CHAPTER XI IMPLEMENTATION PLAN FOR THE PROJECT

11.1 Plan for Procurement of Budget Required for Implementation of the Project

11.1.1 Procurement of the Project Works

As proposed in the Master Plan Study Report (Volume II), this Study contemplates the following procurement approaches to be most advantageous to the project:

(1) Procurement through BOT Schemes

In line with the policy of the Government as well as the MWSS, the basic principle would be to procure the work through maximum use of private financing resources (e.g. BOT). This procurement will be applied to the following work components:

Procurement Package of BOT Schemes

Procurement Package	Works to be Implemented
1 Water Treatment Plant and Transmission Mains up to Service Reservoir (Stage 1 to 2-2)	- Water treatment plant - Pipelines - Antipolo pump station - Antipolo service reservoirs - Taytay service reservoirs - Morong Substation (S/S) - Transmission line from Dolores S/S to Morong S/S - Power supply lines to waterway facilities
2 Agos Hydropower Plant at Agos Dam (Stage 2-1)	- Power waterway including intake, headrace tunnel and penstock - Agos hydropower station including generating equipment and switchyard - Power transmission lines to Morong S/S and Quezelco S/S

(2) Procurement as Government Project

It is proposed that water resources facilities (dams and tunnels) would be implemented as the government project. The work involves a variety of technical risks and requires a large capital cost, which would be excessive burdens to private firms to participate. Its serviceable life is so long as almost semi-permanent with a lifetime of more than 50 years, far longer than ordinary BOT concession period.

Further, the least costly approach is to build the water resources facilities as a government project by utilizing ODA soft loans of a low interest rate and a longer repayment period (say, 20-30 years), which would contribute to minimizing the water cost. The work components proposed for the implementation as the government project cover the following:

Proposed Work Components for Government Project

Procurement Package	Works to be Implemented
1 Kaliwa Low Dam and 1st Waterway up to Water Treatment Plant (WTP) (Stage 1)	- Kaliwa Low Dam and intake - Tunnel No.1 connecting intake and valve house - Valve house at the end of Tunnel No.1
2 Agos Dam (Stage 2-1)	- Agos Dam - Other associated works for supporting regional socio-economic activities
3 2nd Waterway up to WTP (Stage 2-2)	- Intake for 2nd Waterway - 2nd line of Tunnel No.1 - 2nd valve house

11.1.2 Conceivable Financial Sources

(1) Principle for pricing water

As stated in the preceding subsection, the whole project is assumed to be allotted to the following three components:

A. A government scheme for dam and tunnel/waterway (hereinafter referred to as GOVw),

B. A BOT scheme for hydropower development at Agos Dam (BOTa)

C. Another BOT scheme for water treatment and conveyance (BOTw).

The raw water produced by the GOVw scheme will be transferred to the BOT schemes of BOTa and BOTw at a certain water rate. Meanwhile, there are many discussions regarding the current way of pricing water, some of which include the following:

- The water is currently undervalued as it does not reflect its economic cost including the direct supply cost of production and distribution, the opportunity cost of water, and its cost of externalities.
- Metro Manila's water tariff structure is now the lowest among major cities in the ASEAN.
- There is widespread evidence in developed countries that higher water tariffs have reduced water consumption.

In this Study, however, the "full-cost recovery" principle was adopted among others as this is deemed to be most agreeable and practical for the feasibility study. The full-cost implies all the cost to be incurred in carrying out the project such as the direct cost required for engineering and administration, land acquisition cost and resettlement cost, cost for building facilities, financing costs for funding the construction, and O&M costs of the facilities.

Regarding the benefit to be accrued from the project, it is assumed that no return to the government will be generated from the government scheme. This is based on the general philosophy that the purpose of the government scheme is not to gain profit but to supply water as cheap as possible to consumers. For the BOT scheme,

however, a reasonable level of profit is, as a matter of course, indispensable to attract competent BOT proponents.

Therefore, it was assumed in this Study that the water produced by the government scheme will be handed at the entrance of the water treatment plant to the BOT joint venture company with full-cost-recovery basis without any return to the government. It will be, then, treated by the BOT joint venture company and handed to the existing Concessionaires at the exit of the service reservoir to be built by the Project with full-cost basis plus a reasonable return.

(2) Potential funding sources

1) Government scheme (GOVw)

The government scheme component comprises the following:

- Water source development, i.e. construction of Kaliwa Low Dam and Agos Dam, and
- Water conveyance tunnel from Dams up to Morong water treatment plant.

Taking into consideration the elements mentioned above, the finance with a long-term repayment period at concessional interest rate such as ODA loan of foreign government's assistance is most appropriate. Its repayment period is usually near around 20-30 years including a grace period of 5-10 years. In case of the Philippines, as seen in every developing country, the government has a chronic shortage of fund for public infrastructure project. Therefore, the domestic currency portion is desirably to be financed as far as possible through ODA financial sources.

Since the total fund requirement amounts so large, another concessional financing source needs to be sought but an ODA. A co-financing of ODA and development financing institution (DFI) is deemed to be indispensable. The remaining requirement for local fund is to be raised by the government with such fund as the Project will not be responsible in terms of either principal repayment or interest payment, namely a government contribution to the Project. When the significant importance of the Project as the water supply to Metro Manila is recognized, it is not deemed so hard for the government to obtain inter-agency consensus for appropriating the Project.

As a matter of course, it is hard to identify fund sources of ODA and/or DFI at the stage of feasibility study. Concessional loans of such ODA and/or DFI, however, are deemed to be possible judging from their actual achievements of financing practices.

What is peculiar to the finance of either ODA or DFI is that, upon their evaluation of any development project, they are sensitive to social and environmental aspects of the project. The risk of environmental degradation from both natural and social points of view is required to be fully taken into consideration in preparing the Project. Relocation programs, if any, are needed to be established with due consideration of the affected people's livelihood in the future.

2) BOT scheme components

The following two components are assumed to be implemented under BOT basis.

- Water treatment plant and transmission mains (from water treatment plant up to service reservoirs) (BOTw)
- Hydropower plants at Agos Dam (BOTa)

A joint venture company (JVC) will be established under BOT basis. The core of the JVC may be a local water company for BOTw and a local power company (IPP) for BOTa scheme. Other members than the core will include construction companies (possibly joint venture) and operation companies.

Member companies of JVC are required to contribute to share the equity capital of the JVC. The total equity capital is assumed in this Study at 35% of the fund requirement of each BOT scheme following the recent similar BOT study in the Philippines. The remaining 65% of the fund requirement will be financed by either concessional loans of DFI (another 35% is assumed in this Study) or commercial loans of commercial banks (assumed at 30%). Potential lenders of DFI may include either ADB or World Bank.

In the case of BOT scheme, the concession period is assumed to be 25 years for BOT schemes starting from the commencement of operation of the Project to the transfer of the project facilities. The JVC is expected to repay all the debt and secure an appropriate return to its investment before the end of the concession period. Sometimes, an extension of another 25 years may be possible when both the parties of the concession agreement find it advantageous.

11.1.3 Essential Features of Agreements required for the BOT Schemes

Concession agreements required for the BOT Schemes will include many articles stipulating rights and duties of stakeholders. At this stage of feasibility study, however, many relevant matters are unknown. Therefore only the essential features of "Agreements for BOT Schemes" and "Agreements for JVC" are described in this Subsection.

(1) Essential features of the "Agreement for BOT Schemes"

The following basic terms of the Agreement for BOT Schemes assume a JVC for water treatment/conveyance. The same sort of agreement is to be prepared for the JVC of hydropower generation component.

1) The parties

The parties in this Agreement for a BOT Scheme shall be the Government of the Philippines (MWSS) and the Joint Venture Company (JVC) as per composed by present stakeholders as shown in the Agreement for JVC (refer to the following sub-section of "Agreements for JVC").

2) The Project

The parties mentioned above will implement the Project (the water treatment/conveyance component) under the BOT basis. The JVC will buy

the raw water from the Government (MWSS), treat and convey the said water up to the distribution reservoir where the JVC will sell it to the existing Concessionaires (hereinafter referred to as "the Project").

3) Scope of the concession

The Government shall grant a concession to the JVC to empower the following for the period of 25 years:

- to construct the treatment plant, mains and the service reservoir which constitute the borderline of the current Concession Service Area;
- to operate and manage directly all the above-mentioned facilities;
- to raise funds for the implementation of the Project, with both equity and suitable form of loans; and
- to sell water to the current Concessionaires at the price and quality standards determined by the Water Resources Authority of the Philippines (WRAP)[1].

4) Construction of the Project facilities

a) The Government shall bear the costs for the acquisition of the project site and the necessary right-of-way and the population settlement. The JVC shall lease all the land necessary for project implementation.

b) Responsibility for construction cost, schedule and completion of all the project components shall remain with the JVC and shall be on a turnkey basis.

c) Responsibility for obtaining the water rights of the Kaliwa and Kanan Rivers shall remain with the Government.

5) Operation and management (O&M)

O&M shall be the responsibility of the JVC. The responsibility for monitoring and supervision of the O&M activities will remain with the Agos River Basin Committee (ARBC) to be established after the completion of the Project.

Major elements of the O&M regulation that shall be incorporated in this Agreement will include:

[1] WRAP is assumed at this Feasibility Study stage as an agency being mandated for regulatory and supervisory functions against all the activities of the JVC. Before its realization, the NWRB may be assumed to do the same function substituting WRAP.

- Operation parameters;
- Maintenance and repair standards;
- Tariff structure;
- Tariff collection;
- Tariff formulas and adjustment mechanisms.

6) Transfer

The procedure of transferring the Project facility to the Government of the Philippines shall be determined. The Project facility shall be in principle transferred based on its book value, which will be nil when all the facilities are depreciated in the concession period.

Appendices

- Project description and specification
- Description of land and rights of way for the project
- Preliminary design criteria
- EIA and environmental performance reporting system
- Project operation parameters
- Operation and maintenance criteria
- Tariff rates and tariff revision form

(2) Essential features of the "Agreement for Joint Venture Company (JVC)"

The following basic terms of the "Agreement for JVC" assumes a JVC for water treatment/conveyance. The same sort of agreement is to be prepared for the JVC for hydropower generation component.

1) Parties to the Agreement for Joint Venture Company

The parties to this Agreement for JVC may be assumed as follows:

a) A Filipino private investor (local water company)

b) An international private investor (water company)

c) A Filipino private investor (construction company)

d) Local Development Banks

e) International Funding Agencies

Local Development Banks and International Funding Agencies are hereinafter collectively referred to as the DFI (development funding institution).

2) Establishment of the Joint Venture Company

The JVC shall be a limited liability company incorporated in the Laws of the Philippines.

3) Purpose and scope of business of the JVC

The purpose of the investors in establishing the JVC is to realize the Project (water treatment and conveyance component) following the provision of the "Agreement for BOT Schemes".

In order to attain the objective, the JVC shall conclude the following agreements:

a) EPC (Engineering, procurement and construction) agreements between the JVC and a contractor to be identified through competitive bidding;

b) Operation and management agreement between the JVC and a local water company;

c) WSM (Water sales and management) agreement between the JVC and existing Concessionaires;

d) Financial agreements between the JVC and DFIs.

4) Total amount of investment and registered capital

The total amount of investment shall be:

The registered capital of the JVC shall be:	(35% of the total investment)
The total amount of lending shall be:	(65% of the total investment)

5) Marketing

The JVC will sell water to the current Concessionaires at the price that shall be established in the WSM agreement and approved by WRAP.

6) Duration

The duration of the JVC shall be 25 years from the date of issuance of the registration certificate.

11.2 Organizational Structure for Implementing the Project

11.2.1 General

As described in Subsection 11.1.1, the whole project will be broadly split into two components: one is the government scheme for setting up dam and tunnel and another is the BOT schemes for constructing a hydropower and WTP/water conveyance facilities. For the former, a conventional project organization will be adapted. For the latter, however, an organizational structure for BOT scheme is to be devised for its smooth implementation. The Project will be comprehensively administered by MWSS as the executing agency for the Project implementation and as the chair agency of the inter-agency committee of ICCARP as stated below. The holistic concept of the project structure is described in the following subsections.

11.2.2 Inter-agency Coordination Committee

As mentioned in Volume II, an implementation framework is proposed for the Project under the MWSS as an executing agency with an inter-agency coordination committee. It organizational structure is explained below and is depicted in Figure 11.1.

1) Executing agency:	MWSS
2) Name of the committee:	Inter-agency Coordination Committee on Agos River Basin Project (ICCARBP)
3) Composition:	Chairman (1): MWSS Members (9): NEDA, DPWH, DENR, DILG, DOE/NPC, NWRB, DA/NIA, Provinces of Quezon and Rizal
4) Functions of the Committee:	Coordination activities among agencies concerned with such matters that require consensus, cooperation and/or adjustment including land acquisition, water appropriation, environmental conservation and others.
5) Termination:	The ICCARP is to be terminated upon the completion of construction works of the Project and its power and function is to be inherited to the ARBC after necessary modification.

6) Functions of each agency:

MWSS:

a. Comprehensive responsibility for the implementation of the Project as the executing agency of the Project
b. Coordination and management of the project implementation as the chair agency of the ICCARP
c. Preparation and submission of Project documents for approval of ICC (NEDA)
d. Application and permission procedures for water right
e. Responsibility for government scheme comprising project funding, design, contractual matters like pre-qualification, bidding, award, etc.
f. Regulatory and supervisory affairs of all construction works including government scheme and BOT schemes
g. Responsibility for the amicable settlement of relocation problem of the affected families
h. All contractual matters relating to water/power purchase agreements
i. Other administrative matters that are not covered by other member agencies

NEDA (Infrastructure Committee; INFRACOM):

a. Coordination of formulating socio-economic development plan in the region
b. Advisory works for LGUs to plan regional development projects

c. Advisory services for MWSS to apply for ICC approval

d. Advisory services for MWSS to apply for ODA funding

e. Coordination of other development planning relevant to project site

f. Coordination of application for ICC approval of BOT scheme

g. All other ICC related matters of the Project

DPWH:

a. Advisory services for applying for permit on the construction of dam, tunnel and other project facilities

b. Coordination and supervisory services of all construction works including dam, tunnel and waterway

c. Coordination and supervisory services of all river structure construction

d. Management and control of civil works construction schedule

e. Supervisory services of all other civil works of the Project that are not covered by other agencies

DENR:

a. Formulation of environmental quality standard of the Project

b. Monitoring of environmental quality at the project site

c. Formulation of environmental conservation plan of the project site

d. Monitoring and management of conservation of forest land and watersheds

e. Monitoring and supervisory services of environmental impacts taken place by facility construction works

f. Regulatory and supervisory services of all other matters related to environmental conservation that are not covered by other agencies

DOE/NPC:

a. Regulatory and supervisory services for construction of hydropower plants and associated facilities

b. Coordination of power sales from JVC of BOT scheme to NPC

c. Comprehensive advisory and supervisory services for JVC of BOT scheme to build hydropower station

d. Advisory and supervisory services for dam construction

e. Formulation and implementation of rural electrification program of the project site

f. Regulatory and supervisory services of all other matters related to construction of hydropower plants that are not covered by other agencies

NWRB:

a. Evaluation and processing of the water rights of the Project
b. Assessment of impact of water resources development at the Project site
c. Monitoring of water resources development plan of the Agos River
d. Formulation of the Agos River Basin water resources management plan
e Coordination and regulation of all other matters related to water resources development and management that are not covered by other agencies

DA/NIA:

a. Responsibility of formulation and management plans of irrigation water withdrawal at the downstream of the Agos River
b. Formulation of agricultural development plan utilizing stable irrigation water supply induced by the Project
c. Coordination for formulation of rural development program at the site
d. Coordination and regulation of all other matters related to irrigation water resources development and management that are not covered by other agencies

DILG/Provinces of Quezon and Rizal:

a. Formulation of Barangay development programs entailed by the Project
b. Formulation of the program for effective use of social projects like manpower training center and/or medical clinic
c. Coordination of relocation and resettlement program enforced by the Project
d. Coordination and collaboration for rural roads construction with PMO
e. Coordination of all other matters related to Barangay development program that are not covered by other agencies

In addition to the above agencies concerned, the Department of Agrarian Reform (DAR) will be required to attend the meeting of ICCARP as necessary. The DAR will be responsible for coordination and advice to relocation problem of the affected families of the Project.

Meanwhile, it is proposed for smooth implementation of the project to establish a Project Management Office (PMO) of the Project. The PMO will be built in MWSS headquarters and composed of seconded staff of each member agency who will be dispatched for the limited time of the Project construction. Thus, all the expertise of wide range that is required for implementing the Project is procured in the PMO,

which will administer the Project as a whole covering both the government scheme and BOT schemes.

11.2.3 Organizational Structures for Government Scheme

The dam and tunnel are planned to be constructed under the government-initiated scheme as shown in Figure 11.1. The PMO will administer the government scheme together with the BOT schemes. The schematic framework of the government scheme is depicted in Figure 11.2. This is the conventional mechanism for implementing public works. Only exception is the establishment of the ICCARP for coordination of the implementation. The PMO will first select an engineering consultant from pre-qualified parties. The awarded engineering consulting company will make design and prepare tender documents for construction. The PMO will award a construction company through international competitive tender procedures. The engineering consultant will be responsible for supervising the construction works under the administration of the PMO.

An engineering contract will be concluded between the PMO and the engineering consulting company. A construction contract will also be concluded between the PMO and the construction company.

The operation and management of the Government scheme (GOVw) after its completion will be the responsibility of the Agos River Basin Committee (ARBC) which will be established upon the completion of construction works of the Project (Details of the ARBC will be described in 11.4.3). The NWRB as the chair of the ARBC shall delegate the function of the operation and management of the GOVw scheme to MWSS who is assumed to be responsible for this area of water supply through the power/function delegation mechanism as shown in Figure 11.4.

11.2.4 Organizational Structures for BOT Schemes

The water supply related facilities such as water treatment plant and conveyance facilities are planned to be constructed under BOT basis. A hydropower plant is also planned to be built as BOT schemes (Figure 11.1). The PMO will administer these BOT schemes together with the government scheme. The schematic framework of the BOT schemes is depicted in Figure 11.3.

A JVC will be established for a BOT scheme based on the Agreement for JVC. The essential features of this Agreement for JVC is presented in Subsection 11.1.3. The JVC is the project companies to be built for implementing either the water treatment/conveyance project or the hydropower project. Functions of the stakeholders of the JVC are as follows.

i) The *Project Company* is the organization comprehensively responsible for all the aspects of the construction and management of the Project. It is composed of the shareholder companies participating in the joint venture. Its Board of Directors is the top organization for decision making of the Project Company.

ii) The *investors (shareholders)* of the Project Company will include water company, power company, construction company and operation company.

The equity capital of the Project Company will be raised from these investors. The share of the equity capital is assumed at 35% of the total fund requirement following the latest BOT Study in the Philippines.

iii) The *financial institutions* will provide the fund required by the Project except those procured by the equity capital of the investors of the Project Company. The share of loans to be obtained for the Project is assumed at 65% of the total fund requirement following the latest BOT Study in the Philippines.

iv) The *construction joint venture* will participate in the Project construction works after being awarded the tender competition called by the Project Company. In many cases, they are one of the shareholders of the Company.

v) The *operation company* will be responsible for the operation of the Project after its completion. They may also be one of the shareholders of the Project Company such as water company and/or power company.

The operation and management of the BOT schemes including BOTw and BOTa schemes after the completion of the Project will be the responsibility of each JVC by the end of the concession period under the supervision of the ARBC. Member agencies of the ARBC in respective areas shall be responsible for the supervision of its own area; for example, MWSS will be responsible for supervising the GOVw and BOTw water schemes and NPC/DOE for BOTa hydropower scheme.

The NWRB as the chair agency of the ARBC will be the core responsible agency to supervise the operation and management activities of the agencies responsible for each area through the power/function delegation mechanism as shown in Figure 11.4.

11.3 Operation and Maintenance

11.3.1 Current Practice of Operation and Maintenance for Angat Dam and Angat Water Supply Facilities

The main components involved in the proposed Project are largely classified into two categories, namely water resources facility including power generation facility and water conveyance facilities. To set up the operation and maintenance (O&M) plan for the Project, the actual situation of O&M practiced in existing Angat Dam and Angat water supply facilities was investigated in the course of the Feasibility Study as described hereunder.

(1) O&M of Angat Dam

The appropriators in the Angat Reservoir are the National Power Corporation (NPC) for hydropower generation, National Irrigation Administration (NIA) for irrigation within the service area of Angat-Maasim River Irrigation System, and Metropolitan Waterworks and Sewerage System (MWSS) for water supply to Metro Manila.

The normal operation rule curve for Angat Reservoir was adopted in December 1998 under NWRB Resolution No.02-1298.

As a part of Angat Dam Environmental Management System, the following initiatives need to be taken:

- Semi-annual water quality monitoring (potability test, physical and chemical analysis);
- Semi-annual noise monitoring at the powerhouse;
- Monthly oil and grease analysis of effluent;
- Monitoring/inventory of chemical controlled by DENR which are used in the operation of the plant; and
- Domestic and plant waste management. At present, ARHEP is starting the implementation of the Ecological Solid Waste Management Act.

