Regulatory barriers to uptake of farm-scale diffuse pollution mitigation measures

An assessment of Regional Plan requirements and regional council incentives

A report prepared for DairyNZ and MBIE

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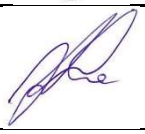	Formatting checked by:	Juliet Milne
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Cover photo: Small scale constructed wetland on a Waikato dairy farm. [Chris Tanner, NIWA]

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Contents

Executive summary

A growing number of mitigation initiatives are being explored and trialled across rural New Zealand to reduce the impact of intensive land use on freshwater quality. Examples include planted riparian buffers, constructed wetlands and woodchip denitrification filters. While the evidence base for the technological efficacy of these mitigation initiatives continues to grow, a wide range of social/behavioural, cultural, economic and regulatory barriers may limit their adoption by landowners. Assessing some of these barriers forms part of the scope of the NIWA-led and MBIE-funded "*Doubling on-farm diffuse pollution mitigation"* research programme on next generation nutrient filter technologies.

In March 2019, NIWA partnered with DairyNZ to assess regional plan requirements likely to apply to common mitigation initiatives intended to reduce farm-scale diffuse nutrient pollution. Landowners may be reluctant to invest in these (and other) mitigation initiatives if the regulatory requirements are uncertain, ambiguous, costly or overly constraining. At the request of DairyNZ, we also compiled a summary of existing incentives (e.g., subsidies) available from regional councils to assist with mitigation uptake.

Regulatory barriers

The scope of assessment was limited to a review of regional plan[1] requirements relevant to the construction, operation and maintenance of edge-of-field, farm-scale mitigation technologies. The evaluation focussed primarily on the following edge-of-field mitigations: constructed wetlands, seepage wetlands, riparian buffers, N-bioreactors, P-filters, detainment bunds, two-stage ditches, bank re-battering, silt traps and in-channel remediation works (e.g., wood or woodchip addition). Such mitigations generally involve activities – such as earthworks, stream diversions, stream bed disturbance and discharges to land or water – that may trigger the need for resource consent(s) in accordance with regional plans prepared under the Resource Management Act 1991. Activities such as land disturbance may also trigger the requirement for consent(s) under other regulation, notably city or district plans and the Building Act 2004. Requirements for consents under other regulation were not reviewed in this report.

The review was desktop-based and involved summarising relevant permitted activity rules in regional plans across New Zealand to identify the common conditions associated with these rules. Resource consent applications and officer reports were reviewed for five mitigation projects, and face-to-face meetings were also held with one or more regulatory and/or land/catchment management staff across four councils to establish how rules were interpreted. Greater Wellington Regional Council, Environment Canterbury, Waikato Regional Council and Bay of Plenty Regional Council were selected as a subset of councils known to have had recent experience with the types of farm-scale diffuse nutrient pollution mitigation measures addressed in this report.

We found that a very wide range of activities associated with the construction, operation and maintenance of edge-of-field, mitigation measures could potentially trigger the requirement for resource consent(s) under regional plan rules. These activities relate to the use of land (e.g., earthworks to construct a wetland), disturbance of river (or lake) beds (e.g., for planting or construction of a culvert or dam), the taking, use, damming or diversion of water, and the discharge of contaminants to land or water (e.g., stormwater during earthworks or agrichemicals from spraying). Although permitted activity rules exist for most of these activities, deposition of

[1] Including the relevant provisions of unitary plans or district plans of the six unitary councils (e.g., Auckland Council, Tasman District Council) that have the responsibilities, duties and powers of a regional council. For the purposes of this report, these councils are referred to as regional councils.

woodchips into land and associated leachate discharges are not authorised by permitted activity rules nor are, in many regions, construction of monitoring bores. Moreover, most permitted activity rules are accompanied by lengthy lists of conditions. Failure to meet one or more of these conditions will trigger the need for resource consent.

An important step is determining whether the proposed mitigation will interact with a river or stream, as defined under the RMA (i.e., includes modified rivers and streams). By avoiding construction in, or modification/disturbance of, the bed or banks of a river, stream, lake or natural wetland, the likelihood that a resource consent will be required is reduced. The volume of earthworks, dimensions of structures, timing of instream activities such as planting and construction of structures, and the amount of water to be taken are also key factors in determining consent requirements.

There is commonality across many of the standard conditions attached to permitted activity rules in regional plans. The provision of fish passage and avoidance of works during fish spawning are almost universal requirements across most permitted activity rules involving the disturbance of the beds of rivers and lakes or the taking, using, damming or diversion of water. Other common conditions include minimising the amount and effects of sediment release to surface water, avoiding or remedying any erosion or scouring of stream banks, and avoiding impeding flood flows and flooding of any neighbouring property.

When it comes to the more specific conditions of permitted activity rules, such as the maximum upstream catchment areas and design criteria for construction of new structures (e.g., culverts and dams), significant regional variation exists. Variation was also found with regard to the use and definition of specific terms in plans. For example, some plans defined a drain while others referred to a drainage canal, a farm drainage canal or a land drainage canal. In a few regions a modified river was distinguished from a highly modified river, with the latter defined as one that had been sufficiently modified and channelled to the extent that it has the characteristics of a drain. Implementation of the recently introduced National Planning Standards will provide for greater consistency in the definitions of many terms used in regional plans (and regional policy statements and district plans), as well as greater consistency in plan structure and layout.

Examination of five recent edge-of-field diffuse pollution mitigation projects across four regions indicated that it is difficult to meet many of the conditions associated with permitted activity rules. In some cases, conditions were not met on technical grounds (e.g., a permitted activity rule for disturbance of a riverbed did not authorise such disturbance for the purposes of wetland construction) or there was no relevant permitted activity rule that applied to an activity (e.g., depositing woodchips into land in a manner that may result in contaminants entering groundwater). In three of the projects, the overall regional plan rule classification for the suite of activities associated with the resource consent application defaulted to discretionary and, in one project, non-complying. This occurred even though the mitigation projects had the primary or sole purpose of environmental enhancement.

It is unlikely that implementation of many diffuse pollution mitigation measures could be catered for through permitted (or even controlled) activity rules, particularly those located in or adjacent to waterbodies. This is because the construction, operation and maintenance of most mitigations have at least the potential to create short-term adverse effects that are easier to manage through more restrictive classes of rules. Mitigation design and implementation must be customised to address specific site and environmental requirements, making it more difficult to establish a single set of standard conditions that could be applied to a permitted or controlled activity rule.

Although it may be inevitable that a resource consent will be required to construct or implement a mitigation in or near the beds of rivers and other natural waterbodies, it might be possible to streamline the consenting process. New restricted discretionary rules that specifically target the suite of activities associated with implementing mitigations could be developed as part of plan change/review processes. Researchers and experienced practitioners could provide information to assist policy makers with the development of these rules, including:

- an overview of common mitigation measures, evidence of the scale and extent of their environmental benefits, and any knowledge gaps around their performance, and
- standard design requirements and recommended best management practices to avoid, remedy or mitigate potential adverse effects associated with their construction, operation and maintenance.

This information could also serve as guidance to assist council staff with their assessment of resource consent applications, thereby further streamlining the consenting process.

Incentives

We assessed the incentives available to landowners to assist with implementation of farm-scale diffuse pollution mitigation measures. After an initial review of regional council websites for relevant funding or subsidy schemes we spoke to relevant staff at each council to identify or clarify eligibility criteria, application requirements and the application process. We met with staff where visits were scheduled with councils to discuss regulatory barriers. We were also given access to email responses to an informal and independent survey of regional council grants and funding undertaken through the regional sector's Land Managers Special Interest Group in mid-2019.

All but one regional council made financial grants or other funds available for environmental enhancement projects, including implementation of diffuse pollution mitigation measures. Although riparian planting and fencing remain the most commonly funded activities, almost half of the councils made available financial or other support (e.g., provision of free or subsidised plants, assistance with consenting and monitoring) for a wider suite of initiatives specifically intended to improve water quality. Further, while some councils have traditionally engaged with any landowner or group interested in environmental enhancement, in some regions funding of projects in catchments with degraded or declining water quality is now prioritised, alongside biodiversity enhancement or protection. Implementation of the National Policy Statement for Freshwater Management, notably the requirement to maintain or improve freshwater, is a key driver behind this, as evidenced by Bay of Plenty Regional Council establishing a new Environmental Programme Grants Policy in 2019.

The availability of regional council funding and assistance to landowners interested in mitigation projects varies from region to region, along with the eligibility criteria and application process. Some of this information is not easy to locate on council websites and staff from several councils indicated a degree of flexibility exists with regard to assessing mitigation projects. It is therefore in the interest of the landowner to contact the council – probably a land or catchment management officer in the first instance – to discuss their individual situation and to identify what type(s) of funding and other assistance may be available.

1 Introduction

A growing number of mitigation tools are being explored and trialled across rural New Zealand to reduce the impact of intensive land use on freshwater quality. Examples include planted riparian buffers, constructed wetlands, and woodchip denitrification filters. While the evidence base for the technological efficacy of these mitigation initiatives continues to grow, a wide range of social/behavioural, cultural, economic and regulatory barriers may limit their potential adoption by landowners. Understanding some of these barriers forms part of the scope of the NIWA-led and MBIE-funded "*Doubling on-farm diffuse pollution mitigation"* research programme on next generation nutrient filter technologies.

1.1 Scope

In March 2019, NIWA partnered with DairyNZ to assess regional plan requirements that apply to common mitigation initiatives designed to reduce diffuse nutrient pollution at the farm-scale. Landowners may be reluctant to invest in these (and other) mitigation initiatives if the regulatory requirements are uncertain, ambiguous, costly or overly constraining. At the request of DairyNZ, we also compiled a summary of existing incentives (e.g., subsidies) available from regional councils to assist with mitigation uptake.

The project was limited to a review of regional plan[2] requirements relevant to the construction, operation and maintenance of edge-of-field, farm-scale mitigation technologies, particularly when sited close to or within waterways and drains. The evaluation considered the following edge-of-field mitigations: constructed wetlands, seepage wetlands, riparian buffers, N-bioreactors, P-filters, detainment bunds, two-stage ditches, bank re-battering, silt traps and in-channel remediation works (e.g., wood or woodchip addition). Implementation of such mitigations generally involves activities such as earthworks, stream diversions, stream bed disturbance, and discharges to land or water. These activities may trigger the need for resource consents in accordance with regional plans prepared under the Resource Management Act 1991 (RMA). Some of these activities, particularly land disturbance and construction of structures such as dams, may also trigger the requirement for consents under other regulation, notably city or district plans and the Building Act 2004. The requirement for consents under other regulation is not reviewed here.

In accordance with the project brief, this review has considered:

- The types of resource consents required (e.g., land use permit to dam or reclaim, water permit to take or divert from a water body, discharge permit to discharge contaminants to land or water), including any variation in regional plan rule requirements:
  - according to whether a watercourse is natural, modified or artificial (and where possible, how councils determine the watercourse 'status'),
  - arising from the proximity of mitigation measures to a water body, including instream *vs* out of stream, and
  - related to the dimensions of structures (e.g., dam wall heights, impoundment volumes or catchment areas, wetland surface area/volume).

[2] Including the relevant provisions of unitary plans or district plans of the six unitary councils (e.g., Auckland Council, Tasman District Council) that have the responsibilities, duties and powers of a regional council. For the purposes of this report, these councils are referred to as regional councils.

- When fish passage would become an issue, and what sort of assessment of effects might be required.
- Existing council programmes that may assist with mitigation uptake, and the potential for mitigation initiatives to act as an offsetting mechanism (e.g., credits in N budgets).
- The core set of information needs, from a regional council perspective, that would likely support a resource consent application(s).

1.2 Approach

1.2.1 Regulatory barriers

The review was desktop-based and involved tabulating a summary of relevant permitted activity rules contained in regional plans across New Zealand, to identify the common conditions associated with these rules. Conditions common to several regional plans may signal areas where particular attention will be needed when developing guidance to assist with policy development or consenting. Resource consent applications and officer reports were then reviewed for five mitigation projects to identify which specific activities triggered a requirement for a resource consent. Face-to-face meetings were also held with one or more regulatory and/or land/catchment management staff across four councils to check interpretation of rules: Greater Wellington Regional Council, Environment Canterbury, Waikato Regional Council and Bay of Plenty Regional Council. These councils were selected as a subset of those that were known to have had recent experience with the types of farm-scale diffuse nutrient pollution mitigation measures considered in this report.

1.2.2 Incentives

The assessment involved an initial review of regional council websites to identify potentially relevant funding or subsidy schemes, followed by telephone calls to each council to identify or clarify eligibility criteria, application requirements and the application assessment process. In most cases, calls were made to a council land management officer. Opportunities to speak with staff face to face were taken where visits were scheduled with councils to discuss regulatory barriers. In addition, following a meeting with land management staff at Bay of Plenty Regional Council in September 2019, we were provided with a suite of individual council email responses on incentives canvassed via the regional sector's Land Managers Special Interest Group (this was undertaken independently of this project).

1.2.3 Caveats and limitations

- Although the review of regional plans focused primarily on rules rather than objectives and policies, all components are applicable when evaluating some proposed activities (e.g., one that triggers a non-complying rule, see Figure 3-1).
- Many regions are in the process of updating their regional plans to give effect to 'rolling' amendments to the National Policy Statement for Freshwater Management (NPS-FM) and the requirements of other recently introduced national legislation. As a result, the status of plans across councils varies from draft to proposed to fully operative, with some regions operating under parts of existing (generally 'dated') plans as well as parts of proposed plans. A pragmatic approach was taken to focus on capturing the most recent thinking around rules, even if the plan was not yet operative (i.e., preference was given to review of draft and proposed plans rather than dated existing plans).

- Rules in five regional plans were reviewed between March and May 2019, with the remaining 11 plans reviewed in March 2020. Due to the highly evolving nature of current regional planning, details of some rules have already changed (e.g., following the release of decisions on Greater Wellington Regional Council's Proposed Natural Resources Plan in July 2019). With a new draft NPS-FM and a new Proposed National Environmental Standard for Freshwater Management released for consultation in September 2019, more changes to plan rules will follow. It was beyond the scope of this report to evaluate changes made in response to very recently released draft and proposed national regulations.
- The structure and content of regional plans vary across regions, with potentially large numbers of rules to check and cross reference. The assessment of permitted activity rules in Section 3 is therefore intended to be indicative, rather than definitive or exhaustive, of the rules most relevant to implementing diffuse pollution mitigation measures.
- Many regional plans now contain both region-wide and sub-regional (catchment-specific) provisions, with potentially up to 10 sub-regional plans at various stages of preparation (e.g., the Canterbury region is divided into 10 zones). For the purposes of this exercise, it was not possible or necessary to review all sub-regional plan rules; the types of activities involved with the construction, operation and maintenance of edge-of-field, farm-scale mitigation technologies tend to be addressed under regionwide plan rules. In reality, if a resource consent was being applied for, the provisions of any relevant sub-regional plan would need to be reviewed to check for additional or specific location-based restrictions or caveats on activities.
- As noted in Section 1.1, there is regulation beyond regional plans that should be checked when considering implementation of edge-of-field, farm-scale mitigation technologies. Examples include district plans, the Building Act 2004 and the Freshwater Fisheries Regulations 1983.
- The discussions held with regional council staff helped to clarify both regulatory barriers and council incentives, but were not in-depth and do not constitute formal council advice for adoption or consenting of specific mitigation measures. As our review of incentives was limited to readily accessible information, it is possible that additional financial or other incentives may exist to those summarised in Section 5.

1.3 Report outline

This report comprises seven sections:

- Section 2 briefly outlines several common edge-of-field, farm-scale mitigation measures to set the scene for the types of activities associated with their construction, operation and maintenance that might require resource consent (Section 3).
- Section 3 summarises the findings from the assessment of regional plan permitted activity rules for common activities associated with the the construction, operation and maintenance of mitigations. It includes an overview of definitions in the RMA and various regional plans that are critical when determining the applicability of regional plan rules.

- Section 4 outlines five recently consented mitigation projects, including the specific activities that triggered the requirement for a resource consent.
- Section 5 summarises our collation of existing incentives offered by regional councils that might assist with uptake of edge-of-field, farm-scale mitigation measures.
- Section 6 discusses the key findings from Sections 3 to 5 and makes a case for the development of specific planning provisions and guidance for mitigation measures. Key information required to support a resource consent application is also summarised.
- Section 7 presents conclusions drawn from the project findings.

2 Overview of mitigation types

In this section we briefly outline several edge-of-field and farm-scale mitigation measures; constructed wetlands, denitrification bioreactors, detainment bunds and riparian buffers. This overview sets the scene for the types of activities associated with their construction, operation and maintenance that might require resource consent (Section 3).

2.1 Constructed wetland

A constructed wetland (CW) is a treatment system that uses natural processes involving wetland vegetation, soils, and their associated microbial assemblages to improve water quality. In the context of this report a CW is an artificial wetland designed to remove sediment and nutrients from agricultural runoff or drainage water that is passed through them.

