2.2.2 Commercial Water Demand

The commercial water use was slightly decreased in the 1980's but, later, the trend was reversed and is expected to continue increasing in the future because, unlike water for industrial use which depends much on private wells, water for commercial use is more dependent on MWSS and the population growth which is projected to be increased by 1.6 times of current level in the target year of 2015. Further, saline intrusion to the groundwater becomes a serious problem in Metro Manila. Therefore, 50 % of the private wells consumption with salinity problems are assumed to be converted to the MWSS CDS systems by year 2000. Furthermore, 50 % of the groundwater use even without salinity problems should be restricted and converted to the MWSS CDS systems after the year 2005.

2.2.3 Industrial Water Demand

Industrial water use, which is at present highly dependent on groundwater, will be raised according to the economic growth by the population growth as same manner as commercial water use. Likewise, the groundwater was considered to be converted to MWSS CDS systems by year 2000 and after 2010 as same as commercial water use.

2.2.4 Other Indicators

Technical indicator such as maximum day demand factor and peak hour demand factor is reflected as; 1) maximum day demand factor is 1.25 which is derived from the past trend which varies from 1.06 to 1.23 and the average is 1.12 and 2) peak hour demand factor is to be 1.75 as same level as decided in AWSOP.

2.3 Development Plan

2.3.1 General

In order to meet the increasing water demand during the twenty-year period from 1996 to 2015, the following development plan is proposed with five year implementation plan. It outlines new water supply system including ensurance of additional raw water sources, expansion of new water treatment facilities, augmentation of distribution network, optimization of the existing water supply system such as rehabilitation and NRW reduction.

The deficit in water supply capacity is summarized as shown in Table 2.2, provided that ongoing projects, AWSOP, UATP, and RPWSIP be implemented completely as scheduled. It shows 560 in 1995, 686 in 2000, 847 in 2005, 1,391 in 2010, and the highest 1,918 mld in 2015.

Table 2.2 Production Capacity to be Expanded (mld)

Description	1995	2000	2005	2010	2015
Daily Ave. Water Demand	2,765	3,360	3,889	4,324	4,746
Daily Max. Water Demand (a)	3,456	4,200	4,861	5,405	5,932
Prospective Production Cap. (b)	2,896	3,514	4,014	4,014	4,014
Deficit = (a) - (b)	560	686	847	1,391	1,918

2.3.2 Acquisition of Water Source

The Kaliwa River is recommended as the most suitable source in view of quantity and quality on which MWSS could depend up to the target year 2015 as shown below. A dual water source system is necessary for a megalopolis like Metro Manila, in cases of unexpected emergencies.

- Satisfactory and stable yield would be expected;
- It could meet the demand by the year 2015 ;
- Satisfactory water quality - there are no harmful substances nor waste water discharges in the basin, now and in the future;
- When its development is integrated with the Kanan River basin, the joint project will be a permanent supply source;
- The elevation of the proposed treatment plant (Pantay) and distribution reservoir (Cogeo) is more favorable due to 'supply by gravity';
- Due to the location of the basin and the treatment plant, it is much easier to increase the supply capacity in the east bank of Marikina River (Rizal), the southernmost parts of NCR (Parañaque, Las Piñas and Muntinlupa), and the service areas in Cavite Province.

2.3.3 Existing Water Supply Capacity

Balance in the system shows that raw water conveyance capacity is 4,650 mld and 4,840 mld by tunnels and aqueducts, respectively, while treatment capacity 4,000 mld is the lowest among the system and indicates the actual potential capacity, provided that AWSOP, UATP, and RPWSIP will be completed as scheduled before year 2000.

2.3.4 Production Capacity to be Expanded

Deficit in the production capacity increases from 560 mld in 1995 to 1,918 mld in 2015. Thus, a new water supply system shall be developed including new raw water sources, because it is apparently that the capacity of the "Angat Novaliches Water Supply System" reaches at its limit. It functions not only additional water supply system but also ensurance of supplemental system in the event of emergency.

Meanwhile, uprate of the existing water supply system, which should be considered to augment the production capacity, may not be acceptable due to their current production capacity which is almost upper limit.

2.3.5 Distribution System to be Improved

The existing distribution system should be improved from the view points of hydraulically, ease of operation and maintenance, and NRW reduction.

The areas supplied by pump should be as small in size as practicable and should be totally isolated from the gravity served areas to minimize maintenance and power costs. The main pipes should be looped and reinforced to attain stable water supply, uniform system pressures and flexible enough during emergencies.

Newly served areas should be isolated from long-served areas to minimize leakage in the old pipe networks. Additional reservoirs should be constructed to have adequate storage capacity for regulation and for emergency. New pipes should be installed to replace old pipes and for filling-in the network to achieve a stable water supply and uniform system pressures. The service area should be subdivided into large blocks to simplify operation and maintenance as shown in Table 2.3.

Consequently, a total of 370 km of main pipe, from 300 to 3,500 mm in diameter, and several reservoirs should be expanded.

Table 2.3 Proposed Distribution Blocks

Block No.	Distribution Lineage	Coverage	Remarks
1	La Mesa Reservoir	part of Quezon, part of Caloocan, Valenzuela	North of La Mesa TP is mostly not served. Valenzuela, supplied now from Bagbag reservoir, is in Block No.1 due to geographical reason and, as planned in AWSOP, will be supplied from La Mesa TP2.
2	Bagbag Reservoir	part of Quezon, Malabon, Navotas, part of Caloocan	This block is adjacent to but different from Block No. 5 because supply comes from Bagbag reservoir (La Mesa TP No.1) only. Caloocan R/P (not in operation) is in this block.
3	Balara, Cubao, San Juan, Pasig Pump Stations	part of Quezon, part of San Juan, part of Pasig, part of Mandaluyong	This block is at higher portion coverage area and is supplied by pumping. This area is planned to be supplied from La Mesa TP2&3 and Balara TP. Balara R/P, Cubao P, San Juan R/P and Pasig R/P are in this block.
4	Fort Bonifacio, Makati PS	part of Makati, part of Taguig	Block No.4 is downstream of Block No. 6 and is supplied by pumping from Balara TP. Makati R/P (not in operation) and F.Bonifacio R/P are in this block.
5	Bagbag Reservoir and Balara Treatment Plant	part of Quezon, Manila, part of San Juan, part of Mandaluyong, part of Makati, part of Pasay, part of Paranaque, part of Las Pinas	This is the largest block in the existing supplied area and is being served from Balara and La Mesa TP by mixed gravity and pumping. D.Tuazon R/P (not in operation), Algeciras R/P, Tondo R/P (not in operation), Ermita R/P. Espiritu R/P (not in operation) and Pasay R/P are in this block. The two plans considered on how to distribute water in this block are the following: Case 1 Distribute water using existing reservoirs and pumps. Case 2 Distribute water entirely by gravity. Case 2 is ideal but will take long time to construct new pipes and replace old pipes, so Case 1 is still needed at the transition period to Case 2.
6	Balara Treatment Plant	part of Marikina, part of Pasig	Block No. 6 is upstream of Block No. 4 and supplied by gravity from Balara TP. The size will be reduced and limited only to western side of Marikina River.
7	Pantay Treatment Plant	part of Marikina, part of Pasig, Pateros, part of Taguig, part of Pasay, part of Paranaque, part of Las Pinas, Muntinlupa, all of Rizal and Cavite.	Present supply coverage is low. To increase supply, planned future source for this area is Laiban Dam at Kaliwa River. Construction of facilities, however, will take a long time.

Note: Pantay system (lineage) has higher water pressure than others, hence, water supply coverage is limited only in areas east of Marikina River, southern part of the NCR, Cavite and Rizal where pipes are or will be relatively new. In the future, after replacement of old pipe lines in the other parts of the system and when all the pipes can already bear high water pressures, reblocking the service area may be considered.

2.3.6 Service Network to be Expanded

The quantity of small diameter pipes (250 mm and smaller pipes) planned for in-filling pipe networks was estimated considering the existing pipe density and the increasing served population. A total estimated quantities of small pipes to be expanded is 4,913 km in length.

2.3.7 Pipe Replacement

The existing distribution pipes has a total length of about 4,300 km. Out of which ACP and 50 % of the pipes of unverified materials, which is possibly a main cause of pipe breakage or water leakage, totaling 2,054 km should be replaced.

2.3.8 Staged Development Plan

To realize the proposed development plan, the following staged development plan is proposed.

Table 2.4 Staged Development Plan

Phase	Implementation Plan
I (1996-2000)	• Full accomplishment of the ongoing projects (AWSOP , UATP, etc.) • F/S and D/D on development of new potential water sources and construction of impound reservoir and related water supply facilities • Implementation of the planned NRW reducing projects • F/S and D/D on prioritized projects in the study (rehabilitation of facilities/equipment, improvement of distribution network, etc.)
II (2001-2005)	• Continuation of development of water sources and staged water supply augmentation project (Stage I) • Continuation of the planned NRW reducing projects • Implementation of improvement of distribution network
III (2006-2010)	• Continuation of staged water supply augmentation project (Stage II and III), including treatment facilities and distribution piping • Continuation of the planned NRW reducing projects • Continuation of improvement of distribution network
IV (2011-2015)	• Operation and maintenance of new water supply systems • Continuation of the planned NRW reducing projects • Continuation of improvement of distribution network • Implementation of rehabilitation of the existing water treatment facilities/equipment • Review of achievement level of target and establish new master plan for next decades

2.4 Operation and maintenance

2.4.1 Non Revenue Water Reduction

Leakage prevention and control demands continuous and consistent effort, not to mention budgetary support. Leak repair in the service areas is, more often than not, a temporary measure to put a stop to the water losses; but a more permanent solution must be instituted.

Through the past experiences and with several projects consistently confirming the fact, the major causes of NRW are leaks, unauthorized use and metering errors. To be able to reduce the NRW to 30 % by the target year 2015 level, as shown in the previous chapter, the following measures should be undertaken systematically:

(1) Controlling unauthorized use of water

- the replacement and monitoring of fire deteriorated hydrants,
- the creation of an illegal connection task force,
- installation and monitoring of public faucets, and
- the investigation and evaluation of by-passes as well as the unauthorized selling of water and unregistered service connections.

(2) Improving metering efficiency

- immediate and periodic inspection of all installed water meters
- standardization of meters and testing

(3) Reducing leakage

- Pipe replacement/renovation to renew old and defective distribution components
- Adoption of stricter quality control and quality assurance on construction activities
- Research and development of new pipe materials, workmanship and technologies which will lengthen the useful life of the distribution facilities.

(4) Institutional Improvement

- Creation of a permanent unit within the MWSS exclusively for NRW activities.

2.4.2 Maintenance and Logistics

The major issues of the operations and maintenance areas are centered in and around the maintenance of facilities and equipment, and logistics of maintenance resources such as materials, spare parts, tools and equipment. This is due to a lack of planning and coordination among operations, maintenance, material control and procurement activities.

In order to improve the operations in the maintenance and logistics functions, the Study Team identified the following three options:

- Option 1 - Re-engineering: MWSS could apply the re-engineering approach and integrate the maintenance and logistics operations to streamline their processes.
- Option 2 - Management Contract: The management contract permits the acquisition of much needed technical and managerial skills such as maintenance planning and scheduling, service parts inventory control, logistics of maintenance resources, etc.
- Option 3 - Joint Venture: A joint venture (JV) with a JV partner that specializes in the provision of maintenance and logistics service to MWSS may be created between MWSS and a private company.

(1) Budget for Maintenance and Repair

Since there is no guideline on budget allocation for repair and maintenance, a substantial portion of the proposed budget requested by operating units is usually cut. In other words, MWSS is operating with profits by sacrificing costs for repair and maintenance, accelerating the deterioration of the facilities and eventually requiring more costly rehabilitation of infrastructure.

As a short-term solution for determining repair and maintenance costs for budgeting purposes, an allocation guideline should be established based on a logical assumption, such as percentage of the total operating expense. Once the total budget for repair and maintenance is determined, the budgeted amount will be allocated to departments, divisions and sections based on a pre-determined formula.

As a long-term strategy, the budget for repair and maintenance work should be increased gradually at an amount that adequately covers costs to maintain infrastructure at required level.

2.4.3 Water Quality Control

To maintain a high level of service, the following quality measures must be implemented:

1) to keep the source water as clean as possible, to effect optimal water treatment, and

2) to prevent contamination of treated water as it flows through the distribution system.

3. Proposed Projects

3.1 Expansion/Augmentation Projects

3.1.1 MWSP III

Considering all the qualitative and quantitative aspects, the implementation of MWSP III should be undertaken to augment the required water demand of 1,918 mld by the target year 2015. This realization of a dual water supply system, together with the Angat-Novaliches Water Supply System run by gravity system, will greatly contribute to the reliability of needed water service in a megalopolis like Metro Manila.

The project components are 1) relocation, 2) land acquisition, 3) Headworks (Laiban Dam, raw water outlet, headrace and hydropower, treated waterways, powerline), and 4) Pantay Treatment Plant, distribution system (Cogeo Reservoir, Mayamot Pressure Control, pipelines).

The implementation of CWSP, however, has major disadvantages such as:

- Utilizing the Laguna Lake water as raw water source, whose quality has seriously deteriorated due to the delay of necessary development of the sewage treatment system;
- Getting the risk of additional investment because of said degradation of the water source should the plans for the water treatment plant be abandoned;
- Going through with the construction of the CWSP treatment plant would still necessitate the construction of the MWSP III treatment plant to be able to keep pace with the water demand. Up to the target year of 2015, MWSP III can cover the demand without CWSP. Thus, the CWSP treatment plant can still be constructed after 2015, which is not really "late" considering that the water from Laguna Lake would have been improved by possible sewage discharge control by then.

3.1.2 Distribution System

(1) Distribution System Improvement/Expansion Project

The distribution system should be expanded in accordance with the proposed big- sized blocks to

simplify operation and maintenance.

The project components are estimated as shown below:

Table 2.5 Pipeline Expansion

Block No.1	Block No.2	Block No.3	Block No.4	Block No.5	Block No.7	Total Length
73 km	12 km	16 km	6 km	32 km	228 km	367 km

Note : Table shows case 2. (Case 1 total length is 373 km)

Table 2.6 Numbers of Reservoir or Pump Station Expansion

Block No.1	Block No.2	Block No.3	Block No.4	Block No.5	Block No.7
3 R/P augment.	1 R renov. 1 R augment.	2 R/P renov. 1P renov.	2 R/P renov. 1P recom't.	Common to Block No.2	1R augment *

Note : R : reservoir, P: pump station *, every facilities to be augmented by MWSP III are excluded.

3.1.3 Service Network Expansion Project

As the distribution system improvement/expansion projects are carried out, the following amount of small pipes (250 mm or smaller) for in-filling should be expanded.

Table 2.7 Service Network Expansion

NCR	Cavite	Rizal	Total
2,850 km	424 km	1,639 km	4,913 km

3.1.4 Alternative Plan

To identify the appropriate water supply system for the target year 2015, possible alternatives were developed on a per block basis; that is, in relation to the proposed water treatment lineages and distribution system in the Master Plan. These alternatives are summarized as follows:

Table 2.8 Proposed Alternative Plan for Expansion/Augmentation Project

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Block.1	Common	Common	Common	Common
Block.2 Block 3	Case 1 (pump and gravity)	Case 1 (pump and gravity)	Case 2 (gravity)	Case 2 (gravity)
Block 4	Common	Common	Common	Common
Block 5	Same as Block 2&3	Same as Block 2&3	Same as Block 2&3	Same as Block 2&3
Block 6	Common	Common	Common	Common
Block 7	W/ CWSP & MWSP III	W/O CWSP, W/ MWSP III	W/ CWSP & MWSP III	W/O CWSP, W/ MWSP III

Among these, Alternative 4 is the most superior alternative technically without looking at other concerns. Alternative 2 is the best when considering the estimated economic burden.

