



Transforming Lowland Waterway Networks

An Implementation Guide for Reimagining the Ararira/LII

Plan prepared by Aqualinc, Learning for Sustainability & EOS Ecology
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This **Implementation Guide (IG)** is designed to work in conjunction the **Catchment Management Plan (CMP)**



The **CMP** can be [downloaded here](#), or via this QR code.



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The Ararira River through
Tārerekautuku Yarrs Lagoon.

Image source: Robin Smith, DOC

Introduction

This Implementation Guide (IG) has been created to facilitate the implementation of the Ararira Catchment Management Plan (CMP)¹. The IG is designed to assist partners and stakeholders in aligning their contributions across various departments and sectors, in order to better move towards the plan's vision. The guide is based on a framework comprising a number of activity areas that collectively support change.

The IG is primarily intended for catchment managers and governance bodies seeking to enhance the performance of freshwater systems, particularly in catchments where land drainage is a crucial element. It is also intended for Iwi/Māori, agribusiness intermediaries, sector organisations, environmental groups, and other partners and stakeholders looking to support collective action. The guide aims to promote inclusiveness and collective action, as well as to increase awareness of specific implementation activity areas that may otherwise be overlooked.



The IG is designed to complement the CMP for the Ararira catchment by providing guidance on the tasks and activities required to achieve the vision for improving waterway health. The IG supports agencies and catchment partners in planning and coordinating their efforts towards constructive collective action.

As an instructional and performance assessment tool, the IG provides a framework to facilitate thinking around the behaviours and tasks necessary for successful implementation. It helps decision-makers and practitioners identify gaps and improve their approach in practice. Additionally, Appendix A provides a self-assessment framework that can stimulate inclusive and forward-looking dialogue among partners and stakeholders around these key activity areas. The self-assessment framework enables participants to gain collective clarity on what works well, what needs improvement, and who can contribute. It can be used by an individual or small group of catchment leaders or as the basis for a large group facilitated exercise, bringing together partners and stakeholders across different workstreams.

¹ EOS Ecology, Aqualinc & Cawthron. 2023. Transforming Lowland Waterway Networks – A Catchment Management Plan (CMP) for Reimagining the Ararira/LII. Prepared in co-design with the Ararira Catchment Management Plan Project Team (Selwyn District Council, Te Taumutu Rūnanga, LII Drainage Committee, Living Water (Fonterra, Department of Conservation), Environment Canterbury, Learning for Sustainability). EOS Ecology Report No. AQU02-21015-01, 100p. <https://bit.ly/3oqpGdS>

TABLE 1:

This document works together with other key resources to provide the roadmap for improving the health of the Ararira catchment waterways for the benefit of future generations.

Project Document Roadmap for Catchment Waterway Improvement	
 Catchment Management Plan (CMP)	 Implementation Guide (IG)
<p>Summary of:</p> <ul style="list-style-type: none">• past & present state• current & future pressures• main challenges. <p>Proposes solutions:</p> <ul style="list-style-type: none">• Catchment-scale approaches designed to decrease ongoing impacts of surrounding land use.• Toolbox of proposed interventions to deal with existing state, plus the legacy of past & present drainage/land use practices. <p>What it does:</p> <p>Sets out plan to fundamentally change how the drainage network is managed by implementing tools that not only deal with existing challenges, but also enhance the catchments biodiversity & cultural values.</p> <p>The plan is grounded by the need to continue to provide effective drainage of productive land.</p> <p>Implementing catchment-scale changes in land/drain management, combined with reach-scale interventions will improve existing condition & reduce catchment pressures. This improves the state of waterways and, ultimately, the receiving environment (Te Waihora/ Lake Ellesmere).</p>	<p>Describes:</p> <ul style="list-style-type: none">• approaches for bringing people together to work towards a shared vision for catchments and to evaluate progress• financial pathways to support implementation of the CMP• planning/consenting requirements of the CMPs proposed toolbox• phasing of works. <p>What it does:</p> <p>Supports the implementation of the CMP. It is based around a framework of 12 key areas, which recognises a number of key activities that collectively support change. The aim of the IG is to stimulate and support a transparent, neutral, open, inclusive and forward-looking dialogue across SDC, mana whenua, partners and stakeholders to ensure that different activities collectively contribute to realising the bigger picture. In this way it works well with assessing progress towards a shared vision – such as that set out in the CMP.</p>



Lincoln wetlands.

Image source: Robin Smith, DDC

Key activity areas required for successful implementation

There are 12 key activity areas in this guide that support the management of a catchment's freshwater system in a synergistic way. Not all of these areas will be necessary in every situation, but missing out on a key area that is needed may result in missing an opportunity for leveraging change. Because implementation pathways must be developed in the context of individual place-based settings, new areas should also be added if necessary. This guide and framework can support implementation efforts in multiple ways, including the following:

- Fostering inclusiveness and participation among stakeholders by identifying their roles and promoting shared responsibility. Two-way communication, transparency, motivation, and consideration of stakeholders' inputs are crucial for a successful process.
- Reducing information gaps, promoting greater accountability, and assessing whether institutional and regulatory arrangements are suitable for delivering intended outcomes.
- Increasing awareness of specific issues that would otherwise not receive the same attention, improve data collection, and enhance social and technical capacity development in catchment management.

These initial key activity areas have been developed from the Ararira project team discussions, the wider Living Water work and projects², and past experience from the project team. This has also been informed by principles of water governance developed by the OECD Water Governance Indicator Framework.³ Collectively, the areas outlined here will be familiar to most agencies and partners. The 12 key activity areas are shown in Figure 1.

The following sections of this IG provide some indicative guidance and information relating to each of the required activity areas, and points to how they can be applied to implementation of a catchment plan – such as the Ararira CMP. A self-assessment framework for reviewing performance against these suggested activity areas for the Ararira Catchment is included in Appendix A.

² www.livingwater.net.nz

³ www.oecd.org/regional/OECD-Water-Governance-Indicator-Framework.pdf

12 Key Areas to Support Effective Catchment Management

FIGURE 1:
Key areas underpinning
effective implementation of
catchment management in the
Ararira Catchment.

Guidance on how to implement the CMP

Both SOCIAL and TECHNICAL aspects are needed for effective implementation of a CMP. All should be considered but, based on circumstances, some will require more emphasis than others.

Social Aspects	1	SHARED DIRECTION – Creating a shared vision, shared values and a process for working constructively together from the start will improve success and increase participation.	Page 6
	2	ENSURING A TE TIRITI-BASED APPROACH – Engagement, inclusion, and establishment of partnerships with mana whenua are vital components of freshwater governance as it acknowledges the role of Māori as kaitiaki (guardians).	Page 8
	3	PARTNERING, ENGAGING & COMMUNICATING – Catchment scale water management relies on engagement and partnering at multiple scales, and effective communication with stakeholders.	Page 10
	4	SUPPORTING COLLECTIVE ACTION – Implementing the CMP requires behaviour change by groups and individuals. Models of behaviour and practice change identify the key factors that need to be present for change to occur.	Page 14
Social & Technical Aspects	5	CAPACITY & CAPABILITY – A mix of technical and social capabilities and capacities will be needed to effectively implement the CMP.	Page 17
	6	REGULATIONS – Legislation, regulations and policies will impact or influence implementation of the CMP. Opportunities exist to influence policies and regulations to benefit implementation.	Page 20
	7	CONSENTING & COMPLIANCE – Implementation of the suite of interventions recommended in the CMP is likely to require resource consents. Global consents may help reduce the cost and technical burden and encourage uptake.	Page 26
	8	FINANCING – Rates revenue funds the current management of the drainage network but is unlikely to fund alternatives that incorporate better environmental or cultural outcomes. However, a spectrum of options exist for financing or subsidising the suite of interventions recommended in the CMP.	Page 30
	9	OPERATIONAL SEQUENCING – Implementation of the CMP will require a framework which supports diverse stakeholders to work together and plan for outcomes through a logical sequence.	Page 40
	10	KNOWLEDGE, INFORMATION & INSIGHTS – The collection of baseline data in the catchment will enable the impact of interventions to be shown. Current Council service targets and performance measures in Activity Management Plans may need to be broadened to incorporate objectives in the CMP.	Page 43
	11	MONITORING & EVALUATION – Reliable project performance information improves accountability, and is an important basis for sound management and encourages learning.	Page 46
	12	ADAPTIVE MANAGEMENT – An adaptive management framework will help catchment managers and stakeholders to react and adapt to changes that occur during implementation. Monitoring and maintenance data will drive engagement and positive change.	Page 49

1 Shared Direction

- Creating a shared vision is an important process for supporting transformative projects. It serves to amplify success, increase participation, and makes it easier to bridge any divide between different members of the community.
- Creating and implementing shared values is an important step for setting up for constructive change. Shared values provide guidance for organisational decision-making and also provide a kind of ethical compass for organisational action.
- A vision and values for the Ararira catchment have been defined as part of the development of the CMP. Implementation of the CMP will need to be consistent with these.

Creating a shared vision is an important process for change projects, serving to amplify success, increase participation, and bridge the divide between project leaders and constituents. Several of the most well-known practitioner-driven change models include developing a vision for the change, a sense of the desired future workings and outcomes of an organisation⁴.

In projects with many different groups involved, individual, shared, and organisational values are all important for project success. Shared values (especially in a catchment context), are the set of values that help different parties and stakeholder groupings relate to one another and see that they share some common principles, aims and aspirations. Organisational values are related to an organisation's central approach to its overarching mission and values. Having shared values builds a sense of shared interest in the direction of the catchment and reflects how individual and group values might align with a bigger catchment picture. It can be easy to think of shared values and organisational values as interchangeable terms, however, this is not the case. Organisations cannot force shared values, neither should they try to do so. Instead, organisations should create a culture that helps foster connections among the wider communities that they serve. To achieve shared values, organisations must look for ways to build meaningful connections between their organisation and others. It is also essential to recognise those people who contribute to these links and help them stay motivated, committed, and accountable to this cause.

Each stakeholder will also hold their own unique beliefs and principles. These reflect the variety of perspectives and

interests that should be considered in developing a catchment programme. Taking the time to understand and respect these individual values can often foster greater engagement and commitment from a wider range of people and groups, as well as help in developing more tailored communication and engagement initiatives.

A useful starting point for facilitating challenging work programmes that integrate many work groups and multiple stakeholders is to find ways to line up these value sets and articulate and guide the multiple activity streams required. Many catchment managers do not have the tools to easily set out, document and communicate complex goals, activity strategies and intended outcomes. Developing a theory of change (ToC) and accompanying logic models can assist by supporting diverse stakeholders to work together and plan for outcomes by envisaging a 'big picture' view of how and why a desired change is expected to happen in a particular context, and to help different groups see how their activities can constructively contribute (see Section 9). Without this, there is a risk that a plan is just a large 'wish list' of activities.

With a shared direction established, it is more feasible to ensure that:

- realistic implementation plans are developed with the different parties involved
- ToC are set out and agreed
- monitoring and evaluation is ongoing, and is used to adapt plans along the way within an adaptive management approach.

⁴ Doten-Snitker, K., Margherio, C., Litzler, E., Ingram, E., & Williams, J. 2021. Developing a shared vision for change: Moving toward inclusive empowerment. *Research in Higher Education*, 62(2), 206-229.

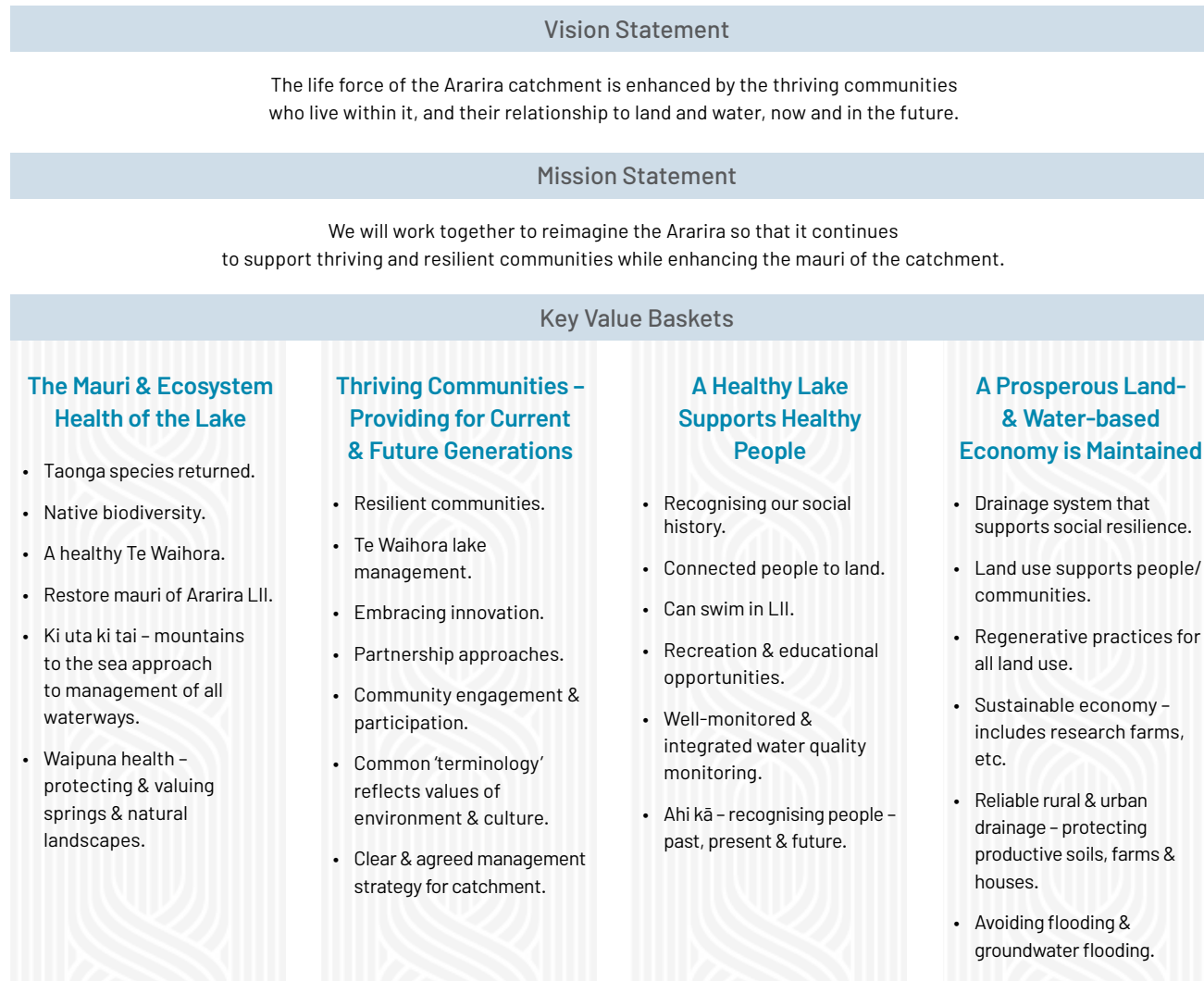


FIGURE 2:
Vision and values for the Ararira Catchment (from CMP).

2 Ensuring a Te Tiriti-based Approach

- Engagement and inclusion of Iwi/Māori are vital components of freshwater governance.
- In the Ararira Catchment there are well established relationships with mana whenua, through established partnerships.
- At a district level, Selwyn District Council (SDC) has partnered with mana whenua to bring multiple values into land drainage management.
- There are linkages between implementation of the Ararira CMP and efforts to restore and rejuvenate the mana, mauri and ecosystem health of Te Waihora.
- Establishing partnerships with mana whenua should be a priority action if this process is being used in other catchments.

Iwi/Māori engagement and inclusion is a vital component of governance. The Local Government Act (1974, 2002), which sets the framework for Councils operating and funding drainage networks (see Section 6.2), including several provisions that require councils to take account of the principles of the Treaty of Waitangi by maintaining and improving opportunities for Iwi/Māori to contribute to local government decision making. The same applies to other legislation that is relevant to catchment management and restoration, including: the Resource Management Act (1991) (and its proposed replacements) and the Conservation Act (1987).

Living Water established a memorandum of understanding (MOU) with Te Taumutu Rūnanga and SDC to enable the parties to work together to produce a CMP for the Ararira drainage district. This aspires to fundamentally change the way waterways in the catchment are valued and managed by incorporating ecological and cultural principles into the design while recognising that drainage would remain a key value. Te Taumutu Rūnanga have been represented on the Project Team during the development of the CMP and this IG.

The vision of the Te Waihora Co-Governance agreement is to **restore and rejuvenate the mana, mauri and ecosystem health of Te Waihora and its catchment**. As the Ararira catchment is a key source of water and contaminant loads to Te Waihora, work that is done to implement the Ararira CMP will have a positive impact on Te Waihora and will be consistent with the Co-Governance vision. The Te Waihora Co-Governors,

representing Ngāi Tahu, Environment Canterbury (ECan), SDC, Christchurch City Council (CCC) and the Department of Conservation (DOC) are key stakeholders as implementation of the CMP progresses.

The Whakaora Te Waihora joint restoration programme, under the governance of the Co-Governance Group, has the following long-term aims:

- Accelerate the restoration of ecosystem health of an internationally significant wetland, notable for its wildlife and native vegetation values.
- Begin the process of restoring and enhancing specific cultural sites and mahinga kai.
- Protection and restoration of lake margin wetland habitats, existing indigenous native vegetation and wildlife, and restoration of specific lowland tributary streams and riparian habitats.
- Improve lake and catchment management practices by focussing on sustainable land use and drainage practices within the catchment.
- Establish a robust monitoring and investigations programme that ensures the lake response to management is understood and management activities are adapted accordingly.

The above aims are consistent with implementation of the tools and solutions that the CMP recommends for the Ararira catchment. The Whakaora Te Waihora strategic summary notes the importance of collaboration with

other stakeholders in the catchment, including the Living Water programme.

Te Taumutu Rūnanga are represented on the Selwyn District Land Drainage Committee – Te Komiti Waiora (see Section 6.1).

SDC recognises and provides for the values and interests of tangata whenua in the district, and acknowledges a number of relevant iwi planning documents.

In a catchment with less well-established partnerships and co-governance arrangements between mana whenua, catchment managers, and other catchment stakeholders, high priority should be put on establishing a partnership arrangement early in the catchment planning process.

For more information:

- **SDC Iwi Management Plans:**
www.selwyn.govt.nz/property-And-building/planning/strategies-and-plans/iwi-management-plans
- **Te Mana Ararira:**
www.livingwater.net.nz/catchment/ararira-lii-river-te-awa-o-araiara/te-mana-ararira-1
- **Te Waihora Co-Governance:**
<https://tewaihora.org/regeneration/co-governance>
- **Whakaora Te Waihora strategic summary:**
https://tewaihora.org/assets/PDFs/Whakaora-Te-Waihora-Strategic-Summary_version-12-May-2022.pdf

3 Partnering, Engaging & Communicating

- Catchment-scale water management relies on engagement at multiple scales.
- National and regional policy and strategy development may not directly involve people at a local level, but policy-makers are increasingly seeing the value of incorporating local perspectives.
- Properly resourced networks and collaborations are needed at a local level. Individuals within these networks are important as ‘change champions’ and intermediaries.
- Broader public engagement, including interest groups and the general public can be important for gaining support of policies and funding mechanisms.

Clear communication and engagement are crucial to encouraging people to be part of the wider catchment management process. These activities should be included as part of the process, not as an afterthought. Communicating and engaging is a continuum from one-way to two-way interactions (see Table 2). Pushing out messages about what you’re doing is not enough by itself; effective two-way communication is essential to support relationships, dialogue, and contribute to building partnerships.

Remember, many people beyond the immediate team can contribute to supporting waterway management. A growing challenge for catchment managers is to also manage two-way communication strategies that support an active dialogue, and account for multiple stakeholder perspectives. Effective communication with external groups can broaden the conversation and increase awareness. Think about relevant organisations and other possible intermediaries outside the core group when identifying interested parties. By engaging stakeholders effectively, communication channels are improved, support for the project can be more effectively created and maintained, and the information gathered can help implementation.

A stakeholder analysis provides a method to identify a project’s stakeholders, assess their interests and needs, and inform project planning. This analysis helps identify goals, the roles of different stakeholder groups, and appropriate forms of engagement. It can also assess the social environment and set expectations

for success. Additionally, a stakeholder analysis can identify characteristics of key stakeholders, conflicts of interest, relationships that enable ‘coalitions’ of project sponsorship, ownership, and cooperation, and assess the appropriate type of participation by different stakeholders.

While stakeholder analysis is essential at the beginning of a project, it can also be used for ongoing assessment and management of relationships within a long-term catchment management programme.

In summary, effective communication, engagement, and stakeholder analysis are key to success in catchment management. By identifying key stakeholders and building relationships, catchment management programmes can be tailored to specific situations and target audiences.

TABLE 2:

Continuum of communication and engagement (from Allen *et al.*, 2018⁵).

Approach	What type of stakeholder engagement is required?
Partnership	<ul style="list-style-type: none"> • Two-way engagement – as a priority. • Co-creation and co-development of activities as the goal/aspiration.
Participation	<ul style="list-style-type: none"> • Two-way engagement – within agreed limits of responsibility possible and appropriate in the particular task. • The stakeholder can be viewed as one of the team. This can help to engage in delivering some tasks (e.g., co-design of operation).
Consultation	<ul style="list-style-type: none"> • Limited two-way engagement – stakeholders are involved through discussion, but are not asked to be responsible for any element of delivery.
‘Push’ communications	<ul style="list-style-type: none"> • One-way engagement – used to tell stakeholders about agency or partnership activity • May involve broadcast information aimed at particular stakeholder groups – often using various Internet-based media channels.
‘Pull’ communications	<ul style="list-style-type: none"> • One-way engagement • Information is made available, and stakeholders choose whether to engage with it, e.g., web pages.

3.1 Catchment Partners & Stakeholders

It is ideal to involve a range of partners and stakeholders when implementing a CMP.

There are several common groupings within any particular catchment:

- **Landowners** who may need to modify their land-use practices or make modifications to their infrastructure.
- **Mana whenua** as Treaty partners, Co-Governors and stakeholders in their own right.
- **Organisations** that influence good practice and can become sources of funding, such as government and industry bodies.
- **Regional and local government** in their roles as asset-owners, managers and regulatory authorities.
- **Intermediaries** – examples range from the private sector, business consultants or research organisations ‘translating’ novel environmental regulations into practice, to innovation networks improving communication flows between technology providers and users. Intermediaries facilitate dialogue, provide guidance, bridge gaps, advocate reform and pioneer novel forms of interaction between other types of stakeholders.
- **Individuals and groups** that have an interest in the catchment and the potential outcomes of implementing the CMP, but who do not have a direct involvement.

In the course of co-designing the Ararira catchment, the Project Team has identified key stakeholders and recorded their likely interests (Appendix B). In order to implement the CMP, a plan for engagement with stakeholders should be developed and updated as needed. Through the project life cycle, stakeholder identification and expectation management are ongoing processes.

⁵ Allen W., Grant, A., Earl, L., MacLellan, R., Waipara, N., Mark-Shadbolt, M., Ogilvie, S., Langer, E.R. & Marzano, M. 2018. The Use of Rubrics to Improve Integration and Engagement Between Biosecurity Agencies and Their Key Partners and Stakeholders: A Surveillance Example. In: Urquhart, J., Marzano, M., Potter, C. (eds) *The Human Dimensions of Forest and Tree Health*. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-76956-1_11

3.2 Different Scales of Activity

Multi-scale activities are necessary to manage water effectively. Here we suggest three scales to provide ideas for communication and engagement activities:

- i. Strategy and policy level development.
- ii. Operational management.
- iii. Support from groups and sectors that are more peripheral to the process.

Effective policy and strategy development should consider the realities of stakeholders and create a supportive social and institutional environment for change to occur. As part of this process, it is necessary to consider the benefits, barriers, and opportunities of suggested changes, run a transparent process, and enable various stakeholders to actively participate. In order to achieve optimal results, multiple policy approaches, including regulatory, economic, and voluntary ones, should be tailored to specific situations and combined with collaborative activities, such as information-sharing and social learning.

It is important that partnerships at the regional or sectoral level are inclusive and involve end-users in order to establish effective operations, and support changing practice on the ground. The role of key individuals and intermediaries in delivering environmental change is crucial. In order for collaborative partnerships to be sustained, funding for voluntary groups and paid

coordinator roles is essential. The use of theories of change (ToC) and logic models can help landowners and catchment managers work together across organisations and silos.

Successful water management requires reaching out to the general public. In order to maximise desired outcomes, campaigns and supporting activities must be tailored and messages must be delivered in a way that captures the attention of the audience. In cases where individuals do not have a specific interest in reconsidering potential management changes or their implications, this is especially important. If the public are aware of water management issues, policies, and activities then there is more likelihood that they will be open to supporting broader policies, such as more targeted public-good rating systems.

All aspects of communication and engagement should be tailored to specific situations and target audiences at multiple scales. Collaborative partnerships and tailored communication and engagement campaigns can help support practice change in complex settings. Table 2 summarises the continuum of approaches and the type of engagement required for each.

For more information:

- **Methodologies for Stakeholder analysis:**
[http://reload-globe.net/cms/attachments/article/56/Lelea_et_al_\(2014\)_StakeholderGuide_final_web.pdf](http://reload-globe.net/cms/attachments/article/56/Lelea_et_al_(2014)_StakeholderGuide_final_web.pdf)
- **Stakeholder analysis:**
https://learningforsustainability.net/pubs/Allen2009-Stakeholder_analysis.pdf
- Kirk, N., Robson-Williams, M., Fenemor, A., & Heath, N. (2022). Employing intermediaries to achieve freshwater quality improvements: lessons from catchment groups in Aotearoa New Zealand. *Australasian Journal of Water Resources*, 26(1), 104–115.



Implementation of the CMP
will enhance recreational
opportunities for local families.

Image source: SDC

4 Supporting Collective Action

- Implementing the Ararira CMP will require behaviour change by groups and individuals.
- Existing models of behaviour and practice change identify the key factors that need to be present for change to occur.
- Focussing on what drives or hinders behaviour change, alongside more traditional methods of changing behaviour, can potentially be used to support successful implementation.
- A mix of approaches is likely to be required to support implementation and bring about behaviour change. Frameworks are available for designing the mix of implementation approaches that will best suit the range of stakeholders involved.

Simply coming up with a plan or vision for the Ararira drainage network isn't enough. Catchment managers need to understand how people make decisions in their groups, communities, and organisations in order to identify motivations and barriers to behaviour and practice change. Recent research suggests that adding a behavioural insights-based approach to the traditional governance methods of legislation, regulation, market forces, material incentives, and communication and education programmes can be effective.⁶ Behavioural approaches can provide another perspective that may help to identify the most effective tools, even in some situations where traditional methods still work.

Our decisions are not always based on the rational processing of information. People are emotional and are influenced by the context of decisions and the way choices are presented. So, catchment managers use behaviour models that focus on behaviours, social norms, and leverage points to create systemic change. This helps us think about developing practice change in a catchment as supporting collective action. With this expanded perspective, we must acknowledge that achieving collective change necessitates fostering positive and constructive practice among all those within a catchment area. This grouping encompasses land managers, policy

makers, and the wide range of intermediaries who significantly contribute to shaping the broader context for land and water decision-making.

Catchment managers need to make decisions on the ground, but others also play an active role in creating the context that guides sustainable development efforts. To foster change at different levels of decision-making, they must consider the capabilities, opportunities, and motivations⁷ of a range of partners, participants, and stakeholders. Integrated policies and governance support sustainable and multi-value catchment management at the local, regional, and national level (see Section 3).

4.1 The 6E's Framework: A Tool for Designing an Implementation Approach

There are a range of tools for designing an implementation approach, that aim to help us link this theory and practice. Catchment managers are generally advised to use a mix of options, taking context and stakeholder characteristics into account.

The UK Defra-developed 6Es policy framework⁸ (Figure 3) is one such tool, which provides a framework to help

⁶ Allen, W. 2021. Influencing practice change: An introduction to behaviour change models and strategies (Presentation). Available online at <https://learningforsustainability.net/pubs/practicechange-intro.pdf>

⁷ www.instituteforgovernment.org.uk/sites/default/files/publications/MINDSPACE.pdf

⁸ Dolan, P., Hallsworth, M., Halpern, D., King, D., & Vlaev, I. 2010. MINDSPACE: influencing behaviour for public policy. www.bi.team/wp-content/uploads/2015/07/MINDSPACE.pdf

Approach

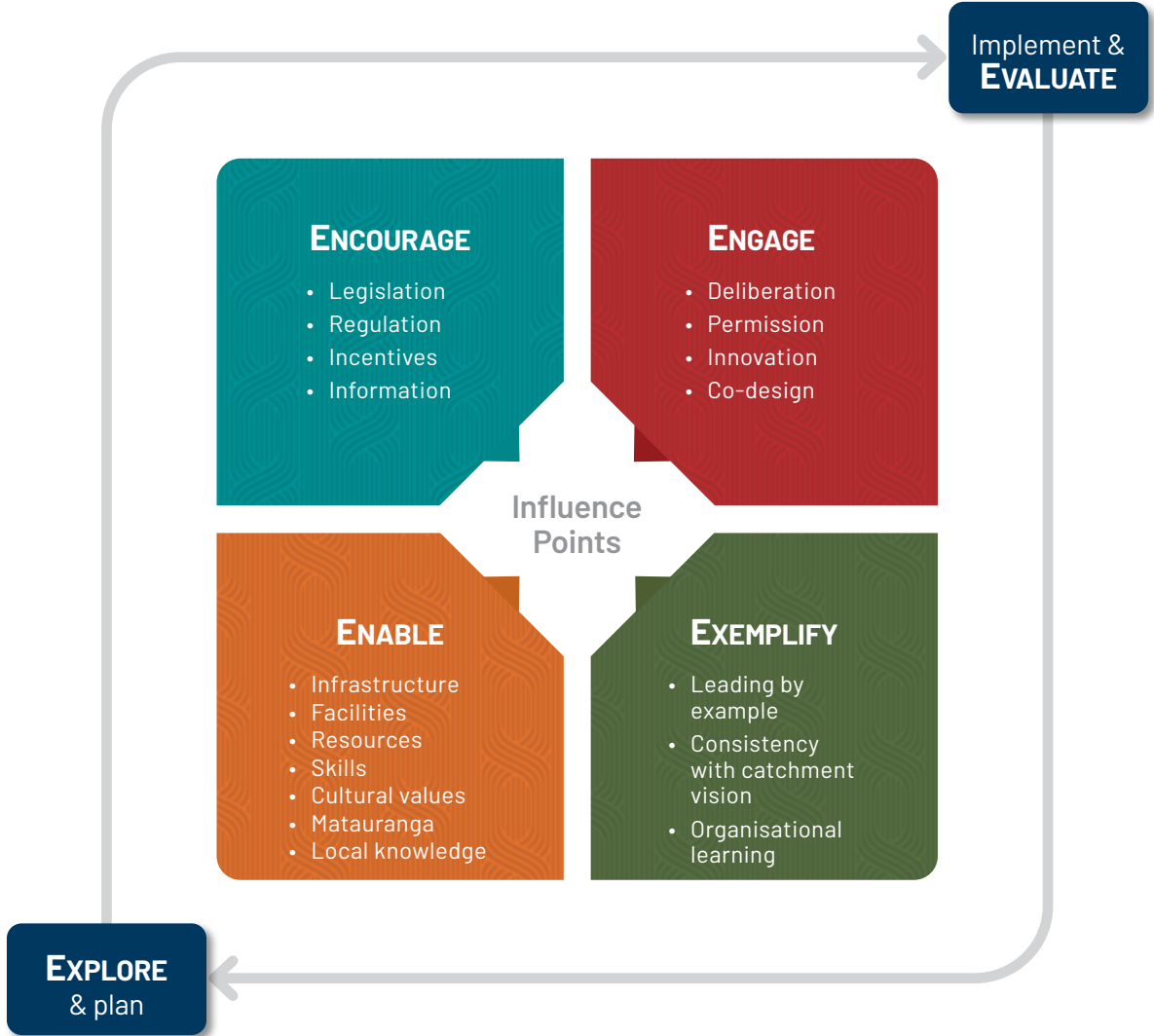


FIGURE 3: Implementation approaches within a broader systemic design and collaborative learning approach (based on the Defra 6Es model).

catchment managers develop a mix of implementation approaches across four broad categories of tools – Enable, Engage, Encourage and Exemplify (the inner circle). Two additional ‘E’s (see Figure 3 – outside circle), Explore and Evaluate, round out a process of informed implementation design and results measurement. Catchment managers can use this checklist to combine approaches across these six broad categories in order to more effectively influence practice change at all levels.

Different people and groups in a catchment will have differing capabilities (financial, time, etc.) and will face different pressures, motivations, and opportunities. This applies to all the different decision-making groupings including governance partners, agency workstreams, farmers and landowners, urban residents, community and environmental groups, and so forth. There are several factors that influence a group’s or an individual’s intention to act:

- i. How significant the action is to them.
- ii. How easy or difficult the action is.
- iii. How much social pressure they are under.

Hence, the need for a mix of approaches to support change.

The mix of approaches drawn from across the 6Es must address the core motivations and barriers of the broader range of stakeholders involved – including SDC and other implementation leaders.

Engaging and enabling those who are most willing and able to act will lead to change. Other groups may also act if agencies, sector organisations or peers demonstrate their own willingness to ‘walk the talk’ and model the collaborative behaviours they wish to promote. For others, it may be necessary to regulate or create minimum or voluntary standards before behaviour is influenced.

For more information:

- **Influencing Practice Change:**
<https://learningforsustainability.net/pubs/practicechange-intro.pdf>
- **A guide on the Com-B model of behaviour:**
www.instituteforgovernment.org.uk/sites/default/files/publications/MINDSPACE.pdf
- **Influencing behaviour change through public policy:**
www.bi.team/wp-content/uploads/2015/07/MINDSPACE.pdf

5 Capacity & Capability

- Both technical and social responses are essential to improve catchment management.
- Staff capacity-building in the water management sector requires both 'hard' (technical) and 'soft' (social) capacity.
- Technical capability and capacities are generally focused on the environment, facilities, equipment and infrastructure.
- Required social capabilities and capacities include facilitation, integrity, effective coordination and communication.

Both technical and social responses are essential in achieving significantly improved catchment management. To date the focus and investment (both in the development of the Ararira CMP, and in other catchment planning projects elsewhere) has emphasised technical components (the in-landscape tools, solutions and management approaches).

It is fundamental to build the right skills and capabilities for things to change. Staff capacity-building in the water management sector requires both 'hard' (technical) and 'soft' (social) capacity (OECD, 2021⁹). There is a growing awareness that facilities, resources and inputs alone will not lead to lasting improvements in water governance performance. The typical technical capacities (generally focused on the environment, facilities, equipment and infrastructure) need to complement social capacities and skills such as facilitation, integrity, effective coordination and communication. In the Aotearoa context, social capacity needs to encompass cultural awareness/competency.

Hard system components in the context of implementing the CMP include:

- institutional arrangements
- legislation
- Crown obligations
- infrastructure

- physical control and monitoring tools
- the recognition of clearly defined roles throughout the sector.

The 'technical' tools and solutions proposed in the CMP encompass modifications to both private and publicly owned drainage infrastructure, and changes to the management of both private and public land.

Soft system changes refer to the social changes people and organisations make such as:

- appreciating new perspectives
- forming new partnerships
- doing things in different ways
- co-designing innovative and locally appropriate solutions.

There are four broad areas where it is important to build capacity to enhance the collaboration and collective action that underpins changing approaches to catchment management:

- People with expertise in social processes are needed at all levels (just as we need technical expertise).
- Different stakeholders need the skills and capacity to engage constructively with others and recognise that they are a part of the wider collective.

⁹ OECD. 2021. Toolkit for Water Policies and Governance: Converging Towards the OECD Council Recommendation on Water. OECD Publishing, Paris. <https://doi.org/10.1787/ed1a7936-en>

- iii. Institutional and organisational cultures that support and encourage genuinely participatory processes.
- iv. Linking monitoring and evaluation with the improvement of collaborative processes and initiatives.

5.1 Workforce

Changes will be required within SDC and/or the Drainage Committee as the drainage network manager. This includes:

- how the network manager works with others
- building organisational capability and capacity (employing/contracting people with social process skills)
- mapping the social journey and where and when change will happen – establishing the linkages between outputs, outcomes and impacts (see Section 9).

As tools and solutions are implemented in the catchment, it is likely that there will be a change in the workforce requirements for operation of the drainage network, with less focus on the more traditional system-wide macrophyte cutting and mechanical removal of sediment. Removal of macrophytes is still likely to be required in the mainstem.

There will be a transition from current maintenance practices to an integrated monitoring and maintenance programme that links monitoring with targeted and proactive maintenance (see Sections 11 and 12).

Wide-scale mechanical clearance will be phased out over time in the classified drainage network. Yet more targeted weed control (especially of planted sections) will be required, both during the establishment phase whilst shade cover establishes, but also in the long-term to monitor and control pest weed species.

Long-term, SDC (or any other entity that manages a drainage network) is likely to need additional capacity in monitoring the integrated approach required to develop, maintain and refine a multi-value waterways network. This will require assessing the performance of the social engagement, learning and partnerships required, as well as maintaining and managing a bespoke environmental and technical monitoring programme.

During the implementation phase there will be a need for specialist input in relation to:

- detailed design of the interventions – how best to support constructive practice change
- preparation of resource consent applications
- project management.

SDC are likely to have the capability (but not necessarily the capacity) to manage implementation of larger-scale/network utility works, for example within the rated drainage network and large-scale wetlands or sediment traps. Physical delivery of network-scale works can be managed in a similar way to other Council infrastructure projects.


For smaller-scale works on private land, facilitation and advice for on-farm practice change will be important. The resourcing required for this is likely to be similar to ECan's existing Zone Delivery and Land Management/Biodiversity Advisor roles, and the Biodiversity roles that Living Water has previously part-funded at SDC (and are now ongoing roles). The skills required for this are mix of technical and social skills, with the ability to:

- clearly articulate the vision for the catchment
- build and maintain successful relationships with a range of stakeholders
- support capacity-building within stakeholder organisation
- advocate for change to produce positive outcomes
- have cultural competence/awareness.

Resourcing in this role(s) would need to sit within SDC's organisation structure in a way that allows interaction between the infrastructure, environmental and social aspects of implementing the CMP. Staff resourcing in all of these areas needs to be targeted and budgeted for, recognising that some of these areas may be best staffed through Iwi/Māori and partner organisations.

For more information:

- **Ensuring Good Water Governance:**
OECD, 2021. Available at www.oecd-ilibrary.org/sites/ed1a7936-en/1/3/6/index.html?itemId=/content/publication/ed1a7936-en&csp_=12881a86f132984c26b8cb0f93652c47&itemIGO=oecd&itemContentType=book#abstract-d1e7227



Kākahi/freshwater mussels are present in the Ararira mainstem.

Image source: EOS Ecology

Regulations

- A number of pieces of legislation are relevant to how land drainage is managed, how maintenance work and other interventions within the land drainage network can be funded, and how consenting requirements for interventions are set. At a local level, the requirements of legislation are enacted through Council Plans, by-laws and policies.
- Government regulations and policy such as the National Policy Statement for Freshwater Management is also relevant: implementation of the CMP needs to be consistent with this.
- Implementation should be consistent with relevant non-statutory plans and strategies.
- SDC delegates responsibility for managing drainage networks to Drainage Committees. Te Komiti Waiora – District Land Drainage and Waterway Committee has recently been established to help facilitate a growing focus on the environmental performance of the land drainage schemes.
- The system changes required to implement the CMP can be helped or hindered by various factors, some of which are unlikely to change, and some of which may be able to be influenced.

The key role of legislation and regulations when trying to influence catchment management is to provide a framework for action, guide decision-making, and ensure compliance with established standards. Legislation and regulations must be collaborative and consultative to support community buy-in and subsequent practice change. Key legislation and regulations that may impact or influence implementation of the CMP are summarised below. Further detail is provided in Appendix C.

It should be noted that the definition of terms such as ‘waterway’ and ‘drain’ is not entirely consistent between different pieces of legislation and council plans. As the CMP is focussed on a transition from ‘drains’ to ‘streams’ we have assumed that all drain channels in the catchment are waterways, however when it comes to obtaining consents, the precise definitions may be important.

The following legislation is relevant in terms of how the classified drainage network is managed, and the framework under which interventions may require resource consents:

- Resource Management Act 1991¹⁰
- Local Government Act 1974
- Local Government Act 2002
- Land Drainage Act 1908

In addition to legislation, there are number of pieces of regulation and government policy that need to be considered, in particular the Essential Freshwater Package, which includes:

- the Resource Management (National Environmental Standards for Freshwater) Regulations 2020
- the Resource Management (Stock Exclusion) Regulations 2020

¹⁰ Note that there is a resource management system reform underway. The government intends to repeal the RMA and replace it with three new pieces of legislation: the Natural and Built Environment Act, the Spatial Planning Act, and the Climate Change Adaptation Act.

- the National Policy Statement for Freshwater Management (NPS-FM) 2020 and the associated National Objectives Framework (NOF)
- the introduction of Freshwater Farm Plans.

Implementing this plan will assist with meeting NPS-FM compulsory values within the ecosystem health section (attributes such as suspended fine sediment, dissolved oxygen, ecosystem processes, physical habitat and aquatic life). However, the compulsory values pertaining to nutrients (in particular nitrogen-species) may not necessarily be achieved through implementation of the CMP. This is because in this springfed system, groundwater nutrients are entering from outside the Ararira's surface water catchment, and thus efforts to reduce them need to be focussed where they are arising. There is a risk that focusing heavily on National Bottom Lines for nitrate and ammonia toxicity may result in attention being diverted from the other values that have been defined for the catchment.

The engagement and work undertaken to develop the Ararira CMP and IG will also be useful for Regional Councils, as under the NPS-FM NOF they are required to develop Freshwater Management Units (FMUs) and identify values and environmental outcomes for each FMU. The monitoring & maintenance programme that is recommended in both the CMP and within this IG (see Section 11) will also assist with the monitoring obligations of Regional Councils under the NPS-FM NOF.

Guidance on the Essential Freshwater policies and regulations implementation indicates that Freshwater Farm plans will be required for farms larger than 20 ha for arable/pasture/combined use, or 5 ha for horticultural land use, in addition to existing Farm Environment Plan (FEP) requirements. Freshwater Farm Plans will be helpful to demonstrate how regulatory requirements are being met on farms, including those under the NES for Freshwater (such as stock holding areas, interim intensification rules, natural wetland rules, intensive winter grazing regulations, nitrogen-cap regulations) and Section 360 Regulations (such as stock exclusion regulations); along with other regional plans and consent requirements. Councils will prioritise catchments within their own region for the introduction and implementation of Freshwater Farm Plans, including a transition from any existing regulated farm environment plans to the new system. It is noted that Freshwater Farm Plans will not replace the need for resource consents or rules. The exact requirements for these plans are unclear at this stage, but they are expected to be phased in from 2023. An overview of Freshwater Farm Plan requirements is shown in Figure 4. Further information can be found on the MFE website.¹¹

There are strong alignments between the context, risk assessment and actions aspects of Freshwater Farm Plans (see Figure 4), and implementation of the CMP. Farmers

and their consultants will be able to use the CMP as the basis of the catchment context that Freshwater Farm Plans need to consider, and as a source of information on actions (tools, solutions) that are likely to be beneficial in the Ararira catchment context.

The requirements of the legislation are enacted through various Regional and District Plans and associated bylaws, policies and codes of practice. These Plans and associated documents, which influence both how the drainage network is managed currently and how interventions would be implemented, including the rules under which resource consents would be sought, include:

- ECan's Land and Water Plan
- ECan Long Term Plan
- ECan Code of Practice for Defences Against Water
- SDC Proposed District Plan
- SDC Long Term Plan
- SDC 5 Waters Activity Management Plan
- various SDC bylaws and policies and codes of practice.

¹¹ <https://environment.govt.nz/acts-and-regulations/freshwater-implementation-guidance/freshwater-farm-plans/#farmers-who-need-a-freshwater-farm-plan>

Freshwater farm plans at a glance

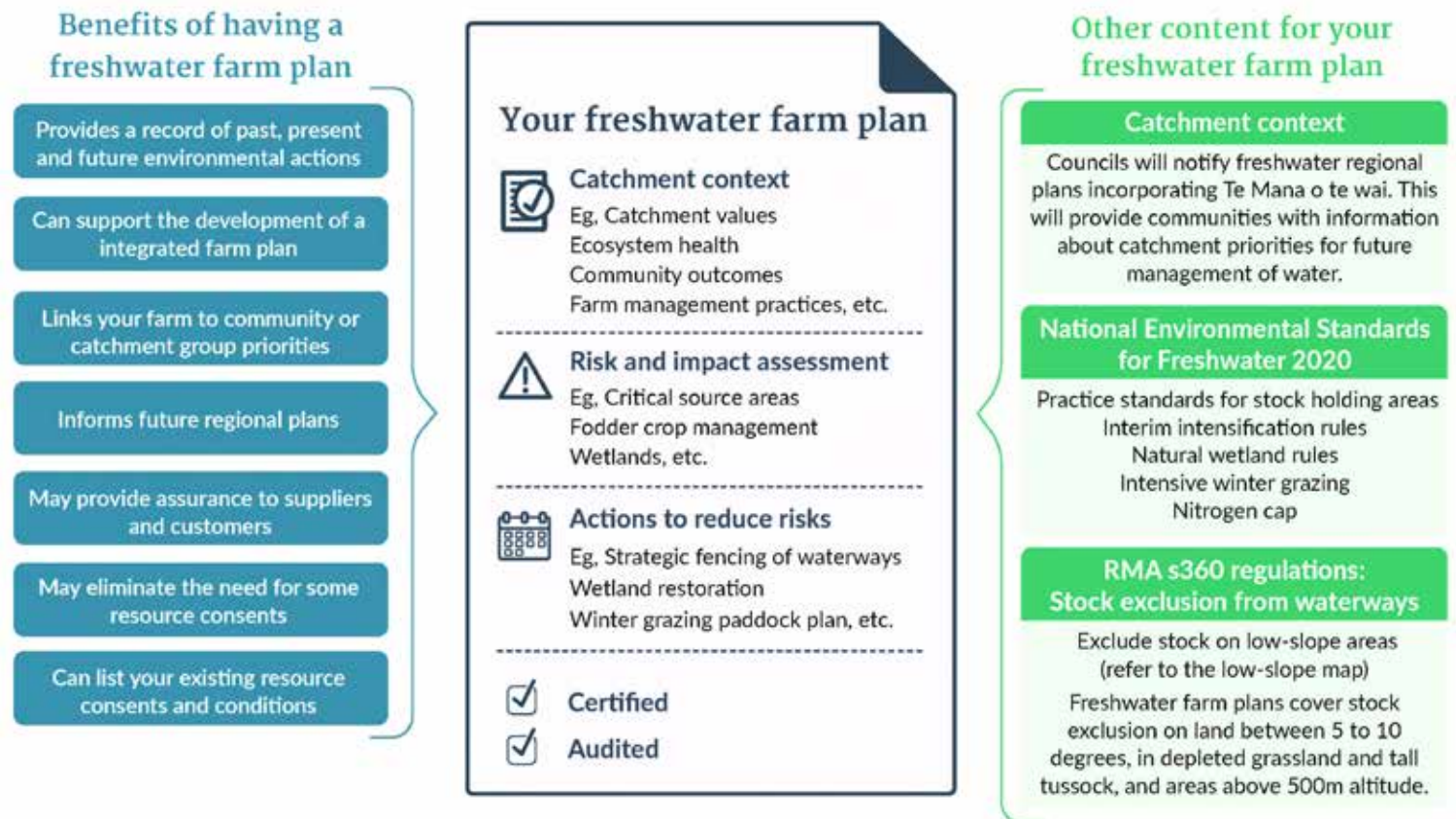


FIGURE 4: Overview of Freshwater Farm Plans – from <https://environment.govt.nz/acts-and-regulations/freshwater-implementation-guidance/freshwater-farm-plans>

Supporting significant gains in the health of New Zealand’s waterways.

There are several non-statutory plans and strategies that are relevant to implementation of the CMP:

- Te Waihora Co-Governance Strategy
- Mahaanui Iwi Management Plan
- Canterbury Water Management Strategy

Although these non-statutory plans and strategies do not directly influence implementation, it is important to consider whether implementation of the CMP will be consistent with them.

Current Council plans are based on an existing work programme for drain maintenance and management, and for catchment enhancement. Some of the latter may involve actions by landowners. The funding and phasing of works required to implement the Ararira CMP needs to take account of these planned activities and their funding.

There may be opportunities to influence the content of future versions of Council plans and strategies in relation to a broader focus in catchments with drainage networks. This shift of focus has already occurred to some extent in ECan's 2021 Long Term Plan.

Appendix C provides further analysis of consistency with relevant policies and targets that they contain.

6.1 SDC Land Drainage Management Structure

SDC is responsible for Land Drainage activities for the Council's Classified Drainage Schemes¹². The drainage schemes comprise a complex network of perennial, intermittent and ephemeral drains which were progressively constructed from the mid 1800's to drain the extensive wetland surrounding Te Waihora.

There are nine individual Drainage Committees (seven land drainage schemes, and two river rating schemes). Council delegates some responsibilities for maintenance and management of the schemes to the individual Drainage Committees. Council service delivery staff work alongside the Committees to prioritise and facilitate maintenance activities which are undertaken by local contractors.

Budget decisions are made via the Council's Annual Plan and Long-Term Plan (LTP). These plans are generally released for public consultation around April, for implementation in July each year. An Activity Management Plan flows on from the LTP.

There is a growing focus on the environmental performance of all of the Selwyn District's land drainage schemes, which are likely to require increased monitoring, reporting and upgrades. To help facilitate this the Council established a District-wide Committee in late 2021 called 'Te Komiti Waiora – District Land Drainage and Waterway Committee'. The Committee is made up of representatives from Te Taumutu Rūnanga, chairs of the catchment committees, four Selwyn Councillors and advisors from the DOC, ECan, and North Canterbury Fish and Game.

¹² Central Government's Water Services Reform Programme (www.waterservicesreform.govt.nz) will see Water Services currently delivered by Councils move to new larger Water Services Entities. The timeframe for the new entities to be functioning and delivering water services will be between early 2025 and mid-2026. SDC's current water services will be performed by a Canterbury and West Coast entity, which will be responsible for developing and delivering future Long-Term Plans and Activity Management Plans. It is likely that there will be significant time pressure for the new entity to produce the first iteration of these Plans. There is uncertainty about Councils' ability to deliver water-related services that fall outside of the current scope of the Water Services Reform. It is possible that land drainage that is currently managed by SDC may become part of the new entity's responsibilities. If this occurs, this IG will be valuable as a starting point for the development of new Plans.

6.2 Regulatory Influences

For the ‘reimagining’ vision of the CMP to be successful, change is required. In order for change to happen, new ways of working, thinking and new structures to support the changes will be required.

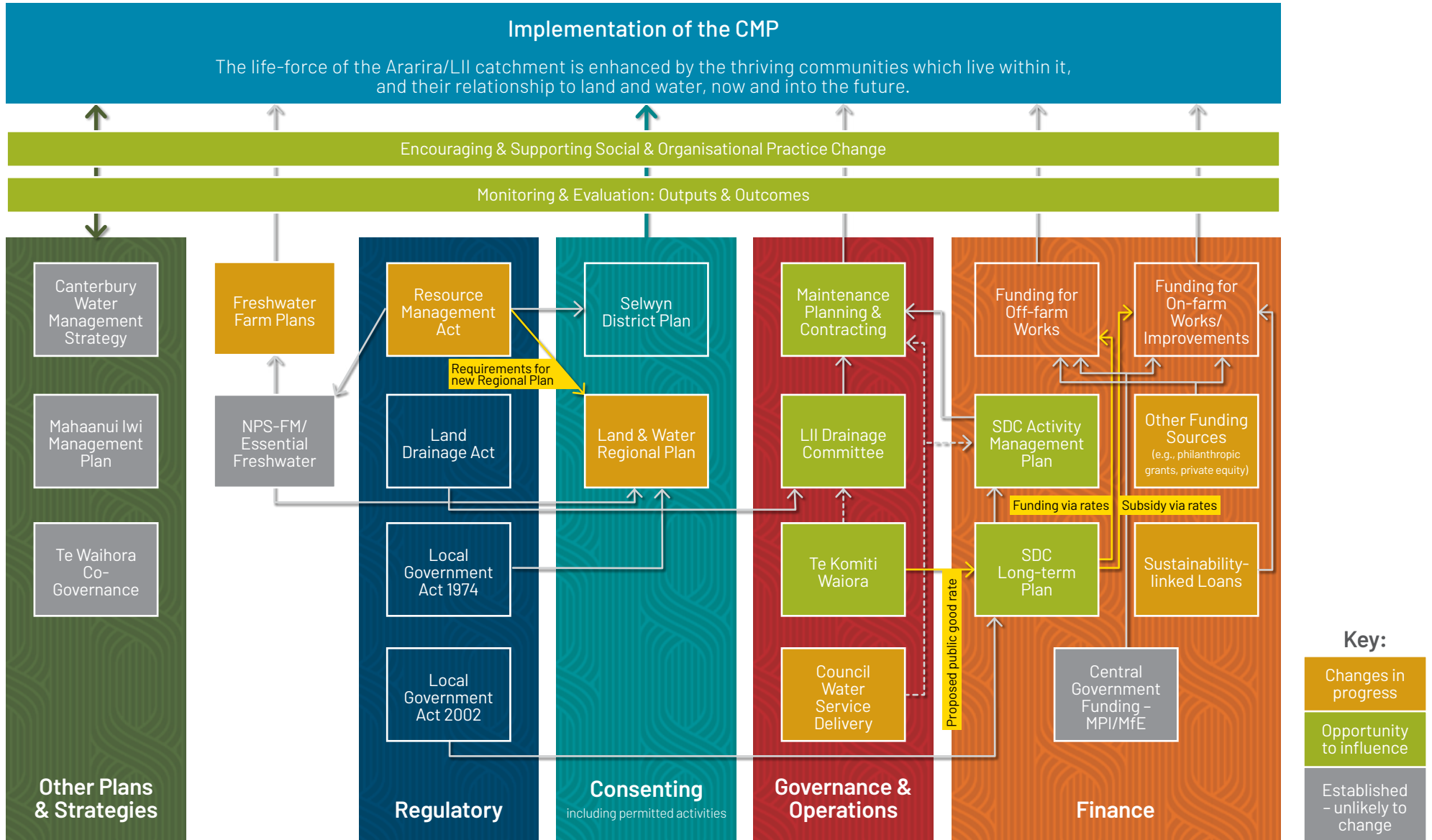
Implementation of the CMP is fundamentally about driving system change. This can be helped or hindered by the various influences, many of which relate to legislation, regulations and plans discussed (Figure 5). The diagram in Figure 5 shows:

- things that are unlikely to change, and are unlikely to be able to be influenced by those implementing the CMP (grey boxes)
- things that are in the process of changing, or likely to change in the near future (orange boxes)
- things that can potentially be influenced or changed in a way that is beneficial for implementation (green boxes).

For more information:

- **MfE Freshwater work programme:**
<https://environment.govt.nz/what-government-is-doing/areas-of-work/freshwater/work-programme>
- **Freshwater Farm Plans:**
<https://environment.govt.nz/acts-and-regulations/freshwater-implementation-guidance/freshwater-farm-plans>
- **SDC land drainage information:**
www.selwyn.govt.nz/services/water/land-drainage
- Links to individual Acts, Plans and Strategies are provided in Appendix C.

Influences ▶



7 Consenting & Compliance

- Implementation of the suite of interventions recommended in the CMP is likely to require resource consents from both SDC and ECan. This would apply both to interventions on private land/private drains, on the rated drainage network, and on other publicly owned land.
- No fatal flaws have been identified that would prevent obtaining resource consents for the suite of proposed interventions included in the CMP.
- There is potentially a role for SDC in applying for global consents, and communicating the existence of these, and the relevant consent conditions to landowners. This approach may make implementation on private land more straightforward for landowners.

Consenting and compliance are essential activities in catchment management. They support the adoption and implementation of environmental policies and regulations. In addition, the development of consenting and compliance processes provides constructive opportunities for public input, which can encourage community involvement and buy-in.

Implementation of the suite of interventions recommended in the CMP is likely to require resource consents from both SDC and ECan. Activities potentially requiring consents include:

- earthworks
- use of land
- works/structures in streams
- temporary diversion and discharge during construction.

No fatal flaws have been identified that would prevent obtaining resource consents for the proposed interventions. Although Assessments of Environmental Effects will be required for consent applications, it is not expected that significant adverse effects will be identified, with the exception of short-term effects during construction.

7.1 Planning & Consenting Requirements for Proposed Interventions

Regional and District Plan rules that are potentially relevant and may trigger the requirement for consents include:

- use of land to excavate material (not including in the riparian zone)
- use of land for vegetation clearance outside the bed of a river but within five metres of a river and any associated discharge of sediment or sediment-laden water
- the installation, maintenance, use, and removal of defences against water including deposition of substances, on or in the bed of a river and excavations, associated diversions, and discharges of sediment
- installation of culverts and consequential deposition of substances on or in the bed of a river, excavation and other disturbance of the river bed, and associated take, discharge, or diversion of water
- introduction or planting of any plant, or the removal and disturbance of existing vegetation in or on the river bed, and any associated discharge of sediment or sediment-laden water
- creating a wetland, including associated taking, use, damming or diversion of water, and discharge of excess or overflow water to surface water
- damming water outside the bed of a river and the constructing, using, altering, maintaining and operating of the dam structures

- damming water in the bed of a river and the constructing, using, altering, maintaining and operating of the dam structures
- temporary diversions associated with undertaking earthworks, culvert construction, or damming activities in and around the riverbed
- minor discharge of contaminants to land in circumstances where it may enter surface water, e.g., herbicides associated with maintaining planting/wetland
- disturbance of the bed and banks of a river to remove fine sediment (<2 mm) for the sole purpose of habitat restoration, and the consequential damming, take, use and discharge of water in circumstances where contaminants may enter water
- discharge of construction phase stormwater to a surface water body or onto land where a contaminant may enter groundwater or surface water
- non-consumptive taking and using water from a river or artificial watercourse and discharge of the same water to the same river or watercourse
- non-consumptive taking and using of groundwater and associated discharge to groundwater (associated with technical possibility that contaminants may enter groundwater as part of wetland function)
- use of land for stockpiling decaying organic matter and any associated discharge

- discharge of a dust suppressant onto or into land in circumstances where it may enter water
- discharge of dust to air beyond the property boundary from land development and unconsolidated materials.

A detailed analysis¹³ of relevant Plan rules, permitted activity conditions and alternative classifications (i.e., the activity status if permitted activity conditions cannot be met), and the interventions potentially affected by each rule, is provided in Appendix D). Detailed design will require an assessment against these rules and conditions to determine specific consenting requirements for each intervention, particularly larger-scale interventions that may require multiple consents. It may be possible to obtain global consents for interventions that will be replicated in a number of locations.

None of the drain channels are noted as flood protection infrastructure on the Flood Protection and Drainage Bylaw 2013 geospatial database. However, large parts of the catchment are within the Selwyn Flood Zone, which will need to be considered when applying for earthworks consents.

Although all waterways that feed Te Waihora are noted as Sites of Significance to Māori in the Selwyn District Plan, no other specific Sites of Significance to Tangata Whenua (as defined in the District Plan) or protected trees are listed in the District Plan in the catchment area where interventions are planned.

Newly formed wetland areas will not be affected by the National Environmental Standards for Freshwater (NES), unless it could be deemed that they were constructed to offset impacts on or restore an existing or former natural wetland. The National Policy Statement for Freshwater Management (NPS-FM) and NES do not apply to constructed wetlands created for other purposes.

Consenting for work on drain channels may differ depending on the land parcel types that the drains are on currently: road reserves, drainage reserves, easements. Each may have different requirements under the District Plan, and different challenges relating to accessing land to implement tools/solutions (see Section 8.5).

7.2 Potential for Global Consents

Global consents (also known as ‘blanket consents’) avoid the need to apply for separate resource consents for the same type of work on different sites. The consented activities need to be similar enough that the same set of consent conditions can apply, despite the locations being geographically separate. At present, Councils often rely on global consents for river engineering maintenance work.

The need to obtain resource consents for relatively minor environmental infrastructure has been recognised as a barrier: at present landowners tend to revert to riparian planting as a default tool, as it doesn’t require consenting.

¹³ Note that this is focussed on the Selwyn District and Canterbury Region. An equivalent analysis would be required if this guide is being used in other areas.

Global consents would be particularly useful for tools to be implemented on private land (such as small wetland construction, channel re-battering, sediment trap construction, log and cobble cluster additions), to reduce the cost and technical burden on landowners and encourage the uptake of these tools. It is likely to be easier for landowners to specify tools in their FEPs if there is a global consent in place.

There is potentially a role for SDC in applying for global consents, and communicating the existence of these, and the relevant consent conditions to landowners.

7.3 Interaction with Work Funded by Ministry for the Environment in Tārerekautuku/Yarrs Lagoon

There are potentially opportunities to implement larger-scale interventions in the Tārerekautuku/Yarrs Lagoon area in conjunction with the work currently being carried out with funding from the Ministry for the Environment's Freshwater Improvement Fund (FIF). This area has been identified in the CMP as being suitable for large-scale wetlands and sediment traps, and re-shaping and planting of the mainstem channel banks.

There may be opportunities to streamline consenting between the FIF project and implementation of the wider CMP.

For more information:

- **ECan Land and Water Regional Plan:**
www.ecan.govt.nz/your-region/plans-strategies-and-bylaws/canterbury-land-and-water-regional-plan
- **Selwyn District Plan:**
www.selwyn.govt.nz/property-And-building/planning/strategies-and-plans/selwyn-district-plan
- **National Environmental Standards:**
<https://environment.govt.nz/acts-and-regulations/regulations/national-environmental-standards-for-freshwater>
- **National Policy Statement for Freshwater Management:**
<https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-freshwater-management>
- **Tārerekautuku Wetland Project:**
www.selwyn.govt.nz/community/our-natural-environment/community-restoration-projects/trerekautuku-yarrs-lagoon-reserve-management-plan/te-waihora-freshwater-wetland-restoration



Koukoupara /bullies,
a mahinga kai species

Image source: EOS Ecology

8 Financing

- Rates revenue collected by SDC is primarily allocated to the current maintenance regime. A transition to lower-intervention/more targeted maintenance will reduce costs in the long term, but this is likely to be offset by increased monitoring costs.
- Proposed changes to the rating structure and the introduction of a public good rate will increase rates revenue, but the scope to fund physical works from this increase is limited.
- A spectrum of options exists for financing or subsidising interventions on private land and at the network utility scale. This includes emerging options that are not yet commonplace in New Zealand, and funding for applied research that may support implementation.
- Indicative unit costs and (where practical) total costs have been estimated for implementing the interventions identified in the CMP. While the estimates themselves are a snapshot in time that will become out of date, the basis of estimation is potentially useful as guidance on the range of issues that will need to be addressed in detailed design and planning of interventions.

This section covers various financing aspects related to implementing the catchment vision set out in the CMP – including the allocation of rates revenue, proposed changes to rating structures, ways to finance and subsidise interventions, and the indicative costs for implementing interventions.

Maintenance of the existing classified network is funded through targeted rates collected by SDC. Individual landowners are responsible for the cost of maintaining other drains on private property. The current rating structure provides little funding for alternatives that incorporate better environmental or cultural outcomes. The current land drainage budget, as detailed in SDC's 5 Waters Activity Management Plan, is allocated predominantly to maintenance.

Current maintenance costs are likely to reduce over time if the proposed interventions are implemented. For example:

- Two-stage channels will reduce sediment inputs from bank slumping.
- Establishment of shade cover will reduce macrophyte growth (and thus the need to remove it) in drain channels.
- Inline sediment traps on permanently-flowing drains, and event-based sediment traps on ephemeral drains will concentrate sediment removal in specific locations that will be easier to access.

Some of this reduction will be offset by increased monitoring costs. This will be a transition rather than a step-change.

The current levels of service set by SDC for the drainage network (see Section 10.2) include a performance measure based on cost per property of operating and maintaining the network. A rates increase on a per-hectare basis to fund catchment-scale interventions (for example, to service debt) would require a change to this level of service.

It is likely to be necessary to source other funding for interventions on a large scale to avoid significant rates increases. Attention should also be placed on ensuring appropriate staff and other resourcing is targeted and budgeted for managing operations and other linked activities (see Section 4).

8.1 Existing Rating Structure

The current rating structure is set in the Selwyn District Long Term Plan (LTP). The targeted land drainage rates for nine drainage schemes within the District collect a total of approximately \$491,000 per annum. The current structure uses a mix of per-hectare, uniform and capital value rates. The rating structure is complex relative to the amount of revenue generated.

The LII Drainage District is rated on a capital value basis, with six classes based on the benefit that land parcels within different parts of the catchment receive from the drainage network. Currently 2,408 properties within the catchment pay the land drainage rate (out of a total of 3,379 properties paying land drainage rates district-wide). The LII Drainage District revenue has been increasing due to subdivision development around Lincoln, and the associated capital value increase of this land. The 2021/2022 rates for the LII Drainage District are summarised in Table 3, and the areas corresponding to each class are shown in Figure 6 and Figure 7.

TABLE 3:
2021/22 targeted rates for the L2 subdivision.
(From – www.selwyn.govt.nz/your-council/plans-And-reports/long-term-plan)

L2 Subdivision (assessed per dollar of capital value in the following categories of the rating area)	Capital Value (\$)	2021/22 rate (\$)	Estimated revenue (\$)
Class A	151,443,245	0.000334	50,582
Class B	158,839,295	0.000209	33,197
Class C	452,025,770	0.000135	61,023
Class D	25,031,830	0.000088	2,203
Class E	24,675,840	0.000068	1,678
Class F	667,844,730	0.000046	30,721
TOTAL:			179,404

8.2 Proposed Changes to the Rating Structure

Te Komiti Waiora – District Land Drainage and Waterway Committee, has agreed to harmonise the land drainage rates across all nine schemes. The proposed changes include:

- a revised land drainage rate structure with a minimum charge, and per-hectare charges differentiated between the first 4 ha and areas above 4 ha
- inclusion of additional properties in some drainage districts.

The rating structure that has been proposed by Te Komiti Waiora for properties within the land drainage district is summarised in Table 4. It is proposed to add 970 additional properties to the LII Drainage District, an increase of approximately 40%. This would infill areas around Lincoln that are not currently rated, as well as additional rural properties within the boundary of the drainage scheme. This is shown in Figure 8. A small number of properties that are currently rated but are outside of the scheme boundary will be removed. Any further subdivision development around Lincoln will further increase the rates revenue for the Drainage District.

The inclusion of additional properties in the LII Drainage District will result in a 37% increase in the rates revenue under the proposed rating structure. Further subdivision development around Lincoln (e.g., as proposed in Plan Change 69¹⁴) would further increase this. While increased rates revenue will assist with transforming maintenance practices and monitoring, the scope for funding physical works is limited.

TABLE 4:
Proposed land drainage rating structure.

Land drainage minimum charge	\$70
Per-hectare charge (first 4 ha)	\$30/ha
Per-hectare charge (above 4 ha)	\$7/ha

14 www.selwyn.govt.nz/property-And-building/planning/strategies-and-plans/selwyn-district-plan/plan-changes/plan-change-69,-rezone-186-hectares-of-rural-outer-plains-to-living-x,-living-z-and-business-1-zones,-lincoln

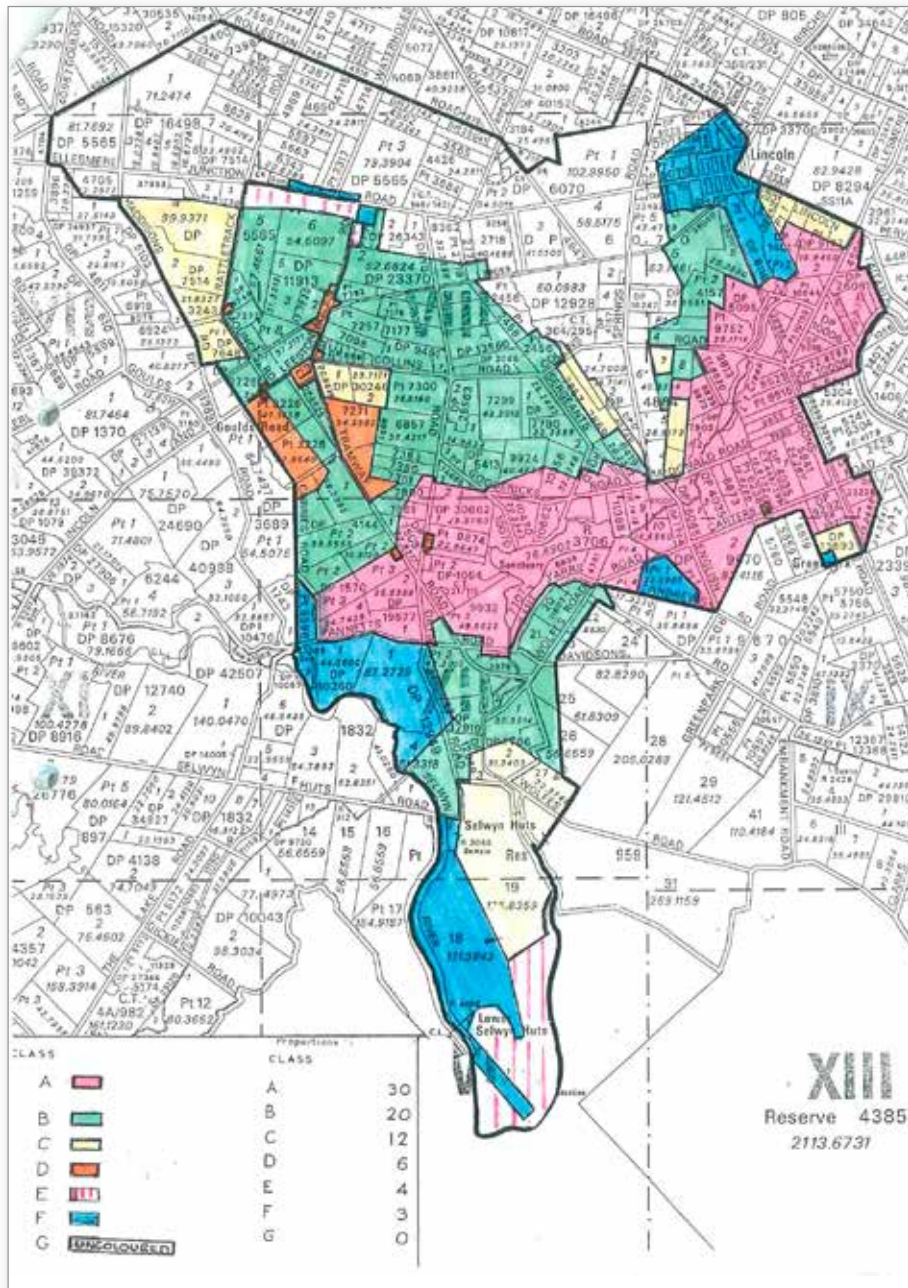


FIGURE 6:
Rating classes for the Ararira drainage district.
Note: Indicative only, as not all rated properties are shown. Source: sdc

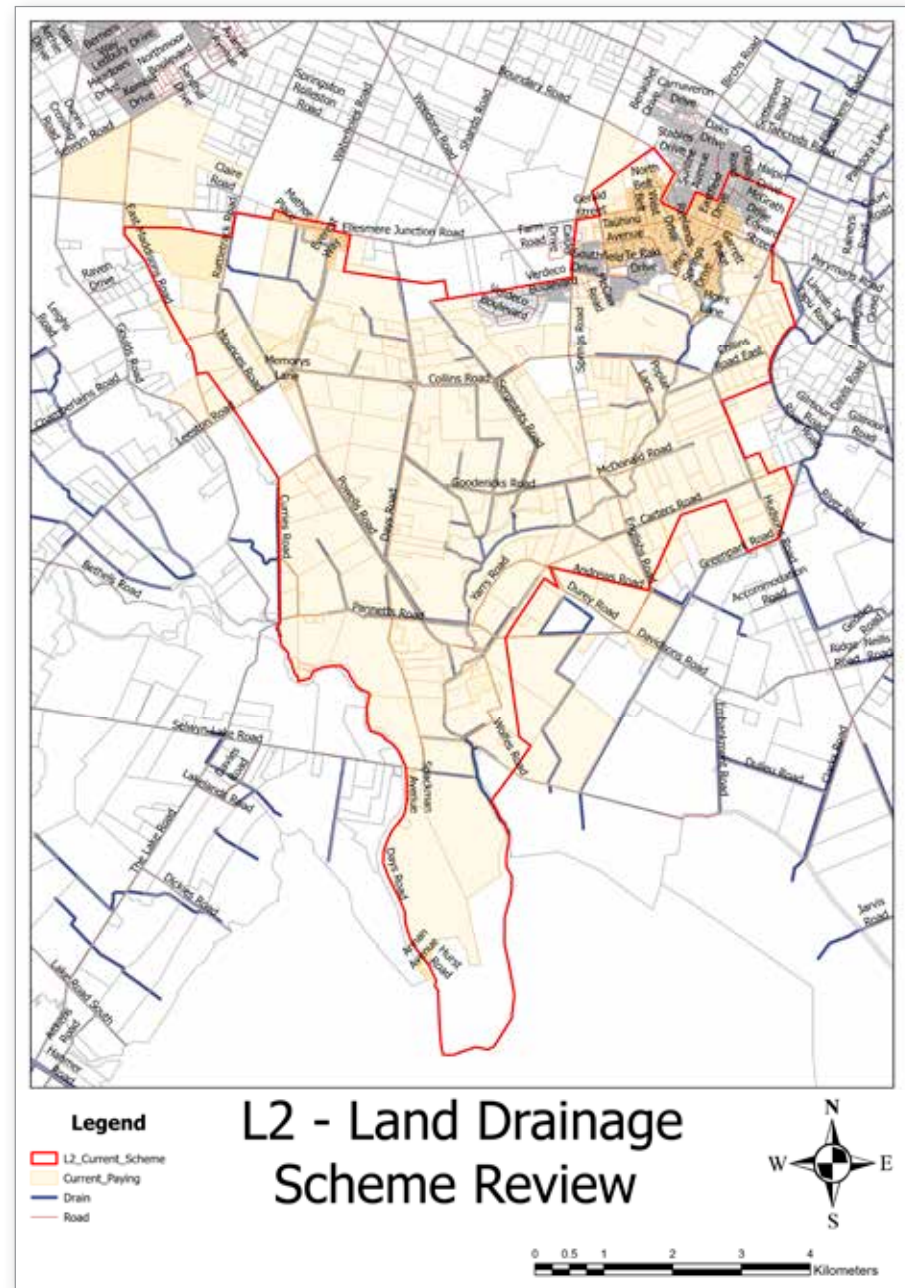


FIGURE 7:
Properties currently rated for the L2 scheme. source: sdc

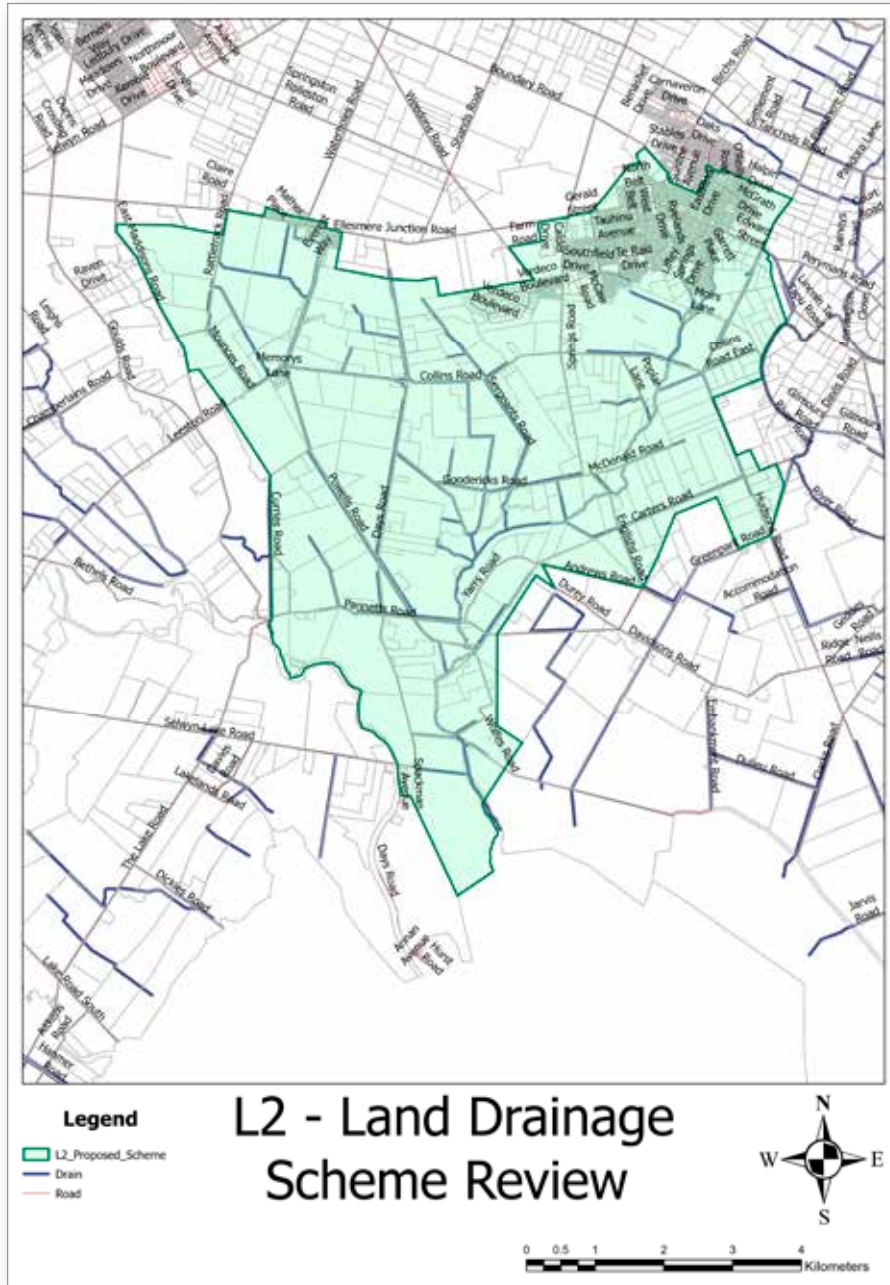


FIGURE 8:
Proposed drainage scheme boundary. Source: SDC

8.3 Public Good Rate

Te Komiti Waiora has instigated a district-wide public environmental/public good rate.

The public good rate would collect \$20 p.a. from 22,775 properties outside of the land drainage scheme areas, i.e., an additional \$227,750 p.a. revenue district-wide. Note that the number of properties is based on the inclusion of additional properties in the land drainage rating areas as described above. There is a limit to how much can be collected through a uniform annual general charge (UAGC).

An indicative budget has been prepared for Te Komiti Waiora, with projects that could be funded through the public good rate. While some funding has been proposed for education, engagement, consenting, etc, there is limited scope to use the additional rates revenue for physical works.

8.4 Options for Financing Catchment-scale Implementation

Figure 9 shows the potential spectrum of funding options, ranging from grants to repayable finance. Options from across this spectrum may be suitable for interventions on both public and private land. Some of the options in Figure 9 may not currently exist in New Zealand, for example equity funding of environmental infrastructure, but they should not necessarily be ruled out as potential future options.

8.4.1 Public land/Infrastructure

The Selwyn District Long Term Plan (LTP) states that the Council will consider funding capital works through internal loans from general reserves when an appropriate return on funds can be generated. These loans are to be repaid through targeted rates and development contributions. Council’s cash reserves may be used to fund capital works related to the drainage network. It is unclear whether these provisions would apply to environmental infrastructure within the drainage network, such as sediment traps or constructed wetlands.

Funding Mechanisms

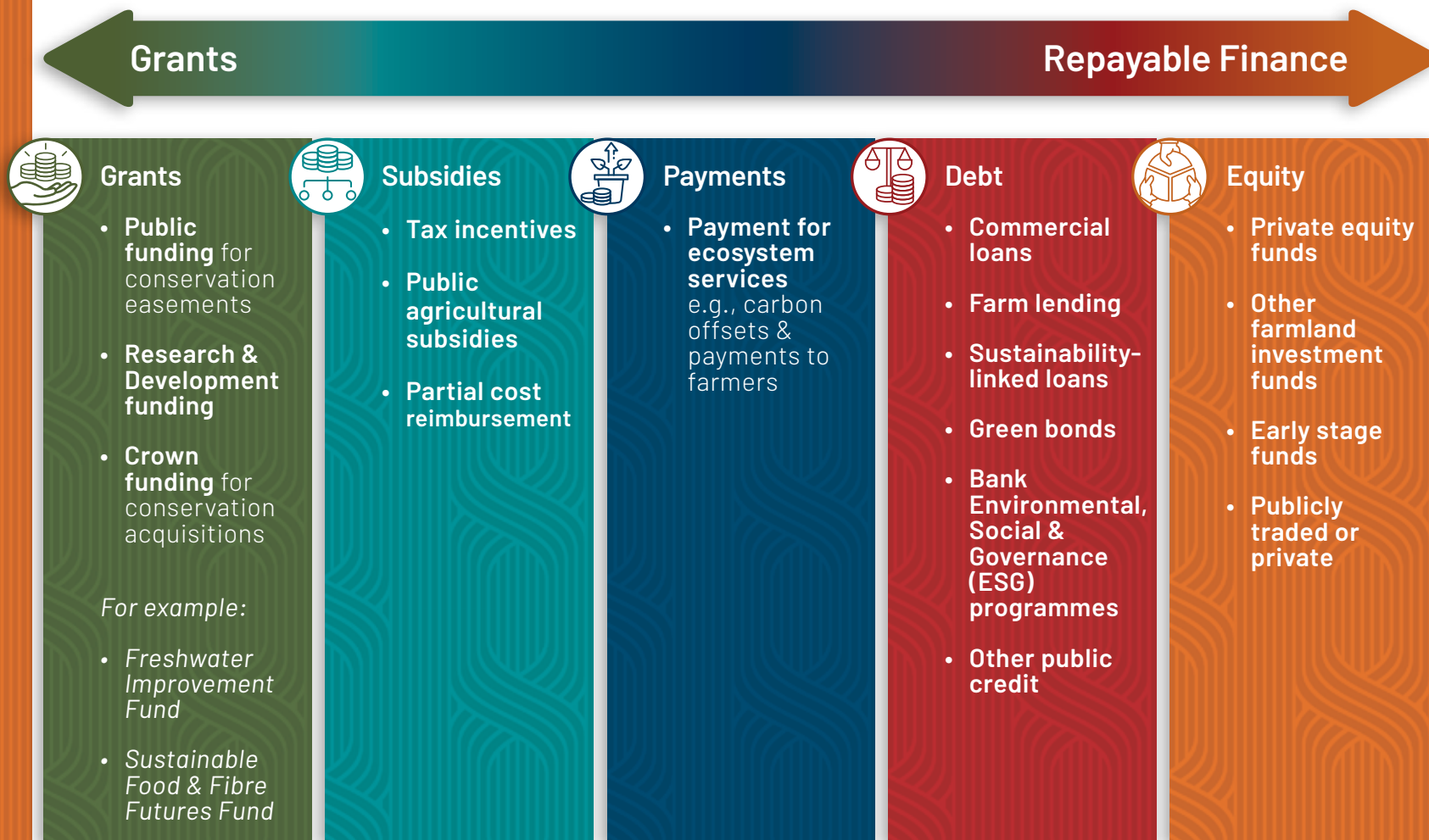


FIGURE 9:

Spectrum of possible financial instruments (adapted from Hallstein and Iseman, 2021¹⁵).

15 Hallstein, E. and Iseman, T. 2021. Nature-based Solutions in Agriculture – Project Design for Securing Investment. FAO and The Nature Conservancy.

It may be possible to offset debt servicing costs for capital expenditure through reduced maintenance costs – this is likely to be the main return on funds. This relies on the maintenance costs reducing over the finance period.

The LTP lists specific reserves from surpluses of \$121,000 for LII drainage de-silting, and \$319,000 for machinery. These reserves are forecast to increase slightly over the next 10 years. While some reserves are likely to be required for maintenance of macrophyte cutting equipment for the mainstem, there may be opportunities for some re-distribution when maintenance requirements change.

The use of a proportion of the development contributions collected by SDC for residential subdivisions to fund catchment-scale interventions should be investigated further. This would help to offset the impact of the subdivision development on the drainage network. At present SDC's Development Contributions policy specifically refers to stormwater development contributions for all new developments that ultimately discharge stormwater to the constructed wetland on Ellesmere Road.

Section 7 of SDC's Development Contribution policy discusses the use of development contributions (cash and land) for establishment of reserves. Factors for considering the suitability of land as a reserve include items that are consistent with the CMP, including:

- ecosystems and biodiversity
- margins of waterways.

Section 7.7.3 of SDC's Development Contribution policy allows for up to 20% of the value of land used for stormwater management can be credited towards development contributions, provided that certain criteria related to the location of the land in relation to existing reserves are met. It may be worth considering broadening the factors and criteria for reserve establishment, and increasing the credit percentage to encourage the establishment of features such as wetlands within new subdivision developments.

Other funding options include:

- Central Government funds such as the Freshwater Improvement Fund. SDC has already secured FIF funding for work at Yarrs Lagoon.
- The Sustainable Food and Fibre Futures Fund (SFFF) may be suitable for part-funding applied research in relation to design and monitoring of interventions.
- Treasury has recently introduced 'green bonds' that can be used for financing government projects with robust environmental outcomes.

8.4.2 Private land/Transformative On-farm Practice

While changes to public infrastructure can be funded to some extent through rates, implementing changes on private land may require a different approach, or a combination of approaches.

If on-farm work, for example event-based sediment traps, will reduce sediment inputs into the classified drains, it may be viable for SDC to consider funding/subsidising this work. Rates rebates are a possible mechanism for this. There may be benefits in SDC bringing drains that are currently private into the classified network.

Riparian planting funded by landowners is tax deductible – i.e., it is an operational expense rather than capital expenditure. There is also funding from various sources available for planting, for example Te Ara Kakariki co-ordinates supply of plants and volunteer labour for 'greendot' planting on private land.

Regional funding such as ECan's new Me Uru Rākau programme may be a source of advice, support and limited capital funding (although note that Me Uru Rākau specifically is focused on a limited number of catchments, not including Ararira at present).

There are trade incentives for companies such as Fonterra to promote environmental sustainability: Fonterra's major customers such as Nestlé, Danone, Starbucks have expectations regarding environmental standards. Suppliers are already being incentivised to go above and beyond the minimum requirements, for example the Fonterra Cooperative Difference and Synlait's Lead with Pride programme pay a premium to suppliers who meet certain standards. It is likely that this approach will become more common across the primary sector.

Banks are increasingly focussing on sustainability: a number of banks offer sustainability-focused lending

for specific environmental projects on-farm. For example, BNZ has recently launched a sustainability-linked loan (SLL) product which can be used for any purpose on a farm and provides interest cost savings if certain environmental and social targets (including sustainable use and protection of water, pollution prevention and control, and protection of healthy ecosystems) are achieved.

8.5 Indicative Cost of Works

We have estimated indicative capital costs for the interventions identified in the CMP, on an item cost or unit rate basis as appropriate. These estimates are concept level ($\pm 30\%$), and may not fully account for all site-specific costs or cost escalation beyond 2022. The estimates are summarised in Appendix E. The estimates include contingencies and a percentage for site establishment.

For interventions where it is reasonable at this stage to estimate the total quantity, total cost estimates are included in Appendix E. The range of estimated costs for two-stage channels is due to a lack of data on channel depths. This range is additional to the $\pm 30\%$ costing uncertainty noted above.

Note that the sum of the item totals in Appendix E does not represent the full cost of catchment-scale implementation, as it does not include items that will have site-specific costs, such as large-scale wetlands and sediment traps, and items where the total number/quantity is unknown at this stage, which as small-scale wetlands and springhead protection.

The basis of cost estimates for the interventions is described in the following sections. These descriptions may also be useful as guidance on issues that will need to be addressed in detailed design and planning of works.

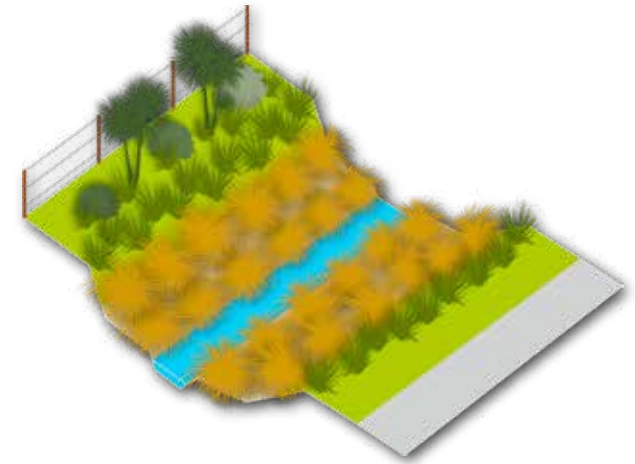
8.5.1 Bank Re-shaping/Two-stage Channels

For small-scale (i.e., permanently-flowing drain channel) two-stage channels/bank re-shaping we have estimated costs for depths ranging from 1 m to 3 m. Within each of these depths, there is a range of costs, dependent on how the re-battering is done. For example, in some locations space constraints may dictate that a two-stage profile can only be achieved on one side, or if there is a hard boundary (such as a road) but where land can be acquired on the other side of the existing channel it may be possible to re-align the channel invert slightly. These options are illustrated in Figure 10.

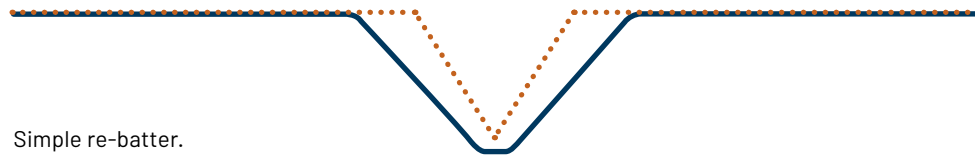
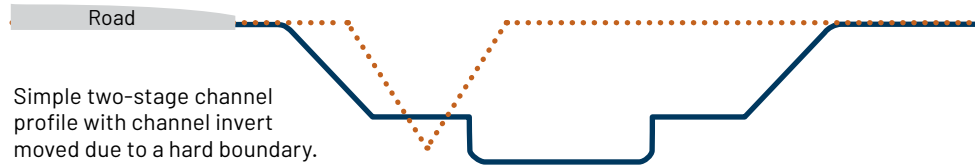
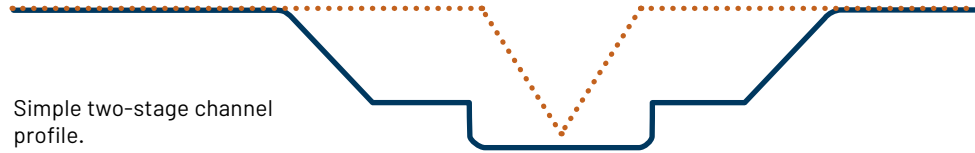
The following is included in the cost estimates (for permanently-flowing channels):

- Hire of excavator and labour.
- Diversion pump.
- Traffic management (if required).
- Sediment control.
- Planting.
- Acquisition of private land where applicable.
- Removal and reinstatement of fences.

Estimates for bank re-shaping in ephemeral channels are taken from the actual reported costs of previous trials conducted by Living Water in the Ararira catchment. This is for a channel without planting (i.e., grass banks), with construction while the channel is dry. Traffic management and fencing are assumed to not be required in this case, as the trial channel was within a farm paddock. For work on roadside ephemeral channels traffic management will be required.



..... Current profile
— New profile



8.5.2 Small-scale Sediment Traps

For small-scale inline sediment traps on permanently-flowing drains, we have assumed that a pre-cast concrete section is used to provide a hard-edged structure that will not be over-deepened/over-widened by excavating accumulated sediment. Approximately 75% of the estimated cost is for the pre-cast concrete section, so considerable savings could be made by using simple excavated sediment traps without hard edges, and ensuring maintenance protocols are in place to minimise the risk of over-widening/over-deepening.

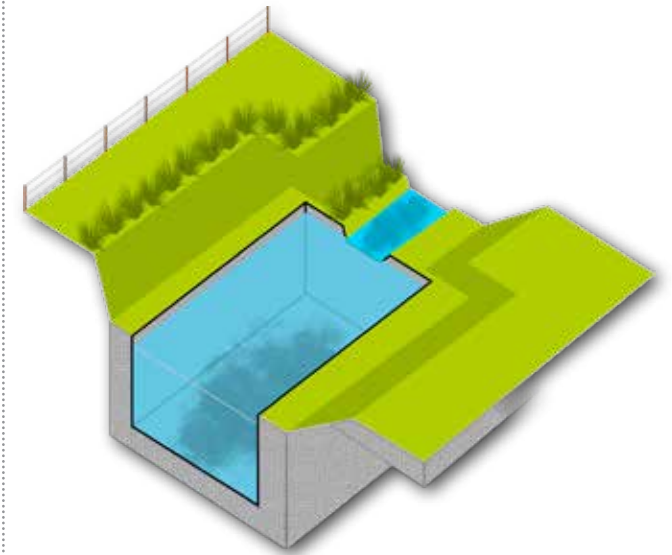


FIGURE 10: Schematic showing options for constructing a two-stage channel where there are space constraints.

The following is included in the cost estimates:

- hire of excavator and labour
- diversion pump
- crane hire
- traffic management (assuming the sediment trap site is adjacent to a public road)
- sediment control
- gravel base beneath the pre-cast concrete section
- geotechnical/hydrogeological site investigation
- pre-cast concrete section.

A small amount of land acquisition cost has been included to account for widening the channel at the sediment trap site. We have not included land acquisition costs for the land required for machine access and material stockpiling during maintenance, as this area will only be needed periodically and could be farmed the remainder of the time. Easements or land access agreements should be considered to ensure that future access to the maintenance area is retained and maintenance is not prevented by other activities on the land

8.5.3 Event-based Sediment Traps

We have costed small-scale event-based sediment traps for ephemeral drains on the basis that they are simple timber structures as trialled in the Waituna Catchment (Southland), and that they are installed when the channel is dry. Note that as these structures are intended for ephemeral or intermittent channels, the design that we have costed does not include provision for fish passage.

The following is included:

- timber poles and palings
- PVC outlet pipe
- excavator and labour hire
- traffic management (not required if the channel is fully on private land).

The cost estimate is consistent with the published information from previous Living Water trials.



8.5.4 Planting & Fencing

For interventions involving fencing and planting riparian margins or spring-head areas, we have assumed that it is not necessary to purchase land.



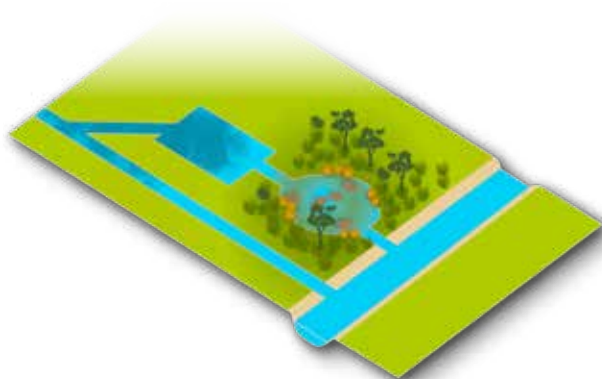
A fenced and planted waterway along private farmland near Sergeants Road in the Ararira catchment.

Wetlands & Large-scale Sediment Traps

The costs of larger-scale interventions such as constructed wetlands and offline sediment traps will be more site-specific, and should be estimated as part of the next stage of design, once sites have been selected. A major cost factor will be whether excess excavated material needs to be removed from the site, or if it can be utilised within the site or as part of the design (for example as landscape features or flood bunding).

An estimate of \$175,000–\$260,000 per hectare for constructed wetlands is given in the Constructed Wetland Practitioner Guide: Design and Performance Standards.¹⁶ A concept-level cost estimate prepared for ECan for a constructed wetland of approximately 4 ha total footprint in a nearby catchment was in the range of \$1.7M–\$3.2M¹⁷: the lower end of this range is higher than the upper end of the per-hectare estimate from the Constructed Wetland Practitioner Guide.

The cost of smaller-scale on-farm wetlands will depend on the volume of excavation required: the cost will be considerably less if naturally low-lying areas are utilised.



¹⁶ Tanner, C.C., Depree, C.V., Sukias, J.P.S., Wright-Stow, A. E., Burger, D.F. & Goeller, B.C. 2022. Wetland Practitioners Guide: Wetland Design and Performance Estimates. DairyNZ/NIWA, Hamilton, New Zealand.

¹⁷ Morphem Environmental, 2019. Silverstream Catchment Wetland Feasibility Assessment. Memo prepared for ECan.

For more information:

- **Rating structure – SDC Long Term Plan:**
www.selwyn.govt.nz/your-council/plans-And-reports/long-term-plan
- **Financing options – SDC Development Contributions Policy:**
www.selwyn.govt.nz/_data/assets/pdf_file/0008/460367/Development-Contributions-Policy-Final.pdf
- **Freshwater Improvement Fund:**
<https://environment.govt.nz/what-you-can-do/funding/freshwater-improvement-fund>
- **Sustainable Food and Fibre Futures Fund:**
www.mpi.govt.nz/funding-rural-support/sustainable-food-fibre-futures
- **Green Bonds:**
<https://debtmanagement.treasury.govt.nz/government-securities/green-bonds>
- **Tax Guidance for riparian planting:**
www.taxtechnical.ird.govt.nz/en/new-legislation/act-articles/taxation-livestock-valuation-assets-expenditure-and-remedial-matters-act-2013/farmers-riparian-planting
- **Te Ara Kakariki:**
www.kakariki.org.nz
- **Indicative costs – Two-stage channel costs from Living Water trials:**
www.livingwater.net.nz/catchment/ararira-lii-river/two-stage-channel-flood-management-and-reducing
- **Indicative costs – Wetland Practitioners' Guide:**
<https://niwa.co.nz/sites/niwa.co.nz/files/wetland%20practitioner%20Guide-web.pdf>

9 Operational Sequencing

- The Ararira CMP sets out a vision and long-term goals for the catchment. Implementation of the CMP will require a number of actions in order to achieve these goals.
- A theory of change (ToC) approach creates a logical sequence from the vision through to inputs, activities, outputs and outcomes.
- Outcomes can be classified as intermediate (short and medium-term) and long-term. In the Ararira, intermediate outcomes include changes to maintenance practices and long-term outcomes include cultural, environmental, social, and economic aspects of the catchment that need to change (or be retained) to achieve the vision.
- Using a ToC approach, an indicative phasing of tasks has been prepared for implementation in the Ararira catchment. This makes the distinction between implementing interventions on private land/privately-owned drains, and interventions on public land/infrastructure at a network utility scale.

Successful catchment-oriented change initiatives often have ambitious goals and involve partners and stakeholders at different decision-making levels; planning specific on-the-ground strategies to achieve those goals can be difficult. A ToC approach (see Appendix F for further detail) has been used to create indicative logic models for implementation of the Ararira CMP, linking inputs and activities to outputs and outcomes over a multi-year time frame.

9.1 Using ToC & Logic Models

A programme's ToC is a road map that outlines how outcomes will be changed and impact will be delivered, and identifies key assumptions and implementation risks. Constructing a sound ToC involves investing time and resources, including a multi-step process with participation at all programme levels. A logic model accompanies a ToC and is a graphic depiction (road map) that presents the shared relationships among the resources, activities, outputs, outcomes, and impact for the programme. As a road map, a logic model specifies causal pathways and the step-by-step relationship between planned work and intended results. Appendix F provides more information on using these tools. It helps organisations and others with catchment responsibilities to focus on important questions, determine necessary data collection, and contributes to improving the buy-in of those involved in implementation. There are strong links to Monitoring & Evaluation and Adaptive Management: Sections 11 and 12 provide further

information on these. Following on from the use of these approaches it is important to set out a clear picture of key phases and activities.

9.2 Indicative Phasing of Work

Developing a logic model for implementation is not a one-off exercise to be used in the design (or evaluation) phase of a CMP, but should be an ongoing process of learning and adaptive management that continues throughout the life of the initiative, taking into account all key areas outlined in this guide. The following figures 11 and 12 provide indicative phasing of activities over time for implementation both on private land, and at the network utility scale on public land/infrastructure. These should be reviewed and updated as implementation progresses. While time frames have been expressed as Phases 1–4+, time frames for these phases will need to be determined as part of more detailed project planning.

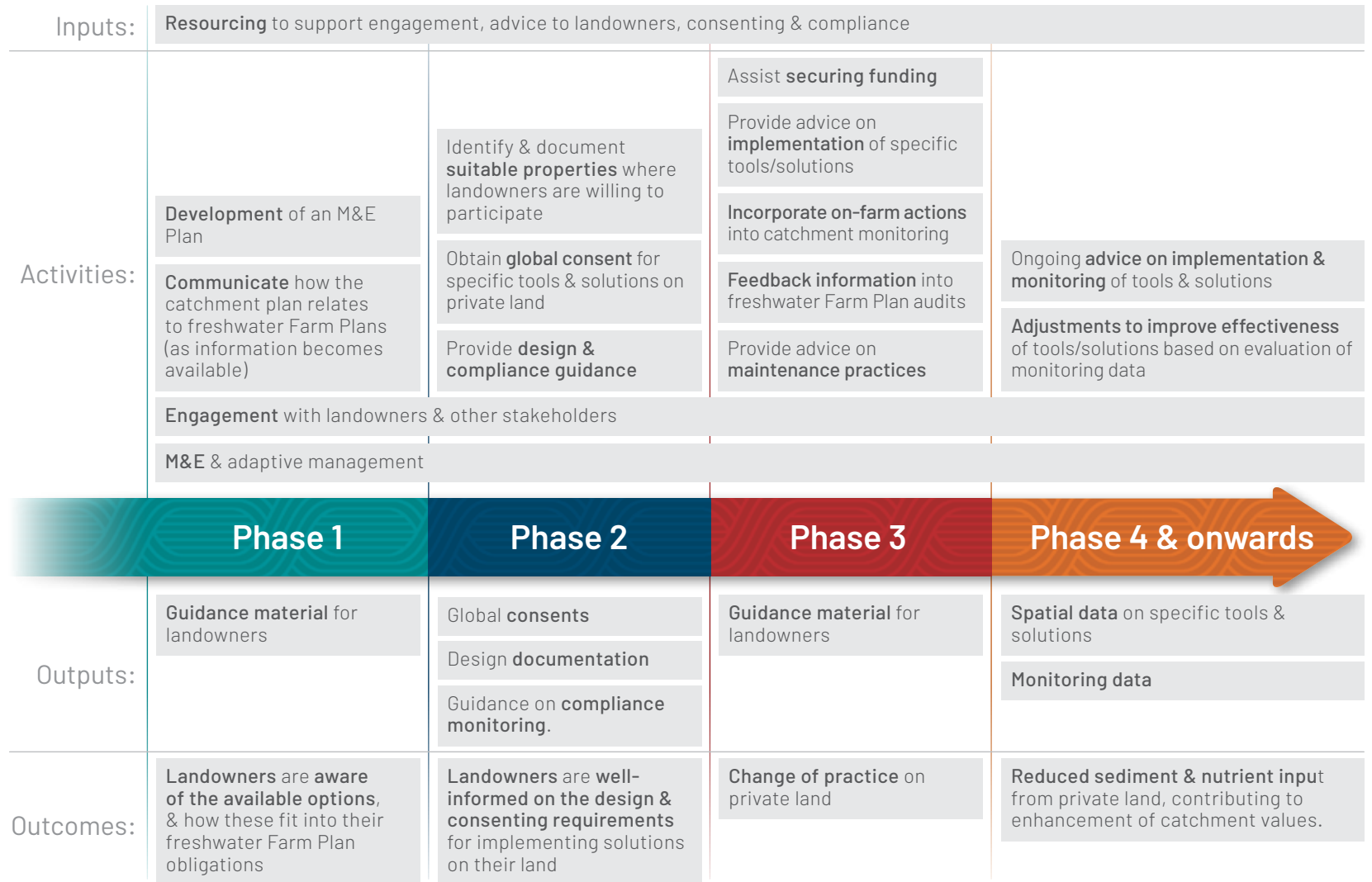


FIGURE 11:
Indicative phasing of work for interventions on PRIVATE LAND.

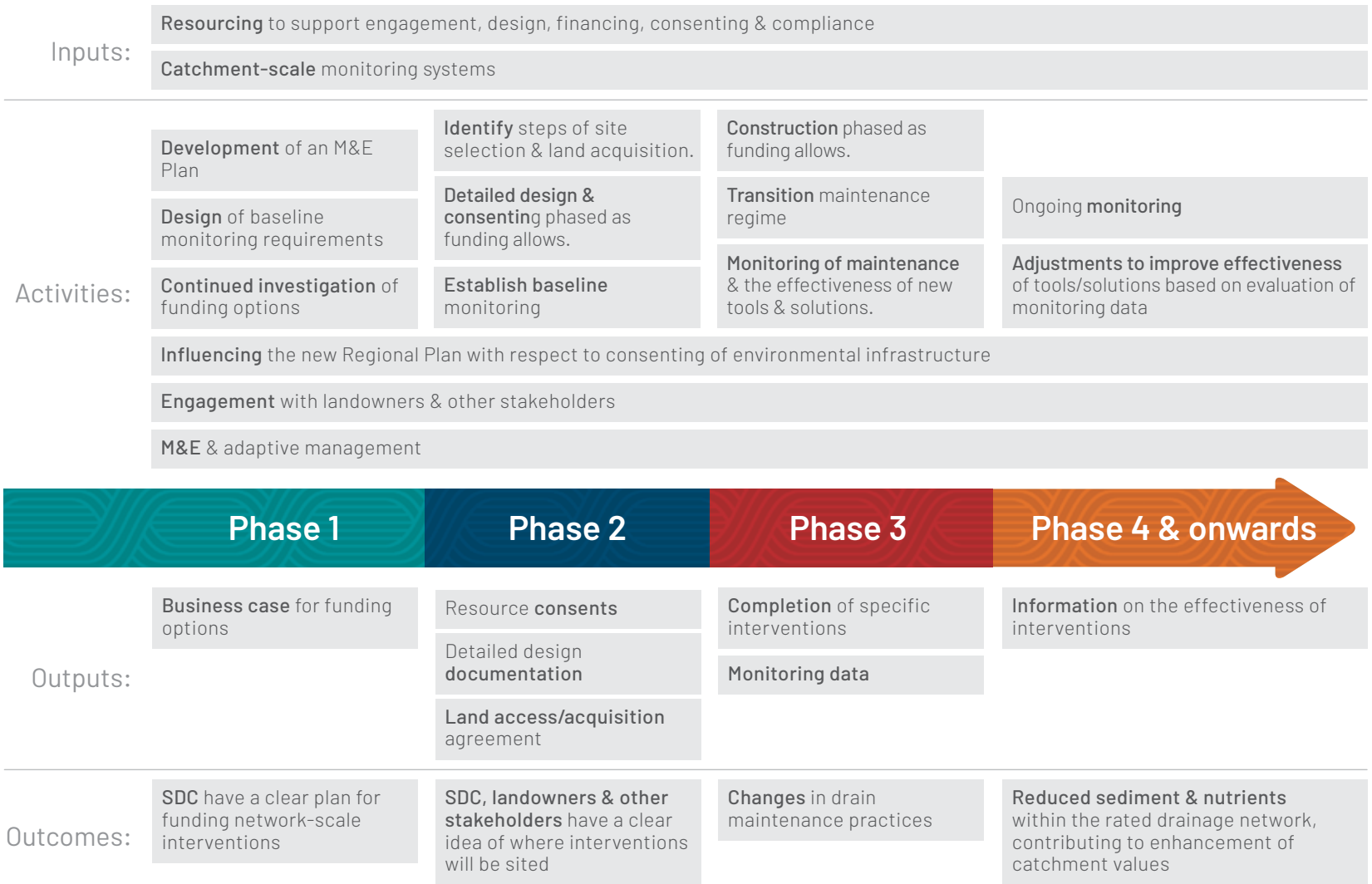


FIGURE 12:
Indicative phasing work for interventions relating to PUBLIC LAND/ INFRASTRUCTURE.

10 Knowledge, Information & Insights

- Taking account of science, Mātauranga Māori and tikanga, and local community knowledge in catchment management can help ensure that management strategies are scientifically sound, culturally appropriate, and socially inclusive. This can lead to more effective, sustainable, and equitable water management practices.
- Collection of baseline data in the Ararira Catchment will be important for showing the effectiveness of interventions.
- Baseline datasets should relate to social, institutional and environmental outcomes, and will need to be a mix of intervention-specific monitoring and data that is aggregated at a larger scale.
- There are strong links between the collection of baseline data, Monitoring and Evaluation, and Adaptive Management sections.
- Data is collected by SDC at present to support assessment of the performance of the land drainage network against service targets. Expanding the service targets to include performance measures relating to the multiple values represented in the Ararira CMP is recommended.

To achieve integrated catchment management, there needs to be a transparent link between water body outcomes and a better understanding of the social and biophysical changes happening in catchments. The different knowledge systems that we have – science, traditional knowledge, culture, as well as local community and lived experience – can all play a critical role in catchment management. We need a science-policy approach that is enabled by, and responsive to, Te Tiriti o Waitangi and Mātauranga Māori. Our science sector (in its broadest sense) must also demonstrate relevance, accessibility, and inclusion if it is to have its greatest impact for all our catchment communities.

- **Scientific knowledge:** Science provides a systematic approach to understanding catchment processes and the impacts of human activities on water resources. Biophysical research, for example can help identify sources of pollution, quantify water quality, and measure the impacts of land use and climate change on water systems. The social sciences can similarly contribute by providing insights into human behaviour, decision-making processes, and social dynamics related to water use and management. The use of social and behavioural sciences can help catchment managers better understand the motivations and values of different stakeholders and this can help develop strategies that are more likely to be successful.
- **Mātauranga Māori:** Weaving mātauranga Māori into decision-making provides a real opportunity to enrich our underpinning research and policy base if we make this an area of focus. Traditional knowledge and culture are often closely tied to local ecosystems and water resources. Indigenous and local communities have developed unique knowledge systems and management practices that have sustained their water resources for generations. In New Zealand incorporating mātauranga Māori and tikanga Māori into catchment management can provide a more holistic approach that considers the social, cultural, and economic aspects of water management, and can help ensure that management strategies are culturally appropriate and effective.
- **Local community knowledge:** Knowledge of local communities may be based on lived experiences and observation. Communities often possess knowledge of catchment processes, local water systems, and historical land use that has not been

captured by scientific research. By incorporating local community knowledge into catchment management, we can better identify water management challenges and opportunities, and support more inclusive, participatory decision making.

10.1 Baseline Data

Baseline data collection is an essential tool for catchment management projects to assess whether they have achieved their intermediate and long-term outcomes. It involves collecting data at the beginning of a project to establish a benchmark against which progress can be measured. In terms of supporting implementation plans this data will need to include data and information on the biophysical, social, economic and cultural characteristics of the catchment, relevant to the required change process.

Establishing a robust set of baseline data in the catchment is important as this will enable the impacts of interventions to be shown. Activities cannot be linked clearly to outcomes without having a baseline in place.

It is recommended that data is as broadly accessible as possible so that stakeholders can see progress being made. However, some datasets relating to individual land parcels or businesses may be private or commercially sensitive at present, and it is recognised that issues around data ownership and governance will need to be addressed.

Some baseline monitoring will be specific to an individual application of a tool (for example the volume of sediment removed from a sediment trap), which is expected to reduce over time as other interventions are applied

upstream to reduce sediment inputs. Consent compliance for tools recommended in the CMP may have specific monitoring requirements. Other monitoring is aggregated over the catchment, for example the total number of maintenance hours required per year.

Intermediate outcomes, such as changes in land management practices or increased community engagement, can be monitored to see if the catchment is moving in the right direction. Long-term outcomes, such as improved water quality or increased biodiversity, can be monitored over a longer period to assess whether the desired changes have been achieved.

We recommend that a spatial framework such as ArcGIS is used to record the location of interventions across multiple scales: from paddock scale to reach catchment scale. Providing this spatial information on a publicly available hub site will allow any user to easily view the spatially-driven information. Without this it will be difficult to link interventions to outcomes. Gathering this data will be dependent on engagement with stakeholders. Ideally, the spatial framework would also be used as a portal for recording monitoring and maintenance data in real-time.

As maintenance practices in the drainage network are expected to undergo a transition rather than a step-change, the current maintenance regime should be recorded as baseline data. This could include:

- mapping of reaches that are cleared mechanically, and recording when this occurs (so that changes can be shown as interventions are implemented)
- mapping of reaches that are sprayed with herbicides,

and recording when this occurs

- litres of chemical used for spraying.

Baseline datasets will be used to support Monitoring and Evaluation (see Section 11). As such, the data should encompass social, institutional and environmental outcomes and states. In many cases intermediate outcomes need to occur before environmental states will change.

As discussed below, some baseline data relating to the performance of the drainage network is currently collected by SDC, for example number of complaints received and the total cost per serviced property.

10.2 SDC Levels of Service

The performance of the land drainage network and its maintenance regime are currently monitored and assessed via service targets in SDC's 5 Waters Activity Management Plan (AcMP). The current service targets relating to land drainage are summarised Table 5.

The existing objectives are still likely to be relevant, as the future vision for the Ararira catchment includes maintaining the drainage function. As part of engagement with stakeholders it will be necessary to ensure that residents understand the objectives of implementing the Plan. There is a risk that performance against the current measures will decline if, for example, there is an expectation in the community that the current maintenance regime will continue without modification.

Some of the key assumptions noted in the AcMP which

are based on ‘business as usual’ may need to be re-visited to account for implementation of the CMP. These include assumptions relating to Levels of Service and service delivery.

In future AcMP, SDC (or another entity that manages the drainage network) may need to add additional objectives in relation to the vision of reimagining lowland

waterways. Recommended additional objectives, service targets and performance measures are summarised in Table 6. An expansion of the levels of service should be one the first implementation actions contemplated by SDC, as this will open up the scope to deliver service levels that address multiple values.

For more information:

- **SDC Activity Management Plan:**
www.selwyn.govt.nz/_data/assets/pdf_file/0017/280214/AcMP-Volume-1-June.pdf

TABLE 5:
Summary of current service targets for land drainage, from the SDC Activity Management Plan.

Objective	Current Service, & Planned/Planned Service 2018–2028	Performance Measure	Performance 2018	Target 2021–2028
Nuisance effects from water services are minimised.	Residents are satisfied with the land drainage network provided.	Proportion of residents rating the land drainage system good or very good.	45%	>40%
	The land drainage network is managed to give a good quality service	The number of complaints received about the performance of the Land Drainage system, expressed per 1,000 rated properties.	3.37	<5
Water services are provided in a cost-effective manner.	The land drainage network is provided at a reasonable cost.	Total average operating cost per serviced property for Land Drainage	\$74	<\$120

TABLE 6:
Proposed additional service targets.

Objective	Planned level of service	Performance measure
Biodiversity, cultural and water quality outcomes are generated in the land drainage network.	The drainage network is modified and maintained to address multiple values.	Number of drain reaches where interventions recommended in the Catchment Plan have been implemented.
The community is engaged in catchment-scale regeneration.	Landowners within the drainage district are engaged and participating in implementation of tools and solutions identified in the CMP.	Number of land parcels where interventions have been implemented by private landowners.



Monitoring & Evaluation

- Monitoring and Evaluation (M&E) is necessary to check that efforts to implement the CMP are producing the desired outcomes.
- The outcomes that require monitoring include both the intermediate and long-term outcomes set out in the indicative phasing logic model for implementation.
- Different types of M&E are needed at different stages of implementation, addressing both outputs (the changes that are made) and outcomes (the progress towards meeting the vision and values for the catchment).
- There are strong links between M&E and adaptive management (Section 12): if monitoring shows that progress is not being made towards achieving outcomes, the approach can be modified.

The co-design process of developing the Ararira CMP recognised the challenges with implementation and the need to be responsive to the constraints and opportunities of people, groups and organisations as they look to change practices and implement tools from the suite of interventions available. It has also identified the need for our plans to be adaptive and allow continually for ‘learning by doing’ or adaptive management (see Section 12). To do this we need appropriate monitoring and evaluation (M&E) tools and processes, and information flows that help the different stakeholders involved check that their efforts are proceeding as planned, and to refine and guide their responses if changes are needed.

11.1 Monitoring & Evaluation & Benefits

Monitoring & Evaluation (M&E) is particularly useful for complex implementation programmes that aim to introduce catchment-wide systems approaches. In such cases, M&E becomes even more essential in evaluating the effectiveness of interventions, identifying successes and challenges, and providing ideas for making necessary adjustments. The M&E process provides support in three main ways: project management, learning and accountability.

Through providing data and information that helps managers to make informed decisions, M&E supports project management. It allows them to assess the effectiveness of their strategies, identify areas of

improvement, and adjust their programmes as necessary. By regularly monitoring progress towards the project’s objectives, managers can ensure that their resources are being used effectively and that the project stays on track.

Monitoring & Evaluation also plays a critical role in supporting learning. By collecting and analysing data, organisations can identify the factors that contribute to success or failure and use this information to make improvements in future projects. This enables organisations to build on their successes and avoid repeating past mistakes. Additionally, M&E can facilitate knowledge sharing and learning within an organisation, helping to disseminate best practices and lessons learned to others working on similar projects.

By providing evidence of the impact of a project, M&E supports accountability. This is critical for demonstrating to stakeholders, including funders and the public, that the project is making a difference. By measuring and reporting on key performance indicators, organisations can demonstrate that they are using resources effectively and achieving their intended outcomes.

11.2 Monitoring & Evaluation & our Theory of Change (ToC)

In Section 9 we introduced the use of ToC and the accompanying logic model as a design tool to help planning. A ToC also aids the development of monitoring and evaluation plans to help stakeholders to assess and adapt progress towards the achievement of desired

long-term outcomes. Once an initiative or vision has been described in terms of desired outcomes and key programme elements through a logic model, critical indicators of performance can be identified and monitored.¹⁸

As Figure 13 illustrates, the aim of evaluation is not solely to estimate the degree of change that has occurred through the intervention, but also to understand why and how that change was (or was not) produced, and so to support learning and adaptive management.¹⁸

- Taking a longer-term view, outcome evaluation looks to assess, amongst other things, programme effectiveness and how much difference has been made.
- Although desired long-term outcomes may take some years to emerge fully, indicators and accompanying targets can be developed in advance for each outcome area to assess the scale of impacts achieved and to refine future planning.

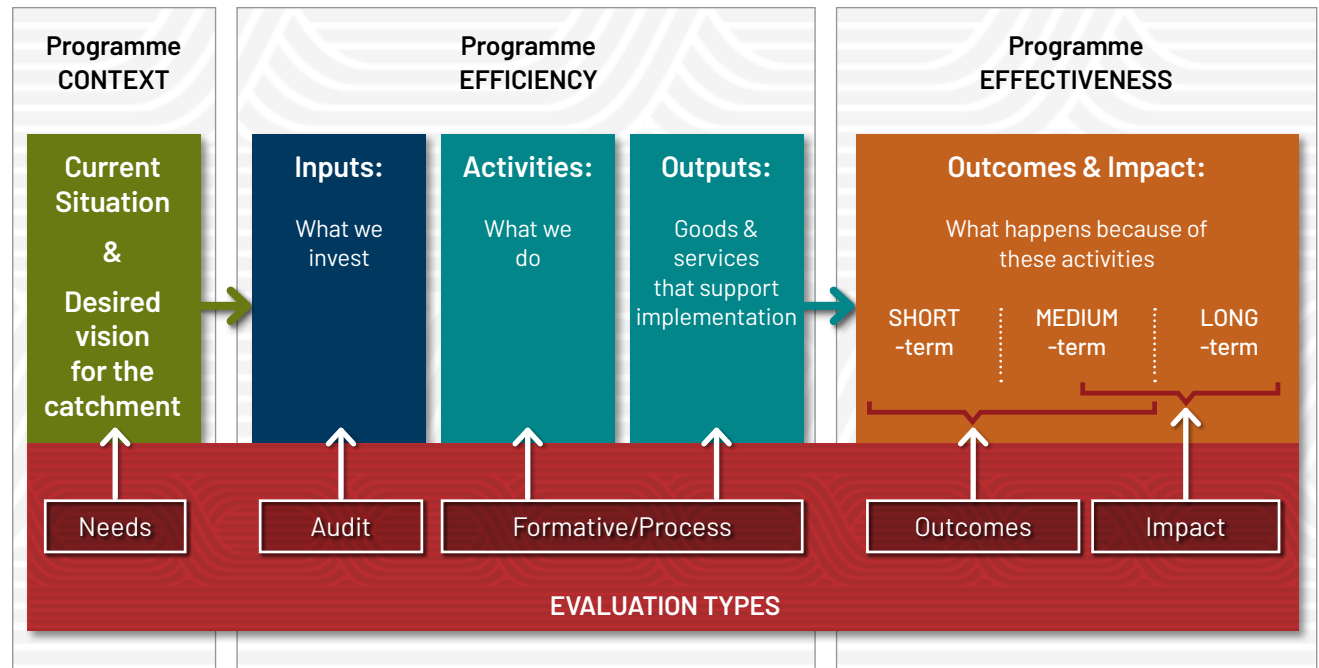


FIGURE 13: A project logic model showing how different evaluation types and approaches can be used to measure progress through different stages of implementation (modified from Learning for Sustainability¹⁹).

18 Allen, W., Cruz, J. & Warburton, B. 2017. How Decision Support Systems can benefit from a Theory of Change approach. Environmental Management, 59(6): 956–965

19 Linking planning with monitoring & evaluation – closing the loop. Learning for Sustainability resource page. Online at <https://learningforsustainability.net/plan-monitor-evaluate>

An M&E programme will help to ensure that the implementation of the CMP via the indicative phasing outlined in Section 9 is producing the anticipated outcomes towards achieving the vision for the Ararira Catchment. This forms part of an adaptive management approach (i.e., if M&E shows that progress is not being made towards outcomes, the implementation can be modified).

11.3 Indicator-based Monitoring & Evaluation Systems

Selecting appropriate and useful indicators and metrics to help guide management and policy initiatives requires careful thought around purpose and scale, iterative refining, collaboration and consensus building. To effectively assess the effectiveness of a complex natural resource management programme, it's crucial to establish a clear understanding of the programme's overall goals and objectives (see Section 1), and the activities and sub-activities that contribute to them (see Section 9). Once the objectives and activities are identified, it is necessary to create specific indicators to track progress. The indicators should be SMART (specific, measurable, achievable, relevant, and time-bound) and reflect the intermediate and long-term goals of the programme. To be useful, indicators must be embedded in a M&E system that is seen as an integral component of a wider adaptive management and decision-making system (see Section 12). Steps for indicator-based reporting should include:

- i. Clarify the purpose, scope and scale.
- ii. Involve the right people.
- iii. Develop a conceptual framework (ToC) and accompanying activity and logic models to identify what needs to be evaluated.
- iv. Identify possible indicators.
- v. Assess the most appropriate candidate indicators and measures.
- vi. Monitor, evaluate, and manage adaptively.

Some of these steps can be undertaken simultaneously or in an iterative manner, despite the fact that they are presented in order here. Team members can use the steps to develop a full set of indicators for a new project, or to rethink indicators and metrics for an existing initiative.

Successful implementation and adaptive management requires appropriate M&E tools, which support project management, learning, and accountability. Integrating project planning, management, and M&E in an adaptive management framework enables systematic examination of interventions and adaptation to changes. Effective indicator-based M&E systems require SMART indicators and a clear understanding of programme goals, objectives, and conceptual frameworks.

For more information:

- Allen W, Fenemor A. & Wood D. 2012. Effective indicators for freshwater management: attributes and frameworks for development. Available at www.learningforsustainability.net/pubs/developing-effective_indicators.pdf

12 Adaptive Management

- Adaptive management will help catchment managers and stakeholders react and adapt to changes that occur during implementation.
- The use of an adaptive management framework can be a useful tool for identifying and managing conflicting expectations: the adaptive management process can be a vehicle for collaborative work and learning amongst stakeholders.
- Links between planning, project management and monitoring and evaluation can be made through an adaptive management framework. This can help to improve project efficiency by ensuring that resources are re-directed as necessary if outcomes are not being achieved.
- An adaptive management framework, and the data that is used to inform it, can be used by multiple stakeholders, and will be valuable for driving engagement and positive change.

An adaptive management approach is important for achieving the shared vision for the catchment, because it allows for flexibility and responsiveness to changing conditions and new information. Freshwater systems are complex and dynamic, influenced by a variety of factors such as climate, land-use, and human activities. As a result, achieving a vision that addresses multiple values in these systems can be challenging, and requires ongoing assessment and adaptation. The ability to adapt requires an environment that promotes intentional learning and flexible project and activity design, minimises the obstacles to modifying programming and creates incentives for managing adaptively.

12.1 It's About the Journey

Integrating project planning, management, and monitoring and evaluation into an adaptive management framework allows catchment managers and stakeholders to systematically examine interventions to adapt and learn. By adapting planning and project management in response to changes, resources can be directed appropriately, reducing the risk of spending resources on ineffective actions.

Catchment-scale projects naturally affect many stakeholders that have different, often conflicting, expectations, adaptive management does not aim to eliminate such differences: it aims to provide a culture and an environment for identifying and discussing differences. If stakeholders are willing to negotiate and seek common ground on some initial steps – even small

ones – adaptive management can provide a home and a process for collaborative discussions and learning, both among Iwi/Māori, catchment communities, agencies, groups and a range of intermediaries.

Adaptive management represents the beginning of a process, not an externally-driven blueprint that must be followed. Even small steps towards seeking common ground can provide a process for collaborative discussions and learning among all stakeholders. It aims to find out which management actions work best in achieving specific objectives while implementing management, rather than changing goals during implementation. By closely monitoring a management strategy, catchment decision-makers can adjust future actions based on interpretation of the monitoring, allowing them to put management practices into action and learn from them.

A catchment management approach that utilises adaptive management should involve stakeholders and partners in planning and implementation. The aim is to improve understanding, generate new ideas and solutions, improve effectiveness and efficiency, build support and legitimacy, and boost resilience and adaptability. Collectively, the key activity areas in this IG can be seen to support an adaptive management cycle (strategy, project, and activity design and implementation; monitoring and evaluation; and learning and adapting). While the adaptive management approaches described in Figure 14 are examples of initial entry points, many of these approaches lead to adjustment in other key dimension areas.

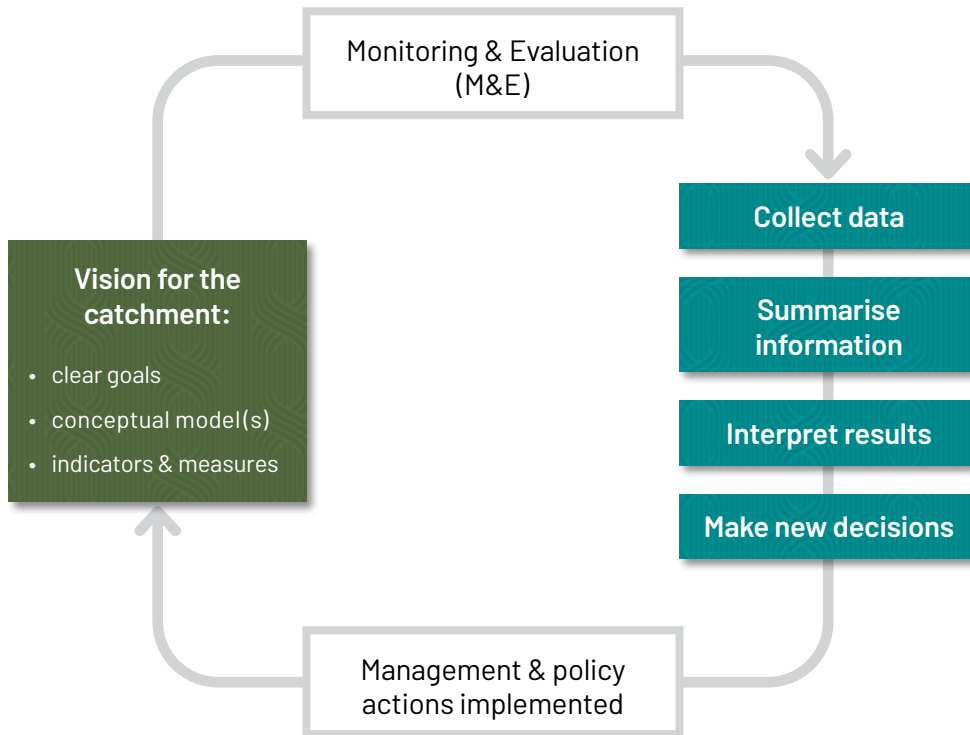


FIGURE 14: Monitoring and evaluation activities in a participatory adaptive management system (modified from Allen *et al.* 2012)²⁰.

20 Allen W, Fenemor A. & Wood D. 2012. Effective indicators for freshwater management: attributes and frameworks for development. Prepared for Aqualinc Research for the MSI Wheel of Water Project. Landcare Research Contract Report LC995, Lincoln. Available at www.learningforsustainability.net/pubs/developing-effective_indicators.pdf

12.2 Addressing Common Technical & Social Barriers

Even though adaptive management is an approach that is potentially flexible and effective for catchment-scale implementation, there are still technical and social hurdles to overcome, as summarised below. These are useful prompts that can help direct our thinking as to how we can improve the different implementation activity areas outlined in this guide.

Technical barriers to adaptive catchment management may include the following:

- It's often hard to predict the consequences of management actions because we don't understand the natural resource system and its links with the driving social system well enough.
- Inadequate data collection and monitoring make it hard for managers to track the effectiveness of their management decisions.
- There aren't enough resources or funding to do the necessary monitoring.
- There are technical limitations, for example a lack of tools and methods for collecting and analysing data.

Social barriers to adaptive catchment management may include:

- There is resistance to change from stakeholders, for example those who have vested interests in current management practices, or those with concerns about the consequences of new approaches.
- Adaptive management strategies are difficult to develop when many of our institutional cultures discourage collaboration, learning, and sharing.
- Limited stakeholder engagement and participation, which can limit the diversity of perspectives and experiences that inform decision-making.
- There can be political and economic pressures, including short-term interests and a focus on immediate gains, that prevent the long-term planning and investment required for adaptive management.

- Legal and policy frameworks that hinder collaboration and knowledge-sharing or do not support adaptive management.
- There can be power imbalances between stakeholders, which can lead to unequal participation and decision-making.

It is essential to address both technical and social barriers if adaptive management is to succeed. For this to happen, we need to focus on collaboration, learning, and knowledge-sharing, as well as investing in research and monitoring activities, and developing legal and policy frameworks that support these activities.

For more information:

- **Resources on Adaptive Management:**
<https://learningforsustainability.net/adaptive-management>



Cutting macrophytes on the main stem of the Ararira/Lil River with the Council's weed cutting boat.

Image source: Robin Smith, DOC

Appendix A: IG Assessment Framework – with Indicative Performance Standard Guidelines

This framework provides a voluntary self-assessment tool to evaluate the readiness of the different implementation activity areas and how this changes over time. This tool can be used to facilitate and engage agency staff and participants in a multi-stakeholder initiative in reflecting collectively on the performance of the various activity areas. The goal is to stimulate a transparent, neutral, open, inclusive, and forward-looking dialogue among different people and groups about what works and what doesn't, what should be improved, and who can do what.

As implementation responses to common water challenges are highly contextual and place-based, the assessment framework is grounded on a bottom-up, multi-stakeholder approach rather than reporting, monitoring, or benchmarking. In the dialogue, we start by developing a broad agreement on the overall aims and vision, and then we ask participants to assess their readiness for implementation across the policy and management activity areas.

1. Begin with the Overall Purpose

Check in with key players about the broad vision that they are aiming for. This review of goals includes both formal goals (the ones set out as a start) and informal goals (those that the individuals bring to the table or that individual groups itself has developed for its members).

2. Assessing Implementation Areas Readiness

Each of the key implementation activity areas are addressed through the different checklist area prompts. Some indicative prompts that could indicate good practice in each dimension are provided to encourage a facilitated discussion and assessment of capability and capacity. What makes it particularly useful as a self-assessment tool is that it only describes indicative criteria for proficiency; it does not attempt to list all the ways that practice could fall short in any particular area, nor does it specify how practice could exceed expectations. This leaves room for practitioners to reflect on the best way forward given their particular organisational, social and biophysical decision making environment.

As a way of getting closure on a performance assessment for each area, participants are asked to come to a consensus on their performance in each area using coloured dots according to a traffic-light system.

This aspect is well covered

We need to think about this as it may be a limiting factor

This factor needs to be addressed as it is limiting team performance

A record is kept of the comments associated with each area of team activities and at the close of the evaluation participants agree a time and place to discuss their response to their 'red dot' and 'yellow dot' factors. Responses can provide evidence of where performance may exceed expectations, or where it might fall short.







3. Strategic Learning & Adaptive Management

Organizations that take up a learning-based and reflective approach do so because they appreciate that their plans – no matter how well specified – will have to shift as circumstances evolve and change. This approach supports adaptive management, allowing organizations to be responsive and flexible to new information and changing conditions. A strategic learning approach ensures that insights gathered from planning, monitoring, evaluation, and various data sources are more likely to be timely, actionable, and future-oriented, contributing to successful outcomes. By employing this approach, program managers, key stakeholders, and partners can effectively assess progress, pinpoint barriers and challenges, and seize opportunities, ultimately enhancing the likelihood of program success.

TABLE A1:
An IG assessment framework.

 Social Aspects  Social & Technical Aspects

Performance Criteria	Rate	Evidence of Performance
<p>1 SHARED DIRECTION:</p> <p>We know where we are going. Strategic direction is jointly planned, theories of change (ToC) are set out and agreed. Mutual benefit is identified in agreed outcomes and the range of underpinning values are articulated and appreciated. Operational plans (#s) are well documented, and targets and milestones are met (%). A number of active partnerships are operating, and partners can be seen to prioritise joint work and their contribution to that.</p>		
<p>2 ENSURING A TE TIRITI-BASED APPROACH:</p> <p>Iwi/Māori/hapū/rūnanga engagement and inclusion is a vital component of environmental governance. Mana whenua are approached early in the project’s conceptualising. Time is taken to develop relationships that reflect their aspirations, priorities, and capacities. Open, two-way dialogue supports ongoing dynamic project management and review. There are a range of formal and informal interactions that demonstrate how the Te Tiriti principles are being met.</p>		
<p>3 PARTNERING, ENGAGING & COMMUNICATION:</p> <p>Multiple communication channels and methods are in place. Plans recognise and support a continuum of two-way and one-way communication activities. This continuum sees one-way push/pull communication methods at one end and two-way collaborations and partnerships at the other. Plans identify a rationale and guidance for appropriate activities at key points in the relationship (adjusted for different stakeholders/audiences). Appropriate networks and collaborations are developed and resourced.</p>		
<p>4 SUPPORTING COLLECTIVE ACTION:</p> <p>Multiple approaches to practice change are employed. Conventional legislation, incentives, messaging and education are used, but often in concert with systems-based approaches which remind us to focus on non-conscious as well as conscious drivers of behaviour; the need to focus on the setting of our behaviours as well as internal motives and drivers; and the need to focus on behaviours rather than solely beliefs, attitudes or intentions. A range of behaviour change theory and models are used to support programme design.</p>		
<p>5 CAPACITY & CAPABILITY:</p> <p>Staff capacity and capability-building takes account of the requirements of the 12 key activity areas indicated in this IG, and include a focus on both ‘hard’ (technical) and ‘soft’ (social) dimensions. Specialist input is available as needed. There is adequate investment in technical capabilities and capacities that focus on the environment, facilities, equipment, and infrastructure required for a well-functioning drainage network.</p>		
<p>6 REGULATIONS:</p> <p>There is a shared understanding of the Central Government legislation, policy principles and guidance requirements across key legislation. This includes including Te Mana o te Wai, NPS-FM obligations, essential freshwater package, etc. as well as regional and district plans. The wider implementation team has (or closely links with) representatives of local and regional government.</p>		

Performance Criteria	Rate	Evidence of Performance
<p> CONSENTING & COMPLIANCE: Consenting is working well, and happens in good time frames. Where possible consenting has been streamlined. Consents have been developed to minimise barriers to uptake. The use of global consents to support work on private land has been considered where possible.</p>		
<p> FINANCING: Indicative unit costs and (where practical) total costs provide guidance around financing and budgeting issues that will need to be addressed in detailed design and planning of interventions. A spectrum of options exists for financing or subsidising interventions on private land and at the network utility scale, and these options are being explored.</p>		
<p> OPERATIONAL SEQUENCING: Demonstrated use of programme theory (such as ToC, logic models, etc) to develop interventions that work in complex settings. ToCs are underpinned by causal and behavioural assumptions. Operational plans (#s) are well documented, indicate practical sequencing of activities, and targets and milestones are met (%). Key activities (such as those in this guide) have been resourced and included where appropriate.</p>		
<p> KNOWLEDGE, INFORMATION & INSIGHTS: Monitoring and evaluation (M&E) and adaptive management frameworks guide the development of knowledge and information needs. An integrated approach draws on the synergies between science, Mātauranga Māori, and local community knowledge. The right baseline data is being collected to show the effectiveness of interventions. Baseline datasets relate to social, institutional and environmental outcomes, across a range of timelines.</p>		
<p> MONITORING & EVALUATION (M&E): The M&E process provides support in three main ways: project management, learning and accountability. Agency staff and teams regularly check in on each other and how they are going, both collectively and individually. Indicators are embedded in a M&E system that is seen as an integral component of the wider management and decision-making system. Reflection is open and 'formalised' as part of regular practice. 'Lessons learned' are readily applied.</p>		
<p> ADAPTIVE MANAGEMENT: Adaptive management of natural resources is a dynamic and iterative approach based on monitoring, evaluating and learning from results to improve management actions. Organisational cultures support participation, information sharing and learning. Active approaches are in place to address common technical and social barriers.</p>		

Points to note when undertaking the self assessment:

- While the checklist is designed to be used by an external evaluator, an agency or lead organisation that has facilitation skills within its own membership can usefully undertake its own evaluation.
- Where participants feel they were doing well, it is useful to prompt them to think about the reasons why this was so. Where participants identify an area where they feel that they have a weakness, they could be offered a short opportunity to work through the barriers and develop steps that could be taken to improve performance in that area.

This checklist-based assessment approach is useful to help develop the capacity of teams and organisations to reflect on their performance in specific areas, and to co-ordinate across areas.

Some tips from use in related areas include:

- Using the checklist in a reflection-based evaluation can help participants identify any factors that may be holding them back.
- Facilitation is critical to the usefulness of the self-assessment approach. An evaluation can seem ‘negative’ – i.e., to be about pointing out weaknesses and gaps. Participants need to feel confident that such an assessment is ‘by them and for them’, but also at the same time can need to be pushed to think beyond the immediate response that ‘everything is alright’.
- The more open an organisation or group’s work environment is to learning and development, the more ready participants will be to look for ways to improve what they are doing. Further, the more experience that those involved in multi-stakeholder interventions get with all the underlying activity areas for successful implementation practices, the more natural and frequent the monitoring of progress becomes.

For more information:

- **Living Water Monitoring & Evaluation:**
www.livingwater.net.nz/case-studies-and-resources/case-studies-4/monitoring-and-evaluation

Appendix B: Indicative Stakeholder Analysis for the Ararira Catchment

Stakeholder	Comment	Further Information
Selwyn-Te Waihora Zone Committee	Is able to allocate some funding for biodiversity projects.	www.ecan.govt.nz/your-region/your-environment/water/whats-happening-in-my-water-zone/selwyn-waihora-zone
LII Drainage Committee	Committee members are landowners in the catchment and are responsible for managing the current maintenance contracts. Represented on Te Komiti Waiora – District Land Drainage and Waterway Committee.	
Silver Fern Farms	Provides support for the farms that they support (beef, lamb, venison). However, as the farms in the catchment are small there is uncertainty as to the level of support that would be provided.	www.silverfernfarms.com
Greater Christchurch Partnership	Includes Lincoln township. Future expansion of Rolleston may spill over into the Catchment.	
Ministry for Primary Industries	Potential funder of some activities or research – e.g., Sustainable Food and Fibre Futures Fund.	
Ministry for the Environment	Potential funder of some activities – e.g., Freshwater Improvement Fund. (has funded the current work underway at Tārerekautuku Yarrs Lagoon).	
Regional & Local Government – in their roles as asset-owner and consenting authorities		
ECan Science Group	Some work being done internally on waterways in the area (relating to high turbidity during periods of low flow in the catchment).	
ECan Consents Section	Consenting authority. Potential role in granting global consents for some interventions.	
ECan Strategy and Policy	Potential role in enabling implementation to proceed more easily via rules in the new Regional Plan.	
Elected representatives	Elected councillors and political champions of the vision for the catchment.	
Intermediaries		
Waihora Ellesmere Trust (WET)	<ul style="list-style-type: none"> Community organisation dedicated to the improvement of the health and biodiversity of Te Waihora/Lake Ellesmere and its catchment. The group developed an ‘integrated monitoring plan’ for the lake. WET have developed resources on sustainable drain management. 	https://wet.org.nz https://wet.org.nz/projects/sustainable-drain-management-project
Fish & Game North Canterbury	NGO with statutory management functions. Interest in working with landowners. Brown trout fishery in the lower end of the LII, as well as game bird hunting.	
Project Crimson	May be able to link to in relation to biodiversity credits.	

NOTE: This list of stakeholders is additional to the Ararira Project MOU partners: Selwyn District Council, Te Taumutu Rūnanga, DOC and Fonterra.

Stakeholder	Comment	Further Information
Te Ara Kakariki	Trust with the goal of increasing biodiversity in Canterbury, related primarily with planting of native vegetation in locations between the Waimakiriri and Rakaia River. Potential source of plants.	www.kakariki.org.nz
Lincoln Envirotown Trust	Would be a way of connecting to the smaller landholders as well as existing connections to local schools.	http://lincolnenvirotown.org.nz
Central Plains Water Trust & Central Plains Water Ltd	The Trust was set up by SDC and CCC to facilitate sustainable development of central Canterbury's water resources. CPW Ltd manages the Central Plains irrigation scheme. CPWL's water quality monitoring programme may extend into the catchment.	www.cpw.org.nz
Enviroschools	Schools engagement programme run by ECan. Ideal way to engage with schools. Lincoln Primary School, Lincoln High School, Lincoln University Early Childhood Centre, Kidsfirst Kindergartens Lincoln, and Ararira Spring Primary are participating in Enviroschools.	
Nature Agents	Run by EOS Ecology and related to schools monitoring the health of their local waterway with monitoring results presented on a publically accessible website. Three schools in Lincoln are involved in the programme (Ararira Springs Primary, Lincoln Primary, Lincoln High). Also connections to Enviroschools wider programme (and all three schools are also enviroschools). Ideal way to engage with schools.	www.natureagents.co.nz
Waterways Centre for Freshwater Management	Joint venture between Lincoln University and University of Canterbury.	www.waterways.ac.nz
University of Canterbury	Information from the CAREX study that included work in the catchment.	
Lincoln University	Academics and students that may be doing work in the catchment – either on waterways or related to land management.	
Water watch	Provides an outdoor experience for schools and community groups to engage people in assessing waterway health.	www.waterwatch.co.nz
PGG Wrightson	Their seed raising research centre is in the catchment.	
Individuals and groups – with interest but no direct involvement in implementation		
Birding NZ	More about individual ornithologists/birders than a group per se.	
Recreational users	Includes kayakers, whitebaiters, eelers, fishers, hunters, birders. A lot of these are more focused in the bottom portion of the catchment.	
Commercial eeling	Te Waihora is a significant commercial eeling fishery (short fin eels). The tributaries, including drainage networks, are important habitat for eels.	

Appendix C: Relevant Legislation, Regulation, Plans & Strategies

This Appendix provides further detail on the legislation, regulation, plans and strategies that are summarised in Section 7.

Legislation

Resource Management Act

Section 13(1) of the Resource Management Act (RMA) states:

“No person may, in relation to the bed of any lake or river, –

- (a) Use, erect, reconstruct, place, alter, extend, remove, or demolish any structure or part of any structure in, on, under, or over the bed; or*
- (b) excavate, drill, tunnel, or otherwise disturb the bed; or*
- (c) introduce or plant any plant or any part of any plant (whether exotic or indigenous) in, on, or under the bed; or*
- (d) deposit any substance in, on, or under the bed; or*
- (e) reclaim or drain the bed –*

unless expressly allowed by a national environmental standard, a rule in a regional plan as well as a rule in a proposed regional plan for the same region (if there is one), or a resource consent.”

There is no national environmental standard that covers land drainage.

Note that the government has begun the process of repealing the Resource Management Act and enacting new laws for managing the environment.

Local Government Act 1974

Part 29 of the Local Government Act 1974²¹ deals with land drainage and rivers clearance, in relation to drainage channels and land drainage works that are under the control of a Council. This includes:

- giving Councils powers to make, maintain, enlarge, alter, extend or repair drainage channels or land drainage works.
- allowing Councils to make bylaws in relation to drainage channels, which may include regulation of fencing, planting, and modification of channels.

Local Government Act 2002

Council Bylaws are made under the Local Government Act 2002. The Act also sets out Councils’ obligations in relation to planning and decision-making. This includes preparation of infrastructure strategies (Section 101B) as part of the long-term plan process, including:

- significant decisions about capital expenditure that the Local Authority expects it will need to make,

- allowing for changes in the level of service, and
- maintaining or improving environmental outcomes or mitigating effects on them.

Section 181 of the Act allows Councils to construct works relating to land drainage on private land, and to access land to maintain works constructed under this section. Schedule 12 lists requirements for completing work under this section.

Land Drainage Act 1908

The Land Drainage Act 1908²² gives Councils powers to construct and maintain drains, including on private land.

Section 2 of the Land Drainage Act (1908) defines a **drain** as including:

“every passage, natural water course or channel on or under ground through which water flows continuously or otherwise, except a navigable river, but does not include a water race as defined in section 58 thereof”

And defines a **watercourse** as:

“watercourse includes all rivers, streams, and channels through which water flows”

Note that Classified Drains are not considered to be water bodies in SDC’s District Plan; they are considered to be a Utility.

²¹ www.legislation.govt.nz/act/public/1974/0066/latest/DLM415532.html

²² www.selwyn.govt.nz/_data/assets/pdf_file/0005/267800/57296001_Stormwater-and-drainage-bylaw-2018_v28.pdf

SDC Bylaws & Policies

SDC's Stormwater and Drainage Bylaw 2018²³ applies to public and private land drainage systems.

The bylaw refers to the SDC Engineering Code of Practice²⁴. Part 5 of the Code of Practice deals with Stormwater and Land Drainage²⁵. Part 5, in turn, refers extensively to CCC's Waterways, Wetlands and Drainage Guide (WWDG)²⁶ in relation to a number of aspects potentially relevant to implementation of the CMP, including:

- design of waterways
- enhancement of natural character and amenity values
- operation and maintenance of control structures and ponds.

Policy S301 – Land Drainage Tailings Policy is included in SDC's Policy Manual²⁷. This policy provides guidance on how material that is removed from the drainage network is to be managed, including removal of material that has built up over a number of years. This policy may need

modification to reflect a change in the maintenance requirements.

Other SDC policies that may have some relevance to implementation include C201 Climate Change, L1 Land Bank, and L2 Leasing and Licencing.

Essential Freshwater Work Programme

National Policy Statement for Freshwater Management 2020

As part of the Government's freshwater work programme, the National Policy Statement for Freshwater Management 2020 (NPS-FM)²⁸ provides local authorities with updated direction on how freshwater should be managed under the Resource Management Act (RMA).

Key requirements under the NPS-FM that are relevant to re-imagining the Ararira Catchment include:

- Freshwater is to be managed in a way that gives effect to Te Mana o te Wai, through involving tangata whenua.
- Improvement of degraded water bodies.

- Encouraging the restoration of wetlands, and avoiding any further loss or degradation of wetlands and streams.
- Working towards target outcomes for fish abundance, diversity and passage.

Nothing that is proposed in the CMP is inconsistent with the objectives of the NPS-FM.

Stock Exclusion Regulations

Stock Exclusion Regulations²⁹ that prohibit access of livestock (specifically: cattle, pigs and deer) to wetlands, lakes and rivers have been developed as part of the Essential Freshwater work programme.

The regulations apply to lakes and rivers greater than 1 m wide and natural wetlands greater than 0.05 ha in size on low slope land areas. The entire Ararira catchment is low slope land³⁰. Note that the definition of river in the RMA excludes artificial watercourses. However, as the Ararira project envisions a transformation from drains to streams, it is important to encourage stock exclusion based on this aspiration, rather than the letter of the law. (Note that

23 www.selwyn.govt.nz/_data/assets/pdf_file/0005/267800/57296001_Stormwater-and-drainage-bylaw-2018_v28.pdf

24 www.selwyn.govt.nz/property-And-building/resource-consent/subdivision/code-of-practice

25 www.selwyn.govt.nz/_data/assets/pdf_file/0011/35399/Part-5-Stormwater.pdf

26 <https://ccc.govt.nz/environment/water/water-policy-and-strategy/waterways-wetlands-and-drainage-guide>

27 www.selwyn.govt.nz/_data/assets/pdf_file/0013/13261/Selwyn-District-Council-Policy-Manual-APPROVED-BY-COUNCIL-on-17-February-2021-Web.pdf

28 <https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-freshwater-management>

29 <https://environment.govt.nz/acts-and-regulations/regulations/stock-exclusion-regulations>

30 <https://mfe.maps.arcgis.com/apps/View/index.html?appid=4431febca3854ee19bb4c67bc94029bb>

stock exclusion can be enforced via the SDC Stormwater and Drainage bylaw, Clause 6.1.(c))

Te Waihora Co-Governance

Te Waihora is co-governed by Te Rūnanga o Ngāi Tahu, the Canterbury Regional Council (ECan), SDC, CCC, and the Te Papa Atawhai (DOC). The co-governance agreement³¹ records the commitments of the signatories to share responsibility for Te Kete Ika a Rākaihautū (Te Waihora) and the wider Te Waihora catchment.

The Whakaora Te Waihora joint restoration programme, under the governance of the Co-Governance Group, has the following vision:

To restore and rejuvenate the mauri and ecosystem health of Te Waihora and its catchment.

Whakaora Te Waihora has the following long-term aims³²:

1. *Accelerate the restoration of ecosystem health of an internationally significant wetland, notable for its wildlife and native vegetation values.*
2. *Begin the process of restoring and enhancing specific cultural sites and mahinga kai.*
3. *Protection and restoration of lake margin wetland habitats, existing indigenous native vegetation*

and wildlife, and restoration of specific lowland tributary streams and riparian habitats.

4. *Improve lake and catchment management practices by focussing on sustainable land use and drainage practices within the catchment.*
5. *Establish a robust monitoring and investigations programme that ensures the lake response to management is understood and management activities are adapted accordingly.*

All of the above aims are entirely consistent with implementation of the tools and solutions being recommended for the Ararira catchment. The Whakaora te Waihora strategic summary notes the importance of collaboration with other stakeholders in the catchment, including the Living Water programme.

Mahaanui Iwi Management Plan 2013

The Mahaanui Iwi Management Plan 2013³³ is a mana whenua planning document that provides a policy framework for the protection and enhancement of Ngāi Tahu values, and for achieving outcomes that provide for the relationship of Ngāi Tahu with natural resources across Ngā Pākihi Whakatekateka o Waitaha and Te Pātaka o Rākaihautū (the area bounded by the Hurunui and Hakatere/Ashburton Rivers).

Drain management is identified as an issue in the Plan. Issue WM14 notes:

Drain management can have effects on Ngāi Tahu values, particularly mahinga kai.

Key policies relating to this issue are:

- To require that drains are managed as natural waterways and are subject to the same policies, objectives, rules and methods that protect Ngāi Tahu values associated with freshwater (WM14.1), and
- To require and uphold agreements with local authorities to ensure that the timing and techniques of drain management are designed to avoid adverse effects on mahinga kai and water quality (WM14.2).

Actions that are listed to give effect to these policies include a number of items that are highly consistent with the vision of the Ararira CMP and other relevant plans/strategies, including:

Inclusion of drains within catchment management plans and farm management plans. This is consistent with the 'drains to streams' vision of the CMP, and the Freshwater Farm Plan process (see Section 7).

Other actions are listed that are entirely consistent with the specific interventions that are proposed in the CMP, for example:

³¹ <https://tewaihora.org/assets/PDFs/2019-June-Te-Waihora-Co-Governance-Agreement.pdf>

³² https://tewaihora.org/wp-content/uploads/2019/11/Whakaora-Te-Waihora-Strategic-Summary_end-of-Phase-One-30-June-2017-version.pdf

³³ <https://mahaanuikurataiao.co.nz/wp-content/uploads/2019/08/Full-Plan.pdf>

- *Riparian margins are protected and planted.*
- *Riparian planting along drains to provide habitat and shade for mahinga kai and bank stability while reducing the frequency and costs of maintenance by reducing aquatic plant growth.*

Actions specifically relating to drain maintenance (for example: *Ensuring drain management/cleaning does not breach the confining layers; Use of low impact cleaning methods such as mechanical ‘finger buckets’, as opposed to chemical methods such as spraying, to minimise effects on aquatic life*) will be addressed through the transition to a maintenance regime that requires less mechanical clearing and spraying.

Other relevant sections of the Plan include:

- **Soil Conservation:** Issue P9 recognises that the mauri of soil resources of the takiwā can be compromised by inappropriate land use and development. Policy 9.4 includes methods/actions that are consistent with both the waterway interventions and on-farm practice changes included in the CMP, for example retiring sensitive areas, farm management that avoids overgrazing, and the restoration enhancement of riparian areas to reduce sediment inputs.
- **Stormwater:** Issue P6 notes that urban, commercial, industrial and rural environments can have effects on water quality. Policies related to this issue include

supporting integrated catchment management planning as a tool to manage stormwater and the effects of land use; and opposing the use of existing natural waterways, wetlands and drains for the treatment of stormwater in both urban and rural environments. This is consistent with the approach taken in the CMP, where the various interventions proposed will contribute to the removal of contaminants from runoff prior to it entering the waterway network.

- **Cultural health of lowland waterways and groundwater:** Issue TW7 notes that the cultural health of lowland waterways in the Te Waihora catchment is degraded as a result of factors including diffuse and point source pollution from intensive rural land use, sewage and stormwater disposal from urban and subdivision activities, and inappropriate drain and waterway management. Policy TW7.1 requires that the restoration of water quality in lowland streams is addressed as a matter of priority in the takiwā, to enable Ngāi Tahu and the wider community to fish, swim and engage with waterways as they once did. This is consistent with the vision of the Ararira Catchment Plan project.

Regional Plans & Strategies

Canterbury Water Management Strategy

The Canterbury Water Management Strategy (CWMS)³⁴ is the high-level framework that ECan and collaborators (Ngāi Tahu, territorial authorities, landholders, industry groups, statutory bodies, NGOs and other agencies) use to manage the multiple demand on Canterbury’s water resources. The vision of the CWMS is:

To gain the greatest cultural, economic, environmental, recreational and social benefits from our water resources within a sustainable framework both now and for future generations.

The CWMS includes targets in 10 broad areas, with goals at various time frames out to 2040 for each target area³⁵. The most relevant target area for the Ararira project is Ecosystem Health/Biodiversity. A number of goals in this target area are directly relevant to the Ararira Catchment Plan: implementing the plan will contribute to achieving these goals. Relevant goals are summarised in Table C1.

Other relevant CWMS targets include:

- **Recreational and amenity opportunities:** This has links to water quality and fish habitat improvements. Implementation of a number of the interventions in the CMP would enhance recreational and amenity values (this is one of the key values for the project), and there

³⁴ www.ecan.govt.nz/your-region/plans-strategies-and-bylaws/canterbury-water-management-strategy

³⁵ www.ecan.govt.nz/document/download?uri=3732128

TABLE C1:
CWMS goals from the Ecosystem Health/Biodiversity target that are relevant to the Ararira catchment.

Ecosystem Type	Goal		
	2025	2030	2040
Wetlands	All existing 2020 wetlands are physically protected through active management.	All prioritised wetlands are under active management where required and are in the process of being restored to a self-sustaining system.	Protected all wetlands.
Hāpua, lagoons & estuaries	All coastal lagoons, hāpua and estuaries show improvement in key ecosystem health indicators compared to 2010.		Examples of thriving coastal lagoons, and lowland or spring-fed ecosystems in each water management zone.
Lowland streams & lakes	Increase in extent of riparian management to protect aquatic ecosystems along prioritised waterways from 2020 figures. 70% of lowland and spring-fed streams with at least good aquatic ecosystem health or showing an upward trend.	Increase in extent of riparian management to protect aquatic ecosystems along prioritised waterways from 2020 figures. 80% of lowland and spring-fed streams with at least good aquatic ecosystem health or showing an upward trend.	100% of lowland and spring-fed streams with at least good aquatic ecosystem health or showing an upward trend.

are opportunities for recreational values to be incorporated into the design of specific projects.

- **Indicators of Regional and National economies:** This target is relevant due to the aim of maintaining a prosperous land-based economy while maintaining the mauri of the catchment. CWMS goals related to this target include:
 - *Develop a way of assessing costs and benefits using a capitals approach that recognises externalities and opportunity costs*
 - *Develop options (including a preferred option) for funding the reinvestment in natural capital, including addressing legacy issues and future opportunity costs.*
 - *Measures in place to assess the economic wealth benefits of freshwater biodiversity (and other ecosystem services) and recreational use of water.*

Canterbury Regional Council Long Term Plan

Although ECan don’t have responsibility for the Ararira drainage network, the 2021–2031 ECan Long Term Plan³⁶ describes a transition to more of a ‘whole of river’ approach rather than the traditional approaches to flood protection and land drainage. This is driven by the Essential Freshwater package.

Canterbury Land & Water Regional Plan

The Canterbury Land and Water Regional Plan³⁷ (LWRP) contains rules that relate to the operation and maintenance of drainage systems, artificial watercourses and associated structures.

Rules 5.75–5.80 in the LWRP set out conditions under which:

- Water may be discharged from drainage systems into rivers, lakes or wetlands as a permitted activity

³⁶ www.ecan.govt.nz/document/download?uri=3983969

³⁷ www.ecan.govt.nz/document/download?uri=3552692

- Contaminants and water resulting from the maintenance of drainage systems may be discharged to water or land.

If these conditions are not met the discharge is a discretionary activity.

Rule 5.138 sets out conditions under which the installation and maintenance of defences against water may be completed as a permitted activity. A key condition is that the work is completed according to the *Canterbury Regional Council Code of Practice for Defences Against Water and Drainage Schemes*.³⁸ This rule does not specifically cover drainage schemes, but it is possible that some of the interventions in the CMP meet the definition of defences against water (see below), which may streamline consenting.

Plan Change 1 of the LWRP is relevant: the lower part of catchment is part of the Cultural Landscape Values Management Area, and farms greater than 10 hectares within this area require a FEP and land use consent to farm.

Code of Practice for Defences Against Water & Drainage Schemes

The Code of Practice (CoP) defines defences against water as:

“Any structure or equipment, including any bund, weir, spillway, floodgate, bank, stopbank, retaining wall, rock or erosion protection structure, groyne, vegetation (including anchored tree protection) or reservoir, that is designed to have the effect of stopping, diverting, controlling, restricting or otherwise regulating the flow, energy or spread of water, including floodwaters, in or out of a water body, artificial watercourse, or artificial lake. For the purpose of this definition, dams are excluded.”

The CoP (Section 1.6) notes that works to maintain drainage schemes are not included in Rule 5.138 (and as such are not permitted activities under that rule, although they may be permitted under Rules 5.75–5.80) but these activities are included in the CoP for operational purposes.

Section 3 of the CoP sets out requirements for different types of work that are relevant to both the existing operation and maintenance of the drainage network, and works that are likely to be required to implement the interventions in the CMP, including:

- drain works:
 - aquatic weed cutting
 - chemical control of weeds
 - mechanical weed clearance
 - silt removal
 - drain bank maintenance and re-battering

- channel realignment
- enhancement planting
- maintenance or enhancement of wetlands and habitat.

District Plans & Strategies

SDC Proposed District Plan

The SDC Proposed District Plan³⁹ is the framework that will guide sustainable development, including rezoning of land, within the District.

The Ararira and tributaries that feed Te Waihora are listed in the Plan as Sites of Significance to Māori

A private plan change (PC69) seeks to rezone approximately 190 ha of rural land within the Ararira catchment, creating 2,000 residential lots and a small commercial area. Large developments such as this should have regard to the CMP, for example:

- Protecting springheads.
- Retaining space for two-stage channels and planting if there are drain channels within the development area.

SDC Long Term Plan

The SDC long term plan (LTP)⁴⁰ sets out the following in relation to land drainage:

³⁸ www.ecan.govt.nz/document/download?uri=3598965

³⁹ <https://eplan.selwyn.govt.nz/eplan>

⁴⁰ www.selwyn.govt.nz/your-council/plans-And-reports/long-term-plan

- Identifies the drainage network as a strategic asset.
- Sets out the basis for charging targeted rates to fund the land drainage network, and the funding sources (and proportions of these sources) for operations and capital works.
- Describes the Council’s approach to 5 Waters, and who benefits from land drainage, including acknowledging that there are broader public benefits that justify some funding from general rates.
- Sets out criteria for taking land for stormwater management in lieu of cash for development contributions.
- Notes the increasing focus on the environmental performance of the land drainage network, and the formation of the district land drainage committee, Te Komiti Waiora (see Section 6.1 and Sections 8.2–3).
- Describes community outcomes and wellbeings related to the land drainage network (see also Table C2).

SDC 5 Waters Activity Management Plan

The 5 Waters Activity Management Plan (AcMP) documents how land drainage (along with drinking water, water races, wastewater and stormwater) contributes to community outcomes and well-beings, and sets the service targets for the drainage network.

The outcomes relevant to the current and future operation of the drainage network are summarised in Table C2.

Implementation of the Catchment Plan will be consistent with the outcomes identified in Table C2. In future versions of the AcMP, SDC may wish to refer to enhancing environmental and cultural values, rather than just minimising averse impacts/effects.

Potential negative effects identified in the AcMP that are relevant to the drainage network are summarised in Table C3.

In general, implementation of the CMP will be consistent with the responses identified

TABLE C2:
Relevant contributions to Community Outcomes, from the 5 Waters Activity Management Plan

Key Community Outcome	Community Outcomes	How 5 Waters Services Contribute
A clean environment	Air, land, water and general environment to be kept in a healthy condition.	Manage the 5 Waters activities in a way that minimises their potential adverse impact on the environment.
A district with a rural identity	A living environment where the rural identity of Selwyn is maintained	Provide water races and land drainage systems that are part of the rural landscape and contribute to the rural theme of Selwyn/ 5Waters services (community and private) are vital for the well-being of rural communities.
A safe place in which to live, work and play	We are safe at home and in the community.	Provide safe drinking water and effective wastewater removal and disposal as well as removal of stormwater and excess groundwater (via land drainage).
	We maintain a coordinated and effective response to, and recover from, emergency and disaster events.	Respond to emergency events by providing safe drinking water and effective wastewater removal and disposal as well as removal of stormwater and excess groundwater (via land drainage).
A prosperous community	Selwyn has a strong economy which fits within and complements the environmental, social and cultural environment of the district.	Effective water races and land drainage systems are essential for productive use of land.
A community which values its culture and heritage	Our district provides a range of arts and cultural experiences and facilities. Local history and heritage is preserved, shared and promoted	Provide water, wastewater and drainage services for cultural activities. All 5Waters activities can impact on the cultural and heritage values and need to be managed to minimise adverse effects.

by SDC in Table C3. Financial pathways that are considered for funding implementation in relation to public infrastructure will need to ensure that capital costs are apportioned equitably over time (however, this should not be viewed as a reason to put off implementation).

Adverse environmental effects as a result of implementation are likely to be limited to temporary, short-term effects during construction. Potential cultural effects on specific sites should be considered in detailed design of larger-scale tools such as constructed wetlands and large-scale sediment traps.

Some of the key assumptions noted in the AcMP which are based on ‘business as usual’ may need to be re-visited to account for implementation of the CMP. These include assumptions relating to Levels of Service and service delivery. Suggested modifications to SDC’s levels of service area included in Section 10.2.

TABLE C3:
Potential negative outcomes on wellbeing, from the 5 Waters Activity Management Plan.

Well-being	Possible/negative effect	The Council's response is to
Social	Floodwaters may also carry contaminants hazardous to health.	Manage stormwater to minimise flooding.
Economic	Failure to levy charges at the appropriate time may result in an excessive burden for future generations.	Consider ‘whole of life’ costs and apportion capital costs equitably over time. Ensure that charges are realistic and do not result in accumulated costs later.
	Ineffective land drainage may damage crops or result in loss of productivity.	Manage system to minimise flooding.
Environmental	The activity has the potential to lower air quality, water quality and quantity and the health of soil and biodiversity.	Avoid, remedy and mitigate adverse effects and strictly adhere to Resource Consent conditions by monitoring before and after works and installations. Take corrective action if problems arise.
Cultural	The activity’s services have the potential to cause damage to heritage sites, artefacts, other structures, landscape features and waterways.	Assess the impact on cultural well-being as a normal part of the decision-making process. Site and locate structures and services sensitively in the landscape and manage them responsibly.
	The pollution of groundwater and surface water is an important cultural issue.	Consult with Tangata Whenua and with the Historic Places Trust early on to avoid disturbances and destruction of important items and features.

Appendix D: Environment Canterbury Land & Water Regional Plan & Selwyn District Plan Rules Potentially Relevant to Interventions in the Ararira Catchment

Use of land to excavate material (not including in the riparian zone).	
Relevant Rules: LWRP 5.175–5.176, Selwyn District Plan Rural Volume 1.4.1, 1.7.1	
Permitted Activity Conditions	<ul style="list-style-type: none"> Excavation within 50 metres of a waterbody must be less than 100 m³. Under the Selwyn District Plan, earthworks must not raise the mean average level of the land or reduce the storage capacity of surface water ponding areas. Under the Selwyn District Plan, earthworks are permitted provided they are set back 20 metres from the edge of any water body, stockpiles within 100 metres of a dwelling are kept moist and consolidated, and the site is filled, recontoured, and replanted to the same state as the surrounding land.
Alternative Classifications	<p>If the activity does not meet the permitted activity rules, it is a restricted discretionary activity, with discretion limited to the actual and potential adverse environmental effects on water quality in lakes, rivers, artificial watercourses, or wetlands.</p> <p>If the activity does not meet the Selwyn District Plan permitted activity rule, it is a restricted discretionary activity, with discretion limited to:</p> <ul style="list-style-type: none"> the potential effects of earthworks on creating or exacerbating flooding on the site or on other properties any positive effects which may offset adverse effects dust nuisance, mitigation and monitoring requirements.
Tools Affected	<ul style="list-style-type: none"> Large-scale two-stage channel Large-scale wetlands Large-scale sediment traps Small-scale wetlands

Use of land for vegetation clearance outside the bed of a river but within 5 metres of a river and any associated discharge of sediment or sediment-laden water.	
Relevant Rules: LWRP, 5.167–5.169, Selwyn District Plan Rural Volume 1.7.1	
Permitted Activity Conditions	<ul style="list-style-type: none"> Earthworks within the riparian margin must cover less than 500 m² or 10% of the area, whichever is lesser, at any time. The concentration of total suspended solids in the discharge may not exceed 50 g/m³ where the discharge is to a spring-fed river, except if the existing concentration is greater than 50 g/m³ in which case Schedule 7 visual clarity standards apply. The concentration of total suspended solids in the discharge may not exceed 100 g/m³ where the discharge is to any other river or watercourse, except if the existing concentration is greater than 100 g/m³ in which case Schedule 5 visual clarity standards apply. Site stabilisation is required upon completion of works. The activity must not be adjacent to an inanga spawning habitat during 1 January–1 June. Selwyn District Plan requires that earthworks within 5 metres of a water body are limited to 100 m² and 40 m³ per 1,000 metres in any 5 year period. The Plan permits any earthworks which has been granted resource consent by the Canterbury Regional Council.
Alternative Classifications	<p>If the activity does not meet the permitted activity rules, it is a restricted discretionary activity. Discretion is limited to:</p> <ul style="list-style-type: none"> the actual and potential adverse environmental effects on water quality in lakes, rivers, artificial watercourses, or wetlands the actual and potential adverse environmental effects on soil quality or slope stability the actual and potential adverse environmental effects on the banks or bed of a waterbody or on its flood carrying capacity.
Tools Affected	<ul style="list-style-type: none"> Small-scale two-stage channel Large-scale two-stage channel Small-scale wetlands Large-scale wetlands Large-scale sediment traps Small-scale in-line sediment traps Riparian planting for main stem habitat

<p>The installation, maintenance, use, and removal of defences against water including deposition of substances, on or in the bed of a river and excavations, associated diversions, and discharges of sediment.</p>	
<p>Relevant Rules: LWRP 5.138, 5.141B</p>	
Permitted Activity Conditions	<ul style="list-style-type: none"> The works must not prevent any existing fish passage. The work is on behalf of a local authority or network utility operator using a CRC-certified plan which is in accordance with the CRC Code of Practice for Defences Against Water and Drainage Schemes. The work must not be near any inanga spawning habitat during 1 March–1 June.
Alternative Classifications	<p>If the activity is not classified by the Plan, it is a discretionary activity.</p>
Tools Affected	<ul style="list-style-type: none"> Small-scale two-stage channel Large-scale two-stage channel Small-scale wetlands Large-scale wetlands Large-scale sediment traps Small-scale in-line sediment traps Small-scale event-based sediment traps

<p>Installation of culverts and consequential deposition of substances on or in the bed of a river, excavation and other disturbance of the river bed, and associated take, discharge, or diversion of water.</p>	
<p>Relevant Rules: LWRP 5.137, 5.141A</p>	
Permitted Activity Conditions	<ul style="list-style-type: none"> Works must not be done in flowing water. Must have capacity for a 5% AEP flood event without increasing upstream water levels. Must not be near any inanga spawning habitat during 1 March–1 June. Must maintain fish passage. Must be 10 metres from any dam, weir, bridge, network utility pole, pylon, or flood protection vegetation, 150 metres from any water level recorder, and 50 metres from any defence against water. Must be less than 25 metres in length.
Alternative Classifications	<p>If the activity does not comply with the permitted activity rules, it is a discretionary activity.</p>
Tools Affected	<ul style="list-style-type: none"> Small-scale inline sediment traps

<p>Introduction or planting of any plant, or the removal and disturbance of existing vegetation in or on the river bed, and any associated discharge of sediment or sediment-laden water.</p>	
<p>Relevant Rules: LWRP 5.163–5.166</p>	
Permitted Activity Conditions	<ul style="list-style-type: none"> Vegetation clearance must not occur in inanga spawning habitat during 1 January–1 June The concentration of total suspended solids in the discharge may not exceed 50 g/m³ where the discharge is to a spring-fed river, except if the existing concentration is greater than 50 g/m³ in which case Schedule 7 visual clarity standards apply. The concentration of total suspended solids in the discharge may not exceed 100 g/m³ where the discharge is to any other river or watercourse, except if the existing concentration is greater than 100 g/m³ in which case Schedule 5 visual clarity standards apply. Planted species must not be on the NZ Register of Unwanted Organisms or Canterbury Pest Management Strategy. No vegetation used for flood control or bank stabilisation may be disturbed without permission of the responsible agency.
Alternative Classifications	<p>The activity is a restricted discretionary activity if it does not comply with the permitted activity conditions (excluding the conditions referenced below). Discretion will be limited to the actual and potential adverse environmental effects of not meeting the conditions.</p> <p>If the activity disturbs vegetation used for flood control or bank stabilisation without permission of the responsible agency, it is a non-complying activity.</p> <p>If the planted species are on the NZ Register of Unwanted Organisms or Canterbury Pest Management Strategy, it is a prohibited activity.</p>
Tools Affected	<ul style="list-style-type: none"> Small-scale two-stage channel Large-scale two-stage channel Small-scale wetlands Large-scale wetlands Springhead protection Riparian planting for main stem habitat

Creating a wetland, including associated taking, use, damming or diversion of water, and discharge of excess or overflow water to surface water.	
Relevant Rules: LWRP 5.159-5.160	
Permitted Activity Conditions	<ul style="list-style-type: none"> The taking, use, damming or diversion of water is at a maximum rate of 5 L/s and 100 m³ per day. The taking of water is non-consumptive, is discharged back into the same waterbody and complies with any limits in Section 11 of the LWRP. The taking of water does not prevent water being taken by any domestic or stock water supply.
Alternative Classifications	If the activity does not comply with the permitted activity rules, it is a discretionary activity.
Tools Affected	<ul style="list-style-type: none"> Large-scale wetland Small-scale wetland

Damming water outside the bed of a river and the constructing, using, altering, maintaining and operating of the dam structures	
Relevant Rules: LWRP 5.154-5.156	
Permitted Activity Conditions	<ul style="list-style-type: none"> The volume of water impounded must less than 20,000 m³, or the maximum depth of water impounded above ground level must be less than 4 metres. If the volume of water impounded is greater than 1,000 m³, the design and construction of the dam must be certified by a Recognised Engineer. The land must not be contaminated or potentially contaminated.
Alternative Classifications	<p>If the activity does not meet the permitted activity rules, it is a discretionary activity provided:</p> <ul style="list-style-type: none"> the dam must not result in downstream river flows less than any minimum flow limit set in Sections 6-15 or, where applicable, the default rules on minimum flow limits in Rule 5.123(2); and the dam must not prevent water being taken by any domestic or stock water supply, or reduce the reliability of supply of any existing legally authorised water take. <p>If these requirements are not met, the activity is non-complying.</p>
Tools Affected	<ul style="list-style-type: none"> Large-scale wetland Large-scale sediment traps

Damming water in the bed of a river and the constructing, using, altering, maintaining and operating of the dam structures.	
Relevant Rules: LWRP 5.154-5.156	
Permitted Activity Conditions	<ul style="list-style-type: none"> The volume of water impounded is less than 5,000 m³ and the maximum depth of water less than 3 metres. The dam must not impound the full flow of the river. Fish passage must not be impeded. The damming of water must not cause the flow to fail to meet any limits in Sections 11 of the LWRP or fall below the minimum flow for the surface waterbody if the waterbody is subject to a minimum flow as set out in Section 11 of the LWRP. Must not prevent water being taken by any domestic or stock water supply, or reduce the reliability of supply of any existing legally authorised water take.
Alternative Classifications	<p>If the activity does not meet the permitted activity rules, it is a discretionary activity provided:</p> <ul style="list-style-type: none"> the dam must not result in downstream river flows less than any minimum flow limit set in Sections 6-15 or, where applicable, the default rules on minimum flow limits in Rule 5.123(2); and the dam must not prevent water being taken by any domestic or stock water supply, or reduce the reliability of supply of any existing legally authorised water take. <p>If these requirements are not met, the activity is non-complying.</p>
Tools Affected	<ul style="list-style-type: none"> Large-scale wetland Large-scale sediment traps

Temporary diversions associated with undertaking earthworks, culvert construction, or damming activities in and around the riverbed.		Minor discharge of contaminants to land in circumstances where it may enter surface water, e.g., herbicides associated with maintaining planting/wetland		Disturbance of the bed and banks of a river to remove fine sediment (<2 mm) for the sole purpose of habitat restoration, and the consequential damming, take, use and discharge of water in circumstances where contaminants may enter water.	
Relevant Rules: LWRP 5.140, 5.141A, 5.141B		Relevant Rules: LWRP 5.99-5.100		Relevant Rules: LWRP 5.146A-B	
Permitted Activity Conditions	<ul style="list-style-type: none"> • Must not be undertaken in inanga spawning habitat during 1 March–1 June. • The temporary diversion must not be in place for more than 4 weeks in any 12 month period. 	Permitted Activity Conditions	<ul style="list-style-type: none"> • Must meet the water quality standards in LWRP Schedule 5 after mixing with the receiving waters. • Total suspended solids concentration must not exceed 100 g/m³. • Must not be from contaminated or potentially contaminated land. 	Permitted Activity Conditions	No permitted activity rules exist for this activity.
Alternative Classifications	If the activity does not comply with the permitted activity rules, it is a discretionary activity.	Alternative Classifications	If the activity does not comply with the permitted activity rules, it is a discretionary activity.	Alternative Classifications	<p>The activity is a restricted discretionary activity provided:</p> <ul style="list-style-type: none"> • there is management plan describing the location, timing, and method of sediment removal, and material management and disposal. The plan must also contain the location of any sensitive ecological habitats and species within 250 metres downstream, and an assessment of the environmental effects of the activity, including how adverse effects will be avoided or mitigated. • damming of the waterbody will not occur for more than 12 hours at any location • the activity is more than 50 metres from any surface water intake. <p>Discretion is limited to:</p> <ul style="list-style-type: none"> • the content of the management plan and proposed methods • the location, method, and timing of sediment removal with respect to ecological considerations • the potential adverse effects on downstream water quality, flows, drinking water supplies, bank stability, surface water takes, freshwater bathing sites, mahinga kai, wāhi tapu, wāhi taonga, and habitats. <p>If the activity does not meet the restricted discretionary activity requirements, it is a discretionary activity.</p>
Tools Affected	<ul style="list-style-type: none"> • Small-scale two-stage channel in permanently flowing areas • Large-scale two-stage channel • Small-scale wetlands • Large-scale wetlands • Small-scale inline sediment traps 	Tools Affected	<ul style="list-style-type: none"> • Planted small-scale two-stage channel • Large-scale two-stage channel • Small-scale wetlands • Large-scale wetlands • Riparian planting for mainstem habitat • Protecting springheads 	Tools Affected	<ul style="list-style-type: none"> • Small-scale sediment trap • Large-scale sediment trap

Discharge of construction phase stormwater to a surface water body or onto land where a contaminant may enter groundwater or surface water.	
Relevant Rules: LWRP 5.94A-B	
Permitted Activity Conditions	<ul style="list-style-type: none"> The area of disturbed land must be less than 1,000 m². The concentration of total suspended solids in the discharge may not exceed 50 g/m³ where the discharge is to a spring-fed river, except if the existing concentration is greater than 50 g/m³ in which case Schedule 7 visual clarity standards apply. The concentration of total suspended solids in the discharge may not exceed 100 g/m³ where the discharge is to any other river or watercourse, except if the existing concentration is greater than 100 g/m³ in which case Schedule 5 visual clarity standards apply. The discharge must not increase the flow in the waterbody by more than 1% of a flood event with an AEP of 20%. The discharge must not be from or into contaminated or potentially contaminated land, or contain any hazardous substances. The discharge must not be within a Community Drinking-water Protection Zone.
Alternative Classifications	<p>The activity is a restricted discretionary activity if it does not meet the permitted activity conditions. Discretion is limited to:</p> <ul style="list-style-type: none"> the actual and potential effects of the discharge on the quality of surface water, aquatic ecosystems, Ngāi Tahu cultural values the actual and potential effects of the discharge on the quality and safety of human and animal drinking water; and Canterbury Land and Water Regional Plan Page the actual and potential adverse environmental effects of the quantity of water to be discharged on the banks or bed of a waterbody or on its flood carrying capacity, and on the capacity of the network to convey that discharge. <p>The potential benefits of the activity to the applicant, the community and the environment.</p>
Tools Affected	<ul style="list-style-type: none"> Small-scale wetland Large-scale wetland Small-scale two-stage channel Large-scale two-stage channel Small-scale event-based sediment traps Small-scale inline sediment traps Large-scale sediment traps

Non-consumptive taking and using water from a river or artificial watercourse and discharge of the same water to the same river or watercourse	
Relevant Rules: LWRP 5.126-5.127	
Permitted Activity Conditions	No permitted activity rules exist for this activity.
Alternative Classifications	<p>The activity is a restricted discretionary activity provided that:</p> <ul style="list-style-type: none"> the water take and discharge does not exceed any limit or flow and allocation regime se3t out for the water body the distance from the point of take to point of discharge is less than 250 metres. <p>Discretion is limited to:</p> <ul style="list-style-type: none"> the rate, volume, and timing of the take, and associated reductions in times of low flow measures to ensure limits are not affected the effects on other authorised takes whether and how fish are prevented from entering the intake and discharge the actual and potential adverse environmental impacts on habitat, ecosystems, water quality, and other values. <p>If the activity does not meet the restricted discretionary activity conditions it is a non-complying activity.</p>
Tools Affected	<ul style="list-style-type: none"> Small-scale wetland Large-scale wetland Large-scale sediment trap

Non-consumptive taking and using of groundwater and associated discharge to groundwater (associated with technical possibility that contaminants may enter groundwater as part of wetland function).	
Relevant Rules: LWRP 5.38-5.40	
Permitted Activity Conditions	<ul style="list-style-type: none"> The volume of the stockpile must be less than 20 m³ and no draining liquid may enter a surface water body. If the stockpile is greater than 20 m³, the stockpile must not be sited within 50 metres of a surface water body, a bore, or the property boundary.
Alternative Classifications	If the activity does not comply with the permitted activity rules, it is a discretionary activity.
Tools Affected	<ul style="list-style-type: none"> Large-scale wetland

Use of land for stockpiling decaying organic matter and any associated discharge.	
Relevant Rules: LWRP 5.38-5.40	
Permitted Activity Conditions	<ul style="list-style-type: none"> The volume of the stockpile must be less than 20 m³ and no draining liquid may enter a surface water body. If the stockpile is greater than 20 m³, the stockpile must not be sited within 50 metres of a surface water body, a bore, or the property boundary.
Alternative Classifications	<p>If the activity does not comply with the permitted activity rules, it is a restricted discretionary activity, provided that the stockpile is the subject of a FEP.</p> <p>Discretion is limited to:</p> <ul style="list-style-type: none"> the actual or potential environmental effects of not meeting the permitted activity conditions. <p>The quality of, compliance with, and auditing of the FEP.</p>
Tools Affected	<ul style="list-style-type: none"> Small-scale wetland Large-scale wetland Small-scale two-stage channel Large-scale two-stage channel Small-scale event-based sediment traps Small-scale inline sediment traps Large-scale sediment traps

Discharge of a dust suppressant onto or into land in circumstances where it may enter water.	
Relevant Rules: LWRP 5.18-5.19	
Permitted Activity Conditions	<ul style="list-style-type: none"> The discharge must be only of vegetable oil, new light fuel, or lubricating oil, and applied at a rate of less than 2 litres/m²/day and 4 litres/m²/year in a way that does not result in pooling or runoff. The discharge must be more than 20 metres from surface water bodies, bores, and soakholes. The dust suppressant used must be approved under the Hazardous Substances and New Organisms Act 1996 and use and discharged in accordance with the approval conditions.
Alternative Classifications	If the activity does not comply with the permitted activity rules, it is a restricted discretionary activity. Discretion is limited to the actual and potential environmental effects of not meeting the permitted activity conditions.
Tools Affected	

Discharge of dust to air beyond the property boundary from land development and unconsolidated materials.	
Relevant Rules: CARP 7.32-7.34	
Permitted Activity Conditions	<ul style="list-style-type: none"> • The area of unsealed surfaces or unconsolidated land must be less than 1,000 m², or a dust management is prepared in accordance with Schedule 2 for larger areas. • The discharge does not cause an offensive or objectionable effect beyond the boundary of the property of origin.
Alternative Classifications	<p>The activity is a restricted discretionary activity if it does not comply with the permitted activity conditions (excluding the conditions referenced below). Discretion will be limited to:</p> <ul style="list-style-type: none"> • the content of the management plan • the frequency, intensity, duration, location, and offensiveness of the discharge • any environmental effects of not meeting the permitted activity conditions • mitigation methods available • the matters set out in Rule 7.2. <p>If the discharge causes an offensive effect beyond the property of origin, it is a non-complying activity.</p>
Tools Affected	<ul style="list-style-type: none"> • Small-scale wetland • Large-scale wetland • Small-scale two-stage channel • Large-scale two-stage channel • Small-scale event-based sediment traps • Small-scale inline sediment traps • Large-scale sediment traps

Appendix E: Indicative Cost Estimates

Indicative capital costs for the interventions identified in the Ararira CMP are summarised in Table E1. These estimates are concept level ($\pm 30\%$), and may not fully account for all site-specific costs or cost escalation beyond 2022. The estimates include contingencies and a percentage for site establishment.

TABLE E1:

Indicative unit cost estimates: concept-level 2022 values.

Intervention	Estimated Cost	Unit
Small-scale two-stage channel/bank reshaping with riparian planting for low cover/heavy shade ^A :		
• 1 m deep channel profile	\$10,500–\$13,800	per 100 metres
• 1.5 m deep channel profile	\$12,300–\$19,800	per 100 metres
• 2 m deep channel profile	\$16,500–\$31,300	per 100 metres
• 3 m deep channel profile	\$30,200–\$59,300	per 100 metres
Small-scale two-stage channel/bank reshaping with grass only ^B	\$3,200	per 100 metres
Large-scale two-stage channel with riparian planting for low cover	Site-specific ^C	
Large-scale wetlands	Site-specific	
Small-scale wetlands	Site-specific	
Large-scale sediment traps	Site-specific	
Small-scale inline sediment traps ^D	\$121,000	per structure
Small-scale event-based sediment traps ^E	\$2,700	per structure
Riparian planting for mainstem habitat ^F	\$49	per metre of waterway
Protecting springheads ^G	\$6,900	per site
Fencing waterways where there is stock access	\$13	per metre of fence (i.e., single side of waterway)
Instream habitat – small-scale two-stage channel with log vanes	\$14,000	per 100 metres
Instream habitat – larger-scale two-stage channel with log vanes	\$35,000	per 100 metres ^H
Instream habitat – cobble clusters	\$450	per site

Notes:

- A. Based on the average channel cross-section in areas identified suitable for constructing two-stage channels. The cost range encompasses a variety of construction options, with the lowest cost being a simple re-batter or half-channel, and the highest cost corresponding to moving the channel invert. Example channel profiles for the channel construction options considered are shown in Figure 10. A 5% site establishment cost has been included.
- B. Earthworks estimate by Living Water for previous two-stage ephemeral channel constructed in the catchment – www.livingwater.net.nz/catchment/ararira-lII-river/two-stage-channel-flood-management-and-reducing
- C. An estimate of \$175,000–\$260,000 per hectare for constructed wetlands is given in Constructed Wetland Practitioner Guide: Design and Performance Standards (NIWA and Dairy NZ, 2022) <https://niwa.co.nz/sites/niwa.co.nz/files/wetland%20practitioner%20Guide-web.pdf>
- D. Based on a 15 metre trap length with a pre-cast concrete section used to create hard edges, and the average channel cross-section at likely sediment trap locations. A 5% site establishment cost has been included.
- E. Based on the average channel cross-section at likely event-based sediment trap locations. Assumes work will be completed while the channel is dry. A 5% site establishment cost has been included.
- F. Includes site preparation, planting, plant guards, and fertiliser tablets for 6 rows of plants on both sides of the waterway.
- G. Assuming a fenced area of approximately 400 m² which is 75% planted.
- H. Based on as-built costs from the Waituna catchment, Southland, with an inflation adjustment applied. These values should be considered in conjunction with two-stage channels with planting.

For interventions where it is reasonable at this stage to estimate the total quantity, total cost estimates are shown in Table E2. The range of estimated costs for two-stage channels is due to a lack of data on channel depths. This range is additional to the ±30% costing uncertainty noted previously.

TABLE E2:

Indicative total costs (based on 2022 concept-level values), for items where a total quantity can be estimated. There are other interventions where the total cannot be reliably estimated at this stage as the total quantities are unknown, for example establishment of small on-farm wetlands and springhead protection. Large-scale wetlands and sediment traps are not included here as they require site-specific design and costing.

Intervention	Estimated Cost	Unit
Small-scale two-stage channel with planting on perennial drains	33,755 metres	\$5,060,000-\$8,440,000
Small-scale two-stage channel without planting on ephemeral/intermittent drains	35,785 metres	\$1,250,000-\$2,398,000
Small-scale inline sediment traps on all perennial drains entering the main stem. ^A	19 locations	\$2,229,000
Small-scale inline sediment traps on second-order perennial flowing drains	5 locations	\$605,000
Small-scale event-based sediment traps on all ephemeral/intermittent drains entering the permanently flowing drains	14 locations	\$37,800
Riparian planting for 75% of mainstem habitat (both sides), not including the headwaters and rivermouth	6,000 metres	\$221,000

Note:

A. There are other potential locations for sediment traps: the quantities used here are not exhaustive.

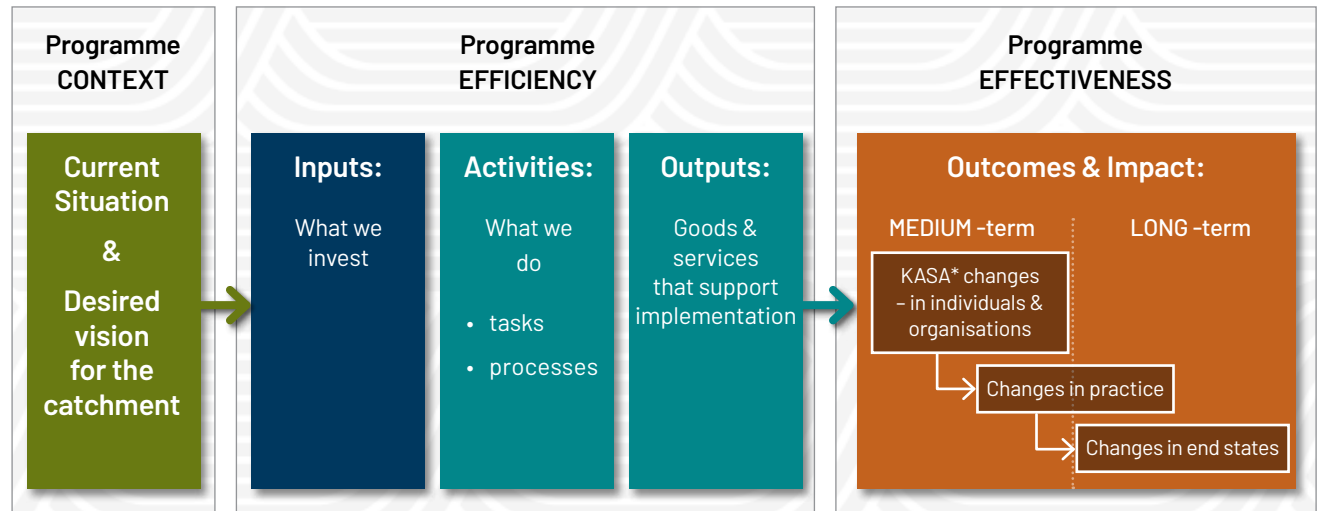
Appendix F: Theory of Change (ToC)

Developing a ToC can assist by supporting diverse stakeholders to work together and plan for outcomes by envisaging a ‘big picture’ view of how and why a desired change is expected to happen. This approach can provide a framework to easily set out, document and communicate complex goals, activity strategies and intended outcomes.

A ToC approach is outcomes-based, and helps those involved to clearly define long-term goals and then map backwards to identify the necessary pre-conditions (often social and institutional) that will be required for success. This requires catchment managers and stakeholders to work together to clearly define their catchment activities as a sequence of inputs, activities and outputs that lead to the desired outcomes.

Developing a ToC requires stakeholders to articulate the assumptions (or evidence) they are using to explain the change process they have mapped out. It encourages an adaptive management approach by inviting on-going questioning of what might influence change in the particular catchment context, and drawing on evidence and learning (via evaluation) during implementation.

Figure F1 summarises the key elements of a ToC for implementing change in a catchment.



* KASA = Knowledge, Attitudes, Skills & Aspirations

FIGURE F1: Key project elements (inputs, activities, outputs and outcomes) and other information needs for a ToC approach (modified from Learning for Sustainability).⁴¹

⁴¹ Linking planning with monitoring & evaluation – closing the loop. Learning for Sustainability resource page. Online at <https://learningforsustainability.net/plan-monitor-evaluate>

There are a number of key elements to be defined within a ToC approach: inputs, activities and outcomes.

- **Inputs** are the required resources including money, staff, equipment and infrastructure (usually measured as counts, such as hours of staff time or dollars spent).
- **Activities** are the interventions and actions that need to be undertaken to achieve specified outputs. This includes the physical changes to the drainage network, such as creation of two-stage channels with planting, and installation of sediment traps.
- **Outputs** are the tangible results.

Outcomes can be split into intermediate (short- and medium-term) and long-term outcomes:

- **Short term:** Changes in individuals and groups –
 - learning, including enhancements to knowledge
 - understanding
 - perceptions
 - attitudes and behaviours ('social' outcomes).
- **Medium term:** Changed skills and practices – changed behaviours to accomplish results, or capabilities. In the Ararira catchment context, this includes changes to the drainage network maintenance practices.
- **Long term:** Changed conditions or states – economic, social, biological or physical changes in a system.

Short-term outcomes may include initial changes that highlight stakeholder awareness, capacities and skills

that can support practice, and behavioural changes (for example, knowledge that is gained or retained, attitudes and aspirations that are changed, and skills acquired).

Medium-term outcomes describe the extent to which the practices and behaviours of stakeholder groups have changed, often accounting for the extent to which these changes have scaled up and out to reach the larger community of stakeholders.

Long-term outcomes include desired goals, such as increased catchment and waterway health, agricultural production, and community well-being, and can be assessed over multiple value areas including social, cultural, economic and environmental.

The main benefit of the ToC approach comes from making different views and assumptions about the change process explicit, especially seemingly obvious ones. A good ToC can specify how to create a range of conditions that help programmes deliver on the desired outcomes. These can include setting out:

- the right kinds of partnerships
- types of forums
- particular kinds of technical assistance
- and tools and processes that help people operate more collaboratively and be more results focused.

ToC as a process emphasises the importance of dialogue with stakeholders, acknowledging multiple viewpoints and recognition of power relations, as well as political, social and environmental realities in the context.

Underpinning Assumptions

Generally, intervention approaches include four types of assumptions:

- **Causal assumption:** Is how and why certain actions and activities will lead to the desired outcomes. It describes the causal links between inputs, activities, outputs, and outcomes.
- **Contextual assumptions:** These are assumptions about the broader social, political, economic, and cultural context in which change takes place. Laws, policies, cultural norms, or market conditions may influence the ToC's success or failure.
- **Implementation assumptions:** Describe the actions and activities necessary to achieve the desired results. Assumptions about resources, capabilities, and strategies for implementing the ToC are included.
- **Risk assumptions:** Describe the potential obstacles, uncertainties, and unintended consequences that may impact the success or failure of the ToC implementation process.

By identifying and testing these assumptions throughout the ToC process, organisations and individuals can ensure that their efforts are more focused, evidence-based, and effective in achieving the desired change.

For more information:

- **Developing a ToC:**
Annie E. Casey Foundation, 2022. Practical theory of change guidance, templates and examples.
Available at www.aecf.org/resources/theory-of-change
- **ToC online guidance:**
Learning for Sustainability Online at <https://learningforsustainability.net/theory-of-change>
- Allen, W., Cruz, J., & Warburton, B. 2017. How decision support systems can benefit from a theory of change approach. Environmental management, 59(6), 956–965. <https://learningforsustainability.net/wp-content/uploads/2017/03/dss-toc-paper.pdf>



Instream and riparian improvements have been implemented along with urban development in some areas.

Image source: EOS Ecology

