- Alternative study for phasing the distribution network development is then conducted based on the selected network configuration.

7.2 FACTORS TO BE CONSIDERED FOR ALTERNATIVE STUDY

In evaluating alternatives, considered were; water demand for each design year, recommended water sources, design criteria for distribution system, storage requirements and locations, and other parameters relevant to the existing and proposed systems.

7.2.1 Planning Stages

In studying of alternatives, planning stages are considered both for the long term and short term development of water supply system as shown below:

Construction Phase	Design Period
Phase I	1986 - 1995
Phase II	1996 - 2010

The long term development shall be completed during the Phase II period, while the short term development by the year 1995.

The Phase I project is further divided into two stages; Stage 1 for 1990 and Stage 2 for 1995 taking into account of practical construction period for the required facilities, especially for internal network and service connections.

7.2.2 Water Demand in Each Design Year

The future water demand as projected in Chapter 5 covering barangays to be served in the respective target years is presented in TABLE 7.2.1.

TABLE 7.2.1 DEMAND PROJECTION BY BARANGAY (DAILY AVE. AND MAX.)

Unit: cu.m/day

Municipality	Barangay	Design Year		
		1990	1995	2010
Cabuyao	Barangay I, II & III	1,000	1,100	1,800
	Bigaa	300	900	1,800
	Sala	200	700	1,600
	Baclaran	-	-	600
	Banay-Banay	-	-	1,500
	Banlic	-	-	1,600
	Butong	-	-	600
	Gulod	-	-	1,700
	Mamatid	-	-	1,700
	Marinig	-	-	2,200
	Niugan	-	-	1,800
	Pulo	-	-	1,700
	San Isidro	-	-	600
	Sub-Total	1,500	2,700	19,200
Sta. Rosa	Barangay I, II & III	800	1,600	2,300
	Aplaya	500	1,400	2,600
	Balibago	800	1,500	2,900
	Dila	200	600	1,100
	Dita	500	1,100	2,200
	Ibaba	100	300	500
	Labas	200	600	1,300
	Macabling	300	800	1,600
	Tagapo	500	1,700	3,700
	Caiñgin	-	-	2,100
	Malitlit	-	-	1,400
	Pook	-	-	2,500
	Sinalhan	-	-	2,500
	Sub-Total	3,900	9,600	26,700
Biñan	De La Paz	1,000	3,300	6,600
	Malaban	1,100	3,500	7,200
	Platero	300	900	1,800
	Poblacion	300	700	1,800
	San Antonio	900	2,700	4,800
	San Jose	300	900	1,600
	San Vicente	500	1,600	3,000
	Sto. Domingo	200	500	900
	Canlalay	-	-	3,400
	Casile	-	-	200
	San Anton	-	-	500
	Tubigan	-	-	1,100
	Zapote	-	-	200
	Sub-Total	4,600	14,100	32,500
Daily Average Demand		10,000	26,400	78,400
Daily Maximum Demand		12,500	33,000	94,000

Note: Fluctuation factor (daily max./daily ave.): 1990 and 1995; 1.25
2010; 1.20

7.2.3 Water Sources Considered

Based on the study of existing and potential water sources performed in Chapter 6, the following source alternatives are considered.

(1) Realignment of Existing Deep Wells

Two existing deep wells in Biñan shall be abandoned due to low water production.

(2) Surface Water

The utilization of Laguna de Bay is a principal alternative of surface water, though it will require a set of water treatment facilities.

(3) Groundwater

The existing groundwater source, excluding the afore-mentioned two wells to be abandoned, is therefore a spring with a water production of about 9,300 cu.m/day.

For future development, the construction of deep wells, the utilization of additional springs and stand-by NIA wells are considered.

In the case of new deep well construction, Sta. Rosa area is identified to be dependable for exploiting about 5,500 cu.m/day from one well based on the hydrogeological studies. The proposed design parameter of deep well is as follows:

Proposed Deep Well	Design Parameter
Well depth	200 m
Casing diameter	300 mm
Estimated discharge	5,500 cu.m/day
Influence area	500 m (radius)

With regard to the standby NIA wells, some of them are no longer operating since the supposed irrigable area have already been converted into residential communities. In most cases, the wells were abandoned due

to stolen electric cables and switch boxes. Because of this, a list of NIA wells for possible future water supply sources was submitted to the NIA to seek for permission to utilize the said wells. During the discussions with a NIA official, it was confirmed that some wells, excluding the free-flowing ones may be converted for water supply purpose. However, observation wells constructed by the NIA cannot be utilized for this purpose.

The available amount of spring water is confirmed to be approximately 12,600 cu.m/day comprising 9,300 cu.m/day from the existing spring source (Matang-Tubig Spring) and 3,300 cu.m/day from other additional springs. Since these springs are located in the area owned by the Canlubang Sugar Estate Group, the negotiation with this owner as well as the approval from the National Water Resources Council is a prerequisite for exploitation of these additional springs.

The water right for the Canlubang Sugar Estate Group in the spring area was identified as shown in APPENDIX 7.2.1.

7.2.4 Distribution System

Alternative study of the distribution system includes the study of various alternative pipeline configurations and routing to arrive at the cheapest possible distribution system that can provide adequate water pressure in the proposed service area.

(1) Pressure Zone

The ground elevation of the proposed service area for the year 2010 varies from 1.5 m to 3.7 m above the mean sea level. In this regard, only one pressure zone is considered for Cabuyao-Sta. Rosa-Biñan area through the year 2010.

(2) System Pressure

In accordance with the LWUA Methodology Manual, the design water pressure in the main pipes with a diameter of more than 150 mm as indicated below will be achieved in the year 2010 (Phase II) for the hourly maximum flow:

- o Max. static water pressure : 7.0 kg/sq.cm
- o Min. dynamic water pressure : 0.7 kg/sq.cm for the residential area; 1.4 kg/sq.cm for the commercial/industrial area.

During the Phase I period, a minor modification to the above-mentioned requirements may be adopted considering of the cost constraints as the intermediate measure of system improvement.

"C" value (Hazen Williams' Formula) being adopted in the said manual is also given below:

ϕ100 mm to ϕ200 mm : C = 110
ϕ250 mm to ϕ500 mm : C = 120
ϕ600 mm and over : C = 130

(3) Fire Protection

Full fire protection with adequate water pressure will be insured during the Phase II period. During the Phase I period, the existing fire hydrants will be utilized. The criteria on the location of fire hydrants as set forth in the LWUA Methodology Manual is summarized as follows:

	Residential Area	Commercial/ Industrial Area
Diameter of Fire Hydrants	100 mm	150 mm
Spacing	180 m	135 m
Hydrant Density	0.3 pc/ha	0.6 pc/ha

The number of fire hydrants can be determined either by spacing or by hydrant density criteria.

To verify the appropriateness of distribution system, a 22 l/sec of fire fighting water from each of two adjacent fire hydrants in the residential area will be checked by the computer-aided network analysis.

(4) Storage Facilities

In coming up with the most cost-effective storage facilities, water demand and storage volume will have to be ascertained. In compliance with the LWUA Methodology Manual, the optimum configuration of the storage facilities will be selected from among the following three alternative schemes:

- Daily maximum supply and maximum storage,
- Intermediate supply and storage (150% of the daily maximum supply), and
- Peak hour supply and minimum storage.

The location of storage facilities will also be studied in relation to the diameter of distribution pipes.

(5) Distribution Network

The most optimum distribution network will be determined from the view point of the least construction cost by means of the computer-aided network analysis by taking into account the afore-mentioned criteria of distribution system.

(6) Equipment/Materials and Unit Costs

The unit costs of water supply equipment and materials were inquired both in Manila and respective study area during the field survey.

The survey results revealed that almost all the equipment and materials are imported or partially manufactured in Manila area and distributed to local areas. These market prices which were mainly pipes and fittings, were compared with the LWUA Methodology Manual at the 1986 price level and it is concluded that the said Manual be referred to estimate the project cost.

With regard to pipe materials, PVC pipe for diameters up to 150 mm and steel pipe for diameters of 200 mm and above are utilized in this study based on the cost comparison. (See APPENDIX 7.2.2 for details)

7.3 ALTERNATIVE STUDY OF WATER SUPPLY SYSTEM

7.3.1 Water Source and Transmission

(1) Water Source Alternatives

1) Development of Alternatives

The alternative water sources in the study area are springs, groundwater and surface water of the Laguna de Bay.

The total water demand in the year 2010 was projected to be around 94,000 cu.m/day which is ten times the level of the present water production. Accordingly, a considerable amount of additional water will be required.

There are two alternatives for the development of additional water sources to meet the said water demand aside from the existing water sources, as enumerated below.

Alternative S-1

- Utilization of spring water and groundwater.

Alternative S-2

- Combination of existing springs, wells and surface water of the Laguna de Bay.

For water conveyance/transmission pipelines of the above water source alternatives, no alternative routing is available for comparison since the proposed pipeline routes are determined considering the road conditions for pipe installation with the shortest length possible. However, the configuration of pipe alignment will be subject to the cost comparison to establish the optimum plan when the staged construction program is introduced.

A schematic system configuration of the water source alternatives including transmission and treatment facilities is shown in FIGURE 7.3.1 and summarized in TABLE 7.3.1.

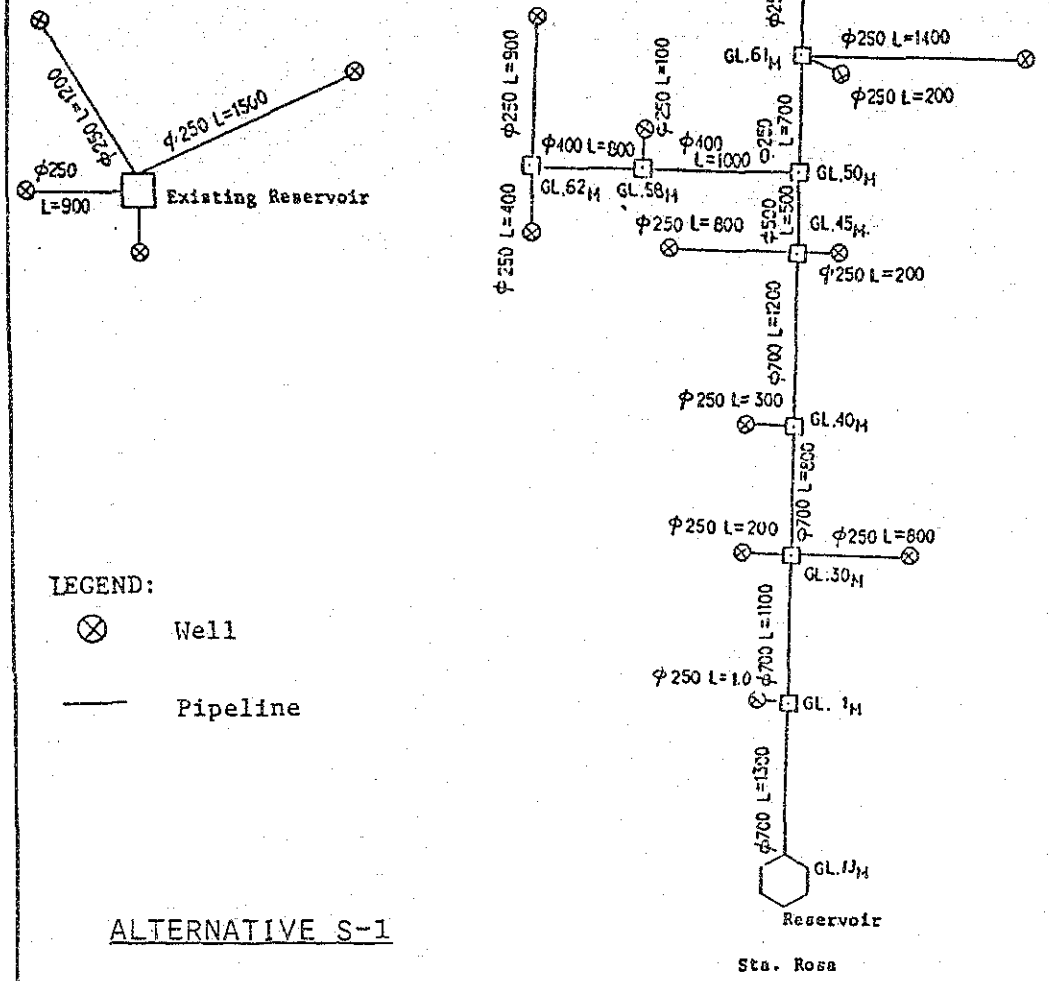


FIGURE 7.3.1 SCHEMATIC SYSTEM CONFIGURATION OF ALTERNATIVES FOR WATER SOURCE AND TRANSMISSION

TABLE 7.3.1 MAJOR FACILITIES OF ALTERNATIVES FOR WATER SOURCE AND TRANSMISSION

Facilities	Alternative S-1	Alternative S-2
Water Source	Deep Well, 16 units (ϕ300mm, 200 m^D)	Deep Well, 4 units (ϕ300mm, 200 m^D) Water Intake, 1 unit (670 1/sec, Laguna de Bay)
Transmission Line	ϕ700 mm - 4,400 m ϕ500 mm - 500 m ϕ400 mm - 1,800 m ϕ350 mm - 700 m ϕ250 mm - 10,000 m	ϕ700 mm - 1,000 m ϕ450 mm - 1,300 m ϕ400 mm - 1,100 m ϕ250 mm - 2,400 m
Water Treatment	----------	Rapid Sand Filter (57,200 cu.m/day)

2) Cost Comparison

A cost comparison of water source alternatives including relevant facilities is summarized in TABLE 7.3.2 and details are given in APPENDIX 7.3.1.

TABLE 7.3.2 COST COMPARISON OF WATER SOURCE AND TRANSMISSION ALTERNATIVES

Facilities	Alternative S-1	Alternative S-2
Water Source	₱ 31,200,000	₱ 16,166,000
Transmission Line	17,745,000	5,997,000
Water Treatment	-	61,204,000
Energy Consumption (15 years)	23,337,000	14,508,000
Maintenance Cost	8,351,000	9,417,000
TOTAL	₱ 80,633,000	₱ 107,292,000

The cost comparison of two alternatives favors Alternative S-1 than Alternative S-2. Beside a lower cost in construction and operation/maintenance, Alternative S-1 has a potential advantage of flexibility on project implementation when it comes to the increase of water demand.

Thus, Alternative S-1 is recommended as the optimum plan for water source development toward the target year of 2010.

(2) Transmission Alternatives

1) Development of Alternatives

In accordance with the selected water source development plan, including transmission pipeline route, alternative pipe alignment plans, the staged construction program is developed as shown in TABLE 7.3.3 and FIGURE 7.3.2.

TABLE 7.3.3 ALTERNATIVES FOR TRANSMISSION PIPE ALIGNMENT

Transmission Line	Alternative T-1			Alternative T-2		
Pipe Alignment	Single Line			Parallel Line		
Construction Phase	Phase I	Phase II	Total	Phase I	Phase II	Total
ϕ700 mm	3,200 m	1,200 m	4,400 m	-	1,200 m	1,200 m
ϕ600 mm	-	-	-	-	3,200	3,200
ϕ500 mm	-	500	500	-	500	500
ϕ450 mm	-	-	-	1,300	-	1,300
ϕ400 mm	-	1,800	1,800	1,100	1,800	2,900
ϕ350 mm	-	700	700	-	700	700
ϕ250 mm	1,400	4,800	6,200	2,200	4,800	7,000
Total	4,600 m	9,000 m	12,600 m	4,600 m	12,200 m	16,800 m

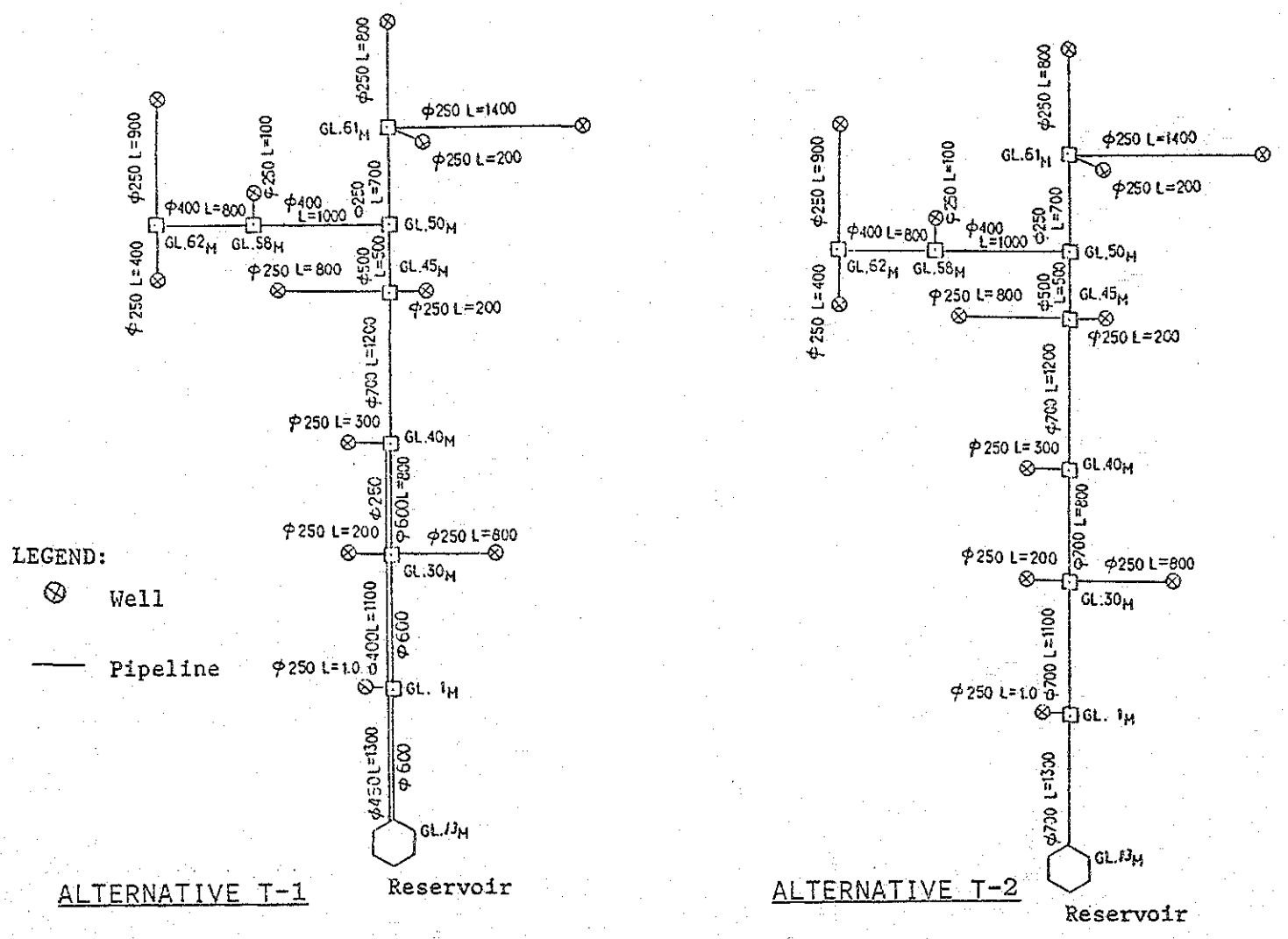


FIGURE 7.3.2 ALTERNATIVES FOR TRANSMISSION PIPE ALIGNMENT

2) Cost Comparison

The cost comparison of two alternatives were made by applying 12% per annum of discount rate. The year of construction for cost comparison purpose is set as 1990 for Phase I and 1998 for Phase II pipelines, respectively.

