

Lower Waitara River Flood Control Scheme

Asset Management Plan



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Summary

Objectives	<p>The Lower Waitara River Flood Control Scheme consists of a number of component infrastructural assets to provide the following:</p> <ul style="list-style-type: none">• security from floods in the Waitara River, up to 3840 cumecs (1% AEP), to the low lying parts of Waitara township on both the left and right banks of the river;• minimal riverbank erosion; and• an unobstructed and stable flood fairway within the maintenance reaches of the Waitara River.				
Term	In perpetuity				
Maintenance	Maintenance is funded to ensure the Scheme objectives will be met.				
Reporting	<p>Annually - Prepare annual maintenance plan and budget. - Discuss and agree with Council (report in LTP) - Report on works undertaken and costs to Council.</p> <p>Three Yearly - Revalue infrastructural assets</p> <p>Six Yearly - Review asset management plan. Agreed and adopted by Council.</p> <p>Flood Performance Report to Liaison Committee and Council on performance of scheme in all floods exceeding 2,500 cumecs at Bertrand Rd.</p>				
Funding	<table><tr><td>Maintenance funded by:</td><td>Targeted rate over the New Plymouth District</td></tr><tr><td>Damage repairs funded by:</td><td>Rates (as above) Financial reserves Reprioritising works Loan</td></tr></table>	Maintenance funded by:	Targeted rate over the New Plymouth District	Damage repairs funded by:	Rates (as above) Financial reserves Reprioritising works Loan
Maintenance funded by:	Targeted rate over the New Plymouth District				
Damage repairs funded by:	Rates (as above) Financial reserves Reprioritising works Loan				
Financial reserves	<p>Aim to:</p> <ul style="list-style-type: none">- Build up reserves to meet above average planned expenditure.- Draw down reserves to meet unexpected expenditure.				
Review of plan	Review when there is a change in maintenance standards, a change in funding policy, or at 6 yearly intervals.				

1. Introduction

1.1 The Plan

This management plan has been prepared to assist those delegated the responsibility for managing the Lower Waitara River Flood Control Scheme on behalf of the Taranaki Regional Council (the Council).

The Lower Waitara River Flood Control Scheme fundamentally provides flood protection to the urban and commercial areas of the Waitara Township. Figure 4 shows the location of the Scheme.

The Lower Waitara River Flood Control Scheme assets include earthen stopbanks, river training groynes, rock riprap protection, concrete flood walls, and floodgates. The current valuation of these assets (in terms of Local Government requirements) to June 2020 is \$9,290,630.

1.2 Purpose and ownership of the Plan

The purpose of this Plan is to provide the means and mechanisms to enable the Scheme Manager to plan for the most efficient economic and sustainable management of the Lower Waitara River Flood Control Scheme.

The Lower Waitara River Flood Control Scheme assets need to be managed, to ensure they continue to effectively deliver 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 Lower Waitara River Flood Control Scheme and the level of maintenance needed to ensure these are met at all times.

The Plan also provides a base against which the Council's performance in maintaining these infrastructural assets can be measured. This management plan will provide a framework for technical, and financial inputs relating to the assets and their impact on long term financial planning.

Responsibility for implementing the Plan lies with the Council, which is the body responsible for managing the asset.

1.3 Duration and review of the Plan

The duration of the Plan is ten years from the date of formal preparation and acceptance by Council. This Plan has also been prepared with a 50-year time horizon. Maintenance costs and rates are current to June 2020.

The Plan will be reviewed and updated, after the proposed Scheme upgrade has been completed and then again after ten years or earlier if required, to ensure that the requirements of the customers are met, and that the assets are maintained at their most effective levels of service.

1.4 Legislative requirements

The principal statute affecting the management of infrastructure assets is the Local Government Act 2002 (the Act).

The Act empowers local authorities to provide a range of services. Specifically, the Act, together with the Soil Conservation and Rivers Control Act 1941, obligates regional councils to minimise and prevent damage by floods and erosion. The Council executing its responsibilities and powers as a catchment authority in terms of the Soil Conservation and Rivers Control Act 1941 constructed the schemes.

Part VI of the Act requires councils to effectively and efficiently manage their finances and assets. This involves planning for the maintenance, loss of service potential and capital upgrade of all assets. The associated funding for these commitments also needs to be provided for.

This asset management plan will assist the Council with defining the basis for determining long-term financial strategies. Information from the Plan will be used in preparing financial plans and statements required by the Act.

The Office of the Controller and Auditor-General (OAG) has a responsibility to ensure that councils comply with the requirements of the Local Government Act 2002. Part of this involves ensuring that councils are adequately providing for the ongoing maintenance, renewal and capital expenditure on infrastructure assets. The OAG has issued a number of guidelines to assist councils in the preparation of asset management plans.

1.5 Assumptions

There are a number of assumptions made in preparation of this asset management plan. These are made using current knowledge and experience, but may vary with time and in the light of further experience. Further, they will be updated when the Plan is reviewed. The assumptions are:

- that the Council will continue to perform its existing functions in respect to the current legislation;
- there will be no major changes that impact upon the role of the Council in terms of soil conservation and river control; and
- financial projections are in 2020/2021 dollars.

1.6 Assets to be managed

The Lower Waitara River Flood Protection Scheme currently covers the Waitara River from the SH3 Bridge downstream to the river mouth but excludes the river training walls on the left and right banks at the river mouth.

The Scheme Assets include:

- The right bank river training stub groynes downstream of the SH3 Bridge
- The large left bank river training groynes between the SH3 bridge and Toohill Park
- The rock riprap lining on both banks of the river
- The left and right bank earthen stopbanks and gabion basket flood walls
- The left bank concrete flood wall adjacent to the ANZCO site
- River channel berm areas
- Access tracks and paths excluding two section of concrete paths funded by the New Plymouth District Council.
- Access prevention structures (bollards and gates)

The extent of the Scheme is shown in Figure 6 with Figure 7 showing the location of the Scheme assets in more detail.

1.7 Scheme history

The original Lower Waitara River Flood Protection Scheme was constructed after the November 1965 flood event. The scheme was designed to contain floods of this magnitude, which were taken at that time to be the 100-year return period flood levels. The stopbanks were constructed with a freeboard of 0.6 to 1.2 metres above the calculated flood levels. The scheme works were constructed between 1968 and 1971 to the design of a consulting engineer (Mr J O Riddell) whose report on the scheme is dated June 1968.

When the State Highway 3 bypass of Waitara was investigated by the then Ministry of Works and Development in 1980/81, the flood capacity of the scheme was reassessed. Over the design period for the State Highway bypass and new Highway Bridge there were several changes made to the 100 year flood flow figures. The new bypass highway bridge was ultimately constructed with less than the full debris clearance for the then agreed 100 year flood flow figures and, has since proven to have less than the required waterway area through the bridge.

This, and the effect of the road embankment cutting off the river berm flood overflows across the Karaka flats, thereby concentrating all the flood flow through the SH3 bypass bridge, had changed the flood flow characteristics of the river in this area. This resulted in extensive modification being required to the original scheme works in the section of the scheme between the Town Bridge and the new State Highway Bridge.

The Council commissioned a review of the Waitara flood protection works in 1989. In this review, R W Morris and Associates calculated a new 100 year flood flow of 2,400 cumecs.

This review indicated the existing rock protection works were in good condition prior to the March 1990 flood.

During the March 1990 flood, major damage occurred in several locations in the scheme and further upstream in other locations on the river.

Following the 1990 flood event, a comprehensive review of the standard of flood protection for the Waitara Township was carried out by the consulting firms of Royds Gardens Ltd and G & E Williams Consultants Ltd. The calculated 100 year flood capacity of the river channel was again revised, the natural characteristics of the river were assessed and new design standards for river protection works were determined. From this a new design channel was drawn up. The stability of the stopbanks was also investigated as were the effectiveness of the seawalls at the river mouth. As a result, the requirements for new works were identified and alternative options appraised.



Figure 2: Waitara River – river control

The study identified that the river channel was relatively stable except for the section between the two bridges where the construction of the state highway bypass had caused changes to the river flood flow characteristics. The seawalls were found not to significantly affect the flood flows or flood levels upstream in the river. A revised 100 year flood return period flow of 3,000 cumecs was calculated.

Following the receipt of the report, the Council proceeded with the construction of an amended channel alignment fitting the natural meander curves for the length of the river between the two bridges. To establish and maintain this alignment a new channel was excavated and a series of seven groynes and other rock protection works were constructed. This construction work was carried out during 1993.



Figure 3: Waitara River bank collapse – 1990

Prior to the recent Scheme upgrade, the Lower Waitara River Flood Protection Scheme was currently considered to provide protection to Waitara from about a 2% Annual Exceedance Probability flood event. Further detailed information about the scheme is provided in the two review reports:

- Waitara Township Flood Protection Review – January 1990 by the Council.
- Lower Waitara River Scheme Review – February 1991 by G & E Williams Consultants and Royds Gardens Ltd Consultants.

1.8 Catchment description

The form and characteristics of the Lower Waitara River are derived from the interaction of the climate and geology of the catchment. The total area of the catchment has an area of some 1,140 square kilometers and covers the northern inland part of the Mount Taranaki volcanic cone and the sharply dissected hinterland to the north east.

The volcanic mountain dominates the geology of the region, and ring plains of volcanic material have built up from a series of cones. Steep straight waterways form down the mountain side and they carry a large amount of large sizes gravel material. On the north eastern side of the mountain these waterways join together to form the Manganui sub-catchment with an area of 292 km².