Section 4 of this report includes examples of constructed surface-flow wetlands which comprise shallow channels planted with tall emergent wetland plants (Figures 2-1 and 2-2). These types of wetland remove nitrate-nitrogen (N) through microbial denitrification, supplemented by plant uptake and accretion in sediments. Denitrification is promoted by close contact with organic sediments and wetland plants that provide anoxic conditions and organic matter (e.g., through decomposing plant litter) for denitrifying microbes. Anoxic conditions can also be created or maintained through the addition of other organic material such as woodchips or sawdust (Tanner et al. 2020).

Surface-flow wetlands also remove phosphorus (P), principally particulate-associated P, primarily through settling in deeper and vegetated parts of the wetland (Tanner et al. 2020). Phosphorus removal can also be promoted using P-sorbing media, including iron- and calcium-rich materials (Ballantine and Tanner 2010), although these materials generally have a finite life and will need to be replaced when saturated.

Wetlands can be constructed off-line or in-stream and generally require significant earthworks. Off-line wetlands generally only intercept a proportion of the flow, and so receive and remove less contaminant (Tanner et al. 2020, Woodward et al. 2020).

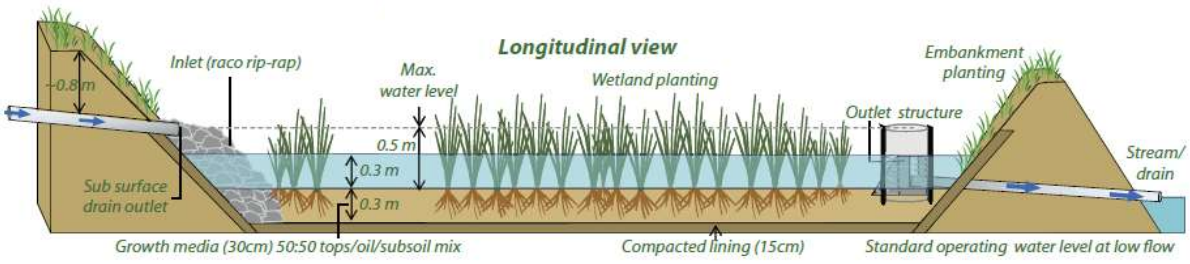

Figure 2-1: Cross section schematic of a surface-flow constructed wetland. Source: Tanner et al. (2010).

Figure 2-2: Small scale constructed wetland intercepting tile drainage on a Waikato Dairy Farm. Photo: Chris Tanner (NIWA).

2.2 Denitrification bioreactor

A denitrification bioreactor is a woodchip denitrification wall or a denitrifying permeable reactive barrier (PRB) but also goes by other names; woodchip bioreactor, denitrifying wall, bioreactor wall, denitrifying bed, and bioreactor bed. These technologies involve placing woodchips or other solid porous organic substrate within the ground below the water table or in a surface water body such as a farm drain. They can also be used to treat subsurface drainage (e.g., tile or mole drains). The organic material provides organic carbon, which stimulates microbial activity that in turn removes nitrate from groundwater or surface water passing through the wall. Similar to constructed wetlands, bioreactors operate under anoxic conditions, favourable to the conversion of nitrate to nitrogen gas. An example of a PRB inserted in a shallow gravel aquifer system is shown Figure 2-3 and outlined as a case study in Section 4.4.

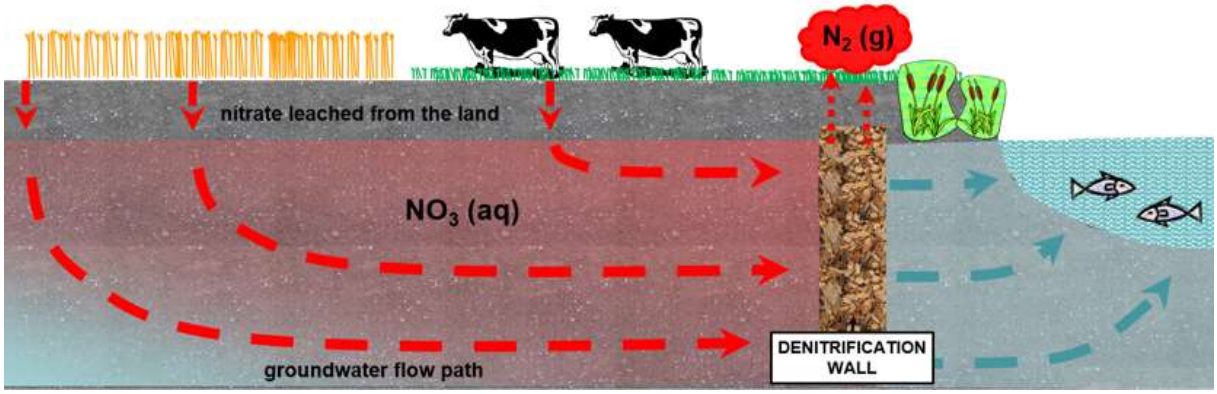

Figure 2-3: Cross section schematic illustrating how a subsurface PBR intercepts and treats nitrate in groundwater. Source: Farmers Weekly (2017).

Bioreactors can be installed either in-line (within a drain, Figure 2-4) or off-line (water is diverted into the bioreactor via an offtake). Inlet and outlet structures are required, with excess flow bypassed. A sediment trap is also required upstream to prevent clogging of the bioreactor bed (Schipper et al. 2010).

Over time the performance of a bioreactor performance will decline. The expected life is 10-20 years depending on the location and the type of carbon source. After this time the carbon source will need to be added to or replaced (Schipper et al. 2010).

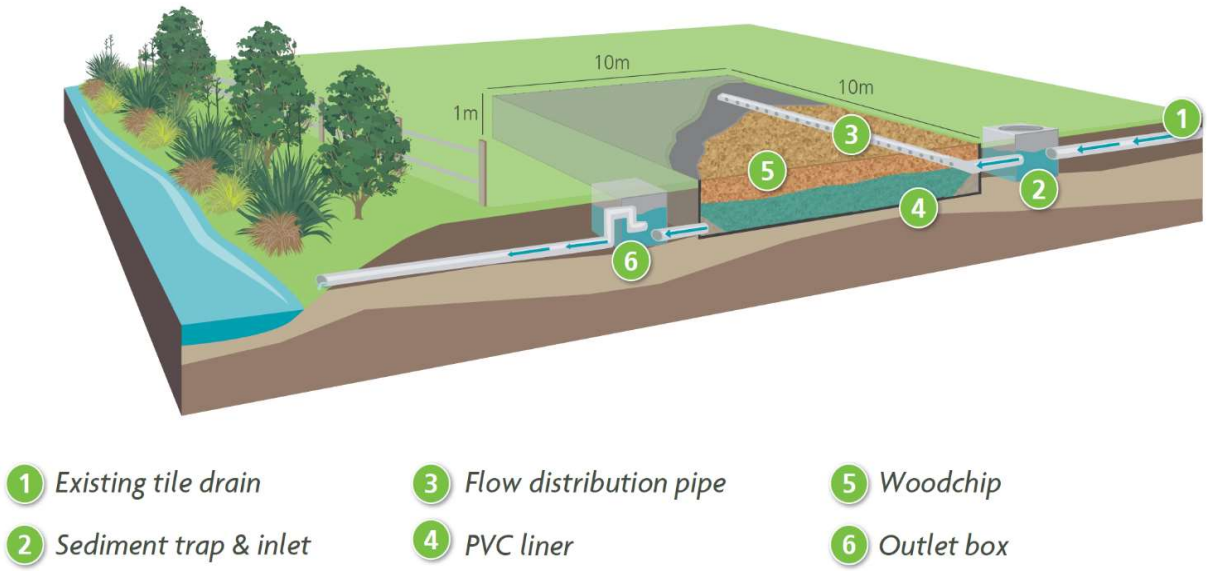

Figure 2-4: In-line bioreactor bed. Source: Tanner et al. (2010).

2.3 Detainment bunds

A detainment bund (DB) is a low (~2 m high) earthen dam with a decanting outlet control. It is constructed to intercept and temporarily hold large quantities of surface runoff from pasture (Levine et al. 2019, Figure 2-5). A DB essentially operates as a sedimentation basin; it works by slowing the velocity of the runoff water, allowing time (~3 days) for fine sediment particles to settle, along with attached P.

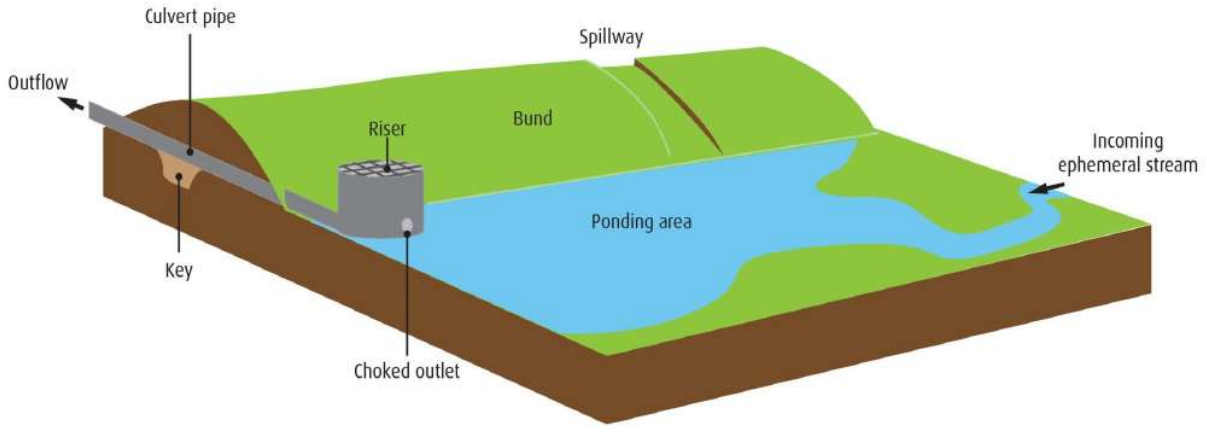

Figure 2-5: Sediment detention bund schematic. Image courtesy of John Paterson (Bay of Plenty Regional Council).

Numerous DBs are in place in the Lake Rotorua catchment. While initially installed to target sediment and particulate P, research has now extended to the capture of dissolved reactive P (DRP). Two approaches are relevant: natural retention of DRP by adherence to sediment whilst held in the DB pond, and enhanced detention following treatment of the pond inflow with a non-toxic flocculant (Dorner et al. 2018). The second approach is still to be assessed in a field-trial.

Detainment bunds require earthworks to create the excavated settling pond/storage area. However, unlike sediment traps which target coarser sediment particles, desilting of the DB to remove accumulated sediment is only infrequent required.

2.4 Riparian buffers

Riparian buffers are vegetated "buffer strips" commonly used to stabilise stream banks and capture and filter sediment, nutrients and other contaminants moving in overland and subsurface flow (Figure 2-6). Riparian buffers can also remove nutrients in shallow groundwater via assimilation in the root zone and denitrification. In addition to improving water quality of adjacent waterbodies, buffer strips provide multiple other benefits (e.g., habitat and shade, increased biodiversity, wildlife corridors).

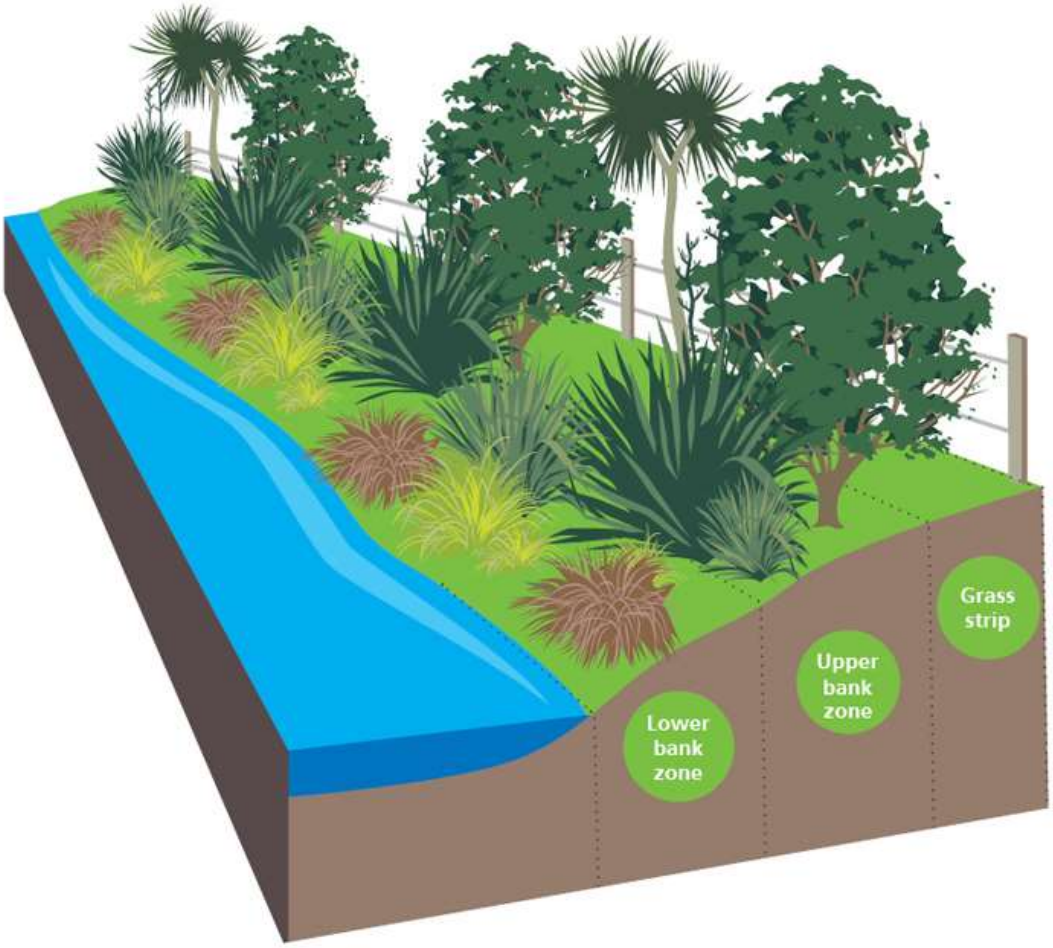

Figure 2-6: Schematic of a riparian buffer, illustrating three different zones. Image from DairyNZ website (https://www.dairynz.co.nz/environment/waterways/planting-waterways/ accessed 20 May 2019).

3 Regulatory requirements

The edge-of-field, farm-scale mitigation measures outlined in Section 2 involve one or more activities (e.g., excavation of land, diversion of water) that may require resource consent from regional councils under Sections 9, 13, 14 and 15 in Part 3 of the RMA:

- Section 9: Restrictions on the use of land
- Section 13: Restrictions on certain uses of beds of lakes and rivers
- Section 14: Restrictions relating to the taking, using, damming or diversion of water
- Section 15: Discharge of contaminants

Consent requirements are determined by examining the relevant regional plan(s) to verify the status of the activity. This section summarises the provisions of relevant regional plan permitted activity rules and associated conditions. If the permitted activity conditions can't be met, a resource consent will be required.

3.1 Activity status

Sections 77A and 87A of the RMA provide for six different classes (status) of activity (Figure 3-1). The rules in a Regional Plan determine the status of a particular activity such as discharging drainage water into another waterbody or constructing a culvert. Many of the activity classes are subject to associated conditions, permissions or requirements that must be met in order for that activity status to apply.

As outlined in Section 3.3, although many of the activities associated with farm-scale mitigations potentially qualify as permitted activities, generally multiple conditions must be satisfied. If this is not possible, the activity status defaults to one that requires resource consent (e.g., a controlled or discretionary activity). Moreover, as illustrated in Section 4, where multiple resource consents are required for a mitigation proposal to proceed, the activities tend to be 'bundled' into one application with the most restrictive activity classification applied to the overall proposal. This highlights the importance of understanding and, where possible, working within the constraints of permitted activity rules.

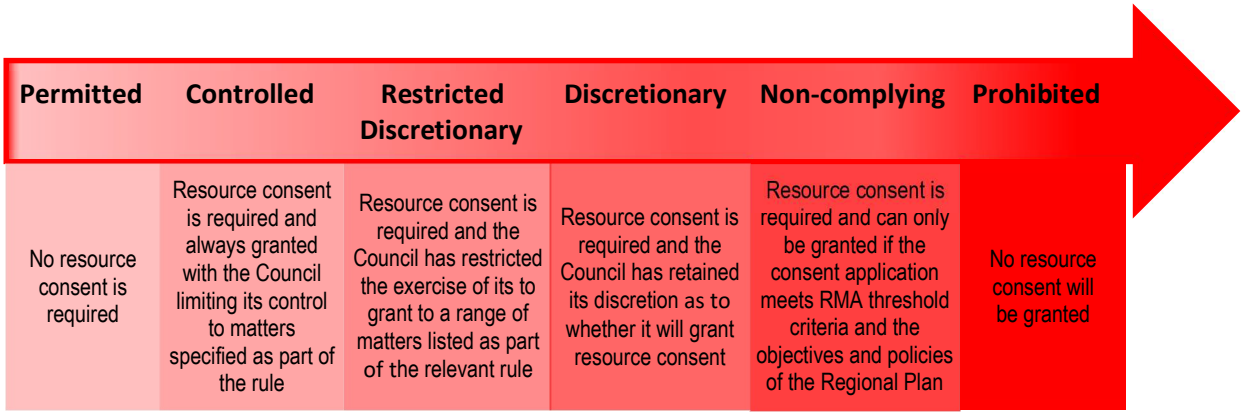

Figure 3-1: Summary of the different classes (status) of activity under the RMA and addressed in regional plans.

