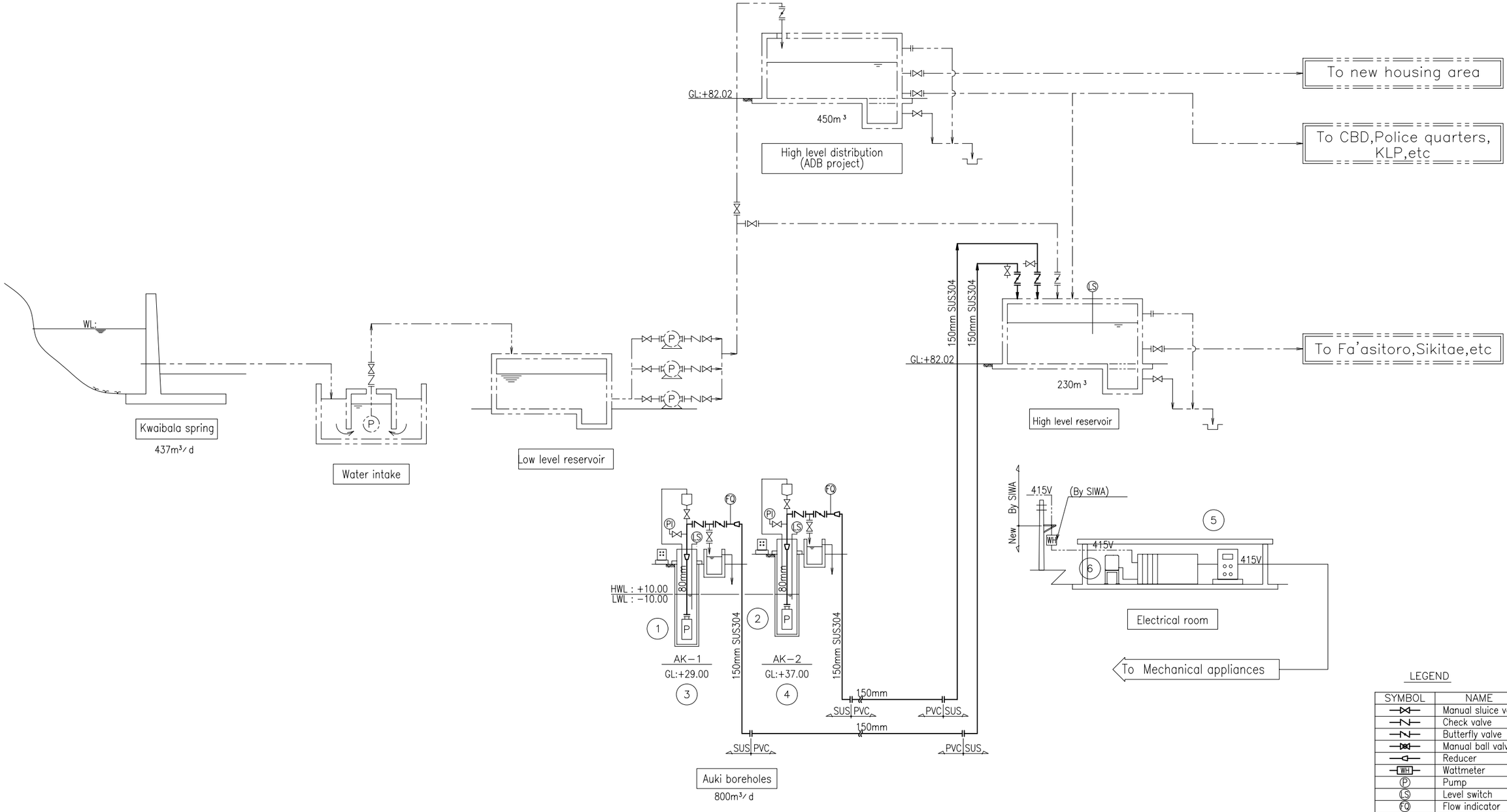


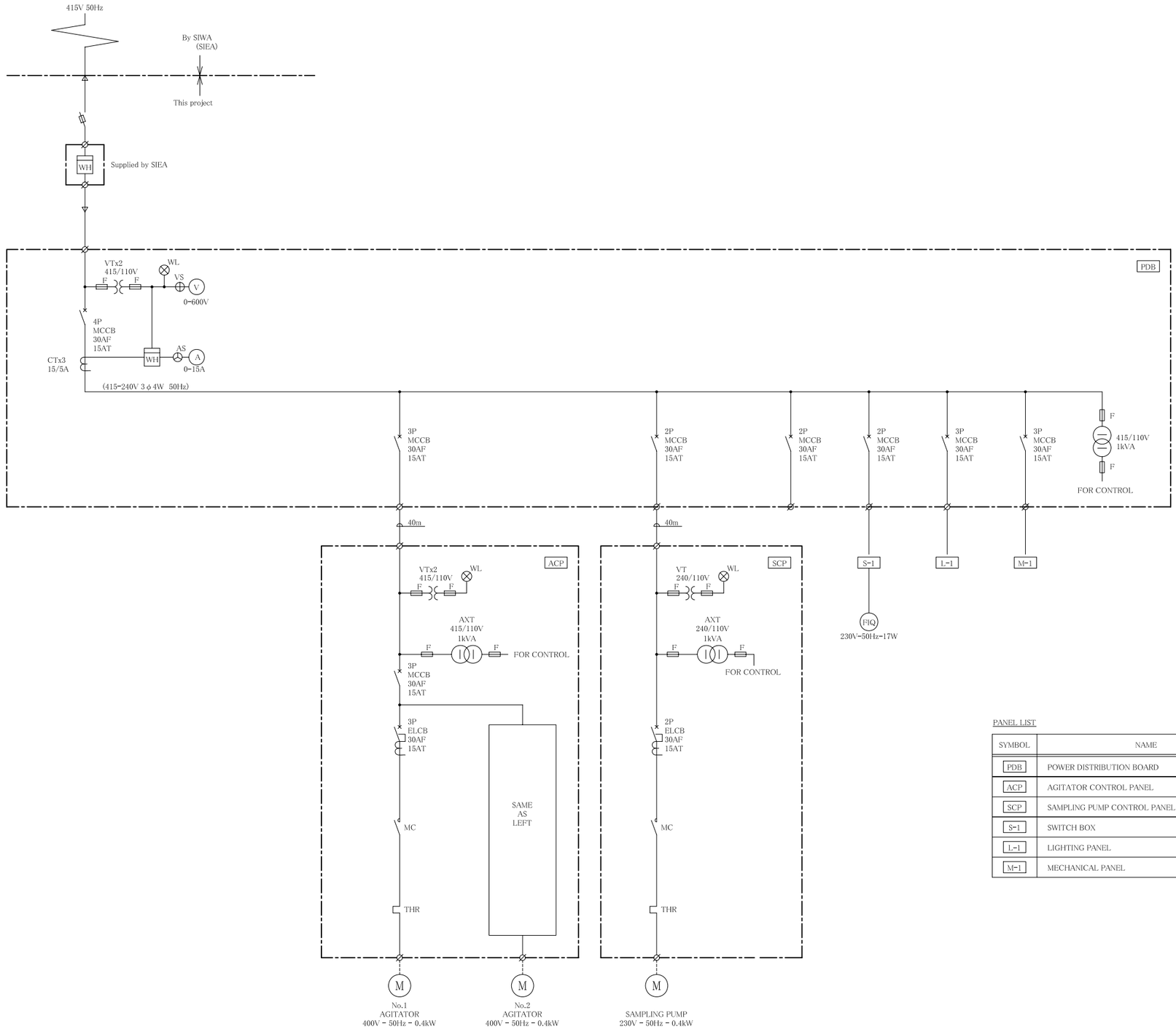
LEGEND

SYMBOL	NAME
	Manual sluice valve
	Check valve
	Butterfly valve
	Manual ball valve
	Reducer
WH	Wattmeter
P	Pump
LS	Level switch
FQ	Flow indicator
PI	Pressure indicator

EQUIPMENT No.	①	②	③	④	⑤	⑥	
NAME	AK−1 bore pump	AK−2 bore pump	AK−1 bore	AK−2 bore	Generator(for emergency)	Fuel tank	
TYPE / MATERIALS	Submergible type/SUS	Submergible type/SUS	/SUS304	/SUS304	Diesel Engine	SS400	

SUS: SUS means stainless steel.

SWS-21 Flow Sheet for Auki City



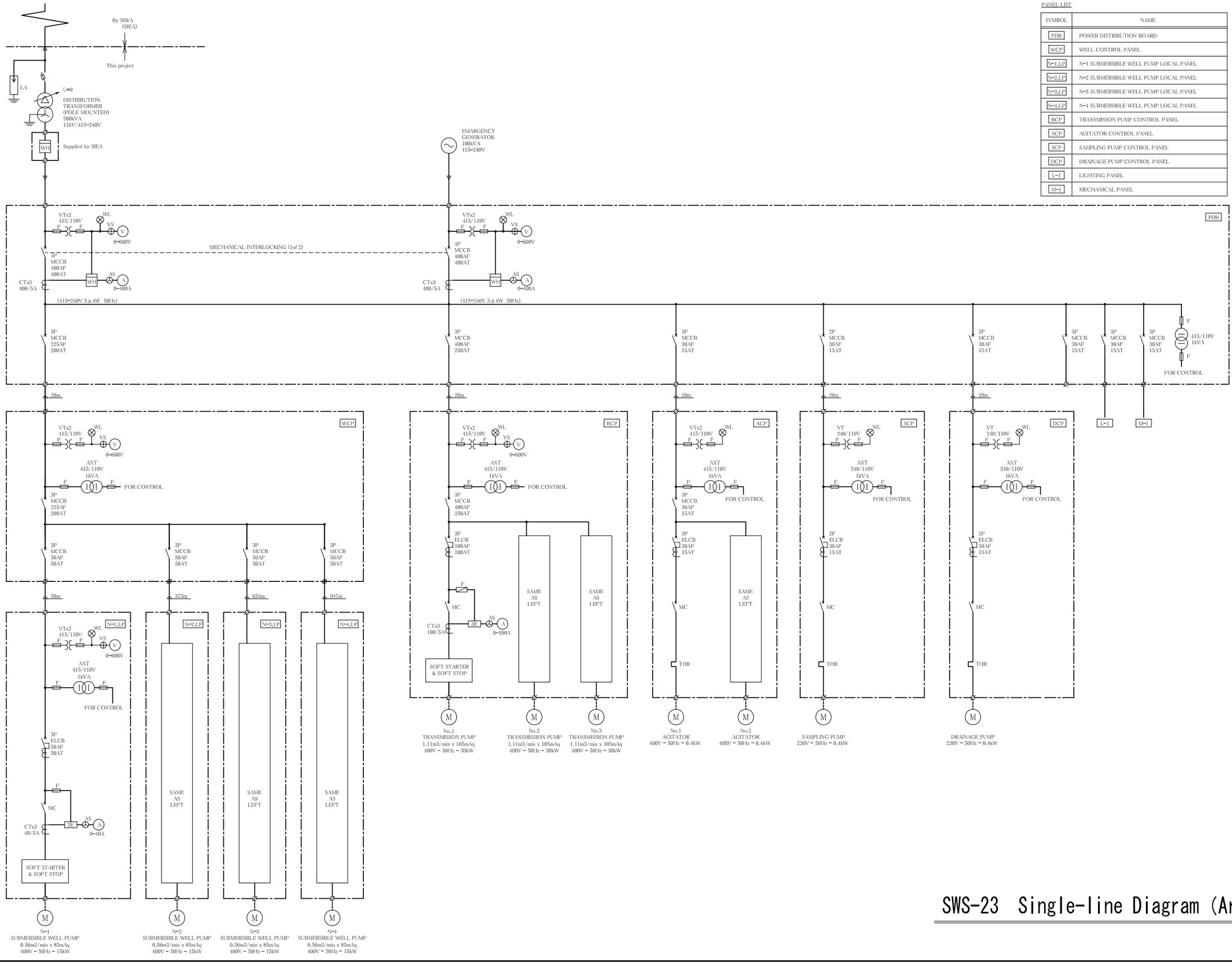
PANEL LIST

SYMBOL	NAME
PDB	POWER DISTRIBUTION BOARD
ACP	AGITATOR CONTROL PANEL
SCP	SAMPLING PUMP CONTROL PANEL
S-1	SWITCH BOX
L-1	LIGHTING PANEL
M-1	MECHANICAL PANEL

SWS-22 Single-line Diagram (Area1)

