Rangitaiki Drainage Scheme Asset Management Plan

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Environment Bay of Plenty
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Foreword

This plan is a statement by Environment Bay of Plenty, the Manager of the Rangitaiki Drainage Scheme, as to how it will manage the assets of the scheme. The plan represents prudent management and in particular, is intended to meet the requirements of s90 (the Policy on Significance) of the Local Government Act 2002.

Executive Summary

The purpose of this plan is to provide a document for the management of the Rangitaiki Drainage Scheme and in particular its infrastructural assets. It describes the level of funding required to meet and maintain the scheme objectives and levels of service.

This plan supersedes the 1998 Rangitaiki Drainage Scheme Asset Management Plan.

The plan covers the assets of the scheme including drains, canals, stopbanks, culverts and various other structures. The current valuation of the assets is $19.4m[1].

Maintenance programmes are already in place and these have ensured that the assets are generally in good condition and are providing the desired levels of service.

Environment Bay of Plenty through its day-to-day management of the scheme receives continuous feedback about the scheme. Informal feedback to date indicates strongly that the ratepayers support the scheme objectives as espoused at the time of construction.

Service levels have therefore been defined to ensure the original scheme objectives are met and maintained.

All structures will be maintained in a workable condition at all times to function to their design standards.

Environment Bay of Plenty has a number of tools which are utilised for the management of its assets. Information systems have been purchased and developed to assist the asset managers with general management, maintenance, operations and long term planning. The principal components are the asset management plans, asset register and the financial management system.

Environment Bay of Plenty has developed a maintenance programme strategy, which will provide for the most efficient and economic operation, to the desired service levels. A detailed assessment has been undertaken of the work requirement, to provide for the long term, sustainable management of the scheme assets.

It is estimated that the Scheme will require an average of $636,000 per year to meet its objectives, an increase of 17% on the 2005/06 budget. This sum will allow the regular and ongoing maintenance and renewal expenditure necessary to keep the assets operating at the required level of service and provide an allowance for occasional significant flood damage repairs. It also includes contributions to flood damage and disaster reserves, investigation projects and loan servicing. However it does not include the costs that may be required to fund more extreme flood or disaster damage repairs beyond the levels predicted in the plan. The scheme is funded by scheme rates.

Regular internal and external independent audits will be carried out to establish a continuous improvement cycle, maintain best practices and to assess the quality of asset management.

[1] Dollars are expressed in June 2006 values other than where original scheme contract costs are given or as unless otherwise noted.

Contents

Chapter 1: Introduction

1.1 Asset to be Managed

The Rangitaiki Drainage Scheme provides benefits of gravity drainage to much of the land on the Rangitaiki Plains. The location of the Plains and the Scheme area are shown in Figure 1.

The scheme has substantial physical assets, including

- 88 km of major canals (arterial) and 240km of drains (regional drains)
- culverts at 146 locations (and flapgate structures at all but three of those)
- 2,700 m of low stopbanks
- four erosion control structures

Figures 1a-1f give indicative positions of the assets.

The current valuation of these assets, in June 2006 dollars[2], is $19.4 m.

Note that the scheme assets do not include the stopbanks, edge protection, floodgates and pump stations of the Rangitaiki Tarawera Rivers Scheme or of the Whakatane River Scheme. (These are the subjects of separate asset management plans.) Nor does the plan include the assets of 34 separate communal pumping schemes which generally discharge into the Rangitaiki Drainage Scheme.

This plan provides a single document intended to assist the managers of the Rangitaiki Drainage Scheme, the Bay of Plenty Regional Council (Environment Bay of Plenty). It supersedes the 1998 Rangitaiki Drainage Scheme Asset Management Plan.

[2] Based on an assumed Cost Construction Index (CCI) of 4930. Although CCI figures are no longer published, Environment Bay of Plenty has made an estimate of what the CCI would be.

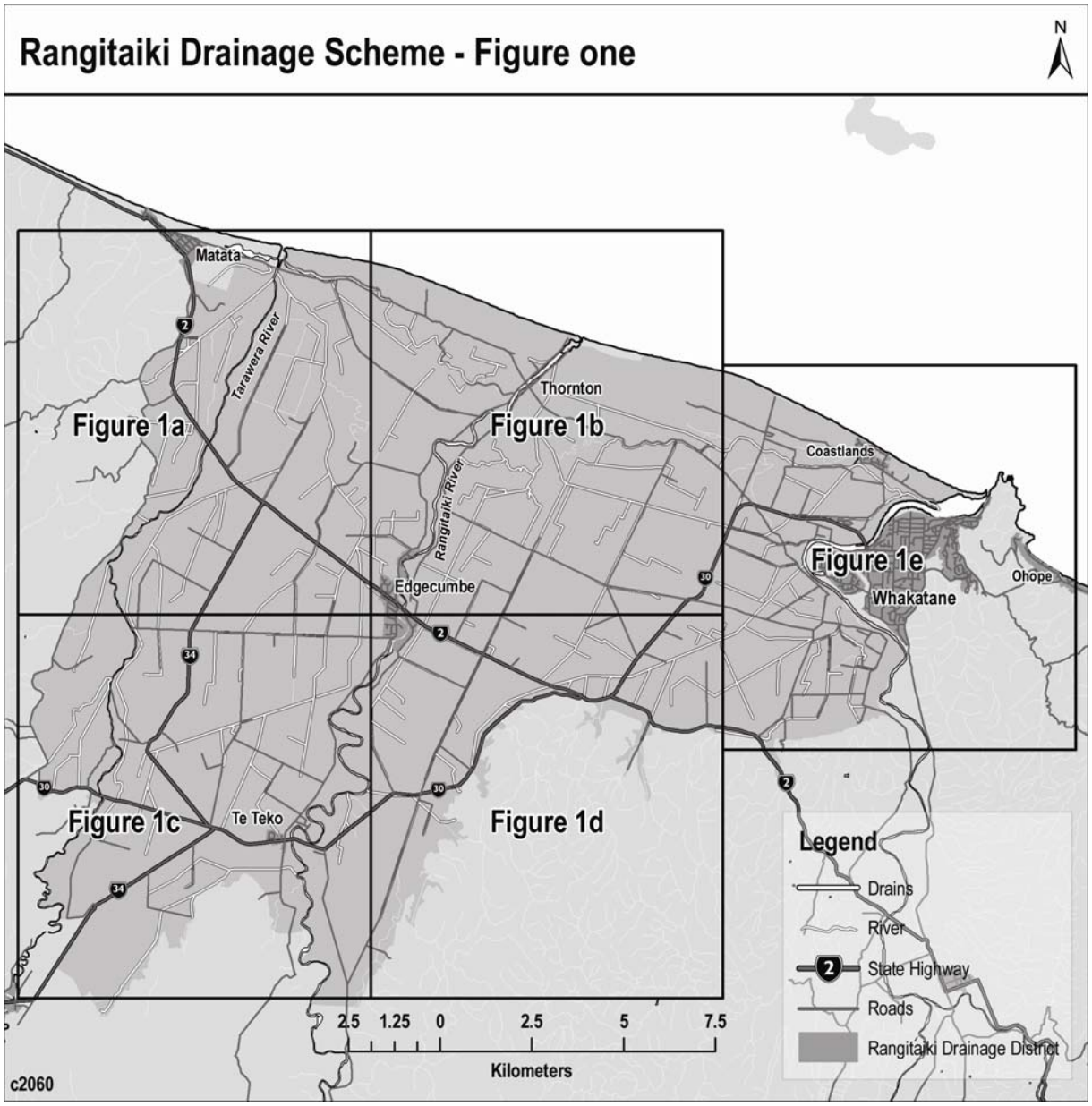


Figure 1 Rangitaiki Plains and Scheme Maintenance Area, and Index Map

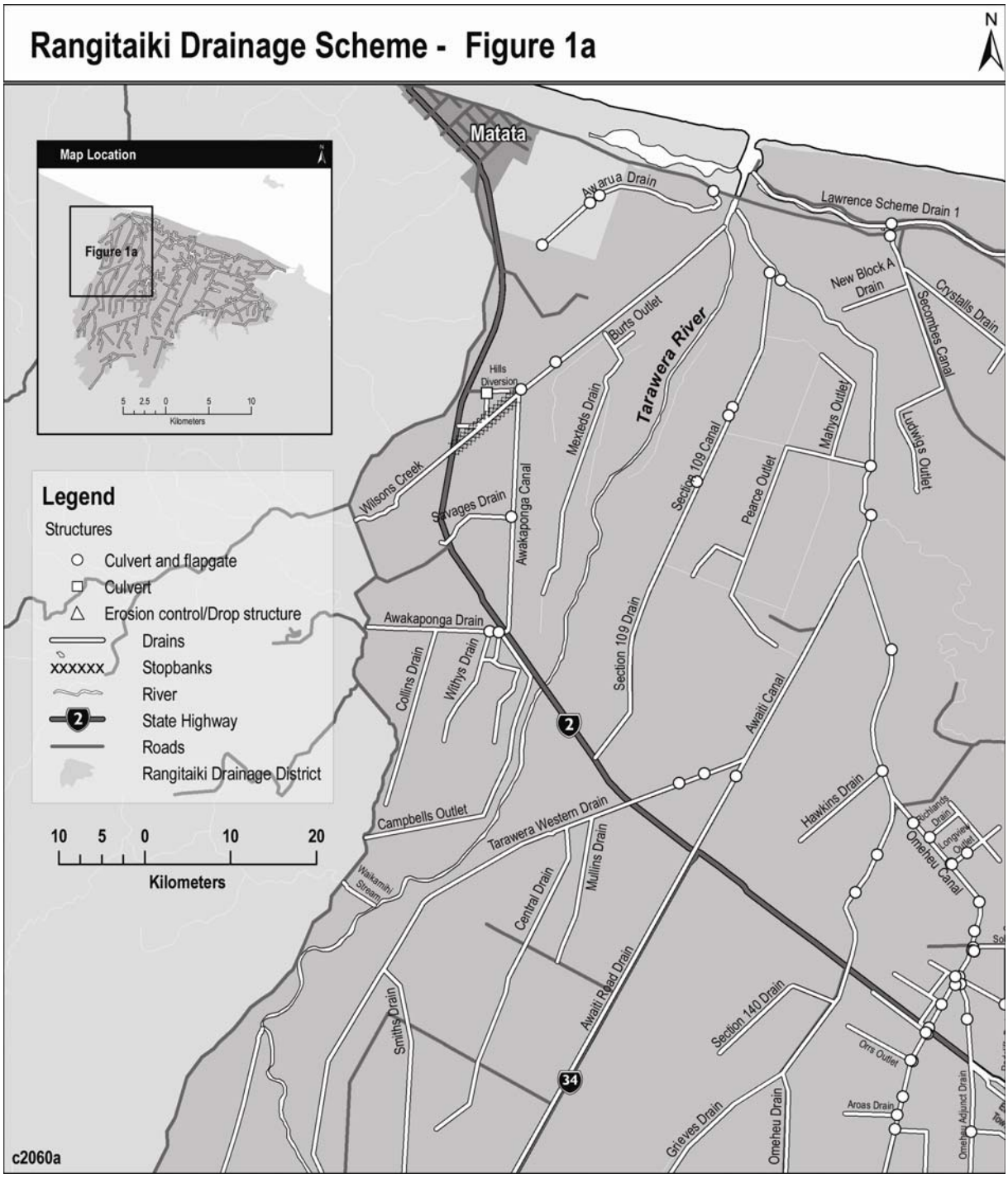


Figure 1a Rangitaiki Drainage Scheme: Map One

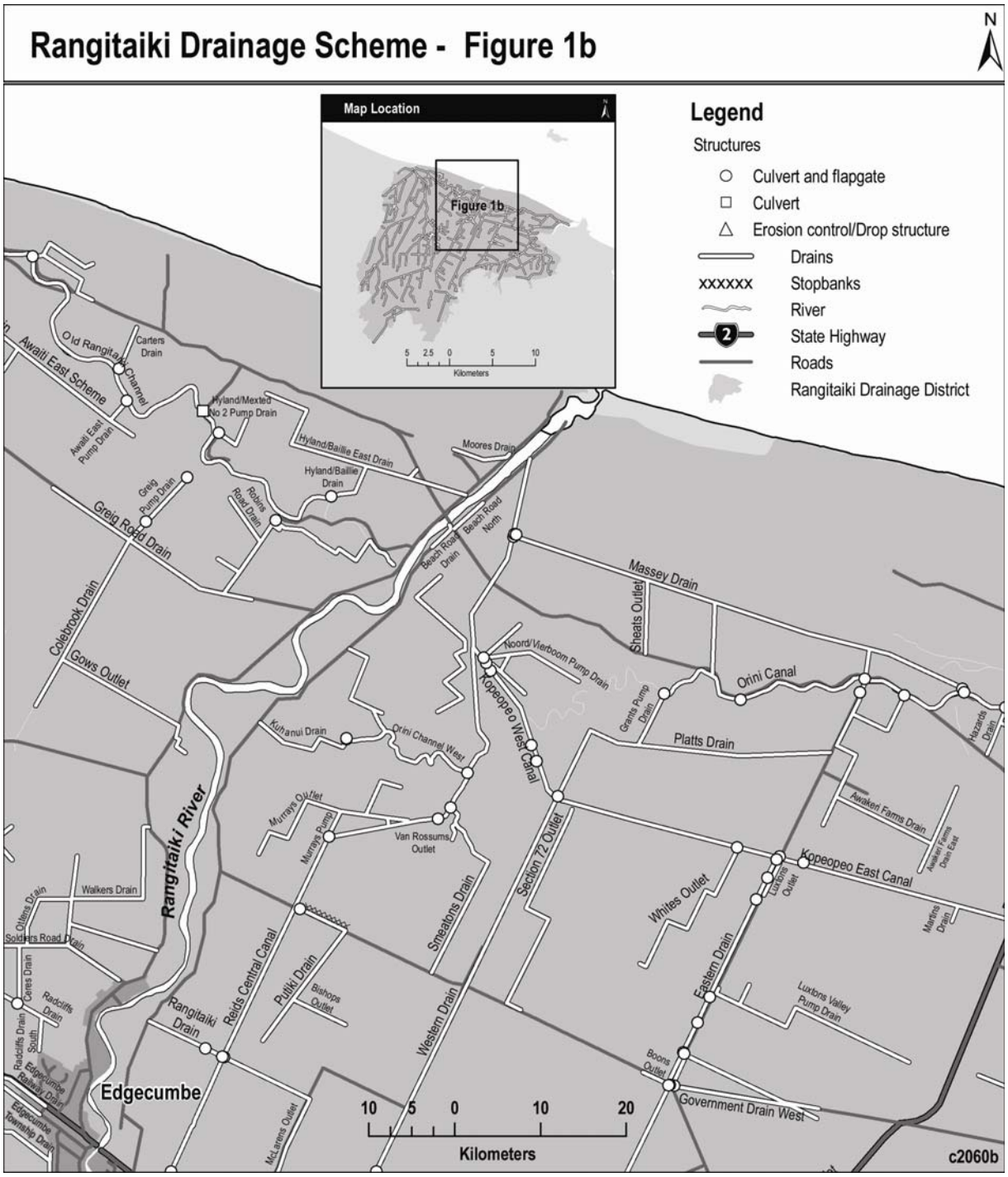


Figure 1b Rangitaiki Drainage Scheme: Map Two

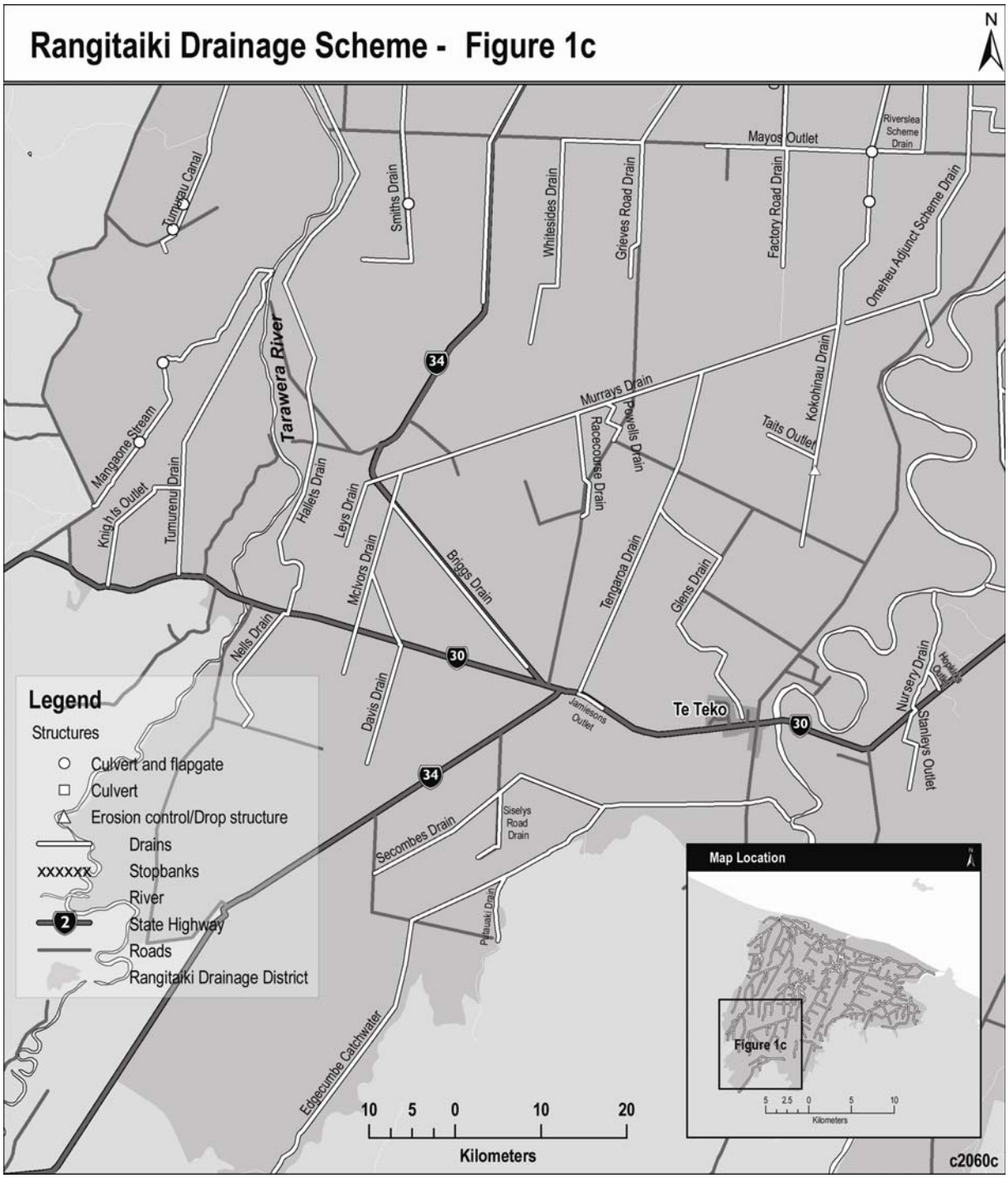


Figure 1c Rangitaiki Drainage Scheme: Map Three

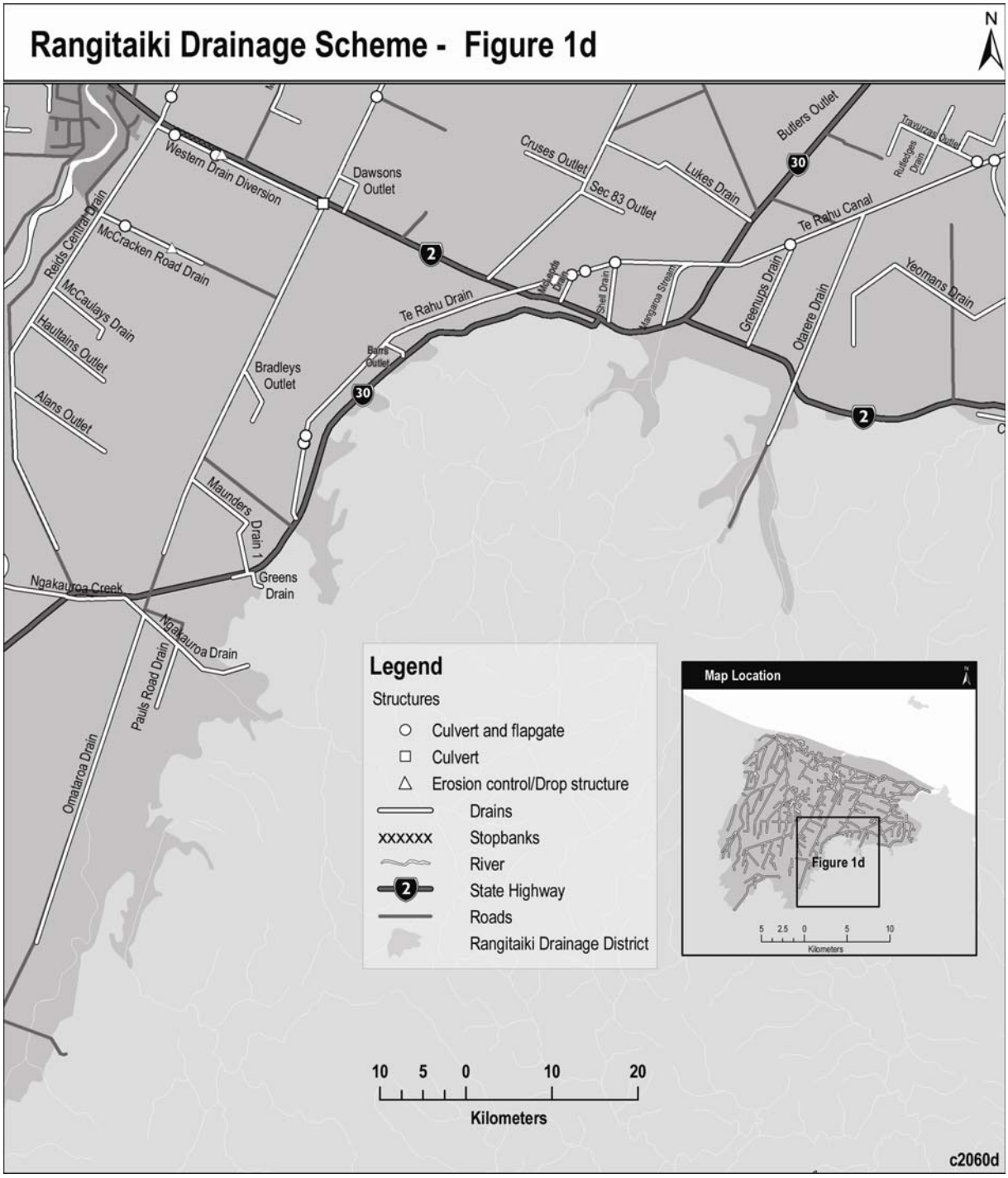


Figure 1d Rangitaiki Drainage Scheme: Map Four

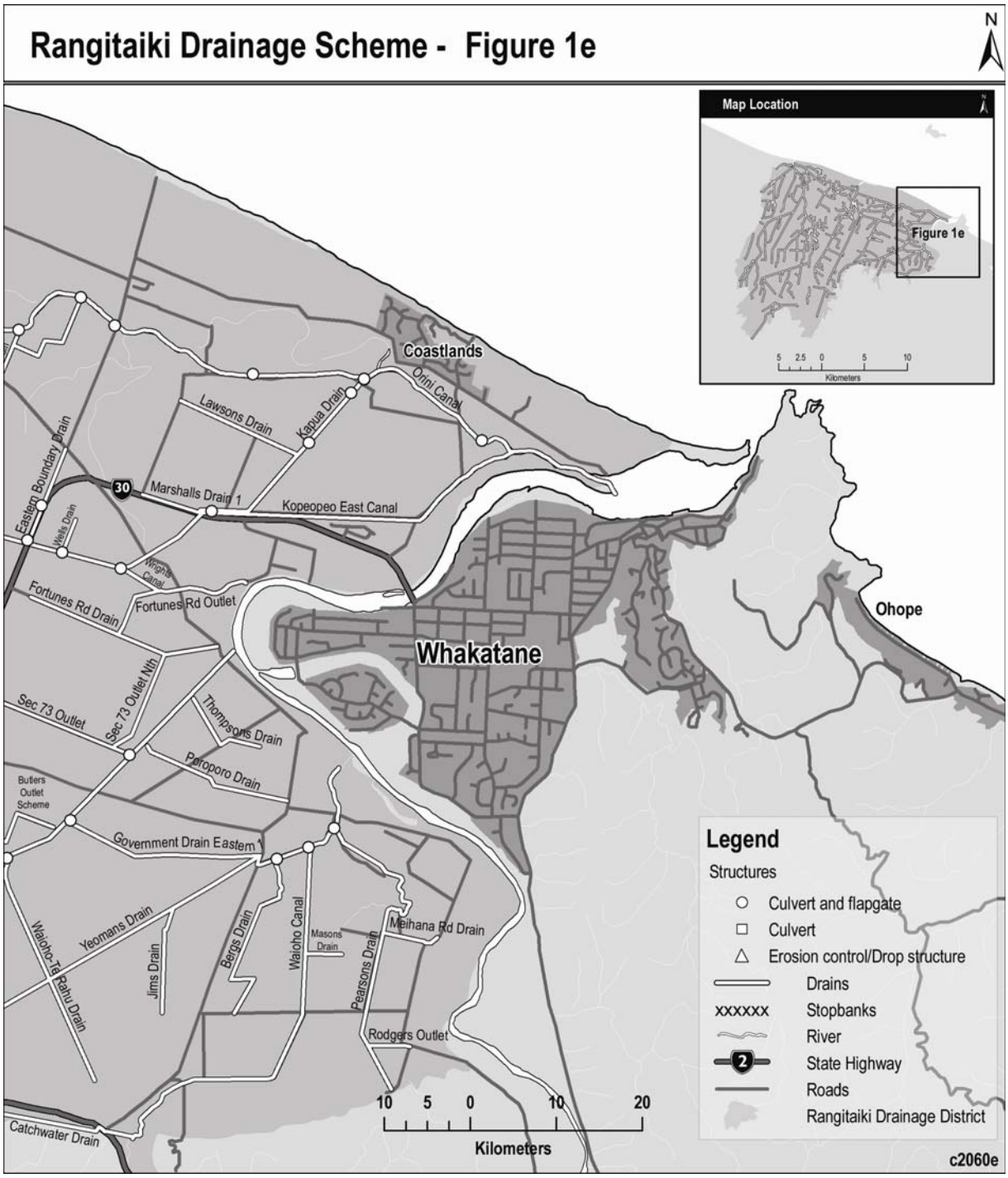


Figure 1e Rangitaiki Drainage Scheme: Map Five

1.2 Scheme History

Survey of the Rangitaiki Plains, at that time consisting largely of wetlands, for European settlement began in 1890. Agricultural development however required drainage of the plains. Following efforts of the settlers, attempts at drainage were made by two unsuccessful Rangitaiki Drainage Boards between 1894 and 1910. However, drainage was more difficult than anticipated, particularly as a result of a large flood in 1892, and in 1910 central government took over responsibility for drainage.

