

## **Appendix-5 Minutes of Discussion (Technical Notes)**

- (1) Preparatory Survey (1st stage) (3 July 2010)**
- (2) Preparatory Survey (1st stage) (19 September 2010)**
- (3) Preparatory Survey (2nd stage) (19 December 2010)**



TECHNICAL NOTE (1)  
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, July 3, 2010

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Eng. Mustafa Mohamaddin Lduis  
Director General  
Kassala State Water Corporation  
Kassala State  
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Mr. Makoto HOMMA  
Chief Consultant,  
JICA Preparatory Survey Team  
Japan

## ATTACHMENT

### 1. Project Site

The Project site is located at the east bank of Gash River in Kassala city. The area of the eastern side of Mt. Mukram is out of Scope. Site map is shown in Annex-1.

### 2. Population

The population of the Project Site is 167,650(2008) and estimated 204,739(2016) according to the Census.

### 3. Housing Plan in Northern distinct

Housing Plan in Northern distinct aims at dealing with the growth of population in Kassala city. There is no limitation for housing.

### 4. Land information

SWC provide the Land information below.

- Land of the Existing Facility: boundary of the Land, Patent roll
- Land for the Source Well Construction Site: boundary of the Land, Patent roll

### 5. Permission to use Existing Irrigation Well around the Test Well Construction Site

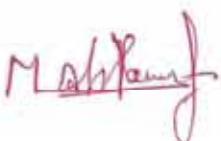
SWC requests the owner of the existing irrigation wells around the test well construction site to measure groundwater level in it for investigation of the radius of influence of the test well during pumping test.

### 6. Stakeholder Meeting regarding EIA

SWC coordinate to hold the Stakeholder Meeting regarding EIA on September and December and the Team will assist.

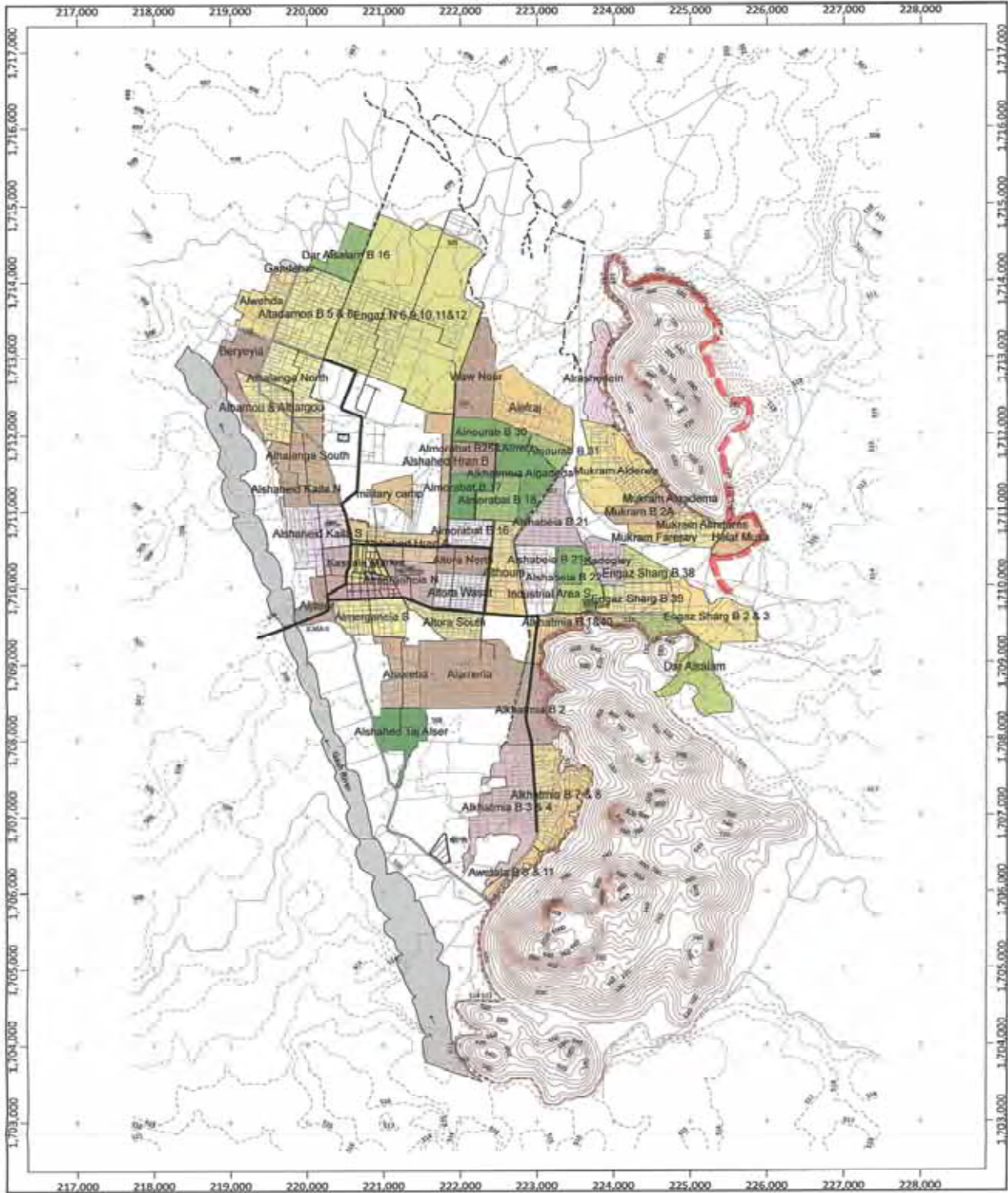
### 7. Water consumption survey

SWC continue to measure the water meters once per week for Water consumption survey.



# KASSALA

# Annex - 1



SCALE 1:25,000

**LEGEND**

- Facilities (Office, Workshop)
- Facilities (Well)
- ▭ Facilities (Conveyance, Stockyard)
- ▨ Planned Well Site
- Paved Main Road
- Paved Road
- Unpaved Main Road
- Unpaved Road
- Footpath
- - - River, Canal

Grid :  
 Projection :  
 Spheroid :  
 Unit of Measurement :  
 Meridian of Origin :  
 Latitude of Origin :  
 Scale Factor at Origin :  
 False Co-ords of Origin :  
 Datum :

UTM Zone 37  
 Transverse Mercator  
 WGS 1984  
 Meter  
 39 deg. East of Greenwich  
 Equator  
 0.9996  
 500,000m Easting  
 Nil in Northing  
 WGS 1984




Index Map



TECHNICAL NOTE (2)  
ON  
THE PREPRATORY SURVEY  
OF  
THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY FACILITIES  
AT  
KASSALA CITY,  
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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, September 19, 2010



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Sudan



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



## ATTACHMENT

Both parties agreed on the followings.

### I. General

#### 1. Cooperation project

The Team prepared the basic plan of the improvement of the water supply facilities at east bank of the Gash River in Kassala City (hereinafter referred to as "the Basic Plan"). Cooperation component(s) will be selected from the Basic Plan and defined as a cooperation project depending on the budget through the meeting between JICA and SWC, scheduled to be held on November 2010. The Basic Plan is shown in the **Appendix-1**.