3.2 Key terms

Many rules in regional plans contain key terms with associated definitions. These definitions must be checked when assessing whether a proposed activity complies with a particular rule. For example, it may be a permitted activity to discharge drainage water into an artificial watercourse but not into a stream. In this instance, it is necessary to check what is meant by "drainage water", "artificial watercourse" and "stream". Although some terms – such as *water* and *river* – are defined under the RMA, there are currently few universal definitions that are used across all regional plans. Each regional plan needs to be checked on a case-by-case basis to interpret rules for various activities.

Table 3-1 summarises some key terms relevant to assessing the status of activities associated with the construction, operation and maintenance of common edge-of-field mitigations. Across the 16 Regional Plans that were reviewed, just seven defined a *drain*, with most (10) defining an *artificial watercourse* and seven defining a *modified watercourse* or a *highly modified watercourse*. *Intermittent* and *ephemeral* (watercourses) were defined in six and seven plans, respectively.[3] Bay of Plenty's Regional Natural Resources Plan (RNRP) contained the most terms relating to drains and different types of watercourses, and was one of seven regional plans to differentiate between a modified and an artificial watercourse. The RNRP also contained a comprehensive description of what does and does not constitute a wetland, accompanied by photographs and a useful diagram (Figure 3-2) that illustrates what constitutes a wetland on land vs a wetland on the bed of a river or lake; this is important because, as illustrated in Section 4, construction of the latter will nearly always require a resource consent.

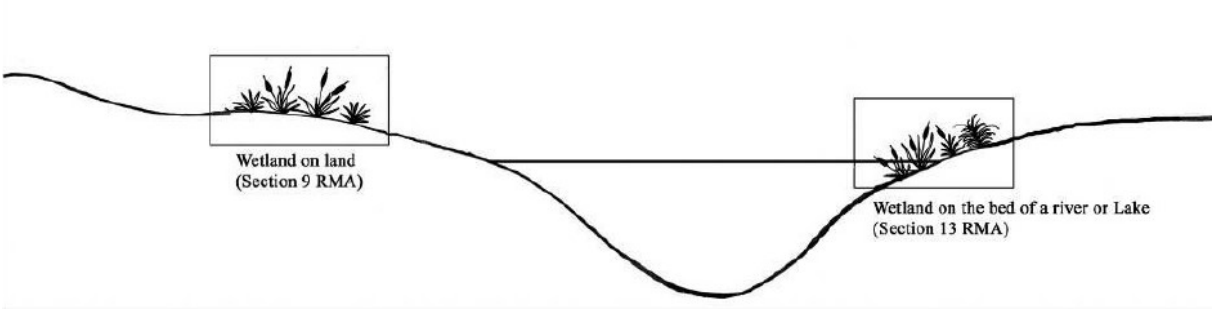

Figure 3-2: Illustration of a wetland on land vs a wetland on the bed of a river or lake. Reproduced from Bay of Plenty Regional Council's Regional Natural Resources Plan.

Although the definitions for common terms vary between regional plans, a *modified watercourse* is consistently differentiated from an *artificial watercourse* and a *drain* by being defined as a river or stream that has undergone some form of modification (e.g., channel straightening). This is (required to be) consistent with the definition of a *river* under the RMA:

> *"A continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal)."*

[3] Note that some regional plans defined terms *indirectly* via the definition of a related term. For example, Taranaki Regional Council's Draft Soil and Water Plan defines a drain as any artificial watercourse and includes references to different types of drains. Similarly, the RMA's definition of a river also include reference to intermittent rivers.

Table 3-1: Selected terms defined in various regional plans of relevance when assessing the status of activities associated with the construction, operation and maintenance of edge-of-field, farm-scale diffuse source pollution mitigation measures. Excludes terms defined or referenced indirectly under other terms (e.g., in the RMA an *intermittent river* is referred to within the definition of *river*). Refer to Appendix A for regional plan references.

	Drain	Drainage / Land Drainage	Drainage Canal	Land Drainage Scheme	Modified Watercourse	Artificial Watercourse	Water Race	Intermittent Watercourse /River	Ephemeral Stream	River	Bed	Groundwater	Bore	Riparian Area / Margin	Vegetation Clearance
RMA										✓	✓				
Northland RC		✓		✓		✓		✓	✓	✓			✓		✓
Auckland C						✓		✓	✓	✓		✓	✓	✓	✓[7]
Waikato RC		✓	✓[1]		✓	✓				✓		✓		✓	✓
Bay of Plenty RC	✓		✓[2]	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
Gisborne DC	✓				✓	✓		✓	✓	✓		✓	✓	✓	✓
Hawke's Bay RC		✓				✓		✓		✓		✓	✓	✓	✓
Taranaki RC		✓			✓					✓	✓			✓	✓[8]
Horizons RC						✓					✓[6]		✓		✓
Greater Wellington RC	✓				✓[5]		✓		✓				✓		✓
Tasman DC			✓[1]		✓	✓				✓		✓	✓		
Nelson CC										✓	✓	✓	✓	✓	✓
Marlborough DC			✓							✓				✓	✓
West Coast DC	✓								✓	✓		✓		✓	✓[8]
Environment Canterbury	✓			✓[4]		✓	✓			✓	✓			✓	✓
Otago RC	✓	✓					✓					✓	✓		
Environment Southland					✓	✓		✓	✓	✓		✓	✓	✓	

[1] Farm Drainage Canal, [2] Land Drainage Canal, [3] Drainage system, [4] Drainage channel, [5] Highly modified river or stream, [6] Active bed, [7] Vegetation alteration or removal, [8] Vegetation disturbance.

An artificial watercourse has a wider definition than a drain in regional plans and tends to cover one or more of man-made channels, irrigation and drainage canals, water supply races, and roadside drains (Figure 3-3). In contrast, a drain is typically defined as an artificial watercourse used for land drainage purposes; it can be a surface drainage channel (Figure 3-3), an open race or sub-surface pipe, a tile or mole drain, or a roadside drain.

Figure 3-3: Examples of watercourses that are not defined as a river under the RMA. Clockwise from top left: An irrigation channel, a water supply race, an artificially constructed drain, an artificially constructed drain lacking surface flow, a hydro canal and a farm drain. Photos: Otago Regional Council[4].

Determining if a waterway is a river or stream may require a discussion with the relevant regional council. The factors the council will consider generally include:

- If the watercourse is shown on a topographical map,
- If the source of the water course is from hills/ranges, etc.,
- If the watercourse has a defined bed or pathway,
- If the watercourse is in an original natural channel,
- Whether or not water flows all or part of the time,
- If the watercourse is 'named' or goes by a local name,
- If the watercourse supports aquatic life, and
- If there are historic structures (e.g., bridge) over the watercourse.

Most of the regional plans define a *riparian area* (or *riparian margin*) and what constitutes *vegetation clearance* (Table 3-1).

[4] *What is a river guide sheet 05112015*, accessed 20 May 2019 from: https://www.orc.govt.nz/media/4408/what-is-a-river.pdf

3.3 Rules for different activities associated with farm-scale mitigations

This section outlines regional plan permitted activity rule requirements relevant to common activities associated with edge-of-field, farm-scale mitigations. Activities have been grouped as follows:

- Earthworks, vegetation clearance and soil disturbance,
- Plant introduction and removal,
- Channel realignment, deepening, widening or cleaning,
- Construction and use of culverts and intake and discharge structures,
- Taking/diverting or discharge of water,
- Dams and damming water, and
- Discharge of contaminants to land and water.

Brief commentary is also provided on the establishment of *monitoring bores and monitoring stations* owing to the significant research and monitoring requirements associated with many newly established or proposed edge-of-field mitigations.

The above list of activities is not considered in relation to natural wetlands because, with the possible exception of specific types of planting and monitoring structures, they are not provided for under permitted activity rules.

3.3.1 General permitted activity conditions

Activities such as construction of culverts, drain maintenance and the introduction or removal of instream plants usually involve disturbance of the bed of a river, stream or artificial waterway. Many regional plans contain a set of *general conditions* that apply to all bed disturbance activities as well as further conditions that relate to the specific activity. For example, the Horizons One Plan permitted activity rule for planting comprises five conditions, one of which is that the activity must meet the general conditions listed in Section 17.3 of the Plan. Some of the conditions summarised in Tables 3-2 to 3-4 frequently appear as general conditions (e.g., maintenance of fish passage). Note that not all of the general conditions have been included in these tables (e.g., avoiding disturbance of archaeological or waahi tapu sites).

Where activities occur in or near waterways specified in a regional plan as being managed for flood protection purposes, additional bylaws (e.g., Canterbury Regional Council Flood Protection and Drainage Bylaw 2013) or conditions may apply (e.g., prior approvals or notification from the relevant council scheme operator, seasonal restrictions).

3.3.2 Earthworks, vegetation clearance and soil disturbance

Most regional plans make provision for small-scale earthworks, vegetation clearance and soil disturbance as permitted activities near waterways in 'low risk' areas (e.g., on stable land). Table 3-2 indicates that conditions placed on permitted activity rules often restrict the area of land or volume of earthworks that can occur within the riparian margin, with the specified area or volume varying between regions. Minimum setback distances often also apply to vegetation clearance (e.g., 5 m in Hawke's Bay region for any permanently flowing river or any other river over 2 m wide), with the distance varying in some regions depending on location (e.g., whether inside an area of high soil erosion risk) and land slope. Common general conditions require any direct discharges of sediment to water to be avoided, and that no significant change in water colour or clarity exists after reasonable mixing, or that instability, subsidence or erosion of land does not occur as a result of the activity.

Table 3-2: Summary of typical permitted activity conditions in regional plans relating to earthworks, vegetation clearance (excluding forestry) and soil disturbance undertaken in close proximity to surface waterbodies (excluding natural wetlands). Not every PA condition is listed. Refer to Appendix A for regional plan references.

	Conditions to be satisfied					
Region	Specific restrictions on area of land or volume of earthworks within the riparian margin	Minimum setback distance from streams for vegetation clearance	Vegetation/soil prevented from entering surface water	No resulting significant change in colour/clarity of adjacent water body (or other s107 effects)	No resulting land instability, subsidence or erosion	Site stabilisation upon completion of works
Northland	200 m^2 exposed earth	10 m	✓	✓	✓	✓
Auckland	1,000 m^2	20 m		✓	✓	✓
Waikato	Soil disturbance and vegetation clearance are not provided for as a permitted activity in any 'high risk erosion area'		✓	Suspended sediment criteria apply	✓	Within 6-12 months
Bay of Plenty	Max. exposed land area 400 m^2 [a]	5-25 m, depending on land slope & location	✓	✓	✓	Within 3 months
Gisborne			✓	✓	✓	✓
Hawke's Bay		5 m	✓	✓		Within 18 months
Taranaki	< 8 ha, 24,000 m^3 soil disturbance			✓	✓	Within 6 months
Manawatu-Whanganui	(2,500 m^2 earthworks per property per 12-month period)	5 m		✓		
Wellington	(3,000 m^2 earthworks per property per 12-month period)		✓	✓	✓	Within 6 months
Tasman	✓	10-20 m depending on land slope and vegetation type [b]	✓	✓	✓	Within 12 months
Nelson		5 m	✓	✓	✓	Within 6 months
Marlborough	1,000 m^2 per 24-month period	8 m		✓	✓	Within 24 months
West Coast	25 m^3		✓	✓	✓	✓
Canterbury	500 m^2 or 10% of the area	5 m		Suspended sediment criteria apply		✓
Otago	No relevant permitted activity rules exist					
Southland	No relevant permitted activity rules exist					

[a] 10 m for designated wetlands, trout spawning sites and other sites of significance. [b] For streams >3 m average bed width.

Environment Canterbury's Land and Water Regional Plan (LWRP) has a specific permitted activity rule for earthworks undertaken over aquifers. This rule requires:

- over coastal confined aquifer systems – more than 1 m of undisturbed material between the deepest part of the excavation and the first aquifer, with a setback distance of 50 m from any surface waterbody where more than 100 m^3 of material is to be excavated, and
- over unconfined and semi-confined aquifers – a maximum of 100 m^3 of material to be excavated unless there is more than 1 m of undisturbed material between the deepest part of the excavation and the seasonal high water table level and the distance from any surface waterbody is at least 50 m.

We did not identify any relevant permitted activity rules for earthworks or vegetation clearance in regional plans for Otago or Southland.

3.3.3 Stream or drain channel realignment, deepening, widening or cleaning

Channel realignment, deepening or widening and removal of bed material (e.g., sediment) as part of channel maintenance are generally only provided for as permitted activities in artificial watercourses such as drains. A few regions (e.g., Wellington, Southland) extend permitted activity status to include maintenance activities in *modified or highly modified rivers* – which are essentially defined as those that have been modified and channelled to the extent that they have the characteristics (in form or function) of an artificial farm drainage canal.

The standard conditions associated with permitted activity rules for alteration or maintenance of drains are similar to those listed for other activities that involve bed disturbance. Conditions include, for example:

- minimising the amount and effects of sediment release,
- no resulting erosion or scour of the banks, or flooding of any neighbouring property,
- seasonal restrictions on the timing of works (e.g., to avoid fish spawning), and
- maintenance of fish passage.

Environment Southland's Proposed Water and Land Plan also requires all reasonable steps to be taken to immediately return to water any fish captured or stranded by the maintenance activity. This is consistent with the Freshwater Fisheries Regulations 1983 which require that fish be immediately returned to a waterbody if they are removed incidentally or intentionally by activities such as the cleaning of drains.

3.3.4 Culverts and intake/discharge structures

Most regional plans make provision for the use, installation or alteration of a culvert – including the associated disturbance of the bed of a lake or river (and therefore any sediment discharge or deposit of materials related with construction) and take, discharge or diversion of water – as a permitted activity subject to various conditions. The conditions vary across regional plans (Table 3-3) but tend to relate to:

- avoiding waterbodies in designated schedules (e.g., sites of ecological significance, designated trout/salmon spawning site),

Table 3-3: Summary of typical permitted activity (PA) conditions in regional plans relating to the use, erection, alteration of a culvert in, on over the bed of rivers, lakes and artificial watercourses. In most cases this activity also permits any associated bed disturbance, discharge of water or sediment, water diversion and deposit of substances in/on the bed. Not every PA condition is listed. AEP = annual exceedance probability. Refer to Appendix A for regional plan references.

Region	Conditions to be satisfied									
	Max. upstream catchment	Location restrictions	Not in a permanently flowing stream	Flood event design criteria	Culvert dimensions apply	Other design-related criteria	Seasonal restrictions on construction (e.g., during inanga or trout spawning)	No increase in erosion or flooding	Sediment-related discharge or receiving water standards to be met	Maintain fish passage
Northland	300 ha	✓		1% AEP	✓	✓		✓	✓	✓
Auckland		✓		10% AEP	✓			✓	✓ (narrative)	✓
Waikato	100 ha	✓	✓	2% AEP unless spillway		✓		✓	✓	✓
Bay of Plenty					✓		✓	✓		✓
Gisborne		✓		20% AEP	✓	✓	✓	✓	✓ (narrative)	✓
Hawke's Bay	150 ha				✓		✓	✓		✓
Taranaki		✓			✓	✓	✓	✓	✓ (narrative)	
Manawatu-Whanganui		✓		5% AEP unless spillway				✓		
Wellington				5% AEP	✓		✓	✓		✓
Tasman		✓		2% AEP	✓	✓	✓	✓	✓	✓
Nelson	10 ha			2% AEP	✓		✓		✓ (narrative)	✓
Marlborough				Secondary flow path	✓	✓	✓	✓	✓	✓
West Coast				✓ (narrative)			✓	✓		✓
Canterbury		✓	✓	5% AEP		✓	✓			✓
Otago								✓	✓	
Southland				✓ (narrative)			✓	✓		✓

- a maximum upstream catchment area that must not be exceeded (e.g., 100 ha in Waikato),
- maximum dimensions of the culvert,
- a design for a minimum-sized flood event (e.g., 1 in 50 year) that avoids any increase in upstream water levels which causes flooding on neighbouring properties,
- a minimum set-back distance from a dam, weir, bridge, network utility pole, defence against water, etc.,
- avoiding works in flowing water,
- avoiding excess release of sediment – often with associated instream visual clarity or suspended sediment criteria,
- the erection or placement of the culvert not causing any downstream erosion, scour or sediment deposition,
- avoiding works during designated fish spawning periods (e.g., May to September in Hawke's Bay), and
- maintaining existing fish passage both upstream and downstream of the culvert or intake/discharge structure.

Some regional plans contain additional requirements for culvert design or construction. For example, Environment Canterbury's LWRP requires that excavated areas are left with battered slopes not steeper than a 3:1 slope angle.

