2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Construction Division

Construction will be conducted simultaneously at 2 separate sites, namely Hawassa and Butajira. This is because the target sites are spread over such a wide area, making it difficult to manage the construction from one location. There will be two construction teams working simultaneously at the Butajira site and with one team at Hawassa, there will therefore be a three-team system working at the same time.

Table 2-19: Construction division

Division	Construction team	Targeted towns
Hawassa	Team A	Adilo, Teferi Kela, Tebela
Butajira	Team B	Tiya, Mito, Alem Gebeya, Kibat
	Team C	Koshe, Kela, Dalocha

(2) Construction Term

The target sites pose no hindrance to the planned construction work, therefore, as far as possible, the main components of construction - such as pipe laying, construction of the housing for the generators and construction of the water supply reservoir - will be started at the same time and/or conducted simultaneously.

The critical path of the Project is the plumbing work including the procurement of pipe materials. A total of 18 months has been allocated to complete this work. The envisaged breakdown being: 2 months of preparation work such as procurement of pipe materials and construction of the site office; 15 months for the pipe laying works; and 1 month for removal of equipment and site clean-up. This is the total time envisaged for all of the works, because all of the other work can be completed during this period.

Table 2-20: Construction term

Work type		Period
Preparation works	Office set up and material procurement etc.	2.0 months
Piping works	Hawassa 13.8 months	15.0 months
	Butajira (Critical pass) 15.0 months	
Clearance works	Office clearance and documentation etc.	1.0 month
Total		18.0 months

(3) Water Supply System

There are existing public faucet-type water service facilities in ten towns targeted in the Project. Therefore it is judged that the water management organizations in these towns are capable of maintaining and operating water supply facilities. However, is not considered capable of operation and maintenance of advanced management systems such as electronic control devices. Therefore, it is planned to make the facilities as simple as possible and to make sure that locally procurable materials and equipment are used in construction to ensure that they are easy to operate and maintain.

2-2-4-2 Implementation Conditions

(1) Access Conditions

Since the majority of the target sites are located on the highway, the access to the target sites is possible even in the rainy season. However, it may be difficult to access some of the construction places in the sites. Therefore when setting the time schedules of the works it is necessary to consider the accessibility to the various sites according to access of the vehicle weight and length.

(2) Use of Local Contractors, Materials and Equipment

Local construction companies are judged to have sufficient construction management expertise for the scale and specifications of the works of the Project. Therefore the Project will actively use their services under the management of Japanese engineers.

The cost of such items will be compared in Ethiopia. However, items will be procured from Japan in cases where local procurement is impossible, or when there are qualities or logistical issues, or when it cannot be obtained within a certain timeframe.

2-2-4-3 Scope of Works

The scope of works for the Project to be implemented by Japanese Grant Aid of the Japanese and Ethiopian sides is shown below:

Table 2-21: Scope of works

Item	Japan	Ethiopia	Remarks
Securement of water source (ground water and spring)	○		Done in preparatory survey
Securement of constructon land		○	SNNPRB, small town
Securement of access road		○	WMO, small town
Securement of storage area for materials		○	Woreda office, small town
Constrction of power supply		○	SNNPRB
Construction of water supply facilities with public faucets	○		
Construction of stell fence (well point and reservoir)		○	WMO, small town
Construction of wood fence (public faucets)		○	WMO, small town
Connection to private connection		○	WMO, small town

2-2-4-4 Consultant Supervision

The Project will be implemented under Japanese Grant Aid by the Government of Japan, and the Government of Ethiopia will enter into an agreement with a Consultant recommended by the Japan International Cooperating Agency (JICA) for detailed design survey and construction supervision. The construction of water supply facilities will be conducted by the Japanese Contractor under contract to the Ethiopian side. The Consultant will dispatch supervision/management personnel as shown below:

Table 2-22: Consultant supervision plan

Division	Personnel	Person in charge	No.	Type
Consultant supervision	Supervision engineer	General overview	1	Spot
	Superviser	Supervision	1	Resident
	Final inspector	Final inspection	1	Spot

2-2-4-5 Quality Control Plan

(1) Concrete

1) Concrete Placing Amount and Concrete Placing Time

In this plan, it is assumed Concrete Placing amount and Concrete Placing Time are as follows

Table 2-23: Concrete placing amount and number of times

Construction object		Small town	Concrete unit quantity (m^3)	No. of facilities (place)	Amount of concrete (m^3)	Time of placing per place	Time of placing
Ground reservoir	72.0m^3	Koshe	45.30	1	45.30	4	4
	15.7m^3	Kela	19.30	1	19.30	4	4
	100.7m^3	Adilo	70.80	1	70.80	4	4
	114.5m^3	Tebela	78.50	1	78.50	4	4
Elevated reservoir	32.8m^3	Tiya	80.40	2	160.80	1	2
	114.8m^3	Teferi Kela	162.00	1	162.00	1	1
	131.2m^3	Mito	207.00	1	207.00	1	1
	122.0m^3	Alem Gebeya	195.00	1	195.00	1	1
	193.7m^3	Kibet	276.00	1	276.00	1	1
Generator house		All towns	13.01	14	182.14	3	42
Total					1,351.54		60

2) Trial Mix and Concrete Testing

Prior to commencement of the works, trial concrete mix will be conducted to decide the content of concrete mix using approved materials for each level of concrete strength. Successful trial mix proportions shall comply with the following conditions. Concrete strength shall be set for target compressive strength for each grade of concrete and fresh concrete slump test results shall be within allowable tolerance. Setting up concrete strength shall also accommodate standard deviation.

3) Concrete Production

It is difficult to secure ready-mixed concrete in this Project area and thus the concrete shall be mixed at the site using a concrete mixing machine.

4) Slump Testing

A fresh concrete slump test shall be conducted at the time of concrete casing. The allowable tolerance of slump figure shall be set at plus-minus 2.5 cm.

5) Concrete Compressive Strength Test

Concrete compressive strength test will be conducted at a laboratory in Hawassa, taking a testing

sample of each casting and within 100m3. Each sample will include 3 pieces.

(2) Iron Reinforcing Bars

Tensile test of iron reinforcing bars (D10, 12, 16 and 20) will be carried out.

(3) Aggregate

The following fine and coarse aggregate tests will be conducted:

- Density and absorbing water rate test
- Sieve-analyst test
- Fine grain quantity test
- Mass of unit volume test
- Abrasion test
- Alkali-Silica reaction test

(4) Water Flow

The total length of the water supply pipes (102.4km) will be tested for water flow as follows:

- Weatherproof test (Joint test, water-filling test)
- Hydraulic test

(5) Bearing Capacity

Plate bearing tests will be conducted to assess the subgrade reaction at the five sites (Tiya, Teferi Kela, Mito, Alem Gebeya and Kibat) where the reinforced concrete and steel frame elevated tanks will be constructed.

2-2-4-6 Procurement Plan

(1) Materials for Construction

In principle, materials and equipment necessary for construction are to be procured locally. However, items will be procured from Japan in cases where local procurement is impossible, or when there are qualities or logistical issues, or when it cannot be obtained within a certain timeframe.

Galvanized steel pipes, valves, materials for construction such as cement, aggregate, wood, power pumps and generators can be procured in Hawassa or Butajira. However, the manufacturers cannot be identified and the reliability and quality, such as deformations, are often a problem. Meanwhile, in Addis Ababa it is easy to procure high quality and very reliable materials and spare parts. Therefore, materials, in principle, will be procured in Addis Ababa. The sources of procurement of the materials for construction in the Project are as follows.

Table 2-24: Procurement of construction materials

Materials to be procured	Procurement			Reason of procurement
	Japan	Ethiopia	Third country	
Cement		○		
Fine aggregate		○		
Coarse aggregate		○		
Steel		○		
Form for concrete		○		
Wood		○		
Fuel		○		
Pipe (GS)		○		
Valves	○	○		Some valves will be procured in Japan.
Submersible pumps		○		
Generators		○		

(2) Machinery for Construction

The general construction machines such as backhoes, dump trucks and concrete mixers, are possible to be leased locally. Therefore, in consideration of shipping charges and the number of days they will be used, and because it is cheaper to lease them than to procure from Japan or a third nation, they will be leased locally.

(3) Transport Packing Plan

In general, when procuring materials from Japan or a third country, it is loaded onto a ship at a major port in that country and transported by container ship to the port in the neighboring country, Djibouti. After unloading, it is transported into Ethiopia by land. This will take 5 to 7 weeks for the marine transportation from Japan to the Djibouti port.

It is a trip of approximately 900km from the Djibouti port to the Southern Nation, Nationalities and People's regional state which is the target site, but will take around 2 to 3 weeks until arrival when taking into account the time it will take for the various necessary procedures.

2-2-4-7 Operation Guidance Plan

Initial operation guidance and operational planning guidance are not conducted in the Project.

2-2-4-8 Soft Component (Technical Assistance) Plan

(1) Objective of Soft Component

The objective of soft component is for the structure of operation and maintenance (O&M) for water supply facilities by the self-help efforts of Water Management Organization (WMO) and the sustainable assistance of the implementation agency.

(2) Output of Soft Component

In order to strengthen of O&M, the output (direct output) is defined after completion of Soft Component as follows.

Output 1: Comprehension of the support system for WMO.
Output 2: Preparation of O&M system for the expansion of water supply facilities
Output 3: Formulation of the plan for the revision of the water tariff.
Output 4: Strengthening of the capability of O&M by Woreda office.
Output 5: Strengthening of the capability of O&M by WMO.
Output 6: Obtaining the understanding of the residents regarding their usage of water in hygienic manners.

(3) Confirmation Procedure of the Output Achievement

Indicators and achievement degree of the Soft Component are defined as below to ensure that WMO can carry out its responsibilities and to confirm the condition of the technical skills and the system for the smooth start-up of the Project.

Table 2-25: Achievement degree of output

No.	Output	Confirmation items of output achievement	Indicator of output achievement (draft)
Output1	Comprehension of the support system for WMO	Recognition of each role including the residents and the person in charge at WMO	・Reporting outcome of hearing opinion ・Report of resident's meeting
Output2	Preparation of O&M system for the expansion of water supply facilities	Review the personnel composition of WMO, and the setting of rules regarding water and the facilities' utilization	・Preparation plan for WMO ・Terms of facility usage
Output3	Formulation of the plan for the revision of the Water tariff	・Formulation of the appropriate plan for the revision of the Water tariff ・Consent of residents for the revision of Water tariff	・Plan of revision of the Water tariff ・Report of resident's meeting
Output4	Strengthening of the capability of O&M by Woreda office.	・Comprehension of the content for the technical training and the acquisition of knowledge concerning maintenance and repair ・Draft plan for execution of monitoring	・Confirmation test ・Plan of the monitoring
Output5	Strengthening of the capability of O&M by WMO.	・Comprehension of the content for the technical training and the acquisition of knowledge concerning maintenance and repairs ・Preparation for the accounting operation	・Confirmation test ・Activity record ・Operation record ・Accounting book
Output6	Obtain the understanding of the residents regarding their use of the new safe water sources.	・Elevate the sanitary consciousness ・Comprehension of the usage of the safe water	・Questionnaire for the residents （Hearing opinion for the residents）

(4) Plan of Soft Component Activities (Input Plan)

1) Division of the Activities

The Soft component activities are categorized into two (2) phases: 1-Before and during construction [Formation of organization], 2-during construction and after completion [Strengthening of O&M and Sanitary education]. The activities will be carried out by the Japanese consultant with the cooperation of

implementation agency (RWRB, Zonal Office and Woreda Office).

Phase 1 : Formation of organization(before construction - during construction)

Output 1	Comprehension of the support system for WMO	⇒	Activity1	: Consciousness of the Support system Implementing Agency
			Activity2	: Description of the corresponding matters of residents
Output 2	Preparation of O&M system for the expansion of water supply facilities	⇒	Activity3	: Formation of organization
			Activity4	: Making user rules for facilities (draft)
Output3	Establishment of a plan for the revision of the water fee	⇒	Activity5	: Establishment a plan for the revision of the water fee
			Activity6	: Announcement for the residents

Phase2 : Enhancement of capability of O&M and Sanitary education (during construction - after construction)

Output4	Strengthening of the capability of O&M by Woreda office.	⇒	Activity7	: Technical training (Woreda)
			Activity8	: Establishment a plan of Monitoring
Output5	Strengthening of the capability of O&M by WMO.	⇒	Activity9	: Technical training (WMO)
			Activity10	: Accounting training.(W.M.O)
Output6	Obtain the understanding of the residents regarding their use of the new safe water sources.	⇒	Activity11	: Sanitary education

2) Content of Activities

Formation of Organization (during construction - after construction)

Output 1: Comprehension of the Support System for WMOs

Activity 1: Consciousness of the Support system- Implementing Agency

Ten towns targeted in this project are under the jurisdiction of 9 Woreda (Kela, Tiya are included in one Woreda), which is also under control of 5 zones.

Consultation with RWRB, Zonal Office should be carried out in advance in order to obtain an understanding of the content of activities and basic policy. After that, the workshop will be held for the C/P of RWRB and people concerned in Zonal Office. In addition, the workshop concerning O&M of the water facilities for the WMO at the initiative of Woreda office will be conducted. In the workshop, an analysis of stakeholders will be conducted in order to encourage a sense of ownership. All stakeholders should understand the current situation and the problems and clarify the role of each organization and the cooperative relation to support the organization of WMO.

Facilitator	Activity form	Target participants	Implementation site	Time required of planning	Number of days required
Consultant (Japanese/Local)	Meeting	Regional water resource bureau	Office of Regional water resource bureau	Preparation in advance:2h Meeting:3h Preparation meeting concerning Joint meeting with C/P and annoucement for Zone:4h	1.5 days
Regional water resource bureau(C/P) Consultant(Japanese/ Local)	Meeting	Zonal office	Each Zonal office (5 Zones)	5 Zone x 3h = 15h Transfer: 5 Zone x 3h = 15h	4 days
Regional water resource bureau(C/P) Zonal office Consultant(Japanese/ Local)	Workshop	Woreda office (9 Woredas)	Each Zonal office (5 Zones)	5 Zone x4h = 20h	2.5 days
Woreda office Consultant(Japanese/ Local)	Workshop	WMO (10 small towns)	Each Woreda office (9 Woredas)	9 Woreda x 3h=27h Transfer: 9 Woreda x 2h=18h	6 days
Total number of days (10 small towns)					14 days

Activity 2: Description of the corresponding matters of residents

Woreda office and WMO will host a workshop as a facilitator for the residents to gain an understanding of their frank opinions, problems, complaints about current water facilities and the means for O&M by WMO.

Meanwhile, during construction or after the donation of new facilities, since the cooperation and support from the residents is indispensable for the construction of new water supply facilities, the workshop will be for the purpose of recognition of the importance of O&M and the role of residents in the early stages.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office WMO Consultant (Japanese/Local)	Workshop	Town Residents (10 small towns)	Meeting place of Town or Office of WMO	10 small towns x 3h = 30h Transfer: Hawassa→Town (RT) + Each Town (RT) = 40h (Total)	10 days
Total number of days (10 small towns)					10 days

Output 2: Preparation of O&M System for the Expansion of Water Supply Facilities

Activity 3: Formation of organization

A workshop will be held for the current WMO to review the past activities, and clarify the issues and problems. Considering the results of the workshop, an appropriate method of member selection, roles of members, the selection system, and operation manual for the organization should be examined for the O&M that takes into account the expansion of water supply facilities in the future. Particularly, since there is no WMO in Teferi and Kela, maintenance information of WMO will be obtained from Kebado which is now managed remotely, thereby, people in Teferi and Kela could consult it to establish a new organization.

As a result of these activities, each town should prepare a plan for the WMO, then the employment plan could be visually recognized taking the necessary staff in the future into consideration. Regarding

the organizational changes based on this project, therefore the implementation agency will continue to provide support in this regard after the completion of the soft component.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office WMO Consultant (Japanese/Local)	Workshop	WMO (10Town)	Office of WMO	10 Town x 4h = 40h Transfer: Hawassa→Town (RT)+Each Town(RT)=40h(Total)	11 days
Total number of days (10 small towns)					11 days

Activity 4: Establishment of terms of facility use

A workshop will be held for the WMO as facilitator Woreda office, analysis of problems concerning the current water use and O&M of water supply facilities is performed. Considering the results, each town will formulate terms of facility use based on the prepared plan for the WMO in Activity 3. After checking with the South Regional Water Resource Bureau whether there are any terms as mentioned above, various items should be included in the terms such as how break-downs will be dealt with (repairs), plan of monitoring, collection system of Water tariffs as established in activity 5, and special measures regarding users who are unable to pay Water tariffs. The workshop can help the WMOs to recognize the necessity of O&M of the water supply facilities, and at the same time, it enables the Woreda office to gain skills for facilitating OJT training. By utilizing the terms of facility usage, therefore the implementation agency will continue to provide support after the completion of the soft component to ensure O&M activities run smoothly into the future.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office WMO Consultant (Japanese/Local)	Workshop	WMO (10Town)	Office of WMO	10 Town x 6h(2times) = 60h Transfer: 10Town x 2h x 2times = 40h	14 days
Total number of days (10 small towns)					14 days

Output 3: Formulation of an Appropriate Plan for Water tariff Revision

Activity 5: Formulation of a plan for revision of the Water tariff

Current Water tariff, average monthly expenditure, reserve fund for O&M etc. will be selected as necessary items for operation of WMO on the basis of the assumed Water tariff which was calculated in the preparation survey. Obtaining advice from the Woreda office, a new rate and period of revision, and operation method should be considered regarding the above items. In order to revise the Water tariff gradually based on this Project, therefore the implementation agency will continue to provide support the Woreda Offices and WMOs in this regard after the completion of the soft component.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office WMO Consultant (Japanese/Local)	Workshop	WMO (10Town)	Office of WMO	10 Town x 4h = 40h Transfer: Hawassa→Town（RT)+Each Town(RT)=40h(Total)	11 days
Total number of days (10 small towns)					11 days

Activity 6: Announcement for the residents

The meeting for the residents of each town will be held. Mainly, the Woreda office should obtain the understanding of the residents by explaining the facilities, the roles of residents and of the WMO regarding O&M, and the necessity of revising the Water tariff and payments. In particular, regarding the revision of Water tariffs, since there is a possibility that residents might object to the proposed revisions to the Water tariffs and to the timing of the fee revisions, it is important to have a workshop and to deepen residents' understanding of the necessity of fee revision to avoid a top-down approach.

Resident meetings will be held depending on the progress of the Project (construction). The number of participants and level of understanding (interest) shall be confirmed. The activities to gain the understanding of the residents is essential, therefore the implementation agency will continue to provide support in this regard after the completion of the soft component.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
WMO Woreda office Consultant (Japanese/Local)	Workshop	Town residents (10Town)	Meeting place of Town or Office of WMO	10 Town x 6h(2times) = 60h Transfer: 10Town x 2h x 2times = 40h	14 days
Total number of days (10 small towns)					14 days

3) O&M and Sanitary Education (during and after construction)

Output 4: Strengthening of the Capability of O&M by Woreda Office.

Activity 7: Technical training (Woreda)

For the sustained O&M of water facilities, it is indispensable for the Woreda office to support the WMOs, which are in charge of daily O&M for the facilities, but the technical capabilities of the Woreda office is not currently at a sufficient level. Therefore, practical training will be given to the Woreda office on fundamental knowledge, break down diagnostics and reporting and repair method. The training will be in accordance to the scale of the break down, and in so doing will give the trainees the ability to judge what kind of repairs are necessary (how and who should deal with an issue). In consideration of the capacity of the Woreda office and the equipment, it is aimed so that Woreda office members can be conscious of their actual capability of handling serious break downs. If they are unable to deal with the issue, they will need to learn steps that need to be taken so that they can rapidly ask upper agencies (zone water office or RWRB) for assistance in dealing with the issue.

For a minor break down, they should increase the technical level of WMOs by giving them direct instructs. Staff members who obtained the skills in the OJT will become an instructor for the technical training in activity 9.It is planned to dispatch a member of EWTI as an instructor for this OJT.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
EWTI Consultant (Japanese/Local)	Training	Woreda office (9 Woreda which have jurisdiction over 10Town)	Office of WMO(3blocks)	3blocks x 14h = 42h Transfer: 5h x RT x 3times = 30h(Addis→Hawassa EWTI staffs) Hawassa→Town（RT)+Each bloc(RT)=24h(Total)	13 days (EWTI) 10 days (Japanese&Local Consultants)
Total number of days (10 small towns, Japanese consultants)					10 days

Activity 8: Making a monitoring plan

Woreda office shall examine the content of monitoring for the WMO and create a monitoring sheet to confirm that the facilities are operated without fail. Operating status, the number of break downs, repair status, balance of payments, the situation of fee collection, WMO's demands/request with respect to the Woreda office and so on will be targeted by the Woreda office as part of its regular monitoring activities.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Consultant (Japanese/Local)	Workshop	Woreda office (9Woreda)	Woreda office (9Woreda)	9Woreda x 6h = 54h Transfer: 9Woreda x 2h = 18h	10 days
Total number of days (10 small towns)					10 days

Output 5: Strengthening of the capability of O&M by WMO

Activity 9: Technical Training (WMO)

Daily maintenance should be performed by WMO to realize a continuous system for O&M. It is desirable that minor repairs be conducted by themselves. Therefore, the Woreda office personnel who were given technical training in Activity 7 will act as facilitators for the practical training of daily maintenance, support system for minor break downs, and technical training for the O&M concerning the procurement of spare parts. At the same time, necessary fundamental knowledge to understand the conditions behind the break down such as the names of the facility parts/equipment and the normal state (know how it should be so as to know when there is an abnormality) and the reporting method are to be instructed. Additionally, operation control is to be practiced in the training because the pumps are to be operated manually. Furthermore, activity record and operation ledger shall be updated to know the actual condition of water facilities, and also the method of registering and reporting to the Woreda office should be taught.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office Consultant (Japanese/Local)	Training	WMO	Office of WMO (10Town)	10 Town x 10h(2times) = 100h Transfer: 10 Town x 2times x 2h = 40h	20 days
Total number of days (10 small towns)					20 days

Activity 10: Accounting training (WMO)

Accounting training regarding administrative work will be held for the WMO, such as collecting Water tariffs, management method, entry and unification of the account book, and operation records for water facilities. In addition, in case of a request of repairs from WMO, the Woreda office shall review how much it charges for repairs (including daily allowance, transportation fee) and its method of calculating expense of part replacement. All information will be shared among organizations concerned.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office Consultant (Japanese/Local)	Training	WMO	Office of WMO (10Town)	10 Town x 5h = 50h Transfer: 10 Town x 2h = 20h	10 days
Total number of days (10 small towns)					10 days

Output 6: Obtaining the Understanding of the Residents Regarding their Usage of the New Safe Water Supply

Activity 11: Sanitary education

Due to the low level of personal hygiene, residents do not use the water facilities continuously. In spite of the fact that it is a cause of water-borne diseases, many households use rain water or storage reservoir water. Continuous use of rainwater is one of the factors that are preventing an increase in the utilization of water supply facilities, which is also affecting the cost estimation concerning O&M of water supply facilities. Consequently, WMO shall take the initiative in carrying out the sanitary education for the residents, in order to encourage the use of facilities sustainably, improve the health status of residents, and to achieve a sustainable system of O&M. In consideration of efficiency, rather than giving individual guidance to each household, the target of the sanitary education will be the PTA (Parents-Teacher Association) and elementary students and so on, so that those who obtaining the knowledge of sanitation can disseminate the hygiene concepts within their own households. The lectures include the prevention of water-borne diseases, spreading epidemic and general knowledge of sanitation about nutrition and avoid overworking. Even if a safe water source is obtained, without taking care (hygiene) about water use and storage, the results would be the same as if rain water was used. Therefore, this education will include lectures on how to use water safely, namely in a hygienic manner.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
WMO Consultant (Japanese/Local)	Training	Town Residents	Meeting place of Town etc. (10Town)	10 Town x 5h = 50h (Including preparation period) Transfer: between towns 10 Town x 2h = 20h	10 days
Total number of days (10 small owns)					10 days

Table 2-26: Implementation plan for soft component

period		Activity		Contents of activity	Form of activity/ Place	Object person	Implementing person	Relevant output/ Output
Phase1 (Before～During construction)	Formation of organization	Output 1	1	Consciousness of the support system—Comprehension of the role of each concerned agency for WMO by workshop	Workshop/ Regional water resource bureau and the woreda office	Regional water resource bureau Zonal office Woreda office WMO	Japanese consultant x 1 (14days) Local consultant x 1 (14days)	Output 1/ Hearing Reporting of result
			2	Description of the corresponding matters of residents—Hearing from the residents regarding acutual support system, explanation of their role	Workshop/ Water supply service office	Residents	Woreda office/WMO Japanese consultant x 1 (10days) Local consultant x 1 (10days)	Output 1/ Resident meeting ・Report
		Output 2	3	Formation of organization—Consideration of method of operation for WMO after eamine the current problems by Implementation of workshop	Workshop/ Water supply service office	WMO	Woreda office Japanese consultant x 1 (11days) Local consultant x 1 (11days)	Output 2/ WMO Plan of maintenance
			4	Making user rules for facilities(draft)—Conducting an analysys of current water use and O&M for facilities, making user rules in each town	Workshop/ Water supply service office	WMO	Woreda office Japanese consultant x 1 (14days) Local consultant x 1 (14days)	Output 2/ User rule of facilities (draft)
		Output 3	5	Establishment a plan for the revision of the water fee—Based on the assumed water fee calculated by preparatory survey, selecting the items required for O&M, the revision of the water fees and the timing of the revision should be determined	Workshop/ Water supply service office	WMO	Woreda office Japanese consultant x 1 (11days) Local consultant x 1 (11days)	Output 3/ Plan of the revision of water fee
			6	Announcement for the residents—Obtaining the residesnts comprehension concerning the revision of water fee formulated in activity 5 and the obligation for the payment	Workshop/ Water supply service office	Residents	Woreda office/WMO Japanese consultant x 1 (14days) Local consultant x 1 (14days)	Output 3/ Resident meeting Report
Phase2 (During and after construction)	Enhancement of capability for O&M and Sanitary education	Output 4	7	Technical training (Woreda) —Technical training will be held for the woreda office concerning the fundamental knowledge and repair of the water facilities	Training/ Woreda office	Woreda office	EWTI (13days) Japanese consultant x 1 (10days) Local consultant x 1 (10days)	Output 4/ Manual of Maintenance and Repair
			8	Establishment a plan of monitoring—making a monitoring sheet for the regular monitoring by the woreda office	Training/ Woreda office	Woreda office	Japanese consultant x 1 (10days) Local consultant x 1 (10days)	Output 4/ Monitoring Plan document
		Output 5	9	Technical training—Fundamental technical training will be held for the person of WMO who is in charge of repair of facilities	Training/ Water supply service office	WMO	Woreda office Japanese consultant x 1 (20days) Local consultant x 1 (20days)	Output 5/ Record of activity Operatio ledger
			10	Accounting training—Technical training regarding administrative work will be held for the person of WMO who is incharge of acconting	Training/ Water supply service office	WMO	Woreda office Japanese consultant x 1 (10days) Local consultant x 1 (10days)	Output 5/ Financial records
		Output 6	11	Sanitary education—Conducting a workshop of sanitary education and safe water for the residents of town	Workshop/ Water supply service office or shool	Residents	WMO Japanese consultant x 1 (10days) Local consultant x 1 (10days)	Output 6/ Sanitary education Implementation report

(5) Procurement Method of Implementation Resources

The human resources for the activity of Soft Component are as follows.

1) The Japanese Consultant

Japanese consultants will be in charge of plan management such as preparation, instructions, conduct, reporting for all activities. In order to summarize them in a short term, people who have a project experience in Ethiopia and full knowledge of Soft component, in addition, understand the situation related to the target town would be required. Therefore, providing people from the consultants contracted in the detail design shall be suited.

2) Local Consultants

Staffs of the WMO, residents of each town speak in Amharic, they know very little English. For this reason, local consultants who will support Japanese consultants and be familiar with a local situation should be required. Local engineer employed in the preparation research can speak English and Amharic

and have also experiences of consultation with the town WMOs, and they are adequate to this activity.

3) EWTI

It is necessary for the O&M of the water supply facilities to enhance a technical capability for the Woreda staff. In order to learn the technical skills for Woreda staffs in the technical training in activity 7, a staff from EWTI who has advanced technical skills and can lecture in Amharic should be adopted. Contact EWTI in advance regarding the programs, an instructor will be sent.

4) Woreda office

Technical training for the engineer of town WMOs in Activity 9 should be planned mainly for the Woreda staffs who have obtained the skills in Activity 7. Additionally, cooperation of Woreda office shall be needed to support the enhancement of capability for WMO with the Consultants. Consequently, at the beginning of Activity 1, Regional water resource bureau should ask Woreda office to cooperate with them.

5) Regional water resource bureau, Zonal office

Cooperation of Regional water resource bureau and Zonal office would be required in order to support the WMO and Woreda office and assist comprehensively the O&M for the water supply facilities in SNNPR. Thus, at the commencement of the Soft component, Regional water resource bureau or Zonal office should be requested to cooperate for each of the activities.

(6) Implementation Schedule of Soft component

The activities to be implemented in the soft component are divided into the following two phases: “Phase 1: Formulation of organization” and “Phase 2: Enhancement of capability of O&M and Sanitary education”. The Japanese consultant will be dispatched 4 times (Total: 5.4 months). “Formulation of organization” will be implemented in 3 construction zones targeting 10 towns from the commencement of work and during work, “Enhancement of capability of O&M and Sanitary education” will be conducted three times from during construction to after construction.

As for the number of days required for the operation for each task, Activity 1 in Phase 1 was carried out for all stakeholders for 14 days, then the number of days required each time could be calculated as [6.0 days x number of towns]. In addition, Amharic is used as the official language and local consultants should be employed in case of absence of Japanese consultants in order to continue the activities and implement the monitoring. Local consultants will report the progress of the project to the Japanese consultants making contact with WMO and Woreda office closely. In response to the results, the Japanese consultants should correct the discrepancy with the overall plan and ask the local staff for feedback.

Table 2-27: Amount of required time (Japanese consultant)

Unit: Day

Activities		Days	No. of target town	Small town
1st	Activity 1	14.0	10	All small towns
	Phase1	18.0	3	Tiya, Kela, Adilo
	Voyage	4.0		
	Internal migration	1.0		
	Reporting	2.0		
2nd	Phase2	18.0	3	Tiya, Kela, Adilo
	Phase1	18.0	3	Kibet, Koshe, Tebela
	Voyage	4.0		
	Internal migration	1.0		
	Reporting	2.0		
3rd	Phase1	24.0	4	Dalocha, Mito, Alem Gebeya, Teferi Kela
	Phase2	18.0	3	Kibet, Koshe, Tebela
	Voyage	4.0		
	Internal migration	1.0		
	Reporting	2.0		
4th	Phase2	24.0	4	Dalocha, Mito, Alem Gebeya, Teferi Kela
	Voyage	4.0		
	Internal migration	2.0		
	Reporting	2.0		
Total		163.0		5.40 M/M

(7) Output for Soft Component

Outputs for the Soft Component are as follows.

- After completion of the Soft Component : Final Report
- Each dispatch of Japanese consultants : Implementation Report of the soft component
- Activity 1: Consciousness of the support system -Implementation agency : Report of hearing results
- Activity 2: Consciousness of the support system -Residents : Report of resident meeting (minutes)
- Activity 3: Formation of organization : Preparation plan for organization of WMO
- Activity 4: Establishment of user terms for facilities : User terms for facilities
- Activity 5: Establishment of a plan for the revision of the Water tariff : Plan for the revision of the Water tariff
- Activity 6: Announcement for the residents : Report of resident meeting (minutes)
- Activity 7: Technical training (Woreda) : Manual of Maintenance and Repair
- Activity 8: Establishment a plan of monitoring : Plan for the monitoring
- Activity 9: Technical training(WMO) : Activity record, Operation ledger
- Activity 10: Accounting training(WMO) : Accounting book
- Activity 11: Sanitary education : Implementation Report of Sanitary education

(8) Obligation of the Recipient Country

In order to achieve the objective of Soft component, in addition to the results of Soft component, it is essential for the continuous O&M by WMO and sustained support by Implementation agency. Additionally, supports of Implementation agency should be required to conduct the organized O&M in this plan continuously and smoothly. Necessary debt at the level of each organization is as follows.

[Regional Water Resource Bureau, Zonal Office, Woreda Office]

- Management of all the programs through collaboration with the Japanese consultants.
- Request for cooperation of related department for the implementation of the program
- Provision of staff of Implementation agency, and expense of field activities, daily allowance and accommodation fee
- Joint meeting, Implementation of each training and work shop, Ensuring of human resources for the work shop, Preparation of meeting place, Defrayment for the operation.
- Regular report from the Woreda office to Zonal office or Regional water resource bureau
- Technical assistance for the WMO
- Monitoring of project, Making a report of monitoring

[WMO]

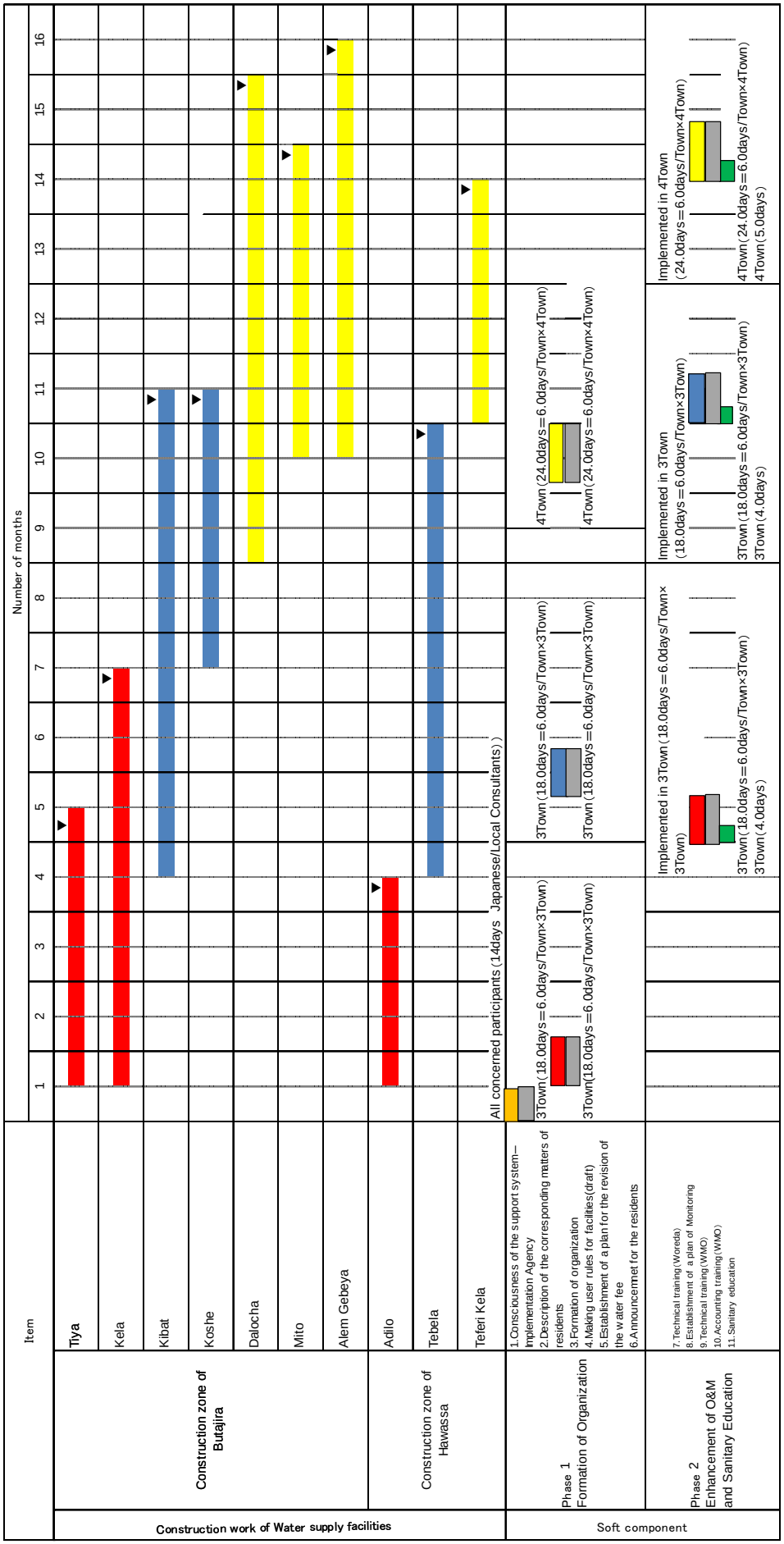
- Cooperation for the Japanese consultants in the local activity
- Ensuring of personnel at the resident's meeting, adjustment of schedule, preparation for the meeting place, expense of operation.

If the annual budget has not been recorded in the implementation agency such as transportation expenses for the people concerned, daily allowance, accommodation fee, etc., difficulty of holding the workshop will be expected. Consequently, in view of the process for the project, preliminary budget application is important.

Table 2-28: PDM for soft component

Summary of Project	Index	Means of procurement	Outside condition
Overall goal O&M for the water supply facilities fonctions sustainably by self-help efforts of WMO and Continuous support by Implementation agency	All facilities is running throughout the year.	Operation ledger of facilities.	
Objective of Soft component O&M for water supply facilities by WMO and Implementation agency should be organized	・Each stakeholder understand the role of organization ・Response capacity of O&M for the water supply facilities should be improved	Reporting outcome of hearing opinion Preparation plan for WMO Terms of facility usage Activity record Accounting book	Regional water resource bureau does not change the policy of O&M under the supervision of WMO
Output 1.Awareness of support system for WMO	1.1The role of each stakeholder for WMO should be clarified 1.2 Residents should be aware of their role.	Reporting outcome of hearing opinion Report of resident's meeting	Organization concerned have no objection against the facilities are operated by residents
2.O&M for the expantion of water supply facilities will be arranged	2.1Review the personnel composition of WMO 2.2 Setting of rules regarding water and the facilities' utilization.	Preparation plan for WMO Terms of facility usage(draft)	
3.Formulation of the appropriate plan for the revision of the water fee	3.1Formulation of the appropriate plan for the revision of the water fee for the operation 3.2 Consent of residents for the revision of water fee should be obtained	Plan of revision of the water fee Report of residents meeting	
4.Strengthening of the capability of O&M by Woreda office	4.1The know ledge of maintenance and repais will be enhanced 4.2 Plan of monitoring will be formulated	Manual of the maintenance and repair Plan of monitoring Confirmation test	
5.Strengthening of the capability of O&M by WMO	5.1The know ledge of maintenance and repais will be enhanced 5.2Preparation for the accounting operation	Activity record Operation ledger for the facilities Accounting book Confirmation test	
6.Obtain the understanding of the residents regarding their use of the new safe water sources	6.1Elevate the sanitary consciousness 6.2Comprehension of the usage of the safe water	Hearing for the residesnts	
Activity			Precondition
Activity1:Consciousness of the support system-Implementation agency Activity2:Description of the corresponding matters of residents Activity3:Formation of organization Activity4:Making user rules for facilities(draft) Activity5:Establishment of a plan for the revision of the water fee Activity6:Announcement for the residents Activity7:Technical training (Woreda) Activity8:Establishment of a plan of monitoring Activity9:Technical training (WMO) Activity10:Accounting training Activity11:Sanitary education			All organizations concerned take an active part in the Project

Table 2-29: Outline of implementation of soft component



Soft component : Upper stage - Japanese Consultant、Middle stage (gray) - Local Consultant、Lower stage (green) : EWTI

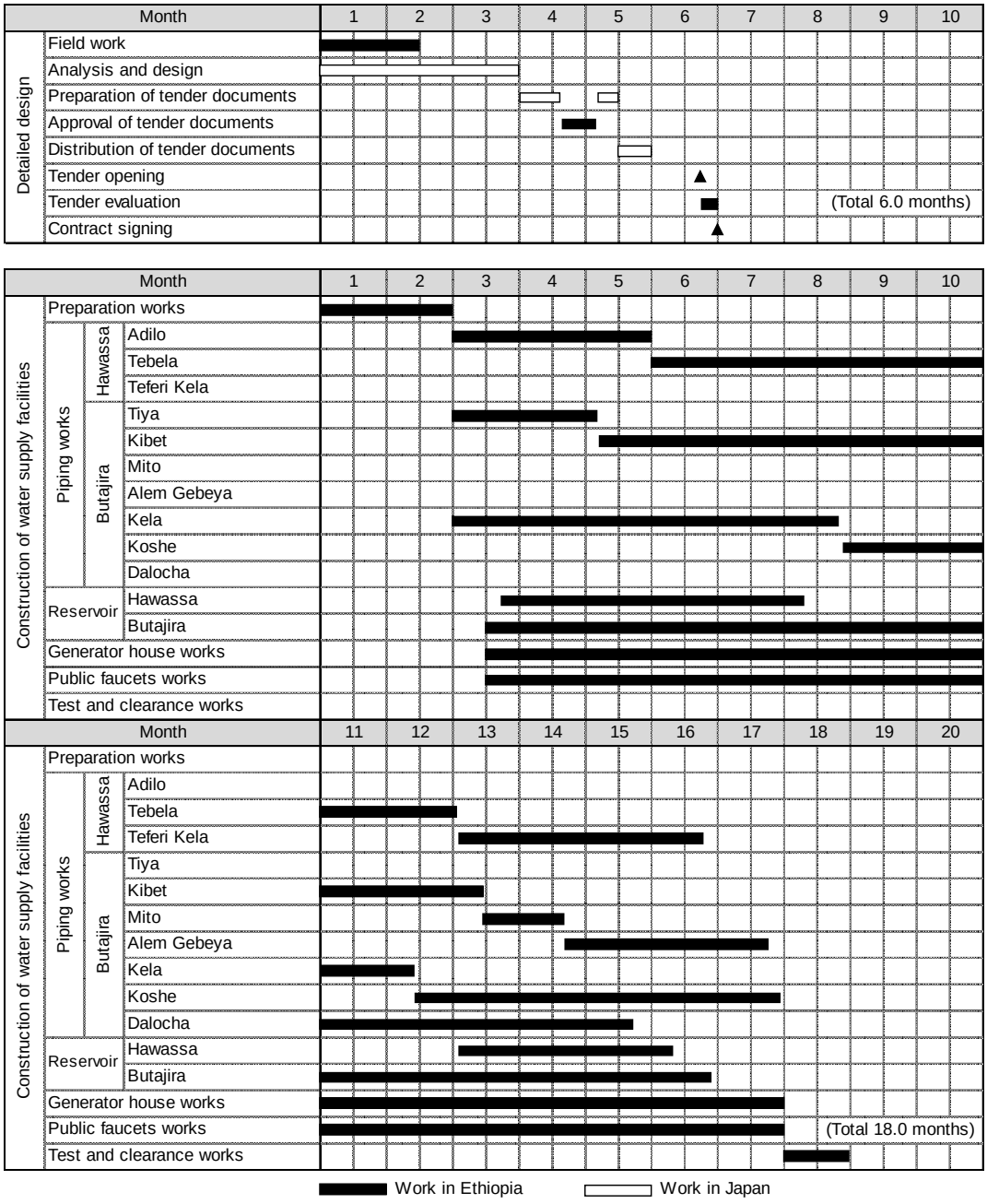
Table 2-30: Basis of calculation of working days for soft component

Period		Activities		Content of Activities	Target Audience	Implementer	Number of working days			Total number of days		
							Japanese consultant (1person)	Local consultant	EWTI	Japanese consultant (1person)	Local consultant	EWTI
Phase1 (Befor ~Under Construction)	Formation of Ogranization	Output 1	1	Consciousness of the Support syster	Regional water resource bureau Zonal office Woreda office WMO	Regional water resource bureau Zonal office Woreda office Japanese consultant (Local consultant)	1.4	1.4		1.4	1.4	0.0
			2	Description of the corresponding matters of residents	Residents	Woreda office WMO (Japanese consultant) (Local consultant)	1.0	1.0		6.0	6.0	
		Output 2	3	Formation of Organization	WMO	Woreda office Japanese consultant (Local consultant)	1.1	1.1				
			4	Making user rules for facilities(draft)	WMO	Woreda office Japanese consultant (Local consultant)	1.4	1.4				
		Output 3	5	Establishment of a plan for revision o	WMO	Woreda office Japanese consultant (Local consultant)	1.1	1.1				
			6	Announcement for the residents	Residents	Woreda office WMO (Japanese consultant) (Local consultant)	1.4	1.4				
Phase 2 (Under~after Construction)	Enhancement of capability of O&M and Sanitary education	Output 4	7	Technical training(Woreda)	Woreda office	EWTI (Japanese consultant) (Local consultant)	1.0	1.0	1.3	6.0	6.0	1.3
			8	Establishment of a plan of Monitoring	Woreda office	Japanese consultant (Local consultant)	1.0	1.0				
		Output 5	9	Technical training(WMO)	WMO	Woreda office Japanese consultant (Local consultant)	2.0	2.0				
			10	Accounting training	WMO	Woreda office Japanese consultant (Local consultant)	1.0	1.0				
		Output 6	11	Sanitary education	Residents	WMO Japanese consultant (Local consultant)	1.0	1.0				
Total							13.4	13.4	1.3	13.4	13.4	1.3

2-2-4-9 Implementation Schedule

The work types to be mostly affected by the weather conditions are concrete works for constructing the reservoirs and generator houses, however, the work volume involved is not huge and these works can be conducted outside of the rainy season. The work type that would have the greatest effect on the implementation plan is the piping works; however, normally the work is conducted in short sections, therefore, weather conditions will not affect the plan too much. On the other hand, the ten target towns are scattered. Therefore, it is better to divide the work area and organize three construction teams, and conduct the work at the same time to increase the economic efficiency of the Project implementation schedule, as shown below.

Table 2-31: Implementation schedule



2-3 Obligation of Recipient Country

(1) Securement of Budget for Bank Commission Fees

On implementation of this Project, SNNPRB as the implementation agency (or assigned agency) has to open an account named the Government of Ethiopia based on the need for banking arrangements. SNNPRB has to cover the cost of various banking fees/commissions to do with the banking arrangements. Therefore SNNPRB has to secure the commission fees for the banking arrangements immediately, and must not delay its payments.

(2) Protocol of Tax Exemption

This Project is conducted within the grant aid framework; therefore, custom duties for Japanese and the persons from third countries involved in the Project, VAT and financial duties are exempted. The implementing agency will have sufficient capacity to arrange the tax exemptions judging from the track record of other grant aid Projects in Ethiopia. However, in the past there have been delays in gaining tax exemptions because of insufficient preparation, therefore, it is important to share information, including with relevant government agencies, to ensure that the tax exemption work is done in a timely manner. BoBED is the contact point for tax exemption procedures and together with SNNPRB will conduct such work.

(3) Securement of Construction Land

In this Project, facilities to be constructed such as reservoirs, generator houses and public faucets are planned to be constructed on the ground where there are existing water supply facilities or on public land; although some of the piping work will be conducted on farm land. The piping works are generally planned not to be conducted during periods when farmers are expected to be busy. However there is a possibility that the pipes will be laid near the ground surface. If this is the case, then it will affect harvest amounts. Compensation amounts and measures to be taken by SNNPRB have already been confirmed.

WMOs and municipalities have to stay in close contact with the Contractor to confirm the compensation land and to explain such matters to the inhabitants.

(4) Securement of Access Road

Most of target towns are located nearby national road; therefore, access of the Contractor is available even in the rainy season. However, there is possibility not to be able to access by heavy and longer vehicles in rainy season because it is not paved in the town. Therefore, before commencement of construction, WMOs and municipality have to hold the explanatory meeting by the Contractor to explain the necessity of access road and prepare them.

(5) Securement of Storage Space for Construction Materials

Total extension of pipeline is 102.4km in targeted 10 towns. In implementation period, a large amount of pipes and valves have to keep temporarily in the town considering implementation schedule and efficiency for works. In the towns, there are ground of existing water supply facilities and empty land; it is easy to secure the storage space for construction materials. However, WMOs and municipality have to

supervise the storage space not to construct the object before commencement of construction and to be cleaned.

(6) Construction of Power Supply

Construction of power supply to the Project has to be conducted by SNNPRB. Power supply has to be completed before the water supply facilities are handed over to WMOs, however, it is better to complete before the commencement of construction, because this will increase the work efficiency of the Contractor. All towns have an electricity supply; therefore there is no difficulty with regard to construction of power supply. SNNPRB has to coordinate the implementation schedule with Ethiopian Electric Power Corporation (EEPCO) in advance.

(7) Construction of Steel Fence (Well Point and Reservoir)

Steel fences are needed to prevent the entry of inhabitants and domestic animals to well points (groundwater) and reservoirs. The construction of fences is not within the scope of this Project, therefore, WMOs or municipalities have to construct them. There is possibility that the implementation schedule will be affected during construction, therefore it is better to correspond to such matters during the test operation period or before operation. Therefore WMOs or municipalities have to prepare the budget to construct fences made of steel and to commence this work immediately.

(8) Construction of Wooden Fence (Public Faucet)

Wooden fences are needed to prevent the entry of domestic animals and to secure hygienic conditions of public faucets. The construction of wooden fences is not within the scope of this Project, therefore, WMOs or municipalities have to construct them. There is possibility that the implementation schedule will be affected during construction, therefore it is better to correspond to such matters during the test operation period or before operation. Therefore WMOs or municipalities have to prepare the budget to construct fences made of wood and to commence this work immediately.

(9) Connection to Private Connection

In 9 towns, except Tiya, water supply service with private connections is operating. The cost of materials and connection was paid for by residents. Private connections are not within the scope of this Project, however, pipelines and valves are designed in order to connect to private connections easily. Installation of the private connection is to be paid for by residents, however, in order to save on the costs for installation, it is desired private connection will connect at the timing of the plumbing by Japanese contractor. Therefore, it is necessary that WMO conducts strict meeting with Japanese contractors, is fully explained to residents by checking the implementation process of plumbing, makes residents to prepare the connection cost before the plumbing, and ensure that all conditions have been met so that installation of private connection can be undertaken immediately at the time of plumbing.

(10) Securement of Staff for Soft Component

Soft component for the strengthening of the capacity of operation and maintenance for water supply facilities is conducted to WMOs and Woreda office. Especially the Woreda office is expected to join in a

positive manner as it is in the position of supporting WMOs directly. Actually, per diem and transportation fee for Woreda staff are the responsibility of WMOs and personnel expenses are the responsibility of the Woreda office. However, the first priority of the Woreda office is to make sure that its staffs are able to join the soft component activities and that it can cover personnel expenses.

(11) Assistance to Reform WMO and Revision of Water Tariff

Reform of structure of WMOs and revision of Water tariffs are conducted through the implementation of the soft component. Woreda Office has to provide suggestions and support these activities sustainably.

(12) Sustainable Assistance by Implementation Agency

The capacity of operation and maintenance of WMOs is expected to be increased through the implementation of the soft component. Sustainable assistance by SNNPRB, zone office and Woreda office is needed in order for the WMOs to be able to operate and maintain the water facilities smoothly and sustainably.

2-4 Project Operation Plan

2-4-1 Operation and Maintenance Situation of Water Supply Facilities

(1) System of Operation and Maintenance

In SNNPR, RWRB exercises jurisdiction over the rural water supply project, however, there are Zonal Office and Woreda Office in each of Zone and Woreda as the local agency of central government, each Zonal Office and Woreda Office is supporting their own lower organization. In addition, in the small city (town) level, WMOs are established by the classification that RWRB evaluates water supply situation of each city (town), operation and maintenance of water supply facilities is carried out by independent accounting system.

Table 2-32: Clarification of support system

Support content		Support target		
		Zonal Water Bureau	WoredaWater Office	Water Management Organisation
Support side	Regional Water Resource Bureau (RWRB)	Regular meeting Financial audit Recepit of reports Revised procedures Conduct a workshops Processig for serious accidents	Regular meeting Financial audit Execution of water analysis Provision of parts for hand pump Technical advice	Procedures at the time of reorganization process of registration/approval Processig for serious accidents Execution of financial workshop
	Zonal Water Bureau		Regular meeting Reciept financial & other reports Execution of water analysis Technical advice	Financial audit Technical advice Processig for serious accidents process of registration/approval
	Woreda Water Office			Regular meeting Financial audit Technical advice Recepit of reports Dispatching technicians for simple or moderate accidents Distribution of spare parts Execution of water analysis Supervising of Water rate revision Supervising of staff employment

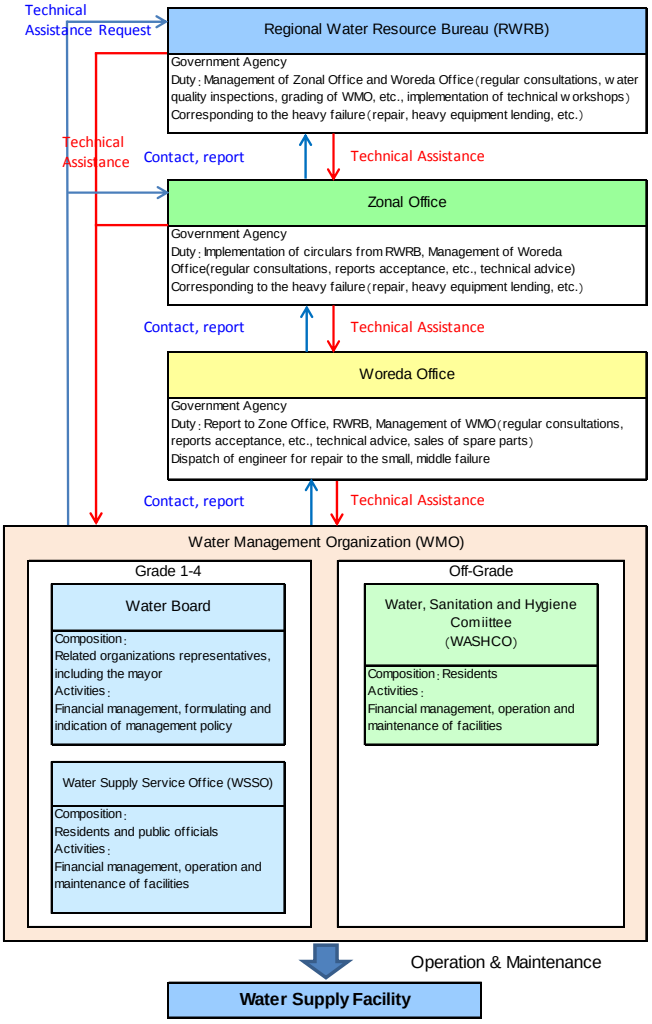


Figure 2-36: Structure of operation and maintenance in SNNPRS

(2) System of Water Management Organization and Activity Condition

In SNNPRS, RWRB grades each town based on the water supply situation, WMOs in accordance with the grade have been established. Among the target 10 towns, Water Supply Service Office was established in 5 towns (Koshe, Kela, Adilo, Kibat, Tebela) corresponding to grade 4, Water, Sanitation and Hygiene Committee (WASHCO) was established in 4 non-rated towns (Tiya, Dalocha, Mito, Alem Gebeya), and each organization is conducting operation and maintenance based on their own operation plans by independent accounting system by the collection of Water tariffs. The remaining 1 town (Teferi Kela), because the existing water supply facilities are small, WMO has not been established. However, WMO of Kebado, which is the neighboring town of Teferi Kela and same Woreda, is remotely managing the water facility with four members of Teferi Kela. Town office of Teferi Kela also knows this situation, from the viewpoint of the expansion of water supply facilities by the Project, town office is preparing the establishment of its own WMO. It is supposed to be establish the Water board in the town which has WMO, and Water Board is supposed to get involved with the activity and financial planning of WMO. However, in the 5 towns of the Project, Water Board is not established because size of organization is small.

