greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

If calling please ask for: Democratic Services

30 May 2018

Te Kāuru Upper Ruamahanga River Floodplain Management Plan Subcommittee

Order Paper for meeting to be held in the Choice Room, Greater Wellington Regional Council, 34 Chapel Street, Masterton on

Tuesday, 5 June 2018 at 10.00am

Membership of Committee

Bob Francis (Chair)

Cr Barbara Donaldson	Greater Wellington Regional Council
Cr Adrienne Staples	Greater Wellington Regional Council
Deputy Mayor Graham McClymont	Masterton District Council
Cr Brian Deller	Carterton District Council
Siobhan Garlick	
Stephanie Gunderson-Reid	
Kate Hepburn	
David Holmes	
Janine Ogg	
Rawiri Smith	
Michael Williams	

Recommendations in reports are not to be construed as Council policy until adopted by Council

Te Kāuru Upper Ruamahanga River Floodplain Management Plan Subcommittee

Order paper for the meeting held on Tuesday, 5 June 2018 in the Choice Room, Greater Wellington Regional Council, 34 Chapel Street, Masterton at 10.00am

Public Business

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

Report 18.184
08/05/2018
File: CCAB-12-291

Minutes of the Te Kāuru Upper Ruamahanga River Floodplain Management Plan Subcommittee meeting held in the Choice Room, Greater Wellington Regional Council, 34 Chapel Street, Masterton on Tuesday, 8 May 2018 at 10:35am

Present

Bob Francis (Chair), Councillors Donaldson and Staples (Greater Wellington Regional Council), Councillor Deller (Carterton District Council), Deputy Mayor McClymont (Masterton District Council), Siobhan Garlick, Kate Hepburn, David Holmes, Janine Ogg, Stephanie Gundersen-Reid and Michael Williams.

Public Business

1 **Apologies**

There were no apologies.

2 **Declarations of conflict of interest**

There were no declarations of conflict of interest.

3 **Public participation**

There was no public participation.

4 **Confirmation of the minutes of 12 September 2017**

Moved *(Cr Donaldson/Cr Deller)*

That the Subcommittee confirms the minutes of 12 September 2017, Report 17.331.

The motion was **CARRIED**.

Noted: Consultation with iwi is on-going regarding plant species to include in buffer areas with public access, to support rongoā (traditional Māori medicinal use of plants).

5 **Te Kāuru Upper Ruamahanga FMP Communications and Engagement Plan for Stage 1 of consultation**

Francie Morrow, Project Manager, Floodplain Management Plans, spoke to the report.

Report 18.126 File: CCAB-2-276

Moved *(Cr Donaldson/ Cr Staples)*

That the Subcommittee:

1. *Receives the report.*
2. *Notes the content of the report.*
3. *Endorses the Te Kāuru Upper Ruamahanga Floodplain Management Plan – Communications and Engagement Plan (Stage 1).*

The motion was **CARRIED**.

6 **Te Kāuru Upper Ruamahanga FMP Communications and Engagement Plan for Stage 1 of consultation**

Francie Morrow, Project Manager, Floodplain Management Plans, spoke to the report and advised the Committee that it is not possible to spray weeds such as Old Man's Beard and blackberry adjacent to rivers. Affected areas need to be cleared and replanted.

Report 18.125 File: CCAB-12-275

Moved *(Mr Holmes/ Cr Deller)*

That the Subcommittee:

1. *Receives the report.*
2. *Notes the content of the report.*

The motion was **CARRIED**.

Noted: The Committee requested officers to contact property owners with weed-affected river banks to discuss remedial options, and investigate with Corrections NZ any possibility for offenders with community detention sentences to work on the public areas of weed-affected river banks.

The meeting closed at 11:35am.

Bob Francis
(Chair)

Date:

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

Report	**2018.188**
Date	10 May 2018
File	CCAB-12-292
Committee	**Te Kāuru Upper Ruamāhanga FMP Subcommittee**
Author	**Francie Morrow - Project Manager, Floodplain Management plans**

Te Kāuru Upper Ruamāhanga FMP draft Volumes 1 and Volume 2 – endorsement for public engagement

1. Purpose

To seek endorsement of the Te Kāuru Upper Ruamahanga Floodplain Management Plan (TKURFMP) Volumes 1 and 2 from the TKURFMP Subcommittee and recommendation of the volumes for public engagement.

2. Background

Te Kāuru Upper Ruamahanga Floodplain Management Plan Subcommittee is responsible for the development and adoption of TKURFMP.

The FMP is being developed in collaboration with Masterton District Council (MDC), Carterton District Council (CDC), Ngāti Kahungunu ki Wairarapa, Ngāti Rangitāne o Wairarapa, and the wider community, primarily through the Te Kāuru Upper Ruamahanga Subcommittee.

Good progress has been made with the development of Volume 1 – background and Overview, and Volume 2 – Rural Responses. Volume 3 - Waipoua Urban Responses is waiting for completion of an updated flood model for the Waipoua River. Results of the updated model will be used to assist development of responses for Masterton.

The three volumes will be combined into a single document prior to a final round of consultation.

The contents of the three draft FMP volumes are:

- Volume 1 – Background and Overview (including Common Methods descriptions)
- Volume 2 – Reach Values, Issues and Rural Responses

- Volume 3 – Waipoua Urban Responses

3. Comment

The Te Kāuru Upper Ruamahanga FMP Subcommittee received early working drafts of Volumes 1 and 2 in December 2016. These were subsequently provided to CDC and MDC councillors in January and February 2017 respectively. Feedback was received and considered by the Subcommittee. Any changes and improvements were discussed with the Subcommittee during workshops throughout 2017. The outcomes of these workshops have been incorporated into draft documents for public engagement.

The updated draft documents for public engagement were presented to the Subcommittee in November 2017 and separately to MDC and CDC in February 2018. Amended versions of the documents were discussed with the Subcommittee in March 2018; minor changes were proposed and have been addressed as outlined in Attachment 1. Endorsement of Volumes 1 and 2 (Attachments 2 and 3) is being sought for the purposes of public engagement.

MDC and CDC have provided endorsement for public engagement from their respective councils.

4. Next Steps

A communications and engagement plan was endorsed by the Subcommittee at a meeting on 8 May 2018. The project team has commenced pre-engagement activities.

Pending endorsement from the Subcommittee, the Greater Wellington Regional Council (GWRC) Environment Committee and iwi partners, the intent is to start public engagement on Volumes 1 and 2 from early July 2018.

The Ruamahanga Whaitua engagement process will be taken into consideration during the TKURFMP engagement process.

5. Consideration of Climate Change

The matters addressed in this report have been considered by officers in accordance with the process set out in the GWRC Climate Change Consideration Guide.

5.1 Mitigation assessment

Mitigation assessments are concerned with the effect of the matter on the climate (i.e. the greenhouse gas emissions generated or removed from the atmosphere as a consequence of the matter) and the actions taken to reduce, neutralise or enhance that effect.

Officers have considered the effect of the matter on the climate. Officers recommend that the matter will have an effect that is not considered significant.

Officers note that the matter does not affect the Council's interests in the Emissions Trading Scheme (ETS) or the Permanent Forest Sink Initiative (PFSI).

5.2 Adaptation assessment

Adaptation assessments relate to the impacts of climate change (e.g. sea level rise or an increase in extreme weather events), and the actions taken to address or avoid those impacts.

GWRC plans for climate change in assessing the degree of future flood hazard and in determining an appropriate response. There are only specific, limited situations in which climate change is not relevant (for example, planning for present-day emergency management).

In assessing flood hazard and determining appropriate structural and/or non-structural response in areas subject to flood risk, GWRC is applying a rainfall increase of 20% to the flood hydrology in the Floodplain Management Plan to account for climate change over the next 100 years.

Guidance from the Ministry for the Environment will be updated from time to time and our approach will be revised in line with any updates.

6. The decision-making process and significance

Officers recognise that the matters reference d in this report may have a high degree of importance to affected or interested parties

The matters requiring decision in this report have been considered by officers against the requirements of Part 6 of the Local Government Act 2002 (the Act). Part 6 sets out the obligations of local authorities in relation to the making of decisions.

6.1 Significance of Decision

Part 6 requires Greater Wellington Regional Council to consider the significance of the decision. The term 'significance' has a statutory definition set out in the act.

Officers have considered the significance of the matter, taking the Council's significance and engagement policy and decision-making guidelines into account. Officers recommend that the matter be considered to have low significance.

Officers do not consider that a form record outlining considerations of decision-making process is required in this instance.

6.2 Engagement

Engagement on the matters contained in this report aligns with the level of significance assessed. The following engagement processes have been followed to date:

- Early engagement with a riverside landowners focus group

- Discussions with landowners of major projects (i.e. Rathkeale stopbank upgrade and realignment)
- Workshops held with Masterton and Carterton District Councils
- Meetings with iwi representatives to seek and confirm support

7. Recommendations

That the Subcommittee:

1. ***Receives*** *the report.*
2. ***Notes*** *the content of the report.*
3. ***Endorses*** *the draft Te Kāuru Upper Ruamahanga Floodplain Management Plan – Volume 1 and Volume 2.*
4. ***Recommends*** *that the Environment Committee approves the draft Te Kāuru Upper Ruamahanga Floodplain Management Plan – Volume 1 and Volume 2 for public engagement.*

Report prepared by:	Report approved by	Report approved by:	Report approved by:
Francie Morrow Project Manager – Floodplain Management Plans	**Mark Hooker** Senior Project Engineer – Floodplain Management	**Graeme Campbell** Manager, Flood Protection	**Wayne O'Donnell** General Manager, Catchment Management

TKURFMP Vol 1 and 2 amendments following March 2018 Subcommittee workshop

Current to 22 May 2018

Amendments to Volumes 1 and 2 were noted during the TKURFMP Subcommittee workshop on 12 March 2018. These amendments, along with minor editorial/design changes suggested by the project team are included in the summary tables below. Responses to the changes are also listed. Other comments, generally positive, were also noted and appreciated at the workshop. These tables only reflect the amendments.

General

Page	Amendments	Response
1,7, 13 4,13,25, 42,45,54	Italicise all cross references to appendices, (i.e." Appendix 1" paragraph 5) And Volumes 2 and 3	Done
All	Make water mark 'DRAFT' on each page	Done

Volume 1

Page	Amendments	Response
All	Add macron to second 'a' in Ruamahanga on all page ribbons	Done
ii	Remove "Ngāti' from before Rangitāne in 2nd paragraph	Done
2	Unbold "This Floodplain… "	Done
3 etc	More space between the Heading 1 number and titles	Done
4	Under 'Cultural' sub section – change to "… between GWRC, MDC, CDC and iwi has been" –so that GWRC, MDC, and CDC all have on-going partnerships with iwi	Done
4	Under 'Ecology' remove "abundance of" on second line	Done
5	In diagram, add macrons to the 'a's	Done
5	In diagram, be clear LTP priorities have been cherry picked. Amend GW wording to "Greater Wellington Regional Council LTP, including Flood Protection values:"	Done
7	Paragraph three, add "(including amendments)" after 2014' (is this the best way to manage this?)	Referenced (Amended 2017).
7	Split paragraph three into two paragraphs, additional paragraph starting from "At a policy level…"	Done
9	Second paragraph, second line, change to "During the 1960s and 70s. river…"	Amended to read 1960s and 1970s

9+ (*new page 10*)	Add a new section after current 2.6, called "Potential future flooding scenarios"	Updated as per draft circulated to sub-committee in May 2018
10	Turn numbering into bullets for drivers	Done
11	Bold "A number of…" and "There were also…" sentences to match page 10	Done
11	Remove 'also' from first line of Section 2.9	Done
11	Reference to old man's beard as key pest plant	Updated to "Environmental risks include potential increase of pest animals and plants, including old man's beard, within larger planted buffers."
13	Change heading to "Responses and Common Methods"	Done
13	Second paragraph, 2nd line – add comma after catchment. Change bit after the new comma to read "which reflect the different natures of the rivers" Also make this change in Appendix 2	Done
13	2nd paragraph, third line, - add "the" before 'western' Also make this change in Appendix 2	Done
13	Please add a sentence at the end of paragraph 2 – "Different management regimes are required for the gravel bed and silt bed rivers, the current flood management practices are discussed in *Appendix 2*, and proposed responses are in *Volume 2*."	Done
14	Paragraph 2, change 'banks' to berms'	Updated to "'River management' refers to works within the bed of the river or on the river berms".
14	Bullet points – add ";" to the end of the first one, "; and" to the end of the second one, and a "." to the end of the third one	Done. Added "; and/or"
15	Second paragraph – turn the semi colon into a colon, and give the "can" a lower case 'c'.	Changed to: The first consideration when assessing any response should be to ask the question: "can we avoid doing work here?"
16	Change the white writing in the table – makes it hard to read	Changed writing to black
16	Remove word 'with' at end of seventh line	Done
17	Make Code of Practice First Common Method	Done
18 (*new page 19*)	Last paragraph – add "and monitoring" after envelopes	Amended to: "Using river bed envelopes and monitoring of long-term rising and falling trends will allow GWRC to make decisions ahead of time regarding when current river management approaches may need to change and how they might change."

19 (*new page 20*)	First paragraph, second sentence – change tool to method	Done
19 (*new page 20*)	First paragraph – add "and Mixed Vegetative Planting" to the end of the sentence of methods (update sentence structure appropriately)	Changed to: "Establishing buffers supports River Edge Envelopes, River Bed Level Monitoring and Mixed Vegetative Planting common methods."
19 (*new page 20*)	Add a bullet point about benefits of nutrient uptake from tree roots	Added bullet point: "Riparian vegetation reduces the nutrients and pathogens from runoff entering the waterways"
19 (*now 20*)	Check for use of soft language - page 19, paragraph 3, last sentence "it is intended to move towards a more diverse mix of planting where possible	Changed to: "Whilst willow trees are frequently used to bind the river bank material together, the FMP will move towards a more diverse mix of planting."
21 (*new page 22*)	Last paragraph – remove "rotary"	Done
22	Second paragraph under Isolated Works Policy, first line – change "are required to" to "will be undertaken"	Done
26	Section 3.3.7 – rename to River Management Access	Done
26	Change first sentence of section 3.3.7 to: "GWRC require access to land order for works to be carried out, either for river channel management or for the construction maintenance of assets."	Done
26 (*new page 27*)	Last paragraph (*now first*), change tense "have relied" to "rely"	Done
27	New section – "3.3.8 Strategic Land Purchase for River Management" to start with paragraph "GWRC's preference is to own…"	Done
29	Remove words "and redundancy" from bullet point	Done
31	Add table heading "Environmental Issues and Actions"	Done
31	Add 'straightening of river channels' as an environmental issue.	Done – We have included the following text in relation to Improvements "Seek to allow the river more room to erode and maintain natural processes"

32	Include iwi support as part of the community support officer.	Paragraph two now reads "Further opportunities exist for GWRC to build upon existing relationships with landowners, iwi and the wider community who wish to be involved in the health of river environments." Included the following as a key task of this role: "Reinforcing partnership with iwi;"
33	Remove care group examples from 4th paragraph to avoid risk of missing any	Done
33	Include photo of what care groups do	TBC
35	Section 4.1.2 second paragraph refer to "one" representative from within the eastern scheme areas	Done
36	Move start of section 4.2 to page 37	Done
38	Change title of Section 4.3 to "Funding Structure"	Done
38-40	Update funding section	Updated as per draft circulated to subcommittee in May 2018
39 on	Check that water mark is on each page	Done
39	MDC requested clarity that: 1. We are not expecting BAU costs to increase 2. We are not exactly sure how costs will be affected into the future 3. There are increased costs for other outcomes (summarised on page 47)	*Added following to General Responses: "Business as usual' operational works costs are included in the table. Although we can't be certain, these are not expected to increase in the future as a result of the changes in operational approaches proposed in this FMP. Operational costs will be reviewed as part of assessing the success of the proposed changes when the FMP is reviewed. There will, however, be an increase in costs for flood and erosion protection associated with the additional outcomes of the FMP listed on pages 43 and 47."*
41	What about the Kopuaranga debt?	Added 'and debts' to paragraph 3, section 4.3.6
42	Section 4.4.1 font of last paragraph	Done
42	Need a new section to introduce Major Project Responses which will be implemented. These come as a bit of a shock.	This is covered in section 4.4.1 Added reference to "refer Volume 2" at top of page
44	River Management - Include reference to the first 5 years as easier to predict, beyond this it is harder to predict.	Add the following sentence to the end of the first paragraph "The first 5 years are easier to predict, beyond this it gets more difficult."
44	Add 's' to link for figure caption	Done
47	Add operational BAU costs to the table	Done

48	Need to consider wording around adaptive management	Changed to: "…can be updated and changed where the need arises . Outcomes of the FMP will be largely be implemented through river management activities authorised through our resource consents. Both the resource consents, and the associated Code of Practice, include adaptive management processes whereby improvements can occur as new information and techniques become available. The consents and the Code of Practice are both mandated through a statutory process."
50	Change consultation to engagement where appropriate	"The community consultation and engagement stage provides…" "Current stage: Engagement with…" and opposite "Engagement with the community on Volume 3…"
51 & 53	Correct spelling of Gundersen-Reid	Done
53	Insert new photo of Gary McPhee without his top hat	No Change. GWRC photos had Gary wearing his hat.
56	Remove "Ngati" in front of Rangitāne o Wairarapa	Done
59	Make new Appendix 3: Current River Management Schemes of the Te Kāuru area	Done
63	Refer to National Policy Statement for Freshwater Management 2014 (NPS-FM, 2014 (2017 Amendment))	Done
63	Change Wai tapu to Wahi Tapu in last line	Done
64	Reference PNRP and District Plan	Included following text extracted from GWRC's Guidelines for Floodplain Management Planning - "Any Regional Plan or District Plan prepared under the RMA is required to put a RPS into practice. These plans help the respective regional and city/district councils to carry out their resource management functions, including managing natural hazards and their associated effects, and to develop ways to deal with the full range of floodplain management planning issues."
Many	Include extra space between the heading one numbers and the title words.I.e. at the top of page 1, 3, etc	Done

Volume 2

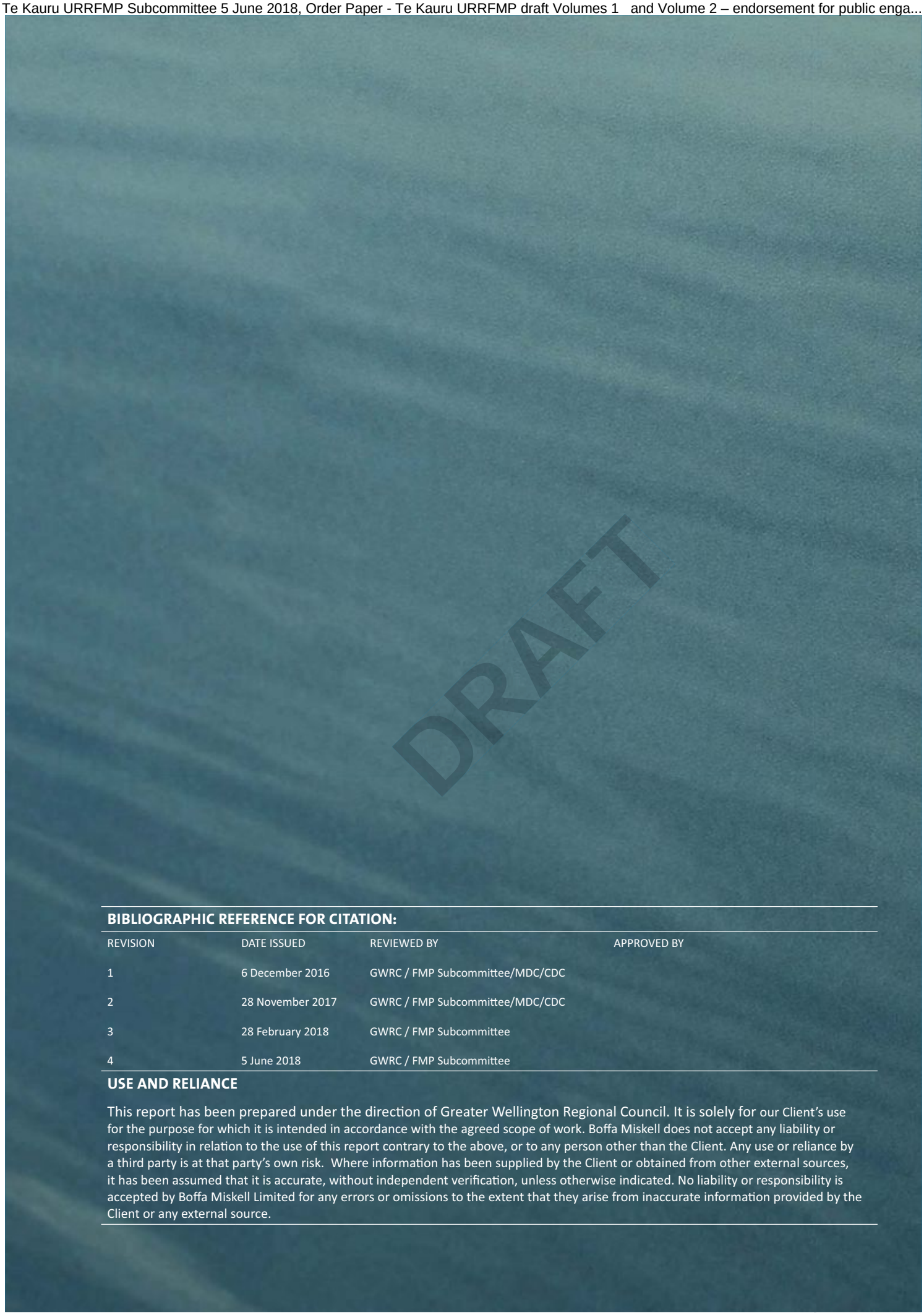
Page	Amendments	Response
viii	Remove extra river names on side of map	Done
5	Provide greater differentiation between infrequently fished and wilderness fishing opportunities	Done
46	Last line on left hand column, add space between “the” and “mixing”	Done
51	Check numbering of Kokotau /Taumata Stopbank on map	Done
92	Issue 156 – remove text stating plan for future retirement of water race	Done
105	Change “rock revetment” to “rock line”	Done
Many	Check dpi/export pic quality of background layers on maps – i.e. lines are not crisp outlining values areas/flood hazard areas etc. Although the issues numbers etc are crisp	Done
All	Make water mark ‘DRAFT’	Done

Attachment 2 to Report 18.188

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

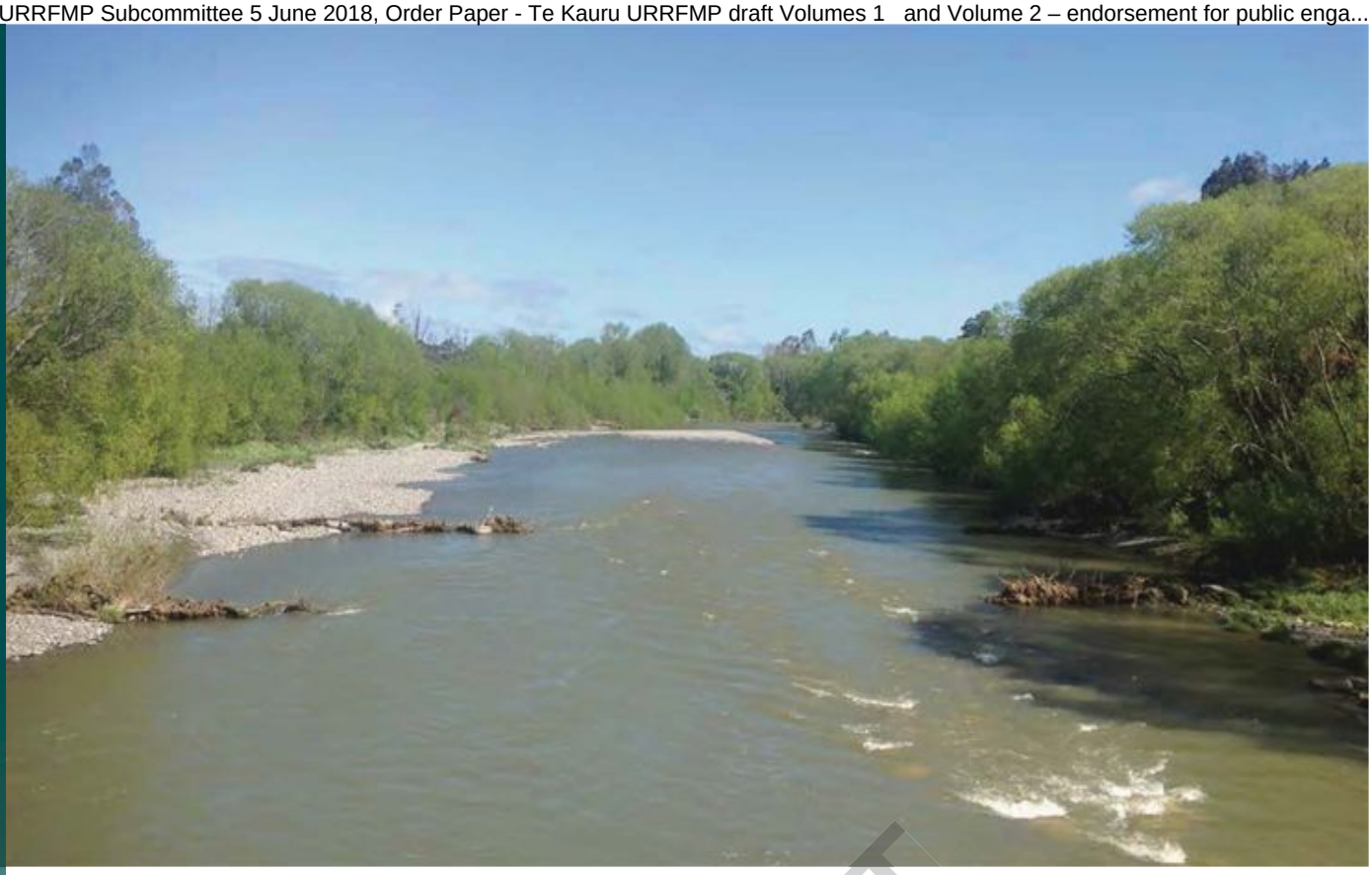
DRAFT FOR COMMUNITY INPUT
TE KĀURU
UPPER RUAMĀHANGA
FLOODPLAIN MANAGEMENT PLAN
VOLUME 1: BACKGROUND AND OVERVIEW

REVISION 4 | JUNE 2018



BIBLIOGRAPHIC REFERENCE FOR CITATION:

REVISION	DATE ISSUED	REVIEWED BY	APPROVED BY
1	6 December 2016	GWRC / FMP Subcommittee/MDC/CDC	
2	28 November 2017	GWRC / FMP Subcommittee/MDC/CDC	
3	28 February 2018	GWRC / FMP Subcommittee	
4	5 June 2018	GWRC / FMP Subcommittee	



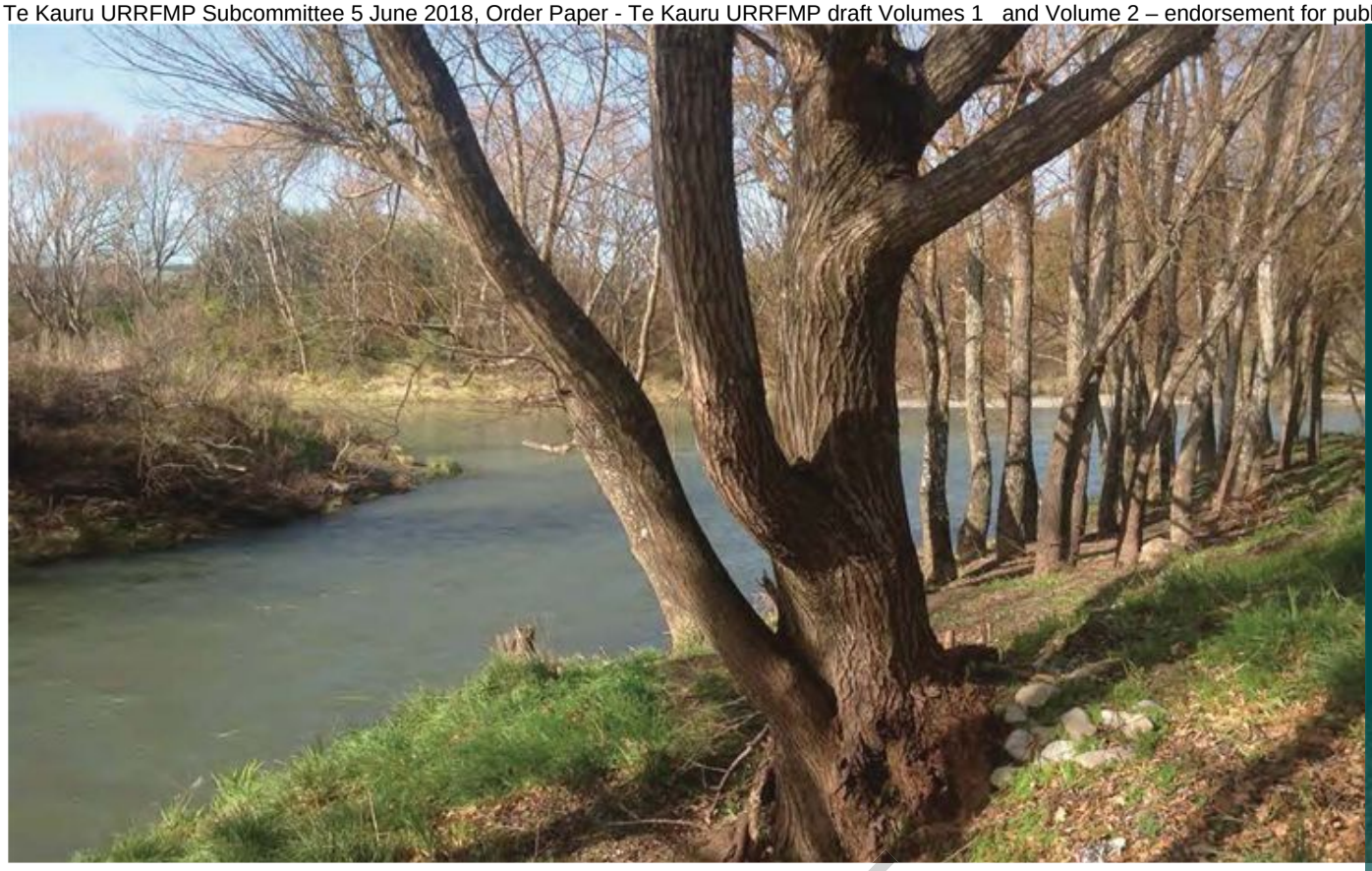
Executive Summary

This Floodplain Management Plan establishes a framework that will help keep people and property safe by proactively managing flood and erosion risks throughout the Te Kāuru Upper Ruamāhanga catchment. Through this framework, the overall vision for the Te Kāuru Upper Ruamāhanga catchment seeks to establish:

"A CONNECTED, RESILIENT, PROSPEROUS AND SUSTAINABLE COMMUNITY, PROUD OF ITS RIVERS, THAT IS INVOLVED IN MANAGING FLOOD RISKS IN A MANNER THAT RECOGNISES LOCAL IDENTITY AND PROTECTS, ENHANCES OR RESTORES NATURAL AND CULTURAL VALUES"

The rivers within the Te Kāuru Upper Ruamāhanga catchment have a history of flooding, causing danger and disruption for people within the catchment. The results of flooding can be devastating and cause damage to property and community assets.

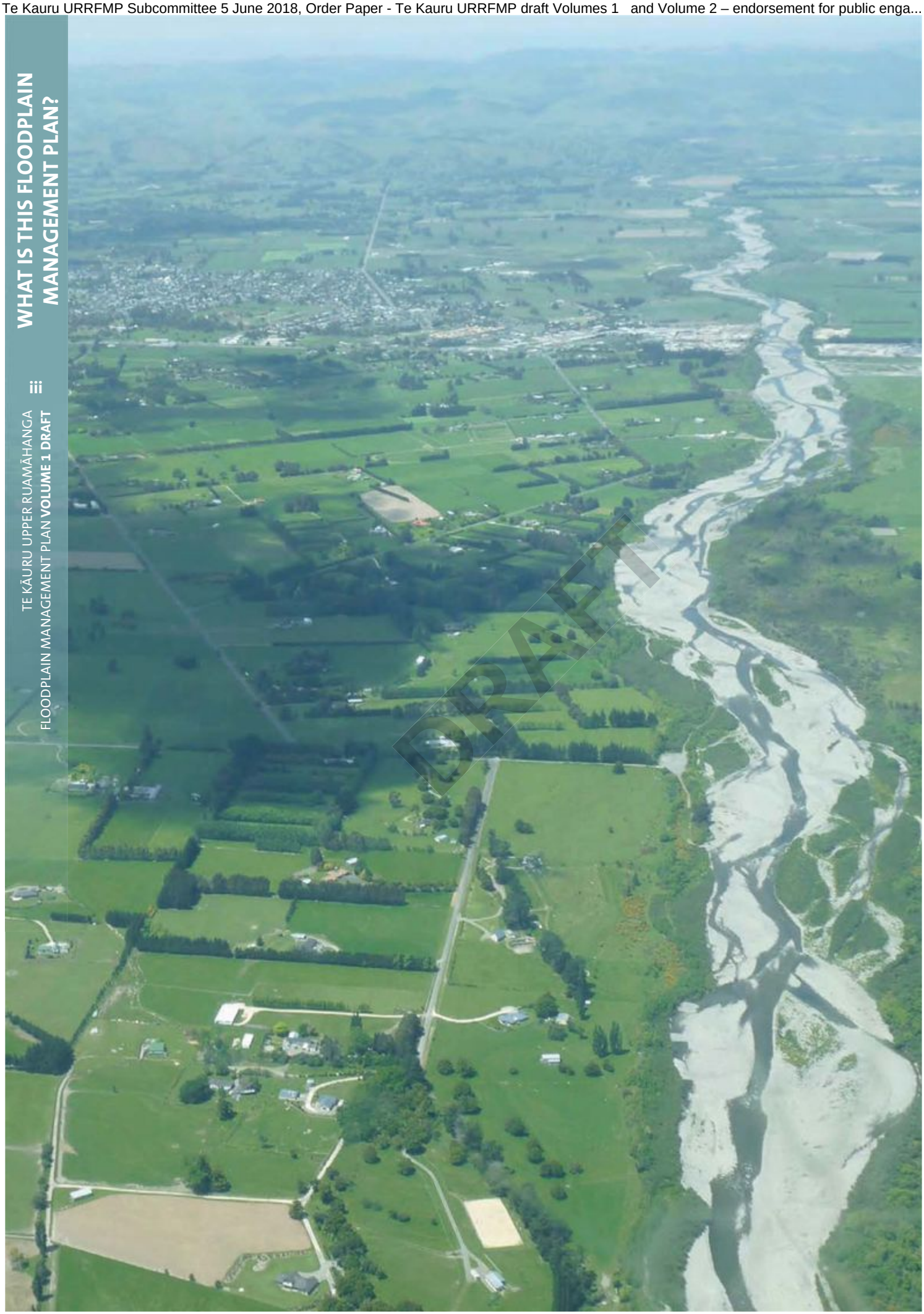
This Floodplain Management Plan represents many years of investigating the most appropriate, comprehensive and long-term approach for managing the flood and erosion risks to both rural and urban land within the Te Kāuru Upper Ruamāhanga catchment. The process of preparing this Floodplain Management Plan has involved the assessment of various options that were based on a vision and set of aims developed early in the process. Importantly, the practicality, cost, environmental impact, cultural values, views/needs of the community, and legislative and policy requirements have all influenced the document.



To allow the community and key stakeholders to make comments before formal adoption, this Floodplain Management Plan has been prepared as a "draft" version for the purpose of public consultation. Once adopted, the document will be the "blueprint" for ongoing and future flood and erosion works within the Te Kāuru Upper Ruamāhanga catchment.

The primary flood and erosion response measures contained in this Floodplain Management Plan are a package of "common methods" and "reach specific responses" (both non-structural and structural) that manage the identified flood and erosion risks throughout Te Kāuru Upper Ruamāhanga. This Floodplain Management Plan has been put together by Greater Wellington Regional Council in collaboration with Carterton District Council, Masterton District Council, Ngāti Kahungunu ki Wairarapa, Rangitāne o Wairarapa, and the wider community.

It is intended that this Floodplain Management Plan will be a long-term plan and living document for the approach to flood and erosion management within the Te Kāuru Upper Ruamāhanga catchment. As such, ongoing monitoring of this Floodplain Management Plan will enable the outcomes to be regularly reviewed. Additionally, a comprehensive review of this Floodplain Management Plan will be undertaken after 20 years, or earlier if the flood hazard is significantly altered by flooding, earthquakes or new information.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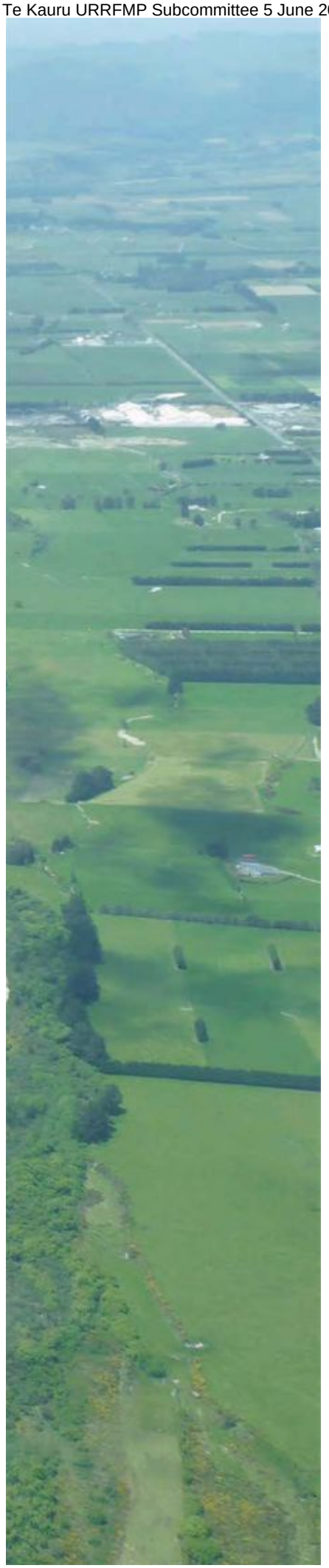


1. What is this Floodplain Management Plan?

The Draft Te Kāuru Upper Ruamāhanga Floodplain Management Plan (FMP) describes the long-term approach to floodplain management within the Te Kāuru Upper Ruamāhanga catchment. This encompasses the upper reaches of the Ruamāhanga River to the Waiohine confluence, and includes the Waipoua, Waingawa, Kopuaranga, Whangaehu, and Taueru (Tauweru) rivers from their headwaters within the Tararua Ranges and Eastern Hills to their confluences with the Ruamāhanga River. The catchment has a total area of approximately 1,560km^2.

Floodplain management planning is commonly used as an effective process to address flooding and erosion issues resulting from our rivers. It provides a long-term plan for managing risks and helping to improve the security and quality of life for present and future generations living on a floodplain. Additionally, it better prepares communities for coping with a flood when it occurs, and aims to ensure that any future development considers flood and erosion risk.

FMPs are non-statutory plans and, as such, their policies and flood mitigation methods have no legal standing as regulations. Regardless, FMPs carry considerable weight in any decision-making given the public process undertaken to prepare the plans and Greater Wellington Regional Council's (GWRC) responsibility for flood protection in the region.

In accordance with GWRC guidelines, this FMP contains information about the rivers and associated tributaries, the risk of flooding and erosion, and what has been done to manage the risk so far. It also describes potential environmental, cultural, and recreational values the community holds in relation to the catchment, and how floodplain management can seek to maintain or improve these values.

Crucially, this FMP sets out the outcomes the community would like to see achieved in the floodplain, including the measures required to minimise risk in the event of a flood. As part of understanding the desired outcomes of the community in preparing this FMP, different local, regional, and national perspectives from a range of parties have been taken into account. Relevant parties have included the Regional and District Councils, iwi, government agencies, infrastructure providers, community groups, and private land and business owners – all of whom have to consider the consequences of flooding. The development process and involved parties are described in more detail in *Appendix 1* of this document.

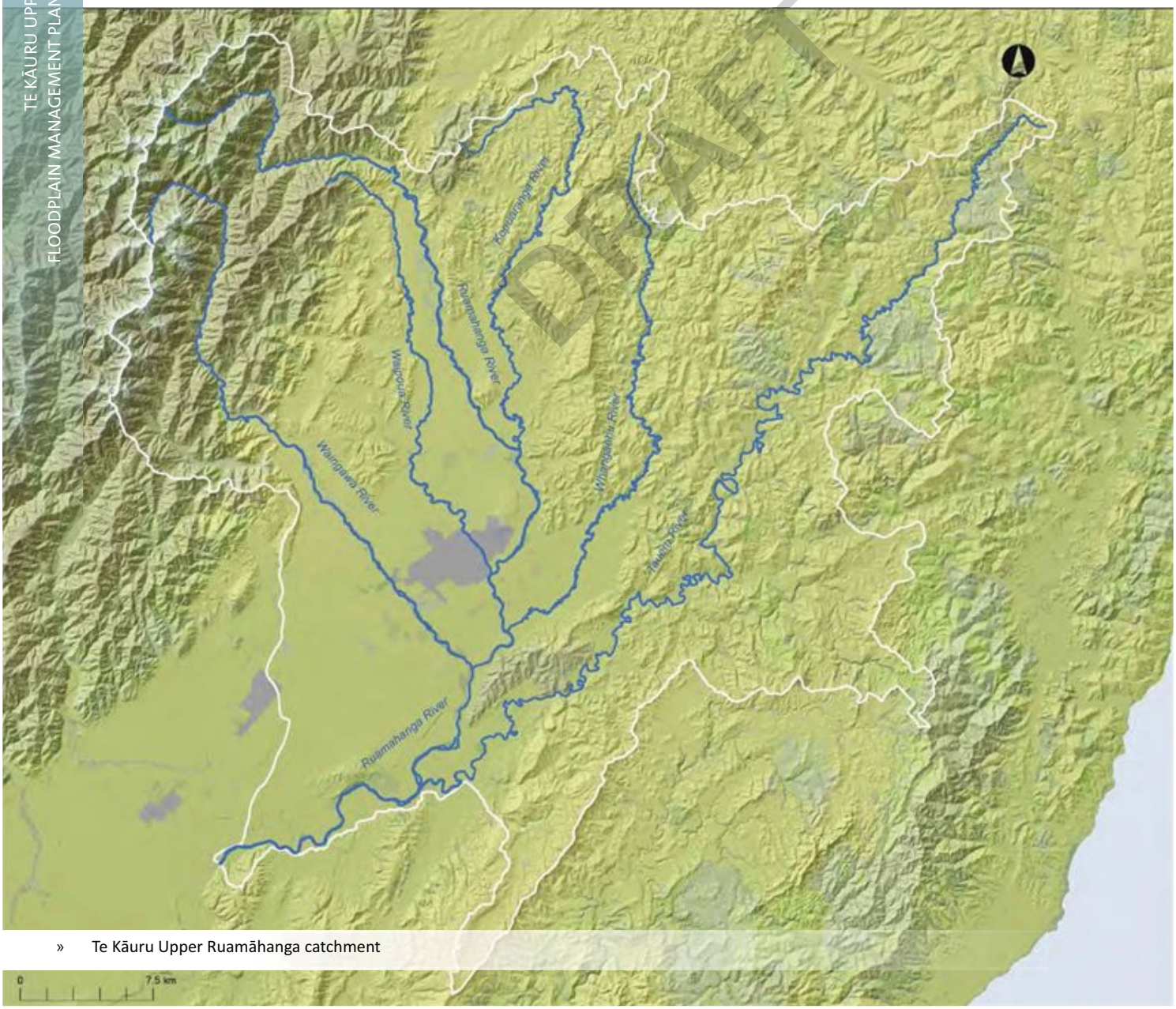
This plan will be the primary floodplain management guidance document for landowners, government agencies, the community, and decision makers to reference when considering the future planning and administration of the Te Kāuru Upper Ruamāhanga catchment. As such, this FMP has been prepared as a living, non-statutory document and it will need to be updated in the future, as required. At the time of any update, all of the interested stakeholders will be consulted to provide input into the long term management of the river catchment.

This Floodplain Management Plan is set out in three volumes:

Volume 1 describes why we need this plan (including the vision and aims), the suite of responses and common methods that will be used throughout the catchment, how the plan will be implemented, and how the community can contribute to the process.

Volume 2 sets out the floodplain management outcomes to be delivered across rural areas of the Te Kāuru Upper Ruamāhanga catchment. The six rivers that make up the Te Kāuru Upper Ruamāhanga catchment have been divided into 20 separate reaches (17 for the western gravel bed reaches, as well as the three eastern silt bed rivers) for the purpose of identifying existing values and flood and erosion issues and thereby directing the most suitable floodplain management responses.

Volume 3 outlines the floodplain management outcomes in relation to the Waipoua River as this relates to the flood risk to the Masterton Urban area .



» Te Kāuru Upper Ruamāhanga catchment

2. Why do we need this Floodplain Management Plan?

2.1 Purpose of the Floodplain Management Plan

The purpose of this FMP is to establish a framework that will assist in keeping people and property safe in the Te Kāuru Upper Ruamāhanga catchment. It will do this by proactively managing the river channels as well as providing land use and protection measures to support the continued appropriate use of both rural and urban land and resources in potential flooding and erosion prone areas. The main purpose of proactively managing flood and erosion risk to people and property is supported by some common underlying themes, including the desire to:

- Avoid risk;
- Reduce the flood risk to people and property;
- Support a resilient local economy and a scheme that is affordable and fairly funded;
- Work with district councils to coordinate long term planning outcomes;
- Recognise the role of tangata whenua and their cultural values;
- Recognise environmental matters; and
- Provide recreational opportunities.

2.2 Values

As with all rivers, the rivers that make up the Te Kāuru Upper Ruamāhanga catchment have a diverse range of values attributed to them. These include a range of intrinsic values encountered throughout the catchment and that influence the way humans relate to and interact with the floodplain. The emphasis of such values shift in response to the culture of the community and may change as generations come and go.

The Resource Management Act (RMA, 1991) sets out the broad framework through which all New Zealand's rivers must be sustainably managed to provide for our social, economic and cultural well-being and to preserve natural character. Within the regional context of the rivers which make up Te Kāuru Upper Ruamāhanga, important values are managed through the Natural Resources Plan and the Ruamāhanga Whaitua process, both of which have identified values through input from the local community and tangata whenua.

Throughout the Te Kāuru Upper Ruamāhanga floodplain the specific values of rivers and their associated natural character include: providing food and resources; contributing to identity; providing for livelihood; sustaining health and wellbeing; and providing recreation opportunities. Many of the values recognised today extend back to pre-European settlement - commonly referred to as cultural values in the development of floodplain management plans.

Te Kāuru – the headwaters of the Ruamāhanga catchment – extends from the Tararua Ranges to the Eastern Hills covering an area of 1,560km^2. The western rivers emerge from the rugged Tararua Ranges, well known for their pristine native forests, onto the fertile Wairarapa Plains. As a result, the upper reaches of these rivers are commonly valued for their beauty, mauri (life force), recreational opportunities and spiritual significance. The eastern rivers are characterised by lower undulating hills dominated by agricultural use. However, strong cultural and ecological values remain alongside several recreational areas.

Through the FMP process, specific sites of value have also been identified across the Te Kāuru Upper Ruamāhanga floodplain. These are shown on a series of maps in *Volumes 2 and 3* of this FMP and encapsulate the following:

Landscape

Each river has been divided into defined reaches, recognising the unique identity each section of river has in terms of river attributes, landscape context and riparian margins. Recognition of landscape value has been informed through landscape character investigations developed to inform the Regional Plan and includes a refined understanding of the level of landscape modification and scenic value for each reach.

Recreational

All of the rivers in the Te Kāuru Upper Ruamāhanga catchment are recognised as having at least some level of recreation value, reflecting the way in which the rivers are used by groups and individuals for pastimes, hobbies or recreation. Such recreation activities include swimming, kayaking, fishing, duck hunting, jet boating and walking and encompass recreation areas established along river margins.

Heritage

The Ruamāhanga River and its tributaries have played an important role in shaping the historic settlement pattern that has evolved within the Wairarapa Valley. Early settlement historically focussed along the margins of the river, and sites of heritage value remain along parts of the Te Kāuru Upper Ruamāhanga floodplain.

Cultural

Ngati Kahungunu ki Wairarapa and Rangitāne o Wairarapa have a close relationship with the rivers, wetlands and floodplains throughout Te Kāuru. This includes sites of specific importance and broader, more holistic cultural values. An on-going partnership between GWRC, MDC, CDC and iwi has been established to ensure better understanding of the range of spatial and non-spatial cultural values which occur.

Land use

Land use values include a range of current and future land-uses relevant to both urban and rural contexts. This includes future development sites, key infrastructure, and sites of potential contamination included in the Selected Land Use Register.

Ecology

Te Kāuru Upper Ruamāhanga is valued for its broad ecological diversity. This includes native and introduced fish species and a range of bird species including several ground nesting species such as the nationally-threatened Buller's Gull. Apart from a more cohesive cover of native vegetation established in the upper reaches of the western rivers, vegetation along the margins of the rivers is dominated by willows with pockets of important habitat, indigenous forest, stonefield and boulderfield, natural wetlands and ponds.

2.3 Vision

The range of values recognised throughout Te Kāuru Upper Ruamāhanga form a primary focus that has shaped and guided the overall vision for this FMP. Key values encapsulated in this vision include: promoting sustainable economic development; protecting and enhancing natural spaces and systems; recognising and improving tangata whenua values; and providing for wider community needs, including building resilient communities. To achieve this vision, the FMP requires people and communities to work together.

The overarching floodplain management vision for the Te Kāuru Upper Ruamāhanga catchment is to establish:

A CONNECTED, RESILIENT, PROSPEROUS AND SUSTAINABLE COMMUNITY, PROUD OF ITS RIVERS, THAT IS INVOLVED IN MANAGING FLOOD RISKS IN A MANNER THAT RECOGNISES LOCAL IDENTITY AND PROTECTS, ENHANCES OR RESTORES NATURAL AND CULTURAL VALUE

The vision of the Te Kāuru Upper Ruamāhanga FMP is aligned with the expected outcomes stated in the Long-Term Plans of the regional and district councils as shown on the following diagram.

TE KĀURU UPPER RUAMĀHANGA FMP VISION:
A connected, resilient, prosperous and sustainable community, proud of its rivers, that is involved in managing flood risks in a manner that recognises local identity and protects, enhances or restores natural and cultural value

Masterton District Council LTP:

- a strong, resilient economy
- a sustainable, healthy environment
- an active, involved and caring community - recreation
- a reliable and well-maintained infrastructure

Carterton Distric Council LTP:

- a vibrant and prosperous economy
- a safe and healthy district
- a district that enjoys recreation
- a district that values and protects its natural environment
- a district that promotes sustainable infrastructure and services

Greater Wellington Regional Council LTP, including flood protection values:

- a resilient community
- a strong economy
- a healthy environment
- recreational use of river corridors

2.4 Aims

Through the development of this FMP, overarching aims were identified that describe the desired outcomes to be achieved through the FMP. More detailed management objectives for each reach or that may be required for specific sites are also included on a reach-by-reach basis in *Volume 2*.

In identifying the overarching aims of the FMP, inspiration was drawn from a range of different sources, including council policies, mission and purpose statements of organisations involved with the FMP, and the issues and values held by affected communities.

While the aims have been split into five groups, there exists a complex relationship across the groups and between individual aims. No prioritisation is implied by the numbering of the aims, which has been used purely to assist discussion.

1. To work together to develop a sustainable floodplain management plan

a. Provide affordable flood hazard management across a whole continuum of flood risk
b. Align with integrated catchment management principles
c. Follow the principles set out in the flood protection Code of Practice
d. Endeavour to make future development and land-use compatible with flood risk

2. To support sustainable economic development

a. Inform the long term plans of local authorities
b. Reduce the likelihood of loss to private property, business and agriculture
c. Make property owners aware of their flood risks and damage potential
d. Manage or reduce the risk to essential public infrastructure and maintain lifelines during flood events.

3. To protect and improve the cultural values of rivers

a. Improve the recognition of the impacts of flood and flood hazard management on cultural activities and values
b. Improve the mauri of waterways within the catchment
c. Improve access for mahinga kai and cultural practices
d. Recognise and consider the interconnectedness of natural systems

4. To recognise local community needs and build resilient communities

a. Make communities aware of their flood and erosion risk
b. Recognise opportunities to support the sustainable aspirations of the community and landowners
c. Identify and support opportunities for improved public access to and along rivers
d. Maintain and improve the level of safety for recreation users of the rivers

5. To protect and enhance our natural spaces

a. Improve awareness and understanding of the natural values and character of the river environment
b. Improve recognition of impacts of flood and flood hazard management on environmental and ecological values
c. Create more space for rivers and their natural processes
d. Improve the water quality and habitat diversity along the rivers
e. Make the use or extraction of natural resources including gravel management sustainable and compliant with relevant policies.

2.5 Legislation, Policies and Principles

Decisions concerning the management of flood risk, such as that associated with the Te Kāuru Upper Ruamāhanga catchment, are informed by a mix of national and regional statutes, policies, and principles that underlie, and set the context for, effective floodplain management planning.

At a legislative level, floodplain management is principally influenced by three key statutes: the Resource Management Act 1991 (RMA); the Local Government Act 2002 (LGA); and the Soil Conservation and Rivers Control Act 1941 (SCRCA). Each of these perform a distinct and important role in managing flood risk, including the ability for a range of regulatory and non-regulatory measures to be introduced that enable central and local government to more effectively manage such risks. Provisions in the RMA, for example, provide a regulatory planning context for regional and city/district councils to control land use to avoid or mitigate natural hazards such as flooding, while the LGA and SCRCA enable regional councils to initiate and fund non-regulatory measures, such as stopbank construction and channel maintenance.

At a national level, the National Policy Statement for Freshwater Management (NPS-FM, 2014 (Amended 2017)) provides direction to local authorities on management of fresh water through establishment of a framework that considers and recognises Te Mana o te Wai (the integrated and holistic well-being of the water) as an integral part of freshwater management. In addition, it also includes a set of objectives and policies that direct that water to be managed in an integrated and sustainable way, with provision made for economic growth within set water quality and quantity limits

At a policy level, the Regional Policy Statement for the Wellington Region (RPS) plays a prominent role in managing natural hazards, such as river flooding. The RPS does this through the policy framework it establishes for the region and that the regional council and district councils are required to give effect to in their respective regional and district plans. Of particular note is the directive in Policy 29 of the RPS that district and regional plans 'avoid subdivision and inappropriate development in areas at high risk from natural hazards'.

GWRC has adopted four core principles that underpin its approach to floodplain management planning, and that reinforce and complement the statutory and policy considerations outlined above. These principles are:

- Avoid building in areas at high risk of flood hazard (e.g. undeveloped 'greenfield' areas)
- Only consider new flood protection infrastructure where existing development is at risk (e.g. dwellings, irrigation infrastructure, dairy sheds)
- Establish standards of flood protection relative to the degree of risk (e.g. a minimum 1% Annual Exceedance Probability (AEP) flood standard for stopbanks constructed to protect existing urban areas and associated land-use)
- Plan for climate change in assessing the degree of flood hazard risk and in determining an appropriate response (e.g. a 0.8m allowance for sea level rise)

These principles played an influential role in informing the range of responses proposed for inclusion within the Te Kāuru Upper Ruamāhanga FMP.

Further supplementary detail relating to the core principles is included in *Appendix 4*.

2.6 Flood History

There has been a long history of river management within the Te Kāuru Upper Ruamāhanga catchment associated with human settlement and the desire of people to protect themselves and their assets from the threat of flooding. Floods that breached the river banks and flowed across the Te Kāuru Upper Ruamāhanga floodplain occurred relatively frequently, especially in the eastern areas of the catchment.

For early Māori, and later the first European settlers, settlements existed through the establishment of seasonal sites. The timing of these would be driven by a range of factors including flood risk, and their location governed by proximity to important and lucrative resources that were often very close to rivers. These sites provided easier transport links, and improved access to water, food, and fertile land and eventually led to permanent settlements.

Following the arrival of Europeans, some of these settlement sites have grown into large permanent towns. The increased size has put them in a position where some parts of the community have spread out into areas of greater hazard. This, combined with changing environmental conditions, can lead to increased pressure between the flood hazard and community aspirations, and if left unchecked results in an increasing risk to life and property.

The Ruamāhanga River is well known to the Wairarapa community for its flood events. During the early 20th century, settlers suffered damage and loss when the Ruamāhanga River overflowed its banks, washing shingle onto valuable pastures. The bed of the river had become badly choked with willows, restricting flood flows, and the channel was of inadequate size for the floodwater volumes and of irregular alignment.

One of the most destructive flood events in the Wairarapa valley took place in 1947. During this event, the flow in the Ruamāhanga River measured 2,580m³/s near Martinborough and was estimated to be a 1% AEP flood event (meaning that there was a 1% chance of this event occurring in any year). The most significant impacts from this event were experienced in the lower reaches of the Ruamāhanga catchment, but floodwaters entered Masterton and other Wairarapa towns, and most of the stopbanks on the Ruamāhanga River were overtopped. This resulted in thousands of acres of farm land being flooded and thousands of drowned livestock. Individual property damages were also significant.

In response to the ongoing risk of flooding, various river management schemes were proposed and implemented to provide river alignment stabilisation, bank edge protection, and improved stopbanking to reduce the incidence of flooding to adjacent floodplain along many sections of the river.

The major flood risk to Masterton comes from the Waipoua River. Additionally, the flood risk from the Waipoua River can be compounded by the backing up effects of flooding in the Ruamāhanga River. Because of this, the Waipoua River was substantially modified and straightened in the 1930s and 1940s, including establishing the existing stopbanks constructed along the margins in response to flooding concerns. The rivers of the Upper Wairarapa Valley are also connected and can be influenced by the same rainfall event, so when one rises the others can follow, worsening the risk of flooding and leading to serious events that have caused significant levels of property damage. This has happened as recently as 1998 and caused damage to a large number of private properties, community assets, and flood protection infrastructure.

The Waingawa River is a steep and powerful river. Fortunately for much of the surrounding community, the river is entrenched within a fairly tight, naturally-confined floodplain. This means that much of the flooding – even in a large flood event – is contained by the river terraces from where it enters the Wairarapa Plains until it joins the Ruamāhanga River. Within these confining terraces, recent river activity can clearly be seen on the ground and more clearly in aerial photography where overflow paths have left their mark both from deposition and scour. While the flood risk from the Waingawa River is limited by its entrenched form, the erosion risk, both modelled and observed, is of significance. This high energy river regularly reshapes its main channel during each flood event.

Historically, the Whangaehu River has caused issues with extensive flooding across the Wairarapa Plains. During the 1960s and 1970s, river management techniques of straightening the river and intensive willow planting were carried out to manage flooding hazards. Unfortunately, these willows eventually led to significant erosion issues after the river channel became 'choked' with vegetation, resulting in the river channel migrating to adjoining areas. This then led to issues with sedimentation causing further channel constrictions.

A number of significant flood events have also occurred in the Taueru River. Similar to the Whangaehu River, willow trees were planted along the length of the Taueru River and have resulted in channel constrictions. A river management scheme was established in 1994 in the lower reaches of the river to address flooding issues.

In 2004 and 2005, extensive flooding occurred on the Kopuaranga River that consequently led to the formation of a river management scheme. As with the Taueru and Whangaehu Rivers, the scheme's work was mainly focused on managing the impacts of flooding related to willows choking river flows in the channel.

» Flooding of Bruce Street 1934

2.7 Future Flooding and Climate Change

Climate change predictions are that large storms will become larger and flooding will become more frequent. This is despite a predicted decrease in the overall annual rainfall in the Wairarapa, and an increase in droughts. With regard to rainfall and flooding, GWRC's current allowance for climate change is for a 1% AEP rainfall event to be 20% greater by 2100.

The underlying science is continuing to evolve; therefore changes in the scientific understanding and/or national guidance mean that this policy is likely to change in the future. For example, the latest science indicates that the intensity of shorter duration storms could increase more than for longer duration storms.

2.8 Drivers and Benefits

The key river management drivers of this FMP include:

- Continued provision of flood hazard management and erosion protection for land beyond the buffers (using sustainable management approaches);
- More equitable distribution of scheme resources; and
- Enhancing environmental and cultural values of the rivers by allowing greater expression of natural river processes, where possible, and attempting to minimise the frequency of in stream works.

This FMP sets out the methods to achieve the vision and aims.

The methods seek to bring a range of benefits including:

- Equity and social benefit - River scheme benefits will be more equitably distributed. In the current situation, some landowners receive the highest level of scheme expenditure (e.g. when a landowner does not provide the space for buffers). Reactive works will no longer be automatically directed towards properties where buffers have not been provided to control erosion, thereby addressing the potential for ongoing unequal cost burdens to other landowners presently within the scheme.
- Increased environmental value of the rivers – The proposed methods ensure that ecosystems and biodiversity have the opportunity to improve. For example, providing more space for the river channel can result in more diverse aquatic and riparian habitat and better connectivity between terrestrial and aquatic ecosystems. A more naturally meandering river creates more variety of flow velocities, depths, and temperature. This also supports greater habitat diversity than is generally available in more restricted or highly managed river channels and provides opportunities for diversity of riparian plants, which provide increased food and shelter for terrestrial ecosystems. These outcomes will work

to improve natural character and conditions which provide for more variety in aquatic life.

- Increased cultural value – This embodies kaitiakitanga (guardianship of, and caring for, the river) by considering the processes on the catchment scale, allowing the rivers to express more of their natural character, behaviour and form. These also enhance a river's mana.
- Economic opportunities – Potential economic opportunities can occur in association with changes in land uses along river corridors. Vegetated buffers may increase productivity in some instances. The honey industry also sees opportunities associated with vegetated buffers that produce food for bees.
- Improved recreational and amenity value – It is anticipated that improved natural character will support more birds and fish, and improved water quality will enhance recreational opportunities within and along the margins of rivers.

2.9 Risks and Constraints

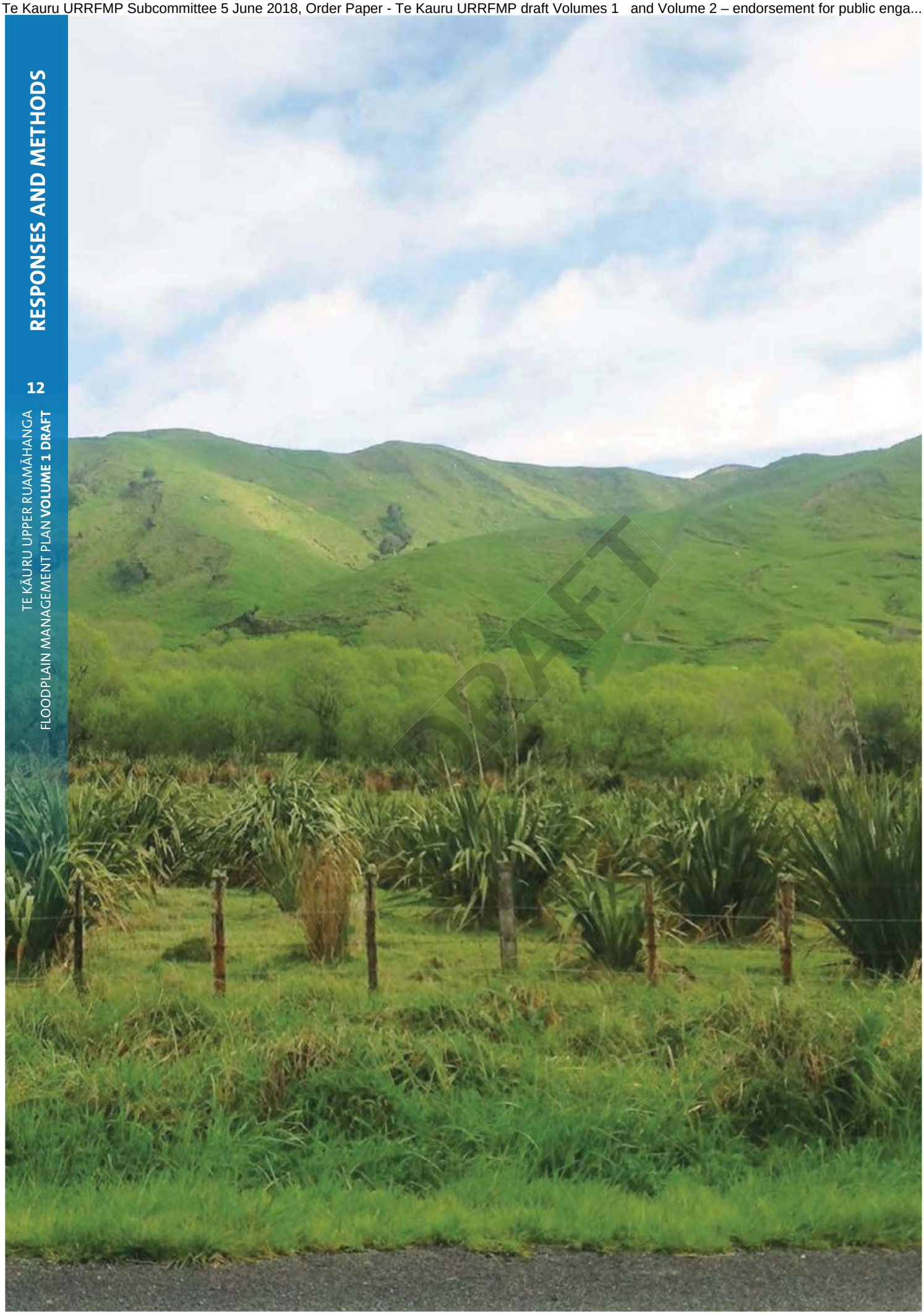
A number of risks associated with the change are acknowledged:

- There is a risk that monitoring and then intervening later will cost more and may be more intense for the river environment compared with more frequent, smaller interventions. The size and nature of this depends on future natural processes in the catchment which are difficult to predict.
- It is also recognised that the prospect of losing current productive land uses within the existing buffer may not be supported by all landowners.
- Environmental risks including potential increase of pest animals and plants, including old man's beard, within larger planted buffers.

There were also several key constraints that had to be considered when assessing management options, including:

- The location of existing assets (such as bridges, roads, houses); and
- Balancing the environmental and cultural values of allowing the river flexibility to behave more naturally with the economic costs of the potential loss of productive land.

Consequently, the outcome of this FMP will be a change in the manner in which river management lines are implemented and the way river works are managed, in order to maximise natural river processes and enhance the environment, while providing the agreed level of flood and erosion protection. This follows the vision and aims of this FMP to protect, enhance and restore natural and cultural values while supporting sustainable economic development and resilient communities.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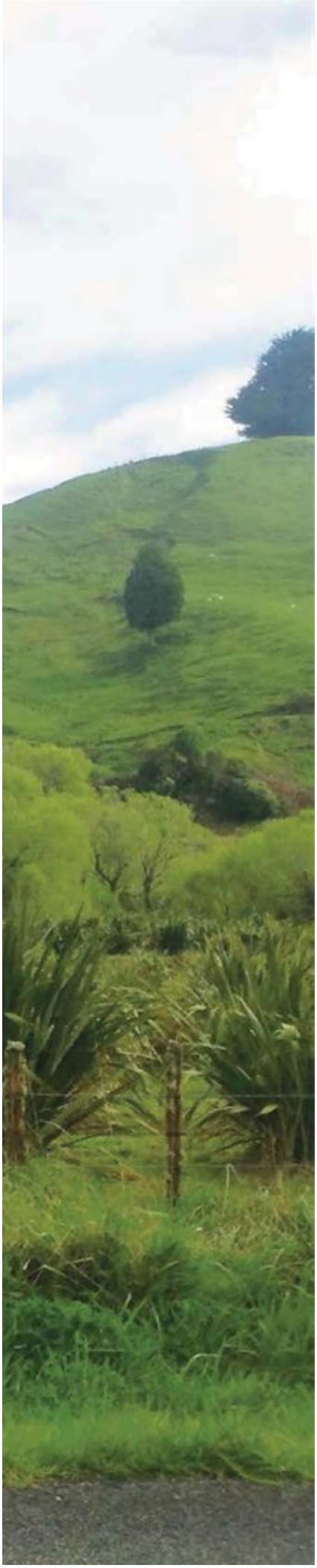


3. Responses and Common Methods

Due to the large area that this FMP covers and the varying types of land-uses and types of rivers within this catchment, a combination of different flood and erosion management responses have been developed.

There are two distinct types of river management schemes operating within the Te Kāuru Upper Ruamāhanga catchment, which reflect the different natures of the rivers. Schemes covering the western side of the valley are dealing with larger, gravel bedded rivers (the Waingawa, Waipoua and Ruamāhanga Rivers). Schemes established on the eastern side include the Kopuaranga, Whangaehu and Taueru Rivers that are smaller, silt bedded rivers coming from the Eastern Hills. Different management regimes are required for the gravel bed and silt bed rivers, the current flood management practices are discussed in *Appendix 2*, and proposed responses are in *Volume 2*.

This section outlines the 'common methods' employed for selective use throughout the Te Kāuru Upper Ruamāhanga catchment. Some common methods apply across the whole area of the Te Kāuru Upper Ruamāhanga catchment, while others are more specific to a particular type of river management regime that only applies to some reaches. In this context, common methods inform the physical interventions undertaken through river management activities.

In particular, this FMP proposes a river management approach that seeks to allow the rivers to behave more naturally, with less frequent intervention, within the current envelopes. This is an explicit attempt to strike a balance between improving the river environments and recognising the economic value of the adjacent land (and the views of those landowners).

Where specific responses are required to address more complex or location-specific issues, these have been identified in *Volumes 2 and 3* of the FMP on a reach-by-reach basis. Such responses include further detail setting out how and where they apply. In some cases, such responses include exceptions to the common methods, and may include project specific measures to address a particular flood or erosion issue. Major Project Responses have been developed in locations where the issues cannot be managed by normal application of the common methods alone.

The set of response types which have been developed to implement this FMP have been categorised into the following five groups described below:

Structural

River Management

Planning and Policy

Emergency Management

Environmental Enhancement

3.1 Structural Responses

Structural responses encompass the development of structures and other physical works designed to keep flood waters away from existing development. Stopbanks and floodwalls are obvious examples of structural works that are typically designed to a specific flood standard, e.g. 1% AEP. Structural responses typically require ongoing bank edge works and channel management to ensure flood defence structures and physical works remain effective. Within the Te Kāuru Upper Ruamāhanga catchment, rock lines, vegetated buffers and groynes are all employed to protect flood defences like stopbanks and maintain the channel's position.

New structural methods, such as stopbanks, are not included in the common methods as they are part of a site-specific response.

3.2 River Management Responses

River Management responses guide GWRC's ongoing physical interventions in the river environment, and as such they are the "sharp end" of this FMP for many people and groups who have an interest in the river environment. 'River management' refers to works within the bed of the river or on the river berms. All river management works must be undertaken in accordance with GWRC's 'River Management Code of Practice'.

Common methods that apply this type of response will be employed by the Flood Protection Operations team through Operational Management Plans (OMPs). Such plans look five to ten years ahead and are developed to be consistent with the directions given in this FMP. The OMPs will set out, reach by reach, the detailed works and priorities for upcoming annual work programmes. The OMPs may need to be revised to take into account damage following flood events. The annual works programme and plans will provide the detail of exactly what and where different activities will be carried out on an annual basis.

River management common methods (outlined in Sections 3.2.1 to 3.2.9) reflect community desires to allow space and freedom for the river to behave more naturally while providing a degree of certainty and protection to neighbouring landowners. This will be achieved for example, by:

- Using envelopes as a management method rather than holding the river to a fixed line (either in its alignment or in the bed levels) (Section 3.2.1 and 3.2.2);
- Using vegetated buffers as the preferred edge protection method and allowing these to be subjected to natural river process (i.e. flexible buffers) (Section 3.2.3); and/or
- Minimising the frequency of interventions in the channel.

The expected outcome is that the river is able to behave in a more natural way with a greater variety of form and habitat as a result. Although it is also intended that GWRC will be required to intervene less frequently in the channel with mechanical means, the overall scale of works will not necessarily be less. This FMP acknowledges that active intervention with machinery in the river environment will still be needed. In some cases, for example to re-establish vegetated buffers following major damage, this intervention will be significant. In other locations, regular work with machinery may still be the best way to achieve the overall outcomes of the FMP where other methods are not effective. Through the FMP and the OMPs, alternatives will be considered and mechanical intervention will be avoided if a better alternative exists (including taking all values described in Section 2.2 above into account).

The FMP and the OMPs seek to strike a balance between the different values in each reach and the benefits of allowing the river to behave more naturally versus the benefits of controlling the river's behaviour to manage flooding and erosion problems (e.g. protect people, properties and productive land). Decisions on which river management common methods to use and how and where to apply them will be made in an open way through the direction given by this FMP, and the direction provided through the OMPs and Code of Practice (described later in Section 3.2.7).

The first consideration when assessing any response should be to ask the question: "can we avoid doing work here?"

Interventions to move the river out of the buffer will generally take place only when:

- The historical channel lines indicate an unusually high risk to adjacent land if the river should erode further; or
- The erosion is continuing further landward with no signs of migrating downstream (i.e. a considerable "hook" is developing which threatens to result in a major realignment of the river); or
- The erosion has occurred and worsened through a series of minor events, giving concern that the land behind the buffer would be threatened by ongoing erosion in further minor events; or
- There is a threat to public infrastructure.

Exceptional circumstances may arise but the OMPs are expected to follow these principles.

To assist with decision making, a hierarchy of intervention is being developed. The general concept is that where there is erosion risk to land within the buffer, the scale and type of works used would be limited to those which result in a low risk of adverse impact. As the risk presented by a particular situation increases and therefore the associated potential impacts, then the range of activities available for intervention also increases to include activities assessed as having medium and high risks of adverse impacts (explained in the table overleaf).

HIERARCHY OF INTERVENTION

	SITUATION	INTERVENTION TYPE	USE OF ACTIVITIES	TIMEFRAME FOR COMPLETION
LOW RISK	Land within buffer is at risk of erosion	Limited intervention / monitoring of risk by staff	Only able to use activities which will result in a low risk of adverse impacts (this will have the effect of limiting work in the wetted channel or in high value riparian areas)	Scheduled regular maintenance (annual work programmes)
MEDIUM RISK	The outer management line is at risk from erosion	Moderate priority intervention	Only able to use activities which will result in low and/or medium risk of adverse impacts, or a limited quantum of high impact activities.	Incorporated within annual work programmes
HIGH RISK	Risk to life Risk of damage to key infrastructure Erosion has occured beyond the outer management line	Immediate intervention	All activities available – with low, medium and high adverse impacts	Urgent – to be completed ahead of programmed work which may be practically deferred to allow for completion of priority, reactive work

This process provides an effective way of aligning the risks that the situation presents with the potential adverse impacts associated with the intervention. In effect, this will mean that low risk situations, such as minor erosion of land within a buffer where there is no critical infrastructure, can only be managed with activities that are not undertaken in the wetted channel. At the other end of the scale if there is a high-risk situation, such as breaching of the outer management line or immediate risk to critical infrastructure, then all of the activities are available including those undertaken in the wetted channel. In further developing this guidance, there will be recognition of the need to maintain a degree of flexibility to deal with different situations that may arise – while still providing enough direction to ensure a high degree of consistency and achievement of the agreed outcomes.

3.2.1 Code of Practice

The Code of Practice guides all river management activities undertaken by GWRC for the purposes of flood and erosion protection across the Wellington Region, irrespective of funding, location or whether an activity requires resource consent. This means it applies to permitted activities as well as those activities for which resource consent is required by the regional plan.

The Code of Practice aims to achieve:

- Greater awareness of the effect of river management decisions and activities on a river's natural character and other significant river values, at both broad (whole of river) scale and detailed (reach or specific site) scale;
- Greater consistency of river management practice across the rivers that GWRC administers and manages; and
- Good management of the environmental and cultural impacts of river management activities.

While consideration of individual catchments has fed into the development of the Code of Practice, it is not intended to determine the best method or activity to use at a catchment, river or reach scale. It provides direction on the detail of how different river management activities are carried out on the ground.

The FMP gives direction on where and how the common methods are applied in specific reaches together with an understanding of the identified values to be taken into account. The OMPs must be consistent with these directions and users of the Code of Practice will need to note these directions or restrictions when planning which activities to use (and how/when/where to use them).

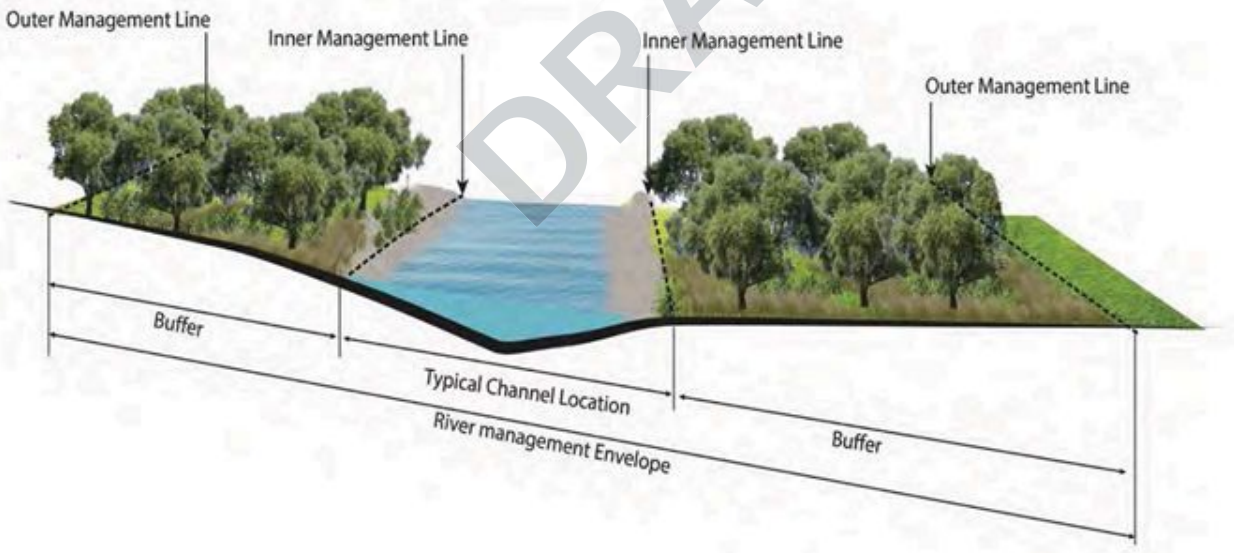
This FMP identifies values that should be managed in certain locations or certain constraints that should apply in choosing the river management activities. However, this is not exhaustive and other constraints will apply in different places and at different times. GWRC staff will need to consider the values at a given location together with the direction in the FMP/OMP when planning annual work programmes. The activities will need to be carried out in accordance with the Code of Practice.

Put simply, the FMP and subsequent OMPs direct which common methods are applicable within each river and/or reach. The decision to implement the available common methods in accordance with the Code of Practice is made by GWRC staff.

