

Draft Hutt River Floodplain Management Plan

For the Hutt River and its Environment

July 2001

HRFMP Draft July 2001

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Summary

Who Should Use This Plan?

The Hutt River Flood Plain Management Plan (the Plan) is important to you if you are a resident of Lower and Upper Hutt cities, or belong to a public agency, interest group, club or business associated with the valley. You should use this Plan to determine:

- if you are directly affected by the flood hazard
- if you will be directly affected by any flood protection structures or possible planning and emergency management measures
- how you can help yourself to prepare for flooding
- how your community's money is used to fund works under the Plan
- where there are opportunities to enhance the river environment that will benefit you.

The Plan contains a wide range of information including:

- areas directly affected by flooding from the Hutt River
- selected *structural* and *non-structural* measures
- environmental enhancement opportunities arising from the *Environmental Strategy*
- work programmes
- funding and cost details
- affected land
- the policy backing for all measures, and the Environmental Strategy.

Councillors, council officers and staff of environmental, health and utility agencies should all use this document in their day-to-day work, supporting a community that continues to live with the river.

The technical terms in the Plan are described in the Glossary. These terms are in *italics* when they appear for the first time in each chapter.

Why This Plan is Important

Flooding from the Hutt River is one of the biggest environmental and emergency management issues facing residents of Hutt Valley. A major flood of the Hutt River could cause injury, even death, and result in hundreds of millions of dollars worth of damage to property and community assets in the Valley. The resulting social disruption, psychological impacts of trauma and stress and economic impact would add considerably to the initial physical impacts of the flood. The Plan contains measures developed to substantially reduce these potentially devastating impacts.

The Wellington Regional Council and Hutt and Upper Hutt City Councils are responsible for ensuring that the flooding problem is appropriately managed. The Plan is a 40-year blueprint for managing and implementing programmes that over time gradually reduce flooding effects from the Hutt River, and reflects the varied and shared responsibilities of the three councils. The Plan presents a holistic approach to managing flood hazard effects, ¹ combining:

- physical protection (structural measures)
- appropriate ways of using land and preparing communities for flooding (non-structural measures)
- opportunities to enhance the river environment (environmental opportunities).

By moving away from a somewhat ad-hoc approach to managing floods, the Plan provides more certainty for Hutt Valley residents in the long-term management of flooding.

How the Developed Floodplain has Influenced this Plan

Ever since humans first settled in the area communities have been learning to live with the Hutt River. Since colonial times, the pattern of development in the Valley has tended to squeeze, confine and modify the Hutt River, while at the same time forming the second most densely populated and asset-rich floodplain in New Zealand. As a result, the approach to managing floods has centred on keeping the river out – building physical protection to control flooding. Measures developed under the Plan have been heavily influenced by this legacy of floodplain development.

These days the key focus of floodplain management planning is increasingly on keeping people and development away from floodwaters. Yet the Plan's main focus remains to keep floodwaters away from the intensively developed urban areas of the floodplain. This means relying heavily on physical protection against flooding. However, the Plan also offers many additional solutions to improve the community's protection and response to flooding.

Flood hazard effects is defined in Chapter 1: Introduction.

What the Plan Does

The Plan is a foundation for implementing structural and non-structural measures, and an environmental strategy for enhancing the river environment. Putting it simply, the Plan records where we have come from in developing measures, and tells you where we are going in implementing them.

The Plan also establishes the framework for paying attention to the community's changing needs as structural and non-structural measures and environmental opportunities are refined and implemented, plan outcomes are monitored and the Plan is reviewed

Design Standard Guides Levels of Protection

The whole basis for the flood protection in this Plan is the 2300 cumec² risk-based design standard.³ A design standard is the river flow (or size of flood) that physical works are designed to withstand.

A *risk-based standard* has been applied to all flood protection measures. What this means in the case of physical protection is that the level of physical works for a local area has mainly been determined by assessing the social, economic and environmental benefits and costs of providing this flood protection. The standards applying to physical works are a mix of the:

- 1900 cumec standard (1 in 100-year flood)⁴
- 2300 cumec standard (1 in 440-year flood)
- 2800 cumec standard (rare flood).

The risk-based design standard means new and upgraded flood defences will protect major urban areas in the floodplain from a 2300 cumec (1 in 440 years) flood. Other areas will have a lower flood standard, with an emphasis on alternative measures. The Plan proposes to spend an estimated \$78 million on physical works over the next 40 years to achieve this standard.

What are Structural Measures?

Structural measures are physical works such as constructing stopbanks, placing rock and planting vegetation to protect river edges. Structural measures also include replacing and modifying bridges and raising residential homes.

A cumec measures water flow. 1 cumec (1m³/sec) equals 1 cubic metre passing a given point every second.

³ See the **Glossary** for a definition of *design standard*, including the 2300 cumec risk-based standard.

¹ in 100 year flood means the flood event will happen on average once every 100 years. This is the probability of flooding.

Types of Structural Measures Planned for the Hutt River

Stopbanks

Stopbanks are the principal defence against flooding in the Hutt Valley. The main stopbanks protecting major urban areas will be upgraded to the 2800 cumec standard. Stopbanks protecting smaller urban areas (including Totara Park, Whirinaki Street, Manor Park) will be upgraded to the 2300 standard. Gemstone Drive's stopbank will be upgraded to the 1900 standard.

Bank Edge Protection and River Realignment

Bank-edge protection works protect river berms and stopbanks from erosion. They include vegetative and light and heavy rock protection placed along river banks. Main stopbanks located very close to the river will generally be protected with heavy rock. Major river realignment will be carried out in the Ava to Ewen reach to relieve flood pressures on western stopbanks.

House Raising

Financial support to raise houses above the 1900 cumec flood level is envisaged for Bridge Road – Gemstone Drive (Upper Hutt) and Belmont (Lower Hutt) residents.

Bridge Replacement

All bridges will be upgraded to the 2800 cumec standard when they reach the end of their useful life. In most cases replacement will be funded solely by bridge owners.

Will These Structural Measures be Failsafe?

These measures provide varying degrees of physical protection against a range of floods, but they cannot be solely relied on by vulnerable communities whose protection will be limited, or in large floods where the additional risk of structural failure increases. This additional risk is known as the *residual risk*⁵, and is provided for by non-structural measures.

What are Non-structural Measures?

Non-structural measures deal with the residual risk of flooding, through improving community resilience against the flood hazard, and helping people to avoid the flooding problem to start with. They address:

- land use: policies and provisions in district plans or voluntary actions that deal with constructing buildings and structures, doing earthworks and using land in a wise manner
- emergency management: preparing the community to cope with flooding.

Non-structural measures are particularly cost-effective. They encourage property owners to take the responsibility for lessening flooding effects on themselves, which can substantially reducing damage costs, and stress and trauma experienced by the community. *Land-use measures* are likely to be strong in areas with little or no structural protection from flooding. *Emergency management measures* target all residents and landowners in the Hutt Valley. They are vital when flooding happens.

⁵ See the **Glossary** and Chapter 1: Introduction for more information about *Residual Risk*.

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Types of Non-structural Measures

Managing Land Uses and Structures

Non-structural principles in Chapter Four propose developing a number of new district plan objectives, policies and rules. These would especially target the few unprotected flood-prone areas located right next to the Hutt River. The principles cover:

- constructing large structures and buildings
- undertaking earthworks
- storing hazardous substances
- locating key utility facilities
- locating new habitable buildings.

Voluntary actions centre on providing technical information and advice to the community about flooding effects and ways to reduce impacts. Information and advice applies to all Hutt Valley residents.

Emergency Management

Emergency management measures will continue to improve:

- knowledge about the flood hazard
- understanding of the effects of floods
- preparedness for flooding
- responding to floods
- recovery following flooding.

Existing emergency management programmes and procedures will be enhanced, to ensure they provide comprehensive community coverage. Examples include:

- providing updated flood hazard information
- examining the potential of other hazards to occur during floods
- improving links with the media.

Improving the quality and coverage of non-structural measures will require increased commitment from the three councils. Developing and implementing measures will particularly involve resource planning and emergency management resources from the city councils on an ongoing basis.

What is the Environmental Strategy?

The Environmental Strategy (the Strategy) identifies opportunities to enhance the Hutt River's environment over time. For this Strategy, the community's preferred blueprint is to develop the river and its margins as a *linear park*, which provides the overall vision for the river and its environment. The vision promotes a tranquil environment where people can escape the bustle of urban life and enjoy the natural character of the river environment.

The Strategy provides concept plans that identify ideas or opportunities for enhancing the river environment in line with the linear park vision. These opportunities are either linked to capital works within each reach along the Hutt River, or exist as separate enhancement opportunities.

The three councils, iwi and the wider community will be responsible for implementing the Strategy. Over the next 40 years, the Regional Council will spend an estimated \$3.9 million on Strategy projects linked to capital works. Additional expenditure on enhancement projects could exceed a further \$8 million over the life of the Plan.

Ultimately, the Strategy will influence the character, function, habitat, look and feel of the Hutt River's environment.

The Plan Process Followed

The Hutt River Floodplain Management Plan brings together many years of intensive work by:

- the Hutt Valley community
- the Wellington Regional Council, Hutt and Upper Hutt City Councils
- the Wellington Tenths Trust, and Te Runanganui o Taranaki Whenui ki te Upoko o te Ika Maui
- various interest groups, public agencies and businesses.

An advisory committee (the Hutt River Floodplain Management Advisory Committee) made up of councillors from the Regional Council, the two Hutt Valley councils and iwi, has steered the process since 1998. Public consultation, commencing with *Living with the River*⁶ in 1995, has helped the Regional Council to develop complementary structural and non-structural options, and an environmental strategy.

During this period the flooding problem has been analysed, local floodplain management issues have been determined, various options were considered, and measures and environmental opportunities have been developed and selected. Meanwhile, existing flood defences have continued to be maintained, and in some cases improved.

The guidance of iwi, community groups, public agencies, business and the wider community will continue to be sought as the three councils implement the Plan.

The Plan's Goals and Expected Performance

This Plan must be able to adapt to the changing needs of successive generations of people living in the Hutt Valley. Gauging the Plan's performance provides information about these changing needs.

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⁶ Living with the River summarises the first phase of investigations into the Hutt River flooding problem. This publication also records the community's major concerns.

The Plan's implementation will be measured against a series of expected goals or *anticipated results*. Measuring anticipated results tells us whether the Plan has achieved what it set out to do, along with the community's reaction to implementation.

The anticipated results will be monitored and reported, as will the Plan's overall performance and direction, and the continued appropriateness and affordability of various measures.

How Do I Find My Way Around the Plan?

The Hutt River Floodplain Management Plan is divided into seven chapters. The *Summary* provides an overview of the proposed flood protection measures and environmental works to be implemented over the next 40 years. It also suggests who should use the Plan.

Chapter One: Introduction sets the scene by describing the Hutt Valley's geographical features, its historical flooding problem, and the Regional Council's approach to floodplain management planning. The Plan's Objectives are also presented.

Chapter Two: Nga Tikanga Maori outlines the relationship tangata whenua have with the Hutt River and its environment. It includes their aspirations for managing the river, and their cultural values and significant sites along the river.

Chapter Three: The Design Standard outlines the way the flood protection standard for the Hutt River was selected and what that new standard means for floodplain management planning in the Hutt Valley. The chapter includes policies supporting the design standard and it also sets the scene for the next three chapters, which explain what is going to be done and how

Chapter Four: Structural Measures is the first of three chapters that explain what is going to be done and how, and outline the policies that provide support to implement the selected structural and non-structural measures, and the Environmental Strategy. This chapter describes the structural measures that will be used to manage the flooding problem in specific areas by physically keeping the floodwaters away from people and property.

Chapter Five: Non-structural Measures describes the non-structural measures that will be implemented. These complement the structural measures by emphasising keeping people away from floodwaters. Strategies are looked at in terms of council regulations, voluntary actions and emergency management.

Chapter Six: The Environmental Strategy outlines opportunities for enhancing the Hutt River's environment as the other measures are put in place. It also displays concept plans that present a possible future look for the river environment.

Chapter Seven: Implementing and Funding the Plan looks at how the work will be funded and carried out.

Finally, *Chapter Eight: Anticipated Results and Monitoring* provides the results and outcomes expected from implementing the Plan, and how we are going to measure if the Plan has done what it set out to achieve. Ongoing monitoring and reviews ensure that the Plan remains in tune with the Hutt community's changing needs.

The *Appendices* provide additional technical information supporting the Plan.

The *Glossary* lists some of the more technical terms and concepts, and provides brief explanations.

The *Bibliography* lists reports from earlier phases of the floodplain management planning process, which provide background and added detail to this Plan.

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Chapter One

Introduction: Preparing the Hutt River Floodplain Management Plan

1.1 Introduction

This chapter sets the scene for the Plan. It describes:

- the Hutt Valley's geography
- the Hutt Valley's present and historical flooding problem, and how future flooding could affect Lower and Upper Hutt City residents
- the Regional Council's approach to managing the flood hazard
- Plan objectives
- the Regional and City Councils' responsibilities for managing the flood hazard.

1.2 Living with the River

The Hutt Valley today covers an area of markedly contrasting land uses. The upper valley and hill areas, which occupy over 65 percent of the full catchment, are mainly covered in mixed regenerating native forests with some exotic plantations. The lower catchment, once itself densely forested, is today heavily developed. Nearly 130,000 people live in the valley, mostly on its floodplain. This vibrant urban community contains a high level of personal, business and public investment in buildings, businesses and utilities, which form a major component of the Wellington regional economy.

The Hutt River is also an important recreational resource. With over one million visits each year, the river has more than any other regional park. Because of its proximity to major urban areas the Hutt River is a unique resource, highly valued by the community, and appreciated by travellers and visitors. But the floodplain is an evolving physical environment. Active geological, alluvial and climatic processes continue to shape the river valley and its headwater environment. It is this changing and changeable nature of the River – combined with its proximity – that creates a problem.

1.3 The Flood Problem

Since people first began living in the Hutt Valley many centuries ago their lives have been influenced by the river. Along with the safe anchorage provided by the harbour, the fertile Hutt River floodplain also attracted early European settlers eager for land and a new life. But within two months of the arrival of the first New Zealand Company ships the river burst its banks and inundated the tiny settlement.

Over the next 150 years intensive settlement and land use have created a highly modified environment. The valley floor and nearby hill slopes have lost most of their natural vegetation cover, and the floodplain has become almost completely urbanised. The quest for land has squeezed the river into its present path, creating a significant flood hazard for the growing Hutt Valley community.

Figure 1 : Hutt River and its Catchment

Map from Living with the River PG 2 goes here

Throughout its recorded history many large floods have swept through the Hutt Valley (see Table 1). Historically, the response has been to progressively build a flood defence system along most of the Hutt River's length, gradually straighten the river channel, and excavate substantial quantities of gravel to improve the river's flood capacity

Mechanical methods were first used to control the river in 1865, and the first flood defences were built in 1894 to protect Petone. Banks were added between 1901 and 1906, stretching from the river mouth to Boulcott, and a gravel extraction and river straightening programme was implemented from 1916. In 1940 the Government began developing residential "state" housing areas in the eastern and northern parts of Lower Hutt Borough. The flood defences were extended north to Taita Gorge and later through Upper Hutt to Maoribank between 1956 and 1972 to protect the new housing estates.

Since 1972 isolated and substandard stopbanks have progressively been extended or rebuilt, and existing stopbanks maintained. Gravel extraction and river straightening has steadily been replaced by a focus on re-establishing bank-edge vegetation and strengthening bank edges. Approximately \$20 million has been spent on these structural works, yet we still do not have a consistent and adequate flood protection system throughout the Hutt Valley. There remain significant areas where improvement works are needed to achieve basic flood security against even 50 to 100-year floods.

Do you want to know more?

- Ref ?: The Hutt River a Modern History
- Ref?: Demographic Trends and Projections for the Wellington Region 1981–2021.

 Monitoring and Evaluation Research Associates, 1998
- Ref ?: Upper Catchment Investigation: Hutt River Floodplain Management Plan. OPUS International Consultants Ltd, 2000
- Ref?: Living with the River, Hutt River Floodplain Management Plan: Phase 1 Summary Report. Wellington Regional Council, 1996
- Ref?: Hutt River Floodplain Management Plan: Environmental Strategy. Wellington Regional Council, 2000

1.4 Flooding Affects Everyone

Chances of Flooding

If we just keep doing the flood protection work we have been doing, there is a significant chance that sections of the existing Hutt River flood defences will fail during the next 100 years. The likelihood that a 1 in 100-year flood with the potential to breach the existing defences will occur during this period is 63 percent – a two in three chance. If that happens, then widespread flooding of the urban areas, resulting from breached stopbanks, will almost certainly occur.

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Technical investigations undertaken as part of the Plan's development have established this.

Table 1: Hutt River Historical Floods

Date	Flood Effects in the Past
1855	The river rose 600 mm higher than had ever been seen before and completely destroyed the third Hutt bridge, already damaged by the 1855 earthquake.
1858	This was the most disastrous flood European settlers had experienced (2000 cumecs). The river burst its banks and flowed across the floodplain into Black Creek and the Waiwhetu Stream. Nine lives were lost in Taita, the Hutt Valley road was deeply gouged, and the new Hutt bridge was damaged.
1878	Two large floods swept the valley, with water covering the entire floodplain. The river overflowed considerably at Boulcott into Black Creek.
1893	A large flood (1500 cumecs) inundated Petone properties, some to over a metre. A second flood (1700 cumecs) also covered most of Petone. As a result the Petone stopbank was built in 1894.
1898	The largest flood on record (2000 cumecs) covered the valley floor. Floodwaters were knee deep in Lower Hutt township and came within 225 mm of the deck of the Hutt bridge. A second flood (1500 cumecs) almost filled the valley again.
1931	The largest flood since the inception of the Scheme structural works in 1901 (1400 cumecs) carried vast quantities of gravel down the river. The flood severely tested the Scheme works, and severe erosion occurred next to the Daly Street stopbank, threatening Lower Hutt. The river rose 5.2 m to within 600 mm of the stopbank crest at Moera. At Silverstream, banks burst and flooded a large area. The Manor Park Bridge and the Haywards suspension bridge were swept away. Extensive gravel deposits and berm erosion occurred at Manor Park, and part of the Taita Gorge road was washed out.
1939	This flood (1600 cumecs) caused floodwaters to cover unprotected areas north of Boulcott. At Silverstream the entire flat became a vast stretch of water. In the protected lower valley water came to within 150 mm of the floodwall crest at Ewen Bridge, and to within 600 mm of the stopbank crest between Ewen and the river mouth.
1976	Heavy rainfall over the floodplain caused all the major streams to flood. A small flood occurred in the Hutt River, closing the floodgates and blocking the outlets of the urban drainage systems. Widespread surface flooding occurred throughout the valley.
1998	Two floods within a week of each other (1305 cumecs and 1540 cumecs) caused extensive bank-edge damage. However, overall the flood protection system coped very well considering the size of the second flood. No breaches occurred. Most damage was sustained at known trouble spots. There was extensive erosion at Block Road, Avalon, Owen Street, Nash Street, Mary Hughes Grove, and Manor Park Golf Course. Low-lying houses were flooded in Hathaway Avenue. The stopbank at Ariki Street was sandbagged when floodwaters began seeping through the base. The Upper Hutt City Council service bridge at Akatarawa was destroyed.
2000	As in 1998, two floods occurred within a week of each other (largest 1245 cumecs). Once again the system coped, with bank edges experiencing light to moderate erosion damage. Sites downstream from Maoribank corner and next to Mary Hughes Grove experienced the worst damage.

The above table uses a number of terms to discuss the history of flooding in the Hutt Valley. These terms, and many like it, are discussed in the Glossary.

1.5 Impacts on the Community

A large flood in the Hutt floodplain would have wide-ranging social and psychological impacts on the Hutt Valley community. There will be physical damage and disruption to homes, schools, workplaces, community facilities (such as public halls and clubrooms), essential services (including hospitals) and emergency services.

A particularly large flood affecting an under-prepared community may cause injury or even death. Utilities such as electricity, water supply and telecommunications could be put out of action for days. Escalating damages to property will heighten the degree of social disruption, stress, and trauma.

The financial cost from such a flood could exceed one billion dollars. Damage to buildings and roads could take many months to repair, crippling the day-to-day functioning of the Hutt Valley community. Recovery from a large flood is likely to be slow. The associated disruption would have an enormous impact on the regional economy, and may affect the national economy as well.

Social and psychological impacts (intangible damages) are likely to cost individuals and the community at least as much again as the physical or tangible damages.

Do you want to know more?

Ref?: Social Impacts???: HRFMP Phase 1 Report. Wellington Regional Council, 199??

Ref?: Living with the River, Hutt River Floodplain Management Plan: Phase 1 Summary Report. Wellington Regional Council, 1996.

1.6 Predicting the Extent of Flooding

The character and extent of large floods can be difficult to understand until they actually happen. However, the Regional Council has put considerable effort into developing scenarios to predict the consequences of flooding.

The figures on pages 8 to 11 are known as flood extent maps. They show the potential extent of floodwaters in the Hutt Valley for a 2300 cumec flood, both with and without the structural works proposed under the Plan. The first figure shows flooding with breaching of the upgraded flood defences. Breaches have been simulated for every kilometre of stopbank length to illustrate the maximum potential extent of flood-prone areas. The second figure shows flooding with no breaching, reflecting the ultimate desired performance of the completed works.

In any one flood it is unlikely that all the stopbank breaches shown would occur, or that the overall extent of flooding would be as great as that shown on the flood maps. The flood for this scenario is assumed to last little more than a day.² The term *breaching* includes overtopping of stopbanks, which is more likely in places where parts of stopbanks are lower than adjoining stopbanks. (This term and many like it are defined in the Glossary.)

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The scenario contains approximations in order to simplify the analysis, but overall fairly represents the types of floods that have been recorded in the past.

Figure 2

Figure 3

Figure 4

Figure 5

1.7 Flood Hazard Effects

What are They?

Flood hazard effects³ are the undesirable results of flooding. In the river corridor fast-flowing waters can erode land from the river's edge and berms, damage stopbanks and other flood protection structures, and deposit sizeable debris (including trees and building material) and sand and gravel from the riverbed.

In developed floodplain areas flood waters are highly dangerous. Fast flows can sweep people off their feet, move vehicles and substantially damage homes and other buildings. Deeper, slow-moving waters or ponding can be equally as dangerous to floodplain occupants.

How they can be Worsened

Flood hazard effects can be worsened by human activities, such as placing structures and buildings inappropriately, or using land poorly. These worsened effects include:

- diverting, blocking or displacing flood flows into other areas
- introducing debris to flood flows, potentially damming waters or damaging structures downstream
- increasing erosion in, and sediment supply from, the upper catchment
- increasing peak flows in floods, thereby increasing flood impacts
- increasing flood levels, which compromise the flood defence system's effectiveness.

What the Human Activities can Cause

For the Hutt River, undesirable land-use activities can cause:

- a cumulative flood hazard effect from many small activities
- effects which may happen infrequently but produce a high potential impact, such as severe stopbank damage.

Cumulative effects are effects that can add to potential impacts caused by other land uses. For example, constructing more small buildings in the river corridor can provide additional sources of debris, and debris carried by flood waters can significantly damage stopbanks and bridges.

³ The meaning of the term *effect* is defined in Section 3 of the Resource Management Act 1991.

Floodplain Management Planning - It Makes Sense

What it Tries to Achieve

Floodplain management planning is an internationally recognised approach and process that provides a comprehensive long-term strategy for managing flood hazard. It aims to achieve sustainable development in-flood prone areas without imposing unacceptable limitations or costs on future generations.

Floodplain management planning emphasises a balance between keeping people away from floodwaters and keeping floodwaters away from people. It recognises *residual risk*: the idea that flood defences can fail, leaving an additional or 'left over' risk for floodprone communities to manage. It also emphasises communities better preparing themselves to cope with floods.

A Changing Approach

Over the last 1,520 years, floodplain management around the world has moved away from a full reliance on engineering structures to prevent flooding. In its place, a modified approach encourages catchment-wide solutions. The principal goal is to avoid building costly flood defences (structural measures), while encouraging stronger emergency management and more appropriate land use (non-structural measures). Behind this modified approach is a recognition that:

- structural defences can fail in large floods
- new development should avoid flood-prone areas
- communities need to be better prepared to cope with flooding.

The balance between structural and non-structural measures will be influenced by practical considerations, such as:

- how developed the floodplain is
- whether the river's natural pathway has been confined.

As a rule of thumb – the greater and more valued the development, the higher the community's expectation will be to protect it using flood defences.

Embracing Modern Ways

The modern approach requires widespread appreciation of flooding risks, and community understanding of options available to manage those risks. New development is strongly discouraged in flood-prone areas, particularly where flood defences are limited. Instead, uses not adversely affected by flooding are encouraged for these areas, including passive recreation, habitat rehabilitation and other less intensive land uses.

For existing development in flood-prone areas, wide-ranging measures are encouraged that raise flood awareness and preparedness, and thereby reduce flood damage, trauma and stress associated with flooding to acceptable levels.

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1.8 Preparing a Floodplain Management Plan for the Hutt Valley

As we have seen, flooding from the Hutt River is a major environmental management issue facing every resident of the Hutt Valley. The Hutt River Floodplain Management Plan (the Plan) provides a comprehensive strategic approach to managing the Hutt Valley's flood hazard problems over the next 40 years.

Preparing this Plan has involved the combined efforts of the Hutt and Upper Hutt City Councils, the Regional Council and tangata whenua, with input from other public agencies, local business, community groups and the general public. These efforts

have played a major role in determining the appropriate mix of measures for the Plan. At the same time, the process to develop flood management measures has updated our collective understanding of the flood hazard.

This Plan must adapt to the:

- changing social and economic needs of successive generations living in the Hutt Valley
- collective understanding of flooding and its impacts
- relationship between flood mitigation measures, us and our environment.

Thus the Plan is a living document and will be formally reviewed every 10 years. It culminates four planning phases involving technical investigations, evaluating options, and selecting measures. These are described in Figure 6.

1.9 Measures to Reduce Flooding Risk

There are many ways to reduce flooding risks. Some are more viable than others, depending on the community's vulnerability to flooding, the extent of existing development, and available funding. This Plan uses two types of risk reduction methods: structural measures and non-structural measures.

Structural measures involve constructing physical works designed to contain floods and limit erosion from the river. These are the more traditional tools for reducing flood risk. Until recently, the Hutt Valley relied heavily on building structural flood defences – such as stopbanks, rock linings and vegetation buffers – to reduce flood risks.

Non-structural measures include land-use planning regulatory methods, voluntary actions, and steps that floodplain residents, groups, businesses, and utility and emergency services can take to prepare for floods. These measures aim to keep people, possessions and development out of floodwater – or better still, away from flood-prone areas. They also improve the community's ability to respond to and recover from floods. Non-structural measures enable a community to be more resilient to flooding through flood awareness, preparation and sensible land use.

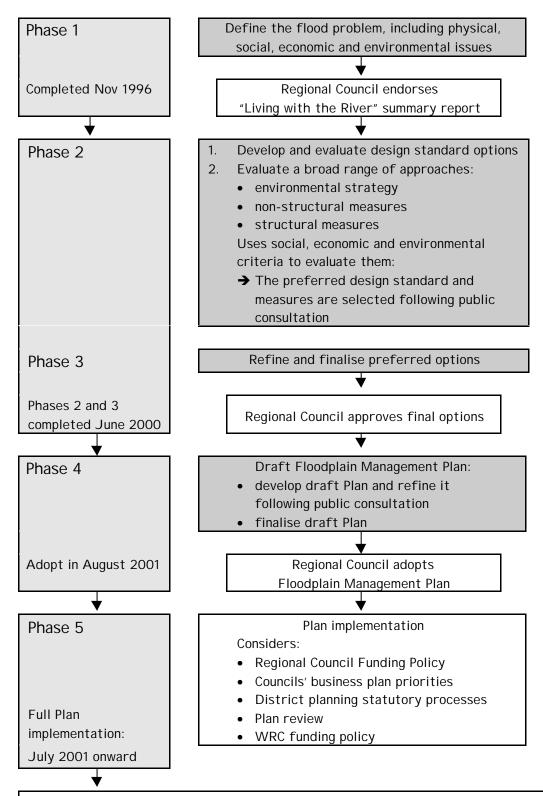
Structural and non-structural measures are equally important management approaches. This Plan uses both in an integrated way to reduce flood hazard effects.

1.10 The Regional Council's Floodplain Management Approach

Floodplain Management Planning Phases

Formulating and implementing this Plan follows five phases, described in Figure 6. The approach illustrated was adopted by the Regional Council to ensure that a viable, economically acceptable, socially appropriate, and balanced set of measures was adopted to manage flood risks on the Hutt River floodplain.

Figure 6: Regional Council Floodplain Management Planning Approach



Each step involves public and Hutt River Floodplain Advisory Committee participation in preparing the recommendations submitted for Council approval.

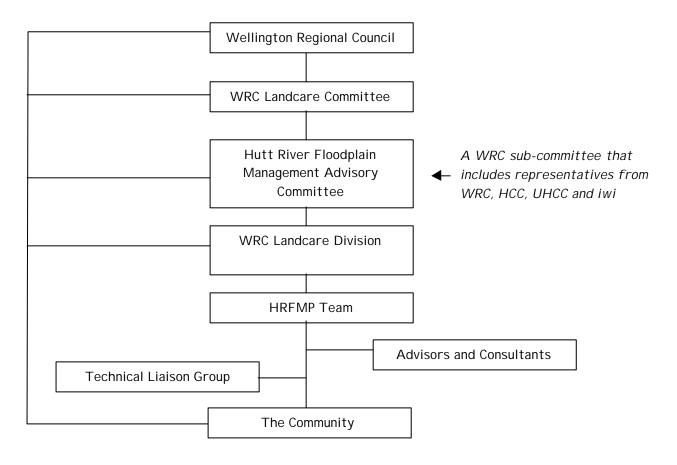
Decision-making Under this Plan

Who made the decisions in all of this? Obviously there needed to be input from a variety of sources, and this input needed to be co-ordinated. The best way to do this was to create a decision-making framework, which provided the process to:

- select acceptable flood mitigation measures
- develop an Environmental Strategy
- form a management plan for implementing measures and the strategy.

This framework also defines who is responsible for preparing, evaluating and deciding on measures to reduce flood risks.

Figure 7: The Decision-Making Framework



Decision-making Roles

Community: provides information and feedback to the Flood Protection Group and the Advisory Committee during consultation rounds.

Hutt River Floodplain Management Advisory Committee: a Regional Council sub-committee that receives advice from the Landcare Division, and recommends flood hazard management decisions to the Landcare Committee.

Regional Council: the full Council receives recommendations on major issues (such as funding, and long-term programmes, and the Plan) from the Landcare Committee, and then makes final decisions on them.

1.11 Determining Issues and Developing Plan Objectives

The Plan Objectives describe the main results and outcomes that this Plan needs to achieve.

Key Floodplain Management Planning Issues

A variety of issues were raised during public consultation on the Phase One investigations in 1996. Further input by the Technical Liaison Group⁴ enabled a broad issues list to be assembled, including:

- minimising risks to life, health, safety and property
- providing clear advice about the flooding risk and the responsibilities for managing that risk
- maintaining and upgrading existing flood defences, and building new ones, to reduce flood risk to an acceptable and affordable level
- reinforcing non-structural measures to manage the residual, or flood risk *left* over after structural measures
- balancing reduced flood damages, community disruption and trauma, with the costs of flood mitigation measures
- considering timeframes for implementing improvements
- protecting the river's ecology from the adverse effects of river management activities
- recognising the river environment as an environmental asset, and actively maintaining and enhancing this environment
- providing for further assessment of small stream and stormwater flooding
- providing for tangata whenua to exercise kaitiakitanga
- providing adequate opportunities for the public and affected parties to evaluate options and influence decisions made
- facilitating a partnership between the three participating councils in developing the Plan.

Developing Plan Objectives

The key issues above provided the basis for developing the Plan's objectives. These define the Plan's scope, decision-making requirements and processes, floodplain management outcomes (what we hope to achieve), and ongoing community involvement. The objectives have been agreed by the Hutt River Floodplain Management Advisory Committee after consultation with the three councils and the public.

