greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

Environmental Code of Practice and Monitoring Plan

For Flood Protection activities

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Preamble

This Environmental Code of Practice (Code) and Monitoring Plan (EMP) have been prepared with the initial purpose of complementing and supporting Greater Wellington Regional Council (GWRC) in renewing resource consents for flood protection operations and maintenance works. However the ultimate purpose of the Code and EMP is more encompassing, as it is intended that it will continue to guide and monitor how all flood protection and erosion control activities are done across the Region.

GWRC seeks a 35 year term for the new resource consents, which is the maximum currently allowed under the Resource Management Act (RMA). To ensure that GWRC management of activities remains appropriate and focused over the life of the new consents, while at the same time retaining the flexibility to change in response to new information over time; it is proposed that an adaptive management regime be approved as part of the resource consent conditions. This approach is integral to the success of the Code.

The aim of adaptive management is to improve environmental, social and cultural management, and outcomes, through a continuous 'learning by doing' cycle of action, monitoring and evaluation of practice. In the context of GWRC's consent applications, this means that this Code, together with the EMP, will directly influence how flood protection and erosion control activities are done over the next 35 years. The specific detail and direction on the methodology that is adopted for individual activities will sit in the Code, rather than reliance being placed on the conditions of the resource consents. Figure 1 outlines the adaptive management regime including feedback loops.

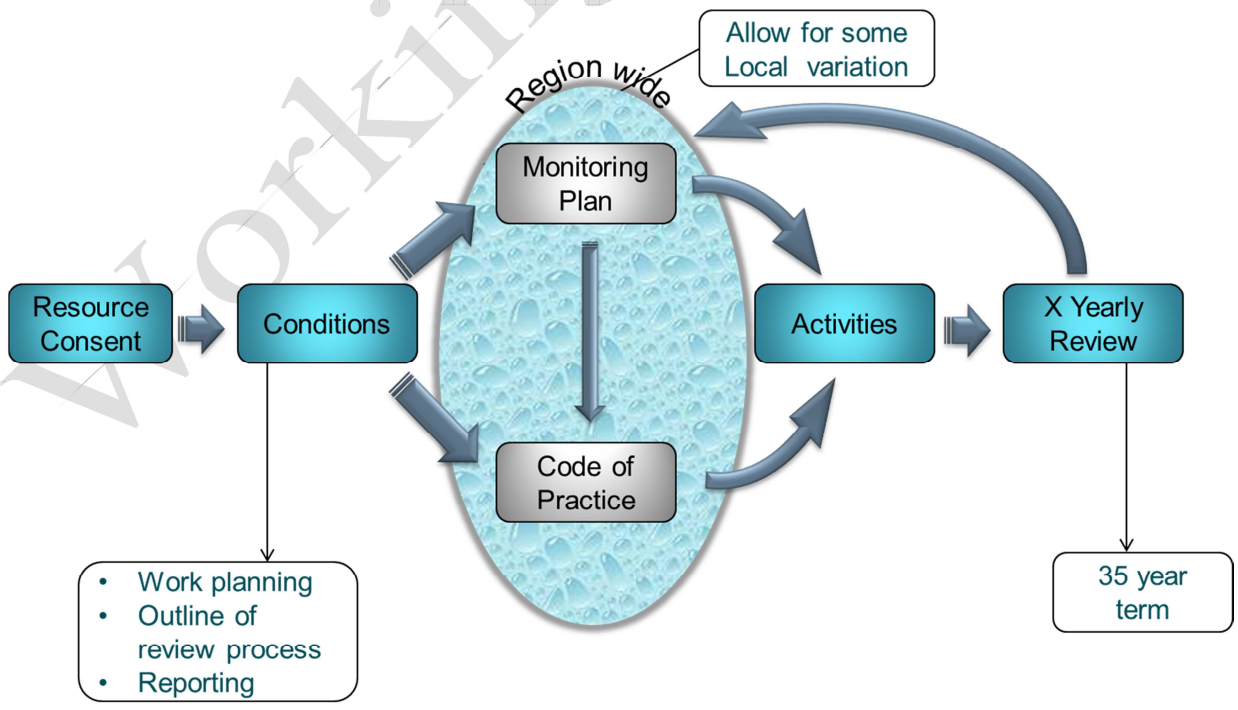


Figure 1: Adaptive management regime as it relates to management of operation and maintenance resource consents

The resource consents are fundamentally linked to use of the Code. Importantly, the resource consents will also require the EMP to be implemented and review processes defined. The review processes will outline how the Code and EMP may be changed based on the information supplied by environmental monitoring, working in partnership with iwi, and engaging with key stakeholders.

The Code has been designed to remain flexible and responsive to improvements in knowledge and understanding of the effects of GWRC work practices on the river environment, and to the changing needs and responses of the community. In this way the Code has documented and formalised the process, undertaken by GWRC over the last 15 years, of continually adapting practices to minimise effects and reflect good practice. Accordingly, the conditions attached to the resource consents will be focused on facilitating implementation of good process, while the Code will be focused on the deliverables of that process, i.e. the practice. As a consequence of doing this, the issue that arises with having conditions that address practice being attached to resource consents – namely, being fixed in time and therefore unable to be altered without going through a formal (and expensive) process – will be significantly reduced or removed altogether. The Code and EMP will be reviewed on an ongoing basis with a formal review proposed on an X-yearly basis[1].

The use of a Code to guide all flood protection and erosion control activities is also intended to provide a mechanism for achieving greater consistency of practice across the rivers GWRC manages, and ensure that decisions are made in the context of a structured framework rather than being driven by preferences of individual river managers. Incorporating a regular review of the Code and EMP means that the results of the environmental monitoring, research, new knowledge, iwi and stakeholder input can all be considered and carried through into practice in a structured and sustainable way.

[1] Timeframe to be determined through consultation with iwi and stakeholders.

1. Introduction

This Code of Practice (Code) is GWRC's key document that directs how **all**[2] flood protection and erosion control activities across the region are done, irrespective of funding, location and whether an activity requires resource consent or not (i.e. it applies to permitted activities as well as those activities for which resource consent is required under the regional plans). The Environmental Monitoring Plan (EMP) is included in the Code and outlines the monitoring that GWRC will do of these activities to allow practice to be adapted should this monitoring show that unexpected or significant effects on values are occurring.

The rivers and watercourses that the Flood Protection (FP) Department of GWRC actively manages are shown in Appendix 2. This Code will replace the current Environmental Code of Practice dated March 1999.

1.1 Relationship to other documents

Four guiding documents sit alongside the Code to set the strategic direction for the work undertaken by GWRC FP department; these are:

- GWRC's Long Term Plan (LTP) outlines the community outcomes and services to be provided over the next 10 years. The current community outcomes[3] for the region are "strong economy, connected community, resilient community, healthy environment and quality of life". In achieving these community outcomes, flood protection is a key activity.

- The FP Asset Management Plan (AMP) identifies the levels of services and strategies required to meet a defined level of risk management on a sustainable and cost-effective basis, and the expenditure and funding needed to achieve this.

- Floodplain Management Plans (FMPs) - where applicable - which are high-level strategic planning tools, through which GWRC seeks to work with other key decision-makers and the community within a specific river catchment to identify and agree policies and options for sustainable flood risk management.

- Environmental or Ecological Strategies (where applicable), which form part of a FMP, and provide details on the objectives and methods for enhancement of the river corridor.

It is intended that the Code will complement these documents, by providing more specific detail on the methods to be employed in achieving the outcomes of these plans. It is important to note, that no methods included in the Code may contravene the requirements of any regional plan or over-ride the requirements of any resource consents issued pursuant to those plans.

[2] While it is intended that the Code will apply to all flood protection activities undertaken by GWRC in the Wellington Region, resource consents for these activities are currently only sought for the Hutt, Otaki, Waikanae and Wainuiomata Rivers (and selected tributaries of these rivers). This is because flood protection activities in other waterways will either be able to be undertaken without the need for resource consent (i.e. as permitted activities) or will be authorised by separate resource consents at a future date.

[3] 2012-2022

GWRC is also working through the Memorandum of Partnership with iwi to determine what this means in terms of the work of the wider organisation (refer to Section 1.6).

1.2 Code of Practice structure

This Code of Practice is broken up into five sections, as follows:

Section One introduces the Code and EMP and how these documents relate to other key GWRC documents. This section also outlines GWRC statutory responsibilities and our relationship with our iwi partners. The key purposes and objectives of the Code and EMP are also explained and the concept of adaptive management and how these principles apply.

Section Two outlines the environmental monitoring plan that GWRC intends to implement. Importantly this plan identifies triggers and how GWRC would response if a trigger was reached.

Section Three describes the values and how these will be recognised and considered in GWRC work.

Section Four describes the culture GWRC aspires to and the ownership of the document as well as describing the protocols for trailing new methods and what constitutes urgent works.

Section Five contains the General and Individual Activity Good Practice Methods that apply to all flood protection activities. These standards reflect good practice that has been derived through general consideration of the values identified in Section 3 and is a stand-alone section intended for daily use by operational staff and machine operators.[4]

1.3 Purpose of the Code and EMP

The primary purposes the Code and EMP are to:

- Identify and describe all flood protection and erosion control activities.
- Describe what is considered good practice, and what is expected from staff and machine operators, when undertaking these activities.
- Provide a mechanism to identify and consider the appropriateness of an activity based on the effects of that activity on the values present.
- Provide a process where the effects of the day to day flood protection and erosion control activities are minimised and/or appropriately mitigated.
- Provide a mechanism to ensure that all staff and contract operators work in a manner that is consistent with good practice.
- Assist in the training of new staff and machine operators employed by GWRC.

4 These will include reference to FP's H&S Standard Operating Procedures and typical detail drawings, which will be submitted as supporting documents.

- Ensure that GWRC management of activities remains appropriate and focused over the life of the resource consents.

- Describe the monitoring programme being undertaken to assess the effects our activities.

- Define monitoring trigger levels and how GWRC may respond to those triggers.

1.4 Outcomes of the Code and EMP

- Good practice in flood risk management is recognised and implemented.

- The river environment is managed to restore and enhance cultural and ecological values and for the community to enjoy.[5]

- The relationship of tangata whenua with water bodies is recognised and provided for[6].

1.5 Statutory obligations

GWRC has statutory responsibility for flood and erosion mitigation in the Wellington Region under section 30 of the RMA 1991 and the Soil Conservation and Rivers Control Act 1941 (sections 10 and 126).

The Soil Conservation and Rivers Control Act 1941 (SCRCA) provides GWRC with the authority to undertake physical works (including structural measures) to mitigate erosion damage and protect property from flooding. Once works have been constructed, GWRC has a duty to continue to maintain these works.

The Local Government Act 2002 requires that any works are of 'good quality', which is defined as being 'efficient', 'effective' and 'appropriate to present and future anticipated circumstances'. The Local Government Act also requires GWRC to undertake its functions in a way that is most cost-effective for households and businesses.

GWRC undertakes these responsibilities primarily through its FP Department. The Department's principal functions[7] are to:

- Understand, manage, and communicate flood risk

- Maintain flood protection and control works

- Improve flood security, and

- Restore and enhance cultural and ecosystem health.

It is important to note that the principles of the above Acts are subject to the purpose and principles of the RMA 1991, the Regional Policy Statement and the Regional Freshwater Plan.

[5] On publicly owned land.
[6] GWRC is yet to determine how this might be delivered beyond Te Puke Taiao and Ara Tahi
[7] Refer to GWRC's LTP 2012-2022

The value of GWRC flood protection infrastructure assets at 30 June 2012 was $262,820,228.

GWRC is not required by law to have a Code or EMP, but these are tools that assist GWRC to carry out its statutory functions in an efficient and effective manner.

1.6 Working in partnership with iwi

Engagement with iwi is based on the principles outlined in the Memorandum of Partnership (MOP) between Tangata Whenua ki te Upoko o te Ika a Maui and Wellington Regional Council[8] (2013).

The MOP acknowledges that GWRC and tangata whenua have a common goal of supporting the environmental, social, cultural and economic wellbeing of the region for the benefit of the regional community, both now and in the future. It also acknowledges that the relationship between tangata whenua and GWRC is one of long standing and is on-going. It operates concurrently at governance, executive and operational levels.

The MOP states that the partnership between GWRC and tangata whenua will manifest both on a one-to-one basis between tangata whenua and GWRC and within the collective forum of all the parties, (known as Ara Tahi). The partnership between the GWRC and individual tangata whenua is the pre-eminent relationship.

GWRC and tangata whenua agree that within their collective and individual relationships the following will apply:

a) The relationship will be mutually beneficial.

b) The relationship is based on good faith, cooperation and understanding.

c) There is commitment to work towards solutions with reasonableness and honesty of purpose.

d) Both parties will seek opportunities to develop new expressions of partnership and to share skills and knowledge.

e) Both parties will seek opportunities to utilise tikanga Māori wherever possible in the conduct of the relationship.

Development and on-going review of the Code and EMP provides an opportunity for GWRC and tangata whenua to work together to further these collective aims. In particular, it provides a vehicle for the sharing of knowledge and exploration of the ways in which tikanga Māori may be incorporated into GWRC work practices. The Code provides tangible evidence of GWRC commitment that works will be undertaken in an agreed manner.

Following initial development of the Code and EMP, the ongoing reviews (see Section 1.7) will provide an ongoing forum for discussions on river management between GWRC and tangata whenua.

[8] Note that this is the correct legal name for the regional council. Elsewhere in this application document, the council is referred to by it promotional name of 'Greater Wellington Regional Council'.

Any specific actions or further collaboration/consultation that may be agreed as a result of the review will be incorporated (as appropriate) into the Code and EMP.

1.7 Review processes

Response to change is a key element of the adaptive management approach referred to in the Preamble; namely, that monitoring affects practice and GWRC has the ability to change and adapt practice over time in response to monitoring results, changing values and to reflect current good practice.

For the Code and EMP to achieve the outcomes listed in Section 1.4, they must be responsive to:

- Changes in values
- New information and research
- Changes in technology
- Evidence gathered from monitoring and field trials
- Feedback from staff involved in implementation of the Code
- The views of iwi and key stakeholders.

Two processes will be undertaken to review the EMP and to provide a mechanism for modifying the Code over time:

- An annual or ongoing review (refer Section 1.7.1) between GWRC and the Technical Panel[9] to allow the progress of the EMP to be tracked and an analysis undertaken of completed flood protection work. This will allow for the collaborative approach taken through the resource consent process to continue.

- A more formal review (refer Section 1.7.2) will occur on the X anniversary of the resource consent or if changes to the Code are required as a result of the annual review. This formal review is an opportunity for GWRC, iwi, key stakeholders and the Technical Panel to undertake a wider review of current practice in the light of the results of the monitoring programme, and identify any changes that should be made to the Code. GWRC will undertake more consultation with these parties as to the most suitable frequency for this review; this is why it is referred to as the 'X' anniversary. The review frequency will be determined following the outcome of these discussions.

[9] Currently this is the Science Group which could potentially morph into the Technical Panel (the Panel). The Panel could be defined as follows: 'The Panel will comprise of not less than five persons, at least two of which are scientists who between them have experience across the areas of freshwater ecology and river geomorphology; the third and fourth members will consist of a river engineer, and a planner (who shall provide support to the Panel and ensure that outcome of the review process is robust from a planning perspective and consistent with the resource consent). All four shall be recognised by their peers as having appropriate knowledge and skill, and their appointment to the Panel shall be approved by the Council (EReg). The fifth person shall be appointed by iwi (this approach is still to be confirmed with iwi). Community input also needs to be incorporated and also potentially stakeholder input if the Technical Panel excludes stakeholders. Terms of Reference for the Panel will also be defined.

In both instances a review report will be produced and submitted to the Environmental Regulation department (EReg)[10]. The role of EReg is to ensure that GWRC is undertaking a genuine process of monitoring and response within the established context of their need to undertake activities for the purposes of flood protection. The review process, including preparation of reports, will be a condition of the new resource consents.

1.7.1 Annual (on-going) review

The annual review will take the form of a meeting with the Technical Panel in October. An annual review report will be prepared and circulated to the Technical Panel one month prior to the meeting. The annual review report would summarise:

- Progress of the EMP
- Monitoring results against the triggers identified in the EMP and GWRC's response to those results
- A narrative on how the Code is working in practice
- Completed and proposed work for the applicable financial years
- Any other relevant information.

The report would also make recommendations on whether any changes to the EMP or Code are required in GWRC's opinion.

The meeting with the Technical Panel will consider and discuss the report and determine if a formal review of the Code and EMP is required.

While the annual review is in progress, GWRC's normal operational and maintenance activities will continue until the review is complete. The exception to this is if monitoring has showed that an activity was having an unexpected or significant effect. If this was to happen than GWRC would stop the use of that activity until the review was complete.

While it is necessary to put dates around when the annual review will happen, if monitoring results showed an unexpected or significant result or a trigger was reached, GWRC would notify the Technical Panel and work through the issue immediately.

Any changes to either the EMP and/or the Code will not be made by GWRC until the formal review has been undertaken (refer Section 1.7.2).

The process whereby issues, if they arise, will be resolved is still to be defined.

The annual review process is outlined in Figure 2, with Table 1 describing process steps in detail. The numbers in bold on the process flow relate to the step in the corresponding table.

[10] EReg are the Environmental Regulation department of GWRC who are the Consenting Authority and responsible for administering the resource consent.

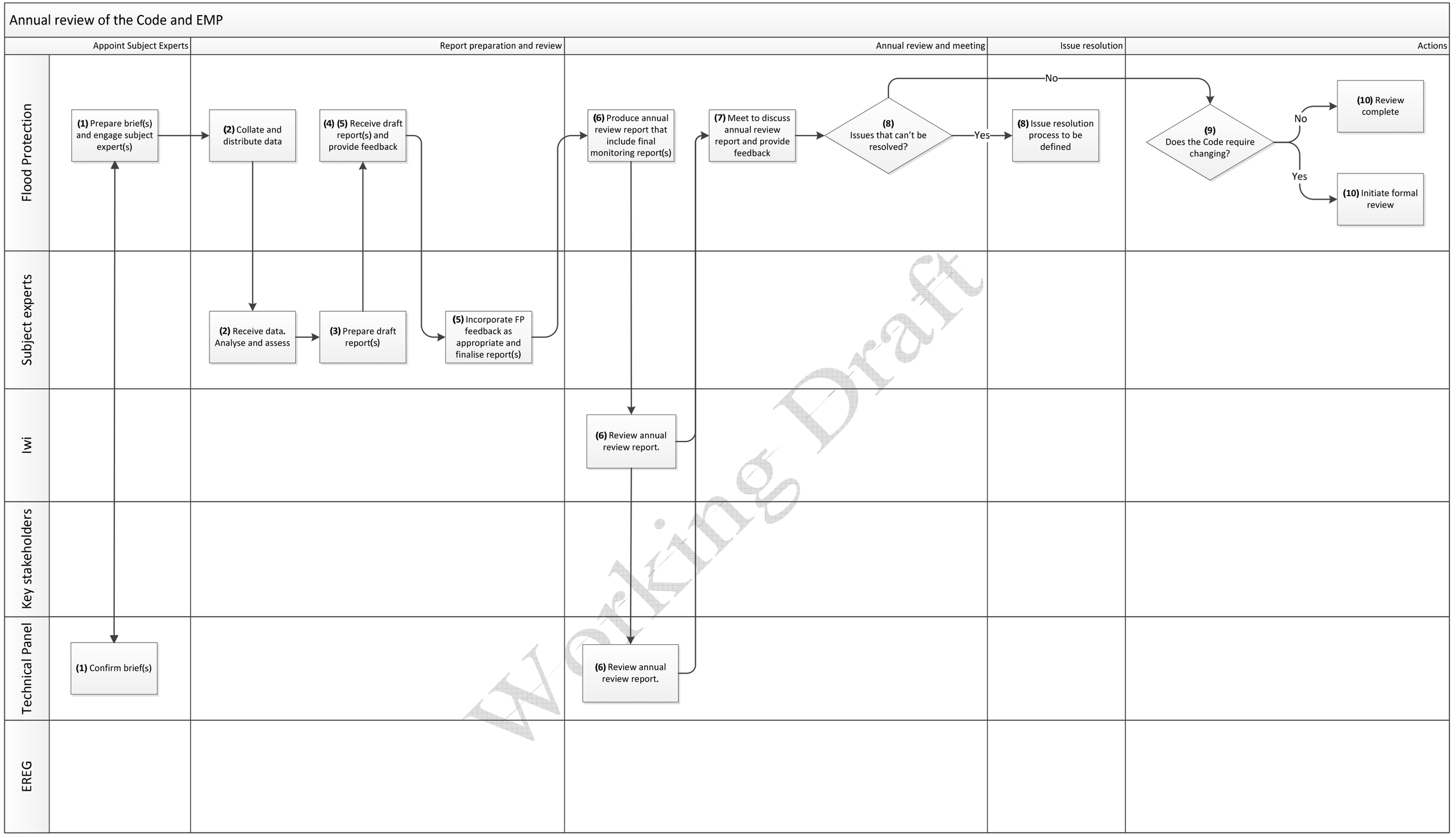


Figure 2: Annual review process

Step	Action	Conducted by	When
Initiate review and appoint subject expert(s)			
1	Prepare monitoring brief(s) and engage subject expert(s). Brief(s) would ask subject expert(s) to analyse and assess relevant data and information. Brief(s) would be confirmed with the Technical Panel to ensure the scope is adequate. Subject expert(s) will be independent and will have the appropriate knowledge and experience, and may include, but not be limited to, a terrestrial and an aquatic ecologist, an iwi representative and a geomorphologist depending on the type of monitoring required.	Flood Protection	Ongoing
2	Collate information and distribute to subject expert(s). Information collected, should include but not be limited to: • Maintenance works completed. • Results of environmental monitoring.	Flood Protection	Ongoing
Monitoring report(s) preparation			
3	Subject expert(s) produce draft report(s).	Subject expert(s)	Ongoing
4	Receive draft report(s).	Flood Protection	Ongoing
5	Flood Protection provides feedback to the subject expert(s) on their draft report(s) and this is incorporated as appropriate and the report(s) finalised.	Flood Protection	Ongoing
Annual review			
6	Flood Protection produces an annual review report that incorporates the monitoring report(s) produced by the subject expert(s). This is circulated to iwi and the Technical Panel prior to the annual review meeting.	Flood Protection Technical Panel	September
7	Flood Protection, iwi and the Technical Panel meet to discuss the annual review report and whether any changes to the EMP or Code are necessary.	Flood Protection	October
Issue resolution			
8	Still to be determined.		

Actions			
9	Does the Code require changing?	Flood Protection	November
10	If the Code does not requiring amending then the review is complete, if the Code does then a formal review would be initiated.	Flood Protection	December

Table 1: Annual review process

1.7.2 X yearly review

Formal review of the Code will generally occur on the X anniversary of the resource consent unless triggered earlier through the annual review process. The X yearly review will take the form of a meeting with iwi, key stakeholders and the Technical Panel.

As for the annual review, a report summarising the preceding X years will produced and will form the basis of the discussion. The report will summarise:

- Monitoring completed to date (at a high level)
- What changes might be necessary to the EMP and/or Code
- How the process has been going to date; and
- If GWRC consider a Section 128 review is required.

The X yearly review is outlined in Figure 3 with Table 2 describing process steps in detail. The numbers in bold on the process flow relate to the step in the corresponding table.

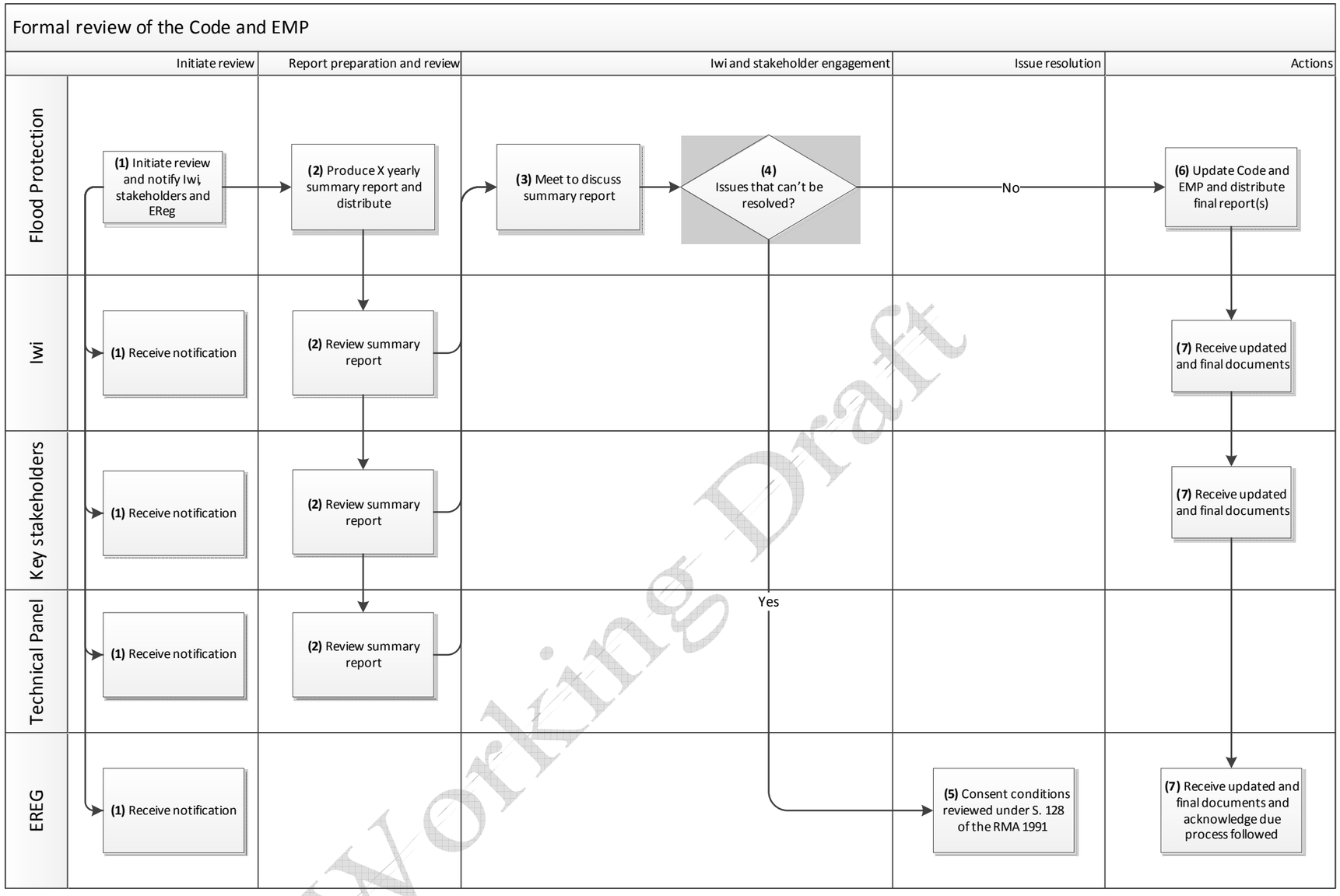


Figure 3: X yearly review

Step	Action	Conducted by	When
Initiate review			
1	Notify EReg, iwi, key stakeholders and the Technical Panel that the Code is being formally reviewed. This should commence on the X yearly anniversary of the resource consent.	Flood Protection	Resource consent anniversary
Report preparation and review			
2	Flood Protection produces a report that summarises the past X years. This is circulated to all parties prior to the formal review meeting.	Flood Protection Iwi Stakeholders Technical Panel	September
Iwi and stakeholder engagement			
3	Flood Protection and all parties meet to discuss the X year report and whether the resource consent conditions should be reviewed under S.128 of the RMA 1991. *It is important to note that the annual review process may also be run concurrently with the formal review process.*	Flood Protection Iwi Stakeholders Technical Panel	October
4	Flood Protection and/or iwi decide if the resource consent should be reviewed under S.128 and notify EReg.	Flood Protection Iwi	October
Issue resolution			
5	EReg review the resource consent under S.128 of the RMA 1991.	EReg	November
Actions			
6	EMP And Code are updated accordingly (if required).	Flood Protection	November
7	Updated EMP and Code are distributed to iwi, key stakeholders, and EReg.	Flood Protection	December

Table 2: X yearly review process

2. Environmental Monitoring Plan[11]

The EMP proposes monitoring the effects of flood protection activities on geomorphology, river nesting birds and aquatic ecology; these, along with cultural monitoring, are considered the key focus areas at this time. Cultural monitoring has not yet been incorporated into the monitoring programme as further discussion with iwi is required.

