

CHAPTER 6

UNACCOUNTED FOR WATER CONTROL PLAN

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6.1 INTRODUCTION

The Unaccounted for Water (UFW) control plan is one element of the overall Master Plan for improvement of water supply in Yangon and therefore also has the planning horizon of the year 2020. This is a long period for consideration of UFW control as a separate activity.

More realistically, once UFW control is properly established it should be regarded as a routine facet of good network management practice. So towards the latter stages of the planning period UFW control activities will be progressively integrated with the operations and maintenance functions of network operations.

It is to be noted that the practice of UFW control applies only to piped water supplies distributed through a network. Groundwater only and point source water supply are not included.

6.1.1 UFW Definition

UFW is simply defined as:

$$\text{UFW} = \text{Net production} - \text{Consumption.}$$

UFW is usually expressed as a percentage of net production.

Readily defined, UFW is not so easily calculated and requires the collection and analysis of a great deal of data to be evaluated. The results of this analysis and the planning decisions (Possibly involving large capital investment) based on it will only be as good as the data input allows. For this reason it is very important that the data collected should be:

- Detailed
- Reliable
- Accurate

The collection and analysis of data and resulting UFW control action is not a one-off activity, but rather a continuing, repeating sequence required to reduce and then maintain levels of losses. If stopped then the losses will soon rise again and the situation deteriorates.

Components of UFW include:

Physical Losses

- Network leakage
- Customer pipe leakage
- Transmission main & Service reservoir leakage.

Non-Physical Losses

- Meter error

- Un-assessed consumption by customers
- Illegal & Forgather connections
- Unaccounted for legitimate use
 - Free supplies
 - Institutional supplies
- Operational use

So if UFW control is to be taken seriously and achieve its potential, it is essential to accurately measure and assess these various elements of water use. A lot of this information will come from flow measurement around the network and therefore clearly requires installation and maintenance of flow metering equipment. A schematic of the inter-relation between these components is shown in Figure 6.1, for typical UFW control activities.

It is important to recognise the problem of high levels of UFW and, after estimating the extent of and impact of the losses, develop a plan to take appropriate action.

It is to be borne in mind that the level of losses and the extent of action to control UFW should at all times be cost affective. The target is not an arbitrary level, but the “economic level of losses” determined on a cost benefit basis. This level may vary and should be reviewed periodically.

As a first step to introduce UFW control in Yangon, where there is clearly a problem of UFW, a framework plan has been prepared and is presented here as follows:

- Present context (Baseline)
- Justification for UFW plan
- Outline & general approach
- Proposed sequencing
- Specific activities checklist & timeline
- Identification of priority projects and preliminary cost estimates.

Activities and initial target figures and progress rates have been cited, as a basis for preliminary planning. Once implementation is under way and detailed data becomes available the targets and planning should be reviewed and modified according to cost benefit criteria.

As a final point it should be emphasised that UFW control will require a lot of sustained effort and will not yield overnight success.

It is essential for the success of a programme that there is the political will and continued support to implement it properly. Without this, UFW control will not be able to be effective.

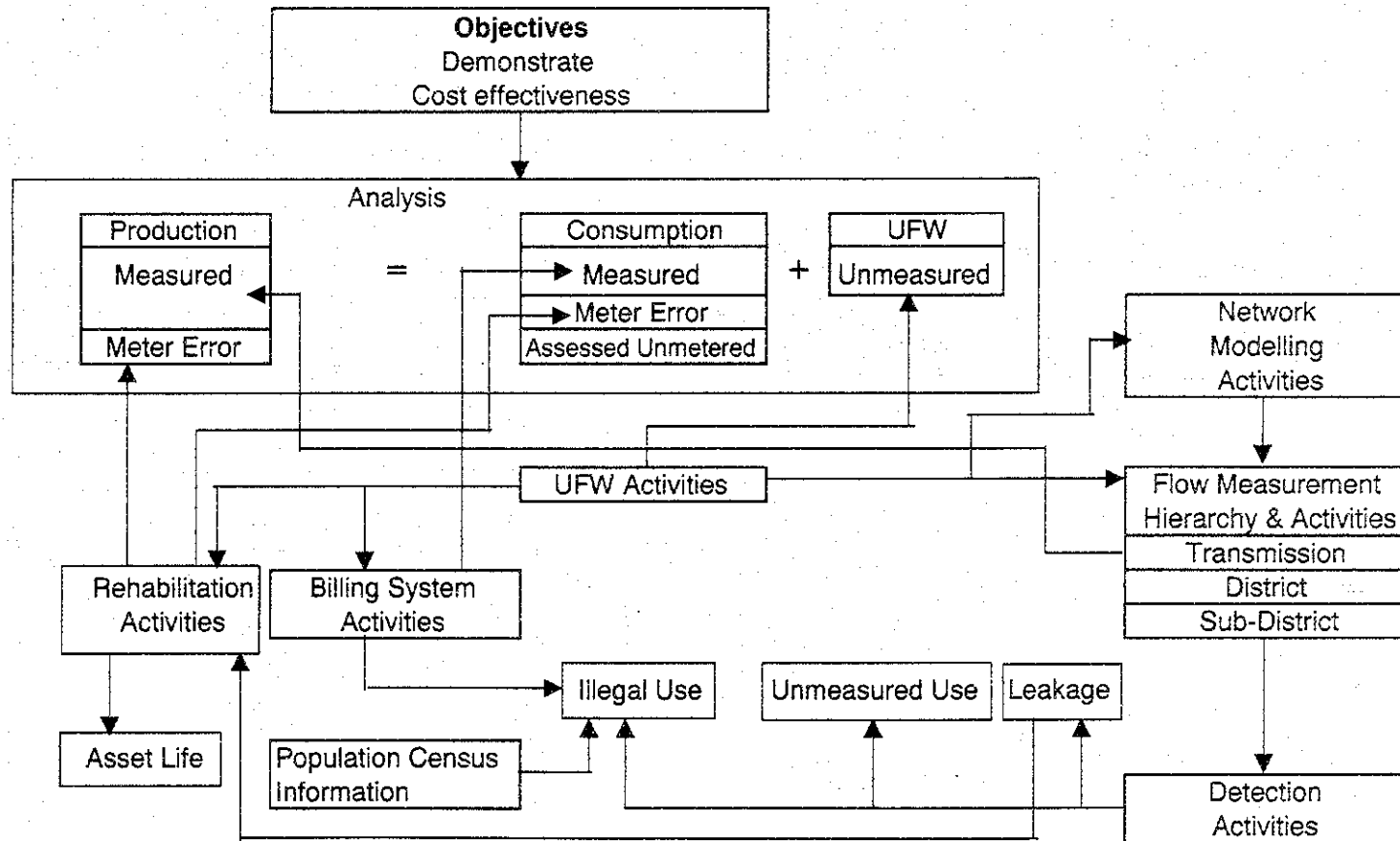


Figure 6.1 Schematic of Inter-related Activities of UFW Control

6.2 BASELINE SITUATION

The requirement for planning is to prepare a strategy up to year 2020. Before this can be done it is necessary to define the starting point and hence review the present situation to serve as a baseline.

This baseline was evaluated and presented in detail in Appendix G. This should be referred to for any information required, but a summary review is given below. This section picks out those points most relevant to providing the planning baseline and context.

First, there follows an extract from the plan prepared for Yangon in 1980 by Metcalf & Eddy. It is reproduced here to illustrate the longevity of the present situation, since the same comments could be repeated almost verbatim today.

6.2.1 Extract From Metcalf & Eddy Report 1980

A satisfactory, efficient and economically viable water supply organisation cannot be achieved in Rangoon merely by increasing the source capacity and providing an adequate distribution system. A number of changes will be required in the RCDC organisation before success can be achieved. The intermediate and higher levels of staff will have to be increased in number and technical expertise. Expenditure on the maintenance, repair and replacement of meters, pumps, pipes, reservoirs, valves, hydrants and other facilities will have to be increased. A vigorous programme to reduce leakage and wastage is essential. RCDC must also work to eliminate unauthorised connections, enforce the payment of bills and remove the very many plumbing fixtures, which have the potential for contaminating the water in the distribution system.

Lack of Basic Data

RCDC have agreed to provide the data on which the study is to be based, but they do not have reliable data on water production and consumption. None of their sources of water are metered and a negligible amount of the water supplied to the public is metered. Some of the water production and water use data provided for the study has been found to be incorrect. These problems have caused delays while additional data have been collected and alternative approaches improvised.

There are about 50,000 military personnel and dependents living in fenced areas reserved for the armed forces (Cantonments). Water is supplied to these areas through several pipes of from 4 to 12 inch diameter. One or more pumps extract water for each of the military supplies from the principal transmission mains. Some military areas also have their own wells in addition to the RCDC supply.

Water Losses

The water supply system in Rangoon is old. There is no systematic effort to identify and repair leaks. Valves are not operated or repaired and many valves are known to be inoperable or leaking. House connections are often made by private contractors, without authorisation or supervision.

Carefully monitored and operated water systems in Europe and USA strive to keep the percentage of unaccounted for water below 25 % of production. It is not difficult therefore to believe that in Rangoon half the water produced cannot be accounted for. In the case of Rangoon however, the loss of more than half the water produced must be viewed in the context of the existing low pressures in the distribution system and the short period of water service each day. If the pressure at standpipes were increased to 30 psi, leakage from water mains would also increase if pressures and hours of service are increased and waste in private residences could increase considerably.

6.2.2 Baseline Summary

Network Condition

- Ageing with over 50% of the network more than 50 years old
- Cast Iron – Circa 80% of the network is cast Iron (not D.I)
- Joints – Most joints are leak prone lead caulked joints
- Under developed
 - lack of secondary mains
 - Lack of section valves etc.
- Long-term lack of capital investment
- Lack of O & M resourcing
- Lot of leakage on service pipes

Service level

- Only 37% of population served
- Most areas have very low pressures
- Large areas have intermittent supplies
- Valve operation limit supply to some areas
- Demand exceeds supply both for
 - Total population
 - Population served

Water Supply Department Operations

- No UFW control plan & activity
- Repair teams under –equipped
- Passive leakage control
- Lack of regulation and or enforcement for consumers
- "Fire - fighting" management approach
- Unclear metering plan.

Flow Measurement

- No production or supply zone flow metering

Consumers

- Low level of metering

- Problems with meter failures from sediment etc.
- Unaccounted for consumption from large connections
- Many non-domestic consumers not metered.

Network Data

- Maps incomplete inaccurate and out of date.

6.2.3 UFW Estimate

Net production: circa 400 Megalitres / day (mld)

Estimated Consumption: circa 140 mld

UFW: 260 mld or $260/400 =$ circa 65%

The UFW is divided between physical (leakage) and non-physical (assessments) losses. At present in Yangon the two are thought to be of similar orders of magnitude because:-

- Leakage is limited by lack of pressure and intermittent supply
- Assessment losses are high because customers are not managed.

Physical losses will be much greater if the network is supplied 24 hours a day at reasonable pressure. Conversely much of the non-physical loss component is probably due to legitimate consumption that is not accounted for. Therefore, for demand estimating purposes it is assumed that:

with UFW : 65% (+/- 10%) of net production
of which Leakage : 50% of net production assumed for demand planning

on the basis not of the situation now, but at some hypothetical point (in the near future) with continuous pressurised service and readily improved consumption assessment.

6.2.4 Leakage Survey Results

This estimate correlates with the results of the leakage survey showing on average 50% leakage with considerable variation depending mainly on the age and material of the pipe.

It is expected prior to any investigation that the key factors affecting leakage will be the age of the pipework and the pressure to which it is subjected. This does not necessarily mean that an older pipe will leak more than a newer one, but that it has a higher probability to do so.

In considering the results from the three model blocks investigated in Yangon, these general expectations are confirmed to some extent, though with provisos.

The results are summarised as follows:

Township	UFW %	Connections	Pressure	Pipe Age (yr)
Insein	16	150	low-medium	3
Yankin	56	150	reasonable	30
Tamwe	20	59	low	70

For Yankin, as can be seen, the older pipework with reasonable pressure has an elevated level of leakage. In Insein, where the pipework of the model block is very new, the leakage would be expected to be very low and this is not representative of the whole network.

Tamwe, has the older pipe network, but it has very low pressure, which can be expected to more than offset the age factor. If the pressure were raised to the same level as Yankin, it is probable that much higher leakage losses would be recorded. Also, the model block was very small.

Form the results obtained the weighted average leakage ratio is around 35%. (weighted by number of properties in the model block.)

All of the model blocks are small in size and the ratio of pipe length/connection is relatively small. If the blocks were large and incorporated a representative ratio of pipe length/property, this would be another factor expected to elevate the leakage losses.

It is estimated that if the average leakage rate from the model blocks is scaled up to include the distribution network, the rate would be around 50%, if pressure is present at the present level. This is consistent with the judgment made for leakage, based on the global estimate of UFW, with components of physical (leakage) and non-physical losses.

6.3 JUSTIFICATION FOR UFW CONTROL

6.3.1 Role of UFW Control

UFW control is primarily an element of demand management, whereby efforts are made to reduce consumption and the need for supply-side increases in capacity. The more demand can be managed the less the need for very capital-intensive investments to build new facilities for supplying more water.

It also has a role on the economic of operations and the extent of the role it has to play is defined by the cost-effectiveness of the measures in terms of:

- Maximising revenue by ensuring that as much water use as possible is paid for (or accounted for)
- Minimising unit operating costs (kyat/m³)

UFW control is an operation function and forms part of network management. The extent and nature of the interventions should always be justified on a cost-benefit basis. In undertaking these assessments of financial benefit, it is important to ascribe costs equitably, since many of the costs

in setting up UFW control measures are also related to other activities.

The detail of the strategy is not part of a long-term development plan and it is subject to constant review and modification as the cost-benefit balance changes. Its principal role in the development plan is to provide targets for overall levels of UFW to allow demand forecasts to be estimated; this aspect is detailed elsewhere in this report.

Non-Physical Losses (NPL)

There are two main justifications for minimising NPL, which are not just economic but more financial

- To account for water consumed properly so that investment is not wasted seeking Physical losses that do not exist
- Ensuring that income is maximised by collecting revenue for water actually consumed

Physical Losses (PL)

The principal justification for minimising PL is that it represents lost efficiency in transfer of water from point of supply to end user. These losses have effects on:

- Need to supply more water to meet customer demand
- Need to build bigger supply facilities
- Operating costs are increased for a given demand level

Thus, the aim of leakage control is to reduce these losses (of efficiency) to the level where further reduction in costs more to achieve than the cost of supplying the extra water.

Operating Expenditure (OPEX)

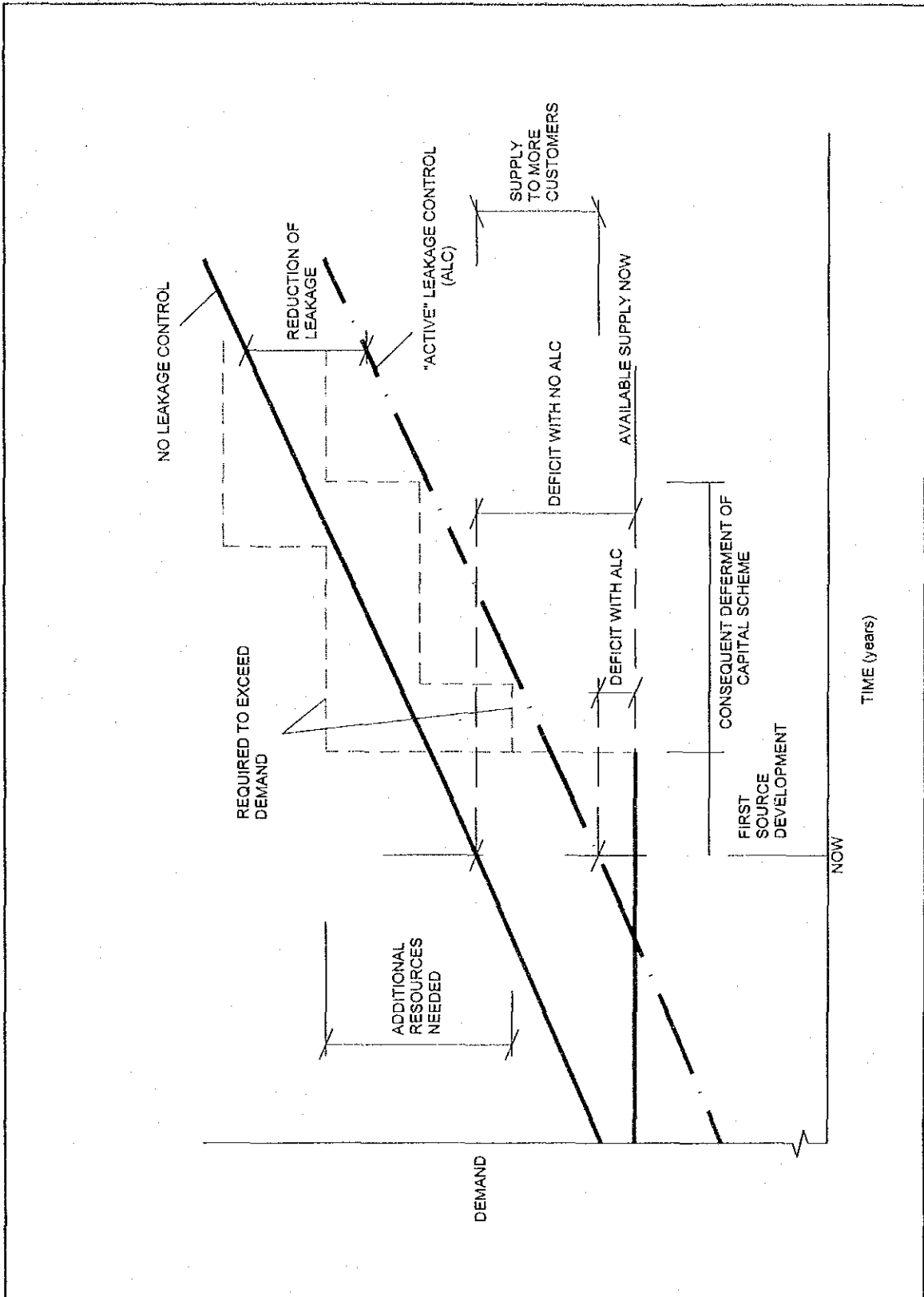
Looking only at Opex, the balance is between the cost of production in terms of consumables and direct costs (e.g electricity, chemicals, staff) and the potential revenue gains set against the cost of stopping the losses.