The hinterland sub-catchment is made up of sedimentary siltstone and sandstones that have been eroded into a landscape of narrow ridges and steep sided valleys. The waterways have relatively flat grades and carry mainly fine suspended material. At the Manganui River confluence the Waitara River has a catchment area of 812 km².

The lower Waitara River channel is deeply entrenched and controlled by bluffs of both sedimentary and volcanic materials. It remains relatively steep until close to the coast and passes gravel bed material derived from the Manganui River through to the sea.

The river has cut down to old volcanic lahars and this harder material is exposed in the river channels and as reefs on both sides of the river mouth. There are also accumulations of large boulders along the lower Waitara River, mainly at the river bends, that are remnant deposits from volcanic eruption flows that have come down the Manganui.

The location of the catchment is shown in Figure 5.

1.9 Climate

Because of its exposure to disturbed weather systems from the Tasman Sea, the Taranaki region is often quite windy, but has few climate extremes. The most settled weather occurs during summer and early autumn. Summers are warm. Typical summer daytime maximum air temperatures range from 19°C to 24°C but seldom exceed 30°C. Winters are relatively mild with daytime maximum air temperatures ranging from 10°C to 14°C but are normally the most unsettled time of the year. Frost occurs inland during clear calm conditions in winter. Annual sunshine hours average about 2000 hours. Northwesterly airflows prevail and sea breezes occasionally occur along the coast during summer.

The mountain and ranges have a strong influence on rainfall in the area by attracting orographic type events which are often associated with frontal systems and depressions moving through the Tasman Sea. Annual rainfall on the upper slopes of the northern Egmont National Park ranges from 1500 to 5000mm.

Although the annual totals are quite high, the way in which rainfall is delivered is more significant. Also of significance is that only 25% of the catchment is located within the National Park and above the 450m contour.

1.9.1 Climate change

Some of the predicted impacts of a moderate rate of climate change for Taranaki include changes in average temperature, sea level rise and rainfall patterns. In general, Taranaki, like much of the west coast of New Zealand, is likely to become warmer and wetter.

Climate scientists estimate that Taranaki's temperature could be up to 3°C warmer over the next 70-100 years. This compares to a temperature increase in New Zealand during last century of about 0.7°C. Taranaki could be up to 20% wetter with more varied rainfall patterns and flooding could become up to four times as frequent by 2070.

As extreme weather events become more frequent or severe, the costs and damages associated with them are also likely to increase.

Allowances have been made in the design of the flood protection works for the effects of climate change.

1.10 Land ownership

The land currently within the Lower Waitara River Flood Protection Scheme boundary is shown in Figure 4.

The land is either vested in the Council as:

- Local purpose (soil conservation, river control and recreation purposes) reserve; or
- Local purpose (soil conservation and river control) reserve.

This land is described as: Lot 1, DP18376 situated in Block 1, Paritutu Survey District and Blocks I and V, Waitara Survey District, and being all that land held in Certificate of Title K1/539 (NZ Gazette 10 August 1995 No 77 p.2125).

Note that all the land within the boundaries of the Lower Waitara River Flood Protection Scheme, including the riverbed and all the assets constructed for the purposes of flood control, are owned and maintained by the Council.

1.11 Protection standard

The Lower Waitara River Flood Control Scheme currently provides protection from flooding in 3,840 cumec flood event with a freeboard allowance of 500mm and an allowance for climate change through to 2065. The climate change allowance was made by adding a further 20% to the 3,200 cumec flood flow. The 3,200 cumec flow was determined in 2013 to be the 1% AEP (annual exceedance probability) flood events.

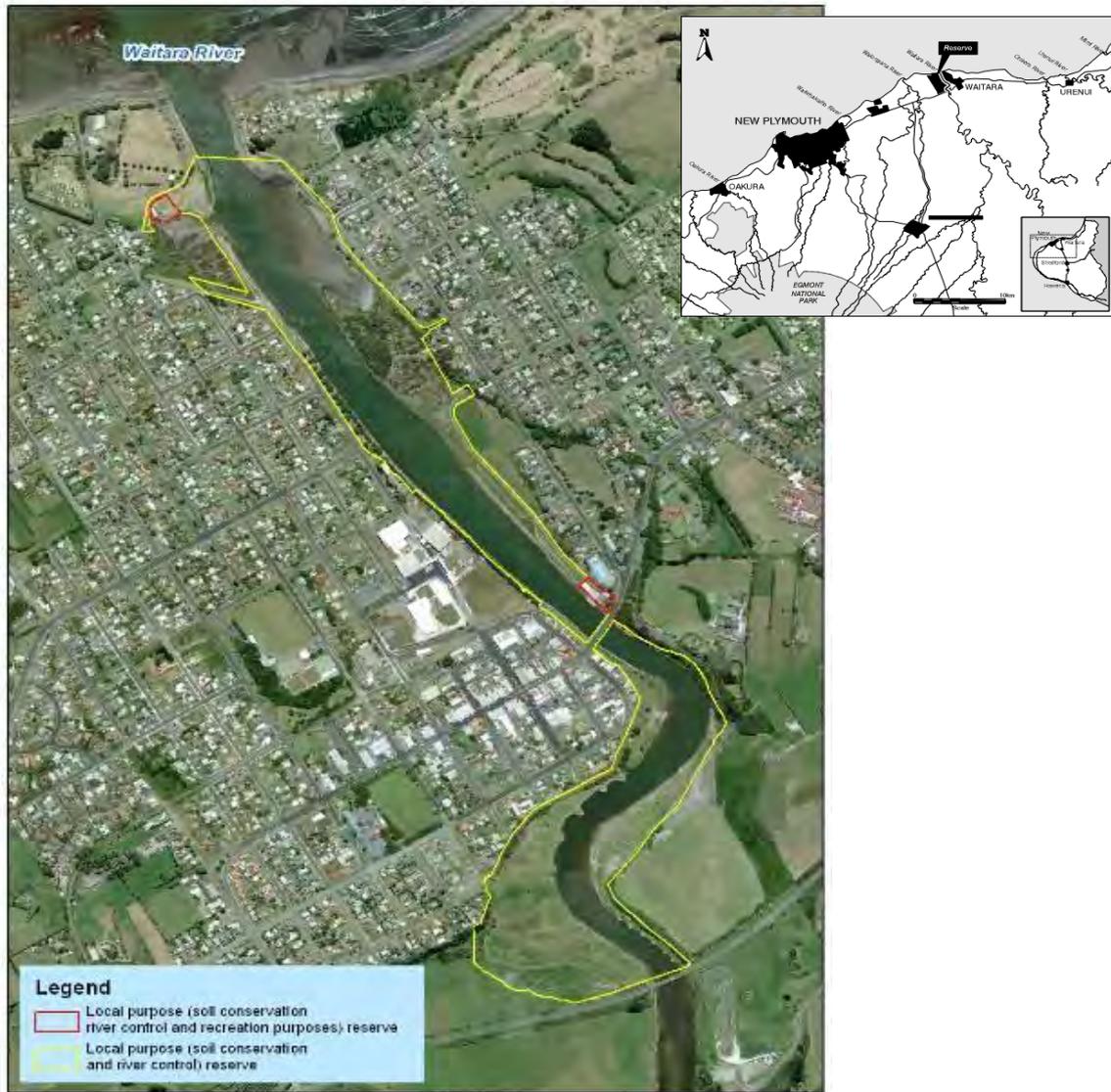
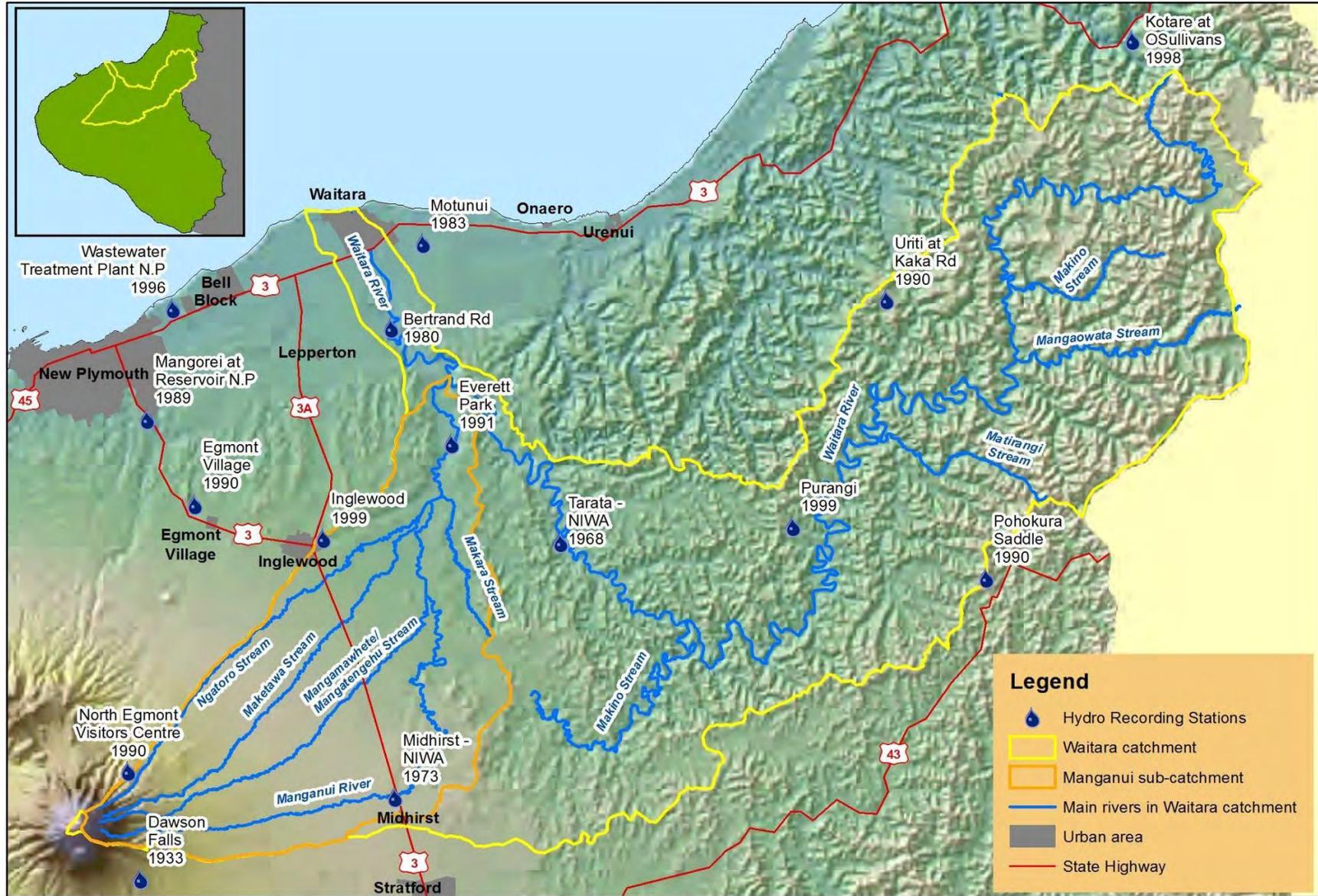