#### 2. The Basic Plan

- 1) There is a possibility of the modification of the components and/or facilities specification shown in the **Appendix-1** with the progress of the discussions and designing.
- 2) The Basic Plan aims at improving current water supply situation, especially for eliminating the water stoppage area through year, and does not cover north housing planning area.
- 3) The Basic Plan has been drawn up based on the preparatory survey results by the Team. The conditions of the Basic Plan are defined as below.
  - Target year : 2016
  - Target area : east bank of Gash River in the Kassala town locality and Musa of Kassala rural locality (refer to **Fig.1-1** of **Appendix-1**)
  - Population : 204,739
  - Piped water service population : 204,739 (100%)
  - Water consumption per capita : 90 l/c/d (domestic : 75 l/c/d, others 15 l/c/d)
  - Leakage loss : improved up to 15% from 35% of 2009
- 4) The Basic Plan shows the water balance between consumption and supply in 2016. The lack in water supply to consumption is to be compensated by developing new groundwater source and/or decreasing leakage loss from the existing old piping. As rehabilitation of old piping takes long period and high cost, the Basic Plan presents an alternative that develops new groundwater sources up to the maximum groundwater development potential.



5) SWC considers the priority of the components of the Basic Plan is as below.

<u>Priority</u>	<u>Components</u>
1.	Rehabilitation of the existing reservoirs of the Mahta WTP
1.	- Construction of new water treatment plant in South - Construction of new boreholes up to groundwater development potential - Construction of distribution main from new water treatment plant to the east service area
3	Rehabilitation of the whole asbestos pipes
4	Construction of new water treatment plant in North

## **2. Rehabilitation project**

Rehabilitation project of the existing reservoirs will be carried out in advance apart from other components for improvement of the water supply facilities, because the existing reservoirs at east bank of Gash River have always the risk of burst due to deterioration of the panel materials and so on. The rehabilitation project includes the existing reservoirs at west bank of Gash River with same condition as at east bank. However, the rehabilitation of the reservoirs at west bank is not always carried out, depending on the limited budget allocated for the project.

## **3. Applicable standards and/or guidelines**

As Sudanese guidelines and/or standards for designing of the water supply facilities are under preparing, Japanese guideline of “Design criteria for waterworks facilities by JWVA (Japan Water Works Association)” can be applied to the projects. As for other Japanese guidelines and/or standards, they are essentially able to be applied to the projects in case SWC approve of their application.

## **4. Technical Assistance**

Sudanese side requests the two technical assistances as below.

- Development of piping database using GIS
- Capacity building of O&M of SWC, if necessary

For the former technical assistance, the piping database has already developed by the Team and SWC, and will be transferred to SWC after completion of the survey.

For the later technical assistance, the following programs are utilized. In addition to the followings, SWC strongly requests the soft component for training operation at the starting of the facilities, conducted by the Consultant.

- OJT (on the job training) by Japanese contractor for initial operation training of the facility
- Capacity development project for provision of the services for basic human needs in Kassala by JICA
- Capacity development project for water sector by JICA

## II. Project for the rehabilitation of the reservoirs at east and west banks of the Gash River

### 1. Scope of the project

The project aims at rehabilitation of the following existing water treatment plant (WTP), composing of reservoirs and incidental facilities such as distribution pumps.

- Mahta WTP at east bank of Gash River
- Garb WTP at west bank of Gash River

Mahta WTP has higher priority than Garb WTP. When both WTPs are impossible to be rehabilitated due to lack in budget, the rehabilitation of Mahta WTP only will be implemented.

### 2. Existing source wells

The existing source wells for both WTPs are out of scope of the project. The water flow into from existing reservoirs to newly constructed reservoirs will be changed over by reconnecting conveyance pipes. The operating duration of 15 source wells for Mahta WTP will be changed from 20 hours to 24 hours.

### 3. Flood countermeasure

In consideration of the 2003 flood damage at Mahta WTP, Mahta WTP takes flood countermeasure in rehabilitation planning.

### 4. Outline of rehabilitation facilities

The rehabilitation of the WTPs is to construct new facilities in the same site.

#### 4-1 Mahta WTP

##### 1) Design capacity

- Daily maximum water consumption : 11,050m<sup>3</sup>/day
- Hourly maximum water consumption : 16,600m<sup>3</sup>/day

##### 2) Scope of facilities to be newly constructed

###### a. Receiving Well

###### b. Reservoir

- Design capacity :  $11,050\text{m}^3/\text{day} \div 24\text{hours} \times 8\text{hours} \times 1 = 3,683\text{m}^3$
- Material : Reinforced Concrete

(\*<sup>1</sup>According to Japanese Design Criteria for Waterworks Facility)

###### c. Distribution Pump Building

###### d. Distribution Pump

###### e. Chlorination Dosing Facility

###### f. Electric Facility (not including transformer for the WTP)

###### g. Generator for Emergency (within 50% of Distribution Pump Load)

#### 4-2. Garb WTP

##### 1) Design capacity

- Daily maximum water consumption : 5,200m<sup>3</sup>/day

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- Hourly maximum water consumption : 7,800m<sup>3</sup>/day
  - 2) Scope of facilities to be newly constructed
    - a. Receiving Well
    - b. Reservoir
      - Design capacity :  $5,200\text{m}^3/\text{day} \div 24\text{hours} \times 8\text{hours} * 1 = 1,733\text{m}^3$
      - Material : Reinforced Concrete
- (\*<sup>1</sup>According to Japanese Design Criteria for Waterworks Facility)

SWC strongly requests the rehabilitation of the existing distribution pumps in addition to above facilities.

### **5. Stoppage of WTP**

Although the both WTPs are required to work continuously without stoppage, they need to stop during changeover of facilities including electrical equipment from existing to newly constructed ones by reconnecting piping and/or cabling.

### **6. Major undertakings to be taken by SWC**

In the implementation of the project, SWC is required to undertake the following measures.

- 1) Provision of cleared, embanked and leveled land
- 2) Removal of the trees at construction site of new facilities inside the existing WTP premise
- 3) Provision of land for a temporary site office, warehouse and stock yard nearby project site
- 4) Preparation of a graded access road to the construction site
- 5) Preparation of a disposal site for the surplus soil generated at construction works
- 6) Provision of electric power
- 7) Construction of a gate and fence
- 8) Dismantlement of the existing facilities after construction of new facilities

## **III. Project for the improvement of water supply facilities at east bank of Gash River in Kassala City**

### **1. Cooperation project**

Cooperation project will be finally defined at the meeting between JICA and SWC held on November 2010 from the Basic Plan by numbering priority of the components. SWC puts highest priority on the rehabilitation project of the existing reservoirs. As for other components, SWC gives high priority to the construction of the new WTP in South. On grounds of the above, the Team and SWC preliminary discussed and mutually confirmed on the project on the assumed scenario that new WTP in South would be constructed. However, the both parties agreed that further technical discussions should be done after the cooperation project is defined.