A summary of cost comparison is shown in TABLE 7.3.4 and details are given in APPENDIX 7.3.1.

TABLE 7.3.4 COST COMPARISON OF ALTERNATIVE TRANSMISSION PIPE ALIGNMENT

Unit:₱ x 1,000

Costs	Alternative T-1			Alternative T-2		
	Phase I	Phase II	Total	Phase I	Phase II	Total
Construction Cost (C)	6,994	8,357	15,351	3,961	13,477	17,438
Present Worth of Construction Cost (Cc)	4,445	2,145	6,590	2,517	3,459	5,976
Present Work of Salvage Value (Cs)	277	418	695	157	675	832
Net Present Worth Comparable Cost (Cn = Cc - Cs)	4,168	1,727	5,895	2,360	2,784	5,144

Based on the result of cost comparison, Alternative T-2 is selected as the optimum plan for constructing transmission lines.

7.3.2 Location and Required Storage Capacity of Reservoirs

(1) Effective Utilization of the Existing Reservoir

With regard to the cost-effective utilization of the existing reservoir, alternative study on water distribution method from the reservoir were at first carried out. The alternatives were developed considering the potential advantages on the ground elevation of the reservoir site in respect to distribute water to Cabuyao area, as follows:

Case 1: Construction of transmission line from the existing reservoir to the vicinity of the poblacion along the existing pipeline route and distribution line, and provision of a reservoir and a pumping station before distribution.

Case 2: Expansion of the existing reservoir and construction of transmission and distribution lines using new routes.

Based on the cost comparison of two alternatives, Case 2 was selected as the optimum plan for the use of the existing reservoir. Details on this study is given in APPENDIX 7.3.2.

(2) Development of Alternatives

The pertinent selection of reservoir location and storage capacity largely contributes to economize the costs of both construction and operation/maintenance.

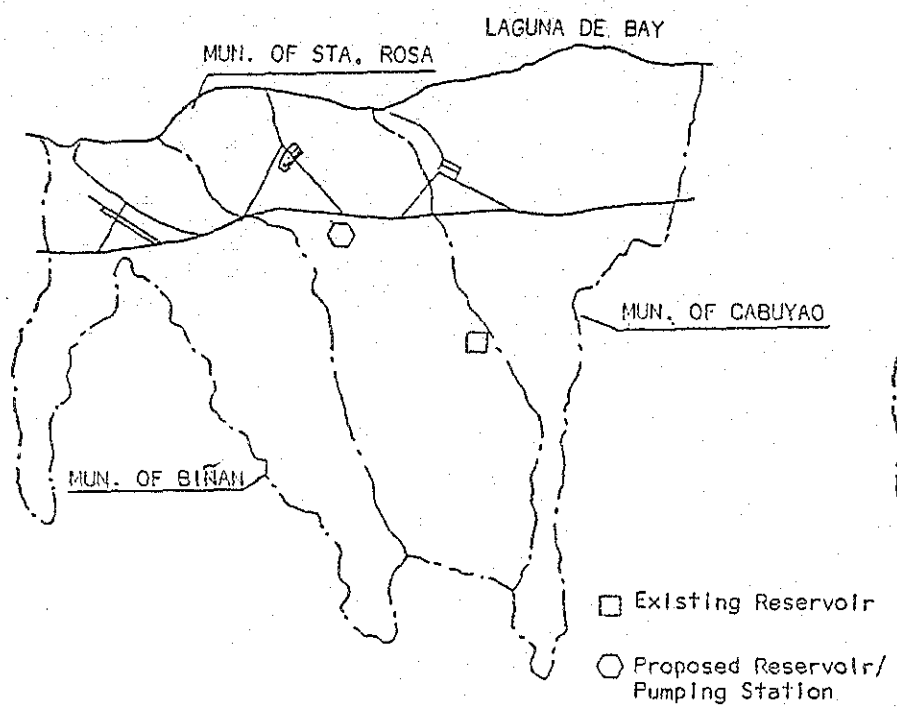
Following alternatives of reservoir locations as shown in FIGURE 7.3.3 were developed considering the existing water supply facilities and the projected water demand for the year 2010 in respective service area municipalities.

Alternative D-1

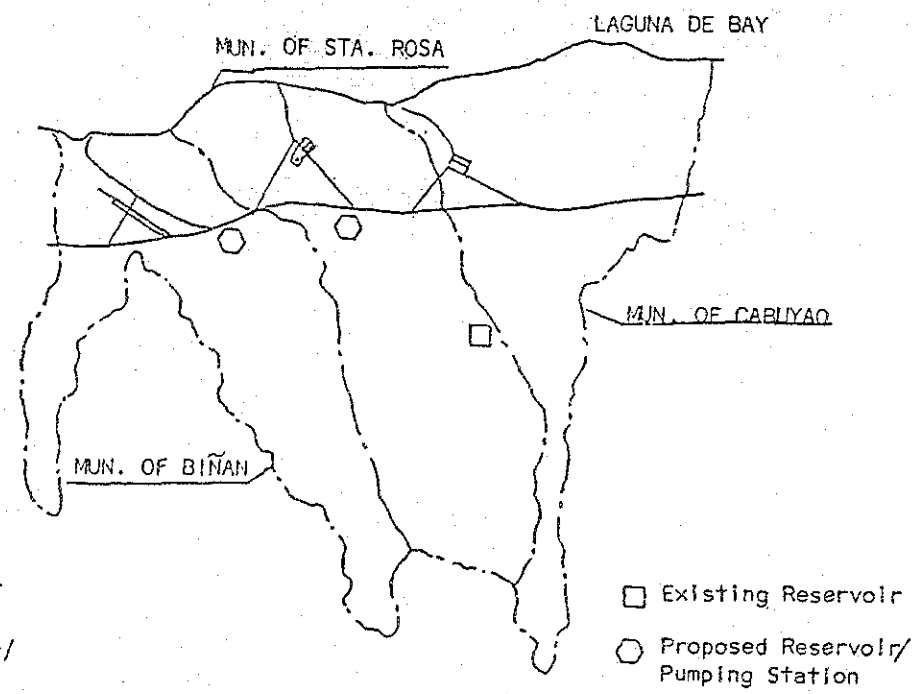
Cabuyao	:	Utilization of the existing reservoir with an expansion to the required storage capacity.
Sta. Rosa & Biñan	:	Construction of a new reservoir with the required capacity in Sta. Rosa.

Alternative D-2

Cabuyao	:	Same as Alternative D-1
Sta. Rosa & Biñan	:	Construction of new reservoirs with the required capacities in Sta. Rosa and Biñan, respectively.



ALTERNATIVE D-1



ALTERNATIVE D-2

FIGURE 7.3.3 RESERVOIR LOCATION ALTERNATIVES

To determine the most optimum storage capacity of respective reservoirs for the above alternatives, three cases for the storage requirement were considered as described in the section 7.3.1. TABLE 7.3.5 shows the required storage capacity estimated for each alternative.

TABLE 7.3.5 STORAGE REQUIREMENTS OF ALTERNATIVES

Unit : cu.m

Storage Volume	Alternative D-1		Alternative D-2		
	Cabuyao	Sta. Rosa	Cabuyao	Sta. Rosa	Biñan
Emergency	1,920	5,920	1,920	2,670	3,250
Maximum					
Operational	2,830	8,730	2,830	3,930	4,830
Total	4,750	14,650	4,750	6,600	8,080
Existing Capacity	1,350	-	1,350	-	-
Required Capacity	3,400	14,650	3,400	6,600	8,080
Intermediate					
Operational	-	-	-	-	-
Total	1,920	5,920	1,920	2,670	3,250
Existing Capacity	1,350	-	1,350	-	-
Required Capacity	570	5,920	570	2,670	3,250
Minimum					
Operational	-	-	-	-	-
Total	1,920	5,920	1,920	2,670	3,250
Existing Capacity	1,350	-	1,350	-	-
Required Capacity	570	5,920	570	2,670	3,250

(3) Cost Comparison

According to the estimated storage requirements of each alternative, it is obvious that the case of the minimum storage requires larger construction cost for water source facilities to cope with the peak hour demand rather than that of the intermediate storage. Thus, a cost comparison of alternatives was performed for the cases of the maximum and intermediate storage capacities.

TABLE 7.3.6 shows a summary of comparative cost. In estimating construction cost of reservoir, the cost function adopted in the LWUA Methodology Manual is referred to.

TABLE 7.3.6 COST COMPARISON OF RESERVOIR ALTERNATIVES

Unit : ₱ x 1,000

Storage Volume	Unit Cost (₱)	Alternative D-1		Alternative D-2	
		Q'ty	Cost	Q'ty	Cost
Maximum					
Water Source					
Deep Well	1,160,000	16 units	18,560	16 units	18,560
Deep Well Pump Station	790,000	16 units	12,640	16 units	12,640
Sub-Total			31,200		31,200
Reservoir					
Cabuyao		3,400 cu.m	3,621	3,400 cu.m	3,621
Sta. Rosa		14,650 cu.m	9,208	6,600 cu.m	5,532
Biñan		-	-	8,080 cu.m	6,295
Sub-Total			12,829		15,448
TOTAL			44,029		46,648
Intermediate					
Water Source					
Deep Well	1,160,000	24 units	27,840	24 units	27,840
Deep Well Pump Station	790,000	24 units	18,960	24 units	18,960
Sub-Total			46,800		46,800
Reservoir					
Cabuyao		570 cu.m	1,157	570 cu.m	1,157
Sta. Rosa		5,920 cu.m	5,160	2,670 cu.m	3,103
Biñan		-	-	3,250 cu.m	3,518
Sub-Total			6,317		7,778
TOTAL			53,117		54,578

Based on the above cost comparison, the case of the maximum storage capacity is cheaper than that of the intermediate storage capacity. When the cost for transmission line from water source to reservoir is taken into account, it is apparent that the case of the maximum storage capacity is more advantageous than the other one.

Thus, the daily maximum supply with the maximum storage capacity is recommended.

7.3.3 Distribution System

(1) Development of Alternatives

Two alternative studies on the distribution system is carried out for the reservoir locations as determined in the fore-going section.

A choice of alternative routes for major distribution pipeline is limited owing to road network as well as size and location of major demand centers in the proposed service area.

The most optimum network configuration of each alternative to allow the peak hour water flow in the year 2010 is determined through the computer-aided hydraulic simulation. TABLE 7.3.7 shows the required distribution facilities excluding commonly required facilities.

TABLE 7.3.7 ALTERNATIVE SYSTEM CONFIGURATIONS OF RESERVOIR AND DISTRIBUTION MAIN

Required Facilities	Alternative D-1		Alternative D-2	
Transmission Line (Sta. Rosa to Biñan)	-		ϕ600 mm, 3,800 m	
Booster Pump Station	-		1 unit (380 l/sec, H=15m) Sta. Rosa to Biñan	
Distribution Pump	1 unit (1,210 l/sec, H=45m) Sta. Rosa area		1 unit (470 l/sec, H=30m) Sta. Rosa area 1 unit (720 l/sec, H=40m) Biñan area	
Distribution Main/Valve	Pipe (m)	Valve (pcs.)	Pipe (m)	Valve (pcs.)
ϕ 700 mm	250	1	250	1
ϕ 600 mm	8,310	28	5,260	18
ϕ 500 mm	1,750	6	-	-
ϕ 450 mm	1,450	5	800	3
ϕ 400 mm	3,000	10	5,800	19
ϕ 350 mm	5,350	18	3,200	11
ϕ 300 mm	11,400	38	14,200	47
ϕ 250 mm	14,650	49	14,400	48
ϕ 200 mm	7,800	26	10,300	34
ϕ 150 mm	6,950	23	2,650	9
ϕ 100 mm	-	-	1,000	3
Total	60,910	204	57,860	193

(2) Cost Comparison

In accordance with the facility requirements as shown in TABLE 7.3.7, the construction costs of the alternatives were estimated including the operation and maintenance costs at the 1986 price level. Construction costs of distribution reservoirs are not considered in the cost comparison since the total storage capacity required for each alternative results in same construction cost.

TABLE 7.3.8 shows the estimated costs for construction and 15 years operation and maintenance.

TABLE 7.3.8 COST COMPARISON OF ALTERNATIVE DISTRIBUTION NETWORK

Cost	Alternative D-1	Alternative D-2
Construction Cost		
Transmission Line	-	6,080
Booster Pump Station	-	5,188
Distribution Pump	-	
for Sta. Rosa	15,011	6,638
for Biñan	-	9,709
Distribution Main		
Pipe	50,309	44,885
Valve	13,266	10,165
Total	78,586	82,665
Operation & Maintenance Cost		
Operators Salary	216	648
Energy	4,902	17,550
Maintenance	7,859	7,678
Total	12,977	25,876
GRAND TOTAL	91,563	108,541

Based on the above cost comparison, Alternative D-1 is selected as the most economical configuration of the distribution system.

7.3.4 Phasing of Distribution Network Development

(1) Development of Alternative

An in depth alternative study on the distribution system being selected in the foregoing section is carried out to establish the most optimum phasing of the overall system for the short term and long term development.

The computer-aided hydraulic simulation of the distribution network is a key subject in this study (See APPENDIX 7.3.3). Two alternative approaches of the study are then considered; Alternative D-1-A consists of a single pipeline alignment, and Alternative D-1-B forms a parallel pipeline alignment. Particular approaches of these alternatives are as follows:

Alternative D-1-A

- The most optimum network configuration to allow the peak hour water flow in the year 2010 is first determined as studied in the previous section.

- Major distribution pipes to be required in Phase I period are identified from the above-mentioned network configuration.

- Phase II distribution network will be completed by installing additional pipes in the area to be served in this period.

Alternative D-1-B

- Based on the optimum route of major distribution pipelines as determined in the previous section, the least cost network configuration, which is mainly the pipe sizes, is determined to satisfy a minimum of 0.7 kg/sq.cm of water pressure under the peak hour water flow during the Phase I period.

- For the Phase II water demand, additional pipes wherever necessary for augmenting the distribution capacity to cope with all the criteria set

forth in the LWUA Methodology Manual are determined. Likewise, several pipeline routes will form a parallel pipe alignment.

The configuration of alternative distribution networks by construction phases is summarized in TABLE 7.3.9.

TABLE 7.3.9 CONFIGURATION OF ALTERNATIVE DISTRIBUTION NETWORKS

Materials	Alternative D-1-A			Alternative D-1-B		
	Phase I	Phase II	Total	Phase I	Phase II	Total
Pipe (m)						
ϕ 150 mm	1,550	5,400	6,950	3,450	6,800	10,250
ϕ 200 mm	900	6,900	7,800	3,800	6,550	10,350
ϕ 250 mm	2,050	8,000	10,050	2,650	8,350	11,000
ϕ 300 mm	2,000	9,400	11,400	1,850	10,500	12,350
ϕ 350 mm	2,000	3,350	5,350	1,750	3,850	5,600
ϕ 400 mm	600	2,400	3,000	-	5,200	5,200
ϕ 450 mm	1,450	-	1,450	900	400	1,300
ϕ 500 mm	1,350	400	1,750	2,900	3,800	6,700
ϕ 600 mm	3,800	4,500	8,300	250	4,500	4,750
ϕ 700 mm	250	-	250	-	-	-
Total	15,950	40,350	56,300	17,550	49,950	67,500
Valves (pcs.)						
ϕ 150 mm	5	18	23	10	23	33
ϕ 200 mm	3	23	26	13	22	35
ϕ 250 mm	7	27	34	9	28	37
ϕ 300 mm	7	32	39	6	35	41
ϕ 350 mm	7	11	18	6	13	19
ϕ 400 mm	2	8	10	-	17	17
ϕ 450 mm	5	-	5	3	1	4
ϕ 500 mm	5	1	6	10	13	23
ϕ 600 mm	13	15	28	1	15	16
ϕ 700 mm	1	-	1	-	-	-
Total	55	135	190	58	167	225

(2) Cost Comparison

Construction costs of each alternative are estimated. These include valves to be installed at every 300 meter intervals.

For this purpose, the year of construction is set in 1990 for Phase I and 1998 for Phase II pipelines. Discount rate applied to each phase is 12% per annum. For reference, 10% and 15% of discount rate are also considered (See APPENDIX 7.3.4).

A summary of cost comparison is presented in TABLE 7.3.10.