Early tasks included

- Opening a cut at Thornton to divert the Rangitaiki direct to the sea, rather than via what is now known as the Old Rangitaiki Channel to the Tarawera River (1913).
- Opening a cut to divert the Tarawera River direct to the sea rather than via the Matata Lagoon (1917)
- Straightening and dredging of the Tarawera River (1910s-1920s)
- Construction of the Te Rahu Canal system between the Mangaroa Stream and the Whakatane River (1913-1923)
- Construction of the Kopeopeo Canal system (1914-1924)
- Construction of the Awaiti-Omeheu Canal systems, including the Section 109 Canal (1912-1925)
- Construction of the Awakaponga Canal (1919-1924)
- Construction of the Tarawera Western Drain (to take seepage from the Tarawera River) (1911?-1922?)

Various other drains were excavated over this period, so that by 1925 the principal drains and canals of today's scheme were in place.

In 1956, responsibility for the drainage scheme returned to a local authority – a reconstituted Rangitaiki Drainage Board.

The Eastern Bay of Plenty Catchment Commission, formed in 1962, and its successors also played a role in the development of the drainage scheme. In particular, introduction of the Rangitaiki and Whakatane Rivers Schemes in the late 1960s formalised a design standard for the drainage scheme. The Rangitaiki River Major Scheme report (Bay of Plenty Catchment Commission (n.d.)) stated

A capacity of 1.1" [28 mm] per day will be required for pumping schemes and canals draining flat areas. This is the value used in the Whakatane River Major Scheme and is based on the following:

(a) For dairying it is considered pumping schemes should be able to handle 5 year critical rainfalls.

(b) The predominant type of farming on the Plains is dairying and the maximum period water can lie on pasture without damage is 3 days in summer and 6 days in winter.

(c) The critical 5 year storm is one in which the following falls are recorded:

- 1st day 5.6" [142 mm]
- 2nd day 0.75" [19 mm]
- 3rd day 0.80" [20 mm]

making a total of 7.15 inches [182 mm]. With estimated losses of 3.8 inches [97 mm] this leaves 3.35 inches [85 mm] to be pumped, i.e. a rate of 1.1 inches [28 mm] per day.

The implication behind this is that the gravity drainage system (of which the Rangitaiki Drainage Scheme is a major part) should be able to allow drainage of 28mm per day, but where that is not possible then a pumping scheme is required.

Where necessary, drains and canals were enlarged to meet the above drainage standards.

The Edgecumbe earthquake of 1987 had a significant impact on the Scheme. Ground levels across the plains were generally lowered, by as much as 2 m near Edgecumbe township. As a result, the water table became closer to the ground surface, drainage patterns changed and in some areas gravity drainage was no longer possible. The bed slope of the canals was generally reduced, and the drainage system as a whole suffered reduced ability. (Barkle, 1988). In response, additional pumping schemes were created to maintain drainage standards. In addition, erosion control structures had to be built to where canals dropped as they crossed the fault scarp left by the earthquake.

Maintenance of the scheme is funded by way of a rate struck over the area of benefit. This area is 29,200 ha. A revised "classification" or differential rating system was introduced in 1994 (replacing a system that had been in place since 1931) that establishes the relative benefit received by all the lands within the scheme. Rates for any property are calculated on the bases of land area and benefit classification of that property. The new system has 12 classes as opposed to the old system with only four classes.

1.3 Rationale for Ownership

The Rangitaiki Drainage Board, took over land drainage responsibilities for the Plains following the passing of the Rangitaiki Land Drainage Act of 1956. The Eastern Bay of Plenty Catchment Commission was created in 1962 in response to flood problems in the region, but they also became responsible for maintenance of the larger canals in the drainage network. In 1964 it became the Bay of Plenty Catchment Commission.

Under the local government reforms of 1989, Environment Bay of Plenty (the Bay of Plenty Regional Council) is the successor organisation to the Catchment authority and the Drainage Board.

Today the continuing management of the Scheme by Environment Bay of Plenty is consistent with s10 of the Local Government Act 2002:

10. Purpose of local government

(b) to promote the social, economic, environmental, and cultural wellbeing of communities, in the present and for the future.

The management is also consistent with the Community Outcomes for the Region, developed following consultation with the community, in particular the following Outcomes

- **Quality, Affordable Infrastructure:** *Our infrastructure - serves business and the community well, contributes to quality of life in the region, and is sensitive to the natural environment.*

- ***A Prosperous and Sustainable Economy:*** *Our productive, diverse regional economy provides long-term sustainable growth and prosperity.*

Furthermore, by virtue of its previous experience, Environment Bay of Plenty has extensive knowledge of the Scheme assets and management issues. It also possesses the engineering expertise required to manage the Scheme.

Chapter 2: General Information

2.1 Purpose and Ownership of the Plan

The purpose of this plan is to provide, within one document, the means and mechanisms to enable the manager of the asset to plan for the most efficient and economic ways to provide for sustainable ongoing management of the Rangitaiki Drainage Scheme.

These assets need to be managed to ensure they continue to effectively deliver the agreed scheme benefits on a long term, sustainable basis. Management requires provision for monitoring, maintenance and in some instances eventual replacement of these assets.

This plan defines the objectives and performance standards for the scheme and the level of maintenance needed to ensure these are met at all times.

The plan also provides a base against which Environment Bay of Plenty's performance in maintaining these infrastructural assets can be measured.

This asset management plan will provide a framework for technical, economic and financial inputs relating to the assets and their impact on long term financial planning.

The ownership of the plan, after consultation with the ratepayers, rests with the policy makers, namely Environment Bay of Plenty which is the body responsible for managing the asset (the Asset Manager). It is essential that there is continuing client (principally scheme ratepayer) input throughout the duration of the plan.

The plan relies on inputs from data provided by the financial systems, from Council policy, and from those who implement the works and contracts to maintain and provide the service.

2.2 Legislative Requirements

The principal regulatory requirements and accepted standards affecting the management of infrastructure assets result from:

- Local Government Act 2002
- Local Government (Rating) Act 2002
- Resource Management Act 1991

- Soil Conservation and Rivers Control Act 1941

- New Zealand Society of Accountants "New Zealand Accounting Standards"; generally accepted accounting practices (GAAP) as defined in particular by FRS – 3: Accounting for Property and Equipment

- National Asset Management Steering Group (NAMS) guidelines on best practice, most recently as outlined in the International Infrastructure Management Manual (IIMM)

The Local Government Act 2002 provides councils with a framework of powers to carry out democratic decision-making and action for and on behalf of its community. It also imposes accountability for prudent management and stewardship of community assets in the present and into the future. The Act requires councils to identify community outcomes and develop a comprehensive long-term council community plan (LTCCP) including the identification of assets and how those assets are to be managed. It is intended that this asset management plan will be a vehicle for developing and recording community outcomes in relation to the river and drainage schemes management, and will be a 'feeder plan' supporting LTCCP functions and forecasts and asset information.

Asset management should also be consistent with the objectives of the Resource Management Act, which requires:

- Sustainable management of physical and natural resources

- Consideration of alternatives and assessment of benefits and costs

- Determination of best practicable options

2.3 Relationship to Other Environment Bay of Plenty Documents

The Asset Management Plan is but one of a number of documents that Environment Bay of Plenty uses to guide the management of Rangitaiki Plains, consistent with the Community Outcomes for the region. All of these documents should complement one another and be consistent with each other. As well as the Asset Management Plan, the documents include:

- Regional Policy Statement.

- Proposed Regional Water and Land Plan. This Plan aims to integrate the management of land and water resources in the Region. It is not yet operative.

- Floodplain Management Strategies. These are non-statutory documents that aim to appropriately manage the flood risk on the region's floodplains. They include advisory, educational and advocacy measures, in addition to referencing statutory measures (e.g. planning controls) and physical works measures (e.g. new flood control assets). The eastern part of the Rangitaiki Plains is covered by the Whakatane-Waimana Floodplain Management Strategy, nearing completion now. The western part will be covered by the Rangitaiki-Tarawera Floodplain Management Strategy, programmed to be developed in the near future.

- Bay of Plenty Regional Council Floodway and Drainage Bylaw 2002. These were adopted in 2003 giving powers to control various activities that may impact upon the level of service provided by scheme assets.

2.4 Duration of the Plan

This plan has been prepared with a 50 year time horizon. However, long term predictions of such factors as maintenance requirements, costs and interest rates are difficult to make now. Consequently, a regular review and updating of the plan will be required. Thus the duration of this plan is 10 years from the date of formal preparation and acceptance by Council.

The plan will be reviewed as required and updated to ensure that the requirements of the customers are met, and that the systems are maintained at their most effective levels of service.

The information prepared under Section 4.0 of this plan will be incorporated in the LTCCP as well as the Annual Plan for each financial year.

2.5 Principal Scheme Features

2.5.1 Catchment Description

The Rangitaiki Plains cover an area of approximately 29,000ha between Matata and Whakatane, extending from the coast to Kawerau, and encompass the lower floodplains of the Rangitaiki, Tarawera and Whakatane Rivers. The plains occupy the Whakatane graben, a large geological depression. As the graben subsided in the past, the sea invaded the graben to several kilometres inland of the current coastline. However, ash and pumice from volcanic eruptions since has been deposited to infill the graben.

The predominant land use is pastoral agriculture – primarily dairy farming, with 50% of the plains used for dairying in 1992 (Environment Bay of Plenty, 1995). Horticulture and grain cropping are other significant land uses. There are also small areas of wetland reserve and urban development.

2.5.2 Overview

The principal scheme features are the 88 km of major canals (arterial) and 240 km of drains. Excess water drains from the Plains via these assets from a network of further smaller drains (private or part of separate pump schemes) into the Tarawera, Rangitaiki and Whakatane Rivers. Figures 1a-1f show the general layout of the Rangitaiki Drainage Scheme.

Chapter 3: Assets

3.1 Objectives of the Scheme

The Rangitaiki Drainage Scheme consists of a number of component infrastructural assets to provide the following:

- Provide everyday drainage of the Rangitaiki Plains
- Remove ponded water from floods
- Prevent overtopping of internal stopbanks (i.e. those alongside drains and canals rather than rivers) in 5% AEP flood events (in conjunction with the stopbank assets of Rangitaiki Tarawera Rivers Scheme alongside the canals).

3.2 Description of the Assets

3.2.1 Stopbanks

Stopbanks (also known as flood banks) are compacted earth structures, which provide protection to urban and rural properties from floodwaters.

Stopbanks are built to a level and grade where they will not be overtopped by the design flood. They are also constructed to appropriate batters and top width to ensure their structural integrity.

3.2.2 Canals and Drains

Excavated channels to allow groundwater and surface water to drain more rapidly from land. Larger drains or canals are referred to as arterial drains, and act as collector drains for smaller drains.

3.2.3 Structures

(a) Erosion Control - Drop Structures

Drop structures are linings of the bed of a watercourse at a discontinuity in the bed profile, and are constructed of rock, rock mattresses, gabions or concrete. They are designed to dissipate the energy of water as it goes over a cascade, without erosion occurring, and so maintain existing gradients upstream and downstream of the structure. Without the structures, the bed would tend to degrade from downstream up through the site.

(b) Erosion Control - Concrete Pad

A concrete pad has been placed in the high flow diversion channel of the Western Drain, to prevent the bed scouring and taking water at a lower level than designed.

(c) Culverts and Flapgates

Culverts are designed to allow flow out of drains in normal conditions (although they can also be used to restrict flow through an otherwise open channel with greater capacity, as at the Western Drain diversion structure). Flapgates on the exit of culverts are designed to close when water levels in receiving channels are high and hence to prevent backflow.

The entrance to larger culverts may have a debris- or trash-screen to prevent debris entering the culvert and causing a blockage. The exit to a culvert will often have a wing wall or headwall to prevent scour of bed immediately downstream of the exit. In some cases culverts also have a headwall at the entrance to improve entrance flow hydraulics.

3.3 Physical Parameters

The following tables 1 to 3 provide a summary of the physical parameters of the Rangitaiki Drainage Scheme assets. The tables are also stored as spreadsheets in the computer files *drain.xls, rangi-drainage stopbanks.xls* and *rangi-drainage structure.xls*, all stored in the directory V:\TS&RD\ASSETS\VALUATIO\rangitaiki drainage\

The methods of valuation are described in section 3.6.

Table 1 Rangitaiki Drainage Scheme - Structure Assets

Location		Floodgate_Type	Description	Dimension (mm)	culvert length (m)	culvert type	Year Built	Estimated Age	Expected Life	(Replacement Value) culvert	flapgate	headwall	sum	(Depreciated Replacement Value)
Erosion Control/Drop Structures														
Western Drain Diversion (Donalds Outlet)			Concrete Pad	100mm slab			1989	17	50				$717	$473
Donalds Outlet			Drop Structure - Gabions & Mattresses				1989	17	50				$24,004	$15,843
McCracken Drain			Drop Structure - Rock	155 tonnes			1989?	17					$6,609	$6,609
Kokohinau			Drop structure - concrete rubble				1997	9					$7,888	$7,888
Culverts														
Pearce Outlet	Awaiti Canal	Cast	Culvert and Flapgate	940 x2	44			35	50	$14,169	$10,254	$3,791	$28,214	$8,464
Secombes Canal	Secombes Canal/Old Rangitaiki Chann	Aluminium	Culvert and Flapgate	940 x2	28			35	50	$33,060	$10,254	$3,791	$47,105	$14,132
Omeheu Adjunct Drain	Omeheu Adjunct Drain	Wooden - Rectangular	Culvert and Flapgate	1800wide	24			35	50	$44,991	$8,414	$17,628	$71,033	$21,310
Government Eastern Drain	Waioho Canal	Wooden	Culvert and Flapgate	1800 wide	52			35	50	$97,481	$8,414	$17,628	$123,523	$37,057
Awakeri Farms Drain	Awakeri Farms Drain	Wooden	Culvert and Flapgate	1600wide	5.5			35	50	$40,704	$8,414	$17,628	$66,745	$20,024
Masey Drain	Reids Central Canal	Cast	Culvert and Flapgate	1600 wide	23			35	50	$31,206	$8,414	$17,628	$57,248	$17,174
Soldiers Drain	Omeheu Canal	Wooden - Rectangular	Culvert and Flapgate	1400 wide	20			35	50	$20,507	$7,625	$12,843	$40,975	$12,293
Radcliffs Drain	Omeheu Canal	Wooden - Rectangular	Culvert and Flapgate	1400 wide	19			35	50	$19,482	$7,625	$12,843	$39,950	$11,985
Pearsons Drain	Waioho Canal	Cast	Culvert and Flapgate	1200x2	40			35	50	$37,793	$13,147	$12,843	$63,783	$19,135
Government Drain Eastern	Te Rahu Canal	Cast	Culvert and Flapgate	1200 x2	18			35	50	$33,184	$13,147	$12,843	$59,174	$17,752
Null	Kopeopeo East Canal	Wooden	Culvert and Flapgate	1100 wide	15			35	50	$12,429	$5,982	$4,371	$22,781	$6,834
Putiki Drain	Putiki Drain	Aluminium	Culvert and Flapgate	1600	29.3		1988	18	50	$39,754	$8,414	$8,814	$56,982	$36,468
McLarens Outlet	Reids Central Canal	Wooden	Culvert and Flapgate	1600	31			35	50	$42,060	$8,414	$8,814	$59,288	$17,786
Omeheu Adjunct Drain	Omeheu Canal	Cast	Culvert and Flapgate	1500	25.5		1988	18	50	$34,598	$8,414	$8,814	$51,826	$33,169
Kopeopeo West CAnal	Kopeopeo West Canal	?	Culvert and Flapgate	1500	28			35	50	$37,990	$8,414	$8,814	$55,218	$16,565
Null	Government Drain West	Cast	Culvert and Flapgate	1500	20.5			35	50	$27,814	$8,414	$8,814	$45,042	$13,513
Section 109 Canal	Section 109 Canal	Aluminium	Culvert and Flapgate	1350	13		1982	24	50	$16,406	$7,625	$6,421	$30,452	$15,835
Null	Awaiti Canal	Cast	Culvert and Flapgate	1300	9			35	50	$23,583	$7,625	$6,421	$37,630	$11,289
Noord/Vierboom Drain	Kopeopeo West Canal	?	Culvert and Flapgate	1200	20		1964?	42	50	$18,436	$6,836	$6,421	$31,693	$5,071
Massey-Orini			Culvert and Flapgate	1200	15	aluflow	upgrade2000	6	50	$13,027	$6,036	$6,421	$27,004	$23,034
Waioho - Te Rahu Drain	Te Rahu Canal	Cast	Culvert and Flapgate	1200	15			35	50	$13,827	$6,836	$6,421	$27,084	$8,125
Awarua Drain to Tarawera River			Culvert and Flapgate	1200	6			35	50	$5,531	$6,836	$6,421	$18,788	$5,637
Massey Drain	Reids Central Canal	Cast	Culvert and Flapgate	1200	23			35	50	$21,201	$6,836	$6,421	$34,459	$10,338
Null	Orini Canal	Cast	Culvert and Flapgate	1000	10			35	50	$8,286	$5,982	$4,371	$18,638	$5,591
Wells Drain	Kopeopeo East Canal	Cast	Culvert and Flapgate	1000	12			35	50	$9,943	$5,982	$4,371	$20,295	$6,089
Orini Channel West	Reids Central Canal	Cast	Culvert and Flapgate	1000	20			35	50	$16,571	$5,982	$4,371	$26,924	$8,077
Null	Eastern Drain	Cast	Culvert and Flapgate	1000	11			35	50	$829	$5,982	$4,371	$11,181	$3,354
Null	Awaiti Canal	Cast	Culvert and Flapgate	1000	11			35	50	$4,971	$5,982	$4,371	$15,324	$4,597
Richlands Outlet	Omeheu Canal	Cast	Culvert and Flapgate	1000	14			35	50	$11,600	$5,982	$4,371	$21,952	$6,586
Kopua Drain	Kopua Drain	Cast	Culvert and Flapgate	1000	1			35	50	$7,457	$5,982	$4,371	$17,810	$5,343
McLeods Drain	Te Rahu Drain	Cast	Culvert and Flapgate	950	15			35	50	$8,855	$5,127	$1,895	$15,878	$4,763
Savages Drain	Awakaponga Canal	Cast	Culvert and Flapgate	900	14.64	RRJ-Y	1982	24	50	$8,643	$5,127	$1,895	$15,665	$8,146
Null	Reids Central Canal	Cast	Culvert and Flapgate	940	19			35	50	$11,217	$5,127	$1,895	$18,239	$5,472
Rangitaiki Drain	Reids Central Canal	Cast	Culvert and Flapgate	940	4.5			35	50	$2,657	$5,127	$1,895	$9,679	$2,904
Greenups Drain	Te Rahu Drain	Cast	Culvert and Flapgate	940	17			35	50	$10,036	$5,127	$1,895	$17,059	$5,118
Bergs Drain	Government Eastern Drain	Aluminium	Culvert and Flapgate	940	10			35	50	$5,904	$5,127	$1,895	$12,926	$3,878
Null	Donalds Outlet	Cast	Culvert and Flapgate	920	21			35	50	$9,151	$5,127	$1,895	$16,173	$4,852
	Awakaponga Canal		Culvert and Flapgate	900	17.07	RRJ - Y	1982	24	50	$10,077	$5,127	$1,895	$17,100	$8,892
	Wilsons Creek		Culvert	900	14.64	RRJ-X	1982	24	50	$8,643		$1,895	$10,538	$5,480
Hills Diversion	Awakaponga Canal	Cast	Culvert and Flapgate	900	17		1997	9	50	$10,036	$5,127	$1,895	$17,059	$13,988
Hawkins Drain	Omeheu Canal	Cast	Culvert and Flapgate	900	24			32	50	$14,169	$5,127	$1,895	$21,191	$7,629
Orrs to Omeheu Canal			Culvert and Flapgate	900	8			35	50	$4,723	$5,127	$1,895	$11,745	$3,524
Aroas Drain	Omeheu Canal	Cast	Culvert and Flapgate	900	11			35	50	$6,494	$5,127	$1,895	$13,516	$4,055
Travurzas Outlet	Te Rahu Canal	Cast	Culvert and Flapgate	900	33		1975?	31	50	$19,482	$5,127	$1,895	$26,504	$10,072
Withys Drain	Awakaponga Drain	Aluminium	Culvert and Flapgate	900	7.5		1975?	31	50	$4,428	$5,127	$1,895	$11,450	$4,351
Marshalls Drain	Kopeopeo East Canal	Cast	Culvert and Flapgate	900	12			35	50	$7,084	$5,127	$1,895	$14,107	$4,232
Massey Drain	Massey Drain	Cast	Culvert and Flapgate	900	10			35	50	$5,904	$5,127	$1,895	$12,926	$3,878
Null	Awarua Drain	Cast	Culvert and Flapgate	900	7			35	50	$4,133	$5,127	$1,895	$11,155	$3,347
McCracken Road Drain	McCracken Road Drain	Cast	Culvert and Flapgate	900	19			35	50	$11,217	$5,127	$1,895	$18,239	$5,472

Table 1 (cont.) Rangitaiki Drainage Scheme - Structure Assets

Location		Floodgate_Type	Description	Dimension (mm)	culvert length (m)	culvert type	Year Built	Estimated Age	Expected Life	(Replacement Value) culvert	flapgate	headwall	sum	(Depreciated Replacement Value)
Rangitaiki Drain	Rangitaiki Drain	Cast	Culvert and Flapgate	900	28.5			35	50	$16,825	$5,127	$1,895	$23,848	$7,154
Null	Western Drain	Aluminium	Culvert and Flapgate	900	20			35	50	$11,807	$5,127	$1,895	$18,830	$5,649
Shell Drain	Te Rahu Drain	Cast	Culvert and Flapgate	900	16			35	50	$9,446	$5,127	$1,895	$16,468	$4,940
Smith Rd			Culvert		14		enlarged2000	6	50				$3,345	$2,944
Awaiti East Pump Scheme	Old Rangitaiki Channel	Cast	Culvert and Flapgate	840	41			35	50	$18,684	$4,262	$1,895	$24,842	$7,453
Baird/Miller Scheme Drain	Orini Canal	Cast	Culvert and Flapgate	800	10			35	50	$4,557	$4,262	$1,895	$10,715	$3,214
Null	Eastern Bay Drain	Cast	Culvert and Flapgate	800	7.5			35	50	$3,418	$4,262	$1,895	$9,575	$2,873
Soldiers Drain	Omeheu Canal	Cast	Culvert and Flapgate	800	9			35	50	$4,101	$4,262	$1,895	$10,259	$3,078
Robins Road Drain	Robins Road Drain	?	Culvert and Flapgate	800	25			35	50	$11,393	$4,262	$1,895	$17,550	$5,265
Soldiers Drain	-NA-	Cast	Culvert and Flapgate	800	2			35	50	$911	$4,262	$1,895	$7,069	$2,121
Hazrads Drain	Orini Canal	Cast	Culvert and Flapgate	800	23			35	50	$10,481	$4,262	$1,895	$16,639	$4,992
Section 73 Outlet	Te Rahu Canal	Cast	Culvert and Flapgate	750	39		1986	35	50	$12,843	$3,397	$1,895	$18,135	$5,441
Null	Awaiti Road Drain	Aluminium	Culvert and Flapgate	700	17			35	50	$7,043	$2,884	$1,895	$11,822	$3,547
Omeheu West Scheme Drain	Omeheu Canal	Cast	Culvert and Flapgate	700	16.5			35	50	$5,810	$2,884	$1,895	$10,589	$3,177
Omeheu West Scheme Drain	Omeheu Canal	Cast	Culvert and Flapgate	700	14			35	50	$4,930	$2,884	$1,895	$9,709	$2,913
Null	Omeheu Canal	Cast	Culvert and Flapgate	700	9			35	50	$3,169	$2,884	$1,895	$7,948	$2,385
Null	Tarawera Western Drain	Aluminium	Culvert and Flapgate	680	12			35	50	$7,043	$2,884	$1,895	$11,822	$3,547
Null	Orini Canal	Cast	Culvert and Flapgate	650	7.5			35	50	$2,641	$2,884	$1,895	$7,420	$2,226
Null	Orini Canal	Cast	Culvert and Flapgate	650	41			35	50	$14,438	$2,884	$1,895	$19,217	$5,765
Omeheu West Scheme Drain	Omeheu Canal	Cast	Culvert and Flapgate	650	13			35	50	$4,578	$2,884	$1,895	$9,357	$2,807
Null	Omeheu Canal	Cast	Culvert and Flapgate	650	9			35	50	$3,169	$2,884	$1,895	$7,948	$2,385
Null	Omeheu Adjunct Drain	Cast	Culvert and Flapgate	650	10			35	50	$3,521	$2,884	$1,895	$8,301	$2,490
Grants Pump Drain	Orini Canal	Aluminium	Culvert and Flapgate	650	32			35	50	$11,269	$2,884	$1,895	$16,048	$4,814
Radcliffs Drain	Radcliffs Drain	Cast	Culvert and Flapgate	640	9			35	50	$2,796	$2,370	$704	$5,871	$1,761
Null	Omeheu Canal	Cast	Culvert and Flapgate	640	9			35	50	$2,796	$2,370	$704	$5,871	$1,761
Null	Omeheu Canal	Cast	Culvert and Flapgate	640	15			35	50	$4,661	$2,370	$704	$7,735	$2,321
Longview Outlet	Omeheu Canal	Cast	Culvert and Flapgate	620	19			35	50	$5,904	$2,370	$704	$8,978	$2,693
Wrights Canal (assumed)	Kopeopeo East Canal	Cast	Culvert and Flapgate	600	14.5			35	50	$5,593	$2,370	$704	$8,667	$2,600
Null	Kopua Drain	Aluminium	Culvert and Flapgate	600	8			35	50	$2,486	$2,370	$704	$5,560	$1,668
Platts Drain	Kopeopeo East Canal	Cast	Culvert and Flapgate	600	17			35	50	$5,282	$2,370	$704	$8,357	$2,507
Null	Te Rahu Drain	Cast	Culvert and Flapgate	600	15			35	50	$4,661	$2,370	$704	$7,735	$2,321
Carters Drain	Old Rangitaiki Channel	?	Culvert and Flapgate	600	26			35	50	$8,079	$2,370	$704	$11,153	$3,346
Soldiers Drain	-NA-	Cast	Culvert and Flapgate	600	2			35	50	$621	$2,370	$704	$3,696	$1,109
Null	Eastern Drain	Cast	Culvert and Flapgate	580	12.5			35	50	$3,107	$2,370	$704	$6,182	$1,855
Null	Tumurau Canal	Aluminium (?)	Culvert and Flapgate	560	14			35	50	$4,350	$2,370	$704	$7,425	$2,227
Withys Pump Drain	Awakaponga Drain	Cast	Culvert and Flapgate	500	21.5			35	50	$3,107	$2,002	$704	$5,814	$1,744
Null	Omeheu Drain	Cast	Culvert and Flapgate	500	13.5			35	50	$3,356	$2,002	$704	$6,062	$1,819
Hazards Drain	Orini Canal	Cast	Culvert and Flapgate	500	23			35	50	$5,717	$2,002	$704	$8,424	$2,527
Grants Pump Drain	Orini Canal	Aluminium	Culvert and Flapgate	500	32			35	50	$7,954	$2,002	$704	$10,661	$3,198
Fox Pump Drain	Orini Canal	Cast	Culvert and Flapgate	480	24			35	50	$4,474	$1,634	$704	$6,813	$2,044
Null	Eastern Drain	Aluminium	Culvert and Flapgate	480	8.5			35	50	$3,169	$1,634	$704	$5,508	$1,652
Null	Awarua Drain	Cast	Culvert and Flapgate	480	4			35	50	$2,237	$1,634	$704	$4,576	$1,373
Null	Omeheu Canal	Cast	Culvert and Flapgate	480	9			35	50	$1,678	$1,634	$704	$4,016	$1,205
Longview Outlet	Omeheu Canal	Cast	Culvert and Flapgate	460	28			35	50	$5,220	$1,634	$704	$7,558	$2,268
Poplar Lane Scheme Drain	Omeheu Canal	Cast	Culvert and Flapgate	460	15			35	50	$2,796	$1,634	$704	$5,135	$1,540
Null	Western Drain Diversion	Cast	Culvert and Flapgate	460	13.5			35	50	$2,517	$1,634	$704	$4,855	$1,457
Murrays Pump	Reids Central Canal	?	Culvert and Flapgate	450	32			35	50	$3,729	$1,634	$704	$6,067	$1,820
Null	Kopeopeo West Canal	?	Culvert and Flapgate	450	17.5			35	50	$3,263	$1,634	$704	$5,601	$1,680
Luxtons Valley Pump Drain	Eastern Drain	?	Culvert and Flapgate	450	18			35	50	$3,356	$1,634	$704	$5,694	$1,708
Null	Mangaone Stream	Cast	Culvert and Flapgate	450	7			35	50	$1,305	$1,634	$704	$3,643	$1,093
Null	Section 109 Canal	Cast	Culvert and Flapgate	450	10			35	50	$1,864	$1,634	$704	$4,203	$1,261
Null	Section 109 Canal	Cast	Culvert and Flapgate	450	11.5			35	50	$2,144	$1,634	$704	$4,482	$1,345
Null	Longview Outlet	Cast	Culvert and Flapgate	450	7			35	50	$1,305	$1,634	$704	$3,643	$1,093
Omeheu West Scheme Drain	Omeheu Canal	?	Culvert and Flapgate	450	9.5			35	50	$1,771	$1,634	$704	$4,109	$1,233
Null	Omeheu Canal	?	Culvert and Flapgate	450	8			35	50	$1,491	$1,634	$704	$3,830	$1,149
Hyland/Mexted No2 Pump Drain	Old Rangitaiki Channel	?	Culvert and Flapgate	450	25			35	50	$4,661	$1,634	$704	$6,999	$2,100
Kuhanui Drain	Orini Channel West	Aluminium	Culvert and Flapgate	450	17.5			35	50	$3,263	$1,634	$704	$5,408	$1,622
Kuhanui Drain	Orini Channel West	Aluminium	Culvert and Flapgate	450	26			35	50	$4,847	$1,634	$704	$6,938	$2,081