Meanwhile, the main activities of WMO is setting of Water tariffs, fee collection, financial management, monitoring and repair of water supply facilities, reporting to the WWO, holding of regular meetings, etc. About the minor repair of water supply facilities in the town, WMO is supposed to repair by themselves. However, because WMO of 4 towns do not have the engineer for repairs, they have been outsourced to private engineers or engineers of Woreda whenever there is failure. Current WMOs and personnel composition are shown in Table 2-33.

Table 2-33: WMOs and personnel composition

Unit: person

Small town	Grade	Current WMO	WMO Member		Running Public Faucet	Water Fee Collector (Salaried worker of another employment)	
			Total	Engineer		Public Faucet	Private Connection
Koshe	4	WSSO	Male:10, Female:1	1	5	5	3
Kela	4	WSSO	Male:5, Female:2	2	12	4	3
Tiya	Off-Grade	WASHCO	Male:5, Female:2	0	3	2	***
Adilo	4	WSSO	10	2	6	6	3
Teferi Kela	Off-Grade	WSSO*	Male:4	2	9	8	3
Dalocha	Off-Grade	WASHCO	Female:4	0	6	7	3
Mito	Off-Grade	WASHCO	Male:5, Female:1	0	8	7	3
Alem Gebeya	Off-Grade	WASHCO	Male:3, Female:3	***	5	5	3
Kibet	4	WSSO	Male:8, Female:3	1	11	7	3
Tebela	4	WSSO	Male:6, Female:1	3	4	3	3

* Satellite management by WMO of neighboring town

(3) Water Tariff

In the target towns, setting of Water tariff is left to each WMO. Therefore, setting of Water tariff is different for each town. Normally, the draft of Water tariff WMOs have prepared is applied to Water

Resource Bureau and/or Zone Water Office and approved after the consultation with the town residents, hearing the opinion of WWO. Revenues from Water tariffs has been appropriated to the monthly cost of the operation and maintenance of water supply facilities such as labor costs, energy costs, communication costs, repair costs, fuel and lubricant costs, office equipment and consumables.

Table 2-34: Water tariff and setting method in each town

Small town	Public Faucet			Private Connection		Setting of water fees	Presence or absence of the repair costs in the water fees
	Birr/20L	Birr/m^3	Fee collection method	Birr/m^3	Fee collection method		
Koshe	0.15	7.5	Water fee collectors collect in cash at public faucets	5.0	Invoices are issued by measuring water meter, users pay at each WMO.	Water Board is not established. After consultation with water in WSSO, obtained the approval of residents, gained the opinion from Woreda Office. applicant from Woreda to Zone, RWRB. The current fee was amended four years ago. Maintenance costs have not been considered in water fees.	
Kela	0.20	10.0		7.0		WMO submits the results of the consultation to Woreda Office, then submitted to Zone.	
Tiya	0.30	15.0		***	***	Decided after consultation of WMO. Current fee is revised in three years ago. Gained approval from residents meeting.	
Adilo	0.40	20.0		18.0	Invoices are issued by measuring water meter, users pay at each WMO.	WMO set in 2011, after When it was promoted from WASHCO to WSSO. Water Board is not established. Appropriate fee was set from the current balance. Fee is high because it considers the fuel cost.	○
Teferi Kela	0.20	10.0		5.0		Fee was revised by the Water Board of Woreda(Dala). Water Board determines with fees of Kebado City and neighboring town. Maintenance costs account for 50% of the fee.	○
Dalocha	0.25	12.5		4.5		After consultation with WASHCO, discussed in DAWDA (36 women), fee is set after confirmation of residents. Maintenance costs are considered.	○
Mito	0.15	7.5		7.5		If accountant judges that budget balance is insufficient, WMO ask the Woreda. After consultation with Woreda, decided the fee with confirmation residents.	
Alem Gebeya	0.15	7.5		5.0		WMO proposed the price increase of fee, but residents opposite. Current fee is set six years ago. Maintenance costs are included in the fees (about 20%).	○
Kibet	0.15	7.5		4.3		WMO submits the result of discussion to Woreda, then submits to the Zone from the Woreda office. Fee was revised in 2012, but the price includig maintenance cost was high, intermediate values was set.	○
Tebela	0.20	10.0		2.0		WMO can set the fee by their own. It has not changed since 2010. Water source is spring by gravity, the cost of the generator, etc. is not applied. Therefore, fee is cheaper than other town.	

On the other hand, based on the result of social survey, payable amount exceeds the current water expenditure as shown in Table 2-35.

Table 2-35: Comparison of water expenditure and payable amount

Small town	Current water consumption		Current water expenditure (Birr/household/ month)	Payable amount*1 (Birr/month)	Willingness to pay*2 (Birr/month)
	L/capita/day	m^3/HH/month			
Koshe	13.05	2.07	11.03	34.63	52.80
Kela	14.81	2.29	16.42	44.82	33.80
Tiya	6.39	0.97	14.52	54.16	50.50
Adilo	10.02	1.96	37.69	44.96	33.00
Teferi Kela	12.04	1.97	9.42	55.79	26.00
Dalocha	12.89	2.24	13.12	36.97	38.50
Mito	25.12	3.29	24.70	62.09	53.30
Alem Gebeya	21.26	3.27	19.42	67.68	34.50
Kibet	28.21	4.84	18.53	40.48	52.80
Tebela	17.48	2.86	6.71	38.75	30.20
Average	16.13	2.58	17.16	48.03	40.54

*1 Adopt a general payable amount (5% of disposable income)

*2 Result of the social survey

(4) Technical Ability of Woreda Office

In Woreda, there is the Woreda Office as local agency of central government. Normally, Woreda Office is in the position to supervise and support the WMO. However, the majority of current main service of Woreda Office is minor support to the village community such as the repair of hand dug wells and hand pumps, spring water protection, and preliminary maintenance. Although repair that WMO cannot cope have been outsourced to private engineers or engineers of Woreda in each failure, since many of the repairs exceed the ability of engineers of Woreda Office, Zone Water Mines & Energy Depart or Water Resource Bureau are corresponding to repairs. If Woreda Office dispatches the engineer to WMO, WMO bears necessary cost such as the daily allowance, cost for transport and spare parts. On the other hand, clerical procedure involved in the organization, such as the establishment or organizational change of WMO and Water Board, setting of Water tariff, report to Zone Water Mines & Energy Depart and Water Resource Bureau, are carried out through the Woreda Office.

Table 2-36: Available support range of Woreda office

Small town	Support of Hardware				Support of Software				Procedures for repair from WMO
	Repair	Supply of spare parts*	Support of parts procurement	Funding	Training of management funds	Technical advice	Technical training	Notice to Zone, RWRB	
Koshe	○					○		○	Pump repair is requested to RWRB, switchboard repair is requested to Zone. Engineer of Butajira maintains the pipe. Arranged after received the request from WMO
Kela						○		○	After received the request from WMO, submits request to Zone, then Zone submits to RWRB. 9 times of medium or more scale repair in a year
Tiya	○				○	○	○		Maintenance of facilities is carried out six times a year (labor cost, transportation expenses is burden by town).
Adilo		△	○		○	○	○	○	After the request from WMO, submits the document for application to Zone. WMO requests the repair to Zone and RWRB twice in year. Zone implements the monitoring of accounting and technical issues.
Teferi Kela		△	○					○	WMO requests the repair to the engineer of Zone through Woreda. If heavy equipment is needed, RWRB is requested.
Dalocha	○	△	○			○	○	○	Repair can be supported by engineer DAWDA hire, but repair of generator request to RWRB, repair of pump request to Zone.
Mito	○	△	○			○	○	○	Maintains water facilities 4 times in year. Repair the failure WMO can not repair, but request the repair of pump and generator to RWRB. Sometimes share the spare parts with WMO.
Alem Gebeya	○					○	○	○	after the request from WMO, maintain with WMO. After received report for repair, request the support to Zone or RWRB.
Kibet					○			○	Received the action plan from WMO, confirm the account. Requests the repair of generator to Zone. About three times a year, rent the construction vehicles from RWRB to WMO.
Tebela		△			○	○	○		Support the account of WMO every month. 2 to 3 times a year, conducts the consultations about water quality improvement and new facilities plan.

* Spare parts are provided by paying if WMO has stock.

(5) Operation and Maintenance Situation of WMOs

WMO is supposed to repair minor failures of water facilities in the town. However, engineers of WMO have not necessarily received technical training relating to repairs, and skill level of engineers is extremely limited, therefore the way that each WMO responds to failures and so on is different.

Table 2-37: Situation of correspondence for repairs

Small town	Public Faucet		WMO		Situation of Repair Correspondence
	Total	Available Number	Engineer	Technical Training	
Koshe	12	5	1		Requests to the engineer of neighboring town, or Zone or RWRB
Kela	15	12	2	○	Engineer WMO hired repair the minor failure. Repair of generator and pump is requested Zone through Woewda.
Tiya	4	3	0		Requests to Woreda.
Adilo	7	6	2	○	Engineer is hired for each failure. Requests several times in a year to Zone.
Teferi Kela	10	9	2		Engineer of WMO of Kebado can not repair, so requests the repair to Zone.
Dalocha	8	6	0		Engineer is hired for repair, but if he can not repair, requests the repair to Zone or RWRB.
Mito	10	8	0	○	Repair of pipe is done by WMO. Maintenance is conducted every day. Other repair is requested to Woreda. Repair of generator, pump is requested to RWRB.
Alem Gebeya	8	5	—	○	Maintenance is conducted with Woreda. Repair of pump is requested to RWRB through Woreda.
Kibet	16	11	1	○	Engineer hired by WMO conducts the maintenance of pipelines 7 times in a year. Generator and pump are repaired by Zone or RWRB.
Tebela	8	4	3	○	Engineer hired by WMO conducts the maintenance of spring (2 times/year), tank (every month), facilities (50 times/year). Generator and pump are repaired by Zone or RWRB.

WMO of target 10 towns is managed by basically revenue of Water tariffs. Water tariffs from public faucets is collected in cash during the open time of public faucets, by the water seller WMO employs, by each jerry can (20.0 L) and drum can. Additional collection of money, such as arrears, does not occur for settlement of accounts by cash.

On the other hand, private connections are widespread at 9 towns except Tiya. Invoice for water consumption is made and distributed. Households that have Private Connection pay to WMO by measurement values of water meter set in each household. If there is a delinquency of Water tariffs, cautions advice is conducted to delinquent in writing. If this is not acted upon the procedure of cutting off the water and court lawsuit are taken. In this way, although system of fee collection for Private Connection is developed, but the case the amount billed for several months is paid collectively is found also. There is concern that while revenue is expected to increase due to the new water supply facilities, there will also be increase of delinquency due to the increase of Private Connection, defect of fee collection, and confusion on the accounting. For the future, if existing fee collection system is used continuously, there is expected to be a shortage of fee collectors, therefore it is necessary to increase the personnel for water meter measurement, invoice distribution, fee collection, etc. Collected Water tariff is deposited in the bank or microfinance by the accountant under the under the management of the leader of WMO except for the money for operating WMO. The main expense items are employment cost like salary, daily allowance, transportation costs, etc., energy bill, communication charge, operation and maintenance costs of water supply facilities like fuel, oil, repair costs, spare parts, etc.

2-4-2 Problem of Current System for Operation and Maintenance

As mentioned above, water supply facilities are operating and maintaining by WMO in each town, some problems are found in current condition. The water supply facilities improved by the Project are planned by the contents and scale that WMO can operate and maintain. However, there are some points that the capability of present system for operation and maintenance is insufficient.

These points are able to be improved to conduct capacity building and technical support by soft component.

Problem 1: The support system to WMO is not fully recognized.

The fundamental structure (line) on the administration which supports, in order, Water Resource Bureau, Zone Water Mines & Energy Depart, Woreda Office, and WMO exists. And also, cooperation on the administrative procedures between each organization exists. The ability of organizational operation and operation and maintenance of water facilities by WMOs is basic level, therefore, it is necessary to support by upper organization. However, the task of Woreda Office, which is closer to WMO, mainly gives support for water supply facilities in rural areas, so, support for the towns is not sufficient.

In addition, although Water Resource Bureau and Zone Water Mines & Energy Department know such a situation, the improvement plan in particular is not taken. Moreover, neither the failure prevention by daily maintenance nor leadership concerning operation and maintenance, such as securement of the repair cost at the time of failure and reporting to Water Resource Bureau and Zone Water Mines & Energy Department at the time of major failure is fully performed by the Woreda Office and WMO. As a result, problems, such as the shortage of repair costs, delay of corresponding to repair by un-reporting to the upper organization, and lack of water supply, have occurred. Therefore, it is necessary to make each upper organization recognize each role, and to strengthen cooperation between organizations. On the other hand, since the member of WMO is fundamentally elected from residents, WMO is main users of water supply facilities. Therefore, the residents in connection with management also need to understand the role in management. For the construction of new water supply facilities, in order to enhance the sense of ownership of all stakeholders, the mutual understanding between the parties is required.

Problem 2: System of operation and maintenance of WMO towards new water supply facilities is insufficient.

In order to correspond to the increase in the household connection and water supply facility users accompanying implementation of the Project, including the need the establishment of Water Board, it is necessary to look over the system of operation and maintenance of WMO, and to consider suitable staff assignment and organization. If existing water tariff collection system is adopted continuously, shortage of manpower is expected, the staff for measuring water meters, distributing invoices, and collecting water tariffs will need to be increased. In addition, it is necessary to improve the water tariff collection method, a periodical maintenance of facilities, etc. about the contents of activity and terms of service in order to operate and maintain water supply facilities sustainably.

Problem 3: The suitable water tariff is not set up.

Water tariffs, which are the sources of income, are supposed to be set at a suitable price in order to cover necessary budget, however, water tariff in each small towns are set at the discretion of WMO without any factual grounding. Therefore WMOs who are failing to conduct repairs and cover employment cost currently exist. In addition, because staff of Water Supply Service Office and Water tariff collector of Water Management Committee are gainful employment, if the employment due to the new water supply facilities increases, the increase of expenditure for labor costs will occur. Furthermore, even in the Water Management Committee which is currently managed by volunteers (unpaid), if upgrade to the Water Supply Service Office has occurred by expansion of water supply facilities scale in future, staff switches to paid employment, there is a possibility that the additional expenditure will occur.

On the other hand, many WMOs do not fund enough repair costs into water tariff, there is no financial leeway enough to correspond when a catastrophic or serious failure occurs. Therefore, sometimes repair is delayed, water supply is interrupted during the period in which the repair budget cannot be secured. Therefore, it is necessary to perform analysis of the present revenue and expenditure, to re-examine the water tariff, and to re-set up a suitable water tariff. Furthermore, it is necessary to get the understanding from residents about the amendment of water tariffs.

Problem 4: The capability of Woreda Offices about operation and maintenance of water supply facilities is not enough.

Woreda Offices are supposed to conduct repairs and offer technical advice when there are breakdowns that are too difficult for WMOs to respond to. However, in fact, the simple work is the main activity for Woreda Offices, such as the repair of hand dug wells, hand pumps, spring protection, and preliminary maintenance in rural areas. Therefore, sufficient support to WMOs is not performed. And also, even the position of the Woreda office is to supervise WMO, the technological level of Woreda Offices is deficient in the basic knowledge about water supply facilities, proper monitoring for failure prevention and ability of leadership are insufficient. In addition, Woreda Office does not conduct the periodic monitoring to figure out the current condition of water supply facilities and management situation.

Therefore, the Woreda Office needs to master the basic knowledge about the water supply facility which is needed when periodical monitoring is carried out, capability to judge the grade of the failure of water supply facility, and how to accurately record and to report to upper organization(s) in a timely manner, and the ability to calculate the expense of repairs.

Problem 5: Operation and maintenance capability of WMO is not enough.

The skill level of the water management organization is extremely limited. For this reason, in most cases WMO outsources the repair whenever failures occur. In towns, because of the lack of basic knowledge about water supply facilities, WMOs take time to respond to minor repairs such as filter replacements of diesel generators and replacement of tap of public faucets, even though such repairs should be able to be easily conducted by WMOs considering their technological level.

On the other hand, in case that heavy equipment of well cleaning is required, failure s that require advanced technology and lot of money such as repair of generators and pumps, WMO engineers can not undertake. Therefore it takes the time to secure the budget to cover repair costs as well as to request the support of an upper organization such as Zone Water Mines & Energy Depart and Water Resource Bureau, and trouble has occurred in supply of stable water. In addition, it is important that the extent of the failure is reported to the Woreda Office, and notified from Woreda Office to Zone Water Mines & Energy Department and Water Resources Bureau, but there is no staff in Woreda Office who can determine the failure condition accurately.

Therefore, it is necessary to carry out the capacity building for engineers of WMO about basic skill for repairs at the time of failure and routine periodic inspection, and to build a system that WMO can judge the condition of failure and report to Woreda Office.

On the other hand, revenue and expenditure of WMO is kept by the accountant by recording the monthly income and outcome to book. However, there are differences in management methods and ability by the town, therefore, loss of the past account book, unknown numbers on account book, and miscalculation, etc. are seen. While the increase of revenue is expected by the new water supply facilities, problems associated with the increase of users of public faucets and private connections (increase of water fees delinquencies, various troubles, etc.) are expected. Moreover, depending on the town, the amount of gross expenditure of the month may exceed the amount of revenue from a water charge, sometimes negative balance occurs. In the months when it is difficult to manage the water supply facilities with only the water tariff, it will be compensated with installation fees for household connections, water meter rental fees, and repair fees of household connections. However, if the money is still insufficient, saving money of WMO and donations are compensated.

Therefore, it is necessary for WMOs to master not only repair skills but fundamental knowledge and skills for the sustainable organizational management.

Problem 6: Understanding of the residents about using of safe water is insufficient.

In the rainy season, since meteoric water, such as rainwater and pond water, is abundant, residents can obtain water easily without using the water of water supply facilities. However, since use of meteoric water causes an increase in the disease rate of water-borne diseases, such as diarrhea and typhoid, it is desirable to use safe water all year. On the other hand, even if safe water is used, how the water is used and stored can mean the same result as using meteoric water. Therefore, residents need to understand promotion of utilization of the water supply facility which leads to securement of safe water and fundamental knowledge about the safe usage of water.

2-4-3 Consideration of System for WMO

(1) Consideration of the Staff for WMO

As mentioned above, each small town is graded by RWRB, WMOs (WSSO or WASHCO) in accordance with the established grades. WMOs are conducting the operation and maintenance of water supply facilities by the independent accounting system. Due to the implementation of the Project, since it

is assumed that the number of households contracted to public faucets and private connections will increase, the structure of WMO will be investigated.

Minimum required personnel configuration of WMO, which RWRB recommended for daily operation and maintenance and minor repairs is shown as below.

Table 2-38: Required personnel of WMO RWRB recommended

Position	Engineer				Accountant
	Pump operation	Electrician and plumber	Management engineer	Total	
Necessary personnel	1	1	1	3	3

* Minimum required personnel configuration RWRB recommended

Although the scale of water supply facilities in each small town is different, the configuration of the facility is the same (pumping to the reservoir tank, then water distribution to the town). Therefore, every target sites are judged to require the same number of personnel configuration. Thus, each three members of engineers and accountants for WMO are ensured. Additional employment is considered if the current member is insufficient.

Currently, water tariffs in each public faucet and private connection have been collected by the water tariff collectors who were hired gainfully. With regard to public faucets, one water tariff collector is required for each public faucet because of buying and selling by cash in each public faucet.

On the other hand, water tariff collection of private connections is conducted by three members of meter reading staff, billing staff and invoice distribution staff, regardless of the size of the contract number of households. Even in Tebela, which the contract number of households is the most, water tariffs are collected by three staffs to 1,350 households; namely 450 households per staff. Collection of water tariffs is done every month, but Tebela is corresponding well with three staffs at present. On the other hand, the increase of private connections is expected, but the ratio of increase is unknown. Therefore, maximum number of private connection in 2020 is assumed by multiplying the population growth rate by the number of private connections of the current situation (2013). The number of water tariff collectors needed for 2020 in each of the small towns is calculated in Table 2-39.

Table 2-39: Number of water tariff collectors needed

Small town	2013			2020				
	Private connection	Water tariff collector	HH tariff collecttor has charge of	Public faucet*1	HH tariff collecttor has charge of*2	Required tariff collector	Number of tariff collector	Increase in the number*3
	HH	Person	HH/person	HH	HH/person	Person	Person	Person
	a	b	c=a÷b	d	e	f=d÷e	g	h=g-b
Koshe	457	3	152.3	634	450.0	1.4	3	0
Kela	453	3	151.0	629	450.0	1.4	3	0
Tiya	***	***	***	0	450.0	0.0	3	3
Adilo	141	3	47.0	196	450.0	0.4	3	0
Teferi Kela	147	3	49.0	204	450.0	0.5	3	0
Dalocha	471	3	157.0	654	450.0	1.5	3	0
Mito	361	3	120.3	501	450.0	1.1	3	0
Alem Gebeya	280	3	93.3	389	450.0	0.9	3	0
Kibet	1,025	3	341.7	1,423	450.0	3.2	4	1
Tebela	1,350	3	450.0	1,874	450.0	4.2	5	2

*1 As assumed maximum number of households in 2020, calculated by multiplying the population growth rate in the number of households for public faucets of 2013

*2 Adopt 450.0 HH/person in Tebela which is a burden of households per person

*3 In Tiya, expected the start of private connections, added three

In Kibat and Tebela, 3.2 and 4.2 members for water tariff collection are required. Therefore, it is assumed to be difficult for the current three members will be able to collect the water tariffs. For this reason, it is considered best to increase one water tariff collector in Kibat and two of Tebela. Also, since it is expected the water service of private connection will start in Tiya, three water tariff collectors are expected to be employed. In of the remaining seven towns, it is proposed that the current system be kept.

(2) Personnel Organization of Each Small Town

1) Koshe

- Present

WMO is composed of 11 members, one of whom is an engineer, and there are three accountants. There are five water tariff collectors for five operational public faucets. This satisfies the necessary number of water tariff collectors. There are three water tariff collectors for private connections.

- After handover to 2020

Some staffs are required for repair and technical issues. Therefore, adding two engineers is desirable. The number of accountants remains three. The amount of public faucets increase to 17, therefore 12 water tariff collectors are needed to be added. Current three water tariff collectors for private connections are considered to be sufficient.

2) Kela

- Present

Two of seven members for WMO are engineers and there is one accountant. There are four water tariff collectors for 12 operational public faucets. This does not satisfy the necessary number of water tariff collectors. There are three water tariff collectors for private connections.

- After handover to 2020

Some staffs are required for expanding the water facilities, repair and technical issues. Therefore, adding one engineer and two accountants are desired. The number of public faucets will increase to 18, therefore 14 water tariff collectors are needed to be added. Current three water tariff collectors are sufficient for private connections.

3) Tiya

- Present

WMO is managed by seven volunteers (without salary). There are no engineers and there are three accountants, so, every repair is outsourced for each failure. There are two water tariff collectors for three operational public faucets.

- After handover to 2020

There are no engineers in WMO; therefore, three engineers are required. The number of public faucets will increase to eight, six water tariff collectors are needed to be added. Three water tariff collectors for private connections are hired for starting of the private connections in future.

4) Adilo

- Present

Two of 10 members for WMO are engineers and there are three accountants. There are six water tariff collectors for six operational public faucets. This satisfies the necessary number of water tariff collectors. There are three water tariff collectors for private connections.

- After handover to 2020

Some staffs are required for expanding the water facilities, repair and technical issues. Therefore, adding one engineer is desired. The number of public faucets will increase to 12, six water tariff collectors are needed to be added. Current three water tariff collectors are sufficient for private connections.

5) Teferi Kela

- Present

The member of WMO from Teferi Kela is only four, two of them are engineers and there is one accountant. Other members are supported by the neighboring town. There are eight water tariff collectors for nine operational public faucets. There are three water tariff collectors from neighboring town for private connections.

- After handover to 2020

One engineer, two accountants, and two general affairs are required. The numbers of public faucets increase to 16, eight water tariff collectors need to add. Current three water tariff collectors are sufficient for private connections.

6) Dalocha

- Present

All of four member of WMO is women, there are one engineer and two accountant, and one accountant is employed from outside. There are seven water tariff collectors for six operational public faucets. This satisfies the necessary number of water tariff collector. There are three water tariff collectors for private connections.

- After handover to 2020

After donating – 2020: Some staffs are required for expanding the water facilities, repair and technical issues. Therefore, adding one technical staff is desired. The numbers of public faucets increase to 18, 11 water tariff collectors need to add. Current three water tariff collectors are sufficient for private connections.

7) Mito

- Present

The number of WMO is six. There are three accountants, however, there is no engineer; so, every repair is outsourced for each failure. There are seven water tariff collectors for eight operational public faucets. This satisfies the necessary number of water tariff collectors. There are three water tariff collectors for private connections.

- After handover to 2020

Some staffs are required for expanding the water facilities, repair and technical issues. Therefore, adding three engineers are desired. The numbers of public faucets increase to 15, therefore eight water tariff collectors need to be added. Current three water tariff collectors are sufficient for private connections.

8) Alem Gebeya

- Present

The number of WMOs is six. There are three accountants, however, there is no engineer; so, every repair is outsourced for each failure. There are five water tariff collectors for five operational public faucets. This satisfies the necessary number of water tariff collectors. There are three water tariff collectors for private connections.

- After handover to 2020

Some staffs are required for expanding the water facilities, repair and technical issues. Therefore, adding three engineers are desired. The number of public faucets increased to 13, eight water tariff collectors need to be added. Current three water tariff collectors are sufficient for private connections.

9) Kibet

- Present

One of 11 members for WMO is the engineer and three are accountants. There are six water tariff collectors for six operational public faucets. This satisfies the necessary number of water tariff collectors. There are three water tariff collectors for private connections.

- After handover to 2020

Some staffs are required for expanding the water facilities, repair and technical issues. Therefore, adding two engineers are desired. The number of public faucets will increase to 17, therefore 10 water tariff collectors need to be added. It is expected one water tariff collector for private connection is added, making a total of four water tariff collectors.

10) Tebela

- Present

Three of seven members for WMO are engineers and one is an accountant. There are three water tariff collectors for four operational public faucets. There are three water tariff collectors for private connections.

- After handover to 2020

Two accountants are required for expanding the water facilities. The number of public faucets will increase to 16, therefore 13 water tariff collectors need to be added. It is expected two water tariff collectors for private connections will be added, bringing the total to five water tariff collectors.

(3) Personnel Structure of WMO

Personnel structure of WMO in 2020 is proposed as shown in Table 2-40.

Table 2-40: Structure of WMOs in 2020

Small town	WMO		Member		Fee Collector (Salaried worker of another employment)			
					Public faucet		Private connection	
	Current	After handover	Current	2020	Current	2020	Current	2020
Koshe	WSSO	WSSO	11	13	5	17	3	3
Kela	WSSO	WSSO	7	10	4	18	3	3
Tiya	WASHCO	WASHCO	7	10	2	8	***	3
Adilo	WSSO	WSSO	10	11	6	12	3	3
Teferi Kela	WSSO*	WSSO	4	9	8	16	3	3
Dalocha	WASHCO	WASHCO	4	9	7	18	3	3
Mito	WASHCO	WASHCO	6	9	7	15	3	3
Alem Gebeya	WASHCO	WSSO	6	9	5	13	3	3
Kibet	WSSO	WSSO	11	13	7	17	3	4
Tebela	WSSO	WSSO	7	9	3	16	3	5

* Satellite management by WSSO of neighboring town.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Obligation of Ethiopian Side

The following cost shall be the burden of the Ethiopian side.

Table 2-41: Cost borne by the Ethiopian Side

Cost borne by the Ethiopian side: approx. 3,867,000 Birr

Contents	Price in Birr
Banking arrangement	185,529
Construction of power supply	1,855,288
Construction of steel fence (well point and reservoir)	445,269
Construction of wood fence (public faucets)	278,293
Installation of service pipe	1,067,957
Land acquisition (land and crops)	12,368
Securement of staffs for soft component	22,263
Total	3,866,967

(2) Condition of Cost Estimation

1) Time of Estimation

The Project cost was estimated in December 2014.

2) Exchange Rate

The Project cost was estimated using the following exchange rate.

1 USD = JPY 110.42

1 Birr = USD 0.05

1 Birr = JPY 5.55

3) Construction Schedule

Construction schedule is 18.0 months shown in the implementation schedule.

4) Others

The Project cost was estimated according to the Guideline of Japanese Grant Aid.

2-5-2 Operation and Maintenance Cost

2-5-2-1 Operation and Maintenance Cost

(1) Elements of Operation and Maintenance Cost

Operation and maintenance cost for water supply facilities is consisted of "Running cost (operation fee, personnel expenses, repair fee and sundry expenses)" and "Renewal cost". This cost is calculated suitably considering the contents of the Project and structure of WMOs in 2020 as target year.

(2) Running Cost

1) Operation Fee

Power supply is easy in the towns because all target towns are connected to the power supply, therefore, power to operate pumps to pump up the groundwater is procured by power grid from Ethiopian Electric Power Corporation (EEPCO). However, the power supply is not stable; therefore, diesel engine generators are planned as a backup to the power grid. Operation fee is calculated on the ratio of operation of power grid and generator based on ratio of electric power interruption.

2) Personnel Expenses

Expenses for staff of WMOs, operators of the pumps and personnel for collecting the water tariff are to be investigated. Water Management Committees have been established in 3 towns (Tiya, Dalocha and Mito), Water Supply Service Offices have been established in 7 towns (Koshe, Kela, Adilo, Teferi Kela, Alem Gebeya, Kibat and Tebela) as Water Management Organizations (WMOs). Personnel expenses are allocated only in 7 towns where Water Supply Service Offices with salaried staffs have been established. One pump operator is allocated for each pump installed in a town. One person is allocated for the collection of fees for each pubic faucet. Meanwhile 3 to 5 personnel are allocated for the collection of fees from private faucet users in all of the towns considering the expected increase in users of private connections in future.

3) Repair Fee

Repair fee is allocated in order to deal with unexpected incidents such as a broken tap or a leaking pipe. It is estimated as 5,000 Birr/month (assumed 1,000 Birr per one repair, and five times per month).

4) Sundry Expenses

Communications expenses, office expenses and a reserve fund for WMOs are allocated as sundry

expenses. It is estimated as 2,000 Birr/month (500 Birr as corresponding fee, 500 Birr as paper and toner, etc., 1,000 Birr as reserve fund).

2-5-2-2 Renewal Cost

Renewal cost is allocated in order to replace equipment such as pumps and generators after 15 years from handing over because renewal period is set as 15 years. Generally, the renewal cost periods are set as 40 years for pipes and 50 years for concrete structural objects, however only the renewal costs of equipment are allocated in this Project.

2-5-2-3 Calculation of Operation and Maintenance Cost

(1) Population and Number of Households

Before the calculation of operation and maintenance cost, population and number of household for each type of water supply facilities in 2020 are set as shown below. Number of households in 2020 is calculated by multiplying the population growth rate (4.8 %/year) by the number of households in 2013.

Table 2-42: Population and number of households in target year 2020

Small town	Population (2020)	Household (2020)		
		Public faucets	Private connection	Total
Koshe	13,721	1,954	634	2,588
Kela	7,017	733	629	1,362
Tiya	3,863	765	0	765
Adilo	9,293	1,227	196	1,423
Teferi Kela	6,634	1,013	204	1,217
Dalocha	13,546	1,689	654	2,343
Mito	6,541	995	501	1,496
Alem Gebeya	7,291	1,033	389	1,422
Kibet	11,323	557	1,423	1,980
Tebela	12,459	411	1,874	2,285
Total	91,688	10,377	6,504	16,881

(2) Operation Fee

In targeted towns, electric power interruption occurs frequently; therefore operation fees were calculated on the premise of using commercial power and diesel engine generator. Ratio of occurrence of electric power interruption is different in each town; therefore, such information was confirmed to the staff of WMOs and/or municipality, then ratio of electric power interruption was calculated based on this result.

Electric power interruption is divided into hourly and daily interruptions. Hourly interruption occurs frequently; however, the actual number of hours and frequency cannot be specified. Therefore the days electric power interruptions occurred in each town was divided by half, and is set as the hourly and daily number of interruptions. Time of hourly interruption is set 3.0 h/day as most common answers from the staff of WMOs and municipality. Electric power interruption occurs frequently during 7:00 to 19:00, therefore daily operation hours were set 12.0 h/day and daily interruption was set as 12.0 h/day.

Table 2-43: Ratio of electric power interruption

Small town	Monhly electric interruption days*1			Monthly operation hours*2	Monthly electric interruption hours			Monthly ratio occuring interruption
	Day of electric interruption	Hourly interrruption	Daily interrruption		Hourly interrruption*3	Daily interrruption	Total	
	day/month	day/month	day/month	h/month	h/month	h/month	h/month	%
	a	b=a÷2	c=a−b	d=12×30	e=b×3	f=c×12	g=e+f	h=g÷d
Koshe	5.0	2.5	2.5	360.0	7.5	30.0	37.5	10.4%
Kela	5.0	2.5	2.5	360.0	7.5	30.0	37.5	10.4%
Tiya	12.0	6.0	6.0	360.0	18.0	72.0	90.0	25.0%
Adilo	6.0	3.0	3.0	360.0	9.0	36.0	45.0	12.5%
Teferi Kela	10.0	5.0	5.0	360.0	15.0	60.0	75.0	20.8%
Dalocha	8.0	4.0	4.0	360.0	12.0	48.0	60.0	16.7%
Mito	8.0	4.0	4.0	360.0	12.0	48.0	60.0	16.7%
Alem Gebeya	7.0	3.5	3.5	360.0	10.5	42.0	52.5	14.6%
Kibet	10.0	5.0	5.0	360.0	15.0	60.0	75.0	20.8%
Tebela	2.0	1.0	1.0	360.0	3.0	12.0	15.0	4.2%

*1 Hourly and daily interruption days cannot be specified, so each day are dual-partitioned.

*2 12 h/day is set for daily electric interruption because interruption occurs 7:00 to 19:00 (12 hour) mostly.

*3 3 h/day is set for hourly electric interruption.

(3) Personnel Expenses

Structures of WMOs that are responsible for operation of water supply facilities are different according to the grade of town. Water supply service offices that employ staff gainfully are established in towns categorized grade 4 and WASHCOs that retain volunteer staff without salary are established in the towns that are not categorized.

Teferi Kela, which has no WMO and Alem Gebeya, which is not categorized currently, will be categorized to grade 4 in the near future. Therefore personnel expenses for the staff of water supply service office were allocated to 7 towns including both towns mentioned above.

Table 2-44: WMOs in 2020

Small town	2013		2020		
	Grade	WMO	Grade	WMO	Paid employ*
Koshe	4	WSSO	4	WSSO	○
Kela	4	WSSO	4	WSSO	○
Tiya	Off-grade	WASHCO	Off-grade	WASHCO	
Adilo	4	WSSO	4	WSSO	○
Teferi Kela	Off-grade	none	4	WSSO	○
Dalocha	Off-grade	WASHCO	Off-grade	WASHCO	
Mito	Off-grade	WASHCO	Off-grade	WASHCO	
Alem Gebeya	Off-grade	WASHCO	4	WSSO	○
Kibet	4	WSSO	4	WSSO	○
Tebela	4	WSSO	4	WSSO	○

* Staff of WSSO are employed gainfully.

(4) Operation and Maintenance Cost for the Project

(a) Running cost and (b) total of running cost and renewal cost were calculated as shown in Table 2-45.

Table 2-45: Operation and maintenance cost for the Project

(a) Running cost

Small town	Precondition							Running cost											
	Water source	Pump Spec.	Pump operation hours	Monthly electric usage amount	Diesel engine generator			Operation fee*1				Personnel expenses*2					Repair fee	Sundry expenses *3	Running cost
					Output	consumption	Ratio of electric interruption	Fuel	Power bill	Total		WSSO	WASHCO	Operator	Water tariff collector (Birr/month)				
		kw	h/day	kwh	kVA	L/h	%	Birr/month	Birr/month	Birr/month		Birr/month	Birr/month	Birr/month	Public faucets	Private connectio	Birr/month	Birr/month	Birr/month
Koshe	Ground water	37.0	8.00	8,880	100	20.0	10.4%	10,433	5,541	15,974	15,974	19,500	***	400	5,950	1,050	5,000	2,000	49,874.0
Kela	Ground water	11.0	8.64	2,851	37	7.1	10.4%	4,000	1,790	5,790	11,903	15,000	***	800	6,300	1,050	5,000	2,000	42,053.0
	Ground water	13.0	8.64	3,370	37	7.1	10.4%	4,000	2,113	6,113									
Tiya	Ground water	5.5	11.09	1,830	22	4.2	25.0%	7,301	967	8,268	16,536	***	0	800	2,800	1,050	5,000	2,000	28,186.0
	Ground water	5.5	11.09	1,830	22	4.2	25.0%	7,301	967	8,268									
Adilo	Ground water	37.0	8.01	8,891	100	20.0	12.5%	12,556	5,417	17,973	35,946	16,500	***	800	4,200	1,050	5,000	2,000	65,496.0
	Ground water	37.0	8.01	8,891	100	20.0	12.5%	12,556	5,417	17,973									
Teferi Kela	Ground water	5.5	8.27	1,365	22	4.2	20.8%	4,530	765	5,295	10,590	13,500	***	800	5,600	1,050	5,000	2,000	38,540.0
	Ground water	5.5	8.27	1,365	22	4.2	20.8%	4,530	765	5,295									
Dalocha	Spring	26.0	8.00	6,240	26	14.7	16.7%	12,314	3,624	15,938	15,938	***	0	400	6,300	1,050	5,000	2,000	30,688.0
Mito	Ground water	11.0	8.00	2,640	37	7.1	16.7%	5,947	1,542	7,489	7,489	***	0	400	5,250	1,050	5,000	2,000	21,189.0
Alem Gebeya	Ground water	18.5	9.26	5,139	45	8.7	14.6%	7,375	3,063	10,438	10,438	13,500	***	400	4,550	1,050	5,000	2,000	36,938.0
Kibet	Ground water	26.0	9.70	7,566	75	14.7	20.8%	18,596	4,175	22,771	33,528	19,500	***	800	8,050	1,400	5,000	2,000	70,278.0
	Ground water	11.0	9.70	3,201	37	7.1	20.8%	8,982	1,775	10,757									
Tebela	Ground water	26.0	8.00	6,240	75	14.7	4.2%	3,097	4,168	7,265	7,265	13,500	***	400	5,600	1,750	5,000	2,000	35,515.0

(b) Total of running cost and renewal cost

Small town	Precondition							Running cost													
	Water source	Pump Spec.	Pump operation hours	Monthly electric usage amount	Diesel engine generator			Operation fee*1				Personnel expenses*2					Repair fee	Sundry expenses *3	Running cost	Renewal cost *4	Running cost + renewal cost
					Output	consumption	Ratio of electric interruption	Fuel	Power bill	Total		WSSO	WASHCO	Operator	Water tariff collector (Birr/month)						
		kw	h/day	kwh	kVA	L/h	%	Birr/month	Birr/month	Birr/month		Birr/month	Birr/month	Birr/month	Public faucets	Private connectio	Birr/month	Birr/month	Birr/month	Birr/month	Birr/month
Koshe	Ground water	37.0	8.00	8,880	100	20.0	10.4%	10,433	5,541	15,974	15,974	19,500	***	400	5,950	1,050	5,000	2,000	49,874.0	9,631.2	59,505.2
Kela	Ground water	11.0	8.64	2,851	37	7.1	10.4%	4,000	1,790	5,790	11,903	15,000	***	800	6,300	1,050	5,000	2,000	42,053.0	11,401.2	53,454.2
	Ground water	13.0	8.64	3,370	37	7.1	10.4%	4,000	2,113	6,113											
Tiya	Ground water	5.5	11.09	1,830	22	4.2	25.0%	7,301	967	8,268	16,536	***	0	800	2,800	1,050	5,000	2,000	28,186.0	11,022.7	39,208.7
	Ground water	5.5	11.09	1,830	22	4.2	25.0%	7,301	967	8,268											
Adilo	Ground water	37.0	8.01	8,891	100	20.0	12.5%	12,556	5,417	17,973	35,946	16,500	***	800	4,200	1,050	5,000	2,000	65,496.0	20,996.5	86,492.5
	Ground water	37.0	8.01	8,891	100	20.0	12.5%	12,556	5,417	17,973											
Teferi Kela	Ground water	5.5	8.27	1,365	22	4.2	20.8%	4,530	765	5,295	10,590	13,500	***	800	5,600	1,050	5,000	2,000	38,540.0	10,854.6	49,394.6
	Ground water	5.5	8.27	1,365	22	4.2	20.8%	4,530	765	5,295											
Dalocha	Spring	26.0	8.00	6,240	26	14.7	16.7%	12,314	3,624	15,938	15,938	***	0	400	6,300	1,050	5,000	2,000	30,688.0	2,654.4	33,342.4
Mito	Ground water	11.0	8.00	2,640	37	7.1	16.7%	5,947	1,542	7,489	7,489	***	0	400	5,250	1,050	5,000	2,000	21,189.0	5,665.7	26,854.7
Alem Gebeya	Ground water	18.5	9.26	5,139	45	8.7	14.6%	7,375	3,063	10,438	10,438	13,500	***	400	4,550	1,050	5,000	2,000	36,938.0	7,324.5	44,262.5
Kibet	Ground water	26.0	9.70	7,566	75	14.7	20.8%	18,596	4,175	22,771	33,528	19,500	***	800	8,050	1,400	5,000	2,000	70,278.0	13,949.7	84,227.7
	Ground water	11.0	9.70	3,201	37	7.1	20.8%	8,982	1,775	10,757											
Tebela	Ground water	26.0	8.00	6,240	75	14.7	4.2%	3,097	4,168	7,265	7,265	13,500	***	400	5,600	1,750	5,000	2,000	35,515.0	8,210.4	43,725.4

*1 Operation fee: Operation time of diesel generator is set based on the ratio of electric interruption.
Diesel fuel price is set 20.9 Birr/L.
Unit ptice for electricity are basic charge 22.558 Birr/month, 0.6088 Birr/kwh (less than 50kwh), 0.6943 Birr/kwh (more than 50kwh).

*2 Personnel expenses: 1,500 Birr/person/month is allocated for the staffs of WSSO.
Personnel expenses of WASHCO employed without salary are not allocated.
400 Birr/person/month is allocated for pump operation.
350 Birr/person/month is allocated for water fee collection of public faucets and private connection.

*3 Sundry expenses: Communications expenses, office expenses and a reserve fund for WMOs are allocated.

*4 Renewal cost: Renewal cost of equipment (renewal period is set as 15 years) is only allocated in this Project.

2-5-3 Comparison of Operation and Maintenance Cost (Water Tariff)

2-5-3-1 Reasonability of Current Water Tariff

The balance between estimated operation and maintenance cost and the amount of fees collected under the current water tariff collection system is as shown in Table 2-46.

Table 2-46: Balance by current water tariff

Small town	Running cost + Renewal cost	Collection amount								Balance
		Current water fee		Planning daily ave. water supply amount (2020)			Collection amount (2020)			
		Public faucet	Private connection	Public faucet	Private connection	Total	Public faucet	Private connection	Total	
	Birr/month	Birr/m^3	Birr/m^3	m^3/month	m^3/month	m^3/month	Birr/month	Birr/month	Birr/month	Birr/month
	a	b	c	d	e	f=d+e	g=b×d	h=c×e	i=g+h	j=i−a
Koshe	59,505.2	7.5	5.0	7,790.0	2,527.6	10,317.6	58,425.0	12,638.0	71,063.0	11,557.8
Kela	53,454.2	10.0	7.0	2,987.7	2,563.8	5,551.5	29,877.0	17,946.6	47,823.6	-5,630.6
Tiya	39,208.7	15.0	0.0	2,895.0	0.0	2,895.0	43,425.0	0.0	43,425.0	4,216.3
Adilo	86,492.5	20.0	18.0	6,215.8	992.9	7,208.7	124,316.0	17,872.2	142,188.2	55,695.7
Teferi Kela	49,394.6	10.0	5.0	4,347.2	875.5	5,222.7	43,472.0	4,377.5	47,849.5	-1,545.1
Dalocha	33,342.4	12.5	4.5	7,790.6	3,016.6	10,807.2	97,382.5	13,574.7	110,957.2	77,614.8
Mito	26,854.7	7.5	7.5	4,107.8	2,068.3	6,176.1	30,808.5	15,512.3	46,320.8	19,466.1
Alem Gebeya	44,262.5	7.5	5.0	4,106.7	1,546.5	5,653.2	30,800.3	7,732.5	38,532.8	-5,729.8
Kibet	84,227.7	7.5	4.3	3,165.0	8,085.9	11,250.9	23,737.5	34,769.4	58,506.9	-25,720.8
Tebela	43,725.4	10.0	2.0	1,772.1	8,080.2	9,852.3	17,721.0	16,160.4	33,881.4	-9,844.0

On this result, the balance of WMO was positive in 5 towns (Koshe, Tiya, Adilo, Dalocha and Mito); therefore, operation of new water supply facilities is possible by current water tariff in 5 towns. Current water tariff is accepted by users; therefore it is better to avoid revising water tariff, even if the current tariff structure is more expensive than the necessary tariff structure in order to cover operation and maintenance cost. Therefore current water tariff is adopted to 5 towns (Koshe, Tiya, Adilo, Dalocha and Mito).

In the meantime, the balance result was negative in 5 towns (Kela, Teferi Kela, Alem Gebeya, Kibat and Tebela). It means not being able to cover operation and maintenance cost by current water tariff. Therefore water tariff is revised in 5 towns (Kela, Teferi Kela, Alem Gebeya, Kibat and Tebela).

2-5-3-2 Consideration of Collectible Water tariff

It is recommended that the new water tariff is revised based on the intention to pay for water, however, in four (Kela, Teferi Kela, Alem Gebeya and Tebela) of the above five small towns, the amount of intention to pay of water is less than amount of ability to pay based on the result of social survey. On the other hand, it is expected to improve the amount of intention to pay by building the awareness of the importance to pay the counter value for safe water by conducting hygiene training in Soft Component. Therefore, water tariff was revised based on the amount of ability to pay of water in consideration with poor water situation.

On the premise that obligation cost on households is not exceeded the amount of ability to pay for water, collective water tariff was calculated and the balance between running cost and renewal cost was confirmed as shown in Table 2-47.

Table 2-47: Balance by collectible water tariff

Small town	Operation and maintenance cost			Cost borne by users			Balance	
	Running cost	Renewal cost	Total	Water tariff payable amount*	Household (2020)	Water tariff collectible amount	Running cost	Running cost+ Renewal cost
	Birr/month	Birr/month	Birr/month	Birr/month	HH	Birr/month	Birr/month	Birr/month
	a	b	c=a+b	d	e	f=d×e	g=f-a	h=f-c
Kela	42,053.0	11,401.2	53,454.2	44.82	1,362	61,044.8	18,991.8	7,590.6
Teferi Kela	38,540.0	10,854.6	49,394.6	55.79	1,217	67,896.4	29,356.4	18,501.8
Alem Gebeya	36,938.0	7,324.5	44,262.5	67.68	1,422	96,241.0	59,303.0	51,978.5
Kibet	70,278.0	13,949.7	84,227.7	40.48	1,980	80,150.4	9,872.4	-4,077.3
Tebela	35,515.0	8,210.4	43,725.4	38.75	2,285	88,543.8	53,028.8	44,818.4

* Adopt a general payable amount (5% of disposable income)

In this result, the balance between the upper limit of price of water tariff collection and “operation and maintenance cost (running cost and renewal cost)” is positive in 4 towns (Kela, Teferi Kela, Alem Gebeya and Tebela). In the cases whereby this amount was positive it represents a surplus, therefore, new water tariff is not needed to be increased to the upper limit.

In the meantime, in Kibat, running cost can be covered however; renewal cost cannot be covered fully. Therefore, the possibility to cover the running cost and renewal cost fully with increasing water tariff collection from household was considered.

2-5-3-3 Setting of Water Tariff

In 5 towns (Kela, Teferi Kela, Alem Gebeya, Kibat and Tebela), the balance was calculated between the amount of collectable water tariff and the amount of running cost and renewal cost, then suitable water tariff collection amount were calculated as shown in Table 2-48.

Table 2-48: Suitable collection amount of water tariff

Small town	Water tariff collection amount	Running cost+ Renewal cost	Balance	Suitable water tariff collection amount*1	Household (2020)	Suitable household expenditure	Water tariff payable amount*2	Balance
	Birr/month	Birr/month	Birr/month	Birr/month	HH	Birr/month	Birr/month	Birr/month
	a	b	c=a-b	d=a-c	e	f=d÷e	g	h=g-f
Kela	61,044.8	53,454.2	7,590.6	53,454.2	1,362	39.2	44.8	5.62
Teferi Kela	67,896.4	49,394.6	18,501.8	49,394.6	1,217	40.6	55.8	15.19
Alem Gebeya	96,241.0	44,262.5	51,978.5	44,262.5	1,422	31.1	67.7	36.58
Kibet	80,150.4	84,227.7	-4,077.3	84,227.7	1,980	42.5	40.5	-2.02
Tebela	88,543.8	43,725.4	44,818.4	43,725.4	2,285	19.1	38.8	19.65

*1 4 small towns balance between water tariff collection amount and total of running & renewal cost is positive are removed the surplus from water fee collection amount.
In Kibat, 4,077.3 Birr was added to cover renewal cost.

*2 Adopt a general payable amount (5% of disposable income)

Based on the result above, in Kibat, suitable water expenditure exceeded 2.02 Birr of expendable water tariff. However, this surplus is cheaper than cost of one meal in a local restaurant (approx. 15.0 Birr) and one box of cigarette (approx. 20.0 Birr) as common expenditure items; therefore it seems residents will be able to pay this surplus. And also, it seems the residents will come to understand the importance of using safe water and be willing to pay for water Therefore, new water tariff setting based on suitable water collection fee is proposed in 5 towns.

In four small towns except Kela, public faucets and private connections already exist, users have accepted these different tariff structures. In this current situation, if only one of these tariffs is increased, there is a high probability that the users will be unhappy.

Therefore, in consideration with water tariff revision, it was thoughtful of not making feeling of unfairness in users. New water tariffs, “(a) water tariff calculated referring the ratio of current unit price” and “(b) water tariff calculated that suitable collection fee was divided by planning daily average water supply amount” are shown as Table 2-49.

Table 2-49: Consideration of setting of water tariff in this Project

(a) New water tariff calculated referring the ratio of current unit price

Small town	Current water tariff (2013)				Planning daily ave. water supply amount (2020)		Obligation fee by users (2020)			New water tariff (2020)	
	Water tariff		Ratio of water tariff		Public faucet	Private connection	Suitable collection fee	Public faucets	Private connection	Public faucet	Private connection
	Public faucet	Private connection	Public faucets	Private connection							
	Birr/m^3	Birr/m^3	%	%	m^3/month	m^3/month	Birr/month	Birr/month	Birr/month	Birr/m^3	Birr/m^3
	a	b	c	d	e	f	g	h=c×g	k=d×g	l=j÷c	m=k÷d
Kela	10.0	7.0	58.8%	41.2%	2,987.7	2,563.8	53,454.2	31,443.6	22,010.6	10.5	8.6
Teferi Kela	10.0	5.0	66.7%	33.3%	4,347.2	875.5	49,394.6	32,929.7	16,464.9	7.6	18.8
Alem Gebeya	7.5	5.0	60.0%	40.0%	4,106.7	1,546.5	44,262.5	26,557.5	17,705.0	6.5	11.4
Kibet	7.5	4.3	63.6%	36.4%	3,165.0	8,085.9	84,227.7	53,534.6	30,693.1	16.9	3.8
Tebela	10.0	2.0	83.3%	16.7%	1,772.1	8,080.2	43,725.4	36,437.8	7,287.6	20.6	0.9

(b) New water tariff calculated that suitable collection fee was devided by planning daily ave. water supply amount

Small town	Current water tariff (2013)		Planning daily ave. water supply amount (2020)			Suitable collection fee	New water tariff* (Ave.)
	Public faucet	Private connection	Public faucet	Private connection	Total		
	Birr/m^3	Birr/m^3	m^3/month	m^3/month	m^3/month	Birr/month	Birr/month
	a	b	c	d	e=c+d	f	g=f÷e
Kela	10.0	7.0	2,987.7	2,563.8	5,551.5	53,454.2	9.6
Teferi Kela	10.0	5.0	4,347.2	875.5	5,222.7	49,394.6	9.5
Alem Gebeya	7.5	5.0	4,106.7	1,546.5	5,653.2	44,262.5	7.8
Kibet	7.5	4.3	3,165.0	8,085.9	11,250.9	84,227.7	7.5
Tebela	10.0	2.0	1,772.1	8,080.2	9,852.3	43,725.4	4.4

* Water tariff of public faucets and private connection are same.

It is proposed that current water tariff is maintained in 5 towns (Koshe, Tiya, Adilo, Dalocha and Mito). Then, in 5 towns (Kela, Teferi Kela, Alem Gebeya, Kibat and Tebela) it is proposed to increase water tariffs as per Table 2-50. These new water tariffs were calculated based on the water payable fee, therefore, it seems to be able to collect new water tariff from the inhabitants. The tariff revision is promoted through the implementation of soft component base on the proposed water tariff.

Table 2-50: Proposed water tariff in this Project

Unit: Birr

Small town	Current water tariff (2013)			Proposed new water tariff (2020)						Revision
				(a) New water tariff calculated referring the ratio of current unit price			(b) New water tariff calculated that suitable collection fee was devided by planning daily ave. water supply amount			
	Public faucet		Private connection	Public faucet		Private connection	Public faucet		Private connection	
	20L	m^3	m^3	20L	m^3	m^3	20L	m^3	m^3	
Koshe	0.15	7.5	5.0	0.15	7.5	5.0	0.15	7.5	5.0	
Kela	0.20	10.0	7.0	0.21	10.5	8.6	0.19	9.6	9.6	Increase
Tiya	0.30	15.0	***	0.30	15.0	0.0	0.30	15.0	0.0	
Adilo	0.40	20.0	18.0	0.40	20.0	18.0	0.40	20.0	18.0	
Teferi Kela	0.20	10.0	5.0	0.15	7.6	18.8	0.19	9.5	9.5	Increase
Dalocha	0.25	12.5	4.5	0.25	12.5	4.5	0.25	12.5	4.5	
Mito	0.15	7.5	7.5	0.15	7.5	7.5	0.15	7.5	7.5	
Alem Gebeya	0.15	7.5	5.0	0.13	6.5	11.4	0.16	7.8	7.8	Increase
Kibet	0.15	7.5	4.3	0.34	16.9	3.8	0.15	7.5	7.5	Increase
Tebela	0.20	10.0	2.0	0.41	20.6	0.9	0.09	4.4	4.4	Increase

Chapter 3

Project Evaluation

CHAPTER 3 PROJECT EVALUATION

3-1 Preconditions

For the smooth implementation of the Project, preconditions to be corresponded by Ethiopian side are shown in Table 3-1. It is important that these are conducted properly and timely by Ethiopian side.

Table 3-1: Preconditions for implementation of the Project

Precondition	Implementation deadline
Ensure the commission of bank arrangements	Before the datail design
Procedure of tax exemption	Before the construction
Securement of the construction site	Before the datail design
Securement of the access road	Before the construction
Securement of the storage of materials and equipment for construction	Before the construction
Install of the primary power supply facility	Before the construction
Construction of steel fence (well point and reservoir)	During test operation or before the operation of water facilities
Construction of wood fence (public faucets)	During test operation or before the operation of water facilities
Installation of service pipe	During the open cut for pipe installation
Securement of staffs for soft component	Before the technical assistance
Reorganization of WMO and revision of water fees	During the technical assistance
Assistance to WMO by WB, Zone and Woreda Offices	After the handover of water facilities

3-2 Necessary Inputs by Recipient Country

(1) Continuous Support to WMOs

In order to operate and maintain water supply facilities by WMO sustainably, reform of WMO and revision of water tariff are needed. Such reform and revision are supported on soft component, however, WB and Woreda Offices as implementation agency have to monitor and support continuously after handing over water supply facilities. Implementation agency agreed to correspond to these issues, however, budget and personnel for them have to be secured in advance for conclusive implementation.