TABLE 7.3.10 COST COMPARISON OF ALTERNATIVE DISTRIBUTION NETWORK (NET PRESENT WORTH)

Unit : ₱ x 1,000

Distribution Network	Discount Rate 10%	12%	15%
Alternative D-1-A			
Phase I: (ϕ100 - ϕ700 mm)			
Pipeline: 9,770 m	10,161	9,735	8,997
Valve : 33 pcs.	3,770	3,612	3,338
Sub Total	13,931	13,347	12,335
Phase II: (ϕ100 - ϕ250 mm)			
Pipeline: 12,140 m	6,390	5,467	4,244
Valve : 41 pcs.	1,708	1,461	1,134
Sub Total	8,098	6,928	5,378
TOTAL	22,029	20,275	17,713
Alternative D-1-B			
Phase I: (ϕ100 - ϕ450 mm)			
Pipeline: 9,770 m	7,716	7,392	6,831
Valve : 32 pcs.	2,027	1,942	1,794
Sub Total	9,743	9,334	8,625
Phase II: (ϕ100 - ϕ500 mm)			
Pipeline: 21,620 m	9,819	8,401	6,520
Valve : 72 pcs.	2,518	2,154	1,672
Sub Total	12,337	10,555	8,192
TOTAL	22,080	19,889	16,817

According to the above cost comparison, the difference of the net present worth of comparable costs is less than 6%. Therefore, further comparison is made by adopting the cost escalation rate; 12% per annum from

1986 to 1989 and 10% per annum for the later project period. The inflated net present worth of comparable cost is shown in TABLE 7.3.11.

TABLE 7.3.11 ESCALATED PROJECT COST OF ALTERNATIVE DISTRIBUTION NETWORK

Unit : ₱ x 1,000

Distribution Network	Discount Rate 10%	12%	15%
Alternative D-1-A			
Phase I	21,920	21,002	19,409
Phase II	27,314	23,368	18,140
TOTAL	49,234	44,370	37,549
Alternative D-1-B			
Phase I	15,331	14,687	13,571
Phase II	41,612	35,602	27,631
TOTAL	56,943	50,289	41,202

Based on the above cost comparison, it is concluded that Alternative D-1-A (single pipeline alignment) is the most optimum plan for phasing the development of the distribution network.

CHAPTER 8
RECOMMENDED PLAN

CHAPTER 8 RECOMMENDED PLAN

8.1 GENERAL

This Chapter presents the recommended plan for the short term and long term development of the CSBWS based on the results of foregoing alternative studies.

The recommended plan consists of two construction phases; Phase I (1986-1995) and Phase II (1996-2010). Phase I period is further divided into two stages; Stage 1 (1986-1990) and Stage 2 (1991-1995) considering the scope of immediate improvements and capital cost requirements.

The proposed implementation program includes the development of water sources and the construction of conveyance, transmission, treatment and disinfection, storage and distribution facilities. The repair and rehabilitation of existing water supply facilities are also considered in the Phase I activities.

This Chapter also presents capital and annual project costs of the recommended implementation schemes.

Some deviations from the technical standards being adopted in the LWUA Methodology Manual have been applied in the Phase I period due to cost considerations. These deviations are: staging of some waterworks facilities to provide lower initial construction costs; provision of lower system pressure, and the postponement of the construction of the administration building to Phase II. All costs presented in this chapter are based on 1986 price level.

8.2 RECOMMENDED WATER SUPPLY SYSTEM

8.2.1 Layout of the Water Supply System

The general layout of the recommended water supply system for Cabuyao-Sta. Rosa-Biñan is shown in FIGURE 8.2.1 and its schematic layout is shown in FIGURE 8.2.2.

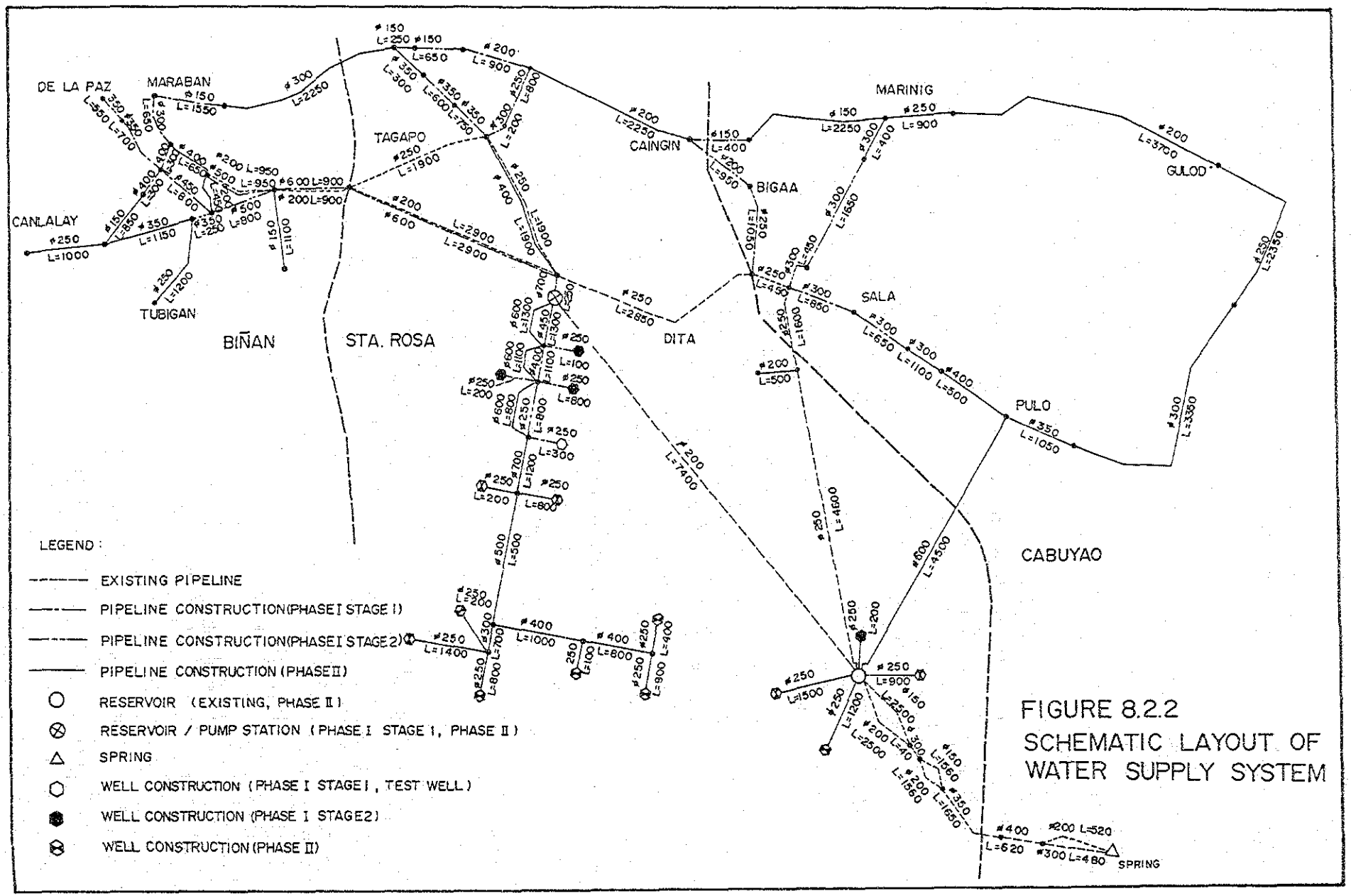


FIGURE 8.2.2
SCHEMATIC LAYOUT OF
WATER SUPPLY SYSTEM

The description of the required facilities by project phase is given in TABLE 8.2.1 and a summary of the major facilities is also given in TABLE 8.2.2.

TABLE 8.2.1 DESCRIPTION OF REQUIRED MAJOR FACILITIES BY PHASE

Phase	Facility	Major Facilities Required
Phase I Stage 1	Source	The existing Matang-Tubig Spring (9,300 cu.m/day) and a test well (5,500 cu.m/day, constructed during this Feasibility Study at Barangay Pulong Santa Cruz in Sta. Rosa) will be used. Total water production will be 14,800 cu.m/day.
	Treatment	Each one unit of constant flow chlorinator will be installed at the existing reservoir and a new reservoir (Sta. Rosa).
	Transmission	Pipe protection work will be carried out for the parallel pipe alignment section (each 400 m for ϕ200 mm and ϕ300 mm) along the river bed from the spring to the existing reservoir. A new transmission line (ϕ250 mm-ϕ450 mm, 3,500 m) will be constructed from the test well to the new reservoir (Sta. Rosa).
	Distribution	A new reservoir (3,105 cu.m) equipped with booster pump (Q=147 l/sec and H=50 m) will be constructed at Balibago in Sta. Rosa. New distribution main (ϕ250 mm-ϕ700 mm, 12,550 m) will be constructed. Internal network will be constructed to cover 340 ha of the existing service area.
	Electricity	Substation will be constructed at the new reservoir (Sta. Rosa). (300 KVA)
	Leakage Detection & Repair	All the existing service connections will be subject to the leakage detection survey. All the unmetered service connections will be installed with water meters and a half of the metered service connections will be subject to replacement of water meters. About 20% of lateral pipes will be subject to replacement.

TABLE 8.2.1 DESCRIPTION OF REQUIRED MAJOR FACILITIES BY PHASE (CONTINUED)

Phase	Facility	Major Facilities Required
Phase I Stage 2	Source	Additional 4 new wells (5,500 cu.m/day/well) will be constructed in Sta. Rosa area. Two existing wells in Biñan area will be abandoned.
	Transmission	Additional transmission line (ϕ250 mm, 1,300 m) will be constructed from new wells to the transmission main.
	Distribution	One additional booster pump (Q=373 l/sec, H=50 m) will be installed at the new reservoir (Sta. Rosa). Additional distribution main (ϕ150-ϕ500 mm, 9,300 m) will be constructed to cover the expanded service area. Additional internal network will be constructed to cover 400 ha of the expanded service area and to increase the network density in Stage 1 service area.
Phase II	Source	A total of 11 additional deep wells (5,500 cu.m/day/well) will be constructed in Sta. Rosa area.
	Treatment	Each one unit of additional constant flow chlorinator will be installed at the existing and new reservoirs.
	Transmission	Additional transmission line (ϕ250-ϕ700 mm, 12,200 m) will be constructed from new wells to the new reservoir (Sta. Rosa).
	Distribution	Existing reservoir will be augmented for additional 2,534 cu.m. New reservoir (Sta. Rosa) will also be expanded for additional 12,431 cu.m together with one additional booster pump (Q=690 l/sec, H=50 m). Additional distribution main (ϕ150-ϕ600 mm, 34,450 m) and internal network will be constructed to cover the expanded service area (500 ha).
	Electricity	Substation in Sta. Rosa will be renewed/augmented. (750 KVA)
	Others	Equipment (pump, water meter, etc.) will be renewed corresponding to the respective service-life.

TABLE 8.2.2 SUMMARY OF MAJOR FACILITIES REQUIRED BY PHASE

Item \ Phase	Phase I		Phase II	Total	Remarks
	Stage 1	Stage 2			
1. Source Facility					
(1) Deep well (ϕ250 x200m)	-	4 units	11 units	15 units	
(2) Pumping facility					
1) Pumping station	1 unit (Test well)	4 units	11 units	16 units	
2) Flow meter (ϕ150)	1 set	4 sets	11 sets	16 sets	
2. Transmission Facility					
(1) Pipe protection (ϕ200, ϕ300)	800 m	-	-	800 m	Spring - Existing Reservoir
(2) Main pipes (ϕ250 - ϕ700)	3,500 m	1,300 m	12,200 m	17,000 m	
3. Distribution Facility					
(1) Reservoir	1 unit (3,105 cu.m)	- (2,534 & 12,431 cu.m)	2 units	3 units	
(2) Pump facility	1 unit	1 unit	1 unit	3 units	
(3) Pump house	1 unit	-	1 unit	2 units	
(4) Chlorination facility					
(constant flow, 22kg/day)	2 sets	1 set	1 set	4 sets	
(constant flow, 45kg/day)	-	-	1 set	1 set	
(5) Power Substation	1 unit	-	1 unit	2 units	
(6) Distribution pipes					
1) Main pipes (ϕ150 - ϕ700 mm)	12,550 m	9,300 m	34,450 m	56,300 m	
2) Valve (ϕ150 - ϕ700 mm)	43 sets	40 sets	112 sets	195 sets	
3) Internal network					
(ϕ100 - ϕ150 mm)	-	1,620 m	6,700 m	8,320 m	
(ϕ 75 - ϕ100 mm)	4,160 m	35,460 m	60,590 m	100,210 m	
4) Service Connection	4,967	15,476	42,953	63,396	
5) Water meter (ϕ1/2" - ϕ3/4")	1,945	-	-	1,945	
6) Flow meter (ϕ350 mm)	1 unit	-	2 units	3 units	
7) Fire protection	-	-	410 sets	410 sets	
4. Administration & Operation Building	1 unit	-	1 unit	2 units	
5. Leakage Detection Service connections	2,907 sets	-	-	2,907 sets	

Note: Excluding replacement/renewal of equipment.

(1) Source Facility

A potential water production at the existing Matang-Tubig Spring will be fully utilized and additional new deep wells (ø300 mm x 200 m-depth, 5,500 cu.m/day/well) will be constructed in Sta. Rosa area. The existing deep well will be abandoned during the Stage 2 of Phase I due to small discharge (See FIGURE 8.2.3).

(2) Treatment Facility

A constant flow chlorinator will be installed at the reservoir.

(3) Transmission Facility

Improvement/protection of the transmission line installed along the bottom of the river between the existing spring and the reservoir shall be given priority. A pipeline from the new wells to the reservoirs will also be constructed.

(4) Distribution Facility

The proposed service area is determined to include the existing service area, the planned urban development area and the area along the major roads (50 m from each side of road shoulder).

The existing reservoir will be fully utilized after necessary expansion of its storage capacity. An additional reservoir will be constructed in Sta. Rosa area.

The storage capacity of the reservoir is determined to be the maximum storage volume (100% of distribution in 24 hour period) together with an emergency storage equivalent to 2 hour supply of the daily maximum water demand. The size of the reservoir is determined in compliance with water demand in each project phase and the emergency storage will be satisfied in the Phase II period.

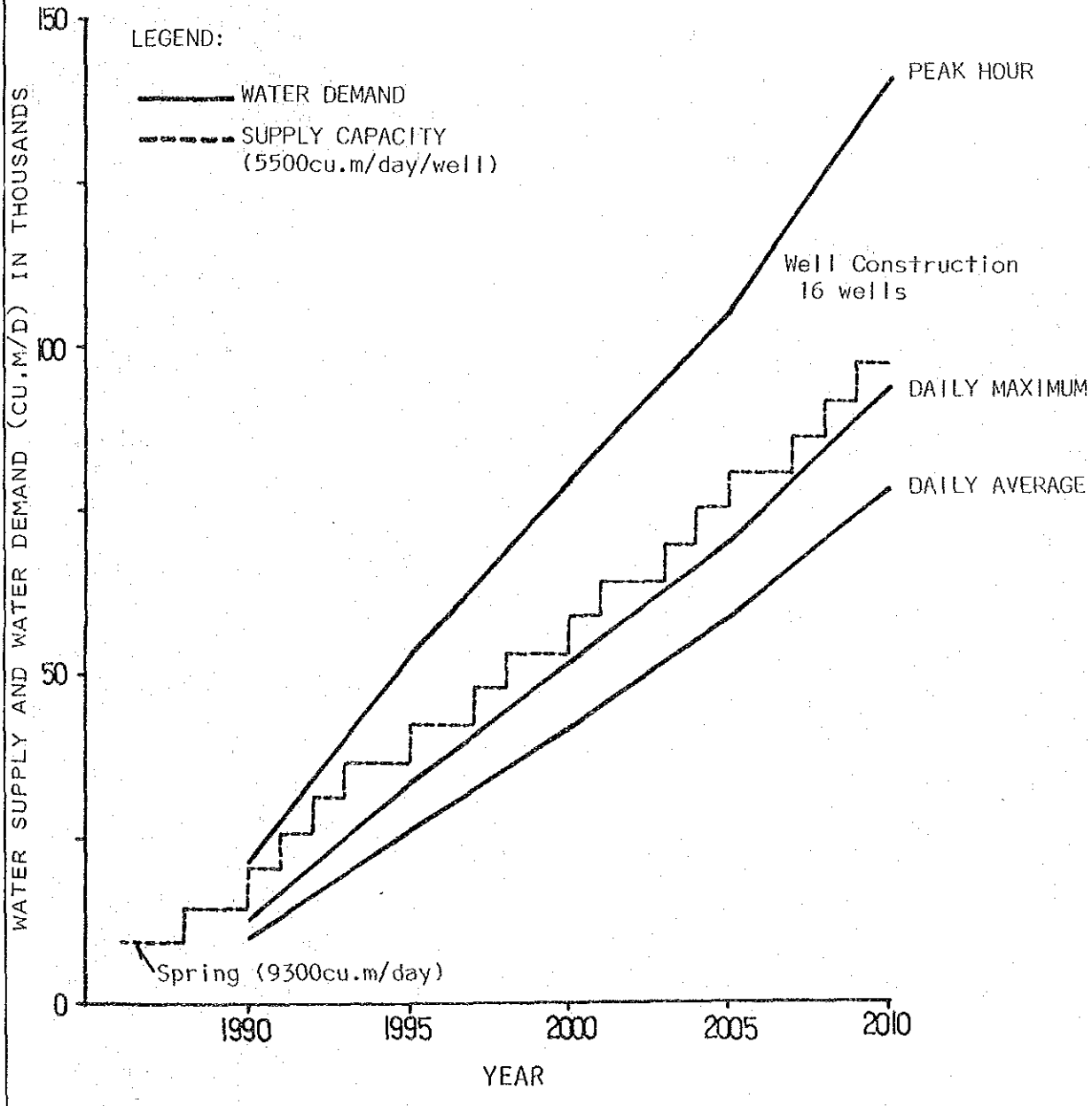


FIGURE 8.2.3

WATER SUPPLY VS. DEMAND CURVE
OF RECOMMENDED PLAN

The existing distribution lines will be utilized as a part of the proposed internal network, but subject to the leakage detection survey and repair/replacement, if necessary.