Figure 4: Land included within the Waitara Local Purpose reserve



2. General Scheme information

2.1 Principal Scheme features

2.1.1 Objectives of the Scheme

The Lower Waitara River Flood Control Scheme consists of a number of component infrastructural assets to provide security from floods in the Waitara River, up to 3,840 cumecs (1% AEP), to the low lying parts of Waitara township on both the left and right banks of the river.

The Lower Waitara River Flood Protection Scheme assets that provide erosion control have been constructed primarily to manage the alignment of the river channel to minimise the risk of damage to the stopbanks as a result of riverbank erosion.

2.1.2 Scheme works' boundaries

Works on the Waitara River within the Lower Waitara River Flood Protection Scheme boundary extend from the SH3 Bridge to the river mouth but exclude the river training walls at the mouth of the river.

The boundaries of the Lower Waitara River Flood Control Scheme are more precisely as follows:

- the upstream boundary of the scheme is located at the downstream side of the State Highway 3 bridge. From this point the western boundary follows the toe of the state highway embankment in a westerly direction for approximately 210 metres. The boundary then crosses the Karaka Flats towards the Brookes Terrace/Cracroft Street intersection for a distance of 250 metres where it then turns eastward to follow the alignment of the stopbanks downstream to finish at the intersection of the rock bank protection and the concrete seawall at the river mouth; and
- the eastern boundary follows the riverbank to the cliffs below Manukorihi Road and then runs downstream from the town road bridge following the alignment of the stopbanks to the end of the eastern stopbank. The downstream boundary is a line between these two downstream extremities on the western and eastern riverbanks close to the river mouth.

The total length of the Lower Waitara River Flood Protection Scheme is approximately 2.52 kilometers measured on the center line of the river.

Channel management works have also been undertaken upstream of the SH3 Bridge and whilst these are currently not considered to be part of the Scheme, have been constructed and maintained by the Council.

It is likely that the Lower Waitara River Flood Protection Scheme will be extended upstream to the end of Mamaku Road to include other key river management assets upstream of the existing Scheme boundary.

2.1.3 Hydrology

The design flood event for the Waitara River is a 3,850 cumec flood event, (the 1% AEP (annual exceedance probability event assessed in 2013)).

2.1.4 Overview of Scheme assets

The Lower Waitara River Flood Protection Scheme assets include:

- a substantial stopbank, up to 5 m high, comprising earth fill and in parts gabion basket floodwalls on the left bank from the end of Brookes Terrace extending downstream past the township tying into a concrete floodwall along side ANZCO and the NPDC effluent storage and pumping site, then back to earth and in parts stopbanks gabion flood walls before ending at the concrete training wall at the river mouth in marine park , a distance of approximately 2.3 kilometres;
- a similar stopbank on the right bank extending from the Town Bridge downstream towards the river mouth, a distance of approximately 1.5 kilometres. Both the stopbanks are between 3.0 and 5.0 metres high. A section of high ground between High Street East and Gold Street forms the stopbank in that reach. The stopbank ends close to where Howard Street joins the river.
- a series of seven rock groynes on the left bank with associated earthworks, and a smaller groyne on the right bank upstream of the Manukorihi Road cliffs all located between the town bridge and the State Highway 3 bridge;
- a continuous rock riprap lining over a distance of 430m on the left bank of the river extending from the Town Bridge upstream to the most downstream groyne referred to above;
- substantial lengths of rock riprap lining between the Waitara Town Bridge and the downstream extent of the Scheme; and
- a section of terraced rock bank lining and six small groyne (barbs) immediately downstream of the State Highway 3 bridge on the right bank for a length of 300 metres, and other areas of rock bank protection in various locations on both river banks throughout the extent of the Scheme.

There are other assets that the Council has constructed and maintained in the Waitara River immediately upstream of the flood control scheme. While they contribute to the overall flood control of the area these are of a relatively minor nature. These upstream items are described as ancillary items and are not included in the scheme but the security of the scheme depends on their continued high standard of maintenance. The minor maintenance expenditure on these ancillary works is funded from the routine maintenance budgets.

Figure 7 details the general location of these assets. The access track and paths are not shown as their inclusion would clutter the drawing.

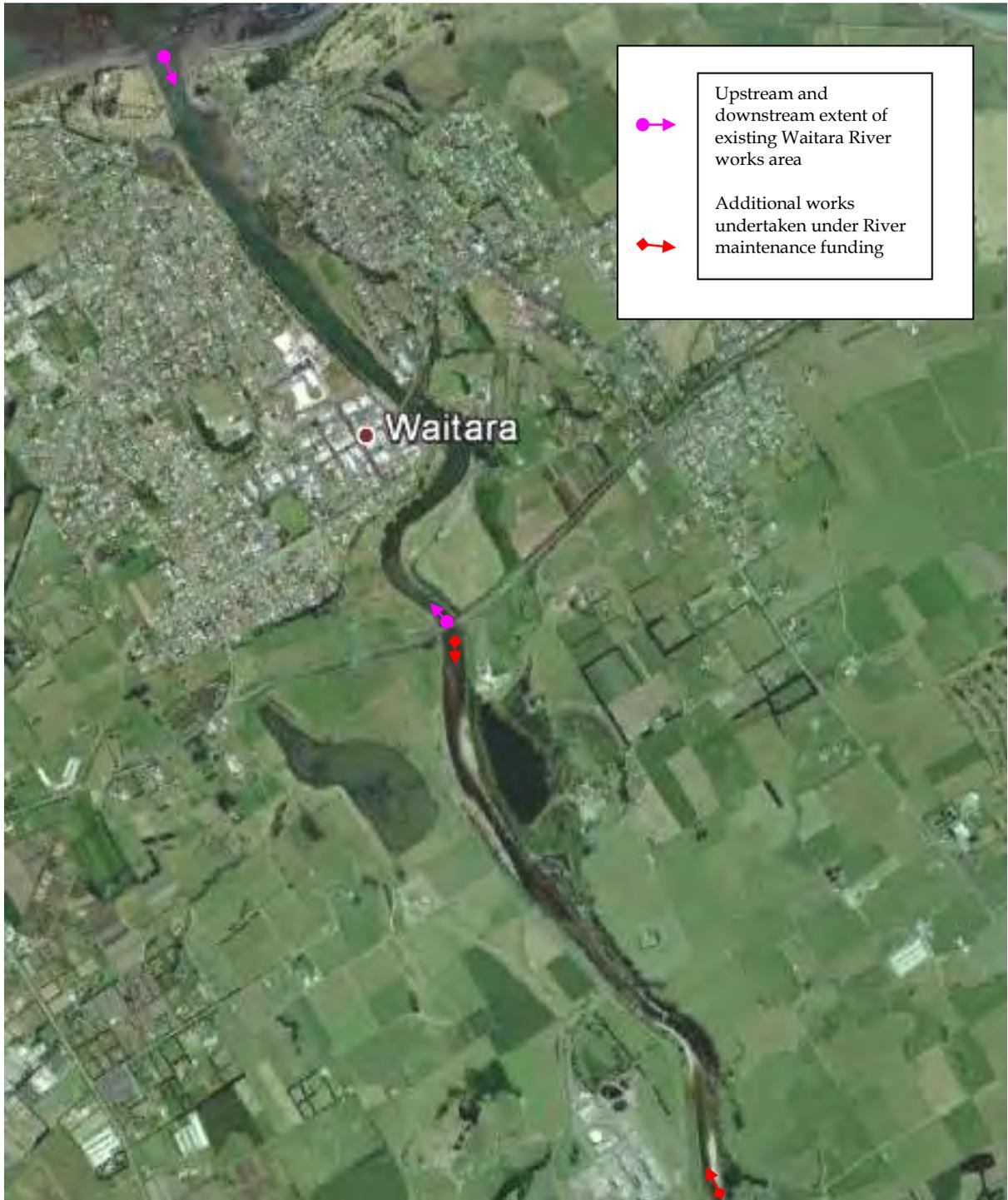


Figure 6: Scheme works area

3. Assets

3.1 Description of assets

3.1.1 Earthfill stopbanks

Earthfill stopbanks are compacted earth structures, which provide protection to the properties in the Waitara Basin from flooding.