3.2.2 River Edge Envelope

River edge envelopes define the lateral extent within which the river will be managed. An 'outer management line' defines the extent that may be eroded in small to moderate floods and/or may be used for vegetated buffer purposes. The space between the banks of the river and the outer management line is also known as a 'buffer'. GWRC will seek to manage the envelope so that the land outside is protected to around a 5% AEP level of service (a flood that has a 5% chance of happening every year), or in normal flooding circumstances.

Landowners make an important contribution to flood and erosion security and ecological benefit by making land available for protection of their own and the community's assets and for allowing natural river behaviour. This contribution is addressed by the proposed approach to strategic land purchase described in Section 3.3.7 of this FMP.



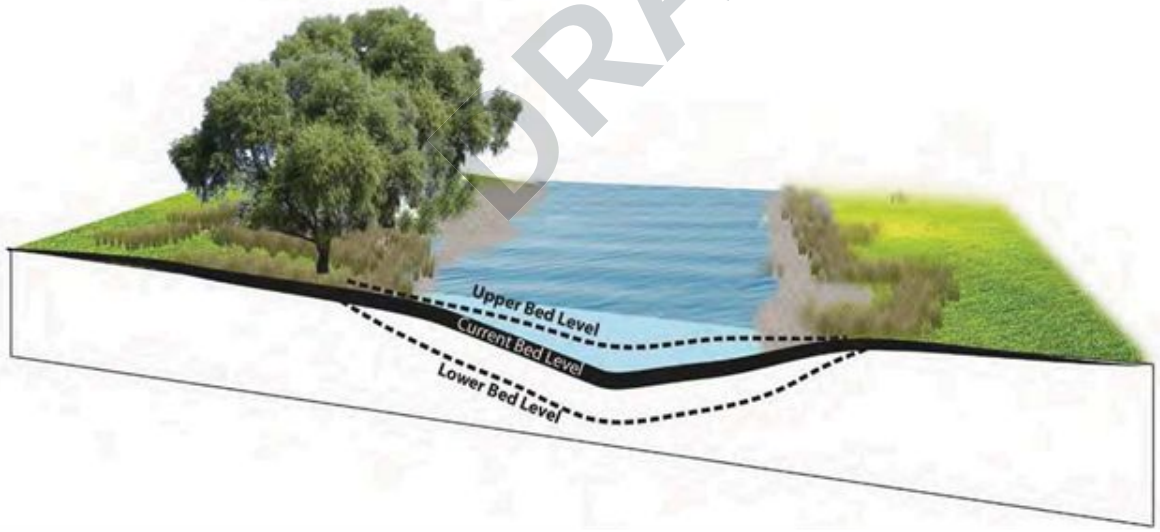
3.2.3 River Bed Level Monitoring

The bed of a river can rise (aggrade) and fall (degrade) over a period of time, and over a longer period of time can fluctuate between these two states. This happens due to natural events, but can also be significantly affected by human activities. This process is particularly evident within a gravel bed river, where rising and falling bed levels can be observed during a relatively short timeframe.

GWRC has an extensive network of cross-sections on all the main rivers in the region and these have been surveyed since the 1990s. Over time, and with more information, longer term rising and falling trends can be recorded to better understand the processes of sediment movement and be used to inform those in the community who are particularly interested in the effect of river bed levels and their close connection to the ground water table.

With sufficient data collected over time, it will be possible to establish river bed envelopes that will include limits for the upper and lower envelope. These envelope limits will be used to identify problems starting to occur so that GWRC can assess the area and determine a response. The actions triggered by these limits may include, for example, a gravel extraction response, a review of the river edge envelopes or prioritisation of other management methods in the reach.

Using river bed envelopes and monitoring of long-term rising and falling trends will allow GWRC to make decisions ahead of time regarding when current river management approaches may need to change and how they might change.



3.2.4 Recognition of Buffers as a River Management Method

Buffers are an envelope of land beyond the river channel that is allocated for erosion control and protection – often but not always in the form of trees. Establishing buffers supports River Edge Envelopes, River Bed Level Monitoring and Mixed Vegetative Planting common methods.

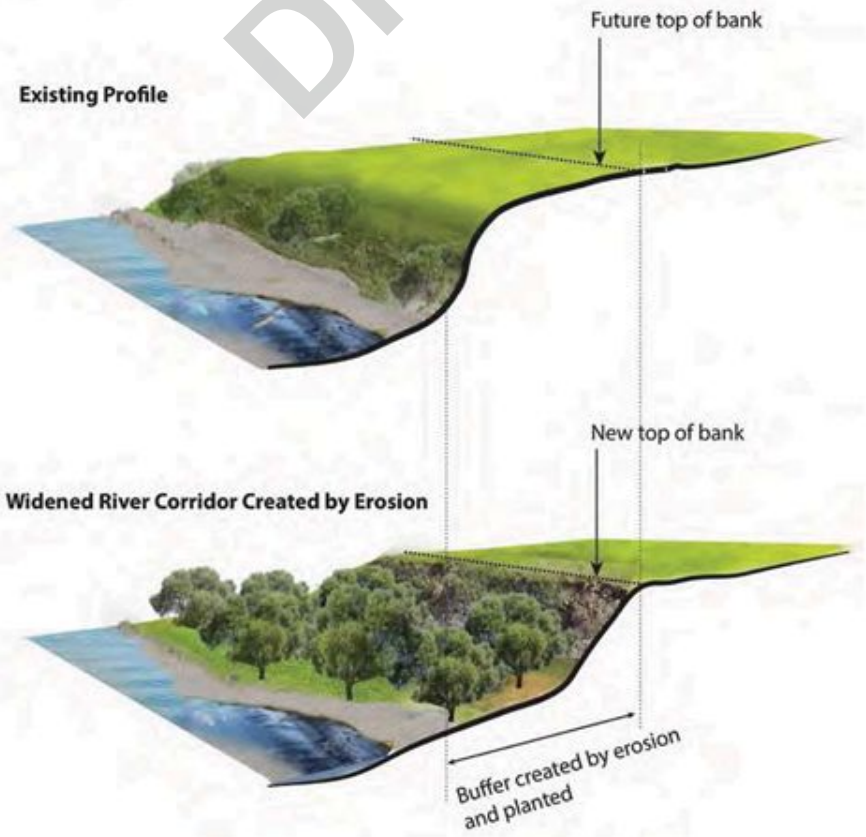
In the Wairarapa, the planting of willow tree buffers for river and erosion management has been a practice for more than 30 years. The advantages of vegetated buffers include:

- Reduced lateral erosion and sedimentation;
- Improved meander alignment and reduced channel distortions;
- Cover and habitat for wildlife; and
- Riparian vegetation reduces the nutrients and pathogens from runoff entering the waterways.

The establishment of vegetation can increase resistance to erosion along a bank edge without preventing erosion occurring altogether. In effect, it slows the erosion process, meaning less land will be eroded compared to bare, unplanted land. Whilst willow trees are frequently used to bind the river bank material together, the FMP will move towards a more diverse mix of planting.

Land which is included within buffers may incur erosion damage prior to erosion control measures being established. For example, during a flood event, a buffer may erode due to erosion prior to subsequent planting being established along a lowered river margin. At times, these buffers naturally refill with gravel and are replanted as river meanders migrate downstream, and at other times these buffers are artificially reconstructed by machine work and replanted.

High banks or erodible cliffs can be included within the buffers. In these cases, vegetation cannot be planted in the buffer because their root zone will be too high above the river to be effective in slowing erosion (or for tree survival). The common method approach is to allow the buffer to partly or fully erode so that a vegetated buffer can be established at river level to protect the land behind the buffer.



Nearly all the land on which these buffers exist is privately owned and there has been mixed success historically in the establishment of vegetated buffers across the catchment. Vegetated buffers are not currently recognised economically within the schemes for their value in managing river erosion.

There is considerable opportunity to combine vegetated buffers with environmental enhancements (explained in Section 3.5). The Environmental Strategy will identify areas where greater environmental enhancement opportunities exist (for example native vegetation and/or wetland restoration). This process can also identify sites where landowners are keen to participate in environmental enhancement efforts, areas where wider buffers could be established and/or areas where additional land could be purchased.

3.2.5 Pool, Riffle, Run Envelope

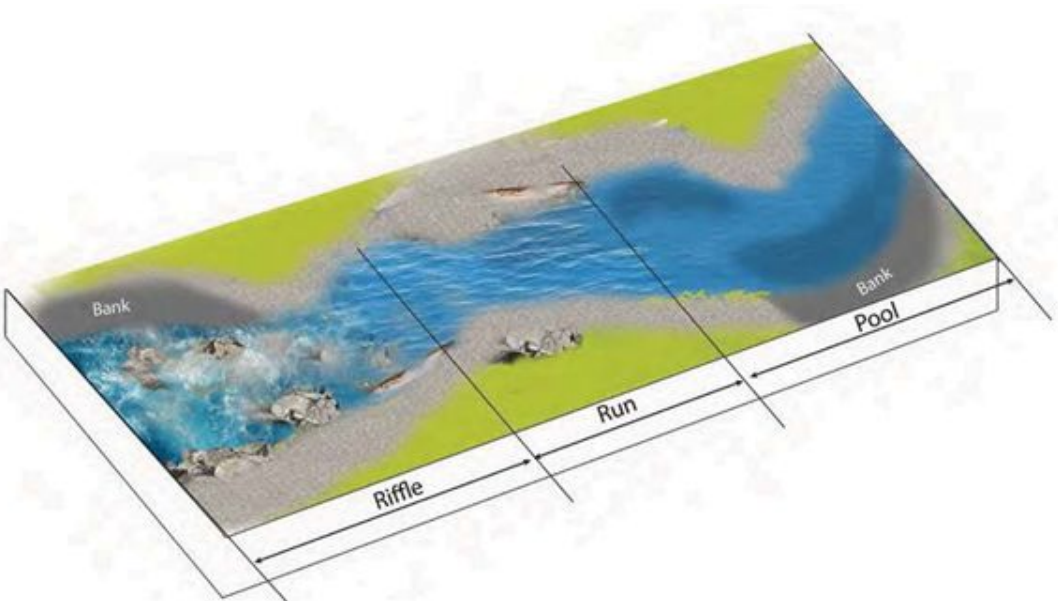
In many rivers, the channel and water level are naturally regulated by sequences of 'pools', 'riffles', and 'runs'. A diverse mix of flows and depths is important in a river system to help create the variety of habitats for fish and invertebrate life, and can also support a range of recreation activities. In a meandering river bed, this diversity is largely provided by the number and occurrence of pool – riffle – run sequences.

A pool, riffle, and run count is a method for ensuring habitat and river form diversity is maintained within a managed river system. Within a highly managed or stable river it is practical to set an exact number of pools, riffles, and runs.

The reaches of the gravel fed rivers flowing from the Tararua Ranges will have a pool, riffle, and run count assigned, with a defined upper and lower acceptable limit per river management reach forming an 'envelope'.

This method will not require intervention in the river system to modify natural changes to the pool, riffle, and run count that may occur during flood events. Use of the pool, riffle, and run count will only be required to inform the planning of the river maintenance works.

The pool, riffle, and run envelope will be included in monitoring and performance measures. By counting the numbers of pools, riffles, and runs, the form of the river and its changes between the surveys can be assessed and compared. In the long term, it will aid the understanding of the trends occurring in the rivers in connection to river maintenance works.

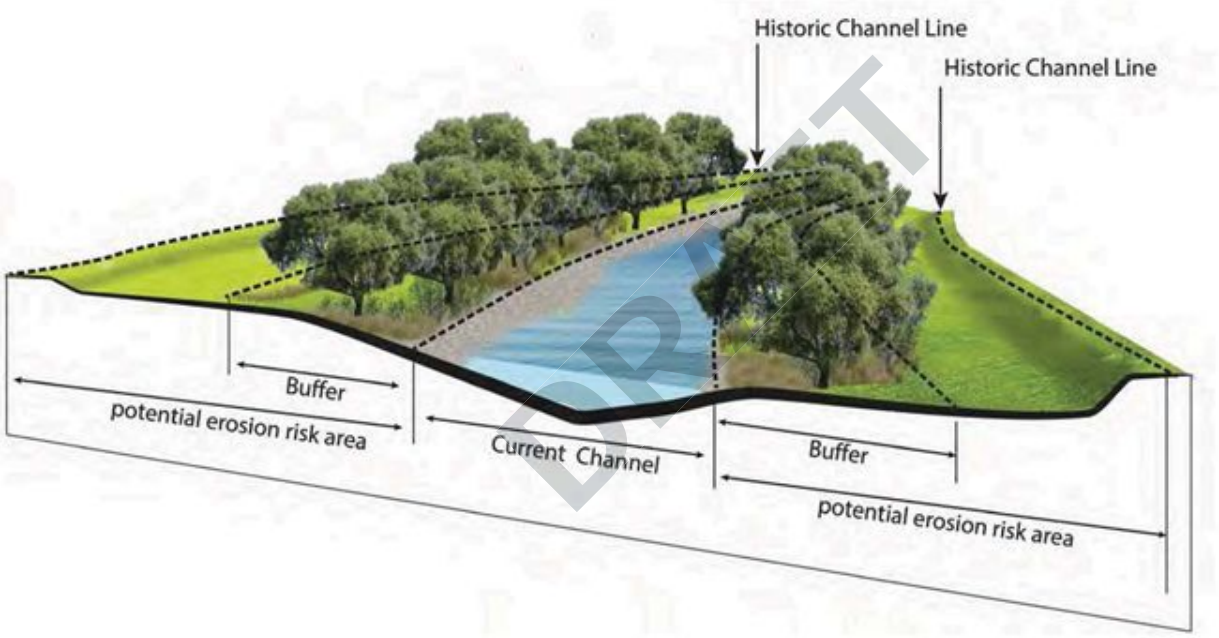


3.2.6 Historic Channel Lines

The river system has in the past meandered widely across the Wairarapa Plains. Some of these historic channels are clearly identifiable due to locations of old river terraces visible in the landform (such as the hillside behind Oxford St in Masterton). In other cases, these historic channels have been infilled to change the land use in that area. During large flood events, these areas of infilled or old channels are often reoccupied by rivers and may become areas of higher hazard or subject to greater erosion impacts.

The identification of photographed and observed historic channel extents on plans within the FMP, and on the operational management plans, will raise awareness of historic landforms and assist informed decision making by property and asset owners when siting infrastructure.

These historic channel lines would be used in an information-only approach, to identify those assets of a farm or business that would not otherwise be controlled under district plan rules for avoidance of hazard. This is intended to include irrigators, cattle shelters, some farm outbuildings and other utility type structures. It may also help with siting of roads or other infrastructure.



3.2.7 Isolated Works Support

GWRC may provide, on application, a financial contribution towards river works that fit within the Isolated Works Policy. Isolated works are privately owned flood or erosion protection works that are undertaken outside areas where GWRC manages river schemes. The intent of the contribution is to provide a level of service to the areas that are not eligible for works under river management schemes.

Minor alterations to the Isolated Works Policy will be undertaken to provide an opportunity for people within existing schemes to access this support. For example, support should be available for erosion control within a river management scheme area if erosion control is not provided for directly in the scheme's level of service. As the Policy is currently written, funding is strictly for areas outside of any existing schemes and this is to be reviewed.

3.2.8 Mixed Vegetative Planting

As mentioned above under the buffer management method in Section 3.2.3, river management in the Wairarapa has relied heavily on willow planting to maintain stable bank edges. This is because willows are fast growing robust trees with branch growth that can reduce flood velocities on berms, and dense root mass that binds the bank-edge soils together. Willow trees can be mechanically transplanted and have been noticed to be more resilient to stress and more likely to survive compared with many other species.

This FMP encourages a transition from an exotic willow planting monoculture approach to a mixed native/exotic planting buffer approach that has been occurring both regionally and nationally. Depending on the location, this could involve using willows for front-line defences and using natives further away from the active bed. Alternatively, under-planting natives into willow stands may occur and when natives are mature enough, the removal, where practicable, of what remains of the willow stands can be carried out.

Including a range of suitable native plant species provides the added benefit of improving biodiversity, enhancing visual amenity, improving water quality, and further stabilising stream and river beds. There is also a growing realisation of the long-term risk of pests and disease when using only willows for river bank plantings. Mixed planting can reduce this vulnerability.

This FMP encourages the creation of opportunities for innovation and research to explore various options and identify the best methodology for mixed vegetation plantings in local circumstances. Examples where mixed vegetative planting has happened along the river could be identified to produce information on the implications and potential for success. There is also an opportunity to explore (with tangata whenua) the planting of rongoa, or traditional healing plant species in areas that can be accessed by the public.

Initiatives to plant and maintain mixed vegetated buffers should ideally be led by the community. GWRC will be able to provide plants and some resources to assist the planting, but ongoing maintenance will rely on community input. GWRC has established good working relationships with landowners who are part of river management schemes, but could explore opportunities to broaden the involvement of these groups and those landowners outside of the river scheme areas. Through the Community Support Officer (recommended by this FMP in Section 3.5.2), advice and support will be made available to landowners who wish to explore mixed vegetative planting.

3.2.9 Alternative Land-uses within Vegetated Buffers

Vegetated buffers in most instances currently serve only a single purpose of making land available for erosion control and protection. Some alternate land uses have been trialled to recognise potential revenue streams from these parcels of land that are not available for the adjacent rural land use (usually cropping, dairy or sheep and beef). These additional revenue streams include beekeeping and growth of willows as an alternate fodder crop for drought periods.

Through the Community Support Officer position recommended by this FMP (as an Environmental Enhancement response), advice and support will be made available to landowners who wish to explore additional revenue opportunities from the vegetated buffers.

There may also be opportunities for land leases for public recreation, access, and flood protection and erosion control purposes.

3.3 Planning and Policy Responses

Planning and Policy responses can include flood mapping; zoning land; rules restricting the type of development allowed in flood-prone areas; development of standards for activities undertaken in flood prone areas; and plan provisions (i.e. rules or consent conditions) to ensure the operation, maintenance, and protection of flood protection works.

River management envelopes which are subject to active erosion could be recognised within district plans, through hazard mapping, zoning and designations, or any combination of these mechanisms.

Plan provisions may also need to consider such matters as location, building, maintenance, operation, and protection of structures, such as stopbanks, weirs, groynes, flood gates, diversions, or other flood protection measures when writing objectives, policies, and rules.

3.3.1 Land-use Controls

To reflect the updated flood and erosion information, District Plan amendments are required to update recommended land-use controls. Amendments include overlays and zones that capture provisions of:

- River Corridor
- Overflow Path
- Ponding (inundation area)
- Residual Overflow
- Residual Ponding
- Erosion Hazard

This FMP concludes that the six-tier approach, or similar, more clearly defines the nature and extent of the flood hazards from direct flood risks and "residual" risks. To see this approach advance, changes need to be made to the Wairarapa Combined District Plan (WCDP). This process can either be carried out under a regular District Plan Review or a separate "Plan Change". The main recommended changes to the WCDP involve:

- Introducing and mapping categories of hazard (most suitably by way of a Flood Hazard Overlay)
- Restricting buildings/structures/earthworks in the River Corridor and Overflow Paths
- Ensuring all new habitable buildings in Ponding and Residual Overflow have elevated floor levels.
- Not allowing any new subdivision in Ponding Areas, or critical infrastructure that doesn't take the hazard into account
- Requiring setbacks from stopbank structures

Until the changes to the WCDP are made when the District Plan is reviewed or changed, the FMP information and outcomes provide Carterton District Council and Masterton District Council with information that can be taken into account in any future planning applications. Furthermore, as an interim measure, the District Plan maps could be updated with the revised flood hazard information, without any need to change the underlying policies or rules. The timing of any review or change to the District Plan will be determined by Carterton District Council, Masterton District Council, and South Wairarapa District Council.

3.3.2 Designations

GWRC is proposing to use the Notice of Requirement process (under the RMA) to designate the proposed major projects and the River Management Envelope. This is described in more detail in Section 3.3.7 "Land Access and Strategic Land Purchase".

3.3.3 Flood Hazard Maps

Flood hazard maps were produced prior to preparing this FMP to help understand and communicate the flood issues. The maps are generated using computer modelling to predict flood behaviour, along with historical data to match the model as closely as possible to past events. A 1% AEP event is used in line with regional policy and guidance documents, but a range of other events are also mapped, including historical floods, and those both smaller and larger than the 1% AEP.

Climate change impacts are included in most of the scenarios because this FMP considers the outcomes with long timeframes where predicted climate change will be significant. Consideration of climate change is required under national guidelines, as well as GWRC policy. Uncertainties in the data and other factors that cannot be included directly in the model are also considered via a freeboard allowance in modelled flood levels.

Mapping is undertaken at a catchment scale rather than modelling the flooding behaviour in detail at a particular site. This scale is appropriate for planning the solutions to flooding, informing emergency management and providing advice on flood hazard for existing or new developments. GWRC uses the information to meet its statutory requirements to understand and manage flood risks. District Councils use the information in carrying out their obligations in District Planning, providing Land Information Memoranda (LIMs), and their functions under the Building Act. Flood hazard maps are important inputs to many of the other common methods.

The flood hazard maps are peer reviewed and represent the best information available at a particular point of time. Over time, technology and information change (for example, more powerful computers are developed and the length of rainfall or river flow records get longer). The flood hazard maps are updated from time to time to reflect these changes and to make sure the information continues to be fit for purpose.

Flood hazard maps will be used to support future plan changes for the WCDP. Depending on the timing of the plan change, and the level of information required at that time, further development work may be required for the flood maps and particularly the erosion hazard areas at that time.

3.3.4 Rural Stopbanks Policy

Stopbanks are embankments built to stop floodwater from rivers flooding nearby land. They may just look like grassy banks, but they have been constructed according to specific engineering designs and standards.

The established stopbanks in the Te Kāuru area have a variety of levels of service (or capacity levels) defined by an AEP. The definition and identification of level of service for each stopbank is provided for stopbanks identified within each reach in *Volumes 2 and 3.*

In assessing the level of service of each stopbank, some existing "legacy" stopbanks within the river schemes have been identified that are less effective in terms of who they benefit and what service they provide. This gives rise to issues of equity between different areas or landowners. To ensure a more equitable outcome can occur, this FMP provides guidance for each stopbank asset, including options such as maintaining, retreating or retiring/transferring the asset. This becomes particularly important when existing stopbanks are located within the buffer. Removing or retreating rural stopbanks from within the buffer will not be considered a high priority for implementation until the integrity of the stopbank is threatened.

This FMP does not propose any new stopbanks to protect rural areas. It is possible in the future that a private landowner may propose to build a stopbank to protect their land. GWRC will consider whether it supports or opposes such a project on a case-by-case basis including consideration of:

- The benefit provided by the stopbank
- Impacts on the flood hazard to other properties
- Vulnerability of the land behind the stopbank, including in the case of stopbank failure
- Stopbank level of service (including that the level of service is not too high, thereby facilitating inappropriate residential development)
- Impacts on river management, particularly distance from the river

3.3.5 Scheme Funding Decision Making Policy

The current scheme funding model addresses flood events up to a 20% AEP event through annual rates, and between 20% AEP and 5% AEP event through reserves. Floods bigger than a 5% AEP event can access funding from GWRC's Major Flood Damage Reserves. Currently, central government funding may be made available following a major flood that exceeds a 2.5% AEP event. However, if additional funding cannot be obtained, damage may need to be tolerated in events greater than 5% AEP magnitude or repair works may need to be completed using debt funding. The decision-making process regarding works required in excess of these funding levels will be clarified by development of a policy that will determine:

- What works can be carried out under annual works;
- What works can be carried out using reserves; and
- How decisions are made regarding works that exceed reserve funds.

3.3.6 Abandonment / Retirement of Assets

There are a number of assets that no longer provide the service or perform the function for which they were designed. These assets have been identified within each reach, including the method of retirement/abandonment and an indicative time frame where practical to do so.

As a general rule, assets for flood protection that exist within a river edge envelope will be retreated to a less erosion prone location, or abandoned/retired, although this will not become a priority until the integrity of the stopbank is threatened.

3.3.7 River Management Access

GWRC require access to land order for works to be carried out, either for river channel management or for the construction maintenance of assets. Often this access needs to be ongoing and have a reasonable degree of certainty. There are a number of ways of achieving this, including:

- Informal access agreements
- Formal access agreements
- Esplanade strips (created during subdivision)
- Easements
- Designations
- Land purchase

The existing river management schemes rely largely on informal goodwill and willingness from landowners to allow river works and buffer establishment on their properties,

although GWRC's existing stopbank assets have been designated in the WCDP. As mentioned above, GWRC is proposing to designate the river management envelope in the District Plan. This will clearly identify that this particular area of land is needed for river management purposes and would enable GWRC to control activities and/or structures that can be located on that land. Before any Notice of Requirement to designate land is made, further consultation with the affected community would be required.

3.3.8 Strategic Land Purchase

GWRC's preference is to own the footprint of stopbanks (these may be leased back to the adjacent landowner for grazing). However, some landowners hold concerns about public ownership of river corridors and margins. These include concerns about the security of their property and changes to the way the land would be managed if in public ownership. In most circumstances in the Wairarapa context GWRC has designations over its structural assets.

Implementing the major projects described in this FMP will require significant works on private land. This may require land purchase in the future. Some of these physical works may be many years away but as a high priority in implementing this FMP, GWRC will seek designations over all sites where future major project responses require assets to be built or relocated.

Implementing the river management / buffer approach in this FMP will require changes in land-use, such as planting open areas of river margin with vegetated buffers. In cases where the landowner would prefer to sell that land to GWRC rather than retain ownership, this FMP proposes funding for GWRC to be able to buy that land. This would also apply to landowners who have already set their land aside to establish vegetated buffers because it is important that they are treated equally. This FMP does not propose to bring all river corridor or buffer land into public ownership. However, a strategic land purchase list will be developed, costed, and a plan put in place to acquire this land over time through mutual agreement via a strategic land purchase fund. This will need to align with reach-specific buffer recommendations, planned major project responses and high-priority sites identified in the Environmental Strategy. An indicative cost for this, based on purchasing half the land that sits within the river management envelopes, is $5 million. GWRC will also support the creation of esplanade strips by District Councils when subdivision of riverside properties takes place.

The strategic land purchase fund will also be available for funding the retreat of infrastructure from the river edge envelope. The contribution from GWRC would be in line with funding policies at the time with the remainder to be funded by the asset owner. The contribution from GWRC would be capped at a level based on an estimate of the cost avoided by retreating the asset. For example, GWRC may contribute to a road being retreated where doing so avoids the need to construct rock groynes. GWRC would contribute the difference in cost between building the rock groynes and what a standard, vegetated buffer approach would cost to implement and maintain. A more comprehensive policy will be developed as part of implementing this FMP.

3.3.9 Protection Against Deforestation in Upper Catchment

The upper catchments of the Western rivers fall within the Tararua Ranges, including in the Tararua Forest Park. Much of this area is protected as Department of Conservation Estate. Areas outside of this that are currently forested have differing levels of protection.

Rules are required to prevent deforestation within the upper catchments to ensure that the run-off characteristics of this area remain intact. This can be achieved through Regional Plan and District Plan rules, as well as advice and support from GWRC.

3.4 Emergency Management Responses

Emergency management plays a very important role in floodplain management planning. When a flood emergency occurs, how well a community copes depends entirely on how well prepared it is – this includes the preparedness of emergency services, public agencies, utility services, businesses, and ordinary residents.

3.4.1 Community Resilience

Community resilience means that communities are well prepared and ready for emergencies and have knowledge, skills, resources, and relationships to respond to and recover from a flood event. When a flood emergency happens, how well a community copes depends on how resilient it is.

Wellington Regional Emergency Management Office (WREMO) will work with the community to increase its resilience through public education programmes. Education symposia address three different target groups:

- Tools for business continuity planning will be offered to the community to increase resilience of their businesses;
- School teachers will be educated about emergency management; and
- Aged residential care facilities will be addressed specifically as these facilities are one of the most vulnerable areas.

Educational brochures developed by WREMO and supported by the materials from this FMP will be available for the public to inform their personal emergency planning.

An outcome of this FMP will be that GWRC provides WREMO with detailed mapping tailored to emergency management uses. These maps include vulnerable access routes or lifelines, and the scale of events that will cause these lifelines to be cut. Additionally, an address list can be produced for properties located within an extent of the 1% AEP flood event, with the intention that the community preparedness message is delivered to these property owners and occupants. Properties that are vulnerable to more frequent floods will be highlighted.

3.4.2 Flood Forecasting and Warning System

GWRC and WREMO together provide a flood warning service for the Wellington Region. Separately from formal warnings, GWRC also makes environmental data, such as river flows and rainfall amounts, available to anyone via a range of methods including its website.

Flood warning is recognised as a major tool for equipping people to take their own actions to avoid flood risk. In a large flood or in areas that have very low levels of flood protection, flood warning is crucial for people who are exposed to these hazards and for emergency managers who are trying to minimise risk to life and property.

The development of this FMP has led to a number of suggestions for improvements to the system. This has occurred in parallel with a 2016 review of GWRC and WREMO's flood warning system.

As an example, some potential areas that have already been identified for investigation or improvement are:

- More focus on supporting people to plan their response to flooding, so that the warning will result in people taking effective action;
- Use of automated technology to supplement telephone trees;
- Providing the means for recipients of flood warnings to manage their own subscriptions to alerts (so that details are kept up to date);
- Additional or relocated gauges to provide greater warning time (especially on the upper reaches of rivers);
- Purchasing advanced weather forecasting and/or supporting improved forecasting through financial contributions (e.g. contributing to a new weather radar site);
- Improved reliability of communications for critical warning sites;
- Additional resourcing to carry out more river gauging to improve the accuracy of flow estimates;
- Opportunities to expand or develop the flood forecasting system to give advance warning of flooding; and
- Developing ways to monitor river flow gauges for landslide dam formation, especially during heavy rainfall events.

3.5 Environmental Enhancement Responses

Environmental Enhancement responses seek to raise the awareness and understanding of the natural values and character of the river environment to encourage and support environmental restoration and maintenance efforts. The primary goal of environmental enhancement responses is to recognise and improve environmental values alongside flood and flood risk management.

3.5.1 Environmental Strategy

The Environmental Strategy coordinates the projects required to deliver the environmental, amenity, and cultural outcomes sought by the FMP that are beyond those achieved solely through flood and erosion risk management. It also helps to coordinate the actions of groups involved in managing the rivers and creates a strategy to enable these groups and organisations to work in a supportive manner.

The preparation of the Environmental Strategy is to be undertaken either in partnership or close collaboration with other affected or interested parties, including, but not limited to, the District Councils, Department of Conservation, iwi, Fish and Game, Forest and Bird, and other identified stakeholders.

The table below sets out the identified environmental issues for the Te Kāuru Upper Ruamāhanga River system, and outlines the general actions that can be taken to enhance the river environment.

Environmental Issues and Actions

ENVIRONMENTAL ISSUES	IMPROVEMENTS
Access and private ownership The majority of the land adjacent to the river is in private ownership. Public access to the river is generally limited to the areas in the DOC estate, including upstream areas of the Ruamāhanga and Waingawa, and urban areas of the Waipoua River	Work with District Councils and support recreation opportunity improvements, including connecting access along the Waipoua, Ruamāhanga and Waingawa Rivers Support landowners who wish to retire farm land and advocate for improved recreational access Integrate buffer planting and wetland creation opportunities with buffer establishment. For example, where buffer land is being purchased or retired in partnership with willing landowners, look at opportunities to create a wider buffer to allow for wetland creation/restoration and native planting behind
Weed management The buffers are infested with weeds including blackberry, tree lucerne and old man's beard	Weed clearance programmes Yearly checks to ensure areas of weed infestation are identified. This shall inform measures required to ensure weeds are kept under control
Crack Willow and Grey Willow Historically, Crack willow (Salix fragilis) was used extensively through the Te Kāuru Upper Ruamāhanga catchment	Reduce the presence of crack willow and restore ecological value to the eastern rivers Use hybrid willows (such as Salix matsudana and tangoio) when carrying out new plantings and, when suitably mature, for use in other protection methods to minimise self-propagation potential Advocate for private planting of natives in association with willows and outside vegetated buffers
Loss of Diversity	Improved buffer planting and widened strips will help improve diversity Support landowners who wish to retire farm land and carry out native planting. Provide information on how to access contestable funding to support these efforts
Loss of mahinga kai	To be developed in association with Kahungunu ki Wairarapa and Rangitāne o Wairarapa
River management River management methods, particularly bull dozer operations in the channel, impact on the environment. These impacts can include loss of aquatic habitat, reduction in water quality and associated reductions in amenity values	Minimise impacts by undertaking works in accordance with the Code of Practice (for river management activities) Utilise other measures which require less regular and /or extensive in stream river works, where possible
Straightening of river channels	Seek to allow the river more room to erode and maintain natural processes

3..2 Community Support Officer

GWRC currently works with communities to manage flood risk from the region's rivers and streams. This includes developing floodplain management plans, providing an advice and consultation service in relation to flood and erosion risks, maintaining and building new flood protection works, maintaining or improving the environment and recreational opportunities, and providing management and advice to Civil Defence during large floods.

Further opportunities exist for GWRC to build upon existing relationships with landowners, iwi and the wider community who wish to be involved in the health of river environments.

There is potential to establish a part time or full-time role to support and advise the community on local projects and initiatives relating to the river environment (i.e. Community Support Officer). The key tasks of this role will include:

- Providing a point of connection with the community;
- Building relationships with local river recreational groups;
- Reinforcing partnership with iwi;
- Calling for volunteers through GWRC website, social media and volunteer websites;
- Facilitating practical education days with community groups including schools, marae, and business organisations; and
- Showcasing the areas of concern in the region and the positive results of volunteer efforts at local events to encourage greater participation.

This role could be facilitated by including a portion of current officer working time for community support and drawing on local expertise and knowledge to work with the broader community, current scheme committees, and landowners. For the Eastern Hills area, this role could cross over with Land Management advisors who already work with rural landowners and have established relationships in the area.

GWRC would seek partnerships with other organisations or agencies to fund this role.

3..3 Care Groups and Clubs

Healthy streams and rivers are an asset for any community. They are peaceful and fun places to be near, have cultural significance and can be full of wildlife.

River care groups can participate in their local rivers by involvement in:

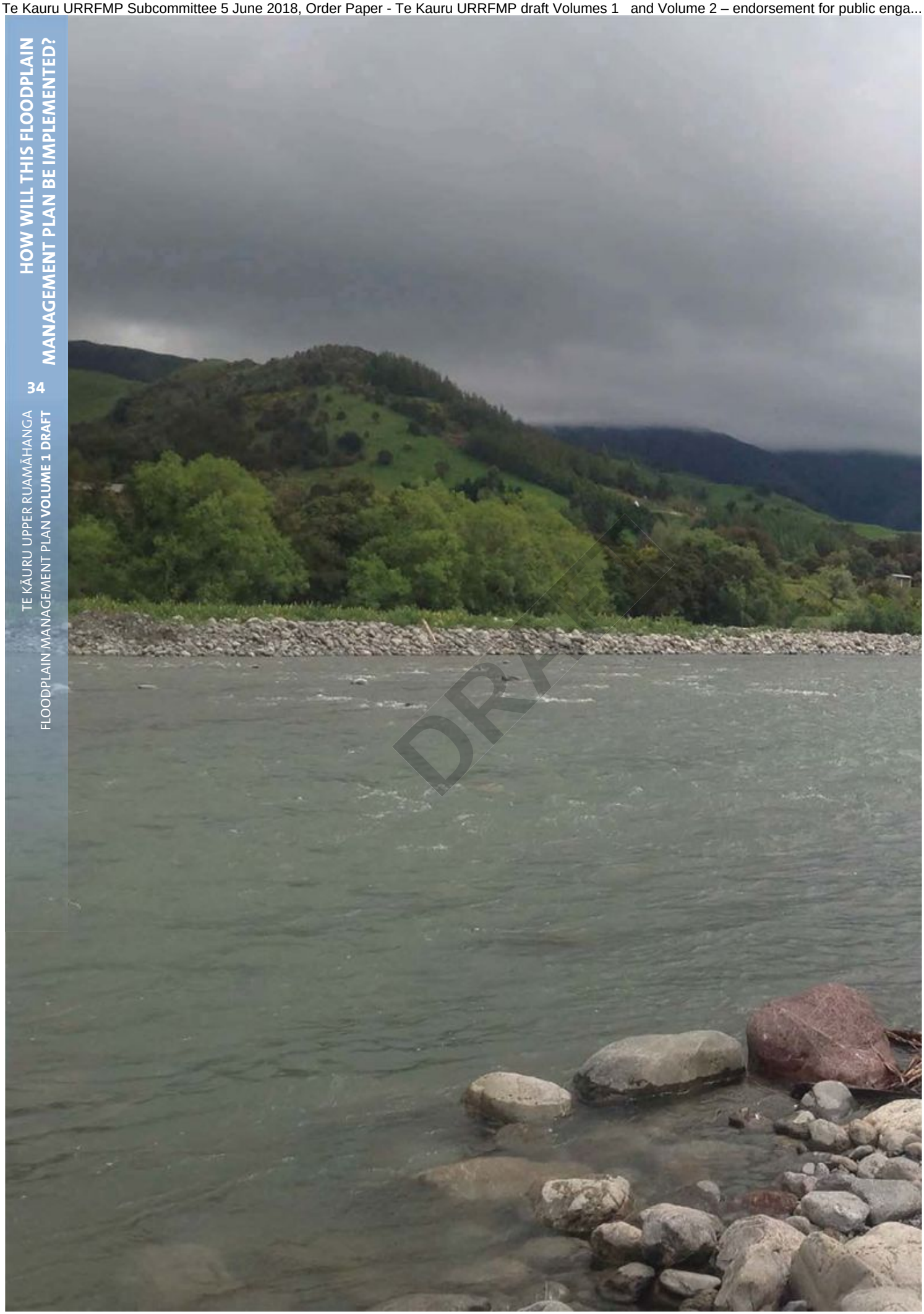
- Delivering native planting programmes and/or other Environmental Strategy outcomes;
- Maintaining vegetation to prevent waterway obstruction;
- Encouraging the community to take a greater interest and have greater involvement in river environments;
- Advocating and working with landowners to improve access;
- Managing animal and plant pests; and
- Monitoring and reporting on river management and FMP implementation on behalf of the community.

The western rivers of the Wairarapa are perhaps more suited to the care group concept than those in the eastern half of the valley, given that they have better public access and higher rates of recreational use.

There are a number of care groups that GWRC currently works with in the Wairarapa. The range of tasks carried out by river care groups can include:

- Strategic planning: developing a stream restoration plan and timeline for the work;
- Communications: keeping all interested people informed;
- Baseline assessment: walking the river/stream and recording what state it is in at the start, so there is something to measure improvements against;
- Research: working to find the most successful and efficient techniques for improving the health of the stream/river; and
- Operations: rubbish removal, planting, weeding and other jobs to restore and maintain a healthy stream/river.

As mentioned in the previous common method description, establishing a Community Support Officer at GWRC will prove useful in building community relations and encouraging the establishment of new river care groups in the western half of the valley.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4. How will this Floodplain Management Plan be Implemented?

This section sets out how the flood protection and management measures in the FMP will be implemented and funded. In short, the implementation measures outlined in this section will be carried out by a number of different authorities and individuals. The majority of the implementation costs will be incurred through methods implemented by GWRC that will likely be funded through rates of various types or via direct contributions from those who benefit.

4.1 Governance

For over 50 years river management schemes have been maintained to protect people, property, infrastructure, and productive rural land in the greater Wellington Region. The schemes have been designed to reduce, mitigate, and manage the flooding and erosion risk throughout the region. The schemes have been drafted and implemented at various times based predominantly on the wishes and support of the local communities.

4.1.1 Existing Governance Structure

The Te Kāuru area includes eight existing schemes that make up a large portion of the floodable land area in the Te Kāuru Upper Ruamāhanga area.

Each scheme has an annual maintenance programme which is identified prior to the start of each new financial year. This programme identifies and prioritises work to be carried out within that financial year. Each scheme also has a committee which is made up of directly affected landowners adjacent to the respective river or reach of river, as well as GWRC and territorial authority representatives. Schemes within Te Kāuru currently report to the Environment Committee of GWRC.

4.1.2 Proposed Governance Structure

For this FMP, it is proposed that the governance structure would comprise a formal Advisory Committee being the 'Upper Ruamāhanga Valley Floodplain Management Advisory Committee'. The specific responsibilities of this committee are outlined in Section 4.4.1 below.

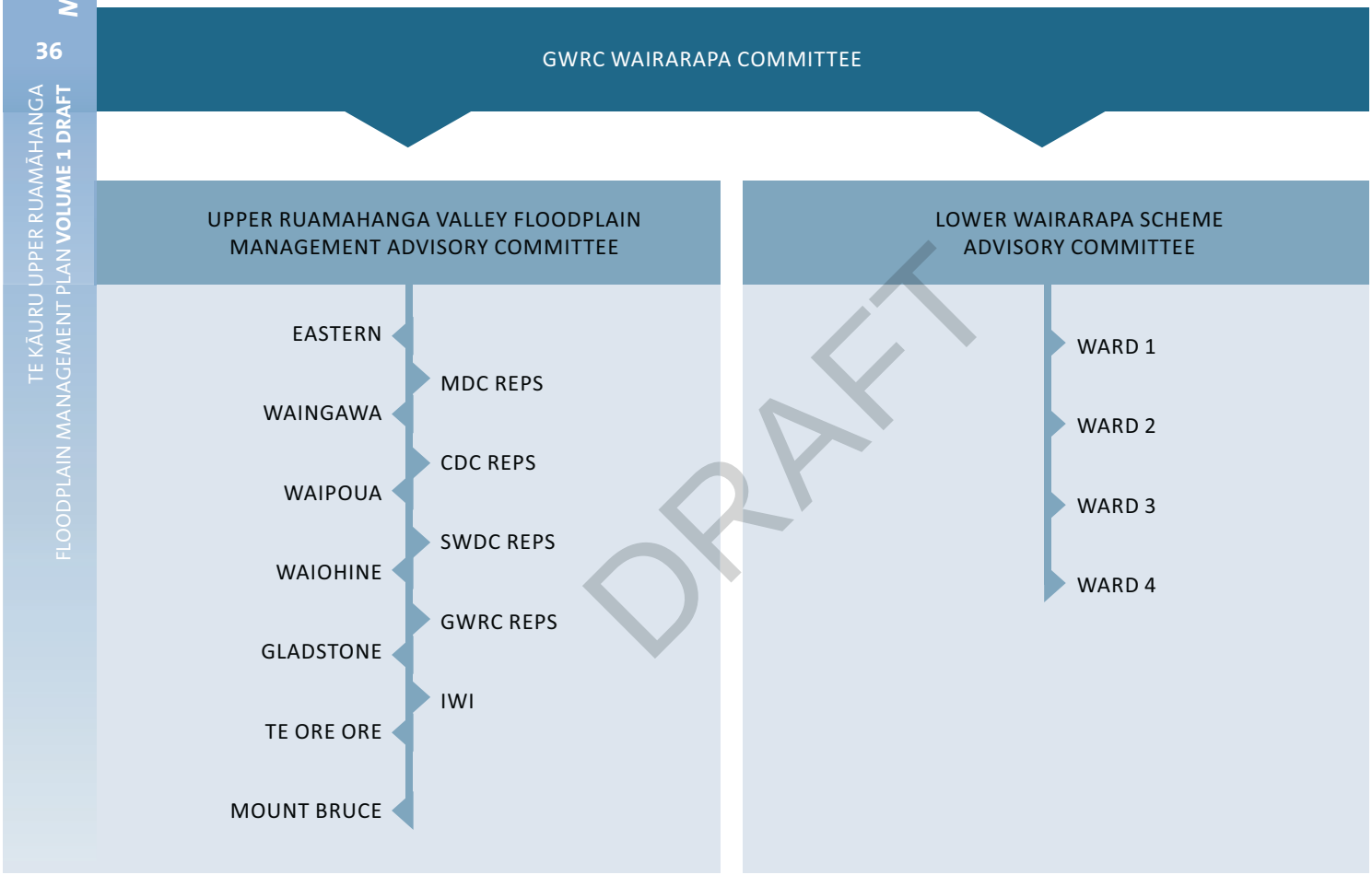
The Advisory Committee would be made up of six representatives from existing scheme areas within the Te Kāuru area (including one from within the eastern scheme areas) as well as two representatives from Carterton District Council, three from Masterton District Council, two from GWRC and two iwi representatives.

With respect to the existing schemes, it is proposed that the committees would still continue to be made up of landowner representatives and other community representatives. The reporting structure of the committees would be retained. In this respect, the committees would continue to have an annual meeting supported by Flood Protection staff from the GWRC Masterton office to consider the annual maintenance works programme and associated expenditure. The scheme representatives would then be able to take these views to the Advisory Committee which in turn is proposed to report to the GWRC Wairarapa Committee.

Upon completion of the Waiohine and Te Kāuru FMPs, it is proposed that the Waiohine scheme would be included in the Upper Ruamāhanga Valley governance area and that the Advisory Committee would have oversight of the implementation of both FMPs. At this point, representation from South Wairarapa District Council

will also be required. The Advisory Committee would meet more frequently than the scheme committees do (perhaps quarterly) in the initial implementation stages of the FMP implementation.

As witnessed through the implementation of the existing schemes, community input is invaluable to implementation, given the wealth of local knowledge and experience they contribute. Additionally, the diversity of representation and knowledge within the scheme committees has improved with the inclusion of representatives from DoC, Fish & Game and iwi representatives. This involvement has contributed to an increase in understanding of the broader values and benefits from the river management work undertaken. In time, representation may evolve further so as to continue to represent the communities through which the rivers flow, as these communities change.



4.2 Responsibilities

The following parties have direct or indirect roles in implementing the FMP:

4.2.1 Upper Ruamāhanga Valley Floodplain Management Advisory Committee

As discussed in Section 4.3 above, an advisory committee would be established to monitor the implementation of the FMP. The role of this advisory committee will be to ensure the action plan in the FMP is further developed and implemented, including monitoring progress against actions. The Upper Ruamāhanga Valley Floodplain Management Advisory Committee (Advisory Committee) would be established by GWRC and operate under an agreed Terms of Reference.

The Advisory Committee would also act as a point of contact for members of the public, landowners and other stakeholders for any issues they might have regarding the plan, including the implementation methods and action plan. It is proposed that the Advisory Committee makes recommendations on implementing the FMP to GWRC and other organisations with responsibilities in this area.

4.2.2 Greater Wellington Regional Council

GWRC would be responsible for the overall coordination and monitoring of the FMP, as well as relevant physical flood protection structures and works such as river management and stopbanks. In addition, GWRC will provide flood hazard mapping and advise territorial authorities (based on the FMP) on flood hazard areas in order to inform the development of appropriate land use planning controls.

4.2.3 District Councils – Masterton and Carterton

Many of the land use planning control measures would be implemented by Masterton District Council and Carterton District Council through their District Plan. These Councils also have a responsibility to maintain and protect public assets, including several bridges established along local roads. District Councils would also implement some environmental enhancements (e.g. walkways on riverside reserves).

4.2.4 Landowners

Landowners in the floodplain are important parties for implementing identified actions as they are the beneficiaries of successful implementation of the FMP. In addition to landowner representation on the Advisory Committee, landowners may be required to work with GWRC staff on particular projects or works that directly affect their land, for example, the final composition of vegetated buffers. Landowners also play an ongoing role in maintaining projects or works (e.g. protecting stopbanks or vegetated buffers from damage by machinery or stock).

4.2.5 Community Groups and Other Parties

Interest or community groups can be a valuable resource and may help to implement various actions. For example, community groups could assist and contribute to the work of other parties, including riparian margin planting works.

4.2.6 NZ Transport Agency and KiwiRail

NZ Transport Agency and KiwiRail are responsible for the maintenance and protection of their assets in the Wairarapa, including bridges which cross the Waingawa, Waipoua, Ruamāhanga and Kopuaranga rivers.

4.2.7 Kahungunu ki Wairarapa and Rangitāne o Wairarapa

Kahungunu ki Wairarapa and Rangitāne o Wairarapa are partners with GWRC within the Wairarapa. This relationship includes maintaining meaningful engagement as required through statutory acknowledgements and as promoted under the proposed Natural Resources Plan (pNRP).

4.3 Funding Structure

There are significant costs associated with the proposed responses in this FMP. A change from the current funding structure is proposed for the implementation of this FMP. Through this draft FMP process, we are seeking agreement on the new approach.

4.3.1 Summary

Currently, landowners within the schemes fund a portion of the total scheme costs. However, to recognise and reflect the wider benefit of the implementation measures, it is proposed that landowner contributions be spread over a wider rate base (for example, all ratepayers in the Carterton and Masterton Districts).

The agreed funding approach must recognise that:

- The FMP seeks to provide greater security, a wider range of benefits, a needs-based approach to river works and some solutions to long-standing problems. This will, in the long term, cost more to implement and maintain than the current river schemes cost;
- The FMP will deliver wider benefits which should be funded from the wider community;
- We are seeking to address current inconsistencies and complexities within and between the schemes; and
- In the FMP, the concept of using the buffer areas for river management purposes will require a change in use of affected land. This contribution has to be recognised or compensated, and in some cases the buffers have already been "given to the river" which would also involve recognition or compensation.

Outcomes and feedback received through consultation on the draft FMP will inform the final proposed funding approach.

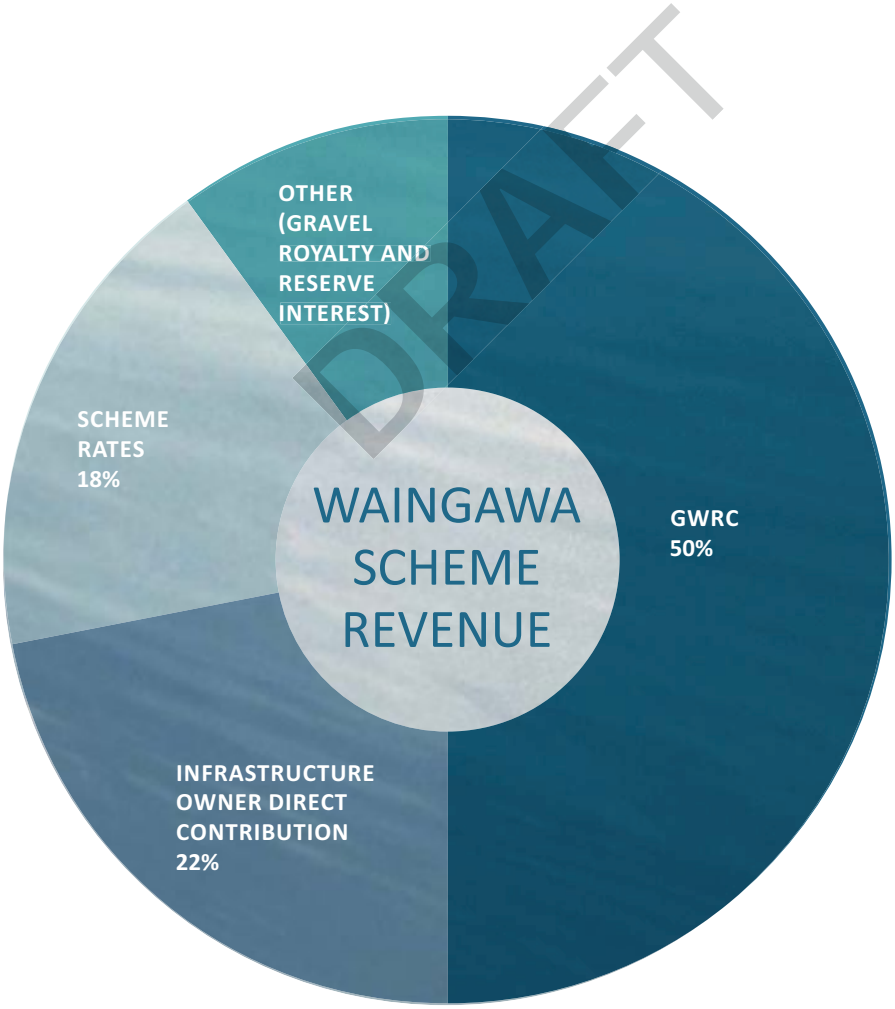
4.3.2 Status Quo

With respect to funding, the existing schemes are divided into different categories, or classifications, of the flood and erosion protection benefit that landowners receive. Landowners are then rated on the basis of which pieces of land fall into these different classifications. As experienced in the schemes, these rating classifications become outdated as situations change or as needs change based on new information. The ratings are also difficult to keep up-to-date as properties change hands. They are overly complex – for example, the Kopuaranga scheme has 12 different classifications for a simple scheme of willow tree removal and management and only $13,000 per year of rates collected. A proportion of the operational costs of the schemes can be funded from the general rates paid by ratepayers across the whole Wellington Region[1]. The rest of the funding is termed the "local share" and must be contributed from the local community in some form.

Scheme landowners currently contribute between 16 to 52% of the total funding of the Te Kāuru schemes, depending on the scheme. The remainder is funded by a mix of:

- Regional Council general rate contribution
- Contributions from infrastructure owners (generally CDC and MDC)
- Revenue from other sources such as royalties on gravel extraction and interest on scheme reserves

The example below shows the breakdown for contributions the Waingawa River scheme in the 2016/17 financial year.



[1]At time of writing, GWRC's Revenue and Funding Policy was being reviewed, with a proposal that the "local share" would move from 50% to 70% of the operational costs

4.3.3 Drivers for Change in Funding Models

1. This FMP is proposing to spend money on major projects and general works that are not necessarily "scheme" based and are a departure from the current scheme approach of annual work programmes. This additional expenditure, likely staged over many years, must be funded and it is doubtful that the current scheme funding approaches are appropriate.
2. The proposed projects and new approaches to managing the rivers are intended to deliver a wide range of benefits including cultural, environmental, recreational, economic and social. The costs of delivering these wider community benefits should rest with the whole community.
3. The current funding arrangements lead to some unintended outcomes. The existing scheme budgets are determined by how much the landowners are (or were historically) prepared to contribute, and the scheme budgets determine how much and what kinds of work are carried out. Seeking wider funding would assist a more coordinated, consistent, fair and needs-based approach.
4. The concept of using the buffer areas for river management purposes means that a change of use in some affected areas is required. A common theme resonating with the landowners of the schemes is that "if the community wants to use this land for community outcomes then the community should be paying for the scheme." This FMP proposes a fair and equitable approach to funding including recognising that some landowners under the existing schemes have already agreed to flood protection measures on their land such as by allowing vegetated buffers to be planted.

4.3.4 Costs and Proposed Funding

At the time of writing, the total funding required to cover the eight schemes in the FMP area is currently approximately $930,000 per year. Of that, landowners fund approximately $260,000. The Revenue and Funding policy is currently under review with a proposal to move to a 70% local contribution to operational costs. Given this proposed change, illustrative examples of the move to a District-wide rating system will be provided during engagement on the draft FMP once the outcome of the changes to Council policy are known.

It is likely that the major projects proposed in the FMP will generally be funded by borrowing money given that these projects deliver long-term benefits. This is consistent with how councils normally fund new infrastructure or major asset upgrades. The costs of this borrowing will be funded in the same way as the scheme operational costs – with a split between the regional contribution and the local share. A possible funding solution for the major projects is that the major projects will have their local share paid for by the beneficiaries. In the case of projects to protect infrastructure (e.g. Hood Aerodrome or the Masterton Water Supply Pipeline) it is proposed that the infrastructure owner (e.g. MDC) would contribute the local share.

Other major projects, such as River Road or South Masterton stopbank seek to improve the protection to properties in the urban area. In these cases, it's difficult to separate the benefit to individual property owners. Given this, it would be fair and reasonable to spread the costs over the wider Masterton urban community. This is particularly the case because, once the Waipoua River options have been confirmed, there will be a range of projects over a period of time to protect different parts of Masterton.

4.3.5 Affordability and Willingness to Pay

Making sure the proposed works and funding arrangements are affordable and spread fairly is important. Staging of works will be crucial in ensuring the works are appropriately funded. The FMP will be implemented over decades and when individual works programmes have been confirmed, the prioritisation and staging of works can be agreed.

Councils fund their infrastructure works through Long Term Plans (LTP). Through the LTP process, Councillors weigh up all the work programmes and proposals for new expenditure and make decisions about what work should be undertaken, and when. This FMP will provide a key input to future LTPs and in the end, the pace of implementation will be controlled by Council decisions on expenditure and the budgets / spend outlined in the LTPs.

Following consultation on this draft FMP and confirmation of the preferred option for the Waipoua River urban reach, the overall benefits/costs and the affordability of different funding and staging options will be investigated before undertaking further community consultation and preparing a proposed FMP.

4.3.6 Scheme Reserves

Currently, the river schemes put money aside in reserve funds to cover years when there is a lot of flood damage. This is literally money put aside for a rainy day! The value of reserves across the schemes currently vary between approximately 100% and 400% of the annual operational / maintenance budget.

The potential flood damages have not been assessed scheme-by-scheme to determine what the reserve targets should be. However GWRC applies a rule-of-thumb that reserves should be at least 200% of the normal annual operational spend. This reserve would only likely cover the 'clean-up' costs and emergency repairs immediately after the flood event, not any subsequent remediation works.

Without major flood events for many years, current reserve balances have built up. If there is any change to funding arrangements that affect how reserves are managed, then contributions made by scheme members over time need to be recognised and we will ensure that reserve balances and debts are treated fairly.

In adopting a level-of-service based approach and the proposed move towards funding river operations from the wider community, the response to flood damage in the future will be less dictated by reserve balances and direct community funds into the locations where the urgency is greatest. Over time it is also likely that the existing scheme reserves would be amalgamated into a single reserve. If this approach is adopted, a transitional period would be required, whereby previous scheme reserves could be "earmarked" for expenditure within that scheme area only.

Central Government has also indicated that it is considering changes to policies on financial support to regions following a large flood event. This may trigger the need to reconsider appropriate reserve levels in the future. However, a reliance solely on Central Government support for large events is not assumed in this FMP.

4.4 Outcomes

This section of the FMP provides more detail for how major elements from each group of FMP responses can be implemented over time. It also includes a table of the general responses (Section 4.6.6) that are more catchment wide (not covered in *Volume 2*) with an indication of cost and priority.

4.4.1 Structural

New structural measures, mainly stopbanks, will be delivered through site-specific 'Major Project Responses'. These responses are described in detail in *Volume 2* and summarised in the table overleaf. The majority of these projects have been developed in response to known problems and situations that have not been resolved through the works programmes contained in the existing schemes.

Response priorities have been indicated as High, Medium or Low. Priority of these response projects is a key area of consultation for this draft FMP. The initial prioritisation in this draft FMP has been based on the nature of the known hazard, the nature of the associated risks, and the perceived urgency of rectifying the existing situation.

Generally, it is proposed that for the High Priority Response Projects (refer summary table overleaf) these will be carried out in the first ten years of FMP implementation.

MAJOR PROJECT RESPONSE SUMMARY (REFER VOLUME 2)

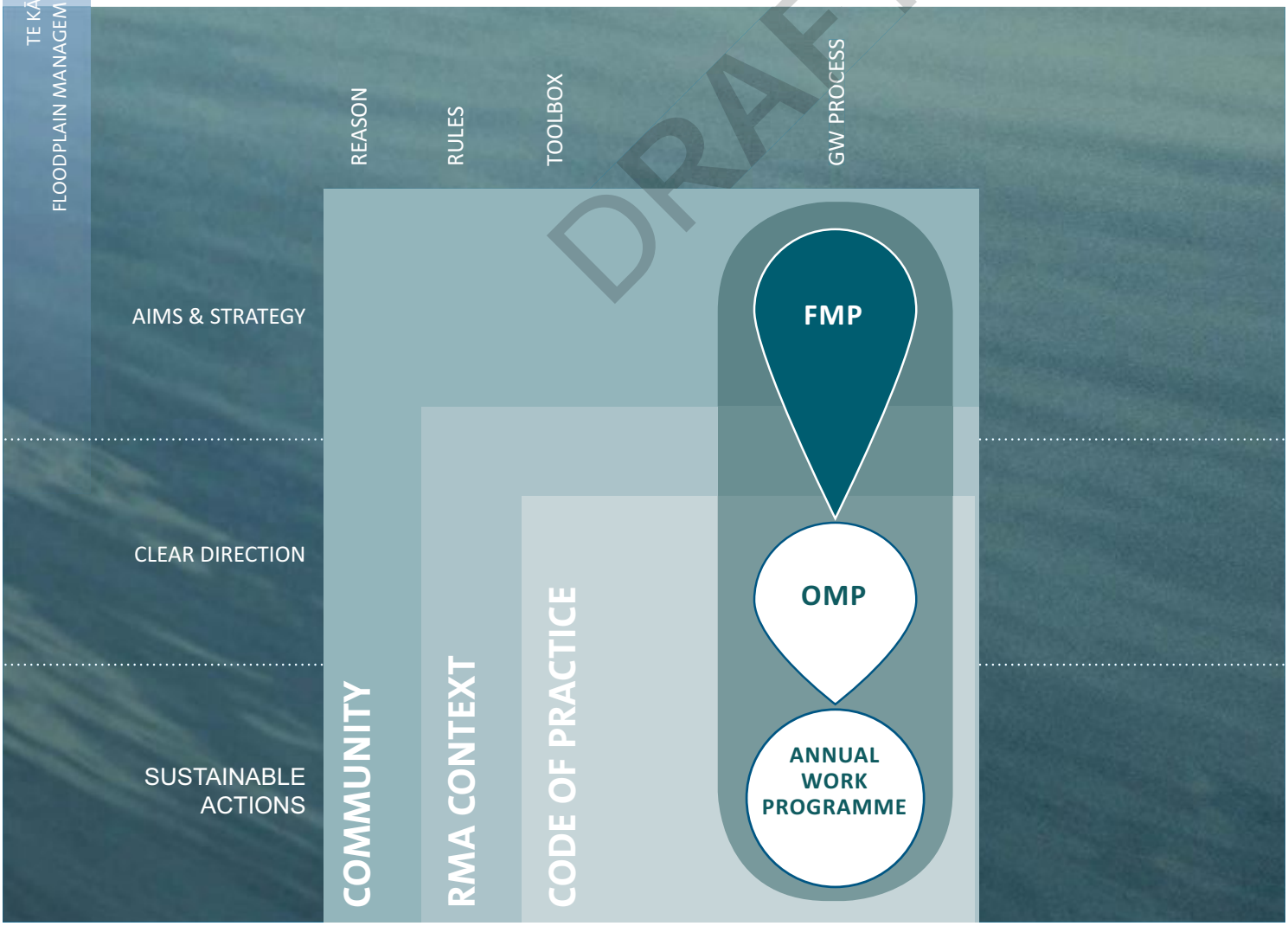
NAME	PROPOSED MANAGEMENT MEASURE	PRIMARY REASON FOR PROPOSED RESPONSE	PRIORITY	COST	FUNDING
RIVER ROAD PROPERTIES	Increase bank protection to river edge at River Road and widen river channel	To increase protection to River Road, Masterton	High	$575,000	Capital funding TBC
RIVER ROAD PROPERTIES	Easements and other legal costs as required	To allow construction/maintenance of groynes and widening of the river	High	$50,000	Capital funding TBC
MDC WATER SUPPLY	Targeted operational river management with revised emergency management plan	To manage risk of erosion posed to the water supply pipeline	High	Varying but of magnitude of $5-20,000 per annum generally, with allowance for targeted emergency works as required	Operational funding
HOMEBUSH WASTE WATER TREATMENT PLANT	Resilience works within headworks facility (plinth for generation, raising electrical works).	To increase resilience of HWWTP headworks in case of stopbank overtopping.	TBC	$50,000	Capital funding TBC
PAIERAU ROAD	Permanent warning signs and improved flood forecasting	To increase the safety of road users by providing permanent warning signs and increasing lead time for road closure to 2.5 hrs.	Medium	$20,000	Capital funding TBC
SOUTH MASTERTON STOPBANK AND URBAN GATEWAY	Contaminated site assessment, visual improvements within the buffer, establishment of public access to the river	Appealing gateway to Masterton, recreational access and contaminated site management.	Medium	$100,000 for contaminated site assessment	Capital funding TBC
RATHKEALE COLLEGE STOPBANK	TBC	To increase flooding protection to Rathkeale College and reduce erosion risk to stopbank and Rathkeale College	Medium	$1,000,000 TBC	Capital funding TBC
MDC WATER SUPPLY	Increase bank protection to river edge at Black Creek	To increase protection to water supply pipeline	Low	Up to $300,000	Capital funding TBC
SOUTH MASTERTON STOPBANK	Retreat existing stopbank to less erosion prone location outside the buffer	Stopbank is non critical asset from flood hazard perspective but may be important for preventing contaminated material entering the river.	Low	$485,000	Capital funding TBC
HOOD AERODROME	Rock revetment connecting terrace with existing rock groyne at the end of the runway	To increase protection to the runway and avoid any contaminated material being eroded into the river.	Low	$755,000	Capital funding TBC

4.4.2 River Management

River management will take place under the hierarchy of this FMP, Operational Management Plans (OMPs) (developed on a five-ten year cycle) and annual work programmes. The first 5 years are easier to predict, beyond this it gets more difficult.

- FMP: Provides the overall direction at a river- and reach-wide scale and principles/policies that apply across the rivers. States what is trying to be achieved with each reach and may give direction on particular management methods to be used or avoided. It also directs major project responses and any exceptions to the common methods.
- OMPs: Contain five to ten years of works programmes, including detailed priorities and management approaches for these works. The OMPs must be consistent with the FMP but through the preparation of the OMPs, these plans may propose changes to the FMP.
- Annual work programmes: Annual programmes of work, based on the OMPs but also dealing with reactive work and prioritising various minor repair and buffer implementation projects. Annual work programmes will be worked through with local river committees.

All works in the rivers will be carried out in accordance with GWRC's Code of Practice (COP). This is a consented document that applies regionally, is evidence-based and regularly updated to provide standards of good practice. The COP does not direct which activities should be used in a specific location (this should come through the hierarchy above and the decisions of GWRC staff) but it does provide for the range of river management activities available and the good practice in how they should be applied.



» Links between FMP, OMP and Annual Work Programme

River management envelopes

The river edge envelopes (design lines) will be reviewed between the Draft and Proposed stages of this FMP after consultation has been undertaken with the community regarding the river management proposals. This review does not intend to make widespread changes to the design lines as they stand, but rather review how the lines have performed and outline particular areas where improvements are required.

Where applicable, and if deemed necessary, modern geomorphology theory will be applied to envelope locations if there is value in doing so to address specific issues. This may include review of locations where the river envelope hasn't been performing in a way that is consistent with the use of vegetated buffers as the primary management tool. To ensure ongoing relevance and consistency, it is proposed that the river management envelopes be reviewed every 20 years as part of a major FMP review.

Other management envelopes (bed level and pool/riffle/run) will be developed as an outcome of this FMP. Monitoring and analysis of river bed levels and gravel volumes will be ongoing as further specified in the final FMP.

Buffers

The main change to river management measures proposed in this FMP is to allow rivers to erode the buffers from time to time, and to not always intervene urgently with works in the wet to "hold the line" to the inner management line. This shift represents a change in approach from frequent, small, reactive responses to less frequent but more often larger works.

Continued use of non-intrusive works such as dry river bed maintenance works and vegetation maintenance will carry on unchanged from past maintenance activities. In order to achieve this, most buffers should be established with dense vegetation in order to slow erosion. The implementation of this new approach is understood to deliver wider benefits to the river system and in turn, to the community.

To be effective, a buffer must be at or only slightly above riverbed level in order for the tree roots to hold the soil. After reaching maturity, willow trees can be "layered" against the bank edge to provide greater protection against erosion. The best sites (and high priority sites for buffer establishment) will be areas where the river has already eroded the buffer, or in some cases where the buffer is in farmland slightly above the riverbed.

Vegetated buffers will be established by planting trees. This includes willow poles supported by mixed native vegetation where possible. This will either be on private land with the agreement of the landowner or on publicly-owned land.

High priority sites for buffer vegetation establishment will be identified through the Operational Management Plans. These sites will generally be:

- Where there is high erosion risk where regular in-stream works have been required to protect the edge; and
- Already eroded by the river; or
- Low farmland where vegetation can be effectively established.

While these sites will be priorities for implementation, there will be an ongoing need to respond to flood behaviour and either reinstate or plant new areas of buffer. Over time, new areas of erosion will occur and create further opportunities. This will require acceptance from landowners that their land may be required for river space, meaning that this land may be allowed to erode back to, or close to, the edge of the river management envelope before physical intervention occurs.

On the other hand, there will be parts of the river edge envelope that are low erosion risk. If these areas are high above the river then there is no benefit in installing dense vegetation. Buffer implementation will be driven in large part by flood events and the behaviour of the rivers.

Cliffs are a special case for buffer establishment. Unless there is an exception identified in the FMP or existing erosion control structure (scheme assets), the preferred use of vegetated buffers applies in these reaches too. In this case, the river managers will wait until the buffer has been eroded (or mostly eroded) down to river level before establishing a vegetated buffer at the toe of the cliff.

Areas where the buffer management method does not apply (instead relying on a higher level of mechanical intervention, or greater use of rock edge protection for example) are identified in the reach-specific approaches as described in *Volume 2*.

The implementation of this changed river management approach will be gradual, taking place over decades. It is also not irreversible, although if unsuccessful, there could be a "re-investment" phase, and a significant reliance on in-stream works involved with regaining the control of river alignment that currently exists. Eroded topsoil would also take some time to re-establish.

The rate of implementation and degree of success will depend to a great extent on funding decisions and flood behaviour over time. Buffer establishment methods will be reviewed and improved. The proposed FMP will set buffer establishment targets for 10-year, 20-year and 40-year timeframes (to align with FMP review points) and associated cost estimates for implementation. It will also include performance measures to confirm that the new approach is delivering the benefits that were expected. This work is still in progress at this draft stage but consultation with the community will be undertaken in more detail in the proposed FMP following feedback on the river management proposals in this draft FMP.

The implementation of these methods and particularly the planting of new buffer areas requires the support and agreement of landowners. Land purchase is allowed for in this draft FMP and will be pursued with landowners who prefer not to own the buffers under this proposed change to the management regime. It is not proposed to compulsorily acquire land or use any other powers to compel landowners to establish vegetation on their land. However, landowners will not receive the full level of service (protection) to their land behind the buffer until a buffer is established to provide such protection.

4.4.3 Planning and Policy

The most important planning and policy methods are the land use controls under the WCDP. These will be progressed in partnership with the District Councils either as a Plan Change or as part of the review of the WCDP.

A Strategic Land Purchase and Asset Retreat policy, and funding, is an important method for enabling the river management implementation described above.

4.4.4 Emergency Management

Emergency management measures will be implemented as described in Section 3.4. These are mainly actions to be taken by departments of GWRC working in partnership with WREMO.

4.4.5 Environmental Enhancement

The key environmental enhancement response is to develop and implement an Environmental Strategy. This will bring different agencies together with a plan and priorities for improvements to the river environments. A Community Support Officer may be an important part of implementing this, and GWRC will be exploring options for co-funding from different agencies to deliver environmental outcomes. It is expected that a small amount of increased cost will be involved in river maintenance activities to provide for better river amenities management.

4.4.6 General Responses

Below is a summary table of the general responses that are discussed throughout this FMP with an indication of priority and cost. These responses are more catchment wide and are therefore not covered in *Volume 2*. Business as usual' operational works costs are included in the table. Although we can't be certain, these are not expected to increase in the future as a result of the changes in operational approaches proposed in this FMP. Operational costs will be reviewed as part of assessing the success of the proposed changes when the FMP is reviewed. There will, however, be an increase in costs for flood and erosion protection associated with the additional outcomes of the FMP listed on pages 43 and 47.

GENERAL RESPONSES SUMMARY

ACTION	DESCRIPTION	SECTION REFERENCE	PRIORITY	COST	FUNDING
Business as Usual Operational Works	Based on 2018 operational budgets	n/a	High	Approximately $540,000 annually	GWRC operational expenditure
Develop bed level envelopes for Waipoua, Waingawa and Ruamāhanga Rivers	A bed envelope with guidance on how to respond to areas of degradation (bed is dropping) and aggradation (bed is filling in)	3.2.2	High	$200,000	GWRC operational expenditure
Develop pool, run and riffle envelopes	Upper and lower envelopes for pool/ riffle/run sequences in different river reaches – to be used in planning programmed physical works	3.2.4	High	$50,000	GWRC operational expenditure
Wairarapa Combined District Plan Review	Developing flood mapping and contributing policy advice for input to District Plan review. New designations for proposed Major Projects.	3.3	High	$200,000	GWRC loan-funded expenditure
Develop Environmental Strategy	A strategy and action plan for specific enhancements in the river environments – multi agency	3.5.1	High	$200,000	GWRC loan-funded expenditure
New governance and funding structures	Establish new governance structures and funding approaches required to implement this FMP. May require changes to Council policies and/or to be implemented via Long Term Plan.	4.1 and 4.3	High	$50,000	GWRC operational expenditure
Design lines review	Review outer and inner design lines in line with operational experience and any new information	4.4.2	High	$200,000	GWRC operational expenditure
Develop framework for decision-making following major floods	An agreed and understood framework for how works will be prioritised following a major flood, and how this relates to normal scheme governance arrangements	3.3.5	Medium	$30,000	GWRC operational expenditure
Strategic land purchase and asset retreat	Funding available for purchase of land for FMP implementation – for buffer establishment, future major projects, environmental strategy implementation, etc. Also for GWRC contribution to retreating public assets out of the buffer when this is a suitable alternative to protecting them in place. Criteria to be developed.	3.3.7	Medium	$5M	GWRC loan-funded expenditure
Emergency management and flood warning improvements	Collaboration with WREMO on emergency management planning. Technical advice and support to WREMO including new mapping. New flood warning infrastructure such as additional rain gauge or flow monitoring sites.	3.4	Medium	$100,000	GWRC loan-funded expenditure for infrastructure upgrades
Community support officer	Potential part- or fulltime resource to establish/support community groups and help to deliver environmental/ recreational/cultural outcomes	3.5.2	Low	$50,000 per annum ongoing	GWRC operational expenditure, seeking partner support
Major review of FMP	Formal review of FMP performance	4.4.7	Low	$300,000	GWRC operational expenditure

4.4.7 Monitoring and Review

Ongoing monitoring of the aims and objectives of the FMP will enable the outcomes to be regularly reviewed. The FMP will be a living document so regular review means that the floodplain management planning process, and flood hazard mitigation measures, can be updated and changed where the need arises. Outcomes of the FMP will be largely be implemented through river management activities authorised through resource consents. Both the resource consents, and the associated Code of Practice, include adaptive management processes whereby improvements can occur as new information and techniques become available. The consents and the Code of Practice are both mandated through a statutory process.

A comprehensive review of the final FMP will be undertaken every 20 years, or earlier if the flood hazard is significantly altered by flooding, earthquakes or new information. A review could also be triggered by major regulatory or resource consent changes.

Operational Management Plans (providing more detail on how the FMP will be implemented operationally over five to ten-year horizons) will be completed and reviewed on a more frequent basis. Minor reviews will also be done yearly through the Regional Council's annual plan process. The comprehensive review would involve re-modelling of the flood hazard to ensure that information was accurate.

The table overleaf summarises what will be reviewed and when.

MONITORING AND REVIEW

REVIEW TIMEFRAME	REVIEW SCOPE	REPORT ON WHAT?
ANNUAL	• Implementation programme • Operational programme summary	• What was proposed • What work was done • Why the difference • Proposals for next year • Summary of implementation status
EVERY 3 YEARS (TO FEED INTO GWRC/CDC/ MDC LONG TERM PLANS)	• Implementation progress • Priority and costs of major projects and operational expenditure • Alignment between different agencies on projects and funding	• Investment priorities • Staging / speed of implementation • Risks and opportunities
INITIAL 10-YEAR REVIEW	• A check that key aspects of implementation are on track • Incorporate changes or new information due to other plans external to the FMP	• Review progress on delivering all high priority major projects • Review how Operational Management Plan process has performed • Review how design envelope and buffer approach has performed, and degree of success in implementing it • Incorporate any changes required due to: » Resource consenting outcomes » Waiohine and Lower Wairarapa Valley Floodplain Management Plans » Whaitua/Natural Resources Plan outcomes » Wairarapa Moana treaty settlement outcomes
EVERY 20 YEARS – MAJOR REVIEW	Scope to be agreed with iwi and stakeholders. Expected to include: • Effectiveness/progress of all common methods and general responses • Progress in implementing major project responses, and what has been achieved (e.g. flood damages saved) • Appropriateness of governance structure and funding approach • Review of catchment hydrology and flood extents • River bed envelopes and river edge envelopes/design lines • Learnings from major flood events • Future budgets proposed – affordability, value and sufficiency • Reprioritising and costing all outstanding works.	To GWRC, MDC, CDC and the Wairarapa River Management Advisory Committee as a standalone report and FMP update following consultation with stakeholders.

5. How can the Community Contribute?

The community consultation and engagement stage provides an opportunity to provide feedback on what is being proposed in the draft FMP. The diagram below outlines the steps involved with the community consultation process. Although this process highlights specific stages at which community feedback is received and incorporated, consultation and engagement with affected parties is occurring throughout the entire FMP process.

TKURFMP VOLUME 1 (BACKGROUND AND OVERVIEW) AND VOLUME 2 (LOCATION SPECIFIC VALUES, ISSUES AND RESPONSES) DEVELOPED

CURRENT STAGE: ENGAGEMENT WITH THE COMMUNITY ON VOLUMES 1 AND 2 OF THE DRAFT TKURFMP

TKURFMP VOLUME 3 (MASTERTON URBAN AREA) DEVELOPED

ENGAGEMENT WITH THE COMMUNITY ON VOLUME 3 OF THE DRAFT TKURFMP

INCORPORATE FEEDBACK FROM THE COMMUNITY INTO A PROPOSED FMP (COMBINE VOLUMES 1, 2 AND 3)

CONSULTATION WITH THE COMMUNITY ON THE PROPOSED TKURFMP (VOLUMES 1, 2 AND 3)

INCORPORATE FEEDBACK FROM THE COMMUNITY INTO THE FINAL TKURFMP

Ways you can provide feedback

VISIT THE 'HAVE YOUR SAY' WEBSITE

ATTEND PUBLIC MEETINGS

RESPOND TO LETTERS SENT TO RIVERSIDE LANDOWNERS

ATTEND LANDOWNER MEETINGS

MONITOR MEDIA RELEASES

CHECK OUT PUBLIC DISPLAYS

VISIT THE PROJECT TEAM AT VARIOUS COMMUNITY EVENTS

CONTACT YOUR LOCAL REPRESENTATIVE ON THE TE KĀURU UPPER RUAMAHANGA RIVER FLOODPLAIN MANAGEMENT SUBCOMMITTEE

Local representatives

NAME	REPRESENTS	EMAIL
Bob Francis [Chairperson]	Community	bobfrancis1@xtra.co.nz
Janine Ogg	Community	oggjanine@gmail.com
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Appendix 1: Floodplain Management Planning Process

Floodplain management planning is the process that aims to create a plan for how to keep people and property safe from floodwaters, and at the same time puts in place steps to prepare people for coping with a flood when it occurs. Specifically, the FMP process involves recognising the necessity to manage risks to life and property, and the economic effect of flooding on the community. It also recognises the impacts of river management practices on environmental, cultural, and social wellbeing.

Work on this FMP began in 2012. Information has been gathered from a range of sources and ideas have been discussed by the FMP Subcommittee. The preparation of this draft FMP followed a three-phase process outlined below.