PANEL LIST

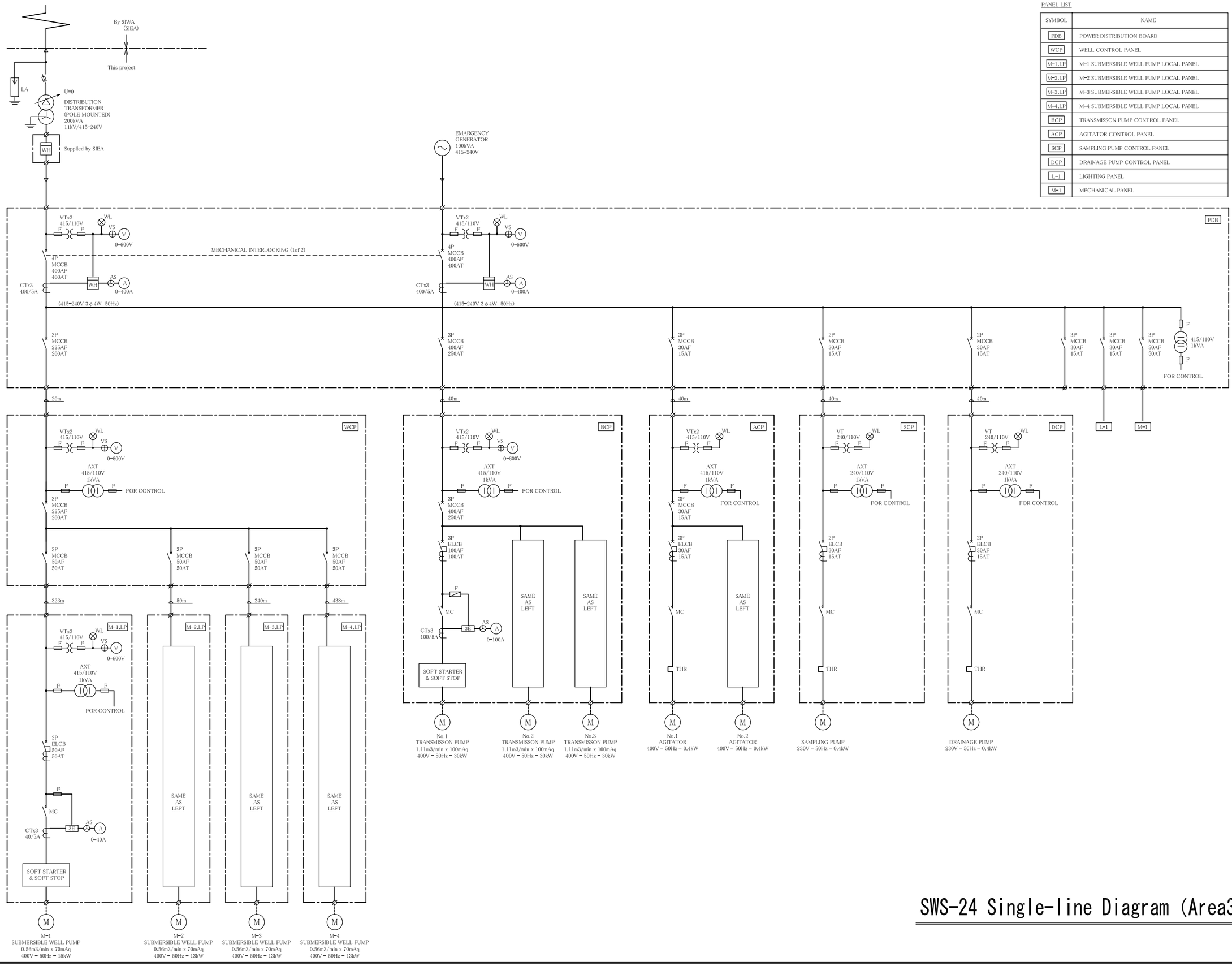
SYMBOL	NAME
PDB	POWER DISTRIBUTION BOARD
WCP	WELL CONTROL PANEL
N-1,LP	N-1 SUBMERSIBLE WELL PUMP LOCAL PANEL
N-2,LP	N-2 SUBMERSIBLE WELL PUMP LOCAL PANEL
N-3,LP	N-3 SUBMERSIBLE WELL PUMP LOCAL PANEL
N-4,LP	N-4 SUBMERSIBLE WELL PUMP LOCAL PANEL
BCP	TRANSMISSON PUMP CONTROL PANEL
ACP	AGITATOR CONTROL PANEL
SCP	SAMPLING PUMP CONTROL PANEL
DCP	DRAINAGE PUMP CONTROL PANEL
L-1	LIGHTING PANEL
M-1	MECHANICAL PANEL



SWS-23 Single-line Diagram (Area2)

PANEL LIST

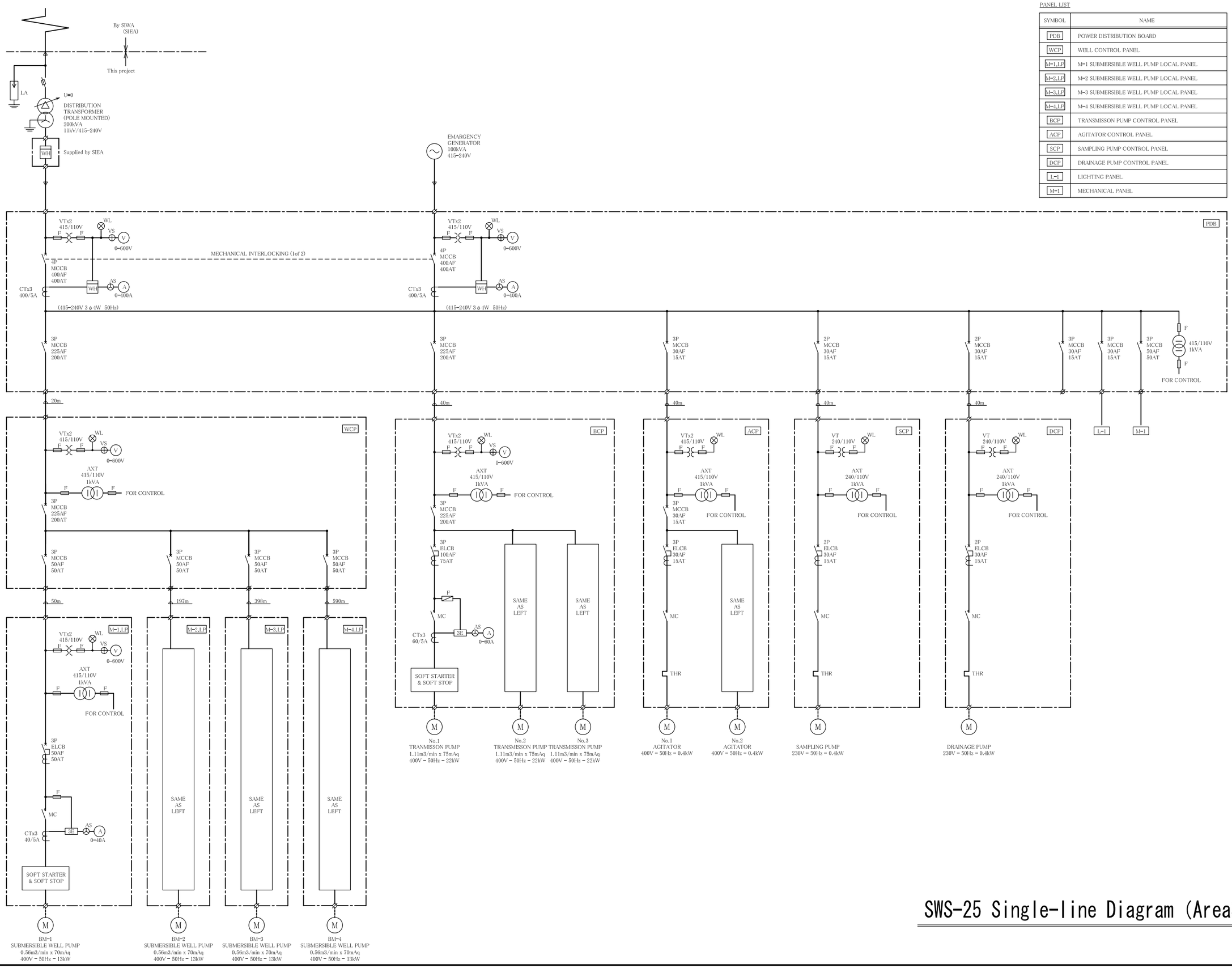
SYMBOL	NAME
PDB	POWER DISTRIBUTION BOARD
WCP	WELL CONTROL PANEL
M-1,LP	M-1 SUBMERSIBLE WELL PUMP LOCAL PANEL
M-2,LP	M-2 SUBMERSIBLE WELL PUMP LOCAL PANEL
M-3,LP	M-3 SUBMERSIBLE WELL PUMP LOCAL PANEL
M-4,LP	M-4 SUBMERSIBLE WELL PUMP LOCAL PANEL
BCP	TRANSMISSON PUMP CONTROL PANEL
ACP	AGITATOR CONTROL PANEL
SCP	SAMPLING PUMP CONTROL PANEL
DCP	DRAINAGE PUMP CONTROL PANEL
L-1	LIGHTING PANEL
M-1	MECHANICAL PANEL



SWS-24 Single-line Diagram (Area3) (1/2)

PANEL LIST

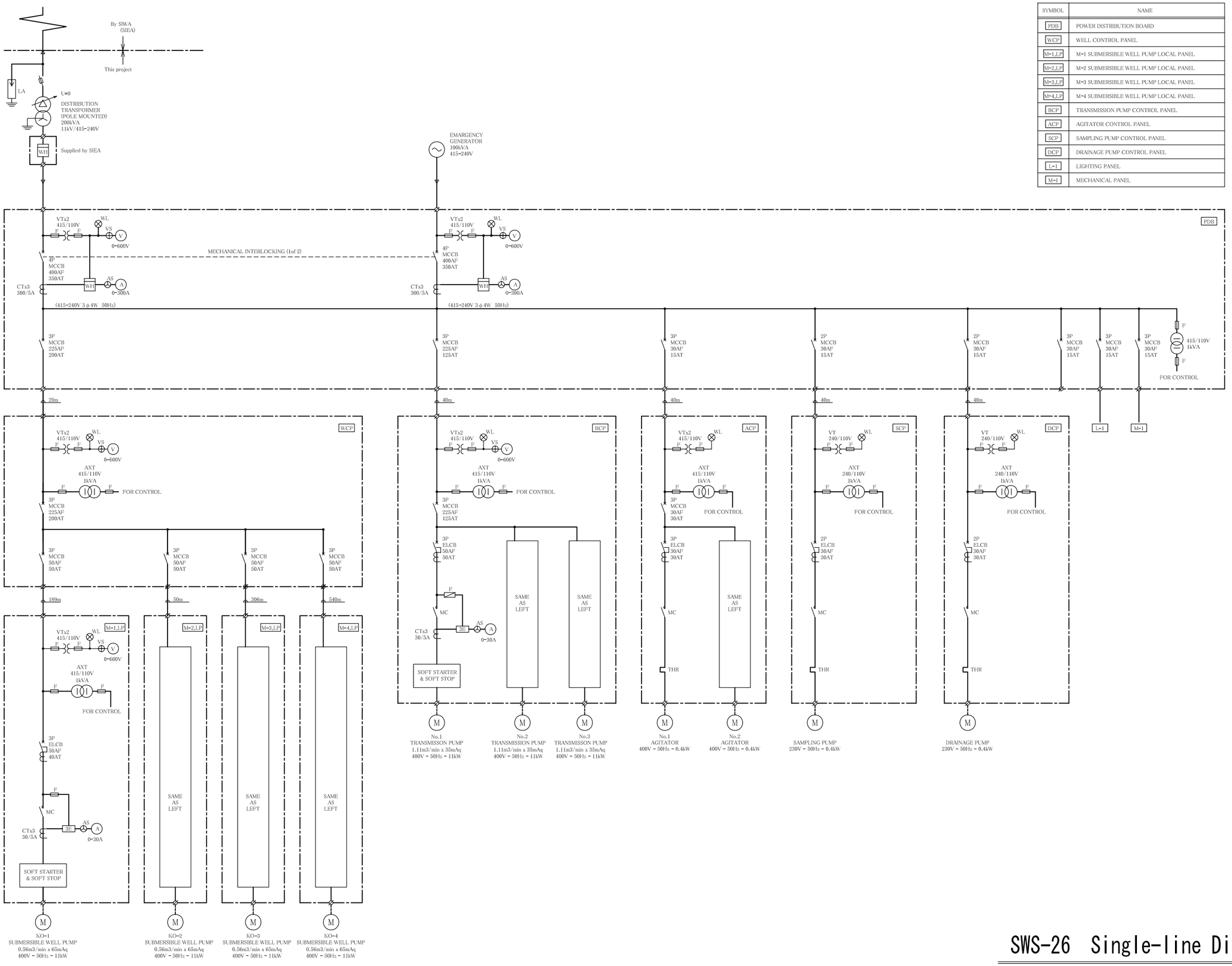
SYMBOL	NAME
PDB	POWER DISTRIBUTION BOARD
WCP	WELL CONTROL PANEL
M-1,LP	M-1 SUBMERSIBLE WELL PUMP LOCAL PANEL
M-2,LP	M-2 SUBMERSIBLE WELL PUMP LOCAL PANEL
M-3,LP	M-3 SUBMERSIBLE WELL PUMP LOCAL PANEL
M-4,LP	M-4 SUBMERSIBLE WELL PUMP LOCAL PANEL
BCP	TRANSMISSON PUMP CONTROL PANEL
ACP	AGITATOR CONTROL PANEL
SCP	SAMPLING PUMP CONTROL PANEL
DCP	DRAINAGE PUMP CONTROL PANEL
L-1	LIGHTING PANEL
M-1	MECHANICAL PANEL



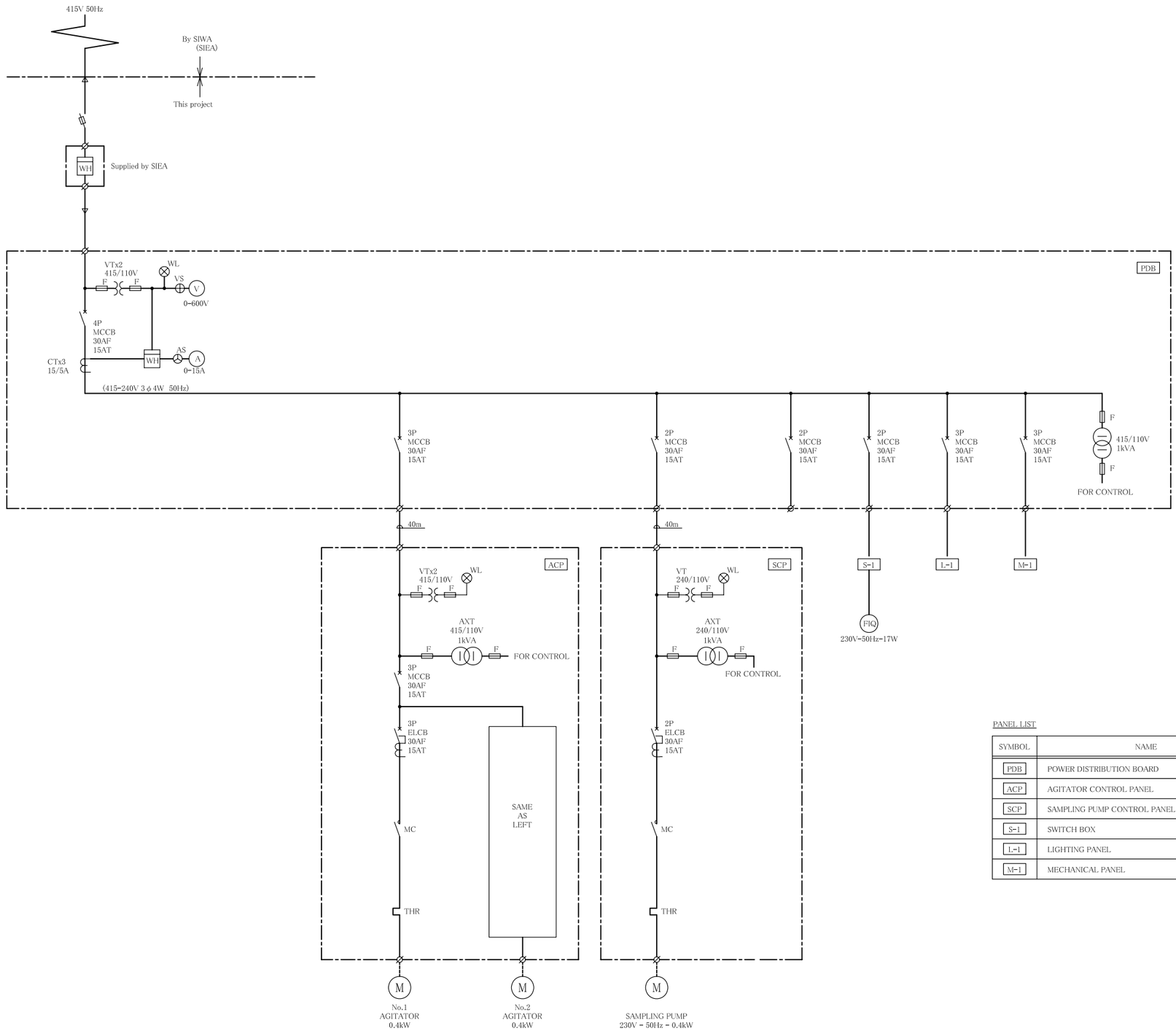
SWS-25 Single-line Diagram (Area3) (2/2)

PANEL LIST

SYMBOL	NAME
PDB	POWER DISTRIBUTION BOARD
WCP	WELL CONTROL PANEL
M-1,LP	M-1 SUBMERSIBLE WELL PUMP LOCAL PANEL
M-2,LP	M-2 SUBMERSIBLE WELL PUMP LOCAL PANEL
M-3,LP	M-3 SUBMERSIBLE WELL PUMP LOCAL PANEL
M-4,LP	M-4 SUBMERSIBLE WELL PUMP LOCAL PANEL
BCP	TRANSMISSION PUMP CONTROL PANEL
ACP	AGITATOR CONTROL PANEL
SCP	SAMPLING PUMP CONTROL PANEL
DCP	DRAINAGE PUMP CONTROL PANEL
L-1	LIGHTING PANEL
M-1	MECHANICAL PANEL



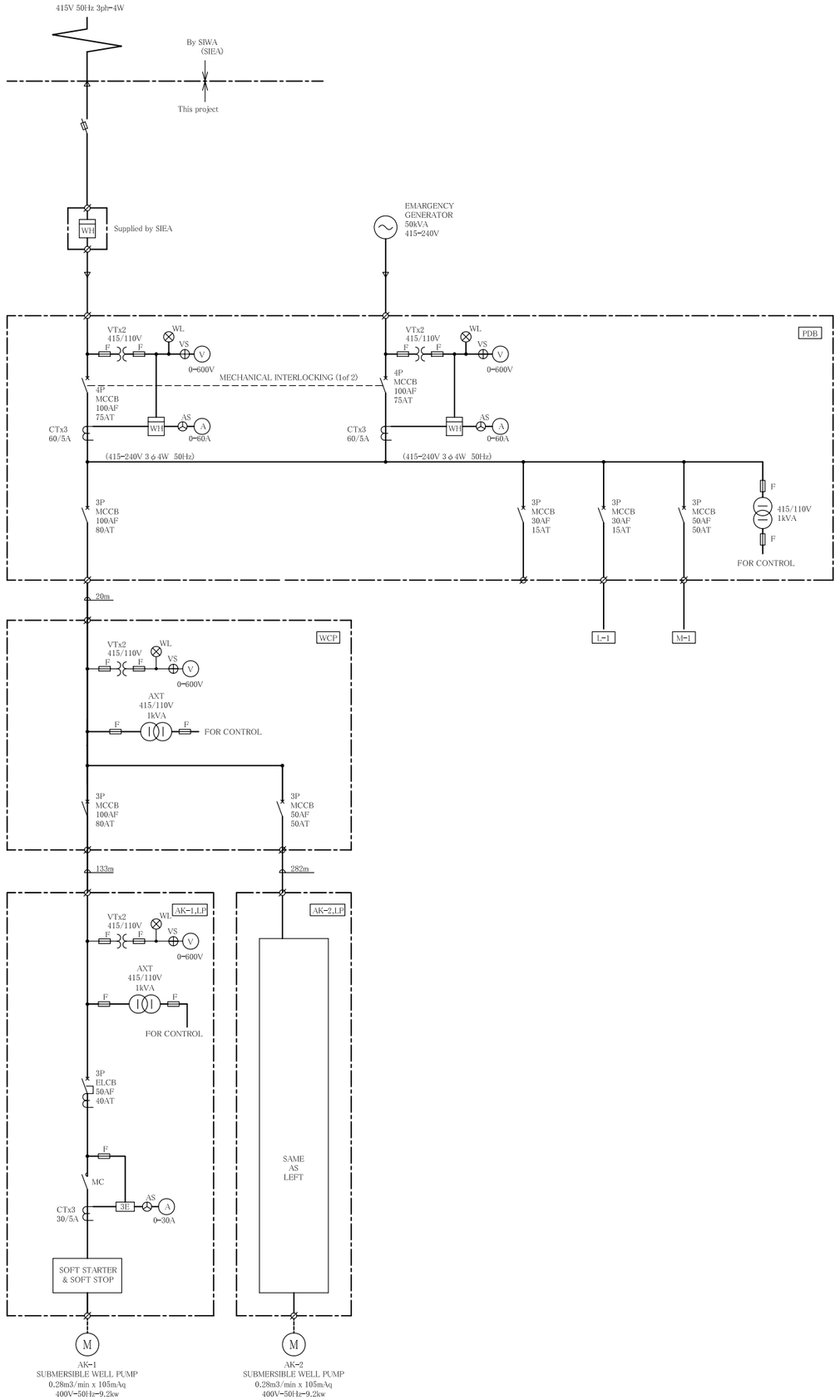
SWS-26 Single-line Diagram (Area7)



PANEL LIST

SYMBOL	NAME
PDB	POWER DISTRIBUTION BOARD
ACP	AGITATOR CONTROL PANEL
SCP	SAMPLING PUMP CONTROL PANEL
S-1	SWITCH BOX
L-1	LIGHTING PANEL
M-1	MECHANICAL PANEL

SWS-27 Single-line Diagram (Area8)



PANEL LIST

SYMBOL	NAME
PDB	POWER DISTRIBUTION BOARD
WCP	WELL CONTROL PANEL
AK-1,LP	AK-1 SUBMERSIBLE WELL PUMP LOCAL PANEL
AK-2,LP	AK-2 SUBMERSIBLE WELL PUMP LOCAL PANEL
L-1	LIGHTING PANEL
M-1	MECHANICAL PANEL

SWS-28 Single-line Diagram (Auki)

2-2-5 Implementation Plan

2-2-5-1 Implementation Concept

This Project is implemented according to the framework of Japan's grant aid. Therefore, after the conclusion of E/N between the governments of the two countries, the Solomon Islands side enters into a contract with a Japanese corporation, which undertakes design, work execution, and procurement of materials and equipment.

Considering the framework of Japan's grant aid and the nature of facility construction works, the implementation plan shall be formulated according to the following basic concept.

(1) Implementing Agency

On the Solomon Islands side, the Ministry of Mines, Energy, and Rural Electrification (MMERE) is the organization that takes charge of supervision and responsibility relating to this Project. Under this Ministry, SIWA acts as the implementing agency. The role of SIWA relating to this Project, as confirmed during the basic design study, is as described below. SIWA will be the party that enters into the contract with the Japanese corporation for the implementation of this Project.

[Roles of SIWA in this Project]

- Confirmation, coordination, and arrangement relating to the scope and content of works between Japan and Solomon Islands.
- Provision of technical information needed for facility design and other activities.
- Operation and maintenance of water supply facilities and provision of technical information relating to management of water supply services.
- Operation and maintenance of facilities and equipment constructed in this Project.

(2) Consultant

This Project is implemented under Japan's grant aid scheme. Therefore, it is necessary to select a Japanese contractor by means of open tender, and to prepare tender documents needed for the selection of contractor. In addition, it is also necessary to conduct appropriate competitive tender, objective supervision of work execution and procurement of materials and equipment, and monitoring of appropriate use of grant aid fund. Therefore, SIWA as the implementing agency on the Solomon Island side needs to enter into a design and supervision contract with a Japanese consulting firm and entrust design and supervision to it. The Consultant to be selected needs to "be familiar with the mechanism of Japan's grant aid" and "have sufficient understanding of the content of this basic design".

(3) Facility Construction Contractor

The Contractor is selected by open tender according to the framework of Japan's grant aid system.

The Solomon Islands side, with the Consultant commissioned to perform design and supervision, needs to conduct fair competitive tender and select the Contractor. The Contractor is required to satisfy the following:

1) Facility Construction Contractor

Because facility construction works are performed in remote areas where social, cultural, and historical environment and background differ from those in Japan, the Contractor shall be a firm that has sufficient experience and good track records in performing similar works in similar countries.

The facilities to be constructed in this Project are water supply facilities in Honiara and Auki. Therefore, the Contractor shall have the ability to construct similar facilities. Because the works include the construction of civil and building facilities including drilling of boreholes, as well as appropriate selection and installation of various facility equipment, the Contractor must be able to establish a construction management system for appropriate management of sub-contractors performing installation of mechanical and electrical equipments for water purification facility.

In addition, it may be necessary to provide services after the completion of works, including the procurement of spare parts in response to additional orders of the Solomon Islands side and the response to mechanical troubles. Therefore, the Contractor must take sufficient measures to ensure the communication after the delivery of the facilities and equipment.

2) Need for Dispatching Engineers from Facility Construction Contractor

While unskilled workers can be procured in Solomon Islands, there is a need to conduct work under the guidance of skilled technicians specializing in borehole drilling, aggregate production, concrete production, framework and steel bar works, waterproofing, installation of electrical facilities and machinery, etc. because of the reasons described below. Therefore, specialized skilled technicians engaging in borehole drilling, civil and building works, and mechanical and electrical equipment works need to be dispatched from Japan or a third country.

- Particularly with respect to borehole works, there are no construction machines and facilities in the country, and there are no workers experienced in borehole works. Considering the extreme importance of borehole works, the progress of which may determine the term of completion of this Project, it is necessary to employ well-experienced borehole contractors who are familiar with local conditions, either from Japan or from a third country.
- Because appropriate and reliable execution of works is needed, it is necessary to ensure that local workers sufficiently understand the different types of works to be performed in parallel and to provide practical instruction to them regarding the arrangements at construction sites and work procedures. In particular, the construction of reinforced concrete structures requires water-tight, uniform, and quality controlled concrete production, conveyance, and laying. In addition, it is necessary to ensure smooth execution of a series of works including framework scaffolding,

support timbering, assembly and installation of framework, processing and assembly of steel bars, and concrete production, conveyance, and laying. For these reasons, it is necessary that skilled workers with sufficient experience in working abroad in aggregate production, concrete production, scaffolding, support timbering, framework, steel bar works, waterproofing, etc. are employed and sent from Japan or a third country.