## **2. Development of sources wells**

- 1) As a result of the survey of the test drilling, maximum groundwater development potential has been estimated at 345m<sup>3</sup>/hr (8,280m<sup>3</sup>/day). This volume is set at the upper limitation of the development amount of water sources wells for the project. (refer to **Fig.1-4 of Appendix-1**)
- 2) If new wells construction is required for the project, the Consultant will drill them during detailed design stage. SWC should secure the land and access road for drilling and make a negotiation with nearby inhabitants if necessary. When carrying out pumping test of the new well, the impact survey on the existing well surrounding new well should be conducted by SWC. The specification of new wells should be indicated by SWC.
- 3) Of the seven test wells, available wells will be converted to product wells for the project.
- 4) Product wells for the project, drilled at the survey and the detail design, should be under control of SWC by the starting of the construction works. SWC should also measure the groundwater level of the product wells twice a month.
- 5) For the designing of conveyance pipes from existing wells to new reservoirs, the Consultant should check the existing well pumps for specifications and installation levels as well as static groundwater levels in cooperation with SWC.
- 6) Groundwater quality of new product wells should comply with the standard of SSMO for drinking water.

## **4. Well pump facilities**

- 1) Well pump facilities are 24 hours working.
- 2) SWC should secure access way and make land leveling for newly constructed well pump facilities.
- 3) Although the project does not include rehabilitation of the existing wells, but includes replacement of the existing well pumps if necessary.
- 4) New well pump facilities install sheds, but do not equip with emergency generators because electricity situation will be certainly improved at the target year. An operator and/or guardsman will not be staffed as well.
- 5) New well pump facilities install a flow meter and a pressure gauge at the outlet pipe of the well pump.

## **5. Construction of conveyance pipes (source wells to reservoirs)**

- 1) The Consultant will conduct a profile leveling from source wells to new reservoirs after the cooperation project is defined. The profile leveling will be conducted during the second preparatory survey, scheduled November– December 2010, or detailed design stage.

- 2) Conveyance pipe routes should be determined through the site survey conducted by both SWC and the Team in consideration of construction and maintenance, because the routes are expected to run through agricultural area and/or along the bank of Gash River. The Consultant should conduct the computation of the conveyance pipes.

## **6. Construction of new WTP in South**

Both parties preliminary discussed the construction of the new WTP in South from a technical point of view and reached to the following conclusion. Both parties have same understandings on the project that the purpose of the project is to solve current water supply problems of water stoppage in east service areas, and that new WTP will be surely able to solve it.

- 1) New WTP will be designed according to Japanese guideline of water works "Design criteria for water works facilities by JWWA". The framework of new WTP is shown as below.
  - a. Receiving Well
  - b. Reservoir (reinforced concrete)
  - c. Distribution Pump Building
  - d. Distribution Pump
  - e. Chlorination Dosing Facility
  - f. Electric Facility (not including transformer for the WTP)
  - g. Generator for Emergency (within 50% of Distribution Pump Load)
- 2) New WTP in South will be constructed at the land which SWC already acquired from a land owner. SWC had been negotiating with the land owner for many months and finally got it by preparing substitute land. Since it is very difficult and almost impossible to acquire new land elsewhere from now on, new WTP will be constructed at the land that SWC already acquired.
- 3) Design capacity of the new WTP shall be finally determined based on the Basic Plan and further survey results according to the Japanese guideline of "Design criteria for waterworks facilities by JWWA."
- 4) For flow rate control of the new WTP with hourly fluctuated demand, appropriate numbers of distribution pumps, including stand-by pump(s), will be installed. The head of pumps will be determined by the results of distribution networks computation.
- 5) Chlorine gas will be utilized for chlorine injection system in the same manner of the existing WTP.
- 6) Flood countermeasures will be considered in designing on ground of the fact that the land was under water at 2003 flood.
- 7) An administration building requested by SWC will be excluded from the new WTP, because the control room for operators and/or staffs will be prepared in the



distribution pump building.

- 8) A work shop and a laboratory will not be installed in the new WTP, because the exiting ones are possibly used.
- 9) SWC is required to ask the State Electricity Corporation to supply electricity up to the new WTP using dual lines in consideration of the continuous and stable WTP operation.

#### **7. Construction of distribution pipes**

- 1) The Consultant should conduct a distribution networks computation in the whole project area using GIS database of piping networks which the Team and SWC have developed through the survey. The computation results will be utilized not only for the project but also for piping rehabilitation plan of SWC in near future.
- 2) The Team will prepare the rehabilitation plan of existing pipes based on the computation results. Demarcations of the rehabilitation of the pipes will be discussed after completion of the computation, expected to be held on the second survey. However, the distribution main pipe from the new WTP in South will be constructed by Japanese side. The demarcation has three options, i.e. (1) construction and materials procurement by Japanese side, (2) construction by SWC and materials procurement by Japanese side, (3) construction and materials procurement by SWC. In case of (2), SWC should allocate and secure budget for construction.
- 3) As uPVC is a standard pipe material of SWC, the project will use uPVC for distribution pipes considering maintenance and procurement. However, the project will use FRP pipes, steel pipes or ductile cast iron pipes for the distribution pipes with 400mm diameter more, because no uPVC pipes are available to such diameter. When selecting pipe material, not only cost but also procurement and maintenance should be taken into consideration.
- 4) 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-2**, because of no obstacles under ground.
- 5) 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.
- 6) If the project includes replacement of existing asbestos pipes and branched service pipes of PE, the demarcation of the replacement has three options, i.e. (1) replacement works and materials procurement by Japanese side, (2) replacement works by SWC and materials procurement by Japanese side, (3) replacement works and materials procurement by SWC. In case of (2), SWC should allocate and secure budget for replacement works.





- 7) Distribution piping networks should equip with stop valves, air valves and drain valves, etc, where necessary, but not equip with fire hydrants as current situation.

#### **8. Equipment for operation and maintenance**

- 1) Most of equipment and machines at Kassala east office do not work. SWC submitted the equipment and machine list to be requested. After discussions, SWC re-presents the equipment and machine list to be requested. The list is shown in **Appendix-3**.
- 2) Machines and equipment for workshop will be installed and placed at the workshop inside Kassala east office of SWC. SWC also requested to rehabilitate the existing workshop building for protecting machines and equipment from dust and sand storm. The rehabilitation of workshop building is put on hold as "pending".
- 3) As for construction machines for piping maintenance works as wells as machines and equipment for workshop, further discussions and examination are necessary considering collaboration with the survey team of the capacity development project for provision of the services for basic human needs in Kassala which will start October 2010..