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The Technical Liaison Group consists of planning, emergency management and operations staff from the three councils, and representatives from utility service providers.

The Plan's Objectives

Improving Floodplain Management

 Selected floodplain management measures constructed or established to an agreed standard are in place within the life of the Hutt River Floodplain Management Plan.

- Solutions for floodplain management that balance benefits and costs to the community are put in place.
- The selected measures account for a level of residual risk, which is acknowledged and accepted by the community.
- The mitigation of the current flood risk from floodplain tributaries is recognised and provided for by the appropriate authorities.
- A long-term programme is provided for achieving the outcomes of the floodplain management plan process in a manner generally acceptable to all stakeholders.

Involving the Community

- Clear advice and accurate information about responsibilities and risks of flooding are provided to the community.
- Sufficient information on the flood hazard is provided to enable agencies and the wider community to improve preparedness of their response to flooding and its adverse effects.
- There is no reduction in the quality of public access to and along the river and opportunities are taken to enhance public access.

Providing for Cultural Values

• The exercise of kaitiakitanga by tangata whenua is recognised and provided for.

Enhancing Environmental Values

 An Environmental Strategy that identifies measures necessary to maintain and enhance the environmental quality of the river and its corridor is an essential component of the Plan.

Incorporating Governance

- A partnership approach between Wellington Regional Council, Hutt City Council and Upper Hutt City Council is facilitated to manage the flood hazard through the annual plan and statutory planning processes.
- The active involvement of stakeholders is recognised and provided for in the decision-making processes.
- All interested and affected parties generally support the objectives of the Floodplain Management Plan.

Do you want to know more?

Ref?: Drafting of Objectives: Hutt River Floodplain Management Plan

Ref?: Living with the River, Hutt River Floodplain Management Plan: Phase 1

Summary Report

Ref: ? Living with the River Newsletter, May 1999 - I ssue No. 2

1.12 The Mandate for Floodplain Management Planning

We have already outlined the decision-making framework, which tells you who will be involved in making the decisions about floodplain management. But if they are to be acted upon these decisions need to be in line with national, regional and local legislation, regulations and policy, and they also ought to take heed of international best practice in floodplain management.

Having the authority to undertake floodplain management planning is called the legal mandate. Two pieces of legislation, the Resource Management Act 1991 and the Soil Conservation and Rivers Control Act 1941, provide the legal mandate to produce and implement floodplain management plans. We take a brief look at these Acts below.

Taken together, the legislation, regulations and policy form a policy framework within which the decision-making must occur. Figure 8 summarises this framework and gives an overview of the various "tools" involved in implementing the Plan's outcomes.

1.13 Resource Management Act: Setting Flood Management Policy

Regional Policy Statement - sets regional approach

As part of its responsibilities under the Resource Management Act 1991, the Regional Council has prepared a Regional Policy Statement. This provides an overview of resource management issues, and sets objectives, policies and methods for managing natural and physical resources. It states that the Regional Council is responsible for producing floodplain management plans, and for setting policies to manage the flooding hazard. It also assigns responsibility to the district and city councils to produce methods for managing the effects of natural hazards.

Regional and District Plans - provide policy and methods

The Regional Council and the Upper Hutt and Hutt City Councils also prepare finer-scale regional and district plans. These plans help the councils to carry out their resource management functions, including managing natural hazards and their associated effects. Objectives, policies and methods to manage flood hazards are developed to deal with the full range of floodplain management planning issues. They also provide the basis for developing non-structural land use measures.

Soil Conservation and Rivers Control Act 1941 - doing flood protection works

The Soil Conservation and Rivers Control Act gives the Regional Council the mandate to protect communities from flooding using the most appropriate methods.⁵ This law also provides the Regional Council with the authority to undertake physical works (including structural measures) to mitigate erosion damage and protect property from flooding. This means that it is up to the Regional Council and the local community to determine those rivers requiring most attention and the nature of the works required. In the Wellington region, only rivers and larger streams are managed by the Regional Council. City and district councils handle smaller urban streams and stormwater channels.

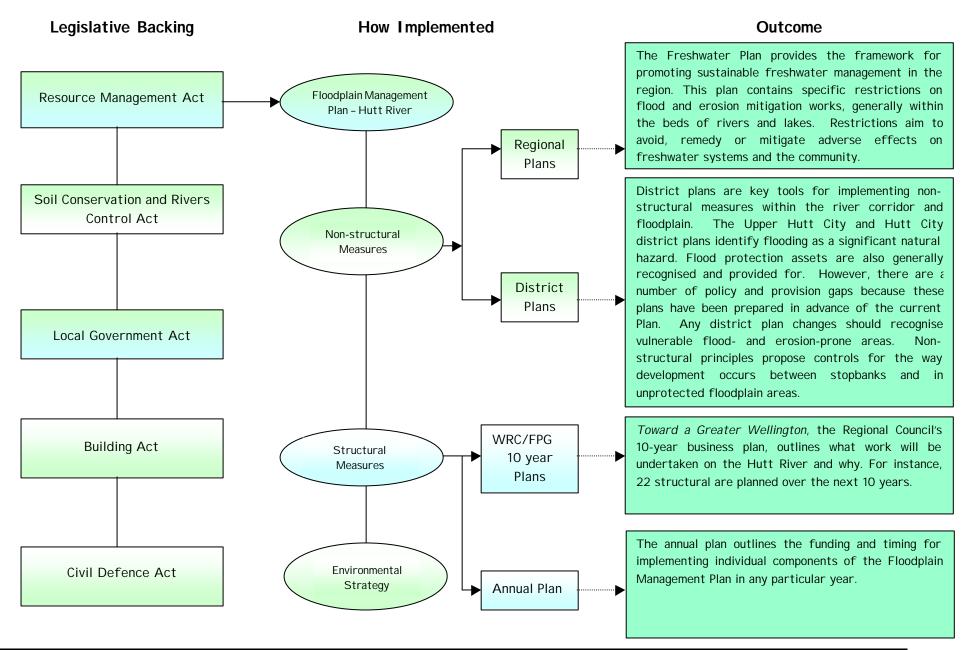
Go to Appendix 2 for more information about regulatory responsibilities.

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⁵ This Act's mandate allowing regional authorities to carry out floodplain management planning or strategies has been largely superseded by the Resource Management Act 1991.

POST HEARING DRAFT July 2001

Figure 8 : Policy Framework



Chapter Two

Nga Tikanga Maori

Tangata Whenua Aspirations for the River

Te Taiao

"In Maori tradition, all elements of the natural world are related through whakapapa (genealogy). The Maori world was created through the union of Ranginui (the sky father) and Papatuanuku (the earth mother). In the beginning, these "primal" parents lay clasped together, and bore many sons. The first son, Tane, grew tired of living in the dark cramped space between his parents. With his feet placed against Rangi and his hands placed against Papa, he forced them apart, creating the space between earth and sky. He and his brothers, including Tangaroa, Tawhirimatea, Tumatauenga, Haumia and Rongo then escaped into Te Ao Marama (the world of light).

Following the separation of their parents, the brothers began to fight for dominance. Tangaroa became the god of the sea. Tawhirimatea decided to remain with his parents and punished his brothers by creating the wind. Tumatauenga became the god of war and Haumia and Rongo became the gods of wild and cultivated foods.

Tane set about creating his own dominion in the form of trees, birds, insects and other living things. He then sought to create human life, and succeeded by combining elements of both Rangi and Papa. He fashioned a female figure from earth, and breathed life – mauri – into her nostrils.

This view of creation embodies both the spiritual and physical elements of the created world: the earth representing those beings that are transitory, and the sky the realm of the undying.

Traditional Maori attitudes to the natural world reflect the relationships created through Rangi and Papa: all living things are their descendants and are thus related. Further, the sense of inter-relatedness between people and nature creates a sense of belonging to nature, rather than being ascendant to it as humans are born from "mother earth" and return to her on their death. In the traditional Maori view, everything in the natural world possesses mauri (the physical life force) which is protected by a Kaitiaki (spiritual guardian) or atua (deity). Humans possess mauri-ora, which is of a higher order than mauri but confers of humans a certain responsibility towards other living things. Preservation of the mauri of any element of the natural world is essential for its survival.

In Maori tradition, human action with respect to natural resources is regulated through the concepts of tapu and rahui. The modern translation of tapu as "sacred" fails to capture the full essence of tapu. Tapu implies a prohibition which, if violated, would have calamitous consequences, quite possibly death. Rahui is a temporary form of prohibition used to preserve birds, fish or any natural product. In many instances the rahui is indicated by a pou rahui, or post, which warns people against trespassing into the area of the rahui. A person's tapu can increase when they die. Rahui is used therefore when a person is drowned in a river. Even if their body is recovered immediately, gathering of fish is prohibited for a period sufficient for the remains of the person to be absent from the food chain. The system recognises the need to balance human need with the survival of a species or resource (the protection of its mauri).

The authority, or mana, to exercise these rules is delegated by the atua to chosen representatives through whakapapa (for example, to members of senior families). These representatives are rangatira (chiefs). Mana is reinforced by the people, providing the rangatira can fulfil their responsibilities. Rangatiratanga is the process of exercising mana."

(Natural Resources Unit of Manatu Maori, Maori Values and Environmental Management, 1991)

2.1 Introduction

This chapter describes Maori values and aspirations for the Hutt River and its environment. The discussion builds on the work undertaken with iwi during the development of the Hutt River Environmental Strategy, itself a key component of the Hutt River Floodplain Management Plan. Significant sites are identified in this chapter, as are iwi aspirations for the river. Policy outcomes and methods for achieving iwi aspirations for the Plan are also identified.

2.2 Ahi Kaa Roa

Te Ati Awa / Taranaki ki Te Upoko Te Ika Maui hold manawhenua over the Hutt River and Te Whanganui a Tara (Wellington harbour). Tangata whenua are those who whakapapa to the original owners of the New Zealand Company (Wellington) Tenths and to hapu lands in the Port Nicholsons purchase block awarded by W.A. McCleverty in 1847 to residents of the several Pa and Kainga of Te Atiawa / Taranaki nui tonu. These original Tenths owners and hapu awardees belonged to Ngati Tawhirikura, Ngati Waiponga, Ngati Te Whiti, Ngati Hamua / Te Matehou, Ngati Puhoromanga, Ngati Tama, Ngati Mutunga, Ngati Tupaia and Ngati Haumia.

Tangata Whenua are today represented by the Wellington Tenths Trust. Te Runanganui O Taranaki Whanui Ki Te Upoko O Te Ika Maui is another representative organisation. There are three remaining tangata whenua marae: Te Tatau O Te Po, located at 437 Hutt Road, Lower Hutt; Pipitea at Thorndon Quay, Wellington; and Waiwhetu at Riverside Drive, Lower Hutt.

Tangata whenua believe that all the elements of the natural world are related and accordingly, the Hutt River cannot be separated from other parts of the environment. For tangata whenua, the mountains, the forests, the harbour, and the people are key components to consider in managing the Hutt River. Hutt River management should recognise this holistic view of the environment.

Kaitiakitanga is an essential part of tangata whenua's relationship with the environment. Central to kaitiakitanga is the understanding that successive generations have a responsibility to protect and nurture the mauri of their natural environment. The nature and form of kaitiakitanga is determined by tangata whenua and can change from area to area. Consequently, involving tangata whenua in activities affecting the Hutt River and its environment is essential, and ensures that Maori aspirations are catered for and met. Tangata whenua maintain their right to take and manage resources from the river, and still fish from the banks and mouth of the river. This right is an essential component of kaitiakitanga.

Manawhenua is the customary authority exercised by an iwi or hapu in an identified area. See the Glossary for the definition of other terms or concepts highlighted in this chapter.

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2.3 Tangata Whenua and the River

The Hutt River is a taonga and is tapu to tangata whenua. Important associations between tangata whenua and the river with tupuna (ancestors), mahinga kai (food), and mana are found in the past settlements, gardens, existing marae and urupa along the river. These areas have special significance for tangata whenua.

Known today as the Hutt River or Heretaunga, the river was formerly known as Te Awa Kairangi "the river of greatest value, or the highly esteemed river", dating back to Ngai Tara settlement. The river was also known as Te Wai-o-Rotu, a name attributed to Ngati Mamoe who lived in the Wellington area for a time. It is said that Ranginui, who was from Heretaunga (Hawkes Bay), changed the name from Te Awa Kairangi to Heretaunga when he arrived in the area in memory of where he had come from.

The river provided both transport and sustenance for Maori. Freshwater fish such as kahawai, piharau, mullet, flounder, eels, and whitebait were found in the river, as well as koura (freshwater crayfish) and watercress. Sites along the river provided paru (a type of mud) for dyeing. The river also provided access to plants and birds found in the inland-forested areas.

Forest clearance caused the river to silt up and the 1855 earthquake altered the riverbed, restricting transport in the river. Today, changes caused by European settlement have had a significant impact on the traditional uses of natural resources in the area. Silting up of the river and pollution has further severely limited contemporary use. While in many cases the river can no longer be used in a traditional manner, it is regularly used in summer by one or more waka, and for fishing.

Waahi Tapu Sites²

In pre-European times, the whole of the Hutt River was important economically and spiritually to Maori. A combination of natural processes, and commercial and private development, has destroyed many important sites near the Hutt River. This does not lessen their importance. The river itself is important to tangata whenua because of the associations that it has with their tupuna. There are a number of places that have special significance to tangata whenua today.

Important areas include washi tapu; the literal translation of washi tapu is "tapu place" or "sacred place". Places can be tapu for different reasons. Some places, such as urupa, are extremely tapu and may not to be openly talked about. Tapu remains even if a place is forgotten and may be rekindled by the discoveries important to tangata whenua. Therefore, activities such as reclamation, earthworks or river works may result in a threat to, or the finding of, washi tapu. The significance of a rediscovered site can rekindle the kaitiaki responsibility of tangata whenua.

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² The tables in this section are taken from information contained in Adkin G L, 1959, *The Great Harbour of Tara – Traditional Maori Place Names and Sites of Wellington Harbour and Environment*, Wellington, Whitcombe and Tombs.

There are two urupa that are still used on the floodplain. Although there are other urupa still known to tangata whenua, they are no longer used. At the Pito One site, the cemetery of the Te Puni family and his hapu, on the eastern side of Te Puni Street (in Petone), contains tombstones sacred to the memory of Honiana Te Puni, paramount chief to Te Ati Awa. The other urupa is at Owhiti at the mouth of the Waiwhetu stream.

Other significant sites are identified in the following tables.

Table 2 : Significant Places

Place	Further Information
Pareraho Hills	The hills about Belmont on the western side of the Hutt Valley
Te Pokai Mangumangu (boundary mark)	A reference point on the tribal boundary line of Te Ati Awa lands of the Wellington area. On arrival of the Europeans, Te Wharepouri included Te Rimurapa (Sinclair Head), Te Pokai Mangumangu, the Rimutaka Range and Turakirae. Te Wharepouri died at his principal pa at Nga Uranga, but was buried near Pito-one.
Uke Tirotiro (peak)	A peak of the Maungaraki range, located by the trig station called Maori Point. The name indicates a Maori lookout point, meaning "hilltop commanding a wide view".

Table 3 : Pa Sites

Pa Site	Further Information
Hikoikoi pa	A stockaded Ngati Awa village at the mouth of the Hutt River, western side. Puwhakaawe was the chief of this pa.
Maori pa	Name unknown, this pa site is located by the Hutt River in Taita, on the landward side of Taita Drive.
Maraenuka pa	A temporary pa built in 1841 and burned down in 1846, on the left bank of the Hutt river at the present site of the Lower Hutt sub station, off Connelly Street. Te Kaeaea or Taringa-kuri was the chief.
Motutara pa	East side of Hutt river opposite the former Belmont railway station.
Ohiti pa Pito-one pa	At the mouth of the Waiwhetu – the urupa at this site is still used. Stockaded pa of Te Ati Awa, situated about Te Puni Street, Pito-
Рио-опе ра	one. The chief, Honiana Te Puni lived at Pito-one and was the ariki or paramount chief of the Ati Awa people in occupation of the Wellington Harbour lands at the time of the arrival of the European settlers. Pito-one was a Ngati Ira name and it was these people that founded a pa there, at the western end of the sand beach before the incoming and victorious Te Ati Awa occupied the position. After the arrival of the European settlers, the Maori occupants of Pito-one re-erected their village a little distance inland at a position on the Te Tuara-whati-o-Te Mana stream.
Te Mako	A place at Te Taitai (or Taita) where Wi Tako Ngatata lived. The exact site was near the present Naenae railway station. The Te Ati Awa chief selected the old site, Wiremu Tako Ngatata for the erection of his first house built in European style and he lived there until the 1855 earthquake. The original pataka 'Nukutewhatewha' that Wi Tako Ngatata had built is currently located at the Dowse Museum.
Ngutuihe pa	On the end of a projecting spur of Puke-atua ridge below the existing Wainui–o-Mata road. Believed to have been a Ngati Ira pa – the name describing the beak of the garfish.
Urupa	The cemetery of the Te Puni family, on the eastern side of Te Puni street, Pito-one. It contains tombstones sacred to the memory of Honiana Te Puni and some of his descendants. Te Kaeaea or Taringa Kuri, the chief of Ngati Tama in the Wellington region at the time was buried in this cemetery but his grave is not marked.
Waiwhetu pa	A Te Ati Awa pa on a sandy spit projecting into the estuary by the Waiwhetu River. Occupied at the time Europeans arrived in 1840.
Puharakeketapu	Battle site on and close to the left bank of the Waiwhetu. Fight took place between allied tribes of Ngai Tahu and Ngati Kahungunu just before 1600AD when Ngai Tahu migrated to the South Island.
Paetutu kainga	A Te Ati Awa kainga on west bank near the Pipe Bridge. Originally it was built as a fortified pa site on an island in an area of swamp. Later on it became an open village on firm ground on the right bank nearly opposite Lever Rexona.
Te Ahi-o- Manono kainga	A former village near where British soldiers built Fort Redwood in 1854. It was located where Lower Hutt currently stands, immediately at the rear of the post office.
Hau-karetu	A Te Ati Awa village – exact location unknown. The old kainga was probably located on the high terrace on the east side of the river, although it (or its cultivations) could have been on the low alluvial flats on the west.
Pa Whakataka	A Ngati Ira village – the exact location is unknown, but situated somewhere near the confluence of the Mangaroa and Heretaunga streams.

2.4 Partnership

The Treaty of Waitangi signifies a partnership between the Crown and Maori. The Courts have interpreted the principles of the Treaty as meaning that each party should act in good faith, in a reasonable and fair manner, and have an understanding of, and a willingness to accommodate, each party's views.

A good relationship with Te Ati Awa / Taranaki ki te Upoko o te Ika a Maui is essential for identifying and providing for Maori interests and values in managing the Hutt River and its environment.

The Plan will take into account Treaty obligations and acknowledges that the Hutt River is a taonga to tangata whenua. Incorporating kaitiakitanga into the River's management is consistent with the Treaty of Waitangi and the sustainable management of the Hutt River.

The following sections outline the views of tangata whenua, the Regional Council and the methods to meet the aspirations of tangata whenua in the Plan.

2.5 Aspirations of Tangata Whenua

Tangata whenua believe that the management of the Hutt River should take into account the following suggestions. The first three aspirations below were identified in the process of developing the Hutt River Environmental Strategy with iwi.

- Discharging toxic and industrial wastes into the river should be stopped, allowing flora and fauna to regenerate and be conserved. Specifically, this should result in re-establishing watercress
- Re-establish swamps alongside the river to provide for flax and paru
- Propagate native forest and plant species alongside the river
- Provide adequate pest management strategies to protect native species

In addition, the Environmental Strategy identifies the following matters as important: Traditional uses of the river and its environment Maori history of the river

Tangata whenua consider re-establishing native flora and fauna, and swamp areas to be priorities. Many of the native species that once grew on the Hutt floodplain have cultural and historic significance. Some of these species are still present, but in low numbers. Opportunities exist to use species that are traditionally harvested, such as flax (*Phormium tenax*) and watercress (*Rorippa microphylla*). Increasing the number of species valued by tangata whenua is important in sustaining the traditional use and values of these species.

Several traditional activities and rights are currently restricted either because of the changed river environment or governance of the Hutt River. The Hutt River Floodplain Management Plan needs to accommodate any such uses by iwi and take into account traditional rights, for example, customary fishing rights and practices.

Hutt Valley history is not well known by many people. Significant cultural sites could be identified, if appropriate, with information boards describing their history. However, any interpretation of such sites requires expertise from tangata whenua regarding their cultural and historical values.

2.6 Policy Outcomes

This section, drawn from the Environmental Strategy, summarises the guidelines for ensuring the needs and aspirations of tangata whenua are met in managing the Hutt River and its environment.

The long-term vision for Maori values identified in the Environmental Strategy is:

Protecting and enhancing the cultural values of the river and its margins.

The vision is supported by the following guidelines:³

- Establish a mechanism for ongoing tangata whenua and community participation in the management of the Linear Park, ensuring tikanga is appropriately applied.*
- Support Te Ati Awa to review the management of all existing sites and areas of cultural significance and prepare an action plan for their future management and protection*
- Encourage tangata whenua to become involved in the interpretation of cultural values and sites, where appropriate.
- Protect sites and areas of cultural significance.
- Erect information boards at sites of cultural importance, where appropriate.
- Plant riparian margins and recreate wetland areas, where appropriate.
- Plant species of cultural importance, where appropriate.
- Allow for traditional uses of the river and its margins.

The symbol * represents those guidelines identified in the Hutt River Environmental Strategy as having urgent priority.

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2.7 Methods to Implement the Vision

To meet the aspirations of tangata whenua, methods are required to implement the long-term vision and guidelines. Three broad areas, summarising the issues important to tangata whenua, are used to address these matters. They are:

- Safeguarding significant sites
- Restoring native species
- Including tangata whenua in managing the Hutt River

A combination of the Hutt River Environmental Strategy, the Regional Policy Statement and the Regional Freshwater Plan is used as the basis for the following methods. All of these documents identify the relationship between tangata whenua and the river as an important consideration.

In addition, a joint project is proposed between Iwi and the Regional Council. This project would develop an implementation strategy to ensure the requirements of tangata whenua are met.

Safekeeping Significant Sites

The Regional Freshwater Plan identifies developing protocols for sites, and plan changes to register sites, as methods to protect sites and areas of significance to tangata whenua. Identifying significant sites in the Environmental Strategy and in this Plan may also serve to educate and alert the public, potentially decreasing further damage to those sites.

A more formal way of protecting washi tapu is to follow the heritage order process. A heritage order can be made to protect "any place of special interest, character, intrinsic or amenity value or visual appeal, or of special significance to tangata whenua" (section 189: RMA). A heritage order means that the special character of the place cannot be disturbed without the consent of the relevant heritage protection authority.

Restoring Native Species

The Hutt River Environmental Strategy identifies areas where the restoration of native species could occur. Although the Strategy is not directly funded, money is set aside from the Regional Council's operational and capital works budgets for planting native species along the river.

The possibility of recreating wetland areas is proposed in an area downstream of Totara Park. Several areas of native plantings are specifically identified. They include the river mouth and estuarine reaches of the river, as well as those areas upstream of Taita to Kaitoke Regional Park. Using ecological corridors as a way to further enhance the Hutt River and its environment underpins many of the proposals put forward in the Strategy for each reach of the Hutt River.

Using native species in plantings will increase the number of species culturally important to tangata whenua and better allow for traditional uses of the river. Increasing the native plants in an area will also enhance the habitat available for other native species, such as inanga (whitebait), kereru (wood pigeon), and tui, to recolonise an area naturally.

Including I wi

Involving iwi in the wider implementation of the Plan is crucial to meet the aspirations of iwi and fulfil the Regional Council's Treaty responsibilities. Iwi representatives are an integral part of the Hutt River Floodplain Advisory Committee, a steering committee that has had a critical role in developing both the Environment Strategy and the Floodplain Management Plan.

The Environmental Strategy identifies the need for a mechanism to involve tangata whenua and the community in decision-making, reviews and implementation of the Strategy. The Strategy proposes that an over-arching management committee of iwi representatives, officers and councillors from UHCC, HCC and WRC investigate options and establish the preferred management framework.

The following proposed implementation project further seeks to include iwi in the implementation, review and evaluation stages of the Hutt River Floodplain Management Plan.

2.8 Implementation Project

The details and timelines for implementing the methods discussed above have not yet been determined. It is proposed that an implementation project be developed between iwi and the Regional Council that seeks to:

- Identify current programmes involving the Hutt River and its environment, ensuring that an integrated approach to managing the river is adopted
- Determine the most appropriate mechanism for including iwi in the Plan's implementation, review and evaluation
- Develop appropriate protocols in future river management programmes, ensuring the needs of tangata whenua are met and aspirations addressed
- Develop a realistic timetable to achieve the methods
- Develop indicators to determine the success of the Environment Strategy and the Plan

The implementation project would be ongoing throughout the life of the Plan, commencing in September 2001.

Chapter Three

The Design Standard: Guiding the Outcomes

3.1 Introduction - This Chapter

When planning for flood protection we need to decide on the largest flood that our new and upgraded flood defences can safely contain. This is called the *design standard*, or design flood. The likelihood that the design flood will occur in any one year is called the *return period* (for example, a 1 percent or 100-year flood).

It gives us an indication of the maximum protection that our *structural* flood protection system can provide. Yet the design standard not only indicates the type and extent *structural measures*, it also influences the sorts of *non-structural measures* that might be appropriate.

Chapter 3 talks about the design standard for the Plan, and the considerations that went into selecting it. It also provides policies supporting the design standard and wider principles of floodplain management planning. In many ways this chapter sets the scene for chapters 4 to 6, which covers the structural and non-structural measures, and the environmental strategy.

3.2 The Design Standard for the Hutt River

Risk-based 2300 Standard Selected

The agreed design standard for the Hutt River is a *risk-based 2300 cumec standard*. The risk-based approach applies varying protection standards to the floodplain. This approach means that an appropriate protection level is provided to each of the Hutt River's distinctive flood-prone areas. In other words, it treats the risk and hazard in a particular area on its merits.

Its main features are:

- an emphasis on protecting existing urban floodplain areas
- upgrading all *major stopbanks*¹ to a 2800 cumec standard capacity (a rare flood), with remaining stopbank protection mostly to a 2300 standard (a 1 in 440-year flood)
- a varying flood standard for other stopbanks, and assistance for house raising.
- bank-edge and berm protecting between a 1900 cumec standard (a 1 in 100year flood) for isolated and small urban areas, and a 2300 standard for main areas
- replacing bridges at the end of their useful life, with new bridges and their associated floodways required to pass a 2800 cumec flood.
- developing appropriate risk-based non-structural measures for varying floodprone areas of the Hutt Valley to compliment the selected structural measures.

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Major stopbanks are those protecting the main urban areas of both cities.

The protection level eventually chosen for each flood-prone area mainly depended on:

- potential damage costs
- area and number of people affected
- an area's vulnerability to flooding and erosion.

3.3 Selecting the Design Standard

The Capacity of the Existing System

Following the review of the Hutt River flood protection system in the late 1940s to 1950, it was decided that new works were required to contain a maximum flood of 100,000 cusecs² (approximately 2800 cumecs). The stopbanks upstream of Kennedy-Good Bridge, except for a few reaches, are adequate to contain a 2800 cumec flow. However, the mix of bank-edge protection berms and stopbanks lack the combined strength necessary to hold such flows.

The lower reaches of the river downstream from Kennedy-Good Bridge have a much lower capacity and security. In fact, at the moment some sections of these stopbanks could breach during an event as low as a 50-year flood.

What Options were Considered

Adopting an overall design standard requires considering:

- how economic, environmental and social benefits balance against costs
- community willingness to pay
- environmental effects of undertaking physical works
- design constraints and uncertainties associated with higher design standards.

An additional yet vital consideration is that an upgraded flood protection system for any design option must be able to pass the design flood with acceptable security (that is, with a low chance of failure).

Several options were developed, investigated and considered:

	Cost ³
Option 1: maintain status quo	
Option 2: upgrade to 1900 cumec standard (100-year flood)	\$54M
Option 3: upgrade to 2300 cumec standard (440-year flood)	\$72.5M
Option 4: upgrade to 2800 cumec standard (rare flood)	\$85M

-

A cusec is one cubic foot of water passing a given point every second.

³ Costs are in 1999 \$.

Option 1 would mean maintaining the existing system without any upgrade but reinstating defences when damages occur.

Option 2 would mean upgrading the system to provide acceptable security in a 1900 cumec (or 100-year) flood.⁴ The 1900 cumec protection level is the minimum standard generally used for rivers in smaller and less developed floodplains throughout New Zealand.

Option 3 would mean upgrading the system to provide acceptable security in a 2300 cumec flood. This is also the design standard used for the Ewen Bridge construction.

Option 4 would mean upgrading the system to provide security in a rare flood, represented by the 2800 cumec flood.⁵ While rare, such a flood can occur in the Hutt River. This standard was also seriously considered because major stopbanks in the floodplain's upper reaches are already constructed to contain this flood.

To provide an upper benchmark, the estimated probable maximum flood for the Hutt River is 7000 cumecs. In theory this is the greatest flood that can occur in the Hutt River, yet in reality a return period in the many thousands of years means it is extremely rare.

Including non-structural measures

All four options presumed that non-structural measures land use and emergency management measures would form a major part of the overall approach to floodplain management planning in Hutt Valley.

Evaluating Design Standard Options

Design standard options were compared using a number of criteria, which included:

- capital costs of potential structural measures
- operational and maintenance costs over the design life of structural measures
- expected flood damage repair costs to the system over the design life
- saved flood damages on the floodplain
- environmental effects of structural works
- social effects (including benefits)
- economic efficiency.

The economic efficiency of the options was evaluated in the followings ways:

- saved flood damages minus the costs of measures (net present value)
- ratio of saved flood damages to the costs of works (benefit/cost)

The flows associated with each option are measured at Taita Gorge in the Hutt River.

The 2800 cumec flow is 1.5 times greater than the 100-year flood flow. This is a standard floodplain management planning approach to determine higher standard options for investigation.

Confirming the Risk-based Design Standard

The Hutt River Floodplain Management Advisory Committee considered detailed information on the four options, seeking public feedback during 1998 before agreeing on a design standard. The selected risk-based 2300 cumec standard combines all four options outlined above. The combination of options selected is the most cost-effective, except for those for Belmont and Bridge Road, Akatarawa.

Because structural and non-structural measures are interdependent, the risk-based approach also applies to developing non-structural measures.

What Options were Rejected

For the major floodplains the 1900 cumec option was rejected because:

- the likelihood of failure over a 100-year period is too high⁶
- ongoing recovery required from more frequent overtopping or breaching would not be practical
- damages and disruption from any failure are likely to be significant.

The 2800 cumec option, while providing substantial protection, is considered too costly to be applied throughout the valley. Similarly, the full 2300 cumec option was not as cost effective, which led to a risk-based standard being selected.⁷

The risk-based standard provides a mix of structural works that maximises community safety and cost-effectiveness. The construction of 2800 stopbanks rather than the lesser 2300 option provides a substantial increase in protection in response to:

- the potential impacts of climate change
- uncertainties about flood behaviour
- eliminating additional future environmental disruption by doing the work only once
- cost considerations.

The additional cost of the higher stopbanks is \$4M

At the other end of the scale, providing stopbank protection to small local areas like Belmont and Bridge Road is neither cost-effective, practical, nor desired by these communities. The full cost of the risk-based 2300 standard is expected to be \$78M.

A 63% chance of flooding with the current climate, and up to 87% under a 30-year climate change scenario. See the Glossary for a full description of the 1900 cumec flood.

See Report xx for more explanation about the standards selected.

3.4 Structural Measures Policy

This section covers the specific policies backing the design standard. The policy has been derived from the process used to develop measures, and the wider principles of floodplain management planning.