(5) Service Connections

As it has been observed during the field survey of existing water supply facilities, there are considerable number of service connections with not-functioning water meters and unmetered service connections. Leakages from service connections were also confirmed.

Resultant from these situation, the implementation of leakage detection survey and repair/replacement of damaged water meters and service connections are to be carried out in the early stage of the Project in order to increase the accounted-for water. The installation of water meters at new service connections and the provision of preventive maintenance program are another prerequisites for the sound operation of future water supply system.

8.2.2 Implementation Program

In accordance with the facility requirements as described in the previous section, the project implementation program is developed as shown in FIGURE 8.2.4.

8.2.3 Project Cost

The project cost is estimated based on the implementation program using the current market price of equipment and materials and the LWUA Methodology Manual at 1986 price level.

A summary of estimated project cost is shown in TABLE 8.2.3 and the detailed break down is given in APPENDIX 8.2.1.

A standby generator for stable supply and the chlorine neutralization equipment for safety measure are not considered in this planning stage, though these are to be studied prior to the expansion of the water supply service.

FIGURE 8.2.4 IMPLEMENTATION PROGRAM

Description	Phase I Stage 1			Phase I Stage 2					Phase II		
	'87	'88	'89	'90	'91	'92	'93	'94	'95	2000	2005	2010
Appraisal & Loan Procedure												
Engineering Service												
- Detailed Design												
- Construction Supervision												
- Leakage Detection		969	969	969								
Source Facility												
- Deep Well (ϕ300x200m)					1	1	1	1			11	
- Deep Well Pump Station (37 kw)			1		1	1	1	1			11	
Transmission Facility												
- Pipe Protection (ϕ300, ϕ200)			800									
- Main Pipe (ϕ250-ϕ450)			3,500		800	200	200	100				
- Main Pipe (ϕ250-ϕ700)											12,200	
Distribution Facility												
- Reservoir (V= 3,050cu.m)												
- Reservoir (V=12,430cu.m)												
- Reservoir (V= 2,530cu.m)												
- Booster Pump Station												
- Main Pipe (ϕ150-ϕ700)			8,450	4,100	9,300							
- Main Pipe (ϕ150-ϕ600)											34,450	
- Internal Network												
o Residential Area (ϕ75-ϕ100)			2,080	2,080	7,100	7,090	7,090	7,090	7,090		60,590	
o Commercial Area (ϕ100-ϕ150)					330	320	320	320	320		6,700	
- Fire Protection (ϕ150)											75	
- Fire Protection (ϕ100)											335	
- Service Connection (ϕ1/2")			2,450	2,450	3,093	3,093	3,093	3,093	3,092		42,879	
(ϕ3/4")			33	33	3	3	2	2	2		74	
- Rehabilitation												
o Water Meter												
o Service Connection												
o Laterals												
- Disinfection (Chlorinator)												
- Electric Sub-Station												
Others												
- Operation Center												
- Administration Building												
- Land Aquisition												
- Vehicle		2 *			1 *	1 *	1 *	1 *		1 1 1 1 1 * * * * *	1 1 1 1 1 * * * * *	1 1 1 * * *
- Replacement of equipments installed in Phase I												

Legend: —— : Continuous Work; - - - : Intermittent Work; * : Procurement

TABLE 8.2.3 SUMMARY OF PROJECT COST

Unit: ₱x1,000

Facility	Phase I		Phase II	Total
	Stage 1	Stage 2		
1) Source	852	8,048	22,132	31,032
2) Transmission	3,503	819	13,477	17,799
3) Distribution	35,577	32,283	112,327	180,187
4) Elec. Substation	3,643	0	4,858	8,501
5) Operation Center/ Adm. Bldg.	1,583	0	1,820	3,403
6) Material & Equip.	1,101	1,761	5,741	8,603
7) Land Acquisition	180	200	1,410	1,790
8) Replacement of Equipment	-	-	20,848	20,848
Sub Total	46,439	43,111	182,613	272,163
Physical Contingency (8%)	3,715	3,449	14,609	21,773
T O T A L	50,154	46,560	197,222	293,936
Leakage Detection	699	-	-	699
Engineering Charge				
Detailed Design (10% of TOTAL)	9,671	-	19,722	29,393
Construction Supervision (4% of TOTAL)	2,006	1,862	7,889	11,757
GRAND TOTAL	62,530	48,422	224,833	335,785
Operation & Maintenance Cost (per annum)	2,086	6,071	16,549	

CHAPTER 9
FINANCIAL FEASIBILITY ANALYSIS

CHAPTER 9 FINANCIAL FEASIBILITY ANALYSIS

9.1 GENERAL

The selected technical alternative for the realization of water supply for the Short Term Development Plan has been shown in Chapter 8. Such a plan must however be verified from a financial point of view. A financial feasibility of the project was analyzed and a financial plan for the allocation of available funds, based on LWUA's guideline, was developed in this chapter.

The analysis of the financial viability of the project covers the revenues which mainly come from water sales, the development costs, the operating and maintenance costs, debt service on the loans, etc. during the first 10 years from the start of the construction of the water system. The Financial Internal Rate of Return (FIRR) is also calculated.

The proposed water rates should be fair, reasonable, and realistic based on the ability of the consumers to pay. In order to achieve this, a socialized rate structure will be adopted.

9.2 EXISTING SYSTEM

9.2.1 Rate Structure

As of July 1986, CSBWS has 2,907 metered and unmetered connections. The following rate structure has been effective since 1984 in the waterworks system.

(1) Water Rates

There are two (2) types of water rates, i.e., flat rates and metered rates, as follows:

a) Flat Rates

With one faucet	₱14.00
Additional faucet	₱ 0.60 every addition

These rates are applicable to unmetered connections.

b) Metered Rates

Consumption Ranges	Water Rates
0-10 cu.m	₱10.00/month (min.)
11-30 cu.m	0.50/cu.m
31-50 cu.m	0.75/cu.m
51-70 cu.m	1.00/cu.m
71-100 cu.m	1.25/cu.m
Over 100 cu.m	1.50/cu.m

These rates are applicable to metered connections.

(2) Connection Service Fees:

Guaranty deposit	₱50.00
Registration and Tapping Fee	₱15.00

The cost of water meter shall be paid by each applicant.

9.2.2 Revenue and Expenditure

The annual revenue and expenditure of the waterworks system in the last four years are shown below:

Year	Revenue	Expenditure	Net Revenue
1982	₱ 681,807	₱545,868	₱135,949
1983	682,175	596,598	85,577
1984	942,559	646,442	296,117
1985	1,055,330	879,566	175,764

The rapid increase of revenue during the last two years was due to the increased number of metered connections and increased volume of water sales.

In 1985, the waterworks' revenue accounted for 2.2% of the Province's total revenue while its expenditure amounted to 2.2% of the Province's total expenditure.

The breakdown of the revenue of the waterworks is shown in TABLE 9.2.1 below.

TABLE 9.2.1 BREAKDOWN OF REVENUE OF CSBWS

	1984	1985
Water Sales	₱935,125.00	₱1,044,828.00
Connection Service Fees	3,000.00	2,835.00
Others	4,434.00	7,667.00
Total	₱942,559	₱1,055,330

The current water rate system is largely beneficial to the customers who consume 10 cu.m to 70 cu.m of water per month. Most residential users fall on this category. In this case, a socialized water rate scheme has to be adopted in the future wherein huge consumers of water will have to pay more.

A breakdown of CSBWS expenditures is shown in TABLE 9.2.2, with the corresponding breakdown in percentages being shown below :

	1983	1984	1985
Personal Services	53.1%	54.1%	50.3%
Maintenance & Operation Expenses	46.3	45.9	49.7
Capital Outlay	0.6	0	0
Total Expenditure	100.0	100.0	100.0

Salaries and wages are the biggest expenditure item followed by supplies & material and electricity cost.

TABLE 9.2.2 EXPENDITURE OF CSBWS

	1983	1984	1985
1. Personal Service			
- Salaries and Wages	₱268,289.22	n.a.	₱347,396.81
- Life	6,184.60		7,854.38
- Retirement	13,393.57		17,078.93
- Medicare	2,366.70		2,892.15
- 1% State Insurance	2,533.67		3,420.87
- Pagibig Premium	7,960.50		6,797.08
- COLA	15,630.70		57,144.55
Sub-Total	₱316,559	₱349,442	₱442,085
2. Maintenance & Operating Expenses			
- Traveling Expenses	₱ 34,664.45	n.a.	₱ 28,000.00
- Supplies & Material	113,691.67		189,848.41
- Repair of Equipment	27,424.30		61,151.59
- Illumination	98,588.99		143,000.00
- Retirement Gratuity	-		15,481.61
- Other Services	1,669.64		
Sub-Total	₱276,039	₱297,000	₱437,482
3. Capital Outlay	₱4,000	0	0
Total Expenditure	₱596,598	₱646,442	₱879,567

9.2.3 Bill Rendering and Collection

Meter readers undertake monthly reading on all the metered connections. Bills are issued for each class of service and are delivered to the customers by bill collectors of the waterworks. Normally, one month elapse between bill issuance and payment. Collections are being done on the day the bills are delivered. About 70% of the bills delivered are paid at the first call of collectors. The average rate of bill collection is placed at 80%.

As a matter of policy, delinquent consumers are given five days from the date the notice of disconnection is received to pay their bills, otherwise service disconnection will be effected. However, in case of non-compliance, another notice demanding payment for the said delinquent bill within 24 hours is given, after which disconnection is finally made if the consumer still fails to pay his bill.

9.3 MARKET SURVEY

The market survey for the Cabuyao-Sta.Rosa-Binan study area was conducted from June 2 to June 15, 1986 with LWUA's cooperation using the simplified market survey method. The number of respondents totaled 7,291 and the estimated coverage ratio in the study area is 31%.

The details of the market survey results is shown in Appendix 9.3.1.

From the market survey, the income distribution of the respondents is determined as follows:

Income Bracket 1/	Cabuyao		Sta. Rosa		Binan		Total	
	Ave. Pesos	Number	Ave. Pesos	Number	Ave. Pesos	Number	Ave. Pesos	Number
₱900 and below	679	160	696	703	592	1,407	630	2,270
₱901 to ₱1500	1,212	321	1,203	940	1,205	1,230	1,205	2,491
₱1,501 to ₱2,500	2,152	157	2,130	554	2,099	637	2,118	1,348
₱2,501 to ₱4,500	3,467	98	3,312	274	3,340	389	3,346	706
₱4,501 and above	8,338	13	5,357	28	5,798	78	5,972	119

As a result of the market survey, the respondents' willingness and unwillingness to connect is summarized as follows :

1/ Residential, excluding no-income and no-answer

Answer	Cabuyao	Sta. Rosa	Binan
Yes	37 %	44 %	49 %
No	25	32	35
With own connection	38	24	14

Note : With respect to type of users, residential users account for 100% in Cabuyao, 97% in Sta.Rosa, and 97 % in Binan, respectively.

It is observed from the results of the survey that the majority of the respondents in the three municipalities who are not yet connected to the existing system are willing to connect to the waterworks system. It is expected therefore that more residents in the Cabuyao-Sta.Rosa-Binan will connect to the new water supply system when it is expanded.

9.4 PROJECT COST AND FINANCING

9.4.1 Project Implementation Schedule and Project Period

As described in Chapter 8, in the project schedule of this study, it is assumed that :

- Design will be completed in 1988
- Construction will be started in 1989 and completed by 1995.

The financial analysis covers a 10-year period which includes the construction period. However, a 20 year period is adopted for the calculation of FIRR.

9.4.2 Financial Conditions

The major potential sources of funds for the Water District are the operating sources and the non-operating sources.

The operating sources are the excess of revenue over expenses. The LWUA's guideline suggests that the District should make a

contribution of 10% to the project cost as equity. However, should the waterworks cannot provide the said equity due to its current tight financial situation, it is suggested that the government will provide a grant to the District to make up for the equity. In this study, 5% of the project cost is set as the equity.

The non-operating sources include loans. In this study, to realize a reasonable water rate structure, the introduction of the LWUA's soft loan into the project in addition to the regular loan is recommended. The loan funds from LWUA will be utilized to finance the balance of the project cost plus capitalized interest. Presently, LWUA's terms include:

(1) Regular loan

Interest : First ₱2 million : 10% per annum
Next ₱5 million : 12% "
Above ₱7 million : 14% "

Duration : Thirty-year loan; disbursements are assumed to be made at mid-year, and the maximum disbursement period is four years.

Principal : Principal repayment is thirty years with one year grace period.

(2) Soft loan

Interest : 10% per annum
Interest is not charged for the first 5 years, with the district to start paying interest on the 6th year. In cases where the project is not completed within 5 years, interest will be capitalized from the 5th year up to the time of completion.

Principal : Principal Repayment is 20 years starting on the 11th year after the start of disbursement.

9.4.3 Project Cost

On the basis of the cost estimate developed in Chapter 8, the project cost for the District in the Short Term Development Plan is estimated at ₱214.64 million and its breakdown is shown in TABLE 9.4.1.

The proposed financing scheme for the project is as follows :

Project Cost		₱214.64	million
Equity	5%	10.73	"
LWUA Regular Loan	50%	107.32	"
LWUA Soft Loan	45%	96.59	"
Capitalized Interest		₱28.08	"
Total Project Cost		₱242.72	million

The computation of capitalized interest and the subsequent debt service obligations of the District is presented in TABLE 9.4.2. The long term borrowing from 1988-95 amounts to ₱231.99 million.

9.4.4 Operating and Maintenance Cost

The operating and maintenance costs shown in TABLE 9.4.3, described in detail in Chapter 8, include all annual expenses necessary in operating the system and maintaining its revenue producing capacity. In the financial projections, the operating and maintenance costs are assumed to increase according to the increase in the capacity of the system with expected inflationary effect as shown in TABLE 9.4.4.

TABLE 9.4.1 BREAKDOWN OF PROJECT COST

(Unit : 1,000 Pesos)

Year	1988	1989	1990	1991	1992	1993	1994	1995	Total
Construction Cost	1,381	37,357	7,701	18,534	6,794	6,793	6,703	4,287	89,550
Physical Contingencies	110	2,989	616	1,483	544	543	536	343	7,164
- Sub Total -	1,491	40,346	8,317	20,017	7,338	7,336	7,239	4,630	96,714
Price Contingencies	481	21,015	6,230	20,244	9,635	12,179	14,906	11,658	96,346
- Estimated Construction Cost -	1,972	61,361	14,547	40,261	16,972	19,515	22,145	16,288	193,060
Engineering Charge	12,790	0	0	0	0	0	0	0	12,790
Leakage Detection(L/D)	233	233	233	0	0	0	0	0	699
Price Escaration for L/D	75	121	175	0	0	0	0	0	371
Construction Supervision	79	2,454	582	1,610	679	781	886	652	7,722
Total Project Cost	15,149	64,169	15,536	41,871	17,651	20,296	23,031	16,940	214,643

Note) Construction Cost : Based on 1986 Price
Inflation Rate : 15% p.a.
Physical Contingencies : 8% of Construction Cost
Engineering Charge : (10% of Construction Cost & Physical Contingencies) + (Price Escalation)
Construction Supervision : 4% of Estimated Construction Cost

TABLE 9.4.2 PROJECTED DEBT SERVICE SCHEDULE

Disbursement Amount		₱203.91 million	
Regular Loan		107.32	"
Soft Loan		96.59	"
Capitalized Interest			
Regular Loan		28.08	"
Soft Loan		0	"
Total Loan		₱231.99 million	
Financed Interest			
Regular Loan	First	₱2 million	10% per annum
	Next	₱5 million	12% "
	Above	₱7 million	14% "
Soft Loan		10% p.a.	

(Unit : ₱ million)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1. Regular Loan										
Disbursement	15.15	64.17	15.54	12.47	-	-	-	-	-	-
Capitalized Interest	0	1.94	11.19	14.94	-	-	-	-	-	-
Operational Interest	-	-	-	-	18.78	18.78	18.72	18.66	18.59	18.51
Principal Repayment	-	-	-	-	0	0.39	0.45	0.51	0.58	0.66
Debt Services	0	0	0	0	18.78	19.17	19.17	19.17	19.17	19.17
2. Soft Loan										
Disbursement	-	-	-	29.40	15.15	17.80	20.53	13.71	-	-
Capitalized Interest	-	-	-	-	-	-	-	-	-	-
Operational Interest	-	-	-	-	-	-	-	-	9.66	9.66
Principal Repayment	-	-	-	-	-	-	-	-	0	0
Debt Services	0	0	0	0	0	0	0	0	9.66	9.66
Total Debt Services	0	0	0	0	18.78	19.17	19.17	19.17	28.83	28.83
Debt at End of Year	15.15	81.26	107.99	164.80	179.95	197.36	217.44	230.64	230.06	229.40

TABLE 9.4.3 PROJECTED OPERATION AND MAINTENANCE COST

(Unescalated)

(Unit : ₱1,000)

Year	Total O&M Cost	Administrative Expenses	Energy	Chemicals	Maintenance	Miscellaneous
1988	1,064	490	-	48	225	301
1989	1,576	522	16	64	417	557
1990	2,086	539	25	99	609	814
1991	2,889	702	121	131	846	1,089
1992	3,679	849	217	163	1,085	1,365
1993	4,481	1,012	314	196	1,319	1,640
1994	5,268	1,159	410	228	1,555	1,916
1995	6,071	1,322	506	260	1,792	2,191
1996	6,071	1,322	506	260	1,792	2,191
1997	6,071	1,322	506	260	1,792	2,191
1998	6,071	1,322	506	260	1,792	2,191

TABLE 9.4.4 PROJECTED OPERATION AND MAINTENANCE COST

(Escalated)

(Unit : ₱1,000)

Year	Total O&M Cost	Administrative Expenses	Energy	Chemicals	Maintenance	Miscellaneous
1988	1,407	648	0	63	298	398
1989	2,396	794	24	97	634	847
1990	3,649	943	44	173	1,065	1,424
1991	5,810	1,412	243	263	1,702	2,190
1992	8,510	1,964	502	377	2,510	3,157
1993	11,919	2,692	835	521	3,509	4,362
1994	16,114	3,545	1,254	697	4,757	5,861
1995	21,358	4,651	1,780	915	6,304	7,708
1996	24,562	5,349	2,047	1,052	7,250	8,864
1997	28,246	6,151	2,354	1,210	8,337	10,194
1998	32,483	7,074	2,707	1,392	9,588	11,723

9.4.5 Escalation of Costs

To account for the effects of inflation, the investment costs and the annual operating and maintenance costs are escalated by 15% compounded per annum.

