7 SUMMARY OF UFW CONTROL PLAN

The body of this appendix has outlined and explained the principles and activities involved in UFW control in general terms, then set out a proposed plan with specific actions and schedules tailored for application to the present situation in Yangon.

In this section, the purpose is to present a short form view of the proposed plan to serve both as an overview summary now and as a reference tool later for monitoring the project once it starts.

This summary is in two forms to serve different needs. First, a checklist of activities is given and second a draft schedule for implementation of the first phase over the initial twelve month period.

From this, a list of priority projects has been drawn up, based on this planning. These will be studied in greater detail in the next phase of this master planning project.

7.1 OVERVIEW OF PLAN

(1) 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
- Record-keeping procedures

7.1.2 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:

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

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.

(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
  Consumer & Connections
- 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.

7.1.3 UFW Water Demand Planning

To recap:

- Present Situation:	65%	UFW	on	400 mld production
- 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 sue 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. This is shown on Figure G 7.1.

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.

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.

7.1.4 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.

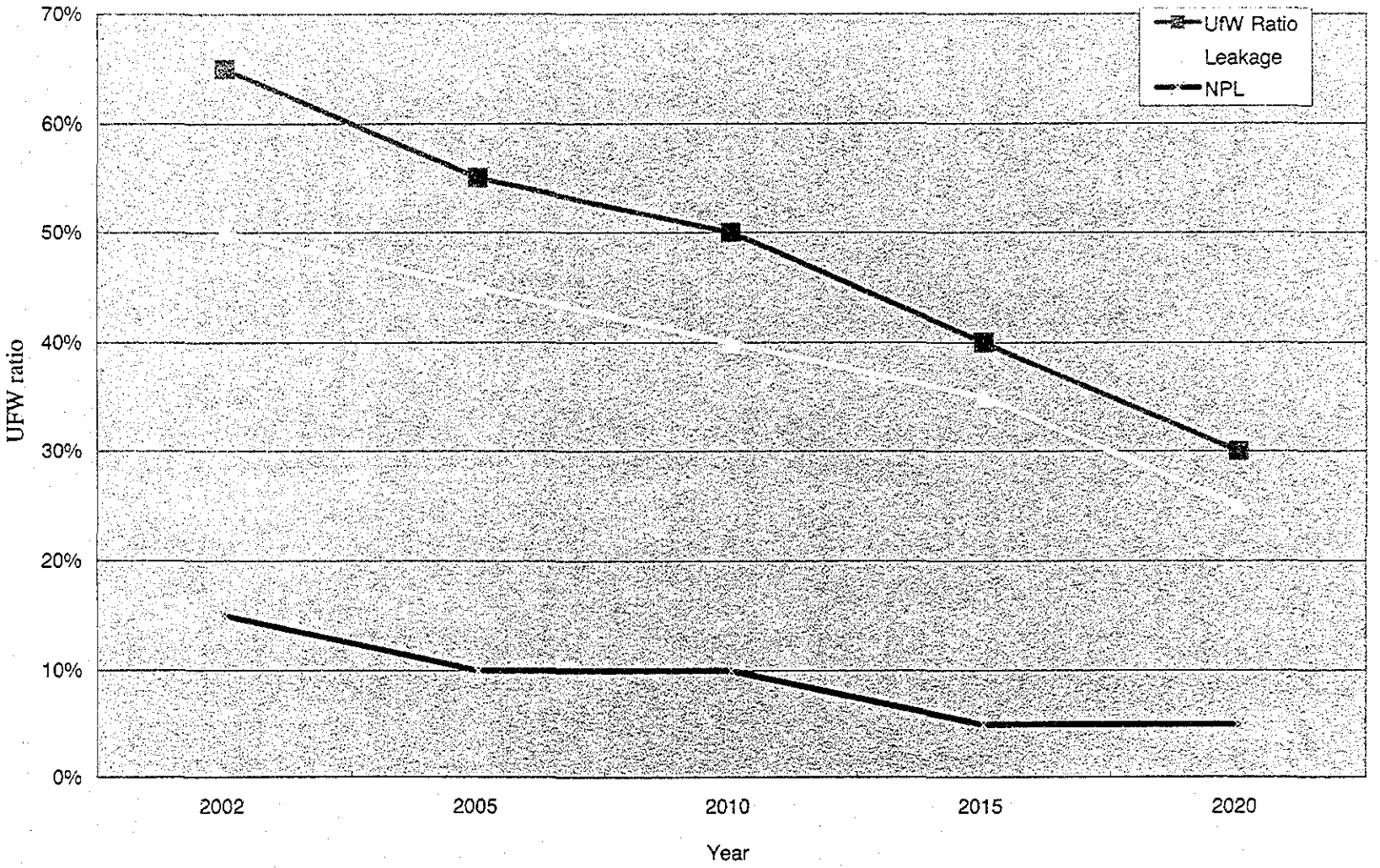

Figure G.7.1 UFW Control: Preliminary Phasing Estimate

(1) Activity 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 G 7.1

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 G 7.1 Checklist of UFW Control Tasks

Item	Activity	Key Action	
No.	Description	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		

(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 (Figure G 7.2). 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 determined during this initial period.