Structural Measure Policies - Quick Reference

Policy 1:	Ensuring Floodplain Management Planning Serves the Community
Policy 2:	Providing an Upgraded Flood Defence System
Policy 3:	Reinforcing Selected Design Standard and Individual Measures
Policy 4:	Maximising Community Benefit
Policy 5:	Using Non-structural Measures to Manage Residual Risk
Policy 6:	Structural Measures Not Targeting Greenfield Areas

Policy 1: Ensuring Floodplain Management Planning Serves the Community

I ssue

The Hutt River floodplain faces a substantial flooding hazard which directly affects 106,000 residents of the Hutt Valley, including all 75,000 floodplain occupants, and up to six billion dollars of public and private property. The risk of severe damage and social disruption from a large flood to the Hutt Valley community is significant, with major implications for the regional economy.

While the nature of the flooding problem may appear massive, the floodplain management planning process can significantly reduce the flood hazard effects and associated impacts. It can do this in a variety of ways, including:

- improving public understanding of the flooding hazard and ways people can prepare for flooding
- minimising risk to life, health and safety by implementing structural and nonstructural measures
- providing opportunities to enhance the river corridor environment in a coordinated and strategic way
- ensuring the community is involved in determining and implementing flood mitigation methods.

Policy

The Regional Council, Hutt and Upper Hutt City Councils will:

 ensure the community recognises that flooding is a natural process and cannot always be prevented or controlled

- ensure careful planning and consultation with the community takes place before implementing flood mitigation methods
- avoid or reduce adverse flooding effects through carefully managing and timing the implementation of flood mitigation methods, and minimising any resulting inconvenience to the community
- maintain community awareness of the flood hazard and provide people with opportunities to improve their preparedness, enabling them to cope better in a flood
- ensure that the community is given adequate warning of an impending flood
- provide opportunities to enhance the river environment through an environmental strategy.

Explanation

Implementing these policies will depend on each council's floodplain management planning responsibilities. Most policies presented above affect non-structural measures. Non-structural measures policy, discussed Chapter 4, helps clarify these responsibilities further.

Policy 2: Providing an Upgraded Flood Defence System

I ssue

In many Hutt Valley floodplain areas the state of existing flood defences means that significant flooding could be life-threatening. In other areas, the risks posed by large floods are not likely to be life-threatening.

Policy

The flood defence system will be upgraded to provide an appropriate protection level by minimising, as much as practicable, any significant threat to life. New stopbank defences are not necessary for areas where risks are not considered life-threatening. In those cases, the normal cycle of redevelopment will provide opportunities to flood-proof flood-prone areas at little cost to the wider community.

Explanation

A new or upgraded flood defence system must target communities at risk. Determining appropriate protection for any floodplain area requires, first and foremost, a risk-based assessment of the threat to life. In some floodplain areas, including undeveloped locations, the threat to life is minimal because significant flood impacts would be isolated to small floodplain areas, and emergency management procedures can be highly effective. In those unprotected areas, non-structural measures will be relied upon to improve safety and lessen potential flood damages. These measures, such as elevating floor levels and strengthening buildings, do not impose significant costs on the community.

Policy 3: Reinforcing the Selected Design Standard and Individual Measures

I ssue

Specific matters regarding flood risk, climate change, environmental and social impacts, and economics influenced selecting a risk-based design standard. These included:

- increasing safety and reducing further the potential damages, particularly for more populated areas
- recognising saved damage costs compared to the costs of measures
- recognising the holistic structural base of the Hutt Valley's existing flood protection system
- accounting for potential climate change scenarios that predict increased frequency of larger floods
- reducing repeated environmental impacts on larger urban areas due to any future increased design standard
- accepting relatively moderate additional costs of constructing higher stopbanks protecting larger urban areas.

The community's preference is the risk-based 2300 design standard as a minimum protection standard.

Policy

The Regional Council has endorsed the risk-based 2300 cumec design standard containing the following main features:

- major stopbanks protecting larger urban areas upgraded to the 2800 cumec standard
- 2300 cumec bank-edge protection to maintain the preferred river alignment and protect major stopbanks

• minor stopbanks protecting smaller urban areas (Manor Park, Totara Park and Whirinaki Crescent) upgraded to the 2300 standard, with associated bank-edge protection to the same standard; Gemstone Drive stopbanks will be upgraded to the 1900 standard, with the same standard of bank-edge protection

- 1900 cumec bank-edge protection and financial assistance for raising houses to the 1900 standard for smaller urban areas (Akatarawa and Belmont) where stopbanks are not present
- a 1900 cumec stopbank and bank-edge protection for Gemstone Drive
- new and replaced bridges and associated waterways to pass 2800 cumec flows.

Explanation

This policy reinforces the design standard's main features influenced by flood risk, climate change, environmental and social impact, and economic matters, and directed by the community's preference, political judgement and input.

Policy 4: Maximising Community Benefit

Lssue

Upgrading the flood defence system can impose considerable social, economic and environmental costs on the community. For all works, the overall community benefit provided by each group of proposed structural works must be considered.

Policy

A strong benefit to the community should be achieved for integrated structural works related to each river reach. At the same time, costs of constructing structural measures need to be affordable to the community.

Explanation

Community benefit can be measured in a number of ways. This Plan has included a range of factors to determine overall benefit and establish a construction priority order.

Calculating overall benefit is strongly weighted towards potential saved damages, the number of people affected, and the significance of the threat to life. Measuring benefit also includes environmental and social factors such as reduced longer-term impacts on the river. An economic benefit occurs when the saved damages over the design life of the structural measures exceed the costs of constructing and maintaining those works.

For selected measures community benefit has driven the prioritising of upgrade works, which is provided in Table 5 (Chapter 4).

Policy 5: Using Non-structural Measures to Manage Residual Risk

I ssue

A residual or 'left over' risk still exists, regardless of the protection level selected. Regular flooding world-wide reveals that structural measures alone do not adequately reduce flooding impacts.

Policy

Non-structural measures will be employed to help manage the residual risk and, in some cases, the full risk where no structural measures are proposed.

Explanation

Together with structural measures, non-structural measures provide for integrated flood hazard management. In this approach, the Plan recognises that a holistic and catchment-wide approach is needed to manage the flood hazard effectively.

Policy 6: Structural Measures Not Intended for Greenfield Areas

I ssue

New development in greenfield and rural areas can ultimately place pressure on the wider community to provide flood and erosion protection.

Policy

The structural measures forming the existing scheme, or additional works provided for under this Plan, will not be extended to protect new or greenfield development. Appropriate non-structural measures should be an integral part of new development.

Explanation

Structural works limit a river's natural processes by confining the river channel and potential flooded area, and they are highly costly to construct and maintain. While past development and channel realignment have created the current need for substantial structural measures, this Plan does not provide for new works to protect greenfield sites. Non-structural measures are generally a more suitable way to manage new development because they:

- avoid or limit exposure to the flood hazard
- impose costs on the developer and land owner rather than on the wider community.

3.5 About the Next Three Chapters

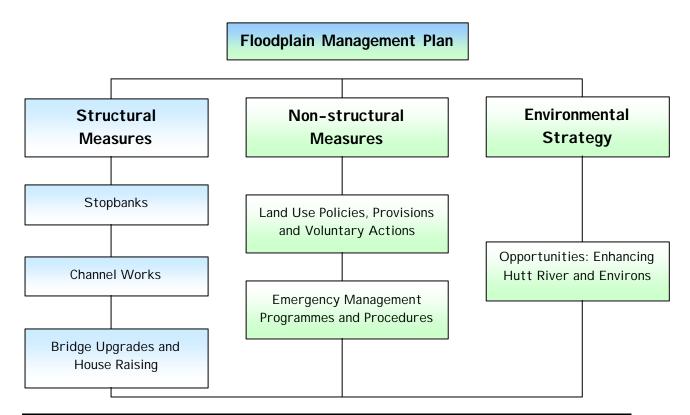
In this chapter we have talked about the design standard, which sets the framework for the sorts of flood mitigation measures and environmental responses to structural works that may be appropriate.

The full Plan outcomes described in the next three chapters (chapters 4 to 6) are a combination of structural and non-structural measures together with an environmental strategy, and they will be implemented over the next 40 years. Figure 9 summarises the types of measures covered by this Plan.

Policies backing the three sets of Plan outcomes for the Hutt River are also presented in each chapter. The policies emphasise critical elements of future floodplain management planning process, and the decisions and selected measures that came from it including:

- the processes used to select flood mitigation measures and the Environmental Strategy
- key aspects of the selected measures and the Strategy including general flood hazard and environmental requirements
- important aspects of operating practice
- the framework for implementing the Environmental Strategy
- city council, iwi and community involvement, decision-making and technical investigation processes, all essential for implementing the Plan
- city and regional council responsibilities
- key environmental and engineering requirements.

Figure 9 : Summary of Flood Mitigation Measures



Do you want to know more?

- Ref?: Evaluation of Existing Hutt River Flood Defences and Upgrade Concept Design
- Ref?: Living with the River, Hutt River Floodplain Management Plan: Phase 1 Summary Report
- Ref: ? Living with the River Newsletter, May 1999 Issue Nos 2–3: *The Design Standard*

Chapter Four

The Outcomes: Upgrading Structural Protection

4.1 Introduction - This Chapter

Structural measures are the physical flood protection measures and channel management methods required by the Plan as the first defence against flood hazard impacts. They are designed to keep flood waters away from existing development.

Stopbanks and floodwalls are typical examples of structural works, while bridge upgrades improve flood capacity and avoid debris dams, helping to preserve a secure flood defence system. Channel works include bank-edge works and channel management. Rock linings, vegetation buffers, and groynes are bank-edge works, which protect flood defences like stopbanks by maintaining the channel's position. Channel management methods are used on a regular basis to reduce the opportunity for the river to erode structural works. These methods include bed and beach recontouring and gravel extraction.

This chapter describes the selected structural flood mitigation measures for the Plan, and presents policies that support these measures.

4.2 Structural Measures

Structural measures are physical structures or works designed to protect people and assets from flooding up to a specified standard. For the Hutt River it is the risk-based 2300 cumec design standard, described in chapter three.

Specific Structural Measures

Major floodplain areas that could suffer significant flood damages will gain upgraded and new stopbanks to the 2800 cumec standard. These stopbanks will be protected by 2300 cumec standard river edge and berm protection. Major floodplain areas include all urban areas except for Totara Park, Manor Park, Heretaunga, Belmont and Akatarawa. Minor floodplain areas, or locations where development is sited close to the river's edge will gain either stopbank protection to 1900–2300 cumec standard, or assistance to raise houses to the 1900 cumec standard.

In summary, the specific measures for the different areas of the Hutt Valley include:

Lower Valley:

- Major stopbanks to the 2800 standard, with associated bank-edge protection to 2300
- Manor Park stopbank to the 2300 standard
- Belmont edge protection to the 1900 standard plus assistance for house raising to 1900.

Upper Valley:

- Major stopbank to the 2800 standard
- Whirinaki Crescent stopbank to the 2300 standard
- Bridge Road edge protection to the 1900 standard, plus assistance for house raising to 1900
- Gemstone Drive stopbank and edge protection to the 1900 standard, plus floodwall to 1900 or assistance for house raising to 1900
- Totara Park stopbank to the 2300 standard.

As structural works are completed over 40 years from 2001, local areas will be consulted further during the design and resource consent application stages. Ongoing consultation will ensure that an appropriate protection level is being provided.

A reach-by-reach description of the structural measures follows shortly ('Structural Measures by Reach'). The descriptions include reach plans, works detail, and the cost and timing of works. More information about the process that determined the design standard is provided in 'How the Structural Measures Were Decided', later in this chapter.

What process was used for developing structural measures?

Developing measures was carried out in the following way:

- 1. Estimate the flood characteristics and levels for the design flow considered
- 2. Identify deficiencies in the existing river alignment and stopbank system
- 3. Determine stable channel alignments and minimum berm widths
- 4. Develop bank edge-protection measures for the design flow considered
- 5. Identify sections of stopbanks where overtopping or breaching can occur
- 6. Develop solutions for raising, strengthening or reconstructing stopbanks where necessary.

Other methods for reducing flood flows and flood levels in the river were considered separately. They included constructing detention reservoirs in the upper catchment, and methods for reducing the flood levels on the floodplain in the event of a failure. However, these measures were not selected.

4.3 Programmed Works Until 2010

Structural works have been programmed until 2010 under the Regional Council's Long-term Financial Strategy. These works are shown in Table 4, and described in more detail in 'Structural Measures by Reach'.

Table 4: Programme for Structural Works until 2010

	Commences	Finishes
Ava to Ewen river realignment and stopbank upgrade	2000/01	2009/10
Ava Railway Crossing waterway improvements	2000/01	2007/08
Melling Bridge waterway study	2001/02	2001/02
Moonshine Bridge waterway study	2002/03	2002/03
Belmont edge-protection works	2002/03	2003/04
Belmont house-raising opportunities	2003/04	2006/07
Bridge Road house-raising opportunities	2003/04	2006/07
Bridge Road edge-protection works	2004/05	2004/05
Akatarawa Road flood defences / house-raising opportunities	2004/05	2004/05
Gemstone Drive stopbank upgrade	2004/05	2005/06
Whirinaki Crescent stopbank upgrade	2004/05	2005/06
Boulcott / Hutt stopbank upgrade	2006/07	Next LTFS
Lower Hutt City Centre stopbank upgrade	2008/09	Next LTFS

Preliminary design work and resource consent investigation will be completed immediately before all structural works begin. The locally affected community will be heavily involved in these investigations, providing feedback on design detail, associated environmental enhancements, or the resource consent application process. In some cases preliminary investigations could take well over a year prior to structural works commencing.

4.4 Structural Measures Priority Schedule

The Structural Measures Priority Schedule (Table 5) indicates the level of potential benefit to floodplain areas provided by the structural works, and provides a guide to the relative priority of works to be undertaken. This means works further down the priority schedule are more likely to be completed later in the 40-year programme of this Plan.

How soon the structural work in your area will be carried out was decided on the basis of a number of criteria (components), and these were ranked (weighted) on the basis of a number of simple indicators. The components used are:

- economic benefit
- existing protection level in each reach
- area and population affected
- social benefits
- environmental benefits.

The approach used to measure priority is simple, certain, and reasonably objective. The floodplain was divided into 13 *reaches* representing common works, rather than rating the 39 individual works. Ratings represent a comparison between today's situation and the potential benefits provided by the upgraded system for each reach area: the greater the benefits, the higher the score.

If you want more detail on this, Appendix 5 covers the method applied to develop the Structural Measures Priority Schedule, including the indicators and criteria used to measure the priority of works.

4.5 Modifying Works Priorities

The Long-term Financial Strategy (LTFS) process has modified the order of works up to 2010 by including works protecting smaller and relatively unprotected communities. The works affect urban areas vulnerable to more regular flooding and erosion from the river, including:

- Belmont
- Bridge Road
- Akatarawa Gemstone
- Whirinaki Crescent.

The LTFS occurs once every three years, and allows the Regional Council and the community to review funding and works priorities for the following ten years. The next LTFS will be in 2002.

The next section contains the order of works set out in the Structural Measures Priority Schedule, based on broad social, environmental and economic criteria.

Table 5 : STRUCTURAL MEASURES PRIORITY SCHEDULE

4.6 Structural Measures by Reach

Mouth Reach: Harbour Mouth to Estuary Bridge (XS 0003-0100)

This reach is characterised by its wide estuarine nature. The channel is bordered on the true left¹ by the Port Road reclamation, and on the true right by an estuary with boat moorings, the gravel extraction plant located on the sand spit, Hikoikoi Reserve and the Hikoikoi Pa site at the mouth of the Te Mome Stream.

Figure 10			

Proposed Measures

Priority	Description	Cost (\$m)	When
6	River mouth channel works (LB/RB)	3.65	Beyond 2010

51

The *true left* bank is the left-hand side of the river when facing downstream.

Channel Works

Channel Management

Gravel extraction is the main river management method used in this reach. Annual extraction of 50,000 cubic metres per year will continue. The extraction area is generally downstream of cross-section 0070 with a limit of 4,000 cubic metres per year between cross-sections 0030 and 0070 to assist in the recovery of bed levels in the vicinity of Estuary Bridge.

Design Channel Alignment

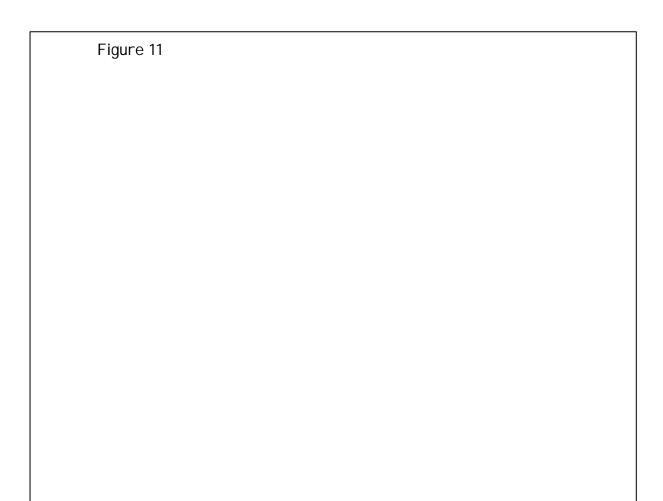
The bank edge of the Port Road reclamation defines the left bank edge of the design channel alignment. This alignment will continue to be maintained by a rock lining. The design channel alignment on the right bank differs from the hydraulic line alignment in that it tapers more sharply from the river mouth boat harbour to Estuary Bridge. The alignment requires removing up to a 45-metre width of material from the spit's eastern side along approximately 250 metres.

Stopbanks

No new or upgraded stopbanks are proposed for this reach.

Moera/Petone Reach: Estuary Bridge to Ava Rail Bridge (XS 0100-0210)

The channel is bound on both banks by low lying floodplains. Shandon Golf Course and Sladden Park adjoin the river along the true right river bank. The Black Creek training bank occupies much of the left bank from the upstream end of this reach. Downstream and landward of the training bank there is light industrial and residential development. Community assets on both sides of this reach are protected by stopbanks.



Proposed Measures

Priority	Description	Cost (\$m)	When
1	Ava Rail Bridge investigations	0.23	2000–2002
1	Ava Rail Bridge waterway improvements	4.77	2003–2008
2	Shandon Golf Course (RB) stopbank	1.72	Beyond 2010
2	Light rock protection works (Estuary to Ava Rail Bridge)	0.43	Beyond 2010
6	Woollen Mills (Estuary to Ava LB) stopbank	3.99	Beyond 2010
6	Relocation and rock lining (Estuary to Ava LB)	2.20	Beyond 2010

Channel Works

Channel Management

Dredging the Black Creek outlet channel will continue (assuming the outlet is retained).

Design Channel Alignment

The design channel alignment in this reach generally follows the existing channel. The only place where the alignment differs significantly is in the vicinity of Woollen Mills Point. Here the river and stopbanks will be realigned. This will involve:

- removing the end of Woollen Mills point (setting back the bank edge by up to 20 metres) along approximately 90 metres, then reshaping the bank and building out the rock line by up to 10 metres along 280 metres downstream of the point)
- realigning the stopbank at Woollen Mills point to provide a minimum 15-metre berm between the new stopbank toe and the top of the new river bank rock line.

The design channel alignment assumes retaining Ava Railway bridge and the Black Creek training bank in their current positions. However, depending on the outcomes of investigations into improving the hydraulic capacity of the bridge, and the possibilities of removing the training bank, there is an opportunity to realign the design channel towards the true right bank. This will allow for easing the bend through the railway bridge and straightening the downstream reach, and will also provide more berm area adjacent to the left-bank stopbank.

Stopbanks

Right Bank

Stopbank upgrades are proposed for the entire reach, and as there are no space limitations the preferred stopbank profile can be provided. The preferred profile has a top width of 4 metres and 3.5 to 1 batters.

Left Bank

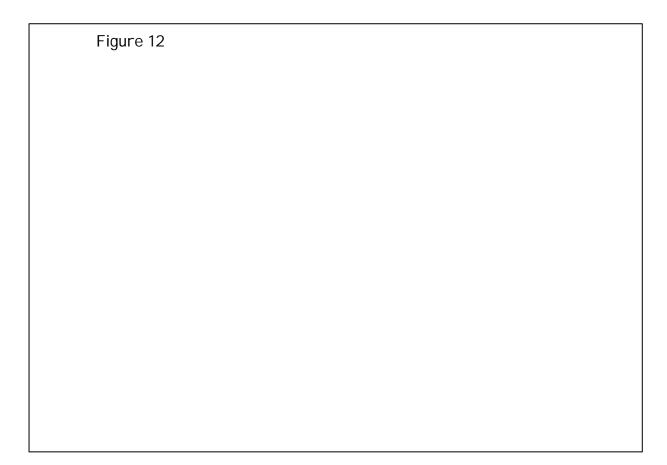
The stopbanks will be upgraded to the preferred profile, including a 5 metre access buffer where possible, and join to the realigned Ava to Ewen floodway immediately upstream of the reach. At Woollen Mills corner a new stopbank will be constructed on a new alignment. Some property purchase will be required to complete this work.

Ava Rail Bridge

Feasible options for improving the Ava railway crossing to pass a 2800 cumec flood will be investigated. The Regional Council and Tranz Rail together will define an acceptable bridge upgrade strategy by June 2002. The strategy is likely to cover replacement timing, bridge design standards, and impacts on adjacent flood protection works.

CBD/Alicetown Reach: Ava Rail Bridge to Melling Bridge (XS 0210-0440)

This reach encompasses a transition in the river, where it moves away from its alignment along the Wellington Fault and adapts to the sea level control at its mouth. The reach is characterised by heavy residential and commercial development on the floodplain, protected by stopbanks that are often located very close to the river.



Proposed Measures

Priority	Description	Cost (\$m)	When
3	Melling Bridge investigations	0.06	2001–2002
3	Strand Park (Ava to Ewen RB) river realignment and land purchase	4.48	2000–2005
3	Tama Street stopbank upgrade (Ava to Ewen RB)	2.48	2000–2007
1	Strand Park stopbank upgrade (Ava to Ewen LB)	2.64	2000–2010
1	Daly Street (Ewen to Melling RB) stopbank upgrade and land purchase	4.61	Design starts 2008–2009
3	Marsden Bend (RB) channel works	1.91	Beyond 2010
3	Pharazyn Street (Ewen to Melling RB) stopbank	3.70	Beyond 2010
1	Riverside car park channel works (LB) and light protection works (Ewen to Melling LB)	1.78	Beyond 2010
14	Land for Melling Bridge upgrade (LB)	8.00	Beyond 2010

Channel Works

Channel Management

Gravel extraction is proposed between Ewen Bridge and Kennedy-Good Bridge. Annual extraction of 10,000 cubic metres from five or six beaches will be undertaken in the CBD and Boulcott reaches.

Design Channel

The design channel through this reach is a smooth transition from the narrow meander form upstream of Ewen Bridge (70-metre-wide channel with a minimum of 15-metre-wide berms), to the wider channel form downstream (90-metre-wide channel with a minimum of 20-metre-wide berms). Upstream of Ewen Bridge the design channel generally fits the existing channel. In this part of the reach, the only significant realignments required are on the left bank at the Riverside car park and the right bank upstream of Marsden Bend.

At the Riverside car park the bank edge will need to be taken back by up to 20 metres. The channel through Tama Bend between Ava and Ewen bridges requires substantial realigning. Both channel banks will be reconstructed over a length of about 700 metres, gaining about 40 metres of berm on the right bank, and a maximum setback of about 50 metres on the left bank. Land purchase will be required. Bank edges will be protected by substantial rock lining.

Stopbanks

Right Bank

Upgrading the existing stopbanks by raising and straightening is proposed through this reach. They will be upgraded to the preferred² profile at the realigned floodway position. Buffer space is generally provided where possible, and no property purchase is required.

Crest walls or other arrangements adjacent to Ewen Bridge will be investigated. Next to Marsden Bend the existing stopbanks require a retaining wall on the street side to avoid purchasing property.

Left Bank

The existing stopbanks will be raised and straightened to the preferred profile, including a 5-metre buffer where possible. Some property purchase is required.

Crest walls or other arrangements adjacent to Ewen Bridge will be investigated. The downstream toe of the stopbank extends into car parks in Daly Street. Tied retaining walls or an adjusted stopbank profile will be considered next to the car park.

Melling Bridge

Bridge flood capacity requirements to meet the 2800 cumec design standard will be investigated.

-

The preferred stopbank profile has a top width of 4.0m and 3.5 to 1 batters.

Boulcott Reach: Melling Bridge to Kennedy-Good Bridge (XS 0440-0660)

The main feature of this reach is the change in channel gradient in the vicinity of the Hutt Golf Club. This gradient change is represented by a decreased channel width extending downstream from the change in grade for approximately 1.5 kilometres. The reach is bounded by State Highway 2 on the right bank, and the Hutt Golf Course on the left.

F1 40
Figure 13
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Proposed Measures

Priority	Description	Cost (\$m)	When
1	Boulcott Golf Course (LB) stopbank upgrade and land compensation	5.44	After 2005
1	Connolly Street (LB) stopbank & land purchase	2.33	Beyond 2010
1	Melling to Kennedy-Good bridge channel works	1.11	Beyond 2010
3	Melling Bridge (RB) stopbank upgrade	0.26	Beyond 2010

Channel Works

Channel Management

Gravel extraction is proposed between Ewen Bridge and Kennedy-Good Bridge. The strategy adopted is annual extraction of 10,000 cubic metres per year from five or six beaches in the CBD and Boulcott reaches. Upstream of Melling Bridge cross-blading will be continued to provide protection to existing and new bank-edge protection.

Design Channel Alignment

The design channel through this reach modifies the existing channel form, with a minimum 25-metre-wide berm. The design channel changes from 90 metres wide at the upstream end to 100 metres wide next to the golf course, and back to 70 metres at the downstream end. The design channel requires some reclaiming of river bed on the left bank immediately downstream of Kennedy-Good Bridge.

Stopbanks

Right Bank

A new section of stopbank will be constructed just upstream of the Melling Bridge. No buffer is provided.

Left Bank

The existing stopbank will be raised and strengthened to the preferred³ profile, with a buffer being provided where possible. Some property purchase is required.

A retaining wall is proposed for the river bank next to Safeway Storage, with property purchase required (identified in Appendix 3). A new section of stopbank will be considered through Hutt and Boulcott golf courses to close the existing flood defence gap near Hathaway Avenue.

The chosen alignment will be determined through the design and consent process in consultation with Hutt and Boulcott Golf Clubs and affected residents. An alignment along Harcourt-Werry Drive also requires further investigation. However, this option is not likely to be desirable as it may reduce the river corridor's flood buffering capacity, and would expose Lower Hutt to a higher risk of stopbank breaching.

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The preferred stopbank profile has a top width of 4.5 metres and 3.5 to 1 batters.

Belmont / Taita Reach: Kennedy-Good Bridge to Pomare Rail Bridge (XS 0660-1090)

Above the Belmont residential area the river is constrained by the Western Hutt Motorway (State Highway 2) on the true right bank and Taita stopbank along much of the River's left bank. Major features of this reach are:

- the Belmont residential area, located on the true right bank upstream of Kennedy-Good bridge, where approximately 10 properties are located immediately next to the river channel
- Taita rock, which forms a major hydraulic and morphologic control in the river system (putting it simply, it controls the slope and direction of the river).
- the sharp bend and large rock groynes below Pomare railway bridge.

Figure 14		

Proposed Measures

Priority	Description	Cost (\$m)	When
4	Kennedy-Good Bridge to Pomare (LB) stopbank upgrade	0.86	Beyond 2010
4	Rock protection at Belmont, Nash Street, and Pomare Rail Bridge (LB/RB)	1.42	Beyond 2010
14	Vegetation at Kennedy-Good Bridge to Pomare Rail Bridge (LB/RB)	1.63	Beyond 2010
8	House raising at Belmont to 1900	0.45	2003–2007

Channel Works

Channel Management

No gravel extraction is planned upstream of Kennedy-Good Bridge. Cross-blading will be continued to provide protection to existing and new bank-edge protection.

Design Channel Alignment

The design channel through this reach is 90 metres wide downstream of Nash Street and narrows to 70 metres at Taita Rock. The design channel requires:

- taking back the left bank berm by up to 20 metres (along approximately 300 metres) opposite the upstream end of the Belmont
- reclaiming the berm up to 30 metres (over 350 metres) on the left bank next to the Australian Rules ground.
- taking back the left bank berm by up to 20 metres (along 500 metres) downstream of the Nash Street erosion site.

Stopbanks

Left Bank

The existing stopbank is already well above the 2800 design level and will not be lowered during upgrade works. However, relocating services and other minor improvements to stopbank integrity will be considered.

Manor Park Reach: Pomare Rail Bridge to Silverstream Bridges (XS 1090-1400)

The Taita stopbank and the Eastern Hutt Road (left bank), and the Manor Park Golf Course (along most of the right bank) contain the river in this reach. A wider channel at the Silverstream bridges changes to a narrow and incised form through Taita Gorge. The major feature is the Stokes Valley Stream confluence on the true left bank, approximately 800 metres upstream of Pomare railway bridge.

Figure 15

Proposed Measures

Priority	Description	Cost (\$m)	When
<mark>13?</mark>	Pomare Rail Bridge to Silverstream Bridge channel works (LB/RB)	1.34	Beyond 2010
13	Manor Park stopbanks to 2300	0.98	Beyond 2010

Channel Works

Channel Management

The general management strategy is to gradually work towards the design channel in this reach, while actively maintaining the current alignment. Apart from proposed structural works, ongoing maintenance is programmed under the Hutt River Asset Management Plan.⁴

Design Channel Alignment

The design channel will be 70 metres wide with 15- to 20-metre-wide berms. This requires:

- reclaiming the berm by up to 45 metres (along an 800-metre length) on the right bank at the upstream end of Manor Park Golf Course
- taking back the left bank berm by up to 20 metres (along 550 metres) in the vicinity of the old Regional Council nursery at Silverstream
- reclaiming the berm up to 25 metres (along 400 metres) immediately upstream of Pomare bridge
- taking back the right bank (Manor Park Golf Course) by up to 20 metres (along 1.4 kilometres) through Taita Gorge.

Stopbanks

Right Bank

Manor Park stopbank will be upgraded to the 2300 cumec standard. No property purchase is required for this work.

Silverstream Road Bridge

The flood capacity of the Silverstream road bridge is a 5-year flood. However, by constructing a floodwall on the left bank the bridge and its associated floodway can attain the required 2800 cumec capacity.

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⁴ The Hutt River Asset Management Plan guides how current and new flood protection structures must be maintained.

Heretaunga Reach : Silverstream Bridges to Moonshine Bridge (XS 1395-1775)

The river in this reach is constrained by State Highway 2 on the right bank and, in the upper part of the reach, the Upper Hutt stopbank on the left bank. The river banks in this reach are lined with extensive protection works with alternating willow buffers and rock lines. On the true right bank the willow buffers are generally reinforced with debris fences.

	Figure 16
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Proposed Measures

Priority	Description	Cost (\$m)	When
10	Moonshine Bridge investigations	0.06	2001–2002
5	Whirinaki Street stopbank to 2300	0.47	2004–2006
8	Trentham to Whakatikei stopbank (part)	0.71	Beyond 2010
10	Moonshine Bridge waterway upgrade	3.31	Beyond 2010

Channel Works

Channel Management

Present channel management strategy in this reach, focusing on extending rock linings in response to bank erosion, will be continued. However, rock groynes may be used in the place of rock linings to prevent further reductions in the natural character of the reach.

Some parts of this reach have become excessively wide and misaligned due to overdeveloped beaches. Beach ripping and clearing will be required periodically to control aggrading beaches and prevent the channel further misaligning. Eventually realigning the channel to the design alignment should help correct this situation so that ongoing in-channel works will be reduced as much as possible.

Design Channel Alignment

The design channel width through this reach ranges from 70 to 75 metres. The design channel will be achieved by:

- reclaiming the left bank berm by up to 35 metres (along a 700-metre length) adjacent to Trentham Memorial Park
- taking back the left bank berm by up to 15 metres (along 600 metres) next to Heretaunga Park
- reclaiming the left bank berms by up to 25 metres (along 600 metres) next to Heretaunga Golf Course.

Stopbanks

The Trentham to Moonshine stopbanks are well above the 2800 design level, so no stopbank improvements are planned for this reach. However, relocating services and other minor improvements will be considered. The existing stopbank at Whirinaki Crescent will be upgraded. No property purchase is required.