For dam safety, the geo-instrumentation and monitoring group conducts monitoring of groundwater table elevations at different points of the dam, dyke and critical areas. Ocular inspections and observations at the dam embankment and its vicinities are gathered and reported periodically.

The Angat River HEP is being operated, managed and maintained by the National Power Corporation. The Plant Manager, with 70 staff, heads the organizational structure of ARHEP as shown in Figure 11.5. In case of UATP, on the other hand, 7 staff including the PMO are engaged in manual O&M works, especially in areas where the use of heavy equipment is not feasible.

(2) O&M of Angat Water Supply Facilities

At present, water supply in Metro Manila is mainly served through the Angat water supply facilities whose water source is the Angat Dam. The present water production capacity is 4,000 MLD comprising of Balara WTPs No.1 (470 MLD), No. 2 (1,130 MLD) and La Mesa WTPs No.1 (1,500 MLD) and No.2 (900 MLD). The total number of staff engaged in water production/treatment is 160 (60 persons at MWCI and 100 persons at MWSI). While, as for distribution facility, there are a total of 17 pump stations/service reservoirs and about 400 km of primary mains in the service areas.

11.3.2 O&M Plan for the Project

The preliminary O&M plans for Agos Dam and Kaliwa-Taytay Waterway are prepared in the present 2nd Field Investigation with reference to those practiced in existing Angat Dam and Angat water supply facilities which are mentioned above, as well as the O&M procedures practiced in Japan, as stated hereunder.

(1) O&M Plan for Agos Dam

Taking into consideration the basin conditions specific to the Agos River Basin as well as the technical aspects of Agos Dam, the following monitoring systems are proposed to be installed for proper operation and maintenance of Angat Dam/Reservoir:

- Inflow monitoring system and flood forecasting and warning system:
- Rainfall stations in the Agos River Basin as well as their telemetering system to transmit the rain records at certain intervals to the Project Control Office should be installed for proper reservoir operation for water supply to Metro Manila and spillway gate operation at the event of flood occurrence in accordance with the gate operation manuals to be prepared.
- Monitoring system of dam behavior during and after reservoir impounding to ensure the safety of Agos Dam:
- Seepage volume of Agos Dam and transformation of dam embankment need to be continuously measured with measuring apparatus after the start of the impounding.
- Environmental monitoring system of the Agos River Basin to monitor the streamflow condition, water pollution, sediment inflow, occurrence of a large volume of silts due to logging of forests, which may have adverse effects on the originally planned functions of Agos Dam/Reservoir:
- The environmental condition of the Agos River Basin should be monitored through installation of the said system.
- Sediment observation system:

  The cross section survey of the reservoir should be periodically carried out along the pre-set survey lines with echo sounder to confirm the sediment volume deposited in the Agos Reservoir.
- Landslide monitoring system

  The equipment to monitor the potential landslide areas in the Agos Reservoir should be installed.
- Coast monitoring system

  The requirement of the coast monitoring system for near-shore of Infanta Peninsula is discussed in the foregoing Chapter IV. However, it should be further examined in next detailed design stage.

The Agos Reservoir will be operated in accordance with the operation rule curves included in the O&M manual that are to be prepared in the next detailed designed stage. In addition, the O&M manuals for the hydroelectric and hydromechanial equipment will need to be adequately prepared. The total staff required for the operation and maintenance of the Agos Dam and Agos power station are roughly estimated at 100 personnel with reference to those of existing Angat Dam and Angat River HEP described above.

(2) O&M Plan for Kaliwa-Taytay Waterway

O&M activities are not only fundamental requirement for daily works, but also for important works from the viewpoint of long term perspective.

The Kaliwa-Taytay Waterway comprises tunnels/pipelines, valve houses, water treatment plant, pump house, service reservoirs,.

The O&M activities for water treatment plant are normally classified into two categories such as daily and periodical ones. The work categories by O&M type are shown below:

Work Categories for Water Treatment Plant by O&M Types

O&M Category	Working Category
Daily Inspection	- Flow rate of water intake and distribution (Taytay SR, Antipolo PS) - Water level at reservoirs - Operating conditions of rapid sand filters and back washing - Operating conditions of wastewater return pump - Operating conditions of chemical dosing/injection facility - Removal and transfer of sludge to the thickener/sludge drying bed - Operating conditions of mechanical/electrical facilities - Water quality examination
Periodical Work	- Removal of dried sludge from sludge drying bed (monthly) - Inspection/repair of mechanical/electrical facilities (annually) - Overhaul of mechanical/electrical facilities (at 5 to 10 year interval)

Likewise, O&M for water conveyance tunnel, transmission pipeline/tunnel and pump station/service reservoirs include daily inspection, site investigation, rehabilitation of damaged pipes, etc. as shown below:

Work Categories for Transmission Trunk Main and Pump Station/Service Reservoirs

O&M Type	Working Items
Daily Inspection	- Operation of pumping facilities and service reservoir - Operation of electrical facilities
Site Investigation	- Visible inspection of water conveyance, transmission and distribution facilities and their surrounding environment including water leak
Rehabilitation	- Replacement/repair of damaged parts
Water Quality Examination	- Periodical water quality examination of respective reservoirs

As for organization for O&M, the required number of staffs for O&M for the Kaliwa-Taytay Waterway by development stage wise is proposed as shown in the tables below:

Required Number of Staff for Water Treatment Plant*

Position/Water supply	910 MLD	1,820 MLD	2,730 MLD	3,640 MLD	Remark
Manager	1	1	1	1	
Administrative	2	2	4	4	
Supervising Engineer	8	8	14	14	Production planning Plant operation Chemical treatment Process quality Plant maintenance
Engineer	7	7	11	11	Plant engineer
Operator	6	6	12	12	Process control
Foreman	4	6	8	10	Head of maintenance team
Technician/worker	24	35	48	60	Facility maintenance Chemical/sludge handling
Driver	2	2	4	4	
Laboratory Analyst	4	6	8	10	Water quality management
Total	58	73	110	126	

Note: The number of above staff includes those for O&M of water conveyance/transmission/distribution facility (Kaliwa Low Dam –Morong WTP - Taytay Service Reservoir)

Required Number of Staff for Pump Station*

Position/Water Supply	40 MLD	80 MLD	340 MLD	680 MLD	Remark
Engineer	1	1	1	2	
Operator	4	4	4	8	Pump operation
Foreman	1	1	1	2	Head of maintenance team
Technician/worker	4	4	4	7	Facility maintenance
Driver	1	1	1	2	
Total	11	11	11	21	

Note: The number of above staff includes those for O&M for transmission/distribution facility for water supply to the Antipolo area (Antipolo Pump Station - Antipolo Service Reservoir)

Water treatment plant and pump station, in particular, must be operated by qualified and well-trained personnel. Thus, adequate practical plant operation and maintenance manuals as well as systematic and highly skilled on-site training for the staff are needed.

O&M manual

The O&M manual including technical literature (equipment), process operation, preventative operation, standard operation, maintenance service schedules, emergency response and policy formulation will need to be prepared.

Among them, the process operating manual is the heart of O&M manual and should include process description, design criteria, operating procedure, trouble shooting guides, emergency response program and servicing and maintenance requirements. The O&M manual should additionally contain the recommended types of forms used for records, logs, and reports.

Operator training

Before starting operation of the water treatment plant/pump station, the training sessions should be provided to operators and technicians with the O&M manual as the textbook. The Project engineer and the heads of the mechanical, electrical instrumentation and control disciplines are assigned as the instructors for each area of expertise. Experiences through actual operation of the existing water treatment plants utilizing the Angat water source are useful information. In addition, representatives of the major equipment manufacturers should also be invited to participate in the training sessions. After starting operation of the facility, periodical training to the concerned staff will be necessary. Especially, training on emergency response and trouble-shooting are important subjects.

11.4 Role of NWRB for the Project and Strengthening of NWRB

11.4.1 General

The need of institutional strengthening of water resources management and development sector has long been recognized since the National Water Summit held in Manila in 1994 where the government publicized the existence of the water crisis in the country and demonstrated its clear commitment to tackle the problem.

On September 12, 2002, at the precise moment of conducting the present Study, the Executive Order 123 was signed by the President. This EO directs NWRB to be

transferred to the Office of the President. Its details are described in the following subsection. The first step of reforming NWRB has at long last commenced.

11.4.2 Current Movements for Strengthening NWRB

The Executive Order (EO) 123, series of 2002 with the title of "Reconstituting the National Water Resources Board (NWRB)", was approved by the President on September 12th 2002, and publicized on September 14th 2002, and thence NWRB was transferred to the Office of the President (OP).

Formerly, the Board of NWRB was composed of, with the Secretary of DPWH as the Chairman, NEDA, DENR, DA, DOH, NIA, MWSS, LWUA and DTI. While, the membership of the new Board is reconstituted to exclude those with direct claims on water resources and is composed of the following agencies:

Chair	:	Secretary of Environment and Natural Resources
Vice-Chair	:	Secretary of Socio-Economic Planning
Members	:	Secretary of Justice
		Secretary of Finance
		Secretary of Health
		Director, National Hydraulic Research Center (NHRC), University of the Philippines
		Executive Director, NWRB Secretariat

The NWRB shall immediately initiate a review of the Implementing Rules and Regulations (IRR) of the Water Code of the Philippines and shall amend it as may be necessary to effectively implement and enforce the provisions of the Code. The NWRB shall likewise formulate a new/revised organization structure for its Secretariat. Upon the approval by the President of the revised organization and manpower structure of the NWRB Secretariat, NWRB shall then be transferred to DENR as one of its bureaus. The LWUA shall cease and desist with its practice of regulating the water tariffs of WDs, which shall thereafter be undertaken by NWRB.

The transfer of NWRB to OP was recommended in the Master Plan Study of 1998 (JICA) and reiterated in the Interim Report of the present Study as well. This EO will be a strong tool to pave the way for strengthening NWRB.

Meanwhile, in August 2002, another "WRAP" bill with a House Bill No. 1109 titled "An Act providing for a comprehensive water resources management to address the national water crisis" was submitted to the Congress. In Chapter 1, it declares that this Act shall be known as "The Water Resources Management Act of 2002" and that "the Water Resources Authority of the Philippines (WRAP)" shall be hereby created. The Authority shall be an attached agency of the Office of the President. The Authority shall exercise the powers and functions of the NWRB.

The Director General of the Authority shall be an ex officio member of the Board of NEDA. The budgetary preparation is made by the creation of "Water Resources Conservation and Development Fund" that is sourced from the raw water fees,

administrative fees, and other revenue of the Authority. Unlike EO, however, it will take a long time for the bill to pass the Congress.

11.4.3 Role of NWRB for the Project

(1) Role of NWRB in ICCARP

As one of the committee members of the Inter-agency Coordination Committee of the Agos River Basin Project (ICCARBP), NWRB shall carry out its own powers and functions originally vested by its Charter and/or Water Code. That may include areas relating to water right coordination, water appropriation among water users at the time of drought, hydrological observations and water related data collection in the Agos River Basin including the Kaliwa and Kanan Rivers, etc.

In addition to these conventional roles, more important matters to NWRB in this implementation stage of the Project, however, are deemed to be prepared for the next stage of the Agos River development/management. For this purpose, there are many for NWRB to learn and acquire from other committee member agencies of various fields of river development/management.

(2) Role of NWRB in ARBC

After the construction completion of the Project, the NWRB is assumed to be the chair agency of the Agos River Basin Committee (ARBC). The River Basin Committee is an organization that is to be upgraded to the River Basin Authority when the idea currently contemplated by NEDA and relevant agencies are realized. Finally, the RBA is expected to be an organ under the umbrella of WRAP as described hereafter in Subsection 11.4.4.

The organizational framework for the development and management of the Agos River Basin is proposed in this Study as depicted in Figure 11.4. As the chair agency of the ARBC, NWRB should solely be responsible for the wide range of areas relevant to the river development and management. These areas comprise water resources conservation sector, which together with water quality management should be the responsibility of DENR, and the flood control sector for which, together with river environment sector, DPWH should be responsible. The sector of water quantity management and water resources development should be covered by the collaboration of all the member agencies including DENR, NEDA, MWSS, DA/NIA, DOE/NPC, DPWH and the Provinces of Quezon and Rizal.

Although powers and functions in coordinating and controlling the river basin development/management as a whole are vested to NWRB as the chair agent of the ARBC, daily routine operational works in every area of development/management works shall be within the responsibility of respective executing agencies. In other words, all the sector-specified operations in this proposed organizational framework are delegated from NWRB as the chair agency of ARBC to each responsible agency.

In line with the expanded range of responsibility, NWRB is required to restructure its functional organization. Five sections at minimum are to be newly established to cover the five water development/management sectors comprising water resources

conservation, water quality management, water quantity management/resources development, flood control, and river environment management. Each section established newly should be staffed with needed workforce who are qualified for each specialized sector.

11.4.4 Recommendations on Strengthening NWRB

(1) Future Vision of NWRB

As stated in the preceding subsection, NWRB is required, after the construction completion of the Project, to be solely responsible for coordinating and controlling the Agos River Basin development and management as a whole as the chair agency of the ARBC. The ARBC may be developed stepwise into the RBA. However, as the Agos River Basin, despite its great importance in supplying water to Metro Manila, is not included in the Major River Basins, an independent RBA for the Agos River Basin may not be necessarily required. It may be crowned with WRAP directly by skipping the level of RBA.

In parallel with the effort for institutional reform of NWRB, there are some areas for NWRB to direct in the short term. They may include the Research and Development (R&D) and Human Resources Development (HRD), both of which will be exercised in the Technology Center of Water Resources Sector newly proposed herein.

These functions in the water resources sector are now dispersed under the responsibility of each agency separately. There must be much duplicated efforts and costs throughout the water sector as a whole. The NWRB is in the right position to take care of these functions comprehensively. The manpower and accumulated expertise of each sector required for this purpose can be transferred to NWRB and reinforced therein.

Although the Department of Science and Technology currently exists as a government agency in the country, the proposed technology center will be the one specified in water resources sector. It is recommendable that NWRB be located in one independent complex where not only the NWRB staff will be housed in a main building but where also the technology center will be accommodated therein. The Technology Center of Water Resources Sector will accommodate all the facilities needed for an R&D and manpower training of the water resources sector.

These areas/facilities to be equipped with the Technology Center will mainly comprise the following related to water resources:

1) Environment Hydraulic Engineering
2) Hydraulic Engineering
3) Environmental Science
4) Geotechnical Earthquake Resistance Engineering
5) Rock Mechanics Engineering
6) Structural Analysis
7) Geo-material Engineering

Such laboratories as geotechnical engineering, environmental science and hydraulic engineering will be established within the NWRB complex. A multipurpose laboratory and a hydraulic engineering yard will also be required.

(2) Recommendations on strengthening NWRB

In the water resources sector of the Philippines, there are many independent agencies that deal with water supply, irrigation, hydropower, flood control, navigation, water pollution, watershed management, etc. With these agencies undertaking programs and projects exclusively within their own sectoral fields of responsibility, conflicts of interest in the utilization of water and overlapping of development activities become more and more apparent. Under this institutional setting, there is a need for an authoritative organization to coordinate and integrate all activities in water resources development and management.

Meanwhile, an essential recommendation is already stipulated in Figure 11.4 that proposes the creation of the Agos River Basin Committee (ARBC). In this committee, the NWRB is positioned as the chair agency of the committee and is vested with powers and responsibilities to administer all the areas of development and management of water resources of the Agos River Basin. The power and responsibility of this water resources administration is actually vested to NWRB through the provision of the Water Code. No new legislative measures will be required for NWRB to establish a committee like ARBC. Only the resolution of the Board of NWRB is needed.

It is recognized that when the new organization, Agos River Basin Committee, is established and functions well, then this will lead to the reform in water resources sector as a whole based on real and holistic needs for development and management of the river basin. In addition, this will also encourage water resources sector approaching to the ideal philosophy for development and management of water resources: "one river, one plan and one management." This is the basic principle of power/function delegation mechanism depicted in Figure 11.4.

In the Master Plan Study of JICA conducted in 1998, an institutional enhancement plan was proposed stepwise, namely:

1) First step: to strengthen NWRB to improve water resources management with the strong recommendation to attach NWRB to the Office of the President and later on to the DENR as an interim measure; and

2) Second step: to create an independent authority for the national and regional water resources development and management.

These are recommendations based on an in-depth study on institutional and organizational sector in the Master Plan Study and are strongly supported by this Study as well. As a matter of fact, the latest enactment of EO 123 seems to indicate one step forward along the direction stated in the above recommendation.

11.5 Implementation Schedule

11.5.1 Proposed Implementation Schedule

In the Master Plan (M/P), completion schedule of the Stage-1 project of Kaliwa-Agos Dam development was assumed to be 2010. This was modified in this study to be 2013 in consideration of the following:

(1) EIA survey identified that the majority of project affected people is reluctant to be relocated. This infers that formation of public acceptance would take a longer time period than the assumed at the time of the Master Plan Study.

(2) In the earlier study, financing from the MWSS's own budget was assumed for the detailed design for enabling the earliest commencement of the Project. In this Study, the financing for the detailed design is assumed to be from ODA fund source, which will also require an extra lead-time.

Thus, the earliest attainable completion schedule of the Stage-1 project is deemed to be Year 2013. In this case, the project can supply water from Year 2014.

Figure 11.6 shows the proposed implementation schedule, which was prepared in due consideration of the water demand-supply balance as explained in Subsection 11.5.2 below.

11.5.2 Water Demand-Supply Balance

Figure 11.7 shows the balance of water demand and supply capacity in the case of commissioning of the proposed project in Year 2013. The demand-supply scenario shown in Figure 11.7 was worked out from the following points of view:

(1) The proposed Project will share the day peak demand of 3,640 MLD (corresponding to the full capacity of the proposed Kaliwa Low Dam- Agos Project) out of the total demand growth of 4,360 MLD arising between the present (4,090 MLD) and Year 2025 (8,450 MLD). The remaining 720 MLD should be met by interim schemes that would be commissioned before the Kaliwa Low Dam- Agos project.

(2) MWSS has decided to implement two interim schemes: that is, a 50 MLD Project at Wawa River and a 300 MLD Project on a performance-based target scheme (one of candidate water sources is the Laguna Lake). The total supply capacity of the two interim schemes is 350 MLD in supply capacity.

(3) This Study assumes that, in order to make up the demand-supply gap arising up to 2025, an additional interim scheme of 370 MLD (720MLD-350MLD) at the minimum should be commissioned in the earliest attainable year (assumed to be 2010 in Figure 11.7). This should be seriously considered by MWSS.

(4) The water demand after 2014 can be met by the water supply from the proposed Kaliwa-Agos Project. However, demand-supply gap would remain until 2016.

Under the condition of limited supply capacity during the period up to 2016, water demand would not grow as originally projected. Figure 11.7 also shows an estimated demand growth curve that would be most likely under the suppressed demand condition. The curve was drawn on a bold assumption that the expansion of service coverage would be slowed down and actual demand would not exceed the actual supply capacity so much due to water rationing inevitably executed by the distributors.

11.5.3 Alternative Implementation Program of the Proposed Kaliwa Low Dam-Agos Project

The proposed schedule (Figure 11.6) assumes that 4 units of water treatment plant (WTP #1-#4) will be commissioned at 3-year interval. This schedule is almost similar to that contemplated in the Master Plan Study. A matter to be noted here is that this program admits the demand-supply gap for the period of 2014-2016.

An alternative schedule may be to commission WTP #2 simultaneously with WTP #1 Unit. In this case, the demand-supply gap in the 2014-2016 period can be eliminated as indicated in Figure 11.7. This alternative plan requires the accelerated completion of the Agos Dam in order to exploit the water resources meeting the required day peak supply of 1,820 MLD (2 units of WTP 910 MLD).

Note: This alternative corresponds to Development Scenario C examined in the M/P.

This alternative development scenario is however not recommendable, since it contains the following difficulties:

(a) The simultaneous implementation of the 'Kaliwa Low Dam+1st Waterway (Stage 1)' and 'Agos Dam (Stage 2-1)' will require a huge amount of initial investment as large as US$ 1.2 billion equivalent (base cost at 2002 price, excluding price contingency, taxes and interest during construction) in one stage.

(b) Even if the supply capacity increases at a large scale at one time, the demand growth would not follow within a short period. A gradual expansion of the supply capacity should be planned.

For the above reasons, the implementation schedule shown in Figure 11.6 is proposed to be the most practical plan.

11.6 Comparison with Other Implementation Options

This Feasibility Study proposes the implementation of Kaliwa Low Dam-Agos Dam project to be mobilized immediately as the priority project. While, two other alternative development options have been contemplated by MWSS (as of October 2002). These are indicated as Plans F and G in the table below, while the plan proposed in this Study is shown as Plan B:

Alternative Development Plans

Plan	Stage 1 (Around 2013)	Stage 2-1 (2015-16)	Stage 2-2 (2019-25)	Remarks
B	Kaliwa Low Dam + Kaliwa-Taytay 1st W'way (550 MLD)	Agos Dam (1,500 MLD)	Kaliwa-Taytay 2nd W'way (3,000 MLD)	Correspond to Scenario B in M/P
F	Laiban Dam + Laiban-Taytay W'way (610 MLD)	Expansion of WTP 610 MLDx2 (1,830 MLD)	Agos Dam + Kaliwa-Taytay W'way (3,330 MLD)	Correspond to Scenario F in M/P
G	Kaliwa Low Dam + Kaliwa-Taytay 1st W'way (550 MLD)	Laiban Dam (1,500 MLD)	Agos Dam + Kaliwa-Taytay 2nd W'way (3,000 MLD)	Correspond to Scenario G in M/P

Notes: (1) MLD is expressed in terms of daily average supply volume at the end of each stage. Day peak capacity of the proposed waterway facilities is 1.21 times the daily average.
(2) In this Study, the supply capacity of Laiban Dam was assessed as 1,830 MLD, which is almost equal to that planned in the previous study (1,900 MLD).