9.4.6 Reserve Requirements

The reserve requirements are tied directly to the acquisition of development loans from LWUA. These are considered as funds necessary to support capital development. LWUA guidelines suggest that 10% of direct water sales be set aside as reserve funds. In this analysis, the allocation for reserves is to be 5% from 1990 to 1991 and 10% from 1992 onward.

9.5 REVENUE ANALYSIS AND WATER RATES

9.5.1 Derivation of Revenue Units

LWUA recommends the adoption of the optional method which is a combination of the revenue unit and the quantity block methods.

The number of revenue units has been computed using the optional method. Under this method the minimum charge varies depending on the size of the connection.[2/] In addition, factors are applied to successive quantity blocks of water consumed per month.

These factors increase as the level of consumption increases since they are set to attain a socialized tariff structure where users with low consumption pay a low average rate while users with high level of consumption pay higher average rate. This scheme will also encourage the poor population to connect to the system.

2/ The use factors for the first 10 cu.m which depend on the size of connections are as follows :

3/8" = 1.0	3/4" = 4.0
1/2" = 2.5	1" = 8.0

The factors used for the minimum charge (Service Charge Revenue Units or SCRUs), and commodity charges for different sizes and types of service connections and total equivalent volume are shown in TABLE 9.5.1 and TABLE 9.5.2, respectively.

9.5.2 Water Rate Structure

It is assumed that the following socialized rate structure for domestic/institutional users with 1/2 inch connections is employed in this analysis :

Quantity Block		Factor
First 10	cu.m/month	1.00
11-20	cu.m/month	1.25
21-35	cu.m/month	1.60
Above 35	cu.m/month	2.10

For commercial/industrial users, the use factors are double.

9.5.3 Feasibility of Charges

The feasibility of charges can be determined by subjecting the required water rates for 1/2 inch connections to the following requirements:

1. Minimum charge (for the first 10 cu.m) must not exceed 5% of the average family income of the low income group.
2. Increase must be limited to 60% of the existing rates in the previous year.

The proposed water rates necessary to achieve financial viability are within the ability-to-pay of the customers. From the projected revenue forecast shown in TABLE 9.5.3, the following water charges for the initial 10 cu.m do not exceed 5% of the average income of the low income class, and anticipated increases are within the 60% limit throughout the study period.

TABLE 9.5.1 SERVICE CONNECTIONS AND SERVICE CHARGE REVENUE UNITS

STRATIFICATION OF SERVICE CONNECTIONS (CSRBWS)

Year	Total Service Connections	Connection Size (inch)							
		Domestic/Government				Commercial/Industrial			
		1/2	3/4	1	Sub-TTL	1/2	3/4	1	Sub-TTL
1988	2,907	2,863	16		2,879	28	0		28
1989	5,391	4,942	49		4,991	400	0		400
1990	7,874	7,020	82		7,102	772	0		772
1991	10,969	9,737	84		9,821	1,148	0		1,148
1992	14,064	12,453	87		12,540	1,524	0		1,524
1993	17,160	15,170	89		15,259	1,901	0		1,901
1994	20,255	17,886	92		17,978	2,277	0		2,277
1995	23,350	20,603	94		20,697	2,653	0		2,653

COMPUTATION OF SERVICE CHARGE REVENUE UNITS (CSRBWS)

Year	Total SCRUS (1,000)	Domestic/Government					Commercial/Industrial				
		X 2.5	X 4.0	X 8.0	Sub-Total	X .12	X 5.0	X 8.0	X 16.0	Sub-Total	X .12
1988	883	7,158	64	0	7,222	867	140	0	0	140	17
1989	1,746	12,355	196	0	12,551	1,506	2,000	0	0	2,000	240
1990	2,609	17,550	328	0	17,878	2,145	3,860	0	0	3,860	463
1991	3,650	24,343	336	0	24,679	2,961	5,740	0	0	5,740	689
1992	4,692	31,133	348	0	31,481	3,778	7,620	0	0	7,620	914
1993	5,734	37,925	356	0	38,281	4,594	9,505	0	0	9,505	1,141
1994	6,776	44,715	368	0	45,083	5,410	11,385	0	0	11,385	1,366
1995	7,818	51,508	376	0	51,884	6,226	13,265	0	0	13,265	1,592

TABLE 9.5.2 EQUIVALENT VOLUME OF WATER SOLD

(Unit : X 1,000)

1988	SCRUS	Consumption (m3)	First 10 m3	11-20 m3 (1.25)	21-35 m3 (1.60)	Above 35 m3 (2.10)	Total Equivalent Volume
Domestic/Gov.		999	345	98	203	353	
Factor			0	1.25	1.60	2.10	
E.v.	867		-	123	324	741	2.054
Commercial/Ind.		64	3	4	15	42	
Factor			0	2.50	3.20	4.20	
E.v.	17		-	11	47	176	250
Total E.V.							2.304

1989	SCRUS	Consumption (m3)	First 10 m3	11-20 m3 (1.25)	21-35 m3 (1.60)	Above 35 m3 (2.10)	Total Equivalent Volume
Domestic/Gov.		1,190	599	89	183	319	
Factor			0	1.25	1.60	2.10	
E.v.	1,506		-	111	293	670	2,580
Commercial/Ind.		224	48	12	42	121	
Factor			0	2.50	3.20	4.20	
E.v.	240		-	31	135	510	916
Total E.V.							3,496

1990	SCRUS	Consumption (m3)	First 10 m3	11-20 m3 (1.25)	21-35 m3 (1.60)	Above 35 m3 (2.10)	Total Equivalent Volume
Domestic/Gov.		1,805	852	143	295	514	
Factor			0	1.25	1.60	2.10	
E.v.	2,145		-	179	473	1,080	3.877
Commercial/Ind.		391	93	21	72	206	
Factor			0	2.50	3.20	4.20	
E.v.	463		-	52	229	865	1,609
Total E.V.							5.486

TABLE 9.5.2 (Cont'd)

(Unit : X 1,000)

1991	SCRUS	Consumption (m3)	First 10 m3	11-20 m3 (1.25)	21-35 m3 (1.60)	Above 35 m3 (2.10)	Total Equivalent Volume
Domestic/Gov.		2,512	1,179	200	413	720	
Factor			0	1.25	1.60	2.10	
E.v.	2,961		-	250	661	1,512	5,385
Commercial/Ind.		594	138	32	109	315	
Factor			0	2.50	3.20	4.20	
E.v.	689		-	80	350	1,322	2,441
Total E.V.							7,826

1992	SCRUS	Consumption (m3)	First 10 m3	11-20 m3 (1.25)	21-35 m3 (1.60)	Above 35 m3 (2.10)	Total Equivalent Volume
Domestic/Gov.		3,218	1,505	257	531	925	
Factor			0	1.25	1.60	2.10	
E.v.	3,778		-	321	850	1,943	6,891
Commercial/Ind.		797	183	43	147	424	
Factor			0	2.50	3.20	4.20	
E.v.	914		-	107	472	1,780	3,273
Total E.V.							10,165

1993	SCRUS	Consumption (m3)	First 10 m3	11-20 m3 (1.25)	21-35 m3 (1.60)	Above 35 m3 (2.10)	Total Equivalent Volume
Domestic/Gov.		3,925	1,831	314	649	1,131	
Factor			0	1.25	1.60	2.10	
E.v.	4,594		-	393	1,039	2,375	8,399
Commercial/Ind.		1,000	228	54	185	533	
Factor			0	2.50	3.20	4.20	
E.v.	1,141		-	135	593	2,237	4,105
Total E.V.							12,505

TABLE 9.5.2 (Cont'd)

(Unit : X 1,000)

1994	SCRUS	Consumption (m3)	First 10 m3	11-20 m3 (1.25)	21-35 m3 (1.60)	Above 35 m3 (2.10)	Total Equivalent Volume
Domestic/Gov.		4,631	2,157	371	767	1,336	
Factor			0	1.25	1.60	2.10	
E.v.	5,410		-	464	1,227	2,805	9,906
Commercial/Ind.		1,203	273	65	223	642	
Factor			0	2.50	3.20	4.20	
E.v.	1,366		-	163	714	2,694	4,937
Total E.V.							14,843

1995	SCRUS	Consumption (m3)	First 10 m3	11-20 m3 (1.25)	21-35 m3 (1.60)	Above 35 m3 (2.10)	Total Equivalent Volume
Domestic/Gov.		5,338	2,484	428	885	1,541	
Factor			0	1.25	1.60	2.10	
E.v.	6,226		-	535	1,416	3,237	11,414
Commercial/Ind.		1,407	318	76	261	751	
Factor			0	2.50	3.20	4.20	
E.v.	1,592		-	191	836	3,155	5,773
Total E.V.							17,187

TABLE 9.5.3 PROJECTED REVENUE FORECAST

(Unit : 1,000 Pesos)

Year	Total Expenses	Rate Unit	Total Equivalent Volume	Total Sales	Bad Debts (3%)	Net Sales	Surplus	Cumulative Surplus
1988	1,407	0.9	2,304	2,074	62	2,011	604	604
1989	2,396	1.3	3,496	4,545	136	4,409	2,013	2,617
1990	3,649	1.3	5,486	7,132	214	6,918	3,269	5,887
1991	5,810	1.9	7,826	14,870	446	14,424	8,614	14,500
1992	27,286	1.9	10,165	19,313	579	18,733	-8,553	5,948
1993	31,087	2.4	12,505	30,012	900	29,111	-1,976	3,972
1994	35,282	2.4	14,843	35,624	1,069	34,555	-727	3,245
1995	40,526	2.7	17,187	46,405	1,392	45,013	4,487	7,732

However, when another LWUA's regular loan is applied to the project instead of the LWUA's soft loan which is employed here, the minimum charge should be increased in a few years before starting the debt services payment for this LWUA regular loan. It is therefore, advisable to apply the LWUA's soft loan into the project.

Period	Mimimum Charge	Monthly Family Income	Percentage of Income Allocated to Water	Percentage Increase
1988	₱22.5	₱ 826	2.7	-
1989	32.5	946	3.4	44
1990	32.5	1,083	3.0	0
1991	47.5	1,234	3.9	46
1992	47.5	1,407	3.4	0
1993	60.0	1,604	3.7	26
1994	60.0	1,829	3.3	0
1995	67.5	2,085	3.2	13

9.6 FINANCIAL SUMMARY

The financial analysis was based on the forecasts of the following financial statements:

1. Income Statement (TABLE 9.6.1)
2. Cash Flow Statement (TABLE 9.6.2)
3. Balance Sheet (TABLE 9.6.3).

The following assumptions were used for the financial projections:

1. Revenue-Tariff levels were based on the following objectives:

   a) Revenue generation should be adequate to meet the minimum financial internal rate of return of 12-14%.

TABLE 9.6.1 PROJECTED INCOME STATEMENT

(Unit : 1,000 Pesos)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
No. of Service Connections	2,907	5,391	7,874	10,969	14,064	17,160	20,255	23,350	23,350	23,350	23,350
Production (m3 x 1,000)	2,126	2,571	3,660	5,010	6,273	7,462	8,579	9,636	9,636	9,636	9,636
Unaccounted for Water (%)	50	45	40	38	36	34	32	30	30	30	30
Consumption (m3 x 1,000)	1,063	1,414	2,196	3,106	4,015	4,925	5,834	6,745	6,745	6,745	6,745
Equivalent Volume (x 1,000)	2,304	3,486	5,486	7,826	10,165	12,505	14,843	17,187	17,187	17,187	17,187
Rate Unit	0.9	1.3	1.3	1.9	1.9	2.4	2.4	2.7	2.7	3.5	3.5
Water Sales	2,074	4,545	7,132	14,870	19,313	30,012	35,624	46,405	46,405	60,155	60,155
Other Revenues	62	136	214	446	579	900	1,069	1,392	1,392	1,805	1,805
- Total Revenues -	2,136	4,682	7,346	15,316	19,892	30,912	36,692	47,797	47,797	61,959	61,959
Direct Cost	1,407	2,396	3,649	5,810	8,510	11,919	16,114	21,358	24,562	28,246	32,483
Administrative Expenses	648	794	943	1,412	1,964	2,692	3,545	4,651	5,349	6,151	7,074
Power & Fuel	0	24	44	243	502	835	1,254	1,780	2,047	2,354	2,707
Chemicals	63	97	173	263	377	521	697	915	1,052	1,210	1,392
Maintenance & Repair	298	634	1,065	1,702	2,510	3,509	4,757	6,304	7,250	8,337	9,588
Miscellaneous	398	847	1,424	2,190	3,157	4,362	5,861	7,708	8,864	10,194	11,723
Bad Debts	62	136	214	446	579	900	1,069	1,392	1,392	1,805	1,805
- Total Costs -	1,469	2,532	3,863	6,256	9,089	12,819	17,183	22,750	25,954	30,051	34,287
Income Before Depreciation	667	2,149	3,483	9,060	10,803	18,093	19,510	25,047	21,843	31,909	27,672
Depreciation	379	2,031	2,700	4,120	4,561	5,069	5,644	6,068	6,068	6,068	6,068
Income Before Interest	288	118	783	4,940	6,242	13,024	13,865	18,979	15,775	25,841	21,604
Interest	0	0	0	0	18,776	18,775	18,721	18,660	28,249	28,169	28,078
Net Income	288	118	783	4,940	-12,534	-5,751	-4,856	319	-12,474	-2,328	-6,474

TABLE 9.6.2 PROJECTED CASH FLOW STATEMENT

(Unit : 1,000 Pesos)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Sources of Funds											
Income Before Depreciation	667	2,149	3,483	9,060	10,803	18,093	19,510	25,047	21,843	31,909	27,672
LWUA Loan	15,149	66,110	26,732	56,810	15,151	17,796	20,531	13,708	0	0	0
Equity	0	0	0	0	2,500	2,500	2,500	3,232	0	0	0
Grant	0	0	0	0	0	0	0	0	0	0	0
-Total Sources of Funds-	15,816	68,259	30,215	65,870	28,454	38,389	42,541	41,987	21,843	31,909	27,672
Applications of Funds											
Investment in Project	15,149	64,169	15,536	41,871	17,651	20,296	23,031	16,940	0	0	0
Capitalized Interest	0	1,941	11,196	14,939	0	0	0	0	0	0	0
[Total Investment]	15,149	66,110	26,732	56,810	17,651	20,296	23,031	16,940	0	0	0
Interest (Regular Loan)	0	0	0	0	18,776	18,775	18,721	18,660	18,590	18,510	18,419
Interest (Soft Loan)	0	0	0	0	0	0	0	0	9,659	9,659	9,659
< Total Operational Interest >	0	0	0	0	18,776	18,775	18,721	18,660	28,249	28,169	28,078
Principal (Regular Loan)	0	0	0	0	0	393	447	508	578	658	749
Principal (Soft Loan)	0	0	0	0	0	0	0	0	0	0	0
< Total Principal Repayment >	0	0	0	0	0	393	447	508	578	658	749
[Total Debt Services]	0	0	0	0	18,776	19,168	19,168	19,168	28,827	28,827	28,827
Working Capital Increase	30	21	68	394	29	496	1,705	789	1,867	2,108	-599
Cash & Other Current Assets	54	66	79	118	164	224	295	388	446	513	589
Accounts Receivable	346	758	1,189	2,478	3,219	5,002	5,937	7,734	7,734	10,026	10,026
Inventories	11	16	29	44	63	87	116	153	175	202	232
Reserves	0	0	0	0	0	0	1,781	2,320	4,641	6,015	6,015
Accounts Payable	235	399	608	968	1,418	1,987	2,686	3,560	4,094	4,708	5,414
Customers' Deposit	145	389	569	1,158	1,485	2,288	2,701	3,503	3,503	4,540	4,540
-Total Applications of funds-	15,179	66,131	26,800	57,204	36,456	39,960	43,904	36,897	30,694	30,935	28,228
Cash Surplus	636	2,128	3,415	8,665	-8,002	-1,572	-1,363	5,090	-8,851	974	-556
Cumulative Cash Surplus	636	2,765	6,180	14,845	6,843	5,272	3,908	8,999	148	1,122	566
Cash Flow	636	2,128	3,415	8,665	-10,502	-4,072	-3,863	1,858	-8,851	974	-556

TABLE 9.6.3 PROJECTED BALANCE SHEET

(Unit : 1,000 Pesos)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Fixed Asset	15,149	81,259	107,991	164,801	182,452	202,748	225,779	242,719	242,719	242,719	242,719
Depreciation	379	2,410	5,110	9,230	13,791	18,860	24,504	30,572	36,640	42,708	48,776
Net Fixed Asset	14,770	78,849	102,881	155,571	168,661	183,888	201,275	212,147	206,079	200,011	193,943
Current Asset	1,047	3,605	7,476	17,485	10,289	10,585	12,038	19,593	13,144	17,877	17,428
-Total Assets-	15,817	82,453	110,357	173,056	178,949	194,473	213,313	231,740	219,222	217,888	211,371
Capital Equity	0	0	0	0	2,500	5,000	7,500	10,732	10,732	10,732	10,732
Government Grant	0	0	0	0	0	0	0	0	0	0	0
Operational Surplus	288	406	1,189	6,129	-6,406	-12,157	-17,012	-16,693	-29,167	-31,495	-37,969
Total Equity	288	406	1,189	6,129	-3,906	-7,157	-9,512	-5,961	-18,435	-20,763	-27,237
Long Term Debt	15,149	81,259	107,991	164,801	179,952	197,355	217,439	230,639	230,061	229,403	228,654
Current Liabilities	380	789	1,177	2,126	2,903	4,275	5,386	7,062	7,596	9,248	9,954
-Total Equity and Liabilities-	15,817	82,453	110,357	173,056	178,949	194,473	213,313	231,740	219,222	217,888	211,371

b) The District should be able to meet its cash requirements and after project completion, to undertake a reasonable amount of investment to continue expansion and improvement of the system.