Moonshine Bridge

Feasible options for improving the Moonshine Bridge to pass a 2800 cumec flood will be investigated. The Regional Council and Transit NZ together will define an acceptable bridge upgrade strategy, which is likely to cover replacement timing, bridge design standards, and impacts on adjacent flood protection works.

Moonshine Reach : Moonshine Bridge to Whakatikei River (XS 1775-1900)

This reach is characterised by steep undeveloped bush land on the right bank, and a wide berm on the left. Major features in this reach are:

- bedrock outcrops in the channel throughout the reach.
- the major bend and rock outcrop at the Whakatikei River confluence and the additional flow from Whakatikei River.

Figure 17

Proposed Measures

Priority	Description	Cost (\$m)	When
10	Moonshine to Maoribank (LB) channel works (part)	0.25	Beyond 2010
8	Trentham to Whakatikei (LB) stopbank (part)	2.00	Beyond 2010

Channel Works

Channel Management

Because of the reasonably stable and confined nature of the river through this reach only limited management requirements have been developed. Some in-channel maintenance may be required to control any developing meanders near Moonshine Bridge.

Design Channel Alignment

Channel stability and a gorge-type setting help control the river's alignment. Consequently a 60-metre-wide channel has been chosen as the design alignment, requiring no major modifying of the existing channel.

Stopbanks

Left Bank

The existing stopbanks directly upstream of Moonshine Bridge will be raised and strengthened on their existing alignment. The remaining stopbanks are above the 2800 design level, and only minor improvements will be considered.

Upper Hutt / Totara Park Reach : Whakatikei River to Norbert Street Footbridge (XS 1900-2390)

Both ends of this reach are constrained by major hydraulic and morphologic controls. The downstream end is controlled by the Whakatikei River confluence, and the top end by the 90-degree bend and major rock outcrops at Maoribank Corner. The upstream end of the reach adjacent to Ngati Tama Park is characterised by high gravel and silt banks on both sides. Both are fixed by rail-iron and gabion basket protection works.

Figure 18

Proposed Measures

Priority	Description	Cost (\$m)	When
10	Whakatikei to Maoribank (LB) stopbank	0.28	Beyond 2010
10	Moonshine to Maoribank channel works (part)	3.35	Beyond 2010
10	Totara Park stopbanks to 2300	1.42	Beyond 2010
10	Elbow Park channel upgrade	1.41	Beyond 2010

Channel Works

Channel Management

Developing a wide design channel in this reach will require removing substantial berm material in the medium to long term. This will be undertaken either through gravel extraction or by allowing the river to widen naturally. In either case, bank shaping, and some rock lining protection planting work will be needed once the required width is achieved.

The wide design channel will probably require ongoing in-channel maintenance to control any developing meanders, although the frequency of these works should be reduced. These activities will include beach ripping, clearing and shaping, as well as some cross-blading.

Ongoing in-channel works will be required to prevent the channel misaligning and subsequently damaging protection works.

Design Channel Alignment

The design channel width extends to 135 metres for this reach, except through Ngati Tama Park where the design channel gradually reduces to 70 metres. The channel width reduction reflects the river adjusting to the bend and bedrock control feature at Maoribank Corner. Changes to the channel include:

- taking back the right bank berm by up to 50 metres along 1.5 kilometres between cross-sections 2080 and 2240
- taking back the left bank berm by up to 85 metres (along 800 metres)
- realigning the rock line on the left bank by up to 20 metres (along 500 metres).

Modifications to the right bank berm will affect Awa-Kairangi Park, where the loss of between 30 and 50 metres of river berm over a 200-metre length will occur.

Stopbanks

Right Bank

The existing stopbank is around the 2300 design level. The modified stopbank may extend the existing stopbank toe by up to 2 metres in some places, but no property purchase is required to accommodate the wider profile.⁵

Left Bank

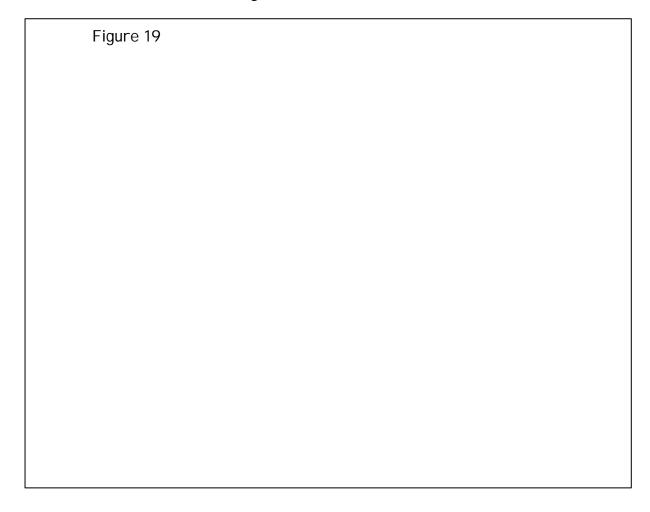
The existing stopbanks are above the 2800 design level, and only minor improvements will be considered.

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The preferred stopbank profile has a top width of 4.5m and 3.5 to 1 batters.

Akatarawa Reach: Norbert Street Footbridge to Gemstone Drive (XS 2390-2690)

This reach is characterised by its gorge-like nature, with the channel narrow and incised with bedrock outcrops. The Akatarawa River forms a control at the top end, where the river turns 90 degrees to flow south.



Proposed Measures

Priority	Description	Cost (\$m)	When
14	Norbert Street Footbridge to Akatarawa channel works	0.34	Part in 2004– 05
12	Akatarawa Road (LB) floodwall at 1900	0.72	2004–05
12	Gemstone Drive channel works to 1900	0.64	2005–06
12	Gemstone Drive (LB) stopbank to 1900	0.15	2005–06
7	Bridge Road house raising to 1900	0.18	2003–2007

Channel Works

Channel Management

Because of the reasonably stable and confined nature of the river, especially through Birchville Gorge, no specific management requirements have been developed or are required for this reach.

Bank edge protection proposed at Gemstone Drive and Bridge Road will be to a 1900 standard.

Design Channel Alignment

The design channel is generally 40 metres wide throughout the reach.

Stopbanks and Other Measures

Left Bank

A 1900 floodwall may be provided on the river side of Akatarawa Road. Alternatively, financial assistance for house raising to the 1900 design level will be available. Akatarawa Road may also be raised to provide access to Akatarawa Bridge if the floodwall option is not selected. A decision on either providing house raising or a flood wall will be made by 2004, after feasibility investigations which will include consultation with local residents.

The existing Gemstone Drive stopbank will be strengthened to meet the 1900 standard. Property purchase is not required.

Right Bank

No stopbanks will be provided, although assistance for house raising to the 1900 design standard will be available.

Te Marua Reach : Gemstone Drive to the Hutt Gorge (XS 2690-3050)

The main features between Gemstone Drive and the Te Marua Golf Club are the:

- over-wide channel
- high gravel terrace on the Teasdale property on the true right bank
- flood diversion cut opposite Te Marua Golf Club.

Above the Te Marua Golf Club the reach is characterised by the Hutt Gorge's steeply rising hills, mainly on the right bank, with occasional bedrock outcrops.

Figure 20		

Channel Works

Channel Management

The river channel is not actively managed upstream of Gemstone Drive by the Regional Council. However, the Council does provide advice on protection work designs and placement when requested by landowners. The advice will be aimed at appropriate works that maintain the design channel alignment. A subsidy of up to 30 percent of costs for approved river works is available to landowners.

Design Channel

The design channel is 40 metres wide upstream of Te Marua Golf Club, but narrows to 30 metres at the Hutt Gorge exit. The design channel selected between the Mangaroa River confluence (cross-section 2770) to the bedrock outcrop at Te Marua Golf Club (cross-section 2900) is 55 metres wide, narrowing to 40 metres at both ends of the reach.

Do you want to know more ?:

- Ref?: Evaluation of Existing Hutt River Flood Defences and Upgrade Concept Design
- Ref ?: Review of Process for Design Standard
- Ref ?: Channel Management and Protection Works Volumes 1 & 2
- Ref?: Living with the River Newsletter, May 1999 Issue No. 2
- Ref: ? Living with the River Newsletter, July 1999 The Design Standard: Issue No. 3

4.7 Structural Measures Policy

How the Structural Measures Were Decided

So far in this chapter we have looked at a wide variety of decisions on the kinds of structural measures – including channel works, stopbanks and berms – that are proposed for the various flood-prone areas of the Hutt Valley. This section looks at how these decisions were arrived at. It covers the specific policies backing the floodplain management approaches selected as part of this Plan. The policy has been derived from operational practice, and what can be learned from the history of flooding in the Hutt Valley.

In particular, policies allowing the Regional Council to operate the flood defence system effectively with minimal impact on other activities and considerations essential for implementing structural measures are included.

Structural Measure Policies - Quick Reference

Policy 7:	Requiring High Flood Defences Standards
Policy 8:	Acquiring Land for Structural Works
Policy 9:	Minimising the Adverse Effects of Physical Works
Policy 10:	Managing the Channel to Protect River Alignments and Flood Defences
Policy 11:	Producing By-laws Protecting Regional Council Assets
Policy 12:	Replacing Bridges
Policy 13:	Considering Flood Detention Dams
Policy 14:	Managing Riverbed Levels
Policy 15:	Managing Gravel Extraction for Flood Protection
Policy 16:	Clarifying Floodplain Management Planning Roles
Policy 17:	Accounting for Stormwater Flooding
Policy 18:	Designing for Climate Change and Earthquakes
Policy 19:	Removing Services
Policy 20:	Locating New Services in the River Corridor
Policy 21:	Rationalising Existing and New Stormwater Outlets
Policy 22:	Protection Benefits for Services
Policy 23:	Protecting Key Network Facilities
Policy 24:	Upgrading the Melling Substation
Policy 25:	Services Crossing the River Corridor
Policy 26:	Agreements for Managing Services

Policy 7: Requiring High Flood Defences Standards

Lssue

High design and construction standards of new and upgraded flood defences can significantly diminish the threat to the safety and lives of Hutt Valley floodplain residents.

Policy

As far as practicable, flood protection structures must be very strong in cases where the protected area cannot be evacuated and failures could lead to lives being lost. Some residual risk of overtopping is acceptable where failure of the flood defence is not life threatening.

Explanation

This policy highlights the need to apply a risk-based approach to separate and distinct floodplain areas. Stronger protection will be needed where lives can be lost, particularly for locations where emergency management procedures cannot be totally effective.

It should be emphasised that failsafe structures are impossible to construct. There will always be a residual risk of failure.

Policy 8: Acquiring Land for Structural Works

I ssue

In some instances the Regional Council will need to acquire land for structural works.

Policy

The Regional Council will preferably acquire management rights to all land needed for structural works at no cost (other than conveyance costs), or as part of land exchanges. Land will be purchased as the final option.

Explanation

Most land marked for structural works is in public ownership, enabling land exchange to take place more readily.

Policy 9: Minimising the Adverse Effects of Physical Works

I ssue

Constructing structural works can result in a range of short- to long-term adverse environmental effects on the river environment. These effects may be caused by physical construction works or the presence of completed structures. Effects can be managed using a number of tools.

Policy

Physical works will need to be appropriately managed to ensure that adverse environmental effects are minimised. The standard for managing construction works will be driven by:

- planning and employing sensible and environmentally responsible construction methods
- setting environmental performance standards throughout the resource consent process
- monitoring the effects of physical works to improve practices where possible and practical.

Upgrading flood protection works will provide opportunities to enhance the river environment to compensate for the unavoidable negative effects of engineering works. The primary tool to promote these opportunities is the Environmental Strategy for the Hutt River.

Explanation

As responsible environmental managers, the Regional Council will plan physical works to achieve a high level of environmental performance. For any physical works, the resource consents process will ultimately determine how the community wishes adverse environmental effects to be managed and monitored.

Structural works provide opportunities through the Environmental Strategy to promote and support projects that maintain or enhance ecological, recreational and landscape benefits for the river environment. These opportunities are likely to be additional to any resource consent requiring the environmental effects of works to be appropriately managed. Policy relating to the Environmental Strategy is presented in Chapter 6.

Policy 10: Managing the Channel to Protect River Alignments and Flood Defences

I ssue

Flood defences can only be effective if the river channel edge is actively managed.

Policy

Channel management structures must be constructed to provide:

- a river alignment that can be maintained to permit the safe passage of floods
- protection to flood defences, such as stopbanks, and to nearby development.

Where practicable, bank-edge works and adjoining berm areas should be designed to be reasonably failsafe from erosion where:

- they protect the flood defences foundations
- failure of the flood defences could lead to lives being lost.

At times it will be necessary to carry out work in the riverbed to protect the river edge.

Explanation

For the Hutt River, actively managing the river channel means a strong focus on providing permanent channel-edge works to ensure the integrity (safety) of the flood defence system. This does not exclude temporary bed re-contouring and gravel extraction to help protect permanent works. Bank-edge protection works will need to perform well if they are to protect stopbanks and adjacent development adequately.

Policy 11: Producing By-laws to Protect Regional Council Assets

I ssue

The Regional Council relies on certain tools to protect flood protection assets, including regional plan rules, notice boards and education. A number of land-use rules relating to protecting flood defence assets are contained in the Regional Council's Transitional Regional Plan. The Transitional Regional Plan will eventually be revoked because it is largely superseded by provisions in the Regional Freshwater and Soil Plans. However, revoking the Transitional Plan will partly remove the Council's ability to help protect flood defence assets from being illegally interfered with, excavated and vandalised.

Policy

The Regional Council will:

- review repealed rules
- determine the scope within existing legislation to produce by-laws protecting flood defence assets
- look at alternative ways to manage this issue (e.g. targeted education campaigns)
- develop new by-laws or other effective approaches to protect flood defence assets, where the need arises.

Explanation

By-laws would only be created where they can act as effective and robust disincentives for illegal interference of the flood defences. As such, new by-laws would need to be weighed against the costs of developing them, their potential effectiveness and alternative approaches.

This policy only relates to the Regional Council's by-law making powers, and not to those of the city councils. There may be scope to consider city council by-law-making powers where appropriate.

Policy 12: Replacing Bridges

Lssue

Some bridge crossings do not have the floodway capacity to pass the design standard flood, nor the ability to withstand high flood debris loads.

Policy

Bridge waterways must be improved to the 2800 cumec standard when the bridge owners decide to replace them. At that stage, the bridge structures must be rebuilt to meet the design standard waterway. Also, the early replacement of substandard bridge waterways should be actively encouraged through joint venture proposals, where the Regional Council facilitates the Plan-related river works improvement in the vicinity of any bridge.

Explanation

This policy also applies to new bridges. Sub-standard flood capacity at the bridges can cause flow bottlenecks and debris traps, which create substantial weaknesses for the flood protection system. This policy aims to eliminate these weaknesses by requiring new bridges and their associated floodways to be upgraded to the 2800 standard. The policy also recognises that early bridge replacement can impose tremendous costs on the community. Satisfactory floodway capacity can also be gained adjacent to the bridges, provided that the safety of flood defences is not compromised. The nature of improvements to the waterway will be driven by methods stated in the Plan. All bridge owners need to be advised of bridge waterway standards, and a mechanism is required to ensure future bridge owners also understand these requirements.

Policy 13: Considering Flood Detention Dams

I ssue

Using flood detention dams in the upper catchment has the potential to reduce peak flood levels, but transfers the intangible flood protection costs and effects to the wider community downstream.

Policy

Detention dams will not be among the suite of flood mitigation measures for the Hutt River catchment and floodplain. Dams should be considered only if the net economic benefits are significantly greater than those for other measures that manage the flood risk within the affected community. Any benefit must also be weighed against any intangible cost.

Explanation

Dams must be effective during a major flood. The Regional Council has investigated potential dam locations in the Hutt River catchment, but none of the sites provided the necessary capability to alleviate the downstream effects of a large flood.

The potential for significant intangible impacts can outweigh the benefits resulting from detention dams; for example, the adverse amenity effects and impacts on natural ecosystems associated with constructing a dam in undeveloped reserve areas. This policy's emphasis on showing significant overall benefit also applies when considering all alternative structural measures.

Policy 14: Managing Riverbed Levels

Lssue

The Hutt Valley community has conflicting views on how the Hutt Riverbed levels should be managed. Opinions range from an expectation that disturbing the riverbed should be minimised for environmental reasons, to a wish to see the return to wide-scale gravel extraction to increase the river's flood capacity. These views exist despite good riverbed monitoring information being made available to the public.

Policy

The Regional Council will seek to improve the public's:

- understanding of how gravel extraction and bed levels relate to river bank erosion
- understanding of how gravel extraction affects river ecology
- awareness of riverbed monitoring information, including regularly publicising monitoring results.

The Regional Council will produce riverbed level management guidelines for the Hutt River. The guidelines will influence how the Council manages bed levels on a day-to-day basis.

Explanation

This policy emphasises the need to better inform the public about the balance between flood capacity, gravel extraction, and bank erosion. The riverbed level management guidelines, together with monitoring information and gravel survey analyses, will help determine gravel extraction requirements along the river. They will also provide a useful tool to better inform the public about riverbed processes and the reasons behind gravel extraction decisions.

Policy 15: Managing Gravel Extraction for Flood Protection

Lssue

Gravel extraction, particularly at the Hutt River mouth, remains an important method to reduce potential flooding effects on floodplain occupants.

Policy

The Regional Council will use gravel extraction as a flood management method where:

- continuing aggradation at the river mouth is likely to cause significant increases in upstream river flooding levels
- significant localised river bed aggradation (gravel build-up) is occurring.

Extraction can only be realistically considered where adverse effects on the community and environment will not be significant.

Explanation

This policy supports undertaking gravel extraction where the positive effect of reducing flooding impacts on the community outweighs:

- the potential for increased erosion of river margins that may threaten the safety of stopbanks
- adverse environmental and social impacts caused by extraction.

Policy 16: Clarifying Floodplain Management Planning Roles

I ssue

The Regional Council has a primary responsibility to facilitate floodplain management planning, as determined by the Regional Policy Statement, Soil Conservation and Rivers Control Act 1941, and Resource Management Act 1991. The city councils also share this responsibility, primarily determined by the Resource Management Act and the Regional Policy Statement.

Policy

The Regional Council will, together with the Hutt and Upper Hutt City Councils, facilitate floodplain management planning for the Hutt Valley. This will involve:

- preparing and implementing a management plan for the Hutt floodplain that will minimise the risk to life and property resulting from a flood
- constructing new and upgraded protection works to construction standards necessary to meet the design standard
- implementing catchment-wide non-structural measures to manage both primary and residual risk
- developing an environmental strategy to enhance the river environment
- periodically reviewing information collected from monitoring, and revising the Hutt River Floodplain Management Plan where the need arises.

Explanation

Shared responsibilities stated above are discussed in Chapter 1. While the Regional Council is the prime driver of the Plan's structural measures, the city councils provide input on the Plan's direction and design standard selection. The councils' main role in the Plan is to implement non-structural measures.

Policy 17: Accounting for Stormwater Flooding

I ssue

Flooding from stormwater systems and small streams is a frequent occurrence in floodplain areas. Some areas can experience more significant and frequent stormwater flooding than others, and damages over time can be substantial.

Residents need to know more about stormwater and river flooding, in terms of both how they differ and how they are connected. There is also some confusion in the community regarding the roles of the regional and city councils in managing stormwater flooding.

The behaviour of stormwater flooding can be very complex because of the urban environment's highly modified nature, and the councils are still improving their own understanding of stormwater floods.

Policy

The Regional Council will give technical assistance to the city councils where requested, to help upgrade the city councils' understanding of stormwater flooding.

The Regional Council will continue to provide the public with information on stormwater and river flooding, including:

- the differences between river and stormwater flooding
- how storm events can simultaneously cause river and stormwater flooding
- how river and stormwater flooding can affect each other.

Explanation

This policy recognises that the city councils have primary responsibility for managing stormwater flooding, including:

- predicting the flood extent and effects
- providing and maintaining stormwater discharge networks
- providing information about stormwater flooding and preparedness measures to the community.

The Regional Council can assist the city councils by providing river flooding data and minor technical support. This policy also supports the public receiving better information regarding the councils' responsibilities, and the nature and effects of stormwater flooding.

Policy 18: Designing for Climate Change and Earthquakes

I ssue

The flood protection system will, on average, be designed to withstand floods that have a 1 in 440-year frequency. The system must also be designed to withstand natural hazards and other phenomena that occur on a similar time-scale or more frequently. Earthquakes and climate change are two phenomena that can significantly and dramatically affect the flood protection system. Climate change scenarios for the next 35 years, provided by the National Institute of Water and Atmospheric Sciences, predict that:

- flooding will occur more frequently
- equivalent flow return periods may halve (e.g. a 1 in 100-year flood becomes a 1 in 50-year event)
- the sea level will rise between 0 and 0.5 metres.

These changes could substantially lessen the flood protection system's effectiveness in the future.

A major earthquake on the Wellington Fault, bordering the Hutt Valley, will occur on average once every 500 years. A major quake could cause wide-scale land subsidence or uplift throughout the Hutt Valley, affecting the relative height of flood defences in relation to the river and sea level. Furthermore, ground shaking from such a flood could seriously damage stopbanks and other protection works. Both effects may render the flood defence system ineffective. The last major earthquake to affect the Hutt Valley occurred on the Wairarapa Fault in 1855. It caused land in the lower valley to rise downstream of Taita Gorge, and shifted the Hutt River mouth 2 kilometres east to its present position.

Policy

The Regional Council will account for climate change and the earthquake hazard in the following ways:

- support the Institute of Geological and Nuclear Sciences to investigate fault rupture on the Wellington and Wairarapa faults, and at the Pacific and Australian plate boundaries
- within reason, incorporate earthquake investigation outcomes into flood protection work designs
- incorporate climate change scenarios by designing major stopbanks to 2800 construction standards
- provide the city councils and the public with information about the potential effects of climate change and earthquakes on the flood protection system.

Explanation

The potential impacts of earthquakes and climate change on the flood protection system cannot be underestimated. Avoiding all impacts is impossible, but the Regional Council may (within reason) improve engineering designs to lessen some effects considerably. However, any design changes must balance improved flood protection safety with additional construction costs and environmental effects.

4.8 Policies for Managing Utilities and Services in the Hutt River Corridor

Existing, relocated, upgraded and proposed services in the River Corridor can be affected by flooding.

Why have policies?

A utilities and services policy is needed to:

- ensure that the Hutt River flood protection system provides the level of protection expected by the community
- ensure that the utilities and services located within the River Corridor provide the level of service expected by the community
- provide utility or service owners with an understanding of the level of protection their assets in the river corridor could receive from the proposed Plan's upgrade works
- help utility or service owners to plan for future management of their assets.

Responsibilities

- Utility and service owners are responsible for protecting services in the River Corridor.
- Where the proposed flood protection upgrade works affect utilities or services, the Regional Council will involve utility and service owners early in the process.
- Utility and service owners will involve the Regional Council if they propose to upgrade existing services or wish to install new services in the Hutt River Corridor.

Existing Services

Policy 19: Removing Services

I ssue

Services in stopbanks or the river corridor can increase the chances of the stopbanks failing and river berms being eroded during floods.

Policy

Existing services will be removed from stopbanks and relocated where possible outside the river corridor during stopbank, river corridor or service upgrading.

Explanation

• Existing services, due to deterioration, failure of the service or substandard installation, could weaken flood defences, initiating their failure during floods.

- Excavation and back filling of stopbanks carried out during maintenance and repairs to services can also initiate failure.
- Service related structures (like manholes) that protrude from the berm or stopbank could cause local scour.
- The Regional Council will assist the utility or service owners to identify suitable routes for new services, where possible.
- Stormwater and sewerage require special considerations. These considerations would be negotiated under Policy 26.

Policy 20: Locating New Services in the River Corridor

I ssue

Services in stopbanks or the river corridor can increase the chances of the stopbanks failing and river berms being eroded during floods.

Policy

New services will not be located in or under a stopbank. New services can be located in other areas of the river corridor (excluding stopbanks) only with the prior approval of the Regional Council.

Explanation

This policy is self-explanatory. Exemptions to this policy for services in the river corridor (excluding stopbanks) would only be considered if they did not put the flood protection system at risk.

Policy 21: Rationalising Existing and New Stormwater Outlets

I ssue

Stormwater outlets can initiate failure of stopbanks, berms and bank-edge protection works. The risk of failure needs to be minimised.

Policy

The number, location and design of existing and new stormwater outlets should be rationalised during stopbank or service upgrading.

Explanation

• The presence of a large number of stormwater outlets crossing the stopbanks will increase the risk to the flood protection system.

- The number of stormwater and sewerage outlets, where possible, should be decreased to reduce the risk to the flood protection system. They also need to be controlled when new stormwater systems are needed.
- Rationalising stormwater outlets means altering the stormwater network so that outlets pass through the stopbank at a limited number of locations.
- Rationalised outlets would provide opportunities for stormwater pumping, potentially benefiting large areas when the stormwater system is overloaded.

Policy 22: Protection Benefits for Services

I ssue

Service assets within the river corridor are at risk of damage from floods. The flood protection system does not directly provide for their protection from damages.

Policy

The structural measures are constructed to provide flood protection. Any protection benefit to utilities or services is secondary, unless individual agreements with any service owners provide a protection benefit.

Explanation

Utility owners should have a clear understanding of the flood protection works that will be provided under the Plan, the timing for their implementation, and the level of additional protection they may provide to service assets. Any agreement between the Regional Council and a service owner for additional protection will have cost implications for the owner.

Alternatively, utility and service owners could provide a higher level of protection to their assets if they desire, providing protection that does not compromise the safety of the flood protection system.

• The Plan's structural measures will be carried out in the order and programme required to meet the flood protection priorities endorsed by the community.

Policy 23: Protecting Key Network Facilities

I ssue

Key utility network facilities within the river corridor could experience flood damage which may put the ongoing functioning of related services during a flood in jeopardy.

Policy

Key utility network facilities should be protected to a 1900 cumec standard and have contingency plans to cope with the loss of the service in a major flood.

Explanation

- Key network utility facilities are those parts of a utility service critical for ongoing function. Damage to these parts would considerably worsen flooding impacts, particularly as they may not be quickly repaired. Examples include electricity transformers and water pumping facilities.
- Through the development of the non-structural measures principles the community has indicated that it requires key utility network facilities in the river corridor to be protected to a 1900 cumec standard.
- Utility owners should have a clear understanding of the flood protection works that will be provided under the Plan, and the timing for their implementation.

Policy 24: Upgrading the Melling Substation

I ssue

The Melling Substation is located in the river corridor, which exposes it to a high risk of flooding.

Policy

The Melling Substation is a special case, and arrangements for maintaining and upgrading this facility within the river corridor have been agreed with the owner.

Explanation

- It is accepted that the relocation of Melling Substation and its network infrastructure is not possible now.
- Transpower have produced a strategy to eventually relocate the key components of the substation beyond the 80-metre alluvial erosion hazard area. The strategy will be implemented over an indefinite period of time, and will be linked to the life of existing equipment at Melling.
- It should be noted that Policy 24 relates to Transpower's strategy. Any other work on the Melling Substation, and associated infrastructure and network, are not exempt from other policies in the Plan.

Policy 25: Services Crossing the River Corridor

I ssue

Service crossings points produce a weakness in stopbanks, and can initiate their failure during floods.

Policy

Services will cross the river at approved or designated service crossings.

Explanation

- Services in or under stopbanks increase the risk to the flood protection system.
 Services in the river corridor must not affect the flood protection structural and maintenance works.
- Designated crossing points will generally be at road crossings or other locations where the risk of stopbank failure risk is limited.
- Service installation will be designed to minimise the risk and interference to the flood defences system (e.g. a water pipe crossing a stopbank should be laid on the stopbank surface contours). They will also need to meet more stringent installation standards than in the past.
- Well-engineered, dedicated crossings reduce risk to the flood protection system and are preferred. Experience has shown that it is difficult to control the quality of the construction and maintenance of a service crossing. However, any benefit arising from multiple crossing points will be considered at the design phase of any structural works. Issues associated with large-diameter pipes will also be considered at the design phase of works.
- The Council will assist service or utility owners to identify suitable routes for new services, where possible.

Policy 26: Agreements for Managing Services

I ssue

Individual agreements governing how services will be managed between the Regional Council and individual service providers are needed.

Policy

An individual agreement governing how services will be managed will be negotiated with each identified service owner during the design phase of the Plan's major structural works, or during service upgrade or new service installation.

Explanation

• This policy will be the primary means for ensuring the security for the flood protection system and certainty for the services. This includes setting appropriate standards for construction and maintenance.

- This policy provides an opportunity for the appropriate location of all utilities and services including services such as lighting for public security and safety.
- In negotiating the specific agreements for new, upgraded or rationalised stormwater or sewerage systems, benefit—cost analysis, design constraints and adverse effects will be recognised.
- The Regional Council will discuss common issues with affected owners and representative groups such as Lifelines and the Wellington Utility Operators Group during the design phase of any structural works under the Plan.
- The benefits to the service owner and the Regional Council will, where possible, be reflected in the agreement.

Do you want to know more?

- Ref?: Evaluation of Existing Hutt River Flood Defences and Upgrade Concept Design
- Ref?: Living with the River, Hutt River Floodplain Management Plan: Phase 1
 Summary Report
- Ref: ? Living with the River Newsletter, May 1999 Issue Nos 2-3: The Design Standard

Chapter Five

The Outcomes: Improving Non-structural Measures

5.1 Introduction

Non-structural measures focus on keeping people away from floodwaters and help the community to cope when flooding occurs. They may influence the way land is used and buildings are constructed, or they may seek to improve the community's preparedness and response to flooding.

Non-structural measures are the most cost-effective flood mitigation approach. They include land-use policy and provisions (regulatory methods), voluntary actions, and emergency management procedures and programmes.

This chapter describes the principles for non-structural measures that have been selected for the Plan. The principles are what the Plan requires the three councils to consider when developing possible land-use controls and emergency management measures to reduce flood hazard impacts. We also look at practical suggestions for non-structural measures, and the policies that back the way the non-structural measures are to be developed..

5.2 When Do We Use Non-structural Measures?

In this Plan, non-structural measures complement the structural measures, and are applied in conjunction with them. Non-structural measures are also used as standalone measures where:

- structural measures are not planned
- development guidelines and controls for undeveloped flood-prone areas are required
- a flood exceeds the design standard, so that we have to rely almost entirely on emergency management procedures.

5.3 Types of Non-structural Measures

Various types of non-structural measures can be used in flood hazard mitigation. In this chapter we will concentrate on three:

- land-use measures councils regulate the kinds of activities that are carried out in various flood-prone areas
- voluntary action those living and working on the floodplain voluntarily take steps to lessen flooding effects on themselves and their properties
- emergency management procedures and programmes for dealing with flooding emergencies.

5.4 Land-Use Measures and Hazard Areas

Obviously the kinds of measures we use will vary depending on how susceptible an area is to flooding – in other words, according to the flood hazard. In this Plan we will be looking at how measures governing land use will be applied to three geographical areas:

- 1. the upper catchment
- 2. the river corridor
- 3. the floodplain.

Figures 21 to 25 show the extent of these areas. The proposed measures for each area are described below:

1. The Upper Catchment

The upper catchment comprises the five catchments within Upper Hutt City:

- Hutt (upper and alpine sections)
- Pakuratahi
- Mangaroa
- Whakatikei
- Akatarawa.

Flood Hazard Effects in the Upper Catchment

The upper catchment is the major source of flooding events affecting the Hutt River. The extent of flooding and its associated impacts can be influenced by activities in this catchment. Inappropriate land-use practices can introduce sediment and debris to the Hutt River system, and increase run-off during storms.

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Figure 21 shows the upper catchment areas, including the type of vegetation cover.

2. The River Corridor

The *river corridor* is that land immediately adjacent to the river. Because of its location, the river corridor represents a significant flooding and erosion hazard to both people and structures (including the flood defences) sited in the corridor.