The above three Plans are compared from three (3) aspects as stated below.

(1) Demand-Supply Balance

Commissioning schedule of the three plans is shown in Figure 11.8 in a comparative form. Similar demand-supply gap is inevitable for all the Plans due mainly to the limited input of interim schemes in preceding years. In this regard, the three Plans are compared almost equally.

(2) Risks in the Implementation

As shown in the table above, the main water sources are two, Agos Dam and Laiban Dam. Hence, a primary decision to be given would be which dam should be implemented first. Table 11.1 shows the technical comparison between the Agos Dam project and the Laiban Dam project for some major items.

Comparing the two dams, it is noted that Laiban Dam project has been suspended for 18 years due to the difficulty of solving the resettlement issue (some 3,000 families to be relocated). Dialogue with and relocation arrangement for 3,000 families are indeed a great task. Mainly in this respect, the implementation of the Laiban Dam project appears to involve the following risks:

- Delay in the commencement of the project if the consent from the people is difficult to obtain, or the failure of acquiring the consent in the worst case
- Difficulty of assuring the funding resources for the construction works, whatever it is from ODA source or BOT source, unless a complete solution of the resettlement issue becomes foreseeable
- Possibility of unexpected delay in construction works due to troubles that may be raised by the PAPs

The possibility of success of solving this issue should be looked into carefully by MWSS prior to the resumption of dialogue with the people if it is attempted.

(3) Cost Effectiveness

For reference purpose, the table below shows the comparison of unit water cost index among the three Plans, which was evaluated in the M/P and updated in this feasibility study.

Summary of Comparison of Unit Water Cost Index

Plan/ Scenario	Proposed Scheme	Project Cost *1 (US$ Mil.)	Present Worth		Equalizing Unit Water Cost *2 (US$/ m^3)
			Water Volume Supplied (Mil. m^3)	Cost to be Recovered (US$ Mil.)	
B	Kaliwa Low Dam + Agos Dam	1,731	1,384	1,040	0.309
F	Laiban Dam + Agos Dam	2,064	1,503	1,041	0.329
G*3	Kaliwa Low Dam + Laiban Dam + Agos Dam	2,102	1,384	1,040	0.357

Notes: *1 Base cost estimate at 2001 price, comprising construction cost, land acquisition/resettlement cost, engineering/administration cost and physical contingency.

*2 Unit water cost at 2001 price, which equalizes the present worth of costs and the present worth of water sale amount, discounted at 12% per annum. The water sale price is escalated at 3% per annum. (See Section 7.4 of the M/P Main Report (Volume II) for detailed definition of the unit water cost index.)

*3 Plan G above is slightly different from Scenario G in M/P in strict term. The former assumes the waterway for 3,000 MLD as contemplated by MWSS, while the latter was planned to have waterway for 3,430 MLD.

Plan G is a variation of Plans B. The Stage 1 project is identical to the Plan B, but in Stage 2 the Laiban Dam is proposed as a main water source to be commissioned first prior to the Agos Dam. Comparing the index values shown in the table above, Plan G is assessed to be less favorably. This is due to the additional cost requirement for the Laiban Dam, while Plan B requires only the Agos Dam. Hence, the Plan G is not recommendable.

On the basis of comparison over a long time span (up to 2025), Plan B is also more favorably assessed than the Plan F.

(4) Recommended Solution

Based on the comparisons stated above, this Feasibility Study strongly recommends the earliest implementation of the proposed Kaliwa Low Dam-Agos Dam project.

The major reasons are summarized below:

(a) The project is only a solution capable of supplying water meeting the full water demand up to Year 2025 by a single project.

(b) Comparison of unit water cost in the Master Plan (M/P) showed that this development scenario is the least cost solution.

(c) The project involves less extent of social problems compared with the Laiban Dam, which is an important factor not to cause the delay of the implementation.

(d) The project has a sufficient tolerance for the extreme droughts. The project is designed for the drought of 10-year recurrence probability, but could supply the designated quantity even under an extreme condition of 30-year drought if the water allocated to hydropower is used for the water supply as an emergency case.

MWSS shall review the implication of this recommendation and mobilize the project to move to the next phase at the earliest time.

11.7 Critical Activities for the Earliest Implementation

Among various activities involved in the implementation, noteworthy items needing special attention are stated below.

(1) Early Decision of Further Proceeding of the Project

As indicated in Figure 11.6, demand-supply balance is projected to become more serious year by year as the completion of the Kaliwa-Agos project delays. The project should be mobilized as early as possible. In this context, the Executing Agency (MWSS) shall make the earliest decision of the implementation of the Project.

(2) Dialogue with the Project Affected People

As soon as the decision for (1) is made, the initial activity to be hastened is the commencement of dialogue with the project-affected people (PAP), especially those living in the proposed Agos Reservoir area. Although the Agos Dam is scheduled under the Stage 2-1 project, its relocation issue is the governing factor determining the social acceptability of the entire project. Hence, the dialogue should be commenced as an initial mobilization activity.

Environmental Impact Assessment (EIA) has revealed that the majority of households in the proposed Agos Reservoir area (50 % in socio-economic survey and 82 % in focus group discussion) expressed 'no or not willing' attitude to the relocation. However, it is expected that people's attitude would change if proper resettlement plan is presented in the dialogue. The number of resettlers is within a manageable range, 174 households, which would not require so long period to complete the dialogue successfully.

The dialogue will be carried out in form of interviews to individuals, focus group discussion and public consultation as conducted during this Feasibility Study stage. Formation of the people's general acceptance through this activity would be a prerequisite requirement for acquiring the financing from funding agencies.

(3) Acquisition of Environmental Clearance Certificate (ECC)

Actions for acquiring the ECC should be commenced in parallel with (2) above. The application documents (EIS) could be prepared using the materials produced by the EIA under this F/S. The EIA has identified no major natural environmental issues that would seriously affect the implementation of the Project. Aside from the relocation issue, representatives of the local government offices and local people expressed their general understanding to the Project at the workshops held during this Feasibility Study.

An item to be clarified for acquiring the approval of the ECC is the resettlement issue mentioned in (2) above. The application should state the complete details of the proposed resettlement plan (RP) including the follow-up programs (such as income restoration plan and livelihood supporting program) and also the proposed process of coordination with the LGUs.

(4) Financing for the Implementation

Initial fund requirement is the fund for the Stage 1 project. However, the evaluation by funding agency will be made for the entire components of the Project to assess the project viability and socio-environmental aspects as a whole.

In view of the magnitude of the proposed Project, especially in terms of investment cost, both the government and funding agency would take prudent steps in deciding the proceeding of the implementation. In this respect, this Study proposes to acquire initially the approval and financing for the detailed engineering design as the first step as shown in Figure 11.6.

Table 11.1 Comparison of Agos Dam Project and Laiban Dam Project (1/2)

Item	Agos Dam Project	Laiban Dam Project
Development Plan		
Development Scale	3,000 MLD (daily average production) 3,640 MLD (day peak capacity)	1,830 MLD (daily average production) *1 2,220 MLD (day peak capacity)
Supply Capability	Capable to meet all demand up to the year 2025 by a single project	Need to add Agos Dam for meeting demand of the year 2020 onward
Unit Water Cost Index	US$ 0.379/m^3 (Plan B) (Evaluation in M/P)	US$ 0.390/m^3 (Plan F) US$ 0.380/m^3 (Laiban alone) (Evaluation in M/P)
Hydrological Features		
Exploitable Water	61.0 m^3/sec - For water supply: 34.7 m^3/sec - For power & downstream: 26.3 m^3/sec	21.2 m^3/sec - All water delivered to water supply conveyance system
Reservoir Water Circulation	Annual inflow volume / Reservoir effective volume =10.03 Annual water use volume / Reservoir effective volume =5.33	Annual inflow volume / Reservoir effective volume =1.57 Annual water use volume / Reservoir effective volume = 1.43
Dry Season Flow in the Agos Lower Reach	26.3 m^3/sec (daily average flow) Note: Present 90% and 95% discharges at Agos damsite are 30.2 m^3/sec and 23.6 m^3/sec, respectively.	21.2 m^3/sec (daily average flow) Note: - do. left -
Reservoir Service Life	100 years at a sediment yield rate of 1,046 m^3/km^2/year	40 years at a sediment yield rate of 1,000 m^3/km^2/year
Tolerance for Droughts	Planned for 10-year probable drought, but capable to supply under a 30-year drought condition if hydropower water is used	Planned for 10-year probable drought (in M/P of this Study)
Implementation Plan		
Completion Year	2013 (Stage 1)	2013
Implementation Cost	US$ 1,730 million equiv. (Plan B) - Stage 1: 1st Waterway 510 - Stage 2-1: Agos Dam 675 - Stage 2-2: 2nd Waterway 545 (Estimate in F/S)	US$ 2,060 million equiv. (Plan F) - Stage 1: Laiban Dam+1st Waterway 870 - Stage-2: Agos Dam+2nd Waterway 1,190 (Estimate in M/P)
Land and Resettlement		
Reservoir Impounded Area	19.1 km^2 at FSL 159 m	20.2 km^2 at FSL 270 m
Resettlement Requirement	Dam and Reservoir: 180 families Waterway: 220 families	Dam and Reservoir: about 3,000 families Waterway: 300-400 families (Estimate in M/P)
Land and Resettlement Cost Estimated	US$ 45 million equivalent or Peso 2.4 billion (Estimate in F/S)	US$ 96 million equivalent or Peso 5.0 billion (Estimate in M/P)

Note: *1; Designed as 1,900 MLD in MWSP III Project

(Continue)

Table 11.1 Comparison of Agos Dam Project and Laiban Dam Project (2/2)

Item	Agos Dam Project	Laiban Dam Project
Facilities		
Dam	Type: Concrete face rockfill dam Embankment Volume: 13 million m^3 Dam Height: 165 m	Type: Concrete face rockfill dam Embankment Volume: 6.2 million m^3 Dam Height: 115 m
Waterway	(Kaliwa-Taytay Waterway – 2 lines) Waterway Length: 38.8 km - Tunnel Portion: 33.9 km - Open-air Work Portion: 4.9 km Diameter: 3.3-3.5 m	(Laiban-Taytay Waterway, for Laiban Dam) Waterway Length: 23.8 km - Tunnel Portion: 14.1 km - Open-air Work Portion: 9.7 km Diameter: 2.7- 3.2-3.6 m (Kaliwa-Taytay Waterway, for Agos Dam) Same as left
PUMP-up of Water to Antipolo	Pump Station: EL. 60 m Antipolo Service Reservoir: EL.260 m Pump Head (statical): 200 m	Pump Station: EL. 90 m Antipolo Service Reservoir: EL.260 m Pump Head (statical): 170 m
Service Reservoir	Volume: 720,000 m^3 in total (in 4 stages) Water Level: EL. 72 m (HWL)	Volume: 360,000m^3 in total (in 3 stages) Water Level: EL. 104.5 m at reservoir EL. 78 m at pressure control station
Technical Aspects to be Further Detailed.	Dam Foundation Design: Additional field investigation shall assess whether the river deposit (40 m thick) could be used as a part of dam foundation. Impact to Infanta Coast: F/S assessed that the impact would be within a manageable range by providing technical countermeasures. Further study should be made based on the measurement of in-situ conditions and through a detailed simulation analysis.	Reservoir Watertightness: Spot discharge measurement conducted during F/S revealed that a part of the Lenatin discharge infiltrate into limestone mass and does not return back to the damsite. This aspect should be looked into by subsequent discharge measurements in order to eliminate any concern for leakage of reservoir water. Sediment at Intake: Intake sill level seems not so high compared with the level of the river channel. A further analysis is recommended to assess the sediment level at this site, since excessive sedimentation would cause the clogging of the bottom intake mouth.
Socio-Environmental Aspects	Natural Environment: No major natural environmental problem is predicted. Resettlement Issue: No strong opposition to the extent of rejecting the project has been raised from both the LGUs and people. About 50-80 % of PAF in the proposed reservoir area is not willing to be relocated. But, this is within a manageable range in view of limited number of PAFs (174 families). Implementation of a proper resettlement plan could solve the issue.	Natural Environment: No major natural environmental problem is predicted Resettlement Issue: In view of the size of resettlement requirement and background to date, this issue involves many hurdles. The major hurdles are: - About 15-25 % of PAFs seems in the attitude of strong objection to the relocation. - Resettlement site meeting the requirement of PAF is difficult to find in the vicinity. Palayang Bayan (60 ha) can provide only residential lots. People in San Ysilo reject the resettlement of PAFs from the reservoir area. The issue seems to involve a great risk of failure in formulating the public acceptance.