The process followed the 'Guidelines for Floodplain Management Planning' (GWRC, 2013).

Phase 1 - Investigation

The first phase of work involved collecting data, and establishing and understanding the flood and erosion problems. In doing this, a clear picture of values of the rivers and the adjacent floodplains was recognised alongside the existing flood and erosion risks. This required an understanding of the relationships between flood hazards, people and communities including the values that are shared and the way in which the interactions between these are managed.

On the technical level, this phase involved hydrological/climatic assessment, cultural values assessment, ecological and landscape assessment, hydraulic modelling and flood hazard mapping, flood damage assessment, and the assessment of implications for existing zoning. During this phase, a significant flood risk was identified for the Masterton urban area from flooding of Waipoua River.

Contact and briefing with affected parties and the community was also carried out by way of an open day and letter drop as well as presentation of the flood hazard maps in Masterton.

The Te Kāuru Upper Ruamāhanga FMP Subcommittee

The FMP Subcommittee, made up of community and local government representatives, was also established during Phase 1. This Subcommittee was set up as a focus and governance group to assist with the different phases of this work.

The Te Kāuru Upper Ruamāhanga River Floodplain Management Plan Subcommittee, chaired by Bob Francis, is made up of:

- the GWRC Councillor for the Wairarapa constituency;
- one other GWRC Councillor;
- one elected member each nominated by Masterton District Council and Carterton District Council;
- one member nominated by Kahungunu ki Wairarapa;
- one member nominated by Rangitāne ō Wairarapa;
- up to two members nominated by the existing scheme committees; and
- up to four community members appointed for their skills and experience relevant to the work of the Subcommittee, whom are all appointed by Council.

Over the course of the FMP development, a few members joined and left the subcommittee for different reasons. We particularly want to acknowledge Councillor Gary McPhee, who passed away during the development of this FMP. All together fifteen members contributed to the FMP Subcommittee process:

BOB FRANCIS [CHAIRPERSON]

Community

STEPHANIE GUNDERSEN-REID

Community

CLLR GRAHAM MCCLYMONT

Masterton District Council

CLLR GARY MCPHEE

GWRC

KATE HEPBURN

Community

CLLR BRIAN DELLER

Carterton District Council

CLLR BARBARA DONALDSON

GWRC

JANINE OGG

Community

ADRIENNE STAPLES

GWRC

DAVID HOLMES

River Scheme

RAWIRI SMITH

Ngāti Kahungunu ki Wairarapa

MICHAEL WILLIAMS

River Scheme

HORIPO RIMENE

Rangitāne o Wairarapa

SIOBHAN GARLICK

Rangitāne o Wairarapa

CLLR MIKE PALMERS

Caterton District Council

Phase 2 - Identify and Assess Management Options

This phase of the FMP process has seen detailed information gathering and considerable consultation with interested parties and stakeholders. In terms of technical studies and referenced documents, a variety of reports and other documents have informed decisions, as well as provided evidence-based conclusions on how the river can best be managed to control the risks associated with flooding and erosion. The consultation has involved numerous meetings, open days, letters, radio coverage, participation in A&P shows, and workshop sessions to gather comments from relevant parties.

During this phase, the aims for this FMP were developed by the FMP Subcommittee in consultation with the community; these are outlined in Section 2. Overarching aims for the catchment were elaborated on for different reaches of the rivers. Based on the identified aims, a multi criteria analysis (MCA) was developed specifically for the Te Kāuru catchment to evaluate river management options. This MCA process tested the options against the overarching FMP aims and identified areas requiring improvement to bring their performance to a level acceptable to the subcommittee.

Over 300 issues were identified associated with rivers, flood and erosion risks. These are detailed in the Vision and Aims report, and *Volume 2* of this FMP.

The technical studies and consultation investigations helped identify and inform flood management options which were considered through a series of workshops run with the FMP Subcommittee including field visits and discussions of the community's needs and appropriate solutions. In this phase, a series of structural and non-structural options were evaluated by the FMP Subcommittee against the aims of the FMP, with the process and outcome being focused on reducing the potential flood and erosion risk.

The FMP Subcommittee workshop topics and associated key decisions are listed in the table below.

DATE	WORKSHOP TOPICS	KEY DECISIONS
20 October 2015	Multi Criteria Analysis (MCA) establishment	
15 March 2016	MCA Recap Common Methods applied across Waingawa River	Use of MCA
14 April 2016	Common Methods: • River Buffer (banks) • River Buffer (beds) • Pool, riffle and run count • Retreat or Retirement of Assets • Governance and funding	Support Pool, Riffle, Run Count and Retreatment of Assets
17 May 2016	Common Methods: • Governance and funding • Mixed vegetated planting • Emergency management • Private bridges across river • Community groups	Support Mixed Vegetated Planting, Emergency Management and Community Groups
17 June 2016	Rathkeale Stopbank Common Methods Endorsement / Feedback	Support High Level Application of all Common Methods
26 July 2016	Waingawa SH2 Gateway / Stopbank River Road Properties	
25 August 2016	Rathkeale Stopbank Options Waingawa Stopbank Update South Masterton Gateway Mauriceville	Support improvements to amenity at South Masterton Gateway Support inclusion of Mauriceville in management Scheme
13 September 2016	Overview of MDC Assets and Flood Risk Implications	Approve Structure and Preparation of Working Draft of FMP

DATE	WORKSHOP TOPICS	KEY DECISIONS
6 December 2016	Issue 1st Working Draft of FMP	
7 February 2017	Feedback on working draft FMP	
7 March 2017	Summary of feedback on the working draft FMP, and outcomes of the feedback	
4 April 2017	Governance MCA summary of major project responses Common methods by river	Approval of outcomes of MCA process with major projects Support identification of use of Common Methods across each river
13 June 2017	Science of hydrological assessment Management of water courses	
22 August 2017	Waipoua Masterton Urban Area Project Group August meeting Feedback from Whaitua consultation regarding 'managing the rivers' Benefits of wider river active bed and vegetated buffers Design lines/river edge envelopes – How were they developed? And how will they be implemented? Major project response updates a. River Road b. Masterton District Council Raw Water Supply Pipeline c. South Masterton stopbank discussion	
12 September 2017	Buffer management report Funding Kopuaranga scheme expansion Rathkeale stopbank	Acceptance of proposed buffer management approach Agreement to include Kopuaranga scheme expansion in the draft FMP
24 October 2017	Implementation of buffers River management descriptions	Acceptance of implantation process for buffer management Draft FMP to have preferred options not multiple options Detail of river management descriptions and level of service descriptions to remain as a supplementary report Confirmed that the preferred river management approach is to generally work within the existing river management envelopes Desire to include designation of the buffers in the draft FMP
28 November 2017	Draft FMP Volumes 1 and 2	Confirm general structure of FMP Review general and more specific comments on content of FMP, covering: • Non-statutory status • Relationship to NPS: Freshwater • Reliance on mixed vegetation • Adaptive Management • Relationship to Code of Practice • Terminology
13 February 2018	Responses to Draft FMP Feedback Rathkeale update Consultation	Confirm feedback responses have been identified Review draft responses That genuine and honest feedback from the community is being sought

There were several key constraints that had to be considered when assessing management options, for example:

- Location of existing assets (such as bridges, roads, houses); and
- Balancing environmental and cultural values of allowing the river flexibility to behave more naturally with the economic costs of the potential loss of productive land.

In particular, the FMP Subcommittee has promoted a river management approach that seeks to allow the rivers to behave more naturally, with less frequent intervention, within the current envelopes. This is an explicit attempt to strike a balance between improving the river environments and recognising the economic value of the adjacent land (and the views of those landowners).

In addition to the workshops outlined above, approximately 20 Subcommittee meetings were also held in Masterton (open for the public) where the FMP Subcommittee endorsed various steps of the project development. All the reports are available to the public through the GWRC official website.

Phase 3 - Prepare draft Floodplain Management Plan

Based on the evaluation of different options against the vision and aims of this FMP, the preferred option combinations were selected by the Subcommittee and are being presented to the community as a "draft" FMP. We are currently in this phase and through this document we are in the process of presenting the preferred options to the community for feedback.

Consultation

One of the key parts of FMP process has been engaging with the community. In particular, engaging with people who may live on or own flood prone land. This FMP brings together several years of intensive work by:

- Key stakeholders and affected parties;
- The rural community;
- The urban community of Masterton;
- The FMP Subcommittee;
- GWRC, Carterton District Council, and Masterton District Council;
- Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa; and
- Various interest groups, public agencies and businesses.

As part of this work, the FMP Subcommittee has been a crucial component of consultation on the future management of the river, has made decisions on detailed technical investigations, and endorsed preferred options for addressing the flood and erosion risks at specific locations. These decisions form the basis of this FMP.

The process of how you can contribute to this FMP is outlined "Section 5: How can the community contribute?".

Appendix 2: Current River Management Practices

River management refers to works within the bed of the river and on the river banks, and the maintenance of stopbanks. Over the last 50 years, river management schemes have been proposed, developed, and are currently maintained. These schemes collectively reduce, mitigate or manage flooding and erosion risk, with the purpose of protecting people, property, infrastructure, and productive rural land. These schemes were formed at various times based on the wishes and support of the local community.

There are two distinct types of river management schemes operating within the Te Kāuru Upper Ruamāhanga catchment, which reflect the different natures of the rivers. Schemes covering the western side of the valley are dealing with larger, gravel bedded rivers (the Waingawa, Waipoua and Ruamāhanga Rivers). Schemes established on the eastern side include the Kopuaranga, Whangaehu and Taueru Rivers that are smaller, silt bedded rivers coming from the Eastern Hills.

Activities and approaches

The current approach to flood risk management in the catchment primarily addresses erosion concerns. The gravel bedded river management schemes use a river management envelope as a tool to maintain a sufficient river channel to accommodate flood flows. The aim is to keep the river's channel within a design alignment and plant edges each side of the active bed in appropriately wide vegetated buffers to enable maintenance of the channel over time.

Along fast flowing erosion prone rivers, modern sterile varieties of willow trees are the preferred type of vegetation used in buffers because of their robust nature and vigorous growth combined with an ability to resist erosion. The principle is that the buffers perform the bulk of the erosion protection and allow the scheme managers to manage break-outs of the river alignment before they damage assets and productive land located behind the buffers and stopbanks. In comparison with earlier willow plantings, such as those done historically on the Whangaehu, Taueru and Kopuaranga Rivers, modern management takes a hands-on approach to establishing and managing the willow plantations so that they do not impinge on the river channel or otherwise cause a nuisance.

Other complementary river management activities used throughout the Te Kāuru Upper Ruamāhanga catchment include:

- Gravel extraction;
- Bed and/or beach re-contouring (moving gravel within the river bed);
- Rock rip-rap (placement of rock lines along the edge/bank of the river);
- Rock groynes (placement of rock built out from the river edge/bank); and
- Vegetation clearance to prevent the build-up of islands in the river channel. This type of work involves using machinery such as diggers and bulldozers on the edge of the river, or sometimes in the river channel itself.

» Gravel management and willow cabling are examples of many works that take place in the rivers.

The focus of current river management has been driven by a desire to minimise the impact of erosion and flooding on agricultural land and a drive to maximise the productive capacity of that land. Agricultural land use remains one of the key drivers behind the need for river and erosion management, and creates the greatest demands on the management of our rivers. This approach came from the prevailing values at the time the schemes were established, where overall economic development was the primary concern. In recent years, concern has been raised about the sustainability of the river management techniques used, and the impacts that these techniques and schemes have had on the river environment and cultural values. As a result of these concerns, and collaborative work between the schemes and community representatives, steps have already been made to change or modify these management practices. This FMP aims to build on these improvements, and includes the concept of giving the river more room to develop a natural form. It also recognises the full range of river and floodplain values as part of the assessment and option development process.

Appendix 3: Current River Management Schemes of the Te Kāuru Area

Upper Ruamāhanga Schemes

There has been a long history of river management on the Upper Ruamāhanga River associated with human settlement and people's desire to protect themselves and their assets (land and structures) from the negative effects of flooding.

The modern Upper Ruamāhanga River Management Scheme was established in 1982 and covered a length of 58km of the Ruamāhanga River from Mount Bruce downstream to the Waiohine confluence. The scheme was designed to protect an area of about 2,760ha of rural land and a number of public utilities using a combination of stopbanks, vegetated buffers and heavy bank protection. The overall guiding philosophy was based on an established set of design lines.

A major review of the Scheme was undertaken in 2001/02 in response to a number of issues, particularly the river management approach and rating classifications which was considered to be inequitable to certain reaches of the scheme. This review resulted in the Upper Ruamāhanga Scheme being split into three sections, namely the Mt Bruce Scheme (25km), the Te Ore Ore Scheme (9km), and the Gladstone Scheme (24km), to reflect the typical quantum of works required and the subsequent relative rating requirements of each section of the river.

Waingawa River Scheme

The Waingawa River Management Scheme covers a length of 17km, stretching from the Atiwhakatu Stream to the Ruamāhanga River confluence downstream. The river is bisected by a number of geological fault lines and this influences the natural characteristics of the river. The floodplain is generally well defined by clear river terraces, indicating where the river has been over a geologic timeframe, although cross country overflows towards Masterton were possible prior to the construction of stopbanks in the vicinity of West Bush/Skeets Road. After a series of floods in 1988 local landowners and the District Councils put forward a request for a river management scheme be set up to manage the effects and to provide ongoing protection to land and community assets. The scheme was established in 1992. Prior to establishing the scheme, any work carried out in the river to mitigate flood and erosion damage was carried out by individual landowners or the utility owner at their own expense.

A significant aspect of the scheme was the mechanism for encouraging the retirement of private land adjacent to the river for the creation of a vegetated buffer. This mechanism involved the agreement of the owner, who then received 10% of the assessed value of the land and the remaining 90% of the assessed value being credited to the scheme rating district to partially offset scheme costs. Over the first 15 years infrastructural assets were developed to mitigate erosion damage, course change and flood hazard to Masterton. After this phase the scheme focused on maintenance works.

Waipoua River Scheme

The Waipoua River Management Scheme covers a length of 18km, stretching from the Mikimiki Bridge to the Ruamāhanga River confluence downstream.

The Waipoua River Scheme was originally established in 1954 to mitigate flooding and erosion hazards for rural land and the Masterton urban area. The scheme was designed to protect an area of about 770ha from flooding. The Scheme consists of stopbanks, grade control weirs, vegetated buffers, protective willow plantings and rail-iron groynes.

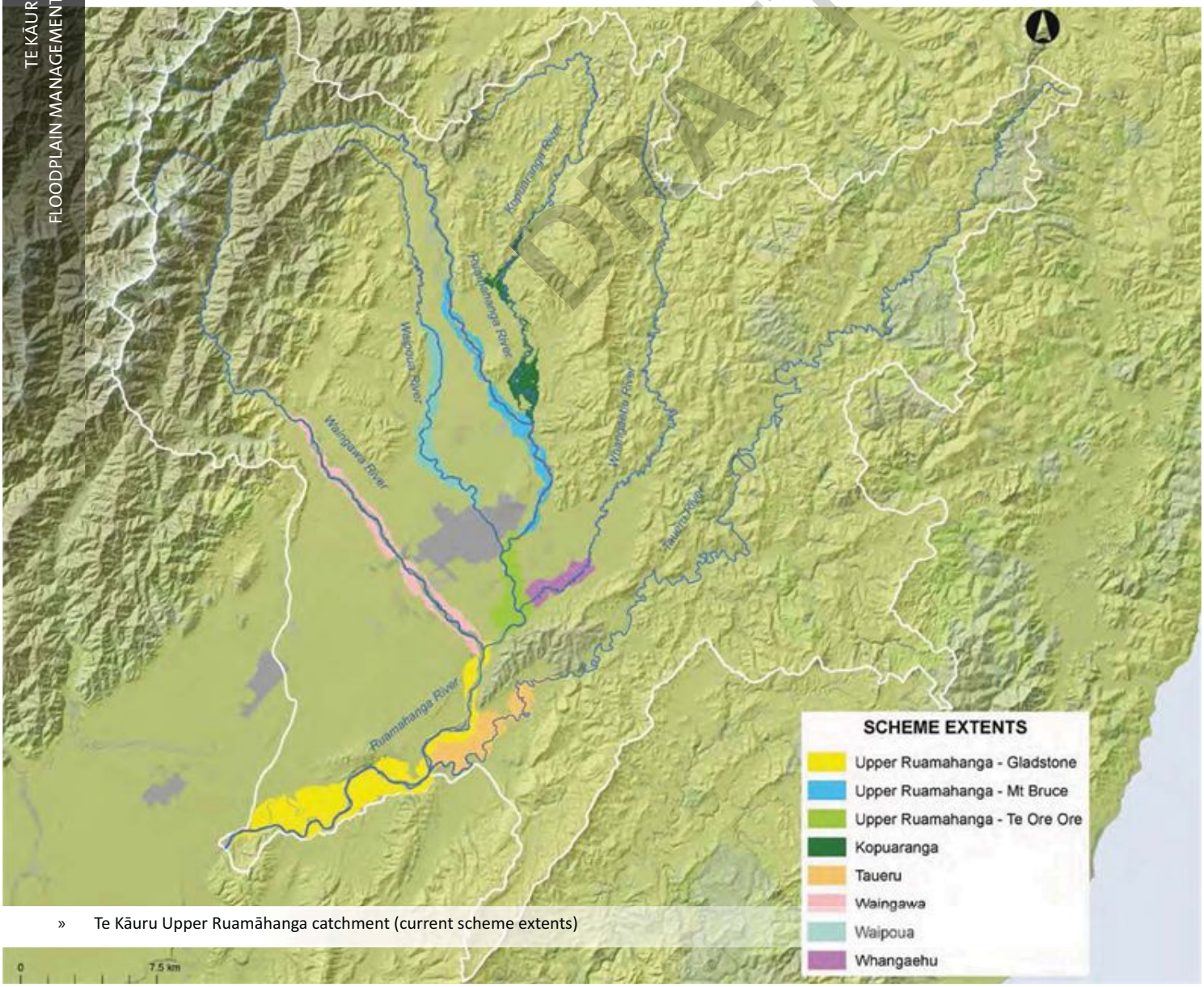
The scheme is split into two parts; the rural reaches and the Masterton urban reach. GWRC is responsible for the implementation and maintenance of both components; however, the funding of the maintenance works within the Masterton urban area is split 50/50 between GWRC and Masterton District Council. There are three grade control weirs in the Masterton urban reach that maintain the water level in the river to ensure sufficient water supply to Queen Elizabeth Park. These weirs are within GWRC list of assets.

Kopuaranga River Scheme

The Kopuaranga River Scheme covers a length of around 27km, from just downstream of Mauriceville to the confluence with the Ruamāhanga at Matapihi. It was established in 2007 in response to flood events during 2004 and 2005. Willows within and near the Kopuaranga River channel were impeding river flows, resulting in reduced channel capacity. The effect of this willow growth was more frequent flooding, particularly on properties in the lower sections of the Kopuaranga catchment. Following community consultation, a scheme was established to fund the selected removal of willows and re-planting of native and exotic species in the lower catchment. In addition, an ongoing maintenance programme involving spraying or cutting willows is undertaken as required. Since the establishment of the Scheme, progressive removal and re-planting of willows has been undertaken.

Whangaehu River Scheme

The Whangaehu River Scheme covers 9km of the river and is a relatively small scheme in terms of the scope of works carried out and expenditure. This scheme was established in 1995 in response to worsening flooding resulting from increased congestion of the river channel from willows and other debris. The scheme extends from the confluence with the Ruamāhanga River up to the Masterton-Castlepoint Road.



» Te Kāuru Upper Ruamāhanga catchment (current scheme extents)

Taueru River Scheme

The Lower Taueru River Scheme covers 18km of the river and is similar in scope to the Whangaehu Scheme. This scheme was established in 1994 to reduce the incidence of flooding in this area due to excessive willow growth within the river channel. The scheme extends from the confluence with the Ruamāhanga River (just upstream from the Gladstone Road Bridge) up to the end of Te Kopi Road. The cause of the flooding (e.g. willow growth reducing the capacity of the river channel) and the resulting scheme works (e.g. original removal of willows and debris, followed by spraying to control re-growth) have many similarities to the Whangaehu River.

Cost of management work (2017) and key protected areas

RIVER	COST OF MANAGEMENT WORK	KEY PROTECTED AREAS
Ruamāhanga	Mt Bruce $125k – typical annual maintenance cost $1.5M – Flood Protection assets value Te Ore Ore $150k typical annual maintenance cost $2.5M Flood Protection asset value Gladstone $160k typical annual maintenance cost $3M Flood Protection asset value	Mt Bruce ($5k/km), Te Ore Ore ($17k/km), and Gladstone areas ($7k/km) Ave. $$ spent per km is indicative of the relative levels of service between the three schemes (i.e. low, high, med respectively)
Waingawa	$179,000 – annual maintenance cost $1.4M – Flood Protection assets	Masterton water supply intake and the water supply pipeline, The railway and state highway bridges, The bank edge at the end of the Hood Aerodrome runway Local and regional utilities infrastructure
Waipoua	$110,000 with around $20,000 identified for the urban reach $3,664,087 assets	Urban Masterton and other public and private assets
Kopuaranga	$23,000 – annual maintenance No Flood Protection assets here	The river management scheme covers 27 km upstream from the confluence with the Ruamāhanga River
Whangaehu River	$7000 – annual budget No Flood Protection assets here	Covers 9 km upstream from the confluence with the Ruamāhanga River
Taueru River	$5000 – annual budget No Flood Protection assets here	It extends for a length of 17.7km from the confluence with the Ruamāhanga

Appendix 4: Legislative and Policy/Principle Context

An outline of the legislation, policies and principles relevant to preparation of the Te Kāuru Upper Ruamāhanga FMP is set out below.

Legislation

There are three key statutes of particular relevance to floodplain management: the Resource Management Act 1991; the Local Government Act 2002; and the Soil Conservation and Rivers Control Act 1941.

Each of these performs a distinct and important role in managing flood risk, including the ability for a range of regulatory and non-regulatory measures to be introduced which enable central and local government to more effectively manage such risks (for example, structural measures such as stopbanks, policy and planning measures such as land use controls, and river management responses such as river edge envelopes and vegetated buffers).

Resource Management Act (RMA)

Natural hazards are a relevant planning concern under the RMA, with the 'management of significant risks from natural hazards' recognised as a matter of national importance (s.6(h)).

To achieve this regional and city/district councils assume specific natural hazard related functions under the Act, with regional councils responsible for controlling the 'use of land for the purpose of avoiding or mitigating natural hazards' (s. 30(1)(c)(iv)) and city/district councils responsible for controlling 'any actual or potential effects of the use, development, or protection of land for the purpose of avoiding or mitigating natural hazards' (s.31(1)(b)(i)).

Functionally, regional councils play a lead role in hazard management, with allocation of responsibilities between agencies outlined in their regional policy statements (s.62(1) (i)).

These requirements, along with other relevant matters in Part 2 of the RMA, provide a regulatory context for regional and city/district councils to control land use to avoid or mitigate natural hazards, such as flooding. This is typically realised through objectives, policies and rules specifically developed for this purpose contained in respective regional and district plans (ss.67/68 and 75/76), and in considering and determining any associated resource consent applications (Part 6 and s.106).

Local Government Act (LGA)

Under the LGA regional and city/district councils are required to have particular regard to the contribution that the core service of 'avoidance or mitigation of natural hazards' makes to their communities (s.11A).

A key requirement under the Act is the preparation of long term plans (LTPs). These act as a vehicle for regional and city/district councils to outline their key activities (expenditure) over the following 10 year planning horizon; they also provide a basis for accountability through the identification and setting of required levels of service and performance measures in relation to groups of activities, such as flood protection (s.93).

As part of the LTP, councils are also required to prepare financial strategies including an indication of the 'expected capital expenditure on network infrastructure, flood protection and flood control works that is required to maintain existing levels of service' (s.101A(3).

The LTP and associated asset management planning process enables councils to determine the level of natural hazard protection to be provided by their assets (in the case of flood protection works), or the level of event they are intended to withstand (in the case of network infrastructure).

Soil Conservation and Rivers Control Act (SCRCA)

While much of the original SCRCA has been repealed, it still empowers regional councils to undertake catchment works to promote soil conservation or minimise and prevent damage by floods and erosion (ss.10 and 133).

Although the Act provides a mandate to undertake works for the purposes of flood protection and erosion control, it does not compel or require regional councils to act on these matters. Furthermore, any proposed works (e.g. stopbanks) are subject to the requirements of the RMA if the activity is not permitted as of right or a resource consent is required under a relevant district or regional plan (s.10A).

National Policy Statement for Freshwater Management 2014 (NPS-FM, 2014 (2017 Amendment))

The NPS-FM is a regulatory instrument issued by the Government under the RMA that provides direction to local authorities on management of fresh water through establishment of:

- a framework that considers and recognises Te Mana o te Wai (the integrated and holistic well-being of the water) as an integral part of freshwater management
- a set of objectives and policies that direct water to be managed in an integrated and sustainable way, with provision made for economic growth within set water quality and quantity limits

Particular provisions in the NPS-FM of relevance to floodplain management include:

- Objective C1 and associated Policies C1 and C2 – these relate to improving integrated management of freshwater and the use and development of land within a catchment.

This, in turn, necessitates regional councils to review the way they manage land use impacts on water quality and quantity, including management of sediment input and land uses that alter water yield (Policy C1), and to recognise the relationship between management of land use, water and provision of all forms of infrastructure, including stopbanks (Policy C2).

- Objective CA1 and associated Policies CA1 and CA2 – these relate to the identification of freshwater management units (FMUs) incorporating all freshwater bodies within a region, along with the establishment of a nationally consistent approach to setting relevant freshwater objectives for these units (the National Objectives Framework).

Ecosystem health and human health for recreation are compulsory values for consideration when developing FMU specific objectives. Aside from these, regional councils may also take into consideration a range of other values, where appropriate to their local/regional circumstances. Such values can include natural form and character (e.g. biophysical, ecological, geological, geomorphological, and morphological aspects), mahinga kai, wahi tapu and water supply (Policy CA2(b) and *Appendix 1*).

Regional Policy Statement for the Wellington Region (RPS)

The RPS contains a specific topic on natural hazards, with river flooding identified as one of the three most significant natural hazards in the region. It also contains the following natural hazard-related objectives:

- Objective 19: The risks and consequences to people, communities, their businesses, property and infrastructure from natural hazards and climate change effects are reduced.
- Objective 20: Hazard mitigation measures, structural works and other activities do not increase the risk and consequences of natural hazard events.
- Objective 21: Communities are more resilient to natural hazards, including the impacts of climate change, and people are better prepared for the consequences of natural hazard events.

To achieve these objectives the RPS relies on four key policies: two that direct district and regional plans that apply in the region, and two that set out matters that need to be considered by councils when processing and determining a resource consent/ notice of requirement, or a change/variation or replacement to a plan. These policies are as follows:

- Policy 15: Minimising the effects of earthworks and vegetation disturbance – district and regional plans.
- Policy 29: Avoiding subdivision and inappropriate development in areas at high risk from natural hazards – district and regional plans.
- Policy 51: Minimising the risks and consequences of natural hazards – consideration.
- Policy 52: Minimising adverse effects of hazard mitigation measures – consideration.

Regarding responsibility for policy implementation, the RPS states that these responsibilities are shared between the regional council and city/district councils (Policy 62), and identifies a range of regulatory and non-regulatory methods, including:

Regulatory

- Method 1: District plan implementation (city and district councils).
- Method 4: Resource consents, notices of requirement and when changing, varying or reviewing plans (Wellington Regional Council and city and district councils).

Non-regulatory

- Method 14: Information about natural hazard and climate change effects (Wellington Regional Council, city and district councils and Civil Defence Emergency Management Group).
- Method 22: Information about areas at high risk from natural hazards (Wellington Regional Council and city and district councils).
- Method 23: Information about natural features to protect property from natural hazards (Wellington Regional Council and city and district councils).

Any Regional Plan or District Plan prepared under the RMA is required to put a RPS into practice. These plans help the respective regional and city/district councils to carry out their resource management functions, including managing natural hazards and their associated effects, and to develop ways to deal with the full range of floodplain management planning issues.

FMP Principles

The FMP approach adopted and implemented by the regional council is premised on a set of four core principles that reflect:

- The evolving nature of council practice in preparing and implementing FMPs throughout the region and the corresponding lessons learnt; and

- The political and economic realities associated with any prospective change to its current approach to managing flood hazard risk (e.g. managed retreat vs building or upgrading flood protection structures).

The principles also reinforce and complement the objectives and policies in the RPS, as well as the council's operational floodplain management guidelines.

The core principles are as follows:

- **Avoid building in areas at high risk of flood hazard**
  Avoiding the construction of residential and other buildings vulnerable to flooding in undeveloped urban and rural areas (i.e. a 'greenfields' situation) exposed to a high level of flood hazard is the most effective way of managing flood risk in these locations in the long-term. In areas subject to a lesser degree of flood hazard, activities and development should be appropriate to the circumstances and should not exacerbate flood risk.
- **Only consider new flood protection infrastructure where existing development is at risk**
  Where existing urban or rural land use and/or development (e.g. dwellings, irrigation infrastructure, dairy sheds) is subject to an unacceptable degree of flood risk the construction of new structural protection measures (e.g. stopbanks, elevating existing buildings) will be considered. This includes circumstances where, for instance, there is an elevated risk to human life or safety or where the impact on lifeline utilities or the local/regional economy is judged to be significant.
- **Establish standards of flood protection relative to the degree of risk**
  In designing and implementing structural and/or non-structural measures within areas subject to flood risk, the following standards are to be applied by GWRC and city/district councils:
  - » Protection of all habitable buildings and urban areas
    - › A minimum 1% AEP flood standard to floor levels for habitable buildings and new development within existing urban areas, along with provision of safe access
  - » Stopbank protection
    - › Where required to protect existing urban areas and associated land use, stopbanks will be constructed to achieve a minimum 1% AEP flood standard
    - › Where required to protect rural areas and associated land use, stopbanks are generally constructed up to a 5% AEP flood standard to alleviate frequent or nuisance flood events
  - » Plan for climate change in assessing the degree of flood hazard risk and in determining an appropriate response
    In assessing flood hazard risk and determining appropriate structural and/or non-structural responses in areas subject to flood risk, GWRC will apply the following allowances for climate change predicted to occur over the next 100 years in the design criteria for its flood hazard investigations:
  - » Current allowances
    - › Increases in rainfall intensity - 20%
    - › Sea level rise - 0.8m

The manner in which these principles are applied to specific catchments is largely determined in discussion with individual communities during the process of preparing a FMP. This includes, for example, consideration of such matters as:

- › What constitutes 'an unacceptable level of risk' to the local community and what are the structural and non-structural measures available to reduce exposure to these risks
- › How estimates of potential flood damage are derived (e.g. current land use and potential future losses under existing development conditions vs increased development opportunities and economic growth resulting from the introduction of structural measures)

Appendix 5: Glossary

1% AEP FLOOD EVENT	A 1% Annual Exceedance Probability flood event has a one percent or one in 100 chance 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.
ACTIVE BED	The area of a river channel which is affected by the river processes of flows, sediment transport and the alteration of bed form during flood events. Outside of flood events, the active bed of a gravel bedded river is normally only partially covered by flowing water (see Wetted channel).
AGGRADATION	Increase in the general level of the active bed through a build-up of bed material sediments. This may arise because a pulse of bed material has moved through a reach or due to changes in river processes affecting the transport of bed material.
ANNUAL EXCEEDANCE PROBABILITY	The chance of a flood occurring in any given year. The probability is expressed as a percentage. For example, a large flood which may be calculated to have a 1% chance to occur in any one year is described as 1% AEP flood.
ASSET/FLOOD PROTECTION ASSET	A useful or valuable structure or material that is valued by Greater Wellington such as stopbanks, rock lining material, bridges, roads, debris fences etc.
BANK	A defined feature at the edge of an active bed, generally marked by a steep change in slope.
BEACH	A general term for areas of deposited bed material within the active bed that is relatively clear of vegetation, often lying between the low flow channel(s) and the banks.
BERM	An area of relatively low lying land within a waterway beyond the active bed, and generally from a bank landwards to a higher natural feature, or flood-containing stopbank. Berms generally have some form of vegetative cover. They are flooded relatively frequently and provide additional flood capacity, while accommodating erosion and active bed migration.
BOULDERFIELD	Land in which the area of unconsolidated bare boulders (> 200 mm diam.) exceeds the area covered by any one class of plant growth-form.
BUFFER / VEGETATED BUFFER	A defined area along the margin of the river that may be prone to erosion in order to guide priorities for river management purposes. Buffers planted with vegetation to control bank erosion are called vegetated buffers.
CATCHMENT	The land area draining through the main stream, as well as tributary streams, to a particular site. It relates to an area above a specific location.
CHANNEL / RIVER CHANNEL	A topographic feature that contains, or has contained, flowing water. The term can be used in a variety of ways depending on context; channels can exist within the active bed of a river, or may refer to the entire active bed. See Wetted channel.
CODE OF PRACTICE	The Code of Practice is the document developed by GWRC that guides all river management activities undertaken by GWRC for the purposes of flood and erosion protection across the Wellington Region.
COMMON METHODS	These provide the suite of methods which are idenitfied in the FMP in response to flood and erosion issues
DEGRADATION	A decrease in the general level of the active bed through removal of bed material sediments. This may arise because a pulse of bed material has moved through a reach or due to changes in river processes affecting the transport of bed material.
DESIGN STANDARD	The standard of the flood management methods designed to contain a flood of a certain size (e.g. the height of river stopbanks).
DESIGNATION	This is an ability to reserve land under the district plan, either to note a hazard or to note the location of a structure to provide protection from that hazard. There are generally strict rules which control what may happen in these areas and they can be used to reserve land for construction in the future
EMERGENCY	A situation that is the result of flood and causes or may cause loss of life or injury or illness or distress or in any way endangers the safety of the public or property.

EMERGENCY MANAGEMENT (CIVIL DEFENCE EMERGENCY MANAGEMENT)	The application of knowledge, measures, and practices for the safety of the public or property. Emergency management responses are designed to guard against, prevent, reduce, recover from, or overcome hazards that may be associated with an emergency. Emergency management includes, without limitation, the planning, organisation, co-ordination, and implementation of those measures, knowledge, and practices.
ENVIRONMENT STRATEGY	Sets the direction for the management and development of the Upper Ruamahanga rivers and their margins.
EROSION	The process of removal of material from a channel, banks or berms by the river flows
FLOOD	Inundation of an area outside the active bed or banks, baseflow channel or channels, of a river due to runoff from a rainfall event or events.
FLOOD HAZARD MAP	A map showing flood hazard in terms of depth of inundation, flow velocities or combined hazard categories for events of different probability. The maps are produced based on computer modelling.
FLOODPLAIN	The low-lying, flat or gently sloping land adjacent to a river channel that is covered with water during floods.
FLOODPLAIN MANAGEMENT PLAN	Long term plan for sustainable management of flood and erosion risks. These plans detail the Regional Council's priorities for flood protection works for specific rivers in the region and set a vision for managing those rivers. The plans have a 40 year planning horizon with planned reviews every 10-15 years.
FLOOD STANDARD	The defined flood (volume, peak, shape, duration, timing) which a flood defence system and its associated facilities are designed to safely pass.
HABITAT	The place or type of site where an organism or population normally occurs.
HAZARD (FLOOD OR EROSION)	Flood or erosion occurrence the action of which can have a negative impact on human life, property, or other aspects of the environment.
INFRASTRUCTURE	Networks, links and arts of facility systems, e.g. transport infrastructure (roads, rail, parking), water system infrastructure (pipes, pumps and treatment works)
ISOLATED WORKS	Privately owned flood or erosion protection works that are constructed outside areas where Greater Wellington manages community flood protection schemes.
KAITIAKITANGA	Guardian or steward or to have guardianship or stewardship.
LIFELINES	Utilities that provide services essential for the ongoing functioning of a community during and following an emergency. They include utility service - telecommunications, gas, electricity and water; and transportation network - road, rail, port and airport services. Other essential services include hospitals and medical centres, and emergency services, such as the police, ambulance and fire services.
MEANDERING RIVER	A river with a curved channel as opposed to a braided river with multiple channels in the river bed. In planform meandering river has a wave form, where a meander refer to a single bend. Meanders are moving due to river flows, sediment transport and associated scour and deposition of the channel and banks.
MITIGATION	For this plan, the act of moderating or reducing the effects of the flood or erosion hazard or flood protection works.
MAURI	The life essence present in things as a result of their being imbued with that character.
NON-STRUCTURAL RESPONSES	Non-structural responses or measures keep people away from flood waters and help the community cope when flooding occurs. They include planning and policy responses (policies and rules in district plans), voluntary actions (information and advice to help people to make their own decisions), emergency management responses, and other.

OPERATIONAL MANAGEMENT PLAN (OMP)	Operational Management Plans are developed by GWRC for specific rivers to provide detailed guidance on the implementation of an FMP at a reach by reach scale. The OMP identifies the management objectives and reach specific values that must be considered in the selection of the most appropriate river management methods to be used for each reach.
OVERFLOW PATH	Overflow paths (also known as flow paths) include areas in the river corridor and on the adjacent floodplain where a large volume of water could flow 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 danger to life. The rise of flood water may be rapid. Evacuation of people and their possessions would be dangerous and difficult, and 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.
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, but 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.
POOL, RIFFLE, RUN	These are the areas in the river channel characterised by diverse mix of flows and depths. 'Pool' is an area of low flow channel where depth is relatively greater and velocity of the flow is lower than in the surrounding parts of the river. 'Riffle' is an area of the low flow channel that is shallow and steep with higher flow velocities and unbroken standing waves over the bed material. 'Run' is an area of the low flow channel with relatively fast consistent flow and shallow depths. Runs form downstream of riffles or between pools.
RESIDUAL RISK	The risk of flooding that exists despite the protection provided by flood protection structures. In other words, it is the additional or "leftover" risk due to possible breaching and overtopping of structures such as stopbanks.
RIPARIAN	The interface between land and a river or stream.
RISK (FLOOD OR EROSION)	The combination of the likelihood and the consequences of a hazard.
RIVER	A continually or intermittently flowing body of fresh water; includes a stream and modified watercourse; but does not include any artificial watercourse.
RIVER BED	The RMA defines a river bed as 'The space of land which the waters of the river cover at its fullest flow without overtopping its banks'. Often the horizontal extent of a river bed defined thus corresponds to the extent of the active bed.
RIVER BED LEVEL ENVELOPE	A management term referring to an area between defined limits within which the measured height of the river bed is allowed to vary, with a minimum of management intervention.
RIVER CORRIDOR	River corridor includes land immediately next to the river channel. It is the minimum area able to contain a major flood and allow the water to pass safely downstream. The extents are identified based on modelled depth and velocities of 1% AEP flood event. The depth and speed of flood waters in the river corridor are such that they represent a potential danger to people and structures.
RIVER MANAGEMENT ENVELOPE	A management term referring to an area between defined limits within which the outer edge of the design channel is allowed to migrate into the buffer under different flow conditions, with a minimum of management intervention.
SELECTED LAND USE REGISTER	Sites that are registered in GWRC's Selected Land Use Register (SLUR) are known (or suspected) to have been involved (historically or currently) in the use, storage or disposed of hazardous substances and as a consequence may contain residues of these substances
SERVICE	As in utility service, is a system and its network infrastructure that supply a community need.
STONEFIELD / GRAVELFIELD	Land in which the area of unconsolidated bare stones (20-200 mm diam.) and/or gravel (2-20 mm diam.) exceeds the area covered by any one class of plant growth form. The appropriate name is given depending on whether stones or gravel form the greater area of ground surface.

STOPBANKS	Banks aligned beside the river to prevent floodwater flowing into floodplain areas. They are also known as flood defences.
STRUCTURAL RESPONSES	Structures or other physical works designed to keep flood waters away from existing development. Stopbanks and floodwalls are obvious examples of structural responses.
SUSTAINABLE MANAGEMENT	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: Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and Safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and avoiding, remedying, or mitigating any adverse effects of activities on the environment.
VEGETATIVE BUFFER	Buffers planted with vegetation to control bank erosion.
WETTED CHANNEL	The area within the active bed currently containing flowing water.

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DRAFT TE KĀURU UPPER RUAMĀHANGA FLOODPLAIN MANAGEMENT PLAN

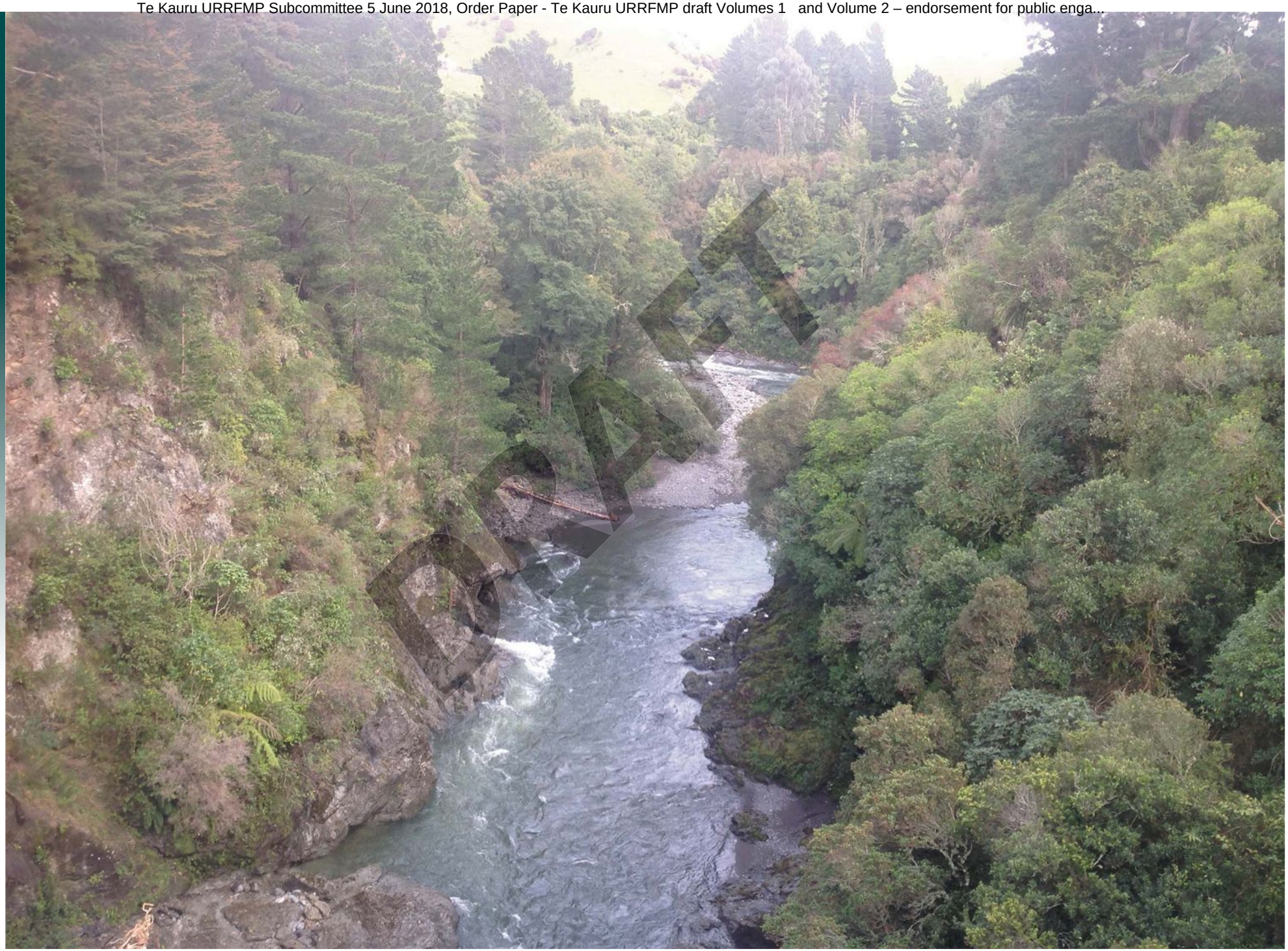
DRAFT FOR COMMUNITY INPUT - REVISION 4

VOLUME 2: LOCATION SPECIFIC VALUES, ISSUES AND RESPONSES

JUNE 2018

BIBLIOGRAPHIC REFERENCE FOR CITATION:

REVISION	DATE ISSUED	REVIEWED BY	APPROVED BY
1	6 December 2016	GWRC / FMP Subcommittee/MDC/CDC	
2	28 November 2017	GWRC / FMP Subcommittee/MDC/CDC	
3	28 February 2018	GWRC / FMP Subcommittee	
4	June 2018	GWRC / FMP Subcommittee	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1. Introduction

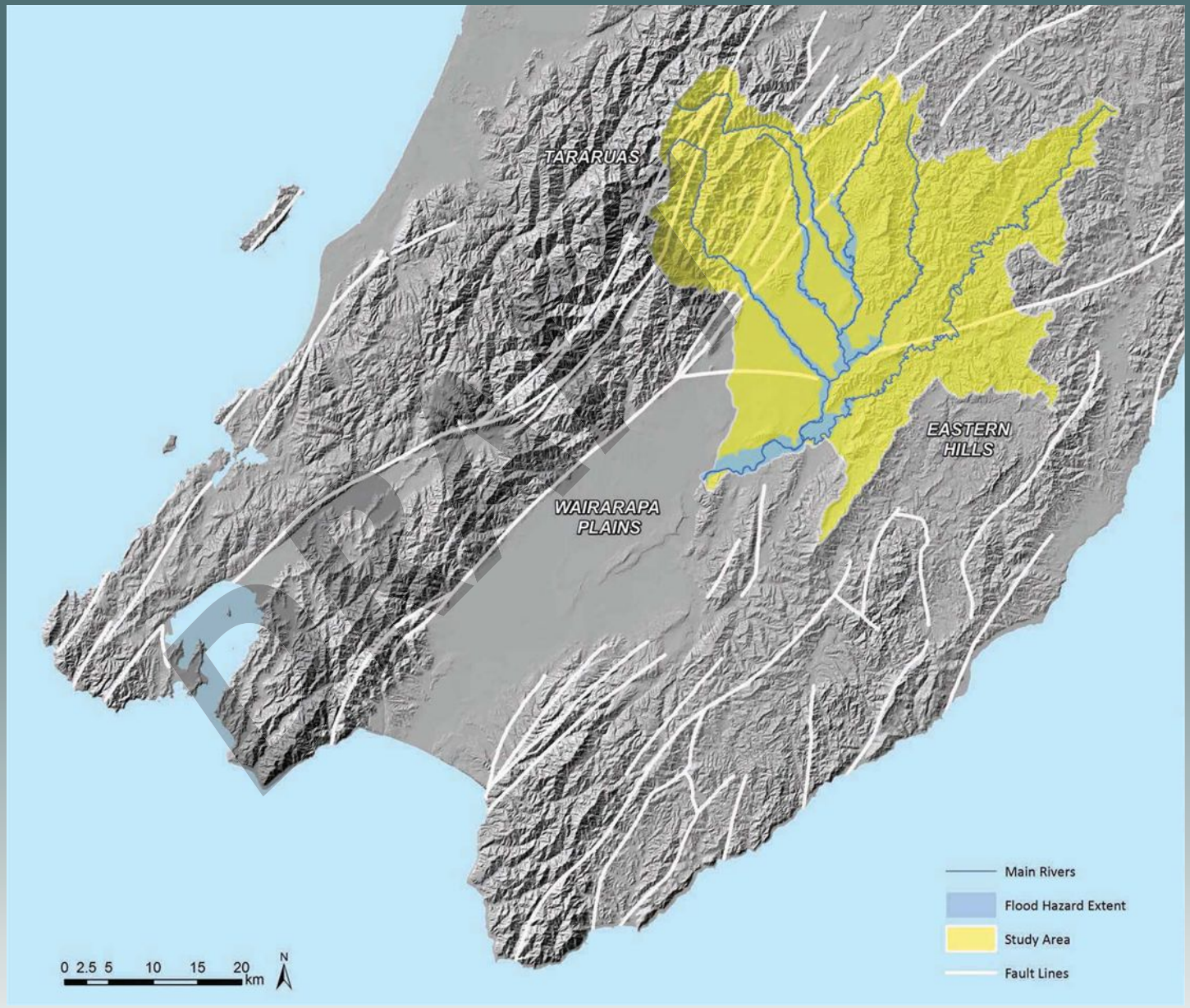
This volume of the Te Kāuru Upper Ruamāhanga Flood Management Plan (FMP) sets out the spatial flood management plan outcomes to be delivered across rural areas of the Upper Ruamāhanga. This should be read in conjunction with Volume 1 of the FMP which sets out the background and overview of the FMP including implementation and responsibilities. The urban Masterton reach of the Waipoua River will be included in Volume 3 once completed.

The six rivers which make up the Upper Ruamāhanga catchment have been divided into 20 separate reaches (17 for the western gravel bed reaches, as well as the three eastern silt bed rivers) for the purpose of directing floodplain management responses. These are also set within the broader catchment and regional context introduced at the beginning of this document . Each reach is then described in terms of the following, reflecting a summary of the findings of Phases 1 and 2 of the three phases of the FMP process:

- The character and values that exist within each reach, including upstream or downstream influences
- The identified flood and erosion issues to be addressed
- The reach specific flood and erosion responses, including major project responses where relevant

The eastern rivers have been amalgamated for the purpose of defining floodplain management responses, given the similar attributes and outcomes which are shared across this area of the catchment.

The information contained in this report has been compiled based on inputs from various documents held by Greater Wellington Regional Council (GWRC) and from the knowledge of GWRC personnel and stakeholders.


TARARUAS
EASTERN HILLS
WAIRARAPA PLAINS
Main Rivers
Flood Hazard Extent
Study Area
Fault Lines
0 2.5 5 10 15 20 km
N

Regional

Wairarapa Valley

The Wairarapa Valley is situated in the Wellington Region at the southern end of Te Ika a Maui, the North Island of New Zealand. It has a temperate climate with distinct seasonal variations. It is known for having relatively stable weather patterns, commonly experiencing long hot relatively dry summers and mild winters.

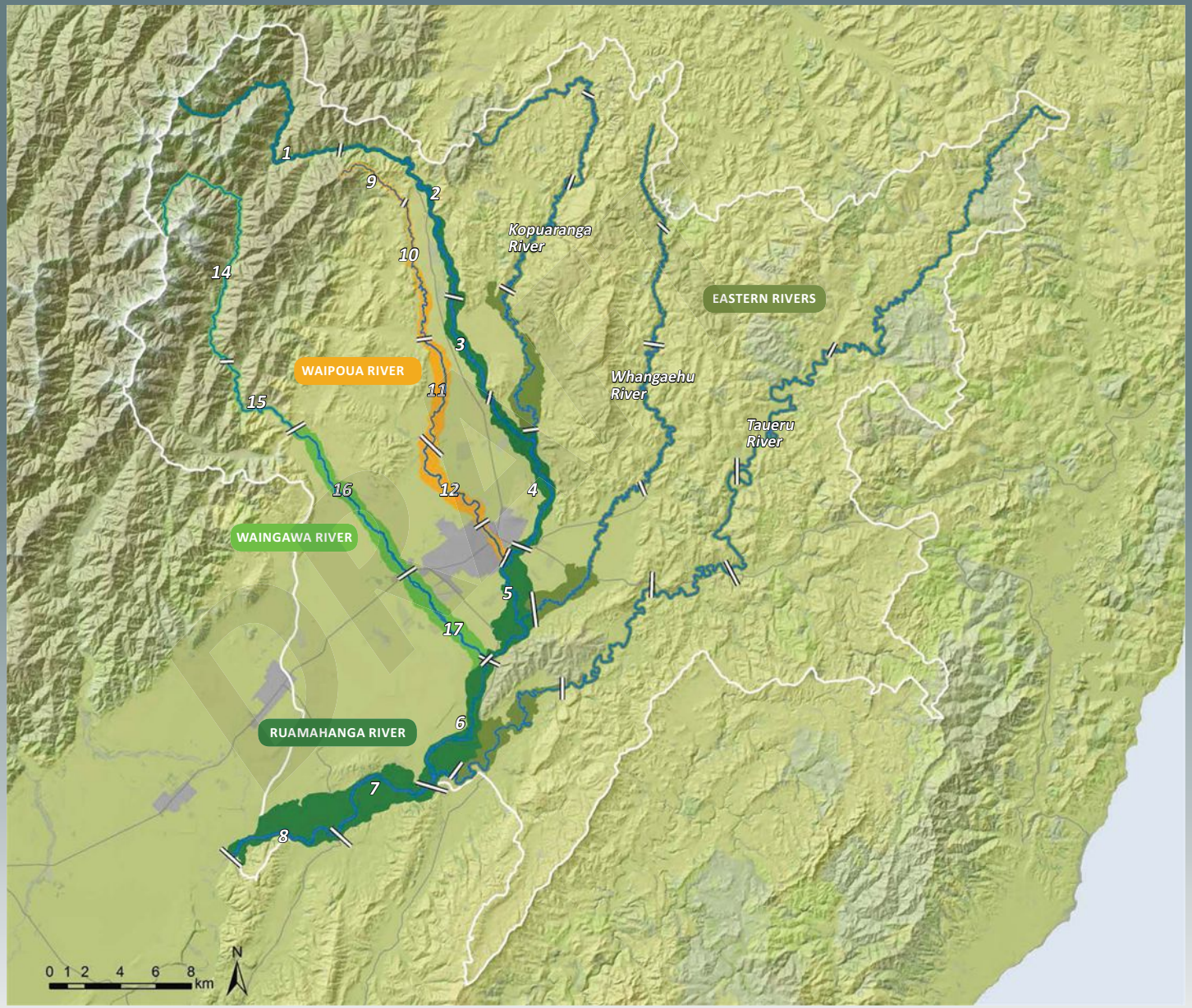
The Wairarapa Valley is made up of: the western Tararua Ranges – formed of greywacke rock of varying ages; the Wairarapa Plains – formed from deposited alluvial gravels and silts; and the eastern hills – formed from deposited marine sediments. The geology of the area is dominated by the underlying active boundary between the Pacific and Australian plates, which have created extensive faulting throughout the valley, predominantly on a north-east/south-west alignment. The largest recorded fault movement occurred in the 1855 Wairarapa magnitude 8.3 earthquake, causing a 13 metre horizontal movement and significant changes to the plains and river systems. These geological and climatic characteristics of the Wairarapa are reflected through the rivers – contrasting between the high energy, gravel bed western rivers and the sluggish, generally soft sediment bed eastern rivers.

Humans have had an influence on floodplain and channel form characteristics in the Wairarapa since early settlement, and it is suggested that the impact of Western civilisation came at a time when the indigenous vegetation was already in a state of flux. Considerable areas of land were cleared through burning in the first few centuries of Māori settlement and the extent of cleared land increased after the arrival of Europeans.

Early observers estimated that around 200,000 acres of the Wairarapa was grassland, 80,000 acres of forest, 25,000 acres of fern and scrub, and 20,000 acres of swamp. The large areas of natural grassland and the close proximity to Wellington made the Wairarapa an attractive area for farming, and this saw the first sheep station in New Zealand being started in 1844. At the time, the land along the Ruamāhanga River was covered with dense bush, and detailed surveys of the Waingawa River from 1900 show native scrub coverage of the banks and islands.

Farming continued to develop, and the introduction of further exotic species – deer, pigs, and possums – continued a trend of deforestation, exposing further areas of the ranges to natural erosive forces. This would, over time, be seen to have impacts on raising the levels of river beds across the plains. European settlers introduced the use of willows as an early bank erosion and flood protection tool to address some of these impacts. With further population increases, more detailed and varied methods were developed to protect both farmland and homes. These included the use of stopbanks, river diversions, improved willow works, reforestation, and exotic pest control.

Rainfall patterns in the catchment are dominated by the Tararua Ranges. These create a relatively dry plains area (800mm average annual rainfall) with a significant increase in rainfall in the mountains (6000mm average annual rainfall).



Upper Ruamāhanga Catchment

Rivers and Settlement within the Upper Ruamāhanga Catchment

The Ruamāhanga is the river into which almost all other rivers in the Wairarapa Valley eventually flow. It connects the Tararuas to Wairarapa Moana, eventually flowing from there into Raukawa Moana / Palliser Bay. The Upper Ruamāhanga catchment extends from the Tararua Ranges to the confluence with the Waiohine River, covering an area of 1,560 square kilometres through which the Waipoua, Waingawa, Whangaehu, Kopuaranga and Taueru (Tauweru) rivers and their tributaries flow.

The western rivers emerging from the rugged Tararua Ranges are well known for their pristine environments near the headwaters and as a result they are much valued for their beauty, mauri, recreational opportunities and spiritual significance. The eastern tributary landform is characterised by undulating hills which are today dominated by agricultural use. However, there remains a strong cultural significance within and around these eastern rivers for Tangata Whenua, and they are popular in some areas for recreational pursuits.

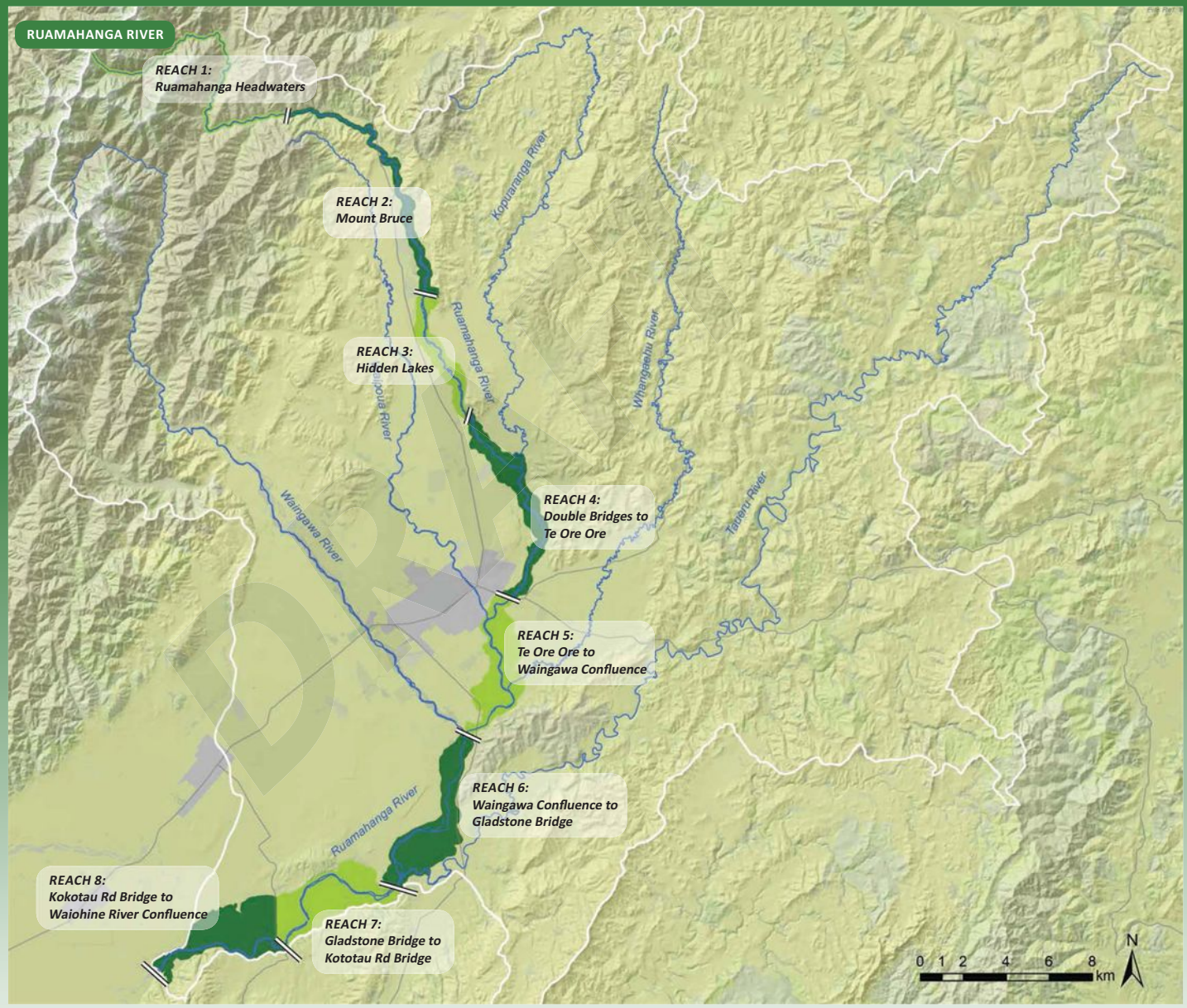
Both the western and eastern tributaries run out onto the fertile Wairarapa Plains which have been formed over time through deposition of alluvial material, including greywacke alluvium from the Tararua Ranges and alluvial silts and sands eroded from a mixture of mudstones, sandstones and limestones which form the Eastern Wairarapa Hills. The land-use of the catchment is dominated by native forest in the upper Tararua Ranges, which transitions into a range of primary production activities (plantation forestry, dry stock grazing, dairying, and cropping), rural lifestyle development, and urban areas on the floodplain.

Tangata Whenua have a long-standing connection spanning many generations with the Ruamāhanga River and all of its tributaries. Both Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa currently share in the role of kaitiaki for these catchments.

While non-Māori have been present in the Wairarapa for a shorter period, over several generations they also have developed strong ties to the land and landforms. Some of the families were present on the first European settler ships, and they have made their mark on the modern social, political and physical landscape through recurrent involvement in the ongoing development changes in the Wairarapa.

Today the Wairarapa has a distinct identity. It has both a legacy of, and a future rich with, cultural significance to Māori. With strong agricultural roots – the leading industry in the area – it is also noted for the quality of its landscape and associated recreational opportunities, and its hosting of a number of regional events and concerts. Home to some 40,000 residents, the Wairarapa has produced or become home to more than a representative share of well-known ambassadors ranging from noted scientists and engineers to popular musicians and film directors.

All rivers of the catchment have a diverse range of values attributed to them, and as generations come and go the emphasis on these values shifts in response to the culture of the people who value them.



Ruamāhanga River

2. Ruamāhanga River

The Ruamāhanga flows from its source in the Tararua Ranges down through steep mountainous terrain and native forests, running through rock-lined gorges and boulder garden rapids before leaving the foothills close to Pukaha / Mount Bruce. From there, it flows through a number of steep-sided gorges where historic river terracing can be seen through the fringes of patchy native and exotic vegetation, before opening out into the pastoral Wairarapa Plains. Here it turns to a more southerly direction flowing downstream through confluences with all of the other rivers which flow through the Wairarapa valley.

The Ruamāhanga is the most significant ancestral river of Wairarapa mana whenua. Its name is attributed to a number of stories relating to its translation of 'Rua' meaning two and 'Māhanga' meaning twins, forks or snare trap. One story is that the translation of two-forks refers to the east/west alternating confluences along its length as it travels from north to south. Another is that its name was given by Haunui-a-Nanaia who caught two birds in a snare trap on the banks of the river.

The main river channel from the State Highway 2 Bridge near Mount Bruce downstream to the Waiohine confluence extends some 58 km. This is characterised by a semi-braided form in its upper reaches and changes to a managed single thread following a gravel corridor in the lower reaches (approximately at Te Ore Ore).

Different soil types have developed at various locations on the floodplain depending on the rate of flood deposition, the source of material, time since deposition, and natural drainage. The natural fertility and erodibility of these soils is quite variable. Inappropriate land-use and lack of shelter may cause wind erosion.

Land use in the catchment includes native forest in the upper catchment within the Tararua Ranges, which transitions to a range of primary production activities (dairying, dry stock grazing, cropping, and plantation forestry), rural lifestyle development, and urban areas (Masterton) on the floodplain.

The Ruamāhanga River has many significant wāhi tapu and archaeological sites associated with its waters and banks, which include urupa, pa, kainga, and middens. Several of the archaeological sites are recorded with the New Zealand Archaeological Association (NZAA) and some urupa also have a registered title.

Key recreational activities include hill walking; wilderness fishing in the Tararua Ranges; jet boating below confluence with the Waingawa River; and kayaking. The Ruamāhanga is also well known for its good quality swimming holes and gravel beaches suitable for summer picnics.

The Ruamāhanga River is an important ecological corridor including nesting sites for birds, habitat and migratory trout for both native and exotic fish species. It is also becoming nationally important for threatened bird life. In recent years it has been recorded as bucking the national trend of decline in black billed gull species, and supports populations of black fronted dotterel, pied stilts, black shags and NZ pipit. The current river managers have worked over the past decade to improve their management techniques to lessen harm to the habitats of these species, with positive impacts on the bird populations.

Within the project extent, 26 different species of fish have been identified, and at some point each of these would have lived in or passed through the Ruamāhanga River. Over half of the 20 species of native fish found within the Te Kāuru Upper Ruamāhanga catchment are considered to be "at risk", meaning that their population nationwide is considered to be declining. The associated restoration of the Wairarapa eel (tuna) fishery is of particular significance to Māori.

General Issues

The Ruamāhanga River is well known to the Wairarapa community for its flood flows. The relatively entrenched upper reaches of the Ruamāhanga River contain much of the flood water, confining it between old river terraces, and its passage is controlled in several locations by prominent rocky outcrops. As it turns to the south at its confluence with the Kopuaranga River it opens into a broader floodplain, and the modelled flood events show a greater extent of the adjacent land under water. This trend of a broadening floodplain continues to its confluence with the Waiohine River.

The flooding of the Ruamāhanga River also strongly influences the flooding in each of its tributaries. If a flood event occurs in the Ruamāhanga River at the same time as any of the tributary rivers, much higher flood levels are experienced in the tributary.

There are several sites of particular concern in relation to erosion risk. These include the banks of the river adjacent to Hidden Lakes and the areas around Henley Lakes and eastern Masterton, both of which are protected by substantial erosion protection works. Flood protection work has recently been upgraded to protect the Masterton Wastewater Treatment Plant. There is also a former Masterton landfill site and several stock bridges and structures related to farming activities along the length of the river at potential erosion risk.

General issues relating to the Upper Ruamāhanga River include:

- lateral erosion of the river banks occurring due to natural processes in the river such as meandering of the channel, degradation and aggradation of the river bed. The stability of river banks can be compromised by degradation or can be affected by additional erosion pressure as the river tries to wind its way around aggradated islands in the middle of the channel
- reduced channel capacity to carry flood waters due to aggradation occurring, generally in the lower reaches
- invasive introduced vegetation species including yellow lupin, tree lucerne, broom and crack willow that dominate in channel areas leading to flood flow obstruction
- threats to existing planted vegetation, predominantly willow buffers from 'old man's beard' and other plant, animal and insect pests that attack the species
- numerous private water intakes from the river channel that require protection to ensure water supply
- the river being restricted within the design lines, creating additional erosion pressure and reduced flood capacity
- the value of the rivers for recreation and habitat at times conflicting with river management works.

Ruamāhanga Headwaters – Reach 1

Character

The upper reaches of the Ruamāhanga River flow through Tararua Forest Park. The river follows a narrow gravel-choked valley surrounded by steep bush-clad mountainous terrain. Much of the headwaters of the Upper Ruamāhanga are in a natural state with pools and rapids enclosed by diverse areas of native vegetation.

Key Characteristics

- Narrow gravel valleys with boulder gardens and pools
- Predominant cover of native vegetation along margins
- Wilderness recreation opportunities

Values

The headwaters of the Upper Ruamāhanga are protected as part of the Department of Conservation (DoC) Estate which provides the setting for wilderness experiences. Overall the landscape has very low levels of landscape modification with corresponding very high scenic value. The entirety of this reach is zoned Rural (Conservation) in the Wairarapa Combined District Plan (WCDP, 2013).

Due to the strong underlying wilderness and scenic values, this reach contains popular walking and tramping tracks with huts leading into the Tararua Ranges. Wilderness fishing is popular, with some grade 2+ kayaking also occurring through boulder gardens and sharp ends. All recreation access is limited to foot access only.

Substantial ecological values have been identified along this reach in association with its underlying conservation value. This includes terrestrial habitats associated with fenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield and boulderfield.

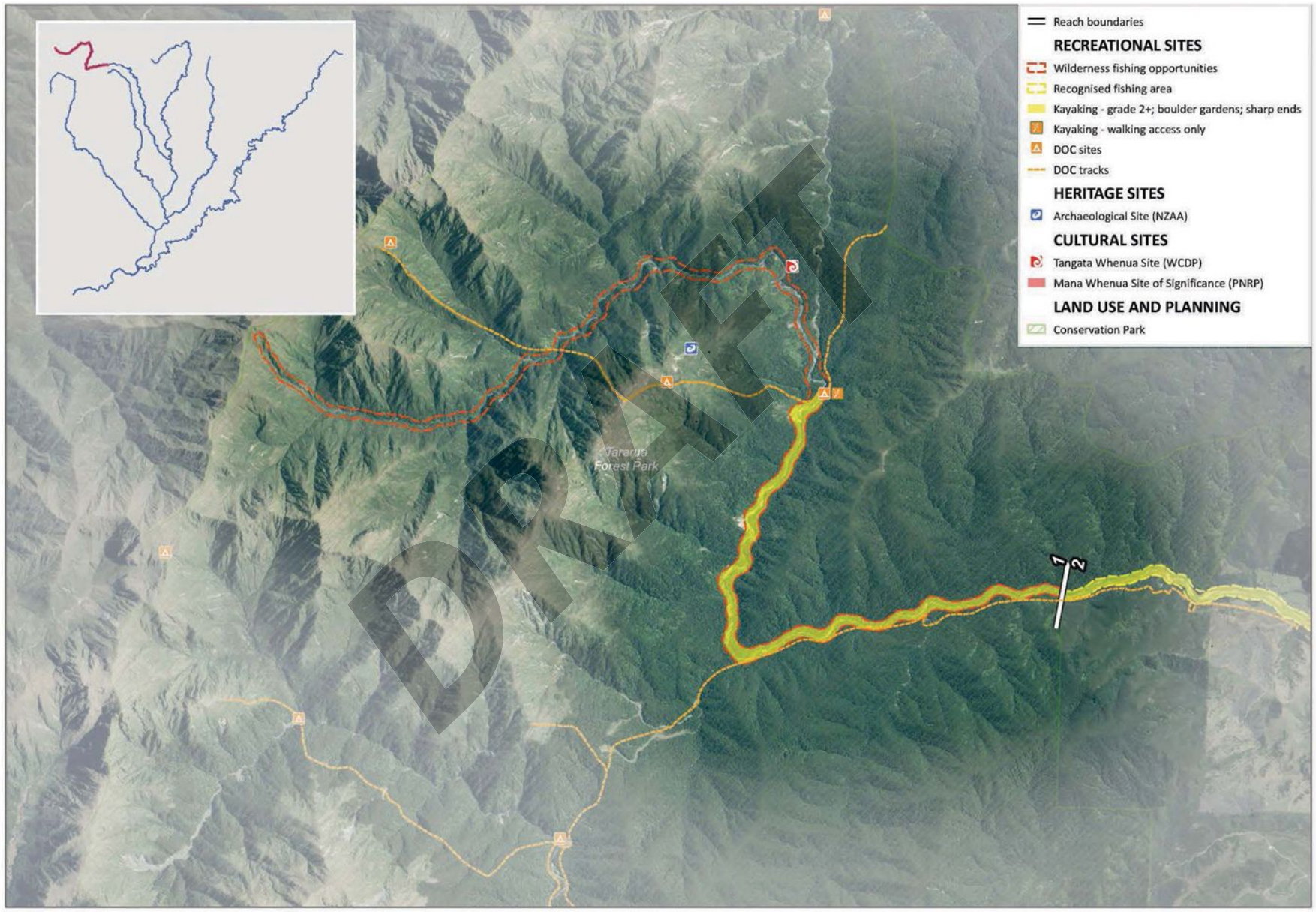
Waahi tapu has been identified in this area with the headwaters providing an important cultural connection to the Tararua Ranges.

Key Floodplain Management Points

- Encourage continued recognition of the values and character of this reach
- Support initiatives that aim to preserve or improve the natural values of this reach

There is no intent to carry out any maintenance activity within this reach as part of the Floodplain Management Plan. There are no specific flood and erosion issues identified for this reach.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Very Low	Very High	Walking tracks and huts (DOC), angler access, kayak access (foot only), kayaking, wilderness fishing	-	Sacred place, waahi tapu; stopover camp, puni; waahi whakawaatera	Rural (Conservation), Road, River.	Fenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield



VALUES - Reach 1: Ruamāhanga Headwaters

Mount Bruce – Reach 2

Character

This reach flows from the base of the Tararua Forest Park south of Mount Bruce (Pukaha) into the Upper Ruamāhanga Plains. In this area, the river remains partially contained within the semi enclosed flat valley floor which follows the base of the Tararua Ranges. The formative influence of the river remains clearly apparent along adjacent terraces aligned in a north-south direction beyond the main channel of the river.

In the upper section of this reach, the river passes through a series of gorges in the vicinity of Mount Bruce Bridge. Below this, much of the river settles into a series of pools, runs and riffles with narrow braids. The margins of the river are predominantly enclosed by mixed native and exotic vegetation which separates the river from adjoining farmland. A more significant area of podocarp forest is also apparent at Dunvegan Forest on the western banks.

Key Characteristics

- Steep rock lined gorges containing boulders, pools and rapids
- Distinct river terraces stepping down to the river corridor
- Mixed exotic and remnant native vegetation

Values

This reach of the river is slightly more modified than the headwaters of the Ruamāhanga, with much of the surrounding landscape used for primary production. Whilst parts of the reach continue through gorges surrounded by indigenous vegetation. The presence of exotic scrub and State Highway 2 also influence its character and values. Overall it has a low level of modification and corresponding high scenic value.

The upper parts of this reach contain popular walking, fishing and kayaking areas accessed from Mount Bruce Bridge and connecting with Tararua Forest Park. South of Mount Bruce Bridge, the presence of flat water with riffles and braids means the area is valued for kayaking, although this area is infrequently fished.

Several important ecological values have been identified along this reach including a Recommended Area for Protection (RAP) encompassing remnant indigenous vegetation at Dunvegan Forest and terrestrial habitats associated with fenced indigenous forest, unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield, boulderfield, natural wetlands and ponds.

There are numerous sites of cultural importance including waahi tapu, an historic village, pā, and waka landing sites.

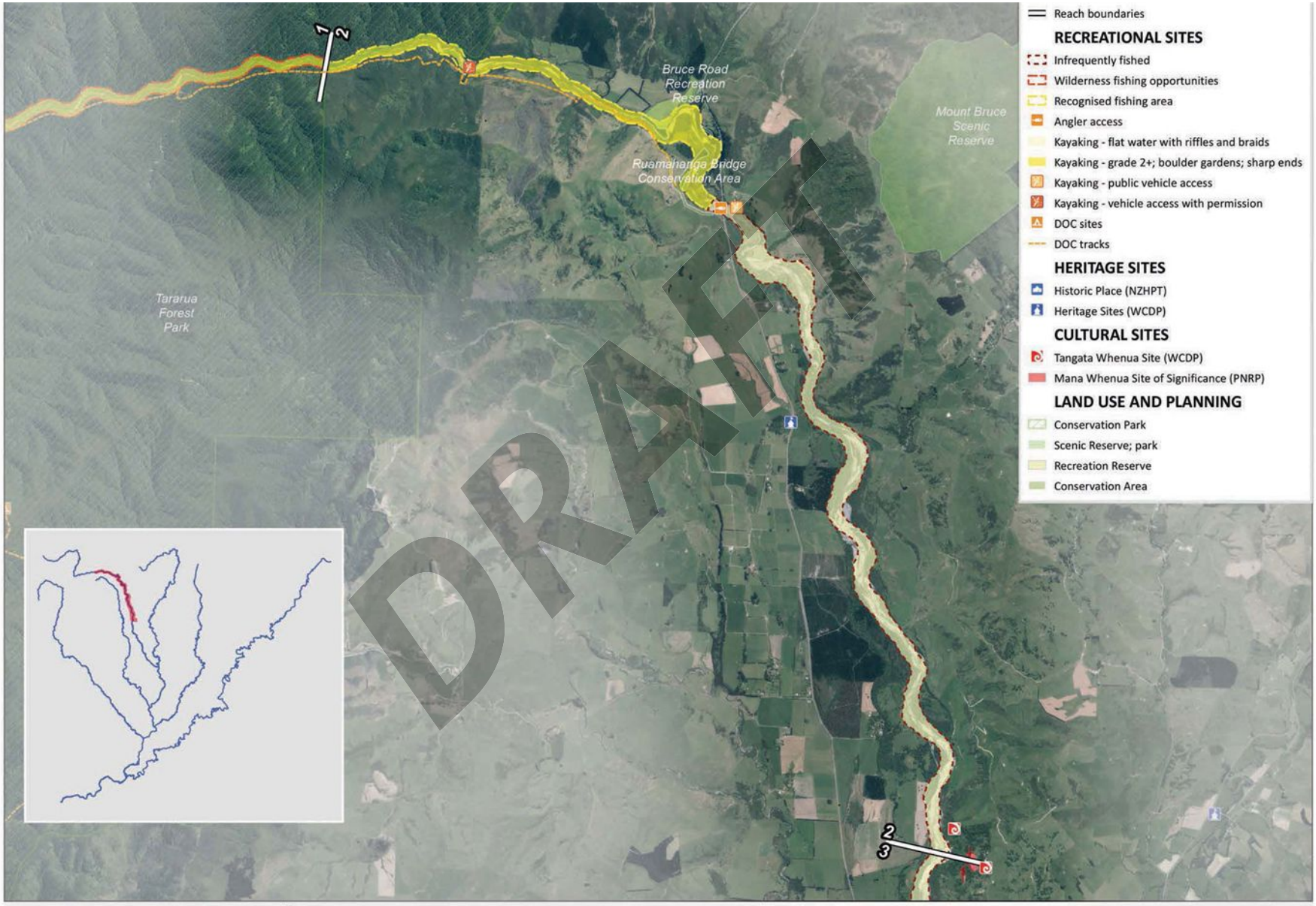
Existing River Maintenance

No river scheme maintenance occurs along this reach. All channel works are initiated by landowners' request and funded using the general isolated works fund.