River Corridor Extent

The river corridor extends from the river mouth to the Hutt Gorge. The outside (landward) toe of all stopbanks determines the width of the corridor in most places. Where there are no stopbanks, the corridor width is set by:

- geological features, including the valley walls, but excluding cliff-top features;
 or
- the extent of a 2800 cumec flood (except where erosion hazard areas lie outside the 2800 extent); *or*
- the riverside margin of existing houses at Belmont and Bridge Road, Birchville, where those properties extend into erosion hazard areas.

Catchment Figure 21

The area upstream of Gemstone Drive, Upper Hutt (the top of the Hutt River Scheme), is treated slightly differently because no structural works are proposed for this reach under the Plan. This means the channel will not be maintained in a fixed position as it is downstream. Consequently, a buffer between potential development and the river's edge, which can move with a migrating river channel (called the *moving erosion area*), defines the area affected by erosion.

Hazard Areas I dentified for the Hutt River Corridor

Some areas of the river corridor are more prone to flood and erosion than others. Identifying these hazard areas allows us to target non-structural measures more effectively. The hazard areas, shown in Figures 22 and 23 distinguish highly floodand erosion-prone land from those areas least affected by flooding.

Hazard areas in the river corridor can be divided into two sorts:

- primary river corridor hazard area, including a:
 - baserock erosion area
 - alluvial erosion area
 - moving erosion area
 - core flooding area
- secondary river corridor hazard area.

What distinguishes the two is the speed of flow and the potential for significant erosion. The primary river corridor is an area of fast-flowing water, whereas the water in the secondary river corridor is slower-flowing and often deeper. The primary river corridor has three erosion hazard areas: the *baserock* and *alluvial erosion areas*, which are fixed, and the *moving erosion area*, which (as the name suggests) moves with the migrating river channel, upstream of Gemstone Drive. The core flooding area is where the flood waters will move quickly, but the erosion risk is not significant.

Detailed reach-by-reach river corridor plans are presented in Appendix 4.

Hazard Effects in the River Corridor

Flooding in the *primary river corridor* can cause substantial impacts including:

- severe damage to structures
- erosion and loss of land to the river
- substantial deposition of flood debris
- extreme danger to occupants.

Areas of high-velocity flood waters, known as *overflow paths*, are typically associated with flooding in the primary corridor.¹

The *secondary river corridor* is dominated by ponding and slower flowing flood waters, while the erosion and flow risks are heavily reduced. *Yet ponded* waters can still cause substantial damage to building interiors and pose a danger to people.

Figures 22 and 23 show the separation between the two major hazard areas of the river corridor.

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The border between the primary and secondary river corridor areas occurs where the product of water depth and velocity is estimated to equal 1.0. The primary river corridor represents those

Figure 22 : Hutt River Corridor Hazard Areas (LH)

Figure 23: Hutt River Corridor Hazard Areas (UH)

3. The Floodplain

The floodplain is all of the remaining flood-prone area outside the river corridor. It extends over much of Lower and Upper Hutt's urban areas, representing the extent of a 2800 cumec flood. A flood of that size could exceed the floodplain's major upgraded stopbanks.

Hazard Areas I dentified for the Floodplain

The floodplain area can be divided into:

- higher-risk floodplain hazard areas (not protected by stopbanks)
- moderate-risk floodplain hazard areas (protected by 1900 or 2300 stopbanks)
- lower-risk floodplain hazard areas (protected by 2800 stopbanks).

Higher risk means the risk of major damage to property and buildings is high and life-threatening situations can easily develop. However, higher-risk floodplain hazard areas are only a small proportion of the entire flood-prone area. They include existing developed residential areas at Belmont and Birchville, which lie beyond the river corridor extent or are landward of erosion hazard areas. Seaview is also a high-risk area.

Moderate and lower risk means property damage is not likely until the structural standard is exceeded (when damages would be higher), and life-threatening situations may develop where water is deep. Lower- and moderate-risk areas extend over much of the floodplain.

Hazard Effects on the Floodplain

If flooding occurs in developed floodplain areas, roads will tend to form *overflow paths* of fast-flowing water, while built-up areas often become slow-flowing and sometimes deep-*ponding areas*. Both can be dangerous for people. While fast-moving waters can sweep people off their feet, deep-ponding areas have their obvious dangers.

A large flood could inundate much of the floodplain. Unprotected areas will be affected just as severely as some river corridor areas. In protected locations, any breaching or overtopping of the stopbanks is likely to cause severe disruption, stress and trauma to floodplain occupants. A large breach may result in substantial damages to assets on the floodplain.

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Figures 24 and 25 show the potential extent of flood-prone areas in a 2800 cumec flood with stopbank breaches. They also show the floodplain divided into higher, moderate- and lower-risk floodplain hazard areas.

Figure 24: Hutt Floodplain Hazard Areas (LH)

Figure 25 : Hutt Floodplain Hazard Areas (UH)

Voluntary Actions 5.5

Unlike land-use measures, voluntary actions apply to all Hutt catchment areas. They include providing the community hazard information, and technical and practical advice on ways to avoid the flood hazard or reduce damages. The city councils are the main 'shop front' for information and advice. The Regional Council's main role is to provide information and advice to the city councils.

5.6 Outcomes for Land-Use Measures and Voluntary Actions

So far we have looked at the kinds of areas that are at risk from flooding or erosion, and the magnitude of that risk. We now need to decide on the sorts of land use that are appropriate in these areas, and the extent to which this should be regulated or left to voluntary action.

Tables 6 to 8 take the different geographical areas covered in this Plan (the upper catchment, river corridor and floodplain), and for each of these show the different kinds of land use activities and the appropriate regulatory methods and voluntary actions that could apply to them. These represent the possible measures that could be derived by putting the non-structural principles into practice.

How to Read the Tables

The tables cover land-use and development activities in terms of:

- the type of activity
- a relevant hazard area involved
- whether the activity would require any form of regulatory control (policy and provisions, or rules) in a district plan, or a voluntary action supported by the three councils
- the flood hazard effects being addressed, and the sorts of quality standards that may need to be met
- any transitional measures required.

A probable activity status 1 is given, but only for potential permitted or noncomplying activities. Other activities, which could be regulated, are represented by listed general standards or other requirements.

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on the level of adverse impacts on the environment or neighbours.

The Outcomes: Improving Non-structural Measures

The activity status tells you whether an activity, such as subdividing land for new residential homes, needs a resource consent. If the activity does need a consent (is regulated or not), then the actual status will determine how strongly the application could be scrutinised. The level of scrutiny in turn generally depends

Note: The regulatory status provided in Tables 6 to 8 reflects the principles for non-structural measures. It is an indication of how the principles could be applied and *should only be read as a general guide*. The eventual regulatory status of any activities will be determined during the formal district plan change development, consultation and hearing process.

Tables 6 to 8 only cover activities that reflect the non-structural principles in Section 5.12.

Do you want to know more?

Ref?: Non-structural Measures: Introducing the River Corridor
Ref?: Non-structural measures: National and International Procedures
Ref?: Confirming Non-structural Measures
Ref:? Living with the River Newsletter, May 1999 - Issue No. 5: Non-structural Measures.

Ref:? Investigation of International Non-structural Procedures for Floodplain Management
Ref:? Upper Catchment Investigations

Table 6: Proposed Land-Use Measures: Upper Catchment

Activity	Regulate/Control	Voluntary Action
Earthworks	Annual rate of earthworks – UHCC District Plan	Monitor and investigate vegetation clearance and soil excavation in the upper catchment
General	Policy in UHCC District Plan	Forward forestry development and harvesting notices to WRC
	Recognise flood hazard responsibilities between UHCC and WRC and general effects on flood risk	 Monitor land-use changes Monitor rural subdivision Promote WRC policy covering WRC land management in the upper catchment land influencing the flood hazard Promote WRC policy to manage the flood risk in the upper catchment

Table 7 : Proposed Land-use Measures: River Corridor Hazard Areas

River Corridor	Primary Riv	er Corridor	Secondary R	liver Corridor
Activity	Regulate/Control	Voluntary Action	Regulate/Control	Voluntary Action
Habitable buildings	Resource consent required – such as for a non-complying activity for any habitable buildings		Resource consent required – such as for a non- complying activity for areas not currently zoned for that activity	
			New buildings require mitigating 2300 flood effects – in greenfield areas currently zoned for that activity	
			Erosion protection required for building adjacent to narrative erosion areas	
Accessory buildings and ancillary structures	Permitted activity – for residential zones requires performance standards governing size and adverse effects to be met For other areas, resource consent may be required controlling:	Provide information for a range of flood scenarios, and encourage alternative siting	Same as for <i>Primary River</i> Corridor	Same as for <i>Primary River</i> Corridor
	 setback of structures from flood protection structures Dimension and orientation of structures 			
	orientation of structures			

River Corridor	Primary Riv	er Corridor	Secondary R	River Corridor
Activity	Regulate/Control	Voluntary Action	Regulate/Control	Voluntary Action
Buildings associated with strong community reliance These are buildings that house important activities which the community or parts of it strongly rely on for their day-to-day functioning (e.g., work places)	Resource consent required – such as for a non-complying activity for any buildings with strong community reliance		Resource consent required controlling: • mitigating effects of 2300 flood – on land currently zoned for that activity (greenfield site) • mitigating effects of 1900 flood – on land currently zoned for that activity (existing developed areas)	Encourage landowners and developers to mitigate effects of a 2300 flood
Buildings with lesser or no community reliance (including all other buildings)	Permitted activity – requires meeting performance standards, on land currently zoned for that activity	Encouraged to mitigate 2300 cumec flood effects (including maintaining safety of the flood defence system)	Permitted activity – requires meeting performance standards, on land currently zoned for that activity	Provide information on a range of flood scenarios for: constructing buildings to various flood standards (encouraging the 2300 standard) siting away from flow paths, protecting key parts of operation.
Subdivision	Resource consent required – such as for a non-complying activity in areas <i>not</i> currently zoned for that activity New property titles tagged where they would not be protected from erosion or flooding.	Strongly discouraged where the resulting uses expose people and assets to an increased hazard level	Same as for <i>Primary River</i> Corridor	Discourage subdivision for habitable use where new development is intended outside existing intensive development zones

River Corridor	Primary Riv	Primary River Corridor		liver Corridor
Activity	Regulate/Control	Voluntary Action	Regulate/Control	Voluntary Action
Subdivision – minor boundary adjustments	Permitted activity		Permitted activity	
Earthworks	Permitted activity – required to meet performance standards avoiding or mitigating adverse flood hazard effects		Permitted activity – required to meet performance standards avoiding or mitigating adverse flood hazard effects	
Hazardous substances – existing areas	Requiring secure storage in a 2300 flood	Information on how to mitigate effects of a 2800 flood will be provided New land uses requiring hazardous substances as a key part of their daily operations will be discouraged from locating in river corridor	Same as for <i>Primary River</i> Corridor	Same as for <i>Primary River</i> Corridor

River Corridor	Primary Riv	er Corridor	Secondary F	River Corridor
Activity	Regulate/Control	Voluntary Action	Regulate/Control	Voluntary Action
Critical facilities Healthcare and emergency services	Resource consent required – such as for a non-complying activity	Alternative siting of key facilities will be promoted	Resource consent required – such as for a non- complying activity	Encourage alternative siting of new healthcare facilities and emergency services
Key Network facilities Key Network facilities are those parts of a utility service critical for ongoing function. Damage to these parts would considerably worsen flooding impacts, particularly as they may not be quickly repaired. Critical facilities are buildings and services where disruption to their associated activities would significantly worsen the potential impacts of a flood.	Resource consent required controlling new and redeveloped key facilities, ensuring they can operate in a 2800 flood Permitted activity — requiring new sewerage and water supply networks to be protected from erosion and scour effects to the 1900 standard	Promote alternative siting of key facilities away from the river corridor 2800 standard contingency plans encouraged for existing facilities	Same as for <i>Primary River</i> Corridor	Same as for <i>Primary River</i> Corridor
New and upgraded bridges	Resource consent required controlling bridges and their associated floodways passing a 2800 cumec flood without adversely affecting any flood defences, or raising upstream flood levels. Akatarawa Bridge is excluded from the 2800 requirement.			

River Corridor	Primary River Corridor		Secondary R	iver Corridor
Activity	Regulate/Control	Voluntary Action	Regulate/Control	Voluntary Action
Information on property titles	Hazard information will be tagged on <i>new property titles</i> where proposed structural works would not protect those properties from: • an identified river erosion hazard • a 2300 flood affecting greenfield areas, or a 1900 flood in existing developed areas.		Same as for <i>Primary River</i> Corridor	

River Corridor	Primary River Corridor		Secondary Riv	ver Corridor
Activity	Regulate/Control	Voluntary Action	Regulate/Control	Voluntary Action
Transitional measures	For land exposed to the flooding hazard, tag information on:		Same as for <i>Primary River</i> Corridor	
These apply while programmed structural	new property titles			
measures to improve flood protection are completed.	 new buildings and significant extensions (where practical and feasible). 			
	Flood hazard information equates to at least:			
	 an identified river erosion hazard 			
	• 1900 cumec flooding.			
	The river corridor boundary at Belmont will be modified following completing bank edge protection works.			

Table 8 : Proposed Land-use Measures : Floodplain Hazard Areas

Floodplain	Higher Ri	sk Areas	Low-to-Moder	ate Risk Areas
Activity	Regulate/Control	Voluntary Action	Regulate/Control	Voluntary Action
Habitable buildings	Resource consent required controlling: • new buildings mitigating 1900 flood effects	Encourage mitigating the effects of a 2300 flood Provide information for the 2300 flood to support constructing buildings to manage flood hazard effects, including flow	No controls recommended	Encourage mitigating the effects of flooding from stopbank breaches or overtopping Provide information for a range of flood breach scenarios to support constructing buildings to manage flooding effects, including ponding and flow
Accessory buildings and ancillary structures		Provide information for a range of floods to support constructing buildings and structures to withstand flow effects	No controls recommended	Same as for Higher Risk Areas
Buildings associated with strong community reliance	Resource consent required controlling mitigating 1900 flood effects – on land currently zoned for that activity	Discourage constructing new buildings in areas not currently zoned for that activity	No controls recommended	Encourage mitigating 2300 cumec flood effects
Buildings with lesser or no community reliance		Encourage mitigating 2300 cumec flood	No controls recommended	

Floodplain	Higher Ri	sk Areas	Low-to-Moder	ate Risk Areas
Activity	Regulate/Control	Voluntary Action	Regulate/Control	Voluntary Action
Subdivision – for uses outside existing zones	Resource consent required – such as for a non-complying activity in areas <i>not</i> currently zoned for that activity	Strongly discouraged where the resulting uses expose people and assets to an increased hazard level	No controls recommended	Same as for Higher Risk Areas
	New property titles tagged where they would not be protected from erosion or flooding			
Subdivision – minor boundary adjustments	Permitted activity		No controls recommended	
Earthworks	Requires avoiding or mitigating adverse flood effects		No controls recommended	Provide information for a range of flood-breach scenarios to support placing fill appropriately
Hazardous substances – existing areas	Resource consent required controlling the securing of substances for a 2300 flood	Mitigating the effects of a 2800 flood will be encouraged	No controls recommended	

Floodplain	Higher Ri	sk Areas	Low-to-Moder	ate Risk Areas
Activity	Regulate/Control	Voluntary Action	Regulate/Control	Voluntary Action
Critical facilities				
Healthcare and emergency services	Permitted activity: new in-patient services required to demonstrate ability to operate services in a 2800 cumec flood new out-patient facilities and emergency services to produce contingency plans meeting the 2800 cumec standard	Alternative siting of new and any existing healthcare facilities and emergency services will be encouraged	Permitted activity for new in-patient services — required to demonstrate ability to operate services in a 2800 cumec flood	New and existing outpatient healthcare facilities and emergency services will be encouraged to produce contingency plans detailing how they will manage a 2800 flood with breaches Provide information for a range of flood breach scenarios to support appropriate siting of emergency services
Key Network Utilities	 Permitted activity: new and redeveloped key facilities required to ensure they can operate in a 1900 cumec flood new networks for sewerage and water supply to meet the 1900 flood standard 		No controls recommended	New and existing network utility facilities will be encouraged to produce contingency plans detailing how they will manage a 2300 flood with breaches Provide information for a range of flood-breach scenarios to support appropriate siting of emergency services

Floodplain	Higher Ris	k Areas	Low-to-Modera	ate Risk Areas
Activity	Regulate/Control	Voluntary Action	Regulate/Control	Voluntary Action
Information on property titles Included as a transitional measure until new structural works are in place	Hazard information will be tagged on new property titles where proposed structural works would not protect those properties from: • an identified erosion hazard • a 2300 flood affecting greenfield areas, or a 1900 flood in existing developed areas		Hazard information will be tagged on new property titles where proposed structural works would not protect those properties from: • an identified erosion hazard • a 2300 flood affecting greenfield areas, or 1900 in existing developed areas	
Transitional measures These apply while programmed measures improving flood protection are completed.	For land exposed to the flooding hazard, tagging information on: new property titles new buildings and significant extensions (where practical and feasible). Flood hazard information equates to at least: an identified river erosion hazard 1900 cumec flooding.		Same as for Higher Risk Areas	

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5.7 Emergency Management Programmes and Procedures

Emergency management under the Hutt River Floodplain Management Plan covers flooding caused by the Hutt River. The strategies encompass the entire Hutt Valley, including the upper catchment areas, the Hutt River corridor and the Hutt River floodplain. Emergency management targets communities at risk from flooding, but also aims to build an environment of self-help and mutual support within the wider community so that people are better able to manage their own emergency response.

Emergency management is provided by emergency management departments of Hutt and Upper Hutt City Councils, and the Regional Council, with the assistance of the emergency services and many voluntary organisations.

The Four Rs of Emergency Management

1. Reduction of Risk

Strategies that reduce the chances of a hazard occurring, or lessen the consequences when it does happen. Current risk reduction strategies include:

- flood hazard analysis
- flood modelling
- flood mapping
- economic assessments
- land-use measures (e.g. building floor-level requirements)
- structural flood protection works
- hazard-related resource consent submissions

2. Readiness

Strategies that prepare for emergency response. Current readiness strategies include:

- warning systems (sirens)
- school education programmes
- community response training
- public education through displays, presentations, and media campaigns
- mutual aid agreements for assistance
- council emergency plans
- training exercises
- emergency services co-ordination meetings
- emergency radio communication networks
- weather warnings headquarters staff training
- monitoring equipment for river alert levels
- emergency resource databases
- pre-emergency contractual agreements for service.

3. Response

Strategies for counteracting the emergency when it occurs. Current response strategies include:

- response plan activation
- emergency operations centre activation
- co-ordinating the response of lifeline organisations
- 24-hour callout procedures
- sandbagging operations
- information release to the media.
- emergency works
- evacuation procedures
- call centre activation
- civil defence centre activation
- welfare centre activation
- international assistance reception.

4. Recovery

Strategies to return the community back to how it was (or better than it was) prior to the emergency. Current recovery strategies include:

- appointing a recovery manager
- recovery plan activation
- mayoral relief fund
- central government assistance
- business continuity plan activation
- relocation plan
- emergency housing provision.

5.8 Outcomes of Emergency Management Measures

The focus of the emergency management measures in this Plan is to increase the service or coverage provided by the councils for all people at risk from the direct or indirect effects of flooding. This does not mean that current emergency management measures are insufficient. It means we want to enhance the current systems to take advantage of new opportunities and innovations.

Major recommendations arising from a joint council evaluation of current emergency management measures are presented in the following table.

Table 9 : General Recommendations for Major Projects

Priority	Task	Funding
Urgent	Seismic study of earthquake hazard in the Hutt Valley	Conducted by the Institute of Geological and Nuclear Sciences – funded through EQC research grant or Council
	Identification of how this hazard may affect flooding and protection works	contributions
	Develop co-ordinated council procedures for media management and utilisation in local and regional events	A joint venture with in-kind contribution from all councils
High	Investigate the value of real-time response information provided via the internet	UHCC, HCC and WRC internal investigations – implementation costs as required from within current budgets
	Develop appropriate packages, if necessary, based on the investigation findings	
	Design a format for flood hazard maps and information that is simple enough to provide to the public	A WRC project to meet the needs of HCC and UHCC
	Investigate the effectiveness of siren systems in the Upper and Lower Hutt Valley	HCC and UHCC projects – funding for implementation will be sought if required
	Upgrade the systems, if necessary, based on investigation findings	
Medium	Investigate landslide hazards in Upper Hutt that may add to flood hazard or damage flood protection works	UHCC project – requires funding
	Investigate hazards on the floodplain that may be triggered by floods (e.g. hazardous substance spills)	HCC and UHCC projects – within current budgets
	Investigate alternate method for distributing preparedness information (e.g. internet, visual methods, signage etc.)	A joint project of all councils within current budgets
	Formalise plan for tracking evacuees who have left the floodplain	HCC and UHCC projects – within current recovery planning
	Develop and agree procedures for administering mayoral relief funds, applying after a flood	A HCC and UHCC project – within current recovery planning
Low	Assess the wider economic impact of flooding for the Lower Hutt Valley	A HCC project to build on known economic effects of flooding
	Investigate sustainable supplies of sand available for sandbagging in the lower valley	A HCC logistics project – within current budgets
	Investigate appropriate alternatives for providing long-term accommodation for evacuees on or away from the floodplain	A joint project of all councils – within current recovery planning

Timeframes

Possible timeframes for implementing these measures can be matched with the priority levels for major projects. These timeframes are also subject to the long-term financial and annual planning requirements of the city councils. As a guideline:

Urgent tasks should be completed in 2002–2003

High priority tasks should be completed by 2004

Medium and Low priority tasks should be completed by 2006–2007

5.9 Implementing Non-structural Measures

Implementing non-structural measures from the principles contained in Chapter 3 will begin immediately after the release of the Plan. Upper Hutt and Hutt City Councils are primarily responsible, although the specific timing and sharing of responsibilities with the Regional Council needs further discussion and agreement between the three councils.

Brochures, maps and technical information would be provided to support voluntary actions. Land-use regulatory methods require considering changes to the city councils' district plans. Emergency management procedures that require upgrading will be targeted, with work commencing immediately.

Do you want to know more?

Ref: ? Confirming Non-structural Measures

Ref: ? Civil Defence Act 1983

Ref: ? Emergency Management Bill 2000

Ref: ? Hutt City Council Civil Defence Plan

Ref: ? Upper Hutt City Council Civil Defence Plan

Ref: ? Wellington Regional Council Civil Defence Plan

5.10 Developing Non-structural Principles

In the first part of this chapter we looked at three main kinds of non-structural measures, and how they could be applied to flood mitigation in the Hutt Valley. These measures were arrived at by working with a selection of guiding principles, which in turn were developed after a decision was made on the size of flood we wanted to protect against (the *design standard*). So, the reasoning goes: if we want to protect against *this* sort of flood, then we need to keep *these* things in mind (the principles) and consider carrying out *these* kinds of actions (the measures).

The non-structural measures principles provide broad standards to guide the way *residual* flood hazard risk in the Hutt Valley needs to be handled. In other words, the way flood-prone land is managed, structures are constructed, and how the community prepares to cope with flooding.

As we have seen, the principles provide the framework for the types of non-structural measures to be implemented as:

- the policies and provisions of council district plans
- voluntary action, information and advice
- emergency management programmes and procedures.

A risk-based approach was used to guide the choice of possible non-structural measures, including the balance between the different sorts of measures.

Developing these principles and outcomes concludes 18 months of work over 1998 and 1999, with input from Hutt City, Upper Hutt City and Wellington Regional Council officers, the Advisory Committee and the public. This does not mean that all the work is finished: we need to remain flexible to modify non-structural outcomes where it is practical and necessary to do so.

5.11 Why the Principles have been Developed

Land Use

The cities' district plans are key tools for implementing the land-use measures. However, both Upper Hutt and Hutt cities' proposed district plans were prepared before the non-structural measures principles were developed for the Plan. This has meant that very few flood hazard management policies and provisions have been included in either district plan so far.

Voluntary Action

Voluntary action plays a crucial role in reducing flooding impacts. The availability of flood hazard information and practical advice from the three councils to support action has until now been limited.

Emergency Management

While existing programmes and procedures provide a broad coverage for the Hutt Valley, the need to upgrade them and improve co-ordination has been recognised.

5.12 Principles for Non-structural Measures

The principles for non-structural measures guide the development of measures that improve the community's resilience to flooding by:

- ensuring the flood protection system is not compromised by development
- appropriately managing flood hazard effects
- discouraging certain new land uses in the river corridor
- encouraging more intensive land uses to be sited in alternative locations, reducing exposure to the flood hazard
- encouraging appropriate land-use practices in upper catchment areas
- allowing flexible mitigation solutions
- providing the community with advice and information so it can be better equipped to cope with flooding
- ensuring emergency management programmes and procedures are comprehensive.

In improving the community's resilience, the principles also account for historical patterns of development and associated amenity issues.

Proposed non-structural measures are considered under the following categories and activities, or locations.

Land-Use Measures:

- 1. Measures for the upper catchment
- 2. Habitable buildings
- 3. Accessory buildings and ancillary structures
- 4. All other buildings
- 5. Subdivision
- 6. Earthworks
- 7. Hazardous substances
- 8. Critical facilities

- 9. Capacity of new bridges
- 10. River corridor land remaining in public ownership
- 11. Information on property titles
- 12. Voluntary actions

and Emergency Management Programmes and Procedures

Land-use measures, applying to the *upper catchment*, *river corridor*, and *floodplain*, are presented in the tables below.

1. Measures for the Upper Catchment

Rate of Earthworks

UHCC will have the ability to control the annual rate of earthworks.

Policy in District Plans

Policy in the UHCC district plan will clearly recognise flood hazard management responsibilities between UHCC and WRC general effects on the flood risk.

2. Habitable Buildings

Primary River Corridor

- Constructing any habitable building to the 2300 cumec standard on land zoned for that purpose will require 1900 (developed areas) or 2300 (greenfield areas) standard erosion protection to be provided.
- The landowner or developer will provide erosion protection. The protection standard, buffer requirements, ongoing maintenance and ownership responsibilities, and costs will also need to be provided for.

Remaining River Corridor

Mitigating Flood Hazard Effects

- Constructing habitable buildings in greenfield areas currently zoned for that use will require 2300 flood effects to be mitigated.
- Constructing new habitable buildings will be discouraged in areas not currently zoned for that land use.

No Adverse Flood Hazard Effects Caused

Constructing habitable buildings will require adverse flood hazard effects to be avoided or mitigated.

Higher Risk Floodplain Hazard Areas

Mitigating Flood Hazard Effects

• All new habitable buildings and significantly redeveloped habitable buildings will be required to mitigate the flood effects of a 1900 cumec flood.

 Developers and landowners will be strongly encouraged to mitigate the effects of a 2300 cumec flood.

Low- to Moderate-Risk Floodplain Hazard Areas

Mitigating Flood Hazard Effects

Developers and landowners protected by stopbanks will be encouraged to consider mitigating the effects of flooding from stopbank breaches or overflows.

3. Accessory Buildings and Ancillary Structures

Primary River Corridor and Higher-Risk Floodplain Hazard Areas Associated with Residential Zones

Building Permitted

Accessory buildings and ancillary structures will be permitted in erosion hazard areas and higher-risk floodplain areas currently zoned for residential purposes.

Mitigating Flood Hazard Effects and Alternative Sites Encouraged

Where practicable, developers and landowners will be encouraged to site accessory buildings and ancillary structures outside the erosion hazard areas and flow paths. Where alternative siting is not possible or desired, encouragement will be given to:

- strengthen buildings/structures to withstand flood hazard effects
- elevate floor levels
- build relocatable buildings.

Remaining River Corridor

No Adverse Flood Hazard Effects

- Accessory buildings and ancillary structures will require adverse flood hazard effects to be avoided or mitigated.
- The setback distance from flood protection structures, and the dimensions and orientation of structures, will determine whether effects are likely to be minor.

Mitigating Flood Hazard Effects and Alternative Sites Encouraged

Where practicable, developers and landowners will be encouraged to site accessory buildings and ancillary structures outside the primary river corridor. Where alternative siting is not possible or desired, encouragement will be given to:

- strengthen buildings/structures to withstand flood hazard effects
- elevate floor levels
- build relocatable buildings.

4. All Other Buildings

(excluding habitable buildings accessory buildings ancillary structures)

Primary River Corridor

- Constructing any building to the 2300 cumec standard on land zoned for that purpose will require 1900 (developed areas) or 2300 (greenfield areas) standard erosion protection to be provided.
- The landowner or developer will provide erosion protection. The protection standard, buffer requirements, ongoing maintenance and ownership responsibilities and costs will also need to be provided for.

Remaining River Corridor and Higher Risk Floodplain Hazard Areas

New Buildings Discouraged

Landowners and developers will be strongly discouraged from siting new buildings in the river corridor. Exposing new buildings to the flood hazard in high risk areas represents unwise floodplain management planning. Selecting alternative sites away from the river corridor will be encouraged.

No Adverse Flood Hazard Effects

All buildings and associated site modification must not cause adverse flood hazard effects.

Compatible with the Plan's Environmental Strategy

Buildings in the river corridor need to be compatible with the predominant uses in the river corridor, including open space, recreation and rural activities. These uses are also generally consistent with the linear park concept, and the general vision for the river corridor area promoted through the Plan's Environmental Strategy.

Buildings Associated with Strong Community Reliance²

Managing the 2300 Flood in Unprotected Greenfield Areas

New buildings constructed in unprotected greenfield areas currently zoned for that land use will require mitigating the effects of a 2300 flood. New buildings will not be allowed in the primary river corridor.

Managing the 1900 Flood in Higher Risk Floodplain Hazard Areas

- New buildings and significantly redeveloped buildings in currently developed higher-risk floodplain areas will be required to mitigate the effects of a 1900 flood.
- Landowners and developers will be strongly encouraged to mitigate the effects of a 2300 flood.

Buildings with Lesser or No Measurable Community Reliance That Concentrate People

Developers and land owners will be strongly encouraged to mitigate the 2300 cumec flood effects for new buildings that concentrate people infrequently. These buildings include sports clubrooms, and smaller-scale commercial and industrial developments.

Buildings Adjacent to Narrative Erosion Areas

Providing Erosion Protection

- Landowners and developers may need to provide erosion protection, and the ongoing maintenance of that protection, for buildings intended for sites adjacent to narrative erosion areas. Erosion protection requirements are additional to mitigating other flood hazard effects.
- Individual buildings will be discouraged from siting in these locations because it may not be feasible to provide erosion protection for single houses. Considerations for new erosion protection include:
 - construction standards
 - who owns and operates the structures
 - who pays for ongoing maintenance and repair
 - providing ability to disperse ponded flood waters
 - providing for residual risk.

Community Reliance is defined in the Glossary.

Low to Moderate Risk Floodplain Areas

Mitigating Flood Hazard Effects

Developers and landowners protected by stopbanks will be encouraged to mitigate the effects of flooding from stopbank breaches or overtopping.

5. Subdivision

River Corridor and Higher Risk Floodplain Hazard Areas

Erosion Hazard Areas: Purpose is Constructing Habitable Buildings

Subdivision in erosion hazard areas for the purpose of constructing new habitable buildings will not be allowed.

Restrictions Outside Existing Zones

Subdividing land intended for uses outside existing zones will be non-complying, apart from minor boundary adjustments.

New Subdivision Discouraged

Subdivision will be strongly discouraged where the resulting uses expose people and assets to an increased flood hazard level.

6. Earthworks

River Corridor and Higher Risk Floodplain Hazard Areas

No Adverse Flood Hazard Effects Caused

- Earthworks, including filling and excavation, will be required to avoid or mitigate adverse flood hazard effects.
- The setback distance from the stopbank, and the volume and orientation of earthworks will determine whether the effects are likely to be minor.

7. Hazardous Substances

River Corridor and Higher Risk Floodplain Hazard Areas

Existing Areas Zoned for Using Hazardous Substances

Securing Stored Substances: Stored hazardous substances must be secure in a 1900 cumec flood.

Additional Mitigation Encouraged

Developers and landowners will be given information on how they can mitigate the effects of a 2800 cumec flood.

New Associated Uses Discouraged

Intended new commercial and industrial land uses that require hazardous substances as a key part of their daily operations will be discouraged from siting in the river corridor.

