Republic of Djibouti
Ministry of Agriculture, Livestock, Fishery and
in charge of Water Resources (MAEM-RH)

THE PREPARATORY SURVEY
ON
THE RURAL WATER SUPPLY PROJECT
IN
SOUTHERN DJIBOUTI

PREPARATORY SURVEY REPORT

March, 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.
OYO INTERNATIONAL CORPORATION

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on the Rural Water Supply Project in Republic of Djibouti, and organized a survey team headed by Mr.Toru Yoritate of Oriental Consultants Co.,Ltd. and consist of Oyo International between January, 2010 to March, 2011.

The survey team held a series of discussions with the officials concerned of the Government of Ministry of Agriculture, Livestock, Fishery and in charge of Natural Resources (MAEM-RH), and conducted a field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of MAEM-RH for their close cooperation extended to the survey team.

March, 2011

Mr. Shinya EJIMA
Director General,
Global Environment Department
Japan International Cooperation Agency

Summary

(1) Description of Country

The Republic of Djibouti, hereinafter Djibouti, is located in the northeast of the African continent, between the Aden Gulf and the Red Sea. It has a population of about 820,000 with an area of 23,200 km^2, having borders with Eritrea, Ethiopia and Somalia.

(2) Background, Chronology and Outline of the Project

It rarely rains in Djibouti and the average annual rainfall is about 150 mm. Since there are no rivers, many people rely on underground water flow below the wadi. However, many shallow wells dry up during the dry season. Even in areas that have water, it is often not drinkable because of high salinity due to the geological features of Djibouti. In urban areas, the water supply ratio is 92%, but in rural areas, the ratio is only 54%. Due to recent droughts, people in rural areas are suffering from not only an insufficient amount of drinking water but also a lack of water for daily use, agriculture and livestock.

(3) Contents of the Project and Outline of the Results

Because of this situation, the Ministry of Agriculture - Livestock and Fisheries in charge of Water Resources, hereinafter MAEM-RH, requested the Japanese Government to (1) construct water supply facilities (deep well, pump with solar system, water tank) at 18 settlements in 21 villages, (2) provide material/equipment for well construction/water resource exploration, and (3) provide technical guidance on handling geophysical exploration equipment. Water supply facilities for the 18 target settlements were chosen from the plan of PNSA (National Programme for Food Security). The Japanese Government has been conducting a preparatory survey since January 2011.

In the southern area of Djibouti, there is a wide area in which underground water is not drinkable. After reviewing the existing well information at the beginning of the survey, it became clear that many of the requested settlements are not suitable for underground water development. Therefore, the Survey Team had discussions with MAEM-RH and decided to add 18 more settlements to the survey (total number of target areas: 36 settlements). Based on the natural/social conditions, 15 settlements were chosen for trial drilling, and finally 9 settlements were chosen for construction of water supply facilities.

Due to the water demand and the groundwater level, hand pumps cannot pump up water from the constructed wells. Thus, power pumps will be applied in this Project. Solar systems will be applied to generate power for the pumps because they are maintenance free. Pumped water will be stored at distribution tanks and water will be gravity supplied to water tap/water points for livestock. FRP (Fiber-Reinforced Plastic) water tanks will be installed because of their high quality and ease of

maintenance and because JICA has had experience installing FRP tanks in other projects in Djibouti. Table-1 shows the target settlements and their water demand.

Table-1 Target Settlements and Water Demand

	Settlement Name	Water Supply Population	Water Demand (m^3/d)	Remarks
7	Sankal（Sabbalou）	3,000	60.0	Drinking Water
8	Zina Male	592	11.8	Daily Use Water
11	Daguiro (2)	682	13.6	Daily Use Water
15	Sek Sabir	1,888	37.8	Drinking Water
16	Assa Koma	1,020	20.4	Daily Use Water
17	Mindil	496	9.9	Drinking Water
18	Afka Arraba	250	5.0	Drinking Water
21	Hambocta	675	13.5	Drinking Water, Supply Water to Primary School
29	Midgarra	875	17.5	Daily Use Water
Total Supply of Drinking Water		6.309	126.2	
Total Supply Water		9,478	189.5	

Among the 9 settlements, water at 4 settlements is not suitable for drinking because the water quality (nitrate and fluoride concentrations) exceeds the standards of WHO guidelines. Although the Survey Team explained the risks related to supplying water with high nitrate and fluoride, the Djibouti Government strongly requested the Japanese Government to construct water supply facilities at these settlements. For these 4 settlements, MAEH-RH shall (1) make sure supplied water will be used only for daily use and not for human consumption, (2) indicate at the site that water is not for human consumption, (3) directly conduct the operation/maintenance of the facility, and (4) regularly monitor the water quality/water usage situation.

The regional population of southern Djibouti for the targeted year (2017) is estimated to be 127,025. Owing to the implementation of this Project, more people can have access to safe water and the water supply ratio is expected to increase by 5%.

Regarding provision of material/equipment for well construction/water resource exploration, the Japanese Government intends to provide the Djibouti Government with material/equipment such as, a mobile workshop, pickup trucks, two dimensional electric resistivity survey equipment, borehole logging equipment, and casing/screens, which will be used for well construction (other than this Project) conducted by the Djibouti Government.

Regarding soft components, the Japanese Government intends to support MAEM-RH to (1) strengthen its capacity to maintain water supply facilities, (2) establish maintenance organizations at 4 drinking water supply settlements, and (3) conduct training to collect/analyze/evaluate data for underground water resource development.

(4) The Term of Construction and Outline of the Project Cost

The total Project period is 21 months comprising of 14 months for water supply facility construction, 8 months for equipment procurement and 6 months for soft components. Of the estimated Project cost, 12 million JPY will be the responsibility of the Djibouti Government.

(5) Project Evaluation

The Project will construct nine water intake facilities (5 of which are for drinking) for nomads in southern Djibouti who suffer from chronic water shortage. 6,300 people, 5% of the population of southern Djibouti, will gain access to drinking water. 3,170 people, 2.5% of the population of southern Djibouti, will gain access to water for domestic use. Owing to the Project, the water coverage area will be increased to 68% by the target year 2017. In addition, it is expected that this Project will result in the decrease of water borne diseases and improvement of the school enrollment rate of children. Also, by using the procured well drilling materials, 20 new wells will be constructed by MAEM-RH, and through the procurement of equipment for water resources surveys and soft components, the ability to implement future rural water supply projects will be improved.

Imperative to the success of this Project is the fulfillment of the obligations and responsibilities of the Government of Djibouti to monitor the established WC and to operate a continuous water intake facility maintenance system through the process of a repair request by the community resulting in the repair by MAEM-RH.

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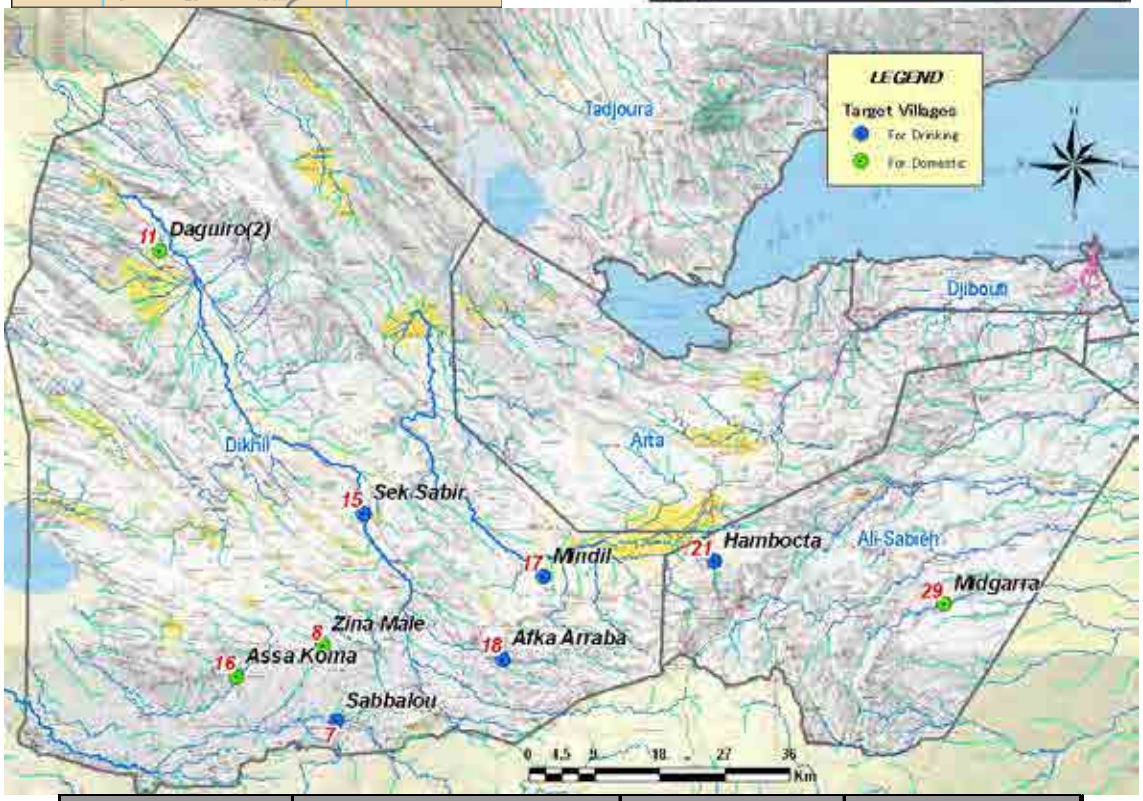

REGION	Name	Latitude N	Longitude E
DIKHIL	7 - SABALLOU	11.00350	42.20873
DIKHIL	8 - ZINAMALE	11.10118	42.18067
DIKHIL	11 - DAGUIRO(2)	11.59117	41.96897
DIKHIL	15 - SEK SABIR	11.26918	42.22931
DIKHIL	16 - ASSA KOMA	11.06161	42.07052
DIKHIL	17 - MINDIL	11.20660	42.43183
DIKHIL	18 - AFKA ARRABA	11.08629	42.40719
ALI-SABIEH	21 - HAMBOUCTA	11.21184	42.67193
ALI-SABIEH	29 - MIDGARRA	11.16117	42.96377

Location Map

Perspective

Photo (1)

Photo-1 Location for a water supply facility that will be constructed by this project (Dikhil Prefecture Afka Arraba).
This photo shows the situation during well drilling. A camp does not exist beside the well drilling site. (There are no camps beside any of the well drilling sites in this project.)

Photo-2 Nomad camp (Dikhil Prefecture Daguiro). Several households stay at this site semi-permanently.

Photo-3 Inhabitants drawing water from a traditional well in the wadi. (Dikhil Prefecture Kouta Bouya)

Photo-4 Situation of the target settlement (Dikhil Prefecture Zina Male). This site is 2 km from the well that will be constructed in this project.

Photo-5 When nomads and their goats passed through the well drilling site that was conducting a pumping test, the goats drank the pumped water. (Dikhil Prefecture Mindil)

Photo-6 Meeting held by settlement leader (Dikhil Prefecture Kouta Bouya)

Photo (2)

Photo-7 In order to access the site, heavy vehicles need to cross a few wadis. Before water supply facility construction, it is necessary to check road access conditions.
It will be difficult for vehicles to cross wadi after the rain due to muddy ground. Even if the wadi is dry, vehicles may be stuck in the sand. (between Dikhil -Sabbalou)。

Photo-8 Stockroom of MAEM-RH
Material/Equipment is placed in a clutter. Even material/equipment that cannot be used are kept.

Photo-9 UNICEF installed a water tank along the national road where there is no water source. Water truck supplies water to the tank regularly. (Dikhil Prefecture Daguiro)

Photo-10 Solar generation system for the water supply facility constructed by Saudi Arabia's project. (Arta Prefecture Chabellei Village)

Photo10 Shallow well along the wadi. The upstream side of the well structure is shaped like a ship's bow in order to protect the well from floods.

Photo12 Water storage facility located along the national road. Water trucks supply water to this storage facility regularly.

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ABBREVIATIONS

Abréviation / Abbreviation	Français / English
AD / GA	: Accord de Don / Grant Agreement
BN	: Budget National
CERD	: Centre d'Étude et de Recherche de Djibouti / Center for Study and Research in Djibouti
DISED	: Department of Statistics and Demographic Studies / Direction de la Statistique et des Études Démographiques
EC	: Conductivité électrique / Electrical Conductivity
E/N	: Échange de Notes / Exchange of Notes
FAO	: Organisation des nations unies pour l'alimentation et l'agriculture / Food and Agriculture Organization of the United Nations
FD / DJF	: Franc Djiboutien / Djibouti Franc
GPS	: Global Positioning System / Système de positionnement mondial
HDPE	: Polyéthylène à haute densité / High Density Polyethylene
INDS	: Initiative Nationale pour le Développement Social / National Initiative for Social Development
IWMI	: Institut International de Gestion des Ressources en Eau / International Water Management Institute
JICA	: Agence japonaise de coopération internationale / Japan International Cooperation Agency
MAEM-RH	: Ministère de l'Agriculture, de l'Elevage et de la Mer chargé des Ressources Hydraulique / Ministry of Agriculture, Livestock and Fisheries in charge of Water Resources
MTBF	: Temps moyen entre pannes / Mean Time Between Failures /
OCDE-CAD / OECD-DAC	: Organisation de Coopération et de Développement Économiques et Comité d'aide au / Organization for Economic Cooperation and Development Assistance Committee / développement
OMS / WHO	: Organisation Mondiale de la Santé / World Health Organization /
ONEAD	: Office National de l'Eau et de l'Assainissement de Djibouti / National Office for Water and Sanitation of Djibouti
PAM / WFP	: Programme Alimentaire Mondiale / World Food Programme /
PMTDI	: Dose Journalière Tolérable Provisoire Maximum / Provisional Maximum Tolerable Daily Intake
PNSA	: Programme National de Sécurité Alimentaire / National Programme for Food Security
PRB	: Bureau de référence de population / Population Reference Bureau
PVC	: Polychlorure de vinyle / Polyvinyl Chloride
RMS	: Moyenne quadratique / Route Mean Square
SDT / TDS	: Solides dissous totaux / Total Dissolved Solids

Abréviation / Abbreviation	Français / English
SGP	: Conduite en acier pour gaz / Steel Gas Pipe
TVA / VAT	: Taxe sur la valeur ajoutée / Value Added Tax
UE / EU	: Union Européenne / European Union
UN	: Nations unies / United Nations
UNICEF	: Fonds des nations unies pour l'enfance / United Nations Children's Fund /
USD	: US Dollar
WB	: Banque mondiale / World Bank
YJ / JPY	: Japanese Yen / Yen japonais

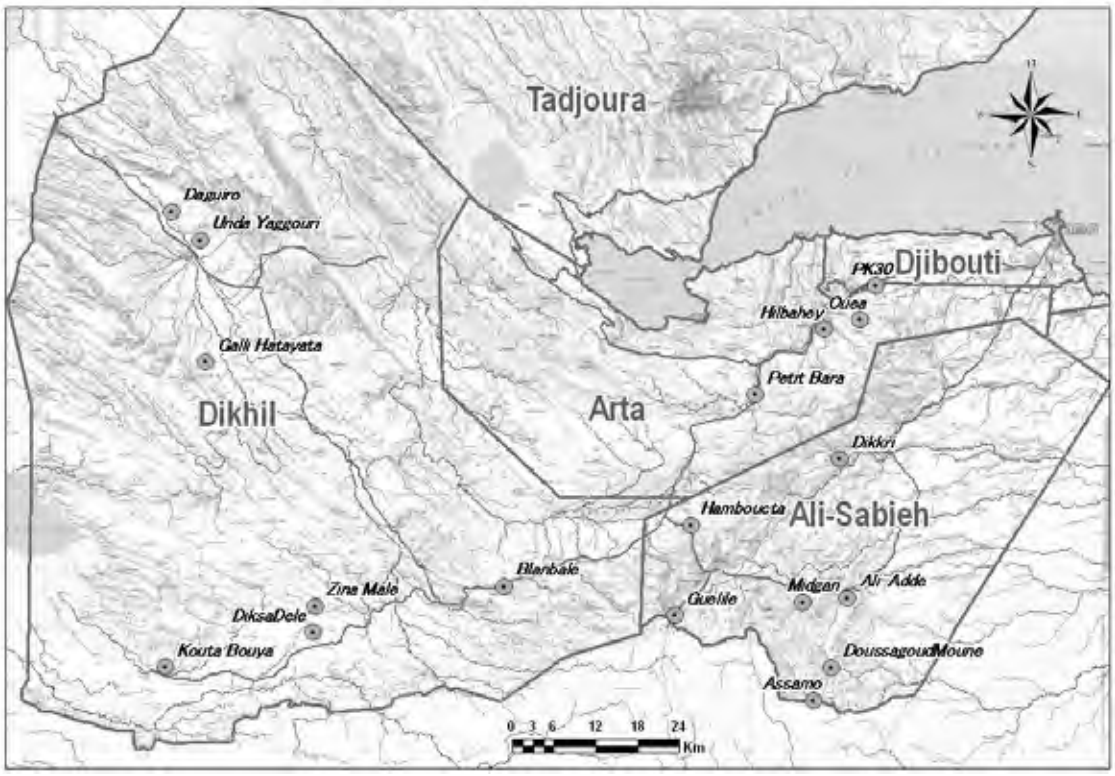
CHAPTER 1 BASIC CONCEPT OF THE PROJECT

It rarely rains in Djibouti with an average annual rainfall of about 150 mm. Since there are no rivers, many people rely on underground water that flows beneath the wadi. However, many shallow wells dry up during the dry season. Even in areas that have water, it is not drinkable in many places because of its high salinity due to the geological features of Djibouti. Because of recent droughts, people in rural areas are suffering from not only insufficient drinking water but also insufficient water for daily use, agriculture and livestock. Furthermore, even in places where there are deep wells, it is difficult for people to get drinking water because there are many cases in which the underground water level is decreasing.

Due to this situation, the Ministry of Agriculture - Livestock and Fisheries in charge of Water Resources, hereinafter MAEM-RH, requested the Japanese Government to (1) construct water supply facilities (deep wells, pumps with solar systems, water tanks) at 18 settlements in 21 villages, (2) provide materials/equipment for well construction/water resource exploration, and (3) provide technical guidance on the use of geophysical exploration equipment. Water supply facilities for the target 18 settlements have been selected from the plan of PNSA (National Programme for Food Security). In PNSA, construction of 95 deep wells was proposed but detailed plans were not made for 64 of them. Among those 64 planned wells, 18 were chosen in 3 prefectures of southern Djibouti (Dikhil, Ali-Sabieh, Arta). The Japanese Government has been conducting a preparatory survey since January 2011. The list of 18 settlements is shown in Table 1-1-1, and their locations are shown in Figure 1-1-1.

Table 1-1-1 The Designated Zones

Region	Village	Settlement	Qt. of Wells
DIKHIL	YOBOKI	(1) UNDA YAGGOURI	2 wells
	HANLE	(2) GAALI HATAYATA	1 well
	MOULOUD	(3) BLAN BALE	1 well
	AS-EYLA	(4) KOUTA BOUYA	1 well
	AS-EYLA	(5) ZINA MALE	1 well
	AS-EYLA	(6) DIKSA DERE	1 well
	YOBOKI	(7) DAGUIRO	1 well
ALI-SABIEH	HAMBOUCTA	(8) HAMBOUCTA	1 well
	GUELILE	(9) GUELILE	1 well
	MIDGAN	(10) MIDGAN	1 well
	HOL-HOL	(11) DIGRI	1 well
	ASSAMO	(12) ASSAMO	2 wells
	DOUSSAGOUD MOUNE	(13) DOUSSAGOUD MOUNE	2 wells
	ALI-ADDE	(14) ALI-ADDE	1 well
ARTA	ALI FAREN	(15) HILBAHEY	1 well
	PETIT BARA	(16) PETIT BARA	1 well
	OUEA	(17) PK30	1 well
	OUEA	(18) OUEA	1 well



Source: JICA Study Team

Figure 1-1-1 Location Map of Requested Settlement

Although the water supply ratio in urban areas is above 90%, the ratio in rural areas is only 54%. The rural area population is about 240,000 people (2009 census). Most of them are nomadic and fetching water is very time consuming. The Djibouti Government has a development policy to promote nomadic people to permanently reside in one area by supplying a sustainable water source. When water is supplied, the Djibouti Government assumes that (1) people will settle down around the water supply facility, (2) primary schools / clinics will be constructed, (3) opportunities for education / medical treatment will increase, (4) jobs will be created related to agriculture and, (5) food self-sufficiency will increase.

In the well construction program of PNSA, the well water pumping rate was planned to be $30m^3/h$ (operating 10 hours/day; $300m^3/day$). However, according to the collected results, most of the wells in Djibouti can only supply water at lower levels than this amount.

In addition, it was reported that the groundwater level is low and is decreasing around the existing boreholes.

To protect it from interference, the water intake facility will be constructed at an adequate distance from existing wells. Also, it is important to ensure continuous operation and that the limit of the amount for pumping water is not exceeded.

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

(1) Upper Aim and Project Aim

As previously stated, it rarely rains in Djibouti and the average annual rainfall is about 150mm. Since there are no rivers, many people rely on underground water that flows below the wadi. In urban areas, the water supply ratio is 92% but in rural areas, it is only 54%. People living in rural areas must invest a lot of time to get water for daily activities. Furthermore, safe, drinkable water is important because it is inseparably connected to education, health, rural development, etc.

The upper aim of this Project is "to improve the living environment of residents in rural areas".

In order to improve the water supply situation in the rural areas of Djibouti, the Djibouti Government prepared a program to rehabilitate/construct wells in 2009. This program aimed at implementing construction of 95 deep wells with a capacity of $30m^3/h$ using a solar based power system (to reduce operation costs). Among the 95 planned wells, 31 wells were constructed by other donors such as Abu Dhabi Foundation and the Saudi Arabia Foundation. For the remaining planned wells (64 wells), this Project will consist of the procurement of drilling equipment and construction of water supply facilities at the 9 high priority settlements. This Project's aim is to raise the population of people who can access safe and sustainable water.

(2) Project Outline

In order to achieve the Project aim above, this Project will (1) construct water supply facilities (deep wells, pumps with solar systems, water tanks) at 5 sites for drinking water and 4 sites for daily use water in 3 prefectures in southern Djibouti (Dikhil, Ali-Sabie, Arta), and (2) provide materials/equipment for well construction/water resource exploration.

Furthermore, in order to enhance the capability of water department staff and to establish an operation/maintenance system, this Project will provide technical guidance on using geophysical exploration equipment and guidance on establishment of a water management committee. Through the guidance to enhance the capability of staff/organization, construction of water supply facilities and the provision of equipment/material, it is expected that the effects of this Project will be enhanced and a sustainable water supply will be provided to the people.

The Project Design Matrix (PDM) of this Project is shown on the next page.

Table 2-1-1 Project Design Matrix (PDM) of the of the Rural Water Supply in Southern Djibouti

Project : Rural Water Supply Project in Southern Djibouti — Project Duration : March 2011 – February 2013

Target Area : 9 Sites (5 sites for drinking and 4 sites for domestic use only) of 9 areas in 2 Districts (Dikhil, Ali-Sabieh) of Southern Djibouti — Target Group : Resident people of target areas and staff of Water Agency

Design Summary	Project Monitoring Indicators	Source of Indicators	External Conditions
Ultimate Goal To improve living conditions of people in target area	• To decrease the ratio of water borne diseases • To decrease time and distance to get water	• Statistic data on healthcare, water hygiene and sanitation • Result of interview surveys of related community people	• Assuming no radical changes in national development policies regarding rural water supply system in Djibouti
Purpose To increase the population who can receive a sustainable and safe water supply in the target area	The rural water supply of Djibouti will be 68% by 2017	• Statistic data of rural water supply sector • Result of interview survey of related community people	• Assuming that the rural water supply project of Water Agency will continue to be implemented after this Project • Assuming that large scale droughts and drying up of well water will not happen
Outputs 1. Construction of facilities and procurement of equipment 1-1. To construct water intake facilities at communities in target areas 1-2. To use the procured equipment for groundwater development projects 2. Soft compornents 2-1. To set up an O&M system for water intake facilities by community people 2-2. To build the capacity of groundwater development and management for staff	1. Construction of facilities and procurement of equipment 1-1. 5 water intake facilities for safe drinking water and 4 water intake facilities for domestic use only will be set up 1-2. Rural water development plan based on a groundwater resource survey will be planned 2. Soft components 2-1. Community organizations (WC, etc.) of O&M for water intake facilities for drinking water will be set up at 4 sites *Total 5 sites (4 sites for domestic use only and Sabbalou) will be managed by Water Agency 2-2. More than 4 staff for water resources surveys, analysis, and monitoring will be employed in the Water Agency	1. Construction of facilities and procurement of equipment 1-1. Project Report (completion report) 1-2. Groundwater development plan (draft), Rehabilitation plan of water intake facility (draft), etc. 2. Soft components 2-1. Name list of WC, etc. 2-2. Analysis results of water resources survey, well ledgers, monitoring implementation records, etc.	• Assuming that breakdown of water intake facility and theft of solar panels will not be happen • Assuming that O&M cost will not increase drastically • Assuming that community people in target sites will not move out of the community in large numbers

Design Summary	Project Monitoring Indicators	Source of Indicators	External Conditions
Activities 1. Construction of facilities and procurement of equipment 1-1.To construct water supply facilities 1-2.To procure equipment for groundwater surveys and necessary equipment and materials for construction of facilities 2. Soft components 2-1. Assistance for setting up an O&M system for water intake facilities 2-2. Capacity building for groundwater development and management	Input 〔Japanese side〕 Construction of facilities: • Construction of 9 water intake facilities (5 sites for drinking, 4 sites for domestic use only) Equipment & Material: • Support vehicles for well drilling works • Equipment for Water Resources Survey • Material & equipment for well construction Human Resources: • Consultant（Engineer） • Constructor • Provider Project Cost: • Construction cost of water intake facility • Procurement cost of equipment & material • Implementation cost for soft components	〔Djibouti side〕 Construction of facility: • Securement of land for construction of facilities, arrangement of applications for construction, etc. • Setting up perimeter fences for facilities Equipment and materials: • Existing related equipment and material, using supporting vehicles, etc. Human Resources: • Staff of Water Agency (including branch office of 3 Districts) • Community People at target sites Project Cost: •Labor cost of Water agency staff (including branch office of 3 districts) • Management & Activity cost（necessary costs for the activities related to constructing facilities and soft components, etc. • Cost for necessary equipment & materials, expendable items • Project management cost and O&M cost	• Assuming that customs clearance and transport is done properly • Assuming that staff who participate in soft components continuously work in Water Agency Pre-condition • Assuming that Djibouti side (Water Agency) understands this Project and they will fulfill their responsibility • Assuming that there are users at the water intake facilities and they will cooperate with this Project

Source: JICA Study Team

2-2 Outline Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

1) Requested Zones and Selection of Object Zones

15 zones have been added to the initial 18 requested zones since there were many zones which could not be accessed during the initial stage or were judged as having bad water quality. The selection of the object zones was carried out by confirming access conditions, natural conditions (water quality), and social conditions (capacity of the operation & maintenance and criticality). Final object zones for the water intake facilities were selected based on the results of well drilling tests in the 15 selected zones. In addition, MAEM-RH asked us to include regions in the northern area in this Project. However, the Study Team explained that the northern region cannot be incorporated into this Project at this time.

Requested zones, additional zones and investigation items in the preparatory survey are shown in Table 2-2-1.

Table 2-2-1 Requested Zones and Contents of the Investigation

Region	Village	No	Zone	Process and Survey Contents					
				Request	M / M	Add. Zone	2D Electrical Survey	Social Condition Survey	Well Drilling Test
DIKHIL	YOBOKI	1	HANLE (UNDA YAGGOURI)	●	●		●	●	
	YOBOKI	2	UNDA YAGGOURI (2)			●		●	●
	AS-EYLA	3	AS-EYLA(GARSSALE DABA)	●					
	AS-EYLA	4	AS-EYLA(DIKSA DERE)		●			●	
	YOBOKI	5	GAALI HATAYATA	●	●		●	●	
	MOULOUD	6	BLAN BALE	●	●		●	●	
	AS-EYLA	7	SABBALOU (for SANKAL)	●				●	●
	AS-EYLA	8	ZINA MALE		●		●	●	●
	AS-EYLA	9	KOUTA BOUYA	●	●		●	●	
	YOBOKI	10	DAGUIRO	●	●		●	●	
	YOBOKI	11	DAGUIRO (2)			●	●		●
	YOBOKI	12	GALAFI			●	●	●	
	YOBOKI	13	HOMBOLA			●	●	●	
	YOBOKI	14	DABUDAYYA			●			
	YOBOKI	15	SEK SABIR			●	●	●	●
	AS-EYLA	16	ASSA KOMA			●	●	●	●
	MOULOUD	17	MINDIL			●	●	●	●
	MOULOUD	18	AFKH ARRABA			●	●	●	●
	YOBOKI	19	GAGGADE			●			
	YOBOKI	20	KORI			●			
ALI-SABIEH	HAMBOUCTA	21	HAMBOCTA	●	●		●	●	●
	GUELILE	22	GUELILE	●	●		●	●	●
	MIDGAN	23	MIDGAN	●	●		●	●	
	HOL-HOL	24	DIGRI	●	●		●	●	
	ASSAMO	25	ASSAMO	●	●		●	●	
	DOUSSAGOUD MOUNE	26	DOUSSAGOUD MOUNE	●	●		●	●	
	ALI-ADDE	27	ALI-ADDE	●	●		●	●	
	HOL-HOL	28	DOUREH	●				●	
	ALI-ADDE	29	MIDDGARRA			●	●	●	●
	ALI-SABIEH	30	OUARABALEI			●	●	●	●
ARTA	ALI FAREN	31	HILBAHEY	●	●		●	●	●
	PETIT BARA	32	PETIT BARA	●	●		●	●	●
	OUEA	33	PK30	●	●		●	●	●
	OUEA	34	OUER		●				
	KARTA	35	DIKA			●			
	KATRA	36	KARTA			●			
Total				18	18	15	26	28	15

【Access Conditions】

Access roads to the zones are unpaved except for part of the national road. There are some roads that have been created by removing scattered rocks. However, most of the access roads are temporary and the conditions change year by year due to erosion caused by floods and landslides. Some places were unable to be reached even though the Water Department staff had visited those sites in the past. Additionally, some areas could not be entered for security reasons. These areas were excluded from the object zones. Incidentally, during the survey, the Djibouti side requested the Japanese side to include the northern region (Tajoura and Obock) in the Project; however, the Japanese side explained that the northern region cannot be included in this Project.

【Natural Conditions (water quality, geology) 】

Groundwater quality was considered by existing well information, investigation of existing wells and an electric survey. Using the existing well information and water quality tests, it became clear that the water quality has a strong relationship with the geography and geology. The outline of the characteristics is as follows:

a. Electric conductivity (EC) of groundwater in rhyolite is high, and is higher in the old geology.
b. Electric conductivity of groundwater in basalt is relatively low, and shows a trend of lower EC in the new geology.
c. Electric conductivity is relatively low in the sedimentary rock.
d. The collapse valley made by movement of the African rift valley has a closed catchment. Chemical substances are concentrated at the center of the catchment. The EC and the content of fluorine and arsenic are high.

On the other hand, the specific resistance value of the area was calculated by using a two-dimensional electrical survey. Distribution of the basalt (thickness) and low resistivity zones (in cases where resistivity is close to zero in Djibouti, groundwater is saline in nature and not suitable for drinking) were identified.

Areas with high potential for groundwater were identified as shown below through examining the water quality of existing wells, hydro-geological conditions and performing a two-dimensional electrical survey.

a. Areas with a thick distribution of basalt at the depth where groundwater can be found.
b. Places that have a wide catchment (wide recharge) area.

【Social Conditions】

Using the social condition survey, priority of the zones was evaluated through examining

objective population, water shortage (consumption amount, water drawing time, waterborne diseases and water resources), willingness to pay for water and willingness to establish a water committee.

【Well Drilling Tests】

Well drilling tests were carried out in the zones selected by access conditions, natural conditions (water quality) and social conditions. The zones where the water quality or water amount was not sufficient were excluded from the object zones in this Project.

The zone selection table, which shows a summary of the above conditions, is shown in Table 2-2-2.

Incidentally, Sankal is facing a serious water shortage, and the potential for groundwater development is very low; therefore, the JICA Study Team drilled a new test well in Sabbalou, located approximately 3.4 km north of Sankal. Walking is the only method of transportation for people in Sankal according to the Social Condition Survey. Presently, it is impossible to establish a water committee in Sankal; however, construction of a water intake facility has been decided under the presupposition that MAEM-RH will manage the facility until a water committee can be established.

Table 2-2-2 Zone Selection Table

	No.	Zone	Access		Natural Condition				Social condition	Reason for Exclusion				
			Road	Security	Water Quality	Topo graphy	Geology	Elec. Survey		Access	Natural Condition	Social Condition	Test Well Drilling	Judgment
DIKHIL	1	HANLE (UNDA YAGGOURI)	○	○	×	×	△	×			High Salinity. Possibility fluoride exceeds WHO Standard	Small population		×
	2	UNDA YAGGOURI (2)	○	○	–	△	○	△	○				× (dry well)	×
	3	AS-EYLA(GARSSALE DABA)	–	–	–	–	–	–	–	-- MAEM-RH changed to 4.Diksa Dere before MM --				×
	4	AS-EYLA(DIKSA DERE)	×	○	–	–	–	–	–	Can not access				×
	5	GAALI HATAYATA	○	○	×	×	○	×	○		High Salinity. Rhyolite area. Possibility fluoride exceeds WHO standard			×
	6	BLAN BALE	○	○	△	×	○	×	○		Small catchment. High salinity			×
	7	**SANKAL (Drilling point is Sabbalou)**	○	○	△	×	○	×	○			Sankal people do not have transportation to Sabbalou. The cannot use.	○	○
	8	ZINA MALE	○	○	○	×	○	○	○				○	○
	9	KOUTA BOUYA	○	○	×	○	×	×	○		High Salinity. Rhyolite area. Possivility fluoride exceeds WHO standard			×
	10	DAGUIRO	○	○	×	×	×	×	○		High salinity			×
	11	DAGUIRO (2)	○	○	△	×	△	△	○				× (high EC)	×
	12	GALAFI	○	○	△	△	○	×				Deep well with solar system is under the operation.		×
	13	HOMBOLA	×	○	–	△	△	△	×	It is difficult to cross wadi		No permanent inhabitants		×
	14	DABUDAYYA	–	×	–	–	–	–	–	Security problem				×

	No.	Zone	Access		Natural Condition				Social condition	Reason for Exclusion				Judgment
			Road	Security	Water Quality	Topo graphy	Geology	Elec. Survey		Access	Natural Condition	Social Condition	Test Well Drilling	
	15	**SEK SABIR**	○	○	○	○	○	○	△				○	○
	16	ASSA KOMA	○	○	○	○	△	△	○				○	○
	17	**MINDIL**	△	○	△	○	○	○	△				○	○
	18	**AFKA ARRABA**	○	○	○	△	○	○	△				○	○
	19	GAGGADE	–	×	–	–	–	–	–	Security problem				×
	20	KORI	×	○	–	–	–	–	–	No Road				×
ALI-SABIEH	**21**	**HAMBOCTA**	○	○	○	×	△	○	○				○	○
	22	GUELILE	○	○	×	×	×	△	○				× (High EC)	×
	23	MIDGAN	○	○	×	×	×	×	○		Low potential. Possibility fluoride exceeds WHO standard			×
	24	DIGRI	×	○	△	○	×	○	×	Cannot access path due to falling rocks		Small population		×
	25	ASSAMO	○	○	×	△	×	×	×		Geology, result of electrical survey shows low potential.	There are many shallow well and a deep well. Water shortage is not serious、		×
	26	DOUSSAGOUD MOUNE	○	○	×	×	×	×	○		High Salinity. Rhyolite area. Possibility fluoride exceeds WHO standard			×
	27	ALI-ADDE	○	○	×	×	×	×	○		High Salinity. Rhyolite area. Possibility fluoride exceeds WHO standard			×
	28	DOUREH	○	○	–	–	–	–	–	-- Excluded by MAEM-RH (It has water intake facility with solar system)--				×
	29	MIDDGARRA (Water resources for 27.Ali Adde)	○	○	–	△	○	△	×				× (High EC)	×
	30	OUARABALEI	○	○	△	×	△	○	○				× (High EC)	×

	No.	Zone	Access		Natural Condition				Social condition	Reason for Exclusion				Judgment
			Road	Security	Water Quality	Topo graphy	Geology	Elec. Survey		Access	Natural Condition	Social Condition	Test Well Drilling	
ARTA	31	HILBAHEY	○	○	○	△	○	○	○				× (dry well)	×
	32	PETIT BARA	○	○	○	△	○	○	○				× (High EC)	×
	33	PK30	○	○	○	○	○	○	○				△ (Small amount)	○
	34	OUER	×	○	–	–	–	–	–	No road				×
	35	DIKA	○	○	×	–	–	–	–		Fluoride exceeds WHO standard. Center of the rift valley and concentrated salinity.			×
	36	KARTA	○	○	–	–	–	–	–		Deep water level	Other donor projects exist.		×

Note : : excluded zone, : Target Zone (Bold letters indicate drinking water zones)

Source: JICA Study Team

2) The Target Year

The target year was reached by agreement as 2017 (five years after the facility construction) in a discussion on the Inception Report and explanation with MAEM-RH. A population census was conducted by DISED (Statistic Department) in 2009. The population of each region is shown in Table 2-2-3.

Table 2-2-3 Population in Djibouti (Census in the year 2009)

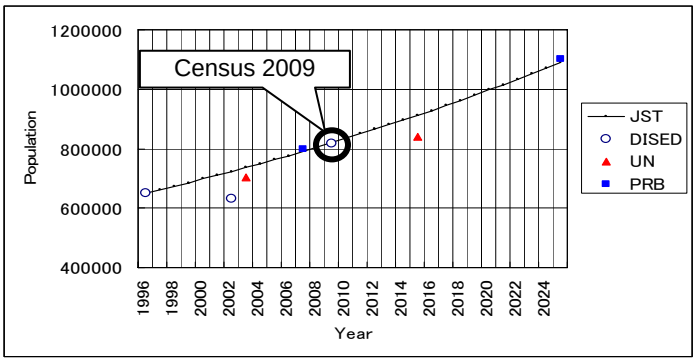
Region	Urban	Rural	Nomad	Total	Rural + Nomad
Djibouti Ville	476,322	-	-	475,322	-
Obock	11,706	9,780	16,370	37,856	26,150
Tadjourah	14,820	23,482	48,402	86,704	71,884
Dikhil	24,886	22,510	41,552	88,948	64,062
Ali Sabieh	37,939	11,977	37,033	86,949	49,010
Arta	13,260	11,345	17,775	42,380	29,120
Total	577,933	79,094	161,132	818,159	240,226
Total (Dikhil, Arta, Ali Sabieh)	76,085	45,832	96,360	218,277	142,192

Population censuses were carried out in 1960 (81,200 people) and 1982. However, the data from 1982 couldn't be found. Many of the data were estimated by several organizations. Population data is shown in Table 2-2-4 and Figure 2-2-1.

Table 2-2-4 The Population Estimation

Year	Estimated Population	Evaluation Org.	Growth Rate
1996	650,000	DISED (oral)	-
2002	632,000	UN[*1]	0.025
2003	703,000	UN[*2]	0.0158
2007	800,000	PRB[*3]	0.018
2015	839,000	UN[*2]	
2025	1,100,000	PRB	

[*1] BILAN COMMUN DE PAYS (CCA)(2002, UN)
[*2] http://www.nationsencyclopedia.com/Africa/Djibouti-POPULATION.html
[*3] Population Reference Bureau (USA)



JST : JICA Study Team
DISED : Direction de la Statistique et des Etudes (DISED)
UN : United Nations
PRB : Population Reference Bureau (USA)

Figure 2-2-1 Population Growth of Djibouti (line shows 1.8% growth)

The approximation curve in Figure 2-2-1 shows a 1.8% population growth rate based on the population of the census in 2009. MAEM-RH has suggested a population growth rate of 3.4% . However, a 2% population growth rate is suitable for consideration according to the 2009 census. Accordingly, the estimated population growth rate of RBP（Population Reference Bureau）in USA is considered to be appropriate. There are few data that have considered population growth rates of rural areas and urban areas separately. Population growth rates that have been estimated by the UN Statistics Division are as follows:

Population Growth Rate (2005-2010): 1.8%
Urban Population Growth Rate (2005-2010): 2.2%
Rural Population Growth Rate (2005-2010): -1.4%

(http://data.un.org/CountryProfile.aspx?crName=Djibouti)

The population (rural + nomadic) of the three objective regions is 142,192 according to the 2009 census. Considering the -1.4% growth rate, the population in the target year (2017) will be 127,025. The calculation shows the number of people will decrease by 10% by 2017.

The object population for the Project, as will be mentioned later, is estimated at 6,309. Therefore, the water coverage rate will increase by about 5.0%.

3) Unit Water Consumption Rate

The request area consists of a majority of nomads. Nomads make their living raising livestock. Thus, it is important to consider the water supply for livestock. The Unit Consumption Rate shall therefore account for not only people but also livestock.

a. Unit Consumption Rate for People

Water consumption per person per day for projects implemented in the past through Japanese Grant Aid were 40L/day/capita (1992 rural water supply), 30L/day/capita for villages and 20 L/day/capita for nomads (1996 rural water supply Phase II). The target of the MAEM-RH is 50L/day/capita. However, this value has not been determined through design criteria, it is just the desired value of the person in charge (refer to Table 2-2-5).

Additionally, water demands according to the climate are shown in World Bank technical documents. 30-40L/day/capita of Unit Water Consumption Rate for public taps in dry zones is shown in this paper (refer to Table 2-2-5).

Table 2-2-5 Unit Consumption Rate (L/day/capita)

Item		Unit Rate	Note
Target of MAEM-RH		50	There is no design criteria
JICA Rural Water Supply Plan (Phase I) 1992		40	House tap and public tap (Khor Angar, Sagalle, Dasbiyo)
JICA Rural Water Supply Plan (Phase II) 1996	Village	30	Dikhil, Arta, Ali-Sabieh, 16 villages, construction of water facility and rehabilitation (pump, tank)
	Nomad	20	
World Bank Technical Paper, no. 60 "Community Piped Water Supply in Developing Countries (1987)"			
Dry zone	Public Tap	30-40	Similar to the target area conditions

Source: JICA Study Team

On the other hand, the average water consumption rate, which was estimated from the social condition survey, is 15L/day/capita (average in object zone is 13L/day/capita).

Because of low precipitation of 150mm/year and high evaporation due to high temperature, the recharge of the groundwater is very low in Djibouti. Therefore, the target area is not an area where the groundwater can be used sufficiently (for instance, there are many wells which have dried up due to water level decline). Water Consumption Unit in this Project will use 20L/day/capita, the same as the JICA Grant Aid Project 1996 Phase II.

b. Unit Water Consumption Rate for Livestock

MAEM-RH does not have design criteria for livestock. Water demand for livestock, as determined by a person in charge of livestock, is shown in Table 2-2-6. As a similar example for dry zones, Unit Consumption Rates are shown in Table 2-2-6 as referred to from IWMI (International Water Management Institute). In the object area, breeding of cows was not common and the main livestock were sheep and camels. Also, a lot of cases were seen where donkeys were being used to carry water.

The required demand is not always easy to determine. Water shortage affects the production of milk. However, water demands as shown in Table 2-2-6, have become standard. Djibouti does not have a permanent river and is lacking in natural water resources. Therefore, livestock is considered to be able to adapt to life without much water. On the other hand, water consumption per day is 36L/day/capita. According to a dissertation on dromedaries (same type as Djibouti), from Sudan University (Effect of water restriction on milk yield and milk composition in camels), their water consumption amount is 36L/day/capita. The Unit Water Consumption Rate shown by MAEM-RH is considered proper and thus has been used for the calculation of demand.

Table 2-2-6 Unit Water Consumption Rates for Livestock

(L/day/capita)

Livestock	MAEM-RH	IEMI[*1]	WB[*2]	Note
Camel	40	50	-	80L/2days/cap（MAEM-RH）
Cow	45	27	16 ~ 18	Rare in object area
Sheep<Dl	3	5	5	

[*1] Water for Food Water for Life (IWMI David Molden, 2007)

[*2] Community Piped Water Supply System in Developing Countries (World Bank Technical Paper)

Source: JICA Study Team

The Unit Water Consumption Rates shown in Table 2-2-7 are used for the Project.