The erection and use of intake and/or discharge structures is generally provided for as a permitted activity. The conditions associated with the permitted activity rule are similar to those that apply to culverts.

3.3.5 Plant introduction and removal

Most regional plans permit plant introduction or disturbance of the beds of rivers or lakes without requiring a resource consent. Table 3-4 summarises some of the relevant permitted activity conditions where plants are introduced into, or removed from, the beds of rivers or lakes. Almost all plans restrict the type or species of plants that can be planted (notably pest plants). Seasonal restrictions are also common conditions, particularly with regard to plant removal, which has to occur outside of common fish spawning or migration periods. In rivers with specified fish values, this limits the window of time available to undertake works to just a few months of the year (e.g., November to February in the Bay of Plenty region).

Many plans seek to protect existing indigenous flora and some also promote new plantings of such flora for the specific purpose of environmental enhancement. For example, permitted activity rule 83 in Taranaki Regional Council's Draft Soil and Water Plan promotes planting or removal of existing vegetation or debris for environmental enhancement purposes.

Other conditions associated with permitted activity rules for plant introduction or removal are standard conditions commonly listed for any activities that involve bed disturbance (e.g., no significant erosion or scour of stream banks, maintenance of fish passage).

Table 3-4: Summary of typical permitted activity conditions in regional plans relating to the introduction, planting or removal of plants (and associated sediment discharge and bed disturbance) in, on or under the beds of rivers and lakes. This list is not exhaustive. Refer to Appendix A for regional plan references.

Region	Conditions to be satisfied							
	Seasonal restrictions (plant removal)	No obstruction of the bed or flow or causing flooding	No release of contaminants other than sediment	Sediment-related discharge or receiving water standards to be met	No significant erosion/scour (otherwise remedy)	Plants shall not replace or damage indigenous flora	Restrictions on plant certain vegetation (e.g., pest plants)	Maintain fish passage
Northland		✓			✓	✓	✓	
Auckland				✓ (narrative)	✓		✓	✓
Waikato	✓	✓	✓	✓	✓	✓	✓	✓
Bay of Plenty	✓				✓	✓	✓	✓
Gisborne	✓	✓	✓	✓ (narrative)	✓		✓	✓
Hawke's Bay	✓	✓			✓	✓		✓
Taranaki	✓	✓		✓ (narrative)	✓		✓	
Manawatu-Whanganui	✓	✓	✓	✓	✓		✓	✓
Wellington	✓	✓	✓	✓	✓		✓	✓
Tasman	✓[a]					✓	✓	✓
Nelson	✓			✓ (narrative)	✓		✓	✓
Marlborough	No permitted activity rule identified except for river control and drainage works carried out by the council							
West Coast	✓	✓		✓	✓		✓	
Canterbury	✓			✓			✓	
Otago		✓		✓	✓		✓	
Southland	✓		✓		✓		✓	✓

[a] Motorised machinery only.

3.3.6 Taking, diverting and discharge of water

There are several permitted activity rules in regional plans related to the taking, diversion and discharge of water, including water pumped from drainage and flood control schemes, and maintenance of artificial watercourses. Common permitted activity conditions across Regional Plans for diversions and discharges of water relate to ensuring that:

- the diversion or discharge remains within the natural catchment,
- the discharge, beyond (defined) reasonable mixing, does not produce –
  - any conspicuous oil or grease films, scums or foams, or
  - any floatable or suspended materials, or
  - any conspicuous change in the colour or visual clarity, or
  - render fresh water unsuitable for consumption by farm animals,
- any erosion occurring as a result of the discharge is remedied as soon as practicable,
- the discharge does not cause or exacerbate the effects of flooding on downstream properties,
- there are no adverse effects on any wetland (e.g., lowering of wetland water levels), and
- fish passage is maintained.

Some regional plans specify a maximum upstream catchment area for a diversion to be a permitted activity (e.g., 2 km^2 in Waikato and 50 ha in Hawke's Bay). A number of regional plans also require specific water quality criteria to be met, notably for suspended sediment and dissolved oxygen.

Environment Canterbury's RLWP has several permitted activity rules that specifically address taking, diverting or discharging water in relation to *constructed wetlands*:

- Rule 5.75 permitting the discharge of drainage water into an artificial watercourse, constructed wetland or into or onto land,
- Rule 5.79 permitting the discharge of contaminants and water from the maintenance of artificial watercourses and associated structures into an artificial watercourse, constructed wetland or into land, and
- Rule 5.159 permitting the enhancing, restoring or creating of a wetland (including the associated taking, use, damming or diversion of water, and discharge of excess or overflow water from the wetland into surface water).

Some of the conditions that relate to these rules are discussed in Section 4.1 where regulatory requirements for the construction of a wetland in Canterbury are outlined.

3.3.7 Dams and damming water

Permitted activity rules exist for both temporary and small permanent dams across most regional plans[5], subject to various conditions. These rules are generally intended to apply to minor damming of clean water and include such things as stock water dams, detention dams for erosion control, dams for wetland creation, prevention of peat shrinkage, and activities related to water harvesting.

Where the construction of a dam is permitted, this generally includes any ancillary:

- take/diversion of water that is part of normal dam operation,
- disturbance/drilling/excavation,
- discharge of water/sediment into water/onto land, and
- deposition of substances in or on the riverbed.

Some of the typical permitted activity conditions associated with permanent damming of water in the bed of a river or stream (Table 3-5) include:

- avoiding damming of specific 'high value' waterbodies,
- a maximum upstream catchment area (e.g., 50 ha in Hawke's Bay and Manawatu-Whanganui),
- maximum water depth (refer Figure 3-4) and storage volume requirements (e.g., 3 m and 20,000 m^3, respectively),
  Note: Where a dam retains 4 m or more depth or holds ≥ 20,000 m^3 of water, a building consent is required in accordance with the Building Act 2004.
- a spillway designed for a minimum flood event (e.g., 1 in 20-year),
- a requirement for a residual flow to be maintained, and
- maintenance of fish passage upstream and downstream of the dam.

Table 3-5 indicates that there is significant variation across regional plans in dam design criteria, including the maximum upstream catchment area that can be dammed, and spillway flood passage design requirements. Some regions also require dam design and construction where the volume of water impounded exceeds a specified volume (e.g., 1,000 m^3 of water in Canterbury and 5,000 m^3 in the Bay of Plenty) to be certified by a "recognised engineer" or a "chartered professional engineer"[6].

[5] The Auckland Council Unitary Plan, Marlborough Environment Plan and Nelson Resource Management Plan (NRMP) appear to be the only regional plans that do not provide for new instream dams as a permitted activity. Under the NRMP, instream damming is a minimum of a discretionary activity.

[6] Under s149 of the Building Act 2004, a "recognised engineer" is registered under the Chartered Professional Engineers of New Zealand Act 2002.

Table 3-5: Summary of typical permitted activity conditions in regional pans to be met for the construction of dams within a river or artificial watercourse – or on land – and the associated damming of water. Not every condition is listed. AEP = annual exceedance probability. Refer to Appendix A for regional plan references.

Region	Conditions to be satisfied									
	Not located in a specified high value watercourse	Max. upstream catchment area	Maximum water depth and volume of impounded water [b]	Spillway flood passage design	Residual flow to be maintained out of dam at all times	No reduction in flood flow conveyance	Sediment discharge criteria apply	No conspicuous change in colour or clarity of receiving waters after reasonable mixing	No contaminant discharge other than sediment	Maintain fish passage upstream and downstream
Northland	✓			1% AEP	✓			✓	✓	✓
Auckland [a]			4 m	1% AEP		✓		✓		✓
Waikato	✓	100 ha	3 m & 20,000 m^3	"maximum probable flood"			✓			
Bay of Plenty	✓ [b]		1.5 m & 5,000 m^3 [c]	100-yr flood	✓					✓
Gisborne	✓	5 ha	3 m & 20,000 m^3			✓		✓	✓	✓
Hawke's Bay		50 ha	4 m & 20,000 m^3	"storm events"	✓	✓				✓
Taranaki	✓	25 ha	3 m (max. height)	"flood flows"				✓		✓
Manawatu-Whanganui	✓	50 ha	3 m [d]	200-yr flood	✓	✓	✓	✓	✓	✓
Wellington		20 ha	3 m [d] & 20,000 m^3	20-yr flood	✓					
Tasman	✓	<20 ha	< 3 m & 5,000 m^3	2% AEP			✓	✓		✓
Nelson	No permitted activity rule identified for the construction of an instream dam									
Marlborough	No permitted activity rule identified for the construction of an instream dam									
West Coast	✓	50 ha	3 m & 20,000 m^3	"maximum probable flood"						✓
Canterbury	✓		3 m & 5,000 m^3		✓					✓
Otago	✓	50 ha	3 m & 20,000 m^3							
Southland	✓	500 ha		✓ (narrative)					✓	✓

[a] Applies to an existing instream dam only (i.e., no permitted activity rule exists to construct a new instream dam). [b] Also, the mean annual daily flow of the river or stream must be ≤ 150 L/s. [c] Applies to dams within rivers; multiple permitted activity rules exist and different criteria apply to dams within artificial watercourses. [d] Check the relevant regional plan for details on how measurements are made.

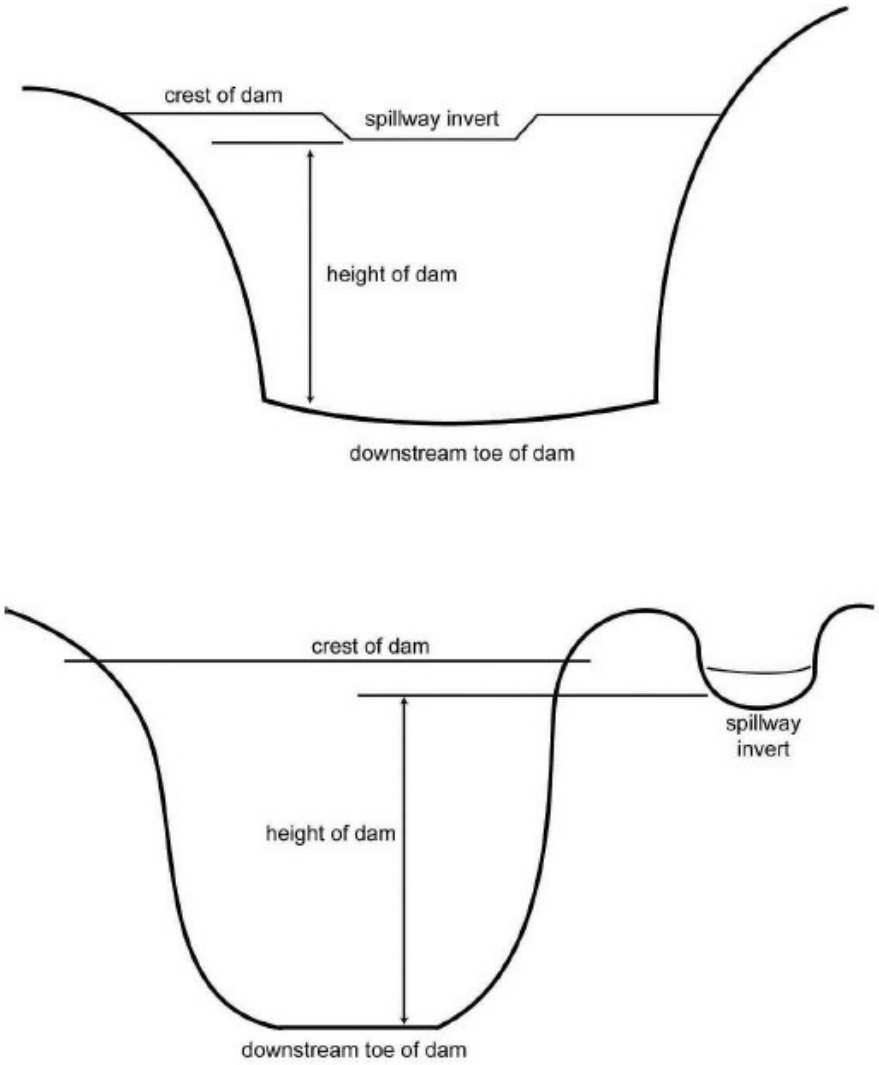

Figure 3-4: Measurement of dam height. Reproduced from Chapter 8 of Bay of Plenty Regional Council's Regional Natural Resources Plan. As indicated in Table 3-5, the maximum water depth authorised as permitted activity in the Bay of Plenty region is 1.5 m, as measured from the lowest point of the dam crest. In the Manawatu-Horizons region, water depth is expressed as the measurement from the natural ground level at the upstream toe of the dam structure.

3.3.8 Discharge of contaminants to land and water

Contaminants (other than sediment related to construction or maintenance of mitigations) associated with edge-of-field mitigations could include aquatic herbicides associated with weed maintenance of riparian or constructed wetland plantings, materials used in the mitigations – including chemicals/substances added to these materials (e.g., woodchip filters dosed with readily biodegradable sources of carbon such as methanol or acetate) – and, where mitigations are in place for research purposes, groundwater tracers (e.g., sodium).

Most regional plans provide for the use of aquatic herbicides over/into water as a permitted activity provided the herbicide used is approved by the Environmental Protection Authority and, for ground-based applications, the applicator has appropriate certification (e.g., a current GROWSAFE® Registered Applicators Certificate or NZQA National Certificate in Agrichemical Application, with the aquatic strand). Avoidance of s107 RMA effects (e.g., rendering of fresh water unsuitable for consumption by farm animals, any significant adverse effects on aquatic life) and advance notification of water users within one kilometre downstream prior to spraying are also common permitted activity conditions.

There does not appear to be any permitted activity provisions in regional plans to:

- deposit organic material such as woodchips or bark into excavated land (especially where it may enter water), or
- discharge methanol or other additives that might be applied to woodchip filters.

Permitted activity rules for discharges of organic matter relate primarily to composting operations and fertiliser application.

The discharge of non-toxic tracer dyes onto land or into surface and ground water is provided for as a permitted activity in some regions (e.g., Wellington) but is a controlled activity in others (e.g., Otago and Southland). Permitted activity conditions limit the types of tracers used and the rate of application. For example, Rule R46 of Greater Wellington Regional Council's Proposed Natural Resources Regional Plan permits the discharge of up to 20 L of dye in solution, 10 kg of salt, or 100 L of salt solution.

3.3.9 Monitoring bores and stations

Under most regional plans, construction of a groundwater bore for monitoring purposes (as opposed to a short-term geotechnical or groundwater investigation) is a controlled rather than permitted activity (i.e., requires resource consent), particularly where drilling is required. This reflects the desire of councils to control aspects such as the bore location, size (including diameter of the bore casing) and depth, screening depth and type, backflow prevention methods, information requirements (e.g., bore logs, piezometric levels, groundwater tests, bore construction details), and to manage the effects of any discharge of contaminants associated with construction. In contrast, most regional plans make provision for the installation of monitoring and sampling structures (e.g., flow recording sites) in waterbodies as a permitted activity, subject to various conditions. Example conditions include restriction of the size of the structure and/or area of stream bed occupied, maintenance of safe fish passage upstream and downstream, and avoiding installation during specified fish spawning periods.

3.4 Synthesis

A very wide range of activities associated with the construction, operation and maintenance of edge-of-field, farm-scale diffuse pollution mitigation measures exist that could potentially trigger the need for resource consent(s) under regional plans. Permitted activity rules exist for most but not all of these activities. Depositing woodchips into land and the associated leachate discharges are not authorised by permitted activity rules, and in many regions, neither is construction of monitoring bores. Most permitted activity rules are also accompanied by lengthy lists of conditions. Failure to meet one or more of these conditions will trigger the need for resource consent.

The first and most important step in determining consent requirements is establishing whether or not the proposed mitigation will in some way interact with a river or stream, as defined under the RMA (i.e., includes modified rivers and streams). By avoiding construction in, or modification/ disturbance of, the bed or banks of a river, stream, lake or natural wetland, the likelihood of requiring resource consent is much lower. The volume of earthworks, dimensions of structures, timing of instream activities such as construction of structures and planting, and the amount of water to be taken are also key factors in determining consent requirements.

There is commonality across many of the standard permitted activity conditions in regional plans associated with mitigation activities that involve use of the land and the beds of lakes and rivers, the taking, using, damming or diversion of water, and the discharge of contaminants to land or water. However, as with the specific terms used and defined in plans, some significant regional variation exists, particularly in specific aspects of permitted activity conditions, such as the maximum upstream catchment areas and design criteria for construction of structures (e.g., culverts and dams). As will be illustrated in Section 4, it can be difficult to meet many of the more specific conditions of permitted activity rules.

4 Case study mitigations and regulatory requirements

In this section we briefly outline five recently consented edge-of-field mitigation projects to identify the activities associated with their construction and operation that triggered the requirement for resource consent. The mitigations span wetlands in Canterbury, Taranaki and Tasman, a permeable reactive bioreactor (woodchip biofilter) in Canterbury, and an instream detention dam in Northland. Information presented in this section is drawn from reviewing the resource consent applications and consent officer or decision reports.