Key Floodplain Management Points

- Protect the Dunvegan Forest RAP site from negative impacts of flooding and erosion

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Low	High	Walking tracks (DOC), angler access, kayak access, fishing, kayaking	Old Settler's Cottage (WCDP)	Tangata whenua site (WCDP), Waahi Tapu, historic village site, historic pā site, historic waka landing site	Rural (Conservation), Rural (Primary Production), Rural (Special), Road, River, State Highway.	Dunvegan Forest Remnants (RAP), Fenced indigenous forest, Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



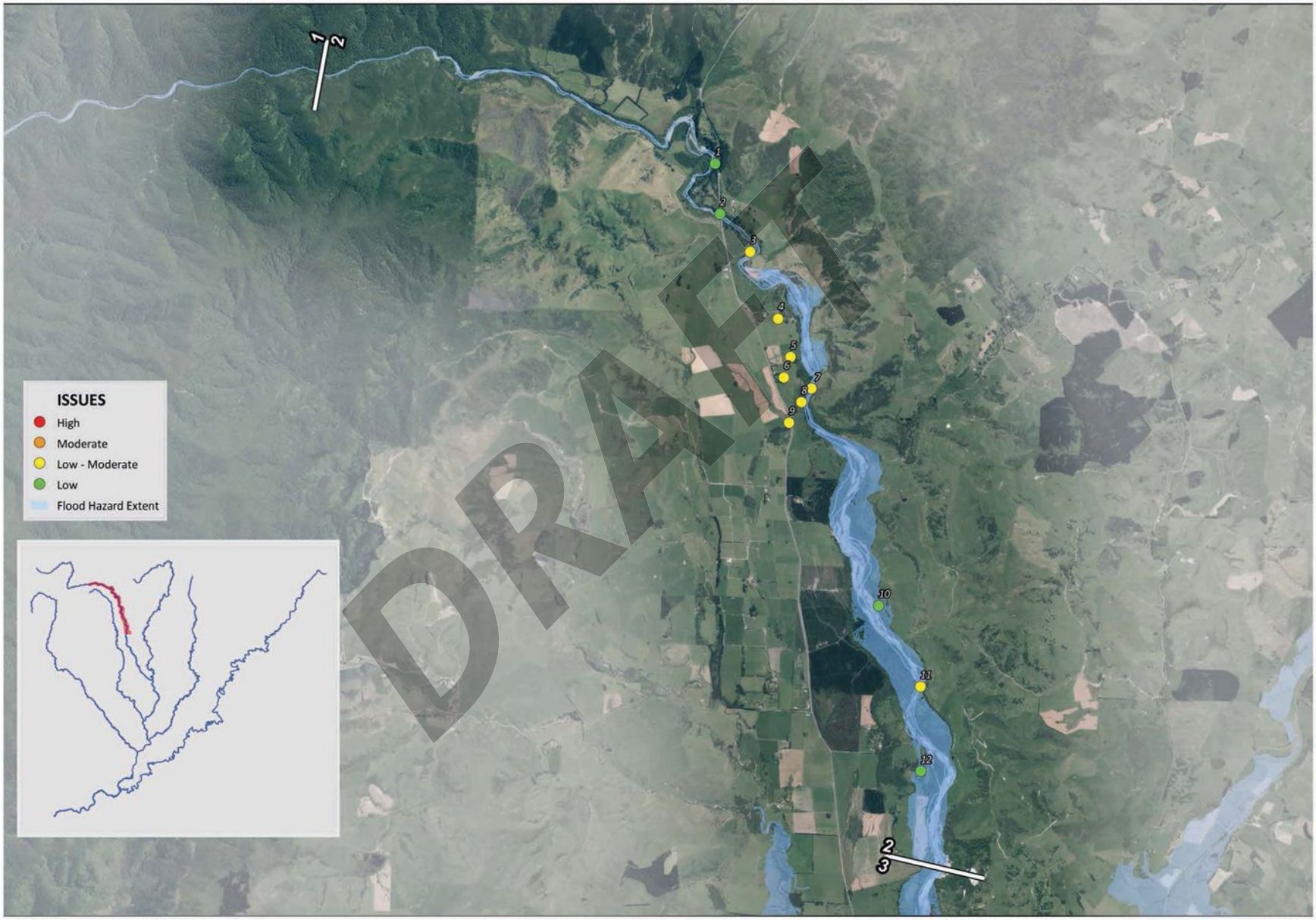
VALUES - Reach 2: Mount Bruce

Mount Bruce – Reach 2

Flood and erosion issues

A total of 12 flood and erosion issues have been identified along this reach. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW	**State Highway 2 [1]** State Highway 2 runs close to a gorge section of the Ruamāhanga, and sits within the erosion study area. The risk of erosion is considered low due to the natural rock formation which controls the erosion risk. **State Highway 2 Bridge [2]** The abutments of the SH2 bridge sit within the erosion study area. The river at this location is well entrenched and the risk to the structure from erosion is considered to be low.	**No defined design channel [10]** No design channel has been developed as a management tool upstream of this location. This provides less certainty for adjacent landowners, however it may be of limited benefit due to surrounding geology acting as a natural control on the river. **Dunvegan Forest RAP site [12]** Dunvegan Forest, a RAP site, sits within the erosion study area and is affected by the 1%AEP flood extent.
LOW TO MODERATE	**Scheme boundary [3]** The upstream boundary of the Upper Ruamahanga schemes sits below the gorge area. It is recommended that this is reviewed in conjunction with landowners in the upstream area, and with reference to issues 93 and 94 **Private houses in erosion study area [4, 5, 6, 8]** A number of house sites sit within the erosion study area. The houses are not affected by the 1%AEP flood event. **Stock access bridge [7]** A privately owned stock access bridge sits within the erosion study area and is potentially at risk of damage linked to flood debris, bed level changes and large flood events.	**SH2 within erosion study area [9]** State Highway 2 sits within the erosion study area at this location. It is considered to be at lower risk due to its distance from the active channel of the river, and the underlying geology. **Private bridge [11]** A private access bridge crosses the river. Its abutments are within the erosion study area. It may be susceptible to debris flows, erosion and bed level changes.
MODERATE		
HIGH		



ISSUES - Reach 2: Mount Bruce

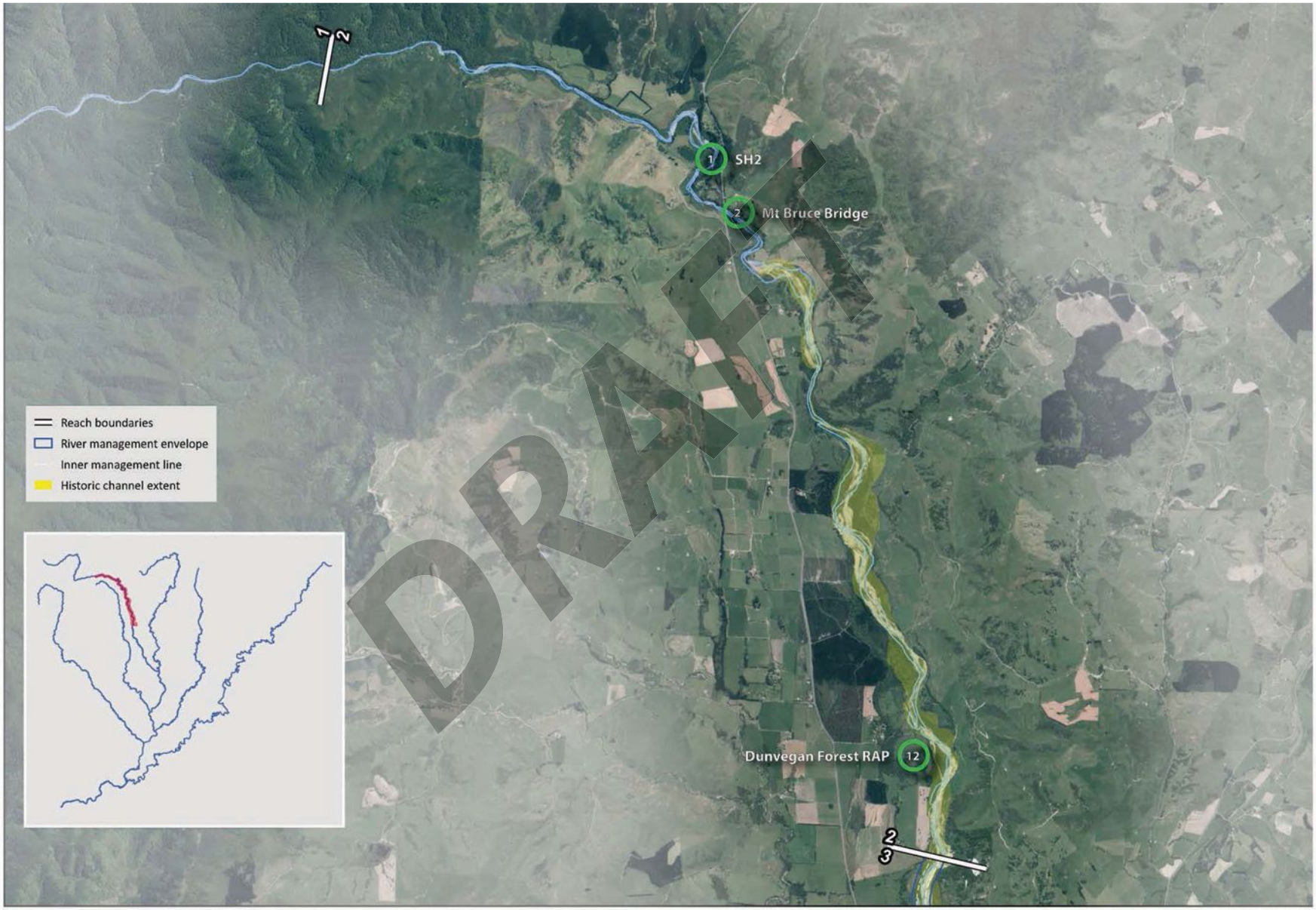
Mount Bruce – Reach 2

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	12	Dunvegan Forest RAP site	River management	Dunvegan Forest is an area of remnant native forest. While there is no requirement to protect this area against natural erosion or flood effects, there is an opportunity to reduce the impacts of flooding and erosion through river management approaches sensitive to impacts on the forest. GWRC to provide advice to the managers of the RAP site on how to avoid erosion losses and damage to the site. Only soft edge protection is required. This area is ideal as a trial site for native edge protection methods.			Landowners	GWRC	Low
	1 2	SH 2 and Mt Bruce Bridge	River management	GWRC Operations to provide information to NZTA if any erosion risk is identified to State Highway 2. NZTA to continue to monitor risks to State Highway 2 and Mount Bruce Bridge. A couple of locations have been identified as being within potential erosion extents, however the risk is considered low and there are no known historic issues that have required management.			NZTA	GWRC	High
		Mt Bruce Bridge	Environmental enhancement	The Mt Bruce Bridge access area is a popular access location. Opportunities will be developed as part of the environmental strategy to formalise this access point to provide clear safe access to the river and associated facilities. Community ownership of these access points is an essential component of their success. GWRC will initiate and support the formation of a care group to work with clubs and individuals that value this location.			GWRC	Community	Low
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Protection against deforestation in upper catchment, land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					
		Entire reach	River management	Remove this reach from the current river scheme. Begin standard Isolated Works funding policy for landowner initiated works upstream of Hidden Lakes.					



RESPONSES - Reach 2: Mt Bruce

Hidden Lakes – Reach 3

Character

This reach undergoes a transition from a semi-enclosed channel in the upper valley into the broader open character of the Upper Ruamāhanga Plains. As the river continues south, the channel increases in width and begins to form a more distinctive semi-braided channel. In association with braids, bank modification also becomes increasingly more prevalent, with shelves covered by willow planting and tree lucerne common along this reach.

Key Characteristics

- Emerging semi-braided form containing riffles and pools
- Willow lined margins
- Open pastoral character culminating along modified river margins

Values

This reach continues through rural land used for primary production and predominantly established in pasture grassland. Beach re-contouring and willow planting becomes more common along this reach together with several areas of indigenous vegetation. Overall the level of landscape modification is medium with medium-high scenic value.

Some kayaking continues along this reach benefitting from flat water with riffles and braids that continue downstream from Mount Bruce Bridge. Whilst fishing remains infrequent in this area, fish passage with the upper reaches remains important. Double Bridges provides a popular swimming site from which kayaking and fishing values also continue downstream.

Terrestrial habitats with identified ecological value along this reach include areas of unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield and boulderfield, and natural wetlands and ponds.

There are also numerous sites of cultural importance along this reach, including a strong association with an historic pā site adjoining Hidden Lakes alongside other house sites, a taniwha lair and established associations with mahinga kai.

Existing River Maintenance

GWRC maintains a river scheme within this reach and collects scheme rates. It is estimated that approximately $6,000 per river km per annum is spent for river maintenance works in this reach.

Annual objectives for river maintenance include:

1. To maintain the river channel free of vegetation and obstruction
2. To maintain the channel within the river design lines. This includes establishment and maintenance of vegetated buffer zone along the river edges
3. To limit structural protection works
4. To maintain existing scheme stopbanks to “as built” standards
5. To control gravel extraction to sustainable levels
6. To enhance and protect river recreational access, wildlife and fishery values
7. To respond to flood events, less than 20% AEP
8. To contribute funds to flood damage reserves to enable response to large flood events

Generally about half of the annual expenditure is allocated to in-channel works such as the construction of gravel groynes in wet or dry areas of river bed, channel alignment in the wet flowing channel, dry-bed channel recontouring, pest plant removal from dry river bed areas, and debris clearance from wet or dry channel areas. This work involves the use of heavy machinery. About 20-30% of annual funds are allocated to buffer maintenance. In general, buffer establishment has had limited success in this reach in the past.

Gravel extraction demands have been historically high in this reach. In recent years extraction has been significantly reduced and is now used sparingly as an alignment management tool.

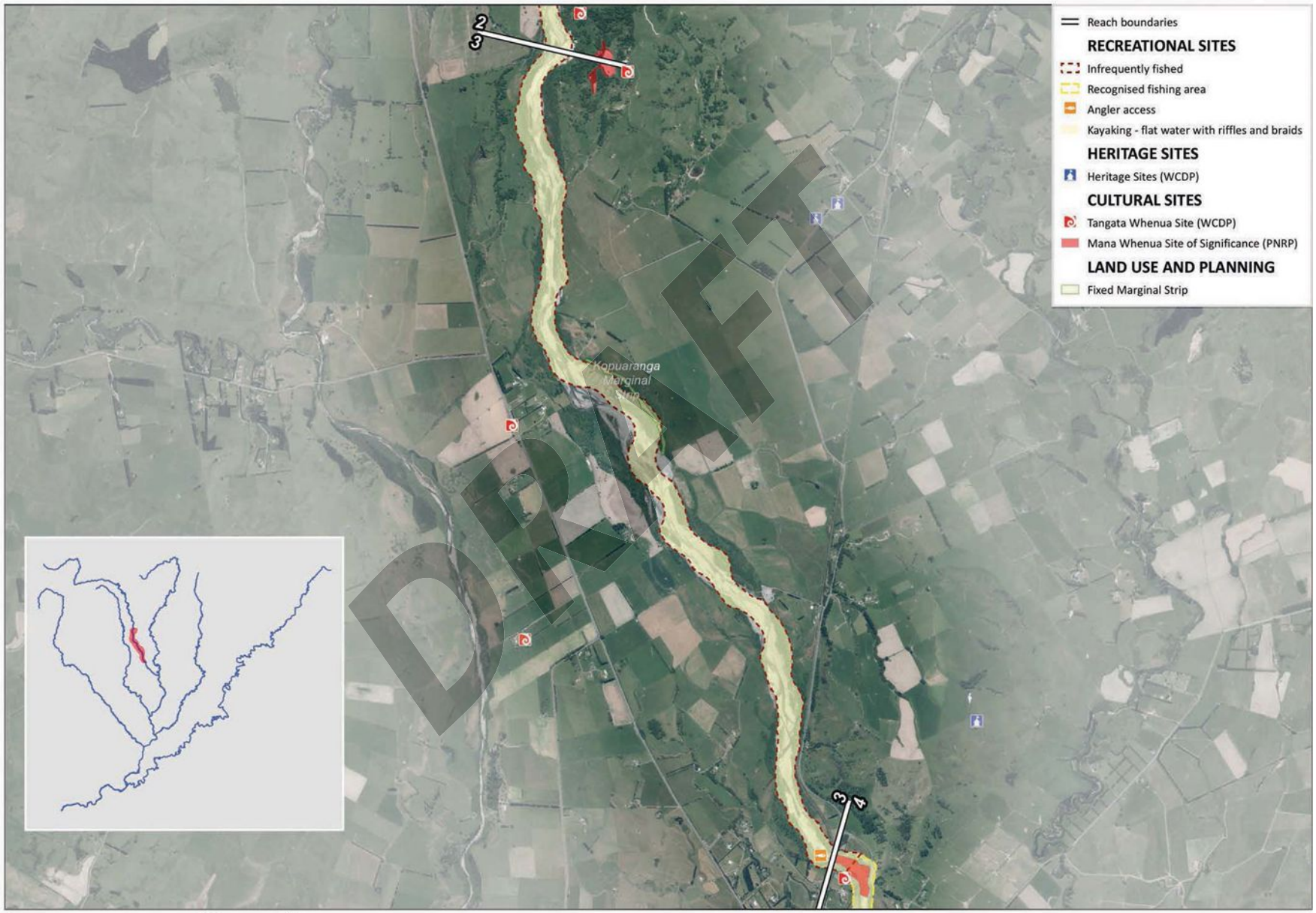
River enhancement expenditure has been between 0% and 3% of total annual expenditure and this FMP proposes to increase this allowance. A Community Support Officer has also been proposed to support enhancement works.

This FMP proposes to shift the focus of river maintenance towards more intensive implementation of vegetated buffers. The design buffers will be allowed to erode when and where appropriate. This method will substitute immediately responding to erosion issues through introducing machinery in river channels, such as occurred in the past.

Key Floodplain Management Points

- Recognise the significance of cultural values associated with this reach
- Sustainably manage the gravel quantities within this reach in order to protect the double bridges from scour or the effects of reduced flood capacity
- Work with the asset owners of the Double Bridges to ensure their protection against flooding and erosion impacts and maintain their ongoing operation

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium - High	Kayaking, infrequent fishing	-	Tangata whenua sites (WCDP) – historic pa site, historic house site, taniwha lair, mahinga kai	Rural (Primary Production), Rural (Special), Road, River, Railway, Flood Protection and Mitigation	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



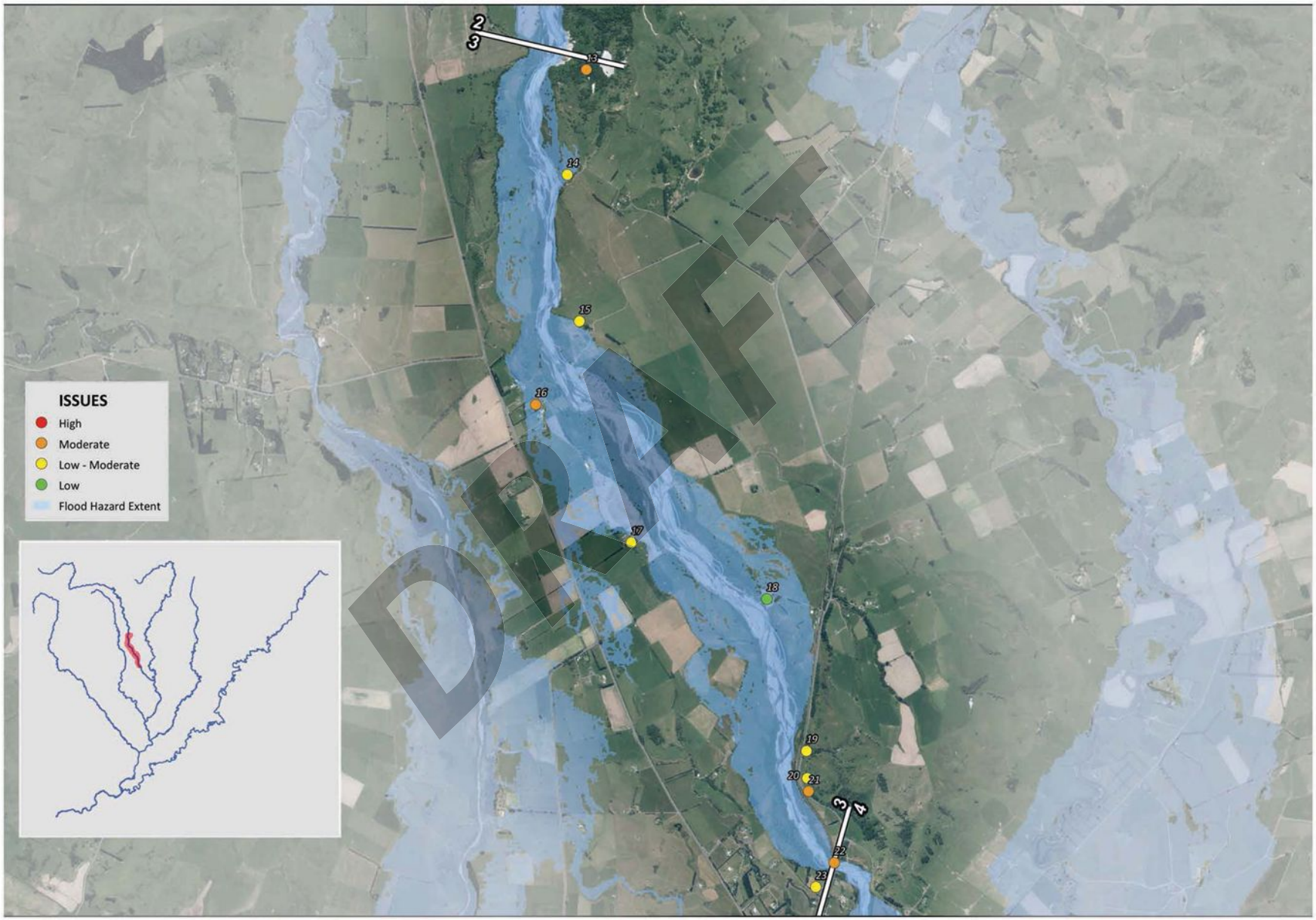
VALUES - Reach 3: Hidden lakes

Hidden Lakes – Reach 3

Flood and erosion issues

A total of 11 flood and erosion issues have been identified along this reach. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW	**Gravel extraction [18]** This location is a good gravel extraction point with good current access. Significant degradation has occurred which may limit opportunities for gravel extraction in the future. Used and licenced by GWRC Flood Protection.	
LOW TO MODERATE	**Farm ancillary buildings [14]** A small group of buildings believed to be farm ancillary structures are located in the erosion study area and are modelled as affected by the 1% AEP flood event. **House within erosion study area [15]** House located within the erosion study area and outside the 1% AEP flood extent. **Houses within flood hazard areas [16, 17]** A couple of houses sit within but near the edge of the erosion study area and are affected by the 1% AEP modelled flood extents.	**Houses in erosion study area [19]** Two houses sit within the erosion study area. These are, however, protected by the railway line and SH2. The erosion risk at this location is believed to be low. **Opaki Kaiparoro Rd in erosion study area [20]** Opaki Kaiparoro Rd sits within the erosion study area. However, it is considered of low risk due to adjacent geology. **Houses in erosion area [23]** There is a small group of houses near the southern abutments of Double Bridges which sit within the erosion study area. These are set far back from the channel edge, and are considered to be of low risk due to underlying geology.
MODERATE	**Hidden Lakes [13]** The Hidden Lakes area is a site of regional significance. It sits within the erosion study area, and the bank edge adjacent to this site is subject to active erosion. There is no requirement to protect this site from natural erosive forces. **Railway line in erosion study area [21]** The main north south railway line sits within the erosion study area. The area is considered to be of lower risk due to surrounding geology and the infrequent use of the line.	**Double Bridges [22]** Both the rail bridge and Opaki Kaiparoro Rd Bridge that make up Double Bridges sit within the erosion study area. Current bed level management allows sufficient freeboard for flooding through the structures up to the bridge soffits. There are, however, concerns about scour around the bridge piers.
HIGH		



ISSUES - Reach 3: Hidden lakes

Hidden Lakes – Reach 3

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	13	Hidden Lakes, Tirohanga	Planning and policy	The site is protected in the proposed Natural Resources Plan. There is no requirement or expectation to protect this site against natural erosion processes. GWRC will avoid upstream or downstream works worsening erosion at this site.			Mana whenua	GWRC	Low
	20	Opaki Kaiparoro Rd	River management	Asset owner to continue to monitor risks to Opaki Kaiparoro Rd. In several locations the road has been identified as being within potential erosion extents, however the risk is considered low and there are no known historic issues that have required management.			Asset owner	GWRC	Low
	22	Double Bridges	River management	GWRC Operations to provide information to asset owners if any erosion risk is identified to Double Bridges.			GWRC	Asset owners	Medium
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/ retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					

RESPONSES - Reach 3: Hidden Lakes

Double Bridges to Te Ore Ore – Reach 4

Character

This reach continues a semi-braided character which becomes progressively more channelised through the Wairarapa Plains along the western toe of Te Ore Ore. The confluence with the Kopuaranga River occurs midway along this reach, below which the river widens and continues a semi-braided form across gravel with pools and riffles. Belts of willow enclose most of the river corridor and include cabled willows in some areas. Much of the surrounding landscape remains in productive rural use including several pivot irrigators, with playing fields and mixed indigenous and exotic vegetation also adjoining the river near Rathkeale College.

Key Characteristics

- Broad semi-braided form
- Continuous belts of willow planting enclosing margins
- Cabled willow trees established in some areas
- Rounded paddocks associated with pivot irrigators
- Proximity to playing fields at Rathkeale College

Values

This reach flows through rural land to the north of Masterton predominantly established in pasture grassland and increasing rural lifestyle settlement. Through this area, the margins of the river become increasingly modified with stop banks and willow and pole planting, particularly adjacent to Rathkeale College. Overall the level of landscape modification is medium with a corresponding medium level of scenic value.

The area is commonly used for fishing and kayaking as it contains flat water which is easily accessible for beginners. Such recreation activities are typically accessed from bridge crossings at Double Bridges and Te Ore Ore Road, with an additional access point identified along Black Rock Road. Swimming is also popular at these access points, as well as a swimming hole identified at Rangitumau Bluff .

Terrestrial habitats with identified ecological values along this reach include fenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield, boulderfield, natural wetlands and ponds. The area also accommodates a breeding population of nationally endangered black-billed gulls along the stonefield and boulderfield areas and represents one of the few locations where populations of this species have grown in number in recent years in New Zealand.

Along the western banks of the river, the main house of Rathkeale College is an important heritage site identified in the WCDP. There are also several cultural sites in this area including marae, historic pā sites, urupa, waahi tapu and mahinga kai associations.

Existing River Maintenance

GWRC maintains a river scheme within this reach and collects scheme rates. It is estimated that approximately $6,000 per river km per annum is spent for river maintenance works in this reach.

Annual objectives for river maintenance include:

1. To maintain river channel free of vegetation and obstruction
2. To maintain the channel within the river design lines. This includes establishment and maintenance of vegetated buffer zone along the river edges
3. To limit structural protection works
4. To maintain existing scheme stopbanks to “as built” standards
5. To control gravel extraction to sustainable levels
6. To enhance and protect river recreational access, wildlife and fishery values
7. To respond to flood events, less than 20% AEP
8. To contribute funds to flood damage reserves to enable response to large flood events

Generally about half of the annual expenditure is allocated to in-channel works such as the construction of gravel groynes in wet or dry areas of river bed, channel alignment in the wet flowing channel, dry-bed channel recontouring, pest plant removal from dry river bed areas, and debris clearance from wet or dry channel areas. This work involves the use of heavy machinery. About 20-30% of annual funds are allocated to buffer maintenance. In general, buffer establishment has had limited success in this reach in the past.

Gravel extraction demands have been historically high in this reach. In recent years extraction has been significantly reduced and is now used sparingly, as an alignment management tool.

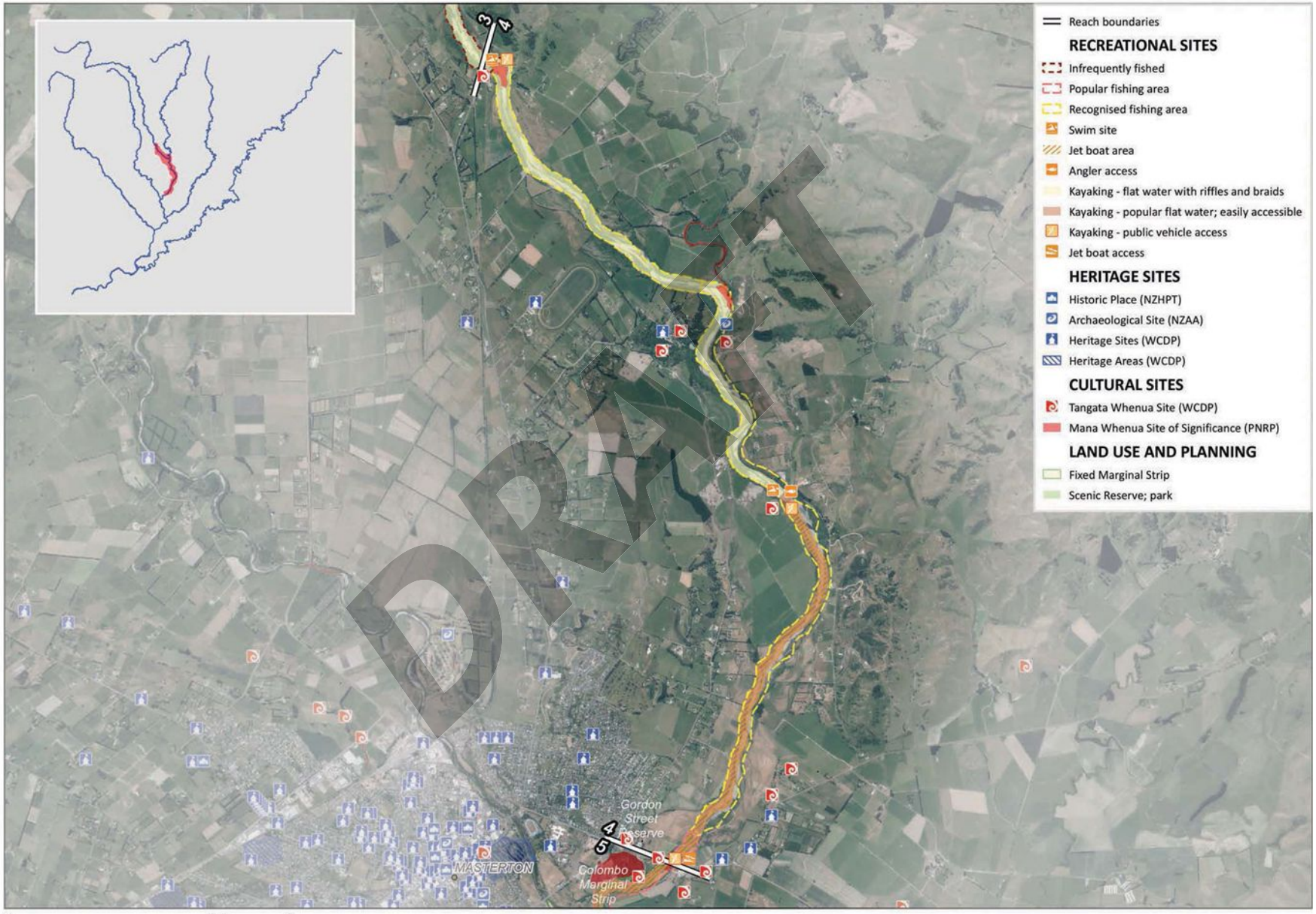
River enhancement expenditure has been between 0% and 3% of total annual expenditure and this FMP proposes to increase this allowance. A Community Support Officer has also been proposed to support enhancement works.

This FMP proposes to shift the focus of river maintenance towards more intensive implementation of vegetated buffers. The design buffers will be allowed to erode when and where appropriate. This method will substitute the immediate response to erosion issues with the machinery in channel works practiced in the past.

Key Floodplain Management Points

- Protect the swimming hole at Rangitumau Bluff and enhance recreational opportunities
- Reduce risk of failure to the stopbanking network which protects Rathkeale College and grounds

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium	Angler access, kayak access, fishing, kayaking, swimming	Rathkeale College (WCDP), pa site and urupa (NZAA)	Tangata whenua Sites (WCDP), Mana whenua Sites of Significance (PNRP) - Marae, historic pa sites, historic sites, urupa, waahi tapu trees, historic baptism sites, mahinga kai, eel weir, pā tuna (kohekutu); mahinga kai; canoe landing place, tauranga waka; water spirit and guardian, taniwha (tuere); swimming place, wāhi kauhoe	Rural (Conservation), Rural (Primary Production), Rural (Special), Road, River, State Highway.	Fenced indigenous forest, mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, natural wetlands and ponds, breeding population of national endangered black billed gulls.



VALUES - Reach 4: Double Bridges to Te Ore Ore

Double Bridges to Te Ore Ore – Reach 4

Flood and erosion issues

A total of 26 flood and erosion issues have been identified along this reach given its close proximity to Masterton. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW

Stopbank within erosion study area [27]

A stopbank sits within the erosion study area and inside the existing management buffer extents.

Water intake [41]

A private subsurface intake that would be adversely affected by any changes in bed level.

Water intake [42]

A water intake sits within the erosion study area for use as part of a frost protection system.

Channel alignment [43]

The channel alignment is being artificially maintained by hard edge protection. The river naturally tends to a wider channel through this reach.

House [44]

A private house sits within the erosion study area. However it is considered of low risk due to underlying geology and distance away from river. No currently managed issues exist.

Te Ore Ore Bridge power lines [48]

Transmission lines cross the river north of the Te Ore Ore Bridge. The pylons are located within the erosion study area but are set back from the river bed and outside the active channel. No currently managed issues exist.

Te Ore Ore Bridge [49]

Te Ore Ore Bridge is relatively new and therefore less susceptible to scour issues. Weirs are located downstream which have historically been used to control bed levels for earlier bridges. These have been modified, and further changes to them could have impacts on this bridge. The bridge abutments sit within the erosion study area.

LOW TO MODERATE

Opaki water race intake [24]

The Opaki Water race intake sits within the erosion study area and is affected by bed level changes within the active channel. The intake bed levels are relatively stable due to the proximity to the Double Bridges . Occasional maintenance undertaken by MDC is required to ensure continued operation.

Rangitumau Road [26]

The road sits within the erosion study area, however it is well protected by a rock bluff and therefore considered to be of low risk. No currently managed issues exist.

Swimming hole [25]

There is a popular but occasionally hazardous swimming hole at the base of the bluff near Rangitumau Road.

House [31]

A single dwelling sits within the erosion study area, but outside and above the 1% AEP flood event extents. No currently managed issues exist.

Rathkeale College outbuildings [32]

A number of small facilities for Rathkeale College are contained within the erosion study area and the 1% AEP flood extents.

River bed armouring [34]

The bed in locations downstream of Rathkeale College has a tendency to become 'armoured' and needs ongoing maintenance. This is believed to be caused by erosion of finer sediments from the adjacent cliffs.

House [36, 35]

Houses are located within the erosion study area and the 1% AEP flood extents . No currently managed issues exist.

Private water intake [37]

A private water take is situated with the erosion study area, however there are no known issues with its ongoing operation. No currently managed issues exist.

Outbuildings [38]

A farm storage building or possibly utility structure is located within the erosion study area, but outside the 1% AEP flood extent. No currently managed issues exist.

Houses [40]

Two houses on Black Rock Road sit within the erosion study area. While these properties sit outside the modelled 1% AEP flood extent, they would be affected by any overflow occurring through the water race.

Industrial yards [47]

Sheds, machinery and possibility of contaminants sitting within the erosion study area and the 1% AEP flood extent. No currently managed issues exist.

Te Ore Ore stopbank [46]

This is a low standard stopbank that protects several properties. The modelled 1% AEP event overtops this stopbank and affects a number of properties behind it and Te Ore Ore/Castlepoint Road.

MODERATE

Erosion control works [28]

Ongoing erosion controls are required to protect the Rathkeale Stopbank which is currently at risk of being undermined.

Henley Lakes water intake [45]

The water intake for Henley Lake occasionally has issues associated with channel alignment and changes in bed level.

Urupa Site [30]

A historic urupa site sits on the edge of a cliff above the Ruamāhanga River and within the erosion study area.

Rathkeale College sewage Pond [33]

Currently unused sewage settlement ponds for Rathkeale College sit within both the erosion study area and the 1% AEP flood extents.

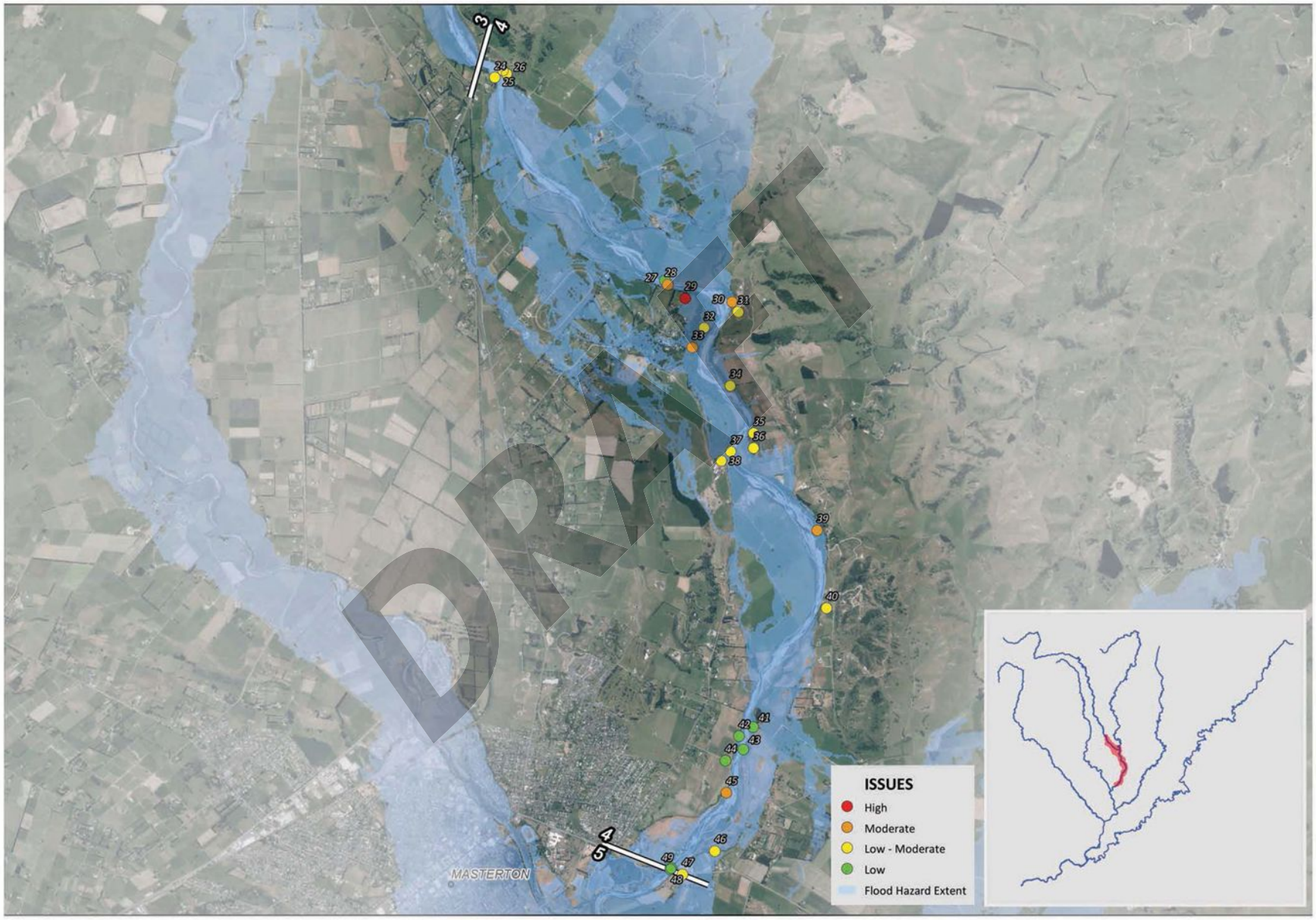
Black Rock Road [39]

Black Rock Road is located within the erosion study area. It has required erosion protection within the last 10 years.

HIGH

Rathkeale stopbank [29]

The Rathkeale Stopbank sits well within the buffer and erosion study area and is currently protected to a low erosion security standard by ongoing erosion management works.



ISSUES - Reach 4: Double Bridges to Te Ore Ore

Double Bridges to Te Ore Ore – Reach 4

Response

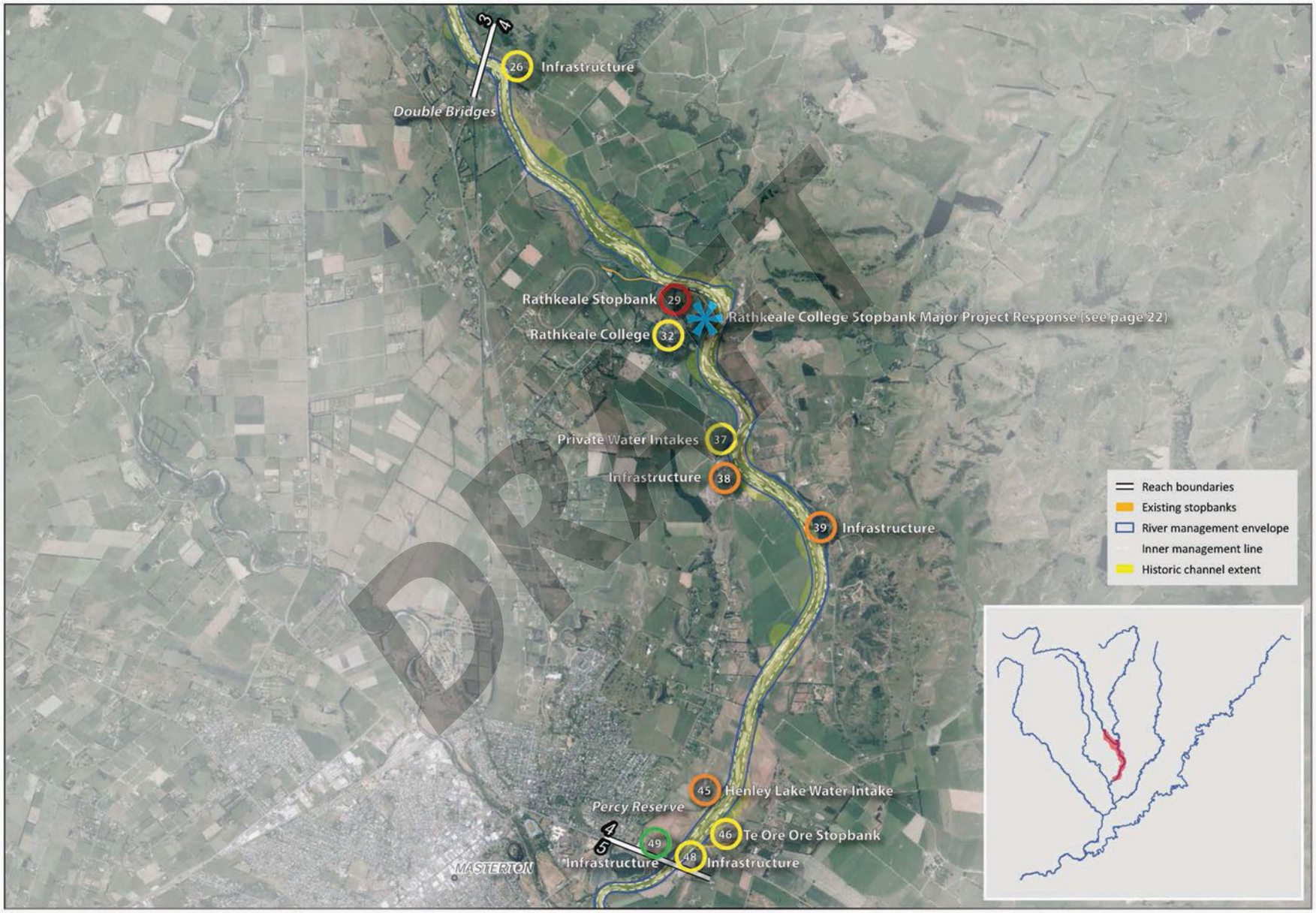
Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	29	Rathkeale stopbank	Emergency management	The stopbank at Rathkeale College breach scenarios will be defined to identify likely overflow routes and consequences of failure affecting the college and accesses to the college. While it is unlikely that a breach or failure of a relocated and upgraded stopbank will occur it is possible that any overdesign event will affect access into the college area during such an event leaving the college, its pupils and staff more vulnerable.	5%	1%	GWRC	Rathkeale College, Landowners	High
	32	Rathkeale College	Emergency management	WREMO to develop an emergency management plan with Rathkeale College for large flood events. In a 1% AEP event without further improvement to the protection infrastructure the college will be cut off from access to external services for a short period of time due to an overland flow path that runs south of the college. Due to local topography it is likely that heavy rainfall events in the vicinity of the college could have a similar effect of cutting road access.		1%	Community	WREMO	High
	45	Henley Lake water intake	River management – Bed level monitoring	GWRC to work with Masterton District Council to maintain security of intake for Henley Lakes. The river management activities will be planned to not compromise intake functionality.			GWRC	MDC	Medium
	46	Te Ore Ore stopbank	River management	Define the level of service requirement to current standard and maintain to this defined standard.			GWRC	Landowners	Medium
	26 38 39 48 49	Infrastructure	Emergency management	Inform asset owners of risks to infrastructure assets in this reach and encourage them to prepare contingency plans to address flood and erosion risks. GWRC and WREMO to provide advice and support if requested.		1%	Asset owners	WREMO	Medium
	37	Private water intake		River management envelopes will contribute to security of private water takes. Private water takes will have low risk of damage up to a 20% AEP event. Damage to structures is more likely up to a 5% AEP event.		20%	Landowners	GWRC	Low
		Percy Reserve	Planning and policy	Policy development to address freedom camping in the reserve			MDC	Community	Medium
		Double Bridges	Environmental enhancement	Establish a care group and work with local groups to formalise this area as a recreation spot. Improve the awareness of safety around water in the vicinity of this area. Raise awareness of cultural significance of the river in the vicinity of Double Bridges.			Community	GWRC	Medium
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					

Stopbank Summary

ISSUE ID	NAME	PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD 1/2/3/4/5 POOR)	CRITICALITY (LOW/MED/HIGH)	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
29	Rathkeale A	Protects school and surrounding area from flooding up around a 5% AEP	450	0	2	High	School/Private Multiple	5%		Continue existing asset management	Low
29	Rathkeale B	Protects school and surrounding area from flooding up around a 5% AEP	900	900	4	High	School/Private Multiple	5%	Directly adjacent to river, trees in stopbank	Major Project Response	High
46	Te Ore Ore	Provides some protection to Te Ore Ore Road and local land up to around a 10% AEP	450	0	3	Low	Multiple private/Public road	10%	Low quality, rutted and uneven crest	Continue existing asset management	Low



RESPONSES - Reach 4: Double Bridges to Te Ore Ore

Major Project Response Summary: Rathkeale College Stopbank

The issue

Rathkeale College is a boys' secondary school located approximately 5km north of Masterton, on an inside bend of the Ruamahanga River. This reach of the Ruamahanga River is extremely narrow, which has caused significant erosion of the banks on both sides of the river.

There is infrastructure within the erosion hazard zone and associated vegetative buffer zone on both banks. A pivot irrigator has been installed on the farmland on the north bank, and a stopbank is present along the boundary of the Rathkeale school grounds.

The stopbank is of poor quality, with mature trees growing too close to the bank on the river side. The buffer between the stopbank and the river is very narrow and has been under consistent erosion pressure. Stopgap erosion protection measures including debris fences and rock groynes have been used to protect the stopbank.

The erosion pressure through this reach is anticipated to remain, and therefore a long-term solution that removes the existing infrastructure from the buffer is necessary.

The current vegetative buffer through this reach is significantly narrower than that present upstream or downstream of the reach. This is not considered ideal as it requires significant expense and work to maintain or reinstate the banks after erosion occurs. Planting the full width of the existing buffer, and potentially widening the buffer through this reach, would be beneficial.

Relationship with common methods

The options being considered through this reach (as outlined below) are consistent with the use of the common methods 'river edge envelopes' and 'recognition of buffers as a river management tool'.

Description

General

GWRC staff and Te Kāuru Upper Ruamahanga FMP Subcommittee members are undertaking discussions with the adjacent landowners to develop an option for this reach. However, these discussions were not complete at the time of production of this Draft FMP.

Options being considered in this reach include:

- Fully planting the existing (narrow) vegetative buffer
- Fully planting a widened vegetative buffer
- Retreating the Rathkeale stopbank further back from the river edge
- Increasing the width of the river channel
- Realigning the river channel

Implications

All the options being considered involve the loss of some productive land for the adjacent landowners. River widening or realignment will have impacts on the river ecology through the reach during construction.

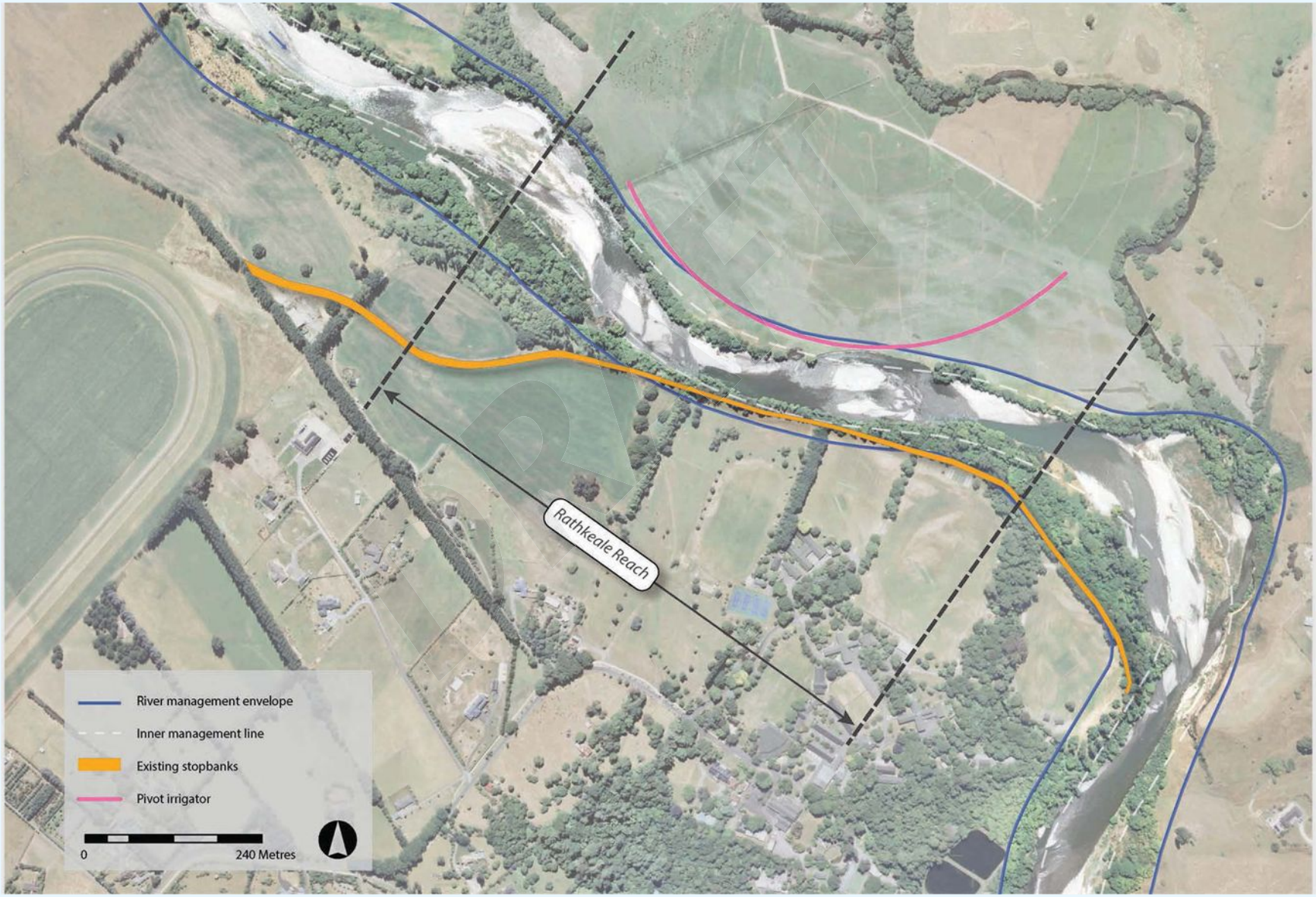
Priority

Medium. There has been recent bank erosion on both sides of the river through this reach, including damage to the Rathkeale stopbank (see photo) although this has since been reinstated.

Level of Service

A 100-year (with climate change) level of service, to be confirmed with Rathkeale College and local residents.

REFERENCE NUMBER	PROPOSED MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR PROPOSED RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
117 and 118	TBC	Low	Erosion by the river, overtopping of stopbank	1% AEP, including climate change	To increase flooding protection to Rathkeale College and reduce erosion risk to stopbank and Rathkeale College	GWRC / Rathkeale?	Medium	$TBC	Capital funding TBC


Rathkeale Reach
River management envelope
Inner management line
Existing stopbanks
Pivot irrigator
0
240 Metres

Te Ore Ore to Waingawa – Reach 5

Character

This reach extends from Te Ore Ore Bridge to the south of Masterton through the Masterton Plains. Urbanising influences characterise parts of the western banks of this reach including increased public access adjoining Henley Lakes, the presence of Masterton Cleanfill, and the earthworks and ponds associated with the Masterton Sewage Works. Below the confluence with the Waipoua River, the river channel tends to be managed as a single thread enclosed by willow and poplar belts along its margins, with limited public access.

Key Characteristics

- Channelised bed through a gravel corridor
- Increasing urbanising influences along its western margins
- Poplar and willow bank planting

Values

Modified banks including stop banks are common along this reach, with willow and poplar tree belts also frequently established throughout this area. This has resulted in a high level of landscape modification overall with corresponding low-medium scenic values.

The close proximity of Masterton has resulted in a variety of recreation values including a well used recreation area established at Henley Lake Park. This includes recognised fishing areas for rainbow trout and perch. The popularity of fishing increases to the north of this reach in closer proximity to the edge of Masterton. Kayaking also occurs throughout this area in association with flatter water which is easily accessible for beginners.

There are swimming sites throughout this reach particularly at the northern end of the reach in close proximity to Masterton. A preference for swim sites upstream of the Masterton Waste Water Treatment Plant was also identified in relation to cultural and recreational values.

Terrestrial habitats of ecological value identified along this reach include areas of unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield, boulderfield, natural wetlands and ponds .

There are numerous cultural sites identified throughout this reach including marae, historic pā and house sites, urupa, baptism sites, mixing of mauri, a taniwha lair and associations with mahinga kai.

Existing River Maintenance

GWRC maintains a river scheme within this reach and collects scheme rates. Approximately $18,000 per river km per annum is spent for river maintenance works in this reach.

Annual maintenance works objectives include:

1. To maintain the river channel free of vegetation and obstruction
2. To maintain the channel within the river design lines. This include establishment and maintenance of vegetated buffer zone along the river edges
3. To implement appropriate structural works to protect assets and infrastructure
4. To maintain scheme stopbanks to “as built” standards
5. To control gravel extraction to sustainable levels
6. To enhance and protect river recreational access, wildlife and fishery values
7. To respond to flood events, less than 20% AEP
8. To contribute funds to flood damage reserves to enable response to large flood events

Historically the river in this reach has been constrained and the current design lines used for river maintenance are classified as extremely narrow. The presence of significant sites such as Henley Lake Park, the Waipoua confluence, Riverside Cemetery, the landfill site, and the Masterton Wastewater Treatment Plant create constraints for the river and its management.

Over time a range of erosion control structures have been established to protect the key assets, including rock groynes and other heavy protection. The presence of these structures at certain locations has created additional erosion pressure in other places. This inconsistency results in a variation in activities across the reach over time. Gravel extraction to manage beach build up is used in this reach. During some years, significant in-stream channel works are completed, and in other years, due to intense gravel extraction, no in-stream channel works are required. There are limitations to the gravel extraction as sustainable gravel yield is a limiting factor.

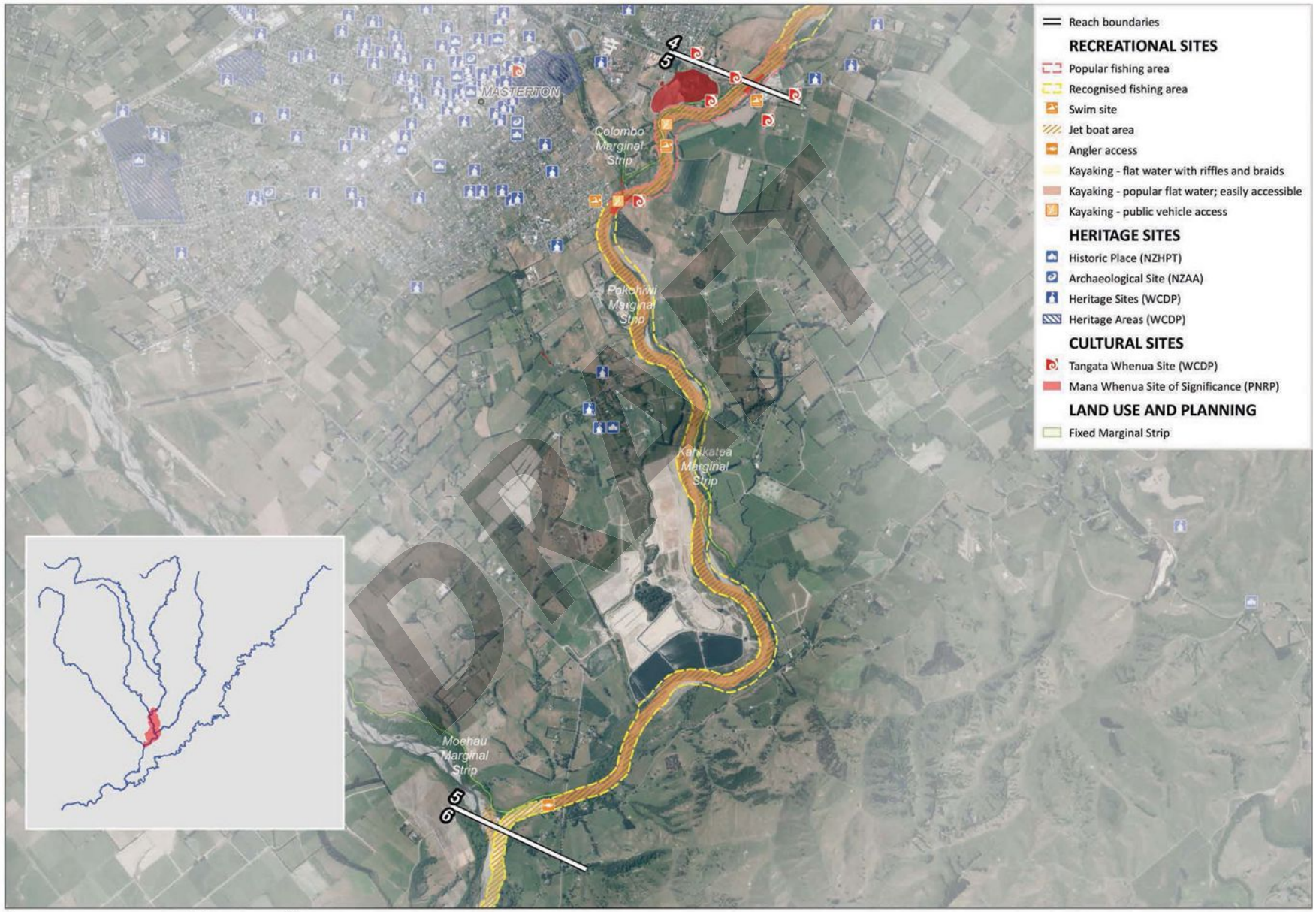
Following this FMP, river maintenance activities in this reach will involve more works to maintain stopbank conditions, and river enhancement opportunities will be better explored and supported. There is an opportunity in this FMP process for the community to decide to raise the level of service in the reach and install more erosion protection structures in currently unprotected areas. This option is associated with higher costs of annual maintenance.

There will be a greater effort to implement buffers where possible, but the FMP acknowledges that maintaining existing rock protection works and continuing to use new rock will be required to project important community infrastructure and assets.

Key Floodplain Management Points

- Recognise the importance of the confluence of the Waipoua and Ruamāhanga Rivers
- Work with Masterton District Council to protect Masterton Waste Water Treatment Plant assets from flooding and erosion impacts
- Work with Masterton District Council to protect Henley Lake Park and recreation area from negative effects of flooding and erosion
- Work with Masterton District council to protect and ensure continued operation of Wardells Road Bridge
- Work with Masterton District Council to protect the Masterton landfill and protect the environment from any damage that may be a risk as a result of flooding and erosion

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
High	Low / Medium	Angler access, kayak access, jet boat access, fishing, kayaking, jet boating, swimming	-	Tangata whenua Sites (WCDP), Mana whenua Sites of Significance (PNRP) - Historic pa sites, historic house sites, historic baptisms sites, marae sites, urupa, taniwha lair, mahinga kai, mixing of mauri, water spirit and guardian, swimming place, wāhi kauhoe, puna rongoā; source of weaving material, puna raranga; outrigger canoe, waka ama	Rural (Primary Production), Rural (Special), Road, River, Residential, Flood Protection and Mitigation, Sewage Treatment and Disposal, Waste Management, Cemetery.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



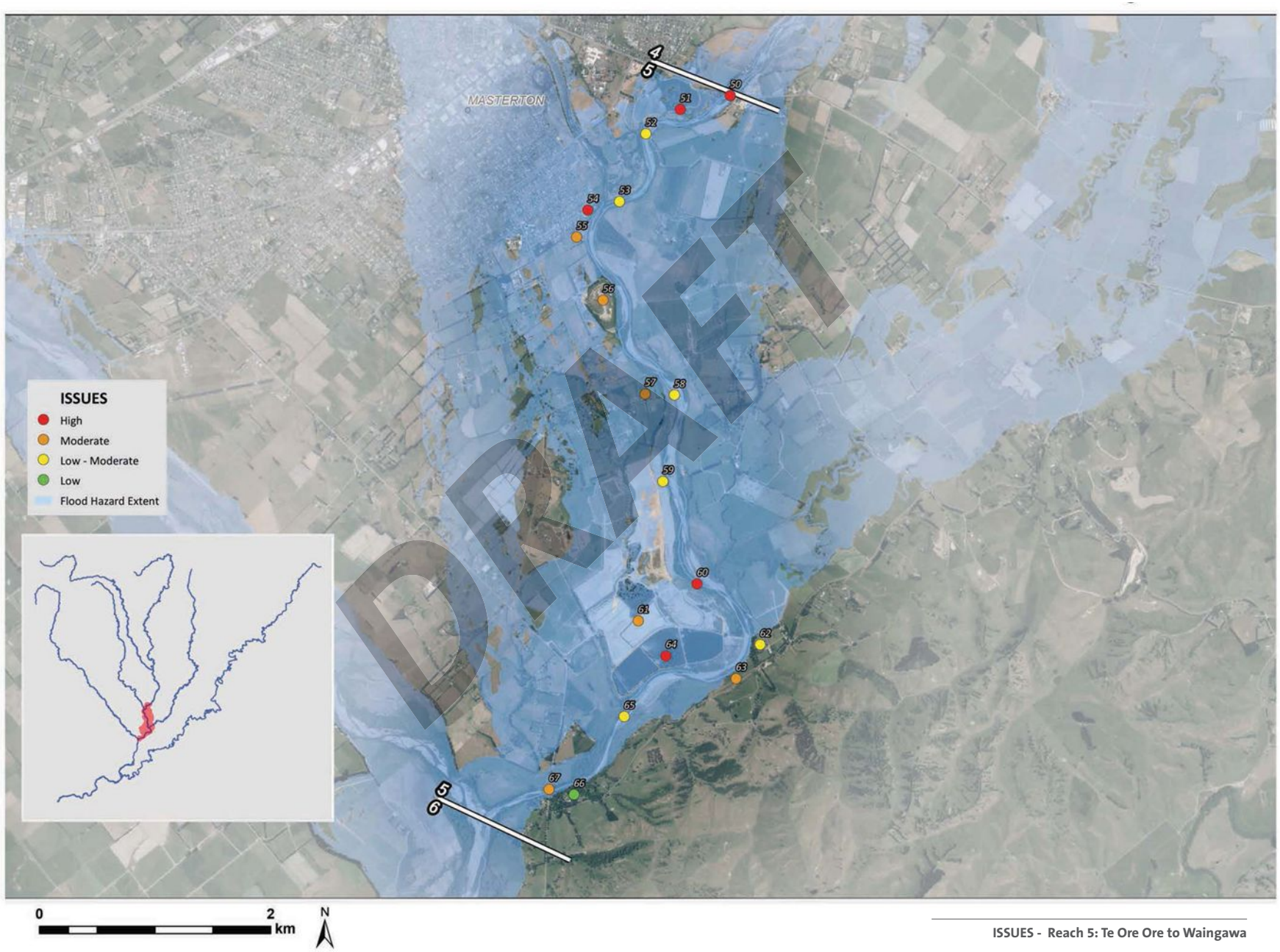
VALUES - Reach 5: Te Ore Ore to Waingawa

Te Ore Ore to Waingawa – Reach 5

Flood and erosion issues

A total of 16 flood and erosion issues have been identified along this reach. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW	**Houses [66]** Three houses sit within the erosion study area, however this area has no history of erosion and the high bank with cemented deposits acts to reduce risk to this location. No currently managed issues exist.	
LOW TO MODERATE	**Transmission lines [52]** Transmission lines cross the river from Henley Lake Park, where pylons on both banks sit within the erosion study area. However these are set back from the bank edges and therefore considered to be at lower risk. No currently managed issues exist. **Narrow channel at confluence [53]** The river becomes very narrow immediately upstream of the confluence with the Waipoua. Flooding frequently occurs across the true left bank affecting a number of paddocks. This has a beneficial effect in reducing erosion pressures at River Road. **Stopbank [59]** The section of the stopbank downstream of the landfill has an unknown level of service. This stopbank is part of the protection for the Wastewater Treatment Plant .	**House [62]** A single dwelling on Lees Pakaraka Road sits within the erosion study area, but is outside the modelled 1%AEP flood extent. It is currently protected by rock erosion protection. **Channel alignment [65]** The channel alignment continues to push outside of its design alignment. Ongoing rock groyne protection has been required to maintain the designed alignment. **Channel alignment [58]** Historically the channel has been wider at this location. The design channel alignment through this reach is very narrow. This possibly has upstream and downstream effects.
MODERATE	**Riverside Cemetery [55]** The cemetery sits within the erosion study area. It has historically suffered erosion and light rock protection is in place to manage some of these effects. **Closed landfill site [56]** This closed landfill site has suffered from ongoing erosion. It is currently protected by a combination of rock groynes and willow buffers. Possible erosion of contaminated material is a concern. **Stopbank [57]** A varying standard stopbank with a level of protection between 5% AEP and 10% AEP. This stopbank is very poor quality, and is infested with trees. A number of downstream properties benefit from the protection it provides, including the Masterton Waste Water Treatment Plant.	**Waste Water Treatment Plant (WWTP) [61]** The Masterton WWTP site is within the erosion study area and the modelled flood extent for the 1% AEP flood event. While the WWTP has some stopbanks with a 1% AEP level of protection, these are not continuous upstream and flooding is modelled to outflank these structures. **Lees Pakaraka Road [63]** Lees Pakaraka Road sits within the erosion study area and on the edge of the 1% AEP flood extent. It is currently protected by rock erosion protection. **Wardells Bridge [67]** The bridge abutments sit within the erosion study area. The bed in vicinity of the bridge has been observed over long period to be a stable site with low risk of erosion and scour. No currently managed issues exist.
HIGH	**Te Ore Ore Bridge weirs [50]** The Te Ore Ore weirs were installed to protect the bridges crossing the river upstream, they have suffered damage in past floods, and for a time were deemed hazardous to river users. Work has been carried out on the weirs to make them less hazardous and less visually obtrusive, however sections of the weirs remain in place, acting like groynes. **Henley Lakes [51]** The banks adjacent to Henley Lakes Park are continually under erosion pressure. There is current work in progress to establish vegetative buffers and retreat the existing bank edge to reduce the erosive impacts. A significant area of the park is within the design channel. The narrow river width creates additional erosion pressure.	**River Road properties [54]** 14 River Road properties sit within the erosion study area. A dangerous erosion hazard was observed here in the 1998 floods and some parts of these properties eroded into the river. This erosion is currently managed by a series of heavy rock groynes, this requires ongoing maintenance and management. **WWTP irrigation beds [60]** The irrigation beds for the Masterton Waste Water Treatment Plant are within the erosion study areas and the erosion management buffer areas for the river. They are vulnerable to greater than a 50% AEP flood event. **WWTP discharge point [64]** The Wastewater Treatment Plant discharge point sits within the erosion study area.



ISSUES - Reach 5: Te Ore Ore to Waingawa

Te Ore Ore to Waingawa – Reach 5

Response

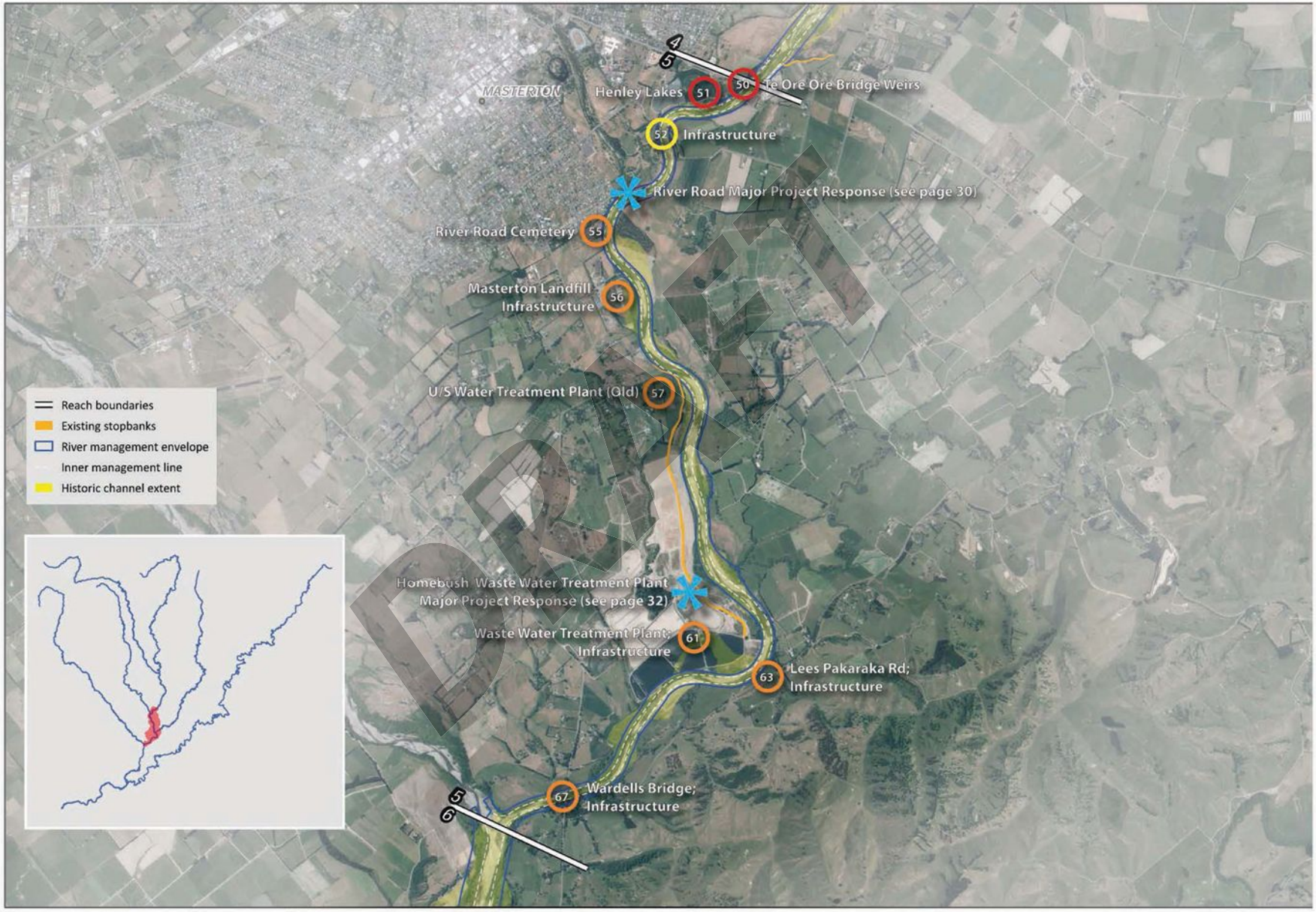
Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	51	Henley Lakes	River management	Narrow design lines to be reconsidered during design lines update process. Until then the narrow channel will be maintained as usual.	20%	5%	GWRC	MDC	Medium
	51	Te Ore Ore Bridge weirs	River management	Remove remains of rail iron and concrete block weirs.			GWRC	MDC	Medium
	55 56	River Road Cemetery and Masterton Landfill	River management	Prior to implementation of the River Road major project response (page 30), continue to maintain the rock groynes established to provide erosion protection.			GWRC	MDC	High
	61	Waste Water Treatment Plant	Planning and policy	Refer to Homebush Waste Water Treatment Plant major project response (page 32)			MDC	GWRC	Medium
	63	Lees Pakaraka Rd	River management	Continue to maintain protection to Lees Pakaraka Road in conjunction with MDC.	5%	5%	MDC	GWRC	Medium
	67	Wardells Bridge	River management	Continue to monitor bed levels and erosion risk to abutments. Supported by the river envelopes tool.		1%	MDC	GWRC	Medium
	52 56 61 63 67	Infrastructure	Emergency management	Inform asset owners of risks to infrastructure assets in this reach and encourage them to prepare contingency plans to address flood and erosion risks. GWRC and WREMO to provide advice and support if requested.		>1%	Asset owners	WREMO	Medium
COMMON METHODS		Entire reach		River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach Entire reach		Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/ retirement of assets, land access & strategic land purchase					
		Entire reach		Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach		Environmental strategy, Community Support Officer, care group and clubs					

Stopbank Summary

ISSUE ID	NAME	PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD 1/2/3/4/5 POOR)	CRITICALITY (LOW/MED/ HIGH)	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
57	U/S Water Treatment Plant (Old)	Provides a low level of protection to properties in immediate vicinity	820	150	4	Low	Multiple private/Public road	10%	Trees in stopbank, crest level discontinuity with WWTP (New) stopbank	Stopbank is low criticality and does not significantly affect flood risk to WWTP	Low
61	WWTP (New)	Provides protection to the Homebush WWTP	1,900	0	2	High	Masterton District Council Wastewater Treatment Plant	1%	This is not a GWRC asset and should be removed from asset register	MDC asset - Remove from GWRC asset register	Low



RESPONSES - Reach 5: Te Ore Ore to Waingawa

Major Project Response: River Road

The issue

A number of residential properties on River Road are located within an erosion hazard area, four of which are in close proximity to the current river bank. Active erosion has been observed in recent years, and during the 1998 flood event some parts of these properties being eroded into the river. While rock groynes have been constructed at the toe of the bank over a long period of time, they were not specifically designed to withstand large flood events and are not considered to provide a high level of security. Immediately downstream of the residential properties on River Road is the Masterton cemetery and the landfill, which are protected by a large number (19) of rock groynes as well as a reasonably well established willow buffer.

Opportunities

The opportunity to widen and deepen the existing overland overflow path on the left berm of the Ruamahanga floodplain was investigated to take a greater amount of flow and become operational in smaller (50% AEP) flood events. This area is a natural overflow path based on the existing topography observations from past floods. Historically the location of the main channel flowed through the area as seen on the cadastral plans. This option provided little reduction in velocities and erosion potential. An alternative to this is to widen and realign the current main river channel through this reach by approximately 30m to make room for construction of rock groynes and a planted buffer on the right bank immediately downstream of the Waipoua confluence. As well as making room for these new groynes and buffer to protect the residential properties on River Road, the widening of this reach would reduce the pressure on the existing rock groynes that are protecting the cemetery and landfill.

Relationship with common methods

Making room for the river is consistent with the river management responses described in the common methods, along with improved planted buffers and rock groynes. The main channel is currently up to 10m inside the inner management line on the left bank.

Description

General

It is proposed that the current erosion risks at River Road, as well as the cemetery and landfill area immediately downstream, should be reduced by widening/realigning the main channel away from the current right bank by approximately 30m, combined with rock groynes and planted buffers. To provide a channel widening solution that fits with the existing structures in this reach requires a total length of widening of approximately 600m. Easements may be required to allow construction of the groynes on the River Road properties.

The 30m widening of this reach over a distance of 600m requires excavation of approximately 40,000m^3 of material. It is expected that approximately half of this would be used for realignment at the upper end of the reach with the remaining being removed from the site through gravel extraction permits.

With the channel widening complete, a series of rock groynes can be constructed for approximately 150m from the confluence of the Waipoua/Ruamahanga Rivers. Approximately six groynes would be constructed over a length of around 150m. Willow buffers would be planted in between the rock groynes to improve the overall level of protection.

Costs

Channel widening/gravel extraction work on the left bank of the Ruamahanga River directly downstream of the Waipoua confluence for 600 m. Up to $60,000 for bed/beach recontouring of 20,000 m^3 in addition to 20,000 m^3 of gravel extraction assumed to be through the permit system and extracted at no cost.

Rock Groynes - up to $575,000 based on each groyne being approximately 250 tonnes, P&G and Contingency of 30% (savings could be achieved through reuse of existing rock, if appropriate). This will include channel widening/gravel extraction work on the left bank of the Ruamahanga River, bed/beach recontouring, and strip vegetation.

Implications

The new rock groynes would be larger in scale than the existing groynes and would need to be sufficiently keyed into the river bank to maximise their structural integrity. This would require accessing and utilising private land associated with the adjacent River Road properties. To ensure protection and future maintenance access to these structures, easements through the affected properties will be required. Other legal considerations may also be required for the crown owned land that would be affected by the enlargement on the left bank. This may involve confirmation of accretion claim status and formalising a river works easement, and discontinued use of this land by the eastern river bank landowners for primary production. Initial consultation with affected property owners has been undertaken in late 2017.