The EMP identifies the monitoring requirements in respect of methods, reporting and review.

2.1 Approach

The EMP proposes a programme of baseline environmental monitoring and specific event monitoring. Baseline monitoring will consist of regular (three yearly) measurement of geomorphological and biological variables in each of the river reaches defined for the Natural Character Index (NCI), which would be used to assess the cumulative effects of activities over time.

Event monitoring for moderate scale works[12] would consist of before/after habitat assessments[13] and for large scale works would include comprehensive before/after/upstream/downstream investigations of water quality, habitat quality, biological monitoring and calculation of NCI, as described in the following sections.

2.2 Baseline Monitoring

2.2.1 Riparian Vegetation

(a) Monitoring outline

Vegetation types within the riparian margins of the Hutt, Wainuiomata, Waikanae and Otaki Rivers will be broadly mapped using aerial photography supported by selected site visits to confirm interpretation. The possibility of using LiDAR survey for this purpose will also be considered. It is intended that these surveys would be completed within three years of the consents being granted and at 9-year intervals thereafter.

(b) Inputs to review process

Changes in riparian vegetation caused by FLOOD PROTECTION activities that significantly alter the character of the river environment and its habitats (this may include both enhancement and degradation of the river environment).

A methodology has yet to be developed for this assessment, including guidelines for the determination of significant change.

If a causal link is evident between an adverse change in the character of the river environment and its habitats and an FP activity this would result in a modification of that activity (or offset of habitat loss by creation of new habitat elsewhere) via review of the

[11] This EMP (Section 2 of this document) has been prepared by David Cameron a Senior Environmental Scientist at MWH. In response to consultation feedback the EMP has be incorporated into the Code rather than being a separate document. This is due to the relationship of the EMP to the Code and vice visa.
[12] The scale of work and the three tier approach proposed in Section 2.3 is still under development.
[13] The applicability of habitat assessment form as a monitoring tool is still under development.

Code. In the event that the cause of the change is not obvious, the appropriate response would be to initiate a more targeted investigation of changes in the river environment.

2.2.2 River Birds

(a) Monitoring outline

Baseline river bird monitoring was undertaken during late 2012 on a number of rivers in the Region including the Hutt, Waikanae and Otaki (McArthur et al 2012). Additional surveys are proposed to:

- Provide quantitative data;
- Describe on-going trends in the distribution and abundance of riverbed nesting birds; and
- Provide information to better assess and quantify the impacts of flood protection activities on river nesting bird populations.

These additional surveys will involve:

1. Two further surveys on the Hutt, Waikanae and Otaki Rivers in October-November 2013 and 2014, using the methods described in McArthur et al (2012).
2. These three year sets of annual surveys are repeated on a regular basis, with a gap of 5 years between surveys (i.e., in years 2012, 2013, 2014, 2020, 2021, 2022, etc.).

(b) Inputs to review process

For the Otaki River it is proposed that if any recorded changes in the average number of breeding pairs reached the levels noted in Table 3, the need for further investigation into the causes of the changes would be triggered.

Triggers are not proposed for the Hutt or Waikanae Rivers until such time as at least one of the four indicator species (banded dotterels, black-fronted dotterels, black-billed gulls and pied stilts) have re-colonised these areas.

Species	**Trigger level**
Banded dotterel	25% or more decline in the average number of breeding pairs detected between one 3-year set of surveys and the next
Pied stilt	25% or more decline in the average number of breeding pairs detected between one 3-year set of surveys and the next
Black-fronted dotterel	50% or more decline in the average number of breeding pairs detected between one 3-year set of surveys and the next

Table 3: River birds - triggers for further investigative work

If, following further investigations, a causal link is evident between a decline in bird numbers and a FP activity this would result in a modification of that activity (or offset of habitat loss by creation of new habitat elsewhere) via the review process. In the event that the cause of the population decline is not obvious, the appropriate response would

be to initiate a more targeted investigation of the species in question in order to quantify survival and nesting success and to identify the cause(s) of the decline. In addition, should an increase in population sizes of indicator species be observed, GWRC will review the trigger levels and revise them downwards if appropriate.

2.2.3 Fish Communities

(a) Monitoring outline

The New Zealand Freshwater Fish Database (NZFFD) contains a significant amount of information about freshwater fish communities in the Wellington Region. However, FP activities can occur across a wide range of habitats, including deeper water habitat which are difficult to survey by electric fishing methods and so are not well represented in the Database.

In order to provide a stronger focus on habitats potentially affected by FP activities, and thus to provide information to better assess and quantify the impacts of these activities, fish surveys will be undertaken on a regular basis within selected watercourses by backpack electric fishing, trapping and spotlighting, in general accordance with the New Zealand Freshwater Fish Sampling Protocols (Joy, David and Lake 2013). Surveys will be undertaken at two locations in each of the watercourses listed below within the first two years of the resource consent (except Hutt which is already completed). Each reach will then be re-surveyed at three-yearly intervals for the duration of the resource consent (or until modified through the review of this EMP). Note, for the Hutt, Otaki and Waikanae Rivers these reaches are coordinated with those defined for NCI assessment and are intended to include one site with a relatively high NCI score and one with a relatively low score. This will provide information on the relationship between fish populations and natural character of the river.

Watercourse	**Survey locations**	**GW Cross Sections**	**Initial survey**
Hutt River	Upstream of Kennedy Good Bridge	XS510 to XS840 S850 to XS1080	Nov 2012 – Feb 2013 (completed)
Waikanae River	Greenaway Road SH1 Bridge to WTP	XS175 to XS230 XS430 to XS550	Nov 2014 – Feb 2015
Waimeha Stream	Waimeha & Ngarara at Golf Club	N.A.	Nov 2014 – Feb 2015
Otaki River	Below SH1 Rahui Road	XS220 to XS360 XS870 to XS990	Nov 2015 – Feb 2016
Wainuiomata River	Burden Ave Hine Road	XS1185 to XS1230 XS1410 to XS1480	Nov 2015 – Feb 2016

Table 4: Monitoring locations of fish populations

(b) Inputs to review process

Sustained changes in native fish abundance or species diversity caused by FP activities.

It is noted that considerable natural variation in fish abundance and diversity can occur as a result of seasonal migrations or disturbance by flood events, or drought, and that the influence of FP activities may be difficult to discern by baseline monitoring as currently proposed. For that reason site specific event monitoring of fish populations using a before/after/upstream/downstream design is also proposed for large scale works (see Section 2.3).

A definition for the determination of sustained change has yet to be agreed.

If a causal link is evident between a sustained change in fish numbers or species diversity and a FP activity this would result in a modification of that activity (or offset of habitat loss by creation of new habitat elsewhere) via the Code and EMP review process. In the event that the cause of the change is not obvious, the appropriate response would be to initiate a more targeted investigation of fish population changes.

2.2.4 Inanga Spawning Habitat

(a) Monitoring outline

Inanga spawning habitat identified on the Hutt River, Opahu Stream, Waikanae River, Waimeha Stream and Otaki River may potentially be affected by flood protection activities. A comprehensive survey of inanga spawning habitat, commissioned by Wellington Regional Council, was undertaken by NIWA in tidal reaches of 21 rivers in the western part of the Wellington Region during 2000 and 2001 (Taylor and Kelly 2001).

Effective avoidance and/or mitigation of effects relies on the availability of up to date information on inanga spawning habitat, and in order to ensure that this is available to GWRC in the development of work programmes under the new resource consents, it is proposed to undertake a further inanga spawning habitat survey in the affected watercourses, comparable to the NIWA study, within the first 36 months of the operation of the new resource consents. The need for further surveys subsequent to this initial work would be addressed in the applicable monitoring report.

(b) Inputs to review process

Significant changes in the area or quality of inanga spawning habitat caused by FP activities.

A methodology has yet to be developed for this assessment, including guidelines for the determination of significant change.

If a causal link is evident between a decline in the area of inanga spawning habitat and a FP activity this would result in a modification of that activity (or offset of habitat loss by creation of new habitat elsewhere) via the Code and EMP review process. In the event that the cause of the change is not obvious, the appropriate response would be to initiate a more targeted investigation of potential causes.

2.2.5 Trout Abundance

(a) Monitoring outline

Annual monitoring of trout abundance has been undertaken in the Hutt and Waikanae Rivers since 1999 in accordance with a memorandum of understanding between Fish and Game NZ and GWRC[14]. The primary objective of this monitoring is to provide information to allow exploration of the relationship between trout abundance and variables such as the timing and magnitude of flood events, and the timing and location of FP activities.

Annual monitoring of trout abundance will continue, using drift dive methodology, at eight reaches on the Hutt River, four on the Waikanae, and two reaches on the Otaki River, in order to continue to develop the database of information available for the assessment of effects of FP activities. As far as is practicable the trout monitoring reaches have been aligned with NCI assessment reaches (outlined in section 2.2.11).

(b) Inputs to Review process

Sustained changes in trout abundance caused by river management operations.

It is noted that considerable variation in trout abundance has been reported for the Hutt and Waikanae Rivers between 1999 and 2014 and that the severity of floods between August and November is thought be a primary cause (Pilkington 2014). It is expected that the trout fish monitoring programme currently underway will eventually gather sufficient data to enable a detailed exploration of the relationship between trout abundance and variables such of flood flows as well and FP activities, but that 20-years of data are likely to be required for this purpose (Pilkington 2014). The trout monitoring programme may be the subject of a review in the future.

2.2.6 River Bed Level Surveys

(a) Monitoring outline

Monitoring of riverbed levels is important due to their impact on flood capacity and channel stability. GWRC currently undertakes riverbed surveys at five yearly intervals on the Hutt, Waikanae and Otaki Rivers; the Wainuiomata River and minor watercourses are excluded from these surveys. Survey data are used to analyse trends in gravel movement and to determine river management policies for the proceeding five year period.

This information also provides input into the proposed investigation of the NCI (outlined in section 2.2.11).

(b) Inputs to review process

Changes in mean riverbed levels outside of design riverbed level envelopes[15] over more than three consecutive cross sections.

An analysis of riverbed levels against design envelopes will be undertaken after each riverbed survey and reported in the annual review report produced for that year. The

[14] This MoU expired in December 2013. GWRC intends to renew this.
[15] River bed levels are managed within defined lower and upper levels, described as an 'envelope', rather than to discrete levels.

principle response is to revise the envelope and/or the gravel extraction programme (sites and volumes).

2.2.7 Aerial Photography

(a) Monitoring outline

Aerial photographs provide a useful tool for river management planning and allow quantification of river morphology and depiction of changes in this over time.

Aerial photography mosaics will be produced at least once every three years over the reaches of the Hutt, Otaki, Waikanae and Wainuiomata Rivers managed by GWRC to ensure that up to date data for management planning and a regular record of river morphology for potential use in assessment of effects of river works is available over the life of the new consents.

(b) Inputs to Review process

Changes in actual channel alignment compared with the design channel alignment over a reach (of 10 cross sections or more) that give rise to significant channel distortions and channel alignment that aggravates bank erosion and effects bed material processes.

2.2.8 Pool and Riffle Counts

The numbers of pools and riffles in a river is a measure of the diversity of aquatic habitat and morphological complexity of a river, which in turn can be used as an indicator of the overall ecological health of the river (particularly when considered in conjunction with other aquatic survey data). Pool and riffle counts will be conducted at least once every three years over the reaches of the Hutt, Otaki and Waikanae Rivers managed by GWRC. The counts will be undertaken by representatives of Wellington Fish and Game and GWRC according to an agreed methodology[16] using aerial photography mosaics flown no more than 12 months prior to the count.

(a) Inputs to review process

A change in pool and riffle counts, compared with an agreed reference number for specified river reaches, which are attributable to FP activities.

If a causal link is evident between a decline in pool counts and a FP activity this would result in a modification of that activity (or offset of habitat loss by creation of new habitat elsewhere) via the Code of Practice and EMP review process. In the event that the cause of the change is not obvious, the appropriate response would be to initiate a more targeted investigation into potential causes.

2.2.9 Deposited Sediment

The amount of deposited sediment on the river bed can be used as an indicator of aquatic habitat quality, and changes in the amounts of deposited sediment can also be used to indicate changes in habitat quality over time. Deposited sediment measurements will be undertaken once every three years in each of the reaches identified for calculation of NCI to allow comparison of the resultant data. These

[16] To be defined. Will be included as part of the MoU renewal.

measurements will also be co-ordinated, as far as is practicable, with the 3-yearly aerial photography outlined above, for the same reason.

The measurements will visual estimates of fine sediment cover and assessment of substrate grain size by Wolman pebble count, in accordance with the protocols provided in Clappcott et al (2011).

(a) Inputs to review process

Significant changes in the proportion of bed substrate covered by fine sediment which is attributable to flood protection activities.

A definition for the determination of significant change has yet to be agreed.

If a causal link is evident between an increase fine sediment cover and an FP activity this would result in a modification of that activity (or offset of habitat loss by creation of new habitat elsewhere) via the Code of Practice and EMP review process. In the event that the cause of the change is not obvious, the appropriate response would be to initiate a more targeted investigation of potential causes.

2.2.10 Riverbank undercutting and overhanging vegetation

River bank undercutting and overhanging vegetation provide opportunities for aquatic habitat diversity, which in turn may contribute to overall aquatic ecological health.

Length of riverbank undercutting and overhanging vegetation will be measured once every three years in each of the reaches identified for calculation of NCI to allow for this parameter to be included in the overall NCI calculation.

(a) Inputs to Review process

Significant changes in the lengths of undercut banks and overhanging vegetation which is attributable to flood protection activities.

A definition for the determination of significant change has yet to be agreed.

If a causal link is evident between a decline in the lengths of riverbank undercutting or overhanging vegetation and an FP activity this would result in a modification of that activity (or offset of habitat loss by creation of new habitat elsewhere) via the Code of Practice and EMP review process. In the event that the cause of the change is not obvious, the appropriate response would be to initiate a more targeted investigation of potential causes.

2.2.11 Natural Character Index

As part of an investment to better understand and assess the nature of the environmental effects of its river management work, GWRC is proposing to further investigate the use of a NCI, under development by Massey University researchers to monitor the degree of departure from current condition of geomorphological characteristics in the Hutt, Otaki, and Waikanae Rivers on a regular basis.

Bed level surveys, wave amplitude (from aerial photography), pool and riffle counts, deposited sediment levels, substrate grain size, length of undercutting, and length of overhanging vegetation would be assessed and used as input to the NCI (details to be confirmed). It is intended that NCI be used as part of the baseline monitoring programme to assess departure from an historic reference condition at each of the NCI reaches defined for these rivers (refer Williams 2013). It is anticipated that this will provide a measure of the cumulative effects on river morphology for specific river reaches.

It is also intended that NCI would form part of any site specific monitoring programme to be developed for larger flood protection works (see Section 2.3 below). The geomorphological variables would be assessed at the works reach and a similar length of river upstream before and after the works. The ratio of these variables (expressed as a combined index of before to after) would be calculated for the works and upstream reaches (i.e. to produce a 'works reach' NCI and an 'upstream reach' NCI).

It should be noted that this science is relatively new and that further work is required to develop and refine the NCI for use in the rivers of the Wellington Region. It is proposed that, that work would be undertaken during the coming summer by a Massey student[17]. Further investigations will need to be undertaken to better establish the link between NCI scores and ecological condition before the NCI could be used as an indicator of ecological condition, or as a trigger for mitigation action. It is intended that this be achieved by (a) a report from Massey to confirm the methodology, (b) an investigation into the relationship between NCI scores and ecological condition (possibly as an extension of the Massey project), (c) a technical review of baseline results from year one (including recommendations about trigger levels) and (d) a Technical Panel decision on future use as a trigger for mitigation action.

(a) Inputs to review process

Following the method development outlined above, a significant change in NCI (to be defined) would trigger the need for mitigation action (to be defined).

2.3 Event Monitoring

In the first instance, event monitoring will focus on those activities deemed to have the most potential for adverse effects, namely wet gravel extraction and bed recontouring. The need for inclusion of other activities would be identified through the review process. For the purpose of determining an appropriate level of monitoring for these riverbed disturbance events, activities have been categorised as minor, moderate and large scale, as described in the following sections.

2.3.1 Minor Scale Works in the Wetted Riverbed

Minor scale works are defined as those affecting less than 150m of wetted riverbed length and/or no more than three days of in-river works.

Baseline monitoring at each NCI reach will be undertaken as described in Section 2.2 above. Over time the baseline monitoring results would be used detect cumulative

[17] to be confirmed

change, either by aggregation of a range of habitat measures via the NCI or as individual components of habitat quality.

No site specific monitoring is proposed for work sites in this category.

2.3.2 Moderate Scale Works in the Wetted Riverbed

Moderate scale works are defined as those affecting between 150m and 500m of wetted riverbed length and/or between three and six days of in-river works.

In addition to the baseline monitoring as described in Section 2.2, site specific before/after habitat assessments will be undertaken at each work site by the operations supervisor using the habitat assessment template included in Appendix 2.

2.3.3 Large Scale Works in the Wetted Riverbed

Large scale works are defined as those affecting more than 500m of wetted riverbed length and/or more than six days of in-river works. This will include large scale gravel extraction or bed re-contouring works which occur relatively infrequently but which result in extensive riverbed disturbance.

At these works, in addition to the baseline monitoring as described in Section 2.2, a site specific EMP will be developed prior to the commencement of work by a suitably experienced aquatic ecologist. The site specific EMP is likely to include some or all of the following, and where possible would be based on a before/after/control/impact design:

a. Water quality monitoring (suspended solids, turbidity, Total-Nitrogen, Total-Phosphorus)

b. Deposited sediment monitoring (sediment cover and substrate size)

c. Habitat mapping at impact and reference sites

d. Macroinvertebrate re-colonisation

e. Survey of fish populations

f. Fine scale monitoring of physical, chemical and biological indicators in estuarine environments (where applicable)

g. NCI calculated for the works and upstream reaches (i.e. to produce a 'works reach' NCI and an 'upstream reach' NCI)

2.3.4 Mechanical Weed Removal from Low Gradient Watercourses

Clearance of aquatic weeds from some low gradient watercourses is undertaken in order to maintain channel capacity and to reduce the risk of flooding. Some of these watercourses, such as the Waimeha Stream in Waikanae, are known to support diverse native fish populations and are highly valued, while in other instances the native fish values are not known.

During the first three year period under the new consents, fish surveys will be undertaken on all perennial streams affected by mechanical clearance of aquatic weeds, before and after the clearance operation. Fish surveys will be undertaken by backpack electric fishing (and where appropriate by trapping and/or spotlighting) in general accordance with the New Zealand Freshwater Fish Sampling Protocols (Joy, David and Lake 2013).

The need for further monitoring of fish populations in these watercourses will be determined during the annual review.

2.3.5 Disturbance of Gravel Beaches

Any river works resulting in continuous or periodic disturbance or gravel beaches on the Otaki River between August and February (the breeding seasons for banded and black fronted dotterels, pied stilts and black backed gulls), or likely to cause any loss of open gravel beach habitat on the Otaki River, will be preceded by a survey of the affected area by a suitably experienced person to identify the presence of breeding birds, nests or chicks.

3. Values[18] and flood protection activities

Underpinning the effective operation of this Code is a consideration of the values identified at the river, reach and/or site level, and how these are considered in the choice of flood protection activities.

Prior to any activity being undertaken, the values will be considered and whether the work should be undertaken (in the first instance) and if so, what method or methods for achieving the desired outcome would be appropriate.

In addition to this, the ongoing review of the Code and EMP will also allow new information relating to values associated with either river systems in general, specific rivers or more locally, specific sites on a river, to be carried into changes in practice as part of the adaptive management regime.

3.1 How will this work?

Consideration of values will operate at a number of levels, from long term work planning, through to day-to-day activities. The Code reflects the consideration of values at national and regional level by the inclusion of standards that are generally applicable to all FP activities and by including any restrictions that may be applied to specific activities on individual rivers or reaches within rivers.

This information will be used by scheme managers during both long term, annual and day-to-day work planning. In addition to this, it is intended that scheme managers and on-site supervisors will utilise the more specific information on the values that may exist in specific reaches or at particular sites to further refine the selection of method or methods that may be suitable in the planning of day-to-day operations. Work practices undertaken at a specific site would be expected to comply with the practices appropriate to the values associated with the river in question; these would be identified at the outset of long-term or annual work planning. Additionally they would take into account any site specific values which may have also been identified during annual work planning, but may need further specific consideration on-site; Figure 4 below broadly describes this process.

[18] Values, as defined in the Draft Natural Resources Plan [for the Wellington Region, September 2014], are the worth or desirability held for a set of qualities, uses or outcomes.

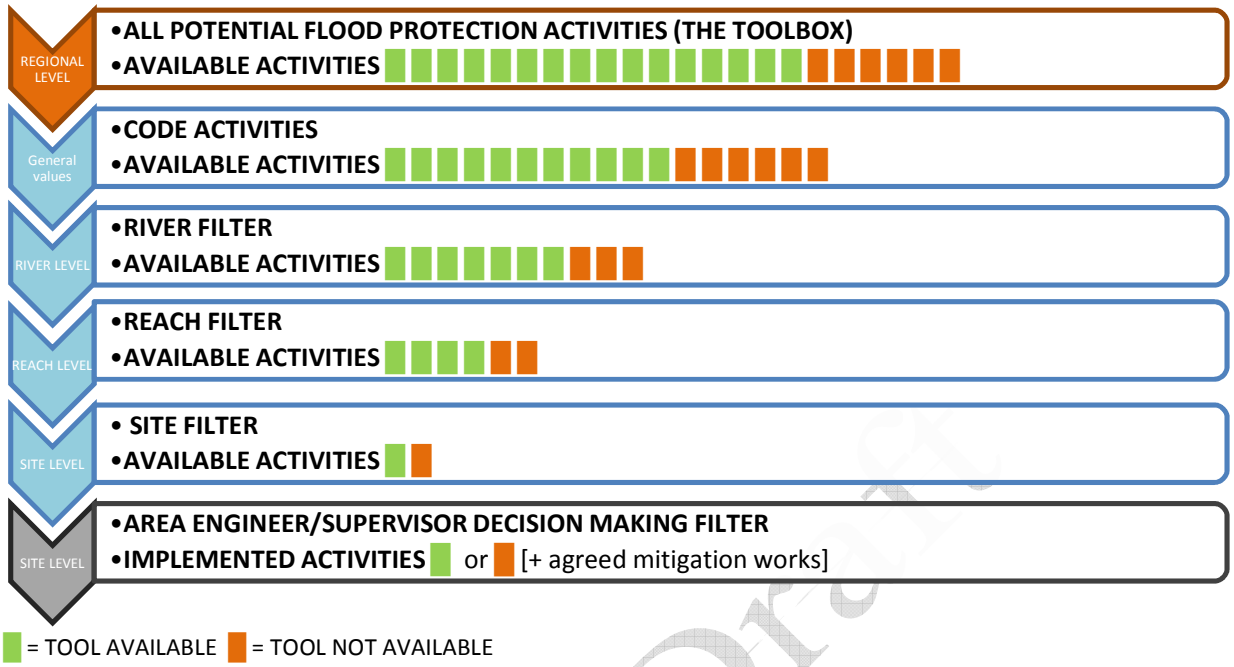


Figure 4: Activity filtering process

Figure 5 outlines the assessment process that is undertaken at both the long term, annual, and day-to-day work planning stage. Through the work planning stage, in selecting the activity to implement it is important to consider whether any intervention is necessary at all. This will be related to the risk of doing nothing and will be determined through a site risk assessment. If doing nothing is not an option then the relevant floodplain management plan or scheme document must be referred to in the first instance. These documents set the strategic direction for each river system and will outline if there is work anticipated as well as limiting what tools are available to use. If no strategic direction exists, and intervention is necessary, then activities should be filtered based on the effect of that activity on the values present in the water course as shown in Figure 4.

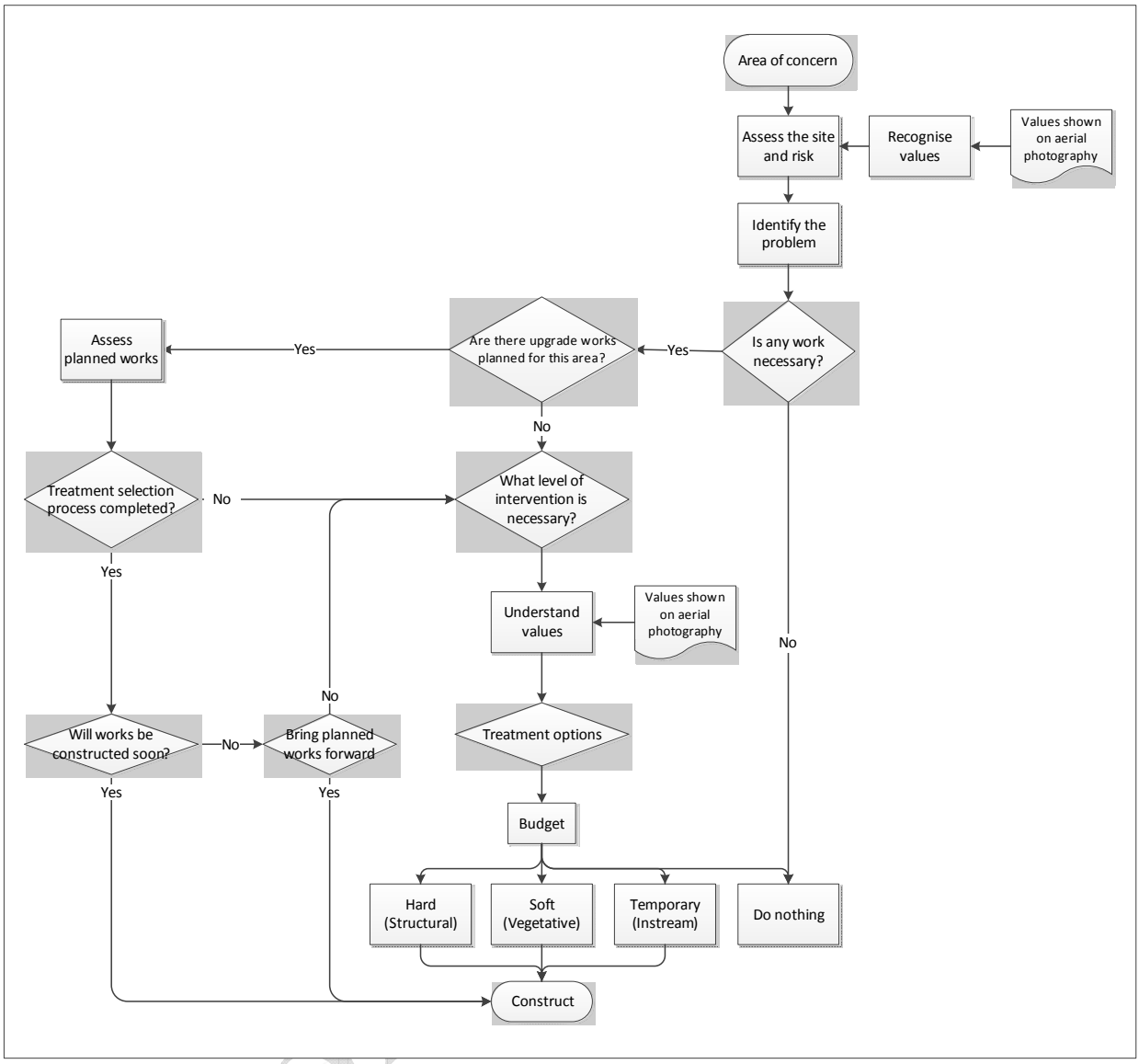


Figure 5: Activity selection process.