2. Reserve Fund ; 10% of direct water sales.

3. Cash ; 1 month of administrative expenses.

4. Accounts Receivable ; 2 months of direct water sales.

5. Bad Debts ; 3% of direct water sales.

6. Inventories ; 2 months of expenses of chemicals.

7. Depreciation ; 2.5% of average gross value of fixed assets.

8. Accounts Payable ; 2 months of direct operating and maintenance costs.

9. Customer's Deposits ; ₱50.00 per service connection.

10. Other Operating Revenues ; 3% of direct water sales.

9.7 FINANCIAL INTERNAL RATE OF RETURN (FIRR)

The Financial Internal Rate of Return is a major consideration affecting capital investment decisions. It measures the effective utilization of the total investment and also the equity employed in the project and shows the compounded growth of investments within the project period.

The rate of return was computed based on the present value of cash inflows and outflows. As shown in TABLE 9.7.1, the rate of return, with the assumptions made, is estimated to be 13.4%.

TABLE 9.7.1 FINANCIAL INTERNAL RATE OF RETURN

(Unit : ₱1,000)

Year	Rate/Unit (₱)	Income before Depreciation	LWUA Loan	Total Investment	Total Debt Services	Working Capital Increase	Net Cash Inflow	Present Value
1988	0.9	667	15,149	15,149	-	30	636	636
1989	1.3	2,149	66,110	66,110	-	21	2,128	1,876
1990	1.3	3,483	26,732	26,732	-	68	3,415	2,654
1991	1.9	9,060	56,810	56,810	-	394	8,665	5,936
1992	1.9	10,803	15,151	17,651	18,776	29	-10,502	-6,341
1993	2.4	18,093	17,796	20,296	19,168	496	-4,072	-2,167
1994	2.4	19,510	20,531	23,031	19,168	1,705	-3,863	-1,813
1995	2.7	25,047	13,708	16,940	19,168	789	1,858	769
1996	2.7	21,843			28,827	1,867	-8,851	-3,227
1997	3.5	31,909			28,827	2,108	974	313
1998	3.5	27,672			28,827	-599	-556	-158
1999	4.2	34,830			28,827	1,611	4,392	1,097
2000	4.2	29,227			28,827	-792	1,192	263
2001	5.0	36,533			30,514	1,718	4,301	835
2002	5.0	29,123			30,514	-1,048	-343	-59
2003	6.0	37,788			30,514	2,081	5,193	783
2004	6.0	27,988			30,514	-1,386	-1,141	-152
2005	7.0	33,905			30,514	1,693	1,698	199
2006	7.0	20,944			30,514	-1,832	-7,738	-799
2007	8.1	24,945			30,514	1,507	-7,077	-644

FIRR = 13.4

9.8 FINANCIAL RECOMMENDATION

The recommended project for the Short Term Development Plan is financially feasible. The proposed water rates for 1/2 inch connections of domestic users to achieve financial self-sufficiency are :

Period	Rate/ Unit	First 10cu.m	11-20cu.m	21-35cu.m	Above 35cu.m
1988	₱0.9	₱22.5	₱2.8	₱3.6	₱4.7
1989	1.3	32.5	4.1	5.2	6.8
1990	1.3	32.5	4.1	5.2	6.8
1991	1.9	47.5	5.9	7.6	10.0
1992	1.9	47.5	5.9	7.6	10.0
1993	2.4	60.0	7.5	9.6	12.6
1994	2.4	60.0	7.5	9.6	12.6
1995	2.7	67.5	8.4	10.8	14.2
1996	2.7	67.5	8.4	10.8	14.2
1997	3.5	87.5	10.9	14.0	18.4

As shown above, rapid increases of Rate/Unit are inevitable in this project during the first three years, since the existing water rate structure is comparatively lower in level. However, after 1991 a moderate increase in the percentage of the water rate is expected annually.

CHAPTER 10
ECONOMIC FEASIBILITY ANALYSIS

CHAPTER 10 ECONOMIC FEASIBILITY ANALYSIS

10.1 GENERAL

The objective of the project is to uplift the social welfare of the community. Therefore, an evaluation of the effectiveness of the project, in terms of socio-economic factors not considered in the financial analysis, is made in this economic analysis.

It may not be possible to evaluate all the costs and the benefits of a project because some of them are not quantifiable or the technical methods to evaluate them quantitatively are not available. It is for this reason that only quantifiable benefits and costs will be included in the analysis.

The comparison between the costs and benefits shall allow an assessment of the economic feasibility of the project.

10.2 METHOD OF ANALYSIS

To evaluate economic feasibility of the project, the Economic Internal Rate of Return (EIRR) should be assessed through the calculations on the economic benefits and costs anticipated from the implementation of the project.

The project is considered economically feasible if the EIRR is higher than the opportunity cost of capital, or the rate of return that can be obtained from the best alternative use of the available capital. For public investment programs such as water supply projects, the opportunity cost of capital is from 12% to 15%.

10.3 ECONOMIC BENEFITS OF THE PROJECT

The implementation of the project will provide the following direct and indirect benefits:

Direct Benefits:

- Increase in the area and population to be served
- Continuous supply of safe water

Indirect Benefit:

- Increase of employment opportunity
- Improvement of health condition
- Increase in consumer satisfaction
- Increase in land values
- Reduction in fire damage
- Increase in income in some productive sectors

The quantifiable benefits considered in the economic feasibility analysis are: increased land value, improved health conditions, and the beneficial value of water (consumer's satisfaction).

Except for the beneficial value of water, all other benefits are held constant after completion of the project.

10.3.1 Increase in Land Values

The water supply improvement project will contribute to an increase in land value of the service area. However, this increased value could be the result of a general increase of productivity due to improved infrastructure which includes a water supply project.

The portion of land values attributable to the water supply system in the service area was determined by comparing the market values of land served and not served by the water system. The average market value of residential land served by the water system is ₱60-120/sq.m, and commercial land is ₱120-200/sq.m, while the average market value of residential land unserved by the water system is ₱30-50/sq.m, and commercial land is ₱120-200/sq.m, respectively.

Generally, it is assumed that 20% of the incremental value of land could be attributed to the water supply project.

The present worth benefit of increase in land values from the project implementation is shown in TABLE 10.3.1.

10.3.2 Improved Health Conditions

The provision of safe, potable water to the population is a prerequisite to attain minimum health standards. However, quantification of health benefits is usually difficult although the direct relationship between safe water supply and improved health is obvious.

In quantifying health benefits, two factors were considered : the cost of time lost due to illness, and the cost of medical expenses.

In computing the cost of the time lost due to illness, not all persons afflicted with water-borne diseases are income-earners. It is assumed in this study that 30% of the population is actually economically active. The average morbidity rate from 1981 to 1985 in Cabuyao was 1,464 out of 10,000. The final figure for the cost of time lost due to illness was derived by taking the economically active portion of those afflicted by water-borne diseases multiplied by ₱57.00 and 15 days based on the assumption that workers earning ₱57.00/day[3/] are unable to work for an average of 15 days per year.

The cost of medical expenses was derived by multiplying the morbidity rate by the served population and the average annual expenditure for medical expenses of ₱200.00.

The sum of the two economic costs related to health benefits was adjusted by 20% to account for the fact that not all water-borne diseases are caused by a poor water system but may also be due to poor personal hygiene or lack of sewerage facilities.

The total present values derived from health benefits is shown in TABLE 10.3.2.

3/ ₱57.00 is assumed as the minimum wage for industrial and agricultural workers.

TABLE 10.3.1 PORTION OF LAND VALUES ATTRIBUTABLE TO PROJECT

Year	Land Use (1,000 sq.m)[1/]		Cost of Land (₱1,000)			
	Residential	Commercial/Industrial/Institutional	Residential (₱30/sq.m)	Commercial/Industrial/Institutional (₱120/sq.m)	Total Cost of Land	20% Due to Project[2/]
1988						
1989						
1990						
1991	720	80	21,600	9,600	31,200	6,240
1992	720	80	21,600	9,600	31,200	6,240
1993	720	80	21,600	9,600	31,200	6,240
1994	720	80	21,600	9,600	31,200	6,240
1995	720	80	21,600	9,600	31,200	6,240
1996						
1997						
1998						
1999						
2000						
2001						
2002						
2003						
2004						
2005						
2006						
2007						

1/ The service area of 340 ha from 1988 to 1990 is projected to increase annually by 80 ha from 1991 up to 1995. Land use is assumed to be 90% residential and 10% commercial.

2/ Portion of land values specifically attributable to water supply project is 20%.

TABLE 10.3.2 HEALTH BENEFITS

(Unit : ₱1,000)

Year	Served Population	Cost of Time Lost to Illness 4/	Cost of Medical Expenses 5/	Total Economic Losses	20% Reduction Due to Project (Benefit)
1988	23,560	885	690	1,575	315
1989	27,070	1,017	793	1,810	362
1990	38,390	1,442	1,124	2,566	513
1991	52,800	1,983	1,546	3,529	706
1992	67,200	2,523	1,968	4,491	898
1993	81,600	3,064	2,389	5,453	1,091
1994	96,000	3,605	2,811	6,416	1,283
1995	110,350	4,144	3,231	7,375	1,475
1996	110,350	4,144	3,231	7,375	1,475
1997	110,350	4,144	3,231	7,375	1,475
1998	110,350	4,144	3,231	7,375	1,475
1999	110,350	4,144	3,231	7,375	1,475
2000	110,350	4,144	3,231	7,375	1,475
2001	110,350	4,144	3,231	7,375	1,475
2002	110,350	4,144	3,231	7,375	1,475
2003	110,350	4,144	3,231	7,375	1,475
2004	110,350	4,144	3,231	7,375	1,475
2005	110,350	4,144	3,231	7,375	1,475
2006	110,350	4,144	3,231	7,375	1,475
2007	110,350	4,144	3,231	7,375	1,475

4/ $30.0\% \times \frac{1,464}{10,000} \times SP \times ₱57 \times 15$ days

5/ $\frac{1,464}{10,000} \times SP \times ₱200$

10.3.3 Beneficial Value of Water

It is assumed that all residents of the served area would be willing to obtain water in sufficient quantities at a given price. In general, water prices charged by the Water District are lower than the real value of water. Taking the benefits for "consumer's satisfaction" into consideration, it is assumed that the economic value of water is 20% higher than the de-escalated average rate per cu.m of water used in the Financial Analysis.

The economic value of water is shown in TABLE 10.3.3.

10.4 ECONOMIC COSTS OF THE PROJECT

The direct costs of the project should be transformed into economic costs. For this purpose, the project cost and operating and maintenance costs are considered in the study. These costs will be converted into the economic costs using factors for shadow pricing. The factors for shadow pricing applicable to the study are as follows:

- Foreign exchange component: 1.3
- Unskilled labor premium : 0.5
- Others : 1.0

All taxes should be excluded in the economic study. It is assumed that the cost for the balance of domestic component includes hidden taxes for 5% of the amount.

10.4.1 Project Cost

By using the shadow pricing factors, the economic project cost is ₱124.99 million which was obtained based on the project cost used in the Financial Feasibility Analysis as shown in TABLE 10.4.1.

TABLE 10.3.3 INCREASE IN CONSUMER STATISFACTION

Year	Incremental Accounted-For Water[6/] (1,000 cu.m/Year)	Price Per cu.m[7/]	Economic Value Per cu.m[8/]	Economic Water Revenues (₱1,000)
1988	-306	2.01	2.41	-737
1989	45	2.96	3.55	160
1990	827	2.67	3.20	2,646
1991	1,737	3.51	4.21	7,313
1992	2,646	3.15	3.78	10,002
1993	3,556	3.56	4.27	15,184
1994	4,465	3.19	3.83	17,101
1995	5,376	3.21	3.85	20,698
1996	5,376	2.86	3.43	18,440
1997	5,376	3.31	3.97	21,343
1998	5,376	2.96	3.55	19,085
1999	5,376	3.17	3.80	20,429
2000	5,376	2.83	3.40	18,278
2001	5,376	3.01	3.61	19,407
2002	5,376	2.69	3.23	17,364
2003	5,376	2.88	3.46	18,601
2004	5,376	2.57	3.08	16,558
2005	5,376	2.68	3.22	17,311
2006	5,376	2.39	2.87	15,429
2007	5,376	2.47	2.96	15,913

6/ The volume of accounted-for water 1.37 of million cu.m in 1986 is deducted from the projected water consumptions throughout the study period to obtain incremental volume.

7/ The price per cu.m was based on the de-escalated average rate/cu.m in the financial analysis.

8/ The economic value was assumed to be 1.2 times the price per cu.m of water.

TABLE 10.4.1 ECONOMIC PROJECT COST

(Unit : ₱1,000)

	Financial Project Cost	Foreign Exchange Component	Domestic Component	Unskilled Labor	Balance of Domestic Component	Taxes (5%)	Others (95%)	SHADOW PRICING: Foreign Exchange Component x 1.3	SHADOW PRICING: Unskilled Labor x 0.5	SHADOW PRICING: Others x 1.0	Total Economic Cost
Civil Works											
Deep Well Facilities	4,661	1,144	3,517	430	3,087	154	2,933	1,487	215	2,933	4,635
Transmission Facilities	2,092	736	1,356	175	1,181	59	1,122	957	88	1,122	2,167
Reservoir	3,109	888	2,221	239	1,982	56	1,883	1,154	119	1,883	3,156
Disinfection Facilities	115	15	100	9	91	5	86	20	5	86	111
Electric Sub-station	1,367	565	802	73	729	36	692	734	37	692	1,463
Distribution Facilities	18,362	5,682	12,680	2,146	10,534	527	10,007	7,387	1,073	10,007	18,467
Service Connection	1,976	180	1,796	537	1,259	63	1,196	234	268	1,196	1,698
Land Acquisition	380	0	380	0	380	19	361	0	0	361	361
Admin. Bldg. & Ope. Ctr.	791	142	649	79	570	28	542	185	39	542	766
Vehicle & Stored Material	0	0	0	0	0	0	0	0	0	0	0
Sub-Total of Civil Works	32,853	9,352	23,501	3,688	19,813	991	18,822	12,158	1,844	18,822	32,824
Equipment											
Deep Well Facilities	4,328	3,094	1,144	0	1,144	57	1,087	4,022	0	1,087	5,109
Transmission Facilities	2,231	1,267	964	0	964	48	916	1,647	0	916	2,563
Reservoir	308	171	137	0	137	7	130	222	0	130	352
Disinfection Facilities	179	135	44	0	44	2	42	176	0	42	218
Electric Sub-station	2,277	1,913	364	0	364	18	346	2,487	0	346	2,833
Distribution Facilities	27,813	19,263	8,550	0	8,550	428	8,122	25,042	0	8,122	33,164
Service Connection	15,997	15,280	717	0	717	36	681	19,864	0	681	20,545
Land Acquisition	0	0	0	0	0	0	0	0	0	0	0
Admin. Bldg. & Ope. Ctr.	792	570	222	0	222	11	211	741	0	211	952
Vehicle & Stroed Material	2,862	1,792	1,070	0	1,070	54	1,016	2,330	0	1,016	3,346
Sub-Total of Equipment	56,697	43,485	13,212	0	13,212	661	12,551	56,531	0	12,551	69,082
Total of C.W. & Equipment	89,550	52,837	36,713	3,688	33,025	1,652	31,373	68,689	1,844	31,373	101,906
Physical Contingencies 9/	7,164	4,227	2,937	295	2,642	132	2,510	5,495	148	2,510	8,153
Engineering Services 10/	12,537	7,397	5,140	516	4,624	231	4,392	9,616	258	4,392	14,266
Leakage Detection	699	0	699	0	699	35	664	0	0	664	664
Project Cost	109,950	64,461	45,489	4,499	40,990	2,050	38,939	83,800	2,250	38,939	124,989

9/ 8% of Total Cost of Civil Work & Equipment
10/ 14% of Total Cost of Civil Work & Equipment as Engineering Charge and Construction Supervision

10.4.2 Salvage Value

TABLE 10.4.2 presents the salvage value of all the capital equipment in the project in 2007. The percentage of the salvage value was based on the remaining service life of the facilities in 2007.

TABLE 10.4.2 SALVAGE VALUE IN YEAR 2007

(Unit : ₱1,000)

Year	Economic Value	Remaining Life in 2007 11/	Salvage Value
1988	13,114	50.0 %	6,557
1989	47,401	52.5	24,886
1990	9,772	55	5,375
1991	23,517	57.5	13,522
1992	8,621	60	5,173
1993	8,619	62.5	5,387
1994	8,505	65	5,228
1995	5,440	67.5	3,672
1996			
1997			
1998			
1999			
2000			
2001			
2002			
2003			
2004			
2005			
2006			
2007			69,800

11/ The average economic life of all items is assumed to be 40 years.

10.4.3 Operating and Maintenance Costs

In the economic analysis, operating and maintenance costs of personnel, power, chemicals, and maintenance are considered. Likewise, this cost category is converted to economic costs by the shadow pricing factors. TABLE 10.4.3 shows the economic operating and maintenance cost.