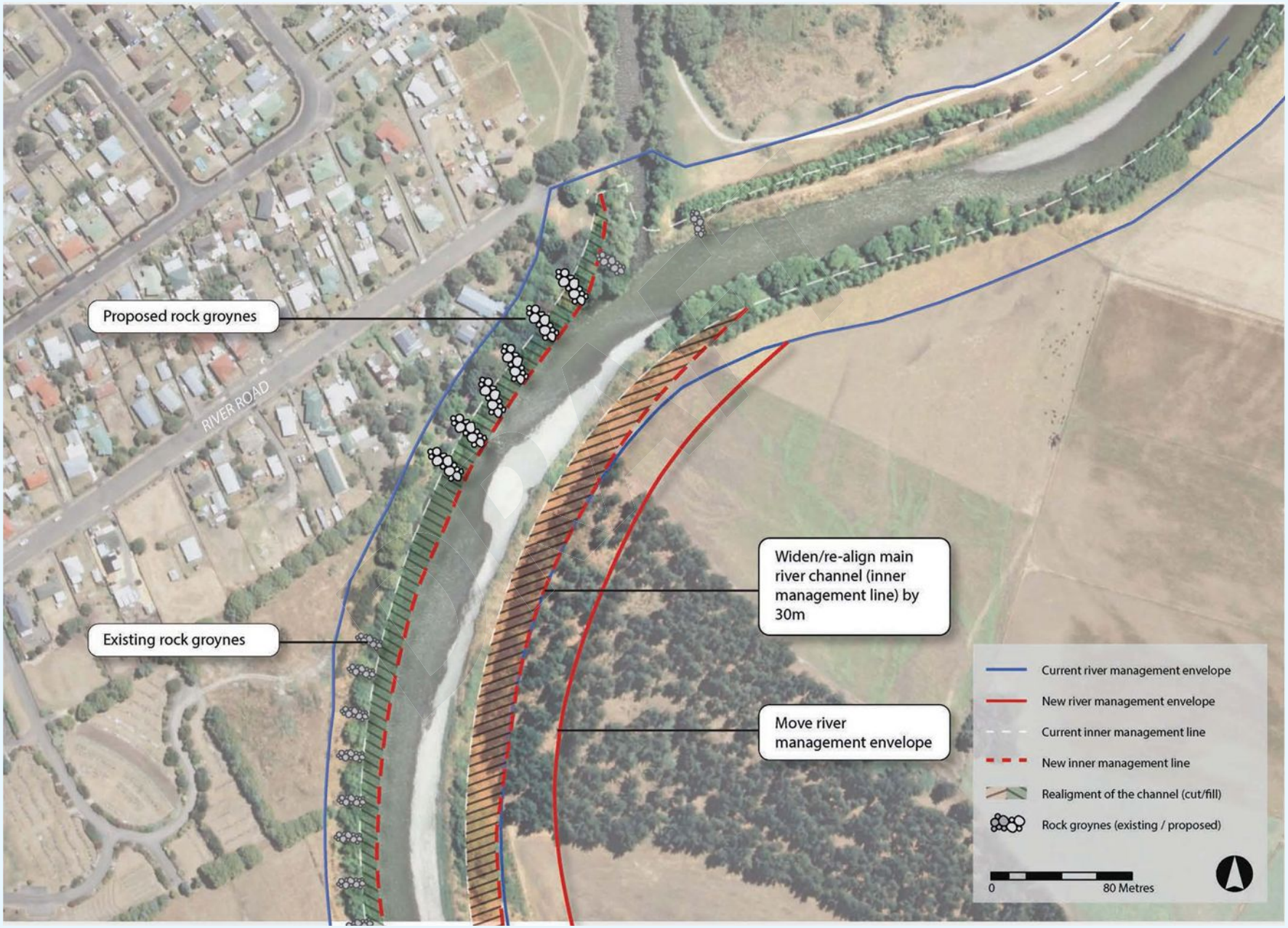
Priority

This response is classified as high importance and high priority.

Level of Service

A 1% AEP level of service is proposed.

REFERENCE NUMBER	PROPOSED MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR PROPOSED RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
80	Increase bank protection to river edge at River Road and widen river channel.	<5% AEP	Erosion by the river	1% AEP	To increase protection to River Road, Masterton	GWRC	High	$575,000	Capital funding TBC
142	Easements and other legal costs as required.	N/A	Erosion by the river	N/A	To allow construction/maintenance of groynes and widening of river.	GWRC/MDC	High	$50,000	Capital funding TBC


Proposed rock groynes
RIVER ROAD
Existing rock groynes
Widen/re-align main river channel (inner management line) by 30m
Move river management envelope
Current river management envelope
New river management envelope
Current inner management line
New inner management line
Realigment of the channel (cut/fill)
Rock groynes (existing / proposed)
0
80 Metres

Major Project Response: Homebush Waste Water Treatment Plant

The issue

The most recent hydraulic modelling of the Upper Ruamahanga and Waipoua Rivers (August 2014) indicates that in a 1% AEP flood event (with Climate Change to 2090) the stopbank adjacent to the Homebush Wastewater Treatment Plant (HWWTP) overtops and inundates the headworks facility (Issue ID 147). However, the base topographic data that was used for this model (2013 LiDAR and stopbank crest survey) was gathered prior to the construction of the new stopbank being completed. The hydraulic model is currently being updated with the as-built survey of the new stopbank and incorporating the thorough review that has been undertaken of the Waipoua design hydrology. Once this modelling has been completed the flood hazard evident to the headworks can be reviewed and the need for any additional works to improve the resilience of the facility considered. Based on the information currently available it is considered prudent to allow a provisional sum for possible flood mitigation works at the headworks facility.

It is also worth noting that the newly constructed pond embankments are approximately 0.5m higher than the stopbanks so it is unlikely that the ponds would be overtopped during a large (over 1% AEP) flood event.

The current hydraulic modelling also shows that the older (lower) section of stopbank downstream of the landfill (Issue ID 145) overtops in the 1% AEP flood event but the overflow tracks to the west of the the HWWTP in the Makoura Stream. Other issues in this reach relating to erosion hazard to the HWWTP irrigation beds (Issue ID 146) and the discharge point (Issue ID 148) can be managed with the common methods.

The newly upgraded stopbank is constructed on MDC land for the specific purpose of protecting MDC asset but is currently recognised as a GWRC asset. Discussion is ongoing around future maintenance and funding responsibilities for this asset.

Opportunities

The updated modelling results will provide a more accurate assessment of the risks to the HWWTP headworks but there will still be the possibility of the stopbank overtopping in an event larger than the 1% AEP flood or failing during an event lower than a 1% AEP flood due to piping or external erosion. Consideration of these residual risks could also be taken into account when considering options for increasing the resilience of the HWWTP headworks. There is the possibility of integrating the Three Rivers Trail and access to the Ruamahanga River in this area but there would need to be careful consideration of health and safety and security issues around the HWWTP ponds and headworks.

Relationship with common methods

The other issues highlighted in this reach can be managed with the common methods, specifically the landfill stopbank "Rural stopbanks policy" (Issue ID 145), "Recognition of buffers as a river management tool" (Issue ID 145) and the "Code of Practice" (Issue ID 146&148).

Description

General

A provisional sum for increasing the resilience of the headworks facility, which could include an elevated plinth for the generator and raising electrical devices above flood levels.

Costs -$50,000 (Provisional sum – subject to updated hydraulic modelling)

Implications

Inundation of the HWWTP headworks could result in damage to electrical equipment and the screens being overwhelmed, which would cause untreated wastewater to be discharged to the river.

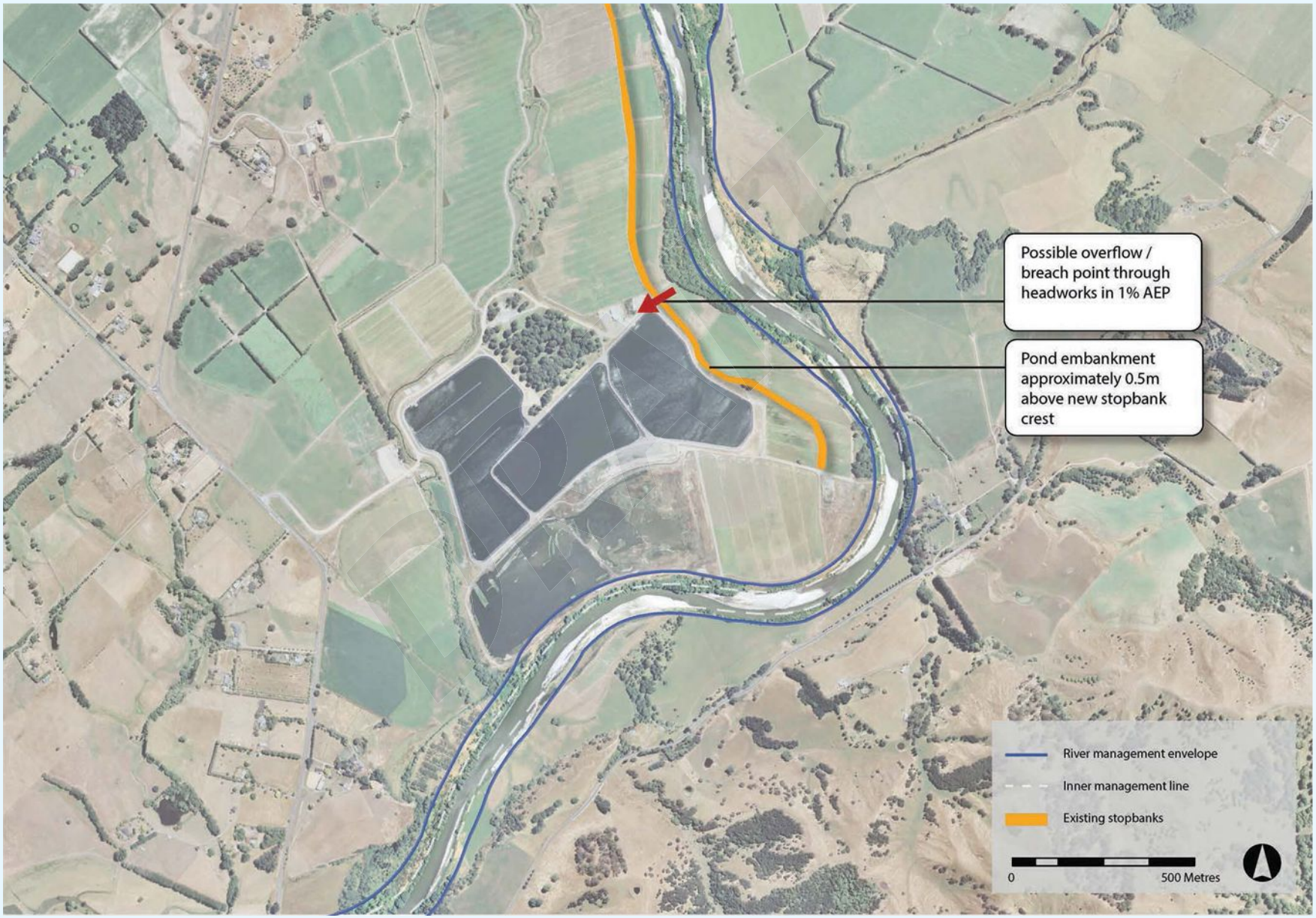
Priority

To be reviewed following completion of modelling (expected 2018).

Level of Service

A 1% AEP level of service is required in HWWTP resource consent.

REFERENCE NUMBER	PROPOSED MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR PROPOSED RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
147	Resilience works within headworks facility (plinth for generation, raising electrical works).	TBC	Stopbank overtopping	1% AEP	To increase resilience of HWWTP headworks in case of stopbank overtopping.	MDC	TBC	$50,000	Capital funding TBC
145, 146 & 148	Common tools								


Possible overflow / breach point through headworks in 1% AEP
Pond embankment approximately 0.5m above new stopbank crest
River management envelope
Inner management line
Existing stopbanks
0
500 Metres

Waingawa to Gladstone – Reach 6

Character

Downstream of the confluence of the Waingawa River, the Ruamāhanga River corridor increases in width and continues a broad semi-braided form. The northern part of the river skirts the western slopes of Foster's Hill before opening out into the Central Plains towards the confluence with the Taueru River to the south. Pockets of remnant native vegetation and willow planting occur inside stop banks established along the eastern river margin.

Key characteristics

- Increasingly semi-braided form where waters of the Waingawa and Ruamāhanga Rivers combine
- Stop banks enclosing remnant native and willow planting

Values

This reach flows through rural land used for primary production and predominantly established in pasture grassland. Stopbanks occur along this reach, some of which enclose native vegetation along the river margin, and result in a medium / high level of modification whilst retaining a medium level of scenic value.

Kayaking and fishing are popular along this reach, taking advantage of the pools, runs and riffles which occur. Jet boating access occurs in this reach, which is a popular area valued for having a semi-braided form which frequently changes course and offers new opportunities to 'read' a different course of navigation along the river. Several swim sites are also located along this reach including areas also associated with jet boat access at Gladstone Bridge.

Important ecological values along this reach include an indigenous forest remnant along the Martinborough Masterton Road (Ruamāhanga River Terrace RAP), together with terrestrial habitats which encompass areas of unfenced indigenous forest, mixed exotic-indigenous forest and indigenous treeland. Important habitat for banded dotterels, black-fronted dotterels and pied stilts also occurs in association with broad stonefield and boulderfield river margins.

Several cultural sites occur along this reach including waahi tapu associated with the mixing of waters from different rivers, an historic house site and an historic spring. Gladstone Inn is also a heritage site identified in the WCDP to the east of Gladstone Bridge.

Existing River Maintenance

GWRC maintains a river scheme within this reach and collects scheme rates. It is estimated that approximately $8,000 per river km per annum is spent for river maintenance works in this reach.

Annual maintenance works objectives include:

1. To maintain the river channel free of vegetation and obstruction
2. To maintain the channel within the river design lines. This include establishment and maintenance of vegetated buffer zone along the river edges
3. To limit structural protection works
4. To maintain existing scheme stopbanks to "as built" standards
5. To control gravel extraction to sustainable levels, and to promote gravel extraction in areas of significant gravel build up
6. To enhance and protect river recreational access, wildlife and fishery values
7. To respond to flood events, less than 20% AEP
8. To contribute funds to flood damage reserves to enable response to large flood events

Generally about half of the annual expenditure in these reaches is allocated to in-channel works that involve the use of heavy machinery. These works include construction of gravel groynes, maintenance of channel alignment, dry-bed channel recontouring, pest plant removal, and debris clearance.

About 15-20% of annual funds are allocated for works to maintain the buffers, which are limited and inconsistent in this part of the river.

The heavy machinery work was used in the past to respond to erosion events in a quick manner. At times non-intrusive maintenance works, such as willow cabling, have been sufficient to repair minor erosion. In some areas, high silt banks are vulnerable to quick erosion loss and have required either channel re-alignment or boulder groynes for erosion control.

Gravel extraction has been variable over the years in this reach with demands high in some areas, and low demand in other areas of gravel build up.

River enhancement expenditure has been between 0% and 3% of total annual expenditure.

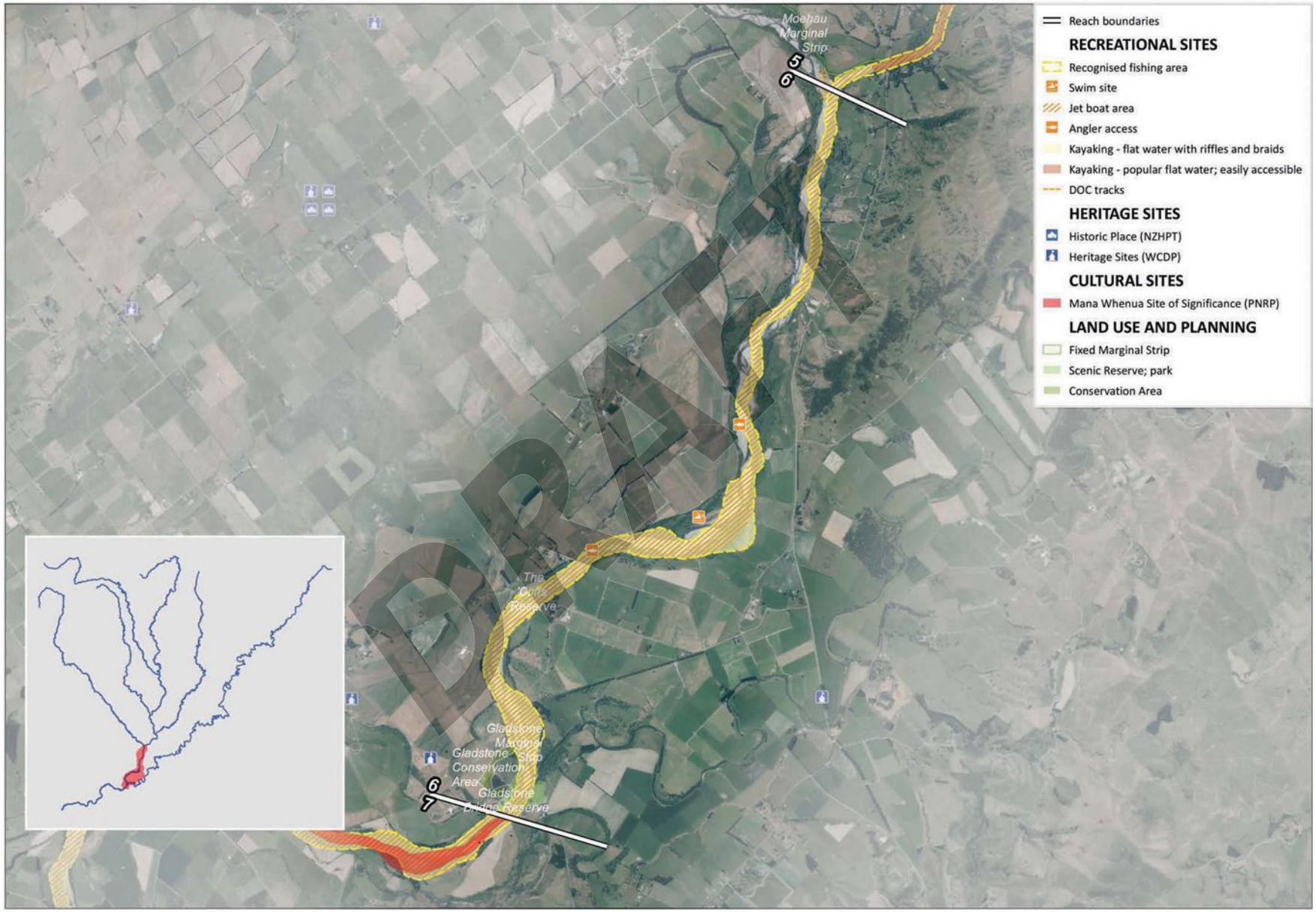
This FMP proposes to shift the focus of river maintenance towards more intensive implementation of vegetated buffers. The design buffers will be allowed to erode when and where appropriate. This method will substitute the immediate response to erosion issues with the machinery in channel works practiced in the past.

It is also planned to address the issues associated with scheme stopbanks and increase river enhancement works.

Key Floodplain Management Points

- Protect the Ruamāhanga River Terraces RAP site from negative impacts of flooding and erosion
- Recognise the importance of the confluence of the Taueru and Ruamāhanga Rivers and the Waingawa confluence
- Work with the asset owner of the Gladstone Bridge to protect and maintain its operation
- Work with Carterton District Council to continue the management of erosion risk to Dakins Road

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium / High	Medium	Angler access, kayak access, jet boat access, fishing, jet boating, swimming	Gladstone Inn (WCDP)	Washing after child birth, historic spring, historic baptism site, historic house site, mixing of mauri	Rural (Primary Production), Rural (Special), Road, River, Flood Protection and Mitigation.	Ruamāhanga River Terrace (RAP), Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



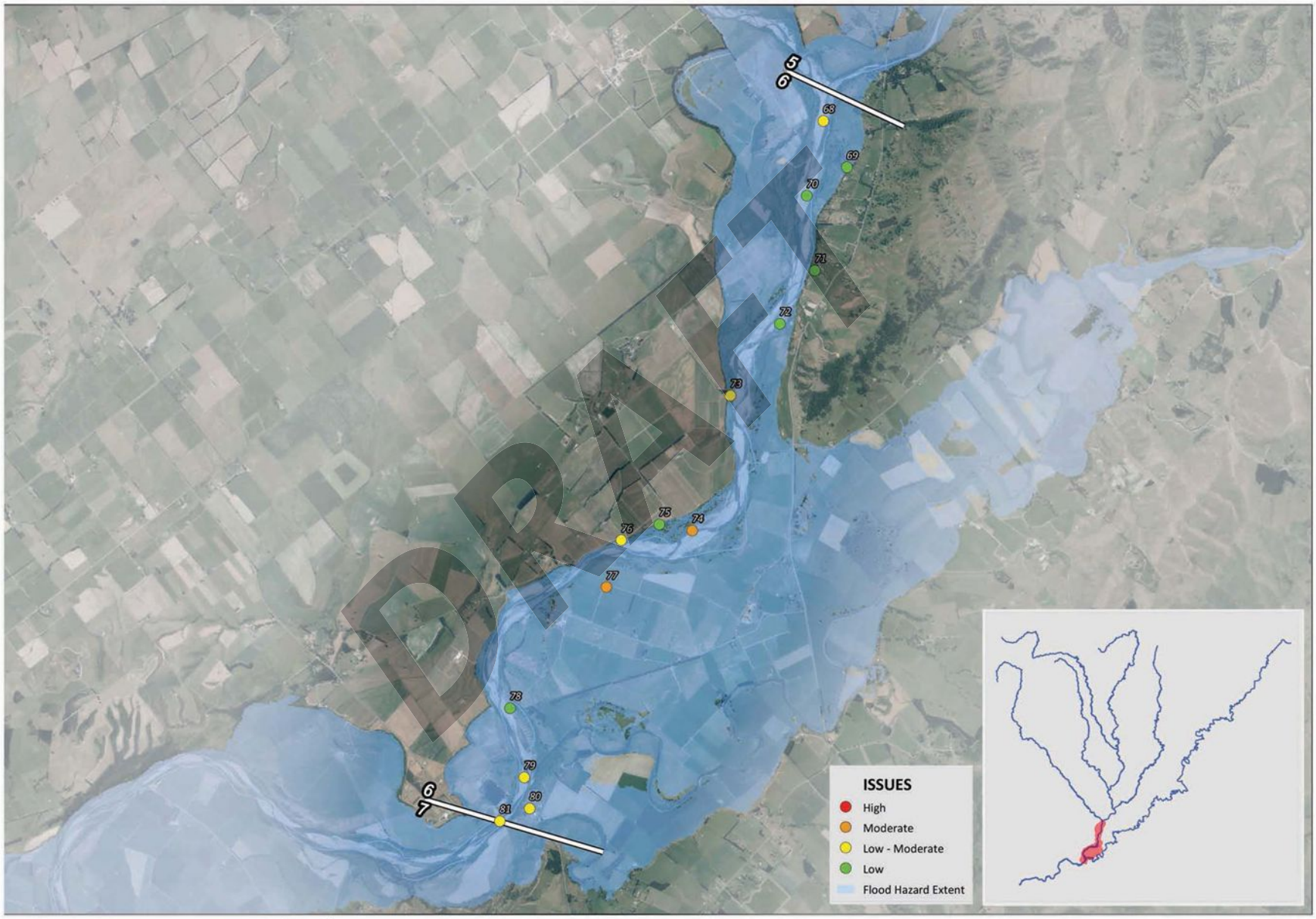
VALUES - Reach 6: Waingawa to Gladstone

Waingawa to Gladstone – Reach 6

Flood and erosion issues

A total of 12 flood and erosion issues are identified along this reach. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW	**Ruamāhanga River Terrace RAP site [69]** The RAP site sits on the edge of the 1% AEP flood extent and within the erosion study area. **Channel alignment [70]** The channel through this area is naturally wider than the design channel alignment. **Houses [71]** Several houses are located within the erosion study area, however they sit on a relatively firm terrace which is resistant to erosion effects. **Channel alignment [72]** The channel in this area tends towards being wider than the design channel. This creates challenging management issues, and puts pressures on the buffer strips on both banks of the river.	**Channel alignment [78]** The buffer widths upstream of the confluence with the Taueru are too narrow and have created ongoing management concerns. **Fish habitat [75]** A number of small springs or backwaters in this area are known to have provided fish habitat over a long period of time. They are affected by erosive forces, but are currently well protected within a buffer area.
LOW TO MODERATE	**Waingawa and Ruamāhanga confluence [68]** Unstable flows caused by the meeting and mixing of the Waingawa and Ruamāhanga Rivers makes the confluence area a challenging location to manage. Gravel deposition also needs management. **Frost protection water intake [73]** The water intake is threatened by ongoing erosion effects. The landowner has provided some of their own erosion protection to protect the structure. **Dakins Road [76]** Erosion affecting the end section of Dakins Road, near Cottier Estate has been addressed in past with rock works. These rock works have protected the immediate area they were installed to protect, but adjacent areas are still affected by erosion.	**Fish passage [79]** The confluence area of the Ruamāhanga and Taueru Rivers is important for fish passage which is prone to being disrupted by natural or artificial sediment/gravel movements. **Gladstone complex [80]** The Gladstone complex includes a pub, several houses and a sports field. It sits within the erosion study area and the 1% AEP flood extent and has a known history of flooding. There is no known history of erosion in this area. **Gladstone Bridge [81]** There are no currently known issues with this bridge. An exclusion zone for extraction exists 100m upstream and downstream from the bridge. The bridge design is not believed to be particularly vulnerable to debris flows, and it has adequate freeboard to its soffit.
MODERATE	**River alignment [74]** The channel needs ongoing and frequent management. Failure to do this means the river spills extra water onto Te Whiti flats and increases the risk of the Te Whiti stopbank overtopping.	**Te Whiti stopbank [77]** The stopbank sits within the erosion study area and in some sections within the buffer areas of the current management scheme. There is risk of erosion reducing the effectiveness of the stopbank. It was reported that this stopbank was overtopped in a 20% AEP event in 2009/2010.
HIGH		



ISSUES - Reach 6: Waingawa to Gladstone

Waingawa to Gladstone – Reach 6

Response

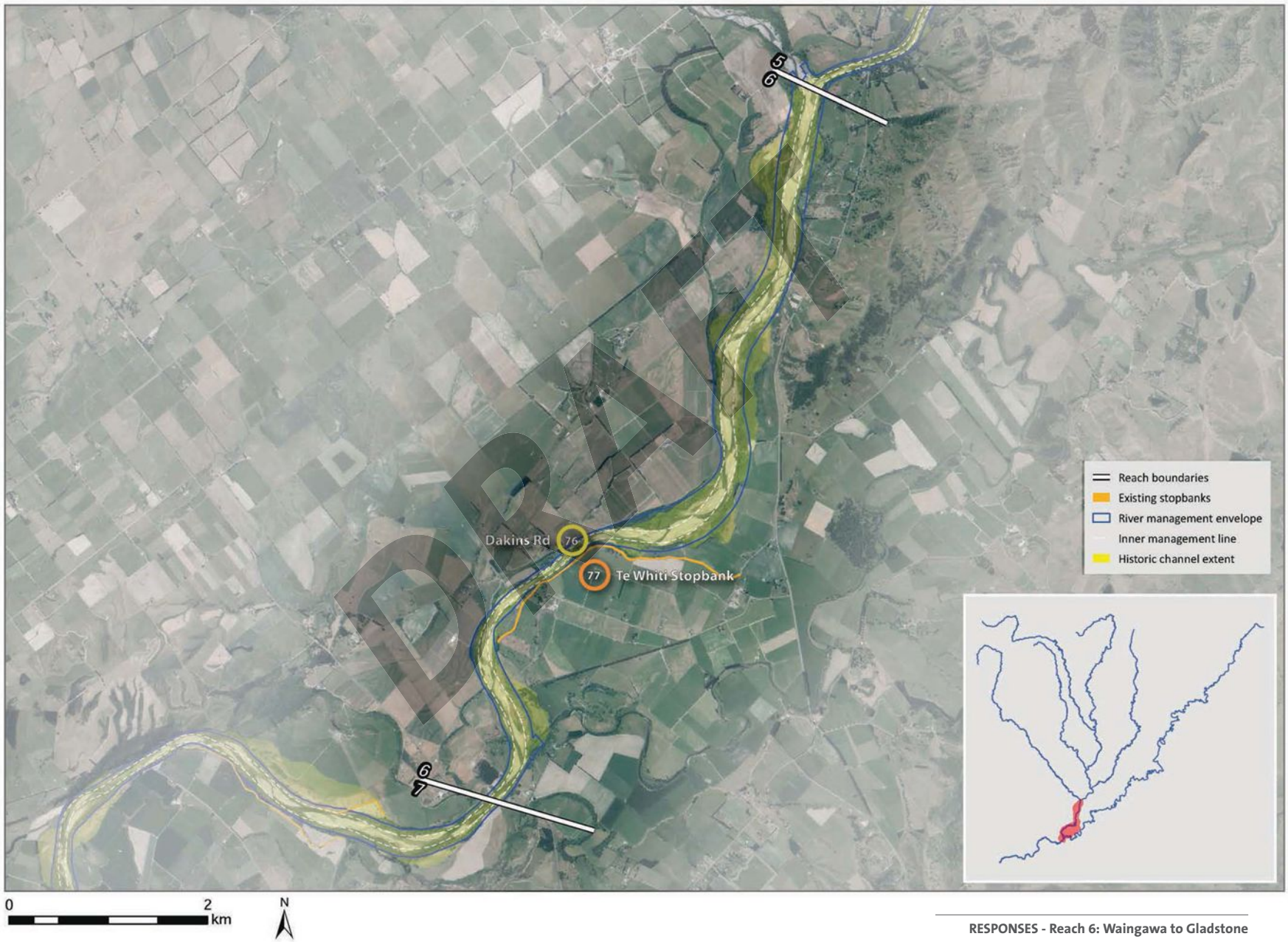
Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	77	Te Whiti stopbank	River management	Realign Te Whiti stopbank to move it outside of the river management envelopes.	10%		GWRC		Medium
	76	Dakins Road	Emergency management	Local residents to prepare emergency evacuation plan in event of Dakins Road erosion occurring. Alternate access route to be identified (i.e. a farm track). A policy may be developed to address freedom camping on the site.		>1%	CDC	WREMO	Medium
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/ retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					

Stopbank Summary

ISSUE ID	NAME	PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD 1/2/3/4/5 POOR)	CRITICALITY (LOW/MED/ HIGH)	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
77	Te Whiti	Provides a level of flood protection to residential property and agricultural land and public road	3,000	220	3	Medium	Private multiple/Public road	20% to 5% (varies)		Continue existing asset management policy. When realigning, try to achieve more consistent level of service	Low



RESPONSES - Reach 6: Waingawa to Gladstone

Gladstone to Kokotau Bridge – Reach 7

Character

To the south of Gladstone Bridge, this reach forms a threaded single channel within a semi-enclosed farmed valley, which extends between Tiffen Hill and the Eastern Wairarapa Hills. The Gladstone cliffs form a prominent backdrop along the eastern banks of this reach before the river swings west towards the base of Tiffen Hill. Willow planting has been used along much of the river margin, with pockets of regenerating indigenous vegetation also established along the base of Tiffen Hill.

Key characteristics

- Semi-enclosed valley form to the east of Tiffen Hill
- Proximity between river and Gladstone Cliffs
- Mix of willow planting, gorse or broom shrubland and regenerating indigenous forest

Values

This reach flows through rural land used for primary production and predominantly established in pasture grassland. Some willow planting has been established along the margins of the river in association with stopbanks north of Tiffen Hill. More natural patterns of regenerating indigenous forest are also established near the toe of Tiffen Hill. This results in a medium level of landscape modification overall and a medium / high level of scenic value.

Kayaking is popular in this area on account of the flat water pools, runs and riffles which occur. This environment is also popular for fishing, including rainbow trout and perch. Jet boating continues along this reach from access points located at both Gladstone and Kokotau bridges. Swimming access is also available from picnic areas adjoining these road bridges, with recreation access recently formalised at Carters Reserve.

Terrestrial habitats with ecological value identified in this area include areas of fenced and unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield, boulderfield, natural wetlands and ponds.

Several cultural sites occur along this reach including a marae, a historic pā site, urupa sites, Parakuiti, a taniwha lair and associations with mahinga kai.

Existing River Maintenance

GWRC maintains a river scheme within this reach and collects scheme rates. It is estimated that approximately $8,000 per river km per annum is spent for river maintenance works in this reach.

Annual maintenance works objectives include:

1. To maintain river channel free of vegetation and obstruction
2. To maintain the channel within the river design lines. This include establishment and maintenance of vegetated buffer zone along the river edges
3. To limit structural protection works
4. To maintain existing scheme stopbanks to “as built” standards
5. To control gravel extraction to sustainable levels, and to promote gravel extraction in areas of significant gravel build up
6. To enhance and protect river recreational access, wildlife and fishery values
7. To respond to flood events, less than 20% AEP
8. To contribute funds to flood damage reserves to enable response to large flood events

Generally about half of the annual expenditure in these reaches is allocated to in-channel works with use of heavy machinery. These works include construction of gravel groynes, maintenance of channel alignment, dry-bed channel recontouring, pest plant removal, and debris clearance.

About 15-20% of annual funds are allocated for works to maintain the buffers that are limited and not consistent in this part of the river.

The heavy machinery work was used in the past to respond the occurring erosion issues in a quick manner. At times non-intrusive maintenance works, such as willow cabling, have been sufficient to repair minor erosion. In some areas, high silt banks are vulnerable to quick erosion loss and have required either channel re-alignment or boulder groynes for erosion control.

Gravel extraction has been variable over the years in this reach with demands high in some areas, and low demand in other areas of gravel build up.

River enhancement expenditure has been between 0% and 3% of total annual expenditure.

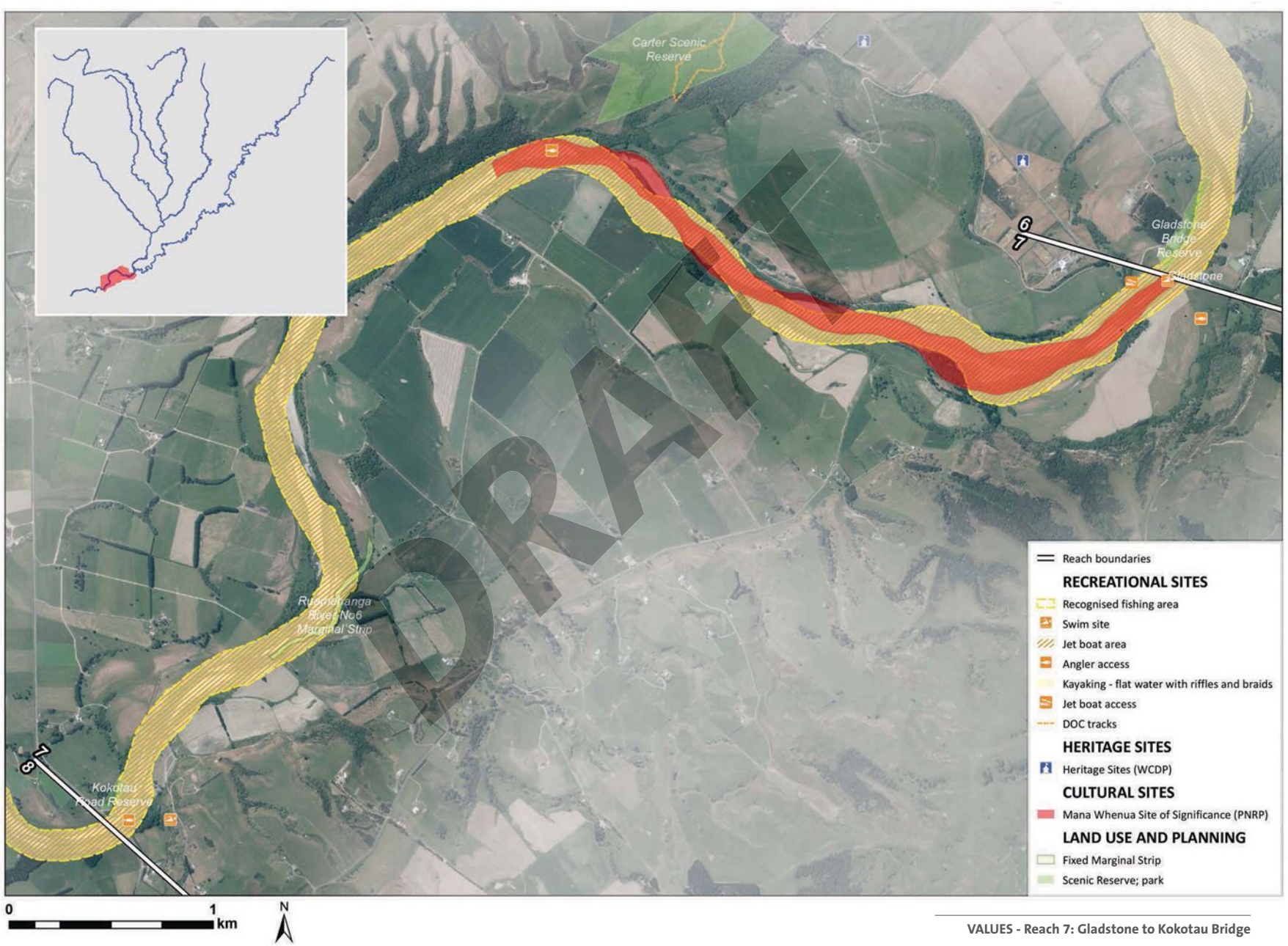
This FMP proposes to shift the focus of river maintenance towards more intensive implementation of vegetated buffers. The design buffers will be allowed to erode when and where appropriate. This method will substitute the immediate response to erosion issues with the machinery in channel works practiced in the past.

It is also planned to address the issues associated with scheme stopbanks and increase river enhancement works.

Key Floodplain Management Points

- Improve the awareness and facilitate the use of Carter Reserve access

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium / High	Angler access, fishing, kayaking, swimming, Gladstone Track (DOC)	-	Mana whenua Sites of Significance (PNRP) - Marae, historic pā site, urupa sites, mahinga kai, significant ancestral place, wāhi tīpuna; water spirit and guardian, taniwha; water utilised for healing, wai ora	Rural (Primary Production), Rural (Special), Road, River, Flood Protection and Mitigation.	Fenced indigenous forest, Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



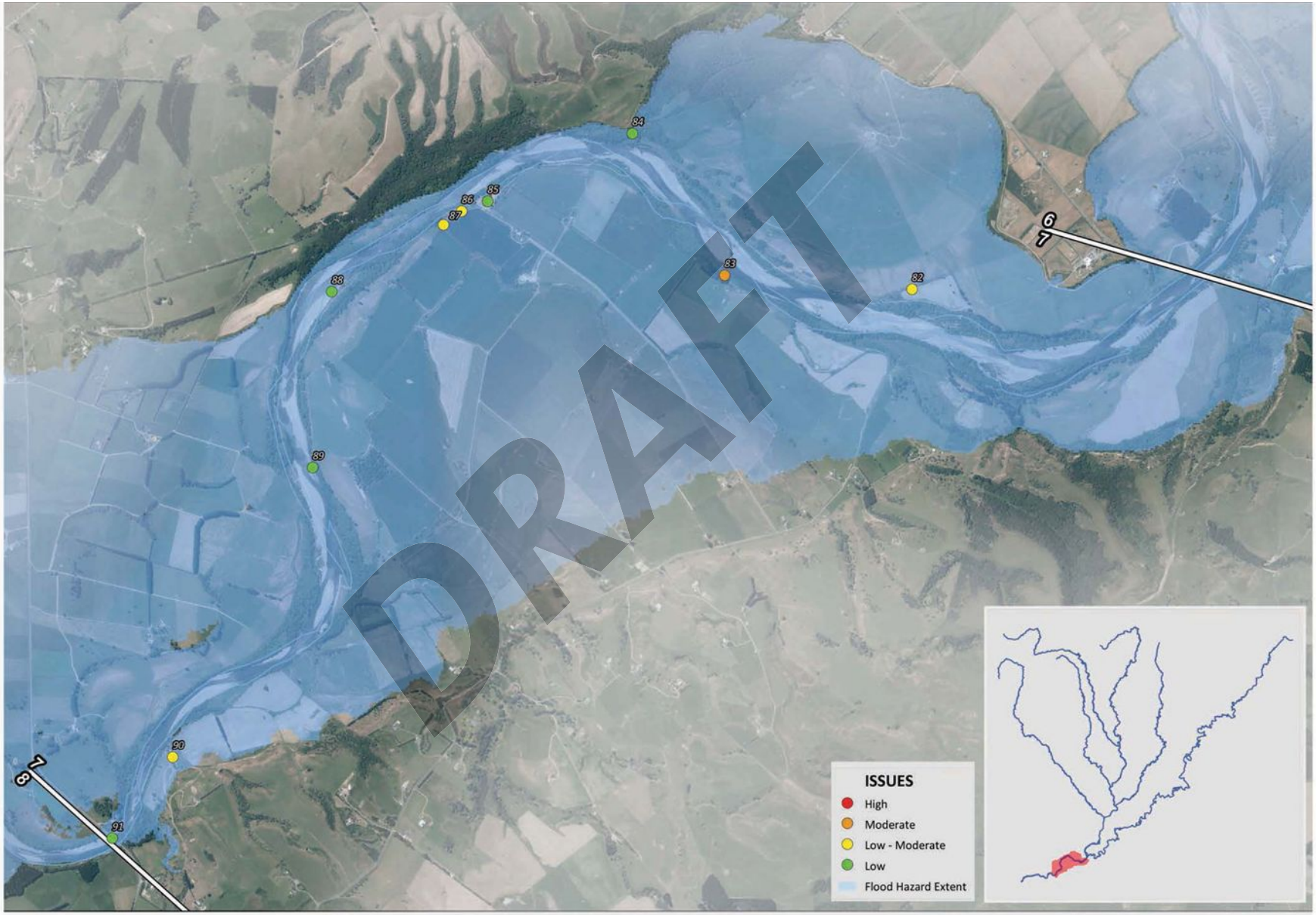
VALUES - Reach 7: Gladstone to Kokotau Bridge

Gladstone to Kokotau Bridge – Reach 7

Flood and erosion issues

A total of 8 flood and erosion issues have been identified along this reach. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW	**Carter Reserve river access [84]** An easement and river access have been recently created here. Possibility that lack of use due to poor awareness may lead to maintenance issues of a community facility. **Ahiaruhe gravel extraction site [85]** Recognised gravel extraction site that is proposed to be used in the future. **Kokotau Bridge [91]** The Kokotau Bridge abutments sit within modelled flood extents and the erosion study area. No currently managed issues exist.	**Channel alignment [89]** Channel naturally widens in this area, this takes the channel outside of the design channel alignment. **Channel alignment [88]** Buffer width on right bank of river is very narrow, and on left bank is very wide. Current channel alignment does not match these alignments.
LOW TO MODERATE	**Ruamāhanga stopbank [82]** This stopbank protects farmland. It is of a very poor standard and overgrown with trees making it highly susceptible to failure. **Farm buildings [86]** Farm utility buildings are located within erosion study area and 1% AEP flood extent. No currently managed issues exist.	**Channel alignment [87]** The channel alignment in this area narrows. This creates both upstream and downstream erosion effects that are hard to manage effectively. **Outbuildings [90]** Outbuildings are located within erosion study area and 1% AEP flood extent. No currently managed issues exist.
MODERATE	**Ahiaruhe stopbank [83]** This stopbank protects farmland against small more frequent flood events. It sits within the erosion study area and close to the river. It is full of trees and therefore at high risk of failure.	
HIGH		



ISSUES - Reach 7: Gladstone to Kokotau Bridge

Gladstone to Kokotau Bridge – Reach 7

Response

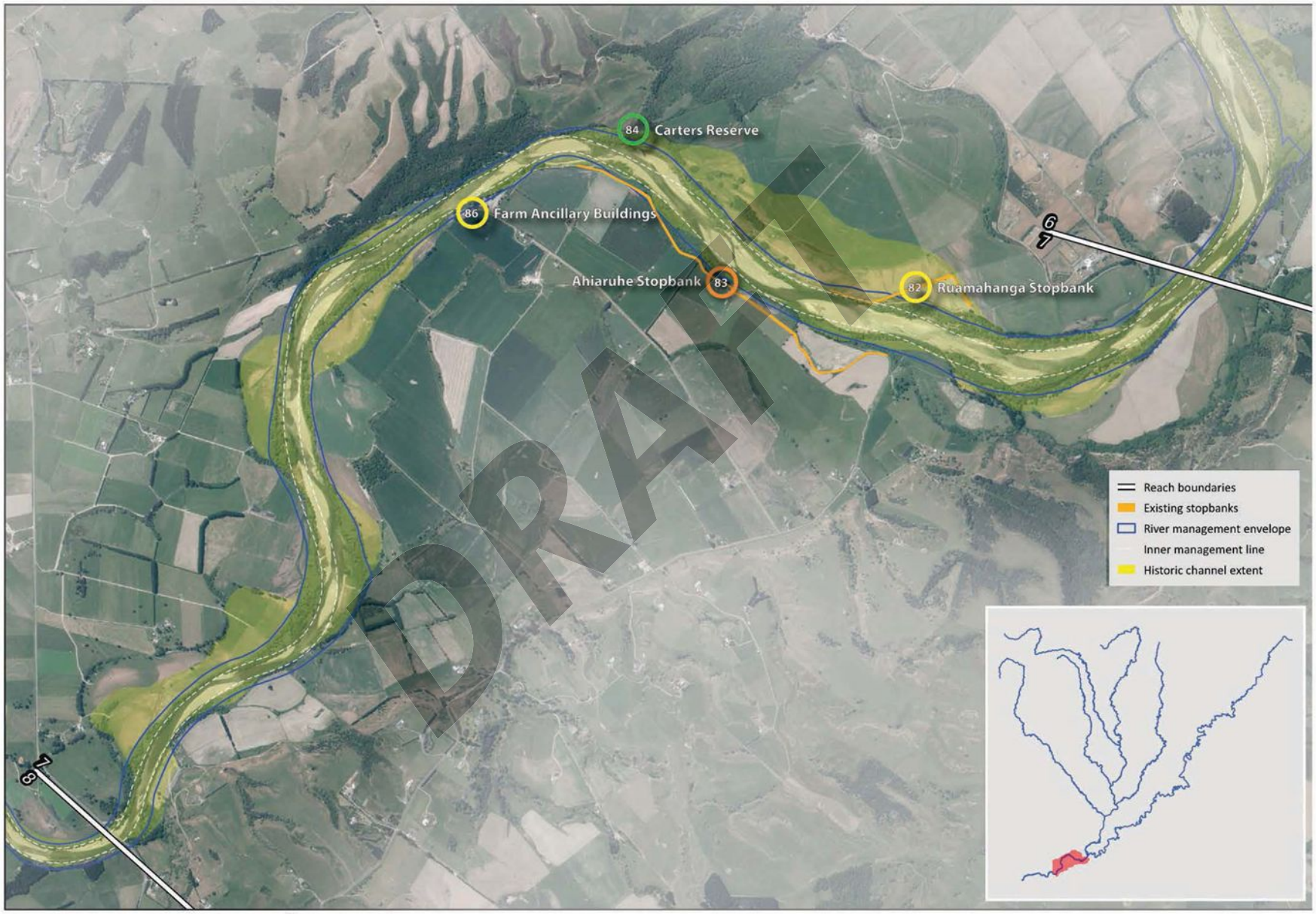
Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	82	Ruamāhanga stopbank	River management	Retire sections of the stopbank that sit within the buffer areas of the river management envelopes. Rebuild the retired section of stopbank outside of buffer management envelope.			GWRC	Landowners	Low
	83	Ahiaruhe stopbank	River management	Retire sections of the stopbank that sit within the buffer areas of the river management envelopes. Rebuild the retired section of stopbank outside of buffer management envelope. Define service level and criticality.	10%		GWRC	Landowners	Low
	84	Carters Reserve	River management	Continue to support the Carters Reserve Care Group. Provide assistance with maintaining access track, planting activities, and encourage the use of the area. Use Carters Reserve as a hub from which to expand mixed vegetative planting.			Community	GWRC	Medium
	86	Farm ancillary buildings	Emergency management	Provide information to property owners regarding potential erosion and flood risks to these structures. Provide advice and support on request.			GWRC	Landowners	Medium
		Ahiaruhe Settlement road homes	Emergency management	Provide information regarding flood risk to home owners. WREMO to contact home owners and discuss lifelines and flood risk issues, and assist with development of home and evacuation plans.		>1%	WREMO	Community	Medium
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/ retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					

Stopbank Summary

ISSUE ID	NAME	PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD 1/2/3/4/5 POOR)	CRITICALITY (LOW/MED/ HIGH)	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
83	Ahiaruhe	Provides limited, local protection from relatively small events	2,000	250	Range 2 - 4	Low	Several agricultural landowners	<10%	Trees in stopbank	"Initial FMP implementation; Continue existing asset management. Long-term implementation explore legacy asset partial abandonment/isolated works."	Low
82	Ruamāhanga	Provides limited, local protection from relatively small events	800	330	4	Low	Individual landowner	20% to 1% (varies)		"Initial FMP implementation; Continue existing asset management. Long-term implementation explore legacy asset partial abandonment/isolated works."	Low



RESPONSES - Reach 7: Gladstone to Kokotau Bridge

Kokotau Bridge to Waiohine – Reach 8

Character

Below Kokotau Road Bridge the Ruamāhanga River re-enters the wider Masterton Plains to the south and flows around the northern toe of Pukengaki. A single thread channel along a contained gravel corridor continues through this reach. The majority of this river reach is enclosed by continuous bands of willows established along the river margin, with isolated totara extending into adjoining farmland from the river margins in some areas.

Key characteristics

- Single channel along contained gravel corridor within wider Masterton Plains
- Predominately willow lined margins
- Isolated totara in some areas

Values

This reach continues through rural land used for primary production and predominantly established in pasture grassland. Willow and some areas of pine form continuous bands along the river corridor in association with limited stopbanks and rock groynes. Pockets of remnant totara also extend into adjoining farmland. Overall the river is identified as having a medium level of landscape modification and a medium level of scenic value.

Fishing and kayaking occur in this area taking advantage of the flat water with pools, runs and riffles which occur. Angling for rainbow trout and perch is popular. Jet boating continues south along this reach from the boating access point located at Kokotau Bridge. Swimming sites are also accessed from picnic areas at Kokotau Road and Forman Jury Road.

Terrestrial habitats with ecological value which continue along this reach include areas of unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield, boulderfield, natural wetlands and ponds .

Several cultural sites occur, including the mixing of mauri at the confluence of the Waiohine.

Existing River Maintenance

GWRC maintains river scheme within this reach and collects scheme rates. It is estimated that approximately $600 per river km per annum is spent for river maintenance works in this reach.

Annual maintenance works objectives include:

1. To maintain river channel free of vegetation and obstruction
2. To maintain the channel within the river design lines. This include establishment and maintenance of vegetated buffer zone along the river edges
3. To limit structural protection works
4. To maintain existing scheme stopbanks to “as built” standards
5. To control gravel extraction to sustainable levels, and to promote gravel extraction in areas of significant gravel build up
6. To enhance and protect river recreational access, wildlife and fishery values
7. To respond to flood events, less than 20% AEP
8. To contribute funds to flood damage reserves to enable response to large flood events

Generally about half of the annual expenditure in this reach is allocated to in-channel works with use of heavy machinery. These works include construction of gravel groynes, maintenance of channel alignment, dry-bed channel recontouring, pest plant removal, and debris clearance. This area downstream of Kokotau Bridge requires less maintenance compare to upper reaches of Ruamahanga. This is due to lower gradients and as consequence the more stable river channel.

About 15-20% of annual funds are allocated for works to maintain the buffers that are limited and not consistent in this part of the river.

The heavy machinery work was used in the past to respond the occurring erosion issues in a quick manner. At times non-intrusive maintenance works, such as willow cabling, have been sufficient to repair minor erosion. In some areas, high silt banks are vulnerable to quick erosion loss and have required either channel re-alignment or boulder groynes for erosion control.

Gravel extraction has been variable over the years in this reach.

River enhancement expenditure has been between 0% and 3% of total annual expenditure.

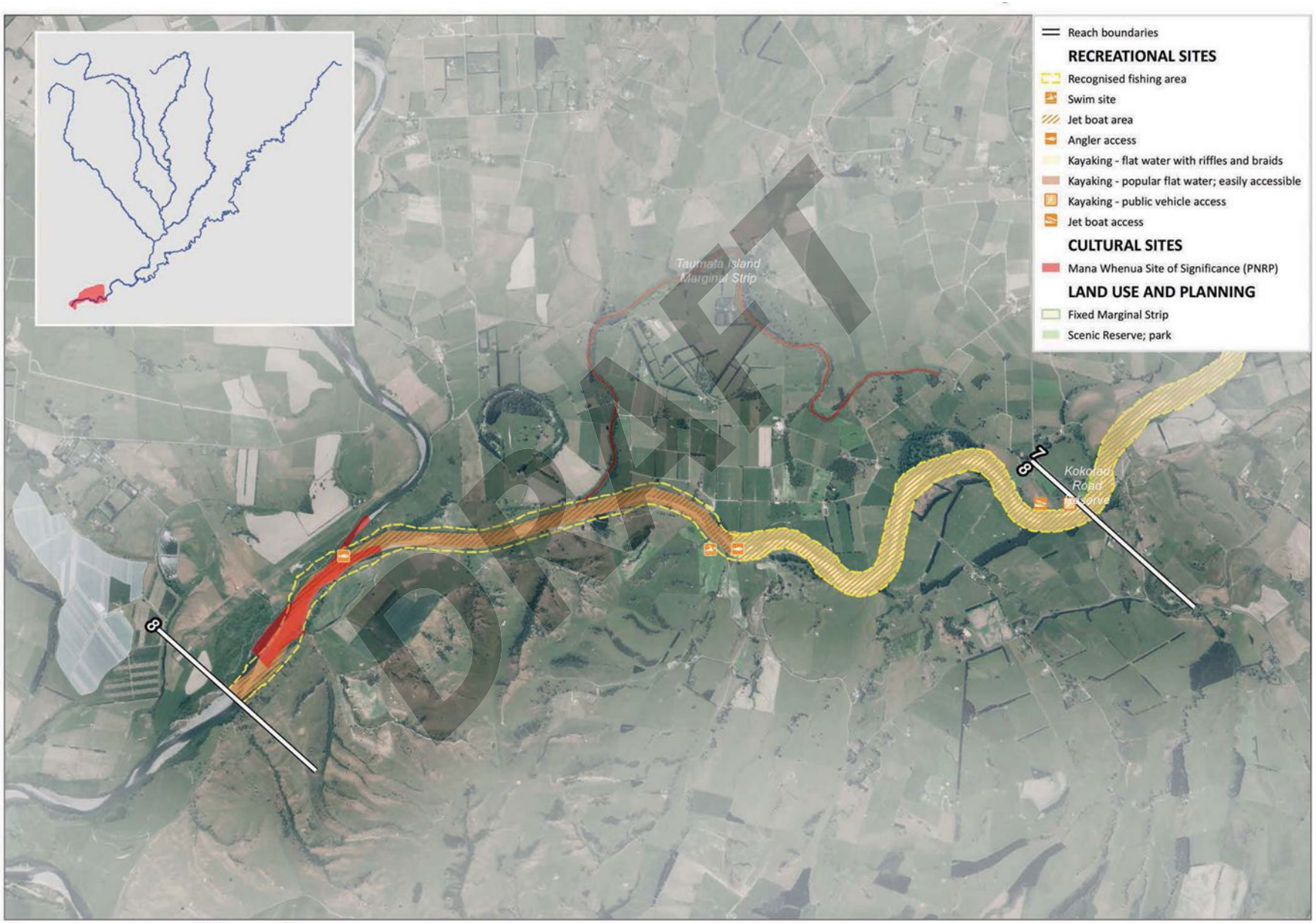
This FMP proposes to shift the focus of river maintenance towards more intensive implementation of vegetated buffers. The design buffers will be allowed to erode when and where appropriate. This method will substitute the immediate response to erosion issues with the machinery in channel works practiced in the past.

It is also planned to address the issues associated with scheme stopbanks and increase river enhancement works.

Key Floodplain Management Points

- Work with the asset owner of Kokotau Road Bridge to protect and maintain its operation
- Ensure that decisions regarding flood risk management take into consideration the outcomes of the Waiohine Floodplain Management Plan

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium	Angler access, kayak access, jet boat access, fishing, jet boating, kayaking and swimming	-	Mana whenua Sites of Significance (PNRP) - significant ancestral place, wāhi tīpuna; water utilised for healing, wai ora; source of medicinal plants, puna rongoā; source of weaving material, puna raranga; mahinga kai; eel harvesting place, mahinga tuna	Rural (Primary Production), Rural (Special), Road, River, Flood Protection and Mitigation.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



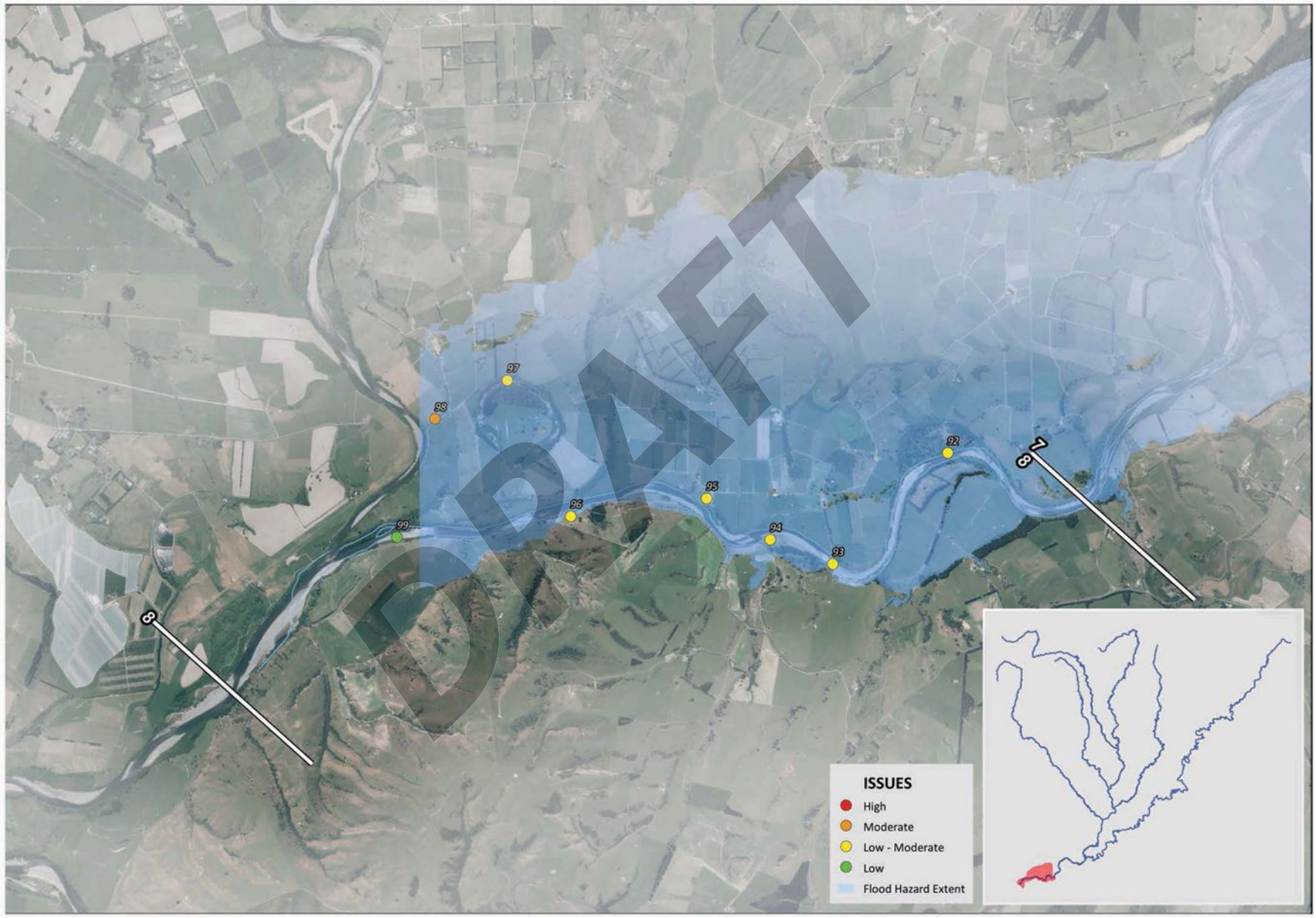
VALUES - Reach 8: Kokotau Bridge to Waiohine

Kokotau Bridge to Waiohine – Reach 8

Flood and erosion issues

Eight flood and erosion issues have been identified along this reach. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW	**Ruamāhanga River and Waiohine River Confluence [99]** Only a small amount of work is required in the area adjacent to the confluence. There are few problems to manage, however scheme members are concerned about their level of contribution vs the benefit received as a result.	
LOW TO MODERATE	**Stopbank [92]** A small stopbank with a low protection level, the stopbank sits within the erosion study area and is within the current erosion management buffer strip. **Channel alignment [93]** The buffer strips are very narrow through this area. **Channel alignment [94]** The design channel alignment in this location is difficult to maintain and it has been recommended that the design lines may need to be changed.	**Farm buildings [95]** A number of farm structures sit within the erosion study area, they are currently on the edge of the design buffer, but it is a very thin strip of trees at this location. **House [96]** Several buildings and a house sit within the erosion study area, and very close to the edge of the design buffer for the river. The design buffer is very thin at this location. **Taumata Lagoon [97]** Taumata Lagoon is a known fish habitat site and sits within the modelled extent of the 1% AEP flood.
MODERATE	**Herrick stopbank [98]** The Herrick stopbank is modelled as outflanked by the 1% AEP flood event from the Ruamāhanga models. The stopbank is part of the Waiohine Flood Protection scheme.	
HIGH		



ISSUES - Reach 8: Kokotau Bridge to Waiohine

Kokotau Bridge to Waiohine – Reach 8

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

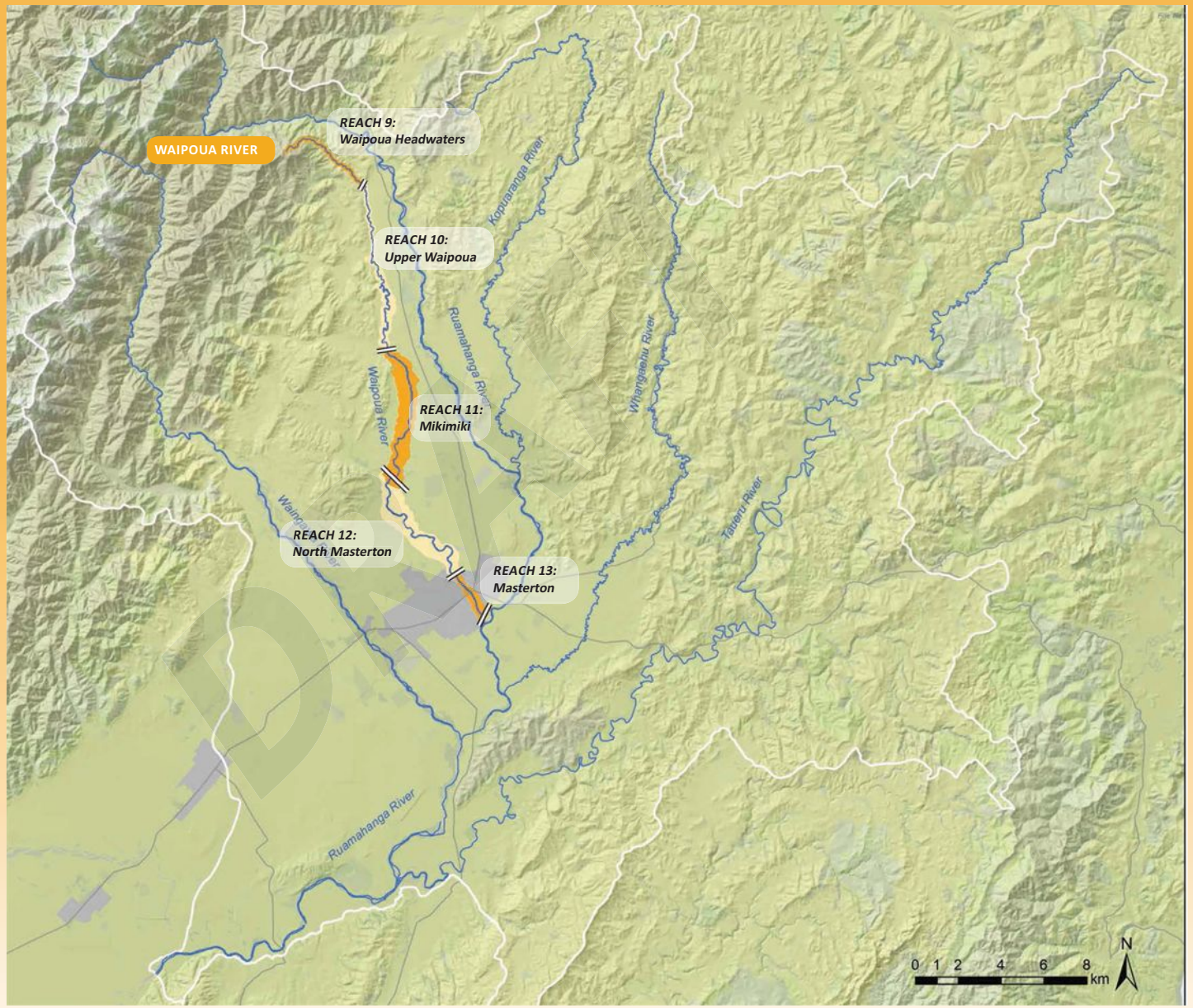
Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSE	92	Kokotau/ Taumata stopbank	River management	Retire the stopbank and remove it from asset register.	10%		GWRC	Landowners	Medium
	98	Herrick stopbank	River management	See Waiohine Floodplain Management Plan					
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/ retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					

Stopbank Summary

ISSUE ID	NAME	PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD 1/2/3/4/5 POOR)	CRITICALITY (LOW/MED/ HIGH)	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
92	Kokotau/ Taumata	Historically constructed to divert water round new channel alignment. Meander cut-off c.1950s. More aptly described as a training bank.	560	560	4	Low	Private individual	20-10%	Trees in stopbank and bank is no more than an area of high ground.	Retire stopbank, no further scheme maintenance, remove from asset register.	Low

RESPONSES - Reach 8: Kokotau Bridge to Waiohine



Waipoua River

3. Waipoua River

The Waipoua River has a catchment area of 149 km^2, with the main river channel from its headwaters to its confluence with the Ruamāhanga River reaching 30 km in length. The headwaters originate from the Blue Range of the Tararuas, flowing down through steep-sided gorges fringed by native forest. A large part of the catchment is within the lower foothills of the range. The river has three major tributaries: the Kiriwhakapapa Stream, the Mikimiki Stream, and the Wakamoekau Creek. These streams join the river as it flows across the Wairarapa plain, before passing through the Masterton urban area to its confluence with the Ruamāhanga River at Te Ore Ore.

The current Waipoua River Management Scheme covers an 18 km length from Mikimiki Bridge to the Ruamahanga confluence. The river channel is characterised as a steep gravel phase river with a relatively stable and narrow single thread channel. The Mikimiki reach and Masterton township reach have been straightened, steepened and shortened.

The naming of the Waipoua River is attributed to Haunui-a-Nanaia testing its depth with a stick prior to crossing, with 'wai' meaning water, and 'poua' meaning to plunge a stick in. The banks of the Waipoua housed one of the first Kainga visited by Europeans in the region, the precise location of which is not known.

The siting of Kaikokirikiri Pa close to both the Waipoua and Ruamāhanga Rivers provides an indication that there are cultural values associated with the area. In *Tawera to TeWhiti* (2005), Potangaroa and Rimene refer to Kaikokirikiri as the main pa of the Masterton area, and also note that the Waipoua used to flow at the foot of the pa. The proximity of the pa to the Waipoua River implies that the wider surrounding environment would have been regularly frequented and used for a range of cultural practices.

The Waipoua floodplain soils are formed from greywacke alluvial parent materials from the Tararua Ranges.

General Issues

The Waipoua is a river of multiple characters. In large flood events, it can be devastating. The river channel itself is fairly entrenched, but of relatively small capacity – only smaller floods can be contained without spilling water out on the floodplain. The erosion risk posed by the Waipoua River flows is smaller than for the other gravel rivers in the project area.

Of all rivers in the Wairarapa, flooding of the Waipoua has the potential to affect most people. The Waipoua River has been modelled as flooding northen Masterton in a large event, affecting approximately 2000 properties, and potentially flooding into 300 homes. There are areas of the northern bank close to Oxford Street with potentially very high flood water levels. There are also security issues of existing stopbank upstream of Masterton.

Additional locations that fall within or close to an identified hazard include the Massey University Riverside property, Mikimiki bridge, and the Mahunga golf course.

The Waipoua River also shares the three key gravel river management issues noted in the Ruamāhanga River section, namely:

- Degradation/aggradation
- Inconsistency in community acceptance of current erosion management practices
- The value of the rivers for recreation and habitat conflicts at times with river management works (the Masterton reach of the Waipoua River is heavily used for water-based and riverside recreation)

Waipoua Headwaters – Reach 9

Character

The Waipoua headwaters form from a small stream which flows from an enclosed steep native bush clad gully within the Tararua Forest Park and through the adjoining largely inaccessible grazed foothills. Patterns of vegetation typically reflect changes in grazing practice. Limited recreation occurs in the Tararua Ranges which adjoin this area outside the Forest Park.

Key Characteristics

- Small stream in bush lined gully
- Isolated foothills stream

Values

The Waipoua headwaters form a steep enclosed tributary stream, which flows through fenced and unfenced indigenous forest on the edge of the Tararua Forest Park, prior to extending into land used for rural primary production and predominantly established in pasture. There is a low level of landscape modification overall with medium to high scenic value.

Existing River Maintenance

GWRC does not maintain river scheme works for this reach. All channel works are initiated by landowners' request and funded using the general isolated works fund.

Key Floodplain Management Points

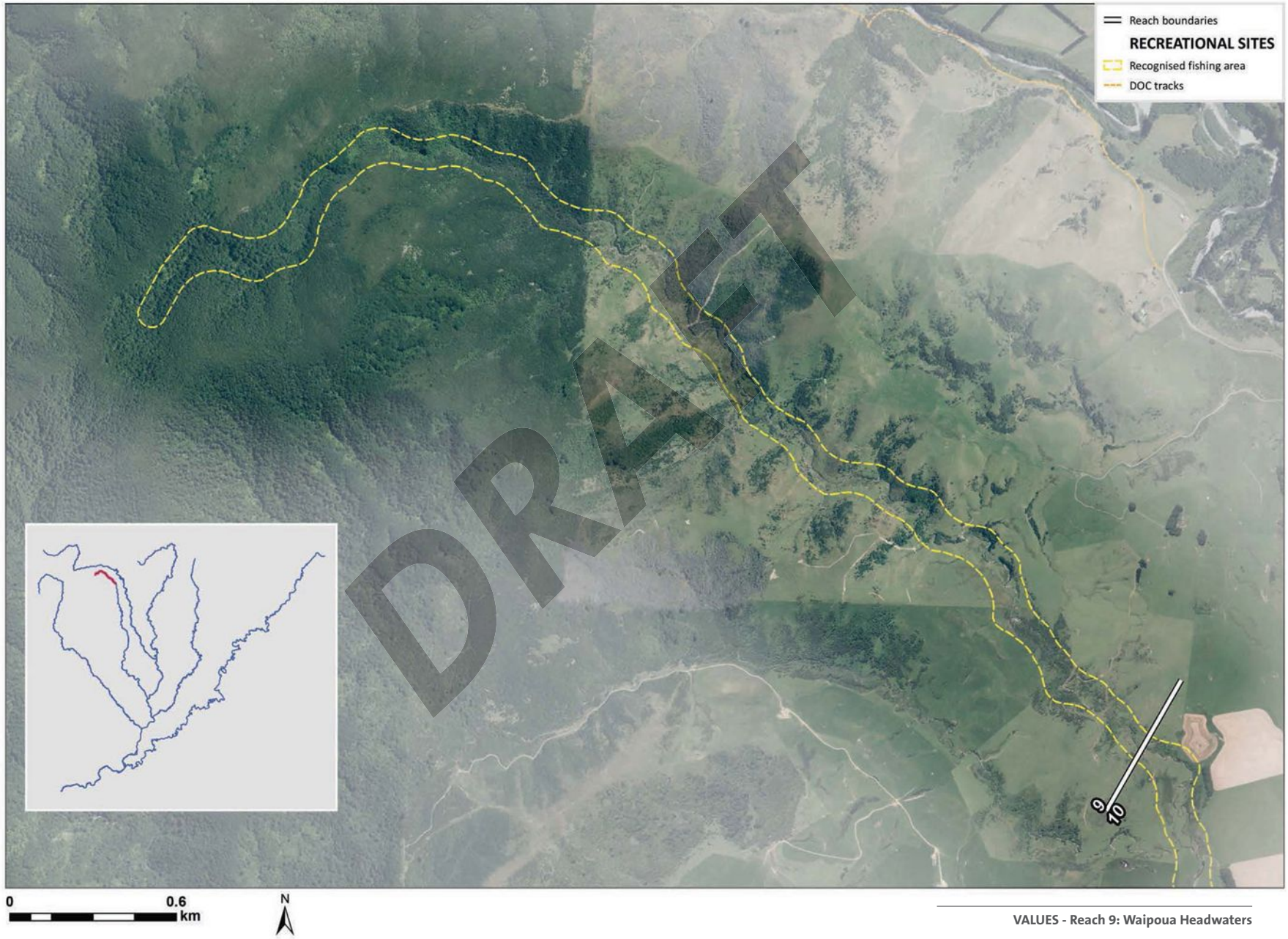
- Encourage continued recognition of the values and character of this reach
- Support initiatives that aim to preserve or improve the natural values of this reach

There is no intent to carry out any form of maintenance activity within this reach as part of the Floodplain Management Plan. There are no specific flood and erosion issues identified for this reach.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES
COMMON METHODS		Entire reach	River management	Isolated works support, Code of Practice
		Entire reach	Planning and policy	Protection against deforestation in upper catchment
		Entire reach	Emergency management	Emergency management planning, flood forecasting and warning system
		Entire reach	Environmental enhancement	Community Support Officer

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Low	Medium / High	Fishing	-	-	Rural (Primary Production), Road.	Fenced indigenous forest, Unfenced indigenous forest



VALUES - Reach 9: Waipoua Headwaters

Upper Waipoua – Reach 10

Character

This reach forms a meandering stream which transitions from the foothills of the Tararua Ranges onto the western edge of the Upper Wairarapa Plains to the Mikimiki Road bridge. As the Waipoua flows south, regenerating native vegetation gradually recedes as grazing becomes prevalent along the river margins. River terraces and cliffs are evident in some areas.

In the lower parts of this reach, areas of planting tend to be separated from the river margins, generating linear shelter belts along paddock boundaries. Wetlands separated from the main river are also common throughout this area.

Key Characteristics

- Transition from a small stream in vegetated foothills into a small river along grazed valley floor
- Localised cliffs, river terraces and rock banks
- Linear shelter planting separated from meandering river course

Values

This reach continues through rural land used for primary production and predominantly established pasture. The course of the river retains a meandering form with gravel beaches, pools and riffles, and flows through rolling farmland. It has a low level of landscape modification overall and medium to high scenic value.

Good early season fishing is identified along this reach of river, with access obtained from Kiriwhakapapa and Mikimiki Road Bridges and by negotiation with private land owners.

Terrestrial habitats with ecological value identified along this reach include areas of unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield, boulderfield, natural wetlands and ponds.

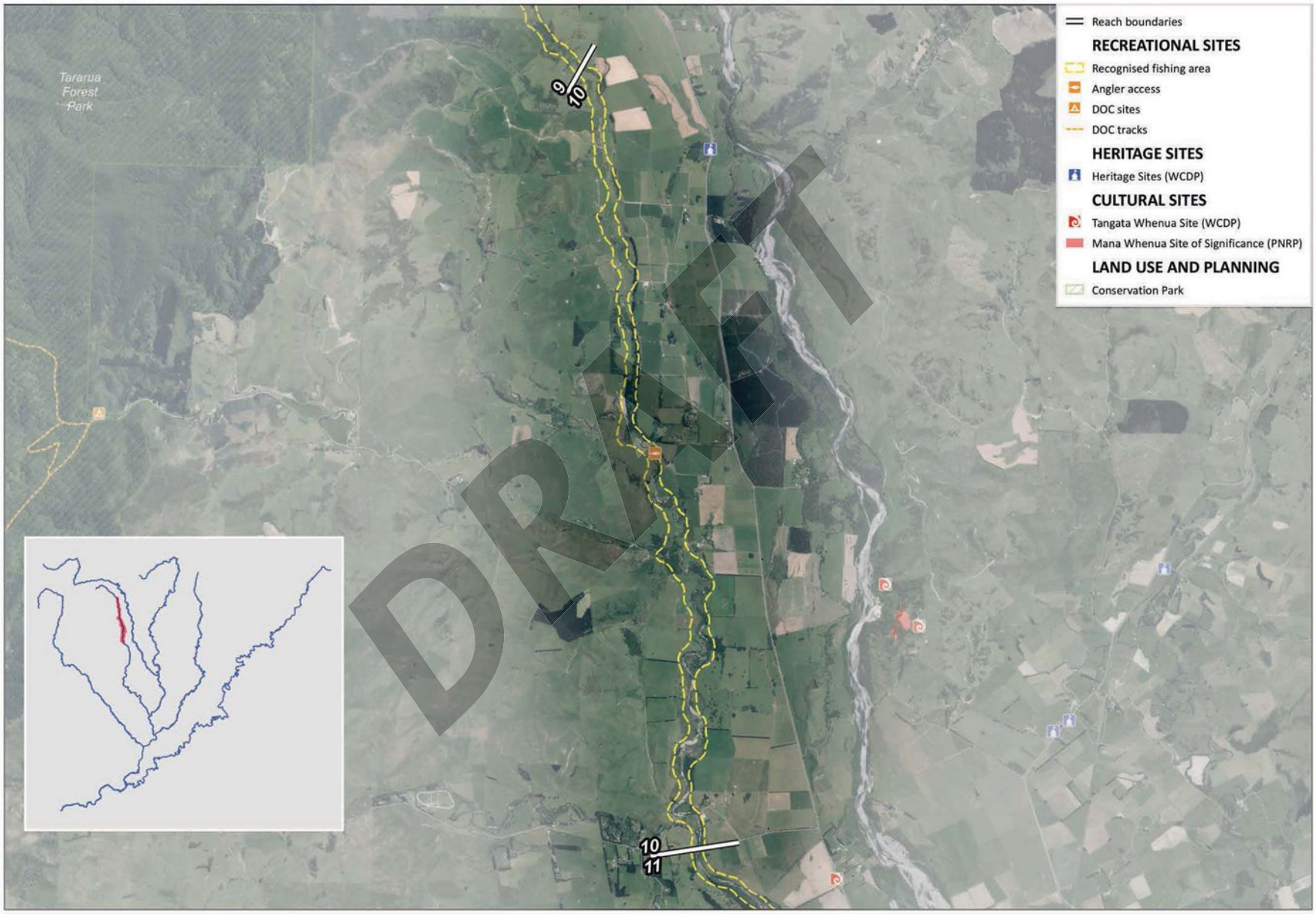
Existing River Maintenance

GWRC does not maintain river scheme works for this reach. All channel works are initiated by landowners' request and funded using the general isolated works fund.