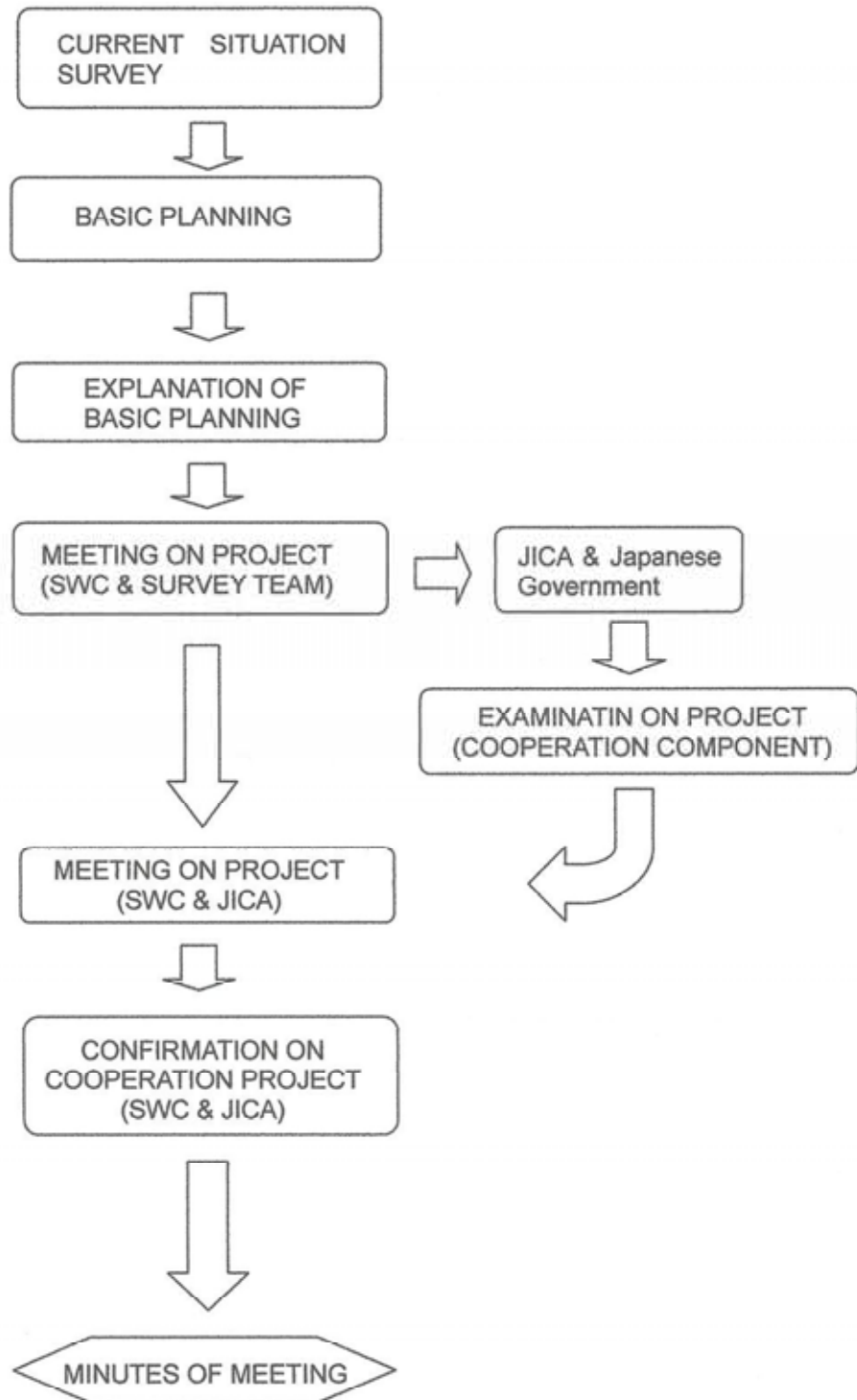
#### **10. Major undertakings to be taken by SWC**

In the implementation of the project, SWC is required to undertake the following measures.

- 1) Provision of cleared, embanked and leveled land
- 2) Provision of land for a temporary site office, warehouse and stock yard nearby project site
- 3) Preparation of a graded access road to the construction site
- 4) Preparation of a disposal site for the surplus soil generated at construction works
- 5) Construction of access road to the new WTP
- 6) Provision of electric power
- 7) Construction of a gate and fence
- 8) Provision of land for new production well site