3.2 NRW Reducing Projects

3.2.1 Old Pipe Renovation Project

Pipe replacement is closely related to leak prevention. The pipes that require replacement are those old pipes mostly found in Quezon City, Manila, and Makati where the early water supply systems were installed. Also, proposed replacement are relatively weak pipes, mainly ACP pipe and unverified materials as listed below:

Table 2.9 Pipe Replacement

Pipe	Necessary length to be replaced
ACP	908 km
50 % of Unverified pipes	659 km
50 % of pipes in Manila, Quezon City and Makati	487 km
Total	2,057 km

3.2.2 Controlling Unauthorized Water Use Project

As a short term plan, maximizing lawful power of the enacted National Water Crisis Act of 1995, the following project should be implemented to reduce NRW level.

- Controlling unauthorized use
- Controlling malfunctioning/tampered meters

3.3 La Mesa Plant No. 1 Rehabilitation Projects

At present, the Balara Water Treatment, originally constructed in 1935 and upgraded last in 1981, has been rehabilitated under a grant aid scheme of the Government of Japan. Rehabilitation works were undertaken to restore, once again, the plant's rated production capacity and improve the quality of the treated water.

It is now necessary that the rehabilitation of La Mesa No. 1, which commenced in 1985, be totally rehabilitated during 2010 to 2015. La Mesa No. 2, rehabilitation of which commenced in mid-1995, will again need rehabilitation if preventive maintenance works are not properly carried out, as detailed in the previous section.

3.4 Priority of the Proposed Projects

Priority is ranked as shown in Table 2.10, considering cost and benefits.

Table 2.10 Priority of the Proposed Projects

Priority	Projects
1	• Accomplishment of the ongoing projects (AWSOP, UATP, and RPWSIP)
2	• Controlling Unauthorized Water Use Project
3	• Old Pipe Renovation Project
4	• MWSP III, including ⇒ Distribution System Improvement/Expansion Project ⇒ Service System Expansion Project
5	• La Mesa TP 1 Rehabilitation Project

3.5 Implementation Plan and Cost

3.5.1 Implementation Plan

The five selected projects should be implemented as shown in Figure 3.

3.5.2 Project Cost

The project comprises the following cost items and summarizes as follows:

- Direct construction cost
- Land acquisition cost
- Engineering services expenses
- Physical contingency

Table 2.11 Project Cost

Alt. 1	Alt. 2	Alt.3	Alt.4
59,498	56,272	60,689	57,461

Note : Unit in Million Pesos

4. Evaluation

4.1 Technical Evaluation

4.1.1 Balance in Demand and Supply

Figure 1 presents the balance between the projected water demand and supply. Each phase is characterized as shown below:

(1) Phase I (1996-2000; full accomplishment of the ongoing projects and preparation for new water supply system)

Depressed water supply conditions will last during the first phase. The water supply capacity will be less than the daily average demand even the ongoing projects be accomplished. The private wells will serve as a dependable water source until turning to the second phase .

(2) Phase II (2001-2005; accomplishment of new water supply system)

In the second phase, all the ongoing projects and the first phase of MWSP III will be accomplished. The water supply capacity will reach just over the average demands but less the maximum demand. In conjunction with that, depressed water supply conditions will be gradually improved if the private well be utilized effectively.

(3) Phase III (2006-2010; stable implementation of augmentation/expansion projects)

After the second phase of the MWSP III project, the supply capacity will exceed the daily maximum demand. This remarkable improvement in the service area can urge private well users to minimize groundwater extraction and convert to the MWSS CDS System.

(4) Phase IV (2011-2015; achievement of the master plan goals)

The surplus during the third phase will be further accelerated by the completion of the MWSP III project during the forth phase. The development of a new water source becomes necessary at this point as actual population will continue to increase, as with the living standards. Reviewing the groundwater sources in Rizal, where a population boom is projected, will become urgent.

4.1.2 Environmental Consideration

Environmental impact assessment was conducted on the following:

1. Source Facilities	• Laiban Dam
2. Conveyance Facilities	• Mayamot
3. Treatment Plants	• Pantay
4. Reservoirs and Pump Stations	• La Mesa No. 2 Reservoir, Bagbag Reservoir, Cogeo Reservoir, Antipolo Reservoir

The overall conclusion of the environmental impact assessment that the effects of both the construction and operation will causes no significant or lasting harm to the environment and should not rule against the implementation of the project, provided that practical countermeasures are taken.

4.2 Financial Evaluation

4.2.1 Approach

The FIRR (financial internal rate of return) is calculated for the master plan period (1995 to 2015) for the purpose of financially evaluating the proposed master plan projects as a whole. The FIRR indicates the discount rate which makes the current value of the financial benefits from projects equal to that of their costs and should be considered in relation to the costs to raise money for projects.

4.2.2 Financial Benefits

Financial benefits of the proposed projects will come from the following five elements:

1. The production capacity at water treatment plant level will be increased due to the construction of the Laiban Dam and related facilities. The maximum production will be 5,964 mld in 2015 as compared to the current 2,896 mld.

2. NRW rate will be improved by the replacement of existing defective pipes and the laying of better quality ones. It will improve from 54.9 percent to 30.0 percent during the master plan period.

3. The service coverage will be expanded due to the laying of new pipes. It will be 90 percent of the MSA population in 2015, up from 60 percent now.

4. The need to rehabilitate water treatment facilities will be deferred by regular preventive maintenance.

5. A power plant will be constructed at the Laiban Dam. Generated electricity will be sold to a retail electricity company.

Since the first three elements complement each other, it is not possible or appropriate to determine financial benefits independently. The following table summarizes the total financial benefits based on a few tariff level schemes:

Table 2.12 Financial Benefits of Proposed Projects

Case	Average tariff (pesos/m^3)	Incremental revenue (million pesos)	Revenue from sale of elect. (million pesos)	Total financial benefits (million pesos)
1	6.43	42,041	4,415	46,456
2	8.68	53,655	4,415	58,070
3	13.05	76,220	4,415	80,635
4	17.36	98,453	4,415	102,868

Case 1: The present tariff will not be revised at the start of 1996, but will be increased every year for inflation and a half of the growth percentage of GRDP per capita for NCR.

Case 2: The present tariff will be raised by 35 percent at the start of 1996 and then adjusted in the same manner as Case 1. MWSS customers will be spending 1 percent of their income for water and sewer/sanitation services.

Case 3: The present tariff will be raised by 107 percent at the start of 1996 and then adjusted in the same manner as Case 1. MWSS customers will be spending 1.5 percent of their income for water and sewer/sanitation services.

Case 4: The present tariff will be revised by 170 percent at the start of 1996 and then adjusted in the same manner as Case 1. MWSS customers will be spending 2 percent of their income for water and sewer/sanitation services.

Revenue from sale of electricity is estimated based on the assumption that the new power plant will have a generating capacity of 30 million watts and will be 70 percent operational. A unit price of P2.00 per kilowatt per hour is used.

4.2.3 Financial Costs

Financial costs are calculated based on the engineering study included in the previous section of this report. In determining operational expenses, the following assumptions are made:

- The new water treatment plant will need a staff of 110 employees to operate.
- Annual maintenance expenses will be 1 percent of accumulated investment amounts excluding land costs.
- Power, chemicals and collection expenses for the incremental increase of revenue water are taken into account.

Financial costs are summarized as follows (in million pesos):

Construction and land	57,461
Maintenance of facilities	6,614
Benefits from preventive maintenance	-627
Variable operating expenses	2,553
Total	66,001

4.2.4 FIRR

Based on the financial benefits and costs as above, FIRR is calculated in the following table:

Table 2.13 FIRR of Proposed Projects

Case	Tariff increase	Financial Benefits (million pesos)	Financial Costs (million pesos)	FIRR
1	Current level	46,456	66,001	-5.4%
2	35%	58,070	66,001	-1.9%
3	103%	80,635	66,001	3.0%
4	170%	102,868	66,001	6.7%

The Study Team is of the opinion that 1 percent should be considered as the upper limit for average households to pay for water and sewer services out of their income. This will allow for a 35 percent tariff increase, resulting in FIRR of negative 1.9 percent for the proposed projects. Since FIRR should be compared to financing costs for undertaking projects, such a rate is far from satisfactory. In order for the proposed projects to be financially viable, the tariff would have to be raised by 170 percent or more at the start of the year 1996 as indicated in the above table, meaning average households would have to spend at least 2 percent of their income on water and sewer services.

5. Conclusion and Recommendations

5.1 Water Sources

The Kaliwa River, as a new water source, will be adequate to meet the projected water demand by the year 2015, covering 90 % of 15.8 million population in the service area of MWSS. This will be the second water source in addition to the existing Angat River. Both sources will not only augment supply but also mutually reinforce or complement each other should unexpected emergencies arise.

Furthermore, the utilization of the Angat Reservoir should be maximized by relocating the water right among its users, the NPC, NIA, and MWSS to cope with ever-increasing water demand as a short term measure, if any.

5.2 Water Treatment Facilities

By MWSP III, Pantay Water Treatment Plant should be constructed in three phases, each with 650 mld capacity and a total capacity of 1,950 mld, utilizing the granted water permit to use (23 cms (= 1,987 mld) by NWRB on August 30, 1979 which will assure the water demand in the target year 2015.

To ensure the total water production, the existing water treatment plants -- Balara and La Mesa Plants, which are the major components of the "Angat Novaliches Water Supply System", should be properly maintained by a well planned and organized preventive maintenance system.

5.3 Distribution Facilities

The following should be considered to ensure stable distribution system in the detailed design stage of the expansion project for the distribution network.

- The pump supplied areas will be as small in size as practicable and will be totally isolated from the gravity served areas to minimize maintenance and power costs.
- The main pipe networks will be looped and reinforced to attain a stable water supply, uniform system pressures and flexibility during emergencies.

- The pipe network that will served new areas should be isolated from hose presently served to minimize leakage in the old pipe networks.
- Additional reservoirs will be constructed should have adequate storage capacities for regulation and for emergency purposes.
- New pipes will be installed to replace old pipes and to fill the network in order to achieve stable water supply and uniform system pressure.

5.4 NRW Reduction

To be able to reduce the NRW 30 % level by the target year 2015, the following measures should be undertaken systematically:

- Control of pilferage and unauthorized water use
- Improvement of metering efficiency
- Renovation of the old pipelines
- Improvement of quality control on construction activities of the distribution system
- Adoption of standardized pipe materials, workmanship, and technologies of the distribution facilities
- Creation of division level of a permanent unit for NRW reduction

5.5 Finance

In order to make the master plan projects financially viable, it is necessary either to increase the financial benefits or to lower the financing costs. It appears the latter is more likely since the former will be very difficult. On the other hand, it may be possible to introduce financing at a lower cost from overseas, such as foreign grants-in-aid.

Part III

Sewerage and Sanitation

Part III

Sewerage and Sanitation

Part III Sewerage and Sanitation

1. Introduction

As of 1994, less than 10 % of NCR is covered by some sewerage systems. In other areas, night soil and part of sullage (gray water) are disposed of at on-site sanitation facilities like septic tank. However, inefficient maintenance of septic tank causes the overflow of wastewater into the drainage system. Residents are exposed to the danger of hygienic problems aside from the pollution of public water body. The discharge of untreated industry wastewater and dumped garbage are the main other pollutants.

To mitigate such pollution conditions in Metro Manila, many studies including Sewerage/Sanitation Master Plan have been made and the review of them were also conducted by some relevant sector agencies. Consolidation and upgrading of existing plan in the sector are urgent requirements under current urbanization progress and continuous development in proportion to the economic growth.

This Master Plan covering entire MWSS jurisdiction was prepared referring to current data and information and considering the water sector Master Plan and organizational/managerial plans. Planning fundamentals and conditions/assumptions on the sewerage/sanitation systems were established through discussion with concerned parties.

2. Review of Current Conditions

2.1 Existing Sewerage/Sanitation and Drainage Systems

2.1.1 Sewerage Systems

There are four sewerage systems in operation in the study area, all of which are separate collection systems under MWSS supervision. The sewerage coverage at present is shown in Table 3.1. Only 7 % (46 km^2 / 636 km^2 = 7) of the NCR is covered by sewerage system areas. As to the service population, total of 1,000,000 persons are accessible to the sewerage systems. This figure means only 11 % of the NCR population are connected to the system.

Table 3.1 Existing Sewerage Systems in the Study Area

System	City/Municipality	Area (ha)	Remarks
Central System	Manila City	2,620	No treatment
Ayala System	Makati	600	
Dagat-Dagatan System	Caloocan,Malabon, Navotas,Manila	333	Only STP is turned over to MWSS
Separate System	Quezon	1,000*	
Total		4,553	

Source ;MWSS
* This figure is based on measurement on the map by study team

2.1.2 Sanitation Facilities

According to the NSO statistics which classify the households by its kind of toilet facilities, water-sealed sanitary toilet is prevailing with 91 % of total households in the NCR, 79 % in Rizal province and 84 % in Cavite province in the study area.

There are two types of septic tanks in accordance with the in-house plumbing system. One is the separate treatment type which receive only the night soil, in which case sludge is discharged directly into drainage system. The other is the combined treatment type which treat all the sewage. Absorption field after sedimentation/digestion tank is sometimes not so functional and overflow finds its way into the drainage system. The number of the septic tanks has not been estimated precisely and future investigation is necessary.

Desludging of septic tank is managed by MWSS. But its frequency is very low mainly due to the difficulty in finding disposal site.

2.1.3 Drainage System

Flood control and main drainage in Metro Manila are managed by DPWH. LGUs (Local Government Units) are responsible for the small drainage facilities. MWSS has not undertaken the drainage projects, except for the PROGRESS (Program to Reduce and Eliminate Sewage from Streets) project in cooperation with MMINUTE (Metro Manila Infrastructure, Utilities and Engineering).

2.2 Previous Studies Relevant to Sewerage/Sanitation Project

Existing master plan "Sewerage and Sanitation Master Plan for Metro Manila " in 1979 has had two major components, one is a sewerage expansion program entailing rehabilitation of existing facilities and monitoring system called METROSS. The present status of each stage targets are shown in Table 3.2. The other component is sanitation program comprising two main items: PROGRESS - minor drainage projects for the depressed area and STAMP - septic tank desludging program. The part of PROGRESS and STAMP were implemented as a component of METROSS - I

Table 3.2 Conditions and Status of 1979 Master Plan Sewerage Projects

Stage	Period	Main Content	Project Status
METROSS-I	1981-1985	- Rehabilitation and Expansion of the Central System - New construction of Tondo Pumping Station and its Outfall	This project is said to have been completed in 1990, but rehabilitation of Central System is still needed and is included in the on-going Manila Second Sewerage Project.
METROSS-II	1986-1993	-Construction of Southern Sewerage System covering separate sewer system in part of Manila , Makati , Pasay and Paranaque.	This project is not yet implemented in spite of some feasibility study and detailed design.
METROSS-III	1994-2000	-Construction of Northern Sewerage System covering separate sewer system in part of Manila, Navotas, Caloocan, Malabon and Quezon City.	This project is also not yet commenced .
METROSS-IV &V	2001~	coverage in San Juan basin ,Laguna and Marikina basin with combined sewer system.	This project is also not yet commenced.

In 1990, the scope of work of the ADB project covered some more components like integrated septic tank desludging work and formulated the Project called "Second Manila Sewerage Project. Based on the study results by the project, MWSS formulated "Manila Second Sewerage Project" in 1994 with financial assistance from WB, which does not include a sewerage expansion scheme and mainly focused on septage management plan. Environmental improvement project/studies entailing sewerage/sanitation works have been conducted by some relevant agencies.

2.3 Water Pollution Status and Future Problems in Metro Manila River System

2.3.1 Present Water Pollution Analysis

Present water quality in Metro Manila River is calculated in use of run-off model developed based on the existing sub-drainage basins as shown in Figure 3.1.