Table 1 (cont.) Rangitaiki Drainage Scheme - Structure Assets

Location		Floodgate_Type	Description	Dimension (mm)	culvert length (m)	culvert type	Year Built	Estimated Age	Expected Life	(Replacement Value) culvert	flapgate	headwall	sum	(Depreciated Replacement Value)
Null	Kopua Drain	Cast	Culvert and Flapgate	400	7.5			35	50	$1,010	$448	$704	$2,088	$626
Laws Scheme Drain	Orini Canal	Cast	Culvert and Flapgate	400	38			35	50	$5,116	$448	$704	$6,053	$1,816
Null	Tarawera Western Drain	Cast	Culvert and Flapgate	400	5.5			35	50	$741	$448	$704	$1,828	$548
Null	Omeheu Adjunct Drain	Cast	Culvert and Flapgate	400	8			35	50	$1,077	$448	$704	$2,153	$646
Null	Mangaone Stream	Cast	Culvert and Flapgate	380	12.5			35	50	$1,683	$448	$704	$2,738	$821
Null	Orini Canal	Cast	Culvert and Flapgate	350	12.5			35	50	$1,683	$448	$704	$2,738	$821
Null	Tumurau Canal	Aluminium	Culvert and Flapgate	350	11			35	50	$1,481	$448	$704	$2,543	$763
Null	Omeheu Canal	Cast	Culvert and Flapgate	330	7			35	50	$798	$320	$704	$1,759	$528
Null	Smiths Drain	Cast	Culvert and Flapgate	330	10			35	50	$1,139	$320	$704	$2,089	$627
Null	Eastern Drain	Cast	Culvert and Flapgate	320	7.5			35	50	$854	$320	$704	$1,814	$544
Null	Kopeopeo West Canal	Cast	Culvert and Flapgate	300	9.5			35	50	$1,082	$320	$704	$2,034	$610
Null	Kopeopeo West Canal	Cast	Culvert and Flapgate	300	13			35	50	$1,481	$320	$704	$2,419	$726
Null	Eastern Drain	Cast	Culvert and Flapgate	300	7.5			35	50	$854	$320	$704	$1,814	$544
Null	Eastern Drain	Cast	Culvert and Flapgate	300	7.5			35	50	$854	$320	$704	$1,814	$544
Null	Eastern Drain	Cast	Culvert and Flapgate	300	7			35	50	$798	$320	$704	$1,759	$528
Null	Awarua Drain	Cast	Culvert and Flapgate	300	13			35	50	$1,481	$320	$704	$2,419	$726
Null	Omeheu Drain	Cast	Culvert and Flapgate	300	16			35	50	$1,823	$320	$704	$2,749	$825
Riverslea Scheme Drain	Omeheu Canal	Cast	Culvert and Flapgate	300	9.5			35	50	$1,082	$320	$704	$2,034	$610
Null	Te Rahu Drain	Cast	Culvert and Flapgate	300	16			35	50	$1,823	$320	$704	$2,749	$825
Kopua Drain	Kopua Drain	Cast	Culvert and Flapgate	300	6			35	50	$604	$320	$704	$1,649	$495
Null	Te Rahu Drain	PVC	Culvert and Flapgate	270	10			35	50	$1,139	$320	$704	$2,089	$627
Null	Te Rahu Drain	PVC	Culvert and Flapgate	270	12			35	50	$1,367	$320	$704	$2,309	$693
Null	Te Rahu Drain	PVC	Culvert and Flapgate	270	9			35	50	$1,025	$320	$704	$1,979	$594
Kapua			Culvert and Flapgate				2000, repaired 2001	5	50				$13,218	$11,897
Whites Outlet	Kopeopeo East Canal	Cast	Culvert and Flapgate	800 x2	19			35	50	$17,317	$8,524	$3,791	$28,610	$8,583
Null	Section 109 Canal	Concrete (hexagonal)	Culvert and Flapgate	740 wide	4.5			35	50	$1,864	$3,397	$1,895	$6,910	$2,073
Hyland/Baillie Drain	Old Rangitaiki Channel	?	Culvert and Flapgate	700 x2	44			35	50	$30,989	$5,767	$3,791	$39,149	$11,745
Null	Eastern Bay Drain	Concrete - Hexagonal	Culvert and Flapgate	700 wide	4			35	50	$8,451	$2,884	$1,895	$12,774	$3,832
Massey Drain	Reids Central Canal	Cast	Culvert and Flapgate	600 x2	20			35	50	$12,429	$4,741	$1,409	$17,937	$5,381
Null	Eastern Drain	Cast	Culvert and Flapgate	600 x2	16.5			35	50	$10,254	$4,741	$1,409	$15,837	$4,751
Null	Kopeopeo East Canal	Wooden	Culvert and Flapgate	600 wide	21.5			35	50	$6,680	$2,370	$704	$9,419	$2,826
Smeatons Drain	Reids Central Canal	Aluminium	Culvert and Flapgate	500 x2	16			35	50	$7,954	$4,004	$1,409	$12,906	$3,872
Lawrence Scheme Drain	Old Rangitaiki Channel	Aluminium	Culvert and Flapgate	480 x2	21			35	50	$7,830	$3,268	$1,409	$12,076	$3,623
Null	Old Rangitaiki Channel	Aluminium	Culvert and Flapgate	480 x2	29			35	50	$10,813	$3,268	$1,409	$14,956	$4,487
Reynolds Drain	Reynolds Drain	Cast	Culvert and Flapgate	450 x3	10			35	50	$5,593	$4,902	$1,409	$11,493	$3,448
Grieg Pump Drain	Grieg Pump Drain/Old Rangitaiki Cha	?	Culvert and Flapgate	450 x2	26			35	50	$9,694	$3,268	$1,409	$13,876	$4,163
Null	Grieg Pump Drain	Cast	Culvert and Flapgate	450 wide	4.5			35	50	$839	$1,634	$704	$3,068	$920
Null	Omeheu Canal	Concrete - Square	Culvert and Flapgate	350 wide	11.5			35	50	$1,548	$448	$704	$2,608	$782
Western Drain			Culvert at Diversion	450	10		1989	17	50	$1,864		$704	$2,480	$1,637
TOTAL													$1,893,970	$696,912

Note – “Null” location refers to a drain of unknown or unrecorded name.

Table 2 Rangitaiki Drainage Scheme - Stopbank Assets

Location	Batters		Top Width	Height	Length	Volume	Basic Cost	Linear Cost	Total Cost	Current Value	Age	Depreciation	Net Value
	inner	outer	m	m	m	m3	1989$	1989$	1989$	2006$			DRC 2006$
Donalds Outlet	3	6	3	1.1	600	5,247	$31,902	$15,252	$47,154	$74,271	17	$3,788	$70,483
Putiki Drain	3	3	3	1	483	2,898	$17,620	$12,278	$29,898	$47,091	33	$4,662	$42,429
Wilsons Creek	2	3	3	1.4	1,600	14,560	$88,525	$40,672	$129,197	$203,495	24	$14,652	$188,844
TOTAL RANGITAIKI DRAINAGE					2,683	22,705	$138,046	$68,202	$206,248	$324,857		$23,102	$301,756

Table 3 Rangitaiki Drainage Scheme - Drain Assets

Type	Length (km)	Volume (cu.m/m)	Excavation Cost	Engineering Cost	Value at CCI 4930
Arterial Canals and Drains	89.06	39	$13,590,132	$2,038,520	$15,628,652
Other regional drains	240.47	3.8	$2,383,579	$357,537	$2,741,116
Total Rangitaiki Drainage	329.53		$15,973,711	$2,396,057	$18,369,768

3.4 Asset Capacity – Design Standards

3.4.1 Stopbanks

The small lengths of Putiki Drain and Donald's Outlet (Western Drain Diversion) stopbanks included in the scheme are designed to allow the 28 mm per day drainage standard to be achieved, without water spilling from the drains into adjacent farmland.

The Wilson's Creek stopbank was designed to a 10 year standard, with 300mm freeboard. The left bank was however lowered by 300mm, to allow controlled spillage. A freeboard of 500 mm is probably more appropriate now, as the creek is vigorous and flooding problems of adjacent land have occurred. In light of this, and changes to the drains resulting from the 2005 floods, the design should be reviewed (see section 3.5.1 below)

3.4.2 Structures

(d) Floodgates and Culverts

Floodgates are designed to stop flow up tributary streams/canals when the main river is in flood and during the rising tide. The culverts are designed to discharge floodwaters and everyday flows when the main river and/or tide recedes.

(e) Drop Structures

Drop structures are generally designed to withstand a 5% AEP flood event. (Note that drop structures could equally have been categorised as "erosion protection" measures, as has been done in the upper Kaituna section of the Kaituna Asset Management Plan, for example.)

3.4.3 Drains

Drains are designed to a 20% AEP standard, of 28 mm/day. They are also intended to maintain the groundwater table to a level appropriate to surrounding ground levels, for the predominant land use (currently dairy farming), without causing over drainage and therefore excessive peat shrinkage.

The drainage system, including the separate communal pumping schemes, has been designed to drain 28 mm per day – the 5 year (20%AEP), 3 day rainfall runoff. (See Section 1.2) This was considered to maintain a water table of 600 mm below ground surface, sufficient for pasture growth.

Horticulture requires a higher standard of drainage – a water table depth of around 1000 mm is required, and water cannot be allowed to pond for more than one day. This requires drainage of 80 mm per day (Barkle, 1988) – somewhat greater than the design standard. As pastoral farming still dominates (and horticultural development on the plains has slowed in recent years), the 28 mm/day design standard has not been changed, and any additional drainage required to support horticulture is assumed to be met by pumping schemes.

Nevertheless, indications are that 28 mm per day is a conservative estimate of the likely runoff from a 5 year, 3 day storm (Environment Bay of Plenty, 2002a).

A study of the Awaiti-Omeheu drainage system (the Awaiti catchment) was undertaken in 1997 (Environment Bay of Plenty, 2002). Results suggest that the canals currently have sufficient capacity for the design flows, but that with a 0.49 m sea level rise (the 1995 estimate of the International Panel on Climate Control – the IPCC – of the rise by the year 2100) and storm surge conditions, freeboard would be compromised. No allowance has been made for any capital works that may be needed in the future to increase capacity. The need for such works will be assessed at the time of the next review of this Plan, using information available at that time (including findings from the next IPCC assessment report, due in 2007).

3.5 Asset Condition

3.5.1 Stopbanks

Short lengths of stopbank, alongside Donald's Outlet, Putiki Drain and Wilson's Creek, have been included as assets in the Scheme. No recent assessment of the condition or of the amount of freeboard that they currently provide has been undertaken.

Stopbanks alongside the major canals have been included in the assets of the Rangitaiki-Tarawera Rivers Scheme or the Whakatane River Scheme as appropriate.

To be consistent, the Wilson's Creek stopbanks should be part of the Rangitaiki-Tarawera Rivers Scheme assets, as they were constructed for flood protection and form part of the same system as the Awakaponga stopbanks (which are classed as Rivers Scheme assets). However, they were overlooked when the Rangitaiki-Tarawera Rivers Scheme asset register was produced. At the next review of the valuations of both the Drainage and Rivers Schemes, they could be reassigned to the Rivers Scheme.

However, it could also be argued that all the stopbanks alongside the canals and drains, currently assets of the two Rivers Schemes, would be better placed under Drainage Scheme assets. That matter can be considered in the future; for now no change will be made.

In other locations on the Plains, excavated material has often been heaped up on the drain edges during the course of drain creation or clearing, providing some degree of protection to the surrounding land from high drain flows. (Council policy is to leave drain clearings on site). However, the protection in such cases is not to a consistent standard and could not be regarded as stopbanks. Furthermore, they cannot be valued separately as stopbanks as the cost of forming them has been included in the drain excavation costs.

Some investigations into the capacity of the canals, drains and stopbanks have been undertaken in recent years, covering part of the network. There is a need to continue the investigations so that the entire network is covered. This is discussed in Section 4.7 below.

The stopbanks were built from channel excavation, with no specifications controlling the type (particle size, grading) of material to be used. As the soils typically have a high sand and pumice content, the stopbank material is not ideal. Indeed, the vulnerability of stopbanks to failure was highlighted by a breach in the Rangitaiki River stopbanks during the July 2004 floods, near Edgecumbe.

Nonetheless, the stopbanks have generally held up well since construction. They are not high and as the catchments are small the floods are of short duration. Therefore they are not subject to sustained periods of high hydrostatic pressure. Nor are the consequences of failure of the stopbanks significant.

3.5.2 **Structures**

A regular programme of maintenance is carried out on all structures. In particular, any working parts that wear out or that are showing signs of age are replaced. Asset condition is monitored by regular inspection (see Appendix 2). Structural concrete is inspected periodically.

Many culverts are present within the drainage network. Previously all but 23 of these were considered to be the responsibility of the landowner concerned and were not considered part of the scheme assets. Unfortunately this policy resulted in many of these culverts being poorly maintained, with problems only becoming evident during flood events. As of 2005, all such culverts are now considered to be Scheme assets in order to ensure that they are maintained in acceptable condition.

While most are in reasonable condition, some are in need of repair or replacement. This has been reflected in the maintenance expenditure tables (Appendix 2) and the renewals expenditure programme of Appendix 6.

Three drop structures have been identified as scheme assets. The gabion structure in Donald's Outlet/Western Drain Diversion is in good condition. The rubble structure in Kokohinau Drain has only recently been installed. The rock structure in McCracken's Drain still offers protection against scour, but it will require topping up in the near future.

Four other drop structures were installed in Western Drain some years ago after the drain was over-excavated. However these structures are no longer visible, are not maintained and have served their purpose of stabilising the bed. They no longer serve any purpose, and have not been included in the Scheme assets.

3.5.3 **Drains**

Drains and canals need regular maintenance to ensure that their capacity remains at design drainage standards. Capacity can be reduced by siltation of the channel or by excessive weed growth, if left unchecked.

Significant volumes of silt enter the Drainage Scheme drains from private pump schemes and from the Manawahe hills, creating additional maintenance requirements. The May 2005 storm lead to an extraordinary amount of silt from the Awakaponga catchment in the Manawahe hills entering the drainage system.

Weed growth is very dependent on weather patterns. A decrease in the number of frosts in recent years has led to weed growth continuing longer into the winter, with the result that weed control has to be continued. Over the current summer, with an El Nino weather pattern, weed growth is particularly strong. Conversely, periods of high rain, and therefore higher flows in the drains, can lead to some self-flushing of the drains, removing weed and silt. As a result, regimented programming of drain maintenance is impractical, and the plan provides estimated average maintenance requirements.

Drain capacity and asset condition will continue to be monitored by visual inspections, physical surveys and scheme reviews including detailed computer modelling.

3.6 Asset Value

Valuation of assets is guided by the International Infrastructure Asset Management Manual (NAMS/IPWEA, 2000).

The valuation of an infrastructural asset can be determined by using either a depreciated value of the original construction (historical) cost; the replacement cost of the components of the asset; or the depreciated replacement cost of the asset.

Usually the asset has been added to over a period of time, and has been upgraded and maintained to a high level of serviceability in order to continue providing the required level of service to its customers and users.

Council (Environment Bay of Plenty) resolved in June 1993 to adopt the following policies:

- That "depreciated replacement cost" be used for the valuation of all structures.
- That drainage networks be valued at replacement cost.
- That depreciated historical cost be used for the valuation of stopbanks.

The assets of the Rangitaiki Drainage Scheme have been valued accordingly.

Following previous discussions with the Audit Office, Council has decided to use "depreciated replacement cost" for the valuation of the stopbanks. This "replacement cost" is based on the "historical cost" (see below).

Depreciation is on the basis of the straight-line method – i.e. a fixed percentage of the undepreciated "start" value is deducted each year.

3.6.1 Stopbanks

The valuation has two components, a direct cost per m^3 and ancillary costs per lineal metre.

Direct costs include:

- Earthworks contract

Ancillary costs include:

- Fencing, grassing
- Culverts
- Compensation
- Staff salaries to prepare, supervise and administer contract.
- Vehicle costs

Stopbank costs have been estimated from the contract costs for developing the section of stopbank alongside Donald's Outlet in 1989. These were \$6.08/m^3 to excavate from the borrow area near the Omeheu Canal and cart it to site, and \$15.33/m to form, compact and topsoil the stopbank (1989 dollars, i.e. to CCI 3130). In addition, \$9.69/m was paid in compensation to the landowners.

However, the contract works also included installation of culverts and construction of a drop structure and compensation was based on a 1.5 year occupancy for the total works. It would be expected that the component of compensation for the stopbank works alone would be less, and the figure of $8.39/m (CCI = 3470) used valuing the Rangitaiki-Tarawera Rivers Scheme stopbanks has been used in the Rangitaiki Drainage Scheme valuations.

Finally, an allowance should be made for design, and contract administration and supervision. The valuations of the Rangitaiki-Tarawera Rivers Scheme stopbanks included such an allowance in the lineal costs. Here an allowance of 20% has been added.

Thus the stopbank works have been valued at (CCI = 3130)

- $6.08/m^3, plus
- $15.33/m x 1.20 + $8.39/m x (3130/3470) = $25.42/m.

It has been assumed that these costs also apply to the stopbanks alongside Putiki Drain and Wilson's Creek.

The stopbanks will be maintained to convey their design floods but settlement of up to 100% of the freeboard will be allowed before stopbank reconstruction will be undertaken. Therefore, the stopbanks value will depreciate to some extent. At this stage the best estimate is that an average reconstruction will be required every twenty years. A depreciation rate of 0.3% has been used, i.e. after twenty years the stopbanks will have lost 6% of their value. Therefore, the valuation of stopbanks is by "depreciated replacement cost" (DRC).

DRC = construction costs x (current CCI/construction date CCI) x (1–0.003 x age)

Figure 2 illustrates the depreciation — only a portion of the stopbank needs to be replaced every 20 years (volume is lost due to settlement and erosion); the remainder is retained.

The total depreciated value is **$301,756** (Table 2).

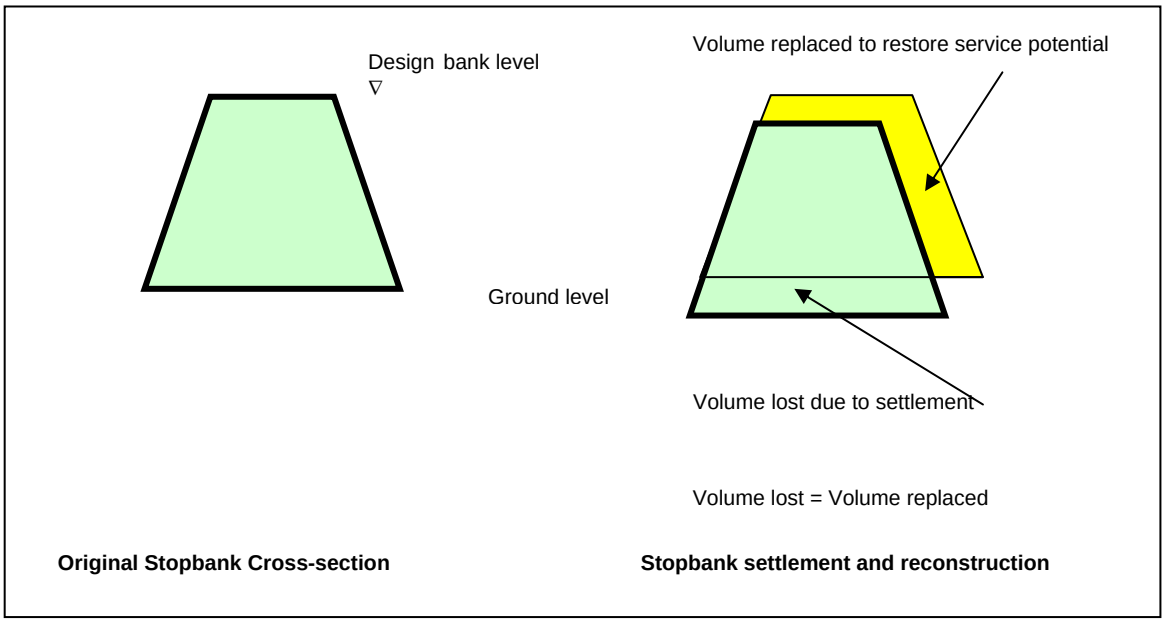


Figure 2 Depreciation of Stopbank

3.6.2 Channel Excavations

Channel excavations have been valued by volume, at $2.52/m^3 and $3.78/m^3 for regional drains and arterial drains/canals respectively. The valuations derive from drain excavation in the Bay of Plenty and data from elsewhere in New Zealand Environment Bay of Plenty (1999). They include an allowance for spreading, harrowing and grassing the diggings. A 15% engineering allowance for design and supervision has not been included in these figures and must be added.

The drain profile is maintained during normal maintenance, so it is not depreciated.

Fences alongside the canal have not been included in the valuation as they are generally private assets of the adjacent landowner. Likewise, farm bridges minor culverts are considered the landowner's responsibility and have not been valued.

The drains and canals (but not including stopbanks on the canals), have been valued at **$18,369,768** (Table 3).

3.6.3 Structures

Erosion Control Structures

Where known, the original contract price is used as the base figure, adjusted to the current CCI, to establish the current replacement cost. The McCracken Drain drop structure value has been based on the unit rate for rockwork applying at the time of the previous Asset Management Plan, adjusted to the current CCI.

No allowance has been made for design and supervision costs, as the structures of the Drainage Scheme are of reasonably straightforward design.

The concrete and gabion/mattress structures are assumed to have a useful life of 50 years and are depreciated. Thus the "depreciated replacement cost" (DRC) is

DRC = construction cost x (current CCI/construction date CCI) x (1 – (age/life))

The rock and rubble structures are topped up as required as part of normal maintenance and are not depreciated.

Current valuations to CCI = 4930 are as in Table 1.

Total Value Erosion Control Structures June 2006 **$30,813**

Culverts

Actual construction costs, adjusted to the current CCI, have been used to value two recently constructed culvert structures: the Smith Road culvert and the Kapua culvert.

In other cases, including the Massey-Orini culvert, replacement costs have been estimated based on current costs of materials, labour and machine hire. All structures have an estimated and knowledge of the age of each structure enables the costs to be calculated.

Although construction costs are also known for the Massey-Orini culvert, that structure has been valued using replacement costs. The current culvert is made of corrugated aluminium (aluflow); aluflow culverts tend to be cheaper that the equivalent concrete culverts. While manufacturers of aluflow claim that the life is in excess of 50 years, in practice this may not be the case and has not been tested in

the field (aluflow being a relatively recent product). Thus all replacement culverts are assumed to be concrete.

All the culvert structures have an assumed useful life of 50 years.

Several structures are of unknown age. In 1996 these were assumed to be mid-way through their lives, and therefore the estimated age in 2006 is assumed to be 35 years.

Where the culvert diameter is greater than or equal to 900mm diameter, the structure will be depreciated. Replacement of all other culverts will be considered part of normal maintenance.

Total Value Culvert Structures June 2006 **$666,099**

3.6.4 Summary of Valuations

In summary, the valuations including allowance for depreciation as described previously, at CCI 4930 (i.e. $ June 2006 forecast) are:

Stopbanks	$301,756
Channel Excavations	$18,369,768
Structures - culverts	$666,099
Drop Structures & Other Erosion protection	$30,813
TOTAL	$19,368,436

3.7 Asset Management Systems

Environment Bay of Plenty has a number of tools that are utilised for the management of its assets.

Information systems have been purchased and developed to assist the asset managers in general management, maintenance, operations and long term planning. As discussed further in Chapter 6, the systems operate largely independently and a more structured, linked asset management system would be expected to be an improvement however.

The current systems comprise:

3.7.1 Asset Register

The asset register constitutes the heart of the asset management system. It provides a definition of assets (description, location), details of physical dimensions and capacity. It also details age and replacement costs. At present the register is in two formats. The initial gathering of information on all Environment Bay of Plenty assets has been incorporated into one initial document, Bay of Plenty Regional Council Asset Register 1993, which is stored in file 0360 04. During the course of producing this asset management plan, the register has been updated and is stored on that file, with copies placed on the relevant scheme files.