## Appendix-1 The Basic Plan

### PROCEDURE OF THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY FACILITIES AT KASSALA CITY



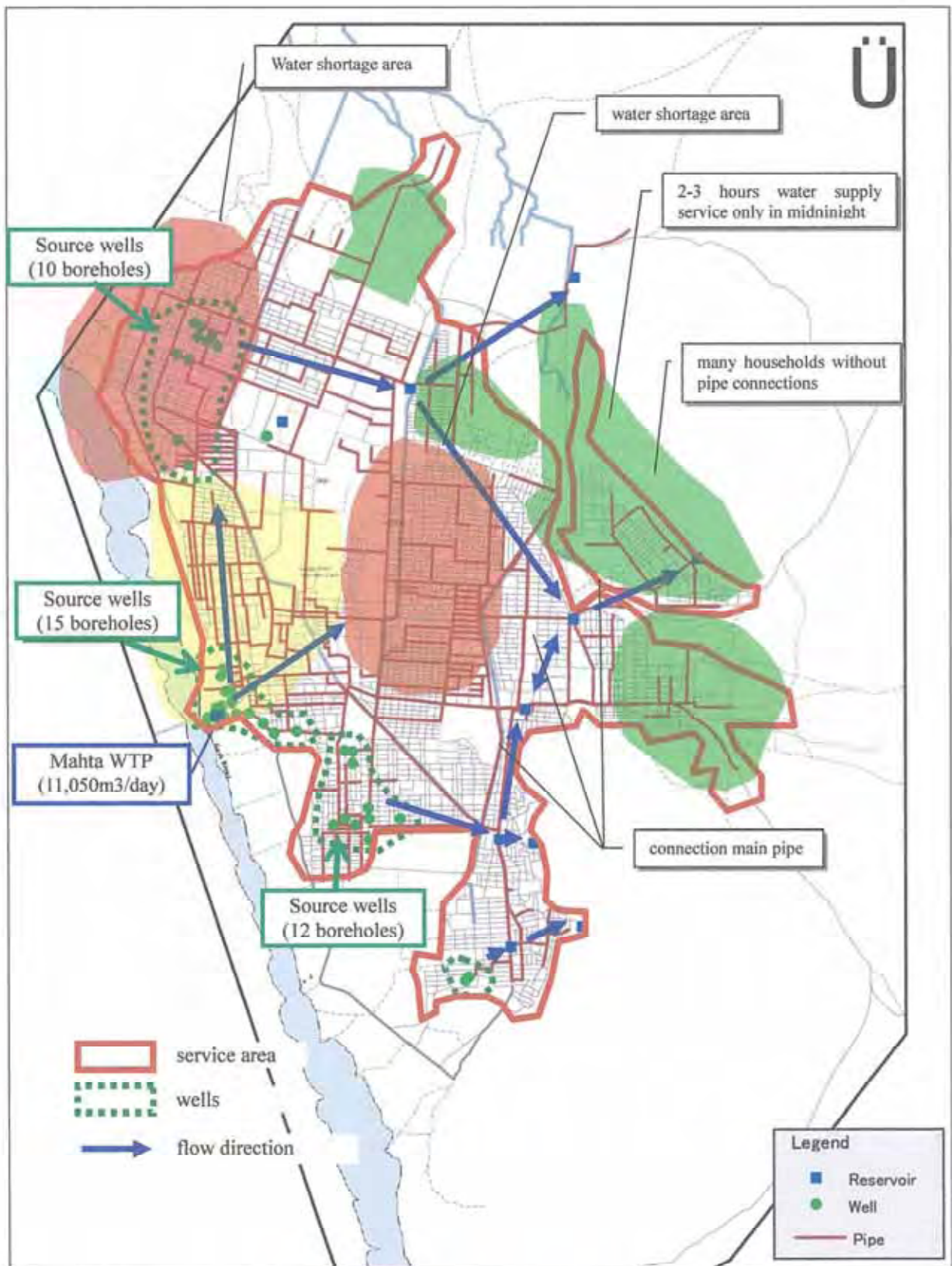


FIG.1-1 CURRENT WATER SERVICE SITUATION

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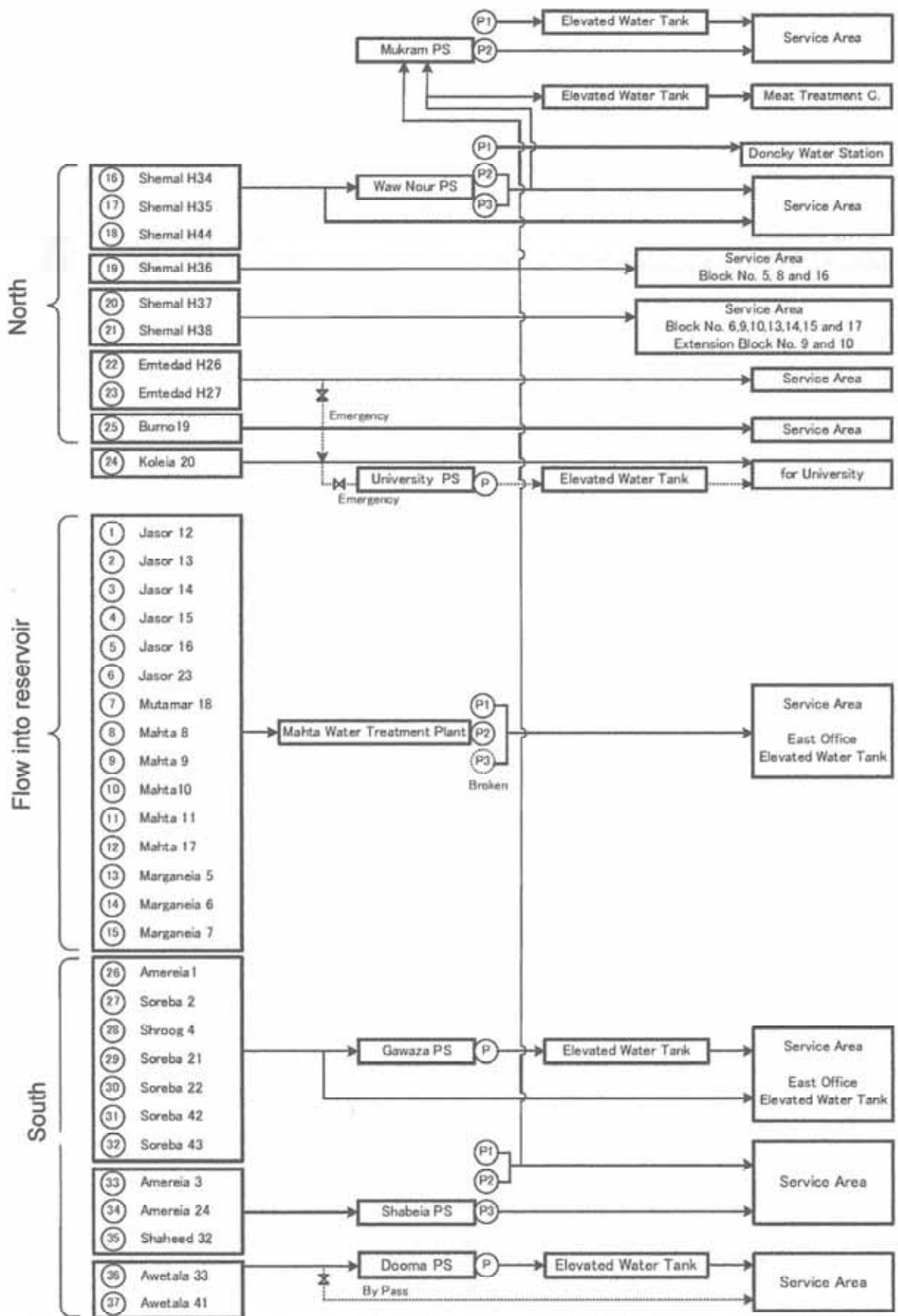


FIG.1-2 EXISTING PIPE CONNECTION

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## BASIC PLANNING

- Target year : 2016
- Target area : Current water service area as shown in FIG.1  
(East district of Kassala Town Locality)  
+ (Musa of Kassala Rural Locality)
- Population : 204,739 (in 2016)

	In 2008 Acc. to Sensus	In 2009 Basis of planning	In 2016 Target year
East district of Kassala Town Locality	165,915	170,113	202,620
Musa of Kssala Rural Locality	1,735	1,776	2,119
<b>TOTAL</b>	<b>167,650</b>	<b>171,889</b>	<b>204,739</b>

- Served population :
  - (in 2009) 125,479 (piped connection service)  
46,410 (others)  
171,889 (TOTAL)
  - (in 2016) 204,739 (piped connection service)  
0 (others)  
204,739 (TOTAL)
- Water consumption per capita :
  - (in 2009) 49 l/c/d (domestic use) □ average incl. piped connection  
and other services  
13 l/c/d (commercial + public use)  
62 l/c/d (TOTAL)
  - (in 2016) 75 l/c/d (domestic use)  
15 l/c/d (commercial + public use)  
90 l/c/d (TOTAL) □ Target of Kassala State WASH strategy  
(2010-2016)
- Leakage loss :
  - (in 2009) 35% estimated by the survey
  - (in 2016) 15% rehabilitation of AC pipes of 98km, and service  
pipes for 21,000 households

*Handwritten mark*

■ Maximum groundwater development potential:

$35\text{m}^3/\text{hr}$  ( $840\text{m}^3/\text{d}$ ) x 9 boreholes =  $315\text{m}^3/\text{hr}$  ( $7,560\text{m}^3/\text{d}$ )

$10\text{m}^3/\text{hr}$  ( $240\text{m}^3/\text{d}$ ) x 3 boreholes =  $30\text{m}^3/\text{hr}$  ( $720\text{m}^3/\text{d}$ )

Total  $345\text{m}^3/\text{hr}$  ( $8,280\text{m}^3/\text{d}$ ) (12 boreholes)

