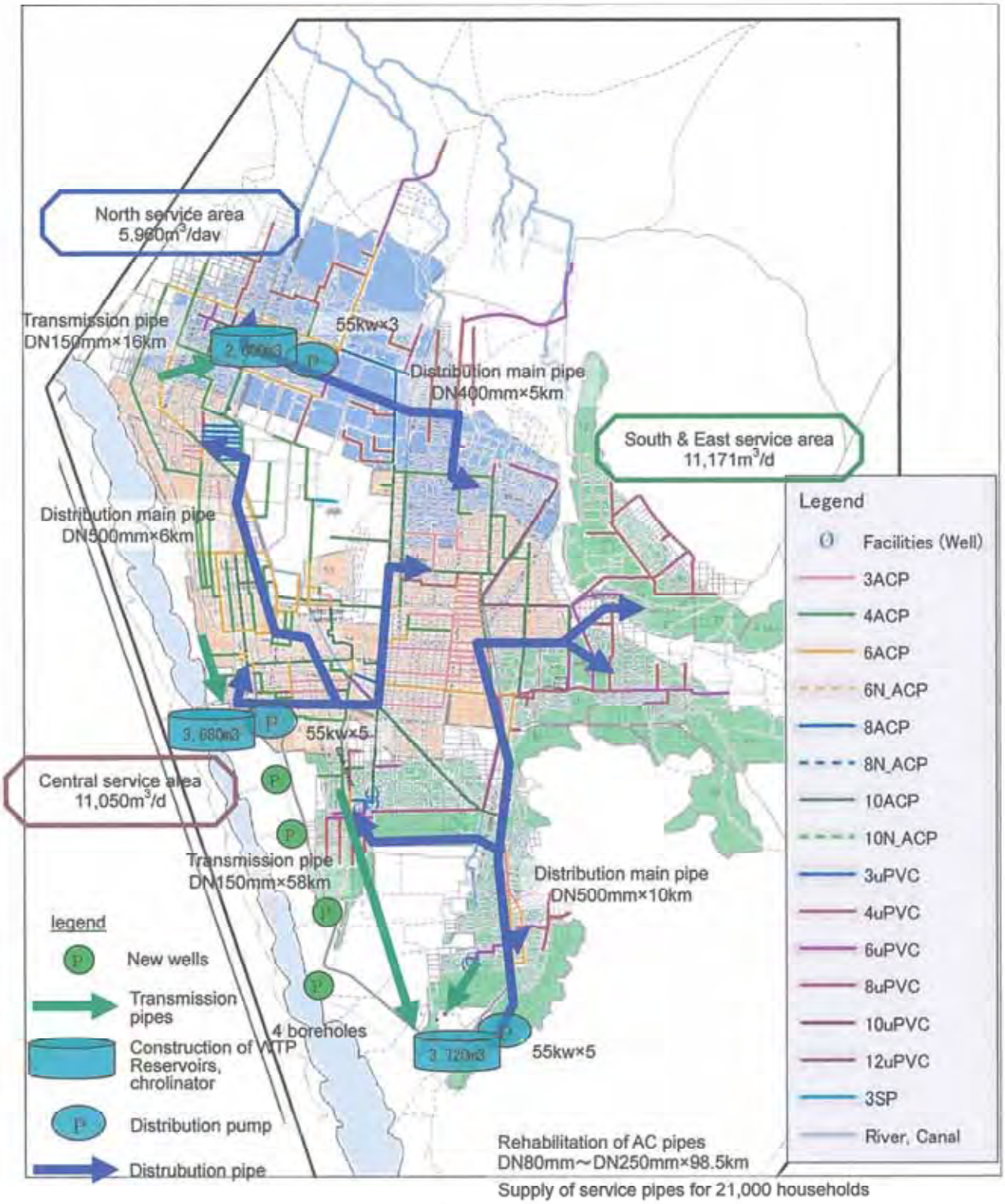


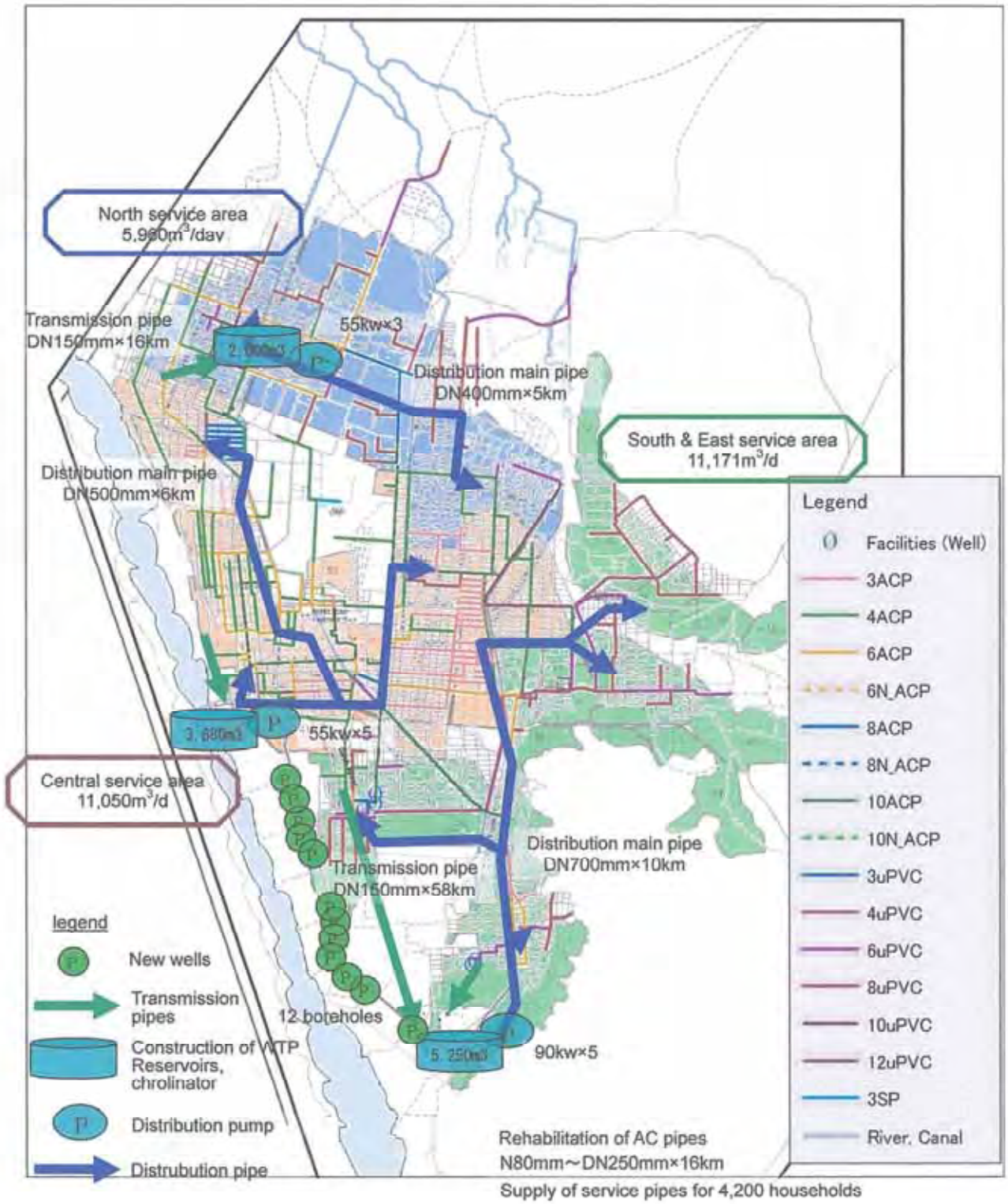
FIG.1-4 DISTUBUTION AREA PLAN

PLAN

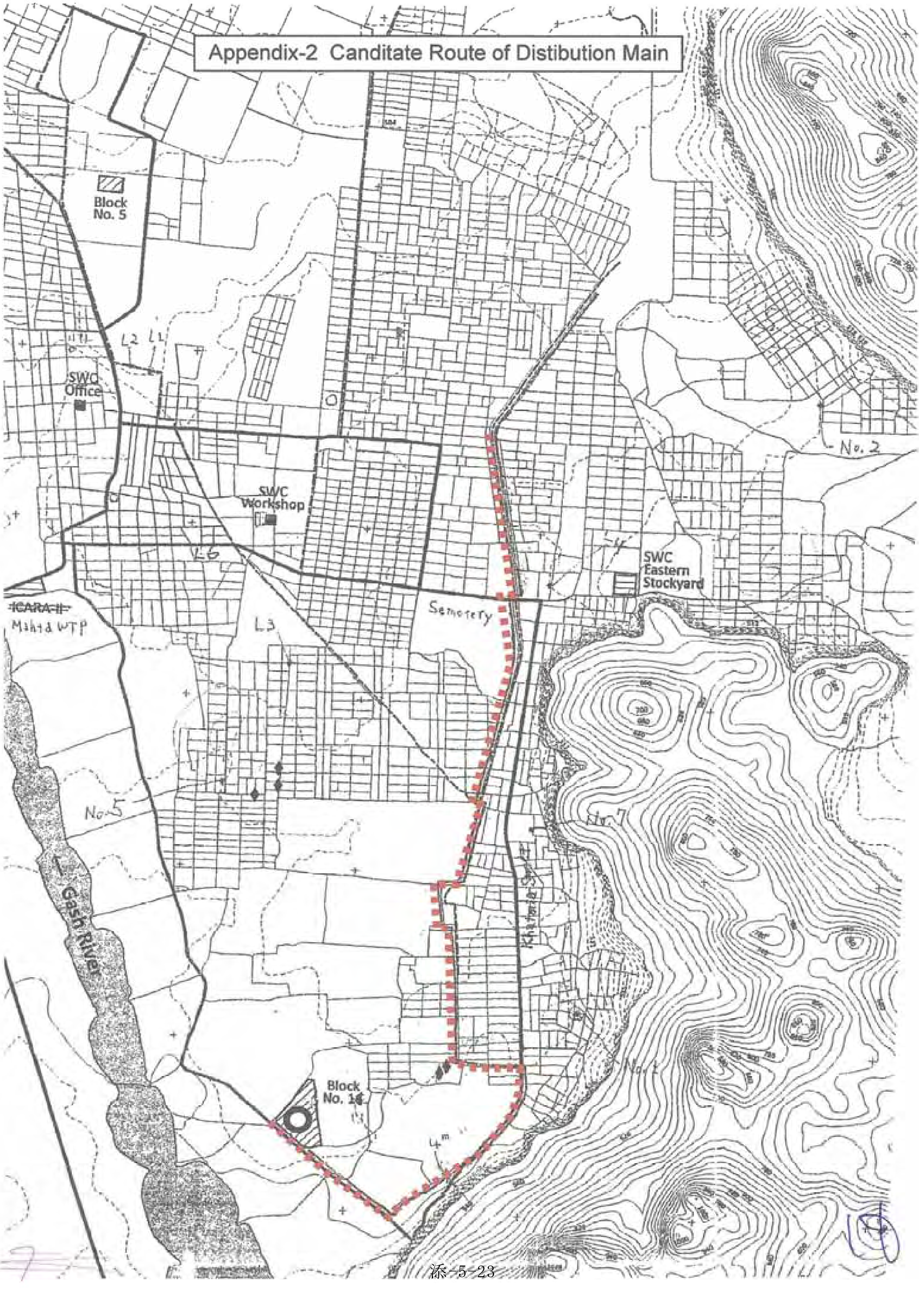


Note) There is a possibility of the modification of facilities specification shown in above figure accirding to the design progress.