The information has then been summarised (in Excel spreadsheet files) before being used for valuation purposes.

The files are:

V:\TS&RD\assets\valuatio\rangitaiki drainage\rangi-drainage stopbanks.xls

V:\TS&RD\assets\valuatio\rangitaiki drainage\drain.xls

V:\TS&RD\assets\valuatio\rangitaiki drainage\rangi-drainage structure.xls

3.7.2 Accounting

Environment Bay of Plenty has until 2006 operated Decfin Financial Management System. This has now been replaced by the Finance1 financial management system.

In the financial system a series of job codes has been set up so that information as to the nature, location, extent and cost of servicing and operating the assets can be identified. (However the cost codes at present do not always line up with the maintenance items identified in Appendix 2 of this Plan. Some work is needed to adjust either the codes or the maintenance item categories).

3.7.3 Asset Management Plan Spreadsheets

The graphs and tables in Chapter 4 and the Appendices of this Plan are from spreadsheets. The files are

V:\TS_RD\ASSETS\PLAN\rangitaiki drainage\rangitaiki drainage amp-2006.xls

V:\TS_RD\ASSETS\PLAN\rangitaiki drainage\rangitaiki drainage maintenance2006.xls

Chapter 4: Maintenance Plan

4.1 Introduction

Maintenance refers to the work necessary to retain the operating standard or service capacity of the scheme and to keep the asset operational. Because natural stream systems are involved, the work needed cannot always be accurately forecast in time but experience gives a very good guide as to the type and general level of work necessary to meet scheme requirements in periods of 'normal' stream flow, i.e. the base level of maintenance.

Maintenance can include works to maintain a structural element e.g. a stopbank or a length of edge protection; an operating cost e.g. weed control; replacement of elements of the system such as culverts or floodgates.

The maintenance plan will set out the programmes and costs required to maintain the desired level of service. The plan covers the 50 year period from 30 June 2006 (i.e. beginning with the 2006/2007 financial year). The 2005/2006 financial year is treated as "year zero".

4.2 Service Levels

4.2.1 General

Environment Bay of Plenty, in drafting this plan, has had to ascertain the scheme ratepayers' views and requirements, in particular whether the original scheme objectives (section 3.1) are relevant for this ten-year plan period. For example, if lower scheme standards were requested and agreed then this plan could allow for deterioration of assets (e.g. stopbank height) by setting service levels which require less maintenance. Audit New Zealand has indicated that such change of standards is acceptable provided it is done following consultation with ratepayers.

After considering the continuous feedback that Environment Bay of Plenty receives from ratepayers about the Scheme, no changes in the scheme objectives as outlined in section 3.1 are proposed. Service levels have been set accordingly.

4.2.2 Stopbanks

Environment Bay of Plenty will maintain the stopbanks to a level to ensure the design flood can be conveyed. For design standards see section 3.4.

Settlement of up to 100% of the design freeboard will be allowed before stopbank reconstruction will be undertaken. (Whereas the River Schemes allow only 50% settlement before reconstruction, Drainage Scheme freeboards are expected to be less and the consequences of bank failure much less severe).

No stopbanking scheme can guarantee absolute protection to the scheme's design standard. Flows much less than the design level can threaten the integrity of the stopbank system. It is, furthermore, difficult to precisely determine the risks of a stopbank breach occurring.

Access is to be available along the top of all stopbanks.

4.2.3 Structures

Environment Bay of Plenty will maintain all structures in a workable condition at all times to function to their design standards.

4.2.4 Erosion Protection — Rockwork

All rockwork and concrete rubble works are to be maintained at all times to 75% of the original design placement rate.

4.2.5 Drains and Canals

The drainage network will be maintained according to priorities determined by hydraulic capacity, i.e. reaches where channel capacity is being compromised (by for example excessive weed growth) will be given most attention.

4.3 Maintenance History

Prior to the 1990s, the drains of the Scheme were dredged frequently, with the result that they were continually increasing in size. As well as being costly, this also had the potential to create the over-drainage and subsidence problems discussed in Section 2.5.1. In more recent times however, excavators have been used much more sparingly.

The drainage weed cutter boat is an important innovation of recent years, reducing use of excavators and of weed spray, with attendant reductions in costs and environmental hazards. The weed boat also has the advantage of providing an indication of the bed levels to the operator, and thus highlighting any need for excavator desilting of the drain.

Since the first version of this Asset Management Plan was adopted, the amount of weed clearing has reduced slightly with clearing being more targeted on clearing areas where weed growth is restricting channel capacity.

4.4 Maintenance Issues

4.4.1 Subsidence

Over-drainage of the plains can result in lowered ground levels, in particular in areas of peat. As ground levels are lowered, additional drainage is in turn required. This process was exacerbated considerably by the 1987 Edgecumbe earthquake. Today, significant areas of the Plains are below sea level or below the perched river levels of the Rangitaiki and Tarawera.

Regular monitoring of channel capacity and drainage standards is therefore important, as is regular review of design standards and economically optimum levels of drainage.

4.4.2 Climate Change - Global Warming Impacts

The possibility of climate change and sea level rise due to the greenhouse effect presents challenges to the management of all river and lake systems. Global warming has the potential to increase the magnitude and frequency of flooding and to cause sea level rise. Thus the capacity of existing flood protection assets must be reviewed periodically as knowledge of the likely impacts of climate change increases. Unfortunately considerable uncertainty still exists over what changes can be expected on a local and regional scale.

(a) Sea Level Rise

The Intergovernmental Panel on Climate Change (IPCC) issues projections on the impact of global warming on sea levels at five yearly intervals. (the next is due in 2007.) A range of estimates exists but latest "most likely" estimates are a 5 to 32 cm rise (mid range estimate 20 cm) from 1990 to 2050 and a 9 to 88 cm rise (mid range estimate 43 cm) from 1990 to 2100 (IPCC, 2001).

Council has adopted the IPCC estimates for the purpose of the Bay of Plenty Regional Coastal Environment Plan. Some provision for sea level rise has been included in some of the schemes (generally a rise of 49 cm, being an earlier IPCC estimate of the rise to 2100). With significant areas of the Plains being low-lying or event below the current sea level, drainage capacity would be reduced by such a rise. Drain capacity in design flood events would also be affected, as noted in 3.4.3 above.

(b) Increased Frequency and Magnitude of Flooding

A second, but less quantified adverse effect of global warming is that the frequency and magnitude of high intensity rainfalls are expected to increase. With climate change, "Increases in high-intensity events are likely at many locations [in the world]" (IPCC, 2001) – i.e. return periods of given size events are expected to decrease. Uncertainty surrounding the changes is high, but current estimates are that the frequency of floods of a particular size will increase between zero and four-fold by the year 2070 AD (New Zealand Climate Change Office, 2003a,b) – i.e. it is likely that the standard of protection offered by existing assets will decrease. Thus it is important that when key structures and those that are difficult to retrofit (e.g. flood walls) come up for construction or renewal that they are designed for likely intensification of flows during their lifetime. (Although in practice design is on a case by case basis and due regard is also had for the certainty of available information, the cost of retrofitting new or renewed structures and the design lifetime of the assets.)

Presently no Regional Plan explicitly covers potential intensification of the hydrological cycle – although it may become implicit in achieving compliance with plan requirements. Various scientific studies to assess the quantum of climate change and implications have been commissioned. Environment Bay of Plenty's river and drainage scheme designs now include provisions for global warming.

4.4.3 Impact of the Interdecadal Pacific Oscillation

The Interdecadal Pacific Oscillation (IPO) is a climate cycle affecting the majority of the Pacific. This cycle has more immediate impact on flood frequency than global warming and is to be considered in any future review of flood protection assets.

The IPO cycle is strongly correlated to heavy rainfall and floods in the Bay of Plenty, resulting in successive “benign” and “active” phases. These phases persist for 20 to 30 years. The cycle shifted to a “benign” phase in the mid-1970s and subsequently to an “active” phase around 1997-98 – i.e. large floods in the Bay of Plenty are expected to be more frequent over the next 20 years than the long term average would suggest.

4.4.4 Hydrology

Almost no recorded high flow data are available for the canals and drains. Empirical flow estimation methods must be used to estimate runoff from design rainfalls. Drain capacity must also be estimated with very little calibration information.

A reasonable network of rainfall recorder stations covers the Plains or nearby areas. Nonetheless, the effect of the IPO as discussed above must also be taken into consideration – it is likely that most of the last 25-30 years were during a “benign” phase.

4.4.5 Plains Conservation Values

Drainage of the plains has come at a significant environmental cost – the loss of most of the pre-European wetlands of the Plains. Prior to the drainage, the area was largely wetland; today only 2% of the original wetlands remain (Environment B·O·P, 1995).

However, wetland is now much more widely appreciated and valued than in the early days of the drainage works. Despite the fundamental conflict of drainage objectives (requiring a lowering of the water table) with wetland preservation objectives (requiring a high water table), moves to protect remaining wetland areas have been made. For example, several small areas have been set aside as reserve, and weir controls have been installed in the Tumurau Lagoon and Kohika wetlands to maintain a high water table. The majority of these measures have been funded from regional rates rather than from the Drainage Scheme.

Furthermore, some effort has been made to protect fish habitat – for instance installation of fish passes in floodgates. Where practical, works are also programmed to minimise wildlife disruption during fish spawning and bird nesting seasons.

Opportunities to enhance the condition and value of the remaining wetland habitat will be identified and considered when upgrading or refurbishment works are required.

Ideally, to ensure successful maintenance in an urban area, scheme managers require access to stream banks. Without public access, access for maintenance cannot be guaranteed, obtaining permissions adds to administration costs, and landowners will sometimes build structures or plant vegetation which physically restricts access.

4.4.6 **Weed Control**

In order to maintain effective drainage, waterways need to be reasonably clear of obstructions to flow such as weed growth. Weed control is the major maintenance item for the Drainage Scheme.

(a) Weed Varieties

Particular weeds that are of concern include

- Parrot's Feather (*Myriophyllum aquaticum*) – a noxious weed that has appeared in the drains of the Tarawera River catchment (i.e. the western portion of the Rangitaiki Plains) in recent years. It is subject to controls under the Environment B·O·P draft Plant Pest Strategy.
- Hornwort (*Ceratophyllum demersum*)
- Oxygen weed – several species are present (e.g. *Egeria densa*)
- Mercer grass – established throughout district.
- Willow weed - established throughout district
- Water plantain – has appeared in Putiki Drain and Bishop's Outlet.
- Poa aquatica (*Glyceria maxima*) – found throughout the drainage network. Rafts of the plant can break off and re-establish elsewhere rapidly.

Alligator weed (*Alternathera philoxeroides*) is another plant pest that is of concern. It has been found in the Awaiti-Omeheu system. Effective control is only achieved with the use of Escort herbicide, for which a consent would be required.

(b) Weed Control Techniques

A range of weed control methods are employed (see Appendix 2), but the most widely used to date are the use of chemical herbicide sprays, a weed-cutting boat and a hydraulic excavator.

Clearance by hydraulic excavator is performed periodically for most drains in the network. While effective, the method is expensive, causes damage to stream banks, and is disruptive to aquatic habitat.

The principal herbicide used is glyphosate (such as "Roundup"). It is used for marginal vegetation only as glyphosate is neutralised on contact with water or earth.

Diquat is another herbicide that is sometimes used to eradicate aquatic weed. It tends to sink through water and clings to submerged aquatic weeds, and so is more suited to larger canals and drains. Environment Bay of Plenty has obtained a consent for its use, although it has not actually been used in recent years due to the introduction of the weed cutter boat.

However, spray usage is increasingly of concern to many people due to possible adverse environmental and health of the sprays. Furthermore, it is possible that particular weeds may develop some resistance to the sprays, or that different varieties of weed that are resistant may become established.

Hence Environment Bay of Plenty has moved to decrease its amount of spraying by using or trialling alternatives. (Indeed a condition of the consent obtained in 1997 for diquat use is that Environment Bay of Plenty investigates alternatives). These have included saltwater flushing, use of a purpose-built weed boat with a mechanical cutter, the use of shade trees to suppress weed growth (Crabbe, 1994), and stocking drains with grass carp (Aquaculture NZ Ltd., 1997).

Floodgates are occasionally opened to flush the system with salt water, and kill weeds intolerant of salt water. This only works in tidally affected areas close to the sea, and has to be used with caution as salt also eradicates marginal vegetation and thereby enhances edge erosion.

A weed cutter boat has been used since 1994. It has proved to be an efficient and effective means of controlling weed growth in larger drains and canals. In addition to directly cutting weed, it opens up the waterway and allows self-flushing of weed and silt by the higher velocities resulting. The weed cutter boat provides immediate and relatively quick clearance of aquatic weeds. It also has a minimal effect on marginal vegetation, thus preventing bank erosion and also providing marginal habitat for wildlife.

The use of shade trees has shown some promise, provided the drain orientation is favourable (east-west), and that appropriate species are used. Trials are being performed to further assess the effectiveness of shade trees. Shade trees will not be suitable for wide drains (due to insufficient shading) nor on drains requiring excavator access to both banks. Hence the use of this technique is likely to be limited to smaller drains of the scheme and to private drains.

In some drains grass carp *(Ctenopharyngodan idella)* are used to control weed growth. Sterile fish are stocked, and the drains selected are made secure to prevent the fish escaping.

4.4.7 2004 and 2005 Floods

Two major recent flood events in the eastern Bay of Plenty affected several river and drainage schemes in the region. Within the Rangitaiki Drainage Scheme area, a large portion of the plains to the east of the Rangitaiki River were inundated for several days in July 2004, following a breach in the Rangitaiki River stopbank and floods in the Te Rahu and Waioho canals. In May 2005, floods impacted heavily on the Awakaponga catchment in particular. As well as damage to the Drainage Scheme assets, the floods have stretched technical and operational resources. A further storm in February 2006 around Matata compounded the impact. From the experience of the eastern Bay of Plenty floods of 1998, the fallout from these more recent floods can be expected to last for several years.

4.4.8 Drain Sediment Contamination

The lower reaches of the Kope-Orini canal system contain contaminated sediments, a result of past discharges from industries in the area. It is likely that major remedial works to remove the sediments will be undertaken. However details have yet to be confirmed, including how the removal will be funded. While central government is expected to contribute, it is unclear at this stage what the implications for the Scheme will be.

4.5 Maintenance Programme

The Council has developed a maintenance programme strategy, which will minimise the risks of failures to the system, and thereby provide for the most efficient and economic operation, to the service standards determined previously. A detailed assessment has been undertaken of the work requirement, to provide for the long-term sustainable management of the scheme assets.

The key work components of the maintenance programme for the Rangitaiki Drainage Scheme are summarised in Table 4, along with a general description of the activity and its estimated required frequency. Frequencies given are for the range of conditions anticipated throughout the scheme.

Table 4 General Asset Management Activities and Assumptions

Item/Activity	Description	Estimated Frequency
Drain Channels		
General Overview	Oversight and general inspection	1 year
Regular Inspection	Regular inspection of drain condition	Ongoing
Cross-section survey	Resurvey for main canals	8 years
	Resurvey of other drains	As required
Bank Maintenance	Miscellaneous bank repairs/weed spray	Ongoing
Maintaining waterway	Weed clearance, drain clearing, desilting	Ongoing
Stopbank		
General Overview	Oversight and inspection	1 year
Survey	Stopbank long section and representative sections	As required
Stopbank reconstruction	Reconstruction for settlement and miscellaneous damage	20 years
Culverts and Flapgates		
Regular inspection	Regular operational check	Ongoing
Culvert cleaning	Desilting, removing blockages	Ongoing
Miscellaneous maintenance	Replacement of floodgate chains/bolts etc	2 years
Ancillary replacement	Replacement of flapgates, winches, retaining walls, timber	17 years
Culverts & flapgate replacement	Full replacement	50 years
Erosion Control Structures		
Regular inspection	Regular inspection of condition	Ongoing
Minor repairs	Minor repairs to gabion and mattress structures	5 years
Replacement	Full replacement	50 years

In general the priority order for maintenance work in the scheme will be

- Keeping channels clear of obstruction
- Maintenance of ancillary works
- Retaining the integrity of the stopbanks
- Retaining the strength and integrity of erosion control works

4.6 Maintenance Costs

4.6.1 Existing

The maintenance expenditure (Environment Bay of Plenty account code 752) for the Rangitaiki Drainage Scheme over recent years (including disaster and flood damage reserve contributions and depreciation/DISP) has been the following:

1998/1999	$520,685
1999/2000	$492,417
2000/2001	$484,370
2001/2002	$491,758
2002/2003	$465,395
2003/2004	$426,654
2004/2005	$388,215

Note that the works programme in 2004/05 was disrupted by the floods in July 2004, hence the relatively low actual expenditure in that year.

The budgeted expenditure for 2005/2006 is $539,000.

4.6.2 Asset Maintenance Expenditure Requirements

Introduction

All expenditure on infrastructure assets will fall into two categories: capital or operating.

(a) Capital Expenditure

Capital expenditure projects are those displaying one or more of the following characteristics:

- Construction works which create a new asset that did not previously exist in any shape or form.
- Expenditure which purchases or creates a new asset (not a replacement) or in any way improves an asset beyond its original design capacity.
- Upgrade works that increase the capacity of the asset.

(b) Operating Expenditure

Renewal accounting treats all upgrading, reconstruction, renewal and renovation work that does not increase the capacity of assets as operating expenditure.

Operating expenditure can be further subdivided into two: normal ongoing routine maintenance works and those other more infrequent but periodic larger projects that upgrade or renew the asset to its full (or original) service potential.

(i) Routine Maintenance Expenditure

Routine Maintenance projects can be expected to display some of the following characteristics:

- regular and ongoing annual expenditure necessary to keep the assets operating at the required level of service, e.g. inspections; management; liaison with ratepayers etc.
- day to day and/or general upkeep works designed to keep the assets operating, e.g. insurance, power costs.
- works which provide for the normal care and attention of the asset including repairs and minor replacements,
- minor response type remedial works i.e. isolated instances where portions or sections of a unit of an asset fail and need immediate repair to make the asset operational again.

Information on the maintenance expenditure is presented in section 4.6.1.

(ii) Renewal Expenditure

Work displaying one or more of the following attributes can be classified as renewal expenditure:

- Works which do not increase the capacity of the asset, i.e. works which improve and enhance the assets restoring them to (or below) their original size, condition, capacity, etc.
- The replacement component of augmentation works which does not increase the capacity of the asset, i.e. that portion of the work which restores the assets to their original size, condition capacity, etc.
- The replacement component of a capital work which replaces the redundant element of an existing asset.
- Reconstruction or rehabilitation works involving improvements, realignment and regrading.
- Renewal and/or renovation of existing assets, i.e. restoring the assets to a new or fresh condition.

In practice, lower cost renewal items are often regarded as routine maintenance. Appendix 2 shows how the distinction has been drawn between routine maintenance and renewals in this plan.

4.7 Expenditure

4.7.1 Repairs and Maintenance and Decline in Service Potential

Appendix 2, Table 1, schedules the projected expenditure required to maintain the scheme under the criteria of this plan. Average annual expenditure on works, including renewals but excluding restoration and capital works, is $604,506.

Appendix 2, Table 2, presents the same data as Table 1 but excluding renewals funding. The annualised difference between Tables 2 and 1 gives the average annual cost of depreciation, i.e. $47,338.

Note that the projected expenditure on maintenance, renewals and decline in service potential has been prepared in terms of costs applying for the 2006/2007 financial year (June 2006 forecast CCI = 4930). The annual expenditure estimates in future years will require updating for inflation. The procedure will be to adjust the base figures in this report by the movement in CCI as forecast to each June immediately preceding the financial year.

These estimates will be reviewed regularly because maintenance practices and costs of works and services will vary over time.

Table 5 and Figure 3 present the works expenditure distribution. They include the following:

(a) Forecast operation and maintenance, based on the data presented in Appendix 2, Table 1.

(b) Predicted renewals, also based on the data presented in Appendix 2, Table 1.

(c) Predicted flood damage, based on the scenario presented in Appendix 5 (refer also to section 4.10.2(a).

Appendix 7 lists the predicted schedule of renewal works.

4.7.2 Projects

Budget is required for projects and investigations. This engineering support covers several tasks including flood forecasting modelling, drain hydraulic modelling, asset management and monitoring of the settlement of the Plains. These investigations are aimed to optimise scheme management to the set performance standards.

As outlined in section 4.10.5, projects are equally funded by scheme rates and a regional rate contribution. The estimated scheme rates share of projects for the next ten years (until 2015/2016) is shown in Table 6. Thereafter, $14,000 has been projected for each year (based on the $11,000 per annum provided in the 1998 Plan, increased by the movement in the CCI).

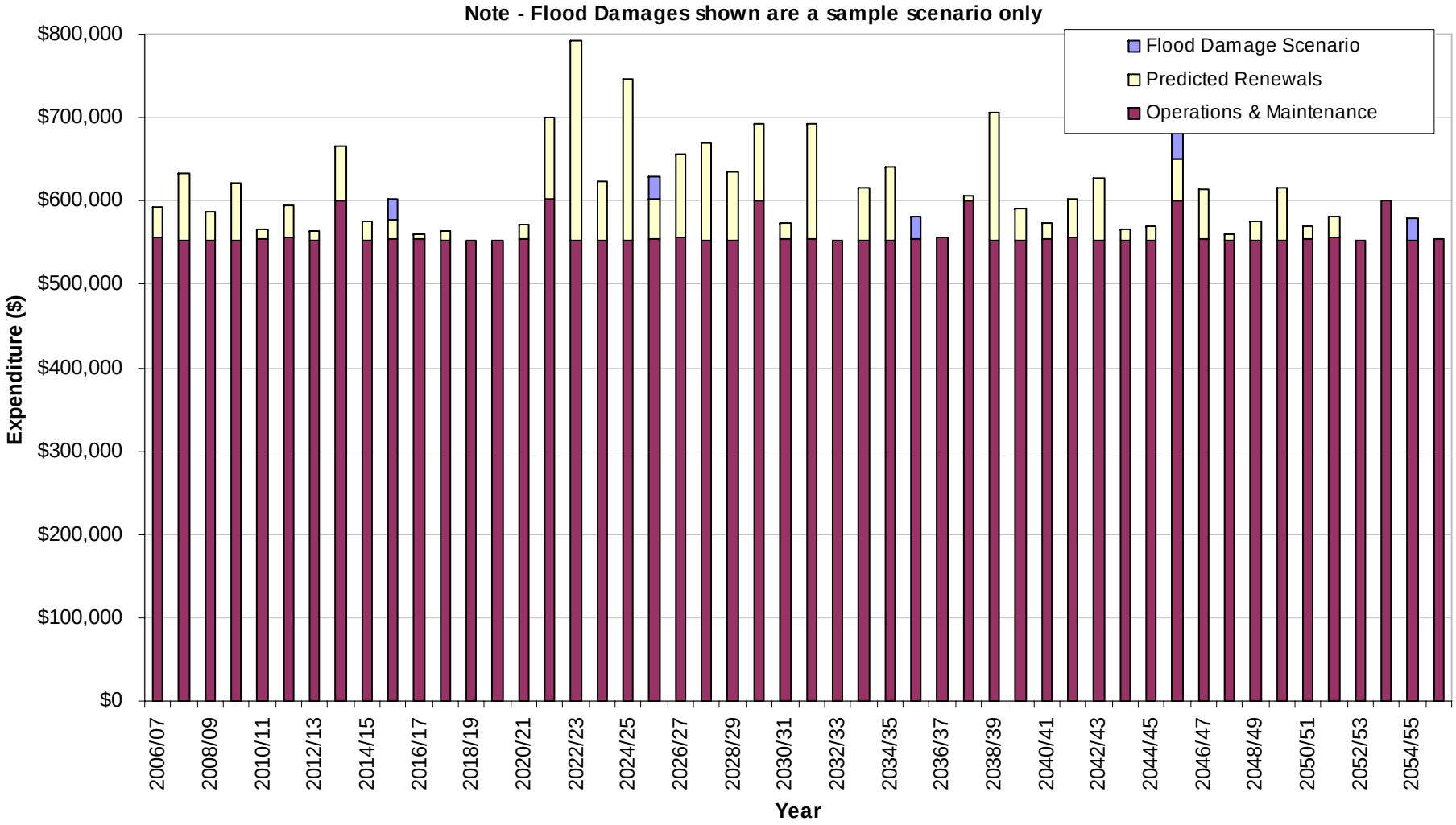
4.7.3 Loan Repayment

The Drainage Scheme currently has no debt. In order to help fund renewal works and to prevent the Renewals Fund from going into significant debt, however, loans will be needed from time to time in the future. The schedule of estimated annual loan repayments is shown in Appendix 6.

Table 5 Rangitaiki Drainage Scheme Works Expenditure Distribution ($ at CCI 4930)

	Year	Routine Maintenance (from App. 2)	Predicted Renewals Cost	Flood Damage Scenario (from App. 4)	Total
1	2006/07	$555,590	$37,168		$592,758
2	2007/08	$553,348	$80,175		$633,523
3	2008/09	$553,348	$33,918		$587,266
4	2009/10	$553,348	$69,127		$622,475
5	2010/11	$554,837	$11,109		$565,945
6	2011/12	$555,909	$39,046		$594,955
7	2012/13	$553,348	$10,254		$563,602
8	2013/14	$599,563	$65,863		$665,426
9	2014/15	$553,348	$21,363		$574,711
10	2015/16	$554,837	$22,086	$26,215	$603,138
11	2016/17	$553,937	$5,982		$559,919
12	2017/18	$553,348	$10,254		$563,602
13	2018/19	$553,348			$553,348
14	2019/20	$553,348			$553,348
15	2020/21	$554,837	$17,810		$572,646
16	2021/22	$601,805	$99,170		$700,974
17	2022/23	$553,348	$239,660		$793,007
18	2023/24	$553,348	$70,919		$624,267
19	2024/25	$553,348	$192,808		$746,155
20	2025/26	$554,837	$47,965	$26,215	$629,017
21	2026/27	$555,909	$101,131		$657,041
22	2027/28	$553,348	$116,295		$669,643
23	2028/29	$553,348	$80,829		$634,177
24	2029/30	$599,563	$92,853		$692,416
25	2030/31	$554,837	$18,017		$572,854
26	2031/32	$553,937	$139,489		$693,426
27	2032/33	$553,348			$553,348
28	2033/34	$553,348	$61,679		$615,026
29	2034/35	$553,348	$87,700		$641,048
30	2035/36	$554,837		$26,215	$581,052
31	2036/37	$555,590			$555,590
32	2037/38	$599,563	$5,844		$605,406
33	2038/39	$553,348	$151,990		$705,338
34	2039/40	$553,348	$38,191		$591,539
35	2040/41	$554,837	$18,274		$573,110
36	2041/42	$555,909	$45,882		$601,791
37	2042/43	$553,348	$74,037		$627,385
38	2043/44	$553,348	$12,818		$566,166
39	2044/45	$553,348	$17,091		$570,438
40	2045/46	$601,052	$49,300	$40,381	$690,733
41	2046/47	$553,937	$59,797		$613,735
42	2047/48	$553,348	$6,836		$560,184
43	2048/49	$553,348	$21,363		$574,711
44	2049/50	$553,348	$62,675		$616,023
45	2050/51	$554,837	$14,396		$569,232
46	2051/52	$555,590	$25,505		$581,094
47	2052/53	$553,348			$553,348
48	2053/54	$599,563			$599,563
49	2054/55	$553,348		$26,215	$579,563
50	2055/56	$554,837			$554,837

Figure 3 Rangitaiki Drainage Scheme
Works Expenditure Distribution



4.8 Funding

The scheme is funded from annual rates levied over a separate rating area known as the Rangitaiki Drainage District.