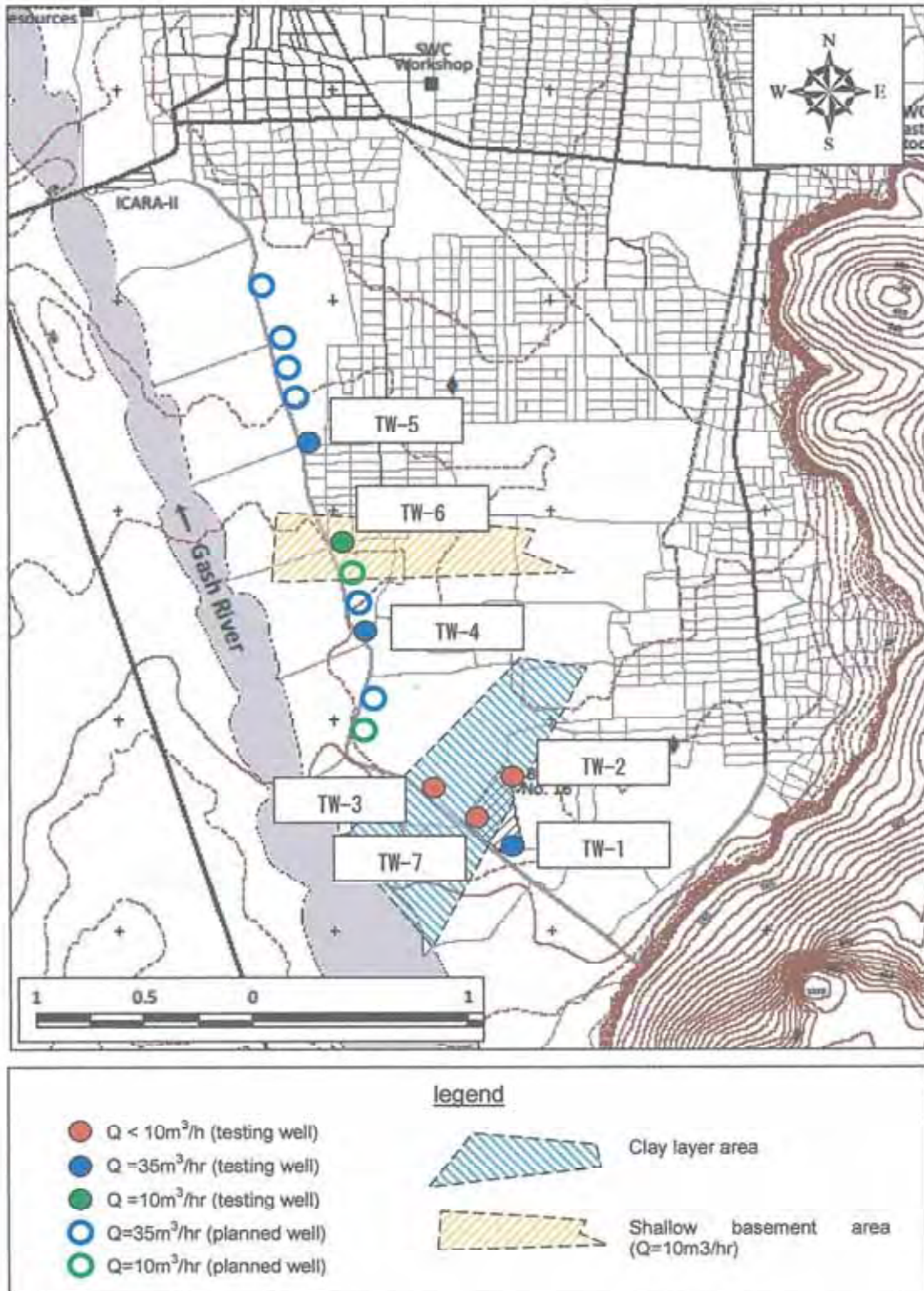


FIG.1-3 MAXIMUM GROUNDWATER DEVELOPMENT POTENTIAL



■ Water balance (in 2016) :

Table 1-1 Water Balance (in 2016)

ITEM	2016 年 Basic plan	2016 年 Alternative
Served population	204,739	204,739
Water consumption per capita (l/c/d)	90	90
Water demand (m3/day)	18,426	18,426
Leakage (%)	15	28
Daily average water consumption (m3/day)	21,678	25,592
Seasonal fluctuation ratio	1.3	1.3
A. Daily maximum water consumption (m3/day)	28,181	33,270
1) Water supply from existing source wells (m3/day)		
Southern wells (11 boreholes) (m3/day)	7,704	7,704
Mahta WTP (15 boreholes) (m3/day)	11,050	11,050
Northern wells (10 boreholes) (m3/day)	6,468	6,468
TOTAL	25,222	25,222
2) Water supply from new wells (m3/day) (Maximum groundwater development potential)	2,959 (8,280)	8,048 (8,280)
B. Water supply amount (1+2) (m3/day)	28,181	33,270
Water balance (A-B)	0	0

Alternative: New wells are to be constructed up to maximum groundwater development potential. In this case, leakage ratio increases up to 28% instead of 15% of the basic plan.