Key Floodplain Management Points

- Apply isolated works policy to this reach, since no river scheme is established in this reach

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Low	Medium / High	Angler access, fishing	-	-	Rural (Primary Production), Rural (Special), Road, River.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



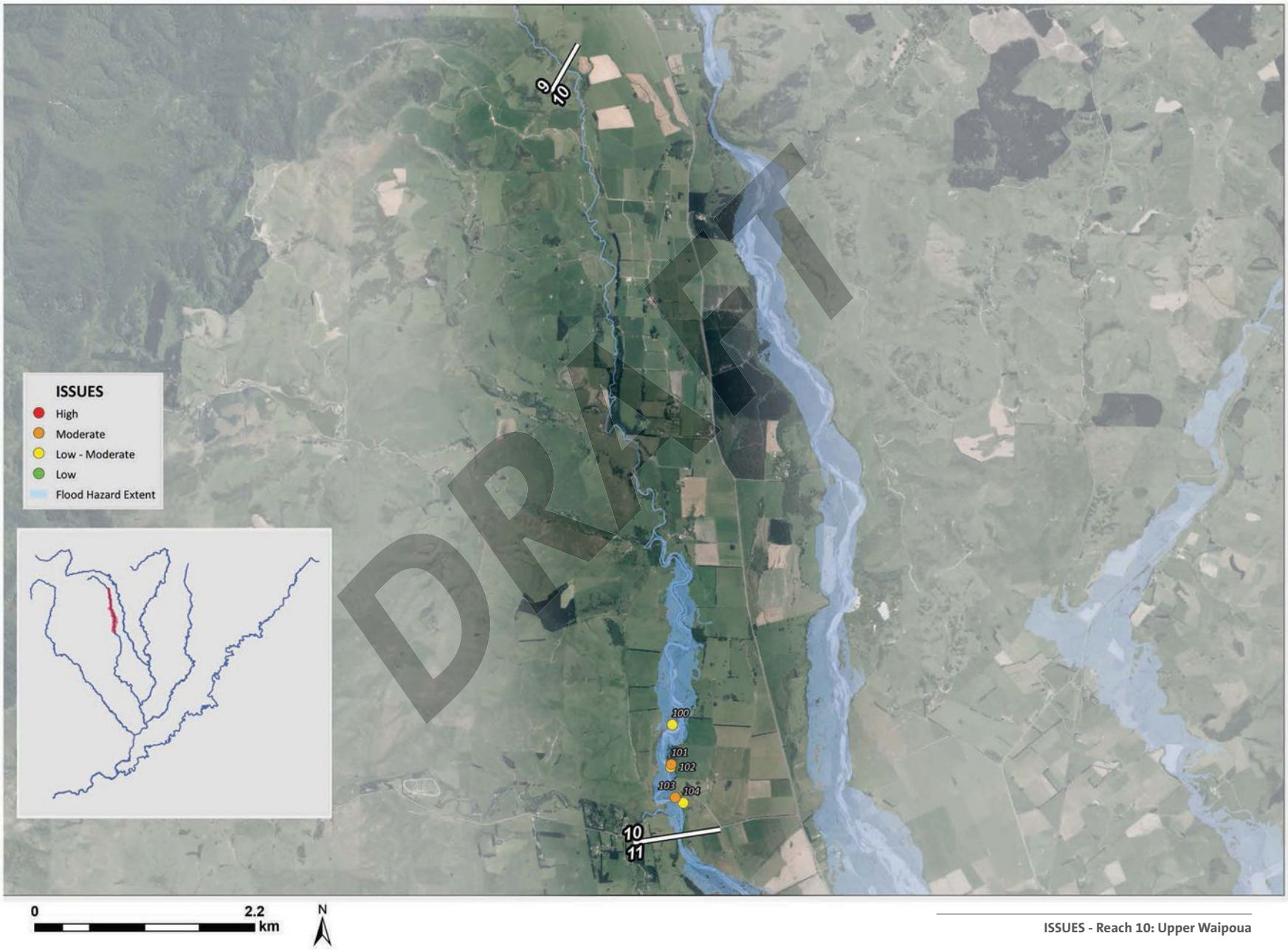
VALUES - Reach 10: Upper Waipoua

Upper Waipoua – Reach 10

Flood and erosion issues

Five flood and erosion issues have been identified along this reach. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW	
LOW TO MODERATE	**Channel alignment [100]** The channel alignment near the lower end of this reach is significantly outside the recommended design fairway. No management is currently carried out by GWRC in this area, and it is maintained privately. **Design channel alignment [102]** Design channel alignments extend beyond the upstream boundary of the scheme, however these are not used for any purpose. **Massey Farm sheds and bridge [104]** Several farm buildings and an access bridge sit within the erosion study area. No currently managed issues exist.
MODERATE	**Scheme boundary extent [101]** The scheme used to extend further upstream than Mikimiki Bridge. The scheme was shortened and upstream management taken over by a private organisation. **Massey Farms water irrigation intake [103]** The intake for the irrigation systems for Massey Farms sits within the erosion study area. No known issues exist with this intake.
HIGH	



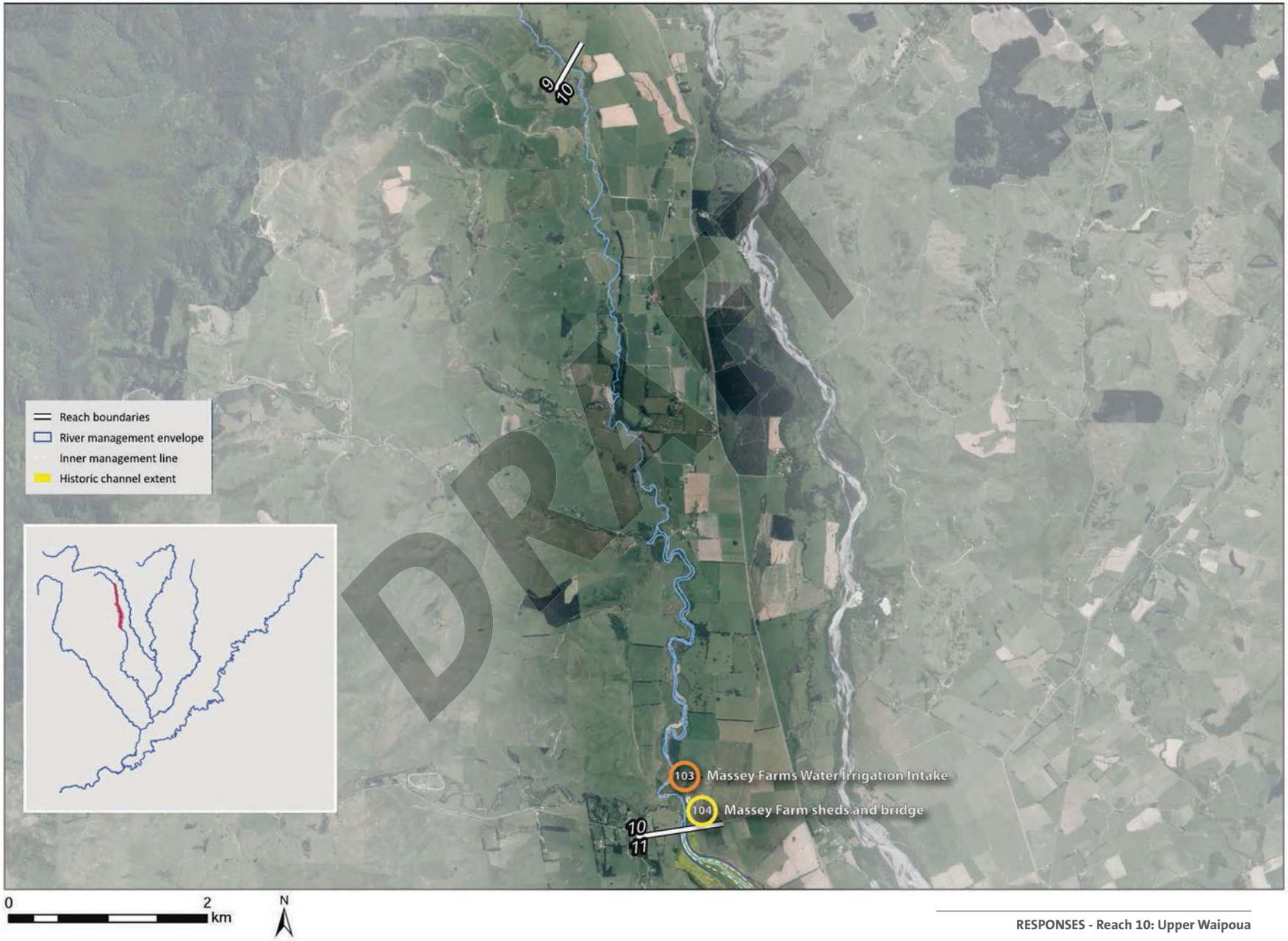
ISSUES - Reach 10: Upper Waipoua

Upper Waipoua – Reach 10

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	104	Massey Farm sheds and bridge	River management	Communicate the potential risk to landowner, continue monitoring the site			Landowner	GRWC	Low
	103	Massey Farms water irrigation intake	River management	River management envelopes will contribute to security of private water takes. Private water takes will have low risk of damage up to a 20% AEP event. Damage to structures is more likely up to a 5% AEP event. Communicate risk to the landowner.		20%	Landowner	GRWC	Low
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					



RESPONSES - Reach 10: Upper Waipoua

Mikimiki – Reach 11

Character

To the south of Mikimiki Road Bridge the river straightens along the toe of the Tararua Foothills. Along this reach, much of the river follows a single channel across bedrock and gravel. The margins of the river are typically shaded by steep banks accommodating narrow bands of mixed willow, poplar and kowhai. Scattered remnant totara are also common throughout adjoining areas of farmland.

Key characteristics

- Single straightened thread along toe of Tararua Ranges
- Steep shaded river banks with continuous margins of mixed willow, poplar and kowhai
- Scattered remnant totara dispersed through adjoining farmland

Values

This reach continues through rural land, which is predominantly pasture. Some beach re-contouring is carried out, and mixed exotic and native planting extends along the river margin, which has been fenced off from adjoining areas of farmland. This has resulted in a medium level of landscape modification overall whilst retaining medium to high scenic values.

Good early season fishing continues along this reach of river, with access obtained from Mikimiki Road Bridge and in other areas by negotiation with private land owners.

Terrestrial habitats with identified ecological value along this reach include areas of fenced indigenous forest, unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield, boulderfield, natural wetlands and ponds.

There are a limited number of specific cultural sites identified along this reach, which include an urupa.

Existing River Maintenance

GWRC maintains a river scheme within this reach and collects scheme rates based on benefit classification. It is estimated that approximately $8,000 per river km per annum is spent for river maintenance works in this reach.

Annual maintenance works objectives include:

1. To maintain channel fairway free of vegetation and obstruction
2. To maintain the channel within the river design lines. This include establishment and maintenance of vegetated buffer zone along the river edges
3. To install appropriate structural protection for river erosion control
4. To maintain scheme stopbanks to “as built” standards
5. To control gravel extraction to sustainable levels
6. To enhance and protect river recreational access, wildlife and fishery values
7. To respond to flood events less than 20% AEP
8. To contribute funds to flood damage reserves to enable response to large flood events

The channel of Waipoua River has been significantly altered and constrained since the beginning of scheme management works in the 1950s. Over the years a significant number of channel straightening works structures have been required to maintain the river within the narrow channel.

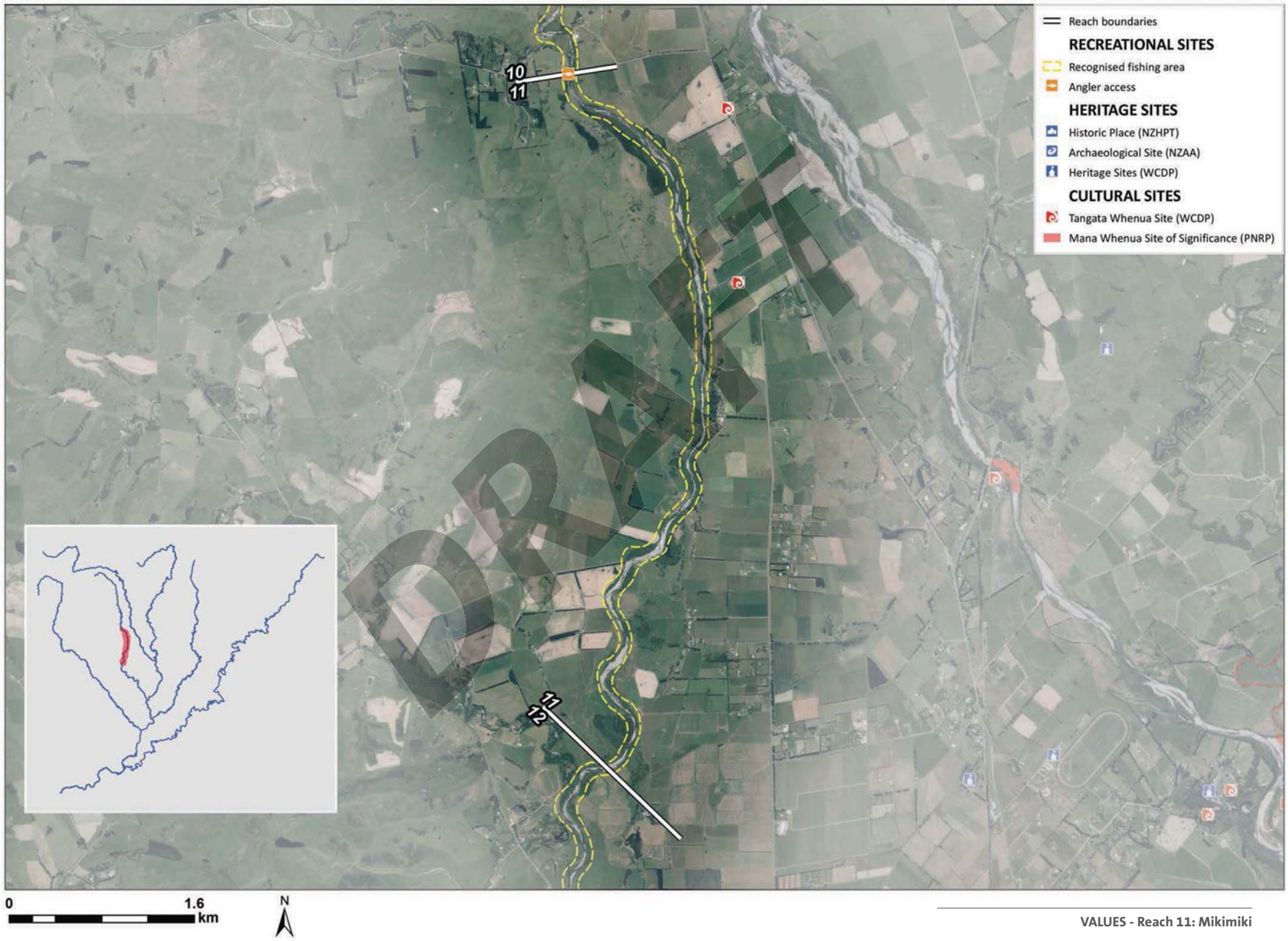
Generally the annual river maintenance activities vary significantly from year to year. Some years only minimal channel disturbance has been required, whereas other years significant channel realignments works have been carried out.

Following this FMP, river maintenance activities in this reach will see more works to maintain stopbank condition, river enhancement opportunities will be better explored and supported and there will be a renewed focus on buffer implementation.

Key Floodplain Management Points

- Establishment of a better flow recorder and flood warning site
- Work with the asset owner of Mikimiki Road Bridge to ensure its continued protection and operation

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium / High	Angler access, recognised fishing area	-	Urupa	Rural (Primary Production), Rural (Special), Road, River.	Fenced indigenous forest, Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



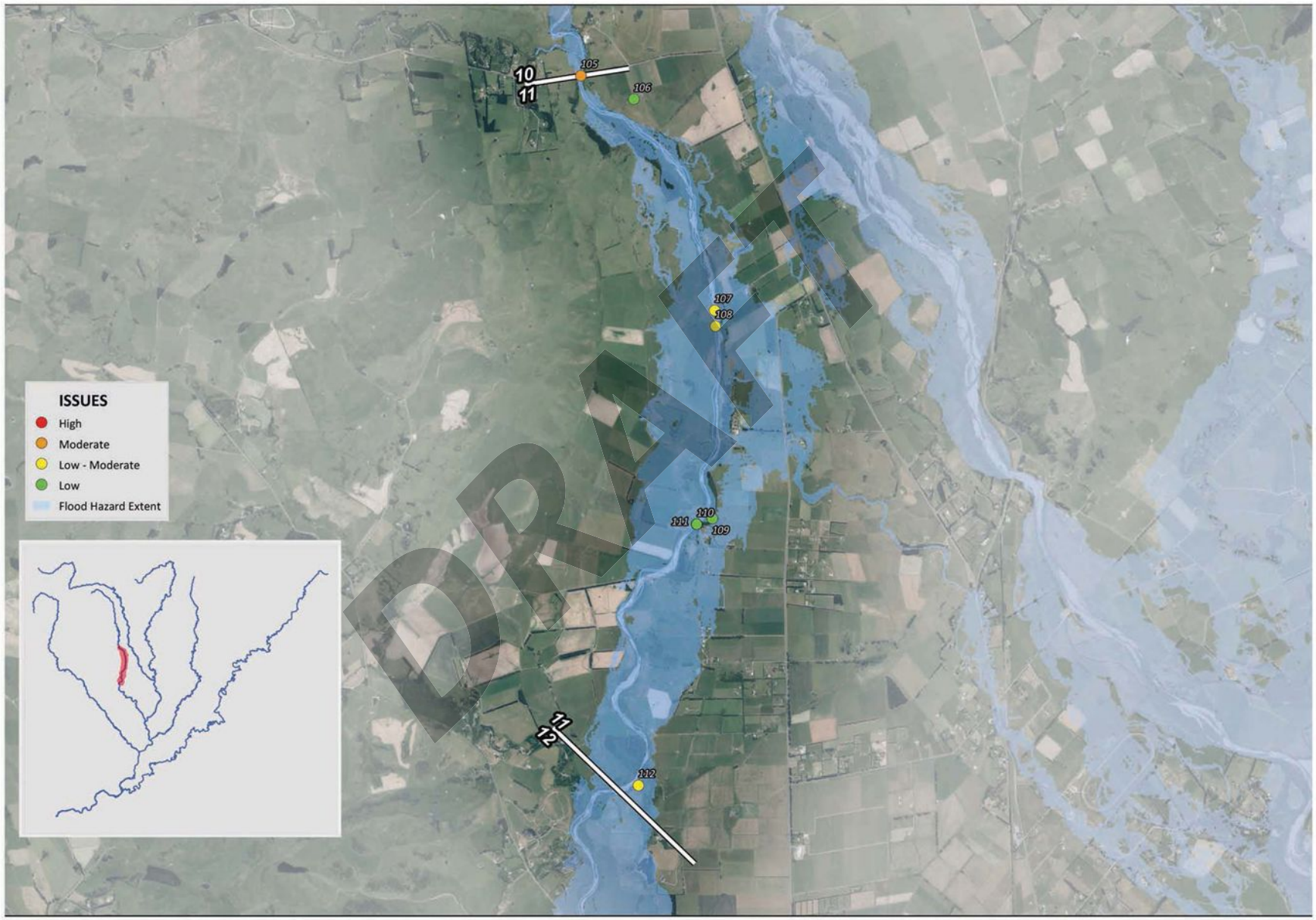
VALUES - Reach 11: Mikimiki

Mikimiki – Reach 11

Flood and erosion issues

A total of eight erosion and flood management issues are identified along this reach. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW	**Farm building [106]** A farm building sits within the modelled 1% AEP flood extent. No currently managed issues exist. **Farm building [109]** A farm outbuilding is located within the 1% AEP flood extent and the erosion study area. No currently managed issues exist. **Private telecom line [111]** A private telecom line runs under the river bed. It is potentially susceptible to damage from erosion and machine work in this area.
LOW TO MODERATE	**Design channel alignment [107, 108]** The design fairway narrows from a width of 85m to 45m. This is unusual and further investigations are required to determine if this is a suitable design channel width. **Stock access / private bridge [110]** A privately owned access bridge sits within the erosion study area and is potentially at risk of damage linked to bed level changes, bank erosion and large flood events. **Private water intake [112]** A private water intake for Watson Lake is located within the erosion study area. No currently managed issues exist.
MODERATE	**Mikimiki Bridge [105]** There is ongoing bed degradation occurring in the vicinity of the bridge. This affects the road, bridge, and water level recorder site. Work has been carried out periodically to tackle scour issues.
HIGH	



ISSUES - Reach 11: Mikimiki

Mikimiki – Reach 11

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	105	Mikimiki Bridge	River management	Work with MDC regarding plans to replace or strengthen the bridge including stabilising the water level recorder site			MDC	GWRC	Medium
	112	Private water intake	River management	River management envelopes will contribute to security of private water intakes. Private water takes will have low risk of damage up to a 20% AEP event. Damage to structures is more likely up to a 5% AEP event. Communicate risk to the landowner.		20%	Landowners	GWRC	Low
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					

RESPONSES - Reach 11: Mikimiki

North Masterton – Reach 12

Character

To the north of Masterton, the Waipoua River moves away from the toe of the Tararua Ranges and follows a meandering course across the Wairarapa Plains. The margins of the river reflect increasing rural lifestyle use with varied willow planting interspersed with poplar and shelterbelts. Bank modification also commences in the lower part of this reach.

Key characteristics

- Meandering single channel
- Increasing rural lifestyle settlement along margins
- Range of willow, shelter belt, amenity planting and hard edges along margins.

Values

This reach flows through increasing rural residential settlement to the north of Masterton. Some beach re-contouring and rock groynes have been established along the edges of the river. Willow and gorse is frequent through this area, with scattered totara also accommodated through adjoining areas of farmland. This has resulted in a medium level of landscape modification overall with medium scenic values.

Good early season fishing continues along this reach of river, with access obtained from Paierau Road Bridge and by negotiation with private land owners. Mahunga Golf Course also occupies the true left bank along this reach.

Terrestrial habitats with identified ecological values along this reach include areas of unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield and boulderfield and natural wetlands and ponds.

There are limited cultural sites identified along this reach encompassing historic pā sites. Levin's Woolstore and Matahiwi College are also identified heritage sites within the WCDP.

Existing River Maintenance

GWRC maintains river scheme within this reach and collects scheme rates based on benefit classification. It is estimated that approximately $8,000 per river km per annum is spent for river maintenance works in this reach.

Annual maintenance works objectives include:

1. To maintain channel fairway free of vegetation and obstruction
2. To maintain the channel within the river design lines. This include establishment and maintenance of vegetated buffer zone along the river edges
3. To install appropriate structural protection for river erosion control
4. To maintain scheme stopbanks to "as built" standards
5. To control gravel extraction to sustainable levels
6. To enhance and protect river recreational access, wildlife and fishery values
7. To respond to flood events less than 20% AEP
8. To contribute funds to flood damage reserves to enable response to large flood events

The channel of Waipoua River has been significantly altered and constrained since the beginning of scheme management works in the 1950s. Over the years a significant number of erosion protection structures have been constructed to maintain the river within the narrow channel. The hard bank protection is not consistent throughout this reach, with some areas having a vegetated buffer management style.

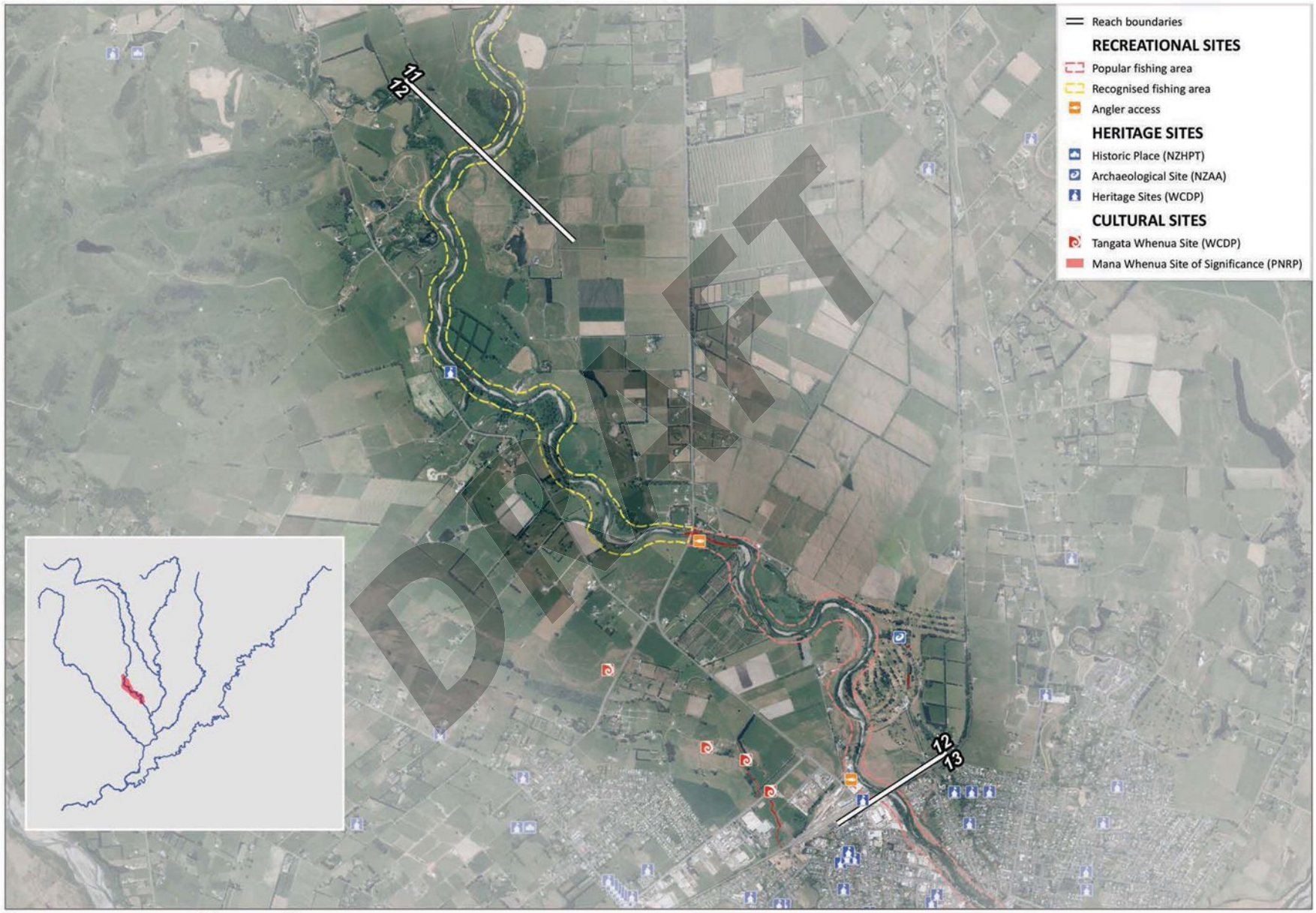
Generally the annual river maintenance activities vary significantly from year to year. Some years only minimal channel disturbance has been required, whereas other years significant channel realignments works have been carried out.

Following this FMP, river maintenance activities in this reach will see more works to maintain stopbank condition, river enhancement opportunities will be better explored and supported and supported, and there will be a renewed focus on buffer implementation.

Key Floodplain Management Points

- Raise the awareness of flood risks and improve the safety of Paierau Road and Matahiwi Road during large floods.
- Work with the community in the vicinity of Paierau Road and the Serpentine confluence to reduce their vulnerability to flooding
- Work with the infrastructure owners of Paierau Road Bridge and the rail bridge to ensure their continued security and operation

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium	Angler access, popular and recognised fishing areas	Levin Woolstore, Matahiwi College (WCDP)	Historic pa sites, mahinga kai (PNRP)	Rural (Primary Production), Rural (Special), Road, River, Industrial, Railway, Flood Protection and Mitigation, Intersection Improvement.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



VALUES - Reach 12: North Masterton

North Masterton – Reach 12

Flood and erosion issues

A total of 23 flood and erosion issues have been identified along this reach on account of its close proximity to Masterton. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW

Private rock line [114]
A rock line has been constructed to protect a water intake, and private property. This is maintained infrequently by GWRC flood protection.

Akura nursery [132]
Akura nursery floods from overland flows originating upstream of the Paierau Road Bridge.

LOW TO MODERATE

Channel alignment [113]
The buffer strip downstream of the boundary between reach 11 (Mikimiki) and this reach has been identified as being too narrow. It is recommended that a wider buffer is established.

Water intake [115]
A private water intake for a lake is situated within the erosion study area. This intake has been protected by privately funded erosion protection works.

Channel alignment [116]
The buffer planting on the true right bank has been protected behind a private rock line. This has reduced vulnerability of this buffer area while the rock line is properly maintained.

Matahiwi Road [117]
A section of Matahiwi Road sits within the erosion study area and is modelled as affected by the 1% AEP flood up to a depth of 0.6m. No currently managed issues exist.

Houses [118, 119, 120]
Several houses are located within the erosion study area and are modelled as affected by the 1% AEP flood event. No currently managed issues exist.

Stopbank proximity to river [121]
The left bank stopbank sits on the edge of the active channel and within the erosion study area. There has been past consideration of relocation of the active channel away from this stopbank, and change of design fairways.

Low quality stopbank [122]
The stopbank is located very close to the river and at higher risk of erosion. It contains substantial tree growth making it vulnerable to storm damage and other failure mechanisms.

Serpentine confluence [123]
Aggradation at the mouth of the Serpentine Stream confluence with the Waipoua is increasing risk of flooding and blockages.

Houses [125]
A house is located within the erosion study area. No currently managed issues exist.

Houses [128]
Houses on Matahiwi/Akura Road are at risk of flooding in a modelled 1% AEP flood event. No currently managed issues exist.

Paierau Road Bridge [126]
The Paierau Road bridge capacity is adding to upstream flooding extents due to its limited capacity to convey flood flows.

Stopbank [130]
The quality, standard, alignment and purpose of the combined flood protection works between the Serpentine confluence and the vicinity of the Paierau Road Bridge are not well defined.

Stopbank [131]
The alignment of the stopbank on the right bank of the river downstream of the Paierau Road Bridge gradually approaches the channel, and at its downstream end is located within the erosion study area.

Stopbank [133]
The stopbank on the left bank of the river is within the erosion study area and has in the past required erosion protection works to protect it from erosion issues.

Houses [134]
Houses are located within the modelled 1% AEP flood extent. No currently managed issues exist.

Mahunga Golf Course [135]
The golf course is located within the modelled 1% AEP flood extent and the erosion study area. Areas of the golf course have eroded in the past.

Channel narrowing [136]
The river channel becomes increasingly confined as it approaches the railway bridge upstream of Masterton. The channel at the Railway Bridge is highly constricted, which limits the amount of flow that can pass under the bridge and into the Masterton reach. This causes modelled upstream flooding of Mahunga Golf Course and properties on the western bank of the river and leads to a modelled eventual overtopping of the railway line near the station, north of Masterton. This will be addressed as part of Volume 3.

Channel alignment [137]
No design fairways have been created for the section of the Waipoua which flows through Masterton. This creates management challenges due to a lack of guidance for river engineers

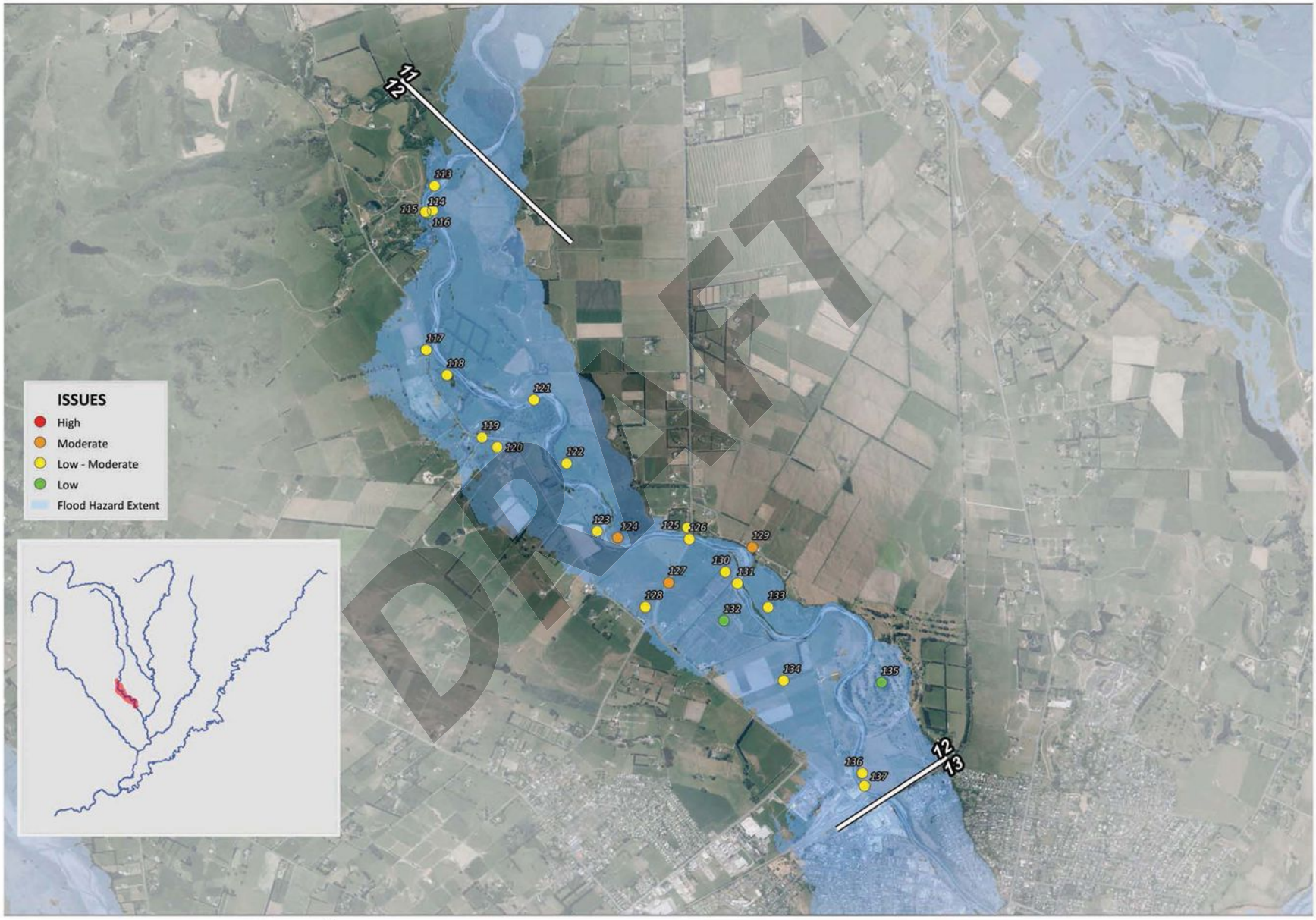
MODERATE

Serpentine stopbank [124]
The Serpentine stopbank is of concern because while it partially protects a number of properties, the management objectives for the structure are unclear. It is also located very close to the river and within the erosion study area.

Paierau Road [127]
The stopbanks upstream of the Paierau Road Bridge overtop frequently, and the road subsequently floods. This is compounded by the northern approach to the Paierau Road Bridge which doesn't provide clear visibility of flood prone area to someone approaching at speed.

Houses [129]
Houses on the left bank are located within the erosion study area. No currently management issues exist.

HIGH



ISSUES - Reach 12: North Masterton

North Masterton – Reach 12

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	114	Private Rock line		Formalise GWRC maintenance for the site and confirm ownership			GWRC	Landowner	Low
	132	Akura nursery	Emergency management	Inform landowner of the potential risk.			GWRC		Low
	117	Matahiwi Road	River management	Inform Akura Nursery about the risks to the road		1%	MDC	GWRC	Low
	122 124 133 131 130 121	Stopbanks	River management	Retreat or remove. Apply rural stopbank common method	Varies		GWRC	Landowner	Medium
	123	Serpentine confluence	River management	Apply bed level monitoring common method to identify the need for a control structure			GWRC		Medium
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					

Stopbank Summary

ISSUE ID	NAME	PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD 1/2/3/4/5 POOR)	CRITICALITY (LOW/MED/ HIGH)	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
121	Matahiwi to Serpentine	Flood protection to multiple properties and public road up to around 5-10% AEP	1,150	580	Ranges from 2 - 4	Med	Private multiple/Public Road	20-10%	Trees in stopbanks	Re-align stopbank where it sits within buffer. May be a retreat scenario in reaction to flood events.	Medium
130 124	Serpentine to Paierau	Flood protection to multiple properties and public road up to around 5-10% AEP	1,000	630	Ranges 2 - 3	Med	Private multiple/Public Road	c20-10%	Vegetation/trees in stopbank	Re-align stopbank where it sits within buffer. May be a retreat scenario in reaction to flood events.	Medium
122	Left Bank to Paierau	Preventing course change? Protecting around 55Ha of productive land from flooding up to a 5% AEP	2,400	980	2	Low	Individual landowners	20-10%		Designation of land along preferred alignment (priority). Continue existing asset management until unviable (TBC at later date).	Medium
131	Akura	Preventing course change? Protecting around 40Ha of productive land from flooding up to a 5% AEP	1,050	645	3	Low	Individual landowners	20-10%	Vegetation/trees in stopbank	Designation of land along preferred alignment (priority). Continue existing asset management until unviable (criteria TBC).	Medium
133	Left Bank Akura	Preventing course change? Protecting around 10Ha of productive land from flooding up to a 5% AEP	900	800	2	Low	Individual landowner	20-10%		Initial FMP implementation. Continue existing asset management. Long-term implementation explore legacy asset partial abandonment/isolated works.	Medium

RESPONSES - Reach 12: North Masterton

Major Project Response: Paierau Road

The issue

The southern approach to Paierau Road bridge is inundated to a depth of approximately 0.5m in a 20% AEP flood and up to 1.0m in a 1% AEP flood. Traffic approaching from the north has a maximum sight distance of approximately 100m, which is considered insufficient within a 100km/hr speed limit zone. Masterton District Council currently operates a road closure procedure but this has limited lead time as there is currently no rainfall based flood forecasting used for emergency notifications. It is proposed to provide permanent warning signs at this site as well as improved road closure warnings to ensure the road is closed before it is significantly inundated.

Opportunities

The proposed response provides improved warning for drivers and will ensure the road is closed in a timely fashion to avoid the risk of a vehicle hitting the deep flowing water at high speed.

Relationship with common methods

The southern approach is inundated due to the low-level rural stopbanks overtopping upstream of Paierau Road (Issue ID 331). These stopbanks are considered to provide an adequate level of protection in line with the Rural Stopbanks Policy provided for in the common methods. It is noted that within this reach there are sections of stopbank within the buffers which could be retreated, particularly in response to a flood related failure. This is also referred to in the Stopbank Assessment Rating Priority Table – Stopbank ID 14 Serpentine to Paierau.

The capacity of the bridge is also noted as a factor that contributes to the frequency of the road flooding (Issue ID 75). It is not considered cost effective or consistent with the visions and aims to enlarge the channel and bridge and to increase the height of stopbanks in this reach to contain flood waters.

Description

General

Permanent warning signs “Road May Flood” to be added the northern and southern approaches and an improved warning system for road closures developed based on rainfall triggers.

Costs - $20,000 ($10,000 new signs, $5,000 improved warning system + $5,000 contingency)

Implications

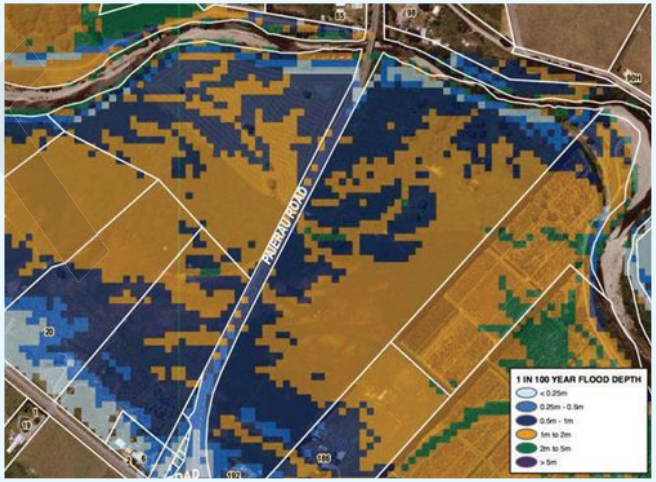
Traffic will be diverted when road is inundated resulting in longer travel times.

Priority

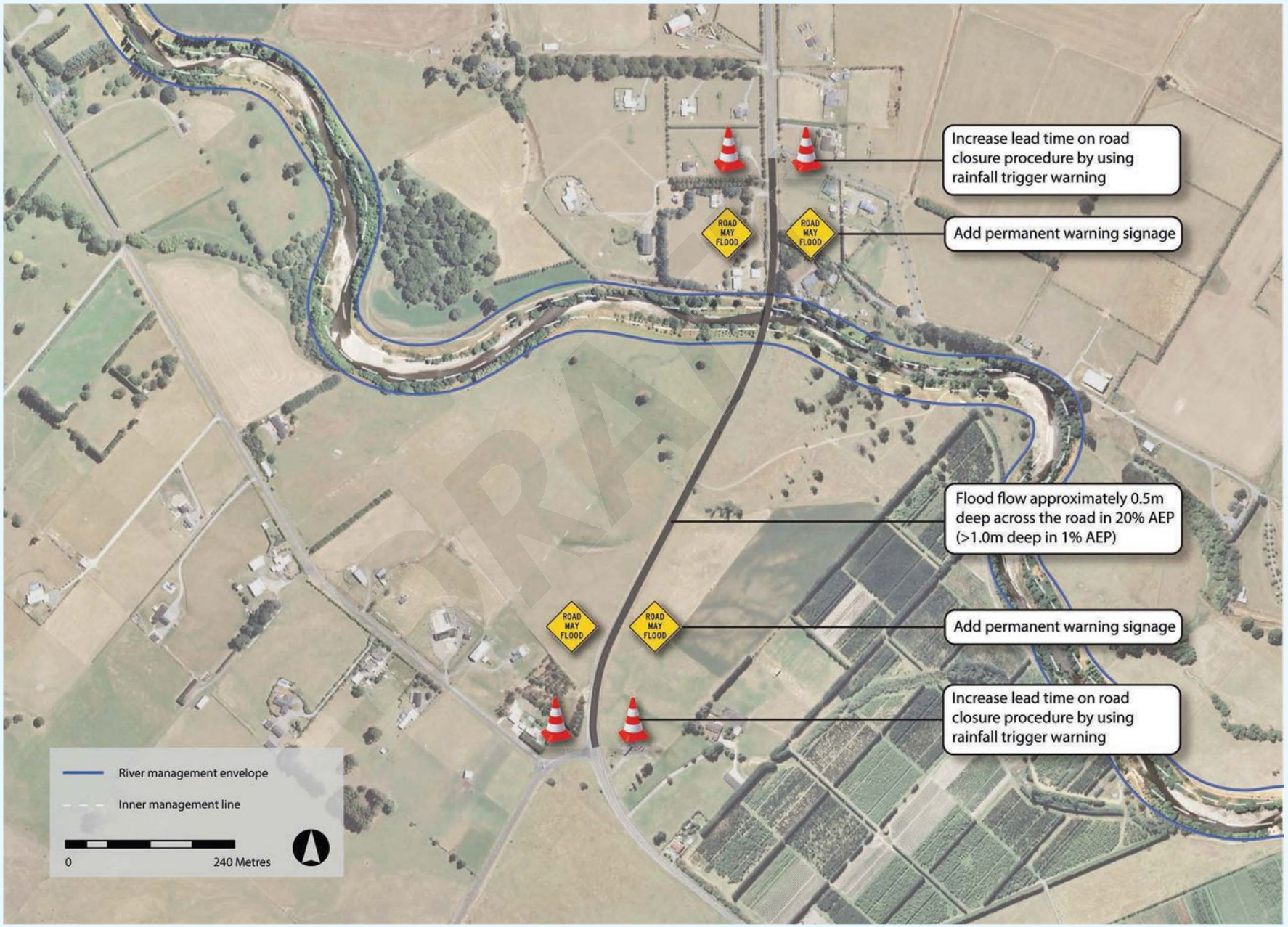
Medium

Level of Service

Currently a warning is provided to MDC Roading Engineer based on 20% AEP flood being exceeded at the Mikimiki flow recorder on the upper Waipoua River. This provides 90 minutes for contractors to mobilise and establish manned road closures at Loopline and Matahiwi Road. A rainfall based warning could potentially increase this warning time to 2.5 hours providing greater certainty of completing road closure before the road becomes innundated.



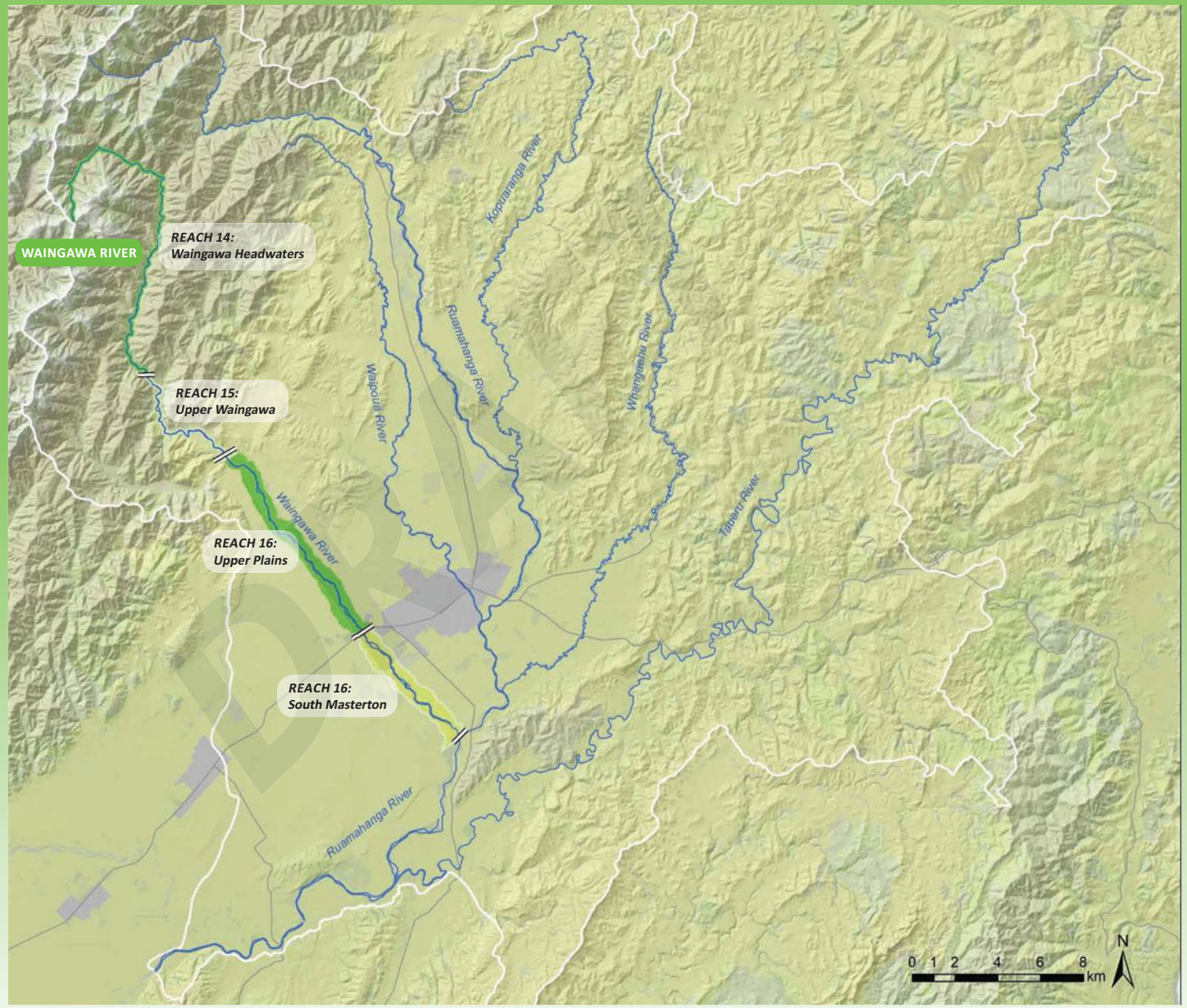
REFERENCE NUMBER	PROPOSED MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR PROPOSED RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
74	Permanent warning signs and improved flood forecasting	90 min warning from Mikimiki	Risk of not responding in time.	Road closure completed prior to inundation in 20% AEP event	To increase the safety of road users by providing permanent warning signs and increasing lead time for road closure to 2.5 hours.	MDC/GWRC	Medium	$20,000	Capital funding TBC


Increase lead time on road closure procedure by using rainfall trigger warning
Add permanent warning signage
Flood flow approximately 0.5m deep across the road in 20% AEP (>1.0m deep in 1% AEP)
Add permanent warning signage
Increase lead time on road closure procedure by using rainfall trigger warning
ROAD MAY FLOOD
River management envelope
Inner management line
0
240 Metres

Masterton - Reach 13

The Masterton Reach of the Waipoua River is being completed separately.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium / High	Medium	Angler access, popular fishing area, kayaking, swimming	Building Facade - 4 Queen Street, Queen Elizabeth Park (WCDP)	Historic house site	Rural (Special), Road, River, Residential, Industrial, Railway, Commercial, Flood Protection and Mitigation, Recreation, Cemetery, Electricity Distribution, State Highway.	Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



Waingawa River

4. Waingawa River

The Waingawa River flows from the Tararua Ranges into the Ruamāhanga River to the south of Masterton. The upper reaches of the river commence in the Tararua Forest Park and flow out onto the Wairarapa Plains from the confluence with the Atiwhakatu Stream near Kaituna.

The Waingawa River was known historically to change its course often. As the river moved and shifted across the plains, some sections of river channel were left isolated. Over time these isolated river channels developed into wetland areas. The name Waingawa stems from the name given by Haunui-a-Nanaia, 'Waiawangawanga' which means troubled or uncertain waters. Like many traditional names, the Waiawangawanga has been shortened to Waingawa for easy pronunciation.

Within the Upper Wairarapa Plains, the river widens to form a broad semi-braided form which follows a fairly direct alignment towards the Ruamāhanga River over a distance of approximately 17km. Here the bed of the river is typically contained by willow margins, with further pockets of remnant forest also retained on terraces which step from the river.

The Waingawa floodplain soils are formed from greywacke alluvial parent materials from the Tararua Ranges. Land use in the catchment is a mix of native forest in the upper catchment transitioning to a range of primary production activities within the Wairarapa Plains. The middle section of river also adjoins rural lifestyle development, and urban areas (Masterton) including the Hood Aerodrome.

Key recreational values include kayaking and wilderness fishing in the upper catchment, with much reduced amounts of these occurring downstream of the foothills (although kayakers are frequently seen in this area close to good vehicle access points where they can get out of the river). Jet boating is also noted as a recreational activity in the lower reaches.

The Waingawa River is an important ecological corridor. Of particular note is the Atiwhakatu Stream tributary, which is noted as a significant fish spawning area. Both rivers contribute to the diversity of fish species present in the study area, and are important for both native and exotic species. The Waingawa River is also the second of the important nesting sites for banded dotterels, and a number of other valued species have been recorded along the river including black shag, pied stilt, black billed gull, and NZ pipit.

The ecological value is reflected in its cultural values, which are linked to wetland areas that formed in cut off channels and old backwaters, becoming areas valued for mahinga kai. It is important to note that the mahinga kai value of the Waingawa River carries across to both Parkvale Stream and Booths Creek. Cultural relationships between these streams, the Waingawa River, the Mangatarere River and the Waiohine River, illustrate the intricacies and complex interconnectedness present within catchments.

General Issues

The Waingawa River is respected by people who live nearby as a high-energy river. This river is mostly entrenched within a fairly tight, naturally-confined floodplain. This means that much of the flooding – even in a large flood event – is contained by naturally-formed historic river terraces from where it enters the Wairarapa Plains until it joins the Ruamāhanga River near Te Whiti. The erosion risk, both modelled and observed, is of much greater concern. The energy of the river regularly reshapes its main channel, and after each flood event the bed of the river is scattered with the remains of trees and vegetation eroded from banks.

Areas of high value, healthy native forest in the upper catchment of the Waingawa are exposed to flooding. On the narrow floodplain within the foothills, the land-use is predominantly lifestyle properties and small holdings with some primary production activities. A small band of industrial processing and production activities is located adjacent to Masterton around the two bridges.

The Waingawa River also contains a number of locations where critical or high value infrastructure sits within or near to the active river corridor. These include the water supply intake and pipeline to Masterton, and the associated treatment plant. In addition, the Masterton-Wellington railway line and SH2 cross the river near Masterton. The Hood Aerodrome runway has also been threatened by erosion risk on a number of occasions. Measurements of the land lost to erosion between 1941 and 2012 along the length of the river indicate that approximately 210 hectares of land which would not have previously been classified as river channel has been lost to erosion. In addition the Waingawa River creates challenges for the establishment of vegetated buffer areas due to its deeply cut channel with areas of vertical river bank.

Waingawa Headwaters – Reach 14

Character

The headwaters of the Waingawa River flow through the Tararua Forest Park. In this area the river passes through bush clad gullies with rock lined gorges, narrow boulder gardens with rapids and pools extending a wilderness character along the course of the river.

Key Characteristics

- Bush clad gullies
- Rock lined gorges and bolder gardens
- Limited visible human presence

Values

The headwaters of the Waingawa flow through fenced and unfenced indigenous vegetation protected as part of the Department of Conservation Estate. Rock lined gorges framed with native beech and podocarp forest exhibit very low levels of landscape modification with corresponding very high scenic value. The entirety of this reach is zoned Rural (Conservation) in the WCDP (2013).

Due to the underlying strong wilderness and scenic values, this reach has a number of popular walking and tramping tracks with huts leading into the Tararua Ranges. Additionally it sees use for wilderness fishing, and some grade 2+ kayaking along boulder gardens and sharp ends. Mitre Flats is a popular fishing and kayaking area along this reach of river with foot access only.

Existing River Maintenance

GWRC does not maintain river scheme works for this reach. All channel works are initiated by landowners' request and funded using the general isolated works fund.

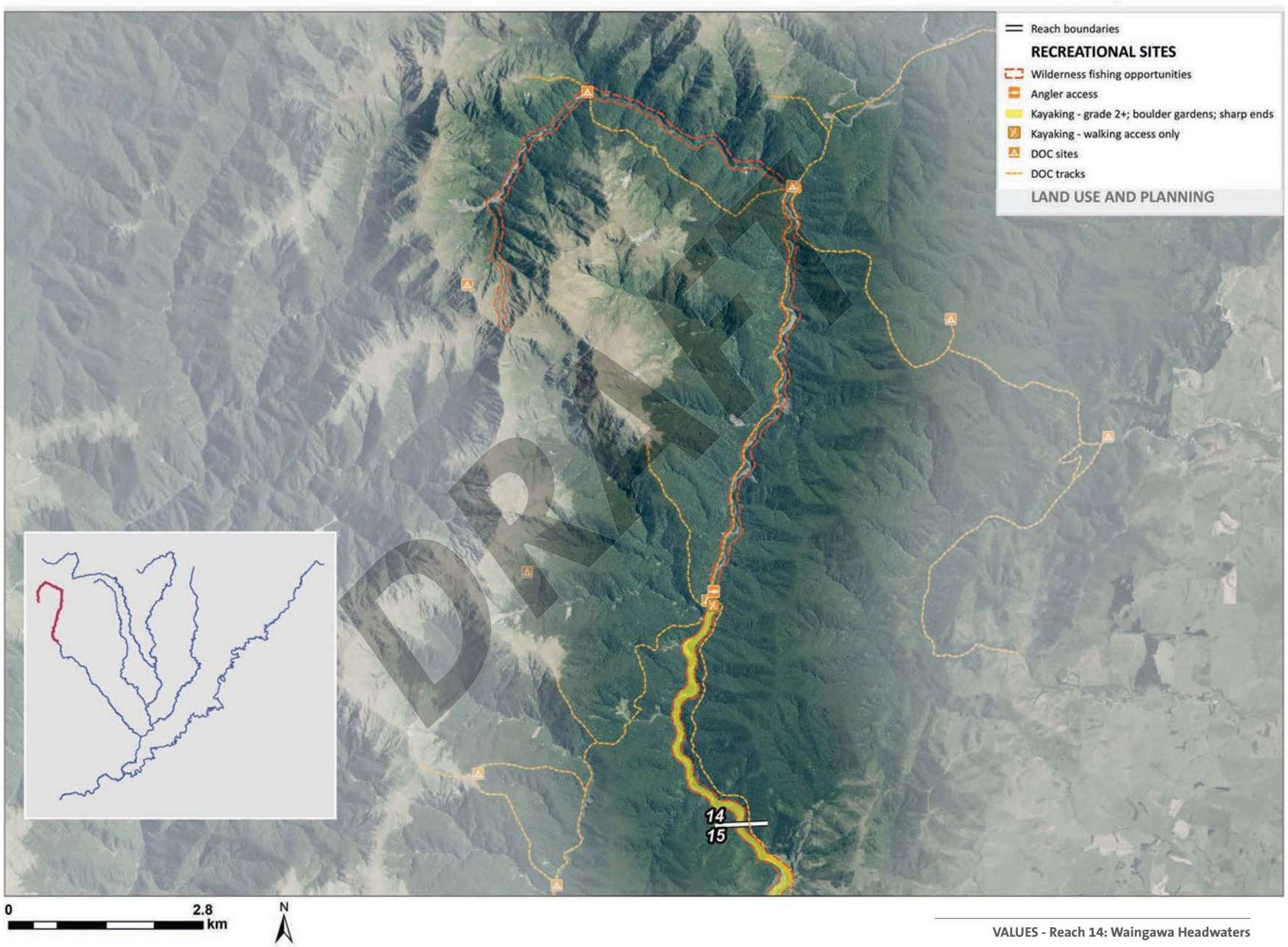
Key Floodplain Management Points

- Encourage continued recognition of the values and character of this reach
- Support initiatives that aim to preserve or improve the natural values of this reach

There is no intent to carry out any form of maintenance activity within this reach as part of the Floodplain Management Plan. There are no specific flood and erosion issues identified for this reach.

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES
COMMON METHODS		Entire reach	River management	Isolated works support, Code of Practice
		Entire reach	Planning and policy	Protection against deforestation in upper catchment
		Entire reach	Emergency management	Emergency management planning, flood forecasting and warning system
		Entire reach	Environmental enhancement	Community Support Officer

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Very Low	Very High	Walking tracks and huts (DOC), angler access, wilderness fishing	-	-	Rural (Conservation), River.	Fenced indigenous forest, Unfenced indigenous forest, Stonefield and boulderfield



VALUES - Reach 14: Waingawa Headwaters

Upper Waingawa – Reach 15

Character

The Upper Waingawa River flows from the Tararua Ranges through an area of low lying foothills separating the headwaters from the wider Wairarapa Plains. As the river emerges from the Tararua Forest Park, the river begins to develop a semi-braided form dispersed between rock lined gorges. The margins of the river continue a dominant cover of native vegetation separating the river from surrounding low intensity rural use. The valley floor associated with the river also includes increasing areas of rural lifestyle use.

Key Characteristics

- Discrete semi-braided areas separated by narrowed rock gorges
- Continuous bands of native vegetation framing the river margin
- Recent rural lifestyle expansion along the valley floor in some areas

Values

This reach of the river is slightly more modified than the Waingawa headwaters which flow through Tararua Forest Park. Gorges with rapids and pools continue wilderness recreation opportunities along the course of the river against a backdrop of areas of native broadleaf plants. Where the river begins to widen, exotic shelter belts and pasture grassland become established along the river margins, with areas of rural lifestyle settlement also established along the lower parts of this reach. This has resulted in a low level of landscape modification overall and a retention of high scenic value.

Walking tracks providing angler and kayak access continue from road ends occurring along this reach, with popular semi-wilderness recreation sites identified at the Blake Stream Confluence and The Pines. The latter site also forms a popular swimming area at the end of Upper Waingawa Road.

Terrestrial habitats with identified ecological values along this reach include fenced indigenous forest, unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield and boulderfield.

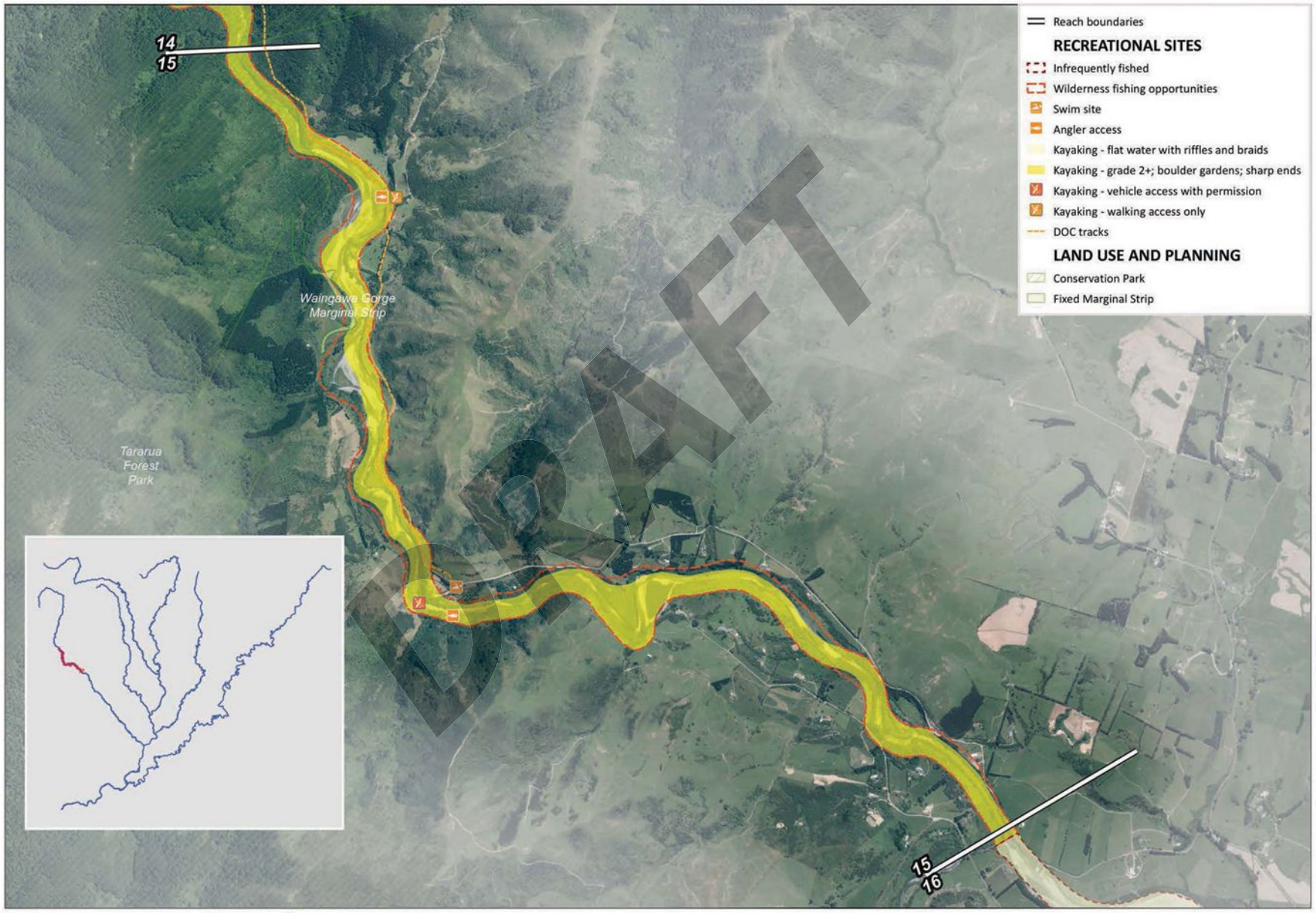
Existing River Maintenance

GWRC does not maintain river scheme works for this reach. All channel works are initiated by landowners' request and funded using the general isolated works fund.

Key Floodplain Management Points

- Work with MDC to improve the security of the Masterton water supply, including intake, pipe crossing and pipe line
- Apply isolated works policy for all maintenance works. No river scheme is established in this reach

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Low	High	Walking tracks (DOC), angler access, kayak access, swimming, kayaking, fishing	-	-	Rural (Conservation), Rural (Primary Production), Rural (Special), Road, River, Water Supply Intake.	Fenced indigenous forest, Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield



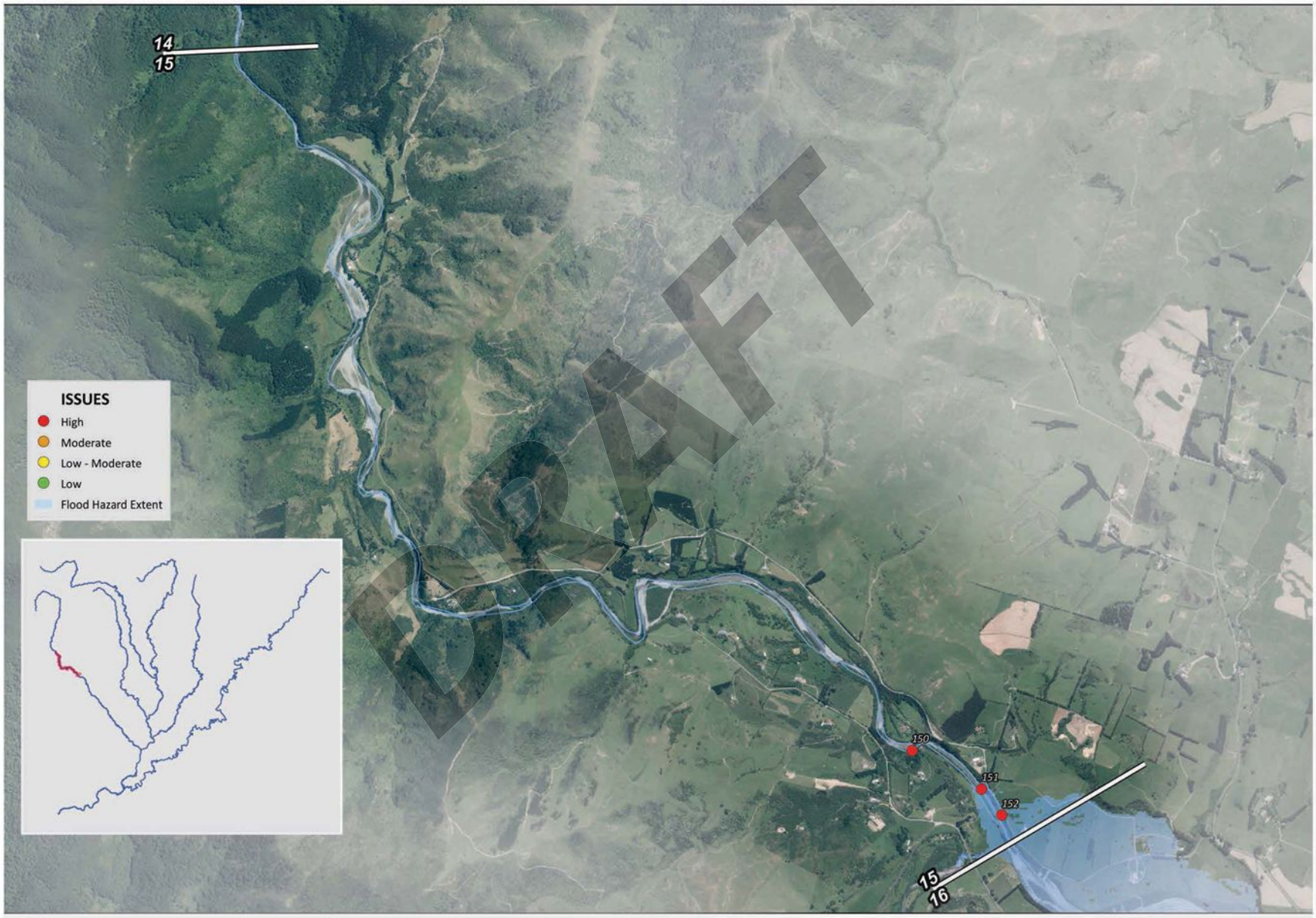
VALUES - Reach 15: Upper Waingawa

Upper Waingawa – Reach 15

Flood and erosion issues

Four erosion and flood management issues are identified along this reach, predominantly associated with Masterton's water supply. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW	
LOW TO MODERATE	
MODERATE	
HIGH	**Masterton District Council water supply intake [150]** The water supply intake for Masterton is located in the foothills area and within a stable gorge-like section of the river. It does sit within the erosion study area. No known issues exist with this intake point. **MDC water supply pipe bridge [151]** The river bed in the vicinity of the pipe bridge is subject to fluctuation, increasing risk of debris flow or scour to structure. Damage to this structure, which may occur as part of a large flood event, would have very significant consequences for the population of Masterton and therefore this issue is considered high priority. **MDC water supply pipeline [152]** The water supply pipeline runs through a narrow strip of land between the river bank and the road. This is under ongoing erosion pressure requiring ongoing management and maintenance of protection assets. Damage to this structure would have significant consequences for the population of Masterton.



ISSUES - Reach 15: Upper Waingawa

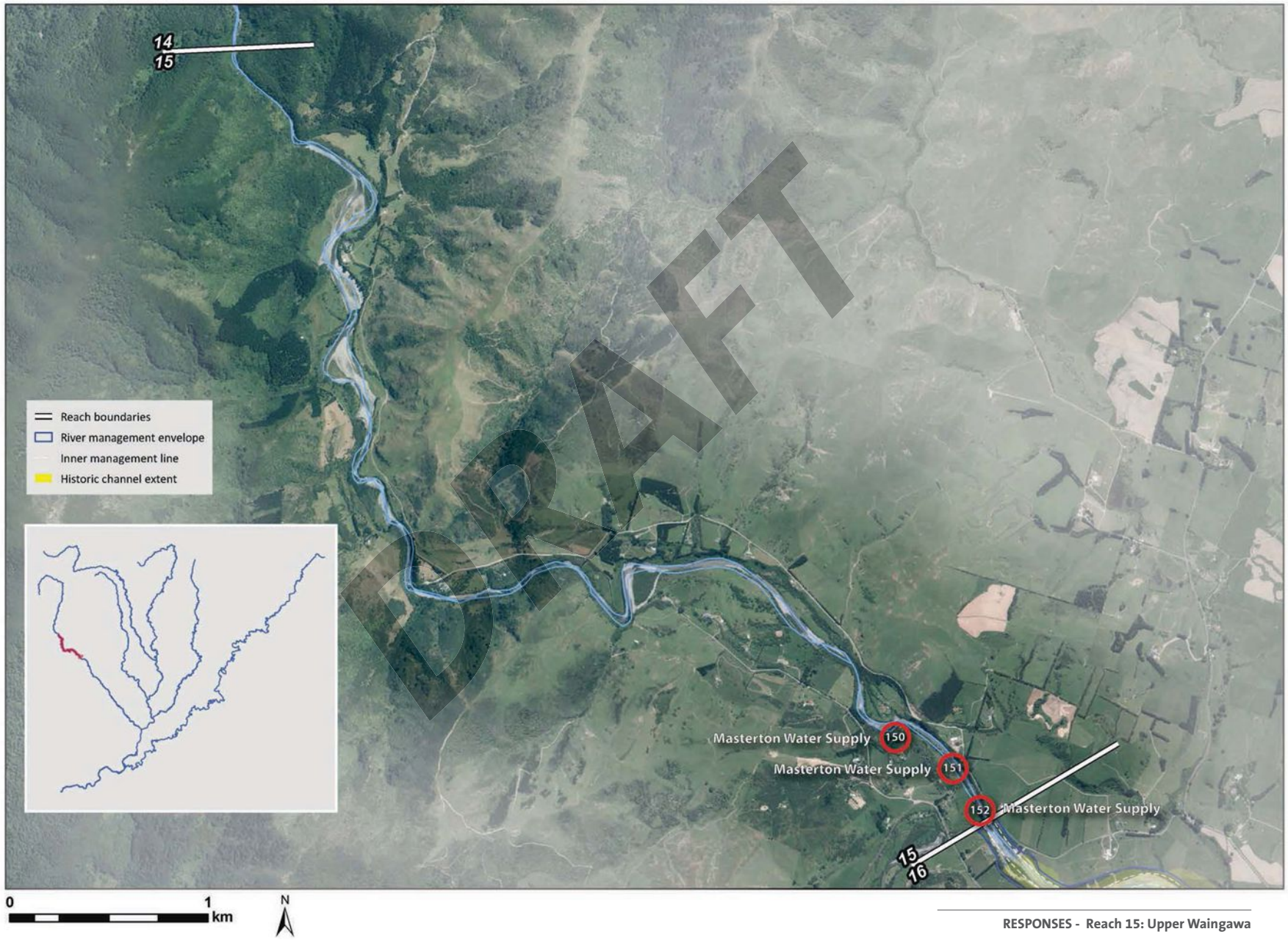
Upper Waingawa – Reach 15

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	150 151 152	Masterton water supply	River management	Provide continued advice and support to MDC with regard to operation of water supply infrastructure. Continue to provide erosion protection to the supply pipeline as a priority for the Waingawa River. Refer to the MDC Raw Water Supply Pipeline major project response (page 94).		1%	MDC	GWRC	High
		Various sites	Environmental enhancement	Formalise an access point to river at Upper Waingawa Road, and explore other sites such as Black Rock Road, South Road, Hughes Line. Initiate a care group and work with clubs that use these locations to maintain the sites and provide suitable and safe access to the river. Maintenance of site to be provided by community supported by local authorities.			GWRC	Community	Medium
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Protection against deforestation in upper catchment, land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					



RESPONSES - Reach 15: Upper Waingawa

Upper Plains – Reach 16

Character

From the confluence with the Atiwhakatu Stream, the Waingawa River emerges onto the Masterton Plains from an area of undulating hills. The State Highway 2 Road Bridge is the landmark delineator between reach 16 and the lower reaches of the Waingawa River. In this area, the river establishes the twisted semi-braided form from which its name is derived.

The margins of this corridor include willow planting and native vegetation. Beyond the river corridor, terraces accommodating mixed agricultural use and vegetation step above the river corridor. Vegetation includes a significant stand of totara and kahikatea surrounding the Masterton Water Treatment Plant along the true left bank of the river, and a significant stand of native forest on the true right bank. Lifestyle blocks are prevalent along Norfolk Road.

Key Characteristics

- Semi-braided form with islands visible from SH2 Bridge
- Margins of mixed willow and remnant native forest
- Increasing settlement in proximity to Masterton

Values

This reach continues through rural land used for primary production that is predominantly established in pasture. River re-contouring works become more frequent in this area, alongside areas of willow planting and large areas of indigenous vegetation. Overall this reach has undergone a low to medium level of landscape modification, and has medium / high levels of scenic value.

Some kayaking continues along this reach resulting from the flat water with riffles and braids. The naturally shifting course of the river results in an unstable environment which is infrequently fished, whilst remaining important for fish passage. Access for both kayaking and fishing is obtained at the end of Skeets Road.

Important ecological values identified along this reach include the Waingawa River Bush RAP site, and identified terrestrial habitats include unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefield and boulderfield.

Existing River Maintenance

GWRC maintains a river scheme within this reach and collects scheme rates. It is estimated that approximately $11,000 per river km per annum is spent for river maintenance works in this reach.

Annual maintenance works objectives include:

1. To maintain channel fairway free of vegetation and obstruction
2. To maintain the channel within the river design lines. This include establishment and maintenance of vegetated buffer zone along the river edges
3. To limit structural protection works
4. To maintain existing scheme stopbanks to “as built” standards
5. To control gravel extraction to sustainable levels
6. To enhance and protect river recreational access, wildlife and fishery values
7. To respond to flood events less than 20% AEP
8. To contribute funds to flood damage reserves to enable response to large flood events

Generally, a significant portion of the annual expenditure is allocated for channel maintenance works using heavy machinery such as removal of pest plant vegetation, construction of gravel groynes, channel alignment maintenance, channel recontouring, and debris clearance. In particular, the Waingawa River requires significant works to maintain the centre channel free from debris and pest plant infestation.

Buffer establishment along the river edges has been reasonably successful in the lower reaches. In the upper reach, roughly upstream of the water treatment plant, the willow planting is limited, with the preference being to allow succession vegetation to establish.

The Masterton water supply line runs along the left bank of the river and it has led to a high priority protection in this reach. The stopbanks have been well maintained in this area.

Gravel extraction demands have been historically high in this reach. In recent years extraction has been consistent and demand has exceeded supply.

River enhancement expenditure has been between 0% and 3% of total annual expenditure.

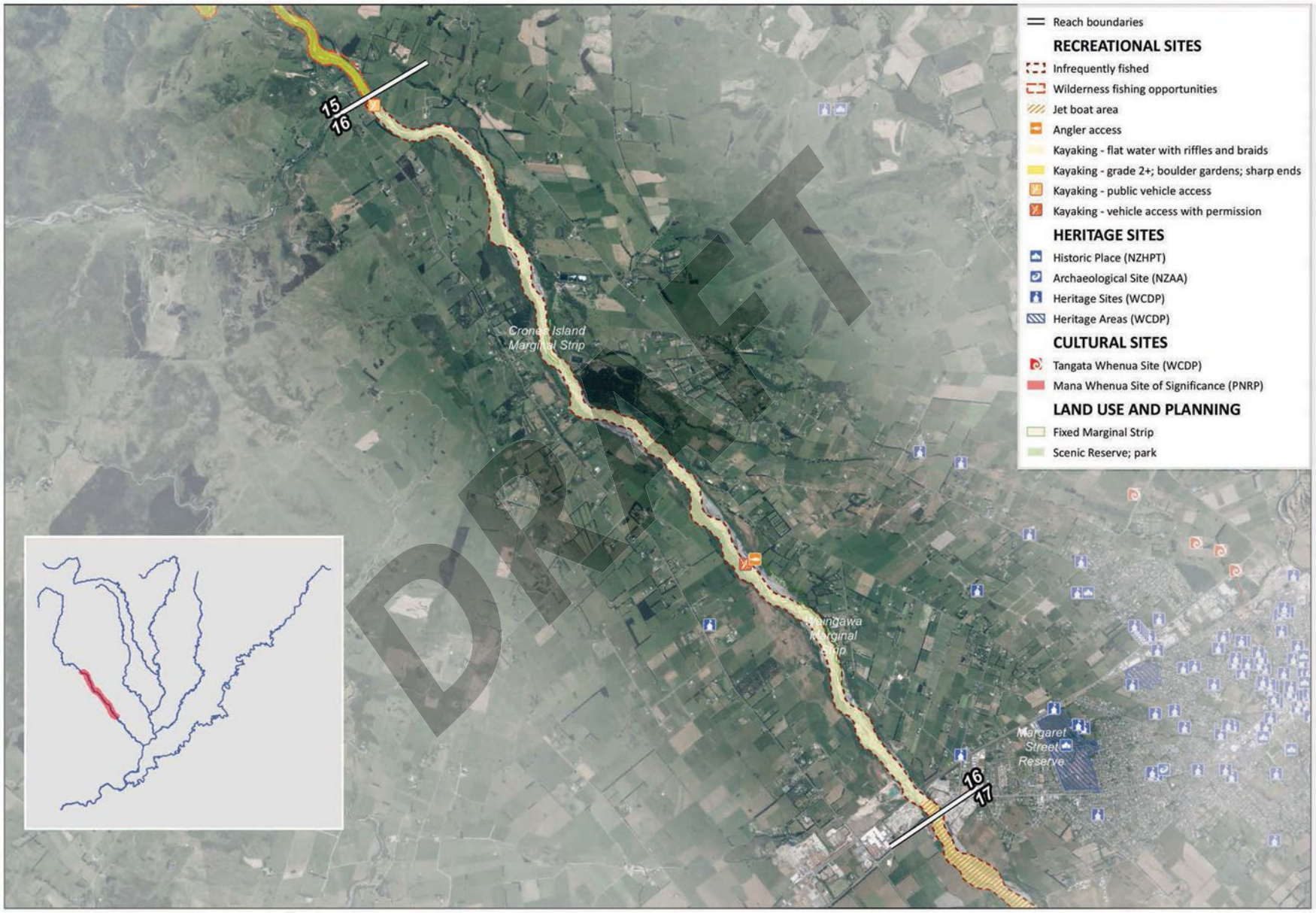
This FMP proposes to shift the focus of river maintenance towards more intensive implementation of vegetated buffers. The design buffers will be allowed to erode when and where appropriate. This method will substitute the immediate response to erosion issues with the machinery in channel works practiced in the past.

It is also planned to increase river enhancement works.