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

Large proportions of the Lower Waitara River Flood Protection Scheme stopbanks have been constructed with material pulled up from the river channel and capped off with a layer of topsoil. The 2013 to 2016 upgrade has added significantly to these stopbanks adding significant layers of far less permeable compacted Taranaki ash.

3.1.2 Gabion basket floodwalls

Gabion basket floodwalls are wire mesh gabion baskets filled with river stones with shotcreting on their river side face which provide protection to the properties in the Waitara Township from flooding.

The floodwalls are built to a level and grade where they will not be overtopped by the design flood.

3.1.3 Concrete floodwalls

Concrete floodwalls are reinforced concrete block walls which provide protection to the properties in the Waitara Township. They have been constructed where there is inadequate area to construct an earth stopbank.

The floodwalls are built to a level and grade where they will not be overtopped by the design flood.

3.1.4 Rock riprap erosion protection (bank lining)

Rock Riprap is rock placed mechanically on an eroded or potentially erodible riverbank to prevent riverbank erosion that may threaten the integrity of the adjacent stopbank or riverbank.

The rock is sized and placed to meet particular standards to ensure it withstands the river forces that occur during large flood events.

3.1.5 Rock groynes

Rock groynes are engineered piles of rock placed on the riverbank extending out into the river flow to guide and divert the flow of the river away from the adjacent riverbank.

3.1.6 Access track

Access tracks in this context are formed access track over the stopbank or along the riverside of the stopbank used to provide access to the river side of the stopbank and river bank for inspection maintenance purposes, and recreational purposes.

3.1.7 Concrete walkway path

Concrete walkway paths are paths located along the top of the stopbank and along the berm land to provide public access for recreational purposes.

3.1.8 Fences and gates

Fences and gates including bollards are installed to control access onto or along stopbanks.

3.1.9 Floodgates

Floodgates are aluminum, steel or wooden flaps that are attached to the rivers end of a culvert that prevent floodwaters flowing up the pipe and flooding land on the inland side of the stopbank when the river level rises.

The pipes and their floodgates through/beneath the stopbank are the property of the New Plymouth District Council but as the failure of the gates can negate the benefits provided by the stopbanks, inspection and monitoring of the floodgates will be undertaken as part of the Scheme asset management activity.

3.1.10 Flood fairway

Whilst a flood fairway is not strictly an asset, it is included here in recognition of the need for ongoing maintenance to ensure that the flood carrying capacity of the river channel is not lost as this will reduce the effectiveness of Scheme's stopbank system.

The flood fairway includes that area of land adjacent to the river edge and below the design flood level.

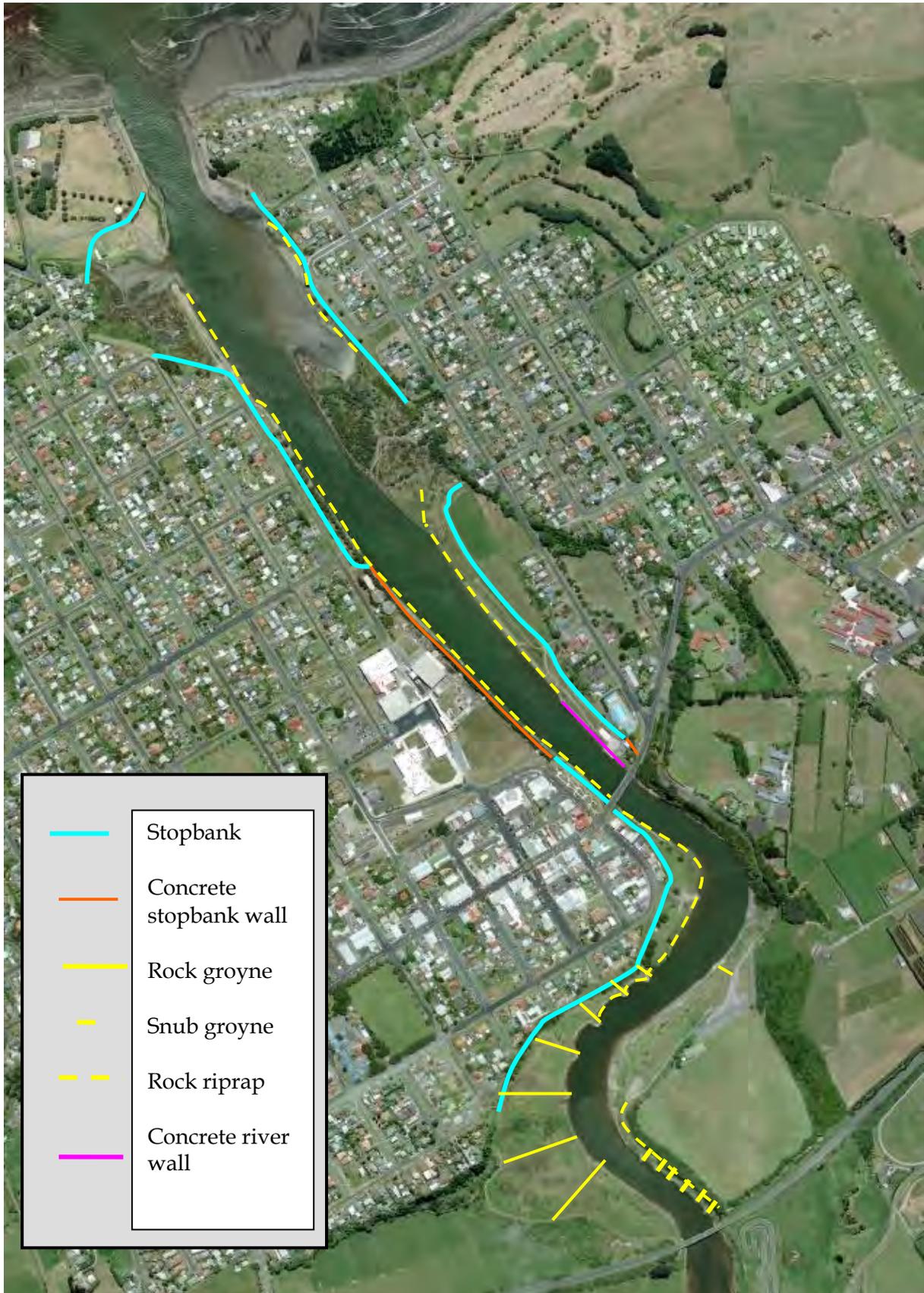


Figure 7: Location of Scheme Assets

3.2 Asset capacity – design standards

3.2.1 Stopbanks, floodwalls and channels

When the Lower Waitara River Flood Protection Scheme works were first constructed in 1968 the design standard was the 1% AEP flood event known at that time. Analysis undertaken in 1979 indicated that the Scheme standard was the 2% AEP standard and not the original 1% AEP standard.

A review of the hydrology of Lower Waitara River catchment undertaken in 2013 as part of the scheme upgrade investigations has determined that the standard of protection was only the 3% AEP standard.

The Scheme is now design to protect Waitara from a 3,840 cumec flood with 500mm of freeboard. In 2013 this standard was assessed to the 1% AEP standard.

3.2.2 Floodgates

Floodgates are designed to stop flow backing up tributary drains or pipe systems when the river channel is in flood and are designed to allow the drainage water to discharge to the river when the flood recedes.

All of the floodgated outlets on the Waitara River are the responsibility of the New Plymouth District Council but should they fail to close during floods, the effectiveness of the stopbank system is compromised. Therefore whilst the capacity of these floodgates is not an issue to be addressed by the Waitara Scheme, ensuring they close effectively is.

3.2.3 Edge protection

Rock riprap is designed to remain effective in a design flood event and will depend on the velocity and the batter slope at the site. Rock in the Waitara River has remained relatively stable and any future rock used must be of a similar or large size and grade.

3.2.4 Rock groynes

Rock groynes are designed to remain effective in a design flood event and will depend on their length, design features and river flow velocity at the site. The groynes in the Waitara River have remained relatively stable and any future rock used must be of a similar or large size and grade. Minor topping up is undertaken as required from time to time to ensure that they remain effective.

3.3 Physical parameters

Table 1: Physical Parameters

Asset Type	Location	Life (years)	Quantity			
Waitara River						
Stopbanks	Left bank Browne Street to Marine Park	indefinite	51,950	m ³	1,890	m
Stopbank	Right Bank Town Bridge to Coast	indefinite	31,550	m ³	1,200	m
Concrete floodwalls	ANZCO Rowing club	50			400 35	m m
Rock riprap	Left bank	indefinite	43,860	tonnes		
Rock riprap	Right bank	Indefinite	19,027	tonnes		
Rock groynes	Left and right banks	Indefinite	31,785	tonnes		
Timber wall	Toohill Park	20			10	m
Concrete river wall	Right bank	25			175	m
Mass Block Wall	Left bank	50			55	m
Gabion Basket flood walls	Left bank - various	50			805	m
Sealed access tracks	East Quay and Marine Park	10	1,160	m ²		
Gravel access track	East Quay	10	195	m		
Concrete walkway	Various	50	560	m		
Bollards	Left and right banks	10	11	no.		
Fence and Gates	Various					
Large Flood gate	West Quay	50	1	no.		
West Quay development	West Quay	50	1	no.		
Bridge temp flood barrier	Town bridge left bank	50	1	no.		