# BASIC PLAN

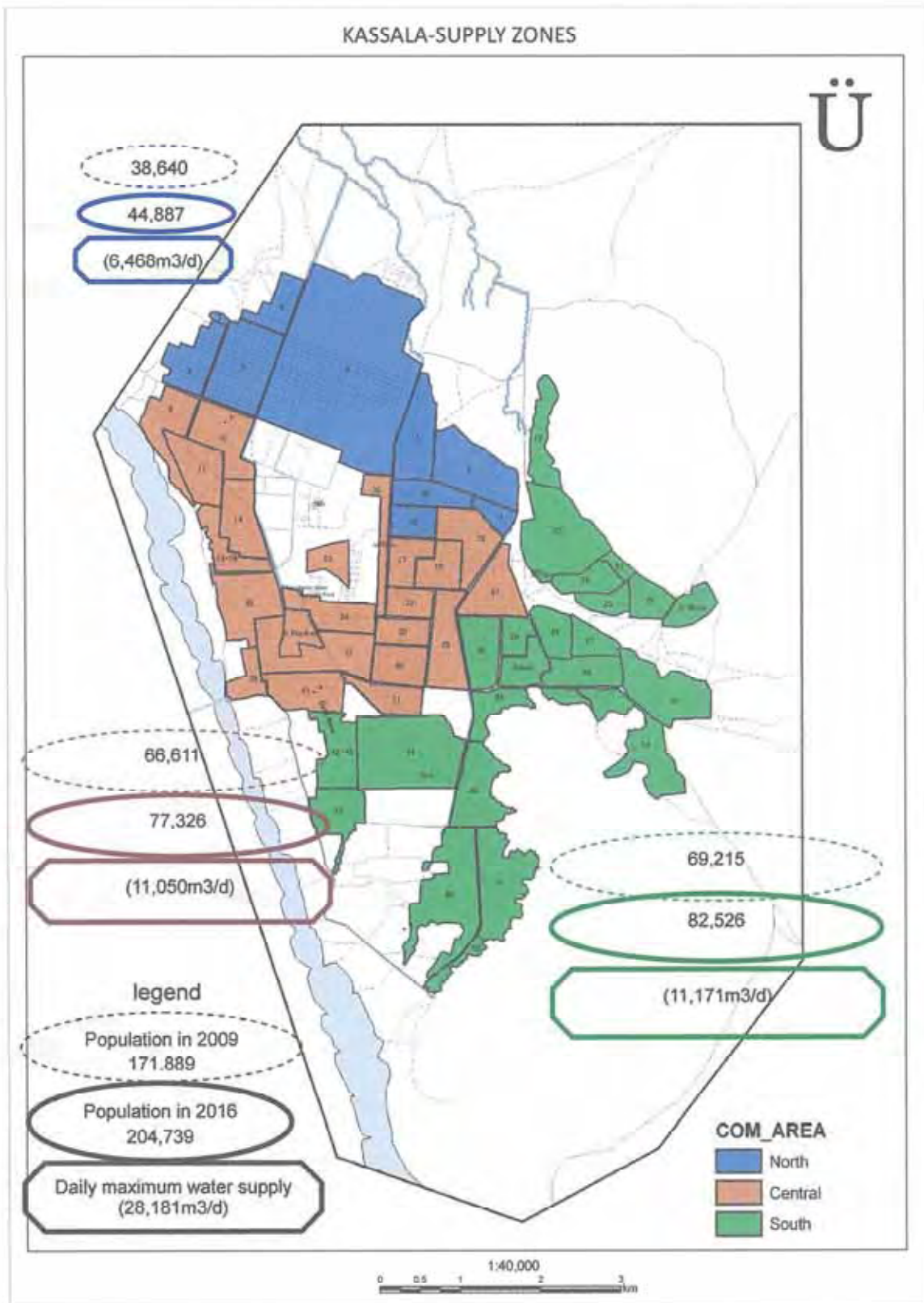
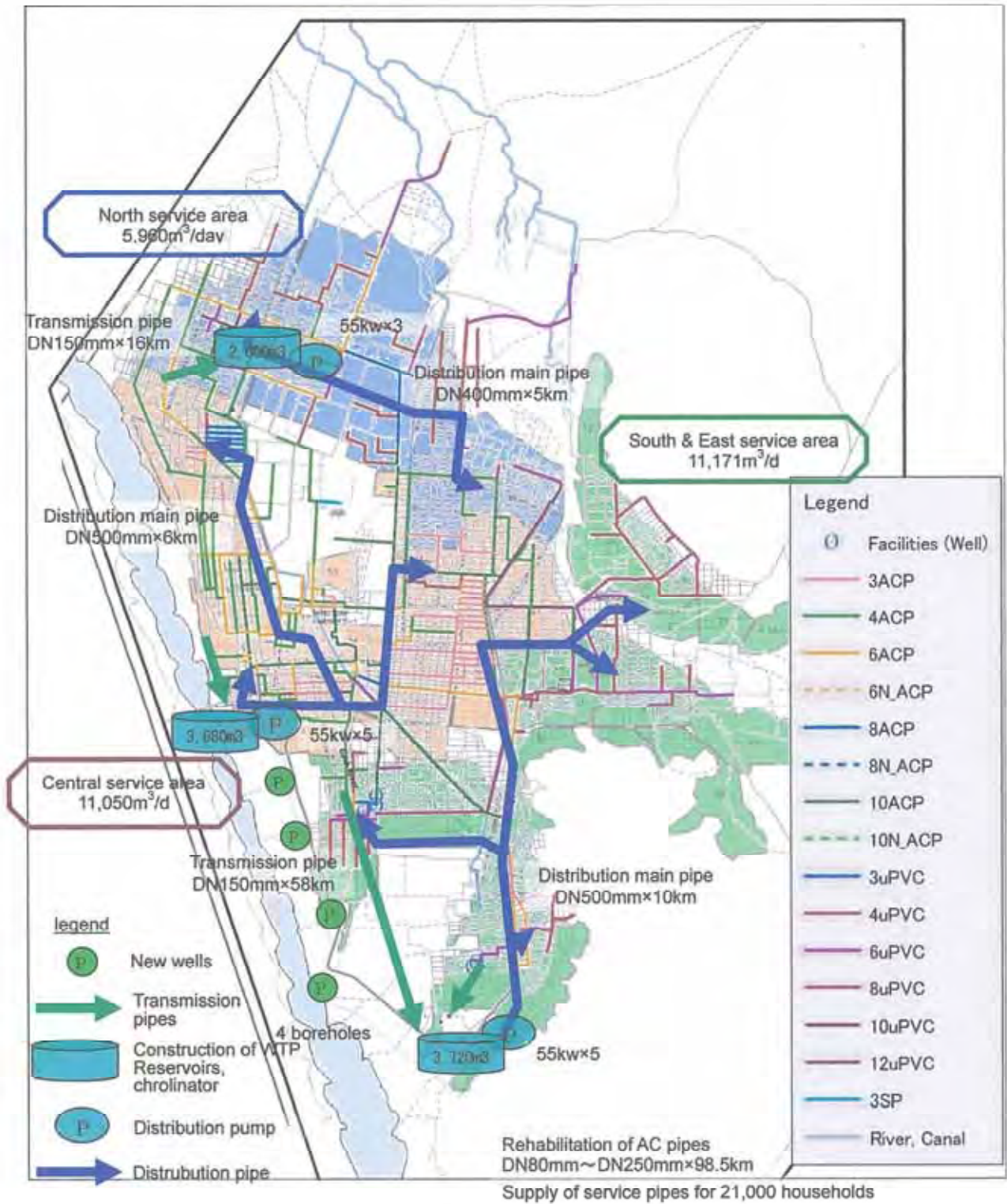