Table 2-2-7 Unit Water Consumption Rates for the Design

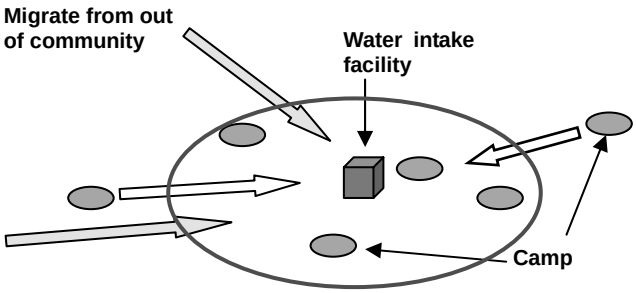
Objects for Water Supply	Unit Water Consumption Rate（L/day）
People	20
Camels	40
Sheep and goats	3

Source:JICA Study Team

4) Object population for water supply and demand

Rural population in the target year 2017 will be decreased by 10%. This calculation is based on the trend that the population shift will concentrate to urban areas. However, at the water facility construction sites, the same macro movement will not occur, and thus, the change in the surrounding object zones must be considered.

In most of the requested zones, camps are not concentrated in the same areas. Distance from the camps to the water facility construction site is not always close. Therefore, a high user population at the beginning of the operation cannot be expected. However, based on the results of the social condition survey, 64% of people have a willingness to migrate to the water point after the water intake facility has been constructed. The reasons behind “do not migrate” are that respondents are already living close to the drilling point, or they feel it is not necessary to migrate because they think that their living place is not far from the drilling point. Therefore, half of the population who answered, “do not migrate” is expected to be water users. 80% of residents are expected to become users of the water facility.



Source: JICA Study Team

Figure 2-2-2 Image drawing of Population Migration

Moreover, the number of nomadic users who come from outside the zone is expected to increase year by year, once news that there is water facility which is supplying water continuously is spread through word of mouth. Population in rural areas tends to decrease based on the population estimation mentioned above. However, supposing that population surrounding the water intake facility does not decrease, the population from the results of the social condition survey can be used as the population of the object zones. The camps that already have safe water are excluded from the summary for the population of the object zones. The expected population of the object zones in the target year 2017 is shown in Table 2-2-8.

Table 2-2-8 Population of the Object Zone

Region	Object Zone	Form of the Camp	Population	Note
DIKHIL	SAKNKL	Main Village	**3,000**	Shallow well near by Etyopian border is used. They cannot use Sabbalou water since they don't have any transportation.
	ZINA MALE	Plateau camps	632	
		Zina Male camp	40	
		Total Population	**592**	
	DAGUIRO(2)	Gablaaf	187	Camps are located in 5 km interval along National Road 1. Water tanks donated by UNICEF are placed beside the National Road 1, however, water is not supplied.
		Ararou	253	
		Dahetou	242	
		Total Population	**682**	
	SEK SABIR	Village	893	
		Surrounding camps	995	
		Total Population	**1,888**	
	ASSA KOUMA	Main camp	680	There are two tanks with no water supply system. One o f them has a solar pump project. However, The project has been suspended since 2009
		Surrounding camps	340	
		Total Population	**1,020**	
	MINDIL	Main camp	128	
		Surrounding camps	368	
		Total Population	**496**	
	AFKA ARABA	Main camp	100	
		Surrounding camps	150	
		Total Population	**250**	
ALI SABIEH	HAMBOKTA	Hambokta village	180	
		Doudouballaleh village	380	
		Nomadic camps	115	
		Total Population	**675**	
	MIDGARRA	Ali Adde Village	1,750	There is no settled resident in Midgarra. Target village Ali Adde is 10km far from Midgarra. Therefore, target population is estimated by half of Ali Adde Village.
		Surrounding camps	2,090	
		Total Population	**875**	

Source: JICA Study Team

A UNICEF implemented project that rehabilitated existing wells and installed solar power generating systems instead of the existing diesel generators was done in 2009 in Djibouti (Le cadre du project de rehabilitation des systems AEP des villages ruraux {Rehabilitation of the Water Supply System in the Rural Villages}). In this project, the average population served was 470 households (3,290 people, 7 people per household) per intake facility. Since there is no data of when water resources development has been done, the speed of population increase can't be estimated. It is not always true that villages have only a few people as in the UNICEF project and in this Project. There is a possibility that a larger amount of people will be users in the future.

5) Water Demand and Water Intake Facility Plan

The population and number of livestock based on the social condition survey and the corresponding water demands are shown in Table 2-2-9. In the beginning of the Project, it is expected that there will be few people in the object zone. Therefore, only livestock owned by passing nomads were considered for the demand. Although a certain level of demand is expected as shown in Table 2-2-9, water demand for the Project is calculated only for people.

Demand of the livestock slightly exceeds the demand for people. It will become necessary to construct a well for livestock if the water demand of livestock is included in this Project. Therefore, the remaining portion that exceeds the population demand can be used for livestock and small agriculture, but mainly currently existing water sources should be used for livestock.

In addition, MAEM-RH requested the Japanese Government to install large capacity pumps and larger water supply facilities for agricultural use. However, if water facilities are considered for agricultural use as well as for drinking or domestic water, the initial and O/M costs become more expensive. Moreover, the risk of the well drying up due to over discharge will increase. Therefore, the Japanese side did not consider facilities for agriculture, and shall build facilities only for drinking and domestic water.

The largest water demand is 60.0 m^3/d in Sankal and the smallest water demand is 5.0 m^3/d in Afka Arraba calculated with a Unit Consumption Rate of 20 L/day/capita.

For this amount of water, it is difficult to pump by hand pump; therefore, a motorized pump shall be used for the water intake facility. On the other hand, nomads are setting up their camps over a wide area different from a normal village. However, they have a willingness to move to an area surrounding the water point in the future. Therefore, the standpoint (water tap) and the supply tank shall be constructed at the water resources site. Additionally, a pipeline shall be laid to the school based on request in Hambocta, and a water tank and standpoint (water tap) shall be constructed at school. The water intake facilities where water taps are constructed on the water resources site is called Type A, and the water intake facilities where water taps are constructed far

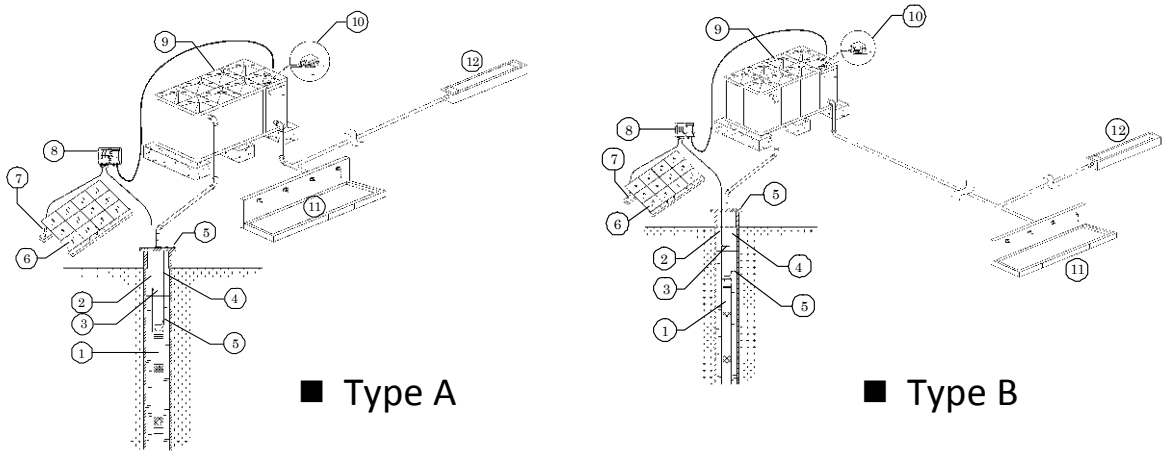
from the water resources site is called Type B. In Type A and Type B, water points for livestock will be constructed. To prevent drinking water from being contaminated, water points for livestock are designed to be located 50 m away from the water tap.

In addition, negative wells in which water quality values exceeded WHO guidelines are not applied for drinking water. JICA Study Team explained the risk of the water repeatedly; however, the Djibouti side strongly requested with diplomatic pressure to construct water intake facilities for negative wells for use for washing, bathing, showering, hand washing, and toilet facilities. Therefore, these negative wells cannot be excluded from the construction of water intake facilities. These facilities will be designed with the same specifications as positive wells. In addition, sign boards and training to warn about the dangers are imperative since water from negative wells cannot be used for drinking.

Types of the water intake facilities are shown in Figure 2-2-3.

Table 2-2-9 Water Demand of the Object Zones

REGION	No.	Object Zone	Population	Livestock (cap.)		Demand for People (m^3/d)	Demand for Livestock (m^3/d)	Type	Note
				Goat	Camel				
DIKHIL	7	Sankal	3,000	750	0	60.0	2.3	A	Transportation is necessary
	8	Zina Male	592	6,000	1,000	11.8	58.0	A	Not for Drink
	11	Daguiro (2)	682	3,400	0	13.6	10.2	A	Not for Drink
	15	Sek Sabir	1,888	1,837	472	37.8	24.4	A	
	16	Assa Koma	1,020	9,900	450	20.4	47.7	A	Not for Drink
	17	Mindil	496	4,520	3	9.9	13.7	A	
	18	Afka Arraba	250	7,950	0	5.0	23.9	A	
ALI SABIEH	21	Hambocta	675	1,000	50	13.5	5.0	B	About 600m to the school
	29	Midgarra	875	1,550	0	17.5	4.7	A	Not for Drink
Total (No.7+15+17+18+21)			6,309						



① Submersible Pump
② Cable
③ Cable Clips
④ Straining Wire
⑤ Wire Clamp
⑥ Solar Panel
⑦ Support Structure
⑧ Control Unit
⑨ Water Tank
⑩ Level Switch
⑪ Public Faucet
⑫ Drinking Trough

Figure 2-2-3 Type of the Water Intake Facility

6) The Benefit Effect

Requested sites have been selected from 95 candidate sites of deep well construction in "National Construction and Rehabilitation Programme for Deep Wells" which is shown in the "Food Security Programme (Programme National de Sécurité Alimentaire : PNSA)". 39 of the 95 wells are located in 3 southern object regions of the Project (Table 2-2-10). The discharge rate is expected to be 30m³/hour/well (more than 200m³/day/well), in PNSA. If the water demand is 50L/day/person, 39 wells will be able to supply 156,000 people. According to the 2009 census, the population of the 3 regions Dikhil, Ali-Sabieh and Alta is 142,192, and will be adequately covered by 39 wells.

Table 2-2-10 Target Number of Well Constructions in "National Construction and Rehabilitation Programme for Deep Wells" in PNSA

Region	First Phase	Second Phase	Third Phase	Total	Three Regions
Dikhil	6	2	4	12	39
Ali Sabieh	7	7	4	18	
Alta	5	2	2	9	
Obock	10	8	7	25	
Tadjourah	10	5	4	19	
Djibouti Ville		12		12	
Total	38	36	21	95	

Source: MAEM-RH / JICA Study Team

The total number of people who will benefit from the selected 5 sites is 6,309, which is 6.6 % of the 127,025 rural populations of 2017. Water coverage by the survey carried out by the WB and MAEM-RH is 54% in the rural areas, and the population of the three southern regions in 2006 was calculated as 148,335. The population served will be 80,101 in the target year, if a -1.4% population growth rate is adopted. New well construction has been done since 2006, and assuming that the population served does not change, the water coverage rate of the target year 2017 will increase to 68.0 % after the construction of wells in this Project.

(2) Natural Conditions (Solar insolation, Seismic force, Wind force)

1) Solar Insolation

Solar insolation is the amount of solar radiation on the surface of the earth, and the quantity is expressed in units of kWh/m^2. The output of solar panel is roughly 0.1 kW/m^2, and this energy of 0.1 kW is enough to run a laptop computer.

The solar insolation of the Project area is shown in Table 2-2-11. The table shows that the value is lowest in January, at 4.91 - 5.56 kWh/m²/day. The highest values, 6.63 - 6.75 kWh/m²/day, were recorded around May. The annual average is 5.98 - 6.26 kWh/m²/day.

The average solar insolation per day of the three target regions is 5.21 kWh/m²/day in January, 6.70 kWh/m²/day in May, and the annual average is 6.10 kWh/m²/day. (As a reference, the average solar insolation of Tokyo was 3.74 kWh/day (NEDO1961~1990))

Table 2-2-11 Solar Insolation in the Project Area

(Unit: kWh/m²/day)

Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.
Region	Djibouti	5.16	5.61	6.07	6.52	6.73	6.59	6.39	6.24	6.36	6.26	5.83	5.22	6.08
	Dikhil	5.56	5.93	6.53	6.75	6.75	6.50	6.31	6.31	6.33	6.43	6.06	5.60	6.26
	Ali-Sabieh	4.91	5.54	6.08	6.51	6.63	6.27	6.10	6.24	6.41	6.26	5.71	5.06	5.98
Average		5.21	5.69	6.23	6.59	6.70	6.45	6.27	6.26	6.37	6.32	5.87	5.29	6.10

Source：NASA Langley Research Center Atmospheric Science Data Center; New et al. 2002

2) Seismic Force

The Government of Djibouti has assigned a seismic intensity of 6 to 8 on the French seismic scale for seismic conditions. A seismic intensity of 8 is applied to the Project. This value corresponds to a level between slightly below five and slightly above five on the Japanese seismic scale.

3) Wind Force

Table 2-2-12 shows wind force in the Project area. The wind force is less than 10 m/s through the whole year.

Table 2-2-12 Wind Force in the Project Area

(Unit: m/s)

Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Region	Djibouti	6.07	5.68	5.01	3.83	3.92	6.51	7.84	7.29	5.20	3.76	4.82	5.56
	Dikhil	5.39	5.14	4.61	3.64	3.69	5.58	6.36	5.86	4.56	3.47	4.08	4.75
	Ali-Sabieh	6.07	5.62	4.85	3.65	3.94	6.63	7.78	7.26	5.26	3.76	4.78	5.54

Source: NASA Langley Research Center Atmospheric Science Data Center; New et al. 2002

Conversely, the report, "The study on the oil-berths reconstruction of port of Djibouti in the Republic of Djibouti (1994, March)" said that wind blows mainly with a velocity of between 10 m/s and 20 m/s even in Khamsin (wind storm) season except when there are climatic abnormalities. Therefore, a wind force of 20 m/s is applied to the Project as one of basic conditions for creating the work execution plan.

4) Air Temperature

Djibouti is a tropical dry climate region, and the highest temperature reaches above 40 °C. Therefore, a maximum temperature of 60 °C will be considered when selecting instruments and designing structures in the Project.

(3) Groundwater Source (Water Quality)

1) Water Quality

a. Characteristics of the Groundwater in the Project Area

The groundwater distributed in the Project area is basically classified as a type of seawater or fossil water, and it is abundant in sodium and chloride ions**.**

The Project area has a particular hydrological characteristic called an "internal drainage basin". An internal drainage basin is described as having rivers/streams ending at the lowest parts of inland water bodies (usually those form lakes or wetlands) and the rivers/streams do not reach the sea. In addition, the Project area is located in a dry desert so that the climatic conditions have been accelerating the accumulation of mineral salts in the soil due to a high evaporation potential. This results in a high salt concentration in the groundwater.

Due to these hydrogeological conditions, the groundwater in the Project area generally contains high total dissolved solids (TDS), shows a high electric conductivity (EC), and concentrations of minerals of salts such as sodium and chloride frequently exceed WHO guideline values for drinking water.

In addition, the Project area is located in the East African Rift Valley so the groundwater might

contain fluoride. A paper[Note] pointed out that groundwater in Gulf basalt areas may contain nitrates (the reason for nitrate concentrations in Gulf basalt is unknown).

b. Water Quality Standards for Water Sources

Table 2-2-13 shows the drinking water quality standards of Japan, WHO and other organizations. Djibouti does not have its own water quality standard for drinking water. According to MAEM-RH, which is responsible for rural water supply, Djibouti has been following WHO standards; however, there are no documents that expressly mention this. In general, water with less than 3,000 μS/cm of electric conductivity has been used for drinking water in Djibouti.

The results of water quality tests of existing wells, which were conducted in this preparatory survey, show that as predicted, some groundwater has a higher concentration of chloride, sodium, and/or sulfate ions than the recommended values in WHO guidelines. In addition, some wells have groundwater that contain higher concentration of fluoride and/or nitrate than the recommended values in WHO guidelines for chemicals that affect health. Therefore, it is obvious that WHO guidelines are not being strictly followed for these water quality items in Djibouti at present.

Some developed countries also have areas with a high salt concentration in groundwater, and the regulated values of salt concentration such as TDS or EC in these areas are sometimes less stringent than the recommended values in WHO guidelines. Utah in the U.S.A., which has the Great Salt Lake, is one of the representatives of these areas, and has drinking water quality standards outside the WHO range. The EU has also applied less stringent water quality standards for salt concentration (EC) than the recommended values in WHO guidelines due to the application of various member countries with different hydrogeological conditions. These two standards were added to Table 2-2-13 for reference.

Drinking water standards of the Kenyan Government are also shown in Table 2-2-13 to provide an example of neighboring counties, which also have areas located in the East African Rift Valley. Based on the information, the following water quality standards are proposed for this Project.

a) Chemicals that affect health

The standards are set to comply with WHO guidelines due to the adverse impacts on human health.

Note Hydrochemical and isotopic characteristics of groundwater in the Gulf Basalts costal aquifer, Houmed-Gaba A. et al; International Symposium on Hydrogeology of volcanic rocks 2008, Djibouti

b) Salt concentration

WHO guidelines have set the recommended levels of items related to salt concentration: TDS, EC, sodium ion, chloride ion and sulfate ion. These concentration levels were set in order to prevent deterioration of taste and scale build up, and not set regarding health effects. Therefore, in cases where the concentration of water quality items related to taste, odor and color exceed the recommended level of WHO guidelines, a maximum level of EC=3,000 μS/cm will be considered acceptable based on the consideration of the standards of countries that have similar groundwater conditions.

c) Iron

WHO guidelines (3rd edition) have no clear recommended value for iron, and the value of 0.3 mg/ℓ is shown as a reference value determined by taste, odor and color. The guidelines state the following: As a precaution against storage in the body of excessive iron, in 1983 JECFA (Joint FAO/WHO Expert Committee on Food Additives) established a PMTDI (provisional maximum tolerable daily intake) of 0.8 mg/kg of body weight, which applies to iron from all sources except for iron oxides used as coloring agents and iron supplements taken during pregnancy and lactation or for specific clinical requirements. An allocation of 10% of this PMTDI to drinking-water gives a value of about 2mg/litre, which does not present a hazard to health. Iron stains can be seen on laundry and plumbing fixtures at levels above 0.3 mg/ℓ; there is usually no noticeable taste at iron concentrations below 0.3 mg/ℓ, and concentrations of 1–3 mg/ℓ can be acceptable for people drinking anaerobic well water.

Drinking water standards of the Government of Kenya, which also has areas located in the East African Rift Valley, state that groundwater with a concentration of iron below 1 mg/ℓ is acceptable.

Therefore, a maximum level of iron concentration of 1 mg/ℓ will be considered acceptable for this Project.

Taking these conditions into account, the following criteria to determine acceptable water quality will be proposed for constructed wells in this Project.

- ✓ To comply with WHO guidelines for chemicals that affect health in drinking water.
- ✓ In case that the concentration of water quality items related to taste, odor and color exceed the recommended level of WHO guidelines, a maximum level of EC=3000 μS/cm will be considered acceptable. When the Djibouti side (MAEM-RH and target villages) accepts the conditions mentioned above, the constructed wells will be treated as successful wells.
- ✓ In the case of iron, a maximum level of 1 mg/ℓ will be considered acceptable. When the Djibouti side (MAEM-RH and target villages) accepts the conditions mentioned above, the constructed wells will be treated as successful wells.

The introduction of instruments for water quality control such as a desalination system is excluded from the Project due to the lack of capacity for operation and maintenance of the system and a lack of human resources.

Table 2-2-13 Comparison of Water Quality Standards for Drinking Water

	No.	Test Items	Unit	Water Quality Standards for Reference						
				Japan	WHO		EU	Utah (U.S.A)	Kenya	
					Guideline Values	Recommended Values			Desirable	Acceptable
Microbiologically safe water										
	1	E-coli	MPN in 100 ml	0	0	—	0	0		
Key chemical contaminants naturally occurring										
	2	Arsenic	mg/l	< 0.01	< 0.01		< 0.01	< 0.01	< 0.05	—
	3	Fluoride	mg/l	< 1.5	< 1.5		< 1.5	< 4.0	< 1.5	3 以下
Key chemicals from agricultural activities and excretion of human and animals										
	4	Nitrate（NO3）	mg/l	< 10	< 50		< 50	< 10	< 10	—
	5	pH		5.8−8.6	—	−	6.5−9.5	6.5−8.5	—	—
	6	Total Residue	mg/l	< 500	—	—	—	—	—	—
		Total Dissolved Solids (TDS)	mg/l	—	—	< 1000	—	< 2000	< 1,000	< 1,500
	7	Iron	mg/l	< 0.3	—	(< 0.3)	< 0.2	< 0.3	< 0.3	< 1
	8	Sodium ion	mg/l	< 200	—	< 200	—	—	< 200	—
	9	Potassium ion	mg/l	—	—	—	—	—	—	—
	10	Calcium ion	mg/l	< 300	—	—	—	—	—	—
	11	Magnesium ion	mg/l	< 300	—	—	—	—	—	
	12	Chloride ion	mg/l	< 200	—	< 250	< 250	< 250	< 250	< 600
	13	Sulfate ion	mg/l	—	—	< 250	< 250	< 1,000	< 400	—
	14	Bicarbonate ion	mg/l	—	—	—	—	—	—	—
	15	Electric Conductivity (EC)	μS/cm	—		(< 1,500)	< 2,500	(< 3,000)	—	—

Note: Bracketed values in the electric conductivity are converted values from TDS. There is some correlation between TDS and electric conductivity (EC), which is generally represented by the equation “EC=1.5 x TDS”.

c. Results of Laboratory Water Quality Test for Drilled Wells

Based on the natural and social conditions, 15 sites were selected for test well drilling. The standard structure of the test well is shown in Figure 2-2-4.

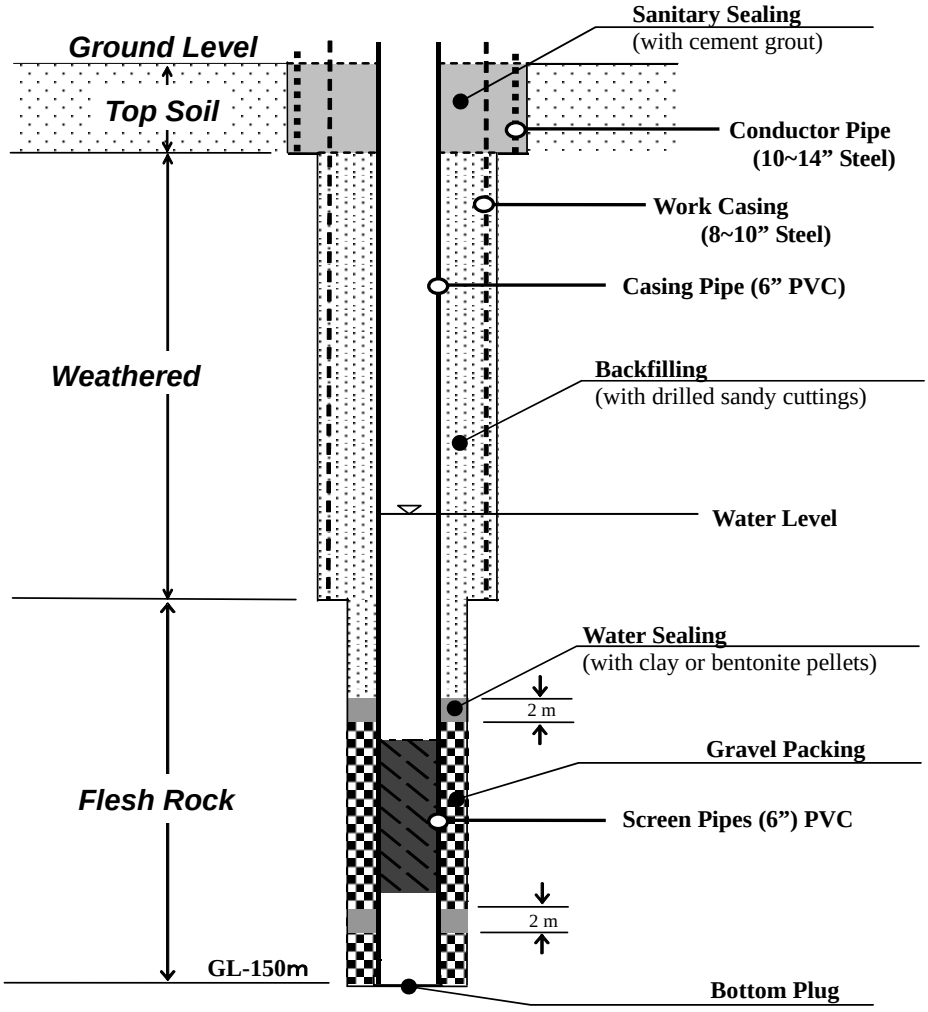


Figure 2-2-4 Standard Structure of the Well

Although MAEM-RH requested the Japanese Government to construct an 8-inch well, the Japanese Government will construct 6-inch wells for the following reasons:

- In a water supply project that Japan implemented in rural areas in Africa, a 5~6 inch well was constructed.
- The average population of target settlements is estimated to be less than 1,000 (maximum 3,000). If a population of 3,000 is applied to calculate water demand, 60m3 (10m3/h) of water will be necessary. Due to this amount and the information on groundwater levels (100 m below ground), a well diameter of 4~6 inches is sufficient. (See Figure 3-2-5 Company G Submersible Pump Performance Curve)
- Submersible pumps generate heat. Water that flows around the submersible pump reduces the heat of pump and prevents overheating. However, if the well diameter is oversized compared to the pump, the flow velocity around the pump will be reduced and the refrigeration effect will be less. (If an adaptor is installed, the flow velocity can be controlled.)

- Comparing a 6-inch well and an 8-inch well, construction costs for an 8-inch diameter well are 20% higher than for a 6-inch diameter well.

The results of laboratory water quality test for drilled wells are shown in the Table below.

Table 2-2-14 Results of Water Quality Test for Drilled Wells

Target Zones	EC (μS/cm)	TDS (mg/l)	Arsenic (mg/l)	Fluoride (mg/l)	Nitrates (mg/l)	Iron (μg/l)	Water Tempe-rature (°C)	Applicab -ility for Drinking Water
Max. Contaminant Level	---	---	0.01	1.5	50	---	---	
Recommended Value	3,000	2,000	---	---	---	0.300	---	
2 - UNDA YAGGOURI (2)	---	---	---	---	---	---	---	No Water
8 - ZINA MALE	**1,000**	**700**	**###**	**0.80**	**78**	**0.360**	**33.9**	**No**
11 - DAGUIRO (2)	4,450	3,852	###	4.0	3	0.065	43.7	No
15 - SEK SABIR	**1,000**	**650**	**###**	**0.92**	**25**	**###**	**39.8**	**Yes**
16 - ASSA KOMA	**2,100**	**1,400**	**0.005**	**3.9**	**17**	**###**	**41.3**	**No**
17 - MINDIL	**2,600**	**1,700**	**###**	**0.66**	**51**	**###**	**42.0**	**Yes**
18 – AFKA ARRABA	**790**	**540**	**###**	**0.4**	**27**	**0.86**	**39.0**	**Yes**
21 - HAMBOCTA	**730**	**520**	**0.001**	**1.1**	**42**	**###**	**38.0**	**Yes**
22 - GUELILE	3,400	2,200	###	0.58	19	0.230	35.1	No
29 - MIDDGARRA	4,310	648	###	2.0	37	0.275	35.6	No
30 - OUARABALEI	8,370	7,085	###	###	12	0.471	33.0	No
31 - HILBAHEY	---	---	---	---	---	---	---	No
32 - PETIT BARA	4,910	3,720	###	###	240	0.039	37.4	No
33 - PK30	**477**	**341**	###	**0.73**	**8.6**	**0.002**	**40.0**	**Yes**
34 - SABBALOU	**920**	**620**	**0.001**	**0.88**	**11**	**###**	**39.8**	**Yes**

Note 1: ###: Less than the quantitative limit

Note 2: Bracketed values in the electric conductivity are converted values from TDS. There is some correlation between TDS and electric conductivity (EC), which is generally represented by the equation "EC=1.5 x TDS".

Source: JICA Study Team

The presence of groundwater was confirmed at 13 of the 15 wells. Based on the water quality analysis, 5 wells were judged to be successful wells, 7 wells exceeded WHO guidelines for values of EC, F, and NO3, and one well, did not have enough water to be deemed successful.

Regarding Zina Male, Daguiro(2), Assa Koma, and Midgarra, the concentration of nitrate ion (which causes cyanosis in infants), fluorine and salinity was found to be much higher than water standards. Due to the poor water quality, the Japanese side had proposed to the Djibouti side not to construct water supply facilities at these sites. However, MAEM-RH strongly requested the Japanese side to construct water supply facilities. Therefore, the Japanese side has agreed to construct water supply facilities at these sites under the condition that signs (as shown in the figure to the right) be installed indicating to resident that water is not drinkable by MAEM-RH.

2) Pumping Amount

Test well results are shown in Table 2-2-15.

In this Project, a solar generator is used for the water supply system. The solar system is designed to cover 1.5 times the water demand.

Table 2-2-15 Results of Well Test (Pumping Test)

Object Zone	Well Depth (m)	SWL (GL-m)	Possible Up-Lift Quantity (m^3/day)	Draw Down (m)	Demand (m^3/d)	Dynamic Water Level for Demand (m)	Specific Capacity (m^3/day/m)	Transmissivity (m^2/day)
2 - UNDA YAGGURI	150	None	None	No Water			---	---
8 - ZINIAMALE	128	37.60	155	11.00	12.0	38.0	14.1	2.9
11 - DAGUIRO(2)	115	11.90	380	8.40			45.2	14.2
15 - SEKISABIR	150	9,90	777	0.25	38.0	10.0	3108.0	268.5
16 - ASSA KOMA	150	72.00	371	0.58	20.4	72.2	639.7	340.0
17 - MINDIL	150	38.00	440	0.27	10.0	38.5	1629.6	806.5
18 - AFKA ARRABA	150	14.00	40	35.50	5.0	30	1.1	0.21
21 - HAMBOCTA	150	58.25	406	0.20	13.6	58.6	2030.0	495.4
22 - GUELILE	150	13.15	259	30.00			8.6	1.9
29 - MIDGARRA	112	3.90	578	19,75			29.7	24.1
30 - OUARABALEI	142	31.10	345	46.98			7.3	3.3
31 - HILBAHEY	150	None	None	No Water			---	---
32 - Petit Bara	152	110.90	600	0.64			384.0	527.0
33 - PK-30	151	81.90	5	46.30	6.30[*1]	120	0.1	0.14
34 - SABALLOU	75	16.75	561	4.60	60.0	18.75	122.0	25.1

[*1] Possible Up-Lift Quantity does not satisfy the quantity of demand

[*2] Dynamic water level is estimated by measuring the drawdown for 10 hours of pumping for design demand.

Source: JICA Study Team

Selected negative wells are not usable for drinking water since some water quality items exceed the maximum contaminant level in WHO guidelines. However, it is possible to use the water for washing, showers, hand washing and toilets. The capacity of the water supply system for negative wells is designed with the same regulations as the positive wells. In addition, MAEM-RH's instructions and installation of signs which show, “the water is not for drinking” are imperative to inform the public on the dangers of negative wells.

(4) Groundwater pumping method

1) Power sources for groundwater pumping

Sufficient fuel for diesel generators as a power source for groundwater pumping was not obtained at any site surveyed in the Study. In addition, it is considerably difficult to operate and maintain diesel generators because engineers must be dispatched in case of breakdown or major repairs and

replacement is fully dependent on the central government.

Therefore, a solar power generation system has been installed in almost all new deep well sites constructed by other donors such as UNICEF, Saudi etc. The solar power generation system is not complicated and mainly consists of solar panels, DC-AC inverter, controller and power transmission cables.In addition, because there are no parts that generate rotation or vibration, breakdown of the system or parts occur considerably fewer times when compared with a diesel engine power generating system.

Table 2-2-16 shows the comparison of construction costs and maintenance costs among three groundwater pumping systems: diesel engine power generation with conventional submersible pump (AC pump), solar power generation with inverter and conventional submersible pump and solar power generation with DC submersible pump. Common construction costs shared by each of the three systems such as water tanks and piping, are not included in the Table. The replacement costs of material and equipment in case of breakdown of the systems are not included as factors of operation and maintenance costs.

Table 2-2-16 Comparison of Construction Costs and Maintenance Costs among Groundwater Pumping Methods

(unit:Japanese Yen)

Description		1 Diesel engine generator with AC Submersible pump	2 Solar power generation with AC Submersible pump	3 Solar power generation with DC Submersible pump
Equipment & Material Cost	Diesel generator (DC2800wh)	300,000	*1) 3,600,000	2,400,000
	DC-AC Inverter	Unnecessary	300,000	Unnecessary
	Control panel	350,000	Unnecessary	Unnecessary
	Submersible pump	350,000	350,000	500,000
	Total	1,000,000	4,250,000	2,900,000
Operation & Maintenance Cost	Fuel cost/year (8hrs/d)	360,000	0	0
	Oil & filter replacement	30,000	0	0
	Inspection, maintenance & repair	30,000	*2) 40,000	*3) 10,000
	Total	420,000	40,000	10,000
	10 years O & M cost	4,200,000	400,000	100,000
Total cost of 10 years operation including cost of facilities		5,200,000	4,640,000	3,000,000

*1) On the assumption that the energy loss by the DC-AC inverter is 30%, 1.5 times the amount of solar panels are necessary when compared to the case where a DC current submersible pump is applied.
*2) One inverter (300,000 Japanese Yen) and one solar panel (100,000 Japanese Yen) are assumed to need replacement once every ten years.
*3) One solar panel (100,000 Japanese Yen) is assumed to need replacement once every ten years.

Source: JICA Study Team

As shown in Table 2-2-16, the initial cost of the diesel engine power generating system is the lowest. But maintenance costs are the highest and more than 400 000 Japanese Yen is required

every year. Comparing the operation of an AC pump with that of a DC pump, more solar panels are necessary to operate the same capacity because of energy loss in the transformation of the DC current by solar energy to an AC one. Therefore, the initial cost becomes higher in the operation of AC pump with solar energy. Also, a DC-AC inverter requires replacement at the earliest time in the system, so the cost of replacement is included in the items of inspection, repair and maintenance considering that the replacement occurs once every ten years.

As confirmed in the site survey, existing solar power generation systems in the surveyed sites appear to be maintenance free. In rural areas where it is very difficult to obtain fuel for a diesel engine generator, a solar power generation system is considered the most effective. In addition, the procurement of spare parts, material and equipment for this generation system seems to present no problems because there are agency offices in Djibouti. While the initial cost of this system is higher than that of a diesel engine generation system, maintenance is easy and the daily operation cost is less. Therefore, solar power generation systems will be applied in this Project.

Moreover, the life of the solar panel itself is said to be 25 years so it is possible the solar panels will not have to be replaced every 10 years, unless unanticipated events, such as theft, occur. If a DC pump is used for the solar power generation system, an inverter is not necessary and operation will continue for a long time without maintenance, unless initial defects exist. If an AC pump is used in the same system, maintenance of the pump is required. While an inverter is required for AC pump application, the MTBF (Mean Time Between Failure) of DC-AC inverter has recently been proven to be more than 20 years with the use of a highly durable condenser.

In addition, hybrid generator systems, which have a diesel generator and solar generator, were requested from the Djibouti side. However, this system will not be adopted for the Project because of low necessity, high initial cost and difficult O/M.

2) Type of pumps

There are two types of pumps: motorized and hand. The motorized pumps are generally divided into conventional submersible pumps and the submersible pumps for solar power generation systems. An AC pump is used in the former and, both AC and DC pumps are used in the latter. Table 2-2-17 shows the comparison of pump-up capacity of the pumps.

Table 2-2-17 Comparison of the Pump-up Capacity

(m^3/day)

Head (m)	Conventional AC pump #5*[1] (6 hours operation)			DC solar pump SQF*[1]	DC solar MONO pump*[2]
	1.1kw	2.2kw	3.0kw	1.2kw	2.8kw
10				66	77
20				44	74
30	36			28	71
40	34			20	49
50	30			15	47
60	21	36		18	32
80		34		13	29
100		30	36	10	18
120		25	33	8	16
150			26		14
Water temperature	For hot spring 75 d.			Upper limit 40 d.	Upper limit 35 d.

Reference: *[1] Grundfos Pump, *[2] Mono Pumps Pty Ltd

A direct current is generated by solar power generation. Therefore, a direct current operated pump can be used without a DC-AC inverter and the occurrence of breakdown is relatively low compared to using an AC pump. In addition, the efficiency of energy utilization is high. In the case of a solar power generation system with a DC-AC inverter and an AC pump, a higher pumping capacity can be achieved by increasing the number of solar panels as needed. This means that acquisition of solar panels and land area etc. is required in accordance with the water production capacity of the facility.

Table 2-2-17 shows that 18m^3/day of water pump-up capacity is anticipated at the total head of 100m when a DC MONO pump is used. The Table also shows that relatively cheap conventional AC pumps are mainly used and a suitable pump with the required water pump-up capacity is selected according to the required total head when diesel engine generated power or external commercial electric power is applicable. As shown in the Study, in cases where high head of pumps and a large pumped-up water volume is required, the use of diesel engine generated power or external commercial electric power is more advantageous as it pumps more water volume than that of the solar generated power systems.

A conventional submersible pump is not applicable for hot water because it is usually designed for cold water. Commercially available DC pumps are usually used for water temperatures up to 40ºC. AC submersible pumps are applicable for water up to 75ºC. Some types of AC submersible water pumps are applicable for water up to 90ºC.

Considering the above-mentioned conditions, DC solar submersible pumpa, which are advantageous from a maintenance standpoint, will be used. In case it is difficult to use DC solar submersible pumps because the wells are deep or the groundwater temperature is high, AC conventional submersible pumps with DC-AC inverters will be used in the Project.

3) Operation of Deep Well Pumps

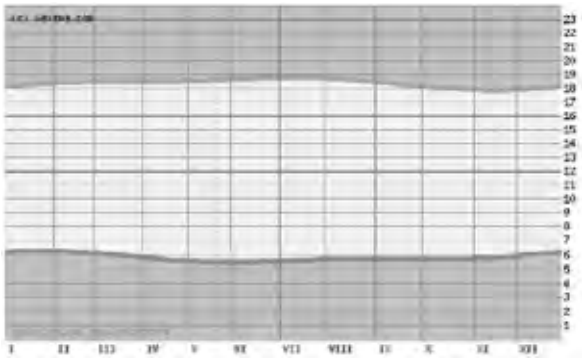
The operation of deep well pumps and water intake facilities is planned to be simple and easy, so the village people can carry it out. In general, the operation is automated. The submersible well pumps will be automatically operated by the solar power generation system used in the Project. A water level sensor will be installed in the well and the operation of the submersible pump will also be controlled in order for the groundwater level not to fall below the pump. An on-off switch power source can be operated manually in case of inspection or emergency such as a breakdown of the water level sensor. In addition, on-off operation of the pump will be controlled in connection with the water level gauge installed in the water tank.

4) Control of water volume

A water flow meter will be installed in the transmission pipe between the well and the water tank. Water flow measurements will be carried out daily to confirm the daily pump-up state. A gate valve will be installed at the distribution pipe and the water supply volume will be controlled by manual valve operation. Moreover, gravity will be used for the water flow from the water tank to the water tap to avoid installation of a booster pump and a required power source.

5) Hours of water pump-up

As shown in Figure 2-2-5, the hours of sunlight in Djibouti are on average, 12 hours a day throughout the year. The solar power generation system is dependent on the intensity of the sunlight and the peak power generation appears at around 12 o'clock. Accordingly, the pump-up water volume reaches a peak around 12 o'clock and becomes lower in the morning and evening, because the rotation of the DC pump motor changes according to the generated power. The design hours to pump-up water are to be 6 hours from 9 A.M. to 3 P.M. for convenience sake in the Project.



Refarence: http://www.gaisma.com/en/location/dikhil.html

Figure 2-2-5 Hours sunlight in Djibouti

(5) Water tank (Operation, capacity and type)

1) Capacity

Groundwater will not be pumped up at night if the solar power generation system is applied as the power source. Village people are apt to use water in the morning. Therefore, it is necessary that enough water is stored for the next day and that the water tank should be filled before the use of

water the next day. If the pumping-up of water is 6 hours from 9 A.M. to 3 P.M., the amount of water stored in the water tank is only half of the needed volume as shown in Figure 2-2-6.

Daily water demand is described as V_0 and half of it is 0.5 V_0. The first water storage in the water tank is carried out up to 0.5 V_0 the day before water supply starts. Water supply is carried out from 6 A.M. to 12 noon. (This means that 0.5 V_0 of the water stored before that day and 0.5 V_0 of water pumped up in that day equals the daily demand of V_0 and the water tank is in an empty state from 9 A.M. to 12 noon because pumped-up groundwater has just been used for water supply). Water storage is still carried out continuously from 12 noon to 3 P.M. on that day. Applying the above mentioned control method for water storage and supply, 0.5 V_0 of water is stored for the demand in the morning of the next day by 3 P.M. when the pumping up of groundwater is finished. Moreover, the volume in the water tank can be half of the daily water demand by applying this control method.

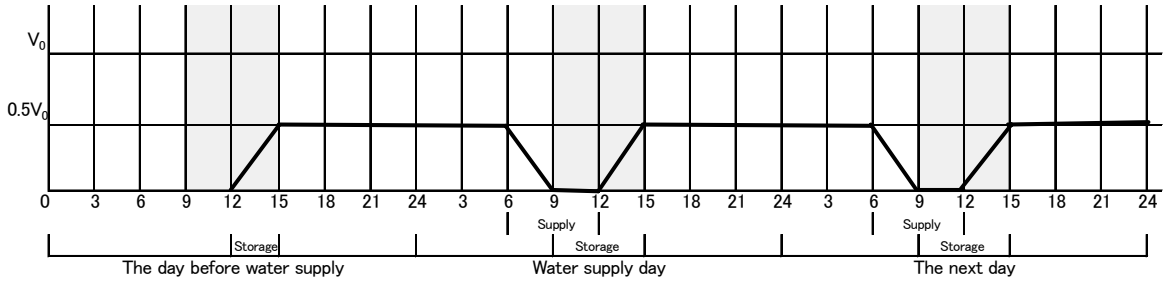


Figure 2-2-6 Pattern of Water Storage and Supply (1)

If there is any problem in the control method mentioned above, it is mentioned for reference that water supply and transportation are carried out from 9 to 12 noon, when there is severe hot weather. Therefore, in order to avoid supplyng water under such severe weather conditions, supplying water can be carried out from 6 to 9 A.M. and from 3 to 6 P.M., and the time from 9 A.M. to 3 P.M. can be used only for water storage. In this case, water volume of V_0 is stored until 3 P.M. and 0.5V_0 remains after water supply of 0.5 V_0 from 3 to 6 P.M. The remaining 0.5 V_0 is stored for the demand the next morning. The volume in the water tank is equal to the daily demand, V_0, in this case as shown in Figure 2-2-7.

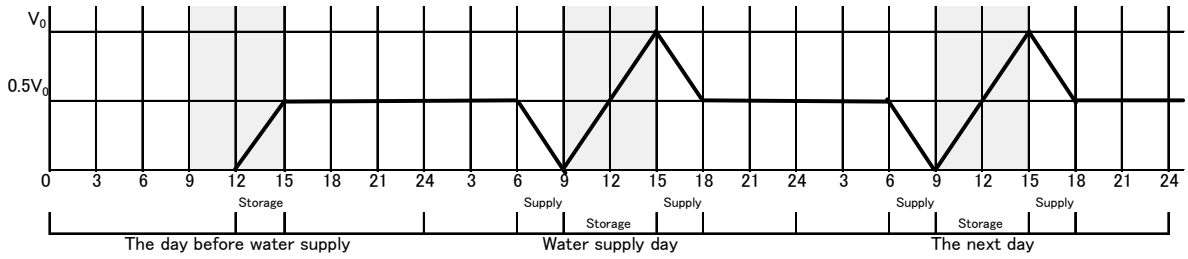


Figure 2-2-7 Pattern of Water Storage and Supply (2)

The required operation time for supply and storage increases in the second pattern. In addition, if more water is needed in the afternoon water supply than planned, a shortage in water supply for the next morning may occur. Finally, because the volume of the water tank in the second pattern is twice of that in the first pattern, the first operation pattern, which supplies water only in the morning, will be applied in this Project in order that the tank volume covers half of the daily water demand. However, the capacity of the submersible pump is designed to withstand 1.5 times the water demand taking into account the seasonal variation; therefore, the capacity of the tank shall be also designed to be 1.5 times larger than demand.