Assumed conditions are :

- 90 % of the BOD generated on-site is discharged. Per capita generation rate is 40 g-BOD/day.
- 6g- BOD / person is added as solid waste load to the human-related BOD load .
- Industrial BOD-load discharge data are adopted from the "Industrial Efficiency and Pollution Control Program (IEPC)" conducted by World Bank consultant in 1992.
- Total run-off ratio up to check points is as follows including the river purification rate.

Domestic BOD run-off ratio	0.2
Industrial BOD run-off ratio	0.6

- River flow rate of 0.039 $m^3/sec/km^2$ was adopted.

2.3.2 Future Water Pollution Analysis

Water quality in target year 2015 was estimated using the same model assuming following conditions.

- BOD generated on-site will increase to 50 g-BOD/day, but solid waste load will be reduced to zero.
- Future industrial BOD load will be constant.

Future water quality is shown in Table 3.3.

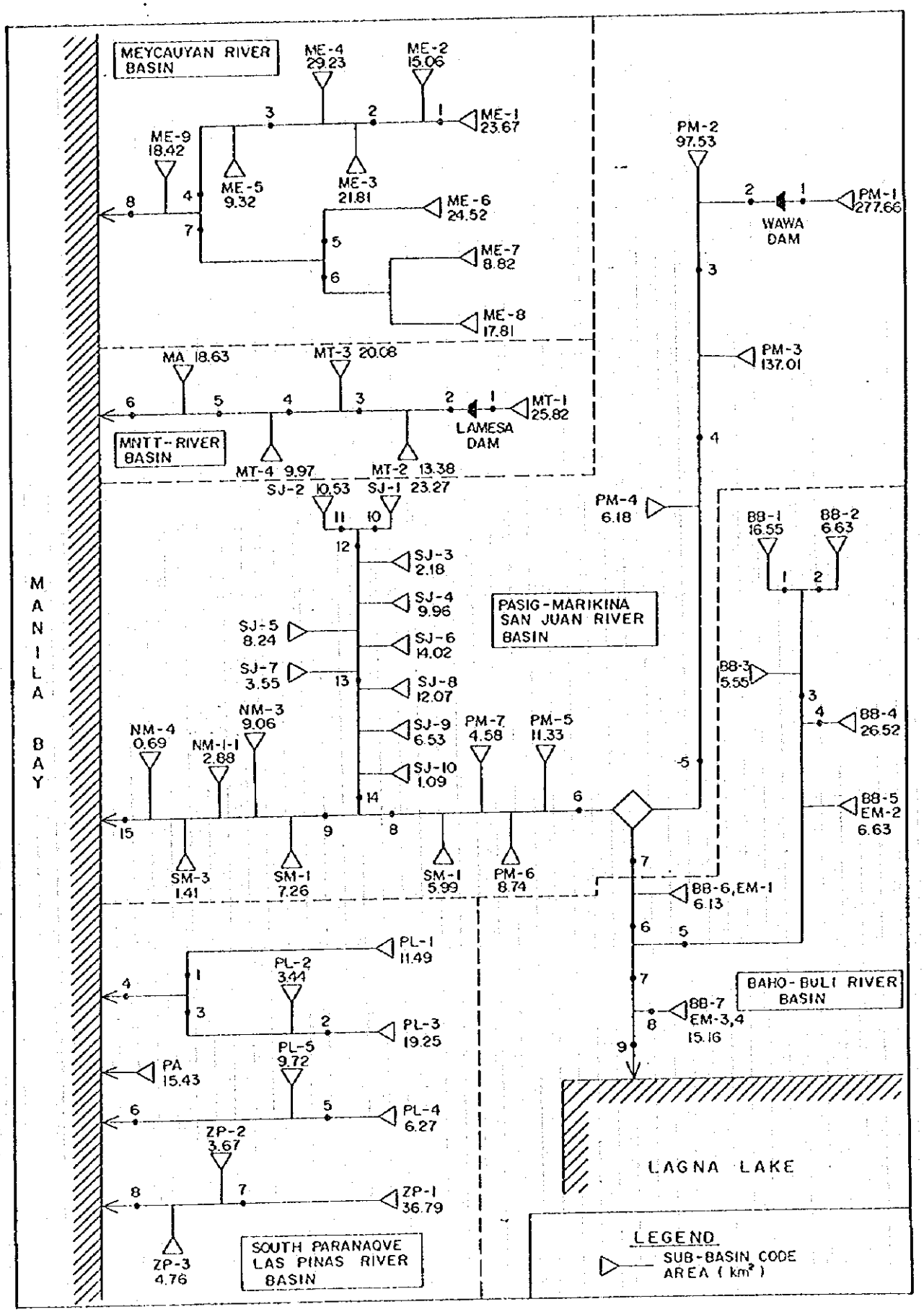


Figure 3.1 Metro Manila River System

Table 3.3 River Water Quality

River System	Checking Point	Water Quality(mg/l)			Existing Data
		1990	2015 without countermeasures	2015 with IEPC project	
	1	2	2	1	
	2	2	2	1	
	3	3	4	3	
	4	5	8	7	Rosario 16
	5	8	12	9	
Pasig-Marikina-	6	8	12	9	Vargas 21
	7				
San Juan	8	24	28	18	Lambingan 22
River	9	30	37	25	Jones 30
	10	60	85	68	Congress 38
	11	60	85	68	
	12	60	85	68	Quezon Blu. 69
	13	61	85	68	Dalro Creek 70
	14	67	90	72	Sanchez 58
	15	29	36	25	
	1	5	9	9	
	2	6	10	10	
Meycauyan	3	8	15	15	
River	4	9	15	15	
	5	36	48	35	
	6	66	85	57	
	7	52	67	47	
	8	29	40	30	
	1	0	0	0	
Malabon-	2	0	0	0	
Tullaba	3	11	19	19	Gulod 20
River	4	19	34	34	North Exp. 60
	5	42	58	46	Mac. HighWay 78
	6	74	93	67	Gov.Pascual 45
	1	95	122	84	
	2	80	109	71	
	3	91	119	81	
Baho-Buli	4	78	104	66	
River	5	85	111	73	
	6	97	125	87	
	7	86	113	75	
	8	76	92	54	
	9	84	109	71	
	1	32	54	49	
	2	27	53	49	Parana. Bridg 14
South	3	27	53	48	
Paranaque-	4	29	53	48	
Las Pinas	5	32	73	67	
River	6	32	71	65	
	7	8	20	20	
	8	11	25	24	

3. Master Plan

3.1 Basic Policy and Conditions for Preparation of Sewerage/Sanitation Master Plan

3.1.1 Type of Plan and Definition

(1) Framework Plan

This plan establishes the development policy for the entire study area, such as a detailed demarcation of both the on-site treatment (without sewer system) area and the off-site areas (with sewer system). The target year for this plan is not fixed but some uncertain future.

(2) Master Plan

This Sewerage Master Plan embraces the long term sewerage development plan of the off-site treatment area up to the year 2015. The Master Plan area will be selected based on social, economic and environmental priorities within the Framework Plan area. The target year of the Sanitation Master Plan is also 2015.

(3) Staged Development Plan

The development plan in sewerage/sanitation planning area is established by stage and by areas.

3.1.2 Basic Policy

(1) Utilization of existing facility/system

The basic policy is to build a financially realistic plan based on a low cost sewerage/sanitation system. Thus, the existing sewerage and sanitation facilities and system, such as the "practical combined sewer system" should be more efficiently utilized.

(2) Cooperation with related sectors

The development cost of a new sewerage and sanitation system can be further reduced by the utilization of private sector systems like the Ayala System or the adoption of a BOT scheme.

(3) Balanced development of water supply and sewerage/sanitation

A well-balanced development between water supply level and sewerage/sanitation facilities has been emphasized recently. In case water supply precede without appropriate sewerage/sanitation facilities, increased sewage may cause degradation of the water environment.

(4) Cooperated development of sewerage and sanitation facility

"Human health" and "environmental protection" are the two major targets of sewerage/sanitation sector. In this Master Plan, improvement of human health is mainly shouldered by the development and appropriate management of sanitation facilities and sewerage systems aiming at water environment protection.

3.1.3 Target Level

Through the discussion between the Study Team and the MWSS counterparts, target levels were limited to a few items described in Table 3.4. The drainage issue is disregarded since MWSS has not been responsible for it.

Table 3.4 Target Level

Category	Item	Existing	Target	Remark
Sanitation	Regular desludging of septic tank	once in more than 15 years in NCR	once in 5 to 10 years in target year 2015 in Level III supply area	projection from 2010 to 2015 is necessary. because MSSP covers up to 2010
Sewerage	Sewer access rate(service coverage)	less than 10% of NCR	nearly 30% of MWSS jurisdiction	depend on cost constraints
	Effluent quality from treatment plant	Ayala WWTP discharge over 65 mg/l BOD con.	Effluent ;less than 30 mg/l to all proposed treatment plant	It is possible that Ayala WWTP clear standard after MSSP

3.1.4 Basic Frame of the Plan

(1) Wastewater Volume and Quality

a) Domestic wastewater

With regard to per capita water consumption rate, projection until the target year of 2015 was conducted from water supply side of this study by the city/municipality. 70% of water consumption was assumed to turn into domestic wastewater volume. BOD load on generation

basis is assumed to be 40 gpcd in 1995, broken down into night soil, 10 gpcd, and sullage, 30 gpcd. For future projections, an annual increase of 0.5 gpcd in sullage will be utilized, while the night soil load is assumed to be constant.

Table 3.5 BOD load of Domestic Wastewater

		1995	2000	2005	2010	2015
BOD (gpcd)	Sullage	30	32.5	35	37.5	40
	Night Soil	10	10	10	10	10
	Total	40	42.5	45	47.5	50

b) Commercial Wastewater

Commercial wastewater is also basically calculated from water supply projections. The discharge ratio is also 70%. Water quality of commercial wastewater is assumed to be the same as that of domestic wastewater.

c) Industrial Wastewater

Basically, industrial wastewater should not be allowed into sewer system and individual or common treatment is to be promoted.

d) Infiltration rate

Groundwater infiltration rate is adopted from former study as follows.

Type	Infiltration rate
Existing System	40 m^3/ha/d
New System	15 m^3/ha/d

e) Peak factor

In this study, peak daily flow factor is assumed to be 1.25 and peak hourly flow factor is 1.75 in accordance with the water supply design criteria.

f) Total Wastewater Volume

The calculation of daily average wastewater volume by each city/municipality for the year 2015 is shown in Table 3.6.

Table 3.6 Wastewater Volume

unit : m3 / d

City/Municipality	Served Pop. (persons)	Areas (km2)	Unit Volume (lpcd)	Wastewater (m3/D) (a)Domestic	(b)Commercial	(c)Industry	Total-case(1) exclu.Industry	Total-case(2) inclu.Industry
Manila	1,633,535	4,181	126	205,825	88,887	13,355	294,712	308,067
Pasay City	465,978	2,251	126	58,713	17,590	2,934	76,303	79,237
Quezon City	2,473,439	16,660	130	321,547	79,119	33,920	400,666	434,586
Calookan City	1,087,241	5,580	133	144,603	12,330	9,078	156,933	166,011
Mandaluyong	269,942	1,120	140	37,792	9,125	8,649	46,917	55,566
Las Pinas	693,735	3,270	133	92,267	4,656	14,746	96,923	111,669
Makati	532,141	1,840	140	74,500	39,025	5,290	113,525	118,815
Malabon	335,826	1,740	133	44,665	4,228	13,955	48,893	62,848
Marikina	490,213	2,280	140	68,630	4,530	5,668	73,160	78,828
Muntinlupa	539,007	3,970	126	67,915	7,126	24,000	75,041	99,041
Navotas	268,680	1,100	126	33,854	2,358	2,489	36,212	38,701
Paranaque	542,127	4,265	140	75,898	8,939	13,439	84,837	98,276
Pasig	622,218	3,160	126	78,399	11,997	47,137	90,396	137,533
Pateros	59,630	185	140	8,348	181	1,231	8,529	9,760
San Juan	146,095	620	140	20,453	5,510	796	25,963	26,759
Tagig	581,971	4,538	140	81,476	4,205	28,844	85,681	114,525
Valenzuela	597,902	4,480	126	75,336	5,278	19,351	80,614	99,965
NCR total	11,339,680	61,240	131	1,490,221	305,084	244,882	1,795,305	2,040,187
Angono	102,470	2,200	112	11,477	251	546	11,728	12,274
Antipolo	518,384	30,610	126	65,316	3,651	12,490	68,967	81,457
Baras	35,231	2,340	112	3,946	91	-	4,037	4,037
Binangonan	265,084	7,270	112	29,689	685	-	30,374	30,374
Cainta	306,106	2,190	126	38,569	3,293	30,287	41,862	72,149
Cardona	61,213	3,120	112	6,856	158	-	7,014	7,014
Jala-jala	30,302	4,930	112	3,394	78	-	3,472	3,472
Morong	58,361	3,760	112	6,536	151	-	6,687	6,687
Pililla	60,858	7,390	112	6,816	158	-	6,974	6,974
Rodorigues	124,681	31,280	126	15,710	939	2,456	16,649	19,105
San Mateo	156,924	6,490	126	19,772	795	2,437	20,567	23,004
Tanay	108,576	24,340	112	12,161	281	-	12,442	12,442
Taytay	221,233	3,364	126	27,875	1,585	14,463	29,460	43,923
Teresa	38,339	1,860	112	4,294	99	-	4,393	4,393
Rizal total	2,087,762	131,144	121	252,412	12,215	62,679	264,627	327,306
Cavite City	106,295	620	112	11,905	3,148	84	15,053	15,137
Bacoor	325,390	5,240	112	36,444	1,455	729	37,899	38,628
Imus	161,438	9,701	112	18,081	816	2,354	18,897	21,251
Kawit	74,764	1,750	112	8,374	258	67	8,632	8,699
Noveleta	31,796	390	112	3,561	81	46	3,642	3,688
Rosario	72,315	920	112	8,099	442	10,053	8,541	18,594
Cavite total	771,998	18,621	112	86,464	6,200	13,333	92,664	105,997
MWSS total	14,199,440	211,005	129	1,829,096	323,499	320,894	2,152,595	2,473,489
ServiceRate	0.9028							

(2) Influent wastewater quality

Wastewater quality is decided as follows, with consideration of the existing plant's data and other country's data.

BOD(mg/l) ; 200, SS(mg/l) ; 200

3.1.5 Framework Plan Area

MWSS's jurisdiction is divided into two areas:

- Area covered by Sewerage (Off-site treatment area)
- Area covered by Sanitation facility (On-site treatment area)

The criteria for coming up with the demarcation are the development plan (land use), population trend, environmental impact factor, construction cost and water supply level.

(1) Population density and construction cost

From simple cost comparison between on-site facilities and off-site system, the off-site system is more economical when population is over 180 persons/ha. Considering the cost of an off-site treatment facility, 200 persons/ha can be used.

(2) Land Use Development

Build-up area, commercial area in the future land use map projected in Part I is the priority areas of off-site treatment. Large scale developments like Fort Bonifacio will be included in the area covered by sewerage.

(3) Environment impact

From estimates of future river water degradation, the San Juan and NMTT river basins, North and South of Manila, Las Pinas and left bank of Marikina areas have high degrees of influence on water pollution. The impact to Laguna Lake also requires early sewerage coverage over lake basin areas.

(4) Water Supply Level

Central Distribution System (Level III) is expected to expand to cover 90 % of population in MWSS jurisdiction by 2015. This area has high priority for off-site treatment.

Sewerage areas decided from the above factors cover almost the same areas as the 1979 master plan area except for Muntinlupa and Manila Bay Reclamation Areas.

3.2 Development Plan on Sewerage

3.2.1 Wastewater Collection System

Two alternative collection systems, separate and combined, were comparatively studied and the combined system is basically recommended as a collection system with an emphasis on the low cost construction to realize sanitation improvement and public water quality improvement considering financial viability. This master plan aims to secure the interceptor system (step 2 in Figure 3.2) and sub-catchment area development is excluded. Intercepting capacity during the rainy season is one x dry weather wastewater flow (DWWF) considering the weather characteristics and dilution effect by the rain.