(2) Monitoring of environmental impact

Impact on the social environment of 10 small towns by implementing the Project is evaluated to be minor.

However, WB has to monitor the impacts such as land use and utilization of local resources, soil erosion, air pollution, noise and vibration especially occurring during construction period regularly, and WB has to encourage to Japanese contractor and WMO to conduct mitigation measures

3-3 Important Assumptions

Important assumptions for implementation of the Project are mentioned below.

- Policy of improvement of rural water supply in SNNPR is not changed.
- Policy of provision technical support of operation and maintenance to WMO by WB, Zone and Woreda Offices is not changed.

3-4 Project Evaluation

3-4-1 Relevance

The Project implementation by Grant Aid is evaluated to be reasonable based on the result of this survey for the following reasons.

- Target of this Project is 91,688 people of targeted 10 small towns in SNNPRS, a considerable number of whom are in the "worse off" category.
- The inhabitants in the targeted 10 small towns use poor water sources (water quality and quantity). The implementation of this Project will enable the distribution of safe and sustainable water to the inhabitants and contribute to improving their lives.
- The Government of Ethiopia aims at "improving living conditions and hygienic conditions in rural areas" as an overall goal. Therefore, implementation of this Project aims to achieve this objective.
- WB and Woreda Offices, as implementing agencies, have enough experience in rehabilitation, operation and maintenance. In addition, water supply facilities to be constructed in this Project are of a common level in Ethiopia, and special techniques are not needed. Therefore, sustainable operation and maintenance by Water Management Organization (WMO) can be expected.
- Water supply facilities to be constructed in this Project are not profit-earning public facilities, therefore it is adapted into the framework of Grant Aid.
- Environment impacts such as land use and utilization of local resources, soil erosion, air pollution, noise and vibration may be generated by the Project implementation, however, it is evaluated to be kept to the minimum by conducting mitigation measures.

3-4-2 Effectiveness

(1) Quantitative Impact

Quantitative impact to be expected by implementation of this Project is shown in Table 3-2.

WMO will record the volume of distribution flow on the management ledger by measuring the flow meter installed at the reservoir tank, therefore, amount of average water supply can be confirmed by looking at the management ledger.

Table 3-2: Quantitative impact after implementation of this Project

Index	Standard value (Actual values in 2013)	Target value (2020) (After three years of project completion)
Average daily water supply amount	786.72 m^3/day*	2,497.84 m^3/day

* The value calculated on the basis of the Ethiopian Design Standard in existing facilities.

(2) Qualitative Impact

Qualitative impact to be expected by implementation of this Project is mentioned below.

- Mitigation of workload (time) for fetching water
- Mitigation of water-borne diseases *
- Promotion of women's advancement in society *
- Improvement of opportunity of school attendance of children *

* These qualitative impacts are expected to be generated in this Project, however, it is difficult to measure the accurate impact level because the external conditions are expected to have a profound effect.

From the above-mentioned contents, implementation of this Project is assessed reasonable and effective.

[Appendices]

1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. Soft Component (Technical Assistance) Plan
6. Other Relevant Data
   * Pipe Network Analysis
   * Collected Data List
7. References
   * Structure of Successful Test Well
   * Results of Water Quality Analysis

Appendix 1

Member List of the Study Team

1. Preparatory Survey

Name	Position	Organization
Mr. Yuji Maruo	Team Leader	Japan International Cooperation Ageny
Mr. Masahito Miyagawa	Cooperation Planning	Japan International Cooperation Ageny
Mr. Takeshi Nakano	Chief Consultant/ Water Supply Facility Planning	Kokusai Kogyo Co., Ltd.
Mr. Kenji Shinoda	Sub Chief Consultant/ Water Supply Facility Design/ Pipe Line Design/ Construction Planning/ Procurement Planning	Kokusai Kogyo Co., Ltd.
Mr. Hisayuki Ukishima	Hydrogeology 1/ Groundwater Development Planning 1	Individual Consultant
Mr. Tsugio Ishikawa	Hydrogeology 2/ Groundwater Development Planning 2	Mitsui Mineral Development Engineering Co., Ltd.
Mr. Masatoshi Tanaka	Test Well Drilling Supervision	Kokusai Kogyo Co., Ltd.
Ms. Izumi Kasai	Environment and Social Consideration/ Socio-Economic Survey	Kokusai Kogyo Co., Ltd.
Mr. Shinichi Ogawa	Cost Estimation/ Operation and Maintenance Planning	Kokusai Kogyo Co., Ltd.

2. Explanation of Draft Final Report

Name	Position	Organization
Mr. Toshio Murakami	Team Leader	Japan International Cooperation Ageny
Mr. Masanori Yamazaki	Cooperation Planning	Japan International Cooperation Ageny
Mr. Takeshi Nakano	Chief Consultant/ Water Supply Facility Planning	Kokusai Kogyo Co., Ltd.
Mr. Kenji Shinoda	Sub Chief Consultant/ Water Supply Facility Design/ Pipe Line Design/ Construction Planning/ Procurement Planning	Kokusai Kogyo Co., Ltd.

Appendix 2

Study Schedule

Preparatory Survey

Date	JICA		Consultant						
	Team Leader	Cooperation Planning	Chief Consultant/ Water Supply Facility Planning	Sub Chief Consultant/ Water Supply Facility Design/ Pipe Line Design/ Construction Planning/ Procurement Planning	Hydrogeology 1/ Groundwater Development Planning 1	Hydrogeology 2/ Groundwater Development Planning 2	Test Well Drilling Supervision	Environment and Social Consideration/ Socio-Economic Survey	Cost Estimation/ Operation and Maintenance Planning
	Yuji Maruo	Masahito Miyagawa	Takeshi Nakano	Kenji Shinoda	Hisayuki Ukishima	Tsugio Ishikawa	Masatoshi Tanaka	Izumi Kasai	Shinichi Ogawa
7-May	Dept. Japan	Dept. Japan	Dept. Japan	Dept. Japan					
8-May	Arriv. ET, JICA report	Arriv. ET, JICA report	Arriv. ET, JICA report	Arriv. ET, JICA report					
9-May	Courtesy call	Courtesy call	Courtesy call	Courtesy call					
10-May	Inland transportation	Inland transportation	Inland transportation	Inland transportation					
11-May	Field survey	Field survey	Field survey	Field survey					
12-May	Field survey	Field survey	Field survey	Field survey					
13-May	M/D discussion	M/D discussion	M/D discussion	M/D discussion					
14-May	M/D signing	M/D signing	M/D signing	M/D signing					
15-May	EOJ & JICA report	EOJ & JICA report	EOJ & JICA report	EOJ & JICA report					
16-May	Dept. Ethiopia	Dept. Ethiopia	Data collection	Data collection					
17-May	Arriv. Japan	Arriv. Japan	Inland transportation	Inland transportation					
18-May			Site scoping	Site scoping					
19-May			Site scoping	Site scoping					
20-May			Site scoping	Site scoping					
21-May			Site scoping	Site scoping					
22-May			Site scoping	Site scoping				Dept. Japan	
23-May			Site scoping	Site scoping				Arriv. ET, JICA report	
24-May			TN signing	TN signing				Data collection	
25-May			Team meeting	Team meeting				Team meeting	
26-May			Data collection	Data collection				Data collection	
27-May			Request quotation	Request quotation				Request quotation	
28-May			Request quotation	Request quotation				Request quotation	
29-May			Data collection	Data collection				Data collection	
30-May			Data collection	Data collection				Data collection	
31-May			Recieve quotation	Recieve quotation				Recieve quotation	
1-Jun			Contrcator evaluation	Contrcator evaluation				Contrcator evaluation	
2-Jun			Contrcator evaluation	Contrcator evaluation				Contrcator evaluation	
3-Jun			Contract	Contract				Contract	
4-Jun			JICA report, Dept. ET	JICA report				JICA report	
5-Jun			Arriv. Japan	Contractor meeting				Contractor meeting	
6-Jun				Contractor meeting				Contractor meeting	
7-Jun				Inland transportation				Inland transportation	
8-Jun				Data collection				Data collection	
9-Jun				Data collection				Data collection	
10-Jun				S/V for survey work				S/V for social survey	
11-Jun				S/V for survey work				S/V for social survey	
12-Jun				S/V for survey work				S/V for social survey	
13-Jun				S/V for survey work				S/V for social survey	
14-Jun				S/V for survey work				S/V for social survey	
15-Jun				Data collection				Data collection	
16-Jun				Data collection				Data collection	
17-Jun				S/V for survey work				S/V for social survey	
18-Jun				S/V for survey work				S/V for social survey	
19-Jun				S/V for survey work				S/V for social survey	
20-Jun				S/V for survey work				S/V for social survey	
21-Jun				S/V for survey work				S/V for social survey	
22-Jun				Data collection				Data collection	
23-Jun				Data collection				Data collection	
24-Jun				S/V for survey work				S/V for social survey	
25-Jun				S/V for survey work				S/V for social survey	
26-Jun				S/V for survey work				S/V for social survey	
27-Jun				S/V for survey work				S/V for social survey	
28-Jun				S/V for survey work				S/V for social survey	
29-Jun				Data collection				Data collection	
30-Jun				Data collection				Data collection	
1-Jul				S/V for survey work				S/V for social survey	
2-Jul				S/V for survey work				S/V for social survey	
3-Jul				Inland transportation				Inland transportation	
4-Jul				JICA report, Dept. ET				JICA report, Dept. ET	
5-Jul				Arriv. Japan				Arriv. Japan	
6-Jul									
7-Jul									
8-Jul									
9-Jul									
10-Jul									
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12-Jul									
13-Jul									
14-Jul									
15-Jul									
16-Jul									
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25-Jul									
26-Jul									
27-Jul									
28-Jul									

Preparatory Survey

Date	JICA		Consultant						
	Team Leader	Cooperation Planning	Chief Consultant/ Water Supply Facility Planning	Sub Chief Consultant/ Water Supply Facility Design/ Pipe Line Design/ Construction Planning/ Procurement Planning	Hydrogeology 1/ Groundwater Development Planning 1	Hydrogeology 2/ Groundwater Development Planning 2	Test Well Drilling Supervision	Environment and Social Consideration/ Socio-Economic Survey	Cost Estimation/ Operation and Maintenance Planning
	Yuji Maruo	Masahito Miyagawa	Takeshi Nakano	Kenji Shinoda	Hisayuki Ukishima	Tsugio Ishikawa	Masatoshi Tanaka	Izumi Kasai	Shinichi Ogawa
29-Jul									
30-Jul									
31-Jul									
1-Aug					Dept. Japan				
2-Aug					Arriv. ET, JICA report				
3-Aug					Data collection				
4-Aug					Inland transportation				
5-Aug					S/V for GP survey				
6-Aug					S/V for GP survey				
7-Aug					S/V for GP survey				
8-Aug					S/V for GP survey				
9-Aug					S/V for GP survey				
10-Aug					S/V for GP survey				
11-Aug					Data collection				
12-Aug					S/V for GP survey				
13-Aug					S/V for GP survey				
14-Aug					S/V for GP survey				
15-Aug					S/V for GP survey				
16-Aug					S/V for GP survey				
17-Aug					S/V for GP survey	Dept. Japan			
18-Aug					Data collection	Arriv. Ethiopia			
19-Aug					S/V for GP survey	Inland transportation			
20-Aug					S/V for GP survey	S/V for GP survey			
21-Aug					S/V for GP survey	S/V for GP survey			
22-Aug					S/V for GP survey	S/V for GP survey			
23-Aug					S/V for GP survey	S/V for GP survey			
24-Aug					S/V for GP survey	S/V for GP survey	Dept. Japan		
25-Aug					Data collection	Data collection	Arriv. Ethiopia		
26-Aug					S/V for GP survey	S/V for GP survey	Inland transportation		
27-Aug					S/V for GP survey	S/V for GP survey	S/V for GP survey		
28-Aug					S/V for GP survey	S/V for GP survey	S/V for GP survey		
29-Aug					S/V for GP survey	S/V for GP survey	S/V for GP survey		
30-Aug					S/V for GP survey	S/V for GP survey	S/V for GP survey		
31-Aug					S/V for GP survey	S/V for GP survey	S/V for GP survey		
1-Sep					Data collection	Data collection	Data collection		
2-Sep					S/V for GP survey	S/V for GP survey	S/V for drilling		
3-Sep					S/V for GP survey	S/V for GP survey	S/V for drilling		
4-Sep					S/V for GP survey	S/V for GP survey	S/V for drilling		
5-Sep					S/V for GP survey	S/V for GP survey	S/V for drilling		
6-Sep					S/V for GP survey	S/V for GP survey	S/V for drilling		
7-Sep					S/V for GP survey	S/V for GP survey	S/V for drilling		
8-Sep					Data collection	Data collection	Data collection		
9-Sep					S/V for drilling	S/V for drilling	S/V for drilling		
10-Sep					S/V for drilling	S/V for drilling	S/V for drilling		
11-Sep					S/V for drilling	S/V for drilling	S/V for drilling		
12-Sep					Inland transportation	S/V for drilling	S/V for drilling		
13-Sep					JICA report, Dept. ET	S/V for drilling	S/V for drilling		
14-Sep					Arriv. Japan	S/V for drilling	S/V for drilling		
15-Sep						Data collection	Data collection		
16-Sep						S/V for drilling	S/V for drilling		
17-Sep						S/V for drilling	S/V for drilling		
18-Sep						S/V for drilling	S/V for drilling		
19-Sep						S/V for drilling	S/V for drilling		
20-Sep						S/V for drilling	S/V for drilling		
21-Sep						S/V for drilling	S/V for drilling		
22-Sep						Data collection	Data collection		
23-Sep						S/V for drilling	S/V for drilling		
24-Sep						S/V for drilling	S/V for drilling		
25-Sep						S/V for drilling	S/V for drilling		
26-Sep						S/V for drilling	S/V for drilling		
27-Sep						S/V for drilling	S/V for drilling		
28-Sep						Inland transportation	S/V for drilling		
29-Sep						JICA report, Dept. ET	Data collection		
30-Sep						Arriv. Japan	S/V for drilling		
1-Oct							S/V for drilling		
2-Oct							S/V for drilling		
3-Oct							S/V for drilling		
4-Oct							S/V for drilling		
5-Oct							S/V for drilling		
6-Oct							Data collection		
7-Oct							S/V for drilling		
8-Oct							S/V for drilling		
9-Oct							S/V for drilling		
10-Oct							S/V for drilling		
11-Oct							S/V for drilling		
12-Oct							S/V for drilling		
13-Oct							Data collection		
14-Oct							S/V for drilling		
15-Oct							S/V for drilling		
16-Oct							S/V for drilling		
17-Oct							S/V for drilling		
18-Oct							S/V for drilling		
19-Oct							S/V for drilling		

Preparatory Survey

Date	JICA		Consultant						
	Team Leader	Cooperation Planning	Chief Consultant/ Water Supply Facility Planning	Sub Chief Consultant/ Water Supply Facility Design/ Pipe Line Design/ Construction Planning/ Procurement Planning	Hydrogeology 1/ Groundwater Development Planning 1	Hydrogeology 2/ Groundwater Development Planning 2	Test Well Drilling Supervision	Environment and Social Consideration/ Socio-Economic Survey	Cost Estimation/ Operation and Maintenance Planning
	Yuji Maruo	Masahito Miyagawa	Takeshi Nakano	Kenji Shinoda	Hisayuki Ukishima	Tsugio Ishikawa	Masatoshi Tanaka	Izumi Kasai	Shinichi Ogawa
20-Oct							Data collection		Dept. Japan
21-Oct							S/V for drilling		Arriv. ET, JICA report
22-Oct							S/V for drilling		Quotation collection
23-Oct							S/V for drilling		Quotation collection
24-Oct							S/V for drilling		Quotation collection
25-Oct							S/V for drilling		Quotation collection
26-Oct							S/V for drilling		Data collection
27-Oct			Dept. Japan				Data collection		Data collection
28-Oct			Arriv. Ethiopia				S/V for drilling		JICA report
29-Oct			Inland transportation				S/V for drilling		Quotation collection
30-Oct			S/V for drilling				S/V for drilling		Quotation collection
31-Oct			Inland transportation				S/V for drilling		Quotation collection
1-Nov			JICA report, Dept. ET				S/V for drilling		JICA report, Dept. ET
2-Nov			Arriv. Japan				S/V for drilling		Arriv. Japan
3-Nov							Data collection		
4-Nov							S/V for drilling		
5-Nov							S/V for drilling		
6-Nov							S/V for drilling		
7-Nov							S/V for drilling		
8-Nov							S/V for drilling		
9-Nov							S/V for drilling		
10-Nov							Data collection		
11-Nov							S/V for drilling		
12-Nov							S/V for drilling		
13-Nov							S/V for drilling		
14-Nov							S/V for drilling		
15-Nov							S/V for drilling		
16-Nov							S/V for drilling		
17-Nov							Data collection		
18-Nov							S/V for drilling		
19-Nov							S/V for drilling		
20-Nov							S/V for drilling		
21-Nov							S/V for drilling		
22-Nov							S/V for drilling		
23-Nov							S/V for drilling		
24-Nov							Data collection		
25-Nov							S/V for drilling		
26-Nov							S/V for drilling		
27-Nov							S/V for drilling		
28-Nov							S/V for drilling		
29-Nov							S/V for drilling		
30-Nov							S/V for drilling		
1-Dec				Dept. Japan			Data collection		
2-Dec				Arriv. ET, JICA report			S/V for drilling		
3-Dec				Inland transportation			S/V for drilling		
4-Dec				S/V for survey work			S/V for drilling		
5-Dec				S/V for survey work			S/V for drilling		
6-Dec				S/V for survey work			S/V for drilling		
7-Dec				S/V for survey work			S/V for drilling		
8-Dec				Data collection			Data collection		
9-Dec				S/V for survey work			S/V for drilling		
10-Dec				S/V for survey work			S/V for drilling		
11-Dec				S/V for survey work			S/V for drilling		
12-Dec				Inland transportation			S/V for drilling		
13-Dec				JICA report, Dept. ET			S/V for drilling		
14-Dec				Arriv. Japan			S/V for drilling		
15-Dec							Data collection		
16-Dec							S/V for drilling		
17-Dec							S/V for drilling		
18-Dec							S/V for drilling		
19-Dec							S/V for drilling		
20-Dec							S/V for drilling		
21-Dec							S/V for drilling		
22-Dec							Data collection		
23-Dec							S/V for drilling		
24-Dec							S/V for drilling		
25-Dec							S/V for drilling		
26-Dec							S/V for drilling		
27-Dec							S/V for drilling		
28-Dec							S/V for drilling		
29-Dec							Data collection		
30-Dec							S/V for drilling		
31-Dec							S/V for drilling		
1-Jan							S/V for drilling		
2-Jan							S/V for drilling		
3-Jan							S/V for drilling		
4-Jan							S/V for drilling		
5-Jan							Data collection		
6-Jan							S/V for drilling		
7-Jan							S/V for drilling		
8-Jan							S/V for drilling		
9-Jan							S/V for drilling		
10-Jan							S/V for drilling		

Preparatory Survey

Date	JICA		Consultant						
	Team Leader	Cooperation Planning	Chief Consultant/ Water Supply Facility Planning	Sub Chief Consultant/ Water Supply Facility Design/ Pipe Line Design/ Construction Planning/ Procurement Planning	Hydrogeology 1/ Groundwater Development Planning 1	Hydrogeology 2/ Groundwater Development Planning 2	Test Well Drilling Supervision	Environment and Social Consideration/ Socio-Economic Survey	Cost Estimation/ Operation and Maintenance Planning
	Yuji Maruo	Masahito Miyagawa	Takeshi Nakano	Kenji Shinoda	Hisayuki Ukishima	Tsugio Ishikawa	Masatoshi Tanaka	Izumi Kasai	Shinichi Ogawa
11-Jan							S/V for drilling		
12-Jan							Data collection		
13-Jan							S/V for drilling		
14-Jan							S/V for drilling		
15-Jan					Dept. Japan		S/V for drilling		
16-Jan					Arriv. ET, JICA report		S/V for drilling		
17-Jan					Inland transportation		S/V for drilling		
18-Jan					S/V for drilling		Inland transportation		
19-Jan					Data collection		JICA report, Dept. ET		
20-Jan					S/V for drilling		Arriv. Japan		
21-Jan					S/V for drilling				
22-Jan					S/V for drilling				
23-Jan					S/V for drilling				
24-Jan					S/V for drilling				
25-Jan					S/V for drilling				
26-Jan					Data collection				
27-Jan					S/V for drilling				
28-Jan					S/V for drilling				
29-Jan					S/V for drilling				Dept. Japan
30-Jan					S/V for drilling			Dept. Japan	Arriv. Ethiopia
31-Jan					S/V for drilling			Arriv. Ethiopia	Quotation collection
1-Feb					S/V for drilling			Data collection	Data collection
2-Feb					Data collection			Data collection	Data collection
3-Feb					S/V for drilling			Team meeting	Team meeting
4-Feb					S/V for drilling			Team meeting	Team meeting
5-Feb					S/V for drilling			JICA report	JICA report
6-Feb					S/V for drilling			Inland transportation	Quotation collection
7-Feb					S/V for drilling			Data collection	Quotation collection
8-Feb					S/V for drilling			Data collection	Data collection
9-Feb					Data collection			Data collection	Data collection
10-Feb					S/V for drilling			Inland transportation	Quotation collection
11-Feb					S/V for drilling			ESC survey	Quotation collection
12-Feb					S/V for drilling			ESC survey	Quotation collection
13-Feb					S/V for drilling			Field survey	Quotation collection
14-Feb					S/V for drilling			Field survey	Quotation collection
15-Feb			Dept. Japan		S/V for drilling			Data collection	Data collection
16-Feb			Arriv. Ethiopia		Data collection			Data collection	Data collection
17-Feb			Inland transport		S/V for drilling			Field survey	Quotation collection
18-Feb			S/V for drilling		S/V for drilling			Field survey	Quotation collection
19-Feb			S/V for drilling		S/V for drilling			Field survey	Quotation collection
20-Feb			S/V for drilling		S/V for drilling			Field survey	Quotation collection
21-Feb			S/V for drilling		S/V for drilling			Field survey	Quotation collection
22-Feb			S/V for drilling		S/V for drilling			Field survey	Data collection
23-Feb			Data collection		Data collection			Field survey	Data collection
24-Feb			Field survey		S/V for drilling			Field survey	Quotation collection
25-Feb			Field survey		S/V for drilling			Report	Quotation collection
26-Feb			Inland transportation		Inland transportation			Inland transportation	Quotation collection
27-Feb			JICA report, Dept. ET		Dept. Ethiopia			JICA report, Dept. ET	JICA report, Dept. ET
28-Feb			Arriv. Japan		Arriv. Japan			Arriv. Japan	Arriv. Japan
1-Mar									
2-Mar									
3-Mar									
4-Mar									
5-Mar									
6-Mar									
7-Mar									
8-Mar									
9-Mar									
10-Mar									
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16-Mar									
17-Mar									
18-Mar									
19-Mar									
20-Mar									
21-Mar									
22-Mar			Dept. Japan						
23-Mar			Arriv. Ethiopia						
24-Mar			Contractor meeting						
25-Mar			Inland transportation						
26-Mar			WB meeting						
27-Mar			WB meeting						
28-Mar			TN signing						
29-Mar			Field survey						
30-Mar			Field survey						
31-Mar			JICA report, Dept.						
1-Apr			Arriv. Japan						
2-Apr									
3-Apr									

Explanation of Draft Final Report

Date	JICA		Consultant						
	Team Leader	Cooperation Planning	Chief Consultant/ Water Supply Facility Planning	Sub Chief Consultant/ Water Supply Facility Design/ Pipe Line Design/ Construction Planning/ Procurement Planning	Hydrogeology 1/ Groundwater Development Planning 1	Hydrogeology 2/ Groundwater Development Planning 2	Test Well Drilling Supervision	Environment and Social Consideration/ Socio-Economic Survey	Cost Estimation/ Operation and Maintenance Planning
	Toshio Murakami	Masanori Yamazaki	Takeshi Nakano	Kenji Shinoda	Hisayuki Ukishima	Tsugio Ishikawa	Masatoshi Tanaka	Izumi Kasai	Shinichi Ogawa
27-Oct									
28-Oct			Dept. Japan	Dept. Japan					
29-Oct			Arriv. ET, JICA report	Arriv. ET, JICA report					
30-Oct			Inland transportation	Inland transportation					
31-Oct			WB discussion	WB discussion					
1-Nov		Arriv. Ethiopia	WB discussion	WB discussion					
2-Nov	Dept. Japan	Data collection	Data collection	Data collection					
3-Nov	Arriv. Ethiopia	Data collection	WB discussion	WB discussion					
4-Nov	Team meeting	Team meeting	Team meeting	Team meeting					
5-Nov	M/D discussion	M/D discussion	M/D discussion	M/D discussion					
6-Nov	M/D signing	M/D signing	M/D signing	M/D signing					
7-Nov	Courtesy call	Courtesy call	Courtesy call	Courtesy call					
8-Nov			Dept. Ethiopia	Dept. Ethiopia					
9-Nov			Arriv. Japan	Arriv. Japan					
10-Nov									

Appendix 3

List of Parties Concerned in the Recipient Country

Name	Organization	Position
Mr. Kebede Gerba	MoWE	State Minister
Mr. Nuredin Mohammed	MoWE	National Program Management Unit Coordinator, Water Supply & Sanitation
Mr. Dereje Girma	MoFED	Deputy Director, Bilateral Cooperation Directorate
Mr. Meseref Shebe	MoFED	Asia Desk
Mr. Tesfaye Yigezeu Kelkay	Hawassa Water Resource Bureau	Bureau Head
Mr. Abas Mohammed Abmed	Hawassa Water Resource Bureau	Bureau Head
Mr. Wubshet Tsegaye Kalo	Hawassa Water Resource Bureau	Water Supply & Schemes Admin. Core Process Owner
Mr. Tadele Kirbu Weldesemayat	Hawassa Water Resource Bureau	Water Res. Study & Manag. Core Process Owner
Mr. Haileberhan Zena Mamo	Finance and Economic Div. Bureau	Bureau Head
Mr. Bekele Kassaye	Hawassa Water Resource Bureau	Deputy Manager
Mr. Sammuel Tamiru	South Water Works Construction	Deputi Manager
Mr. Sheriff Hussein	South Water Works Construction	Admin. Process Owner
Mr. Woldeberhan Kuma	Environmental Protection Authority	Coodinator
Mr. Muhuddin Abdella Muctar	Ethiopian Geological Survey Groundwater Resource Assesment Directorate	Director
Mr. Belete Deraro	Water Supply Service Office	Head
Mr. Shaleka Mecheta	Municipality	Deputy Head
Mr. Tirunehe Marke	Mincipality	Manager
Ms. Alemtshey Hailu	Sodo Woreda Water Mine and Energy	Water Engineer
Mr. Ashenafi Aboste	Municipality	Head
Mr. Tagaye Negusey	Water Supply Service Office	
Mr. Mesele mengestu	Municipality	Head
Mr. Semu Tadlse	Water Mnagement Committee	Chairperson
Mr. Belayneh seifu	Water Supply Service Office at Buya	Head
Mr. Tilahun Chaka	Water Management Committee	Casher
Mr.Weldy Weshemeto	Municipality	Head
Mr. Ayele Mademo	Water Supply Service Office	Chairperson
Mr. Belachew Tsegaye	Municipality	Head
Mr. Gizaw Buchacho	Dara Wereda Kebado Town Water and Severage Office (Teferi Kela)	Head
Mr. Yosef	Dara Wereda Kebado Town Water and Severage Office (Teferi Kela)	Planning Engineer
Mr. Mitiku Tomoto	Mincipality Human Resources	Process owner
Ms. Semira Assefa	Dalocha DWWDA	Chairperson
Ms. Yasin Sermelo	Dalocha DWWDA	Accuntant
Mr. Sherefa Sultan	Dalocha Municipality	Head
Mr. Ashenafi Ketefo	Dalocha Municipality	Manager
Mr. Abas Hassen	Lanifaro Water Mine and Energy Office/Water Committee	Head
Mr. Abedulemenan Haji	Mito Municipality	Head
Mr. Shikor Ahemed	Mito Water Mnagement Committee	Chairperson
Mr. Ahmed Alagey	Tora Municipality	Head
Mr. Sultan Edris	Sankura Water Mine and Energy Office	Head
Mr. Mudin Lalo	Alem Gebeya Water Management	Head
Mr. Kemal Mola	Alem Gebeya Municipality	Head

Name	Organization	Position
Mr. Sheicho Delgeba	Kibat Water Supply Service Office	Head
Mr. Temkin Seid	Kibat Municipality	Head
Mr. Omer Abdurehim	Kibat Development Planning	
Mr. Kedir Shikur	Kibat Water Supply Service office	Accountant
Mr. Abraham Azhe	Welayta Zone Water Mine and Energy	Head
Mr. Maru Werkneh	Tebela Water Supply Service Office	Chairperson
Mr. Tadios Meskely	Tebela Municipality	Deputy Head
Mr. Milkias Goa	Tebela Municipality	Manager
Mr. Takehiro Okubo	Embassy of Japan in Ethiopia	Minister-Cousellor
Mr. Kazuhiro Sasaki	Embassy of Japan in Ethiopia	Second Secretary
Mr. Daisuke Nakanishi	Embassy of Japan in Ethiopia	Second Secretary
Mr. Kimiaki Jin	JICA Ethiopia Office	Chief Representative
Mr. Atsushi Nakagawa	JICA Ethiopia Office	Senior Representative
Mr. Takusaburo Kimura	JICA Ethiopia Office	Senior Representative
Mr. Yuichi Ichikawa	JICA Ethiopia Office	Representative
Mr. Itsuro Takahashi	JICA Ethiopia Office	Representative
Mr. Ephrem Fufa Leta	JICA Ethiopia Office	In-house Consultant for Water Sector

Appendix 4

Minutes of Discussions

Minutes of Discussions

May 14, 2013

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON THE PROJECT
FOR WATER SUPPLY DEVELOPMENT TO THE SMALL TOWNS
IN RIFT VALLEY BASIN IN
SOUTHERN NATIONS, NATIONALITIES AND PEOPLE'S REGIONAL STATE
IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

In response to a request from Government of the Federal Democratic Republic of Ethiopia (hereinafter referred to as "Ethiopia"), the Government of Japan decided to conduct a Preparatory Survey on the Project of the Small Towns Water Supply Development in Rift Valley Basin in Southern Nations, Nationalities and People's Regional State (hereinafter referred to as "the Project") and entrusted the survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Ethiopia the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Dr. Yuji Maruo, Senior Advisor, JICA, and is scheduled to stay in the country from 8 May 2013 to 16 May 2013.

The Team held a series of discussions with the official s concerned of the Government of Ethiopia and conducted a field survey in the Project area.

In the course of discussions and field survey, both parties confirmed the main items described in the attached sheets. The Team will proceed to further work and prepare the Preparatory Survey Report.

Hawassa, 14 May 2013

丹尾祐治

Dr. Yuji Maruo
Team Leader
Preparatory Study Team
Japan International Cooperation Agency

Mr. Abas Mohammed Ahmed
Bureau Head
Water Resources Bureau
Southern Nations, Nationalities and
People's Regional State
Federal Democratic Republic of Ethiopia

Mr. Haileberhan Zena Mamo
Bureau Head
Finance and Economic Development Bureau
Southern Nations, Nationalities and
People's Regional State
Federal Democratic Republic of Ethiopia

Japan International Cooperation Agency
1

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the access to safe drinking water for the people in the target areas by constructing water supply schemes.

2. Project area

The project area is small towns located in Southern Nations, Nationalities and Peoples' Regional State (hereinafter referred to as "SNNPRS") as shown in Annex-1.

3. Responsible and implementing organization

The responsible and implementing organization is Regional Water Bureau, SNNPR (hereinafter referred to as "RWB"). The organization chart of RWB is shown in Annex-2.

4. Items requested by the Government of Ethiopia

(1) Construction and rehabilitation of water supply scheme
(2) Capacity building for staff managing water scheme (Soft component)

5. Japan's Grant Aid Scheme

5-1. The Ethiopian side understood the Japan's Grant Aid Scheme explained by the Team as described in Annex-3.
5-2. The Ethiopian side will take necessary measures as described in Annex-4 for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.
5-3. JICA will report to the Ethiopian side if there are any other undertakings based on the result of this survey.
5-4. The Team explained that implementation of the preparatory survey is not a commitment of the approval of the Project.

6. Schedule of the Survey

6-1. The consultant members in the Team will proceed to further surveys in Ethiopia until February 2014.
6-2. JICA will prepare the draft report of the Preparatory Survey (hereinafter referred to as "the Survey") in English and dispatch a mission to Ethiopia in order to explain its contents in June 2014.
6-3. In case the contents of the draft report are accepted in principle by the Government of Ethiopia, JICA will complete the final report and send it to the Government of Ethiopia around September 2014.
6-4. Ethiopian side requested early commencement of implementation of the Project to the Team.

7. Other relevant issues

7-1. Title of the Project

Both sides agreed to name the title of the Project "The Project for Water Supply Development to the Small Towns in Rift Valley Basin in Southern Nations, Nationalities and People's Regional State" instead of "The Project of the Small Towns Water Supply

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Development in Rift Valley Basin in Southern Nations, Nationalities and People's Regional State"

7-2. Selection of target small town

Both sides confirmed that target small towns will be selected based on criteria. The Team explained that 11 small towns will be selected through site surveys by the Team, and socio-economic survey as well as review of existing water facilities will be carried out in order to scrutinize 11 towns. And the Team will execute test drilling, water quality as well as yield test to collect necessary data for designing the water scheme based on available water quantity as well as water demand. The Team explained that total number of small towns as target sites of the Project will be within 11 towns. And the Team also explained in case target sites will be reduced due to budgetary limitation of the Project. So far, both sides agreed to select 7 towns as indicated in Annex-1, and the remaining 4 towns will be selected in a few days. Some proposed towns have been replaced due to the presence of on-going projects.

7-3. Criteria for the project site selection

Both sides confirmed that the Project sites will be determined through the criteria described as below:

(1) Demand of safe and stable water supply
(2) Accessibility to the site (including security for working) as well as securing land to build a pump house, elevated water tank and other necessary facilities
(3) Situation of existing water supply facilities and performance of existing Water, Sanitation and Hygiene Committee (hereinafter referred to as "WASHCO")
(4) No duplication of project
(5) Operation and Maintenance
- Capacity of existing Town Water Supply Utility or WASHCO
- Affordability of regular salary payment for pump operator of water supply scheme
- Willingness to pay for water tariff to cover operation and maintenance cost of the scheme, including regular salary for a pump operator
- Affordability to pay for water tariff among expected users of the scheme
- Availability of after services and spare parts

(6) Hydro-geological condition allows to provide water with standard quality and quantity in Ethiopia

7-4. Design year and water coverage

Both sides confirmed that design year of the Project will be set as the year 2020. While preparing the outline design of water supply schemes, the Team intends to acquire 100% water coverage of the projected water demand at the year of 2020 as much as safe yield of source exceeds the amount of demand.

7-5. Test borehole drilling

The Team will identify the most suitable water source. In case, no other suitable source is identified, the test well drilling will be carried out. The Team explained that the purpose of test borehole drilling is to confirm groundwater availability for the development of water supply schemes in the target small towns. Those boreholes which

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are confirmed with sufficient yield and drinkable water quality will be converted to the production wells in the construction stage. Successful boreholes would be properly protected by the Ethiopian side until the commencement of the construction stage of the Project.

Necessary number of test boreholes may differ from town to town according to population to be provided with water. However, maximum number of test borehole is fixed to 24 based on survey duration as well as amount of budget allows.

If any test borehole is dry well or yield insufficient amount, the Team will consult with relevant personnel of RWB for their advices what to do with these boreholes, whether to be abandoned or leave it as it is to be used for other purposes, etc.

7-6. Specification of water supply scheme

The Ethiopian side has understood an explanation made by the Team that specification of water supply scheme will be decided based on the results of the survey. Major determinants are water yield and number of people to be provided with water.

The Team also explained that operation and maintenance cost is far cheaper if the power of commercial grid is used than using a generator. Therefore, it is JICA's policy to use the power of commercial grid as much as possible. However, the Ethiopian side requested the Team to install backup generator since blackout is frequent in those areas due to chronic power shortage. The Team explained that the Team will investigate present power supply condition and operation and maintenance cost in each case in respective target small towns, and assess if the request is relevant.

In connection to this, the Team requested to the Ethiopian side to extend power line from the existing grid to the newly drilled borehole site preferably before the completion of water scheme, if condition allows. And the Ethiopian side has agreed on this.

7-7. Demarcation with government and other Donors/NGOs projects

Ethiopian side confirmed that there is no duplication among government, Donors and NGOs on the sites of the Project, and agreed to be responsible for coordination among them.

7-8. Undertakings by the Ethiopian side

The Team requested to the Ethiopian side to secure necessary amount of budget and to abide by undertakings listed below for the smooth implementation of the Survey and the Project in addition to the major undertakings described in Annex-4.

(1) To provide the Team with available relevant data, information and materials necessary for the execution of the Survey
(2) To answer the questionnaire presented by the Team
(3) To ensure the safety and security of the Team
(4) To secure any permissions for the Team to take photographs and to enter into private properties and restricted areas for proper execution of the Survey
(5) To allow the Team to bring back to Japan the necessary data, information, maps and materials related to the survey, in order to prepare the survey reports
(6) To assign necessary number of counterparts personnel with its own expenses to the team during their stay in Ethiopia to undertake the following activities;
- To make appointments and set up meetings with relevant authorities wherever

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the Team intends to visit,
- To collect the data and information,
- To conduct site survey,
- To inspect test drilling and pumping test.

(7) To secure plot of land necessary for newly constructed facilities including test boreholes, pipelines, distribution reservoirs and public taps

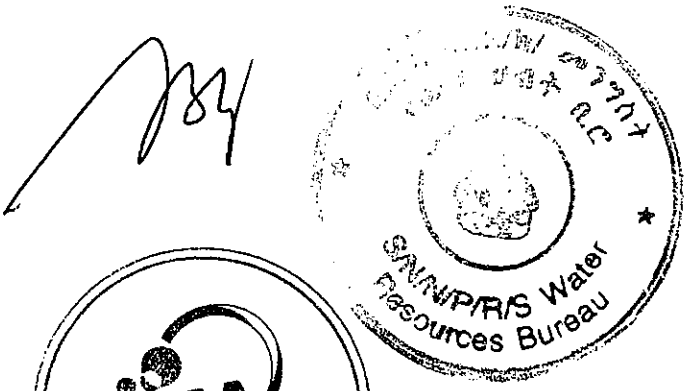
(8) To take prompt action for exemption and refund of VAT in coordination with relevant departments

(9) To carry out Environmental Impact Assessment (EIA) for the Project, if necessary and to obtain approval from the relevant authority until February 2014 and to bear the necessary expenses

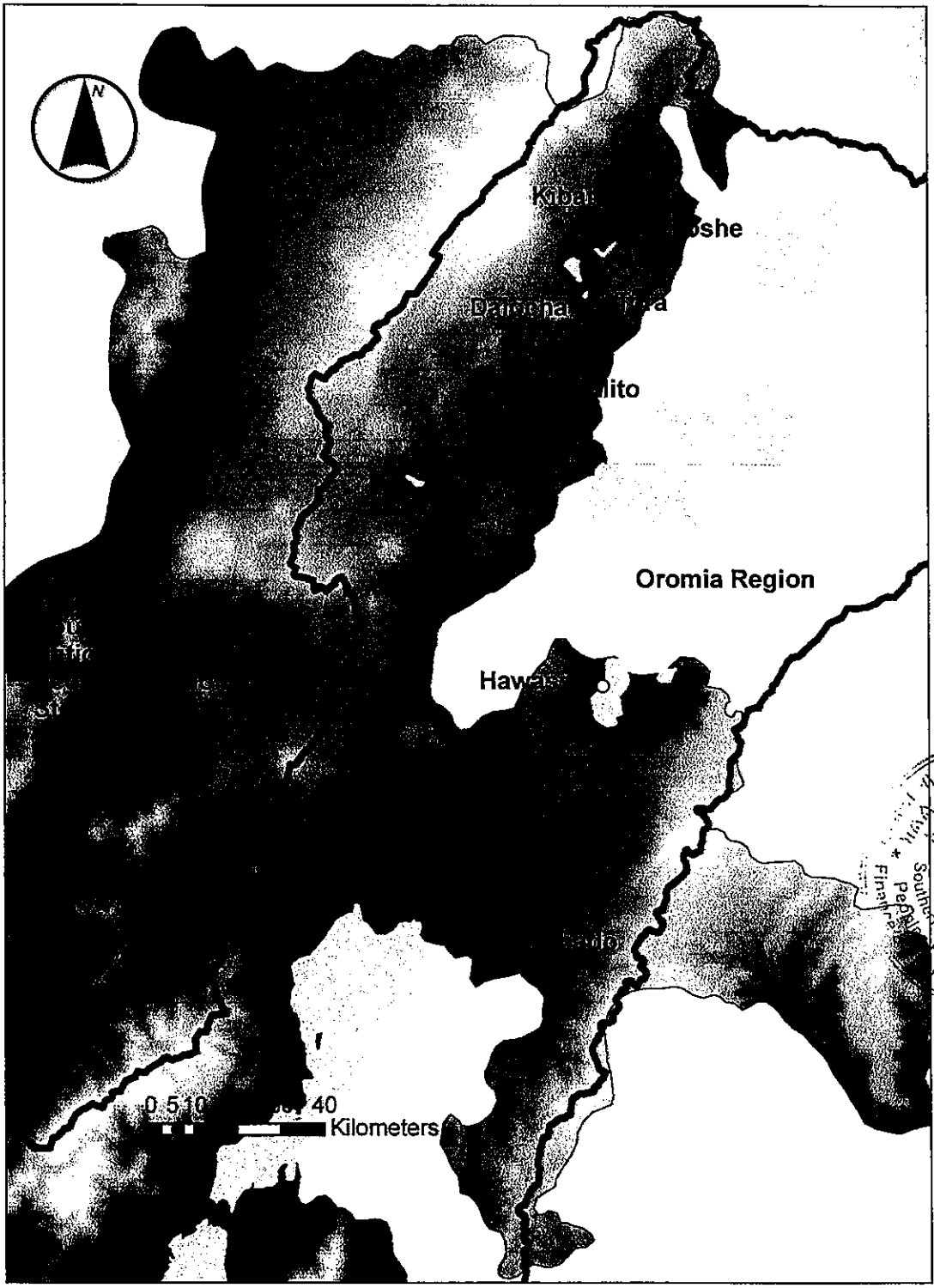
(10) To capacitate existing WASHCO or upgrade to Town Water Supply Utility, if possible

(11) To protect test sources which are to be used for developed scheme until the commencement of the construction

Annex
1. Project Area Map
2. Organization Chart of Regional Water Bureau, SNNPR
3. Japan's Grant Aid
4. Major Undertakings to be taken by Each Government



Annex-1



Notes:

The tentatively selected 7 small towns are shown in the map.

The remaining 4 additional small towns will be selected shortly.

PROJECT AREA MAP

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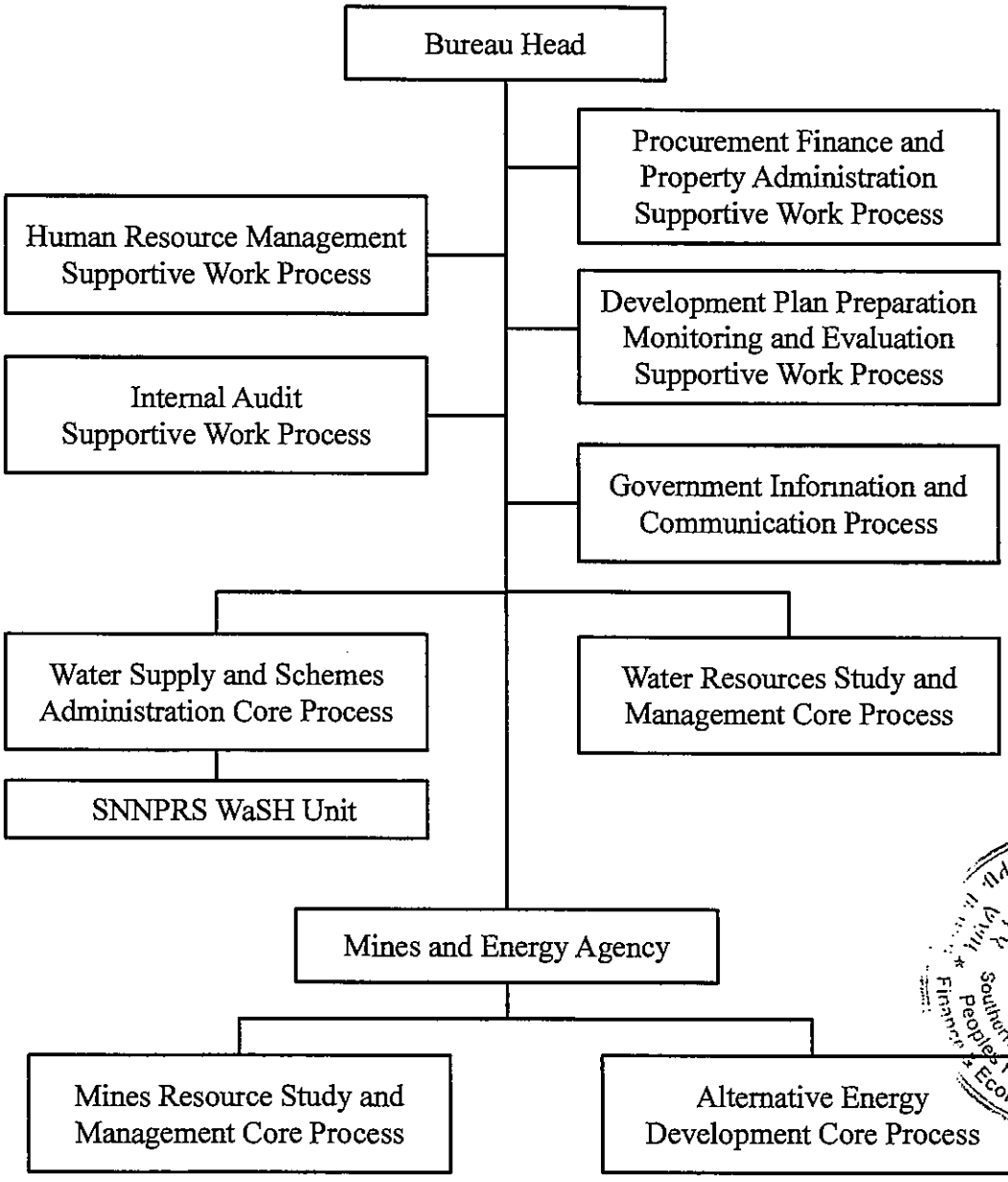
1

Annex-2



ORGANIZATION CHART OF REGIONAL WATER BUREAU, SNNPR

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SNNPRS Water Resources Bureau

JAPAN'S GRANT AID

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

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

1. Grant Aid Procedures

The Japanese Grant Aid is conducted as follows-

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

2. Preparatory Survey

(1) Contents of the Survey

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

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.

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- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

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

JICA requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

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

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responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

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

(4) Necessity of "Verification"

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

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex.

(6) "Proper Use"

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

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should

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

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

(9) Authorization to Pay (A/P)

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

(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA socio-environmental guideline.

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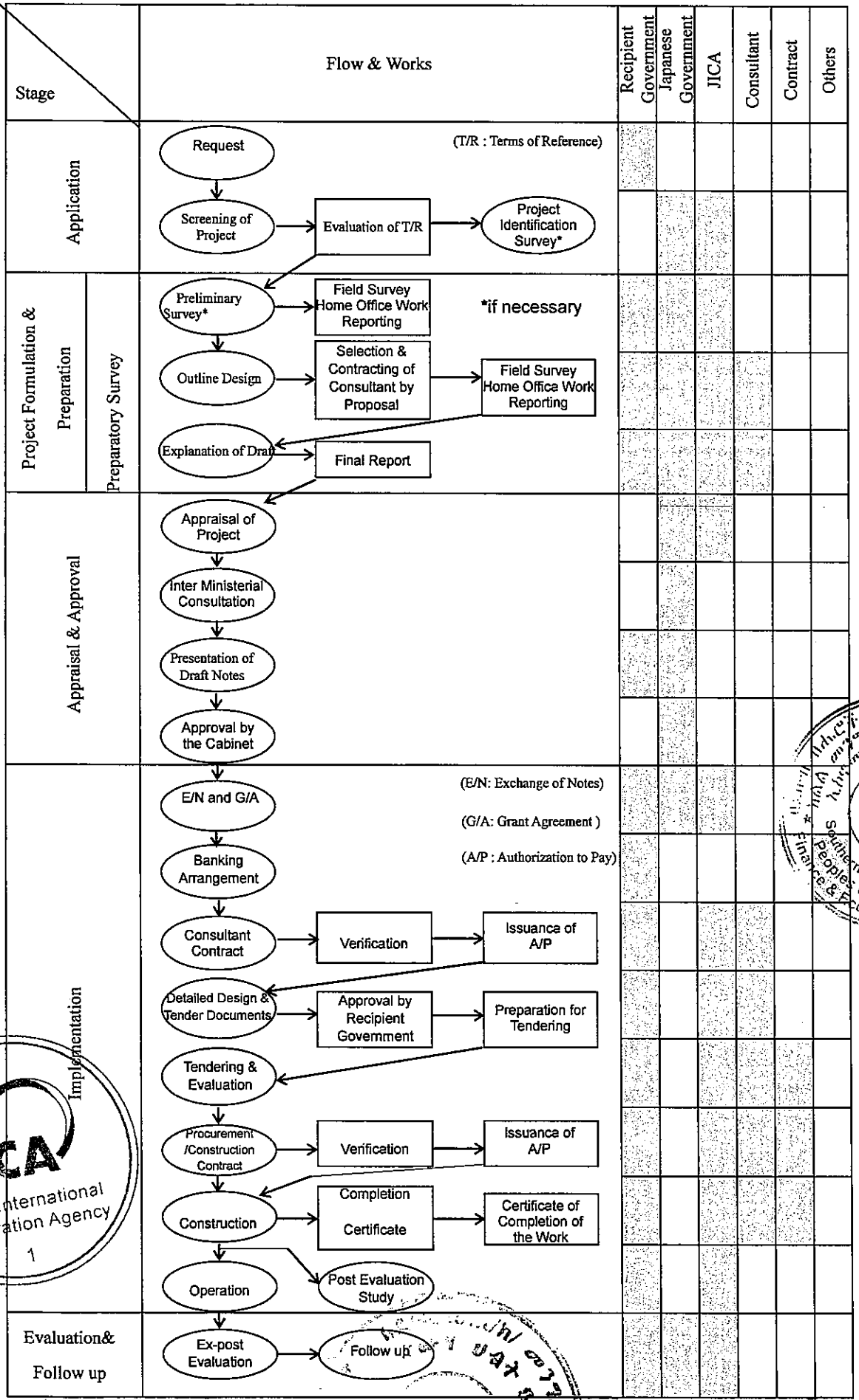
SNNPRS Water Resources Bureau

Southern Nations Nationalities & Peoples Regional Government Finance & Economy Development

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES



Annex-4

MAJOR UNDERTAKINGS TO BE TAKEN BY EACH GOVERNMENT (CONSTRUCTION)

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

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

JICA Japan International Cooperation Agency

Southern Nations Nationalities & Peoples Regional Government Finance & Economy Development Bureau

Resources Bureau

1

Technical Notes

May 24, 2013

TECHNICAL NOTES
ON THE PREPARATORY SURVEY
ON THE PROJECT
FOR WATER SUPPLY DEVELOPMENT TO THE SMALL TOWNS
IN RIFT VALLEY BASIN IN
SOUTHERN NATIONS, NATIONALITIES AND PEOPLE'S REGIONAL STATE
IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

Based on the Minutes of Discussions signed on the 14th day of May 2013 between the Preparatory Survey Team (hereinafter referred to as "the Team") of Japan International Cooperation Agency (hereinafter referred to as "JICA") and Water Resource Bureau, Southern Nations, Nationalities and People's Regional State (hereinafter referred to as "WRB") on the Project for Water Supply Development to the Small Towns in Rift Valley Basin in Southern Nations, Nationalities and People's Regional State (hereinafter referred to as "the Project"), the consultant members of the Team are conducting field surveys and discussions.

Based on reconnaissance field survey and discussions with the authorities concerned, WRB and the Team (hereinafter referred to as "both sides") confirmed the technical conditions described in the attached sheets.

Hawassa, May 24, 2013

Mr. Abas Mohammed Ahmed
Bureau Head
Water Resource Bureau
Southern Nations, Nationalities and
People's Regional State
Federal Democratic Republic of Ethiopia

Takeshi NAKANO
Chief Consultant
Preparatory Survey Team
Kokusai Kogyo Co., Ltd.
Japan

ATTACHMENT

Both sides agreed and confirmed the following items:

1. Name of the responsible and implementing organization

Both sides agreed to integrate the name of the responsible and implementing organization "Water Resource Bureau, Southern Nations, Nationalities and People's Regional State (hereinafter referred to as "WRB")".

2. Target sites

(1) In the M/D singed on May 14, 2013, 7 towns were listed as target towns for Study on Environment and Social Condition. Those are Koshe, Mito, Tora, Kibat, Dalocha, Tebela (Humbo) and Kebado. However, according to our reconnaissance field survey, Kebado has already acquired very high water coverage rate, so that the Team proposed to replace it with Teferi Kela which is located at the same Woreda as Kebado.

(2) Regarding the remaining 4 towns, both sides agreed to add the following sites; Kela, Tiya, Adilo and Alem Gebeya.

(3) However, the Team expresses it concerns that Kela and Tiya are located at areas where the groundwater potential is relatively low according to the previous JICA Study. And accessibility to the possible drilling sites in Kela and Tiya may be very difficult during the rainy season. The Team also explained that both accessibility and hydrogeological conditions will be examined through Study on Environment and Social Condition as well as Surveys on Natural Condition.

(4) Both sides agreed to conduct socio-economic survey as well as review of existing water facilities at 11 towns as mentioned above. Based on the result of these surveys, necessary number of test boreholes will be decided.

3. Population

The Team calculated the population of each site based on the census data (year 2013) of Central Statistical Agency (CSA) provided by Finance and Economic Development Bureau (BoFED), Southern Nations, Nationalities and People's Regional State. And the Team adopted the population growth rate as 4.8 % (in urban area) per year.

4. Water supply basic unit

Both sides agreed to set water supply basic unit as twenty (20) liters per capita per day (20 l/c/d).

5. Unit integration

The unit for the survey is according to SI (International System).