3.4 Asset condition

3.4.1 Stopbanks

Stopbanks on the Lower Waitara River Flood Protection Scheme are largely built from material pulled up from the river channel with an outer coating of compacted Taranaki Ash.

The 2013 - 2016 scheme upgrade of the stopbank resulted in the banks being raised significantly and in doing so overlaying them with a thick layer of Taranaki Ash which has significantly increased their ability to withstand the depth of flood flows without piping.

The shape and overall profile of the stopbanks are regular with a 3m top width and batter slopes between 1.75:1 and 2:1.

The raising of the stopbanks up to the 3840 cumec standard with 500mm of freeboard was completed in June 2016.

Bank integrity can and has in the past on the Waitara River, been compromised wear and tear caused by vehicle access and pedestrian and bike access, and from trees growing on or near the bank. All problem trees have been removed and access is now controlled to limit as far as possible damage through careless use. Ongoing maintenance will prevent these issues from reducing stopbank integrity.

However, it is possible that significant damage repair works may be needed in the future should river bank erosion put the bank at risk.

Where the stopbanks are located close to the rivers edge, heavy rock riprap has been placed to prevent the loss of the available berm and the potential risk of undermining.

Stopbank asset condition and stability will continue to be monitored by visual inspection and physical surveys.

Settlement of up to 150mm of the freeboard will be allowed before stopbank reconstruction will be undertaken.

3.4.2 Structures

A regular programme of maintenance will be carried out on all structures. Asset condition is monitored by regular inspection. Structural concrete is inspected periodically.

New concrete walls were constructed on the right bank downstream of the town bridge in 2014 and along the left bank alongside ANZCO in 2015.

These banks have been designed and constructed to a high standard, are set well back from the river edge and consequently provide a high standard of protection.

3.4.3 Edge protection

There are no areas protected with vegetation or anchored tree protection works.

Rock riprap and groynes are generally in good condition but can vary to some degree depending on their location, age and its previous maintenance. Replenishment is generally not required but will be undertaken if the riprap reduces to 75% of its design quantity.

3.4.4 Access tracks, gates and bollards

The condition of sealed and unsealed access tracks are monitored regularly and will be maintained as required to prevent damage such as potholes expanding and requiring a larger level of maintenance to return the asset to its desired performance standard.

Gates and bollards will need little maintenance unless vandalised. Regular inspection of padlocks will be undertaken to ensure access can always be achieved.

3.5 Asset management system

The Taranaki region has a relatively small number of river control schemes within which infrastructural assets have been constructed and these schemes have a relatively small number of assets.

Because of this, it is possible to manage and keep track of these assets with very simple tools. Other councils that have a large network of infrastructural assets generally have an array of asset management tools used for the management of their assets.

The infrastructural assets are recorded in a simple Excel spreadsheet located on the Council's file system, Number 2571023.

The Council does not have a Schedule of River Scheme Assets located within its financial record system.

3.6 Asset value

River scheme infrastructural assets in the Taranaki region are valued at current replacement value.

The valuation of the Lower Waitara River Flood Protection Scheme assets are reviewed and updated annually following a detailed inspection of the total Scheme. This is a practical option as the area involved and the number of Scheme assets is relatively small.

The 2020 asset values are set out in Table 2 and in internal document 'Asset Valuation Spreadsheet 2571023'.

Table 2: Asset Values (30 June 2016)

Asset Type	Left or Right bank	Location	Quantity				Value 30/6/2020 \$
Erosion Control							
Rock Blanket	LB	Mouth	380	tonne			17,900
Rock Lining	LB	McNaughton Street	3,020	tonne			186,510
Rock Bench	LB	Milliscreen – Signal Box	4,500	tonne			211,950
Rock Lining & shelf	RB	East quay	3,117	tonne			146,810
Rock Lining	RB	Rowing Club to Island	3,210	tonne			151,190
Rock Lining	LB	ANZCO	15,140	tonne			713,080
Rock Lining	LB	Town Bridge to Wharf	6,290	tonne			296,250
Rock Lining	LB	Queen Street	4,000	tonne			188,400
Rock Lining	LB	Between Bridges	10,180	tonne			479,470
Rock Lining	LB	SH3 Bridge	380	tonne			17,900
Rock Lining	RB	SH3 Bridge	9,700	tonne			456,860
Rock Lining	RB	River island	3,000	tonne			141,300
Rock lining	RB	Between groynes	260	tonne			12,250
Timber Wall	LB	Toohill Park	10	m			6,690
Rock Groynes							
Groynes 1, 2, 3, 4, 5, 5.6, 6, 7	LB	Between Bridges	30,025	tonne			1,419,810
Snub groynes	LB		1,760	tonne			82,900
Stopbanks							
Earth bank	LB	Marine Park	1,800	m ³	200	m	3,087,580
Earth bank	LB	d/s ANZCO	14,000	m ³	750	m	
Earth bank	LB	d/s Town Bridge	1,250	m ³	140	m	
Earth bank	LB	u/s Town Bridge	34,900	m ³	800	m	
Earth bank	RB	u/s High Street East	26,550	m ³	550	m	
Earth bank	RB	d/s Gold Street	15,000	m ³	650	m	
Concrete wall	RB	Rowing Club			35	m	93,850
Concrete wall	LB	ANZCO			400	m	718,920
Gabion Basket walls	LB	Various			805	m	342,480
Mass Block Wall	LB	U/S Toohill Park			100	m ³	53,720

Mass Block Wall	RB	Norman Street			76	m ³	40,820
Toe drain	LB	Queen Street					15,830
Bridge Flood Barrier	LB	Town Bridge					54,880
Access ways etc							
Sealed access tracks	RB	Richmond Street	1020	m ²			111,430
Gravel Access	RB	d/s Richmond Street	195	m			21,570
Bollards	LB&RB	Various	11	No.			4,120
Fences and rails	LB&RB	Various					38,710
Flood gates Bridge and pump station	LB	Town Bridge and West Quay					9,280
Concrete walkways	LB	Various					72,070
West quay development	LB	West Quay					96,100
TOTAL							\$9,290,630

Frodo:2571017

4. Maintenance and renewals plan

4.1 Asset management system

Maintenance refers to the work necessary to retain the operating standard or service capacity of the scheme and to keep the asset operational. Because a natural river system is involved, the work needed cannot always be accurately forecast in time. However, experience gives a very good guide as to the type and general level of work necessary to meet scheme requirements in periods of 'normal' river 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;
- Regular operational activities, e.g. fairway/channel weed spraying and mowing; and
- Replacement of elements of the system such as walls.

The maintenance plan will set out the programmes and costs required to maintain the desired level of service.

4.2 Service levels

4.2.1 General

The current standard of protection provided by the Lower Waitara River Flood Protection Scheme is the 1% AEP standard (3,840 cumec capacity).

The hydraulic capacity provided by river control works can be determined with reasonable consistency and accuracy. The greater problem is in determining the security of the primary defenses, stopbanks and floodgated outlets - against erosion. The level of risk of failure can only be roughly estimated.

The greater part of expenditure on maintenance of most river control systems is on erosion protection works. Whilst the erosion protection on the Waitara River is almost exclusively achieved using rock riprap, the deep nature of the channel and the relatively soft sediments that make up the bed in some areas means that in some parts of the Scheme the rock riprap can be prone to gradual deterioration as settlement occurs.

Since the major works undertaken following the large flood in 1990, there has been very little significant riverbank erosion and the risk of this has been further reduced by a programme of rock protection works that has extended the left bank rock riprap protection upstream to the large river training groynes located downstream of SH3 and the strengthening of the rock riprap adjacent to the ANZCO site following the removal of the large Pohutukawa trees along this reach of the river.

The floodgated outlets although not strictly scheme assets, are generally well protected with adjacent rock riprap or are set well back from the river edge and not at risk of being damaged by erosion.

Minor damage to the erosion protection works at a critical location could result in a failure of the primary stopbanks, leading to inundation of a large part of the floodplain, i.e. the scheme's value could be retained almost 100%, but its operating standard severely compromised.

Further, in many instances major damage to the erosion protection works could occur even though all floodwater is contained within the system.

4.2.2 Stopbanks

The Council will maintain the stopbanks to a level to ensure the design flood can be conveyed. For design standards see Section 3.2.

4.2.3 Structures and walls

The Council will maintain all structures in a workable condition at all times to function to their design standards.

4.2.4 Edge protection – rock riprap and groynes

Rock riprap and groynes are generally in good condition and will be monitored periodically. Replenishment is generally not required but will be undertaken if the riprap reduces to 75% of the in-place rock.

4.2.5 Drainage outlets and floodgates

The flood gated drainage outlets on the Waitara River are assets owned by the New Plymouth District Council. Notwithstanding that the Taranaki Regional Council will inspect and clear the floodgated outlets on a regular basis as their failure will negate to some extent the effectiveness of the stopbank system.

4.3 Maintenance history

Maintenance works on the Lower Waitara River Flood Protection Scheme has involved regular activities such as stopbank mowing and weed spraying. Less regular maintenance has involved the tidying up and topping of bank rock riprap linings and groynes and the removal of gravel build ups in the flood fairway from time to time.