3.2.2 Wastewater Treatment System

Required conditions for the treatment method is enumerated below:

- To clear effluent target level and make effluent not hazardous
- To be able to cope with fluctuation both in influent volume and quality
- Disposal of generated sludge is easy
- Construction cost is low
- Maintenance cost is low
- Operation and Maintenance is easy

To prevent the degradation of Manila Bay and other river systems, a target level of BOD 30 mg/l which corresponds to Class "B"- NPI is hereby recommended. Another constraint is space. A location that can house a huge plant is difficult to acquire in Metro Manila, so the plant sites should be efficiently utilized.

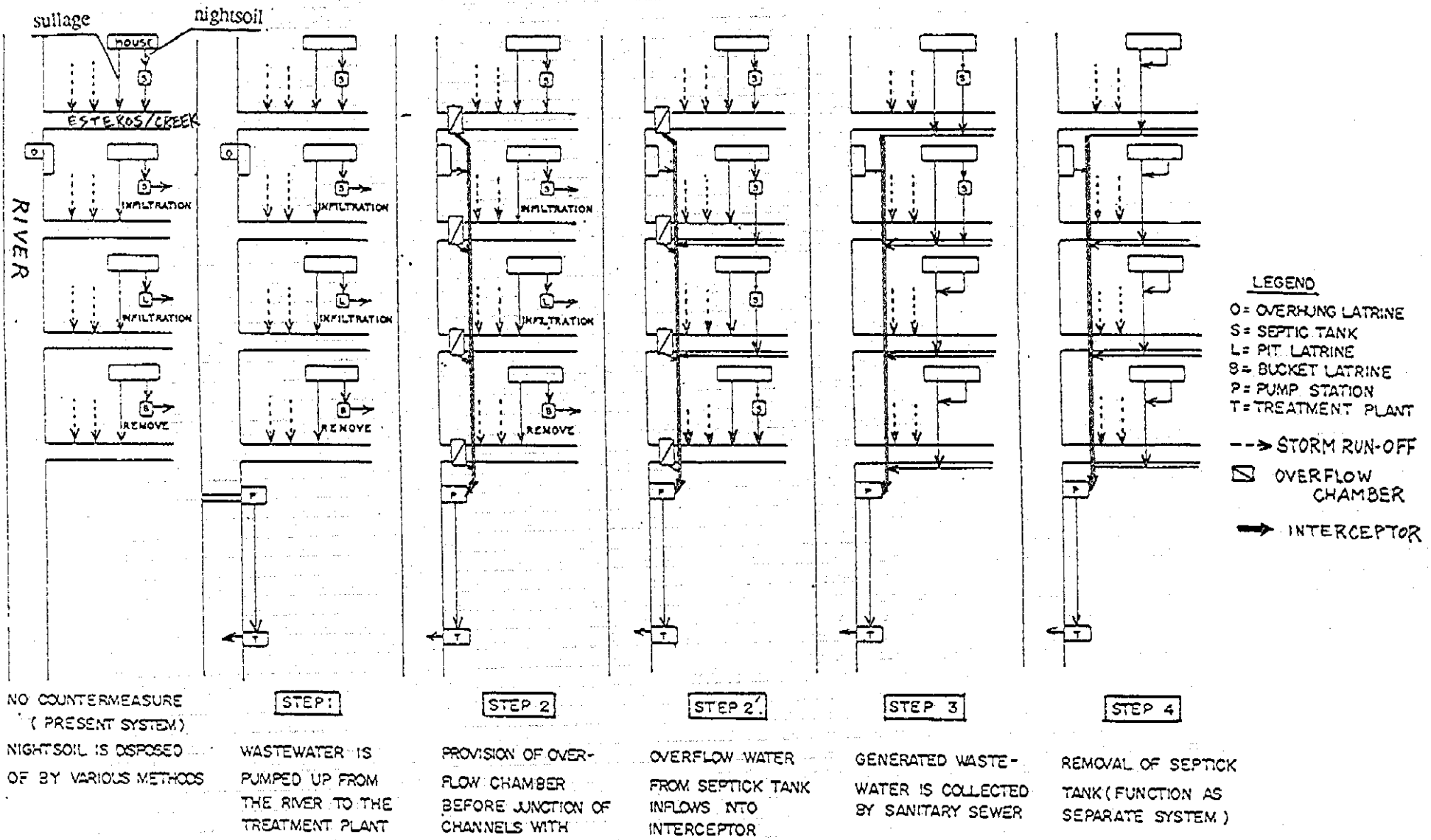


Figure 3.2 Staged Improvement Plan

Applicable treatment method are selected and shown below:

1. Stabilization Pond (SP)
2. Aerated Lagoon (AL)
3. Oxidation Ditch (OD)
4. Conventional Activated Sludge (AS)

As to the sludge treatment, a drying bed after reducing the volume by thickening/digesting is economical as far as site permits. Dry sludge can be disposed together with solid waste or recycled for agricultural use.

3.2.3 Sewerage System

Considering the potential WWTP site, the following plans were compared assorting 27 "sewerage zone" which are mainly in compliance with the sub-drainage basin concept.

- Small Scale Inland Treatment System (SSITS)
- Medium Scale Inland treatment system(MSITS)
- Large Scale Inland treatment System (LSITS)
- Ocean Outfall System (OOS)
- Improved Ocean Outfall System(IOOS)

Each plan is evaluated from qualitative and cost aspect and MSITS was selected due to its flexibility and initial investment saving.

Through the careful investigation of the recommended MSITS catchment area, optimized Sewerage Framework Plan was finalized and shown in Table 3.8 and Figure 3.3.

Table 3.7 Comparison Table of Sewerage System

	SSITS	MSITS	LSITS	OOS	IOOS
Outline	Framework Plan area is divided into 16 small scale system,each has treatment plant	Framework Plan area is divided into 8 medium scale system,each has treatment plant	Framework Plan area is divided into 4 large scale system,each has treatment plant	Collection system is same as LSITS and wastewater is discharged without treatment	Primary treatment is added to OOS before discharging
Environmental Impact	no bad influence to the water bodies	no bad influence to the water bodies	no bad influence to the water bodies	raw sewage discharged into Manila Bay have bad influence on not only ecology but also human health through pollution, food chain	influence is lower than OOS but still highly dangerous to ecology
Flexibility of Implementation	Priority area can be initially implemented	flexible implementation is rather possible compared to LSITS	local area implementation is affected by long trunk main and remote treatment plant site	same as LSITS	same as LSITS
Operational Effectiveness	Too many treatment plants make operation complicated	appropriate areawise operation and maintenance system is possible	Central control and operation is effective	same as LSITS. Operation includes check of bay water condition	Same as OOS
Investment Impact	One catchment area is small and initial investment works well	moderate invest-benefit effect can be accomplished	Due to its large catchment area, initial investment-effect is low	same as LSITS	same as LSITS
Cost	4	2	1	3	5
Total Evaluation		○			

Table 3.8 Outline of Sewerage System

	System Name	Zone	Area (ha)	Population (persons)	Wastewater (dailymax) (m^3/D)
1	Marikina	San Mateo, Part of Baho-Buli	5,814	1,104,226	274,057
2	East Mangahan	Baho-Buli	3,945	739,484	171,429
3	West Mangahan	Ortigas,West Mangahan, Taguig	5,111	1,062,550	254,277
4	Muntinlupa	Muntinlupa	3,786	665,929	162,347
5	Paranaque	Paranaque, Las Pinas	6,557	1,323,275	317,313
6	South Manila	Central-south Pandacan, Gadalupe, South Manila NAIA	4,666	1,557,338	396,447
7	Ayala	Ayala	900	273,985	83,024
8	Bonifacio	Bonifacio	1,080	192,918	48,273
9	Central Manila	Central North Sampaloc, Balut, DagatDagatan Caloocan	3,692	1,723,686	386,890
10	North Manila (MNTF river basin)	Tuliahan, Malabon, Navotas,	5,851	1,480,709	337,492
	North Manila (San Juan River basin)	North Quezon, Cubao, San Juan, Mandaluyong	9,290	2,023,217	515,183
	sub-total		15,141	3,503,926	852,675
	Total		50,692	12,147,320	2,946,732

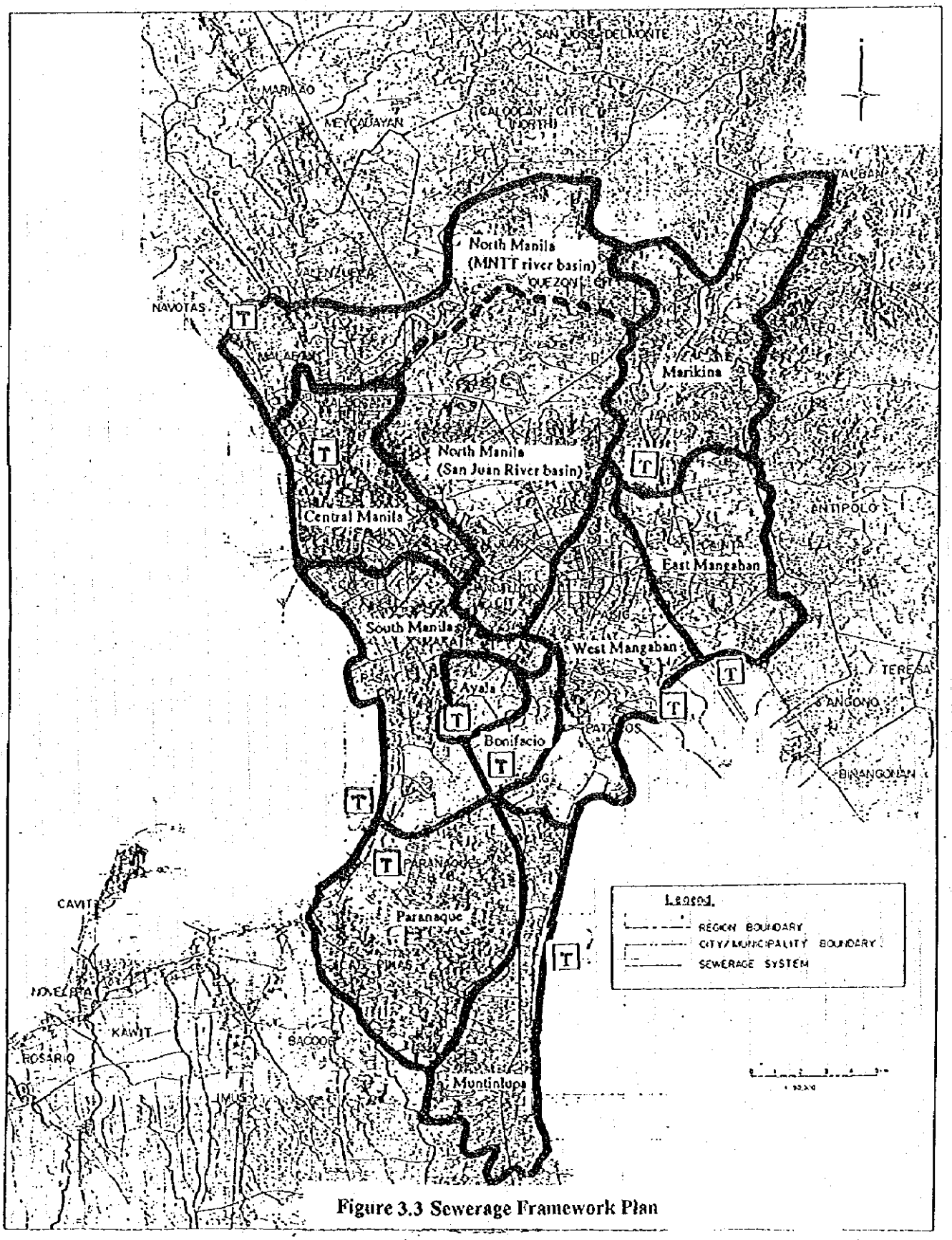


Figure 3.3 Sewerage Framework Plan

3.2.4 Sewerage Master Plan

The 10 systems were evaluated and prioritized from the following points: development of the area, cost-benefit (cost per beneficiary), cost recovery (willingness/affordability to pay), and environmental impact. The areas where sewerage development is highly recommended and financially feasible up to 2015 have been designated in the Master Plan area including existing service areas. The selected development areas are South Manila System (former METROSS-II area), Central Manila System (part of former METROSS-III area), south part of San Juan River basin in North Manila System and Ortigas and its vicinity in West Mangahan System. The Master Plan area is shown in Figure 3.4 and Table 3.9.

Table 3.9 Outline of Master Plan Area

System	zone	Area (ha)	Population (persons)	WWTP		Remark
				System	Capacity (daily ave m3/d)	
West Mangahan	Ortigas	1,594	347,000	A.L	72,000	
South Manila	Gadalupe	588	162,000	A.L	207,000	
	South Manila	1,779	561,000			
	NAIA	430	228,000			
	Total	2,797	951,000			
Ayala	Ayala	600	183,000	A.S	40,000	Existing
Central Manila	Central+Pandacan	2,620	1,383,000	(1) O.D (2)Ocean Outfall for the existing system	OD 162,000 for Sampaloc Caloocan Balut Dagat-Dagatan	2,620 (Manila) +333 (D.D) are already sewered
	Sampaloc	511	173,000			
	Caloocan	628	353,000			
	Balut	138	66,000			
	Dagat-Dagatan	676	355,000			
	Total	4,573	2,330,000			
North Manila	Cubao	3,120	649,000	A.L	282,000	800ha of Cubao and 200ha of North Quezon are already sewered
	San Juan	2,244	519,000			
	Mandaluyong	460	123,000			
	NorthQuezon	200	42,000			
	Total	6,024	1,333,000			
Ground Total		15,588	5,144,000			

A.L= Aerated Lagoon, OD= Oxidation Ditch, A.S= Activated Sludge

In response to the former Studies, following review was proposed

- Full rehabilitation of the Ayala Treatment plant is necessary.
- Upgrading of the Luneta Lift Station for the deferred Fort Santiago Pumping Station to compensate for the clogged Pasig River siphon.

3.2.5 Staged Development Target

The First Stage is the implementation of all on-going MSSP sewerage projects. These are the rehabilitation of the existing system, including the implementation of Phase 2 of the Ayala Treatment Plant and alternatives for the Fort Santiago Pumping Station. The Second stage is the expansion of sewerage system (interceptor system) to the high priority areas.

3.2.6 Operation and Maintenance of Sewerage System

Recommendation on routine O&M work were made on sewer pipe, pumping station and wastewater treatment plant.

3.3 Development Plan on Sanitation

3.3.1 On-site Treatment Facilities

Criteria for the septic tank was considered regarding ground water level and permeability of the absorption field. Ground water level should be 3~5m lower than ground surface level considering the leaching chamber depth. In case permeability prohibits soil absorption, some type of purification device (up-grading) or up-grading to communal treatment system is recommended.

Communal treatment facility is as follows.

- Communal-scale septic tank
- Japanese-type JOHKASOU/Bio-Module
- Anaerobic sludge blanket reactor
- Korean-type of treatment facility

3.3.2 Septage Management Plan

Regular desludging is indispensable for the proper management of septic tanks. In 1994, the septage management plan consisting of regular desludging and transfer by an appropriate vehicle, temporary ocean dumping, and construction of septage treatment plant was recommended by a World Bank consultant.