PLAN (Alternative)



Note) There is a possibility of the modification of facilities specification shown in above figure accirding to the design progress.


Appendix-2 Canditate Route of Distibution Main
Block No. 5
SWC Office
SWC Workshop
SWC Eastern Stockyard
ICARA-II
Mahta WTP
Semetery
Gash River
Block No. 16
No. 2
No. 5
No. 7
Khatmia Street
L2
L1
L6
L3
4m

Appendix-3 Requested Equipment

1) Construction equipment

Table 3-1 List of Construction Equipments Required

Name of Equipment	Specification	Quantity	Remarks
Backhoe Loader	Excavating Bucket 1.0m3, Loader Bucket 0.4m3, 92HP	1	Loader& Excavator
Truck with Crane		1	

2) Machines and Tools for Workshop

Table 3-2 List of Workshop Machines Required

Name of Equipment	Specification	Quantity	Remarks
Fixed Drilling Machine		1	
Movable Drilling Machine		2	
Welding Machine		1	
Threading Machine	0.5～4"	1	
Cutter Machine		1	
Leath Machine		1	
Oxy-ceteling Equipment		2	

Table 3-3 Mechanical Tools for Work Shop Required

NO	Items	Specification	Quantity
1	Bench	1m x2m	2
2	Smith's anvil		1
3	Hammer	Cross pane hammer &Ball pane hammer	4
4	Sledge hammer	Double faced sledge &straight pane sledge	2
5	Chisels	Flat, cross cut, half round,	6
6	Calipers	Out side, inside, divider &odd legs	6
7	Centure punch		4
8	Pin punch		4
9	Bevel gauge		2
10	Out side micrometer caliper		2
11	Radius gauge		2
12	Scriber		2
13	Hack saw		6

NO	Items	Specification	Quantity
14	Vernier sliding caliper		2
15	Files	Flat, square, triangle, knife, half round, round rat tail files	4 for each one
16	Drills	Twist drills	2 set
17	Reamers		1
18	Set of hand taps		2
19	Measuring tools	Ruler, tape 5m, 10m length	3
20	Vise	For light and heavy duty	4
21	Iron brushes		6
22	Block &tackle	1/2 ton	2
23	Pliers	Different types for mechanical works	12
24	Chain wrench	For holding metal pipe 3"-4"-6"-dimeter	6
25	Spanner	Different sizes and types	3 set
26	Screw drivers	Different sizes & shapes	3 set
27	Hoover	700W	2
28	Stock & dies	2/8" to 7/8"	2 set
29	Alenkey		2 set
30	Right angle steel rule		4
31	Pipe wrench	18"-24"-30"-36"-	8
32	Cutter wheel	2"-3"-4"-6"	Each 2

Table 3-4 Electrical Tools for Work Shop Required

NO	Items	Specification	Quantity
1	Insulated Screw	Different sizes and shape	3 sets
2	Insulated pliers	For electric works(500V)	4
3	Cutters	For single core wire 1.5mm-16mm	4
4	Insulation cutters	For single core wire 1.5mm-16mm	4
5	Cable shoes pliers	Suitable for working 1.5mm-16mm	4
6	Measure	For measuring insulation resistance	1
7	Measuring instrument	For A-V-Ohm values(digital type)	2
8	HZ Meter	Digital type	2
9	Clip meter	Digital type	2
10	Hand drill machine		2
11	Plastic hammer	Half pound	4
12	Spanners	Different sizes, shapes & types	4 sets
13	Drills	4mm-18mm	2 sets
14	Cables shoes	1.5mm-16mm	
15	Expender	3 legs for heavy duty	2
16	Expender	2 legs for light duty	2
17	Expender	2 legs for small bearing	2

TECHNICAL NOTE (3)
ON
THE PREPRATORY SURVEY
OF
THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY FACILITIES
AT
KASSALA CITY,
IN
SUDAN

In the course of discussions and the preparatory survey (hereinafter referred to as "the Survey") on the Project for Improvement of Water Supply Facilities at Kassala City in Sudan (hereinafter referred to as "the Project"), Kassala State Corporation (hereinafter referred to as the "SWC") and the JICA Preparatory Survey Team (hereinafter referred to as the "the Team") have confirmed on the technical issues as described in the attached.

Kassala, December 19, 2010

Eng. Hashim Mohamed Abdulatief
Acting Director General
Kassala State Water Corporation
Kassala State
Government of National Unity
Sudan

Mr. Makoto HOMMA
Chief Consultant,
JICA Preparatory Survey Team
Japan

ATTACHMENT

Both parties agreed on the followings.