3.2 What are these values?

The Draft Natural Resources Plan identifies the values in Table 5 below.

Shared values – recognising commonalities in values – water quality	
Values	Commonality
Ecosystem health and mahinga kai	In practice water quality that provides for ecosystem health outcomes also has the potential to provide for mahinga kai
Contact recreation and Maori use	Contact recreation in freshwater is managed to a level to allow immersion
Intrinsic values	
Values	Activities **associated with values**
Ecosystem health and function	Freshwater systems, marine systems, coastal and estuarine systems, bird habitat, marine life habitat, dune ecosystem function and habitat, protecting the welfare of tuna/eels, places for fish to survive and repopulate
Biodiversity	Protecting indigenous biodiversity (plants and animal), Healthy freshwater biodiversity, preventing extinctions - fish, invertebrates, whitebait, grey mullet, frogs, lizards, algae, variety of creatures, diversity of native birds
Waterway Character	Protecting river form – the mix of riffles, rapids and pools, flowing water, free flowing, channel process effect ecological habitat
Use values – direct	
Values	Activities **associated with values**
Human sustenance, health and welfare	Healthy food, clean water, well-being and health, drinking water, marae supplies, domestic stock drinking water, fire fighting
Wai tapu	Sacred waters, ceremonial waters
Infrastructure integrity	Reliable drinking water supplies, seasonal water harvesting and storage, coastal navigation, decreased flood risk, human potable water, recycling and reusing water, efficient use of water
Active recreation /Contact recreation	Opportunity for recreational variety, coastal fishing, beach swimming, boating, water sports (fresh and marine), canoeing, surfing rafting, sport fishing – trout
Waste removal and dilution	Dilution and dispersal of waste, runoff and leaching
Mahinga Kai	Direct gathering of food, places of food
Transportation and navigation	Transportation and navigation

Use values – economic	
Values	Activities **associated with values**
Food and fibre production	Food, agricultural production (livestock and horticulture), cultivation, organic agricultural production, clean irrigation water
Commercial enterprise	Commercial fisheries, eel fishing, commercial recreation (eg rafting), gravel extraction, eco-tourism, electricity generation, tourism, industrial use, disposal of waste
Industrial processes	Clean water for industry

Table 5: Natural Resources Plan values

These values are also the basis for the values considered important for the Code, and the Code takes them into account in the definition of the general standards and the specification of any particular restrictions, on the basis of currently known information.

NOTE THAT CONSIDERATION OF CULTURAL VALUES HAS NOT YET BEEN INCORPORTATED INTO THE CODE

As part of the on-going development of the Code, it is proposed that for each river, the relevant values will eventually be identified and displayed spatially on appropriately scaled maps. The availability of this information will introduce further objectivity, transparency, sustainability and refinement in the process of selection of appropriate work methods by scheme managers, (although the outcomes may be little different from those that already occur via the more subjective application of individual expertise and knowledge).

4. Using the Code

For the Code to be a 'living document', i.e. one that continues to reflect good practice over time and is actively used by GWRC to guide its work practices, there are a number of actions, processes and protocols that must be established. These are outlined below.

4.1 A Code culture

This Code is an integral part of decision-making at both management and operational levels in much the same way that health and safety is incorporated into everyday decision making.

A Code culture has at its heart the following principles:

- Understanding the purpose of the Code and the outcomes it aims to achieve.
- Understanding the actions required to enable the Code to deliver the desired outcomes.
- A willingness and commitment to the implement, use and develop the Code.

Over time, use of the Code will become part of business as usual. To achieve this, relevant GWRC staff and contractors will be introduced to the use of the Code. This will include specific identification of the actions required of individual staff members. Annual 'refresher' sessions on the use of the Code, to keep relevance for staff alive and 'top of mind', will be held.

4.1.1 Flood Protection work planning

- Specific consideration of the Code requirements will be an agenda item in all work planning meetings.
- Staff will refer to the Code prior to consideration/design or commencement of any works on the ground.

4.1.2 Documenting work

For the Code to be sustainable and remain effective, it is essential for records of work practices to be kept, and provision made for GWRC staff to record any observations where practice is not achieving the desired outcomes or could be improved.

Other relevant information that may be used to improve work practices over time, such as complaints that may be received from the public, should also be recorded.

4.2 Document ownership and management

The Code has been created by GWRC for its own use. To that extent, GWRC has sole responsibility for the administration of the Code documentation. Notwithstanding this, the Code will be a useful guide for others doing flood protection and erosion control activities in the region.

As explained in Section 1.7, iwi, key stakeholders and advisers, community groups and landowners are involved in reviewing and updating the Code.

Active management of the Code document is necessary to keep it up to date and to ensure that all staff and the public have access to the latest copy. This will require:

- Appointment of a staff member with primary responsibility for management of the Code document.
- Establishment of a protocol around the management of the Code document, including:
    - The master copy of the Code is held by GWRC, FP and this is the only copy to which approved amendments may be made.
    - The latest copy of the Code will be available on the GWRC website at all times
    - The number of hard copies of the Code on issue will be recorded, to ensure all are updated when required.
    - GWRC, FP is responsible for ensuring that updates to the Code are made as agreed following the review, and that updated copies of the Code are made available to all parties and posted on the GWRC website.

4.2.1 Distribution and availability

- All GWRC, FP staff shall have access to a copy of the Code and refer to the Code when formulating plans for flood protection and erosion control work.
- All GWRC, FP staff and contracted staff shall have access to a copy of the Code and should refer to it before designing or undertaking any work on the ground.
- The Code shall be available for public inspection on the GWRC website and (in hard copy) at all GWRC offices and depots.

4.3 Trialling new activities or methods

GWRC will wish to trial new methods, activities or strategies for river management from time to time

Before any new method or activity is included in the Code it will undergo a full appraisal through the formal review process. The appraisal process may include on-site trials of the new method or activity.

Prior to undertaking any trial of a new method or activity, GWRC will determine:

- The purpose of the trial;
- The site or sites at which the trial will be undertaken;
- The times when the trial will be undertaken and the total length of time expected to undertake the trial;
- The expected effects or outcomes of the trial;

- The parameters by which any outcomes of the trial will be measured;
- Any environmental monitoring that will be required to measure the progress or success of the trial; and
- The people who will be responsible for evaluating the trial and any specialist expertise that may be required.

The results of any new method or activity trials will be included in the review of the Code and EMP, and any decision to include the new method or activity in the Code will be made via the review process.

4.4 Urgent Works

Urgent works are measures taken to address an immediate issue or problem where erosion or flooding is placing flood protection structures, other infrastructure or property under direct threat of damage.

Urgent works are often temporary measures, such as placement of rock, or diversion of the active channel, to provide a 'stop-gap' solution until a more permanent solution to the problem is put in place.

In such cases, it may not be possible to adhere to all the good practice guidelines of the Code of Practice. However, the following will still apply:

- Construction materials used for urgent works will be compatible with the environment (i.e. no concrete rubble or car bodies or other foreign material)
- It is still expected that machinery used for urgent works will comply with the guidelines relating to operation of machinery contained in the Code

It is expected that all GWRC staff and machine operators will comply with the guidelines relating to safety contained in the Code.

5. Good Practice Methods

5.1 Defining good practice

In the context of this Code good practice means selecting an appropriate action or group of actions to address an erosion or flood issue, which takes account of the identified values associated with that river and site to provide an appropriate and acceptable outcome.

5.2 Structure of this Section

Section 5.3 contains a list of General Good Practice Methods that apply to all flood protection activities. These standards reflect good practice that has been derived through general consideration of the values identified in Section 3.

Section 5.4 describes the specific methods that apply to individual activities, and any specific locational restrictions on those activities. Again, these methods reflect good practice that has been derived, and will continue to evolve, through more specific consideration of the values identified in Section 3 as they apply to individual rivers, or parts of rivers.

Section 5.5 contains a protocol for Urgent works.

Section 5.6 contains a protocol for trialling of new activities or methods of undertaking activities.

It is important to note that the Code does not authorise any activity to be undertaken; rather, it describes how that activity should be undertaken. For ease of reference, some guidance is given as to whether individual activities may or may not be undertaken without resource consent under current regional plans.

5.3 General Good Practice Methods

There are several actions or practices that apply to many, or all, flood protection activities. Rather than specifying these for every individual activity, they have been combined into a list of general practices that will apply as appropriate in every situation where flood protection works are undertaken, as detailed below.

Work Phase	Action/practice	Personnel responsible
Pre-works planning	Work planning & budgeting	Flood Protection managers
	Work Plan communication	Area Engineer/Site supervisors
Works Implementation	Onsite works planning & checks	Area Engineer/Site supervisors
	Work recording	
	Recording of complaints and concerns	
	Operation & maintenance of machinery	
	Construction material storage & stockpiling	
	Sediment control	
	Formation of access from the banks to the river bed	
	Management of noise, dust, odour, traffic	
	Management of safety	
	Consideration of opportunities for environmental enhancement	
	Discovery of artefacts or koiwi (historic human remains)	

General Good Practice Methods

Work planning & budgeting

Description

All flood protection staff will take an active role in the implementation of good practice.

All staff responsible for managing work programmes must recognise the need for good practice at the outset of flood protection work planning, and adherence to good practice must be included as part of the sign-off process for work plans by GWRC managers and appropriate stakeholder groups. The need for managers to ensure that work programmes are achievable and appropriately funded forms part of good practice.

Actions

- The planning and development of all flood protection works must take account of:
  - **Plans -** the directions and requirements of any Floodplain Management Plan and associated Environmental or Ecological Strategy, Flood Protection Department Asset Management Plan and the GWRC Long Term Plan
  - relevant provisions of any **Iwi** Management Plan, or obligations arising from Treaty of Waitangi settlements.
  - the requirement to maintain the **flood carrying capacity** of the waterway
  - the **necessity of intervention** and the consequences and cost of doing nothing
  - the **effectiveness of the proposed works** to address the flood protection or erosion issue requiring intervention
  - if the required **works are permitted**, either by the rules in the regional plans or by granted resource consents
  - the **conditions** attached to any relevant resource consents
  - the balance between **cost and affordability**
  - the availability of **suitable plant and equipment**
  - **Values -** the general values of the river and any site specific values and associated restrictions on work practice or hours of operation. In particular, any practices that have been agreed in conjunction with the Environmental Monitoring plan
  - the sensitivity of the work and any **consultation requirements** and **exclusion periods** (see Table 6)
  - the desirability of undertaking in-river works and earthworks on the river berms during dry **weather** and lower flow periods to minimise **sediment inputs** to the river, and any sediment control measures required
  - any defined **low flow thresholds** below which in-river work may not be desirable because of the disruption to in-stream habitat
  - design considerations that contribute to **protection or enhancement of instream values**
  - design considerations that contribute to **maintenance or enhancement of habitat diversity and natural character**
  - opportunities for appropriate **enhancement** of the river corridor
  - any need to monitor works in accord with the **Environmental Monitoring Plan**
  - any **new methods under trial** and the limitations around their use
- All work planning should include identification of the utilities that may be affected by the work, including rail, sewer, water supply, overhead and underground electricity, telecommunications and gas lines and associated infrastructure
- **The person responsible for approving work programmes and plans must be satisfied that any contractors engaged to undertake work on behalf of the Flood Protection Department**

are able to undertake and complete the work in an appropriate manner, and in accordance with this Code

- Managers must ensure that consultation relating to work programme development and/or the use of specific methods in individual work plans, which may be required by the Environmental Monitoring Programme or resource consent conditions, is undertaken prior to the implementation of the relevant work plans.
- Appropriate recording of work planning must be undertaken, particularly where decisions relating to considerations of values are made.

Table 6: Works restriction periods[19]

River	Criteria	Affected Areas	Summer		Autumn			Winter			Spring			Summer
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wainuiomata	Restricted ability to operate machinery	Actively flowing channel Berms												
	Peak recreational use	Actively flowing channel Berms												
	Inanga spawning habitat	Tidal estuary edge vegetation	No restriction: no inanga spawning habitat occurs within or near the area managed by GWRC Flood Protection											
	Trout spawning habitat	Actively flowing channel	No restriction: very limited trout spawning habitat occurs within the area managed by GWRC Flood Protection											
	Peak native fish migration	Actively flowing channel									1 Sept to 30 Nov			
	Low river flows	Actively flowing channel	Avoid work in the actively flowing channel during periods when the river flow recedes below the minimum flow specified in GWRC's Regional Plan											
	River bird nesting habitat	Dry beaches	No restriction: no significant river bird nesting habitat has been identified in the area managed by GWRC Flood Protection											
Hutt (incl. parts of Akatarawa, Stokes Valley, Speedy's and Te Mome Streams)	Restricted ability to operate machinery	Actively flowing channel Berms												
	Peak recreational use	Actively flowing channel Berms												
	Inanga spawning habitat Inanga fishing	Tidal estuary edge vegetation			1 March to 31 May (Hutt River between XS100 XS210)					15 August to 30 November				
	Trout spawning habitat	Actively flowing channel	No restriction: no significant trout spawning habitat occurs within the area managed by GWRC Flood Protection											
	Peak native fish migration	Actively flowing channel									1 Sept to 30 Nov			
	Low river flows	Actively flowing channel	Avoid work in the actively flowing channel during periods when the river flow recedes below the minimum flow specified in GWRC's Regional Plan											
	River bird nesting habitat	Dry beaches	No restriction: no significant river bird nesting habitat has been identified in the area managed by GWRC Flood Protection											

[19] Note: The restriction periods outlined here should be regarded as interim only. Further work is currently underway on a more targeted approach to avoiding works in critical habitats at critical times for fish spawning and migration, while maintaining sufficient flexibility to enable GWRC to undertake the routine operations and maintenance activities required to effectively manage the flood hazard.

River	Criteria	Affected Areas	Summer		Autumn			Winter			Spring			Summer
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Waikanae (incl parts of Waimeha and Ngarara Streams)	Restricted ability to operate machinery	Actively flowing channel Berms												
	Peak recreational use	Actively flowing channel Berms												
	Inanga spawning habitat Inanga fishing	Tidal estuary edge vegetation			1 March to 31 May (Waikanae River XS20 to XS110 & Waimeha Stream DS of Ngarara Stream)					15 August to 30 November				
	Trout spawning habitat	Actively flowing channel					1 May to 31 July							
	Peak native fish migration	Actively flowing channel								1 Sept to 30 Nov				
	Low river flows	Actively flowing channel	Avoid work in the actively flowing channel during periods when the river flow recedes below the minimum flow specified in GWRC's Regional Plan											
	River bird nesting habitat	Dry beaches	No restriction: no significant river bird nesting habitat has been identified in the area managed by GWRC Flood Protection											
Otaki (incl parts of Ngatoko, Waimanu, Rangiuri Streams & Katihuki & Pahiko Drains)	Restricted ability to operate machinery	Actively flowing channel Berms												
	Peak recreational use	Actively flowing channel Berms												
	Inanga spawning habitat Inanga fishing	Tidal estuary edge vegetation			1 March to 31 May (Otaki River XS20 to XS120, & on the Rangiuru Stream and Katihiku Drain)					15 August to 30 November				
	Trout spawning habitat	Actively flowing channel	No restriction: no significant trout spawning habitat occurs within the area managed by GWRC Flood Protection											
	Peak native fish migration	Actively flowing channel								1 Sept to 30 Nov				
	Low river flows	Actively flowing channel	Avoid work in the actively flowing channel during periods when the river flow recedes below the minimum flow specified in GWRC's Regional Plan											
	River bird nesting habitat	Dry beaches								Work on dry gravel beaches from 1 August and 28 February will be preceded by a survey to ID presence of indicator species and establish of exclusion zones.				

Work Plan communication

Description

Many works are routine and will not involve the need for any formal consultation prior to their implementation. If works are of such a scale that consultation with outside parties is required, then this would be undertaken prior to, or in conjunction with, the development of work programmes.

Notwithstanding this, good practice demands that flood protection works programmes are undertaken on a 'no surprises' basis with stakeholders. This means that even though no formal consultation may be required, advance notice of planned works should be given to these people. Stakeholders may include:

- Regulators (e.g. GWRC Environmental Regulation Department, district councils)
- Other statutory bodies (e.g. NZ Fish & Game – where the river is identified as having values for trout, and DOC – where the river has native fish values)
- Iwi
- Landowners/land owner committees, scheme liaison committees
- Owners or occupiers of neighbouring properties
- Community groups, river care groups
- Owners or operators of infrastructure in the river corridors
- Recreational users
- Staff or consultants responsible for environmental monitoring associated with flood protection or other river work
- GWRC Biodiversity department staff (where works are within or adjacent to areas identified as having high biodiversity values)

The form and content of notification and the length of advance notice that might be given will be driven by the scale and nature of the works, whether the affected area is in public or private ownership, and any agreements that have been made with stakeholders. GWRC staff are expected to use their judgement as to who should be notified prior to the undertaking of on-site works, taking into account both formal obligations and actions that would be expected of a good operator.

Actions

- Scheme Managers will produce a weekly work plan outlining scheduled works and affected areas/sites for the following week. This will be emailed to the Manager, GWRC Environmental Regulation Department and any other stakeholders or interested parties prior to works scheduled for the following week. This notification will also be posted on the GWRC website.
- Any significant changes or updates to the work plan made after notice has been given shall be emailed to all parties and posted on the website as soon as possible.

On-site works planning & checks

Description

All staff carrying out work on-site have primary responsibility for ensuring that all works are undertaken in accordance with environmental good practice methods. On-site staff must apply their judgement in the implementation of all works programmes. As part of this, a number of final checks should be carried out before any works commence.

Actions

- Prior to any works commencing, the person responsible for supervising the on-site work will:
  - make a final check of available information (including local knowledge) relating to any identified site specific values and make changes to the scheduled work programme if necessary or seek further advice, as appropriate
  - check all appropriate notifications have been actioned (refer to Work Plan Communication General Good Practice sheet)

Work recording

Description

An accurate record must be kept of work undertaken. This information is important for asset management purposes, compliance monitoring and to inform the on-going development and evolution of the Code. The detail of the records should be appropriate to the nature and scale of the work, the sensitivity of any values affected by the work, and the purpose or purposes for which the information will be used, including any specific requirements of the Environmental Monitoring Plan.

Actions

- The person responsible for supervising the on-site work will record work undertaken. In particular, the following should be specifically noted:
  - the location, number and size of groynes or other structures
  - the location and length of rock lining
  - construction duration and hours of work, including time in active river channel
  - the location and lineal length of river bed recontouring
  - details of any river diversion work
  - the number of willow poles or stakes, or native plants planted and total planted area
  - details of any habitat enhancement work undertaken
  - anything relating to the work or the site that is prescribed by the Environmental Monitoring Plan
  - photographs should be taken, where appropriate, to assist with recording of work undertaken
- The person responsible for recording work undertaken will ensure that all records, photographs and other data collected is appropriately filed

Recording of complaints & concerns

Description

An accurate record of complaints or concerns about flood protection works or work practices, and of any actions taken to resolve them, must be kept. This information is relevant in alerting staff to potential problems with work practices and provides an opportunity to review practices where complaints have arisen to see if any changes are required. Complaints records need to be accessible to managers and will be reconsidered in the regular reviews of work practices by GWRC managers and in the formal review of the Code.

Actions

- All staff (both management and operational) will record all complaints received and ensure that the records are appropriately filed.
- Staff will respond to complaints as appropriate, either directly or by elevation to a higher management level for response. In all cases the intended action will be communicated to the complainant and appropriately recorded.
- Flood protection managers will include a review of the records of complaints and concerns in regular internal management reviews of work practice and will ensure that this information is carried into the formal review of the Code.

Operation & maintenance of machinery

Description

The presence of machinery in the river bed creates the potential for accidental discharges of contaminants such as lubricants, hydraulic fluids or fuel to the river environment.

The operation of machinery in river beds also creates the potential for transfer of organisms and pest plants from catchment to catchment, through the entrainment of organisms, seeds, spores or pieces of vegetation in the wheels and body of machinery. This risk is greater when machinery that may have been used in many different locations, or in other regions or islands, is supplied by contractors. In particular, there is potential for the transfer of the exotic alga *Didymosphenia geminata* (Didymo) where machinery may have previously been used in South Island waterways.

These issues can be minimised through the actions noted below.

Actions

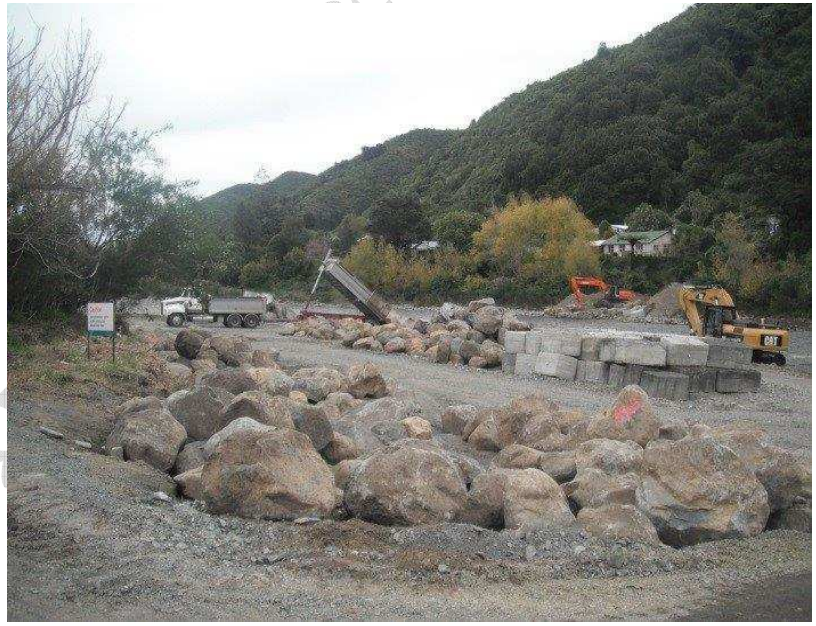
- The person responsible for supervising the on-site work must ensure that:
  - prior to the commencement of any work, any contractor operating machinery in the river bed on behalf of GWRC is aware of the obligation on them to adhere to the requirements of this Code
  - any machinery that has transferred from a different waterway will be delivered on-site in a clean condition, to avoid the spread of unwanted pests and organisms. The standard to achieve is: **no visible soil or plant matter.** For guidance on how this may be achieved refer to the National Pest Control Agencies machinery hygiene guidelines (2013), which can be found at: http://www.waikatoregion.govt.nz/Documents/Keepitclean.pdf
  - machinery that has been used in South Island Waterways will be cleaned in accordance with MPI policy prior to use in another waterway. For details, refer to: www.biosecurity.govt.nz/pests/didymo/cleaning
  - all machinery used for flood protection work is fit for purpose and well maintained
  - prior to commencement of any in-river works, all machinery is checked to ensure that there are no obvious oil, fuel or other leaks
  - no equipment or machinery will be cleaned in a river or stream bed, or at a location where runoff from cleaning activities can enter a waterway
  - machinery is not re-fuelled, either within the river bed, on the foreshore or seabed, or within 10 metres of a waterway.
  - fuel is not stored at any location where it could enter a waterway
  - all machinery is removed from the riverbed or foreshore at the end of each day and stored above the anticipated flood level when unattended, to avoid the possibility of floodwaters damaging and/or washing it away
  - in the event that a spill of fuel, hydraulic fluid or other potential liquid contaminants occurs, immediate steps shall be taken to contain the spilt contaminant. The spilt contaminants and any material used to contain it shall be removed from the site where practicable, and disposed of at an authorised landfill. A record shall be kept of the spill and actions taken.

Cleaning machinery in a wash bay

Construction material storage & stockpiling

Description

FP will store a range of construction materials in readiness for both programmed construction works and to allow immediate repairs following flood events. The amount and types of stockpiled materials will be dependent on the size and scale of existing and planned infrastructure. While it is desirable for stockpiled materials to be readily accessible, it is also important that they are not located so as to cause constrictions to the flood carrying capacity of the river, potential hazards or a reduction in amenity value of the river environment. As a general rule, construction materials will be stored on the river berms, although small stockpiles of materials may be left on the river bed temporarily during active construction work.



Good stockpile management during groyne construction

Actions

- The person responsible for supervising construction work must ensure that:
  - stockpiles of construction materials used during active construction works are only located in the river bed for the duration of the work
  - stockpiles of construction materials are not located so as to unduly constrict the capacity of the river channel or deflect the flow of the river and cause erosion problems further downstream
  - all materials associated with construction and maintenance of structures are removed from the river bed at the end of construction works and stored or disposed of at an appropriate site
  - stockpiles of construction materials on the river berms are maintained in a tidy state and are fenced or otherwise isolated, where necessary, to limit public access to them and ensure public safety.

Sediment control

Description

Flood protection works have the potential to generate elevated suspended sediment levels in the river (i.e. increase turbidity). This can arise through both direct disturbance of the river bed in the active channel, and indirectly, via sediment entrainment in stormwater runoff from areas on the banks and berms that have been disturbed by earthworks. In both cases, ground disturbance should be avoided as far as is practicable, and where it is unavoidable, measures must to be undertaken to minimise the extent of disturbance and the potential for mobilisation of sediment.

