

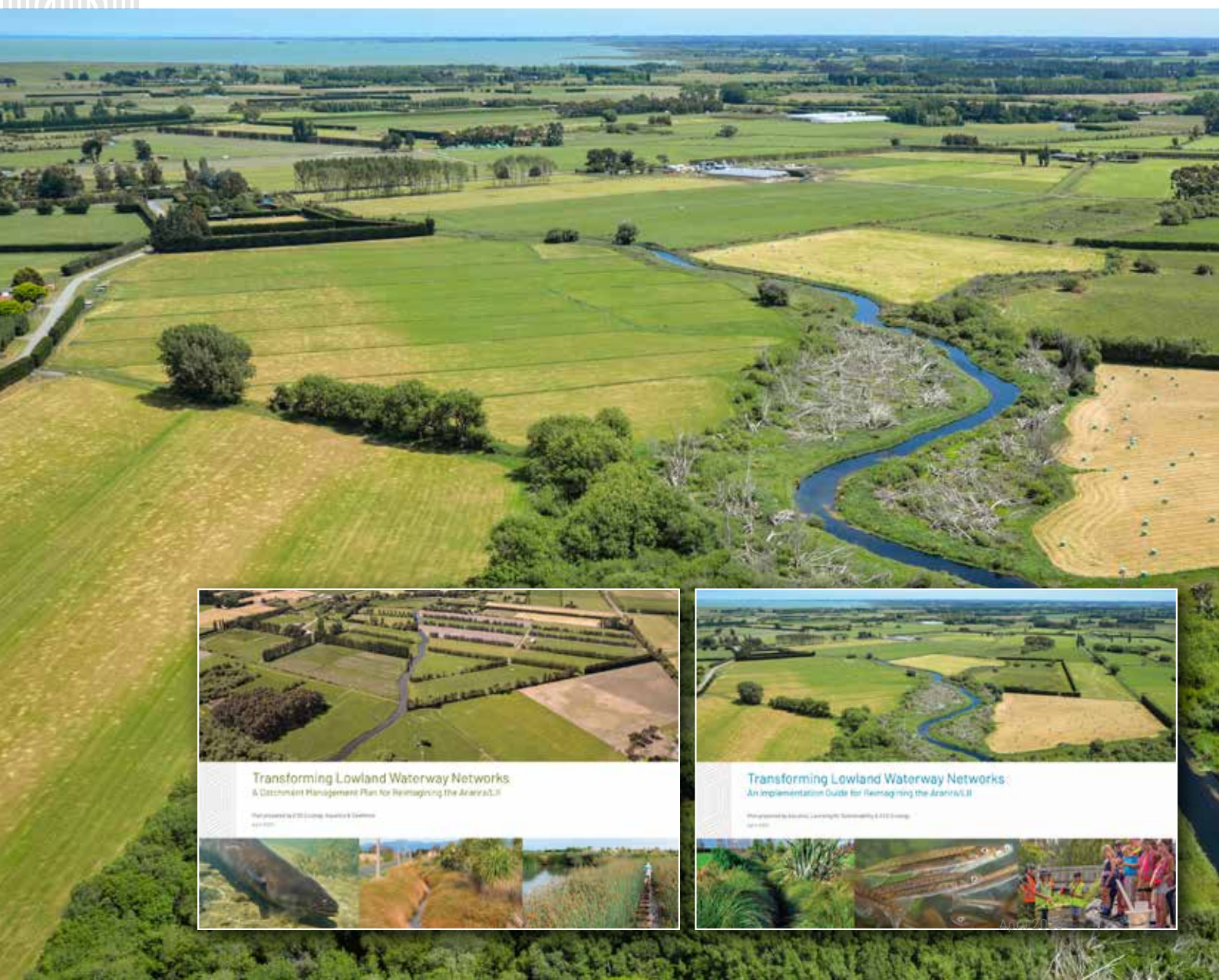


Transforming Lowland Waterway Networks

Summary of the Catchment Management Plan & Implementation Guide for Reimagining the Ararira/LII

Prepared by EOS Ecology, Aqualinc, Cawthron & Learning for Sustainability

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Introduction

Across New Zealand, artificial drainage networks are usually designed and managed for land drainage only. Yet these waterways are part of a wider network of waterways that discharge to sensitive receiving environments, and often provide the only remaining habitat for freshwater species in modified lowland areas. Standard maintenance practices to remove sediment and aquatic weeds also damage habitat of aquatic biota and contribute significant amounts of sediment and nutrients to receiving water bodies.