Annual rates are based on estimated expenditure. Actual expenditure will usually vary from estimated expenditure in any one year, and therefore the scheme account will at year end have a credit or debit balance which will be carried forward into the next year as at present.

Funds are used for repairs and maintenance, decline in service potential (depreciation), and if necessary for repayment of loans.

The method by which decline in service potential is recognised and funded has been discussed extensively with both the Office of the Auditor General and its agent, Audit New Zealand, and their advice taken. As a result the decline in service potential will be funded annually with funds initially set aside under what is known as a renewals-based accounting system. A "rolling" estimate by year of renewal expenditure requirements has been calculated. All renewal expenditure (for example, stopbank top-ups or refurbishment of major culverts) restores service potential of the assets; that is there is no element of upgrading (increasing of service potential) involved. For further details of how the renewals fund will operate refer to section 4.7.1(c).

4.8.1 Disaster Reserves

(a) Background

In 1993, Council resolved to create a Disaster Reserve to help fund any repairs to uninsured infrastructural assets following a disaster. This resolution was based on the expectation that in event of a disaster the Government would provide for 60% of the loss (subject to certain conditions), under the Government's Disaster Recovery Plan. The remaining 40% was to be the responsibility of the local authority. Environment Bay of Plenty had a risk assessment undertaken by Marsh and McLennan Ltd in 1993, which concluded that earthquakes presented the greatest potential for damage to infrastructural assets. Different scenarios were examined and the Council, upon professional advice, decided that the disaster event to be planned around was a 1 in 300 years earthquake which could cause an expected maximum loss of $10.5 million to the region's infrastructural assets (based on a CCI of 3470). As an interim step, Council resolved to build up the various scheme reserves over a ten-year period to half the value of the $4.2 million local share (i.e. $2.1m), with clear implication that in the event of a disaster, any shortfall in any scheme's local share would be found by way of borrowing.

Following that Council resolution, targets were set for disaster funds for each of the major rivers schemes in the region. Each target reflected that scheme's vulnerability. In the case of the Rangitaiki Drainage Scheme, the target fund was assessed at $226,000 (at CCI 3470).

(b) Current Policy

The Government's decision to decline Environment Bay of Plenty's application for funding of losses sustained in the 1998 floods, and a recent review of the risk assessment of uninsured river and drainage scheme infrastructural assets

(Cousins et. al (2002) and JLT Consultancy (2002)), led Council to revise its disaster reserves targets.

The review of the risk concluded that

- that for events of less than 1,000 years return period, the infrastructural assets are more vulnerable to tsunami and floods, than they are to earthquake damage.

- The damage from volcanic activity is only of significance for remote probability events. Such events may also significantly change the landscape and thus render the current scheme setups inappropriate

- it would be appropriate to adopt the 500-year tsunami as the target disaster event to be planned around, in which case the expected maximum loss is $5.8 million. (It is assumed that this figure applied at CCI = 4450, and so becomes $6.4m at CCI = 4930).

Assuming no central government contribution, and again assuming that reserves and borrowing would provide equal contributions to the recovery, a suitable revised target for the Rangitaiki Drainage Scheme at CCI = 4930 is

0.5 x $6.4m ÷ $2.1m x $226,000

i.e. approximately $345,000.

$140,360 was withdrawn from the fund following the July 2004 floods, and as at 30 June 2005, the balance of the Rangitaiki Drainage portion of the fund stood at $104,942. No contributions have been budgeted for 2005/06.

As of 30 June 2005, the total account of the Rangitaiki Drainage Scheme had a credit balance of $258,427 (from underspends in previous years). Assuming 5% interest accrued in the interim, it is assumed that $234,811 of this credit balance can be transferred to the disaster fund to bring the fund to its target value. Appendix 4 shows the fund balance over time, incorporating interest. In practice, interest earned on the fund will be used to reduce rate funding requirements provided the target balance has been met, rather than be allowed to compound in the fund.

There is a possibility however that a further withdrawal will be needed to help fund repairs following the May 2005 storm.

Because of the infrequency and unpredictability of disaster events, no prediction has been made as to the timing or size of disaster recovery works which may result in withdrawals from the disaster reserve.

4.8.2 **Flood Damage Reserves**

Presently (and more significantly in the past), a percentage of the maintenance budget has been spent on repairing flood damage which results from moderate size floods. However experience has shown, even on schemes where a comprehensive annual programme of works is undertaken, there is still a requirement to have funds set aside to finance damage that does occur periodically from floods. Accordingly, a flood damage reserve, capped at $25,000 at CCI 3790, was created when the 1998 Rangitaiki Drainage Scheme Asset Management Plan was adopted. At CCI 4930,

a revised target is $33,000. Funds from this reserve are used only for flood damage repairs. The effect of the reserve is a relative smoothing out of the rate requirement from year to year.

A flood needs to have been at least a 5 year event before such funds can be used for repairs. Damage from lesser events is covered separately by an annual maintenance provision of $5,697 as in Appendix 2.

Following flood damage in July 2004, $20,031 was withdrawn from this account in January 2005. As at 30 June 2005, the reserve balance was $14,976.

As noted above, the total account for the Scheme had a significant credit balance at 30 June 2005. After this credit balance is used to build up the Disaster Reserve to its target balance, a surplus still remains and this is to be transferred to the Flood Damage Reserve.

Thereafter, annual payments will be at up to $7,000 as required to maintain the target. (These figures will need to be adjusted in line with changes in inflation as measured by CCI). Also, if necessary, Environment Bay of Plenty will borrow to fund flood damage repairs, although given that the damages are unlikely to be great it is more likely that shortfalls would be met from any credit working balances at year end or by raising rates in following years.

Appendix 4 contains a graph and table showing the manner in which the flood damage reserve might operate. In the scenario shown, four “significant” floods resulting in $20,000 damage each and one “major” flood resulting in $30,000 damage occur, plus monitoring costs for each as outlined in Appendix 4. Exact figures cannot be given because floods obviously occur at random intervals. What is presented is a typical scenario, illustrating the accumulation of the fund and use of the fund for the medium sized flood events postulated at average 5 yearly intervals. The prediction of expenditure on future flood events is always subject to a degree of uncertainty. A scheme can go several years (or decades) without experiencing a major flood or, conversely, a cluster of major floods may occur. To illustrate this point the so called 50 year flood is the flood that is equalled or exceeded on average once every 50 years. However, during any particular 50 year period there is a 26.4% chance of two or more 50 year floods occurring. If there was an adverse clustering of floods then the flood damage reserve would likely be insufficient, requiring additional loan funding.

In the previous asset management plan, an allowance for flood monitoring costs was included in the maintenance budget. Estimates of these costs were annualised. In this plan, the annualised costs (other than for "annual" sized floods) have been taken from the routine maintenance allowance, and the actual costs as incurred will be taken from the flood damage reserve and replaced as required to top up the fund. This ensures that sufficient funds will be available if and when a flood occurs. An allowance for monitoring of "annual" size floods is kept as part of the routine maintenance however.

Unlike the disaster reserves, no interest has been assumed to accrue on the flood damage reserves, as the occurrence of floods, although unpredictable, is expected to be more frequent than for disasters.

With larger flood events, input from other staff is required, and some survey of peak flood levels or of channel changes will be required. (Assume for a 10 year event, 4 days field work for a surveyor, surveying peak water level marks. Assume for a 50 year event a complete resurvey of major drains and canals is required). In

developing the expenditure distribution over time, the 10 year and 50 year event costs have been annualised.

4.8.3 Renewals Reserves

As a result the decline in service potential will be funded annually with funds initially set aside under what is known as a renewals based accounting system. A "rolling" estimate by year of renewal expenditure requirements has been calculated. All renewal expenditure – for example, culvert replacements or stopbank top-ups – restores service potential of the assets; that is there is no element of upgrading (increasing of service potential) involved.

The Office of the Auditor General has advised that the renewals fund can be used not only to fund renewals expenditure but also to fund the annual principal portion of the scheme's existing loan repayments.

Details of how the renewals fund is forecast to operate are presented in a table and graph in Appendix 5. Where the renewals fund would otherwise go into significant deficit, loans will generally be required to fund renewal works.

4.8.4 Benefits to Other Infrastructure

In many locations the drainage scheme offers significant benefit to Whakatane District Council and Transit New Zealand roading assets and to Ontrack railway assets. Other utilities that receive similar benefits include Natural Gas Corporation, electricity and telecommunications companies. In general none of these organisations contribute financially to toward the maintenance of the drainage scheme. However, in the past when the drainage scheme assets have needed maintenance (e.g. bank erosion repairs) to protect roading or other infrastructural assets, the relevant authority has met the repair costs. Environment Bay of Plenty will continue to seek costs for such works in the future. These contributions have not however been included in the funding analysis in Table 6 and Figure 4.

4.8.5 Interest

The reserve funds will also attract relatively small amounts of interest that may reduce rates and or even loan requirements. However, future interest rates are unknown and, other than for the disaster reserve funds as discussed above, the effect of interest earnings has not been allowed for in this plan.

4.8.6 Analysis of Funding Requirements

Table 6 and Figure 4 present the funding requirements for all activities including loan charges. They are based on data presented in Appendices 2 to 6. The funding requirements are met entirely by rates.

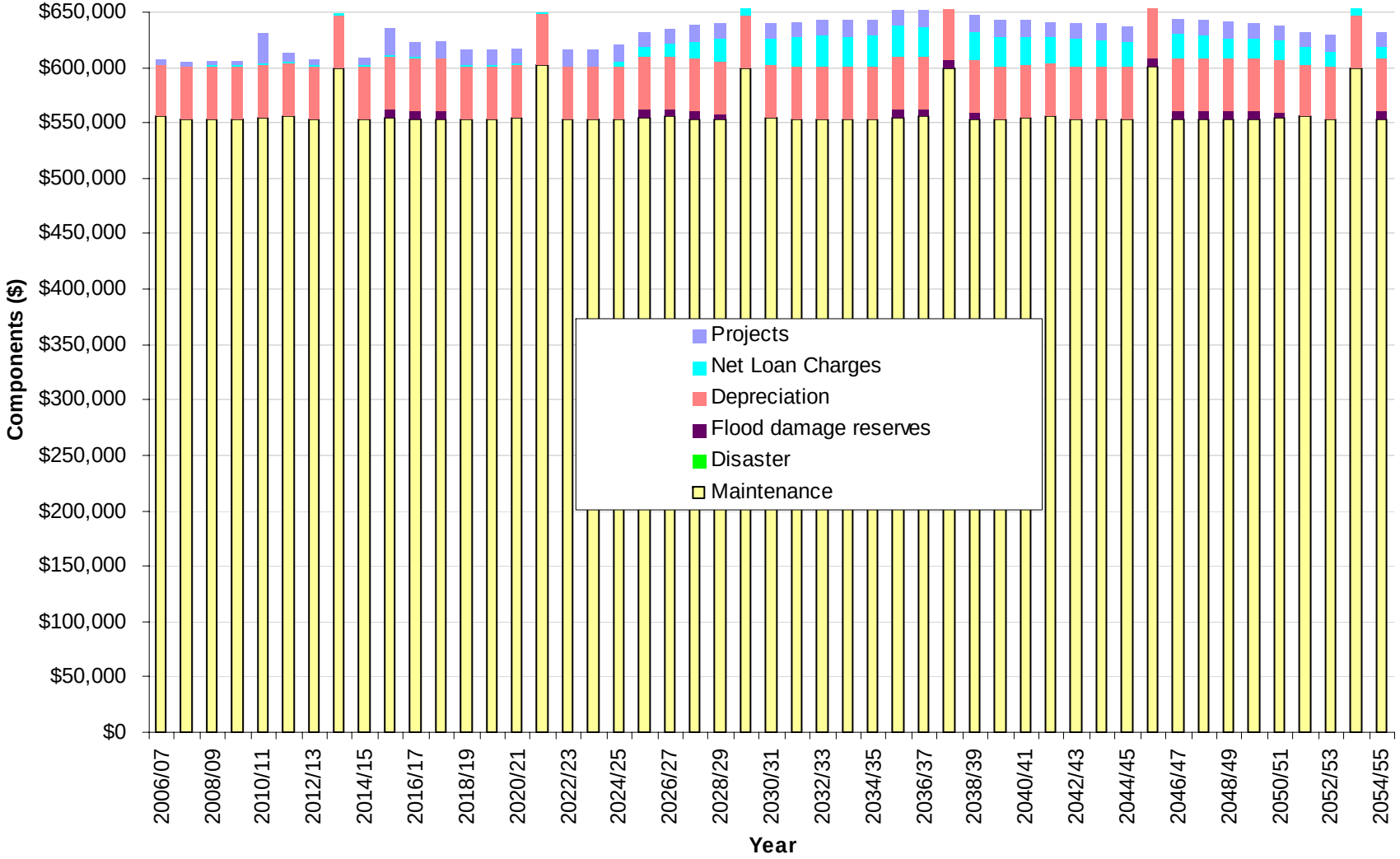
The 2006/07 rate requirement is $606,828, an increase of 11.6% on the budgeted 2005/06 rate take of $543,600. The forecast average annual rate take over the first ten years is $616,606 or 13.4% above the 2005/06 budgeted rate. Over the 50 years of the plan, the forecast average rate is $635,910, an increase of 17% from the budgeted 2005/06 rate take.

(Note that figures will depend on how the flood damage and disaster reserves are operated and upon the calls made upon them.)

Table 6 Rangitaiki Drainage Scheme - Funding Requirements

	Year	Projects	Maintenance	Disaster reserves	Flood damage reserves	Depreciation	Subtotal	Loans: Total principal	Loans: Total interest	Total Loan Charges	Less Principal funded from depreciation	Net Loan Charges	Total Funding Requirement
1	2006/07	$3,900	$555,590	$0	$0	$47,338	$606,828	$0	$0	$0	$0	$0	$606,828
2	2007/08	$3,900	$553,348	$0	$0	$47,338	$604,586	$0	$863	$863	$0	$863	$605,448
3	2008/09	$3,200	$553,348	$0	$0	$47,338	$603,886	$1,150	$1,682	$2,832	$1,150	$1,682	$605,568
4	2009/10	$2,800	$553,348	$0	$0	$47,338	$603,486	$1,150	$1,971	$3,121	$1,150	$1,971	$605,457
5	2010/11	$26,200	$554,837	$0	$0	$47,338	$628,375	$1,650	$2,241	$3,891	$1,650	$2,241	$630,616
6	2011/12	$7,100	$555,909	$0	$0	$47,338	$610,348	$1,650	$2,117	$3,767	$1,650	$2,117	$612,465
7	2012/13	$3,900	$553,348	$0	$0	$47,338	$604,586	$1,650	$1,993	$3,643	$1,650	$1,993	$606,579
8	2013/14	$0	$599,563	$0	$0	$47,338	$646,901	$1,650	$1,869	$3,519	$1,650	$1,869	$648,770
9	2014/15	$6,200	$553,348	$0	$0	$47,338	$606,886	$1,650	$1,746	$3,396	$1,650	$1,746	$608,632
10	2015/16	$24,900	$554,837	$0	$7,000	$47,338	$634,075	$1,650	$1,622	$3,272	$1,650	$1,622	$635,697
11	2016/17	$14,000	$553,937	$0	$7,000	$47,338	$622,276	$1,650	$1,498	$3,148	$1,650	$1,498	$623,774
12	2017/18	$14,000	$553,348	$0	$7,000	$47,338	$621,686	$1,650	$1,374	$3,024	$1,650	$1,374	$623,060
13	2018/19	$14,000	$553,348	$0	$0	$47,338	$614,686	$1,650	$1,251	$2,901	$1,650	$1,251	$615,937
14	2019/20	$14,000	$553,348	$0	$0	$47,338	$614,686	$1,650	$1,127	$2,777	$1,650	$1,127	$615,813
15	2020/21	$14,000	$554,837	$0	$0	$47,338	$616,175	$1,650	$1,003	$2,653	$1,650	$1,003	$617,178
16	2021/22	$14,000	$601,805	$0	$0	$47,338	$663,143	$1,650	$879	$2,529	$1,650	$879	$664,022
17	2022/23	$14,000	$553,348	$0	$0	$47,338	$614,686	$1,650	$756	$2,406	$1,650	$756	$615,442
18	2023/24	$14,000	$553,348	$0	$0	$47,338	$614,686	$1,650	$632	$2,282	$1,650	$632	$615,318
19	2024/25	$14,000	$553,348	$0	$0	$47,338	$614,686	$1,650	$5,083	$6,733	$1,650	$5,083	$619,769
20	2025/26	$14,000	$554,837	$0	$7,000	$47,338	$623,175	$7,750	$9,306	$17,056	$7,750	$9,306	$632,481
21	2026/27	$14,000	$555,909	$0	$7,000	$47,338	$624,248	$7,750	$11,349	$19,099	$7,750	$11,349	$635,597
22	2027/28	$14,000	$553,348	$0	$7,000	$47,338	$621,686	$11,250	$16,262	$27,512	$11,250	$16,262	$637,948
23	2028/29	$14,000	$553,348	$0	$5,000	$47,338	$619,686	$14,100	$20,074	$34,174	$14,100	$20,074	$639,760
24	2029/30	$14,000	$599,563	$0	$0	$47,338	$660,901	$16,450	$23,016	$39,466	$16,450	$23,016	$683,917
25	2030/31	$14,000	$554,837	$0	$0	$47,338	$616,175	$19,050	$24,009	$43,059	$19,050	$24,009	$640,184
26	2031/32	$14,000	$553,937	$0	$0	$47,338	$615,276	$19,050	$26,368	$45,418	$19,050	$26,368	$641,644
27	2032/33	$14,000	$553,348	$0	$0	$47,338	$614,686	$24,100	$28,538	$52,638	$24,100	$28,538	$643,223
28	2033/34	$14,000	$553,348	$0	$0	$47,338	$614,686	$24,100	$27,293	$51,393	$24,100	$27,293	$641,978
29	2034/35	$14,000	$553,348	$0	$0	$47,338	$614,686	$24,850	$28,494	$53,344	$24,850	$28,494	$643,180
30	2035/36	$14,000	$554,837	$0	$7,000	$47,338	$623,175	$28,150	$28,982	$57,132	$28,150	$28,982	$652,157
31	2036/37	$14,000	$555,590	$0	$7,000	$47,338	$623,928	$28,150	$26,871	$55,021	$28,150	$26,871	$650,799
32	2037/38	$14,000	$599,563	$0	$7,000	$47,338	$667,901	$28,150	$24,759	$52,909	$28,150	$24,759	$692,660
33	2038/39	$14,000	$553,348	$0	$6,000	$47,338	$620,686	$28,150	$25,648	$53,798	$28,150	$25,648	$646,334
34	2039/40	$14,000	$553,348	$0	$0	$47,338	$614,686	$32,150	$27,157	$59,307	$32,150	$27,157	$641,843
35	2040/41	$14,000	$554,837	$0	$0	$47,338	$616,175	$33,300	$25,778	$59,078	$33,300	$25,778	$641,953
36	2041/42	$14,000	$555,909	$0	$0	$47,338	$617,248	$33,800	$24,475	$58,275	$33,800	$24,475	$641,722
37	2042/43	$14,000	$553,348	$0	$0	$47,338	$614,686	$35,300	$25,062	$60,362	$35,300	$25,062	$639,747
38	2043/44	$14,000	$553,348	$0	$0	$47,338	$614,686	$38,300	$24,591	$62,891	$38,300	$24,591	$639,277
39	2044/45	$14,000	$553,348	$0	$0	$47,338	$614,686	$38,300	$22,057	$60,357	$38,300	$22,057	$636,743
40	2045/46	$14,000	$601,052	$0	$7,000	$47,338	$669,390	$32,700	$21,088	$53,788	$32,700	$21,088	$690,478
41	2046/47	$14,000	$553,937	$0	$7,000	$47,338	$622,276	$34,500	$21,727	$56,227	$34,500	$21,727	$644,003
42	2047/48	$14,000	$553,348	$0	$7,000	$47,338	$621,686	$33,350	$20,992	$54,342	$33,350	$20,992	$642,678
43	2048/49	$14,000	$553,348	$0	$7,000	$47,338	$621,686	$29,350	$18,687	$48,037	$29,350	$18,687	$640,373
44	2049/50	$14,000	$553,348	$0	$7,000	$47,338	$621,686	$27,000	$18,046	$45,046	$27,000	$18,046	$639,732
45	2050/51	$14,000	$554,837	$0	$5,000	$47,338	$621,175	$25,800	$17,538	$43,338	$25,800	$17,538	$638,712
46	2051/52	$14,000	$555,590	$0	$0	$47,338	$616,928	$25,800	$15,649	$41,449	$25,800	$15,649	$632,577
47	2052/53	$14,000	$553,348	$0	$0	$47,338	$614,686	$20,750	$13,950	$34,700	$20,750	$13,950	$628,636
48	2053/54	$14,000	$599,563	$0	$0	$47,338	$660,901	$20,750	$12,441	$33,191	$20,750	$12,441	$673,342
49	2054/55	$14,000	$553,348	$0	$7,000	$47,338	$621,686	$20,000	$10,959	$30,959	$20,000	$10,959	$632,645
50	2055/56	$14,000	$554,837	$0	$7,000	$47,338	$623,175	$16,700	$9,630	$26,330	$16,700	$9,630	$632,805

Figure 4 Rangitaiki Drainage Scheme
Total Funding Requirements



Chapter 5: Creation/Acquisition/Disposal

No new capital works (as defined in section 4.6.2) have been included in the funding requirements identified in this plan. It is not envisaged that the design standard for drainage or flood protection will change. However, this cannot be guaranteed. It may be that the community indicates a desire for a greater (or lesser) standard before the end of the long time frame used in this plan.

Disposal of assets does not normally occur in management of river or drainage schemes. Assets are usually fixed to the ground and design standards are not generally lowered. No disposal of assets has been envisaged in the development of this plan.

However this version of the asset management plan sees the Scheme adopt a number of additional culverts. The Wilson's Creek stopbank is also added to the register of assets.

The asset register is updated annually, while the scheme is revalued every five years.

Chapter 6: Asset Management Improvement

Good asset management requires continual improvement of the systems, processes and data that support an asset management plan.

6.1 Asset management systems

One of the observations made in preparing this Asset Management Plan, and asset management plans of other river and drainage schemes managed by Environment Bay of Plenty, has been that the asset registers, the financial reporting system, the annual plan budget forecasts and the asset management tables are all stored and managed separately. While all are valuable tools, and although there are some links between various of these, they are generally not set up in any structured way. At best it is therefore time-consuming updating information across the spreadsheets and databases; at worst, despite best efforts to avoid it, data could be missed or overlooked or mistakes in entering data could be made.

It therefore seems timely to consider a more formalised "asset management information system" (also referred to as an "asset management system" or AMS). The IIMM defines an asset management system as

> *"a combination of processes, data, software, and hardware applied to provide the essential outputs for effective AM* [asset management]*"*

and goes on to note that

> *"AM information systems have become an essential tool for the management of infrastructure assets in order to effectively deal with the extent of analysis required to support:*
>
> - *the increasing size and complexity of infrastructure assets and their operations*
> - *data required for sophisticated deterioration modelling and strategic financial planning functions*
> - *optimisation of and justification for renewal and capital investment programmes."*

The principal asset management improvement activity over the duration of this plan will be the further consideration and continued development of an appropriate AMS. Emphasis will need to be placed on the software and in particular on any database programming requirements.

A range of issues and considerations in setting up an AMS are described in Section 4.1 of the IIMM. These will need to be worked through. The requirements of an AMS for the river and drainage schemes managed by Environment Bay of Plenty include

- a single system, used by all relevant staff
- easy to use
- for each asset, the ability to identify expenditure, maintenance records, forecast works, condition, age etc
- for each asset, the ability to enter new information on condition, works requirements etc
- the ability to extract forecasts of annual budgets and staff resource requirements
- the ability to produce graphical or map-based outputs, and links to the corporate GIS
- links to the corporate financial system (Finance1)
- links to photographic databases
- the ability to update salary and wage rates, vehicle rates, etc and to have the effect transferred throughout the system automatically.

A range of other requirements will be identified as an AMS is developed and refined.

Recent and relevant developments within Environment Bay of Plenty include the recent moved to a new financial system, “Finance1”. An AMS would ideally incorporate Finance1, as well as the geographic information system (GIS) maintained by Environment Bay of Plenty.

Environment Bay of Plenty has also convened an internal working party to consider council-wide needs for asset management systems.

Looking nationally, a useful example of an AMS is that developed by Horizons Regional Council. Horizons developed its own AMS for its river and drainage management activities after concluding that propriety systems did not meet its needs (and in particular being too complicated). Although in its current state it probably would not totally meet the needs of Environment Bay of Plenty, it does have several features of interest. (Horizons Regional Council, 2005 and Joseph, 2005)

6.2 Asset Register - Culverts

This Plan sees many culvert structures become part of the Scheme assets. A list of the culverts, their sizes, materials and condition was prepared in 2000. This list needs updating to confirm the valuations, maintenance requirements and replacement dates for the structures. In the first instance this will be the task of a staff member to be appointed to a new position dedicated to floodgate maintenance.

Chapter 7: Quality assurance systems

Quality assurance systems are designed to maintain consistency in standards, procedures and methods, and to ensure that an audit trail can be followed. A common approach for organisations, both private and public, has been to seek ISO9000 series accreditation, with certification by an independent auditor that the system has been implemented and is being followed. This is an expensive process, and has not been undertaken by Environment Bay of Plenty, but nonetheless various sets of best practice procedures, guidelines and protocols have been adopted that help provide quality assurance. In the context of the management of the Rangitaiki Drainage Scheme assets, these include

- **Health and Safety Manual** (Environment Bay of Plenty, 2002b)
- **Environmental Code of Practice for Rivers and Drainage Maintenance Activities** (Environment B·O·P, 2001)

Over time this list will be expanded. Additions might include:

- filing and record keeping (both paper and electronic) procedures. (Any AMS adopted would be expected to have such procedures)
- photographic record storage procedures
- survey procedures and standards
- safety procedures
- contract administration guidelines and requirements
- instrument calibration procedures
- training programmes

A quality assurance system might be viewed as a set of contract conditions to be fulfilled by asset managers or their contractors.

The system in action needs to be audited.

Finally, review of the procedures will also be appropriate at various times, to ensure that current best practices are maintained.