Annex

1. Result of Site Selection

SNNPRS Water Resources Bureau

Annex 1 – Result of Site Selection

Site Definition				Basic Data						Water Source Condition, Plan									Reservoir Condition, Plan						Implemented Plan	Remarks	Determination
				Population				Water Demand		Borehole				Spring, Others					Required Tank Volume	Reservoir Tank (m3)							
Zone	Woreda	Town Kebele	Site	2007	2013	Growth Ratio	2020	Average	Maximum	Existing			Test Drilling	Existing			New Spring	Coverage for Source		Existing		New	Coverage for Tank				
				BoFED, CSA	BoFED, CSA	(%)	Projection	(m3/day)	(m3/day)	Quantity	Convert	Quality		Quantity	Convert	Quality		(%)	(m3)	Volume	Convert		(%)				
Gurage	Mareqo	Town	Koshe	6,880	9,882	4.8	13,721	355	426	8.0L/s 3.0L/s	230m3/d –	– –	1	–	–	–	–	54.0	178	100	100	80	56.2	IRC, USAID	Water source, Water facilities (Tank, Pipelines) should be improved	○
	Sodo	Town	Buei	6,966	10,005	4.8	13,891	360	431	3.3L/s 4.7L/s 8.0L/s	95m3/d 135m3/d 230m3/d	– – –	–	–	–	–	–	106.6	180	200	200	–	111.1	–	Every facilities are sufficient	×
		Town	Kela	3,519	5,054	4.8	7,017	182	218	2.3L/s	66m3/d	–	2	2.3L/s	66m3/d	–	–	60.6	114	100	100	20	87.7	–	Water source, Water facilities should be improved	○
		Town	Tiya	1,937	2,782	4.8	3,863	100	120	1.5L/s	–	–	2	–	–	–	–	0.0	62	10	0	70	0.0	–	Every facilities are poor World Heritage is located	○
		Kebele	Amawute	2718	–	2.8	3,892	101	121	–	–	–	–	–	–	–	–	0.0	63	0	0	–	0.0	–	Not a small town, cost-effectiveness is low	×
	Meskan	Kebele	Hamuse Gebeya (Bamo)	4152	–	2.8	5,945	154	185	–	–	–	2	–	–	–	–	0.0	96	0	0	100	0.0	–	Out of target site because of Kebele	×
Kembata Timbaro	Kedia Gamela	Town	Adilo	4,660	6,693	4.8	9,293	241	289	3.9L/s	114m3/d	–	2	–	–	–	–	39.5	150	50	50	100	33.3	–	Every facilities are poor	○
	Anigacha	Town	Anigacha	6,819	9,794	4.8	13,598	352	422	2.0L/s 5.5L/s	58m3/d 158m3/d	– –	–	–	–	–	–	51.1	176	150	150	–	85.2	WASHCO	Facilities are improving	×
	Dayiboya	Town	Dayiboya	8,122	11,665	4.8	16,196	419	503	2.7L/s	78m3/d	–	–	–	–	–	–	15.7 or more	210	200	200	–	95.2	WASHCO	Facilities are improving	×
	Tibaro	Town	Kalate	1,441	2,069	4.8	2,873	74	89	–	–	–	–	–	–	–	–	0.0	46	–	0	–	0.0	–	Out of boundary of Rift Valley Basin	×
Sidama	Dara	Town	Kebado	7,333	10,532	4.8	14,623	378	454	7.1L/s	204m3/d	–	–	–	–	–	–	44.9	189	100	100	–	52.9	2011–2012 Developed by Japan	Already developed	×
		Town	Teferi Kela	3,327	4,778	4.8	6,634	172	206	6.0L/s	–	–	1	–	–	–	–	0.0	107	50	0	110	0.0	–	40 years has past since existing facilities were developed	○
	Malga	Town	Manicho	4,017	5,770	4.8	8,011	207	249	5.0L/s	–	Iron	–	–	–	–	1	0.0	130	2	0	–	0.0	WASHCO	Facilities are under construction by using spring	×
Silite	Dalocha	Town	Dalocha	6,793	9,756	4.8	13,546	351	421	?	?	Fluoride	0	700m3/d	700m3/d	Fluoride	–	166.4	175	300	300	0	171.4	–	More than 100% coverage for town, but pipelines are connected to Kebele, totally around 80,000 population	○
	Lanifaro (Lanfuro)	Town	Mito	3,280	4,711	4.8	6,541	169	203	1.6L/s	–	–	3	–	–	–	–	0.0	106	15	0	90	0.0	–	Every facilities are poor	○
		Town	Tora	9,167	13,165	4.8	18,279	473	568	7.0L/s 2.0L/s	201m3/d –	? ?	2	–	–	–	?	35.4	237	150	100	140	42.2	–	Every facilities are poor	○
	Sankura	Town	Alem Gebeya	3,656	5,251	4.8	7,291	189	226	2.05L/s	–	–	4	–	–	–	–	0.0	118	16	0	120	0.0	–	Every facilities are poor Paved road is under construction town is growing	○
	Siliti	Town	Kibat	5,678	8,155	4.8	11,323	293	352	3.6L/s 3.2L/s	103m3/d 92m3/d	? ?	1	–	–	–	–	55.4	147	140	0	150	0.0	–	Layout of reservoirs is the worse	○
Wolayita	Humbo	Town	Tebela	6,247	8,973	4.8	12,459	322	387	–	–	–	0	1000m3/d	1000m3/d	–	1	258.4	161	90	50	120	31.1	–	Quantity of water is sufficient, but water facilities are poor	○

Technical Notes

July 1, 2013

TECHNICAL NOTES
ON THE PREPARATORY SURVEY
ON THE PROJECT
FOR WATER SUPPLY DEVELOPMENT TO THE SMALL TOWNS
IN RIFT VALLEY BASIN IN
SOUTHERN NATIONS NATIONALITIES AND PEOPLE'S REGIONAL STATE
IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

Based on the Minutes of Discussions signed on the 14th day of May 2013 between the Preparatory Survey Team (hereinafter referred to as "the Team") of Japan International Cooperation Agency (hereinafter referred to as "JICA") and Water Resource Bureau, Southern Nations Nationalities and People's Regional State (hereinafter referred to as "WRB") on the Project for Water Supply Development to the Small Towns in Rift Valley Basin in Southern Nations Nationalities and People's Regional State (hereinafter referred to as "the Project"), the consultant members of the Team are conducting field surveys and discussions.

Based on reconnaissance field survey and discussions with the authorities concerned , WRB and the Team (hereinafter referred to as "both sides") confirmed the technical conditions described in the attached sheets.

Hawassa, Ju l y 1, 2013

Mr. Abas Mohammed Ahmed
Bureau Head
Water Resource Bureau
Southern Nations, Nationalities and
People's Regional State
Federal Democratic Republic of Ethiopia

Kenji SHINODA
Sub Chief Consultant
Preparatory Survey Team
Kokusai Kogyo Co., Ltd.
Japan

ATTACHMENT

The Team recommended the following items:

1. The implementation sites for Test Well Drilling

During the field survey, the Team confirmed the sufficient quantity of spring water in Dalocha town. Both sides agreed to conduct the Test Well Drilling at ten (10) sites (Koshe, Kela, Tiya, Adilo, Teferi Kela, Mito, Tora, Alem Gebeya, Kibat Tebela) except Dalocha.

2. Project Realization

The Team can not continue project implementation at the site where the result of water quality analysis conducted after Test Well Drilling exceeds the Ethiopian Water Quality Standard and there is no alternative water source (spring water).

3. Correspondence for the site belonging to the high fluorine contamination area

Some target sites belong to the high fluorine (F) concentration area. The Team confirmed that the children are affected by fluorine. If the water quality value is under the Ethiopian standard but it exceeds the WHO criteria, both sides confirmed to consider eliminating the site or not. Both sides agreed to confirm the willingness and acceptance of the target site about fluorine removal system at household level.

Above statements were accepted by WRB.

ANNEX

1. Water Demand Calculation
2. Brief Summary - Table for the Site Plan
3. Existing Water Facilities Drawing

Water Demand Calculation

1. Basic Number

No.	Zone	Woreda	Site (Town)	Existing Population 2013	Projection of pop. 2020	School : Number of students				Pacients in Hospital, Clinic
						Primary	Secondary	College	Total	
1	Gurage	Mareqo	Koshe	9,882	13,721	2,348	985	0	3,333	60
2		Sodo	Kela	5,054	7,017	1,750	960	0	2,710	70
3			Tiya	2,782	3,863	867	0	0	867	25
4	KembataTimbaro	Kedia Gamela	Adilo	6,693	9,293	1,916	1,230	0	3,146	50
5	Sidama	Dara	Teferi Kela	4,778	6,634	1,633	916	0	2,549	40
6	Silite	Dalocha	Dalocha	9,756	13,546	3,899	1,694	0	5,593	140
7		Lanifaro	Mito	4,711	6,541	1,600	487	0	2,087	40
8		(Lanfuro)	Tora	13,165	18,279	3,984	1,417	0	5,401	100
9		Sankura	Alem Gebeya	5,251	7,291	1,819	545	0	2,364	65
10		Siliti	Kibat	8,155	11,323	4,541	1,389	0	5,910	80
11	Wolayita	Humbo	Tebela	8,973	12,459	1,648	3,450	0	5,098	40
Total				79,200	109,967	26,005	13,053	0	39,058	710

--- Annual Growth Rate of Population ---
Growth Rate : 4.8 %

--- Number of students and pacients ---
It is based on the result of field study.

2. Water Demand

(AD : 2013)

Unit : m3/day

No.	Site (Town)	Daily Water Demand(m3/day)				Ineffective water 15 %	Average Daily Supply	Maximum Daily Supply factor : 1.2	Peak Hourly Supply factor : 2.0
		General 20 l/c/day	School 5 l/c/day	Hospital, Clinic 25 l/c/day	Total				
1	Koshe	197.64	16.67	1.50	215.81	32.37	248.18	297.82	496.36
2	Kela	101.08	13.55	1.75	116.38	17.46	133.84	160.61	267.68
3	Tiya	55.64	4.34	0.63	60.61	9.09	69.70	83.64	139.40
4	Adilo	133.86	15.73	1.25	150.84	22.63	173.47	208.16	346.94
5	Teferi Kela	95.56	12.75	1.00	109.31	16.40	125.71	150.85	251.42
6	Dalocha	195.12	27.97	3.50	226.59	33.99	260.58	312.70	521.16
7	Mito	94.22	10.44	1.00	105.66	15.85	121.51	145.81	243.02
8	Tora	263.30	27.01	2.50	292.81	43.92	336.73	404.08	673.46
9	Alem Gebeya	105.02	11.82	1.63	118.47	17.77	136.24	163.49	272.48
10	Kibat	163.10	29.55	2.00	194.65	29.20	223.85	268.62	447.70
11	Tebela	179.46	25.49	1.00	205.95	30.89	236.84	284.21	473.68
Total		1,584.00	195.32	17.76	1,797.08	269.57	2,066.65	2,479.99	4,133.30

Unit of Water Demand : 20 l/c/day (Average Daily Demand)
5 l/c/day (School)
25 l/c/day (Hospital)

Ineffective Water : 15 %

Factor of Water Supply 1.2 (Maximum Daily Supply)
2.0 (Peak Hourly Supply)

(AD : 2020)

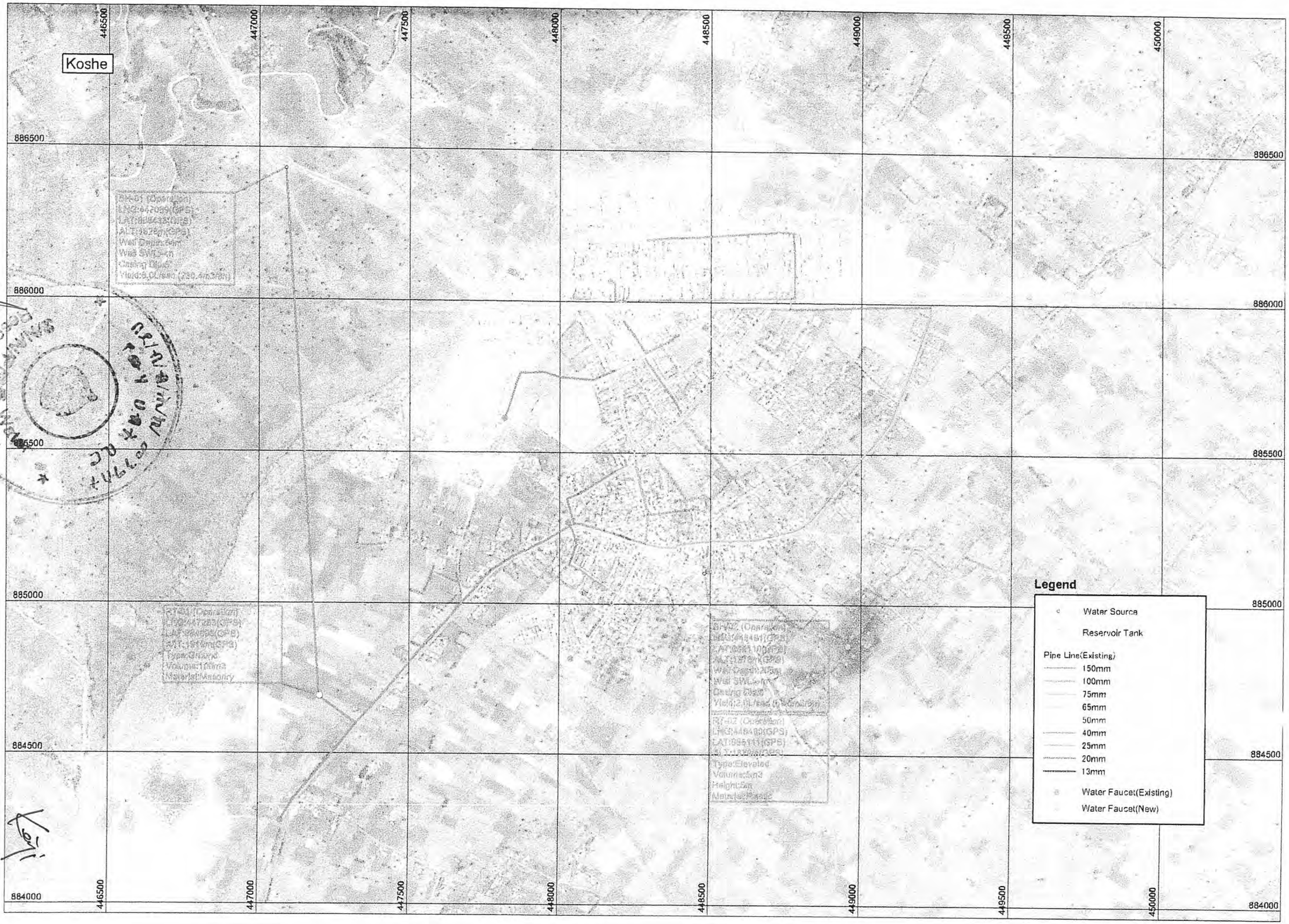
Unit : m3/day

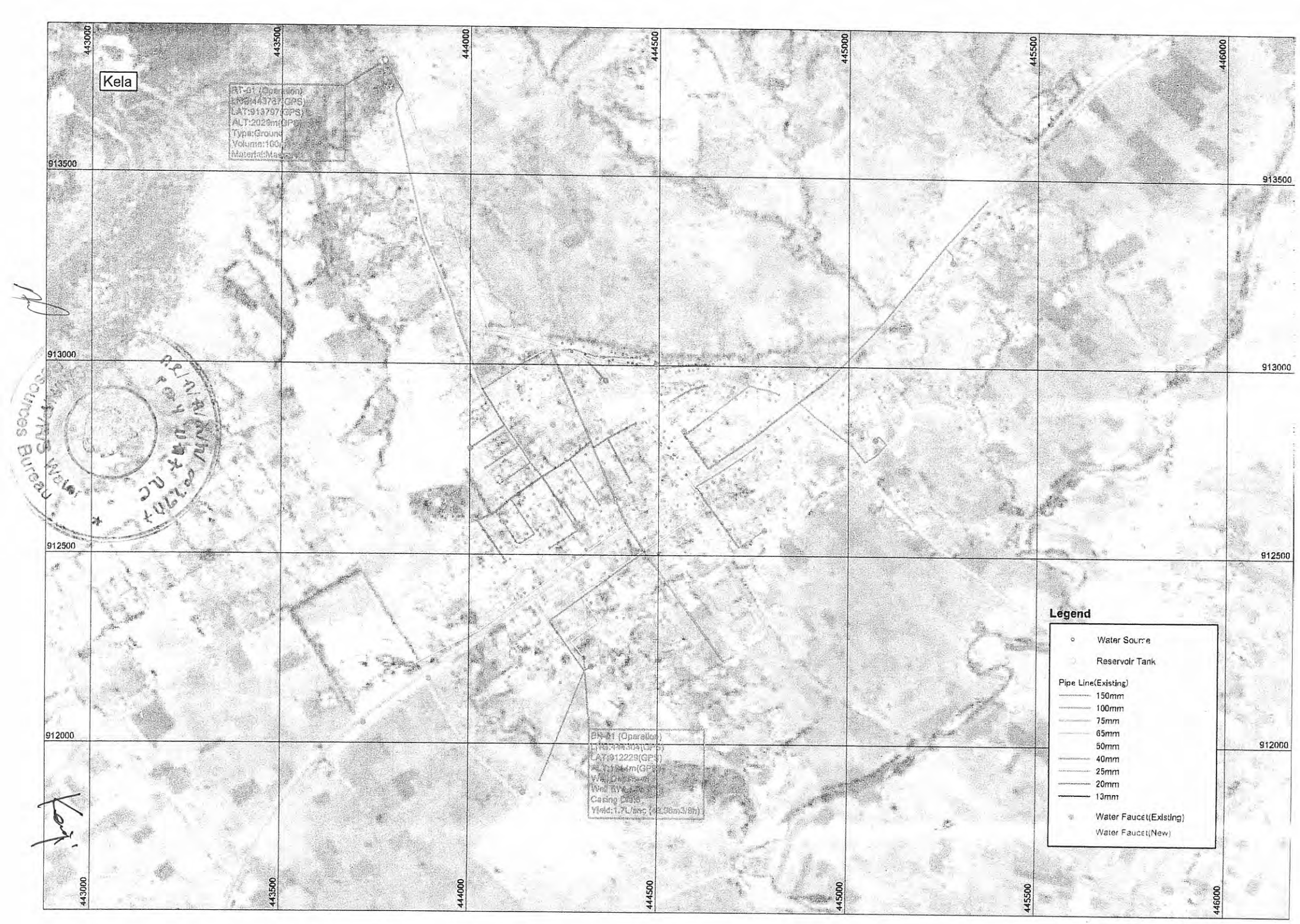
No.	Site (Town)	Daily Water Demand(m3/day)				Ineffective water 15 %	Average Daily Supply	Maximum Daily Supply factor : 1.2	Peak Hourly Supply factor : 2.0
		General 20 l/c/day	School 5 l/c/day	Hospital, Clinic 25 l/c/day	Total				
1	Koshe	274.42	16.67	1.50	292.59	43.89	336.48	403.78	672.96
2	Kela	140.34	13.55	1.75	155.64	23.35	178.99	214.79	357.98
3	Tiya	77.26	4.34	0.63	82.23	12.33	94.56	113.47	189.12
4	Adilo	185.86	15.73	1.25	202.84	30.43	233.27	279.92	466.54
5	Teferi Kela	132.68	12.75	1.00	146.43	21.96	168.39	202.07	336.78
6	Dalocha	270.92	27.97	3.50	302.39	45.36	347.75	417.30	695.50
7	Mito	130.82	10.44	1.00	142.26	21.34	163.60	196.32	327.20
8	Tora	365.58	27.01	2.50	395.09	59.26	454.35	545.22	908.70
9	Alem Gebeya	145.82	11.82	1.63	159.27	23.89	183.16	219.79	366.32
10	Kibat	226.46	29.55	2.00	258.01	38.70	296.71	356.05	593.42
11	Tebela	249.18	25.49	1.00	275.67	41.35	317.02	380.42	634.04
Total		2,199.34	195.32	17.76	2,412.42	361.86	2,774.28	3,329.13	5,548.56

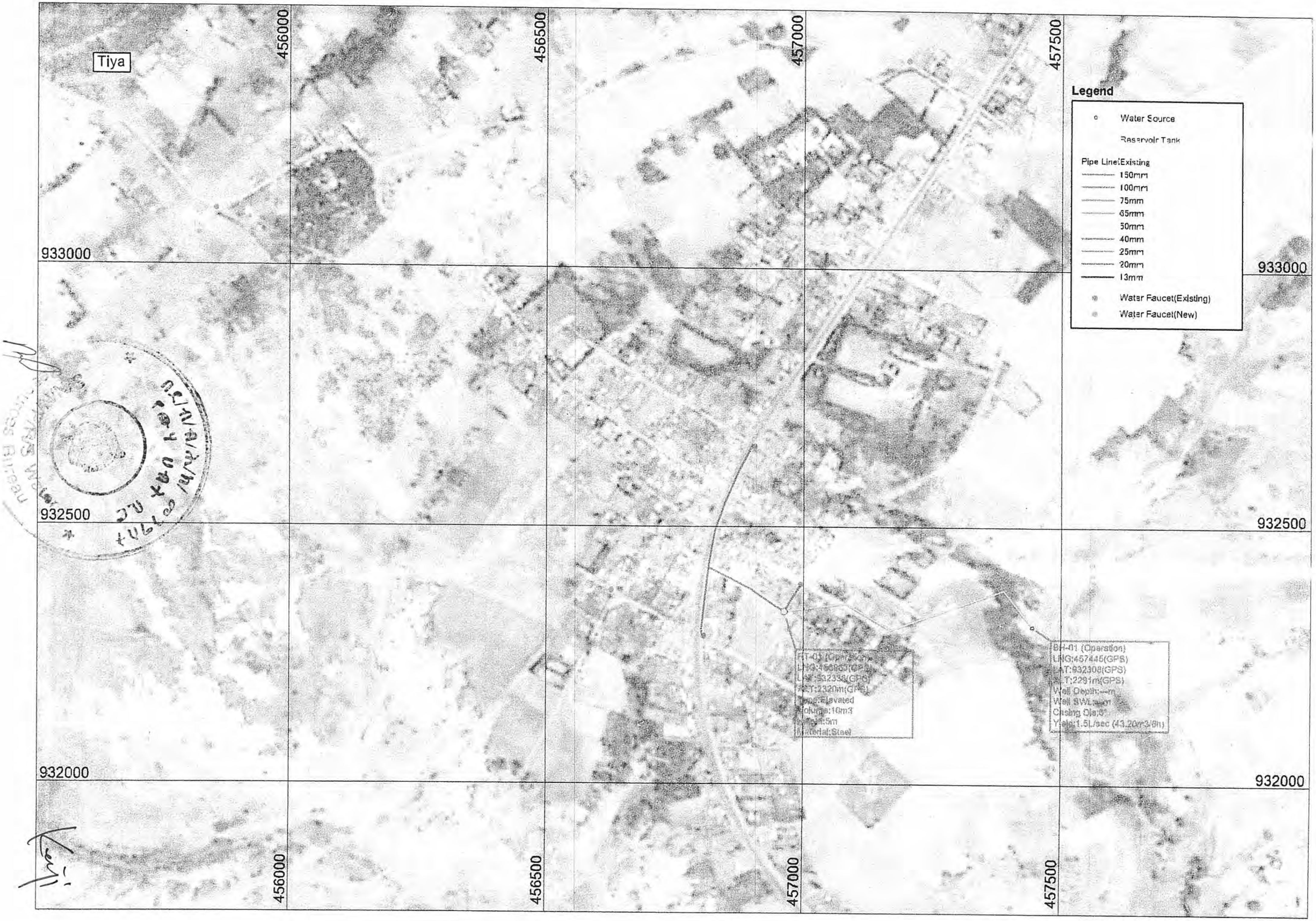
Keiji

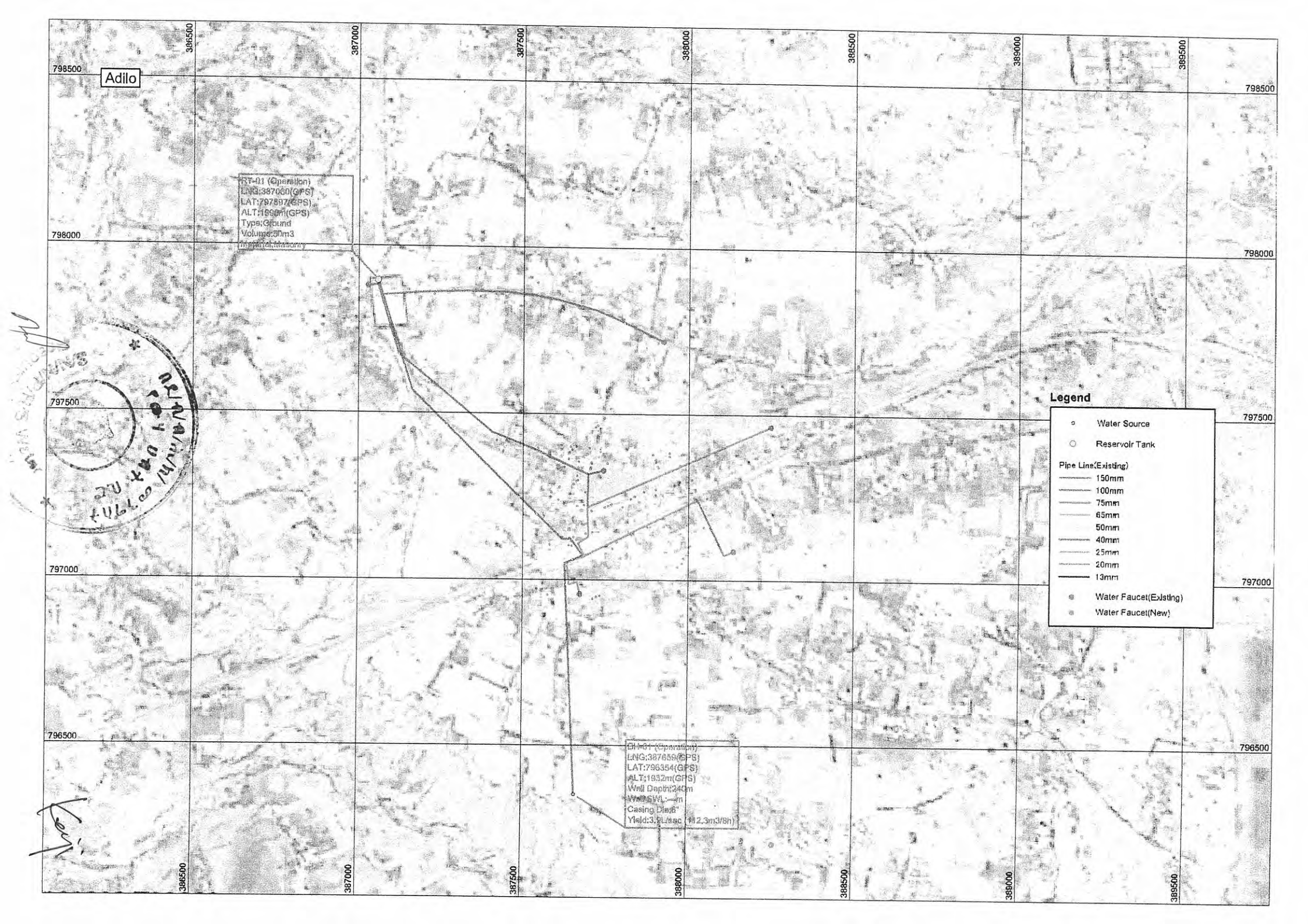
Brief Summary – Table for the Site Plan

Site Definition				Basic Data					Water Source Condition, Plan										Reservoir Condition, Plan					Feed Mode	Implemented Plan	Remarks	Soft Component for Fluoride
				Population			Water Demand		Borehole				Spring, Others						Required Tank Volume	Reservoir Tank (m3)			Current Coverage for Tank	(House Conection: HC, Water Faucet:WF)			
									Existing			Test Drilling	Existing			New Spring	Current Coverage for Source		Existing		New					
Zone	Woreda	Town Kebele	Site	2013 BoFED, CSA	Growth Ratio (%)	2020 Projection	Average (m3/day)	Maximum (m3/day)	Quantity	Convert	Quality		Quantity	Convert	Quality		(%)	(m3)	Volume	Convert		(%)				
Gurage	Mareqo	Town	Koshe	9,882	4.8	13,721	336.48	403.78	8.0L/s 2.0L/s	230m3/d –	F:2ppm F:2ppm	1	–	–	–	–	57.0	168	100	100	70	59.5	HC:382 WF:9	IRC, USAID	Borehole JICA drilled was improved by USAID, additional borehole is needed and facilities should be improved. Agreement from town about soft component for Fluoride is needed.	○
	Sodo	Town	Kela	5,054	4.8	7,017	178.99	214.79	1.7L/s	49m3/d	–	2	–	–	–	–	22.8	112	100	100	20	89.3	HC:414 WF:9	Govt of Ethiopia (2012)	Borehole and Reservoir had been completed by Govt of Ethiopia, but those are not enough, additional borehole and Water facilities should be improved.	–
		Town	Tiya	2,782	4.8	3,863	94.56	113.47	1.5L/s	–	–	2	–	–	–	–	0.0	59	10	0	60	0.0	HC:0 WF:3	–	Every facilities are poor. Borehole, reservoir, pipeline etc. every facilities should be replaced. World Heritage is located.	–
Kembata Timbaro	Kedia Gamela	Town	Adilo	6,693	4.8	9,293	233.27	279.92	3.9L/s	114m3/d	F:1ppm	2	–	–	–	–	40.7	146	50	50	100	34.2	HC:105 WF:6	World Vision (2010)	Every facilities were constructed by World Vision, but volume of facilities are not enough. Additional Reservoir and extention of pipelines are needed.	–
Sidama	Dara	Town	Teferi Kela	4,778	4.8	6,634	168.39	202.07	6.0L/s	–	–	1	–	–	–	–	0.0	105	50	0	110	0.0	HC:132 WF:10	–	40 years has past since existing facilities were developed. Every facilities should be improved.	–
Silite	Dalocha	Town	Dalocha	9,756	4.8	13,546	347.75	417.30	–	–	–	0	691.2m3/d	691.2m3/d	F:2ppm	–	165.6	174	300	300	0	172.4	HC:502 WF:8	–	Pipelines are connected to Kebele, totally around 80,000 population. But facilities, only for town will be improved. Agreement for Fluoride soft component is needed.	○
	Lanifaro (Lanfuro)	Town	Mito	4,711	4.8	6,541	163.60	196.32	1.6L/s	–	F:1ppm	3	–	–	–	–	0.0	102	15	0	110	0.0	HC:313 WF:10	–	Every facilities are poor. Borehole, reservoir and pipelines etc. every facilities should be improved.	–
		Town	Tora	13,165	4.8	18,279	454.35	545.22	7.0L/s 2.0L/s	201m3/d –	F:2ppm F:2ppm	2	–	–	–	–	36.9	227	150	100	130	44.1	HC:566 WF:13	Govt of Ethiopia (2010)	Borehole and Reservoir had been completed by Govt of Ethiopia, but those are not enough and other facilities are poor. Agreement for Fluoride soft component is needed.	○
	Sankura	Town	Alem Gebeya	5,251	4.8	7,291	183.16	219.79	2.05L/s	–	F:5ppm	4	–	–	–	–	0.0	114	16	0	120	0.0	HC:177 WF:8	–	Every facilities are poor. Facilities shoild be improved, but if the Fluoride contents of test well drilling is over Ethiopian standard, that site will be eliminated from this project.	○
	Siliti	Town	Kibat	8,155	4.8	11,323	296.71	356.05	3.6L/s 3.2L/s	103m3/d 92m3/d	– –	1	–	–	–	–	54.8	148	140	0	150	0.0	HC:849 WF:15	–	Layout of reservoirs is the worse. New reservoir should be set at adequate location.	–
Wolayita	Humbo	Town	Tebela	8,973	4.8	12,459	317.02	380.42	–	–	–	1	397.4m3/d	397.4m3/d	–	–	104.5	159	90	0	160	0.0	HC:ND WF:8	–	Water facilities are poor. Over 40 years has past since the reservoirs were constructed, every facilities should be improved.	–


Koshe
Legend
Water Source
Reservoir Tank
Pipe Line(Existing)
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)
Type:Elevated
446500
447000
447500
448000
448500
449000
449500
450000
886500
886000
885500
885000
884500
884000
SNNPRS Water Resources Bureau


Kela
443000
443500
444000
444500
445000
445500
446000
913500
913000
912500
912000
Legend
Water Source
Reservoir Tank
Pipe Line(Existing)
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)


Tiya
456000
456500
457000
457500
933000
932500
932000
Legend
Water Source
Reservoir Tank
Pipe Line:Existing
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)
BH-01 (Operation)
LNG:457445(GPS)
LAT:932308(GPS)
Yield:1.5L/sec (43.20m3/8h)


Adilo
RT-01 (Operation)
LNG:387060(GPS)
LAT:797897(GPS)
ALT:1993m(GPS)
Type:Ground
Volume:50m3
Material:Masonry
BH-01 (Operation)
LNG:387659(GPS)
LAT:796354(GPS)
ALT:1932m(GPS)
Well Depth:240m
Water Level:—m
Casing Dia:6"
Yield:3.9L/sec (12.3m3/8h)
Legend
Water Source
Reservoir Tank
Pipe Line(Existing)
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)
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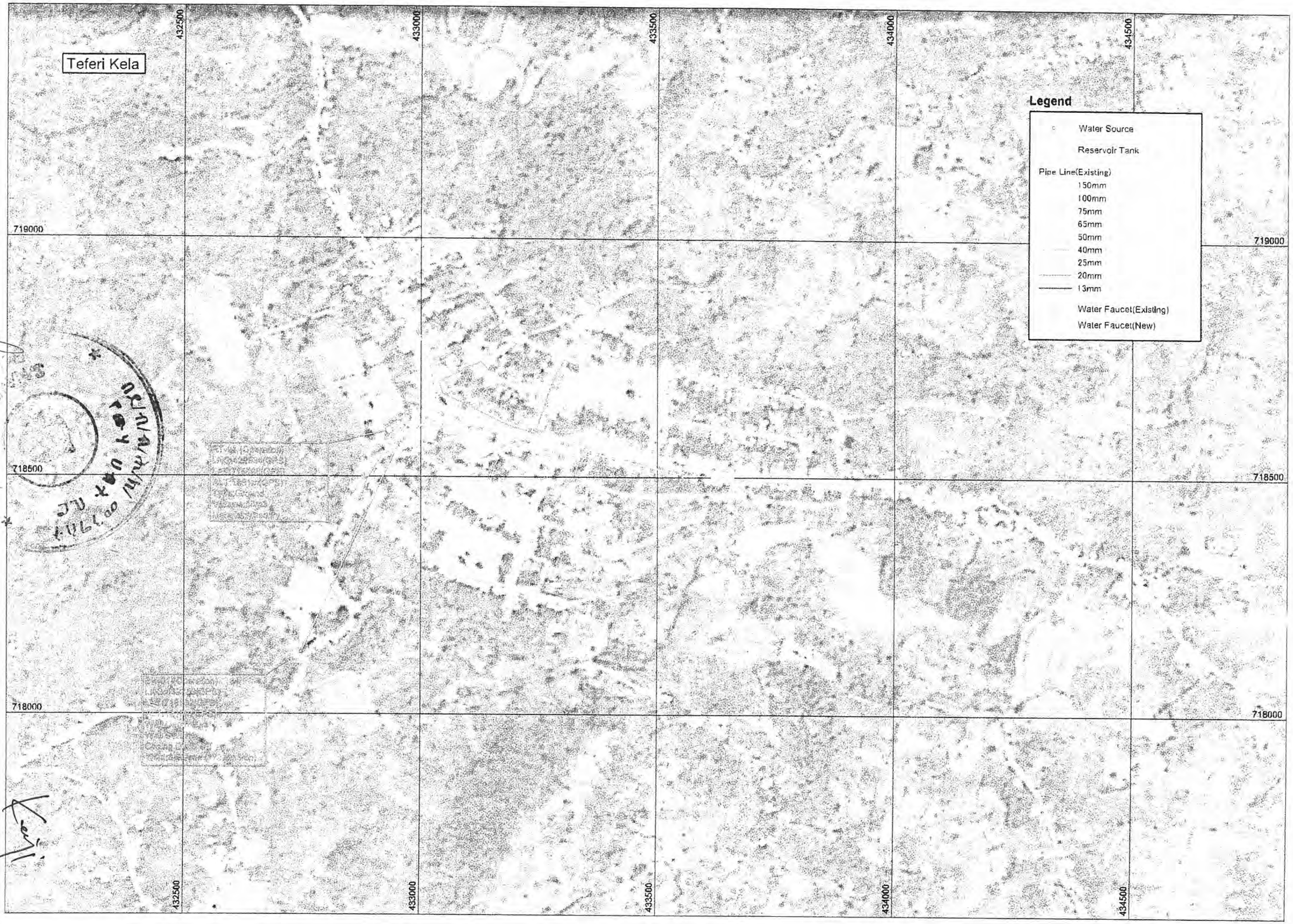
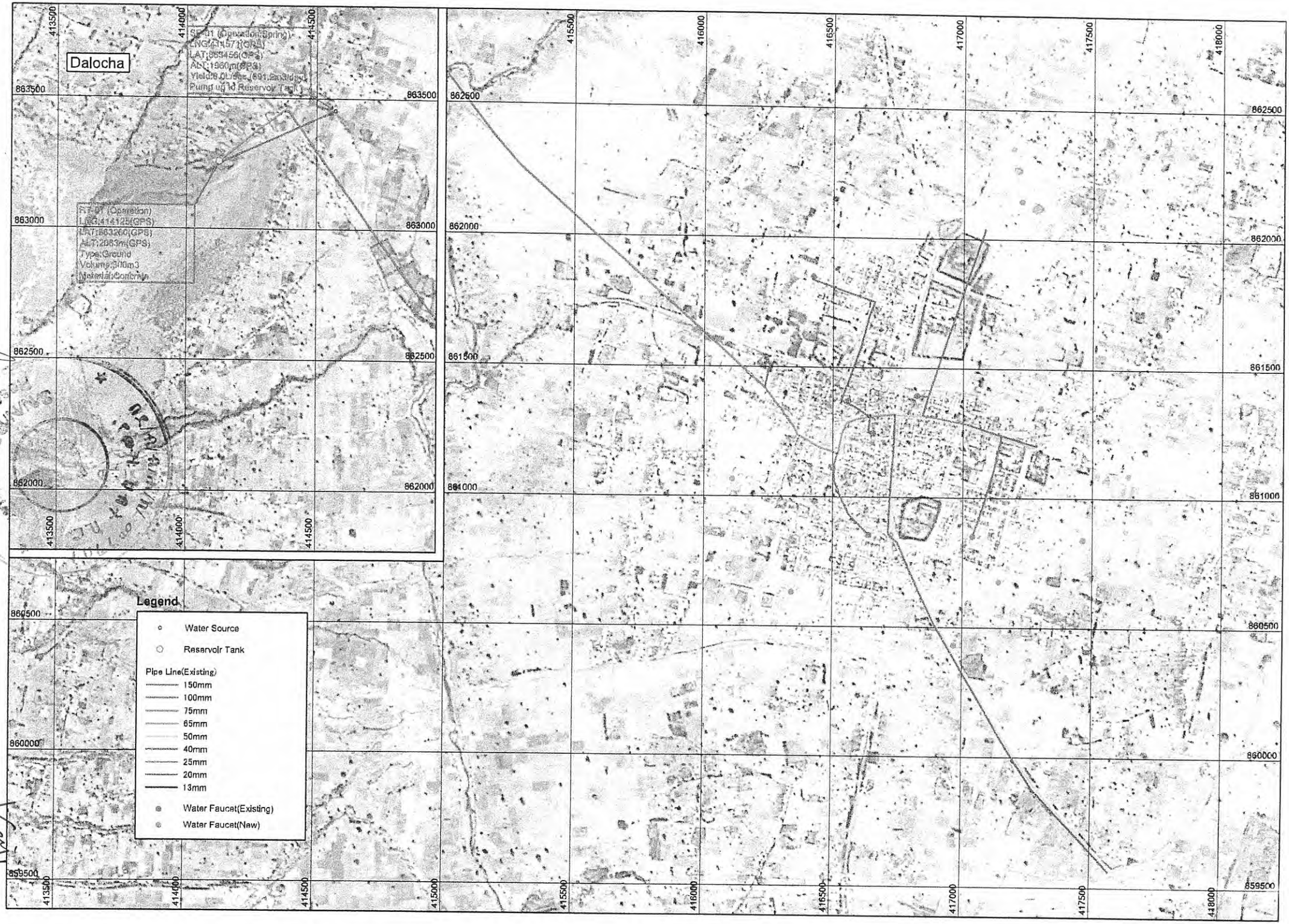
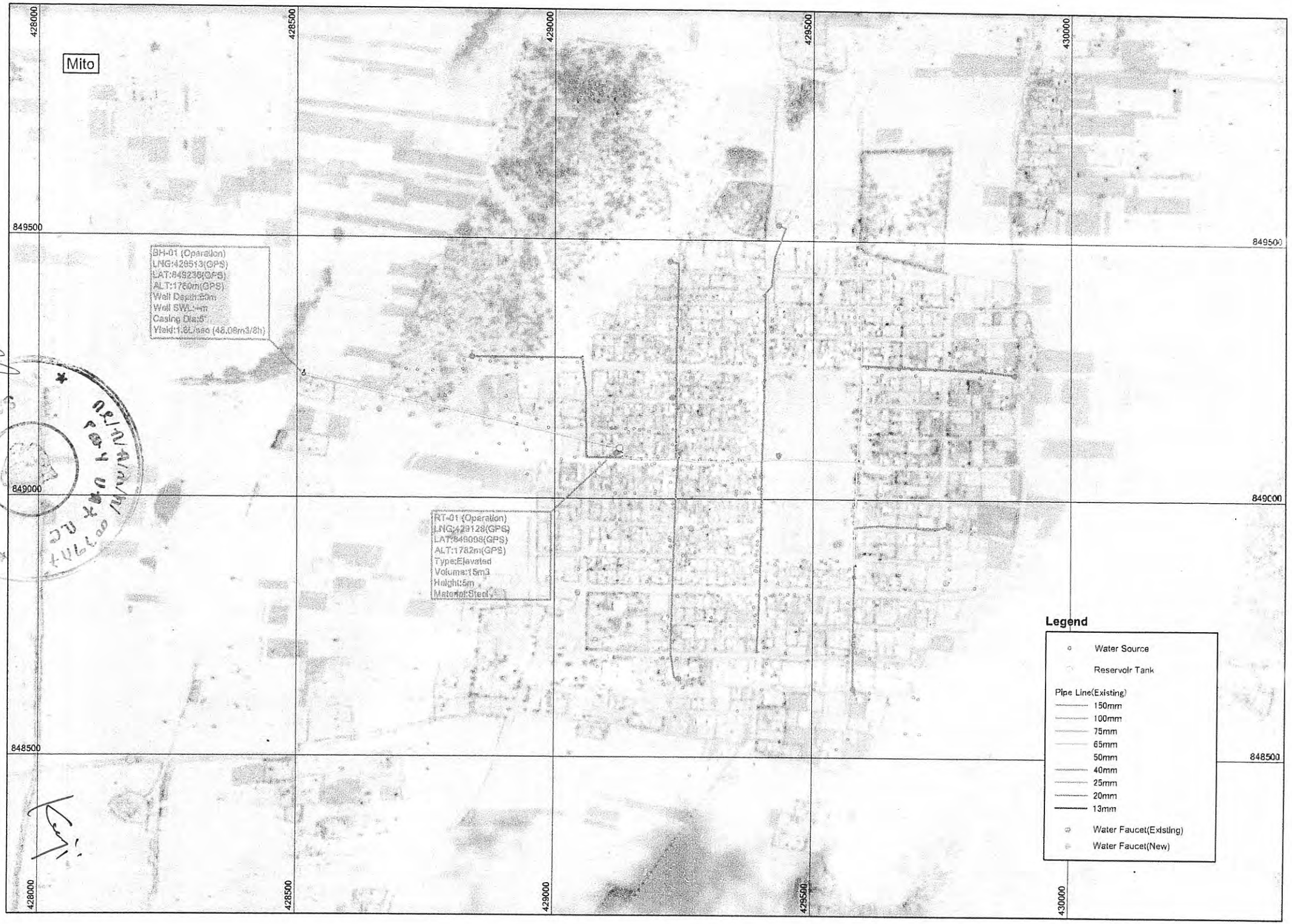
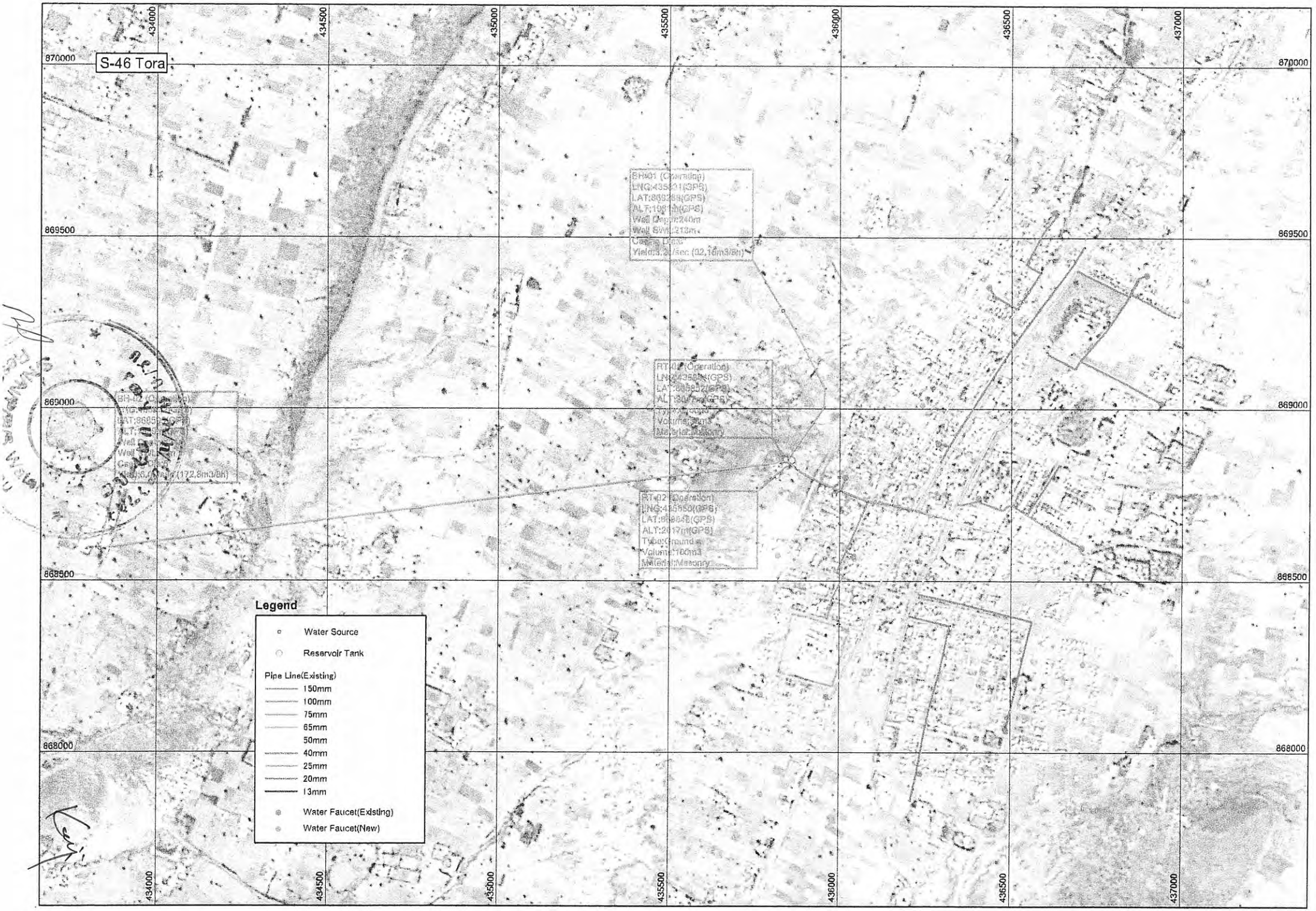
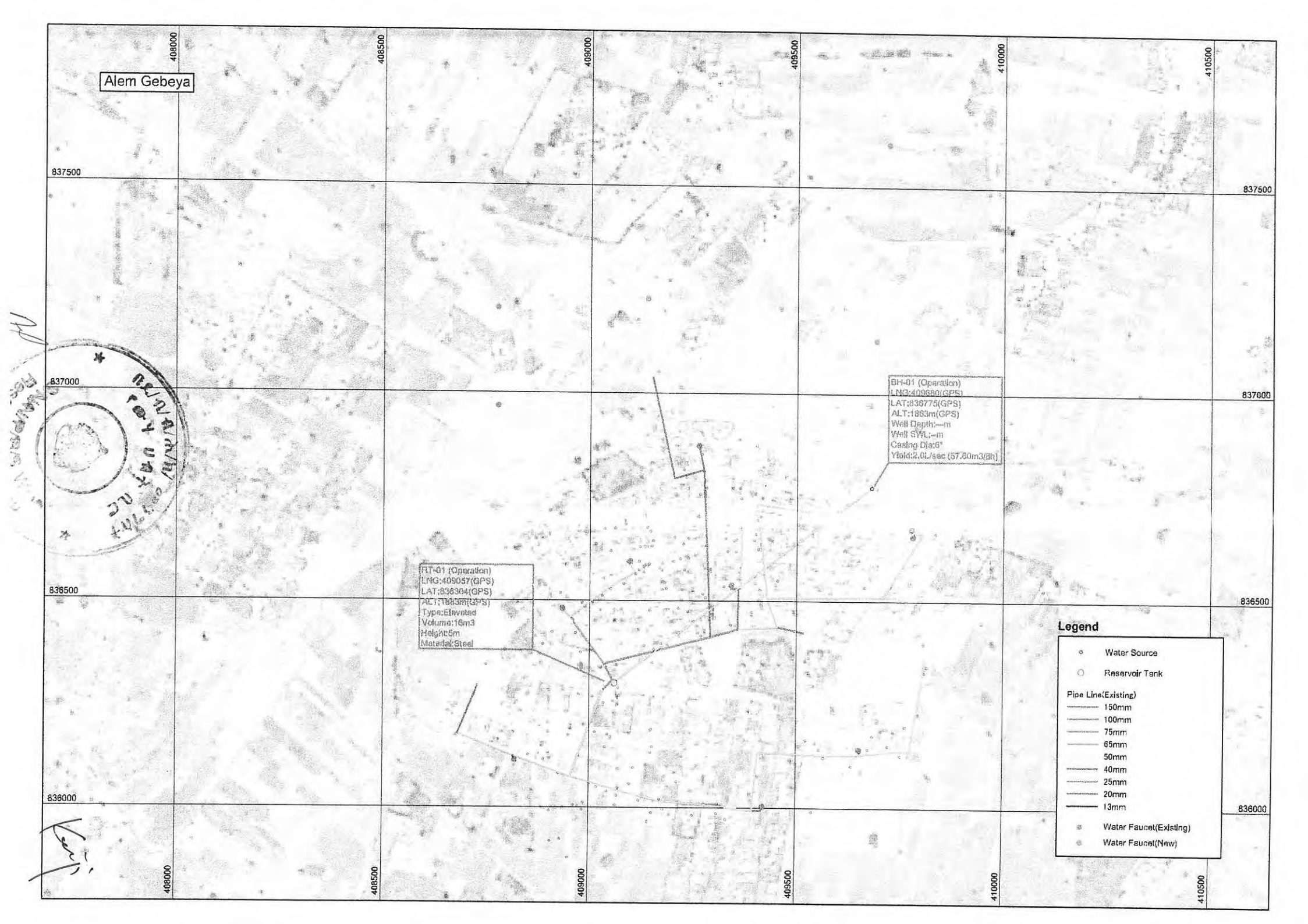
387000
387500
388000
388500
389000
389500
798500
798000
797500
797000
796500

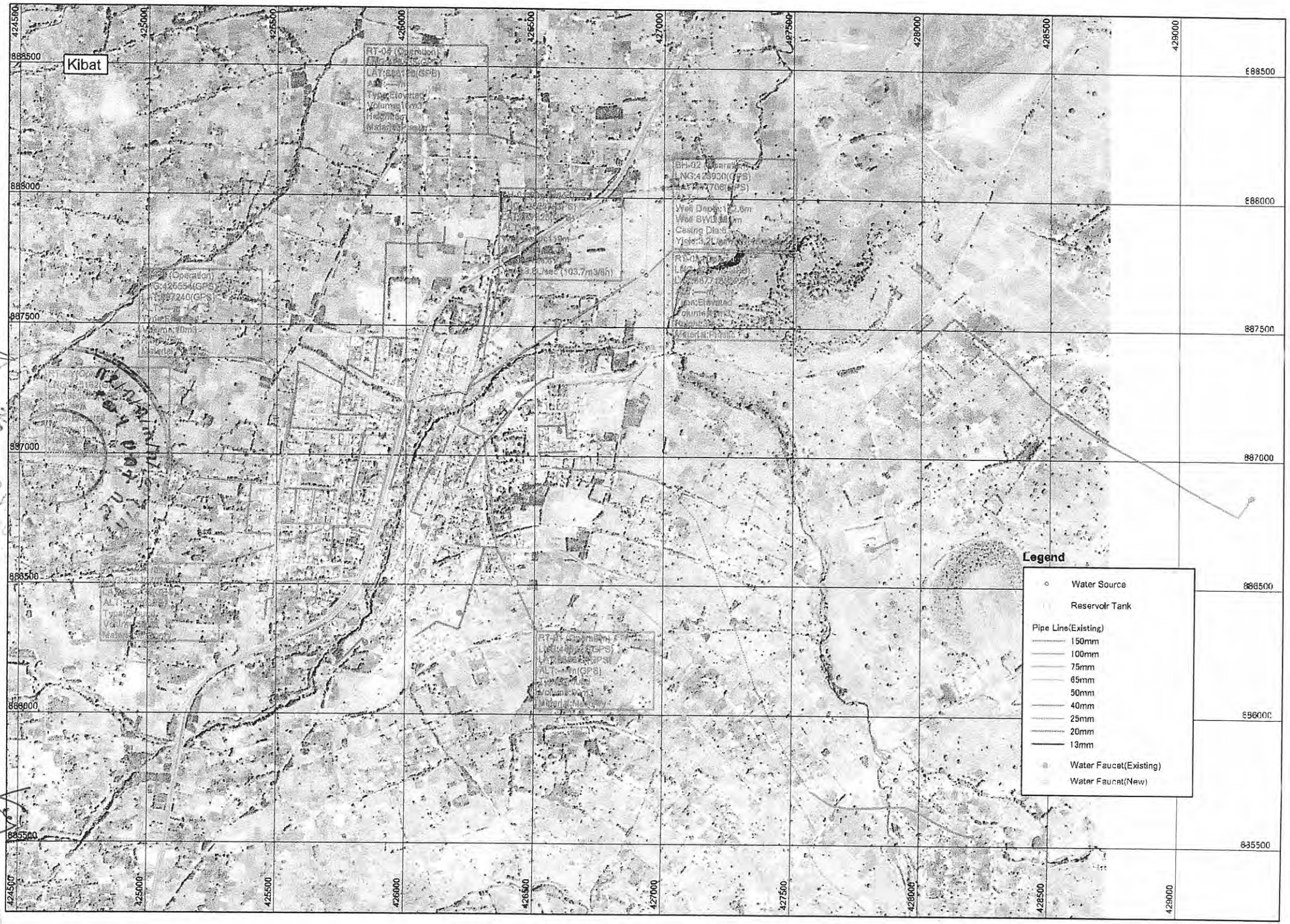

Teferi Kela
Legend
Water Source
Reservoir Tank
Pipe Line(Existing)
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)
432500
433000
433500
434000
434500
719000
718500
718000

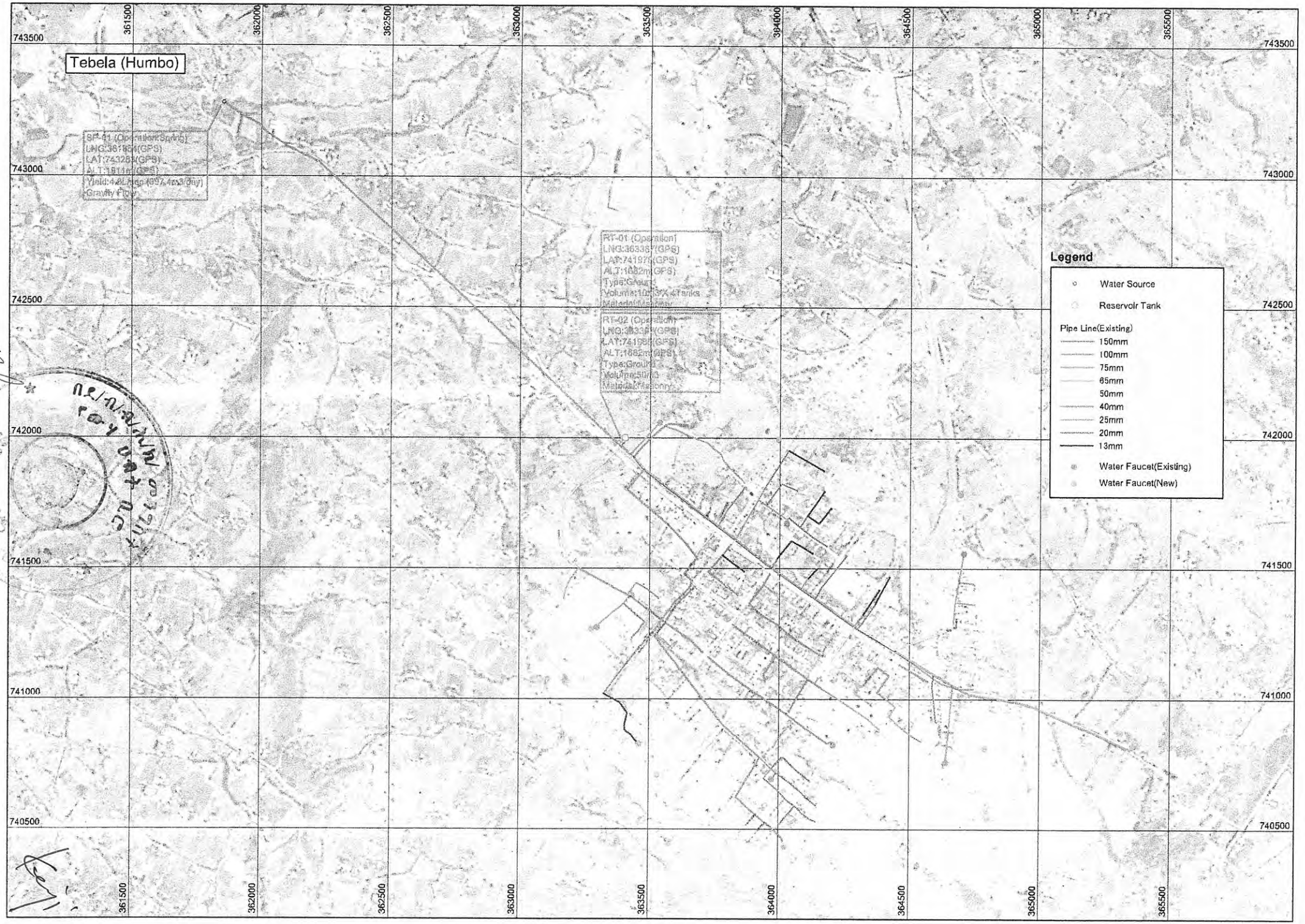

Dalocha
R.T-01 (Operation)
LNG:414125(GPS)
LAT:863260(GPS)
ALT:2963m(GPS)
Type:Ground
Volume:300m3
Material:Concrete
Legend
Water Source
Reservoir Tank
Pipe Line(Existing)
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)


Mito
428000
428500
429000
429500
430000
849500
849000
848500
BH-01 (Operation)
LNG:429513(GPS)
LAT:849236(GPS)
ALT:1760m(GPS)
Well Depth:50m
Well SWL:--m
Casing Dia:6"
Yield:1.6L/sec (46.08m3/8h)
RT-01 (Operation)
LNG:429128(GPS)
LAT:849008(GPS)
ALT:1782m(GPS)
Type:Elevated
Volume:15m3
Height:5m
Material:Steel
Legend
Water Source
Reservoir Tank
Pipe Line(Existing)
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)


S-46 Tora
434000
434500
435000
435500
436000
436500
437000
870000
869500
869000
868500
868000
BH-01 (Operation)
LNG:435401(GPS)
LAT:869288(GPS)
ALT:1981m(GPS)
Well Depth:240m
Well SWL:213m
Casing Dia:6"
Yield:3.2l/sec (92.16m3/8h)
RT-01 (Operation)
Type:Ground
Volume:80m3
Material:Masonry
RT-02 (Operation)
LNG:435950(GPS)
ALT:2017m(GPS)
Type:Ground
Volume:160m3
Material:Masonry
Legend
Water Source
Reservoir Tank
Pipe Line(Existing)
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)


Alem Gebeya
408000
408500
409000
409500
410000
410500
837500
837000
836500
836000
BH-01 (Operation)
LNG:409680(GPS)
LAT:836775(GPS)
ALT:1863m(GPS)
Well Depth:---m
Well SWL:--m
Casing Dia:6"
Yield:2.0L/sec (57.60m3/8h)
RT-01 (Operation)
LNG:409057(GPS)
LAT:836304(GPS)
ALT:1863m(GPS)
Type:Elevated
Volume:16m3
Height:5m
Material:Steel
Legend
Water Source
Reservoir Tank
Pipe Line(Existing)
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)


Kibat
Legend
Water Source
Reservoir Tank
Pipe Line(Existing)
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)


Tebela (Humbo)
RT-01 (Operation)
Legend
Water Source
Reservoir Tank
Pipe Line(Existing)
150mm
100mm
75mm
65mm
50mm
40mm
25mm
20mm
13mm
Water Faucet(Existing)
Water Faucet(New)
743500
743000
742500
742000
741500
741000
740500
361500
362000
362500
363000
363500
364000
364500
365000
365500

Technical Notes

March 28, 2014

TECHNICAL NOTES
ON THE PREPARATORY SURVEY
ON THE PROJECT
FOR WATER SUPPLY DEVELOPMENT TO THE SMALL TOWNS
IN RIFT VALLEY BASIN IN
SOUTHERN NATIONS, NATIONALITIES AND PEOPLE'S REGIONAL STATE
IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

Based on the Minutes of Discussions signed on the 14th day of May 2013 between the Preparatory Survey Team (hereinafter referred to as "the Team") of Japan International Cooperation Agency (hereinafter referred to as "JICA") and Water Resource Bureau, Southern Nations, Nationalities and People's Regional State (hereinafter referred to as "WRB") on the Project for Water Supply Development to the Small Towns in Rift Valley Basin in Southern Nations, Nationalities and People's Regional State (hereinafter referred to as "the Project"), the consultant members of the Team are conducting field surveys and discussions.