1. Components of the Project

Based on the M/D dated November 28, 2010, the components of the Project boned by Japanese side have been determined as shown below.

a) Construction of new source wells in South; necessary numbers of source wells for required groundwater development amount
b) Construction of a new water treatment plant in South
c) Construction of new conveyance pipes from source wells to reservoirs in South
d) Construction of distribution main from new water treatment plant in South to the existing water supply network

As for the following components, they will be discussed with JICA and Japanese government in Tokyo by examining the results of the survey.

e) Construction of distribution pipes where required for keeping adequate water supply service based on the pipe network analysis
f) Procurement of necessary and justifiable construction equipment and machines and tools for workshop with rehabilitation of the workshop
g) Technical Assistance for capacity building of operation and maintenance of the State Water Cooperation of Kassala State

The overall plan of improvement of water supply facilities at Kassala City is summarized as shown below.

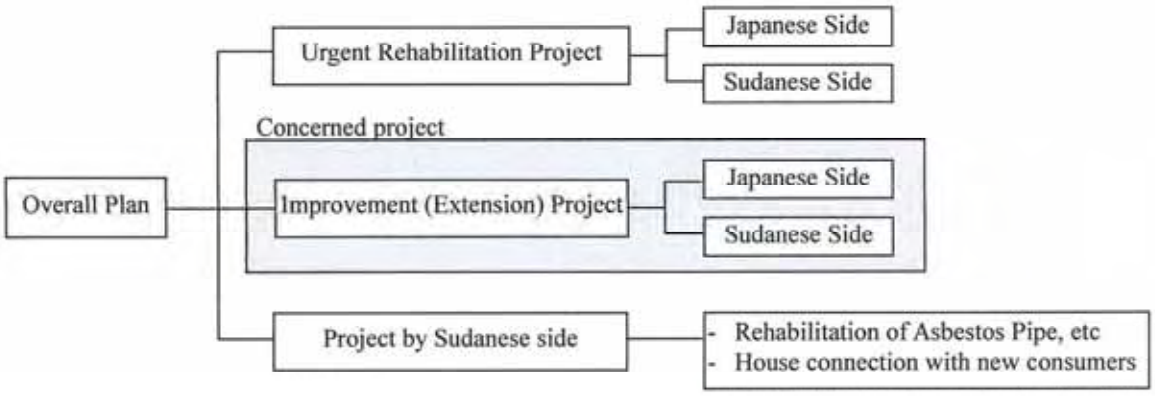


Figure-1 Overall Plan

2. Conditions of the water supply plan

The condition of water supply plan is finalized as shown below.

- Target year : 2016
- Target area : east bank of Gash River in the Kassala town locality and Musa of Kassala rural locality
- Population : 204,739
- Piped water service population : 204,739 (100%)
- Water consumption per capita : 90 l/c/d (domestic:75 l/c/d, non-domestic15 l/c/d)
- Leakage loss : improved up to 28% from 35% of 2009

3. Water balance in 2016

The water balance in 2016 is finally summarized as shown below, considering condition changes in the existing wells. The well No.43 in South has been out of use at present because of its small discharge observed by the Study team, then, the number of the existing wells in South has been changed from eleven (11) to ten (10). The discharge of the well No.36 in north has been changed from 2m3/hour to 17m3/hour by re-measuring it.

Table-1 Water balance in 2016

	l/c/d	population	amount m3/day
1. Water consumption			
a. Served population (pipe connection ratio: 100%)		204,739	
b. Domestic water use	75.00	204,739	15,355
c. Non-domestic water use = b x 20%			3,072
d. Daily average water consumption b + c			18,427
e. Daily maximum water consumption = d x seasonal factor(1.3)			23,954
f. Required water supply = e / (1-leakage ratio(0.28))			33,270
2. Water supply from the existing supply points			
a. Water supply from Mahta WTP			11,050
b. Water supply from source wells in South			7,536
c. Water supply from source wells in North			6,828
d. Total			25,414
3. Required water development amount = (1.f)-(2.d) < maximum water development potential (8,280m3/day)			7,856

Note) All the existing wells will be working for continuous 24 hours.

4. Development of new product wells

1) As shown in the table 2.1, required new water supply amounts to 7,856m3/day (327m3/hour). Of the seven test wells, four wells will be used as production wells including three wells of 35m3/hour and one well of 10m3/hour, then, amount to 115m3/hour. Therefore, numbers of new product wells equivalent to 212m3/hour are required to be developed. Such wells will be developed by the Japanese consultant and under control of SWC by the staring of the construction work, with SWC measuring their groundwater levels twice a month.

2) Groundwater quality of new product wells should comply with the standard of SSMO for drinking water.

3) Casing size shall be 10 inches in diameter as indicated by SWC, and a stand pipe of the casing shall be 2m above ground level for protecting wells from flood damage.

5. Construction of new product well facilities

1) Based on the design conditions that power distribution environment will be certainly improved in target year and that product wells will be working for 24-hours continuously, the design concepts of the product wells are shown as below.

- Diesel generator(s) for emergency use are(is) installed for operating required numbers of new product wells equal to 50 percent of water product of all the new water wells.

- No guardsman/operator is staffed (uninhabited facility)

- Staffs belonging to new WTP in South will supervise new well facilities.

- A well pump shall automatically stop when groundwater comes down under the well pump.

- A well pump shed installs for protecting instrumentation and an electrical panel, etc. from prank or theft.

2) New product well facility consists of the following equipments

a. well pump
b. riser pipes
c. air valve
d. check valve
e. stop valve
f. integrating flow meter
g. pressure gauge
h. operating panel with a protecting device against no-flow operation of the well pump
i. well pump shed

6. Survey for connection work of existing product wells

1) The 10 numbers of exiting product wells in South as shown below will be connected with new conveyance pipes through which water is sent to new WTP in South.