Actions

In-river works

- The person responsible for supervising the on-site work must:
  - review the weather forecast prior to the commencement of works and only undertake works during suitable weather and river flow conditions
  - divert the waterway around the work site, or if that is not practicable, ensure that all work is carried out in a way that minimises the operation of machinery in the active channel
  - plan works to minimise the number of river crossings made by machinery and ensure that each river crossing has a single entry and exit point
  - plan works to ensure that the amount of time machinery operates in the active channel is minimised

Out of river works

- The person responsible for supervising the on-site work must:
  - review the weather forecast and undertake the work during suitable weather conditions, so that run-off from disturbed areas is minimised
  - minimise the amount of ground disturbance by ensuring that only the areas necessary for access and the work are cleared
  - stage work so as to minimise the work area exposed to erosion. Rather than opening up the whole site, it may be appropriate to work the site in smaller, discrete areas on a progressive basis
  - apply appropriate erosion and sediment control measures suitable to the work and work location; this may include installing silt fencing and settling ponds to intercept runoff
  - stabilise the site as soon as possible by applying mulch and/or replanting
  - protect stormwater inlets by wrapping geotextile cloth around or across the sump grate. A coarse aggregate may be placed on top of the geotextile cloth to act as a filter and hold the geotextile in place. This is a secondary control measures and must be used in conjunction with other control measures unless no other option exists
  - inspect sediment control measures regularly and after rain fall events to ensure their continued effectiveness until the site has been stabilised and revegetated.
  - in relation to berm-reduction earthworks, consider the formation of temporary gravel bunds at the river edge to act as a buffer to sediment runoff into the river, where it is practicable to do so.

Other

Further information for out of river works can be found in the Erosion and Sediment Control Guidelines for the Wellington Region (GWRC 2002).

Silt fencing adjacent to earthworks on berm

Silt fencing and ground stabilisation around newly installed wingwall

Formation of access from the banks to the river bed

Description

Preliminary works may be necessary to enable access to a site and/or to facilitate flood and erosion protection activities.

This may include clearance of vegetation & formation of tracks on river berms; formation of access across bank edges onto the river bed by mechanical disturbance of the bank edge and/or mechanical shifting and shaping of gravel on the river bed at specific sites. Minor recontouring (shaping) of the river bed may also be necessary to create a suitable working platform for construction works.

Actions

- The person responsible for supervising the on-site work must:
  - ensure that all machine operators **use existing access** points to the river bed wherever possible
  - **limit the creation of new access points** as far as is practicable, but consider also whether this may lead to significant additional tracking in the river bed which could otherwise be avoided
  - select the location of any new access points carefully, so as to **limit the amount of disturbance** to the river bed and banks
  - note that where material is required to form access from the river bed to the bank it is preferable to source it from the local river bed, to **avoid introduction of foreign material** to the river environment
  - ensure that where foreign material is used to create an accessway, it is **clean and compatible** with the river environment
  - ensure that any access ways **do not constrict the flow or capacity** of the river channel
  - **limit the amount of any vegetation clearance** and bank disturbance to the minimum necessary
  - in particular, avoid vegetation clearance adjacent to **Key Native Ecosystems**
  - where practicable, undertake **remedial treatment** and/or replanting of any disturbed bank and berm areas following works completion, particularly if the access point is not permanently required

Temporary vehicle access track on river bed, formed by blading with a bulldozer

Site clearance – vegetation removal

Management of noise, dust, odour, traffic

Description

Activities involving machinery have the potential to generate noise, dust, unpleasant odours and additional traffic, which may adversely affect nearby residents or members of the public who use the area. With careful management such effects can be avoided, minimised or appropriately mitigated. Good management of such effects will help to ensure that the work is completed efficiently while maintaining relationships with regulators, landowners, and the community.

Larger projects are likely to have a specific Environmental Management Plan containing specific details of how any adverse effects arising from the project are to be managed. For small projects and routine operations, the actions below provide an outline of good practice.

Actions

- The person responsible for supervising the on-site work must:
  - adopt a 'no surprises approach' – consider who is likely to be affected by the works and follow pre-works communication protocols.
  - consider the type of construction machinery to be used. Is a quieter machine available? Would muffling of machinery be appropriate?
  - manage the movement of construction machinery on and off site, liaising with contractors as necessary. Are there sectors of the community that are more sensitive than others? Is there a school in the neighbourhood and do you need to avoid the use of public roads during school pick up and drop off? Is there recreational use of the area that needs special consideration?
  - manage the hours of operation, including start up and close down of machinery, taking account of the proximity of residential areas, any noise sensitive facilities, and the requirements of other users of the river corridor. In noise sensitive areas or watercourses used for recreation:
    - All works conducted on weekdays should cease by 7.00 pm
    - All works conducted on Saturdays should cease by 3.00 pm
    - No works should be conducted on Sundays or public holidays
  - consider applying water to exposed surfaces during dry or windy conditions to manage dust. Exposed surfaces may include the work area, internal haul roads, and public roads.
  - consider halting dust producing activities in dry or windy conditions such as stripping or spreading topsoil.

Restrictions

☒ Transpower transmission lines prior notification must be given to the Environmental Manager, Transpower. Mitigation measures such as the use of water carts and/or hosing facilities to control dust emissions in the vicinity of transmission lines should be used where appropriate.

Watering road to minimise dust from truck movements

Management of safety

Description

The safety of operational staff and the general public must be considered in the undertaking of all flood protection and erosion control works and activities. In addition, the safety of all users of the river corridor must be considered when flood protection and erosion control works are designed and constructed. Users may include swimmers, canoeists, rafters, anglers, walkers, cyclists.

Actions

- All Flood Protection Department staff must adhere to all GWRC Health & Safety Standard Operating Procedures (SOPs) when undertaking any flood protection works or operations
- The person responsible for supervising on-site work must ensure that:
  - all works comply with the *New Zealand Electrical Code of Practice for Electrical Safe Distances (NZCEP 34:2001)* – in particular, Section 2 and the restrictions on earthworks, and Section 5 which relates to the maintenance of safe distances between mobile plant and electricity lines.
  - prior to any excavation works are undertaken, a check is made for the presence of any underground services. This may involve the use of a service such as **beforeUdig** (http://www.beforeudig.co.nz/)
  - where possible, and it is safe to do so, public access is maintained for the duration of the work. Barriers and signage to advise the public of the work and to direct them around the work area should be used as appropriate. If work is of such a scale to cause major disruption advice is sought from GWRC's communications team
- River managers must ensure that if any structure becomes unsafe or poses a significant threat to public safety, it is made safe as soon as the hazard becomes known, and the structure is repaired or removed as soon as possible

Safety fencing around work site

Maintenance and protection of ecological values

Description

Instream fauna & habitat

Streams and rivers contain a variety of habitats, which provide shelter and sustenance for a wide variety of species, including fish (both native and introduced) aquatic invertebrates, and aquatic plants. These habitats are closely linked to those on the riparian margin, and the vegetation surrounding a stream has a large impact and interaction with habitat diversity in-stream. For example, the root structures of large trees are ideal habitats for eel, a culturally and economically valuable species. Overhanging riparian vegetation provides shade over the water (which helps to lower water temperatures), and contributes leaf and twig litter that is a food source for aquatic microbes and invertebrates. Woody material in a stream helps trap leaf and twig matter and provides shelter and spawning habitat for fish.

Flood protection activities have the potential to alter ecosystems in a number of ways, including:

- Removal of vegetation from stream banks, which can lead to increased erosion, sedimentation, and increase the temperature of the stream by removing shade trees
- Reducing the diversity of instream habitats, which include pool, riffle and run environments. Each of these habitat types is important for different species
- Changing the flow regime, which might restrict fish movement or habitat suitability for fish or invertebrates
- Changing the substrate or material of the stream bed, either by direct disruption, compaction, or deposition of suspended sediment from released from instream works further upstream. Different substrate types are important for different species and change of substrate may interfere with the ability of organisms within it to feed and reproduce

Many New Zealand fish migrate between salt and freshwater environments at certain times of the year, and are especially vulnerable to disturbance at these times. In addition, fish passage can be blocked by structures like culverts, weirs and fords. This may prevent them from breeding and feeding, which can lead to adverse impacts on their population numbers. It is a legal responsibility to provide for fish passage under both the Conservation Act 1987 (Freshwater Fisheries Regulations) and the Resource Management Act (sections 14 & 17), and this must be considered in planning for works involving construction and maintenance of structures such as floodgates or culverts.

In general, in-stream works should be managed so that the amount of time machinery operates in the river is kept to a minimum. This will involve the need for judgement from works managers, taking into consideration such things as:

- The desirability of using larger machinery to enable faster completion of the work
- Managing work hours so that disturbance can be limited to one twelve hour period, rather than over separate time periods

In-stream works are generally not undertaken in extreme low flow situations (i.e. when flows recede below the minimum flows specified in the GWRC Regional Freshwater Plan), as this can place additional stress (e.g. from siltation, habitat removal) on aquatic ecosystems at a time when they are already under stress.

Birds and bird habitat

Beaches on the gravel beds provide potential habitat for riverbed nesting birds. Three species – banded dotterels, black-fronted dotterels and pied stilts – are particularly important in some rivers in the Wellington Region,

notably the Otaki River and some Wairarapa rivers. Studies to date have identified the timing of floods, invasion of woody weeds and the presence of predators as key factors that impact on the nesting success of these birds. The effects of flood protection activities are less certain, but it is important that works involving the operation of machinery on river beds consider factors such as timing to avoid key breeding times and the maintenance of separation distances from any known nests. Scalping of beaches to keep them clear of vegetation contributes in a positive way to maintenance of bird habitat (provided it is not undertaken during the breeding season).

Actions

- Flood protection works must be undertaken in a manner that ensures that impacts on instream ecology are minimised and ecosystem diversity is maintained as much as is practicable. To achieve this the person responsible for supervision of on-site works must:
  - take all reasonable steps to minimise sediment loadings and increased turbidity during the implementation of all activities requiring excavation of the river bed
  - use sediment and erosion control measures to make sure that impacts of work undertaken instream and on the river banks are contained within the work area as far as is practicable
  - limit the amount of tracking of machinery in the active channel and the number of times stream crossings are made. Use a single crossing point where practicable.
  - manage hours of operation to ensure instream habitat has at least 12 hours of recovery time in every 24 hours, during which there is no in-river work. For work that extends over a longer timeframe, provide two consecutive work-free days in every seven to allow for ecosystem recovery wherever possible
  - retain vegetation cover and shading over streams as much as possible while not constraining the channel capacity by:
    - limiting the amount of trimming of riparian vegetation to the minimum necessary
    - rather than mowing river berms right to the bank edges, consider establishing appropriate vegetation on bank edges, or at least allow grass to grow longer at the bank edge
  - bund any areas where pouring of concrete is undertaken to prevent any runoff containing cement entering the watercourse
  - in soft-bedded streams where weed or silt removal is required, where practicable, consider staggering the removal programme so as to maintain some areas of vegetation at intervals along the stream, or on one bank of a stream, so as to maintain a minimum level of fish habitat
  - ensure that there is adequate provision for fish passage at all times during construction and maintenance work. In particular:
    - in relation to culverts, it is important to ensure that there is continuous access up and down the culvert, and that water is of an adequate depth and of low velocity for fish to pass through
    - any fish entrapped by works should be captured and relocated upstream to clear water as soon as possible
  - observe the restrictions on works in the areas specified for individual rivers as noted in Table 6

Consideration of opportunities for environmental enhancement

Description

Flood protection works offer an opportunity for enhancement of both instream habitat and the adjacent river corridor to be undertaken in conjunction with the works. Any enhancement of the adjacent river corridor must be undertaken in the context of, and in accordance with, the objectives of any FMP or Environmental Strategy for the river or watercourse in question.

Actions

- Managers will consider opportunities for enhancement, during the design of all flood protection works programmes and incorporate them as appropriate into the works programme and budget. This may include:
  - fencing of riparian margins to facilitate vegetation establishment
  - native planting in the river corridor (in accordance with the directions of any FMP and Ecological or Environmental Strategy)
  - retention or enhancement of native vegetation adjacent to any identified Key Native Ecosystems, seeking advice from GWRC Biodiversity staff on appropriate species and location of planting where necessary
  - track/trail development
  - provision of amenities and facilities (if appropriate)
- The person responsible for supervising on-site works shall endeavour to create opportunities for the maintenance of aquatic and terrestrial ecological habitats wherever possible. This may include:
  - removal of any barriers to fish passage (e.g. perched culverts) or enhancement of fish passage (e.g. use of rock ramps)
  - creating additional refuges for fish within rock lining
  - leaving or creating backwater areas in the active river bed
  - leaving woody debris in the river bed where it does not pose an undue flood risk
  - riffle and pool creation

Community planting on the banks of the Opahu Stream to re-establish inanga habitat

GWRC staff planting natives in the Hutt River corridor

Newly formed trail on the Hutt River

Discovery of artefacts or koiwi (historic human remains)

Description

Although archaeological sites will generally be avoided where they are known to exist, any flood protection works involving ground disturbance and excavation have the potential to disturb unidentified archaeological sites or human remains. Where flood protection work needs to be undertaken in the vicinity of known archaeological sites, appropriate consultation will be undertaken and an appropriate course of action agreed prior to the commencement of any works.

Evidence of archaeological sites can include charcoal, oven stones, shell middens, ditches, banks, pits, old building foundations, artefacts of Maori or European origin or human remains (koiwi).

If flood protection works result in an isolated discovery of any archaeological items, work will cease immediately and will not be re-started until the appropriate consultation and an agreed course of action for further work developed.

Actions

- Where flood protection work is likely to affect a known historic or archaeological site, work plan managers will seek advice from an appropriately qualified archaeologist prior to any work commencing.
- Site supervisors will ensure that:
  - in the event of finding any archaeological sites, artefacts, koiwi, all work affecting the area will cease immediately, management staff are informed
- Management staff will ensure that where any archaeological site, artefact or koiwi is discovered:
  - advice is sought from a suitably qualified archaeologist
  - notification is given, as appropriate to:
    - The Wellington Tenths Trust and the Port Nicholson Block Settlement Trust (in relation to the Hutt & Wainuiomata Rivers)
    - Te Runanga o Toa Rangatira (in relation to the Hutt and Wainuiomata Rivers and Porirua Stream)
    - Te Runanga Ati Awa ki Whakarongotai Inc (Waikanae River)
    - Ngati Raukawa - Nga Hapu o Otaki (in relation to the Otaki River)
    - Kahungungu ki Wairarapa (in relation to Wairarapa rivers)
    - Rangitane (in relation to Wairarapa rivers)
    - Heritage New Zealand
    - The NZ Police

Restrictions

☒ Work shall not be recommenced in the affected area until the appropriate group or groups have been consulted and a plan of action agreed upon

5.4 Individual Activity Classification

The activities covered by the Code are listed in the table below. Activities are primarily classified according to whether they occur in/on the river bed, or outside the river bed, to align with the distinctions made between such activities in the RMA and the Wellington regional plans.

Definition of river bed

As per the RMA and RFP definition, **the river bed** means 'the spaces of land which the waters of the river cover at its fullest flow without overtopping its banks'. 'Banks' are not defined in the RMA, but the definition implies that all the parts of a river's banks below the level where they are 'overtopped' also form part of the river 'bed'. Where the edges of the banks are well defined the extent of the bed should therefore also be relatively well defined; however in cases where the bank edge is not clearly defined by, for example, the edge of a terrace, or a clear change in gradient, the extent of what is considered to be the river bed may be less apparent. In the context of the Code, the 'river bed' is assumed to refer to the beaches and channel(s) of the **active river bed**, i.e. **the area worked by the river on a continuous basis**, which would generally include areas covered by small freshes up to about the size of the annual flood flow. **'Out of river'** refers to the berms adjacent to the river and includes any stopbanks; these are areas where works will not be directly in contact with the waters of the river or the active river bed.

It should be noted also that erosion protection structures are classified as both 'impermeable' and 'permeable' because of the way current rules in the Regional Freshwater Plan for the Wellington Region (RFP) are written, but this is largely arbitrary because some so-called 'impermeable' structures are not impermeable in the true sense of the word. 'Impermeable' structures are constructed of hard materials and are generally designed to give long-term protection to the river banks. Permeable structures are of lower structural strength than the 'impermeable' works, and can be semi-permanent in nature or designed as temporary measures giving protection to willow plantings while they are established.

Activity Location	General Activity Type	Individual Activities
In or on the river bed	Construction & maintenance of "Impermeable" Erosion Protection Structures	• Rock & Block groynes • Gravel groynes • Rock lining (rockline, rip-rap, toe rock) • Gabion baskets • Gabion structures • Reno mattresses • Grade control structures
	Construction & maintenance of "Permeable" Erosion Protection	• Debris fences • Permeable groynes • Debris arrester
	Demolition and removal of existing structures	• Impermeable structures • Permeable structures
	Maintenance of existing outlet structures	Structural repairs to, cleaning and clearance of: • Existing culverts and floodgate structures that discharge directly to the river/waterbody
	Channel shaping or realignment	Mechanical: • Beach ripping • Beach recontouring • Channel diversion cut • Ripping in the active (flowing) channel • Bed recontouring • Bank contouring & reconstruction
	Channel capacity maintenance	• Beach scalping • Removal of flood debris • Gravel extraction from 'dry' beaches • Gravel extraction from the active (flowing) channel • Mechanical clearing of drains • Mechanical clearing of minor watercourses • Mechanical clearing – Opahu Stream (Hutt River) • Mechanical clearing – Chrystalls Lagoon
	Planting	• Willow poles & stakes
	Construction & maintenance of vegetative structures	• Layered willows • Tree groynes

Activity Location	General Activity Type	Individual Activities
		• Tethered willows
	Maintenance of riparian vegetation	• Mechanical mowing of banks & berms from the river bed • Trimming & mulching of bankside vegetation (while operating from the river bed)
Outside the river bed	Construction of structures and tracks on berms	Construction of: • Floodwalls • Footbridges • Fences • Access ways • Cycleways • Walkways and associated new stormwater drains and culverts
	Maintenance of berms, structures and tracks	Structural repairs to, and maintenance of: • Berms • Stopbanks & training banks • Floodwalls • Footbridges • Fences • Access ways, cycleways, walkways • Stormwater drains • Stormwater culverts (including clearance of debris)
	Planting on berms	• Tree planting – native • Tree planting - willow
	Maintenance of riparian vegetation	• Trimming and mulching of trees (from outside the river bed) • Removal of old trees • Mowing stopbanks & berms (not involving machinery in river bed)
River mouths and Coastal Marine Area	Management of river mouths	• Excavation, disturbance of, and deposition on, beach areas above Mean High Water Springs (MHWS) water level • Excavation of foreshore (i.e. areas between MHWS and MLWS) • Movement and re-deposition of excavated material onto the foreshore • Maintenance of existing structures (including groynes, training walls, debris arrester)

Individual Activity Good Practice Methods

Construction and maintenance:

Rock & Block Groynes

Description

Groynes are used to maintain channel alignment or to remedy or prevent bank erosion where softer methods such as layered or tethered willows are not effective or need to be supported with hard structural work. Groynes project out from the bank edge over the river bed to deflect the direction of the flow of water. They slow flow velocities and gravel movement in the vicinity of the river bank, thus reducing the erosive power of the water at the bank edge and/or encouraging gravel deposition. They can be constructed entirely from rock boulders, or have a gravel or concrete block core. Occasionally gravel may be used in conjunction with rock, particularly in situations where construction of the groyne is deemed to be relatively urgent and/or rock supply is limited.

Typical dimensions for concrete blocks used in such work are 1.6m x 0.8m x 1 m, with a weight of approximately 3 tonnes. They have no exposed reinforcing steel and have a cast-in lifting eye to allow them to be cabled together.

Construction typically involves using a hydraulic excavator to excavate a trench 1.0 -3.0 m deep. Rocks (and/or concrete blocks or gravel) are placed in the trench and keyed into the adjacent bank to form the base of the groyne. Additional rock is then placed as a capping to shape the groyne.

Generally an area of less than 100 m² of river bed would be disturbed in the construction of a groyne.

Preliminary activities, including formation of access to the river bed, diversion of the active channel and minor bed recontouring to form a suitable working platform for machinery, may need to be undertaken ahead of groyne construction works.

Maintenance would include repairs to damage, top-up of capping rock or upgrading of all or part of the structure.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, construction & maintenance of impermeable erosion protection structures (including rock and block groynes) must be authorised by resource consent.

Key Potential Benefits

- Lateral bank erosion is prevented, protecting adjacent property and infrastructure
- Channel alignment is maintained
- River bed habitat stability is maintained
- River habitat diversity may be enhanced by the creation of scour pools and sheltered embayments

Key Potential Adverse Effects

- During construction:
  - disturbance of river bed habitat
  - release of suspended sediment to the river
  - deposition of sediment downstream
  - loss of riparian vegetation
  - disturbance of recreational use
- Long term:
  - reduction in the overall natural appearance of the river bank and river corridor
  - reduction in suitable habitat for fish and invertebrates at the bank edge

Required Actions

- Prior to a decision to undertake groyne construction, managers will assess whether the work is necessary, taking into account:
  - the urgency of the work and consequences of not undertaking it
  - the degree of digression of the channel from its design alignment and/or desired plan form
  - the state of the buffer zone, including its stability and the extent of any erosion
  - the stability and strength of the banks, including the severity of any undercutting
  - the environmental effects of the work and available alternatives to achieving the desired outcomes
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Structures must be designed and approved by a suitably qualified person to ensure in particular that:
  - they do not constrict flows or reduce the channel capacity
  - they are aligned on the design channel alignment. If a design channel alignment does not exist then the structure is placed to fit the natural meander curvature of the channel
  - construction materials are compatible with the river environment and are clean and free of soil, mud, clay or other soluble debris
  - rock is suitably sized, founded and suitably keyed into bank edges to prevent the structure being outflanked by the river
  - if a series of groynes is to be installed, the spacing is suitable for the site.
  - future maintenance and access requirements are considered with a view to minimising on-going disturbance of the river bank and riparian zone
- Construction should be supervised by a suitably experienced person to ensure that:
  - all works are undertaken in accordance with the actions and design requirements noted above
  - machinery is located and operated from the bank where practicable, or from a dry working platform formed on the river bed as far as possible
  - prior to creation of bunds in the river channel around the working area, an assessment is made of (a) the necessity of bunding, (b) the relative merits of full bunding vs bunding only on the upstream side of the works, (c) the effects associated with disturbance of the bed associated with bund creation vs the effects of operating machinery in the active channel
  - areas used for stockpiling of construction materials are reinstated at the completion of works
- Annual/regular inspections of all groynes will be undertaken to check that the structures are performing their intended function and are well maintained

Restrictions

- ☒ Concrete rubble will not be used to construct these structures
- ☒ To protect aquatic ecology and habitat, works should not be undertaken in the actively flowing channel at the times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Other

- Drawing RL-5317/21[20] in Appendix A provides further guidance

Typical rock groyne – Otaki River

Groyne construction, showing use of bunding to protect works from flowing water and use of a formed working platform to elevate machinery out of flowing water

[20] To be included.

Foundation excavated and groyne core of concrete blocks placed out of flowing water

Completed rock groynes – Waipoua River

Groyne placement. Machinery working close to bank edge to minimise disturbance to the riverbed

Construction and maintenance:

Gravel Groynes

Description

Construction of gravel groynes may sometimes be undertaken in conjunction with bed recontouring to afford temporary protection to eroding river banks or to riverside plantings by acting as a sacrificial buffer. Gravel groynes may also be used a means of temporarily deflecting river flow, or for storing excess gravel deposits in order to maintain channel capacity (particularly in Wairarapa rivers in the latter case).

Groynes are formed by using a bulldozer and/or excavator and truck to re-position bed material into a bank edge, or onto a beach, and shape it into the desired form and alignment. Gravel groynes are easier and less expensive to construct than groynes constructed from rock, but they provide a less permanent or short-term solution as they are more likely to be eroded by floodwaters.

Maintenance would include mechanical re-shaping of the structure.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, construction & maintenance of impermeable erosion protection structures (including gravel groynes) requires resource consent.

Key Potential Benefits

- Lateral bank erosion is prevented, protecting adjacent property and infrastructure
- Protection is afforded to riverside planting, to allow it to become established
- Channel alignment is maintained
- Channel capacity is maintained
- May contribute to localised channel scour and creation of pools, adding to aquatic habitat diversity

Key Potential Adverse Effects

- Disturbance of river bed habitat
- Release of suspended sediment to the river
- Deposition of sediment downstream
- Disturbance of recreational use
- Reduction in the overall natural appearance of the river bank and river corridor

Required Actions

- Prior to a decision to undertake groyne construction, managers will assess whether the work is necessary, taking into account:
  - the urgency of the work and consequences of not undertaking it
  - the environmental effects of the work and available alternatives to achieving the desired outcomes
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Structures must be designed and approved by a suitably qualified person to ensure in particular that:
  - they do not constrict flows or reduce the channel capacity
  - they are aligned on the design channel alignment
  - they have a plan and cross-sectional profile suited to the natural form of the river
- Construction should be supervised by a suitably experienced person to ensure that:
  - all works are undertaken in accordance with the actions and design requirements noted above

Restrictions

- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Gravel groynes- Waingawa River

Gravel groynes- Waingawa River

Construction & maintenance:

Rock Lining

Description

Can also be referred to as:

- Rockline
- Rip rap
- Toe rock

Rip-rap consists of rock boulders placed against a section of river bank to form a longitudinal wall that armours and protects the softer bank material behind it from scouring and slumping. Rip-rap thus also affords protection to the river berms and infrastructure located alongside the river channel.

Construction involves using hydraulic excavators to shape a section of river bank to a specified slope and to excavate a trench in the river bed to a design scour depth.

Filter cloth or a filter material (usually gravel sourced in-situ) can be placed on the prepared slope prior to placement of the rock in the trench and up the slope batter. A full rock wall typically extends up to a height equivalent to a 2 year return period flood.

Toe rock linings are constructed in a similar way but do not extend higher than approximately 1 m above low flow water levels.

Preliminary activities, including formation of access to the river bed, diversion of the active channel and minor bed recontouring to form a suitable working platform for machinery, may need to be undertaken ahead of construction works.

Maintenance would include repairs to damage, topping-up of rock or upgrading of all or part of the structure.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, construction & maintenance of rock lining must be authorised by resource consent.

Key Potential Benefits

- Lateral bank erosion is prevented, protecting adjacent property and infrastructure
- Channel alignment is maintained
- River bed habitat stability is maintained
- River habitat diversity may be enhanced by the creation of opportunities for riparian planting behind the rock lining; also by the creation of scour pools in situations where lining is placed on the outside of bends.