If there are no losses, the network efficiency is 100% and all production is sold, which maximises revenue and has no wasted operating expenditure. Thus, the goal is to reduce the losses (and so increase efficiency) as much as possible until it becomes too expensive.

Capital Expenditure (CAPEX)

By using "demand management", where use is reduced rather than supply increased can be very cost effective in Opex terms. But it can be greatly more effective if Capex is deferred or avoided, because it is usually cheaper to delay building reservoirs and Water Treatment Plants as long as possible and maybe include staging of the capacity.

This deferral of Capex is shown diagrammatically in Figure 6.2



JICA THE STUDY ON IMPROVEMENT OF WATER SUPPLY SYSTEM
IN YANGON CITY IN THE UNION OF MYANMAR

FIG 6.2

Diagrammatic Representation of The Deferment of Capital Expenditure

6.3.2 Example Calculations

At YCDC presently, there is not the information to do a cost/benefit assessment. Also, the balance will be very dependent on the final plans for improvement of the water supply system generally, although reduction of UFW has its role to play in assisting the water supply planning by reducing the total amount of capacity that needs to be built. The following calculations also illustrate the potential order of figures involved based solely on consideration of opex and revenue.

Opex Costs

Using Present costs

(source YCDC)

Year 2000/2001

Expenditure 59.91 million Kyats

Water revenue 318.91 million Kyats

With UFW 65 %

Estimated Production 400 mld

146 million m³/year

Estimated Consumption 140 mld

51 million m³/year

Production Cost 0.41 Kyat/m³

Average Tariff 6.24 Kyat/m³

ASSUME:

UFW 30 %

Volume saved 51.1 million m³/year

Cost of UFW reduction 0.5 kyat/m³ (produced)

Production 146 million m³/year (unchanged)

And all additional water is sold

Then:

Extra revenue 319 million Kyats (531517 Dollars)

Cost 73 million Kyats (121667 Dollars)

So

Net Benefit-Cost 246 million Kyats (409,850 Dollars) (annual)

This calculation is to illustrate the benefits and only covers operating expenses and revenue. This does not take account any changes or increase in water tariffs. Capital expenditure calculation would be likely to greatly increase the benefits of "deferred capex"

UFW Benefit to Demand Management

Looked at another way, in terms of the benefits to easing the requirements for increased supply and increasing demand with the available supply, the following examples are given as an illustration.

Either: (reversing the previous calculation)

Consumption now	140 Mld
Consumption final	280 Mld (doubled)

Using per capita consumption	190 lcd	rate at present
Then: 140 Mld serves	750,000	population
280 Mld serves	1,500,000	population

Using per capita consumption	140 lcd	rate after UFW reduction
Then: 280 Mld serves	2,000,000	population

Or:

Demand in 2020	
Population	6.5 million
Population served	5 million
PCC (equiv)	250 lcd (includes non-domestic consumption)

Total demand	1250 mld
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Supply

Surface water	1500 mld	max yield
Ground water	0 mld	allowed for peak demand

Demand in 2020 = approx 85% of supply max. from achievable water sources

So if UFW exceeds 15% then supply is less than demand and rationing is required.

To put it another way:

If UFW stays at 65% then with full exploitation of available surface water resources:

Supply = 1500 mld	Demand = 1250 mld	UFW = 65%
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Available supply = $1500 \times 0.35 = 525$ mld = circa 40% of demand

Hopefully, this illustrates just how especially important UFW control is to Yangon. If UFW is not reduced by a large amount, it will never be possible to fully satisfy demand with the present scope for exploiting water resources. To increase supply further

will require development of very expensive solutions.

6.4 OUTLINE APPROACH OF UFW CONTROL PLAN

As has been clear in reviewing the baseline situation, YCDC is starting from nothing in respect of UFW control and has considerable problems related to all the various aspects and activities concerned.

Therefore, the four underpinning principles of this plan are:

1. YCDC have to get involved in action on all fronts of UFW control (to a greater or lesser degree)
2. It is not possible to do everything at once and immediately, so the approach will be to start small and expand progressively until the entire network is effectively covered.
3. A general strategy is proposed, which will need to be adapted and modified to suit changing circumstances
4. Economically justified action

6.4.1 Context

A UFW control plan is often prepared and implemented in a relatively stable context, where the water supply utility has fully established the service coverage and has a fully developed network.

In Yangon, this will not be the case for some considerable time to come. As a result, UFW control will have to be implemented within the context of major changes and developments, which it will affect and which will have an effect on it.

It will be important to ensure good co-ordination and integration with such general water supply improvement activities as:

- Increased duration and pressure of supply to areas
- Expansion of the service area
- Rehabilitation and reinforcement of the existing network
- Organisational strengthening
- Increased water supply

6.4.2 Policy Decisions

Similarly, the environment for UFW control will be influenced by decisions and details of general policies including:

- Metering of consumers
- Byelaws and standards (& enforcement thereof)
- New works design & construction

- Tariffs
- Application of information systems (especially GIS)
- Institutional changes
- Customer education

6.4.3 General Approach

As mentioned previously, UFW control will start on a small-scale and then expand progressively as the practices become established. Concomitant with this approach, the activities will be prioritised and concentrated to maximise the benefits. For example, this will entail focussing on such factors as:

- Large users
- High Leakage Areas

To have the most effect, especially in the early years, work will commence for all UFW control tasks in those areas that have “good” service (i.e. continuous supply and “high” pressure) and once they have been “controlled” then they will be maintained in that state.

Initially, there will also be a lot of work to be done to get all systems set up and operational, including:-

- Installation of equipment (mainly flow meters)
- Surveys
- Data collection and analytical procedures

6.5 PROGRESSION & SEQUENCE OF UFW CONTROL PLAN

For a plan with a final horizon of 2020, there are three levels and timelines, which in this instance are defined as:

Long-term Strategic	Phase 3	After year 3	2006-20
Immediate & Preliminary	Phase 1	Year 1	2003
Medium Term Tactical	Phase 2	Year 1-3	2003-2005

Thus, the general strategy, approach and broad definition of required action have been established. This includes fixing a baseline reference, a final target and an initial estimate of the phasing to get from one to the other. This is summarised in the section on UFW Water Demand Planning.

6.5.1 Characteristics of the Sequence

As an overview, the three phases can be characterised as follows:

Phase 1: Preliminary

- Initiation and start up of all activities across the board
- Training and practice of basic techniques and methods
- Installation of equipment especially production and zone flow meters
- Surveying
- Mapping of Network
- Establishment of UFW Control Unit and Team
- Work on Trial "pilot" areas
- Technical Assistance – Intensive effort for detailed planning, implementation and technology transfer

Phase 2: Medium term

- Establish routine procedures
- With increasing time-based data, review UFW levels and adapt control efforts
- Progressively repeat and expand task to cover more and more of the network
- Continue and complete surveying
- Reduce and phase out technical assistance as UFW unit becomes self-sufficient
- Prioritise and direct UFW control activities

Phase 3: Long term

On a 5 year cycle:

- Review UFW levels and control measures strategically
- Modify and prepare a plan and revised objectives
- Continue and repeat UFW control, prevention and monitoring
- Continue expansion of area covered until complete
- Continue to increase level of detail, specificity of data by progressive sub-division of the network into smaller areas (to the extent justified)

General

UFW control work will start in the good service areas. One or several "pilot" areas will be set up (possibly based on wards) and subject to the gamut of activities, including but not limited to:-

- Mapping and consumer survey
- Large user identification & monitoring
- Meter repair and replacement
- Leakage survey & detection (applying different techniques as appropriate)
- Timely repair of leaks

When the pilot area has been completed, a lower level of activity will be continued to maintain the UFW control in the area.

A new set of pilot areas will be set up and the intensive efforts directed in these new areas. This sequence continues, building up the area of coverage until a complete district or zone has been done. Then the next district is started.

The probable first division of the network into districts will be based on townships for areas outside the downtown sector. This latter central area network is such that division by township may not be appropriate or practical.

6.5.2 Resource Allocation

In the early stages, a dedicated effort will be required to get UFW control established. To do this a special task force will be set up, with a UFW control team at its core. The size of the team will be limited to be manageable and for training to be focussed. Eventually, they will expand the number of staff involved and the original core team will have an important training role in their own right.

Ultimately, this team will expect to be integrated with and possibly absorbed into the general network management organisation. At all times, the UFW unit will require the support and co-operation of network staff and management at all levels.

Associated with the work of the UFW team, is the need for improved repair capability to deal with the leaks located. More repair teams, properly equipped and supplied with the correct repair items for different situations, will have to be set up at the same time as the UFW unit.

6.6 UFW WATER DEMAND PLANNING

To recap:

- Present Situation: 65% UFW on 400 mld production
- UFW components: 50% PL and 20% NPL
- Target level: 30% UFW on increased production

At present, as described previously, the UFW is considered to be divided fairly evenly between physical and non-physical losses. The progression of these elements is expected to be generally as follows: -

Non-Physical Losses (NPL)

This will be brought "under control" relatively quickly as a lot of unaccounted for water use is investigated and properly assessed or measured. It will be reduced to a more or less constant level, beyond which it will not vary greatly; provided proper control is maintained.

Fairly arbitrarily, the NPL element will be considered to be less than or equal to 10 % of net production within 5 years. It will then be further lowered to 5% in the last stage of the plan as the consumer consumption data is made more specific. This factor will be greatly influenced by the final decision on metering policy for consumers.

NPL is not a dominant factor, but it is still important to reduce it as far as possible, not least to:

- Maximise revenue by ensuring all consumption is accounted for and paid for
- Ensure physical loss reduction efforts are not misinformed or misdirected by misleading results

Physical Losses (PL)

Physical losses or leakage will quickly become very predominant as unaccounted for consumption issues are resolved. It will then also be the factor that can be most readily affected and by which UFW losses can be reduced. So within the first 5 years, leakage will become the principal, modifiable loss element.

The pattern is expected to proceed something like the following:

- Initially, leakage will rise or plateau with the combined effects of leakage control and improvements in service duration and pressure
- Then Leakage levels will stay fairly high for a while
- Next leakage will reduce quite markedly as the leak control measures take effect on an appreciable proportion of the existing network and the rehabilitation and expansion schemes improve the condition of the pipework
- Latterly, Leakage will reduce more and more slowly as results become increasingly difficult and less cost-effective to achieve.
- Finally, UFW will be reduced to an asymptotic level as it approaches the hypothetical "economic level of leakage".

Initially, the progression has been estimated on a block basis, descending in a series of steps of differing duration.

As a note, it should be remembered that the UFW target level should be based on cost-benefit analysis and these figures are just to serve as a starting point. They are intended to be achievable and give something to work towards without being too arduous or discouraging at this stage.

6.7 SUMMARY OF PLANNED UFW CONTROL ACTIVITIES

It has been explained that action will be required on all aspects of UFW control, as well as some

related activities. The general approach to implementing and phasing this policy has been outlined. In this section, the particular elements of this approach are summarised.

6.7.1 Activities Checklist

To provide an overview of the range of activities and to provide a form of ready reference, a checklist of the tasks with the key action for phase 1 and for phase 2 identified has been compiled. This is shown in Table 6.1.

It is to be noted that not all of these categories will necessarily be carried out by nor be the sole responsibility of the UFW control Unit.

Table 6.1 Checklist of UFW Control Tasks

Item No.	Activity Description	Key Action	
		Phase 1	Phase 2
1	GENERAL MANAGEMENT & UFW CONTROL PLANNING		
1.a	UFW Control Programme	Plan & Establish	Review & Modify
1.b	UFW Control Project Team	Set up & Train	Continue
1.c	Reporting & Information Systems	Develop & Establish	Keep up to date
1.d	UFW Ratio	Analyse & Review	Repeat periodically
1.e	Cost-benefit Analysis for UFW Activities	Analyse & Review	Repeat periodically
2	PHYSICAL LOSS ACTIVITIES		
2.a	Trunk Mains Leakage Investigation	Visual Inspection	Repeat annually
2.b	Service Reservoir Leak Investigation	Drop test for leaks	Repeat 4 yearly
2.c	Network Leak Detection Programme	Prepare requirements	Reinforce & Expand
	ALC Leak Detection Team	Set up, train & Practise	Implement progressively
2.d	Pressure Management	N/A	Review when pressures improved
2.e	Leak Repair Programme		
	Network Repair Team	Set up repair team(s)	Scale to suit needs
	Network Repair Materials	Review repair items required and set up	Supply & maintain stock of repair items
	Repair Reporting	Monitor repair teams	Continue
2.f	Service Pipe Repair Programme	Combine with rehabilitation programme	
3	NON-PHYSICAL LOSS ACTIVITIES		
3.a	Large Users (Consumers)	Define, identify & install meters	Monitor closely & check meters often
3.b	Domestic Metering Policy	Define & plan	Implement plan
3.c	Domestic Meter Testing		
	Meter Test & Repair Facilities	Set up & install test & calibration equipment	Maintain
	Meter Testing Programme	Establish routine	Continue
3.d	Unmetered Use by Category		

3.e	Assessment of Unmetered Use by Sampling of Groups	Identify sample groups and monitor	Continue as required
4 MEASURING & PRIORITISING of UFW ACTIVITIES			
4.a	Production Metering		
	Surface Water	Review & Install	Monitor
	Ground Water	Review requirements	Install & Monitor
4.b	Bulk Metering in Network	Review & Install	Monitor
4.c	District or Zone Metering in Network		Begin to Install & monitor
4.d	Waste Metering Programme	Set up pilot areas	Repeat & Expand
4.e	DMA Management		
4.f	Analysis of Night Flows		Use nightlines
4.g	Prioritisation of Areas for ALC & Rehab.	Use results to prioritise high leak areas	Develop and continue
5 ASSOCIATED ACTIVITIES			
5.a	Mapping of Network and Recording of Network Data	Mobilise: start in "good service" areas	Continue and finish then keep up-to-date
	Data Capture & Presentation	Set up and apply	
	Field Survey Work	Establish Methods	
5.b	Establishment and Updating of Customer Database	Combine with network mapping	
	Data Capture & Presentation	Set up and apply	Continue and finish then keep up-to-date
	Field Consumer Audit Survey	Establish Methods	
5.c	New Works and Network Rehabilitation	Maintain good co-ordination for plans & ensure UFW control included in design	
5.d	O&M Departments - co-ordination	Maintain good co-ordination for works	
5.f	Public Education & Information	Set Policy & Practice	Begin to implement
5.g	Byelaws & Technical Standards	Set Policy & Practice	Begin to implement
6 TECHNICAL ASSISTANCE PROGRAMME			
	UFW Control Management	Full-time support	Reduce level
	Including special inputs on:		
	Mapping survey and capture		
	Information systems		
	DMA design & Implementation		
	Meter sizing & selection		
	Meter Testing & Calibration		
	Metering Policy		
	Byelaws & Technical standards Policy & Implementation		

6.7.2 Timetable for First Period

A draft outline of a timetable for the first phase of implementation of the UFW Control Plan is shown on the following pages. This will be refined at the start-up of the project, with more detailed planning. The schedule for phase 2 will be developed and defined at the end of phase 1 based on the lessons learned, progress made, resources available and crucially the priorities de-

terminated during this initial period.