Based on the result of the field study, test well drilling and discussions with the authorities concerned, WRB and the Team (hereinafter referred to as "both sides") confirmed the technical matters described in the attached sheets.

Hawassa, March 28, 2014

Ato. Tesfaye Yigezu Kelkay
Bureau Head
Water Resource Bureau
Southern Nations, Nationalities and
People's Regional State
Federal Democratic Republic of Ethiopia

Mr. Takeshi NAKANO
Chief Consultant
Preparatory Survey Team
Kokusai Kogyo Co., Ltd.
Japan

ATTACHMENT

1. Result of Test well drilling

Test well drilling was conducted at seventeen (17) points in ten (10) towns, namely Koshe, Kela, Tiya, Adilo, Teferi Kela, Mito, Tora, Alem Gebeya, Kibat and Tebele, as shown in the table below. Five (5) points, namely Tiya-2, Tora-1, 2, Alem Gebeya-2 and Kibat-2, were found to be Dry Holes. At Tora, both test wells were found to be Dry Holes. The Team came to the conclusion that there are no other possible sites to develop ground water close to Tora town. Therefore, Tora is excluded from the target of Project. Eleven (11) successful wells will be converted to production wells for the Project.

At Teferi Kela-2, test well drilling is still conducting and will be completed by the middle of April 2014.

Result of test well drilling

Zone	Woreda	Town	No.	Drilling Depth (m)	Total Pipe Length (m)	Casing Length (m)	Screen Length (m)	Yield (L/sec)	SWL (m)	DWL (m)
Gurage	Mareqo	Koshe	1	200	200	164	36	36.5	15.90	33.97
	Sodo	Kela	1	99	99	81	18	5.2	17.25	25.52
			2	100	100	76	24	5.0	7.80	52.83
		Tiya	1	180	180	150	30	2.0	71.60	123.10
			2	180	Dry Hole					
Kembata Timbaro	Kedia Gamela	Adilo	1	244	244	226	18	5.0	193.78	194.41
			2	260	260	230	30	5.0	198.00	198.07
Sidama	Dara	Teferi Kela	1	120	120	96	24	5.0	12.45	35.12
			2	Drilling work will be completed by the middle of April 2014.						
Silite	Dalocha	Dalocha	Not conducted							
	Lanifaro (Lanfuro)	Mito	1	101	101	83	18	14.3	29.40	36.34
		Tora	1	222	Dry Hole					
			2	250	Dry Hole					
	Sankura	Alem Gebeya	1	176	176	152	24	9.7	112.20	122.12
			2	120	Dry Hole					
	Siliti	Kibat	1	147	147	123	24	13.0	78.10	86.97
			2	177	Dry Hole					
Wolayita	Humbo	Tebela	1	86	86	68	18	35.6	12.72	34.45
Total				2,662	1,713	1,449	264			

2. Water quality standard to be applied

WRB requested the Team to apply the Ethiopian Water Quality Standard to the Project in consideration of current water supply situation, water shortage and difficulty to develop new water source, at candidate towns. The Team will convey the request to JICA Headquarter and final decision will be delivered at the time of explanation of draft report.

3. Result of water quality analysis

Water quality analysis was conducted fourteen (14) samples of test well drilling sites and

fifteen (15) samples of existing water sources (wells and springs). All twenty nine (29) samples were satisfied the Ethiopian Water Quality Standard. Regarding Fluoride (F) content, six (6) samples out of twenty nine (29) samples exceed the value of WHO Guideline (1.5 mg/L), however they are less than that of Ethiopian Water Quality Standard (3.0 mg/L).

Water sample of test well drilling at Teferi Kela-2 will be analyzed, if it will be found to be Successful Well.

4. Utilization of existing wells

In the town where yield of the test wells are sufficient to cover the entire population with eight (8) hours pumping operation a day, namely Koshe, Adilo, Mito and Tebela, existing wells will not be utilized in the Project. However in those towns where yield of the test wells are not sufficient at such condition described above, namely Kela, Alem Gebeya and Kibat, pumping operation time will be extended up to twelve (12) hours a day and existing wells also will not be utilized. As for Tiya where yield of the test wells even with twelve (12) hours pumping operation a day are not sufficient to cover the population, existing well also will be utilized to compensate the water deficiency.

At Teferi Kela, utilization of existing well will be decided based on the result of test well drilling.

5. Policy of water supply facility planning

Water supply facilities for the Project will be designed at ten (10) towns as shown in the table below.

Water supply facility to be designed

Zone	Woreda	Town	Water souce	Main facilities to be designed
Gurage	Mareqo	Koshe	Ground water	Reservoir, generator house and main pipe lines
	Sodo	Kela	Ground water	Reservoir, generator house and main pipe lines
		Tiya	Ground water	Reservoir, generator house and main pipe lines
Kembata Timbaro	Kedia Gamela	Adilo	Ground water	Reservoir, generator house and main pipe lines
Sidama	Dara	Teferi Kela	Ground water	Reservoir, generator house and main pipe lines
Silite	Dalocha	Dalocha	Spring	Collection chamber and main pipe lines
	Lanifaro	Mito	Ground water	Reservoir, generator house and main pipe lines
		Tora	Excluded	
	Sankura	Alem Gebeya	Ground water	Reservoir, generator house and main pipe lines
	Siliti	Kibat	Ground water	Reservoir, generator house and main pipe lines
Wolayita	Humbo	Tebela	Ground water	Reservoir, generator house and main pipe lines

The Team explained to WRB the following facility planning policy, and WRB accepted it.

- Existing reservoir tanks and distribution pipe lines will include in the water supply facility planning of the Project, when the Team judge that those facilities are able to be utilized without any technical problems.
- The Team proposed that target of the Project is installing main pipe lines, primary and secondary distribution pipe lines, with the public faucet at end of those pipe lines.

6. Environmental and social consideration

Both sides discussed with Land Administration, Users and Environmental Protection Authority (LAUEPA) regarding the scope of environmental and social consideration for the Project. Both sides agreed to conduct the preliminary environmental assessment and submit the environmental impact study report, because the screening of environmental conditions was already conducted on Development Study and the facilities to be planned will not be huge scale. Both sides prepared and submitted the report, and LAUEPA accepted it.

7. Schedule

Based on the result of field survey, the Team will analyze and design water supply facility plan and calculate the Project budget in Japan, then will explain the draft report to WRB on August 2014.

P23

Minutes of Discussions
November 5, 2014

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR WATER SUPPLY DEVELOPMENT
TO THE SMALL TOWNS IN RIFT VALLEY BASIN
IN SOUTHERN NATIONS, NATIONALITIES AND PEOPLE'S REGIONAL SATE
IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
(EXPLANATION ON DRAFT REPORT)

In May 2013, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Preparatory Survey Team on the project for Water Supply Development to the Small Towns in Rift Valley Basin in Southern Nations, Nationalities and People's Regional State (hereinafter referred to as "the Project") to the Federal Democratic Republic of Ethiopia (hereinafter referred to as "Ethiopia") and thorough discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the study.

JICA dispatched to Ethiopia the Draft Report Explanation Team (hereinafter referred to as "the Team"), which was headed by Mr. Murakami, Senior Advisor of JICA, from November 3rd -7th, 2014 to consult the Ethiopia authorities on the components of the draft report.

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

Hawassa, 5th November, 2014

Mr. Toshio Murakami
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Mr. Tesfaye Yigezu Kelkay
Bureau Head
Water Resources Bureau
Southern Nations, Nationalities and
People's Regional State
Federal Democratic Republic of Ethiopia

Mr. Tesfaye Tafesse Fitta
Bureau Head
Finance and Economic Development Bureau
Southern Nations, Nationalities and
People's Regional State
Federal Democratic Republic of Ethiopia

ATTACHMENT

1. Components of the Draft Report

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

2. Japan's Grant Aid Scheme

2-1 The Ethiopia side understood the scheme of Japan's Grant Aid Scheme as described in Annex-1 and Annex-2.

2-2 The Ethiopia side agreed to take the necessary measures for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented, as described in Annex-3.

3. Responsible and Implementing Organization

The responsible and implementing organization is Water Resources Bureau (hereinafter referred to as "WRB"), Southern Nations, Nationalities and People's Regional State. The organization chart of WRB is shown in Annex-4.

4. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to Ethiopia by the end of January, 2015.

5. Other Relevant Issues

5-1 Project Sites

Ten (10) small towns which are shown in the Annex-5 and 6 were selected as the project sites based on the result of the preparatory surveys and analysis in Japan. As it is agreed on Technical Notes on March 28th, 2014, 1 small town (Tora) was excluded from the project site as a result of test well drilling and confirmation of existing water source.

5-2 Components of the Project

The components of the project are shown in Annex-7.

5-3 Project Cost Estimate

The Team explained the estimated project cost to the Ethiopia side as shown in Annex-8. Both sides confirmed that this estimated cost was provisional and would be examined further by the Government of Japan for its financial approval. Furthermore, both sides confirmed that this estimated cost is confidential and should never be duplicated in any forms or released to any other parties until the relevant contracts are awarded by the executing agency, in order to secure fairness of tender procedure.

5-4 Water Consumption Rate

Both side agreed to set water consumption rate as twenty (20) liters per capita per day (20l/c/d) in accordance with Universal Access Program in the Technical Notes on May 24th, 2013. The Team proposed to amend it from twenty (20) liters per capita per day to twenty five (25) liters per capita per day (25l/c/d) in Mito and Kibet based on the result of survey. And the Ethiopia side agreed it.

Amended Water Consumption Rates are shown below.

20l/c/d : Koshe, Kela, Tiya, Adilo, Teferi Kela, Alem Gebeya, Tebela, Dalocha

25l/c/d : Mito, Kibet

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5-5 Water Quality Standard to be applied

In March, 2014, WRB requested the Team to apply the Ethiopian Water Quality Standard to the Project in consideration of current water supply condition, water shortage and difficulty to develop new water sources at candidate small towns. As a result of the consideration in Japan, the Team accepted the request and applied the Ethiopian Water Quality Standard to the Project.

5-6 Utilization of the Existing Wells

In 2 small towns (Tiya and Kibet), existing wells are utilized to compensate yield of the new wells. In other small towns, only new wells or existing spring are supposed to be utilized to the Project. JICA recommended keeping the existing wells as backup water sources to address the emergency case and meet the growing water demand in the future. And the Ethiopia side understood it.

5-7 Installation of Standby Generator

Base on the result of the survey, the Team determined to install standby generator. However the team requested to utilize the commercial grid as much as possible and undertake necessary actions to secure the commercial grid. And the Ethiopia side agreed it.

5-8 Installation of Service Pipes

The Team explained that the Project will install and replace transmission and distribution pipelines and residents need to install service pipes and following objects at expenses of them for continued utilization of existing household connections in the section where the existing distribution pipelines are supposed to be replaced. The Team also emphasized that it is necessary to install these objects at the same time as replacement of main pipelines for minimizing the expenses of residents and preventing the leakage of water. And the Team recommended that the residents shall bear the expenses for installation of service pipes and The Water Management Organization (hereinafter referred to as "WMO") and WRB shall supervise it. And the Ethiopia side agreed it.

5-9 Revision of Water Tariff

The team presented the draft of revised water tariff and explained the necessity of revision of it to maintain the water supply. The Team also requested that WRB shall support revision of water tariff by WMO based on the plans which are supposed to be drawn up in the term of technical assistance. And the Ethiopia side agreed it.

5-10 Operation and Maintenance cost

The Team proposed that WMO shall cover the costs for operation, management, minor repairs, routine inspections of schemes and rehabilitations/replacements of facilities such as pumps and generators. And the Ethiopia side agreed it.

5-11 Revision of WMO

The team presented the draft of revised structure of WMO and explained the necessity of it to maintain the water supply. The Team requested that WRB shall support the revision of WMO based on the plans which are supposed to be drawn up in the term of technical assistance. And the Ethiopia side agreed it.

5-12 Support for Operation and Maintenance

The Team requested that WRB shall implement necessary support to lower branches, and instruct Zonal Water offices and Woreda Water offices to support WMO appropriately while utilizing the outputs of previous technical cooperation project "The Water Sector Capacity Development Project In Southern Nations, Nationalities and Peoples' Region" which was implemented form 2007 to 2011. And the Ethiopia side agreed it.

Southern Nations Nationalities & Peoples Regional Government Water & Economy Development Bureau

JICA Japan International Cooperation Agency

5-13 Implementation of mitigation

The team explained revision of the result of Preliminary Environmental Assessment and mitigations of environmental impacts which should be taken in the term of construction. And Ethiopia side agreed to monitor prospected environmental impacts and take necessary mitigations based on the result of monitoring. And the Ethiopia side agreed it.

5-14 Land Acquisition

WRB confirmed that there is no obstacle in acquiring the land for construction of public faucets, reservoir tanks, generator houses and the collection chamber etc., except for the farmland which are prospected to be crossed by the pipelines. As to the farmland, the Team presented estimated cost for land acquisition and emphasized that the Ethiopia side would take appropriate measure in accordance with related Law of Ethiopia and guideline of JICA. And the Ethiopia side agreed to submit official letter regarding the securance of the land for the construction site and the policy of acquisition of farmland to JICA Ethiopia Office by the commencement of the construction works in order to avoid any possible trouble during the implementation term. And the Ethiopia side agreed it.

5-15 Necessary Records

The Team explained that the project effects shall be confirmed by the verifiable manner since the project is commenced under the Japan's Grant Aid. The team also requested that WRB ensure the all necessary records related to the amount of water supply as well as the operational records of the water supply facilities. And the Ethiopia side agreed it.

5-16 Other Undertakings by the Ethiopia Side

(1) Securing Project Sites

Ethiopia side agreed to take necessary measure for securing the project sites until commencement of the Project.

(2) Allocation of Necessary Budget

The Ethiopia side agreed to allocate the necessary amount of budget (Annex-8) timely for smooth implementation of the Project, and assign counterpart personnel by its own expense to the Japanese consultants during the implementation of the Project.

(3) Tax Exemption

Ethiopia side agreed to to take necessary measures to exempt Japanese nationals who will be engaged in the Project from all duties and related fiscal charges which may be imposed in Ethiopia with respect to local procurement under the verified contract.

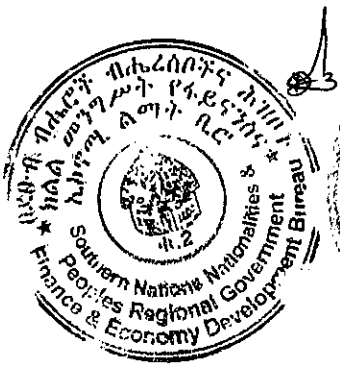
Ethiopia side also agreed to take necessary measures to implement smooth custom clearance for the materials and equipment for the Project to be imported from Japan or third countries.

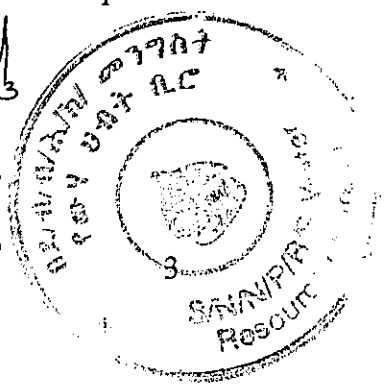
(4) Protection of Test Boreholes

The Ethiopia side agreed to protect the test boreholes drilled in the survey until the commencement of the Project.

5-17 Climate Change

Both side confirmed that the Project is expected to contribute to adaptation to climate change.





Annex-1 Japan's Grant Aid Scheme
Annex-2 Flow Chart of Japan's Grant Aid Procedures
Annex-3 Major Undertakings to be Taken by Each Government
Annex-4 Organization Chart of the Responsible Organization
Annex-5 Project Site Map
Annex-6 Selected Target Sites
Annex-7 Components of the Project
Annex-8 Project Cost Estimate

Annex-1

JAPAN'S GRANT AID

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

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

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures:

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

2. Preparatory Survey

(1) Contents of the Survey

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

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view

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- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.

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

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

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

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

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

(2) Selection of Consultants

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

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(3) Eligible source country

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

(4) Necessity of "Verification"

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

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex.

(6) "Proper Use"

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

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

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

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

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(9) Authorization to Pay (A/P)

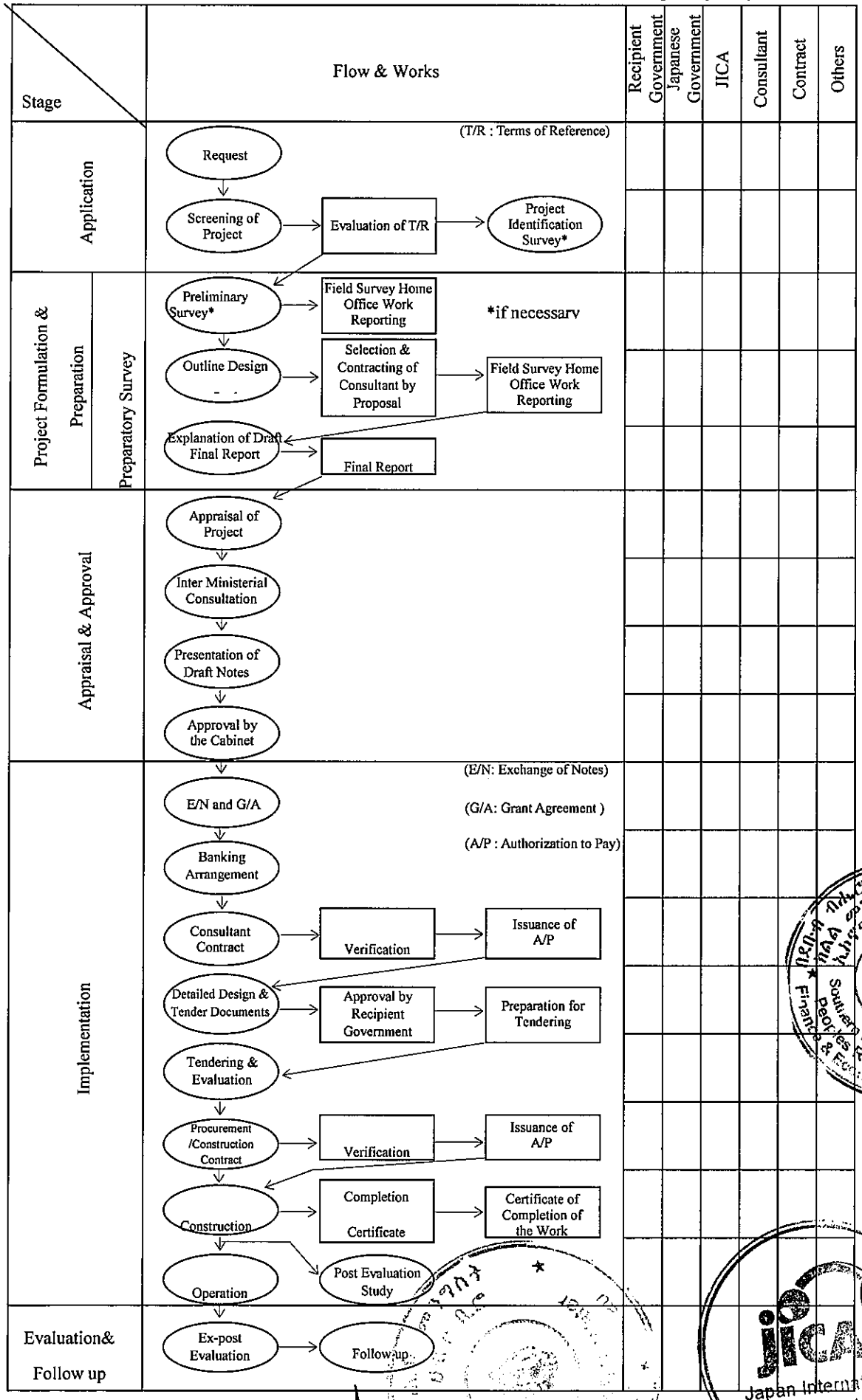
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

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

Annex-2

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES



Annex-3

MAJOR UNDERTAKINGS TO BE TAKEN BY EACH GOVERNMENT
(CONSTRUCTION)

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

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

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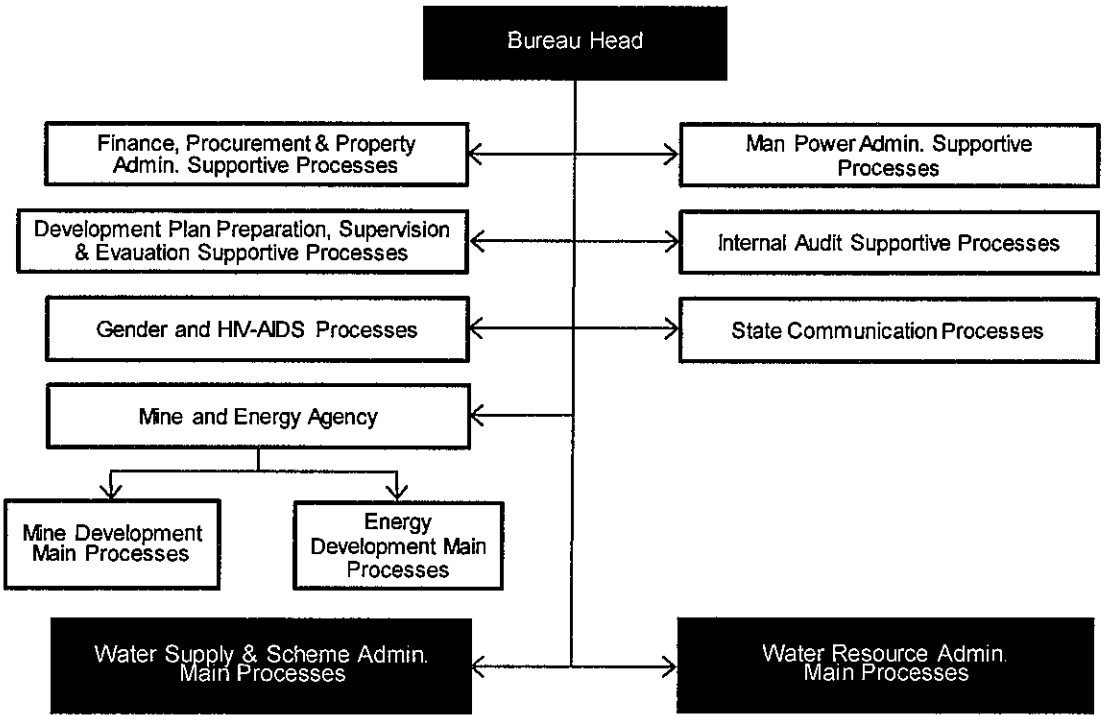
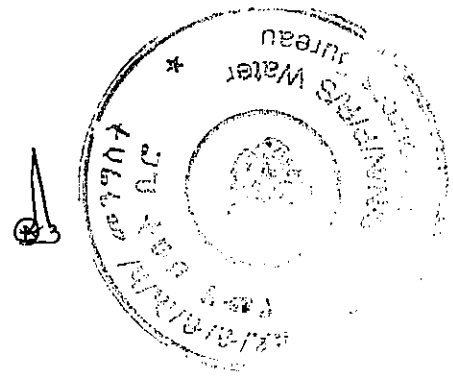
Organization Chart of the Responsible Organization

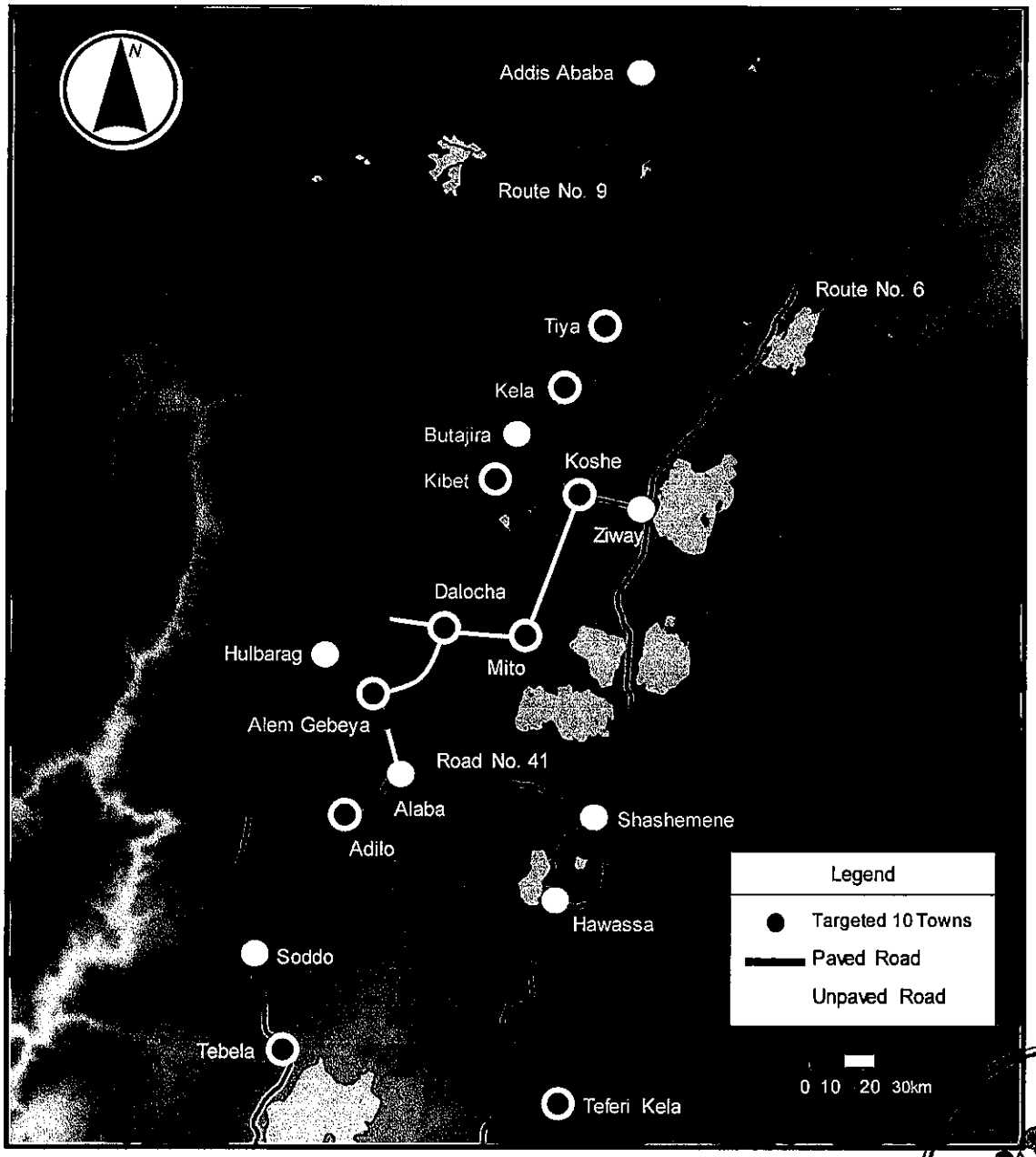
Water Resources Bureau
Southern Nations, Nationalities and People's Regional State





Annex-5

Project Site Map



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Southern Nations Nationalities & Peoples Regional Government Finance & Economy Development Bureau

Annex-6

Selected Target Sites

No.	Zone	Woreda	Small Town
1	Gurage	Mareqo	Koshe
2		Sodo	Kela
3			Tiya
4	Kembata Timbaro	Kedia Gamela	Adilo
5	Sidama	Dara	Teferi Kela
6	Silite	Dalocha	Dalocha
7		Lanifaro	Mito
8		Sankura	Alem Gebeya
9		Siliti	Kibet
10	Wolayita	Humbo	Tebela

Annex-7

Components of the Project

1. Construction of Water Supply Facilities : 10 small towns as listed below

Small Town	Well points	Generator house	Transmission pipe	Collection chamber	Reservoir	Distribution pipe	Public faucet
	Place	Place	m	Place	Place	m	Place
Koshe	1	1	2,170	0	1	6,497	17
Kela	2	2	5,740	0	1	8,600	18
Tiya	2	2	2,610	0	2	3,990	8
Adilo	2	2	3,080	0	1	4,250	12
Teferi Kela	2	2	3,140	0	1	4,370	16
Dalocha	0	0	0	1	0	12,240	18
Mito	1	1	970	0	1	2,880	15
Alem Gebeya	1	1	2,010	0	1	6,290	13
Kibet	2	2	7,060	0	1	10,510	23
Tebela	1	1	1,430	0	1	14,590	16
Total	14	14	28,210	1	10	74,217	156

2. Technical Assistance consists of :

No.	Output	Confirmation item of output achievement	Measurement
Output1	Comprehension of the support system for WMO	* Recognition of the each role including the residents and the person in charge for WMO	* Reporting outcome of hearing opinion * Report of resident's meeting
Output2	Preparation of O&M system for the expansion of water supply facilities	* Review the personnel composition of WMO, and the setting of rules regarding water and the facilities' utilization	* Preparation plan for WMO * Terms of facility usage
Output3	Formulation of the plan for the revision of the water fee	* Formulation of the appropriate plan for the revision of the water fee * Consent of residents for the revision of water fee	* Plan of revision of the water fee * Report of resident's meeting
Output4	Strengthening of the capability of O&M by Woreda office.	* Comprehension of the content for the technical training and the acquisition of knowledge concerning maintenance and repare * Draft plan for excution of monitoring	* Confirmation test * Plan of the monitoring
Output5	Strengthening of the capability of O&M by WMO.	* Comprehension of the content for the technical training and the acquisition of knowledge concerning maintenance and repaire * Preparation for the accounting operation	* Confirmation test * Activity record * Operation record * Accounting book
Output6	Obtain an understatanding from the residents regarding the usage for the safety water.	* Elevate the sanitary consciousness * Comprehension of the usage of the safety water	* Questionnaire for the residents (Hearing opinion for the residents)

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*** This page is closed due to the confidentially.**

Confidential

Annex-8

Project Cost Estimate

Cost borne by the Japanese side: approx. [redacted] million Japanese Yen

Contents	Price in JPY (million JPY)
Construction of water supply facilities at 10 small towns	[redacted]
Transmission & distribution pipes, reservoirs, collection chamber, pressure reduced tanks, public faucets etc.	
Supervision	[redacted]
Soft components	[redacted]
Total	[redacted]

Cost borne by the Ethiopian side: approx. 3,867,000 Birr

Contents	Price in Birr
Banking arrangement	185,529
Construction of power supply	1,855,288
Construction of steel fence (well point and reservoir)	445,269
Construction of wood fence (public faucets)	278,293
Installation of service pipe	1,067,957
Land acquisition (land and crops)	12,368
Securement of staffs for soft component	22,263
Total	3,866,967

Japan International Cooperation Agency

4

Southern Nations Nationalities & Peoples Regional Government Finance & Economy Development Bureau

Appendix 5

Soft Component
(Technical Assistance) Plan

The Federal Republic of Ethiopia

The Projct for Water Supply Development To the Small Towns in Rift Valley Basin in Southern Nations, Nationalities and People's Regional State

Soft Component Plan

(Technical Assistance)

December 2014

Kokusai Kogyo Co. Ltd.

Soft Component (Technical Assistance) Plan

１．　Background to plan the soft component

"The Projct for Water Supply Development To the Small Towns in Rift Valley Basin in Southern Nations, Nationalities and People's Regional State" constructs the water supply facilities with public faucets in order to improve the ratio of water supply, to continuously provide the safe water to the target 10 small towns in Southern Nations, Nationalities and
People's Regional State. And also, the Project conducts technical assistance for organizing the operation and maintenance system of water management organization.

１－１　Operation and Maintenance Situation of Water Supply Facilities

（１）System of Operation and Maintenance

In SNNPR, RWRB exercises jurisdiction over the rural water supply project, however, there are Zonal Office and Woreda Office in each of Zone and Woreda as the local agency of central government, each Zonal Office and Woreda Office is supporting their own lower organization. In addition, in the small city (town) level, WMOs are established by the classification that RWRB evaluates water supply situation of each city (town), operation and maintenance of water supply facilities is carried out by independent accounting system. However, the ability of organizational operation and operation and maintenance of water facilities by WMOs is basic level; there is a room for improvement. Also, for such a situation, correspondence of Woreda Office, which is management organization of water facility, is also not quick. Meanwhile, each organizations are aware of this situation, but at present, do not specifically taken measures. As a result, the repair for failure delay, and sometimes water supply to the residents is limited.

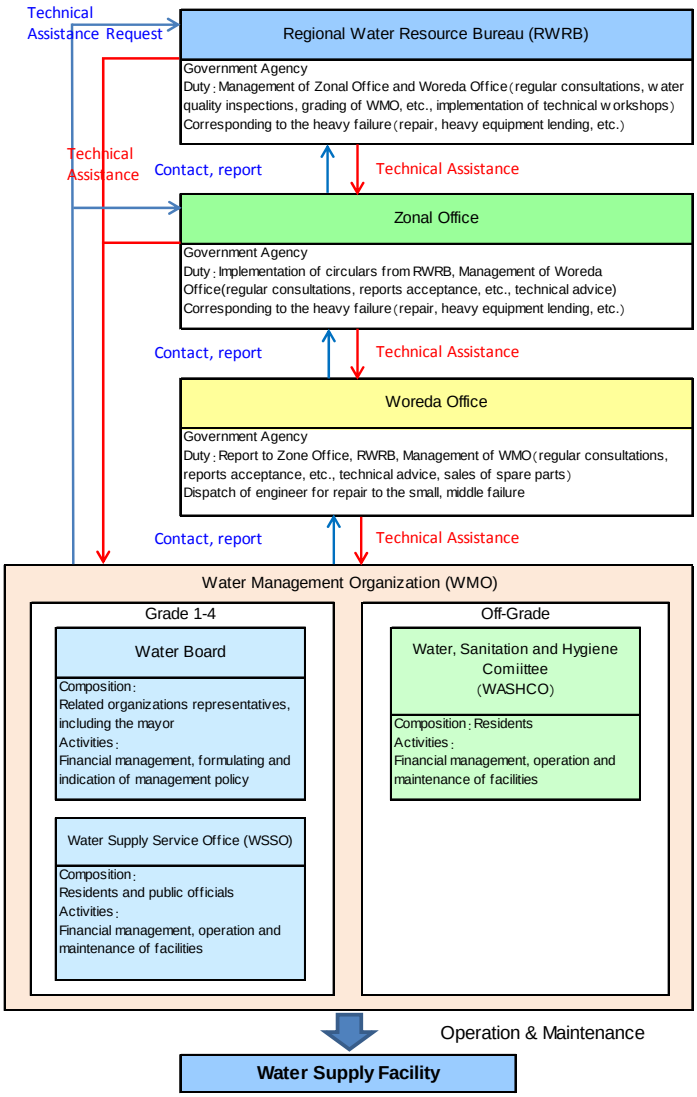


Figure1 Structure of Operation and Maintenance in SNNPR

Table 1 Support system

Support content		Support target		
		Zonal Water Bureau	WoredaWater Office	Water Management Organisation
Support side	Regional Water Resource Bureau (RWRB)	Regular meeting Financial audit Recepit of reports Revised procedures Conduct a workshops Processig for serious accidents	Regular meeting Financial audit Execution of water analysis Provision of parts for hand pump Technical advice	Procedures at the time of reorganization process of registration/approval Processig for serious accidents Execution of financial workshop
	Zonal Water Bureau		Regular meeting Reciept financial & other reports Execution of water analysis Technical advice	Financial audit Technical advice Processig for serious accidents process of registration/approval
	Woreda Water Office			Regular meeting Financial audit Technical advice Recepit of reports Dispatching technicians for simple or moderate accidents Distribution of spare parts Execution of water analysis Supervising of Water rate revision Supervising of staff employment

（2）System of Water Management Organization and Activity Condition

In SNNPR, RWRB grades each town based on the water supply situation, WMOs in accordance with the grade has been established. Among the target 10 towns, Water Supply Service Office was established in 5 towns (Koshe, Kela, Adilo, Kibat, Tebela) corresponding to grade 4, Water, Sanitation and Hygiene Committee (WASHCO) was established in 4 non-rated towns (Tiya, Dalocha, Mito, Alem Gebeya), and each organization is conducting the operation and maintenance based on each activities plan by independent accounting system by the collection of water fees. The remaining 1 town (Teferi Kela), because the existing water supply facilities is small, WMO has not been established. However, WMO of Kebado, which is the neighboring town of Teferi Kela and same Woreda, is remote managing the water facility with four members of Teferi Kela. Town office of Teferi Kela also knows this situation, from the viewpoint of the expansion of water supply facilities by the Project, town office is preparing the establishment of the own WMO. It is supposed to be establish the Water board in the town which has WMO, and Water Board is supposed to get involved with the activity plan and financial of WMO. However, in the 5 towns of the Project, Water Board is not established because size of organization is small.

Table 2　Water management organizations that differ by grade

Grade	Point	WMO	Small town
1	Over 90%	Water board and WMO	Hawassa
2	81-90%		Sodo, Dila, Hosana, Arbaminch
3	66-80%		Yergachefe
4	45-65%		Koshe, Kela, Adilo, Kibet, Tebela
Out of grade	Less than 45%	Water committee	Tiya, Dalocha, Mito, Alem Gebeya

Table 3　Grading criteria

Standard of valuation of WMO			Point
1	Human resources and management situation	Employment staff	11
		Office environment	9
2	Water supply	Annual pumping discharge	4
		Annual water sales	4
		Average water fee	4
		Average water consumption	4
3	Annual balance of payments	Income	11
		Financial assets	6
		Expenditure	9
4	The number of users of water supply facilities	Number of private connection	6
		Number of public faucet	11
5	General information of the target town	Population	4
		Social, economic, political value	6
6	Quality of service	Effectiveness of water supply	4
		User satisfaction	6
Total			100

Meanwhile, the main activities of WMO is set of water fees, fee collection, financial management, monitoring and repair of water supply facilities, reporting to the WWO, holding of regular meetings, etc.. About the minor repair of water supply facilities in the town, WMO is supposed to repair by themselves. However, because WMO of 4 towns do not have the engineer for repair, they have been outsourced to private engineers or engineers of Woreda in each failure.

The current WMO and constitution of each town is shown as follows. After time, increasing the number of personnel is required, because there is a possibility of a shortage of members for water fee collection by the increase of public faucets, private connection of water, and facility users. In addition, in order to realize more sustainable operation and maintenance of water supply facilities, review for the personnel structure of each WMO is also required.

Table 4　WMOs and Personnel Composition

Unit: person

Small Town	Grade	Current WMO	WMO Member		Running Public Faucet	Water Fee Collector (Salaried worker of another employment)	
			Total	Engineer		Public Faucet	Private Connection
Koshe	4	WSSO	Male:10, Female:1	1	5	5	3
Kela	4	WSSO	Male:5, Female:2	2	12	4	3
Tiya	Off-Grade	WASHCO	Male:5, Female:2	0	3	2	***
Adilo	4	WSSO	10	2	6	6	3
Teferi Kela	Off-Grade	WSSO*	Male:4	2	9	8	3
Dalocha	Off-Grade	WASHCO	Female:4	0	6	7	3
Mito	Off-Grade	WASHCO	Male:5, Female:1	0	8	7	3
Alem Gebeya	Off-Grade	WASHCO	Male:3, Female:3	***	5	5	3
Kibat	4	WSSO	Male:8, Female:3	1	11	7	3
Tebela	4	WSSO	Male:6, Female:1	3	4	3	3

* Satellite management by WMO of neighboring town

（3）Water Fees

In the target town, setting of water fee is left to each WMO. Therefore, setting of water fee is different for each town. Normally, the draft of water fee WMOs have prepared is applied to Water Resource Bureau and / or Zone Water Office and approved after the consultation with the town residents, hearing the opinion of WWO. Revenues from water fees has been appropriated to the monthly cost of the operation and maintenance of water supply facilities such as labor costs, energy costs, communication costs, repair costs, fuel and lubricant costs, office equipment and consumables. However, since many of the town does not fund enough repair costs, there is no financial leeway enough to correspond to when the catastrophic serious failure has occurred. Therefore, sometimes repair is delayed, water supply is interfered during the period in which the repair budget cannot be secured. In addition, because staff of Water Supply Service Office and water fee corrector of Water Management Committee are gainful employment, if the employment due to the new water supply facilities has increased, the increase of expenditure for labor costs will be occurred. Furthermore, even in the Water Management Committee which is currently managed by volunteers (unpaid), if upgrade to the Water Supply Service Office has occurred by expansion of water supply facilities scale in future, staff switches to paid employment, there is a possibility that the additional expenditure occur. On the other hand, there is a possibility of increase in revenue due to an improvement of water supply facilities and the increase of water usage. Therefore, it is necessary to review the water fee with the expenditure that can be assumed in the future based on the review of the current revenue and expenditure.

Table 5　Water Fee and Setting Method in each Town

Small town	Public Faucet			Private Connection		Setting of water fees	Presence or absence of the repair costs in the water fees
	Birr/20L	Birr/m^3	Fee collection method	Birr/m^3	Fee collection method		
Koshe	0.15	7.5	Water fee collectors collect in cash at public faucets	5.0	Invoices are issued by measuring water meter, users pay at each WMO.	Water Board is not established. After consultation with water in WSSO, obtained the approval of residents, gained the opinion from Woreda Office. applicant from Woreda to Zone, RWRB. The current fee was amended four years ago. Maintenance costs have not been considered in water fees.	
Kela	0.20	10.0		7.0		WMO submits the results of the consultation to Woreda Office, then submitted to Zone.	
Tiya	0.30	15.0		***	***	Decided after consultation of WMO. Current fee is revised in three years ago. Gained approval from residents meeting.	
Adilo	0.40	20.0		18.0	Invoices are issued by measuring water meter, users pay at each WMO.	WMO set in 2011, after When it was promoted from WASHCO to WSSO. Water Board is not established. Appropriate fee was set from the current balance. Fee is high because it considers the fuel cost.	○
Teferi Kela	0.20	10.0		5.0		Fee was revised by the Water Board of Woreda(Dala). Water Board determines with fees of Kebado City and neighboring town. Maintenance costs account for 50% of the fee.	○
Dalocha	0.25	12.5		4.5		After consultation with WASHCO, discussed in DAWDA (36 women), fee is set after confirmation of residents. Maintenance costs are considered.	○
Mito	0.15	7.5		7.5		If accountant judges that budget balance is insufficient, WMO ask the Woreda. After consultation with Woreda, decided the fee with confirmation residents.	
Alem Gebeya	0.15	7.5		5.0		WMO proposed the price increase of fee, but residents opposite. Current fee is set six years ago. Maintenance costs are included in the fees (about 20%).	○
Kibet	0.15	7.5		4.3		WMO submits the result of discussion to Woreda, then submits to the Zone from the Woreda office. Fee was revised in 2012, but the price includig maintenance cost was high, intermediate values was set.	○
Tebela	0.20	10.0		2.0		WMO can set the fee by their own. It has not changed since 2010. Water source is spring by gravity, the cost of the generator, etc. is not applied. Therefore, fee is cheaper than other town.	

According to the results of social study, the payable amount of water fee of residents is higher than current expenditure in most of the town. In Adilo, current expenditure is higher than the payable amount,

this is the reason that the water fee is set higher than the other town. By figure out the current water usage and payable amount of residents, it is necessary to review the water fee that considers of the operation and maintenance and repair costs of water supply facilities.

Table6 Comparison of Water Expenditure and Payable Amount

Small town	Current Water Consumption		Current Water Expenditure (Birr/household/ month)	Payable amount*1 (Birr/month)	Willingness to Pay*2 (Birr/month)
	L/capita/day	m^3/HH/month			
Koshe	13.05	2.07	11.03	34.63	52.80
Kela	14.81	2.29	16.42	44.82	33.80
Tiya	6.39	0.97	14.52	54.16	50.50
Adilo	10.02	1.96	37.69	44.96	33.00
Teferi Kela	12.04	1.97	9.42	55.79	26.00
Dalocha	12.89	2.24	13.12	36.97	38.50
Mito	25.12	3.29	24.70	62.09	53.30
Alem Gebeya	21.26	3.27	19.42	67.68	34.50
Kibet	28.21	4.84	18.53	40.48	52.80
Tebela	17.48	2.86	6.71	38.75	30.20
Average	16.13	2.58	17.16	48.03	40.54

*1 Adopt (5% of disposable income) by the World Bank

*2 Result of the social survey

（4）Technical Ability of Woreda Office

In Woreda, there is the Woreda Office as local agency of central government. Normally, Woreda Office is in the position to supervise and support the WMO. However, the majority of current main service of Woreda Office is minor support to the village community such as the repair of hand dug wells and hand pumps, spring water protection, and preliminary maintenance. Although repair that WMO cannot cope have been outsourced to private engineers or engineers of Woreda in each failure, since many of the repairs exceeds the ability of engineers of Woreda Office, Zone Water Mines & Energy Depart or Water Resource Bureau are corresponding of repair. If Woreda Office dispatches the engineer to WMO, WMO bears necessary cost such as the daily allowance, cost for transport and spare parts. On the other hand, clerical procedure involved in the organization, such as the establishment or organizational change of WMO and Water Board, setting of water fee, report to Zone Water Mines & Energy Depart and Water Resource Bureau, carry out through the Woreda Office. However, as the position to supervise WMO, Woreda Office does not conduct the periodic monitoring to figure out the current condition of water supply facilities and management situation.

Table7 Available Support Range of Woreda Office

Small town	Support of Hardware				Support of Software				Procedures for repair from WMO
	Repair	Supply of spare parts*	Support of parts procurement	Funding	Training of management funds	Technical advice	Technical training	Notice to Zone, RWRB	
Koshe	○					○		○	Pump repair is requested to RWRB, switchboard repair is requested to Zone. Engineer of Butajira maintains the pipe. Arranged after received the request from WMO
Kela						○		○	After received the request from WMO, submits request to Zone, then Zone submits to RWRB. 9 times of medium or more scale repair in a year
Tiya	○				○	○	○		Maintenance of facilities is carried out six times a year (labor cost, transportation expenses is burden by town).
Adilo		△	○		○	○	○	○	After the request from WMO, submits the document for application to Zone. WMO requests the repair to Zone and RWRB twice in year. Zone implements the monitoring of accounting and technical issues.
Teferi Kela		△	○					○	WMO requests the repair to the engineer of Zone through Woreda. If heavy equipment is needed, RWRB is requested.
Dalocha	○	△	○			○	○	○	Repair can be supported by engineer DAWDA hire, but repair of generator request to RWRB, repair of pump request to Zone.
Mito	○	△	○			○	○	○	Maintains water facilities 4 times in year. Repair the failure WMO can not repair, but request the repair of pump and generator to RWRB. Sometimes share the spare parts with WMO.
Alem Gebeya	○					○	○	○	after the request from WMO, maintain with WMO. After received report for repair, request the support to Zone or RWRB.
Kibet					○			○	Received the action plan from WMO, confirm the account. Requests the repair of generator to Zone. About three times a year, rent the construction vehicles from RWRB to WMO.
Tebela		△			○	○	○		Support the account of WMO every month. 2 to 3 times a year, conducts the consultations about water quality improvement and new facilities plan.

* Spare parts are provided by paying if WMO has stock.

（5）Operation and Maintenance Situation of WMOs

As mentioned above, WMO is supposed to repair minor failure of water facilities in the town. However, engineer of WMO are not necessarily got technical training relating to repair, skill level of engineer is extremely limited. For this reason, most of case is that WMO outsources the repair whenever the failures occur. In the case of minor failures, WMO ask the repair to the engineer of Woreda Office or repairman of neighboring cities. On the other hand, in case that heavy equipment of well cleaning is required, failure that require advanced technology and lot of money such as repair of generators and pumps, which correspondence of failure is difficult to WMO, since it takes the time to ensure the repair cost and to request the support to the upper organization such as Zone Water Mines & Energy Depart and Water Resource Bureau, trouble has occurred in supply of stable water. In addition, it is important that the extent of the failure is reported to the Woreda Office, and notified from Woreda Office to Zone Water Mines & Energy Depart and Water Resources Bureau, but there is no staff in Woreda Office who can determine the failure condition accurately. Therefore, it is necessary to carry out the capacity building for engineers WMO about basic skill for repairs at the time of failure and routine periodic inspection, and to build a system that WMO can judge the condition of failure and report to Woreda Office.