- Because many of the construction sites are adjacent to existing water supply facilities, sufficient attention and precautions shall be required to minimize the possibility of disruption of water supply to inhabitants either resulting from a fault during work or for reasons related to the work. Because construction sites are near the living areas of inhabitants in the neighborhood, sufficient measures shall be taken to ensure the safety and hygiene of workers and inhabitants during work. In addition, careful work execution plans shall be formulated and implemented to minimize water pollution, soil collapse and discharge, traffic congestion and disruption, etc. associated with the construction work in confined mountainous areas with frequent heavy rain.

2-2-5-2 Matters Requiring Attention in Implementation and Procurement of Materials and Equipment

The matters requiring attention in the formulation of execution plans are as follows:

(1) Facility Construction

- Treatment of turbid water generated from borehole drilling: Take care so that turbid water may not contaminate nearby streams and affect the water used by inhabitants.
- Prevention of contamination of Lunga River resulting from quarrying of raw aggregates: Take care not to affect the water used by inhabitants in downstream areas.
- Treatment of turbid water generated from aggregate production plant: Same as above.
- Establishment of appropriate aggregate production plant: Establish a plant that satisfies the qualitative and quantitative requirements for the production of highly water-tight concrete.
- Treatment of dust and turbid water generated from concrete production plant: Take care not to affect the living of inhabitants in the neighborhood.
- Establishment of appropriate concrete production plant: Establish a plant that satisfies the qualitative and quantitative requirements for the production of highly water-tight concrete.
- Precautions in constructing concrete structures: The construction sites are extremely confined and adjacent to existing water supply facilities, and only limited space is available for material storage, temporary facilities, support timbering and framework, steel bar installation, concrete laying, etc. during work. It is therefore necessary to develop and implement work execution plans with extreme care for safety. In addition, it is necessary to use work procedures and work methods with special care extending beyond safety management, such as the protection of existing old water

supply facilities and the identification and protection of buried facilities in service.

- Safety management for outsiders and theft prevention in construction sites: In all construction sites, traffic guards and security personnel must be stationed to ensure safety management for outsiders and theft prevention.

(2) Procurement of Materials and Equipment

- Except for raw aggregates, materials and equipment are difficult to procure locally. All materials and equipment, construction machines, and temporary facilities must be procured from Japan or a third country.
- In particular, the marine transportation from Japan is monopolized by one transport company, which operates transportation once in a month. In this situation, it is necessary to develop and implement careful plans for procurement and transport of construction materials, equipment, construction machines, etc.

2-2-5-3 Scope of Work

(1) Facility Construction

The list of works that must be performed before the completion of facilities and the scope of work between Japan and Solomon Islands are as shown in Table 2-2-48.

Table 2-2-48 Scope of Work between the Two Countries Relating to Facility Construction

Work Items	Japan	SI	Remarks
A. Honiara City			
1. Borehole facility construction			
- Securing/leveling the sites and removing/relocating the existing facilities/materials		○	
- Preparing all access roads to the sites		○	
- Borehole construction (4 areas x nos.4 Boreholes=nos.16 boreholes)	○		
- Borehole pump equipment installation (capacity800m^3/day)	○		Head:65m - 85m
- Water conveyance pipeline (D150mm PVC pipe 8km long)	○		
- Installing fences and gates around the sites		○	
- Installing outdoor lights around the sites		○	
2. Turbidity reduction facility construction			
- Securing the sites		○	
- Leveling the sites and removing/relocating the existing facilities/materials		○	
- Relocating the existing pump facilities		○	
- Construction of new building relocating pumps installation/ancillary pipeline for the above pump station	○		
- Replacing the existing electrical pole (the site for Kombito Settling Basin for Turbidity Reduction)		○	
- Preparing the access road		○	
- Settling Basin for Turbidity Reduction construction (Konglai spring and Kombito spring)	○		
- Laying 415V power cable		○	
- Supplying and installing power receiving facility	○		
- Installing watt-hour meter		○	
- Installing fences and gates around the sites		○	
- Installing outdoor lights around the sites		○	
3. Disinfection facility construction (4 places for pump stations, 2 places for Settling Basin for Turbidity Reduction)			
- Construction of house for the facility	○		
- Supplying and installing the facilities	○		
- Installing fence and gate around the sites		○	
- Installing outdoor lights around the sites		○	
4. Water transmission pump stations construction (4 stations, 1600m^3 x 2units/station)			
- Securing/leveling the sites and removing/relocating the existing facilities/materials		○	
- Preparing all access roads to the sites		○	
- Construction of pump house	○		
- Supplying and installing the facilities	○		
- Laying 11KV power cable		○	
- Supplying and installing power receiving facility	○		
- Installing watt-hour meter		○	
5. Emergency generator facility (4 diesel engine generators)			100kVA
- Supplying and installing the facilities	○		
6. Distribution reservoirs - 5 sites (Tasahe, Titinge, Lower West Kolaa, Skyline, Panatina)			
- Securing the sites		○	
- Leveling the sites and removing/relocating the existing facilities/materials		○	
- Preparing all access roads to the sites		○	

Work Items	Japan	SI	Remarks
- Distribution reservoirs construction	○		RC or Steel structure
- Installing fences and gates around the sites		○	
- Installing outdoor lights around the sites		○	
7. Water transmission/distribution mains construction			
- Securing the sites		○	
- Preparing all access roads to the sites		○	
- Supplying and constructing the above pipelines (ab.28.2km)	○		D=50mm - 200mm
- Supplying, constructing and connecting pipelines to the consumers		○	D=50mm
8. Securing the sites for raw aggregates pits		○	
9. Securing and leveling the site for aggregate plant		○	
10. Securing and leveling the site for concrete plant		○	
11. Securing and leveling the sites for yards, stockpiles, repair shop, storages, etc.		○	
12. Obtaining all permissions for the construction from the authorities concerned		○	
B. Auki City			
1. Borehole facility construction			
- Securing/leveling the sites		○	
- Preparing all access roads to the sites		○	
- Borehole construction (1 area x nos.2 Boreholes = 2 Boreholes)	○		
- Borehole pump equipment installation (capacity400m^3/day)	○		Head : 105m
- Construction of house for electrical equipment	○		
- Laying 415V power cable		○	
- Installing watt-hour meter		○	
- Supplying and installing power receiving facility	○		
- Water conveyance pipeline (D150mm PVC pipe 400m long)	○		
- Emergency generator facility (No.1 Diesel generators)	○		50kVA
- Installing fences and gates around the sites		○	
- Installing outdoor lights around the sites		○	
- Securing/leveling yards, stockpiles, storages, etc.		○	

Note: ○ indicates responsible works. SI means Solomon Islands.

2-2-5-4 Construction Supervision Plan

(1) Construction Supervision Structure of the Contractor

1) Facility Construction

(i) Implementation Structure of the Contractor

Because the facilities to be constructed in this Project are water supply and distribution facilities, the Contractor shall establish a structure for collaboration among construction company, borehole drilling company, pump manufacturer, etc. Because the Project sites for facility construction are in Solomon Islands far from Japan, the outline of the implementation structure of the Contractor should be as shown in Fig. 2-2-16.

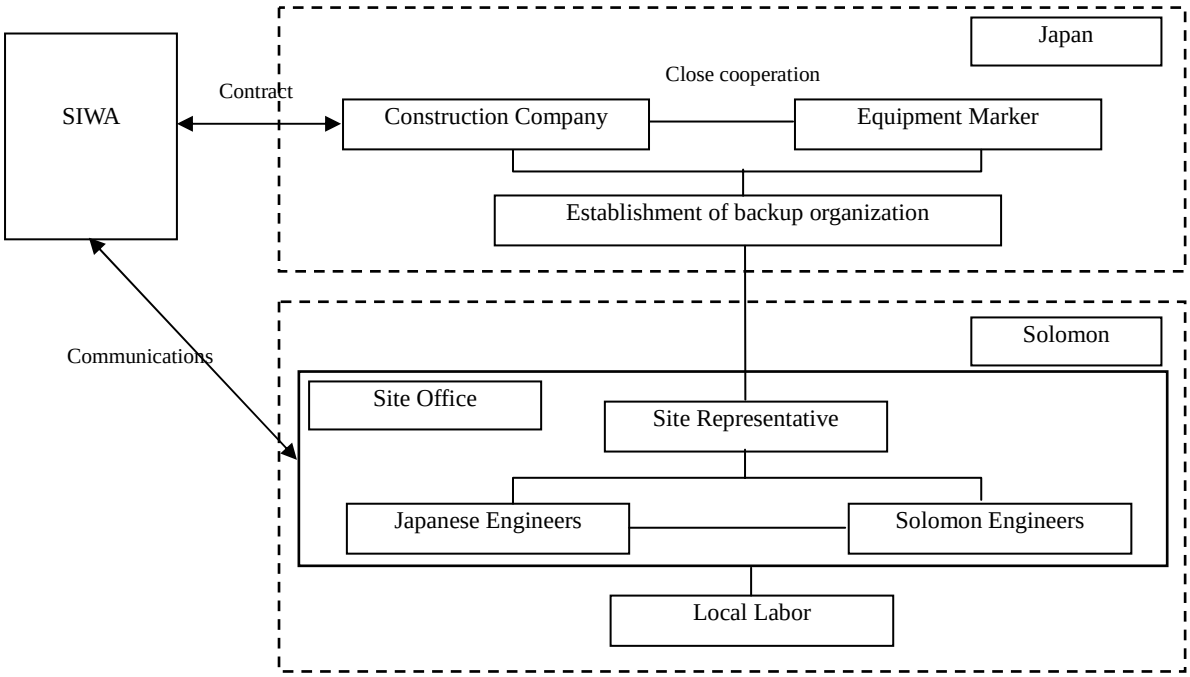


Fig. 2-2-16 Implementation Structure of Facility Construction Contractor

(ii) Backup Structure in Japan

The Contractor must establish a backup structure in Japan to provide comprehensive coordination of the all aspects of facility construction including civil engineering and architectural works, manufacture and installation of water supply and distribution equipment, pipe installation, etc., as well as technical and financial support to the local construction management office

(iii) Local Construction Management Office

The Contractor must establish a construction management office in Solomon Islands to execute all facility construction works including civil engineering and architectural works, installation of water supply and distribution equipment, pipe installation works, etc., and establish a management structure ensuring consistent and smooth execution of works in the country. In Solomon Islands, this construction management office executes facility construction works, locally employing specialist engineers, skilled workers, operators, drivers, workers, materials and equipment suppliers, etc.

The local procurement of workforce, including engineers and skilled workers, and that of materials and equipment needed for facility construction are considerably difficult. Process control, quality control, safety management, etc. must be conducted by engineers and skilled workers from a third country under the management by Japanese engineers with sufficient experience in facility construction within Japan's grant aid projects.

- Because the works must be completed within the framework of Japanese accounting system and Japan's grant aid system, process control must be conducted by engineers having full

understanding of these systems.

- The construction works must be positioned as a model case in Solomon Islands, providing technology transfer relating to construction management methods. For this reason, construction management must be conducted incorporating the work procedures, quality control methods, and safety management methods used in Japan.
- It is necessary that work techniques and construction management methods are transferred to the implementing entity of Solomon Islands and local engineers and workers

In addition, because works on multiple facilities in multiple work types are executed simultaneously in the limited area of the premises, it is necessary to execute facility construction using the structure for construction management by Japanese staff as shown in Table 2-2-49.

Table 2-2-49 Structure for Construction Management by Japanese Contractor

Type	Status	Person	Tasks and Duration to Stay
Resident Supervisor	Whole Period	1	Discuss with the Solomon Islands side and contractors, verify and arrange the construction scope and schedule, totally manage execution and procurement supervision. Stay from commencement to completion of the construction work.
Chief Civil/Building Supervisors	Whole Period	1	Assist the Resident Supervisor (RS) with the management and sometimes take RS's duty. Stay from commencement to completion of the civil and building works respectively.
Supervisor for Building Works	Short Period	1	Supervise the schedule, quality and safety of building works. Stay during civil building works.
Supervisor for Civil Works	Short Period	1	Supervise the schedule, quality and safety of civil works. Stay during civil and structural works.
Supervisor for Electrical works	Short Period	1	Supervise the schedule, quality, safety and trial operation of electrical facilities including building equipment works.
Supervisor for Mechanical works	Short Period	1	Supervise the schedule, quality and safety and trial operation of all mechanical facilities.
Office Manager	Whole Period	1	Handle the affairs relating to contract and routine paperwork. Stay from commencement to completion of the construction works.

The Contractor also needs to employ engineers and skilled workers from Japan and a third country and employ local workers, so that construction management is conducted using local workers in combination with engineers and skilled workers from Japan and the third country.

- Skilled workers and local workers are directed and supervised directly on each construction site under the guidance of Japanese and third country engineers.

(2) Construction Supervision Structure of Consultant

The Consultant supervises and directs the Contractor for the purpose of achieving "completion of facility construction within the specified term of works", "ensuring the quality of works specified in contract documents", and "safe execution of works". Because a role of the Consultant is to perform independent confirmation and supervision of the appropriate execution of facility construction within the framework of Japan's grant aid, it performs the supervision of the entire project, acting in the position indicated in Fig. 2-2-17.