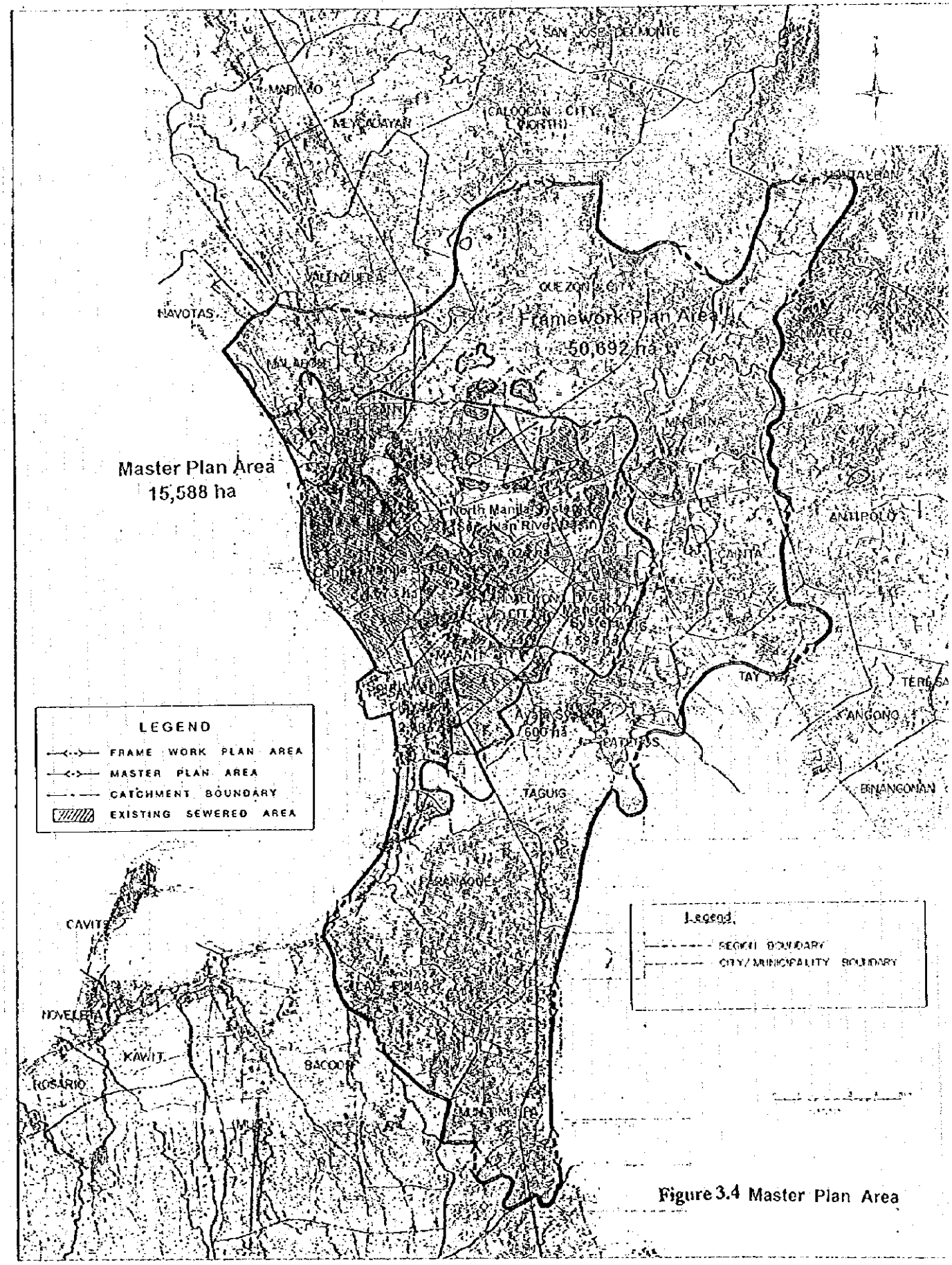


Figure 3.4 Master Plan Area

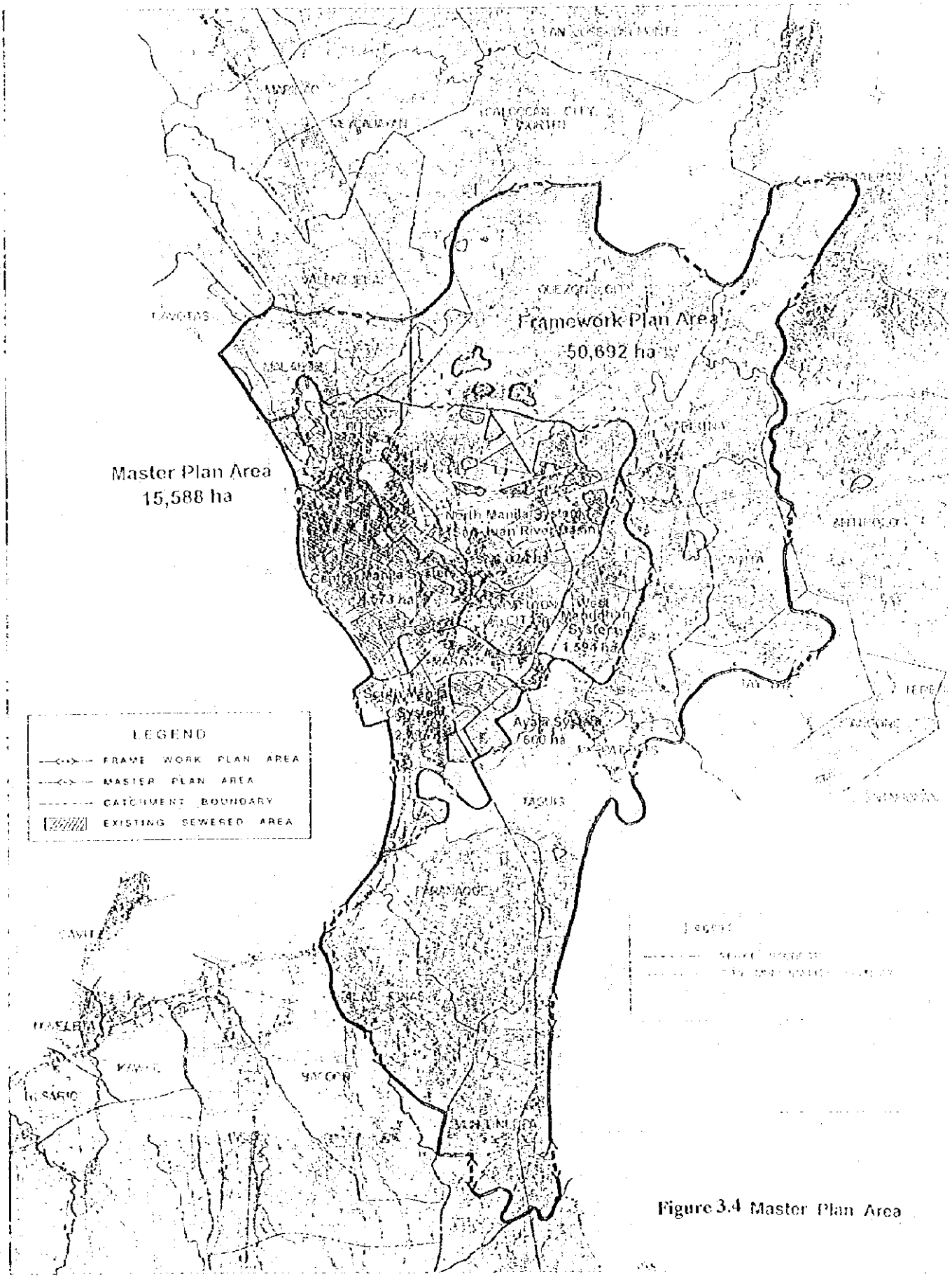


Figure 3.4 Master Plan Area

Since its target area was limited within the NCR, service area shall be expanded to the area where MWSS is expected to serve with Level III by 2015 to balance the water supply and sanitation levels.

Outside of the NCR, septage collection and treatment for the area where MWSS is going to supply water is necessary. The alternatives are 1) expansion of STP proposed in MSSP for adjacent provinces and 2) construction of another STP.

Recommendations are;

1. Cavite Province will be covered by proposed Paranaque STP since total septic tank number in the Province is not so large to construct new STP.
2. Rodriguz and San Mateo will be covered by MSSP-proposed Quezon STP.
3. New STP will be constructed for the Rizal Province except Rodriguez and San Mateo because water supply will cover wide areas. Treatment method is the same as other proposed plants in the NCR, which is coagulation and activated sludge method. It covers wide areas and transfer station is to be considered.

Total septage management plan is shown Figure 3.5.

3.3.3 Staged Development Plan

The development of the septage management plan in stages up to the year 2010 was also included in MSSP. Construction of the proposed STP will end in 2008 and expansion and new construction of the STP outside of the NCR will be scheduled for the 2009~2015 period.

4. Proposed Projects

4.1 Type of Projects and Prioritization

The Project types are 1) septage management project, 2) rehabilitation/upgrading project of existing sewerage facilities and 3) augmentation (expansion) of the sewerage system to the unsewered areas. Sewerage/sanitation projects are enumerated in Table 3.10 including the projects proposed in MSSP.

Table 3.10 Project Summery

1. Sewerage Project			
No.	Project Name	Project Type	Remarks
1-A	Ayala Sewage Treatment Plant Rehabilitation (Phase 1)	Rehabilitation of existing sewerage facilities	MSSP - Phase 1 project
1-B	Ayala Sewerage System Rehabilitation	Rehabilitation of existing sewerage facilities	MSSP - Phase 1 project
1-C	Manila Central Sewerage System Rehabilitation	Rehabilitation of existing sewerage facilities	MSSP - Phase 1 project
1-D	South Manila System Expansion	Expansion of Sewerage System	
1-E	Central Manila System Expansion	Expansion of Sewerage System	
1-F	North Manila System Expansion	Expansion of Sewerage System	
1-G	West Mangahan(Ortigas) System Expansion	Expansion of Sewerage System	
1-H	Ayala STP Rehabilitation (Phase 2)	Rehabilitation of existing sewerage facilities	MSSP - Phase 2 project
2. Sanitation Project			
2-A	Septage Collection and Hauling	Septage Management Project	MSSP - Phase 1 project
2-B	Barging of Septage for Sea Dumping	Septage Management Project	MSSP - Phase 1 project
2-C	Barge Loading Station Construction (Phase 1)	Septage Management Project	MSSP - Phase 1 project
2-C'	Barge Loading Station Construction (Phase 2)	Septage Management Project	MSSP - Phase 2 project
2-D	Dagat-Dagatan Septage Treatment Plant Construction	Septage Management Project	MSSP - Phase 1 project
2-E	Supply of Laboratory Equipment, Vacuum Car/Accessories and Other Vehicles	Septage Management Project	MSSP - Phase 1 project
2-F	Dagat-Dagatan STP 2nd Stage Construction	Septage Management Project	MSSP - Phase 2 project
2-G	Dagat-Dagatan STP 3rd Stage Construction	Septage Management Project	MSSP - Phase 2 project
2-H	Quezon City STP 1st Stage Construction	Septage Management Project	MSSP - Phase 2 project
2-I	Quezon City STP 2nd Stage Construction	Septage Management Project	MSSP - Phase 2 project
2-J	Paranaque STP 1st Stage Construction	Septage Management Project	MSSP - Phase 2 project
2-K	Taguig STP Construction	Septage Management Project	MSSP - Phase 2 project
2-L	Quezon City STP 3rd Stage Construction	Septage Management Project	Septage Treatment Plant expansion for Rizal Province
2-M	Paranaque STP 2nd Stage Construction	Septage Management Project	Septage Treatment Plant expansion for Cavite Rizal Province
2-N	Binangonan STP Construction	Septage Management Project	Septage Treatment Plant expansion for Rizal Province

Another promising studies/researches related to the technical problems are as follows.

- Manila Bay Monitoring plan
- Manila Bay environmental survey
- Dagat-Dagatan Collection System Rehabilitation Study

At present, septage management projects have a higher priority than the sewerage projects. The rehabilitation of existing sewerage facilities have a higher priority the the expansion of the system judging from the expensive cost of new construction. In short, the priority can be outlined as shown below:

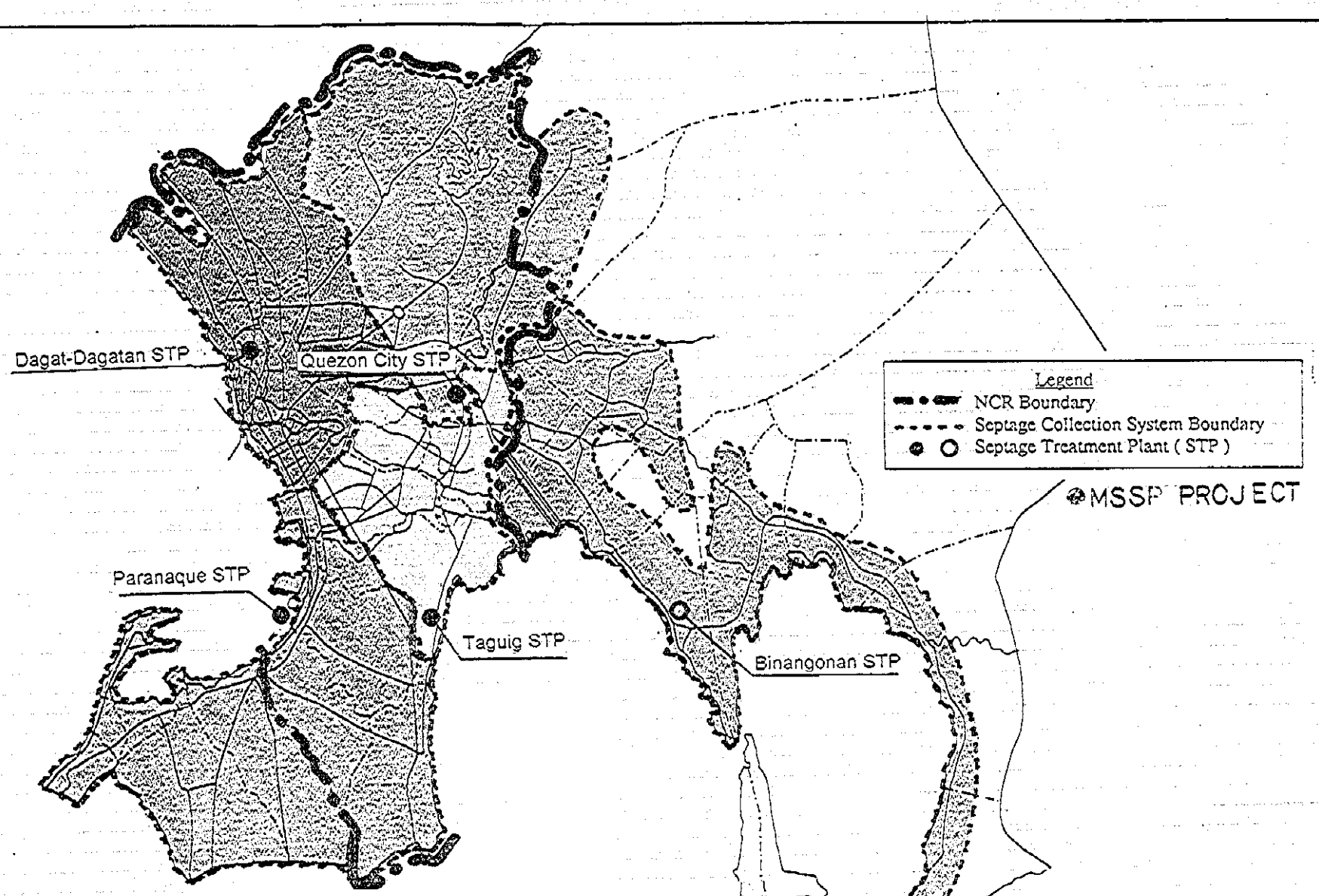


Figure 3.5 Septage Collection Plan

Priority	Project Type
1st	septage management project,
2nd	rehabilitation/upgrading project of existing sewerage facilities and
3rd	augmentation (expansion) of sewerage system to the unsewered areas.