2) Type of water tank

It seems very difficult to construct a concrete water tank in a rural area when considering assurance of quality, easiness of construction, schedule control, etc. As shown in previous Japanese Grant Aid projects, FRP (Fiber Reinforced Plastic) panel water tanks have structural and functional stability and provide service for more than 15 years after construction. Therefore, the same FRP panel tanks will be applied in this Project.

3) Water supply hours

As mentioned in the previous section 5-1, water supply is planned for 6 hours from 6 A.M. to 12 noon.

(6) Pipe material

The transmission pipeline from the riser pipe at the well sites to the water tanks will be buried except in the vicinity of wells and water tanks. The pipe material to be used is class 10 (design pressure is 1.0MPa), galvanized steel pipe with an inner surface of polyvinyl chloride coating (hereinafter called SGP with PVC coating). HDPE pipe (High Density Polyethylene pipe) or PVC pipe (Polyvinyl Chloride pipe) will be used according to the topography and required pipeline length.

SGP pipe is used for above-ground pipelines in the vicinity of wells and water tanks considering weathering of the pipeline from sunlight and easiness of pipeline installation. Pipeline from the gate valve from the water tank down to the water tap will be buried and made of PVC pipe.

1) Transmission pipeline

The transmission pipeline from the riser pipe at the well site to the water tank is mostly buried as mentioned above except in rocky areas where it is considered preferable to install pipeline above ground. If SGP pipe is buried, appropriate anti-corrosion measures such as anti-corrosion taping must be taken.

2) Distribution pipeline

The distribution pipeline from the water tank to the water tap and to the water point for livestock is mostly buried and Class 10 PVC pipe will be used. However, suitable weather proofing measures such as anti-corrosion taping must be taken for the pipeline extruding above the ground. Where above ground pipeline installation is suitable, SGP pipe will be used.

3) Water taps

Four taps are to be installed at the public faucet. Because one tap will have enough water pressure to fill a 20L (liter) jerry can within 20 seconds, 4 taps can supply water for 720 people. One water tap will be able to supply water to 2,160 people if water supply is carried out for 3 hours. The installation of two public faucets is planned for the Sankal site. (Installation of a deep well is planned at Sabbalou.)

4) Water points for livestock

There is very little rainfall and groundwater recharge in the target area; therefore, groundwater capacity is limited and it is expected that groundwater level will decrease if used for long periods. Considerably severe groundwater resources are anticipated at the Project sites. Therefore, supplying water to people is the first priority and water is to be supplied to livestock only if there is surplus water. Accordingly, water points for livestock are planned to be small (5m×0.8m).

2-2-2 Basic Plan (Facility plan/Equipment plan)

(1) Planning of general layout of facility

As mentioned above, water intake facilities consist of deep wells, solar power generation, water tanks, water taps and water points for livestock. The arrangement of facilities will be as compact as possible in order to minimize the land reclamation area. Deep well and solar power generation facilities are fenced together for security reasons. At the sites where water points for livestock are planned, they will be placed at a distance of around 50m from the water tap for sanitary reasons.

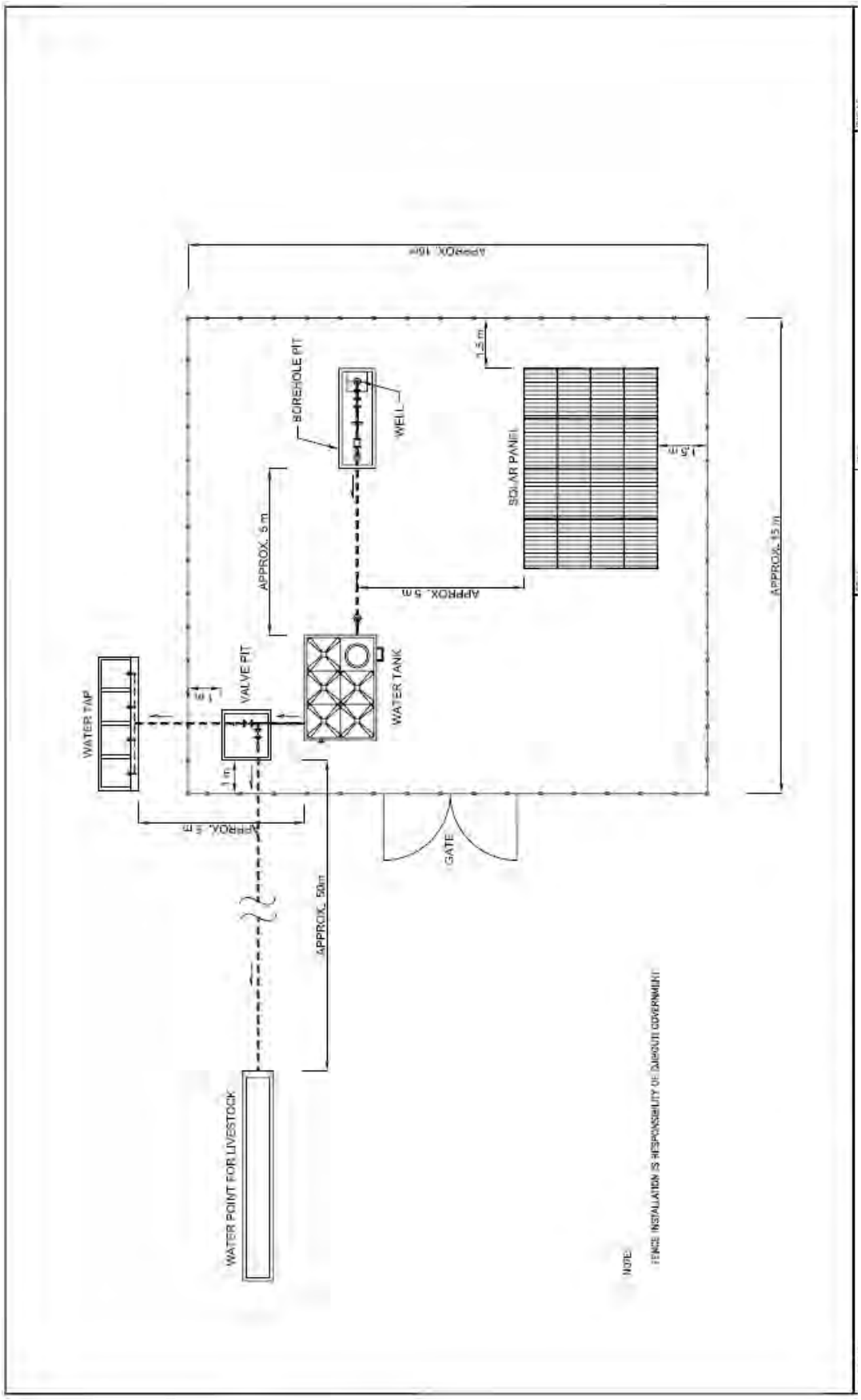


Figure 2-2-8 General Layout of Facilities

(2) Equipment Plan

1) Basic Policy of Equipment Plan

The Djibouti side has requested the following items: (1) support vehicles, materials and equipment for well drilling works and (2) equipment for a water resource survey. Regarding item (1), the Water Department possesses three well drilling rigs and support vehicles. The equipment is in good, working condition and can be used for the execution of drilling works.

On the other hand, the warehouses for the spare parts for the equipment, drilling materials and machines are not well organized, and there is no system for inventory control of the stock. The Water Department, with its current lack of budget, cannot carry out well drilling works, and depends on the fund of foreign assistance. Drilling status for three years are shown in Table 2-2-18.

Table 2-2-18 Results of Drilling by MAEM-RH

Region	Zone	Number of Drilling	Positive Well	Negative Well	Source of Funding
2008					
Obock	Fididis	1	1		ONG Kuweit
	Andoli	3	0	3	BN
	Heldleh	1	1		BN
Tadjourah	PK9	2	1	1	Lootha
	Ambabo	2	1	1	Lootha
Arta	Damerjog	3	2	1	Abou Yacer
	Douda	1	1		BN
	Nagad	1	1		BN
	Karta	1	0	1	BN
Sub Total		15	8	7	
2009					
Dhikil	Abou Yousouf	1	1		ALBIRI
	Gami	1	1		BIN ZEYD
Obock	Indai	2	1	1	BIN ZEYD
Tadjoura	Bolli	1	1		BIN ZDYD
	Lac Assal	3	3		USA
	PK9	1	1		ONEAD
Ali-Sabieh	Iskoutr	1	1		BIN ZEYD
	Aramadoleh	2	2		ONEAD
Sub Total		12	11	1	
2010					
Djibouti	Loyada	1	1		Budget National
	E16	1	1		ONEAD
	Doraleh	4	4		ONEAD
	PK12	1	1		Budget National
	Wead F3	1	1		Budget National
Arta	Karta F6	1	0	1	Budget National
Tadjourah	Garabissan	2	0	2	Budget National
	Balho	1	1		Budget National
Obock	Kbor Aoger	1	1		Budget National
Sub Total		13	10	3	

Source: MAEM-RH

According to previous results, on average, MAEM-RH drills 13 wells/year and 7 wells are in the southern areas of Djibouti. MAEM-RH has a 3-year plan from 2011 ~ 2013 as shown in Table 2-2-19.

Table 2-2-19 Drilling Plan of MAEM-RH in Southern Djibouti (2011 – 2013)

Year	Reconaissance Well		Production Well		Total Drilling Sites	Drilling Lenght (m)	Estimated Production Rate (m^3/h)
	<150m	150m<	<150m	150m<			
2011	2	6	4	1	13	2,520	10 － 30
2012	3	8	9	1	21	3,450	10 － 35
2013	4	4	10	2	20	3,130	10 － 40
Sub-Total	9	18	23	4	――	――	――
G-Total	27		27		54	9,100	――

Source: JICA Study Team

MAEM-RH has 3 drilling machines and 2 drilling teams. If each team drills a well in northern/southern Djibouti respectively, 1 drilling machine will be used in southern Djibouti. If drilling materials/equipment are provided to MAEM-RH, the Djibouti Government will have some margin in its budget. Since MAEM-RH has drilled 7 wells on average per year in the past, it can be estimated that MAEM-RH can drill 10 wells if there is some surplus in the budget of the government.

Although MAEM-RH has a plan for 3 years, this Project will only provide materials for well drilling (drilling bits, casing, screens) and cars for drilling work for 2 years for drilling conducted in the southern area. Since this Project targets southern Djibouti, casing and screens that will be provided, can only be used in the 3 prefectures in southern Djibouti. Before MAEM-RH uses the provided material, MAEM-RH shall submit a report to JICA including the drilling schedule such as planned drill locations, drilling depth, drilling period, etc. After the drilling work, MAEM-RH shall submit a report to JICA.

About item (2), water resource survey equipment, electric resistivity survey equipment, which is indispensable for hydro geological investigation for groundwater development, and various measuring instruments that are used for monitoring groundwater conditions shall be included in the equipment plan. Therefore, the following two items will be supplied for the Project:

i) Item (1) Support vehicles for well drilling works:
   Mobile workshop 1 unit, Vehicle for survey 2 units and drilling material for two years well construction (20 wells).
ii) Item (2) Equipment for water resource survey:
   Electric resistivity survey equipment, water level indicators, etc.

After examining the condition of existing equipment and local survey results based on the contents of the request from the Djibouti side, the equipment to be supplied for the Project is as shown in the following requested equipment lists and the selection tables.

Table 2-2-20 Requested Equipment and Evaluation (Well drilling equipment & materials)

Item No.	Equipment name, specification	Number/Classification				Evaluation
		Request	Existing	Plan	Judge	
A. Support vehicles for well drilling works						
1	Mobile Workshop, 4WD, with crane	2	-	1	△	The Water Department does not have a mobile work shop . It's needed for site repair & maintenance of well drilling related equipment. 1 unit shall be provided.
2	Cargo truck with crane, 4WD	1	2	−	×	Support vehicles for well construction will not be supplied, because there are no well construction plans.
3	Fuel tank truck, 4WD, 8m³ tank	2	-	−	×	As above.
4	Vehicle for survey and supervision, 4WD	4	2	2	△	The well construction section is using the two existing units for well construction etc. Two units shall be used for the electric resistivity survey, water quality & geological survey by the water resource research section. A double cabin pickup will be supplied for the transportation of various equipment & materials.
5	Electric welding machine	2	1	−	×	Equipment for well construction will not be supplied, because there are no well construction plans.
6	Camper, with bed and desk	2	-	−	×	The necessity of a camper is low at the well drilling site.
7	Generator, 80kVA, trailer type	2	−	−	×	Equipment for well construction will not be supplied, because there are no well construction plans.
8	Spare parts & consumables for vehicles, for 2 years	1	−	1	△	Spare parts for equipment and consumables such as filters and V belts shall be procured. The quantity shall be the minimum necessary.
9	Spare parts for the 3 existing rigs of the Water Department	2	−	−	×	Because they have not been procured by Japan, assessment on specifications of necessary parts is difficult.
B. Pipes for well drilling works Stainless & PVC casing/screen, Stainless conductor pipes etc.		1set	−	1set	△	Casing and Screen for 20 wells. These are sufficient for 2 years for MAEM-RH
C. Well drilling tools DTH hammer bit, tricone bit, attachment tools etc.		1set	−	1set	△	Hammer bit, tricon bit, etc. for 20 wells drilling.
D. Mud water agents Bentonite, mud water control agents		1set	−	1set	△	Bentnite is not possible to get in Djibouti and important for well drilling.
E. Others Lubricant, mud water control equipment (hydrometer, viscosity meter), fuel purification equipment		1set	−	1set	△	The gravimeter and viscometer, which are necessary for mud water management, shall be target for procurement.

Note) ○ : Planning subject, △ : Number reduced, × : Out of plan

Source: JICA Study Team

Table 2-2-21 Requested Equipment and Evaluation (Water resource survey equipment)

Item No.	Equipment name, specification	Number/Classification				Evaluation
		Request	Existing	Plan	Judge	
Water resource survey equipment						
1	Water level indicator, 200m	4	2	2	△	Dispatch 2 units to the headquarters, 1 each for the Dikhil & Ali-Sabieh branch.
	Water level indicator, 100m	4	2	2	△	
	Water level indicator, 50m	4	-	4	○	
2	Electric conductivity meter	4	-	2	△	The same item as No.13. Makes a total of 4 units including two existing pH/EC meters. Dispatch 2 units to the headquarters, 1 each for the Dikhil & Ali-Sabieh branch.
3	pH meter	4	-	2	△	
4	Borehole depth gauge, 300m	4	-	-	×	The necessity is low for use for measurement of existing well depth. If used, it is necessary to pull up the well pump.
	Borehole depth gauge, 200m	4	-	-	×	
	Borehole depth gauge, 100m	4	-	-	×	
5	Well water sampler, 300m	4	-	1	△	It will be used for water sampling at well drilling works and for existing wells, though it may not be used frequently.
	Well water sampler, 200m	4	-	1	△	
	Well water sampler, 100m	4	-	1	△	
6	Digital camera	3	-	-	×	It is not an article that is necessary for the grant project.
7	Electric resistivity survey equipment, with accessories & analysis software	2	1	1	△	In Djibouti, the geological features data for groundwater development is scarce, and this article is indispensable for groundwater surveys in the future.
8	Electric cables, 400m coil	8	-	-	×	Shall be included as accessories of the above-mentioned electric resistivity survey equipment.
9	Transceiver	8	-	5	△	Five units in total are used with 1 observer and 4 electrodes on the electric resistivity survey site, for use by 1 team.
10	Electrician tool set, screw driver, pliers, etc.	1	-	1	○	Will be used for electric wire preparation, equipment repair work, etc. on the site.
11	Water level indicator, 30m	4	-	-	×	It is possible to substitute with the 50m water level indicator.
12	Borehole depth gauge, 30m	4	-	-	×	The necessity of the borehole depth gauge is low.
13	pH / EC meter	4	2	-	×	The same article as No.2 and 3.
14	Clinocompass	4	1	3	△	For measuring the direction & inclination of stratum & fault in the geological survey. 1 each for every four geologists of the section including 1 existing unit.
15	GPS	4	2	2	△	Shall be used for positional confirmation in the geological survey and existing well investigation. Dispatch 2 units to the headquarters, 1 each for the Dikhil & Ali-Sabieh branch.
16	Borehole logging equipment, with accessories	2	-	-	△	It is necessary for making casing program and geological condition survey.
17	Mirror stereoscope	3	-	1	△	Shall be used to read the aerophotographs etc. 1 unit will be supplied.

Note) ○ : Planning subject, △ : Number reduced, × : Out of plan

Source: JICA Study Team

2) Equipment Improvement Plan

Based on the basic policy of the equipment plan, the equipment for this Project will be procured as shown in Table 2-2-22.

Table 2-2-22 List of Equipment to be Procured

Item No.	Equipment name	Contents (main specification or composition)	Quantity	Application
1. Support Vehicles for Well Drilling Works				
1-1	Mobile workshop	Truck with crane type Mobile workshop, 4WD, Van body equipped, Crane capacity: 3t Equipped with various equipment & tools: Engine generator welder, Gas welding & cutting set, Air compressor, Mechanic tools, Measurement devices, Electric tools & instruments, etc.	1	Shall be used for the site repair and maintenance of well drilling related equipment.
1-2	Vehicle for survey	Double cabin pickup truck, 4WD	2	Shall be used for electric resistivity survey, water quality and the geological survey by the water resource research section.
2. Equipment for Water Resources Survey				
2-1	Water level indicator, 200m	Steel wire reinforced rope type, buzzer or red lamp indicating type	2	For well drilling works and measurement of existing well water levels.
	Water level indicator, 100m		2	
	Water level indicator, 50m		4	
2-2	Electric conductivity meter	Measurement range: pH 0-14 or more	2	For water quality test
2-3	pH meter	Measurement range: 0-9.99S/m or more	2	For water quality test
2-4	Well water sampler, 300m	Bailer sampler type	1	For well drilling works and sampling of existing well water.
	Well water sampler, 200m		1	
	Well water sampler, 100m		1	
2-5	Electric resistivity survey equipment	Corresponding model for two-dimensional survey, 4 channels or more, Measurement range: ±10V or more, Accessories (400m code reel 8 pieces), with analysis software	1	Shall be used for the geological features investigation and groundwater survey. Multi channel type that can be used for two-dimensional surveys.
2-6	Transceiver	Communication range: 500m or more, dry battery type	5	For electric resistivity survey site.
2-7	Electrician tool set	Set of screwdrivers, pliers, files, soldering iron, etc., portable type	1	Will be used for the electric wire preparation and the equipment repair works, etc. on the site.
2-8	Clinocompass	Direction & angle: 360 degrees indication, with case	3	For measuring the direction & inclination of stratum & fault in the geological survey.
2-9	GPS	Measurement item: Latitude/Longitude/ Altitude, Measurement accuracy: 15m RMS or less, Portable type	2	Shall be used for positional confirmation in the geological survey and existing well investigation.
2-10	Mirror stereoscope	Desk-top type for reading aerophotographs	1	Shall be used to read the aerophotographs etc.

Item No.	Equipment name	Contents (main specification or composition)	Quantity	Application
3. Material and Equipment for Well Construction				
3-1	Pipes for drilling	Stainless tube, PVC pipe (30% of total is screen)	1	It shall be used for well construction in southern Djibouti for two years
3-2	Equipment and tools for drilling	- Drilling bit for drilling - Fishing equipment - Tools	1	It shall be used for well construction in southern Djibouti for two years
3-3	Equipment and tools for mad water control	- Bentnite - Equipments for mad water control	1	It shall be used for well construction in southern Djibouti for two years

Note) ○ : Planning subject, △ : Number reduced, × : Out of plan

Source: JICA Study Team

2-2-3 Design Plan Outline

Drawings of the layout, plan and elevation of the facilities are shown below.