FIG.1-4 DISTUBUTION AREA PLAN

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# PLAN

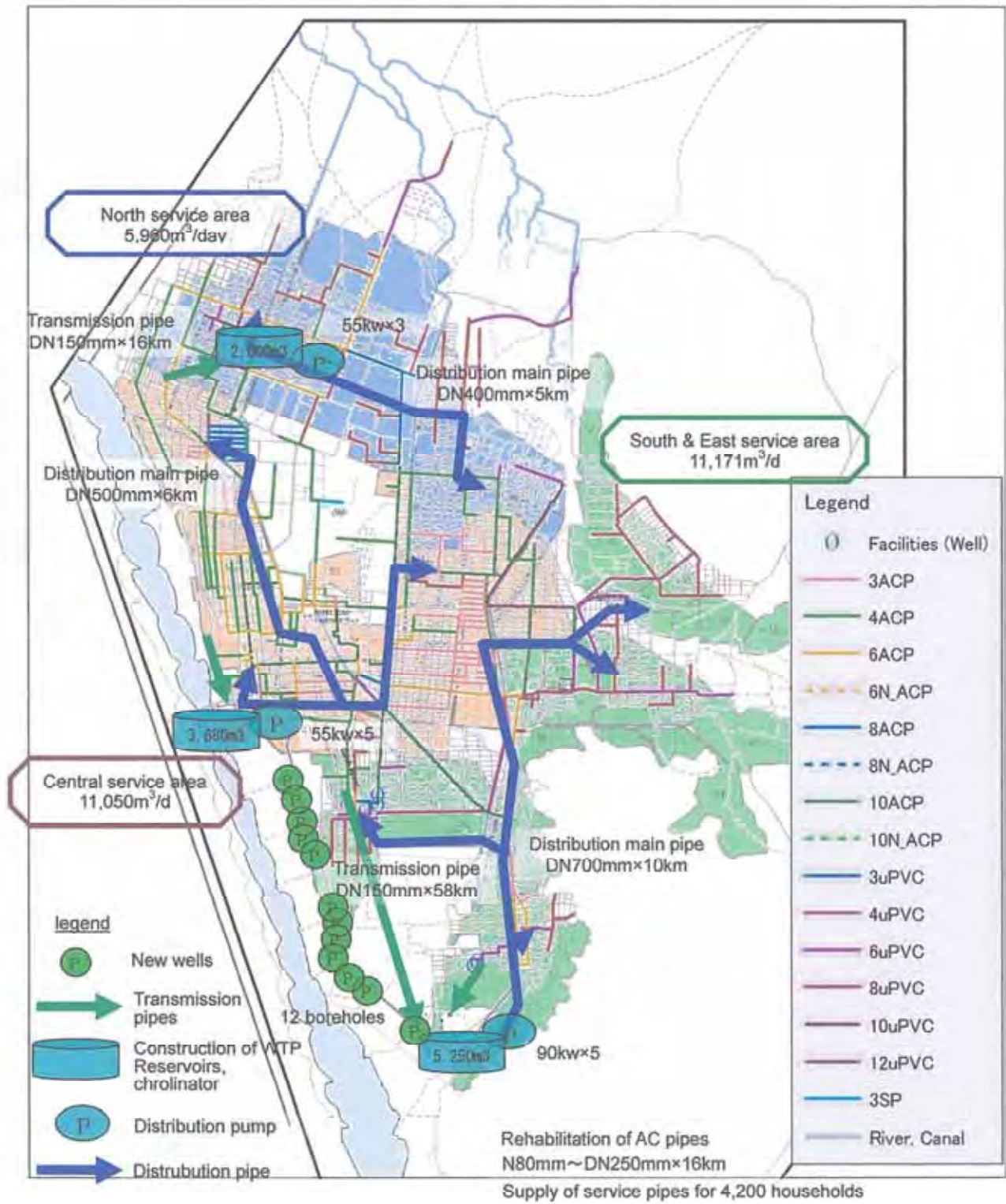


Note) There is a possibility of the modification of facilities specification shown in above figure according to the design progress.

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# PLAN (Alternative)

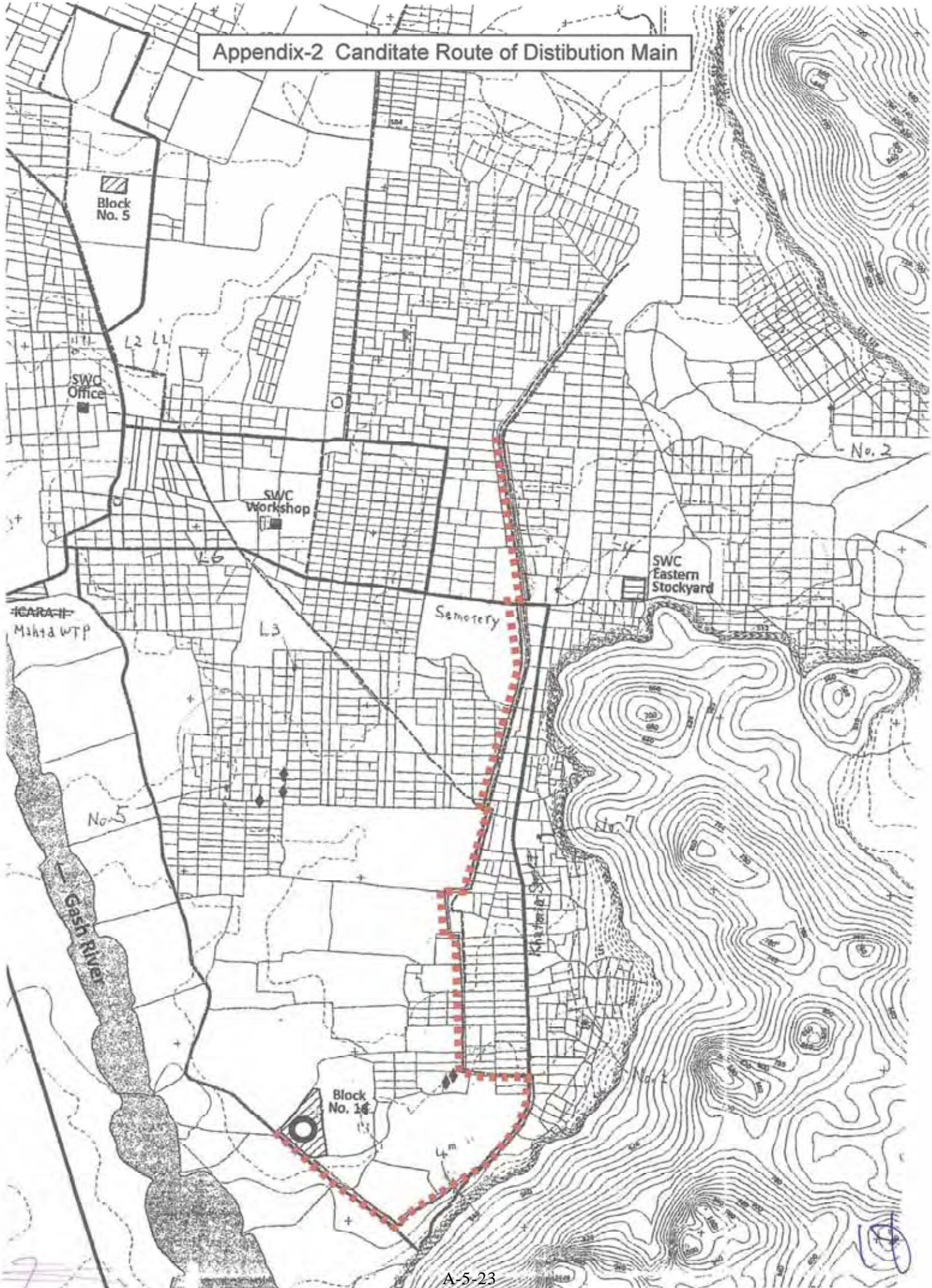


Note) There is a possibility of the modification of facilities specification shown in above figure according to the design progress.

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Appendix-2 Candidate Route of Distibution Main



## Appendix-3 Requested Equipment

### 1) Construction equipment

Table 3-1 List of Construction Equipments Required

Name of Equipment	Specification	Quantity	Remarks
Backhoe Loader	Excavating 1.0m <sup>3</sup> , Loader Bucket 0.4m <sup>3</sup> , 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