In each type of project, the areawise prioritization is described as follows:

a) septage management project

Prioritization in NCR was set up in MSSP and service coverage of Cavite City comes next prior to the Rizal Province due to its dense population.

b) Rehabilitation

Implementation plan shown in MSSP should be observed.

c) Expansion of Sewerage System

The former METROSS I&II area has higher priority in compliance with the National Master Plan in 1988 except the MNTT river basin. San Juan River basin comes next due to its high BOD discharging load. Ortigas along Pasig River has lower priority than the other areas.

4.2 Project Cost

Project Cost in 1995 cost base is summarized below including the MSSP project.

Table 3.11 Project Cost (in Million Pesos)

1. Sewerage Project					
No.	Project Name	Total Cost	Foreign	Local	Remark
1-A	Ayala Sewage Treatment Plant Rehabilitation (Phase 1)	97.45	55.94	41.51	MSSP
1-B	Ayala Sewerage System Rehabilitation	144.53	-	144.53	MSSP
1-C	Manila Central Sewerage System Rehabilitation	205.01	69.50	135.51	MSSP
1-D	South Manila System	1,360.27	311.67	1,048.60	Expansion
1-E	Central Manila System	1,308.82	382.29	926.53	Expansion
1-F	North Manila System	2,759.28	473.15	2,286.13	Expansion
1-G	West Mangahan(Ortigas) System	875.11	187.85	687.26	Expansion
1-H	Ayala STP Rehabilitation (Phase 2)	670.89	268.36	402.53	
Sub-total		7,421.36	1,748.76	5,672.60	
2. Sanitation Project					
2-A	Septage Collection and Hauling	260.02	-	260.02	MSSP
2-B	Barging of Septage for Sea Dumping	160.76	-	160.76	MSSP
2-C	Barge Loading Station Construction (Phase 1)	22.19	-	22.19	MSSP
2-C'	Barge Loading Station Construction (Phase 2)	11.10	-	11.10	
2-D	Dagat-Dagatan Septage Treatment Plant Construction	323.79	130.81	192.98	MSSP
2-E	Supply of Laboratory Equipment, Vacuum Car/Accessories and Other Vehicles	177.41	141.93	35.48	MSSP
2-F	Dagat-Dagatan STP 2nd Stage	450.87	215.97	234.90	
2-G	Dagat-Dagatan STP 3rd Stage	629.94	254.49	375.45	
2-H	Quezon City STP 1st Stage	1,539.60	622.00	917.60	
2-I	Quezon City STP 2nd Stage	1,161.00	469.04	691.96	
2-J	Paranaque STP 1st Stage	1,539.60	622.00	917.60	
2-K	Taguig STP	1,539.60	622.00	917.60	
2-L	Quezon City STP 3rd Stage	290.25	117.26	172.99	
2-M	Paranaque STP 2nd Stage	580.50	234.52	345.98	
2-N	Binangonan STP	1,539.60	622.00	917.60	
Sub- total		10,226.23	4,052.02	6,174.21	
Grand total		17,647.59	5,800.78	11,846.81	

4.3 Implementation Schedule

As to the septage treatment plant, MSSP proposed construction schedule up to 2008 and additional construction plan after MSSP is set-up from 2009 to 2015. The sewerage system expansion schedule is set-up in accordance with the areawise priority. See figure 3.6 and 3.7.

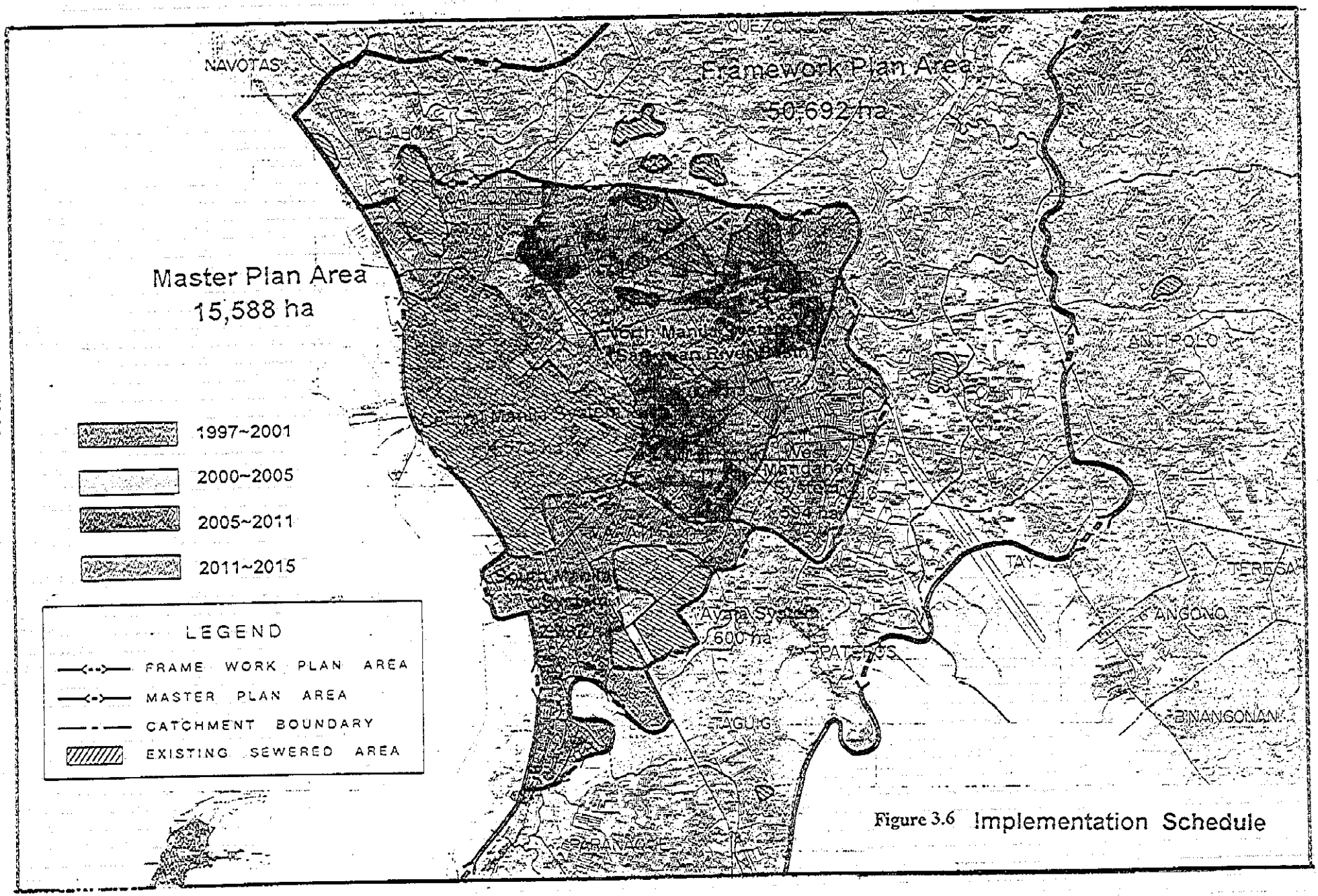


Figure 3.6 Implementation Schedule

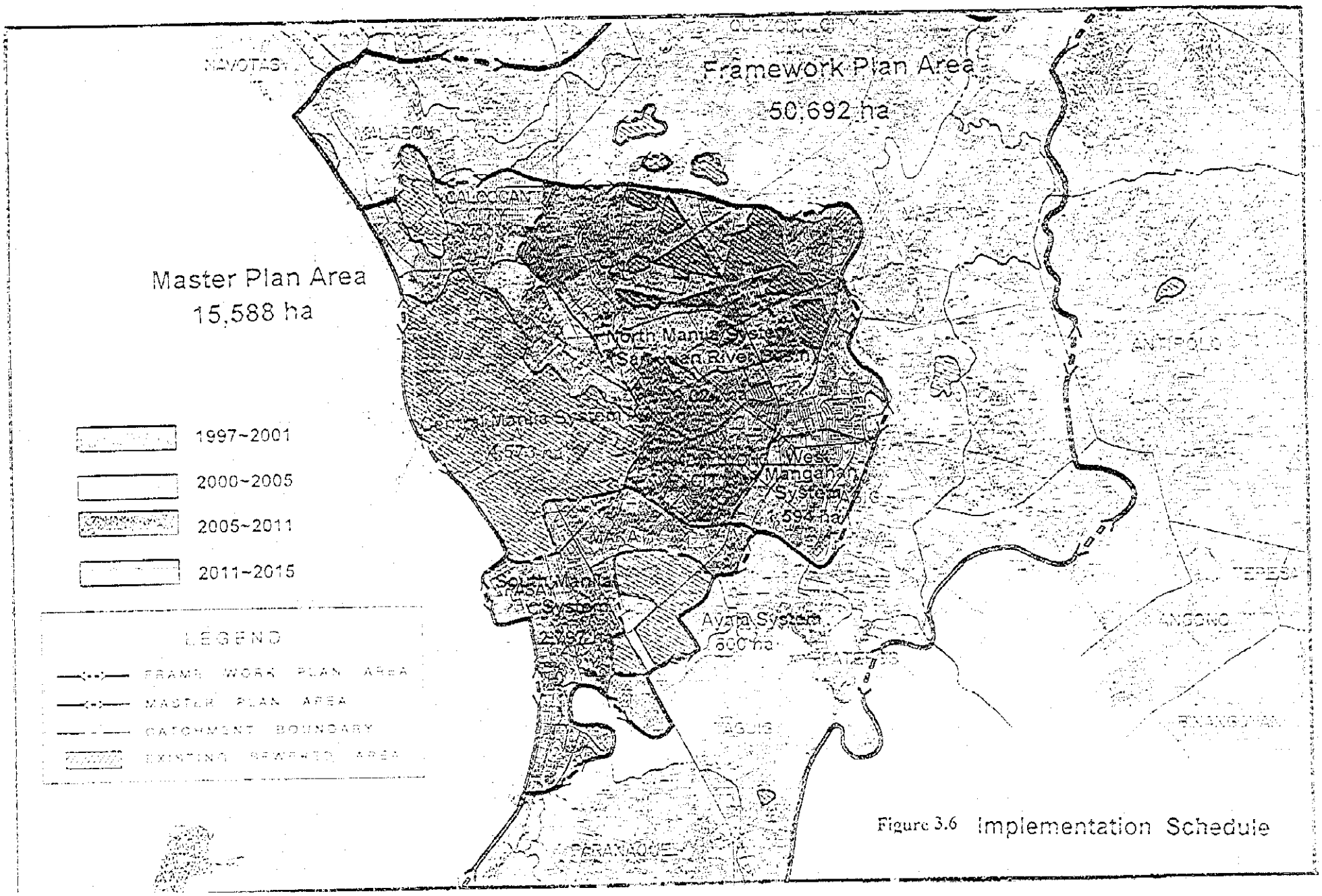


Figure 3.6 Implementation Schedule

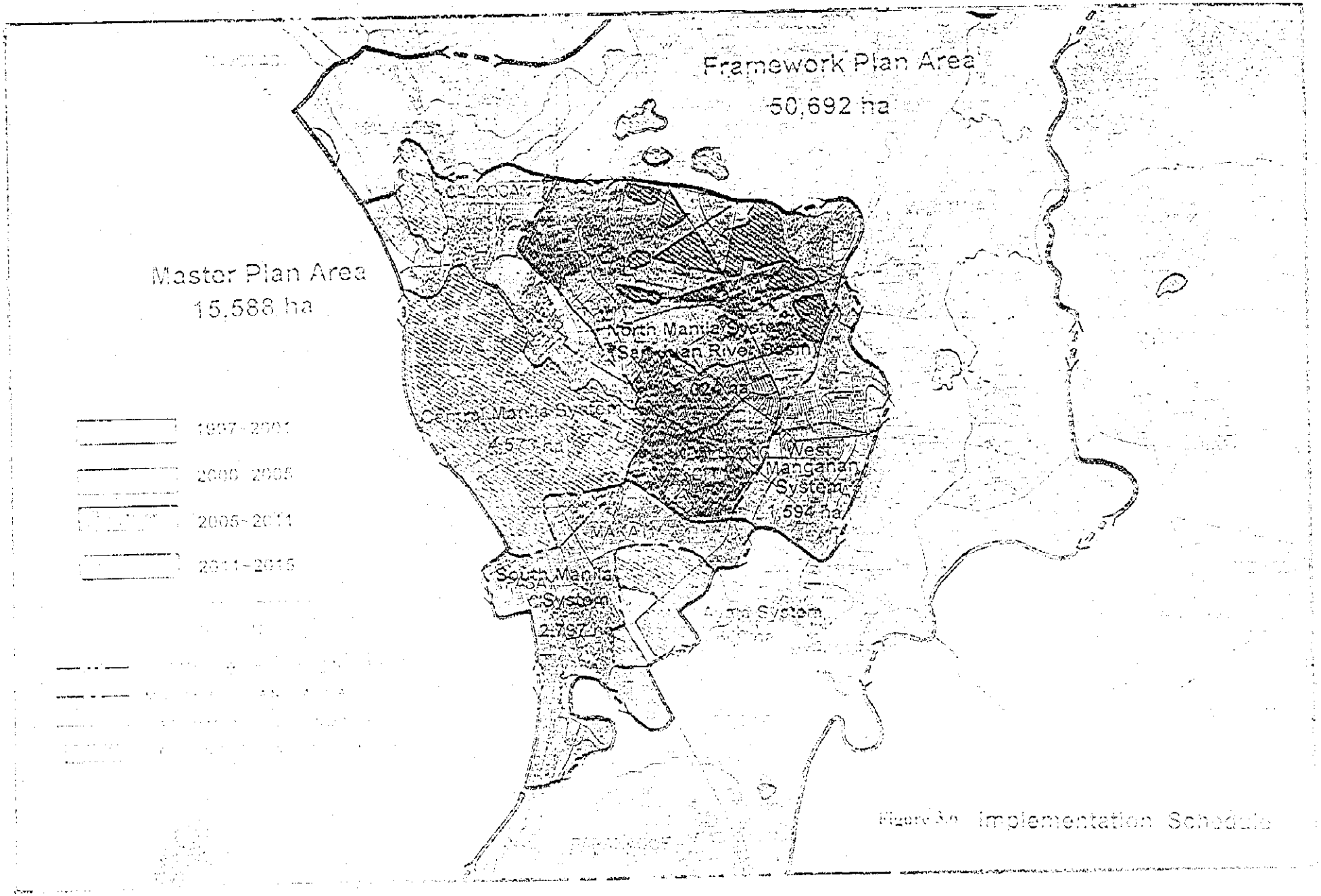
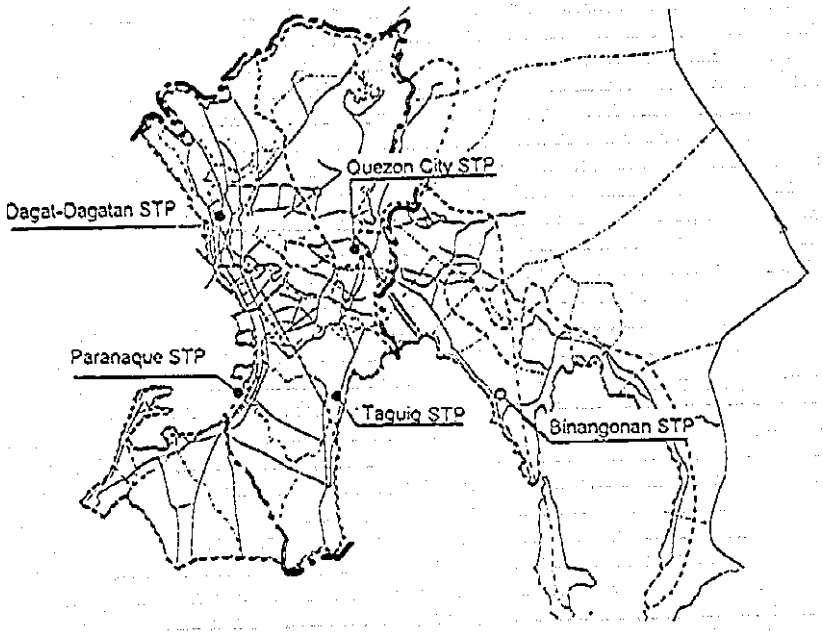


Figure 3.1 Implementation Schedule



Septage Treatment Plant Construction Schedule				
STP	Stage	Period	Capacity (m^3/d)	Total Capacity (m^3/d)
Dagat-Dagatan	1st	1996~1998	200	200
	2nd	1999~2000	300	500
	3rd	2006~2007	400	900
Quezon City	1st	1999~2001	600	600
	2nd	2004~2005	400	1,000
	3rd	2014	100	1,100
Taguig		2000~2002	600	600
Paranaque	1st	2005~2007	600	600
	2nd	2009~2010	200	800
Binangonan		2011~2013	600	600

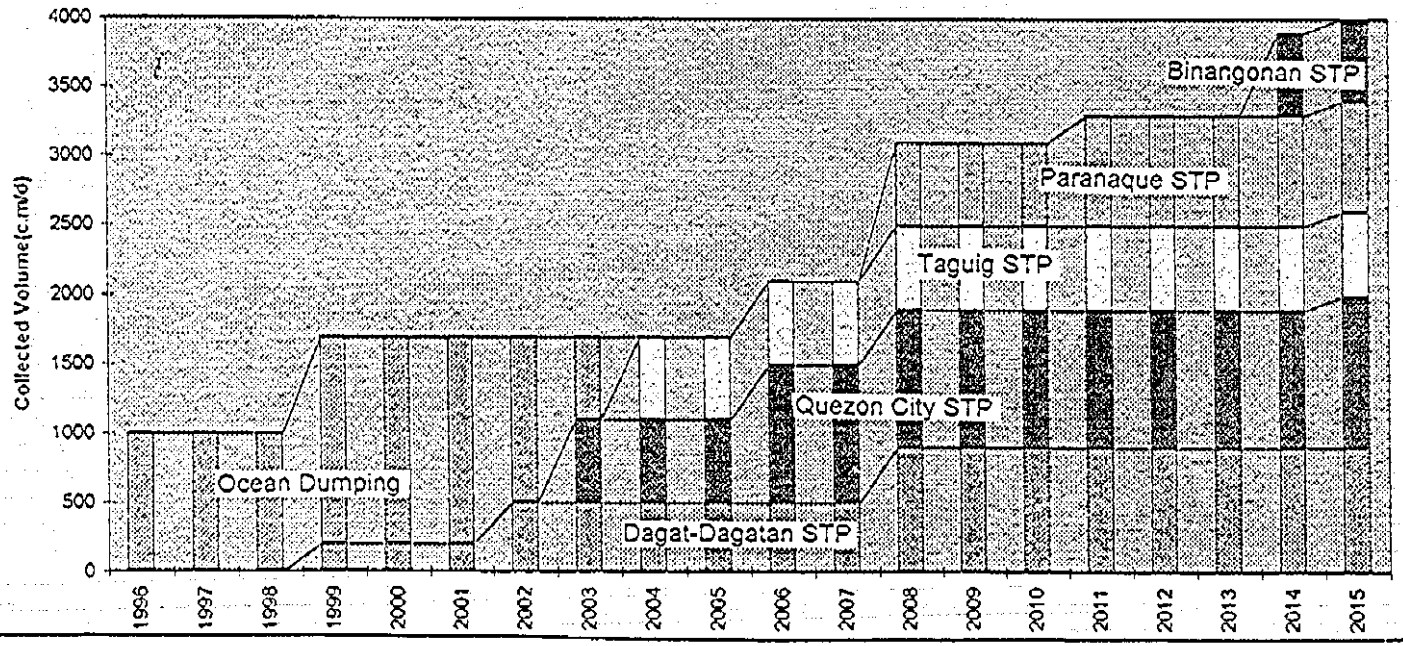


Figure 3.7

SEPTAGE TRETMENT PLANT
STAGED PLAN

5. Evaluation

5.1 Technical Evaluation

5.1.1 Environmental Improvement

90 % of MSS jurisdiction population, which means approximately 14.2 million people will be served regular desludging of septage and it will remarkably reduce danger of human contact with sewage by improving septic tank function. Another significant benefit that may be derived from the sewerage/sanitation project is public water quality improvement. , The water quality in 2015 is estimated Table 3.12 and Figure 3.8.

Table 3.12 Water Quality in Pasig River in terms of BOD (mg/l)

River System / Location / Case	Pasig River				San Juan River
	Check Point No. 6	Check Point No. 8	Check Point No. 9	Check Point No. 15	Check Point No. 14
1990 (calculation basis)	8	24	30	29	67
2015 without countermeasures	12	28	37	36	90
2015 with only IEPC	9	18	25	25	72
2015 IEPC&Sewerage/ Sanitation	7	12	15	14	29

5.1.2 Environmental Protection

Potential environment-related nuisance are screened and summarized in Table 3.13.

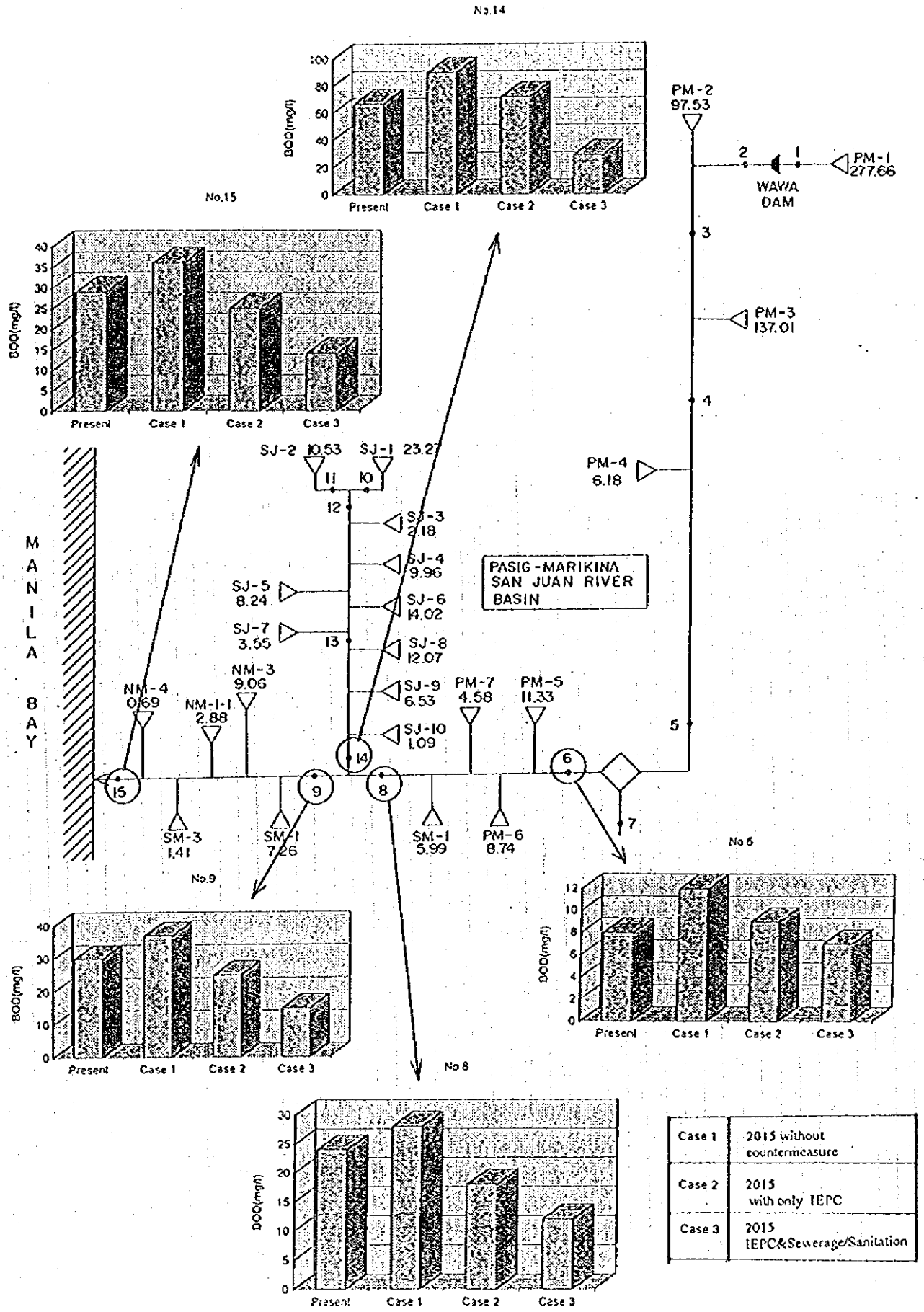


Figure 3.8 Water Quality Projection

Table 3.13 Environmental Problems

Problems by stage	Impact	Countermeasures
Related to the Siting of Facilities		
1. Interference with other utilities/Street, traffic/blocking of access to the building	1. Nuisance/disturbance to public	1. Alignment of sewer route to mitigate interference with other utilities
2. Nuisance hazard to neighboring areas	2. Nuisance/hazards to workers and neighbors	2. Careful planning/ design /O&M and enough buffer zone
3. Inadequate resettlement provision	3. Social inequities	3. Adequate planning and budgeting
4. Impairment of historical /cultural /movements area	4. Loss or impairment of these values	4. Careful planning and offsetting measures
During Design Stage		
1. Overflow/bypassing hazard	1. Pollution and Flooding	1. Proper design/O&M and operation monitoring
2. Inadequate management of industrial wastewater	2. Damage to sewers/treatment plants	2. Careful planning/ design and operation monitoring
3. Hazard of sulfide corrosion	3. ditto	3. ditto
4. Odors and noise from treatment process or sludge disposal operation	4. Nuisance to public	4. Site treatment work only near compatible land use. Select appropriate technology Include odor control and low noise equipment
During Construction Stage		
1. Silt runoff from construction operation	1. Soil erosion, damage to water quality/land value	1. Proper resurfacing and construction monitoring
2. Dust/odors/fume	2. Hazard to the workers and nearby residents	2. Appropriate control
3. Prolonged period of sewer construction	3. Traffic congestion/ blocking of access to building	3. Careful construction scheduling
4. Noise and vibrations	4. Hazard to the workers and nearby residents	4. Appropriate control
During Operation Stage		
1. Hazard to health/safety of workers a) Toxic gas in sewers and hazardous materials in sewage b) Communicable disease hazards c) sewer trench cave-in monitoring	1. a) serious health/safety hazards b) ditto c) ditto	1. Careful O&M and operation, monitoring a) Careful O&M programs of emergency b) Careful O&M program and monitoring c) ditto
2. Inadequate operation stage monitoring	2. O&M likely to depreciate	2. Check in overall system functioning
3. Overflow from sewers	3. Nuisance/public health hazard	3. Routinely inspect sewers for illegal connection and obstruction Clean sewer as required Provide monitoring system with alarms for pump station failure Educate public to prevent disposal of solid waste into sewers

5.2 Financial Evaluation

5.2.1 Approach

FIRR (financial internal rate of return) is calculated for the master plan period (1995 to 2015) for the purpose of financially evaluating the proposed master plan projects as a whole. FIRR indicates the discount rate which makes the current value of the financial benefits from projects equal to that of their costs and should be considered in relation to the costs to raise money for projects.

5.2.2 Financial Benefits

Financial benefits of the proposed sewer/sanitation projects will come from the following three elements:

1. The reconfiguration of the tariff will give better grounds to charge customers for regular desludging activities.
2. The rehabilitation and construction of sewer treatment plants and related facilities will significantly increase MWSS's capacity to desludge septic tanks.
3. Since the new sewer/sanitation tariff scheme will completely depend on that of water, the increase in water revenue due to the master plan waterworks projects will also result in the increase in sewer/sanitation revenue.

The following table summarizes the total financial benefits based on a few tariff level schemes:

Table 3.14 Financial Benefits of Proposed Projects

Case	Average tariff (pesos/m^3)	Incremental revenue (million pesos)
1	6.43	20,634
2	8.68	26,335
3	13.05	37,410
4	17.36	48,323

Cases 1 to 4 are the same as the water operation.

5.2.3 Financial Costs

Financial costs are estimated by the engineering study and summarized as follows (in million pesos):

Construction and land:	
Sewer	7,421
Sanitation	10,226
Total	17,647
Operating expenses:	
Sewer	1,856
Sanitation	5,849
Total	7,705
Total	25,352

5.2.4 FIRR

Based on the financial benefits and costs as above, FIRR is calculated in the following table:

Table 3.15 FIRR of Proposed Projects

Case	Tariff increase	Financial Benefits (million pesos)	Financial Costs (million pesos)	FIRR
1	Current level	20,634	25,352	-10.8%
2	35%	26,335	25,352	2.0%
3	103%	37,410	25,352	29.0%
4	170%	48,323	25,352	(*)

(*)Note: The cash flow will be positive for most years in this case. Therefore, FIRR cannot be calculated.

The above FIRR may look better than that for the water operation. It should not be forgotten, however, that unlike the water operation the sewer/sanitation master plan projects will not bring a satisfactory situation to the sewer/sanitation sector in the year 2015. It should rather be considered as just a start, and therefore, it is easily assumed that more projects will be mandatory after that year, which will make the application of the "full cost recovery" concept to the sewer/sanitation operation almost impossible.

6. Conclusion and Recommendation

(1) Human health should be protected mainly through the appropriate management of sanitation facilities. The sewerage systems aim at water quality improvement through the utilization of interceptor sewerage systems.

(2) Of the 50,692 hectare Framework Plan Area, new coverage of 11,035 hectares by interceptor sewer systems using existing waterway is the target level of the Sewerage Master Plan. The total service area will increase to 15,588 hectares.

(3) Rehabilitation of the existing sewerage system up to the expected level is another target in the sewerage sector

(4) Although new development is limited to the construction of interceptor and treatment plant considering the budgetary constraints, sub-catchment area development should be also promoted with the cooperation of the central government, LGU and other agencies including private sectors keeping pace with the economic development

(5) Acquisition of WWTP land is to be negotiated urgently

(6) Balancing with water supply service at level III, improvement of septic tank efficiency by regular desludging should be strongly promoted in the MWSS jurisdiction prior to the sewerage projects.

Part IV

Institution, Organization and Operation

Part IV. Institution, Organization and Operations

1. Reform

1.1 Background

MWSS is under a great pressure on the need for organizational reform. The underlying external and internal factors are as follows:

(1) External Factors

1. Enactment of the National Water Crisis Act of 1995 that gives emergency powers to the President to address the nationwide water crisis through negotiated contracts for expansion projects under BOT and/or related schemes, the reorganization of MWSS including private sector participation, and the upgrading of MWSS compensation upon reduction of NRW to 40%
2. Recent developments involving legislative actions to increase the authorized capital and ceilings for outstanding MWSS foreign and domestic loans
3. GOP policy to accelerate the infrastructure development and to improve operations and maintenance with heavy investment by private sector using privatization schemes
4. ADB and IBRD covenants and requirements to maintain a rate of return exceeding 8 percent, AR balance within three billing months, reduction of NRW, etc.
5. Recent criticism by politicians, news media and leaders representing consumers against inefficient MWSS operations.

(2) Internal Factors

1. Coping with bureaucratic red tape and sectionalism preventing smooth and efficient operations by MWSS in spite of the fact that its organization consists of functional and inter-dependent units
2. Need of organizational simplification through integration and adjustment of duplicated and overlapping positions and functions
3. Introduction of new technology such as sophisticated information systems, telecommunications, automatic mapping and telemetry systems that make the existing skills and ways of working obsolete and require a new set of skills

4. Need of operational improvement to streamline the existing complex and lengthy operating procedures through re-engineering of the core and supporting functions based on the new information systems
5. Consumers' requirements that MWSS provide more customer-oriented services
6. Improvement of overall corporate performance through efforts for reduction of NRW and an increase of revenue and internal cash generation for funding new projects.

1.2 Key Issues

(1) Inefficiency

The most critical management issue for MWSS is "inefficiency of organization and operations" represented by the following three key macro measures in 1995:

1. Slow expansion of service coverage: Population served by piped water supply is 6.5 million or 60%.
2. High non-revenue water: Non-revenue water ratio is 55%.
3. Low productivity: Number of staff per 1000 connections is 10 employees.

The following table compares macro measures in three comparable major cities in Asia:

Table 4.1 Comparison of Macro Measures

Measures	Manila	Bangkok	Jakarta
Service Coverage	60%	79%	25%
Unaccounted Water (NRW)	55%	31%	57%
Staff per 1000 Connections	10p	5.5p	10.2p

Note: Data on Manila in 1995, Bangkok and Jakarta in 1991
Source: ADB Water Utilities Data Book - Asia and Pacific Region

The above table indicates that operational efficiency of MWSS (Manila) in 1995 is far behind compared with the water utilities in Bangkok in 1991, but slightly better than Jakarta.

(2) Vicious Cycle

The inefficiency of MWSS organization and operations is caused by a vicious cycle in MWSS management that is explained as follows:

1. **Low Revenue and High Cost**: Water revenue does not grow as fast as planned by MWSS due to higher non-revenue water level, inefficient billing and collection, difficulty in increasing water tariffs, etc. In addition operating expenses, especially personnel, have been increasing faster than revenue growth, so internal cash generation (ICG), a funding source of capital expansion projects, is being diminished.

2. **Budget Constraints**: Due to slow growth of water revenue and low level of ICG, budget appropriation for operating expenses and capital expansion projects is always constrained and MWSS can not allocate a budget to meet the requirements of each operating unit at reasonable level.

3. **Poor Operations**: Budget constraints become the major contributing factor for delay in capital expansion projects and poor operations and maintenance of existing equipment, facilities and pipe network. Due to those constraints and an inefficient procurement process, construction projects are often behind schedule, and supply materials, spare parts, tools and maintenance equipment are always in short supply throughout the MWSS organization.

4. **Degradation of Services**: Delay in construction limits water supply capacity of MWSS and slows down the expansion of service connections to meet the population growth in its service area. In addition, poor operations and maintenance coupled with delay in expansion projects become a major cause of water shortage that degrades customer services, e.g., frequent interruption of water supply, low water pressure and poor water quality. Thus, the number of service connections does not increase as fast as planned, a large amount of water is wasted and customers dissatisfied with the services do not pay their water bill regularly. Those problems are also basis for public criticism against inefficient management and form strong opposition for MWSS to raise water tariffs.

The above problems are closely interrelated and manifest themselves as a vicious cycle in the operations of MWSS.

(2) Monopoly and Regulations

There are two fundamental causes for inefficiency of MWSS organization and operations. One is monopoly of MWSS operations and the other is government regulations.

A water utility is a natural monopoly because of the nature of water being a basic necessity in life with no alternative service or goods. In addition, MWSS as a government-owned and controlled corporation (GOCC) enjoys an integrated monopoly from development of water sources through distribution of water to consumer. Due to this natural and government-owned integrated monopoly of operations in the water supply service, the principle of competition to create incentives for efficiency does not work for MWSS at present.

MWSS, as a GOCC and public utility, is also heavily regulated by various laws and government regulations at the same level as other government administrative agencies in areas such as personnel, procurement, finance, etc. This makes it difficult for MWSS to introduce commercial principles into its organization and operations to improve operational efficiency.

1.3 Approaches

In order to improve overall efficiency of organization and operations, MWSS must be transformed into a more responsive and accountable organization for consumers and other stakeholders through reforms at various levels, as follows:

- Institution
- Organization
- Operations
- Human resources
- Finance

(1) Institution

It is extremely difficult for MWSS to remove the aforementioned vicious cycle of management through self-efforts for internal improvement because the underlying issue of inefficiency is deeply related to the institutional setup so that commercial and competitive principles do not effectively work. In order to solve this fundamental issue, the existing setup must be structurally changed through external forces.

First, the existing legal framework surrounding MWSS operations must be reviewed and necessary legislative action must be taken by the government, if necessary, to facilitate reform. In June 1995, the National Water Crisis Act of 1995 was approved by the Congress and the Implementation Rules and Regulations are being formulated by GOP. The amendment of the MWSS Charter (RA 6234), still in discussion in Congress, must also be approved as soon as possible to assist MWSS in strengthening its financial aspect. Necessary legislative steps to be taken by the government will be recommended by the Joint Executive-Legislative Water Crisis Commission to be formed under the National Water Crisis Act of 1995.

Second, MWSS could be broken up into multiple units in order to create a competitive environment through the lessening of the integrated monopoly. Combined with unbundling, private sector participation (PSP) could also be introduced to develop incentives for competition and to revitalize MWSS operations based on the introduction of the commercial principle.

(2) Organization

The existing MWSS could be transformed into a more efficient and responsive organization for consumers and other stakeholders. The National Water Crisis Act of 1995 stipulates that the President of the Republic is empowered to revamp the executive leadership and reorganize MWSS and LWUA. (At the time of writing this Final Report, MWSS is being reorganized according to Executive Order No. 286 Issued on December 6, 1995 pursuant to Republic Act No. 8401 otherwise known as the National Water Crisis Act of 1995.)

The strategy for the future MWSS organization will be centered around decentralization of routine operations including the customer service and O&M areas, empowerment by enhancing corporate

planning capability and right-sizing through operational improvement, introduction of advanced information technology and outsourcing of non-mission-critical operations.

(3) Operations

MWSS could also be improved at the operational level, mainly through internal self-efforts with minimum support from outside organizations and/or professionals. Operations improvement will be achieved through a full implementation of the Information System Plan (ISP) and the Change Management Program (CMP), re-engineering of the inefficient core operating processes, and contracting out non-mission-critical activities.

(4) Human Resources

As the characteristics of the MWSS organization and operations change in the future, the skill-set of existing employees will also require change. An organizational success of MWSS in the future will highly depend upon its ability to secure, develop and retain the right people. Since HRD is a long-term issue, appropriate strategies should be established based on defining future core skills and competency required.

In addition, the incentive system together with the career path must be reviewed and modified in such a manner as to motivate managers and employees. Section 3.4 of Chapter 3 discusses the strategies to be taken for strengthening the HRD and management areas.

(5) Finance

In the financial management area, the existing tariff structure must be reviewed and a new one proposed. New financial sources to fund the future capital expansion projects should also be sought.

2. Review of Current Operation

2.1 Laws and Regulations

MWSS as a GOCC and its operations as public utility are heavily regulated by various laws and rules. Major areas of operations regulated by laws are water supply and resources, land use, water related environmental protection, and sewerage and sanitation. MWSS organization, management and employment are also regulated by the MWSS Charter, the Administrative Code, the Salary Standardization Law, and the Attrition Law. Recently, the National Water Crisis Act of 1995 and the BOT Law have become extremely important for MWSS in view of restructuring its organization to cope with the impending water crisis. The amendment of the MWSS Charter (RA 6234) to increase the capitalization of MWSS and foreign/domestic outstanding loans and to stipulate expeditious resolution of right-of-way problems is still pending and should be approved by the Congress as soon as possible to expedite capital expansion projects and improve operations.

2.2 Organization

Key issues of the MWSS organization can be summarized as follows:

1. MWSS's current centralized organization appears to have been designed mainly for the execution of development and expansion projects; however, this style of organization may not be suitable for operations-and-maintenance and for customer services which need the delegation of authority for speedy decision making.
2. There are simply too many middle managers, and consequently, each one does not supervise many staff. The natural consequence of this is a bureaucratic attitude and a slow decision making process. Furthermore, this requires managers to spend more time on "management for its own sake".
3. The "self-sufficient" concept of operations appears to be a problem from the viewpoint of organizational efficiency. MWSS needs many functions in the organization in order to be self-sufficient. This increases the complexity of operations and contributes to inefficiency. In addition, this tendency is also observed among the functional areas.
4. There are some instances where duties are spread among different operating units without considering their inter-relationship. This is typically shown by the distribution of planning, and monitoring and evaluation functions. Monitoring and

evaluation activities are separated from the former, thus they only refer to previous or historical data rather than to planned objectives. Furthermore, plans are sometimes enacted using previous performance or historical data rather than the objectives to be achieved.

2.3 Operations

Major issues of MWSS operations are summarized as follows:

(1) Planning and Budget

1. In order to develop the most effective plans, it is important that the Corporate Planning Group coordinate with other departments and divisions more extensively regarding their planning activities, and that they consolidate and integrate functional plans developed by operating units at various levels.
2. The Study Team observed that planning activities are not effectively followed up in the evaluation process and consequently the results are not incorporated in the next planning cycle. Currently the Corporate Planning Group does not have the evaluation function, which is under the Performance Monitoring and Evaluation Division in the MIS Group.
3. MWSS does not appear to have clear perceptions of the mid- and long-term economic developments affecting water demand in the MWSS service area. It should collect, maintain and update information (such as national plans, economic forecasting, infrastructure development projects, industrial development, etc.) for corporate planning purposes and for furnishing various managers with data for planning and implementation.
4. The Planning Division of the Planning and Programming Department lacks the manpower required to develop project plans, long-range in particular, from the perspective of management and control. Furthermore, it does not undertake the requisite monitoring and evaluation process for coordinating all ongoing projects for the corporate-wide infrastructure program.
5. Responsibility for project management should belong to project managers in the Construction Area. However the Planning Division (Engineering Area) should also be involved here for the purpose of coordinating these activities with Corplan which

handles corporate-wide programs, particularly the use of scarce resources such as funds, manpower, equipment and materials. Maximum flexibility to respond to unexpected problems could be achieved through a continuous cycle of project planning, execution and evaluation by a centralized group.

6. The Study Team observed that planning activities performed by operating units are not efficient due mainly to the complicated planning process and the procedures required by the COA and MWSS policies of strictly adhering to budget control. Lack of coherence and coordination with the corporate-wide integrated plans and programs makes it difficult to secure enough management resources for critical and strategic business processes or activities. Operating units make their own plans without interfacing with Corplan, so their activities are executed on this basis. Sometimes, operating units do not develop any plans and go on doing jobs as routine work without considering corporate-wide goals. Situations like these make it hard for MWSS to control and manage corporate-wide and individual division's missions and objectives effectively.
7. The budget preparation process for MWSS starts with an estimation of revenue. When doing so for the budget year, revenue is calculated based upon such variables as water production, billing efficiency and water tariffs. In the past, a problem existed with the billing efficiency in that it was usually set at an unattainably high level. It appeared to be a "wish" rather than a "target". Because MWSS's activities (both operational and investing) were budgeted based upon this "wished" revenue which would not materialize, these budgeted expenditures had to be revised during the year. Thus, the current budget preparation policy does not prove to be an effective management tool.

(2) Engineering and Construction

1. The problem resulting from two groups (Engineering and Construction) implementing a project is a possible lack of coordination. This is very real in the case of project management where the personnel from the Engineering Area handle planning, feasibility study and design, and the personnel from the Construction Area handle construction and acceptance, with nobody coordinating the work of these two areas. At present, there are various communication problems between them. Project

management may not be handled so effectively through the traditional function-oriented organization of MWSS which is somewhat bureaucratic and focuses on control.

2. Documentation of vital information during the implementation phase is very important, especially when the project is transferred to the Operations Area, so that when equipment needs repairs the necessary background information is readily available without consulting Engineering and/or Construction personnel .
3. As the Engineering and Construction Areas go through various implementation phases, the personnel acquire skills and experience which may not be available in written form. These acquired skills should be transferred to other employees through programs that MWSS could develop, either through lectures or on-the-job training, so that the number of skilled and experienced personnel can increase. In the process, those among them with leadership qualities could become principal engineers, increasingly in demand as more projects are implemented. Hence continuous skills transfer programs are relevant to build a pool of such engineers.
4. At present, planning and design phases are conducted mainly by the Engineering Area, while the involvement of Operations, QC, Corplan and Finance is low or nonexistent. Operations should be involved in the early stages of the project so that design concept and other important issues are discussed with Engineering. The QC function should also be involved at an early stage in order to prepare test specifications before acceptance tests are performed. Corplan and Finance should also enter the planning phase in order to identify alternative funding sources.
5. The documentation of all important aspects of a project (such as preliminary study, feasibility study, design specifications, bidding, awards, drawings and 'as-constructed' plans) is very important not only during the implementation of projects but also for future reference. In addition, manuals such as AWWA Standards reference manuals and handbooks are to be properly kept. All these should be compiled, properly coded and stored in the central engineering data library. The responsibility of the engineering document library should be assigned at the corporate level, and specific guidelines should be prepared as to the documents to be stored and what group is in charge.

(3) Maintenance and Logistics

1. Major issues are centered in and around maintenance of facilities and equipment, and logistics of maintenance resources such as supply materials, spare parts, tools and maintenance equipment. This is due to the lack of maintenance planning and coordination among operation, maintenance, material control and procurement activities. In spite of the fact that those activities are closely related, they are performed by different offices and departments, each unit functioning rather independently, resulting in inefficient maintenance and repair work.
2. It is extremely important for MWSS that the procurement planning of materials, spare parts, tools and equipment required for maintenance and repair work be performed based on the maintenance plan and schedule far in advance, since the procurement process requires many steps and a long time. Presently materials, spare parts, tools and repair equipment are often not available when preventive or emergency maintenance or repair is necessary. Therefore, requisition orders are prepared as a result of finding items out-of-stock during maintenance or repair. Critical supply materials and spare parts should be maintained as stock item and whenever those items are used, inventory must be replenished before they become out of stock.

(4) Customer Services

1. In some cases, new customers have to wait for more than six months before they can get new water services, despite MWSS's policy that the duration of water service installation should be fifteen days. The major cause for delay appears to be the lack of clear definitions of responsibilities for the parties concerned.
2. MWSS implemented the Sectoralization Scheme which has been generally well accepted by the customer service area, including sector and branch offices. However, there is some confusion on the definition and segregation of responsibilities among operating units, especially maintenance and leak repair work of the distribution network system, between the Operations and the Customer Service areas. This is due to the fact that the Sectoralization Scheme has been implemented by MWSS in a short period of time while negotiating budgetary arrangements with DBM.

3. Some citizens seem to be less conscious about the importance of water service. The majority are not aware of the operations of MWSS to expand reliable water service and to cope with the problem of low water supply capacity; they think that water supply is unlimited. Consumers unconsciously waste water for non-essential purposes. There is definitely a need for more public campaigns on the proper use of and reasonable tariffs for water service.

(5) Information System and Communications

1. Judging from current insufficient manpower in both the MIS function and user departments and delays in training and data conversion, the current implementation schedule of ISP appears too aggressive and therefore the project is at high risk. To lessen this, MWSS has recently decided to adopt a phased approach for the implementation of ISP and to focus their project efforts on the Customer Servicing System and the Financial Management System. However, ISP also requires CMP to be in place in order to maximize its objective of streamlining various functional operations corporate-wide. A detailed action plan for CMP has yet to be developed by the Reorganization Committee and the Manpower Committee. In order to take full advantage of the implementation of ISP and CMP, the two projects must be carried out under close coordination in a mutually complementary manner to yield great synergy.
2. Activities performed in various functional areas of MWSS are planned, monitored and evaluated using various data and information. A major issue of communications is a lack of an information control system that includes data gathering , storing, updating and sharing. The information control system must be supported by good hardware such as communication lines and equipment, and also by a reporting mechanism and cross functional coordination in order to develop smooth and accurate information transfer in the organization. However, existing communications systems in MWSS are very weak in both. Another major barrier that prevents smooth communications is the corporate culture such as bureaucratic red tape, blocking smooth communication flow among departments and divisions with high invisible walls.