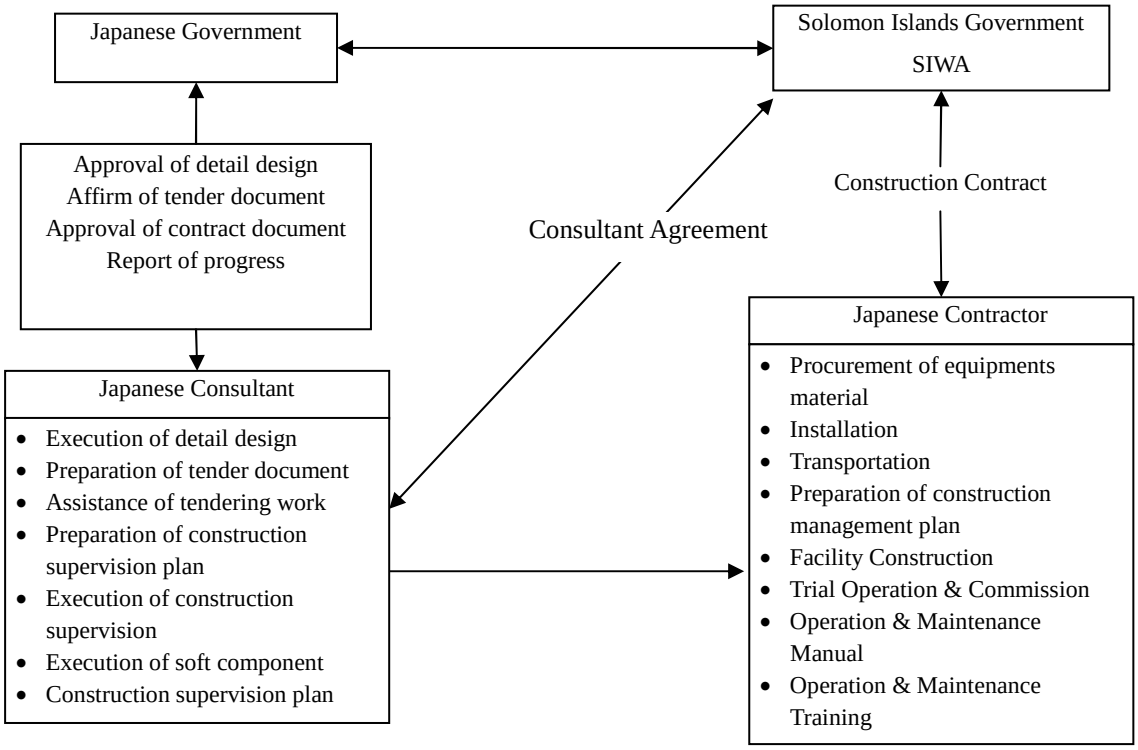


Fig. 2-2-17 Diagram of Relationships in Project Implementation

Predicated on the Japan's grant aid system, the Consultant bases its activities on the principles of the basic design and organizes a consistent project team that seamlessly performs execution design and work supervision to ensure smooth execution of works. At the stage of construction supervision, the Consultant dispatches the following supervisors with the expertise suitable to the works according to the work schedule, and let them supervise process control, quality control, and safety management.

Overall work supervisor	1 person (stationed)
Borehole drilling work supervisor	1 person (spot)
Pipeline work supervisor	1 person (spot)
Building and reservoir work supervisor	1 person (spot)
Machine facility work supervisor	1 person (spot)
Electrical facility work supervisor	1 person (spot)

In addition, supervisors from Japan, as necessary, participate in the witnessed inspection at the

factory and pre-shipment inspection regarding the materials and equipment manufactured in or imported from Japan or a third country for the purpose of preventing troubles after delivery.

(3) Basic Concept of Construction Supervision

As the basic policy of construction supervision, the Consultant supervises work performance to ensure the completion of the works within the specified term of works and supervises and directs the Contractor to ensure safe execution of works.

The following describes important points requiring attention in construction supervision.

1) Construction Schedule Control

For each of the following items, the Consultant compares the progress of works scheduled by the Contractor at the time of contracting and the actual progress monthly and weekly. If a delay is expected, the Consultant alerts the Contractor, requests the submission of corrective measures, and gives directions to ensure completion within the construction period.

- Confirmation of the amount of work done
- Confirmation of actual delivery and use of major materials and equipment
- Confirmation of actual use of engineers, skilled workers, workers, etc.

2) Safety Control

The Consultant confirms the adequacy of safety control plan prepared by the Contractor, confirms the actual implementation of the plan, and supervises the works in and around the Project sites to prevent labor accidents and accidents involving outsiders during execution of works. Safety control shall be executed using the following means:

- Confirmation of the development of safety control plan and appointment of safety manager by the Contractor
- Confirmation of the adequacy of the formulated safety control plan and appointed a person –in-charge for safety control
- Confirmation of actual implementation of safety control plan
- Confirmation of the adequacy of the planned operation routes of construction vehicles and precautions in vehicle operation, and confirmation of compliance to the plan
- Confirmation of worker welfare programs and provision of holidays and rest times

In addition, the Consultant must employ local engineers for the following activities and use the local engineers in combination with the above-mentioned Japanese engineers in the implementation of construction supervision.

- To monitor the progress of facility construction on the site of each construction work under the guidance of Japanese engineers

- To participate in discussion of details with relevant organizations, test and analysis organizations, organizations issuing design guidelines, etc. under the guidance of Japanese engineers
- To act as the major counterpart of Japanese engineers and learn the methods for construction supervision and materials and equipment procurement supervision

3) Construction Supervision in Japan

In Japan, the Consultant shall establish the system needed for the comprehensive project supervision described below and perform overall supervision of activities conducted in Solomon Islands and in Japan.

- Confirmation of content of contracts and confirmation of processes, progress, and product quality
- Seeking solution to troubles on the site and giving directions to the Contractor
- Technical and financial support to the local office of the Consultant

Because the following activities are conducted in Japan, it is necessary to establish an appropriate system for supervision in Japan.

- Quality supervision of materials and equipment manufactured in Japan (confirmation of production drawings and other documents, witnessing factory inspection, verification of test results, etc.)
- Pre-shipment inspection of quantities of equipment

2-2-5-5 Quality Control Plan

Based on the items listed below, the Consultant performs supervision to check whether or not the quality of facilities, materials and equipment described in the contract documents (technical specifications and execution design documents) is satisfied by the Contractor.

If the product quality is considered unsatisfactory, the Consultant shall alert the Contractor and request necessary amendment and corrective measures. Quality supervision shall be performed using the following means.

- Reviewing catalogs, specifications, and production drawings for materials and equipment
- Reviewing or witnessing test results and factory inspection results for materials and equipment
- Reviewing installation manuals, on-site test operation, adjustment, and inspection manuals, and execution drawings for materials and equipment
- Supervision of on-site installation works and witnessing test operation, adjustment, and inspection
- Checking the Contractor’s execution drawings
- On-site inspection of roller compacting, bar arrangement, concrete strength, etc. during construction works
- On-site confirmation of work performance and work methods

- Checking as-built drawings for facilities and the amount of work done on the site

The quality control plan in construction supervision is shown in Table 2-2-50.

Table 2-2-50 Quality Control Plan

Construction Type	Control Item	Method	Frequency
Steel Tank Materials	Strength & size	Confirmation of factory Inspection reports	Every approval
	Appearance & size	Visual inspection & dimension measurement	Every delivery
Steel Tank Construction	Torque	Torque Wrench	
	Water leakage	Water filling test	After completion
Pipe Materials	Strength & size	Confirmation of factory Inspection reports	Every approval
	Appearance & size	Visual inspection & Dimension measurement	Every delivery
Pipe laying	Depth	Marking	All joints
	Leakage	Hydraulic test	All pipe laying extension
Paving	Base course	Plate bearing test	Every 1 km
Foundation ground	Soil bearing capacity	Plate bearing test	Every structure
Concrete	Aggregate	Grain size test	Every 3000m^3
	Cement	Physic & chemical test	Every 1000 ton
	Ready mixed concrete	Slump, air & chlorides	Every installation
	Concrete strength	Compressive strength test	Every 100m^3
Reinforcement bar	Strength	Tensile strength	Every 200 ton
	Bar arrangement	Bar arrangement inspection	Every installation
Structure workmanship	Workmanship dimension	Dimension measurement	All major components
Water proofing	Material quality	Confirmation of quality control certificates	Every approval
	Film thickness & adhesive strength	Film thickness test & tension test	Every structure
	Paint film	Visual inspection	Every structure
	Leakage	Water filling test	
Mechanical installation	Installation accuracy	Measurement of installation location	All equipment
	Function	Loading operation test	All equipment at the trial operation
Electrical installation	Installation accuracy	Sequence test	All equipment
	Function	Insulation resistance test	All equipment at the trial operation

2-2-5-6 Materials and Equipment Procurement Plan

(1) Materials and Equipment for Construction of Facilities

1) Sources of Procurement of Materials and Equipment

The materials and equipment for construction of facilities will be procured locally, on condition that requirements regarding specifications, quality, supply volume, term of delivery, etc. are satisfied.

The materials and equipment that have problems in quality, work scheduling, etc. in terms of specifications, quality, supply volume, term of delivery, etc. are planned to be procured from Japan, based on the principles of Japan's grant aid. However, in the case of items that are not produced in Japan with needed specifications and quality, as well as in the case that procurement from a third country is considered advantageous in terms of price and other aspects, procurement from a third country needs to

be considered.

Because none of the basic materials and equipment needed for civil engineering and architectural works is produced in Solomon Islands, all materials and equipment except for aggregates need to be imported. Therefore, the sources of procurement of major materials and equipment for construction of facilities are planned as listed in Table 2-2-51.

Table 2-2-51 Sources of Procurement of Facility Construction Materials (Main Materials and Equipment)

Item	Local	Japan	Third Country	Remarks (Third county for procurement)
Equipment and Materials				
Cement			○	Australia or New Zealand
Aggregate	○			
Admixture		○	○	
Steel Tank		○	○	Ditto
Reinforcing bar		○	○	Ditto
Formwork material		○	○	Ditto
Scaffolding & timber material		○	○	Ditto
PVC pipe		○	○	Ditto
Borehole pump		○	○	Ditto
Water transmission pump		○	○	Ditto
Valve		○	○	Ditto
Disinfection facility		○		
Power receiving facility		○	○	Ditto
Emergency diesel engine generator		○	○	Ditto
Flow meter & water gage		○	○	Ditto
Asphalt concrete		○	○	Ditto
Construction Equipment / Machinery				
Aggregate plant		○		
Concrete plant		○		
Dump truck		○		
Wheel loader		○		
Back hoe		○		
Truck crane		○		
Concrete mixer car		○		
Concrete pump car		○		
Generator		○		
Borehole construction equipment		○		
Truck with crane		○		
Bulldozer		○		

(2) Transport of Materials and Equipment

The transport of construction materials and equipment from Japan or a third country involves lengthy marine transport, unloading at the port, land transport from the port to warehouses and materials storage yards, and storage. In addition, the items destined for Auki City need to be transported by sea from the port in Honiara City and then transported by land to the warehouses and materials storage yards. Packing methods that can sufficiently withstand such marine and land transport shall be used.

The landing port in Solomon Islands is Honiara Port, which is on the route of scheduled liners and is equipped with unloading facilities. This port is available for use in this Project.

The main roads from Honiara Port to the warehouses and materials storage yards planned in

Honiara City are sufficient for the traffic of large trucks in terms of pavement surface condition, road width, etc. No significant difficulty is expected in land transport.

2-2-5-7 Soft Component (Technical Guidance) Plan

(1) Background for Planning Soft Component

The Project aims at securing safe and stable water supply through development of new water source (new groundwater wells), construction of settling tank for turbidity reduction for eliminating turbid water in the network during and after heavy rain, construction of new water reservoirs and establishment of block distribution system.

SIWA, management authority for conducting operation and maintenance of the facilities to be constructed in the Project, has been doing operation and maintenance of the existing water supply facilities. However, they are facing with the following issues:

1) Establishment of Daily Control System for Water Quality

SIWA has basic skills for water quality analysis. However, they do not have water quality control system including daily water quality monitoring system and communication system when water quality exceeds its standard. They are required to establish water quality control system consisting of defining water quality items to be analyzed/frequency of analysis/sampling points, keeping and sorting-out of data, diagnosis for abnormal cases, procedures for taking actions in case of emergency, etc.

2) Control of Water Distribution Volume and Water Pressure in Water Supply System

Since SIWA has not conducted water distribution control according to the water distribution volume and water pressure, a part of the distribution districts are suffering from extremely low pressure. For coping with this problem, block distribution system will be adopted for stabilizing water distribution volume and water pressure.

In order for SIWA to implement an appropriate control for water distribution volume and water pressure in the service areas, it is required for SIWA to do water distribution and water pressure control in each block of distribution districts.

3) Economical Operation for Facilities

Since rising price of electric power is affecting financially for SIWA's management, economical operation of facilities based on water demand and water quality is required to minimize the cost for operating pump equipment and chlorine disinfection equipment.

Furthermore, SIWA has no experience with operation and maintenance for settling basin for

turbidity reduction. Issues mentioned in items 1) to 3) above are related each other and they can be summarized as three issues of “understanding of water supply system”, “learning method for operation and maintenance of water supply system” and “learning method for taking record, sorting out and utilizing of water quality and quantity data”.