A full upgrade of the stopbanks has been undertaken over the period 2013 to 2016.

The construction of concrete pathways, the reformation of the access track upstream of Toohill park and the development at West Quay has significantly lifted the standard of access to this area and improved the access to the downstream berm land for recreational purposes.

Extensive clearing works of overgrown trees from the stopbanks as part of the upgrade works and the clearing of weeds and trees on Mangaroa Island has also been undertaken to maintain the flood carrying capacity of the river channel.

4.4 Maintenance programme

The Council has now developed a maintenance programme, which will minimize 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 required to provide for the long term sustainable management of the Lower Waitara River Flood Protection Scheme assets.

The key work components of this are summarised in Table 3 below, along with a general description of the activity and its estimated required frequency. Frequencies given are for the range of conditions anticipated throughout the Lower Waitara River Flood Protection Scheme.

The Lower Waitara River Flood Protection Scheme assets have been separated into distinct components to ensure the Scheme assets are inspected at a level that identifies all maintenance issues. Inspection and reporting at a large scale can result in important items being missed.

Table 3: Maintenance frequency

Item/Activity	Description	Estimated Frequency
Channel/ Flood fairway <ul style="list-style-type: none"> • General overview • Cross section survey • Gravel beach mtce • Berm mtce 	<ul style="list-style-type: none"> • Overview and general inspection of channel • Resurvey at previous cross section locations • Clear gravel buildup when required • Tree and weed clearing • Grass mowing (frequency varies with location) 	<ul style="list-style-type: none"> • 1 yearly • 5 yearly • As required • 1 yearly • 2 monthly
Riverbanks <ul style="list-style-type: none"> • Normal inspection • 6 Monthly inspection • Vegetation control • Vegetation control • Rock riprap 	<ul style="list-style-type: none"> • Overview and general inspection of river banks • Detailed inspection looking for erosion damage to riverbanks and rock works and vegetation congestion • Clear/maintain trees • spray/clear weeds • Realign, and top-up as inspection identified 	<ul style="list-style-type: none"> • 1 yearly • 6 monthly • 2-3 yearly • 6 monthly • As required
Stopbanks <ul style="list-style-type: none"> • Detailed inspections • Survey • Mowing • Miscellaneous mtce 	<ul style="list-style-type: none"> • Complete walkover inspection • Stopbank long section & representative cross sections • Mow all grass stopbank areas • Miscellaneous minor repairs to grass cover, weed control, barriers 	<ul style="list-style-type: none"> • 6 monthly • 5/10 yearly • Monthly • 1 yearly
Floodgates <ul style="list-style-type: none"> • Operational check • Annual inspection 	<ul style="list-style-type: none"> • Regular operation check • Integrity check 	<ul style="list-style-type: none"> • 2 monthly • 1 yearly
Structures <ul style="list-style-type: none"> • Walls 	<ul style="list-style-type: none"> • Visual integrity check • Debris check and clearance 	<ul style="list-style-type: none"> • 1 yearly • After floods

In general the priority order for maintenance work in the Lower Waitara River Flood Protection Scheme will be:

- retaining the integrity of the stopbanks and flood walls;
- retaining the strength and integrity of erosion control works;
- keeping channels and flood fairways clear of obstruction; and
- maintenance of ancillary works.

4.4.1 Programmed inspections

All programmed inspections must be recorded on the inspection sheets set out in Appendix 1 and filed in the inspections folder kept on the River engineering office.

All matters identified as needing action must be completed as soon as practicable and marked off on the inspection sheets once completed.

4.5 Maintenance costs

4.5.1 Existing

The maintenance expenditure for the Lower Waitara Flood Protection Scheme over recent years has been as follows:

2010/11	\$ 11,244
2011/12	\$ 42,640
2012/13	\$ 19,669
2013/14	\$ 62,325
2014/15	\$ 8,130
2015/16	\$ 36,741
2016/17	\$ 43,465
2017/18	\$ 1,533
2018/19	\$ 7,091
2019/20	\$ 38,369

The expenditure in the years 2011/12 and 2013/14 included renewal expenditure. The low expenditure in 2014/15, 2017/1/, and 2018/19 occurred as a result of large areas affected by the upgrade works.

4.5.2 Asset maintenance expenditure requirements

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

(a) Capital expenditure

Capital expenditure projects are those displaying one or more of the following characteristic.

- 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 which increase the capacity of the asset.

This work would be charged to: "Waitara River Flood Control Scheme Upgrade" – 940010 070 0000

(b) Operating expenditure

All maintenance, upgrading, reconstruction, renewal and renovation work that does not increase the capacity of assets is treated as operating expenditure.

Operating expenditure can be divided further into two; normal ongoing day to day routine maintenance works and those other more infrequent 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. insurances, 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.

This work would be charged to: "Waitara River Maintenance" – 30 03 02 2455

- (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.

This work would be charged to: "Maintenance Works Rivers" – 30 03 02 2466

4.6 Expenditure

With the completion of the major upgrade works undertaken over the period 2013 to 2016, Expenditure in the foreseeable future will focus almost entirely on maintenance with some minor renewals.

A long term program of monitoring and maintenance works with detailed cost estimates and the average annual expenditure required to ensure the Scheme is maintained to its full service potential is set out in Section 6.

5. Funding and financial planning

5.1 Accounting policies

It is the accounting policy of the Council that the Lower Waitara River Flood Control Scheme's assets are not depreciated. The funds required to maintain the asset in an as new condition are considered to be the maintenance budgets in the forthcoming period.

The Council uses the following procedures when applying the above policy:

- all expenditure (routine maintenance, flood damage maintenance and maintenance works) to maintain the existing as new condition (as required by the scheme objectives) is considered to be normal maintenance work and is financed as part of the maintenance budgets established for the period; and
- any additional new minor capital works that increases the assets performance ability are included in the capital works budget for the period, but, are still financed from the accumulated reserve funds.

The Council also values the assets annually.

5.2 Revenue and financing policy

It is the Council's policy that river control schemes are funded by targeted rates over the community benefiting from the protection.

The Lower Waitara and Waiwhakaiho Schemes have catchments that, when combined, comprise a substantial portion of the New Plymouth district. Significant flood control assets are managed and maintained within these catchments but because of the types of assets involved, normal maintenance costs are relatively minor. Accordingly, the Lower Waitara and Waiwhakaiho Schemes are funded from a rate that is a 100% capital value based works and services rate, applied over the whole of the New Plymouth district. This system is considered to be the most administratively efficient and appropriate funding mechanism.

5.3 Funding for disaster relief

The Taranaki Regional Council has made the decision to be self-funding in the event of a major disaster in the flood management scheme areas. This philosophy exists due to:

- the potentially high cost of insurance (relative to the benefits)
- the low probability of accessing Government or other disaster funding through participation in projects such as LAPP (Local Authority Protection Programme)
- the ability of the Council to reinstate the assets without significant financial implications

5.4 Routine maintenance costs

Routine maintenance costs for the Lower Waitara River Flood Protection Scheme assets are relatively constant and easy to estimate. The cost of routine maintenance has been based in the past on historical trends. The estimated costs include monitoring and maintenance of riverbanks and berms, stopbanks, floodwalls, floodgates, structural walls, monitoring and maintenance. The new maintenance programme is set out in Section 4.4 and estimated maintenance costs are set out in Section 6.

5.5 Flood damage funding

Due to the variability of flood events and their unpredictability, determining an appropriate programming of flood damage maintenance expenditure is more difficult than estimating routine maintenance allowances. Annual flood damage maintenance expenditure will vary greatly, from virtually nothing to large costs when a substantial rock works sustain major damage. Costs over a number of years could be very low, then, during a period of more intense flooding, maintenance costs could increase greatly to well beyond the annual average.

Therefore, no sensible programming of the flood damage costs can be prepared. Rather the estimated annual average flood damage maintenance cost should be used to guide annual scheme funding, with the unexpended portion of the budgeted costs accumulated year by year. This level is estimated at \$15,000 per annum.

In the cases where there are significant flood damage repairs, the process established in section 5.6 would be utilised to reinstate the schemes to as new condition.

5.6 Non-routine maintenance costs

From time to time the Council needs to expend additional funds to maintain the level of protection offered by the flood control schemes because either the river channel dynamics have significantly changed or the Council's knowledge and understanding of the schemes has improved. This expenditure is not of a capital nature as the overall level of protection offered by the schemes has not changed. Accordingly, it is included in the Annual Works Rivers budget. This expenditure has to be funded using the same funding policy as the other maintenance expenditure.

The planned maintenance works are included in the reserve fund movements for the next ten years (refer to Councils AMP for the Lower Waitara River and Waitara River Flood Protections Schemes report, #905429. This expenditure is funded from the accumulated reserve fund balances. However, where the reserve balance is not sufficient to finance the maintenance works expenditure, then the level of the targeted rate would have to be increased.

5.7 Capital works funding

Capital expenditure that increases the level of protection provided by a scheme will generally be funded by either external or internal borrowing. This reflects the long life of the assets and the need to spread the costs of those assets over the life of the assets. Interest and principal repayments for the borrowing will be funded by the targeted rate.

5.8 Financial planning

The funding of expenditure on the Lower Waitara River Flood Protection Scheme is by way of a targeted rate. This is currently set to cover all expenditure in accordance with the Revenue and Financing Policy.