6.7.3 UFW Control Plan Long-Time: Phase 3

During the first periods, phase 1 and 2, a number of results will have ensued:

- Established, experienced staff in the UFW control team
- reliable teams for active leakage control and repair
- programme of activities directed to UFW reduction and loss control
- Installation of production and bulk metering equipment
- data recording and collection systems set up and operating
- data results giving historical data, trends, seasonal variations etc.
- a much clearer picture of the situation with respect to:
 - UFW losses and the division between leakage and non-physical losses
 - The status of programmes such as rehabilitation and expansion of the system

Phase 3, the remainder of the master plan period duration, will not represent a major change of approach or activity, but rather a continuation and adaptation of those being followed in the previous phase. As noted previously, UFW control is the repetition of tasks to achieve and maintain reduced levels of losses.

Guidelines for further action can only be suggested in general terms, which will be decided and detailed at the end of the first phase. In essence, the procedure will be to continue with the activities of the first period, modified and adapted according to review of the costs, benefits and priorities of UFW control.

ACTIVITY	ACTIVITY DESCRIPTION	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
		1	2	3	4	5	6	7	8	9	10	11	12	13
	Unaccounted for Water Reduction Strategy													
1	UFW CONTROL PLANNING & MANAGEMENT													
1.a	Initial review & establishment of UFW Programme													
1.b	Set up UFW Control Project Team													
1.c	Develop & Establish Reporting & Information Systems [Computerised Information Systems procurement]													
1.d	Analyse & Review Ufw Ratio													
1.e	Cost-benefit analysis for Ufw activities													
2	PHYSICAL LOSS ACTIVITIES													
2.a	Trunk Mains Leakage Investigation													
2.b	Service Reservoir Leakage Investigation													
2.c	Network Leak Detection Programme ALC Leak detection team													
2.d	Pressure Management	N/A												
2.e	Leak Repair Programme Network Repair Team Network Repair Materials Repair Reporting													
2.f	Service Pipe Repair Programme													
3	NON-PHYSICAL LOSS ACTIVITIES													
3.a	Large Users (consumers)													
3.b	Domestic Metering Policy	N/A												
3.c	Domestic Meter Testing Meter test & repair Facilities Meter Testing Programme													
3.d	Unmetered Use by category													
3.e	Assessment of unmetered use by sampling of groups													
3.f	Waste prevention programme													
4	MEASURING & PRIORITISING of UFW ACTIVITIES													
4.a	Production Metering Surface Water Ground Water													
4.b	Bulk Metering in Network													
4.c	District or zone metering in Network													
4.d	Waste Metering Programme													
4.e	DMA Management	N/A												
4.f	Analysis of Minimum Night Flows													
4.g	Prioritisation of Areas for ALC & Rehab.													

Figure 6.3 Unaccounted for Water Control Plan for YCDC in Yangon: Phase 1 (1/2)

ACTIVITY	ACTIVITY DESCRIPTION	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
		1	2	3	4	5	6	7	8	9	10	11	12	13
5	ASSOCIATED ACTIVITIES													
5.a	Mapping of Network and Recording of Network Data Data Capture & Presentation													
	Field Survey Work													
5.b	Establishment and Updating of Customer database Data Capture & Presentation													
	Field Consumer Audit Survey													
5.c	New Works and Network Rehabilitation - co-ordination													
5.d	O&M Departments - co-ordination													
5.e	District Inspectors	N/A												
5.f	Public Education & Information	N/A												
5.g	Byelaws & Technical Standards													
6	TECHNICAL ASSISTANCE PROGRAMME													
	UFW Management													
	Mapping survey and capture													
	Information systems													
	DMA design & Implementation													
	Meter sizing & selection													
	Meter Testing & Calibration													
	Metering Policy													
	Byelaws & Technical standards Policy & Implementation													

KEY:
 Primary Activity OR First period of activity **—————**
 Continuation of activity once set up or after first period **~~~~~**

Figure 6.3 Unaccounted for Water Control Plan for YCDC in Yangon: Phase 1 (2/2)

Five years is an appropriate period for long term projections of UFW control activities. It is proposed that during this extended long term period, this should be the interval for undertaking a detailed review of the situation and preparing a strategic plan for the coming period. This 5 year plan will then be detailed, reviewed and modified periodically (e.g. annually) to achieve the overall objectives set. Thus, the strategic review at the beginning of phase 3 will be repeated every five years.

Some particular items to review include:

Organisational Aspects

Review the organisation that has been set up for UFW control. Either confirm or make needed organisational changes.

Rechecking Data

Where justified, proceed by steps, first repeating the original program of checking water balance data. Examine potential savings offered by alternative methods of procedure.

Pressure Reduction

Examine possible reductions in pressure including the use of PRV's if this has become relevant.

Updating District & Waste Metering

Further extend the pilot schemes for waste meter districts by stages, beginning in those Sections where excessive leakage is expected. Alternatively, or additionally, extend district metering by subdividing the original large districts and increase the frequency of monitoring districts

Application of New techniques & Technologies

Review developments in techniques and equipment used in UFW control and consider their applicability to Yangon, cost-benefit assessment

Renewal / Calibration of Metering & Other Equipment

The issue of the need for replacement, repair, recalibration of equipment, especially network flow meters should be reviewed periodically and not ignored.

Updating & Improving Active Leakage Control

Re-examine possible improvements using additional training, equipment, labour, and incentives.

Public Relations

Establish respect for byclaws by appointing plumbing inspectors to improve standards of consumers' internal plumbing or by such other means as appear practicable.

New Works and Repairs

Pay particular attention to improving the standard of construction of new works and repairs to ensure that all work is properly inspected and may be expected to remain leak-free for years to come.

6.8 RESOURCES AND ORGANIZATION

It is now germane to outline the resources needed to begin implementation of the UFW Control Plan. In order to be effective over a sustained period, it is essential that adequate financial resources and budgets are available for this. There are five main aspects to be considered:

1. Organisation for UFW control
2. Personnel to staff the team
3. Training and skills acquisition for the staff
4. Technical assistance to the organisation
5. Material and equipment resources

6.8.1 Organization - UFW Task Force Approach

UFW Control Team

To implement the structures and measures needed to begin the process of reducing UFW to economic levels, a separate, dedicated section will be essential. This section and its manager need to have sufficient authority and the requisite autonomy to be able to make progress once the plan has been agreed.

The UFW control section must be set up immediately on starting the programme. It should be considered as a permanent unit, not a time limited, temporary one; though ultimately many or all of its functions may be subsumed within the operations of mainstream departments, such as distribution or customer services.

The applied methodologies should in most cases be introduced at pilot level and then applied progressively to other areas of the township or city, once the method has been tested and any problems resolved. However, with 33 townships, it is necessary also to retain a global overview to identify priority areas and to evaluate the cost-benefits before full implementation of the programme.

Phase 1

During the first twelve months of operation, the UFW control unit will be set up, trained, developed and become firmly established. Within this period, it is expected that the first half will be principally occupied with setting up, preparing and training and the latter half will be practice and trial implementation.

For phase 1 the team will be kept relatively small and exclusive, so that it remains manageable and all its members can be properly trained. This is a relatively long lead-in time, because YCDC is starting from zero and a change in approach is needed.

Phase 2

At the end of phase 1, a review will be carried out to determine the future direction of

efforts and reinforcement of the team that is needed, along with the additional resources required. The role of the original core team will then be modified to include training and supervising additional staff brought in to cope with the expanded work programme.

Repair Teams

A properly resourced repair section should also be set up and equipped at the same time as the UFW control section. Though probably part of the distribution department, the repair section will have close ties with the UFW team, mainly physical loss group, and work co-operatively.

The same principles apply to this repair section as to the UFW control team. That is to develop a small, strong competent core then review the full scale of the requirements to reduce UFW levels according to a timetable and finally provide the resources and staffing accordingly.

The size of these first stage teams should be limited to around 12 to 15 persons, though later many more staff will be involved in one way or another. The suggested composition of the UFW control team is given in the following section. The size of the repair teams does not include unskilled labour.

6.8.2 Personnel to Staff the Team

(1) UFW control Staffing

UFW Project Manager

To ensure that effective action is taken a well-qualified project manager responsible for UFW should be appointed. The project manager must be allocated sufficiently experienced staff to develop a separate UFW team and should be given suitable assistance to undertake special studies. Additionally, the task force manager may be assisted by one or more consultants or other technical assistance.

UFW TEAM

The typical titles of each of the members of the team is described below: The proposed UFW team structure is shown in Figure 6.4.

Team Leader :	maybe combined function with the project manager
Data Control Engineer:	Co-ordinates with team for data collection and analysis

Non-Physical Loss Team

NPL Controller:	1 Engineer	manages the NPL team,
Technical Controller:	1 Technician	Specialised in Water Meters

Administrative Controller: 1 Technician specialised in consumer issues

Physical Loss Team

PL Controller: 1 Engineer manages the PL team.

Draughtsman: prepares network drawings for work and updates,

Network Preparation Team: 1 or 2 Technicians Specialised in Pipework

Leak Detection Teams: 2 Technicians Specialised in Leak Detection 2 teams

All other manpower needed for the field surveys, and all field operation and works are to be taken from relevant other departments. Passive leakage control (repair of visible leaks and operations upon request of consumers) remains the "maintenance and repair" tasks of the township staff.

(2) Co-operation and Co-ordination

It must be emphasised that Water Loss Control is the duty of all water supply department staff and not only UFW team. Equally, all sections or departments are involved in the work and should co-operate with the UFW team.

6.8.3 Training

To start with, about three employees should go for a period of up to three months to a developed country where they will be given special training using modern equipment and will work with trained inspectors employed by another water authority. If two or more employees working in the area of repairs could undergo similar training, it will be advantageous as they can learn the standards of workmanship required to ensure the best possible repair under difficult conditions.

One of those selected should be an engineer or technician with an aptitude for teaching. This person does some training of additional employees required to build up the team later on. This initial training of a few selected staff should be part of an ongoing scheme. An incentive for new recruits should be the potential to be selected for training abroad.

Overseas training should provide short, formal courses at specialised training centres that include:

- (a) theory of leakage control;
- (b) practical experience in the use of a wide variety of equipment
- (c) maintenance of and simple repairs to all equipment.

This is followed by a hands-on operational work during the daytime and at night, covering all forms of active control. The technical assistance consultants should also provide on-the-job training and experience, including pipelines & cable location, flow measurements, tapping mains under pressure, use of insertion flow meters, repairs to pipes and services, flushing mains and

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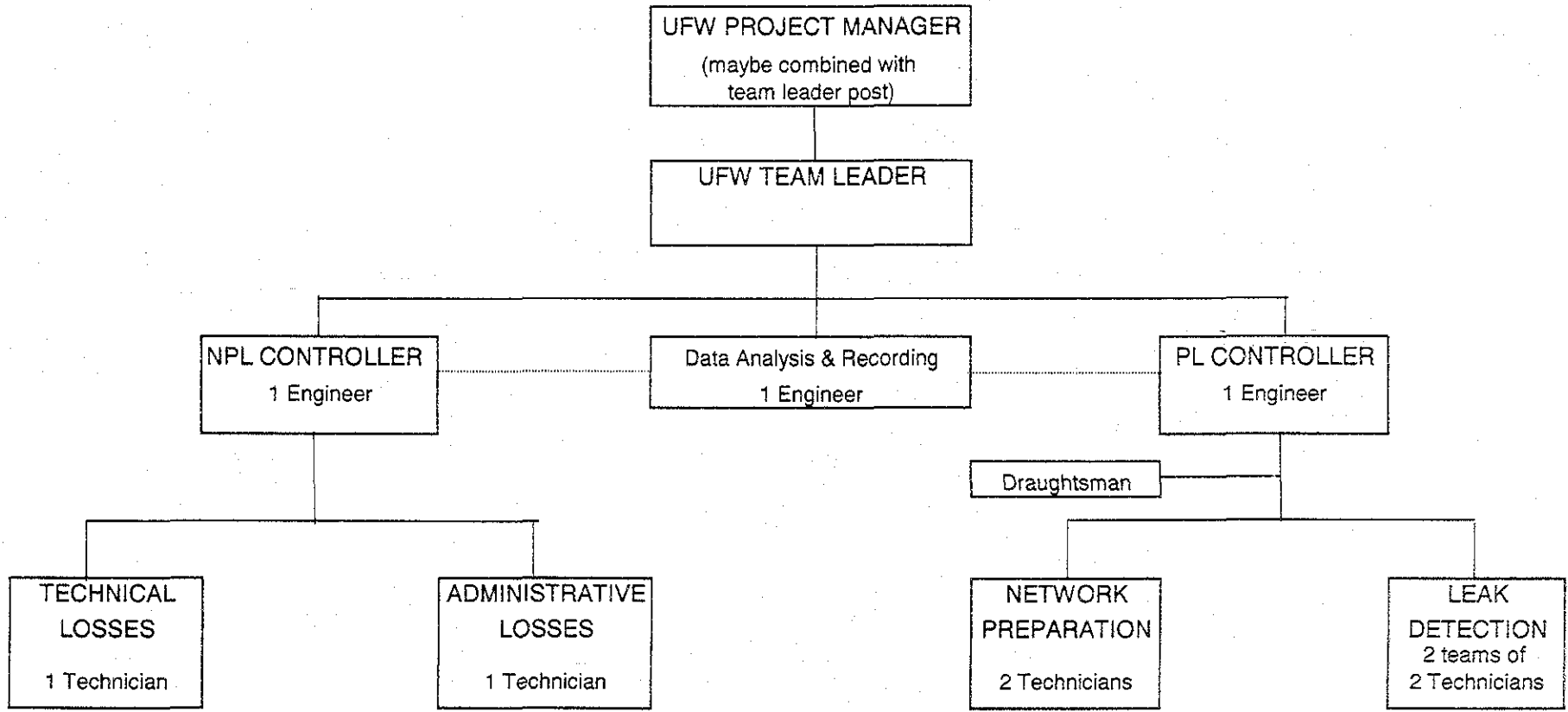


Figure 6.4 UFW Team Organization

sterilisation, testing valves to ensure tight shut-off, the use of portable test equipment and data loggers for flow and pressure, and setting up a district metering system and a waste meter district.

Arranging for such training is one of the first steps to be taken in implementing a program for improved leak control. The recommended optimum solution is that overseas training is supplemented by on-the-job training as part of the terms of reference for technical assistance.

6.8.4 Technical Assistance

It must be stressed that leak control is not a short-term activity, which once begun can then come to an end. Experience shows that unless the control program is perpetuated indefinitely, soon after cessation the UFW figure is as high as ever. The need for appointing a competent, long-term consultant to assist the authority should be seriously considered.

A key part of any contract with a consultant is the establishment of an effective permanent organisation in the authority and a commitment to continue advising the authority on the detailed solutions of problems encountered during the first year or longer. Of equal importance is provision by the authority of a sufficient number of suitably motivated, intelligent, and qualified "counterpart" employees to gain the necessary training and experience to take over the operation at the end of the consultant's contract.

Areas to be considered for some form of technical assistance include:

- General UFW Technical Management Assistance (e.g. Technical Assistance Unit)
- Mapping survey and capture
- Information systems
- DMA design & Implementation
- Meter sizing & selection
- Meter Testing & Calibration
- Metering Policy
- Byelaws & Technical standards Policy & Implementation

6.8.5 Material and Equipment Resources

Having identified and trained the staff needed for the UFW control plan, it is important that due consideration is also given to ensuring adequate materials and equipment are provided to do the job effectively.

Much equipment and material will be needed, but in three main categories:

1. Office-based drawing and data records and functional equipment for staff
2. Equipment and transport for fieldwork including specialist leak detection equipment
3. Repair materials, tools and equipment of the type and quantity necessary to get repairs effected in a timely and effective manner.

These elements need to be considered and defined in preparing detailed budgets for the project

and a first tranche will be needed at a very early stage. Sufficient allowance within these categories, especially 2 & 3 must be made for training and practice materials, to allow staff to gain the necessary skills.

6.9 COST ESTIMATES AND IDENTIFICATION OF PRIORITY PROJECTS

The period for the master plan is up to 2020, for which this UFW Control Plan has been prepared. Additionally, this study is to further investigate and develop pre-feasibility assessments for those immediate priorities that have been identified as being:

- In the initial 2 to 3 year project period
- Requiring substantial inputs of materials and/or personnel by outside agencies

These projects are summarised as follows:

- Set up UFW Control team and ALC teams
- Production Metering
- First level Bulk Metering
- Set up meter repair and test workshop
- Map the network
- Map the customer & property database
- Specify and Install Information systems
- Repair Teams with equipment
- Waste metering pilot projects

In support of this and to look at the disbursement scheduling, preliminary cost estimates have also been prepared for the UFW control plan main elements and these are presented in Table 6.2 and Figure 6.5. The costs are split between foreign (J) and local (M) components.