Table-2 Product wells in South

NO.	Well No.	Production (m3/hour)	Production (m3/day)	remarks
1	41	16	384	
2	33	52	1,241	
3	32	25	596	

NO.	Well No.	Production (m3/hour)	Production (m3/day)	remarks
4	21	38	909	
5	22	45	1,080	
6	2	37	888	
7	1	30	720	
8	3	35	840	
9	24	14	336	
10	4	23	543	
11	(43)	-	0	discarded by SWC
12	(42)	-	0	discarded by SWC
	-	314	7,536	

2) As no performance curves (Q-H) of the existing pumps above are available, it is difficult to make a judgment on their suitability to the project. Because the existing pumps are required to send water to the new WTP in South changing from the direct connections with the existing pipe network and booster pumps. Therefore, the existing well pumps will be probably replaced with new ones.

3) The survey on their suitability to the project will be conducted by the consultant during next survey for detailed design, with its methodology examined during basic design in Japan.

7. Connection work of existing product wells

1) The connection work with new conveyance pipes will be carried out at the implementation stage by the contractor. After completion of the detailed design, its specification can be finalized.

2) The followings show current situation of existing well facilities. Some of existing facilities are probably rehabilitated, and the basic concepts of designing will be examined in Japan during basic design. If an existing generator is necessary to be replaced, and a new generator and its shed will be installed by SWC. If an existing well pump is necessary to be replaced, a new well pump and its shed will be installed by Japanese side.

Table-3 Existing well facilities in South

Well No.	Pump type	Diesel generator	Pump shed	Guardsman /operator
41	land-based motor pump	installed		staffed
33	land-based motor pump	installed	installed	staffed
32	submersible motor pump	installed		staffed
21	submersible motor pump	installed		staffed
22	submersible motor pump	installed		staffed
2	submersible motor pump	installed	installed	staffed
1	submersible motor pump	installed	installed	staffed
3	land-based motor pump	installed		staffed
24	submersible motor pump	installed		staffed
4	submersible motor pump	installed		staffed

8. Construction of water conveyance pipes

1) **Appendix-1** shows water conveyance pipes routes. Although an individual water conveyance pipe system; one water conveyance pipe for one well pump, is ideal for efficient well pump operation, limited pipe laying space does not allow employing such an ideal system. The Team will evaluate combining conveyance pipes system in Japan during basic design.

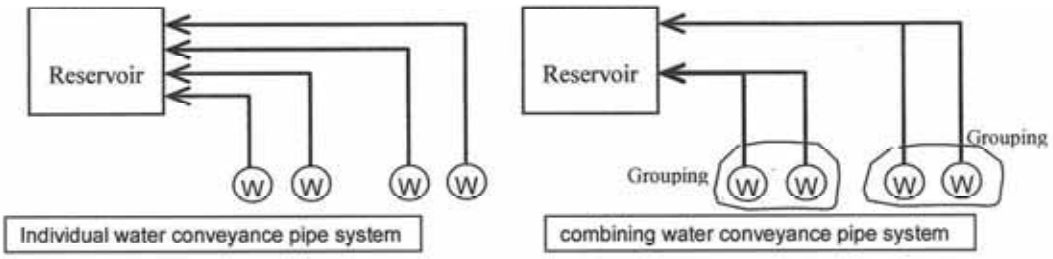


Figure-2 Water Conveyance Pipe System

2) The combining water conveyance pipes system shall be reviewed by using new data of well yield and dynamic groundwater level obtained from the detailed design survey. If necessary, the combining water conveyance pipes system will be modified.

3) Water conveyance pipes along the bank of Gash River are able to be laid inside the space of 10m from the edge of bank road slope as shown below.

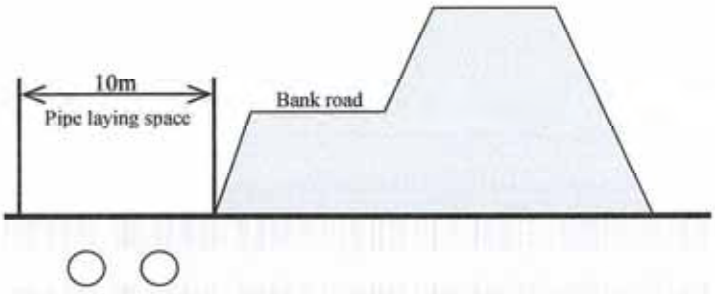


Figure-3 Pipe laying Space for Water Conveyance Pipe

4) Water conveyance pipes should equip with stop valves, air valves and drain valves, etc, where necessary.

9. Construction of new WTP in South

1) New WTP will be designed by utilizing Japanese guideline of water works "Design criteria for water works facilities by JWWA".

2) New WTP consists of same components as Mahta WTP design.

3) Design capacity

a. Daily maximum water distribution amount
= (water production of new wells)+(water production of existing wells in South)
= 7,856m3/day + 7,536m3/day=15,392m3/day (641.3m3/hour)

b. Hourly maximum water distribution amount
= (daily maximum water distribution amount) x (time factor)
= 15,392m3/day x 1.5=23,088m3/day (962m3/hour)

4) Components of facilities
a. Receiving Well (2 wells)
b. Concrete made reservoir (2 wells)
c. Distribution Pump Building
d. Distribution Pump (including stand-by pump)
e. Chlorination Dosing Facility
f. Electric Facility (not including transformer for the WTP)
g. Generator for Emergency (within 50% of distribution pump load)

5) Flood countermeasures will be considered in designing on ground of the fact that the land was under water at 2003 flood.