(3) UFW Control Plan Long-term: 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.

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 framework 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.

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						N/A ?							
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							N/A						
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 G7.2 Unaccounted for Water Control Plan for YCDC in Yangon: Phase 1

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 G7.2 Unaccounted for Water Control Plan for YCDC in Yangon: Phase 1

7.1.5 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 G 7.2 and Figure G 7.3. The costs are split between foreign (J) and local (M) components.

Table G7.2 UFW Control Plan
PROJECT COST ESTIMATES

Item	Description	Unit cost $(2001)		Units	Number of Units (total for period)										Remarks
		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		80,000		128,000	50,000	128,000		128,000	
	Personnel (excl. ALC teams)		24,000	annual		1		3		5		5		5	
	Training	80,000	8,000	Lump Sum	1	1		1		1		1		1	
	Equipment	50,000		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)		4,800	annual		2		14		50		100		100	20 teams finally
	Training		4,000	Lump Sum		2		4		4		10		10	
	Equipment	32,500		Lump Sum	2		4		10		20		20		5 year equipment life
UfW Repair Unit (not truly UFW cost)					300,000	136,800		100,800	500,000	384,000	1,000,000	780,000	1,000,000	780,000	
	Personnel (team of 5 tech.s +labour)		7,200	annual		14		14		50		100		100	1 repair team/ALC team
	Training		6,000	Lump Sum		6				4		10		10	finally, but start quicker
	Equipment	50,000		Lump Sum	6				10		20		20		
	Metering & Data Collection				**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					310,000				
	Meter Chambers		1,500	Lump Sum		15									
	Meters, Loggers etc.	31,000		Lump Sum	15						10				10 yr equipment life
	Operating costs			annual											replace meter only
District/Zone Metering							480,000	21,000	800,000	35,000	320,000		480,000		
	Meter Chambers		700	Lump Sum				30		50					
	Meters, Loggers etc.	16,000		Lump Sum			30		50		20		30		10 yr equipment life
	Operating costs			annual											replace meter only
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		600			10		90		150		150		150	
	Meters, Loggers etc.	8,500			10		90		150		250		300		30 new /year +10 yr life
	Operating costs														
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	lump sum per meter
	Operating costs														
	Physical Loss Control				**3,120,000**	**114,000**									
ALC Teams				see UFW Unit											
Pressure Management		120,000	14,000	Lump Sum	1	1									
Repair Materials		3,000,000		One off	1										
Service Pipe Repairs			100,000	One off		1									
	Non-Physical Loss Control				**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)		10,000	annual		1		3		5		5		5	
	Metering & Calibration (annual)	120,000		annual	1		3		5		5		5		includes replacement
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	includes replacement
Domestic Consumers						27,000		81,000		3,135,000		1,320,000		1,320,000	
	PCC surveys		27,000	annual		1		3		5					

Table G7.2 UFW Control Plan
PROJECT COST ESTIMATES

Item	Description	Unit cost $(2001)		Units	Number of Units (total for period)										Remarks
		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	
	Universal Metering (one-off)		3,000,000	*One off*						1					
	Meter replacement & Repair (ann)		264,000	annual								5		5	
Meter Repair Workshop					20,000	22,588		36,000		60,000		60,000		60,000	
	Workshop		10,588	Lump Sum		1									
	Equipment	20,000		Lump Sum	1										
	Operating costs (annual)		12,000	annual		1		3		5		5		5	
	Related Activities				**450,000**	**540,000**	**33,000**	**356,400**		**594,000**	**33,000**	**594,000**		**594,000**	
Information systems					300,000	360,000									
	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								237,600		396,000		396,000		396,000	
	Preparation			?											
	Enforcement		79,200	annual				3		5		5		5	
District Inspectors		33,000	39,600				33,000	118,800		198,000	33,000	198,000		198,000	
	Equipment	33,000		Lump Sum			1				1				10 yr equipment life
	Personnel		39,600	annual				3		5		5		5	
Mapping of Network		100,000	120,000		100,000	120,000									
	Field Survey	100,000	100,000	One off	1	1									
	Recording & Data Input		20,000	One off		1									
Mapping of Customers (combined w.Network)		50,000	60,000		50,000	60,000									combined w. network survey
	Field Survey	50,000	50,000	One off	1	1									
	Recording & Data Input		10,000	One off		1									
	Technical Assistance														
UFW Consultants					**888,000**	**88,800**	**1,776,000**	**177,600**							
	Technical Assistance Unit	888,000	88,800	annual	1	1	2	2							team of 3 for 3 yrs permanent plus visiting experts