Key Potential Adverse Effects

- During construction:
  - disturbance of river bed habitat
  - release of suspended sediment to the river
  - deposition of sediment downstream
  - removal of riparian vegetation
  - disturbance of recreational use
- Long term:
  - reduction in the overall natural appearance of the river bank and river corridor
  - separation of channel from floodplain, with consequent limitation of sediment supply from banks
  - enhanced scouring of the adjacent river bed (as banks no longer absorb river energy)
  - reduction in riparian vegetation and habitat

Required Actions

- Prior to a decision to undertake rock line construction, managers will assess whether the work is necessary, taking into account:
  - the urgency of the work and consequences of not undertaking it
  - the degree of digression of the channel from its design alignment and/or desired plan form
  - the state of the buffer zone, including its stability and the extent of any erosion
  - the stability and strength of the banks, including the severity of any undercutting
  - the environmental effects of the work and available alternatives to achieving the desired outcomes
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Structures must be designed and approved by a suitably qualified person to ensure in particular that:
  - the slope batter is suitable; generally 1.5:1 or 2:1
  - they are aligned on the design channel alignment. If a design channel alignment does not exist then the structure is placed to fit the natural meander curvature of the channel
  - construction materials are compatible with the river environment and are clean and free of soil, mud, clay or other soluble debris
  - rock is suitably sized, founded and keyed into bank edges to prevent undermining or outflanking
  - future maintenance and access requirements are considered with a view to minimising on-going disturbance of the river bank and riparian zone
- Construction should be supervised by a suitably experienced person to ensure that:
  - all works are undertaken in accordance with the design requirements and actions noted above
  - preparation of the batter, excavation of the foundation and placement of rock is done by a machine operating from the river bank, where practicable
  - areas used for stockpiling of construction materials are reinstated at the completion of works
- Annual/regular inspections of all rock lined areas will be undertaken to check that the structures are performing their intended function and are well maintained

Restrictions

- ☒ Concrete rubble will not be used to construct these structures
- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ Areas of rock lining will not be constructed in identified inanga spawning areas[21] unless absolutely necessary and an off-set plan is developed in conjunction with a suitably qualified ecologist
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Other

- Drawing RL-5317/24[22] in Appendix A provides further guidance

[21] As per the 2001 report
[22] To be included.

Battering of bank being done from the top of the bank edge

Placement of rock; machine working from the bank

Excavating trench for foundation rock with machine located out of flowing water

Maintenance – repairs to rock lining. Note platform formed in riverbed as machine is unable to work from the bank edge to rebuild this section of lining

Construction and maintenance:

Gabion baskets, gabion structures, reno mattresses

Description

Gabions are wire mesh baskets (typically 2m x 1m x 1m) filled with rock (either quarry rock or locally sourced riverbed material). They are generally used to provide isolated protection for banks and services such as stormwater outlets, service crossings, bridge abutments or access tracks.

Construction involves excavation of a trench at the toe of the bank to a depth of one basket. Baskets are lowered into the trench, and filled with rock. Empty baskets are then placed on top laced together and filled to form the required protection structure. Sometimes the baskets are anchored to driven railway irons concealed in the bank.

Construction is undertaken in the dry and thus preliminary activities, including formation of access to the river bed, diversion of the active channel and minor bed recontouring to form a suitable working platform for machinery, may need to be undertaken ahead of construction works.

Gabion structures are formed using railway irons, wire cables and mesh, and are used to protect and stabilise bank edges. Willows are normally planted behind the back irons and over time the willow roots extend through the structure and assist in binding it together, while the willows grow over the works and hide the irons and basket work.

Construction involves driving of railway iron piles at 1 m spacings along the inner (river-side) edge of the structure, and typically an iron is also driven 1 – 1.5 m behind these irons at 3 m spacings (to provide a back anchor). Piles normally only extend 1 -1.5 m above low flow level. Longitudinal cables are strung along the piles to create a 'fence'. Gabion or chain link mesh is then laid behind the irons and wired to the longitudinal cables. A flap is left at the base to form the bottom of the basket work. Gravels are then placed in the baskets and mesh is usually placed to cap the structure. The main limitation of the work is the difficulty in founding to an adequate depth to avoid undermining.

Reno mattresses are wire mesh baskets that have wider and thinner dimensions than the more blocky gabions. They are filled with stones generally derived from the in-situ bed material but quarry rock may also be used; they can be used for both bank protection and channel linings. Construction generally requires preparation of the ground surface, which may involve minor earthworks on berm areas, or minor excavation or recontouring of the river channel. In the latter case temporary diversion of the river flow may be required

Maintenance to all the above structures would include repairs to damage, or upgrading of all or part of the structure.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, construction & maintenance of impermeable erosion protection structures must be authorised by resource consent.

Key Potential Benefits

- Lateral bank erosion is prevented, protecting adjacent property and infrastructure
- Channel alignment is maintained
- River bed habitat stability is maintained
- River habitat diversity may be enhanced by the creation of opportunities for riparian planting behind the rock lining

Key Potential Adverse Effects

- During construction:

- disturbance of river bed habitat
- release of suspended sediment to the river
- deposition of sediment downstream
- removal of riparian vegetation
- disturbance of recreational use

- Long term:
  - reduction in the overall natural appearance of the river bank and river corridor
  - reduction in riparian vegetation and habitat

Required Actions

- Prior to a decision to construction, managers will assess whether the work is necessary, taking into account:
  - the urgency of the work and consequences of not undertaking it
  - the environmental effects of the work and available alternatives to achieving the desired outcomes
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Structures must be designed and approved by a suitably qualified person to ensure in particular that:
  - diversion works are undertaken as appropriate
  - they do not constrict flows or reduce the channel capacity
  - they are appropriately founded and keyed into the river bank
  - construction materials are compatible with the river environment and are clean and free of soil, mud, clay or other soluble debris
  - future maintenance and access requirements are considered with a view to minimising on-going disturbance of the river bank and riparian zone
- Construction should be supervised by a suitably experienced person to ensure that:
  - all works are undertaken in accordance with the design requirements noted above
  - preparation of the bank, excavation of the foundation and placement of rock is done by a machine operating from the river bank, where practicable

Restrictions

- ☒ Concrete rubble will not be used to construct these structures
- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Formation of gabion structure; note separation of works from flowing channel and machine operating out of the water

Construction and maintenance:

Grade control structures

Description

Grade control structures are low rock, rock and concrete or concrete block barriers constructed across the width of a watercourse to raise or maintain the river bed level and thereby reduce the channel gradient and flow velocity. They are used to prevent bed scour and encourage gravel deposition with the goal of maintaining the river bed level, generally in areas where there is a need to protect infrastructure such as bridge piles and flood protection structures. Grade control structures can vary in scale from major structures in large waterways, to a few blocks placed in the bed of small watercourses.

Maintenance would include repairs to damage, or upgrading of all or part of the structure.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, construction & maintenance of impermeable structures in the river bed must be authorised by resource consent.

Key Potential Benefits

- Bed erosion and scour is reduced or prevented, protecting the integrity of property and infrastructure
- Channel alignment is maintained
- River bed habitat stability is maintained
- River bed sedimentation may be reduced

Key Potential Adverse Effects

- During construction:
  - disturbance of river bed habitat
  - release of suspended sediment to the river
  - deposition of sediment downstream
  - disturbance of recreational use
- Long term:
  - loss of amenity or recreational access
  - reduction or loss of fish passage may become a significant barrier across the watercourse if the sediment supply regime changes significantly, and structure becomes exposed

Required Actions

- Prior to a decision to undertake construction, managers will assess whether the work is necessary, taking into account:
  - the urgency of the work and consequences of not undertaking it
  - the sediment transport regime in the river
  - the presence and severity of any existing bed scour
  - the environmental effects of the work and available alternatives to achieving the desired outcomes
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets**)
- Structures must be designed and approved by a suitably qualified person to ensure in particular that:
  - the design is appropriate to the site and takes into account the fishery or recreational values of the river
  - diversion works are undertaken as appropriate
  - they do not constrict flows or reduce the cross sectional area of the channel
  - they are properly founded and keyed into the river bed and banks

- construction materials are compatible with the river environment and are clean and free of soil, mud, clay or other soluble debris
- fish passage is maintained
- future maintenance and access requirements are considered with a view to minimising on-going disturbance of the river bank and riparian zone

- Construction should be supervised by a suitably experienced person to ensure that all works are undertaken in accordance with the design requirements noted above

Restrictions

- ☒ No concrete blocks, rails or timber are to be used for construction of new grade control structures
- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Construction and maintenance:

Permeable structures

Description

Debris fences are iron and cable fences that extend from the bank into the river channel. They are used to support the creation or re-establishment of a willow buffer zone along the edge of the river channel, and so maintain channel alignment.

They are interplanted with willows and afford protection to these by trapping flood debris and slowing flows (and gravel movement). Willows planted in a river bed without debris fences are very vulnerable to flood damage and are much less likely to establish than those planted with fences.

Fences are constructed by driving railway iron posts (or similar) 3 -5 metres apart into the river bed in a series of discrete lines generally at a 45^{o} angle from the channel alignment. The posts stand approximately 1.2 m above the bed. Three to four steel cables are strung through the posts to form the fence. Rock or concrete blocks may be placed at the tip for additional stability.

It is usually necessary to contour the site with a bulldozer to create a smooth construction platform and also to divert the flowing channel away from the works site. The irons are driven with a hydraulic hammer mounted on a large excavator.

The placement of debris fences has, in some instances, been of some concern where vegetation fails to become properly established and the channel subsequently shifts so that the fence lies in the main river flow. In such cases, they can pose a significant threat to rafters and canoeists in high flows.

Permeable groynes act in a similar way to debris fences but are more robust and give greater control of flow direction and edge protection. A variety of construction materials have been used in the past; either timber (post and rail) or a combination of rail irons and timber.

Maintenance would include cleaning and removal of debris, repairs to damage, or upgrading of all or part of the structures.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, construction & maintenance of permeable erosion protection structures must be authorised by resource consent.

Key Potential Benefits

- Lateral bank erosion is prevented, protecting adjacent property and infrastructure
- Channel alignment is maintained
- River bed habitat stability is maintained
- River habitat diversity may be enhanced by the creation of scour pools and sheltered embayments

Key Potential Adverse Effects

- During construction:
  - disturbance of river bed habitat
  - release of suspended sediment to the river
  - deposition of sediment downstream
  - loss of riparian vegetation
  - disturbance of recreational use
- Long term:
  - cumulative effect of reduction in the overall natural appearance of the river bank and river corridor associated with willow use

- reduction in suitable habitat for fish and invertebrates at the bank edge

Required Actions

- Prior to a decision to undertake construction, managers will assess whether the work is necessary, taking into account:
  - the urgency of the work and consequences of not undertaking it
  - the environmental effects of the work and available alternatives to achieving the desired outcomes
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Structures must be designed and approved by a suitably qualified person to ensure in particular that:
  - diversion works are undertaken as appropriate
  - they do not constrict flows or reduce the channel capacity
  - future maintenance and access requirements are considered with a view to minimising on-going disturbance of the river bank and riparian zone
  - the safety of recreational users is taken into account
- Construction should be supervised by a suitably experienced person to ensure that all works are undertaken in accordance with the design requirements and actions noted above
- Debris fences will be maintained on a regular basis to ensure that they perform their intended function and do not create undue risks to the safety of recreational users. This may include:
  - structural maintenance, including tightening of cables, replacement of posts or cross members
  - replacement or replanting of willows associated with the debris fence
  - recontouring of the adjacent beach or river bed
- Where debris fences are continuously outflanked by the river, consideration will be given to their removal and adoption of a more permanent solution to maintaining the river alignment

Restrictions

- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Debris fence construction (driving irons) – Otaki River

Debris fences interplanted with willow poles - Otaki River

Repairs to timber permeable groynes on the Wainuiomata River. Note the separation of the work area from the active channel through the use of bunding

Construction and maintenance:

Debris arrester

Description

A debris arrester can be constructed from railway irons, steel beams, or pipes that are driven into the bed and tied together with horizontal irons, or it may consist of discrete concrete or wooden posts that are placed at intervals across the river bed. More robust than a debris fence, an arrester is designed to catch flood debris and prevent it from travelling downstream where it may cause damage to bridges or other structures.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, construction & maintenance of permeable erosion protection structures (including debris arresters) must be authorised by resource consent.

Key Potential Benefits

- Protection of downstream structures from damage

Key Potential Adverse Effects

- During construction:
  - disturbance of river bed habitat
  - release of suspended sediment to the river
  - loss of riparian vegetation
  - disturbance of recreational use
- Long term:
  - reduction in the overall natural appearance of the river bank and river corridor
  - creation of navigational hazard to recreational users
  - reduction of channel capacity, disruption of channel alignment and ecological habitat if not designed properly or regularly clear of trapped debris
  - removal of material that provides food and habitat for aquatic organisms

Required Actions

- Prior to a decision to construction, managers will assess whether the work is necessary, taking into account:
  - the likely benefits of the work and the consequences of not undertaking it
  - the environmental effects of the work and available alternatives to achieving the desired outcome
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Structures must be designed and approved by a suitably qualified person to ensure in particular that:
  - they do not constrict flows or reduce the channel capacity
  - they are appropriately founded and keyed into the river bed
  - construction materials are compatible with the river environment and are clean and free of soil, mud, clay or other soluble debris
  - future maintenance and access requirements are considered with a view to minimising on-going disturbance of the river bank and riparian zone
- Construction should be supervised by a suitably experienced person to ensure that all works are undertaken in accordance with the design requirements and actions noted above

- Debris arresters must be regularly maintained and cleared of debris to ensure that they perform their intended function effectively and do not constrict the channel

Restrictions

- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Debris arrester (timber poles) across Waimeha Stream

Debris arrester at Maoribank bend on the Hutt River

Debris arrester across Speedy's Stream

Debris arrester across the Porirua Stream

Demolition and removal:

Existing structures

Description

Structures are most likely to be removed following partial or total failure, and a decision being taken not to reconstruct. Removal is necessary to prevent creation or aggravation of erosion of the adjacent river banks, to remove danger to river users, and for visual reasons.

Preliminary works, including creation of access to the site and/or formation of a suitable working platform for machinery may be required ahead of demolition works.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, demolition and removal of structures from the river bed must be authorised by resource consent.

Key Potential Benefits

- Maintenance of the channel carrying capacity
- Removal of potential hazard to navigation and recreational use
- Improvement to the overall natural appearance and amenity value of the river bank and river corridor

Key Potential Adverse Effects

- Disturbance of river bed habitat
- Release of suspended sediment to the river
- Disturbance of recreational use

Required Actions

- If a structure has become damaged or partially destroyed, and a decision is made that it will not be repaired, then it will be removed from the waterway as soon as practicable
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- All material associated with the structure will be removed from the river or stream and disposed of, or stockpiled at an appropriate location.

Restrictions

- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Maintenance:

Existing outlet structures

Description

This includes structural repairs to, and maintenance of existing head walls, wingwalls, culverts, and steel grilles, flap gates and any other features associated with outlet structures discharging to the river. Maintenance can include upgrade of part or all of the structure, clearance of debris, water blasting and painting.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, maintenance of structures in the river bed may need to be authorised by resource consent, depending on the extent of the proposed maintenance work.

Key Potential Benefits

- The functionality of flood protection works is maintained
- Effective management of community flood protection assets and investment

Key Potential Adverse Effects

- Disturbance of river bed habitat
- Release of suspended sediment or other contaminants to the river
- Loss of riparian vegetation
- Disturbance of recreational use

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Undertake works from the bank, rather than from within the active channel wherever possible
- Where work must be undertaken in the river, undertake diversion works as appropriate

Restrictions

- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Repairs to floodgates

Repairs to floodgates

Channel shaping:

Beach ripping

Description

Beach ripping is involves dragging a tine behind a bulldozer or tractor to loosen the upper surface layer (armour) of the beach. Undertaken on beaches above the active channel, the purpose of the activity is to loosen gravels and thus encourage mobility and more consistent movement of the bed material during future freshes and floods when the beach is inundated. In this way, ripping helps to prevent formation of channel distortions and reduces lateral bank erosion.

Ripping is a low impact activity that promotes further natural recontouring of the bed by the river. It is undertaken with the ultimate aim of lessening the need for more extensive channel shaping works at a later stage.

Beach ripping may be undertaken as a discrete activity, or may be undertaken in conjunction with other activities such as beach recontouring. Although beach ripping is undertaken out of flowing water, the constraints of a site may require that machinery undertaking the work will need to enter the wetted channel to gain access to the site (and to turn around, for example), in order to complete the required work effectively.

Resource Management Act 1991

Disturbance of dry beaches is a permitted activity under the current Regional Freshwater Plan for the Wellington Region, provided it complies with the prescribed permitted activity conditions.

Key Potential Benefits

- Prevention of the formation of an armoured top layer on the gravel bed, and maintenance of mobility of the river bed gravels
- Facilitation of gravel movement during floods
- Prevention of channel distortions and bank erosion
- Can reduce the need for more invasive bed recontouring

Key Potential Adverse Effects

- Temporary disturbance of bird nesting habitat
- Release of suspended sediment to the river in the first fresh following the work
- Temporary disturbance of recreational use
- Temporary reduction in amenity values

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Work is undertaken out of the wetted channel. If any ripping work is to be undertaken in the wet, then refer to the good practice sheet for 'Ripping in the active (flowing) channel'
- A 5 m buffer strip should be left at the bank edge of the beach to avoid disturbance of the bank and any riparian vegetation

Restrictions

☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Beach ripping – Hutt River

Channel shaping:

Beach recontouring

Description

Beach recontouring involves the mechanical movement and redistribution of sands and gravels on areas of dry bed, above the wetted channel and away from flowing water. Carried out as a discrete activity, its purpose is to streamline and shape a beach to avoid any future obstructions to flow, and to thus establish pre-conditions that will act to reduce channel distortions and bank erosion in future flood events. Beach recontouring involves a level of disturbance of the bed that has more impact than ripping, but less effects than bed recontouring or cutting of diversion channels.

It can also be undertaken as part of site preparation associated with establishment of structures or planting, in conjunction with beach ripping or bed recontouring, or as a part of gravel extraction operations.

Although beach recontouring is an activity undertaken out of flowing water, it should be noted that the constraints of a site may require that machinery undertaking recontouring work will need to enter the wetted channel to gain access to the site and to effectively the required work effectively.

Resource Management Act 1991

This is a permitted activity under the current Regional Freshwater Plan for the Wellington Region, provided it complies with the prescribed permitted activity conditions.

Key Potential Benefits

- Removes obstructions to flow
- Helps to maintain channel alignment, reduce bank erosion and prevents the river bed profile from becoming flattened out during floods
- Helps to reduce the need for bed recontouring in the active channel
- Enhancement of bird nesting habitat on the river bed

Key Potential Adverse Effects

- Disturbance of bird nesting habitat
- Release of suspended sediment to the river in the first fresh following the works
- Disturbance of recreational use

Required Actions

- Prior to a decision to undertake beach recontouring, managers will assess whether the work is necessary, taking into account:
  - the urgency of the work and consequences of not undertaking it
  - the degree of digression of the channel from its design alignment and/or desired plan form
  - the state of the buffer zone, including its stability and the extent of any erosion
  - the stability and strength of the banks, including the severity of any undercutting
  - the environmental effects of the work and available alternatives to achieving the desired outcomes
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- The work is planned and approved by a suitably qualified person to ensure in particular that:

- flows are not constricted or the capacity of the channel reduced
- the works are in accordance with any design alignment requirements for the river

- Construction should be supervised by a suitably experienced person to ensure that all works (including the final bed profile) are undertaken in accordance with the design requirements and actions noted above
- A 5 m buffer strip should be left at the bank edge of the beach to avoid disturbance of the bank and any riparian vegetation

Restrictions

☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Channel shaping:

Channel diversion cut

Description

Diversion cuts through a beach area may be undertaken to realign the low flow channel where it has moved too far from its design alignment, or to resolve a bank erosion problem. In braided river systems, diversion cuts may be used to assist the development of secondary braids in order to maintain channel capacity, or to divert a dominant braid which may be eroding the lateral buffer zone. Undertaken either as a discrete activity or in conjunction with other works, a diversion cut assists in establishment and maintenance of a more uniform and better aligned channel form.

Diversion cuts through beach areas are mainly undertaken away from the active channel, and are more commonly used in wider, semi-braided or braided rivers, rather than in single channel rivers. In single channel rivers the preference would be to use bed recontouring to maintain channel alignment; diversion cuts would generally only be undertaken in a single channel river where a major channel distortion had occurred, which could not easily be addressed solely by bed recontouring.

Establishment of the diversion cut involves mechanical excavation of a new channel on the desired new alignment through an area of the river bed outside the active channel. The excavated material may be placed between the side of the new channel and the active channel which is to be realigned or it may be removed to another location in the river bed.

The excavation cut is bunded at the upstream end and a flow restriction barrier placed at the downstream end while excavation work proceeds to minimise silt discharges. When the new channel is completed, the end bunds are removed to allow diversion of the active channel into the newly formed channel (this may either be done immediately by mechanical means or may be done naturally by the river over time). Some bed recontouring, to push excavated material across the old channel alignment (if it is not to be retained as a backwater habitat area) may also be required to achieve the finished profile.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, the cutting of channel diversions in the active river channel must be authorised by resource consent.

Key Potential Benefits

- Lateral bank erosion is prevented or remedied, protecting adjacent property and infrastructure
- Channel alignment is maintained or re-established
- Channel capacity is maintained
- The need for permanent structures may be reduced or avoided
- River habitat diversity may be enhanced by the creation of a design meander pattern and provision of backwater areas in the channel, where appropriate

Key Potential Adverse Effects

- During construction:
  - disturbance of dry river bed habitat
  - release of suspended sediment to the river (once water is diverted into the completed channel)
  - deposition of sediment downstream
  -
  - disturbance of recreational use

Required Actions

- Prior to a decision to form a diversion cut, managers will assess whether the work is necessary, taking into account:

- the urgency of the work and consequences of not undertaking it
- the degree of digression of the channel from its design alignment and/or desired plan form
- the state of the buffer zone, including its stability and the extent of any erosion
- the stability and strength of the banks, including the severity of any undercutting
- the environmental effects of the work and available alternatives to achieving the desired outcomes

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Diversion cuts are planned and approved by a suitably qualified person to ensure in particular that:
  - flows are not constricted or the capacity of the channel reduced
  - the works are in accordance with any design alignment requirements for the river
- Construction should be supervised by a suitably experienced person to ensure that all works (including the final bed profile) are undertaken in accordance with the design requirements and actions noted above
- A 5 m buffer strip should be left at the bank edge of the beach to avoid disturbance of the bank and any riparian vegetation

Restrictions

- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Channel shaping

Ripping in active (flowing) channel

Description

Ripping of the bed in the wet channel is a technique used in some rivers to improve the low flow channel form and alignment through riffle zones in particular.

The activity involves dragging a tine that is mounted on a bulldozer or excavator through riffle sections of the active channel, in order to loosen the bed material and encourage its mobility. The intention is to mitigate any sharp directional changes in the channel at such points and thus maintain a more regular channel meander pattern.

Although the activity involves mechanical disturbance of the bed, with associated aquatic habitat disturbance and temporary release of sediment to the water column, the activity is less invasive and less extensive than bed recontouring and thus the scale of these effects is relatively less than with bed recontouring.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, disturbance of the active river channel must be authorised by resource consent.

Key Potential Benefits

- Lateral bank erosion is prevented or remedied, protecting adjacent property and infrastructure
- Channel alignment is maintained
- The need for more invasive and extensive bed recontouring may be reduced or avoided
- River habitat diversity may be maintained

Key Potential Adverse Effects

- Disturbance of river bed habitat
- Minor release of suspended sediment to the river
- Disturbance of recreational use

Required Actions

- Prior to a decision to undertake ripping in the active channel, managers will assess whether the work is necessary, taking into account:
  - the urgency of the work and consequences of not undertaking it
  - the degree of digression of the channel from its design alignment and/or desired plan form
  - the environmental effects of the work and available alternatives to achieving the desired outcomes
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Work is planned and approved by a suitably qualified person to ensure in particular that:
  - flows are not constricted or the capacity of the channel reduced
  - the works are in accordance with any design alignment requirements for the river
- Construction should be supervised by a suitably experienced person to ensure that all works (including the final bed profile) are undertaken in accordance with the design requirements and actions noted above

Restrictions

☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6

Channel shaping:

Bed recontouring

Description

Bed recontouring (formerly referred to as 'cross-blading') is mechanical shaping or realignment of a section of the active channel to establish or maintain a design alignment, and/or to reduce erosion (typically at the outside of a bend). It is another tool for management of the channel form in order to establish preconditions that will effectively accommodate future flood events and reduce the amount of future remedial work.

It is used in situations where channel realignment cannot be effectively achieved by a diversion cut or in-river ripping of riffles. It may be used as an alternative to the construction of permanent protection structures in the first instance.

Bed recontouring can be undertaken as a discrete activity for these purposes, but may also be undertaken on a lesser scale as part of preparation of the river bed for construction works or in association with 'wet' gravel extraction.

Bed recontouring may involve direct pushing of material from dry beach areas across the active channel, and/or pushing of material from the active channel onto beach areas, to achieve a new channel form.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, recontouring of the active river channel must be authorised by resource consent.

Key Potential Benefits

- Lateral bank erosion is prevented or remedied, protecting adjacent property and infrastructure
- Channel alignment is maintained or re-established
- The need for permanent structures may be reduced or avoided
- River habitat diversity may be enhanced by the creation of a design meander pattern and provision of backwater areas in the channel, where appropriate

Key Potential Adverse Effects

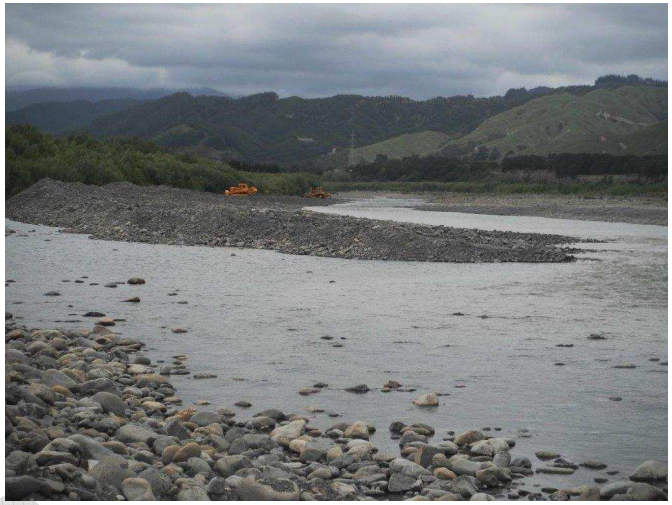
- During construction:
  - Significant local disturbance of river bed habitat
  - release of suspended sediment to the river
  - deposition of sediment downstream
  - accidental fish mortality
  - loss of riparian vegetation
  - disturbance of recreational use

Required Actions

- Prior to a decision to undertake bed recontouring, managers will assess whether the work is necessary, taking into account:
  - the urgency of the work and consequences of not undertaking it
  - the degree of digression of the channel from its design alignment and/or desired plan form
  - the state of the buffer zone, including its stability and the extent of any erosion
  - the stability and strength of the banks, including the severity of any undercutting
  - the environmental effects of the work and available alternatives to achieving the desired outcomes
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- The person responsible for on-site supervision must ensure that:

- the minimum amount of bed recontouring necessary is undertaken
- bed recontouring will generally proceed in an upstream direction from the downstream end of the reach being worked to allow fish disturbed by the activity to escape downstream. However, any filling in of old channels cut off as a result of the works should proceed from the upstream end in a downstream direction, for the same reason
- at the completion of bed recontouring work flows are not constricted or channel capacity is not reduced
- the works are in accordance with any design alignment, channel plan form and finished bed profile requirements for the river
- future maintenance and access requirements are considered with a view to minimising on-going disturbance of the river bank and riparian zone
- a 5 m buffer strip is left at the bank edge of any beaches to avoid disturbance of the bank and any riparian vegetation

♦ If repeated bed recontouring is required at a particular site then consideration will be given to a more permanent solution, such as the use of groynes or rock lining.