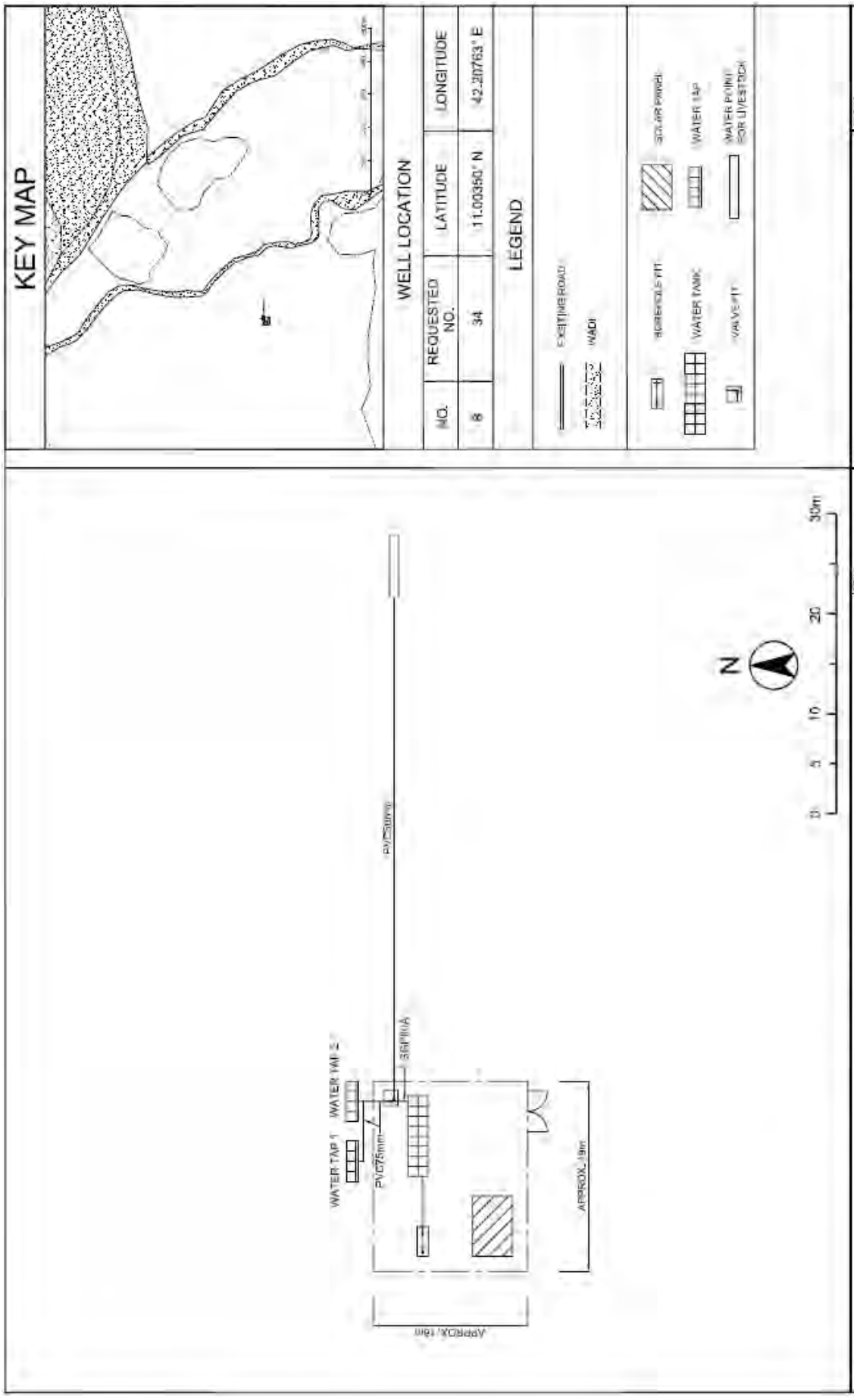


Figure 2-2-9 Layout of Facility (1)【Sabbalou (Sankal)】

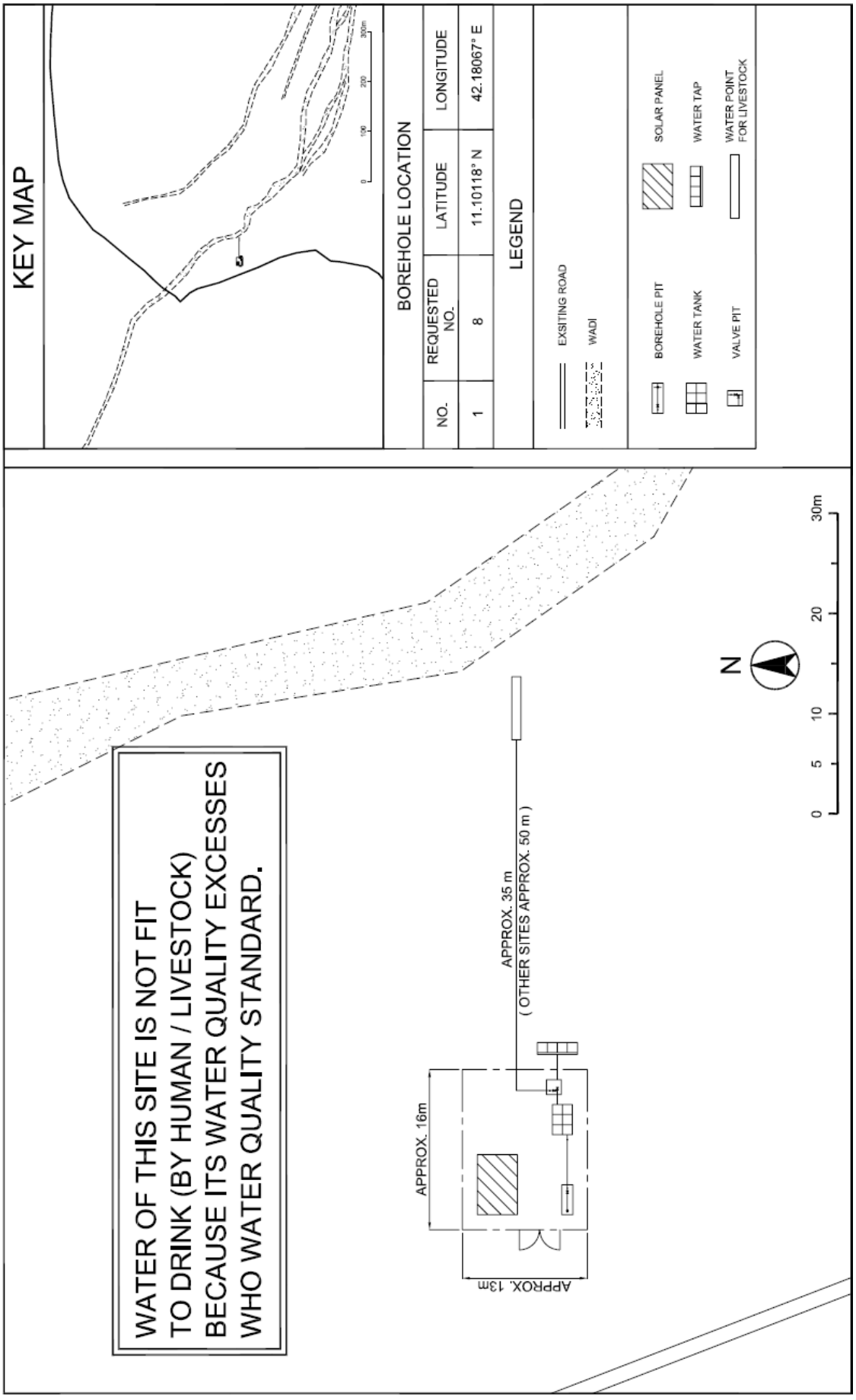


Figure 2-2-10 Layout of Facility (2)【Zina Male】

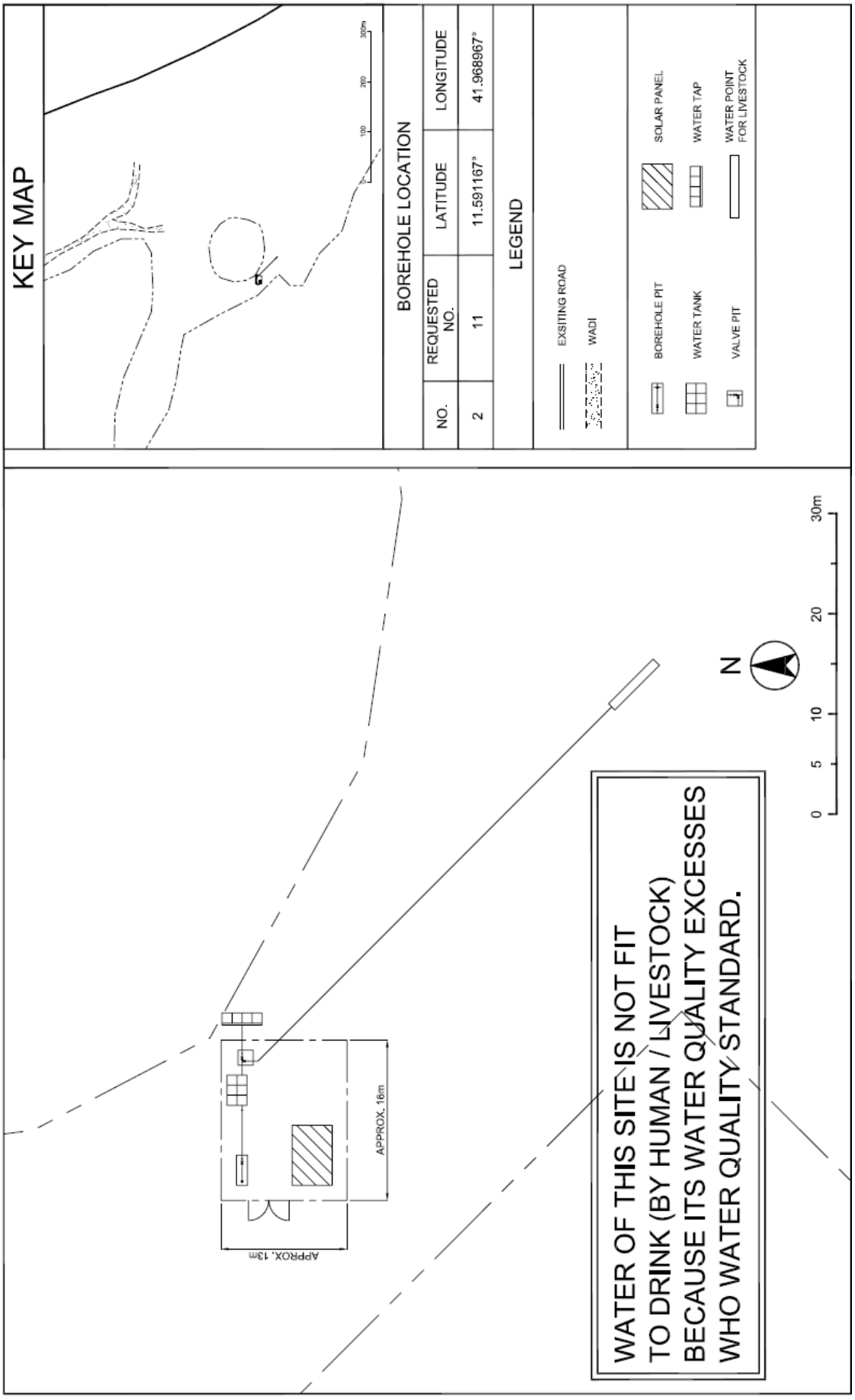


Figure 2-2-11 Layout of Facility (3)【Daguiro (2)】

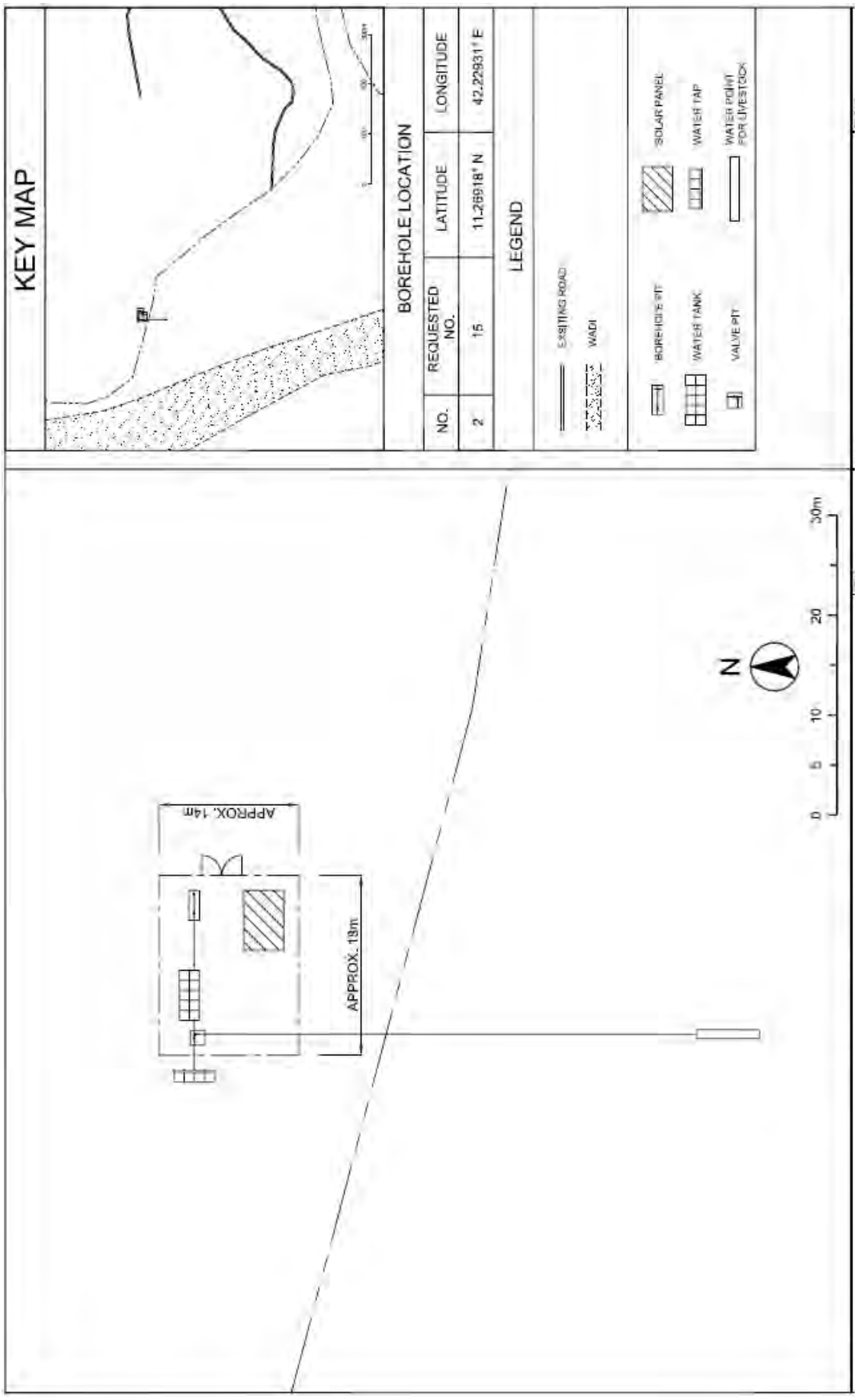


Figure 2-2-12 Layout of Facility (4) 【Sek Sabir】

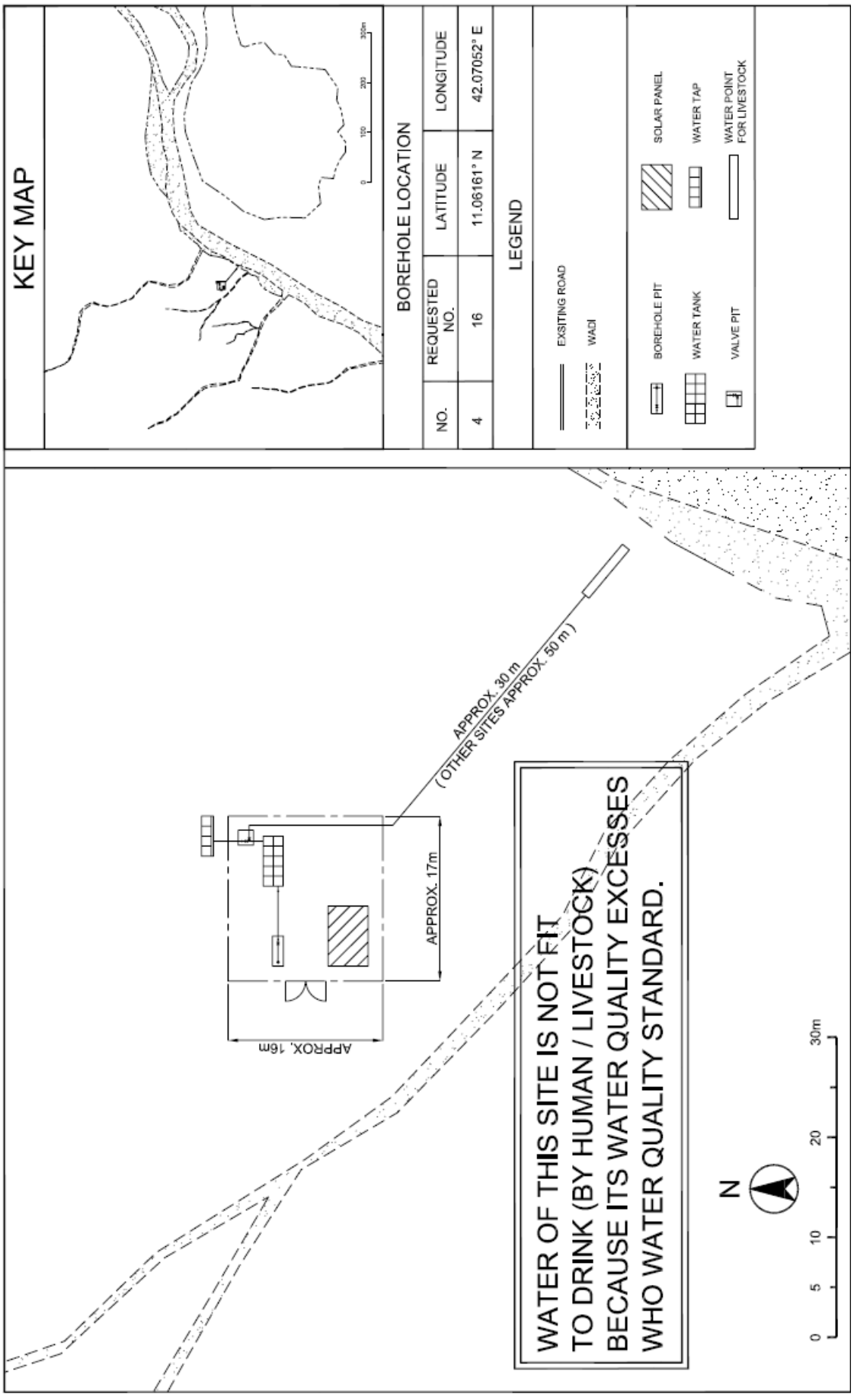


Figure 2-2-13 Layout of Facility (5)【Assa Koma】

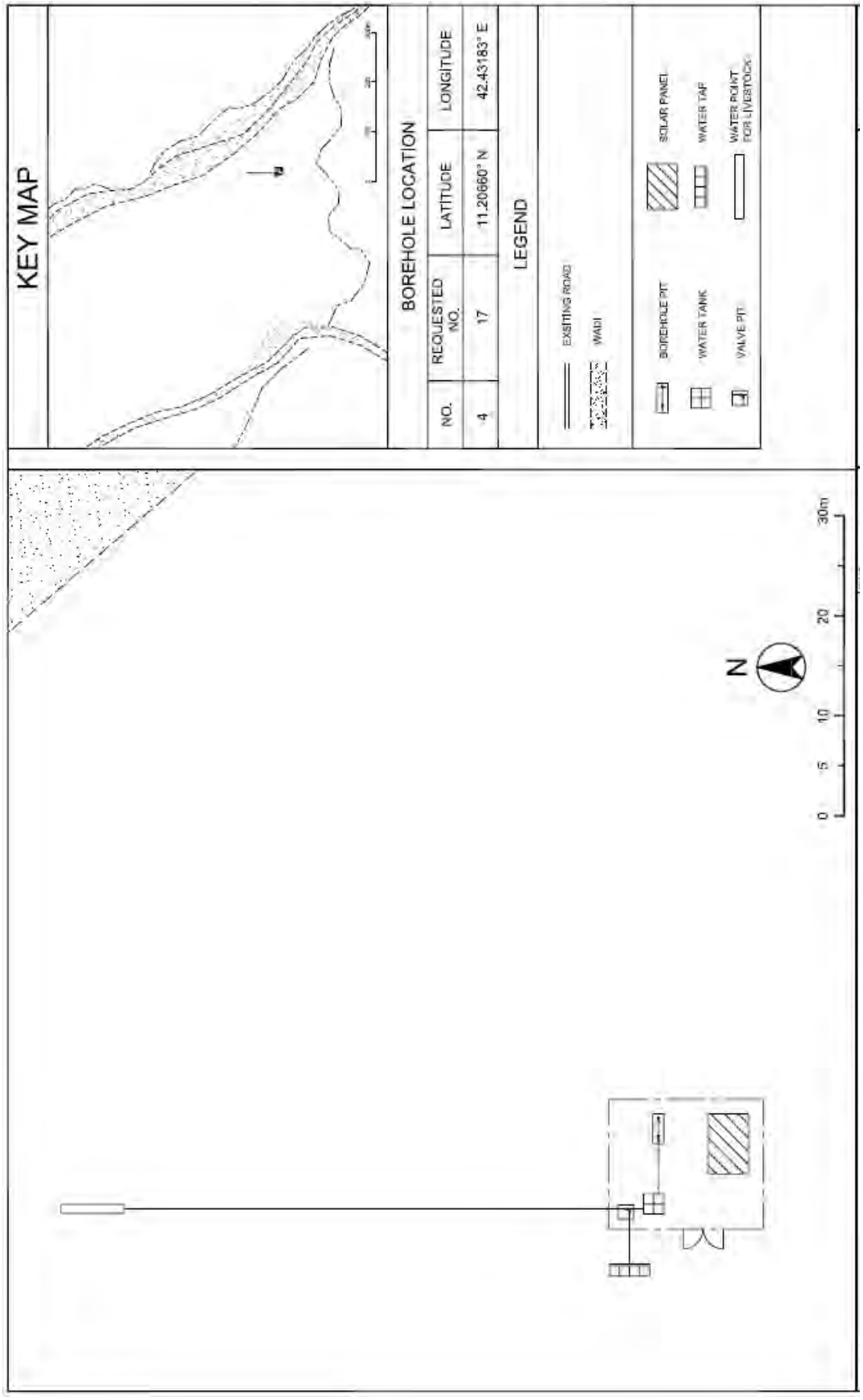


Figure 2-2-14 Layout of Facility (6)【Mindil】

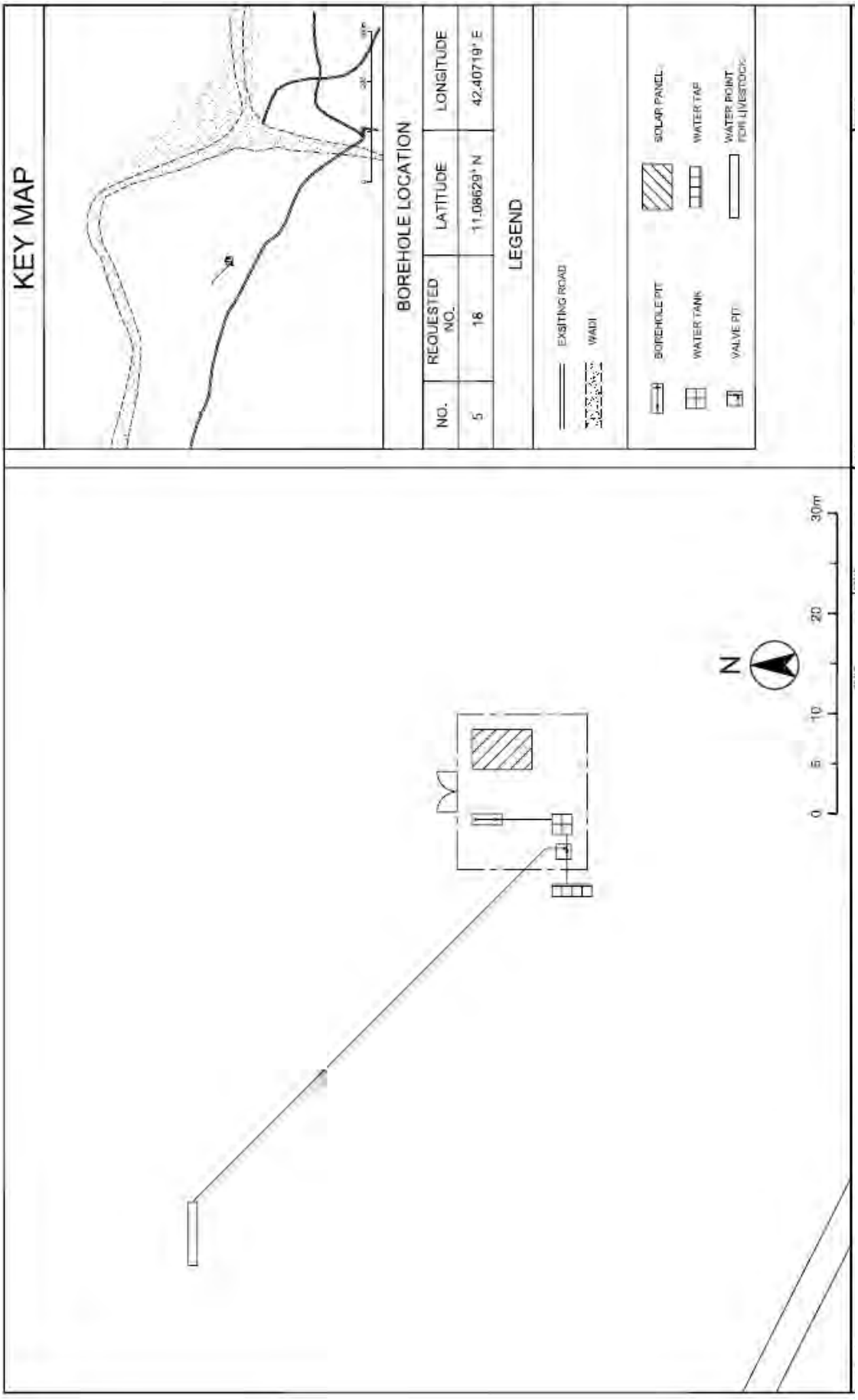


Figure 2-2-15 Layout of Facility (7)【Afka Arraba】

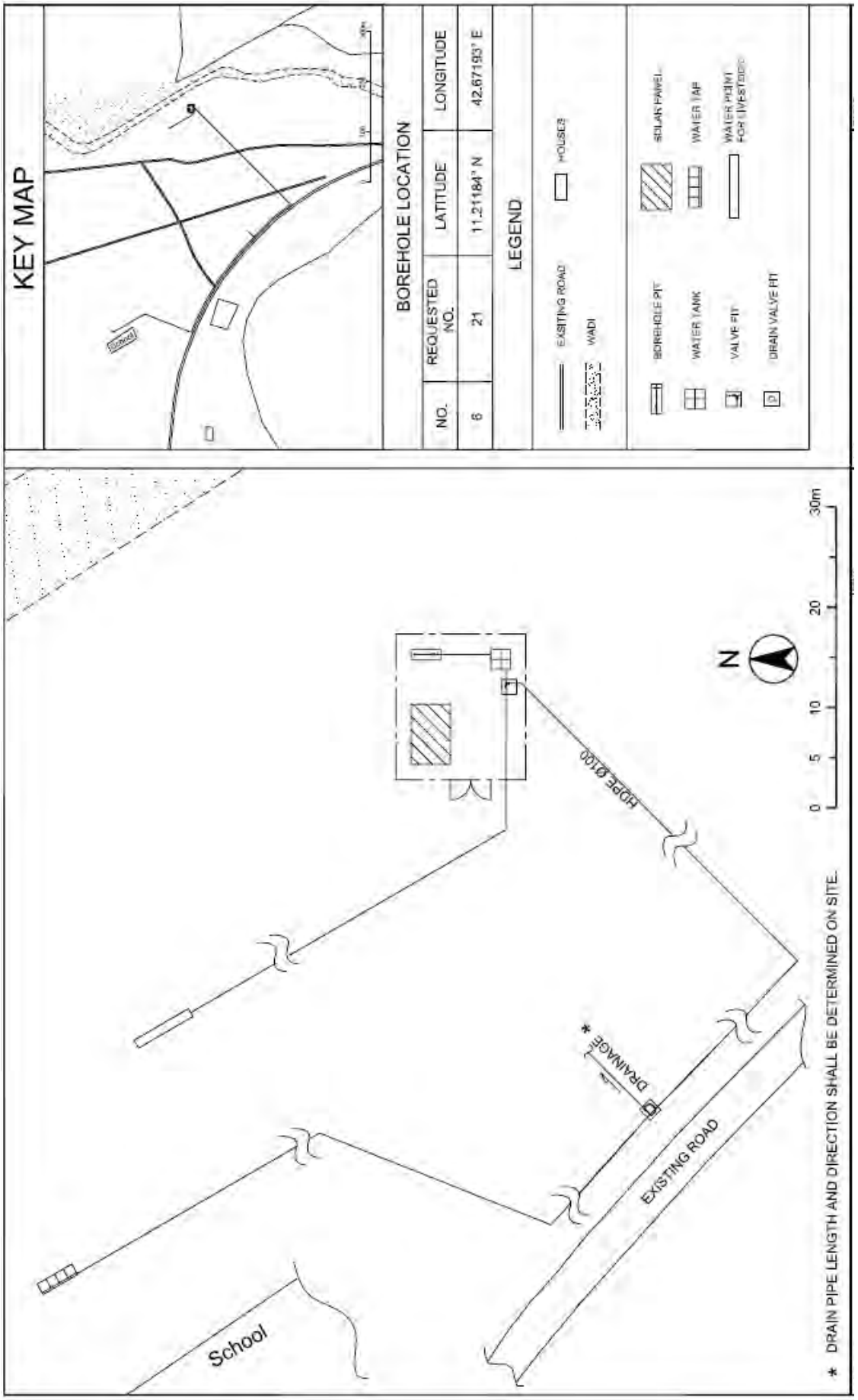


Figure 2-2-16 Layout of Facility (8)【Hambokta】

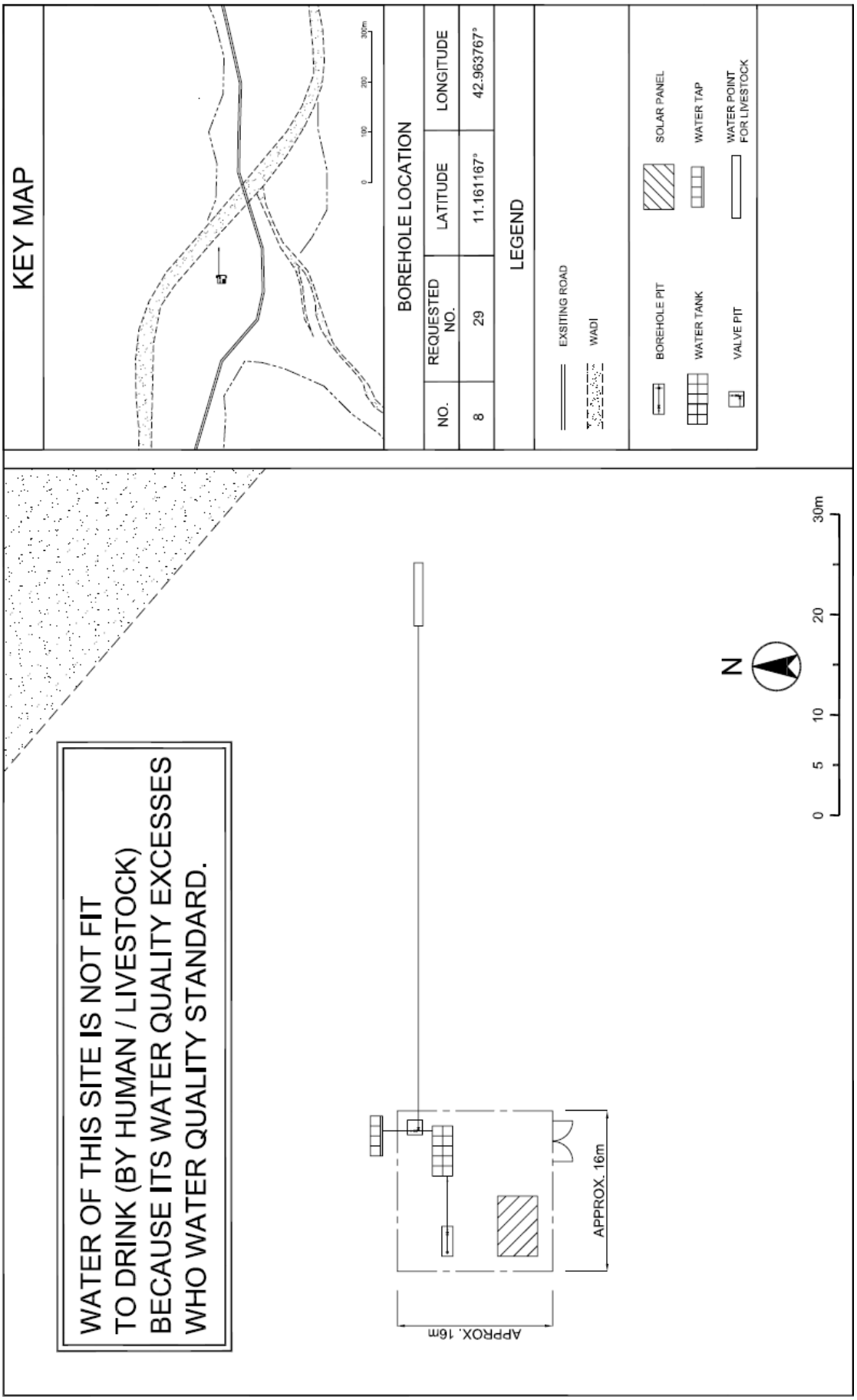


Figure 2-2-17 Layout of Facility (9)【Midgarra】

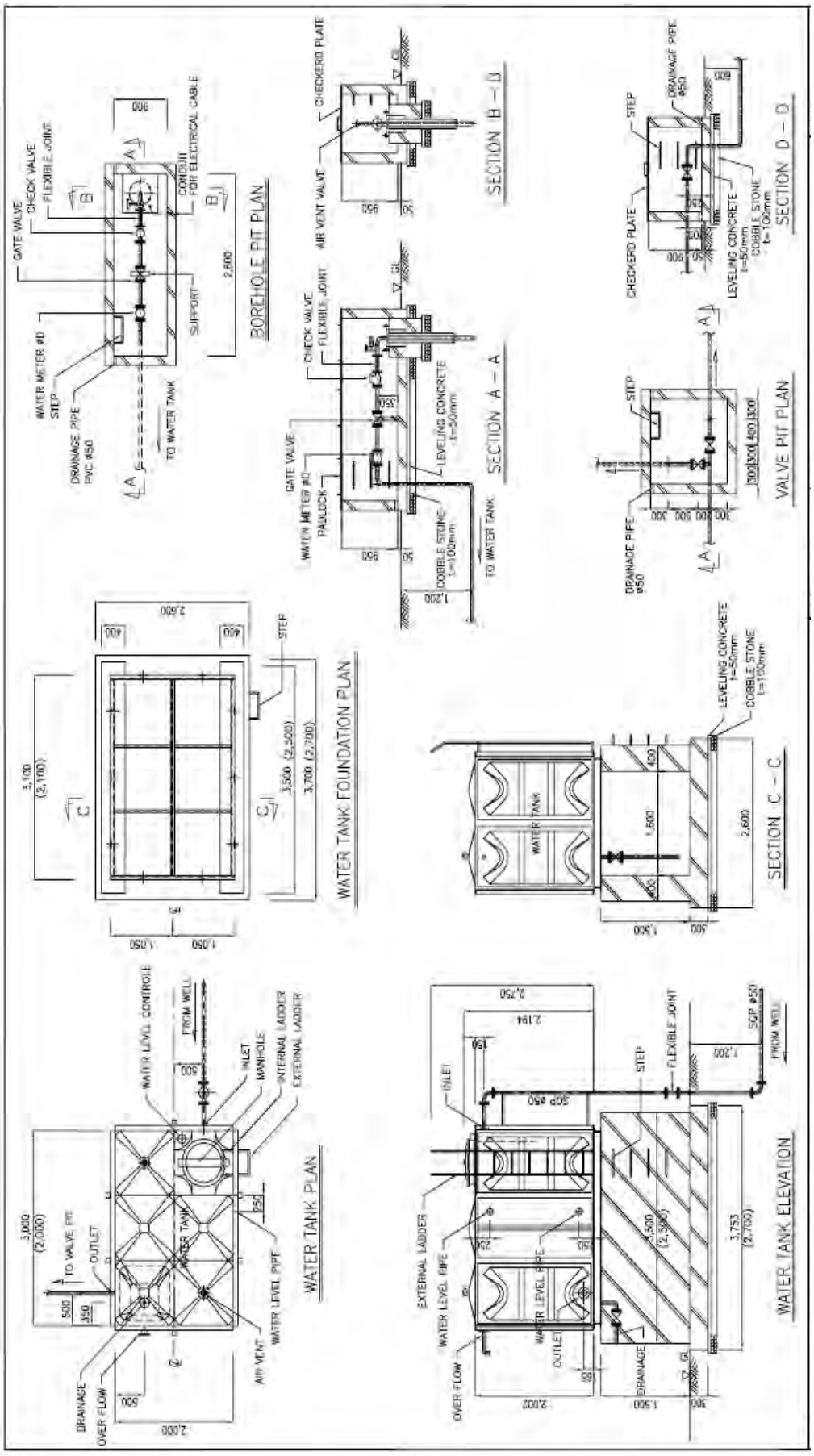


Figure 2-2-18 Plan and Elevation of Facility (1)

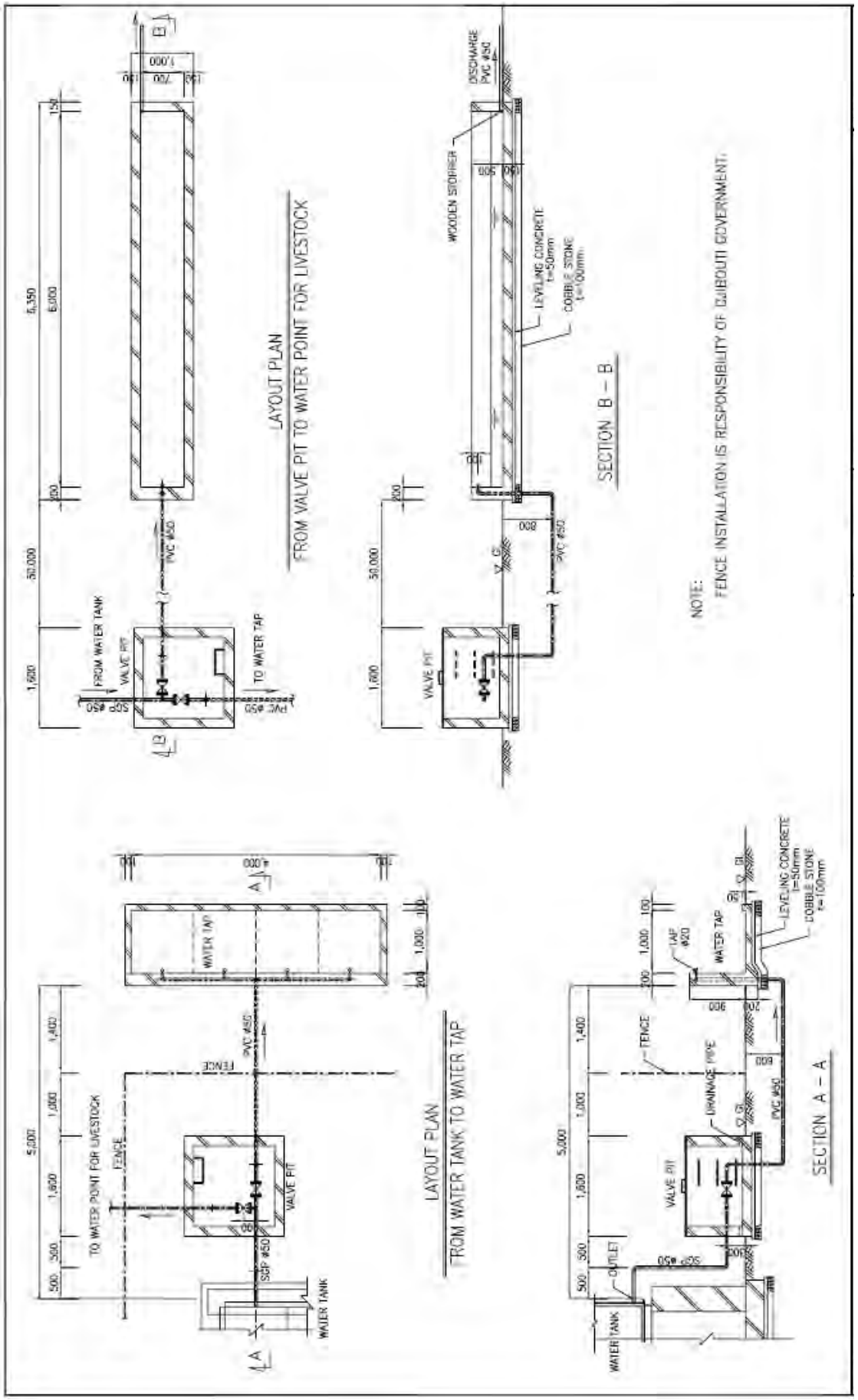


Figure 2-2-19 Plan and Elevation of Facility (2)

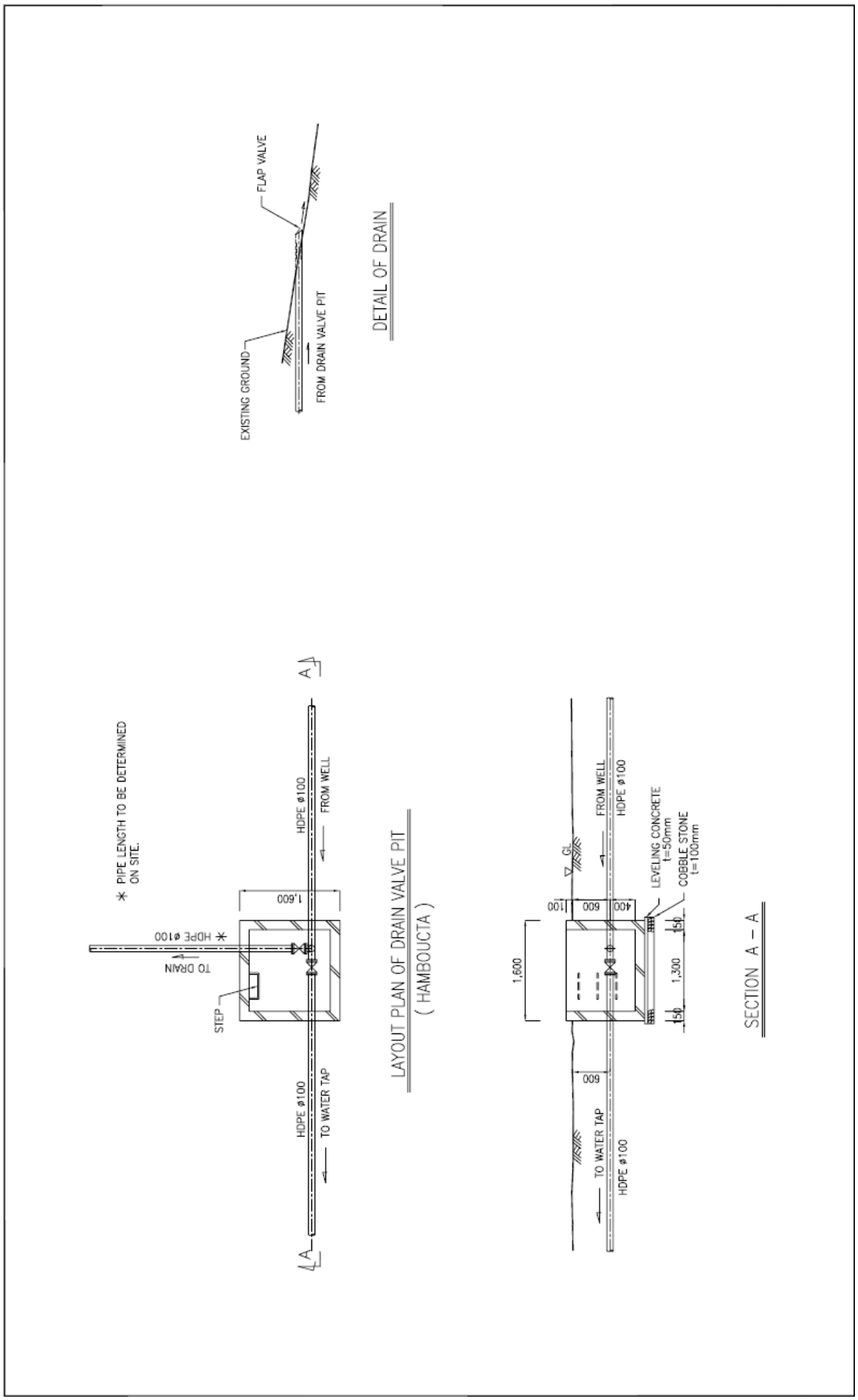


Figure 2-2-20 Plan and Elevation of Facility (3)

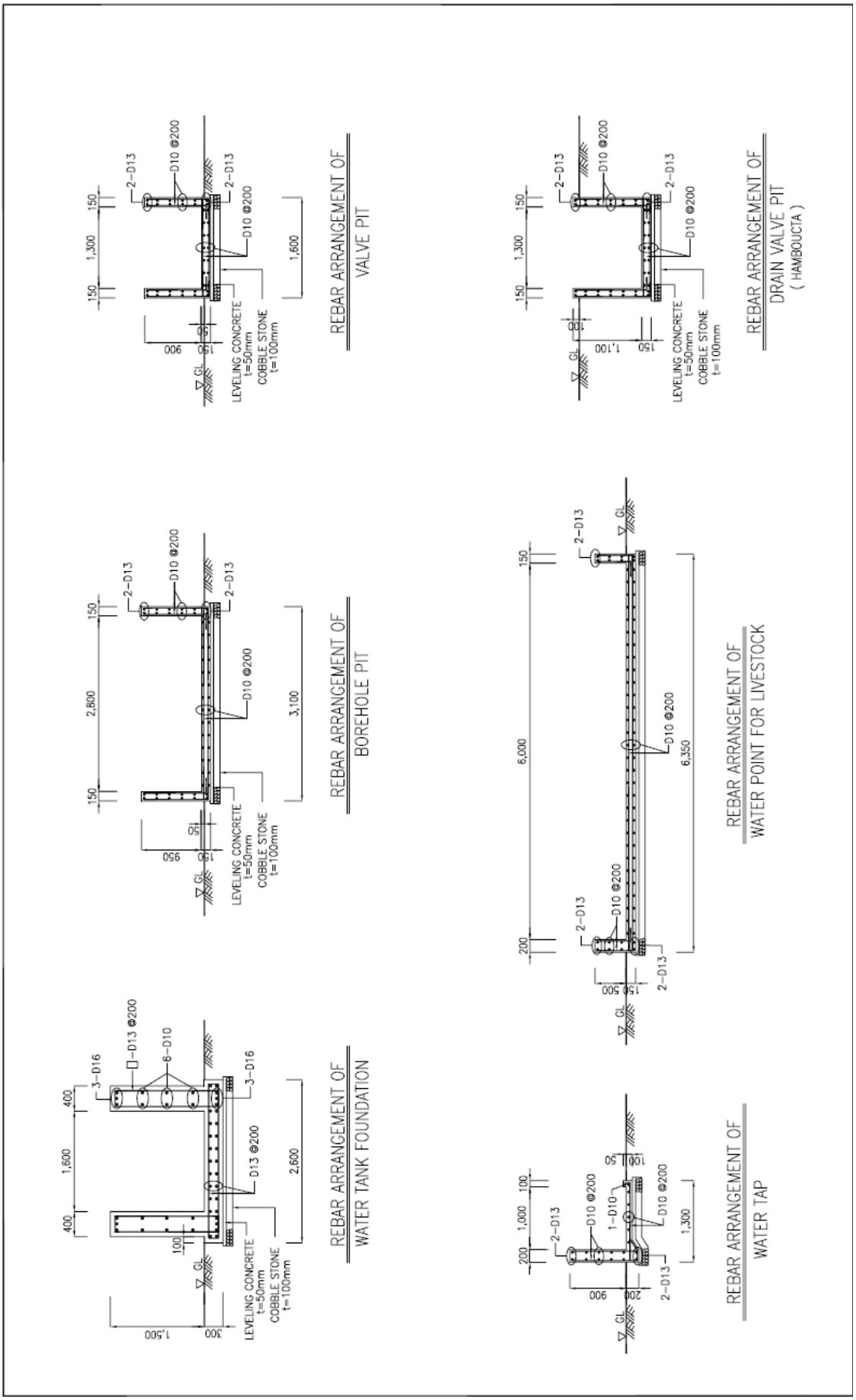


Figure 2-2-21 Plan and Elevation of Facility (4)

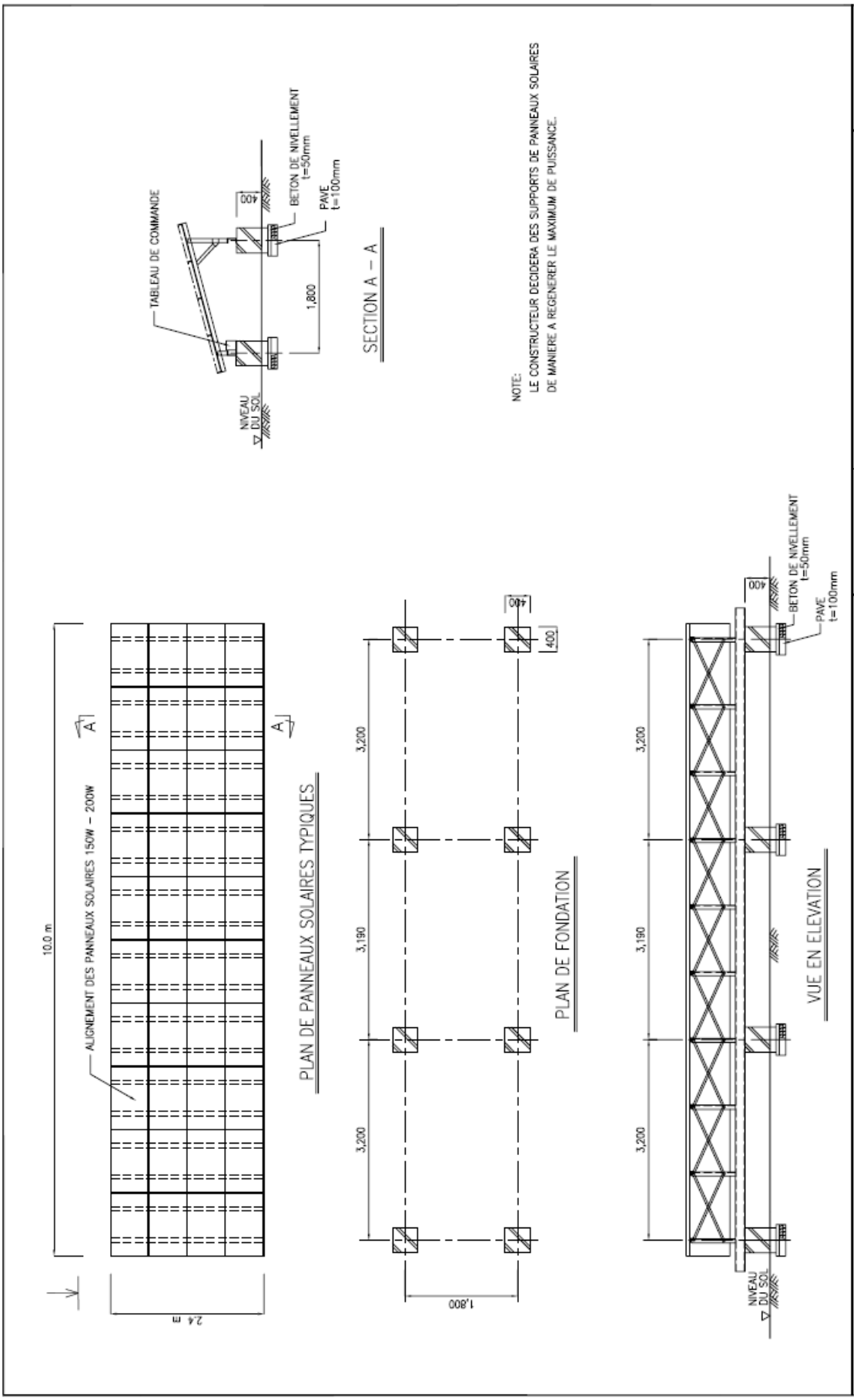


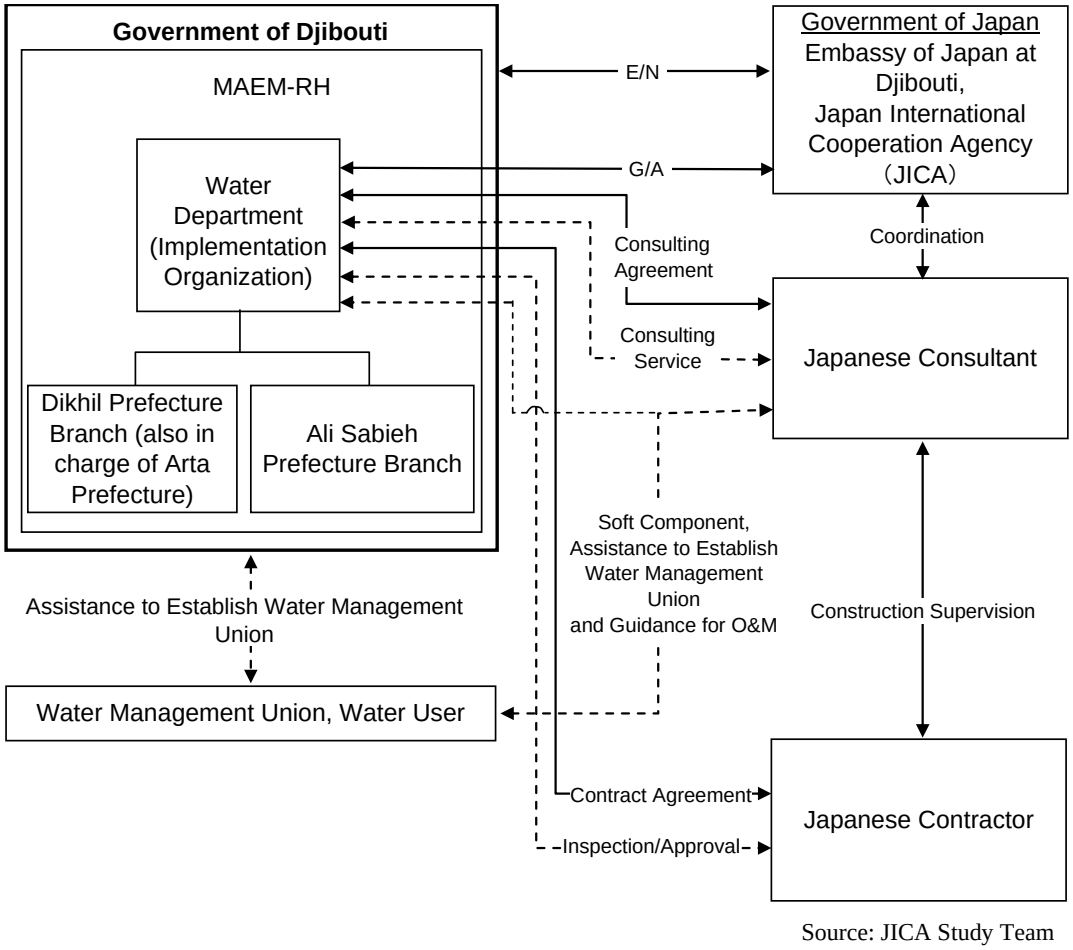
Figure 2-2-22 Plan and Elevation of Facility (5)

2-2-4 Construction Plan / Procurement Plan

2-2-4-1 Construction Policy / Procurement Policy

This Japanese Grant Aid Project will be conducted based on the conditions stated in the E/N agreed on by the governments of Djibouti and Japan, and in the G/A agreed on by the government of Djibouti and JICA. The implementing organization is the Water Department of MAEM-RH. The Water Department is responsible for the implementation plan, material/equipment procurement, facility construction and operation/maintenance of facilities/equipment. After water facilities are constructed, a water management committee, which will be established by water users, will conduct the operation/maintenance of the facility. Therefore, the Water Department (including prefectural branches) has to continuously assist with the establishment of committee, education of water users, conducting of monitoring, etc.

The Water Department must employ a Japanese Consultant Firm to conduct detail design, preparation of tender documents, tendering, supervision of material/equipment procurement, construction supervision and soft components. Furthermore, the contractor shall also be from a Japanese Company. The Japanese Contractor will conduct equipment/material procurement and facility construction based on the agreement with MAEM-RH and/or the Water Department. The Japanese Consultant will supervise the Japanese Contractor. The implementation structure of this Project is shown in the Figure below.



Source: JICA Study Team

Figure 2-2-23 Relevant Institutions and Implementation Structure

2-2-4-2 Points for Construction / Procurement

(1) Point for Construction

1) Ground Leveling Work

Ground leveling work will be conducted at areas where wells, solar panels and water tanks will be located and where pipeline will be installed. Ground leveling work will be done by bulldozer.

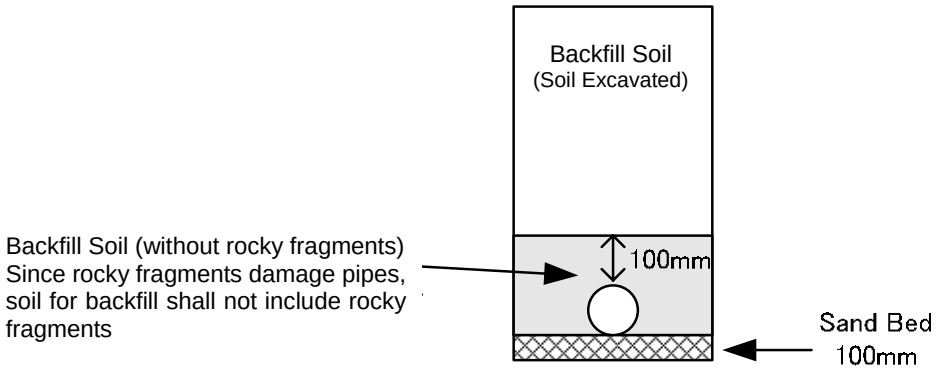
2) Excavation Work

Excavation work is necessary to install underground pipelines and to construct concrete structures. Since the required excavation depth for this Project is not deep, the open cut method will be applied.

The construction site is mostly covered by basalt (hard rock), as seen in Figure 2-2-24. Since it will be difficult to excavate by only using a backhoe, a 1,300kg breaker will be used for the construction.

Figure 2-2-24 Generally, Construction Site is covered by Basalt (hard rock) (Left Figure) Breaker is used to Excavate Basalt Ground (Right Figure)

3) Pipe Foundation and Backfilling Soil



Source: JICA Study Team

Figure 2-2-25 Pipeline Installation

In order to reduce stress/strain on the pipes, the sand bed shall be paved under the pipe. According to Japanese Water Facility Design Guidance (p474. 2000, JWWA), the sand bed, composed of sand or good quality soil, shall be thicker than 100mm. Therefore, in this Project, the sand bed is proposed to be 100mm as seen in the Figure above.

As mentioned above, the construction area is covered by basalt. Thus, rocky fragments will be in the excavated soil and they will damage the pipe surface. If the PVC pipe or HDPE surface is damaged, the strength of the pipe will be weakened. When SGP surface is damaged, the pipe will rust. Therefore, backfill soil without rocky fragments shall be used to backfill 100mm above the pipe, as seen in the Figure above.

4) Waste Treatment

Waste generated during the construction work (such as surplus soil and concrete) shall be transported to a waste disposal site decided by MAEM-RH. Although the location of the waste

disposal site has not been decided yet, it should not be far from the site because the construction site is located in areas where the present population density is relatively low.

5) Temporary Material/Equipment Storage

Material and equipment necessary for the construction will be transported to each site and will be kept in the storage yard. Since the site is relatively flat and is not being used, it will not be difficult to set up a storage yard. In order to prevent material/equipment from being stolen, a guard will be assigned.

(2) Labor Conditions

There are major overseas construction companies in Djibouti, which construct American and French military bases and their surrounding infrastructures. These companies also construct infrastructure funded by donors. Since these companies have experience that is similar to this Project, there will be companies that have the ability to conduct this Project. Since these companies can be the subcontracted by the Japanese Construction Company, the Project cost will be calculated based on the unit prices collected from these companies.

(3) Construction Material/Equipment Procurement

1) Common Construction Material

In Djibouti, construction materials such as cement, reinforcing bars and wood forms are usually imported from Pakistan, India or other countries so it is not difficult to purchase these common construction materials. Furthermore, since sand and aggregates can be obtained easily in Djibouti, they will not be difficult to purchase. Therefore, common construction materials will be purchased in Djibouti. Since salt content deteriorates reinforcing bars, it is necessary to take care not to use aggregates that contain salt.

2) Groundwater Pumping Equipment

For ease of maintenance, solar power will be used for the submergible pumps. Although there are companies that provide submergible pumps or solar panels in Djibouti, they are not the official companies of the manufactures. Since the well pumping equipment used in Djibouti is all imported from overseas, this Project will use equipment made in Japan.

3) Pipeline / Water Tank / Solar Panel

Djibouti uses imported pipeline/FRP water tanks. Although pipelines used in Djibouti are all imported from overseas, pipelines such as PVC pipe or HDPE pipe are not difficult to purchase from the local market. Therefore, PVC pipe and HDPE pipe will be purchased in Djibouti. Since GSP with inner surface lining and FRP tanks that will be used in this Project are not common in Djibouti, GSP will be imported from Japan.

Table 2-2-23 Procurement of Major Construction Materials

Construction Material	Local	Other Countries	Japan
Cement	◎		
Reinforcing Bar	◎		
Aggregate	◎		
Wood Form	◎		
Pipeline	◎ (PVC, HDPE)		◎ (SGP)
Deep Well Pump			◎
Solar Panel			◎
FRP Tank			◎

Source : JICA Study Team

Construction Equipment

There are construction machines owned by major construction companies in Djibouti for common construction. Since this Project does not need specialized construction machines, the Project cost will be calculated based on the construction machine rental prices collected from these companies.

2-2-4-3 Scope of Works

(1) Construction Responsibility

Construction responsibility is divided as shown in the Table below.

Table 2-2-24 Responsibility of Construction

Responsibility of Construction	Japan	Djibouti
1. Construction of Water Intake Facility		
1.1 Secure Land for Construction		○
1.2 Provide Temporary Road for Construction		○
1.3 Develop Access Road		○
1.4 Construct Water Intake Facility	○	
1.5 Ground Leveling Facility Land	○	
1.6 Install Fence/Gate		○
2. Pipeline Installation		
2.1 Secure Land for Construction		○
2.2 Develop Access Road		○
2.3 Install Pipeline	○	
3. Water Tank Construction		
3.1 Secure Land for Construction		○
3.2 Develop Access Road		○
3.3 Construct of Water Tank	○	
3.4 Ground Leveling Facility Land	○	
3.5 Install Fence/Gate		○
4. Construction of Water Tap		
4.1 Secure Land for Construction		○
4.2 Construction of Water Tap	○	

Source: JICA Study Team

(2) Procurement Responsibility

Regarding the procurement of material/equipment, it is the responsibility of Japan until materials/equipment is handed over to Djibouti. When materials/equipment arrives at Djibouti port, it is the responsibility of the Djibouti side to handle the procedures for prompt custom clearance and tax exemption. After materials/equipment are in Djibouti, it is the responsibility of Djibouti to operate, maintain and store them.

2-2-4-4 Construction Supervision Plan / Procurement Supervision Plan

(1) Construction Supervision Plan

This Project will be conducted based on the policy of Japanese gratuitous financial aid. The Consultant for this Project will conduct execution design, construction supervision and technical assistance such as improving the abilities of Water Department's staff and advising Water Department's staff/water users on the sustainable operation of water facilities.

Furthermore, following the policy of Japanese gratuitous financial aid, procurement of materials/equipment and facility construction will be conducted by a Japanese Contractor. Under the responsibility of the Japanese contractor, a local company might be chosen as a subcontractor.

1) Execution Design

The Consultant will conduct detail design and prepare tender documents and other documents necessary for the Project execution.

2) Tender

The Consultant will assist MAEM-RH and the Water Department on deciding the contractor for the procurement of materials/equipment and construction. After the contractor has been selected, Japanese Government approval is necessary before the execution of agreement.

3) Construction Supervision

The Consultant will assist MAEM-RH/Water Department by having discussions before construction, inspecting equipment at the factory, supervising the contractor during equipment installation, construction, etc. to assure that the Project will be completed in the period mentioned in the G/A. Furthermore, during the construction period, the Consultant will provide technical assistance so that water users will be able to sustain operation and maintenance of the water intake facilities.

(2) Procurement Supervision Plan

Materials/Equipment that will be provided for this Project are principally items that can be found in Djibouti or imported from Japan. However, if it is cheaper to import the materials/equipment

that may require after-sales service from third countries, procurement from a third country will be considered.

In order to ensure smooth procurement, the Consultant and procurement trader shall proceed as follows.

1) Procurement Supervision by Consultant

To ensure smooth transfer, the following work items shall be carried out:

- Meeting with contractor
- Confirmation of order contents
- Inspection before the factory shipment
- Supervision of technical training and transfer of the maintenance manual by procurement supplier.

2) Procurement Supplier

- Site procurement manager shall be dispatched to Djibouti when procured equipment arrives in Djibouti.
- Explanation of operation and maintenance methods for vehicles and geophysical survey machines shall be done in MAEM-RH.
- The manufacturer shall provide training on pump maintenance after commissioning continuously, if necessary.

2-2-4-5 Quality Management Plan

Since salinity deteriorates reinforcing bars, it is necessary not to use aggregate that contains salt content. During the concrete casting, it is essential not to use salty water so the concrete shall reach the designed strength. Therefore, before concrete casting at each construction site, a grain size test shall be conducted in order to mix concrete in the given composition. When casting concrete, a test piece shall be prepared and shall be transported to Djibouti city for a compressive strength test.

Before transporting reinforcing bars to each construction site, 1 reinforcing bar shall be taken as a sample for a tension test. If the reinforcing bar does not meet the accepted standards, the reinforcing bars shall not be used.

Regarding pipelines, a flow examination will be conducted after the pipes are installed so that inadequate jointing can be found.

2-2-4-6 Procurement Plan for Equipment and Materials

(1) Procurement Plan

The equipment to be procured by the Project is not produced in Djibouti. Japanese and other

foreign pick up trucks are available in Djibouti local markets so it is possible to procure this vehicle through local agencies. The mobile workshop is composed of various specialized equipment and tools for repair and maintenance. Thus, if procuring these from third countries, it will be difficult to ensure the quality of each item in the limited time given for execution. In Djibouti, there are some local agents of Japanese vehicles who have available equipment for repairs but to ensure quality, the mobile workshop shall be imported from Japan.

For the equipment for the water resources survey, it is all relatively small, so even if it is imported from Japan, the transportation costs will be comparatively low. Consequently, considering the reliability of Japanese products, this equipment shall be procured from Japan. For electric resistivity survey equipment, transceivers and GPS etc., good quality products from third countries are available on the market; therefore, procurement from third countries will be considered.

The country of origin for the equipment being procured for the Project shall be fundamentally considered as shown in the following Table.

Table 2-2-25 Procurement Classification of the Equipment

Item No.	Equipment name	Procurement classification			Application
		Japan	Local	Third country	
1. Support Vehicles for Well Drilling Works					
1-1	Mobile workshop	○			
1-2	Vehicle for survey	○		○	South Africa, EU, USA
2. Equipment for Water Resources Survey					
2-1	Water level indicator	○			
2-2	Electric conductivity meter	○			
2-3	pH meter	○			
2-4	Well water sampler	○			
2-5	Electric resistivity survey equipment	○		○	EU, USA
2-6	Transceiver	○		○	EU, USA
2-7	Electrician tool set	○			
2-8	Clinocompass	○		○	EU, USA
2-9	GPS	○		○	EU, USA
2-10	Mirror stereoscope	○			

Source: JICA Study Team

(2) Transportation Plan

The equipment to be procured by the Project will be loaded at the port of landing of the procurement country (In Japan, Yokohama). After that, it will be transported by sea to the port of delivery, Djibouti port. The marine transportation period will be about 30 days from Japan via Singapore, 15 to 30 days from EU, 30 days from the USA, and 45 to 60 days from South Africa because there is no existing direct freight route. After unloading and passing through customs

clearance, all the equipment will be delivered to the Headquarters of the Water Department, MAEM-RH.

(3) Equipment Procurement Schedule

The equipment delivery schedule shall be approximately 7 months in total including: 150 days for the manufacturing of mobile workshop, 45 days for marine transport, customs clearance and inland transportation, and 15 days for the commissioning period which includes the installation (for some items), equipment checks, running tests and hand-over activities by the supplier's engineer.

2-2-4-7 Technical Assistance Plan

Training will be carried out for O&M of the facilities and equipment provided for the Project.

Table 2-2-26 Initial Operation Guide (Commisioning)

Item		Content	Schedule	Target persons
Water intake facility	Pump	Training of maintenance methods for pump (check and maintenance) will be held after commissioning,	During Commissioning	CP(MAEM-RH/ Branch office)
	Operation	Open/close of valve following the design policy.	In soft-components	CP, WC
	Cleaning	Cleaning of solar panel/water storage tank etc.	In soft-components	WC
	Flow rate management	Training for measurement methods for pump displacement, its occasion, and evaluation method.	In soft-components	CP, WC
Electric survey	Two-dimensional electric survey	Lecture and practice on groundwater exploration method/measurement/analysis.	In soft-components	CP
Well logging machine		Training for measurement and operating method	During Commissioning	CP(MAEM-RH/ Water Resources Board)

Source: JICA Study Team

2-2-4-8 Soft Component Plan

(1) Necessity of Implementation of Soft Components

1) Assistance for setting up an O&M system for water intake facilities

In Djibouti, water supply services such as groundwater survey/analysis, site selection of facilities, setting up of water intake facilities, and O&M are managed by the government (Water Department and their Regional branches) for free. In recent years, the Water Department adopted a policy that O&M of water intake facilities is to be managed by the Regional branches of the Water Department or by resident people who use the water. A special section for these activities was set up in the Water Department and two staffs were assigned. A WC was organized at an

existing water intake facility during a UNICEF solar generation installment project. However, O&M and sensitization training for resident people and regular monitoring were not carried out after this project.

Nine water intake facilities will be set up at 9 zones in the Project. For proper use and O&M of these facilities, a WC will be set up for every water intake facility in the Project following the policies on rural water supply service in Djibouti. However, the target areas are nomadic compounds. There are various camps scattered throughout the community and people have not enough opportunity of cooperative activity for their daily life. Some of the camps are far from the water intake facilities. Because of these factors, the O&M system such as daily operation of facility, checking/management, collecting water user fees, etc. by community people (e.g. WC) should be determined individually according to the situation at each site. Therefore, the existing method for set up of a WC based on UNICEF experience in Djibouti will be reviewed and technical assistance will be needed to do a study and implement various methods for O&M in these communities.

There are 5 settlements for which the water facility supplies drinkable water. Among these 5 settlements, a water management committee will be established at 4 settlements because these settlements' inhabitants told the social survey team that they are willing to operate/maintain the water supply facility by themselves when the facility is constructed. Regarding the remaining settlement, operation/maintenance of the water supply facility will be conducted by MAEM-RH for the time being, because the inhabitants in this settlement already have a water resource for which they pay a fee. There are 4 settlements for which the water facility cannot supply drinking water (for daily use only). The operation, maintenance, and guidance on the use of water at these facilities will be conducted by MAEM-RH..

2) Capacity Building for Groundwater Development and Management

The main service of the water resource department in the Water Department is groundwater development. They use electric surveys as a tool of groundwater resource. At present, there are 2 engineers for electric surveying. They have had experience on electric surveys in other projects by donors, and have knowledge of the operation of vertical electrical sounding with existing equipment for electric surveys (1 kid). In the preparatory survey, a two-dimensional electric survey was found to be most useful for understanding geologic structure and artificial presumption of salty water for groundwater surveys in Djibouti. For future improvement of accuracy/efficiency, it will be advisable to carry out two-dimensional electric surveys.

Two engineers engaged in this preparation survey and learned the measuring methods of the two-dimensional electric survey. However, selection of the area for the electric survey, decisions on survey lines, analysis/interpretation of survey results, and decisions on drilling points for boreholes will be decided by the JICA Project team. If the local engineers can learn these methods,

it will have a positive effect on capacity building for site selection for groundwater development. Also, it will lead to improving their success rate and reductions of cost for groundwater development.

On the other hand, it is important to keep updating, accumulating and evaluating data for improvement of development accuracy on such things as conducting of electric surveys, comparison of borehole data (geology, water quality, water level) and geology. However, at present, earlier records of electric surveys and drilling have not been well organized. Therefore, it is difficult to create comprehensive survey results of past and present data. Also, new implementation plans for groundwater surveys cannot be planned based on past data. Therefore, improvement/building up the database is one of the major problems that must be overcome.

(2) Contents of Soft Components

The following technical assistance is proposed for effective water resource development and sustainable O&M of the water intake facilities in this Project.

1) Assistance for Setting up an O&M system for Water Intake Facilities
2) Capacity Building for Groundwater Development and Management

The outline is as follows:

1) Assistance for Setting up an O&M system for Water Intake Facilities

<Purpose>

To set up a WC (group or person in charge) and establish operation systems by community people overseen by the Water Department at each drinking water intake facility.

<Activities>

(a) To review the O&M system of water supply, to determine how to organize the WC (group or person in charge) and to introduce training/sensitization methods
(b) To set up the WC (group or person in charge) and give training (sensitization) on O&M of each drinking water intake facility in target zone
(c) To think about and try to manage a monitoring system of O&M conditions and a repair/maintenance system in case of breakdown at the water intake facility

<Output>

(a) O&M system for each drinking water intake facility run by community people will be arranged.
(b) WC (group/person) in charge of O&M at each drinking water intake facility will be set up in the target zone.
(c) A monitoring system and payment/maintenance system for each water intake facility will be improved.

Table 2-2-27 Evaluation Method of Effectiveness

Activity Item	Direct Outputs (After completion of Soft-component Activities)	Evaluation Item for Effectiveness
To review the existing O&M system of water supply, determine how to organize the WC (group or person in charge) and training/sensitization methods	O&M system of water intake facility by community people will be arranged	Manual for setting up of WC, sensitization of users, O&M and repair of water intake facility etc.
To set up WC (group or person in charge) and training (sensitization) for O&M of water intake facility in target zone	WC (group or person in charge) for O&M of water intake facility will be set up in target zone.	Name list of WC members/person (group or person in charge), user rules, activities of hygiene & sanitation education, and situation of user fee collection of water intake facility etc.
To think about and try to manage a monitoring system of O&M conditions and repair/maintenance system in case of breakdown at the water intake facility	Monitoring system and payment/maintenance system for water intake facility will be improved.	Monitoring system and its implementation frequency, service system for breakdown of facility, and request formats for monitoring & maintenance, etc.

Source: JICA Study Team

1) Capacity Building for Groundwater Development/Management

<Purpose>

To teach staff of the water resources section in the Water Department how to measure/analyze two-dimensional electric surveys and speculate on aquifer structure. In addition, they will be taught sustainable methods for survey plans and monitoring.

<Activities>

(a) Lecture on water resource electric surveys
(b) Measuring practice on two-dimensional electric surveys
(c) Analysis/interpretation of measuring data and management of water resources data

<Output>

(a) Staff of the water resources section in the Water Department will learn methods of measurement, analysis, evaluation, and selection of drilling points using two-dimensional electric surveys.
(b) Staff of the water resources section in the Water Department will be able to create a plan for a two-dimensional electric survey and carry out monitoring.

Table 2-2-28 Evaluation Method of Effectiveness

Activity Item	Direct Outputs (At the end of Soft-component Activity)	Evaluation item for effectiveness
Lecture on water resource electric survey and measuring practice on two-dimensional electric survey.	Staff of the water resources section in the Water Department will learn methods of measurement, analysis, evaluation, and selection of drilling points using two-dimensional electric surveys.	Result of capacity check of engineers (usage of equipment, analysis of measurement results, deliberation of hydraulic conditions, site selection of borehole construction, etc.)
Analysis/interpretation of measuring data and management of water resources data	Staff of the water resources section in the Water Department will be able to create a plan for a two-dimensional electric survey and carry out monitoring.	Storage/accumulation of measuring data, determination capacity of high ability point for groundwater development, and monitoring situation of existing boreholes, etc.

Source: JICA Study Team

(3) Schedule of Soft Components

1) Assistance for setting up for O&M system of water intake facility

After reviewing methods of establishment and training of the WC, preceding construction of the water intake facility, activities for organizing the WC and training the members on the O&M of the facility, sanitation and hygiene education, etc. will be carried out for about 2.5 months. A few months later, trials and re-arrangement of monitoring and repair systems of the facility will be carried out for about 1.4 months.

2) Capacity Building of groundwater development and management

After equipment for the electric survey is procured, lectures and practice on measurement/analysis will be carried out for capacity building of staff in the water resources section. Additionally, data arrangement/management will be taught for using monitoring well after construction facilities are finished. The total time required will be about 1 month.

2-2-4-9 Implementation Schedule

The implementation plan (tentative) of the total Project is shown in Table 2-2-29.

Table 2-2-29 Implementation Schedule (Tentative)

Implementation Plan (Tentative)

The Preparatory Survey on the Rural Water Supply Project in Southern Djibouti

Item			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Contrace	Exchange of Notes (E/N)			▼																								
	Consultant Contract				▼																							
Implementation Design	Detail Design Site Survey	1.00				▬																						
	Study in Japan / Detail Design	1.50					═																					
	Tender Work I Prepare Tender Document	1.00						═																				
	Approve Tender Document	0.50							▬																			
	Tender Work II Bid Announcement									▼																		
	Explain Situation / Provide Document	0.50								═																		
	Tender / Tender Evaluation / Discussion	0.50										▬																
	Contract with Contractor											▼																
Construction Work	Construction Material Procurement / Transportation / Custom Clearance											▬	▼															
	FRP Tank Procurement / Transportation / Custom Clearance											▬	▬	▼														
	Solar System											▬	▬	▬	▬	▬	▬	▼										
	Construction	9.00																										
	No.34 - SABBALOU													▬				▪▪										
	No.8 - ZINA MALE														▬			▪▪										
	No.16 - ASSA KOMA															▬		▪▪										
	No.15 - SEK SABIR																▬	▪▪										
	No.11 - DAGUIRO(2)																	▬	▪▪									
	No.18 - AFKH ARRABA																		▬	▪▪								
	No.17 - MINDIL																		▬	▪▪								
	No.21 - HAMBOCTA																			▬	▪▪							
	No.29 - MIDGARRA																				▬	▪▪						
	Test Run / Adjustment	1.0																				▬						
	Hand Over	1.0																					▬					
Equipment Procurement	Equipment Procurement (Manufacture / Inspection / Transportation)											▬	▬	▬	▬	▬	▬	▬	▬	▬								
	Installation / Inspection / Hand Over																			▬								
Soft Component	Groundwater Development / Managing Guidance	1.00																			▬							
	O/M Management	3.90															▬	▬	▬	▬	▬	▬						
	Total Evaluation	0.80																						▬				

: Work in Japan

: Work in Djibouti

▪▪▪▪▪▪ Pump / Solar Panel Installation 2 site / a month

Detail Design: 1 2 3 4 5

Tender: 6 7 8 9

Construction: 10 11 12 13 14 15 16 17 18 19 20 21

2-3 Obligations of the Government of Djibouti

The scope of the works to be undertaken by the Government of Djibouti is as follows:

- Acquire and develop land for the construction of water intake facilities and access roads to the construction sites
- Secure and provide land for the storage of equipment and materials and for temporary work during the construction period
- Provide necessary data and materials for this Project
- Acquire the necessary permissions for implementation of this Project
- Secure cooperation from residents living in the vicinity of the construction site and implement necessary measures regarding traffic control
- Provide land for a disposal site for waste created by the construction work and for an outlet point for wastewater
- Assist with the procedure of customs clearance and tax benefits for importing equipment and materials to be procured in this Project.
- Make payments and hold the burden of expense of commissions for Banking Arrangements (B/A) and Authorization to Pay (A/P)
- Provide the necessary support for immigration/long-term stays of Japanese citizens engaging in any business (procurement of the equipment and materials, construction and consultant services) regarding implementation of this Project.
- Ensure the appropriate use and maintenance of procured equipment and materials, and constructed facilities created by this Japanese Grant Aid Project
- Bear all necessary expenses (cost of surveys, construction/development, maintenance, etc.), other than those to be borne by the Japanese Grant Aid, necessary for the execution of this Project.
- O/M of water intake facilities at five (5) zones (Daguiro(2), Middgarra, Assa Koma, Zina Male, Sabbalou)
- Explanation, enlightenment and signboard installation regarding the health influence and important notices related to the usage of water intake facilities at four zones (Daguiro(2), Middgarra, Assa Koma, Zina Male)

2-4 Project Operation

2-4-1 Operation and Maintenance of Water Intake Facilities

Although there is a seasonal river (Wadi) in Djibouti, there is no permanent river. Throughout the year, the Wadi has a low level of flowing water; therefore, groundwater is the only regular utilizable water source for rural water supply. Water supply in rural areas is provided by the Djibouti

government free of charge. The department in charge of rural water supply is the Water Department of MAEM-RH.

Existing O&M system of water intake facility is as the following figure.

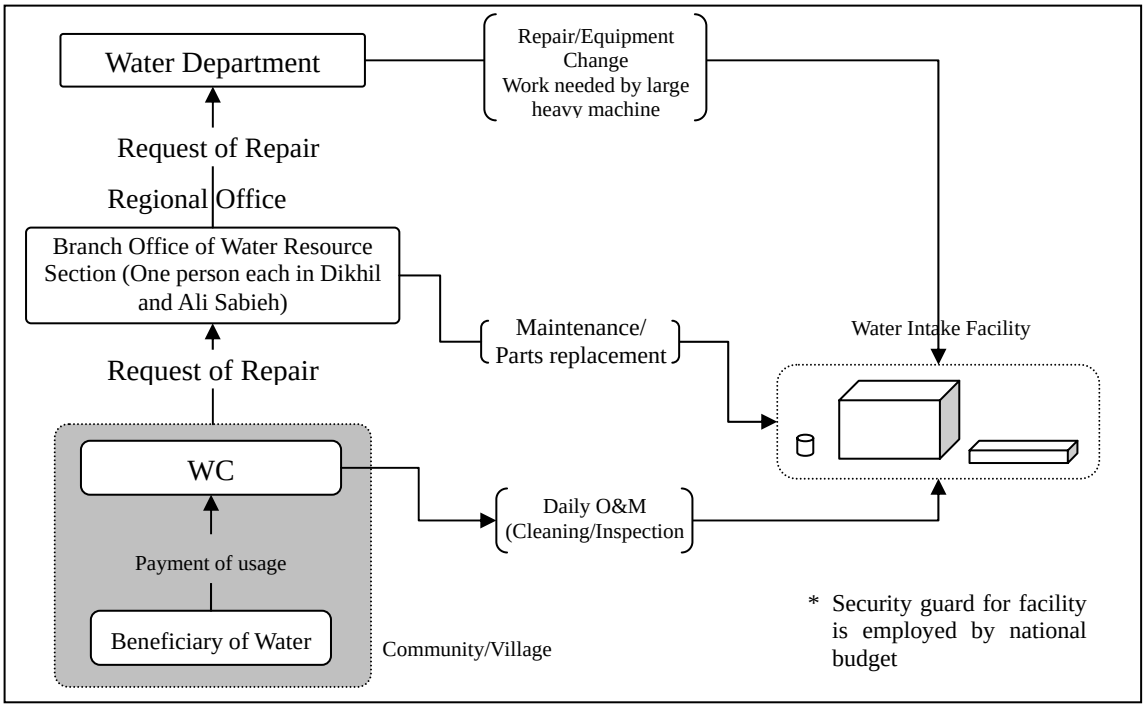


Figure2-4-1 O&M System of Rural Water Intake Facility

In the case where a water intake facility breaks down and cannot operate, the users of the water intake facility make a request for repairs to a branch office of the Water Department in the Regional Office. However, there are only 2 staffs in the branch office (1 person each for Dikhil and Ali-Sabieh) for carrying out normal O&M activities. Realistically, it is difficult for the Water Department to carry out repairs and O&M in a timely manner in the existing system.

As a result, the Water Department realized that a benefit assessment is needed for daily O&M of the water intake facilities, and a Water Decentralization Support section (2 staff) was established in the Water Department. Their section promotes setting up a WC at the community level to oversee the installation of a solar system replacing the existing system (diesel generating system) with aide from UNICEF. As a general rule, O&M of water intake facilities is managed by the beneficiary, and the Project team proposes the establishment of a WC consisting of community residents administered by the Djibouti government.

However, as there are no residents near most construction points of the water intake facilities, it is difficult to establish new WCs. UNICEF set up a WC in a community that had cohesiveness and an existing water intake facility. On the other hand, the target zones of this Project are nomadic

compounds, and most zones are made up of scattered camps. For establishment of a WC, it is indispensable to gain understanding on the necessity of the WC from each camp. Also proposing an adaptive O&M system for each zone, such as utilization of existing self-defense groups or assignation of a person in charge of O&M under the Water Department, is required.

The situations in the target communities are summarized in Table 2-4-1.

Table 2-4-1 Situation of Target Zone

No.	Zone Name	Difficulty/Problem	Difficulty Level of Setting up WC
15	Sek Sabir	It is important to confirm coordination among camps because of the large number of users.	Low
17	Mindil	Camps are scattered within a 5km radius. Construction of shallow wells and roads, purchase of livestock, and immunizations etc. are to be implemented with residents.	Average
18	Afka Arraba	The relationship among camps needs to be confirmed. Residents are settled but the population is small.	Low
21	Hambocta	The relationship among camps needs to be confirmed. Coordination with primary schools and existing facilities (farm boreholes) must also be considered.	Average

The installation of a solar component to the diesel generating system will reduce the fuel expenses regularly required in Djibouti. Also, compared to the diesel generating system, it will be easier for residents to manage, maintain and inspect. Because of this burden reduction, this method has been proposed to the branch office. On the other hand, it is difficult to carry out O&M on pumps of water intake facilities compared to hand pump wells usually used by residents. Therefore, O&M (inspection/repair) of the water intake facility pumps needs to be managed by the Water Department.

However, both the Water Department and the residents do not have the budget to buy spare parts. In case of a breakdown, there is a high possibility that the operation of the water intake facility will be stopped for a long time. In addition, there is neither a list of parts that have broken down nor a procurement plan for equipment needing repair in the Water Department. Therefore, the facility may continue to be broken down in the new fiscal year (e.g. the inverter of the solar system which was set up by HINDI in the Region of Ali-Sabieh broke down and was left without maintenance for almost one year). The Djibouti government (Water Department) must be obliged to allocate an appropriate budget for O&M of these facilities. In view of this situation, provision of spare parts will be required for some length of time during the construction of the water intake facilities.

As mentioned above, the objectives for the O&M plan of the water intake facilities in the Project are as follows:

i. Introduction of solar systems for sustainable use with minimum maintenance
ii. Establishment of a voluntary O&M management system by residents/users by setting up WC consisting of residents, with utilization of existing residential groups (ex. self-defense groups

or women groups etc.), or assignment of a person in charge of O&M (individual) at the water intake facilities etc. (However, this is limited to the water intake facilities which are expected to be used by residents.)

iii. Procurement of spare parts for 10 years

iv. Capacity building for management of the facilities by the Water Department including the branch office and improvement of management for O&M of facilities by the Water Department

2-4-2 Concept of O&M System of Sater Intake Facilities

The Djibouti government promotes decentralization and most rural water supply projects in African countries have been carried out based on benefit principle. However, managing a water supply program by benefit principle is an idealistic theory. In Djibouti, there are difficulties with both natural and social factors: (1) it is difficult to use groundwater sources for hydraulic/hydrology/geology (quantity/quality) due to low rainfall levels and the fact that most basin boundaries are close to each other, (2) deep groundwater level, (3) nomadic life has a low return cash income because of livestock posturing, (4) nomadic camps are scattered and distant from the water intake facilities.

Considering these factors, managing the O&M for an expensive facility (solar system or motor pump) is impossible through a benefit principal system when compared to a normal rural water supply (hand pump well) on a permanent basis. The validity of the introduction and establishment of such an expensive facility cannot be implemented without full support of the Djibouti government. This support must include budgetary allocations for regular checking/monitoring and rehabilitation in case of breakdown.

Therefore, the repair and renovations of the O&M system as the facilities age should not be done through a benefit assessment scheme.

2-4-3 O&M System (Coordination with Government)

It is assumed that a low-cost O&M system for each water intake facility in the Project will be introduced. The daily O&M will be carried out by the WC consisting of residents or an alternate existing group/person in charge (individual). However, in case of system trouble or a decrease in pump displacement, support (repair) from an engineer of the Water Department or an agent of the solar system manufacturer will be required. The O&M system (Draft) is shown in Figure 2-4-2

(1) Beneficial Residents

The Water Department (Water Decentralization Support section) will assist in establishing the WC (group or person in charge). Under the Leader of the community (chief or grand chief), the residents

will have the responsibility of daily O&M (checking, operation, cleaning, light maintenance (changing parts), watching, and recording the operations of the facility).

(2) Water Department

According to the results of the water quality survey and information of the existing wells, the groundwater in Djibouti has a lot of calcium. To ensure sustainable usage, regular cleaning of the calcium deposits on the pump are required. Based on the maintenance contract, dismantling of the pump should be carried out a representative from the manufacturer in attendance. However, there is no branch office for the pump manufacturer. In addition, the beneficiary has no financial resources. Because of these factors, maintenance should be carried out by the Water Department. Maintenance staff should be placed in the branch office of the Water Department. However, these staff are currently located only in the headquarter office. Therefore, for the present, the branch office should carry out inspection work through corroboration with headquarters. In addition, the technical capability of the Water Department to perform regular inspections on the submerged well pump is low. Therefore, the manufacturer will provide maintenance training at the time of commissioning.

The Water Department doesn't have a budget for maintenance but it needs to maintain the solar pump systems constructed by Abu Dhabi fund or Saudi Arabia fund. The Water Department has also made a request to UNICEF to collect funds for this plan.

After establishment of a WC, regular monitoring of the O&M system for the water intake facility is required. The Water Decentralization Support section was slated to monitor the system twice after setting up the WC in the UNICEF project. However, it is not possible to find any results on its feasibility.

Spare parts must be procured and stored in the warehouse of the Water Department. However, the warehouse of the Water Department does not have an effective stock management system. Before procurement of spare parts for the Project, the Water Department should be requested to keep and effectively organize the storage rooms.

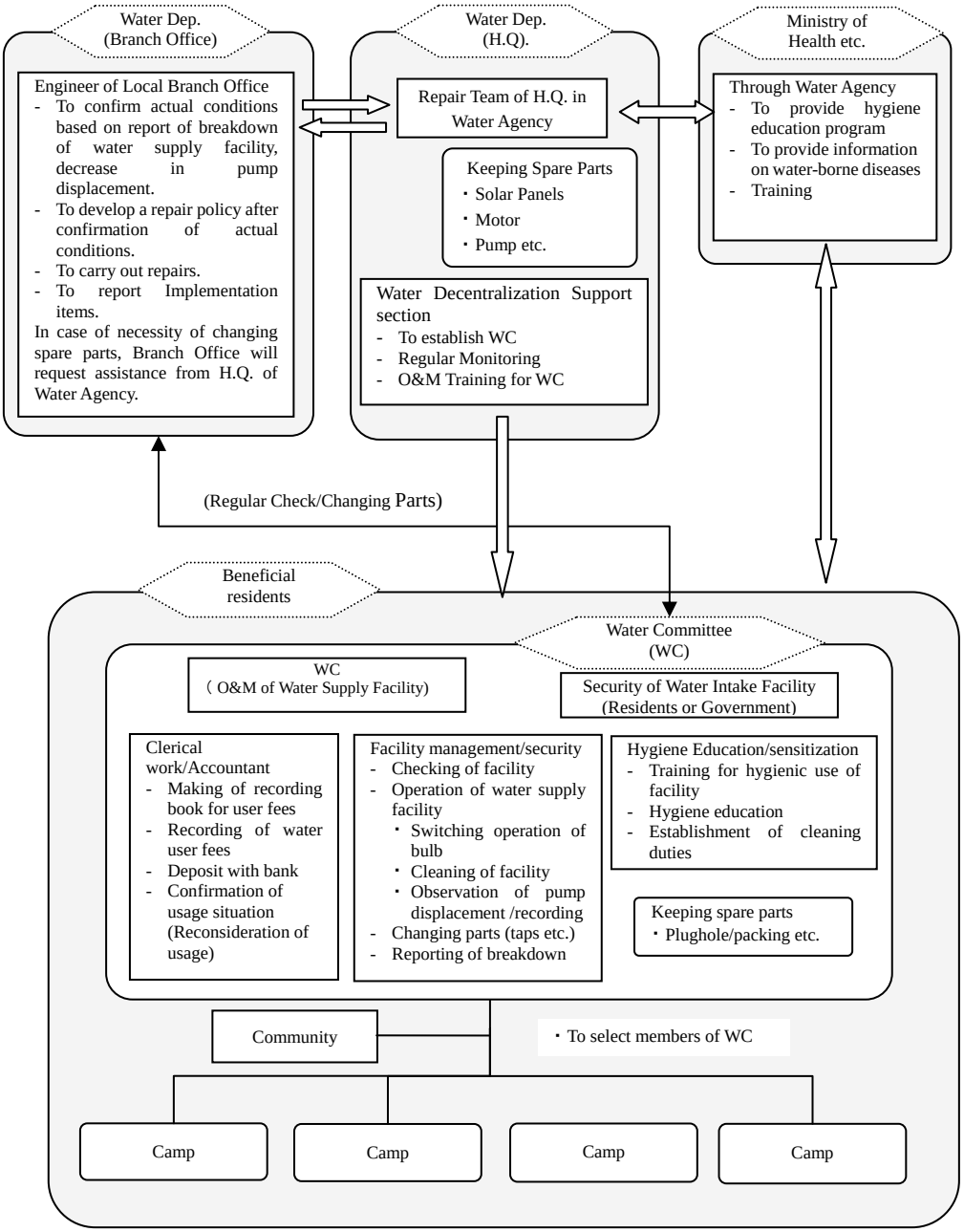


Figure 2-4-2 O&M system (Tentative)

(3) Ministry of Health

There is a Sanitation Section in the Water Department. However, staff have not been assigned to this section. In general, the Sanitation Section gives training on sanitation, hygiene education and information related to the hygiene and sanitation of Djibouti. Training on hygiene education for the Project will be coordinated with UNICEF or the Ministry of Health.

The roles of related members are shown in Table 2-4-2.

Table 2-4-2 Role of Each Organization for O&M of Water Intake Facilities

O&M item	Residents	WC	Branch Office of Water Department	Water Department	Manufacturing company	Remark
Cleaning of facility (Water area /Tank/ Solar)	◎	○	△	×	×	It is recommended that residents clean up the facility on a rotating and voluntary basis. Implementation method should be discussed and decided by each community.
Security of facility (Prevention of theft, Water theft, Damage)	○	◎	×	◎	×	As policy of Water Department, government will employ and assign security guards for the facility. However, some guards were not paid a salary. Therefore, it is recommended the beneficiary be responsible for security. If government will pay salary, security guards will be selected from residents.
Checking of facility	×	◎	○	△	×	Engineers from the branch office cannot be responsible for repairs. At present, it is difficult to implement regular monitoring. Checking of the facility will be carried out by WC to enhance awareness of ownership.
Operational Management of facility (Opening and closing of bulb, measurement of flow rate meter, manually turn the power off, collection of user fees from visitors)	×	◎	△	×	×	Operational management is one of the responsibilities of WC. The person in charge of operation will measure the water supply amount and inform the WC. The hourly water supply will be revised by the WC. It is very important to improve their sense of ownership of the facility. In addition, valve control of the facility is privileged work. This must be considered when choosing the person in charge of selection or regular shift work.
Collecting water fees (Collect user fees from neighboring community as well.)	×	◎	×	△	×	Person in charge of operational management should also collect user fees. They should check the user fees and record them in the cashbook. Generally, the accountant will manage the collected money.
Changing expendable parts (1) (tap/packing etc)	×	◎	△	×	×	There were a lot of facilities with broken taps. Also expendable item like packing need to be changed regularly. Spare parts should be kept and changed by the WC members.
Changing expendable parts (2) (Solar panel, Pump, bulb, controller, others)	×	×	◎	○	×	Spare parts, which are stored in the Water Department, will be used for changing expendable parts. In case of a need for heavy equipment, equipment of the Water Department, such as cranes, will be used. If possible, a contract between the Water Department and manufacturing company may be required for prompt action. However, it will incur a high cost.
Replacement of Equipment/system (solar panel, pump, others)	×	×	◎	◎	○	(Difficulty after 10 years) Construction, which cannot be repaired by spare parts, will require a budget through a donor project. Before implementation, a survey will be required.

◎：Main Worker ○：Joint responsibility △：Assistance for work/training ×： Others

(4) Establishment of WC

A lot of nomads live in target areas. Houses are not close together in this community. Camps (groups of a few families) are scattered throughout the zone. Therefore, it is somewhat difficult to regularly work together with cooperation among the camps. For management of the water intake facilities, it is very important to establish a group like a WC, to collaborate among camps and residents, and to develop a cooperation system. A WC was previously established by the Water Decentralization Support Section at a water intake facility where UNICEF installed a solar system. Based on the results of the preparatory survey, the existing WC composition will be used as a sample on how to organize a committee. This sample WC composition is shown Figure 2-4-3.

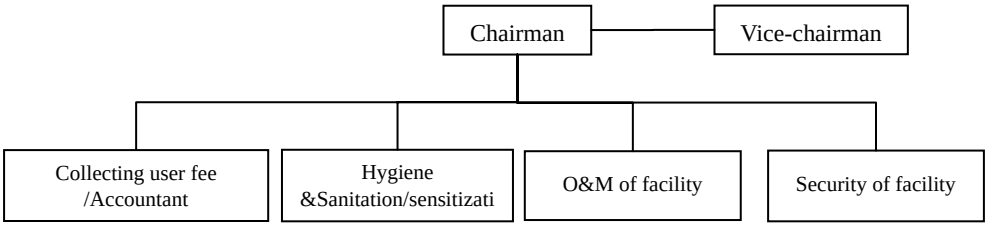


Figure 2-4-3 Composition of WC (Sample)

<WC>

The following items are to be discussed and decided by the water committee and overseen by the Chairman or by WC members.

1) To make regulations of the WC

Discussions will be held on the responsibilities of the WC, selection of members, length of term, dismissal, organization of committee, etc.

2) Making of terms for water use

a) Usage time

At the beginning, the time of operation will be from 6 A.M. to 12 noon. If necessary, the operation time will be changed according to requirements.

b) Decision on method for collecting user fees

In general, water user fees will be paid in cash dependent on the amount of water use. For households that have no income, discussions will be had on payment methods in lieu of cash such as cleaning the water facility or bartering livestock or crops etc. Also, discussions will be had on payment methods for persons having only seasonal income (harvesting time etc.). In this case, residents will pay a one-time water fee when they have income.

c) Regulation for water users from neighboring communities

Regarding water users from neighboring communities or nomadic strangers or visitors, a water user fee (collection or free), amount of water user fee etc. will be decided and confirmed through a users agreement between the WC and neighboring communities.

3) Decision on water user fee operation system

Usage and fund administration of water user fees such as the purchase of water when the facility breaks down, spare parts (water taps, packing), requests for repairs and transportation fees for repairs, etc. will be decided by the WC.

4) Selection of successors of WC members

WC members should be replaced regularly to ensure transparency and maintain a sustainable and sound operation. This will lead to an increased awareness of total ownership. The length of the term of WC members and selection methods for succeeding members etc. will be discussed.

5) Plan for voluntary activities of residents (users)

Cleaning of the water intake facilities (solar panels, water storage tanks, etc.) will be done by users (residents) on a voluntary basis.

<Collecting user fees/Accountant>

i. Making a (community) list of user names
ii. Administering water user fee collection based on a system decided by the WC
iii. Collecting Water fees from neighboring users at the water point
iv. Keeping the collected money (generally, the accountant has responsibility and in many cases, keeps the money at her/his house.
v. Purchasing spare parts (after sending a request to an engineer in the district branch office)

<Training (sensitization) Plan for Residents>

Sensitization activities such as hygiene & sanitation education and training of the water usage system will be planned/carried out for residents (users).

<O&M of water intake facility>

i. Management of water supply hours (feed valve will open from 6 A.M. to 12 noon as initial water supply hours)
ii. Observation of the flow rate meter
WC members will check the flow rate meter three times a day (6 A.M., 12 noon, and 6 P.M.). Also, they will record the pumping rate and quantity consumed, and monitor usage

conditions and pump capacity. If the operation has some problems, the person in charge will propose a change in operation hours to the WC.

iii. Cleaning the solar panel surface

Cleaning will be carried out everyday by volunteers among the residents or by the WC

iv. Replacement of parts such as water taps or packing

A few sets of spare parts will be provided upon the completion of the facility. After that, the required quantity of replacement parts and the purchase amount for one year will be determined and reported/requested for procurement to the WC.

v. Requests for repairs to the branch office of the Water Department

In case of a decrease in pump displacement, a stoppage in pumping water, or a breakdown of the water level sensor in the water storage tank etc., the WC will ask for confirmation of the situation and request repairs by an engineer from the branch office of the Water Department.

vi. Security of facility

The WC will keep watch and protect the solar panels and the facility from theft or damage.

vii. Others

The target community in this Project is not of general colonial morphology as it has nomadic characteristics. Each target area will determine a suitable system for itself without adhering strictly to the above sample composition of a WC (e.g. application of an existing group like self-defense or women's mutual assistance). The person in charge of O&M will be assigned under the management of Water Department/community leader.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

Costs Covered by Djibouti Side: DJF 23.5 million (About JPY 11.9 million)

	Items	Cost (million DJF)	Note
1	Installation of net fence	16.2	9 sites
2	Road Rehabilitation	1.2	3 sites
3	Counterpart Allowance	5.1	564 M/D
4	Bank Commissioning	1.0	
	Total	23.5	

2-5-2 Operation and Maintenance Costs

(1) O&M Cost of Water Intake Facility

The pumping system applied to the Project is a submergible pump with a solar power generator that is able to work without requiring any operation and maintenance to a certain degree. However,

periodical checks (mainly for abrasion of rotating parts and calcium scale adhesion) are necessary in order to maintain use the pump for a long period. In addition, repair and replacement of parts is necessary in case of breakdown. The estimation of spare parts for 10 years and operation and maintenance costs are shown below. Also, if a DC pump is used, it will not require maintenance so repair/maintenance costs are not anticipated.

Table 2-5-1 Spare Parts per Zone

Item		Amount	% of main body	Note
Solar Panel		1	5%	The longevity of a solar panel is approximately 25 years and no breakdown is expected.
Water Level Sensor in Water Tank		1 set	100%	1set for one tank
Open – Shut valve		1 set	100%	Change once every 10 years
Water Tap (for one year)		1 set/500 persons	5%	1 tap per 500 persons. 1 breakdown per year.
DC Pump	Pump itself	1 set	100%	Highly resistant to abrasion and scale coating. Maintenance free. Normally, durability is more than 10 years. It can be replaced when it is broken.
	Control Unit	1 set	100%	Lifetime is more than 10 years It can be replaced when it is broken.
AC Pump	Shaft/bearing	3 sets	300%	Consumables (Replaced upon inspection)
	Motor parts	3 sets	300%	Consumables (Replaced upon inspection)
	DC-AC Inverter	1 set	100%	Lifetime is more than10 years. It can be replaced when it is broken.

Table 5-2-2 shows the items for operation and maintenance for each Water Supply Facility and the approximate estimates when using a submergible pump with a solar power generator.

Table 2-5-2 Items for O&M of the Water Intake Facility and Expenses

Item	Management Item	Expense	Responsible for Expense
Facility Management	Security Guard (Prevention of Robbery)	DJF 30,000 /month	MAEM-RH
	Security Guard (Prevention of Robbery)	DJF 5,000～10,000 /month	WC
	Operation & Maintenance (Control of the bulb / Operation Record)	0	WC
	Cleaning (tank / solar)	0	WC, residents
	Miscellaneous costs (Stationary for Operation Record)	DJF 1000/year	WC
Maintenance (Part Replacement)	Taps, Packing (Once a year)	DJF 6000 / 500 persons /year	WC
	Annual Maintenance Check	DJF 40,000 DJF (Vehicle) DJF 15,000 (Fuel) DJF 20,000 (Diam for 2 persons)	MAEM-RH
Renewal of the Facility (After 10 years)	Solar Panel	JPY 2,500,000	Rehabilitation Projects by donors such as JICA will be responsible.
	Water Pump Controller	JPY 1,500,000	

: WC is responsible for the administrative and maintenance expenses of the water intake facility.

The security guard of the facility is to be paid approximately DJF 30,000 per month by the Water Department. In order to afford DJF 30,000 for the security guard, each household needs to contribute DJF 300 for camp areas with 100 households. Therefore, it is necessary to place a person in charge of security in the WC. In addition, the Government of Djibouti (Water Department) shall hire a security guard for the five water intake facilities for which a committee is not established.

The WC will pay an allowance to the security guard considering that the security guard is usually required to work longer than other positions. The minimum wage of African countries is JPY 2,000 to 5,000 or DJF 4,000 to 10,000 per month (there is no minimum wage system in Djibouti). Although the prices in Djibouti are comparatively higher than in neighboring countries, it is necessary to consider the fact that a cash-based economy is not popular in the target area and the activities by the WC are basically voluntary. Thus the water charge will be determined under the assumption of paying DJF 5,000 to 10,000 per month to the security guard.

There are few required O&M activities for a solar power generator with a submersible pump system. The most frequent operation and maintenance activity will be the purchase and replacement of spare parts like the taps and packing. As the WC implements these activities, the sense of ownership by the residents will increase (The highlighted section of Table 2-5-2 shows the items that are to be implemented by the WC). Table 2-5-3 shows the estimation (O&M cost for the facility) to be paid by the people of each camp. Also, the willingness of residents to pay is shown in Figure 5-2-1.

Table 2-5-3 Water User Fee per Household

No.	Name of the Target Zone	Population	Taps, Packing and Miscellaneous Cost	Water Charge/Household(note 1		Willingness to pay DJF(note 2
				Allowance to Watchman DJF 5,000 /month	Allowance to Watchman DJF10,000 /month	
15	Sek Sabir	1,888	25,000	30	51	200
17	Mindil	496	7,000	90	171	100
18	Afka Arraba	250	7,000	179	339	300
21	Hambokta	675	13,000	72	131	125

Note 1 : Water user fee is estimated for 8 persons per household.
Note 2 : Payment of willingness is shown median of answer from questionnaire survey.
: Not affordable case based on the willingness to pay.

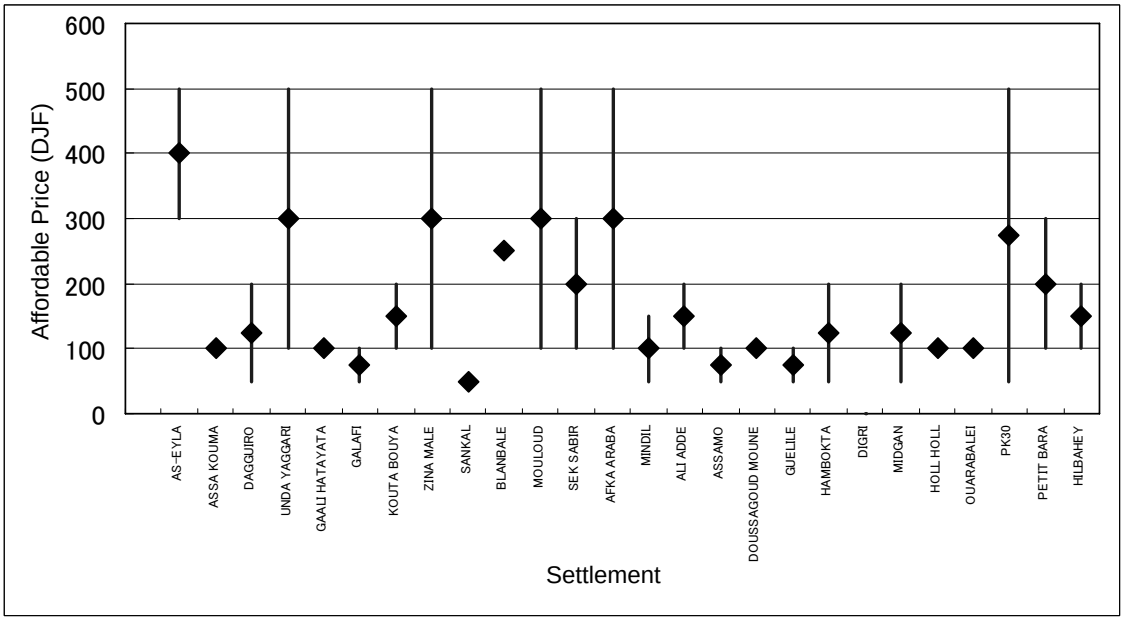


Figure 5-2-1 Willingness to Pay for Water from the Social Condition Survey

As shown in Table 2-5-3, three camps cannot afford the water charge if DJF 10,000 is paid to the security guard per month, while the actual water charge will fall below the affordable price for all the camps if DJF 5,000 is paid per month. Ultimately, water charges and the allowances for the security guard and personnel need to be determined by the WC. Since all the estimated population will not necessarily be the users, these facts must be taken into consideration.

(2) Confirmation on the possibility of the establishment of WC

The target zone of the Project consists of scattered nomadic camps and has no cohesive zone form. The leader of the target zone has signed the agreement to establish the WC in order to operate and maintain the proposed water facility. This agreement contains the following conditions: 1) collecting the water user fees, 2) O&M of the facility, 3) repairing the facility, and 4) Establishment of the WC which enlightens the community on the usage and the sanitation of the water facility. However, the generality and reliability of the leaders' answers upon discussion vary from camp to camp, since the Social Condition Survey of the Project was given to only a few representatives from some of the scattered camps.

The main issue of the Project is that the people who will benefit from the proposed water facilities are the nomads who live in the scattered camps. Generally, resident organizations such as a WC are established in order to sustain the operation and maintenance of facilities. In the target area, people settle in the camps and work as farmers a few kilometers around the camps. There are shallow relationships among the scattered camps and their residents. Therefore, it is an important issue for the beneficiary people to recognize the water facility as their own, to understand the necessity of operation and maintenance and the role of the WC and to enter into activities with trust in each other.

In order to clear the concerns mentioned above, the Project implemented a supplemental camp survey on the zones that will perform the O&M (the areas which were added later or remained uninformed due to access difficulty, etc.) In addition, the Project team explained the Project and the requirements for operation and maintenance by residents and the establishment of the organizations such as WC and their persons in charge. As a result, it was revealed that camps recognize each other relatively well (people grasp which family lives in which part of the camp) and have some cases to work together for such reasons as maintenance of the road, construction of the well, group vaccinations and purchase of livestock.

In case that residents who live in the target zone have no initiative or intention on O&M such as activation of the existing organization or appointment of required personnel, the Water Department will assign the personnel for operation and maintenance at any cost.

(3) Support the establishment of the WC through Technical Assistance

Through technical assistance, the Project Team will help with establishment of the WC (or other alternate organizations and residents in charge) and implementation of sensitization activities with the personnel of the Water Department.

1) The Project Team will review the methodology of monitoring and improve the operation and maintenance of the existing WC (review the accordance and discordance with the management committee of UNICEF, the establishment process of the WC and the maintenance methods (how to check and repair)) with the Water Decentralization Support Section and representatives from other departments and personnel from the regional branch.

2) Establishment of the WC, assignment of necessary personnel and training for each person of the committee will be implemented in each camp during the construction of the facility.

3) After a few months, the monitoring will be initiated from the camps at which the construction of the facility is completed in order to confirm the operation status of the WC. The methodology of monitoring will be improved based on the review of the monitoring results.

(4) Requests to Government of Djibouti

The essential factors for maintaining the water supply system is to check and repair the facilities periodically and to sustain the O&M system of the WC. Solar power generation pumping systems can work for a long period without any maintenance. DC pumps can also work without any maintenance until they fail. However, periodical maintenance checks are necessary in order to enhance the longevity of AC pumps, since abrasion of rotating parts and scale adhesion can occur. In addition, if the proper operation and maintenance methods are not sustained, troubles such as a

decrease in the generated electricity, decrease in the water supply due to broken taps, or stoppage of pumping due to theft of the solar panels can occur. Therefore, the Water Department that manages the local water supply in Djibouti needs to support the effective and sustained operation of the water supply facilities.

The required items for this purpose are as follows:

1) Preparing a budget for the periodic operation and maintenance check of water intake facilities

2) Preparing a budget for monitoring the operation status of the WC

3) Monitoring and analysis on the daily working status of the water intake facilities

2-6 Other Relevant Issues

During the preparatory survey, there were issues as follows:

(1) Djibouti side requested the scope of work to be changed during the survey
(2) Djibouti side did not conduct obligations that had been stated in the minutes.

In the Djibouti regional water supply project conducted by other donors, MAEM-RH could select/change the target area flexibly according to the progress of the project (results of the successful/failure wells). This might have resulted in MAEM-RH thinking that the Japanese Government will allow them to select/change the target locations flexibly. In the preparatory survey, 15 wells were drilled. These drilling locations were selected based on the natural/social conditions, and the locations were agreed between the survey team and MAEM-RH prior to drilling. Although the drilling locations were agreed upon, MAEM-RH requested a change to 7 locations in 2 northern prefectures in Djibouti, which are not in the scope of this Project. Moreover, MAEM-RH also requested changing some drilling locations at the last minute before drilling. MAEM-RH needs to understand that contents decided in the preparatory survey cannot be changed easily during the implementation stage (detail design stage, construction stage).

Costs for the access road/fence construction, counterpart allowance for travel expenses, and drilling 20 wells (1st year: 10 wells) are the responsibility of Djibouti in the implementation stage. During the preparatory survey, the costs for access road/counterpart allowance for travel expenses were the responsibility of the Djibouti side. However, drilling fell behind schedule because the access road was not provided by MAEM-RH on schedule and MAEM-RH did not provide counterpart allowance for travel expenses. In the implementation stage, the Djibouti side is responsible for costs that will be incurred in 2012; thus, the Djibouti side needs to get this budget allowance in the year 2011.

In the preparatory survey, wells were drilled. During the implementation stage, water supply facilities will be constructed over the wells. Management of the wells is the responsible of MAEM-RH. If a well cannot be used anymore due to a natural disaster (floods, etc.) or the well is damaged by people (by throwing stones into the well), the water facility will not be constructed and an alternative well will not be drilled

CHAPTER 3 PROJECT EVALUATION

3-1 Recomendations

3-1-1 Prerequisites Necessary for Implementing the Project

In order to implement this Grant Aid Project, it is essential for Djibouti to understand the framework/rules of Japan Grant Aid and conduct its obligations according to the contents stated in [2-3 Obligations of the Government of Djibouti] and [2-6 Other Relevant Issues]. In particular, securing of the budget is important and directly related to success or failure of Project implementation. Budget requirements include but are not limited to, daily allowance for staff to perform the soft components, construction of access roads, building fences for the water intake facilities, procedural costs that affect the implementation of the Grant Aid and borehole construction using procured drilling materials. Furthermore, it is essential that the Djibouti Government reduce its dependence on donors such as UNICEF and improve its organization to be more independent, more voluntary, more cooperative and more noble.

Furthermore, this Project targets areas where nomadic camps exist. In many cases, there are no inhabitants living around the location of water supply facilities at this time. Therefore, this preparatory survey has chosen locations where people are expected to stay permanently (or semi-permanently). The inhabitants that will settle around the water supply facilities shall understand the concept of Japan Grant Aid and shall cooperate in the activities necessary to operate/maintain the water supply facilities.

3-1-2 External Conditions Necessary to Achieve Project Plan

In order to achieve sustainalble benefits from this Project, it is essential that the Djibouti side (1) continuously monitor the operation/maintenance of the water supply facilities constructed by this Project, and (2) make sure that if the facilities are damaged, the repair system (inhabitants report to the water department and the water department repairs the facility) will function. Furthermore, it is essential that the techniques/experience achieved by Water Department staff through soft component technical guidance will be used for regional water supply projects that will be conducted by the Djibouti Government in the future.

The Djibouti Government is responsible for construction and maintanence of water supply facilities for the regional water supply. However, as most of the water supply facilities were constructed by donors such as Japan, the Djibouti side is not able to implement water supply projects independently. Due to the recent decentralization policy, beneficiaries are responsible for water supply facility operation/maintenance. Based on this policy, UNICEF assisted in establishment of a water management committee at its water supply project. However, enlightenment activities and monitoring techniques that should have been implemented by the Djibouti Government were not taught to the water management committee or inhabitants. Although there are cases in which

inhabitants reported damage of the water supply facility to the Water Department, the Water Department did nothing to repair the facility due to a shortage of budget and staff.

O/M of the water intake facility in Sabbalou (there are 3.4 km between Sankal and Sabbalou and there is no transportation at present) and the four zones where groundwater quality does not meet WHO guidelines (Zina Male, Datuiro (2), Assa Koma and Midgarra) shall be done by MAEM-RH instead of the residents, because establishing a WC is difficult.

Therefore, it is essential that the Djibouti side (1) continuously monitor the maintenance of the water supply facilities, (2) regularly perform inspections/repairs of the facilities by making sure that they have enough budget and staff without depending on donors.

3-2 Project Evaluation

3-2-1 Appropriateness

If MAEM-RH can fulfill the conditions stated in 3-1 above, it is appropriate that Japan Government conduct this Project for the reasons below:

(1) This Project targets rural settlements in southern Djibouti. Inhabitants in this area are relatively poor and the population of those who will be able to access safe water is estimated to be 6,300, which is 5% of the total estimated rural population in 2017. In addition, the population that will gain access to domestic water is estimated to be about 3,170.

(2) Due to recent droughts, nomadic people are facing a water shortage situation and they are losing their livestock. When the water supply facilities in this Project are completed, nomadic people will use the water . This Project will increase areas that supply water, and as a result, will increase the tendency for nomadic people to settle down in one area, and will improve their living conditions.

(3) After this Project is implemented, the Djibouti Government shall secure the budget and staff for water supply facility operation/maintenance. This Project has prepared plans for easy operation/maintenance of the facilities.

(4) PNSA (National Programme for Food Security), part of the INDS (National Initiative for Social Development), created a target to develop groundwater at high priority water insufficient regional areas. This Project will contribute to achieving that target.

(5) Inhabitants that use water from the facilities of this Project will establish a water management committee so that they can perform operation, maintenance and repair the facility easily. In order to conduct these activities, facility users will need to pay the committee. However, the amount of payment will be minimal and the water management committee will not be a high profit organization.

(6) It is considered that there are no negative impacts in terms of the environment.

(7) Since nomadic people lives in the target areas, it will be difficult for the beneficiaries to pay for the water. Thus, this Project will apply solar systems for which maintenance costs will be minimal. Further, this Project will provide spare parts for 10 years so that the facilities will not be required to shut down for long periods in case of trouble.

(8) Soft components and well construction materials will support the well construction done by MAEM-RH and will improve the ability of groundwater development by MAEM-RH.

3-2-2 Effectiveness

(1) Quantitative Effect

Index Name	Standard Value (2010)	Target Value (2017)
Population that uses water supply facility for drinking	About 80,100 people	An additional 6,309 people. In total 86,409.
Water supply ratio	Regional water supply ratio: 57% (it is estimated that the population in the southern area will be 140,200)	Regional water supply ratio: 68% (it is estimated that the population in the southern area will be 134,400)
Population that uses water supply facility for domestic use	About 80,100 people	Additionally, 9,480 people. In total: 89,580.
Number of water supply facility	About 650 facilies (Documents provided by MAEM-RH does not show the existing conditions of the facilities)	Increase to 29 facilities 4.5% of total number (1) Construct by this project - 9 sites (fixed) (2) Construction by the Djibouti side by using equipment and materials provided by this Project - 20 sites (if all 20 wells are successful wells). In addition, if water intake facilities are constructed for these 20 wells, 16,000 people (800 people per village in average) will be supplied.
Water management committee	Around 10 committees (Established with the cooperation of UNICEF)	4 water management committees will increase (40% increase)

Source: JICA Study Team

(2) Qualitative Effect

- People will gather around the water supply facility and permanent inhabitants will increase.
- Illnesses due to unclean water will decrease.
- Due to the gathered inhabitants, the possibility that a primary school will be constructed will increase. As a result, the number of school children will increase in the future.
- Due to the provision of a mobile workshop, the efficiency of well drilling/rehabilitation will increase (MAEM-RH can respond more often).
- Water management committee (committee or person in charge) will have the ability to operate/maintain the water supply facility, and can change water taps, etc. by themselves.

- When the water supply facility is not working, inhabitants will ask the Water Department to repair the problem. The request system will be established in this Project. Therefore, water supply facility operation/repair will be conducted.
- Staff of the Water Department will achieve the ability to conduct electrical detection, analyse the data of electrical detection, and decide locations for drilling.
- Staff of the Water Department will achieve the ability to conduct well logging and analyse the data from well logging. This will result in the staff gaining the ability to conduct casing planning based on the results of well logging.
- If the well register book is improved, groundwater data will be stocked/managed and regular monitoring can be conducted. Therefore, MAEM-RH can plan for future maintenance and new water resource development.
- Construction of an additional 20 wells will be implemented at the sites to be planned and selected by the Djibouti side. Staff in charge in MAEM-RH will have experience in a series of procedures from hydrological surveys to well construction to evaluation of results.

Annex-1

Member List of the Study Team

Table A1-1 During the Field Survey in Djibouti

Name	Position	Organization
Ryuichi KATO	Team Leader	JICA
Toshio MURAKAMI	Technical Advisor	JICA
Takeharu KOJIMA	Project Coordinator	JICA
Toru YORITATE	Chief Consultant / Groundwater Development / OM Plan	Oriental Consultants Co., Ltd.
Jun MATSUO	Sub Chief Consultant / Hydrogeology	OYO International Co., Ltd.
Ichiro TANAKA	Hydrogeology / Water Quality Survey	OYO International Corporation
Itsuo NOZAWA	Water Supply Plan / Desalination Plant	OYO International Corporation
Christian ROUVIERE	Social Condition Survey / Environmental and Social Consideration	Oriental Consultants Co., Ltd.
Hironori HONMA	Cost Estimate / Machinery and Procurement	Oriental Consultants Co., Ltd.
Annkay ASAKURA	Cost Estimate / Construction / Coordinator	Oriental Consultants Co., Ltd.
Norihiko IGUCHI	Translator (French)	Oriental Consultants Co., Ltd.

Table A1-2 During the 1st Explanation for the Overview Report (Draft)

Name	Position	Organization
Ryuichi KATO	Team Leader	JICA
Takeharu KOJIMA	Project Coordinator	JICA
Toru YORITATE	Chief Consultant / Groundwater Development / OM Plan	Oriental Consultants Co., Ltd.
Ichiro TANAKA	Hydrogeology / Water Quality Survey	OYO International Corporation
Annkay ASAKURA	Cost Estimate / Construction / Coordinator	Oriental Consultants Co., Ltd.
Norihiko IGUCHI	Translator (French)	Oriental Consultants Co., Ltd.

Table A1-3 During the 2nd Explanation for the Overview Report (Draft)

Name	Position	Organization
Keiko SANO	Team Leader	JICA
Rie HIRAI	Grand Aid / Country Development Cooperation Project Coordinator	Ministry of Foreign Affairs
Takeharu KOJIMA	Project Coordinator	JICA
Toru YORITATE	Chief Consultant / Groundwater Development / OM Plan	Oriental Consultants Co., Ltd.
Norihiko IGUCHI	Translator (French)	Oriental Consultants Co., Ltd.

Annex-2

Study Schedule

Table A2-1 Preparatory Survey 1 (Main Survey)

	Date	Government Member			Consultant Member				
		Ryuichi KATO Team Leader	Takeharu KOJIMA Project Coordinator	Toshio MURAKAMI Technical Advisor	Toru YORITATE Chief Consultant / Groundwater Development / OM Plan	Jun MATSUO Sub Chief Consultant / Hydrogeology	Ichiro TANAKA Hydrogeology / Water Quality Survey	Annkay ASAKURA Cost Estimate / Construction / Coordinator	Norihiko IGUCHI Translator (French)
1	1/15 Fri		Dep. Haneda		Depart Narita			Depart Narita	
2	1/16 Sat		Arr. Djibouti		Arrive Djibouti			Arrive Djibouti	
3	1/17 Sun		C/C JICA Djibouti, Embassy C/C MoFreign MAEM-RH		C/C to JICA Djibouti, Embassy C/C to Foreign Ministry, MAEM-RH			C/C to JICA Djibouti, Embassy C/C to Foreign Ministry, MAEM-RH	
4	1/18 Mon	Dep.Haneda		Arr.Djibouti					
			Meeting with MAEM-RH					Meeting with MAEM-RH	
5	1/19 Tue	Arr.Djibouti	Site Survey					Site Survey	
6	1/20 Wed	Site Survey						Site Survey	
7	1/21 Thu	Meeting on draft M/M						Meeting on draft M/M	
8	1/22 Fri	Internal Meeting						Internal Meeting	
9	1/23 Sat	Meeting on draft M/M						Meeting on draft M/M	
10	1/24 Sun	AM : Meeting on final draft M/M、PM : Signing of M/M						Data collection	
11	1/25 Mon	AM : Report to JICA Djibouti, Embassy					Dep. Haneda	Office Setup Labor Contract	Interpretation
		Depart Djibouti			Data Collection Preparation for Electric Survey Test Well Tender				
12	1/26Tue	Report to JICA Ethiopia、(Embassy)					Arr.Djibouti		
		Depart Addis Abeba		Dep.Addis Abeba			Data Collection		
13	1/27 Wed	Arrive Haneda		-					

	Date	Consultant Member							
		Toru YORITATE Chief Consultant / Groundwater Development / OM Plan	Jun MATSUO Sub Chief Consultant / Hydrogeology	Ichiro TANAKA Hydrogeology / Water Quality Survey	Itsuo NOZAWA Water Supply Plan / Desalination Plant	Christian ROUVIERE Social Condition Survey / Environmental and Social Consideration	Hironori HONMA Cost Estimate / Machinery and Procurement	Annkay ASAKURA Cost Estimate / Construction / Coordinator	Norihiko IGUCHI Translator (French)
14	1/28 Thu	Meeting with MAEM-RH Data Collection	Preparation for Elec Survey Test Well Negotiation	Data Collection Data Analyse				Office Setup Labor Selection	Interpretation For Mr.Yoritate
15	1/29 Fri								
16	1/30 Sat								
17	1/31 Sun								
18	2/1 Mon	Data Collection Meeting with DISED, FAO UNICEF, MoH	C/C to Dikhil, Arta, Ali-Sabieh Electric Survey In Kout Bouya,	Meeting with JICA & MAEM-RH Laboratory Water Sampling Survey				Contract With Driller Labor Laborator Internet Car Lease	Interpretation For Mr.Yoritate
19	2/2 Tue								
20	2/3 Wed								
21	2/4 Thu								
22	2/5 Fri	Drilling Contract Agreement							
23	2/6 Sat	Meeting with MOI,MOE	Elec. Survey In Assamo						
24	2/7 Sun								
25	2/8 Mon	Meeting with Red Cross FEWS NET ONEAD MAEM-RH	Elec. Survey Unda Yaggouri Daguiro Garssale Daba	Water Sampling Survey in Dikhil Ali-Sabieh Arta		Dep. Narita			Interpretation For Mr.Yoritate
26	2/9 Tue					Arr. Adis			
27	2/10 Wed					Arr. Djibouti			
28	2/11 Thu					Meeting with MAEM-RH & Surveyer			
29	2/12 Fri				Dep. Narita				
30	2/13 Sat				Arr. Djibouti				
31	2/14 Sun				CP meeting				
32	2/15 Mon	C/C Dikhil, Arta and Ali-Sabieh Site Reconaissans	Elec. Survey Ali-Adde Midgan PK30		Site Survey Dikhil Ali-Sabieh Arta	Data Collection C/C Prefecture Dikhil Arta Ali-Sabieh		Accounting and Coordination Work	Interpretation For Mr.Matsuo
33	2/16 Tue								
34	2/17 Wed								
35	2/18 Thu								
36	2/19 Fri								
37	2/20 Sat								
38	2/21 Sun								
39	2/22 Mon	Meeting with MAEM-RH Discussion of Additional site Water Quality Test contract	Elec. Survey ZinaMale Assa Koma Data Analysis	Data Arrangemento f Existing Well Water Quality Survey		Social Condition Survey in Dikhil			Interpretation For Mr. Matsuo Translation Of Document
40	2/23 Tue								
41	2/24 Wed								
42	2/25 Thu								
43	2/26 Fri				Data Collection				
44	2/27 Sat								
45	2/28 Sun	Meeting with MAEM-RH		Dep. Dibout					
46	3/1 Mon		Elec. Survey Daguiro In Danan Wadi	Arr. Narita	Site Survey in PK30 Meeting with MAEM-RH Data Collection		Dep. Narita	Site Survey for Construction Plan	Interpretation And Translation Of Document
47	3/2 Tue	Dep. Dibouti					Arr. Djibouti		
48	3/3 Wed	Arr, Dubai					Meeting with MAEM-RH Existing Equipment		
49	3/4 Thu	Arr. Narita							
50	3/5 Fri								
51	3/6 Sat								

52	3/7 Sun						Survey		
53	3/8 Mon		Elec. Survey Ouarabalei Galafi Sec Savir		Site Survey In Dikhil Ali-Sabieh Survey of Supplyer	Social Condition Survey in Ali-Sabieh	Site Survey Material Survey General Contractor Survey	Site Survey for Construction Plan	Interpretation And Translation Of Document
54	3/9 Tue								
55	3/10 Wed								
56	3/11 Thu								
57	3/12 Fri								
58	3/13 Sat								
59	3/14 Sun								
60	3/15 Mon		Elec. Survey Hilbahei Petit Bara Digri Meeting with Drilling Company		Meeting with Solar Comp.	Social Condition Survey in Ali-Sabieh And Dikhil	Hearing for Request equipment Meeting with General Contractor	Construction condition Survey	Interpretation And Translation Of Document
61	3/16 Tue								
62	3/17 Wed				Dep. Dibouti				
63	3/18 Thu				Arr. Narita				
64	3/19 Fri								
65	3/20 Sat								
66	3/21 Sun								
67	3/22 Mon		Elec. Survey Digri Habmbocta Guelile Dousagoud Moune Petit Bara Drilling				Existing Equipment Survey Construction Company Survey		Interpretation Site Survey With Mr, Matsuo
68	3/23 Tue					Dep. Dibouti			
69	3/24 Wed					Arr. Narita			
70	3/25 Thu								
71	3/26 Fri								
72	3/27 Sat								
73	3/28 Sun								
74	3/29 Mon						Site Condition Survey		Interpretation And Translation Of Document
75	3/30 Tue		Meeting with Drilling Company, MAEM-RH						
76	3/31 Wed								
77	4/1 Thu							Collected Data Arrangement Collection of Quotation	
78	4/2 Fri	Dep. Narita							
79	4/3 Sat	Arr. Djibouti							
80	4/4 Sun	Meeting with MAEM-RH							
81	4/5 Mon		Elec. Survey Hombora Sankal Guelile						
82	4/6 Tue	Discussion about Drilling interruption with MAEM-RH, JICA Dibouti							
83	4/7 Wed								
84	4/8 Thu						Meeting with JICA Djibouti MAEM-RH	Collection of Quotation	
85	4/9 Fri								
86	4/10 Sat								
87	4/11 Sun								
88	4/12 Mon								
89	4/13 Tue		Elec. Survey Ali Adde Assamo				Dep. Dibouti		Dep. Dibouti
90	4/14 Wed						Arr. Narita		Arr. Narita
91	4/15 Thu								
92	4/16 Fri								
93	4/17 Sat								
94	4/18 Sun								
95	4/19 Mon	Site Visit To see Chief of the Village	Data Analysis Meeting with JICA Djibouti Japanese Embassy MAEM-RH					Accounting and Coordination Work	
96	4/20 Tue								
97	4/21 Wed								
98	4/22 Thu								
99	4/23 Fri								
100	4/24 Sat								
101	4/25 Sun								
102	4/26 Mon	Meeting with MAEM-RH							
103	4/27 Tue								
104	4/28 Wed								
105	4/29 Thu								
106	4/30 Fri	Dep. Djibouti	Dep. Djibouti					Dep. Djibouti	
107	5/1 Sat	Arr. Adis	Arr. Adis					Arr. Adis	
108	5/2 Sun	Arr. Narita	Arr. Narita					Arr. Narita	

Table A2-2 Preparatory Survey 2
(Additional Survey 1 – SV of Test Well Drilling)

	Date	Jun MATSUO Supervision of Test Well Drilling
1	6/6 Sun	Dep. Narita
2	6/7 Mon	Arr. Djibouti
3	6/8 Tue	Meeting with MAEM-RH
4	6/9 Wed	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
5	6/10 Thu	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
6	6/11 Fri	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
7	6/12 Sat	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
8	6/13 Sun	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
9	6/14 Mon	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
10	6/15 Tue	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
11	6/16 Wed	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
12	6/17 Thu	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
13	6/18 Fri	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
14	6/19 Sat	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
15	6/20 Sun	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
16	6/21 Mon	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
17	6/22 Tue	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
18	6/23 Wed	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
19	6/24 Thu	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
20	6/25 Fri	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
21	6/26 Sat	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
22	6/27 Sun	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
23	6/28 Mon	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
24	6/29 Tue	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
25	6/30 Wed	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
26	7/1 Thu	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
27	7/2 Fri	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
28	7/3 Sat	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
29	7/4 Sun	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
30	7/5 Mon	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
31	7/6 Tue	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
32	7/7 Wed	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
33	7/8 Thu	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
34	7/9 Fri	Meeting with MAEM-RH, Al-Shaleif EST. and Other Related Organization
35	7/10 Sat	SV of Drilling in PK30
36	7/11 Sun	SV of Drilling in PK30
37	7/12 Mon	SV of Drilling in PK30
38	7/13 Tue	SV of Drilling in PK30
39	7/14 Wed	SV of Drilling in PK30
40	7/15 Thu	SV of Drilling in Petit Bara
41	7/16 Fri	SV of Drilling in Petit Bara
42	7/17 Sat	SV of Drilling in Petit Bara
43	7/18 Sun	SV of Drilling in Petit Bara
44	7/19 Mon	SV of Drilling in Petit Bara
45	7/20 Tue	SV of Drilling in Petit Bara
46	7/21 Wed	SV of Drilling in Petit Bara
47	7/22 Thu	SV of Drilling in PK30, and Pumping Test in Petit Bara
48	7/23 Fri	SV of Drilling in PK30, and Pumping Test in Petit Bara
49	7/24 Sat	SV of Drilling in Midgaara
50	7/25 Sun	SV of Drilling in Midgaara
51	7/26 Mon	SV of Drilling in Midgaara
52	7/27 Tue	SV of Drilling in Ouarabalei
53	7/28 Wed	SV of Drilling in Ouarabalei
54	7/29 Thu	SV of Drilling in Ouarabalei
55	7/30 Fri	SV of Drilling in Daguiro
56	7/31 Sat	SV of Drilling in Daguiro
57	8/1 Sun	SV of Drilling in Daguiro and Pumping Test in PK30
58	8/2 Mon	SV of Drilling in Daguiro and Pumping Test in PK30
59	8/3 Tue	SV of Drilling in Daguiro and Pumping Test in PK30
60	8/4 Wed	SV of Drilling in Zina Male and Pumping Test in PK30
61	8/5 Thu	SV of Drilling in Zina Male and Pumping Test in PK30
62	8/6 Fri	SV of Drilling in Zina Male and Pumping Test in PK30
63	8/7 Sat	SV of Drilling in Assa Koma and Pumping Test in Midgarra
64	8/8 Sun	SV of Drilling in Assa Koma and Pumping Test in Midgarra
65	8/9 Mon	SV of Drilling in Assa Koma and Pumping Test in Midgarra
66	8/10 Tue	SV of Drilling in Assa Koma and Pumping Test in Ouarabalei
67	8/11 Wed	Meeting with MAEM-RH
68	8/12 Thu	Meeting with MAEM-RH
69	8/13 Fri	Arr. Adis
70	8/14 Sat	Arr. Narita

Table A2-3 Preparatory Survey 3
(Additional Survey 2 – SV of Test Well Drilling and Social Situation Survey)

	Date	Toru YORITATE Chief Consultant / Social Survey	Seiju IKEDA Supervision of Test Well Drilling
1	9/18 Sat	Dep. Narita	
2	9/19 Sun	Arr. Djibouti	
3	9/20 Mon	Meeting with MAEM-RH & Ali-Shaleif Est.	
4	9/21 Tue	Meeting with Unicef, MAEM-RH, Ali-Shaleif Est, / Meeting with Social Survey Staff	
5	9/22 Wed	Meeting with MAEM-RH & Ali-Shaleif Est.	
6	9/23 Thu	Instruction of Social Survey	
7	9/24 Fri	Survey in Afka Arraba	
8	9/25 Sat	Survey in Afka Arraba, Mindil	Dep. Narita
9	9/26 Sun	Survey in Sankal	Arr. Djibouti
10	9/27 Mon	Survey in Mindil, SV of Drilling in Hambocta	Djibouti to Dikhil
11	9/28 Tue	Survey in Mindil,	SV of Drilling in Hambocta, Pumping Test in Zina Male
12	9/29 Wed	Visit to Kontali W.C.	SV of Drilling in Hambocta, Pumping Test in Zina Male
13	9/30 Thu	Survey in Mindil	SV of Drilling in Hambocta, Pumping Test in PK30
14	10/1 Fri	Survey in Unda Yaggouri, Zina Male	SV of Drilling in Hambocta, Pumping Test in PK30
15	10/2 Sat	Pumping Test Hambocta	SV of Drilling in Guelile, Pumping Test in PK30
16	10/3 Sun	Survey in Hambocta, SV in Guelile	SV of Drilling in Guelile, Pumping Test in PK30
17	10/4 Mon	SV in Guelile, Back to Djibouti	SV of Drilling in Guelile, Pumping Test in Hambocta
18	10/5 Tue	Meeting with MAEM-RH & Ali-Shaleif Est.	SV of Drilling in Guelile, Pumping Test in Hambocta
19	10/6 Wed	Meeting with MAEM-RH & Ali-Shaleif Est.	SV of Drilling in Hilbahey, Pumping Test in Guelile
20	10/7 Thu	Meeting with MAEM-RH, Unicef and PAM	SV of Drilling in Hilbahey, Pumping Test in Guelile
21	10/8 Fri	Visit to Bondara Nomad Camp W.C.	SV of Drilling in Hilbahey, Pumping Test in Guelile
22	10/9 Sat	Laboratory, C/C to JICA	SV of Drilling in Hilbahey, Pumping Test in Guelile
23	10/10 Sun	Laboratory, C/C MAEM-RH, Dep. Djibouti	SV of Drilling in Hilbahey, Pumping Test in Guelile
24	10/11 Mon	Arrive Narita	SV of Pumping Test in Guelile
25	10/12 Tue		SV of Pumping Test in Guelile
26	10/13 Wed		SV of Pumping Test in Guelile
27	10/14 Thu		SV of Drilling in Afka Arraba
28	10/15 Fri		SV of Drilling in Afka Arraba
29	10/16 Sat		SV of Drilling in Seki Sabir
30	10/17 Sun		SV of Drilling in Seki Sabir
31	10/18 Mon		SV of Drilling in Seki Sabir
32	10/19 Tue		SV of Drilling in Seki Sabir
33	10/20 Wed		SV of Drilling in Seki Sabir
34	10/21 Thu		SV of Drilling in Seki Sabir
35	10/22 Fri		SV of Drilling in Seki Sabir, Pumping Test in Afka Arraba
36	10/23 Sat		SV of Drilling in Seki Sabir, Pumping Test in Afka Arraba
37	10/24 Sun		SV of Drilling in Seki Sabir, Pumping Test in Afka Arraba
38	10/25 Mon		SV of Drilling in Seki Sabir, Pumping Test in Afka Arraba
39	10/26 Tue		SV of Drilling in Mindil, Pumping Test in Seki Sabir
40	10/27 Wed		SV of Drilling in Mindil, Pumping Test in Seki Sabir
41	10/28 Thu		SV of Drilling in Mindil, Pumping Test in Seki Sabir
42	10/29 Fri		SV of Drilling in Mindil, Pumping Test in Seki Sabir
43	10/30 Sat		SV of Drilling in Sabbalou, Pumping Test in Mindil
44	10/31 Sun		SV of Drilling in Sabbalou, Pumping Test in Mindil
45	11/1 Mon		SV of Drilling in Sabbalou, Pumping Test in Mindil
46	11/2 Tue		SV of Drilling in Assa Koma, Pumping Test in Sabbalou
47	11/3 Wed		SV of Drilling in Assa Koma, Pumping Test in Sabbalou
48	11/4 Thu		SV of Drilling in Assa Koma, Pumping Test in Sabbalou
49	11/5 Fri		SV of Drilling in Assa Koma
50	11/6 Sat		SV of Drilling in Assa Koma
51	11/7 Sun		Data Arramgement
52	11/8 Mon		Data Arramgement
53	11/9 Tue		Data Arramgement
54	11/10 Wed		Data Arramgement
55	11/11 Thu		Data Arramgement、C/C JICA Djibouti
56	11/12 Fri		Depert Djibouti
57	11/13 Sat		Arrive Narita

Table A2-4 During the 1st Explanation for the Overview Report (Draft)

	Date	Government Member		Consultant Member			
		Ryuichi KATO Team Leader	Takeharu KOJIMA Project Coordinator	Toru YORITATE Chief Consultant	Ichiro TANAKA Hydrogeology	Annkay ASAKURA Construction	Norihiko IGUCHI Translator (French)
1	11/20 Sat			Dep. Narita			
2	11/21 Sun			Arr. Djibouti			
3	11/22 Mon			Meeting with MAEM-RH			
4	11/23 Tue						
5	11/24 Wed						
6	11/25 Thu				Depart Narita		
7	11/26 Fri				Arrive Djibouti		
8	11/27 Sat			Meeting with SG of MAEM-RH			
9	11/28 Sun	Arr. Djibouti	Arr. Djibouti				
		Courtesy Call to JICA Djibouti, Embassy of Japan					
10	11/29 Mon	Meeting with MAEM-RH					
11	11/30 Tue	Meeting with MAEM-RH					
12	12/1 Wed	Meeting with MAEM-RH					
13	12/2 Thu	AM: Signing of M/M					
			Depart Djibouti				
14	12/3 Fri	Depart Djibouti	Arrive France	Consultant members leave Djibouti for Tokyo			
15	12/4 Sat	Arrive Narita	Arrive Narita	Consultant members arrive at Tokyo			

Table A2-5 During the 2nd Explanation for the Overview Report (Draft)

	Date	Government Member			Consultant Member	
		Keiko SANO Team Leader	Rie HIRAI Project Coordinator	Takeharu KOJIMA Project Coordinator	Toru YORITATE Chief Consultant	Norihiko IGUCHI Translator (French)
1	1/6 Thu		Depart Narita			
2	1/7 Fri		Arrive Djibouti			
3	1/8 Sat	Depart Narita	CC to Ministry of Foreign Affairs, Discussion with Ministry of Agriculture			
4	1/9 Sun	Arrive Djibouti	Discussion with Ministry of Agriculture			
5	1/10 Mon	Discussion of Draft Minutes, Discussion of Draft Minutes	Discussion with Minister and Japanese Ambassador to Djibouti			
6	1/11 Tue	Signing of Minutes Depart Djibouti	Depart Djibouti	Signing of Minutes		
7	1/12 Wed		Arrive Narita	further studies		
8	1/13 Thu			Depart Djibouti		
9	1/14 Fri			Arrive Narita		

Annex-3

List of Parties Concerned in the Recipient Country

Table A3 List of Concerned People

(1) Ministry of Agriculture, Livestock Industry, Fisheries and Water Resources

Mr. Abdoulkader Kamil	Minister
Mr. Idriss Abdou Ali	Deputy Minister
Mr. Gamal Eldin Houssein	Director of Water Resources Department
Mr. Kamil Daoud Ali	Manager of Water Resources Department
Mr. Ahmed Hassan Mohamed	Manager of Construction
Dr. Tabarak Mohamed Ismael	Officer
Mme. Souad Souleiman	Officer
Mr. Ibrahim Houmed Mohamed	Officer
Mr. Aouled Djama	Officer
Mr. Warsama Osman	Officer
Mr. Said Kaireh Youssouf	Officer
Mr. Mohamed Koorah	Officer
Mr. Ali Mohamed Ali	Officer
Mr. Abdallah Watta	Officer

(2) Ministry of Foreign Affairs and International Cooperation

Mr. Abdoulkader Houssein	Director
Mr. Moussa Mohamed Moussa	Officer

(3) CERD

Dr. Jalludin Mohamed	President
Mr. Said Ismael	Director
Mr. Bouh Houssein	Officer
Mr. Abdi Abdillahi	Officer
Mr. Samatar Abdi Osman	Officer
Mr. Konate Sekou Tidiani	Officer

(4) Ministry of Education

Mr. Mohamed Ali Hared	Officer

(5) Ministry of Health

Mr. Samatar Mohamed	Director

(6) UNICEF

Dr. Aouldsidi Ould	Expert

(7) FAO（Food and Agriculture Organization)

Mr. Abdoulkader Ismail	Assistant to Director

(8) Japanese Embassy in Djibouti

Mr. Masaki Noke	Ambassador
Mr. Jun Shimmi	Ambassador
Mr. Toru Sugio	First Secretary
Mr. Tatsuya Ueda	Secretary

(9) JICA Djibouti Office

Mr. Tanaka Hidekazu	Director
Mr. ICHIJO Motonobu	Researcher

(10) Chiefs

Mr. Walho Gada Walho	(Hambola/Agna/Dikhil)
Mr. Mohamed Hamad Moussa	(Ararou/Daguirou/Dikhil)
Mr. Moussa Eldin Ali	(Sabir/Seik village/Dikhil)
Mr. Djama Guedi Dideh	(Afka Araba/Harou/Dikhil)
Mr. Helem Hamad Hachim	(Ado Bouyi/Zinamale/Dikhil)
Mr. Mohamed Abass Hassan	(Koutabouya/Koutabouya/Dikhil)
Mr. Abdoulkader Witti Mohamed	(Afahtou/Koutabouya/Dikhil)
Mr. Mohamed Sougueh Barreh	(Mindil/Mouloud/Dikhil)

Mr. Ibrahim Didé Doualé	(Hamboukta/Hamboukta/Ali-Sabieh)
Mr. Ahmed Wais Robleh	(Elbahey/Elbahey/Arta)
Mr. Okal Elmi Miguil	(Omar Jagaa/Petit-Barra/Arta)
Mr. Abdallah Wais Robleh	(Gued balaran/Petit-Barra/Arta)
Mr. Djama Dirir Wais	(Gabanass/PK30/Arta)
Mr. Hassan Guelleh Olow	(Daguwein/Ouarabalei/Ali-Sabieh)
Mr. Moussa Sougueh Amir	(Daguwein/Assamo/Ali-Sabieh)
Mr. Mohamed Elmi Egueh	(Godawar/Doussagoudmoune/Ali-Sabieh)
Mr. Idriss Samriyé	(Refugee camp/Ali Addé/Ali-Sabieh)
Mr. Ismael Darar Yabeh	(Galilé/Galilé/Ali-Sabieh)

Annex-4

Minutes of Discussion

French

PROCÈS-VERBAL DE LA DISCUSSION
SUR L'ÉTUDE PRÉPARATOIRE
POUR
LE PROJET D'ALIMENTATION EN EAU POTABLE RURALE
DANS LA RÉGION SUD
EN
RÉPUBLIQUE DE DJIBOUTI

En réponse à la requête présentée par le Gouvernement de la République de Djibouti (désigné ci-après par « Djibouti »), le Gouvernement du Japon a décidé de mettre en œuvre une étude préparatoire pour le Projet d'alimentation en eau potable rurale dans la région sud en République de Djibouti (désigné ci-après le « Projet ») et l'a confiée à l'Agence Japonaise de Coopération Internationale (désignée ci-après par la « JICA »).

La JICA a envoyé à Djibouti une mission chargée de l'Étude préparatoire (désignée ci-après la « Mission ») dirigée par M. Ryuichi KATO, Conseiller supérieur auprès du Directeur général, Département de l'Afrique, JICA. La Mission est restée à Djibouti du 16 au 25 janvier 2010.

La Mission a tenu une série de discussions avec les responsables concernés du Gouvernement de Djibouti et a mené le travail sur le terrain dans les zones concernées par l'Étude.

À l'issue des discussions et du travail sur le terrain, les deux parties ont confirmé les éléments principaux indiqués dans les documents joints en annexe. La Mission procédera au reste du travail et préparera le rapport final de l'Étude préparatoire.

Djibouti, le 24 janvier 2010

M. Ryuichi KATO
Chef de mission
Equipe d'étude préparatoire
Agence Japonaise de Coopération Internationale

M. Idris ABDOU ALI
Secrétaire Général,
Ministère de l'Agriculture, de l'Elevage et de la Mer chargé des Ressources Hydrauliques
République de Djibouti

M. Badri ALI BOGOREH
Secrétaire Général
Ministère des Affaires Etrangères et de la Coopération Internationale
République de Djibouti

APPENDICE

1. Objectif du Projet

La présente Étude a pour objectif d'améliorer les conditions d'alimentation en eau potable (AEP) dans la région sud de Djibouti à travers la construction des installations d'alimentation en eau potable.

2. Site(s) du Projet

Les sites du Projet se trouvent dans les Régions de Dikhil, Ali-Sabieh et Arta tels qu'indiqués à l'Annexe-1. Les sites définitifs seront déterminés au cours du travail sur le terrain. En cas de nécessité d'ajouter d'autres villages, ces derniers seront sélectionnés dans le cadre du « Programme de Développement de l'Hydraulique Rurale. »

3. Organisation responsable du Projet

3-1 Organisme responsable de la gestion du Projet
Ministère de l'Agriculture, de l'Elevage et de la Mer chargé des Ressources Hydrauliques (désigné ci-après par le «MAEM-RH »).

3-2 Organisme responsable de l'exécution du Projet
Direction de l'eau, MAEM-RH

3-3 L'organigramme du MAEM-RH est indiqué à l'Annexe-2.

4. Rubriques demandées par le Gouvernement du Djibouti

4-1 Après les discussions tenues avec la Mission, il a été définitivement demandé par le Gouvernement de Djibouti les rubriques décrites à l'Annexe-3. La Mission a promis de les transmettre au Gouvernement du Japon.

4-2 La partie djiboutienne s'intéresse plutôt à un système AEP avec des conduites d'adduction d'eau qu'un équipement d'approvisionnement sur site équipé d'une simple pompe à main. Ayant compris l'intérêt de la partie djiboutienne, la Mission a expliqué toutefois que l'équipement AEP pourrait se déterminer également selon des conditions naturelles et sociales de chaque site.

4-3 La JICA évaluera la pertinence de la demande et recommandera au Gouvernement du Japon pour approbation.

5. Système de la coopération financière non-remboursable du Japon

5-1 La partie djiboutienne a compris le système de la coopération financière non-remboursable du Japon expliqué par la Mission tel que décrit à l'Annexe-4.

5-2 La partie djiboutienne prendra les dispositions nécessaires décrites à l'Annexe-5 de manière ài se conforment aux conditions de mise en œuvre de la coopération financière non-remboursable pour mener à bien le Projet.

5-3 La JICA informera la partie djiboutienne de toute autre disposition à prendre nécessaire s'il y a lieu sur la base du résultat de la présente Étude.

5-4. L'équipe a expliqué que l'exécution de l'Étude préparatoire n'a aucun rapport à l'approbation du Projet par le Gouvernement du Japon.

6. Calendrier de l'Étude

6-1 L'équipe d'étude (Consultant) procèdera à l'exécution du reste de travail à Djibouti jusqu'au 12 avril 2010. Chef de l'équipe d'étude quittera Djibouti fin février et travaillera au Japon jusqu'à la mi-mars pour la concertation avec la JICA sur le résultat provisoire du travail sur site à Djibouti.

6-2 La JICA préparera un avant-projet du rapport final de l'Étude en anglais et en français et enverra une mission à Djibouti vers mi-septembre 2010 pour la présentation du contenu de ce rapport final.

6-3 Avec l'accord principal du Gouvernement de Djibouti sur le contenu de l'avant-projet susmentionné, la JICA finalisera le rapport final et l'envoyer au Gouvernement de Djibouti vers le mois du janvier 2011.

7. Autres points discutés

7-1 Il a été confirmé par les deux parties que l'année cible avec la population cible projetée correspondrait à celle qui vient cinq (5) ans après l'achèvement du Projet.

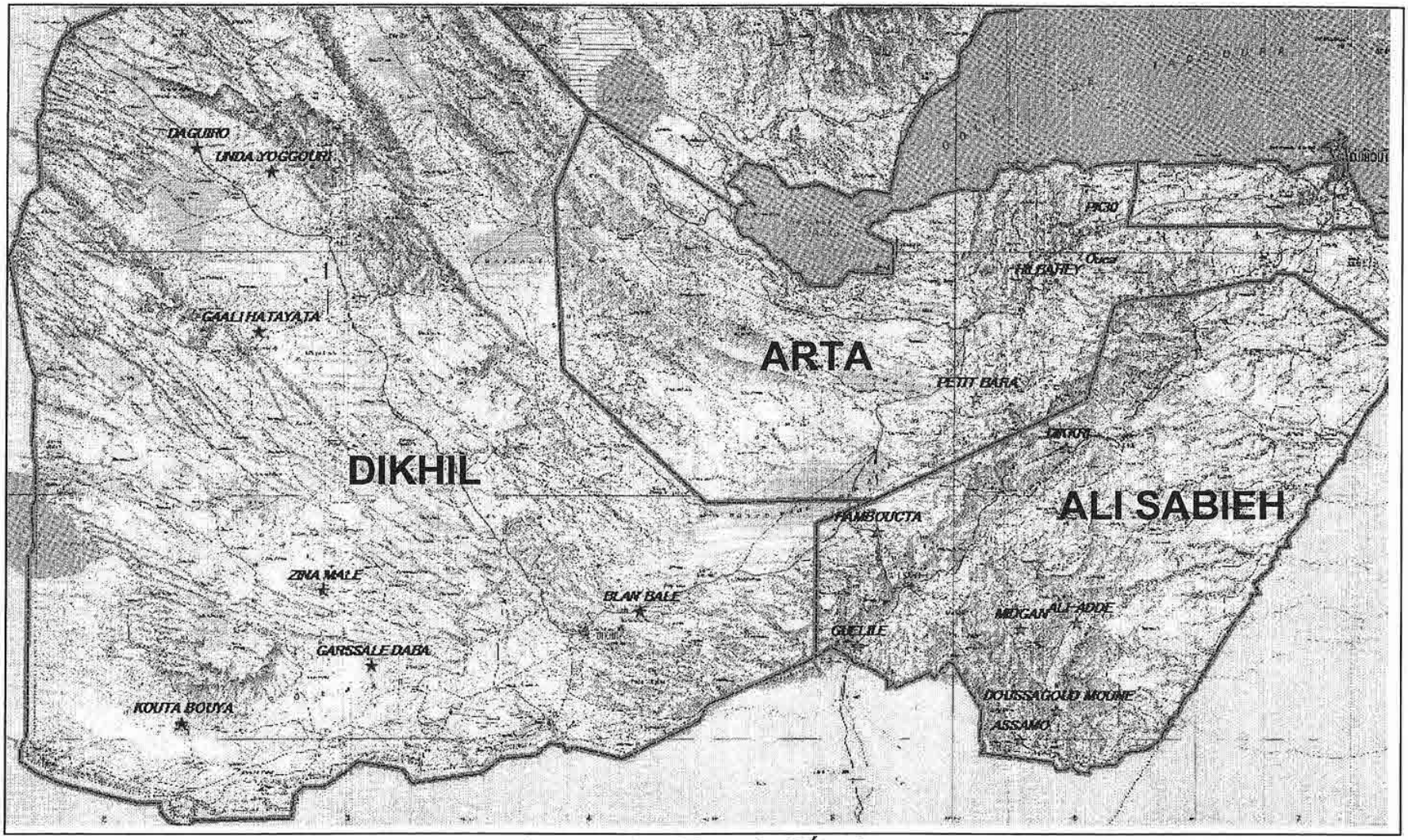
7-2 Il a été confirmé par les deux parties que le but principal du Projet consisterait à développer le système AEP rural et que l'eau superflue seule serait destinée à l'usage agricole.

7-3 En plus du rapport de commencement, la Mission a expliqué le tableau récapitulatif joint en annexe-6 indiquant les rubriques faisant l'objet de l'Étude y compris les dispositions à prendre par la partie djiboutienne dont le contenu a été retenu par cette dernière qui s'engage à y coopérer pleinement.

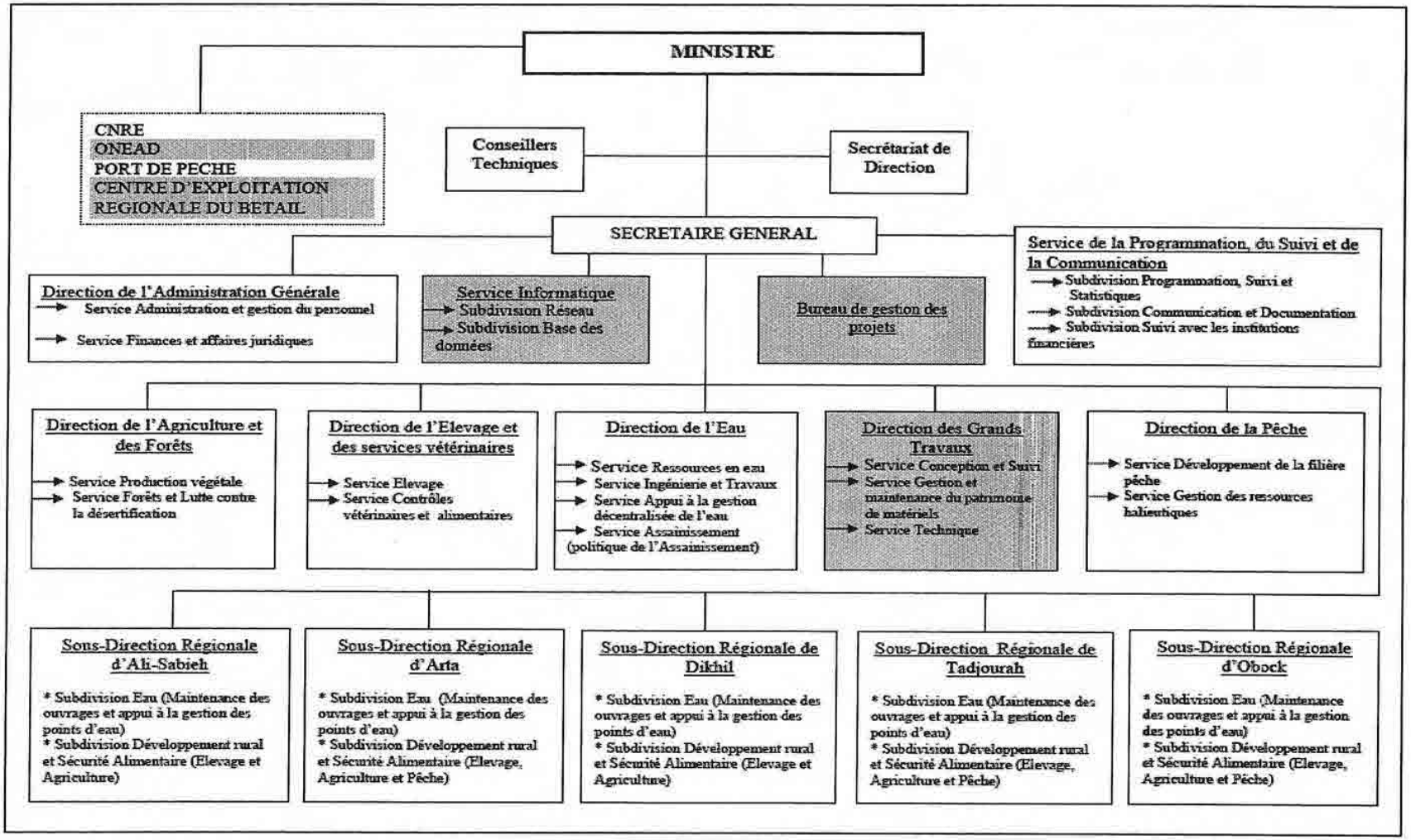
(Fin de texte)

Annexes

1. Carte des sites de l'Étude
2. Organigramme
3. Rubriques demandées par le Gouvernement de Djibouti
4. Système de la coopération financière non-remboursable du Japon
5. Dispositions principales à prendre par chaque Gouvernement
6. Tableau récapitulatif des rubriques faisant l'objet de l'Étude



Annexe-1 Sites de l'Étude



Annexe-2 Organigramme

Annexe-3 Rubriques demandées par le Gouvernement de Djibouti

Rubriques demandées

No.	Composante	Spécification
1	**Construction de 21 équipements d'approvisionnement en eau souterraine dans 18 villages** (L'équipement d'approvisionnement en eau souterraine inclut les suivants)	
(1)	Forage	
(2)	Équipement AEP (Cellules photovoltaïques, pompes électriques, réservoirs, bornes fontaines et abreuvoir inclus)	
2	**Approvisionnement d'équipement et matériel**	
	➢ Équipement et matériel pour le forage	
	➢ Équipement d'étude scientifique	
3	**Soft Component**	
	➢ Formation à la maîtrise du matériel géophysique et électrique	
	➢ Formation technique à la maîtrise de la diagraphie	

Zones demandées

pour la construction des équipements d'approvisionnement en eau souterraine

Région	Village	Zone	No. Forage
DIKHIL	YOBOKI	(1) UNDA YAGGOURI	2
	HANLE	(2) GAALI HATAYATA	1
	MOULOUD	(3) BLAN BALE	1
	AS-EYLA	(4) KOUTA BOUYA	1
	AS-EYLA	(5) ZINA MALE	1
	AS-EYLA	(6) DIKSA DERE	1
	YOBOKI	(7) DAGUIRO	1
ALI-SABIEH	HAMBOUCTA	(8) HAMBOUCTA	1
	GUELILE	(9) GUELILE	1
	MIDGAN	(10) MIDGAN	1
	HOL-HOL	(11) DIGRI	1
	ASSAMO	(12) ASSAMO	2
	DOUSSAGOUD MOUNE	(13) DOUSSAGOUD MOUNE	2
	ALI-ADDE	(14) ALI-ADDE	1
ARTA	ALI FAREN	(15) HILBAHEY	1
	PETIT BARA	(16) PETIT BARA	1
	OUEA	(17) PK30	1
	OUEA	(18) OUEA	1

Coopération financière non-remboursable du Japon

Le Gouvernement du Japon (ci-après dénommé le « GDJ ») est au centre de l'exécution des réformes organisationnelles pour améliorer la qualité des opérations de l'APD, et dans le cadre de ce réajustement, une nouvelle loi de la JICA est entrée en vigueur au 1er octobre 2008. Basée sur la loi et la décision du GDJ, la JICA est devenue l'agence exécutive de la Coopération financière non-remboursable du Japon pour les projets généraux, pour la pêche et pour la coopération culturelle.

La coopération financière non-remboursable consiste en des fonds non-remboursables pour le pays bénéficiaire qui permettront de fournir les installations, les équipements et les services (services techniques ou transport des produits, etc.) pour le développement socioéconomique du pays, selon les principes suivants et conformément aux lois et réglementations y afférentes du Japon. La coopération financière non-remboursable n'est pas effectuée sous forme de don de matériel en nature au pays bénéficiaire.

1. Procédure de la coopération financière non-remboursable du Japon

La coopération financière non-remboursable du Japon est menée selon les principes suivants :

a) Étude préparatoire (ci-après dénommée « l'Étude »)

- L'Étude menée par la JICA.

b) Estimation et approbation

- Estimation par le GDJ et la JICA. Approbation par le conseil des ministres du Japon

c) Décision de l'exécution

- L'Échange de Notes entre le GDJ et un pays bénéficiaire

d) Accord de Don (ci-après dénommé l'« A/D »)

- Accord conclu entre la JICA et un pays bénéficiaire

e) Exécution

- Mise en œuvre du Projet sur la base de l'A/D

2. Étude préparatoire

(1) Contenu de l'Étude

L'Étude a pour but de fournir un document de base nécessaire pour l'estimation du Projet par la JICA et le GDJ. Le contenu de l'Étude consiste à :

a) Confirmer l'arrière-plan de la requête, les objectifs et les effets du Projet ainsi que les capacités de maintenance du pays bénéficiaire nécessaires à l'exécution du Projet ;

b) Évaluer la pertinence de la coopération financière non-remboursable d'un point de vue technologique et socioéconomique ;

c) Confirmer le concept de base du plan convenu après concertations entre les deux partis ;

d) Préparer une conception de base du Projet ; et

e) Estimer les coûts du Projet

Le contenu de la requête du pays bénéficiaire n'est pas obligatoirement approuvé en tant que contenu de la coopération financière non-remboursable. La conception de base du Projet doit être confirmée par rapport au cadre de la coopération financière non-remboursable du Japon.

La JICA demande au Gouvernement du pays bénéficiaire de prendre toutes les mesures qui pourraient s'avérer nécessaires pour assurer son indépendance lors de l'exécution du Projet. Ces mesures doivent être garanties même si elles n'entrent pas dans la juridiction de l'organisme du pays bénéficiaire en charge de l'exécution du Projet. Par conséquent, l'exécution du Projet doit être confirmée par toutes les organisations concernées du pays bénéficiaire par la signature des procès-verbaux des concertations.

(2) Sélection des consultants

En vue de la bonne exécution de l'Étude, la JICA utilise un (des) consultant(s) enregistré(s). La JICA effectue une sélection basée sur des propositions soumises par ces derniers.

(3) Résultat de l'Étude

Le rapport de l'Étude est relu par la JICA et après confirmation de la pertinence du Projet, la JICA recommande au GDJ d'effectuer une estimation sur l'exécution du Projet.

3. Plan de la coopération financière non-remboursable du Japon

(1) E/N et A/D

Après l'approbation par le conseil des ministres du Japon du Projet proposé par le Gouvernement bénéficiaire, l'Échange de Notes (ci-après dénommé l'« E/N ») sera signé entre le GDJ et le Gouvernement du pays bénéficiaire pour formulcr unc demande d'aide, qui sera suivie par la conclusion de l'A/D entre la JICA et le Gouvernement du pays bénéficiaire afin de définir les clauses nécessaires pour l'exécution du Projet, telles que les conditions de paiement, les responsabilités du Gouvernement du pays bénéficiaire, et les conditions d'obtention.

(2) Sélection des consultants

Le(s) consultants(s) pour l'Étude sera (seront) recommandé(s) par la JICA au pays bénéficiaire pour également travailler sur l'exécution du Projet après l'E/N et l'A/D en vue de maintenir l'uniformité technique.

(3) Pays d'origine éligible

La coopération financière non-remboursable du Japon doit être en principe réservée exclusivement à l'achat dc produits provenant du Japon ou du payas bénéficiaire, et aux services des ressortissants japonais ou du pays bénéficiaire. Lorsque la JICA et le Gouvernement du pays bénéficiaire ou son autorité désignée le jugent nécessaire, la coopération financière non-remboursable peut être utilisée pour les produits ou les services tels que le transport d'un pays tiers (autre que le Japon ou le pays bénéficiaire). Toutefois, dans le cadre de la coopération

financière non-remboursable, les principaux contractants, à savoir les sociétés de construction, la société de commerce nécessaires à l'exécution de la coopération, et le consultant principal doivent être exclusivement des ressortissants japonais. (Le terme « ressortissant japonais » signifie les personnes physiques japonaises ou les personnes morales japonaises dirigées par des personnes physiques japonaises.)

(4) Nécessité de la vérification

Le gouvernement du pays bénéficiaire ou son représentant autorisé conclura les contrats en Yen japonais avec les ressortissants japonais. Ces contrats seront vérifiés par la JICA. Cette vérification est nécessaire car les fonds de la coopération financière non-remboursable proviennent des contribuables japonais.

(5) Principales dispositions à prendre par le Gouvernement du pays bénéficiaire

Lors de l'exécution de la coopération financière non-remboursable, le pays bénéficiaire devra prendre les dispositions suivantes :

a) Acquérir des secteurs de terrain nécessaires pour les sites du Projet et les débarrasser, niveler et défricher avant le commencement de la construction,

b) Pourvoir les systèmes de distribution d'électricité, d'alimentation en eau et d'éventuelles installations nécessaires à l'intérieur et autour des sites,

c) Assurer le bâtiment avant l'approvisionnement en cas d'installation de l'équipement,

d) Assurer toute dépense et exécution prompte pour le déchargement, dédouanement au port de débarquement et le transport interne des produits achetés dans le cadre de la coopération financière non-remboursable,

e) Exonérer les nationaux japonais des droits de douane, des taxes intérieures et d'autres charges fiscales qui pourraient être imposés au pays bénéficiaire à l'égard de l'achat des produits et des services effectué sous les contrats vérifiés,

f) Accorder aux nationaux japonais dont les services seront nécessaires pour la fourniture des produits et des services effectuée sous les contrats vérifiés les facilités nécessaires pour leurs entrées et séjours dans le pays bénéficiaire, afin qu'ils puissent effectuer leur travail.

(6) « Usage adéquat »

Le Gouvernement du pays bénéficiaire est requis d'entretenir et d'utiliser les installations construites et les équipements achetés dans le cadre de la coopération financière non-remboursable du Japon de manière adéquate et efficace et de désigner le personnel nécessaire pour le fonctionnement et la maintenance ainsi que de prendre en charge toutes les dépenses autres que celles couvertes par la coopération financière non-remboursable.

(7) « Exportation et réexportation »

Les produits achetés dans le cadre de la coopération financière non-remboursable ne doivent pas être exportés ou réexportés à partir du pays bénéficiaire.

(8) « Arrangement bancaire (A/B) »

a) Le Gouvernement du pays bénéficiaire ou son représentant autorisé devra couvrir un compte à son nom dans une banque au Japon (ci-après dénommée la « Banque »). La JICA exécutera la coopération financière non-remboursable en procédant aux paiements en Yen japonais pour couvrir les obligations du Gouvernement du pays bénéficiaire ou de son représentant autorisé conformément aux contrats vérifiés.

b) Les paiements seront effectués lorsque les demandes de paiement seront présentées par la Banque au Gouvernement du Japon conformément à l'autorisation de paiement émise par le Gouvernement du pays bénéficiaire ou de son représentant autorisé.

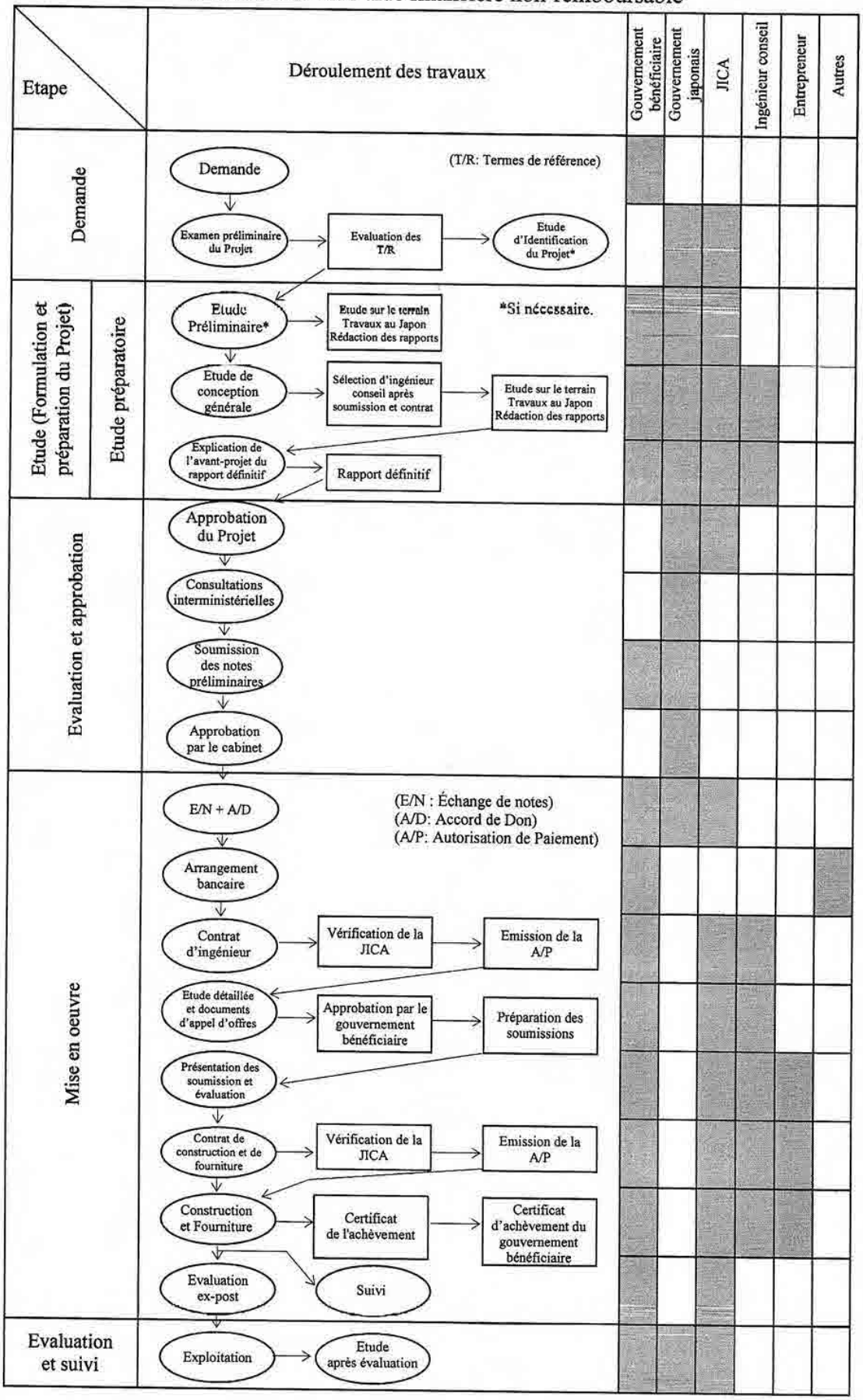
(9) Autorisation de paiement (A/P)

Le Gouvernement du pays bénéficiaire devra régler à la Banque la commission de notification de l'autorisation de paiement et la commission de paiement.

(10) Considérations sociales et environnementales

Le pays bénéficiaire doit assurer les considérations sociales et environnementales pour le Projet et doit suivre les règlements environnementaux du pays bénéficiaire et les directives socio-environnementales de la JICA.

La Procédure de l'aide financière non-remboursable



Annexe-5

DISPOSITIONS A PRENDRE PAR CHAQUE GOUVERNEMENT

(Construction))

No	Rubriques	Gouvernement du Japon	Gouvernement du pays bénéficiaire
1	Acquérir [un secteur] / [des secteurs] de terrain nécessaire[s] pour la mise en oeuvre du Projet et [le/les] aménager le terrain		•
2	Construire un/une/des		
	1) Bâtiment	•	
	2) Portes et de murs aux sites et autour des sites		•
	3) Parking	•	
	4) Voie (routes) à l'intérieur du site	•	
	5) Voie (routes) à l'extérieur du site		•
3	Fournir les installations hors du terrain mentionnée[s] à (a) ci-dessus telles que les systèmes d' électricit é, de distribution et d'écoulement d'eau ainsi que les autres systèmes auxiliaires nécessaires pour la mise en oeuvre du Projet		
	1) Electricité		
	a. Branchement du réseau de distribution électrique jusqu'au site		•
	b. Installation de ligne électrique à l'intérieur du site	•	
	c. Installation de disjoncteur principal et de transformateur	•	
	2) Alimentation en eau		
	a. Aménagement de la conduite principale d'eau de la ville jusqu'au site		•
	b. Système de distribution d'eau à l'intérieur du site (réservoirs de réception et surélevés)	•	
	3) Drainage		
	a. Aménagement des égouts principaux de la ville (égout pluvial et d'autres)		•
	b. Installation du système de drainage et d'égout (égouts des eaux usées, égout pluvial et d'autres) à l'intérieur du site	•	
	4) Gaz		
	a. Aménagement du réseau de distribution de gaz jusqu'au site		•
	b. Installation du système de fourniture de gaz à l'intérieur du site	•	
	5) Système téléphonique		
	a. Extension de la ligne téléphonique jusqu'au tableau de distribution du bâtiment		•
	b. Fourniture du tableau de distribution et extension de la ligne après le tableau de distribution	•	
	6) Mobilier et Equipements		
	a. Meubles de bureau généraux (moquettes, rideaux, tables, chaises et autres)		•
	b. Equipement pour le projet	•	
4	Assurer le déchargement et le dédouanement rapides des produits aux ports de déchargement du pays bénéficiaire et assister au transport interne desdits produits		
	1) Transport maritime (aérien) des produits originaires du Japon	•	
	2) Exonération d'impôts et dédouanement des produits au port de débarquement du pays bénéficiaire		•
	3) Transport interne du pays entre le port de débarquement et le site	(•)	(•)
5	Assurer que des droits de douane, des taxes intérieures et d'autres charges fiscales qui pourraient être imposés au pays bénéficiaire à l'égard de l'achat des produits et des services [seront exonérés]/ [seront supportés par l'Autorité sans utiliser le Don].		•
6	Accorder aux nationaux japonais dont les services seront nécessaires pour la fourniture des produits et des services les facilités nécessaires pour leurs entrées et séjours dans le pays bénéficiaire, afin qu'ils puissent effectuer leur travail.		•
7	Assurer que l'/les établissement(s) et les produits seront entretenus et utilisés d'une manière convenable et efficace pour la mise en œuvre du Projet		•
8	Supporter tous les frais nécessaires pour la mise en œuvre du Projet à part les frais qui sont couverts par le Don		•
9	Prise en charge des commissions suivantes de la banque de change japonaise pour les services bancaires basés sur les arrangements bancaires (A/B)		
	1) Commission de notification de l'autorisation de paiement (A/P)		•
	2) Commission de paiement		•
10	Assurer la prise en considération des questions environnementales et sociales dans la mise en œuvre du Projet		•

(A/B : Arrangement Bancaire, A/P : Autorisation de Paiement)

Annexe-6 Tableau récapitulatif des rubriques faisant l'objet de l'Étude

Rubrique		Contenu	Remarque	Demande de l'équipes d'étude
1	Collecte de données	- Questionnaire - Interview	- Fond de la requête - Documents pour l'ensemble de l'Étude	- Réponses autant rapides que possible - Assistance et proposition pour la collecte de données - Arrangement pour prise de contacte avec les organismes concernés (organisations internationales, donateurs, etc.)
2	Exploration géophysique (géoélectrique)	Exploration verticale 13 sites	3 sondages par site	- Disponibilité d'un local pour la soumission - Disponibilité de la vue aérienne des environs des villages concernés - Accompagnement du personnel homologue pour l'exploration géophysique et essai de forage (1/30 ~ 4/7)
		Exploration à deux dimensions 8 sites	1 sondage par site	
3	Forages d'essai	8 forages d'essai (6 pouces) Profondeur moyenne 150m	Soumission 25 janv. Début de forage : 10 janv. souhaité	
4	Analyse d'eau	Prélèvement des eaux souterraines et analyse d'eau	32 forages existants 8 forages de reconnaissance JICA : Total 40 éprouvettes	- Laboratoire homologue pour l'analyse d'eau - Confirmation du registre de forage et forage servant à l'analyse d'eau (6 à 18 fev.) - Accompagnement du personnel homologue pour le prélèvement d'eau (6 au18 fév.)
5	Planification matériel AEP	Étude des conditions actuelles du terrain Étude des installations des forages existants	Réservoirs surélevés, conduites de transfert, alimentation en électricité	- Présentation des installations AEP existantes et accompagnement du personnel homologue
				- Accompagnement du personnel homologue pour la confirmation des sites se portant candidat pour la construction des installations (20 février au 4 mars)
6	Enquête sociale	Enquête par questionnaire	18 villages	- Concertation au sujet de la méthodologie de l'enquête (rubrique de l'enquête ou autres) - Accompagnement du personnel homologue pour l'Étude sur le terrain (20 février au 11 mars)
7	Estimation du coût de projet	- Prix unitaire - Situation du terrain - Étude des conditions d'approvisionnement	Estimation d'au mois 3 entreprises Conditions d'accès, trajet de canalisation	- Présentation des entreprises et/ou constructeurs et prise de rendez-vous avec eux -Accompagnement du personnel homologue pour l'étude sur le terrain (13 au 25 mars)
8	Sélection des sites	- Mise en place des critères de sélection	- Rendement de forage, qualité d'eau, demande d'eau (population bénéficiaire), voies d'accès, possibilité de la gestion et entretien	- Concertation au sujet de la sélection des villages de remplacement
9	Plan de fonctionnement et de maintenance	- Confirmation des installations existantes	- Considération de la situation technique et économique ; - Effectif de personnel	- Présentation de la réalisé et de la planification de la méthodologie de fonctionnement et planification

PROCÈS-VERBAL DE LA DISCUSSION
SUR L'ÉTUDE PRÉPARATOIRE
POUR
LE PROJET D'ALIMENTATION EN EAU POTABLE RURALE
DANS LA RÉGION DU SUD
EN
RÉPUBLIQUE DE DJIBOUTI

En janvier 2010, l'Agence Japonaise de Coopération Internationale (ci-après désignée la « JICA ») a envoyé en République de Djibouti (ci-après désigné « Djibouti ») une mission chargée de l'étude préparatoire pour le Projet d'alimentation en eau potable rurale dans la région du sud en République de Djibouti (désigné ci-après le « Projet »). À travers les discussions, l'étude sur le terrain à Djibouti et l'analyse au Japon des résultats de l'étude préparatoire, la JICA a élaboré un avant-projet de la conception de base du Projet.

Pour la présentation et la consultation auprès du gouvernement de Djibouti sur les composantes de la conception de base du Projet, la JICA a envoyé du 28 novembre au 2 décembre 2010 une mission, dirigée par M. Ryuichi KATO, Conseiller supérieur auprès du Directeur général, Département de l'Afrique, JICA, chargée de la présentation de la conception de base du Projet (ci-après désignée la « Mission »),.

À l'issue des discussions, les deux parties ont confirmé les éléments principaux tels qu'indiqués dans les documents joints en appendice.

Djibouti, le 2 décembre 2010

M. Ryuichi KATO
Chef de mission
Equipe d'étude préparatoire
Agence Japonaise de Coopération Internationale

M. Idris ABDOU ALI
Secrétaire Général,
Ministère de l'Agriculture, de l'Elevage et de la Mer chargé des Ressources Hydrauliques
République de Djibouti

M. Badri ALI BOGOREH
Secrétaire Général
Ministère des Affaires Etrangères et de la Coopération Internationale
République de Djibouti

APPENDICE

1. Les composantes de l'avant-projet du rapport final de l'étude préparatoire

La partie djiboutienne est d'accord avec et accepte en principe les composantes de l'avant-projet du rapport final de la conception de base du Projet présenté par la Mission, excepté les points suivants qui devront être réglés avant la considération future de la réalisation de la coopération financière non-remboursable.

1-1. La construction des forages de reconnaissance

La partie djiboutienne évoque ses craintes quant à la pérennité (la qualité) des ouvrages hydrauliques réalisés. La Mission déclare que les forages de reconnaissance positifs ont été correctement construits et qu'ils peuvent être utilisés en tant que forage d'exploitation.

1-2 Normes et standards concernant la qualité d'eau

L'étude préparatoire avère que 2 sur 8 sites concernés sont affectés par des substances nuisibles à la santé humaine : l'un est Assa Koma contenant le fluor et l'autre est Zina Male contenant le nitrate, chacun dépassant la valeur directive préconisée par l'OMS en tant que norme relative à l'eau potable. La Mission déclare exclure ces deux sites du Projet.

La partie djiboutienne souhaite que, en tenant compte de la spécificité des conditions à la fois naturelles et sociales à Djibouti, la Mission agisse de manière plus pratique et tolère exceptionnellement la situation du site Assa Koma, en particulier, où le potentiel hydraulique est significativement élevé. Dans ces pareils sites, des eaux souterraines peuvent présenter une valeur agricole non négligeable.

La Mission déclare se référer auxdites normes de l'OMS sauf le cas de mise en place d'une norme quelconque djiboutienne sur des nuisances des eaux souterraines.

1-3 Requête de matériels et équipements supplémentaires

La partie djiboutienne insiste pour inclure les matériels de foration et de diagraphie dans le Projet pour la raison qu'ils sont essentiels pour ses activités de développement hydraulique dans le futur.

Le MAEM-RH maintient sa proposition élaborée dans le cadre du plan triennal, demande à la JICA d'accepter cette proposition et s'engage à remettre à la JICA dans un délai de 10 jours l'ensemble des documents nécessaires pour leur évaluation dans le cadre du présent Projet.

1-4 PK 30

La Mission explique que le débit disponible de PK30 est faible ne satisfaisant que 2/3 de la consommation projetée.

La partie djiboutienne propose, vu le potentiel hydraulique important de la zone, de quêter à ses propres charges un forage positif et d'inclure dans le Projet l'installation de point d'eau si c'est le cas.

La Mission déclare impossible de l'inclure dans le Projet selon le calendrier actuel.

2. Le système de coopération financière non-remboursable du Japon

La partie djiboutienne comprend le système de coopération financière non-remboursable du Japon et prendra les mesures nécessaires et allouera le budget nécessaire pour mener à bien le Projet de manière à réaliser la coopération financière non-remboursable du Japon. Le système de coopération financière non-remboursable du Japon ainsi que les mesures nécessaires à prendre sont décrits dans les Annexe 4 et 5 du procès-verbal signé par les deux parties le 24 janvier 2010.

3. Organisations responsables du Projet

3-1 Organisme responsable de la gestion du Projet
Ministère de l'Agriculture, de l'Elevage et de la Mer chargé des Ressources Hydrauliques (désigné ci-après par le «MAEM-RH »).

3-2 Organisme responsable de l'exécution du Projet
Direction de l'eau, MAEM-RH

4. Autres points discutés

4-1. Estimation du coût de projet

La Mission a expliqué à la partie djiboutienne l'estimation du coût de projet telle qu'indiquée en Annexe-1. Les deux parties ont confirmé qu'il est compris dans ce coût estimatif certains sites pouvant être exclus du Projet et que la présente estimation n'est que provisoire et sera examinée ultérieurement par le gouvernement du Japon au moment de son approbation du don. De plus, les deux parties confirment que ce coût de projet estimé ne devra être reproduit sous quelle forme que ce soit ni communiqué à une quelconque tierce partie en aucun cas, et ce jusqu'à ce qu'un contrat concerné soit concédé par le MAEM-RH. Cette interdiction vise à assurer l'équité dans la procédure d'appel d'offres.

4-2. Dispositions budgétaires pour la gestion et l'entretien des points d'eau

La Mission a expliqué le coût de gestion et d'entretien estimé des points d'eau tel qu'indiqué en Annexe-2 et demandé à la partie djiboutienne de prévoir un budget nécessaire y afférente en cas de réalisation du Projet. Dans cette estimation sont compris certains sites concernés pouvant être exclus du Projet.

La Mission a expliqué que si un village bénéficiaire n'est pas en mesure de se charger des frais de gestion et d'entretien, le MAEM-RH s'en chargera.

4-3. Les engagements de la partie djiboutienne

En plus des dispositions à prendre par la partie djiboutienne, la Mission lui demande de prendre en charge les points suivants en cas de réalisation du Projet et la partie djiboutienne déclare prendre les mesures nécessaires :

a) Respecter les engagements du gouvernement de Djibouti concernant le système de coopération financière non-remboursable du Japon ;
b) Disposer et payer le personnel homologue et ses activités y compris des primes de déplacement;
c) Construire des clôture et/ou autres protections équivalentes pour les installations de point d'eau y compris des postes de gardiennage ;
d) Aménager des voies d'accès aux sites de projet ;
e) Obtenir tout licence ou permis nécessaire concerné ;

f) Faciliter le dédouanement des matériels et équipements importés ;

g) Mettre à la disposition de l'entrepreneur et du Consultant des terrains réservés aux bureaux de chantier, camp de base et aires de stockage ;

4-4. Renforcement de la capacité

Les deux parties se mettent d'accord pour la nécessité d'un programme d'assistance technique spécifique au Projet, appelé la « Composante Soft », comme suit :

- Renforcement de la capacité technique de gestion et d'entretien
- Renforcement de la capacité d'exploration des ressources en eau

La partie djiboutienne s'engage à déployer son personnel, à ses propres charges, pour l'exécution de la Composante Soft et à prendre en charge ses dépenses réelles encourues et ce en cas de réalisation du Projet.

4-5. Sites de projet

Les sites de projet sont les suivants :

[Sek Sabir, Mindil, Afka Arraba, Sabbalou, Hamboucta]
PK30, ZinaMale et AssaKoma à confirmer.

4-6. L'utilisation des forages

a) Bien que la partie djiboutienne insiste sur l'utilisation des eaux souterraines pour l'agriculture et l'élevage, les deux parties ont convenu que l'objectif principal du Projet consiste en développement de l'eau potable qui ne pourrait utilisée pour l'agriculture et l'élevage que lorsqu'il y a un surplus. La Mission signale que la surexploitation des forages dépassant leur capacité nominale provoquerait la baisse du niveau permanente de la nappe phréatique, la détérioration continue de la qualité des eaux souterraines et la réduction de la durée de vie de la pompe ;

b) Tous les forages de reconnaissance sont scellés. La partie djiboutienne sera responsable de maintenir les forages positifs. Tout forage subit de vandalisme au moment de l'étude détaillée sera exclu de l'étendue du Projet ;

c) La partie djiboutienne rapportera à la JICA toute activité ayant trait à la construction de forage ou à l'installation d'un point d'eau ayant éventuellement lieu autour des sites du Projet ;

4-7. Situation de Sabbalou Sankal

a) La Mission explique que les villageois de Sankal utilisent les forages de Sabbalou gratuitement puisque les points d'eau de Sabbalou sont maintenus par le MAEM-RH et non par les villageois de Sabbalou. La JICA est en train de planifier un forage à Sabbalou pour alimenter les villageois de Sankal et insiste sur le fait qu'il sera maintenu également par le MAEM-RH ;

b) A part le tableau-2 de l'Annexe-2, la partie djiboutienne saisit la situation et s'engage à prendre les mesures nécessaires pour la gestion et l'entretien du point d'eau de Sabbalou à construire dans le Projet.

c) La partie djiboutienne insiste sur la nécessité de transport de l'eau potable entre Sabbalou et Sankal pour l'alimentation en eau potable du village de Sankal, notamment, pour l'école et le dispensaire qui a été prévu par le gouvernement. La Mission a répondu que l'intégration dans le Projet de la provision des installations et équipements supplémentaires ou des moyens de transport de l'eau potable a été évalué difficile sur le plan technique et économique.

4-8. Provision de pièces de rechange

La partie djiboutienne insiste pour la provision de 10 ans de pièces de rechange en raison de la sévérité des conditions naturelles et fiscales à Djibouti. La Mission déclare l'envisager seulement lorsque la partie djiboutienne prépare un espace propre de stockage de ces matériels doté d'un système cohérent de gestion de stock. La partie djiboutienne s'engage à prévoir ledit espace.

4-9. Initiatives futures de Djibouti

La partie djiboutienne pourvoira des hôpitaux et écoles des sites de projet.

Annexe-1 : Coût estimatif de projet
Annexe-2 : Coûts annuels

Confidential

Annexe-1: Coût estimatif de projet

Note: Dans cette estimation sont inclus certains sites pouvant être exclus du Projet.

Tableau-A. Coût de forage du gouvernement du Japon

Unité : Million de yen

Désignation	Coût
Installations	
Machinerie et matériels	
Composante Soft	
Supervision des travaux de construction	
Total	

Tableau-B. Coût de forage du gouvernement de Djibouti

Désignation	Coût (million de yen)	Coût (million de DJF)
Construction de clôture	7,5	14,4
Construction de voies d'accès	0,6	1,2
Coûts homologues	3,1	5,9
Arrangement bancaire	0,4	0,73
Total	11,6	22,2

Annexe-2: Coûts annuels

Note: Dans cette estimation sont inclus certains sites pouvant être exclus du Projet.

Tableau-C. Coût annuel encouru au gouvernement de Djibouti

Rubrique	Coût (mille yen)	Coût (mille DJF)
Carburant véhicule	20,8	40,0
Homologues	74,7	144,0
Total	95,5	184,0

Tableau-D, Coût annuel encouru aux comités villageois

Rubrique	Coût (mille yen)	Coût (mille DJF)
Pièces de rechange	56	108
Gardiennage + Robinetier	498	960
Frais divers	4,2	8,0
Total	558	1 076

PROCÈS-VERBAL DE LA DISCUSSION

SUR L'ÉTUDE PRÉPARATOIRE

POUR

LE PROJET D'ALIMENTATION EN EAU POTABLE RURALE

DANS LA RÉGION DU SUD

EN

RÉPUBLIQUE DE DJIBOUTI

(2ème mission pour la présentation de la conception de base)

En janvier 2010, l'Agence Japonaise de Coopération Internationale (ci-après désignée la « JICA ») a envoyé en République de Djibouti (ci-après désigné « Djibouti ») une mission chargée de l'étude préparatoire pour le Projet d'alimentation en eau potable rurale dans la région du sud en République de Djibouti (désigné ci-après le « Projet »). À travers les discussions, l'étude sur le terrain à Djibouti, l'analyse au Japon des résultats de l'étude préparatoire et les discussions sur le premier avant-projet de la conception de base du Projet, la JICA a élaboré un avant-projet révisé de la conception de base du Projet.

Pour la présentation et la consultation auprès du gouvernement de Djibouti sur les composantes de l'avant-projet révisé de la conception de base du Projet, la JICA a envoyé du 8 au 13 janvier 2011 une mission dirigée par Mme. Keiko SANO, Directrice de la Division Afrique 2 (Département de l'Afrique de la JICA), chargée de la 2ème présentation de l'avant-projet de la conception de base du Projet (ci-après désignée la « Mission »),

À l'issue des discussions, les deux parties ont confirmé les contenus tels qu'indiqués dans les documents joints en appendice.

Djibouti, le 11 janvier 2011

Mme. Keiko SANO

Chef de mission

Equipe d'étude préparatoire
Agence Japonaise de Coopération
Internationale

M. Idris ABDOU ALI

Secrétaire Général

Ministère de l'Agriculture, de l'Elevage et de la
Mer chargé des Ressources Hydrauliques
République de Djibouti

M. Mohamed ALI HASSAN

Secrétaire Général P.I.

Ministère des Affaires Etrangères et de la
Coopération Internationale
République de Djibouti

APPENDICE

1. Les composantes de l'avant-projet du rapport final de l'étude préparatoire

La partie djiboutienne est d'accord avec les composantes de l'avant-projet révisé de la conception de base du Projet présenté par la Mission.

2. Le système de coopération financière non-remboursable du Japon

La partie djiboutienne a pris acte du système de coopération financière non-remboursable du Japon et prendra les mesures nécessaires et allouera le budget nécessaire pour mener à bien le Projet de manière à réaliser la coopération financière non-remboursable du Japon. Le système de coopération financière non-remboursable du Japon ainsi que les mesures nécessaires à prendre sont décrits dans les Annexe 4 et 5 du procès-verbal signé par les deux parties le 24 janvier 2010.

3. Organisations responsables du Projet

3-1 Organisme responsable de la gestion du Projet
Ministère de l'Agriculture, de l'Elevage et de la Mer chargé des Ressources Hydrauliques (désigné ci-après par le «MAEM-RH »).

3-2 Organisme responsable de l'exécution du Projet
Direction de l'eau, MAEM-RH

4. Autres points discutés

4-1. Estimation du coût de projet

La Mission a expliqué à la partie djiboutienne l'estimation du coût de projet telle qu'indiquée en Annexe-1. Les deux parties ont confirmé que la présente estimation n'est que provisoire et sera examinée ultérieurement par le gouvernement du Japon. De plus, les deux parties confirment que ce coût de projet estimé ne devra être reproduit sous quelle forme que ce soit ni communiqué à une quelconque tierce partie en aucun cas, et ce jusqu'à ce qu'un contrat concerné soit concédé par le MAEM-RH. Cette interdiction vise à assurer l'équité dans la procédure d'appel d'offres.

4-2. Dispositions budgétaires pour la gestion et l'entretien des points d'eau

La Mission a expliqué le coût de gestion et d'entretien estimé des points d'eau tel qu'indiqué en Annexe-2 et demandé à la partie djiboutienne de prévoir un budget nécessaire y afférent en cas de réalisation du Projet.

La Mission a expliqué que si un village bénéficiaire n'est pas en mesure ou manque de se charger des frais de gestion et d'entretien, le MAEM-RH s'en chargera. La partie djiboutienne a pris note et accepte.

4-3. Les engagements de la partie djiboutienne

En plus des dispositions à prendre par la partie djiboutienne, la Mission lui demande de prendre en charge les points suivants en cas de réalisation du Projet et la partie djiboutienne déclare prendre les mesures nécessaires :

a) Respecter les engagements du gouvernement de Djibouti concernant le système de coopération financière non-remboursable du Japon ;

b) Disposer et payer le personnel homologue et ses activités y compris des primes de déplacement;

c) Construire des clôture et/ou autres protections équivalentes pour les installations de point d'eau y compris des postes de gardiennage ;

d) Aménager des voies d'accès aux sites de projet ;

e) Obtenir tout licence ou permis nécessaire concerné ;

f) Faciliter le dédouanement des matériels et équipements importés ;

g) Mettre à la disposition de l'entrepreneur et du Consultant des terrains réservés aux bureaux de chantier, camp de base et aires de stockage ;

4-4. Renforcement de la capacité

Les deux parties se mettent d'accord sur la nécessité d'un programme d'assistance technique spécifique au Projet, appelé la « Composante Soft », comme suit :

- Renforcement de la capacité technique de gestion et d'entretien
- Renforcement de la capacité d'exploration des ressources en eau

La partie djiboutienne s'engage à déployer son personnel, à ses propres charges, pour l'exécution de la Composante Soft et à prendre en charge ses dépenses réelles encourues et ce en cas de réalisation du Projet.

4-5. Sites de projet

Les sites de projet sont les suivants :

[Sabbalou, Zina Male(*), Daguiro(*), Sek Sabir, Assa Koma(*), Mindil, Afka Arraba, Hamboucta, Midgarra(*)]

4-6. La qualité de l'eau de certains sites de projet

a) La Mission déclare que l'eau souterraine des sites de projet marqués par (*) contient du fluor ou du nitrate dont la teneur dépasse les valeurs directives préconisées de l'OMS et qu'elle serait éventuellement nuisible à la santé humaine des villages concernés ;.

b) La partie djiboutienne comprend les risques expliqués par la Mission et insiste néanmoins sur le fait que ces sites marqués par (*) soit retenus dans le Projet.

c) La Mission a expliqué qu'ils seront retenus dans le Projet sous les conditions suivantes et la partie djiboutienne a pris note et apportera sa coopération en la matière :

- Des plaques de signalisation doivent être installées à chaque borne fontaine pour indiquer que l'eau n'est pas potable. L'eau doit être destinée à l'usage domestique ;
- Le MAEM-RH informera régulièrement les habitants des sites marqués par (*) que l'eau de ce forage n'est pas potable ;
- Le MAEM-RH sera responsable de l'exploitation et la maintenance des points d'eau construits dans les sites marqués par (*) ;

- Tout risque quel qu'il soit relevant de la qualité de l'eau des sites marqués par (*) sera pris en charge par la partie djiboutienne ;

4-7. Fourniture du matériel de forage

a) La partie djiboutienne déclare que le matériel de forage sera stocké aux magasins de stockage situés dans l'enceinte du MAEM-RH. La machinerie fournie dans le projet doit être également stocké aux magasins de stockage situés dans l'enceinte du MAEM-RH ;
b) La partie djiboutienne n'utilisera ce matériel que pour les forages de la région du sud de Djibouti. La partie djiboutienne prévoira un budget nécessaire pour la construction des installations de point d'eau en cas de forage positif ;
c) La partie djiboutienne préparera un plan de construction des forages pour l'ensemble de ces matériels et le soumettra au bureau de la JICA/Djibouti. La partie djiboutienne informera tous les six mois la JICA/Djibouti de l'état d'avancement des travaux de forage.

4-8. L'utilisation des forages

a) Bien que la partie djiboutienne insiste sur l'utilisation des eaux souterraines pour l'agriculture et l'élevage, les deux parties ont convenu que l'objectif principal du Projet consiste en développement de l'eau potable qui ne pourrait être utilisée pour l'agriculture et l'élevage que lorsqu'il y a un surplus. La Mission signale que la surexploitation des forages dépassant leur capacité nominale provoquerait la baisse du niveau permanente de la nappe phréatique, la détérioration continue de la qualité des eaux souterraines et la réduction de la durée de vie de la pompe ;
b) Tous les forages de reconnaissance sont scellés. La partie djiboutienne sera responsable de maintenir les forages positifs. Tout forage ayant subit des actes de vandalisme au moment de l'étude détaillée sera exclu de l'étendue du Projet ;
c) La partie djiboutienne rapportera à la JICA toute activité ayant trait à la construction de forage ou à l'installation d'un point d'eau ayant éventuellement lieu autour des sites du Projet ;

4-9. Situation de Sabbalou Sankal

a) La Mission explique que les villageois de Sankal utilisent les forages de Sabbalou gratuitement puisque les points d'eau de Sabbalou sont maintenus par le MAEM-RH et non par les villageois de Sabbalou. La JICA est en train de planifier un forage à Sabbalou pour alimenter les villageois de Sankal et insiste sur le fait qu'il sera maintenu également par le MAEM-RH ;
b) La partie djiboutienne a pris note et s'engage à prendre les mesures nécessaires pour la gestion et l'entretien du point d'eau de Sabbalou à construire dans le Projet.
c) La partie djiboutienne insiste sur la nécessité de transport de l'eau potable entre Sabbalou et Sankal pour l'alimentation en eau potable du village de Sankal, notamment, pour l'école et le dispensaire qui ont été prévus par le gouvernement. La Mission a répondu que l'intégration dans le Projet de la fourniture des installations et équipements supplémentaires ou des moyens de transport de l'eau potable a été évalué difficile sur le plan technique et économique.

4-10. Provision de pièces de rechange

La partie djiboutienne insiste pour la provision de 10 ans de pièces de rechange en raison de la sévérité des conditions naturelles et fiscales à Djibouti. La Mission déclare l'envisager seulement lorsque la partie djiboutienne mettra en place un espace de stockage propre de ce matériel doté d'un système de gestion de stock cohérent. La partie djiboutienne s'engage à prévoir ledit espace.

4-11. Les préoccupations de la partie djiboutienne

La partie djiboutienne a présenté ses préoccupations ci-dessous indiquées :

- L'énergie des pompes destinées au système photovoltaïque doit être assurée par le courant alternatif et non courant continu ;
- Les installations doivent être sécurisées soit au moyen de batterie ou par la mise en place d'un système hybride équipé à la fois de générateur et de panneau solaire ;
- Le réservoir doit être construit en maçonnerie au lieu de FRP;
- La capacité de réservoir doit être augmentée;
- Le nombre de forages devant être exploités par la partie djiboutienne en utilisant le matériel fourni dans le Projet doit être augmenté ;
- Le nombre de paramètre de l'appareil de diagraphie doit être augmenté.
- Les instruments de mesure du niveau d'eau de forages doivent être plus efficaces, notamment jusqu'à une profondeur de 300 m.

4-12. Initiatives futures de Djibouti

La partie djiboutienne pourvoira des hôpitaux et écoles sur les sites de projet.

4-13 La région du nord

La partie djiboutienne insiste sur la nécessité d'un projet similaire pour la région nord du pays à cause des sécheresses chroniques et de l'insuffisance de point d'eau. La partie djiboutienne soumettra une requête officielle pour la région nord par voie diplomatique. La Mission explique que le présent Projet devra s'achever avec réussite pour la considération d'un éventuel projet futur.

Annexe-1 : Coût estimatif de projet

Annexe-2 : Coûts annuels

Confidential

Annexe-1: Coût estimatif de projet

Note : Dans cette estimation sont inclus certains sites pouvant être exclus du Projet.

Tableau-A. Coût de forage du gouvernement du Japon

Unité : Million de yen

Désignation	Coût
Installations	233,9
Machinerie et matériels	159,8
Composante Soft	19,4
Supervision des travaux de construction	85,5
Total	498,6

Tableau-B. Coût de forage du gouvernement de Djibouti en phase de construction

Désignation	Coût (million de DJF)
Construction de clôture	16,2
Construction de voies d'accès	1,2
Coûts homologues	5,1
Arrangement bancaire	1,0
Total	23,5

Annexe-2: Coûts annuels

Tableau-C. Coût annuel encouru au gouvernement de Djibouti

Rubrique	Coût (million DJF/an)
Carburant véhicule	0,04
Homologues	0,16
Gardiennage	1,80
Gestion/entretien de 5 villages**	0,10
Total	2,10

** : **Dans** 5 villages sont inclus Sabbalou, Zina Male, Daguiro, Assa Koma, Midgarra

Tableau-D, Coût annuel encouru aux comités villageois (4 villages***)

Rubrique	Coût (mille DJF)
Pièces de rechange	48,0
Gardiennage + Robinetier	240,0
Frais divers	4,0
Total	292,0

***: Dans 4 villages sont compris Sek Sabir, Mindil, Afka Arraba, Hamboucta

Tableau-E Coûts du gouvernement djiboutien encourus par le forage****

Rubrique	Coût (million DJF/an)
Mobilisation/Démobilisation	1,0
Creusage/Perçage	8,0
Prime Homologues	9,0
Total	18,0

**** : Ces coûts sont pour 10 forages. La partie djiboutienne réalisera 20 forages au total. Aucun coût de construction des installations de point d'eau n'y est compris.

English

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON
THE RURAL WATER SUPPLY PROJECT IN SOUTHERN DJIBOUTI
IN
THE REPUBLIC OF DJIBOUTI

In response to a request from the Government of the Republic of Djibouti (hereinafter referred to as "Djibouti"), the Government of Japan decided to conduct a Preparatory Survey of the Rural Water Supply Project in Southern Djibouti (hereinafter referred to as "the Project") and entrusted the Survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to The Djibouti the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Mr. Ryuichi KATO, Senior Advisor to the Director General, Africa Department, JICA, and is scheduled to stay in the country from 16th January 2010 to 25th January 2010.

The Team held the series of discussions with the officials concerned of the Government of Djibouti and conducted a field survey in the Project area.

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

Djibouti, 24th January 2010

Mr. Ryuichi KATO
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Mr. Idriss ABDOU ALI
Secretary General,
Ministry of Agriculture, Livestock and
Fisheries in Charge of Water Resources
The Republic of Djibouti

Mr. Badri ALI BOGOREH
Secretary General
Ministry of Foreign Affaires and International
Cooperation,
The Republic of Djibouti

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the water supply condition in Southern Djibouti through the construction of water supply facilities.

2. Project site (s)

The sites of the Project will be in villages of Regions of Dikhil, Ali Sabieh and Arta is as shown in Annex-1. Exact sites will be determined in the course of the survey. If additional villages and sites are to be necessary, they will be selected from "Program for Rural Hydraulic Development".

3. Responsible and Implementing Organization

3-1. The responsible organization is Ministry of Agriculture, Livestock and Fisheries in Charge of Water Resources (hereinafter referred to as "MAEM-RH").

3-2. The implementing organization is Department of Water, MAEM-RH.

3-3. The organization chart of MAEM-RH is shown in Annex-2

4. Items requested by the Government of Djibouti

4-1. After discussions with the Team, the items described in Annex-3 were finally requested by the Government of Djibouti. The Team promised to convey the request to Japan.

4-2. The Djibouti Side prioritized piped water supply facilities rather than on-site handpump facilities. The Team understood the priority, but explained that the specifications of the water supply facilities will also be determined by natural and social conditions of each site.

4-3. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

5-1. The Djibouti side understood the Japan's Grant Aid Scheme explained by the Team as described in Annex-4.

5-2. The Djibouti side will take necessary measures as described in Annex-5 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 Djibouti 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. Consultant members in the Team will proceed to undertake further studies in Djibouti until 12 April 2010. The Consultant Team Leader will leave Djibouti from end of February until mid March to report interim findings.

6-2. JICA will prepare the draft report of the Survey in English and French and dispatch a mission to Djibouti in order to explain its contents around the middle of September 2010.

6-3. In case the contents of the draft report are accepted in principle by the Government of Djibouti, JICA will complete the final report and send it to the Government of Djibouti around January 2011.

7. Other relevant issues

7-1. Both sides confirmed that target year for the projection of target population of the Project would be set around five years after the completion of the Project.

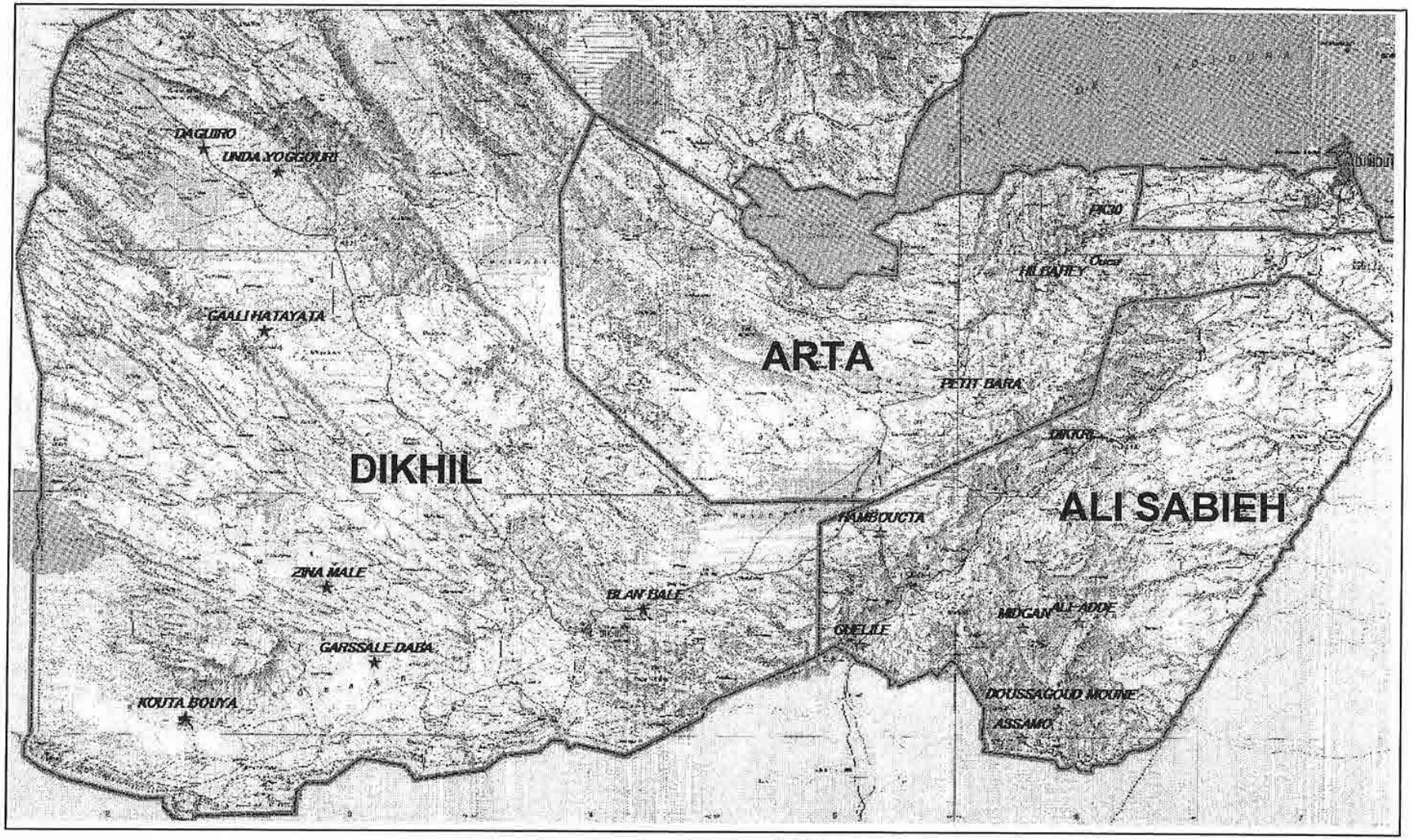
7-2. Both sides understood that the project's main objective is development of drinking water and only surplus water will be used for agricultural use.

7-3. In addition to the Inception Report, the Team explained Annex-6 which lists further study items and arrangements and undertakings to be taken by the Djibouti Side. The Djibouti Side understood the contents and promised full cooperation.

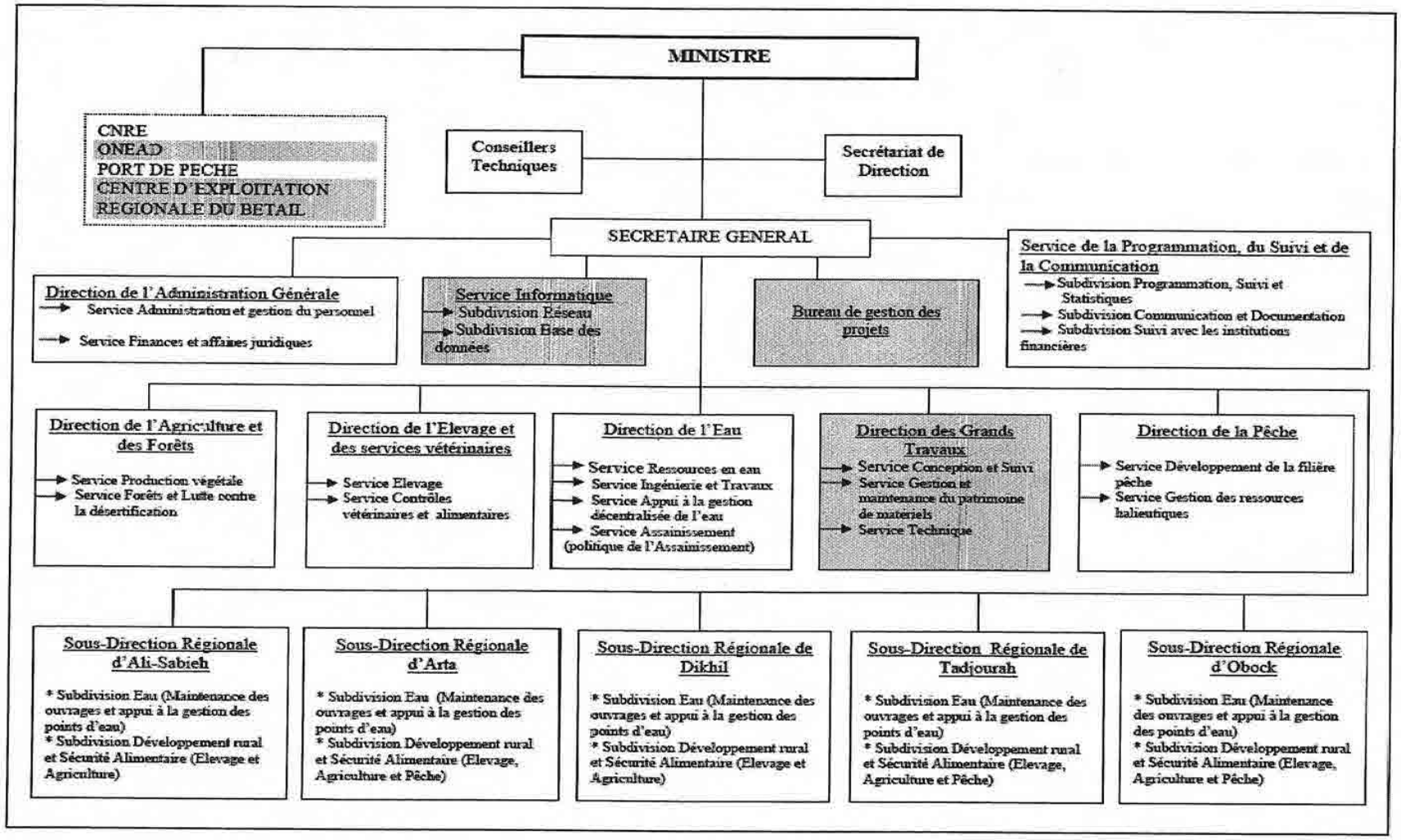
(End of Document)

Annexes

1. Project Site Map
2. Organization Chart
3. Items requested by the Government of Djibouti
4. Japan's Grant Aid
5. Major Undertakings to be taken by Each Government
6. Study Items of the Survey



Annex-1 Project Sites



Annex-2 Organization Chart

A4-32

Annex-3 Items requested by the Government of Djibouti

Requested Components

No.	Component	Specification
1	**Construction of 21 groundwater supply facilities in 18 villages** (groundwater supply facilities include the below)	
(1)	Well	
(2)	water supply facility (including solar cells, electric pumps, tanks, public taps and water tracks)	
2	**Procurement of equipment and materials**	
	➢ Related equipments and materials for well drilling	
	➢ Scientific survey equipment	
3	**Soft Component**	
	➢ Technical guidance for Electric-geophysical equipment	
	➢ Technical guidance for Borehole Logging	
	➢	

Requested villages for Construction of Groundwater Supply Facilities

Region	Village	Zone	
DIKHIL	YOBOKI	(1) UNDA YAGGOURI	2 wells
	HANLE	(2) GAALI HATAYATA	1 well
	MOULOUD	(3) BLAN BALE	1 well
	AS-EYLA	(4) KOUTA BOUYA	1 well
	AS-EYLA	(5) ZINA MALE	1 well
	AS-EYLA	(6) DIKSA DERE	1 well
	YOBOKI	(7) DAGUIRO	1 well
ALI-SABIEH	HAMBOUCTA	(8) HAMBOUCTA	1 well
	GUELILE	(9) GUELILE	1 well
	MIDGAN	(10) MIDGAN	1 well
	HOL-HOL	(11) DIGRI	1 well
	ASSAMO	(12) ASSAMO	2 wells
	DOUSSAGOUD MOUNE	(13) DOUSSAGOUD MOUNE	2 wells
	ALI-ADDE	(14) ALI-ADDE	1 well
ARTA	ALI FAREN	(15) HILBAHEY	1 well
	PETIT BARA	(16) PETIT BARA	1 well
	OUEA	(17) PK30	1 well
	OUEA	(18) OUEA	1 well

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.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of a 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

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By 8.19

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.

(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.

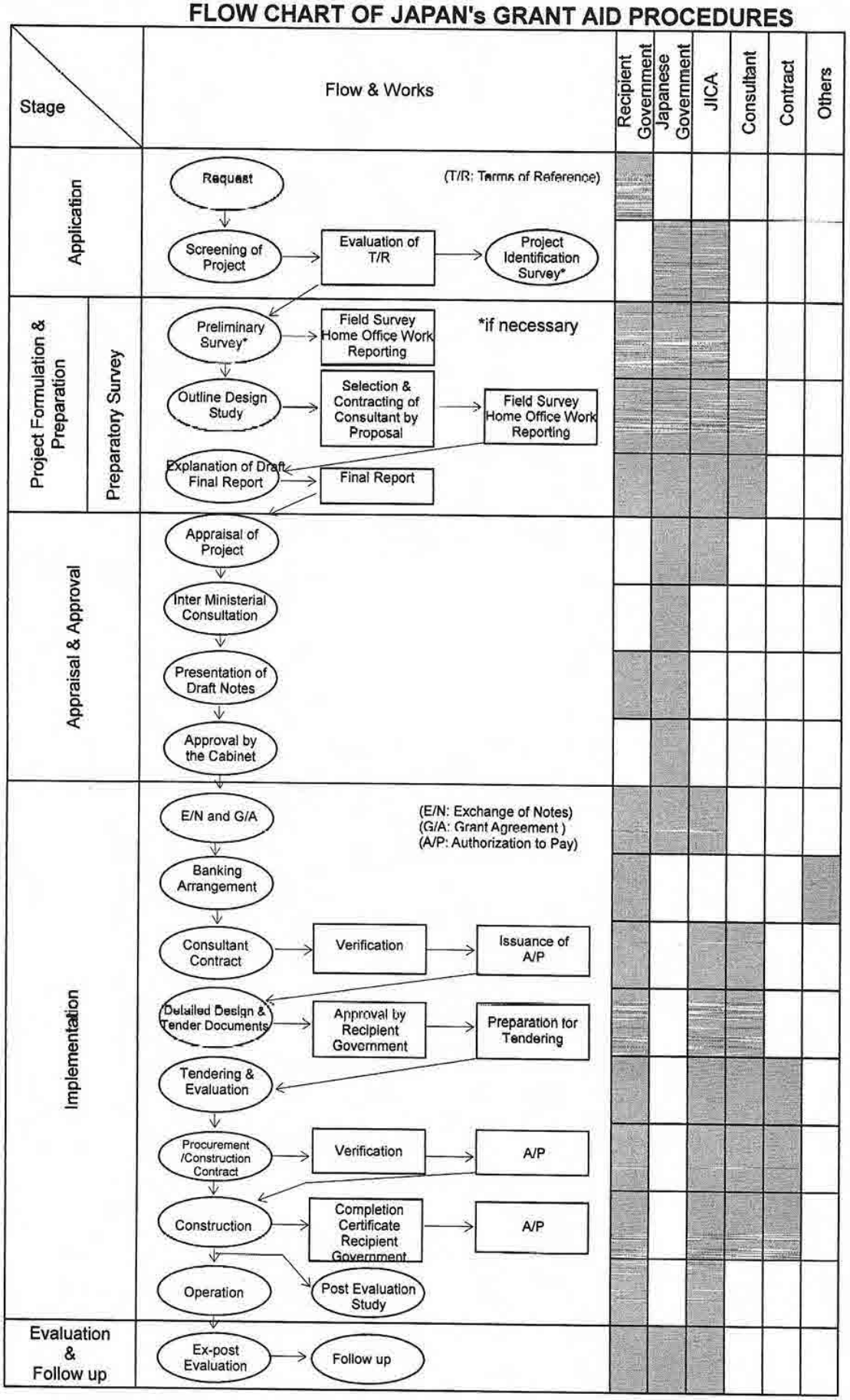
(9) Authorization to Pay (A/P)

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.

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



Annex-5

Major Undertakings to be taken by Each Government
(architecture)

No	Items	To be covered by Grant Aid	To be covered by Recipient side
1	To secure land [a lot] /[lots] of land necessary for the implementation of the Project and to clear the [site]/[sites];		•
2	To construct the following facilities		
	1) The building	•	
	2) The gates and fences in and around the site		•
	3) The parking lot	•	
	4) The road within the site	•	
	5) The road outside the site		•
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the [site]/[sites]		
	1) Electricity		
	a. The distributing line to the site		•
	b. The drop wiring and internal wiring within the site	•	
	c. The main circuit breaker and transformer	•	
	2) Water Supply		
	a. The city water distribution main to the site		•
	b. The supply system within the site (receiving and/or elevated tanks)	•	
	3) Drainage		
	a. The city drainage main (for storm, sewer and others to the site)		•
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	•	
	4) Gas Supply		
	a. The city gas main to the site		•
	b. The gas supply system within the site	•	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame / panel (MDF) of the building		•
	b. The MDF and the extension after the frame / panel	•	
	6) Furniture and Equipment		
	a. General furniture		•
	b. Project equipment	•	
4	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	(•)	(•)
5	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] / [be borne by the Authority without using the Grant]		•
6	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		•
7	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		•
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		•
9	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		•
10	To give due environmental and social consideration in the implementation of the Project.		•

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

Annex 6 Study Items of the Survey

Survey Items		Contents	Remark	Request Items form Survey Team
1	Data Collection	- Questionnaire - Interview	- Confirmation of the request background - Collection of data covering whole study items	- Answer for questionnaire as soon as possible. - Assistance and recommendation for the data and information collection -Make appointment with the related institute and other donors
2	Geophysical survey (electrical survey) for selection of the drilling point	Vertical survey 13 site	3 points per site	- Provision of the room for tender opening - Borrow aero photo of covering target village - Accompaniment of the counterpart for the geophysical survey and test well drilling (1/30 ~ 4/7)
		Two dimension survey 8 points	1 survey per site	
3	Test well drilling Confirmation of yield, water quality and geology	8 test wells (6 inches) Average of the drilling depth:150m	Tender opening Jan. 25 . Expected date of the start drilling : Feb. 10	
4	Water quality survey Density and distribution of As, F and Salinity	Groundwater sampling and water quality analysis	32 from existing wells 8 from JICA test wells Total 40 samples	- Introduction of the laboratory which is authorized by the government - Confirmation of ledger of the wells, and selection of the well for water quality sampling - Accompaniment of the counterpart for the groundwater sampling (Feb. 6 to 18)
5	Water supply system planning	Survey for site condition Condition survey for existing water supply system	Elevated Tank, Transmission Pipe, electricity	- Introduction of existing water supply system and accompaniment to the facilities - Accompaniment of the counterpart to the candidate site of the water supply system construction (2/20 to 3/4)
6	Social condition survey Demand, capability of the O/M, review of the implementation system	Hearing survey by the questionnaire	18 villages	- The discussion about the examination method (Item of the questionnaire and so on) - Accompaniment of the counterpart to the questionnaire survey (2/20 to 3/11)
7	Project cost estimation	- Unit price survey - Procurement condition survey (procurement plan) - Site condition survey (construction plan)	- Estimation from three firms - Access condition to the site - Land condition for Pipeline	- Introduction of supplier and constructor and make an appointment - Accompaniment of the counterpart to the site survey (13 au 25 mars) - Confirmation of the equipment related with the drilling
8	Selection of the candidate site	- Make criteria of the selection condition.	- Well yield, water quality, demand (benefit population) access, possibility of the O/M	- Discussion of the alternative villages (It will select from high priority order of southern three district in the list of 95 villages)
9	Planning of the O/M	- Confirmation of the existing facilities	- consideration of technical and economical situation - Number of the stuff	- Introduction of the Existing method and plan of the O/M and visit the site where the O/M going well

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE RURAL WATER SUPPLY PROJECT IN SOUTHERN DJIBOUTI
IN
THE REPUBLIC OF DJIBOUTI
(Explanation of Draft Outline Design)

In Janurary 2010, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team on the Rural Water Supply Project in Southern Djibouti (hereinafter referred to as "the Project") to the Republic of Djibouti(hereinafter referred to as "Djibouti"), and through discussion, field survey, and technical examination of the results of the survey in Japan, JICA prepared a Draft Outline Design of the Survey.

In order to explain and to consult with the Government of Djibouti on the components of the Draft Outline Design, JICA sent to Djibouti the Draft Outline Design Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Ryuichi KATO, Senior Advisor to the Director General, Africa Department, JICA, from 28th of November to 2nd of December, 2010.

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

Djibouti, December 2, 2010

Mr. Ryuichi KATO
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Mr. Idrise ABDOU ALI
Secretary General,
Ministry of Agriculture, Livestock and Fisheries in Charge of Water Resources
The Republic of Djibouti

Mr. Badri ALI BOGOREH
Secretary General,
Ministry of Foreign Affaires and International Cooperation,
The Republic of Djibouti

ATTACHMENT

1. Components of the Draft Final Report

The Djibouti side agreed and accepted in principle the components of the Draft Outline Design explained by the Team except for the following items. The items should be resolved before further consideration of implementing grant aid.

1-1 Construction of Test Boreholes

The Djibouti side mentioned concerns for the sustainability (quality) of test boreholes constructed by the JICA Team.

The JICA Team mentioned that the successful test boreholes have been constructed properly and the successful test boreholes will be used as production boreholes.

1-2 Water Quality Standards

The JICA Team explained that out of the 8 candidate sites, the groundwater of AssaKoma contained Fluoride, and that of ZinaMale contained Nitrate. Both exceed the standards of WHO Drinking Water Guidelines and may give negative effect to health. JICA explained that both sites should not be included in the Project.

The Djibouti side explained that taking into account the specific natural and social conditions in Djibouti, the JICA Team should be practical and mitigate the standards, especially in AssaKoma, where the groundwater potential is high. Such boreholes can be used for agriculture.

JICA Team mentioned that it has no choice but to refer to WHO Guidelines if Djibouti's Standards does not exist.

1-3 Request for Additional Materials and Equipment

The Djibouti side insisted on including borehole building materials and logging machine in the Project, because the materials are essential for Djibouti for further construction of boreholes.

The Djibouti side has elaborated a proposal in accordance with "the 3 year plan" and asked the JICA Team to accept this proposal as request for additional borehole building materials in the framework of the Project. The Djibouti side also committed to present to the JICA Team within ten days the additional documents and information necessary for evaluation of the materials.

1-4 PK 30

The JICA Team explained that the yield of the test borehole in PK30 is low, only to provide 2/3 of the projected demand.

The Djibouti side insisted that because PK30 is an area which has high groundwater potential, the Djibouti side will construct boreholes at its own expense. The Djibouti side also proposed to the JICA Team to include construction of water supply facilities of the borehole constructed by Djibouti side in the Project.

The JICA Team explained that it is not possible to do so under the present schedule.

2. Japan's Grant Aid scheme

The Djibouti side understood the Japan's Grant Aid Scheme and would take the necessary measures and allocate necessary budget properly for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented. The Grant Aid Scheme and necessary measures were described in the Annex 4 and Annex 5 of the Minutes of Discussions signed by both sides on 24th January, 2010.

3. Responsible and Implementing Agency

3-1.The Responsible Agency is Ministry of Agriculture, Livestock and Fisheries in Charge of Water Resources (hereinafter referred to as "MAEM-RH").

3-2. The implementing organization is Department of Water, MAEM-RH.

4. Other Relevant Issues

4-1. Project Cost Estimate

The Team explained to the Djibouti side the project cost estimate as attached in Annex 1. Both sides confirmed that these cost estimates include some sites which may be deleted from the Project and that this cost estimate is provisional and would be examined further by the Government of Japan .

Furthermore, both sides confirmed that this project cost estimate should never be duplicated in any form nor released to any other party(s) until the relevant contracts are awarded by MAEM-RH. This embargo is for securing fairness of tender procedure.

4-2. Budget arrangement for operation and maintenance of the water supply facilities

The Team explained the estimated cost for management, operation and maintenance of water supply facilities as described in Annex-2 and requested the Djibouti side to allocate necessary budget if the grant is implemented. These cost estimates include some sites which may be deleted from the Project.

The Team explained that if the village consumers cannot afford the maintenance costs, MAEM-RH shall compensate.

4-3. Undertakings of the Djibouti side

In addition to the above undertakings, the Team requested the Djibouti side to carry out followings if the grant is implemented. The Djibouti side agreed to take necessary measures.

a) Abide by major undertakings of the Government of Djibouti regarding Japan's general grant aid scheme.
b) Arrange and pay for counterpart personnel and its activities, including travel allowances
c) Construct fences or other kinds of protection for the water supply facilities, including housing for security personnel.
d) Improve / maintain access roads to construction sites
e) Obtain related licenses and permits
f) Facilitate customs clearance for imported equipment and materials
g) Secure lands for site office, base camp and stockyard for Japanese contractor and consultant

4-4. Capacity Development

Both sides concurred on the necessity of a technical assistance program so-called

"Soft Component Program" in the Project and confirmed the contents of Soft Component Program as follows:

- Capacity enhancement of operation and maintenance skills
- Capacity enhancement of water resources exploration

The Djibouti side committed to deploy counterpart personnel at its cost to implement the Soft Component Program and bear their local cost if the grant is implemented..

4-5. Project Sites

The Projects Sites will be the below.
[Sek Sabir, Mindil, Afka Arraba, Sabbalou, Hamboucta]
PK30, ZinaMale and AssaKoma are under consideration

4-6. Utilization of boreholes

a) The Djibouti side insisted on utilizing the groundwater for agricultural and livestock use, but both sides finally agreed that the Project's main objective is development of drinking water and only surplus water will be used for agricultural and livestock use. JICA side warned that overuse of boreholes above its capacity may result in permanent decline of groundwater level, permanent deterioration of groundwater quality and shorten the lifespan of pumps.
b) All boreholes of test drilling have been sealed. The Djibouti side will be responsible for maintaining the successful test boreholes. Any vandalized boreholes at the timing of the detailed design will be out of the scope of the Project.
c) Any activity regarding construction of boreholes or construction of water supply facilities around the Project sites will be reported to JICA by Djibouti side.

4-7. Situation of Sabbalou and Sankal

a) The JICA Team explained that villagers in Sankal are using boreholes in Sabbalou for free because the existing boreholes in Sabbalou are maintained by MAEM-RH and not the villagers in Sabbalou. JICA is planning to construct a borehole in Sabbalou for Sankal villagers, and insisted that it should also be maintained by MAEM-RH.
b) Apart from Annex 2 table C, the Djibouti Side understood the situation and promised to arrange for operation and maintenance of the new Sabbalou borehole to be constructed in the Project.
c) Taking into account the situation in Sankal, the Djibouti side insisted on necessity of transportation of water between Sabbalou and Sankal for water supply to Sankal. The JICA Team answered that provision of additional facilities and equipment in the Project, for transportation of water has been accessed as technically and economically difficult.

4-8. Provision of Spare Parts

The Djibouti side insisted for provision of 10 years worth of spare parts due to severe natural and fiscal conditions in Djibouti. The JICA Team explained that it will only be procured if the Djibouti side provides proper storage space and proper management. The Djibouti side promised to provide the above.

4-9. Further Initiatives by Djibouti

The Djibouti side will provide hospitals and schools for project sites.

End

Annex-1 : Project Cost Estimates
Annex-2 : Annual Costs

Confidential

Annex-1: Project Cost Estimates

Note: These estimates include some sites which may be deleted from the Project.

Table-A. Cost borne by the Government of Japan

Unit: Million yen

Items	Cost
Facilities	tbd
Machinery and materials	tbd
Soft Component	tbd
Construction supervision	tbd
Total	tbd

tbd: to be decided

Table-B. Costs borne by the Government of Djibouti

Items	Cost (million yen)	Cost (million DJF)
Construction of Fencing	7.5	14.4
Construction of Access Roads	0.6	1.2
C/P costs	3.1	5.9
Banking Arrangements	0.4	0.73
Total	11.6	22.2

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE RURAL WATER SUPPLY PROJECT IN SOUTHERN DJIBOUTI
IN
THE REPUBLIC OF DJIBOUTI
(Explanation of Draft Outline Design 2)

In Janurary 2010, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team on the Rural Water Supply Project in Southern Djibouti (hereinafter referred to as "the Project") to the Republic of Djibouti(hereinafter referred to as "Djibouti"), and through discussion, field survey, and technical examination of the results of the survey in Japan, and discussions of the original Draft Outline Design, JICA prepared a revised Draft Outline Design of the Survey.

In order to explain and to consult with the Government of Djibouti on the components of the revised Draft Outline Design, JICA sent to Djibouti the Draft Outline Design Explanation Team 2(hereinafter referred to as "the Team"), which is headed by Ms. Keiko SANO, Director, Africa Division 2, Africa Department, JICA, from 8th of January to 13th of January, 2011.

As a result of discussions, both sides confirmed the main contents described on the attached sheets.

Djibouti, January 11th, 2011

Ms. Keiko SANO
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Mr. Idriss ABDOU ALI
Secretary General,
Ministry of Agriculture, Livestock and Fisheries in Charge of Water Resources
The Republic of Djibouti

Mr. Mohamed Ali Hassan
For Secretary General
Ministry of Foreign Affaires and International Cooperation,
The Republic of Djibouti

ATTACHMENT

1. Components of the Draft Final Report

The Djibouti side agreed the components of the revised Draft Outline Design explained by the Team.

2. Japan's Grant Aid scheme

The Djibouti side understood the Japan's Grant Aid Scheme and would take the necessary measures and allocate necessary budget properly for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented. The Grant Aid Scheme and necessary measures were described in the Annex 4 and Annex 5 of the Minutes of Discussions signed by both sides on 24th January, 2010.

3. Responsible and Implementing Agency

3-1.The Responsible Agency is Ministry of Agriculture, Livestock and Fisheries in Charge of Water Resources (hereinafter referred to as "MAEM-RH").
3-2. The implementing organization is Department of Water, MAEM-RH.

4. Other Relevant Issues

4-1. Project Cost Estimate

The Team explained to the Djibouti side the project cost estimate as attached in Annex 1. Both sides confirmed that this cost estimate is provisional and would be examined further by the Government of Japan .

Furthermore, both sides confirmed that this project cost estimate should never be duplicated in any form nor released to any other party(s) until the relevant contracts are awarded by MAEM-RH. This embargo is for securing fairness of tender procedure.

4-2. Budget arrangement for operation and maintenance of the water supply facilities

The Team explained the estimated cost for management, operation and maintenance of water supply facilities as described in Annex-2 and requested the Djibouti side to allocate necessary budget if the grant is implemented.

The Team explained that if the village consumers cannot afford or fail to pay for the maintenance costs, MAEM-RH shall compensate. The Djibouti side agreed it.

4-3. Undertakings of the Djibouti side

In addition to the above undertakings, the Team requested the Djibouti side to carry out followings if the grant is implemented. The Djibouti side agreed to take necessary measures.

a) Abide by major undertakings of the Government of Djibouti regarding Japan's general grant aid scheme.
b) Arrange and pay for counterpart personnel and its activities, including travel allowances
c) Construct fences or other kinds of protection for the water supply facilities, including housing for security personnel.
d) Improve / maintain access roads to construction sites
e) Obtain related licenses and permits

f) Facilitate customs clearance for imported equipment and materials
g) Secure lands for site office, base camp and stockyard for Japanese contractor and consultant

4-4. Capacity Development

Both sides concurred on the necessity of a technical assistance program so-called "Soft Component Program" in the Project and confirmed the contents of Soft Component Program as follows:

- Capacity enhancement of operation and maintenance skills
- Capacity enhancement of water resources exploration

The Djibouti side committed to deploy counterpart personnel at its cost to implement the Soft Component Program and bear their local cost if the grant is implemented.

4-5. Project Sites

The Projects Sites will be the below.
[Sabbalou, Zina Male(*), Daguiro(*), Sek Sabir, Assa Koma(*), Mindil, Afka Arraba, Hamboucta, Midgarra(*)]

4-6. Water Quality of Some Project Sites

a) The Team stated that the groundwater in Project Sites with (*) marks contain Flouride or Nitrate above the WHO Guideline levels and may be hazardous to the health of village consumers.
b) The Djibouti side understood the risks explained by the Team, but insisted that the Project Sites with (*) marks be included in the Project.
c) The Team explained that it will include the Project Sites with (*) marks under the below conditions. The Djibouti Side understood the explanation and promised to cooperate.
   - Plates will be installed on each tap to warn that the water is not suitable for drinking. The water should be used for domestic use.
   - The MAEM-RH will regularly inform the inhabitants of the Project Sites with (*) marks that the water of the borehole is not suitable for drinking.
   - The MAEM-RH will be responsible for the operation and maintenance of the water supply facilities of the Project Sites with (*) marks.
   - Whatever risk that occur from the water quality of the Project Sites with (*) marks will be resolved by Djibouti Side.

4-7. Procurement of Borehole Building Materials

a) The Djibouti side explained that the borehole building materials will be stored in the warehouse in the headquarters of MAEM-RH. Procured machinery will also be stored in the warehouse in the headquarters of MAEM-RH.
b) When utilizing the above materials, the Djibouti side will only construct boreholes in the Southern Area of Djibouti. The Djibouti side will allocate necessary budget for construction of water supply facilities of the successful boreholes.
c) The Djibouti side will prepare a borehole construction plan for the above materials and submit it to JICA Djibouti. The Djibouti side will report to JICA Djibouti of the progress of the borehole construction every 6 months.

4-8. Utilization of boreholes

a) The Djibouti side insisted on utilizing the groundwater for agricultural and livestock

use, but both sides finally agreed that the Project's main objective is development of drinking water and only surplus water will be used for agricultural and livestock use. JICA side warned that overuse of boreholes above its capacity may result in permanent decline of groundwater level, permanent deterioration of groundwater quality and shorten the lifespan of pumps.

b) All boreholes of test drilling have been sealed. The Djibouti side will be responsible for maintaining the successful test boreholes. Any vandalized boreholes at the timing of the detailed design will be out of the scope of the Project.

c) Any activity regarding construction of boreholes or construction of water supply facilities around the Project sites will be reported to JICA by Djibouti side.

4-9. Situation of Sabbalou and Sankal

a) The JICA Team explained that villagers in Sankal are using boreholes in Sabbalou for free because the existing boreholes in Sabbalou are maintained by MAEM-RH and not the villagers in Sabbalou. JICA is planning to construct a borehole in Sabbalou for Sankal villagers, and insisted that it should also be maintained by MAEM-RH.

b) The Djibouti side will engage to arrange for operation and maintenance of the new Sabbalou borehole to be constructed in the Project.

c) Taking into account the situation in Sankal, the Djibouti side insisted on necessity of transportation of water between Sabbalou and Sankal for water supply to Sankal. The JICA Team answered that provision of additional facilities and equipment in the Project, for transportation of water has been accessed as technically and economically difficult.

4-10. Provision of Spare Parts

The Djibouti side insisted for provision of 10 years worth of spare parts due to severe natural and fiscal conditions in Djibouti. The JICA Team explained that it will only be procured if the Djibouti side provides proper storage space and proper management. The Djibouti side promised to provide the above.

4-11. Concerns of the Djibouti Side

The Djibouti side explained its concerns as mentioned below.

- The solar pumps should be AC instead of DC.
- Batteries should be included.
- Installation of batteries and hybrid system which includes both generators and solar panels should be applied.
- The reservoir tanks should be made from concrete and blocks instead of FRP.
- The capacity of the reservoir tanks should be increased.
- The numbers of boreholes to be constructed by the Djibouti side utilizing the equipment procured by the Project should be increased.
- The parameters of the well logging equipment should be increased.
- The depth of water level measurement instruments should be more than 300 meters.

4-12. Further Initiatives by Djibouti

The Djibouti side will provide hospitals and schools in the project sites.

4-13. Northern Regions

The Djibouti side insisted the necessity of a similar project for the northern regions of Djibouti, because of the frequent draught and severe water supply conditions. The

Djibouti side will submit an official request of a project for the northern region through diplomatic channels. The Team mentioned that the successful implementation of the Project is essential for consideration of a project in the northern region.

End

Annex-1 : Project Cost Estimates
Annex-2 : Annual Costs

Confidential

Annex-1: Project Cost Estimates

Table-A. Cost borne by the Government of Japan

Items	Cost(million yen)
Facilities	233.9
Machinery and materials	159.8
Soft Component	19.4
Construction supervision	85.5
Total	498.6

Table-B. Costs borne by the Government of Djibouti at Construction Stage

Items	Cost(million DJF)
Construction of Fencing	16.2
Construction of Access Roads	1.2
C/P costs	5.1
Banking Arrangements	1.0
Total	23.5

Annex-2:Annual Costs

Table-C. Annual Costs to be borne by Government of Djibouti

Items	Cost(million DJF/year)
Fuel of the Car	0.04
C/P costs	0.16
Security	1.80
O/M of facilities of 5 villages**	0.10
Total	2.10

**: 5 villages include Sabbalou, Zina Male, Daguiro, Assa Koma, Midgarra

Table-D. Annual Costs to be borne by Village Committee(4 villages***)

Items	Cost(thousand DJF)
Spare Parts	48.0
Security Guard + Valve operation	240.0
Sundry Expenses	4.0
Total	292.0

***: 4 villages include Sek Sabir, Mindil, Afka Arraba, Hamboucta

Table-E. Costs borne by the Government of Djibouti to construct boreholes****

Items	Cost (million DJF/year)
Mobilization/Demobilization	1.0
Drilling	8.0
C/P costs	9.0
Total	18.0

****: The costs are for construction of 10 boreholes. Total of 20 boreholes will be constructed by Djibouti side. Construction cost of water supply facility is not included.