10.5 ECONOMIC INTERNAL RATE OF RETURN (EIRR)

EIRR is determined based on economic costs and benefits of the projects. TABLE 10.5.1 shows the computation of the EIRR. The EIRR is 12.3%. Since this rate exceeds barely the opportunity cost of capital of 12%, and a number of unquantifiable benefits will be also conceived from the implementation of the project, the project is considered economically feasible and an undertaking of the project is suggested itself to proceed positively.

TABLE 10.4.3 INCREMENTAL ECONOMIC OPERATION & MAINTENANCE COST

(Unit : ₱1,000)

Year	Financial O & M Cost	Foreign Exchange Component	Domestic Component	Taxes (5%)	Others (95%)	SHADOW PRICING Foreign Exchange Component x 1.3	SHADOW PRICING Others x 1.0	Economic O & M Cost	Net Economic O & M Cost
1987	880	160	720	36	684	208	684	892	-
1988	1,064	159	905	45	860	207	860	1,067	175
1989	1,576	319	1,257	63	1,194	415	1,194	1,609	717
1990	2,086	470	1,616	81	1,535	611	1,535	2,146	1,254
1991	2,889	537	2,352	118	2,234	698	2,234	2,932	2,040
1992	3,679	893	2,786	139	2,647	1,161	2,647	3,808	2,916
1993	4,481	1,104	3,377	169	3,208	1,435	3,208	4,643	3,751
1994	5,268	1,315	3,953	198	3,755	1,710	3,755	5,465	4,573
1995	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410
1996	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410
1999	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410
2000	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410
2001	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410
2002	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410
2003	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410
2004	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410
2005	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410
2006	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410
2007	6,071	1,526	4,545	227	4,318	1,984	4,318	6,302	5,410

TABLE 10.5.1 ECONOMIC INTERNAL RATE OF RETURN

(Unit : 1,000 Pesos)

Year	Total Economic Benefits	Total Economic Costs	Net Benefits	Present Value
1988	-422	13,289	-13,711	-13,711.0
1989	522	48,118	-47,596	-42,375.3
1990	3,159	11,026	-7,867	-6,235.8
1991	14,259	25,557	-11,298	-7,973.1
1992	17,140	11,537	5,603	3,520.4
1993	22,515	12,370	10,145	5,674.9
1994	24,624	13,078	11,546	5,750.2
1995	28,413	10,850	17,563	7,787.4
1996	19,915	5,410	14,505	5,726.0
1997	22,718	5,410	17,308	6,083.1
1998	20,560	5,410	15,150	4,740.6
1999	21,904	5,410	16,494	4,595.0
2000	19,753	5,410	14,343	3,557.5
2001	20,882	5,410	15,472	3,416.6
2002	18,839	5,410	13,429	2,640.2
2003	20,076	5,410	14,666	2,567.1
2004	18,033	5,410	12,623	1,967.1
2005	18,786	5,410	13,376	1,855.8
2006	16,904	5,410	11,494	1,419.8
2007	17,388	-64,390	81,778	8,993.6
			EIRR (%)=	12.32

CHAPTER 11
ORGANIZATION AND MANAGEMENT

CHAPTER 11 ORGANIZATION AND MANAGEMENT

11.1 PRESENT ORGANIZATION STRUCTURE

The CSBWS is owned by the provincial government of Laguna and is managed and operated by the Cabuyao-Sta. Rosa-Biñan Provincial Waterworks.

A total of thirty-one (31) personnel compose the present staff of the system. It is headed by a waterworks superintendent who has direct supervision over all operations. See FIGURE 11.1.1 for the present organizational structure of the system.

The waterworks system basically follows the rules and regulations promulgated by the defunct NAWASA. Since the system's transfer from NAWASA to the province in 1979, only one resolution was passed, that is; the increase in water rates in january 1984.

11.2 PROPOSED ORGANIZATION STRUCTURE

11.2.1 Introduction

The proposed organization structure for the CSBWS is the water district structure. The JICA Study Team believes that with the water district organization structure, the water system can look forward to dedicated policy makers providing continuity of policy and its consistent enforcement; to financial independence and business-like management; to capable, qualified and regularly trained personnel; and to freedom from political interference in its operations, particularly on hiring and water rates setting.

The JICA Study Team, however, proposes some changes on both the staffing guidelines, as well as the organization chart, without shaking the basic water district structure.

11.2.2 Examination of the LWUA Methodology Manual

The number of water district employees depends primarily on the total number of service connections. Based on this concept, LWUA's Methodology Manual proposes the following staff requirement for a water district.

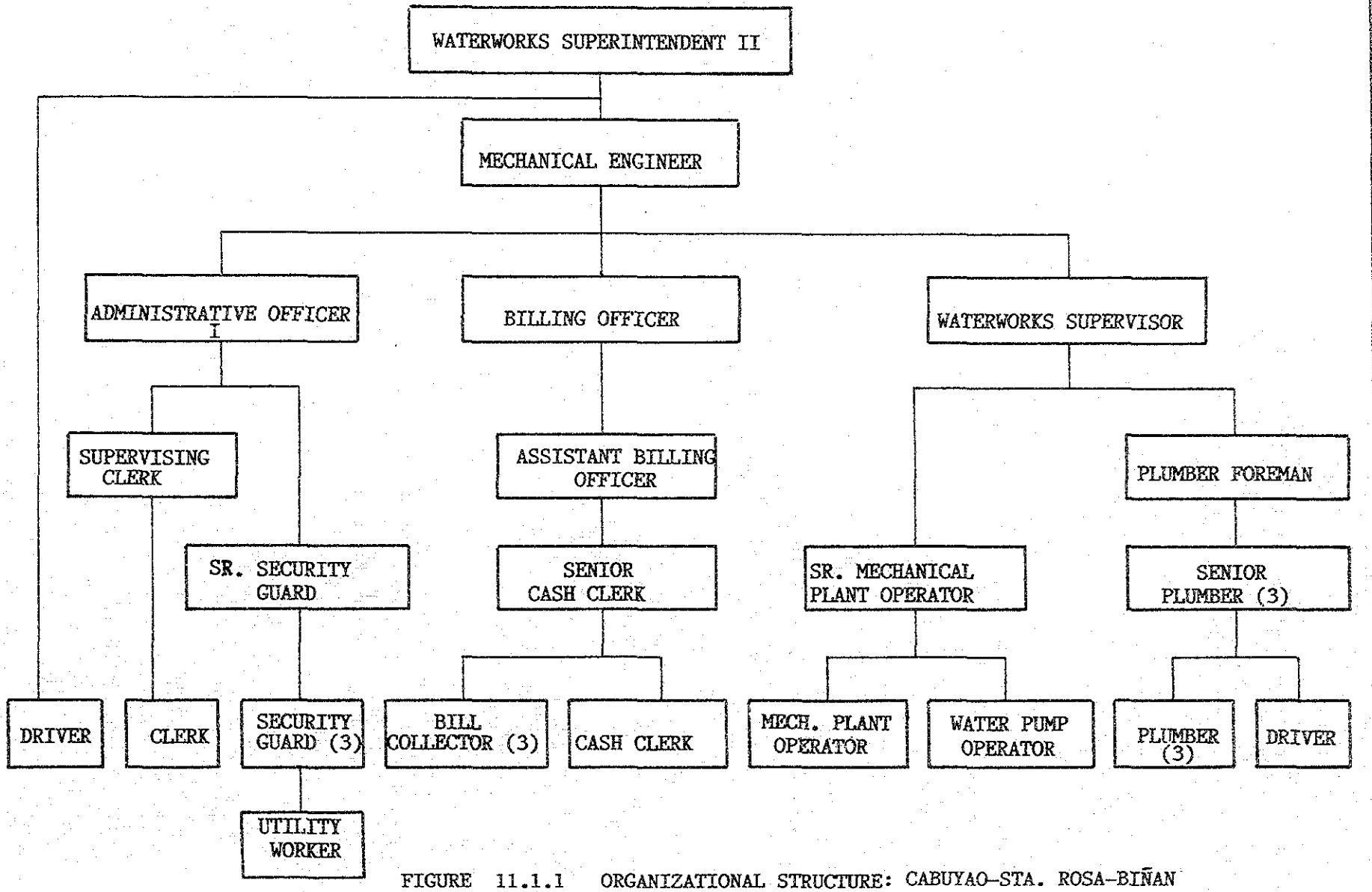


FIGURE 11.1.1 ORGANIZATIONAL STRUCTURE: CABUYAO–STA. ROSA–BIÑAN WATERWORKS SYSTEM

Personnel	No. of Connections				
	2,000	5,000	10,000	15,000	20,000
General Manager	1	1	1	1	1
Administrative Staff	7	14	20	22	23
Technical Staff	16	35	59	75	92
Commercial Staff	12	25	40	52	64
- meter readers, bill collectors, inspectors	(6)	(14)	(25)	(32)	(42)
- other employees	(6)	(11)	(15)	(20)	(22)
Total Staff	36	75	120	150	180
Staff/1,000 Connections	18	15	12	10	9

Note: The above data do not include personnel for construction of new connections, etc. which are considered to be part of development cost. These development expenses entail additional staff which is assumed to be 15 personnel per 1,000 additional service connection.

Moreover, the above figures are related to a water supply system without treatment plant. If such plant were necessary, additional 10 to 15 employees for each treatment plant with a capacity ranging from 10,000 to 50,000 cu.m/day may be considered.

Above-indicated table shows the staff requirement corresponding up to 20,000 connections. Therefore, we cannot use this table to compute the number of personnel both for Angeles Water District and Dagupan Water District in 1995 and 2010, since they will apparently be beyond the extent of the table.

It is possible, not to mention, that it can be estimate the number of personnel exceeding 20,000, on the basis of some assumption of personnel number per 1,000 connections. But it seems to be slightly forcible.

Therefore, JICA Study Team checked the formula derived from the result of a statistical analysis of the number of personnel in relation to the number of connections for 38 existing water districts for the years 1979, 1980 and 1982.

The guideline proposes two staffing levels. The first level has been proposed for the period 1986 - 1995; the second for the period 1996 - 2010.

The upper staffing level for the period 1996 - 2010 was computed from the formula:

$$\log (\text{no. of employees}) = \log (\text{no. of connection}) \times 0.8311 - 1.2113$$

See FIGURE 11.2.1 for the number of personnel needed for the Cabuyao-Sta. Rosa-Biñan Water District, once formed, using the LWUA Methodology Manual.

The lower level, which was assumed for the earlier period from 1986 - 1995, allows a 30 percent reduction in Staff below the calculated value.

Using the above mentioned formula, the number of personnel for CSBWS, if formed into a water district, could be computed as follows:

Design Year	No. of Employees
1995	184
2010	626

It is true that the formula presented by LWUA as a guideline in this study is based on the results of a Statistical analysis of the existing water districts. But no evaluation has been indicated whether the figures which were derived from the formula are appropriate or not.

Considering the actual scope and content of operation and management work, the number of personnel computed from the LWUA Methodology Manual, seems to be rather high, particularly for the year 2010.

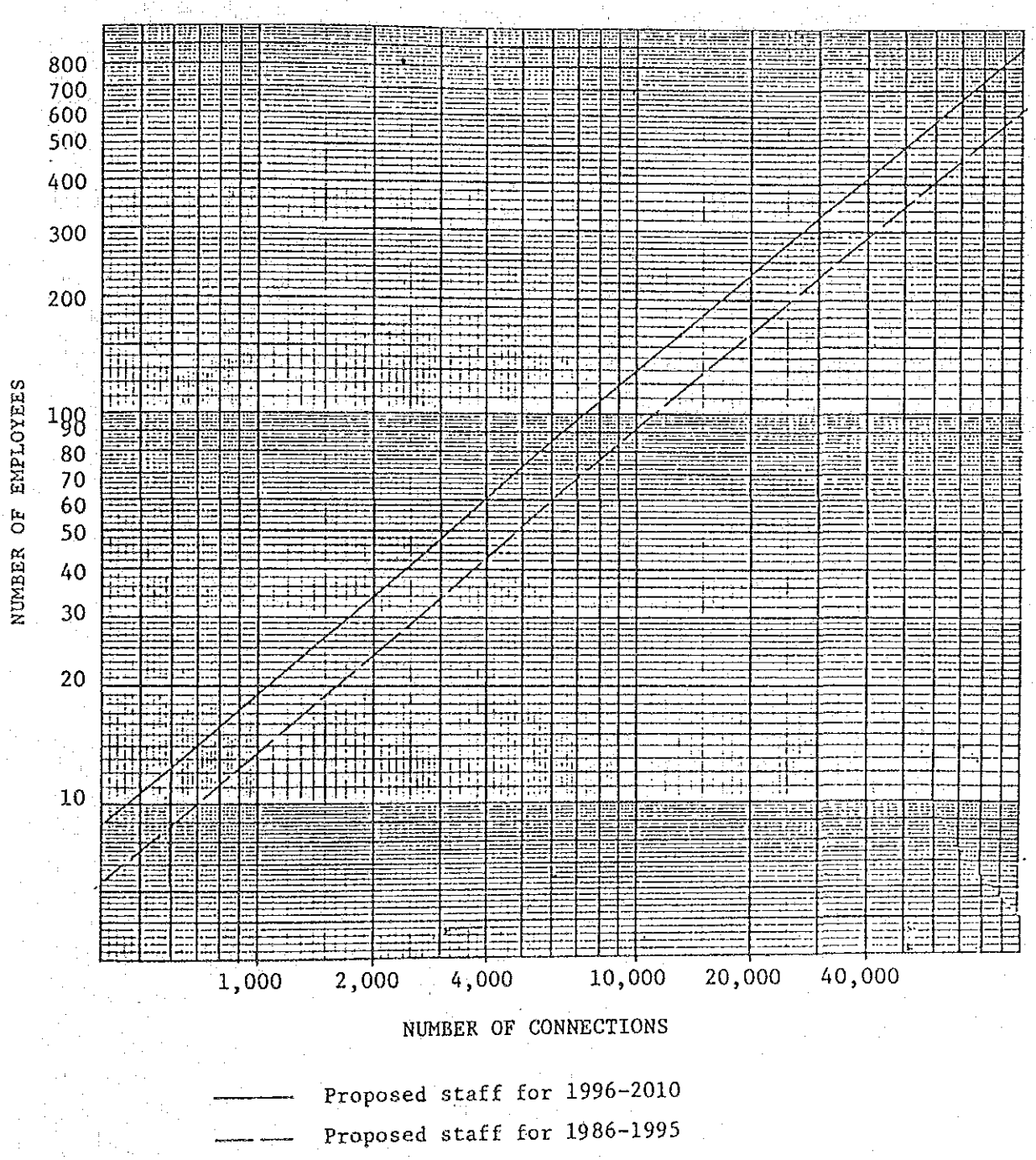


FIGURE 11.2.1 PROPOSED WATER DISTRICT STAFF BY LWUA METHODOLOGY MANUAL

In this study, therefore, a new proposal regarding the number of personnel based on the appropriate performance of individual work may be recommended.

11.2.3 Proposed Guideline of JICA Study Team

The task of management is to carry policy into effect with the fullest efficiency within the limits assigned; that is, to attain the maximum performance at the minimum cost. It is the duty of management to create conditions which will bring about the optimum uses of all resources available to the water district.

Based on this concept, the JICA Study Team closely examined the present structure of the existing CSBWS, not only regarding to the number of personnel but also the quality of the services to be provided to the consumers. Also considered as a reference were the statistical data regarding to the number of personnel and the organizational structures of CSBWS in a developed country.

The procedure which has been adopted in this study is, at first, to divide the organization of a water district into two main branches:--

a) The administrative and commercial division, comprising what may be termed the business management (including matters concerning water charges) of the water district.

b) The engineering and technical division, embracing the design and construction of minor extension or improvement works utilizing internal reserve fund; and the operation, renewal, and maintenance of existing works.

Secondly, the number of personnel has been computed considering the present number of personnel of said waterworks and appropriate performance of individual assignment.

TABLE 11.2.1 shows the JICA Study Team's on the personnel needed to man the proposed water district by scope and content of work.

TABLE 11.2.1 STAFFING GUIDELINE

DIVISION AND POSITION OF STAFF	NUMBER	CONTENTS OF WORKS, REMARKS
General Manager	1	Sec.23 of Provincial Water Utilities Act of 1973
ADMINISTRATIVE AND COMMERCIAL		
Asst. General Manager	1	
General Affairs Division Manager Staff	 1 2 (< 20,000 connections) 4 (< 50,000 connections)	°Correspondence °Filing °Agendas °Establishment °Resister of Land, fixed assets °Tenancies °Statistics °General Information and Returns °Board Work, Contracts °Miscellaneous
Account Division Manager Staff	 1 3 (< 10,000 connections) 5 (< 30,000 connections) 7 (< 50,000 connections)	°Cash Receipts and Payments °Revenue Expenditure °Capital Expenditure °Borrowing Powers °Rates and Rating °Wages and Insurance °Recoverable Charges °Procurement of Equipment and Materials °Supplies °Miscellaneous Costs
General Service Division Manager Clerk Mechanics Staff	 1 1 1 4 - 10	°Store-keeping °Transportation °Utilities 4 for less than 10,000 conn., 6 for less than 20,000 conn., 10 for more than 20,001 conn.

TABLE 11.2. 1 STAFFING GUIDELINE (continued)

DIVISION AND POSITION OF STAFF	NUMBER	CONTENTS OF WORKS, REMARKS
Water Charges Division		°Assessments °Resister of Supplies °Guarantees °Meter Charges °Revision of Charges °Statistics °Water Survey °Meter Reading (Consumption, Complaints, Reports) °Collection of Water Charges
Manager	1	
Clerk	2 (<20,000 connections) 3 (<30,000 connections) 5 (<50,000 connections)	
Meter Reader	Proportional to the no.of conn.	° One (1) meter reader per 1,500 connections
TECHNICAL		
Asst. General Manager (Eng'r)	1	
Distribution Division		°Preservation of Water Sources,Prevention of Pollution °Afforestation (in case of spring source) °Operation and Maintenance °Service Reservoirs °Transmission Mains/ Distribution Mains* °Pumping Stations * Hydrants and Valves * Waste Inspection * Extentions, Renewals, Cleaning and Repairs,Street Repairs
Manager (Eng'r)	1	
Mechanics	2	
Electrician	1	
Pump Operators	2 for every 5 stations	
Reservoir Attendants	2	° Two (2) attendants per one reservoir
Pipeline Patrol	Prop'l to the Pipeline length	° One (1) staff per every five (5) kilometer for the first 60 km, then add one per every ten (10) kilometer
General Maintenance	3	° Painters, Blacksmith & c.