Technical assistance to cope with the above-mentioned issues is required to SIWA for at least securing sustainability of outputs from the Project.

(2) Objectives of the Soft Component

Among SIWA staff, 15 staff members of water supply section of engineering service department shall achieve the following objectives:

- Understanding water supply system
- Conducting operation and maintenance for water supply system
- Taking record, sorting out and utilizing of water quality and quantity data

(3) Outputs from the Soft Component

Outputs from the Soft Component are as follows:

1) Understanding of water supply system

- ✓ Water supply system from borehole facilities to water transmission pump station and distribution reservoir is understood.
- ✓ Treatment process and functions for settling basin for turbidity reduction is learned.

2) Learning method for operation and maintenance for water supply system

- ✓ Necessity for stopping water intake based on water quality of raw water can be judged.
- ✓ Monitoring and control based on water quality/quantity of raw water and water quality /water demand of distributed water can be conducted.
- ✓ Injection of disinfection agent can be done properly.
- ✓ Monitoring and control for water quality and quantity of distributed water can be conducted.

3) Learning method for taking record, sorting-out and utilizing of water quality and quantity

- ✓ Taking record, sorting-out and utilizing of water quality and quantity of raw water into settling basin for turbidity reduction can be conducted.
- ✓ Taking record and sorting-out of data for water intake, water transmission and water distribution volumes can be conducted. Then, based on those data, demand projection of water distributed can be conducted and plans for required water transmission volume and operating control of water distribution can be formulated.

- ✓ Taking record, sorting-out and utilizing of data for water quality and water pressure of distributed water can be done.

(4) Methods for Confirming Achievement of Outputs

Achievement level of outputs from the Soft Component shall be examined by confirming acquirement level of knowledge and improvement level of routine works by utilizing acquired knowledge.

- ➢ Acquirement level of knowledge : Short tests will be done at the end of training.
- ➢ Improvement level of routine works : It will be evaluated by monitoring actual works.

Methods for examining achievement level of outputs from the Soft Components are described in Table 2-2-52.

Table 2-2-52 Methods for Confirming Achievement of Outputs

Item	Output	Method for Confirming Achievement
Understanding of water supply system	Understand water supply system from water source facilities to water distribution facilities ➢ Flow sheet of water supply system from water source facilities to water distribution facilities can be prepared.	Conducting short tests (80% mark or more)
	Understand functions of settling basin for turbidity reduction	Conducting short tests (80% mark or more)
Learning operation & maintenance method for water supply facilities	Learning water intake control from water source based on water quality of raw water ➢ Measuring turbidity of water source and stopping water intake in an emergency case can be done.	Achievement level shall be judged by the Japanese consultant.
	Learning monitoring and control for each facility ➢ Operation according to water quality/quantity of raw water and water demand of service areas can be done.	Conducting short tests (80% mark or more)
	Learning appropriate injection method for disinfection agent ➢ Proper dilution of sodium hypochlorite, calculation of its concentration and injection volume of its solution, and measurement of residual chlorine can be done.	Conducting short tests (80% mark or more)
	Learning monitoring and control method for water quality and water pressure of distributed water	Achievement level shall be judged by the Japanese consultant.
Learning record & control and utilization method for water quality and quantity data	Learning operation by taking data for water quality and quantity of raw water and utilization of the data ➢ Operation control sheet and conduct daily/weekly inspections can be done. ➢ Prepare monthly report compiling data obtained by inspections can be done.	Achievement level shall be judged by the Japanese consultant.
	Learning operation by taking data for volumes of water intake, water transmission and water distribution ➢ Operation control sheet and conduct daily/weekly inspections can be done. ➢ Prepare monthly report compiling data obtained by inspections can be done.	Achievement level shall be judged by the Japanese consultant.
	Learning operation by taking water quality and water pressure for distributed water ➢ Operation control sheet and conduct daily/weekly inspections can be done. ➢ Prepare monthly report compiling data obtained by inspections can be done.	Achievement level shall be judged by the Japanese consultant.

At the time of execution of soft component, the construction of the facilities would have been completed and operation of facilities would have started. Practical training using actual data is conducted during the training period, and the results of this training will be used for confirmation of the achievement of outputs.

(5) Soft Component Activities (Input Plan)

1) Contents of the Soft Component

Trainings shown in Table 2-2-53 shall be conducted.

Table 2-2-53 Training Schedule (Draft)

	Contents for Training	Schedule(day)														
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th
Understanding of water supply system	Introduction of water supply system	▒														▒	▒
	Process on settling basin for turbidity reduction	▒														▒	▒
Learning operation & maintenance method for water supply facilities	Water quality management for water source	▒	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒
	Operation and maintenance on intake, tranmisson	▒	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒
	and distribution facilities																
	Management of disinfection	▒	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒
	Management of water quality and pressure on tap	▒	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒
Learning record & control and utilization method for water quality and quantity data	Arranging operation data on settling basin for turbidity reduction	▒	▒													▒	▒
	operation and maintenace using data			■	■	■	■	■	■	■	■	■	■	■	■		
	Arranging date on intake, transmission, distribution and service pipe	▒	▒													▒	▒
	operation and maintenace using data			■	■	■	■	■	■	■	■	■	■	■	■		
	Arranging data on water quality and pressure	▒	▒													▒	▒
	operation and maintenace using data			■	■	■	■	■	■	■	■	■	■	■	■		

▒ Lecture/Test
■ Practice

2) Trainer for the Soft Component

As trainers for the Soft Component, two (2) engineers of Japanese consulting firm will be allocated. Working items by the Japanese consultants are as follows:

- ✓ Preparing training plan
- ✓ Preparing text books (several kinds of manuals) to be used during training
- ✓ Preparing tools for sorting out the data for water quality and quantity by MS-Excel
- ✓ Conducting lectures and on-site (or practical) training
- ✓ Evaluation of training outputs (preparing report)

3) Targeted Trainees

Targeted trainees are the following staff and they will be the staff of water supply section of engineering service department of SIWA.

- ✓ Persons-in-charge who will work for operation and maintenance of the facilities to be constructed in the Project
- ✓ Staff who has received OJT for operation of the facilities to be constructed in the Project

(6) Procurement of Execution Resources for the Soft Component

Most of the materials and equipment to be applied for the construction of settling tank for turbidity reduction, borehole facilities and water transmission pump station will be procured from Japan. Therefore, direct-assistant scheme by the Japanese consultant who is familiar with those materials and equipment shall be applied for the Soft Component.

(7) Implementation Schedule of the Soft Component

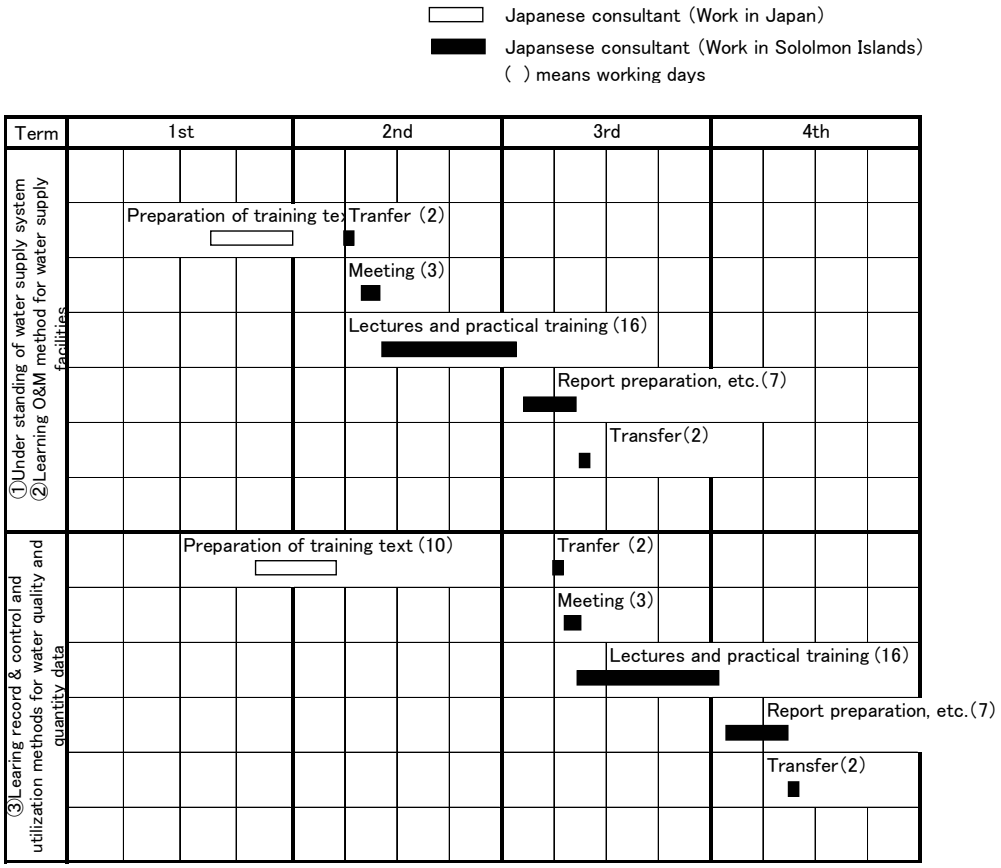
Since the Soft Component is required to be conducted using the facilities constructed in the Project, it will be implemented at the time around handing-over of the facilities to the Solomon Islands side.

Tentative implementation schedule for the Soft Component for the Project is shown in Table 2-2-54. The implementation schedule shall be planned so as to minimize the involvement of the Japanese consultants and select the most reasonable period for the training.

1st Stage Understanding of water supply system / Learning method of operation and maintenance of water supply system

2nd Stage Learning method of taking record, sorting-out and utilizing of water quality and quantity data

Table 2-2-54 Soft Component Implementation Schedule (Draft)



(8) Manual and Reports in the Soft Component

Manuals and reports to be prepared for the Soft Component for the Project are showed in Table 2-2-55.

Table 2-2-55 Manual and Reports in the Soft Component

Outputs	Remarks
Operation and maintenance manual for water supply facility	● Basic function and equipment component of water supply facility ● O&M records of water supply facility ● Judgment criteria required for O&M activity on water supply facility ● O&M plan for water supply facility ● Records and data management and keeping ● List of required data and data analysis way ● Utilizing way of analyzed data for O&M activity
Assessment report on understanding of trainees	Summary and assessment of the questionnaire forms and short tests given to the trainees
Soft Component completion report (English)	For submission to the implementing agency in Solomon Islands (According to the JICA Soft Component Guideline: April 2004)
Soft Component completion report (Japanese)	For submission to JICA (ditto)

(9) Responsibilities of the Implementing Agency in the Recipient Country

1) Practicability for Implementation

Since SIWA has much desire for technical transfer of three (3) objectives in the Soft Component to SIWA staff, practicability for implementation is considered high.

However, in order to achieve those objectives of the Soft Component, institutional and financial conditions of SIWA have to be guaranteed.

Recently, SIWA have been recruiting new staff for operation and maintenance (O&M) and it is expected that organization for O&M should be strengthened by the completion of facility construction work for the Project. Also, financial situation is relatively in good condition with surplus in the balance in the fiscal year of 2007 and there are no problems in the financial aspect for implementation of the Soft Component.

Therefore, it is considered that SIWA is capable of bearing necessary undertakings by Solomon Islands side for implementation of the Soft Component.

2) Impeding Factors and Required Actions by SIWA

Although no impeding factors in training items are expected, trainees for the Soft Component should satisfy with the following requirements. In order to meet these requirements, SIWA is required to make those trainees acquire the necessary skills for the training. Also, key personnel for O&M should be trained for all the items of the Soft Component.

✓ Acquiring basic operation method of computer

- ✓ Acquiring operation method of operating system (MS-Excel and MS-Word)
- ✓ Securing enough time necessary for class-room training and practical training (4 hours a day)

SIWA is required to prepare the following for smooth implementation of the Soft Component:

- ✓ Personal computers (4 units), Software (1 set), Printer (1 unit)
- ✓ Training place (one room in SIWA head office)

In addition, in the training for "Leaning method for taking record, sorting out and utilizing of water quality and quantity data, SIWA is required to prepare hardware such as personal computers, etc. before commencement of the training. For this reason, SIWA is requested to prepare for the training, working closely with the Japanese consultant who will provide application software for data process.

For the above-mentioned hardware and software, it has been confirmed during the field survey of the basic design study that all the necessary items are ready in SIWA and will be utilized for the training of the Soft Component.

2-2-5-8 Implementation Schedule

The facility construction in this Project is executed after the exchange of notes (E/N) between the two countries following the authorization by the Japanese government. The implementation of this Project is considered to require the time of approximately 30 months, including detailed design, tender procedures, construction and soft component. Because the completion of all construction work components marks the completion of a water supply system, it is impossible to divide facilities in parts and commence the use of facilities in phases. Because it is difficult to plan the year-based implementation according to the fiscal years in Japan, it is necessary to use the national bond system.