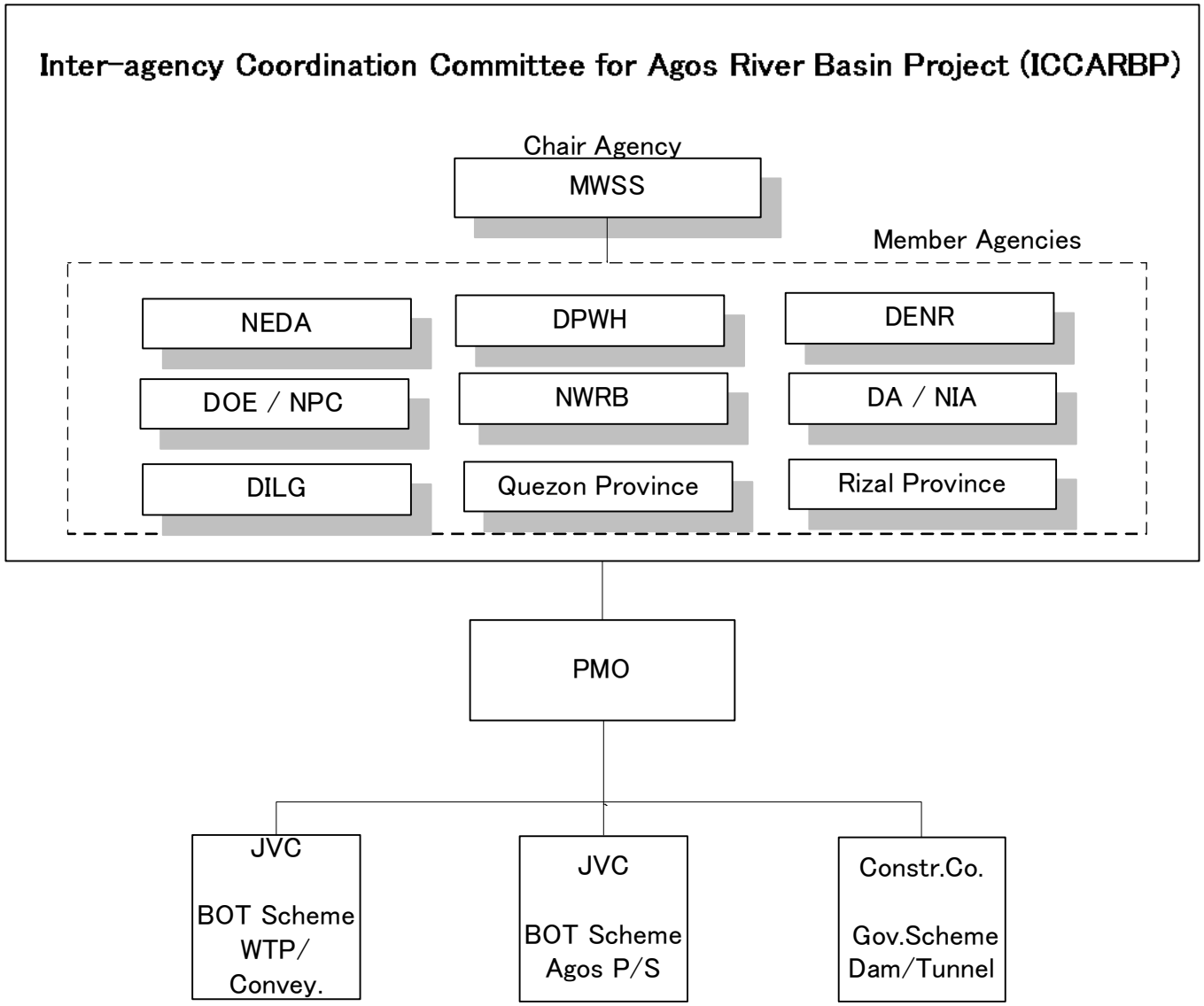


Figure 11.1 Proposed Basic Organizational Structure for Project Implementation

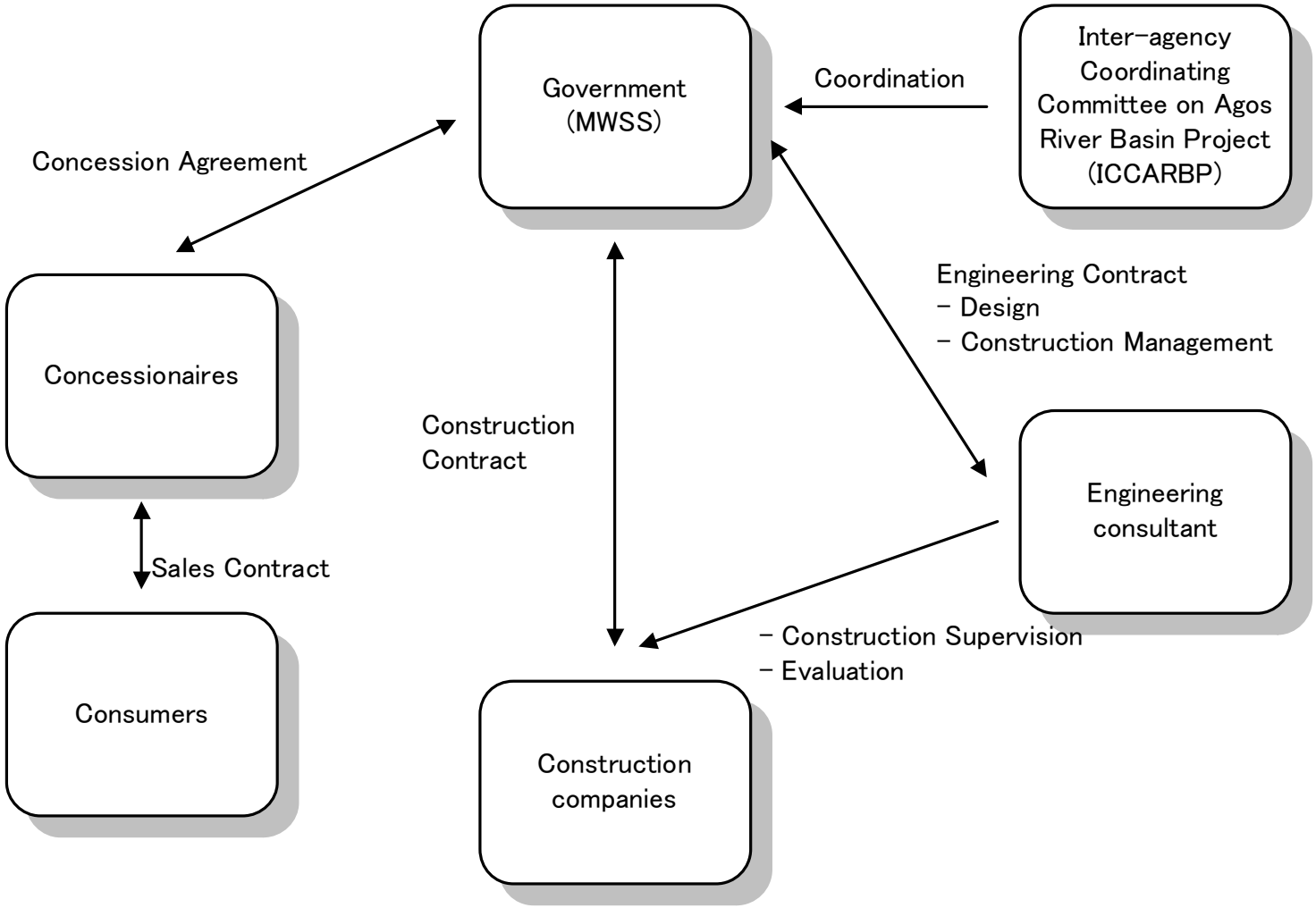


Figure 11.2 Schematic Framework of Government Scheme

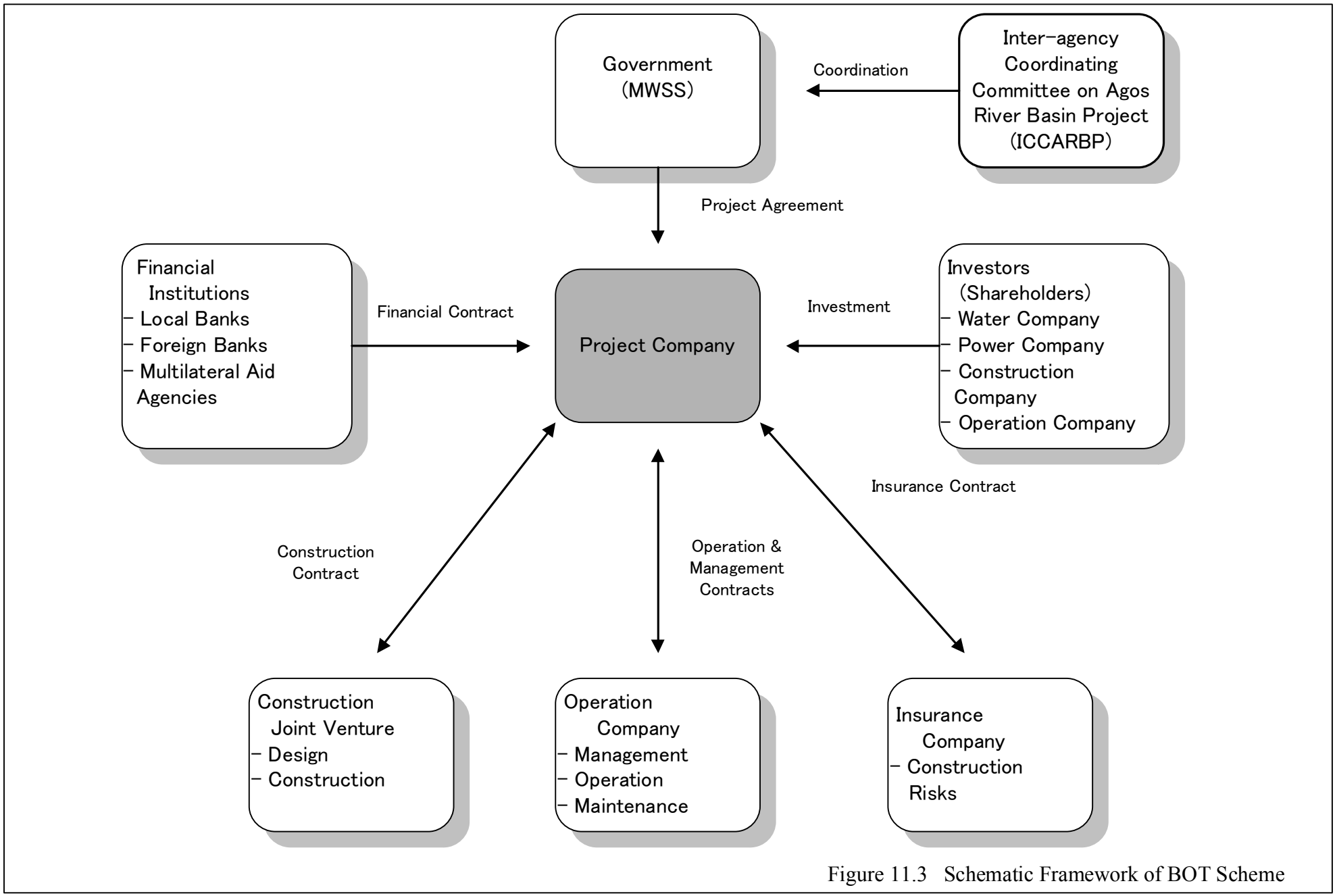


Figure 11.3 Schematic Framework of BOT Scheme

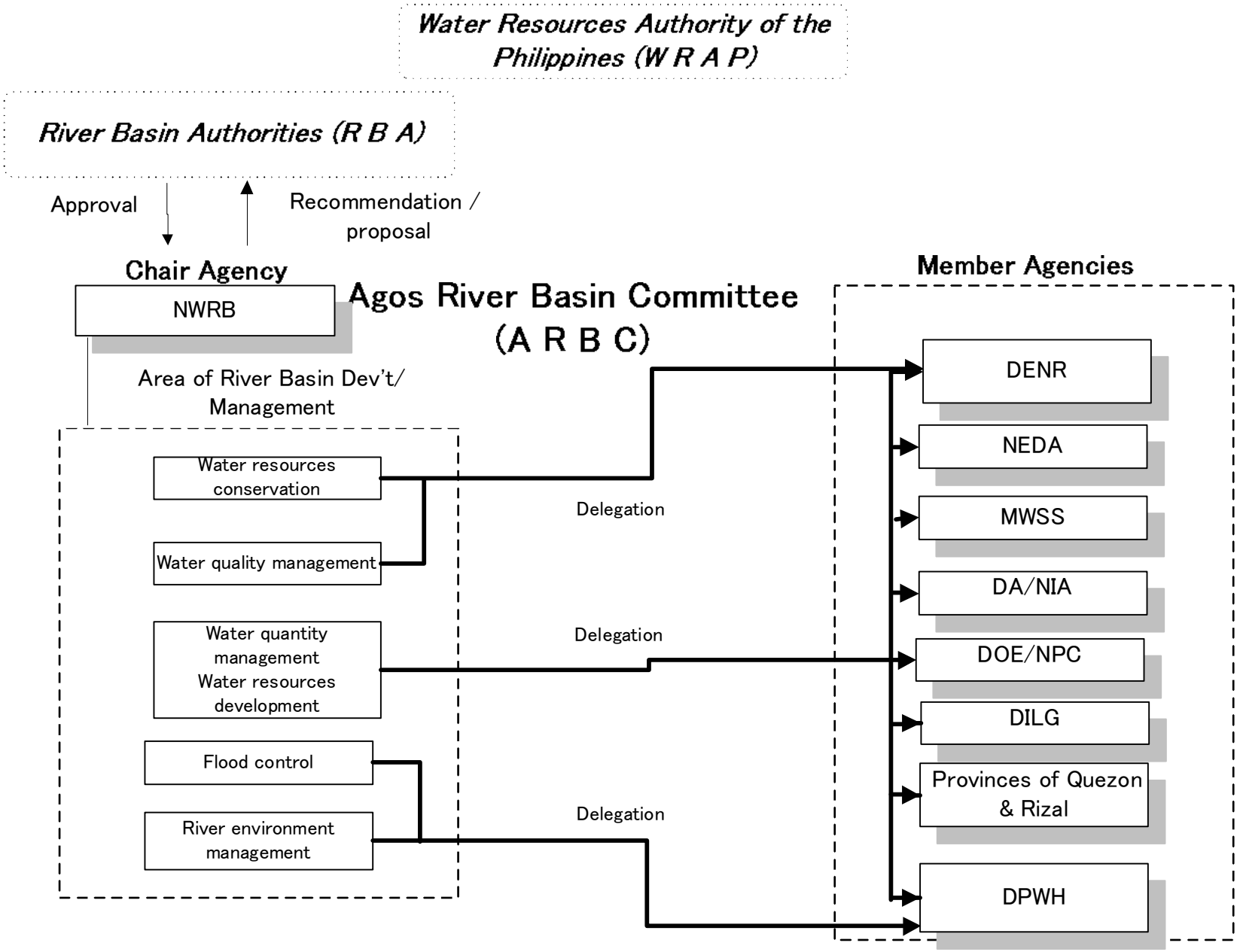


Figure 11.4 Proposed Organizational Framework for Development and Management of Agos River Basin

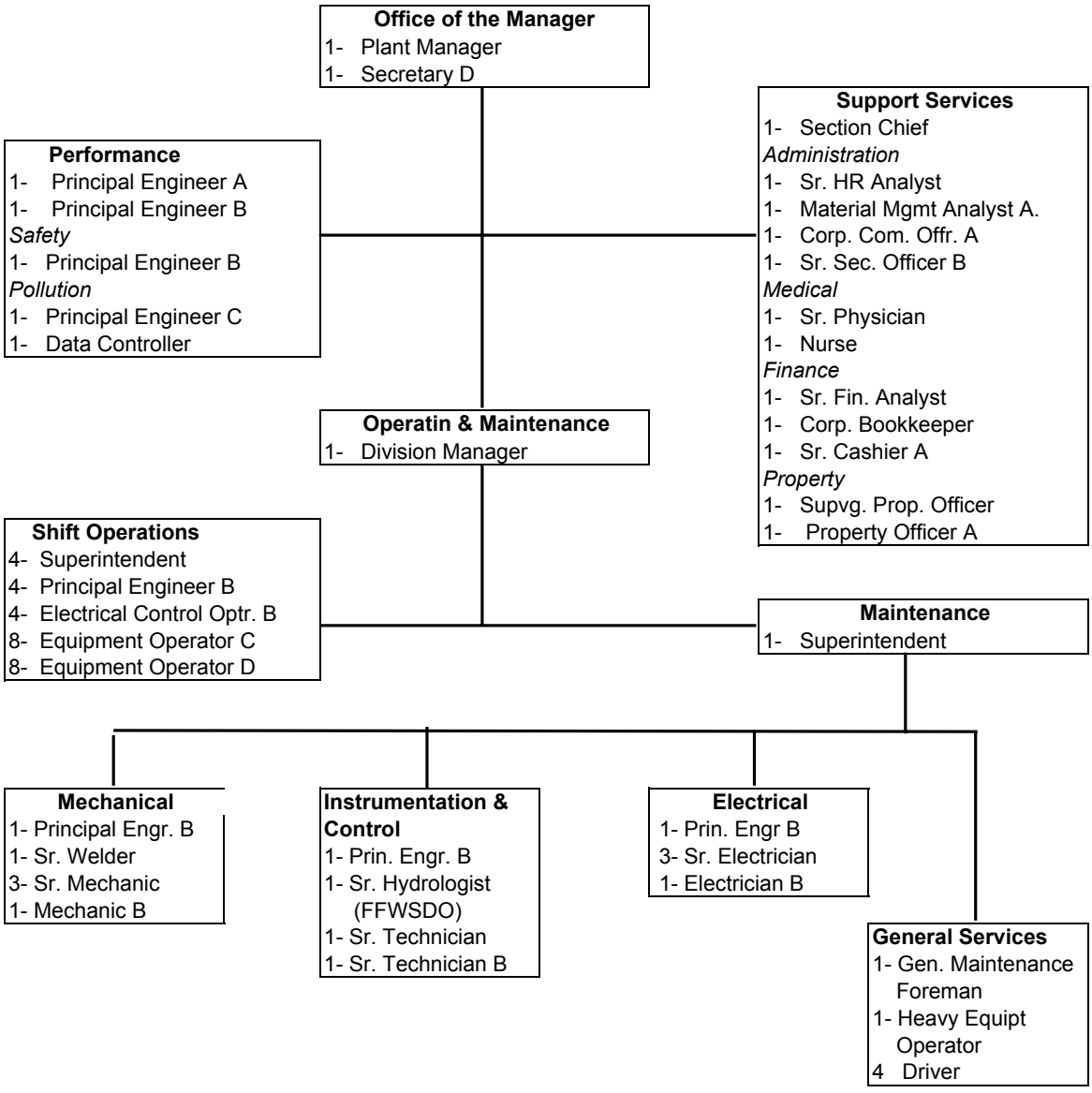
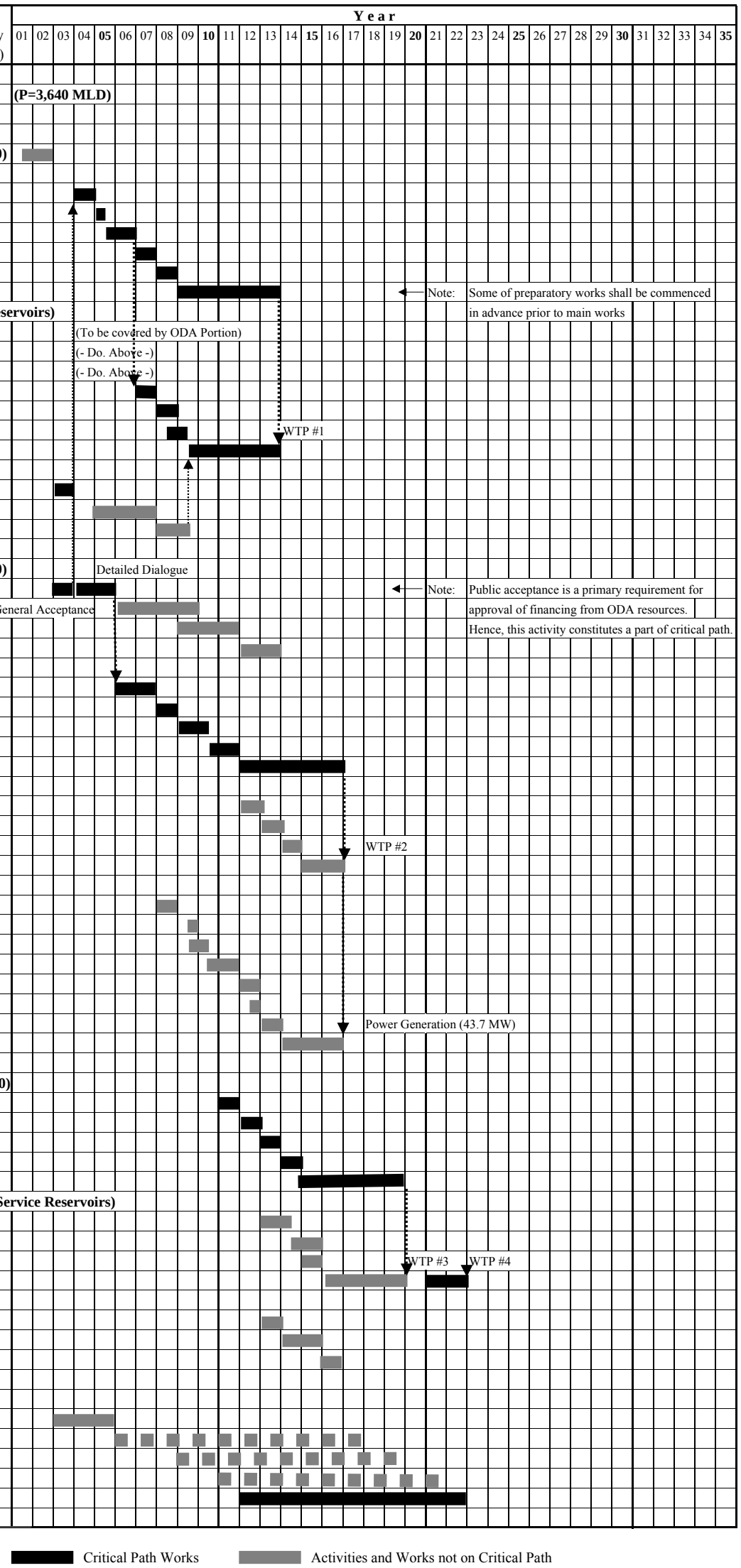


Figure 11.5 Organization of O&M Staff for Existing Angat Hydropower Plants

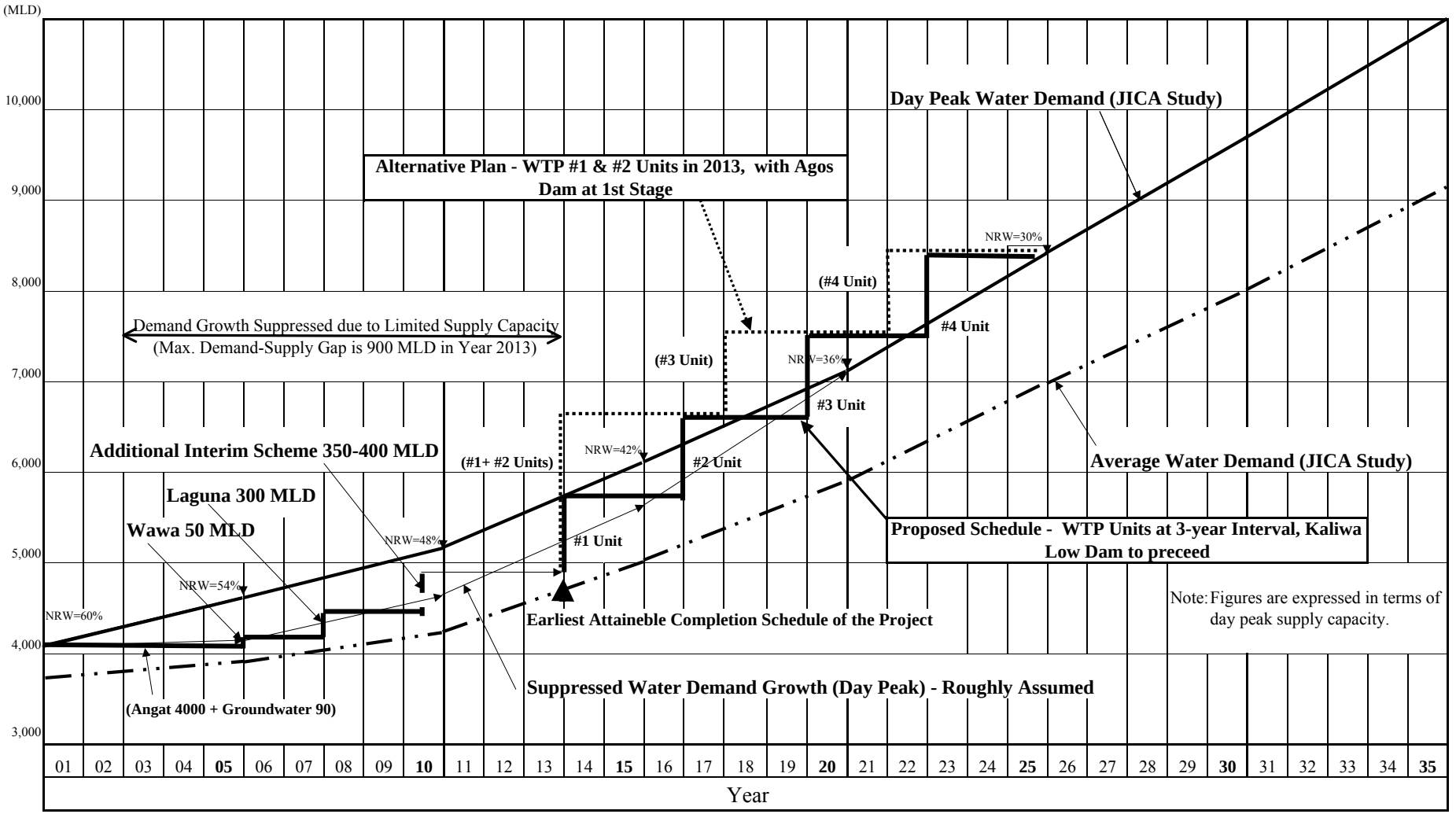
Plan No.	Description	Water Supply (MLD)
AGOS DAM DEVELOPMENT		**3,000**
Stage 1	**Kaliwa Low Dam with Kaliwa-Taytay 1st Waterway**	**750**
(B-1)	**Feasibility Study under JICA Development Study**	**(P=910)**
	Implementation of ODA Portion (Kaliwa Low Dam+1st Waterway Tunnel)	
	- Financing for Detailed Design	
	- Selection of Consultant	
	- Detailed Design and Tender Documents	
	- Financing for Construction	
	- Tender and Evaluation	
	- Construction	
	Implementation of BOT Portion (WTP #1 Unit + 1st Waterway up to Service Reservoirs)	
	- Financing for Basic Design (MWSS Own Finance)	
	- Selection of Consultants	
	- Basic Design and BOT Tender Documents	
	- Tender for BOT Contract	
	- Financial Arrangement (by BOT Contractor)	
	- Detailed Design and Work Procurements	
	- Construction	
	Land Acquisition and Compensation (Mainly for BOT Portion)	
	- Dialogue with Affected People	
	- Land Acquisition and Compensation	
	- Relocation of People	
Stage 2-1	**Agos Dam + WTP #2**	**750**
(B-2-1)	**Land Acquisition and Compensation**	**(P=910)**
	- Dialogue with People to be Inundated by Reservoir	
	- Land Acquisition and Compensation	
	- Resettlement Site Infrastructure	
	- Relocation of Households	
	Implementation of ODA Portion (Agos Dam)	
	- Financing for Detailed Design and Construction	
	- Selection of Consultants	
	- Detailed Design and Tender Documents	
	- Tender and Evaluation	
	- Construction of Agos Dam	
	Implementation of BOT Portion (WTP #2 Unit)	
	- Negotiation with BOT Concessionaire	
	- Financial Arrangement	
	- Detailed Design	
	- Construction	
	Implementation of BOT Portion (Agos Hydropower)	
	- Financing for Basic Design (MWSS Own Finance)	
	- Selection of Consultants	
	- Basic Design and BOT Tender Documents	
	- Tender for BOT Contract	
	- Financial Arrangement	
	- Procurement of EPC Contracts (by BOT Contractor)	
	- Detailed Design	
	- Construction	
Stage 2-2	**Kaliwa-Taytay 2nd Waterway + WTP #3 & #4**	**1,500**
(B-2-2)	**Implementation of ODA Portion (2nd Waterway Tunnel)**	**(P=1820)**
	- Financing for Detailed Design and Construction	
	- Selection of Consultants	
	- Detailed Design and Tender Documents	
	- Tender and Evaluation	
	- Construction	
	Implementation of BOT Portion (WTP #3 & #4 Units and 2nd Waterway up to Service Reservoirs)	
	- Negotiation with BOT Concessionaire	
	- Financial Arrangement	
	- Detailed Design	
	- Construction	
	Land Acquisition and Compensation (Mainly for BOT Portion)	
	- Dialogue with Affected People	
	- Land Acquisition and Compensation	
	- Relocation of Households	
-	**Installation of Trunk Distribution Mains (by Distribution Concessionaires)**	
	- Agreement of Installation Programs	
	- Financial Arrangement by Concessionaires	
	- Detailed Design and Tender Documents	
	- Procurement of Contracts	
	- Installation of Trunk Distribution Mains in Stages	



Note: Completion schedule of the Agos Dam development was assumed to be 2011 in the earlier Study (Interim Report). This is modified to 2013 in consideration of the following:
(1) EIA survey identified the relatively strong opposition from local residents. This infers that time requirement for getting the public acceptance should be longer.
(2) Financing for detailed design is now assumed to be from ODA fund resources, which will require some lead time.
In the earlier study, financing from MWSS own budget had been assumed for the detailed design to expede the implementation.