Bed recontouring in Otaki River – Upper Wallaces (XS 750 -780 approx)

Bed recontouring in Waikanae R – Blakes corner XS 220

Restrictions

☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6

☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Bed recontouring in Wainuiomata River – near Wood Street

Bed recontouring in Hutt River – near Bridge Road

Channel shaping:

Bank contouring or reconstruction

Description

Shaping or reconstruction of bank edges and berms will normally occur following flood damage. The intention of this work is generally to reinstate the bank or berm to its original height and alignment, although some adjustments may be made to the alignment and slope of the bank to improve stability or to make provision for planting.

It may be necessary to divert the river away from the affected bank, and to remove some riparian vegetation, to allow reconstruction work. Generally, the bank edge will be rebuilt by placing fill in layers. Fill can be sourced from a suitable adjacent beach where available; otherwise weathered overburden sourced from a quarry would be used.

Following reconstruction, the new bank edge will be stabilised by construction of one or more appropriate bank protection works.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region any shaping of the river bank edges or berms where the work affects the river bed requires resource consent.

Key Potential Benefits

- Lateral bank erosion is prevented, protecting adjacent property and infrastructure
- Channel alignment is maintained or re-established
- River bed habitat stability is maintained

Key Potential Adverse Effects

- During construction:
  - disturbance of river bed habitat
  - release of suspended sediment to the river
  - deposition of sediment downstream
  - loss of riparian vegetation
  - disturbance of recreational use

Required Actions

- Prior to a decision to bank contouring or reconstruction, managers will assess whether the work is necessary, taking into account:
  - the urgency of the work and consequences of not undertaking it
  - adjustments to the bank alignment or slope that may result in improved stability or assist with preparation for planting works
  - other channel alignment work adjacent to the bank that may be required to remove any on-going erosive pressure on the re-instated bank
  - the environmental effects of the work and available alternatives to achieving the desired outcomes
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Works should be undertaken from the bank, rather than from within the active channel, wherever possible

Restrictions

- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Channel maintenance:

Beach scalping

Description

Beach scalping involves mechanical clearance of woody and herbaceous weeds and grasses from gravel beaches. This is necessary to prevent a reduction in flood flow velocities which in turn encourages gravel aggradation and a reduction in channel capacity. Vegetation if left can also result in well established and stable beaches that can give rise to channel distortions and bank erosion.

Mechanical clearance is typically performed using a bulldozer, large excavator or front end loader to strip the vegetation and loosen the armouring layer. The vegetation is crushed and left to break down or become light flood debris. The activity involves excavation or disturbance of bed material but does not typically result in a discharge of sediment to the flowing channel.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region the removal of vegetation from the river bed is a permitted activity, provided the activity complies with the prescribed permitted activity conditions.

Key Potential Benefits

- Lateral bank erosion is prevented or remedied, protecting adjacent property and infrastructure
- Channel alignment is maintained
- Channel capacity is maintained
- Reduces potential for gravel and sediment aggradation
- Habitat for river bed nesting birds is maintained

Key Potential Adverse Effects

- Disturbance of bird nesting activity
- Disturbance of recreational use

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- In order to minimise disturbance of the river bed this work should be undertaken at the same time as other activities such as beach ripping, where practicable
- A 5 m buffer strip should be left at the bank edge of the beach to avoid disturbance of the bank and any riparian vegetation

Restrictions

☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Channel maintenance:

Removal of flood debris

Description

Flood debris is defined in the RFP as 'material deposited on the river bed as a result of wreckage or destruction resulting from flooding', and it can include trees, slip debris, collapsed banks, the remains of structures, and other foreign material including abandoned vehicles, but does not include the normal fluvial build-up of gravel.

Removal of flood debris is necessary because blockages reduce channel cross-sectional area which result in higher flood levels. In addition, if allowed to occur, build-up of obstacles may deflect flood flows into banks, causing lateral erosion.

Removal of flood debris covers only the minimal amount of work needed to clear the bed or structures within the bed of flood debris; any beach or bed contouring completed at a location where debris removal occurs is accounted for as beach or bed recontouring.

It is important to note that flood debris in the channel can provide and enhance the variety of available aquatic habitat for macroinvertebrates and fish. Debris should therefore only be removed where necessary to manage flood or erosion risks.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region the removal of flood debris from the river bed is a permitted activity, provided the activity complies with the prescribed permitted activity conditions.

Key Potential Benefits

- Channel capacity is maintained
- The risk of erosion is reduced
- Risks to the safety of recreational users are reduced
- The amenity value of the river is maintained

Key Potential Adverse Effects

- Loss of shelter or spawning sites for fish or aquatic invertebrates

Required Actions

- Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)
- Large logs or other debris should not be from the channel unless necessary to maintain channel capacity, in order to provide for maintenance of aquatic habitat for fish and invertebrates
- If large logs are to be removed from the channel, and where it is appropriate to do so (i.e. land is not in private ownership), iwi are to be notified, to allow for potential use of those logs

Restrictions

- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Channel maintenance:

Gravel Extraction from beaches (dry extraction)

Description

Gravel bed material is currently extracted to maintain the flood carrying capacity of the channel (which is reduced when aggradation raises the level of the river bed) and to protect lateral erosion protection works that may be threatened by localised gravel build-ups that confine and direct the channel.

Material can be excavated from both the beaches (i.e. above the flowing channel) and/or from the flowing channel within the river bed, depending on the management objectives for the particular river and river reaches in question. Removal of gravel from beaches above the normal low flow water level, where there is no extraction activity in the flowing channel, is referred to as **'dry' extraction'**. In this case, all works are undertaken out of running water, except for any river crossings for access or for transport of extracted gravel and minor shaping of the beach at the water edge to ensure a smooth profile.

Extraction is usually carried out using either hydraulic excavators or front end loaders which load onto trucks (either road trucks or large off-road dumpers). Extraction proceeds in uniform strips parallel to the river channel, to a depth no lower than 0.2 m above the normal level of the adjacent flow. Small stockpiles of the extracted gravel may be formed on a daily basis, but would not normally be left in the floodway for longer than the working day. The extracted gravel is transported to the processing plant using existing access tracks and/or public roads wherever possible. For remote beaches trucks may need to travel along the dry river bed, and may need to cross the river. Such crossings should be kept to a minimum, and restricted to a single point of entry and exit.

At the end of extraction, beaches are to be left with an even surface and profile sloping down towards the channel, to ensure that there are no major discontinuities that could divert future floodwaters. The next flood will then re-work the bed to a more natural form.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region gravel extraction requires resource consent.

Key Potential Benefits

- Maintenance of flood carrying capacity of channel
- Maintenance of stable channel alignment and optimum bed levels
- Protection of infrastructure and assets located in the floodplain

Key Potential Adverse Effects

- Disturbance of river bed nesting birds and bird nesting habitat
- Temporary disturbance of recreational access and use

Required Actions

- Prior to approval of a gravel extraction programme, managers will assess whether the work is necessary, taking into account:
  - the results of the most recent bed level surveys and gravel volume analyses
  - available information on short and long term trends in aggradation and degradation in the river bed
  - any other available information on factors affecting the long term sediment supply; such as changes in catchment hydrology, land cover and slope stability etc.
  - the environmental effects of the work and available alternatives to achieving the desired outcomes

- Gravel extraction work plans must be planned and approved by a suitably qualified person to ensure in particular that:
  - the works are in accordance with any design envelope and design alignment requirements for the river
  - all contractors undertaking gravel extraction work for GWRC are appropriately briefed and have a proven track record of undertaking works in accordance with the requirements of this Code
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- No excavation is to be undertaken lower than 0.2 m above the adjacent water level
- A 5 m buffer strip should be left at the bank edge of the beach to avoid disturbance of the bank and any riparian vegetation
- Extraction works must be supervised by a suitably experienced person to ensure that:
  - all works are undertaken in accordance with the design requirements and actions noted above
  - access to beaches is via single entry and exit points
  - tracking of machinery in the river is kept to a minimum
  - the final surface of the beach is left in a tidy state and with a profile suited to the design objectives for the channel (which may include a smooth profile at the water's edge)

Restrictions

☒ In any one financial year (1 July – 30 June) the amount of gravel extracted shall not exceed that required to maintain the flood carrying capacity of the channel. This shall be determined by regular bed level surveys and gravel volume assessments. Where a design envelope has been developed for a river, the amount of gravel extracted will be in accordance with maintenance of river bed levels within this envelope

☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Dry gravel extraction – Waikanae River

Dry gravel extraction – Hutt River

Channel maintenance:

Gravel Extraction from the flowing channel (wet extraction)

Description

Gravel bed material is currently extracted to maintain the flood carrying capacity of the channel (which is reduced when aggradation raises the level of the river bed) and to protect lateral erosion protection works that may be threatened by localised gravel build-ups that confine and direct the channel.

Gravel extraction may also be used as tool to maintain channel alignment – particularly in Wairarapa rivers.

Material can be excavated from both the beaches (i.e. above the flowing channel) and/or from the flowing channel within the river bed, depending on the management objectives for the particular river and river reaches in question. Removal of gravel from the flowing channel is referred to as **'wet' extraction'**. In this case, machinery is required to work in the water to move gravel from the channel onto the adjacent beaches, from where it can be extracted. This method is an important tool in reaches which are subject to active channel aggradation which cannot be managed effectively by dry extraction alone.

Although wet gravel extraction involves short-term disturbance to the river bed habitat, it also affords more opportunities than dry extraction to establish and maintain a well-defined low flow channel with a 'natural' slope up to the beach, and to enhance the meander pattern of the river channel and consequent habitat diversity in the longer term.

Extracted gravel may be removed from the river bed for off-site uses elsewhere, or it may be placed to other locations within the river bed – either for storage or for use in river management activities.

Where possible, gravel extraction operations should be combined with flood protection channel alignment activities for efficiency and effective river management, and to minimise overall disturbance of the ecology and ecological habitat at the affected site.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region gravel extraction requires resource consent.

Key Potential Benefits

- Maintenance of flood carrying capacity of channel
- Maintenance of stable channel alignment and optimum bed level
- Protection of infrastructure and assets located in the floodplain
- Provides opportunity to enhance instream habitat diversity in the longer term by alteration of channel form to a new design meander

Key Potential Adverse Effects

- Short term reduction in water quality due to release of sediment
- Alteration of downstream habitat due to sedimentation
- Short-term loss of invertebrate habitat and invertebrate populations
- Accidental fish mortality
- Release of nutrients trapped in sediment, resulting in adverse effects on water quality downstream
- Removal of habitat and food sources for fish, which may result in population decline
- Disturbance of birds and disturbance or removal of bird nesting habitat
- Temporary disturbance of recreational access and use

Required Actions

- Prior to approval of a gravel extraction programme, managers will assess whether the work is necessary, taking into account:
  - the results of the most recent bed level surveys and gravel volume analyses
  - available information on short and long term trends in aggradation and degradation in the river bed
  - any other available information on factors affecting the long term sediment supply; such as changes in catchment hydrology, land cover and slope stability etc.
  - the environmental effects of the work and available alternatives to achieving the desired outcome
- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Gravel extraction work plans must be planned and approved by a suitably qualified person to ensure in particular that:
  - the works are in accordance with any design envelope and design alignment (including design meander and pool-run-riffle sequence) requirements for the river
  - the works are undertaken in accordance with the methodology detailed below
  - the needs of any environmental monitoring associated with the gravel extraction programme are considered
  - all contractors undertaking work for GWRC are appropriately briefed and have a proven track record of undertaking works in accordance with the requirements of this Code.
- Construction must be supervised by a suitably experienced person to ensure that:
  - all works are undertaken in accordance with the design requirements and actions noted above
  - all works are undertaken in accordance with the work methodology described below
  - appropriate communication is undertaken with personnel responsible for management of any environmental monitoring associated with the work
  - a 5 m buffer strip is left at the bank edge of beaches to avoid disturbance of the bank and any riparian vegetation

Restrictions

- ☒ In any one financial year (1 July – 30 June) the amount of gravel extracted shall not exceed that required to maintain the flood carrying capacity of the channel. This shall be determined by regular bed level surveys and gravel volume assessments. Where a design envelope has been developed for a river, the amount of gravel extracted will be in accordance with maintenance of river bed levels within this envelope
- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with the restrictions specified in Table 6

Wet Gravel Extraction Methodology

The current extraction methodology has been used in the Hutt River since 2006, following consultation and agreement with key stakeholders (Fish & Game NZ, DOC and some iwi representatives). This methodology, which is dependent upon the development of a 'design meander' for the river or reach, is now being extended into other rivers.

Preparatory works

Prior to commencement of works, the person responsible for design and approval of the work plan will refer to the Environmental Monitoring Plan to ensure that any monitoring requirements, communication or other actions relating to the activity are incorporated into the work plan as appropriate.

The most recent cross section surveys will be compared with the design profile and cross sections to determine cut and fill depths and to accurately calculate available gravel volumes (see Figure 1). From this, a detailed extraction plan will be prepared for use by the operator(s) – see Figure 2. This plan should show the specific extent of the works for each operational stage, and the finished form of the river channel, including the low flow channel centre line (thalweg) and an indicative active channel width.

In addition to the extraction plan, the work plan should also identify specific actions that will be undertaken to minimise the time that operations in the active channel will occur, and to avoid other adverse effects as far as practicable. In particular, and will include items such as:

- The extraction methods to be used
- The machinery to be used
- Operation timing, taking account of any requirements to manage noise and effect on recreational use
- Access routes to be used
- Requirements around plant condition
- Requirements around repairs and refuelling of machinery
- Health and safety requirements, including management of public health and safety
- A complaints procedure

In-channel works

The low flow channel is deepened by pushing gravel material from the low flow channel up onto the adjacent beach, to form a temporary stockpile. This work is carried out by one or more D9 bulldozers, depending on the size of the beaches. At some smaller beaches where the low flow channel is relatively deeper and well-defined (generally in the downstream end of the reach) an excavator located on the beach, rather than in the channel, can be used. In some instances it may be necessary to cut a new channel through an existing beach to achieve the design meander pattern.

Work commences at the downstream end of each beach with a lowering and re-shaping of the riffle; the machine will then continue shaping the low flow channel, moving in an upstream direction to create a lowered pool.

Upon completion of the pool deepening some re-shaping of the riffle may be required to ensure the desired cross-over has been achieved.

As the river reworks the altered meander pattern and lowered riverbed, the adjoining willow stands and bank edges may become exposed and vulnerable to erosion. This may require further re-shaping of riffles (either by re-contouring or ripping) and re-establishment of the beach shape to maintain the design meander, which in turn protects the willows

and bank edge. This additional channel shaping is most likely to happen after a flood. It may also be necessary to use additional vegetative protection measures (e.g. willow layering, tree groynes and tethered willows) to protect the most vulnerable willow stands and bank edges.

Gravel removal

The temporary gravel stockpiles are allowed to drain sufficiently before gravel removal commences. The raised beach can then be lowered progressively by the contractor.

Work commences at the downstream end of the beach and proceeds upstream. Gravel is extracted in strips parallel to the river flow, working from the front of the beach to the rear. This stage of the operation takes place above normal water levels, and no further re-working of the low flow channel is required. The raised beach also remains largely intact during flood events.

A front end loader is used to load the gravel onto either road trucks or large off-road dump trucks, which then transport it offsite via existing haul roads for processing (see photograph).

Beach re-contouring

At the completion of the gravel extraction operation the remaining beach may be re-contoured to give a smooth profile, with a central rise, downward slope to the low flow channel, and a well-defined water edge (where possible). Where the low flow channel is shaped with a bulldozer, there may be the need to further shape the beach edge with an excavator to achieve this. The purpose of this is to ensure a minimum of re-working by the river is required to re-establish a 'natural' channel form and shape.

Front-end loader loading an off-road dumper truck

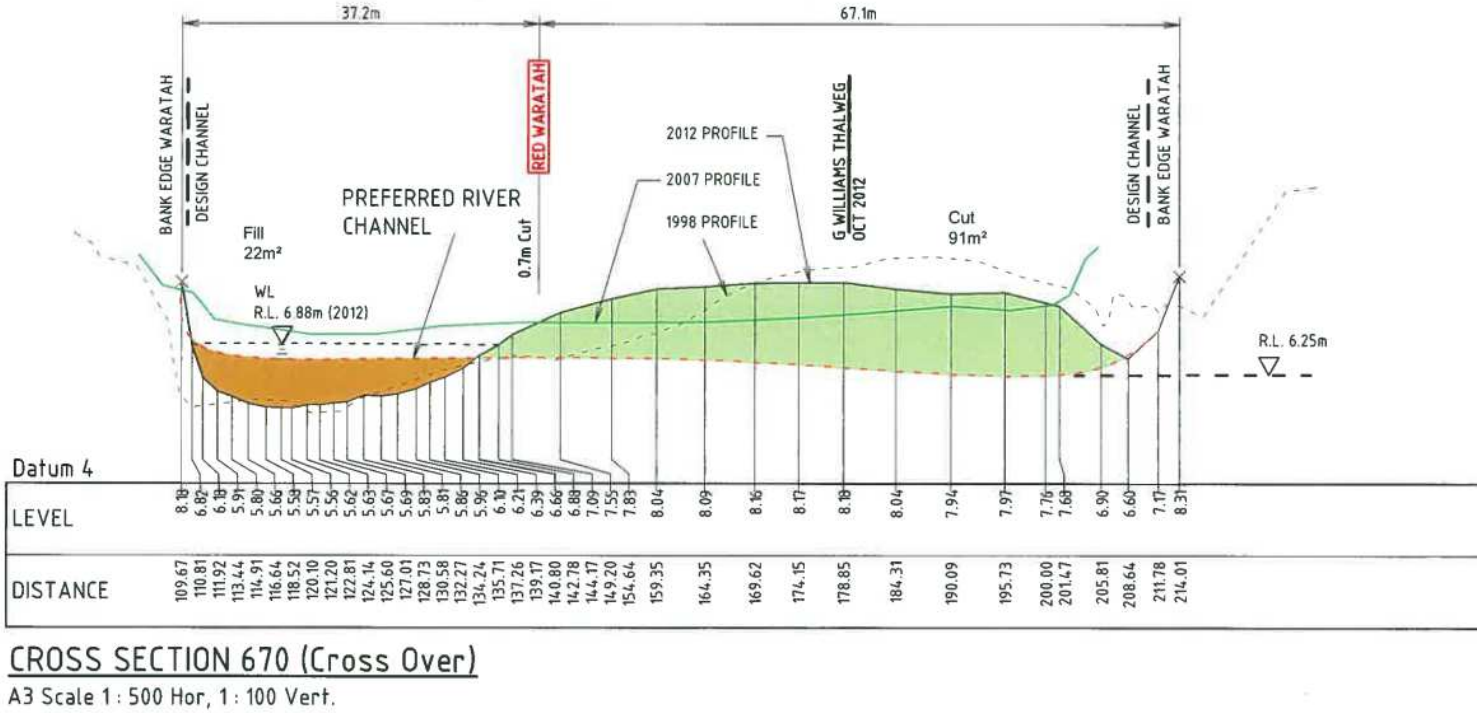


Figure 1: A typical channel cross section

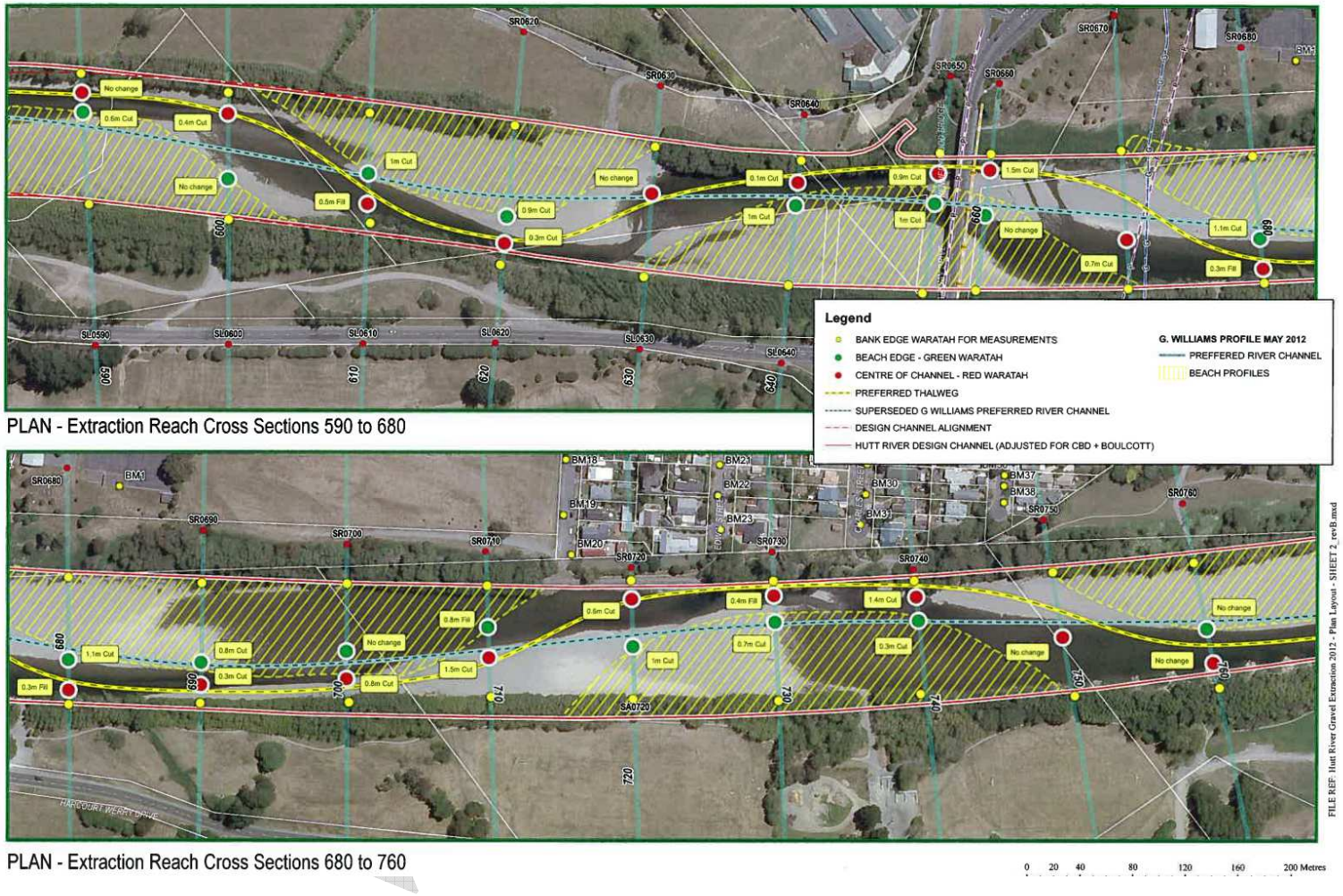


Figure 2: A typical gravel extraction plan

Channel maintenance:

Mechanical clearing of minor watercourses

Description

Aquatic weed and sediment is extracted periodically from some smaller watercourses to maintain their bed levels and flood carrying capacity. The aim is to maintain a balance between flood capacity (reduced by higher bed levels) and the threat of undermining the river banks and any bank protection works (increased by lower bed levels).

The activity involves excavation using a cleaning bucket mounted on a hydraulic excavator. The excavator operates from the river bank, and excavated material is placed on the bank where it cannot re-enter the channel, or may be removed from the site altogether.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region removal of vegetation and associated disturbance of the river bed is generally a permitted activity, while extraction of sediment from the river bed, particularly from the wet channel, would generally require resource consent.

Key Potential Benefits

- Maintenance of effective land drainage, productivity & use of adjacent land
- Maintenance of flood carrying capacity of channel
- Protection of infrastructure and assets on adjacent land
- Enhancement of aquatic habitat by improvement of oxygen levels, control of pest plants, improved fish passage

Key Potential Adverse Effects

- Short term reduction in water quality due to release of sediment
- Loss of vegetation cover and spawning vegetation for fish and invertebrates
- Accidental fish mortality
- Release of nutrients trapped in sediment, resulting in adverse effects on water quality downstream
- Removal of habitat and food sources for benthic invertebrates and fish
- Short-term reduction in visual/amenity values and unpleasant odour effects

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods(refer to relevant sheets)**
- The frequency of clearance is no more than is required to maintain flows and flood conveyance capacity
- Works should be supervised by a suitably experienced person to ensure that:
  - machinery is operated from the side of the watercourse, rather than from within it wherever possible
  - works proceed from the upstream end of the reach to the downstream end, to minimise the release of sediment and debris downstream
  - a self-draining 'weed bucket', that permits easy drainage of water and any entrapped fish back into the watercourse, is used
  - examination of excavated material is undertaken and any fish trapped by the works are recovered and relocated to clear water upstream of the works

- at least one observer, in addition to the digger operator, is present to assist with finding, capturing and relocating of trapped fish
- in general, 10% of the aquatic vegetation within the cleared watercourse is retained to assist recolonisation of aquatic organisms and plants
- additionally, where practicable, selected ecological refuge areas are left in the channel at intervals to assist recolonisation of the invertebrate populations present in the watercourse

Restrictions

- ☒ Machinery will not be operated in stream channels unless absolutely necessary
- ☒ To protect aquatic fauna and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6

Channel clearance - Pahiko Drain (Otaki)

Channel maintenance:

Mechanical clearing – Opahu Stream (Hutt River)

Description

The lower Opahu Stream channel forms an isolated arm, 750 m long, on the true left bank of the Hutt River, downstream of the Ava Rail Bridge. The arm forms a sheltered low energy environment alongside the main channel of the Hutt River, and the riparian vegetation established within it provides inanga spawning habitat. Silt and tidal debris gets washed into this channel, and needs to be removed periodically, principally for aesthetic reasons.

This work is undertaken by a long reach excavator from the river banks. The excavated silts and organic debris are loaded onto trucks for disposal off site. The channel adjacent to the training bank would generally require maintenance dredging over the full 750 m length approximately every 5 years.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region this activity requires resource consent. The activity is authorised under the granted resource consent for flood protection activities held by GWRC for the Hutt River.

Key Potential Benefits

- Maintenance of flood carrying capacity of channel
- Protection of infrastructure and assets on adjacent land
- Enhancement of aquatic habitat by improvement of oxygen levels, provision of suitable spawning habitat for inanga and other fish species

Key Potential Adverse Effects

- Short term reduction in water quality due to release of sediment
- Loss of vegetation cover and spawning vegetation for fish and invertebrates
- Accidental fish mortality
- Release of nutrients trapped in sediment, resulting in adverse effects on water quality downstream
- Removal of habitat and food sources for benthic invertebrates and fish

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- The frequency of clearance is no more than is required to maintain design flows and water levels
- Works should be supervised by a suitably experienced person to ensure that:
  - works proceed from the upstream end of the reach to the downstream end, to minimise the release of sediment and debris downstream
  - an appropriate free-draining bucket is used
  - examination of excavated material is undertaken and any fish removed from the stream by the works are recovered and relocated to clear water upstream of the works
  - where possible, at least one observer, in addition to the digger operator, is present to assist with finding, capturing and relocating of trapped fish

Restrictions

- ☒ No work to be undertaken during inanga spawning – refer to Table 6
- ☒ No removal of riparian vegetation

Channel maintenance:

Mechanical clearing – Chrystalls Lagoon (Otaki River)

Description

The Waimanu Stream drains an area of foothills and river terrace lying in the vicinity of Rahui Rd, on the eastern side of the Otaki River upstream of SH 1. In its lower reaches the stream flows through Chrystalls Lagoon on the true right bank of the river within the floodplain in an area known as Chrystalls Bend. The lagoon is a man-made structure formed during construction of the flood protection works at Chystalls Bend. Waimanu Stream flows for a further 200 m (approximately) after exiting the lagoon before entering the main channel of the Otaki River at the downstream end of the bend.