6.10 SUMMARY OF RECOMMENDATIONS

The key recommendations and conclusions are summarised as follows:

- UFW is a big problem in Yangon and should be properly addressed
- UFW control efforts should be integrated with general water supply improvements
- A team should be set up and trained as soon as possible and charged with the task of beginning to deal with the problem
- Similarly, repair teams should be set up trained and supplied with proper repair materials
- UFW control will require a long and sustained effort over many years
- Cost-benefit analysis will determine the level of UFW to be aimed for

The key target and sequence objectives for preliminary planning are:

- UFW now 65 %
- Overall Target 30%
- Leakage Ratio Target:
 - 45% 2005
 - 40% 2010
 - 35% 2015
 - 25% 2020

With large scale rehabilitation and expansion, leakage rates in these new areas should be much lower and so this target could be improved on.

Table 6.2 UFW Control Plan: Project Cost Estimates (1/2)

Item	Description	Unit cost \$(2001)		Units	Number of Units (total for period)									
		Internatl.	Local		Setup 02		03 to 05		05 to 10		10 to 15		15 to 20	
		J	M		J	M	J	M	J	M	J	M	J	M
Project Control														
					495,000	186,400	130,000	264,000	825,000	768,000	1,700,000	1,428,000	1,650,000	1,428,000
UFW Control Unit					130,000	32,000	0	80,000	0	128,000	50,000	128,000	0	128,000
	Personnel (excl. ALC teams)	0	24,000	annual		1		3		5		5		5
	Training	80,000	8,000	Lump Sum	1	1		1		1		1		1
	Equipment	50,000	0	Lump Sum	1						1			
ALC Teams					65,000	17,600	130,000	83,200	325,000	256,000	650,000	520,000	650,000	520,000
	Personnel (team of 2 technicians)	0	4,800	annual		2		14		50		100		100
	Training	0	4,000	Lump Sum		2		4		4		10		10
	Equipment	32,500	0	Lump Sum	2		4		10		20		20	
UFW Repair Unit (not truly UFW cost)					300,000	136,800	0	100,800	500,000	384,000	1,000,000	780,000	1,000,000	780,000
	Personnel (team of 5 tech.s +labour)	0	7,200	annual		14		14		50		100		100
	Training	0	6,000	Lump Sum		6		0		4		10		10
	Equipment	50,000	0	Lump Sum	6				10		20		20	
		0	0											
	Metering & Data Collection	0	0		650,000	48,500	2,445,000	315,000	4,075,000	525,000	4,255,000	390,000	4,530,000	390,000
Production Metering & Bulk Supply Zones					465,000	22,500	0	0	0	0	310,000	0	0	0
	Meter Chambers	0	1,500	Lump Sum		15								
	Meters, Loggers etc.	31,000	0	Lump Sum	15						10			
	Operating costs	0	0	annual										
District/Zone Metering					0	0	480,000	21,000	800,000	35,000	320,000	0	480,000	0
	Meter Chambers	0	700	Lump Sum				30		50				
	Meters, Loggers etc.	16,000	0	Lump Sum			30		50		20		30	
	Operating costs	0	0	annual										
Pilot Area/Waste Metering/DMA's					85,000	6,000	765,000	54,000	1,275,000	90,000	2,125,000	90,000	2,550,000	90,000
	Meter Chambers	0	600			10		90		150		150		150
	Meters, Loggers etc.	8,500	0		10		90		150		250		300	
	Operating costs	0	0											
Network Preparation (part of Rehab costs)					100,000	20,000	1,200,000	240,000	2,000,000	400,000	1,500,000	300,000	1,500,000	300,000
	Valves etc.	10,000	2,000	Lump Sum	10	10	120	120	200	200	150	150	150	150
	Operating costs	0	0											
		0	0											
	Physical Loss Control	0	0		3,120,000	114,000	0	0	0	0	0	0	0	0
ALC Teams		0	0	see UFW Unit										
Pressure Management		120,000	14,000	Lump Sum	1	1								
Repair Materials		3,000,000	0	One off	1									
Service Pipe Repairs		0	100,000	One off		1								
		0	0											
	Non-Physical Loss Control	0	0		540,000	219,588	1,560,000	627,000	2,600,000	4,045,000	2,600,000	2,230,000	2,600,000	2,230,000
Large Users					120,000	10,000	360,000	30,000	600,000	50,000	600,000	50,000	600,000	50,000
	Monitoring & Control (annual)	0	10,000	annual		1		3		5		5		5
	Metering & Calibration (annual)	120,000	0	annual	1		3		5		5		5	
Non-Domestic Consumers					400,000	160,000	1,200,000	480,000	2,000,000	800,000	2,000,000	800,000	2,000,000	800,000
	Metering & Calibration (annual)	400,000	160,000	annual	1	1	3	3	5	5	5	5	5	5
Domestic Consumers		0			0	27,000	0	81,000	0	3,135,000	0	1,320,000	0	1,320,000
	PCC surveys	0	27,000	annual		1		3		5				
	Universal Metering (one-off)	0	3,000,000	One off						1				
	Meter replacement & Repair (ann)	0	264,000	annual								5		5

Table 6.2 UFW Control Plan: Project Cost Estimates (2/2)

Item	Description	Unit cost \$(2001)		Units	Number of Units (total for period)									
		Internatl.	Local		Setup 02	03 to 05	05 to 10	10 to 15	15 to 20					
Meter Repair Workshop					20,000	22,588	0	36,000	0	60,000	0	60,000	0	60,000
	Workshop	0	10,588	Lump Sum		1								
	Equipment	20,000	0	Lump Sum	1									
	Operating costs (annual)	0	12,000	annual		1		3		5		5		5
		0	0											
	Related Activities	0	0		450,000	540,000	33,000	356,400	0	594,000	33,000	594,000	0	594,000
Information systems					300,000	360,000	0	0	0	0	0	0	0	0
	GIS	100,000	120,000	One off	1	1								
	MIS	100,000	120,000	One off	1	1								
	CIS	100,000	120,000	One off	1	1								
Byelaws & Technical Standards					0	0	0	237,600	0	396,000	0	396,000	0	396,000
	Preparation	0	0	?										
	Enforcement	0	79,200	annual				3		5		5		5
District Inspectors					33,000	39,600	0	0	33,000	118,800	0	198,000	33,000	198,000
	Equipment	33,000	0	Lump Sum				1				1		
	Personnel	0	39,600	annual				3		5		5		5
Mapping of Network					100,000	120,000	0	0	0	0	0	0	0	0
	Field Survey	100,000	100,000	One off	1	1								
	Recording & Data Input	0	20,000	One off		1								
Mapping of Customers (combined w.Network)					50,000	60,000	0	0	0	0	0	0	0	0
	Field Survey	50,000	50,000	One off	1	1								
	Recording & Data Input	0	10,000	One off		1								
		0	0											
	Technical Assistance	0	0											
UFW Consultants					888,000	88,800	1,776,000	177,600	0	0	0	0	0	0
	Technical Assistance Unit	888,000	88,800	annual	1	1	2	2						
		0	0											

Period Totals					6,143,000	1,197,288	5,944,000	1,740,000	7,500,000	5,932,000	8,588,000	4,642,000	8,780,000	4,642,000
Total per year					6,143,000	1,197,288	1,981,333	580,000	1,500,000	1,186,400	1,717,600	928,400	1,756,000	928,400

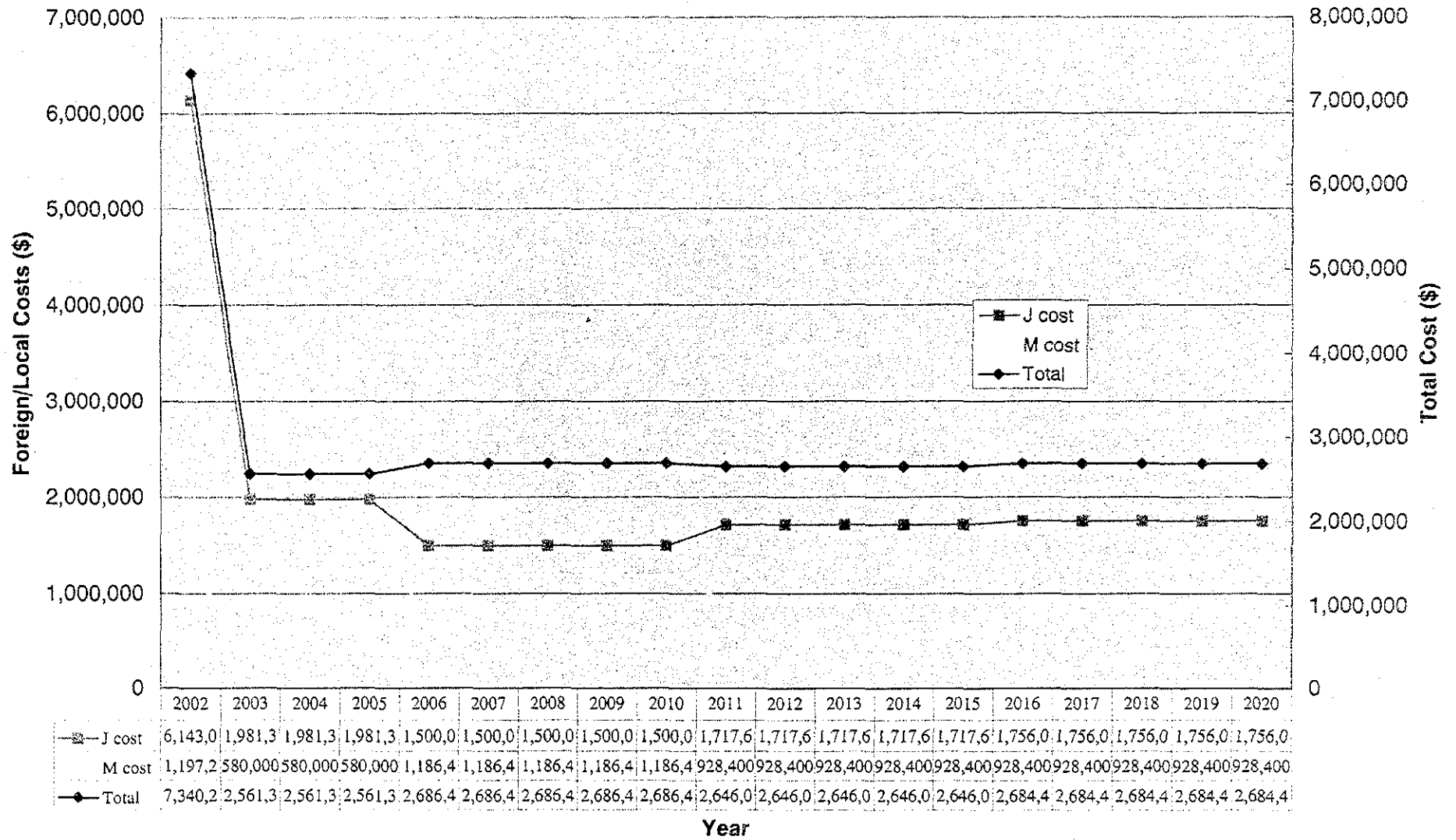


Figure 6.5 UFW Cost by Year

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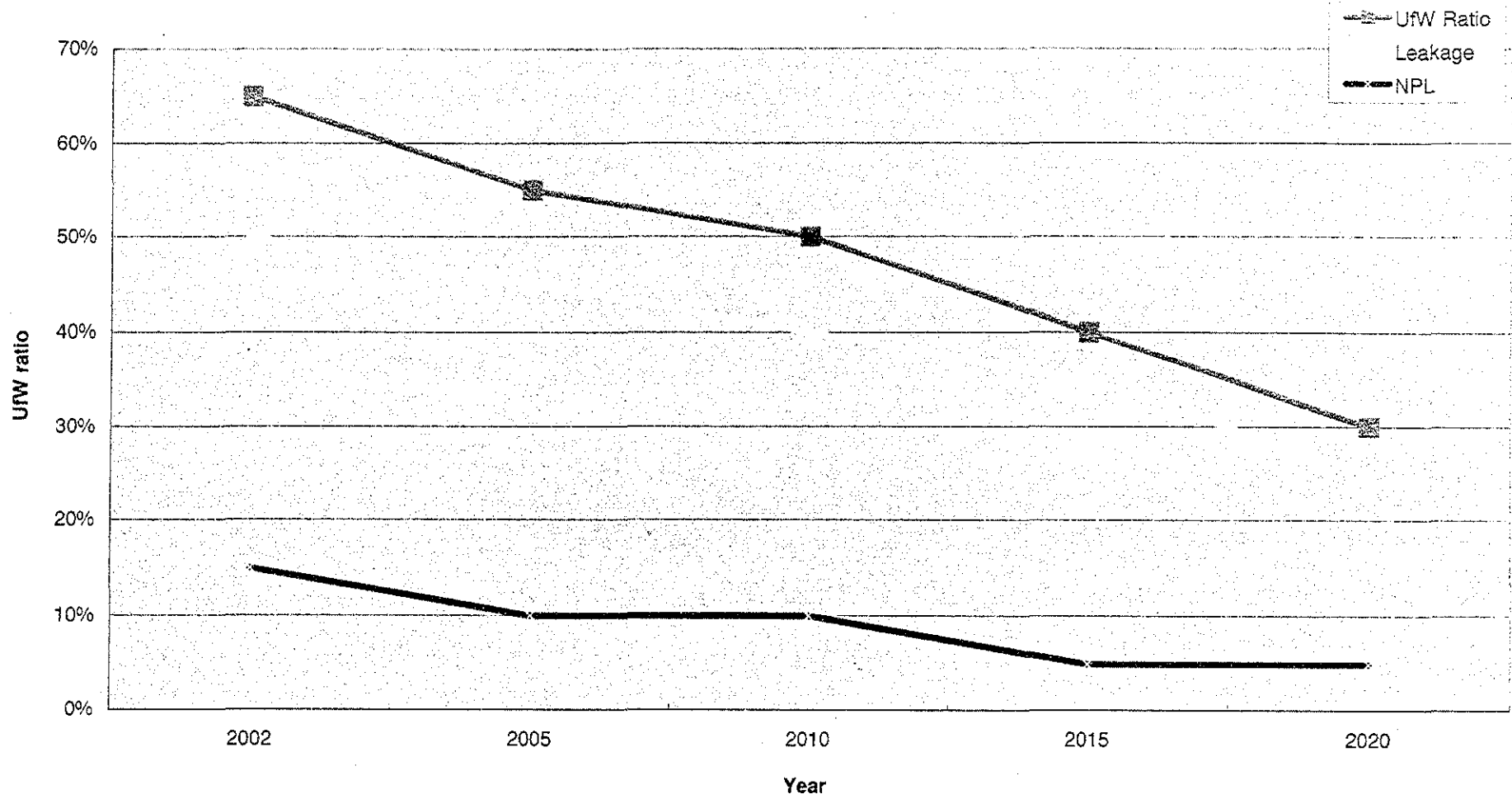


Figure 6.6 UFW Control: Preliminary Phasing Estimate

CHAPTER 7

INSTITUTIONAL AND ORGANIZATIONAL DEVELOPMENT PLAN

CHAPTER 7 INSTITUTIONAL AND ORGANIZATIONAL DEVELOPMENT PLAN

The institutional and organizational development plan of the Master Plan (MP) presented in this Chapter should be considered as an integral part of the overall Plan. The overwhelming importance of institutions and organizations may be highlighted by the fact that they provide the machinery for the implementation of the entire Plan as a whole.

Institutions are referred to as formal structures with established lines of command, a legal framework with a high level of endurance, among others. Organizations, on the other hand are temporary structures, which may either be in the process of formation or moving towards structural stability. Their working arrangements are yet to be formalized so are their legal framework. In other words, institutions as referred to in this Chapter are permanent bodies while the organizations are not.

Within an institution may be several organizations, which are on their way towards formalizing the structures. For instance, the Water Supply and Sanitation (engineering) department itself is an institution whereas the proposed Planning, Programming and Monitoring division which itself is in the process of formation within the former is considered an organization.

Hence, the focus of this Chapter is both on institutions and organizations.

Institutions and organizations exist to perform a task be it water supply, operation & maintenance or any other task. So much so managers in the process of projects and programme planning encourage their formation and establishment.