Chapter 8: Monitoring

8.1 Effectiveness Monitoring

Traditional performance monitoring techniques are not easily applied to management of river and drainage schemes. Outcomes depend on the occurrence of unpredictable flood events, and the nature of fluvial hydraulics is complex and subject to random phenomena. However, it is still possible to apply the general principles of monitoring. Indeed, performance monitoring is required in order to adequately manage the assets. Review of the asset management plan will also depend on findings of performance monitoring.

The goal of the drainage scheme management is to maintain ground water at optimum levels for the current land use, by maintaining the desired levels of drainage capacity. More specific objectives against which to monitor performance have been identified in section 3.1 of this plan. In summary these are:

- Provide everyday drainage of the Rangitaiki Plains
- Remove ponded water from floods
- Prevent overtopping of internal stopbanks (i.e. those alongside drains and canals rather than rivers).

Other outcomes will be relevant, such as environmental enhancements. These will be described in various regional plans, and also in the Rivers and Drainage Environmental Code of Practice. Scheme management needs to be compatible with these.

Performance indicators, with which to measure the achievement of the goal and objectives, or progress towards them, are difficult to establish. Using indicators based on actual events, such as actual area of inundation or actual damages, are not ideal given that the causes and results may be beyond the reasonable expectations of the asset management. Hence at this stage the monitoring consists of reviewing the drainage capacity and of qualitative reporting.

The drainage capacity is reviewed regularly with the aid of modelling techniques and the 8-yearly cross-section surveys of the main canals. . The cross-section surveys can be used to help identify current drainage capacity and trends in capacity.

The cross-section surveys can also be used to help identify volumetric changes to the drainage channel and banks, and possibly local points of erosion or deposition.

The surveys are thus one of the most important monitoring programmes for management of the scheme.

It is possible to develop other quantitative measures regarding the standard of protection, based on flood modelling techniques and risk assessment methods, using indicators such as annual average damages. However, a large component of the performance monitoring is qualitative. Assessment of the condition of the scheme, its operation, and the degree of risk failure (that is, at less than design event storms) will need comment. Trends in these aspects will need to be identified also, in order to assess the effectiveness of the scheme asset management.

The assessment will be aided by the use of photographic records (and comparison of these taken over time), by regular reports on scheme operation and performance, and by feedback from scheme beneficiaries. Access to reliable information, current and historical, on the scheme performance, is required, and it is thus important that adequate data collection and information storage procedures are followed, as identified in quality assurance systems.

The monitoring will be performed at the following levels.

(a) **Asset Manager**

The Asset Managers (Rivers & Drainage Section) already monitor the scheme on a continual basis. Reports from the asset managers — such as six weekly reports to the Operational Services Committee of the council - on the performance of the scheme (as well as work done, funds spent, etc) should be copied to the separate (and centrally accessible) asset management file for the scheme.

(b) **Internal**

Performance monitoring will also be undertaken internally within Environment Bay of Plenty by the Manager of Technical Services, and reported upon periodically to the Operational Services Committee. The report will draw links between the performance of the scheme and the scheme management. The monitoring performed by the asset managers will also be audited and used as input into the report.

At eight yearly intervals, the Technical Services Department will reassess the design capacity of the drainage network

(c) **External**

It is essential that appropriate external audits be carried out to:

- assess the internal audit activities, the validity of their processes, and verify their conclusions and strategies adopted.
- judge the relative status of the organisation and its performance in asset management with respect to:

  – benchmarking with other like organisations

  – comparison with best practice

- Assess the relative improvement achieved since the previous external audit and compare this performance with what was capable of being achieved.

- Assist the Asset Managers and the internal audit/plan review team (Technical Services Section) to improve their activities and to derive better guidelines and assessment procedures.

- Confirm the technical content in the Asset Management Plan is sound and correctly applied in developing Asset Management Plan outputs.

Suitably qualified independent persons will undertake management and technical audits every five years from the commencement of the plan.

The findings of the independent management and technical audit will be reported to Council and be included, in summary form, in the Annual Report of the year that the audit was performed.

Consideration should be given to other organisations involved in the delivery of similar services using similar infrastructure. Reciprocal auditing with other regional councils would minimise the costs to Environment Bay of Plenty of external audits.

8.2 Condition Monitoring

The condition of assets is monitored by staff during routine inspections and general overview inspections, as noted in Appendix 2. However, an AMS should allow the condition of any asset to be entered into the asset database and for the condition to be queried via that database (see Chapter 6). This may require some quantitative index or scoring scale of the condition to be developed for each class of asset.

8.3 Cost Monitoring

8.3.1 Internal

Annual plan and annual report requirements ensure that cost or financial monitoring is already performed. With use of the corporate financial system discussed in section 3.7.2, the potential to perform detailed cost analysis, and analysis of cost-effectiveness, exists. (The ease of doing so would improve with an AMS as discussed in Chapter 6.)

A cost monitoring report shall accompany, or form an identifiable part of, the Technical Services commentary on the scheme discussed in 8.1 above.

8.3.2 Financial Audits (External)

The Local Government Act requires that independent annual financial and performance audits be undertaken on the Council, which may include all significant activities.

The Audit opinions will be included in the Annual Report.

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Appendices

Appendix 1 – Responsibilities and Roles in Asset Management

Appendix 2 – Asset Maintenance Requirements

Appendix 3 – Disaster Reserve

Appendix 4 – Flood Damage Reserves

Appendix 5 – Renewals Fund

Appendix 6 – Loan Repayments

Appendix 7 – Renewals Works Schedule

Appendix 1 – Responsibilities and Roles in Asset Management

(Based on structure of Environment Bay of Plenty as at March 2006)

Principal Roles

- Asset Managers: Rivers and Drainage Section (Environment Bay of Plenty)

  Responsible for day to day management of the Scheme. Assistance with preparing, monitoring and reviewing the Asset Management Plan.

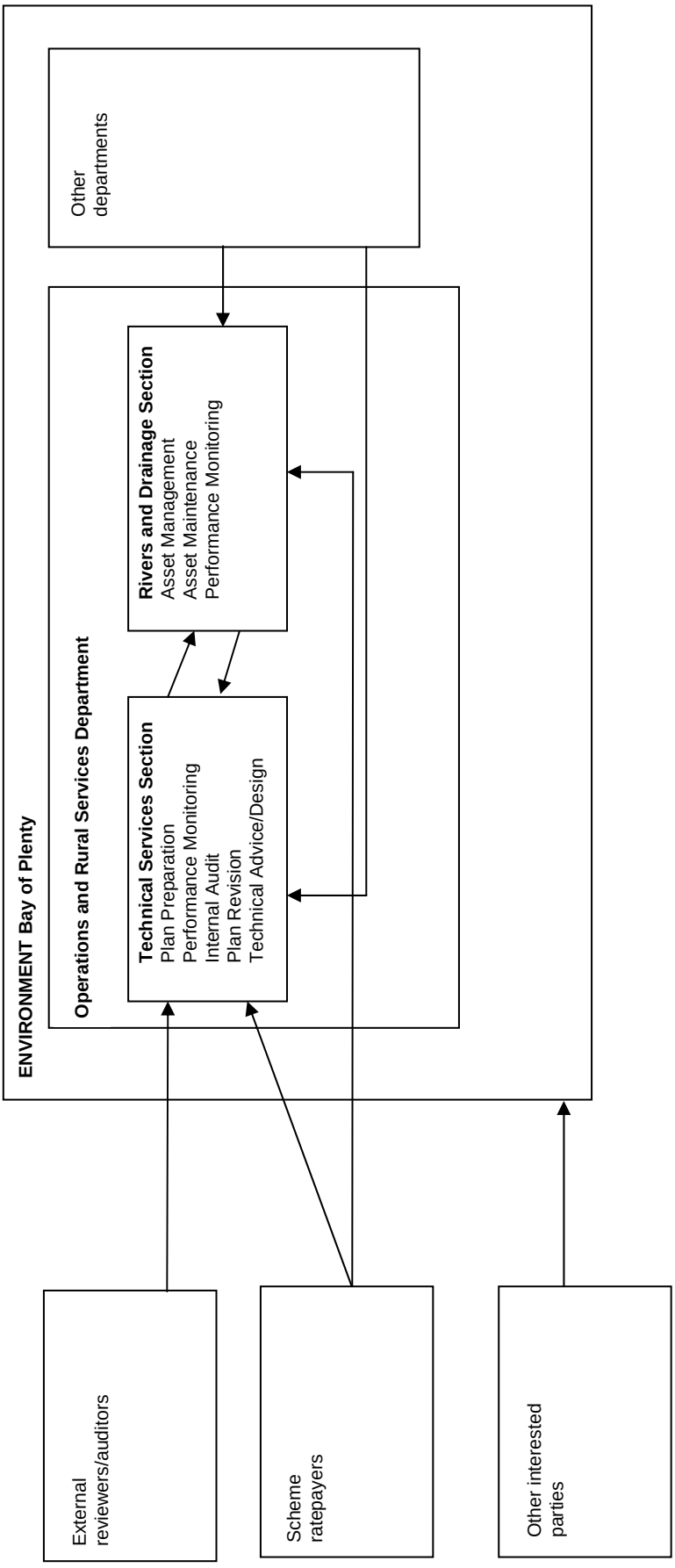
- Asset Management Plan preparation, monitoring and revision: Technical Services Section (Environment Bay of Plenty)

  Responsible for providing technical advice regarding the design and management of the Scheme. Responsible for preparing and revising the Asset Management Plan, and for monitoring the plan and the performance of the scheme.

Other sections and departments will have input into plan preparation and revision — in particular, to ensure consistency with various regional plans.

Consultation with external parties, in particular scheme ratepayers, will occur in the preparation and revision of the plan. External parties have also provided feedback about the scheme performance in the past, and the monitoring role they thus undertake is expected to continue.

The following diagram illustrates the relationships between the various parties that have roles in management of the assets.



Parties with Roles in Asset Management of the Rangitaiki Drainage Scheme

Appendix 2 – Asset Maintenance Requirements

1 General

1.1 Management

Group Manager Operational Services	5 days
Manager Rivers and Drainage	25 days
Manager Technical Services	0.5 days
Asset Management/Works Engineer	57.5 days
Asset Administration Officer	35 days
Computer Services	$9900
Information Services	$2100
Hydrological Recorders	$8700
Consultancy Fees	$2000

A significant amount of public liaison is required, due to the large number of landowners that have Drainage Scheme channels crossing their properties, and hence the staff time requirement is relatively high compared to river schemes.

An allowance for consultancy fees is included to cover occasional legal, technical and insurance advice.

1.2 General Overview

Annual inspection of the general condition of canals, major culverts and flapgates, drop structures. Documentation of findings.

- Asset Management Engineer and Supervisor – 1.5 days each
- Vehicle costs – 150km @ $0.50/km.

(Informal inspections by Technical Services staff also occur occasionally as part of resource consent applications. Associated costs are not borne by the Scheme.)

1.3 External Costs

Valuation New Zealand: Charges have been reduced to zero.

Rate Commission: allow	$26,200
Rate Remission:	$5,500
Insurance of Structures	$1,700

General management staff costs of $75,000 per annum have been included.

1.4 Asset Valuation

Assets require formal five yearly re-valuation.

Allow:

- Manager Technical Services 1 days
- Manager Rivers and Drainage 0.5 day
- Asset Management Engineer 0.5 day

1.5 Asset Management Plan Revision

The life of this Plan, and hence the frequency of revision is 10 years.

Included in Projects budget.

1.6 Ongoing Inspection

In Ongoing inspection of the culverts, flapgates, weed growth, channel condition. Responding to public/landowner enquiries.

- Asset Management Engineer – 20 days, plus vehicle costs of 120km/day @ $0.45/km
- Supervisor – 200 days, plus vehicle costs of 120km/day @ $0.50/km

1.7 Cross-Section Survey

Resurvey of major canals every 5 years provided there are no significant floods. Additional survey may be required on an occasional basis, including survey of the drains and stopbanks within the scheme. However a significant cost will not be involved, and such surveys are likely to be part of projects, for example modelling exercises, and so are best considered to be part of the projects allowance in Table 6. (See Section 4.7).

Note also that the stopbanks of the canals will be surveyed as part of the maintenance of the Rangitaiki-Tarawera Rivers Scheme.

1.7.1 Benchmark Installation

A set of permanent benchmarks at cross-section locations is needed, to ensure consistency between surveys and more efficiently carry out future surveys. At present there is no such set of benchmarks. Assuming installation of 10 benchmarks per day (i.e. 5 cross-sections), allow

- 2 labourers x 24 days
- Travel 24 days x 2 (return trip) x 25 km (average 1-way trip).

This is a one-off cost and is best placed under project budgets, although minor maintenance costs will occasionally be needed to replace benchmarks. These costs will be small and can be absorbed as part of the cross-section survey work.

1.7.2 Cross-Section Survey

Surveyor and 2 labourers complete an average of 6 cross-sections per day. (For smaller drains, it will be possible to get away with a surveyor and only one labourer assisting. In most cases however a boat will be required to survey the sections, in turn requiring a surveyor plus two labourers assisting). Office work to reduce and analyse data is approximately 50% of the field time for the surveyor.

Using the last major survey of the canals, in 1997 (Environment Bay of Plenty, 2002a)

- Awaiti Canal - 14 cross-sections (12.4 km)
- Omeheu Canal - 20 cross-sections (9km)
- Omeheu Drain – 8 cross-sections (4.5km)
- Old Rangitaiki Channel - 12 cross-sections (7.3km)
- Tarawera Western Drain - 12 cross-sections (9.7km)
- Section 109 Canal – 5 cross-sections (3.6km)
- Awakaponga Canal - 5 cross-sections (4.8km)
- Wilson's Creek - 2 cross-sections (0.8km)
- Mayo's Outlet – 2 cross-sections (0.8km)
- Grieves Drain - 3 cross-sections (only 2 surveyed in 1997) (1.9km)

The last Kopeopeo West survey (Environment B·O·P Level Book 449) had 8 cross-sections (1.8km).

For the remaining arterial drains, assume an average cross-section spacing of 800m. Thus

- Te Rahu Canal – 6300m – 8 cross-sections
- Sercombe's Canal – 1560 m - 2 cross-sections
- Copepod East Canal – 9800m – 12 cross-sections
- Orini Canal – 10000m – 12 cross-sections

Total number of cross-sections to be surveyed – 125

- Assume 21 days field work (surveyor plus two labourers)
- Travel - 21 days x 2 (return trip) x 25 km (average 1-way trip)

1.7.3 Benchmark Levelling

In addition, the benchmarks will need to be re-levelled prior to each survey, due to ongoing settlement of the Plains and possible damage to benchmarks (e.g. by farm machinery). The total length of canal and drain to be surveyed, from above, is

84.3km. As level runs will be along both banks, the length of levelling becomes approximately 169km. Approximately 5km can be levelled per day, so allow

- Surveyor plus labourer - 34 days
- Travel – assume 34 days x 2 (return trip) x 25 km (average 1-way trip)

1.8 Flood Monitoring - Streams

A typical annual flood event would require monitoring and inspection. Allow, above and beyond routine inspections:

- Asset management engineer – 1 day
- Supervisor – 2 days
- Labourers – 2 @ 2 days
- Vehicle travel - 500km.

The monitoring costs for "significant" and "major" floods are to be covered by the Flood Damage Reserve. The reserve has been increased by the monitoring cost of a major flood. The monitoring costs of a significant flood and a major flood are not part of the routine maintenance budget therefore. Refer to Appendix 5.

1.9 Flood Damage Repairs - Streams

An allowance to repair damages to assets caused by small floods and freshes is required. Allow:

- Asset management engineer – 1 day
- Supervisor – 3 days
- Labourers – 2 @ 3 days
- Vehicle travel – 7 x 2 x 20km = 280km

A typical fresh also requires 25 hours hire of an excavator (at $100/hour) along with transport of the excavator (at $150 per day – allow twice).

Should this requirement be considered light in comparison to the equivalent sum budgeted for in River Scheme Asset Management Plans, it must be realised that velocities in drains are low, that there are few bends in the drains, and that freshes can sometimes be beneficial by clearing excess weed growth.

These works are additional to routine maintenance but are not covered by the flood damage reserve.

2 Channel

2.1 Weed Clearance

Weed clearance is an ongoing activity. The need for it can vary from year to year; the weather in some years is such that weed growth is prolific, while at other times

floods can clear the weed growth. Several techniques are commonly used at present, as follows.

2.1.1 Weed Boat

In some of the arterial and larger drains, a purpose-built weed boat that cuts weed is used to clear weeds. These are

Drain	**Length (km)**
Awakaponga Drain	0.6
Awakaponga Canal	5.1
Awaiti Canal	7.4
Omeheu Canal (to Otakiri Rd)	6.3
Kopeopeo East	4.7
Kopeopeo West	1.8
Orini Canal	8.9
Old Rangitaiki Channel	8.25
Tumurau Canal	2.6
Tarawera Western Drain (downstream of SH2)	1.4
Te Rahu Canal	2.15
Fortunes Rd Drain	2.02
Eastern Drain (downstream of MacLean Rd)	2.05
Western Drain (downstream of Putiki Road)	3.4
Section 72 Outlet	1.1
Section 109 Canal	3.83
Tumuranui Drain (the lower 1.5 km)	1.5
Massey Drain	2
Collins Drain	0.6
Miscellaneous Streams	4 (total)
TOTAL length of drain weed boat operates over	69.7

Weed cuttings now tend to be removed rather than left to float downstream. The costs of removal (with an excavator) are included under drain clearing (section 2.2 below).

The weed boat is also used in the Reids Central Canal, however this is charged to the Rangitaiki-Tarawera Rivers Scheme.

Note that use of the weed boat requires sufficient water in the canals. If levels drop too low, control will need to revert to clearing by excavator.

The cost of the weed boat and operator is $65 per hour. In addition, a Hiab truck is needed to transport the weed boat, at $100/day.

In recent years the boat has been used for approximately 300 hours per year, with approximately $5000 required for transport of the boat.

Allow also 2 days each for a supervisor and labourer.

2.1.2 Spray

For remaining canals and drains, weeds are controlled by spraying (except as noted below under Hand Clearance). The spraying season lasts from September to May in most years, as sprays are ineffective in winter. Individual sections could be sprayed up as many as 5 times per year, depending on weed growth, but typically a reach would be sprayed once per year *on average*.

There are also costs associated with resource consents and ERMA approvals for spraying. These have been included in the general management above.

(a) Parrot's Feather

Some of the spraying (in particular, of Parrots Feather) is done with a boat. Allow:

- 2 labourers x 25 days
- Spray boat - 25 days (assuming 6 hours operating per day) @ $50/hour
- Other vehicle costs (transport of boat etc) - 2 x 20km/day x 25 days

In recent years, the sprays cost for Parrot's Feather control has been about one-third of that for other pest plants. The total spray cost budgeted for 2005/06 is $18,100, so it is assumed that one-quarter of this will be spent on Parrot's Feather control.

(b) *Other Aquatic Pest Plants*

The length of drain cleared with the weed boat is 70km, leaving 260km to be sprayed. Typically in recent years, spray equipment has been used for 130 days per annum, indicating that have been covering 2 km per day can be covered. (The previous plan assumed a rate of 1.5km/day, but efficiency has improved since then.)

Spraying is usually undertaken by labourers operating out of a ute. (In some instances, a tractor with a single operator is used. However, the bulk of spraying is done with the first option, and so this has been used in developing the budgets in this plan).

Assume

- 328.09km (total drain length) – 69.7km (drains cleared with weed boat) = 258.39 km @ 2 km/day = 130 days
- Sprays - $18,100 x 75%.
- Vehicle costs – assume 130 days x 25km (average one-way trip) x 2 (return trip) at 50c/km.
- Labour costs – assume 1500 hours (based on typical expenditure), i.e. 188 days
- Contractors - $3000 (used occasionally for spraying work).

2.1.3 Hand Clearance

On windy days and during winter, sprays cannot be used. In such cases, weed spraying is delayed until conditions are suitable, but in some instances weeds are cleared by hand. In addition, weed has to be manually cleared from pump screens.

During the 1997 calendar year, a total of 15.71km of drain were cleared by hand, requiring 741.5 hours of labour. This equates to a clearance rate of 320m per day for two workers, which is the rate assumed in Appendix 3.

Hand clearance occurs less frequently than when the last Asset Management Plan was prepared. A total of 2.5km per annum is assumed now.

- Vehicle costs – Assume 2 x 20km/day @ $0.50/km

2.1.4 Other Techniques

Other techniques used or under investigation include

- Clearance by hydraulic excavator. This is covered in 2.2 below.
- Opening floodgates to flush the system with salt water. This only works in tidally affected areas close to the sea. Associated costs are minimal.
- The use of shade trees to retard weed growth. Trials showed that this technique had promise, although again it is not suitable in all conditions. (Crabbe, 1994). However it does tend to restrict access to the drain, and so has not been used widely.
- Stocking drains with grass carp. Costs of carp replacement are met from capital budgets.
- A tractor-mounted weed cutter.

2.2 Drain Clearing

Hydraulic excavators are used periodically to clear silt deposits and weed growth in the drains. They are also used on some occasions to clear up cut weed left by the weed cutter boat.

Frequencies and rates of clearance by excavator vary amongst canals and also over time. The Awakaponga and Te Rahu Canals tend to require more frequent clearing than many other canals and drains due to high silt runoff from hills upstream. Some drains need no clearing at all.

Use of the Environment Bay of Plenty excavator at $110 per hour is assumed for the arterial drains – allow $60,000 per annum.

Plant hire excavators at an average of $100/hour are used for the remaining drains – allow $25,000 per annum.

Excavator transport is required when shifting between drains - assume 50 days per year at $150 each.

2.3 Bank Repairs

Bank repairs, using rotten rock, are needed on occasions. Other tasks required from time to time are clearing banks of trees, fencing repairs and occasional bridge abutment repair that has been damaged during other maintenance.

The expenditure in recent years has typically been approximately $30,000pa. Allow

- Supervisor – 5 days
- Labourer/operator 25 days
- EBOP excavator 8 days
- Other vehicle costs 15 x 20km x 2
- Material costs $2500
- Contractor $20,000

3 Structures

3.1 Culverts and Flapgates

3.1.1 Inspection, Clearing and Miscellaneous Maintenance

Regular check of flapgates and culverts. Cleaning and clearage of blockages. Allow:

- Supervisor 25.5 weeks = 128 days.
- Labourer 45 days
- Vehicle costs (128 + 20) days x 40km/day @ $0.50/km.
- Chainsaws – 15 days @ $35/day

Replacement of floodgate chains, bolts and other minor regular requirements, based on a 2year cycle. 147 flapgates included in Scheme. Assume $100 materials per flapgate.

Allow also - 5 days for use of a plant hire excavator

3.1.2 Replacement of Minor Culverts

Replacement of minor culverts, those less than 900mm diameter, has been considered to be part of normal maintenance. There are 93 such culverts, and assuming a life of 50 years for each, typically about two per year will need replacing. (Flapgates will need replacing more frequently; the additional cost has not been included for now.)

Allow an amount equal to twice the average replacement cost of the 93 culvert structures

3.1.3 Ancillary Replacement – Larger Culverts

Replacement of flapgates on larger culverts (i.e. 900mm diameter or larger). This item is treated as a renewal.

An average life of around 17 years has been assumed. However, as the flapgates will be replaced in when the culvert and headwall are replaced (every 50 years), the flapgates only will be assumed to be replaced an additional two times within the 50 year period. (Thus the replacement interval is shown as 25 years in Appendix 3).

Estimated replacement dates for the various flapgates are given in Appendix 8. In practice insufficient information is available to assess the likely actual replacement date of each, but Appendix 8 is considered sufficient to budget replacement costs over the long term. Note the age of many of the culverts and flapgates is unknown. Where this is the case, either the remaining life has been estimated after a field inspection or a replacement date has been assumed.

3.1.4 Culvert Replacement – Larger Culverts

Life of culvert and headwall estimated to be 50 years. As noted above, it is assumed that the flapgates will be replaced at the same time. Estimated replacement dates are shown in Appendix 8 (again the same uncertainty regarding the likely actual replacement dates applies to the structure).

This item is treated as a renewal.

3.2 Drop Structures – Rock Gabion and Mattress

3.2.1 Gabion and Mattress Repairs

Minor repairs to the gabions and mattresses, such as repairs of small holes or to the netting, are assumed to be needed on average every five years. Assumed costs are 0.5 days for two labourers plus supervision, and $250 materials.

3.2.2 Replacement

Flow over the drop structure only occurs in heavy rain events – the structure is dry for most of the time. It is currently in good condition, and a life of 50 years is considered a reasonable expectancy.

3.3 Drop Structures – Rock and Rubble

3.3.1 Rock Replacement

As these drop structures are also dry under most conditions, they are not expected to need frequent maintenance. Rock and rubble may need topping up after floods, but the cost would be met from flood damage budgets in that case.

Nevertheless, occasional topping up will be required, as rock settles or gets displaced over time. It is assumed that every 15 years, 25% of the rock or rubble will need replacement. This item is treated as normal maintenance rather than renewal.

4 Stopbanks

4.1 Culvert Removal

In a few locations, there are gravity outlets through stopbanks that are now redundant and are not maintained, but that would otherwise be considered Drainage Scheme assets. Without maintenance, there is a risk that the culverts will present opportunities for flow or seepage paths through the banks, undermining the integrity of the stopbanks. Therefore it is prudent that these culverts be completely removed and backfilled.

The remaining outlet where this is the case is the gravity outlet at the Nicholas pump stations. Others may yet be identified.

Costs involved per culvert are – supervisor plus two labourers for 0.5 days, an excavator for 4 hours @ $100/hour, transport of excavator at $120, and compaction equipment hire at $100. It is assumed that the small quantities of any extra fill needed will be available on site.

Although not periodic, this item is treated as a renewal as it upgrades the assets to design standards. For the purposes of this Plan, removal of the culvert has been given a nominal frequency of one occurrence in 50 years (in the year 2006/07).

4.2 Stopbank Reconstruction

It is anticipated that stopbank reconstruction will be required to restore banks to full design height. It is difficult to ascertain what settlement will occur; the best estimate is that every 20 years, 5% by volume and 20% by length requires work. Direct costs per cubic metre are assumed the same as for construction, but ancillary costs are only assumed to be 60% and no allowance has been made for any compensation.

Thus, using the costs in Section 3.6.2,

- direct costs of reconstruction are $\$6.08/m^3$ x (4760/3130) = $\$9.58/m^3$, and
- ancillary costs of reconstruction are $15.33/m x 1.20 x (4760/3130) x0.60 = $17.39/m.