P=: Day peak water supply capacity,
BOT: Build, operate and transfer,
EPC: Engineering, Procurement and construction

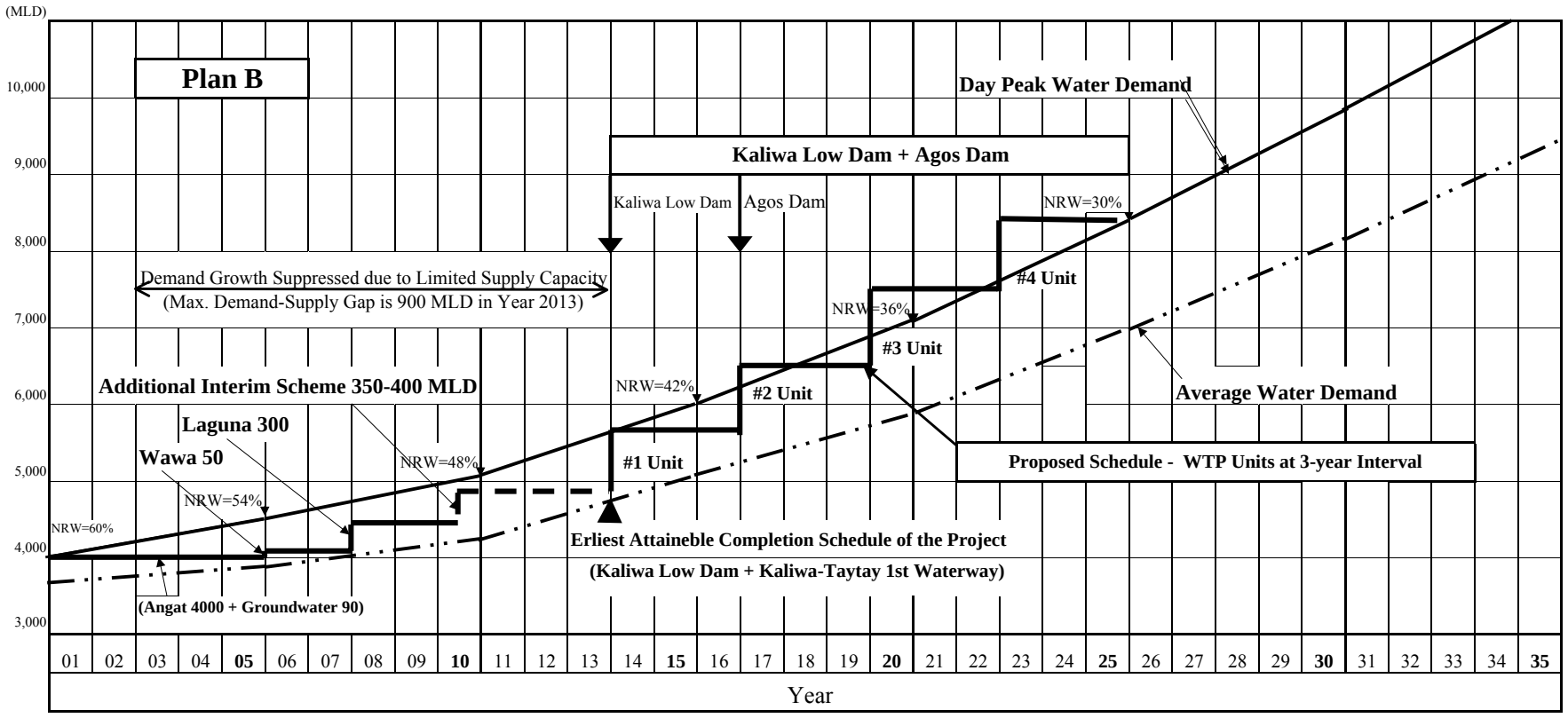
Figure 11.6 Implementation Schedule of the Proposed Project (Schedule Meeting Demand up to Year 2025)

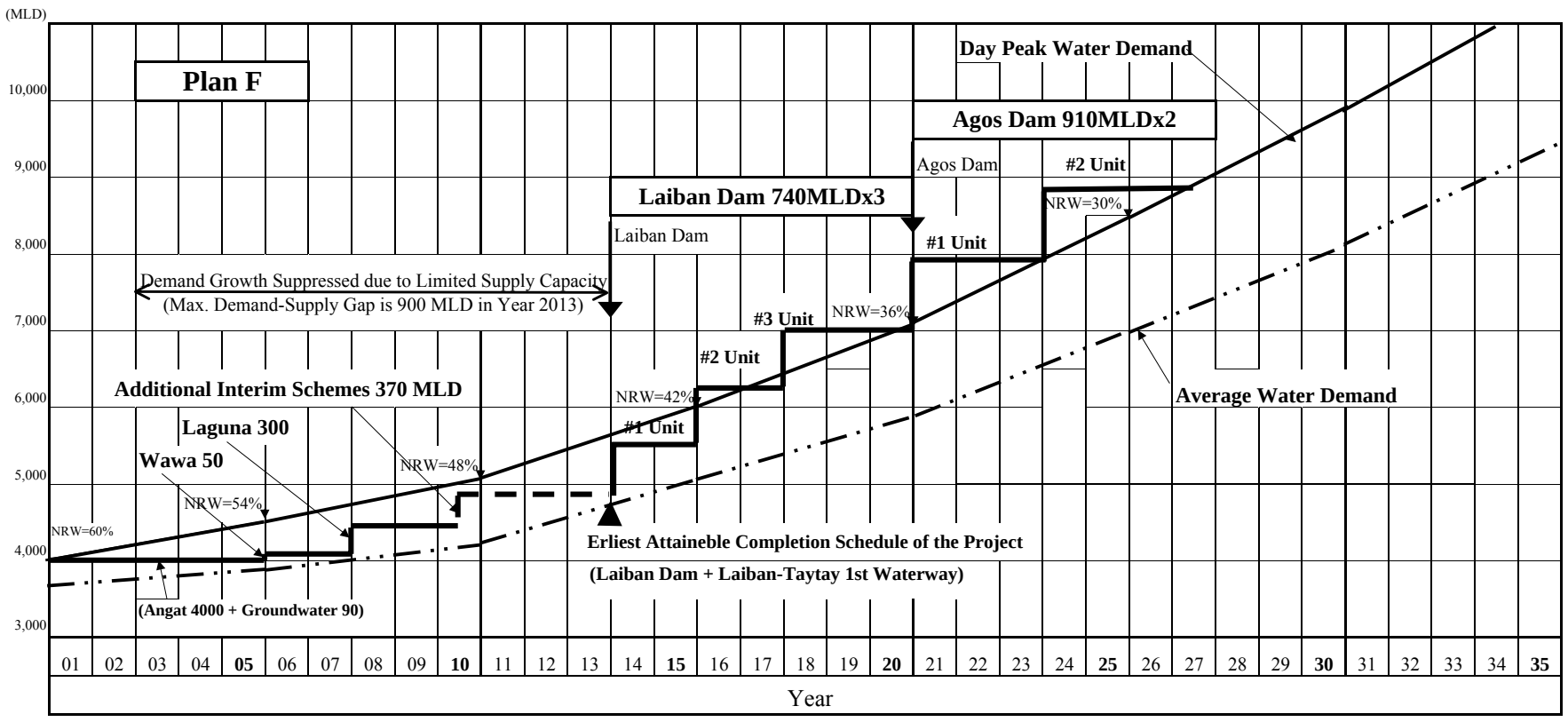


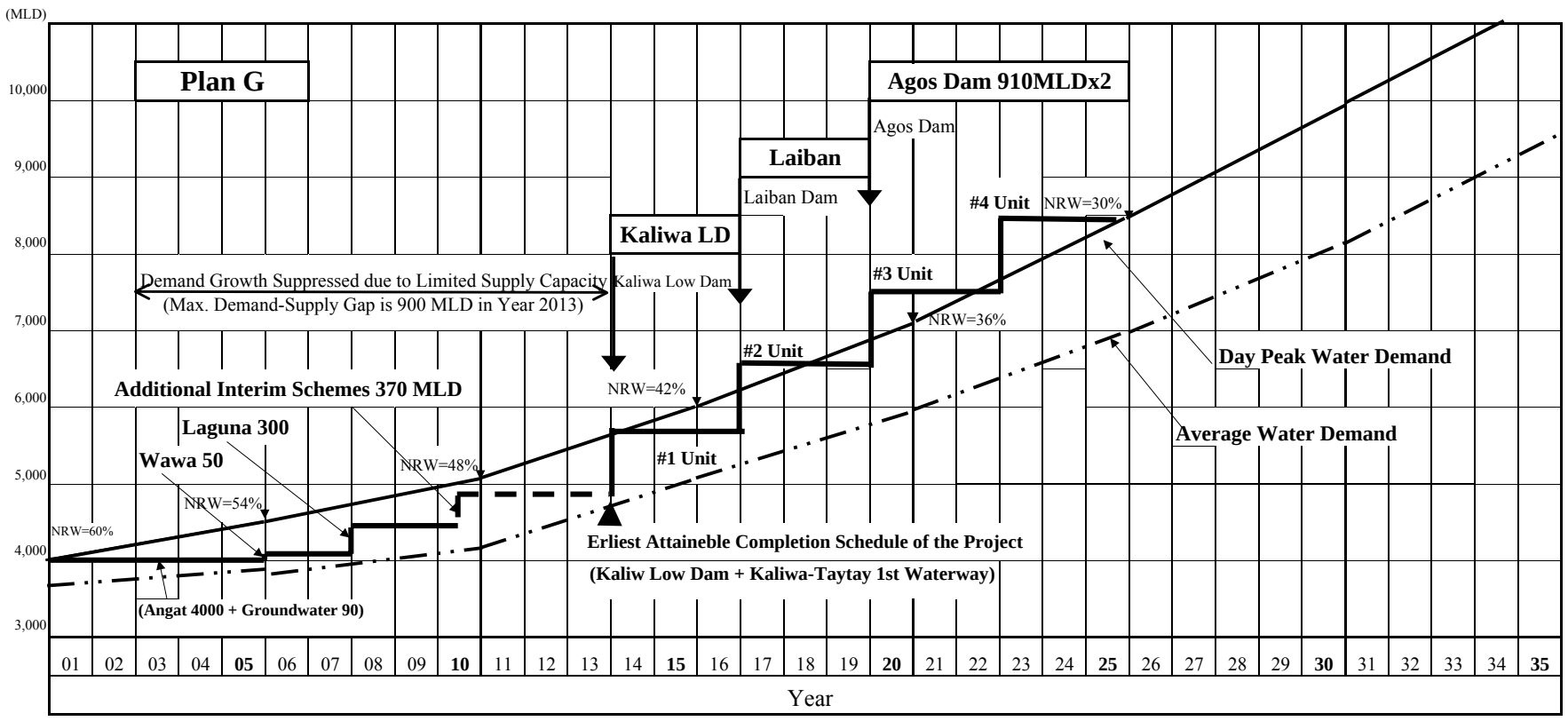
Note: 1. In terms of demand-supply balance, most critical period will continue until 2013. This may cause the suppression of water demand growth to a serious extent for more than 10 years.

2. In the above case, maximum demand-supply gap is as large as 900 MLD in 2013. This suggests the need of either the additional input of Interim Schemes or the acceleration of NRW Reduction program.

Figure 11.7 Day Peak Water Demand and Supply Capacity Balance







Note: WTP capacity shown in MLD above represents the day peak production capacity.
Daily average production is about 82 % of the day peak capacity on the basis of day peak factor of 1.21(1/1.21=0.82).

Figure 11.8 Alternative Development Scenarios - Day Peak Water Demand and Supply Capacity Balance

CHAPTER XII EVALUATION OF THE PROJECT

12.1 Framework of Project Evaluation

In line with the recent government policy for public works project, the Project is contemplated mainly under the private sector investment, namely on BOT basis, excluding one government-initiated scheme. However, before proceeding to financial analysis, the Project is to be evaluated from the point of view of national socio-economy as a whole. Actually, the ICC of NEDA requests all the BOT applications to be evaluated from the point of view of the socio-economy as a whole. In this Chapter, the project evaluation is carried out from both economic and financial aspects with a framework shown below:

Framework of the Project Evaluation

Project components Abbreviations	Raw water supply GOVw	Treated water supply BOTw	Agos Hydropower BOTa
Construction	Dam / tunnel	WTP/conveyance	Power station
Executing agency	MWSS	Project company	
Project structures	Government initiated	BOT basis	
Fund sources	ODA loan, DFI loan, Government contribution	Equity capital, DFI loan, Commercial loan	
Economic evaluation			
Viewpoint of analysis	Socio-economy as a whole		
Evaluation criteria	EIRR		
Financial analysis			
Viewpoint of analysis	GOP (MWSS)	Project company	
Evaluation criteria	Loan repayment	FIRR, ROE, WACC and DSCR	

The general conditions of the whole project evaluation are described hereunder.

(1) Division by scheme

As shown in the above table, the whole project is physically composed of three (3) schemes namely a raw water supply scheme to be administered by government (GOVw), a water treatment and conveyance scheme to be managed on BOT basis (BOTw) and a hydropower generation scheme to be built on BOT basis (BOTa). Therefore, financial analysis is conducted for each of these three schemes. While, economic evaluation is conducted for two aspects: one for an integrated water supply scheme combining GOVw and BOTw, and another for an independent hydropower generation scheme, BOTa. The reason why GOVw and BOTw schemes are evaluated as the integrated one is that these two schemes have the common purpose to supply water to Metro Manila and that they can function only when they are operated in combination.

(2) Joint cost allocation

The joint cost of the Agos Dam that is defined as such cost that gives benefits commonly to either the water production or the hydropower generation was first tested if it can be partially borne by the Agos hydropower scheme. After

examination, however, it was found that the hydropower scheme is not so beneficial that it can bear any portion of the joint cost of the Agos Dam. Therefore, all the joint cost of the Agos Dam was allocated to the GOVw scheme.

(3) Loss of water and power

The physical loss and NRW in total were assumed to be 1% for the GOVw scheme (from the intake at the dam to the entrance of WTP) and another 1% for the BOTw scheme (from the entrance of WTP to the exit of service reservoirs). These losses are incorporated in the computation for evaluation.

(4) Pertinent costs

The costs for coastal monitoring near Infanta and landslide prevention at the Agos Dam reservoir are not included in the project cost. However, there is a possibility of incurring such costs depending on the actual field conditions in the future when the Project is implemented. Hence, they are incorporated in the project evaluation as operation and maintenance costs of the Project. They are included in the cost of GOVw scheme.

12.2 Economic Evaluation

12.2.1 Conditions and Assumptions

The following conditions and assumptions are made for the economic evaluation.

1) The project cost is estimated as described in Chapter IX of this Volume IV.

2) The monetary value is in principle indicated in US Dollar. The foreign exchange premium is adjusted to reflect real value by applying a standard conversion factor of 0.83 that was utilized in a recent appraisal report of Water Resources Development Project in the Philippines conducted by the World Bank. This adjustment is needed as there is a gap between the official exchange rate and real exchange rate due to the scarcity of foreign currency in the country.

   The US Dollar is adopted in estimating the local currency portion to avoid the influence of the possible future fluctuation in the foreign exchange rate of the Philippines Peso.

3) The shadow pricing of the wage rate for unskilled labor is incorporated in such a way that 10% of the local currency portion in average is assumed as unskilled labor wage. This portion is discounted by 50% for shadow pricing of the unskilled labor. Under the current labor market situation with the unemployment ratio of around 11% throughout the country, this shadow pricing is deemed necessary.

4) The economic value of the land to be committed to the Project including those to be submerged by the reservoirs is to be shadow-priced by estimating the value of the production foregone. In case of the present Project, however, this conventional way was not adopted. Instead, the land acquisition and resettlement are treated in such a way that all the people to

be displaced by the Project will be recovered the same conditions as they received before the displacement in terms of either land and/or housing. These costs are incorporated in the Project cost.

5) The operation and maintenance costs of the facilities to be built by the Project are incorporated in this economic evaluation by the following manners:

   i) For facilities of civil works like dams, waterways and powerhouse buildings: 0.5% of capital cost;

   ii) For metal works/equipment: 2.5% of capital cost

6) The evaluation period is taken at 50 years from the start of construction of the first stage. The replacement of metal works/equipment is considered for 90% of the capital costs every 20 years.

7) In this Study, the water tariff rate is considered to be the minimum level of consumers' willingness to pay for water. In order to make water tariff comparable to project cost, we added to the Project cost such non-project cost as those of distribution mains and pipeline networks for the sake of economic evaluation.

8) The loss of water was taken into account in such a manner that 2% loss was assumed on the way from the water intake at dam site to the exit of service reservoirs, and thereafter NRW was considered according to the water supply program showing gradual improvement from the current level of 50-60% to 30% in and after 2025.

9) The opportunity cost of capital is assumed at 12% in this Study following recent practices of similar studies in the Philippines.

12.2.2 Derivation of Economic Cost

The base cost (at 2002 market prices) of the Project including direct cost, indirect cost of engineering, administration costs and physical contingency is estimated as shown in Table 12.1. The base cost is adjusted to economic cost based on the conditions and assumptions stated in the preceding subsection 12.2.1.

12.2.3 Estimate of Economic Benefit

The economic benefit is composed of three sources: the benefit from domestic and municipal water supply, hydropower generation and external benefit.

(1) Water supply (Integration of GOVw and BOTw)

In principle, economic benefit of water supply project is measured by consumers' willingness to pay (WtP). The WtP represents how much consumers are ready to pay for the satisfaction or utility they expect to obtain from utilizing water. The WtP naturally differs by quality of the water as the satisfaction or utility of water differs by the quality of water.

Apparently, consumers' water demand is composed of two parts in terms of quality; one is non-quality water for general use including washing clothes, water closet,

bathing, cleaning, gardening and others, and the other is quality water for drinking and/or cooking. When consumers' WtP for water is measured, these two different quality waters must be taken into consideration. In this Study, these two kinds of waters are integrated to evaluate the consumers' WtP for water.

Firstly, for non-quality water, water tariff is assumed to represent the WtP of consumers. However, instead of the presently valid water tariff, the water tariff prevailed before the privatization, namely September 1st 1997, is adopted as the surrogate of consumers' WtP, because the tariff rate was largely bargained down by competitive bidding at the time of privatization. The water tariff before privatization seems to reflect the consumers' WtP better than the present one.

Secondly, for quality water, bottled water prevailing at markets is taken into consideration. In reality, consumers nowadays purchase the bottled quality water at markets for drinking or cooking uses everyday. According to the information we obtained, an average household with five families consumes one 5 gallon-bottled water a day. Since average water consumption of an average household with five families is estimated at 20 cubic meters per month, the share of bottled water is computed at 2.8% (= 5 gallons x 30 days/20 cubic meters). The present evaluation assumed conservatively, however, that one percent at minimum of water demand is procured from the bottled water. The WtP is computed by the procedures stated below:

i) The averaged water tariff rate in 1994 was estimated at Peso 7.8 per cubic meter based on the MWSS annual report 1994 (the water tariff rate as of August 1997 was not availed to us). The averaged water rate as of June 2001 was computed on the basis of the water rate of 1994 at Peso 13.6 per cubic meter by applying consumer price index (CPI).

ii) Meanwhile we estimated the price of bottled water from market price. The cheapest bottled water is 50 Pesos per five-gallon vessel at gas stations that is equivalent to Peso 2,641.8 per cubic meter.[1]

iii) Finally, the consumers' WtP for water was computed at Peso 38.9 per cubic meter as shown below:

$$WTP = 13.6 \times 0.99 + 2{,}641.8 \times 0.01 = \text{Peso } 38.9 \text{ per cubic meter}$$

The benefit stream of water supply presented in Table 12.3 is computed based on this unit benefit multiplied by the water volume to be supplied from the Project.

The inference on the consumers' WtP for water stated above is based on the reasoning that price fluctuation of the bottled water cannot be neglected when the WtP of piped water is considered. The WtP for piped water may increase when the price of bottled water skyrockets by some possible reasons like supply shortage. To the contrary, the WtP for piped water may reduce when the price of bottled

[1] 1 gallon = 3.785343 liter. Prevailing market prices of bottled water are more expensive than the five-gallon container:
320 ml bottle: Peso 10.0
500 ml bottle: Peso 12.5
1000 ml bottle: Peso 15.0

water decreases by some reasons like over-production. Therefore, the WtP for piped water cannot be evaluated correctly without taking into consideration the price of the bottled water.