6) An administration building is excluded from the new WTP, because the control room for operators and/or staffs will be prepared in the distribution pump building.

7) A work shop and a laboratory are not installed.

10. Construction of distribution main

1) Distribution main is required to be laid for conveying water from the WTP in South to existing piping networks. The distribution main will be constructed by Japanese side. The route of the distribution main is planned to run along the drainage canal as shown in **Appendix-1**, because of no obstacles under the ground.

2) If the water pressure of the new WTP in South is enough to send water to existing service area, the project will employ the way to send water directly to service area without using existing booster pumps, Mukram PS, Shareba PS, Gawage PS and Dooma PS.

3) Distribution main should equip with stop valves, air valves and drain valves, etc, where necessary, but not equip with fire hydrants as current situation.

11. Presentation of upgrading plan of existing water pipe network

1) In response to request from SWS on the upgrading plan of existing pipe network as described in the Technical Note (2), clause 7. 1) & 2) dated 19 September, 2010, the Team has presented the plan attached with **Appendix-1**. The computation results suggest that some of existing pipes are required to be added. The red-colored pipes show additional new ones. The total length of additional pipes can be estimated at

around 6.3km.

2) This matter will be discussed with JICA and Japanese government in Japan whether involving in the project, and/or their demarcation.

3) Although SWC has requested the installation of fire hydrants, the Team answered that ~~it is impossible to involve in this Project.~~ they will review the SWC request.

12. Equipment for operation and maintenance

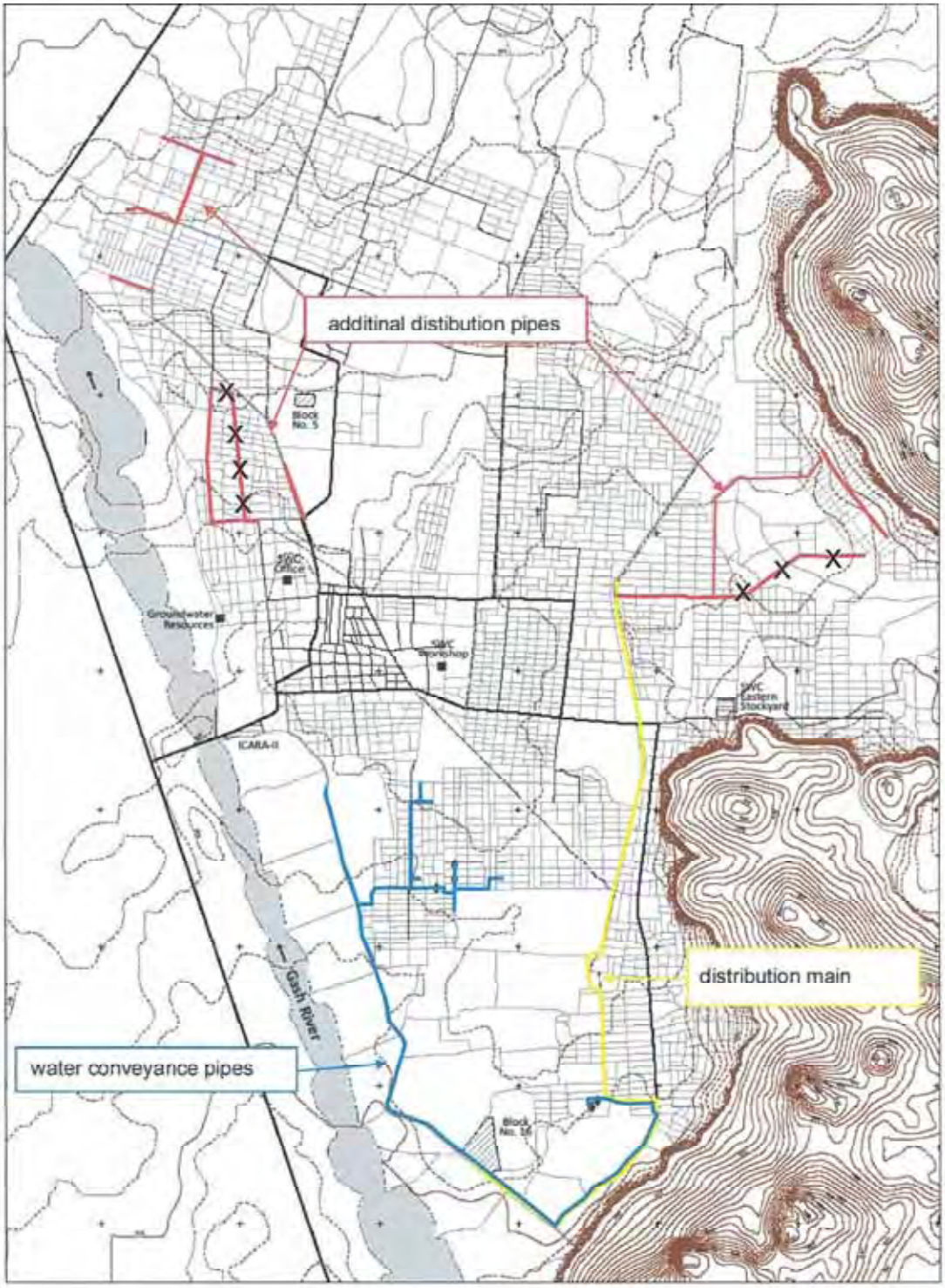
1) SWC has resubmitted the revised equipment and machine list to be requested h attached with **Appendix-2**.

2) This matter will be discussed with JICA and Japanese government in Japan including whether involving in the project, and/or their demarcation.