8. Critical Facilities

River Corridor

Healthcare Facilities and Emergency Services

New healthcare facilities and emergency services will not be established in the river corridor.

Key Network Utilities Managing Flood Effects

Key network utility facilities will be required to ensure they can operate in a 2800 cumec flood. (Alternative siting away from the river corridor will be promoted.)

Higher Risk Floodplain Hazard Areas

Healthcare Facilities and Emergency Services Managing Flood Effects

- New in-patient healthcare facilities will be required to show they can operate services in a 2800 cumec flood.
- New out-patient facilities and emergency services will be required to produce contingency plans detailing how they will manage a 2800 cumec flood.

Alternative Siting Encouraged

Alternative siting of healthcare facilities and emergency services away from higher risk floodplain areas will be encouraged.

Key Network Utilities Managing Flood Effects

Key network utility facilities will be required to ensure they can operate in a 2800 cumec flood. (Alternative siting away from the river corridor will be promoted.)

Moderate and Lower Risk Floodplain Hazard Areas

Emergency Services, Healthcare Facilities and Network Utilities Managing Flood Effects

- New and existing in-patient healthcare facilities will be required to show they can operate services in a 2800 cumec flood with breaches.
- New and existing out-patient facilities and emergency services will be encouraged to produce contingency plans detailing how they will manage a 2800 cumec flood with breaches.

9. Capacity of New and Replaced Bridges

Passing the 2800 Cumec Flood

New bridges will be required to pass a 2800 cumec flood without adversely affecting any flood defences, or raising upstream flood levels. Akatarawa Bridge (Birchville) is excluded from the 2800 cumec requirement.

10. River Corridor Land Remaining in Public Ownership

Land should remain in public ownership enabling:

- flood hazard effects to be more easily managed
- land uses to be actively discouraged from siting in the River Corridor.

11. Information on Property Titles

Tagging hazard information on new property titles

Hazard information will be tagged on new property titles where proposed structural works would not protect those properties from:

- an identified river erosion hazard³
- a 2300 flood affecting greenfield areas, or 1900 flood in existing developed areas.

Tagging hazard information on new structures and additions

Where practical and feasible, hazard information will be tagged on existing titles where new buildings and major additions are constructed. Affected titles are those where proposed structural works would not protect those properties from:

- an identified river erosion hazard⁴
- a 2300 flood affecting greenfield areas, or 1900 flood in existing developed areas.

Accessory structures and ancillary buildings will be excluded from these requirements.

12. Voluntary Actions

Upper Catchment

Voluntary actions in the upper catchment will include:

- monitoring and investigating the effects of vegetation clearance and soil excavation in the upper catchment
- forwarding forestry development and harvesting notices to the WRC
- monitoring land-use changes
- monitoring rural subdivision
- developing WRC policy affecting WRC upper catchment land
- developing WRC policy to manage the flood risk in the upper catchment

Uses sections 221(1) and 224(c) of the Resource Management Act 1991 to achieve this.

Uses sections 221(1) and 224(c) of the Resource Management Act 1991 to achieve this.

River Corridor

Voluntary actions in the river corridor will include providing information for a range of flood scenarios to support:

- constructing ancillary structures and accessory buildings
- constructing other buildings to the 2300 flood standard, and siting in alternative locations.

Floodplain

Voluntary actions in the floodplain will include:

- providing information for a range of flood breach scenarios affecting moderate and lower risk areas to support:
 - constructing buildings to manage flooding effects, including ponding and flow
 - appropriate siting of emergency services
 - placing fill
- providing information for the 2300 cumec flood affecting higher risk areas to support:
 - constructing ancillary structures and accessory buildings to withstand flow effects
 - constructing habitable buildings to manage flood effects.

Providing Information to Support Voluntary Actions

The Regional Council will provide flood hazard information to Hutt and Upper Hutt City Councils, and directly to the community where appropriate. The city councils have the primary responsibility for passing information to the community.

Information will include:

- floodplain risk area maps
- river corridor plans
- flood extent maps
- more detailed depth and flow information for all flood-prone areas.

This information will be reproduced through LIMS and PIMS⁵ as appropriate.

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⁵ LIM stands for land information memorandum, while a PIM is a property information memorandum. They contain a wide range of information about a chosen parcel of land, including the presence of access easements or natural hazards, or services such as stormwater drains. Including all publicly available hazard

Flood hazard information should also be provided in brochures on flood risk, targeting localised areas. This may be supported by basic material covering emergency management to provide a full round-up of non-structural measures. The extent, nature and form of the information is still to be decided.

An additional brochure series describing localised floodplain management planning measures is intended as support for the Plan document. The brochures would be produced by the Regional Council, and be limited in detail. Therefore, both Hutt and Upper Hutt City Councils would need to consider producing more detailed information in a promotional form.

5.13 Emergency Management Measures

Emergency management is a core business function of local government. The Civil Defence Act 1983 requires local and regional councils to plan and prepare for flood emergencies.

The Hutt City, Upper Hutt City and Wellington Regional Councils endorse the Four Rs of comprehensive and integrated emergency management and sustainable hazard management. This is an 'all hazards' approach, and requires co-ordinated planning for managing floods ranging from 'puddles to floods'.

The following are key principles developed for emergency management programmes and procedures.

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information in LIMS and PIMS is a statutory requirement. Guidance may be given for the way this information is presented.

Emergency Management Programme and Procedures

Emphasising Individual Responsibility

Programmes and procedures will encourage Hutt Valley residents to manage themselves in a flood. A resilient community is made up of people who are prepared to respond and recover.

Reviewing Measures Regularly

Conduct regular reviews of all emergency management programmes and procedures to ensure they are:

- Relevant
- Current
- Appropriate

Covering Extreme Floods

Ensure measures adequately cover extreme floods beyond the design standard flood.

Programming Enhancements

Plan to enhance measures identified during the initial review of emergency management measures (December 1999 to March 2000). Considerations include:

- options for enhancing measures
- timeframes for implementation
- funding and resourcing requirements
- expected outcomes

Considering Timeframes for Structural Measures

Provide information on the timing for structural works. A focus should be on milestones when works significantly improve safety of floodplain areas.

Providing Information

Provide the community with simple, visual, correct and accessible information.

Prioritising Communities at Risk

Ensure that people in flood-prone areas are receiving an acceptable level of emergency management information and advice. Residents in higher-risk floodplain areas would be given first priority for receiving new information and advice.

Modifying Information According to Risk

Modify advice and information to highlight differences in the risk and likely consequences of flooding across flood-prone areas.

Improving Connections with the Media

Improved links between the media and emergency managers are necessary to ensure the community has basic and accurate information during and after floods.

Improving Links with Emergency Services

Current emergency management co-ordination between the councils and emergency services will be improved.

5.14 Policy Supporting Non-structural Measures

The policies that were the basis for developing non-structural measures are provided in this section. Policies support the non-structural principles, and the way in which measures will be developed and implemented from the principles.

5.15 Non-structural Measures Policies

Non-structural Measure Policies - Quick Reference

Policy 27:	Providing Flexibility for Agreed Non-structural Principles
Policy 28:	Principles Guiding Non-structural Measures
Policy 29:	Developing Balanced Measures Appropriate to Hutt Valley
Policy 30:	Applying Risk-based Approach to Non-structural Measures
Policy 31:	Sharing Responsibilities for Implementing Measures
Policy 32:	Using Flexible Mitigation Methods

Policy 27: Providing Flexibility for Agreed Non-structural Measures Principles

I ssue

Non-structural measures principles have been developed, modified and finalised relatively quickly and the final principles and associated outcomes are reasonably complex. Therefore the implications for how the measures should be developed need further examination at the local level.

Policy

The Hutt and Upper Hutt City Councils require flexibility to develop non-structural measures in a way that enables a number of matters to be considered. These include, but are not limited to, legal validity, annual plan priorities, difficulties of implementing measures, and fairness and balance.

Explanation

The flexibility described in this policy will provide the three councils with the necessary forum to continue exchanging ideas and developing sound non-structural solutions.

Policy 28: Principles Guiding Non-structural Measures

Lssue

The potential look and make-up of the eventual non-structural measures need to be clearly understood by all three councils. Developing guiding principles, or brief and clear statements of intent, supports this need.

Policy

The comprehensive suite of non-structural measures principles will be used to further develop, refine and implement non-structural measures.

Explanation

The principles clearly guide the way residual flood hazard risk in the Hutt Valley needs to be managed. The principles are a reference point to guide further development of land-use and emergency management measures.

Policy 29: Developing Balanced Measures Appropriate to the Hutt Valley

I ssue

Non-structural measures can impose significant restrictions on land uses in floodprone areas. Measures must balance landowner rights against a need to reduce flood impacts on people directly at risk. In achieving this balance, measures must not only be reasonable and fair, but also responsible. This requires using a wide range of nonstructural tools to achieve the desired balance.

Policy

- 1. The non-structural measures principles will require that final measures be balanced, fair, and responsible. Recommended measures must also be legally sound.
- 2. Balanced measures will require:
 - applying a risk-based approach (rather than applying one flood standard), which treats land-use activities at varying locations more fairly
 - developing voluntary actions enabling the suitability of proposed policies and provisions to be tested
 - forming legally defensible and enforceable policies and provisions, which are not difficult for councils to implement
 - ensuring adverse amenity effects are not likely to be significant, including adverse visual, noise, access and general amenity.
- 3. Wide-ranging measures will provide appropriate non-structural solutions, including:
 - land use policy and provisions in district plans
 - information and advice encouraging voluntary action
 - emergency management programmes and procedures.

Explanation

This policy requires that non-structural measures be balanced. This means that dangers posed by the potential hazard are balanced against costs and the practicalities of implementing measures. Balance does not mean that strong non-structural measures should not be considered. Legal advice has generally moderated the principles, making them fairer. Moderating adverse amenity effects, developing voluntary actions, and using a risk-based approach to develop measures are all ways to help ensure that balance is achieved.

Policy 30: Applying a Risk-based Approach to Non-structural Measures

I ssue

The Regional Council has endorsed a risk-based approach for flood protection in the Hutt Valley for non-structural measures. This approach has been used to determine the balance between the design standard and individual structural measures for the Hutt River. There are merits in applying the same approach to non-structural protection in order to account for varying flood hazard risk.

Policy

Non-structural measures need to be developed in a way that accounts for the varying flood hazard risk between the various flood-prone areas.

Explanation

A varying non-structural protection standard not only responds to the varying flood hazard affecting different river corridor and floodplain areas, but also retains consistency with the design standard.

Policy 31: Sharing Responsibilities for Implementing Measures

I ssue

While Hutt City and Upper Hutt City Councils are the primary implementers of nonstructural measures, responsibilities for further developing and implementing measures, also involving the Regional Council, need to be clarified.

Policy

- District Plan change process: both city councils will drive the plan change or variation processes. However, the Regional Council will have an active role helping to form district plan policy and provisions, and supporting the councils during consultation, under the city councils' direction.
- Voluntary action: the Regional Council will play a support role to the city councils by providing technical flood hazard information.
- Emergency management procedures and programmes: while the city councils
 are primarily responsible for implementing measures, the Regional Council is
 available to play a co-ordinating role in providing information and developing
 enhanced measures. Joint-venture projects between the councils will also be
 promoted.

Explanation

The Regional Council's supporting role in further developing and implementing non-structural measures needs further discussion with the two city councils. The Regional Council's normal emergency management functions mean it is positioned to help co-ordinate efforts to enhance emergency management measures. Joint-venture projects have many advantages, including consistency of approach and cost savings. Current civil defence law reform suggests that the Regional Council may play a more significant emergency management administrative role in future.

Policy 32: Using Flexible Mitigation Methods

I ssue

Landowners and developers require flexibility to mitigate flood hazard effects on existing and new land uses. While there is no one correct way of mitigating hazards in flood-prone areas, some methods may be less desirable because they create additional problems.

Policy

Flexible methods that minimise flood hazard effects will be promoted. However, these methods must not cause additional problems such as:

- reducing the integrity of the flood protection system
- creating an unacceptable additional hazard for adjoining land owners and other floodplain occupants
- unduly compromising emergency services
- requiring stronger river alignment control in undeveloped areas
- creating significant ongoing maintenance and costs to the flood protection system.

Explanation

This policy assigns importance to allowing flexibility, while at the same time not creating additional and unacceptable problems. According to this policy there are many reasons why certain land uses may not be appropriate in some instances. That part of the policy is likely to be more relevant for highly hazardous locations, such as erosion-prone river corridor areas.

Do you want to know more?

- Ref: ? Confirming Non-structural Measures
- Ref: ? Resource Management Act 1991
- Ref: ? Civil Defence Act 1983
- Ref: ? Emergency Management Bill 2000
- Ref: ? Hutt City Council Civil Defence Plan
- Ref: ? Upper Hutt City Council Civil Defence Plan
- Ref: ? Wellington Regional Council Civil Defence Plan

Chapter Six

The Outcomes: Enhancing the River Environment

6.1 Introduction

The Environmental Strategy (the Strategy) sets out the long-term vision for developing and managing the Hutt River environment as a *linear park*. The vision of a linear park is to provide a tranquil environment for people to escape the hustle and bustle of urban life and to enjoy the natural character of the river. By its nature, the vision promotes mainly passive uses of the river environment.

This chapter outlines the opportunities for enhancing the River's environment proposed by the Environmental Strategy, and presents policies that support the Strategy. Potential opportunities range from improving areas for passive recreation, to developing indigenous ecological habitats. The Strategy's concept plans, provided at the end of the chapter, support this vision.

6.2 What the Environmental Strategy Is

Kaupapa - Vision

The river and its corridor are developed as a linear park that provides a tranquil environment where people can go to escape the hustle and bustle of urban life, and enjoy the natural character of the river environment.

6.3 The Strategy's Purpose

The Environmental Strategy guides management of the Hutt River and its corridor in a way that:

- maintains and enhances the river environment
- provides for a range of recreational uses
- contributes positively to the community's spiritual, mental and physical well-being.

The Environmental Strategy is governed by the Floodplain Management Plan's general principles. Accordingly, any proposals or activities covered in the Environmental Strategy will not compromise the integrity of the flood defence system.

6.4 Area Covered by the Environmental Strategy

The area covered by the Environmental Strategy runs from Kaitoke Regional Park in the north, to Seaview Marina at the river mouth. Te Ati Awa / Taranaki ki te Upoko te Ika Maui hold manawhenua over the river and the harbour, and are the kaitiaki of the area.

The majority of the land is in public ownership and is administered by either the Upper Hutt City Council, the Hutt City Council or the Wellington Regional Council.

Existing open spaces and habitat connected to the Hutt River were considered in determining which areas should be covered by the Strategy. Current land uses are varied and include recreation areas, farms and forests. Other areas covered by the Strategy are generally industrial.

6.5 Developing the Strategy

The Strategy was developed jointly with iwi, the Regional Council, and the two city councils between 1999 and 2000. The Department of Conservation, NZ Fish & Game and the community also provided input. The concept for the Strategy borrows from similar strategies developed for the Waikanae and Otaki Rivers. Those strategies arose from the community's desire to see the river environment enhanced in a co-ordinated manner as structural works projects were completed. By promoting a wider range of enhancement projects, including areas not directly affected by the structural works, this Strategy is an extension of that initial approach.

6.6 Guiding Principles and Environmental Strategy Policies

The guiding principles were used to develop the concepts, proposals and recommendations for the river and specific areas. They aim to achieve the purpose of the overall Strategy. These guiding principles are to:

- protect and enhance the ecosystems of the river and its margins
- protect and enhance the cultural and historic values of the river and its margins
- protect and enhance the visual quality of the river and its margins
- improve and extend passive recreational facilities
- allow iwi to participate in decision-making and appropriately apply tikanga
- provide for continuing community input.

6.7 Opportunities Promoted by the Strategy

The Strategy contains concept plans involving significant changes to the river environment. These changes can only be implemented incrementally, as funds and opportunities become available. Proposals coming from the Strategy are subject to the resource management process, and resource consents may be required. The landowner's permission must also be gained before any projects are undertaken.

We also include some "kite flying" ideas in the Strategy. These ideas show what *could* be done, not necessarily what *should* be done. They have been included to give further ideas for proposals and to illustrate the overall concept for each area. The feasibility and desirability of "kite flying" ideas need to be investigated closely before they can be implemented.

The following list indicates the priorities for implementing a range of initiatives under the Strategy. The individual items are derived from the reach-based proposals for the river environment.

Table 10: Environmental Strategy Priorities Summary

Priority	Project / Activity		
Urgent	Prepare an ecological management strategy for the Hutt River catchment		
	Support Te Ati Awa in reviewing culturally significant sites and areas		
	Establish a joint management committee, which includes representatives from Hutt and Upper Hutt City Councils, the Regional Council and Te Ati Awa		
	Establish a mechanism for ongoing tangata whenua and community input		
	Trial the use of salt-tolerant plant species for use in bank protection works		
High	Employ a river ranger		
	Control access for cars and motorbikes		
	Prepare a plan to formalise access to and along the whole length of the river		
Medium	Investigate environmental education opportunities		
	Remove barriers to fish movement		
	Develop protocols with other agencies for managing Hutt River ecosystems		
	Erect information boards		
	Upgrade existing tracks		
	Upgrade existing facilities		
	Investigate land acquisition options		
Priority	Project / Activity		
Low	Establish a heritage trail		
	Develop a unified signage system		
	Produce recreational guides		
	Extend tracks and walkways		
	Provide additional facilities		

6.8 Opportunities and Obligations

While the Strategy promotes a range of projects, it does not prescribe what a person or an organisation should do. The proposals were developed using a holistic approach that considered the whole river and its corridor over a 40-year period. On this basis, opportunities for enhancing the river and its margins were identified, regardless of ownership. This approach helps to identify future opportunities that may otherwise be lost.

The recommendations and proposals in the Strategy place no additional obligations on any of the parties involved. They are actions that *can* be adopted if funding becomes available.

6.9 Environmental Strategy Policy

The policies, issues and explanations detailed in the following sections reflect the guiding principles above. They have been derived from reach objectives and guidelines contained in the Environmental Strategy.

The policies apply to the river generally rather than to specific locations or sites. They either:

- direct what is appropriate within the linear park (e.g. to control conflicting recreational uses); *or*
- identify actions for implementation (e.g. upgrade the Hutt River Trail to an all-weather surface).

Environmental Strategy Policies - Quick Reference

Policy 33:	Ecosystems and Ecological Processes
Policy 34:	Maori – History and Cultural Values
Policy 35:	Contemporary History
Policy 36:	Landscape and Visual Quality
Policy 37:	Recreation
Policy 38:	Tangata Whenua and Community

Policy 33: Ecosystems and Ecological Processes

I ssue

Development within the floodplain affects ecological values and processes. In the past this has been at the expense of indigenous ecological values.

Policy

Protect and enhance the ecological values of the river and its margins.

Explanation

The Hutt River – its bed and banks, and the surrounding floodplain – form a series of interrelated ecosystems, each with distinct natural processes. These processes include physical ones such as rainfall and flooding, and biological ones such as plant and animal reproduction, migration and colonisation.

Human activities within these ecosystems affect each process differently. Human development of the floodplain has changed the ecology fundamentally, particularly during the 20th century. Often development has gone ahead without any thought to the effects on indigenous ecological values and processes.

Furthering our collective understanding of the ecological processes, and our effect on them, will help the wider community adapt Environmental Strategy projects to protect and enhance indigenous values.

Policy 34: Maori - History and Cultural Values

I ssue

Te Ati Awa / Taranaki ki te Upoko te Ika Maui hold manawhenua over the river and harbour. Tangata whenua maintain their right to take and manage resources from the river, and retain a tradition of fishing from both banks and the river mouth.

Policies

- Protect and enhance the cultural values of the river and its margins.
- Ensure that tangata whenua participate in the management of the Hutt River, and in implementing the Environmental Strategy.

Explanation

The Hutt River is a taonga of the tangata whenua. It is an important symbol associated with tupuna (ancestors), food and sustenance. The banks are places of Maori settlement, gardens and urupa (burial grounds). The river is tapu because of its association with these features and qualities. There are a number of places that have special significance to tangata whenua, including existing marae, urupa and sites of old settlements.

This policy requires ongoing consultation with tangata whenua to ensure the cultural values of the river are protected and enhanced. Involving tangata whenua in this way is consistent with the Treaty of Waitangi.

Policy 35: Contemporary History

I ssue

Historic sites and structures along the Hutt River form an important part of the area's cultural heritage. The changing history of the area over the last 150 years is reflected along the entire length of the Hutt River and the river corridor.

Policy

Protect and enhance the historic values of the river and its margins.

Explanation

There are many significant historic sites within the linear park. The influx of European immigrants brought changing land uses and buildings. Farming gave way to industries such as saw milling, manufacturing, retailing and boat building, and evidence of these historical developments can still be seen today. The history of the Hutt Valley is in danger of being lost if steps are not taken to preserve sites and educate people about them.

Policy 36: Landscape and Visual Quality

I ssue

The Hutt River and its environment have distinct landscape qualities that are appreciated by the Hutt communities and contribute to the area's unique identity.

Policy

Protect and enhance the visual quality of the river and its margins.

Explanation

The Hutt River and its tributaries were instrumental in creating the floodplain landscape. A few small remnants of the native vegetation that once covered the plain still remain. Almost continuous bands of exotic vegetation, mostly willows, stretch along the banks from Birchville down to the sea. These can restrict people's view and appreciation of the river.

In implementing this policy, consideration must be given to an area's unique identity during the development of Environmental Strategy projects. An area's unique identity is derived from its landscape and visual qualities.

Policy 37: Recreation

I ssue

The Hutt River and its corridor is extensively used for a variety of activities, and there are opportunities to improve recreational amenities. However, conflicts exist between some uses, and particular care is needed to resolve these conflicts and ensure a balanced approach to considering all recreational uses.

Policy

- Improve and extend passive recreational facilities and uses of the river and its margins.
- Consider compatible recreational uses on a reach-by-reach basis, or as otherwise appropriate, in consultation with the community.

Explanation

Given the close proximity to major population centres, the Hutt River is a unique resource greatly valued by the local community. The river and its corridor are well used for recreational activities including angling, swimming, canoeing, rafting and walking, as well as for other more contentious activities such as driving cars and motorbikes, and exercising dogs and horses. There are opportunities to improve areas that are unattractive or where access is difficult, promote the river, and resolve conflicts between users.

Recreational uses are best considered on a reach-by-reach basis as enhancement projects are developed.

Considering contentious activities, such as vehicle access, requires a balanced approach, without compromising the passive recreational focus of the Environmental Strategy. Public discussion and monitoring information should support this process. Monitoring information could include measuring biophysical effects, or the impacts on other recreational users. Activities that may have a major adverse effect on the river environment and impact significantly on other users should be discouraged.

Policy 38: Tangata Whenua and Community

I ssue

Tangata whenua and community involvement is critical to the success of the Environmental Strategy.

Policy

Involve iwi and the community in decision-making and make sure that tikanga is appropriately applied.

Explanation

Kaitiakitanga is an essential part of the relationship tangata whenua have with the environment. Central to Kaitiakitanga is the understanding that successive generations have a responsibility to protect and nurture the mauri of their natural environment.

In some areas local communities have a strong connection with the Hutt River, with good access, views of the river and berms, and a sense of ownership. In these places many of the local residents voluntarily monitor inappropriate behaviour, such as littering and vandalism. In other areas, roads and stopbanks physically and visually limit people's affiliation with the river. Experience has shown that where the local community is actively involved in specific enhancement projects and management, problems littering and vandalism, are reduced.

Ultimately, involving Tangata Whenua and the community should ensure that people's appreciation and enjoyment of the Hutt River and its environment are increased.

6.10 The Concept Plans for Hutt River

The following four concept plans show the Hutt River from Wellington Harbour to Kaitoke Regional Park. The concept plans define each character area or "reach" of the River, detailing the broad environmental objectives and the key proposals for each area. The plans also show existing and proposed access tracks, historic features, open space and recreational facilities, and vehicle access.

Do you want to know more?

Ref?: Hutt River Environmental Strategy

Ref?: Environmental Strategy

Ref: ? Living with the River Newsletter, May 1999 - I ssue No. 4: Environmental

Strategy

Figure 35 : Concept Plans here

Figure 36 : Concept Plans here

Figure 37 : Concept Plans here

Figure 38 : Concept Plans here

Chapter Seven

Implementing and Funding the Plan

7.1 Introduction: Shared Responsibilities and Costs

This chapter details responsibilities for implementing and funding flood mitigation measures and environmental enhancement proposals contained in the Plan.

Responsibility for implementing this Plan is shared in the following way:

- Structural measures: the Regional Council has responsibility for physical flood protection and works, with utility agencies and the city councils taking primary responsibility for their flood-prone assets (including stormwater outlets, and sewerage and communications infrastructure).
- *Non-structural measures*: Hutt and Upper Hutt City Councils are primarily responsible for implementing land-use policy and provisions and emergency management measures, with the Regional Council providing substantial support.
- *Environmental Strategy*: the three councils will share responsibilities, with iwi being actively involved. The Regional Council facilitates implementing the Strategy.

Implementation costs will generally lie where they fall. Most costs for implementing the Plan will be incurred by the Regional Council, funded mainly by rates from Hutt Valley residents.

7.2 How the Selected Measures are Funded and Implemented

Current Regional Council Funding Policy

The Regional Council, through rates, provides funding for implementing the various parts of the Plan. The Regional Council funding policy determines the proportion of rating available. The current policy for implementing flood protection¹ is:

- 0 to 50% general rate from the regional community
- 50 to 100% from a special rate, a scheme rate, or funds directly contributed.

Funding for structural measures will be shared 50:50 between Upper or Lower Hutt Cities' residents and the regional community.

The Regional Council's Long-term Financial Strategy (LTFS), *Towards a Greater Wellington Region*, provides funds for structural, non-structural and environmental enhancement projects. The LTFS describes which flood mitigation capital works will be undertaken between 2000 and 2010. The LTFS places high importance on:

- keeping people and communities safe from flood hazards
- preventing economic losses from potential damages
- ensuring that communities are ready to cope in flood emergencies

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This policy is subject to review at least every three years under the Council's business plan.

• implementing non-structural measures, which complement the flood protection works

- maintaining existing assets before committing to capital improvements
- enhancing 'special places' such as the river environment
- using sustainable floodplain mitigation measures.

7.3 Structural Measures

Funding

The Regional Council has endorsed a \$78 million capital works (structural measures) programme and a priority schedule for upgrading the Hutt River flood protection system to the risk-based 2300 cumec design standard. This works out at about \$2 million a year, but does not cover additional spending on maintaining works or repairing damages. The works programme is subject to ongoing review under the LTFS process. These reviews will continue to look at the affordability and appropriateness of measures, and other issues such as the influence of earthquakes and climate change on works.

Implementation

All structural measures have been prioritised according to their social, economic and environmental benefits, and the vulnerability of existing stopbanks to flood damages. Both the agreed works programme and structural measures priority schedule are presented in Section 4.5.

7.4 Non-structural Measures

Funding and Resources

Funding for implementing non-structural measures will come from programmed budgets.

Land-use policy and provisions will be implemented through proposed changes to the city councils' district plans, with both councils driving that process. The Regional Council's Landcare Division will provide resources to assist the city councils through any district plan change process.

The Regional Council will also provide technical information and help in organising voluntary actions and enhanced emergency management programmes and procedures for the three councils. While the councils will be collectively responsible for developing these measures, the city councils are the primary implementers.

Resourcing details for implementing emergency management measures will depend on:

- the amount of Regional Council assistance requested by the city councils
- required time-frames for implementing enhanced measures
- how much resourcing and funding is required annually
- whether operational budgets already exist for developmental work
- current national civil defence emergency management law reforms.

These considerations will influence the city councils' future business planning in the civil defence emergency management area.

Implementation

Developing and implementing non-structural measures will commence after the Plan's release. Upper Hutt City and Hutt City Council are the primary implementers, with the Regional Council providing a supporting role. Non-structural principles guiding the way residual flood hazard risk in Hutt Valley will be managed are presented in Section 5.12.

Land Use Measures

The cities' district plans are the key tools for implementing the land-use measures described above. Land-use measures will be implemented through changes to Hutt and Upper Hutt cities' district plans, and driven by the respective city councils. Under their direction the Regional Council will have an active role:

- helping to develop changes to policy and provisions in the district plans
- providing technical assistance
- supporting the councils in consulting the community.

The district plan change process is an independent statutory process under the Resource Management Act 1991, and will determine the ultimate make-up of any district plan policies and provisions.

Emergency Management Programmes and Procedures

The city councils are primarily responsible for implementing measures to enhance community preparedness. As well as providing technical assistance, the Regional Council can play a co-ordinating role. That role should encourage a consistent approach to programmes and procedures, while allowing each city council to determine the specific content of their own measures.

Voluntary Actions

The Regional Council will support the city councils by providing flood hazard information. The Regional Council will also produce brochures describing localised floodplain management measures, which support the Plan.

Ensuring Emergency Management and Voluntary Actions are Implemented

Unlike land-use measures, voluntary actions and emergency management measures do not have any statutory mechanism to cover their implementation. The three councils will need to ensure that related actions and programmes are steadily implemented by setting completion targets, and programming these into their business planning.

7.5 Environmental Strategy

Funding and Resources

The flood protection capital works programme includes a 5% allocation – or approximately \$3.9 million over the next 40 years – for Environmental Strategy projects related to these works. However, the costs of implementing the basic components of the Strategy are in the order of \$12 million. Maintenance costs are also likely to increase as more and improved facilities are developed.

The Strategy's recommendations and proposals place no extra funding obligations on the three councils. Instead, additional enhancement projects will be implemented as and when funding becomes available in response to community desire. Likely funding sources are the three councils and community groups.

Funding provisions within the Regional Council's LTFS for environmental enhancement works on the Hutt River are as follows.

Hutt River Ranger (eight years from 2002/03) Habitat enhancement (four years from 2003/04)	\$ 922,000 \$ 34,000
Environmental Strategy implementation (2007/08) Environmental enhancement associated with capital works (indirect) (5% of \$15 million)	\$ 50,000 \$ 750,000
TOTAL	\$1,756,000

The Environmental Strategy also contains works that have little additional financial impact on the three councils, including policy changes and ongoing operational maintenance of the river environment.

Implementation

The Environmental Strategy will be considered as flood protection works are designed and implemented. As yet, no implementation programme for the Strategy has been formed, although priorities for proposals have been developed. A steering group representing iwi and the three councils will be formed to oversee the Strategy's implementation.

Some proposals outlined in the Environmental Strategy have already been included in the Regional Council's annual planning process and the LTFS. These include funding research and trialling salt-tolerant species suitable for whitebait habitat, and establishing a mechanism for ongoing tangata whenua and community input into managing the linear park.

7.6 Ongoing Consultation

Consultation has played – and continues to play – a critical part in developing the Plan and its outcomes.

Advisory Committee and Tangata Whenua

The Hutt River Floodplain Management Advisory Committee² structure would be retained to exchange information with the community, and to recommend on future decisions required throughout the Plan's implementation. The Committee would also act as an initial forum for reporting on the Plan's progress and providing advice to the Regional Council. The frequency of meetings may be reduced to annually or biannually, or to holding special meetings as needs arise.

In addition to Advisory Committee involvement, tangata whenua will be included in formal ongoing consultation as the Environmental Strategy is implemented, and throughout the recurring resource consent processes for flood protection works.

Note: This section may be modified pending the Advisory Committee's consideration of Report 01.487.

The Wider Community

The size of the affected community means that forming a single community resource group which represents the interests of all floodplain residents would be difficult to achieve. Instead, the Regional Council would establish and maintain contact with various resident and interest groups to aid Plan monitoring.³

Both the Advisory Committee and local user and residents groups will be used to share information between the councils and the community.

-

Includes representatives of the three councils and tangata whenua.

These groups may also help to co-ordinate local input to the Environmental Strategy.

7.7 Consultation on Measures and the Environmental Strategy

Structural Measures

Agencies, iwi, community groups and local residents will be consulted during the design and resource consent application stage for each structural measure. Good consultation will also form an important part of any planned land purchase.