Any under-expenditure on the scheme is transferred to the North Taranaki/Waitara River Control Scheme reserve. Similarly, any over-expenditure is funded from a transfer out of the reserve. As at 30 June 2020 the balance of this reserve was approximately \$1.2 million.

Each year, the targeted rate is expected to fund the routine maintenance plus any flood damage maintenance work identified in the annual review of the schemes. As noted above, if there is an unusually high level of repairs arising out of the annual review then this will be funded via the process outlined in Section 5.1.

If there were no significant repairs arising out of the annual inspections then the reserve fund would continue to grow. The appropriate maximum level for the reserve needs to be considered.

This level is dependent upon the Council's ability to reinstate the assets as a result of a rare large damaging flood event. The Council has a philosophy of self-insurance to recover the service potential of the scheme assets after such an event. The estimated worst case scenario is total flood damage of \$500,000. The Council needs to be able to fund this level of expenditure at a maximum.

5.9 Funding for disaster relief

In all river flood control schemes the damage caused by the rare large floods is particularly hard to estimate and can vary greatly. This damage occurs at irregular intervals, with unpredictable timing. In the case of a major flooding event it is proposed that funding for reinstatement be accessed through the following hierarchy:

- First, any unused/uncommitted funds from the maintenance budgets for the river control schemes for that financial year will be used;
- Second, any balance remaining in the reserve fund will be used;
- Third, any surplus Council-wide cash and investment balances will be loaned to the scheme reserve fund; and
- Finally, consideration will be given to the raising of debt finance.

The individual options available will be considered on a case by case basis.

6. Maintenance and monitoring cost estimates

Table 4 sets out the ongoing cost of maintaining and monitoring of the Lower Waitara River Flood Protection Scheme.

The frequency of the works have been estimated but may vary as a result of the frequency of flood events and other changes that may necessitate more frequent activities in some areas.

The actual will vary from year to year but will be known when annual budgets are prepared.

Table 4: Long Term monitoring and Maintenance Requirements

Item	Work Description	Work Frequency	contractor cost	TOTAL annualised
		Years		Excluding Staff
General	General overview			
	Cross section survey Waitara	5	8,000	1,600
	Consultant	1	2000	2,000
Riverbank and berms	Channel Management			
	Vegetation control	1	7,000	7,000
	Rock riprap	1	3,000	3,000
	Rock bench tidy up	3	2,100	700
	Groyne replenishment	3	2,100	700
	Gravel beach mtce	5	5,000	1,000
Stopbanks	Detailed inspections			
	Survey	5	4,500	900
	Mowing	1	20000	20,000
	Miscellaneous mtce	1	8,000	8,000
	gates/ bollards	1	3000	3,000
	tracks and paths	1	3000	3,000
TOTALS				\$50,900

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Table 5 and Figure 8 set out the estimated cost of managing and maintaining the Lower Waitara River Flood Protection Scheme for the period 2021 to 2031.

The estimates separate the staff and internal cost from external costs that would be contracted out. The flood damage allowance is as per Section 5.3.

Table 5: Cost estimates 2021 to 2031

Year	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
Contracting Costs	\$ 46,000	\$ 56,100	\$ 51,000	\$ 50,500	\$ 50,200	\$ 46,000	\$ 54,000	\$ 53,100	\$ 50,500	\$ 48,100
Total Annual Maintenance cost	\$ 46,000	\$ 56,100	\$ 51,000	\$ 50,500	\$ 50,200	\$ 46,000	\$ 54,000	\$ 53,100	\$ 50,500	\$ 48,100

Note: In addition to these costs, an allowance for flood damage of \$15,000 is shared with the Lower Waiwhakaiho Flood Control Scheme and the Okato Scheme.

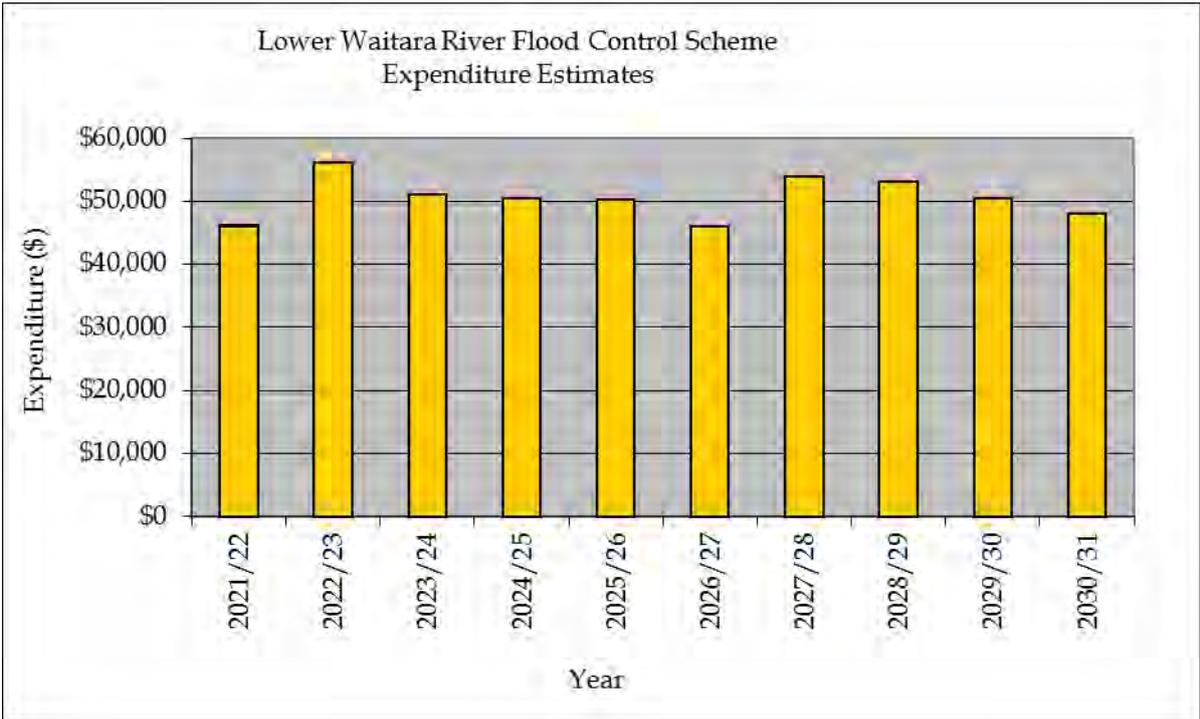


Figure 8: Cost estimates 2021 to 2031

7. Infrastructure Strategy

This Infrastructure Strategy identifies:

- the infrastructure issues for the Scheme for the period from 2015 to 2045; and
- the principle options for managing those issues and the implications of the options.

The Lower Waitara River Flood Control Scheme is currently (2014) being upgraded to provide protection to the 1% Annual Exceedance Probability (AEP) flood event with an allowance for increase flood levels arising from climate change to the year 2065. The upgrade works will be completed by 30 June 2016.

The land use in the area protected by the Scheme is a mixture of commercial, industrial and residential with the majority of the area being residential. The 1% AEP protection standard is considered to be the accepted standard for town the size of Waitara.

Changes in the land uses are likely to occur over time but it is unlikely that the percentages of land use type will vary significantly over the next 30 years. The value of the assets in Waitara protected by the Scheme are very unlikely to change significantly over the next 30 years to warrant an upgrade to a higher standard of protection. Notwithstanding this, once the current upgrade has been completed there is no plan to further upgrade to the level of service provided by the Scheme before 2065 as the Scheme will provide at least 1%AEP standard until that date.

The risk to the Scheme infrastructure arising from natural disasters is low. The nature and ongoing maintenance of the assets make them resistant to significant damage in large flood events. Any damage that did occur would be funded from Scheme Reserves. \$15,000 is budgeted each year for the repair of flood damage from the North Taranaki Schemes and if unspent, accumulates in the Scheme reserves account.

The Scheme has infrastructural assets that fall into six types. The following table sets out how the Council will manage these asset types.

Asset Type	Renewal or replacement requirements	Expenditure
Earth stopbanks	<ul style="list-style-type: none"> • No replacement required. Stopbanks will be maintained to the design levels and standards 	Operational
Gabion basket structures	<ul style="list-style-type: none"> • Gabion baskets have a design life in the order of 100 years. The first gabion baskets were constructed in the Scheme in 2014. • Some minor maintenance may be required. • No replacement required before 2047. 	Operational
Concrete structures	<ul style="list-style-type: none"> • Concrete structures have a design life in the 50 to 100 year range. The concrete structures in the Scheme will all be constructed post 2014 as part of the Scheme upgrade works . • No replacement required before 2047. 	Nil
Concrete culverts and flood gates	<ul style="list-style-type: none"> • All culverts and floodgates are New Plymouth District Council assets. 	Nil
Rock riprap	<ul style="list-style-type: none"> • Rock does not need replacement. Minor topping up may be required very irregularly. 	Operational

Ancillary minor structures	<ul style="list-style-type: none"> Gates, fences, access tracks and bollards have a life shorter than 30 years but individually have a low replacement cost and will be replaced as a maintenance activity as required 	Operational
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Risk Management

The following table sets out the risk faced by the Scheme assets by natural disasters and indicates the financial implications and potential size of the of that risk.

The potential risk to the Scheme assets arise from over design flood events and from earthquakes.