7.1 PURPOSE

The purpose of this Chapter is to identify and present the plan for institutional and organizational development that includes their arrangements for the purpose of water supply management under the MP. As already mentioned earlier, the main purpose of institutions and organizations is to perform task/s. Hence, the discussion in this Chapter follows the important tasks of City water supply management.

The proposals are outlined in section 7.3 followed by a proposed schedule for implementation in section 7.4. The latter section also discusses the proposed beginning and end date together with the duration for each main activity.

It is to be noted that the proposals presented are only at a broader level. It would be necessary to prepare details of activities pertaining to each broad area for implementation.

The last section of this Chapter outlines an approximate cost of institutional and organizational development plan. It is to be noted that the cost estimations are *gross approximations at this stage*. They need to be reviewed, modified and changed, as more reliable details are available in the feasibility stage.

7.2 METHODOLOGY

The methodology employed to formulate proposals comprises of three components. The main component was the institutional and organizational analysis including the constraints for proper functioning conducted by the study team. This analysis was based on the existing status already discussed in Chapter 3. Each institutional and organizational issue was analysed in order to ascertain what potential improvements are needed and the strategy to deal with, considering the proposals that are being made to improve City water supply system.

The other components of the methodology were discussions with the stakeholders, making observations and estimations by the study team. Discussions with stakeholders and making observations on each identified improvement with a view to implementation resulted in identifying the necessary institutions and their potential arrangements.

7.3 MAIN INSTITUTIONAL AND ORGANIZATIONAL ISSUES

As already pointed out above, the Master Plan presents only the main issues and some important activities in a much broader sense. The Plan indicates several areas where further studies are needed before implementation itself could be begun.

It is suggested that the issues identified are prioritised and then action plans prepared showing the beginning and end date for each activity. The action plan should be meticulously followed and closely monitored.

The main issues are discussed in sub-sections from 7.3.1 to 7.3.9.

7.3.1 Organizational Changes

The present structure of WSS department (already discussed in Chapter 3) is in principle considered adequate to improve City water supply. However, certain changes are suggested to the existing divisions and sections to strengthen their capacity.

The five main changes proposed are listed below:

- o Creation of a new division for planning, programming and monitoring (PPM)
- o Reorganization of water distribution division, store section, research section and computer section
- o Placement of computer and research sections under the new PPM division
- o Operationalization of Water Quality Monitoring section
- o Institute improved working arrangements.

It is suggested that the other divisions will wherever necessary be supported and strengthened depending on the outcome of further review at the feasibility stage of the current project.

It is suggested that the expected functions of all divisions/sections are defined and a functional analysis is performed to identify any overlapping as well as unassigned functions.

(1) Organizational structure of divisions/sections

It is proposed to change the organizational structure of Water Distribution division, institute planning functions in each division and township, and a new division and 3 sections are created. The main changes suggested are described below.

1) Planning, Programming and Monitoring division

A new division is proposed to be created for taking leadership in planning, programming and monitoring (PPM) responsibilities. It is suggested that the Engineer (CE) himself heads this division. By placement of this new division directly under the CE will convey the over-riding importance of this division and its functions. This will also make it possible for the CE to devote a considerable time for corporate issues such as setting goals and long-term targets, coordination with other agencies, monitoring, etc. The CE will be the de facto head of this division. In practice a senior planner assisted by other staff undertakes the work of the division.

It is proposed that the research and computer sections are strengthened, capable staff recruited and other resources provided. The two sections are proposed to be relocated within the PPM division.

On a separate argument, considering the importance of training throughout the department on the one hand and the lack of capacity of the Finance and Administration division to handle training on the other, it is suggested that a training section is established within the PPM division. When the human resources division is better organized to handle training needs, the training section could be relocated within human resources in future.

The CE in his new position will be assisted by a team of officers including a senior planning and programming specialist, 2-3 planning and monitoring assistants and other supporting staff. It is suggested that a senior planning and programming specialist is initially provided under a bilateral programme of assistance. In the long-term it is proposed that a national staff member replaces the advisor.

The proposed organizational chart for this division is given in Figure 7.1.

A tentative list of functions, staff composition and equipment suggested for the PPM division is found in Table 7.1.

It is suggested that detailed functions of the PPM division and its sections are developed in close consultation and collaboration with relevant stakeholders.

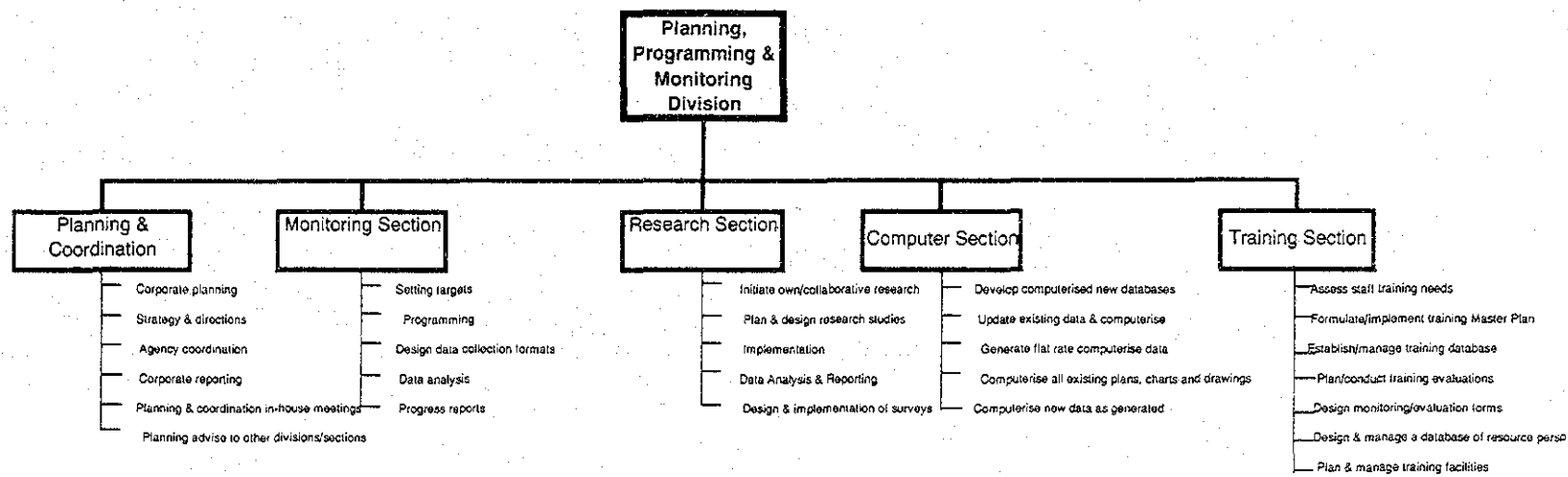
In order to initiate, and strengthen planning and programming capabilities of other divisions, it is suggested that a relevant position is established in each. It is expected that planning and programming staff of other divisions under the directions and guidance of the PPM will assist develop divisional / sectional plans.

2) Water Distribution Division

Water distribution division is the key to effective operation and maintenance of the transmission and distribution systems with low level of water leaks. The revenue generation capacity of the department is also influenced by the effectiveness of this division. The above suggests that strengthening of this division should be a top priority.

It is proposed to reorganize the division to include five sections. Each section will have several task-oriented teams to carry out specific work throughout the supply system. The division will have new responsibilities such as customer and client relations, control of unaccounted for water, data analysis and reporting, etc. These changes call for a new name for this division. The name suggested is "Water Distribution Services Division".

The proposed organizational chart for this division is presented in Figure 7.2.



7-5

Figure 7.1 Organization Chart and Functions of Planning, Programming and Monitoring Division

Table 7.1 Functions and Staffing of Planning, Programming and Monitoring Division

Title	Functions	Staff
Planning, Programming & Monitoring (PPM) Division	<ul style="list-style-type: none"> • Initiate development of an organizational vision and long-term plan (up to year 2020) • Assist other divisions / sections and field offices in work planning, target setting, programming and monitoring • Assist prepare roles and functions for each division and section • Coordination with other ministries / agencies 	<ul style="list-style-type: none"> • Division Head (CE) • Planning, Programming & Monitoring Advisor (to be replaced by a permanent staff member) • Planning assistants (SAE) 2 positions
Research Section	<ul style="list-style-type: none"> • Plan & conduct own research (hardware and software) to improve water supply • Plan and undertake collaborative research with other agencies • Unit to be established within PPM Division 	<ul style="list-style-type: none"> • Professional engineer with experience in research management • Research assistant
Computer Section	<ul style="list-style-type: none"> • Planning & organizing to develop a computerised database covering all work areas of the department • Computerise all data, maps and charts relevant to water supply and management • Generate progress reports as required by PPM • Other present functions 	<ul style="list-style-type: none"> • No changes needed at this stage
Training Section	<ul style="list-style-type: none"> • Assist conduct an assessment of training needs • Collaborate in the formulation of training Master Plan from 2000 to 2020 	<ul style="list-style-type: none"> • Training specialist (short-term to be replaced by a qualified

	<ul style="list-style-type: none"> • Plan and implement specific training programmes as per the Master Plan • Design formats for data collection and develop a training database • Responsible for planning and implementing training evaluations • Develop and maintain training facilities • Develop and manage a database of resource persons 	<p>staff member)</p> <ul style="list-style-type: none"> • Trainer (SAE rank) • Supporting staff
Monitoring Section	<ul style="list-style-type: none"> • Plan and design programme of monitoring • Design formats for data collection and strategy for computerisation • Advise all other divisions and township offices in data collection and verification • Data analyses and reports 	<ul style="list-style-type: none"> • AE rank as head • 1-2 monitoring assistants (SAE)

Note: Supporting staff to be recruited as required

A tentative list of functions, staff composition and equipment suggested for the PPM division is found in Table 7.1.

It is suggested that detailed functions of the PPM division and its sections are developed in close consultation and collaboration with relevant stakeholders.

In order to initiate, and strengthen planning and programming capabilities of other divisions, it is suggested that a relevant position is established in each. It is expected that planning and programming staff of other divisions under the directions and guidance of the PPM will assist develop divisional / sectional plans.

2) Water Distribution Division

Water distribution division is the key to effective operation and maintenance of the transmission and distribution systems with low level of water leaks. The revenue generation capacity of the department is also influenced by the effectiveness of this division. The above suggests that strengthening of this division should be a top priority.

It is proposed to reorganize the division to include five sections. Each section will have several task-oriented teams to carry out specific work throughout the supply system. The division will have new responsibilities such as customer and client relations, control of unaccounted for water, data analysis and reporting, etc. These changes call for a new name for this division. The name suggested is "Water Distribution Services Division".

The proposed organizational chart for this division is presented in Figure 7.2.

A brief discussion on the proposed functions for different sections is given below. The functions of O&M section are discussed in section 7.3.4.

Customer and client service section

The customer and client service section is responsible for instituting water connections and meters, dealing with water customers and clients together with the development of relevant databases.

As discussed in Chapter 4, the overall service ratio is to be increased from 37% in 2000 to 70% in 2020. It is proposed that the final service ratio of 70% is achieved by a gradual increase in service ratio of 50% in 2005, 60% in 2010, 65% in 2015 and finally 70% in 2020. Of course the rate of increase in service ratio among townships would be different from 2000 to 2020. The above increase in service ratio is expected to follow the construction schedule planned.

The proposed increase in service ratio calls for a substantial lift in the actual connection rate between 2002 and 2020. The overall increase in the connection rate is given in Table 7.2. The Tables 7.3 to 7.7 show the expected increase in connection rate by townships for years 2,000, 2005, 2010, 2015 and 2020 respectively.

Table 7.2 Rate of Increase of Water Connections by Year

Year	Served Population	Number of Connections*	Total Connections Number	Service Ratio (%)
2000	1,443,441	206,206	206,206	37
2002-2005	2,201,500	108,294	314,500	50
2006-2010	2,973,000	110,214	424,714	60
2011-2015	3,601,650	89,807	514,521	65
2016-2020	4,311,300	101,379	615,900	70

Note: (*) It is assumed that one connection serves seven persons.

It is to be noted that the current connection number in the above Table (ie.206,206) does not compare with the number of connections as reported by YCDC (Chapter 3, Table 3.11) ie.112,315. This could either be due to sharing of one connection by several units or data accuracy problem or both.

It should be emphasised that the expected connection rates for different years are estimated using more accurate data. This is one of the main tasks to be performed at the Feasibility Study (FS) of the current study.

The comparison of expected figure with the actual connection rate at present would indicate the man power and other resources that would have to be committed in order to bring about the desired connection rate. The average actual connection rate at present is about 750 with a maximum of 1300 connections per month. This rate is expected to go up to a maximum of 2,256 new connections per month in 2002-2005 (Table 7.4).

It is to be highlighted that the increase in new connections for any given phase will have to be put in place before the beginning of the next phase. For instance, the 110,214 new connections will have to be fixed at the latest by 2010. Hence, it would be necessary to consider new arrangements in order to achieve the connection rate as presented in above Table.

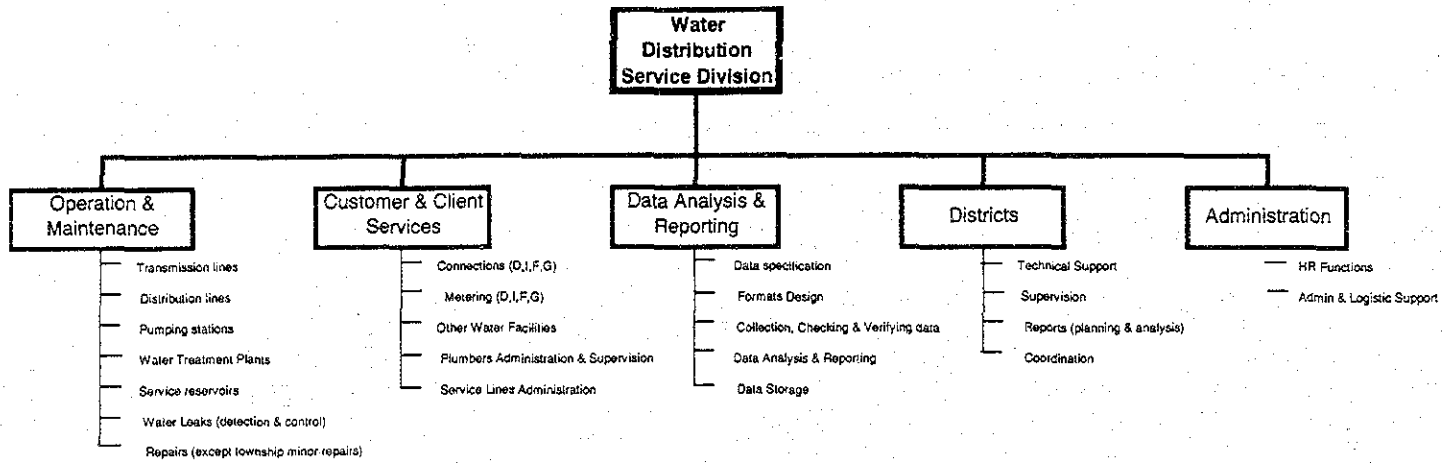


Figure 7.2 Organization Chart and Functions of Water Distribution Service Division

It is inevitable that such an increase can only be achieved by two main institutional arrangements. Firstly, it is obviously necessary to increase the staff responsible for connections in water distribution division from the present 6 to about 15. This represents an increase of connection staff by nearly 3 fold. Additional staff would also be necessary to provide meters for the current unmetered connections. It is realistic that meter connection for the existing backlog of unmetered connections be phased out until 2015. This is an additional demand for which resources should be allocated.

Secondly, more efficient institutional arrangements to provide connections would be needed. It is necessary to work out the details of staff increase and the necessary institutional arrangements to cope up with the demand for connections.

Table 7.3 Expected Service Ratio and New Connections by Township in 2000

Township	Population in 2000	Service Ratio (%)	Served Population in 2000	Served Units in 2000
Ahlonge	45,870	26	12,044	1,721
Bahan	100,139	91	91,622	13,089
Botataung	55,434	88	48,684	6,955
Dagon	42,079	97	40,974	5,853
Dagon Myothit (East)	58,108	0	0	0
Dagon Myothit (North)	107,045	0	0	0
Dagon Myothit (Seikka)	19,245	0	0	0
Dagon Myothit (South)	147,804	0	0	0
Dala	81,317	12	9,954	1,422
Dawbon	83,787	2	1,721	246
Hlaing	176,751	10	18,170	2,596
Hlaingthaya	209,714	0	0	0
Insein	253,421	10	26,082	3,726
Kamayut	87,325	47	41,022	5,860
Kyauktada	46,405	100	46,405	6,629
Kyeemyindaing	92,113	20	18,817	2,688
Lanmadaw	42,742	97	41,311	5,902
Latha	34,254	100	34,254	4,893
Mayangone	192,694	67	128,947	18,421
Migalardon	179,982	20	35,456	5,065
Mingalartaungnyunt	115,597	99	114,759	16,394
North Okkalapa	304,339	66	200,791	28,684
Pabedan	49,969	100	49,969	7,138
Pazundaung	40,390	100	40,390	5,770
Sanchaung	82,951	40	32,869	4,696
Seikan (port)	1,452	20	290	41
Seikkyi Kanaungto	26,938	0	0	0
Shwepyitha	181,484	0	0	0
South Okkalapa	231,849	68	157,686	22,527
Tamwe	135,242	92	123,921	17,703
Thaketa	294,582	14	41,839	5,977
Thingahgyun	253,119	7	18,883	2,698
Yankin	112,859	59	66,581	9,512
Total	3,887,000	37	1,443,441	206,206

Note: Unit refers to domestic, commercial/industry or departmental connection. Being a small number, foreign connections are excluded from the above estimation

For details on above estimations, please refer to Chapter 4 Table 4.19.