Table8 Situation of Correspondence for Repair

Small town	Public Faucet		WMO		Situation of Repair Correspondence
	Total	Available Number	Engineer	Technical Training	
Koshe	12	5	1		Requests to the engineer of neighboring town, or Zone or RWRB
Kela	15	12	2	○	Engineer WMO hired repair the minor failure. Repair of generator and pump is requested Zone through Woewda.
Tiya	4	3	0		Requests to Woreda.
Adilo	7	6	2	○	Engineer is hired for each failure. Requests several times in a year to Zone.
Teferi Kela	10	9	2		Engineer of WMO of Kebado can not repair, so requests the repair to Zone.
Dalocha	8	6	0		Engineer is hired for repair, but if he can not repair, requests the repair to Zone or RWRB.
Mito	10	8	0	○	Repair of pipe is done by WMO. Maintenance is conducted every day. Other repair is requested to Woreda. Repair of generator, pump is requested to RWRB.
Alem Gebeya	8	5	—	○	Maintenance is conducted with Woreda. Repair of pump is requested to RWRB through Woreda.
Kibet	16	11	1	○	Engineer hired by WMO conducts the maintenance of pipelines 7 times in a year. Generator and pump are repaired by Zone or RWRB.
Tebela	8	4	3	○	Engineer hired by WMO conducts the maintenance of spring (2 times/year), tank (every month), facilities (50 times/year). Generator and pump are repaired by Zone or RWRB.

WMO of target 10 town is managed by basically revenue of water fees. Water fees from public faucets is collected in cash during the open time of public faucets, by the water seller WMO employs, by each jerry can (20.0 L) and drum can. Additional collection of money, such as arrears, does not occur for settlement of accounts by cash.

On the other hand, private connections become widespread at 9 towns except Tiya. Invoice for water consumption is made and distributed, households which has Private Connection pay to WMO by measurement values of water meter set in each household. If there is a delinquency of water fees, cautions advice is conducted to delinquent n writing, after then, the procedure of cut off the water and court lawsuit are taken. In this way, although system of fee collection for Private Connection is developed, but the case the amount billed for several months is paid collectively is found also. While revenue increased is expected due to the new water supply facilities, Increase of delinquent due to the increase of Private Connection, defect of fee collection, and confusion on the accounting is apprehended. For the future, if existing fee collection system is used continuously, it is expected the shortage of fee collectors, therefore it is necessary to increase the personnel for water meter measurement, invoice distribution, fee collection, etc.

Collected water fee is deposit in the bank or microfinance by the accountant under the under the management of the leader of WMO except for the money for operating WMO. The main expense items are employment cost like salary, daily allowance, transportation costs, etc., energy bill, communication charge, operation and maintenance costs of water supply facilities like fuel, oil, repair costs, spare parts, etc. Revenue and expenditure of WMO is kept by the accountant by recording the monthly income and outcome to book. However, there are differences in management methods and ability by the town, therefore, Loss of the past account book, unknown numbers on account book, and miscalculation, etc. are seen. Moreover, depending on a town, the amount of gross expenditure of the month may exceed the amount of revenue from a water charge, sometimes negative balance occurs. In the month it is difficult to manage the water supply facilities only by the water fee, installation fees for household connection, water meter rental fee, repair fee of household connection is compensated. However, if the money is insufficient

yet, saving money of WMO and donations are compensated.

Table9 Annual Revenue and Expenditure of WMO

Unit: Birr

Small town	2010/11			2011/12			2012/13		
	Revenue	Expense	Balance	Revenue	Expense	Balance	Revenue	Expense	Balance
Koshe	***	***	***	***	***	***	229,145	379,523	-150,378
Kela	81,395	72,577	8,818	98,098	130,945	-32,847	156,286	162,178	-5,892
Tiya	38,070	28,618	9,452	37,776	27,459	10,317	46,398	21,462	24,936
Adilo	***	50,762	***	255,294	226,417	28,877	255,114	290,927	-35,813
Teferi Kela	63,588	51,570	12,018	84,489	55,680	28,809	79,911	56,100	23,811
Dalocha	212,660	196,058	16,602	200,861	184,078	16,783	216,194	203,452	12,742
Mito	***	***	***	235,000	115,000	120,000	248,000	144,000	104,000
Alem Gebeya	211,355	175,792	35,563	224,345	182,490	41,855	238,640	205,362	33,278
Kibet	257,270	331,539	-74,269	220,926	393,806	-172,880	288,667	430,106	-141,439
Tebela	62,200	22,800	39,400	87,500	39,600	47,900	97,753	48,000	49,753

（6）Water-borne Disease

The people of each towns is using water from public faucets, household connection, surface water such as rainwater, rivers, swamps, ponds, and shallow wells. Therefore, many households use rainwater and surface water in the rainy season. Moreover, it is confirmed that even the household utilizes public faucets and household connection, since there are problem about the condition and status of utilization of existing water supply facilities, people are taking insanitary water as a result. The following table is the number and ratio of patients concern about the water-borne diseases of one year and each town. For the relationship between the ingestion of insanitary water and disease, it is considered that reduction of morbidity is expected by consciousness of presidents is improved.

Table10 Ratio of Water-borne Disease

Unit：person/%

Small town	Population	Water-born Disease									
		No.1		No.2		No.3		No.4		No.5	
Koshe	9,882	Diarrhea		Dermatosis		Acute gastroenteritis		Dysentery			
		919	9.3%	932	9.4%	753	7.6%	736	7.4%	***	***
Kela	5,054	Typhoid		Acute gastroenteritis		Parasitosis		Diarrhea			
		2,284	45.2%	1,395	27.6%	503	10.0%	349	6.9%	***	***
Tiya	2,782	Typhoid		Acute gastroenteritis		Helminthiasis		Dermatosis		Diarrhea	
		473	17.0%	331	11.9%	181	6.5%	151	5.4%	87	3.1%
Adilo	6,693	Typhoid		Acute gastroenteritis		Helminthiasis		Dermatosis			
		620	9.3%	287	4.3%	275	4.1%	115	1.7%	***	***
Teferi Kela	4,778	Diarrhea		Helminthiasis		Typhoid		Dermatosis			
		792	16.6%	563	11.8%	417	8.7%	140	2.9%	***	***
Dalocha	9,756	Diarrhea		Typhoid		Helminthiasis		Dermatosis			
		2,652	27.2%	2,417	24.8%	504	5.2%	165	1.7%	***	***
Mito	4,711	Typhoid		Epidemic typhus		Dermatosis		Intestinal parasite			
		1,570	33.3%	502	10.7%	471	10.0%	430	9.1%	***	***
Alem Gebeya	5,251	Diarrhea		Helminthiasis		Typhoid		Dermatosis			
		1,201	22.9%	874	16.6%	271	5.2%	149	2.8%	***	***
Kibet	8,155	Acute gastroenteritis		Dysentery		Dermatosis		Epidemic typhus			
		2,408	29.5%	1,836	22.5%	1,066	13.1%	777	9.5%	***	***
Tebela	8,973	Typhoid		Diarrhea		Dermatosis					
		1,873	20.9%	299	3.3%	281	3.1%	***	***	***	***

* %: Total prevalence for the population

1 – 2 Background to implement the soft component

Water supply facilities are operating and maintaining by WMO in each town, some problems are found in current condition. The water supply facilities improved by the Project are planned by the contents and scale that WMO can operate and maintain. However, there are some points that the capability of present system for operation and maintenance is insufficient.

Problem 1: The support system to WMO is not fully recognized.

The fundamental structure (line) on the administration which supports in order of Water Resource Bureau, Zone Water Mines & Energy Depart, Woreda Office, and WMO exists. And also, cooperation on the administrative procedures between each organization exists. However, the task of Woreda Office, which is closer to WMO, mainly has the support for water supply facilities in rural areas, so, support for the town is not sufficient. in addition, although Water Resource Bureau and Zone Water Mines & Energy Depart know such a situation, the improvement plan in particular is not taken. Moreover, neither the failure prevention by daily maintenance nor leadership concerning about operation and maintenance, such as securement of the repair cost at the time of failure and the report to Water Resource Bureau and Zone Water Mines & Energy Depart at the time of major failure is fully performed to the Woreda Office and WMO. As a result, problems, such as the shortage of repair costs, delay of corresponding to repair by un-reporting to the upper organization, and lack of water supply, have occurred. Therefore, it is necessary to make each upper organization recognize each role, and to strengthen cooperation between organizations. On the other hand, since the member of WMO is fundamentally elected from residents, WMO is main users of water supply facilities. Therefore, the residents in connection with management also need to understand the role in management. For the construction of new water supply facilities, in order to enhance the sense of ownership of all stakeholders, the mutual understanding between the parties is required.

Problem 2: System of operation and maintenance of WMO towards new water supply facilities is insufficient.

In order to correspond to the increase in the household connection and water supply facility users accompanying implementation of the Project, including the need the establishment of Water Board, it is necessary to look over the system of operation and maintenance of WMO, and to consider suitable staff assignment and organization. In addition, it is necessary to improve the water fee collection method, a periodical maintenance of facilities, etc. about the contents of activity and terms of service.

Problem 3: The suitable water fee is not set up.

Essentially, in order to work out the required budget, the water fee which is the main income should set up the proper value. However, water fees in each town are set without any ground by the discretion of WMO. Therefore, there are towns which are insufficient of the budgets for repair and employment cost in the present condition. In future, with the construction of new facilities, further increase of the staff and the cost of operation and maintenance of WMO are assumed. Therefore, it is necessary to perform analysis of the present revenue and expenditure, to re-examine the water fee, and to re-set up a suitable water fee. Furthermore, it is necessary to get the understanding from residents about the amendment of water fee.

Problem 4: The capability of Woreda Office about operation and maintenance of water supply facilities is not enough.

Woreda Office is to offer the repair and technical advice to the failure which cannot respond by WMO. However, in fact, the simple work is the main activity for Woreda Office, such as the repair of hand dug well, hand pump, spring protection, and preliminary maintenance at rural area. Therefore, sufficient support to WMO is not performed. Moreover, at present, the technological level of Woreda Office is deficient in the basic knowledge about water supply facilities, proper monitoring for failure prevention and ability of leadership are insufficient.

From this situation, in order to prevent failure, it is necessary to grasp the working situation of water supply facilities exactly, and to perform periodical monitoring. Moreover, when the failure of water supply facilities which cannot respond by Woreda Office occurs, it is important to give the capability which grasps the situation correctly and it reports to Zone Water Mines & Energy Depart or Water Resource Bureau. Therefore, Woreda Office needs to master the basic knowledge about the water supply facility which is needed when periodical monitoring is carried out, capability to judge the grade of the failure of water supply facility, and they were accurately recorded, how to report to the upper organization timely, and the ability to calculate the expense of repair.

Problem 5: Operation and maintenance capability of WMO is not enough.

In the town, because of the lack of basic knowledge about the water supply facility, WMO is takes time to respond to minor repairs such as Filter replacement of diesel generator and replacement of tap of public faucets, normally the technological level of WMO can repair easily. Moreover, in an accounting side, some points which should be improved, such as the problem about fee collection, such as bullet payment of delay charge, delinquency, and threatening notice, mismatch of account book and operation record of facilities, loss of account book (past records), and lack of the knowledge about cash payment and receiving etc., appear here and there. Therefore, it is necessary to master fundamental knowledge and skill required in order that WMO may carry out the maintenance of the water supply facilities about the repair skill which can respond to slight failure, technic in the hardware side of the method of a periodic check, and skill in the soft side relevant to the administration of an organization.

Problem 6: Understanding of the residents about using of safe water is insufficient.

In the rainy season, since meteoric water, such as rain water and cistern water, is abundant, residents can obtain water easily without using the water of water supply facility. However, since use of meteoric water causes an increase in the disease rate of water-born diseases, such as diarrhea and typhoid, it is desirable to use safe water in all year. On the other hand, even if it uses safe water, the storage situation and some directions for use cause the same result as the meteoric water use. Therefore, residents need to understand promotion of utilization of the water supply facility which leads to securement of safe water and fundamental knowledge about the safe usage of water.

2. Objective of Soft Component

The objective of soft component is for the structure of operation and maintenance (O&M) for water supply

facilities by the self-help efforts of Water Management Organization (WMO) and the sustainable assistance of the implementation agency.

3. Output of Soft Component

In order to strengthen of O&M, the output (direct output) is defined after completion of Soft Component as follows.

Output 1: Comprehension of the support system for WMO.
Output 2: Preparation of O&M system for the expansion of water supply facilities.
Output 3: Formulation of the plan for the revision of the water fee.
Output 4: Strengthening of the capability of O&M by Woreda office.
Output 5: Strengthening of the capability of O&M by WMO.
Output 6: Obtaining the understanding of the residents regarding their usage of water in hygienic manners.

4. Confirmation Procedure of the Output Achievement

Indicators and achievement degree of the Soft Component are defined as below to ensure that WMO can carry out its responsibilities and to confirm the condition of the technical skills and the system for the smooth start-up of the Project.

Table11 Achievement Degree of Output

No.	Output	Confirmation item of output achievement	Measurement(draft)
Output1	Comprehension of the support system for WMO	Recognition of the each role including the residents and the person in charge for WMO	・Reporting outcome of hearing opinion ・Report of resident's meeting
Output2	Preparation of O&M system for the expansion of water supply facilities	Review the personnel composition of WMO, and the setting of rules regarding water and the facilities' utilization	・Preparation plan for WMO ・Terms of facility usage
Output3	Formulation of the plan for the revision of the water fee	・Formulation of the appropriate plan for the revision of the water fee ・Consent of residents for the revision of water fee	・Plan of revision of the water fee ・Report of resident's meeting
Output4	Strengthening of the capability of O&M by Woreda office.	・Comprehension of the content for the technical training and the acquisition of knowledge concerning maintenance and repare ・Draft plan for excution of monitoring	・Confirmation test ・Plan of the monitoring
Output5	Strengthening of the capability of O&M by WMO.	・Comprehension of the content for the technical training and the acquisition of knowledge concerning maintenance and repaire ・Preparation for the accounting operation	・Confirmation test ・Activity record ・Operation record ・Accounting book
Output6	Obtain an understatanding from the residents regarding the usage for the safety water.	・Elevate the sanitary consciousness ・Comprehension of the usage of the safety water	・Questionnaire for the residents (Hearing opinion for the residents)

5. Plan of Soft Component Activities (Input Plan)

5.1 Division of the Activities

The Soft component activities are categorized into two (2) phases: 1-Before and during construction [Formation of organization], 2-during construction and after completion [Strengthening of O&M and Sanitary education]. The activities will be carried out by the Japanese consultant with the cooperation of implementation agency (RWRB, Zonal Office and Woreda Office).

Phase 1 : Formation of organization(before construction - during construction)

Output 1	Comprehension of the support system for WMO	⇒	Activity1	: Consciousness of the Support system Implementing Agency
			Activity2	: Description of the corresponding matters of residents
Output 2	Preparation of O&M system for the expansion of water supply facilities	⇒	Activity3	: Formation of organization
			Activity4	: Making user rules for facilities (draft)
Output3	Establishment of a plan for the revision of the water fee	⇒	Activity5	: Establishment a plan for the revision of the water fee
			Activity6	: Announcement for the residents

Phase2 : Enhancement of capability of O&M and Sanitary education (during construction - after construction)

Output4	Strengthening of the capability of O&M by Woreda office.	⇒	Activity7	: Technical training (Woreda)
			Activity8	: Establishment a plan of Monitoring
Output5	Strengthening of the capability of O&M by WMO.	⇒	Activity9	: Technical training (WMO)
			Activity10	: Accounting training.(W.M.O)
Output6	Obtain the understanding of the residents regarding their use of the new safe water sources.	⇒	Activity11	: Sanitary education

5.2 Content of Activities

(1) Formation of Organization (during construction - after construction)

Output1: Comprehension of the Support System for WMOs

Activity1: Consciousness of the Support system- Implementing Agency

Ten towns targeted in this project are under the jurisdiction of 9 Woreda (Kela, Tiya are included in one town), which is also under control of 5 zones.

Consultation with RWRB, Zonal Office should be carried out in advance in order to obtain an understanding of the content of activities and basic policy. After that, the workshop will be held for the C/P of RWRB and people concerned in Zonal Office. In addition, the workshop concerning O&M of the water facilities for the WMO at the initiative of Woreda office will be conducted. In the workshop, an analysis of stakeholders will be conducted in order to encourage a sense of ownership. All stakeholders should understand the current situation and the problems and clarify the role of each organization and the cooperative relation to support the organization of WMO.

Facilitator	Activity form	Target participants	Implementation site	Time required of planning	Number of days required
Consultant (Japanese/Local)	Meeting	Regional water resource bureau	Office of Regional water resource bureau	Preparation in advance:2h Meeting:3h Preparation meeting concerning Joint meeting with C/P and annoucement for Zone:4h	1.5days
Regional water resource bureau(C/P) Consultant(Japanese/ Local)	Meeting	Zonal office	Each Zonal office (5 Zone)	5 Zone x 3h = 15h Transfer: 5 Zone x 3h = 15h	4days
Regional water resource bureau(C/P) Zonal office Consultant(Japanese/ Local)	Workshop	Woreda office (9 Woreda)	Each Zonal office (5 Zone)	5 Zone x4h = 20h	2.5days
Woreda office Consultant(Japanese/ Local)	Workshop	WMO (10town)	Each Woreda office (9 Woreda)	9 Woreda x 3h=27h Transfer: 9 Woreda x 2h=18h	6days
Total number of days (10Town)					14days

Activity2: Description of the corresponding matters of residents

Woreda office and WMO will host a workshop as a facilitator for the residents to gain an understanding of their frank opinions, problems, complaints about current water facilities and the means for O&M by WMO. Meanwhile, during construction or after the donation of new facilities, since the cooperation and support from the residents is indispensable for the construction of new water supply facilities, the workshop will be for the purpose of recognition of the importance of O&M and the role of residents in the early stages.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office WMO Consultant (Japanese/Local)	Workshop	Town Residents (10Town)	Meeting place of Town or Office of WMO	10 Town x 3h = 30h Transfer: Hawassa→Town(RT)+Each Town(RT)=40h(Total)	10days
Total number of days (10Town)					10days

Output2: Preparation of O&M System for the Expansion of Water Supply Facilities

Activity3: Formation of organization

A workshop will be held for the current WMO to review the past activities, and clarify the issues and problems. Considering the results of the workshop, an appropriate method of member selection, roles of members, the selection system, and operation manual for the organization should be examined for the O&M that takes into account the expansion of water supply facilities in the future. Particularly, since there is no WMO in Teferi and Kela, maintenance information of WMO will be obtained from Kebado which is now managed remotely, thereby, people in Teferi and Kela could consult it to establish a new organization.

As a result of these activities, each town should prepare a plan for the WMO, then the employment plan could be visually recognized taking the necessary staff in the future into consideration. Regarding the organizational changes based on this project, therefore the implementation agency will continue to provide support in this regard after the completion of the soft component.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office WMO Consultant (Japanese/Local)	Workshop	WMO (10Town)	Office of WMO	10 Town x 4h = 40h Transfer: Hawassa→Town(RT)+Each Town(RT)=40h(Total)	11days
Total number of days (10Town)					11days

Activity4: Establishment of terms of facility use

A workshop will be held for the WMO as facilitator Woreda office, analysis of problems concerning the current water use and O&M of water supply facilities is performed. Considering the results, each town will formulate terms of facility use based on the prepared plan for the WMO in Activity 3. After checking with the

South Regional Water Resource Bureau whether there are any terms as mentioned above, various items should be included in the terms such as how break-downs will be dealt with (repairs), plan of monitoring, collection system of water fees as established in activity 5, and special measures regarding users who are unable to pay water fees. The workshop can help the WMOs to recognize the necessity of O&M of the water supply facilities, and at the same time, it enables the woreda office to gain skills for facilitating OJT training. By utilizing the terms of facility usage, therefore the implementation agency will continue to provide support after the completion of the soft component to ensure O&M activities run smoothly into the future.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office WMO Consultant (Japanese/Local)	Workshop	WMO (10Town)	Office of WMO	10 Town x 6h(2times) = 60h Transfer: 10Town x 2h x 2times = 40h	14days
Total number of days (10Town)					14days

Output 3: Formulation of an Appropriate Plan for WaterFfee Revision

Activity5: Formulation of a plan for revision of the water fee

Current water fee, average monthly expenditure, reserve fund for O&M etc. will be selected as necessary items for operation of WMO on the basis of the assumed water fee which was calculated in the preparation survey. Obtaining advice from the woreda office, a new rate and period of revision, and operation method should be considered regarding the above items. In order to revise the water fee gradually based on this Project, therefore the implementation agency will continue to provide support the Woreda Offices and WMOs in this regard after the completion of the soft component.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office WMO Consultant (Japanese/Local)	Workshop	WMO (10Town)	Office of WMO	10 Town x 4h = 40h Transfer: Hawassa→Town(RT)+Each Town(RT)=40h(Total)	11days
Total number of days (10Town)					11days

Activity6: Announcement for the residents

The meeting for the residents of each town will be held. Mainly, the woreda office should obtain the understanding of the residents by explaining the facilities, the roles of residents and of the WMO regarding O&M, and the necessity of revising the water fee and payments. In particular, regarding the revision of water fees, since there is a possibility that residents might object to the proposed revisions to the water fees and to the timing of the fee revisions, it is important to have a workshop and to deepen residents' understanding of the necessity of fee revision to avoid a top-down approach.

Resident meetings will be held depending on the progress of the Project (construction). The number of participants and level of understanding (interest) shall be confirmed. The activities to gain the understanding of the residents is essential, therefore the implementation agency will continue to provide support in this regard after the completion of the soft component.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
WMO Woreda office Consultant (Japanese/Local)	Workshop	Town residents (10Town)	Meeting place of Town or Office of WMO	10 Town x 6h(2times) = 60h Transfer: 10Town x 2h x 2times = 40h	14days
Total number of days (10Town)					14days

(2) O&M and Sanitary Education (during and after construction)

Output4: Strengthening of the Capability of O&M by Woreda Office.

Activity7: Technical training (Woreda)

For the sustained O&M of water facilities, it is indispensable for the woreda office to support the WMOs, which are in charge of daily O&M for the facilities, but the technical capabilities of the Woreda office is not currently at a sufficient level. Therefore, practical training will be given to the Woreda office on fundamental knowledge, break down diagnostics and reporting and repair method. The training will be in accordance to the scale of the break down, and in so doing will give the trainees the ability to judge what kind of repairs are necessary (how and who should deal with an issue). In consideration of the capacity of the woreda office and the equipment, it is aimed so that woreda office members can be conscious of their actual capability of handling serious break downs. If they are unable to deal with the issue, they will need to learn steps that need to be taken so that they can rapidly ask upper agencies (zone water office or RWRB) for assistance in dealing with the issue.

For a minor break down, they should increase the technical level of WMOs by giving them direct instructs. Staff members who obtained the skills in the OJT will become an instructor for the technical training in activity 9.It is planned to dispatch a member of EWTI as an instructor for this OJT.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
EWTI Consultant (Japanese/Local)	Training	Woreda office (9 Woreda which have jurisdiction over 10Town)	Office of WMO(3blocks)	3blocks x 14h = 42h Transfer: 5h x RT x 3times = 30h(Addis→Hawassa EWTI staffs) Hawassa→Town(RT)+Each bloc(RT)=24h(Total)	13days(EWTI) 10days (Japanese&Local Consultants)
Total number of days (10Town, Japanese consultants)					10days

Activity8: Making a monitoring plan

Woreda office shall examine the content of monitoring for the WMO and create a monitoring sheet to confirm that the facilities are operated without fail. Operating status, the number of break downs, repair status, balance of payments, the situation of fee collection, WMO's demands/request with respect to the woreda office and so on will be targeted by the woreda office as part of its regular monitoring activities.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Consultant (Japanese/Local)	Workshop	Woreda office (9Woreda)	Woreda office (9Woreda)	9Woreda x 6h = 54h Transfer: 9Woreda x 2h = 18h	10days
Total number of days (10Town)					10days

Output5: Strengthening of the capability of O&M by WMO

Activity9: Technical Training (WMO)

Daily maintenance should be performed by WMO to realize a continuous system for O&M. It is desirable that minor repairs be conducted by themselves. Therefore, the Woreda office personnel who were given technical training in Activity 7 will act as facilitators for the practical training of daily maintenance, support system for minor break downs, and technical training for the O&M concerning the procurement of spare parts. At the same time, necessary fundamental knowledge to understand the conditions behind the break down such as the names of the facility parts/equipment and the normal state (know how it should be so as to know when there is an abnormality) and the reporting method are to be instructed. Additionally, operation control is to be practiced in the training because the pumps are to be operated manually. Furthermore, activity record and operation ledger shall be updated to know the actual condition of water facilities, and also the method of registering and reporting to the Woreda office should be taught.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office Consultant (Japanese/Local)	Training	WMO	Office of WMO (10Town)	10 Town x 10h(2times) = 100h Transfer: 10 Town x 2times x 2h = 40h	20days
Total number of days (10Town)					20days

Activity10: Accounting training (WMO)

Accounting training regarding administrative work will be held for the WMO, such as collecting water fees, management method, entry and unification of the account book, and operation records for water facilities. In addition, in case of a request of repairs from WMO, the Woreda office shall review how much it charges for repairs (including daily allowance, transportation fee) and its method of calculating expense of part replacement. All information will be shared among organizations concerned.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
Woreda office Consultant (Japanese/Local)	Training	WMO	Office of WMO (10Town)	10 Town x 5h = 50h Transfer: 10 Town x 2h = 20h	10days
Total number of days (10Town)					10days

Output 6: Obtaining the Understanding of the Residents Regarding their Usage of the New Safe Water Supply

Activity 11: Sanitary education

Due to the low level of personal hygiene, residents do not use the water facilities continuously. In spite of the fact that it is a cause of water-borne diseases, many households use rain water or storage reservoir water. Continuous use of rainwater is one of the factors that are preventing an increase in the utilization of water supply facilities, which is also affecting the cost estimation concerning O&M of water supply facilities. Consequently, WMO shall take the initiative in carrying out the sanitary education for the residents, in order to encourage the use of facilities sustainably, improve the health status of residents, and to achieve a sustainable system of O&M. In consideration of efficiency, rather than giving individual guidance to each household, the target of the sanitary education will be the PTA (Parents-Teacher Association) and elementary students and so on, so that those who obtaining the knowledge of sanitation can disseminate the hygiene concepts within their own households. The lectures include the prevention of water-borne diseases, spreading epidemic and general knowledge of sanitation about nutrition and avoid overworking. Even if a safe water source is obtained, without taking care (hygiene) about water use and storage, the results would be the same as if rain water was used. Therefore, this education will include lectures on how to use water safely, namely in a hygienic manner.

Facilitator	Activity form	Target participants	Implementation site	Time required	Number of days required
WMO Consultant (Japanese/Local)	Training	Town Residents	Meeting place of Town etc. (10Town)	10 Town x 5h = 50h (Including preparation period) Transfer: between towns 10 Town x 2h = 20h	10days
Total number of days (10Town)					10days

Table12 Implementation Plan for Soft Component

period		Activity		Contents of activity	Form of activity／Place	Object person	Implementing person	Relevant output ／Output
Phase1（Before～During construction）	Formation of organization	Output 1	1	Consciousness of the support system－Comprehension of the role of each concerned agency for WMO by workshop	Workshop/ Regional water resource bureau and the woreda office	Regional water resource bureau Zonal office Woreda office WMO	Japanese consultant x 1 (14days) Local consultant x 1 (14days)	Output 1／Hearing Reporting of result
			2	Description of the corresponding matters of residents－Hearing from the residents regarding acutual support system, explanation of their role	Workshop／Water supply service office	Residents	Woreda office/WMO Japanese consultant x 1(10days) Local consultant x 1 (10days)	Output 1／Resident meeting ・Report
		Output 2	3	Formation of organization－Consideration of method of operation for WMO after eamine the current problems by Implementation of workshop	Workshop／Water supply service office	WMO	Woreda office Japanese consultant x 1(11days) Local consultant x 1 (11days)	Output 2／WMO Plan of maintenance
			4	Making user rules for facilities(draft)－Conducting an analysys of current water use and O&M for facilities, making user rules in each town	Workshop／Water supply service office	WMO	Woreda office Japanese consultant x 1(14days) Local consultant x 1 (14days)	Output 2／User rule of facilities(draft)
		Output 3	5	Establishment a plan for the revision of the water fee－Based on the assumed water fee calculated by preparatory survey, selecting the items required for O&M, the revision of the water fees and the timing of the revision should be determined	Workshop／Water supply service office	WMO	Woreda office Japanese consultant x 1(11days) Local consultant x 1 (11days)	Output 3／Plan of the revision of water fee
			6	Announcement for the residents－Obtaining the residesnts comprehension concerning the revision of water fee formulated in activity 5 and the obligation for the payment	Workshop／Water supply service office	Residents	Woreda office/WMO Japanese consultant x 1(14days) Local consultant x 1 (14days)	Output 3／Resident meeting Report
Phase2 (During and after construction)	Enhancement of capability for O&M and Sanitary education	Output 4	7	Technical training(Woreda)－Technical training will be held for the woreda office concerning the fundamental knowledge and repair of the water facilities	Training／Woreda office	Woreda office	EWTI(13days) Japanese consultant x 1(10days) Local consultant x 1 (10days)	Output 4／Manual of Maintenance and Repair
			8	Establishment a plan of monitoring－making a monitoring sheet for the regular monitoring by the woreda office	Training／Woreda office	Woreda office	Japanese consultant x 1 (10days) Local consultant x 1 (10days)	Output 4／Monitoring Plan document
		Output 5	9	Technical training－Fundamental technical training will be held for the person of WMO who is in charge of repair of facilities	Training／Water supply service office	WMO	Woreda office Japanese consultant x 1(20days) Local consultant x 1 (20days)	Output 5／Record of activity Operatio ledger
			10	Accounting training－Technical training regarding administrative work will be held for the person of WMO who is incharge of acconting	Training／Water supply service office	WMO	Woreda office Japanese consultant x 1(10days) Local consultant x 1 (10days)	Output 5／Financial records
		Output 6	11	Sanitary education－Conducting a workshop of sanitary education and safe water for the residents of town	Workshop／Water supply service office or shool	Residents	WMO Japanese consultant x 1(10days) Local consultant x 1 (10days)	Output 6／Sanitary education Implementation report

6．Procurement Method of Implementation Resources

The human resources for the activity of Soft Component are as follows.

(1) The Japanese Consultant

Japanese consultants will be in charge of plan management such as preparation, instructions, conduct, reporting for all activities. In order to summarize them in a short term, people who have a project experience in Ethiopia and full knowledge of Soft component, in addition, understand the situation related to the target town would be required. Therefore, providing people from the consultants contracted in the detail design shall be suited.

(2) Local Consultants

Staffs of the WMO, residents of each town speak in Amharic, they know very little English. For this reason, local consultants who will support Japanese consultants and be familiar with a local situation should be required. Local engineer employed in the preparation research can speak English and Amharic and have had also experiences of consultation with Town WMO, they are adequate to this activity.

(3) EWTI

It is necessary for the O&M of the water supply facilities to enhance a technical capability for the Woreda staff. In order to learn the technical skills for Woreda staffs in the technical training in activity 7, a staff from EWTI who has advanced technical skills and can lecture in Amharic should be adopted. Contact EWTI in advance regarding the programs, an instructor will be sent.

(4) Woreda office

Technical training for the engineer of Town WMO in Activity 9 should be planned mainly for the Woreda staffs who have obtained the skills in Activity 7. Additionally, cooperation of Woreda office shall be needed to support the enhancement of capability for WMO with the Consultants. Consequently, at the beginning of Activity 1, Regional water resource bureau should ask Woreda office to cooperate with them.

(5) Regional water resource bureau, Zonal office

Cooperation of Regional water resource bureau and Zonal office would be required in order to support the WMO and Woreda office and assist comprehensively the O&M for the water supply facilities in SNNPR. Thus, at the commencement of the Soft component, Regional water resource bureau or Zonal office should be requested to cooperate for each of the activities.

7. Implementation Schedule of Soft component

The activities to be implemented in the soft component are divided into the following two phases: “Phase 1: Formulation of organization” and “Phase 2: Enhancement of capability of O&M and Sanitary education”. The Japanese consultant will perform in the spot dispatch of 4 times (Total: 5.4 months). “Formulation of organization” will be implemented in 3 construction zones targeting 10 towns from the commencement of work and during work, “Enhancement of capability of O&M and Sanitary education” will be conducted three times after construction from under construction.

As for the number of days required for the operation for each task, Activity 1 in Phase 1 was carried out for all stakeholders for 14 days, then the number of days required each time could be calculated as [6.0 days x number of towns]. In addition, Amharic is used as the official language and local consultants should be employed in case of absence of Japanese consultants in order to continue the activities and implement the monitoring. Local consultants will report the progress of the project to the Japanese consultants making contact with WMO and Woreda office closely. In response to the results, the Japanese consultants should correct the discrepancy with the overall plan and ask the local staffs to feedback.

Table13 Amount of Time Required (Japanese Consultant)

unit : days

Activities		Days	No. of target town	Small town
1st	Activity 1	14.0	10	All towns
	Phase1	18.0	3	Tiya、Kela、Adilo
	Voyage	4.0		
	Internal migration	1.0		
	Reporting	2.0		
2nd	Phase2	18.0	3	Tiya、Kela、Adilo
	Phase1	18.0	3	Kibat、Koshe、Tebela
	Voyage	4.0		
	Internal migration	1.0		
	Reporting	2.0		
3rd	Phase1	24.0	4	Dalocha、Mito、Alem gebeya、Teferi kela
	Phase2	18.0	3	Kibat、Koshe、Tebela
	Voyage	4.0		
	Internal migration	1.0		
	Reporting	2.0		
4th	Phase2	24.0	4	Dalocha、Mito、Alem gebeya、Teferi kela
	Voyage	4.0		
	Internal migration	2.0		
	Reporting	2.0		
Total		163.0		5.40 M/M

8. Output for Soft Component

Outputs for the Soft Component are as follows.

- After completion of the Soft Component : Final Report
- Each dispatch of Japanese consultants : Implementation Report of the soft component
- Activity 1: Consciousness of the support : Report of hearing results system -Implementation agency
- Activity 2: Consciousness of the support system: Report of resident meeting (minutes) -Residents
- Activity 3: Formation of organization : Preparation plan for organization of WMO
- Activity 4: Establishment of user terms : User terms for facilities for facilities
- Activity 5: Establishment of a plan : Plan for the revision of the water fee for the revision of the water fee
- Activity 6: Announcement for the residents: Report of resident meeting (minutes)
- Activity 7: Technical training (Woreda) : Manual of Maintenance and Repair
- Activity 8: Establishment a plan of monitoring : Plan for the monitoring
- Activity 9: Technical training(WMO) : Activity record, Operation ledger
- Activity 10: Accounting training(WMO) : Accounting book
- Activity 11: Sanitary education : Implementation Report of Sanitary education

9. Cost Estimation for Soft Component

Cost estimation for the Soft component is as indicated below.

Table14 Cost Estimation for Soft Component

Items	Price (JY)
Personnel Expenses	4,455,333
Direct Cost	4,499,008
Indirect Cost	5,702,827
Total	14,657,168

１０．Obligation of the recipient country

In order to achieve the objective of Soft component, in addition to the results of Soft component, it is essential for the continuous O&M by WMO and sustained support by Implementation agency. Additionally, supports of Implementation agency should be required to conduct the organized O&M in this plan continuously and smoothly. Necessary debt at the level of each organization is as follows.

[Regional Water Resource Bureau, Zonal Office, Woreda Office]

- Management of all the programs through collaboration with the Japanese consultants.
- Request for cooperation of related department for the implementation of the program
- Provision of staff of Implementation agency, and expense of field activities, daily allowance and accommodation fee
- Joint meeting, Implementation of each training and work shop, Ensuring of human resources for the work shop, Preparation of meeting place, Defrayment for the operation.
- Regular report from the Woreda office to Zonal office or Regional water resource bureau
- Technical assistance for the WMO
- Monitoring of project, Making a report of monitoring

[WMO]

- Cooperation for the Japanese consultants in the local activity
- Ensuring of personnel at the resident's meeting, adjustment of schedule, preparation for the meeting place, expense of operation.

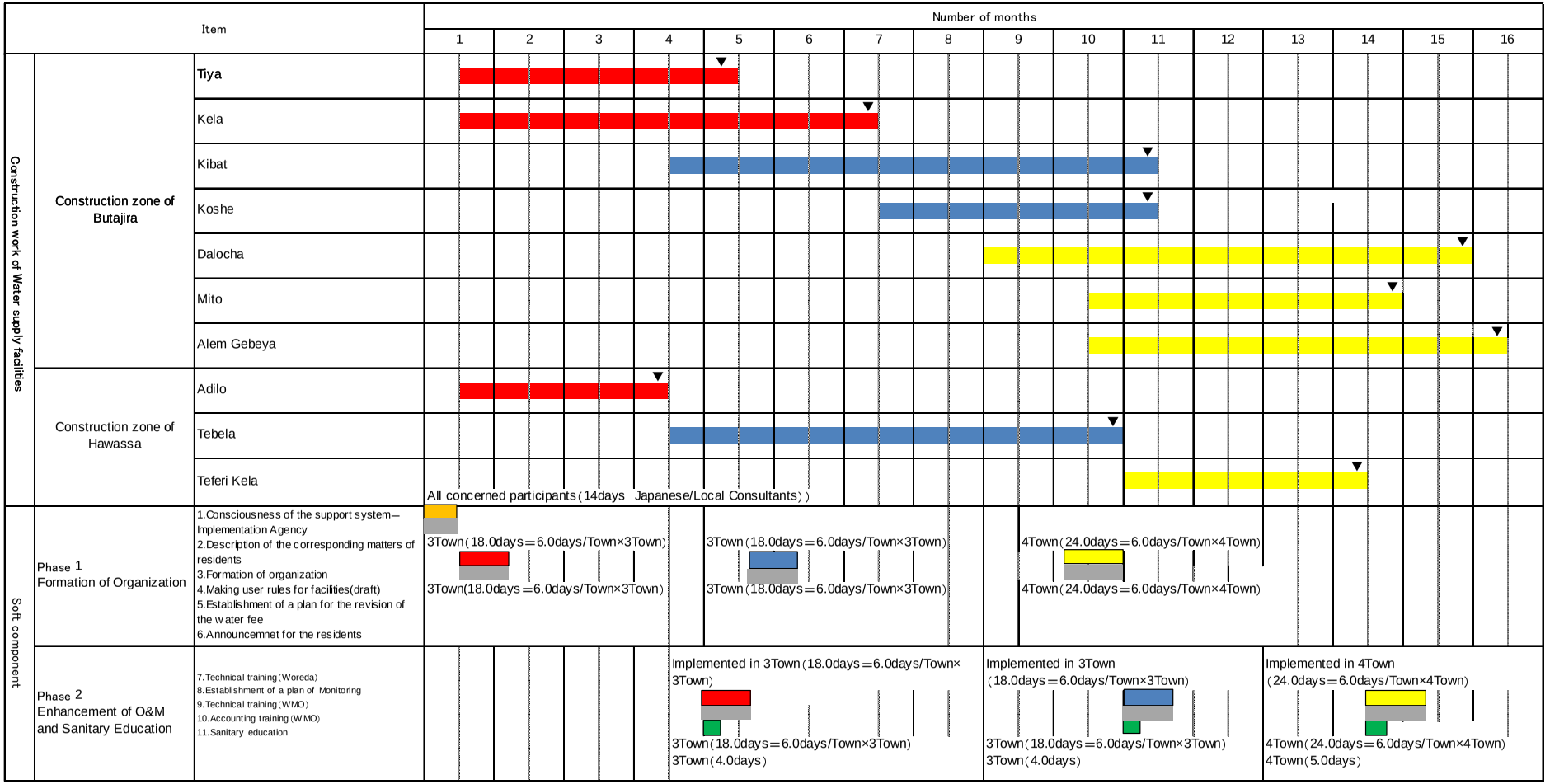
If the annual budget has not been recorded in the implementation agency such as transportation expenses for the people concerned, daily allowance, accommodation fee, etc., difficulty of holding the workshop will be expected. Consequently, in view of the process for the project, preliminary budget application is important.

Annex1

Table15 PDM for Soft Component

Summary of Project	Index	Means of procurement	Outside condition
Overall goal O&M for the water supply facilities fonctions sustainably by self-help efforts of WMO and Continuous support by Implementation agency	All facilities is running throughout the year.	Operation ledger of facilities.	
Objective of Soft component O&M for water supply facilities by WMO and Implementation agency should be organized	・Each stakeholder understand the role of organization ・Response capacity of O&M for the water supply facilities should be improved	Reporting outcome of hearing opinion Preparation plan for WMO Terms of facility usage Activity record Accounting book	Regional water resource bureau does not change the policy of O&M under the supervision of WMO
Output 1.Awareness of support system for WMO	1.1The role of each stakeholder for WMO should be clarified 1.2 Residents should be aware of their role.	Reporting outcome of hearing opinion Report of resident's meeting	Organization concerned have no objection against the facilities are operated by residents
2.O&M for the expantion of water supply facilities will be arranged	2.1Review the personnel composition of WMO 2.2 Setting of rules regarding water and the facilities' utilization.	Preparation plan for WMO Terms of facility usage(draft)	
3.Formulation of the appropriate plan for the revision of the water fee	3.1Formulation of the appropriate plan for the revision of the water fee for the operation 3.2 Consent of residents for the revision of water fee should be obtained	Plan of revision of the water fee Report of residents meeting	
4.Strengthening of the capability of O&M by Woreda office	4.1The knowledge of maintenance and repais will be enhanced 4.2 Plan of monitoring will be formulated	Manual of the maintenance and repair Plan of monitoring Confirmation test	
5.Strengthening of the capability of O&M by WMO	5.1The knowledge of maintenance and repais will be enhanced 5.2Preparation for the accounting operation	Activity record Operation ledger for the facilities Accounting book Confirmation test	
6.Obtain the understanding of the residents regarding their use of the new safe water sources	6.1Elevate the sanitary consciousness 6.2Comprehension of the usage of the safe water	Hearing for the residesnts	
Activity			Precondition
Activity1:Consciousness of the support system-Implementation agency Activity2:Description of the corresponding matters of residents Activity3:Formation of organization Activity4:Making user rules for facilities(draft) Activity5:Establishment of a plan for the revision of the water fee Activity6:Announcement for the residents Activity7:Technical training (Woreda) Activity8:Establishment of a plan of monitoring Activity9:Technical training (WMO) Activity10:Accounting training Activity11:Sanitary education			All organizations concerned take an active part in the Project

Annex2



Soft component：Upper stage - Japanese Consultant、Middle stage(gray) - Local Consultant、Lower stage（green）：EWTI

Figure2 Outline of Implementation of Soft Component

Annex3

Table16 Basis of Calculation of Working Days for Soft Component

Unit: days

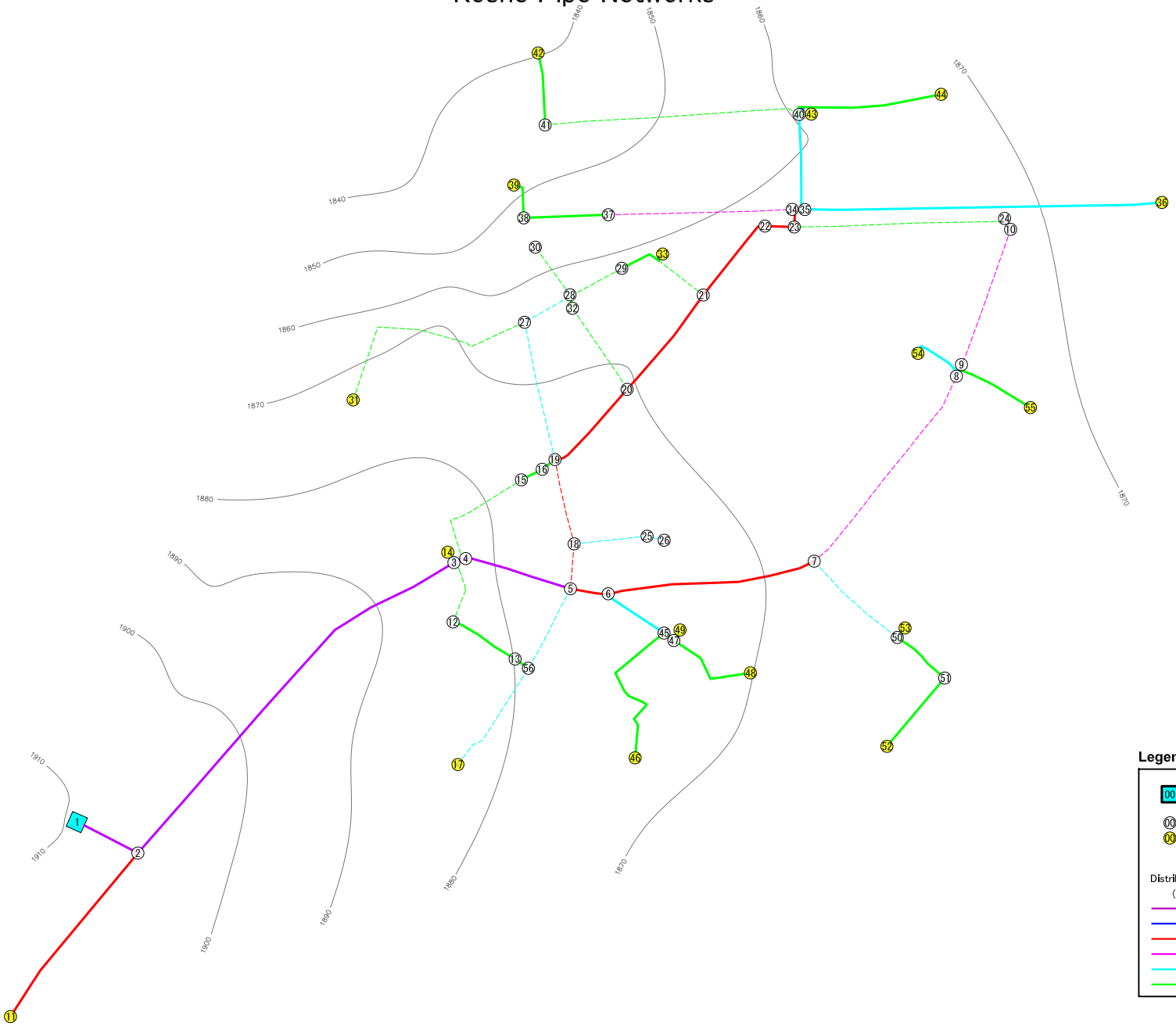
Period		Activities		Content of Activities	Target Audience	Implementer	Number of working days			Total number of days		
							Japanese consultant (1person)	Local consultant	EWTI	Japanese consultant (1person)	Local consultant	EWTI
Phase1 (Befor～Under Construction)	Formation of Ogranization	Output 1	1	Consciousness of the Support syster	Regional water resource bureau Zonal office Woreda office WMO	Regional water resource bureau Zonal office Woreda office Japanese consultant (Local consultant)	1.4	1.4		1.4	1.4	0.0
			2	Description of the corresponding matters of residents	Residents	Woreda office WMO (Japanese consultant) (Local consultant)	1.0	1.0		6.0	6.0	
		Output 2	3	Formation of Organization	WMO	Woreda office Japanese consultant (Local consultant)	1.1	1.1				
			4	Making user rules for facilities(draft)	WMO	Woreda office Japanese consultant (Local consultant)	1.4	1.4				
		Output 3	5	Establishment of a plan for revision o	WMO	Woreda office Japanese consultant (Local consultant)	1.1	1.1				
			6	Announcement for the residents	Residents	Woreda office WMO (Japanese consultant) (Local consultant)	1.4	1.4				
Phase 2 (Under～after Construction)	Enhancement of capability of O&M and Sanitary education	Output 4	7	Technical training(Woreda)	Woreda office	EWTI (Japanese consultant) (Local consultant)	1.0	1.0	1.3	6.0	6.0	1.3
			8	Establishment of a plan of Monitoring	Woreda office	Japanese consultant (Local consultant)	1.0	1.0				
		Output 5	9	Technical training(WMO)	WMO	Woreda office Japanese consultant (Local consultant)	2.0	2.0				
			10	Accounting training	WMO	Woreda office Japanese consultant (Local consultant)	1.0	1.0				
		Output 6	11	Sanitary education	Residents	WMO Japanese consultant (Local consultant)	1.0	1.0				
Total							13.4	13.4	1.3	13.4	13.4	1.3

Appendix 6

Other Relevant Data

Pipe Network Analysis

Koshe Pipe Networks



------Koshe <<Hazen-Williams Formula>>------

Tank	1	Maximum EHP	42.655	(m)
Node	55	Minimum EHP	1.657	(m)
Line	59	Maximum I	35.878	(‰)
Pump,Decom	0	Maximum V	0.852	(m/s)

Convergence Gap (cm)

Calculation 14 (times)

<< Explanatory Notes >>

- Node -
HP: Head Pressure
GL: Ground Level
EHP: Effectual Head Pressure
Qc: Consumption of Water

- Line -
D: Diameter
L: Length of Pipe
Coef: Friction Coefficient
Q: Quantity of Flow
V: Velocity of Flow
I: Hydraulic Gradient
HL: Head Loss
P: Add Pressure

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
1	1909.720	1909.720		0.000	-9.951	Reservoir Tank
2	1909.192	1905.668		3.524	0.000	
3	1906.164	1883.071		23.093	0.000	
4	1906.117	1882.410		23.707	0.000	
5	1905.536	1875.284		30.252	0.000	
6	1904.511	1873.565		30.946	0.000	
7	1902.502	1869.147		33.355	0.000	
8	1900.765	1867.137		33.628	0.000	
9	1900.758	1866.658		34.100	0.000	
10	1900.758	1869.152		31.606	0.000	
11	1909.040	1907.383		1.657	0.535	WF
12	1905.817	1884.136		21.681	0.000	
13	1905.428	1879.639		25.789	0.000	
14	1906.092	1883.245		22.847	0.535	WF
15	1902.656	1877.529		25.127	0.000	
16	1901.995	1875.842		26.153	0.000	
17	1904.458	1883.288		21.170	0.535	WF
18	1904.181	1875.885		28.296	0.000	
19	1901.574	1875.026		26.548	0.000	
20	1898.876	1870.555		28.321	0.803	PS,SS
21	1896.986	1864.739		32.247	0.000	
22	1895.569	1860.993		34.576	0.052	HC
23	1895.146	1861.332		33.814	0.000	
24	1895.146	1869.139		26.007	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
1	2	150.0	147.747	110	9.951	0.563	3.571	0.528	0.000
2	3	150.0	939.570	110	9.416	0.533	3.223	3.029	0.000
2	11	80.0	447.777	110	0.535	0.106	0.340	0.152	0.000
3	4	150.0	17.047	110	8.628	0.488	2.742	0.047	0.000
3	12	40.0	139.065	110	0.253	0.202	2.492	0.347	0.000
3	14	40.0	7.269	110	0.535	0.426	9.944	0.072	0.000
4	5	150.0	243.235	110	8.006	0.453	2.387	0.581	0.000
4	15	40.0	263.560	110	0.622	0.495	13.131	3.461	0.000
5	6	80.0	82.144	110	3.745	0.745	12.486	1.026	0.000
5	56	50.0	191.080	110	0.282	0.143	1.022	0.195	0.000
5	18	80.0	97.015	110	3.979	0.792	13.970	1.355	0.000
6	7	80.0	453.485	110	2.140	0.426	4.429	2.009	0.000
6	45	50.0	144.569	110	1.605	0.818	25.651	3.708	0.000
7	8	65.0	515.025	110	1.070	0.323	3.373	1.737	0.000
7	50	50.0	243.732	110	1.070	0.545	12.106	2.951	0.000
8	9	65.0	7.418	110	0.535	0.161	0.935	0.007	0.000
8	54	50.0	110.719	110	0.535	0.273	3.354	0.371	0.000
9	10	65.0	333.226	110	0.000	0.000	0.000	0.000	0.000
9	55	40.0	174.199	110	0.535	0.426	9.944	1.732	0.000
12	13	40.0	156.330	110	0.253	0.202	2.492	0.390	0.000
15	16	40.0	50.361	110	0.622	0.495	13.131	0.661	0.000
18	19	80.0	186.614	110	3.979	0.792	13.970	2.607	0.000
18	25	40.0	158.279	110	0.000	0.000	0.000	0.000	0.000
19	20	80.0	220.495	110	3.704	0.737	12.236	2.698	0.000