Asset Type	Disaster Type	Risk	Financial Risk	Expenditure type to fund repair
Earth stopbanks	Flood	Some minor damage possible. If a stopbank was to fail, the damage to the stopbank would be very localised	Minor	Operational
	Earthquake	Could suffer significant damage from cracking and slumping	Significant	Capital
Gabion basket structures	Flood	Minimal	Minor	Operational
	Earthquake	Could suffer significant damage from cracking	Medium	Capital
Concrete structures	Flood	Minimal	Minor	Operational
	Earthquake	Could suffer significant damage due to foundation failure	Significantly	Capital
Rock riprap	Flood	Moderate risk of rock riprap needing to be repositioned or topped up	Moderate	Capital
	Earthquake	Minimal	Minor	Operational
Ancillary minor structures	Flood	Moderate risk of damage	Minor	Operational
	Earthquake	Minimal	Minor	Operational

The indicative estimated set out below for the management of the Scheme assets is drawn from Section 6 of this plan. There will be no capital expenditure over the next 30 year period.

Year(s)	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031	2031/ 2036	2036/ 2041	2041/ 2046	2046/ 2051
Estimated operating costs (\$1000's)	46	56	51	51	50	46	54	53	51	48	255	255	255	255

Assumptions Made

The assumptions made in determining the above estimates are:

- That the frequency and size/nature of the future maintenance works required are in line with that which has occurred over recent years.
- That the frequency of damaging flood events and the damage that occurs in these events does not change significantly.

8. Performance monitoring

As well as the regular inspection and monitoring of Lower Waitara River Flood Protection Scheme assets to ensure that they maintain their integrity and provide the required flood standard, there is a need to monitor the performance of the Scheme in relation to its protection standard.

Traditional performance monitoring techniques are not easily applied to management of river 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 Lower Waitara River Flood Protection Scheme is to maintain the risk of flood damage at acceptable levels, by maintaining the desired levels of flood protection and erosion control (note that the risk of flood damage rather than actual flood damage is referred to).

Cross section surveys are one of the most important monitoring programmes for management of the Lower Waitara River Flood Protection Scheme. The cross section surveys can be used to help identify volumetric changes to the river and stream channels and banks, and possibly local points of erosion or deposition. Using the cross-section information, changes in cross sectional area of the river that may impact on flood carrying capacity of the channel can be monitored and the design flood levels can be reassessed every fifteen years or so. Any significant reduction in channel cross section would require more frequent reassessment. Stopbank surveys are used to monitor the available freeboard.

8.1 River and stream channel cross sections

Full cross section surveys are to be undertaken on the Waitara River channel at 3 to 5 year intervals and compared with the previous cross sections to identify:

- whether or not there has been any significant change in the channel cross sectional area that may impact on the flood carrying capacity of the channel; and
- Whether or not there is any degradation trend that may be affecting the integrity of the erosion control works.

If significant changes are noted, the results of this monitoring must be referred to the Rivers Manager for assessment.

All cross section surveys must be drawn up, printed and hung in the engineering plan cabinet.

8.2 Flood level monitoring

On the Waitara River, flood flows that get to within 2 meters of the stopbank crest at any point along the river must be monitored closely. If possible maximum water levels must be

observed and pegged during the flood event and later surveyed. If the actual event cannot be monitored, as soon as possible after the flood event has receded, the highest debris marks must be carefully observed, pegged and surveyed.

Care must be taken with observing the debris levels especially on the steep sections of the river banks.

It cannot be stressed strongly enough how important this information is. Good actual flood information will enable the flood models to be checked and stopbank levels fine-tuned if required.

The Waitara River flood levels must be pegged from Browne Street at the upstream end of the left bank stopbank to the coast and on the right bank from the Town Bridge to the coast.

If practicable, flood levels should also be recorded upstream of the Town Bridge on the right bank and upstream of the SH3 Bridge on the left bank as far as possible. Flood levels downstream of SH3 are the most critical.

If flood levels are pegged during an event, the time at which the various parts of the river were pegged must be recorded.

8.2.1 Record keeping

All monitoring records must be filed in the Council's electronic filing system with clear reference to the channel being monitored, and the dates of the event.

Appendix 1

Inspection Sheets

Lower Waitara River Flood Control Scheme

Detailed Left Bank Stopbank Inspection (6 – monthly) 1 of 7

Inspected by:			Date:		
	Condition		Comment	Action Required	Date Actioned
	Good	Poor			
Browne Street to Toohill Park					
Grass cover					
Access track at toe					
Fences and gates					
Trees & weeds					
Toohill Park to Town Bridge					
Grass cover					
Trees & weeds					
Access road crossing					
Bollards					
Retaining walls u/s Town Bridge inside of bank					
Gabion basket flood wall					
Bank interface with Bridge					
Town Bridge to Wharf					
Grass cover					
Trees & weeds					
Bank interface with Bridge					

Lower Waitara River Flood Control Scheme

Detailed Left Bank Stopbank Inspection (6 – monthly) 2 of 7

Inspected by:			Date:		
	Condition		Comment	Action Required	Date Actioned
	Good	Poor			
ANZCO concrete wall					
Apparent structural integrity					
Affect of trees					
Queen Street to Domett Street					
Grass cover					
Trees & weeds					
Access road crossing					
Bank interface with flood gate control structure					
Bollards and gates					
Marine Park					
Grass cover					
Trees & weeds					
Access road crossing					
Boating Club floodgate crossing					

Lower Waitara River Flood Control Scheme

Detailed Right Bank Stopbank Inspection (6 – monthly) 3 of 7

Inspected by:			Date:		
	Condition		Comment	Action Required	Date Actioned
	Good	Poor			
Town Bridge to Mangaroa Island					
Grass cover					
Apparent structural integrity Rowing Club wall					
Access road crossing					
Fences, gates & bollards					
Trees & weeds					
Culvert crossing d/s end					
Mangaroa Island to Howard Street					
Grass cover					
Trees & weeds					
Access track crossing					
Fences, gates & bollards					
Culvert crossing d/s end					

Lower Waitara Flood Control Scheme

Detailed Riverbank and Berm Inspection (6 – monthly) 4 of 7

Inspected by:			Date:		
	Condition		Comment	Action Required	Date Actioned
	Good	Poor			
Upstream of Browne Street					
Berm surface					
Trees & weeds					
Riverbank stability					
Access track					
Rock riprap					
Browne Street to Toohill Park					
Berm surface					
Trees & weeds					
Riverbank stability					
Access track					
Rock riprap					
Toohill Park to Town Bridge					
Berm surface					
Trees & weeds					
Riverbank stability					
Rock riprap					

Lower Waitara Flood Control Scheme

Detailed Riverbank and Berm Inspection

5 of 7

Inspected by:			Date:		
	Condition		Comment	Action Required	Date Actioned
	Good	Poor			
Town Bridge to Wharf					
Berm surface					
Trees & weeds					
Riverbank stability					
Rock riprap					
Wharf to Queen Street					
Berm surface					
Trees & weeds					
Riverbank stability					
Rock riprap					
Queen Street to Boat Club					
Berm surface					
Trees & weeds					
Riverbank stability					
Rock riprap					
Boat Club to rivermouth					
Berm surface					
Trees & weeds					
Riverbank stability					
Rock riprap					

Lower Waitara Flood Control Scheme

Detailed Riverbank and Berm Inspection (6 – monthly) 6 of 7

Inspected by:			Date:		
	Condition		Comment	Action Required	Date Actioned
	Good	Poor			
Town Bridge to Mangaroa Stream					
Berm surface					
Trees & weeds					
Riverbank stability					
Rock riprap					
Sealed access track					
Gravel access track					
Mangaroa Island					
Berm surface					
Trees & weeds					
Riverbank stability					
Downstream of Mangaroa Island					
Berm surface					
Trees & weeds					
Riverbank stability					
Rock riprap					

Lower Waitara Flood Control Scheme

Groynes (Annually) 7 of 7

Inspected by:			Date:		
	Condition		Comment	Action Required	Date Actioned
	Good	Poor			
Large groynes - Town Bridge to SH3 Bridge					
Left Bank					
Right Bank					
Groynes and rock upstream SH3					
Left Bank					
Right Bank					

Lower Waitara Flood Control Scheme
Floodgates
(6 – monthly)
1 of 2

Inspected by:			Date:		
	Condition		Comment	Action Required	Date Actioned
	Good	Poor			
Upstream Town Bridge left bank					
Browne Street - 450mm					
Domett Street - 750mm					
Queen Street- 450mm					
West Quay - 250mm					
Town Bridge - 300mm					
Town Bridge to McNaughton St					
Pump station 1650 & 1200mm			internal gates		
ANZCO MID Big square			No gates		
Tanks - 600mm					
u/s milliscreen tanks - 450mm					
Milliscreen tanks - 300mm			No gates		
High St West u/s -375mm d/s 450mm					
High St to Pratt St - 375mm					
Pratt St - 450mm					
McNaughton St - 1600mm			No gates		
Wetland beside Boating Club					
Norman St - 275mm					
Sailing Club - 375mm					

Lower Waitara Flood Control Scheme

Floodgates (6 – monthly) 2 of 2

Inspected by:			Date:		
	Condition		Comment	Action Required	Date Actioned
	Good	Poor			
Downstream Town Bridge right bank					
Richmond – 575mm					
High St East – 600mm					
Atkinson – 1200mm					
Howard - 2/1200mm					

NOTE: Any problems with the Waitara River floodgates must be referred directly to New Plymouth District Council.

The current (2012) contact person is: Rob Campbell 027 333 5698 06 759 6132