(2) External social benefit of water supply scheme

When social aspects of water supply benefit are taken into consideration, the time value of housewives freed up from caring water should not be neglected. We conservatively limited the extension of new connection to be realized by the Project only to the "Tubig para sa Barangay" (TPSB, Water to the Barangay) program that is driven by MWCI for urban poor people. Based on this program data, we estimated the economic benefit to be accrued from whole program of supplying water to the urban poor including the similar one of MWSI. The estimation procedure is as shown in Table 12.4. It was assumed that the beneficiaries after freed from caring water will work outside for earning revenue. Working two (2) hours per day in six (6) months a year will bring Pesos 11,400 per year assuming the daily labor wage of Pesos 250. Again, based on the actual and forecasted numbers of beneficiaries of TPSB program of MWCI, we estimated the external social benefit, which was incorporated in the evaluation. The percentage share of the beneficiaries to the total population was computed at around 21% of the total for both years of 2002 and 2020, which is deemed reasonable.

(3) Hydropower generation (BOTa)

The economic benefit accrued from hydropower generation is estimated by the method of alternative thermal power plant. The cost of thermal power plants with the same capacity as those planned in the Agos hydropower scheme is computed. This cost is considered as economic benefit since, from the point of view of the socio-economy as a whole, it is the value to be saved by constructing the hydropower plants contemplated in this Project.

The thermal power plant of combined cycle is assumed to be the alternative of the Agos hydropower according to its supply characteristics. The cost stream of the alternative thermal power plant was considered as the benefit stream of the hydropower scheme according to the disbursement schedule of the alternative thermal as shown in Table 12.6.

12.2.4 Computation of EIRR

(1) Water supply (Integration of GOVw and BOTw)

The cost flow of the integrated water supply scheme is shown in Table 12.2. All the costs and benefits are consolidated in Table 12.3 and the EIRR of 16.7% was derived. This EIRR exceeds not only the opportunity cost of capital assumed at 12% in this Study, but also the ICC (NEDA) standard of 15%, which means that the Project is economically justified.

(2) Hydropower generation (BOTa)

Table 12.5 shows the computation of EIRR for BOTa scheme. The resulted EIRR was 14.4% with B/C ratio of 1.1 at 12% discount rate. The EIRR exceeds the OCC assumed at 12% in this Study.

Meanwhile, when the intangible social benefit of hydropower scheme is considered, the above EIRR would rise higher than the derived value. Some typical social benefit of power generation is presented in the succeeding Subsection 12.5.1 (2).

12.2.5 Sensitivity Test of EIRR

(1) Water supply (Integration of GOVw and BOTw)

The sensitivity of the EIRR was examined by increasing and decreasing the values of construction cost and total benefits by 10% respectively. The result is shown below. In the case of the worst conditions of cost increase by 10% with benefit decrease by 10%, the EIRR decreases to 14.0%. The EIRR still keeps the level higher than the opportunity cost of capital of 12%.

Sensitivity of EIRR for GOVw and BOTw

	Cost: -10%	Cost: Normal	Cost: +10%
Benefit:+10%	19.6	18.1	16.7
Benefit: Normal	18.2	16.7	15.4
Benefit: -10%	16.7	15.3	14.0

(2) Hydropower generation (BOTa)

The sensitivity of the EIRR was examined by the same way as water supply. The result is as shown below. In the case of the worst conditions of cost increase by 10% with benefit decrease by 10%, the EIRR goes down to 9.4%. But, when the above-stated intangible social benefit of electricity is taken into consideration, the BOTa scheme is deemed to be justified from the point of view of socio-economy as a whole.

Sensitivity of EIRR for BOTa

	Cost: -10%	Cost: Normal	Cost: +10%
Benefit:+10%	21.8	17.5	14.4
Benefit: Normal	17.9	14.4	11.9
Benefit: -10%	14.4	11.6	9.4

12.3 Financial Analysis

12.3.1 General

The purpose of financial analysis differs by each scheme as described below.

(i) GOVw scheme:

The purpose of financial analysis of GOVw is to verify if the full-cost-recovery can be realized in implementing the GOVw scheme. It will be proved when no deficit is observed in the cash surplus stream of the projected cashflow statement.

(ii) BOTw scheme:

The function of BOTw is to treat the raw water that is purchased from GOVw scheme and to sell the treated water to the Concessionaires at the exit of service reservoirs. The purchasing price of raw water of GOVw at the entrance of WTP will be determined by the equalizing water rate (EWR) that makes the total cost stream of GOVw equal to its total revenue stream by discounting with the rate of 12%. While the selling price of treated water at the exit of service reservoirs should be high enough for the BOT company to gain appropriate profit. Finally, this selling price is required to meet the affordability-to-pay of consumers at the household level.

(iii) BOTa scheme:

The financial viability of BOTa hydropower scheme relies on the assumed selling price of electricity. Therefore, the sensitivity test will be important for the scheme.

12.3.2 Conditions and Assumptions

The following conditions and assumptions were adopted for the financial analysis.

1) The project cost is estimated as described in Chapter IX of this Volume IV.

2) The financial cost was derived based on the base cost estimated at 2002 market prices by adding VAT (10%) for both foreign and local costs, and inflation (2% per annum for foreign currency portion and 3% for local currency portion of the capital cost).

3) The cost flow of capital expenditures and O&M costs of each scheme is compiled by stage-wise in Table 12.7.

4) The financing terms and conditions were assumed for each possible fund source as shown below:

Assumed Financing Terms and Conditions for Each Possible Fund

Capital Requirement	Interest rate (% p.a.)	Repayment period (years)	Front-end fee (% p.a.)	Commitment fee (% p.a.)
- GOVw scheme				
75%: ODA loan	2.0	20	-	-
15%: DFI loan	4.5	15	1.0	0.75
10%: GOP contribution	-	-	-	-
- BOT scheme				
35%: DFI loan	4.5	15	1.0	0.75
30%: Commercial loan	10.0	10	1.0	0.75
35%: Equity capital	-	-	-	-

Front-end-fee is charged at the time of loan agreement conclusion. Commitment fee is charged against outstanding balance of loan. It is assumed in this Study that interest payment will be exempted during the construction period and that it will be paid from the year of operation start after being capitalized during the said period.

5) An initial working capital that is needed one year before the commissioning was estimated at 50% of annual O&M cost.

6) Financing plan for capital cost

As shown in the small table of the previous page, the GOVw scheme is assumed to be financed by ODA loan, DFI (Development Financing Institution) and GOP capital contribution.

The construction expenditure is assumed to be financed initially by equity capital (for BOT schemes) or GOP contribution (for GOVw scheme). Loans were assumed to be allotted thereafter following the usual practice required by lenders.

Available sources for funding were assumed to include: GOP capital contribution, ODA loan of foreign government, DFI concessional loan and commercial bank loan. The current interest rate of DFI loan is based on variable LIBOR and it has been reducing recent years. Therefore, the historical LIBOR for three years back was averaged to determine the assumed interest rate of DFI loan.

The financial charges including front-end-fee and commitment-fee and the initial working capital were assumed to be covered by the equity capital (for BOT schemes) or GOP contribution (for GOVw scheme).

7) Concession period

The concession period for BOT schemes was assumed to be 25 years following the usual practice of BOT scheme in the Philippines. When the concession period is terminated, all the property of the Project will be transferred to the government.

8) Depreciation and amortization

The depreciation of the project property was assumed for the period equal to the concession period for BOT schemes and for 50 years for GOVw scheme. Replacement of metal works and/or electrical equipment was considered every 20 years for 90% of the relevant property values. Financing charges during the construction period was amortized under the straight-line method for the first 5 years of operation.

9) Taxes and custom duties

Custom duties levied on imported goods were assumed to be free. The project companies were assumed to be exempted from profit tax (35% of operating income) for the first 6 years of operation assuming that the BOT schemes may obtain the “Pioneer Status” defined by BOI.

10) Dividend payment

The dividend was assumed to be paid to investors at 90% of net profit if the requirement of debt-service-reserve-account is satisfied. The said requirement calls for the project company to reserve 50% of the annual debt service (interest payment and principal repayment) as a separate depository account (“escrow account”).

11) Package loan by stage-wise

In this financial analysis, it is assumed that loan agreements will be concluded by each stage of construction. Therefore, interest payment and principal repayment are computed by stage-wise for each scheme. The interest during the construction is consequently calculated for each scheme by stage-wise as well.

12.3.3 Capital Expenditures of each Scheme

The capital expenditures including base cost, VAT and price contingency of each scheme were arranged in Table 12.7 and are summarized in the table below. The disbursement schedule of capital expenditures by scheme is arranged according to the construction schedule as shown in the said table.

Capital Expenditures in Each Stage

(Unit: US$ million)

GOVw scheme				BOTw scheme				BOTa
Stage 1	Stage 2-1	Stage 2-2	Total	Stage 1	Stage 2-1	Stage 2-2	Total	Stage 2-1
338.8	737.9	270.5	1,347.2	335.8	137.8	600.3	1,073.9	122.0

12.3.4 Equalizing Water Rate

The equalizing water rate is defined as the water rate that makes the scheme's total cost equal to the scheme's total revenue by discounting at the rate of 12%. In other words, when the raw water is sold at the EWR, then the cost of GOVw scheme can be fully recovered. The EWR was computed stage-wise for GOVw and BOTw schemes respectively. The result of the EWR computation is summarized below and the computation of EWR of GOVw at Stage 2-2 is presented in Table 12.8.

Equalizing Water Rate (EWR)

(Pesos/m^3)

	Stage 1	Stage 2-1	Stage 2-2
GOVw scheme	7.3	18.7	7.3
BOTw scheme	14.2	22.8	12.0

The high EWRs in Stage 2-1 are caused by the large investment for the Agos Dam.

The EWR of BOTw scheme means that, if the treated water is sold at this EWR, the cost of BOTw scheme can be fully recovered. The EWR computation for BOTw at Stage 2-2 is presented in Table 12.9.

12.3.5 GOVw Scheme

Since it is assumed that no return is to be expected for GOVw scheme, the financial analysis of GOVw aims at ascertaining the possibility of loan repayment. Table 12.10 enumerates assumption for financial analysis of GOVw scheme. Table 12.11 compiles financing terms and IDC computation.

The resulted cashflow statement is compiled in Table 12.12. As shown in the Table, the only revenue of GOVw is generated from "Sales to BOTw". This is brought about by selling raw water at the EWR of 7.3 Peso/cum (ref. table shown above). The cashflow table also verifies that some cash surplus is generated from the initial

stage of operation after interest payment and principal repayment of loans are rendered.

12.3.6 BOTw Scheme

Conditions and assumptions made for financial analysis of BOTw scheme are compiled in Table 12.13 and financial terms and conditions with a computation of IDC (interest during construction) are presented in Table 12.14 as well.

The financial analysis of BOTw was made firstly based on the EWR at Stage 2-2 (12.0 Pesos/m^3). The derived financial indices showed that the scheme cannot be feasible with this water rate as a BOT basis: cash surplus being negative for 3 initial years, FIRR at 11.3%, ROE at 7.5% and WACC at 6.4%. It is inevitable because the EWR of 12.0 Pesos/ m^3 does not include any profit to BOTw scheme but covers only full cost of GOVw and BOTw schemes.

Regarding the selling price of the treated water, it should be such value that covers not only full cost but an appropriate profit to run the project company. The "appropriate" level of the price, however, is obscure and arbitrary. In addition, the "price" is in principle subject to the fluctuation of demand and supply. In connection with the price, we analyze it here from the point of view of the possible implementation of a BOT scheme.

The rate of return on equity (ROE) is an indicator to be targeted by investors. Investors would aim at a ROE that covers not only the financing cost but an appropriate profit and risks that investors should shoulder. The lowest level may be set at the opportunity cost of capital in the society, that is assumed at 12% in this Study. An examination was carried out concerning the respondence of the water rate toward the value of the ROE to be expected under the financial terms and conditions assumed in the present Study. The result is shown below:

Relation between ROE and Price of Water

ROE	12.0%	13.0%	14.0%	15.0%	16.0%	17.0%	18.0%
Price of Water (Pesos/m^3)	14.2	14.7	15.3	15.9	16.5	17.1	17.7

A relationship of straight-line proportion is observed between ROE and water rate. The ROE increases 1 % point according to the increase of water rate by 0.5-0.6 P/m^3. The price of water will actually be determined in the agreement to be concluded between the Project company and the Concessionaires. In this Study, however, the ROE of 15% is proposed taking into consideration long-term interest rates and/or yields of national bond.

Actually, the criteria that ROE should be greater than 15% was adopted in the Laiban dam study that is similar by nature to the present Project.

The financial analysis of BOTw scheme was conducted by applying the water rate of 15.9 Pesos/m^3 that corresponds to the ROE of 15%. Table 12.15 shows the resulted cashflow statement in which no deficits of cash surplus is observed. The FIRR was derived at 17.6% as shown in Table 12.16. Computation formula of ROE is shown in Table 12.17 and WACC was derived at 9.0% as shown in Table 12.18.

The minimum DSCR in the projected cashflow statement was 1.4 at the first year with gradual yearly improvement. These financial indices are deemed to show the scheme's financial viability under BOT basis.

The selling price of water should be examined taking into consideration the consumers' affordability-to-pay for water. It is verified in Table 12.19. The water developed by the Project is blended with the existing Angat water in the Table. The water rate of 15.9 P/m^3 (at 2002 price level) determined on the basis of the ROE of 15% is tested for affordability assuming the future GRDP projection in NCR with NEDA's projected growth rate of 6% per annum up to 2025. The future improvement of NRW (30% in 2025) is also incorporated. The resulted percentage of household expenditure for water to the family monthly income in 2025 was calculated at 0.8% in NCR. According to the Family Income and Expenditure Survey in 1997 (NSO, June 1999), the total expenditure for fuel, light and water occupied 5.5% of monthly family income in NCR. Judging from this statistics, the above 0.8% is naturally deemed to ascertain the consumers' affordability-to-pay for water.

12.3.7 BOTa Scheme

The financial analysis of BOTa scheme was made under the assumption of a selling price of 3.5 Pesos/kWh (in 2002 prices, See Annex H of Volume V). The relevant financial analysis is included in Tables 12.20 to 12.25. The resulted cashflow (Table 12.22) shows no deficit of cash surplus with minimum DSCR of 2.5 at the first year. The FIRR was derived at 25.6%, real ROE was derived at 38.4% and WACC was derived at 17.9%. These financial indices can be said to show the scheme's financial viability under BOT basis. The selling price of power would affect financial achievements in the case of BOTa scheme. The change of financial indices is shown below:

Financial Indices by Selling Price of Electricity

Unit price (P/kWh)	FIRR (%)	ROE (%)	WACC (%)	Deficit of cash surplus	Minimum DSCR (times)
2.5	19.1	26.8	13.7	none	1.7
3.0	22.5	33.0	15.9	none	2.1
3.5	25.6	38.4	17.9	none	2.5
4.0	28.5	43.3	19.6	none	2.9
4.5	31.3	47.6	21.1	none	3.3

Tables 12.20 to 12.25 show the computation results of the above financial indexes for BOTa scheme.

12.3.8 Summary of Project Evaluation Results

Analytical indices of economic evaluation and financial analysis of the Project are summarized in the table below:

Summary of Results of Economic Evaluation and Financial Analysis

Scheme	EIRR (%)	FIRR (%)	ROE (%)	WACC (%)	Minimum DSCR (times)
GOVw	16.7	-	-	-	-
BOTw		17.6	15.0	9.0	1.2
BOTa	14.4	25.6	38.4	17.9	2.5

12.4 Evaluation of Water Schemes (GOVw + BOTw) Stage 1

12.4.1 General

Taking into consideration the large amount of capital investment required for the whole project, an examination of economic feasibility and financial viability of Stage 1 of the integrated water project that is composed of GOVw and BOTw schemes was carried out. This examination assumes the case where the project was planned as a whole with three stages at the initial phase but, by some reasons, the construction was brought to a halt when the Stage 1 construction was completed. Therefore, the utilization of a part of the capital investment rendered in Stage 1 are forced to be postponed until later stages, which means "a prior investment." This may inevitably affect the feasibility of the Stage 1 construction.

12.4.2 Computation of Economic Internal Rate of Return (EIRR)

For the EIRR computation, the cost estimated based on market prices was first adjusted to economic cost (Table 12.2). The cost required for construction of Stage 1 facilities covering both GOVw and BOTw schemes were compared with the benefit to be accrued at the Stage 1. In order to derive the O&M costs for Stage 1, the total O&M costs presented in Table 12.3 were allotted for simplicity in proportion to the share of Stage 1 water supply volume toward the total water supply volume of the whole stage. The benefit was computed based on the water supply volume scheduled for Stage 1 with a maximum throughput of 750 MLD.

As the result of computation, an EIRR of 15.0% was derived for Stage 1 of the integrated project of GOVw and BOTw schemes as shown in Table 12.26. This EIRR is to be compared with the EIRR of 16.7% that is computed for the integrated water project of GOVw and BOTw schemes of whole stages as shown in the preceding subsection of 12.2.4. The reason of lesser EIRR may be attributed to the prior investment rendered in Stage 1 for later stages like waterways and treatment plants. Although it is worse than the EIRR for the whole stage, the derived EIRR for Stage 1 exceeds the opportunity cost of capital of 12% and indicates that the integrated water project of GOVw and BOTw can be economically justified even when it is implemented independently from the whole project.

The sensitivity test was carried out with varying costs and benefits by 10% respectively. The EIRR under the worst case of cost increasing 10% with benefit decreasing 10% was derived at 12.2% which was still higher than the opportunity cost of capital of 12%.

12.4.3 Financial Analysis of Stage 1 of the Integrated Project of GOVw and BOTw

Capital expenditures of the integrated water project composed of GOVw and BOTw schemes are presented for each year in Table 12.7. The total investment amounts to US$ 674.6 million with breakdown of US$ 338.8 million for GOVw and US$ 335.8 million for BOTw. The construction period extends to nine (9) years.

Table 12.27 compiles the projected cashflow statement of the Stage 1 water project. In estimating the revenue for Stage 1, the water rate of 17.7 P/m^3 (2002 price level) was assumed based on the predetermined ROE of 15%. For the cost side, the raw water purchase from GOVw scheme was considered to cover all the costs incurred from raw water production of GOVw. Therefore, the cost to be analyzed in computing financial indicators thereafter is limited to the costs proper to BOTw scheme.

As shown in Table 12.27, no deficit in the item of "cash surplus" is observed and the minimum DSCR is 1.7 in the first year.

Table 12.28 presents the calculation of FIRR. After incorporating the raw water purchase from GOVw and deducting income tax to be paid by BOTw, the FIRR of 16.6% was derived.

Table 12.29 compiles derivation of ROE. The total income to investors including dividend and cash surplus is compared to the equity capital injected by investors. As stated in the preceding sub-section of 12.3.6, the ROE of 15% is predetermined in this Study. The dividend and cash surplus are generated from the water rate that brings ROE of 15%.

Table 12.30 shows the derivation of real cost of borrowing and WACC. The loan required for Stage 1 financing is compared with the debt service including interest payment, principal repayment and other financial charges. The derived real interest rate and ROE generate the WACC of 9.1%.

The necessary condition for a BOT scheme to be implementable to investors is that the FIRR is greater than WACC. This requirement is satisfied for Stage 1 water project composed of GOVw and BOTw schemes as explained above. Therefore, the water project contracted to Stage 1 can be said financially viable. It is to be noted, however, that this financial analysis becomes meaningful on the assumption that the ROE of 15% brought about by the water rate of 17.7 P/m^3 can be realized by BOTw scheme.

The consumers' affordability-to-pay for water was tested for the water rate of 17.7 P/m^3 based on the formula shown in Table 12.19. The share of payment to water in monthly family income was computed at 0.9% in 2025, which is deemed to be within the range of affordability-to-pay of consumers.

12.4.4 Summary of Evaluation Results for Stage 1 Project

The result of project evaluation of Stage 1 of the integrated water project (GOVw + BOTw schemes) is summarized hereunder.

Summary of Evaluation Result of GOVw + BOTw Schemes (Stage 1 Project)

Scheme	EIRR (%)	FIRR (%)	ROE (%)	WACC (%)	Minimum DSCR (times)
GOVw + BOTw	15.0	16.6	15.0	9.1	1.7

12.5 Project Evaluation from Technical Aspects

12.5.1 General

The proposed project involves a variety of technical risks peculiar to the site conditions and difficulties to be tackled by proper planning and design. At this feasibility study stage, the following have been taken into account to avoid and/or mitigate such risks:

12.5.2 Technical Risks Involved in the Project

(1) Risk to Earthquakes

The project site is located close to the Philippine Fault (Infanta Fault), which is known as a major active fault. The Agos Dam is only about 8 km distant from the Fault. The major structures, particularly the Agos Dam, are exposed to seismic risks that may be caused by the fault activities. However, the risks involved are of the nature that can be solved by proper design of the structures at the stage of detailed design. Preliminary design in this Feasibility Study has been prepared in due consideration of this risk factor.

(2) Agos Dam Foundation Geology

Field investigation revealed that the thickness of the river deposit is as deep as 40m, which makes the dam to be a giant dam of 165 m high. Moreover, there exist three (3) low velocity zones in the dam foundation area and other two (2) zones on the abutments, running in the direction perpendicular to the dam axis. This requires the stability and foundation designs of the dam to be carefully examined at the stage of the detailed design. These low velocity zones, however, are not of the extent seriously affecting the technical feasibility of the dam.

(3) Reservoir Watertightness

There exist a large limestone mass (called Daraitan limestone) at the upstream part of the proposed Agos reservoir. A concern held at the beginning of the field investigation was the leakage of reservoir water through the limestone mass. The field investigation has, however, identified that there would be no possibility of the leakage. Nevertheless, this issue should be further investigated for confirmation during the detailed design stage and monitored during the impoundment of the reservoir.

(4) Assumed Active Fault on the Tunnel No.1 Route

Tunnel No.1 will cross a major fault that is suspected by PHILVOLCS as an assumed active fault. Construction of the tunnel should pay utmost care at this fault section as described in the succeeding Subsection 12.5.5.

(5) Stability of Coastlines of Infanta-General Nakar Plain

Under the present condition, the Agos River yields about 980,000 m^3 of sediments per year, of which about 300,000 m^3 is deemed as bed loads. After the completion of the Agos Dam, the yield is foreseen to reduce to about 90,000 m^3 including 30,000 m^3 of bed loads. This will give some extent of influence to the environments of the coastlines.

The extent of the influence is difficult to predict at present stage and therefore should be monitored over a period of decades. This Study foresees that the impact, if occurring, can be minimized by provision of training work at the river mouth and jetties along the coastlines.

12.5.3 Tolerability for Extraordinary Droughts

The Agos Reservoir can ensure stable supply of water for the designed demand of 3,000 MLD. The reservoir has a total effective capacity of 409 million m^3, which is capable of yielding 5,300 MLD of water at the maximum (total of 3,000 MLD for water supply and 2,300 MLD equivalent for power). With this gross yield capacity, the reservoir can supply the designated water of 3,000 MLD without a major deficiency even in the droughty year of 30-year recurrence probability, on a basis that water use for power is reduced accordingly.

12.5.4 Development Program Consistent with the Growth of Water Demand

The proposed project envisages a staged development meeting closely with the growth of water demand. Water source facilities (Kaliwa Low Dam and Agos Dam) are planned to be commissioned one by one at the stage when the demand requires such water sources. Waterways will be implemented in 2 stages and water plants (water treatment plant and service reservoirs) in 3 to 4 stages. This stage-wise development can minimize the cost burden in terms of the present worth of investment costs.

12.5.5 Adoption of Appropriate Construction Method

Planning and design of the proposed facilities took into account the adoption of construction methods most appropriate to the respective site conditions. Noteworthy items of such consideration include:

(1) Use of TBM for Tunnel No.1

Most part of Tunnel No.1 is geologically composed of rocks of good quality having strength of 600-1,000 kg/cm^2, where the tunneling by TBM is considered effective and less costly. Present construction plan envisage the use of 2 units of TBM.

(2) Tunneling through Assumed Active Fault

As stated in Subsection 12.5.2 (4), Tunnel No.1 is presumed to pass an assumed active fault at 25-km point from the waterway intake. The tunneling work in the fault zone requires a careful planning. During the excavation, a steel pipe, 600-800 mm in diameter depending on the fault length, will be laid in the fault section as an evacuation way for construction workers in the event of unanticipated occurrence of earthquakes. The tunneling method in the fault zone will be by NATM.

The tunnel is lined with steel pipe, surrounded by low-density cellular concrete (say, 30 kg/cm^2 in strength) so that the cellular concrete can absorb any displacement caused by earthquakes.

(3) Tunneling of Tunnel No.2

Tunnel No.2 passes partly beneath the Antipolo City area, where many deep wells exist. Although the present plan foresees that the tunnel does not pass through the aquifer rock zones, care will be made not to affect the groundwater condition in the area. At the front face of tunneling, probe holes will be drilled prior to the excavation and, if any notable water seepage is observed, pre-excavation grouting will be made in order not to cause the excessive inflow of groundwater. With this method, the tunneling will pay a maximum possible care for eliminating concerns for lowering groundwater levels in the area.

(4) Use of Conventional Construction Methods

Most of the proposed works are of conventional type of construction, except for the tunneling by TBM stated above. This will afford the maximum participation of local construction industries.

12.5.6 Operation and Maintenance Aspects

The proposed project does not include any specific O&M skills requiring very high technologies. Most of O&M duties are attainable by proper training of personnel by means of lectures and on-site practices. The training program will include the assignment of O&M guidance experts in respective fields for a year period at the beginning period of the O&M operations.

Some of the facilities for facilitating the O&M works, contemplated in the project planning, are as follows:

- Installation of rain gauges in the upper basins and water level gauges in the proposed reservoir area (for facilitating the operation of reservoir)
- Installation of water levels, discharge meters, water quality meters and communication system for waterway system
- Power line carrier for communication between power stations and substations
- Alarm system for releasing of flows to the river reaches downstream from the Agos Dam (for information of fluctuation of the river water levels)

12.5.7 Procurement of LCBs

In this Study, details of construction packages are not worked out. However, the Project, at least in the Government initiated portion (Dams and Tunnel No.1), envisages to have Local Competitive Bidding (LCB) contracts as many as appropriate. The works will include access road, transmission lines, reservoir clearing, and bank erosion and flood protection works. BOT projects will also adopt many LCB contracts.

12.5.8 Other Technical Aspects Considered in Layout Planning and Structure Design

The design of the project facilities has taken into account various factors with a view to overcoming the difficulties particular to the sites and also reducing the construction costs. Some of the noteworthy items are introduced below to emphasize that the Project is properly planned and designed. More detailed descriptions are given in the respective Chapters presented hereinbefore.

(1) Use of Riverbed Deposits as Dam Foundation (See Figure 8.2-Dam Drawing)

Present design contemplates to place the downstream part of rockfill dam embankment on the riverbed deposits. This can reduce the volume of dam foundation excavation by about 800,000 m^3, which contributes to the reduction of construction cost by about US$ 3.5 million equivalent. Nevertheless, the appropriateness of this proposed design is subject to further review in the detailed design stage from viewpoint of dam structural stability.

(2) Layout of River Diversion Works (See Figure 8.1-Dam Drawing)

A particular aspect at the Agos damsite is the thick riverbed deposit of 40 m deep as stated before. A difficulty foreseen is the possibility of excessive seepage of water through the deposit layer below the upstream cofferdams.

In order to reduce the seepage water quantity, present design contemplates the provision of a slurry-trench impervious wall excavated in the deposit layer beneath the cofferdams. Further, cofferdams were laid out at the locations of some 500-m upstream from the dam excavation area. This layout plan has necessitated the construction of two (2) cofferdams, one each on the Kaliwa River and Kanan River.

(3) Design of Kaliwa Low Dam (See Figure 7.2-Kaliwa Low Dam Drawing)

Kaliwa Low Dam is in service only for 3 years until it is submerged by the Agos reservoir. Hence, the structure is proposed to be of a temporary type in order to reduce the construction cost.

(4) Alignment of Tunnel No.1

Tunnel No.1 was originally aligned to pass through a route along chains of ridges in order to have enough ground cover. During the field investigation, however, it was found that a major fault runs almost in parallel to the tunnel route at the downstream part. This has required modifying the tunnel alignment so that the tunnel crosses the fault perpendicularly. This brings about two technical difficulties; i.e., (i) shallow ground cover sections in the downstream part and (ii) difficulty in laying-out of access adits. However, these are of the natures capable of solving technically.

(5) Layout of Water Treatment Plant (See Figure 7.5-WTP Drawing)

Water Treatment Plant (WTP) is proposed at Barangay Lagundi area in Municipality Morong. The WTP requires a large area of about 100 ha including earth and sludge disposal areas. The area is presently used partly for well-organized

fruits plantation, while the other parts are rainfed cultivation lands and bush lands. Acquisition of the lands may be a time-consuming work, but is believed to involve no particular difficult factors.

In the case of occurrence of unpredictable difficulty of serious nature, a possible contingent plan is the shifting of the site to an area envisaged in alternative waterway route (Plan B-1b) examined in the Master Plan Study. However, such a need would not be likely.

(6) Alignment of Pipeline Route (See Figure 7.1-Pipeline Drawing)

Pipeline between WTP and Tunnel No.2 Inlet is laid out along the route where no major land acquisition and household relocation issues would arise. The exception is a 500-m section just upstream of the Tunnel No.2 Inlet, where the pipeline crosses a local housing area. The affected households can be relocated to the nearby area.

Originally, the Tunnel No.2 Inlet site was planned at the toe of a limestone hill located at about 500 m north from the present route. The change was obliged, since the field investigation revealed that the limestone hill is already under the process of authorization for aggregate quarrying and production.

(7) Selection of Service Reservoir Sites (See Figure 7.10, Figure 7.12 & 30-S/R Drawing)

Service Reservoirs (S/R), one each at Taytay and Antipolo, were sited in consideration of minimizing the potential issues which may arise in connection with land acquisition and household relocation. The areas allow constructing the reservoirs having water levels high enough to supply by gravity to the planned distribution areas. Judging from the existing condition of the site, there would be no particular problems that would affect the construction works.

12.6 Project Evaluation from Viewpoint of Social and Environmental Aspects

12.6.1 Intangible Benefits to be Accrued from the Project

An effort was made to incorporate all the tangible benefits accrued from the Project into economic and financial evaluations in the preceding Subsections 12.1 to 12.4. While, the intangible benefits attributable to the Project are identified and enumerated as far as possible in this subsection.

The intangible benefits to be acquired from the Project are described below:

(1) Intangible Benefits from Water Supply

Health improvement

It is often reported that, when the safe water becomes available, the incidence of water-borne diseases like diarrhea and dysentery decreases significantly.

According to the statistics of DOH, the number of patients suffered from diarrhea amounted to 866,400 in the Philippines in 2000. The diarrhea was

the top cause of morbidity followed by bronchitis, pneumonia, influenza and hypertension. The distribution by age group shows that, out of the total patients of diarrhea, the largest share of 62% were the infants of less than four (4) years old. While, the statistics also indicate the reducing trend of diarrhea morbidity rate per 100 thousand populations from the highest ceiling of 2000 in 1994 to nearly 1000 in 2000. During the same period, the service coverage of household connection in Metro Manila is estimated to have increased from less than 60% to nearly 70%[2]. Although the effect is hard to be counted in the project evaluation, this noticeable inverse correlation is deemed to indicate the effect of water supply for reducing water-borne diseases.

Sanitary improvements

Affluent water makes it easier for housewives to clean their accommodations both inside and outside. Washing clothes can be done easily as well. These lead to the sanitary improvement at home.

Amenity enhancement

People can be released from worrying about water everyday. They are encouraged to improve living environments through cleaning rooms and/or washing clothes more often than before, which makes daily life more comfortable.

Households education

Getting water and its transporting jobs were major household-work to housewives of no water connection. With the piped water supply, they can have not only water but also time. The time created can be allotted to children's education and/or self-improvement.

Social participation

The time saved can also be used for social activities such as those of cooperatives and/or local associations.

Income earning

Low-income people may find job opportunities outside homes utilizing the freed-up time. The earned income will contribute raising their living standard. Their expenditures at markets will also help increase regional incomes. The housewives' revenue through working outside by utilizing the freed-up time is incorporated in the project evaluation as an external social benefit.

Reduction of water expenditure

In the case of urban poor, they can reduce water payments by connecting with the piped water supply as they were forced to pay more expensive water (refer to subsection 3.6.2). The expenditure saved can be diverted to

[2] "Study on Water Supply and Sewerage Master Plan of Metro Manila" JICA, 1996; and the Interim Report.

purchase other goods than water, which will go a long way to increase consumption.

Social inclusion

As already stated in subsection 3.6.2, the consciousness of social inclusion of urban poor cannot be neglected. The residents in the poor communities that now have water connections can feel that they have become a legitimate part of the society. They will be given some sense of self-esteem and encouraged to pursue further improvements.

(2) Hydropower generation

Amenity enhancement

Released from darkness at night, people can enjoy longer time availed in the evening for chatting with family and/or friends and for reading books, etc. Some people may become capable to watch TV at home.

Crime prevention

With streetlights shining at night, the incidence of crime may decrease.

Prevention of unrestricted logging

In rural areas, cooking utensils using electric power can replace fire-woods, which can contribute to prevent unrestricted logging in forests.

Social inclusion

Similarly to the social inclusion that is observed for the case of water supply, the consciousness of social inclusion can be expected for beneficiaries of new power supply.

(3) Contribution to regional development

There are several social projects pertinent to the Project of which benefits are not counted in Project evaluation but are to be recognized as benefits of the Project. They are enumerated as follows:

a. Bank erosion protection effects
b. Conveniences of boat-landing place and washing places
c. Improvement of irrigation water intake
d. Conveniences of access roads and/or footpaths
e. Contribution of manpower training center
f. Contribution of medical clinic
g. Conveniences of rural electrification

(4) Employment effects during the construction period

Enhancement of employment

The cumulative number of laborers to be employed in the construction period of 16 years in total is estimated at about 172,000 persons. (For this

estimate, the monthly labor wage of 5,000 Pesos for unskilled labor and 10,000 Pesos for skilled labor were assumed.)

Ripple effects through expenditure increase

The cumulative amount of wages to be paid to the above-mentioned laborers is estimated at about Pesos 15,500 million during the whole construction period. Actually, this is justifiably counted in the project evaluation as cost of the Project. However, its income effects and ripple effects entailed with laborers' expenditures are not considered in the project evaluation. These constitute the intangible effects of the Project.

12.6.2 Evaluation from Social Aspects

As stated in Chapter V, the proposed Agos reservoir will inundate 21 Sitios (hamlets) situated along the Kaliwa river and Kanan river, which will necessitates the relocation of 174 families. The relocation quantity is less compared with that of the Laiban Dam (about 3,000 families). Nevertheless, the relocation being virtually involuntary resettlement, the issue is not a small problem from social aspect and hence should be tackled with the utmost care. In this regard, the Study proposed a comprehensive resettlement plan.

The construction of waterway also requires the relocation of some 222 families. The waterway passes mostly in fairly developed rural areas. Unlike the case of the reservoir, the relocation can be made to the nearby areas where people presently live. In most cases, people will not need to change their livelihood if they are provided with proper area of land and housing equivalent to the present one.

Other than the resettlement, the Project involves no major social issues. Nevertheless, an importance is to organize the proper planning of construction works and proper coordination with local governments/people in order to minimize any other social problems that may be arising due to specific situation in the particular sites.

12.6.3 Evaluation from Natural Environmental Aspects

In view of huge development scale and varieties of construction works, the Project would bring about relatively wide range of impacts on the natural environments. Among others, the following four (4) major impacts are noteworthy:

(1) Loss of forest-agriculture-dwelling lands of 20 km^2 due to inundation by the Agos reservoir

(2) Production foregone in the areas procured for construction of water conveyance facilities: 100 ha for water treatment plant, 20 ha for Taytay Service Reservoir, 7 ha for Antipolo Service Reservoir and 9 ha for Antipolo Pump Station

(3) Reduction of the dry-season river flow from the present 30 m^3/sec (present 90 % discharge) to 26.3 m^3/sec

(4) Reduction of sediment yields in the Agos downstream reach from 980,000 m^3/year to 90,000 m^3/year, which may give consequences of lowering of the

riverbed levels and also the possible change of sediment environments of coastlines in the Infanta-General Nakar alluvial plain.

These four impacts are regarded as the change of natural conditions that are unavoidable consequences arising from the construction of the Project. No substituting measure could be taken for (1) and (2) above. These must be accepted as substitutes of other beneficial effects brought about by the Project. For the issues of (3) and (4), provision of technical countermeasures as discussed in the preceding sections could mitigate the extent of impacts.

12.7 Feasibility of Procurement of BOT Packages

12.7.1 General

AS proposed in Chapter XI, parts of the Project, 'water treatment and conveyance facilities' and 'Agos hydropower', are procured through BOT contracts. In this Study, the former is called 'BOTw' and the latter 'BOTa'. In view of large scale of the proposed works, in particular BOTw, one of the concerns may be whether the proposed work packages are of the type and nature suitable for the procurement through BOT contract. This Section gives a view as to what would be expected and what should be considered in procuring the BOT packages.

12.7.2 Technical Viewpoint

Water source development and tunnel project (Kaliwa Low Dam+Agos Dam+No.1 Tunnel) is proposed as a government project ('GOVw'). It involves various technical risks and uncertainties in view of type of the works containing a huge dam (Agos Dam, 165 m high) and a long tunnel (No.1 Tunnel, 27.5 km long).

On one hand, there are no major technical uncertainties involved in the BOTw scheme. The majority of the works are conventional type open-air constructions, such as plant yard earthworks, pipelines, structural works and equipment installations, where the technical risks could be minimized by proper investigations and designs conducted in advance.

BOTa is a hydropower project of moderate size. The work consists of a waterway tunnel of about 755 m long, a powerhouse, metal works, generating equipment, transmission lines and substations, all of which are conventional type of construction. Unknown factors, such as hydrological and geological aspects, will be made clear in advance through the detailed investigation to be carried out by GOVw, which will reduce technical apprehensions in the BOT bidding.

Overall, both the BOTw and BOTa do not contain such major technical difficulties that would make the BOT proponents reluctant to offering their interest for bidding.

12.7.3 Financial Viewpoint

The 1st stage of BOTw will require a huge amount of investment of the order of US$ 336 million equivalent (including price contingency and taxes). The investment cost for BOTa is some US$ 122 million.

These are less compared with the investment made to San Roque Dam Project, which was as large as US$ 620 million equivalent (after-finance cost of power package). The project is nearly on completion.

Laiban Dam Project envisages the implementation through BOT procurement, in which the investment requirement is foreseen to be about US$ 1 billion equivalent in total covering all components of the project including dam. It is said that several proponents have shown their interest to the participation in the project.

Judging from these experiences, the scale of investment requirement is presumed not to be a critical factor making the procurement of BOT packages difficult.

The most important factor would be the agreement of water purchase and selling rates. BOTw purchases the water from GOVw and sells it to the existing concessionaires (MWCI and MWSI). A proper setting of these two water rates is the obligation of MWSS in order to make the BOTw attractive to the proponents. The same can be said for the energy selling rate in BOTa.

If the BOTw proponents have a confidence for equitable return from the project, say, more than 15 % in terms of ROE, they will be willing to offer their bids.

12.7.4 Socio-Environmental Viewpoint

Compared with GOVw project, both the BOTw and BOTa involve less extent of environmental problems in both the natural and social aspects. EIA identified that there would be no major potential problems in the BOTw scheme area. While, BOTa is a part of the GOVw scheme, where most of the problems arising would be solved within the scope of the GOVw scheme. Only an obligation imposed to BOTa is the requirement of release of the designated river maintenance discharge to the river reaches downstream of Agos Dam during its operation stage.

Land acquisition and resettlement issue may be deemed by the BOT proponents to constitute uncertain factors that may affect their construction works. However, this issue should, in principle, be managed under the responsibility of the executing agency (MWSS) and hence would not be the risk to the BOT proponents.

On one hand, BOT proponents should assume their responsibility for proper on-site coordination with LGU and local residents in carrying out the construction work and subsequent O&M work,

12.7.5 Security Viewpoint

Peace and order condition in the project area has been kept in the good state in general. During the field investigation in 2002, however, there occurred several incidents of disturbance by insurgent groups (NPA and RHB) in the surrounding areas. The incidents occurred were a clash between the army and insurgents at the Kanan river middle reach and the insurgents' attacks to private facilities in the northern part of Rizal Province, southern part of Quezon Province and other areas to the west of Metro Manila.

These incidents have created an apprehension that similar sort of incidents may happen in the Project Area during construction stage and also O&M stage, unless

the present situation is improved. BOT proponents will presumably have a fear for incidental accidents caused by such insurgents' obstruction. The executing agency (MWSS) should assure that they would organize necessary coordination with army and police for keeping the 'peace and order' in the Project Area so that the BOT proponents would not have excessive apprehension to this issue. Otherwise, this issue may cause high bidding price, which is not beneficial to the Project.

12.7.6 Competitiveness of BOT Tenders

Summarizing the factors stated above, this Study presumes that the executing agency could expect to have a competitive bidding in procuring the proposed BOT packages. The following are noted:

- Both the BOTw and BOTa are virtually public works projects under the management of the government agencies. Unlike the pure commercial project, BOT proponents can expect the government equitable support to their undertaking, especially in legal, contractual and water/power revenue aspects. This will encourage the BOT proponents to be positive to the Project.
- Stable and assured revenue is expected in view of the nature of the Project (water and power supply). For ambitious enterprises, the Project is deemed to offer a good business chance. They are leading conglomerate companies in the Philippines, particularly those related to water, power and construction industries, and also trading companies, manufacturers and constructors abroad.
- As stated above, the projects involve no major difficulties in both the technical and socio-environmental viewpoints.

Like the case of Laiban Dam, it is expected that at least a few to several proponents will offer their interests.

Table 12.1 Base Costs at 2002 Market Prices

(1) GOVw

(Unit: US$ 10^6)

Cost Item	Stage 1			Stage 2-1 (Agos Dam)			Stage 2-2			Total		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
Land	0.0	21.0	21.0	0.0	18.0	18.0	0.0	6.3	6.3	0.0	45.3	45.2
Civil	130.5	48.0	178.5	236.8	153.5	390.3	100.5	34.4	134.9	467.8	235.9	703.8
Metal	3.8	0.6	4.4	4.2	0.7	4.9	1.2	0.1	1.3	9.2	1.4	10.7
Electrical	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Sub Total	134.3	69.6	203.9	241.0	172.2	413.2	101.7	40.8	142.5	477.0	282.6	759.9
EA+Ph. Cont.	31.7	16.4	48.2	56.9	40.7	97.6	24.0	9.6	33.7	112.7	66.8	179.5
Total	166.1	86.0	252.1	292.6	210.6	503.2	125.8	50.5	176.3	584.5	347.1	931.6
FC : LC =	65.9%	34.1%	100.0%	58.3%	41.7%	100.0%	71.4%	28.6%	100.0%	62.8%	37.2%	100.0%
Civil/(Civil+Metal+Electrical)=			97.6%			98.8%			99.0%			98.5%

(2) BOTw

(Unit: US$ 10^6)

Cost Item	Stage 1			Stage 2-1			Stage 2-2			Total		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
Land	0.0	2.6	2.6	0.0	0.0	0.0	0.0	3.9	3.9	0.0	6.5	6.5
Civil	91.1	50.7	141.8	17.2	18.7	35.9	115.8	76.8	192.6	224.1	146.2	370.3
Metal	24.2	4.3	28.5	13.9	2.4	16.3	47.0	8.3	55.3	85.1	15.0	100.1
Electrical	20.3	6.7	27.0	16.7	4.9	21.6	35.3	10.7	46.0	72.3	22.3	94.6
Sub Total	135.6	61.7	197.3	47.8	26.0	73.8	198.1	99.7	297.8	381.5	187.4	571.5
EA+Ph. Cont.	32.0	14.6	46.6	11.3	6.1	17.4	46.8	23.6	70.4	90.1	44.3	135.0
Total	167.6	79.4	258.3	59.1	32.3	91.3	244.9	123.3	368.5	471.6	234.9	718.1
FC : LC =	67.9%	32.1%	100.0%	64.7%	35.3%	100.0%	66.5%	33.5%	100.0%	66.7%	33.3%	100.0%
Civil/(Civil+Metal+Electrical)=			71.9%			48.6%			65.5%			65.5%

(3) BOTa

(Unit: US$ 10^6)

Cost Item	Stage 2-1		
	FC	LC	Total
Land	0.0	0.0	0.0
Civil	14.4	6.4	20.7
Metal	2.9	0.5	3.4
Electrical	39.3	4.4	43.7
Sub Total	56.6	11.3	67.8
EA+Ph. Cont.	13.4	2.7	16.0
Total	69.9	13.9	80.8
FC : LC =	83.4%	16.6%	100.0%
Civil/(Civil+Metal+Electrical)=			30.5%

Grand Total (GOVw+BOTw+BOTa)

(Unit: US$ 10^6)

Cots Item	Grand Total		
	FC	LC	Total
Land	0.0	51.8	51.7
Civil	706.3	388.5	1,094.8
Metal	97.2	16.9	114.2
Electrical	111.6	26.7	138.4
Sub Total	915.1	481.3	1,399.2
EA+Ph. Cont.	216.2	113.7	330.6
Total Base Cost	1.126.0	595.9	1,730.5
FC : LC =	65.4%	34.6%	100.0%
Civil/(Civil+Metal+Electrical)=			81.3%

Table 12.2 Economic Cost Disbursement of Integrated Water Supply Scheme

(Unit: US$ 10^6)

No.	Year	GOVw							BOTw							Grand Total of Economic Cost
		St. 1		St. 2-1		St. 2-2		GOVw	St. 1		St. 2-1		St. 2-2		BOTw	
		Economic Cost	O&M costs	Economic Cost	O&M costs	Economic Cost	O&M costs	Economic Cost	Economic Cost	O&M costs	Economic Cost	O&M costs	Economic Cost	O&M costs	Economic Cost	
1	2004							0.0							0.0	0.0
2	2005	3.6						3.6	0.5						0.5	4.1
3	2006	5.1		1.0				6.1	0.7						0.7	6.8
4	2007	6.3		1.0				7.3	0.7						0.7	8.0
5	2008	6.3		2.1				8.4	0.7						0.7	9.1
6	2009	32.8		2.1				34.9	22.6						22.6	57.4
7	2010	55.4		2.1				57.5	44.0						44.0	101.5
8	2011	51.3		44.6				95.9	61.2						61.2	157.1
9	2012	50.4		113.8				164.1	62.6						62.6	226.8
10	2013	29.9		94.5				124.4	39.8						39.8	164.2
11	2014		1.3	84.4		0.7		85.1		2.5			0.3		0.3	85.4
12	2015		1.3	84.4		36.9		121.3		2.5	42.7		0.7		43.4	164.6
13	2016		1.3	45.5		43.8		89.2		2.5	42.7		45.3		88.0	177.2
14	2017		1.3		2.5	40.6		40.6		2.5		1.3	68.2		68.2	108.8
15	2018		1.3		2.5	37.5		37.5		2.5		1.3	65.1		65.1	102.6
16	2019		1.3		2.5	8.9		8.9		2.5		1.3	47.4		47.4	56.3
17	2020		1.3		2.5		0.9	0.0		2.5		1.3	0.0		0.0	0.0
18	2021		1.3		2.5		0.9	0.0		2.5		1.3	59.5		59.5	59.5
19	2022		1.3		2.5		0.9	0.0		2.5		1.3	59.5		59.5	59.5
20	2023		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
21	2024		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
22	2025		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
23	2026		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
24	2027		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
25	2028		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
26	2029		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
27	2030		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
28	2031		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
29	2032		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
30	2033	5.5	1.3		2.5		0.9	5.5	60.2	2.5		1.3		4.2	60.2	65.7
31	2034		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
32	2035		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
33	2036		1.3	5.6	2.5		0.9	5.6		2.5	40.7	1.3		4.2	40.7	46.3
34	2037		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
35	2038		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
36	2039		1.3		2.5	1.6	0.9	1.6		2.5		1.3		4.2	0.0	1.6
37	2040		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
38	2041		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
39	2042		1.3		2.5		0.9	0.0		2.5		1.3	110.3	4.2	110.3	110.3
40	2043		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
41	2044		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
42	2045		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
43	2046		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
44	2047		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
45	2048		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
46	2049		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
47	2050		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
48	2051		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
49	2052	5.5	1.3		2.5		0.9	5.5	60.2	2.5		1.3		4.2	60.2	65.7
50	2053		1.3		2.5		0.9	0.0		2.5		1.3		4.2	0.0	0.0
Economic Capital Cost																
- Total		251.9		481.1		169.9		902.9	353.2		126.0		456.5		935.7	1,838.6
- Replacement Cost		10.9		5.6		1.6		18.1	120.4		40.7		110.3		271.5	289.6
- Initial Investment Cost		241.0		475.5		168.3		884.8	232.8		85.3		346.1		664.3	1,549.1

Table 12.3 Economic Internal Rate of Return (EIRR) for Integrated Water Scheme

(Unit: US$ 10^6)

No.	Year	Capital Costs / Replacement			Operation and Maintenance Costs					Total Cost	Water Supply (MLD)	NRW (%)	Economic Benefits			B - C
		Project Facilities	Distribut'n Main	Subtotal	Project Facilities	Distribution Costs (1)	Coastal Prevention	Land slide Prevention	Subtotal				Water Supply	External Benefits	Total Benefit	
1	2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.3	0.0	0.0	0.0	0.0
2	2005	4.1	0.0	4.1	0.0	0.0	0.0	0.0	0.0	4.1	0.0	54.0	0.0	0.0	0.0	-4.1
3	2006	6.8	0.0	6.8	0.0	0.0	0.0	0.0	0.0	6.8	0.0	52.7	0.0	0.0	0.0	-6.8
4	2007	8.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	51.5	0.0	0.0	0.0	-8.0
5	2008	9.1	0.0	9.1	0.0	0.0	0.0	0.0	0.0	9.1	0.0	50.3	0.0	0.0	0.0	-9.1
6	2009	57.4	0.0	57.4	0.0	0.0	0.0	0.0	0.0	57.4	0.0	49.1	0.0	0.0	0.0	-57.4
7	2010	101.5	0.0	101.5	0.0	0.0	0.0	0.0	0.0	101.5	0.0	48.0	0.0	0.0	0.0	-101.5
8	2011	157.1	71.4	228.5	0.0	0.0	0.0	0.0	0.0	228.5	0.0	46.7	0.0	0.0	0.0	-228.5
9	2012	226.8	71.4	298.2	0.0	0.0	0.0	0.0	0.0	298.2	0.0	45.5	0.0	0.0	0.0	-298.2
10	2013	164.2	11.2	175.4	0.0	0.0	0.0	0.0	0.0	175.4	0.0	44.3	0.0	0.0	0.0	-175.4
11	2014	85.4	11.2	96.6	3.8	19.6	0.0	0.0	23.4	120.0	620.0	43.1	94.3	64.5	158.8	38.8
12	2015	164.6	11.2	175.8	3.8	19.6	0.0	0.0	23.4	199.2	620.0	42.0	96.2	65.5	161.7	-37.5
13	2016	177.2	4.1	181.4	3.8	19.6	0.0	0.0	23.4	204.8	620.0	40.7	98.3	66.5	164.8	-40.0
14	2017	108.8	4.1	112.9	7.7	39.9	0.0	0.0	47.6	160.4	1261.0	39.5	204.2	67.5	271.6	111.2
15	2018	102.6	4.1	106.7	7.7	43.4	0.0	3.0	54.0	160.7	1370.0	38.3	226.2	68.5	294.7	134.0
16	2019	56.3	4.1	60.5	7.7	43.4	0.0	3.0	54.0	114.5	1370.0	37.1	230.5	69.5	300.0	185.5
17	2020	0.0	12.2	12.2	8.5	59.8	0.0	3.0	71.3	83.5	1890.0	36.0	323.7	70.6	394.2	310.7
18	2021	59.5	12.2	71.7	8.5	66.9	0.0	3.0	78.4	150.1	2113.0	34.7	369.2	71.6	440.8	290.7
19	2022	59.5	12.2	71.7	8.5	71.2	8.4	3.0	91.1	162.8	2250.0	33.5	400.6	72.7	473.3	310.4
20	2023	0.0	12.2	12.2	12.7	80.9	0.0	3.0	96.7	108.8	2558.0	32.3	463.6	73.8	537.4	428.6
21	2024	0.0	12.2	12.2	12.7	88.0	0.0	3.0	103.7	115.9	2781.0	31.1	512.6	74.9	587.6	471.7
22	2025	0.0	0.0	0.0	12.7	94.9	0.0	3.0	110.6	110.6	3000.0	30.0	561.9	74.9	636.9	526.2
23	2026	0.0	0.0	0.0	12.7	94.9	0.0	3.0	110.6	110.6	3000.0	30.0	561.9	74.9	636.9	526.2
24	2027	0.0	0.0	0.0	12.7	94.9	9.5	3.0	120.2	120.2	3000.0	30.0	561.9	74.9	636.9	516.7
25	2028	0.0	0.0	0.0	12.7	94.9	0.0	3.0	110.6	110.6	3000.0	30.0	561.9	74.9	636.9	526.2
26	2029	0.0	0.0	0.0	12.7	94.9	0.0	3.0	110.6	110.6	3000.0	30.0	561.9	74.9	636.9	526.2
27	2030	0.0	0.0	0.0	12.7	94.9	0.0	3.0	110.6	110.6	3000.0	30.0	561.9	74.9	636.9	526.2
28	2031	0.0	0.0	0.0	12.7	94.9	0.0	3.0	110.6	110.6	3000.0	30.0	561.9	74.9	636.9	526.2
29	2032	0.0	77.1	77.1	12.7	94.9	10.8	3.0	121.5	198.6	3000.0	30.0	561.9	74.9	636.9	438.3
30	2033	65.7	0.0	65.7	12.7	94.9	0.0	3.0	110.6	176.3	3000.0	30.0	561.9	74.9	636.9	460.6
31	2034	0.0	0.0	0.0	12.7	94.9	0.0	3.0	110.6	110.6	3000.0	30.0	561.9	74.9	636.9	526.2
32	2035	0.0	18.1	18.1	12.7	94.9	0.0	3.0	110.6	128.7	3000.0	30.0	561.9	74.9	636.9	508.1
33	2036	46.3	0.0	46.3	12.7	94.9	0.0	3.0	110.6	157.0	3000.0	30.0	561.9	74.9	636.9	479.9
34	2037	0.0	0.0	0.0	12.7	94.9	12.3	3.0	122.9	122.9	3000.0	30.0	561.9	74.9	636.9	513.9
35	2038	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
36	2039	1.6	8.9	10.5	12.7	94.9	0.0	0.0	107.6	118.1	3000.0	30.0	561.9	74.9	636.9	518.7
37	2040	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
38	2041	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
39	2042	110.3	0.0	110.3	12.7	94.9	0.0	0.0	107.6	218.0	3000.0	30.0	561.9	74.9	636.9	418.9
40	2043	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
41	2044	0.0	32.8	32.8	12.7	94.9	0.0	0.0	107.6	140.5	3000.0	30.0	561.9	74.9	636.9	496.4
42	2045	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
43	2046	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
44	2047	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
45	2048	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
46	2049	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
47	2050	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
48	2051	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
49	2052	65.7	0.0	65.7	12.7	94.9	0.0	0.0	107.6	173.3	3000.0	30.0	561.9	74.9	636.9	463.6
50	2053	0.0	0.0	0.0	12.7	94.9	0.0	0.0	107.6	107.6	3000.0	30.0	561.9	74.9	636.9	529.2
NPV (12%) =		468.6	78.4	547.1	22.5	151.0	2.3	4.6	180.3	727.4					1,035.9	
Total =		1,838.6													EIRR =	16.7%
															B/C(12%)=	1.42

Note: (1) Costs for water distribution including primary distribution mains.

Table 12.4 Economic Benefit Accrued from TPSB Program

1) Projected population served								
- Year	2000	(2002)	2005	2010	2015	2020	2025	Growth Rate in 2000-2025
- Total Population in Project Area (x 1000 Persons)	8,120	8,414	9,703	11,286	13,785	16,147	19,109	3.5%
2) Projected TPSB Population Served								
- TPSB beneficiaries (MWCI only)		702					1,652	
- No. of HH of TPSB beneficiaries (MWCI only)		117					275	
- % share of TPSB (MWCI+MWSI) to population served:		20.7%					21.5%	
3) Revenue in two Concessionaires area (US$ mil.):		63.7			64.5		74.9	

Notes: TPSB: "Tubig para sa Barangay" (Water to the Barangay)

Assumed daily labor wage:		250	Peso /day	
Revenue per person per day:		62.5	Peso /day	=250*(2hours/8hours)
Working days per person in a year:		182.5	days	= 365 / 2
(by assuming that the beneficiaries work 2 hours per day in half a year)				
Annual revenue in MWCI area in 2002:		1,335	Peso mil.	=250*(2/8)*182.5*117/10^3
No. of population served in 2000:	MWCI =	3,273	*10^3	40.3%
	MWSI =	4,847	*10^3	59.7%
	Total =	8120	*10^3	100.0%

Total = MWCI * (1/0.403)

Total revenue in two Concessionaires areas in 2002:	3,311	Peso mil.	=1,335 / 0.403
	63.7	US$ mil.	
Total revenue in two Concessionaires areas in 2025:	3,897	Peso mil.	
	74.9	US$ mil.	

Table 12.5 Computation of EIRR for BOTa Scheme

(Unit: US$ 10^6)

No.	Year	Capital Cost	O&M Cost	Economic Cost	Economic benefit				B - C
					Capital Benefit	Fixed O&M Benefit	Variable O&M Benefit	Total Benefit	
1	2004	0.0		0.0				0.0	0.0
2	2005	0.0		0.0				0.0	0.0
3	2006	0.0		0.0				0.0	0.0
4	2007	0.0		0.0				0.0	0.0
5	2008	0.0		0.0				0.0	0.0
6	2009	0.0		0.0				0.0	0.0
7	2010	0.0		0.0				0.0	0.0
8	2011	0.0		0.0				0.0	0.0
9	2012	3.8		3.8				0.0	-3.8
10	2013	5.9		5.9				0.0	-5.9
11	2014	6.7		6.7	11.5			11.5	4.8
12	2015	33.9		33.9	19.1			19.1	-14.8
13	2016	31.0		31.0	7.7			7.7	-23.3
14	2017	0.0	1.5	1.5		1.6	7.3	8.9	7.3
15	2018	0.0	1.5	1.5		1.6	7.3	8.9	7.3
16	2019	0.0	1.5	1.5		1.6	7.3	8.9	7.3
17	2020	0.0	1.5	1.5		1.6	7.3	8.9	7.3
18	2021	0.0	1.5	1.5		1.6	7.3	8.9	7.3
19	2022	0.0	1.5	1.5		1.6	7.3	8.9	7.3
20	2023	0.0	1.5	1.5		1.6	7.3	8.9	7.3
21	2024	0.0	1.5	1.5		1.6	7.3	8.9	7.3
22	2025	0.0	1.5	1.5		1.6	7.3	8.9	7.3
23	2026	0.0	1.5	1.5		1.6	7.3	8.9	7.3
24	2027	0.0	1.5	1.5		1.6	7.3	8.9	7.3
25	2028	0.0	1.5	1.5		1.6	7.3	8.9	7.3
26	2029	0.0	1.5	1.5		1.6	7.3	8.9	7.3
27	2030	0.0	1.5	1.5		1.6	7.3	8.9	7.3
28	2031	0.0	1.5	1.5		1.6	7.3	8.9	7.3
29	2032	0.0	1.5	1.5		1.6	7.3	8.9	7.3
30	2033	0.0	1.5	1.5		1.6	7.3	8.9	7.3
31	2034	0.0	1.5	1.5		1.6	7.3	8.9	7.3
32	2035	0.0	1.5	1.5		1.6	7.3	8.9	7.3
33	2036	51.4	1.5	52.9	34.4	1.6	7.3	43.3	-9.6
34	2037	0.0	1.5	1.5		1.6	7.3	8.9	7.3
35	2038	0.0	1.5	1.5		1.6	7.3	8.9	7.3
36	2039	0.0	1.5	1.5		1.6	7.3	8.9	7.3
37	2040	0.0	1.5	1.5		1.6	7.3	8.9	7.3
38	2041	0.0	1.5	1.5		1.6	7.3	8.9	7.3
39	2042	0.0	1.5	1.5		1.6	7.3	8.9	7.3
40	2043	0.0	1.5	1.5		1.6	7.3	8.9	7.3
41	2044	0.0	1.5	1.5		1.6	7.3	8.9	7.3
42	2045	0.0	1.5	1.5		1.6	7.3	8.9	7.3
43	2046	0.0	1.5	1.5		1.6	7.3	8.9	7.3
44	2047	0.0	1.5	1.5		1.6	7.3	8.9	7.3
45	2048	0.0	1.5	1.5		1.6	7.3	8.9	7.3
46	2049	0.0	1.5	1.5		1.6	7.3	8.9	7.3
47	2050	0.0	1.5	1.5		1.6	7.3	8.9	7.3
48	2051	0.0	1.5	1.5		1.6	7.3	8.9	7.3
49	2052	0.0	1.5	1.5		1.6	7.3	8.9	7.3
50	2053	0.0	1.5	1.5		1.6	7.3	8.9	7.3
NPV (12%) =		22.2		25.1				27.5	
Total =		132.6						EIRR =	14.4%
Replacement =		51.4						B/C(12%)=	1.09
Eco. Cost =		81.3							

Table 12.6 Economic Benefit for BOTa Scheme

(1) Cost of Alternative Thermal

1-1) Asumed Alternative Thermal : Combined Cycle

1-2) Annual Disbursement Schedule of Assumed Alternative Thermal

No. of Year	Disbursement Ratio
1st Year	30%
2nd Year	50%
3rd Year	20%
Total	100%

3) Unit Cost of Alternative Thermal and Adjustment Factor

Item	Unit Cost	Adjustment Factor
Ck: Capital cost per kW	Ck=700 (US$/kW)	Af1= 1.279
Cf: Fixed O&M cost per kW	Cf=28.65 (US$/kW)	Af1= 1.279
Cv: Variable O&M cost per kWh	Cv=0.0217 (US$/kWh)	Af2= 1.061

(2) Power/Energy Output of Four Alternative Plans

2-1) Peak Power Output		
- Installed Capacity	51.5	(MW)
- 90% Guaranteed Power	42.7	(MW)
2-2) Annual Energy Output		
- Primary Energy	215.3	(GWh/year)
- Secondary Energy	102.9	(GWh/year)
- Total Energy Production	318.2	(GWh/year)

(3) Annual Economic Benefit Measured by Costs of Alternative Thermal

3-1) Annual Disbursement of Initial Invetment Cost

No. of Year	Disbursement Ratio	Cost (US$ million)
- 1st Year	30%	11.5
- 2nd Year	50%	19.1
- 3rd Year	20%	7.6
Total	100%	38.2

3-2) Annual O&M Cost (US$ million)

Item	Cost (US$ million)
(1) Annual Fixed O&M Cost	1.56
(2) Annual Variable O&M (Energy) Cost	7.33