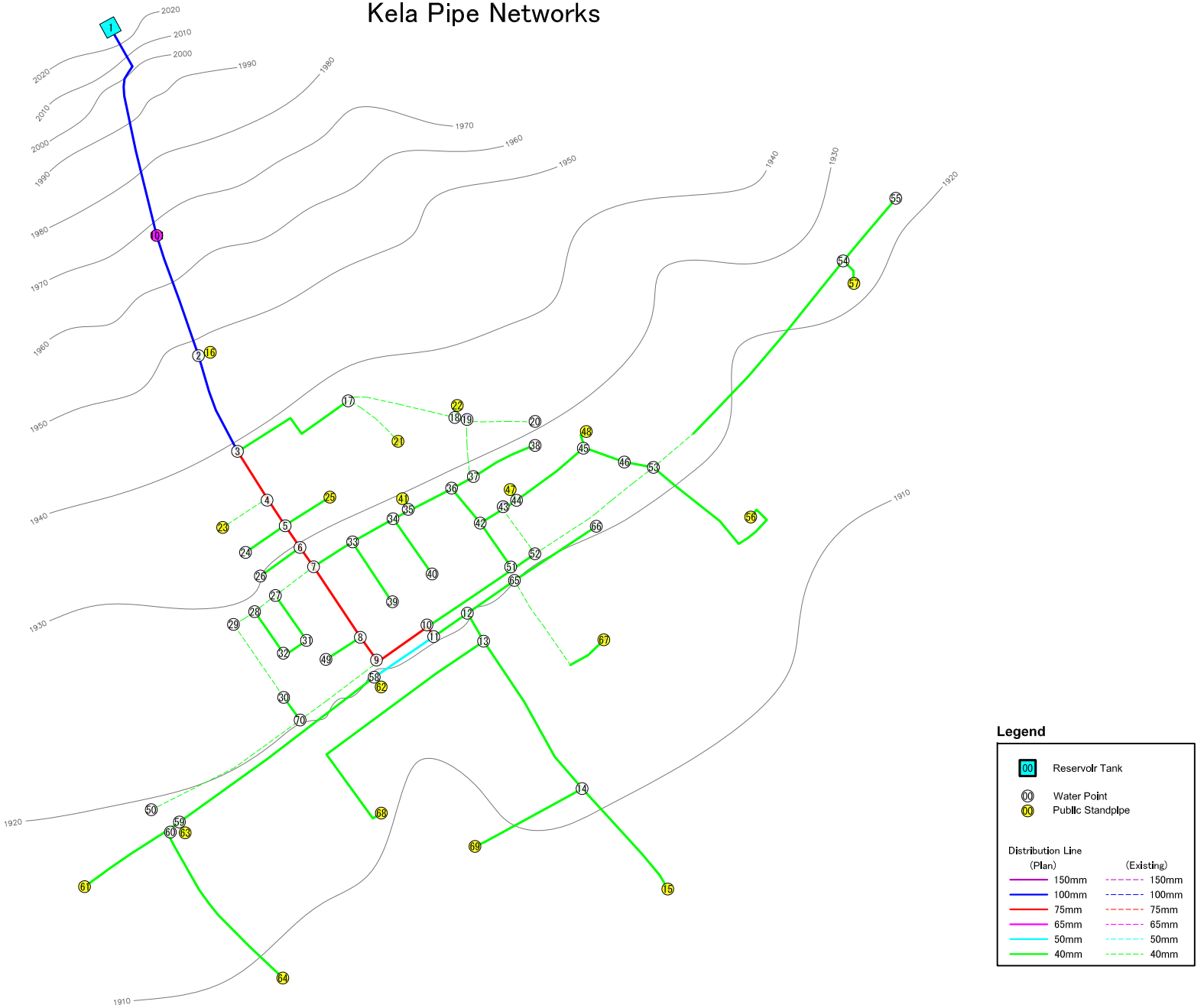
--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
25	1904.181	1872.823		31.358	0.000	
26	1904.181	1871.898		32.283	0.000	
27	1898.928	1865.020		33.908	0.000	
28	1898.741	1863.759		34.982	0.000	
29	1897.738	1862.937		34.801	0.000	
30	1898.741	1856.565		42.176	0.000	
31	1894.024	1875.027		18.997	0.535	WF
32	1898.749	1864.368		34.381	0.000	
33	1896.979	1861.995		34.984	0.535	WF
34	1894.890	1860.977		33.913	0.000	
35	1894.829	1860.943		33.886	0.000	
36	1892.221	1871.908		20.313	0.535	WF
37	1894.513	1858.187		36.326	0.000	
38	1892.699	1852.591		40.108	0.000	
39	1891.919	1849.846		42.073	0.535	WF
40	1889.336	1860.315		29.021	0.000	
41	1883.866	1848.883		34.983	0.000	
42	1882.400	1839.745		42.655	0.536	WF
43	1889.274	1860.834		28.440	0.535	WF
44	1886.197	1868.769		17.428	0.535	WF
45	1900.803	1872.038		28.765	0.000	
46	1897.199	1873.656		23.543	0.535	WF
47	1900.523	1872.038		28.485	0.000	
48	1898.256	1870.005		28.251	0.535	WF
49	1900.428	1872.038		28.390	0.535	WF
50	1899.552	1867.845		31.707	0.000	
51	1898.208	1867.193		31.015	0.000	
52	1896.290	1867.684		28.606	0.535	WF
53	1899.526	1867.830		31.696	0.535	WF
54	1900.393	1866.204		34.189	0.535	WF
55	1899.026	1868.599		30.427	0.535	WF
56	1905.341	1879.300		26.041	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
19	27	50.0	303.199	110	0.897	0.457	8.728	2.646	0.000
20	21	80.0	261.639	110	2.787	0.555	7.223	1.890	0.000
20	32	40.0	222.294	110	0.115	0.091	0.573	0.127	0.000
21	22	80.0	204.163	110	2.728	0.543	6.944	1.418	0.000
21	33	50.0	129.327	110	0.059	0.030	0.056	0.007	0.000
22	23	80.0	63.126	110	2.676	0.533	6.700	0.423	0.000
23	24	40.0	464.151	110	0.000	0.000	0.000	0.000	0.000
23	34	80.0	38.208	110	2.676	0.533	6.700	0.256	0.000
25	26	40.0	37.965	110	0.000	0.000	0.000	0.000	0.000
27	28	50.0	114.746	110	0.362	0.184	1.625	0.186	0.000
27	31	40.0	493.119	110	0.535	0.426	9.944	4.903	0.000
28	29	40.0	125.131	110	0.476	0.379	8.016	1.003	0.000
28	30	40.0	130.223	110	0.000	0.000	0.000	0.000	0.000
34	35	80.0	13.664	110	2.141	0.426	4.433	0.061	0.000
34	37	65.0	402.668	110	0.535	0.161	0.935	0.376	0.000
35	36	50.0	777.601	110	0.535	0.273	3.354	2.608	0.000
35	40	50.0	213.887	110	1.606	0.818	25.680	5.493	0.000
37	38	40.0	182.455	110	0.535	0.426	9.944	1.814	0.000
38	39	40.0	78.437	110	0.535	0.426	9.944	0.780	0.000
40	41	40.0	548.221	110	0.536	0.427	9.978	5.470	0.000
40	43	40.0	6.300	110	0.535	0.426	9.944	0.063	0.000
40	44	40.0	315.732	110	0.535	0.426	9.944	3.140	0.000
41	42	40.0	146.947	110	0.536	0.427	9.978	1.466	0.000
45	46	40.0	362.364	110	0.535	0.426	9.943	3.603	0.000
45	47	40.0	7.785	110	1.070	0.852	35.878	0.279	0.000
47	48	40.0	227.992	110	0.535	0.426	9.943	2.267	0.000
47	49	40.0	9.601	110	0.535	0.426	9.940	0.095	0.000
50	51	40.0	135.164	110	0.535	0.426	9.943	1.344	0.000
50	53	50.0	7.577	110	0.535	0.273	3.354	0.025	0.000
51	52	40.0	192.803	110	0.535	0.426	9.943	1.917	0.000
29	33	40.0	94.730	110	0.476	0.379	8.016	0.759	0.000
28	32	40.0	13.200	110	-0.115	-0.091	-0.573	-0.008	0.000
16	19	40.0	32.050	110	0.622	0.495	13.131	0.421	0.000
13	56	40.0	34.710	110	0.253	0.202	2.492	0.086	0.000
56	17	50.0	263.334	110	0.535	0.273	3.354	0.883	0.000

Kela Pipe Networks



------Kela <<Hazen-Williams Formula>>------

Tank	1	Maximum EHP	45.768	(m)
Node	70	Minimum EHP	0.000	(m)
Line	76	Maximum I	39.838	(‰)
Pump,Decom	1	Maximum V	0.901	(m/s)

Convergence Gap (cm)

Calculation 15 (times)

<< Explanatory Notes >>

- Node -
HP: Head Pressure
GL: Ground Level
EHP: Effectual Head Pressure
Qc: Consumption of Water

- Line -
D: Diameter
L: Length of Pipe
Coef: Friction Coefficient
Q: Quantity of Flow
V: Velocity of Flow
I: Hydraulic Gradient
HL: Head Loss
P: Add Pressure

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
1	2033.481	2033.481		0.000	-5.055	Reservoir Tank
2	1965.040	1948.611		16.429	0.000	
3	1963.632	1939.003		24.629	0.000	
4	1961.979	1934.691		27.288	0.000	
5	1961.114	1931.676		29.438	0.000	
6	1960.473	1929.715		30.758	0.000	
7	1959.924	1927.879		32.045	0.000	
8	1958.739	1921.506		37.233	0.000	
9	1958.319	1920.697		37.622	0.000	
10	1957.427	1919.230		38.197	0.000	
11	1957.301	1919.382		37.919	0.000	
12	1954.764	1920.142		34.622	0.000	
13	1953.589	1917.509		36.080	0.000	
14	1950.542	1910.984		39.558	0.000	
15	1949.916	1904.148		45.768	0.245	WF
16	1964.999	1947.839		17.160	0.245	WF
17	1959.059	1938.153		20.906	0.000	
18	1957.258	1933.940		23.318	0.000	
19	1957.249	1933.795		23.454	0.000	
20	1957.249	1930.478		26.771	0.000	
21	1958.753	1932.350		26.403	0.245	WF
22	1957.245	1933.940		23.305	0.245	WF
23	1961.721	1935.409		26.312	0.245	WF
24	1961.114	1932.389		28.725	0.000	
25	1960.862	1931.725		29.137	0.245	WF

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
1	101	100	343.295	110	5.055	0.644	7.339	2.520	-63.296
2	3	100	210.221	110	4.810	0.613	6.694	1.407	0.000
2	16	40	17.325	110	0.245	0.195	2.341	0.041	0.000
3	4	80	111.520	110	4.110	0.818	14.830	1.654	0.000
3	17	40	279.276	110	0.700	0.558	16.375	4.573	0.000
4	5	80	65.349	110	3.865	0.769	13.234	0.865	0.000
4	23	40	109.816	110	0.245	0.195	2.341	0.257	0.000
5	6	80	54.666	110	3.620	0.720	11.723	0.641	0.000
5	24	40	98.500	110	0.000	0.000	0.000	0.000	0.000
5	25	40	107.663	110	0.245	0.195	2.341	0.252	0.000
6	7	80	46.860	110	3.620	0.720	11.723	0.549	0.000
6	26	40	98.489	110	0.000	0.000	0.000	0.000	0.000
7	8	80	171.332	110	2.722	0.542	6.915	1.185	0.000
7	27	40	96.172	110	0.318	0.253	3.801	0.366	0.000
7	33	40	92.568	110	0.579	0.461	11.527	1.067	0.000
8	9	80	60.660	110	2.722	0.542	6.915	0.419	0.000
8	49	40	82.427	110	0.000	0.000	0.000	0.000	0.000
9	10	80	122.894	110	2.795	0.556	7.263	0.893	0.000
9	70	40	197.500	110	-0.073	-0.058	-0.251	-0.049	0.000
10	11	80	23.660	110	2.360	0.470	5.309	0.126	0.000
10	51	40	206.970	110	0.435	0.346	6.783	1.404	0.000
11	12	40	82.703	110	0.983	0.783	30.676	2.537	0.000
11	58	50	145.391	110	1.377	0.702	19.314	2.808	0.000
12	13	40	65.294	110	0.737	0.587	17.995	1.175	0.000
12	65	40	115.933	110	0.246	0.196	2.359	0.273	0.000

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
26	1960.473	1930.360		30.113	0.000	
27	1959.558	1928.000		31.558	0.000	
28	1959.452	1927.934		31.518	0.000	
29	1958.779	1923.150		35.629	0.000	
30	1958.582	1921.437		37.145	0.000	
31	1959.514	1923.394		36.120	0.000	
32	1959.493	1923.846		35.647	0.000	
33	1958.857	1927.851		31.006	0.000	
34	1957.755	1927.888		29.867	0.000	
35	1957.369	1928.381		28.988	0.000	
36	1956.956	1927.710		29.246	0.000	
37	1957.045	1929.157		27.888	0.000	
38	1957.045	1929.063		27.982	0.000	
39	1958.857	1922.723		36.134	0.000	
40	1957.755	1922.963		34.792	0.000	
41	1957.348	1928.381		28.967	0.245	WF
42	1956.028	1925.554		30.474	0.000	
43	1955.538	1925.545		29.993	0.000	
44	1955.413	1925.256		30.157	0.000	
45	1954.354	1926.058		28.296	0.000	
46	1954.278	1923.551		30.727	0.000	
47	1955.395	1925.554		29.841	0.245	WF
48	1954.286	1927.010		27.276	0.245	WF
49	1958.739	1921.905		36.834	0.000	
50	1957.549	1918.461		39.088	0.245	PS
51	1956.023	1920.945		35.078	0.000	
52	1955.600	1921.917		33.683	0.000	
53	1954.243	1922.430		31.813	0.000	
54	1952.914	1923.896		29.018	0.000	
55	1952.914	1920.546		32.368	0.000	
56	1953.426	1914.149		39.277	0.245	WF
57	1952.801	1921.601		31.200	0.245	WF
58	1954.493	1920.240		34.253	0.000	
59	1934.161	1918.427		15.734	0.057	HC
60	1933.900	1918.427		15.473	0.000	
61	1933.432	1915.083		18.349	0.245	WF
62	1954.478	1919.523		34.955	0.245	WF
63	1934.148	1917.143		17.005	0.245	WF
64	1929.415	1909.205		20.210	0.585	WF, SS
65	1954.491	1919.576		34.915	0.000	
66	1954.491	1921.720		32.771	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
13	14	40	359.190	110	0.491	0.391	8.482	3.047	0.000
13	68	40	571.453	110	0.246	0.196	2.359	1.348	0.000
14	15	40	267.493	110	0.245	0.195	2.341	0.626	0.000
14	69	40	245.917	110	0.246	0.196	2.359	0.580	0.000
17	18	40	244.116	110	0.455	0.363	7.379	1.801	0.000
17	21	40	130.855	110	0.245	0.195	2.341	0.306	0.000
18	19	40	5.072	110	0.210	0.168	1.766	0.009	0.000
18	22	40	5.679	110	0.245	0.195	2.341	0.013	0.000
19	20	40	136.507	110	0.000	0.000	0.000	0.000	0.000
19	37	40	115.628	110	0.210	0.168	1.766	0.204	0.000
27	28	40	53.117	110	0.224	0.179	1.990	0.106	0.000
27	31	40	110.228	110	0.094	0.075	0.396	0.044	0.000
28	29	40	177.006	110	0.318	0.253	3.801	0.673	0.000
28	32	40	102.017	110	-0.094	-0.075	-0.396	-0.040	0.000
29	30	40	51.827	110	0.318	0.253	3.801	0.197	0.000
31	32	40	54.418	110	0.094	0.075	0.396	0.022	0.000
33	34	40	95.542	110	0.579	0.461	11.527	1.101	0.000
33	39	40	146.024	110	0.000	0.000	0.000	0.000	0.000
34	35	40	33.543	110	0.579	0.461	11.527	0.387	0.000
34	40	40	136.666	110	0.000	0.000	0.000	0.000	0.000
35	36	40	98.991	110	0.334	0.266	4.166	0.412	0.000
35	41	40	8.815	110	0.245	0.195	2.341	0.021	0.000
36	37	40	50.163	110	-0.210	-0.168	-1.766	-0.089	0.000
36	42	40	90.239	110	0.545	0.434	10.285	0.928	0.000
37	38	40	138.678	110	0.000	0.000	0.000	0.000	0.000
42	43	40	52.927	110	0.515	0.410	9.269	0.491	0.000
42	51	40	113.817	110	0.030	0.024	0.047	0.005	0.000
43	44	40	9.301	110	0.628	0.500	13.384	0.124	0.000
43	52	40	110.842	110	-0.113	-0.090	-0.559	-0.062	0.000
44	45	40	197.707	110	0.383	0.305	5.357	1.059	0.000
44	47	40	7.621	110	0.245	0.195	2.341	0.018	0.000
45	46	40	94.286	110	0.138	0.110	0.810	0.076	0.000
45	48	40	29.162	110	0.245	0.195	2.341	0.068	0.000
51	52	40	55.214	110	0.465	0.370	7.667	0.423	0.000
52	53	40	296.448	110	0.352	0.280	4.577	1.357	0.000
53	54	40	567.522	110	0.245	0.195	2.341	1.329	0.000
53	56	40	348.657	110	0.245	0.195	2.341	0.816	0.000
54	55	40	165.147	110	0.000	0.000	0.000	0.000	0.000
54	57	40	48.292	110	0.245	0.195	2.341	0.113	0.000
58	59	40	510.374	110	1.132	0.901	39.838	20.332	0.000
58	62	40	6.427	110	0.245	0.195	2.341	0.015	0.000

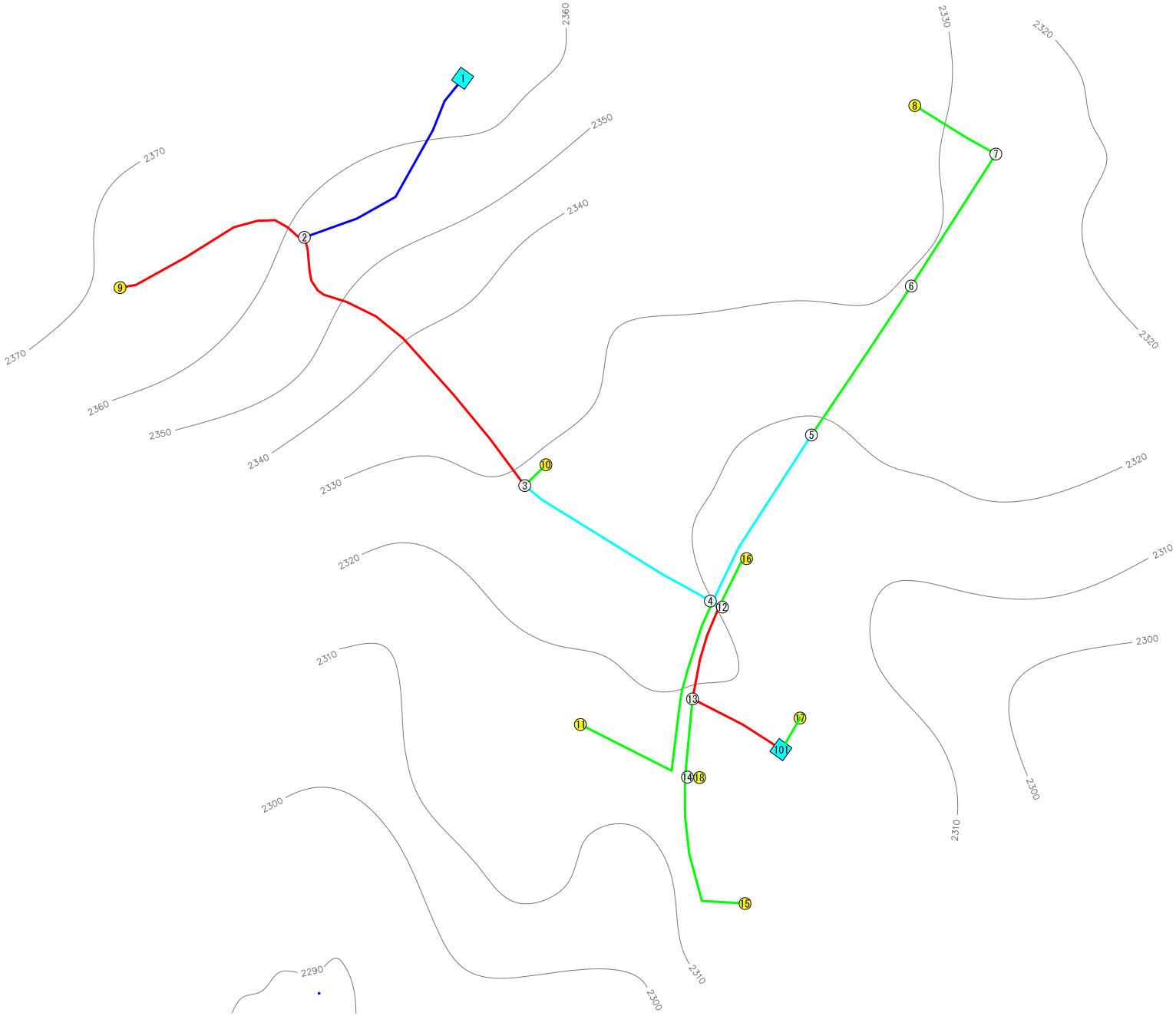
--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
67	1953.804	1915.690		38.114	0.246	WF
68	1952.241	1912.444		39.797	0.246	WF
69	1949.962	1906.120		43.842	0.246	WF
101	1967.665	1967.665	63.296	0.000	0.000	BPT
70	1958.369	1920.520		37.849	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
59	60	40	11.632	110	0.830	0.661	22.421	0.261	0.000
59	63	40	5.560	110	0.245	0.195	2.341	0.013	0.000
60	61	40	200.019	110	0.245	0.195	2.341	0.468	0.000
60	64	40	382.306	110	0.585	0.466	11.733	4.485	0.000
65	66	40	198.090	110	0.000	0.000	0.000	0.000	0.000
65	67	40	291.038	110	0.246	0.196	2.359	0.687	0.000
101	2	100	357.760	110	5.055	0.644	7.340	2.626	0.000
46	53	40	43.300	110	0.138	0.110	0.810	0.035	0.000
30	70	40	56.200	110	0.318	0.253	3.801	0.214	0.000
70	50	40	350.370	110	0.245	0.195	2.341	0.820	0.000

Tiya Pipe Networks



------Tiya <<Hazen-Williams Formula>>------

Tank	2	Maximum EHP	54.503	(m)
Node	17	Minimum EHP	5.404	(m)
Line	18	Maximum I	16.359	(‰)
Pump,Decom	0	Maximum V	0.557	(m/s)

Convergence Gap (cm)

Calculation 12 (times)

<< Explanatory Notes >>

- Node -
HP: Head Pressure
GL: Ground Level
EHP: Effectual Head Pressure
Qc: Consumption of Water

- Line -
D: Diameter
L: Length of Pipe
Coef: Friction Coefficient
Q: Quantity of Flow
V: Velocity of Flow
I: Hydraulic Gradient
HL: Head Loss
P: Add Pressure

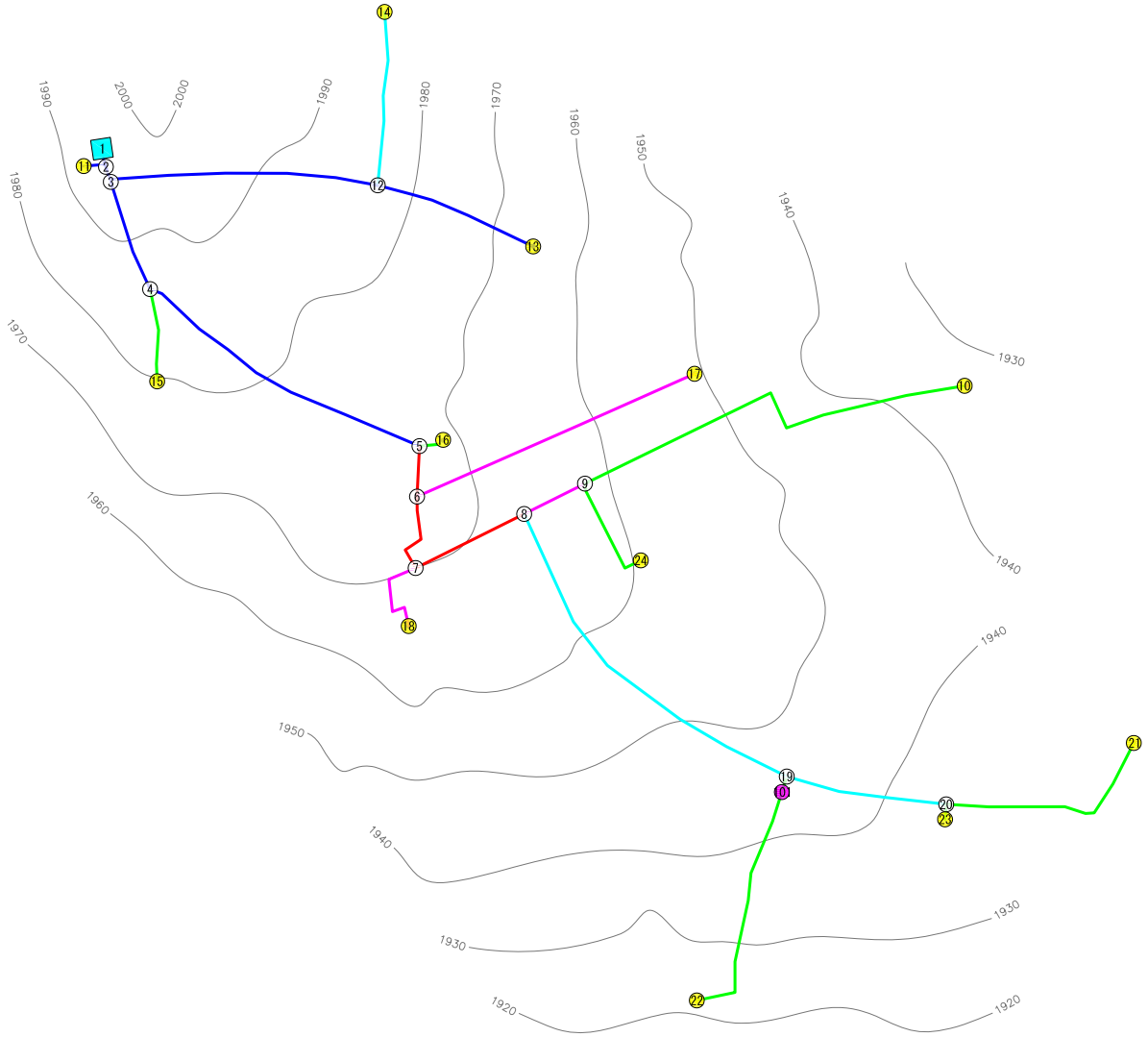
--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
1	2374.912	2364.912		10.000	-1.582	Reservoir Tank
101	2330.000	2320.000		10.000	-1.400	Reservoir Tank
2	2374.579	2358.950		15.629	0.000	
3	2373.655	2329.119		44.536	0.000	
4	2370.670	2320.726		49.944	0.000	
5	2369.677	2319.155		50.522	0.159	PS
6	2368.323	2328.945		39.378	0.000	
7	2367.138	2325.923		41.215	0.000	
8	2366.424	2332.844		33.580	0.349	WF
9	2374.525	2369.121		5.404	0.350	WF
10	2373.399	2329.274		44.125	0.374	HC, WF
11	2368.566	2314.063		54.503	0.350	WF
12	2329.744	2319.523		10.221	0.000	
13	2329.770	2320.552		9.218	0.000	
14	2327.567	2315.470		12.097	0.000	
15	2326.290	2314.275		12.015	0.350	WF
16	2329.304	2316.806		12.498	0.350	WF
17	2329.719	2318.590		11.129	0.350	WF
18	2327.539	2315.341		12.198	0.350	WF

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
1	2	100	390.441	110	1.582	0.202	0.854	0.333	0.000
2	3	80	579.635	110	1.232	0.245	1.594	0.924	0.000
2	9	80	347.633	110	0.350	0.070	0.155	0.054	0.000
3	4	50	371.019	110	0.858	0.437	8.044	2.984	0.000
3	10	40	49.930	110	0.374	0.298	5.124	0.256	0.000
4	5	50	325.848	110	0.508	0.259	3.047	0.993	0.000
4	11	40	464.270	110	0.350	0.279	4.532	2.104	0.000
4	12	50	13.176	110	+++++	+++++	+++++	+++++	+++++
5	6	40	300.499	110	0.349	0.278	4.509	1.355	0.000
6	7	40	262.755	110	0.349	0.278	4.508	1.185	0.000
7	8	40	158.304	110	0.349	0.278	4.509	0.714	0.000
12	13	80	162.770	110	-0.350	-0.070	-0.155	-0.025	0.000
12	16	40	97.124	110	0.350	0.279	4.533	0.440	0.000
13	14	40	134.640	110	0.700	0.557	16.359	2.203	0.000
13	101	80	194.340	110	-1.050	-0.209	-1.185	-0.230	0.000
14	15	40	281.725	110	0.350	0.279	4.532	1.277	0.000
14	18	40	6.277	110	0.350	0.279	4.532	0.028	0.000
17	101	40	62.000	110	-0.350	-0.279	-4.533	-0.281	0.000

Adilo Pipe Networks



Legend

- 00 Reservoir Tank
- 00 Water Point
- 00 Public Standpipe
- 00 Break Pressure

Distribution Line

(Plan)	(Existing)
100mm	100mm
75mm	75mm
65mm	65mm
50mm	50mm
40mm	40mm

―――――Adilo <<Hazen-Williams Formula>>―――――

Tank	1	Maximum EHP	37.280	(m)
Node	24	Minimum EHP	0.000	(m)
Line	24	Maximum I	26.908	(‰)
Pump,Decom	1	Maximum V	0.914	(m/s)

Convergence Gap (cm)

Calculation 13 (times)

<< Explanatory Notes >>

- Node -
HP: Head Pressure
GL: Ground Level
EHP: Effectual Head Pressure
Qc: Consumption of Water

- Line -
D: Diameter
L: Length of Pipe
Coef: Friction Coefficient
Q: Quantity of Flow
V: Velocity of Flow
I: Hydraulic Gradient
HL: Head Loss
P: Add Pressure

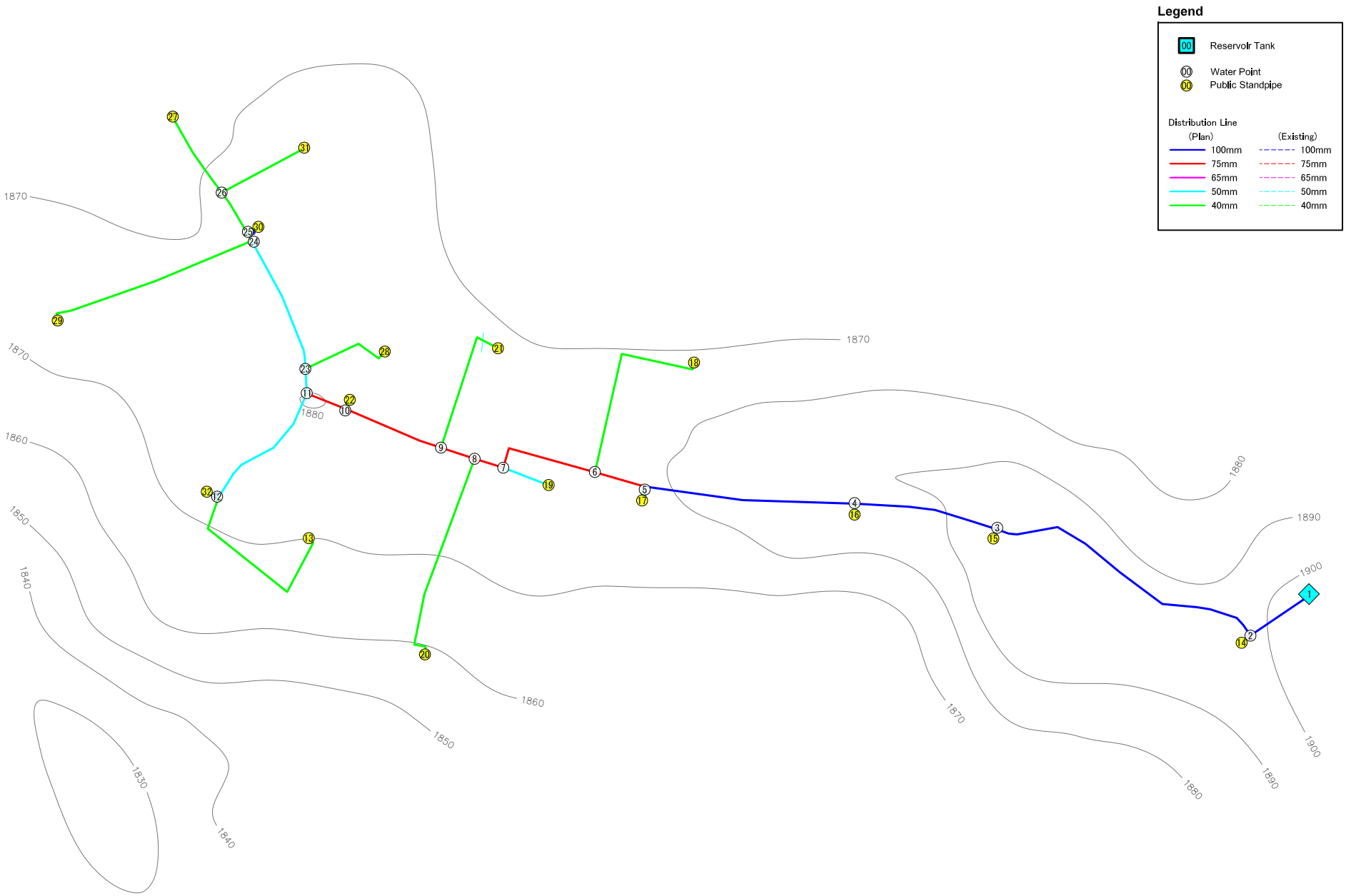
――― NodeData ―――

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
1	1995.660	1995.660		0.000	-7.175	Reservoir Tank
2	1995.450	1995.123		0.327	0.000	
3	1995.066	1993.448		1.618	0.218	SS
4	1993.172	1986.799		6.373	0.000	
5	1989.001	1972.582		16.419	0.000	
6	1987.417	1973.733		13.684	0.000	
7	1985.412	1970.723		14.689	0.340	PS
8	1983.652	1967.145		16.507	0.000	
9	1983.133	1962.950		20.183	0.045	HC
10	1974.212	1936.932		37.280	0.547	WF
11	1995.445	1993.855		1.590	0.547	WF
12	1994.833	1983.879		10.954	0.000	
13	1994.793	1964.576		30.217	0.547	WF
14	1993.610	1985.600		8.010	0.547	WF
15	1991.232	1979.393		11.839	0.547	WF
16	1988.464	1971.266		17.198	0.547	WF
17	1986.824	1951.391		35.433	0.547	WF
18	1985.229	1965.878		19.351	0.547	WF
19	1962.784	1944.171		18.613	0.000	
20	1958.642	1936.631		22.011	0.000	
21	1953.831	1932.992		20.839	0.549	WF
22	1938.655	1920.724		17.931	0.549	WF
23	1958.588	1937.036		21.552	0.549	WF
24	1980.793	1959.939		20.854	0.549	WF
101	1944.171	1944.171	18.613	-0.000	0.000	

――― LineData ―――

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
1	2	100	14.989	110	7.175	0.914	14.039	0.210	0.000
2	3	100	31.623	110	6.628	0.844	12.122	0.383	0.000
2	11	100	36.077	110	0.547	0.070	0.119	0.004	0.000
3	4	100	235.094	110	5.316	0.677	8.057	1.894	0.000
3	12	100	539.939	110	1.094	0.139	0.431	0.233	0.000
4	5	100	633.009	110	4.769	0.608	6.589	4.171	0.000
4	15	40	187.221	110	0.547	0.436	10.361	1.940	0.000
5	6	80	101.589	110	4.222	0.840	15.589	1.584	0.000
5	16	40	51.803	110	0.547	0.436	10.361	0.537	0.000
6	7	80	166.330	110	3.675	0.731	12.057	2.005	0.000
6	17	65	609.368	110	0.547	0.165	0.974	0.593	0.000
7	8	80	243.480	110	2.788	0.555	7.229	1.760	0.000
7	18	65	187.393	110	0.547	0.165	0.974	0.182	0.000
8	9	65	136.459	110	1.141	0.344	3.800	0.519	0.000
8	19	50	775.519	110	1.647	0.839	26.908	20.868	0.000
9	10	40	861.068	110	0.547	0.436	10.361	8.921	0.000
9	24	40	224.348	110	0.549	0.437	10.431	2.340	0.000
12	13	100	336.413	110	0.547	0.070	0.120	0.040	0.000
12	14	50	350.090	110	0.547	0.279	3.495	1.223	0.000
19	20	50	326.115	110	1.098	0.559	12.700	4.142	0.000
101	22	40	528.746	110	0.549	0.437	10.431	5.516	0.000
20	21	40	461.222	110	0.549	0.437	10.431	4.811	0.000
20	23	40	5.143	110	0.549	0.437	10.432	0.054	0.000
19	101	40	0.010	110	0.549	0.437	10.436	0.000	-18.613

Teferi Kela Pipe Networks



------Teferi Kela <<Case.2 : Hazen-Williams Formula>>------

Tank	1	Maximum EHP	40.023	(m)
Node	31	Minimum EHP	9.246	(m)
Line	31	Maximum I	24.939	(‰)
Pump,Decom	0	Maximum V	0.803	(m/s)

Convergence Gap (cm)

Calculation 13 (times)

<< Explanatory Notes >>

- Node -
HP: Head Pressure
GL: Ground Level
EHP: Effectual Head Pressure
Qc: Consumption of Water

- Line -
D: Diameter
L: Length of Pipe
Coef: Friction Coefficient
Q: Quantity of Flow
V: Velocity of Flow
I: Hydraulic Gradient
HL: Head Loss
P: Add Pressure

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
1	1910.320	1906.320		4.000	-5.158	Reservoir Tank
2	1909.535	1894.606		14.929	0.000	
3	1906.383	1897.137		9.246	0.000	
4	1904.980	1883.041		21.939	0.000	
5	1903.155	1879.119		24.036	0.000	
6	1901.993	1875.998		25.995	0.000	
7	1899.822	1875.025		24.797	0.000	
8	1899.309	1875.119		24.190	0.000	
9	1898.790	1875.721		23.069	0.000	
10	1897.777	1878.856		18.921	0.000	
11	1897.448	1880.076		17.372	0.000	
12	1895.696	1874.242		21.454	0.289	PS
13	1894.788	1869.755		25.033	0.280	WF
14	1909.525	1893.912		15.613	0.280	WF
15	1906.352	1897.024		9.328	0.280	WF
16	1904.932	1881.521		23.411	0.281	WF
17	1903.135	1879.242		23.893	0.281	WF
18	1901.056	1874.315		26.741	0.281	WF
19	1899.594	1876.166		23.428	0.281	WF
20	1898.289	1858.266		40.023	0.281	WF
21	1895.949	1870.395		25.554	0.621	WF, SS
22	1897.747	1879.255		18.492	0.281	WF
23	1896.630	1880.192		16.438	0.000	
24	1893.533	1877.210		16.323	0.000	
25	1893.226	1876.525		16.701	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
1	2	100	102.978	110	5.158	0.657	7.620	0.785	0.000
2	3	100	458.814	110	4.878	0.621	6.871	3.152	0.000
2	14	40	3.406	110	0.280	0.223	2.998	0.010	0.000
3	4	100	227.860	110	4.598	0.586	6.159	1.403	0.000
3	15	40	10.323	110	0.280	0.223	2.998	0.031	0.000
4	5	100	332.919	110	4.317	0.550	5.480	1.824	0.000
4	16	40	15.775	110	0.281	0.224	3.018	0.048	0.000
5	6	80	81.022	110	4.036	0.803	14.342	1.162	0.000
5	17	40	6.642	110	0.281	0.224	3.018	0.020	0.000
6	7	80	173.090	110	3.755	0.747	12.547	2.172	0.000
6	18	40	310.555	110	0.281	0.224	3.018	0.937	0.000
7	8	80	47.188	110	3.474	0.691	10.863	0.513	0.000
7	19	40	75.442	110	0.281	0.224	3.018	0.228	0.000
8	9	80	55.860	110	3.193	0.636	9.293	0.519	0.000
8	20	40	337.855	110	0.281	0.224	3.018	1.020	0.000
9	10	80	162.712	110	2.572	0.512	6.226	1.013	0.000
9	21	40	216.773	110	0.621	0.494	13.105	2.841	0.000
10	11	80	65.413	110	2.291	0.456	5.026	0.329	0.000
10	22	40	10.039	110	0.281	0.224	3.018	0.030	0.000
11	12	50	221.607	110	0.850	0.433	7.905	1.752	0.000
11	23	50	38.925	110	1.441	0.734	21.008	0.818	0.000
12	13	40	303.023	110	0.280	0.223	2.998	0.908	0.000
12	32	40	1.015	110	0.281	0.224	3.018	0.003	0.000
23	24	50	220.320	110	1.160	0.591	14.059	3.098	0.000
23	28	40	142.932	110	0.281	0.224	3.018	0.431	0.000

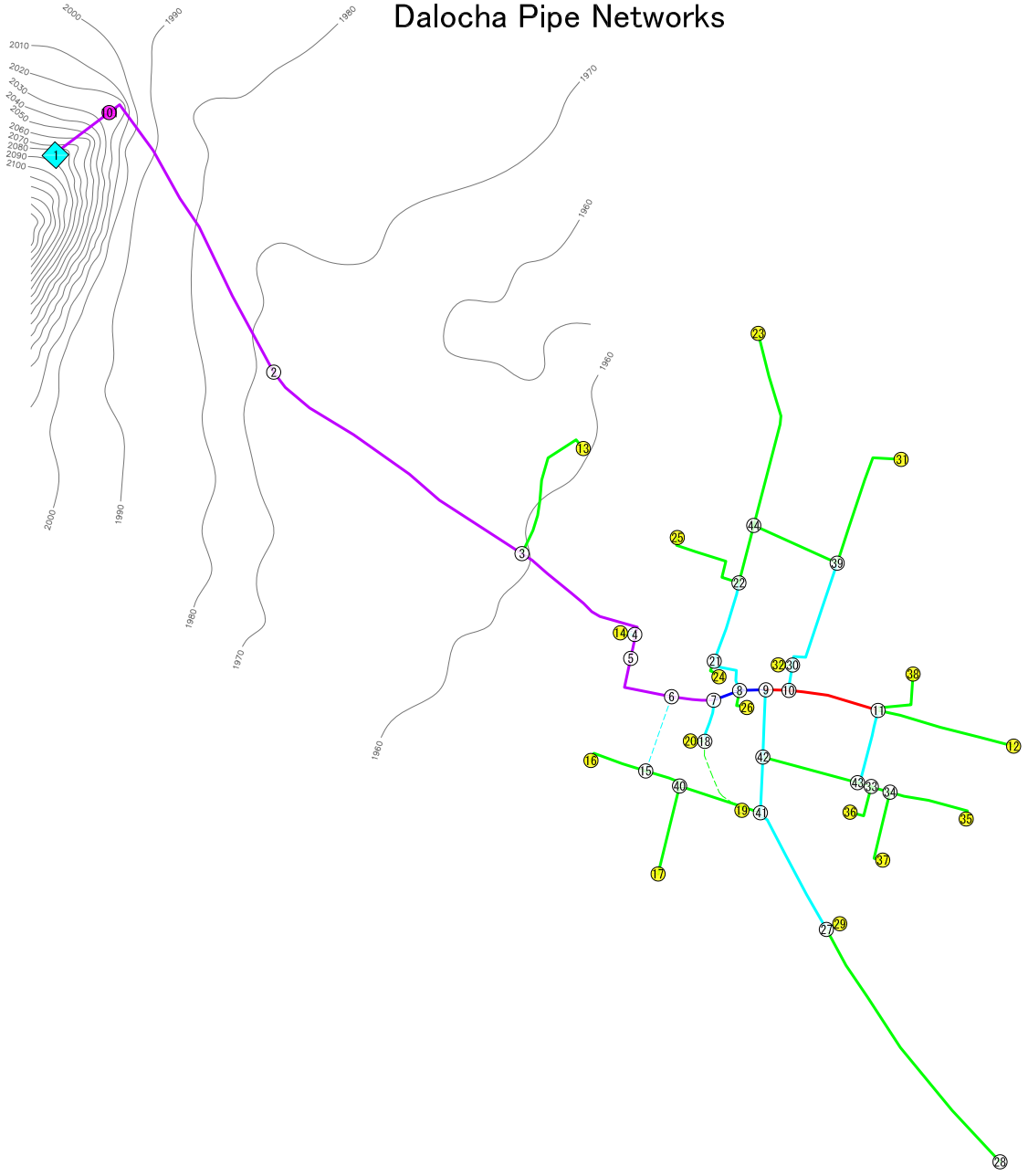
--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
26	1892.280	1872.950		19.330	0.036	HC
27	1891.854	1863.362		28.492	0.281	WF
28	1896.199	1877.847		18.352	0.281	WF
29	1892.519	1872.834		19.685	0.281	WF
30	1893.215	1876.489		16.726	0.281	WF
31	1891.835	1877.421		14.414	0.281	WF
32	1895.693	1874.523		21.170	0.281	WF

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
24	25	40	12.300	110	0.879	0.700	24.939	0.307	0.000
24	29	40	335.896	110	0.281	0.224	3.018	1.014	0.000
25	26	40	77.446	110	0.598	0.476	12.221	0.946	0.000
25	30	40	3.804	110	0.281	0.224	3.018	0.011	0.000
26	27	40	141.129	110	0.281	0.224	3.018	0.426	0.000
26	31	40	147.318	110	0.281	0.224	3.018	0.445	0.000

Dalocha Pipe Networks



Legend

00	Reservoir Tank
00	Water Point
00	Public Standpipe
00	Break Pressure

Distribution Line

(Plan)	(Existing)
150mm	150mm
100mm	100mm
75mm	75mm
65mm	65mm
50mm	50mm
40mm	40mm

------Dalocha <<Hazen-Williams Formula>>------

Tank	1	Maximum EHP	57.060	(m)
Node	44	Minimum EHP	0.000	(m)
Line	48	Maximum I	70.866	(‰)
Pump,Decom	1	Maximum V	1.230	(m/s)

Convergence Gap (cm)

Calculation 14 (times)

<< Explanatory Notes >>

- Node -
HP: Head Pressure
GL: Ground Level
EHP: Effectual Head Pressure
Qc: Consumption of Water

- Line -
D: Diameter
L: Length of Pipe
Coef: Friction Coefficient
Q: Quantity of Flow
V: Velocity of Flow
I: Hydraulic Gradient
HL: Head Loss
P: Add Pressure

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
1	2074.150	2074.150		0.000	-10.340	Reservoir Tank
2	2011.566	1954.506		57.060	0.000	
3	2007.224	1959.680		47.544	0.000	
4	2005.381	1961.978		43.403	0.000	
5	2005.068	1963.532		41.536	0.000	
6	2004.171	1964.740		39.431	0.000	
7	2003.788	1963.941		39.847	0.000	
8	2002.395	1963.366		39.029	0.000	
9	2001.705	1963.636		38.069	0.000	
10	2000.578	1963.271		37.307	0.000	
11	1998.989	1964.748		34.241	0.119	HC
12	1994.224	1965.700		28.524	0.515	WF
13	2002.434	1959.427		43.007	0.515	WF
14	2005.224	1961.978		43.246	0.515	WF
15	2000.229	1966.988		33.241	0.000	
16	1998.317	1966.448		31.869	0.515	WF
17	1995.191	1965.588		29.603	0.515	WF
18	2001.835	1966.753		35.082	0.000	
19	1998.136	1967.018		31.118	0.515	WF
20	2001.777	1966.416		35.361	0.515	WF
21	1998.288	1962.708		35.580	0.000	
22	1994.493	1964.382		30.111	0.000	
23	1985.486	1969.210		16.276	0.515	WF
24	1997.864	1962.754		35.110	0.515	WF
25	1991.519	1963.988		27.531	0.515	WF

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
1	101	150	250.000	110	10.340	0.585	3.833	0.958	-57.064
2	3	150	1132.693	110	10.340	0.585	3.833	4.342	0.000
3	4	150	528.629	110	9.825	0.556	3.487	1.844	0.000
3	13	40	516.975	110	0.515	0.410	9.266	4.790	0.000
4	5	150	99.128	110	9.310	0.527	3.157	0.313	0.000
4	14	40	16.949	110	0.515	0.410	9.262	0.157	0.000
5	6	150	284.034	110	9.310	0.527	3.156	0.897	0.000
6	7	150	154.966	110	8.166	0.462	2.476	0.384	0.000
6	15	50	287.861	110	1.144	0.583	13.694	3.942	0.000
7	8	100	101.834	110	7.074	0.901	13.676	1.393	0.000
7	18	50	155.341	110	1.092	0.556	12.571	1.953	0.000
8	9	100	96.410	110	4.985	0.635	7.153	0.690	0.000
8	21	50	166.022	110	1.574	0.802	24.738	4.107	0.000
8	26	40	74.489	110	0.515	0.410	9.266	0.690	0.000
9	10	80	84.469	110	3.882	0.773	13.346	1.127	0.000
9	42	50	240.480	110	1.103	0.562	12.812	3.081	0.000
10	11	80	335.784	110	2.218	0.442	4.733	1.589	0.000
10	30	50	93.921	110	1.664	0.848	27.427	2.576	0.000
11	12	40	514.192	110	0.515	0.410	9.266	4.764	0.000
11	43	50	275.240	110	1.069	0.545	12.088	3.327	0.000
11	38	40	241.592	110	0.515	0.410	9.266	2.239	0.000
15	16	40	206.408	110	0.515	0.410	9.266	1.913	0.000
15	40	40	145.900	110	0.629	0.500	13.404	1.956	0.000
18	19	40	323.390	110	0.577	0.459	11.437	3.698	0.000
18	20	40	6.230	110	0.515	0.410	9.266	0.058	0.000

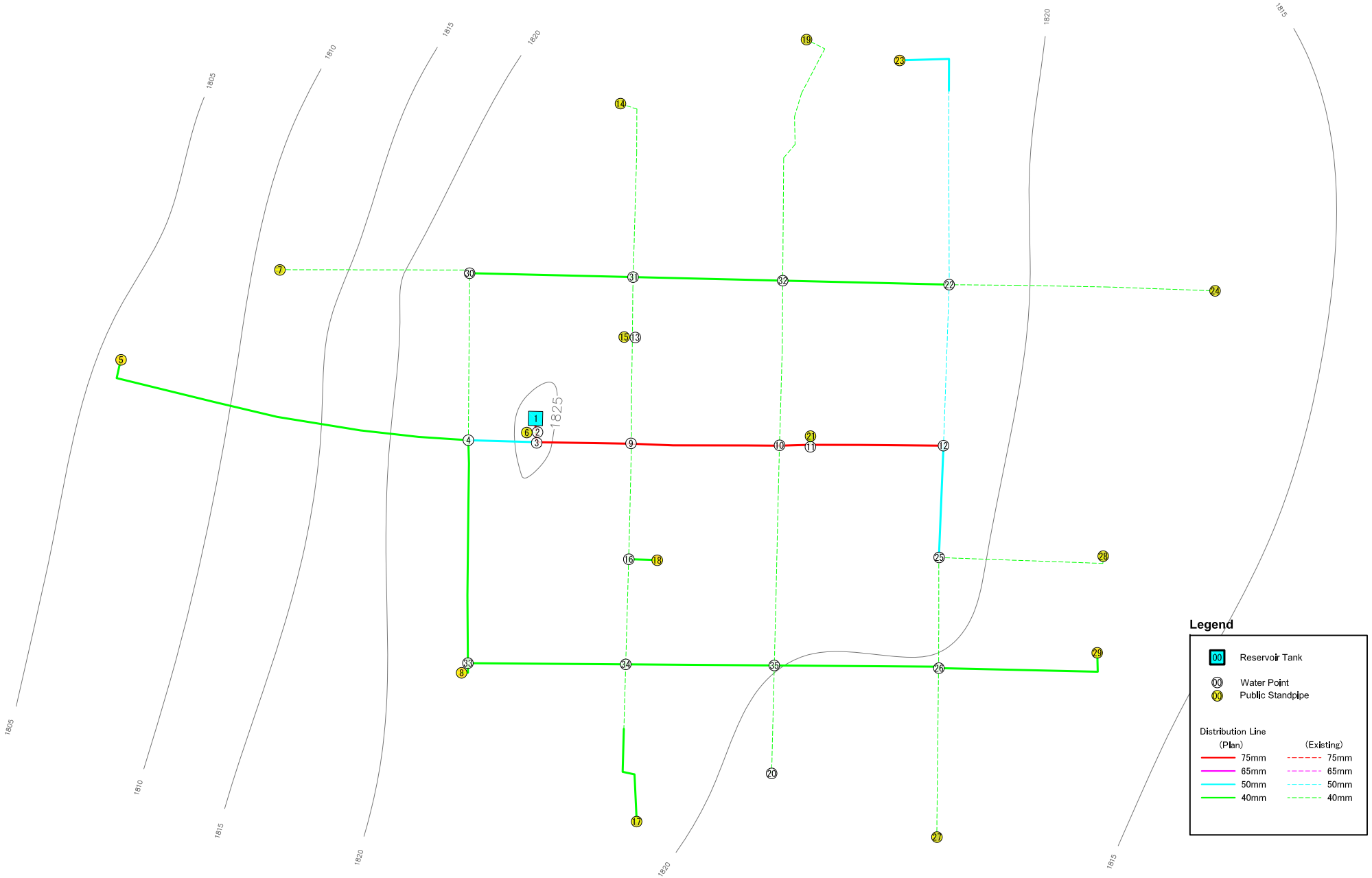
--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
26	2001.705	1964.676		37.029	0.515	WF
27	1993.916	1965.374		28.542	0.000	
28	1990.540	1960.212		30.328	0.288	SS
29	1993.769	1965.369		28.401	0.515	WF
30	1998.002	1962.358		35.644	0.000	
31	1987.200	1968.607		18.593	0.515	WF
32	1997.941	1962.450		35.491	0.515	WF
33	1992.549	1965.878		26.671	0.000	
34	1991.740	1965.616		26.124	0.000	
35	1988.955	1964.764		24.191	0.515	WF
36	1991.037	1966.494		24.543	0.515	WF
37	1989.202	1965.693		23.509	0.515	WF
38	1996.750	1963.866		32.884	0.515	WF
39	1991.941	1963.331		28.610	0.663	PS
101	2016.128	2016.128	57.064	0.000	0.000	BPT
40	1998.274	1966.782		31.492	0.000	
41	1998.050	1966.607		31.443	0.000	
42	1998.624	1966.720		31.904	0.000	
43	1995.662	1966.200		29.462	0.000	
44	1991.956	1966.870		25.086	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
21	22	50	319.590	110	1.059	0.540	11.875	3.795	0.000
21	24	40	45.739	110	0.515	0.410	9.266	0.424	0.000
22	44	40	247.430	110	0.544	0.433	10.253	2.537	0.000
22	25	40	320.993	110	0.515	0.410	9.266	2.974	0.000
27	28	40	1068.942	110	0.288	0.229	3.158	3.376	0.000
27	29	40	15.806	110	0.515	0.410	9.266	0.146	0.000
30	39	50	438.749	110	1.149	0.586	13.815	6.061	0.000
30	32	40	6.560	110	0.515	0.410	9.266	0.061	0.000
33	34	50	71.717	110	1.030	0.525	11.281	0.809	0.000
33	36	40	163.254	110	0.515	0.410	9.266	1.513	0.000
34	35	40	300.564	110	0.515	0.410	9.266	2.785	0.000
34	37	40	273.978	110	0.515	0.410	9.266	2.539	0.000
39	31	40	511.581	110	0.515	0.410	9.266	4.740	0.000
101	2	150	1189.920	110	10.340	0.585	3.834	4.562	0.000
40	17	40	332.690	110	0.515	0.410	9.266	3.083	0.000
19	40	40	243.680	110	-0.114	-0.090	-0.564	-0.137	0.000
19	41	40	68.410	110	0.176	0.140	1.264	0.086	0.000
42	43	40	370.150	110	0.476	0.379	8.004	2.963	0.000
42	41	50	127.510	110	0.627	0.320	4.504	0.574	0.000
41	27	50	581.103	110	0.803	0.409	7.114	4.134	0.000
43	33	40	43.915	110	1.545	1.230	70.866	3.112	0.000
39	44	40	336.640	110	-0.029	-0.023	-0.045	-0.015	0.000
44	23	40	698.259	110	0.515	0.410	9.266	6.470	0.000

Mito Pipe Networks



------Mito <<Hazen-Williams Formula>>------

Tank	1	Maximum EHP	22.793	(m)
Node	34	Minimum EHP	5.619	(m)
Line	40	Maximum I	28.414	(‰)
Pump,Decom	0	Maximum V	1.162	(m/s)

Convergence Gap (cm)

Calculation 13 (times)

<< Explanatory Notes >>

- Node -
HP: Head Pressure
GL: Ground Level
EHP: Effectual Head Pressure
Qc: Consumption of Water

- Line -
D: Diameter
L: Length of Pipe
Coef: Friction Coefficient
Q: Quantity of Flow
V: Velocity of Flow
I: Hydraulic Gradient
HL: Head Loss
P: Add Pressure

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
1	1834.996	1824.996		10.000	-5.838	Reservoir Tank
2	1834.772	1824.930		9.842	0.000	
3	1834.493	1824.947		9.546	0.000	
4	1832.938	1824.002		8.936	0.000	
5	1830.953	1808.160		22.793	0.357	WF
6	1834.745	1824.985		9.760	0.357	WF
7	1829.969	1812.037		17.932	0.357	WF
8	1830.646	1823.089		7.557	0.357	WF
9	1832.937	1824.626		8.311	0.000	
10	1831.797	1823.384		8.413	0.000	
11	1831.675	1822.668		9.007	0.000	
12	1831.314	1820.732		10.582	0.000	
13	1831.011	1825.099		5.912	0.000	
14	1829.767	1823.824		5.943	0.357	WF
15	1830.975	1825.155		5.820	0.358	WF
16	1830.990	1823.778		7.212	0.000	
17	1829.115	1821.691		7.424	0.460	WF, SS
18	1830.839	1823.701		7.138	0.358	WF
19	1829.131	1823.348		5.783	0.358	WF
20	1830.569	1820.740		9.829	0.041	HC
21	1831.640	1822.679		8.961	0.358	WF
22	1830.053	1821.300		8.753	0.000	
23	1828.401	1821.998		6.403	0.688	WF, PS
24	1828.643	1816.326		12.317	0.358	WF
25	1830.529	1820.634		9.895	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
1	2	80	7.878	110	5.838	1.162	28.414	0.224	0.000
2	3	80	11.048	110	5.481	1.091	25.274	0.279	0.000
2	6	40	5.836	110	0.357	0.284	4.701	0.027	0.000
3	4	50	76.917	110	1.411	0.719	20.212	1.555	0.000
3	9	80	106.868	110	4.070	0.810	14.564	1.556	0.000
4	5	40	422.224	110	0.357	0.284	4.701	1.985	0.000
4	30	40	186.700	110	0.549	0.437	10.434	1.948	0.000
4	33	40	245.590	110	0.505	0.402	8.936	2.195	0.000
9	10	80	166.444	110	2.707	0.539	6.847	1.140	0.000
9	13	40	119.365	110	0.695	0.553	16.131	1.925	0.000
9	16	40	129.907	110	0.668	0.532	14.987	1.947	0.000
10	11	80	34.476	110	1.899	0.378	3.552	0.122	0.000
10	32	40	187.850	110	0.438	0.348	6.853	1.287	0.000
10	35	40	241.840	110	0.370	0.295	5.031	1.217	0.000
11	12	80	149.570	110	1.541	0.307	2.413	0.361	0.000
11	21	40	7.380	110	0.358	0.285	4.725	0.035	0.000
12	22	50	180.771	110	0.795	0.405	6.975	1.261	0.000
12	25	50	126.115	110	0.747	0.381	6.222	0.785	0.000
13	31	40	70.000	110	0.337	0.268	4.218	0.295	0.000
13	15	40	7.686	110	0.358	0.285	4.726	0.036	0.000
16	34	40	113.280	110	0.310	0.247	3.613	0.409	0.000
16	18	40	31.804	110	0.358	0.285	4.725	0.150	0.000
22	23	50	309.041	110	0.688	0.351	5.343	1.651	0.000
22	24	40	298.334	110	0.358	0.285	4.726	1.410	0.000
25	26	40	124.290	110	0.389	0.310	5.510	0.685	0.000