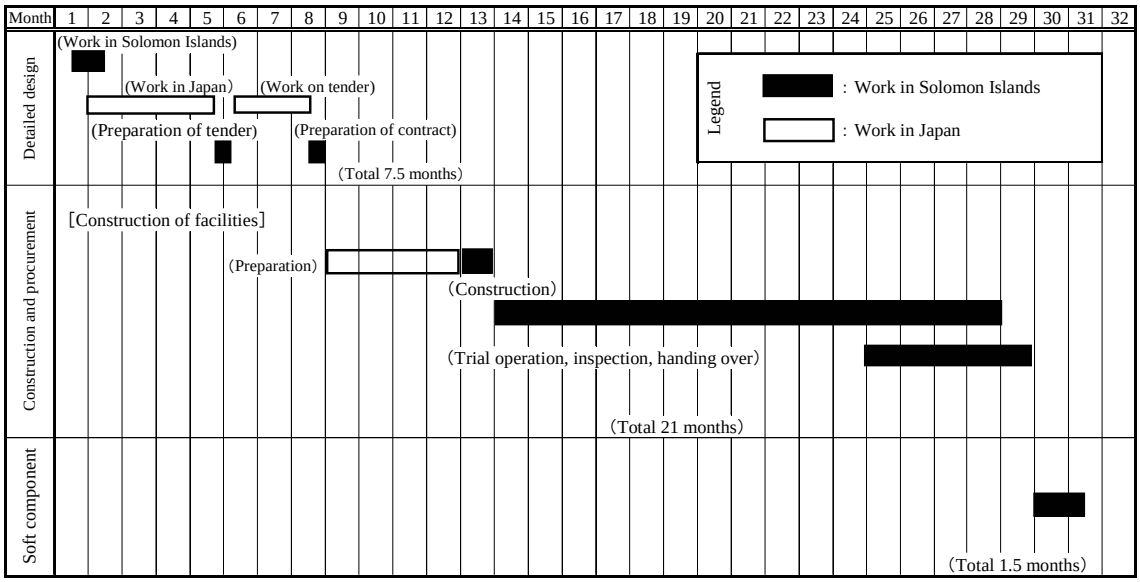
The execution design needs to be developed with the precision needed for the preparation of specification documents for tendering, and this work comprises two field studies (research and discussion for confirmation of design content) and design works in Japan. The required time is expected to be approximately 8 months.

After execution design, tendering is conducted and then facility construction begins. Facility construction, including preparation, construction works, inspection/test operation, will require approximately 21 months from the conclusion of the construction contract to the completion of works.

After completion of works, the soft component will be executed for the purpose of supporting the implementing organization in Solomon Island so that they can perform satisfactory operation, maintenance, and management of the facilities constructed in this Project. The time needed for execution is approximately 1.5 months.

Based on the above, the Project implementation schedule regarding the matters in the responsibility of the Japanese side is as shown in Table 2-2-56.

Table 2-2-56 Project Implementation Schedule



2-3 Obligations of Recipient Country

The Project is composed of Japanese cooperation and the works to be undertaken by the Solomon Islands side with their self-effort. The summary of obligation works by the Solomon Islands side is as follows:

1. To explain about the Project to the residents living near the facility construction site and hold a stakeholder meeting
2. To secure the land for construction site of the Project facilities through proper legal procedures
3. To remove the existing facilities and materials from the planned construction site and to level the land prior to the commencement of construction by the Japanese side
4. To immediately remove and reinstall pumps and electrical equipment to the new Konglai pump building to be constructed by the Japanese side.
5. To undertake fence and gates in and around borehole facility, transmission pump, distribution reservoir, etc.
6. To supply power necessary for pumping equipment at such as boreholes (The voltage shall be 11kV in Honiara and the voltage for Auki city shall be 415V. Power receiving equipment shall be the scope of the Japanese side)
7. To execute construction and improvement of access roads to the construction sites for the Project facilities
8. To secure quarry site for sand and gravel
9. To secure temporary yard for construction materials in Honiara City and Auki City
10. To secure sites for concrete batching plant and crusher plant in Honiara City
11. To obtain permit from the authorities related to pipe laying work
12. To lay distribution branch pipes and service pipes necessary for house connection in the unserved area where water distribution mains are to be constructed under the Project
13. To supply chemicals such as chlorine agent necessary for disinfection at turbidity reduction facility and chlorine disinfection facility
14. To assign engineers, staff and operators to receive OJT for improvement of O&M and water quality control and Soft Component (technical and/or managerial assistance) for the proper operation and maintenance for turbidity reduction facility to be constructed under the Project
15. To use and maintain properly and effectively all the facilities constructed, and equipment and materials provided under the Japan's Grand Aid.
16. To take necessary procedures for issue of A/P required for payments to the Japanese Consultant and/or Contractor(s) and to bear the following commissions to a bank in Japan for the banking services based upon the Banking Arrangement.

- Advising commission of A/P
- Payment commission

17. To ensure prompt unloading and customs clearance of the goods for the Project at the port of disembarkation in Solomon
18. To accord Japanese nationals whose services may be required in connection with the supply of products and services under the verified contract(s) such facilities as may be necessary for their entry into Solomon and stay therein for the performance of their works
19. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Solomon Islands with respect to the supply for the products and services under the verified contract(s). And to take necessary measures for such tax exemption.
20. To bear all the expenses, other than to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment.

2-4 Project Operation Plan

2-4-1 Basic Policy

For long-term effective use of the facilities constructed under the Project and stably and continuous water supply with reflecting the change in daily demand, operation and management of plant and protection of facility environment are indispensable. The Solomon side should carry on suitable protection and maintenance of the facilities and the equipment derived from increase in reliability, safety and effectiveness for preserving the ability and the function of the facilities and the equipment, and constant water supply. Figure 2-4-1 shows the basic policy of maintenance of the facility in the Project.

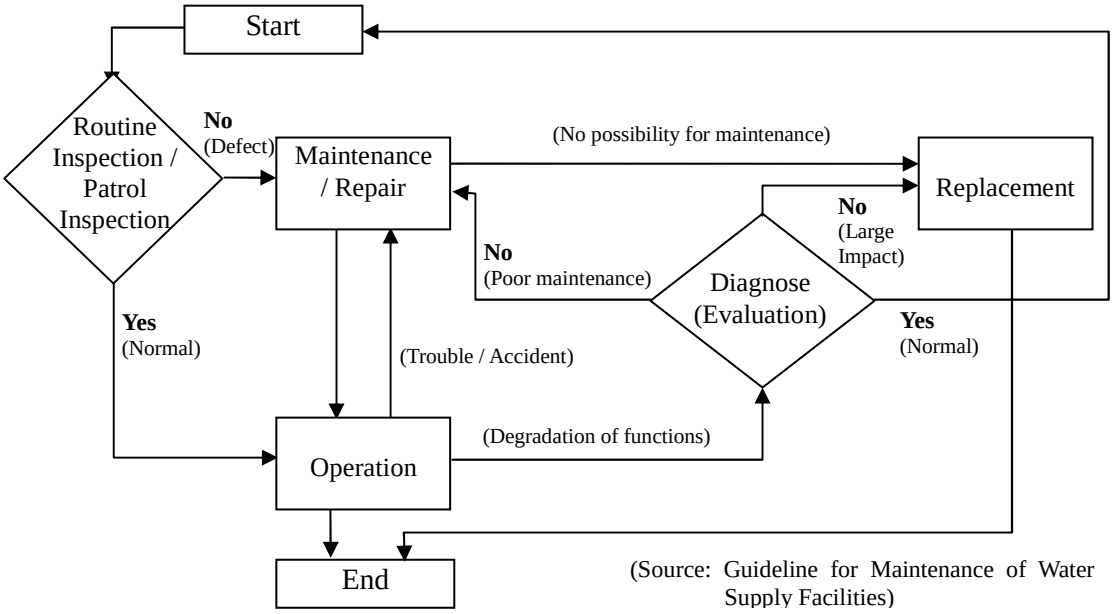


Figure 2-4-1 Maintenance Flow of Water Supply Facilities

The Contractor will give technical guidance on the operation and maintenance of newly procured equipment to SIWA in the period of the contract. However, the Consultant will conduct technical guidance on the systematic utilization of the turbidity reduction facility through the soft component.

2-4-2 Items for Regular Check

Based on the policy mentioned above, the following points are the basic items that SIWA shall conduct for maintenance and management of the water treatment plant.

Operation Management: Carrying on operation and control under normal circumstances

Maintenance Management: Carrying on maintenance, repair and prepare so that the facility, equipment and device can show full ability for operation.

Table 2-4-1 shows the main items for O&M of the new water treatment plant.

Table 2-4-1 Main Items for Operation and Maintenance (O&M)

Classification	Main Management Item
Operation Management	**[Water volume control]** Controlling equipments and devices conforming to the target water volume **[Water quality control]** 1) Measuring turbidity of raw water and effluent and check whether treated water meet the design water quality value. When turbidity of raw water is expected to exceed the set turbidity, inlet valve shall be closed. Then, after turbidity reaches to the acceptable level, the valve shall be reopened. 2) Measuring residual chloride after disinfection and confirming whether it becomes lower than the value. After the measurement, resetting injection rate of disinfection reagent, if required. 3) Sorting out and analyzing records of turbidity control and utilizing them as the data for examining optimum operation method of turbidity reduction facility and turbidity control.
Maintenance	**[Inspection Item]** Inspecting and checking facilities, equipments and devices with meters and naked eyes and repairing and maintaining faults or breakdowns. Additionally securing and protecting safety of chemicals (chloride) needed for disinfection. **[Prevention]** Renewing facilities, equipments and devices periodically depending on the importance and characteristics even without any breakdowns. This leads to a safe and secure operation since ensuring reliability and safety over facilities, equipments and devices may increase.

SIWA is required to carry on appropriate O&M of equipment according to O&M manuals of equipments supplied by production makers. Table 2-4-2 and Table 2-4-3 indicate the standard checking items of pumps and power receiving equipments as the main equipment for water supply facilities

Under the Project, the Consultant will provide manuals for O&M for turbidity reduction facility and water quality control. SIWA is required to utilize these manuals for analysis of operation record, establishing management target, water quality control, etc. and makes an effective and appropriate operation of the whole water supply facilities.

Table 2-4-2 Standard Check List for Pump Equipment

Pump	Daily (during operation)	Record in operation diary (transmission volume, check with naked eyes, abnormal noise, shaft temperature, leakage, pressure of inflow and outflow)
	Monthly	Check of shaft oil and grease Check of gland packing
	Every 6 months	Replacement or refilling of shaft oil and grease Precision of the shaft centre Measurement of vibration and noise Tightening each part of the equipment
	Every year	Dismantling check (abrasion of rotating parts, aperture of gliding parts, corrosion of inside, choking with substances, paint) Check of accessories and spares
Motor	Daily (during operation)	Record in operation diary (electrical currency, check with naked eyes, abnormal noise, shaft temperature, leakage)
	Every 6 months	Refilling of shaft grease Measurement of vibration and noise Check of temperature of shaft
	Every year	Check of shaft holder Measurement of non conductance resistance value

Table 2-4-3 Standard Check List for Power Receiving Equipment

Item	Content (Method)	Regular Inspection	Normal Inspection	Precise Inspection
Appearance	Open/Close display device, Display Condition	○	○	
	Abnormal Noise and odor	○	○	
	Hot Coloring at end points	○	○	
	Cracks, faults and stains of bushing and pipes	○	○	
	Rust on found case, hang base, etc.	○	○	
	Abnormal Temperature	○	○	
	Tightness of bushing end (mechanical check)	○	○	
Operation and control devices	Display condition of each equipment	○	○	○
	Rotation order		○	○
	Rust and stains of controlling box and its inside		○	○
	Oil change and cleanness		○	○
	Tightness of electricity wiring connection	○	○	○
	Open/close display condition		○	○
	Air and oil leakage (with air pressure, etc.)		○	○
	Pressure before and after operation (with air pressure, etc.)		○	○
	Operation meter condition		○	○
	Rust, deformation, damage on spring (repair)	○	○	○
	Abnormal pins for connection		○	○
	Spare electricity circuited breaker and relay		○	○
Measure-ment and test	Non conductance resistance		○	○
	Contact resistance			○
	Heater snapper line		○	○
	Movement test for the relay		○	○

2-4-3 Spare Parts Purchase Plan

Spare parts are divided into (a) consumable parts which may be replaced periodically and (b) replacement parts or emergent spare parts, which are necessary for accidents, etc., for replacement. Thus, it is necessary that the Solomon side shall purchase those main goods in accordance with the periodical inspection cycle as described before.

2-4-4 Structure for Operation and Maintenance

SIWA is planning to bring the staffs for the new water supply facilities by relocation of staff for the existing facilities. However, since the water supply facilities are expanded through the implementation of the Project, it is required for SIWA to recruit new staff for operation and maintenance work in addition to the relocation.

Table 2-4-4 shows job type and role for maintenance staff of SIWA.

Table 2-4-4 Job Type and Role of Maintenance Staff of SIWA

Job Type	Role in Maintenance Work
Plumber	Connection, installation, repair, maintenance and associated works for pipes and valves
Ordinary labor	Assisting maintenance work
Carpenter	Construction and repair of administration building, installation of forms for concrete work, fabrication of furniture
Electrician	Connecting electric cables to the facilities after transformation of voltage, relocating cables, repair, maintenance, associated works
Pump operator	Operation, maintenance and taking records of pump equipment and disinfection facilities, operation of borehole pumps, transmission pumps, discharging pumps and bleaching powder injection pumps
Construction equipment operator	Operation and maintenance work of construction equipment
Water quality analysis staff	Sampling, analyzing and sorting out of analyzed results

Table 2-4-5 shows the facilities of which SIWA staffs are to be in charge and the required additional number of staff after completion of the Project.