Non-structural Measures

Non-structural measures will be developed in greater detail during Plan implementation, and associated public involvement may further modify them. Community involvement will be required particularly to develop emergency management programmes and procedures. Consultation is also part of the statutory process for making changes to the cities' district plans.

Environmental Strategy

Environmental Strategy proposals, and all projects linked to specific flood protection works, will require consultation with land owners, iwi, respective community groups and clubs, and agencies. Resource consent requirements may demand additional consultation.

Consultation is a vital step to enable proposals and projects to develop beyond the Environmental Strategy's key concepts.

7.8 Additional Funding for Flood Mitigation

Flood Contingency Fund and Reserves Policy

The purpose of the Fund and Reserves policy is to provide a contingency fund in case significant and unforeseen flood damage to the Council's flood mitigation assets occurs.

The fund operates at two levels:

- Western Regions Flood Contingency Fund (FCF), for floods up to a 25-year flood
- Major Flood Protection Recovery Fund (MRF), for major floods exceeding a 25-year flood.

\$300,000 is contributed annually to the overall fund, of which \$200,000 goes to the FCF. Funds are currently provided in equal proportions from the Regional Council general rate and local area river reserves.

When money is drawn from the Hutt's local area reserve to repair flood damage, Hutt Valley residents are rated for flood damage costs in the following year in order to reimburse the reserve.

7.9 Asset Management

The Council has adopted the following principles for asset management.

- Defining the levels of service.
- Delivering existing or desired levels of service.
- Ensuring assets are maintained in perpetuity without the loss of their service potential.
- Ensuring assets are managed and maintained in their most cost effective way over their life-cycle.

The Hutt River Asset Management Plan, adopted in July 2000, will ensure that flood protection assets are constructed and maintained to the risk-based 2300 cumec standard. The LTFS provides \$1,045,000 annually for maintaining existing assets at their current service levels. Table 11 shows the current and proposed service levels.

The Asset Management Plan has estimated the current value (30 June 1999) of Hutt River flood protection assets maintained by the Regional Council to be \$37 million. The Plan will be updated three-yearly.

Table 11 : Current and Proposed Service Levels

Service	Current	Proposed
Flood Protection	Variable: from less than 1900 cumec protection (100-year flood) at Belmont, Hathaway Avenue etc. to about 2800 cumecs (about a 3000-year flood) with moderate security in Upper Hutt CBD.	Risk-based 2300 cumec standard (440-year flood) with: 2800 cumec capacity for principal stopbanks, protected to 2300 cumec standard edge protection 2300 cumecs for local stopbanks, including Totara Park, Manor Park and Whirinaki Cres. Additional local areas standards also include: Belmont 1900 cumec edge protection and house raising Bridge Road 1900 cumec edge protection and house raising Gemstone Drive 1900 cumec edge protection no stopbanks will be constructed downstream from Estuary Bridge.
Erosion	Land and assets protected by stopbanks – average to very high service level Land and assets in floodway – low to moderate service level	Land and assets protected by stopbanks – very high service level Land and assets in floodway – low to high service level
Flood Warning and Response	High: comprehensive flood warning system and procedures in place	Very high: with enhanced procedures and emergency management measures
Environmental Enhancement	Basic: clear rubbish, maintain access tracks, mow river berms, and limited environmental plantings.	High: linear park vision, river ranger, capital improvements through capital works and environmental enhancement proposals

Do you want to know more?

Ref?: Towards A Greater Wellington Regional - Investing in the future: Wellington Regional Council Ten Year Plan 2000–2010

Ref: ? Living with the River Newsletter, July 1999 – Issue No. 3: *The Design Standard*

Ref ?: Flood Protection Asset Management Plan

Chapter Eight

Anticipated Results and Monitoring: Measuring Outcomes and Reviewing the Plan

8.1 Introduction

How will we know if the Plan is working, and whether it can be improved on? To answer this question we first need to have a very clear idea of what results we hope to achieve. Then we need to be able to monitor whether we have achieved these results, and to have in place arrangements for reviewing the plan.

The Plan's intended outcomes, or *anticipated results*, are what will be measured to determine the Plan's performance. Monitoring is concerned with how we measure the anticipated results.

This chapter presents the Plan's intended outcomes, discusses how these outcomes will be measured, and looks at arrangements for reviewing the overall Plan.

8.2 Anticipated Results

What they Cover

In summary, the anticipated results for the Plan are to:

- adopt and implement flood mitigation measures and the Environmental Strategy
- reduce adverse flood hazard effects
- manage the residual flood hazard
- involve the community
- involve tangata whenua in implementing the Plan
- enhance environmental values
- manage adverse environmental effects of works.

The anticipated results have been developed from the Plan objectives (provided in Chapter 1), the performance of the measures, additional floodplain management planning issues concerning flood hazard effects, and issues relating to adverse environmental effects from physical works. These additional issues have been drawn mainly from the Otaki and Waikanae Plans to ensure regional consistency in measuring floodplain management plan performance.

The anticipated results will be measured for the 40-year life of this floodplain management plan, but will commence from 1991 – the start of the floodplain management planning process. The progress on anticipated results will be measured every 10 years. Any dollar values cited will be stated in year-2000 dollars.

Measuring the anticipated results requires identifying simple and effective indicators. A monitoring strategy to clarify the anticipated results, and determine how and when monitoring should take place, will be developed. These matters are covered in 'Reviewing the Floodplain Management Plan' later in this chapter.

What is an Anticipated Result?

Anticipated results are the outcomes that the Plan intends to achieve. They are important because they focus on the things that must be monitored during the life of a plan in order to measure a plan's performance. One way to represent anticipated results is to produce clear *statements of intent*. These can cover a range of issues including:

- implementing policies and objectives
- environmental performance
- decision-making
- ongoing consultation.

The approach adopted here has been adapted from the Ministry for the Environment / Opus International Consultants District Plan Monitoring Project.

SEPARATE TEXT BOX

8.3 Adopting and Implementing the Plan: Anticipated Results

Balanced and Affordable Flood Management Solutions

- Adopted structural and non-structural solutions show an overall social, economic and environmental benefit to the community.
- The community accepts the costs of selected structural and non-structural measures.

Progress in Implementing Measures

- Structural measures are constructed in accordance with annual and business plan targets.
- Non-structural land-use measures are established in district plans and through other means that support voluntary actions.
- Enhanced non-structural emergency management measures are established through the respective councils' annual and business plans, and implemented at regular intervals.
- The Environmental Strategy is implemented in a manner acceptable to the community and tangata whenua.

Performance of Measures

• Flood defences withstand moderate or large floods to their respective risk-based design standards.

- All flood defence assets are maintained to agreed standards described in the Hutt River Asset Management Plan.
- Non-structural emergency management measures enable the community to improve their individual and collective response to a significant flood event.
- The financial costs of flood damages are significantly reduced.

A Partnership Approach with City Councils

• Developing and implementing the Plan involves Hutt City and Upper Hutt City Councils in decision-making.

8.4 Reducing Adverse Flooding Effects: Anticipated Results

Reducing General Effects and Damages

- Risk of injury or death resulting from flooding is reduced.
- Levels of potential social disruption from flooding are reduced.
- Levels of potential damages resulting from flooding are reduced.
- People in the Upper Hutt and Hutt city communities cope better with a flood.

Recognising Flood Risks Posed by Tributary Watercourses

• The Regional Council, through investigation and supplying data, supports and assists the territorial local authorities to manage small floodplain tributaries.

Maintaining Optimum Flood Capacity

- The floodway is maintained to optimise the river's flood capacity while limiting the extent and degree of lateral erosion, and additional adverse effects.
- Gravel extraction is undertaken in a way that optimises the Hutt River's flood capacity, without causing significant bank erosion and adverse environmental effects.

8.5 Managing Residual Flood Hazard Effects: Anticipated Results

Accepting Residual Flood Risk

• The community understands and accepts the residual risk associated with the selected suite of structural and non-structural measures.

Ensuring Residual Flood Hazard Effects are Mitigated

- Non-structural measures reduce residual flood impacts on the Hutt and Upper Hutt city communities.
- New development or areas of redevelopment avoid or mitigate the adverse effects of significant floods.
- A mix of voluntary decisions and regulation in district plans substantially reduces:
 - exposure of new and redeveloped assets (public or private) to the flood hazard in moderate and higher-risk areas
 - people's vulnerability to the flood hazard.
- Emergency management programmes and procedures enable the Hutt and Upper Hutt city communities to respond quickly and effectively to a range of flooding events.

Managing Effects on Neighbouring Property and Land

• New development or redevelopment does not increase the flood hazard on the flood protection system, or neighbouring land and structures.

8.6 Involving The Community: Anticipated Results

Agreeing on a Long-term Programme

• The community, iwi, key agencies and community groups accept the programme timeframes for implementing flood mitigation measures and the Environmental Strategy.

Providing Clear, Accurate and Full Information

- The community receives clear, accurate and full information regarding:
 - agency responsibilities
 - the flood hazard associated with the existing and upgraded flood protection system

- measures adopted to manage the flood hazard
- design and programming of structural works

- adverse effects of structural works on the river and its environment.

8.7 Involving Tangata Whenua: Anticipated Results

Exercising Kaitiakitanga

- Tangata whenua are active in decision-making regarding managing the Hutt River and its environment.
- The relationship of tangata whenua, their culture and traditions with the environment is recognised and provided for.

8.8 Enhancing Environmental Values: Anticipated Results

Ensuring Quality Access to the River

 The existing quality of public access to and along the river is maintained or improved.

Implementing the Environmental Strategy

- The Environmental Strategy's guidelines to maintain and enhance the quality of the river and its environment are implemented.
- Projects implemented through the Environmental Strategy enhance the quality of the river and its environment.

8.9 Managing Adverse Environmental Effects: Anticipated Results

Minimising Adverse Effects of Works

- Adverse effects associated with flood mitigation works are mitigated or avoided to an acceptable community standard, determined by the resource consent process and compliance monitoring requirements.
- Flood mitigation works do not create significant long-term adverse effects on the environment.

8.10 Monitoring Anticipated Results and Reviewing the Plan

Why Monitor and Review?

Ongoing Plan monitoring will enable the Plan's outcomes to be regularly reviewed. Reviews mean that the floodplain management planning process, and flood hazard mitigation measures, can be updated and changed where the need arises.

Monitoring and review of the Plan will:

- measure progress made achieving the above-listed anticipated results
- evaluate the overall performance of the Plan.

Developing a Monitoring Strategy

Over 30 anticipated results have been developed from the Plan objectives and related issues. The sheer number of anticipated results means that developing monitoring priorities, associated indicators, and realistic reporting requirements requires considerable effort. A monitoring strategy will be formulated by June 2002 to tackle the need to:

- clarify what each anticipated result specifically measures
- identify higher-priority anticipated results so that we can start measuring them immediately
- develop staggered starting dates for monitoring the remaining anticipated results
- identify appropriate indicators to measure anticipated results
- determine monitoring programmes and baseline survey requirements
- develop annual and longer-term reporting requirements to meet the Regional Council's Long-term Financial Strategy, Annual Plan and Floodplain Management Plan review timeframes
- identify the community's role in monitoring.

The strategy will allow anticipated results to be modified – or even dropped where they are superseded or become outdated. Any changes to the anticipated results will need to be regularly reported.

Devising Indicators to Measure Results

An important part of forming a monitoring strategy will be developing the specific indicators. Indicators are simple measures that enable us to gauge the progress the Plan is making. Indicators need to be simple, be easily measured, be cost-effective, and provide reliable data. Indicators can measure trends, patterns and overall performance in many ways, including:

- progress towards a set goal or target (e.g. completing structural works or implementing land-use controls)
- changes in behaviour (e.g. the community response to flooding events)

• changes in attitude and understanding (e.g. knowledge of the flood hazard)

- changes in environmental conditions (e.g. population, volume of gravel or river flows, climate change)
- linking human activity to environmental problems (e.g. hazard exposure through new development)
- reaching a threshold (e.g. predicted costs of mitigation measures)
- following a process (e.g. involving the community, iwi and councils in future decision-making).

8.11 Reviewing the Floodplain Management Plan

The Plan will be reviewed every 10 years, or if the flood hazard is significantly altered by flooding, earthquakes or new information. Minor reviews will also occur yearly through the Regional Council's Annual Plan process. Table 12 summarises what will be reviewed and when.

A new floodplain management plan will be produced after 40 years, or earlier should any review outcomes require it.

Table 12: What will be Reviewed

Timeframe	Reviewing What ?
Every year (in line with the Flood Protection Group's annual plan	Programme to implement measures and the Environmental Strategy
	Operational programme summary
Every three years (in line with the	Priority and cost of works
Regional Council's Long-term Financial Strategy	Preliminary report on anticipated results
Every ten years	Processes for implementing the Plan
	Progress on implementing emergency management methods
	Hydrology
	Flood extent and hydraulics
	Capital and operational expenditure budgets
	Full report on key anticipated results
Important triggers	
When the flood hazard is significantly changed by	Proposed land-use measures compared with agreed non-structural principles
completing structural works	Flood hazard and extent maps (floodplain
Following a major flood	and river corridor)
 Prior to approval of district and regional plans, including plan changes 	Performance of the flood protection works
When high priority anticipated results are not being met	

8.12 Future Role of Hutt Community in Monitoring the Plan

There will be a future role for the Hutt community in monitoring the progress of the Plan. The Hutt community, the city councils, iwi and other agencies and interest groups will provide feedback on the Plan's implementation, including monitoring and review.

Do you want to know more?

Ref ?: District Plan Monitoring: A Guide to Getting Started

Appendix 1

Flood Emergency Procedures, Response and Recovery

Local Civil Defence and Emergency Management

Response Procedures

The Hutt City and Upper Hutt City Councils are responsible for managing emergency events in their areas, where civil defence measures are required.

A flood can become a civil defence emergency if evacuations are required, roads need to be closed, the emergency services (Police, Fire Service) do not have enough resources to do the tasks that are required, or emergency housing and welfare are needed. To respond effectively to an emergency, the councils work with the emergency services, essential services providers (for example, water suppliers, electricity suppliers), volunteer organisations and people with specialist information (such as MetService, or the Regional Council Flood Protection Group).

Figure A1 gives examples of organisations involved in responding to flooding emergencies, while Figure A2 shows what tasks are done as the flood event escalates into an emergency.

Emergency Operations Centre

The city councils manage emergency events from specialised Emergency Operations Centres. The role of these centres is to gather information, organise the appropriate response, and disseminate information about the emergency back to the affected communities.

Representatives from the essential response organisations such as the Police, Fire Service, utility companies and medical services may be present at the Emergency Operations Centres to offer expert advice and updates on the situation. If it is a declared civil defence emergency, the response representatives will direct their organisations according to priorities set by the local civil defence organisation.

The Hutt City Council Emergency Operations Centre is located at The Pavilion, Laings Road, Lower Hutt. The Upper Hutt City Council Emergency Operations Centre is located on the ground floor, Council Buildings, Ferguson Drive, Upper Hutt.

Recovery

If necessary, the councils will appoint local disaster recovery managers. These managers will work alongside any central government recovery personnel.

Actions to enhance recovery start in the early part of the emergency response and continue until essential services are restored to a minimum operating standard. Civil defence powers (such as the councils' abilities to evacuate and requisition equipment) are not maintained during the recovery period.

The contributing councils may provide additional financial assistance and resources to the community during the recovery phase.

Regional Emergency Management

General Responsibilities

Regional emergency management is the responsibility of the Regional Council, under the Civil Defence Act 1983. However, if the proposed civil defence and emergency management law reforms are enacted, emergency management at a regional level would become the responsibility of a Civil Defence / Emergency Management Group (CDEMG). The CDEMG would be made up from all territorial local authorities in the Wellington region, the Regional Council, and Marlborough District Council. The CDEMG would also receive input from the Police, Fire Service, Lifelines organisations and other emergency responders.

Because of the possibility of this change, the following sections have been divided into "Current Arrangements" and "Possible Future Arrangements".

Response Procedures

Current Arrangements

The Regional Council gets involved when a local council or emergency services are overwhelmed by the emergency, and are unable to manage the event effectively. In this situation the Regional Council's role is to:

- co-ordinate group resources
- prioritise emergency responses
- provide public information
- facilitate communication between emergency responders
- direct the response.

Possible Future Arrangements

These roles would be taken up by the CDEMG under the proposed new legislation.

Emergency Operations Centre

Current Arrangements

The Regional Council may operate either from the National Emergency Operations Centres located at the Beehive, from the Regional Council Centre, or from a mobile facility.

Possible Future Arrangements

It is expected that the CDEMG would operate out of many Emergency Operations Centres. The selection of an Emergency Operations Centre depends on the type of emergency event, and the areas affected. Possible Centre locations are Wellington Emergency Management Office, Hutt City Council, Masterton District Council, and the CDEMG Emergency Management Office.

During an emergency, members of the CDEMG and representatives from the emergency services, health providers and lifelines would be present at the Emergency Operations Centre as needed. They would provide advice about the best strategies for response, and the status of their resources to be able to respond.

Recovery

Current Arrangements

Priorities for regional recovery are the safety of people, social restoration, economic restoration and physical restoration. The Regional Council may appoint a recovery manager to guide the recovery process if necessary.

Possible Future Arrangements

Regional recovery would become the responsibility of the CDEMG.

National Emergency Management

Response Procedures

The Ministry for Emergency Management may become involved in emergency response when more than one region is involved, international co-ordination is required or national or central government resources (such as the NZ Defence Force) are required.

If the National Emergency Operations Headquarters is activated, it is located in the sub-basement of the Beehive, Bowen Street, Wellington.

The Department of Internal Affairs provides funding for emergency expenditure related to accommodating, transporting, feeding and clothing emergency evacuees. Other emergency expenditure may be eligible for subsidy if expenditure is greater than the threshold of 0.01 percent of net equalised rateable value.

Recovery

The Ministry for Emergency Management may appoint a Disaster Recovery Coordinator to work with affected communities and institute necessary programmes of disaster recovery.

Figure A1: Examples of Support Organisations

NZ Police: law and order, evacuations, normal Police role

NZ Fire Service: fire fighting, rescue
Hutt Valley Health: medical treatment

Public Health: provide advice on health issues

NZ Red Cross: emergency clothing
Salvation Army: emergency feeding

WRC Flood Protection: provide flood warnings and advice

MetService: provide weather advice

Civil Defence centres: provide collection point for information and people

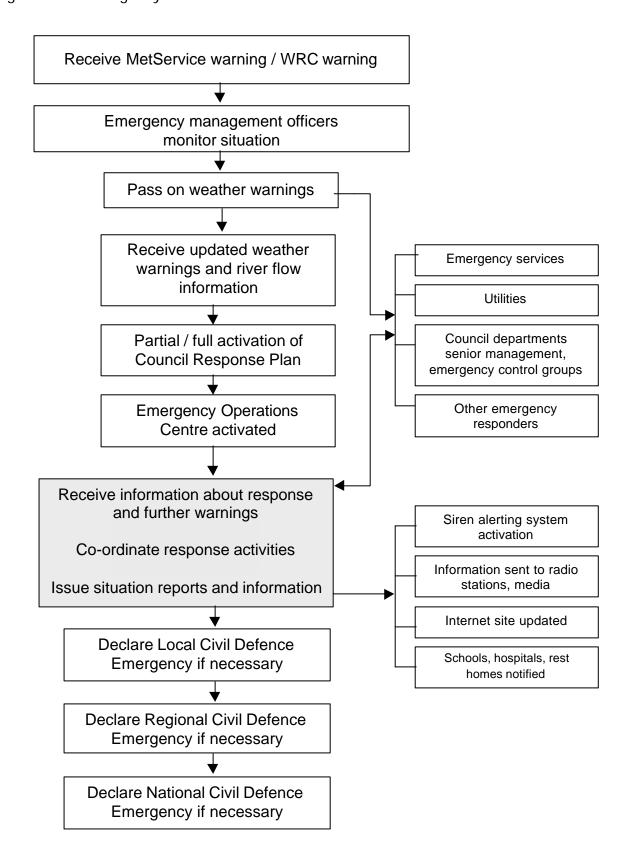
needing assistance.

Wellington Free Ambulance: transportation of injured restoration of highways Excel: transportation of highways

WRC Investigations: pollution response
United Networks: electricity restoration

Nova Gas, AGL: gas restoration

Figure A2: Emergency Procedures



Flood Warning System

Existing System

The flood warning system for the Hutt River consists of rainfall recording stations and river level recorders. These recorders send data through to the Regional Council flood base, located at the Regional Council Centre. Flood forecasts and flood warnings are generated and passed on to those people who are potentially affected. Figure A3 provides an overview of this process.

Flood Detection

There are nine rainfall recording stations relevant to the Hutt River. Seven of these stations are telemetered.

Rainfall recording stations trigger alarms at certain intensities of rainfall. Table A1 gives an idea of trigger levels for various areas.

Table A1 : Alarm trigger levels for selected Hutt areas

Area A	Amount of rainfall in a
	2-hour period (mm)
Cemetery (Akatarawa Valley)	20
Phillips Station (Kaitoke headwaters)	20
Warwicks Station (Akatarawa Hill Road	summit) 15
Centre Ridge Station (Rimutaka Incline)	20
Te Marua Station (treatment plant)	20
TVL Station (Mangaroa Valley)	20
Mabey Road (Avalon)	20

These alarms are automatically transmitted back to the Regional Council flood base. The information is then fed into a flood-forecasting model which forecasts the river heights for a period of up to 12 hours.

Nine river-level recorders measure the height of the river, and seven of these are telemetered. The telemetered river-level recorders are located on the Hutt River at Kaitoke, Te Marua, Birchville and Taita Gorge, as well as on the Akatawara and Mangaroa Rivers, and Waiwhetu Stream. Non-telemetered recorders are located on the Whakatikei Pakuratahi Rivers. The Birchville river-level recorder is backed up by an alternative interophone system.

Flood Warning Time

The flood warning time is how long a person subject to a flood has to react. The warning time is determined by the time taken to detect flooding, recognise its characteristics, and issue warnings. The approximate warning times for the Hutt River once a rainfall alarm has been activated are:

Kaitoke:	1:30 hours	
Birchville:	3:00 hours	
Taita Gorge:	3:45 hours	
HCC Car Park:	4:30 hours	
Harbour:	5:00 hours	

Passing on Flood Information

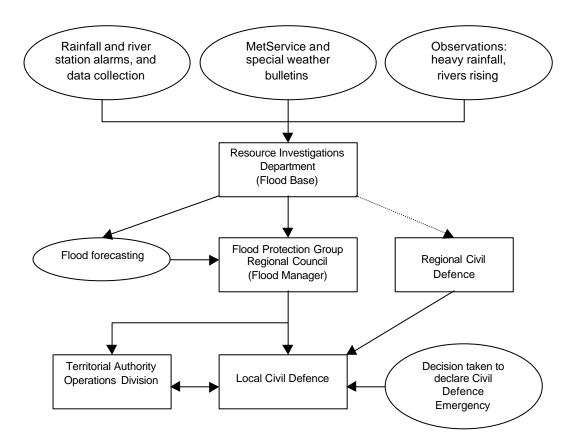
Public warnings are issued by:

- MetService (heavy rain forecast)
- Hutt City Council or Upper Hutt City Council (surface flooding, stormwater problems, slips, etc.)
- Police (road closure, delays, etc.)
- Regional Council Flood Protection (flood warning).

Flood warning information may be circulated by radio, television, or telephone. The Regional Council Flood Manager disseminates information directly to local and regional civil defence and emergency management organisations. These organisations, in turn, pass on the warnings to those who may be affected.

The public can also directly access river level and rainfall data from the telemetered sites via the Hydroline service. This data is automatically updated every three to six hours, and more frequently during floods. The information is also available via the Regional Council website: www.wrc.govt.nz.

Figure A3 : Overview of Flood Warning System



Appendix 2

Legislative Framework for Floodplain Management Planning

Relevant Legislation

This appendix covers key parts of relevant legislation that guide:

- managing natural hazards principally flooding
- the jurisdiction for undertaking flood-protection works
- managing the effects of works.

Resource Management Act 1991

The primary statute under which the natural and physical resources of the region are managed is the Resource Management Act 1991 (RMA). The RMA provides for the preparation of regional and district plans to assist the Regional Council and the Hutt and Upper Hutt City Councils to carry out their functions in order to achieve the purpose of the Act. The functions we are interested in here involve managing the relationships between land use and development in the region, and natural hazards.

Managing Natural Hazards

Section 30: The Regional Council has numerous responsibilities including:

- (a) The establishment, implementation and review of objectives, policies and methods to achieve integrated management of the natural and physical resources of the region.
- (b) The preparation of objectives and policies in relation to any actual or potential effects of the use, development, or protection of land which are of regional significance.
- (c) The control of the use of land for the purpose of –

. . .

(iv) The avoidance or mitigation of natural hazards.

Section 31: Hutt City and Upper Hutt City Councils have responsibility for:

- (a) The establishment, implementation and review of objectives, policies and methods to achieve integrated management of the effects of the use, development, or protection of land and associated natural and physical resources of the district.
- (b) The control of any actual or potential effects of the use, development, or protection of land, including for the purpose of the avoidance or mitigation of natural hazards...

Natural hazards are those naturally occurring events that threaten human life, property or other aspects of the environment. Section 2 of the Act defines natural hazards as:

any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, land slip, subsidence, sedimentation, wind, drought, fire or flooding) the action of which adversely affects or may adversely affect human life, property or other aspects of the environment.

Other Key Parts and Sections

These relate to the wider management of the environment, covering broad matters such as:

- natural character
- public access
- Maori traditions and culture
- managing amenity values and ecosystems
- using and developing natural and physical resources
- recognising heritage values
- considering alternative approaches.

Part II of the Act contains a number of specific provisions that must be taken into account when considering the use, development or protection of the region's water bodies and associated floodplains.

Section 5 states the purpose of the Act to be *to promote sustainable management of natural and physical resources*.

Section 6 of the Act identifies a number of matters of national importance the Council must recognise and provide for in managing the use, development and protection of the natural and physical resources, including:

- (a) The preservation of the natural character of ... wetlands, lakes and rivers and their margins, and the protection of them from inappropriate use and development.
- (d) The maintenance and enhancement of public access to and along ... lakes and rivers.
- (e) The relationship of Maori and their culture and traditions with their ancestral lands, waters, sites, waahi tapu and other taonga.

Section 7 of the Act identifies a number of additional matters the Council must have particular regard to in managing the use, development and protection of the natural and physical resources, including:

- (a) Kaitiakitanga.
- (b) The efficient use and development of natural and physical resources.
- (c) The maintenance and enhancement of amenity values.
- (d) Intrinsic values of the ecosystems.
- (e) Recognition and protection of the heritage values of sites, buildings and places, or areas.
- *(f) Maintenance and enhancement of the quality of the environment.*

Section 32 of the Act requires councils to be objective in preparing regional and district plans. In particular, when determining objectives, policies and methods, they must have regard to available alternatives and the reasons for and against options, including their costs and benefits. In preparing this Plan, the various options have been discussed with members of the community, and the approach in the Plan is that preferred by the community as a whole.

Soil Conservation and Rivers Control Act 1941

The Soil Conservation and Rivers Control Act 1941 includes provisions for "the prevention of damage by erosion" and "the protection of property from damage by floods". Within the general powers (Section 126) of this Act, the principal function of every catchment board is "to minimise and prevent damage within its district by floods and by erosion". These catchment boards, whose powers have now been assumed by regional councils, were given wide powers in relation to watercourses.

Preventing Erosion

Section 126: General Powers of Catchment Boards:

- 2. Each Board shall have all such powers, rights and privileges as may reasonably be necessary or expedient to enable it to carry out its functions, and in particular each Board shall have power to construct, reconstruct, alter, repair, and maintain all such works and do and execute all such other acts and deeds, including the breaching of any stopbank, as may in the opinion of the Board be necessary and expedient for:
- a) (Repealed)
- b) Controlling or regulating the flow of water in and from watercourses
- c) Preventing or lessening any likelihood of the overflow or breaking of the banks or any watercourse
- d) Preventing or lessening any damage which may be occasioned by any such overflow or breaking of the banks
- e) Preventing or lessening erosion or the likelihood of erosion
- f) Promoting soil conservation.

Building Act 1991

The Building Act 1991 and Building Regulations 1992 provide a performance-based building control system that applies to the construction, alteration, demolition and maintenance of most structures within the Hutt area. The controls within the Building Act assist in ensuring that development is compatible with the prevailing flood hazard, and that the overall level of flood damage will not be increased significantly. Examples of types of controls available through the Building Act are setting floor levels and filling sites.

Recent case law has ruled that in certain instances the Resource Management Act can override the Building Act.

Relationship of Floodplain Management Plans with the Regional Policy Statements and Plans

The Council made the decision that the region's floodplain management plans would not be statutory documents in themselves. The approach was taken that regional and district plans would be used to ensure that the non-structural methods are achieved, and the Flood Protection Group annual and business plans would be primarily used to implement the structural methods.

See Figure 8 in Chapter 1 for a summary of the roles of the various planning instruments in implementing the Floodplain Management Plan outcomes.

Regional Policy Statement

The Regional Policy Statement provides an overview of the resource management issues and sets the policies and methods by which the Wellington Regional Council seeks to achieve integrated management of the natural and physical resources of the region. The Regional Policy Statement contains objectives, policies and methods covering a wide range of resource management issues, including the mitigation of natural hazards and the management of fresh water. Method 14 in the Natural Hazards chapter requires the Council to implement natural hazards policies through regional plans.

Towards a Greater Wellington Region

Towards a Greater Wellington Region is the Regional Council's Long-term Financial Strategy. It outlines:

- what the Council plans to do between 2000 and 2010
- why the Council is going to do it
- what it will cost particularly the impact on rates
- how the community will benefit
- what challenges the Council will face.

Regarding flood protection, the 10-year action programme includes the preparation of floodplain management plans, flood hazard assessments and scheme reviews; and the management and improvement of river corridors, stopbanks and associated flood protection assets. The Strategy is reviewed every three years.

Flood Protection Group Business Plan

The business plan's long-term performance targets are:

- floodplain management plans completed for all regionally significant rivers by 2005
- flood hazard assessment completed for western region rivers and streams affected by flooding and erosion, by 2005
- implement the adopted floodplain management plans for the Hutt, Otaki and Waikanae by 2040
- service levels of flood protection assets are maintained in accordance with asset management plans
- complete and implement environmental strategies for regionally significant rivers at a rate acceptable to the community.

Annual Plan

The annual plan is prepared as required under the Local Government Amendment Act 1996. All local authorities must prepare an annual plan. The annual plan must outline the nature and scope of activities undertaken by the organisation over the financial year, along with the funds required to undertake these activities.

Floodplain Management Plans

The Council has resolved that floodplain management plans should have no formal statutory basis, but should be used as working guidance documents with respect to carrying out floodplain management, evaluating the options, and establishing the overall outcome desired. These plans are, therefore, non-statutory documents prepared in consultation with the community. In comparison to Regional Plans (which cover a diverse range of issues), the Hutt Valley Floodplain Management Plan specifically deals with management of the river and its environment, and providing flood protection measures. At the same time the Plan provides the framework for guiding land use and development on the floodplain.

Regional Plans

References to relevant regional plan objectives, policies and methods will be included in the final Plan document.

District Plans

References to relevant district plan objectives, policies and methods will be included in the final Plan document.

Phases of Floodplain Management Planning

Phase One: Defining the Flood Problem

The nature, extent and severity of flood hazards were determined, and the values of the community, development and the area's environmental issues were recognised. Outcomes are reported in the Phase One summary document, *Living with the River*. This document draws together the findings of the detailed reports prepared as part of the documentation of Phase One investigations.

Phase Two: Evaluating the Effectiveness of All Flood Mitigation Options

Evaluation included initial selection of some options (or a combination) and used technical, social and environmental databases established in the preceding phase. Factors considered included physical flood conditions, land requirements, costs, benefits and economic efficiency, visual impact, development pressure, and social/community values regarding perceived risk and level of protection. Mitigation methods are those that modify:

- the flood event stopbanks, detention dams, channel improvements
- damage susceptibility zoning and building permit restrictions, flood proofing, flood warning and community preparedness
- the flood loss burden insurance, disaster relief, etc.

References to source documents will be included in the final Plan document.

Phase Three: refining the chosen options

Refining options takes into consideration:

- impacts of works on the environment
- engineering considerations
- social, economic, and social benefits.

References to source documents will be included in the final Plan document.

Phase Four: drafting

Drafting the Hutt Floodplain Management Plan. The public consultation and submissions phase forms a critical part of this process.

Phase Five: implementation

Theoretically, implementation will occur when the Plan is completed. In reality, the rate of implementation will depend on many factors, including the Regional Council's Long-term Financial Strategy and the Flood Protection Group's business plan. Implementing structural measures can commence during Phase Three, prior to non-structural measures being selected.

HRFMP DRAFT July 2001

Appendix 3

Property Affected by River Corridor Boundary and Structural Works

HRFMP DRAFT July 2001

Appendix 4

River Corridor Reach Plans

Appendix 5

Priority Schedule for Structural Works : Approach Used

Developing a Priority Schedule for Structural Works

Appendix 5 details the methodology used to develop a priority schedule for proposed structural works under the Hutt River Floodplain Management Plan.

How Have We Done It?

Weighting Components

Under the priority schedule each component has been weighted as follows:

1.	economic benefits:	60%	_
2.	social benefits:	10%	
3.	environmental benefits:	10%	
4.	present protection level:	10%	
5.	number of people directly affected:	5%	
6.	area directly affected:	5%	

The range of components and their associated weighting are based on the priority schedules established for the Otaki and Waikanae Floodplain Management Plans. The weighting applied to each component was heavily influenced by public feedback during the consultation phases of those Plans.

Proposed Works Grouped for Extensive Reaches

The existing priority list considers individual works. The revised schedule groups individual works into 13 more extensive suites of works. Reaches were selected to ensure independence between each of the individual floodplain areas. These reaches cover all urban areas protected by proposed works.

Considering Environmental and Social Costs

Environmental costs are not included. The costs and effects of actual works have been considered in broad terms during the design standard and structural works selection process (prior to October 1999). These effects will be assessed in more detail during the resource consent and application processes for each set of works. The merit of each set of works will be determined in the light of these effects.

Basis for Evaluating Components

The basis for evaluating environmental, social and economic components is the comparison of:

- a snapshot of the existing situation concerning flood-prone land
- changes to the existing situation provided by proposed improvements to the flood protection system.

Using Simple Indicators

The indicators chosen to reflect social, environmental and economic benefits are all relatively easy to understand and measure, because where possible they are standalone, certain, and limited in subjective value judgements. A desire to keep this wider evaluation of benefits as straightforward as possible influenced the selection of indicators.

Components Measured

1. Economic Benefits

The costs are based on concept designs and have an accuracy of \pm 30 percent. Average annual saved damages are calculated on a reach-by-reach basis by estimating the damages that can be saved by upgrading each reach to the risk-based 2300 cumec standard.¹

Benefit-cost ratios have been calculated based on saved damages and implementation costs. The damage costs originally assessed in 1990² were indexed to reflect 1999 costs. The damages include direct and indirect tangible costs to:

- residential, commercial and industrial/business properties.
- public services and utilities.

It was assumed that the implementation of structural measures would be at an average expenditure rate of \$2 million per year.

A total weighting of 60 percent was distributed equally among the annual flood damages saved and the benefit—cost ratio.

2. Social Benefits

The components to determine environmental benefits are:

- *a)* disruption
- b) stress and trauma.

HRFMP Phase 3 Investigations: Risk Assessment and Hydraulic Modelling. Wellington Regional Council, September 1999.

² HRFMP Phase 1 Investigations: Flood Damage Assessment. Wellington Regional Council, September 1999.

The potential benefit of community preparedness and non-structural land-use measures has not been measured.

Social benefits receive a 10 percent weighting, with each component comprising 5 percent. The variables representing each component combine equally to make 5 percent. Area and population multipliers (percentage of greatest affected population) have been applied to measures of disruption and stress and trauma, respectively.

a) Disruption

Business areas: area of industrial, business and commercial development

What measured	Area of industrial, business and commercial zones
How measured	Determine area contained in these zones located in flood- or erosion-prone areas
Data source	Proposed District Plan zone maps
Scoring	Relative area affected (%)

Assumptions: All relevant zones are assumed to contain full commercial, industrial or business activities, despite the fact that zone maps incorporating additional areas have not yet been developed for these uses. No distinction is made between the level of disruption attributable to each land use type.

Residential areas: number of schools

What measured	Presence of primary and secondary schools
How Measured	Determine numbers of schools located in flood- or erosion-prone areas
Data sources	GIS data; street map directories
Scoring	High schools and intermediates = 2
	Primary schools = 1

Assumptions: High schools and intermediates are considered as being generally larger than primary schools, despite some primary schools having similar-size roles. No distinction is made between areas on the basis of ponding depth. Any school sited on the flood extent margin must have 30 percent of the school area covered by the predicted flood extent in order to be counted.

Key facilities: number of hospitals and sub-stations

Key facilities are the highly vulnerable parts of emergency and community services and infrastructure. Damage to key facilities will escalate the impacts of flooding.

What measured	Presence of hospitals and sub-stations
How measured	Determine numbers of hospitals and sub-stations located in flood- or erosion-prone areas
Data sources	GIS data; street map directories
Scoring	Relative numbers present in each area (%) Hospitals = 1 Sub-stations = 2

Assumptions: Hospitals counted incorporated those providing over-night stays, including some rest-home facilities.³ No distinction is made between the size and significance of hospitals. Sub-stations were given an extra point because of the direct impacts on all valley residents of losing power.

Emergency services or telecommunications facilities were not included because they are able to operate from remote sites. Water supply or sewerage services have also not been counted, though it may be worth considering relative lengths of lines receiving improved protection. Additional reduced disruption effects to the wider region as a measure of benefit (for example, telecommunications and transportation links) were not counted.

b) Stress and Trauma

Flow, erosion and ponding: area of hazard

What measured	Area of ponding, flow and erosion hazard affecting urban areas	
How measured	Determine area affected by varying ponding severity, or flow and erosion located in flood- or erosion-prone areas	
Data sources	Draft 2300 cumec Flood Extent Pla Plans; draft Geographic Flood Risk	
Scoring	Low ponding (0-0.5m)	= 1
	Moderate ponding (0.5m-1.0m)	= 2
	Deep ponding (1.0m	= 3
	High velocities and potential erosion	n = 4

Assumptions: Population and area multipliers adjust disruption, stress and trauma measures because size and numbers are directly related to social impact.

3. Environmental Benefits

The components to determine environmental benefits are:

- a) ecology
- b) recreation and landscape
- c) heritage.

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³ Hospitals included were Hutt Hospital, Boulcott Private Surgical Hospital, Bloomfield Medical Hospital, Elderslea Medical Hospital, Woburn Aged Care Complex, and Watsonia Hospital.

Environmental benefits receive a 10 percent weighting, with each component comprising 3.3 percent. The variables representing each component combine equally to make 3.3 percent.

a) Ecology

Erosion protection: riparian plantings and rock lining

What measured	Degree of ecological improvement provided by reduced erosion
How measured	Evaluate the difference between current actual and potential erosion levels, and improved erosion protection
Data source	Use expert engineering opinion
Scoring	Low to High: scores 1–3

Assumptions: Rock linings and riparian vegetation enhance in-stream and riparian values. Riparian vegetation provides shading, shelter for fish, and acts as a buffer for pollutant and sediment run-off. Rock linings – and to a lesser degree riparian vegetation – prevent more regular erosion and scour of berm areas. This reduces the input of sediment to the active bed and channel. Rock linings also provide pool areas and additional habitat for fish species.

The current incidence of erosion was measured by combining areas of actual erosion with areas of potential erosion. Potential erosion was determined by judging the existing alignment and current erosion protection. The degree of improved protection was averaged for each extended reach area. In most cases, areas of high increased future benefit combined with low benefit areas to give an overall medium benefit.

Additional reaches downstream of Te Marua not specific to urban areas were included for this assessment including:

- Melling to Belmont (RB)
- Belmont to Pomare (RB)
- Pomare to Silverstream (RB)
- Silverstream to Moonshine (RB)
- Moonshine to Totara Park (RB)
- Norbert St to Akatarawa Bridge (RB and LB)
- Gemstone Drive (RB).

Ecological areas: areas with ecological and conservation values

What measured	Presence of ecological and conservation sites in the river corridor and on the floodplain
How measured	Determine numbers of parks, reserves and KNEs (Key Native Ecosites) sites with these values located in flood or erosion prone areas
Data Source	Department of Conservation Ecosite database; KNE database
Scoring	Relative numbers present in each area (%)

Other Indicators Considered

Increases in Indigenous Species

The Environmental Strategy provides no certainty about increases in indigenous species.⁴ The floodplain and river corridor environment are heavily modified, therefore actual increases in indigenous vegetation cover are likely to be minimal.

Habitat Quality

The Environmental Strategy provides no certainty about increases in habitat quality. Assessments would not be comparing like with like. Comparing varying reaches provides difficulties assessing differing habitats (for example, comparing habitat values of estuarine areas with mid the reaches).

b) Recreation and Landscape

Landscape damage: affected area

What measured	Flood-prone area affected as an indicator of the damage extent
How measured	Determine size of the flood-prone area affected by each suite of works
Data Source	GIS calculations
Scoring	Relative area affected (%)

Assumptions: The greater the area, the greater the damage.

Special areas: parks and reserves with recreational values

What measured	Presence of parks and reserves
How measured	Determine numbers of parks, reserves located in flood- or erosion-prone areas
Data sources	Proposed District Plan listings; street map directories
Scoring	Relative area affected (%)

Assumptions: Parks and reserves have a greater amenity value than other less developed river corridor areas, because they are generally maintained for more intensive recreational use.

Note: No distinction was made between park and reserve sizes. For instance, Fraser Park is intensively used for sports as well as more passive uses. Some smaller parks would not be used to anywhere near that degree.

The Environmental Strategy provides conceptual ideas for enhancing various reaches of Hutt River, in line with the selected linear park vision. Potential projects exist as ideas at this stage, and require tangata whenua, relevant council committees, user groups and clubs, other agencies, and the wider community to consider and evaluate them before enhancement projects are selected.

7

Other Indicators Considered

Capex Works

Five percent of all capital works expenditure is allocated to environmental enhancements. This expenditure is likely to equate to basic improvements to the river environs. Certain reaches may be more intensively developed for recreational uses than others, so comparing existing amenity with future amenity may be unfair.

The Environmental Strategy provides no certainty about the nature of improved recreational amenity. Placing value on the nature of upgraded recreational amenity is likely to be very subjective.

c) Heritage

Heritage Sites: Sites with Heritage Values

What measured	Presence of heritage sites
How measured	Determine number of heritage sites located in flood- or erosion-prone areas
Data source	Proposed District Plan heritage listings; waahi tapu listings in the Environmental Strategy and Phase 1 investigations
Scoring	Relative numbers present in each reach (%)

Note: The Jackson Street precinct in Petone has not been scored. However, it is an area containing significant values. One solution is to give the overall area a higher individual score (perhaps 10).

4. Present Protection Level

The present level of protection associated with each suite of works is the flood that can be contained by the stopbanks without overtopping or breaching due to structural failure.

5. Number of people directly affected

6. Area and Population Affected

These are direct measurements of areas liable to flooding and the number of people affected in each reach. It should be noted that the flood extent of some reaches overlaps; for example: KGB to Pomare (left bank) reach overlaps part of the Ava to KGB (LB) reach.

Glossary and References

Glossary

accessory building

A building that is not part of the principal building(s) on the site, the use of which is incidental to the principal building(s) on the site. Where no principal building is erected on a site, it is a building accessory to the use of the principal building permitted on the site. Accessory buildings include, but are not limited to:

- a tool or garden shed
- garage
- playroom
- recreation room
- glasshouse
- swimming pool
- spa pool
- buildings accessory to rural land uses
- buildings for providing utility services
- accessory buildings constructed for industrial or commercial land uses.

Accessory buildings do not include any habitable building or room.

The build-up of gravels and other materials deposited by

flowing water in the bed of a river.

Land at the top of gravel-based river banks that is being actively eroded by the river. The AEA has an 80m width, measured from the design channel, except where land strikes rising hillsides or residential homes. For residential properties, the AEA extends to the riverward margin of any dwelling. The AEA width is based on the effects of two or

three large floods occurring in quick succession.

The AEA is modified by the extent of the historical river channel from the general period 1930–1975. This period was chosen for two reasons:

- It represents a period when river management and development pressures increased significantly, resulting in the constriction of the active riverbed.
- A series of aerial photos from the period provided an accurate historical record.

Those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness and aesthetic coherence, and its cultural and recreational attributes.

The cost of flood damages expected on average each year due to floods that occur infrequently.

aggradation

alluvial erosion area (aea)

amenity values

annualised flood damages

ancillary structures

These include, but are not limited to:

- **Fences**
- posts
- railings
- street light poles.

Ancillary structures also include any network utility structure, other than a building.

Outcomes that the Plan intends to achieve (see Chapter 6).

Plans that assist with the physical and financial management of the Council's assets.

Rock works, vegetation or other types of protection provided on the edge of a river bank to prevent erosion. Edge protections combined with the river berm provide security for stopbanks.

Land at the top of high bedrock-based river banks that is being actively eroded by the river. The BEA has a 20m width, measured from the cliff base or design channel, whichever is the greater. The exceptions are where the BEA strikes rising hillsides or areas of residential homes.

Flood flows may erode and cause slumping of baserock escarpments. Relatively solid rock faces rise above even the 2800 cumec flood level in some locations, yet can gradually erode away over a long period of time, affecting the stability of land above the rock face.

The BEA recognises the instability of river banks along the river, representing the land margin required to manage the river. The BEA width was selected following an evaluation of erosion on Hutt River escarpments. Typical areas where the BEA applies are Moonshine (right bank), Whakatikei Confluence (right bank) and Maoribank to Gemstone drive (both banks).

The side slope of a stopbank or stream bank edge.

The moving of gravel that has built up on the inside of bends in the river to the outer eroding edge. A bulldozer or digger is usually used to push the gravel across the dry bed. Bed recontouring involves moving gravel across the watercourse, and is also known as cross-blading. Alternatively, beach recontouring only involves disturbing the dry bed.

Both methods are short-term, relatively cost-effective approaches to realigning river channels. They are usually undertaken to support willow plantings and bank edge protection work, and as a temporary emergency measure.

The riverbed is disturbed as are the banks, usually with a short- to medium-term loss of habitat and water quality, and disturbance to bird and aquatic life. The normal management practice is to undertake this work when adverse effects will be minimised: outside fish spawning and migration, and bird nesting periods.

anticipated results

asset management plans

bank edge protection works

baserock erosion area (BEA)

batter

bed and beach re-contouring

berms

Low-lying flat land adjacent to the river bank. Berms are a natural extension to the main channel, and carry water during small floods.

breaching

Breaching occurs when flood waters attack and erode stopbanks and floodwalls, eventually breaking through to flow through previously protected floodplain areas.

cumec

A cumec measures water flow. 1 cumec equals 1 cubic metre of water passing a given point every second (1m³/sec).

A **1900 cumec flood** is equal to a 1 in 100-year event. It has about a 1% chance (1 in 100) of being equalled or exceeded in any one year. On average, this is expected to occur once in 100 years, based on past flood records, though in reality it could happen at any time.

A **2300 cumec flood** is equal to a 1 in 440-year event. It has about a 0.23% chance (1 in 440) of being equalled or exceeded in any one year. On average, this is expected to occur once in 440 years, based on past flood records, though in reality it could happen at any time.

A **2800 cumec flood** is equal to a rare event. It has less than a 0.1% chance of being equalled or exceeded in any one year.

channel works

See structural measures.

contingency works

The repair of any bank protection works and the re-contouring of the bed of the river necessary to protect permanent dwellings and utilities and bank protection works from an imminent threat of erosion.

community preparedness

An appreciation of the likely effects of flooding and a knowledge of the relevant emergency management readiness, flood response and recovery programmes and procedures. It ensures that the community has the ability to cope with a flood. People who are prepared will respond more appropriately to flood warnings.

critical facilities

Essential facilities that add a whole dimension to the consequences of a flood if those facilities are inundated by flood waters. They include emergency services, emergency assembly points, hospitals, nursing homes, network utilities, hazardous waste facilities, facilities housing crucial records, and the like.

crest walls

Walls used to raise the effective height of existing stopbanks. Crest walls will be considered in locations where the existing stopbank is in good condition and the space is limited for widening. These walls are usually constructed of concrete.

degradation

The lowering of a land surface (including riverbeds) by erosion.

design channel

The optimum river channel width and alignment to carry floods. A theoretically developed natural and sustainable channel has been refined to match the existing form of the Hutt River as far as reasonable. It is the channel that will be maintained for the Hutt River in order to lessen the potential for berm areas, stopbanks and developed urban areas to be

damaged in floods.

design standard

Flood mitigation methods designed to contain a flood of a certain size. The design standard for the Hutt River is based on the 440-year flood, which equates to 2300 cumecs flowing at Taita Gorge.

development

Erecting a building, carrying out excavations, using land or a building, or the subdividing land. *Infill development* refers to developing vacant blocks of land that are generally surrounded by developed properties. *Greenfield development* refers to developing properties in previously undeveloped areas, e.g. the urban subdivision of an area previously used for rural purposes.

effects (flood hazard effects)

The adverse effects of the flood hazard. Effects include erosion of land, and damage to structures and land by waters and flood debris. These effects can be worsened by human activities. Fast flowing or ponded flood waters are dangerous for people, becoming more severe where floods affect urban areas.

Minimising adverse effects means taking all practical and reasonable steps to limit adverse effects. This implies allowing minor effects, but does not mean that all adverse effects must be eliminated.

See Chapter 1: Introduction for a more detailed explanation. The term *effect* is described in Section 3 of the Resource Management Act 1991.

emergency management measures

See non-structural measures.

Environmental Strategy

The Environmental Strategy sets out the long-term vision for developing and managing the Hutt River environment as a linear park. The Strategy provides concept plans and identifies opportunities to enhance the river environs following the linear park vision. Potential opportunities range from improving areas for passive recreation, to developing indigenous ecological habitats.

existing developed areas

Those areas that are already developed with intensive land uses.

flood

A relatively high stream flow that overtops the natural or artificial banks in any part of a stream or river.

flood defences

Physical features that protect the community from the effects of flooding. They include stopbanks, river berms protecting stopbanks, and bank edge protection works.

flood hazard

The potential for damage to property or people due to flooding and associated erosion.

floodplain

The portion of a river valley, adjacent to the *river corridor*, which is covered with water when the river overflows during floods.

floodplain hazard areas

These areas are defined by the standard of proposed structural protection. *Higher risk floodplain hazard areas* will not be protected by stopbanks. In these areas, there is a

significant threat to human life, and the potential for damage to properties and buildings is high. New development can also threaten the integrity of flood defence structures. See Section 5.4 for more detail.

flood prone

A term to describe land that would be inundated during a flood. For the Hutt Valley, this term defines land flooded by a 2300 cumec event if no stopbanks were in place.

flood warning

The process used to warn a community of an impending flood. Warnings to the general public may be provided by methods such as local radio stations and street alarm systems.

floodway

The area where most water flows during a flood. It is often aligned with naturally defined channels. If even partially blocked, floodways can cause a significant redistribution of flood flow, which can then adversely affect other areas.

They are also areas of swifter and often deeper flow. The floodway includes land adjacent to the riverbed, required to maintain an adequate corridor for the safe passage of flood waters to the sea.

geomorphology

The land form and landscape of a particular place, shaped by physical processes.

gravel extraction

The selective removal of surplus gravel from the riverbed. Extraction has two main purposes: (1) to maintain optimum flood capacity without worsening bank erosion; (2) to correct misalignments and ease flow pressure against eroding banks. Extraction occurs on the beaches in the riverbed and, excluding river crossings, usually does not involve work in flowing water.

greenfield areas

Include land zoned for development but which is not yet developed, such as residential zoned land upstream of Birchville, Upper Hutt.

Greenhouse Effect

Warming that results when the earth's atmosphere traps the sun's heat. The atmosphere allows most of the sunlight that reaches it to pass through and heat the earth's surface. The earth sends the heat energy back into the atmosphere, but much of this heat doesn't pass freely back into space because certain gases in the atmosphere absorb it. Absorbed heat warms the atmosphere, and in turn, warms the Earth's surface.

groynes

Structures built perpendicular to the river bank to push fastflowing water away from the bank edge. They are intended to halt erosion and maintain river alignment.

impermeable rock snub groynes

These consist of rocks which jut into the river at a sharp angle to the flow, in order to deflect the flow away from the bank. Snub groynes are more appropriate on straight reaches of a river, but they are less cost-effective than rock rip-rap. ?????? History of use on the Hutt ??????

rock head groynes

These give a lower strength erosion protection than rock riprap. However, they are considerably cheaper and, depending on their location and design, quite effective. They consist of rows of railway irons cabled together in herringbone pattern and pointing from 45 to 60 degrees downstream from the river bank. The groynes reduce flood velocities and trap silt, resulting in progressive vegetation and sediment build-up around them.

debris fences

Tree groynes are used to provide a moderate, cost-effective level of protection, where the river has meandered outside the design channel alignment but there are no significant assets at immediate risk. Existing tree groynes will be maintained where they remain effective. However, the use and location of tree groynes requires careful evaluation.

The place or type of site where an organism or population

normally occurs.

habitable buildings Buildings that people use for a range of living activities,

containing specific sleeping, central living and dining areas.

hapu Sub-tribe.

habitat

hazard A hazard is created when there is an interaction between a

flood event and the human use and development on the

floodplain.

house raising The action of raising the floor level on existing houses to

reduce potential flood damage.

hydraulic capacity

The maximum water flow (measured in m³/sec) that can be

carried by the flood defence system.

hui A meeting.

infill development See development.

infrastructure Networks, links and parts of facility systems, e.g. transport

infrastructure (roads, rail, parking) or water system infrastructure (pipes, pumps and treatment works).

iwi Tribe or people.

kaitiakitanga Includes guardianship and the ethic of stewardship based on

the nature of the resource itself. It is defined by tangata

whenua in accordance with tikanga maori.

key network facilities Physical parts of a utility service critical for ongoing function.

Damage to these parts would considerably worsen flooding impacts, particularly as they may not be quickly repaired. Examples include electricity transformers and water pumping

facilities.

land This term includes land covered by water.

land-use measures See non-structural measures.

left bank See true left bank.

linear park

The long-term vision or kaupapa for the river corridor determined through the *Environmental Strategy*. The aim of the linear park is to provide a tranquil environment for people to enjoy the natural character of the river.

Long-term Financial Strategy

The Regional Council's long-term business strategy covering priorities for Council funding and expenditure over a 10-year period. It can be revised every three years, with submissions from the community influencing decisions on the strategy.

mahinga kai

An area where Maori traditionally gather (or gathered) food.

major stopbanks

Extensive stopbanks protecting the main urban areas of Upper and Lower Hutt.

manaakitanga

The practice of caring for others.

mana whenua

The customary authority exercised by an iwi or hapu in an identified area.

marae

Traditionally, the central area of a village used for gatherings, councils, etc.

mauri The life essence present in all things.

mitigation

meander

The act of modernising or reducing the effects of an event – in

The natural wave-like pattern of a river on a floodplain.

this case, a flood.

native (plants)

Produced in or naturally belonging to a particular region or area.

non-structural measures

Non-structural measures mainly deal with the *residual risk* of flooding. These measures keep people away from flood waters and help the community cope when flooding occurs. *Land-use measures* influence the way land is used and buildings are constructed, while *emergency management measures* seek to improve the community's preparedness and response to flooding. Non-structural measures are the most cost-effective flood mitigation approach.

non-structural principles

These are statements guiding how land should be developed and used, and how the community should be supported in a flood emergency.

other buildings

Not habitable buildings, accessory buildings or ancillary structures. They include, but are not limited to:

- industrial and commercial buildings
- buildings used for education and public assembly, and other buildings which concentrate people
- healthcare and emergency service buildings
- · buildings used for recreation.

overflow path

The overflow path includes areas in and adjacent to the *river corridor* where a large volume of water would flow over a floodplain during a major event. They are often areas of land which lead fast-flowing water away from the *river corridor* and over the floodplain.

The depth and speed of flood waters are such that development could sustain major damage, and there may be potential danger to life. The rise of flood water may be rapid. Evacuation of people and their possessions would be dangerous and difficult; social disruption and financial loss could be high. A blocked overflow path could potentially cause a significant redistribution of flood flows to other areas of the floodplain. Due to water depths and velocities, overflow paths are generally unsuitable for development, unless adequate flood avoidance and/or mitigation provisions are made.

overtopping

The process of floodwaters flowing over the top of stopbanks and floodwalls.

pa

A fortified village.

planting

River management relies heavily on willow planting to maintain stable bank edges. Branch growth reduces flood velocities on berms and the willow's dense root mass binds the bank edge soils.

Planting typically consists of willow poles being placed in furrows in the ground. Locations for planting are carefully chosen, with consideration given to the surrounding environment. Hybrid willows that are less susceptible to spreading are used. The willow stands down the banks are maintained by replanting areas where bank erosion has occurred, and periodically cutting and layering mature trees (this thickens stands and promotes new growth).

Plantings are beneficial for river ecology. They reduce the amount of sediment being introduced to the river system, and provide shade for fish species.

ponding area

Ponding areas are those areas where flood waters would pond either during or after a major flood event.

Water speed is slow in ponds. However, water levels could rise rapidly. Evacuation of people and their possessions may be difficult, especially on foot, and may need to be by boat. There could be danger to life. Social disruption may be high. Generally, ponding areas are unsuitable for development, unless adequate avoidance and mitigation provisions are made.

rahui

A restriction on access; a prohibition.

Real Time Flood Forecasting Model

A computer model that uses data collected on rain as it falls, to predict flood flows in the river before the flows occur.

residual risk

The risk of flooding that exists despite the protection provided by flood protection structures. In other words, it is the additional or 'left over' risk due to possible breaching and overtopping of stopbanks.

right bank

riparian management

See true left bank.

This is the management of the riparian zone, which consists of the berms and the floodway. The riparian zone is an important ecological link between the river and land-based ecosystems. Good riparian management is essential for minimising bank erosion, maintaining healthy ecosystems and ensuring good water quality, for example.

Typical maintenance of rip-rap involves topping up and tidying the structure. Repairs are generally undertaken by a large hydraulic excavator, working from the adjacent bank, picking up and replacing rocks. Additional rock may be required, and repair work can usually be undertaken without diversion of the river flow.

A varying flood protection standard is applied across the floodplain. The standard varies depending on:

- potential damage cost for each area
- area and number of people affected
- an area's vulnerability to flooding and erosion.

For the Hutt, the standard is based on the 2300 cumec flood, with 2800 cumec stopbanks for principal urban areas.

Riverbed is defined in the Resource Management Act 1991: "In relation to any river, the space of land which the waters of the river cover at its fullest flow without overtopping the banks."

The river corridor comprises land immediately adjacent to the river. It is the minimum area able to contain a major flood and enable the water to pass safely to the sea. Because of its location, the river corridor represents a significant flooding and erosion hazard to people and structures, including the flood defences, sited in the corridor.

The river corridor extends from the river mouth to the Hutt Gorge. The outer limit is set by:

- the outside (landward) toe of all stopbanks
- geological features, including the valley walls, but excluding cliff-top features
- the extent of the 2800 cumec flood (except where erosion hazard areas lie outside the 2800 extent)
- the river-side margin of existing houses at Belmont and Bridge Road, Birchville, where those properties extend into erosion hazard areas.

The area upstream of Gemstone Drive, Upper Hutt (the top of the scheme) is treated slightly differently because no structural works are proposed for this reach under the Plan. Consequently, a buffer between potential development and the river's edge, which can move with a migrating river channel, defines the area affected by erosion.

risk-based standard

riverbed

river corridor

The river corridor contains:

• primary river corridor hazard area (PRC) including a:

- baserock erosion area
- alluvial erosion area
- narrative erosion area

secondary river corridor hazard area (SRC).

The primary and secondary corridor separates an area of fast-flowing water (PRC) from an area of slower-flowing and often deeper water (SRC). The PRC contains three erosion hazard areas. The baserock and alluvial erosion areas are fixed, while the narrative area moves with the migrating river channel, upstream of Gemstone Drive.

The depth and speed of floodwaters are such that existing development in the corridor could sustain major damage, and there is potential danger to life. Water may rise rapidly. Evacuation of people and their possessions would be extremely difficult. Social disruption and financial loss could be very high.

Most types of development would worsen the impact of flooding on other properties in the vicinity, posing a potentially significant threat to the safety of flood defences. Even a partially blocked river corridor would cause a significant redistribution of flood flow, likely to adversely affect other areas. The river corridor is compatible with open space, recreation and rural land uses. It is not suitable for intensive developments.

Involves moving the existing riverbed by retreating one river bank and reclaiming the other. River realignment works may cause substantial disruption to river users in the affected area, and disturb river habitat and ecology.

The amount of rainfall that ends up as stream flow.

Large boulders placed directly onto the bank to prevent the river eroding the bank and below scour depth in the active channel. Disturbance to the environment is minimised by separating the river flows from the work area with bunds (bund construction involves machinery working in flowing water for a short time). Also known as *rip-rap*.

As in *utility service*, is a system and its network infrastructure that supply a community need.

For habitable buildings this means large extensions or rebuilding 40% or more of existing habitable floor area in any one phase of redevelopment.

As defined by section 5 of the Resource Management Act:

Managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well being and for their health and safety while:

river realignment

run-off

rock lining

service

significant redevelopment

sustainable management

a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

- b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and
- avoiding, remedying, or mitigating any adverse effects of activities on the environment.

stopbanks

Banks aligned beside the river to prevent floodwaters flowing into floodplain areas.

strong community reliance

Occurs where the community will experience significant disruption due to flood damages. The community can be reliant on goods and services sold in a building (e.g. major retail centres), employment associated with a building, or services supplied within the building that regularly concentrate people (e.g. education facilities).

structural measures

Structural measures are structures or other physical works designed to keep flood waters away from existing development. Stopbanks and floodwalls are typical examples of structural works, while bridge upgrades improve flood capacity and avoid debris dams, helping to preserve a secure flood defence system. Channel works include bank edge works and channel management. Rock linings, vegetation buffers and groynes are bank edge works, which protect flood defences like stopbanks by maintaining the channel's position. Channel management methods are used on a regular basis to reduce the opportunity for the river to erode structural works and river berms. These methods include gravel extraction, and bed and beach re-contouring.

tangata whenua

People of the land: the iwi or hapu (sub-tribe) that hold customary authority over a particular area.

taonga

Highly regarded physical or spiritual treasures or property.

tapu

Temporary restriction or ban on use.

telemetry

Automatic recording of rainfall and river-level data linked to the flood base (WRC) via a radio network.

territorial local authority

A city council or district council, in this case Kapiti Coast District Council.

Te Tutohinga o te Whakaaetanga

The Charter of Understanding between the Council and the iwi in its area.

threshold of motion regime

The flow at which sediment transport commences.

tikanga Maori

Maori customary values and practices.

tino rangatiratanga

Chieftainship; chiefly authority; full authority.

true left bank

The *left bank* of the river facing downstream. The opposite bank is the *true right bank*. Totara Park sits on the right bank of the Hutt River, while Lower Hutt CBD is on the left.

urupa Burial ground.

utility A service that is essential for a safe, healthy and functioning

community. These include - but are not limited to - energy,

telecommunication, sewerage and water supply.

vegetation buffer See planting.

waahi tapu A sacred site, as defined by a hapu or iwi who are kaitiaki for

the waahi tapu.

wetland This includes permanently or intermittently wet areas,

shallow water, and land water margins that support a natural ecosystem of plants and animals adapted to wet conditions.

zone/zoning Areas of land classed for a certain range of land uses; e.g.

residential zoning specifically provides for residential homes as well as associated structures, such as garages and

storage sheds.

Activities in these zones must not produce adverse effects on neighbouring properties and the wider environment. Other land uses such as industrial development are not intended for

residential zones because they are incompatible.

References

A reference list has not been included in the Consultation Draft of the Plan. It will be included as part of the final Plan.