Silt transported by the Waimanu Stream, and also carried into the lagoon during higher flows in the Otaki River is trapped by weed within the lagoon. This results in a gradual in-filling of the lagoon, and period excavation of silt is required approximately every 5 years in order to maintain it.

Diversion of Waimanu Stream and draining of the lagoon is necessary prior to excavation operations. Excavation is undertaken by a large excavator, and silt is loaded onto dumper trucks for transport to an off-site location for disposal.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region this activity requires resource consent. The activity is authorised under the granted resource consent for flood protection activities held by GWRC for the Otaki River.

Key Potential Benefits

- Maintenance of flood carrying capacity of channel
- Maintenance of the aquatic habitat within the lagoon
- Maintenance of the amenity values associated with the lagoon

Key Potential Adverse Effects

- Short term loss of aquatic habitat by reduction of water levels and removal of substrate
- Removal of habitat and food sources for benthic invertebrates and fish
- Loss of vegetation cover and spawning vegetation for fish and invertebrates
- Accidental fish mortality
- Potential for release of nutrients trapped in sediment, resulting in adverse effects on water quality

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- The frequency of clearance is no more than is required to maintain the lagoon
- Works should be supervised by a suitably experienced person to ensure that:
  - diversion works ensure that the Waimanu Stream cannot enter the lagoon while excavation works are in progress, in order to minimise the release of sediment and debris downstream
  - an appropriate free-draining bucket is used

- examination of excavated material is undertaken and any fish trapped by the works are recovered and relocated to clear water upstream of the works
- where possible, at least one observer, in addition to the digger operator, is present to assist with finding, capturing and relocating of trapped fish
- suspended sediment in the excavated pond is allowed to settle before the diversion of the Waimanu Stream through the lagoon is reinstated

Restrictions

☒ To minimise adverse effects on fish, works should not be undertaken at any times specified in Table 6

Silt excavation in Chrystalls Lagoon. Note use of self-draining weed bucket

Planting in the river bed:

Willow poles and stakes

Description

This involves planting willow stakes or poles along the edges of river banks in the river bed and generally within the prescribed buffer zone adjacent to the design low flow channel, in order to bind and support the bank edge and so maintain a stable river alignment.

Branch growth also reduces water velocities at the bank edge which assists in erosion protection. For this reason trees may also be planted in association with other structural works (groynes or debris fences) to further reinforce these works.

Currently willow trees are the species considered most suitable for 'front-line' river edge flood protection, and willow planting forms an essential part of current river protection work nationwide. Willows are easy to establish, grow rapidly and form an intricate root system that is ideal for binding and strengthening river banks and structural measures such as permeable groynes and debris fences. They can also be 'layered' (i.e. cut and anchored in place on the river bank where they will re-grow). Generally, the same results cannot be achieved using native species. This means the most realistic alternatives to willows are likely to be structural works (e.g. rock lining), which involves higher costs and arguably increased environmental impact.

Planting is generally carried out between June and September. Four planting methods are used:

- By hand, using a crow bar. Willow stakes are cuttings 1 – 1.5 m long and approximately 2.5 cm in diameter. Stakes or poles (i.e. large cuttings more than 3 m long) are usually cut from existing stands.
- 'Rip planting' using an excavator or planting tine. The tine is dragged through the river bed at up to 1 m depth and the stakes/poles or rooted stock planted behind the moving tine. This is most commonly used where large areas of planting are required.
- 'Trench planting' using a digger. Willow poles are planted in a trench dug and backfilled by the excavator. This method is used where willows are planted in very dry areas or immediately adjacent to fast flowing water.
- Planting using a mechanical auger to prepare holes for stakes or poles.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region planting of crack and grey willow on the margins of rivers is a permitted activity, provided there is compliance with the prescribed permitted activity conditions.

Key Potential Benefits

- Improved stability and strength of buffer zone adjacent to active channels
- Maintenance of stable channel alignment
- Protection of infrastructure and assets located in the floodplain

Key Potential Adverse Effects

- Disturbance of river bed nesting birds and bird nesting habitat
- Temporary disturbance of recreational access and use

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Sterile cultivars are to be use in all western rivers

- Sterile cultivars are to be used in Wairarapa Rivers where possible
- Planting works should be supervised by a suitably experienced person to ensure that:
  - spacing and alignment of plantings is appropriate for the specific river and site
  - a smooth river bed profile is left following planting, to ensure that flood flows are not constricted

Restrictions

- ☒ Planting works are not to be undertaken in the active channel. (Note that on occasion planting does occur in areas of river bed that are covered with water by seepage and/or back flow.. This does not include anywhere in the dominant active channel and where work is undertaken in such wet areas, measures must be taken to minimise sediment entering the active channel)
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with restrictions specified in Table 6

Trench planting – Hutt River

Willow poles and stakes and layered willows – Hutt River

Construction & maintenance:

Vegetative structures

Description

Vegetative structures include:

- Layered willows
- Tree groynes or 'clumps', which project out from the bank
- Tethered willows, placed along a bank edge

Willow layering involves felling large willows growing at the river edge (or bending and snapping using a digger) so that they lie obliquely towards the river in a downstream direction. The intent is to allow the willows to sucker from branches on the ground once they are covered in silt and gravel. The tree is wired to its stump to prevent it breaking off in a flood.

Tree groynes perform the same purpose as layered willows, but are constructed where there are no available trees at the bank edge. In this case, large willow or poplar trees are cut from a nearby source and placed in a shallow trench that has been excavated at the desired location. The trees are bundled with wire rope and securely fixed to driven railway irons and/or buried concrete block weights. The base of the trees are covered with gravel to encourage root growth, and willow poles are planted between the groynes.

Tethered willows are similar to tree groynes, but are placed alongside the bank edge to be protected, rather than jutting out into the river channel. Again, they may be held in place with wire ropes and concrete blocks.

Some initial site preparation is usually associated with construction of vegetative structures. Typically it may involve some excavation and/or mechanical disturbance of the river bed and bank, to provide access to the working area and to facilitate construction works.

Willow poles would normally be planted behind the tethered willows to facilitate the establishment of the buffer layer.

Layering is normally completed in the August – December period following completion of planting work.

Maintenance of existing layered and tethered trees usually involves strengthening by cabling-in additional tree material, and inter-planting with additional poles.

If existing vegetative structures (cabled willows & tree groynes) start to show signs of failure a decision may be made to remove them to reduce the potential for them to create a hazard during future floods. This would involve excavation using a hydraulic excavator, and removal from the river bed.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, layering and tethering of willows is a permitted activity, provided that it:

'(1) is not in a river, or part of a river, identified by Policy 4.2.10 (Appendix 2 – water bodies with a high degree of natural character); and

(2) extends into the available river bed width from the bank no more than whichever is the lesser of:
- 10% of the width of the water body; or
- 5 metres; and

(3) does not use crack willow, Salix fragilis, or grey willow, Salix cinerea, except on the margins of rivers where they are already predominant'

and provided that it complies with the prescribed permitted activity conditions. Any work not complying with these requirements would need resource consent.

Key Potential Benefits

- Bank stability is enhanced and risk of erosion is reduced, protecting adjacent property and infrastructure
- Channel alignment is maintained
- River bed habitat stability is maintained
- River habitat diversity may be enhanced by shading afforded by overhanging vegetation, woody inputs to the stream, and shelter afforded by tree roots at the bank edge

Key Potential Adverse Effects

- During construction:
  - disturbance of river bed habitat
  - release of suspended sediment to the river
  - deposition of sediment downstream
  - temporary loss of riparian vegetation
  - disturbance of recreational use
- Long term:
  - cumulative effect of reduction in the overall natural appearance of the river bank and river corridor associated with willow use

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- The person responsible for supervising on-site works must ensure:
  - all staff are aware of the risks involved in this work and the safety practices that must be observed
  - only the minimum area needed to complete the work is disturbed
  - tether anchors are tied with wire rope extending in a downstream direction (as this prevents willows from shifting; if ties are placed extending in an upstream direction there is the potential for slack in the tie to remain)
- Hybrid stock will be planted in areas where crack willows are removed, to provide sterile stock for future use.

Restrictions

- ☒ Crack willows will not be used in areas where they do not already occur.
- ☒ To protect aquatic ecology and habitat, works should not be undertaken in the actively flowing channel at any sites or at any times specified in Table 6
- ☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with restrictions specified in Table 6

Tethered willows and tree groynes – Hutt River

Tethered willows and tree groynes – Hutt River

Maintenance of riparian vegetation:

Mowing from the river bed

Description

Mowing of river berms is generally done from the bank, and does not require the operation of machinery in the river bed. However, in a few places where access is restricted, mowing of the river berms may need to be undertaken from the river bed. In such instances, it may also be necessary to gain site access via the river bed – refer to general good practice sheet on formation of access for further guidelines.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, entry or passage across the river bed is a permitted activity.

Key Potential Benefits

- Channel capacity is maintained
- Amenity values and recreational access is maintained

Key Potential Adverse Effects

- Disturbance of river bed and river bed habitat
- Reduction or removal of bankside vegetation providing shade to the adjacent aquatic habitat
- Minor release of suspended sediment to the river
- Disturbance of recreational use

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods(refer to relevant sheets)**
- Only a rubber-tyred machine will be used, to minimise disturbance of the stream bed

Restrictions

☒ Mowing from the stream channel will only be done in the following locations:
  - Stokes Valley Stream
  - Porirua Stream

Mowing – Stokes Valley Stream

Maintenance of riparian vegetation:

Trimming & mulching of bankside vegetation from the river bed

Description

Maintenance of willow plantings on the river edge would generally involve removal of unstable trees and mulching to:

- maintain channel capacity by preventing the lateral spread of edge plantings into the channel
- clear survey sight lines
- maintain recreational access to the river

Mulching of standing willows in the buffer zone can be used as an alternative to layering, to prevent the trees becoming too large and unstable. Although initially this may be visually unsightly, the effects are short-lived as willow rejuvenation proceeds.

Mulching is also prepare areas for planting.

Clearance may be done by a mower/mulcher mounted on an excavator and/or by hand.

Resource Management Act 1991

Under the current Regional Freshwater Plan for the Wellington Region, entry or passage across the river bed, and removal of vegetation from the river bed are permitted activities.

Key Potential Benefits

- Channel capacity is maintained
- Bank stability is maintained
- Accurate survey of the bank edges is facilitated
- Access for recreation is maintained

Key Potential Adverse Effects

- Loss of riparian vegetation and consequently, inputs of woody material, leaves and insects to the aquatic environment
- Reduction in riparian shading of the river
- Loss of shelter or spawning sites for fish or aquatic invertebrates
- Disturbance of recreational use
- Reduction in amenity values until vegetation re-grows

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Ideally mulching should be undertaken when trees are dormant (i.e. before spring growth is occurring)
- Works should be undertaken from the bank, or from dry beaches, rather than from within the active channel wherever possible
- Trimmed vegetation should be mulched on-site, or disposed of in a suitable location away from the river, where they will not be washed into the channel and create obstructions downstream

Restrictions

☒ To protect river bed nesting birds and nesting habitat, works undertaken on dry river beds must comply with restrictions specified in Table 6

Construction of structures and tracks on berms

Description

Construction works are mostly associated with development of the river trails and implementation of works on the river berms and stopbanks, in accordance with specific environmental strategies for particular rivers.

Minor works associated with management or improvement of the riparian margins are also included; this may include erection of footbridges, boundary fences.

Associated with this work there may be a requirement for new stormwater culverts under trails, and drainage channels constructed across the river berms to carry stormwater to the river.

Resource Management Act 1991

The current Regional Freshwater Plan for the Wellington Region does not apply to activities undertaken outside the river bed.

The Regional Soil Plan for the Wellington Region applies to land disturbance on areas lying outside of the river bed. In this situation, the activities are generally permitted, provided any earthworks fall within the limits prescribed.

Key Potential Benefits

- Access for recreation or other purposes is improved
- Amenity values are improved

Key Potential Adverse Effects

- Short-term disturbance of recreational use while works are undertaken
- Ground disturbance and associated sediment entrainment in stormwater runoff
- Reduction in the natural appearance of the river corridor

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Structures must be designed and approved by a suitably qualified person to ensure in particular that:
  - the works are in accordance with any FMP and associated Environmental Strategy
  - construction materials are compatible with the river environment and are clean and free of soil, mud, clay or other soluble debris that could be washed into the river
  - future maintenance and access requirements are considered with a view to minimising on-going disturbance of the river bank and riparian zone
- Construction should be supervised by a suitably experienced person to ensure that:
  - all works are undertaken in accordance with the design requirements noted above

Constructing fences on the Hutt River berm

Maintenance of berms, stopbanks, structures and tracks

Description

Includes:

- Reinstatement of damage to stopbanks & berms that may have been caused by flooding, rainfall runoff or vandalism. The intention of this work is to reinstate the berm or stopbank to its original height/profile
- Minor repairs to and general maintenance of footbridges, fences, culverts and other minor structures
- Mechanical cleaning of stormwater channels

Generally, repairs of berms or stopbanks will involve the placement of suitable fill in layers. Fill may be sourced either from beaches on the river bed or from elsewhere, depending on design requirements. The intention is to reconstruct the berm to a similar height and alignment prior to erosion. Following reconstruction, the berm will be replanted as appropriate, and stopbanks will be topsoiled and re-grassed.

Resource Management Act 1991

The current Regional Freshwater Plan for the Wellington Region does not apply to activities undertaken outside the river bed.

The Regional Soil Plan for the Wellington Region applies to land disturbance on areas lying outside of the river bed. In this situation, the activities are generally permitted, provided any earthworks fall within the limits prescribed.

Key Potential Benefits

- Flood protection assets are maintained in good order
- The risks of damage to berms and stopbanks from storm events are reduced
- Amenity values are maintained

Key Potential Adverse Effects

- Short-term disturbance of recreational use while works are undertaken
- Ground disturbance and associated sediment entrainment in stormwater runoff

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Works should be supervised by a suitably experienced person to ensure that:
  - all works are undertaken in accordance with any specific design requirements (where repairs involving earthworks are to be undertaken)
  - sediment and erosion control measures are put in place where earthworks are to be undertaken
  - any trimmed vegetation is mulched on-site or disposed of away from the river to ensure it cannot be carried away by future flooding
  - stormwater drains are cleared when dry, wherever possible, to minimise discharges of sediment to the river

Grading river trail – Hutt River

Stormwater channel clearance – Hutt River

Planting on berms

Description

Planting is undertaken on river berms to complement erosion protection structures and river edge plantings, and to establish a suitable vegetative buffer to support the bank edges and assist in maintenance of a stable river alignment.

Generally willows will only be used within the 20 - 30 m wide buffer zone closest to the river. Behind this buffer, native trees can also be used to supplement or replace willow plantings, and for any amenity or other planting undertaken in accordance with the FMP or Environmental Strategy for the river.

Planting is generally carried out between June and September. For willows, four planting methods are used:

- By hand, using a crow bar.
- 'Rip planting' using an excavator or planting tine. The tine is dragged through the river bed at up to 1 m depth and the stock planted behind the moving tine. This is most commonly used where large areas of planting are required.
- 'Trench planting' using a digger. Willow poles or rooted plant stock are planted in a trench dug and backfilled by the excavator.
- Planting using a mechanical auger to prepare holes for stakes/poles or rooted stock.

Native trees are planted either by hand using a spade, or mechanically, with the use of a small digger – depending on plant size.

Site preparation, in the form of spraying or mulching may also be required.

Resource Management Act 1991

The current Regional Freshwater Plan for the Wellington Region does not apply to activities undertaken outside the river bed.

The Regional Soil Plan for the Wellington Region applies to land disturbance on areas lying outside of the river bed. In this situation, the activities are generally permitted, provided any earthworks fall within the limits prescribed.

Key Potential Benefits

- Improved stability and strength of berms
- Maintenance of stable channel alignment
- Protection of infrastructure and assets located in the floodplain

Key Potential Adverse Effects

- Temporary disturbance of recreational access and use
- Reduction in natural biodiversity associated with use of willow

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Prior to approval of any planting plan, managers or site supervisors should assess both the necessity for the planting and the suitability of the proposed plant types in relation to the objectives and directions of any relevant Floodplain Management Plan, Environmental or Ecological Strategy for both the river corridor and the affected site
- Restrict willow planting to the buffer zone at the river edge. This is generally 20 – 30 m wide.
- Only use sterile willow cultivars for willow planting in western rivers
- Use sterile willow cultivars wherever possible in Wairarapa rivers
- Consider the use of native trees behind frontline plantings wherever practicable. Assessment of practicability includes consideration of:

- the availability of a care group to assist with establishment of the plantings
- the need for spray release of native plants, and the cost of this work
- the availability of suitable stock (plants in keeping with any ecological objectives for the river corridor and eco-sourced)
- the need for fencing

♦ Construction should be supervised by a suitably experienced person to ensure that:
- all works are undertaken in accordance with the design requirements noted above

Planted willows above river bed – Waikanae River

Rip planting on berm – Hutt River

Trench planting on berm – Wainuiomata River

Planting willow poles in buffer zone; native planting in foreground

School children planting native trees

Maintenance of riparian vegetation

Description

This includes:

- Mulching of vegetation
- Removal of damaged or dead trees
- Mowing of berms

where machinery is operated on the banks, away from the river bed.

Also see the relevant good practice sheet for Spraying[23] .

Resource Management Act 1991

The current Regional Freshwater Plan for the Wellington Region does not apply to activities undertaken outside the river bed.

The Regional Soil Plan for the Wellington Region applies to the removal of vegetation from areas lying outside of the river bed. In this situation, the activities are generally permitted, provided the total amount of vegetation removed falls within the limits prescribed.

Key Potential Benefits

- Flood protection assets are maintained in good order
- Amenity values are maintained in the longer term

Key Potential Adverse Effects

- Short-term disturbance of recreational use while works are undertaken
- Ground disturbance and associated sediment entrainment in stormwater runoff
- Short-term reduction in visual amenity

Required Actions

- Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)

Mulching of scrubby vegetation

[23] To be developed.

Mowing of berms – Hutt River

River mouth cutting

Description

This involves periodic cutting of a new opening at the mouth of specific rivers, including excavation and redistribution of sand on the foreshore and seabed (i.e. within the Coastal Marine Area). Areas of beach (i.e. above the MHWS water level, and thus outside the Coastal Marine Area) may also be disturbed, both by vehicle tracking, excavation and redistribution of sand.

Resource Management Act 1991

River mouth cutting is permitted by the Regional Coastal Plan for the Wellington Region **provided that it is undertaken in accordance with defined trigger levels** in the following watercourses:

- Waitohu Stream
- Otaki River
- Mangaone Stream
- Hadfield Drain
- Waimeha Stream
- Tikotu Stream
- Wharemauku Stream
- Whareroa stream
- Wainui Stream
- Waikakariki Stream
- Makara Stream
- Lake Onoke
- Unnamed Stream, approximately 190 m south of the seaward end of Sunrise Way, Riversdale
- Unnamed Stream, approximately 145 m north of the seaward end of Sunrise Way, Riversdale
- Unnamed Stream at the seaward end of Karaka Drive, Riversdale
- Motuwaireka Stream
- Castlepoint Stream

GWRC holds resource consent for river mouth cutting in the Waikanae River.

Key Potential Benefits

- River mouth alignment is maintained
- Capacity to safely convey flood waters is maintained or improved
- Assets, infrastructure and property adjacent to the river mouth are protected from erosion

Key Potential Adverse Effects

- Short-term disturbance of foreshore and seabed and associated habitat
- Short-term reduction in visual clarity in adjacent coastal water due to entrained fine sediment
- Short-term reduction in recreational access
- Short-term reduction of estuarine habitat and associated ecological values

Required Actions

- **Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)**
- Undertake works in accordance with the methodology described below

Restrictions

☒ No sand or other material is to be removed from beach or foreshore areas or the sea bed

Methodology

- The new alignment is positioned directly downstream of the centre of the design channel alignment. A trench is excavated to form a pilot channel, and the excavated sand is used to block off the active channel. The pilot channel is not connected to the main channel at this stage. This work is undertaken at low tide when the sand is firmer and the machinery does not need to work in water
- Water ponds in the upstream channel until the following low tide, when the block in the pilot channel is removed, releasing the ponded water upstream into the new channel. The new channel is then deepened and widened naturally by the river flow.
- The material excavated during the cutting of the new channel is to be spread on the foreshore to assist in the realignment of the river outlet and/or erosion control at the outlet.
- Generally the work will involve the use of hydraulic excavators, loaders and a dump truck.
- Ideally the operation should be undertaken during low flows and at spring tides when tidal variation is largest. The operation should be completed over a single 24 hour period.

Otaki River mouth – pilot channel formation

Otaki River mouth – cut under construction

Otaki River mouth – releasing bund

Waimeha Stream mouth – formation of bund to block mouth

Otaki River – Cut completed

Waimeha Stream mouth – pilot channel under construction

Waimeha Stream mouth – completed channel, diversion open

Waikanae River mouth cut

Construction of new structures in the CMA

Description

Resource Management Act 1991

Required Actions

- Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)
- Undertake works in accordance with the methodology described below

Restrictions

☒

Other

Maintenance of structures in the CMA

Description

This may involve repairs to:

- rock groynes
- rock lining
- training walls

and

- clearance and repair of debris arresters

which are located in the CMA at the mouths of rivers.

Typically, it involves replacement of rock that has been moved or eroded out by flood action. Such work can generally be undertaken without the need to operate machinery in the flowing channel. Occasionally structures may need to be partially reconstructed, which may require more extensive work, including the operation of machinery in the flowing channel.

Resource Management Act 1991

Under the current Regional Coastal Plan, minor repairs, maintenance or alteration to existing structures in the CMA, and also demolition of structures are permitted activities, subject to prescribed permitted activity conditions. Resource consent is required for more extensive repairs and maintenance that cannot comply with the permitted activity conditions.

Key Potential Benefits

- River mouth alignment is maintained
- Capacity to safely convey flood waters is maintained or improved
- Assets, infrastructure and property adjacent to the river mouth are protected from erosion

Key Potential Adverse Effects

- Short-term reduction in recreational access
- If machinery is operated in the flowing channel:
  - disturbance of foreshore and seabed and associated habitat
  - reduction in visual clarity in adjacent coastal water due to entrained fine sediment
  - loss of riparian vegetation and associated habitat

Required Actions

- Managers and on-site works supervisors must implement all general good practice methods (refer to relevant sheets)
- Construction materials used in repairs should be compatible with the existing structure
- All surplus materials will be removed from the site at the end of works, and the structure and works area will be left in a tidy and safe state

Restrictions

☒ Any in-river works must comply with the restrictions noted in Table 6

Urgent Works

Urgent works are measures taken to address an immediate issue or problem where erosion or flooding is placing flood protection structures, other infrastructure or property under direct threat of damage.

Urgent works are often temporary measures, such as placement of rock, or diversion of the active channel, to provide a 'stop-gap' solution until a more permanent solution to the problem is put in place.

In such cases, it may not be possible to adhere to all the good practice guidelines of the Code of Practice. However, the following will still apply:

- GWRC will consult with iwi if sites of significance to them are affected.[24]
- Construction materials used for urgent works will be compatible with the environment (i.e. no concrete rubble or car bodies or other foreign material)
- It is still expected that machinery used for urgent works will comply with the guidelines relating to operation of machinery contained in the Code
- It is expected that all Flood Protection staff will comply with the guidelines relating to safety contained in the Code

[24] Protocol to be developed.

New Method Trials

- The Flood Protection Department will wish to trial new methods, activities or strategies for river management from time to time
- Before any new method or activity is considered for inclusion in the Code of Practice it will undergo a full appraisal by the Flood Protection Department via an established process that has been agreed in advance with the Environmental Regulation Department. The appraisal process may include on-site trials of the new method or activity.
- Prior to undertaking any trial of a new method or activity, the Flood Protection Department will determine:
    - The purpose of the trial
    - The site or sites at which the trial will be undertaken
    - The times when the trial will be undertaken and the total length of time expected to undertake the trial
    - The expected effects or outcomes of the trial
    - The parameters by which any outcomes of the trial will be measured
    - Any environmental monitoring that will be required to measure the progress or success of the trial
    - The people who will be responsible for evaluating the trial and any specialist expertise that may be required
- The results of any new method or activity trials will be included in the regular review of the Code of Practice, and any decision to include the new method or activity in the Code of Practice will be made via the review process.

Appendix 1: Flood Protection Department Vision and Goals

The foundation of all work undertaken by GWRC is its overall vision which is:

Greater Wellington Regional Council - Vision

"Greater Wellington promotes Quality for Life by ensuring our environment is protected while meeting the economic, cultural and social needs of the community"

In terms of the Flood Protection Department, a further vision and set of specific goals and objectives have been developed to guide the way in which this work is undertaken. These are as follows:

Flood Protection Department – Vision

"A prosperous community safe from the consequences of flooding with rivers and streams in a natural state providing ecological diversity and recreational opportunities"

Flood Protection – Goals (What do we want to do?)