Table 1 – Rangitaiki Drainage Scheme Maintenance Requirements – Including Renewals

Work Description		Works																				Total	Total
		Frequency	Group Manager		Manager		Asset Mgt Engineer		Design Engineer		Asset Administration		Surveyor		Labour		Supervisor		Vehicle/Plant			Other Costs		Annualised
		years	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	km	cost	km			
General																								
Management		1	5	5942	25.5	20559	57.5	32154		0	35	16058		0		0		0	4500	2025		$2,000	$78,739	$78,739
General Overview		1					1.5	838.81					0		0	0	1.5	498.9	150	75			$1,413	$1,413
Ongoing Inspection		1					20	11184								0	200	66520	26400	13080			$90,784	$90,784
Computer Charges		1																				$9,900	$9,900	$9,900
IS Charges		1				0		0		0				0		0		0		0		$2,100	$2,100	$2,100
Rate Commission		1				0		0		0				0		0		0		0		$26,200	$26,200	$26,200
Rate Remission		1																				$5,500	$5,500	$5,500
Hydrology charges		1																				$8,700	$8,700	$8,700
Insurance		1				0		0		0				0		0		0		0		$1,700	$1,700	$1,700
Asset Valuation		5			1.5	1209.4	0.5	279.6		0				0		0		0		0			$1,489	$298
Flood monitoring. Annual	Flood monitoring. Annual	1			0	0	1	559.21		0				0	4	800	2	665.2	500	250			$2,274	$2,274
						0		0		0				0		0		0		0			$0	
Flood Damages		1				0	1	559.21		0			0	0	6	1200	3	997.8	280	140		$2,800	$5,697	$5,697
Drains and Canals	Survey - cross-sections	8				0		0		0			42	16380	42	8400		0	1050	525			$25,305	$3,163
	Survey - benchmark relevelling	8											34	13260	34	6800			1700	850			$20,910	
	Bank Repairs, Tree Clearing, Fencing Repairs etc	1				0		0		0				0	25	5000	5	1663	600	7340		$22,500	$36,503	$36,503
						0		0		0				0		0		0		0			$0	
Drain Clearance		1																			1.75		$0	$0
	Canals and arterial drains	1				0		0		0				0		0		0		60000	87.97		$60,000	$60,000
	Other regional drains	1				0		0		0				0		0		0		0	216.108	$25,000	$25,000	$25,000
	Excavator Transport	1																				$1,500	$1,500	$1,500
Weed Boat	*Total*	1													2	400	2	665.2		25000	69.7		$26,065	$26,065
Weedspray	Other	1				0		0		0				0	187.5	37500		0	5196.6	7797	259.83	$16,575	$61,872	$61,872
	Parrot's Feather	1													50	10000			1000	8000		$4,525	$22,525	$22,525
Hand Clearance		1													15.63	3125			312.5	1956.3	2.5		$5,081	$5,081

Table 1 (cont'd)

Work Description		Works																				Total	Total
		Frequency	Group Manager		Manager		Asset Mgt Engineer		Design Engineer		Asset Administration		Surveyor		Labour		Supervisor		Vehicle/Plant			Other Costs		Annualised
		years	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	km	cost	km			
Structures																								
Culverts and Flapgates	Misc. Maintenance	2														0				0		$14,700	$14,700	$7,350
	Cleaning and Clearing Blockages	1													45	9000	127.5	42407	5920	3485		$4,000	$58,892	$58,892
	Minor culvert structure replacement	1																				$15,552	$15,552	$15,552
Flapgate Replacement:	Pearce Outlet Awaiti Canal	25																				$10,254	$10,254	$410
	Secombes Canal Secombes Canal/Old Rangita	25																				$10,254	$10,254	$410
	Omeheu Adjunct Drain Omeheu Adjunct Drain	25																				$8,414	$8,414	$337
	Government Eastern DraWaioho Canal	25																				$8,414	$8,414	$337
	Awakeri Farms Drain Awakeri Farms Drain	25																				$8,414	$8,414	$337
	Masey Drain Reids Central Canal	25																				$8,414	$8,414	$337
	Soldiers Drain Omeheu Canal	25																				$7,625	$7,625	$305
	Radcliffs Drain Omeheu Canal	25																				$7,625	$7,625	$305
	Pearsons Drain Waioho Canal	25																				$13,147	$13,147	$526
	Government Drain Eastern Te Rahu Canal	25																				$13,147	$13,147	$526
	Null Kopeopeo East Canal	25																				$5,982	$5,982	$239
	Putiki Drain Reids Central Canal	25																				$8,414	$8,414	$337
	McLarens Outlet Reids Central Canal	25																				$8,414	$8,414	$337
	Omeheu Adjunct Omeheu Canal	25																				$8,414	$8,414	$337
	Kopeopeo West Canal Kopeopeo West Canal	25																				$8,414	$8,414	$337
	Null Government Drain West	25																				$8,414	$8,414	$337
	Section 109 Canal Awaiti Canal	25																				$7,625	$7,625	$305
	Null Awaiti Canal	25																				$7,625	$7,625	$305
	Massey Vierboom	25																				$6,836	$6,836	$273
	Massey-Orini	25																				$6,836	$6,836	$273
	Waioho - Te Rahu Drain Te Rahu Canal	25																				$6,836	$6,836	$273
	Awarua Drain Tarawera River	25																				$6,836	$6,836	$273
	Massey Drain Reids Central Canal	25																				$6,836	$6,836	$273
	Null Orini Canal	25																				$5,982	$5,982	$239
	Wells Drain Kopeopeo East Canal	25																				$5,982	$5,982	$239
	Orini Channel West Reids Central Canal	25																				$5,982	$5,982	$239
	Null Eastern Drain	25																				$5,982	$5,982	$239
	Null Awaiti Canal	25																				$5,982	$5,982	$239
	Richlands Outlet Omeheu Canal	25																				$5,982	$5,982	$239
	Kopua Drain Kopua Drain	25																				$5,982	$5,982	$239
	McLeods Drain Te Rahu Drain	25																				$5,127	$5,127	$205
	Savages Drain Awakaponga Canal	25																				$5,127	$5,127	$205
	Null Reids Central Canal	25																				$5,127	$5,127	$205
	Rangitaiki Drain Reids Central Canal	25																				$5,127	$5,127	$205
	Greenups Drain Te Rahu Drain	25																				$5,127	$5,127	$205
	Bergs Drain Government Eastern Drain	25																				$5,127	$5,127	$205
	Null Donalds Outlet	25																				$5,127	$5,127	$205
	Awakaponga Canal	25																				$5,127	$5,127	$205
	Hills Diversion Awakaponga Canal	25																				$5,127	$5,127	$205
	Hawkins Drain Omeheu Canal	25																				$5,127	$5,127	$205
	Orrs Omeheu Canal	25																				$5,127	$5,127	$205
	Aroas Drain Omeheu Canal	25																				$5,127	$5,127	$205
	Travurzas Outlet Te Rahu Canal	25																				$5,127	$5,127	$205
	Withys Drain Awakaponga Drain	25																				$5,127	$5,127	$205
	Marshalls Drain Kopeopeo East Canal	25																				$5,127	$5,127	$205
	Massey Drain Massey Drain	25																				$5,127	$5,127	$205
	Null Awarua Drain	25																				$5,127	$5,127	$205
	McCracken Road Drain McCracken Road Drain	25																				$5,127	$5,127	$205
	Rangitaiki Drain Rangitaiki Drain	25																				$5,127	$5,127	$205
	Null Western Drain	25																				$5,127	$5,127	$205
	Shell Drain Te Rahu Drain	25																				$5,127	$5,127	$205

Table 1 (Cont'd)

Work Description		Works Frequency	Group Manager		Manager		Asset Mgt Engineer		Design Engineer		Asset Administration		Surveyor		Labour		Supervisor		Vehicle/Plant			Other Costs	Total	Total Annualised
		years	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	km	cost	km			
Culvert, Headwall, Flapgate Replacement																								
	Pearce Outlet Awaiti Canal	50																				$28,214	$28,214	$564
	Secombes Canal Secombes Canal/Old Rangita	50																				$47,105	$47,105	$942
	Omeheu Adjunct Drain Omeheu Adjunct Drain	50																				$71,033	$71,033	$1,421
	Government Eastern DraWaioho Canal	50																				$123,523	$123,523	$2,470
	Awakeri Farms Drain Awakeri Farms Drain	50																				$66,745	$66,745	$1,335
	Masey Drain Reids Central Canal	50																				$57,248	$57,248	$1,145
	Soldiers Drain Omeheu Canal	50																				$40,975	$40,975	$820
	Radcliffs Drain Omeheu Canal	50																				$39,950	$39,950	$799
	Pearsons Drain Waioho Canal	50																				$63,783	$63,783	$1,276
	Government Drain Eastern Te Rahu Canal	50																				$59,174	$59,174	$1,183
	Null Kopeopeo East Canal	50																				$22,781	$22,781	$456
	Putiki Drain Reids Central Canal	50																				$56,982	$56,982	$1,140
	McLarens Outlet Reids Central Canal	50																				$59,288	$59,288	$1,186
	Omeheu Adjunct Omeheu Canal	50																				$51,826	$51,826	$1,037
	Kopeopeo West Canal Kopeopeo West Canal	50																				$55,218	$55,218	$1,104
	Null Government Drain West	50																				$45,042	$45,042	$901
	Section 109 Canal Awaiti Canal	50																				$30,452	$30,452	$609
	Null Awaiti Canal	50																				$37,630	$37,630	$753
	Massey Vierboom	50																				$31,693	$31,693	$634
	Massey-Orini	50																				$27,084	$27,084	$542
	Waioho - Te Rahu DrainTe Rahu Canal	50																				$27,084	$27,084	$542
	Awarua Drain Tarawera River	50																				$18,788	$18,788	$376
	Massey Drain Reids Central Canal	50																				$34,459	$34,459	$689
	Null Orini Canal	50																				$18,638	$18,638	$373
	Wells Drain Kopeopeo East Canal	50																				$20,295	$20,295	$406
	Orini Channel West Reids Central Canal	50																				$26,924	$26,924	$538
	Null Eastern Drain	50																				$11,181	$11,181	$224
	Null Awaiti Canal	50																				$15,324	$15,324	$306
	Richlands Outlet Omeheu Canal	50																				$21,952	$21,952	$439
	Kopua Drain Kopua Drain	50																				$17,810	$17,810	$356
	McLeods Drain Te Rahu Drain	50																				$15,878	$15,878	$318
	Savages Drain Awakaponga Canal	50																				$15,665	$15,665	$313
	Null Reids Central Canal	50																				$18,239	$18,239	$365
	Rangitaiki Drain Reids Central Canal	50																				$9,679	$9,679	$194
	Greenups Drain Te Rahu Drain	50																				$17,059	$17,059	$341
	Bergs Drain Government Eastern Drain	50																				$12,926	$12,926	$259
	Null Donalds Outlet	50																				$16,173	$16,173	$323
	Awakaponga Canal	50																				$17,100	$17,100	$342
	Wilsons Creek	50																				$10,538	$10,538	$211
	Hills Diversion Awakaponga Canal	50																				$17,059	$17,059	$341
	Hawkins Drain Omeheu Canal	50																				$21,191	$21,191	$424
	Orrs Omeheu Canal	50																				$11,745	$11,745	$235
	Aroas Drain Omeheu Canal	50																				$13,516	$13,516	$270
	Travurzas Outlet Te Rahu Canal	50																				$26,504	$26,504	$530
	Withys Drain Awakaponga Drain	50																				$11,450	$11,450	$229
	Marshalls Drain Kopeopeo East Canal	50																				$14,107	$14,107	$282
	Massey Drain Massey Drain	50																				$12,926	$12,926	$259
	Null Awarua Drain	50																				$11,155	$11,155	$223
	McCracken Road Drain McCracken Road Drain	50																				$18,239	$18,239	$365
	Rangitaiki Drain Rangitaiki Drain	50																				$23,848	$23,848	$477
	Null Western Drain	50																				$18,830	$18,830	$377
	Shell Drain Te Rahu Drain	50																				$16,468	$16,468	$329
	Smith Rd	50																				$3,345	$3,345	$67
	Kapua	50																				$24,842	$24,842	$497

Table 1 (Cont'd)

Work Description		Works Frequency	Group Manager		Manager		Asset Mgt Engineer		Design Engineer		Asset Administration		Surveyor		Labour		Supervisor		Vehicle/Plant			Other Costs	Total	Total Annualised
		years	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	km	cost	km			
Other replacements	Western Drain Diversion (Donalds Outlet) conc. Slat	50																				$717	$717	$14
	Donalds Outlet Drop Structure	50																				$24,004	$24,004	$480
Minor repairs	Donalds Outlet Drop Structure	5					0.25	139.8							1	200						$250	$590	$118
Top up	Drop Structure - Kokohinau	15																				$1,972	$1,972	$131
	McCrackens Rd	15																				$1,652	$1,652	$110
Stopbank																								
Reconstruction	Donalds Outlet	20					0.3	167.9	0.322	167.9												$4,106	$4,442	$222
	Putiki Drain	20					0.242	135.16	0.259	135.2												$2,692	$2,962	$148
	Wilsons Creek	20					0.801	447.73	0.859	447.7												$11,211	$12,107	$605
Culvert Removal -	Nicholas P.S. gravity outlet	50					0.5	279.6							1	200	0.5	166.3				$620	$1,266	$25
TOTAL (Including Renewals)																								$604,506

Table 2 –Asset Maintenance Requirements – Excluding Renewals

Work Description		Works Frequency	Group Manager		Manager		Asset Mgt Engineer		Design Engineer		Asset Administration		Surveyor		Labour		Supervisor		Vehicle/Plant			Other Costs	Total	Total Annualised
		years	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	km	cost	km			
General																								
Management		1	5	5941.9	25.5	20559	57.5	32154			35	16058					0	0	4500	2025		2000	78739	78739
General Overview		1					1.5	838.81									1.5	498.9	150	75		0	1413	1413
Ongoing Inspection		1					20	11184									200	66520	26400	13080		0	90784	90784
Computer Charges		1																				9900	9900	9900
IS Charges		1																				2100	2100	2100
Rate Commission		1																				26200	26200	26200
Rate Remission		1																				5500	5500	5500
Hydrology charges		1																				8700	8700	8700
Insurance		1																				1700	1700	1700
Asset Valuation		5			1.5	1209.4	0.5	279.6															1489	298
Flood monitoring: Annual	Flood monitoring: Annual	1					1	559.21							4	800	2	665.2	500	250			2274	2274
Flood Damages		1					1	559.21							6	1200	3	997.8	280	140		2800	5697	5697
Drains and Canals	Survey - cross-sections	8											42	16380	42	8400			1050	525			25305	3163
	Survey - benchmark relevelling	8											34	13260	34	6800			1700	850			20910	
	Bank Repairs, Tree Clearing, Fencing Repairs etc	1													25	5000	5	1663	600	7340		22500	36503	36503
Drain Clearance		1																			1.75			
	Canals and arterial drains	1																		60000	87.97		60000	60000
	Other regional drains	1																			216.108	25000	25000	25000
	Excavator Transport	1																				1500	1500	1500
		1																						
Weed Boat	*Total*	1													2	400	2	665.2		25000	69.7		26065	26065
Weedspray	Other	1													187.5	37500			5196.6	7797.025	259.83	16575	61872	61872
	Parrot's Feather	1													50	10000			1000	8000		4525	22525	22525
Hand Clearance		1													15.625	3125			312.5	1956.25	2.5		5081	5081
Structures																								
Culverts and Flapgates	Misc. Maintenance	2																				14700	14700	7350
	Cleaning and Clearing Blockages	1													45	9000	127.5	42407	5920	3485		4000	58892	58892
	Minor culvert structure replacement	1																				15552.09	15552	15552
Minor repairs	Donalds Outlet Drop Structure	5					0.25	139.8							1	200						250	590	118
Top up	Drop Structure - Kokohinau	15																				$1,972	1972	131
	McCrackens Rd	15																				$1,652	1652	110
TOTAL (Excluding Renewals)																								557168

Appendix 3 – Disaster Reserve

Rangitaiki Drainage: Disaster Reserve Account Incorporating Interest Earned

Year		Total Contribution	Year Start Balance	Interest Earned	Year End Balance
					$104,942
0	2005/06	$0	$104,942	$5,247	$110,189
1	2006/07	$0	$345,000	$17,250	$362,250
2	2007/08	$0	$362,250	$18,113	$380,363
3	2008/09	$0	$380,363	$19,018	$399,381
4	2009/10	$0	$399,381	$19,969	$419,350
5	2010/11	$0	$419,350	$20,967	$440,317
6	2011/12	$0	$440,317	$22,016	$462,333
7	2012/13	$0	$462,333	$23,117	$485,450
8	2013/14	$0	$485,450	$24,272	$509,722
9	2014/15	$0	$509,722	$25,486	$535,208
10	2015/16	$0	$535,208	$26,760	$561,969
11	2016/17	$0	$561,969	$28,098	$590,067
12	2017/18	$0	$590,067	$29,503	$619,570
13	2018/19	$0	$619,570	$30,979	$650,549
14	2019/20	$0	$650,549	$32,527	$683,076
15	2020/21	$0	$683,076	$34,154	$717,230
16	2021/22	$0	$717,230	$35,862	$753,092
17	2022/23	$0	$753,092	$37,655	$790,746
18	2023/24	$0	$790,746	$39,537	$830,284
19	2024/25	$0	$830,284	$41,514	$871,798
20	2025/26	$0	$871,798	$43,590	$915,388
21	2026/27	$0	$915,388	$45,769	$961,157
22	2027/28	$0	$961,157	$48,058	$1,009,215
23	2028/29	$0	$1,009,215	$50,461	$1,059,676
24	2029/30	$0	$1,059,676	$52,984	$1,112,659
25	2030/31	$0	$1,112,659	$55,633	$1,168,292
26	2031/32	$0	$1,168,292	$58,415	$1,226,707
27	2032/33	$0	$1,226,707	$61,335	$1,288,042
28	2033/34	$0	$1,288,042	$64,402	$1,352,445
29	2034/35	$0	$1,352,445	$67,622	$1,420,067
30	2035/36	$0	$1,420,067	$71,003	$1,491,070
31	2036/37	$0	$1,491,070	$74,554	$1,565,624
32	2037/38	$0	$1,565,624	$78,281	$1,643,905
33	2038/39	$0	$1,643,905	$82,195	$1,726,100
34	2039/40	$0	$1,726,100	$86,305	$1,812,405
35	2040/41	$0	$1,812,405	$90,620	$1,903,025
36	2041/42	$0	$1,903,025	$95,151	$1,998,177
37	2042/43	$0	$1,998,177	$99,909	$2,098,085
38	2043/44	$0	$2,098,085	$104,904	$2,202,990
39	2044/45	$0	$2,202,990	$110,149	$2,313,139
40	2045/46	$0	$2,313,139	$115,657	$2,428,796
41	2046/47	$0	$2,428,796	$121,440	$2,550,236
42	2047/48	$0	$2,550,236	$127,512	$2,677,748
43	2048/49	$0	$2,677,748	$133,887	$2,811,635
44	2049/50	$0	$2,811,635	$140,582	$2,952,217
45	2050/51	$0	$2,952,217	$147,611	$3,099,828
46	2051/52	$0	$3,099,828	$154,991	$3,254,819
47	2052/53	$0	$3,254,819	$162,741	$3,417,560
48	2053/54	$0	$3,417,560	$170,878	$3,588,438
49	2054/55	$0	$3,588,438	$179,422	$3,767,860
50	2055/56	$0	$3,767,860	$188,393	$3,956,253

Assumptions

Annual Contribution (excl. inflation) $0

Target (Year 0, CCI = 4930) $345,000

Portion of Scheme overall credit balance 30 June 2005 transferred to fund 30 June 2006 $234,811

Interest 5 %

(Note, in practice the fund will not grow to this extent - interest earned will be used to offset rate funding requirements for the Scheme., provided the target is met).

No withdrawals forecast (i.e. scenario only)

Appendix 4 – Flood Damage Reserves

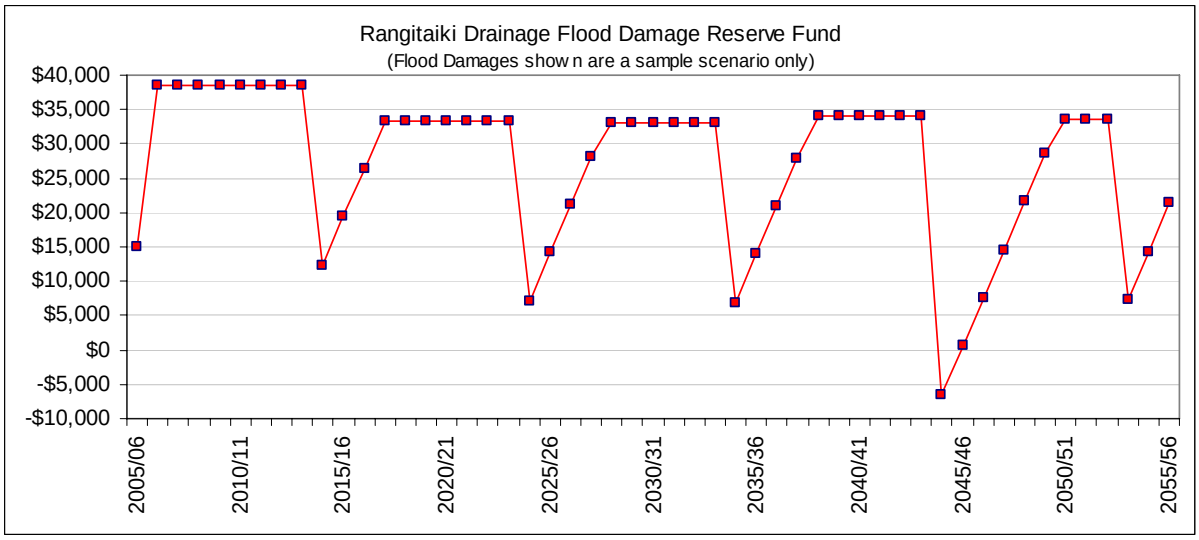
	Year	Contribution to Reserve	Flood Damage (scenario only)	Change to Balance	Year End Fund Balance
0	2005/06		$0	$0	$14,976
1	2006/07		$0	$23,616	$38,592
2	2007/08		$0	$0	$38,592
3	2008/09		$0	$0	$38,592
4	2009/10		$0	$0	$38,592
5	2010/11		$0	$0	$38,592
6	2011/12		$0	$0	$38,592
7	2012/13		$0	$0	$38,592
8	2013/14		$0	$0	$38,592
9	2014/15		$26,215	-$26,215	$12,377
10	2015/16	$7,000	$0	$7,000	$19,377
11	2016/17	$7,000	$0	$7,000	$26,377
12	2017/18	$7,000	$0	$7,000	$33,377
13	2018/19		$0	$0	$33,377
14	2019/20		$0	$0	$33,377
15	2020/21		$0	$0	$33,377
16	2021/22		$0	$0	$33,377
17	2022/23		$0	$0	$33,377
18	2023/24		$0	$0	$33,377
19	2024/25		$26,215	-$26,215	$7,161
20	2025/26	$7,000	$0	$7,000	$14,161
21	2026/27	$7,000	$0	$7,000	$21,161
22	2027/28	$7,000	$0	$7,000	$28,161
23	2028/29	$5,000	$0	$5,000	$33,161
24	2029/30		$0	$0	$33,161
25	2030/31		$0	$0	$33,161
26	2031/32		$0	$0	$33,161
27	2032/33		$0	$0	$33,161
28	2033/34		$0	$0	$33,161
29	2034/35		$26,215	-$26,215	$6,946
30	2035/36	$7,000	$0	$7,000	$13,946
31	2036/37	$7,000	$0	$7,000	$20,946
32	2037/38	$7,000	$0	$7,000	$27,946
33	2038/39	$6,000	$0	$6,000	$33,946
34	2039/40		$0	$0	$33,946
35	2040/41		$0	$0	$33,946
36	2041/42		$0	$0	$33,946
37	2042/43		$0	$0	$33,946
38	2043/44		$0	$0	$33,946
39	2044/45		$40,381	-$40,381	-$6,435
40	2045/46	$7,000	$0	$7,000	$565
41	2046/47	$7,000	$0	$7,000	$7,565
42	2047/48	$7,000	$0	$7,000	$14,565
43	2048/49	$7,000	$0	$7,000	$21,565
44	2049/50	$7,000	$0	$7,000	$28,565
45	2050/51	$5,000	$0	$5,000	$33,565
46	2051/52		$0	$0	$33,565
47	2052/53		$0	$0	$33,565
48	2053/54		$26,215	-$26,215	$7,349
49	2054/55	$7,000	$0	$7,000	$14,349
50	2055/56	$7,000		$7,000	$21,349

Notes Flood Damages shown are a sample scenario only

If the fund goes into significant deficit, additional borrowing will be required to repair flood damage. No allowance for such borrowing has been made in this plan.