Key Floodplain Management Points

- Protect the Waingawa River Bush RAP site from negative impacts of flooding and erosion
- Work with MDC to improve the security of the Masterton water supply, including pipe line and treatment works
- Maintain the additional protection for Masterton provided by the Skeets Road stopbanks
- Work with Carterton District Council to maintain the erosion security of the Taratahi water race intake
- Work with the asset owner of the electricity distribution network to relocate pylons outside of the active channel
- Address the security concerns regarding the stopbank between the SH2 and rail bridges and promote relocation of this industrial area outside of the flood zone, and possibly redefine this area of land into a public recreation site
- Work with the infrastructure owners of the railway bridge and road bridge to ensure their continued operation and security
- Work with the Wairarapa Water Use Project in relation to dam and irrigation proposals within the vicinity of this reach

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Low / Medium	Medium / High	Angler access, kayak access, kayaking, infrequent fishing	-	-	Rural (Primary Production), Rural (Special), Road, River, Industrial, Railway, State Highway, Flood Protection and Mitigation, Water Supply and Education.	Waingawa River Bush (RAP), Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield



VALUES - Reach 16: Upper Plains

Upper Plains – Reach 16

Flood and erosion issues

A total of 29 erosion and flood management issues are identified along this reach, predominantly associated with water supply and rural development west of Masterton. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW

MDC water supply future treatment site [165]
The site designated for potential future water treatment site sits within the erosion study area and modelled 1% AEP flood extent. No currently managed issues exist.

SLUR site [173]
A site on the selected land use register (SLUR) which sits within the erosion study area.

Contractors yards [175]
Contractors yards are located within the erosion study area and are affected by modelled 1% AEP flood extents.

Channel alignment [180]
The buffer zones on the true right bank between the two bridges are very narrow, and have been recommended for review.

LOW TO MODERATE

Farm buildings [155]
A number of farm buildings including a milking shed sit within the modelled 1% AEP flood extents and erosion study area. No currently managed issues exist.

Houses [159]
Houses are located within the erosion study area.

MDC Water Treatment Plant – sludge treatment area [161]
The sludge treatment sections of the water treatment plant are located on the lower river terraces and within the erosion study area. No currently managed issues exist.

Historic river channel [166]
An old river channel sits within the overflow path of the updated 1% AEP flood. The old gravel river bed has been planted over and closed off with a stopbank.

Channel alignment [167]
A lack of buffer zones at this location has created ongoing management issues and difficulty in maintaining the river within agreed design lines. The true right bank erosion currently extends beyond the designed buffer.

Flapgates in stopbanks [170]
Two flapgates in Skeets Stopbank create possible back flow routes. These are occasionally blocked open because of misunderstandings about their purpose and use.

Buildings [172]
There are several buildings which sit within the erosion study area and modelled flood extents. No currently managed issues exist.

Transmission powerlines [176]
Pylons just upstream of the Railway Bridge sit on the berms and are within the erosion study area. No currently managed issues exist.

Rail bridge [177]
Bed degradation is a managed and known issue in the area around the railway bridge.

Contractors yards [178]
Contractors yards are located within the erosion study area and affected by the 1% AEP flood extent. Known erosion management issues exist in this area.

Sewer and water Supply pipeline [182]
Both sewer and water pipelines are clipped to the road bridge across the Waingawa. No currently managed issues exist.

MODERATE

Upper Waingawa Road [154]
The Upper Waingawa Road is modelled to be flooded to a depth of up to 0.9m in a 1% AEP flood.

House [153]
A house is located within the erosion study area and modelled 1% AEP flood extents. No currently managed issues exist.

Waingawa river bush RAP site [158]
The RAP site sits within the erosion study area and is part of the buffer strip along this bank. It is also very close to the design channel alignment. No currently managed issues exist.

MDC Water Treatment Plant – main facility [160]
Parts of the water treatment plant sit within the erosion study area. No currently managed issues exist.

House [163]
A single dwelling sits within the modelled flood extent for the 1% AEP flood. No currently managed issues exist.

House [164]
A single dwelling sits within the erosion study area. This house is also within the existing Wairarapa Combined District Plan erosion area. It is not modelled to be affected by the 1% AEP flood extent. No currently managed issues exist.

Tararua drive stopbanks [168]
The stopbanks in this location are of low level, and their crest height is frequently monitored.

House [169]
The house and outbuildings are within the erosion study area but sit outside the modelled 1% AEP flood extent. No currently managed issues exist.

Distribution network powerlines [174]
A pole which is part of the distribution network for local electricity sits in the active channel on the river bed. Adjacent pylons sit close to the river berms and are at risk of erosion.

Road Bridge [183]
The bed degredation is a managed problem in the area around the road bridge.

Pumpstation for sewer pipeline [184]
The sewer pipeline pump station is located within the erosion study area and on the edge of the 1% AEP flood extents. No currently managed issues exist.

Channel alignment [181]
The buffer zones on the true left bank between the two bridges are very narrow and have been recommended for review.

HIGH

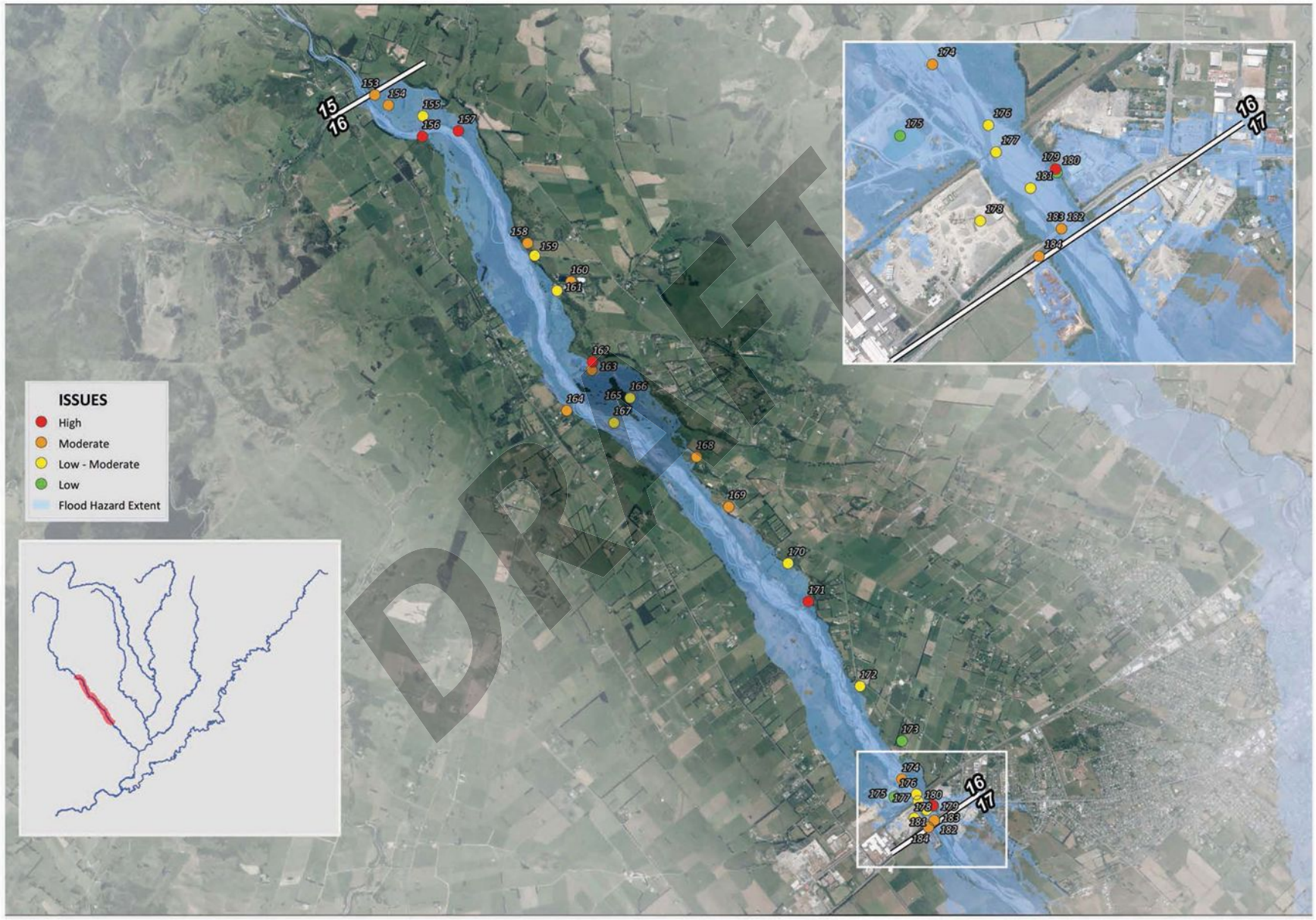
Taratahi water race intake [156]
Bed degradation in the vicinity of the water race has meant ongoing difficulties with maintaining water flow into the race. There is also a difficult balance to achieve between scour and aggradation effects due to the location of the intake in relation to the channel alignment.

MDC water supply pipeline [157]
Bed degradation at Black Creek is creating a risk to the Masterton Water Supply pipeline, which sits within the erosion study area.

MDC water supply boost pump station [162]
The boost pump station for the Masterton water supply sits within the 1% AEP flood extents. No currently managed issues exist.

Skeets stopbanks [171]
The stopbank in this location cut off an historic overflow path that connected the Waingawa to the Waipoua River near Akura. It is a good quality stopbank maintained by GWRC but a failure could have flooding consequences for Masterton. High criticality.

Stopbank [179]
The stopbank on the true left bank between the two bridges is of very poor quality due to the mixing of wood mulch with the other materials used in its construction. It is believed to be of high failure risk and flooding through this area would affect the industrial yards further along the bank edge and along the fringes of Masterton. Material from this bank has been washed into the river in past events.



ISSUES - Reach 16: Upper Plains

Upper Plains – Reach 16

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP) CURRENT	LEVEL OF SERVICE (AEP) TARGET	RESPONSIBILITY PRIMARY	RESPONSIBILITY SECONDARY	PRIORITY
SPECIFIC RESPONSES		Various sites	River management	Utilisation of river edge envelope common method. Establishment of successful buffer planting along the Waingawa is difficult in many places due to the high, steep sided and actively eroding banks. A key tool to enable buffer establishment is shallower profile banks which are then able to be planted to establish river edge vegetation. Shallower bank profiles will require the sacrifice of some buffer areas to the river to enable formation of more gentle slope gradients.	20%	5%	GWRC	Landowners	Medium
	156	Water race	River management	Ongoing maintenance plan linked to bed level monitoring to maintain security of water race until replacement or retirement. Duplication and redundancy for Water Race intake through Water Wairarapa.			CDC	GWRC	Medium
	157 160 161 162	Infrastructure	River management	MDC responsible for contingency and repair plan to address the risk of loss of water supply infrastructure. MDC responsible for inspection of infrastructure attached to bridges to be undertaken after flood events. Refer to the MDC Raw Water Supply Pipeline major project response (page 94).		1%	MDC	GWRC	High
	171	Skeets Road stopbank	River management	The Skeets Road stopbanks are built and maintained to a high standard. They provide protection against overflows from the Waingawa River. These overflows would enter the Masterton urban area in event of their breach. Continuation of existing asset monitoring and maintenance plan for these stopbanks is essential.	1%	1%	GWRC		High
	154 155 163 164 169 171 172 174	Community assets and houses	Emergency management	Add Upper Waingawa Road to WREMO register of lifelines affected by large scale flood events. Add asset owners for vulnerable assets at ID24 and ID25 to WREMO register of vulnerable assets. Advise WREMO of breach scenario consequences for Skeets Road stopbank and development of contingency plan.		>1%	WREMO	MDC	Medium
		River access points	Environmental enhancement	Develop access locations at downstream of SH2 bridge on the left bank of the river and explore other potential sites. Formalise and monitor.			GWRC	MDC	High
		Masterton Gateway	Environmental enhancement	Identify Masterton Gateway site and develop as an amenity and recreation access site. This links with the South Masterton Stopbank Major Project Response.			MDC	GWRC	High
		Masterton Gateway	Environmental enhancement	Support formation of Masterton Gateway care group, and encourage planting of native species at gateway to Masterton. Support initiatives to improve the values of the gateway area. Work with groups to improve quality of access points and rubbish clean up and reporting.			GWRC	MDC	High
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					

Stopbank Summary

ISSUE ID	NAME	PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD 1/2/3/4/5 POOR)	CRITICALITY (LOW/MED/HIGH)	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
168	Tararua/Totatara	Protection of property and historic overflow path to Masterton	731	0	3	Low	Private multiple	Unknown - estimated 2%	Series of three banks linking up natural high ground. Furthest downstream of the three stopbanks appears to offer little to no additional flood protection and is basically the natural high ground - question need to retain as asset.	Continue existing asset management	Low
171	Skeets Road	Protection of property and overflow path to Masterton	550	0	2	Low	Private multiple	Unknown - estimated 2%	Does not seem to be significantly affected by 100yr flood	Continue existing asset management	Low
	Upper Manaia Road	Limited purpose for this stopbank - length within buffer is basically gravel groyne utilised as an operational tool to divert flows and protect downstream alignment	130	40	2	High	Private multiple/Public Road	Unknown - estimated 2%	Training bank/gravel groyne rather than true stopbank	If threatened consider part realign	Low
179	South Masterton	Protects industrial estate and overflow path to SW Masterton	280	280	4	Low	Industrial properties	<1%	Quality uncertain, weed and tree infestation	Major Project Response	Low


154 Community assets and houses
155 Community assets and houses
157 MDC Water supply pipeline
Water Race 156
Masterton District Council Raw Water Supply Line Major Project Response (see page 94)
15
16
160 Infrastructure
161 Infrastructure
162 Infrastructure
163 Community assets and houses
Community assets and houses 164
168 Tararua/Totatara
169 Community assets and houses
171 Skeets Rd Stopbank; Infrastructure
172 Community assets and houses
174 Community assets and houses
South Masterton stopbank (see page 96)
16
17
Reach boundaries
Existing stopbanks
River management envelope
Inner management line
Historic channel extent
0
2.2
km
N
DRAFT

Major Project Response: Masterton District Council Raw Water Supply Pipeline

The issue

Masterton District Council abstract potable water from the Waingawa River through an intake structure and pipeline which feeds the water treatment plant located approximately 5km downstream. Following treatment the potable water is then distributed throughout Masterton. The water supply intake is located on the right bank of the Waingawa River approximately 700m upstream of the Atiwhakatu confluence. Approximately 370m downstream of the intake, the pipeline crosses to the left bank of the Waingawa River. From this point the pipeline is in close proximity to the left bank of the Waingawa River in a number of locations (less than 20m in some areas) before it reaches the water treatment plant. Due to the close proximity and highly erosive nature of the Waingawa River, the pipeline is considered to be at risk from lateral bank erosion. It has been threatened and even exposed on a number of occasions in the past.

The past management regime has utilised a combination of boulder groynes (sourced from within the river) and channel alignment works (bed and beach recontouring) to provide a degree of protection. These maintenance activities are a short term intervention which requires frequent renewal based on changes in river alignment and bank erosion during even relatively minor flood events.

The primary area of concern is at the Black Creek confluence . At this location the river transitions from the foothills of the Tararua Ranges out onto the alluvial floodplain and the reach character changes from a relatively confined narrow channel into a wider, more variable channel with a more semi braided morphology. The location most under threat is on the outside bend of a relatively tightly formed "S" bend. The river bed is naturally degrading (lowering) at this location which causes difficulties for Caterton District Council (CDC) in maintaining sufficient water levels in the river for water to flow into the Taratahi Water Race, which is located approximately 250 m upstream from the Black Creek confluence. CDC have constructed a boulder weir in the river to ensure water levels are high enough to act as a partial-weir and aid diversion of water into the water race. This weir has the potential to affect the river flow direction during floods by directing the main flow towards the left bank of the river and increasing the erosion potential on the outside of the bend at this location, where the water pipeline is in close proximity to the current river bank.

Opportunities

In the future there may be opportunities though the Wairarapa Water Use project to provide both municipal and water race water requirements via a dam proposed within the adjacent Black Creek catchment. This project is currently going through a feasibility assessment and therefore it is too early to be considered by the proposed project response in this FMP.

MDC have an emergency management plan to deal with any interruption to the supply of water to the treatment plant. There is sufficient storage in the water supply system to provide three days of potable water to Masterton. This provides sufficient time to enable deployment of a temporary pumping system directly from the river powered by diesel generators. Once this is set up it is possible to use this temporary system for as long as it takes to undertake the pipeline repairs and whatever emergency river works that are needed.

Relationship with common methods

River management envelopes exist and are utilised, although some modification of these lines may be necessary. Where the pipe alignment is within the identified buffer zone, an exemption from the general buffer approach is required to recognise the importance of the asset and the associated need for a higher level of service than a vegetative edge approach at these sites. The effectiveness of vegetated buffers in the steeper, incised upper reaches of the Waingawa River are also somewhat limited and the vegetation will typically only slow down the rate of erosion rather than preventing it all together.

Description

General

Response Option 1 (Structural)

To provide a higher level of security at the most at-risk site it is considered that a minimum of three rock groynes are required at the Black Creek confluence. See the plan on the next page for location and general arrangement.

Response Part 2 (Coordinated River Management and Emergency Management Planning)

This response would look to establish a Memorandum of Understanding between GWRC and MDC to enable the risks associated with the pipeline to be mitigated through a combination of Emergency Management Planning and River Management specific to the MDC Water Pipeline. This would establish a shared organisational understanding around annual level of service expectations implemented through the established river management scheme, and potential requirements in the event of an emergency situation whereby the pipeline was threatened or compromised by the effects of river erosion.

Costs

Part 1
Three Rock Groynes - up to $300,000 based on each groyne being approximately 450 tonnes. This includes preliminary and general works, contingency of 30%, and design, consenting, and supervision.

Part 2
Approximately of $5-20,000 per annum with an emergency funding allowance of around $50,000 in the event of a significant flood event (river works only, excludes pipeline repair).

Implications

Implementation of Part 1 of the response will provide MDC with an increased level of security for their raw water main at the location identified as having the highest likelihood of failure. This will also reduce the cost of reactive maintenance requirements.

Implementation of Part 2 of the response provides for improved procedures to manage the risk associated with the pipeline and in the event of an emergency situation allows for incident recovery minimising any impacts on the community.

Both responses should include a management strategy for proactively working with CDC to ensure that the work carried out to the intake of the Taratahi Water Race minimises potential negative effects on the opposite bank adjacent to the MDC pipeline.

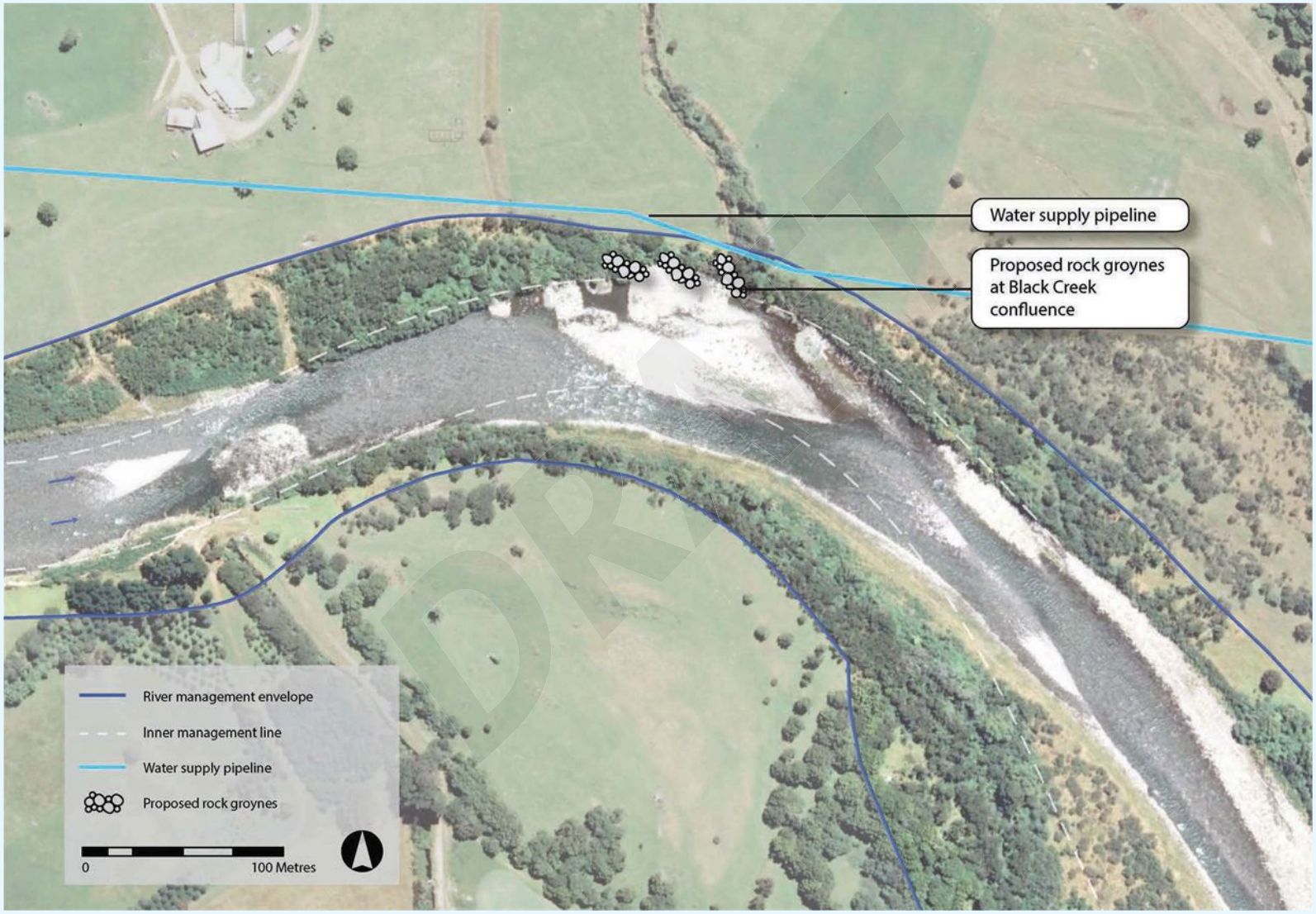
Priority

This response is classified high priority given the importance of the asset to be protected. Response Part 1 is considered low priority in the early years of FMP implementation but could be triggered following a changing cycle of flood events, GWRC/MDC agreement or a future FMP review. Response Part 2 is considered high priority.

Level of Service

Up to 1% AEP level of service, to be confirmed with MDC.

REFERENCE NUMBER	PROPOSED MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR PROPOSED RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
7	Increase bank protection to river edge at Black Creek confluence	Low-medium	Erosion by the river	Up to 1% AEP	To increase protection to water supply pipeline	MDC supported by GWRC	Low	Up to $300,000	Capital funding
7	Targeted operational river management with emergency management plan	Low - medium	Erosion by the river	>1% AEP	To manage risk of erosion posed to the water supply pipeline	GWRC (river management) MDC (Emergency management plan)	High	Varying but of magnitude of $5-20,000 per annum generally, with allowance for targeted emergency works as required	Operational funding


Water supply pipeline
Proposed rock groynes at Black Creek confluence
River management envelope
Inner management line
Water supply pipeline
Proposed rock groynes
0
100 Metres

Major Project Response: South Masterton Stopbank

The issue

There are a number of issues associated with the section of the Waingawa River between the rail bridge and SH2 bridge.

- The stopbank on the left (northeastern) side of the Waingawa River between the railway and SH2 bridges is located within the buffer and is at risk of erosion. This stopbank is also in relatively poor condition, although it has been assessed as "fit for purpose" as it is providing protection for a relatively small area of industrially zoned land and is therefore not considered to be a critical asset. It is at risk of failure in an extreme flood event.
- Managing the channel alignment through this reach is useful for reducing the scour risk at the rail and road bridges.
- The property on the immediate landward side of the stopbank has historically been used for timber treatment and is confirmed as being a contaminated site (SLUR – SN/06/141/02).

Opportunities

Improvements to the visual appearance, recreational opportunities, public access, and ecological value of the river margins on approach to Masterton from the south.

Relationship with common tools

The location of the stopbank within a buffer means that consideration needs to be given to retreating the stopbank to a less erosion prone location or abandoning/retiring the asset.

Description

General

The main risk to this reach of the river is lateral erosion of the river banks leading to erosion and failure of the left bank stopbank. The consequences of failure of the stopbank, in terms of flood inundation, are limited to a relatively isolated area of industrial land immediately adjacent to the stopbank. In addition to the consequences of inundation, there is also the potential for contaminated material to be eroded into the river or mobilised through groundwater flows.

The extent of contamination of the site and possible pathways for the contamination to mobilise into the surface or groundwater are currently unknown. A detailed site investigation is required to understand the extent and degree of contamination and the environmental risks this presents. This investigation would also include an assessment of options for containing or remediating the contaminants on the site. Remediation of the site could be done in conjunction with the retreat of the stopbank beyond the buffer. .

It is proposed to maintain the status quo in terms of river management using the common methods to maintain the stopbank in its current position whilst the risks and mitigation options associated with the site contamination are investigated in parallel with consideration of retreating the stopbank.

Costs

Contaminated site investigation - $100,000.

Further costs for remediation and retreat of the stopbank will be dependent on the outcomes of the contaminated site investigation.

Implications

There is a residual risk of failure of the stopbank or an over-design event that needs to be managed while the investigations are being undertaken. It is likely that this can be managed through appropriate flood warnings and education of the residents and businesses affected.

Priority

Medium priority to undertake the contaminated site investigation. Priority for future works would be dependent on the outcomes and risks identified in the contaminated site investigation but is unlikely to be more than medium unless serious contamination close to the river is identified.

Level of Service

The response provides the status quo in terms of the level of service as well as managing the residual risk through emergency management provisions. The longer term plan for the stopbank and the wider area can be developed once there is a better understanding of the site contamination and any remediation or containment requirements.

REFERENCE NUMBER	PROPOSED MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR PROPOSED RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
31	Retreat existing stopbank to less erosion prone location outside the buffer.	2-10% AEP	Erosion by the river	5% AEP	Stopbank is non critical asset from flood hazard perspective but may be important for preventing contaminated material entering the river.	GWRC	Low	$485,000	Capital funding TBC
31	Contaminated site assessment, visual improvements within the buffer, establishment of public access to the river	20-1% AEP	Erosion by the river	TBC	Appealing gateway to Masterton, recreational access and contaminated site management.	MDC/GWRC	Medium	$100,000 for contaminated site assessment	Capital funding TBC


Confirmed contaminated site (SLUR – SN/06/141/02)
Existing stopbank at risk of erosion, future depending on outcome of the contaminated land investigation. Intention to move stopbank beyond the buffer
Improvements to visual appearance of river margins on approach to Masterton
River management envelope
Inner management line
Existing stopbanks
Improvements to visual appearance
0
80 Metres

South Masterton – Reach 17

Character

The Waingawa River continues a twisted semi-braided form to the east of the State Highway 2 Bridge. The margins of the river corridor are more consistently established in willows, separating the river from adjoining areas of pasture and cropland. Hood Aerodrome, urban edge development and gravel extraction also influence the character of the river. In other areas, the river retains a varied and dynamic semi-braided form.

Key Characteristics

- Broad semi-braided form
- Consistent willow planting along margins

Values

The close proximity of the southern end of Masterton together with gravel extraction visible from State Highway 2 Bridge frequently detracts from natural values associated with the river. Overall this results in a perceived medium / high level of landscape modification with medium scenic values retained along the wider reach.

Some kayaking occurs along this reach on account of the continuation of flat water with riffles and braids flowing from the upper reaches of the river. State Highway 2 Road Bridge also forms the upper limit of jet boating typically encountered along the Waingawa.

Fishing remains infrequent throughout this reach because of the changing course of the river. Whilst fish passage remains important, the form of the river remains unstable and does not typically hold fish within it. Popular swimming sites are identified at South Road and Hughes Line on each side of the river immediately above Hood Aerodrome.

Terrestrial habitats with identified ecological values along this reach include mixed exotic-indigenous forest, indigenous treeland, stonefield and boulderfield, natural wetlands and ponds.

Wetlands along the margins of the Waingawa River were important for gathering mahinga kai, with cultural sites also associated with the mixing of mauri as water flows into the Ruamāhanga at the bottom end of this reach.

Existing River Maintenance

GWRC maintains river scheme within this reach and collects scheme rates It is estimated that approximately $11,000 per river km per annum is spent for river maintenance works in this reach.

Annual maintenance works objectives include:

1. To maintain channel fairway free of vegetation and obstruction
2. To maintain the channel within the river design lines. This include establishment and maintenance of vegetated buffer zone along the river edges
3. To limit structural protection works
4. To maintain existing scheme stopbanks to “as built” standards
5. To control gravel extraction to sustainable levels
6. To enhance and protect river recreational access, wildlife and fishery values
7. To respond to flood events less than 20% AEP
8. To contribute funds to flood damage reserves to enable response to large flood events

Generally, a significant portion of the annual expenditure is allocated for channel maintenance works using heavy machinery such as removal of pest plant vegetation, construction of gravel groynes, channel alignment maintenance, channel recontouring, and debris clearance. In particular, Waingawa River requires significant works to maintain the centre channel free from debris and pest plant infestation.

Buffer establishment along the river edges has been reasonably successful in the lower reaches. In the upper reach, roughly upstream of the water treatment plant, the willow planting is limited with the preference being to allow succession vegetation to establish.

The Masterton water supply line runs along the left bank of the river and it led to high protection priority for this part. The stopbanks have been well maintained in that area.

Gravel extraction demands have been historically high in this reach. In recent years extraction has been consistent and demand exceeded supply.

River enhancement expenditure has been between 0% and 3% of total annual expenditure.

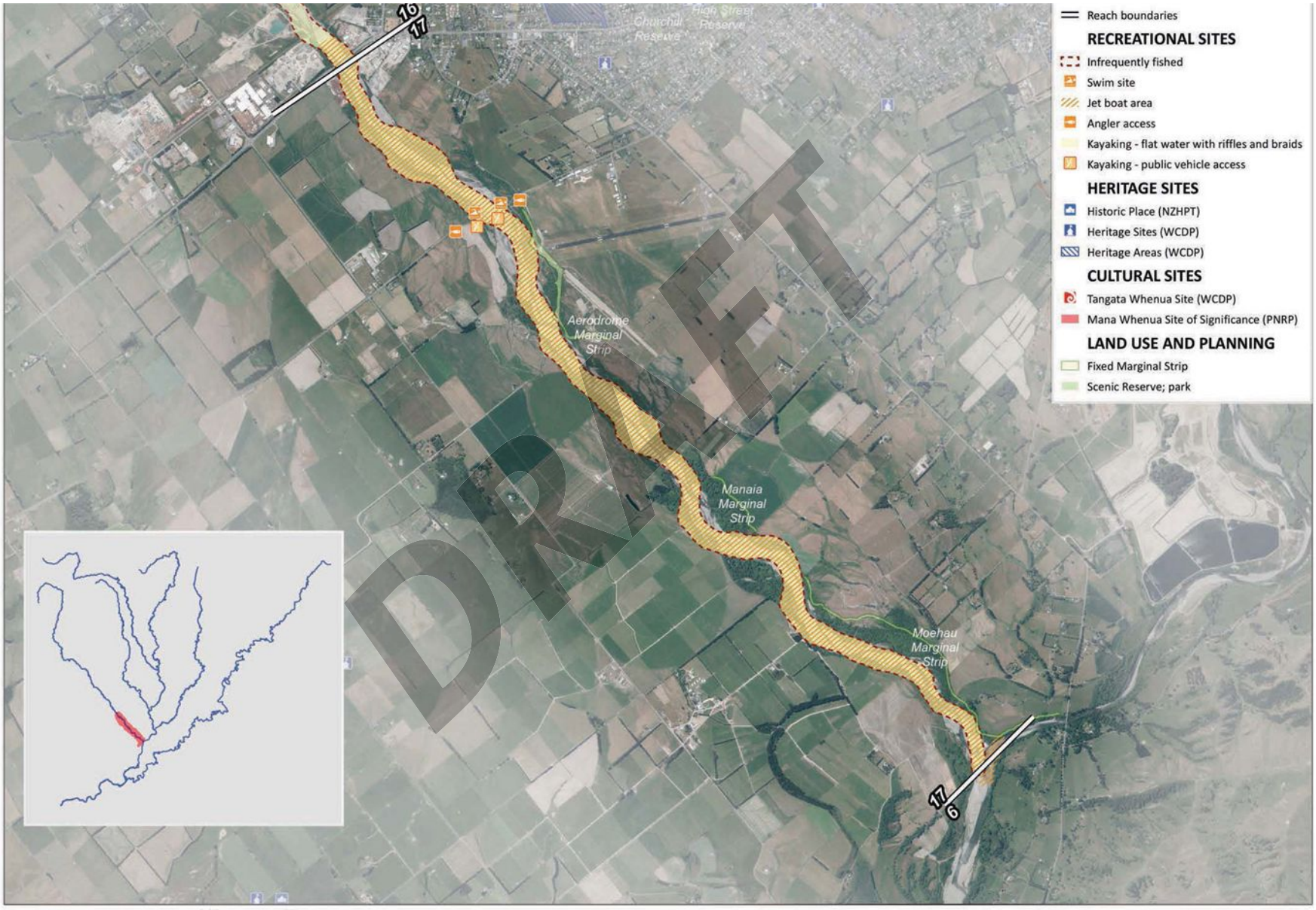
This FMP proposes to shift the focus of river maintenance towards more intensive implementation of vegetated buffers. The design buffers will be allowed to erode when and where appropriate. This method will substitute the immediate response to erosion issues with the machinery in channel works practiced in the past.

It is also planned to increase river enhancement works.

Key Floodplain Management Points

- Work with the owners of Hood Aerodrome to maintain the operation and security of their facility
- Work with MDC and CDC to address the dumping of rubbish that occurs at access points along this reach
- Continue to develop land access and retirement agreements to widen the river corridor
- Recreation management to encourage good quality recreation opportunities

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium / High	Medium	Angler access, kayak access, kayaking, jet boating, swimming , infrequent fishing	-	Mixing of mauri	Rural (Primary Production), Rural (Special), Road, River, Industrial, State Highway, Aerodrome and Recreation Purposes.	Mixed exotic-indigenous forest, Indigenous treeland, Stonefield and boulderfield, Natural wetlands and ponds



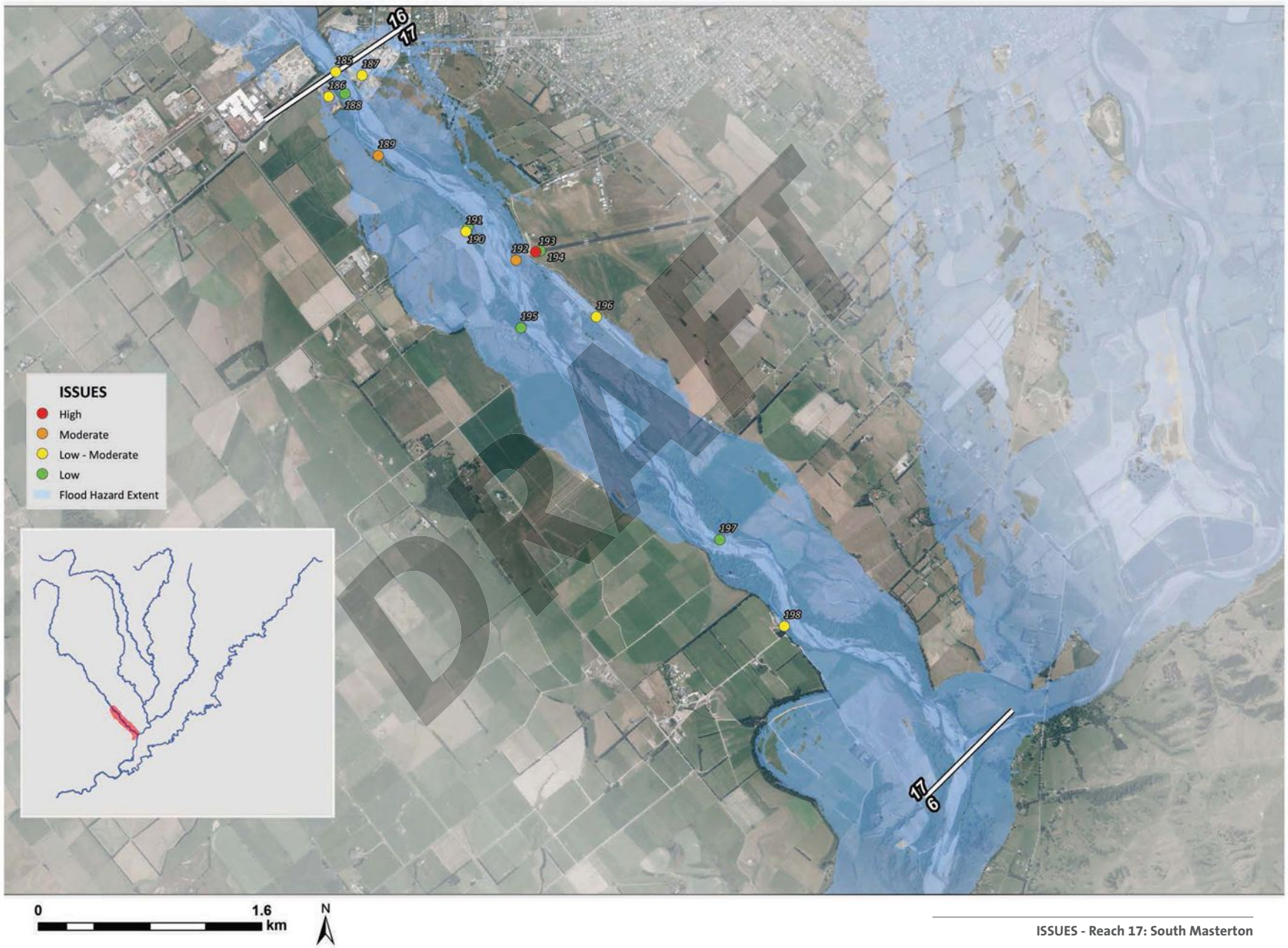
VALUES - Reach 17: South Masterton

South Masterton – Reach 17

Flood and erosion issues

A total of 13 erosion and flood management issues are identified along this reach. Issues have been ranked according to their consequence and likelihood (i.e. risk) and assigned an ID number [xx].

LOW	**Powerlines [188]** Distribution network powerline pylons are located within the erosion study area 30m downstream of SH2. No currently managed issues exist. **Illegal dumping site [190]** This recreation access site is affected by illegal dumping of rubbish. **SLUR site [194]** The aerodrome is a registered SLUR site which sits within the erosion study area	**Water intake [195]** There is a private water intake structure located within the erosion study area. It is not known to have any issues. **Distribution network [197]** The pylon on the true right bank sits within the erosion study area, the true left bank is believed to be outside of the erosion study area extents. No currently managed issues exist.
LOW TO MODERATE	**Powerlines [185]** Transmission network power line pylons are located within erosion study area. No currently managed issues exist. **Contractor's yards [186, 187]** Contractor's yards are located within the erosion study area and 1% AEP flood risk. Erosion management is an ongoing issue at this location. **Recreation area [191]** The good access to the end of Hughes Line makes it a popular area for recreation groups. There is interest in developing this access and area further from a number of interest groups.	**Drag strip [196]** The Masterton drag strip is located within the erosion study area and is affected by the modelled 1% AEP flood. No currently managed issues exist. **Private water intake [198]** A private water intake is located within the erosion study area. No currently managed issues exist.
MODERATE	**Land retirement agreements [189]** Land use changes are currently underway in this area to increase the amount of buffer strip available to manage riverbank erosion. **Flight path [192]** Tree height has a controlled level for aircraft taking off from the aerodrome.	
HIGH	**Aerodrome runway [193]** The aerodrome runway is known to be affected by erosion and has been eroded in recent past (2000). Situated within the erosion study area.	



ISSUES - Reach 17: South Masterton

South Masterton – Reach 17

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES		Various sites	River management	Utilisation of river edge envelope common method. Buffer plantings within the Waingawa River are challenging in many places. A key tool to their establishment is the erosion of banks to create shallower profile banks which are then able to be planted to establish river edge vegetation. Shallower bank profiles will require the sacrifice of some buffer areas to the river.	20%	5%	GWRC	Landowners	Medium
	192	Flight path	River management	Maintain tree height within the buffer zone and under the flight path restrictions.			GWRC	MDC	High
	191 190	Recreational access sites	Environmental Enhancement	Develop and formalise access points on true right and left banks, establish care groups to manage these areas.			Community	GWRC	Medium
		Three Rivers Trail	Environmental Enhancement	As part of the Environmental Strategy, establish Three Rivers Trail to link Masterton to the Waingawa, Ruamāhanga, and Waipoua Rivers. Incorporate as part of larger Trails Wairarapa projects/initiatives. Link to tourism Wairarapa.			Community	GWRC	Medium
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental Enhancement	Environmental strategy, Community Support Officer, care group and clubs					

RESPONSES - Reach 17: South Masterton

Major Project Response: Hood Aerodrome

The issue

The runway for the Hood Aerodrome has been continually affected by erosion and was close to getting washed away during a flood in 2000 (see photograph on the right side). Four rock groynes constructed following this flood provide some degree of protection but are at risk of being outflanked from upstream. A number of small floods in 2015 and in early 2016 caused erosion to occur upstream of the runway. In response to this 1100 willow poles were planted in June 2016 along with some minor in-channel works in an attempt to realign the river to its desired design alignment and establish a vegetated buffer. In a steep, dynamic river, such as the Waingawa, willow protection works are only able to slow down the rate of erosion and will not be capable of completely preventing it. If a greater level of security to the runway is desired then a rock revetment is required from the terrace to tie in with the upstream rock groyne. The revetment would be 140 m long and would act in part as a deflector groyne to direct the main flow away from the runway.

Opportunities

The proposed response provides a higher degree of security to the runway, which would be of particular importance if commercial flights are re-established from the site. It also avoids the risk associated with potentially contaminated land (Selected Land Use Register SN/06/004/02 Manawatu Aerial Topdressing, Category I) being eroded into the river.

Relationship with common methods

The current management of this reach using willows combined with in-channel works is aligned with the common methods of recognition of buffers as a river management tool and the Code of Practice. The proposed response with the use of a revetment/training groyne is a standard response provided for in the Code of Practice.

Description

General

A 140 m long rock revetment extending from the terrace to the existing upstream rock groyne.

Costs

$755,000 (3,650 t rock @ $130/t (placed with geotextile) $474,000 + $29,000 Preliminary and general, 30% Contingency, 20% Design, consenting, and supervision.)

Implications

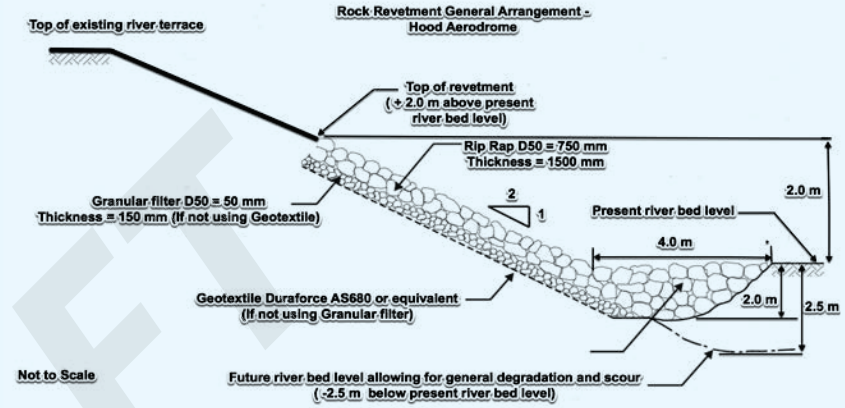
Possibly diverts erosion issue to opposite side of river by providing hard point on left bank.

Priority

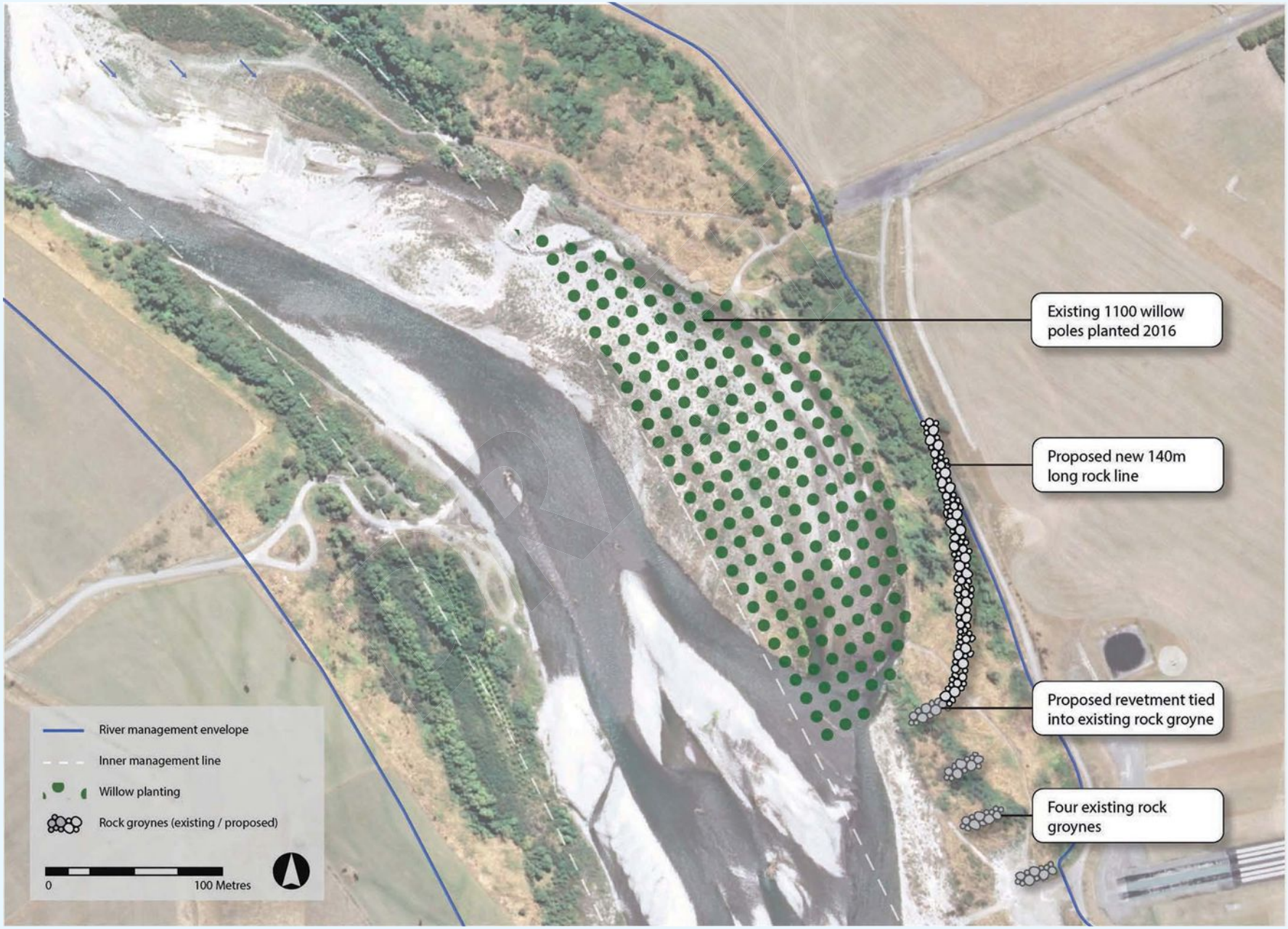
Currently a low priority but if a new commercial operator is found for the aerodrome then this could change.

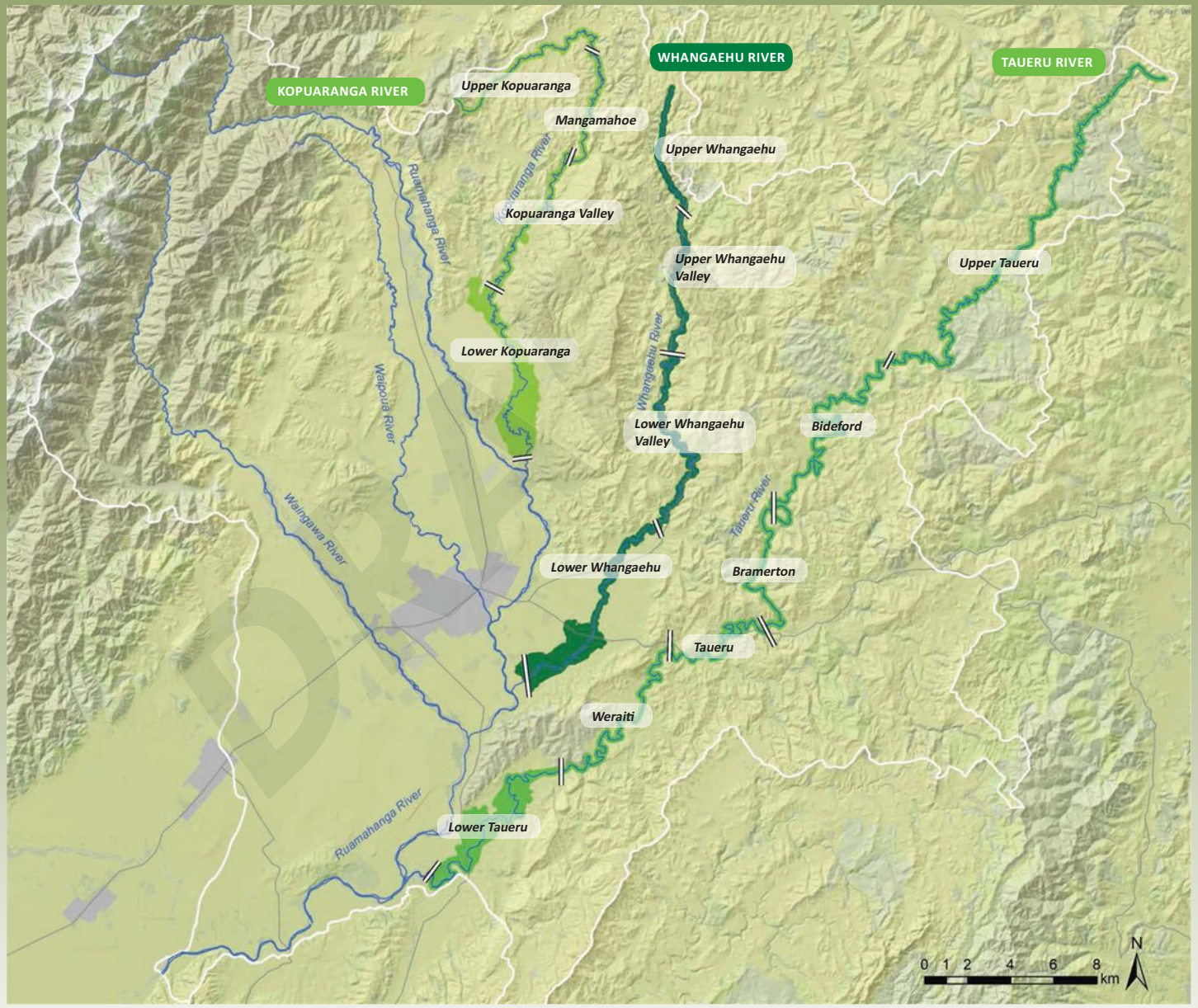
Level of Service

Up to 2% AEP level of service to be confirmed in discussion with MDC and potential commerical operator for aerodrome.



REFERENCE NUMBER	PROPOSED MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR PROPOSED RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
ID 39, 40 & 41	Rock revetment connecting terrace with existing rock groyne at the end of the runway	Low	Erosion by the river	2% AEP	To increase protection to the runway and avoid any contaminated material being eroded into the river.	MDC/GWRC	Low	$755,000	Capital funding TBC


Existing 1100 willow poles planted 2016
Proposed new 140m long rock line
Proposed revetment tied into existing rock groyne
Four existing rock groynes
River management envelope
Inner management line
Willow planting
Rock groynes (existing / proposed)
0
100 Metres



Eastern Rivers

5. Eastern Rivers

The Kopuaranga, Whangaehu and Taueru (Tauweru) Rivers have been grouped together as the Eastern Rivers. Their character, values, and flood and erosion issues are broadly similar, as are the management objectives and techniques used.

The floodplains of the Eastern Rivers are relatively sparsely populated, although this is increasing with lifestyle block development in the lower reaches, particularly on the Kopuaranga and Whangaehu Rivers in areas closer to Masterton. This is having an impact on informal access arrangements to recreational and cultural sites. Mauriceville, on the Kopuaranga River, is the largest settlement.

The rivers are generally considered to have low to medium levels of landscape modification, tending towards higher levels of modification in the lower reaches. The three rivers have low/medium levels of scenic value in their lower reaches, with areas of medium/high scenic value tending to occur in the upper reaches (and coinciding with less modified reaches). In many areas, willow trees dominate the channel form. In the reaches where current scheme maintenance is taking place, crack willow infestation has been controlled. Elsewhere crack willow infestation is a big problem due to the channel constriction it causes.

Land-use in the catchments is predominantly primary production activities (dairying, dry stock grazing, cropping, and plantation forestry) with a few scattered areas of native forest. There is little evidence of lifestyle type development in the upper catchments.

All three rivers are used for game bird hunting and fishing. The Kopuaranga River is the most fished of the three. The lower Taueru River is used for kayaking. A number of informal access arrangements are in place for recreational access.

Several cultural value sites occur throughout the Eastern Rivers. This includes Kopuaranga settlement and Kohekutu Pā along the Kopuaranga River, and multiple pā and urupa along the Taueru River. Whilst there are no specific sites recorded on the the Whangaehu River, this is known to be very significant to local Maori, containing many waahi tapu areas and important spiritual connection with Rangitumau.

The Kopuaranga and Taueru Rivers were important travel routes for Maori travelling north and north-east respectively. As a result, these two rivers have mahinga kai values in their channels and surrounding forested areas. In particular, the upper Taueru River is noted for freshwater crayfish and the lower Taueru River for eels. This eel fishery remains important.

There is limited ecological information on the Eastern Rivers in relation to the abundance of birdlife and fish species. There are a number of areas of habitat value, such as natural ponds/wetlands and patches of indigenous forest (both fenced and unfenced). The lower Taueru River also contains the Te Kopi Road and Peters Bush RAPs.

General Issues

- Flooding of large areas of farmland (entire valley floors) and access routes cut off
- Lifestyle block development near Masterton
- Potential for greater erosion/changes in channel form in the future as a consequence of willow removal

Kopuaranga River

Character and Values

The Kopuaranga River flows into the Ruamāhanga River to the north of Masterton. The headwaters originate in the northern Wairarapa hill country to the east of Mount Bruce. The main river channel from its headwaters to its confluence with the Ruamāhanga River is 58 km in length.

The Kopuaranga River has a number of small tributaries. The main channel flows on a northeast course from its source in Mount Bruce to Hastwell, where it crosses a relatively wide valley before turning south. The river then flows south within a narrow valley, following the line of the West Wairarapa fault. In its lower reaches the river turns away from the fault line and follows an old course of the Ruamāhanga River, joining the Ruamāhanga River east of Opaki.

The name Kopuaranga means fish in a deep or dark pool, and the river has long been associated with fishing.

In its upper reaches across the Hastwell's Valley, the river channel is characterised as an entrenched channel. The river then flows within a narrow fault-formed valley in a tightly meandering channel. On its lower reaches, the river channel becomes wider and straighter, with sections of tighter meandering channels.

The Kopuaranga floodplain contains a mix of soils formed from sandstone, limestone and siltstone. Vast tracts of the fertile Kopuaranga river deposits were used as gardens for centuries. Land use in the catchment is now predominantly in primary production activities (dairying, dry stock grazing, cropping and plantation forestry) with a few scattered areas of native forest throughout the catchment.

In terms of recreation values, the Kopuaranga River is popular for fishing and game bird hunting, and in some areas this has led to enhancement of natural wetlands and ponds, improving the ecological value of the river.

Two cultural sites have been identified along the Kopuaranga River, these being Kopuaranga settlement, and Kohekutu Pā. However the river used to form part of a northwards travel corridor and it has value for mahinga kai, related to both the river and the surrounding forested area.

Key characteristics by reach:

Upper Kopuaranga

- Small stream corridor through rolling pastoral landscape
- Grass banks with bank slumping in areas

Mangamahoe

- Enclosed valley landform containing road and rail corridor
- Tightly meandering willow choked corridor
- Flax and cabbage tree planting reintroduced in some low lying areas

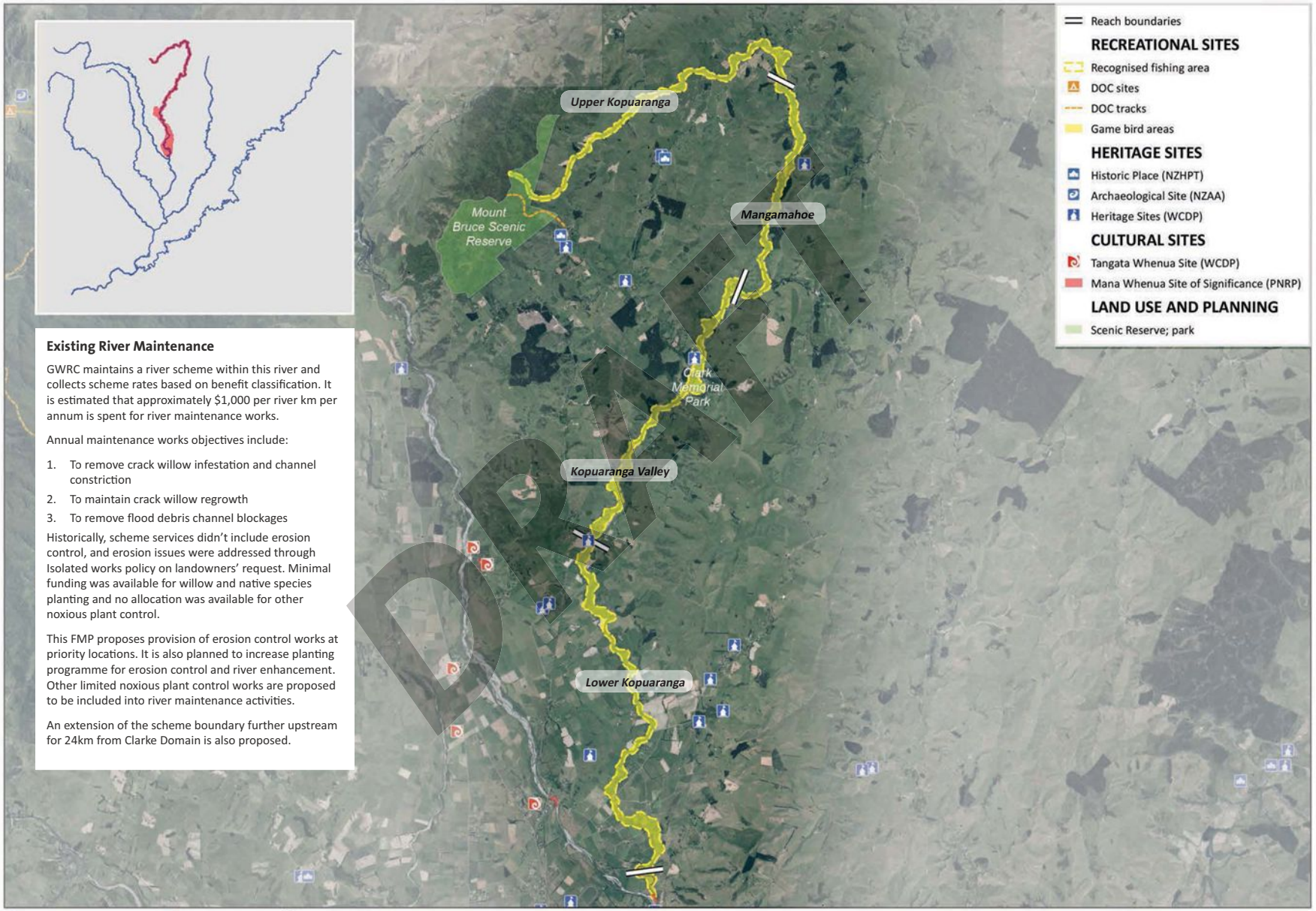
Kopuaranga Valley

- Meandering river corridor along semi-enclosed valley landform
- increasing rural lifestyle development along river margin
- Mixed willow, exotic planting and grass margins

Lower Kopuaranga

- Meandering course along eastern edge of Wairarapa Plain
- Sparsely settled farmed margins
- Mixed poplar, willow and conifer margins

REACH	LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
	LANDSCAPE MODIFICATION	SCENIC VALUE					
Upper Kopuaranga	Low / Medium	Medium	Fishing, game bird hunting	-	-	Rural (Conservation), Rural (Primary Production), Rural (Special), Road, River, Railway.	Natural wetlands and ponds
Mangamahoe	Low / Medium	Low / Medium	Fishing, game bird hunting	-	-	Rural (Primary Production), Rural (Special), Road, River, Railway, Cemetery.	Unfenced indigenous forest, Mixed exotic-indigenous forest
Kopuaranga Valley	Medium	Medium	Fishing, game bird hunting			Rural (Primary Production), Rural (Special), Road, River, Railway, Recreation, Education, Telecommunication.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Natural wetlands and ponds
Lower Kopuaranga	Medium	Low / Medium	Fishing, game bird hunting	Kopuaranga Truss Bridge (WCDP)	Kopuaranga settlement	Rural (Primary Production), Rural (Special), Road, River, Railway.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Natural wetlands and ponds



Existing River Maintenance

GWRC maintains a river scheme within this river and collects scheme rates based on benefit classification. It is estimated that approximately $1,000 per river km per annum is spent for river maintenance works.

Annual maintenance works objectives include:

1. To remove crack willow infestation and channel constriction
2. To maintain crack willow regrowth
3. To remove flood debris channel blockages

Historically, scheme services didn't include erosion control, and erosion issues were addressed through Isolated works policy on landowners' request. Minimal funding was available for willow and native species planting and no allocation was available for other noxious plant control.

This FMP proposes provision of erosion control works at priority locations. It is also planned to increase planting programme for erosion control and river enhancement. Other limited noxious plant control works are proposed to be included into river maintenance activities.

An extension of the scheme boundary further upstream for 24km from Clarke Domain is also proposed.

VALUES - Kopuaranga River

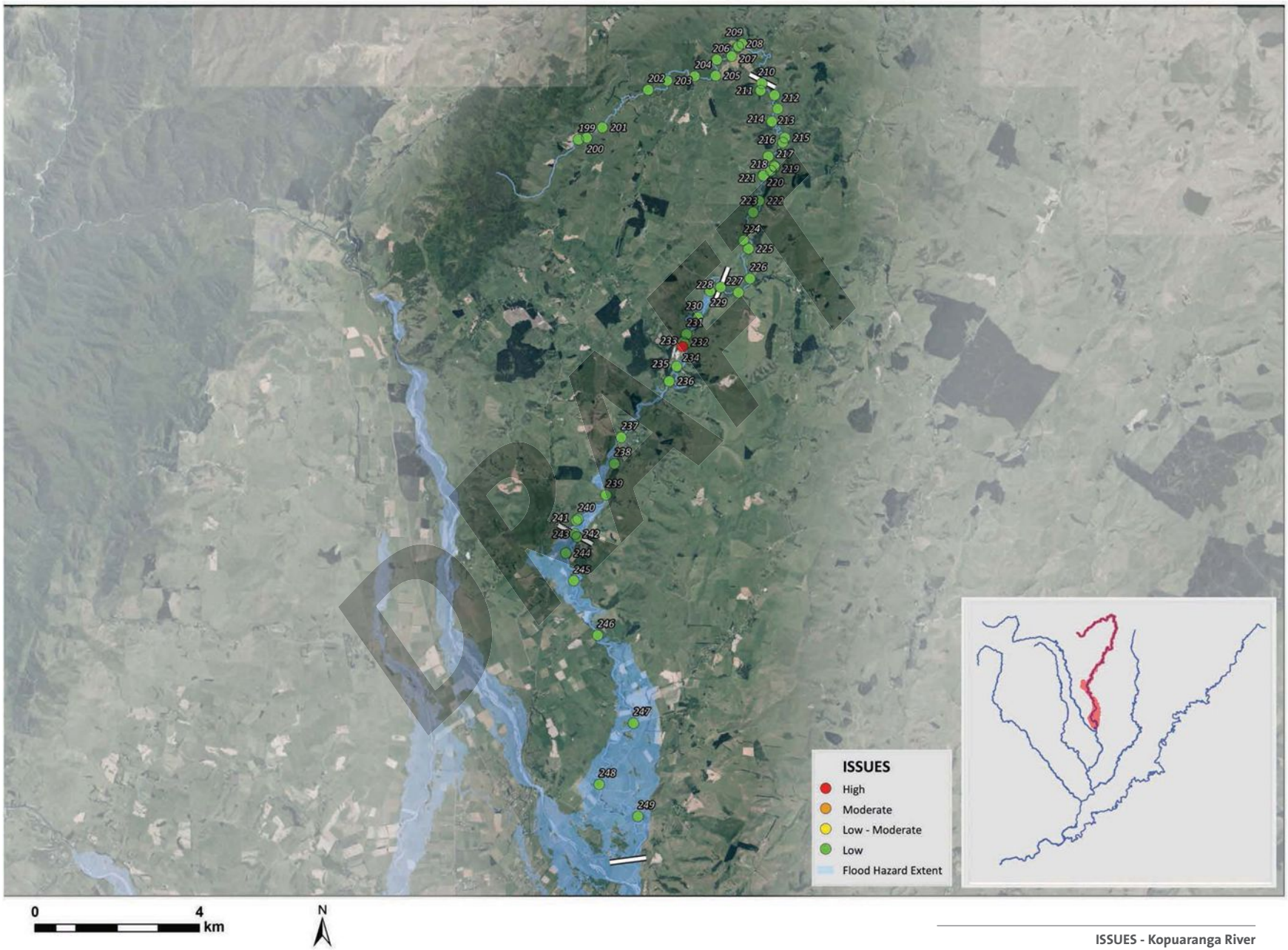
Kopuaranga River

Issues

The Kopuaranga River is prone to overtopping the banks of its incised (deeply cut) channel and spilling out onto the floodplain, even in relatively small flood events. This combined with a channel choked with willows may lead to extensive flooding across the plains affecting farms, homes and a number of rural roads.

There is minimal erosion risk posed by the Kopuaranga River, although there are concerns regarding silts washed from the banks and into the stream from its upper reaches. In its lower reaches it sits within a remnant overflow path of the Ruamāhanga River. A number of rural assets, structures, farm tracks and buildings have been included in the erosion hazard study area.

LOW	**Road [199]** Within erosion study area **Road [200]** Within erosion study area **Road [201]** Within erosion study area **Road [202]** Within erosion study area **Culvert/road [203]** Within erosion study area **Private road/culvert [204]** Within erosion study area **Road [205]** Within erosion study area **Outbuildings [206]** Within erosion study area **Road [207]** Within erosion study area **Private access/culvert [208]** Within erosion study area **Outbuildings [209]** Within erosion study area **Road/bridge & graveyard? [210]** Within erosion study area **Rail bridge [211]** Within erosion study area **Road [212]** Within erosion study area **Road [213]** Within erosion study area	**Rail [214]** Within erosion study area **Road [215]** Within erosion study area **Private access/bridge [216]** Within erosion study area **Rail [217]** Within erosion study area **Road [218]** Within erosion study area **Private bridge [219]** Within erosion study area **Woolshed [220]** Within erosion study area **House and buildings [221]** Potential oxbow cut-off **Private access/bridge [222]** Within erosion study area **Shed [223]** Within erosion study area **Rail [224]** Within erosion study area **Private access/bridge [225]** Within erosion study area **Road [226]** Within erosion study area **Road [227]** Within erosion study area	**Rail and private access [228]** Within erosion study area **Private bridge [229]** Within erosion study area **Private access/outbuildings [230]** Within erosion study area **Road [231]** Within erosion study area **Road bridge [232]** Within erosion study area **Rail bridge [233]** Within erosion study area **Private access [235]** Within erosion study area **Rail and road access [236]** Within erosion study area **Stock bridge [237]** Within erosion study area **Rail [238]** Within erosion study area **Road bridge [239]** Within erosion study area **Private access bridge [240]** Within erosion study area **Road [241]** Within erosion study area **Private access bridge [242]** Within erosion study area **Railway bridge [243]** Within erosion study area	**Private access bridge [244]** Within erosion study area **Private access bridge [245]** Within erosion study area **Donovans Road Bridge [246]** Within erosion study area **Stock bridge [247]** Within erosion study area **Stock bridge [248]** Within erosion study area **Private access bridge [249]** Within erosion study area
LOW TO MODERATE				
MODERATE				
HIGH	**Mauriceville settlement [234]** Within 1% AEP flood extent and affected by the erosion study area			



ISSUES - Kopuaranga River

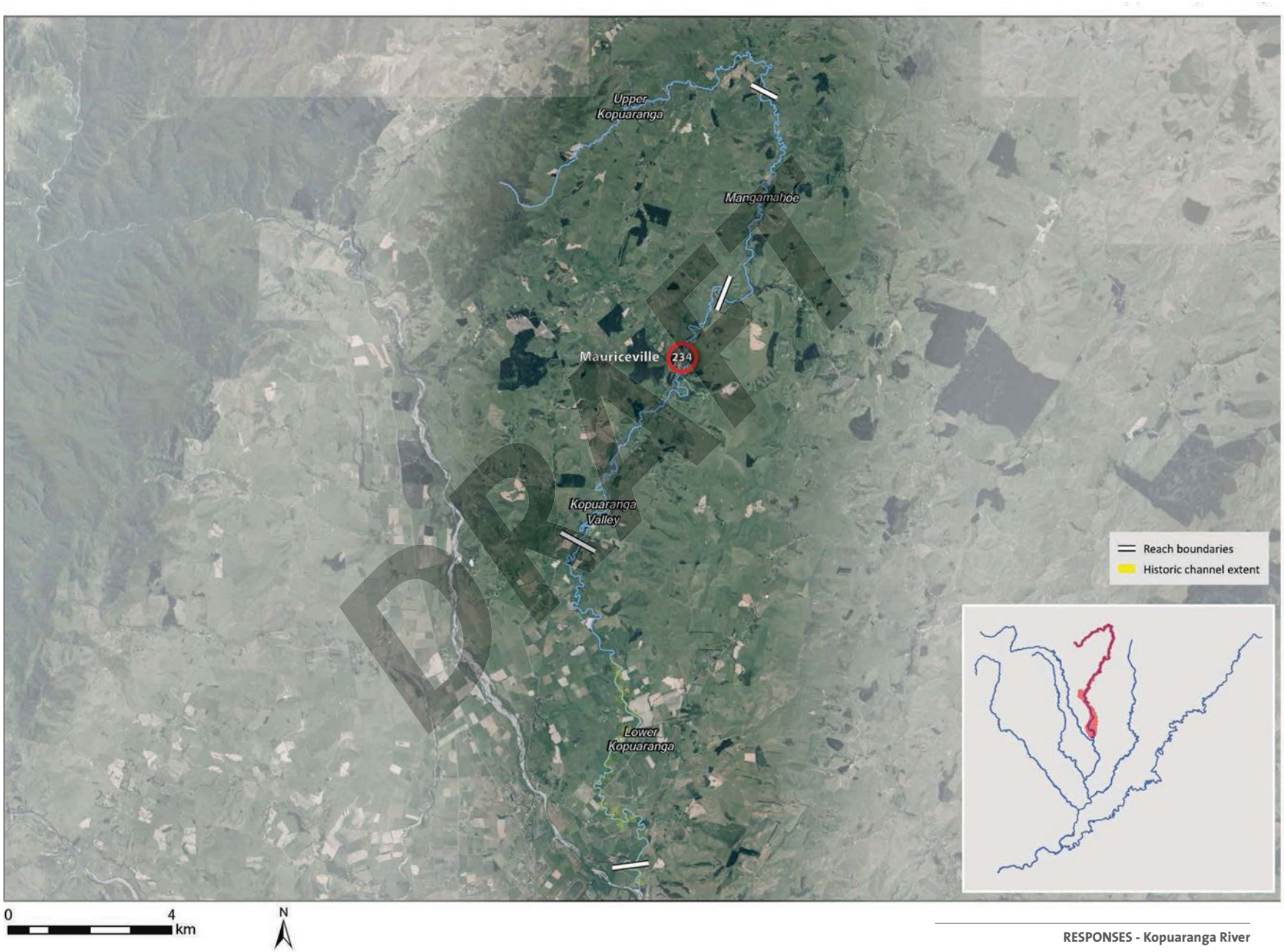
Kopuaranga River

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	234	Mauriceville	Emergency management	Provide flood hazard advice to Mauriceville	20%	5%	GWRC	Landowners	Medium
		Entire reach	River management	Scheme boundary extension to include Mauriceville. 10-year development phase in upper reach (upstream 24 km) prioritising willow removal and constriction point widening. Provision of erosion control management at priority locations within scheme (targeting downstream affected areas as a result of upstream drainage improvements).			GWRC	Landowners	Medium
COMMON METHODS		Entire reach	River management	River edge envelope, recognition of buffers as a river management tool, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs					



RESPONSES - Kopuaranga River

Whangaehu River

The Whangaehu River extends from the northern area of the Upper Wairarapa to the Ruamāhanga to the south-east of Masterton. The altitude of the Whangaehu catchment ranges from approximately 410 metres in the headwaters to around 90-95 metres at the lower end of the Te Ore Ore plains.

The upper reaches of the river flow from steep hill country near Ihuraua, and the river flows for some 32 kilometres to the Ruamāhanga River. It flows due south in the middle of a long rectangular catchment following the line of the ancient Alfredton fault. The steep catchment sides contain the river in a narrow valley in this area. In the lower reaches it meanders across the Te Ore Ore plains east of Masterton.

Formalised access to the Whangaehu River is limited, although a number of informal access agreements have been established between fishing and hunting recreation groups or individuals and landowners.

The Whangaehu River is very significant to Maori, with several cultural sites along the river and in the adjacent hills.

The Whangaehu catchment contains a mix of soils formed from sandstone, limestone and siltstone. Land-use in the catchment is predominantly primary production activities – dairying, dry stock grazing, cropping, and plantation forestry – with a few scattered areas of native forest throughout the catchment. There is little evidence of lifestyle type development in the upper catchment, although a number of subdivided lifestyle-sized lots have been created on the Te Ore Ore plains closer to Masterton.

Key characteristics by reach:

Upper Whangaehu

- Meandering stream through strongly rolling hills
- Mixed forestry and pastoral land use
- Open stream margins with sporadic willow and regenerating vegetation in upper reaches

Upper Whangaehu Valley

- Transition from stream to river
- Strongly rolling valley floor
- Steep gorges with mixed indigenous and willow vegetation

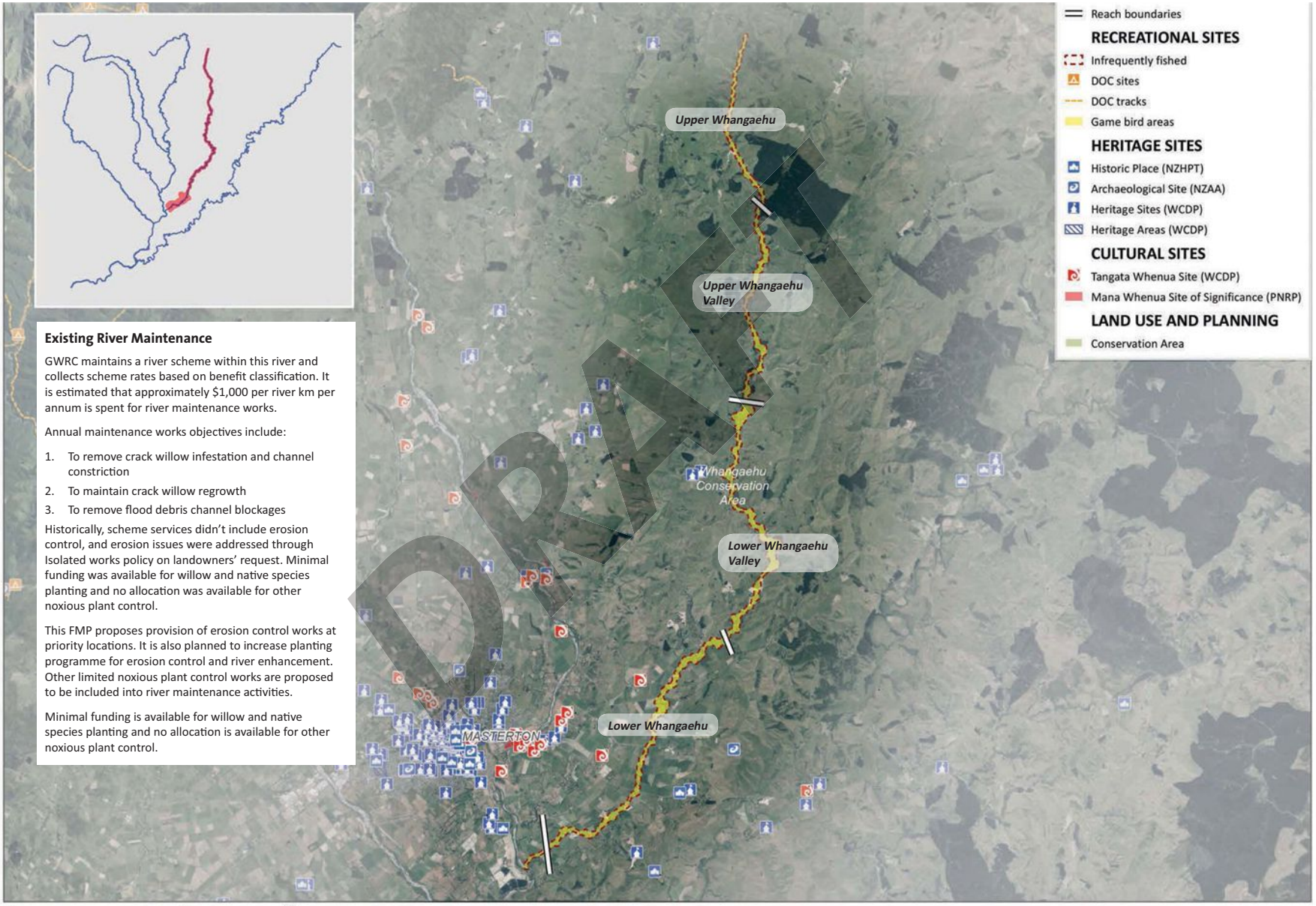
Lower Whangaehu Valley

- Meandering valley floor course
- Mixed willow and kanuka along margins

Lower Whangaehu

- Steeply incised grass banks
- Stock fencing separating river margins from surrounding areas
- Mixed poplar, willow and alder planting

REACH	LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
	LANDSCAPE MODIFICATION	SCENIC VALUE					
Upper Whangaehu	Low / Medium	Medium / High	Game bird hunting, infrequent fishing	-	-	Rural (Primary Production), Road, River.	-
Upper Whangaehu Valley	Low / Medium	Medium / High	Game bird hunting, infrequent fishing	-	-	Rural (Primary Production), Road, River.	indigenous forest, Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland
Lower Whangaehu Valley	Medium	Medium / High	Game bird hunting, infrequent fishing			Rural (Primary Production), Road, River.	Fenced indigenous forest, Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland
Lower Whangaehu	Medium	Low / Medium	Game bird hunting, infrequent fishing	-	-	Rural (Primary Production), Rural (Special), Road, River.	Mixed exotic-indigenous forest, Indigenous treeland



Existing River Maintenance

GWRC maintains a river scheme within this river and collects scheme rates based on benefit classification. It is estimated that approximately $1,000 per river km per annum is spent for river maintenance works.