It is suggested that staff capable of dealing with customers and clients are appointed to customer service section.

Table 7.4 Expected Service Ratio and New Connections by Township from 2002-05

Township	Service Ratio (%)	Cumulative (2000-05) Served Population	Served Population in 2002-05	Number of Units (2002-05)	Monthly Connection Number
Ahlonge	45	21,637	9,593	1,370	29
Bahan	97	99,622	8,000	1,143	24
Botataung	94	53,869	5,185	741	15
Dagon	100	43,029	2,055	294	6
Dagon Myothit (East)	10	7,616	7,616	1,088	23
Dagon Myothit (North)	20	28,191	28,191	4,027	84
Dagon Myothit (Seikka)	10	2,523	2,523	360	8
Dagon Myothit (South)	20	38,926	38,926	5,561	116
Dala	21	19,319	9,365	1,338	28
Dawbon	40	38,970	37,249	5,321	111
Hlaing	40	74,230	56,060	8,009	167
Hlaingthaya	10	27,487	27,487	3,927	82
Insein	40	112,397	86,315	12,331	257
Kamayut	60	54,841	13,819	1,974	41
Kyauktada	100	46,405	0	0	0
Kyeemyindaing	38	37,069	18,252	2,607	54
Lanmadaw	100	42,742	1,431	204	4
Latha	100	34,444	190	27	1
Mayangone	75	160,782	31,835	4,548	95
Migalardon	40	83,620	48,164	6,881	143
Mingalartaungnyunt	100	118,673	3,914	559	12
North Okkalapa	74	256,684	55,893	7,985	166
Pabedan	100	49,969	0	0	0
Pazundaung	100	41,194	804	115	2
Sanchaung	55	46,942	14,073	2,010	42
Seikan (port)	20	290	0	0	0
Seikkyi Kanaungto	10	3,082	3,082	440	9
Shwepyitha	10	23,787	23,787	3,398	71
South Okkalapa	76	190,443	32,757	4,680	97
Tamwe	98	136,962	13,041	1,863	39
Thaketa	40	134,224	92,385	13,198	275
Thingahgyun	31	86,138	67,255	9,608	200
Yankin	69	85,393	18,812	2,687	56
Total	50	2,201,500	758,059	108,294	2,256

Note: Unit refers to domestic, commercial/industry or departmental connection. Being a small number, foreign connections are excluded from the above estimation

For details on above estimations, please refer to Chapter 4, Table 4.19.

Table 7.5 Expected Service Ratio and New Connections by Township from 2006-10

Township	Service Ratio (%)	Cumulative (2000-10) Served Population	Served Population in 2006-10	Number of Units Connected in 2006-10	Monthly Connection Number
Ahlonge	63	32,256	10,619	1,517	25
Bahan	100	104,375	4,753	679	11
Botataung	100	59,531	5,662	809	13
Dagon	100	44,000	971	139	2
Dagon Myothit (East)	30	28,454	20,838	2,977	50
Dagon Myothit (North)	40	70,088	41,897	5,985	100
Dagon Myothit (Seikka)	30	9,424	6,901	986	16
Dagon Myothit (South)	40	96,775	57,849	8,264	138
Dala	30	30,815	11,496	1,642	27
Dawbon	48	54,377	15,407	2,201	37
Hlaing	48	93,523	19,293	2,756	46
Hlaingthaya	30	102,692	75,205	10,744	179
Insein	48	149,550	37,153	5,308	88
Kamayut	73	69,765	14,924	2,132	36
Kyauktada	100	46,405	0	0	0
Kyeemyindaing	55	57,582	20,513	2,930	49
Lanmadaw	100	42,742	0	0	0
Latha	100	34,635	191	27	0
Mayangone	83	198,050	37,268	5,324	89
Migalardon	48	116,549	32,929	4,704	78
Mingalartaungnyunt	100	121,830	3,157	451	8
North Okkalapa	83	323,855	67,171	9,596	160
Pabedan	100	49,969	0	0	0
Pazundaung	100	42,014	820	117	2
Sanchaung	70	61,939	14,997	2,142	36
Seikan (port)	20	290	0	0	0
Seikkyi Kanaungto	30	10,657	7,575	1,082	18
Shwepyitha	30	88,869	65,082	9,297	155
South Okkalapa	84	227,459	37,016	5,288	88
Tamwe	100	145,672	8,710	1,244	21
Thaketa	48	183,476	49,252	7,036	117
Thingahgyun	54	168,260	82,122	11,732	196
Yankin	79	107,122	21,729	3,104	52
Total	60	2,973,000	771,500	110,214	1,837

Note: Unit refers to domestic, commercial/industry or departmental connection. Being a small number, foreign connections are excluded from the above estimation

For details on above estimations, please refer to Chapter 4, Table 4.19.

Table 7.6 Expected Service Ratio and New Connections by Township from 2010-15

Township	Service Ratio (%)	Served Population	Served Population (2011-2015)	New Connection Number (2011-2015)	Monthly Connection Number
Ahlonge	82	43,985	11,729	1,676	28
Bahan	100	106,559	2,184	312	5
Botataung	100	61,691	2,160	309	5
Dagon	100	44,993	993	142	2
Dagon Myothit (East)	32	36,609	8,155	1,165	19
Dagon Myothit (North)	42	88,583	18,495	2,642	44
Dagon Myothit (Seikka)	32	12,125	2,701	386	6
Dagon Myothit (South)	42	122,314	25,539	3,648	61
Dala	39	44,823	14,008	2,001	33
Dawbon	52	68,498	14,121	2,017	34
Hlaing	52	106,375	12,852	1,836	31
Hlaingthaya	32	132,126	29,434	4,205	70
Insein	52	179,638	30,088	4,298	72
Kamayut	87	85,863	16,098	2,300	38
Kyauktada	100	46,405	0	0	0
Kyeemyindaing	73	80,571	22,989	3,284	55
Lanmadaw	100	42,742	0	0	0
Latha	100	34,827	192	27	0
Mayangone	92	241,561	43,511	6,216	104
Migalardon	52	146,653	30,104	4,301	72
Mingalartaungnyunt	100	125,071	3,241	463	8
North Okkalapa	91	404,312	80,457	11,494	192
Pabedan	100	49,969	0	0	0
Pazundaung	100	42,850	836	119	2
Sanchaung	85	77,907	15,968	2,281	38
Seikan (port)	23	334	44	6	0
Seikkyi Kanaungto	32	13,233	2,576	368	6
Shwepyitha	32	114,340	25,471	3,639	61
South Okkalapa	92	269,208	41,749	5,964	99
Tamwe	100	151,185	5,513	788	13
Thaketa	52	226,415	42,939	6,134	102
Thingahgyun	77	267,741	99,481	14,212	237
Yankin	90	132,144	25,022	3,575	60
Total	65	3,601,650	628,650	89,807	1,497

Note: Unit refers to domestic, commercial/industry or departmental connection. Being a small number, foreign connections are excluded from the above estimation

For details on above estimations, please refer to Chapter 4, Table 4.19.

Table 7.7 Expected Service Ratio and New Connections by Township from 2016-20

Township	Service Ratio (%)	Served Population (2000-20)	Served Population in 2016-20	Units Connected in 2016-20	Monthly Connection Number
Ahlonge	100	56,916	12,931	1,847	31
Bahan	100	108,789	2,230	319	5
Botataung	100	63,930	2,239	320	5
Dagon	100	46,009	1,016	145	2
Dagon Myothit (East)	33	44,400	7,791	1,113	19
Dagon Myothit (North)	43	106,271	17,688	2,527	42
Dagon Myothit (Seikka)	33	14,705	2,580	369	6
Dagon Myothit (South)	43	146,736	24,422	3,489	58
Dala	48	61,782	16,959	2,423	40
Dawbon	56	85,775	17,277	2,468	41
Hlaing	56	120,277	13,902	1,986	33
Hlaingthaya	33	160,242	28,116	4,017	67
Insein	56	214,503	34,865	4,981	83
Kamayut	100	103,206	17,343	2,478	41
Kyauktada	100	46,405	0	0	0
Kyeemyindaing	90	106,267	25,696	3,671	61
Lanmadaw	100	42,742	0	0	0
Latha	100	35,021	194	28	0
Mayangone	100	292,237	50,676	7,239	121
Migalardon	56	183,440	36,787	5,255	88
Mingalartaungnyunt	100	128,399	3,328	475	8
North Okkalapa	100	500,938	96,626	13,804	230
Pabedan	100	49,969	0	0	0
Pazundaung	100	43,703	853	122	2
Sanchaung	100	94,895	16,988	2,427	40
Seikan (port)	28	407	73	10	0
Seikkyi Kanaungto	33	16,008	2,775	396	7
Shwepyitha	33	138,671	24,331	3,476	58
South Okkalapa	100	316,213	47,005	6,715	112
Tamwe	100	156,906	5,721	817	14
Thaketa	56	277,751	51,336	7,334	122
Thingahgyun	100	387,442	119,701	17,100	285
Yankin	100	160,885	28,741	4,106	68
Total	70	4,311,300	709,650	101,379	1,690

Note: Unit refers to domestic, commercial/industry or departmental connection. Being a small number, foreign connections are excluded from the above estimation. For details on above estimations, please refer to Chapter 4, Table 4.19.

Districts section

In view of the expected increase in billing rate, the capacity of townships has to be expanded. As the districts section has the responsibility for coordination of all townships and districts operations, its capacity has to be increased. The asking capacity includes servicing the existing customers as well as the additional customers who would be provided with water by 2020. The latter figure stands at 70% by the target year.

The current billing rate for flat rate water charges is about 90% whereas the metered billing rate is nearly 100%. As discussed above, it is expected to convert all flat rate accounts to metered accounts by 2015. Hence, in future all customers will be billed based on meter reading by the target year. However, the flat rate accounts will continue until 2015. In the interim, it is therefore necessary to increase billing rate for flat connections to achieve 100%.

As much as billing is important collection of water charges is equally important. Similar to the increase in billing load the collection load will also increase by several folds. On an argument similar to the connection rate, it is therefore necessary to investigate measures to increase billing rate. This would obviously call for an increase in staff numbers in the townships as well as in the connection section, better procedures including coordination and institutional arrangements. These details are to be worked out at subsequent stages of the project.

Data analysis and reporting section

The main function of this section is to collect operational data from other sections, plan and undertake data collection by itself and finally carryout data analysis work. The data collection and analysis tasks would cover all work areas of the division such as O&M, leakage control, connections, billing, collection, etc. The relevant activities concerning unaccounted for water are already discussed in Chapter 6.

Data collection, analysis and reporting being new functions, it is critical that staff possessing the relevant capabilities is recruited to this section.

Training of new and existing staff, and the provision of equipment and other hardware and software facilities are needed. The details of these facilities will be worked out during the feasibility stage. The section 7.3.3 discusses some staff training needs.

4) Stores section

The store section of the department needs to be reorganized, staff capacity strengthened and the store itself is equipped with adequate supply of spare parts and other supplies. It is

anticipated that the reorganization will enable the store section to meet all spare parts and chemicals needed for management of the water supply system in an efficient and in a cost-effective manner.

The reorganization will include but not confined to the following components:

- Capacity enhancement through staff training on store management
- Develop and institute modern store management principles and inventory control procedures
- Reorganize the store (with spare parts properly numbered and displayed) and expand the store in such a way to stock the total departmental requirements of spare parts and chemicals
- Appoint other staff for management of the store and to build relationships with spare parts and chemicals dealers.

It is expected that the performance of store section will be enhanced by new staff placement, training, studies proposed in section 7.3 and other changes suggested within the department. The management of the spare part and chemicals dealer network could be a function that may well suit for the store section.

5) Electrical and Mechanical Division

Proposed in Chapter 5 are several new facilities (pumping stations, water treatment plants, tube wells, service reservoirs, etc.) to improve water supply in the City. It is necessary that the Electrical and Mechanical division is adequately equipped to service new and existing facilities. The present organizational structure of this division is considered adequate to address the requirements at this stage. However, some existing facilities need to be improved and new facilities are proposed.

An assessment of these facilities, manpower requirement and the cost estimations will be made at the feasibility stage.

6) Water Quality Monitoring Section

It is proposed that the water quality section is strengthened with new and qualified staff and is equipped with adequate hardware to carry out its assigned functions. The arrangements are already being planned to build a laboratory for the section.

The initial focus will be on water quality monitoring of the YCDC-owned system. This long-run, it is proposed that this section in collaboration with the relevant authorities start monitoring water quality of the City water supply system at large. It is suggested that the functions are undertaken in close coordination with YCDC Health department

The main changes proposed are the definition of its functions, provision of hardware facilities for quality measurement, recruitment of staff, and training of both existing and new staff.

7) Other divisions

It is considered that other divisions may not need reorganization at this stage. It is however to be stated that the actual work to be performed by other divisions be evaluated at the time of feasibility stage. The results from such analyses are utilized in making appropriate changes at that stage.

It would be appropriate that the Finance and Administration division be broadened in effected, training section which now sits in PPM could be moved over to the human resources division.

(2) Planning, programming and progress monitoring

As discussed in Chapter 3, several changes are necessary for the department to be able to accomplish of its expected functions in an effective manner. In this connection, planning, programming and monitoring functions should be developed, strengthened and effectively utilized.

Planning comprises of corporate planning and strategy, and operational planning. The corporate planning and strategy will focus on the vision, the goals and a long-term plan for the department. The focus of operational planning will be the implementation of specific activities developed under the overall corporate plan.

Once a corporate plan is formulated indicating long-term targets, it is necessary to prepare a programme of action to achieve the plan. The programme will specifically show a series of achievable targets (short-term) in respect of each long-term goal, the details of institutional arrangements, modalities of implementation and other working arrangements. The programme may also be known as an operational plan. Actions shown in the programme must be monitored closely to ensure the accomplishment of both short-term and long-term goals and thereby to facilitate realisation of the broader goal namely, to enable a reliable supply of potable drinking water for the entire City population. Towards this end, an effective system of monitoring is proposed.

In keeping with the planning, programming and monitoring culture to be developed within the department, a suitable planning position within each of the 30 township offices is suggested. The township planner under the direction and guidance of the PPM will assist the

township engineer to develop, monitor and implement township programme within the overall departmental plan.

The PPM in close consultation with divisional and township plans will formulate the departmental plan for a specified duration.

It is suggested that institutional arrangements for planning relating to the district set up are formulated as appropriate.

(3) Coordination arrangements

It is proposed that the existing coordination arrangements such as the monthly meeting of township engineers and the bi-monthly meeting with the heads of divisions/sections both chaired by the CE will continue, with certain modifications made. It is suggested that a substantial portion of the meeting is devoted to discuss progress of divisional plans, problems and solutions.

Some new coordination arrangements proposed for the implementation of the Master Plan are listed below:

- A planning meeting comprising of all head of divisions chaired by the CE to decide on a broader plan for the department. The PPM will assist in the preparation of this plan
- The PPM will identify targets and the major activities relevant for each township for presentation at the monthly meeting of township engineers chaired by the CE.
- The township engineers will be asked to prepare township plans and to set targets with dates
- The PPM will prepare and present achievements by each township at subsequent monthly meetings
- The staff of PPM will work closely with their counterparts in the divisions and townships to assist target setting, develop own plans, programming, monitoring and preparation of reports.
- Subsequent meetings of the head of divisions will review progress achieved and agree on remedial action, if needed.

It is suggested that the above arrangements are institutionalised beyond the Master Plan period.

7.3.2 Human Resources

The present status of human resources and some of the main problems were discussed in Chapter 3. It is expected that the Master Plan would strengthen the capacity of the departmental staff to manage its own water system efficiently, productively, economically and in a sustainable manner. For this purpose, strengthening of human resources within the department is a necessary requirement. The main areas for such strengthening are discussed below:

(1) Staffing

It is suggested that staff requirements considering the new work areas proposed in the Master Plan are assessed and arrangements to recruit new staff are made. In the meantime, action needs to be taken to fill all existing vacant posts, the professional posts in particular.

The following proposals are submitted:

- Prepare a recruitment policy and a plan to accomplish needs
- Fill all vacant positions in head office and in field offices including the townships
- Determine professionals (type and number) to carry out new functions and prepare policy of recruitment of such staff
- Prepare details for staff placement
- Provide any pre-service training if needed

(2) Job analysis

It is proposed that job functions and description are prepared, reviewed and finalised. Once job descriptions are prepared, a job analysis should be carried out to assess whether the descriptions cover all functional areas of the department and thereby to identify duplications as well as missing gaps, if any. The job analysis should include both head office and field offices. Initially, the emphasis should be to review and prepare job descriptions for all of the professional staff.

Rationalization of job functions should be an essential part of the job analyses. The purpose of job rationalization is especially to free the senior managers from being involved in undertaking day-to-day tasks. It is suggested that such tasks be delegated to other senior staff.

Once the job analysis for the professional staff has been completed the attention be then placed to conduct similar job analysis for other ranks. The Finance and Administration division of the department assisted possibly by the Master Plan project would undertake the latter.

As suggested in section 7.3.1, the recruitment of some key staff from other professions (non-engineering professionals) becomes a necessity to implement the Master Plan. As the department does not have a history of recruitment of non-engineers for senior management

positions, it is suggested that the relevant recruitment procedures are developed. Together with planning for new recruitments a salary review need to be carried out. As discussed in Chapter 3, the present salary structure for staff is considered inadequate to sufficiently motivate them to do their jobs effectively. Hence, a salary revision in keeping with the agreed government principles and procedures is suggested.

(3) Professional development programme

As discussed in Chapter 3, a considerable number of "professionals" who by virtue of their experiences have been promoted to higher ranks. The majority of such staff has not had any professional training in engineering. Nevertheless, they manage water supply operations in key areas including being in-charge of operations in several townships.

It is recommended that the above staff be provided with opportunities aimed at securing professional training on water supply and sanitation. Considering the number of professionally unqualified staff in-charge of townships (11 out of 30 townships at present), it would be quite possible to organize professional courses in collaboration with higher educational institutes in the country.

Two other proposals are suggested. Firstly sharing of knowledge gathered following the completion of overseas/in-country study/tour are suggested. Possibilities are presentations, discussions and mini-workshops. It is necessary that members who have completed a tour or study either overseas or in a local institution upon return to the department present a seminar to their fellow professionals. The Master Plan proposes several opportunities for study both overseas and in-country. Occasions for knowledge sharing are expected to increase remarkably in future. It is suggested that the department should capitalise on such opportunities to provide professional development to others especially those who have not had the benefit of professional training.

Secondly, the professional staff should be encouraged to pursue their activities in professional associations wherever possible. It is necessary to examine what opportunities exist in this area

It is expected that the implementation of the above two proposals will have a positive impact on professional development.

Staff training is closely associated with human resources which is discussed in the next section.

7.3.3 Training

The importance of training for efficient management of all departmental work has been highlighted in Chapter 3. The Master Plan proposes that this requirement is met by a twofold

strategy namely, (a) undertaking a training needs assessment and (b) formulation of a training Master Plan for the period 2000 to 2020.

The training needs assessment is the significant tool to assess training needs as well as the facilities available for training within the department. The proper identification of training needs including facilities is a fundamental requirement before the design of a package of training to suit staff at different levels of the department. Hence, the training needs assessment becomes a very high priority.

Some of the specific areas for training together with the approximate number of staff to be trained are listed in Table 7.8. It is to be noted that the Training Master Plan will show a plan to train all ranks of staff mentioned in the above Table and those not.

Much of the training listed in the above Table can be provided in-country. It is suggested that overseas training is resorted to whenever the facility does not exist within the host country. The training needs assessment referred to above will identify details including what different types of training can be provided in-country vis-a-vis overseas.

The suggested modes of training are of 7 types (Table 7.9). It is proposed that the optimum combination involving both in-country and overseas training is worked out in the Training Master Plan.

It is suggested that the Terms of Reference (TOR) for training needs assessment is drawn up such that all needs and types are thoroughly addressed.

The Appendix Table K-9 outlines some concerns for consideration in undertaking the training needs assessment.

Based on the outcome of the above assessment, it is suggested that the preparation of a training Master Plan addressing requirements through to 2020 is undertaken.

Some significant training milestones to be accomplished by the current project are outlined below:

- Management training for corporate staff would initially focus on the development of an organizational vision and long-term goals up to 2020
- Each professional staff of the department should participate at least in one professional training every other year while each professional staff without such qualification should undergo training every year

- Professional staff without qualifications need to acquire professional qualifications within a stipulated time period
- Professional staff training will include both engineering and other professional subjects (ie. data collection & analysis, planning, monitoring, customer management, etc.) relevant to their work.

It is expected that the training Master Plan will address to above issues.

Table 7.8 Example of Staff Training Needs by Work Area

Subject area	Examples of Training Activity	Trainees	
		Rank	Number
Reservoir management	Prevention of contamination, monitoring of water level and water quality	All professional and supervisory staff of 4 reservoirs	12
Water Treatment Plant	Prevention of contamination, monitoring of raw and treated water quality, determining correct combination/amount of water treatment chemicals, adding and mixing chemicals, keeping records	Engineers and supervisors of 2 Water treatment Plants	6
Groundwater	Prevention of contamination, monitoring of water level and water quality	Township engineer & engineering assistants	22
Ponds management	Prevention of contamination, cleaning, on-site water treatment	Township engineer & assistants	25
Pumps	Operation and maintenance of mechanical and electrical equipment, keeping records, minor repairs	Engineers and supervisors of pump	12
Water transmission line	Daily inspection of leakage or damaged portion	Leakage prevention team engineers and supervisors	18
Water quality analysis	Determine sampling sites, sample collection, determine types of analyses, analyse data, frequency of sampling, reaching conclusions	Quality control supervisors and assistants in Water Quality Monitoring section	10
Service reservoirs	Water level monitoring and control, keeping and analysis of records	Engineers, assistant engineers and supervisors of O&M section	39
Distribution lines	Daily inspection of leakage or damaged portion, repair of defects, collecting and recording data	Engineers, assistant engineers and supervisors of O&M section	99
Service lines	ditto	Engineers, assistant engineers and supervisors of O&M section	33
Water leaks and unaccounted for water	Training on water leakage detection using modern equipment, preparation of annual leakage deduction plan, gathering, recording and analysis of data	Relevant engineers and supervisors of O&M section	33
Repairs of mechanical / electrical gadgets	Up grade repairing skill, basic records and data analysis	Engineers, assistant engineers and supervisors of Electrical & Mechanical division	10

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Meter repair	Detecting problems and repairing meters using modern techniques	Workshop staff in-charge of meter repairs	33
Data collection, checking and editing, summarising	Identify data types, develop databases, preparation of formats, data checking	Township engineer & planning assistants, planning assistants in divisions, district engineer, planning assistants in PPM	70
Corporate planning & strategy	Organization vision, organization strategy, long-term and short-term plan	Corporate staff	12
Targets & work programming	Setting targets, programme preparation to achieve targets, monitoring, programme review, evaluation	Planning assistants in PPM, divisions & townships	40
Information & communication materials	Determine subjects, types of materials for different situations, using IE materials	Representative staff from townships, districts and NGO	70
Store management & inventory control	Store management principles, inventory control, creation and operation of computer-aided inventory system	Operational staff of store, township store assistants	35
Customer & client management	Preparation of customer databases, identify data types, customer/client feedback, complaints management and recording	Staff of customer & client service section, relevant staff of townships	65
Data analysis & reporting	Data analysis, preparation of tables, reporting	Planning assistants in PPM, divisions & townships	40

Note: Above data need to be verified when more details of proposed work are available in the feasibility stage

Table 7.9 Examples of Modes of Proposed Training

Training Mode	Description
Induction	All new recruits if already not in possession of the relevant skills
In-service	All ranks of staff. More frequently for professional staff
On-the-job	All new recruits especially junior professionals
Long-term	Professional staff leading to recognized qualifications. Could be either in-country or overseas
Short-term	Professional staff leading to recognized qualifications. Could be either in-country or overseas
Study tours	Professional staff of all types either in-country or overseas
Professional events	Professional staff participation in professional talks, seminars, workshops etc. Includes participation in seminars abroad.

7.3.4 Operation & Maintenance, Repairs and Parts

The four main proposals to strengthen the operation and maintenance (O&M) of the system are:

- (a) Strengthening of O&M section
- (b) Development of O&M manuals and procedures
- (c) Institutional arrangements and
- (d) Undertake some relevant studies.

The other important items such as staff training and customer awareness building relating to O&M are found elsewhere.

The above proposals are briefly discussed below.

(1) Strengthening O&M section

The main changes proposed are: (a) institutionalise O&M and repairs functions within water distribution service division (b) staff consolidation and (c) access to spare parts and repair funds. Details of the first item were already discussed in section 7.3.1 (3). It is suggested that functions of the O&M section are developed in the feasibility stage.

Six main teams within the newly institutionalised O&M section are proposed. Their main function is to strengthen O&M activities relevant to the operational area (see Table 7.10). It is to be noted that some of these teams may already be in "existence" which need to be properly identified, staffed and made operational.

These teams and their main responsibilities are summarised in the Table below:

Table 7.10 Functional Areas and Some Responsibilities of O&M Teams

Title of Team	Operational Area	Responsibilities
Transmission & Distribution Lines	All transmission & distribution lines	Operation and maintenance activities of transmission and distribution lines
Pumping Stations	5 existing and 12 proposed pumping stations	O&M, minor repairs and gathering & recording data
Service Reservoirs	3 existing and 11 proposed service reservoirs	Flow measurement and adjustment, O&M, repair of minor leaks and data gathering, recording & basic analysis
Water Treatment Plants	6 water treatment plants	Plant operation, O&M, adding and mixing chemicals, data gathering, recording and analysis
Leak Detection & Control	Transmission, distribution, service lines	Detect new and existing leaks and repair them in a systematic way covering the entire supply system. Doesn't include service lines.
Repairs*	Transmission and distribution lines, facilities	Assess repairs needed and repair the defects.

Note: * Repairs to electrical and mechanical fit outs will be undertaken by Electrical & Mechanical division

It is necessary that the staff numbers and composition of different teams are determined, allocate individual staff members to each team, provide training and equip the teams with funds and materials. The O&M teams should have access to advance funds the limit of which are to be specified. They should also have access to the departmental store, which is proposed to be adequately equipped (Section 7.3.1 (2)).

With above teams in place and the staff members trained, it would now be possible to release the CE from being involved in routine O&M tasks such as the approval for new connections for apartments, authorising repair Works Authority (Chapter 3), etc. This would make it possible for the CE to devote considerable time on corporate planning and strategy development. The proposed changes, on the other hand are expected to expedite urgent O&M work.

It is also suggested that O&M and repairs by township staff are improved by training, development of efficient procedures and keeping proper records of work.

(2) Manuals and procedures

As already discussed in Chapter 3, the current procedures are either outdated or may not formally exist at all. Given the above scenario, the relevant staff within their resources attempts

to fix problems relating to O&M. Their action will always not bear fruits. The other major problem is the absence of proper standards concerning the quality of repairs and maintenance work. The latter issue is a major obstacle to improve standards of repairs undertaken by private plumbers at present. The private plumbers carry out repair work on customer service lines. The quality of repairs themselves and the spare parts used are found to be far from the desired standards.

In solving above problems, it is proposed that an O&M manual and the standards (of spare parts, fit outs and chemicals) for use in the supply system are produced. Their production should be followed by awareness creation, education and training of staff on new roles as well as to make private plumbers thoroughly familiar with standards and procedures.

(3) Studies

As a part of the procedure to strengthen the capability of the department to undertake O&M effectively, two studies are proposed. A brief description of the proposed studies is given in the table below:

Table 7.11 Themes and Purpose of Studies to Strength Operation & Maintenance

Name of Study	Purpose	Description
Status of O&M and repair	Assess process & quality of repairs and O&M on the system and propose measures to improve.	The study will have 2 parts. Part 1 focuses on customer repairs while the second part will cover the operational status of private plumbers registered with the department
Adequacy of spare parts, tools and stores	The 4 components of this study are: (1) Assess spare parts and chemicals required for O&M (2) Prepare a list of spare parts & chemical dealers in Yangon and propose a system of management (3) Assess tools required for O&M of main system and distribution system (4) Identify where needed and assess size of township stores	The first component will produce a list of spare parts and chemicals needed to manage the system for 2 years. The second component is aimed at improving the availability of quality spare parts in Yangon in partnership with the private sector The third component will result in a list of tools needed by O&M staff The fourth component will lead to building of stores in townships as a part of strengthening O&M

Note: The scope and the specific Terms of Reference for all above studies will have to be developed.

It is suggested that additional recommendations as proposed by above studies are taken up for implementation.

(4) Awareness and training

It is recommended that the relevant township staff should be made aware of O&M procedures, of the manual itself and the process of its development. Hence staff familiarisation workshops should form an important part of the development of the O&M manual. When the new manual is available, all townships and main system O&M staff should be thoroughly familiar with the standards, methods and procedures. Towards this end it is suggested that several staff workshops are organized.

The township staff may use relevant sections from the manual to educate customers on new O&M standards as well as expectations. Information materials such as posters, leaflets and brochures need to be prepared to build customer knowledge on basics of O&M relating to their sections (the service lines and connections). This aspect is further discussed in section 7.3.6.

The proposed investments on O&M hardware and leakage control are discussed in Chapter 5.

7.3.5 Database Development and Management

As discussed in Chapters 2 to 5, the lack of data concerning almost all areas of management of the present water supply system is a major drawback for improvement. The roots of the present situation are many. Firstly, an up-to-date database covering important parameters such as population, household numbers, extent of different land use types etc. is not available at present. Secondly, a little emphasis is given for data collection and to verify the accuracy of data already collected. Thirdly, whatever data is available is not stored properly. Hence, the available data cannot be easily retrieved for planning.

It is to be noted that the Master Plan itself was formulated using data sourced from a variety of directions. The accuracy and the coverage of data utilized in this preparation are considered doubtful for some areas. It is in the above context that the development and management of an accurate database is to be highlighted.

(1) The focus

The immediate focus of databases should be on areas useful for the management of the YCDC-owned water supply system. Once this is developed, the attention may then be placed on the development of a database covering the water supply for the entire City (to include non-YCDC supply). It is hoped that the department will have developed a comprehensive database covering water supply for the entire City by 2020.

(2) Types of data and information

In principle, two basic types of data and information important for management of the water supply system are records (ie. numbers of customers, number of meters, population, number of industries, etc.) and information on figures and objects (drawings, maps and plans). As discussed in Chapter 3 and in Appendix O, the status of data collection is not conducive for effective management of the system.

(3) Strategy and guidelines

It is suggested that a strategy aimed at developing an effective and a current database addressing to all concerns is prepared. The strategy itself should define types of databases to be created, procedures for data collection (including the specification of necessary formats) and identify who is responsible for the management of databases at different levels of the organization. As discussed in section 7.3 (1), the development of the database management strategy, procedures and the framework all should become the explicit functions of the PPM division. This division would assume to be the caretaker of the database including making it available for other divisions/ sections, townships and others concerned. The scope of PPM division should specifically identify its responsibility for data collection, storage, up-dating and the overall management.

The Appendix Tables O-1 and O-2 suggest some areas for development of databases of critical importance.

7.3.6 Customer and Clients Relations / Management

Customers are the primary beneficiaries of the water supply programme. They contribute to the revenue of the department to be utilized in the management of facilities. Hence, the relationship between customers and department should be managed so that both groups benefit from each other.

(1) Types of customers

As discussed in Chapter 3, customers fall into three broad groups namely, those who pay for water (flat and metered customers), users of free water (free water connection customers, customers of communal tanks and standpipes) provided by the department and others (users of lakes and ponds) who benefit from water facilities owned and managed by the department. In addition, customers in the City in general who at present do not benefit from YCDC water should also be viewed as customers. It is more appropriate to identify the latter group as "future customers".

It is to be highlighted that the needs, the nature of interactions and the amount contributed to department's revenue by the above three groups are different. Hence, the programme of management of the 3 groups of customers should be different.

The focus of customer management will initially be on those who benefit from individual water connections, realizing that there would not be any unmetered customers in future. This includes both who pay for water and those not. The customer management programme would then focus on the users of other facilities either owned or provided by YCDC. Once a programme to manage existing customers is fully developed, the programme itself may expand to all water customers in the City as a whole.

(2) Proposals

Three main proposals are submitted. They are the development of a reliable and an accurate customer database, a client database, and education of customers and clients. These proposals are described in the next sections.

1) Customer database

The development of a customer database should be a priority. In this regard, it is necessary to identify data needs, design proper formats for data collection and data themselves should be continuously up-dated. The database should cover all three broad types of customers (ie. paid customers, free water users and users of other YCDC facilities). It should produce information such as names, addresses and phone numbers. The paid customers should be identified in details such as the type of water connection (domestic, commercial, government, foreign with all categories split by flat and metered rate). The database should also cover customer complaints and how well the complaints are handled. These databases should be continuously updated as new and revised data are gathered.

2) Client database

An accurate database of clients such as plumbers, dealers of chemicals and spare parts and others with whom the department work with is another priority. It is suggested that clients such as plumbers and dealers are registered within the department. They may be asked to send in returns such as the type and number of work done, areas of repair work, etc. at regular intervals. This information would reveal a valuable source of information for the management of the supply network and for planning.

3) Customer and client education

Finally, an effective programme aimed at providing better information and education for customers as well as clients is needed. The customer education should focus on improving

water sanitation, effective water use with reduced waste, information about the status of City water supply and the plans for improvement, and water tariffs, among many other potential subjects. The sanitation programme should particularly concentrate on those customers who obtain their domestic water from communal tanks and ponds/lakes.

On the other hand, the clients need information such as O&M strategies, standards and procedures. They also need to be educated for the execution of quality repair work of customer lines and connections, and training on modern techniques to detect repair needs.

It is observed that the type of skills needed to educate the diversity of water customers are not possessed by the staff at present. Moreover, it would take a considerable effort and a long time to develop staff skills in this area. In the meantime, several non-governmental organizations (NGOs) in Myanmar possess a rich experience in building awareness of and providing education for people on sanitation, and working effectively with resource poor communities. Considering the above, it is suggested that the responsibility for conducting customer awareness and education programmes under the direction of the department be handed over to a few carefully selected NGOs. They are more effective in providing education at grassroots level and are capable of developing participatory arrangements needed for cleaning communal tanks, ponds and lakes. The IE materials and database development work will significantly strengthen developing better work relationships between the staff and the customers.

Hence, the Master Plan proposes that small grants are provided to selected NGOs for the purpose of customer awareness building, education and possibly training on identified subjects. These activities will be planned and managed under the supervision of the water distribution and customer services division and the township staff.

The Appendix Table K-10 provides some areas for improvement of customer awareness, training and provision of education.

It is also recommended that the responsibility for attending to customer complaints and their needs be transferred from head office staff to township staff.

The reorganized water distribution and customer service division would coordinate customer relations. In townships, the meter reading and administrative staff who have contacts with the customers need to be trained in handling of complaints and recording the relevant information. The NGOs would assist meter reading staff in developing productive relationships between staff and customers and recording all work carried out.

7.3.7 Information and Education Materials

Information and education materials are designed to provide information (connection procedures, regulatory matters, billing procedure, new water tariffs, etc.) and to educate (proper water habits, methods of water saving, cleaning water facilities, value of free water, etc.) water customers. The IE materials also provide information to clients such as registered plumbers and spare parts dealers. These materials will have a positive impact on developing an informed group of customers and clients. The result would be the improved management of the supply system including its O&M.

The only IE material being utilized at present is the newspapers the penetration of which among the City water customers is considered to be poor.

It is proposed that following actions are undertaken:

- Identify important subjects for the preparation of IE materials. Include areas such as the present status of water supply system and the proposed improvements to City water supply, among others
- Develop potentially useful education/communication materials (ie. posters, leaflets, brochures, etc.) to provide publicity and to educate stakeholders
- Plan to distribute materials in customer and client educational programmes.

Several staff workshops are proposed to identify the type of materials while the writing itself would be by a consultant. Other broad areas of work are presented in section 6.4.

7.3.8 Legislative and Regulatory Matters

It is to be highlighted that a large number of users share the same water source, and its optimal use while source protection should be a priority. It is foreseen that YCDC will have to own drinking water facilities throughout the City in future. As a result, several legal issues relating to the ownership and management of water resources and facilities are likely to emerge in future. Given the above context, it is critically important that water law is prepared and made operational as a matter of priority. In this regard, it is noted that YCDC has already embarked on the development of a law relating to aspects of water use and management in the City. The law should be formulated, agreed upon and be brought into action.

As discussed in Chapter 3, the present byelaws and regulations are inadequate and outdated (much of it is still based on 1922 byelaws and regulations) to handle the present circumstances. The byelaws in use for instance do not mention about different water connections, communal tanks, and lakes and ponds, which dominate the current supply system. In effect, the present regulatory structure does not represent the needs of the entire supply system.

It is proposed that the byelaws and regulations are made comprehensive, explicit and be focussed both on regulatory as well as educational aspects. The latter is missing in the existing framework.

The other four aspects of the regulatory environment that need to be developed are:

- (a) Delegation of authority to the frontline staff to implement regulations under the supervision of higher ranks;
- (b) Make frontline staff aware of the byelaws and regulations and provide them with training
- (c) Print revised byelaws and regulations and distribute copies to the relevant township staff
- (d) Preparation of leaflets and other print media highlighting specific parts of byelaws for the knowledge of customers and clients.

The above activities suggest that awareness and educational aspects are equally important as the regulatory framework itself. It is expected that the awareness and training needs as far as the regulatory framework is concerned are accomplished by the Training Master Plan (section 7.3.3) while information sharing aspects are considered in the development of information materials (section 7.3.7)

It is suggested that the PPM provides leadership in the development of the regulatory framework.

7.3.9 Communal Water Supply Facilities

The Chapter 3 of this MP provides data on the number of communal tanks supplying water to customers. Many customers who depend on communal supply sources are so poor that it is likely the cost can not be absorbed by them. On the other hand, the small businesses which obtain water from this source of supply should be encouraged to pay the cost.

The MP proposes arrangements to secure the participation of this category of water users in the management of their facility. Among the tasks expected are:

- Awareness building and education for customers aimed at water saving, facility cleaning, maintaining sanitary standards
- Persuade business customers to pay for water
- Train free water use customers on cleaning etc.

In addition, the MP proposes that this facility is expanded wherever considering the economic conditions of the users in different parts of the City.

Among the institutional and organizational arrangements suggested with regard to communal tanks are:

- Creation of structures which provide dedicated service to communal tanks/users
- Making organizational arrangements to facilitate planning, operation and maintenance of the facilities as well as data collection and management
- Staffing to educate, train and build awareness of users of communal facilities
- Secure the assistance of other organizations in educational and training campaigns
- Organizational arrangements to analyse quality of water in communal tanks.

In the meantime, the byelaws and regulations, and the production of EC materials it is expected will strengthen the capacity of the department to deal with this category of water users.

Because of the problems involved in management and water waste, and in keeping with the current YCDC policy, it is recommended that standpipes are discontinued.

7.3.10 Ponds and Ponds Management

The ponds whether artificially created or natural are an important fixture in the landscape in Yangon City. The number of ponds and the estimated number of users of this facility in meeting their domestic water demands were discussed in Chapter 3. Given the large number of people depended upon this facility and the important role in providing water supply particularly in the dry season, the MP recommends that ponds and pond management are to be streamlined.

The proposed activities are:

- Develop a reliable and up-to-date database on ponds and pond users
- Provide protection to ponds
- Provide bridges in ponds where not available
- User education on hygiene in and around the pond
- Participatory cleaning of ponds and water purification efforts

The MP recommends a balance in investment across City landscape to include both pipe water supply and improvement of ponds.

In order to support above activities, the MP recommends following institutional actions:

- Include ponds/ponds management roles in Water Distribution division
- Staffing as appropriate
- Organizational arrangements to provide training, education and other facilities for cleaning
- Secure the assistance of other organizations to educate customers / community

7.3.11 Ward Boundaries

Another constraint affecting the development and management of a proper database is the existing township/ward boundaries. As discussed in Chapter 2, the present boundaries are unclear and several consumers within a given ward are in fact not considered as its residents. Another problem is the inconsistent numbering of wards within townships (Chapter 2).

It is suggested that both township and ward boundaries are made clear and a consistent method of ward numbering be adopted. These strategies will have a positive impact on the development of a customer database and its management for optimum performance.

7.4 DEVELOPMENT PLAN

An analysis of institutions and organizations proposed with a view to identify an approximate time frame for their implementation is presented in this section.

It is to be noted that many of the broader activities are to be taken up for implementation as a package. In other words, certain activities will have to be undertaken simultaneously.

Bearing this in mind, it would be useful to group together activities by their order of priority for consideration in the feasibility stage (Table 7.12).

Table 7.12 Priorities of Institutional and Organizational Activities

Broad Activity Area	Priority (Immediate to less urgent)
Human Resources strengthening	Immediate
Training Master Plan	Immediate
Creation of Planning, Programming & Monitoring capabilities	2 nd priority (Would follow from previous work)
O&M strengthening including support	2 nd priority (Would only result from a balance of trained personnel)
Legislative & Regulatory work	3 rd priority
Customer / Client Training & Education	4 th priority *

Note: * Does not mean that customer/client education is of least important. Effective education and training will only be possible after the development of procedures, regulatory framework, and the capable staff are in place.

Some activities such as the development and management of databases, production of information and education materials, etc. are of critical importance in strengthening the department. It is to be highlighted that their strengthening would flow only after the creation of an effective human resources development plan and proceeded by a comprehensive training plan.

It is to be emphasised that the above list of priorities are slightly adjusted during the feasibility stage of the project considering the construction packages and the time schedule for its implementation.

The beginning and completion dates for each broad activity, and the duration are presented in Figures 7.3 to 7.6.

7.5 COST

The approximate costs for each of the main items were estimated (Table 7.13). It is suggested that the costs are revised as more accurate data become available during the feasibility stage of the project. The long-term and short-term staff training is recommended of which the cost is not estimated at this stage.

Table 7.13 indicates the summary of institutional development cost by the 7 main areas of the Master Plan. More details including the annualised project costs for institutional development are found in Appendix Tables K-11 and K-12.

Table 7.13 Summary of Institutional Development Cost

Main Activity Area	Summary Cost (\$) *	Percentage of Total
Planning, Monitoring & Programming	376,500	32
Operation & Maintenance and repairs	360,000	31
Training	237,900	20
Human Resources Planning & Development	104,000	9
Customer Relations & Education	85,800	7
IE Materials	7,500	1
Legislative & Regulatory	6,500	1
Total	1,178,200	100

Note: * Departmental staff cost excluded

Main Activity	Project Year, 1-20 (Year 1 refers to 2000 and year 20 refers to 2020)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<i>A. Organizational strengthening</i>																				
1. Create, institutionalise and operationalise PPM			■																	
2. Reorganize water distribution service division			■																	
3. Reorganize Store section				■																
4. Reorganize water quality monitoring section			■																	
5. Develop role and functions for each division/section				■	■															
6. Plan and institutionalize coordination arrangements				■																
7. Develop, review & manage database																				
<i>B. Human Resource Development</i>																				
1. Determine staff numbers/ranks by work area			■																	
2. Create job descriptions and conduct job analysis				■																
3. Staff recruitment																				
4. Plan, institute & manage professional development programmes																				
5. Develop/update & manage database																				

Note: Staff training is presented in Figure 7.6

Figure 7.3 Organizational Strengthening and Human Resources Development Plan and Implementation Schedule

Main Activity	Project Year, 1-20 (Year 1 refers to 2000 and year 20 refers to 2020)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Strengthening organization for O&M			■																	
2. Preparation of O&M manual and procedures			■																	
3. Manual & procedures reports				▲																
4. Plan and undertake related studies																				
(a) O&M and status of customer repair			■																	
(b) Assessment of spareparts and tools			■																	
5. Study reports				▲																
6. Customer awareness and education campaigns																				
7. Development & management of O&M database																				
8. Staff training																				
9. O&M planning & management																				

Figure 7.4 Operation & Maintenance Improvement Plan and Implementation Schedule

Main Activity	Project Year, 1-20 (Year 1 refers to 2000 and year 20 refers to 2020)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<i>A. Customer Relations</i>																				
1. Create customer relations section within water distribution service division			■	■																
2. Planning & development of a database			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3. Plan & review awareness and education programmes			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
4. Plan & review NGO contracts				■			■			■										
5. Update & manage database			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
6. Manage customers & their complaints			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
7. Develop and manage NGO contracts				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
<i>B. Clients management</i>																				
1. Institutionalise client management within water distribution service division			■	■																
2. Develop & manage client database				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3. Client management				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
<i>C. Information & educational materials</i>																				
1. Appoint consultant to formulate appropriate materials			■																	
2. Review subjects/ types of materials & production				■		■		■					■							
3. Distribution of IE materials in educational activities				■				■				■				■				■

Figure 7.5 Customer Relations and Information & Education Materials Development Plan

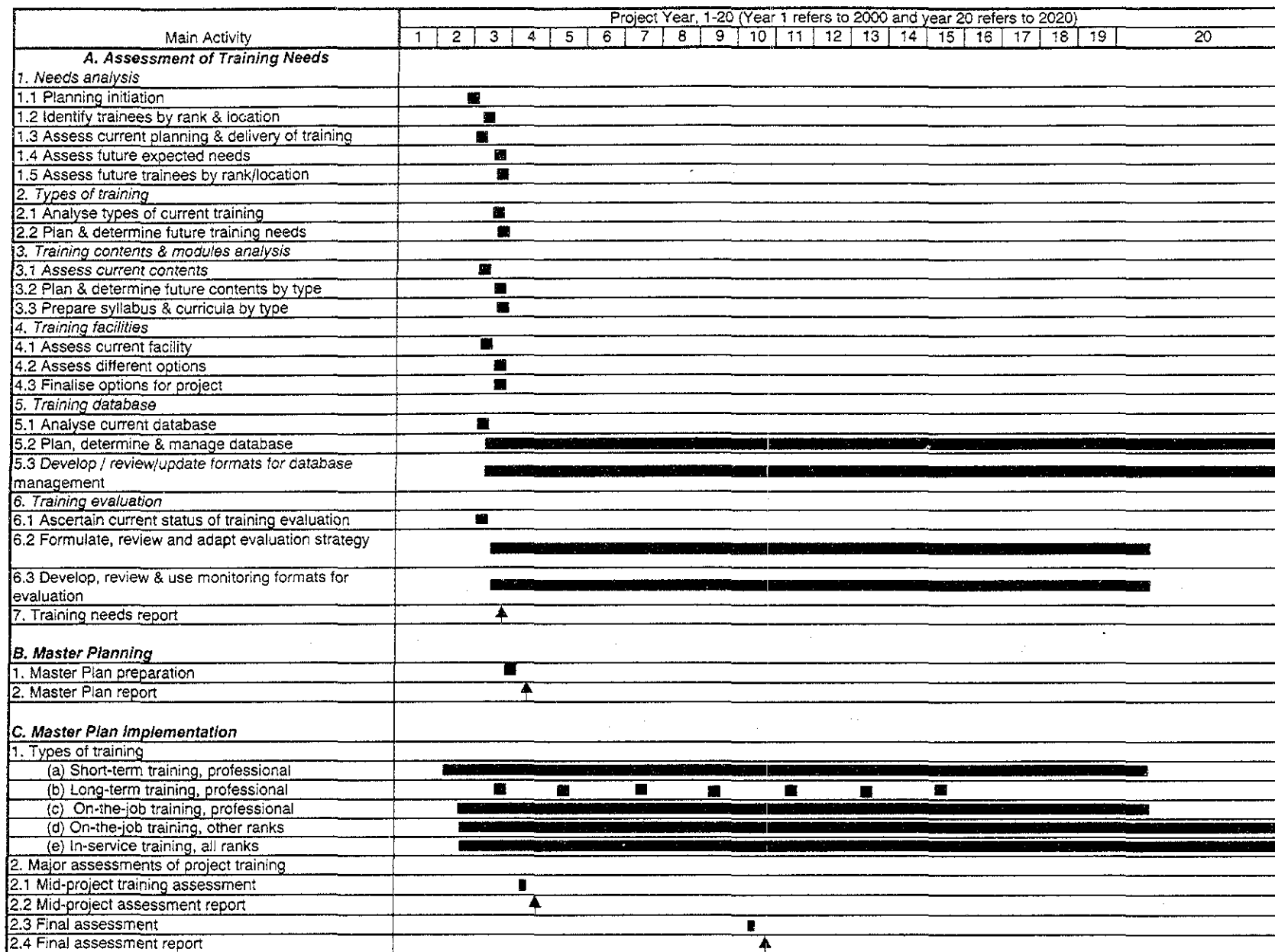


Figure 7.6 Training Plan and Implementation Schedule