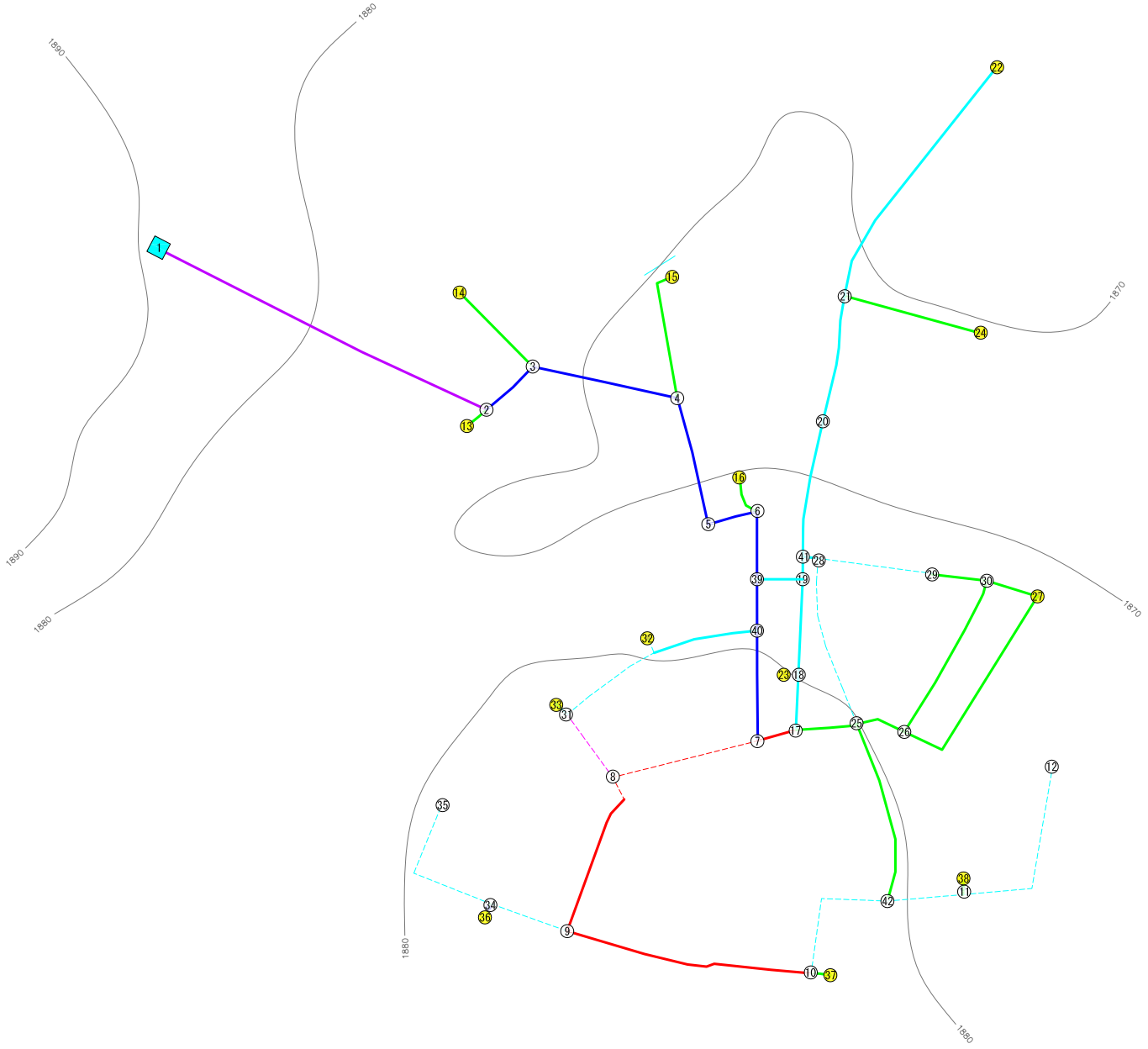
--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
26	1829.844	1817.921		11.923	0.000	
27	1828.945	1818.886		10.059	0.358	WF
28	1829.620	1817.623		11.997	0.358	WF
29	1828.899	1815.184		13.715	0.358	WF
30	1830.990	1824.012		6.978	0.000	
31	1830.716	1825.097		5.619	0.000	
32	1830.510	1823.650		6.860	0.000	
33	1830.744	1823.070		7.674	0.000	
34	1830.580	1822.980		7.600	0.000	
35	1830.580	1821.780		8.800	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
25	28	40	192.253	110	0.358	0.285	4.726	0.909	0.000
26	27	40	190.238	110	0.358	0.285	4.725	0.899	0.000
26	29	40	200.001	110	0.358	0.285	4.726	0.945	0.000
30	7	40	217.127	110	0.357	0.284	4.702	1.021	0.000
31	14	40	201.876	110	0.357	0.284	4.701	0.949	0.000
32	19	40	291.784	110	0.358	0.285	4.725	1.379	0.000
33	8	40	20.887	110	0.357	0.284	4.701	0.098	0.000
34	17	40	194.934	110	0.460	0.366	7.517	1.465	0.000
35	20	40	127.638	110	0.041	0.033	0.085	0.011	0.000
30	31	40	183.780	110	0.192	0.153	1.493	0.274	0.000
31	32	40	169.630	110	0.172	0.137	1.215	0.206	0.000
32	22	40	185.970	110	0.251	0.200	2.458	0.457	0.000
33	34	40	177.560	110	0.148	0.118	0.921	0.163	0.000
34	35	40	167.240	110	-0.002	-0.002	0.000	0.000	0.000
35	26	40	184.210	110	0.327	0.260	3.997	0.736	0.000

Alem Gebeya Pipe Networks



Legend

- 00 Reservoir Tank
- 00 Water Point
- 00 Public Standpipe

Distribution Line

(Plan)	(Existing)
150mm	150mm
100mm	100mm
75mm	75mm
65mm	65mm
50mm	50mm
40mm	40mm

------Alem Gebeya <<Hazen-Williams Formula>>------

Tank	1	Maximum EHP	29.790	(m)
Node	41	Minimum EHP	6.952	(m)
Line	46	Maximum I	9.468	(‰)
Pump,Decom	0	Maximum V	0.645	(m/s)

Convergence Gap (cm)

Calculation 14 (times)

<< Explanatory Notes >>

- Node -
HP: Head Pressure
GL: Ground Level
EHP: Effectual Head Pressure
Qc: Consumption of Water

- Line -
D: Diameter
L: Length of Pipe
Coef: Friction Coefficient
Q: Quantity of Flow
V: Velocity of Flow
I: Hydraulic Gradient
HL: Head Loss
P: Add Pressure

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
1	1898.748	1888.748		10.000	-5.431	Reservoir Tank
2	1898.001	1873.394		24.607	0.000	
3	1897.176	1872.538		24.638	0.000	
4	1895.502	1865.712		29.790	0.000	
5	1894.236	1873.525		20.711	0.000	
6	1893.745	1873.607		20.138	0.000	
7	1892.617	1881.471		11.146	0.056	HC
8	1891.805	1883.855		7.950	0.000	
9	1890.957	1883.781		7.176	0.000	
10	1890.169	1881.534		8.635	0.000	
11	1886.523	1878.719		7.804	0.131	SS
12	1885.742	1876.339		9.403	0.436	PS
13	1897.808	1873.126		24.682	0.369	WF
14	1896.282	1873.630		22.652	0.369	WF
15	1894.333	1868.081		26.252	0.370	WF
16	1893.398	1871.665		21.733	0.370	WF
17	1892.590	1881.108		11.482	0.000	
18	1892.481	1880.013		12.468	0.000	
19	1892.496	1877.150		15.346	0.000	
20	1890.717	1864.591		26.126	0.000	
21	1889.339	1867.189		22.150	0.000	
22	1888.506	1876.171		12.335	0.370	WF
23	1892.371	1880.381		11.990	0.370	WF
24	1888.093	1868.821		19.272	0.370	WF
25	1892.273	1880.324		11.949	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
1	2	150	641.861	110	5.431	0.307	1.163	0.747	0.000
2	3	100	112.130	110	5.062	0.645	7.358	0.825	0.000
2	13	40	38.633	110	0.369	0.294	4.998	0.193	0.000
3	4	100	261.695	110	4.693	0.598	6.396	1.674	0.000
3	14	40	178.970	110	0.369	0.294	4.998	0.894	0.000
4	5	100	230.432	110	4.323	0.551	5.494	1.266	0.000
4	15	40	232.775	110	0.370	0.295	5.023	1.169	0.000
5	6	100	89.436	110	4.323	0.551	5.493	0.491	0.000
6	39	100	111.880	110	3.953	0.504	4.655	0.521	0.000
6	16	40	69.047	110	0.370	0.295	5.023	0.347	0.000
7	8	80	264.707	110	1.754	0.349	3.066	0.812	0.000
7	17	80	69.998	110	0.571	0.114	0.383	0.027	0.000
8	9	80	300.995	110	1.677	0.334	2.820	0.849	0.000
8	31	65	137.214	110	0.077	0.023	0.026	0.004	0.000
9	10	80	442.914	110	1.307	0.260	1.777	0.787	0.000
9	34	40	143.188	110	0.370	0.295	5.023	0.719	0.000
10	11	50	385.110	110	0.937	0.477	9.468	3.646	0.000
10	37	40	29.502	110	0.370	0.295	5.023	0.148	0.000
11	12	50	340.005	110	0.436	0.222	2.296	0.781	0.000
11	38	40	6.975	110	0.370	0.295	5.023	0.035	0.000
17	18	50	98.313	110	0.295	0.150	1.112	0.109	0.000
17	25	40	108.697	110	0.276	0.220	2.920	0.317	0.000
18	19	50	169.144	110	-0.075	-0.038	-0.089	-0.015	0.000
18	23	40	21.975	110	0.370	0.295	5.023	0.110	0.000
19	41	50	32.300	110	0.834	0.425	7.631	0.246	0.000

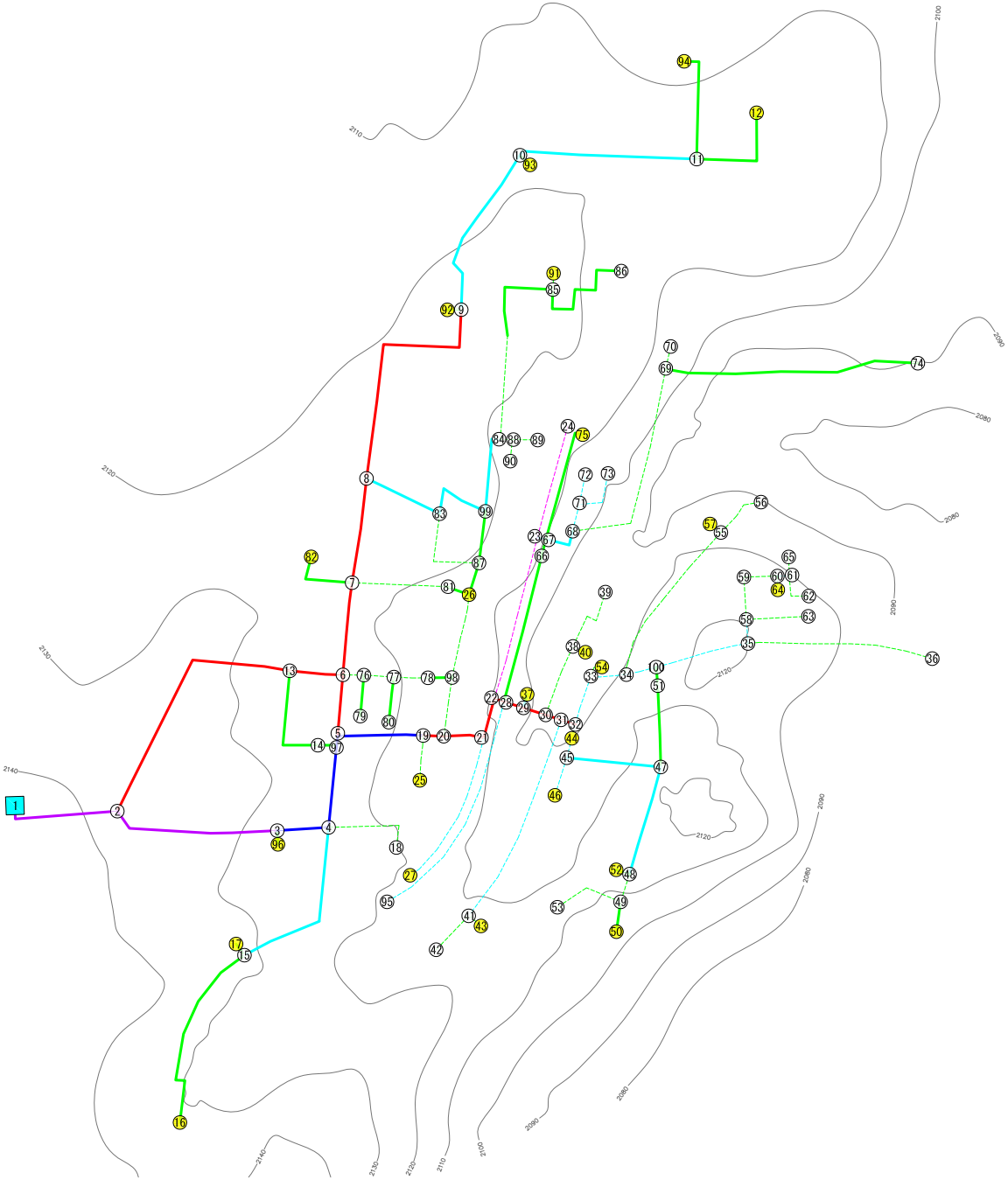
--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
26	1892.125	1879.357		12.768	0.000	
27	1891.840	1870.393		21.447	0.370	WF
28	1892.246	1876.439		15.807	0.000	
29	1892.165	1873.446		18.719	0.000	
30	1892.052	1871.508		20.544	0.000	
31	1891.802	1883.168		8.634	0.000	
32	1892.039	1879.887		12.152	0.370	WF
33	1891.756	1883.391		8.365	0.370	WF
34	1890.237	1883.060		7.177	0.000	
35	1890.237	1881.702		8.535	0.000	
36	1890.210	1883.258		6.952	0.370	WF
37	1890.021	1881.444		8.577	0.370	WF
38	1886.488	1878.515		7.973	0.370	WF
39	1893.224	1877.280		15.944	0.000	
40	1893.026	1879.140		13.886	0.000	
41	1892.249	1876.260		15.989	0.000	
42	1892.273	1880.540		11.733	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
20	21	50	225.315	110	0.740	0.377	6.116	1.378	0.000
21	22	50	491.656	110	0.370	0.189	1.694	0.833	0.000
21	24	40	247.970	110	0.370	0.295	5.023	1.246	0.000
25	26	40	91.063	110	0.201	0.160	1.626	0.148	0.000
25	28	50	306.150	110	0.075	0.038	0.088	0.027	0.000
26	27	40	392.857	110	0.130	0.104	0.725	0.285	0.000
26	30	40	305.683	110	0.071	0.057	0.237	0.073	0.000
28	29	50	204.990	110	0.169	0.086	0.396	0.081	0.000
31	32	50	215.918	110	-0.293	-0.149	-1.096	-0.237	0.000
31	33	50	27.166	110	0.370	0.189	1.694	0.046	0.000
34	35	50	272.803	110	0.000	0.000	0.000	0.000	0.000
34	36	40	5.506	110	0.370	0.295	5.023	0.028	0.000
39	40	100	69.230	110	3.044	0.388	2.869	0.199	0.000
40	7	100	224.402	110	2.381	0.303	1.821	0.409	0.000
41	20	50	250.626	110	0.740	0.377	6.116	1.533	0.000
39	19	50	81.340	110	0.909	0.463	8.954	0.728	0.000
32	40	50	198.100	110	-0.663	-0.338	-4.983	-0.987	0.000
28	41	50	26.450	110	-0.094	-0.048	-0.134	-0.004	0.000
29	30	40	95.790	110	0.169	0.134	1.174	0.112	0.000
27	30	40	94.160	110	-0.240	-0.191	-2.253	-0.212	0.000
25	42	40	320.590	110	0.000	0.000	0.000	0.000	0.000

Kibet Pipe Networks



Legend

- 00 Reservoir Tank
- 00 Water Point
- 00 Public Standpipe

Distribution Line

(Plan)	(Existing)
150mm	150mm
100mm	100mm
75mm	75mm
65mm	65mm
50mm	50mm
40mm	40mm

------Kibet <<Hazen-Williams Formula>>------

Tank	1	Maximum EHP	46.642	(m)
Node	99	Minimum EHP	8.358	(m)
Line	106	Maximum I	26.282	(‰)
Pump,Decom	0	Maximum V	1.012	(m/s)

Convergence Gap (cm)

Calculation 16 (times)

<< Explanatory Notes >>

- Node -
HP: Head Pressure
GL: Ground Level
EHP: Effectual Head Pressure
Qc: Consumption of Water

- Line -
D: Diameter
L: Length of Pipe
Coef: Friction Coefficient
Q: Quantity of Flow
V: Velocity of Flow
I: Hydraulic Gradient
HL: Head Loss
P: Add Pressure

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
1	2150.850	2140.850		10.000	-9.506	Reservoir Tank
2	2149.963	2139.079		10.884	0.000	
3	2149.186	2127.460		21.726	0.000	
4	2147.640	2123.382		24.258	0.000	
5	2145.566	2125.171		20.395	0.000	
6	2145.482	2122.633		22.849	0.000	
7	2144.111	2124.921		19.190	0.000	
8	2143.243	2126.090		17.153	0.000	
9	2141.969	2122.030		19.939	0.000	
10	2136.691	2118.864		17.827	0.000	
11	2134.185	2115.446		18.739	0.000	
12	2132.944	2113.439		19.505	0.356	WF
13	2146.150	2124.685		21.465	0.000	
14	2145.831	2125.494		20.337	0.000	
15	2143.337	2131.180		12.157	0.250	PS
16	2141.042	2132.684		8.358	0.356	WF
17	2143.321	2132.326		10.995	0.356	WF
18	2147.640	2121.059		26.581	0.000	
19	2143.956	2118.412		25.544	0.000	
20	2142.953	2117.023		25.930	0.000	
21	2140.780	2111.295		29.485	0.000	
22	2138.861	2109.638		29.223	0.000	
23	2136.790	2110.175		26.615	0.000	
24	2136.790	2114.186		22.604	0.000	
25	2143.441	2118.110		25.331	0.356	WF

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
1	2	150	270.495	110	9.506	0.538	3.281	0.887	0.000
2	3	150	414.307	110	7.026	0.398	1.874	0.776	0.000
2	13	80	654.797	110	2.480	0.494	5.822	3.812	0.000
3	4	100	126.103	110	6.669	0.849	12.259	1.546	0.000
3	96	40	3.921	110	0.357	0.284	4.701	0.018	0.000
4	97	100	201.859	110	5.707	0.727	9.187	1.854	0.000
4	15	50	432.899	110	0.962	0.490	9.941	4.304	0.000
4	18	40	236.547	110	0.000	0.000	0.000	0.000	0.000
5	6	80	150.876	110	0.697	0.139	0.555	0.084	0.000
5	19	100	209.879	110	5.177	0.659	7.670	1.610	0.000
6	7	80	226.922	110	2.531	0.504	6.046	1.372	0.000
6	76	40	51.420	110	0.479	0.381	8.097	0.416	0.000
7	8	80	258.050	110	1.844	0.367	3.361	0.867	0.000
7	81	40	247.593	110	0.331	0.263	4.084	1.011	0.000
7	82	40	170.566	110	0.357	0.284	4.701	0.802	0.000
8	9	80	609.511	110	1.427	0.284	2.091	1.275	0.000
8	83	50	199.052	110	0.417	0.212	2.110	0.420	0.000
9	10	50	435.924	110	1.070	0.545	12.106	5.277	0.000
9	92	40	8.011	110	0.357	0.284	4.701	0.038	0.000
10	11	50	438.914	110	0.713	0.363	5.709	2.506	0.000
10	93	40	4.251	110	0.357	0.284	4.701	0.020	0.000
11	12	40	265.486	110	0.356	0.283	4.677	1.242	0.000
11	94	40	274.941	110	0.357	0.284	4.701	1.293	0.000
13	6	80	130.610	110	2.313	0.460	5.115	0.668	0.000
13	14	40	275.641	110	0.168	0.133	1.158	0.319	0.000

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
26	2142.917	2115.382		27.535	0.356	WF
27	2140.163	2119.354		20.809	0.356	WF
28	2138.498	2108.265		30.233	0.000	
29	2137.799	2102.452		35.347	0.000	
30	2137.102	2099.897		37.205	0.000	
31	2136.679	2099.397		37.282	0.000	
32	2136.375	2099.958		36.417	0.000	
33	2134.010	2097.610		36.400	0.000	
34	2133.057	2101.605		31.452	0.000	
35	2132.339	2110.281		22.058	0.000	
36	2132.339	2085.697		46.642	0.000	
37	2137.778	2103.256		34.522	0.356	WF
38	2136.256	2096.736		39.520	0.000	
39	2136.256	2093.164		43.092	0.000	
40	2136.242	2097.330		38.912	0.356	WF
41	2135.837	2112.616		23.221	0.000	
42	2135.837	2115.240		20.597	0.000	
43	2135.762	2113.679		22.083	0.356	WF
44	2135.456	2100.764		34.692	0.356	WF
45	2134.636	2101.402		33.234	0.000	
46	2134.185	2103.583		30.602	0.356	WF
47	2132.542	2115.322		17.220	0.000	
48	2129.820	2112.995		16.825	0.000	
49	2128.928	2108.872		20.056	0.000	
50	2128.583	2104.541		24.042	0.356	WF
51	2132.564	2106.378		26.186	0.250	SS
52	2129.794	2112.844		16.950	0.356	WF
53	2128.500	2111.373		17.127	0.250	PS
54	2133.868	2097.537		36.331	0.356	WF
55	2131.057	2096.956		34.101	0.000	
56	2131.057	2090.742		40.315	0.000	
57	2131.009	2096.918		34.091	0.356	WF
58	2132.246	2109.531		22.715	0.000	
59	2132.081	2103.667		28.414	0.000	
60	2131.676	2100.249		31.427	0.000	
61	2131.676	2099.808		31.868	0.000	
62	2131.676	2100.802		30.874	0.000	
63	2132.246	2103.362		28.884	0.000	
64	2131.641	2101.405		30.236	0.356	WF
65	2131.676	2096.788		34.888	0.000	
66	2138.498	2108.323		30.175	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
15	16	40	490.699	110	0.356	0.283	4.677	2.295	0.000
15	17	40	3.342	110	0.356	0.283	4.677	0.016	0.000
19	20	80	50.343	110	4.821	0.960	19.929	1.003	0.000
19	25	40	110.148	110	0.356	0.283	4.677	0.515	0.000
20	21	80	98.801	110	5.084	1.012	21.991	2.173	0.000
20	98	40	136.350	110	-0.263	-0.210	-2.675	-0.365	0.000
21	22	80	99.817	110	4.728	0.941	19.225	1.919	0.000
21	27	50	391.161	110	0.356	0.181	1.577	0.617	0.000
22	23	50	409.489	110	0.668	0.340	5.060	2.072	0.000
22	28	80	25.044	110	4.060	0.808	14.500	0.363	0.000
23	24	50	281.908	110	0.000	0.000	0.000	0.000	0.000
23	67	50	21.176	110	0.668	0.340	5.060	0.107	0.000
28	29	80	48.215	110	4.060	0.808	14.500	0.699	0.000
28	66	40	387.735	110	0.000	0.000	0.000	0.000	0.000
28	95	50	590.268	110	0.000	0.000	0.000	0.000	0.000
29	30	80	56.962	110	3.704	0.737	12.234	0.697	0.000
29	37	40	4.425	110	0.356	0.283	4.677	0.021	0.000
30	31	80	41.701	110	3.348	0.666	10.146	0.423	0.000
30	38	40	180.957	110	0.356	0.283	4.677	0.846	0.000
31	32	80	36.952	110	2.992	0.596	8.239	0.304	0.000
31	41	50	533.929	110	0.356	0.181	1.577	0.842	0.000
32	33	50	124.270	110	1.366	0.696	19.025	2.364	0.000
32	44	50	34.970	110	1.626	0.829	26.282	0.919	0.000
33	34	50	87.645	110	1.010	0.515	10.876	0.953	0.000
33	54	40	30.435	110	0.356	0.283	4.677	0.142	0.000
34	100	50	70.910	110	0.654	0.333	4.863	0.345	0.000
34	55	40	427.802	110	0.356	0.283	4.677	2.001	0.000
35	36	40	456.267	110	0.000	0.000	0.000	0.000	0.000
35	58	50	59.038	110	0.356	0.181	1.577	0.093	0.000
38	39	40	180.786	110	0.000	0.000	0.000	0.000	0.000
38	40	40	3.092	110	0.356	0.283	4.677	0.014	0.000
41	42	40	116.135	110	0.000	0.000	0.000	0.000	0.000
41	43	40	15.983	110	0.356	0.283	4.677	0.075	0.000
44	45	50	49.257	110	1.270	0.647	16.632	0.819	0.000
45	46	40	96.633	110	0.356	0.283	4.677	0.452	0.000
45	47	50	231.563	110	0.914	0.466	9.046	2.095	0.000
47	48	50	273.750	110	0.962	0.490	9.941	2.721	0.000
47	51	40	199.262	110	-0.048	-0.038	-0.114	-0.023	0.000
48	49	40	71.217	110	0.606	0.482	12.525	0.892	0.000
48	52	40	5.532	110	0.356	0.283	4.677	0.026	0.000
49	50	40	73.854	110	0.356	0.283	4.677	0.345	0.000

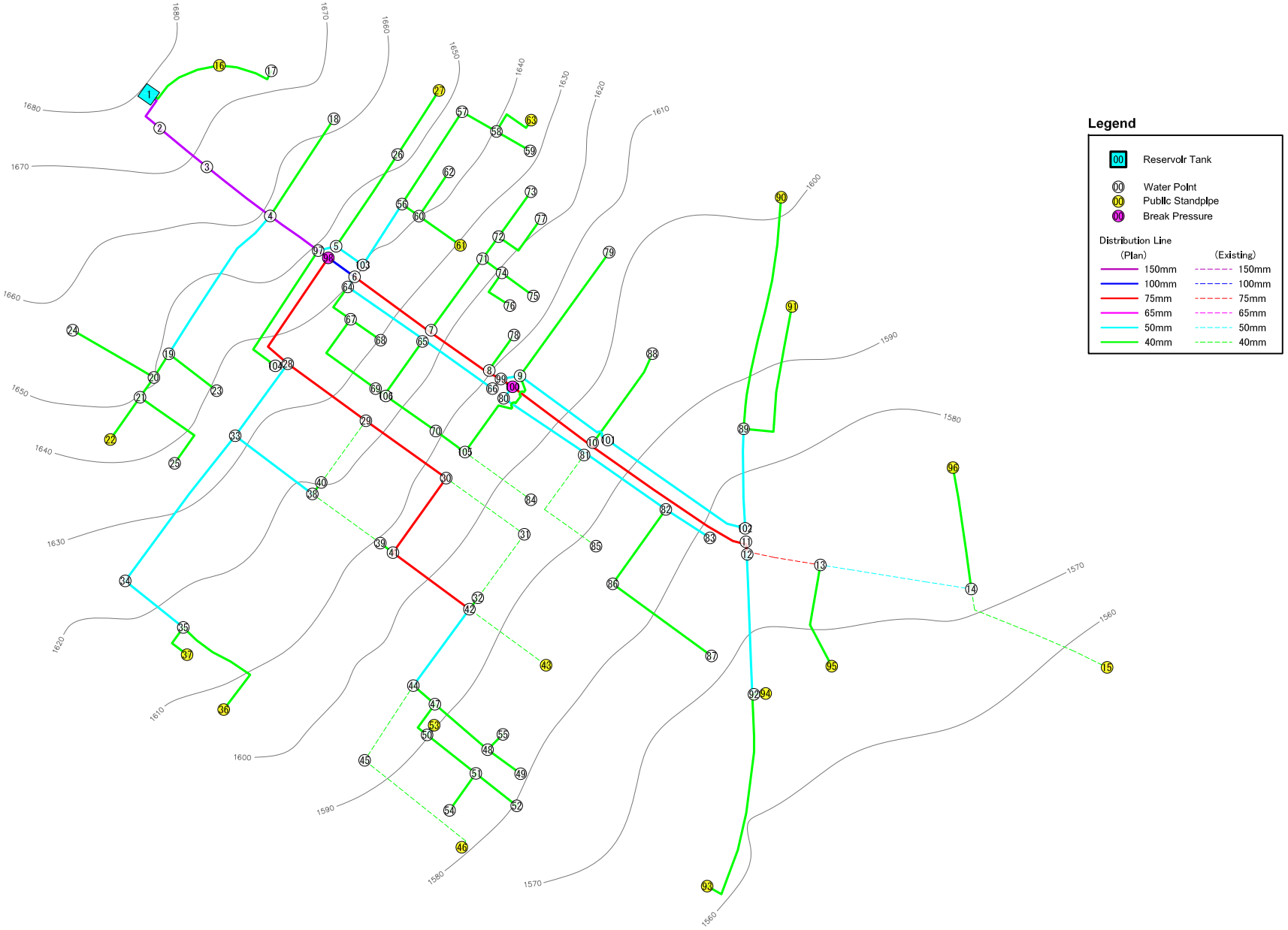
--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
67	2136.682	2108.095		28.587	0.000	
68	2136.568	2102.470		34.098	0.000	
69	2134.639	2106.042		28.597	0.061	HC
70	2134.639	2107.806		26.833	0.000	
71	2136.568	2105.941		30.627	0.000	
72	2136.568	2106.436		30.132	0.000	
73	2136.568	2102.376		34.192	0.000	
74	2133.124	2091.008		42.116	0.250	PS
75	2135.351	2112.332		23.019	0.357	WF
76	2145.066	2122.276		22.790	0.000	
77	2144.470	2121.038		23.432	0.000	
78	2143.793	2119.135		24.658	0.000	
79	2145.066	2123.687		21.379	0.000	
80	2144.470	2121.325		23.145	0.000	
81	2143.099	2117.965		25.134	0.000	
82	2143.309	2128.245		15.064	0.357	WF
83	2142.823	2124.603		18.220	0.000	
84	2141.679	2118.845		22.834	0.250	PS
85	2139.365	2122.430		16.935	0.000	
86	2139.365	2114.809		24.556	0.000	
87	2142.798	2118.980		23.818	0.000	
88	2141.679	2117.527		24.152	0.000	
89	2141.679	2114.879		26.800	0.000	
90	2141.679	2118.391		23.288	0.000	
91	2139.177	2122.201		16.976	0.357	WF
92	2141.931	2121.967		19.964	0.357	WF
93	2136.671	2118.914		17.757	0.357	WF
94	2132.893	2107.830		25.063	0.357	WF
95	2138.498	2120.196		18.302	0.000	
96	2149.168	2126.958		22.210	0.357	WF
97	2145.786	2124.878		20.908	0.000	
98	2143.318	2116.772		26.546	0.000	
99	2142.517	2121.355		21.162	0.000	
100	2132.712	2105.603		27.110	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
49	53	40	176.255	110	0.250	0.199	2.430	0.428	0.000
55	56	40	131.054	110	0.000	0.000	0.000	0.000	0.000
55	57	40	10.240	110	0.356	0.283	4.677	0.048	0.000
58	59	50	104.191	110	0.356	0.181	1.577	0.164	0.000
58	63	40	152.352	110	0.000	0.000	0.000	0.000	0.000
59	60	40	86.780	110	0.356	0.283	4.677	0.406	0.000
60	61	40	24.246	110	0.000	0.000	0.000	0.000	0.000
60	64	40	7.488	110	0.356	0.283	4.677	0.035	0.000
61	62	40	88.867	110	0.000	0.000	0.000	0.000	0.000
61	65	40	42.976	110	0.000	0.000	0.000	0.000	0.000
67	68	50	93.469	110	0.311	0.158	1.228	0.115	0.000
67	75	40	283.306	110	0.357	0.284	4.701	1.332	0.000
68	69	40	529.735	110	0.311	0.248	3.641	1.929	0.000
68	71	40	71.348	110	0.000	0.000	0.000	0.000	0.000
69	70	40	58.494	110	0.000	0.000	0.000	0.000	0.000
69	74	40	623.395	110	0.250	0.199	2.430	1.515	0.000
71	72	40	75.603	110	0.000	0.000	0.000	0.000	0.000
71	73	40	133.830	110	0.000	0.000	0.000	0.000	0.000
76	77	40	73.651	110	0.479	0.381	8.097	0.596	0.000
76	79	40	100.940	110	0.000	0.000	0.000	0.000	0.000
77	78	40	83.608	110	0.479	0.381	8.097	0.677	0.000
77	80	40	111.265	110	0.000	0.000	0.000	0.000	0.000
83	99	50	180.990	110	0.370	0.188	1.692	0.306	0.000
83	87	40	229.783	110	0.047	0.037	0.109	0.025	0.000
84	85	40	492.333	110	0.357	0.284	4.701	2.314	0.000
84	88	40	29.543	110	0.000	0.000	0.000	0.000	0.000
85	86	40	308.178	110	0.000	0.000	0.000	0.000	0.000
85	91	40	39.868	110	0.357	0.284	4.701	0.187	0.000
88	89	40	62.123	110	0.000	0.000	0.000	0.000	0.000
88	90	40	59.718	110	0.000	0.000	0.000	0.000	0.000
97	5	100	22.660	110	5.874	0.748	9.693	0.220	0.000
14	97	40	39.250	110	0.168	0.133	1.158	0.045	0.000
98	26	40	216.718	110	0.216	0.172	1.847	0.400	0.000
78	98	40	58.640	110	0.479	0.381	8.097	0.475	0.000
81	26	40	44.510	110	0.331	0.263	4.084	0.182	0.000
26	87	40	81.230	110	0.190	0.152	1.468	0.119	0.000
99	84	50	197.720	110	0.607	0.309	4.237	0.838	0.000
87	99	40	127.390	110	0.237	0.189	2.206	0.281	0.000
100	35	50	236.832	110	0.356	0.181	1.577	0.374	0.000
51	100	40	44.050	110	-0.298	-0.237	-3.361	-0.148	0.000

Tebela Pipe Networks



------Tebela <<Hazen-Williams Formula>>------

Tank	1	Maximum EHP	61.561	(m)
Node	105	Minimum EHP	0.000	(m)
Line	110	Maximum I	18.875	(‰)
Pump,Decom	2	Maximum V	0.693	(m/s)

Convergence Gap (cm)

Calculation 16 (times)

<< Explanatory Notes >>

- Node -
HP: Head Pressure
GL: Ground Level
EHP: Effectual Head Pressure
Qc: Consumption of Water

- Line -
D: Diameter
L: Length of Pipe
Coef: Friction Coefficient
Q: Quantity of Flow
V: Velocity of Flow
I: Hydraulic Gradient
HL: Head Loss
P: Add Pressure

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
1	1678.381	1678.381		0.000	-8.058	Reservoir Tank
2	1678.199	1676.007		2.192	0.000	
3	1677.925	1668.631		9.294	0.000	
4	1677.566	1658.226		19.340	0.000	
5	1677.260	1646.157		31.103	0.000	
6	1645.968	1639.002		6.966	0.000	
7	1644.782	1622.461		22.321	0.000	
8	1643.881	1609.817		34.064	0.000	
9	1643.512	1607.250		36.262	0.000	
10	1606.354	1594.223		12.131	0.000	
11	1604.665	1576.966		27.699	0.000	
12	1604.599	1576.369		28.230	0.000	
13	1604.334	1573.896		30.438	0.000	
14	1601.814	1571.704		30.110	0.000	
15	1599.537	1554.241		45.296	0.428	WF
16	1677.401	1674.463		2.938	0.428	WF
17	1677.401	1672.897		4.504	0.000	
18	1677.566	1661.599		15.967	0.000	
19	1676.781	1648.368		28.413	0.000	
20	1676.403	1650.357		26.046	0.000	
21	1676.077	1649.234		26.843	0.000	
22	1675.378	1643.766		31.612	0.428	WF
23	1676.781	1637.273		39.508	0.000	
24	1676.403	1658.797		17.606	0.000	
25	1676.077	1636.907		39.170	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
1	2	150	83.441	110	7.630	0.432	2.183	0.182	0.000
2	3	150	125.506	110	7.630	0.432	2.184	0.274	0.000
1	16	40	149.000	110	0.428	0.341	6.578	0.980	0.000
3	4	150	164.522	110	7.630	0.432	2.184	0.359	0.000
16	17	40	114.000	110	0.000	0.000	0.000	0.000	0.000
4	18	40	238.669	110	0.000	0.000	0.000	0.000	0.000
4	19	50	353.552	110	0.428	0.218	2.219	0.784	0.000
4	97	150	147.141	110	7.202	0.408	1.962	0.289	0.000
5	26	40	255.729	110	0.428	0.341	6.578	1.682	0.000
5	103	50	66.552	110	0.858	0.437	8.043	0.535	0.000
6	7	80	190.750	110	2.570	0.511	6.215	1.186	0.000
6	64	50	22.396	110	0.462	0.236	2.561	0.057	0.000
7	8	80	145.068	110	2.570	0.511	6.215	0.902	0.000
7	71	40	185.171	110	0.000	0.000	0.000	0.000	0.000
8	78	40	94.800	110	0.000	0.000	0.000	0.000	0.000
8	99	80	59.324	110	2.570	0.511	6.215	0.369	0.000
9	79	40	346.013	110	0.000	0.000	0.000	0.000	0.000
9	105	40	160.990	110	-0.462	-0.368	-7.592	-1.222	0.000
9	101	50	201.565	110	0.888	0.452	8.572	1.728	0.000
10	11	80	379.980	110	2.144	0.427	4.445	1.689	0.000
10	88	40	228.134	110	0.000	0.000	0.000	0.000	0.000
11	12	80	14.833	110	2.144	0.427	4.445	0.066	0.000
12	13	80	153.988	110	1.286	0.256	1.725	0.266	0.000
12	92	50	293.306	110	0.858	0.437	8.043	2.359	0.000
13	14	50	313.913	110	0.857	0.437	8.026	2.519	0.000

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
26	1675.578	1651.057		24.521	0.000	
27	1674.548	1651.380		23.168	0.428	WF
28	1644.045	1635.621		8.424	0.000	
29	1643.271	1622.653		20.618	0.000	
30	1642.713	1606.313		36.400	0.000	
31	1642.272	1593.231		49.041	0.000	
32	1641.889	1593.630		48.258	0.000	
33	1642.480	1632.547		9.933	0.000	
34	1639.482	1624.862		14.620	0.000	
35	1638.259	1615.631		22.628	0.000	
36	1636.555	1606.840		29.715	0.428	WF
37	1637.740	1613.522		24.218	0.428	WF
38	1642.476	1618.695		23.781	0.240	PS
39	1642.343	1608.422		33.921	0.000	
40	1642.554	1619.897		22.657	0.000	
41	1642.324	1606.516		35.808	0.000	
42	1641.848	1593.133		48.715	0.000	
43	1640.565	1583.234		57.331	0.428	WF
44	1638.171	1595.288		42.883	0.504	SS
45	1636.966	1593.401		43.565	0.000	
46	1635.119	1580.862		54.257	0.428	WF
47	1638.041	1591.871		46.170	0.000	
48	1638.041	1584.353		53.688	0.000	
49	1638.041	1580.780		57.261	0.000	
50	1637.491	1590.581		46.910	0.000	
51	1637.491	1583.731		53.760	0.000	
52	1637.491	1579.621		57.870	0.000	
53	1637.394	1590.441		46.953	0.428	WF
54	1637.491	1583.958		53.533	0.000	
55	1638.041	1584.216		53.825	0.000	
56	1675.278	1643.225		32.053	0.000	
57	1673.786	1645.217		28.569	0.000	
58	1673.249	1638.793		34.456	0.000	
59	1673.249	1630.264		42.985	0.000	
60	1674.995	1639.154		35.841	0.000	
61	1674.312	1629.658		44.654	0.429	WF
62	1674.995	1640.497		34.498	0.000	
63	1672.573	1633.373		39.200	0.429	WF
64	1645.910	1639.553		6.357	0.000	
65	1645.717	1622.587		23.130	0.000	
66	1645.717	1608.138		37.579	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
13	95	40	216.040	110	0.429	0.342	6.606	1.427	0.000
14	15	40	346.172	110	0.428	0.341	6.578	2.277	0.000
14	96	40	251.694	110	0.429	0.342	6.606	1.663	0.000
19	20	40	57.525	110	0.428	0.341	6.578	0.378	0.000
19	23	40	124.015	110	0.000	0.000	0.000	0.000	0.000
20	21	40	49.567	110	0.428	0.341	6.578	0.326	0.000
20	24	40	193.066	110	0.000	0.000	0.000	0.000	0.000
21	22	40	106.207	110	0.428	0.341	6.578	0.699	0.000
21	25	40	206.667	110	0.000	0.000	0.000	0.000	0.000
26	27	40	156.576	110	0.428	0.341	6.578	1.030	0.000
28	29	80	198.581	110	1.997	0.398	3.898	0.774	0.000
28	33	50	183.135	110	0.887	0.452	8.548	1.565	0.000
29	30	80	202.675	110	1.656	0.330	2.755	0.558	0.000
29	40	40	165.594	110	0.341	0.272	4.329	0.717	0.000
30	31	40	197.743	110	0.239	0.190	2.230	0.441	0.000
30	41	80	188.070	110	1.417	0.282	2.065	0.388	0.000
31	32	40	171.786	110	0.239	0.190	2.230	0.383	0.000
33	34	50	374.326	110	0.856	0.436	8.009	2.998	0.000
33	38	50	199.338	110	0.031	0.016	0.017	0.003	0.000
34	35	50	152.730	110	0.856	0.436	8.009	1.223	0.000
35	36	40	259.065	110	0.428	0.341	6.578	1.704	0.000
35	37	40	78.793	110	0.428	0.341	6.578	0.518	0.000
38	39	40	178.517	110	0.132	0.105	0.746	0.133	0.000
41	42	80	195.395	110	1.549	0.308	2.436	0.476	0.000
42	43	40	195.049	110	0.428	0.341	6.578	1.283	0.000
42	44	50	194.834	110	1.360	0.693	18.875	3.678	0.000
44	45	40	183.136	110	0.428	0.341	6.578	1.205	0.000
44	47	50	58.412	110	0.428	0.218	2.219	0.130	0.000
45	46	40	280.895	110	0.428	0.341	6.578	1.848	0.000
47	48	40	143.082	110	0.000	0.000	0.000	0.000	0.000
47	50	40	83.596	110	0.428	0.341	6.578	0.550	0.000
48	49	40	83.846	110	0.000	0.000	0.000	0.000	0.000
48	55	40	44.387	110	0.000	0.000	0.000	0.000	0.000
50	51	40	127.588	110	0.000	0.000	0.000	0.000	0.000
50	53	40	14.837	110	0.428	0.341	6.578	0.098	0.000
51	52	40	107.151	110	0.000	0.000	0.000	0.000	0.000
51	54	40	93.297	110	0.000	0.000	0.000	0.000	0.000
56	57	40	225.926	110	0.429	0.342	6.606	1.493	0.000
56	60	40	42.860	110	0.429	0.342	6.606	0.283	0.000
57	58	40	81.278	110	0.429	0.342	6.606	0.537	0.000
58	59	40	79.924	110	0.000	0.000	0.000	0.000	0.000

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks
67	1645.782	1635.190		10.592	0.000	
68	1645.782	1629.145		16.637	0.000	
69	1645.483	1624.169		21.314	0.000	
70	1645.296	1611.823		33.473	0.000	
71	1644.782	1623.759		21.023	0.000	
72	1644.782	1624.408		20.374	0.000	
73	1644.782	1625.112		19.670	0.000	
74	1644.782	1618.883		25.899	0.000	
75	1644.782	1612.558		32.224	0.000	
76	1644.782	1614.590		30.192	0.000	
77	1644.782	1620.521		24.261	0.000	
78	1643.881	1611.385		32.496	0.000	
79	1643.512	1608.420		35.092	0.000	
80	1607.250	1606.765		0.485	0.000	
81	1607.250	1593.912		13.338	0.000	
82	1607.250	1585.177		22.073	0.000	
83	1607.250	1578.995		28.255	0.000	
84	1644.734	1596.510		48.224	0.000	
85	1607.250	1587.541		19.709	0.000	
86	1607.250	1584.688		22.562	0.000	
87	1607.250	1573.056		34.194	0.000	
88	1606.354	1591.898		14.456	0.000	
89	1636.490	1584.581		51.909	0.030	HC
90	1633.293	1601.293		32.000	0.429	WF
91	1634.383	1593.500		40.883	0.429	WF
92	1602.240	1568.172		34.068	0.000	
93	1599.284	1560.623		38.661	0.429	WF
94	1602.196	1568.093		34.103	0.429	WF
95	1602.906	1566.688		36.218	0.429	WF
96	1600.151	1579.974		20.177	0.429	WF
97	1677.277	1646.157		31.120	0.000	
98	1646.157	1646.157	31.120	0.000	0.000	
99	1643.512	1607.250		36.262	0.000	
100	1607.250	1607.250	36.262	0.000	0.000	
101	1641.784	1594.223		47.561	0.000	
102	1638.527	1576.966		61.561	0.000	
103	1676.725	1639.002		37.723	0.000	
104	1677.277	1635.621		41.656	0.000	
105	1644.734	1606.260		38.474	0.000	
106	1645.469	1622.900		22.569	0.000	

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
58	63	40	102.334	110	0.429	0.342	6.606	0.676	0.000
60	61	40	103.384	110	0.429	0.342	6.606	0.683	0.000
60	62	40	109.446	110	0.000	0.000	0.000	0.000	0.000
64	65	50	190.309	110	0.281	0.143	1.017	0.194	0.000
64	67	40	95.919	110	0.182	0.145	1.343	0.129	0.000
65	66	50	170.981	110	0.000	0.000	0.000	0.000	0.000
65	70	40	139.527	110	0.281	0.224	3.017	0.421	0.000
67	68	40	75.155	110	0.000	0.000	0.000	0.000	0.000
67	69	40	222.336	110	0.182	0.145	1.343	0.299	0.000
71	72	40	55.825	110	0.000	0.000	0.000	0.000	0.000
71	74	40	49.027	110	0.000	0.000	0.000	0.000	0.000
72	73	40	114.836	110	0.000	0.000	0.000	0.000	0.000
72	77	40	130.282	110	0.000	0.000	0.000	0.000	0.000
74	75	40	80.148	110	0.000	0.000	0.000	0.000	0.000
74	76	40	98.895	110	0.000	0.000	0.000	0.000	0.000
80	81	50	202.079	110	0.000	0.000	0.000	0.000	0.000
81	82	50	201.631	110	0.000	0.000	0.000	0.000	0.000
81	85	40	272.856	110	0.000	0.000	0.000	0.000	0.000
82	83	40	107.841	110	0.000	0.000	0.000	0.000	0.000
82	86	40	187.837	110	0.000	0.000	0.000	0.000	0.000
86	87	40	251.360	110	0.000	0.000	0.000	0.000	0.000
89	90	40	483.996	110	0.429	0.342	6.606	3.197	0.000
89	91	40	318.994	110	0.429	0.342	6.606	2.107	0.000
92	93	40	447.465	110	0.429	0.342	6.606	2.956	0.000
92	94	40	6.734	110	0.429	0.342	6.606	0.044	0.000
97	5	50	1.000	110	1.286	0.655	17.016	0.017	0.000
97	98	150	0.010	110	5.916	0.335	1.363	0.000	-31.120
98	6	100	66.552	110	3.032	0.386	2.848	0.190	0.000
98	28	80	274.431	110	2.884	0.574	7.697	2.112	0.000
99	9	80	0.010	110	0.426	0.085	0.222	0.000	0.000
99	100	80	0.010	110	2.144	0.427	4.445	0.000	-36.262
100	10	80	201.565	110	2.144	0.427	4.445	0.896	0.000
100	80	50	19.538	110	0.000	0.000	0.000	0.000	0.000
101	102	50	379.980	110	0.888	0.452	8.572	3.257	0.000
102	89	50	237.629	110	0.888	0.452	8.572	2.037	0.000
103	56	50	179.831	110	0.858	0.437	8.043	1.446	0.000
97	104	40	274.431	110	0.000	0.000	0.000	0.000	0.000
105	84	40	166.700	110	0.000	0.000	0.000	0.000	0.000
106	70	40	129.000	110	0.182	0.145	1.343	0.173	0.000
69	106	40	10.200	110	0.182	0.145	1.343	0.014	0.000
70	105	40	74.000	110	0.462	0.368	7.592	0.562	0.000

--- NodeData ---

Node	HP (m)	GL (m)	EHP 1st(m)	EHP 2nd(m)	Qc (l/s)	Remarks

--- LineData ---

Node ST	Node EN	D (mm)	L (m)	Coef C	Q (l/s)	V (m/s)	I (‰)	HL (m)	P (m)
40	38	40	18.000	110	0.341	0.272	4.329	0.078	0.000
39	41	40	25.000	110	0.132	0.105	0.746	0.019	0.000
32	42	40	18.000	110	0.239	0.190	2.230	0.040	0.000

Collected Data List

No.	Item	Configuration	Original/ Copy	Issuing Institution	Year
1	Environmental Policy	Electronic File	Copy	Federal Democratic Republic of Ethiopia Environmental Protection Authority	1997
2	Proclamation No. 89/1997 Federal Rural land Administration	Electronic File	Copy	Federal Negarit Gazeta of the Federal Democratic Republic of Ethiopia	1997
3	Ethiopian Water Resources Management Policy	Book	Copy	Federal Democratic Republic of Ethiopia Ministry of Water Resources	1999
4	Environmental Impact Assessment Guideline Document	Electronic File	Copy	Federal Democratic Republic of Ethiopia Environmental Protection Authority	2000
5	Ethiopian Water Sector Strategy	Book	Copy	Federal Democratic Republic of Ethiopia Ministry of Water Resources	2001
6	Ethiopian Water Sector Policy	Electronic File	Copy	Federal Democratic Republic of Ethiopia Ministry of Water Resources	2001
7	Environmental Impact Assessment Procedural Guideline Series 1	Electronic File	Copy	Federal Democratic Republic of Ethiopia Environmental Protection Authority	2003 Nov.
8	Draft Rural Water Supply and Sanitation Design Criteria	Electronic File	Copy	Ministry of Water Resources, Rural Water Supply and Sanitation Department	2005 Apr.
9	Gender Mainstreaming Field Manual For Water Supply & Sanitation Projects	Electronic File	Copy	Ministry of Water Resources Women's Affairs Department	2005 Dec.
10	Council of Ministers Regulation No.115/2005 Ethiopian Water Resources Management Regulations	Electronic File	Copy	Federal Negarit Gazeta of the Federal Democratic Republic of Ethiopia	2005 Mar.
12	Southern Nations Nationalities and People's Region (SNNPR) Livelihood Profiles Regional Overview	Electronic File	Copy	USAID	2005
13	Urban Water Supply Design Criteria	Electronic File	Copy	Ministry of Water Resources, Urban Water Supply and Sanitation Department	2006 Jan.
14	2004/5 Household Income, Consumption and Expenditure Survey (HICE) Volume I, II	Electronic File	Copy	Federal Democratic Republic of Ethiopia Central Statistical Agency (CSA)	2007
15	Butajira – Ziway areas Development Study	Electronic File	Copy	Ministry of Water Resources (MoWS) Ethiopian Water Technology Centre (EWTEC)	2008 Jan.

No.	Item	Configuration	Original/ Copy	Issuing Institution	Year
16	Ethiopia: Overview of Selected Biodiversity	Electronic File	Copy	Biodiversity Indicators Development National Task Force for the Project of UNEP-WCMC	2010
17	Experience and Future Direction in Ethiopian Rural Land	Electronic File	Copy	World Bank Presented at the Annual World Bank Conference on Land and Poverty	2011 Apr.
18	The WaSH Implementation Framework	Electronic File	Copy	Federal Democratic Republic of Ethiopia	2011 Aug.
19	The Study on Groundwater Resources Assessment in the Rift Valley Lakes Basin in Ethiopia, Final Report (Data Book)	Electronic File	Copy	JICA (Japan International Cooperation Agency)	2012
20	The 2010/11 Ethiopian Households Consumption – Expenditure (HCE) Survey, Result for : Country Level Statistical Report	Electronic File	Copy	Federal Democratic Republic of Ethiopia Central Statistical Agency (CSA)	2012 Dec.
21	Rural Land Policy, Rural Transformation and Recent Trends in Large-scale Rural Land Acquisitions in Ethiopia	Electronic File	Copy	European Report Development	2012
22	Ethiopian Investment Commission Factor Cost	Electronic File	Copy	Ethiopian Investment Commission	2014 Jun.
23	Geological Map, 838C2 KELLA	Geological Map	Copy	EMA (Ethiopian Mapping Agency)	
24	Geological Map, 838C4 BUTAJIRA	Geological Map	Copy	EMA	
25	Geological Map, 838D1 BUI	Geological Map	Copy	EMA	
26	Geological Map, 838D3 KOSHE	Geological Map	Copy	EMA	
27	Geological Map, 738A1 DALOCHA	Geological Map	Copy	EMA	
28	Geological Map, 738A2 TORA	Geological Map	Copy	EMA	
29	Geological Map, 738A3 WILBAREG	Geological Map	Copy	EMA	
30	Geological Map, 738A4 MITO	Geological Map	Copy	EMA	
31	Geological Map, 738B1 ZIWAY	Geological Map	Copy	EMA	
32	Geological Map, 738B3 BULBULA	Geological Map	Copy	EMA	
33	Geological Map, 737D4 SHONE	Geological Map	Copy	EMA	
34	Geological Map, 638A4 YIRGA ALEM	Geological Map	Copy	EMA	
35	Geological Map, 638C3 DILA	Geological Map	Copy	EMA	

No.	Item	Configuration	Original/ Copy	Issuing Institution	Year
36	Geological Map, 637B2 SODO	Geological Map	Copy	EMA	
37	Geological Map, 637B3 GESUBA	Geological Map	Copy	EMA	
38	Geological Map, 637B4 TEBELA	Geological Map	Copy	EMA	