4.1 Te Ahuriri constructed wetland, Canterbury

In 2018, Environment Canterbury sought resource consents from both its regulatory arm and the Selwyn District Council for work associated with the restoration of a remnant channel of the Huritini/Halswell River that had been managed as part of Murrays Drain, and to construct a 6 ha wetland (4.87 ha of wetted footprint at the top operating water level) (Figure 4-1). The purpose of the restoration project is to enhance water quality within Te Waihora catchment and support improved mahinga kai and mātauranga Māori values at the site. The project was developed by Te Waihora Co-Governance Group and has been partly funded under the Ministry for the Environment's Freshwater Improvement Fund (Ford 2018).

The remnant channel is the original path of the Huritini/Halswell River before it was straightened and modified to mitigate flood events. At the time of making the consent application, the remnant channel was effectively functioning as a farm drain; it had minor flow from adjacent paddocks and was often stagnant. It was also overgrown with weeds and had a high level of sedimentation. The proposal included cleaning the remnant channel prior to reconnecting it to the main reach of the Huritini/Halswell River to restore flow and ecological values (Morphum Environmental 2018).

Figure 4-1: Proposed wetland location and location of proposed structures. The application site is within Te Ahuriri Reserve, which is broadly defined as the historic footprint of Te Ahuriri Lagoon. Te Ahuriri is approximately 4 km south of Tai Tapu. Source: Morphum Environmental (2018).

According to the consent application (Morphum Environmental 2018), around 5% of the mean annual flow of the river would be diverted into the remnant channel. Water from the re-engaged channel would then be diverted into a constructed wetland to treat water from the larger catchment and enhance habitat values. The area was originally part of a wetland that extended to Te Waihora/Lake Ellesmere prior to it being drained to provide pasture for agriculture. In addition to improving water quality, the plan was intended to significantly enhance ecological values and to support aspirations for improved mahinga kai (Morphum Environmental 2018).

4.1.1 Activities and regulatory assessment

The project involved significant earthworks to construct the wetland (around 25,000 m^3 across an approximate area of 61,000 m^3) and diversion of approximately 50 L/s of water from the Huritini/Halswell River (Morphum Environmental 2018). Other proposed activities included vegetation management and planting, construction of structures (e.g., culverts, weirs and spillways), disturbance of the bed and banks of the remnant channel, and monitoring. An assessment of these activities against Environment Canterbury's Regional Land and Water Plan (RLWP) (Table 4-1) by Morphum Environmental (2018) indicated that:

- Despite functioning as a drain, the remnant channel must be considered part of a river and no relevant permitted activity rules exist to allow disturbance of the bed of a river to remove fine sediment, even if the sole purpose of doing so is for habitat restoration (i.e., at least one resource consent was always going to be required).
- Several activities triggered consents and/or a consent under a more stringent RLWP rule largely on technical grounds. For example:
  - Because a discharge of contaminants to groundwater as part of a functioning wetland was possible, (albeit unlikely and, in the case of possible minor infiltration, any contaminants lost to groundwater from the wetland would likely be of a lower concentration than those in the existing groundwater), classification of the discharge defaulted from a likely permitted activity to a discretionary activity.
  - Despite little evidence that inanga spawn in the remnant channel, the area was defined as spawning habitat in the RLWP and, with the possibility that culvert construction and vegetation removal might extend into the spawning season,[7] consent was required.
  - Although the decision was made to pump water abstracted during cleaning of the remnant channel to pasture rather than return it to the channel [as required under Rule 11.5.46 (for Te Waihora sub-region)] because the water would be sediment-laden and shouldn't be discharged back to the channel, the activity subsequently shifted from a restricted discretionary to a full discretionary activity.
- Because one activity – the proposed diversion of water from the Huritini/Halswell River – could not meet one condition (Table 4-1) of the relevant permitted activity rule for non-consumptive water takes – this defaulted to a non-complying activity and meant that the overall status of the suite of activities for which consents were sought

[7] Morphum Environmental (2018) concluded that the disconnected and degraded state of the remnant channel meant it was highly unlikely that much inanga spawning habitat existed.

also defaulted to *non-complying*.[8] As indicated by Figure 3-1 in Section 3.1, a non-complying activity has to meet a higher threshold test for consent to be granted. However, because in this instance the proposed activities were to enhance the environment, the decision to grant consent was unlikely to be a difficult one.

Table 4-1: Summary of key proposed wetland construction and operation activities assessed against relevant region-wide rules in Environment Canterbury's RLWP. As this information relates to an actual location-specific consent application, the rules for the relevant sub-region (Te Waihora) were also assessed.

Activity	Permitted Activity (PA) Rule	Consent trigger (PA or other conditions breached)	Activity status
Stormwater discharge	Rule 5.94A: Discharge of construction phase stormwater	Area of disturbed land exceeds 1,000 m^2	Restricted discretionary activity (Rule 5.94B)
Surface water diversion	Rule 5.126: Diversion of surface water for non-consumptive water takes	The take is non-consumptive but the distance from the point of take to point of return is >250 m	Non-complying activity (Rule 5.127)
Cleaning the remnant channel	**None** – minimum of a restricted discretionary activity (RDA under Rule 5.146A) to disturb the bed of a river to remove fine sediments < 2 mm	Conditions of RDA met – the sole purpose of disturbance is for habitat restoration	Restricted Discretionary activity (Rule 5.146A)
	Within Selwyn Te Waihora sub-region: None – minimum of a restricted discretionary activity (RDA under Rule 11.5.46) to disturb the bed of a river to remove fine sediment	The water abstracted during cleaning of the remnant channel will be sediment-laden so will be pumped to pasture rather than returned to the river as required under Rule 11.5.46 (i.e., cannot meet RDA status)	Discretionary activity (Rule 11.5.47)
Discharge to groundwater from wetland	Rule 5.131: The non-consumptive taking and use of ground water and associated discharge to groundwater	The take is non-consumptive and there is no use of ground water but there was a technical possibility that contaminants may enter groundwater as part of wetland function which is not authorised under Rule 5.131	Discretionary activity (Rule 5.132)
Culvert construction	Rule 5.137: Diversion or discharge of water and contaminants as a result of the excavation and disturbance of a riverbed, or the establishment of a structure or defence against water	The culverts will be constructed in an area identified as inanga spawning habitat and this may extend into the spawning season. Also, areas will not be rehabilitated to the original state given the intent is to create a wetland	Discretionary activity (Rule 5.141A)
Wetland creation	5.159: The enhancing, restoring or creating of a wetland	The proposed diversion of water exceeds the permitted maxima of 5 L/s and 100 m^3/day	Discretionary activity (Rule 5.160)
Vegetation removal and planting	Rule 5:163 The introduction or planting of any plant, or the removal or disturbance of existing vegetation in, on or under the bed of a lake or river and any associated discharge of sediment or sediment-laden water	The area is identified as inanga spawning habitat and vegetation removal may extend into the spawning season	Restricted discretionary activity (Rule 5.164)
Earthworks	Rule 5.175: The use of land to excavate material	The excavation volume is more than 100 m^3 and will occur within 50 m of a surface water body	Restricted discretionary activity (Rule 5.176)

[8] Consistent with case law, where a group of related activities are bundled together, the most restrictive activity status is applied to the entire proposal.

4.1.2 Consent requirements

The Environment Canterbury consent officer's report (Ford 2018) identified nine activities associated with the wetland construction project that met permitted activity rules and did not require consent:

- the discharge of agrichemicals to land where it may enter water,
- the installation of culverts and diversion structures outside the bed of a river,
- use and maintenance of culverts and diversion structures in the bed of a river,
- the use of land for stockpiling decaying vegetation,
- diversion of water through the channel,
- the discharge of a vertebrate toxic agent onto land including the bed of a river in circumstances where a contaminant may enter water or into water,
- the discharge of a dust suppressant onto or into land in circumstances where a contaminant may enter water, and
- discharge of dust to air from earthworks and stockpiles.

Two land use consents, two water permits, and a discharge permit were required to authorise the following 11 activities:

- use of land for excavation over an aquifer,
- use of land for the creation of a wetland,
- use of land for the removal of riparian vegetation within 10 m of a riverbed,
- use of land within the bed of a river for fine sediment removal,
- use of land within the bed of a river for removing and planting vegetation,
- use of land within the bed of a river for deposition (stockpiling) of sediment,
- use of the bed of a river for the installation of culverts and diversion structure,
- non-consumptive take of surface water from channel and discharge of this water to land where it may enter surface water,
- taking of groundwater for dewatering and discharge of this water to land where it may enter surface water,
- discharge of stormwater to land, and
- the diversion of water through the wetland and into the river.

In addition to these five resource consents:

- a land use consent for earthworks was required from Selwyn District Council under the Selwyn District Plan in relation to a Site of Significance to Tangata Whenua, and
- authorisation was required under the Canterbury Regional Council Flood Protection and Drainage Bylaw 2013 for (a) the planting of vegetation within 7.5 m of the banks of Murrays Drain and the Huritini/Halswell River, and (b) the removal or damage to any existing riparian vegetation that may be currently providing erosion protection.

4.1.3 Assessment of environmental effects

The environmental effects considered in the assessment of the resource consent application (Ford 2018) included positive effects (principally the potential to improve water quality and both biodiversity and mahinga kai values), and also the potential for adverse effects:

- on water quantity (e.g., arising from the diversion),
- on water quality (e.g., sediment from earthworks and discharges, spills of hazardous substances such as oil or diesel from construction machinery),
- on aquatic and terrestrial ecology (e.g., stranding of fish during dewatering and removal of accumulated sediment and weeds in the remnant channel),
- caused by exacerbation of natural hazards (e.g., flooding),
- on amenity values (e.g., during construction), and
- on cultural values.

The consents were granted with various conditions to avoid, remedy or mitigate these effects, including the preparation and adherence to an Erosion and Sediment Control Plan, a Fish Salvage and Relocation Plan, a Planting Plan and a Dust Management Plan. Water quality monitoring was also a condition of consent.

4.2 Awatuna constructed wetland, Taranaki

In 2019, Taranaki Regional Council (TRC) sought resource consents from its regulatory arm to undertake damming and excavation works to construct an ~4,000 m^2 wetland in a section of an unnamed tributary of the Oea Stream on Wylam Dene farm near Awatuna (Figure 4-2). The purpose of constructing the wetland was to monitor its effectiveness at removing contaminants in surface runoff and subsurface drainage on the farm. The wetland, comprising three cells separated by rock filters, was funded by TRC's 'Wetland Consent Fund' and designed by NIWA with the intent to monitor its efficacy in improving water quality over a three-year period. Lessons learnt from the planning, construction, operation and monitoring would assist with future wetland promotion and proposals across the Taranaki Region (Arnoux 2019).

4.2.1 Activities and regulatory assessment

The consent officer's report assessed the application against the existing Regional Freshwater Plan for Taranaki (RFRP) which has been operative since 2001. Under the provisions of the RFRP, the proposed excavation of the unnamed tributary and construction of the wetland were deemed a discretionary activity; the relevant permitted activity rule does not permit realignment of more than 200 m of stream channel as was required to construct the wetland. Damming of the unnamed tributary also failed to meet permitted activity fish passage requirements and defaulted to a discretionary activity; the V-notch weirs required for monitoring water flows would create a barrier to fish passage (Carter 2019).

Two resource consents were therefore required to authorise the following activities:

- excavation of the unnamed tributary and construction of the wetland, and
- damming of the unnamed tributary.

While not stated in the officer's report, we assume that other activities, such as the temporary diversion of stream water during wetland construction and planting of the wetland and buffer areas met existing permitted activity rules.

Figure 4-2: Proposed site for constructed wetland at Awatuna. Source: Taranaki Regional Council.

4.2.2 Assessment of environmental effects

The consent officer's report (Carter 2019) cited the primary potential adverse effects of the proposed activities as:

- reduced water quality, and localised erosion and scour,
- the dam being unable to safely pass high flow,
- erosion at dam outlets, and
- effects on aquatic life, including loss of habitat and restriction/obstruction of fish passage.

The consents were granted with a suite of conditions to avoid, remedy or mitigate these effects, including prevention of instream works between May and October, sediment control measures to minimise sediment discharge to the stream, and establishment of fish passage after the proposed three-year monitoring period.

Positive effects of the proposal were cited as the potential to improve water quality in the downstream catchment and the development of methods that can be applied on a wider scale to provide additional regional water quality improvements (Carter 2019).

4.3 Page constructed wetland, Tasman

In February 2020, Tasman District Council (TDC) granted itself resource consent to construct a six-cell wetland in an intermittently flowing stream on private land in the Fish Creek catchment near Golden Bay (Figure 4-3). The wetland was designed by NIWA to treat stormwater run-off from dairy farm pasture for the purpose improving the water quality of the downstream receiving environment, Fish Creek, a highly valued tributary of Te Waikoropupu Springs near Golden Bay.

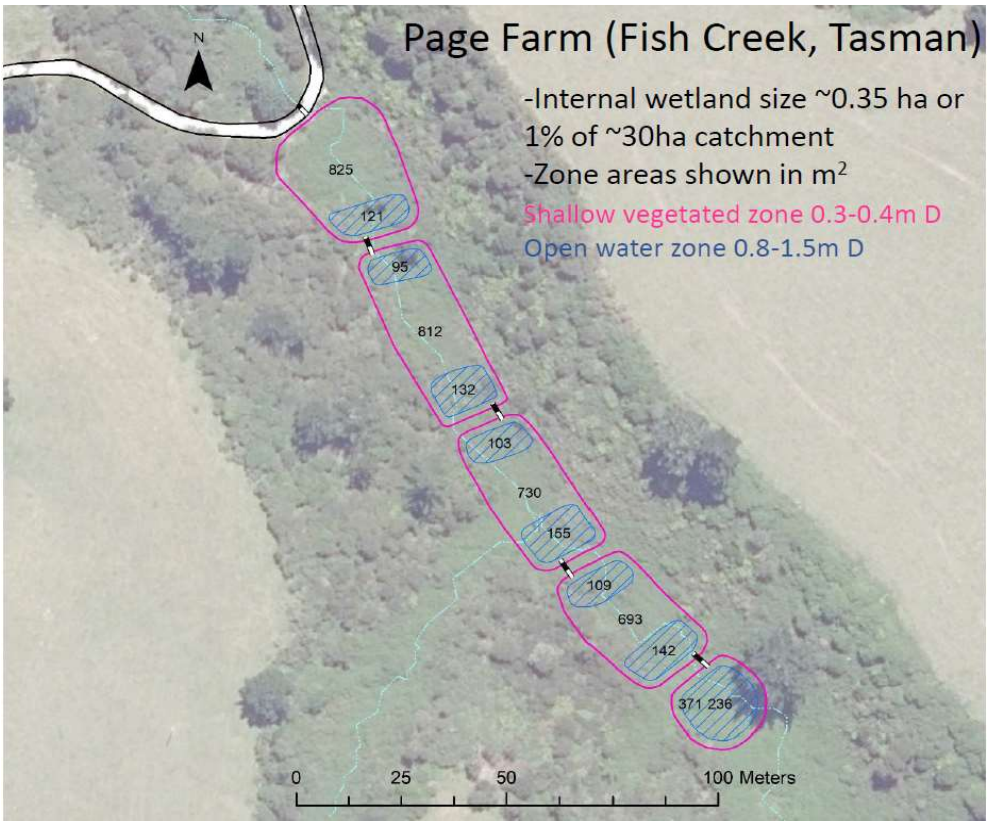

Figure 4-3: Conceptual aerial diagram of the proposed constructed wetland on Page Farm in the Fish Creek catchment, Golden Bay. The D denote depth. Source: Tasman District Council.

4.3.1 Activities and regulatory assessment

The proposed works oulined in the consent application included constructing an access track to the site, removing exotic vegetation, digging a series of small retention ponds and waterways, planting of native wetland vegetation, and maintenance and monitoring. The consent officer's decision report (Dodd 2020) identified that the overall suite of activities did not comply with relevant permitted activity rules for land and streambed disturbance in the Tasman Resource Management Plan (TRMP). The conditions of the permitted activity rules that weren't met are not specified, but correspondence with TDC identified multiple consent triggers, including the volume of earthworks, the close proximity of earthworks to a watercourse, and the area of catchment upstream of the proposed damming activities (Table 4-2, James[9], pers. comm.). Overall, Dodd (2020) deemed the application a discretionary activity in accordance with Rule 28.1.8.1 (structures, bed disturbances and planting). This was partly on technical grounds because the permitted activity rule for disturbance of a river or lakebed does not authorise such disturbance for the purposes of wetland construction. Therefore, even if other activities associated with the wetland had satisfied permitted activity requirements, a

[9] Trevor James – Senior Resource Scientist, Tasman District Council.

resource consent would always have been required for wetland construction (unless it had been located outside of the riverbed).

Table 4-2: Key activities associated with the proposed wetland construction and operation that did not meet permitted activity rules under TDC's TRMP.(Source: Trevor James, pers. comm.)

Activity	Permitted Activity (PA) Rule	Consent trigger (PA or other conditions breached)	Activity status
Earthworks, and land recontouring for access track construction	Rule 18.5.2.1: Land disturbance	Volume of earthworks exceeds 50 m^3 and is within 20 m of a stream bank	Controlled activity (Rule 18.5.2.2) or restricted discretionary activity (Rule 18.5.2.5)
		The cuts exceed 1 m in height	
Wetland construction	Rule 28.1.6.1: Riverbed or lakebed disturbance	Wetland construction in a riverbed is not a permitted purpose for bed disturbance	Discretionary activity (Rule 28.1.8.1)
Wetland weir construction	Rule 28.2.2.1: Dam structures	The surface catchment area for the dam exceeds 20 ha, the dam is within 10 m of a road and the dam spillway is not designed to pass a 2% AEP rainfall event	Discretionary activity (Rule 28.2.2.4)

4.3.2 Assessment of environmental effects

The consent decision report (Dodd 2020) cited the primary potential adverse effects on the environment of the proposed activities as:

- erosion and sedimentation during construction,
- adverse visual effects associated with land disturbance, and
- impairment of the cultural health of waterways.

The consents were granted with a suite of conditions to avoid, remedy or mitigate these effects, including carrying out the earthworks in accordance with a certified Erosion and Control Sediment Plan, prompt reinstatement of exposed ground within completion of earthworks and, six months after construction, holding an on-site meeting with members of Manawhenua ki Mohua (the iwi entity representing Ngāti Tama, Ngāti Rārua and Te Ātiawa in Mohua/Golden Bay) to appraise the wetland site and its ability to improve stormwater quality.

4.4 Permeable reactive barrier – Silverstream Reserve, Canterbury

In 2018, the Institute of Environmental Science and Research Limited (ESR) was granted resource consent for activities associated with the construction and operation of a 60-m long subsurface denitrifying permeable reactive barrier (PBR) or woodchip denitrification wall at Silverstream Reserve, Clarkville, north of Christchurch (Figure 4-4). The proposal forms part of a research trial that aims to develop a way to enhance denitrification of groundwater to reduce levels of nitrate in shallow groundwater systems before they impact receiving surface waters such as streams and lakes (Wadsworth 2018). The water table at the Silverstream site rests within 0.5 m of ground level and groundwater nitrate-nitrogen concentrations are consistently 6-7 mg/L (Burbery et al. 2019).

As part of a separate application, ESR obtained resource consent to discharge sodium chloride into groundwater to better understand groundwater movement; this information was needed to assist

with refining the design of the proposed PRB and to ensure correct orientation of monitoring wells along the groundwater flow path (Duke 2017).

The PRB comprises an approximately 50/50 w/v mix of woodchip and gravel fill. The PRB is positioned in a dewatered trench excavated to 3 m below ground level, with the trench orientated at 90 degrees to the direction of local groundwater flow so that groundwater flows naturally through the PRB for treatment (Wadsworth 2018).

Figure 4-4: Proposed PBR site location and location of bores for the discharge of sodium chloride tracer solution to groundwater. The site is within Silverstream Reserve, Clarkville in the Waimakariri District (ESR, in Duke 2017).

4.4.1 Activities and regulatory assessment

Table 4-3 indicates that at least two activities were not provided for under permitted activity rules in Environment Canterbury's RLWP, thereby triggering the need for resource consent:

- the use of sodium chloride as a water tracer, and
- the depositing of the woodchip and gravel filter material into groundwater.

Consents were ultimately also required for earthworks and the discharge of contaminants – namely dissolved organic carbon (DOC), arising as leachate from woodchips in the PBR – to groundwater.

Although proposed discharges were within the area controlled by the Waimakariri River Regional Plan (WRRP), contaminants were deemed unlikely to enter surface water so the rules in the WRRP did not apply (Wadsworth 2018).

Separate land use consent was sought from the Waimakariri District Council to use Silverstream Reserve for the trial.

Table 4-3: Summary of key proposed PBR construction and operation activities assessed against relevant region-wide rules in Environment Canterbury's RLWP.

Activity	Permitted Activity (PA) Rule	Consent trigger (PA or other conditions breached)	Activity status
Groundwater take for salt tracer testing	Rule 5.113: Taking and using of < 5 L/s and 10 m^3 per property per day of groundwater	**None** (no consent required) – groundwater take and use is within the specified criteria	Permitted
Sodium chloride discharge to groundwater	None – minimum of a controlled activity to discharge a water tracer to groundwater, a river, lake or artificial watercourse	N/A	Controlled activity (Rule 5.101)
Earthworks for PBR installation	Rule 5.175: Use of land to excavate material over an aquifer	Volume of excavated material exceeds 100 m^3 and there is more than 1 m of undisturbed material between the deepest part of the excavation and the seasonal high-water table level	Restricted Discretionary activity (Rule 5.176)
Installation of PBR	**None** – minimum of a controlled activity (CA under Rule 5.177) to use land for depositing > 50 m^3 of material over an unconfined or semi-confined aquifer	Some Rule 5.177 conditions can't be met: the volume of vegetative matter in the PBR fill exceeds 3%, the fill material is deposited into groundwater, and a management plan is required* (i.e., CA status is not met)	Restricted Discretionary activity (Rule 5.178)
Discharge to groundwater from PBR	Rule 5.98: Discharge of water or "minor contaminants" onto or into land in circumstances where a contaminant may enter groundwater	The discharge from the PBR fill material is directly into groundwater	Discretionary activity (Rule 5.100)

* This condition breach was cited in Tadworth (2018) but, in our view, should be considered irrelevant because it appears to relate to cleanfills.

4.4.2 Assessment of environmental effects

Assessment of ESR's resource consent application (Wadsworth 2018) identified the positive effect of a better understanding of the potential of the PRB as a mitigation measure for improving groundwater and surface water quality, as well as the potential for several adverse effects on:

- groundwater quality and groundwater users (e.g., primarily as a result of DOC from woodchip leachate creating anoxic conditions and stimulating the mobilisation of phosphorus, iron, manganese and arsenic present in aquifer sediments),
- surface water quality (e.g., should the anoxic groundwater plume reach the Silver Stream), and
- Tangata Whenua values (e.g., impacts on intrinsic values of water).

Several conditions proposed by ESR to monitor the impacts of the woodchip filter on groundwater quality were included in the resource consents. As at early 2019 – and as predicted by ESR – the PRB had led to mobilisation of arsenic, iron and manganese from the greywacke aquifer sediments, but this was limited to an anoxic area immediately downgradient of the PRB (Burbery et al. 2019). The PRB is located approximately 260 m from the Silver Stream by line of sight, and over 500 m away when following groundwater flow.

4.5 Roberts Farm detention dam, Northland

As part of the Living Water Partnership (LWP) between the Department of Conservation and Fonterra, several detention dams have been constructed on dairy farms in the Kaipara Harbour catchment in Northland to reduce sediment flow to waterways and the harbour. One such dam is located on the Roberts' Farm at Riponui, northwest of Hikurangi. An existing 2.5 m high dam with a water storage capacity of approximately 6,000 m^3 exists within an 11 ha catchment on the farm (Figure 4-5). The Living Water Partnership proposed to enhance sediment detention by increasing dam storage capacity to 9,000 m^3.

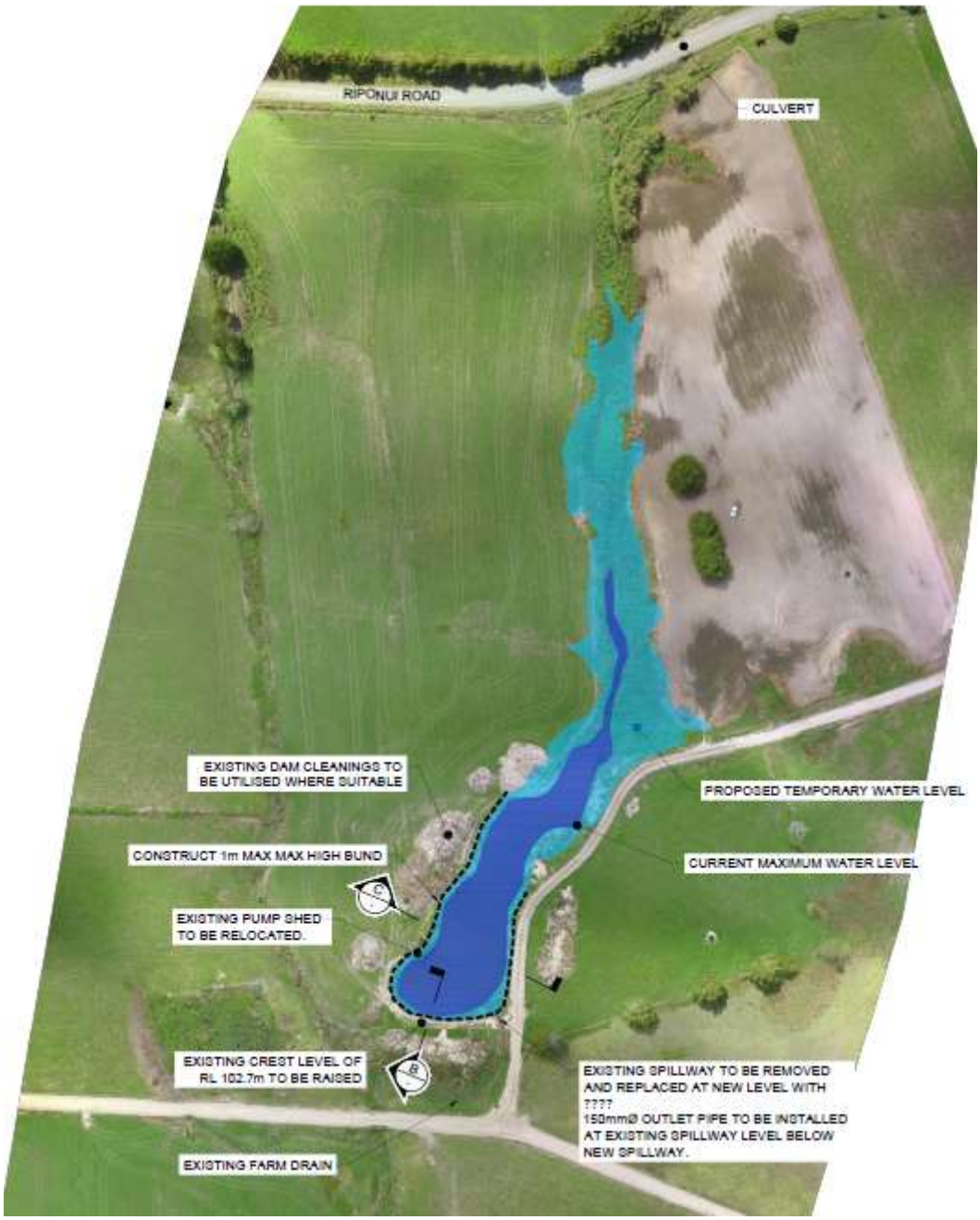

Figure 4-5: Aerial plan of the Roberts Farm detention dam in Riponui. Source: LWP (2018).

4.5.1 Activities and regulatory assessment

Increasing the dam's water storage capacity required around 700 m^3 of earthworks, raising the dam height by 1 m, and reconfiguring the spillway with a 150 mm diameter outlet pipe and a 3 m wide emergency spillway (LWP 2018). According to the Northland Regional Council consent decision report (NRC 2018), these works were intended to greatly reduce peak outflow from the dam, increase water storage capacity and enhance sediment retention. However, increasing the stored water volume of a dam is not provided for under the relevant permitted activity rule (Rule 28.1.1, existing dams)[10] of the Regional Water and Soil Plan for Northland (RWSP); the earthworks proposed to increase the height of the dam were therefore deemed a controlled activity under Rule 28.2.2[11] of the RWSP, as well as Rule C.3.1.5 of the Proposed Regional Plan for Northland (PRP). The LWP subsequently applied for a land use consent from NRC.

4.5.2 Assessment of environmental effects

The adverse environmental effects of the proposed dam modification were determined to be no more than minor. This decision was made on the basis that there was already an existing dam on-site and that suitable clay material previously excavated from inside the dam reservoir would be used to raise the dam height and also extend it along both sides of the dam as an earth bund (NRC 2018). It was also noted that:

- the dam is located well upstream from property boundaries,
- the purpose of the proposal was to enhance water quality by trapping sediment, and
- the stream on which the dam is located flows intermittently through pasture; negligible habitat exists for aquatic ecosystems (i.e., the overall ecological values were considered low).

Resource consent was subsequently issued to LWP to increase the height of the Roberts' dam. One of the conditions of consent required that:

- all outflows of water from the dam are effectively dissipated to minimise scouring of the streambed and erosion of the stream bank,
- the spillway and outlet channel are installed, constructed and maintained to cope with all flood events up to and including a 1-in-100 year storm return period, and
- provision is also made in the design and construction for safe discharge of flood flows in excess of the 1-in-100 year storm overflow spillway capacity.

4.6 Synthesis

The five edge-of-field diffuse pollution mitigation case studies outlined in this section all required resource consent from the relevant regional council (and in some cases, the relevant district council as well) to authorise construction. In three of five cases, the overall regional plan rule classification for the suite of proposed construction and operation activities was discretionary; in one case the overall classification was non-complying. These classifications applied even though the mitigation projects all had the primary purpose of environmental enhancement.

[10] Rule 28.1.2 is cited in NRC (2018) but this permitted activity rule relates to dams constructed after 18 March 2006; the Roberts' dam was constructed prior to 1994.

[11] This may be Rule 28.2.1 as well as Rule 28.2.2. The NRC (2018) cites Rule 28.1.1 but this relates to the permitted activity.

In three cases, activities associated with the mitigation proposals were not accommodated under existing regional plan rules (e.g., deposit of woodchips into land in a manner that would enter groundwater), resulting in an automatic requirement for at least one resource consent. Te Ahuriri wetland in the Canterbury region provides an example where several activities triggered a requirement for consents and/or a consent under a more restrictive plan rule, largely on technical grounds. For example, the proposal to discharge sediment-laden water abstracted from the remnant channel of the Huritini/Halswell River to pasture rather than return it to the channel during bed cleaning triggered the requirement for consent under a discretionary rule.

5 Incentives for installing edge-of-field, farm-scale mitigations

In this section we summarise the findings of a review of readily accessible information regarding regional council funding or subsidy schemes available to assist with the uptake of edge-of-field, farm-scale mitigation initiatives. We accessed material on-line and followed this with telephone calls to each council to gain a better understanding of access to funding, criteria which need to be met, and the application process. In most cases, calls were made to a council Land Management Officer, or a Catchment or Environmental Programmes Advisor. Opportunities to speak with staff face to face were taken where visits were scheduled with councils to discuss regulatory barriers. In arranging one of these visits – with Bay of Plenty Regional Council (BoPRC) land management staff in September 2019 – we were advised of an informal, parallel (but independent) survey of regional council grants and funding undertaken through the regional sector's Land Managers Special Interest Group (SIG). We were given the opportunity to collate the email responses and we have used these to supplement the information obtained from our website searches and telephone calls.

5.1 Financial incentives

A summary of the information gathered on regional council incentives is provided in Table 5-1. The availability of funding appears to generally reflect current regional priorities, particularly protection and restoration of waterways through planting and fencing. Some councils award funding based on the prioritisation of catchments (e.g., where water quality or ecosystem health does not meet regional or national requirements), such as Waikato Regional Council and BoPRC. In the Lake Rotorua catchment (Bay of Plenty), where land use change is required to meet catchment nitrogen targets, landowners can obtain subsidies worth approximately $2,500 to $5,500 to engage a nutrient advisor. Further to this, where advice indicates land use change is the only option, the affected landowner can access an additional subsidy to engage a business advisor to look at alternative land uses (Cross[12], pers. comm.). Funding to enable farmers in the Lake Rotorua catchment to engage nutrient specialists and business advisors is sourced from a combination of central government and council rates.

Some council land management advisors noted that other funding (not listed) is available for managing specific sediment-related issues and erosion (e.g., in hill country) – a priority for several councils. One council advisor also noted that, in contrast to other regions, their concern is not nitrogen (although issues with nitrogen did exist), but with phosphorus and sediment loss.

With the exception of West Coast Regional Council, funding is available for a range of activities which are intended to improve environmental outcomes. Common activities are riparian planting and fencing waterways; in conversation, council advisors noted that a wider range of activities intended to improve water quality would be considered.

The eligibility criteria for grants and subsidies across councils are somewhat broad, and some council advisors take a case-by-case approach in order to provide advice that fits the site. The application process for many incentives begins with a call to a Land Management Advisor, who is likely to visit the site of the proposed project.

Although the majority of incentives require co-funding, the criteria for accessing subsidies vary between regions. Some definitions of co-funding include labour as a landowner contribution. Other funding is defined as an arranged work-programme which takes place over a period of time. Another form of financial incentive is the supply of appropriate riparian plants at cost or free of charge.

[12] Rosemary Cross, Team Leader – Land Management, Bay of Plenty Regional Council.

Table 5-1: Summary of financial incentives available through regional and unitary councils (e.g., funding grants, subsidies) that may support implementation of edge-of-field, farm-scale diffuse pollution mitigation measures. This summary is based on a review of council websites, telephone calls to councils and a review of council responses to a survey coordinated by the Land Managers Special Interest Group in mid-2019. The information is intended to be indicative only.

Region	Financial incentives			
	Fund/grant	Co-funding	Funding/grant rate	Activities covered and other fund details
Northland	Environment Fund	✓	50%	Supports activities towards improving environmental outcomes. Varied projects including soil conservation and water quality
Auckland	Regional Environment and Natural Heritage Fund	✓	$5,000-40,000 per project	Projects should contribute to the protection, improvement, and/or restoration of waterways. Up to 50% funding for a one-year project and 20% funding for multi-year projects. Application open 16 July – 31 August
Waikato	Waterways and Wetland Management Fund	✓	Total annual fund is $40,000	For activities which benefit waterways, such as planting and fencing. Relates to regional priority catchments
Bay of Plenty	Riparian Management Programme	✓	$220,000/yr max. for biodiversity protection and enhancement $75,000/yr max. for riparian protection and enhancement $10,000/yr max. to support for care groups to enhance environmental values	A range of activities, including alternative water supplies, fencing, planting for riparian and erosion protection and control, wetland construction. Co-funding is provided, with preference given to the highest priority actions in 12 identified "focus catchments" where specific reductions in contaminant levels are required to meet ecological, cultural or human health objectives established through implementation of the NPS-FM. For farm-scale mitigations, such as sediment traps and constructed wetlands, up to 80% of the construction cost may be met with a grant where these mitigations are identified as a 'priority action 1' (the maximum grant rate drops to 50% for 'priority action 2' and 25% for non-focus catchments). Actions are prioritised *"based on the likelihood/degree to which mitigation works will address the water quality of concern"* (BoPRC 2019)
Gisborne	Natural Heritage Fund	✓	$30,000/yr max.	Biodiversity focus – includes fencing, planting, plant costs and site preparation. For privately owned land, where other funding can't be used. Can be allocated to one or more projects
Hawke's Bay	?	N/A	75% for riparian protection and enhancement 75% (75-100% for reversion of land) for interventions to improve water quality	Tukituki priority catchments, specific projects and HBRC hotspots. Small grants of up to $750 are also available for non-profit groups and small businesses to enhance environmental values through the Local Environment Action Fund (LEAF)
Taranaki	Riparian Management Programme	✓	N/A*	For the protection and restoration of regionally significant wetlands (RSW), which have 50% or more regionally important species. * Plants supplied at cost, with some funding for RSW Note: According to Arnoux (2019), there is also a 'Wetland Consent Fund' derived from financial contributions made by holders of resource consents for piping and drainage. One of the priorities under this fund is creation of constructed wetlands to mitigate the effects of piping by intercepting contaminants after they exit subsurface drainage. The first project of this nature was funded in 2020 (see Section 4.2)

Table 5-1 *cont*.: Summary of financial incentives available through regional and unitary councils (e.g., funding grants, subsidies) that may support implementation of edge-of-field, farm-scale diffuse pollution mitigation measures. This summary is based on a review of council websites, telephone calls to councils and a review of council responses to a survey coordinated by the Land Managers Special Interest Group in mid-2019. The information is intended to be indicative only.

Region	Financial incentives			
	Fund/grant	Co-funding	Funding/grant rate	Activities covered and other fund details
Manawatu-Whanganui	Environment Grant	✓	Maximum of $10,000	For biodiversity and/or riparian protection and enhancement and other interventions to improve water quality, as well as support for care groups to enhance environmental values
Wellington	Riparian Programme, LTP and strategic funding	✓	50% for biodiversity or riparian protection and enhancement 34% for interventions to improve water quality	Biodiversity or riparian protection and enhancement activities at scheduled sites in the regional plan and endangered forest systems, other interventions to improve water quality, and support for care groups to enhance environmental values
Tasman	Rivers and Streams Management Fund, Catchment Enhancement Fund	✓	50%, with $80-100,000 in total/yr	For biodiversity and/or riparian protection and enhancement and other interventions to improve water quality, as well as support for care groups to enhance environmental values. Covers materials only, which is 50% for fencing
Nelson	Healthy Rivers Fund, LTP funding	✓	$10,000 maximum	For riparian protection and enhancement to achieve freshwater outcomes. Includes support for care groups to enhance environmental values. Up to $13,000 is also available to support protection/enhancement of significant natural areas through directly engagement of private land contractors by council
Marlborough	Landowner Assistance Programme	✓	50-87.5% depending on the project	Financial assistance is available for fencing, native plant re-vegetation, and pest and weed control. A general limit of $15,000/site and $30,000/property
West Coast	N/A	N/A	N/A	N/A
Canterbury	Multiple funding streams	✓	50-100% depending on fund	For biodiversity and/r riparian protection and enhancement of biodiversity, interventions to improve water quality and support for care groups to enhance environmental value. Applies to private or public land, with priority areas set under Zone Implementation Plans. Grants are classified under the one banner rather than separated out into different activities. Requires third party funding (may include labour in contribution)
Otago	ECO Fund	✓	$250,000/yr, in three funding rounds	Case-by-case focus on the benefit of activities on the community. Three funding rounds: January, May and September. Applications for over $150,000 require co-funding
Southland	Farm Enablement Grant	✓	50%, max. $5,000 per applicant ($100,000 in total/yr)	Activities that benefit the environment with a focus on water quality (e.g., engineered wetland, sediment traps, culverts, riparian planting and fencing). Open to farmers with a Focus Activity Farm Plan with recommended actions to improve water quality
	Environmental Enhancement Fund		Up to 50%, $40,000 annually available	Activities that focus on biodiversity protection and enhancement (e.g., native planting, fencing, pest control, wetland restoration), but potential crossover with activities that mitigate pollution. For large projects (over $1,000) funding will only be given to those that are secured by long-term protection of the site

Common exclusions on the award of funding are for activities required as part of "good management" practices or by legislation, such as stock exclusion or a mitigation activity that is required as a condition of resource consent. In most cases retrospective funding is also excluded. Some grants have few outright exclusions.

Several councils appear to have reviewed their funds and or funding criteria in recent years. For example, in July 2019, BoPRC approved a new Environmental Programmes Grant Policy to guide staff – principally Land Management officers – on the use of financial resources for biodiversity and sustainable land management activities[13]. Like many other councils, BoPRC had traditionally engaged with landowners anywhere across the region to offer advice and co-funding, meaning resources were often provided to individual landowners that were willing to undertake environmental enhancement (i.e., resources were not necessarily prioritised to focus on degraded or at-risk catchments or even to take a whole-of-catchment perspective) (de Monchy[14], pers. comm. 2019). As noted in Table 5-1, the new approach outlined in BoPRC (2019) is for co-funding through grants and environmental programmes to be *"preferentially applied to the highest priority actions in focus catchments"*[15] where specific reductions in contaminant levels are needed in order to meet ecological, cultural or human health objectives established through implementation of the NPS-FM.

5.2 Non-financial incentives

Some councils provide information on riparian planting to complement funding, while others provide this in place of funding. In the Lake Rotorua catchment, a dedicated phone hotline is being set up to give landowners in the region a single point of access to information and advice (e.g., subsidies, plan rules) that will be provided by land management officers (Cross, pers. comm.).

Several councils have provided assistance with applications for resource consents associated with diffuse pollution mitigation projects. For example, in both case studies of wetlands constructed on private farmland outlined in Section 4, the regional council applied and paid for the costs of obtaining resource consent. Each council is also monitoring wetland performance.

5.3 Additional comments

One barrier noted by council advisors was a lack of landowner awareness of the options available to assist them with environmental initiatives. Although information is generally available on council websites, the information is often packaged to be easily digestible so it is not comprehensive or detailed. In addition, we found that websites were not always up to date. Discussions with council advisors may identify more options for funding and, because many councils administer multiple funds, it may be necessary for landowners to engage with staff from multiple departments (e.g., land management and biodiversity officers).

Some advisors noted the importance of ensuring that landowners or groups seeking funds were aware that the continued maintenance of any enhancements (e.g., wetland plants) was their responsibility, and not that of the council. There was some concern that with a change of land ownership or over time the completed enhancement or mitigation work may lose efficacy or even be disestablished (Tikkisetty[16] pers. comm.).

[13] Sustainable land management activities are defined as *"works designed to protect or improve water quality by reducing the loss of contaminants from land, as well as managing erosion"* (BoPRC 2019).

[14] Pim De Monchy, Coastal Catchments Manager, BoPRC.

[15] Support will continue for Care Groups and biodiversity programmes but the number and value of environmental programmes outside of focus catchments will reduce (BoPRC 2019).

[16] Bala Tikkisetty, Sustainable Agricultural Advisor – Technical, Waikato Regional Council.

6 Discussion

In this section we briefly discuss the key findings of Sections 3, 4 and 5 in relation to regional plan rules and council incentives relevant to the construction, operation and maintenance of edge-of-field, farm-scale diffuse pollution mitigation measures. We comment on some of the variation that exists across regional plans and suggest specific planning provisions and guidance for mitigation measures that would be useful. We then summarise the core information needs to support regulatory assessments of mitigation proposals, drawn from standard conditions commonly attached to relevant permitted activity rules and consenting commentary provided in regional plans. Lastly, we briefly return to council incentives to support implementation of mitigations, with a focus on a recently approved policy for environmental grants prepared by Bay of Plenty Regional Council.

6.1 Regional differences

The assessment in Section 3 identified a wide range of activities associated with the construction, operation and maintenance of edge-of-field, farm-scale diffuse pollution mitigation measures that need to be checked against regional plan rules to determine resource consent requirements. While there is significant commonality across many general requirements (summarised in Section 6.3), including the need to maintain fish passage and minimise the release of sediment during instream works, many of the more specific requirements, including the design of structures such as culverts and dams, vary from region to region.

Some regional differences can be expected, reflecting both differences in the timing of plan development and evolution, as well as difference in environmental factors (e.g., soil types, rainfall and timing of fish spawning). However, the lack of consistency in terminology and definitions used across regional plans was surprising. Greater standardisation of key terms would be beneficial for all users of plans, including researchers and practitioners involved with designing and implementing diffuse pollution mitigation measures.

Variation in the definition and use of terms in regional plans was examined previously (e.g., Boffa Miskell Limited (2015)). The Ministry for the Environment holds a definitions database for terms used and defined in both regional and district plans and we note standard definitions for some terms relevant to this report (e.g., drain) form part of the recently introduced National Planning Standards (MfE 2019a). These Standards also set requirements to promote greater consistency in the structure and layout of regional plans (as well as regional policy statements and district plans).

6.2 Specific planning provisions and guidance for mitigation measures

With the common exception of riparian planting in riverbeds and river margins, very few of the regional plans we reviewed in Section 3 contained rules that made specific mention of edge-of-field, farm-scale diffuse pollution mitigation measures. This likely reflects the current state of implementation of other more 'technical' mitigations such as constructed wetlands and woodchip denitrification filters; these mitigations are not yet commonplace across New Zealand. Moreover, unlike other well-established farm-scale activities, such as on-site wastewater treatment, there is a smaller evidence base regarding their operational performance and limited guidance regarding design. Lack of information limits the development of specific rules to address activities associated with their implementation (e.g., for depositing woodchip filter material into land). This means that mitigation proposals are currently evaluated against more generic rules for activities involving the use of land, the use of beds of lakes and rivers, the taking, using, damming or diversion of water, and the discharge of contaminants.[17] As evidenced from several case studies in Section 5, this can result

[17] The Nelson Regional Management Plan (NRMP) was one of the few regional plans with a permitted activity rule for planting that explicitly referenced constructed wetlands.

in part of an activity falling outside the scope of a rule(s) and triggering consent under a discretionary rule.

While diffuse pollution mitigation measures seek to have *positive* effects in terms of water quality and environmental outcomes, it is inevitable that their construction, operation and maintenance have at least the potential to create short-term *adverse* effects that need to be avoided, mitigated or remedied through specific conditions on a resource consent. This is particularly the case where mitigations intercept streams, groundwater or other waterbodies. In addition, because mitigations need to be designed to suit specific site and environmental conditions, it seems unlikely that their implementation could be catered for through standard conditions attached to permitted (or even controlled) activity rules. One obvious exception is where the mitigation is relatively small in scale and located away from natural water bodies (e.g., no resource consents were required for the Kaiwaiwai constructed wetland in southern Wairarapa).

Although a resource consent seems inevitable in order to construct a mitigation in or near the beds of rivers and other natural waterbodies, it may be possible to streamline the consenting process. New restricted discretionary rules that specifically target the suite of activities associated with implementing mitigations could be developed as part of plan change/review processes. This approach would seem consistent with the intent of the recently proposed new draft National Policy Statement for Freshwater Management (NPS-FM, MfE 2019b), and provisions in the Proposed National Environmental Standards for Freshwater. For example, Policy 3 of the draft new NPS-FM (MfE 2019b) specifically seeks to ensure *"that the health and wellbeing of waterbodies and freshwater ecosystems is maintained or improved".*

Researchers and practitioners could assist with the development of new rules and streamlining the consent process by developing guidance for council staff. This guidance could provide:

- an overview of common mitigation measures, evidence of the scale and extent of their environmental benefits, and outline any knowledge gaps around their performance, and
- standard design requirements, and recommended best management practices to avoid, remedy or mitigate potential adverse effects associated with their construction, operation and maintenance.

From this guidance material, it may be possible for councils to develop both specific plan provisions and consenting guides to facilitate implementation of diffuse pollution mitigation measures. Ancillary activities associated with mitigation construction (e.g., the discharge (release) of sediment associated with streambed disturbance when constructing a weir) will also need to be considered to minimise the number of rules that may otherwise be triggered.

Environment Canterbury's Land and Water Regional Plan (LWRP) contains an example of a restricted discretionary rule that provides for disturbance of the bed and banks of a river to remove fine sediment (i.e., less than 2 mm in diameter) for the sole purpose of habitat restoration. However, as was illustrated in the proposal to restore the remnant channel of the Huritini/Halswell River as part of constructing a wetland at Te Ahuriri Reserve (Section 4.1), one of the requirements associated with the rule was not met; consequently, the fine sediment removal defaulted to a full discretionary activity under a different rule. This suggests that developing restricted discretionary rules that can be applied 'universally' to environmental enhancement activities may be a challenge. The challenge will likely be even greater in regions such as Manawatu-Whanganui where a resource consent is required for existing intensive farming land use activities within targeted water management sub-zones; in cases where activities in these sub-zones do not meet revised Table 14.2 nitrogen leaching rates

specified in Proposed Plan Change 2 to the Horizon's One Plan, they will default to a full discretionary activity, as would any associated proposed mitigation measures (Baish[18], pers. comm.).

6.3 Core information needs for regulatory assessment

For efficiency, resource consent applications should consider the suite of activities associated with a mitigation proposal, including any activities that are covered under permitted activity rules. Section 88 and Schedule 4 of the RMA set out the requirements for making a consent application and preparing an Assessment of Environmental Effects (AEE). Figures 6.1 to 6.4 summarise some more specific information requirements relevant to the construction, operation and maintenance of diffuse source mitigation measures. These figures link common construction, operation and maintenance activities to relevant sections of Part 3 (Duties and Restrictions) of the RMA:

- Section 9 (of the RMA): Restrictions on the use of land,
- Section 13: Restrictions on certain uses of beds of lakes and rivers,
- Section 14: Restrictions relating to the taking, using, damming or diversion of water, and
- Section 15: Discharge of contaminants.

The information presented in these figures has been drawn from the assessment of permitted activity rule and consenting requirements in Sections 3 and 4 of this report, respectively. The information is only intended to indicate the type of details a council would require when considering a resource consent application; the large variation across regional plans in the specific requirements of some rules dictates that the relevant regional plan provisions (and other legislation) must be consulted. In addition, consultation with iwi and stakeholders such as the Department of Conservation[19] and Fish & Game Council would likely be expected.

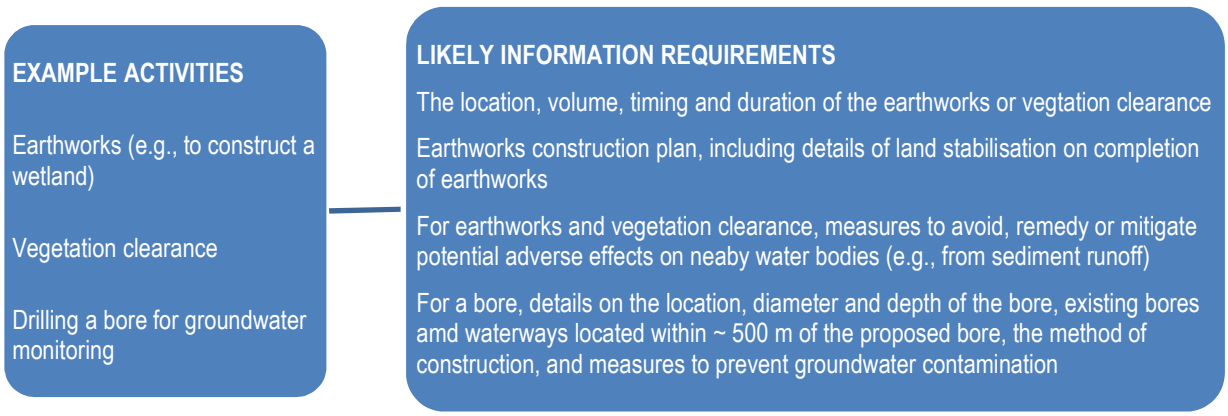

Figure 6-1: Key information likely to be required by regional councils when considering a resource consent application for activities that involve the use of land (as per s9 of the RMA). The activities listed are examples of those commonly associated with construction and maintenance of diffuse pollution mitigation measures.

[18] Lynette Baish, Senior Policy Analyst, Horizons Regional Council.

[19] Separate to the requirements of a regional plan, under the Freshwater Fisheries Regulations 1983, culverts, fords, dams and diversion structures that impede fish passage require approval from the Department of Conservation.

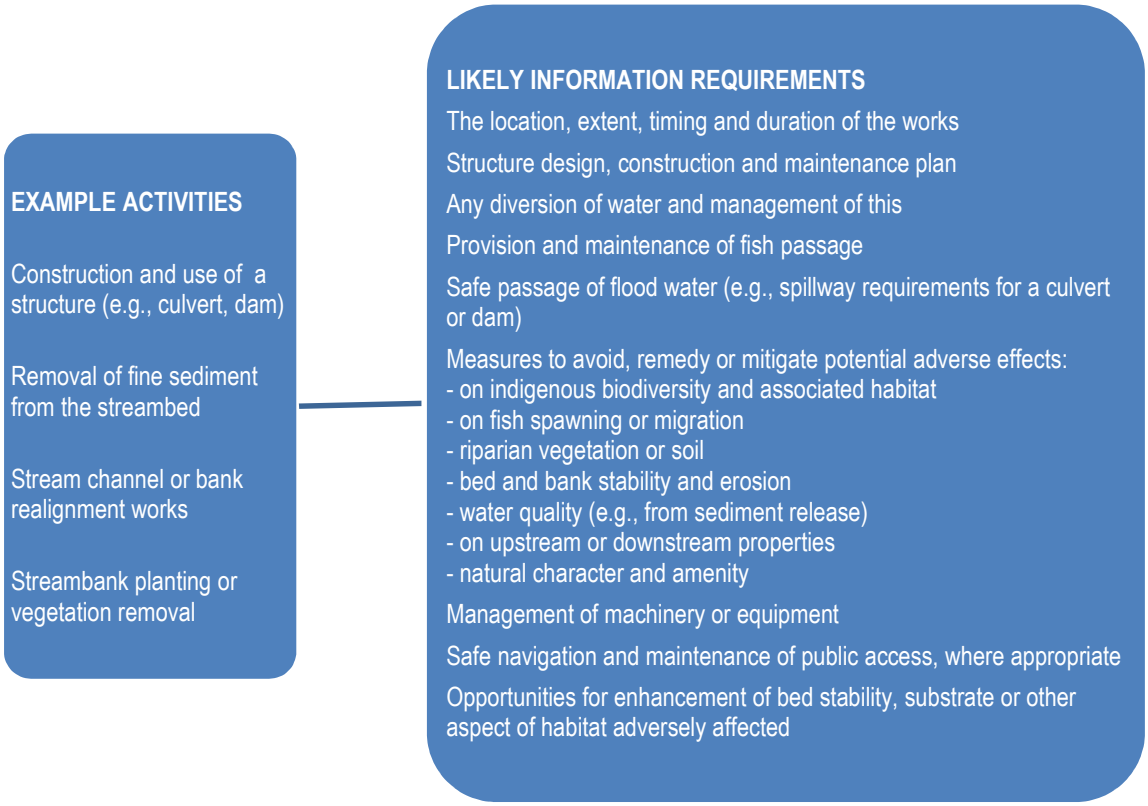

Figure 6-2: Key information likely to be required by regional councils when considering a resource consent application for activities that involve the use of the beds of lakes and rivers (as per s13 of the RMA). The activities listed are examples of those commonly associated with construction and maintenance of diffuse pollution mitigation measures.

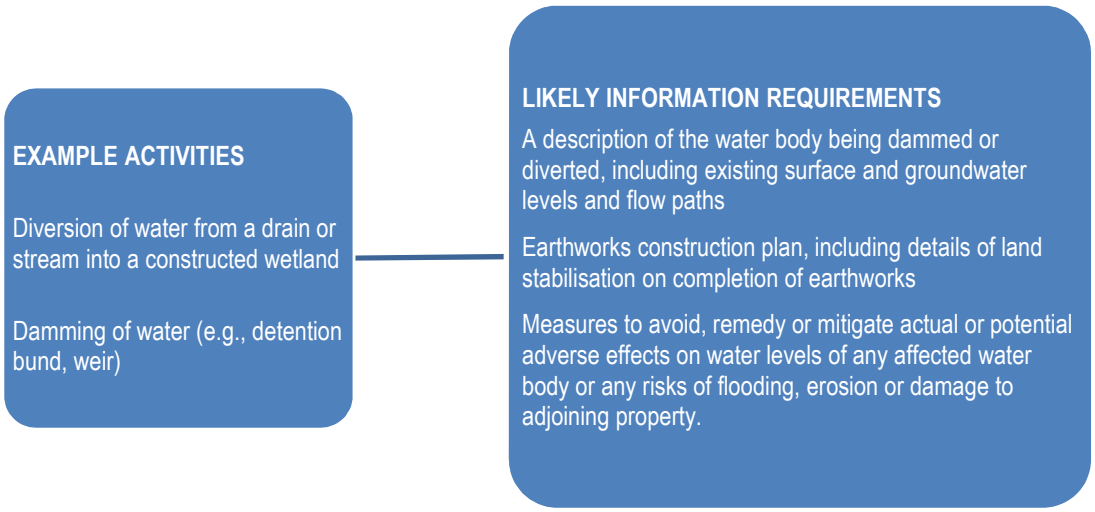

Figure 6-3: Key information likely to be required by regional councils when considering a resource consent application for activities that involve the taking, using, damming or diversion of water (as per s14 of the RMA). The activities listed are examples of those commonly associated with construction, operation and maintenance of diffuse pollution mitigation measures.

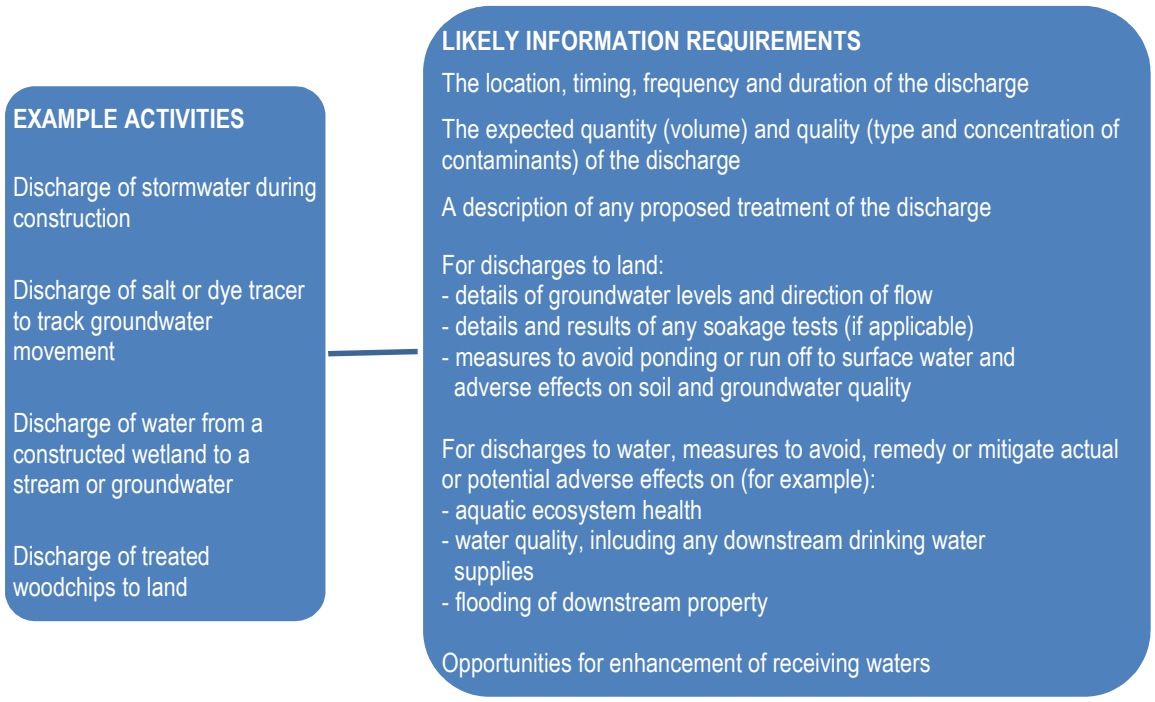

Figure 6-4: Key information likely to be required by regional councils when considering a resource consent application for activities that involve the discharge of contaminants to land or water (as per s15 of the RMA). The activities listed are examples of those commonly associated with construction, operation and/or maintenance of diffuse pollution mitigation measures.

6.4 Incentives for installing edge-of-field, farm-scale mitigations

Our review identified that all but one regional council made available financial grants or other funds for environmental enhancement projects. These might support landowners when implementing diffuse source mitigation measures. The most commonly funded activities were riparian planting and fencing, activities that have been promoted by councils for several decades. Almost half of regional councils, including Waikato, Bay of Plenty, Hawke's Bay, Horizons, Greater Wellington, Environment Canterbury and Environment Southland, appear to have reviewed the scope and criteria for environmental enhancement projects they have traditionally funded; support is now available for a wider suite of initiatives to specifically improve water quality.

Although we are not aware of an equivalent to BoPRC's Environmental Programmes Grant Policy, which has an explicit focus on funding activities likely to improve water quality in priority catchments (as opposed to primarily protecting or enhancing biodiversity), NPS-FM implementation is likely the key driver behind the broadening of funding initiatives offered by other councils such as Horizons and Environment Southland. In Canterbury, freshwater management is now largely occurring at a sub-regional scale, with funding for interventions to improve water quality (as well as other environmental enhancements) allocated according to priorities established within each sub-regional Zone Implementation Plan (Davie[20], pers. comm. 2019).

We did not identify any specific cases where mitigation initiatives were considered by councils for their potential to serve as an offsetting mechanism (e.g., credits in N budgets). The primary focus appears to be how mitigations can reduce contaminant loss to freshwater (e.g., nitrate leaching from dairy pasture or cropping) and, consequently, to improve compliance with regional plan limits and targets. Biodiversity enhancement is also of interest.

[20] Dr Tim Davie, Chief Scientist, Environmental Canterbury.

7 Conclusions

A very wide range of activities associated with the construction, operation and maintenance of edge-of-field, farm-scale diffuse pollution mitigation measures could potentially trigger the need for resource consent(s) under regional plans. Determining which activities require consent is not straightforward; multiple rules must be checked related to the use of land (e.g., earthworks to construct a wetland), disturbance of river or lake beds (e.g., for planting or construction of a culvert or dam), the taking, use, damming or diversion of water, and the discharge of contaminants to land or water (e.g., stormwater during earthworks or agrichemicals from spraying). Moreover, rules across multiple plans would need to be checked (e.g., operative and proposed regional plans as well as, in any cases, district plans) when developing a proposal to implement a mitigation tool.

For researchers, practitioners and farm advisers working across multiple regions, the situation is further complicated because the layout of plans, the use and definitions of some terms (e.g., modified river vs. highly modified river), and specific aspects of some rules (e.g., design criteria for the construction of culverts and dams) differ between councils. Implementation of the recently introduced National Planning Standards should help improve consistency in plan structure, layout and terminology.

Although permitted activity rules exist for most activities relevant to the construction, operation and maintenance of diffuse pollution mitigation measures, the rules are generally accompanied by lengthy lists of conditions. Examination of the consenting process associated with five recent edge-of-field diffuse pollution mitigation projects indicated that it was difficult to meet all of these conditions. In some cases:

- conditions were not met on technical grounds (e.g., a permitted activity rule for disturbance of a riverbed did not authorise such disturbance for the purposes of wetland construction), or
- there was no relevant permitted activity rule that applied to an activity (e.g., deposit of woodchips into land in a manner that would enter groundwater).

In three of the projects, the overall regional plan rule classification for the suite of construction and operation activities defaulted to discretionary and, in one project, non-complying. This occurred even though the mitigation projects had the primary or sole purpose of environmental enhancement.

It is unlikely that implementation of diffuse mitigation measures could be catered for through permitted (or even controlled) activity rules. This is because:

- construction, operation and maintenance of most mitigations have at least the potential to create short-term adverse effects that are easier to manage through more restrictive classes of rules, and
- design and implementation must be customised to address specific site and environmental requirements, making it more difficult to establish a single set of standard conditions that could be applied to a permitted or controlled activity rule.

Although construction or implementation of a mitigation in or near the beds of rivers and other natural waterbodies almost inevitably will require a resource consent, it might be possible to streamline the consenting process. New restricted discretionary rules that specifically target the suite of activities associated with implementing mitigations could be developed as part of plan change/review processes. Researchers and experienced practitioners could provide information to assist with the development of these rules. This information could also serve as guidance to assist

council staff with their assessment of resource consent applications, thereby further streamlining the consenting process.

Although all but one regional council provides funding to support landowners with implementation of diffuse pollution mitigation measures, accessing the funding isn't necessarily straightforward. Application processes are specific to each council and information on websites is not always complete or current. While a land or catchment management officer is the logical point for initial contact, many councils administer multiple funds and landowners may need to engage with other council staff as well (e.g., biodiversity officers).

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Hawke's Bay RC	Madeline Hall, Catchment Advisor
Taranaki RC	Jess Shailer, Land Management Officer Regan Phipps, Science Manager – Hydrology/Biology
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Nelson CC	Susan Moore-Lavo, Environmental Programmes Advisor
Environment Canterbury	Tegan Woodworth*, Consents Planner David Murphy*, Programme Implementation Manager for Whakaora Te Waihora Tim Davie*, Chief Scientist
West Coast RC	Alyce Melrose, Policy Planner
Otago RC	Shayde Bain, Communications and Engagement Advisor Richard Pettinger, Senior Analyst – Freshwater and Land
Environment Southland	Mark Oster, Biodiversity Programme Leader David Hicks, Team Leader – Land and Water Vicky Collard – Senior Policy Planner

* Discussion in person

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Appendix A Regional Plan references

All regional plans were accessed on-line between March and May 2019 or in March 2020.

Council	Regional/Unitary Plan reference
Northland RC	Proposed Regional Plan for Northland https://www.nrc.govt.nz/media/14867/proposed-regional-plan-appeals-version-july-2019-website-v20.pdf
Auckland Council	Auckland Unitary Plan (operative in part) https://unitaryplan.aucklandcouncil.govt.nz/pages/plan/Book.aspx?exhibit=AucklandUnitaryPlan_Print
Waikato RC	Waikato Regional Plan (WRP)* https://www.waikatoregion.govt.nz/Council/Policy-and-plans/Rules-and-regulation/Regional-Plan/Waikato-Regional-Plan/
Bay of Plenty RC	Bay of Plenty Regional Natural Resources Plan (RRNP)* https://atlas.boprc.govt.nz/api/v1/edms/document/A3490282/content
Gisborne DC	Tairāwhiti Resource Management Plan http://www.gdc.govt.nz/the-tairawhiti-plan/
Hawke's Bay RC	Regional Resource Management Plan* https://www.hbrc.govt.nz/documents-and-forms/rrmp/?url=/our-council/policies-plans-strategies/rrmp/
Taranaki RC	Draft Regional Freshwater and Land Management Plan (RFLMP) https://www.trc.govt.nz/assets/Documents/Plans-policies/SoilWaterPlanReview/DraftPlan-April2015W.pdf
Horizons RC	One Plan* https://www.horizons.govt.nz/publications-feedback/one-plan
Greater Wellington RC	Proposed Natural Resources Plan (PNRP)* https://pnrp.gw.govt.nz/assets/Uploads/Proposed-Natural-Resources-Plan-for-the-Wellington-Region-July-2015.pdf
Tasman DC	Tasman Resource Management Plan (TRMP) https://tasman.govt.nz/my-council/key-documents/tasman-resource-management-plan/
Nelson CC	Nelson Resource Management Plan (NRMP) http://www.nelson.govt.nz/environment/nelson-resource-management-plan/nelson-resource-management-plan-2/view-the-nrmp/
Marlborough DC	Proposed Marlborough Environment Plan (PMEP) https://www.marlborough.govt.nz/your-council/resource-management-policy-and-plans/proposed-marlborough-environment-plan/accessing-the-proposed-marlborough-environment-plan
Environment Canterbury	Canterbury Land and Water Environment Plan (LWRP)* https://eplan.ecan.govt.nz/eplan/#Rules/0/55/1/25081
West Coast RC	Regional Land and Water Plan (RLWP) https://www.wcrc.govt.nz/publications/regional-plans/regional-land-and-water-plan
Otago RC	Regional Plan: Water for Otago (RPW) https://www.orc.govt.nz/plans-policies-reports/regional-plans-and-polices/water#download
Environment Southland	Proposed Southland Water and Land Plan (SWLP) https://www.es.govt.nz/about-us/plans-and-strategies/regional-plans/proposed-southland-water-and-land-plan