TABLE 11.2.1 STAFFING GUIDELINE (continued)

DIVISION AND POSITION OF STAFF	NUMBER	CONTENTS OF WORKS, REMARKS
Service Works Division		°Meter Fixing and Repairs
Manager	1	°Meter Fixing °Exchanging and Testing °Repairing
		°Plumbing
		°Laying and Maintenance of Service Pipes and Fittings °Plumbing Repairs °Testing of Fittings
Fitters	Proportional to the no.of conn.	° Two(2) fitters for the first 20,000 connections, then add one (1) fitter for every additional 10,000 connections
Meter Repairman	Proportional to the no.of conn.	° Two(2) repairers for the first 10,000 connections, then add one (1) repairer for every additional 10,000 connections
Plumbers	Proportional to the no.of conn.	° Two(2) plumbers for the first 20,000 connections, then add one (1) plumber for every additional 10,000 connections
Laborers	Proportional to the no.of conn.	° Two (2) laborers for the first 20,000 connections, then add one laborer forevery additional 10,000 connections

It was decided by JICA Study Team, to assign no bill collector based on the assumption that the consumers will pay water charges directly to the water district of through their affiliated banks.

TABLE 11.2.2 shows the summary of the present (1986) and the proposed staffing pattern (1995 and 2010) for Cabuyao-Sta. Rosa-Biñan.

11.2.4 Proposed Organization Structure

The organization structure proposed for the CSBWS is basically the water district structure.

The water system/district will be headed by a five-man Board of Directors, as per PD 198, who will come from the various sectors of the community and will be appointed by the mayor or governor, as the case may be. It is this Board that will set all the policies of the water system/district.

The everyday affairs of the water system/district will be managed by the General Manager who will be appointed by the Board of Directors.

The two broad divisions of the system/district will be:

a) Administration and Commercial Division
b) Technical Division

The proposed number of personnel for both divisions is:

	1995	2010
General Manager	1	1
Administrative and Commercial	44	79
Technical	36	61
Total	81	141

FIGURE 11.2.2 shows the proposed organization chart for the Cabuyao-Sta. Rosa-Biñan Water District.

TABLE 11.2.2 SUMMARY OF PRESENT (1986) AND PROPOSED (1995 and 2010) STAFFING PATTERN (CABUYAO-STA. ROSA-BINAN)

	1986	1995	2010
Population Served	23,560	110,400	287,800
No. of Connections	2,907	23,400	66,400
Supply Capacity (cu.m/d)	10,000	32,900	94,000
Length of T/D Main (m)	27,000	35,000	73.000
No. of Pump Stations	2	6	17
General Manager	-	1	1
ADMINISTRATIVE AND COMMERCIAL			
Assistant General manager	-	1	1
General Affairs	2	4	6
Accountancy	2	6	8
General Services	7	13	13
Water Charges			
Manager	-	1	1
Clerk	4	3	6
Meter Reader	-	16	44
Bill Collector	3	-	-
Sub-Total	7	20	51
Total	18	44	79
TECHNICAL			
Assistant General Manager	1	1	1
Distribution			
Manager	-	1	1
Mechanics	3	2	2
Electrician	-	1	1
Pump Operator	1	3	4
Reservoir Attendant	-	4	6
Patrol	-	7	13
General Maintenance	-	3	3
Sub-Total	4	22	31
Service Works			
Manager	-	1	1
Fitter	-	3	7
Meter Repairman	-	4	8
Plumber	7	3	7
Laborer	1	3	7
Sub-Total	8	14	30
Total	13	36	61
GRAND TOTAL	31	81	141

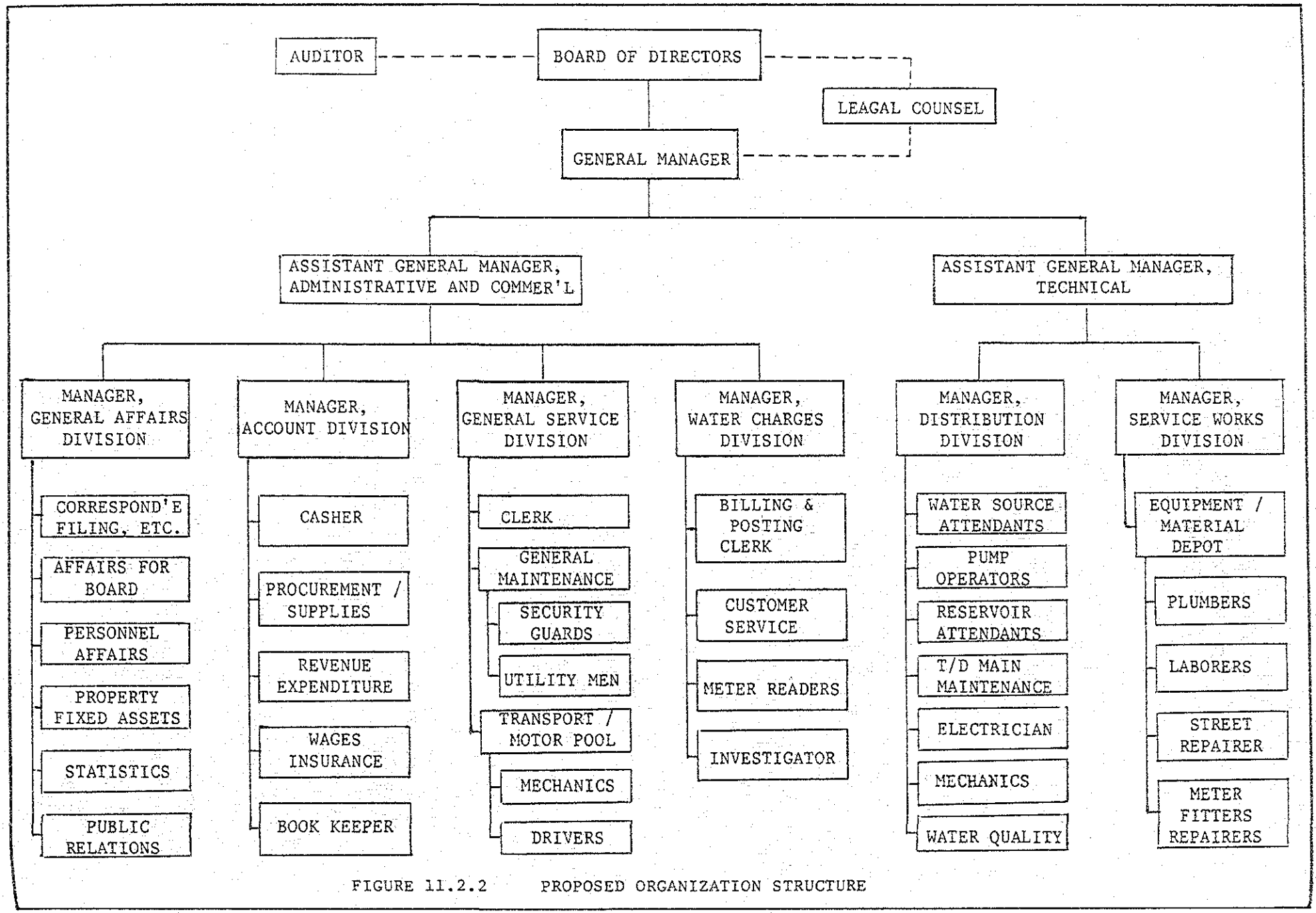


FIGURE 11.2.2 PROPOSED ORGANIZATION STRUCTURE

11.3 MANAGEMENT

11.3.1 Importance of Management

As stated in Section 11.2.3, the task of management is to carry policy into action with the fullest efficiency within the limits assigned; that is, to attain maximum performance at minimum cost. It is the duty of management to create conditions which will bring about the optimum use of all resources available to the water district. Thus the scope of management carries with it a lot of responsibilities.

The continuous and successful operation of a water district depends largely on the patronage of its consumers. The consumers would only patronize a water district if it can provide them safe water in sufficient quantities at all times at a cost within their reach. Patronage of consumers can be achieved through good management.

11.3.2 Functions and Duties of General Manager/Staff

FIGURE 11.2.2. shows the departmental organization in a medium-sized water district whose sources of supply are deep wells. (If its sources are surface water, the treatment plant staff should be added.)

Many of the functions indicated on the chart are common to the four proposed water districts respectively, although relatively small water districts (e.g., Cabuyao-Sta. Rosa-Biñan Water District) may find it unnecessary to departmentalize during the early stage.

A carefully planned organization is essential to ensure that the needs of consumers throughout the area can be promptly appreciated and efficiently met. Thus, it is also desirable that every member of the organization not only understand and realize the significance and importance of his or her particular function but also properly discharge that particular function.

(1) The General Manager

Provincial Water Utilities Act of 1973 prescribes the Officers and Employees as follows:

> "SEC. 23. The General Manager. --- At the first meeting of the Board, or as soon as practicable, the Board shall appoint, by a majority vote, a general manager and shall define his duties and fix his compensation. Said officer shall serve at the pleasure of the Board. (As amended by Sec. 9, PD 768)
>
> SEC. 24. Duties. --- The duties of the General Manager and other officers shall be determined and specified from time to time by the Board. The General Manager, who shall not be a director, shall have full supervision and control of the maintenance and operation of water district facilities, with power and authority to appoint all personnel of the district: Provided, that the appointment of personnel in the supervisory level shall be subject to approval by the Board. (As amended by Sec. 10, PD 768)"

Thus, the duties fall, to a large extent, within the sphere of administration. The General Manager should therefore, have managerial ability, and a thorough knowledge of the administrative machine which he controls. Managerial ability implies the ability to select suitably trained or qualified staff, to delegate work and responsibility wisely, and to create and maintain a spirit of co-operative enthusiasm throughout the entire organization. The General Manager must be able to co-ordinate the efforts of the several different sections, and should keep in close touch with the more important matters being dealt with by each.

Since water industry is mainly concerned with the problems of the collection of water, its storage, treatment (at least chlorination), and distribution, it is most desirable that the General Manager is a chartered civil/sanitary engineer who also has managerial abilities on general, and especially, financial matters.

Presently, however, the four study areas are not yet managed as a water district, for these systems to start out rightly, it must be able to

have a man of managerial competence and experience appointed as a General Manager.

Therefore, the first priority should rather be given to managerial ability rather than to be an engineer. In case any other non-technical person is appointed as the General Manager, the General Manager should be assisted by a chief engineer.

Although the General Manager is responsible for the day-to-day conduct of affairs of the water district, he should not become too immersed in details. He should exercise over-all supervision and control, thereby giving himself ample time to plan the improvement/development of the Water District carefully in anticipation of the consumer's needs, and to deal promptly with unforeseen situations of major importance as they arise.

(2) The Administrative machine

As indicated in the FIGURE 11.2.2, the proposed organization of the water district can be divided into two main branches:--- (1) the Administrative, and (2) the Technical.

These two branches are in contact at many points, and are so interdependent that a high degree of co-operation is essential to ensure coordination of effort, economy in working, and proper balance between income and expenditure. Each of these two main branches is, in turn, divided into a number of subsections.

As efficient administration cannot be achieved by staff in watertight compartments, officers in charge of departments should not only possess a detailed knowledge of every aspect of the work of their respective departments, but should also take an interest in, and have a general knowledge of, the work of other departments.

In the organization depicted in functional form in FIGURE 11.2.2, it seems not necessary to mention the scope of the individual works one by one basis. Keynotes or recommendations are as follow:---

11.3.3 Problems Arising from the Transition of Administrations

Transition from the existing water supply organizations to the respective water districts will inevitably take time. Each water authority then should make necessary preparations for setting up respective water districts in various aspects -- legislative, budgetary, personnel and technical.

(1) Personnel

a) Appointment of qualified personnel to the key positions is indispensable for good management of a water district. Generally, it might be somewhat difficult to get well educated or qualified personnel in local cities and municipalities, especially in areas far from Metro Manila. However, there are other aspects that may make up for apparent lack of education or qualification. These are experience, the right attitude and the potential or capacity of a person to learn.

b) If the employees who belong to the existing water supply authorities will transfer to the proposed water districts there will be no displacement, since the number of employees of the existing water supply authorities are less than the proposed number of personnel required for water districts in the target years 1990 and 2010.

However, there may be problems on absorbing dead wood or unwanted employees. It may be best to terminate such employees services at the start of the water district operations so as not to complicate matters further.

c) It is recommended that the experience of the personnel who have worked for a long time for the relevant water authority and are well acquainted with that water supply system, managerially or technically, be made good use of.

d) In the procedures for recruitment, if necessary, any newly formed water district may fully utilize LWUA's assistance to obtain de-

sirable personnel, especially for managerial positions. It is expected, therefore, LWUA can use its testing system to recommend the most appropriate candidate as required water district.

e) Attention should be given to procedures for the recruitment, proper use and retention of technical personnel including the establishment of career structures.

f) Training of personnel on all levels and categories is a vital aspect in relation to work performance, morale and retention of staff. It was disclosed through the study, that most of the staff of all the four water supply systems have not enjoyed the benefits of any kind of training at all. Before and after the formation of these systems into water districts, LWUA should train the personnel from the board of directors and General Manager down to the plumber.

g) An information dissemination and public relations programs should be developed. The water districts serves the people and needs the support of the people, especially on payment of water bills or when the water rates are increased. It should therefore regularly inform and educate its public on the plans and programs of the water district and on the correct usage of water.

(2) Change of Charging System

a) At present, in the waterworks of Angeles City, Dagupan City and Cabuyao-Sta. Rosa-Biñan, the combined use of flat rate system and metered system is adopted, while in Bayombong-Solano only a flat rate system is adopted because all the faucets are unmetered.

In principle, the proposed four water districts should be operated and managed on the basis of 100% metering, in accordance with the Letter of Instruction No. 700, June 1, 1978, to insure correct charging of water actually consumed and discourage its wasteful use. One hundred (100) percent metering is the basis of the water tariff structure and, in effect, is the basis for financial viability.

b) To install water meters (including replacement of the nonfunctioning/malfunctioning meters) to all the consumers takes time. Therefore, it is necessary to stipulate a provisional rate regulation of combined use of flat rate and metered system, fixing the target date by which 100% metering should be realized.

c) Since the life of water meters is about 8 years, the water district should have a plan to replace water meters installed at every customer once in 8 years basis and to guarantee the budget and manpower necessary for its execution.

11.3.4 Problems Arising from Rapid Expansion of the Systems

(1) Coordination During Construction Period

According to the demand projection in the target year for the Short Term Development, the size of the water supply systems will more than double compared to its present size.

Considering the rapid expansion of the water supply systems, there may be much inconvenience caused by the construction work. For instance, to minimize water interruption and traffic congestion caused by pipe laying work, it is necessary to develop close coordination and cooperation between the respective water district and LWUA (Engineering Services) together with the local transportation authorities and inform the people to be affected by the expansion project.

11.4 OTHER RECOMMENDATIONS

11.4.1 LWUA Assistance

Immediately upon their formation into water districts, it is recommended that the LWUA install an appropriate commercial operation system (CPS) for back of the said water districts. Also, an effective and sustained training programs for both water district officials and personnel should be formulated and implemented as soon as possible. A rational public information and education program should also be undertaken by the new water districts.

The JICA Team also reminds that the LWUA maximize its assistance to the proposed water district upon its formation. It is expected that partially the proposed water district will need LWUA's assistance in all aspects of its operation and financial, technical and institutional. It is believed that this package of assistance will greatly enhance the water system's capability to provide an adequate and efficient water service to its consuming public.

11.4.2 Formation of Water Districts

Basically, LWUA provides every necessary assistance once a water-works system is formed into a water district. Yet, under the decree that created both LWUA and the water district (PD 198, as amended), the formation of a water district is at the option of the local governments concerned.

There is actually a very positive trend towards the formation of water districts in the above-mentioned four study areas. Members of the Sangguniang Panlalawigan/Panglunsod have been taking an increasing interest in the importance of an improved water supply system. The JICA Team believes LWUA can facilitate things by having a more aggressive program or campaign in water district formation itself; but should include effective information measures to promote formation through grass-roots and media based campaigns.

11.4.3 Mutual Interdependence

Another recommendation is to study the possibilities regarding a "mutual interdependence" between LWUA and MWSS for areas close to Metro-Manila.

This does not intend to contradict to the spirit of the legislation of Provincial Water Utilities Act and its related Letter of Instructions (No. 683, March 30, 1978).

Cabuyao-Sta. Rosa-Biñan area, one of the four study areas of this Municipal Water Supply project, will have enough water source to cope with

its future demand, even in the target year of the long term development plan, 2010.

This is because said area is blessed with an abundant groundwater resources which was listed up once as one of the nine potential sources of water supply for Metro Manila beyond the year 1990.

At present, MWSS supplies water to the Metro Manila and 29 contiguous municipalities. The service area to be covered by the on-going extension program (which is called as MWSP III) includes Muntinglupa and part of the Province of Cavite (Rosario, Imus and Bacoor) in its southern area.

Cabuyao-Sta. Rosa-Biñan area, especially Biñan area is adjacent to this southern limit of MWSS service area.

Therefore, if Cabuyao-Sta. Rosa-Biñan area was supplied by MWSS, the water charge of MWSS would be applied. This means that however the cost of expansion works for the said area may be, it will be shouldered by millions of consumers who live in MWSS service area. Considering the amount of the construction cost and the corresponding population served, the increase of water rates charged the consumers would be minimal.