13. Demarcation of the project

The demarcation of the project is essentially planned as shown in the **Appendix-3**. As power receiving works burned by SWC are very important elements, the Team has proposed the power receiving plan of loop system for keeping stable and reliable power receiving without stoppage. The proposed plan is attached with **Appendix-4**.

Appendix-1 Piping routes of water conveyance and distribution main, and location of additional pipes plan of existing pipes network



Appendix-2 Revised equipment list for operation and maintenance to be requested

1) Construction equipment

List of Construction Equipments Required

Name of Equipment	Specification	Q'ty
Backhoe Loader	Excavating Bucket 0.25m3-0.3m3, Depth more than 2.0m, Loading Bucket 1. 0m3	2
Truck with Crane	4ton Truck with 2.9t Crane	1

2) Machines and Tools for Workshop

List of Workshop Machines Required

Name of Equipment	Specification	Q'ty
Fixed Drilling Machine	15" heavy duty	1
Hand Drill Machine	Up to 10mm	2
Welding Machine	30-225 amperes	1
Pipe Threading Machine	0.5"-4"	1
Pipe Cutter Machine	0.5"-4"	1
Oxyacetylene Equipment		2

Mechanical Tools for Work Shop Required

No.	Items	Specification	Q'ty
1	Bench	1m x2m	2
2	Smith's anvil		1
3	Hammer	Cross pane hammer &Ball pane hammer	4
4	Sledge hammer	Double faced sledge &straight pane sledge	2
5	Chisels	Flat, cross cut, half round,	6
6	Calipers	Out side, inside, divider &odd legs	6
7	Centre punch		4
8	Pin punch		4
9	Bevel gauge		2
10	Out side micrometer caliper		2
11	Radius gauge		2
12	Scriber		2
13	Hack saw		6
14	Vernier sliding caliper		2
15	Files	Flat, square, triangle, knife, half round, round rat tail files	4 each
16	Drills	Twist drills	2 sets
17	Reamers		1
18	Set of hand taps		2
19	Measuring tools	Ruler, tape 5m, 10m length	3
20	Vise	For light and heavy duty	4

No.	Items	Specification	Q'ty
21	Iron brushes		6
22	Block &tackle	1/2 ton	2
23	Pliers	Different types for mechanical works	12
24	Chain wrench	For holding metal pipe 3"-4"-6"-dimeter	6
25	Spanner	Different sizes and types	3 sets
26	Screw drivers	Different sizes & shapes	3 sets
27	Hoover	700W	2
28	Stock & dies	2/8" to 7/8"	2 sets
29	Allen key		2 sets
30	Right angle steel rule		4
31	Pipe wrench	18"-24"-30"-36"-	8
32	Cutter wheel	2"-3"-4"-6"	2 each
33	Tool Box	Holding above tools	1
34	Tachometer	50 to 50000 rpm	1
35	Emergency Light	Twin 6-Volt with Nickel Cadmium battery	1
36	Submersible Pump	Engine type, 3"	2

Electrical Tools for Work Shop Required

No.	Items	Specification	Q'ty
1	Insulated Screw	Different sizes and shape	3 sets
2	Insulated pliers	For electric works(500V)	4
3	Cutters	For single core wire 1.5mm-16mm	4
4	Insulation cutters	For single core wire 1.5mm-16mm	4
5	Cable shoes pliers	Suitable for working 1.5mm-16mm	4
6	Measure	For measuring insulation resistance	1
7	Measuring instrument	For A-V-Ohm values(digital type)	2
8	HZ Meter	Digital type, 0-60Hz	2
9	Clip meter	Digital type, up to 1000V, 100A	2
10	Hand drill machine	Up to 10mm	2
11	Plastic hammer	Half pound	4
12	Spanners	Different sizes, shapes & types, 4mm-16mm	4 sets
13	Drills	4mm-18mm	2 sets
14	Cables shoes	1.5mm-16mm	
15	Expender	3 legs for heavy duty	2
16	Expender	2 legs for light duty	2
17	Expender	2 legs for small bearing	2