Fund Balance at 30 June 2005 = $14,976

$23,616 from total Scheme account credit balance at 30 June 2005 to be transferred to Fund in 2006/07

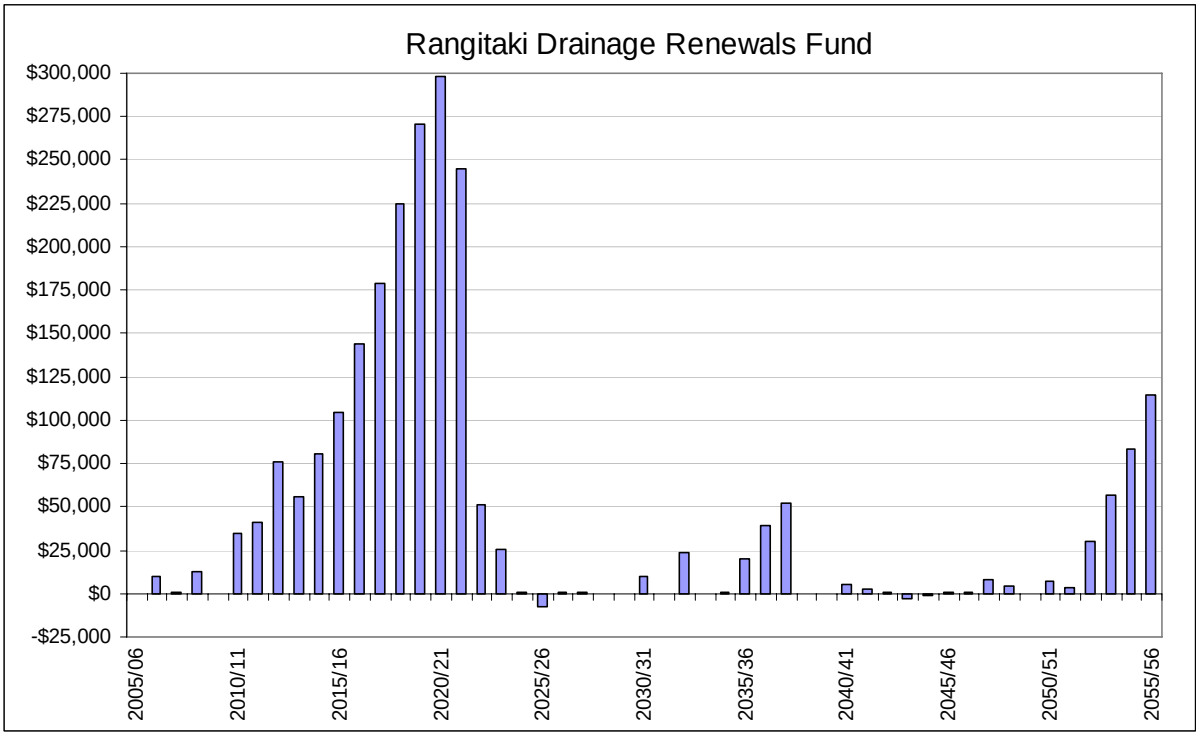


Flood Monitoring Cost Estimates (Included in above Tables and Graphs)

	Frequency	Manager		Asset Mgt Engineer		Design Engineer		Surveyor		Labour		Supervisor		Vehicle/Plant		Total
	(years)	days	cost	days	cost	days	cost	days	cost	days	cost	days	cost	km	cost	
Significant	10			2	1118	2	1042	6	2340	4	800	2	665	500	250	$6,215
Major	50	1	806	4	2237	3	1563	9	3510	6	1200	2	665	800	400	$10,381

Appendix 5 – Renewals Fund

	Year	Depreciation Funded	Loans Principal total	Loans funded by depreciation	Net Depreciation to Renewal Fund	Renewals funded by loans	Renewals Expenditure	Fund Balance
	2005/06							$0
1	2006/07	$47,338	$0	$0	$47,338		$37,168	$10,170
2	2007/08	$47,338	$0	$0	$47,338	$23,000	$80,175	$333
3	2008/09	$47,338	$1,150	$1,150	$46,188		$33,918	$12,603
4	2009/10	$47,338	$1,150	$1,150	$46,188	$10,000	$69,127	($336)
5	2010/11	$47,338	$1,650	$1,650	$45,688		$11,109	$34,244
6	2011/12	$47,338	$1,650	$1,650	$45,688		$39,046	$40,886
7	2012/13	$47,338	$1,650	$1,650	$45,688		$10,254	$76,320
8	2013/14	$47,338	$1,650	$1,650	$45,688		$65,863	$56,145
9	2014/15	$47,338	$1,650	$1,650	$45,688		$21,363	$80,470
10	2015/16	$47,338	$1,650	$1,650	$45,688		$22,086	$104,072
11	2016/17	$47,338	$1,650	$1,650	$45,688		$5,982	$143,779
12	2017/18	$47,338	$1,650	$1,650	$45,688		$10,254	$179,213
13	2018/19	$47,338	$1,650	$1,650	$45,688		$0	$224,901
14	2019/20	$47,338	$1,650	$1,650	$45,688		$0	$270,589
15	2020/21	$47,338	$1,650	$1,650	$45,688		$17,810	$298,468
16	2021/22	$47,338	$1,650	$1,650	$45,688		$99,170	$244,987
17	2022/23	$47,338	$1,650	$1,650	$45,688		$239,660	$51,015
18	2023/24	$47,338	$1,650	$1,650	$45,688		$70,919	$25,784
19	2024/25	$47,338	$1,650	$1,650	$45,688	$122,000	$192,808	$665
20	2025/26	$47,338	$7,750	$7,750	$39,588		$47,965	($7,712)
21	2026/27	$47,338	$7,750	$7,750	$39,588	$70,000	$101,131	$745
22	2027/28	$47,338	$11,250	$11,250	$36,088	$80,000	$116,295	$538
23	2028/29	$47,338	$14,100	$14,100	$33,238	$47,000	$80,829	($53)
24	2029/30	$47,338	$16,450	$16,450	$30,888	$62,000	$92,853	($18)
25	2030/31	$47,338	$19,050	$19,050	$28,288		$18,017	$10,253
26	2031/32	$47,338	$19,050	$19,050	$28,288	$101,000	$139,489	$53
27	2032/33	$47,338	$24,100	$24,100	$23,238		$0	$23,291
28	2033/34	$47,338	$24,100	$24,100	$23,238	$15,000	$61,679	($149)
29	2034/35	$47,338	$24,850	$24,850	$22,488	$66,000	$87,700	$639
30	2035/36	$47,338	$28,150	$28,150	$19,188		$0	$19,827
31	2036/37	$47,338	$28,150	$28,150	$19,188		$0	$39,016
32	2037/38	$47,338	$28,150	$28,150	$19,188		$5,844	$52,360
33	2038/39	$47,338	$28,150	$28,150	$19,188	$80,000	$151,990	($442)
34	2039/40	$47,338	$32,150	$32,150	$15,188	$23,000	$38,191	($445)
35	2040/41	$47,338	$33,300	$33,300	$14,038	$10,000	$18,274	$5,320
36	2041/42	$47,338	$33,800	$33,800	$13,538	$30,000	$45,882	$2,976
37	2042/43	$47,338	$35,300	$35,300	$12,038	$60,000	$74,037	$977
38	2043/44	$47,338	$38,300	$38,300	$9,038		$12,818	($2,802)
39	2044/45	$47,338	$38,300	$38,300	$9,038	$10,000	$17,091	($855)
40	2045/46	$47,338	$32,700	$32,700	$14,638	$36,000	$49,300	$484
41	2046/47	$47,338	$34,500	$34,500	$12,838	$47,000	$59,797	$525
42	2047/48	$47,338	$33,350	$33,350	$13,988		$6,836	$7,677
43	2048/49	$47,338	$29,350	$29,350	$17,988		$21,363	$4,302
44	2049/50	$47,338	$27,000	$27,000	$20,338	$38,000	$62,675	($35)
45	2050/51	$47,338	$25,800	$25,800	$21,538		$14,396	$7,108
46	2051/52	$47,338	$25,800	$25,800	$21,538		$25,505	$3,141
47	2052/53	$47,338	$20,750	$20,750	$26,588		$0	$29,730
48	2053/54	$47,338	$20,750	$20,750	$26,588		$0	$56,318
49	2054/55	$47,338	$20,000	$20,000	$27,338		$0	$83,656
50	2055/56	$47,338	$16,700	$16,700	$30,638		$0	$114,295


Rangitaki Drainage Renewals Fund
$300,000
$275,000
$250,000
$225,000
$200,000
$175,000
$150,000
$125,000
$100,000
$75,000
$50,000
$25,000
$0
-$25,000
2005/06
2010/11
2015/16
2020/21
2025/26
2030/31
2035/36
2040/41
2045/46
2050/51
2055/56

Appendix 6 — Loan Repayments

	Year	Borrowing	Repayments Total principal	Total interest	Total Loan Charges	Less Principal funded from depreciation	Net loan charges
1	2006/07	$0	$0	$0	$0	$0	$0
2	2007/08	$23,000	$0	$863	$863	$0	$863
3	2008/09	$0	$1,150	$1,682	$2,832	$1,150	$1,682
4	2009/10	$10,000	$1,150	$1,971	$3,121	$1,150	$1,971
5	2010/11	$0	$1,650	$2,241	$3,891	$1,650	$2,241
6	2011/12	$0	$1,650	$2,117	$3,767	$1,650	$2,117
7	2012/13	$0	$1,650	$1,993	$3,643	$1,650	$1,993
8	2013/14	$0	$1,650	$1,869	$3,519	$1,650	$1,869
9	2014/15	$0	$1,650	$1,746	$3,396	$1,650	$1,746
10	2015/16	$0	$1,650	$1,622	$3,272	$1,650	$1,622
11	2016/17	$0	$1,650	$1,498	$3,148	$1,650	$1,498
12	2017/18	$0	$1,650	$1,374	$3,024	$1,650	$1,374
13	2018/19	$0	$1,650	$1,251	$2,901	$1,650	$1,251
14	2019/20	$0	$1,650	$1,127	$2,777	$1,650	$1,127
15	2020/21	$0	$1,650	$1,003	$2,653	$1,650	$1,003
16	2021/22	$0	$1,650	$879	$2,529	$1,650	$879
17	2022/23	$0	$1,650	$756	$2,406	$1,650	$756
18	2023/24	$0	$1,650	$632	$2,282	$1,650	$632
19	2024/25	$122,000	$1,650	$5,083	$6,733	$1,650	$5,083
20	2025/26	$0	$7,750	$9,306	$17,056	$7,750	$9,306
21	2026/27	$70,000	$7,750	$11,349	$19,099	$7,750	$11,349
22	2027/28	$80,000	$11,250	$16,262	$27,512	$11,250	$16,262
23	2028/29	$47,000	$14,100	$20,074	$34,174	$14,100	$20,074
24	2029/30	$62,000	$16,450	$23,016	$39,466	$16,450	$23,016
25	2030/31	$0	$19,050	$24,009	$43,059	$19,050	$24,009
26	2031/32	$101,000	$19,050	$26,368	$45,418	$19,050	$26,368
27	2032/33	$0	$24,100	$28,538	$52,638	$24,100	$28,538
28	2033/34	$15,000	$24,100	$27,293	$51,393	$24,100	$27,293
29	2034/35	$66,000	$24,850	$28,494	$53,344	$24,850	$28,494
30	2035/36	$0	$28,150	$28,982	$57,132	$28,150	$28,982
31	2036/37	$0	$28,150	$26,871	$55,021	$28,150	$26,871
32	2037/38	$0	$28,150	$24,759	$52,909	$28,150	$24,759
33	2038/39	$80,000	$28,150	$25,648	$53,798	$28,150	$25,648
34	2039/40	$23,000	$32,150	$27,157	$59,307	$32,150	$27,157
35	2040/41	$10,000	$33,300	$25,778	$59,078	$33,300	$25,778
36	2041/42	$30,000	$33,800	$24,475	$58,275	$33,800	$24,475
37	2042/43	$60,000	$35,300	$25,062	$60,362	$35,300	$25,062
38	2043/44	$0	$38,300	$24,591	$62,891	$38,300	$24,591
39	2044/45	$10,000	$38,300	$22,057	$60,357	$38,300	$22,057
40	2045/46	$36,000	$32,700	$21,088	$53,788	$32,700	$21,088
41	2046/47	$47,000	$34,500	$21,727	$56,227	$34,500	$21,727
42	2047/48	$0	$33,350	$20,992	$54,342	$33,350	$20,992
43	2048/49	$0	$29,350	$18,687	$48,037	$29,350	$18,687
44	2049/50	$38,000	$27,000	$18,046	$45,046	$27,000	$18,046
45	2050/51	$0	$25,800	$17,538	$43,338	$25,800	$17,538
46	2051/52	$0	$25,800	$15,649	$41,449	$25,800	$15,649
47	2052/53	$0	$20,750	$13,950	$34,700	$20,750	$13,950
48	2053/54	$0	$20,750	$12,441	$33,191	$20,750	$12,441
49	2054/55	$0	$20,000	$10,959	$30,959	$20,000	$10,959
50	2055/56	$0	$16,700	$9,630	$26,330	$16,700	$9,630

Appendix 7 —Renewals Works Schedule

Note: In practice, insufficient information is available to assess the likely actual replacement date of each item, but this schedule is considered sufficient to budget replacement costs over the long term.

Year	Predicted Renewals Cost	Predicted Renewals Description (for fuller description of sites, refer to spreadsheets *rangitaiki drainage maintenance 2006.xls* (worksheet *distribution over time*) and *rangi-drainage strucutre.xls*
2006/07	$37,168	Flapgate: Orrs-Omeheu, Aroa-Omeheu, Omeheu Adjunct-Canal, Travurzas-Te Rahu. Nicholas PS gravity outlet removal Stopbank: Wilsons Creek
2007/08	$80,175	Flapgate: Govt Eastern-Waioho, Govt Eastern-Te Rahu, Omeheu Adjunct McLarens-Reids Central, Govt West, Waioho-Te Rahu, Savages-Awakaponga, Awakapaonga, Massey. Flapgate & culvert: Awarua
2008/09	$33,918	Flapgate: Awakeri Farms, Soldiers-Omeheu, Radcliffs-Omeheu, Greenups-Te Rahu, Hawkins-Omeheu,
2009/10	$69,127	Flapgate: Massey-Reids Central (x2), Pearsons-Waioho, Kope East, Awaiti, Kopua, McLeods-Te Rahu, Donalds, Shell-Te Rahu. Stopbank: Donalds, Putiki
2010/11	$11,109	Flapgate: Orini, Western
2011/12	$39,046	Flapgate: Putiki-Reids Central, Kope West, Wells-Kope East, Richlands-Omeheu, Bergs-Govt East, Rangitaiki Drain.
2012/13	$10,254	Flapgate: Hills Diversion, McCracken,
2013/14	$65,863	Flapgate: Pierce-Awaiti, Marshalls-Kope East. Flapgate & culvert: Massey-Vierboom, Awarua-Tarawera
2014/15	$21,363	Flapgate: Secombes-ORC, Eastern, Withys-Awakaponga.
2015/16	$22,086	Flapgate: Section 109-Awaiti, Awaiti, Massey-Orini,
2016/17	$5,982	Flapgate: Orini Channel West - Reids CC,
2017/18	$10,254	Flapgate: Reids CC, Rangitaiki Drain-Reids CC
2018/19		
2019/20		
2020/21	$17,810	Flapgate & culvert: Kopua
2021/22	$99,170	Flapgate & culvert: Govt Drain West, McLeods-Te Rahu, Greenups-Te Rahu, Hawkins-Omeheu
2022/23	$239,660	Flapgate: Omeheu Adjunct, Omeheu Adjunct-Canal. Flapgate & culvert: Govt Eastern-Waioho, McLarens-Reids Central, Aroas-Omeheu, Withys-Awakaponga

Year	Predicted Renewals Cost	Predicted Renewals Description (for fuller description of sites, refer to spreadsheets *rangitaiki drainage maintenance 2006.xls* (worksheet *distribution over time*) and *rangi-drainage strucutre.xls*
2023/24	$70,919	Flapgate & culvert: Govt Drain East-Te Rahu, Orrs-Omeheu,
2024/25	$192,808	Flapgate-Awarua. Flapgate & Culvert: Awakeri Farms Drain, soldiers- Omeheu, Radcliffs-Omeheu, Waioho-Te Rahu, Massey Drain
2025/26	$47,965	Flapgate & culvert: Awaiti, Donalds Outlet, Shell-Te Rahu
2026/27	$101,131	Flapgate: Pearsons-Waioho. Flapgate & culvert: Kope East, Massey-Reids CC, Orini
2027/28	$116,295	Flapgate & culvert: Kope West, Wells-Kope East, Richlands-Omeheu, Western Drain
2028/29	$80,829	Flapgate & culvert: Putiki- Reids CC, Rangitaiki Drain
2029/30	$92,853	Flapgate: Awarua-Tarawera, Hills Diversion-Awakaponga Flapgate & culvert: Pearce-Awaiti, Bergs-Govt East, Marshalls-Kope East, McCracken Rd Drain Stopbank: Donalds, Putiki
2030/31	$18,017	Flapgate: Massey-Vierboom. Flapgate & culvert: Eastern Drain
2031/32	$139,489	Flapgate & culvert: Secombes-ORC, Awaiti, Savages-Awakaponga, Awakaponga, Wilsons Withys-Awakaponga
2032/33		
2033/34	$61,679	Flapgate: Massey-Orini. Flapgate & culvert: Orini Channel West-Reids CC, Reids CC, Raingitaiki Drain- Reids CC,
2034/35	$87,700	Flapgate & culvert: Massey-Reids CC, Section 109-Awaiti
2035/36		
2036/37		
2037/38	$5,844	Flapgate: Marshalls-Kope East. Concrete Slab: Western Drain Diversion
2038/39	$151,990	Flapgate: Hawkins-Omeheu. Flapgate & Culvert: Omeheu Adjunct, Omeheu Adjunct-Canal. Drop Structure: Donalds Outlet
2039/40	$38,191	Flapgate: Govt East-Waioho, McLarens-ReidsCC, Kopua, McLeods-Te Rahu, Orrs-Omeheu, Aroas-Omeheu
2040/41	$18,274	Flapgate: Govt East-Te Rahu, Travursas-Te Rahu.
2041/42	$45,882	Flapgate: Awakeri Farms, Soldiers-Omeheu, Radcliffs-Omeheu, Waioho-Te Rahu, Greenups-Te Rahu, Massey, Awarua
2042/43	$74,037	Flapgate: Donalds, Shell-Te Rahu. Flapgate & culvert: Pearsons-Waioho
2043/44	$12,818	Flapgate: Massey-Reids CC, Awaiti
2044/45	$17,091	Flapgate: Kope East, Orini, Western Drain
2045/46	$49,300	Flapgate: Putiki-Reids Central, Kope West, Wells-Kope East, Richlands-Omeheu, Bergs-Govt East, Rangitaiki Drain.

Year	Predicted Renewals Cost	Predicted Renewals Description (for fuller description of sites, refer to spreadsheets *rangitaiki drainage maintenance 2006.xls* (worksheet *distribution over time*) and *rangi-drainage strucutre.xls*
2046/47	$59,797	Flapgate: Govt West, Awarua-Tarawera, Savages-Awakaponga, Awakaponga, McCrackenRd Flapgate & culvert: Hills Diversion-Awakaponga
2047/48	$6,836	Flapgate: Massey-Vierboom.
2048/49	$21,363	Flapgate: Secombes-ORC, Eastern, Withys-Awakaponga.
2049/50	$62,675	Flapgate & culvert: Massey-Orini, Smith Rd, Kapua
2050/51	$14,396	Flapgate: Massey-Reids CC, Orini Channel West-Reids CC
2051/52	$25,505	Flapgate: Section 109-Awaiti, Awaiti, Reids CC, Rangitaiki Drain-Reids CC
2052/53		
2053/54		
2054/55		
2055/56		

Glossary

Accrual Accounting
Recognition of revenues as they are earned and expenses as they are incurred.

Activity
An activity is the work undertaken on an asset or group of assets to achieve the desired outcome.

Annual Plan
A document produced annually by local authorities to inform stakeholders of its objectives, intended activities and expenditure required for a period of one financial year.

Asset
A physical facility of value that enables services to be provided and has an economic life of greater than 12 months.

Asset Management (AM)
The combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required level of service in the most cost effective manner.

Asset Management System (AMS)
A system (usually computerised) for collecting, analysing and reporting data on the utilisation, performance, life cycle management and funding of existing assets. Also known as an Asset Management Information System.

Asset Management Plan (AMP)
A plan developed for the management of one or more infrastructural assets that combines multi-disciplinary management techniques (including technical and financial) over the life cycle of the asset in the most cost effective manner to provide a specified level of service. A significant component of the plan is a long term cash flow projection for the activities.

Asset Management Strategy
A strategy for asset management covering, the development and implementation of plans and programmes for asset creation, operation, maintenance, rehabilitation/replacement, disposal and performance monitoring to ensure that the desired levels of service and other operational objectives are achieved at minimum cost.

Asset Register
A record of asset information considered worthy of identification, including inventory, historical, financial, condition, construction, technical and financial information about each.

Basic Asset Management
Asset management which relies primarily on the use of an asset register, maintenance management systems, job/resource management, condition assessment and defined levels of service in order to establish alternative treatment options and long term cash flow predictions.

Priorities are usually established on the basis of financial return gained by carrying out the work (rather than risk analysis and optimised renewal decision making).

Capital Expenditure (CAPEX)
Expenditure used to create new assets or to increase the capacity of existing assets beyond their original design capacity or service potential. CAPEX increases the value of an asset.

Cash Flow
The stream of costs and/or benefits over time resulting from a project investment or ownership of an asset.

Components
Specific parts of an asset having independent physical or functional identity and having specific attributes such as different life expectancy, maintenance regimes, risk or criticality.

Condition Monitoring
Continuous or periodic inspection, assessment, measurement and interpretation of resulting data, to indicate the condition of a specific component so as to determine the need for some preventive or remedial action.

Corrective Maintenance
The actions performed, as a result of failure to restore an item to a specified condition. Corrective maintenance may or may not be programmed.

Critical Assets
Those assets for which the financial or service level consequences of failure are sufficiently severe to justify proactive inspection and rehabilitation. Critical assets have a lower threshold for action than non critical assets.

Current Assets
Those assets that are expected to be realised in cash or sold or consumed within one year of an organisation’s balance date.

Current Replacement Cost
The cost of replacing the service potential of an existing asset, by reference to some measure of capacity, with an appropriate modern facility, e.g. modern equivalent asset.

Decommission
Activities required to take an asset out of service.

Deferred Maintenance
A shortfall in rehabilitation work required to maintain the service potential of an asset.

Depreciated Replacement Cost (DRC)
The replacement cost of an existing asset after deducting an allowance for wear or consumption to reflect the remaining economic life of the existing asset.

Depreciation
The wearing out, consumption or other loss of value of an asset whether arising from use, passing of time or obsolescence through technological and market changes. It is accounted for by the allocation of the historical cost (or re-valued amount) of the asset less its residual value over its useful life.

Deterioration Rate
The rate at which an asset approaches failure.

Discounting
A technique for converting cash flows that occur over time to equivalent amounts at a common point in time.

Discount Rate
A rate used to relate present and future money values, e.g. to convert the value of all future dollars to the value of dollars at a common point in time, usually the present.

Disposal
Activities necessary to dispose of decommissioned assets.

Economic Life
The period from the acquisition of the asset to the time when the asset, which physically able to provide a service, ceases to be the lowest cost alternative to satisfy a particular level of service. The economic life is at the maximum when equal to the physical life however obsolescence will often ensure that the economic life is less than the physical life.

Equity
The residual interest in the assets of the entity after deduction of its liabilities.

Facilities Audit
The physical audit of a facility to provide input for life cycle costs analysis, short term maintenance planning and long term planning purposes.

Financial Statements
Balance sheets, profit and loss accounts, statements of changes in financial position, notes and other statements which collectively are intended to give a true and fair view of the state of affairs and profit or loss of an entity for a defined period.

Generally Accepted Accounting Principles (Gaap)
Approved financial reporting standards (within the meaning of the Financial Reporting Act 1993) so far as those standards apply to a particular entity; or, where there are no approved standards, accounting policies that are appropriate to the entity and have authoritative support within the accounting profession in New Zealand.

Geographic Information System (GIS)
Software which provides a means of spatially viewing, searching, manipulating, and analysing a database of records.

Inflation Rate
A rate of increase applied to costs incurred at a future date to reflect the relative purchasing power of money in terms of a chosen time, usually the present.

Infrastructural Assets
Stationary systems forming a network and serving whole communities where the system as a whole is intended to be maintained indefinitely at a specified level of service potential by the continuing replacement and refurbishment of its components.

Internal Rate Of Return
The discount rate for which the 'net present value' is zero.

Level of Service
The definition of service quality for a particular activity (i.e. roading) or service area (i.e. street lighting) against which the service performance may be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, environmental acceptability and cost.

Life
A measure of the anticipated life of an asset or component, such as time, number of cycles, distance intervals etc.

Life Cycle
Life cycle has two meanings:

(a) The cycle of activities that an asset (or facility) goes through while it retains an identity as a particular asset i.e. from planning and design to decommissioning or disposal.

(b) The period of time between a selected date and the last year, over which the criteria (e.g. costs) relating to a decision or alternative understudy will be assessed.

Maintainability
A characteristic of design and installation usually identified by the time and effort that will be required to retain an asset as near as practical to its new or desired condition within a given period of time.

Maintenance
All actions necessary for retaining an asset as near as practical to its original condition, but excluding rehabilitation or renewal.

Maintenance Plan
Collated information, policies and procedures for the optimum maintenance of an item, or group of items.

Maintenance Standards
The standards set for the maintenance service such as preventive maintenance schedules, operation and maintenance manuals, codes of practice, estimating criteria, statutory regulations and mandatory requirements in accordance with maintenance quality objectives.

Market Value
The estimated amount at which an asset would be exchanged on the date of valuation, between a willing buyer and a willing seller, in an arms length of transaction after profit, marketing, and when the parties have each acted knowledgeably, prudently and without compulsion.

Modern Equivalent Assets
Assets that replicate what is in existence with the most cost efficient asset performing the same level of service.

Operation
The active process of utilising an asset which will consume resources such as manpower, energy, chemicals and materials. Operation costs are part of the life cycle costs of an asset.

Performance Monitoring
Continuous or periodic quantitative and qualitative assessments of the actual performance compared with specific objectives, targets or standards.

Planned Maintenance
(i) Periodic - necessary to ensure the reliability or sustain the design life of an asset.
(ii) Predictive - condition monitoring activities used to predict failure.
(iii) Preventive - maintenance that can be initiated without routine or continuous checking (e.g. using information contained in maintenance manuals or manufacturers' recommendations) and is not condition-based.

Recoverable Amount
Is the greater of the amount recoverable from an assets further use and ultimate disposal, and its current net realisable value.

Rehabilitation
Works to rebuild or replace parts or components of an asset, to restore it to a required functional condition and extend its life, which may incorporate some modification. Generally involves repairing the asset to deliver its original level of service (i.e. heavy patching of roads, slip lining of sewer mains, etc) without resorting to significant upgrading or renewal using available techniques and standards.

Renewal
Works to upgrade refurbish or replace existing facilities with facilities of equivalent capacity or performance capability.

Renewal Accounting
A method of infrastructure asset accounting which recognises that infrastructure assets are maintained at an agreed service level through regular planned maintenance, rehabilitation and renewal programmes as set out in the asset management plan. The relevant rehabilitation and renewal costs are treated as capital expenditure and any loss in service potential is recognised as an expense.

Repair
Action to restore an item to its previous condition after failure or damage.

Replacement
Complete replacement of an asset that has reached the end of its life, so as to provide a similar or agreed alternative level of service.

Replacement Cost
The cost of replacing an existing asset with a substantially identical new asset.

Risk Management
The application of a formal process to the range of possible values of key factors in order to determine the resultant ranges of outcomes and their probability of occurrence.

Routine Corrective Maintenance
Corrective maintenance, excluding emergency corrective and programmed corrective maintenance.

Routine Maintenance
Day to day operational activities to keep the asset operating (replacement of light bulbs, cleaning of drains, repairing leaks, etc) and which form part of the annual operating budget, including preventative maintenance.

Service Maintenance
Service undertaken seasonally or annually to enable the required level of service to be delivered.

Service Potential
At any point in the life of an asset, its ability to provide a service over and above a minimum acceptable standard.

Statement of Standard Accounting Practice (Ssap)
Methods of accounting approved by the Council of the NZ Society of Accountants for application to all financial statements.

Statement of Financial Performance
A report on the net surplus/deficit, and its components, arising from activities or events during a given period, that are significant for the assessment of both past and future financial performance.

Statement of Financial Position
Disclosure of all assets and liabilities of the entity, appropriately classified including resources, financing structure and contingencies.

Statement of Objectives
A formal expression of the mission and overall objectives of the reporting entity.

Statement of Resources
A description in physical terms of the major resources held by the reporting entity.

Statement of Service Performance
A report for each significant activity undertaken by the reporting entity, on the degree of success achieved in meeting agreed targets, in qualitative and quantitative terms.

Unplanned Maintenance
Corrective work required in the short term to restore an asset to working condition so it can continue to deliver the required service or to maintain its level of security and integrity.

Useful Life
May be expressed as either:

(a) The period over which a depreciable asset is expected to be used, or
(b) The number of production or similar units (i.e. intervals, cycles) that is expected to be obtained from the asset.

Valuation
Estimated asset value which may depend on the purpose for which the valuation is required, i.e. replacement value for determining maintenance levels or market value for life cycle costing.

Value Management
An evaluation process which addresses the technical and functional dimensions at the early stages of a project (i.e. establishment of project objectives, preparation of project brief and consideration of concept/design options) to ensure a fully integrated approach has been taken, the project is consistent with strategic goals and non-build solutions (including demand management) have been properly assessed.