Annual maintenance works objectives include:

1. To remove crack willow infestation and channel constriction
2. To maintain crack willow regrowth
3. To remove flood debris channel blockages

Historically, scheme services didn't include erosion control, and erosion issues were addressed through Isolated works policy on landowners' request. Minimal funding was available for willow and native species planting and no allocation was available for other noxious plant control.

This FMP proposes provision of erosion control works at priority locations. It is also planned to increase planting programme for erosion control and river enhancement. Other limited noxious plant control works are proposed to be included into river maintenance activities.

Minimal funding is available for willow and native species planting and no allocation is available for other noxious plant control.

VALUES - Whangaehu River

Whangaehu River

Issues

The small channel capacity of the main channel of the Whangaehu is frequently exceeded during heavy rainfall or storm events. When the river overtops its banks the floodwaters flow across the floodplain and into secondary or historic channels spread across the large flat area of the floodplain.

Historically, flooding in the Whangaehu River would have been exacerbated by blockages in the confined channel.

Flooding across the floodplain cuts off a number of communities when the east-west roads from Masterton are flooded. In many places the bridges are high enough above the floodplains to remain dry, but the roads on either side of them are covered with water deep enough to cause severe hazard for motor vehicles.

The erosion risk is relatively small due to the low energy of this river, and its limited ability to modify the surrounding geology. A number of bridges, sections of rural roads, and farm outbuildings are included within the erosion hazard study area. The river is, however, susceptible to silting from its banks and the hills in the catchment.

LOW

Road [250]
Within erosion study area
Road bridge [251]
Within erosion study area
Outbuildings [252]
Within erosion study area
Road and private access [253]
Within erosion study area
Road [254]
Within erosion study area
Private access/bridge [255]
Within erosion study area
House and buildings [256]
Within erosion study area
Road [257]
Within erosion study area
Road bridge [258]
Within erosion study area
Stock bridge [259]
Within erosion study area
Private access/bridge [260]
Within erosion study area
Road [261]
Within erosion study area
Road [262]
Within erosion study area
Road [263]
Within erosion study area
Stock bridge [264]
Within erosion study area
Road [265]
Within erosion study area
Private access [266]
Within erosion study area
Stock bridge [267]
Within erosion study area
Outbuildings [268]
Within erosion study area
Outbuildings [269]
Within erosion study area
Private access bridge [270]
Within erosion study area
Outbuildings [271]
Within erosion study area
Stock bridge [272]
Within erosion study area
Stock bridge [273]
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Access bridge [274]
Within erosion study area
Woolshed [275]
Within erosion study area
Road [276]
Within erosion study area
Access bridge [277]
Within erosion study area
Outbuildings [278]
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Private access bridge [279]
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Road [280]
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House and buildings [282]
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Outbuildings [288]
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Road bridge [289]
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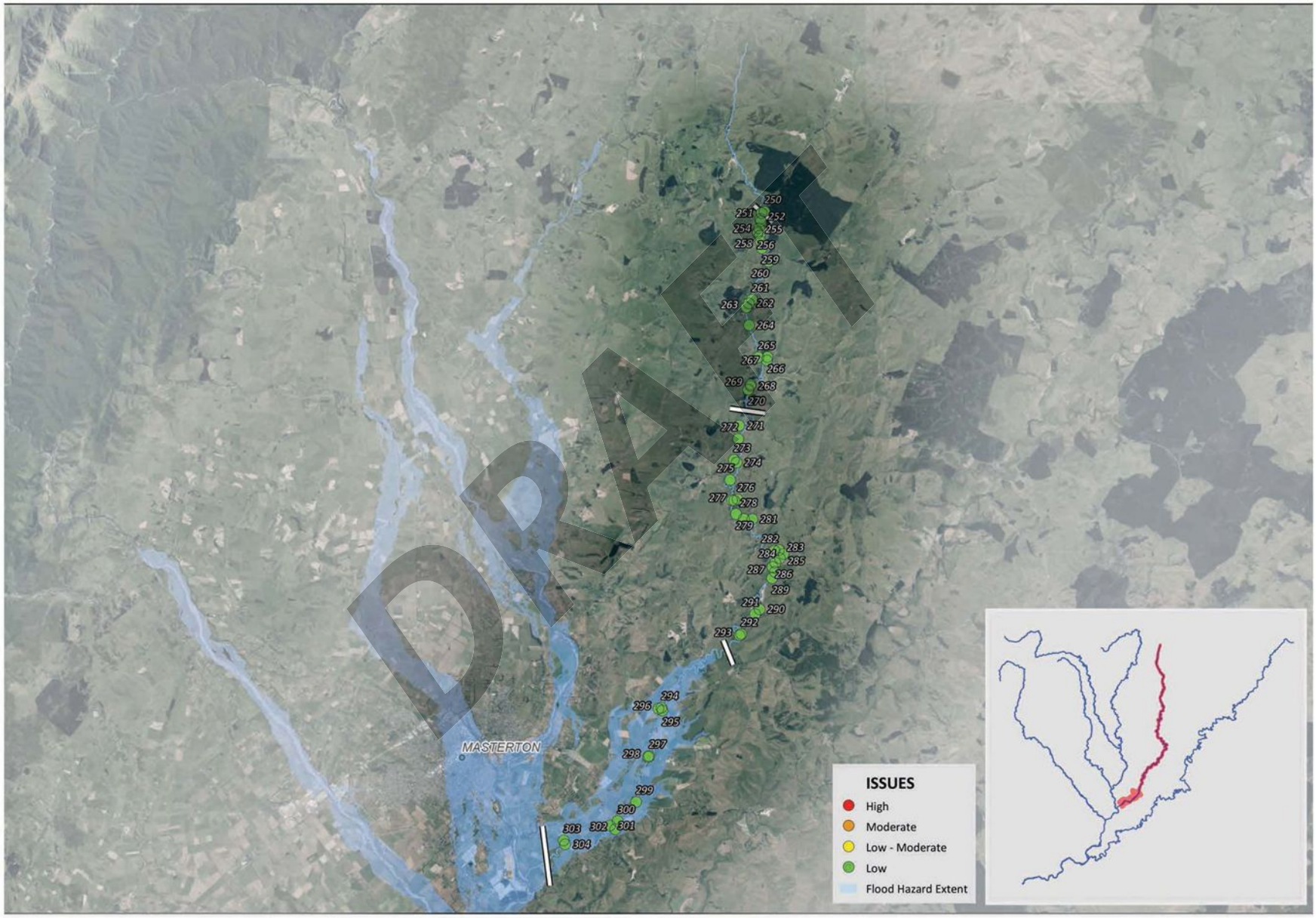
Road bridge [300]
Within erosion study area
Stock bridge [301]
Within erosion study area
Stock bridge [302]
Within erosion study area
Private access bridge [303]
Within erosion study area
Private access [304]
Within erosion study area

LOW TO MODERATE

MODERATE

HIGH



ISSUES - Whangaehu River

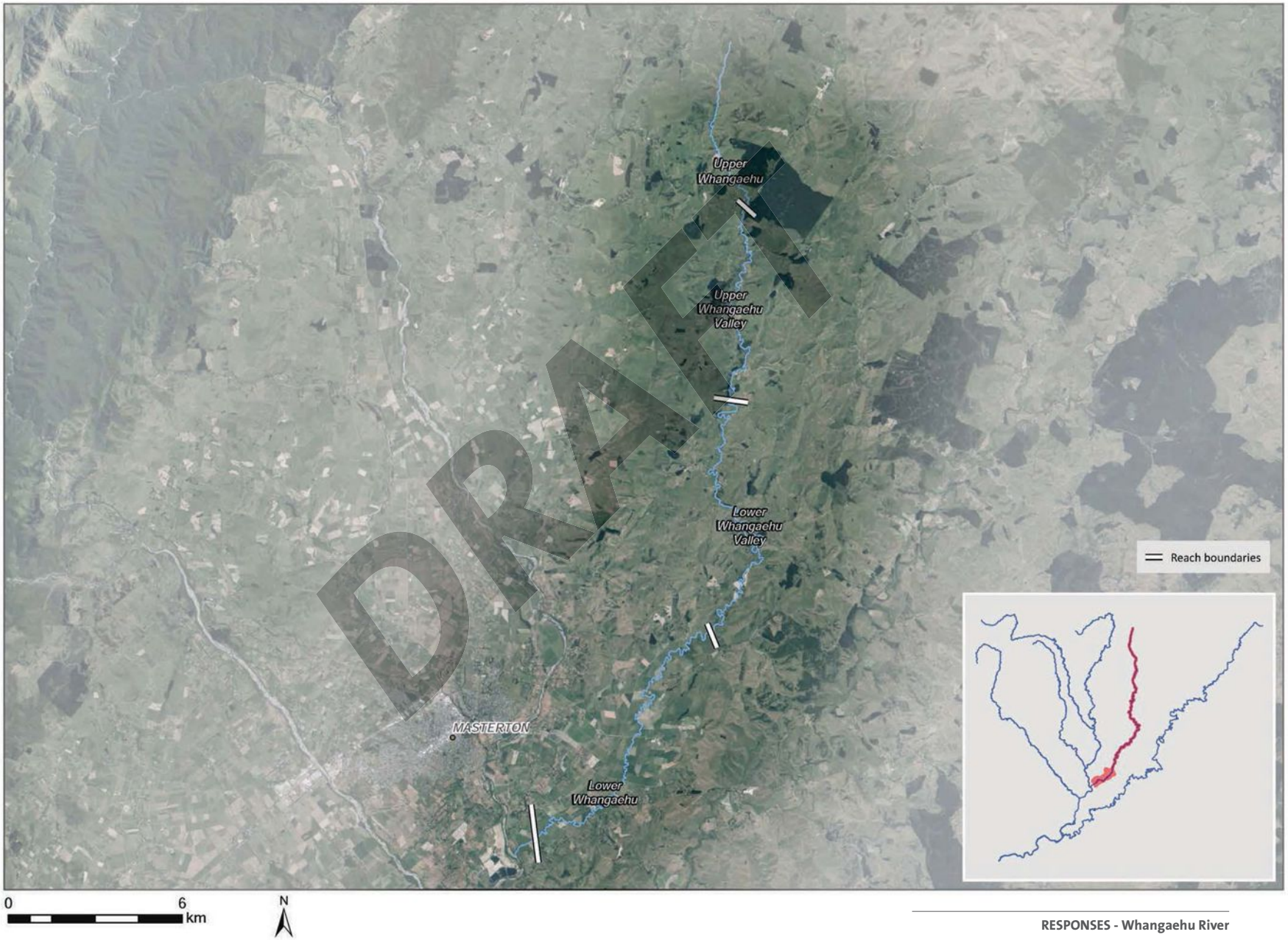
Whangaehu River

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES
COMMON METHODS		Entire reach	River management	River edge envelope, recognition of buffers as a river management tool, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs



RESPONSES - Whangaehu River

Taueru River

The Taueru (also known as Tauweru) River forms the eastern most river in the study area, and flows through the eastern Wairarapa Hills before connecting with the Ruamāhanga to the west of Gladstone along the eastern edge of the wider Wairarapa Plains. This has a total catchment area of 498 sq km and the main channel has a total length of 69 kilometres.

The river has a number of small tributaries, and comparably, for the size of the catchment, has a relatively small and narrow river channel. The upper reaches of the river pass through strongly rolling terrain containing pasture and forestry. The main river channel in the lower reaches has a relatively low gradient with a meandering pattern.

The Taueru River can be translated to mean "hanging in clusters".

The Taueru River catchment contains a mix of soils formed from sandstone, limestone and siltstone in the eastern Wairarapa hill country. Land use in the catchment is predominantly primary production activities (dairying, dry stock grazing, cropping, and plantation forestry), with a few scattered areas of native forest throughout the catchment. Farming activity, which dominates the modern land-use along its length, has had a substantial impact on the landform of the river. Pockets of good quality remnant native vegetation remain in some less accessible steep-sided gully areas, including isolated locations where remnant totara and kahikatea can be found. Within the managed area of the river, introduced vegetation in the form of clumps of willow and poplar dominates the channel form. Outside of the managed area, much of the floodplain and banks are grazed. This diverse mix of character has meant that reaches have generally been classified as having medium level of modification.

The floodplain of the Taueru River is relatively sparsely populated, with the development spread evenly along the length of the river and generally confined by the topography of the narrow valley.

The Taueru is particularly significant to Maori due to its historic significance as a travel route towards the north east and the coastal areas along the eastern side of New Zealand. This led to the formation of a number of settlements. There are several cultural sites identified along the river including locations of pa, urupa and mahinga kai. The Taueru River was a particularly abundant source of freshwater crayfish. Eels were more abundant in lower reaches of the river and today these parts of the river remain a valued fishery.

The remnant pockets of native vegetation and the river form make it important in some locations for recreational pursuits, which include game bird hunting, fishing and kayaking.

The lower reaches of the Taueru include several RAP sites, including Te Kopi Road and Peter Bush.

Key characteristics by reach:

Upper Taueru

- Mixed forestry and farmland
- Meandering stream with open grazed margins
- Corridors and clumps of willow and poplar trees

Bideford

- Meandering willow lined corridor
- Isolated gorges with remnant totara and kahikatea

Bramerton

- Sweeping river form, semi-enclosed river corridor
- Open grazed pasture banks
- Pockets of remnant indigenous forest

Taueru

- Meandering course cut below river terraces
- River terracing containing historic settlement
- Open grazed margins with sporadic willow, poplar and eucalypts

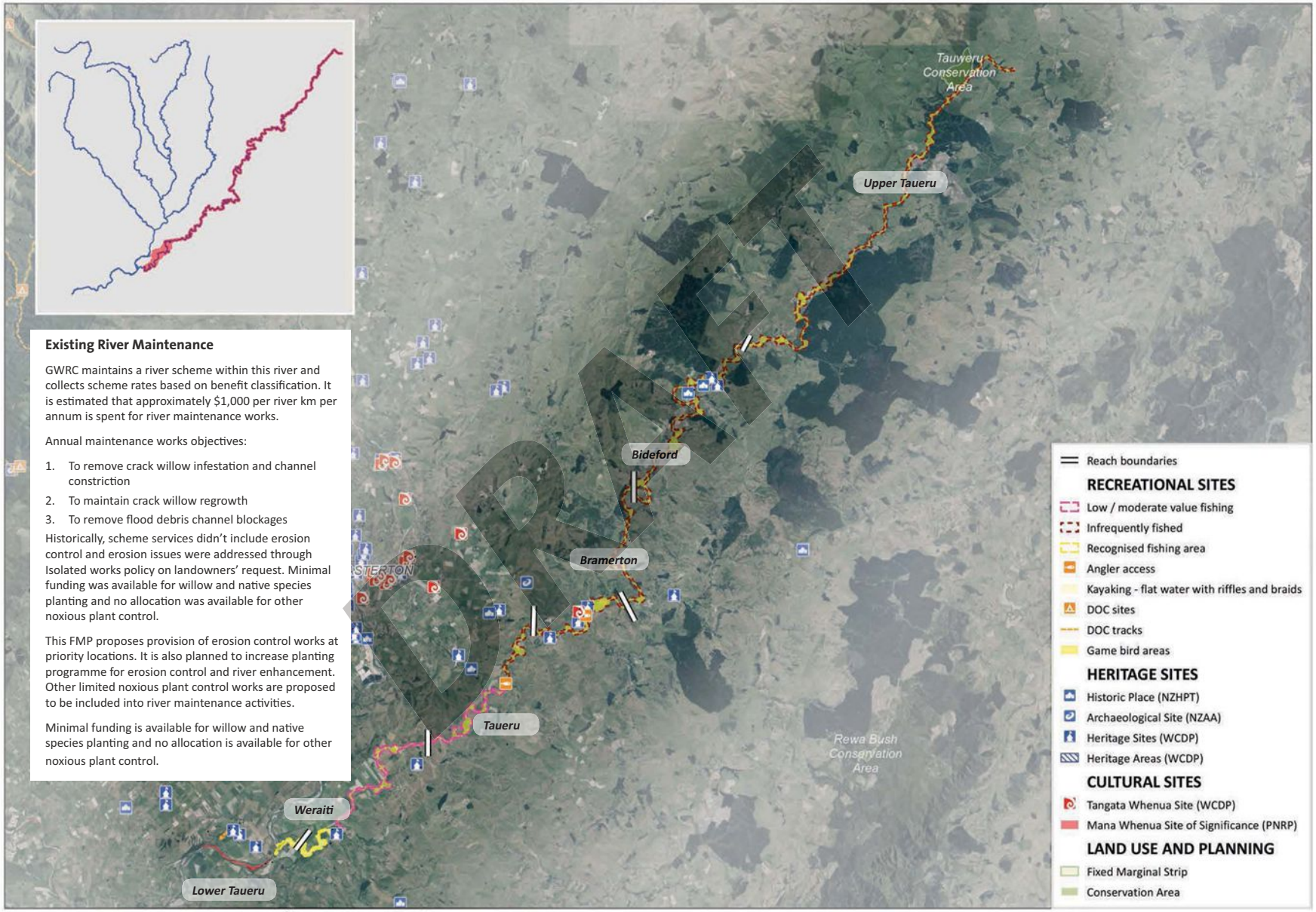
Weraiti

- Incised channel meandering through enclosed river terraces
- Mixed willow and pasture margins

Lower Taueru

- Incised channel meandering through the Wairarapa Plains
- Grassed margins separated from surrounding rural land use

REACH	LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
	LANDSCAPE MODIFICATION	SCENIC VALUE					
Upper Taueru	Medium	Medium / High	Game bird hunting, infrequent fishing	-	-	Rural (Primary Production), Road, River.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland
Bideford	Low / Medium	Medium	Game bird hunting, infrequent fishing	-	-	Rural (Primary Production), Road, River.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous Vegetation
Bramerton	Medium	Medium	Game bird hunting, infrequent fishing			Rural (Primary Production), River.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous Vegetation
Taueru	Medium	Medium	Angler access, game bird hunting, infrequently fished	-	Historic pa site, urupa and mahinga kai	Rural (Primary Production), Road, River.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Natural wetlands and ponds
Weraiti	Medium	Low / Medium	Angler access, game bird hunting, low/ moderate value fishing	-	-	Rural (Primary Production), Rural (Special), Road, River.	Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland
Lower Taueru	Medium	Medium	Kayak access, kayaking, game bird hunting, excellent fishing	Memorial Oaks (WCDP)	Urupa	Rural (Primary Production), Rural (Special), Road, River, Flood Protection and Mitigation.	Te Kopi Road (RAP), Peter's Bush (RAP), Unfenced indigenous forest, Mixed exotic-indigenous forest, Indigenous treeland, Natural wetlands and ponds



Existing River Maintenance

GWRC maintains a river scheme within this river and collects scheme rates based on benefit classification. It is estimated that approximately $1,000 per river km per annum is spent for river maintenance works.

Annual maintenance works objectives:

1. To remove crack willow infestation and channel constriction
2. To maintain crack willow regrowth
3. To remove flood debris channel blockages

Historically, scheme services didn't include erosion control and erosion issues were addressed through Isolated works policy on landowners' request. Minimal funding was available for willow and native species planting and no allocation was available for other noxious plant control.

This FMP proposes provision of erosion control works at priority locations. It is also planned to increase planting programme for erosion control and river enhancement. Other limited noxious plant control works are proposed to be included into river maintenance activities.

Minimal funding is available for willow and native species planting and no allocation is available for other noxious plant control.

VALUES - The Taueru River

Taueru River

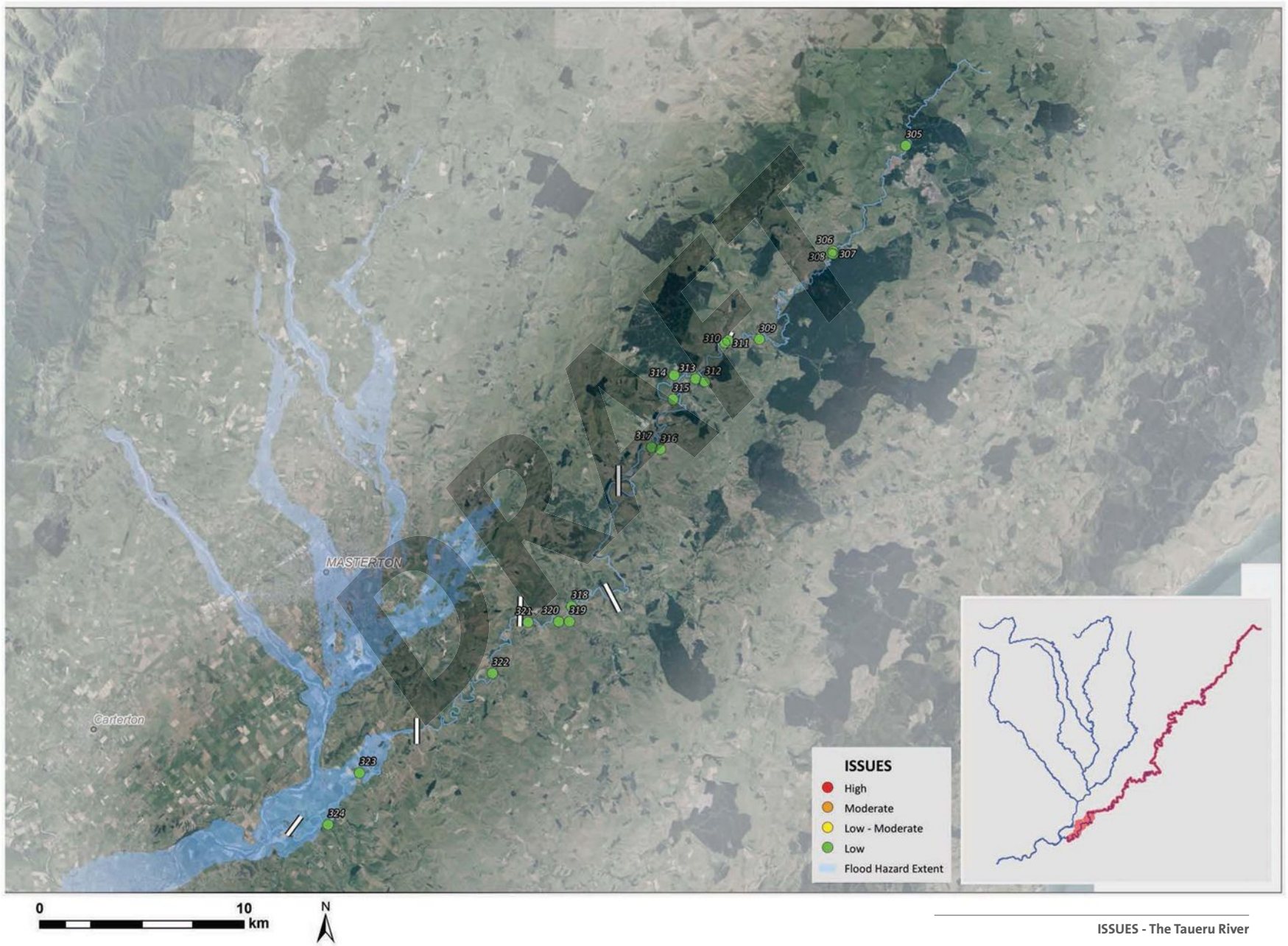
Issues

Flooding frequently overtops the banks of the river to flow across the floodplain, and to a lesser extent through secondary channels. The large catchment of Taueru has led to some significant floods in the past.

The key risks relate to flooding of productive land, access routes to residential property, and the flood risk for rural homes.

The erosion risk posed by the Taueru River is very limited, and only a small number of bridges and structures sit within the erosion hazard study area. The river however is susceptible to heavy silting from sediments washed from its banks and hills in the catchment.

LOW	**Road and Bridge [305]** Within erosion study area	**Road bridge [310]** Within erosion study area	**Private access bridge [315]** Within erosion study area	**Stock bridge [320]** Within erosion study area
	House and outbuildings [306] Within erosion study area	**Road [311]** Within erosion study area	**Private access [316]** Within erosion study area	**Private access bridge [321]** Within erosion study area
	House and outbuildings [307] Within erosion study area	**Road [312]** Within erosion study area	**Private access bridge [317]** Within erosion study area	**Road bridge [322]** Within erosion study area
	Private access bridge [308] Within erosion study area	**Private access bridge [313]** Within erosion study area	**Road bridge [318]** Within erosion study area	**Private access bridge [323]** Within erosion study area
	Private access bridge [309] Within erosion study area	**Private access bridge [314]** Within erosion study area	**Stock bridge [319]** Within erosion study area	**Road bridge [324]** Within erosion study area
LOW TO MODERATE				
MODERATE				
HIGH				



ISSUES - The Taueru River

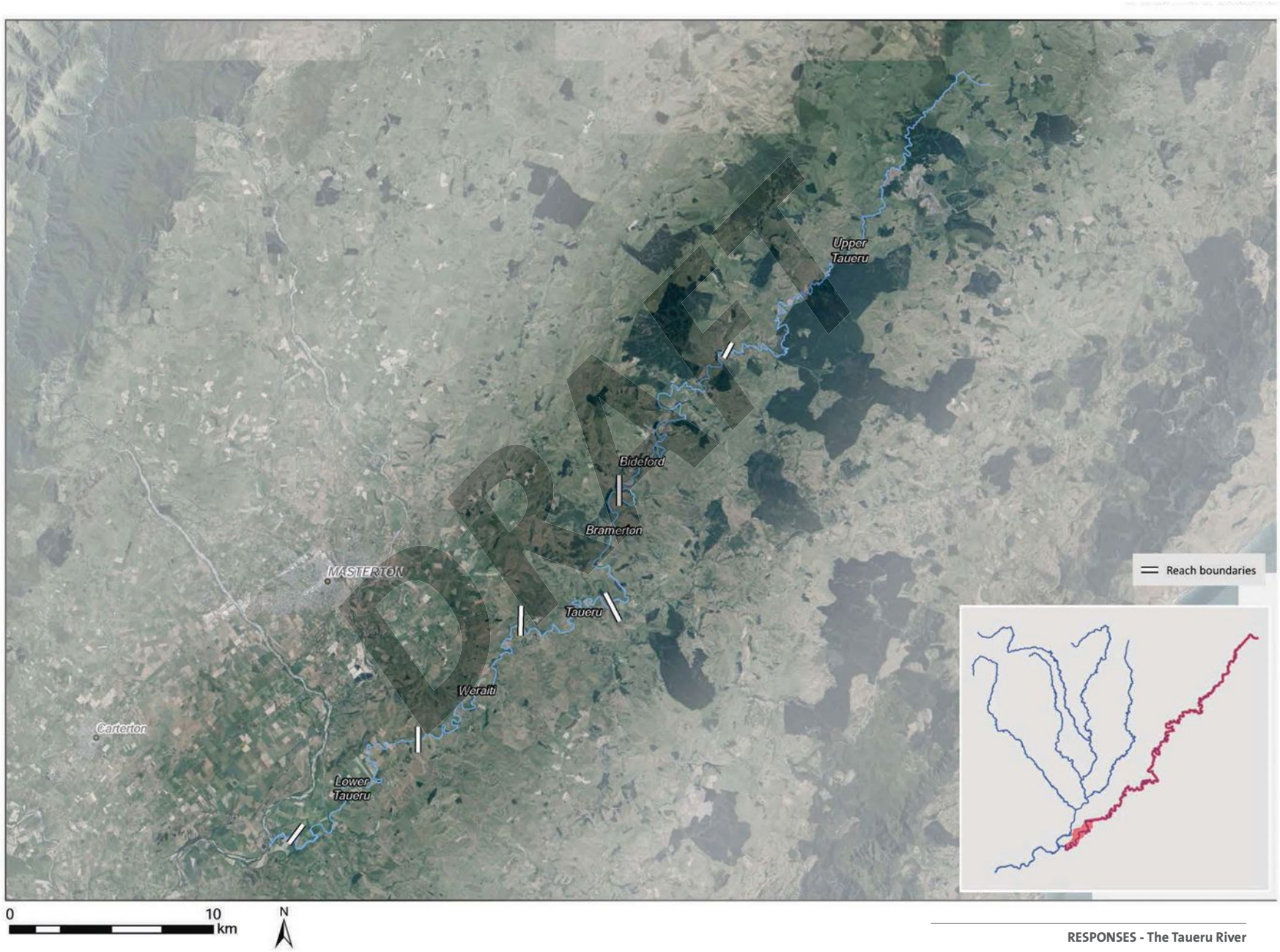
Taueru River

Response

Common methods and specific responses that apply to this reach are set out below. The common methods used to address specific issues are listed in Appendix 1.

Reach Specific Responses

	ISSUE ID	SITE	TYPE OF RESPONSE	PROPOSED MEASURES
COMMON METHODS		Entire reach	River management	River edge envelope, river bed level monitoring, recognition of buffers as a river management tool, pool-riffle-run envelope, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses within planted buffers
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, scheme decision policy, abandonment/retirement of assets, land access & strategic land purchase
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, care group and clubs



RESPONSES - The Taueru River

Appendix 1
Issues Summary

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES - FOR GENERAL RESPONSES FOR EACH REACH REFER TO RESPONSE SUMMARY

ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
1	Ruamāhanga	2	State Highway 2	SH2 runs close to a gorge section of the Ruamāhanga River and sits within the erosion study area. The risk of erosion here is considered low because of natural rock control. Further information on geology may clarify any risk.	Erosion	Infrastructure	Low	River edge envelope	Code of Practice		3rd party asset owner liaison	
2	Ruamāhanga	2	SH2 bridge	SH2 crosses the Ruamāhanga and the abutments sit within the erosion study area. This section of the river is well entrenched and gorge like and risk to this structure is considered low.	Erosion	Infrastructure	Low	River edge envelope	Code of Practice		3rd party asset owner liaison	
3	Ruamāhanga	2	Scheme upstream boundary location	The upstream boundary of the Scheme sits below the gorge area of the river, it is recommended that this is reviewed in consultation with landowners in this area.	Erosion	Flood Protection	Low to Moderate	River edge envelope				Scheme expansion unlikely
4	Ruamāhanga	2	House	A house at 2036A SH2 sits within the erosion study area extent, but outside the modelled 1%AEP flood area.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
5	Ruamāhanga	2	House	A hosue at 1986 SH2 sits within the erosion study area extent, but outside the modelled 1% AEP flood area.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
6	Ruamāhanga	2	House	A house at 1964 SH2 sits within the erosion study area extent, but outside the modelled 1% AEP event.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
7	Ruamāhanga	2	Private stock bridge	There is a stock bridge that crosses the river which sits within the erosion study area and potentially at risk of damage from debris flows, bed level changes and flood events.	Flood & Erosion	Infrastructure	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
8	Ruamāhanga	2	House	A habitable structure sits within the erosion study area.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
9	Ruamāhanga	2	SH2	SH2 sits within the erosion study area extent, but is considered to be at low risk because of geology in area and distance from active channel.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Code of Practice		3rd party asset owner liaison	
10	Ruamāhanga	2	Channel alignment	No design channel exists for upstream of scheme boundary.	Erosion	Flood Protection	Low	River edge envelope				
11	Ruamāhanga	2	Private bridge	A private bridge structure crossing the river with abutments is within the erosion study area. This may be susceptible to debris flows, erosion issues, and bed level changes.	Flood & Erosion	Infrastructure	Low to Moderate	River bed level monitoring	Emergency management planning			
12	Ruamāhanga	2	Dunvegan Forest Remnants RAP sites	Dunvegan Forest Remnants are within erosion study area and within the 1% AEP modelled flood extent.	Flood & Erosion	Environment	Low	River edge envelope	Protection against deforestation in the upper catchment	Flood hazard maps		
13	Ruamāhanga	3	Site of regional significance	The Hidden Lakes area is a site of regional significance. It is within the erosion study area extents and current regional planning is unclear if there will be a requirement to protect this against possible future erosion.	Erosion	Cultural Value	Moderate	River edge envelope	Code of Practice	Environmental strategy		
14	Ruamāhanga	3	Outbuildings	Possible farm ancillary buildings are within the erosion study area and within the 1% AEP flood area.	Flood & Erosion	Business	Low to Moderate	River edge envelope	Flood hazard maps	Emergency management planning		
15	Ruamāhanga	3	House	A house at 65 Fenemor Road is located within the erosion study area. It is situated outside the 1% AEP flood area.	Flood	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
16	Ruamāhanga	3	Houses	Houses near 1158 SH2 are within the erosion study area. The properties around these houses are within the 1% AEP flood area.	Flood & Erosion	House	Moderate	River edge envelope	Flood hazard maps	Emergency management planning		
17	Ruamāhanga	3	House	A house at 1050 SH2 sits within erosion study area. The house is not wtihin the 1% AEP flood area but areas of the surrounding property area affected.	Flood & Erosion	House	Low to Moderate	River edge envelope	Flood hazard maps	Emergency management planning		
18	Ruamāhanga	3	Gravel extraction site	This location is a good gravel extraction point with good current access, it is used and licensed by GWRC Flood Protection.	Land use	Flood Protection	Low	River bed level monitoring	Code of practice			

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES - FOR GENERAL RESPONSES FOR EACH REACH REFER TO RESPONSE SUMMARY

ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
19	Ruamāhanga	3	Houses	Houses at 8 Opaki Kaipararo Road and 212 Opaki Kaipararo Road are within the erosion study area.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
20	Ruamāhanga	3	SH2	SH2 sits within the erosion study area but is considered to be at low risk because of the geology.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Emergency management planning		3rd party asset owner liaison	
21	Ruamāhanga	3	Railway line	The main north-south railway line sits within the erosion study area, the natural rock control in this area is currently protecting the line. The line is infrequently used.	Erosion	Infrastructure	Moderate	River edge envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
22	Ruamāhanga	3	Double bridges	The SH2 and Rail bridges are susceptible to bed level changes. Current bed levels provide adequate freeboard for the bridge soffits, however there are concerns about scour around the piers. The bridge abutments are protected by natural rock controls.	Flood & Erosion	Infrastructure	Moderate	River bed level monitoring	Code of Practice	Emergency management planning	3rd party asset owner liaison	
23	Ruamāhanga	3	Houses	The houses in vicinity of the southern bridge abutment are within the erosion study area, however are likely to be protected by the natural rock controls around the SH2 and Rail bridges.	Erosion	House	Low to Moderate	River edge envelope	Emergency management planning			
24	Ruamāhanga	4	Opaki water race intake	This water race intake is reasonably stable and only requires occasional maintenance to ensure it operates.	Erosion	Infrastructure	Low to Moderate	River bed level monitoring	Code of Practice	Emergency management planning	3rd party asset owner liaison	
25	Ruamāhanga	4	Swimming hole	The double bridges swimming hole is very popular, but it is also a hazardous swimming location.	Land use	Recreation	Low to Moderate	Environmental strategy	Community Support Officer			
26	Ruamāhanga	4	Bluff Rangitumau Road	The road sits within the erosion study area but is likely to be of low risk due to natural rock control.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Emergency management planning			
27	Ruamāhanga	4	Stopbank	Stopbank within the buffer, needs to be moved to the outer extent of buffer and away from erosion pressures from river.	Flood & Erosion	Flood Protection	Low	River edge envelope	Rural stopbank policy			
28	Ruamāhanga	4	Erosion control works	Erosion control works for Rathkeale stopbank are used to maintain the design fairway in this area.	Erosion	Flood Protection	Moderate	River edge envelope			3rd party asset owner liaison	Major project response
29	Ruamāhanga	4	Stopbank	The Rathkeale stopbank is located in the erosion study area. It currently requires protection from bank erosion.	Erosion	Flood Protection	Moderate	River edge envelope			3rd party asset owner liaison	Major project response
30	Ruamāhanga	4	Urupa	A historic urupa site which sits on the edge of a cliff above the Ruamāhanga River and is located within the erosion study area.	Erosion	Cultural	Moderate	River edge envelope	Environmental strategy			
31	Ruamāhanga	4	House	A house at 143A Matapihi Road sits within the erosion study area, but it is outside the 1%AEP flood area.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
32	Ruamāhanga	4	Rathkeale College buildings	Rathkeale College sheds are located within the erosion study area and the 1%AEP flood area.	Flood & Erosion	Business	Low to Moderate	Flood hazard maps	Emergency Management Planning	Community resilience	3rd party asset owner liaison	Major project response
33	Ruamāhanga	4	Rathkeale College sewage pond	The sewage treatment ponds for Rathkeale College are located within the erosion study area and are within the 1% AEP flood area.	Flood & Erosion	Business	Moderate	Flood hazard maps	Emergency Management Planning	Community resilience	3rd party asset owner liaison	Major project response
34	Ruamāhanga	4	Bed armouring	The river bed is becoming armoured (hard packed together) due to the addition of finer sediments falling onto it from the cliffs above.	Erosion	Flood Protection	Low to Moderate	River bed level monitoring	Isolated Works support			
35	Ruamāhanga	4	House	A house on 7 Matapihi Road is located within the erosion study area but outside the 1% AEP flood area.	Erosion	House	Low to Moderate	River edge envelope	Emergency management planning			
36	Ruamāhanga	4	Houses	At 365 Black Rock Road,the house is located within the erosion study area and sits on the edge of the 1%AEP flood area.	Flood & Erosion	House	Low to Moderate	Flood hazard maps	River edge envelope	Emergency management planning		
37	Ruamāhanga	4	Private water take	A private water intake for an irrigation system is located within erosion study area. No known issues.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Community resilience			
38	Ruamāhanga	4	Outbuilding	A farm storage or utility building is located within the erosion study area but outside the 1% AEP flood area.	Erosion	Business	Low to Moderate	River edge envelope	Code of Practice			

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39	Ruamāhanga	4	Road	Black Rock Road is within the erosion study area at this location, it has required erosion protection within the last decade.	Erosion	Infrastructure	Moderate	River edge envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
40	Ruamāhanga	4	Houses	147 to 240 Black Rock Road have houses which sit within the erosion study area. The houses on these properties sit outside the 1%AEP flood area.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
41	Ruamāhanga	4	Water intake	The subsurface gallery intake consent application would be at risk of channel degrade.	Erosion	Infrastructure	Low	River bed level monitoring	Code of Practice			
42	Ruamāhanga	4	Private frost protection intake	The private water intake for frost protection system sits within the erosion study area.	Erosion	Infrastructure	Low	River edge envelope	Code of Practice	Emergency management planning		
43	Ruamāhanga	4	Channel alignment	At XS245+50m - hard edge protection holds a narrow design channel alignment at this location, the river may naturally tend to a wider channel.	Erosion	Flood Protection	Low	River edge envelope	Code of Practice			
44	Ruamāhanga	4	House	138 Gordon Street sits within the erosion study area, but is well set back from the river channel behind a high bank.	Erosion	House	Low	River edge envelope	Emergency management planning			
45	Ruamāhanga	4	Henley Lake water intake	The channel alignment and bed levels in this area cause intake problems for water to Henley Lake.	Erosion	Infrastructure	High	River edge envelope	River bed level monitoring		3rd party asset owner liaison	
46	Ruamāhanga	4	Te Ore Ore stopbank	The stopbank is believed to be of low standard of protection but several properties behind it are affected by the modelled 1% AEP flood area.	Flood	Flood Protection	Low to Moderate	Rural stopbank policy	Code of Practice	Flood hazard maps		
47	Ruamāhanga	4	Industrial yards	Sheds, machinery, possible contaminants are sitting within the erosion study area and the 1%AEP flood area.	Flood & Erosion	Environment	Low to Moderate	River edge envelope	Flood hazard maps	Community resilience		
48	Ruamāhanga	4	Powerlines north of Te Ore Ore bridge	Transmission lines are located north of the Te Ore Ore bridge and the pylons are located outside river bed but may be affected by the erosion study area.	Erosion	Infrastructure	Low	River edge envelope	Emergency management planning		3rd party asset owner liaison	
49	Ruamāhanga	4	Te Ore Ore Bridge	This bridge is relatively new and therefore risk of scour issues is unlikely. It may be affected by changes to weir arrangements, and abutments sit within erosion study area.	Flood & Erosion	Infrastructure	Low	River bed level monitoring	River edge envelope			
50	Ruamāhanga	4	Te Ore Ore weir	Ongoing effects of damaged rock and rail weirs across the river. It is visually unattractive and a safety concern for recreation users of the river.	Erosion	Recreation	High	Code of Practice	Environmental strategy			
51	Ruamāhanga	5	Henley Lake	Henley Lake park area is being eroded and historically has been threatened by erosion. There is a current staged land retreat in progress to allow greater room for the river.	Erosion	Recreation	High	River edge envelope	Code of Practice			
52	Ruamāhanga	6	Powerlines	Transmission lines cross the river, the pylons are located outside river bed but within the erosion study area.		Infrastructure	Low to Moderate	River edge envelope	Emergency management planning		3rd party asset owner liaison	
53	Ruamāhanga	5	Narrow river channel	River flows regularly break out onto paddocks on the true left bank of the river, this alleviates some of the erosion and flood risks to River Road properties.	Flood & Erosion	Flood Protection	Low to Moderate	River edge envelope	Code of Practice			
54	Ruamāhanga	5	Houses	Approximately 14 River Road properties are at risk of erosion from the Ruamāhanga River. They have historically been threatened in floods.	Flood & Erosion	House	High	River Edge envelope	Code of Practice	Emergency Management Planning		Major project response
55	Ruamāhanga	5	Cemetery	The cemetery sits within the erosion study area. It has historically suffered from erosion and light rock protection is in place to manage some of these effects.	Erosion	Infrastructure	Moderate	River edge envelope	Code of Practice			
56	Ruamāhanga	5	Closed landfill	Potential erosion of contaminated material. This area has eroded previously, it is now protected with light rock and willows.	Erosion	Environment	Moderate	River edge envelope	Code of Practice			
57	Ruamāhanga	5	Stopbank	A 10-20-year stopbank infested with trees has an increasing risk of failure which would affect the Wastewater Treatment Plant.	Flood & Erosion	Flood Protection	Moderate	Code of Practice	Rural stopbank policy			
58	Ruamāhanga	5	Channel alignment	The true left bank of the channel in this location is maintained by groynes on an alignment outside of the design fairway.	Erosion	Flood Protection	Low to Moderate	River edge envelope	Code of Practice			

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59	Ruamāhanga	5	Stopbank	The level of service of this stopbank is unclear from downstream of the closed landfill.	Flood	Flood Protection	Low to Moderate	Rural stopbank policy	Code of Practice			
60	Ruamāhanga	5	WWTP irrigation beds	A proposed irrigation area is protected by a vulnerable ~2-year stopbank. These irrigation beds currently sit within the buffers and are within the erosion study area and 1% AEP flood area.	Flood & Erosion	Infrastructure	High	Recognition of buffers as a river management tool	Flood hazard maps		3rd party asset owner liaison	
61	Ruamāhanga	5	MDC Waste Water Treatment Plant	The Wastewater Treatment Plant sits within both the erosion study area and the 1% AEP flood area. There are some 1% AEP stopbanks protecting the asset however these are outflanked further upstream.	Flood & Erosion	Infrastructure	Moderate	Flood hazard maps	River edge envelope	Emergency management planning	3rd party asset owner liaison	Major project response
62	Ruamāhanga	5	House	A house at 374A Lees Pakaraka Road sits within the erosion study area.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
63	Ruamāhanga	5	Road	Lees Pakaraka Road sits within the erosion study area and on the edge of the 1% AEP flood area.	Flood & Erosion	Infrastructure	Moderate	River edge envelope	Flood hazard maps	Emergency management planning	3rd party asset owner liaison	
64	Ruamāhanga	5	WWTP discharge point	The Wastewater Treatment Plant discharges treated water to the Ruamāhanga River.	Land use	Environment	High	River edge envelope	Code of Practice		3rd party asset owner liaison	
65	Ruamāhanga	4	Channel alignment	Historically the channel was wider at this location than the current very narrow design channel alignments.	Erosion	Flood Protection	Low to Moderate	River edge envelope	Historic channel lines			
66	Ruamāhanga	5	Three houses	Three houses in erosion study area are considered to be at lower risk than the road upstream due to high bank and cemented deposits. There is no history of erosion.	Erosion	House	Low	River edge envelope	Code of Practice	Emergency management planning		
67	Ruamāhanga	5	Wardells Bridge	The river bed in the location of this bridge is observed to be a very stable site, with low risk of erosion or scour. The road to the north of the bridge is within by the 1% AEP flood area.	Flood & Erosion	Infrastructure	Moderate	Code of Practice	Flood hazard maps		3rd party asset owner liaison	
68	Ruamāhanga	6	Waingawa-Ruamāhanga confluence	Instability from Waingawa flows influences the Ruamāhanga at this location making it a very challenging area to manage and the river management lines are very difficult to achieve.	Erosion	Flood Protection	Low to Moderate	River edge envelope	Code of Practice			
69	Ruamāhanga	6	Ruamāhanga river terrace RAP site	An RAP site is on the edge of the 1%AEP flood extent and within erosion study area.	Flood & Erosion	Environment	Low	River edge envelope	Environmental strategy	Flood hazard maps		
70	Ruamāhanga	6	Channel alignment	The channel is naturally wider than the design channel alignment in this location.	Erosion	Flood Protection	Low	River edge envelope	Code of Practice			
71	Ruamāhanga	6	Houses	There are several houses located in the erosion study area. They are located on reasonably firm material, on a high terrace which is unlikely to erode.	Erosion	House	Low	River edge envelope				
72	Ruamāhanga	6	River alignment	This section of the river has proved to be a challenge to manage to the river management lines and pushes out towards the edge of its buffers on both banks.	Erosion	Flood Protection	Low	River edge envelope	Code of Practice			
73	Ruamāhanga	6	Frost protection water intake	There is an erosion threat to a private water intake located within the erosion study area, the landowner has provided some protection.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
74	Ruamāhanga	6	River alignment	The river alignment in this location needs constant management and if alignment is not well managed, it spills extra water onto Te Whiti Flats, and the Te Whiti stopbank is at risk of overtopping.	Flood & Erosion	Flood Protection	Moderate	River edge envelope	Code of practice			
75	Ruamāhanga	6	Fish habitat	This is a site for fish habitat.	Land use	Environment	Low	Land use controls	Environmental strategy			
76	Ruamāhanga	6	Dakins Road - public road	Erosion affecting the end section of Dakins Road, near Cottier Estate has been addressed in past with rock works. These rock works have protected the immediate area they were installed to protect, but adjacent areas are still affected by erosion.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Isolated Works support	Emergency management planning		
77	Ruamāhanga	6	Te Whiti Stopbank	The stopbank sits within the erosion study area and in places within the current buffers. There is a risk that it may erode and expose protected areas. It currently protects a known flooding area.	Flood & Erosion	Flood Protection	Moderate	River edge envelope	Code of practice			
78	Ruamāhanga	6	Channel alignment	Buffer widths upstream of the Taueru confluence require review.	Erosion	Flood Protection	Low	River edge envelope				

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79	Ruamāhanga	6	Fish passage	This is an important confluence between the Ruamāhanga and Taueru Rivers.	Land use	Environment	Low to Moderate	Environmental strategy				
80	Ruamāhanga	6	Gladstone complex	The Gladstone pub, sports fields and several houses sit within the erosion study area and are within the 1%AEP flood area Despite these risks there is no recorded history of flooding or erosion.	Flood & Erosion	Business	Low to Moderate	Flood hazard maps	River edge envelope	Emergency management planning		
81	Ruamāhanga	6	Gladstone Bridge	There are no known issues of scour or erosion at this bridge, however an exclusion zone applies to 100m upstream and downstream. Freeboard to soffit is ok and debris flow risk is ok.	Flood & Erosion	Infrastructure	Low to Moderate	Code of Practice				
82	Ruamāhanga	7	Stopbank	This stopbank protects farmland and is of very poor quality. It is overgrown with trees and believed to be susceptible to failure.	Flood & Erosion	Flood Protection	Low to Moderate	Rural stopbank policy				
83	Ruamāhanga	7	Ahiaruhe Stopbank	This stopbank protects farmland against small, more frequent, flood events. It is located within the erosion study area and close to the river. It is full of trees and has a high risk of failure.	Flood & Erosion	Flood Protection	Moderate	Rural stopbank policy				
84	Ruamāhanga	7	River access	An easement has been created to allow access to Carter Reserve. This site is not being promoted and there is a risk that disuse may lose future opportunities.	Land use	Recreation	Low	Care groups and clubs	Environmental strategy	Land use controls		
85	Ruamāhanga	7	Gravel extraction site	Ahiaruhe gravel extraction site	Land use	Flood Protection	Low	Code of Practice				
86	Ruamāhanga	7	Outbuildings	Farm or other utility buildings are located within the erosion study area and 1% AEP flood area.	Flood & Erosion	Business	Low to Moderate	Flood hazard maps	River edge envelope			
87	Ruamāhanga	7	Channel alignment	The channel in this locations narrows at XS201 and widens out at XS198. This creates erosion issues upstream and downstream of this location.	Erosion	Flood Protection	Low to Moderate	River edge envelope	Code of Practice			
88	Ruamāhanga	7	Channel alignment	Buffer width on true right bank of river is very narrow and on the true left of river is very wide. The currently managed alignment does not match design alignments.	Erosion	Flood Protection	Low	River edge envelope				
89	Ruamāhanga	7	Channel alignment	The channel naturally widens in this area outside of the design channel alignment.	Erosion	Flood Protection	Low	River edge envelope	Code of Practice			
90	Ruamāhanga	7	Outbuildings	There are outbuildings within the erosion study area and 1% AEP flood area.	Flood & Erosion	Business	Low to Moderate	Flood hazard maps	River edge envelope			
91	Ruamāhanga	7	Kokotau Bridge	No known issues with this bridge, abutments sit within erosion study area and the road to north is within the 1%AEP flood area.	Flood & Erosion	Infrastructure	Low	Code of Practice	River bed level monitoring	Flood hazard maps		
92	Ruamāhanga	8	Stopbank	A small stopbank with a low protection level is within the erosion study area.	Flood & Erosion	Flood Protection	Low to Moderate	Rural stopbank policy				
93	Ruamāhanga	8	Channel alignment	The buffer strip in this area is very narrow and needs to be wider.	Erosion	Flood Protection	Low to Moderate	River edge envelope				
94	Ruamāhanga	8	Channel alignment	The design channel alignment in this location is difficult to maintain and it has been recommended that the design lines may need to be reviewed.	Erosion	Flood Protection	Low to Moderate	River edge envelope				
95	Ruamāhanga	8	Farm buildings	250 Taumata Road contains a number of structures at risk of erosion on the edge of a thin buffer, it is also within the 1% AEP flood area.	Flood & Erosion	Business	Low to Moderate	Flood hazard maps	River edge envelope	Emergency management planning		
96	Ruamāhanga	8	House	A house on 142 Foreman-Jury Road is within the erosion study area and on the edge of the modelled 1% AEP flood area. Several buildings near the address are within the buffer.	Flood & Erosion	House	Low to Moderate	River edge envelope	Flood hazard maps	Emergency management planning		
97	Ruamāhanga	6	Taumata Lagoon	A potential fish habitat site is within the 1% AEP flood area.	Flood	Environment	Low to Moderate	Land use controls	Environmental strategy	Flood hazard maps		

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99	Ruamāhanga	8	Kokotau to Waiohine scheme reach	There is little funding spend in this area. The landowners that contribute to the wider schemes have questions about value for money for them.	Flood & Erosion	Flood Protection	Low	Code of Practice	Community Support Officer			
100	Waipoua	10	Channel alignment	The channel alignment in this area is identified as being significantly outside the recommended design fairway.	Erosion	Flood Protection	Low to Moderate	River edge envelope				Volume 3
101	Waipoua	10	Scheme upstream boundary expansion	The scheme has previously been longer, extending upstream into the Massey Farm property.	Flood & Erosion	Flood Protection	Moderate	River edge envelope	Scheme decision making policy			Scheme expansion unlikely
102	Waipoua	10	Design lines	There are currently design lines in place for the Waipoua River upstream of the scheme boundary, however, they are not used for any purpose.	Erosion	Flood Protection	Low to Moderate	River edge envelope				
103	Waipoua	10	Massey irrigation water intake	The intake for the irrigation system sits within the erosion study area.	Erosion	Infrastructure	Moderate	River edge envelope	Code of Practice			
104	Waipoua	10	Massey farm sheds and bridge	Several farm buildings and an access bridge sit within the erosion study area.	Erosion	Business	Low to Moderate	River edge envelope	Code of Practice			
105	Waipoua	11	Mikimiki bridge	There is observed ongoing bed degradation which affects the bridge, road and the water level recorder site. Work has been carried out in the past to tackle issues with scour.	Erosion	Infrastructure	Moderate	River bed level monitoring	Code of Practice		3rd party asset owner liaison	
106	Waipoua	11	Farm building	A farm outbuilding is located within the modelled 1%AEP flood area.	Flood	Business	Low	Flood hazard maps	Community resilience			
107	Waipoua	11	Channel alignment	The design fairway narrows at this location and may require revision - XS40+100m - 85m narrows to a 45m design width.	Erosion	Flood Protection	Low to Moderate	River edge envelope				
108	Waipoua	11	Design lines	Current design lines have been identified as possibly too narrow.	Erosion	Flood Protection	Low to Moderate	River edge envelope				
109	Waipoua	11	Farm outbuilding	A farm outbuilding is located with the modelled 1%AEP flood area and within the erosion study area.	Erosion & Flood	Business	Low	Flood hazard maps	Community resilience			
110	Waipoua	11	Bridge	A private bridge is located within this property. There are possible issues with the abutments creating an obstruction to flow and being susceptible to erosion.	Erosion	Infrastructure	Low	Code of Practice	Community resilience			
111	Waipoua	11	Telecom line	A private telco line which runs beneath the river bed that is potentially susceptible to damage by machinery or scour.	Erosion	Infrastructure	Low	River bed level monitoring	Code of Practice	Emergency management planning		
112	Waipoua	11	Water intake	A private water intake for Watson Lake is within the erosion study area.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Code of Practice			
113	Waipoua	12	Channel alignment	The buffer strip in this area has been identified as being too narrow and it is recommended that a wider buffer be established in accordance with the recommended design channel alignments.	Erosion	Flood Protection	Low to Moderate	River edge envelope				
114	Waipoua	12	Private erosion structures	These erosion protection structures were privately constructed, but have from time to time been maintained by GWRC operations.	Erosion	Flood Protection	Low	Code of Practice	Isolated Works support			
115	Waipoua	12	Water intake	A private water intake for a lake on private property is situated within the erosion study area.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Code of Practice			
116	Waipoua	12	Channel alignment	The buffer planting on the true right bank has been reinforced with a rock line. This has made the buffer strip narrow in this area, however due to the protection a review of the appropriate buffer may be appropriate.	Erosion	Flood Protection	Low to Moderate	River edge envelope	Code of Practice			Volume 3
117	Waipoua	12	Road	A section of Matahiwi Road is within erosion area and modelled to be 0.6m deep in a 1%AEP flood.	Erosion & Flood	Infrastructure	Low to Moderate	Flood hazard maps	River edge envelope	Emergency management planning	3rd party asset owner liaison	
118	Waipoua	12	House	A house at 236 Matahiwi Road is situated within the erosion study area and the 1%AEP flood area.	Erosion & Flood	House	Low to Moderate	Flood hazard maps	River edge envelope	Emergency management planning		

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119	Waipoua	12	Houses	A number of properties on Matahiwi Road are modelled to be within the 1%AEP flood area.	Flood	House	Low to Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
120	Waipoua	12	Road	Road at risk of flooding during a modelled 1%AEP event to a depth of between 0.3m and 0.8m.	Flood	Infrastructure	Low to Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
121	Waipoua	12	Stopbank	The stopbank on the true left banks sits on the edge of the active channel and within the erosion study area. There has been past consideration of revision of the design lines in this location to relocate the active channel away from the structure.	Erosion	Flood Protection	Low to Moderate	Rural stopbank policy	River edge envelope			
122	Waipoua	12	Low quality stopbank	This stopbank is very close to the river and at risk of erosion. It is affected by substantial tree growth making it vulnerable to storm damage and piping effects along root pathways.	Erosion	Flood Protection	Low to Moderate	Rural stopbank policy	Code of Practice			
123	Waipoua	12	Serpentine confluence	Aggradation in the area of the Serpentine confluence with the Waipoua River increases the likelihood of flooding and blockage.	Flood	Flood Protection	Low to Moderate	River bed level monitoring	Code of Practice			
124	Waipoua	12	Serpentine stopbank	This stopbank is of concern because it partially protects a number of properties however the management objectives of the structure are unclear. It is very close to the river and within the erosion study area.	Erosion & Flood	Flood Protection	Moderate	Rural stopbank policy	Emergency management planning			
125	Waipoua	12	Houses	There are houses within erosion study area.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
126	Waipoua	12	Bridge capacity	The Paierau Road bridge is potentially creating additional flooding problems upstream.	Flood	Infrastructure	Low to Moderate	Flood forecasting and warning system			3rd party asset owner liaison	
127	Waipoua	12	Paierau Road	The stopbanks upstream of the Paierau Road bridge overtop and flood the road frequently creating a hazard to life.	Flood	Infrastructure	Moderate	Flood forecasting and warning system	Emergency management planning	Community resilience	3rd party asset owner liaison	Major project response
128	Waipoua	12	Houses	Matahiwi Rd/Akura Road homes are at risk of flooding in a 1%AEP modelled flood event.	Flood	Infrastructure	Low to Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
129	Waipoua	12	Houses	There are houses within erosion study area.	Erosion	House	Moderate	River edge envelope	Code of Practice	Emergency management planning		
130	Waipoua	12	Stopbank	The quality, standard of protection, alignments and purpose of the flood protection infrastructure in the area of the Serpentine confluence is variable and has been of concern for sometime.	Flood & Erosion	Flood Protection	Low to Moderate	Rural stopbank policy	Code of Practice			
131	Waipoua	12	Stopbank	The stopbank on the true right bank of the river gets close to the river channel and within the erosion study area at its downstream extent.	Flood & Erosion	Flood Protection	Low to Moderate	Rural stopbank policy	Code of Practice			
132	Waipoua	12	Akura Nursery	Akura Nursery floods from overland flow originating from upstream of Paierau Road bridge.	Flood	Land use	Low	Flood forecasting and warning system	Emergency management planning	Community resilience		
133	Waipoua	12	Stopbank	The stopbank on the true left bank of the river is withinthe erosion study area and has required protection to reduce risk.	Flood & Erosion	Flood Protection	Low to Moderate	Rural stopbank policy	Code of Practice			
134	Waipoua	12	Houses	There are houses located within the 1%AEP flood area.	Flood	House	Low to Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
135	Waipoua	12	Golf course	The golf course is located in the modelled 1%AEP flood area and is also within the erosion study area.	Erosion & Flood	Land use	Low	Flood hazard maps	River edge envelope	Emergency management planning		

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136	Waipoua	12	Narrowed channel	The river channel becomes more confined as it approaches the railway bridge upstream of Masterton.	Flood	Land use	Low to Moderate	River Edge envelope				
137	Waipoua	13	Channel alignment	No design fairways have been created for the section of the Waipoua River which flows through Masterton. This creates management challenges due to a lack of guidance for river engineers.	Erosion	Flood Protection	Low to Moderate	River edge envelope				Volume 3
138	Waipoua	13	Oxford Street properties Flooding	There are houses in the flood hazard area.		Flood	High	Flood hazard maps				Volume 3
139	Waipoua	13	Stopbank	The alignment of the stopbank puts it close to the active channel and within the erosion study area. The stopbank is modelled to overtop in a 1% AEP flood event. There are known low spots along its length which may have created flooding issues in paddocks.	Flood & Erosion	Flood Protection	Low to Moderate	Flood hazard maps				Volume 3
140	Waipoua	13	Bed control weirs	Structures which cross the channel to prevent channel degradation are susceptible to damage in high flow events and susceptible to erosion. Ownership of these structures is unclear and may rest either with MDC or GWRC.	Erosion	Flood Protection	Moderate	Code of Practice	River bed level monitoring	River edge envelope	3rd party asset owner liaison	Volume 3
141	Waipoua	13	Sewer lines	Sewer lines run down both banks of the Waipoua River along its length through Masterton. These are located on the river side of the stopbanks and within erosion study areas.	Erosion	Infrastructure	Low to Moderate	Code of Practice	River bed level monitoring	River edge envelope	3rd party asset owner liaison	Volume 3
142	Waipoua	13	Bed control weirs	Structures which cross the channel to prevent channel degradation are susceptible to damage in high flow events and susceptible to erosion. Ownership of these structures is unclear and may rest either with MDC or GWRC.	Erosion	Flood Protection	Moderate	Code of Practice	River bed level monitoring	River edge envelope	3rd party asset owner liaison	Volume 3
143	Waipoua	13	Channel alignment	There is a mismatch between the fairways and the extents of the bed control weirs in the urban reach of the Waipoua River.	Erosion	Flood Protection	Low to Moderate	River edge envelope	Code of Practice			Volume 3
144	Waipoua	13	Bed control weirs	Structures which cross the channel to prevent channel degradation are susceptible to damage in high flow events and susceptible to erosion. Ownership of these structures is unclear and may rest either with MDC or GWRC.	Erosion	Flood Protection	Moderate	Code of Practice	River bed level monitoring	River edge envelope	3rd party asset owner liaison	Volume 3
145	Waipoua	13	Irrigation water intake	The rugby grounds irrigation water intake is located within the erosion study area.	Erosion	Infrastructure	Low	Code of Practice	River bed level monitoring	River edge envelope	3rd party asset owner liaison	Volume 3
146	Waipoua	13	Sewer siphon	The Landsdowne sewer siphon crosses the river and is at risk from flood damage and is within the erosion study area.	Flood & Erosion	Infrastructure	Low	Code of Practice	River bed level monitoring	River edge envelope	3rd party asset owner liaison	Volume 3
147	Waipoua	13	Emergency sewer discharge point	An emergency sewer discharge point is located on the river bank.	Land use	Environment	Low to Moderate	Code of Practice	River bed level monitoring	River edge envelope	3rd party asset owner liaison	Volume 3
148	Waipoua	13	Channel alignment	No design fairways have been created for the section of the Waipoua which flows through Masterton. This creates management challenges due to a lack of guidance for river engineers responsible for the scheme management.	Erosion	Flood Protection	Low to Moderate	River edge envelope				Volume 3
149	Waipoua	13	Bed control weirs	Structures which cross the channel to prevent channel degradation are susceptible to damage in high flow events and susceptible to erosion. Ownership of these structures is unclear and may rest either with MDC or GWRC.	Erosion	House	Low to Moderate	River Edge envelope	Code of Practice	Emergency Management Planning		Major project response
150	Waingawa	15	MDC water supply intake	Part of the Masterton water supply network is located in the headwaters of the Waingawa River. In relatively stable gorge section.	Erosion	Infrastructure	High	Emergency management planning				
151	Waingawa	15	MDC water supply pipe bridge	There are problems with build up of the river bed level, the risk of debris flow damage. This poses a risk to the water supply to Masterton.	Erosion	Infrastructure	High	River bed level monitoring	Emergency management planning			Major project response
152	Waingawa	15	MDC water supply pipeline	There is a currently managed erosion risk to the main water supply pipeline. It is located between the river bank and the road.	Erosion	Infrastructure	High	River edge envelope	Code of Practice	Emergency management planning		Major project response

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153	Waingawa	16	House	A house at 114 Waingawa Road is in the erosion study area and in 1%AEP flood area.	Erosion & Flood	Erosion & Flood	Moderate	Flood hazard maps	River edge envelope	Emergency management planning		
154	Waingawa	16	Upper Waingawa Road	The upper Waingawa Road is modelled to be flooded to a depth of 0.9m in a 1%AEP flood.	Flood	Infrastructure	Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
155	Waingawa	16	Farm buildings	A milking shed and other outbuildings are in the erosion study area and flood risk area.	Erosion & Flood	Erosion & Flood	Low to Moderate	Flood hazard maps	River edge envelope	Emergency management planning		
156	Waingawa	16	Taratahi water race intake	Bed degradation means achieving water intake level is difficult, river alignment is difficult to maintain with current alignment, it is necessary to balance between scour and aggradation to keep intake clear.	Erosion	Infrastructure	High	River bed level monitoring	Pool, riffle, run envelope	River edge envelope		
157	Waingawa	16	MDC water supply pipeline	Bed degradation at Black Creek is creating a risk to the Masterton water supply pipeline. The pipeline also sits within the erosion study area at this location.	Erosion	Infrastructure	High	River bed level monitoring	River edge envelope	Emergency management planning		Major project response
158	Waingawa	16	Waingawa River bush RAP sites	Waingawa River Bush RAP site is within the design channel buffer and close to the edge of the design channel alignment.	Erosion	Environment	Moderate	River edge envelope	Environmental strategy			
159	Waingawa	16	Houses	Houses are located within the erosion study area.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
160	Waingawa	16	MDC Water Treatment Plant - Main facility	Parts of the Masterton Water Treatment Plant are within the erosion study area, the main plant is not affected by this.	Erosion	Infrastructure	Moderate	River edge envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
161	Waingawa	16	MDC Water Treatment Plant - Sludge area	The sludge treatment sections of the MDC water treatment plant are located on the lower terraces within the erosion study area.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
162	Waingawa	16	MDC water supply - Boost pump station	The boost pump station for the Masterton water supply is located within the 1%AEP flood area.	Flood	Infrastructure	High	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
163	Waingawa	16	House	There is a house in flood hazard area - the address is unclear.	Flood	House	Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
164	Waingawa	16	House	A house at 636D Norfolk Road sits within the erosion study area and Wairarapa Combined District Plan erosion area. It is not affected by the modelled 1%AEP flood area.	Erosion	House	Moderate	River edge envelope	Code of Practice	Emergency management planning		
165	Waingawa	16	MDC water supply	An area designated for potential future water treatment that sits within the erosion study area and the 1% AEP flood area.	Flood	Infrastructure	Low	Land use controls	Code of Practice		3rd party asset owner liaison	
166	Waingawa	16	Historic river channel	An old river channel used to flow through this location, and an overflow path in the updated 1%AEP flood area. The old gravel river bed has been planted over and closed off with a stopbank.	Erosion	Flood Protection	Low to Moderate	Historic channel lines	Land use controls	Rural stopbank policy		
167	Waingawa	16	River alignment	Buffer zones are an issue at this location. There has been ongoing trouble managing the river to within the design lines. Erosion on true right bank is currently beyond the buffer extents.	Erosion	Flood Protection	Low to Moderate	River edge envelope				
168	Waingawa	16	Tararua Drive atopbanks	The stopbanks in this location are of low level and crest height is monitored. It is recommended that the levels are confirmed (Tararua Drive - 3no. Low level banks).	Flood	Flood Protection	Moderate	Rural stopbank policy				
169	Waingawa	16	House	At 65 Totara Park Drive the house and outbuildings are in the erosion study area, they are not within the 1%AEP flood area.	Erosion	House	Moderate	River edge envelope	Code of Practice			
170	Waingawa	16	Flap-gates in stopbank	Two flap-gates in Skeets stopbank create possible back flow routes. These are occasionally blocked open because of misunderstandings.	Flood	Flood Protection	Low to Moderate	Code of Practice				

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171	Waingawa	16	Skeets stopbank	This stopbank protects against and overflow path which has historically connected the Waingawa River to the Waipoua River. It is currently maintained by GWRC Flood Protection but a failure could have flood consequences for Masterton.	Flood	Flood Protection	High	Code of Practice	River edge envelope			
172	Waingawa	16	Buildings	There are several buildings which are part of 123 Upper Manaia Road and 161 Upper Manaia Road which sit with the erosion study area.	Erosion	House	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning		
173	Waingawa	16	SLUR Site	A site at 81 Upper Manaia Road is registered on the SLUR database and sits within the erosion study area.	Erosion	Environment	Low	River edge envelope	Code of Practice	Emergency management planning		
174	Waingawa	16	Distribution powerlines	Pylons just upstream of the rail bridge - distribution network. One pole is currently situated in the river bed, the others are at risk of erosion on berms.	Erosion	Infrastructure	Moderate	River edge envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
175	Waingawa	16/17	Contractors yards	Contractors yards within the erosion study area and are within the 1%AEP flood area. Known erosion management area.	Erosion & Flood	Business	Low	Flood hazard maps	River edge envelope	Emergency management planning		
176	Waingawa	16	Transmission powerlines	Pylons just upstream of rail bridge - transmission lines. Pylons sit on the edge of the erosion study area.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
177	Waingawa	16	Rail bridge	Contractors yards within the erosion study area and are within the 1%AEP flood area. Known erosion management area.	Erosion & Flood	Infrastructure	Low to Moderate	River bed level monitoring	Code of Practice		3rd party asset owner liaison	
178	Waingawa	16	Contractors yards	Contractors yards within the erosion study area and are within the 1%AEP flood area. Known erosion management area.	Erosion & Flood	Business	Low to Moderate	Flood hazard maps	River edge envelope	Emergency management planning		
179	Waingawa	16	Stopbank	This stopbank is believed to be a high failure risk.	Erosion & Flood	Flood Protection	High	River edge envelope	Emergency management planning			Major project response
180	Waingawa	16	Channel alignment	The buffer zones between the two bridges are very narrow, and have been recommended for review.	Erosion & Flood	Flood Protection	Low	River edge envelope				
181	Waingawa	16	Channel alignment	The buffer zones between the two bridges are very narrow and have been recommended for review.	Erosion	Flood Protection	Moderate	River edge envelope				
182	Waingawa	16	Sewer, water on road bridge	Key infrastructure is at low risk of being damaged by flood and debris flows attached to the road bridge.	Erosion & Flood	Infrastructure	Low to Moderate	Flood hazard maps	Emergency Management Planning		3rd party asset owner liaison	
183	Waingawa	16	Road bridge	Bed degradation is a managed problem in the area around the road bridge.	Erosion & Flood	Infrastructure	Moderate	River bed level monitoring	Code of Practice		3rd party asset owner liaison	
184	Waingawa	17	Pump station for sewer line	The pump station is located on the edge of the 1%AEP flood area, and within the erosion study area.	Erosion & Flood	Infrastructure	Moderate	Flood hazard maps	River edge envelope	Emergency management planning	3rd party asset owner liaison	
185	Waingawa	17	Powerlines	Transmission network power line pylons are located within erosion study area, 200m downstream of SH2.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Code of Practice	Emergency Management Planning	3rd party asset owner liaison	
186	Waingawa	17	Contractors yards	Contractors yards within the erosion study area and are within the 1%AEP flood area. Known erosion management area.	Erosion & Flood	Business	Low to Moderate	Flood hazard maps	River edge envelope	Emergency management planning		
187	Waingawa	17	Contractors yards	Contractors yards within the erosion study area and are within the 1%AEP flood area. Known erosion management area.	Erosion & Flood	Business	Low to Moderate	Flood hazard maps	River edge envelope	Emergency management planning		
188	Waingawa	17	Powerlines	Distribution network power line pylons are located within erosion study area, 30m downstream of SH2.	Erosion	Infrastructure	Low	River edge envelope	Code of Practice	Emergency Management Planning	3rd party asset owner liaison	
189	Waingawa	17	Land retirement agreements	There is ongoing work to manage buffers through land use change to planted willow buffers.	Land use	Flood Protection	Moderate	River edge envelope	Mixed vegetation planting			

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190	Waingawa	17	Illegal dumping	The good access and relatively secluded location make this site a popular location for illegal rubbish dumping.	Land use	Environment	Low	Environmental strategy	Community Support Officer	Care groups and clubs		
191	Waingawa	17	Recreation area	The good access to the end of Hughes Line makes it a popular area for recreation groups. There is interest in developing this access and area further from a number of interest groups.	Land use	Recreation	Low to Moderate	Community Support Officer	Care groups and clubs	Environmental strategy		
192	Waingawa	17	Flight path	There is a controlled level for tree height for aircraft taking off from the Hood Aerodrome.	Land use	Flood Protection	Moderate	Code of Practice				Major project response
193	Waingawa	17	Aerodrome runway	The aerodrome runway is known to be affected by erosion and has been eroded in the recent past (2000), it is situated within the erosion study area.	Erosion	Infrastructure	High	River edge envelope			3rd party asset owner liaison	Major project response
194	Waingawa	17	SLUR Site	Hood Aerodrome is a registered SLUR site which sits within the erosion study area.	Erosion	Environment	Low	Emergency management planning	Land use controls	Environmental strategy		
195	Waingawa	17	Private water intake	A private water intake is located within the erosion study area.	Erosion	Infrastructure	Low	River edge envelope	Code of Practice			
196	Waingawa	17	Drag strip	The drag strip sits within the erosion study area and is within the 1%AEP flood area.	Erosion & Flood	Environment	Low to Moderate	River edge envelope	Flood hazard maps			
197	Waingawa	17	Distribution powerlines	Pylons for a distribution network area located within the erosion study area on the true right bank and may be close to the erosion study area boundary on the ture left bank.	Erosion	Infrastructure	Low	River edge envelope	Emergency Management Planning	Community resilience	3rd party asset owner liaison	
198	Waingawa	17	Private water intake	A private water intake is located within the erosion study area.	Erosion	Infrastructure	Low to Moderate	River edge envelope	Code of Practice			
199	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
200	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
201	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
202	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
203	Kopuaranga	Kopuaranga River	Culvert/road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
204	Kopuaranga	Kopuaranga River	Private road/culvert	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
205	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
206	Kopuaranga	Kopuaranga River	Outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
207	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
208	Kopuaranga	Kopuaranga River	Private access/ culvert	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
209	Kopuaranga	Kopuaranga River	Outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES - FOR GENERAL RESPONSES FOR EACH REACH REFER TO RESPONSE SUMMARY

ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
210	Kopuaranga	Kopuaranga River	Road/bridge & graveyard	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
211	Kopuaranga	Kopuaranga River	Rail bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
212	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
213	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
214	Kopuaranga	Kopuaranga River	Rail	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
215	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
216	Kopuaranga	Kopuaranga River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
217	Kopuaranga	Kopuaranga River	Rail	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
218	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
219	Kopuaranga	Kopuaranga River	Private bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
220	Kopuaranga	Kopuaranga River	Woolshed	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
221	Kopuaranga	Kopuaranga River	House and buildings	Potential oxbow cut-off		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
222	Kopuaranga	Kopuaranga River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
223	Kopuaranga	Kopuaranga River	Shed	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
224	Kopuaranga	Kopuaranga River	Rail	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
225	Kopuaranga	Kopuaranga River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
226	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
227	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES - FOR GENERAL RESPONSES FOR EACH REACH REFER TO RESPONSE SUMMARY

ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
228	Kopuaranga	Kopuaranga River	Rail and private access	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
229	Kopuaranga	Kopuaranga River	Private bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
230	Kopuaranga	Kopuaranga River	Private access/ outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
231	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
232	Kopuaranga	Kopuaranga River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		Scheme expansion proposed
233	Kopuaranga	Kopuaranga River	Rail bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
234	Kopuaranga	Kopuaranga River	Mauriceville settlement	Within 1% AEP flood area and within the erosion study area.		Flood	High	Flood hazard maps	Code of Practice	Isolated Works support		
235	Kopuaranga	Kopuaranga River	Private access	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
236	Kopuaranga	Kopuaranga River	Rail and road access	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
237	Kopuaranga	Kopuaranga River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
238	Kopuaranga	Kopuaranga River	Rail	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
239	Kopuaranga	Kopuaranga River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
240	Kopuaranga	Kopuaranga River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
241	Kopuaranga	Kopuaranga River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
242	Kopuaranga	Kopuaranga River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
243	Kopuaranga	Kopuaranga River	Rail bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
244	Kopuaranga	Kopuaranga River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
245	Kopuaranga	Kopuaranga River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES - FOR GENERAL RESPONSES FOR EACH REACH REFER TO RESPONSE SUMMARY

ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
246	Kopuaranga	Kopuaranga River	Private access bridge (may be MDC maintained - Donovan's Road)	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
247	Kopuaranga	Kopuaranga River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
248	Kopuaranga	Kopuaranga River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
249	Kopuaranga	Kopuaranga River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
250	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
251	Whangaehu	Whangaehu River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
252	Whangaehu	Whangaehu River	Outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
253	Whangaehu	Whangaehu River	Road and private access	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
254	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
255	Whangaehu	Whangaehu River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
256	Whangaehu	Whangaehu River	House and buildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
257	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
258	Whangaehu	Whangaehu River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
259	Whangaehu	Whangaehu River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
260	Whangaehu	Whangaehu River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
261	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
262	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
263	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES - FOR GENERAL RESPONSES FOR EACH REACH REFER TO RESPONSE SUMMARY												
ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
264	Whangaehu	Whangaehu River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
265	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
266	Whangaehu	Whangaehu River	Private access	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
267	Whangaehu	Whangaehu River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
268	Whangaehu	Whangaehu River	Outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
269	Whangaehu	Whangaehu River	Outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
270	Whangaehu	Whangaehu River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
271	Whangaehu	Whangaehu River	Outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
272	Whangaehu	Whangaehu River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
273	Whangaehu	Whangaehu River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
274	Whangaehu	Whangaehu River	Access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
275	Whangaehu	Whangaehu River	Woolshed	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
276	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
277	Whangaehu	Whangaehu River	Access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
278	Whangaehu	Whangaehu River	Outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
279	Whangaehu	Whangaehu River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
280	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
281	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES - FOR GENERAL RESPONSES FOR EACH REACH REFER TO RESPONSE SUMMARY

ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
282	Whangaehu	Whangaehu River	House and buildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
283	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
284	Whangaehu	Whangaehu River	Road and bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
285	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
286	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
287	Whangaehu	Whangaehu River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
288	Whangaehu	Whangaehu River	Outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
289	Whangaehu	Whangaehu River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
290	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
291	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
292	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
293	Whangaehu	Whangaehu River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
294	Whangaehu	Whangaehu River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
295	Whangaehu	Whangaehu River	Outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
296	Whangaehu	Whangaehu River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
297	Whangaehu	Whangaehu River	Outbuildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
298	Whangaehu	Whangaehu River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
299	Whangaehu	Whangaehu River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
300	Whangaehu	Whangaehu River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES - FOR GENERAL RESPONSES FOR EACH REACH REFER TO RESPONSE SUMMARY

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301	Whangaehu	Whangaehu River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
302	Whangaehu	Whangaehu River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
303	Whangaehu	Whangaehu River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
304	Whangaehu	Whangaehu River	Private access	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
305	Taueru	Taueru River	Road and bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
306	Taueru	Taueru River	House and buildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
307	Taueru	Taueru River	House and buildings	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
308	Taueru	Taueru River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
309	Taueru	Taueru River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
310	Taueru	Taueru River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
311	Taueru	Taueru River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
312	Taueru	Taueru River	Road	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
313	Taueru	Taueru River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
314	Taueru	Taueru River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
315	Taueru	Taueru River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
316	Taueru	Taueru River	Private access	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
317	Taueru	Taueru River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
318	Taueru	Taueru River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
319	Taueru	Taueru River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		

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ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
320	Taueru	Taueru River	Stock bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
321	Taueru	Taueru River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
322	Taueru	Taueru River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
323	Taueru	Taueru River	Private access bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		
324	Taueru	Taueru River	Road bridge	Within erosion study area		Erosion	Low	Code of Practice	Emergency management planning	Isolated Works support		