Table 2-4-5 Facilities in Charge and Required Additional Staff Number after Completion of the Project

Job Description	Facilities in Charge after Completion of the Project	Current Number of Staff	Required Additional Number of Staff	Number of Staff after Completion of the Project
Plumber[*1]	Piping work for turbidity reduction facility, borehole facility, water conveyance pipeline, water transmission pipeline and water distribution network	7	2	9
Ordinary labor	Not specified	6		6
Carpenter	Not specified	1		1
Electrician[*2]	18 nos. of borehole (16 in Honiara and 2 in Auki), 4 nos. of water transmission pump station, 6 nos. of disinfection facility, 2 nos. of turbidity reduction facility	2	1	3
Pump operator[*3]	16 nos. of borehole, 4 nos. of water transmission pump station, 6 nos. of disinfection facility, 2 nos. of turbidity reduction facility	2	3	5
Construction equipment operator	Not specified	2		2
Water quality analysis staff[*4]	18 nos. of borehole, 4 nos. of water transmission pump station, 2 nos. of turbidity reduction facility	1	2	3
Total		21	8	29

Notes:

1. Works by plumbers are categorized into planned piping work, repairing work in emergency case and maintenance work. After completion of the Project, load for maintenance work will be increased.
2. Same as item-1 above. In addition, it is expected that supporting work for pump operators should be increased.
3. In principle, pump operator will do patrol monitoring and checking. The patrol monitoring shall be conducted from 10:00 to 12:00 and from 13:00 to 16:00. After completion of the Project, working volume will be increased with start-up and stop of equipments, visual check of operation condition, opening and closing valves, periodical maintenance, repair and reinstatement in case of troubles, etc. Patrol monitoring and checking shall be conducted daily and the results shall be recorded.
4. The number of sampling will be increased by 14 nos in total - 8 nos. for raw water and 6 nos. for treated water. Although the number of sampling and water quality analysis is increased, only two additional staffs will be sufficient after completion of the Project because it is expected that main routine works for the staff should be measurement and record of turbidity and residual chlorine.

2-5 Project Cost Estimate

2-5-1 Initial Cost Estimate

The cost to be borne by the Solomon Islands side for the Project is as follows:

Estimated cost for undertakings by the Solomon Islands side: approx. 191.6 million JPY

Organization	Item	Project Cost (million JPY)	
SIWA	Leveling of construction sites	3.5	191.6
	Installation of fences at the constructed facility sites	4.7	
	Relocation of the existing water pipelines	4.2	
	Removal of the existing facilities and structures	12.0	
	Improvement of access road to the facility sites	109.4	
	Laying electric cable of 11kV to new facilities	4.2	
	Installation of service pipes and secondary distribution pipelines to supply water to each customer	53.6	

Conditions for the above estimate are as follows:

① Starting Date of Estimation: 31st October 2008

② Exchange Rate:

US$1.0 = JPY107.97 (Average of the last 6 months from 30th April 2008)

SBD1.0 = JPY14.39 (Average of the last 6 months from 30th April 2008)

③ Execution Period: Facility construction over three Japanese fiscal years

④ Others: The Project shall be implemented under the Japanese Grant Aid scheme.

2-5-2 Operation and Maintenance Cost

(1) Operation and Maintenance Cost

The operation and maintenance cost of borehole facilities, turbidity reduction facilities, water transmission pump stations and distribution reservoirs to be constructed in the Project (except head office expenses of SIWA) is composed of cost for electricity, chemicals (chloride and aluminum sulfate), personnel expenses and purchase of spare parts of each equipment.

Each expense is calculated with the following conditions. Table 2-5-2 shows the result of the calculation.

(i) Electricity: Annual electricity consumption x Average electricity charge

(ii) Chemicals (chlorine): Annual consumption x Price of chemicals

(iii) Personnel Expense: Annual average income of staff x Additional number of O&M staff
(The number of staff for O&M to be increased after completion of the Project is mentioned in Chapter 2-4)

(iv) Spare Parts: Body Cost x 3% per year

Annual O&M cost of SIWA after completion of the Project is expected to be increased by SBD10.0 million. However, revenue from water sales will be increased by SBD10.3 million from the

revenue before the Project implementation through the increase of customers by expanding water distribution networks to the unserved areas. Therefore, it is considered that expenses to be increased by the Project implementation can be covered by the increase of water revenue.

(2) Renewal Plan for Mechanical and Electrical Equipment

In this Project, main equipments such as borehole pumps, water transmission pumps and electrical equipment related to power receiving and emergency generator will be installed in the related facilities. These mechanical and electrical equipments are expected to be replaced in the period defined in Table 2-5-1.

Table 2-.5-1 Expected Service Life of Equipment for the Project

Equipment Name	Category	Expected Service Life
Borehole Pump	Submersible pump	10 years
Water Transmission Pump	Surface pump	15 years
Electrical Equipment		15 years

Table 2-5-1 O&M Cost after Completion of the Project (Increased Cost only)

Item	Expected Expenses							
1. Electricity Cost	Equipment	A	B	C	D (A x B x C)	E (D x 365/year)	F	G (E x F)
		Output (kW)	Number in duty (unit)	Operation hour (hr/day)	Daily power consumption (kWh/day)	Annual power consumption (kWh/year)	Electricity charges (SBD/kWh)	Annual Expenses (SBD)
	Borehole pumps	15	5	24	1,800	657,000	3.9866	2,619,196
		13	7	24	2,184	797,160	3.9866	3,177,958
		11	4	24	1,056	385,440	3.9866	1,536,595
		9.2	2	24	442	161,184	3.9866	642,576
	Transmission pumps							
	- Tasahe station	30	2	24	1,440	525,600	3.9866	2,095,357
	- Titinge station	30	2	24	1,440	525,600	3.9866	2,095,357
	- Skyline station	22	2	24	1,056	385,440	3.9866	1,536,595
	- Borderline station	11	2	24	528	192,720	3.9866	768,298
	Existing Konglai uplifting pump	55	3	24	-3,960	-1,445,400	3.9866	-5,762,232
	Other equipment	142	---	---	142	51,830	3.9866	206,625
	Total					2,236,574		8,916,326
2. Chlorination Cost	Item	A	B	C (A x B)	D (C x 365/year)	E		F (D x E)
		Injection (kg/hr)	Operation hour (hr/day)	Daily consumption (kg/day)	Annual consumption (Ton/year)	Unit price of chlorine (SBD/Ton)		Annual Expenses (SBD)
	Chlorine	---	---	46	16.8	14,175		237,998
3. Personnel Expenses	Item	A	B	C (A/B)	D			E
		Total salary (SBD/year)	Total number of employee (person)	Annual average (SBD/person・year)	Additional staff (person)			Annual Salary (SBD)
	Salary & wages	2,663,580	75	35,514	8			284,115
4. Spair Parts Cost	Item	A	B					C (A x B)
		Price of equipment (SBD)	Ratio for spair parts (%/year)					Annual Expenses (SBD)
	Spair Parts	18,318,750	0.03					549,563
	Sum of expenses to be increased after completion of the Project							**9,988,002**
Revenue Increase	Item	A	B	C	D			E
		Sold water (Year 2007) (m^3/year)	Sold water (Year 2010) (m^3/year)	Increase of sold water [B]－[A] (m^3/year)	Averaged water charge (SBD/m^3)			Increase of Water Revenue [C] x [D] (SBD/year)
	Honiara City	5,448,833	6,913,465	1,464,632	6.50			9,520,108
	Auki City	118,100	254,405	136,305	6.00			817,830
Sum of revenue to be increased after completion of the Project								**10,337,938**
Balance between revenue and expenses after completion of the Project								**349,936**

CHAPTER 3

PROJECT EVALUATION AND RECOMMENDATIONS

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

3-1 Project Effects

Current issues and their countermeasures, and project outputs from implementation of the Japanese assistance and the Solomon Islands undertakings are summarized in Table 3-1.

Table 3-1-1 Current Issues, Countermeasures in the Project and Project Effect

No.	Item	Current Issues	Countermeasures in this Project	Project Effect
[Honiara City]				
1	Water source	Water intake volume from Konglai Spring, the main water source of Honiara City, is unstable due to frequent blockages.	Dependency on Konglai Spring as unstable water source shall be reduced to 35% and reliable groundwater shall be newly developed to meet the water demand in 2010.	Water consumption for domestic use of 170 LCD is secured even if blockage of Konglai Spring has occurred, during the period of which the water consumption is reduced to as low as 110 LCD.
2	Water pressure in network	25% of the population of the service area in Honiara are suffering from low water pressure and can not receive water supply during peak demand hours.	Water distribution system shall be improved by block distribution system and optimization of pipe diameters, in order to secure the minimum water pressure of 10m in water head at the end of network.	Low pressure areas where the water pressure becomes almost nil during the peak hours in the day time are eliminated.
3	Water distribution system	Water transmission system and distribution pipeline are not separated so that water distribution to the service areas is not stable.	Each water distribution district shall have one water source and one distribution reservoir in principle (so called “block distribution system”) so that water supply facilities in each district can function independently.	Stable water supply volume and water pressure are secured by the adoption of block distribution system.
4	Pipe diameters	Pipe diameters are too small to transfer the required water to customers. Inadequate pipe diameter is also one of the causes of low water pressure.	Enough pipe diameters shall be adopted after the examination by hydraulic analysis of water distribution network to cope with the water demand in 2010.	Enough and stable water pressure is secured.
5	Storage capacity of reservoirs	Currently, capacity of existing service reservoirs is as low as 5.7 hour-volume of daily maximum water supply, and it is difficult to supply enough water during peak hours and in emergency case.	Storage capacity of distribution reservoirs shall have a 12 hour-volume of daily maximum water supply, to stabilize water supply during taking into account peak-hours demand and emergency case.	Capacity of distribution reservoirs is increased from 5.7-hour volume (or 7,280m^3) to about 12-hour volume (or 14,630m^3) of the maximum daily water supply so that water supply service can cope with peak demand during the daytime and in emergency cases.
6	Turbidity of spring water	Tap water often shows high turbidity and become unsuitable for domestic use after heavy rain in the service areas of Konglai Spring and Kombito Spring sources.	Turbidity reduction facility shall be installed near the intake point of Konglai and Kombito Spring sources.	Accidents of turbid water distribution to the network during and after heavy rain are almost eliminated.
7	Unserved areas	Unserved water supply area accounts for 30% of water service areas of SIWA.	Water distribution mains shall be expanded to the unserved areas.	Served population is increased from 55,656 in 2007 to 71,685 in 2010 and service ratio is increased from 73% in 2007 to 83% in 2010.

No.	Item	Current Issues	Countermeasures in this Project	Project Effect
[Auki City]				
1	Water source	Water intake volume from the existing Kwaibala Spring is less than the water demand in Auki City. Therefore, water consumption for domestic use is as low as 75LCD in 2007, which is only 40% of other provincial centers.	Two (2) boreholes shall be newly developed to meet the water demand in 2010.	Maximum daily water supply is increased from 540m^3/day in 2007 to 1,106m^3/day in 2010.
2	Water supply service	The residents in Auki City are suffering from water supply rationing being executed for 4 hours a day because the yield of water source is much short of the actual demand.	New borehole facilities shall be connected with the water distribution system which has been rehabilitated by ADB project.	Continuous 24-hour water supply will be realized.

3-2 Recommendations

For securing implementation of the Project and sustainable operation and maintenance by SIWA, issues to be implemented and improved by SIWA and their recommendations are mentioned as follows:

(1) Implementation of Undertaking Works by the Solomon Islands Side

For smooth implementation of the Project and achievement of the Project purpose, SIWA is required to secure necessary budget for undertaking works by the Solomon Islands such as improvement of access roads to the facility construction sites, removal and relocation of underground utilities and obstacles, leveling of the sites, installation of branch distribution pipes and service pipes, etc., and carry out those works in accordance with the construction schedule by the Japanese Contractor.

(2) Water Quality Control

In the Project, turbidity reduction facility will be introduced to the Solomon Islands for the first time. Water quality control will become more important in the operation and maintenance work of the whole water supply facilities as well as the facility. However, SIWA do not possess basic testing equipments for water quality necessary for routine water quality control and in addition, water analysis staff is not enough in number, and knowledge and skill of the existing water analysis staff is required to be improved.

SIWA is needed to make their efforts to improve skills for water quality control by utilizing the Soft Component to be applied in the Project.

(3) UFW Reduction Activity

Among unaccounted-for water (UFW) of about 45% in the water supply service by SIWA, it is assumed that leakage ratio accounts for about 40% as a result of JICA development study.

In the Project, new boreholes will be developed for meeting the requirement of the water demand in 2010 and further development of water sources will be required to cope with water demand increase after 2010. However, large investment will be needed for the development of new water sources. Reduction of UFW is considered as one of the alternative water sources to avoid such a large investment.

SIWA is required to establish leakage reduction unit or section recruiting new staff in addition to the staff who were trained for leakage survey skills during JICA development study. When UFW reduction activity is made root as routine work and UFW can be reduced, development of new water source can be delayed.