Appendix-3 Demarcation of the project

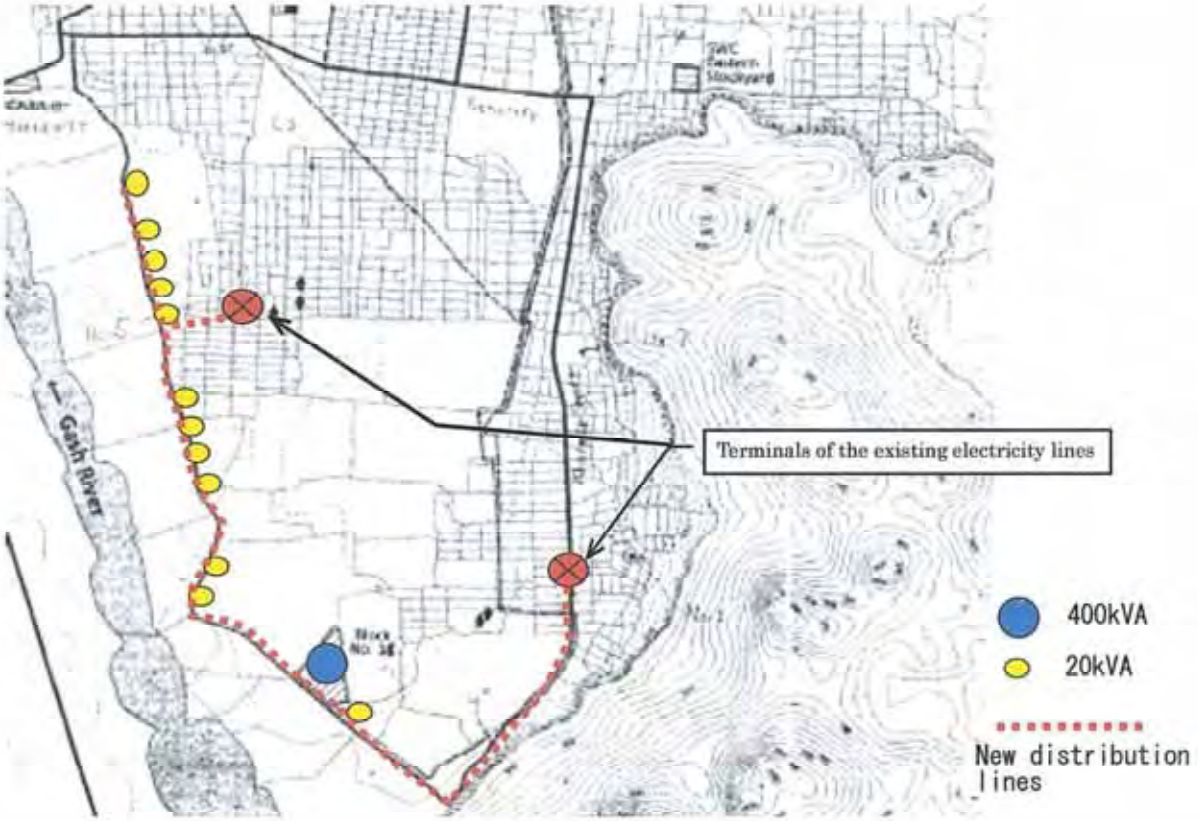
PS : Preparatory Survey　　BS : Before the starting of the construction work
DD : Detailed Design stage　　CW : Construction Work

Items	executing term	Japan	Suadan
1. Development of new product wells converted from test wells (4 wells)			
✓ Under control of wells	BS		X
✓ Periodical groundwater level measurement	BS		X
2. Development of new product wells			
✓ Securing of the drilling site	DD		X
✓ Clearance of the site (Incl. bush)	DD		X
✓ Securing of access road	DD		X
✓ Negotation with inhabitants concerned, if necessary	DD		X
✓ Geopghysical exploration	DD	X	
✓ Test drilling	DD	X	
✓ Pumping test	DD	X	
✓ Impact survey on existing wells surrounding new wells during pumping test	DD		X
✓ Under control of wells	BS		X
✓ Periodical groundwater level measurement	BS		X
3. Construction of wells facilities for new wells of item 1&2			
✓ Acquisition of well facility land	BS		X
✓ Clearance of well facilities land	BS		X
✓ Development & pumping test prior to construction	CW	X	
✓ Well outlet completion	CW	X	
✓ Installation of well pump facilites incl. electrical panel	CW	X	
✓ Construction of well houses	CW	X	
✓ Construction of power distribution lines up to new wells	CW		X
4. Survey for connection work of existing product wells	Detailed survey method will be examined and determined in Japan		
✓ Survey for connection work of existing product wells	DD	X	
✓ Attendance at testing, removal and reinstallation of an existing pump, if necessary	DD		X
✓ Informing inhabitants of temporary water supply decrease or stoppage during testing, if necessary	DD		X
✓ Informing inhabitants and getting their agreement on construction of temporary drainage, if necessary	DD		X
5. Rehabilitation of the existing wells (10wells)			
✓ Replacement of the existing well pump, if necessary	CW	X	
✓ Installation of the incidental equipment	CW	X	

PS : Preparatory Survey BS : Before the starting of the construction work
DD : Detailed Design stage CW : Construction Work

Items	executing term	Japan	Suadan
✓ Replacement of the existing generator, if necessary	CW		X
6. Construction of coveyance pipes			
✓ Clearance of obstarction on the pipe routes	BS		X
✓ Conctruction of conveyance pipes from new wells to new reservoirs	CW	X	
✓ Conctruction of conveyance pipes from exiting wells to new reservoirs	CW	X	
7. Construction of new WTP in south			
✓ Land leveling of the constreuction site	BS		X
✓ Improvement of the acccess road (construction road), if necessary	CW		X
✓ Constuction of facilities - Receiving wells - Reservoirs - Distribution pump building - Distibution pumps - Chlorine dosing equipment - Emergency generator - Electrical equipment & instrumentation	CW	X	
✓ Installation of pipes inside WTP	CW	X	
✓ Construction of roads inside WTP	CW	X	
✓ Construction of gate(s) & fences	CW		X
✓ Condtruction of power distribution lines up to new WTP incl.a transformer	CW		X
8. Construction of distribution main			
✓ Clearance of the obstacles on the distibution main route, if necessary	BS		X
✓ Connection with existing pipes	CW	X	
✓ Connection with the exiting outlet pipes of booster pumps	CW	X	
9. Improvement of existing pipes network by adding new pipes where required	To be dicussed with JICA & Japanese Government		
✓ Procurement of piping materilas			
✓ Installation works			
10. Construction equipment & machines and tools for workshop	To be dicussed with JICA & Japanese Government		
✓ Procurement of construction equipment			
✓ Procurement of machines and tools for workshop			
✓ Rehabilitation of workshop			
11. Training of SWC stafff			
✓ Initial operation training of new facilities by the contractor	CW	X	
✓ Initial management training of new WTP by the consultant (Soft component)	CW	To be dicussed with JICA & Japanese Government	

Appendix-4 Proposed power receiving system



Loop power receiving system