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

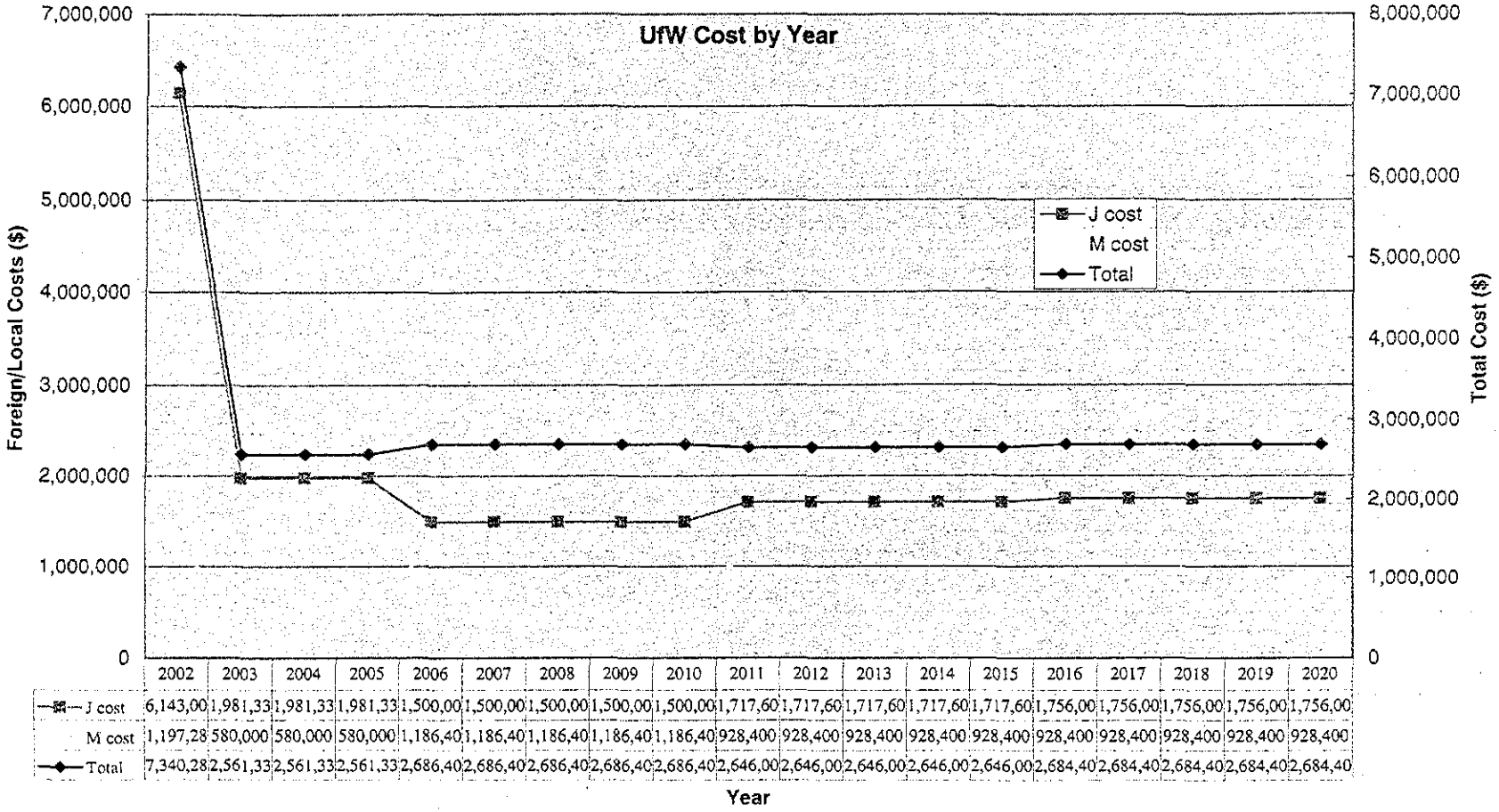

Figure G 7.3 UFW Cost by Year