- ***Avoid the loss of life as a consequence of flooding;***
- ***Ensure use and development of land is compatible with the flood risk;***
- ***Inform and empower communities to take appropriate action about avoiding flood risk;***
- ***Contribute to the economic wellbeing of the region through flood risk management;***
- ***Recognise the relationship of tangata whenua with water bodies and the cultural values they attribute to rivers and streams;***
- ***Enhance the environmental quality of rivers and streams;***
- ***Recognise and provide for the recreational use of rivers and streams; and***
- ***Encourage best practice in flood risk management.***

Flood Protection Objectives (what can we achieve)

- ***Avoid the loss of life as a consequence of flooding***
  - *Design and maintain flood protection assets so they perform to or above expectation*
  - *Advise people of the flood risk*

- ***Ensure use and development of land is compatible with the flood risk***

  - *Communicate and provide advice on flood risk to decision makers and the community, so that appropriate decisions are made about land use in the first instance*

- ***Inform and empower communities to take appropriate action about flood risk***

  - *Help the community avoid and manage flood risks through the provision of information and advice*

- ***Contribute to the economic wellbeing of the region through flood risk management***

  - *Agree levels of service with the community*

  - *Maintain schemes to the agreed standard*

  - *Inform landowners about flood risk management through implementation of sustainable land management practices and provision of advice on appropriate flood risk responses*

- ***Recognise the relationship of tangata whenua with water bodies and the cultural values they attribute to rivers and streams***

  - *Engage with tangata whenua to understand the values associated with different rivers and floodplains when investigating and evaluating floodplain management options*

  - *Consider the role of tangata whenua in the decision-making process*

- ***Enhance the environmental quality of rivers and streams***

  - *Enhance the environment in undertaking flood protection capital, operational and maintenance works*

  - *Raise public awareness of the important ecological and recreational function that rivers assume*

  - *Foster a sense of community responsibility for flood protection and the river environment through leading by example, providing education and encouraging active community participation*

- ***Recognise and provide for the recreational use of rivers and streams***

  - *Provide for passive recreation in the river environment.*

  - *Provide access to rivers in a managed way to support recreational use while protecting the environment and managing flood risks.*

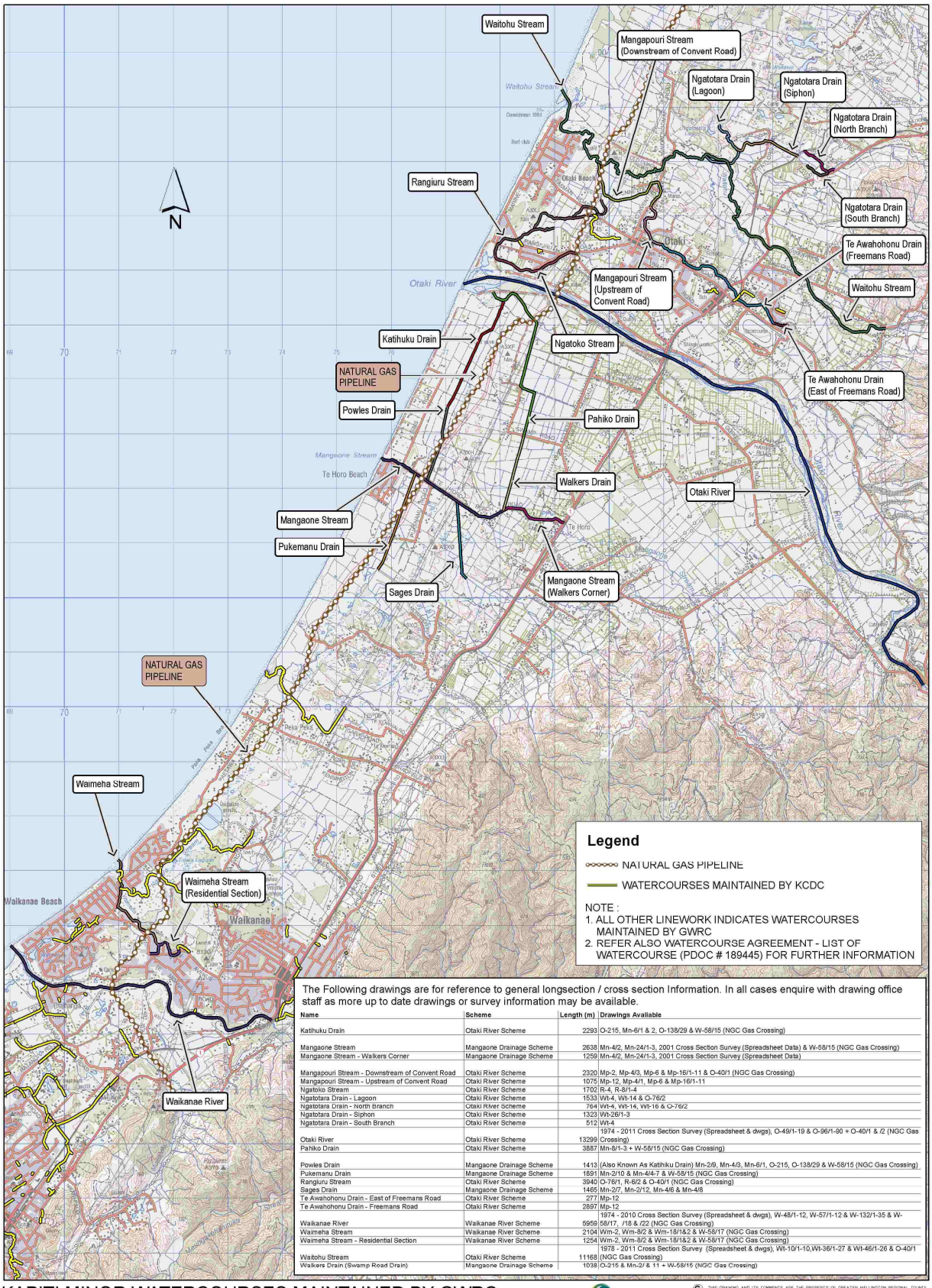
- *Work with recreational and community groups to create opportunities for enhanced recreation use and community enjoyment of the river consistent with the identified flood risk and quality of the natural environment.*

➢ ***Encourage best practice in flood risk management***

- *Provide national and regional leadership through sound floodplain management planning practice*
- *Develop 'best practice' skills, knowledge and culture within the department*
- *Ensure departmental work is consistent with the floodplain management guidelines*

These high-level visions, goals and objectives set the overall direction in which floodplain management planning is undertaken by Greater Wellington Regional Council.

Appendix 2: Watercourses maintained by GWRC



The Following drawings are for reference to general longsection / cross section Information. In all cases enquire with drawing office staff as more up to date drawings or survey information may be available.

Name	Scheme	Length (m)	Drawings Available
Katihuku Drain	Otaki River Scheme	2293	O-215, Mn-6/1 & 2, O-138/29 & W-58/15 (NGC Gas Crossing)
Mangaone Stream	Mangaone Drainage Scheme	2638	Mn-4/2, Mn-24/1-3, 2001 Cross Section Survey (Spreadsheet Data) & W-58/15 (NGC Gas Crossing)
Mangaone Stream - Walkers Corner	Mangaone Drainage Scheme	1259	Mn-4/2, Mn-24/1-3, 2001 Cross Section Survey (Spreadsheet Data)
Mangapouri Stream - Downstream of Convent Road	Otaki River Scheme	2320	Mp-2, Mp-4/3, Mp-6 & Mp-16/1-11 & O-40/1 (NGC Gas Crossing)
Mangapouri Stream - Upstream of Convent Road	Otaki River Scheme	1075	Mp-12, Mp-4/1, Mp-6 & Mp-16/1-11
Ngatoko Stream	Otaki River Scheme	1702	R-4, R-8/1-4
Ngatotara Drain - Lagoon	Otaki River Scheme	1533	Wt-4, Wt-14 & O-76/2
Ngatotara Drain - North Branch	Otaki River Scheme	764	Wt-4, Wt-14, Wt-16 & O-76/2
Ngatotara Drain - Siphon	Otaki River Scheme	1323	Wt-26/1-3
Ngatotara Drain - South Branch	Otaki River Scheme	512	Wt-4
Otaki River	Otaki River Scheme	13299	1974 - 2011 Cross Section Survey (Spreadsheet & dwgs), O-49/1-19 & O-96/1-90 + O-40/1 & /2 (NGC Gas Crossing)
Pahiko Drain	Otaki River Scheme	3887	Mn-8/1-3 + W-58/15 (NGC Gas Crossing)
Powles Drain	Mangaone Drainage Scheme	1413	(Also Known As Katihiku Drain) Mn-2/9, Mn-4/3, Mn-6/1, O-215, O-138/29 & W-58/15 (NGC Gas Crossing)
Pukemanu Drain	Mangaone Drainage Scheme	1891	Mn-2/10 & Mn-4/4-7 & W-58/15 (NGC Gas Crossing)
Rangiuru Stream	Otaki River Scheme	3940	O-76/1, R-6/2 & O-40/1 (NGC Gas Crossing)
Sages Drain	Mangaone Drainage Scheme	1465	Mn-2/7, Mn-2/12, Mn-4/6 & Mn-4/8
Te Awahohonu Drain - East of Freemans Road	Otaki River Scheme	277	Mp-12
Te Awahohonu Drain - Freemans Road	Otaki River Scheme	2897	Mp-12
Waikanae River	Waikanae River Scheme	5959	1974 - 2010 Cross Section Survey (Spreadsheet & dwgs), W-48/1-12, W-57/1-12 & W-132/1-35 & W-58/17, /18 & /22 (NGC Gas Crossing)
Waimeha Stream	Waikanae River Scheme	2104	Wm-2, Wm-8/2 & Wm-18/1&2 & W-58/17 (NGC Gas Crossing)
Waimeha Stream - Residential Section	Waikanae River Scheme	1254	Wm-2, Wm-8/2 & Wm-18/1&2 & W-58/17 (NGC Gas Crossing)
Waitohu Stream	Otaki River Scheme	11168	1978 - 2011 Cross Section Survey (Spreadsheet & dwgs), Wt-10/1-10,Wt-36/1-27 & Wt-46/1-26 & O-40/1 (NGC Gas Crossing)
Walkers Drain (Swamp Road Drain)	Mangaone Drainage Scheme	1038	O-215 & Mn-2/ & 11 + W-58/15 (NGC Gas Crossing)

KAPITI MINOR WATERCOURSES MAINTAINED BY GWRC

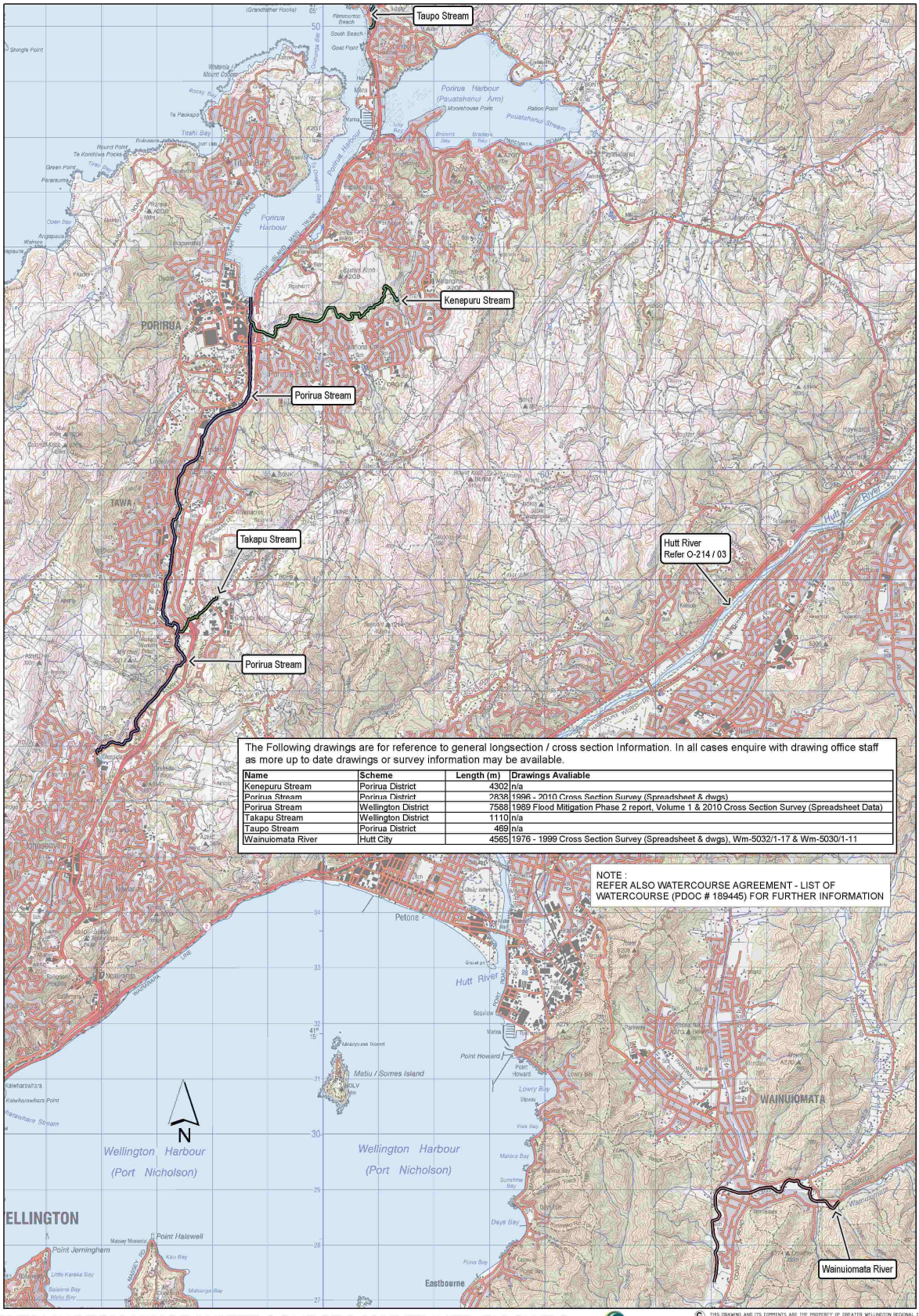
DWG File Ref : O-214-01.mxd

A3 Scale 1 : 60,000 0 0.45 0.9 1.8 Kilometers

greater WELLINGTON THE REGIONAL COUNCIL

File Ref : N / 60 / 1 / 1
DOC # 681583

DRAWING No. **O-214 / 01**



The Following drawings are for reference to general longsection / cross section Information. In all cases enquire with drawing office staff as more up to date drawings or survey information may be available.

Name	Scheme	Length (m)	Drawings Avaliable
Kenepuru Stream	Porirua District	4302	n/a
Porirua Stream	Porirua District	2838	1996 - 2010 Cross Section Survey (Spreadsheet & dwgs)
Porirua Stream	Wellington District	7588	1989 Flood Mitigation Phase 2 report, Volume 1 & 2010 Cross Section Survey (Spreadsheet Data)
Takapu Stream	Wellington District	1110	n/a
Taupo Stream	Porirua District	469	n/a
Wainuiomata River	Hutt City	4565	1976 - 1999 Cross Section Survey (Spreadsheet & dwgs), Wm-5032/1-17 & Wm-5030/1-11

NOTE :
REFER ALSO WATERCOURSE AGREEMENT - LIST OF WATERCOURSE (PDOC # 189445) FOR FURTHER INFORMATION

WELLINGTON MINOR WATERCOURSES MAINTAINED BY GWRC

PORIRUA / WAINUIOMATA

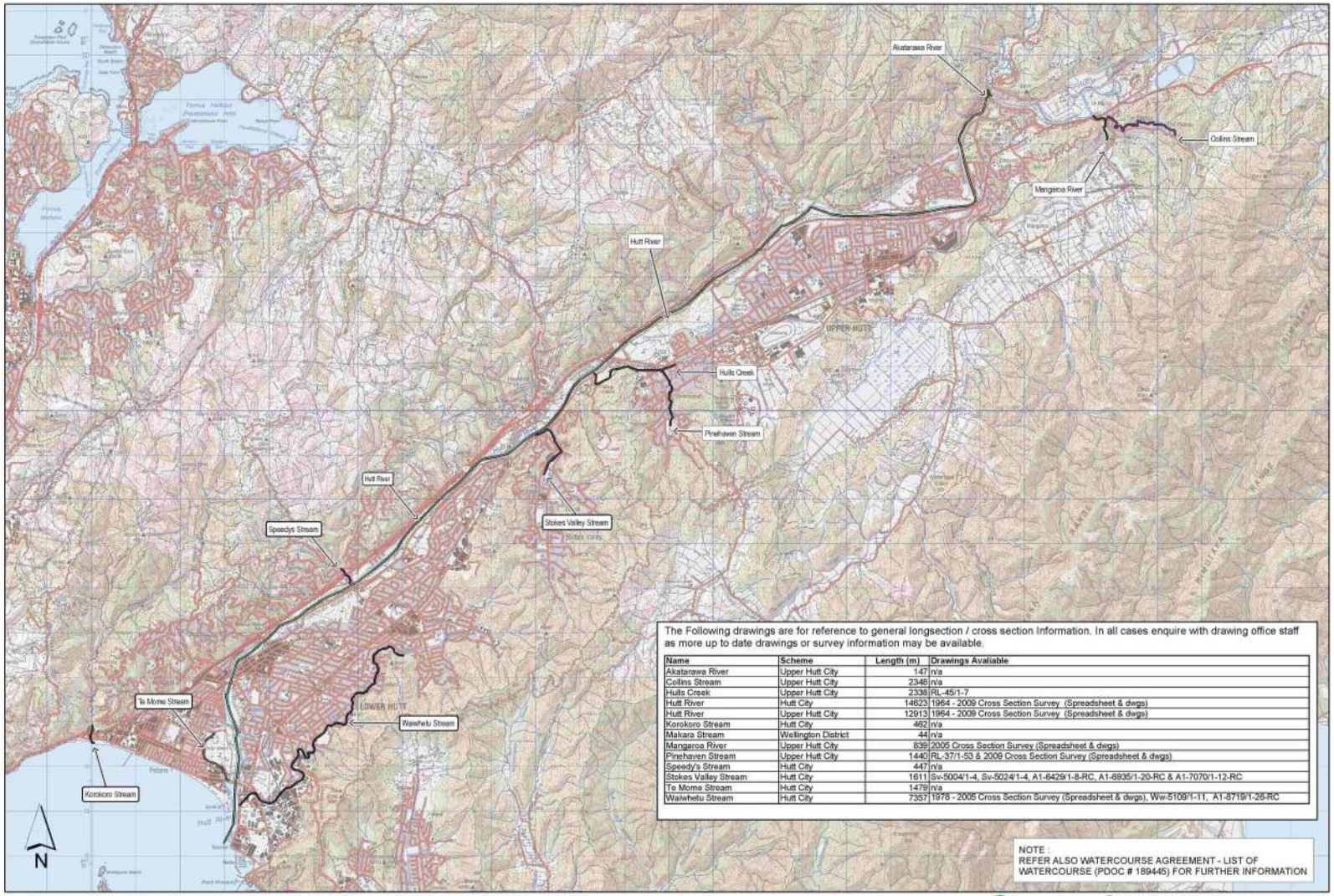
DWG File Ref : O-214-02.mxd
A3 Scale 1 : 60,000

0 0.475 0.95 1.9 Kilometers

greater WELLINGTON
THE REGIONAL COUNCIL

File Ref : N / 60 / 1 / 1
DOC # 681583

DRAWING No. **O-214 / 02**



The Following drawings are for reference to general longsection / cross section information. In all cases enquire with drawing office staff as more up to date drawings or survey information may be available.

Name	Scheme	Length (m)	Drawings Avaliable
Akatarawa River	Upper Hutt City	147	n/a
Collins Stream	Upper Hutt City	2348	n/a
Hulls Creek	Upper Hutt City	2338	RL-45/1-7
Hutt River	Hutt City	14623	1964 - 2009 Cross Section Survey (Spreadsheet & dwgs)
Hutt River	Upper Hutt City	12913	1964 - 2009 Cross Section Survey (Spreadsheet & dwgs)
Korokoro Stream	Hutt City	462	n/a
Makara Stream	Wellington District	44	n/a
Mangaroa River	Upper Hutt City	839	2005 Cross Section Survey (Spreadsheet & dwgs)
Pinehaven Stream	Upper Hutt City	1440	RL-37/1-53 & 2009 Cross Section Survey (Spreadsheet & dwgs)
Speedy's Stream	Hutt City	447	n/a
Stokes Valley Stream	Hutt City	1611	Sv-5004/1-4, Sv-5024/1-4, A1-6429/1-8-RC, A1-6935/1-20-RC & A1-7070/1-12-RC
Te Mome Stream	Hutt City	1479	n/a
Waiwhetu Stream	Hutt City	7357	1978 - 2005 Cross Section Survey (Spreadsheet & dwgs), Ww-5109/1-11, A1-8719/1-26-RC

NOTE :
REFER ALSO WATERCOURSE AGREEMENT - LIST OF WATERCOURSE (PDOC # 189445) FOR FURTHER INFORMATION

WELLINGTON MINOR WATERCOURSES MAINTAINED BY GWRC

HUTT VALLEY

DWG File Ref : O-214-03.mxd

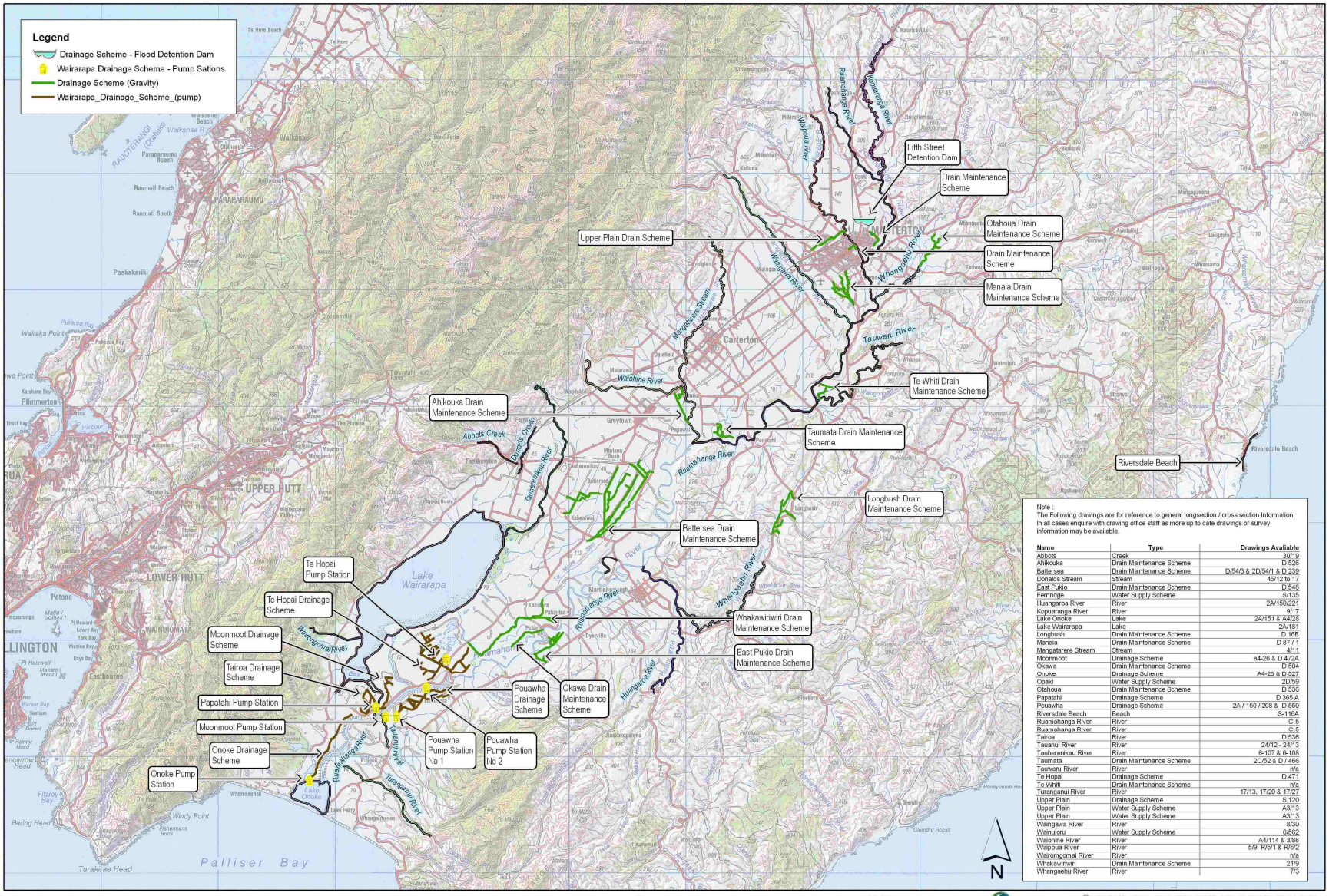
0 1 2 4 Kilometers

A3 Scale 1 : 75,000

greater WELLINGTON THE REGIONAL COUNCIL

File Ref : N / 60 / 1 / 1
DOC # 681583

DRAWING No. **O-214 / 03**



WAIRARAPA RIVERS & DRAINAGE SCHEMES MAINTAINED BY WRC

DWG File Ref : O-214-04.mxd

0 5 10 20 Kilometres

A3 Scale 1 : 280,000

greater WELLINGTON THE REGIONAL COUNCIL

File Ref : N / 60 / 1 / 1
DOC # 681583

DRAWING No. **O-214 / 04**

Appendix 3: Habitat assessment template

Habitat Assessment Template for Consented River Maintenance Work requiring between three and six days work in the wetted river channel Western Rivers

Applicable consent			
□ WGNxxx – Wainuiomata River		□ WGNxxx – Hutt River	
□ WGNxxx – Waikanae River		□ WGNxxx – Otaki River	
Type of Work Proposed			
□ Bed re-contouring; lineal metres_____(m)		□ Groyne construction; lineal metres____(m)	
□ Other:		lineal metres____(m)	
Date of pre-works assessment:		Assessors name:	
Date of work:		Landowners Name:	
Location of assessment:			
River cross section: XS_____; +_____(m) to XS_____; +_____(m)			
□Right Bank	□Left Bank	□Mid Channel	
Pre-works Habitat Assessment			
Site length (definition)	Approximate length of assessment site:_____(m)		Photographic record
Wetted vs. dry channel width	Average wetted width over assessment site:_____(m) Average dry width over assessment site:_____(m)		Pre-works photo date:
Flow conditions	□ Low flow	□ Base flow	□ High flow
Flow types present In linear metres (definition)	Rapid:_____(m)	Deep run:_____(m) Shallow run: (m)	Riffle:_____(m)	Pools: _____(m) Pools (number):
Maximum depth found within assessment site	Maximum depth:_____(m)	Approximate lineal distance of max depth length: _____(m)	
Wetted bank habitat (definition)	Total length of wetted habitat against bank:_____(m)		
Overhanging vegetation	Total length of overhanging vegetation:_____(m)		
Bank undercut	Total length of undercut:_____(m)		
Channel shape	□ Artificially channelised	□ Straight	□ Weakly sinuous	□Strongly sinuous
Braided channel?	□ Single thread channel	□ Split channel	□ Braided channel	

Definitions:

Site length is the length of the area being assessed. The area affected by works may be less.

Flow conditions are generalized as low, base or high. For accurate measurement refer to GWRC record on the date of assessment

Deep run is deeper than 0.6m (thigh high)

Rapid habitat is an area of fast moving broken white water

Riffle habitat is an area of fast moving turbulent water

Wetted bank habitat is the total length of wetted channel against a bank edge. This may be greater than the assessment site length (e.g. if wetted bank is on both sides of the site or on an island

Post-works Habitat Assessment				
Date of post-works assessment:		Assessors name:		
Site length (definition)	Approximate length of assessment site: (m)			Photographic record
Wetted vs. dry channel width	Average wetted width over assessment site: (m) Average dry width over assessment site: (m)			Pre-works photo date:
Flow conditions	□ Low flow	□ Base flow		□ High flow
Flow types present In linear metres (definition)	Rapid: (m)	Deep run: (m) Shallow run (m)	Riffle: (m)	Pools: (m) Pools (number):
Maximum depth found within assessment site	Maximum depth: (m)	Approximate lineal distance of run length (m)		
Wetted bank habitat (definition)	Total length of wetted habitat against bank: (m)			
Overhanging vegetation	Total length of overhanging vegetation: (m)			
Bank undercut	Total length of undercut: (m)			
Channel shape	☐ Artificially channelised	☐ Straight	☐ Weakly sinuous	☐Strongly sinuous
Braided channel?	☐ Single thread channel	☐ Split channel	☐ Braided channel	

Aerial perspective of work site	
Before work	After work

Flow path
Has the flow trajectory been changed in such a way that it will affect downstream habitat: □yes □no. If yes what are the effects:

Backwater habitat
Has existing backwater habitat at this work site been affected by the works: □yes □no. If yes, provide details: Has new backwater habitat been created at the works site: □yes □no. If yes provide details:

What other 'best practice' methods have been implemented at the site: