CHAPITER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

2-1-1 Overall Goal and Project Objective

The target sites requested by the Government of the Gambia in 2001 consisted of 30 villages in NBD, LRD and CRD covering some 55,000 population (the design population for 2015). Field surveys conducted in the basic design study in 2003 found that 7 sites out of 20 for construction of new piped water supply schemes were already been included in water supply projects funded by other donors. In view of this fact, other 7 sites were selected in NBD, WD, LRD and CRD instead of these overlapping sites. Meanwhile, one site out of 10 with the existing piped water schemes constructed in the previous grant aid project was deleted from the requested sites since the pumping system had already been converted from the diesel generator to the solar-powered one by another donor. In summary, construction of new water supply facilities and conversion of the pumping system of the existing water schemes are to be implemented in 29 villages in 4 Divisions.

At present, residents in these villages are inaccessible to stable and safe water supply, which worsens the incidence of water borne/related diseases due to an unhygienic environment. Also, women and children are burdened daily by fetching water in terms of time taken and severe labour. Therefore, the project aims to achieve provision of stable and safe water supply for the 80,000 population[1] in the underprivileged living conditions. As the overall goals of the project, it is expected that provision of safe and stable water supply from the constructed water supply facilities in the project will produce outputs such as increase of coverage of reliable water supply, improvement of hygiene and living conditions, reduction in water borne/related diseases, and mitigation of heavy burden of water fetching.

The indicators and means of verification to measure the impact of the project are elaborated as described in Table 2-1 Logical Framework of the Project. Key indicators and their means of verification are as follows.

[1] Estimated population at the target year of 2015

(Project Objective)

The community members at the target sites can use safe water in a sustainable manner.

Indicators	Means of Verification
1) The water quality at all target sites meets the Gambian/WHO standard for drinking water throughout the year.	Water quality analyses results
2) 35 lit/person/day of water is supplied from the constructed water supply facilities at all target sites throughout the year.	Operation records, Interviews with local residents
3) The constructed water supply facilities are operational throughout the year.	Operation records

Output 1

Water supply facilities are constructed at all target sites that meet the criteria both in water quality and quantity.

Indicators	Means of Verification
1) New water supply facilities are constructed at 20 target sites by 2008.	Project completion report
2) Solar pumping systems are installed at the existing water supply facilities owned by 9 target sites by 2008.	Project completion report
3) Quality and served quantity of water from the constructed facilities meets the design criteria of the project.	Water quality analyses results, Project completion report

Output 2

The community-based management system of the constructed water supply facilities is established at the target sites.

Indicators	Means of Verification
1) The operation and maintenance costs of the constructed facilities are covered by water fees paid by the users.	Accounting records of VWCs
2) All target villages conclude maintenance contracts with local private service provider and declaration of commitment with DWR.	Maintenance contracts between the villages and private service providers, Declaration of commitment by the villages

Table2-1 Logical Framework of the Project (Project Design Matrix: PDM)

Project Title: Rural Water Supply Project | Target Area: 29 villages in 4 Divisions | Ver. 2.0
Target Group: Residents of target 29 villages (approx. 80,000) | Project Period: July, 2004～March, 2008 | Edited: October, 2003

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumptions
Overall Goal ☐ Health and hygiene conditions of the target group are improved. ☐ Time and labour inputs for water fetching decrease, especially for women and children.	☐ Incidence of water borne/related diseases at the target sites decrease. ☐ Water fetching hours decrease at the target sites compared with before the project.	☐ Interview ☐ Interview	
Project Objective The community members at the target sites can use safe water in a sustainable manner.	☐ The water quality at all target sites meets the Gambian/WHO standard for drinking water throughout the year. ☐ 35 lit/person/day of water is supplied from the constructed water supply facilities at all target sites throughout the year. ☐ The constructed are operational throughout the year.	☐ Water quality analyses results ☐ Operation records, interviews with residents ☐ Operation records	☐ The established operation and maintenance system will be maintained by DWR. ☐ Provision of the primary health care services in the target area will be improved. ☐ The Gambian side will continue hygiene education and activities to improve environmental sanitation.
Outputs 1. Water supply facilities are constructed at all target sites that meet the criteria both in water quality and quantity. Outputs to be Realized through Software-Component 2.The community-based operation and maintenance system of the constructed water supply facilities is established at the target sites. 3. The community members firmly understand importance and ways of safe and efficient use of water from the constructed facilities. 4. Monitoring and supervisorysystem of operation and maintenance activities conducted by the VWCs and the private service providers are reinforced at the public sector, i.e. DWR and local authorities.	1-1 New water supply facilities are constructed at 20 target sites by 2008. 1-2 Solar pumping systems are installed at the existing water supply facilities owned by 9 target sites by 2008. 1-3 Quality and served quantity of water from the constructed facilities meets the design criteria of the project. 2-1 VWC members at all target sites complete training on daily operation and maintenance of the facilities. 2-2 VWCs at all target sites produce operation plans of the water facilities including internal regulations and financial report. 2-3 All target villages conclude maintenance contracts with a private service provider and declaration of commitment with DWR. 2-4 Operation and maintenance costs are covered by water fees paid by the users. 3-1 Compared with before the project, water usage from unhygienic water sources decreases. 3-2 Compared with before the project, differential usage of water sources are practiced depending on purposes. 3-3 Compared with before the project, practice of appropriate hygiene behaviour of the residents increase in terms of water source protection, proper treatment of drinking water and hand washing. 4-1 Effectiveness of capacity building activities, collection and payment of operation and maintenance fund and measures taken at breakdowns of the facilities are monitored and records are compiled by DWR and the local authorities.	1-1 Project completion report 1-2 Project completion report 1-3 Water quality analyses results, Project completion report 2-1 Progress report of activities 2-2 VWC regulations, action plan 2-3 Maintenance contracts between the villages and service provider, Declaration of commitment by the villages 2-4 Accounting record of VWCs 3-1 Progress report of activities 3-2 Progress report of activities, Rules of water use in each village 3-3 Progress report of activities 4-1 Monitoring report, Water supply facility inventory	☐ Groundwater potential does not aggravate. ☐ The water quality from the sources does not deteriorate. ☐ Population of the target sites does not fluctuate too sudden. ☐ Socio-economic conditions at target sites do not aggravate. ☐ Private enterprises continue maintenance services.

Activities

【Facilities construction/ Equipment procurement】

1-1. to construct new water supply facilities with solar pumping system at target 20 sites.
1-2. to convert the existing pumping system to solar powered one at target 9 sites which water facilities were constructed in the previous grant aid project.
1-3. to procure supporting vehicles for construction works and equipment for operation and maintenance.

【Support for Capacity Building on O&M】(Software-component)

2-1. to form an agreement for operation and maintenance system of solar powered water supply facilities among DWR and local authorities.
2-2. to facilitate understanding on roles and responsibilities of each stakeholder in operation and maintenance among the target group.
2-3. to form/ reorganise VWCs and conduct training of the committee members for capacity building.
2-4. to facilitate conclusion of maintenance contracts between VWCs and service provider as well as declaration of commitment by VWCs to DWR.
3-1. to train community health workers at the target sites on participatory hygiene education.
3-2. to conduct participatory hygiene education programme at the target sites.
4-1. to advise to DWR and the local authorities on formulation of a monitoring and evaluation plan and its implementation to monitor capacity building activities, execution of obligations of the communities and the service providers for operation and maintenance, and impact brought from the interventions.

Inputs

【Japanese Side】

Human resources:
Basic design study team, Detailed design study team, Consultant team for supervision of the project implementation, Contractor for construction works and procurement of equipment

Equipment:
Supporting vehicles for construction works, Motorbikes, Computer

Fund:
Grant aid for procurement of equipment, construction of water facilities, support for establishment of O&M system and supervision of the project implementation

【The Gambian Side】

Human resources:
Counterpart personnel, Drilling team, Motivators

Equipment:
Drilling rig and related equipment

Fund:
Counterpart fund for personnel involved from the Gambian side and other operational costs

Trained personnel (operator, VWC members, community health workers) continue activities.

Precondition

Import and custom clearance do not delay significantly.

The target communities have willingness to be responsible for operate and maintain water supply facilities.

Groundwater is secured at target sites that is adequate in quantity and quality.

2-1-2 Outline of the Project

As a result of discussions with the executing agency, field surveys and analyses of survey results, the contents of the project are formulated as outlined in Table 2-2. A list of the target sites of the project is also shown in Table 2-3.

Table 2-2 Outline of the Project

1. Facilities	1) Construction of piped water supply facilities with solar pumping system	20 sites
	2) Conversion of diesel generator to solar pumping system of the existing water supply facilities constructed in the previous grant aid project	9 sites
2. Equipment	1) Procurement of supporting vehicles for construction works • Pick-up truck • 4WD station wagon 2) Procurement of equipment for operation and maintenance • Motorbike • Computer	 2 units 1 unit 8 units 1 set
3. Training	1) Support for strengthening operation and maintenance system (Software-component programme) • Community mobilisation/ sensitisation • Hygiene education • Capacity building of human resources for operation and maintenance • Facilitation of maintenance contract conclusions	
	2) Groundwater development (On the Job Training: OJT) • Borehole drilling technologies • Geophysical survey technologies • Monitoring of groundwater development • Repair and maintenance of drilling equipment	

Table 2-3 List of the Project Sites

1. Construction of new water supply facilities with solar pumping system (20 sites)	
Target Sites	Division
1. Medina Sering Mass	NBD
2. Tuba Kolong	NBD
3. Nawleru	NBD
4. Dumbutu	LRD
5. Jali	LRD
6. Nema	LRD
7. Massembe	LRD
8. Pakali Ba	LRD
9. Wellingara Ba	LRD
10. Sukuta	CRD (North)
11. Nianija Bakadagy	CRD (North)
12. Sami Pachonki	CRD (North)
13. Dankunku	CRD (South)
14. Piniai	CRD (South)
15. Saruja	CRD (South)
16. Galleh Manda	CRD (South)
17. Sambang Complex	CRD (South)
18. Jahally	CRD (South)
19. Sohm	WD
20. Sutusinjang	WD

2. Conversion of diesel generator to solar pumping system of the existing water supply facilities constructed in the previous grant aid project (9 sites)	
Target sites	Division
1. Fass Omar Sahor	NBD
2. Katchang	NBD
3. Njaba Kunda	NBD
4. Toniataba	LRD
5. Bureng	LRD
6. Baro Kunda	LRD
7. Mamut Fana	CRD (South)
8. Madina Umfally	CRD (South)
9. Brikama Ba	CRD (South)

NBD : North Bank Division (6 sites)
LRD : Lower River Division (9 sties)
CRD : Central River Division (12 sites)
WD : Western Division (2 sites)

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

This project aims to provide a stable supply of safe drinking water to 29 sites in 4 Divisions of the Gambia where rural residents are having difficulties in securing reliable water supply. In the project, groundwater will be development as water source for the new piped water supply schemes with solar pumping system. Also, pumping system of the existing water supply facilities constructed in the previous grant aid project will be converted from diesel generator to the solar-powered one. Equipment and materials necessary for construction of the facilities as well as operation and maintenance will be procured. Further, to support users to properly manage, operate and maintain the water supply facilities, a software-component programme will be implemented. The design policy of the project is as follows.

2-2-1-1 Basic Policy

(1) Scope of Cooperation

1) In order to effectively use the limited budget of the grant aid assistance, the requested 29 sites in 4 Divisions will undergo a screening process in accordance with the selection criteria of the project sites.
2) Feasibility on application of solar pumping system in the project will be examined with consideration of Japan's grant aid policy, comparison with diesel engine-powered system, and operation and maintenance system of the beneficiaries.

3) Concerning procurement of equipment, since a follow-up study was conducted to purchase spare parts of existing drilling equipment owned by DWR and to repair it, procurement of these materials will not be included in this project. Meanwhile, a minimum supply of support vehicles for construction works, motorbikes and computer for operation and maintenance activities will be included.

4) In the Gambia, the beneficiary communities are supposed to bear primary responsibility of operation and maintenance of water supply facilities in rural areas. In this project, a software-component programme will be executed to support community mobilisation/ sensitisation and hygiene education as well as strengthening the operation and maintenance system of the constructed water supply facilities.

(2) Site Selection

1) Sites for Construction of New Water Supply Facilities

As a result of discussions with the Gambian government, after replacing the sites duplicated with other donor projects, 20 villages were confirmed as the target sites of the basic design study for construction of new water supply facilities. Also, the following eight criteria were agreed with the Gambian side to select the project sites, as described in the Minutes of Discussions of August 2003 in Banjul. Table 2-4 shows the evaluation table for screening of the project sites for construction of new water supply facilities.

①Groundwater having sufficient yield and good quality can be secured.
②Access to the target site is not a problem.
③The target site does not have existing facilities capable of providing safe and stable water supply.
④The residents of the target site earnestly desire water supply facilities and willing to pay for the required operation and maintenance costs.
⑤The residents of the target site are willing to form a water committee and properly operate and maintain the facilities.
⑥Land necessary for construction of water supply facilities can be assured.
⑦Projects of other donors are not in duplication at the target site.
⑧Project cost effectiveness is proper.

As a result of the screening, since all 20 target sites satisfy the selection criteria, the project will cover these sites for construction of new water supply facilities.

Table 2-4 Evaluation Criteria

Table 2-4 Evaluation Table for Construction of New Water Supply Facilities in Accordance with Site Selection Criteria

Site No.	Village Name	Division	Population			① Development Potential of Water		② Accessibility*3	Existing Water Source used for Drinking				Water Source used for other than drinking	Problems of Present Water Supply System	③ Necessity for Water Facility	④ Willingness to Pay O&M Fee	⑤ Willingness to Form Committee	⑥ Land Availability	⑦ Duplication with Other Project	⑧ Cost Effectiveness	Overall Evaluation (Feasibility for Project)	DWR Priority
			1993 Census	2003 Forecast *1	2015 Forecast *2	Yield	Quality		Hand Dug Well	Open Concrete Lined Shallow Well	Shallow Well with Handpump	Borehole with Handpump										
N-9	Tuba Kolong	NBD	1,239	1,586	2,133	◎	◎	◎	10	1	2	—		Not enough good water. Long queue at water point.	◎	◎	◎	◎	◎	◎	Feasible	9
N-10	Medina Sering Mass	NBD	2,149	2,751	3,700	◎	◎	◎	—	3	1	—	Hand Dug Well	Long queue at water point. Not enough good water. Long distance to water source. Handpump frequently break. Water lowering of open well in dry season. Not enough water for livestock.	◎	◎	◎	◎	◎	◎	Feasible	1
N-11	Nawleru	NBD	530	678	912	◎	◎	◎	—	—	3	—	Hand Dug Well	Frquent breakdown of handpump. Water fetching is hard labour. Shallow well water lowering in dry season. Water insufficient for livestock.	◎	◎	◎	◎	◎	◎	Feasible	20
W-1	Sohm	WD	704	901	1,212	◎	◎	◎	—	2	3	—		Water in open well lowers in dry season. Water lowering in shallow well due to use for large scale farm. Distance to water facility to far.	◎	◎	◎	◎	◎	◎	Feasible	19
W-2	Sutusinjang	WD	980	1,254	1,687	◎	◎	◎	—	—	4	—		No. of users for one shallow well to large, so long waiting time. Use open well to save fetching time.	◎	◎	◎	◎	◎	◎	Feasible	14
L-1	Nema	LRD	1,060	1,357	1,825	◎	◎	◎	—	—	4	—	Hand Dug Well	No. of users per shallow well too large, so long waiting time (3 hrs/time). Not enough water for livestock.	◎	◎	◎	◎	◎	◎	Feasible	13
L-3	Dumbutu	LRD	749	959	1,289	◎	△	◎	—	—	3	—		Long distance to water source. Not enough usable water. Long time for water fetching.	◎	◎	◎	◎	◎	◎	Feasible	18
L-8	Jali	LRD	930	1,190	1,601	◎	◎	◎	—	—	2	—	Open Concrete Lined Shallow Well	Frequent breakdown of handpump. Water fetching is hard labour. Long distance to water source. Congestion at water point.	◎	◎	◎	◎	◎	◎	Feasible	15
L-9	Pakali Ba	LRD	1,088	1,393	1,873	◎	△	◎	1	—	2	—		Since one shallow well is the only safe water source, not enough water.	◎	◎	◎	◎	◎	◎	Feasible	12
L-10	Massembe	LRD	914	1,170	1,574	◎	◎	◎	—	—	2	—	Hand Dug Well	Long distance to water source. Frequent breakdown of handpump.	◎	◎	◎	◎	◎	◎	Feasible	16
L-11	Wellingara Ba	LRD	1,515	1,939	2,608	◎	◎	◎	7	—	5	—		No. of users per shallow well is too large, so water insufficient. Long time to fetch water.	◎	◎	◎	◎	◎	◎	Feasible	5
M-2	Piniai	CRD	1,231	1,576	2,119	◎	◎	◎	—	6	3	1		Water of shallow well with handpump (at school) has iron taste and odor. Long distance to water source. Congestion at water point. Not enough water for livestock.	◎	◎	◎	◎	◎	◎	Feasible	10
M-5	Saruja	CRD	1,536	1,966	2,644	◎	△	◎	—	—	3	—	Open Concrete Lined Shallow Well	Water quality of one shallow well with handpump deteriorates in rainy season to prevent drinking.	◎	◎	◎	◎	◎	◎	Feasible	4
M-6	Dankunku	CRD	1,516	1,941	2,610	◎	◎	◎	—	7	4	—		No. of users per shallow well with handpump is too large, so not enough water. Households far from shallow well with handpump must use open shallow welll.	◎	◎	◎	◎	◎	◎	Feasible	6
M-8	Sami Pachonki	CRD	2,000	2,560	3,443	◎	◎	◎	—	4	3	—		Water of shallow well lower in dry season. No. per shallow well with handpump too large, so long time to fetch water (must queue from 4-5 a.m.).	◎	◎	◎	◎	◎	◎	Feasible	2
M-9	Sukuta	CRD	1,109	1,420	1,909	◎	◎	◎	—	1	1	—		Spare parts for handpump difficult to procure (only at Banjul). Water fetching is hard labor. Long queue to fetch water.	◎	◎	◎	◎	◎	◎	Feasible	11
M-10	Galleh Manda	CRD	1,543	1,975	2,656	◎	◎	△	—	7		—		Water in 3 of 7 open shallow wells lower or dry up in dry seaon. Not enough water for livestock.	◎	◎	◎	◎	◎	◎	Feasible	3
M-11	Jakhally	CRD	1,406	1,800	2,421	◎	◎	◎	—	8	1	—		No. of users per shallow well with handpump is too large, so households far from this well rely on open shallow well.	◎	◎	◎	◎	◎	◎	Feasible	8
M-12	Nianija Bakadagy	CRD	859	1,100	1,479	◎	△	△	—	—	4	—	Shallow Well with Handpump, Open Concrete Lined Shallow Well	No. of users per shallow well with handpump is too large, so long queue. One shallow well with handpump has salty taste, so cannot drink.	◎	◎	◎	◎	◎	◎	Feasible	17
M-13	Sambang Complex	CRD	1,478	1,892	2,544	◎	◎	◎	—	—	6	—		Water level lowering in shallow well during dry season.	◎	◎	◎	◎	◎	◎	Feasible	7

*1,*2*: Calculated based on 1993 population using growth rate of 2.5% as design criteria of DWR

*3: ◎Good △Fair ×Bad

Water quality: △ Attention to be paid to possibility of salinity.

Accessibility : △ Construction works during rainy season should be with attention.

2) Prioritisation of the Project Sites

It was explained to the Gambian side that number of the project sites might be reduced due to budget restrictions even if the above criteria are met. The Gambian side suggested that priorities be given to sites which satisfy the following conditions.

①Sites requested for new construction should have priority over the sites with existing water facilities constructed in the previous grant aid project.

②Sites having larger population are prioritised.

The above two additional conditions were added to Table 2-4 for prioritisation of the project sites.

3) Sites for Conversion of the Pumping System

As for 9 sites requested as conversion of existing diesel generator driven system to solar pumping system, a requirement is that the water supply facilities are to be operational even after installation of the solar pumping system. These water supply facilities were constructed through Japan's grant aid assistance from 1992 to 1994, which means that the facilities have been operating for over 10 years. Furthermore, the sites were evaluated to determine if the present water committees are functioning properly and the villagers are continuously willing to pay for the operation and maintenance costs. During the field survey, these sites were surveyed on the state of operation and maintenance and technical condition of the water supply facilities. As explained in Appendix 5-1 Operation and Maintenance Situation of the Existing Water Supply Facilities with Japanese Assistance (1992-1994), the results of the survey revealed that the water supply facilities have been continuously operated in spite of their having difficulty to afford diesel cost which has steeply risen compared with the implementation period of the previous project. Also, the villagers showed strong willingness to be responsible for operation and maintenance of the facilities at all 9 sites. Therefore, these sites will be taken up for conversion of the pumping system.

(3) Consideration on Rationale to Apply Solar Pumping System

From 1983 up to the present, DWR, UNDP/UNCDF, EDF, the Government of Saudi Arabia and other organisations have assisted in applying solar pumping system in rural water supply in the Gambia. Cost recovery by the beneficial communities, adoption of maintenance services by local private enterprises and creation of monitoring systems with cooperation between DWR and donor agencies have helped to keep the solar pumping systems in operation. Now, there are 105 piped water supply schemes with solar pumping system around the country to make this the standard type for the reticulation system in the Gambia

Since adoption of solar pumping system is requested in this project as well, its rationale and feasibility were assessed from environmental and socio-economic viewpoints and upon comparison with the conventional diesel engine-powered system. The detailed results are explained below.

1) Background and Present Situation of Application of Solar Pumping System in the Gambia

The solar pumping system was first introduced in 1983 as a pilot project with assistance from UNDP and Saudi Arabia at Kaiaf and Jambanjali villages. In succession to the results of the project, solar pumping systems spread around the country in 1990s with funds from UNDP/UNCDF, EDF and Saudi Arabia.

The Gambian government requested to the Japanese government installation of solar pumping systems to piped water supply schemes for the first time in 1990 when the basic design study for the previous grant aid project was conducted. As a result of the study, the basic design of the previous project included 7 sites out of the total 30 sites to be installed solar pumping systems. The implementation of the project started in 1992, but in 1994, assistance from Japan had to be stopped due to the coup d'etat in the Gambia. Upon confirming the political stability, construction of water supply facilities with solar pumping system were requested again in 2001 by the Gambian government.

Table 2-5 shows the number of presently operating piped water supply schemes in the Gambia. DWR has constructed water supply facilities in cooperation with other donors, but has not yet experienced construction on its own by using its budget allocation. On the other hand, EDF has commenced construction of new solar pumping systems at 29 sites from 2003 in addition to the existing 82 schemes they assisted in the past.

Table 2-5 Number of Existing Piped Water Supply Facilities in the Gambia

Donor	No. of Sites with Solar Pumping System	No. of Sites with Diesel Generator	Implementation Year	Future Plan for Installation of Solar System
1. EDF	82	0	1990-2003	29 sites decided in 2003
2. UNDP/UNCDF	10	0	1999-2001	In planning
3. Saudi Arabia	12	0	2001-2003	In planning
4. Japan	1*	9	1992-1994	Under consideration
Total	105 (92.1%)	9 (7.9%)	-	-

* Converted from diesel generator by EDF

The 105 solar pumping systems spread in the country accounts for 92.1% of the piped water supply schemes under the responsibility of DWR. Whereas the 9 conventional diesel generator systems (7.9%) were constructed through Japanese grant aid assistance from 1992 to 1994. Though 10 schemes were constructed in the project, EDF converted the diesel generator to a solar pumping system due to failure of the pump.

2) Comparison between Solar Pumping System and Diesel Generator System

Due to step rise of diesel cost, the community members in the target sites prefer solar pumping system in which operation and maintenance costs are lower than the diesel generator. The advantages and disadvantages are compared for both systems as shown in Table 2-6.

Presently, the user fee for water supply facilities with solar pumping system is GMD10/person/year on average and this is providing a stable water supply. However, although over GMD30/person/year is spent for diesel generator system, the residents are complaining that a continuous operation of the facilities is difficult, hence unstable water supply. Moreover, due to deterioration of conditions of the generators from using over 10 years, the repair costs are increasing to cause difficulties in running the facilities. As revealed in Table 2-6, solar pumping system has more advantages than diesel generator in the context of rural water supply in the Gambia.

Table 2-6 Comparison between Solar and Diesel Engine-Powered Pumping System

Parameter	Solar Pumping System	Diesel Generator System
1. Operation and Maintenance 1) Running Cost	1. No cost necessary since fuel and consumables are not needed.	1. Diesel fuel cost needed. 2. Consumables such as lubricants and filters require replacement in accordance with operation time. 3. GMD43,500-65,000 needed annually for fuels and consumables for each system
2) Maintenance Cost (Actual)	1. Actual cost of 40 systems of EDF: 1) Constructed 1993-1995: of 33 systems, 16 (48.5%) repaired at GMD23,716 2) Constructed 1999: 7 systems (no repairs within guarantee period) 3) Other than periodic inspection, necessary repairs in one year (2000) was 16 systems out of 33 (48.5%) at GMD60,368, or GMD3,773/system/year. Repairs were inverter connection replacement on 12 systems, pump repair on 4 systems (1 serious pump repair). 2. Fixed O&M cost (annual subscription fee for contract with local maintenance service provider) and repair costs (actual) was total GMD8,459/system/year.	1. Water committee handles O&M. Main repairs include ① battery replacement, ② generator repair at 5 villages (50%), ③submersible pump repair and replacement, ④pipe leakage repair, ⑤tap and valve repair. 2. Serious repair was replacement of submersible pump at GMD70,000 paid by residents. Also, generator running 10 years deteriorated requiring frequent repairs costing GMD25,200 for 4 systems. 3. In the follow-up study (2002), though there was a village with bank balance of GMD45,000, in 2003, the balance used up at 8 villages (80%) due to high fuel costs to cause difficulties in continuous operation. 4. Residents paying over GMD30/person/year as

Parameter	Solar Pumping System	Diesel Generator System
	3. GMD19,000/year was raised for O&M fund. After utilizing a part of the fund for maintenance of the system, GMD10,541/system/year is reserved as a balance of the bank account. 4. Water fee for above O&M payment method is GMD10/person/year.	water fee.
3) Operation and Inspection	1. Basically, maintenance free. 2. Cleaning of solar module surface needed but at low frequency and technical skill not needed.	1. Operator must turn on and stop pump manually. 2. Other than diesel fueling, periodic lubrication and filter replacements needed. 3. Skilled operator needed.
4) Operation in Remote Areas	1. Since fuel not needed, operation in remote areas possible.	1. Operation in remote areas require time, labour and money for buying and transporting fuels.
5) Measures against Theft	1. Recently, solar modules are stolen for reselling. 2. As anti-theft measure, using special bolts or welding the solar modules are introduced.	1. Taps stolen
2. Environmental Impact 1) Noise, Exhaust	1. No noise or exhaust gas, so environmentally friendly.	1. Noise and exhaust during operation 2. Since small scale, environmental consideration on noise and exhaust not needed.
3. Appropriate Technology 1) Experience in the Gambia	1. Since 1993, 105 solar pumping systems in operation in the Gambia.	1. In the Gambia, only 9 diesel systems operating. 2. These constructed 1992-1994 by Japanese grant aid while one other diesel system converted into solar pumping system by other donor.
2) Supply of Parts, Repair Capability	1. Presently, 3 European manufacturers of solar pumping system have dealers in Banjul including inspection and repair services to remote areas. 2. Parts available through local dealers. 3. Japanese solar pumping equipment also procurable.	1. European products available but not popular for water supply facilities. Government supported O&M system not available. 2. Parts procurement and repairs of Japanese grant assisted facilities as well as their O&M handled directly by water committees.
3) Response to Water Demand of Residents	1. If water demand becomes high by addition for livestock or gardening, limited in scale. 2. Water demand gives priority to drinking for villages.	1. Since scale can be larger than solar, livestock watering is possible. 2. Since operation time not restricted to insolation, can extend time, so can plan for multi-purpose use.
4. Renewal of Facilities 1) Capital Investment	1. Livestock watering not included in water demand: Total:¥23.5million (GMD5.1million) /facility 1) Borehole construction: GMD0.56million 2)Machinery house: 0.04 million 3) Pumping system: 0.84 million 4) Elevated water tank: 0.37 million 5) Distribution facilities: 0.89 million 6) Mobilization/ demobilisation: 1.42 million 7) Supervision: 0.98 million GMD1 = ¥4.59	1. Livestock watering not included in water demand: Total: ¥24.0million (GMD5.2million) /facility 1) Borehole construction: GMD0.56million 2)Machinery house: 0.56 million 3) Pumping system: 0. 39million 4) Elevated water tank: 0.37 million 5) Distribution facilities: 0.89 million 6) Mobilization/ demobilisation: 1.43 million 7) Supervision: 1.0 million GMD1 = ¥4.59
2) Replacement Period	1. Modules: 15-20 years 2. Inverter: 5-10 years 3. Submersible Pump: 10-15 years	1. Generator: 7-12 years 2. Control Panel: 14-18 years 3. Submersible Pump: 10-15 years
3) Evaluation: Comparison of capital, renewal, and running costs after 20 years	1. If capital investment of diesel generator powered type is 100, solar is 98. Existing concept of capital investment for solar system being high is changing. 2. In case of water metering method, base of the subscription fee for maintenance is	1. Say capital investment for diesel generator system is 100. 2. If same rate system as solar, then GMD30/person/year is applied, this cannot replace generator after 10 years. So, need to raise water fee.

Parameter	Solar Pumping System	Diesel Generator System
	GMD1.75/m3 and GMDD30/person/year. 3. According to DWR, GMD30/person/year for a village with 2,000 population can cover replacement cost of solar system. However, under this condition, presently manufacturers apply 5-year guarantee, while donors are supporting spare parts for next 5 years. UNDP/UNCDF project of 1999 procured 5 years' lot of spare parts. 4. Present water fee under the flat rate system of the subscription fee for maintenance is GMD10/person/year.	3.Presently, over GMD30/person/year is collected for operation of water scheme with diesel generator system, but continuous operation is difficult.

3) Requirements for Application of Solar Pumping System

Local conditions of the Gambia were surveyed in accordance with each item of requirements for application of the solar pumping system as listed in Table 2-7. As a result of the survey, it is confirmed that development plans of the Gambian government, capacity of the executing agency, participation of local service providers as well as Village Water Committees, and other natural and socio-economic conditions satisfy requirements to apply the system.

Table 2-7 Requirements for Application of Solar Pumping System

Item	Description	Survey Results
1. Development Plans and Executing Agency	1.Conforms to the Gambia's development plans, energy policy, and rural development policy related to solar use.	1. In the Gambia's development plan, Vision 2020, and PRSP 2002, assuring drinking in rural areas to improve living conditions of residents is given highest priority. 2. In line with the development plans, the national energy policy (2001) and action plan (2002) were prepared with emphasis on promotion of renewable energy, especially, solar energy. Also, as means to reduce O&M costs along with drinking water assurance for the rural population, solar pumping systems contribute to poverty reduction, and therefore, support for promotion of solar pumping system have been continued by international organisations and bilateral donors since the 1990's.
2. Natural Conditions	1. Solar can be used as natural, clean energy. 2. Located in West Africa where use of solar energy is favourable in terms of insolation, irradiation, and rainfall. 3. Groundwater potential appropriate for solar use in terms of yield, quality, and water level. 4. Groundwater potential of target area is sufficient in quality and quantity. 5. Land for facilities construction can be secured.	1. Since the Gambia is located in the Sahel area, solar can be fully used and this clean energy is free. 2. Insolation of target area is annually over 6 hours. • Irradiation is over 5.22 kWh/m^2/day, which is sufficient for power generation with solar energy. • The basic design study was conducted Aug. to Sep. during rainy season, but there were no days of completed non-insolation and even after a heavy shower, enough insolation for solar use was confirmed. Therefore, the rainy season does not have large influence on operation of solar pumping systems. 3. Groundwater from borehole can be used as water source for target area. • Static water levels of boreholes are 10-25m, pumping water levels are within 40m. 4. Groundwater potential of target area is suffice, with max. design population of 5,000 persons, and design yield of 180m^3/day is possible. 5. At all target villages, flat land area of about 200m^2, necessary for construction of water supply facilities around borehole, can be secured and agreed by relevant residents.

Item	Description	Survey Results
3. Social Conditions	1. Target village is appropriate scale for solar pumping system.	1. Served population is between 900 and 5,000 persons. • Design supply rate is 35 lit/cap/day.
4. Other Donors	1. Achievements of other donors and Japan's assistance in water sector	1. Presently 105 solar pumping systems constructed in cooperation by other donors are in operation around country. 2. From 1993, Village Water Committees initiated O&M of solar pumping systems in rural areas, and until now (2003), no system has been abandoned due to technical, social and economic problems. 3. The system is praised by both beneficiary residents and the government due to low cost responsibilities of villagers. 4. Diesel generator systems were constructed at 10 sites by Japanese grant aid assistance from 1992 to 1994, but at one site, since the pumping facility broke down, in 1999, EDF converted it into a solar pumping system. 5. Presently there are only 9 diesel generator systems, but the water committees of these schemes are requesting conversion of pumping system into solar-powered one because diesel is expensive and generators used over 10 years are becoming deteriorated to increase O&M costs. 6. The state of operation of existing water supply schemes with diesel generator systems constructed through Japan's grant aid was surveyed. The VWCs have operated and maintained the water schemes for over 10 years to supply safe drinking water to the residents. This achievement is being praised by the executing agency, but now the facilities are becoming deteriorated and required rehabilitation. Therefore, continued assistance from Japan for installation of solar pumping systems was requested.

4) Conclusion on Application of Solar Pumping System

As a result of the field surveys, feasibility of adoption of solar pumping system in this project can be justified by the facts of strong request by the communities, its wide spread in the Gambia, experiences of other donors in supporting application of the system, consistency with development plans, advantage of costs for initial investment, operation and replacement compared with diesel generator, and an established structure of maintenance services for the solar pumping system through participation of local private enterprises in the maintenance activities in addition to the communities and DWR. Therefore, solar pumping system is applied in this project.

2-2-1-2 Policy towards Natural Conditions

(1) Climate

The target area is located in the southernmost part of the Sahel and distributed in the tropical savanna climate zone. The rainy season and dry season are distinct with annual average rainfall of 600 to 850mm. The rainy season is from June to October with heavy rains from July to September when unpaved roads become inaccessible and construction works might be difficult. Therefore, the

construction schedule will fully consider the climatic conditions and accessibilities to the project sites.

(2) Hydrogeology

The target area is flat land of less than 50m altitude along the Gambia River. Small hills of few to tens of meters high are scattered in the target villages. Traditional hand dug wells and concrete-lined shallow wells with handpumps are found in the villages, but water levels drastically lower during the dry season making water fetching difficult. In some target villages, seawater intrusion in the Gambia River is feared.

Since groundwater potential is favorable from geological and hydrogeological conditions, if groundwater from depths of 70 to 100m is used, a stable and safe supply of water can be anticipated. Confined groundwater found in sandstone of Tertiary and Mesozoic Era has high potential with good quality. From collected hydrogeological information and geophysical prospecting results, the appropriate drilling method and effective groundwater development method, as well as specification of necessary equipment and materials will be planned. The success rate of borehole deilling and average drilling depth for the 20 sites requiring construction of new boreholes will be decided from analysis of field survey results, geophysical prospecting results, and existing data.

(3) Water Quality

The Gambia has its own water quality standards. The WHO guidelines for drinking water quality are also used as reference.

As water quality problems in the survey area, seawater intrusion since seawater is confirmed up to 200km inland along the Gambia River, and contents of iron and free carbonate need consideration. To determine the extent of these problems in the target sites, water qualities of existing water sources in each site were analysed. Those water sources include unprotected hand dug wells and concrete lined shallow wells with handpumps. From the results of analyses as shown in Table 2-8, ammonium, coliform group bacteria and plate count bacteria were found. This reveals that groundwater from the existing shallow wells are contaminated with organics through living together with livestock.

Table2-8 Water Quality Analyses of Existing Water Sources at Project Sites

Parameter	Water Quality Standard		N-9	N-10	N-11	W-1	W-2	L-1	L-3	L-5	L-8	L-9	L-10	L-11	M-2	M-5	M-6	M-8	M-9	M-10	M-11	M-12	M-13
	GAMBIA (mg/L)	WHO (mg/L)	Tuba Kolong	Medina Sering Mass	Nawleru	Sohm	Sutusinjang	Nema	Dumbutu	Baro Kunda	Jali	Pakali Ba	Massembe	Wellingara	Piniai	Saruja	Dankunku	Sami Pachonki	Sukuta	Galleh Manda	Jakhally	Bakadagy	Sambang Complex
Temperature	Acceptable	—	29.4	29.4	30.1	29.5	29.2	29.9	29.7	30.3	29.3	30.1	9.3	30.8	30.7	32.5	31.5	31.1	30.6	30.6	28.9	31.3	30.9
pH (site)	6.5-8.5	6.5-8.5	5.23	4.99	5.75	5.3	5.22	5.5	5.09	6.35	5.73	6.21	4.23	5.33	5.13	5.42	4.18	5.57	5.79	4.01	5.99	4.33	6.08
pH	6.5-8.5	6.5-8.5	—	—	—	—	6.5	—	—	7.6	7.6	—	—	—	6.8	6.8	6.5	6.2	7.1	7	6.5	7.8	6.8
EC(us/cm) (site)	1,300	—	79	125.3	179.4	351	389	399	185.4	865	68	353	758	161.7	117.3	627	1,317	51.8	51.8	62.8	613	421	204
EC(us/cm)	1,300	—	—	—	—	—	302	—	—	765	76.5	—	—	—	93.1	620	1,342	117	35.8	67.9	601	422	206
TDS	1,000	1,000	30.5	52.3	72.7	15	13.9	199.3	88.3	—	34	173.7	376	67.6	44.3	301	664	55.7	16.6	31.9	291	204	98.7
Alkalinity	—	—	5	5	20	10	15	10	5	135	10	35	0	10	10	10	0	15	10	0	50	0	15
Acidity	—	—	75	50	70	55	60	135	65	100	50	65	75	55	125	65	90	115	55	50	90	120	50
Ammonia	0.5	1.5	0.08	1.27	0	0	0.08	1.22	0.12	—	0.03	0	1.4	1.15	0.12	0	0.01	0	0	0.02	0.1	0	0
Nitrate as NO3-	10	50	9.5	43	47.3	12.7	2	98	49.5	—	4.6	143.7	153.6	51.2	3.5	14	20.5	3.8	3	2.6	15.2	5.2	3.5
Nitrite as NO2-	0.03	3	0.001	0.003	0.004	0.004	0	0.008	0.005	—	0.006	0.006	0.003	0.005	0.001	0.036	0.004	0	0.02	0.001	0.003	0.006	0.004
Fluoride	1.5	1.5				ND					0.14				0								
Copper	—	1	0.01	0.24	0.07	0.07	0	0.08	0.05	—	0	0.06	0.08	0.06	0	0	0	0	0	0	0	0	0
Manganese	150	0.1	0.001	0.061	0.02	0.11	0.017	0.215	0.064	—	0.022	0.01	0.627	0.064	0.095	0.36	1.01	0.093	0.03	0.26	0.135	0.219	0.03
Iron	0.3	0.3	0.03	0.03	0.02	0.01	0.02	0	0.03	—	0.01	0.01	0.04	0.02	0	0	0.01	0.02	0	0.01	0	0.14	0
Arsenic	—	0.01				ND					ND				ND								
Sodium	150	200	5.8			5.8				25.9	2.4				5.6	18.2						15.3	
Potassium	NS	—	0.2	0.3	0.2	0.3	0.3	2	—	—	—	—	—	—	4.3	6.2	0.5	5.9	4.4	3.6	5.7	7.2	5.3
Sulfate	250	250	0	0	0	0	2	0	—	—	2	—	—	—	3	—	—	—	—	—	—	—	—
Chloride	250	250	68.9	89.5	105	48.98	7.38	87.97	—	—	10.33	—	—	—	20.17	80.68	150.07	14.29	6.39	6.38	52.47	36.9	25.58
Calcium	250	—	20	10	20	5	5	55	20	140	20	60	60	30	15	115	130	15	10	30	130	45	20
Magnesium	150	—	1	2	1	1	0.5	7	3	15	2	6	13	5	2	15	17	2	0.5	1	10	9	4
Chemical Oxygen Demand	—	—	17	10	8	5	3	5	5	4	3	5	5	6	5	5	6	3	4	4	4	6	4
Coliform Group	0/100ml	0/100ml	nil	nil	Detect	nil	Detect	Detect	Detect	Detect	Detect	Detect	Detect	Detect	Detect	Detect	Detect	Detect	Detect	Detect	Detect	Detect	Detect

Results provided by Japan Industrial Water Association
analysis not made according to the survey principle

ND: Not Detected

Therefore, upon discussions with the executing agency, support to awareness activities and hygiene education on proper water use and handling will be considered in the project.

Policy on Free Carbonate Treatment

In some areas of the Gambia, groundwater having low pH is confirmed. The confined groundwater to be used for this project generally tends to have low pH with free carbonate though its level is not as significant as the existing water sources. Therefore, influence on concrete structures is feared. In this condition, consideration on selection of construction materials as well as facility design for sprinkling, aeration and other measures during pumping of groundwater will be required.

(4) Environmental Consideration

The environmental consideration on groundwater development for this project is conducted by DWR through technical decision from a water resources conservation viewpoint. DWR has confirmed that environmental impact assessment (EIA) is not necessary due to the following reasons.

① Water resources development and facilities construction of this project are on a small scale.

② Seawater intrusion and land subsidence related to groundwater pumping are not probable at the most target sites.

③ Basically, the residents in the target sites are not in disagreement with the project.

1) Groundwater Lowering, Land Subsidence and Seawater Intrusion due to Overpumping

Since the boreholes to be constructed in this project will be of small diameter (150 mm), the yield will be relatively low. Thus groundwater interference should not be of concern. Also, the borehole will be completed to avoid contamination of water from the surface. From the viewpoint of water resources development and conservation, DWR is periodically monitoring the groundwater level fluctuations, and therefore, environmental impacts in the future are sufficiently considered.

2) Impact on Environment from Wastewater of Water Supply Facilities

Since yield for water supply facilities is relatively low, wastewater from these

facilities is also low. For this project, public faucets will be constructed with soak away pits to infiltrate wastewater into the ground. From a viewpoint of environmental consideration, VWCs and beneficiary residents will be obliged to follow environmental sanitation procedures through periodic cleaning activities under the monitoring of DWR and other relevant organisations.

2-2-1-3 Policies on Socio-Economic Conditions

The present populations of the surveyed villages in the area are: for the sites for construction of new water supply schemes, 680 to 2,700; and for the sites for conversion of the pumping systems, 2,300 to 3,900. The average persons per household are 8 to 10.

(1) Policy on Economic Liability and Activities of the Communities

Most of the villagers live on agriculture, main products being rice, maize, sorghum, peanuts and vegetables. Livestock rearing is another important livelihood, particularly in the areas of North Bank Division and Central River Division where there are many households that own many cattle to graze. The major income source apart from agriculture and livestock farming is the remittance from family members both at the cities and abroad away from home. Sometimes networks of workers living away from their families are developed to give financial assistance of their home village for improvement of living conditions. Income from agriculture is obtained only in the months from December to February after the crops are harvested, and during the other months, especially in the rainy season from June to September, people have hard time gaining income, they depend upon supplementary income such as remittance from family members living in the cities and abroad, cattle rearing or retailing. Therefore, consensus building towards payment of the maintenance costs, mode of payment and timing will be made with considering the seasonal calendar of farming and availability of cash income in the target villages.

The population of females is more than the males, probably because the males are working outside at the main cities in and out of the country. Women do both housework and agricultural work as well as water drawing, a hard labour which women and children plays an important role. Thus, a typical one-day labour time of women is more than that of men. Therefore, consideration on location and usage of the tap stands will be taken to the women's perception and viewpoint.

(2) Policy on Culture and Religious Tradition

An intervention for strengthening operation and maintenance system will be conducted taking considerations of the religious background, to such religious events as Ramadan, and also to the male dominance on decision making process and social participation, since the main religion in the Gambia is Islam.

Also, villages in the Gambia are administered by the traditional leaders such as village heads and chiefs who have significant influence on the daily life of villagers. In addition to this traditional hierarchy, councillors are responsible for management of the development issues in the respective areas under the decentralisation policy of the government. Meantime, Muslim leaders have a great influence on the community members in terms of morals and norms in their daily life. For facilitation of community participation in the management of water supply facilities constructed in the project, the intervention for community mobilisation and capacity building will be conducted respecting these existing social structures in the target villages, tradition and social norms, since the cooperation from community leaders is indispensable to mobilisation of community members.

(3) Policy on Health and Hygiene

The existing water sources that the villagers use for drinking at the target sites are in general, shallow wells with hand pumps. These shallow wells are lined with a concrete ring, and are equipped with one or two hand pumps. These wells are standardised by the DWR as point-source type water sources. However, because the numbers of the source are few compared to the population, the number of users per well becomes large, which consequently cause congestion at the water points, increase of waiting-time for water fetching and insufficient water quantity per household. Also, from these shallow wells coliform bacteria were detected.

The water quality of these handpump equipped shallow wells are controlled by DWR only once upon the completion of well construction by chlorination. Through direct observations at the water points, washing of clothes, cattle trough and refuse pits were seen close-by the sources, meaning that the environmental sanitation of the source area is not maintained properly. Therefore, hygiene education programme will be conducted in the project to improve hygiene awareness and behaviour of the residents.

Regarding the handling of drinking water by the residents, it was observed that percentage of use of plastic container with a lid and bucket without a lid for drawing water was about the same. Drinking water is generally stored in unglazed pots, which is filtered through thin cloth. In the Gambia, chlorination or boiling is not a common habit for treatment of drinking water.

Most of the sanitation facilities in the households are traditional pit latrines enclosed by bricks or straws. For the schools and the rural health centres, VIP latrines are currently being constructed with provisions of construction materials such as concrete and reinforcing bars from the Department of Community Development.

The Department of Medical and Health have full realisation of the importance of sanitation for clean drinking water, but as they are not capable enough to manage the drinking water quality on their capacity, DWR demands the project to manage the environmental sanitation. As the management of environmental sanitation and hygiene behaviour associated with water use is essential for safe and stable water supply, giving assistance to the hygiene education programme to the residents in this project would be appropriate. Therefore, cooperation will be made to DWR, local authorities and the target villages.

2-2-1-4 Policy towards Construction and Procurement

Quality control for materials such as concrete, mortar and concrete blocks are maintained according to the Gambia's construction standards. However, the standard itself fails to meet the quality needed for facilities, thus the facilities that have enough performance or capability cannot be constructed, consequently meaning that it is not an appropriate standard for construction works of the project under the Japanese grant aid assistance. Therefore, the Japanese construction standard will be applied in this project. The labour safety standards will be basically conformed to the Gambia's standard given in the labour legislations, and so prevention from lack of oxygen, wearing safety belts, installation of fall prevention handrails on temporary scaffoldings and safety covers of the operational parts of machines will be conducted accordingly. In addition, the Japanese standards will be applied wherever the Gambia's standards fall short.

Equipment and materials to be used for construction are those for solar pumping systems, as well as pipes, submersible motor pumps, reinforced steel bars, cement, aggregates, etc. Although most of the equipment and materials are not manufactured

domestically, local agencies having sufficient stock have been established, and so they are easily obtained. Therefore, relative construction materials shall be procured locally.

As for the procurement of equipment such as supporting vehicles and motorbikes, local agencies are also well developed, so they too will be basically procured locally from viewpoints of price, delivery time and maintenance. Equipment that is locally popular shall be prioritised as the maintenance is easier done and after-service care can be expected.

2-2-1-5 Policy on Use of Local Contractors

In the Gambia, there are no private companies that have borehole drilling equipment and are capable of drilling boreholes, and the only equipment available for groundwater development is owned by DWR, which was procured in 1992 under the previous Japanese grant aid project. Therefore, construction of boreholes in this project will be conducted with utilising the existing drilling machine to be made available by DWR and under the management by the Japanese contractor. DWR is keen to construct boreholes with the cooperation of Japan and also requested for technology transfer concerning groundwater development including borehole drilling. Thus, it would be appropriate to conduct On-the-Job Training of technologies such as borehole drilling, groundwater development and geophysical prospecting through actual work.

On the other hand, there are capable local companies for construction of water supply facilities, and so these local contractors will be utilised in the construction works under the Japanese prime contractor. The quality of facilities construction that meets the required standards in the Japanese grant aid projects is expected to be achieved through management and quality control by Japanese engineers and through appropriate technical guidance to the local contractor.

2-2-1-6 Policy towards Capacity of Executing Agency on Operation and Maintenance

(1) Department of Water Resources (DWR)

The executing agency of the Project is the Department of Water Resources (DWR), Department of State for Fisheries, Natural Resources and the Environment and its headquarters is situated in Banjul. The budget of the DWR of recent years (2001-2003) is shown in Table 2-9. The fiscal year starts from January and ends in

December, and the budgetary demand for DWR are conducted from July to August the previous year. The whole budget for DWR of the year 2003 is GMD4,292,000 (approx. ¥19,700,000), of which 88.3% is labour cost. Thus, it is very difficult to develop water resources and construct water supply facilities on its own, so they seek assistance from donors for construction, and as for operation and maintenance, community participation is adopted with cooperation from the local authorities. Therefore, the situation of DWR as stated above will be taken into account upon implementation of this Project.

Table 2-9 The Budget of DWR in the Past Three Years (2001-2003)

thousand GMD

Fiscal Year	Budget	Details			
		Labour	R&D	O&M	Others
2001	2,500.5	1,912.4	483.0	71.7	33.4
2002	4,153.4	3,681.4	370.0	62.0	40.0
2003	4,292.0	3,790.0	400.0	67.0	35.0

R&D: Research and Development; O&M: Operation and Maintenance (1GMD = JPY 4.59)

It has been confirmed that the DWR, upon the project operation, will organise 1) counterpart personnel for hydrogeological survey, 2) borehole drilling team and utilisation of the existing drilling machine owned by DWR, 3) water quality analysis team, and 4) motivators responsible for the target divisions who will facilitate organising VWCs, community mobilisation/ sensitisation and hygiene education.

The organisation chart of the Department of State for Fisheries, Natural Resources and the Environment is given in Fig. 2-1.

(2) Utilisation of the Existing Drilling Equipment

The drilling machine for groundwater development procured in the previous grant aid project has been used, maintained and managed relatively carefully by DWR, and the department has utilised them even after the interruption of the Japanese grant aid project in 1994. The drilling team of the DWR in particular is the Gambia's only institution that has borehole drilling techniques, and has ensured on their own efforts to acquire the operation and maintenance expenses and their field of activities by drilling boreholes for the projects by other Departments such as the Agricultural Department and the Fisheries Department as well as the projects supported by the external donor agencies. Table 2-10 below shows the performance of the borehole construction by DWR from 1996 to 2001.

Fig. 2-1 Organisation Chart of the Executing Agency

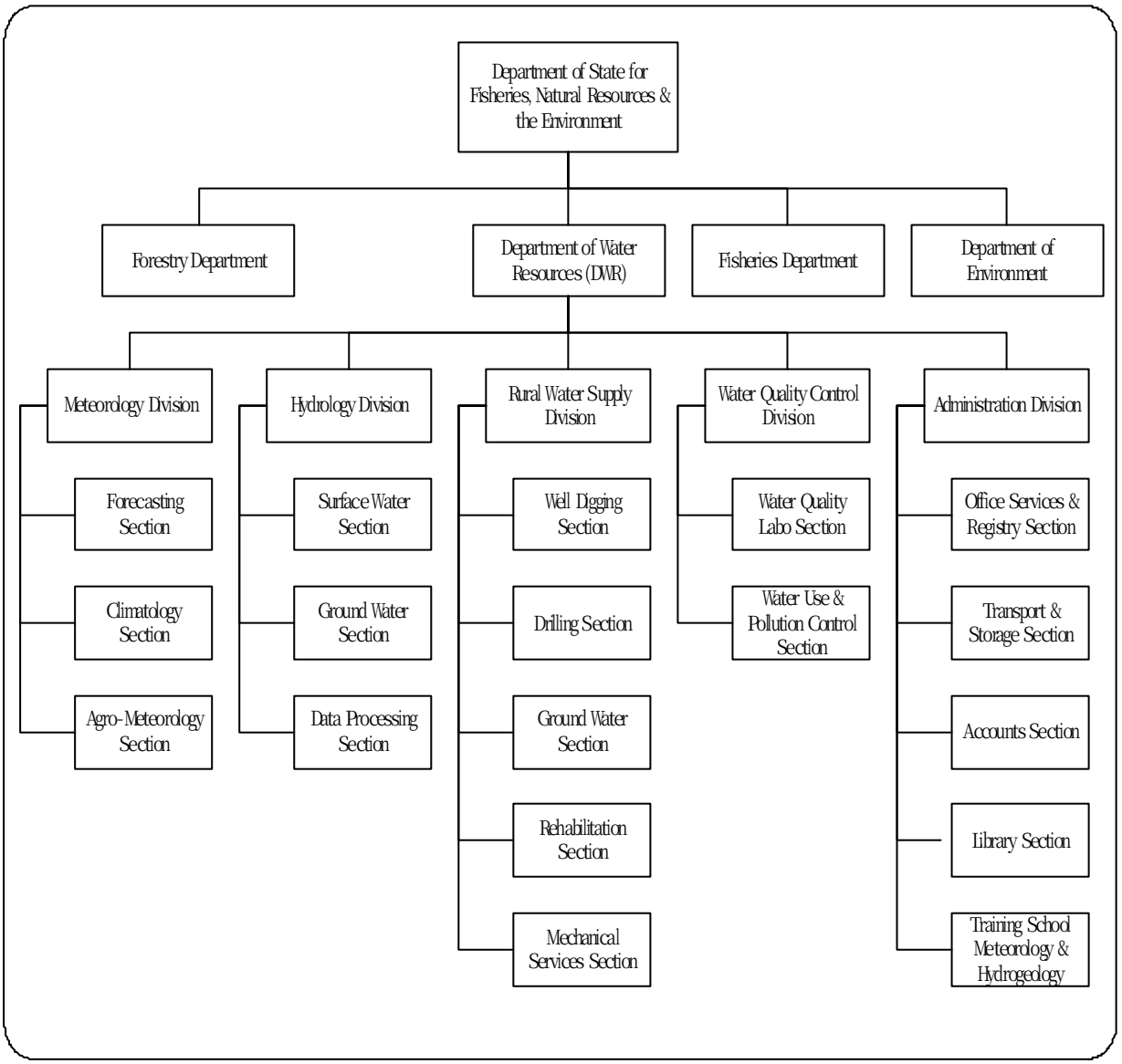


Table 2-10 Borehole Drilling Performance by DWR (1996 - 2001)

No.	Year of drilling	Number of boreholes	Drilling Depth (m)
1	1996	7	53m～115m
2	1997	4	85m
3	1998	5	65m～109m
4	1999	8	61m～91m
5	2000	4	55m～91m

Also, as a result of the follow-up study in 2002, the spare parts required for service of the drilling machine were procured by JICA, and, as of October 2003, the repair works of drilling machine have been finished by a Japanese engineer and is ready for operation. Taking this into account, the procurement of new spare parts for the drilling machine and supporting vehicles as requested by DWR will not be conducted in this project. The consumables for the drilling machine to be required for construction works will be under the responsibility of the Japanese contractor during the project implementation.

2-2-1-7 Policy on Grade of Facilities

The grade of the facilities constructed will be targeted as follows:

1) Durable as public infrastructure
2) Easy to operate/check/repair for maintenance
3) Basically the Japanese construction standards shall be applied while methods normally used in the Gambia shall be utilised for the construction method.

The method applied for each construction work are given in Table 2-11 below:

Table 2-11 Present Construction Methods in the Gambia and Methods Adopted in the Project

	Locally Used Method	Applied Method	Reasons
1.Drilling works	1) Rotary type drilling rig is used. 2) Mud circulation method is applied for alluvium and sedimentary rocks. 3) Down the Hole Hammer (DTH) method is applied for hard rocks. 4) UPVC is used for casing/screens.	As shown left	1) General method applied in the Gambia will be implemented. 2) As above 3) As above 4) As above
2.Earth works	1) Simple hand excavation is applied for earth works of civil and plumbing works.	As shown left	Basically local excavation method will be applied for laterite soil.
3.Plumbing works	1)UPVC if buried outside. 2)Steel pipes for installation in machinery house, high-pressure section of distribution pipes, road crossing section and exposed sections.	As shown left	1) General method applied in the Gambia will be implemented. 2) As above
4.Construction works for facilities	1) RC and mortar finish for roofing, flooring and columns. 2) Concrete block masonry for walls.	As shown left	1)General method applied in the Gambia will be implemented. 2) Materials are procured locally.
5.Concrete	1)Mixing-in-place by hand	Utilise Pot-type portable facility for mixing-in-place by machines	1) Taking into account the uniformity, strength of concrete and the promptness and efficiency of the work, mixing-in-place by machines is applied.

2-2-1-8 Policy on Construction/ Procurement Methods and Implementation Schedule

(1) Drilling Period

Boreholes will be drilled at 20 sites in the target 4 divisions. The approach roads in the rural areas are unpaved, thus the construction period needs to be planned with due consideration on accessibility in rainy seasons. Hydrogeologically, groundwater development will be conducted in relatively problem-free sediments of Quarternary period and sandstone of Miocene. However, the DTH method cannot be applied for borehole drilling, expecting the main components as gravels and sand stones, instead, rotary type mud circulation method is applied with which adequate construction period and development after drilling need to be taken up. Considering the hydrogeological conditions, the drilling success rate is expected to be rather high. As a criterion for a successful borehole by DWR, yield is set at more than $5m^3$/hour. These taken into consideration, the most appropriate construction period is planned.

Another point for construction period is a yearly conclusive drilling works and construction of water supply facilities to be adopted with due consideration on contents and scope of works in the project for efficient use of the limited budget of the grant aid. Due to capacity of the local contractor(s), number of the construction teams will be limited to implement the works simultaneously. Therefore, the implementation period of the project will be divided into phases with considering appropriate number of the target sites to be completed by the construction teams in a single fiscal year.

(2) Borehole Specifications

Structure of the borehole structure to be constructed under the project adopts the standard specifications generally applied in the Gambia.

(3) Specifications of Piped Water Supply Facilities

Construction method commonly used in the Gambia will be basically applied for construction of water supply facilities in this project as mentioned above. Local contractor(s) will be utilised as the subcontractor(s) of the Japanese prime contractor. Equipment and materials will not be procured from Japan in principle but those which are locally available including the ones manufactured in the third countries will be utilised. Especially, for planning the procurement of the solar

pumping system which is the precondition of the project, specification and source of origin will be decided with due consideration of operation and maintenance as well as installation of the system. Involvement of local agents, which have appropriate capacity for provision of maintenance services based on the maintenance contract with the target communities, is required for supply and installation of the solar pumping system. Therefore, products from the third countries which the local agents in the Gambia deal with will be considered for the procurement.

2-2-2 Basic Plan (Facility / Equipment and Materials Plan)

The content of the requested project is construction of piped water supply facilities with boreholes and procurement of equipment for construction works and operation and maintenance activities. However, it is difficult to execute all the contents of the request considering an appropriate scale of the Project. Therefore, a most appropriate basic design is planned as follows in accordance with "2-2-1 Design Policy" being analysed and evaluated from the viewpoint of the necessity, effectiveness, and appropriateness.

2-2-2-1 Water Supply Facilities Plan

(1) Selection of Water Sources

The water source for the target villages of this project needs to have stable quantity and be safe and hygienic. Moreover, it is necessary to select a water source at the most economical point in view of operation and maintenance. As the water sources in the project area are very limited, the construction of borehole through groundwater development is most recommended. The confined groundwater can be secured as the water source in the project area, thus the possibility of human or natural pollution is little. The project will use a source that has clean and stable water which does not require a treatment process.

(2) Design Criteria of Water Supply Planning

Design criteria necessary for water supply planning is examined as follows.

① Population

The information on the actual population of the target villages was collected from multiple sources: statistics, interviews at the administrative Divisions, socio-economic survey, and field survey by the basic design study team. As a result, it turned out that the most accurate and detailed data were from the census executed in 2003, but these are still provisional data at present. Therefore, population of each target site will be considered from the census in 1993 together with the one done in 2003.

② Design Target Year

The design target year will be 2015 which is stated in the Water Resources Development Strategy under preparation by DWR in accordance with the Millennium Development Goal which aims "to cover 100% of the population with safe and stable drinking water until 2015" as well as the Gambia's "Vision 2020" and the PRSP (2002).

③ Population Growth Rate

Analysis of the population census of 1993 and 2003 shows the yearly population growth rate as 2.5% to 4.2%. The rural population growth rate is lower than that of urban areas, and therefore, in this project the minimum ratio of 2.5% is taken.

④ Unit Water Supply Rate

The unit supply rate adopted by DWR is 30l/capita/day at the lowest for rural areas and 45l/capita/day in semi-urban areas. In the urban areas, the unit supply rate is 75l/capita/day. The "Water Resources Development Strategy" which DWR is currently compiling adopts 35l/capita/day for rural water supply. In addition, livestock counting from 100 to 1000 heads (such as cattle, horse, donkey, sheep, goat and chicken) are counted with 35l/head/day as cattle correspondent number in the rural area. In this project, considering the efficiency of solar pumping systems, the drinking water will be limited only for human consumption, and the water from existing shallow wells will be used for livestock watering. In conclusion, the unit supply rate in this project will be set at 35l/capita/day at DWR criterion for rural water supply.

⑤ Design Supply Rate

The design supply rate is calculated as follows:

Design Supply Rate = Design Served Population × Unit Supply Rate

⑥ Storage Tank (Elevated Tank, 5m height)

The volume of water storage will be determined according to the design supply rate. The storage volume is desirably 60% of the design supply rate estimating the pumping hours of the solar pumping system and water demand peak hours. The project plans the economical and effective operation in the village through water supply on demand. The storage tanks in the 20 target villages are to be the following 3 types targeting 60% of the design supply rate.

- Elevated water tank: 30m^3
- Elevated water tank: 50m^3
- Elevated water tank: 70m^3

Storage Capacity:
The pumping starting time is restricted by insolation such that peak hours for water demand in the area are incorporated into the design to secure the demand for the following morning. This demand is estimated at 50% of the design water supply rate. Further, additional 10 % of the design supply rate is to be secured for emergency and adjustment in order to provide sustainable water supply services.

i) Peak hours

Peak hours are the hours in a day when water demand is the highest. Reflecting the water supply situation in the Gambia, the project sets peak hours as 3 hours between 5:00 to 8:00 in the morning and 2 hours in the evening totaling 5 hours a day. The storage capacity at peak hours is estimated to cover 1.5 times of the hourly average supply rate, as well as secure water for 3 hours in the following morning.

ii) Pumping hours

Solar systems employed in the Gambia generally require daylight hours of 6 hours. Therefore, this project also designs pumping hours as 6 hours.

(3) Borehole Design Criteria

The water source for the project is confined groundwater pumped up through a borehole. The confined groundwater is safe and stable and it hardly dries up even in dry seasons. The project area is situated in a flat area which is covered by thick sediments from Quaternary Alluvium layer to Mesozoic sedimentary rocks. Sand, gravel, sandstone and conglomerate layers form the most common aquifers. The boreholes drilled in the past targeted those aquifers and the borehole depths range from 40m to more than 400m. The most developed aquifer at present is the sandstone from Tertiary/Miocene and the average depth is about 100m. Following are the design criteria of the boreholes.

1) Average drilling depth of the borehole for the project: 90m

The average depth is determined from the analysis of geophysical survey

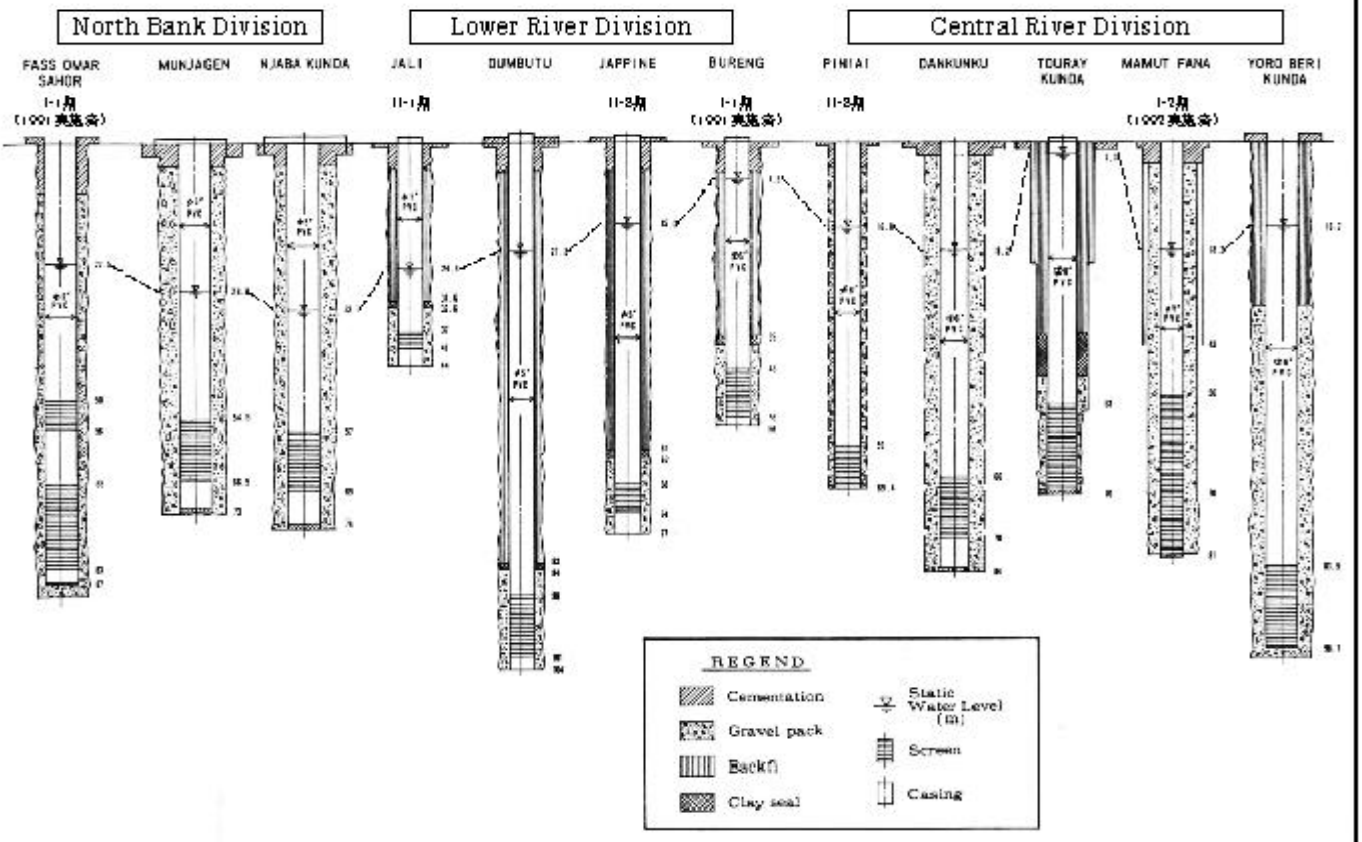
using Schulumberger prospecting method and existing boreholes. Figure 2-2 shows the structures of existing boreholes in the project area. The average depth of existing boreholes is 90m ranging from 44m to 104m. Table 2-12 shows the drilling depths for the target sites on the basis of hydrogeological and geophysical survey results.

Table 2-12 Design Borehole Drilling Depths

No.	Site Name	Drilling Depth (m)	Composition of Sediments
Phase I			
W-1	Sohm	90	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
W-2	Sutusijang	80	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
L-8	Jali	90	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
L-3	Dumbutu	100	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
N-11	Nawleru	90	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
N-10	Madina Sering Mass	90	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
N-9	Tuba Kolong	90	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
Phase II			
M-10	Galleh Manda	100	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
M-11	Jahally	90	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
M-5	Saruja	70	Sand, Clay, Silt, Gravel
M-8	Sami Pachonki	100	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
M-9	Nianija Bakadagy	80	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
M-12		80	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
Phase III			
L-9	Pakali Ba	90	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
L-11	Wellingara Ba	100	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
M-6	Dankunku	80	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
M-2	Piniai	90	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
M-13	Sambang Complex	90	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
L-1	Nema	100	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
L-10	Massembe	90	Sand, Clay, Silt, Gravel, Sandstone, Mudstone
Total		1,790m (Average 89.5m)	

2) Success Rate of Borehole Drilling

From the actual results of drilling in the Gambia, the success rate of borehole construction is more than 90%. The recent results of drilling work from the data of DWR show that there are no failure cases. According to the geophysical survey results, in some areas near to the Gambia River, very low resistivity values reveal possibility of saline water. Considering the result of the Basic Design Study, it is recommended to make an additional electrical prospecting during the detailed design study at the implementation stage. Given the above preconditions, the success rate of 100% is adopted for this Project.



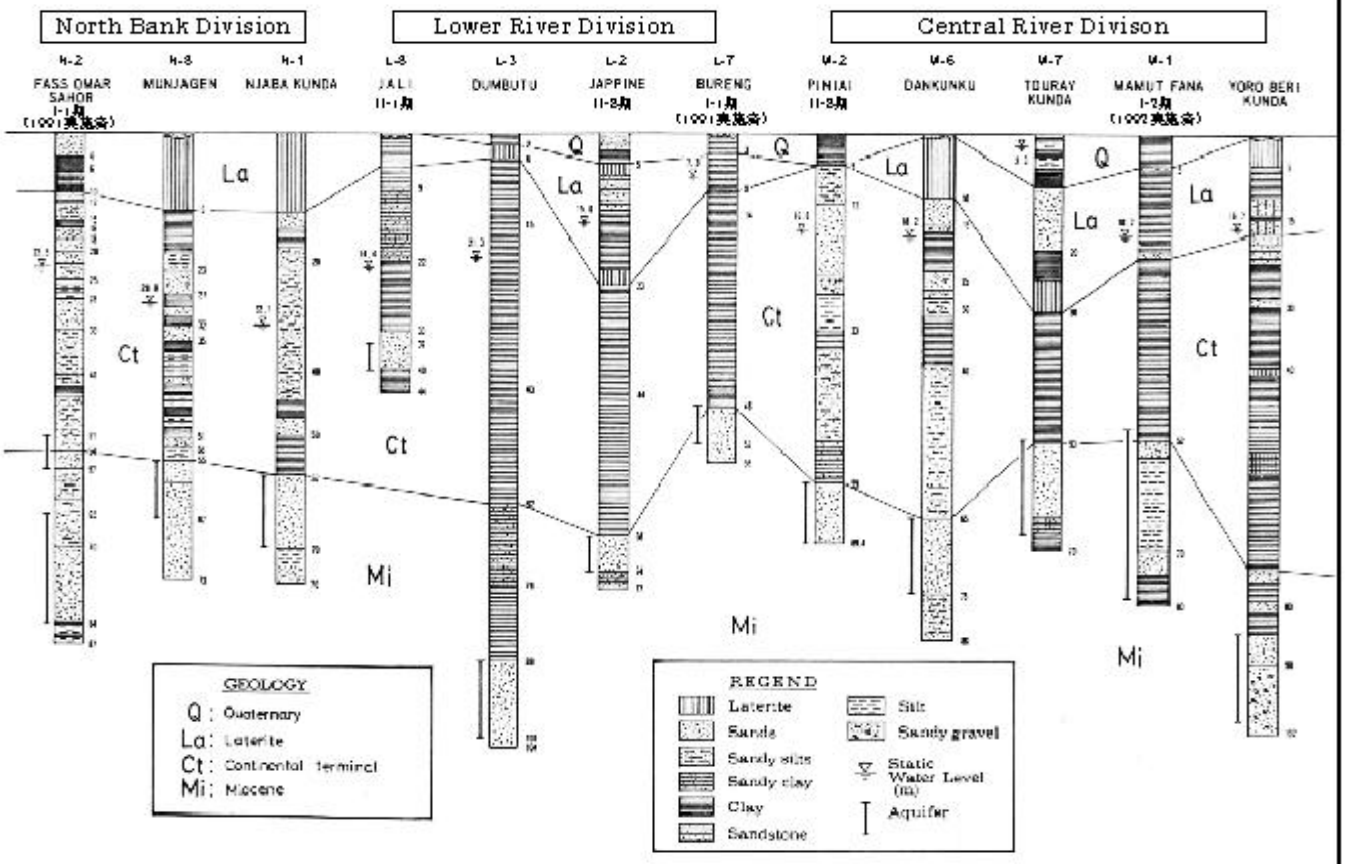


Fig.2-2 Borehole Structure & Geological Logs in The Project Area

3) Structure of Borehole

Figure 2-3 shows the borehole structure.

① Drilling diameter: 250 mm～350mm (10 to 14 inches)

② Casing and screen diameter: 150mm（6 inches）

③ Material of casing and screen: For the borehole up to 100m depth, the casing and screen are UPVC pipes. To prevent contaminants from the surface, the upper 20m are cemented.

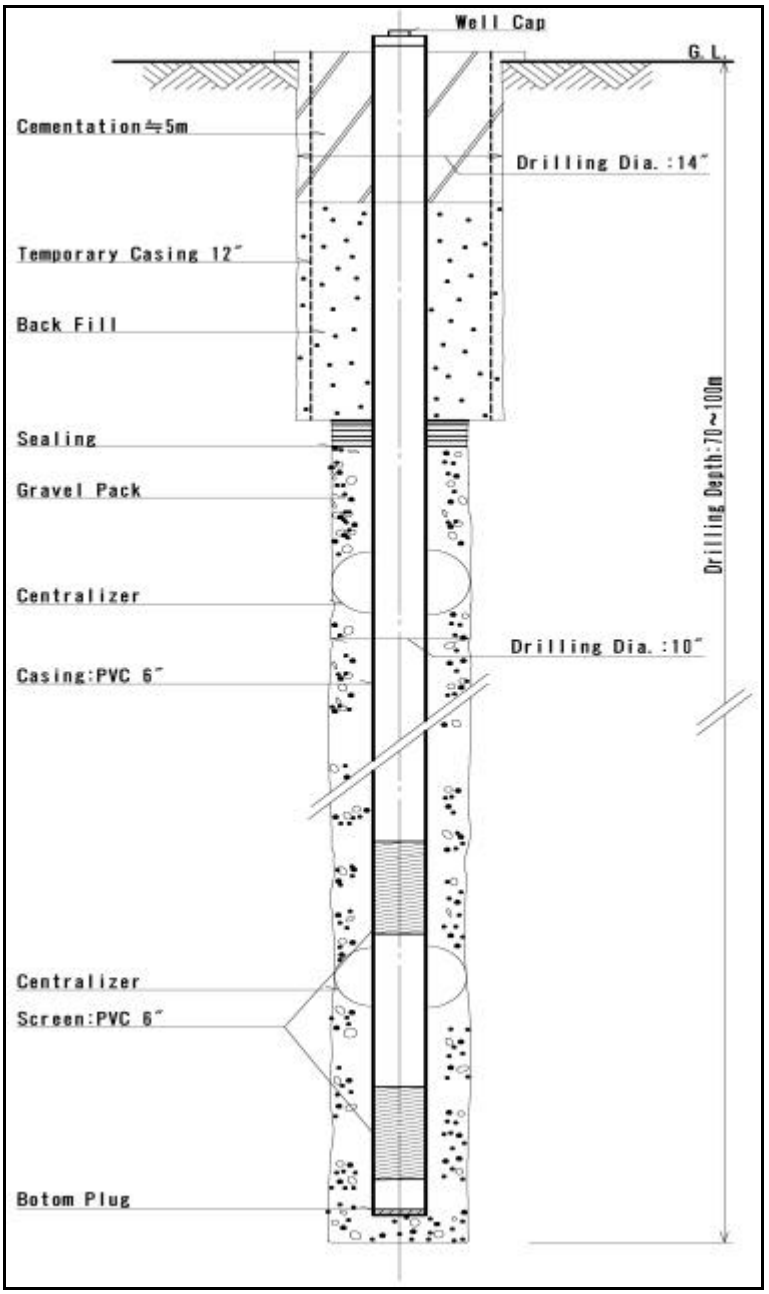


Fig. 2-3 Borehole Structure

2-2-2-2 Facilities Design

Provided the precedent analysis, the basic design for the project is elaborated as outlined below.

(1) Plan for Borehole as Water Source

The number of boreholes to be constructed under this project is 20 and is planned as follows.

1) Selection of Drilling Points

The selection of the drilling points at the target sites are based on the consensus of the villagers as well as hydrogeological and geophysical survey results. For planning of the water supply facilities, the water sources and elevated water tank are placed near to each other as much as possible.

2) Borehole Diameter

Drilling diameter: 250～350mm (10～14 inches)
Casing diameter: 150mm (6 inches)

3) Drilling Depth

The drilling depths vary depending on the hydrogeological conditions of the area. The average drilling depth was determined through analysis of the existing boreholes on information such as well depths, aquifer depths, geological formations, static water levels, fracture zones, and weathered zones in addition to the results of hydrogeological survey and electrical prospecting. The average depth in the project is estimated as 90m.

4) Casing and Screen

The material of casing and screen is UPVC, which DWR usually employs, considering its workability, weight and resistance. The length of each piece is standardised (see Figure 2-3 Standard Borehole Structure). In case the average depth is 90m, the screen length is to be its 30% (27m) and the casing is 70% (63m) considering the borehole specifications in the Gambia and hydrogeological analysis.

5) Centralizer

To keep the casing and screen in the centre of the borehole, centralizers will be installed.

6) Cementation and Gravel Packing

The upper part of a borehole down to 20m will be cemented to avoid contamination from the surface. The annulus space between the aquifer and casing will be packed with appropriate gravels.

7) Pumping System

Pumping system will be selected from the accessibility of spare parts and repair in the Gambia. The executing agency does not specify a standard type for pump, yet a type is selected which generally is used for solar pumping systems in the Gambia.

(2) Water Supply Facilities Plan

The water supply facilities plan is summarised below.

① Population

The design served population is projected from the present population based on the population census of 1993 and 2003.

② Design Target Year

The design target year is 2015 according to the Water Resources Development Strategy under preparation by DWR.

③ Population Growth Rate

Analysis of the population census shows the yearly population growth rate of the Gambia as 2.5% to 4.2%. The rural population growth rate is lower than that of urban areas, and therefore, in this project the minimum ratio of 2.5% is taken.

④ Unit Water Supply Rate

The "Water Resources Development Strategy" which DWR is currently compiling adopts 35l/capita/day as the unit supply rate for rural areas. In addition, for livestock such as cattle, horse, donkey, sheep, goat and chicken, the unit supply rate of 35l/h/d is adopted as cattle correspondent number. However for this project, considering the efficiency and scale of solar pumping systems, the water use from the constructed facilities will be limited only for human consumption and the water from existing shallow wells will be used for livestock watering. In conclusion, the unit supply rate of this project is set at 35l/capita/day.

⑤ Design Supply Rate

The design supply rate is calculated as follows:

Design Supply Rate = Design Served Population × Unit Supply Rate

⑥ Storage Tank (Elevated Tank, 5m height)

The volume of water storage will be determined according to the design supply rate. The storage volume is desirably 60% of the design supply rate estimating the pumping hours of the solar pumping system and water demand peak hours. The project plans the economical and effective operation in the village through water supply on demand. The storage tanks in the 20 target villages are to be the following 3 types targeting 60% of the design supply rate.

- Elevated water tank: $30m^3$
- Elevated water tank: $50m^3$
- Elevated water tank: $70m^3$

i) Peak Hours

Reflecting the water supply situation in the Gambia, the project sets peak hours as 3 hours between 5:00 to 8:00 in the morning and 2 hours in the evening totalling 5 hours a day. The storage capacity at peak hours is estimated to cover at least 1.5 times of the hourly average supply rate so that water can be sufficiently secured in the early morning time.

ii) Pumping Hours

Solar systems employed in the Gambia generally require daylight hours of 6 hours. Therefore, this project also designs pumping hours as 6 hours.

2-2-2-3 Plan for Equipment and Materials

(1) Policy on Procurement of Equipment and Materials (Necessity of Procurement)

Vehicles owned by DWR are those that were procured in 1992 under the previous Japanese grant aid project. These vehicles are still in use after 10 years since procurement, and the management and maintenance conditions by DWR is evaluated as satisfactory.

However, because of lack of spare parts for some equipment, borehole construction works are hindered. The Government of the Gambia requested to the Government of Japan a follow up cooperation in March 2001 to improve such a situation. In January 2002, a follow up study was conducted and finally in July

2003 spare parts were delivered to DWR and the repair works were made by a Japanese engineer in October 2003. Following is the summary of the study results of condition of the existing equipment owned by DWR.

Table 2-13 Condition of Existing Equipment

No.	Equipment	Specification	Use	Q'ty	Condition (Oct.2003)
1	Drilling rig, truck mounted	Type: Rotary Drilling diameter: φ8-1/2" Depth: 200m	Development of groundwater in the rural area for 「Integrated Water Use Project」 and similar projects.	1 set	Parts for hydraulic system, swivel head were procured and serviced by a Japanese engineer under the follow-up scheme.
	Truck for above	6×6, 250ps engine GVW ：24,000kg			Repair of engine, and procurement of parts and consumables were done by the follow-up scheme.
2	Drilling tools	Mud circulation tools, fishing tools, casing tools, drilling bits, repair tools	To be used for drilling work.	1 set	Drilling tools fitted to the geological condition were supplemented by the follow-up scheme.
3	Air compressor (trailer type)	Discharge: 15m^3/min Pressure: 1.0Mpa	For airlift and well development during drilling work	1 set	In good condition
4	Geoelectrical prospecting equipment	Output: 400V Max. Current: 200mA Current range:1~200mA Input impedance: 1MΩ	Use for geophysical prospecting	1 set	In good condition
5	Logging equipment	Logging depth: 300m Item:resistivity, SP, gamma	To determine the aquifer depth	1 set	In good condition
6	Equipment for data analysis	Computer: laptop type Printer: 9-Pin Dotmatrix Software: for data analysis	To analyse the geophysical survey data	1 set	In good condition
7	Equipment for pumping test	Submersible motor pump: 500L/min×80mH Trailer mounted generator: 50Hz-380V-37KVA Other: accessories	To determine the borehole potential	1 set	Necessary parts for repair the damaged pump were procured by the follow-up scheme.
8	Equipment for water quality analysis	Conductivity meter, pH meter	To measure the groundwater quality	1 set	In use
9	Cargo truck with 3 ton crane	4×4, 185HP, GVW ：6,000kg	For transportation of drilling equipment and materials	1 unit	Repair of engine, and procurement of parts and consumables were done by the follow-up scheme.
10	Water tank truck	4×4, 165HP, Tank: 4,000 litter	Transportation of water for construction work	1unit	Repair of engine, and procurement of parts and consumables were done by the follow-up scheme.
11	Station wagon	4×4, 120HP	Transportation of drilling team, monitoring of operation and maintenance activities	1 unit	New on e will be procured in this project since the existing one is in use for monitoring and supervision of routine works by DWR.

No.	Equipment	Specification	Use	Q'ty	Condition (Oct.2003)
12	Pick-up truck	Double cabin, 4×4, 80HP	Transportation of drilling team, monitoring of operation and maintenance activities	2 units	One of two trucks is scrapped. The other is in use for monitoring and supervision of routine work by DWR. Another one vehicle will be procured for implementation of this project.
13	Pump hoist truck	Capacity: 5,000kg Main reel: 60m	Rehabilitation of existing boreholes, installation of submersible pumps	1 unit	Supply of parts, basically consumables, were done by the follow-up scheme.

These drilling equipment and supporting vehicles were procured in 1992 under the previous Japanese grant aid project. As a result of the discussion with DWR based on the assessment of conditions of the equipment, DWR and the basic design study team agreed to utilise all the existing equipment listed above in this project apart from the supporting vehicles for transportation of drilling team.

Meanwhile, the Government of the Gambia requested to the Government of Japan the following.

① Procurement of spare parts for drilling equipment and vehicles
② Renewal of supporting vehicles
③ Procurement of consumables and spare parts for water supply facilities

The request was validated through the basic design study, and principles for cooperation were drawn as follows.

① Procurement of Spare Parts for Drilling Equipment and Vehicles

A follow-up cooperation was rendered in 2002 and spare parts required for service of the drilling equipment were procured in 2003. Therefore, this project will not include new procurement of these items.

② Supporting Vehicles for Construction Works

The supporting vehicles are important for transportation of drilling teams. Two out of three existing vehicles were serviced by the follow-up cooperation and are being utilised by DWR for supervision and monitoring of construction and operation and maintenance. Therefore, occupation of these vehicles for this project will hinder the daily activities of DWR. By this reason, DWR requested supporting vehicles necessary for implementation of this project as summarised in Table 2-14.

Table 2-14 Specifications of Supporting Vehicles to be Procured

Vehicle	Q'ty	Usage
Station wagon	1 unit	• Geophysical prospecting/borehole construction supervision • Transportation of equipment and drilling teams • Monitoring
Pick-up truck	2 units	• Borehole construction supervision • Transportation of materials such as drilling tools, gravel, cement and others • Transportation of drilling teams • Transportation of equipment and personnel for hydrogeological survey • Transportation of pumping test equipment and personnel • Transportation of water quality analysis personnel • Transportation of logging materials and personnel

The vehicles that DWR is currently using were procured in 1992 under the pervious Japanese grant aid project and have already been used for 10 years. Moreover:

(1) The vehicles are operating in the normal daily work of DWR, hence lack of supporting vehicles for implementation of this project,

(2) Usually, the life span of the vehicles are 5 to 6 years while 1 out of 3 existing ones was scrapped,

(3) If the project uses the existing vehicles during the execution of this project, there is a possibility for inefficiency of construction works due to break down of the vehicles.

Considering the above, the project will procure the supporting vehicles that the Government of the Gambia requested.

Moreover, with regard to operation and maintenance of the water supply facilities, it turned out that the software component programme needs supporting equipment which DWR requested to the study team during the survey period. Presently, motivators dispatched from DWR to each Division are responsible for facilitation of mobilisation of community members and their capacity building for operation and maintenance of water supply facilities, but there is an insufficiency of means of transport to the field. Meanwhile, a database is being established by DWR and EDF for monitoring the water tariff payment of the residents and the maintenance activities. For the water supply facilities constructed under this project, the same type of database needs to be established for monitoring of the operation and maintenance activities by the communities and local service providers, but there is no computer equipment available for the project. Therefore, equipment shown in Table 2-15 need to be procured.

Table 2-15 Specifications of Supporting Equipment to be Procured for Operation and Maintenance

Item	Specifications	Q'ty	Needs
1. Equipment for operation and maintenance 1) Motor bike	Displacement: 125CC	1 set (8 units)	• For the community awareness activities and training of water committees. Also for mobilisation of the DWR motivator after the construction of the water supply facilities and follow-up activities. • In 1990, EDF, UNDP/UNCDF procured a motorbike, but it is deteriorated and it will be difficult to use in this project.
2. Computer for operation and maintenance 1) Computer 2) Software	To connect with the existing database	1 set	Operation and maintenance situation of the existing water supply facilities are monitored by DWR and EDF using a database. In this project, it is necessary to procure equipment to connect to the existing database to monitor the operation and maintenance condition of the water supply facilities constructed under the project.

(2) Policy on Procurement of Spare Parts for Solar Pumping System

The operation and maintenance of the solar pumping systems have few differences among donors but their basic frameworks have been formulated in the Gambia. The contents are as follows.

- □ To conclude a maintenance contract between a village and local private maintenance service provider.
- □ The supplier of the solar pumping system assures a five-year guarantee to each facility.
- □ Provision of spare parts from the project approximately for 5 years after the guarantee period

Each donor is providing spare parts as a part of scope of the project. For example, Table 2-16 shows a list of parts procured by UNDP/UNICEF. The quantity is based on necessary amount for a five-year period. Projects for construction of water supply facilities with solar pumping system in the Gambia, the unit of each device itself is usually procured as the spare parts of the solar pumping system.

Table 2-16 Quantity of Spare Parts Procured for 10 Sites in a Project funded by UNDP/UNCDF

Item of Spare Parts	Q'ty
• Submersible motor pump	10 units
• Inverter (A)	2 units
• Inverter (B)	2 units
• Solar panel	3 sheet
• Junction box	3 units

Considering the durable years of the equipment procured by other donors, it may seem to be over procured. However, even during the usable life period, standby parts need to be provided during repairs on parts broken by unexpected incidents such as 1) natural climatic calamities as lightning, 2) wire disconnections due to wind, rain and sandstorms. This project considers sustainable water supply the foremost objective, and therefore, will procure the minimum necessary spare parts.

(3) Procurement of Spare Parts for Solar Pumping System

1) The guarantee period for equipment procured by the project is one year unless otherwise specified. However, the following measures are taken for operation and maintenance of solar pumping systems at impoverished villages in the Gambia. As pointed out in a case study in Senegal about operation and maintenance of solar pumping system (November, 2003 by JICA), 11 countries of CILSS including the Gambia normally procure spare parts together with 5-year guarantee period for solar pumping system. Therefore, spare parts for 5 years were requested to this project as well.
2) Similarly, a case of UNDP/UNCDF (1999-2001) in the Gambia procures spare parts for 5 years in addition to 1year guarantee period as a support for the operation and maintenance system managed by the beneficiary communities. Stable water supply is thus assured for 6 years for villagers, while water fees can be collected among villagers and saved for maintenance costs which may incur at the 7th year and thereafter. This will sustain a long-term operation of the system.
3) On the other hand, EDF (2002-2003) procures spare parts for 5 years together with a guarantee period of 5 years. The donor secures more than 10 years operation of the facility. In the meantime, these communities can raise operation and maintenance fund, which assumedly enables a long-term operation (15-20 years) of the system.
4) Spare parts for 5 years were also requested to this project. Upon consideration, procurement of spare parts for 5 years is excessive from the view point of Japan's grant aid scheme. Therefore, the project will procure a minimum set of spare parts and a 5-year guarantee period is also planned. During this period villagers can raise maintenance funds on their own for operation and maintenance after the term of guarantee.
5) The project allows local maintenance companies to utilise the spare parts procured under the project at occasions of breakdowns of the solar pumping system at the target sites within 5 years. This aims at an expeditious response to the problem and efficiency for cost sharing. The maintenance companies will return the same

parts later. This system will mitigate financial burden of keeping spare parts stock for 5 years on the maintenance company's account and facilitate security and cooperative system of the project. To sum, the minimum quantity of the spare parts procured by the project will be utilised for operation and maintenance within and after 5 years of the guarantee period.

6) The spare parts to be procured in the project are of minimum quantity (each 1 unit). This minimum quantity reflects the cost sharing by the local villagers and convenience of local maintenance companies. Further, for this project, 5 years as the guarantee period can give villagers the opportunity to raise and save operation and maintenance funds. Therefore, the facilities to be constructed aim at 6 to 10 years sustainable operation, which can be realised through assistance from Japan and self-effort activities by the villagers. Figure 2-4 shows the outline of the plan with regard to spare parts procurement. The guarantee period of 5 years, which is normally 1 year, becomes common in the Gambia based on the support by EDF. The direct construction costs of this project precondition economical prices even with 5 years' guarantee period. The Gambia is a member of CILSS, and other CILSS countries such as Senegal secure the aforementioned conditions (fair prices and 5 year guarantee, 6 to 10 years sustainable operation of the facilities) with introduction of solar pumping system for effective water supply at poor villages.

(4) Procurement of Submersible Pumps, Inverter, Solar Panel as Spare Parts

① Proper specification of pumps are selected from the borehole yield corresponding to the water demand at the target sites. A solar pumping system includes a selected pump, solar panels, inverter, and a control device of the elevated water tank.

Since the types of pumps are numerous, the corresponding spare parts also become numerous. Therefore, in consideration of phase-wise completion and 5 years' guarantee period, the types of pumps were categorised to minimise the spare parts procurement. The spare parts for submersible motor pump are categorised into similar pump types, and spare parts are procured as one unit for one type from type A to I as shown in Table 2-17.

Fig 2-4 Structure of Maintenance Services of Solar Pumping System

Operation & Maintenance Schedule of Solar Pumping System	
Warranty Years 1 2 3 4 5	After Warranty Years 6 7 8 9 10 11 12 13
① 5 Years Warranty by the Contractor	② Maintained by Spare Parts Supplied by the Project

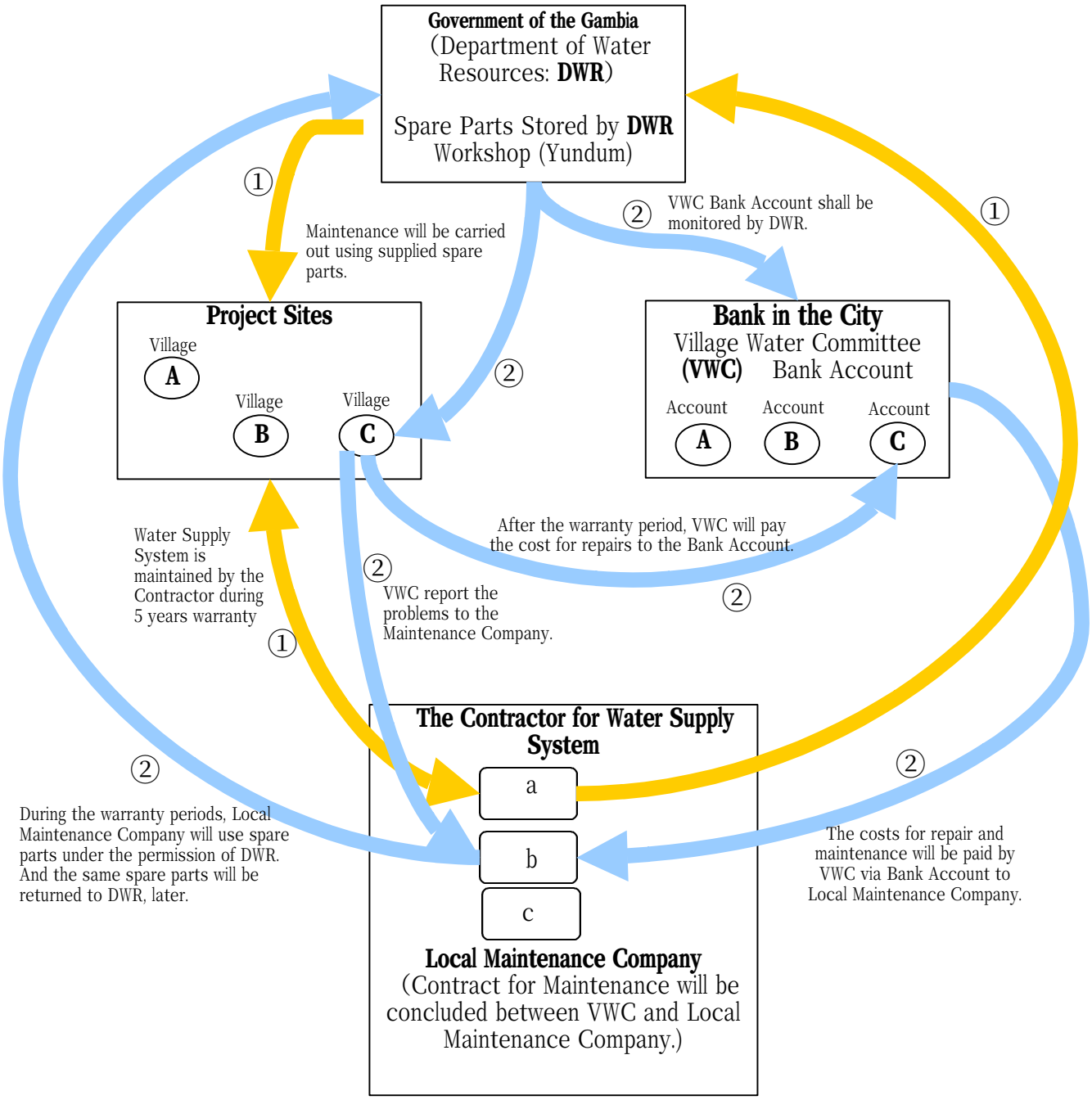


Table 2-17 Procurement Schedule of Spare Parts for Solar Pumping System

Item	Type	Quantity			Total
		Phase I	Phase II	Phase II	
1. Submersible Pump	(A)	1	-	-	1
	(B)	1	-	-	1
	(C)	1	-	-	1
	(D)	-	-	1	1
	(E)	-	-	1	1
	(F)	1	-	-	1
	(G)	1	-	-	1
	(H)	-	-	1	1
	(I)	1	-	-	1
	Subtotal	6	0	3	9
2. Inverter	(A)	1	1	1	3
	(B)	1	1	1	3
	(C)	1	1	1	3
	(D)	1	1	1	3
	Subtotal	4	4	4	12
3. Solar Panel	(A)	2	6	10	18
	(B)	17	14	8	39
	Subtotal	19	20	18	47

② From the field survey, the inverter is revealed to be the most vulnerable part against breakdown and need frequent replacement. Table 2-17 shows procurement of 4 types (A-D) in each phase.

③ As a result of the field survey, at 3 to 4 sites out of 105 existing solar pumping systems installed in the projects of EDF and UNDP/UNCDF, panels are stolen or broken down due to stones thrown to the panels or dust. These give less efficiency in operation of the systems though the water schemes are not stopped altogether. Against these thefts and damages of the modules, a guard is selected to patrol by villages and paid allowance by the maintenance service providers if it is during the guarantee period of the solar pumping system. However, a third party's criminal deeds against the facility need to be covered by the villagers even within the guarantee period of 5 years. Referring to the past experiences (2.8 to 3.8%), 3% of standby panels are to be procured in this project to secure the expeditious services and operation efficiency. Meanwhile, the villagers pay for the solar panel, which are used for repair of the system, from the collected maintenance fund. This will also allow unexpected incidences at different villages. Table 2-18 (A) to (C) estimates the minimum necessary spare parts to be procured for each phase. Table 2-19 shows specifications of the solar pumping system to be installed at each target site.

Table 2-18 (A) Quantity of Spare Solar Panels (Phase 1)

	N-9	N-10	N-11	W-1	W-2	L-3	L-8	N-1	N-2	N-3	Total
Panel Type	A	B	B	B	B	B	B	B	B	B	-
Panel Qt'y	51	85	30	38	48	30	48	85	85	85	-
Standby Panel (A)	2	-	-	-	-	-	-	-	-	-	2
Standby Panel (B)	-	3	1	1	1	1	1	3	3	3	17

Total 2-18 (B) Quantity of Spare Solar Panels (Phase 2)

	M-5	M-8	M-9	M-10	M-11	M-12	M-1	M-3	M-4	Total
Panel Type	A	B	B	A	A	B	B	B	B	-
Panel Qt'y	51	85	30	38	48	30	48	85	85	-
Standby Panel (A)	2	-	-	2	2	-	-	-	-	6
Standby Panel (B)	-	3	1	-	-	1	3	3	3	14

Total 2-18 (C) Quantity of Spare Solar Panels (Phase 3)

	L-1	L-9	L-10	L-11	M-2	M-6	M-13	L-5	L-6	L-7	Total
Panel Type	A	B	B	B	B	B	B	B	B	B	-
Panel Qt'y	51	85	30	38	48	30	48	85	85	85	-
Standby Panel (A)	-	-	-	2	-	2	2	-	2	2	10
Standby Panel (B)	1	1	1	-	2	-	-	3	-	-	8

Table2-19 Specifications of Solar Pumping System to be Installed

Phase	Name	Type	Target Village/Number	Specification			No. of Target Sites	Qt'y
				Yield L/min	Length m	Output kw		
Phase I	Submersible Pump	(F)	N-9：Tuba Kolong W-2：Sutusinjang L-8：Jali	156～207	50m	4.0	3	1
		(B)	N-11：Nawleru	89	45m	2.2	1	1
		(C)	W-1：Sohm	118	48m	3.0	1	1
		(A)	L-3：Dumbutu	125	43m	1.9	1	1
		(G)	N-10：Medina Sering Mass N-2：Fass Omar Sahor	313～360	50～60m	7.5	2	1
		(I)	N-1：Njaba Kunda N-3：Kachang	501～511	56m	7.5	2	1
	Inverter	(A)	N-11,W-1,L-3	-	-	Below 4.0	3	1
		(B)	W-2,L-8	-	-	4.0	2	1
		(C)	N-9	-	-	5.5	1	1
		(D)	N-10,N-1,N-2,N-3	-	-	Below 8.5	4	1
	Solar Panel	(A)	N-9	-	-	110w	1	2
		(B)	N-1,N-2,N-3,N-10,N-11,W-1,W-2,L-3,L-8	-	-	100w	9	17
Phase II	Submersible Pumps	(F)	M-5：Saruja M-9：Sukuta M-10：Galleh Manda M-11：Jakhaly	186～257	44m	4.0	4	1
		(G)	M-8：Sami Pachonki M-1：Mamutu Fana	303～335	48m	7.5	2	1
		(C)	M-12：Bakadagy	144	42m	3.0	1	1
		(I)	M-3：Brikama Ba	391～494	47～56m	7.5	2	1
	Inverter	(A)	M-12	-	-	Below 4.0	1	1
		(B)	M-9,M-10,M-11	-	-	4.0	3	1
		(C)	M-5	-	-	5.5	1	1
		(D)	M-8,M-1,M-3,M-4	-	-	Below 8.5	4	1
	Solar Panel	(A)	M-5,M-10,M-11	-	-	110w	3	6
		(B)	M-8,M-9,M-12,M-1,M-3,M-4	-	-	100w	7	14
PhaseIII	Submersible Pump	(E)	L-1：Nema	177	38m	3.0	1	1
		(F)	L-9：Pakali Ba L-11：Wellingara Ba M-2：Piniai M-6：Dankunku M-13：Sambang Complex	182～254	32～44m	4.0	5	1
		(H)	L-6：Toniataba L-7：Bureng	352～386	43m	7.5	2	1
		(D)	L-10：Massembe	153	42m	3.0	1	1
		(I)	L-5：Baro Kunda	431	58m	7.5kw	1	1
	Inverter	(A)	L-1,L-10	-	-	Below 4.0	2	1
		(B)	L-9,M-2,M-13	-	-	4.0	3	1
		(C)	L-11,M-5,L-6,L-7	-	-	5.5	4	1
		(D)	L-5	-	-	Below 8.5	1	1
	Solar Panel	(A)	M-6,M-13,L-6,L-7	-	-	110w	4	10
		(B)	L-1,L-9,L-10,L-11,M-2,L-5	-	-	100w	6	8

2-2-3 Basic Design Drawing

Table 2-20 summarises the design of the water supply facilities at 29 target villages. The basic design drawings of Figures 2-5 to 2-9 show water supply facilities with solar pumping systems, and Figures 2-10 to 2-29 show the site plans for target sites.

(1) Figure 2-5 to Figure 2-9 Water Supply Facilities with Solar Pumping Systems

(2) Figure 2-10 to Figure 2-29 Site Plan of Target Sites

Table2-20 Water Supply Facilities Plan

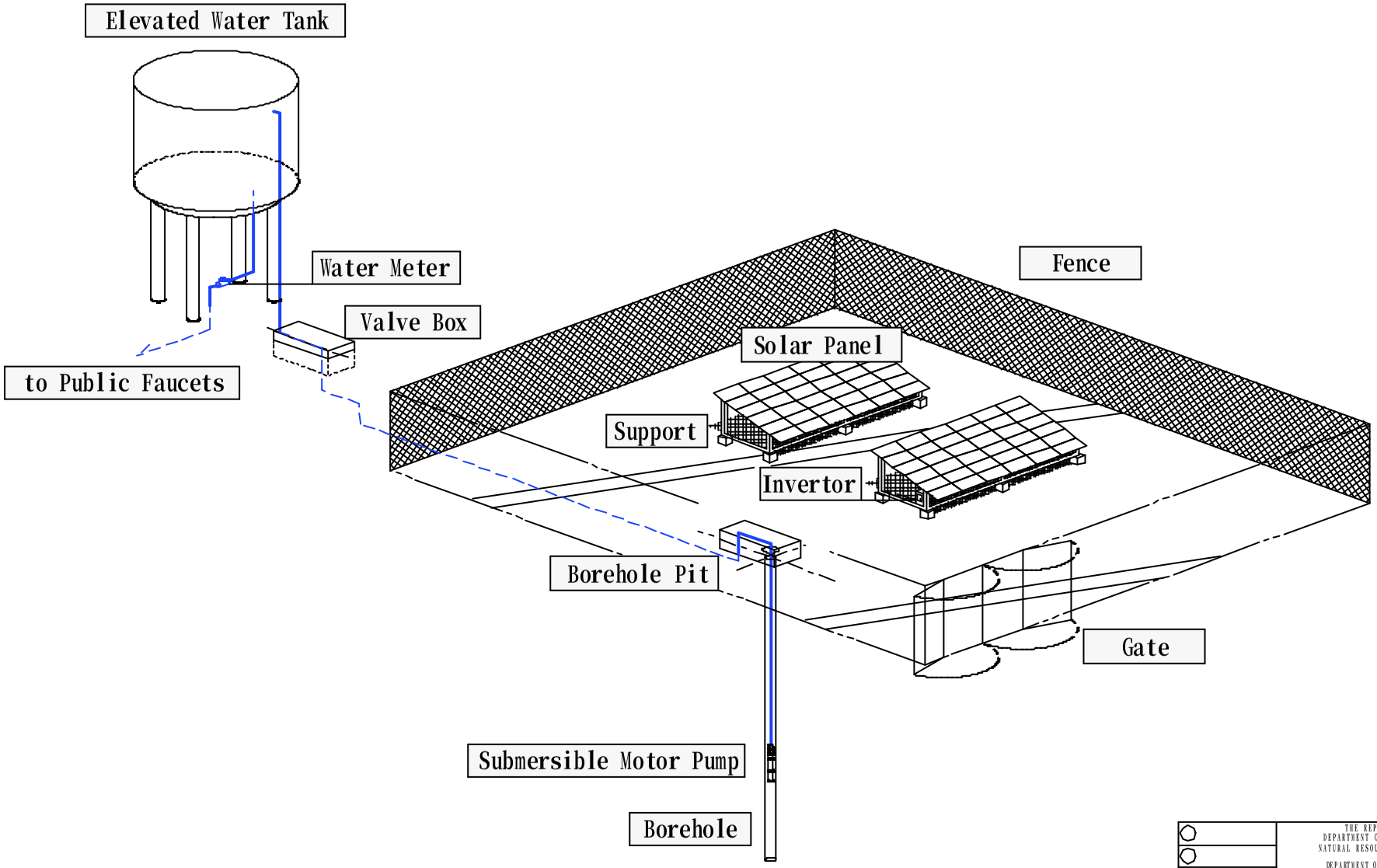
Construction of Water Supply Systems （２０ Sites）： Solar Pumping System

①Division	② No.	③Site Name	④Target Site			⑤Population		⑥Growth Rate	⑦Supply Population	⑧Unit Consumption	⑨Supply Demand	⑩Water Source (Borehole)									⑪ Pumping Hour	⑫Pumping Rate	⑬Tank Capacity			⑭Pump		⑮Pipe Dia	⑯Public Faucets	⑰Pipeline Length ϕ25mm～110mm
			Oreginal	Renew	Solar	1993	2003		2015	35L/Cap/day		Water Source	Dia (mm)	TD (m)	SWL (m)	SC (m /n/m)	Drowdown (m)	PWL (m)	Discharge (m³/h)	Discharge (L/min)		(L/h)	Day demand60%	Ajust	Existing	Discharge (L/min)	Total Head (m)	inch	(No.)	(m)
North Bank	N-9	Tuba Kolong	○			1,239	1,586	2.5%	2,133	35	74,655	Borehole	150	90.0	25.2	3.4	3.7	28.9	34.0	567	6	12,443	45	50		207	50	3	17	2,749
	N-10	Madina Sering Mass	○			2,149	2,751	2.5%	3,700	35	129,500	Borehole	150	90.0	22.5	3.3	6.5	29.0	33.0	550	6	21,583	78	70		360	50	3	28	3,346
	N-11	Nawleru		○		530	678	2.5%	912	35	31,920	Borehole	150	90.0	23.6	10.8	0.5	24.1	108.0	1,800	6	5,320	19	30		89	45	2	5	600
	Sub-Total					**3,918**	**5,015**		**6,745**																			**50**	**6,695**
Western	W-1	Sohm		○		704	901	2.5%	1,212	35	42,420	Borehole	150	90.0	25.0	3.4	2.1	27.1	250.0	4,167	6	7,070	25	30		118	48	2	13	2,935
	W-2	Sutusijang		○		980	1,254	2.5%	1,687	35	59,045	Borehole	150	80.0	25.0	3.4	2.9	27.9	250.0	4,167	6	9,841	35	30		164	49	2	15	3,494
	Sub-Total					**1,684**	**2,155**		**2,899**																			**28**	**6,429**
Lower River	L-1	Nema	○			1,060	1,357	2.5%	1,825	35	63,875	Borehole	150	100.0	15.6	8.9	1.2	16.8	156.0	2,600	6	10,646	38	50		177	38	3	12	1,466
	L-3	Dumbutu	○			749	959	2.5%	1,289	35	45,115	Borehole	150	100.0	21.3	14.0	0.5	21.8	213.0	3,550	6	7,519	27	30		125	43	2	9	1,164
	L-8	Jali	○			930	1,190	2.5%	1,601	35	56,035	Borehole	150	90.0	24.0	2.6	3.6	27.6	240.0	4,000	6	9,339	34	30		156	49	2	11	1,662
	L-9	Pakali Ba	○			1,088	1,393	2.5%	1,873	35	65,555	Borehole	150	90.0	21.6	8.2	1.3	22.9	216.0	3,600	6	10,926	39	50		182	44	3	13	1,844
	L-10	Massembe	○			914	1,170	2.5%	1,574	35	55,090	Borehole	150	90.0	18.2	3.9	2.4	20.6	182.0	3,033	6	9,182	33	30		153	42	2	9	1,131
	L-11	Wellingara Ba		○		1,515	1,939	2.5%	2,608	35	91,280	Borehole	150	100.0	8.5	5.6	2.7	11.2	85.0	1,417	6	15,213	55	50		254	32	3	16	3,066
	Sub-Total					**6,256**	**8,008**		**10,770**																			**70**	**10,333**
Central River	M-2	Piniai	○			1,231	1,576	2.5%	2,119	35	74,165	Borehole	150	90.0	18.2	36.0	0.3	18.5	182.0	3,033	6	12,361	44	50		206	40	3	17	7,436
	M-5	Saruja	○			1,536	1,966	2.5%	2,644	35	92,540	Borehole	150	70.0	18.9	5.3	2.9	21.8	189.0	3,150	6	15,423	56	50		257	43	3	24	3,415
	M-6	Dankunku	○			1,516	1,941	2.5%	2,610	35	91,350	Borehole	150	80.0	18.2	8.2	1.9	20.1	182.0	3,033	6	15,225	55	50		254	41	3	14	2,435
	M-8	Sami Pachonki	○			2,000	2,560	2.5%	3,443	35	120,505	Borehole	150	100.0	20.9	6.7	3.0	23.9	209.0	3,483	6	20,084	72	70		335	45	3	20	2,187
	M-9	Sukuta	○			1,109	1,420	2.5%	1,909	35	66,815	Borehole	150	80.0	18.0	5.3	2.1	20.1	180.0	3,000	6	11,136	40	50		186	41	3	16	2,207
	M-10	Galleh Manda	○			1,543	1,975	2.5%	2,656	35	92,960	Borehole	150	100.0	20.9	6.7	2.3	23.2	209.0	3,483	6	15,493	56	50		258	44	3	19	2,456
	M-11	Jahally		○		1,406	1,800	2.5%	2,421	35	84,735	Borehole	150	90.0	15.1	3.8	3.7	18.8	151.0	2,517	6	14,123	51	50		235	40	3	22	2,039
	M-12	Bakadagy		○		859	1,100	2.5%	1,479	35	51,765	Borehole	150	80.0	18.2	3.4	2.5	20.7	182.0	3,033	6	8,628	31	30		144	42	2	14	2,213
	M-13	Sambang Complex		○		1,478	1,892	2.5%	2,544	35	89,040	Borehole	150	90.0	17.5	22.1	0.7	18.2	175.0	2,917	6	14,840	53	50		247	39	3	25	3,785
	Sub-Total					**12,678**	**16,230**		**21,825**																			**171**	**28,173**
Total			13	7	0	**24,536**	**31,408**		**42,239**																			**319**	**51,630**

Rehabilitation of JICA Project （９ sites）： Solar Pumping System

①Division	② No.	③Site Name	④Target Site			⑤Population		⑥Growth Rate	⑦Supply Population	⑧Unit Consumption	⑨Supply Demand	⑩Water Source (Borehole)									⑪ Pumping Hour	⑫Pumping Rate	⑬Tank Capacity			⑭Pump		⑮Pipe Dia	⑯Public Faucets	⑰Pipeline
			Original	Renew	Generator	2000	2003		2015	35L/Cap/day		Water Source	Dia (mm)	TD (m)	SWL (m)	SC (m^3/h/m)	Drowdown (m)	PWL (m)	Discharge (m^3/h)	Discharge (L/min)		(L/h)	% of Day Demand	Ajust	Existing	Discharge (L/min)	Total Head (m)	inch		
North Bank	N-1	Njaba Kunda			○	3,560	3,834	2.5%	5,156	35	180,460	Existing	150	93.0	23.7	10.8	2.8	26.5	108.0	1800	6	30,077	44%		80	501	49	3	Existing	Existing
	N-2	Fass Omar Sahor			○	2,220	2,391	2.5%	3,215	35	112,525	Existing	150	87.0	22.5	3.3	5.7	28.2	33.0	550	6	18,754	44%		50	313	60	3	Existing	Existing
	N-3	Katchang			○	3,630	3,909	2.5%	5,257	35	183,995	Existing	150	92.0	17.8	6.9	4.4	22.2	69.0	1150	6	30,666	43%		80	511	56	3	Existing	Existing
	Sub-Total					**9,410**	**10,134**		**13,628**																				
Lower River	L-5	Baro Kunda			○	3,060	3,295	2.5%	4,432	35	155,120	Existing	150	101.0	18.3	6.7	3.9	22.2	67.0	1117	6	25,853	52%		80	431	58	4	Existing	Existing
	L-6	Toniataba			○	2,740	2,951	2.5%	3,968	35	138,880	Existing	150	92.0	9.9	3.9	5.9	15.8	39.0	650	6	23,147	58%		80	386	43	3	Existing	Existing
	L-7	Bureng			○	2,500	2,692	2.5%	3,621	35	126,735	Existing	150	56.0	7.3	5.6	3.8	11.1	56.0	933	6	21,123	63%		80	352	43	4	Existing	Existing
	Sub-Total					**8,300**	**8,938**		**12,021**																				
Central River	M-1	Mamut Fana			○	2,150	2,315	2.5%	3,114	35	108,990	Existing	150	92.0	21.6	3.9	4.7	26.3	39.0	650	6	18,165	73%		80	303	48	3	Existing	Existing
	M-3	Brikama Ba			○	3,510	3,780	2.5%	5,084	35	177,940	Existing	150	102.0	20.9	6.8	4.4	25.3	68.0	1133	6	29,657	45%		80	494	47	3	Existing	Existing
	M-4	Madina Umfally			○	2,780	2,994	2.5%	4,026	35	140,910	Existing	150	98.0	15.1	3.8	6.2	21.3	38.0	633	6	23,485	46%		65	391	56	3	Existing	Existing
	Sub-Total					**8,440**	**9,089**		**12,224**																				
Total			0	0	9	**26,150**	**28,161**		**37,873**																				

Total	**50,686**	**59,569**	**80,112**

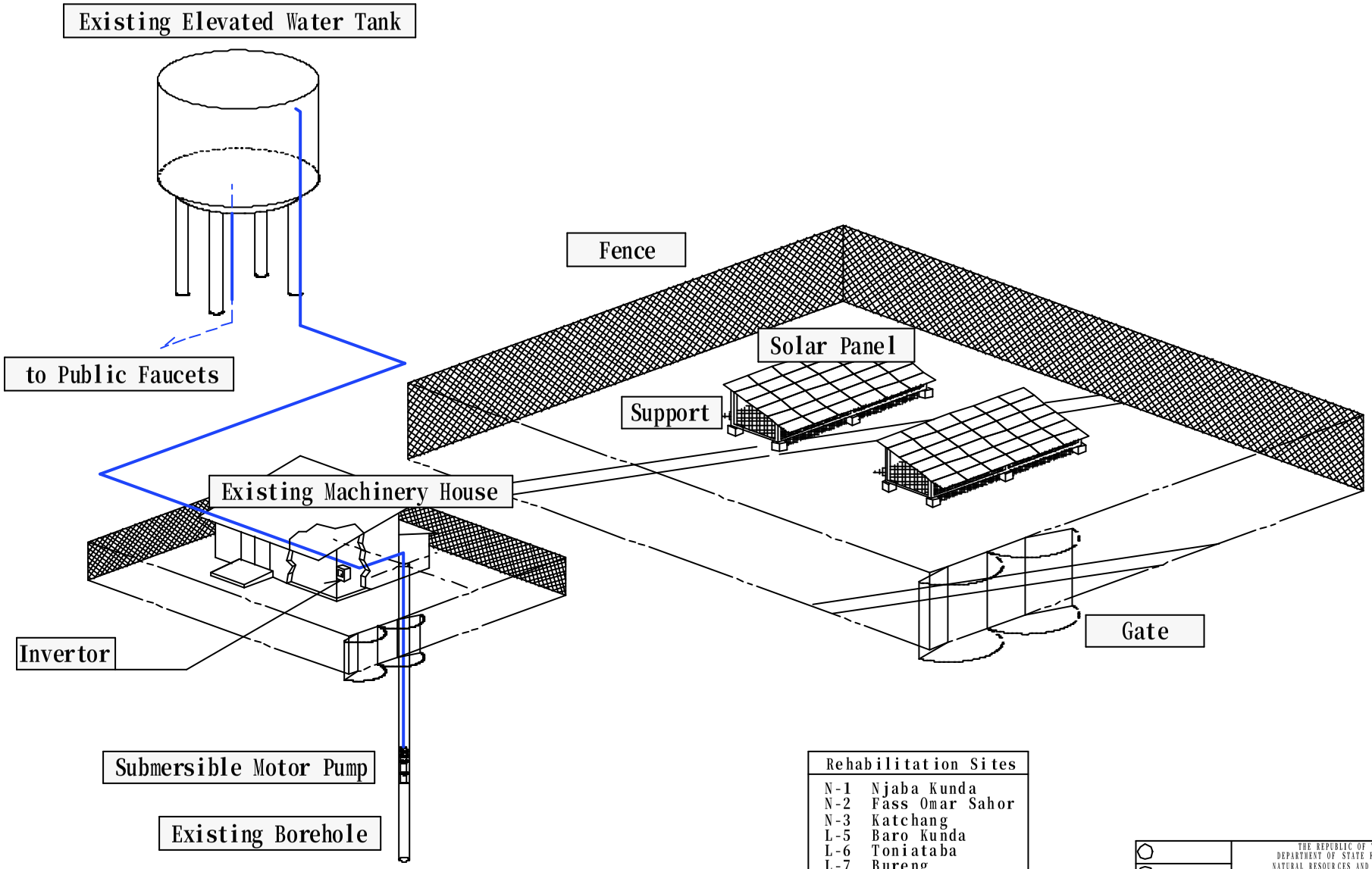


THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)

Construction of
New Water Supply Facility with
Solar Pumping System

Fig. 2-5

JAPAN TECHNO



Rehabilitation Sites	
N-1	Njaba Kunda
N-2	Fass Omar Sahor
N-3	Katchang
L-5	Baro Kunda
L-6	Toniataba
L-7	Bureng
M-1	Mamut Fana
M-2	Brikama Ba
M-3	Madina Umfally

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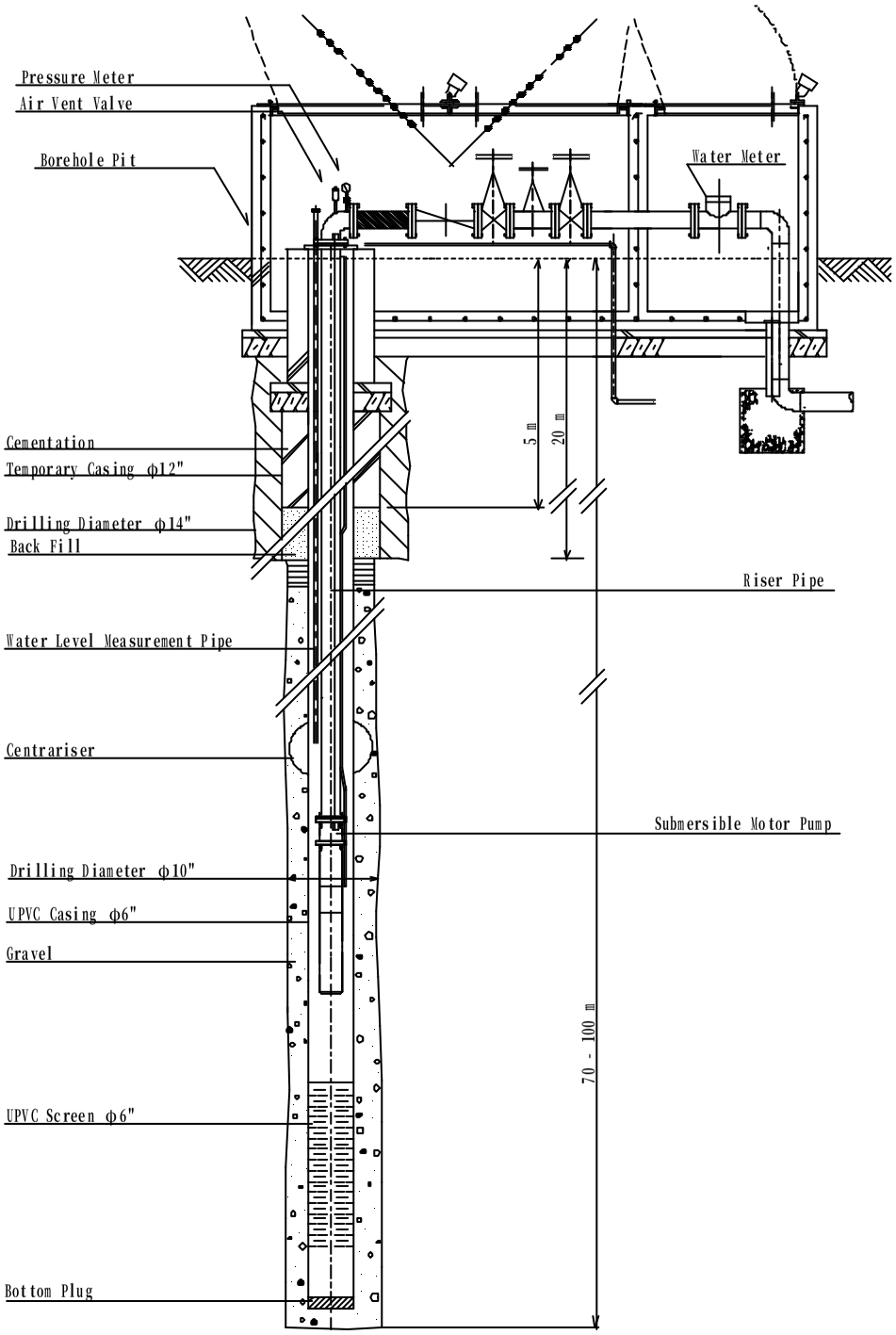
DEPARTMENT OF WATER RESOURCES (DWR)

Conversion to
Solar Pumping System for
Existing Water Supply Facility

Fig. 2-6

JAPAN TECHNO



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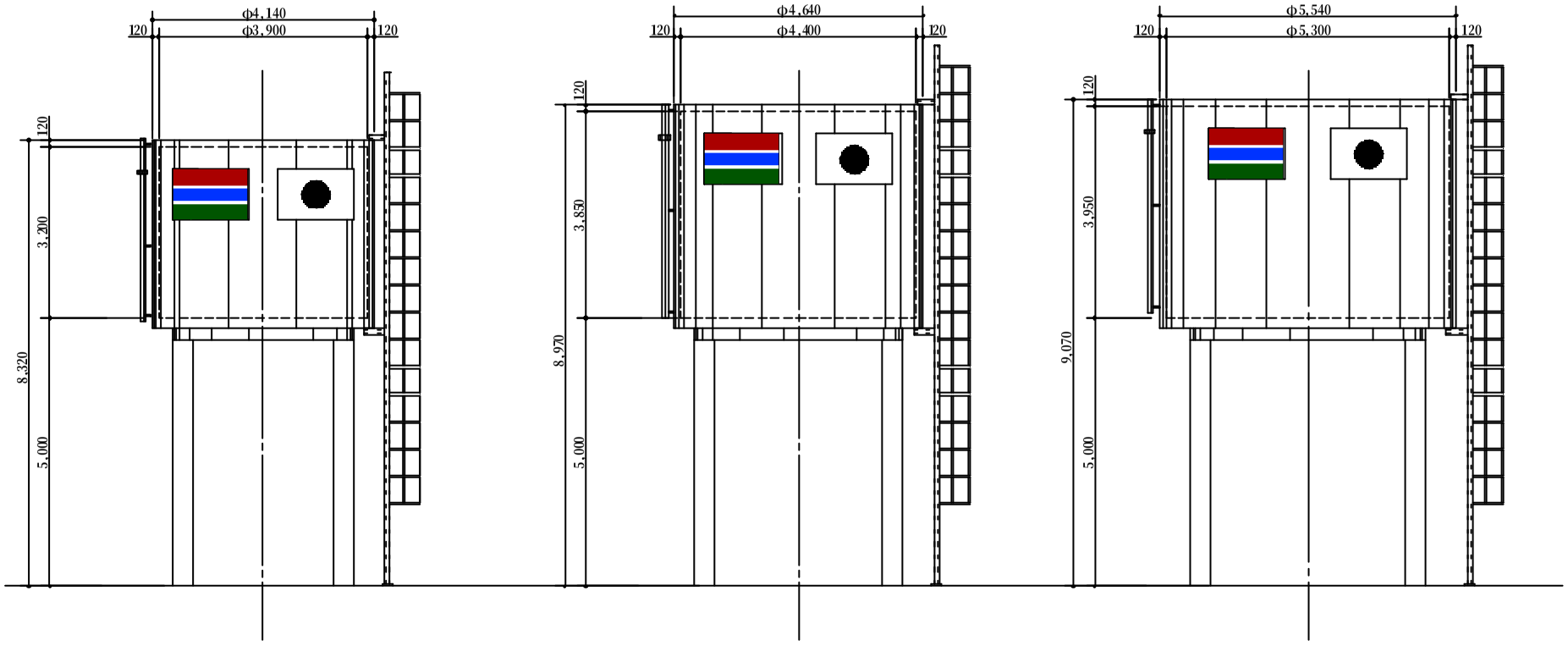
DEPARTMENT OF WATER RESOURCES (DWR)

Borehole & Borehole Pit

Fig. 2-7

JAPAN TECHNO



Elevated Water Tank 30m^3

Elevated Water Tank 50m^3

Elevated Water Tank 70m^3

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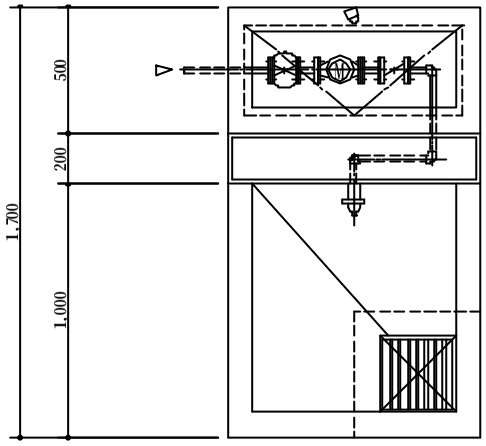
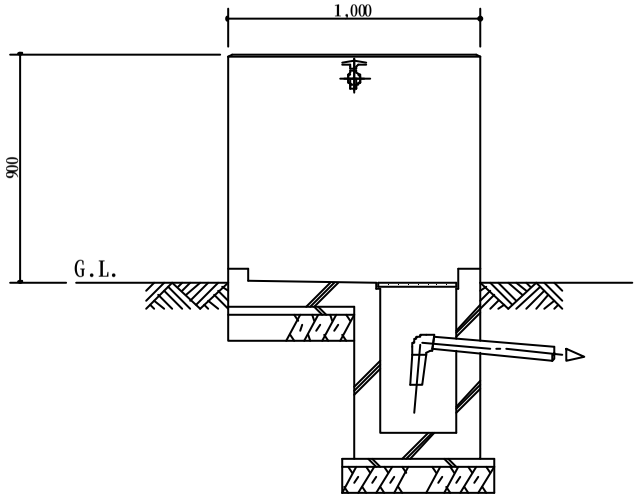
DEPARTMENT OF WATER RESOURCES (DWR)

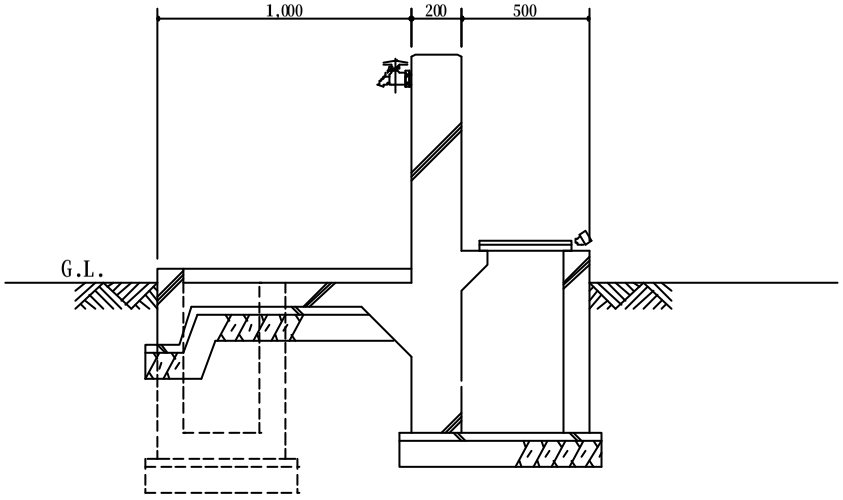
Elevated Water Tank
30, 50 & 70m^3

Fig. 2-8

JAPAN TECHNO







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Public Faucet

Fig. 2-9

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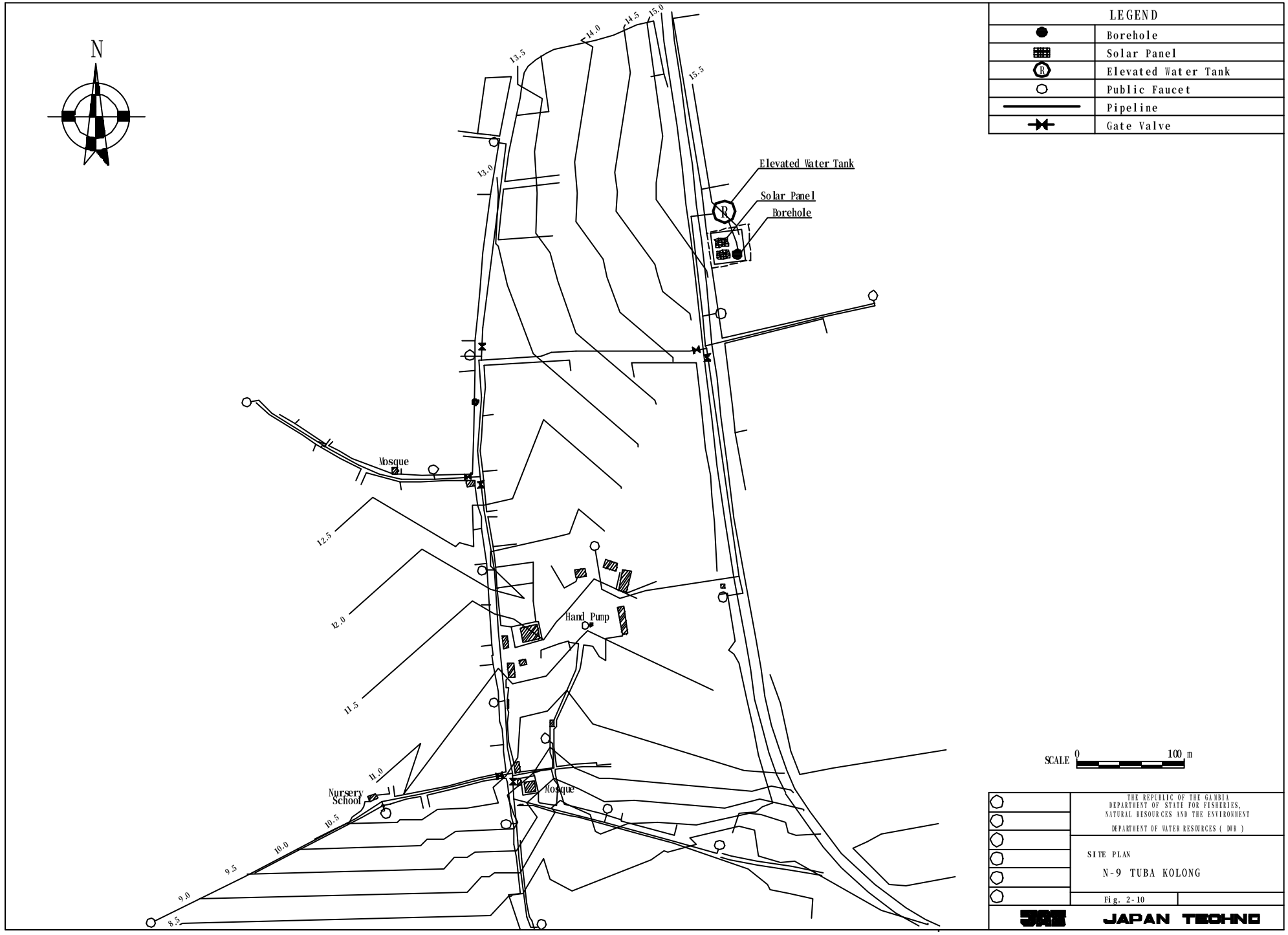
N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
Elevated Water Tank
Solar Panel
Borehole
Mosque
Hand Pump
Nursery School
Mosque
13.5
14.0
14.5
15.0
15.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
SCALE 0 100 m
THE REPUBLIC OF THE GAMBIA
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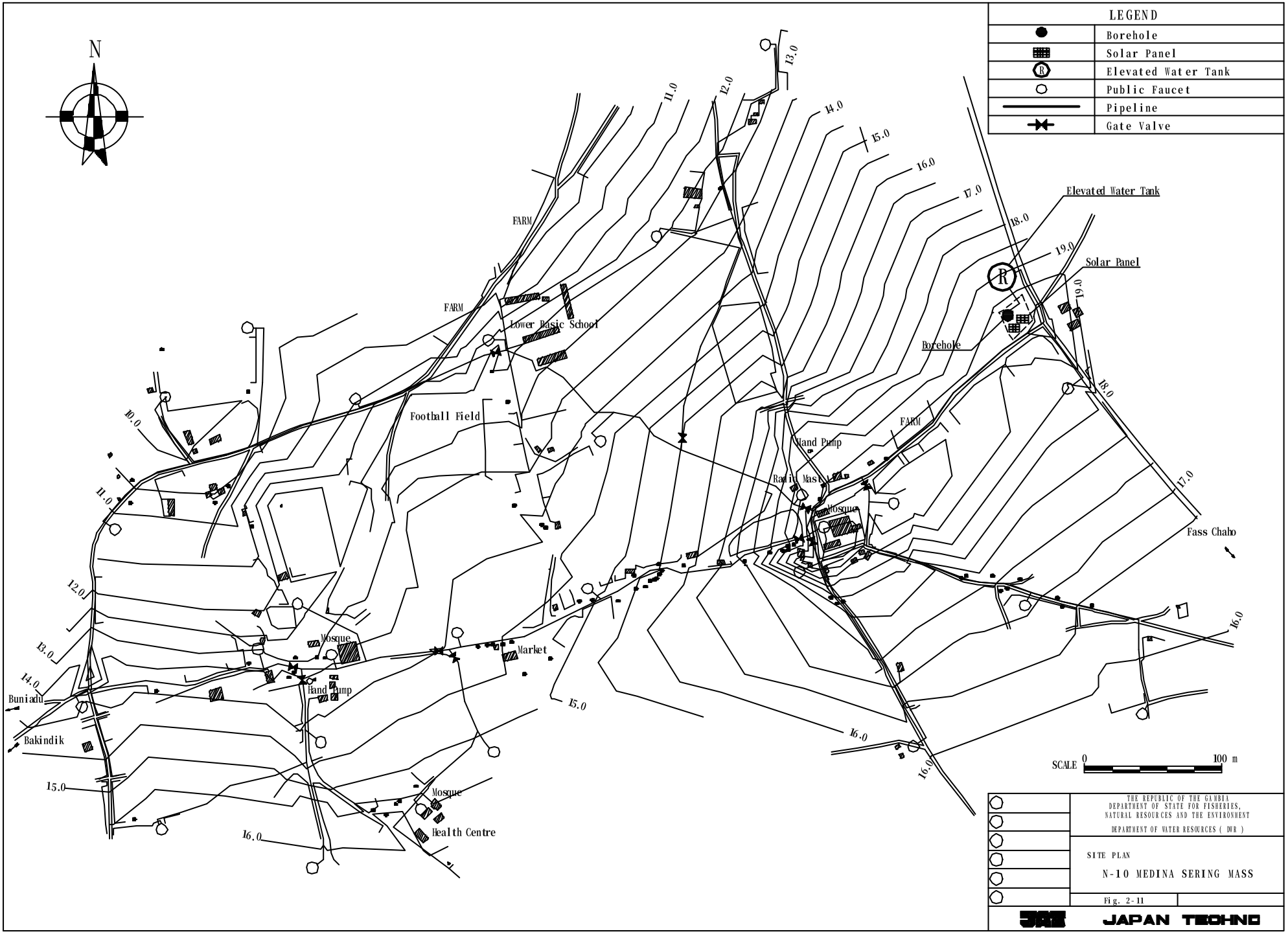
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
N-9 TUBA KOLONG
Fig. 2-10
JAPAN TECHNO


N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
Elevated Water Tank
Solar Panel
Borehole
Lower Basic School
Football Field
FARM
Hand Pump
Radio Mast
Mosque
Market
Health Centre
Fass Chalo
Bunjadu
Bakindik
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
SCALE 0 100 m
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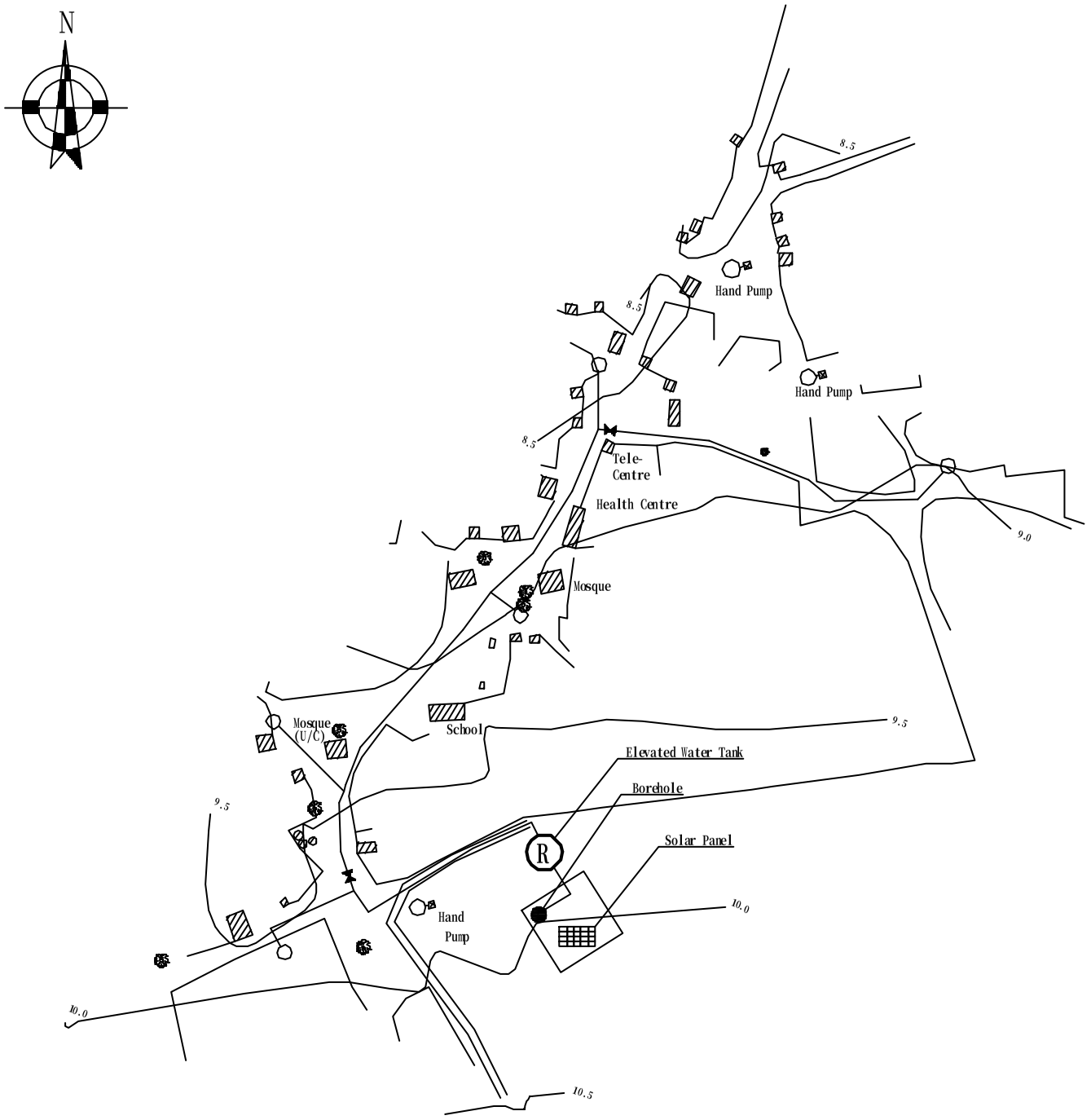
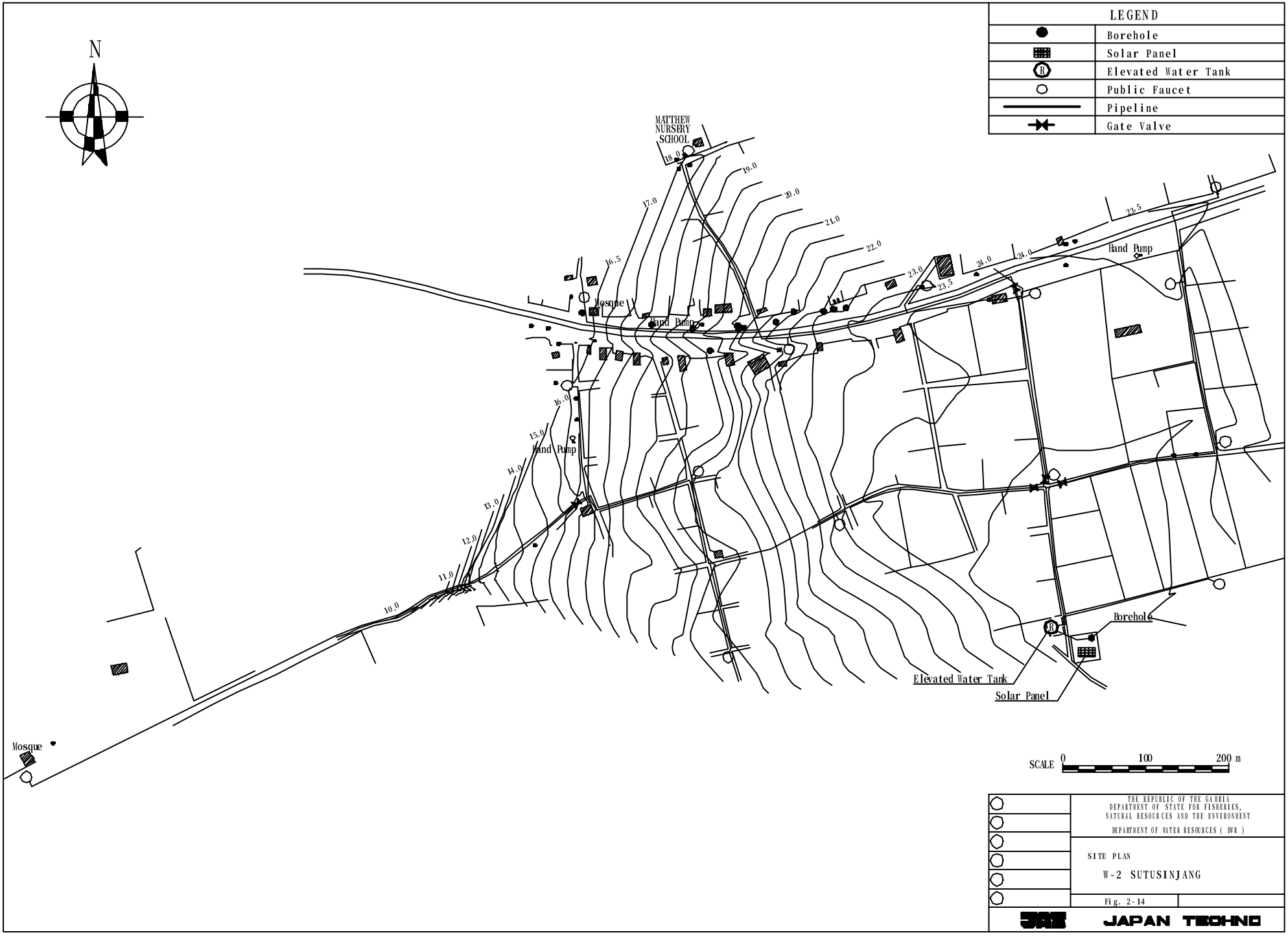
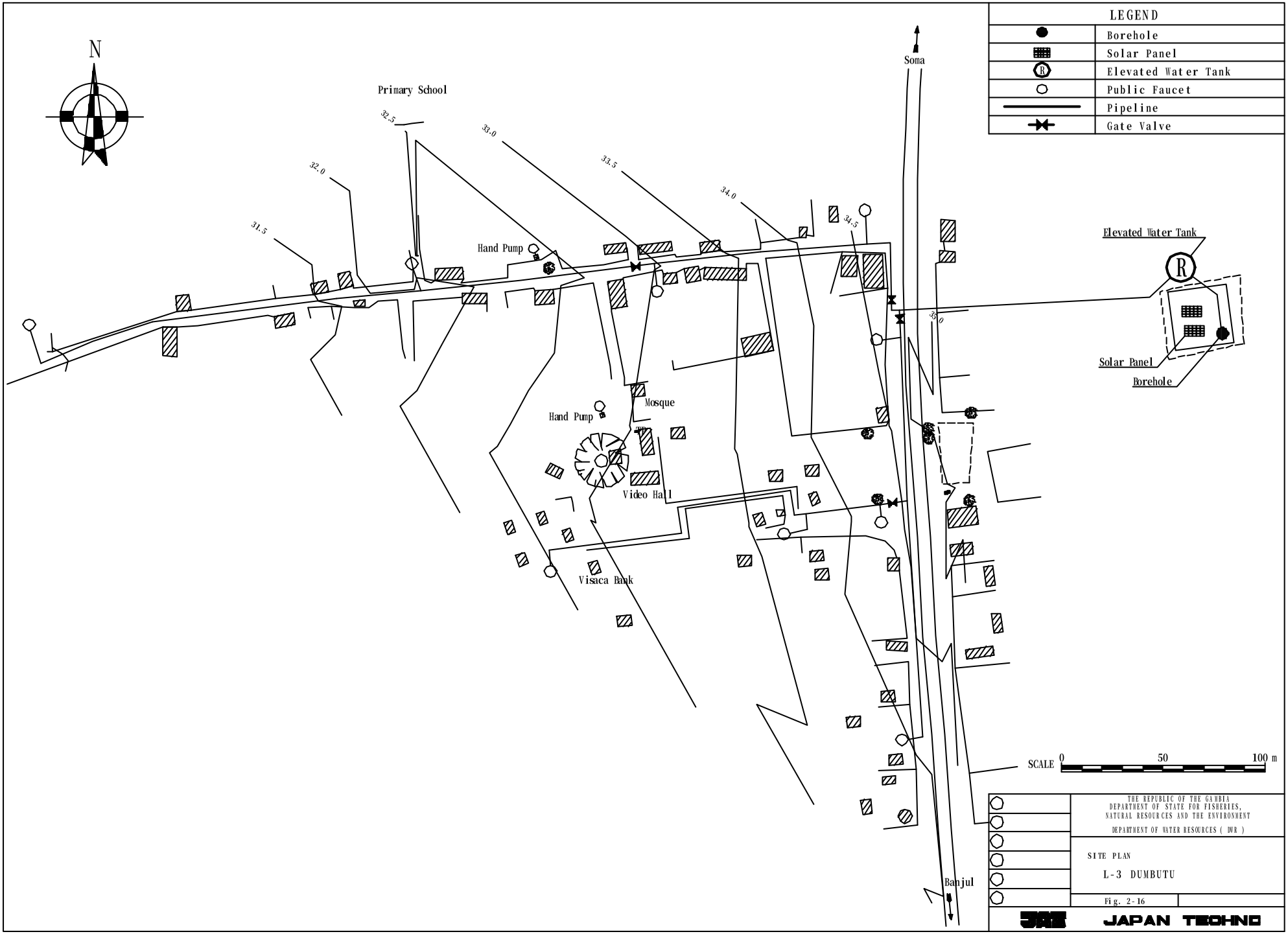
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
N-10 MEDINA SERING MASS
Fig. 2-11
JAPAN TECHNO

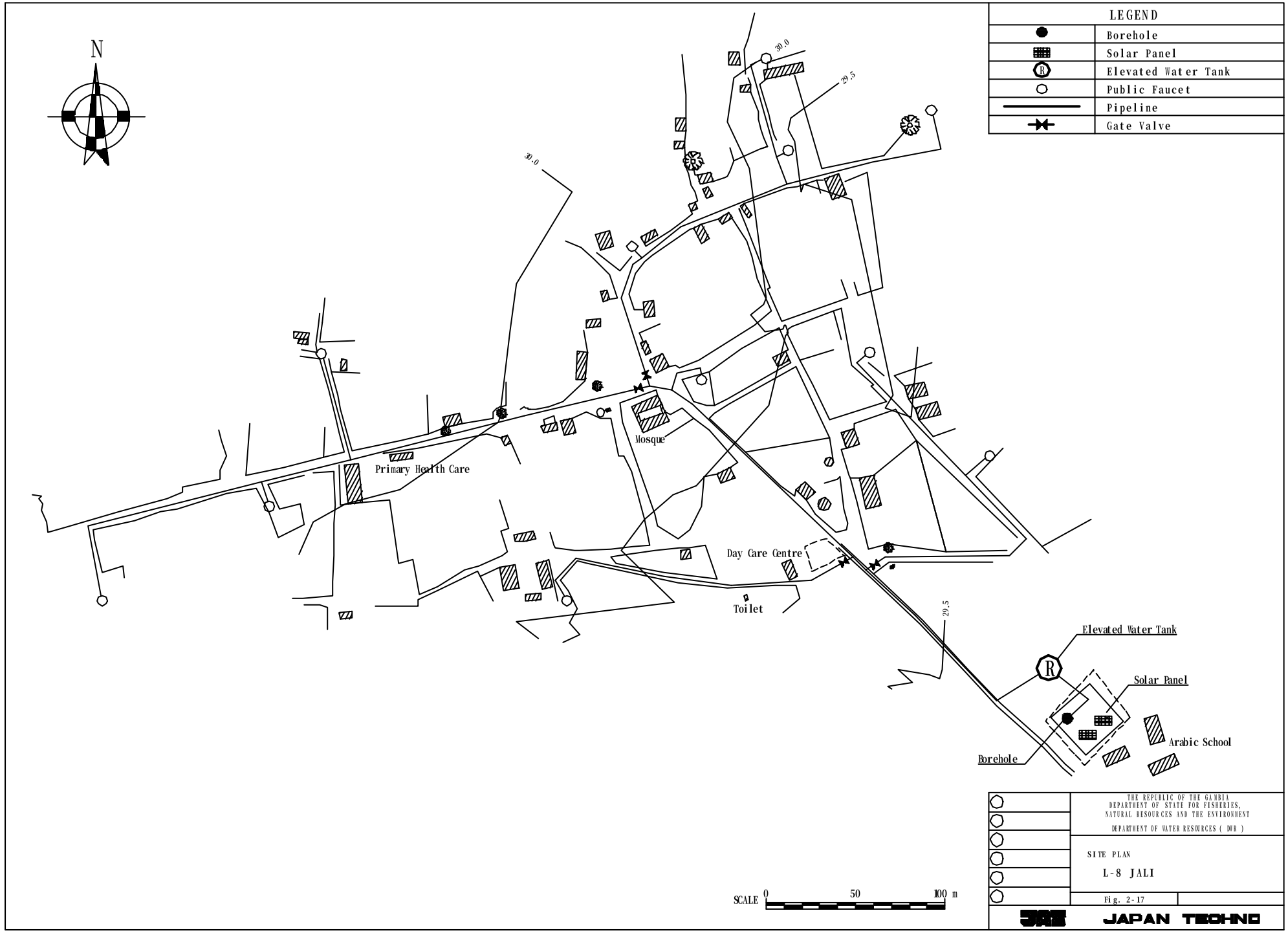

N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
8.5
Hand Pump
8.5
Hand Pump
8.5
Tele-
Centre
Health Centre
9.0
Mosque
Mosque
(U/C)
School
9.5
Elevated Water Tank
Borehole
9.5
Solar Panel
R
10.0
Hand
Pump
10.0
10.5
SCALE 0 50 100 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
N-11 NOWLERU
Fig. 2-12
JAPAN TECHNO

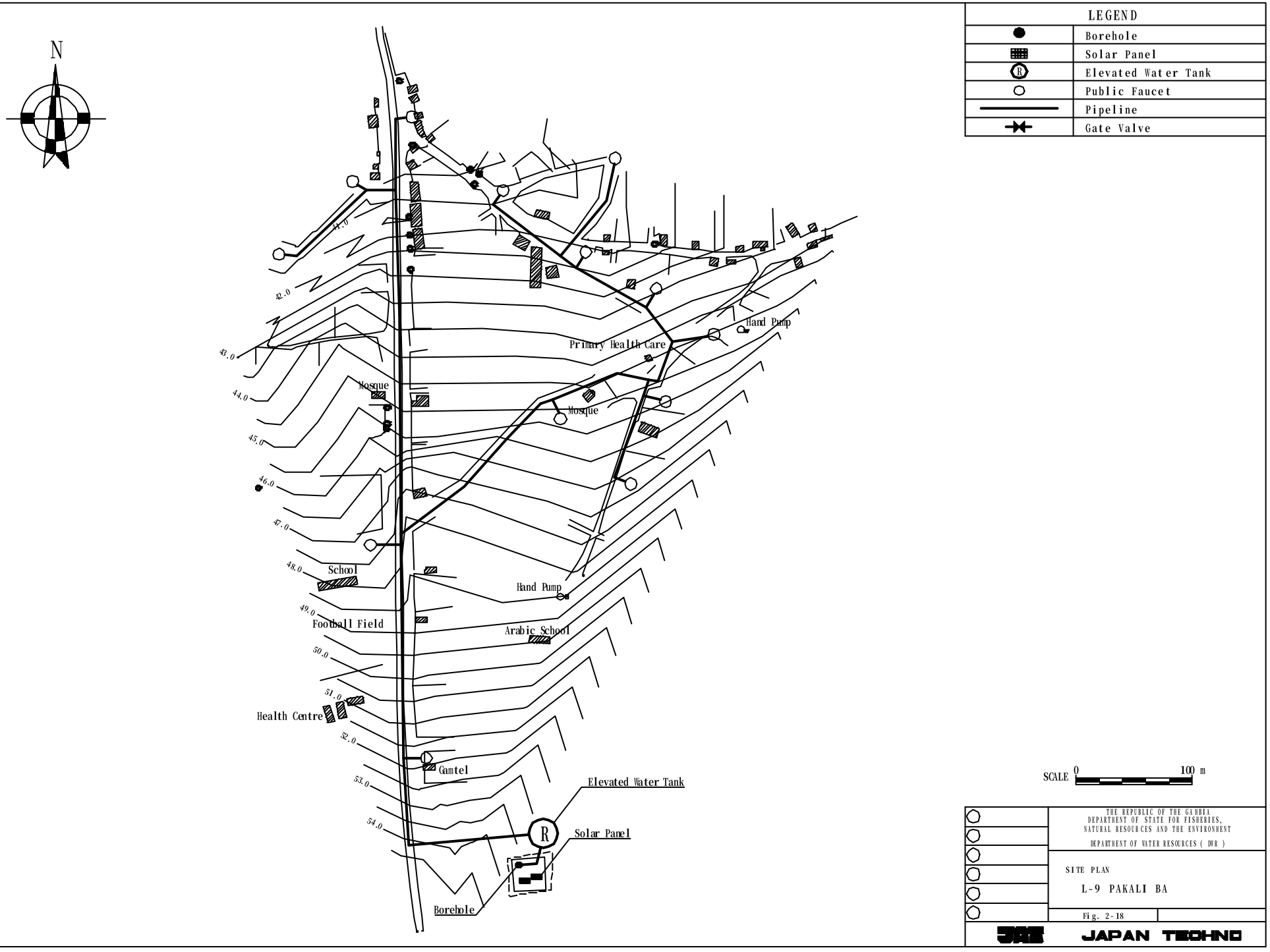

N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
Elevated Water Tank
Borehole
Farm
Solar Panel
School
Mosque
Hand Pump
Football Field
Christian Childrens' Fund (COF) Compound
Public Toilet
Hand Pump
Old Nursery School
Mosque
SCALE 0 100 200 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES, NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
W-1 SOHM
Fig. 2-13
JAPAN TECHNO

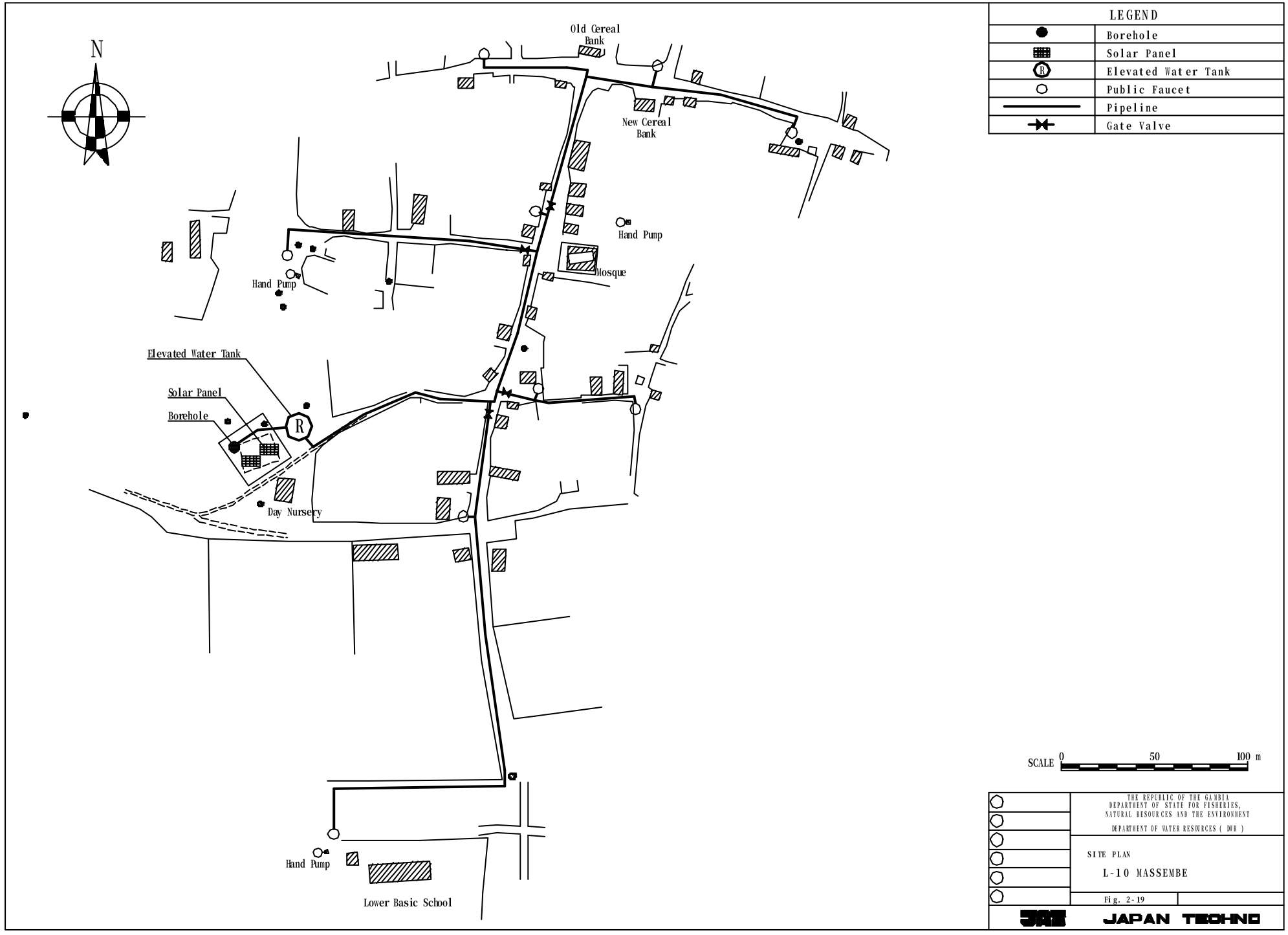

LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
N
MATTHEW NURSERY SCHOOL
Mosque
Hand Pump
Hand Pump
Hand Pump
Borehole
Elevated Water Tank
Solar Panel
Mosque
SCALE 0 100 200 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES, NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
W-2 SUTUSINJANG
Fig. 2-14
JAPAN TECHNO

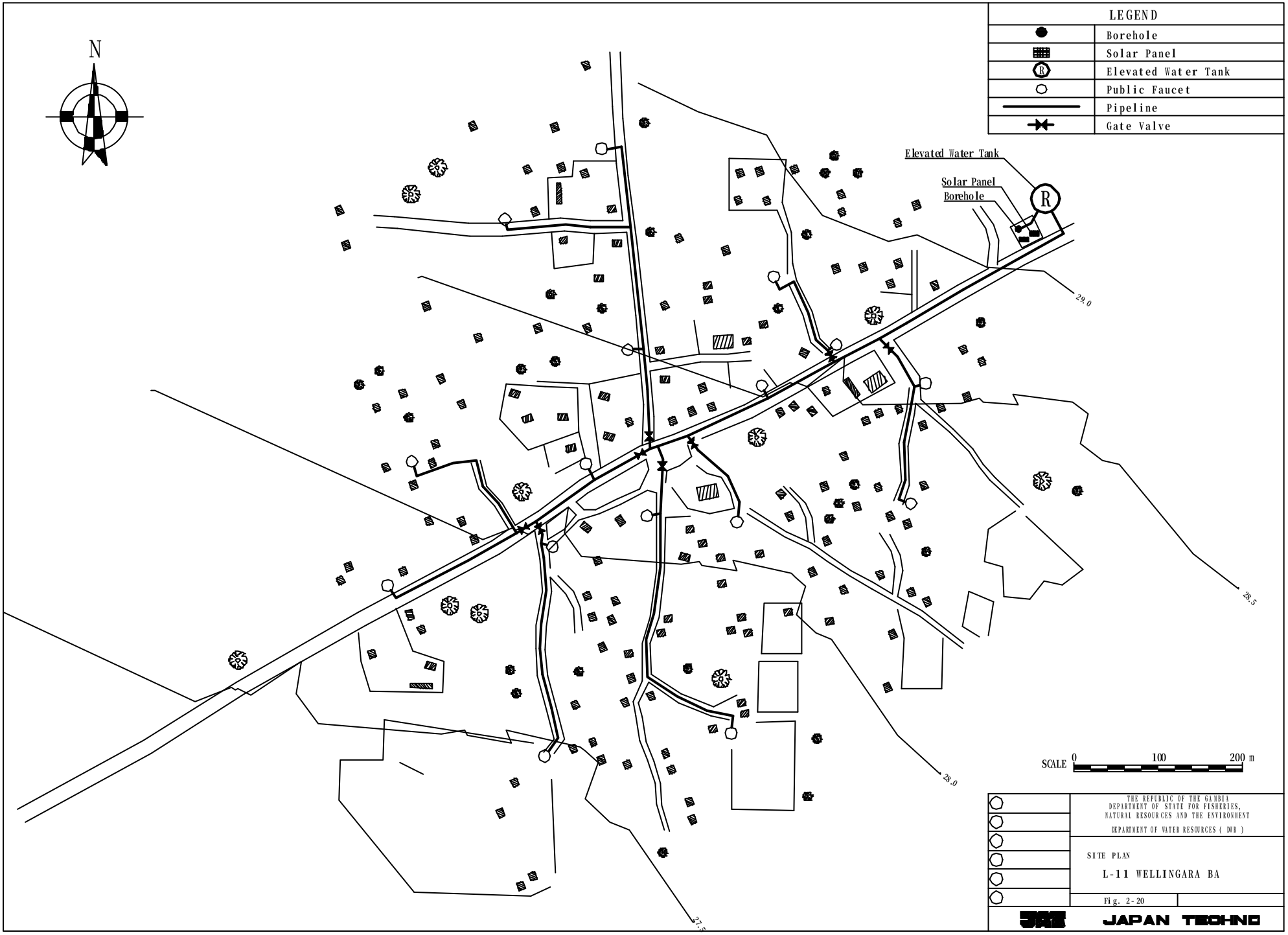

N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
34.5
35.0
35.5
36.0
36.5
37.0
37.5
38.0
38.5
39.0
39.5
40.0
40.5
41.0
41.5
Hand Pump
Mosque
Hand Pump
Hand Pump
Primary School
Day Care Centre
Elevated Water Tank
Solar Panel
Football Field
Borehole
Soma
Banjul
SCALE 0 100 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
L-1 NEMA
Fig. 2-15
JAPAN TECHNO

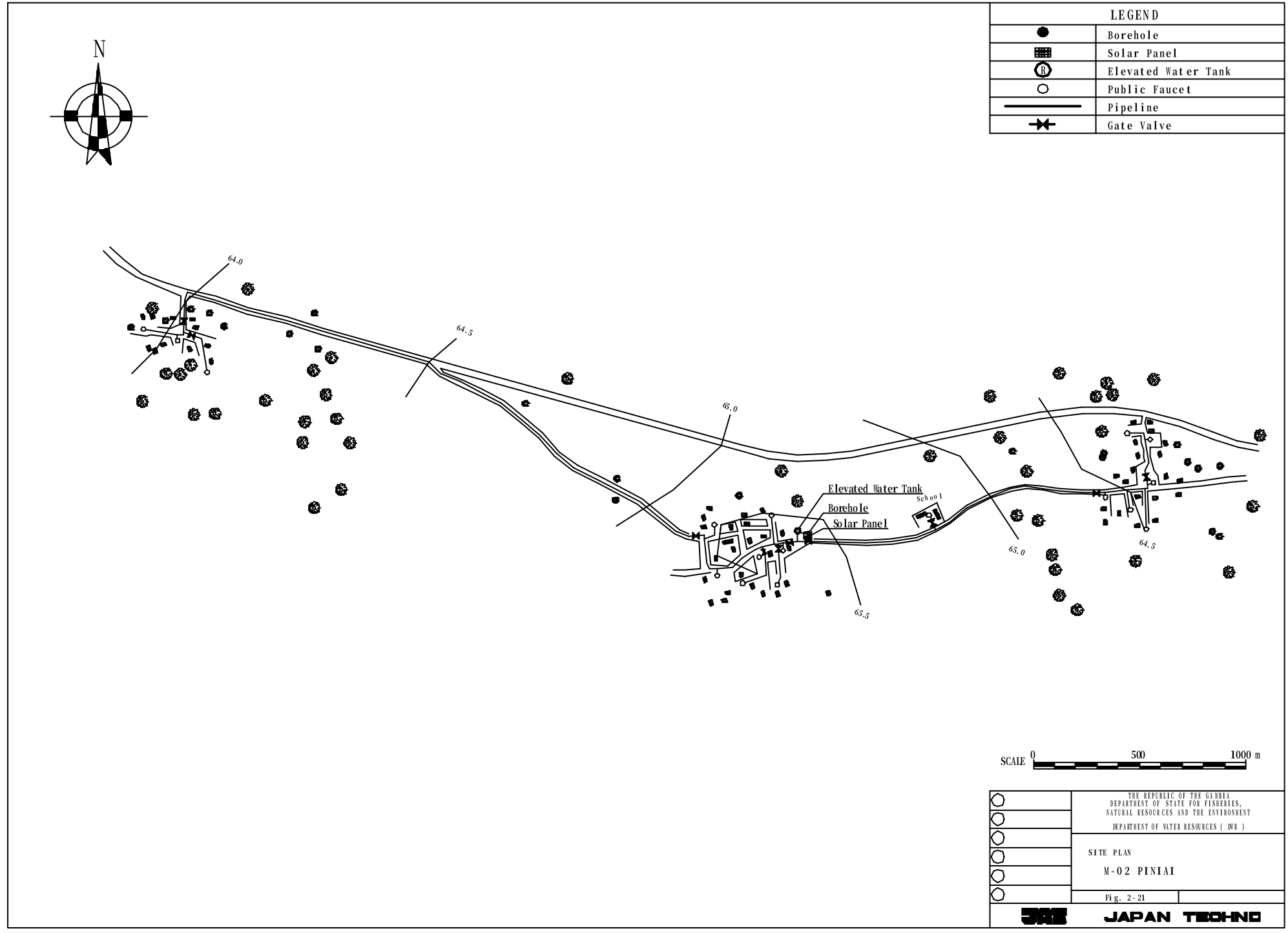

N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
Soma
Primary School
32.5
33.0
32.0
33.5
34.0
31.5
34.5
35.0
Hand Pump
Elevated Water Tank
Solar Panel
Borehole
Mosque
Hand Pump
Video Hall
Visaca Bank
Banjul
SCALE 0 50 100 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
L-3 DUMBUTU
Fig. 2-16
JAPAN TECHNO


N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
30.0
29.5
30.0
Mosque
Primary Health Care
Day Care Centre
Toilet
29.5
Elevated Water Tank
Solar Panel
Arabic School
Borehole
SCALE 0 50 100 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
L-8 JALI
Fig. 2-17
JAPAN TECHNO

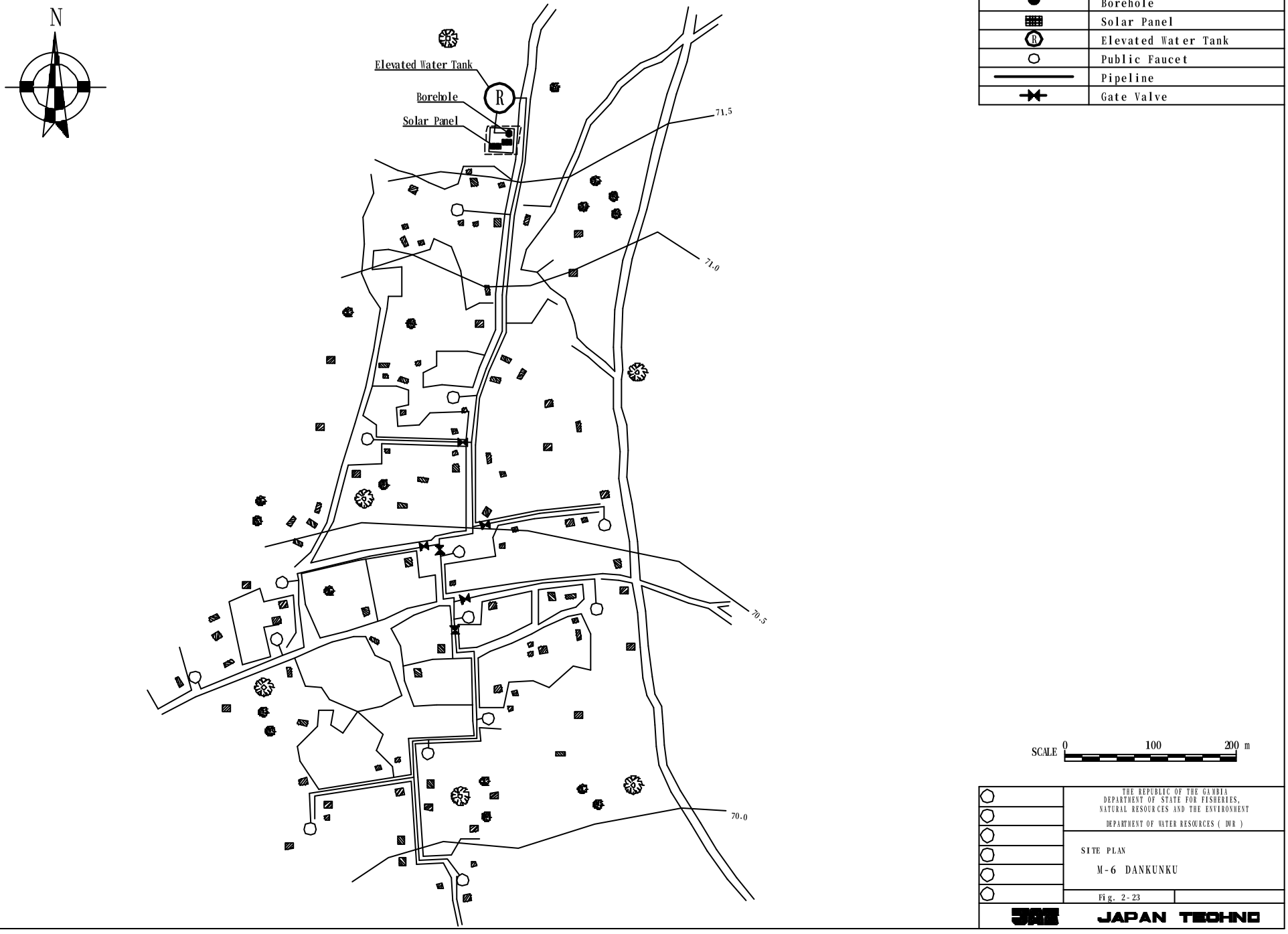

N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
42.0
43.0
44.0
45.0
46.0
47.0
48.0
49.0
50.0
51.0
52.0
53.0
54.0
Hand Pump
Primary Health Care
Mosque
Mosque
School
Hand Pump
Football Field
Arabic School
Health Centre
Camtel
Elevated Water Tank
Solar Panel
Borehole
SCALE 0 100 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
L-9 PAKALI BA
Fig. 2-18
JAPAN TECHNO

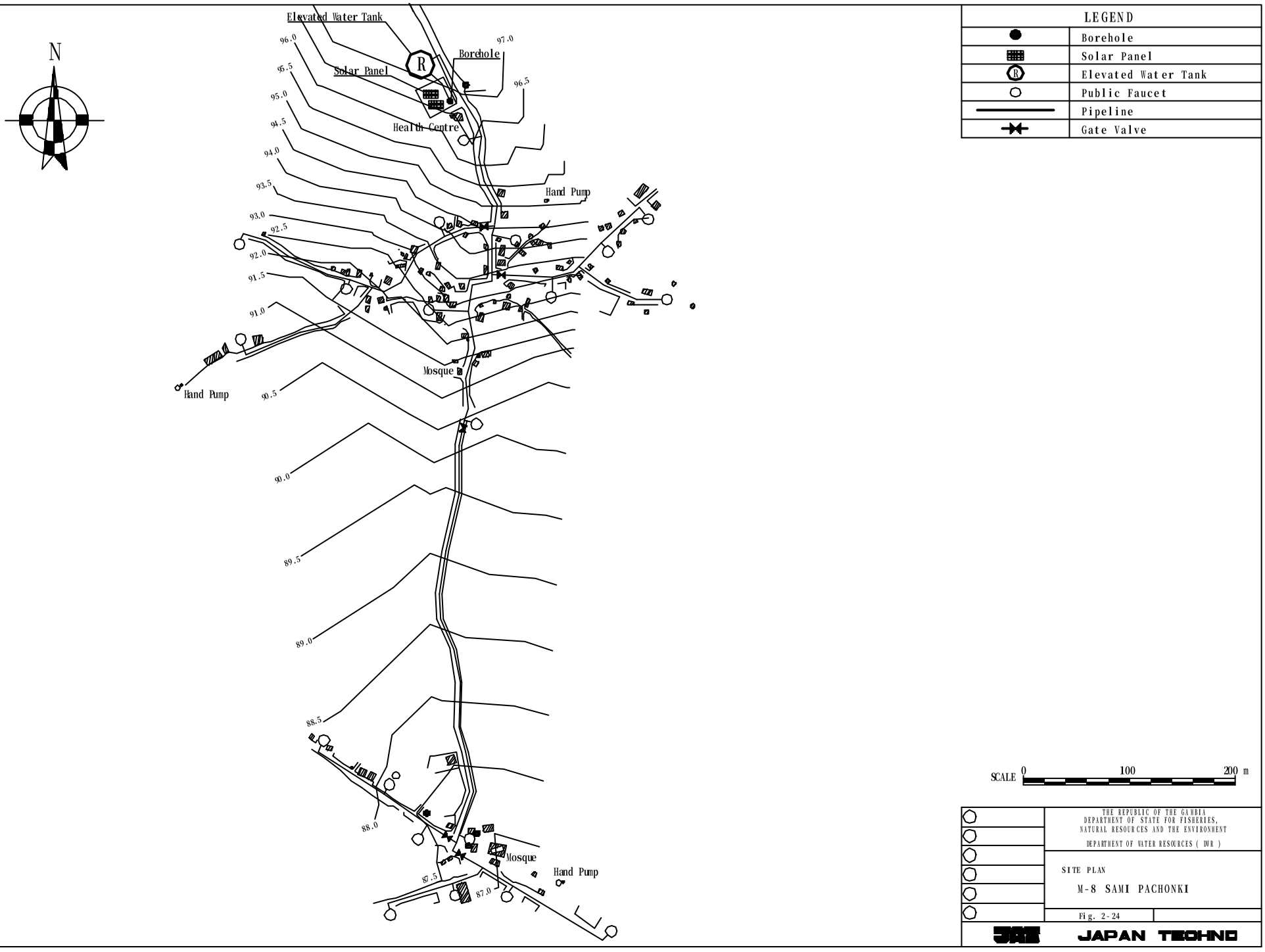

N
Old Cereal Bank
New Cereal Bank
Hand Pump
Mosque
Hand Pump
Elevated Water Tank
Solar Panel
Borehole
R
Day Nursery
Hand Pump
Lower Basic School
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
SCALE 0 50 100 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES, NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
L-10 MASSEMBE
Fig. 2-19
JAPAN TECHNO

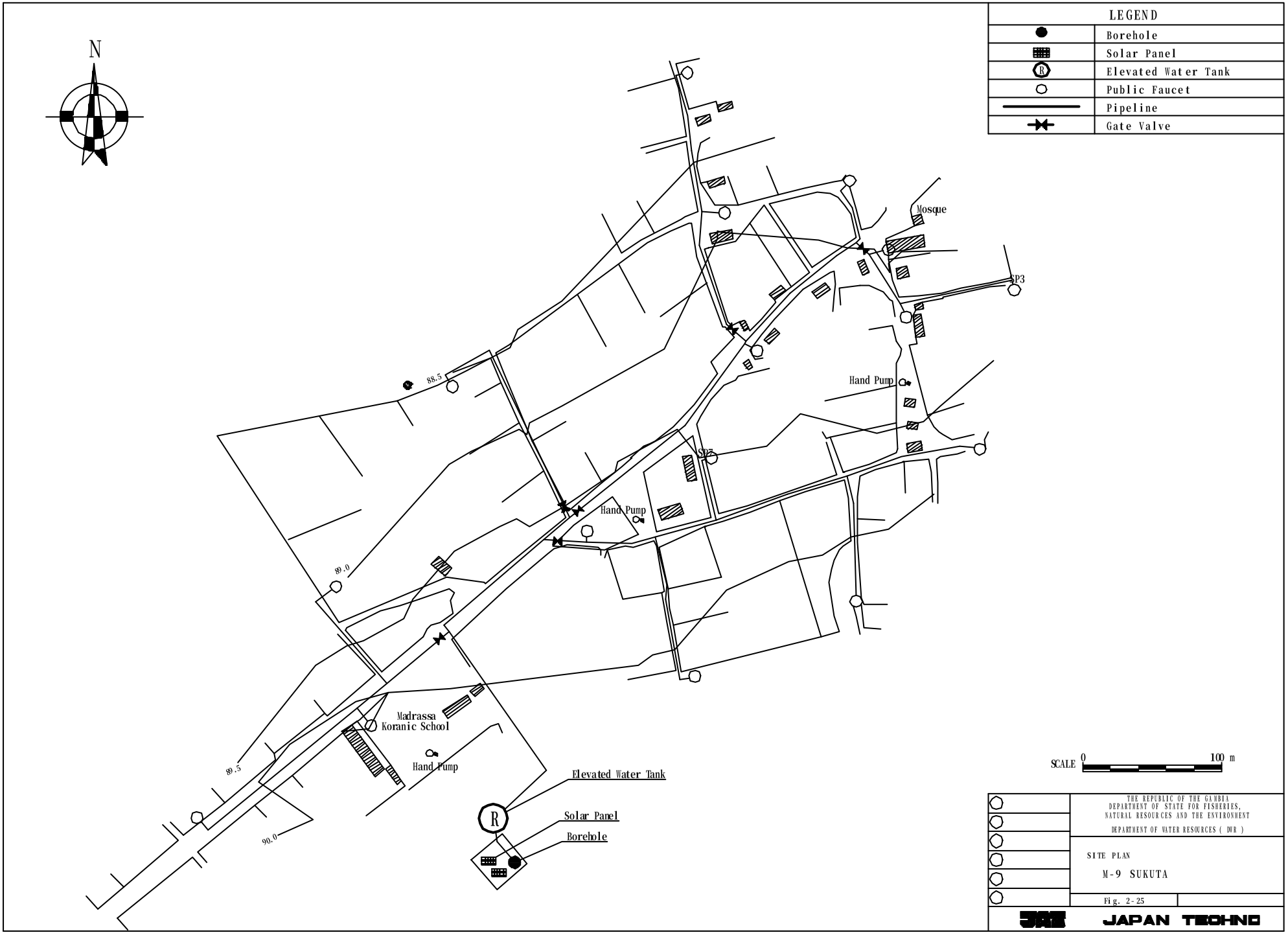

N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
Elevated Water Tank
Solar Panel
Borehole
R
29.0
28.5
28.0
27.5
SCALE 0 100 200 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
L-11 WELLINGARA BA
Fig. 2-20
JAPAN TECHNO

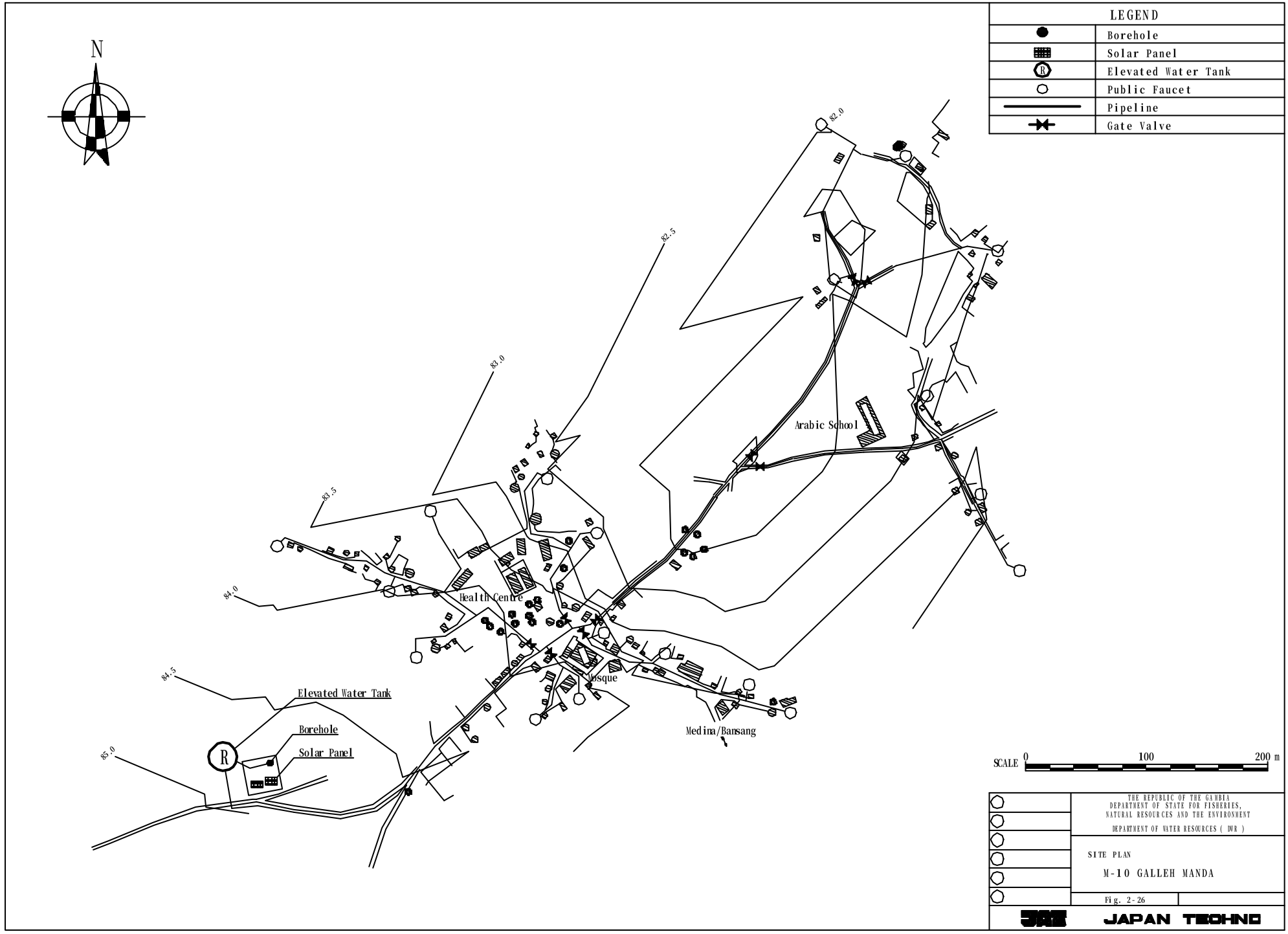

N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
64.0
64.5
65.0
65.5
Elevated Water Tank
Borehole
Solar Panel
School
SCAIE 0 500 1000 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
M-02 PINIAI
Fig. 2-21
JAPAN TECHNO

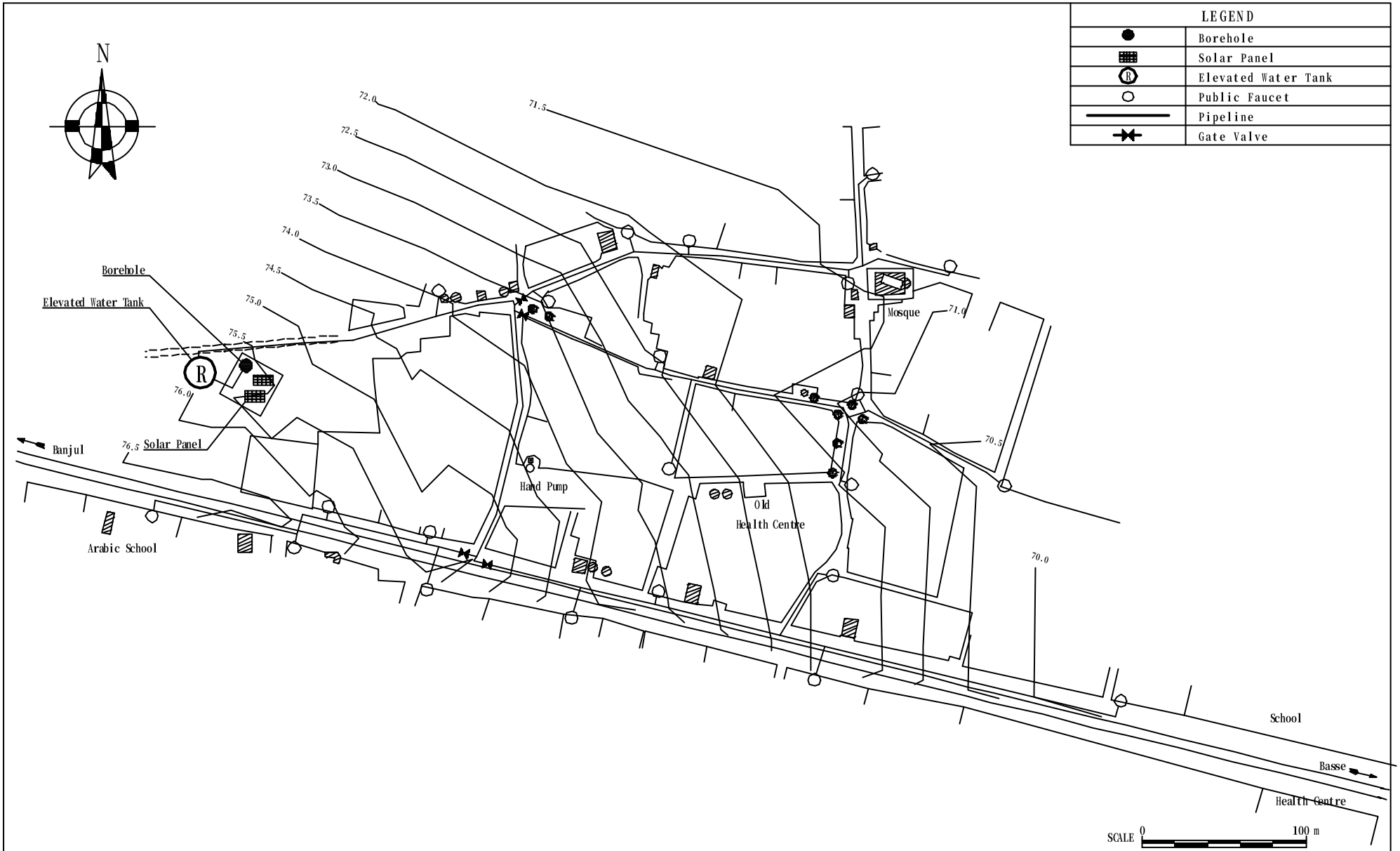

N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
Mosque
Telecenter
Primary Health Care
Hand Pump
Open Space
Hand Pump
Elevated Water Tank
Solar Panel
Borehole
School
Sapu
Brikama Ba
71.5
72.0
72.5
73.0
73.5
74.0
74.5
75.0
75.5
76.0
76.5
77.0
77.5
78.0
78.5
79.0
79.5
80.0
80.5
SCALE 0 100 200 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES, NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
M-5 SARUJA
Fig. 2-22
JAPAN TECHNO

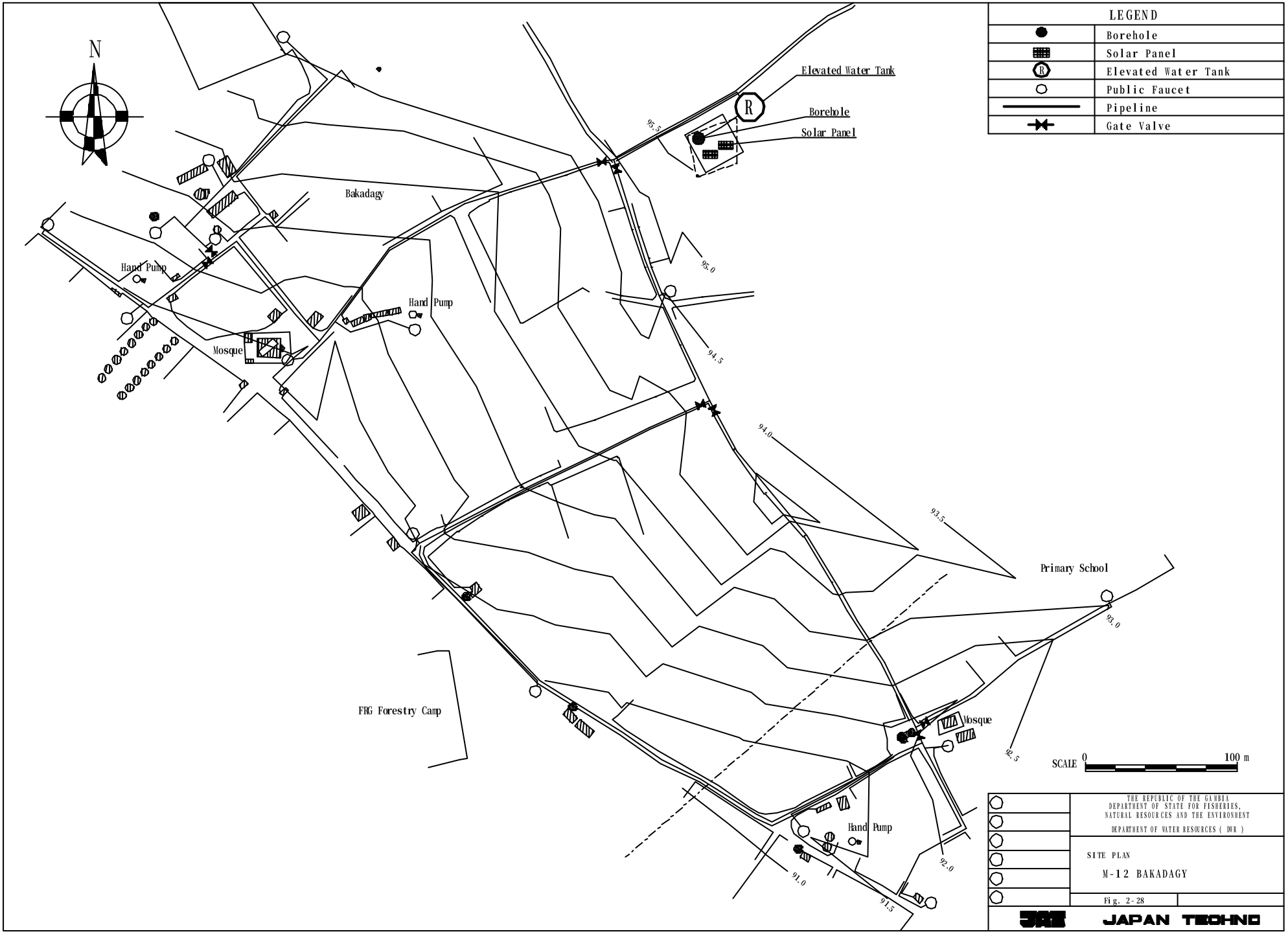

N
Elevated Water Tank
Borehole
Solar Panel
R
71.5
71.0
70.5
70.0
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
SCALE 0 100 200 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
M-6 DANKUNKU
Fig. 2-23
JAPAN TECHNO

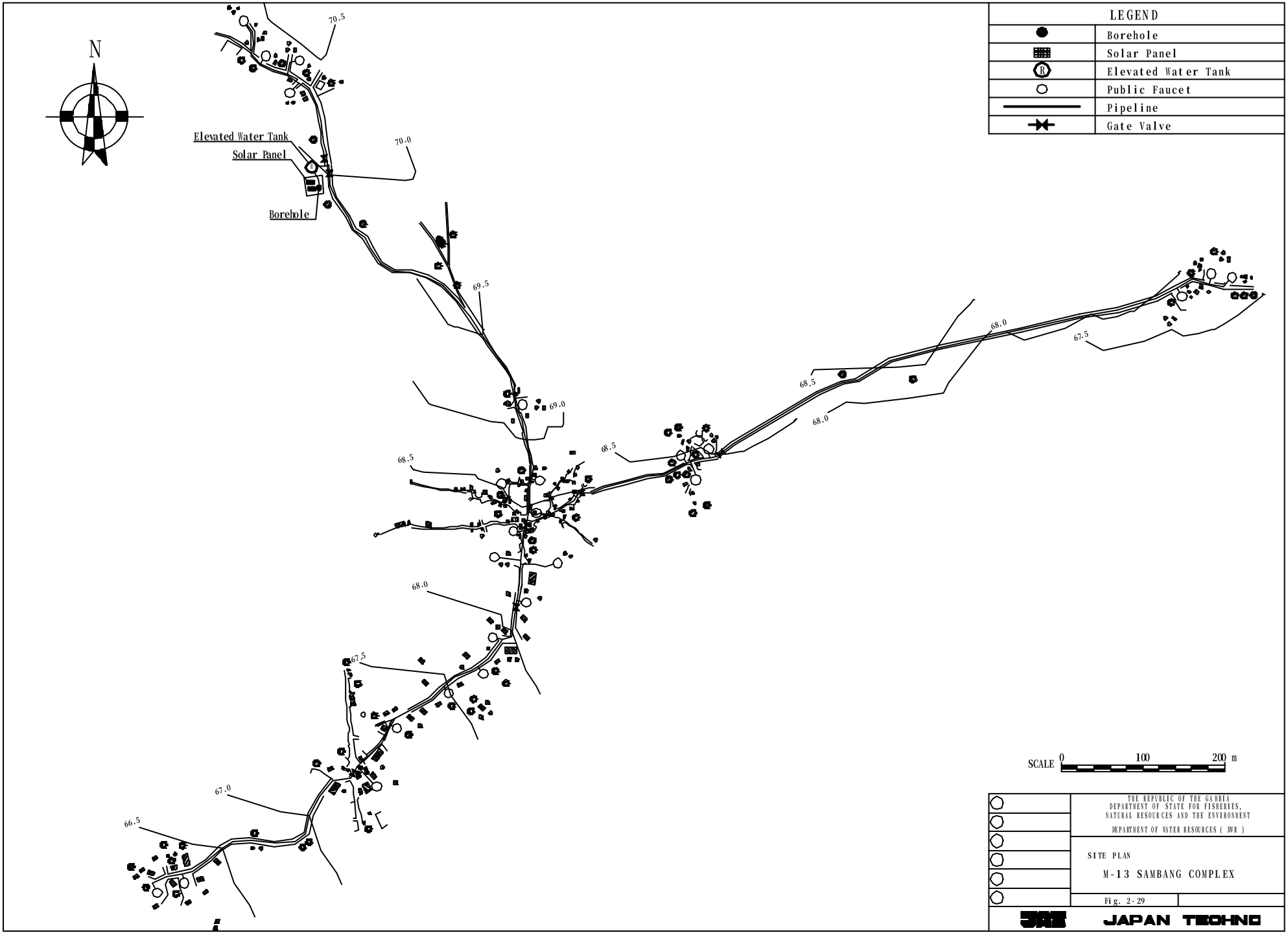

N
Elevated Water Tank
Borehole
Solar Panel
Health Centre
Hand Pump
Mosque
Hand Pump
Mosque
Hand Pump
96.0
95.5
95.0
94.5
94.0
93.5
93.0
92.5
92.0
91.5
91.0
90.5
90.0
89.5
89.0
88.5
88.0
87.5
87.0
97.0
96.5
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
SCALE 0 100 200 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
M-8 SAMI PACHONKI
Fig. 2-24
JAPAN TECHNO


N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
Mosque
P3
Hand Pump
SP2
Hand Pump
88.5
89.0
89.5
90.0
Madrassa
Koranic School
Hand Pump
Elevated Water Tank
Solar Panel
Borehole
R
SCALE 0 100 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
M-9 SUKUTA
Fig. 2-25
JAPAN TECHNO


N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
82.0
82.5
83.0
83.5
84.0
84.5
85.0
Arabic School
Health Centre
Mosque
Medina/Bansang
Elevated Water Tank
Borehole
Solar Panel
R
SCALE 0 100 200 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
M-10 GALLEH MANDA
Fig. 2-26
JAPAN TECHNO


LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
N
72.0
71.5
72.5
73.0
73.5
74.0
74.5
75.0
75.5
76.0
76.5
71.0
70.5
70.0
Borehole
Elevated Water Tank
R
Solar Panel
Banjul
Mosque
Hand Pump
Old
Health Centre
Arabic School
School
Basse
Health Centre
SCALE 0 100 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
M-11 JAKHALLY
Fig. 2-27
JAPAN TECHNO


N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
Elevated Water Tank
Borehole
Solar Panel
Bakadagy
Hand Pump
Hand Pump
Mosque
95.5
95.0
94.5
94.0
93.5
93.0
92.5
92.0
91.5
91.0
Primary School
FRG Forestry Camp
Mosque
Hand Pump
SCAIE 0 100 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
M-12 BAKADAGY
Fig. 2-28
JAPAN TECHNO


N
LEGEND
Borehole
Solar Panel
Elevated Water Tank
Public Faucet
Pipeline
Gate Valve
Elevated Water Tank
Solar Panel
Borehole
70.5
70.0
69.5
69.0
68.5
68.0
67.5
67.0
66.5
SCALE 0 100 200 m
THE REPUBLIC OF THE GAMBIA
DEPARTMENT OF STATE FOR FISHERIES,
NATURAL RESOURCES AND THE ENVIRONMENT
DEPARTMENT OF WATER RESOURCES (DWR)
SITE PLAN
M-13 SAMBANG COMPLEX
Fig. 2-29
JAPAN TECHNO

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The prime contractor for the project to be implemented under the Japan's grant aid assistance needs to be a Japanese firm, which will be obliged to be technically and financially accountable for the project supervised by a Japanese consultant. This project consists of borehole drilling, construction of water supply facilities and procurement of supporting vehicles for construction works and equipment for operation and maintenance. Since these vehicles and equipment are required for construction works and other interventions in the implementation stage of the project, it is desirable that the construction company thoroughly procures these items.

The entire responsibility is borne by the Japanese firm for the construction works. Drilling of boreholes will be executed by DWR using existing drilling equipment owned by the department under the supervision of the Japanese prime contractor. Further, effective deployment of a local company is possible for construction of water supply facilities. The Japanese firm conducts technology transfer regarding groundwater development works to the counterpart personnel. Figure 2-30 shows the implementation system of the project.

2-2-4-2 Implementation Conditions

The conditions in relation to the procurement of equipment and materials and the construction of facilities under the project are as follows:

(1) The target sites are 29 villages in 4 divisions located in rural area. In many cases, access leads from paved roads to unpaved sandy or clayish roads. The climate of the target area is the tropical savanna climate clearly divided into rainy and dry seasons. A rainy season lasts 4 to 5 months whereby conditions of unpaved roads get worse and are often flooded. This makes access to target sites extremely difficult. Considering these local conditions, construction will be conducted during the non-rainy season, except the sites along the main roads, in order to safely transport drilling equipment and other construction materials.

(2) Construction and social safety seem not to be a grave concern, yet incidences of traffic accidents need to be paid utmost attention.

(3) With regard to laws and regulations, as the project is executed within a framework of national development plan of the Gambia, less problems are expected to occur

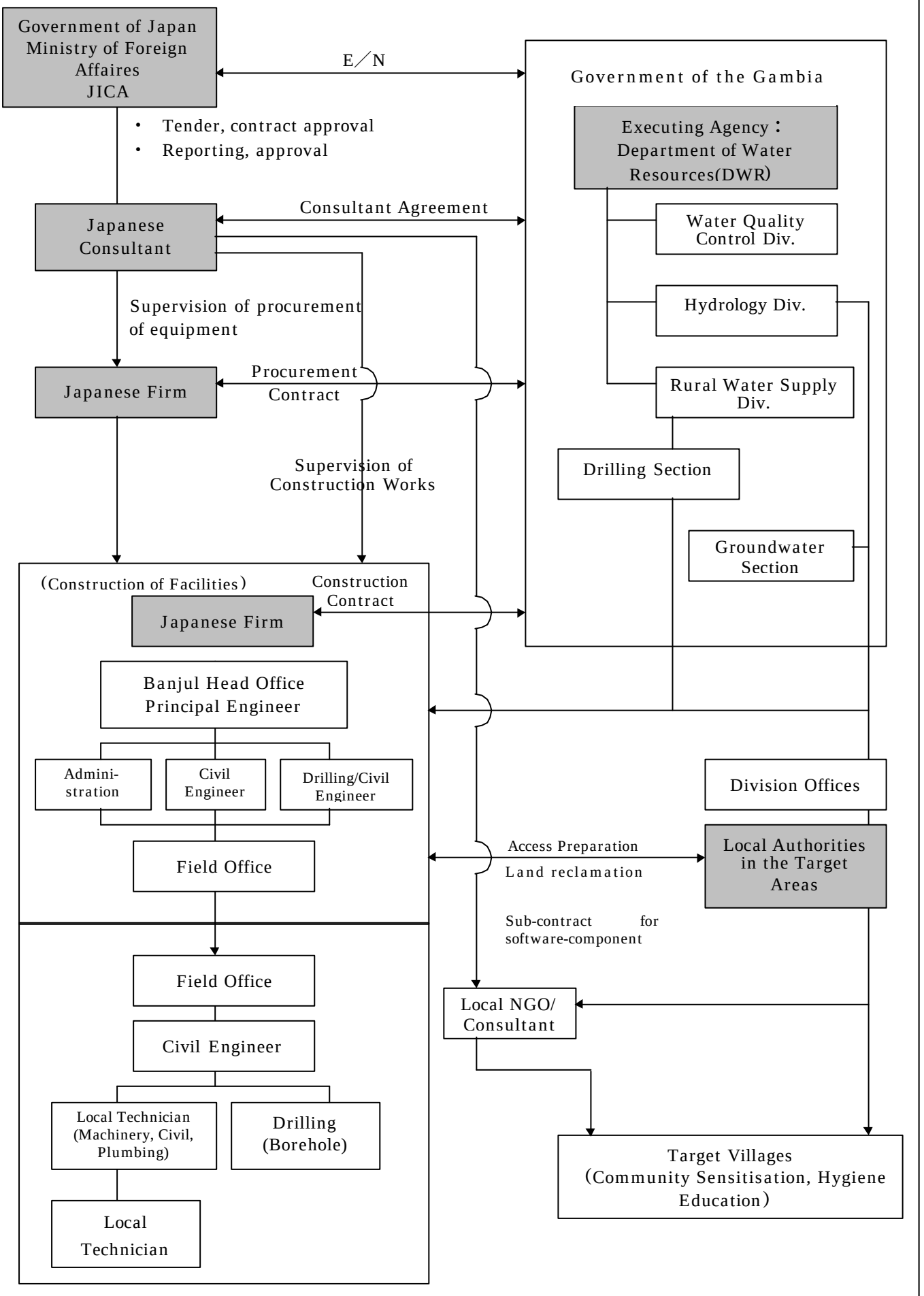


Figure 2-30 Implementation System of the Project

with use of water and land acquisition. Environmental concerns related to groundwater development are supervised by DWR, thus construction works need to be implemented in conformity with regulations.

2-2-4-3 Scope of Works

(1) Responsibilities of the Japanese Side

① To construct boreholes and water supply facilities.
② To procure equipment and materials for supporting construction works and operation and maintenance.
③ To conduct software component programme for establishment of operation and maintenance system and capacity building of personnel for community mobilisation, hygiene education and operation and maintenance.
④ To implement the OJT on drilling technologies, geophysical survey, groundwater monitoring, repair and maintenance of drilling equipment to engineers of DWR through borehole and water supply facilities construction.
⑤ To render consulting services for detailed design, construction and procurement supervision.

(2) Responsibilities of the Gambian Side

① To ensure land acquisition for construction of water supply facilities and to prepare access road to the target sites.
② To dispose DWR engineers of groundwater development, drilling and geophysical survey for technology transfer.
③ To take necessary measures by DWR and other relevant organisations for establishment and strengthening of the operation and maintenance system and health and hygiene education apart from the interventions to be covered by the software component programme.
④ To monitor continuously adequate usage and conservation of groundwater resources.

2-2-4-4 Consultant Supervision

The project will be implemented under Japan's grant aid assistance. Therefore, a Japanese consulting firm will be in charge of detailed design, and supervision of procurement and construction works. The consultant supervises inspection of equipment and materials procured locally. After embarking the construction, a resident engineer will be dispatched to supervise the construction works seamlessly from drilling to construction of facilities. Further, the resident engineer will support

the consultant in charge of the software component programme for supervision of the activities as the consultant in charge only conducts spot supervision in the field. The table below shows the contents of work of the Japanese consultant.

Table 2-21 Scope of Works of the Japanese Consultant

1.	Before construction and procurement	Detailed Design Study Tender document preparation Tender organisation Evaluation of tender results Support of contract conclusion
2.	Construction and procurement	Construction supervision Procurement supervision Support for software component Report writing

In each phase one resident engineer looks after construction works. However, construction is executed at 3 to 5 sites simultaneously and construction of structures, plumbing works and installation of solar pumping system are conducted in parallel with each other. Therefore, a local assistant engineer (1 person) is required to support the Japanese resident engineer.

The roles and responsibilities and grades (technical level) of the consultant are as summarised in Table 2-22.

Table 2-22 Assignment of the Consultant for Supervision of the Project

	Consultant	Grade	Contents of works
1.	Resident engineer	4	• Be disposed of at sites during the construction period to supervise the construction and procurement • Report monthly to JICA office in Senegal • Report to DWR, organise meetings with the contractor, control quality of works and security as well as reporting to Tokyo

2-2-4-5 Quality Control Plan

Quality control of the construction works and equipment and materials will be conducted as follows.

(1) Equipment and Materials

Almost all equipment and materials can be procured in the Gambia. Therefore, quality control of the equipment and materials will be done in the

process below.

1) A procurement officer of the prime contractor checks the quality before making any orders.
2) After the equipment and materials arrive at the sites, engineers will check the delivered quality.
3) The resident engineer from the consultant will check them before they can be used for the construction works.

(2) Borehole Drilling

- Sampling of the soil is carried out at 2 m intervals and at points where stratums change in order to gauge the hydrogeological conditions.
- After electric logging, the screen position will be selected by the Japanese drilling engineer.
- Casing pipes and screens will be installed, and gravel will be packed.
- Pumping tests will be conducted under the supervision of the engineer with confirmation by the consultant.
- Water samples are taken before the end of the continuous pumping test to analyse the water quality.

(3) Concrete Works

Compressive strength tests of concrete are to be conducted at the concrete works of each facilities as specified in Table 2-23.

Table 2-23 Number of Times for Compressive Strength Test of Concrete

Facilities	Part of Test	Number of Test
Elevated Water Tank	Foundation, slab, wall, roof	3 times (3 samples each)
Machinery House	Foundation, column	3 times (3 samples each)

For mixing-in-place concrete, slump test, compression and strength test, air ratio test, and content of chloride test will be conducted. Also, sieve analysis and density test will be used for aggregate.

(4) Reinforcing Steel Bar Works

The prime contractor will submit the following documents to the consultant for

quality control of the reinforcing steel bar works.

1) Classification, type and name of manufacture of the reinforcing steel bar
2) Schedule of submission of quality assurance certificate or results of strength and durability of the structure

(5) Plumbing Works

All the piping materials including joints and valves will be inspected by direct observation and/or temporary durability tests. After the pipe installation and before back-filling, the pressure test will be conduced to check leakage at the pipes.

2-2-4-6 Procurement Plan

(1) Policy on Procurement of Equipment and Materials

The project principally procures equipment and materials from the Gambia unless quality and quantity are not adequate. According to a field survey, production of construction materials in the Gambia is still limited, and variety of materials are imported in the local market, which are available at markets and outlets.

(2) Local Procurement

Manufacturers exist in the country for construction materials such as cement, aggregate, and concrete block to enable procurement in the Gambia. Main pipe materials of UPVC, casing screen and pumping equipment are to be locally procured, yet in necessary cases, third country procurement may have to be considered. On the other hand, steel and cast iron are not produced in the country but circulated in the market so that local procurement is possible.

(3) Procurement from Japan and Third Countries

Since equipment and materials for this project will be procured mainly from the Gambia and the third countries in necessary cases, procurement from Japan is not specified in this project. Table 2-24 lists the main procurement origins of equipment and materials for the project.

Table 2-24 Classifucation of Origin of Equipment and Materials to be Procured

Equipment and Materials	Origin of Procurement			Remarks
	the Gambia	Japan	Third Country	
(Construction Materials)				
Cement, gravel, concrete block	○			
Casing, screen	○		○	
Reinforcing bar	○		○	
Pipes (Pipes, valve)	○		○	
Solar pumping equipment	○		○	
(Equipment)				
Supporting vehicles	○			
Operation and maintenance equipment	○			

2-2-4-7 Implementation Schedule

Implementation process of the project under the grant aid scheme is as follows.

1) Exchange of Notes (E/N)
2) Consultant agreement
3) Detailed Design Study
4) Tender document preparation
5) Tender, contractor contract
6) Procurement of materials and equipment
7) Transport of materials and equipment/ custom clearance
8) Construction of water supply facilities
9) Handover of the facilities

The project will be implemented during approximately 45 months upon conclusion of the E/N. Since the project is implemented under the scheme of Japanese grant aid assistance, a Japanese prime contractor is responsible for execution of the construction works. Under a supervision of the prime contractor, boreholes drilling will be conducted by DWR using existing drilling equipment owned by the department while local contractors will be utilised in the construction of water supply facilities. Nevertheless, Japanese engineers need to supervise the quality of works as grant aid project at the 29 targets sites employing limited number of reliable local engineers. These conditions will limit simultaneous construction to 3 or 4 sites.

The project scope for each fiscal year is to be self-conclusive, yet due to a long

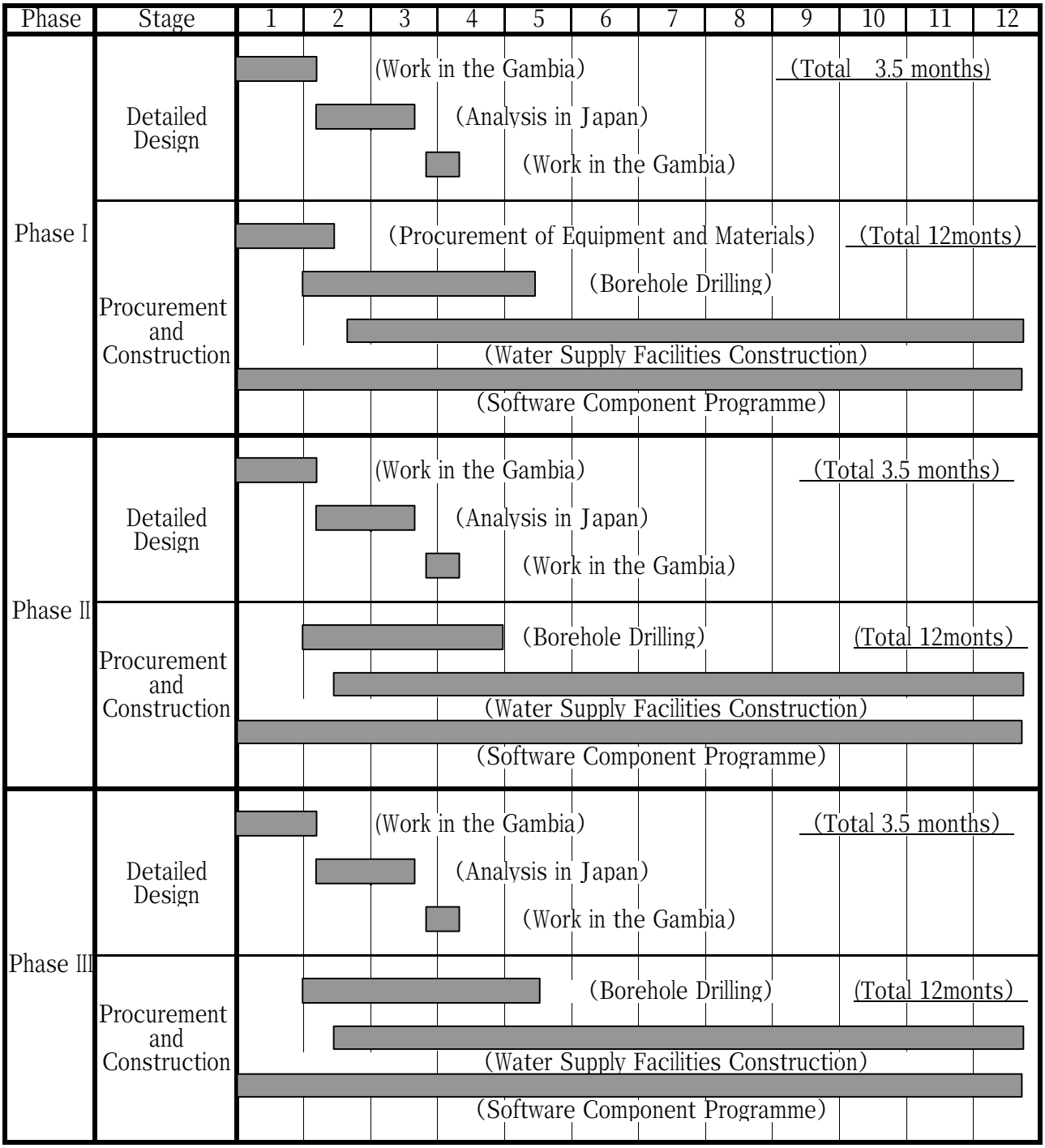
construction period and the condition of the workability mentioned above, the scope of works will be divided into 3 phases as shown in Table 2-25.

Table 2-25 Description of Phase-Wise Implementation

Phase	Construction and Procurement	Consultant
Phase I	• Procurement of materials and equipment • Borehole drilling (7 sites) • Construction of piped water supply facilities (7 sites) • Conversion of pumping system of existing facilities (3 sites)	• Detailed design study • Tender document, tender supervision • Procurement/construction supervision • Support for software component programme
Phase II	• Borehole drilling (6 sites) • Construction of piped water supply facilities (6 sites) • Conversion of pumping system of existing facilities (3 sites)	• Detailed design study • Tender document, tender supervision • Procurement/construction supervision • Support for software component programme
Phase III	• Borehole drilling (7 sites) • Construction of piped water supply facilities (7 sites) • Conversion of pumping system of existing facilities (3 sites)	• Detailed design study • Tender document, tender supervision • Procurement/construction supervision • Support for software component programme

The implementation schedule based on the above is shown in Table 2-26.

Table 2-26 Project Implementation Schedule



2-3 Obligations of the Recipient Country

Given the case that the Government of Japan approves the project for implementation under Japan's grant aid scheme, in order for the project to precede in a smooth manner, the Gambian side needs to carry out the following obligations in addition to the tasks specified in 2-2-4-3(2).

(1) Responsibilities of the Gambian Side

① To secure, clear and reclaim the lands for construction of boreholes and water supply facilities.
② To construct or rehabilitate access roads to the target sites.
③ To secure, clear and reclaim the lands for the operation base of the construction works.
④ To arrange a stockyard for procured equipment and materials.
⑤ To assure the personnel and budget incurred for operation and maintenance of procured equipment.
⑥ To assure the personnel and budget incurred for supervision of borehole and facilities construction.
⑦ To provide information and materials necessary to the project.
⑧ To operate and maintain effectively procured equipment and materials and constructed water supply facilities.
⑨ To bear all necessary costs other than those covered by the grant aid.

(2) Procedures

① To accord Japanese nationals, whose services may be required in concord with the verified contracts of the project, their entry into the Gambia and stay therein for the performance of their work.
② To exempt equipment, materials and services in concord with the verified contracts of the project from customs duties, internal taxes and other fiscal levies which may be imposed in the Gambia.
③ To ensure prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the goods procured in concord with the verified contracts of the project.
④ To bear advising commission for an Authorization to Pay (A/P) and payment commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement (B/A).
⑤ To bear expenses for insurance incurred on the procured vehicles.

The aforesaid obligations of the Gambian side had been explained to and discussed with the Government of the Gambia. These are justified as adequate, considering the necessity and relevance to the executing agency and beneficiary communities.

2-4 Operation and Maintenance Plan of the Project

The government of the Gambia adopts principles of community-based management and establishment of support services by the public and private sectors as the basic polity of operation and maintenance in the rural water supply projects. These principles will form the basic framework of the operation and maintenance system of this project. Figure 2-31 shows the frameworks of the proposed operation and maintenance system of the project. In consideration of the issues revealed in the review of the current operation and maintenance activities for the existing water supply facilities in the target areas, the following approaches are to be focused on in the operation and maintenance plan of this project.

(1) Confirmation of Awareness of Target Communities on Ownership and Responsibilities for Operation and Maintenance of Water Supply Facilities

The community members of the target sites are users and responsible body for operation and maintenance of water supply schemes to be constructed in the project. They are required to undertake necessary measures to maintain and utilise the facilities in sustainable manner. Based on the policy that the ownership and responsibilities of operation and maintenance of the constructed water facilities belong to the user communities, awareness and willingness of the target communities on ownership and responsibilities were surveyed by key informant interviews and sample household survey. The survey results show their awareness and willingness are high enough to be prepared for cooperation to the project.

In the implementation stage of the project, increased understanding of the community members will be enhanced not only on users' rights but their responsibilities and duties in operation of the water scheme. Construction of water supply facilities will be commenced after the explicit commitment of the communities in operation and maintenance including cost-sharing is confirmed.

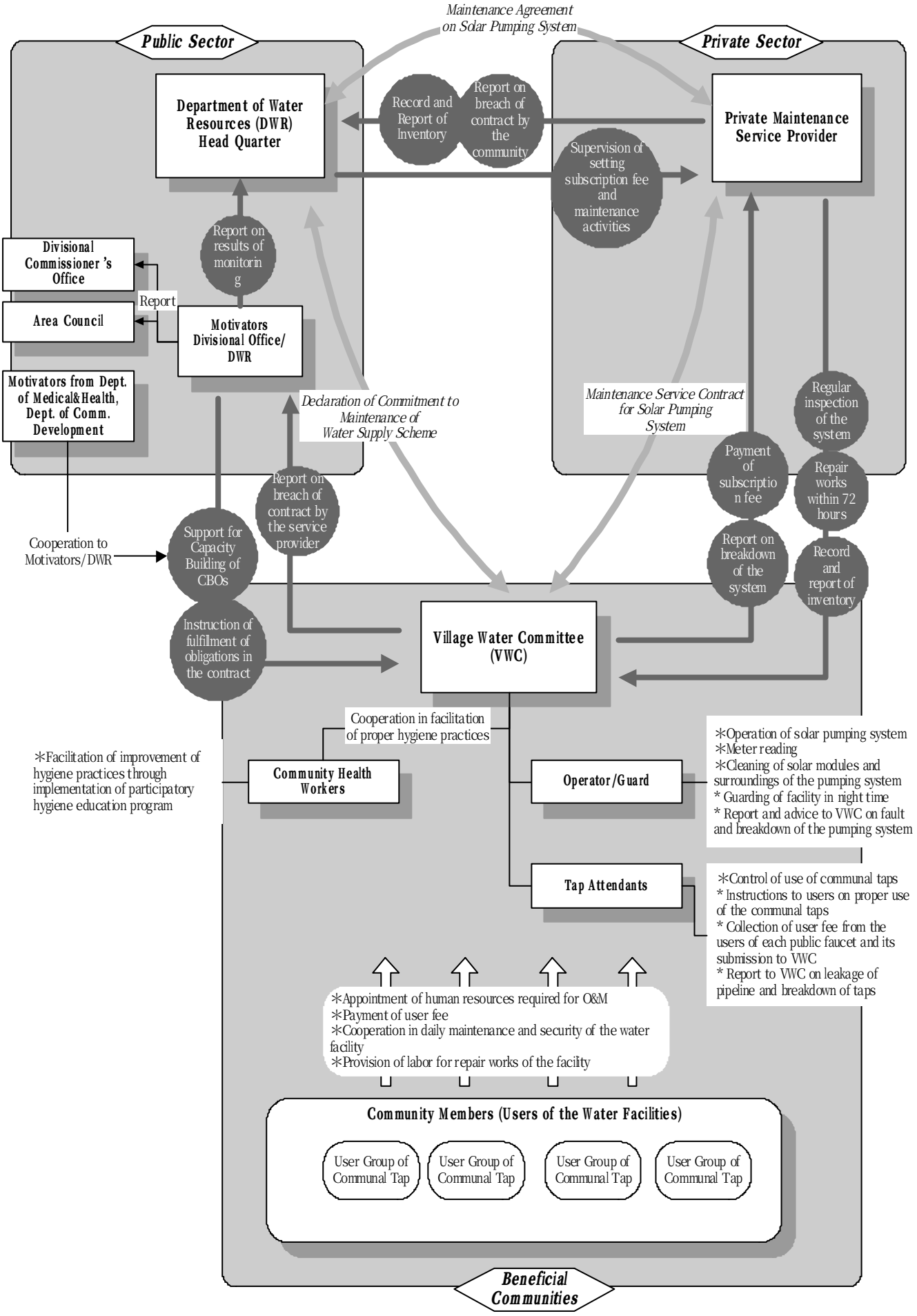


Figure 2-31 Proposed Operation and Maintenance System of the Project

(2) Leadership of the Village Water Committee in Operation and Maintenance Activities

The Village Water Committee (VWC) will be formed in each target site as the main body to lead operation and maintenance activities at village level. The committee consisting of members elected among the user communities will be placed under the Village Development Committee (VDC) that coordinates development issues and activities as a whole in the village. Approximately ten members will compose a VWC including chairperson, vice-chairperson, secretary, treasurer, and auditor. Emphasis should be put on enhancement of understanding of both men and women on significance of active participation of women in decision-making process, with considering the social background of the target areas that the decision-making process for the common interests of the community is often dominated by males.

Roles and responsibilities of the VWC are as follows:

1) Preparation of action plan and facilitation of implementation of the plan for improvement of water and sanitation in the village
2) Coordination in daily operation and maintenance activities, and facilitation of allocation of resources (human resources, materials, and funds) required for the activities
3) Provision of instructions for proper use of the water facilities and preparation of rules on water use
4) Conflict resolution related to use of water supply facilities
5) Assuring access to the support services for operation and maintenance to be provided by the public and private sectors

VWCs responsible for operation and maintenance of existing water supply facilities have been established in each target site either by themselves or by the external supports from donors or government organisation. However, the degree of their performance is varied. Thus, the options for formation of the VWC either to reorganise the existing one or to form a new committee will be decided through dialogue and discussion with the target communities in consideration of process of establishment of the existing committee, type of water supply facility which the committee is taking care of, and past experiences of the committee members to receive trainings for their capacity building.

Daily operation and maintenance of the water scheme will be undertaken by the operator who will also serve as security guard and tap attendants to be appointed by the community members. They will conduct following duties under

supervision of VWC.

[Operator/ Guard]

1) Daily operation of solar pumping system
2) Metering
3) Cleaning of solar modules and surroundings of the pumping system
4) Prevention of theft and vandalism on the solar pumping system during night time
5) Reporting and advise to VWC in case of trouble and breakdown of the solar pumping system

[Tap attendants]

1) Control of communal taps
2) Instructions to users for proper use of the communal taps
3) Collection of user fee from users of each public faucet and its submission to VWC
4) Reporting to VWC in case of leakage of pipeline and breakdown of taps

(3) Maintenance Service Contract with Local Maintenance Company (Private Service Provider)

The community will commission a local maintenance company as the private service provider to maintain the solar pumping system by entering into a maintenance service contract with the service provider. After completion of the water supply schemes followed by handing over of the facility from DWR to the community, the community represented by the VWC chairperson will sign the contract with a witness of DWR. Term of contract is usually five years while the contract is renewed automatically unless negotiation for amendment is proposed by either party.

There are two models of the maintenance service contract in the Gambia based on the payment terms to the service provider: one applying fixed charge (flat rate system) and the other introducing progressive tariff according to the amount of water consumption (metered rate system). The contract model to be applied in this project will be finalised through negotiation between DWR and the local agent after selection of supplier of the solar pumping system. In either case, the private service provider will only be responsible for maintenance and repair of solar pumping system consisting of a pump unit, solar modules and pumping main, and storage tank while the user community will be responsible for repair of reticulation and public faucets.

The community will also appoint operator/guard and tap attendants as mentioned in (2) above and assure appropriate use and maintenance of the facilities under supervision of VWC. They are required to ensure payment of the subscription fee of the maintenance service contract to the service provider. Meanwhile, the service provider will undertake periodical inspection and maintenance of the solar pumping system and repair the system within seventy two hours after report of breakdown from the community is given. Table 2-26 shows responsibilities shared among the user communities, private service provider and DWR in operation and maintenance of the solar-powered water supply scheme.

Table 2-27 Demarcation of Responsibilities in Operation and Maintenance of Solar-Powered Water Supply Facilities

	Village	Private Service Provider	DWR
Operation	• Meter reading by the operator (daily)	—	—
Preventive Inspection and Maintenance	• Cleaning of solar modules (brushing) and surroundings of the pumping system, and weeding by the operator • Sensitisation of users by VWC and tap attendants on proper use of communal taps and prevention of waste of water as well as illegal connection	• Regular inspection, adjustment and repair of solar pumping system • Recording the maintenance inventory and reporting to DWR and the community • Reporting to DWR and the community on any fault on the borehole and waste of water from the facility	• Monitoring and supervision of maintenance activities by the communities and private service provider
Prevention of Theft and Vandalism	• Employment of security guard • Construction of the guard house • Guarding of facilities in daytime	• Payment of allowance to the operator/guard (included in the subscription fee of the service contract)	• Adoption of specifications of the water facilities to prevent thefts
Repair	• Reporting the service provider on breakdown of the solar pumping system • Repair works of leakage and breakdown of taps, including contracting for the repair works with local contractor	• Repair works within 72 hours from a report of breakdown • Keeping spare parts of the solar pumping system	• Monitoring and supervision of repair works by the private service provider • Support of the communities in repair or replacement of pipeline (provision of materials and technicians paid by the communities)

(4) Support Services by the Public Sector

1) Monitoring and Supervision by DWR in Maintenance Service Contract

In an implementation of operation and maintenance based on the maintenance service contract between the communities and the private service provider, DWR will be responsible for monitoring and supervision of those maintenance activities by both parties based on execution of their obligations determined in the contract. As described in Table 2-26 above, DWR will monitor performance of both parties and take administrative measures or provide arbitration for conflict resolution in case of nonfulfillment of the contract by either party.

The motivators attached to each Division from DWR will monitor operation and maintenance activities in each target site and report it to the Divisional Commissioner and DWR headquarters in case that they observe delay in payment of the subscription fee or improper use of the water facilities by the community, or delay in inspection and repair works by the service provider. The information will be crosschecked with reports submitted by VWCs and the service provider and determine the necessity of interventions by DWR. Prompt settlement of the problems are expected through provision of technical monitoring activities by DWR in order to assure proper operation and maintenance of the water schemes by the communities and the service provider.

2) Support for the Communities by Divisional Offices and Area Councils

Divisional offices and Area Councils have responsibilities in identification of needs related to development issues of the area and improvement of living conditions of the communities, and their realisation. Thus, these offices will also provide support and advise to the communities to assure their access to the sustainable water supply. Advice and instruction to the community from the Divisional office or Area Council are effective to settle the issues related to operation and maintenance which are originated in the social and cultural background of the particular area since those offices keep close relationship to the communities and coordinate interests among the community members.

In addition, staffs attached to the Divisional level from ministries

responsible for improvement of water and sanitation form a task force for the water and sanitation sector in the Division with staff from the Divisional office and Area Council. They exchange information, coordinate the interventions and provide technical support to the local authorities in improvement of water and sanitation conditions in the Division.

Motivators of DWR, Department of Medical and Health, and Department of Community Development, as core members of the task force, undertake community mobilisation/ sensitisation and capacity building of the community-based organisations as well as monitoring and supervision of the activities of those organisations for improvement of water supply and sanitation. In this project, the motivators will facilitate needs/problem analysis for the community members and activities for technical support to the communities as a catalyst among the village, Divisional and national level through the process of project implementation, operation and maintenance.

(5) Cost-Sharing for Operation and Maintenance

The expenses for operation and maintenance of the constructed water scheme will basically be covered by the users. The costs to be borne by the user communities for daily operation and maintenance of the facility are: a) subscription fee for the maintenance service contract of the solar pumping system, b) allowance for the operator/guard (in some cases, it is included in a) above), and c) cost for repairing facilities apart from solar pumping system such as taps and pipeline.

These expenses will be recovered by the collection of user fee from users of the facility. The communities who request for construction of water supply facilities in the village are required to raise a certain amount of upfront contribution as a part of the operation and maintenance fund prior to commencement of the construction works in order to prove their commitment and financial capability. Same strategy will be introduced in this project as well. The upfront contribution and user fee collected from the community members will be kept in a bank account of the VWC and the subscription fee will also be paid to the private service provider with utilising the fund.

The amount of the charge by the private service provider is determined in the

contract. Meanwhile the amount to be charged to each household to cover the operation and maintenance costs including the subscription fee is to be decided by each community under the initiative of VWC in consideration of number of user households, socio-economic conditions and vulnerable groups in the community. In the implementation of the project, several options as well as information on indicative costs for operation and maintenance are to be presented to the communities for setting an amount of user fee and its collection mechanism so that the communities will be able to raise the fund efficiently and appropriately. Expenses for operation and maintenance of the water supply facilities to be constructed in this project and indicative cost to be borne by a household are described in "5-2 Operation and Maintenance Cost".

As alternative funding sources for operation and maintenance apart from user fee collection, most of the target communities of this project have income sources such as selling agricultural crops of community gardens, support from VDC, and remittance from the family members working in urban areas or abroad. Since the majority of the target communities depend on their living on the income from agriculture, the monthly income level varies though the year and the expenses in cash in lean months are a heavy burden for them. It is expected that payment of user fee of water supply service will also be affected by those socio-economic conditions. Therefore, it is recommended to secure several financial sources for the operation and maintenance costs by enhancing income generation through communal activities as well as facilitating fee collection in a relatively large amount in the harvest seasons.

(6) Hygiene Management

Provision of safe water supply cannot be achieved only by the installation of water supply facilities but through proper hygiene management. If latrines, refuse pits and animal waters trough are installed close to the water sources without consideration of the environmental sanitation, they cause contamination of water sources. Moreover, poor awareness and practice of the community members in hand washing and safe means of transport and storage of drinking water result in decrease of positive impacts of safe water supply.

Positive impacts for improvement of living conditions through utilisation of the

water supply facilities can be maximised by enhanced understanding and practice of proper use and management of safe water supply as well as the sense of ownership of the community members. Therefore, hygiene management of water sources and user communities are to be given a great concern in operation and maintenance of water facilities. Awareness and behaviour changes of the community in hygiene will be facilitated by the community health workers to be trained in the project, in collaboration with the VWC members.

(7) Capacity Building and Institutional Strengthening of Stakeholders in Operation and Maintenance

Regarding the establishment of the operation and maintenance system of the constructed facilities as described above, the Gambian side will bear the primary responsibility on it in conformity with the principle of the Japanese grant aid assistance on demarcation of responsibilities between the Japanese side and the recipient country. Taking it into consideration, the Japanese side will extend support only in capacity building and institutional strengthening of stakeholders related to operation and maintenance as its scope of works, aiming at realisation of sustainable water supply from the constructed water facilities and earliest achievement of expected impacts. Details on interventions involving the Software-Component Programme for establishment of operation and maintenance system are described in “2-5 Interventions for Capacity Building and Institutional Strengthening (Software-Component Programme)” below.

2-5 Interventions for Capacity Building and Institutional Strengthening (Software-Component Programme)

2-5-1 Programme Background

Adoption of the community-based operation and maintenance system with support services by the public and private sectors is the basic policy of the operation, maintenance and management of the rural water supply projects implemented by the Department of Water Resources (DWR) as the competent authority in the Gambia. For the operation and maintenance system of the solar pumping system, provision of support services by the private sector (private maintenance service provider) has been established through strategic policy of the government of the Gambia.

This project aims to realise safe and stable water supply to the target communities through construction of the piped water schemes with solar pumping system. The operation and maintenance system for the schemes is to be established in the target sites of the project with improvement of capacity of the communities on utilisation of such private service providers as well as enhancement of sense of ownership and responsibility by the community members so that they can access the water supply through facilities to be constructed in the project in a sustainable and effective manner.

In view of these requirements, the government of the Gambia supports the communities to improve their understanding and capacity to utilise and manage the support services for operation and maintenance activities as a part of the initial investment of the project for construction of the water supply facilities. The effective measure to establish the operation and maintenance system is to execute the interventions for capacity building and institutional strengthening of the responsible actors with considering the process and progress of the project implementation including before and after the construction works of the water facilities. Meanwhile, this kind of activities to initiate the structure of the operation and maintenance system requires relatively large amount of input within the limited period of the project implementation. Since the government of the Gambia has a financial constraint to manage these activities with solely depending on their own budget, the interventions to support establishment of the operation and maintenance system have been executed as a part of the initial investment of the project with financial and technical assistance from the donors. In relation with this project, DWR, executing agency of the project, is

also requesting that the activities for capacity building and institutional strengthening are implemented as a part of the initial investment to be funded by the Japanese Government.

In the Gambia, a basis of the operation and maintenance system in the form of collaboration among the communities, public and private sectors has been developed accordingly through the rural water supply projects funded by EDF and UNDP/UNCDF. Therefore, positive impacts expected from the stable and safe water supply can be realised in the earliest stage through the software-component programme for capacity building and institutional strengthening by utilising the existing resources and institutional arrangements which have been put in place through the past projects.

(1) Basic Strategies and Approaches for Establishment of Operation and Maintenance System

Forming the VWC in each village, users of the water facilities bear the primary responsibility for daily operation and maintenance and fundraising for the operation and maintenance costs in the rural water supply projects executed by DWR. Meanwhile, the government agencies such as DWR is responsible for facilitating creation of sense of ownership of the community members towards management of the water facilities, supporting the communities to build their capacities required for operation and maintenance, promoting participation of the private sector as well as training human resources in the sector, and supervising the mechanism of operation and maintenance activities implemented by the communities and private sector.

Placing importance upon the participation of private sector as a wing of the community-based operation and maintenance system, the Gambia has been focusing its efforts on improving sufficient delivery of the support services to the communities by promoting involvement of the private sector in the rural water supply projects. In case of maintenance of solar pumping systems, each user community enters a maintenance service contract for the system with the local agent of the supplier under supervision by DWR. It is expected that the operation and maintenance system with collaboration among communities, public and private sectors will realise sufficient management of the water scheme in terms of costs and time as well as facilitation of active participation of the community members with sense of ownership.

EDF and UNDP/UNCDF have been major donors supporting establishment of operation and maintenance system for the solar pumping systems through rural water supply projects in the Gambia. In the EDF projects, continuous endeavor has been made to bring about participation of the private sector in provision of the maintenance services. Meanwhile, the UNDP/UNCDF projects have put emphasis on an integrated approach that is meant for realisation of positive impacts from interaction among strengthening the community-based management of the water supply, improvement of sanitation, and promotion of health and hygiene education. These interventions by the two donors deserve to be considered as models of the accompanying measures of the rural water supply projects for construction of the water supply facilities with solar pumping systems.

Involving in those projects as the executing agency, DWR has tried to adopt a strategy to set up the operation and maintenance system of the water schemes with considering the achievement and lessons learnt from the past projects supported by the said two donors. As a result, based on the principles of community participation and shared-responsibility, the department focuses on strengthening the support services by the public and private sectors, improving management skills of VWCs, and integrating the sanitation and hygiene component in establishment of the sustainable operation and maintenance mechanism of piped water schemes.

In the long term, responsibility of planning and implementing the development activities including rural water supply is to be transferred to the Area Councils in conformity with the Local Government Act adopted in 2002. The highest priorities for the Area Councils at this stage are to increase staff and build their capacity as well as to secure sources of revenue. Though further efforts will be required for the local authorities to take the real initiative in tackling development needs of the communities including provision of water supply, this project will promote the sharing of information and roles related to the implementation of the project between DWR and the local authorities with considering the decentralisation policy in terms of responsibility of the administrations in operation and maintenance of rural water supply.

(2) Issues to be Solved

While the support services by the private sector has already been set in the Gambia, operation and maintenance system by the communities who utilise these services is required to be established in each target village. In addition, past experiences in similar projects funded by other donors brought some significant lessons learnt on establishment of operation and maintenance system such as necessity to strengthen management capacity of the VWCs, to focus on the hygiene education and to facilitate proper water use. In consideration of these points, this project emphasises interventions to support establishment of the operation and maintenance system at the community level which is the primary responsible body of maintenance activities as well as users of the water supply facilities. Main issues to be focused on in the software component programme are as follows:

a) Promotion of the Maintenance Service Contract between the Local Maintenance Company (Private Service Provider) and the Target Communities:

Learning from the experiences of the projects funded by EDF, this project will also apply the maintenance service system based on the contract between the private maintenance service provider and the target communities after making consensus between DWR and affected Divisions on basic framework of the operation and maintenance system.

b) Integrated Approach on Improvement of Water Supply, Hygiene Education and Improvement of Environmental Sanitation:

Approaches employed in the projects funded by UNDP/UNCDF will be introduced in this project in relation with community mobilisation/sensitisation, formation and capacity building of VWCs and hygiene education as the activities to support establishment of operation and maintenance system at the village level.

c) Capacity Building of VWCs in Management of the Water Supply:

The project will assist improvement of capacity of the VWCs, which represent the respective community for the maintenance service contract with the private service provider, in relation with management of the contract, pricing the user fee to raise maintenance fund and planning its collection so that the communities can access and utilise the maintenance services appropriately. Furthermore, the project will support planning and implementation of the water resources conservation and proper control of water use by the user communities.

2-5-2 Objective of Programme Intervention

The project objective is that safe water is supplied from the constructed or rehabilitated existing system in a sustainable manner. The immediate objective of the Software-Component Programme in this project is to support the Gambian government to establish the community-based management system of these water supply schemes under the collaboration among the community and public and private sectors. This accompanying measure will help achieve the project objective and enhance sustainability of positive impacts of the project.

2-5-3 Outputs of the Programme (Direct Effects)

Direct effects or outputs anticipated through implementation of the Software-Component Programme are explained below.

Output 1: The community-based management system of the water supply facilities is established in the target sites.

The target sites of this project have a structure of VWCs which have been responsible to maintain the existing water supply facilities in the village such as hand dug wells with handpumps. The existing committees can be considered as the main body of the operation and maintenance activities at the village level in this project as well, provided that training of the members as well as reorganisation of the committee will be conducted to fulfill the requirements of operation and maintenance plan of the solar pumping system to be constructed in the project. As the outputs of these activities for organisational restructuring and capacity building of the committee members, an operation plan of the water scheme will be formulated by each VWC. It will contain a) regulation of the committee, b) financial management plan including collection of operation and maintenance fund to afford the subscription fee for the maintenance service contract, opening of a bank account, and rules on financial report, c) policy to employ an operator/guard of the solar pumping system, and d) rules on use and maintenance of public faucets.

It will also be required that the target communities will sign the declaration of commitment to maintenance of the water scheme witnessed by DWR and local authority and raise agreed amount of the upfront contribution for the operation

and maintenance fund prior to the commencement of the construction works. Each target community will conclude a maintenance service contract with a private service provider with utilising such maintenance fund.

Output 2: The community members firmly understand importance and ways of safe and efficient use of water from the constructed water scheme.

Transformation of awareness and behaviour of the community members will be facilitated in terms of

a) safe use of water source as well as the supplied water and utilisation of water for improvement of household and personal health and hygiene conditions.
b) conservation of the water resources and consciousness of costs for water use.

Several studies on review of the past rural water supply projects in the Gambia point out problems on attitude and practice of the community members such as inappropriate hygiene management of water sources and surrounding areas due to a) construction of latrines, refuse pits, and water trough for domestic animals close to the water sources and b) insufficient hygiene practices on hand washing, transport and storage of water, hence decrease of positive impacts of safe water supply. The socio-economic survey conducted during the basic design study of this project also revealed that people in the community practice washing, animal watering and construction of refuse pits near to water sources and do not pay enough attention to hygiene management at transport, storage and handling of drinking water.

Positive impacts towards improvement of living conditions to be realised by sustainable use of safe water supply will be ensured by proper understanding on and practice of utilisation and management of safe water as well as sense of ownership of the communities. This project will, therefore, include activities to enhance improvement of environmental sanitation and proper hygiene practices.

The project will also encourage understanding of users on capacity of the constructed water supply facilities and importance to control usage of each water source as well as prevention of waste of supplied water, with increasing awareness on costs related to water resources conservation and water use. Since the subscription fee for the maintenance service contract in this project is supposed to be determined by the volume of water consumption from the constructed water scheme in the village, water consumption by each community member will directly affect the amount to be

paid from the village to the private maintenance service provider. Therefore, the community members are required to understand that waste of water and consumption of large amount of water for animal watering and gardening will result in unnecessary increase of operation and maintenance fund to be borne by the user community. Utilisation of existing water facilities for such purpose apart from the domestic use can also be advised to the communities as well as proper operation of communal taps.

Output 3:	Monitoring and supervision system of maintenance activities conducted by the VWCs and the private service providers are reinforced at the public sector, i.e. DWR and the local authorities.

It is required that DWR will monitor a) impacts of the activities to support capacity building of the communities in management of water supply and b) fundraising of maintenance fund and payment of the subscription fee by the user communities and periodical maintenance as well as repair works at a fault of the solar pumping system by the service providers based on the contract between the parties. Those records need to be saved in a database at the DWR headquarters to be referred to and utilised for sustainable operation and maintenance of the project and formulation of the new projects in future.

While the information related to results of monitoring on maintenance activities has been recorded by individual project-basis in cooperation with donors, DWR has not yet realised integration of information on these individual projects into an entire inventory or database for the department. Therefore, the department has difficulty in implementation of sufficient monitoring and supervision of maintenance activities by the communities and service providers. Considering this situation, this project will support DWR to formulate and implement a monitoring and evaluation plan including establishment of the database which can be operated by the department. Furthermore, it is expected that required information will be efficiently collected and shared between DWR and local authorities by getting the local authorities, which support the operation and maintenance activities close to the target villages, involved in the process of monitoring and supervision process.

The major means of verification to confirm achievement of the outputs mentioned above are listed as follows:

1) Regulations and action plans of the VWCs, rules of water use in each target sites
2) Declaration of commitment to maintenance of the solar pumping system to be signed by the target communities and witnessed by DWR and local authorities
3) Maintenance service contract to be made between the target communities and the private service provider
4) Training manual on participatory hygiene education as well as establishment of operation and maintenance system
5) Monitoring and evaluation plan to be formulated by DWR
6) Completion report of the Software-Component Programme

2-5-4 Assignment of Personnel

Personnel to be assigned to implement the Software-Component Programme are the following.

(1) Japanese Consultant in charge of Operation and Maintenance (1 person)
[Assignment period: total 4.72 M/M]

The consultant will be responsible for planning the software-component programme, supervising the entire implementation process of the programme, reporting to the client and the Japanese side, and coordinating activities with the schedule of the construction works. This staff will also provide training and advices on approaches and methodologies of the planned activities to local staff who will be involved in implementation of the programme so that the expected outputs can be achieved from each activity. The consultant in charge of operation and maintenance shall be sufficiently experienced in the social development field.

(2) Programme Coordinator from Local NGO or Consultant (1person)
[Assignment period: total 20.04M/M]

Under the supervision of the Japanese consultant, the programme coordinator will be responsible to manage the progress and outputs of each activity as well as performance of the personnel who will be directly involved in the activities at the village level and to make periodical reports to the Japanese consultant. Since the DWR headquarters does not have a staff specialised in social development, the

programme coordinator will be appointed from the local NGOs or consultants based in the Gambia. The programme coordinator should be fully experienced in training of facilitators, promotion of community participation and formation of community-based organisation, and hygiene education. Fluent communication skills in local languages used in the target areas are also required.

(3) Motivators in Each Division (3 persons per Division)

DWR has motivators in each Division to facilitate interaction with the communities in establishment of the operation and maintenance system. They conduct activities related to community mobilisation/ sensitisation and capacity building in cooperation with the motivators from the Department of Community Development and Department of Medical and Health. Usually, three motivators from these departments form one team to facilitate community mobilisation and training of VWCs.

These motivators have been involved in interventions to establish operation and maintenance systems for wells with handpumps and solar generated water supply schemes funded by other donors. Through these experiences, they have developed skills and knowledge on participatory planning and evaluation, and training of VWCs. Therefore, these existing human resources in Divisional offices of DWR and relevant organisations will be utilised in this project for implementation of the activities on capacity building of the target communities under supervision by the programme coordinator.

In consideration of different approaches and experiences of these motivators in supporting communities for operation and maintenance and capacity building in accordance with the projects they have been involved, training of the motivators will be required in this project to level out their skills and knowledge based on the proposed operation and maintenance framework and to get same degree of understanding on approaches and methodologies of the planned activities.

(4) Community Health Workers (2 persons per project site)

Proper understanding and practice of hygiene management by the user communities are indispensable for realisation of sustainable and safe water supply.

Community health workers will be appointed among the residents of each target site and be trained in implementation of the participatory hygiene education in this project in order to facilitate behavioural change of the community members on their own initiative. The rationale of the approach to train local human resources as the community health workers is that they live in the target communities of the project and are familiar with the living environment and social conditions of the village, hence ensuring continuation of hygiene education even after completion of the project as well as appropriate contents of messages and methods of their delivery in hygiene education.

2-5-5 Intervention Plan

(1) Intervention to be Borne by the Japanese Side

Outline of the intervention to be borne by the Japanese side is shown in Table 2-27 in the next page. In a series of discussions with DWR during the Basic Design Study in the Gambia, the Gambian side requested to the Japanese side that activities to support establishment of operation and maintenance system at the village level as well as facilitation of the maintenance service contracts between the private service provider and the target communities are to be implemented as a scope of works by the Japanese side in the project. The activities summarised in Table 2-27 mentioned above are designed with considering this request from DWR. For activities at the village level, approaches and methodologies employed in similar rural water supply projects funded by EDF and UNDP/UNCDF were referred.

Participation of stakeholders including the target communities and fulfillment of their responsibilities in the project will be facilitated through implementation of these activities. The planned activities will be implemented into three stages of “Pre-Construction Stage”, “Construction Stage”, and “Handing-over Stage” in the project. Interventions at each stage have following purposes.

1) “Pre-Construction Stage”:
   - To mobilise stakeholders of the project at national, divisional and village levels.
   - To train facilitators, i.e. motivators and community health workers, who will be responsible for implementation of the planned activities at village level.
   - To conduct training of VWCs, the focal point at the village level, by the motivators to strengthen their skills and capacity to be required for

Table 2-28 Summary of the Planned Activities in the Software-Component Programme

Stage	Activities	Target Group	Required Period (Approx.)	Total Period		Responsible Persons	Venue	Outputs from the Activities
				Time	Total No. of Days			
Pre-Construction Stage	1 Action planning on establishment of operation and maintenance system of the water supply facility and its monitoring and evaluation	Counterpart personnel from DWR and staff from relevant organisations (approx. 10 persons)	5 days / entire period of the project	1	5	Japanese consultant, local NGO/consultant	Banjul	Monitoring and evaluation plan formulated by DWR
	2 Training of field staff (motivators)	Total 12 persons (3 persons/ Division x 4 Divisions)	3 days / entire period of the project	1	3	Japanese consultant, local NGO/consultant	Banjul	Training manuals for VWC and community health workers
	3 Mobilisation of stakeholders at Divisional level	Staff from Divisional offices and Area Councils, Chiefs in the affected districts, members of the Water and Sanitation task force (Total 60 persons, approx. 15 persons/ Division x 4 Divisions)	1 days / Division	4	4	Japanese consultant, local NGO/consultant, motivators	Each Division(NBD, WD, LRD & CRD)	Workshop proceedings
	4 Orientation of objectives, detailed activities and implementation set-up of the project	Community members in the targeted 29 sites	2 days / site	29	58	local NGO/consultant, motivators	Target site	Monitoring sheet of the activity recorded by the motivators
	5 Formation/ reorganisation of VWCs	Community members in the targeted 29 sites	1 days / site	29	29	local NGO/consultant, motivators	Target site	Monitoring sheet of the activity recorded by the motivators, copies of regulations for operation of VWC, copies of declaration of commitment to maintenance of water facilities
	6 Participatory analysis on problems related to present water and sanitation conditions in the target villages	Community members in the targeted 29 sites	3 days / site	29	87	local NGO/consultant, motivators	Target site	Monitoring sheet of the activity recorded by the motivators, copies of community maps showing present status of water & sanitation in the target sites
	7 Capacity building of VWCs							
	7.1 Needs assessment of the VWCs on capacity building	VWC members (total 290 persons, approx. 10 members/ VWC x 29 sites)	2 days / site	29	58	local NGO/consultant, motivators	Target site	Monitoring sheet of the activity recorded by the motivators
	7.2 Improvement of knowledge and skills on daily operation and maintenance of the water scheme	VWC members (total 290 persons, approx. 10 members/ VWC x 29 sites)	3 days / site	29	87	local NGO/consultant, motivators	Target site	Monitoring sheet of the activity recorded by the motivators
	7.3 Training in financial management of operation and maintenance fund	Treasurers of VWCs and tap attendants (total 320 persons, 1 treasurer & approx. 10 tap attendants/ site x 29 sites)	2 days / site	29	58	local NGO/consultant, motivators	Target site	Monitoring sheet of the activity recorded by the motivators
	7.4 Training for improvement of leadership required for facilitation of proper water use and skills for participatory planning and evaluation	VWC members (total 290 persons, approx. 10 members/ VWC x 29 sites)	3 days / site	29	87	local NGO/consultant, motivators	Target site	Monitoring sheet of the activity recorded by the motivators, copies of VWC action plans
	7.5 Training in conservation and management of water resources	VWC members (total 290 persons, approx. 10 members/ VWC x 29 sites)	2 days / site	29	58	local NGO/consultant, motivators	Target site	Monitoring sheet of the activity recorded by the motivator, draft rules on water use
Construction Stage	8 Participatory hygiene education							
	8.1 Training of community health workers in methodologies of the participatory hygiene education	Community health workers selected in each target site (total 58 persons, 2 persons/ site x 29 sites)	5 days / Division	6	30	local NGO/consultant, motivators	Conducted in each Division (NBD, WD, LRD & CRD) per Phase	Workshop proceedings
	8.2 Implementation of the participatory hygiene education programme for facilitation of appropriate handling of the water sources and drinking water as well as improvement of hygiene practices	Community members in the targeted 29 sites	2 days / month/ site	total	492	motivators, community health workers	Target site	Monitoring sheet of the activity recorded by the community health workers
	9 Facilitation of community participation in daily maintenance, protection of the water facilities and regular payment of the maintenance fund	Community members in the targeted 29 sites	1 days / month/ site	total	246	local NGO/consultant, motivators, VWCs	Target site	Monitoring sheet of the activity recorded by the motivators, including report of the VWCs
Handing-Over Stage	10 Promotion of maintenance service contracts between the target villages and the private service provider	VWC	2 days / site	29	58	local NGO/consultant, motivators	Target site	Monitoring sheet of the activity recorded by the motivators, copies of the maintenance service contracts
	11 Impact evaluation of the software-component programme and formulation of the action plan for operation and maintenance in the post-project period	VWC and community members in the targeted 29 sites	3 days / site	29	87	local NGO/consultant, motivators	Target site	Summary of evaluation results, Action plans of VWCs on operation and maintenance activities in the post-project period

coordination between the community and external agencies, leadership to take the initiative in participating in the process of construction works and preparation of maintenance system, and financial management as well as action planning.

2) "Construction Stage":
   - The VWCs to facilitate community participation in implementation of the project and community health workers to conduct participatory hygiene education programme periodically with utilising knowledge and skills obtained through the trainings in the pre-construction stage.
   - Motivators to monitor these activities to be implemented by the VWCs and community health workers and to advise them on problems observed and improvement of the activities.

3) "Handing-over Stage":
   - To support the VWCs for proper understanding on terms and conditions of the maintenance service contract and promote required arrangement to enter into the contract.
   - To evaluate achievement and impacts of the software-component programme with the community members at the end of the programme.
   - To review the action plan formulated in the pre-construction stage by each target community so that the recommendations and lessons learnt drawn in the evaluation mentioned above can be reflected in the action plan.

Detailed implementation plan of each activity is explained below.

A. Pre-Construction Stage

Module 1 Action planning on establishment of operation and maintenance system of the water supply facility and its monitoring and evaluation
[Required period for the activity: 5 days for entire project period]

1) Objectives
   - □ To facilitate understanding of the DWR counterpart personnel and staff from relevant organisations on basic policy, implementation set-up and schedule of the project, and roles of each stakeholder to be involved in the project.
   - □ To make consensus on roles and responsibilities of each stakeholder in the proposed operation and maintenance system of the project and approaches to establish the system with participation of the private sector.
   - □ To agree on objectives, target groups, approaches and methodologies, implementation set-up and schedule of the software-component programme and important points to coordinate with the schedule of construction works.
   - □ To formulate a) detailed work schedule of the planned activities under the

software component during implementation period of the project and b) monitoring and evaluation plan on maintenance activities to be implemented by the target communities and the private service provider in the post-project period.

2) Target Group

DWR counterpart personnel and staff from relevant organisations (approx. 10 participants)

※ Department of Medical and Health and Department of Community Development can be considered as the participants from the relevant organisations to the workshop with considering that these departments are members of the Water and Sanitation Working Group of the Gambia together with DWR and that they work in the water supply and sanitation sector in cooperation with DWR. Since the DWR motivators will facilitate the planned activities at the Divisional and village levels in collaboration with the motivators from these two departments, participation from these relevant organisations to this workshop will be significant to obtain understanding from the overseers of motivators in each department on the basic plan and implementation policy of the project and to discuss effective approaches and methodologies for establishment of operation and maintenance system based on the integrated approach of water, sanitation and health.

3) Responsible Person and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/Consultant (1 person)	5 days	Preparation and facilitation of the workshop, Recording the proceedings
Japanese Consultant (1 person)	5 days	Explanation of basic plan and design of the project including the software-component programme, advice on making consensus on operation and maintenance plan and formulating monitoring and evaluation plan

4) Tentative Programme

	Main Topics	Time (Approx.)
Day 1	1. Objectives and rules of the workshop	0.5 hours
	2. Feedback of problems observed in the Basic Design Study in relation with water and sanitation conditions in the target areas and review by the participants (setting common view on the present conditions of the target areas of the project)	2.5 hours
	3. Logical framework of the project	1.5 hours
	4. Basic policies, implementation set-up and schedule of the project	1.5 hours
Day 2	1. Stakeholders analysis in relation with operation and maintenance system of the solar-powered water supply scheme	2.5 hours

	2. Problem analysis on past experiences in establishment of operation and maintenance system	2 hours
	3. Objective analysis on establishment of operation and maintenance system	2 hours
Day 3	1. Basic approaches on establishment of operation and maintenance system (decentralisation, integrated approach of water, sanitation and hygiene education, consideration of gender aspects/ vulnerable groups, cost recovery)	2.5 hours
	2. Consensus on the operation and maintenance system	2.5 hours
	3. Objectives, target groups, methodologies, responsible persons and implementation schedule of the software-component activities	1.5 hours
Day 4	1. Objectives and indicators of monitoring and evaluation during and after the project	2.5 hours
	2. Review of the existing monitoring and evaluation system and information flow of DWR	1.5 hours
	3. Determining implementation plan and information flow for monitoring and evaluation	2.5 hours
Day 5	1. Formulation of implementation guideline of planned activities for motivators	5 hours
	2. Recap and evaluation of the workshop	1 hour

5) Methodologies

The Project Cycle Management (PCM) method, brainstorming and organisational analysis will be employed to facilitate discussion, analyses and planning by the participants with combining plenary meetings and group works.

6) Output from the Activity

- Monitoring and evaluation plan formulated by DWR and relevant

Module 2 Training of Field Staff (Motivators)

(Required period for the activity : 3 days for entire project period)

1) Objectives

- To equip motivators with knowledge and skills required to facilitate process of community mobilisation and capacity building of the VWCs at the village level, based on the implementation set-up, methodologies and monitoring and evaluation plan agreed in Module 1.
- To review and revise the draft training manuals for VWCs and community health workers which will be prepared by the local NGO/consultant staff in advance of the training of the motivators under the supervision of the Japanese consultant.
- To make consensus on the monitoring and evaluation plan of each activity and ways to record and report the activities with using the monitoring sheets.

2) Target Group

Motivators appointed in the target Divisions of the project from DWR, Department of Medical and Health, and Department of Community Development (Total 12 participants, Approx. 3 motivators/ Division x 4 Divisions)

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	3 days	Preparation of the training workshop including drafting the training manuals for VWCs and community health workers, facilitation of the training and recording the proceedings
Japanese Consultant (1 person)	3 days	Explanation of basic plan and design of the project, advice on coordination with the entire implementation schedule of the project as well as the construction works and on methodologies of each activity with considering the expected outputs

4) Tentative Programme

	Main Topics	Time (Approx.)
Day 1	1. Objectives and rules of the workshop	0.5 hours
	2. Basic policies, implementation set-up and schedule of the project	1hour
	3. Operation and maintenance system of the project and roles and responsibilities of each stakeholder	1hour
	4. Contents of planned activities, expected outputs, important points, implementation set-up and schedule of the software-component programme	2hours
	5. Review and problem analysis on past experiences in capacity building of communities and hygiene education	2.5hours
Day 2	1. Methodologies to facilitate confirmation of social conditions, identification of problems of the communities, and problem analysis on water, sanitation and health conditions (theory and practice)	2hours
	2. Methodologies for capacity building of VWC (theory and practice)	3hours
	3. Methodologies for training of community health workers in participatory hygiene education (theory and practice)	3hours
Day 3	1. Review and revision of the draft training manuals for VWCs and community health workers	3hours
	2. Confirmation of monitoring and evaluation plan of the project	3hours
	3. Recap and evaluation of the workshop	1hour

5) Methodologies

Draft training manuals for VWC and community health workers will be prepared by the local NGO/consultant staff in advance of the training workshop of the motivators and be distributed in the workshop. Revision of the draft training manuals will be done by the participants efficiently through using them in the

training practically. Lectures on theory and exercises such as role playing will be combined in the programme in order to enhance practical skills of the participants. Also, the implementation guideline for motivators on the planned activities which is formulated in Module 1 will be used in the training together with the manuals so that the motivators can have clear views of their expected roles and outputs of the software-component.

6) Output from the Activity

Training manuals for VWC and community health workers

Module 3 Mobilisation of Stakeholders at Divisional Level
(Required period for the activity: Total 4 days, 1day ／Division x 4 Divisions)

1) Objectives

- To explain basic policies, detailed activities, implementation set-up and schedule of the project to the stakeholders in Divisions where the target sites are located and request for their cooperation in the project.
- To make consensus on roles and responsibilities of each stakeholder and the communication flow in implementation, operation and maintenance of the project.

2) Target Group

Staff of the Divisional Office and Area Council, Chiefs of the affected districts of the project, and members of the water and sanitation task force in the Division including the motivators trained in Module 2 (total 60 persons, approx. 15 participants/ Division x 4 Divisions)

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Total 4 days	Preparation and facilitation of the workshop, recording of proceedings of the workshop
Japanese Consultant (1 person)	Total 4 days	Explanation of basic policies, contents, implementation set-up and schedule of the project, operation and maintenance plan, policy on community participation, and responsibilities of the beneficial communities

4) Tentative Programme

	Main Topics	Time (Approx.)
Day 1	1. Objectives of the workshop	0.5hours
	2. Background, basic policies and contents, implementation set-up, and schedule of the project	1.5hours
	3. Operation and maintenance system of the project, roles and responsibilities of each stakeholder, policies on facilitation of community participation and responsibilities of the user communities	1.5hours
	4. Details of the software-component programme including planned activities, expected outputs, implementation set-up and schedule	1.5hours
	5. Communication flow of the project	1hour
	6. Questions and answers	1hour

5) Methodologies

The workshop will be proceeded mainly in the form of lecture or explanation by the local NGO/ consultant staff and the Japanese consultant. Key messages and information contained in the explanation of the project will also be emphasised through answering to questions and comments from the participants and discussions with them.

6) Output from the Activity

Workshop proceedings

Module 4 Orientation of Objectives, Detailed Activities and Implementation Set-up of the Project

(Required period for the activity: Total 58 days, 2 days/ site x 29 sites)

1) Objectives

- To explain the basic plan of the project to the community leaders in the affected areas such as the Ward Councillors and members of the Ward Development Committees as well as leaders in the target communities such as the village heads, members of the Village Development Committees (VDC), religious leaders, and women's group, and to request for their cooperation in the project.
- To organise the orientation workshop for the entire community members in each target site on the date when the community leaders agree at the introductory visit mentioned above.
- To explain, to the community members, objectives and detailed activities of the project, implementation schedule, expected roles of each stakeholder, and responsibilities of the communities including cost-sharing for the operation and maintenance.
- To confirm willingness of the community members to accept the project and

their responsibilities.

2) Target Group

Community members in the targeted 29 sites

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Total 58 days	Explanation of the project to the community leaders and other community members
Motivators	Total 58 days	Coordination and facilitation of arrangement of the community meetings

4) Methodologies

The local NGO/ consultant will lead the meeting to explain details on the project on behalf of the Japanese consultant. It is expected that the project can be smoothly launched in the target sites by encouraging proper understanding of the community members on the basic plan and design of the project. The motivators will attend the meeting to assist the local NGO/ consultant staff in facilitating the exercises and recording the minutes of discussions.

The local NGO/ consultant staff will explain, to the community members, the background, detailed activities, and implementation set-up of the project, and responsibilities of the communities including cost-sharing for the operation and maintenance at the orientation meeting in each target site. In order to facilitate proper understanding of the community members, the local NGO/ consultant staff and motivators will utilise visual aids such as illustrations of the water supply facilities, a plan of the entire scheme to be constructed in the village and a diagram showing flow of the maintenance fund contributed by the user communities as well as its usage. In case that the target site has a large-scale community consisting of several sub-villages, the staff will ask advice from the community/village leaders at the introductory visit on the venue and form of the orientation meeting suitable for the community.

5) Output from the Activity

Monitoring sheet of the activity recorded by the motivators

Module 5 Formation/ Reorganisation of the VWCs

(Required period for the activity: total 29 days, 1 day/ site x 29 sites)

1) Objectives

- To make consensus of the community members on roles and responsibilities

of the VWC in the project.

- To agree with the community members on regulation for operation of the VWC including composition of the membership, term of office, procedures for election of the members, decision-making process, and reporting to the VDC and entire village meeting.
- To elect VWC member, which usually consists of approximately ten persons, i.e. a chairperson, vice-chairperson, secretary, treasurer, auditor, and members.
- To request the VWC members to cooperate in detailed design study in confirmation of the locations of water supply facilities in each site and to remind the community members about fundraising for the operation and maintenance as well as opening a bank account.

2) Target Groups

Community members in the targeted 29 sites

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Total 151.5 days*	Monitoring of the activity facilitated by the motivators and verification of achievement of objectives and expected results of each activity
Motivators	Total 29 days	Facilitation of the activity at the village level

* The local NGO/ consultant staff will not be directly involved in facilitation of the activities at the village level after Module 4. Instead, the staff will visit each site for one day/ month/ site during the implementation period of Module 5 to Module 7.5 to monitor and verify the progress and achievement of the activities to be facilitated by the motivators and to give them advice on improvement of their approaches and methods. The assignment period of the local NGO/consultant staff in the table above indicates the total number of days of involvement for the monitoring visits from Module 5 to Module 7.5.

4) Methodologies

Following clarification of roles and responsibilities of VWC under the project, the participants will discuss which measures the village should choose, either establishment of a new VWC for operation and maintenance of the new water scheme or utilisation/ reorganisation of the existing VWC in the village. In case that they have an existing VWC in the village, the motivator will discuss with the participants the problems related to operation of the committee such as inactivity, concentration of a burden on specific individuals and poor attention to the gender balance in composition of the membership. Considering necessary measures to solve these problems, the motivators will advise the communities on preparation

of the regulation for operation of the VWC.

After the community members agree on the roles, responsibilities and regulations of the VWC, the committee members will be elected from the community members. The motivators are to organise the group discussions divided into male and female groups, if necessary, so that the opinions of female participants can be positively reflected in selection of the committee members. Following the election, the VWC will sign on a form of the declaration of commitment which describes responsibilities of the communities on operation and maintenance of the solar-powered water supply system to be constructed in this project and is to be endorsed by the village head with the witnesses of DWR and the local authority.

5) Output from the Activity
   - Monitoring sheet of the activity recorded by the motivators
   - Copies of regulations of the VWCs
   - Copies of declaration of commitment to maintenance of the solar-powered water supply system signed by the VWCs

Module 6 Participatory Analysis on Problems Related to Present Water and Sanitation Conditions in the Target Villages
(Required period for the activity: Total 87 days, 3 days/site x 29 sites)

1) Objectives
   - To formulate common views among the community members on present situation and problems to be solved in relation with the water and sanitation conditions in the target site with utilising exercises of the participatory analysis on needs of the community for improvement of the living conditions.
   - To specify the target groups, attitude and behaviour, and key messages which should be focused on in the participatory hygiene education programme based on the results of analysis on knowledge, attitude and practice of the community members on relations among increase of reliable conditions of water supply and sanitation, proper hygiene practice, prevention of water-borne/related diseases, and improvement of health.
   - To set indicators to be used for evaluation at the completion of the project based on discussion with the community members on expected impacts on improvement of their living conditions which would be brought by the construction of reticulation system, establishment of the operation and maintenance and promotion of hygiene education.
   - To collect the baseline data of those indicators defined by the community members.

2) Target Group

Community members in the targeted 29 sites

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Refer to Module 5, 3)	Monitoring of the activity facilitated by the motivators and verification of achievement of objectives and expected results of each activity
Motivators	Total 87 days	Facilitation of the activity at the village level

4) Tentative Programme

	Main Topics	Time (Approx.)
Day 1	1. Objectives and rules of the workshop	0.5hours
	2. Confirmation of composition of the community and present conditions of water and sanitation in the village	2.5hours
	3. Needs/ problem analysis on use of water/sanitation facilities as well as quality and quantity of existing water sources	2hours
	4. Present status of diseases infection for the community members, transmission routes of the water-borne/related diseases and preventive measures	1.5hours
Day 2	1. Problem analysis on present conditions of sanitation and hygiene practices, specifying attitude and practices which attribute water-borne/related diseases and groups which have such attitude and practices	2.5hours
	2. Options to be taken by the communities for improvement of the existing water and sanitation conditions, linkage between mitigation of those identified problems and improvement of overall living conditions	2hours
	3. Analysis on resources available in the village for improvement of water and sanitation, such as sources of cash income, seasonality of fundraising, skilled persons and type of skills which they have, and materials locally available	1.5hours
Day 3	1. Expected results to be brought by the input from the external support, such as construction of water facilities and establishment of operation and maintenance system, and interventions by the community members	2hours
	2. Setting indicators for impact evaluation of the project	1hour
	3. Confirmation of the baseline data for the indicators	2hours
	4. Recap and evaluation of the workshop	1hour

5) Methodologies

After confirmation of composition of the community and location of existing water and sanitation facilities in the village on a community map to be drawn by the participants, needs/ problem analysis will be done to assess use of existing water supply/ sanitation facilities and perceptions of the community members on quality and quantity of water sources with using the community map and pocket chart. A diagram will also be utilised to enhance understanding of the

participants on proper hygiene practices to prevent diseases as well as routes of diseases transmission such as fingers, excreta, fly, water and food. For discussion on actions to be taken for mitigation of the identified problems, a tool of the three-pile sorting will be used to compare the perceptions of the community members on present status and expected situation to be realised in the future in relation with the water and sanitation conditions in the village. Then, the participants will discuss options and measures to be taken by the community, households and individuals, past experiences by the community, and available resources in order to decrease the gap.

The workshop will be proceeded by the group works with using focused group discussion and plenary sessions for feedback of finding from the group works so that different views and needs of adult men, adult women and youth/ children can be respected in the analyses and discussions.

During the basic design study, the PRA exercises were conducted in six sites to collect qualitative information supplementary to the sample household survey which were implemented in all of the target sites with using structured interview with questionnaires. Those PRA exercises focused on collection of qualitative data representing present situation of the target sites such as existing water and sanitation conditions and gender roles. Meanwhile, in the implementation stage of the project, the PRA will be conducted in all the target sites including the six villages where the exercises were implemented in the basic design study since detailed profile of each target community will be required to determine approaches and methods of capacity building and hygiene education for the community. Quantitative data obtained from the sample household survey in the basic design study will also be referred to for specifying topics of the workshops and setting indicators and baseline data for evaluation.

6) Output from the Activity
   - Monitoring sheet of the activity recorded by the motivators
   - Copies of the community maps showing the present status of water and sanitation in the target sites

Module 7 Capacity Building of the VWCs

Module 7.1 Needs Assessment of the VWCs on Capacity Building
(Required period for the activity: total 58 days, 2 days/sites x 29 sites)

1) Objectives

- To agree with the VWC members on detailed plan of trainings for them under the project based on assessment of their needs to improve their capacity as well as the present level of their knowledge and skills in terms of community management and operation and maintenance of water supply scheme.

2) Target Group

VWC members selected in Module 5 (Total 290 persons, Approx. 10 members/VWC x 29 sites)

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Refer to Module 5, 3)	Monitoring of the activity facilitated by the motivators and verification of achievement of objectives and expected results of each activity
Motivators	Total 58 days	Facilitation of the activity at the village level

4) Tentative Programme

	Main Topics	Time (Approx.)
Day 1	1. Objectives and rules of the workshop	0.5hours
	2. Review of experiences of the VWC members in the existing community-based organisations and activities of the VWC conducted after their appointment	2hours
	3. Analysis of "expectations" and "fears" of the committee members in fulfilment of their roles and responsibilities	1hour
	4. Reconfirmation of roles and responsibilities of the committee and each member	2hours
Day 2	1. Analysis of contribution/ preventive factors in fulfilment of roles and responsibilities of the VWC members	2hours
	2. Skills to be strengthened and improved for realisation of roles and responsibilities of the VWC, assessment of the training needs, confirmation of availability of human resources and indigenous knowledge in the village which can satisfy the required conditions	2hours
	3. Confirmation of the implementation schedule of the training and target group of each session	1.5hours
	4. Recap and evaluation of the workshop	1hour

5) Methodologies

On the first day, the participants will visualise and share "expectations" and "fears" of each member in executing the activities of the committee since its establishment based on the roles, responsibilities and regulations of the VWC agreed by the entire community in Module 5. Then, the participants will reconfirm function of the VWC and roles of each member through group discussions.

On the second day, the participants will analyse situations and attitude which will contribute/ hinder fulfilment of the roles and responsibilities of the VWC members. The preventive factors for capacity building of the VWC will be paid enough attention to in the training sessions for the VWC while the contribution factors will be strengthened through the training. A detailed implementation schedule of each training session will be developed by the motivators and participants based on the results of this needs assessment and the training manuals for the VWCs compiled in Module 2.

When the motivators confirm a schedule of the training sessions with the participants, they are required to consider seasonal calendar of each target site such as farming season and religious festivals. Consideration for season, time and venue convenient for female members should also not be overlooked in scheduling the trainings.

6) Output of the Activity

Monitoring sheet of the activity recorded by the motivators

Module 7.2 Improvement of Knowledge and Skills on Daily Operation and Maintenance of the Water Scheme

(Required period for the activity total 87 days, 3 days/ site x 29 sites)

1) Objectives

- To encourage understanding of the VWC members on basic design of the water supply scheme to be constructed in the project including composition of the facility, design criteria and demarcation of responsibilities between the user communities and private service providers in operation and maintenance of the water scheme.
- To explain details of daily maintenance of a) solar pumping system and b) communal taps and reticulation which are to be born by the user community including appointment of operator/guard and tap attendants who will be involved in the maintenance activities at the village level.

- To make consensus on means of cost-recovery applicable for the community for the operation and maintenance of the water scheme based on discussion on several options of pricing the user fee and its collection and other measures to secure income sources for the cost-recovery.

2) Target Group

VWC members in the targeted 29 sites (total 290 persons, approx. 10 members/ VWC x 29 sites)

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Refer to Module 5, 3)	Monitoring of the activity facilitated by the motivators and verification of achievement of objectives and expected results of each activity
Motivators	Total 87 days	Facilitation of the activity at the village level

4) Tentative Programme

	Main Topics	Time (Approx)
Day 1	1. Objectives and rules of the training	0.5hours
	2. Composition and design criteria of the water supply scheme to be constructed in the project	2hours
	3. Demarcation of responsibilities between the community and maintenance service provider in operation and maintenance of the water scheme	2hours
	4. Support services by the public sector in operation and maintenance	1.5hours
Day 2	1. Daily maintenance activities of the solar pumping system and required human resources and materials for the maintenance	1hour
	2. Daily maintenance of communal taps and pipelines, required human resources and materials for the maintenance activities	1hour
	3. Details of operation and maintenance costs for the water scheme, principle of cost-sharing by the users	2hours
	4. Options for cost-recovery of the operation and maintenance activities	2hours
Day 3	1. Feedback of findings and consensus from discussions in Day 1 & 2 to the entire community	1.5hours
	2. Consensus on options for cost-recovery	1.5hours
	3. Criteria for selection of operator/ guard and tap attendants who will be involved in the daily maintenance activities	1hour

5) Methodologies

Demarcation of responsibilities of the user communities and maintenance service provider will be clarified in accordance with the composition of the water scheme with utilising the training manuals for the VWC developed in Module 2 as well as the visual aids used in the orientation meetings in Module 4. Concerning options of cost-recovery for the operation and maintenance of the water scheme,

the participants will discuss how they should deal with issues such as a) ensuring equity in cost-sharing among the households or user groups of same communal tap based on the volume of water consumption, b) facilitation of access of the vulnerable groups to the safe and reliable water supply, and c) increase of the maintenance costs caused by illegal water use or ignorance of leakage of water.

Issues discussed by the VWC members in this training session will be finally fed back to the entire community meeting to obtain approval from the community members on detailed plan of operation and maintenance activities to be borne by the community including measures for cost-recovery of the operation and maintenance costs. The motivators will also agree with the VWCs and other community members on selection criteria for operator/guard and tap attendants in each target site who will be involved in the maintenance activities under the supervision of the VWCs.

* Technical training of the operator/guard in operation and daily maintenance of the solar pumping system is not included in the activities of the software-component programme since it will be covered by the scope of works of the contractor for the construction works at the handing-over of the facilities.

6) Output from the Activity

Monitoring sheet of the activity recorded by the motivators

Module 7.3 Training in Financial Management of Operation and Maintenance Fund
(Required period for the activity: total 58 days, 2 days/site x 29 sites)

1) Objectives

- To equip the participants with knowledge and skills to be required for collection of the operation and maintenance fund and its financial management.
- To make consensus on procedures to use the operation and maintenance fund and mode of financial report to the entire community.

2) Target Group

Treasurers of VWCs and tap attendants selected after Module 7.2 in the targeted 29 sites (total 320 persons, 1 treasurer and approx. 10 tap attendants/ site x 29 sites)

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Refer to Module 5, 3)	Monitoring of the activity facilitated by the motivators and verification of achievement of objectives and expected results of each activity
Motivators	Total 58 days	Facilitation of the activity at the village level

4) Tentative Programme

	Main Topics	Time (Approx.)
Day 1	1. Objectives and rules of the training	0.5hours
	2. Roles of treasurer and tap attendants in collection and management of the maintenance fund	1.5hours
	3. Flow of the maintenance fund from collection, saving and use	2hours
	4. Recording an account book (theory and practice)	3hours
Day 2	1. Rules on collection and keeping of the maintenance fund	1hour
	2. Procedures to use the maintenance fund (approval in the village)	1hour
	3. Mode of financial report to the VWC and entire community (theory and practice)	3hours
	4. Conditions to contribute for payment by the user communities	1hour
	5. Recap and evaluation of the training	1hour

5) Methodologies

Based on the option for cost-recovery for the operation and maintenance which will have been agreed among the community members in Module 7.2, treasurers of the VWCs and tap attendants will confirm their roles in collection of the user fees for the maintenance fund to be paid by the users of the reticulation system. The participants will learn basic knowledge and skills of financial management through lectures and exercises with using training manuals of VWC developed in Module 2 as well as formats of the accounting book and financial report.

6) Output of the Activity

Monitoring sheet of the activity recorded by the motivators

Module 7.4 Training for Improvement of Leadership Required for Facilitation of Proper Water Use and Skills for Participatory Planning and Evaluation

(Required period for the activity: total 87 days, 3 days/ site x 29 sites)

1) Objectives

- To improve leadership of the VWC members and skills for participatory problem analysis and action planning/ management which will be required to guide and facilitate participation in operation and maintenance as well as appropriate use of water facilities by the user communities.

□ To enhance awareness of the VWC members on consideration of gender and vulnerable groups in planning and implementation of the communal activities.

2) Target Group

VWC members of the targeted 29 sites (total 290 persons, Approx. 10 members/ VWC x 29 sites)

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Refer to Module 5, 3)	Monitoring of the activity facilitated by the motivators and verification of achievement of objectives and expected results of each activity
Motivators	Total 87 days	Facilitation of the activity at the village level

4) Tentative Programme

	Main Topic	Time (Approx.)
Day 1	1. Objectives and rules of the training	0.5hours
	2. Review of the problem analysis/ objective analysis related to present status of water and sanitation	1.5hours
	3. Action by the VWC to facilitate changes expected by the communities for improvement of water and sanitation conditions	2hours
	4. Coordination and communication with the internal organisations in the village and external agencies at implementation of the activities by VWC	2hours
Day 2	1. Means of communication, contribution/ preventive factors of communication	2hours
	2. Resistance to "change" in the communal activities and its measures	2.5hours
	3. Conflict resolution in relation with water and sanitation issues	2.5hours
Day 3	1. Planning and implementation of communal activities with consideration on gender and vulnerable groups	2hours
	2. Formulation of VWC action plan	2hours
	3. Monitoring and evaluation of the action plan	2hours
	4. Recap and evaluation of the training	1hour

5) Methodologies

With referring to the results of problem/ objective analyses concerning present status of water and sanitation in the target villages conducted in Module 6, the participants will discuss the VWC action plans to realise improvement of existing water and sanitation conditions which is expected by the community members. For strengthening the skills for management of the project cycle by their own initiative, the VWC members will use the tools, which can be applied in the project cycle such as problem/needs analysis, resolving problems, action planning and monitoring and evaluation, in actual exercises to formulate the action plan.

The participants will also learn skills for communication, conflict resolution and facilitation to take the initiative in the communal activities through case study and role playing in the training.

6) Output from the Activity
   - Monitoring sheet of the activity recorded by the motivators
   - VWC action plans

Module 7.5 Training in Conservation and Management of Water Resources
(Required period for the activity: total 58 days, 2 days/sites x 29 sites)

1) Objectives
   - To equip the VWC members with knowledge on protection of environmental sanitation of the water sources and surrounding areas of the communal taps, prevention of waste of water, and facilitation to utilise the water sources.

2) Target Group
   VWC members in the targeted 29 sites (Total 290 persons, approx. 10 members/ VWC x 29 sites)

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Refer to Module 5, 3)	Monitoring of the activity facilitated by the motivators and verification of achievement of objectives and expected results of each activity
Motivators	Total 58 days	Facilitation of the activity at the village level

4) Tentative Programme

	Main Topics	Time (Approx.)
Day 1	1. Objectives and rules of the training	0.5hours
	2. Present status of management of the water sources in the village	2hours
	3. Management of water source and environmental sanitation surrounding the communal taps and provision of safe water supply	1.5hours
	4. Needs assessment on water use in the village	2hours
Day 2	1. Encouragement of utilisation of water sources according to the usage	1.5hours
	2. Measurers to be taken for prevention of illegal use of water from the piped water scheme	2hours
	3. Drafting the rules on water use	2.5hours
	4. Recap and evaluation of the training	1hour

5) Methodologies

Utilising the community map developed in Module 6 and information obtained in the transect walk in the village, the participants will confirm the problems related to management of environmental sanitation surrounding the existing water supply facilities and enhance their understanding on importance of conservation of water sources to maintain the safe water supply. This activity will also encourage understanding of the VWC members on necessity and importance of the participatory hygiene education which will be started after Module 7.5. In consideration of a) protection of environmental sanitation of water sources and adjacent areas to the sources, and b) conservation and utilisation of water resources, the VWC members will draft the rules on water use and obtain an approval from the entire community on the draft rules by the commencement of the construction works.

6) Output from the Activity

- Monitoring sheet of the activity recorded by the motivators
- Rules on water use drafted by the VWCs

Module 8 Participatory Hygiene Education

Module 8.1 Training of Community Health Workers in Methodologies of the Participatory Hygiene Education

(Required period for the activity: total 30 days, 5 days/ Division where the construction works will be implemented in the phase x 6 sessions in total)

1) Objectives

- To equip the community health workers with knowledge and skills required to implement participatory hygiene education programme at the village level.
- To make consensus on ways to monitor and record the hygiene education programme.

2) Target Group

Community health workers appointed by the community members in each target site (total 58 persons, 2 persons/ site x 29 sites)

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Total 12 days	Monitoring of the activity facilitated by the motivators and verification of achievement of objectives and expected results of each activity
Motivators	Total 30 days	Facilitation of the activity at the village level

4) Tentative Programme

	Main Topics	Time (Approx.)
Day 1	1. Objectives and rules of the workshop	0.5hours
	2. Roles of the community health workers in the project	1hour
	3. "Expectations" and "Fears" at fulfilment of the roles	1hour
	4. Review of the present water and sanitation environment and situation of diseases infection in the target villages	2hours
	5. Relation between the water-borne/related diseases and water and sanitation environment, control of faeco-oral routes of diseases transmission to prevent water-borne/related diseases, Cluster of hygiene practices (theory)	3hours
Day 2	1. Methodology of participatory hygiene education; "water resources management, water use and hygiene practices" (theory)	1 day
	2. Ditto (practice)	
	3. Feedback of the problems observed in the practice of the methods	
Day 3	1. Methodology of participatory hygiene education; "use of sanitation facilities", "personal hygiene" (theory)	1 day
	2. Ditto (practice)	
	3. Feedback of the problems observed in the practice of the methods	
Day 4	1. Methodology of participatory hygiene education; "household and community hygiene" (theory)	1 day
	2. Ditto (practice)	
	3. Feedback of the problems observed in the practice of the methods	
Day 5	1. Work schedule for implementation of the hygiene education programme in the target sites, recording and reporting the activities	2.5hours
	2. Prioritized topics and target groups of the hygiene education programme in each target site	2.5hours
	3. Establishment of a rapport with VWC	1hour
	4. Recap and evaluation of the workshop	1hour

5) Methodologies

Based on the manuals for the community health workers compiled in Module 2, lectures on theory of the participatory hygiene education and exercises such as role playing will be organised in order to ensure the proper understanding of the participants on the methodologies. It is effective to set the themes such as "water resources management", "water use", "use of sanitation facilities (excreta disposal)", "personal hygiene", and "management of environmental sanitation" and to explain the usage of different tools of the participatory hygiene education related to each theme so that the participants will be able to work out the programme with flexibility in accordance with the target groups and the given conditions of the target sites.

In addition, the participants will confirm the prioritised topics and target groups as well as the problems related to knowledge, attitude and practice of the target communities in hygiene management which are identified in Module 6 to reflect them in implementation of the hygiene education programme in each village.

6) Output from the Activity
Workshop proceedings

B. Construction Stage

Module 8.2 **Implementation of the Participatory Hygiene Education Programme for Facilitation of Appropriate Handling of the Water Sources and Drinking Water as well as Improvement of Hygiene Practices**
(Required period for the activity: total 492 days, 2 days (2 times) / month / site x implementation period of the construction works in each Division)

1) Objectives
- To enhance awareness of the community members on importance of appropriate hygiene practices and to encourage their behavioural change through the process of participatory problem analysis, action planning and monitoring by the community members

2) Target Group
Community members in the targeted 29 sites

3) Responsible Persons and Assignment Period
Community health workers trained in Module 8.1 (total 492 days, 2 days (2 times)/ month/ site throughout the implementation period of the construction works in each village)

4) Methodologies
Tools for the participatory hygiene education will be used in order to pay attention to the process of analysis and decision-making by the participants themselves. The specific target group and topics for each session will be decided by the community health workers in consultation with the community members in accordance with the problems observed in each session and interested area of the participants. Prioritised topics and target groups to be confirmed in Module 8-2 will also be considered when planning the detailed programme of the activity.

The community health workers will fill in the monitoring sheets on the proceedings of the activity, topics discussed, tools applied, and reaction of the participants in each session. The sheets will be submitted to the motivators during their visits to the villages for Module 9 mentioned below.

5) Output from the Activity

Monitoring sheet of the activity recorded by the community health workers

Module 9 Facilitation of Community Participation in Daily Maintenance, Protection of the Water Facilities and Regular Payment of the Maintenance Fund
(Required period for the activity: total 246 days, 1 day/month/site x implementation period of the construction works in each Division)

1) Objectives

- To enhance sense of ownership of the community members towards the water supply facilities and facilitate participation and fulfilment of responsibilities of the communities in operation and maintenance activities based on the action plan formulated by the VWCs in Module 7.4.
- To facilitate cooperation from the community members for storage and protection of the construction materials as well as provision of labour during the construction works of the water scheme and fundraising for operation and maintenance costs.
- To monitor and make advice on the activities to be implemented by the VWCs for promotion of the community participation in the project.

2) Target Group

Community members in the targeted 29 sites

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Total 123 days	Check of reports submitted from motivators, community health workers and VWCs, verification of achievement of objectives and expected results of each activity
Motivators	Total 246 days	Monitoring and supervision of activities to be implemented by the VWCs and community health workers
VWC members	Total 246 days	Facilitation of community participation in the project implementation in each village

4) Methodologies

VWCs will feed back the progress of the construction works to the entire community in the village meeting once a month and mobilise community

members in cooperation for the project implementation. The VWCs will also report to the communities on status of fundraising for the operation and maintenance.

Motivators will receive the records of activities compiled by the VWCs at their visits to the target villages and submit those records to the local NGO/consultant staff together with the monitoring sheets. The local NGO/consultant staff will visit the target site for 0.5 days/site/month during the implementation period of this module and verify the actual progress of the activity as well as reports from the motivators.

5) Output from the Activity

Monitoring sheet of the activity recorded by the motivators, including report of the VWCs

C. Handing-Over Stage

Module 10 Promotion of Maintenance Service Contracts between the Target Villages and the Private Service Provider

(Required period for the activity: Total 58 days, 2 days/site x 29 sites)

1) Objectives

- To enhance understanding of the VWC members on terms and conditions of the maintenance service contract of the solar-powered water supply facilities.
- To enhance understanding of the VWC members on interventions by the public sector at the breach of the contract by either the community or service provider and support services available by the public sector

2) Target Group

VWC members of the targeted 29 sites

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Total 44.5 days *	Monitoring of the activity facilitated by the motivators and verification of achievement of objectives and expected results of each activity
Motivator	Total 58 days	Facilitation of the activity at the village level

* In the same way as Module 5 to 7.5 mentioned before, the local NGO/consultant staff will be involved in the monitoring and supervision of the activities to be done by the motivators for 1 day/ site/ month during the implementation

period of Module 10 to 11. The assignment period of the local NGO/consultant indicated in the above table shows total number of days of his/her assignment throughout Module 10 to 11.

4) Tentative Programme

	Main Topics	Time (Approx.)
Day 1	1. Objectives and rules of the workshop	0.5hours
	2. Maintenance service contract system of the solar-powered water supply facilities and contents of the maintenance services	1hour
	3. Rights and responsibilities of the user communities, measures to be taken for breach of the contract	2hours
	4. Procedures to be followed at breakdown of the pumping system	1hour
	5. Conditions of employment of operator/ guard	1.5hours
Day 2	1. Basis of the subscription fee and mode of payment	2hours
	2. Support services by the public sector	1hour
	3. Feedback of the discussions to the entire community	3hours
	4. Signing the contract and approval by the entire community	1hour

5) Methodologies

Support to the VWCs for fulfilment of their rights and responsibilities determined in the maintenance service contract will be extended through enhancing their understanding on terms and conditions of the contract and promoting to enter into the contract smoothly.

6) Output from the Activity

- Copies of maintenance service contracts between the target villages and private service provider
- Monitoring sheets of activity recorded by the motivators

Module 11 Impact Evaluation of the Software-Component Program and Formulation of the Action Plan for Operation and Maintenance in the Post-Project Period

(Required period for the activity: Total 87 days, 3 days/ site x 29 sites)

1) Objectives

- To evaluate achievement and impacts of the software-component programme with participation of the target communities.
- To reflect recommendations and lessons learnt to be drawn from the evaluation results in operation and maintenance plan for the post-project period.

2) Target Group

Community members of the targeted 29 sites and VWC members

3) Responsible Persons and Assignment Period

Responsible Person	Assignment Period	Scope of Works
Local NGO/ Consultant (1 person)	Refer to Module 10	Monitoring of the activity facilitated by the motivators and verification of achievement of objectives and expected results of each activity
Motivators	Total 87 days	Facilitation of the activity at the village level

4) Tentative Programme

	Main Topics	Time (Approx.)
Day 1	1. Objectives and rules of the workshop	0.5hours
	2. Confirmation of the evaluation framework	1.5hours
	3. Review of implementation process of the activities	2hours
	4. Performance and process evaluation	3hours
Day 2	1. Confirmation of indicators for the impact evaluation	1.5hours
	2. Impact evaluation	3hours
	3. Summarising evaluation results	2hours
Day 3	1. Drawing recommendations and lessons learnt	2hours
	2. Operation and maintenance activities after completion of the project	2hours
	3. Review and revision of the VWC action plan	2hours
	4. Recap and evaluation of the workshop	1hour

5) Methodologies

Applying indicators set in Module 6, review and evaluation of the activities will be done by the community members with using participatory evaluation methods such as PRA. The evaluation results, recommendations and lessons learnt will be reflected in the operation and maintenance activities by the communities in the post-project period and these will also be compiled as the completion report to DWR.

6) Output from the Activity

- Summary of results of the evaluation on achievement of the expected outputs and impacts of the interventions
- Action plans of VWCs on operation and maintenance activities after completion of the project

(2) Interventions to be Borne by the Gambian Side

After the constructed water supply facilities are handed over to the target

communities and have started their operation, DWR will continue monitoring of the communities on a) collection and management of the maintenance fund, b) implementation of proper hygiene practices including environmental management of the water sources, and c) daily maintenance activities of the facilities as well as prevention of waste of water from public faucets.

Detailed plan of monitoring and evaluation will be discussed and formulated with DWR and local authorities during implementation of the software-component programme in this project. Motorbikes to be procured in the project will be utilised as means of transport for the motivators to continue monitoring activities in the post-project period. A computer will also be procured in the project and be used at the DWR headquarters to keep records and information of these monitoring activities.

2-6 Cost Estimation

2-6-1 Project Cost Estimation

The grand total cost required for implementation of the project is estimated 901 million Japanese Yen. Based on the aforementioned division of shares in the expenses between Japan and the Gambia, the followings are estimated in accordance with conditions of summation. However, this cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

2-6-1-1 Cost borne by the Japanese Government

Total Project Cost Estimate **Approx. 868 million Yens**

(1) North Bank Division:

- Construction of Piped Water Supply Facilities with Solar Pumping System): 3 sites
- Conversion of Diesel Generator to Solar Pumping System for Existing Piped Water Supply Facilities: 3 sites

Item		Cost Estimate (million Yens)
Construction	Construction of Borehole and Elevated Water Tank, Plumbing, Installation of Solar Pumping System and Pubic Faucets	127
Detail Design, Construction Supervision, Software-Component Programme		40

Cost Estimate (Sub-Total) **Approx. 167 million Yens**

(2) Western Division:

- Construction of Piped Water Supply Facilities with Solar Pumping System: 2 sites

Item		Cost Estimate (million Yens)
Construction	Construction of Borehole and Elevated Water Tank, Plumbing, Installation of Solar Pumping System and Pubic Faucets	48
Detail Design, Construction Supervision, Software-Component Programme		15

Cost Estimate (Sub-Total) **Approx. 63 million Yens**

(3) Lower River Division:

- Construction of Piped Water Supply Facilities with Solar Pumping System: 6 sites
- Conversion of Diesel Generator to Solar Pumping System for Existing Piped Water Supply Facilities: 3 sites

Item		Cost Estimate (million Yens)
Construction	Construction of Borehole and Elevated Water Tank, Plumbing, Installation of Solar Pumping System and Pubic Faucets	166
Detail Design, Construction Supervision, Software-Component Programme		52

Cost Estimate (Sub-Total) Approx. 218 million Yens

(4) Central River Division:

- Construction of Piped Water Supply Facilities with Solar Pumping System: 9 sites
- Conversion of Diesel Generator to Solar Pumping System for Existing Piped Water Supply Facilities: 3 sites

Item		Cost Estimate (million Yens)
Construction	Construction of Borehole and Elevated Water Tank, Plumbing, Installation of Solar Pumping System and Pubic Faucets	311
Detail Design, Construction Supervision, Software-Component Programme		97

Cost Estimate (Sub-Total) Approx. 408 million Yens

(5) Procurement of Equipment and Materials:

Item	Cost Estimate (million Yens)
Motorbike 8 units Supporting vehicle 3 units Computer 1 set	12

Cost Estimate (Sub-Total) Approx. 12 million Yens

2-6-1-2 Cost borne by the Gambian Government

(1) Land acquisition/clearance: GMD 6.26 million (Approx. JPY 28.73 million)

(2) Personnel Cost of the Counterpart: GMD 0.48 million (Approx. JPY 2.20 million)

(3) Upfront Contribution by the Target Communities for Operation and Maintenance : GMD 0.40 million (Approx. JPY 1.84 million)

Total; GMD 7.14 million (Approx. JPY 32.77 million)

2-6-1-3 Conditions for Estimation

a.	Estimation Base	August 2003
b.	Exchange Rate	1 US$ = 119.63 JPY 1 GMD = 4.59 JPY
c.	Period of Construction and Procurement	Implemented in three (3) phases according to schedule shown in previous section.
d.	Others	This project is to be implemented in accordance with the guidelines for grant aid assistance of the Japanese government.

2-6-2 Operation and Maintenance Costs

Operation and maintenance activities are needed for the solar pumping system to be installed in the project. The following conditions are set to calculate tentative fees to be contributed by the user villagers and further evaluated whether the quantities are adequate. Table 2-28 shows the results of tentative calculation of operation and maintenance cost for solar pumping system.

(1) Preconditions

1) The collection system of the subscription fee for the maintenance service is the metered-rate system recommended by DWR. The user communities pay GMD1.75/m^3 to a local maintenance company. For contents of the maintenance service contract, refer to 2-4-1 (3) Maintenance Service Contract with Local Maintenance Company.
2) This calculation does not include costs for repair or replacement of distribution pipes, which works will be required after long operation period.
3) The payment rate by users in target villages is provisionally estimated at 80%.
4) Assumed a present population of 2,000 in a village with population growth rate of 2.5% and unit supply rate of 35lit/person/day, calculation is made for 20 years after start of operation.
5) Renewal years of solar pumping systems and unit costs
   - ◆ Inverter (Renewal years: 6.2; US$2,008)
   - ◆ Submersible motor pump (Renewal years: 12.6; US$1,905)
   - ◆ Solar panel (Renewal years: 18.2; US$503/piece)

Table 2-29 Operation and Maintenance Cost for Solar Pumping System

O&M Fees : 40 GMD/Person/Year (Expected)

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Population	2,000	2,050	2,101	2,154	2,208	2,263	2,319	2,377	2,437	2,498	2,560	2,624	2,690	2,757
Water Consumption (m3	25,550	26,189	26,843	27,515	28,202	28,907	29,630	30,371	31,130	31,908	32,706	33,524	34,362	35,221
(A)Income														
Advance Fund	20,000													
Collection	64,000	65,600	67,240	68,921	70,644	72,410	74,220	76,076	77,978	79,927	81,925	83,974	86,073	88,225
Total	84,000	65,600	67,240	68,921	70,644	72,410	74,220	76,076	77,978	79,927	81,925	83,974	86,073	88,225
(B)Expenditure														
Maintenance Fee	44,713	45,830	46,976	48,150	49,354	50,588	51,853	53,149	54,478	55,840	57,236	58,667	60,133	61,637
(A) ー (B)	39,288	19,770	20,264	20,771	21,290	21,822	22,368	22,927	23,500	24,087	24,690	25,307	25,940	26,588
Renewal Cost								52,331						49,650
Balance	**39,288**	**59,057**	**79,321**	**100,092**	**121,381**	**143,203**	**165,571**	**136,167**	**159,667**	**183,754**	**208,444**	**233,751**	**259,690**	**236,628**

Year	14	15	16	17	18	19	20
Population	2,826	2,897	2,969	3,043	3,119	3,197	3,277
Water Consumption (m3	36,101	37,004	37,929	38,877	39,849	40,846	41,867
(A) Income							
Adovance Fund							
Collection	90,430	92,691	95,008	97,384	99,818	102,314	104,871
Total	90,430	92,691	95,008	97,384	99,818	102,314	104,871
(B) Expenditure							
Maintenance Fee	63,178	64,757	66,376	68,035	69,736	71,480	73,267
(A) ー (B)	27,253	27,934	28,632	29,348	30,082	30,834	31,605
Renewal Cost					340,834		
Balance	**263,881**	**291,815**	**320,447**	**349,796**	**39,044**	**69,878**	**101,482**

(Operation and Maintenance Condition)
- Present Population: 2,000 and Population Growth Rate: 2.5%
- Water Fees Collection Rate: 80%
- Water Fees: GMD 40/person/year
- Renewal Cost for Module: 50%

	Price (Dalasi)	Renewal Year
Module	13,109/Panel	18.2
Invertors	52,331	6.2
Submersible Motor Pump	49,650	12.6

6) The results of a tentative calculation indicate renewal years of solar panel to be 18.2 years, yet it is too burdensome for villagers to bear the cost of all panels. Also, assumed is no necessity for renewal of all solar panels with the aforementioned renewal years. Therefore, this provisional calculation estimates 50% of all modules to be replaced in the said period.

(2) Conclusion

The results of tentative calculation suggest that GMD40/person/year of user fees (JPY183.6/person/year) can cover a portion of renewal costs of the solar pumping system as well as its daily operation and maintenance.

Maintenance of the solar pumping system to be installed in this project preconditions a maintenance service contract between the target villages and a local maintenance company. The estimated renewal years may not apply to some cases. In all cases, the estimated amount GMD40/person/year is understood as feasible based on the results of socio-economic survey, to be afforded by the community members. Section "2-2-1-1 Basic Policy (3) Consideration on Rationale to Apply Solar Pumping System" elaborates relevance of introduction of the solar pumping system in the project in comparison with the diesel engine-powered one. As of 2003, more than GMD30/person/year is paid by the users for the diesel cost to run the diesel generator of the existing piped water schemes constructed in the previous grant aid project. Yet complaints about unsustainable operation of the facilities are heard from the users due to steep rise of the diesel cost, thus estimated GMD40/person/year is adequate level of operation and maintenance cost for the solar pumping system for the target year of 2015.