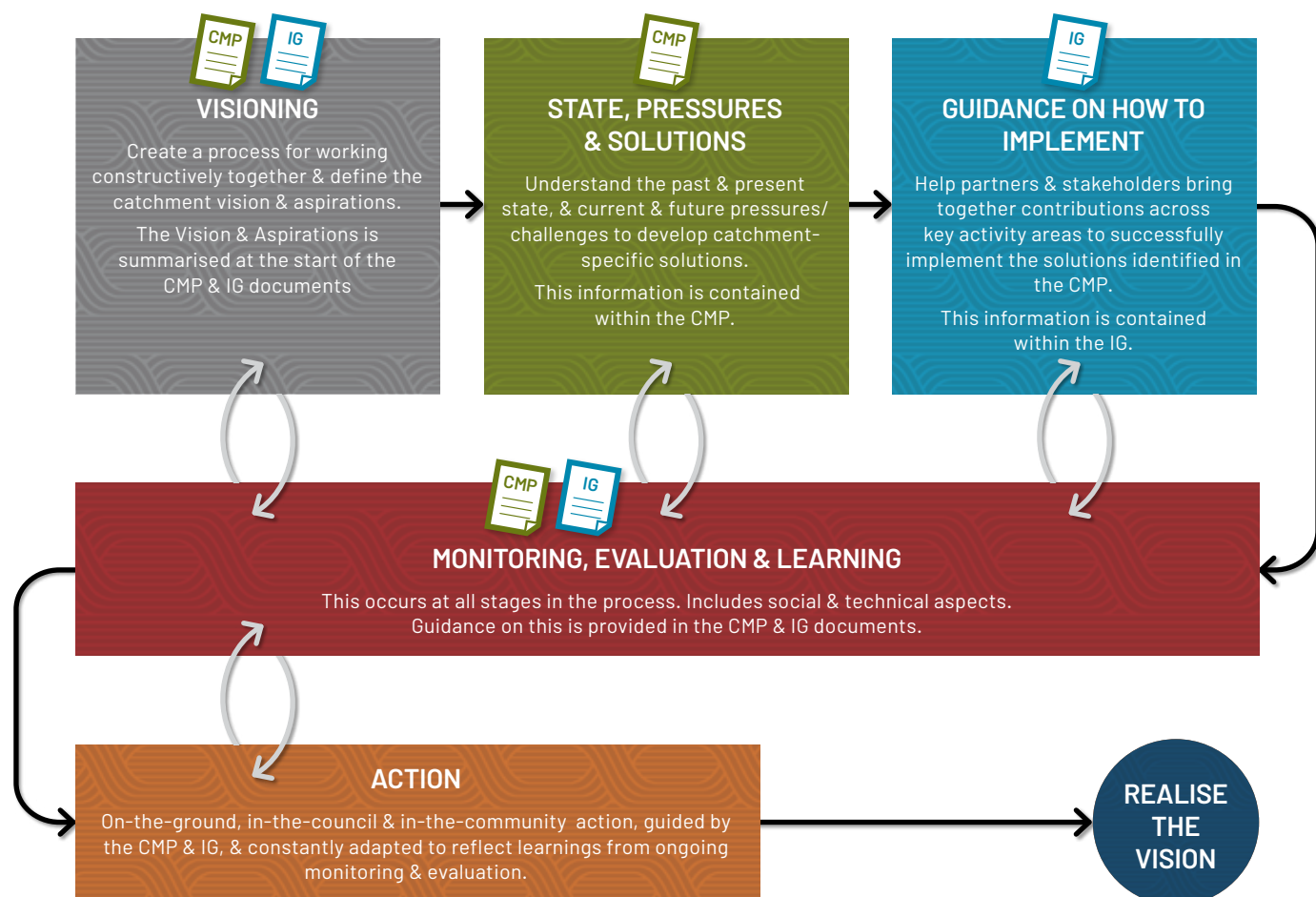
Te Mana O Te Wai – the key concept enshrined in New Zealand's National Policy Statement for Freshwater Management – obliges us to prioritise the health and well-being of water ahead of our own needs. The Ararira Catchment Management Plan (CMP) and Implementation Guide (IG) provide a vision for change, and guidance across a range of key activity areas that support a joined-up and collective approach to implementation. The changes proposed for the Ararira may also provide the momentum required to initiate change in other catchments and provide an example for others to follow.

TRANSFORMING LOWLAND WATERWAY NETWORKS

The CMP and IG will allow Selwyn District Council (SDC) to be 'plan ready' for improving the health and mauri of Te Waihora and the Ararira/LII catchment. As a 'process for change', the plans could be applied to other drainage districts within the Te Waihora catchment and other similar lowland regions elsewhere in New Zealand.

Included in the CMP are a suite of catchment scale and 'toolbox' (reach-scale) solutions designed to create improvements for the Ararira/LII catchment's network of ephemeral, intermittent and perennial waterways. The IG is designed to complement the CMP by providing guidance on the tasks and activities required to achieve the vision for improving waterway health. It supports agencies and catchment partners in planning and coordinating their efforts towards constructive collective action.

A Process for Transforming the Lowland Waterway Network of the Ararira/LII Catchment: Five key stages of co-design & collective action to realise the Vision



Project Document Roadmap for Catchment Waterway Improvement



Catchment Management Plan (CMP)

Summary of:

- past & present **state**
- current & future **pressures**
- main **challenges**.

Proposes solutions:

- **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.

What it does:

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.

The plan is grounded by the need to continue to provide effective drainage of productive land.

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).



The **CMP** can be
downloaded here,
or via this QR code.



CMP CITATION:

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



Implementation Guide (IG)

Describes:

- **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**.

What it does:

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.



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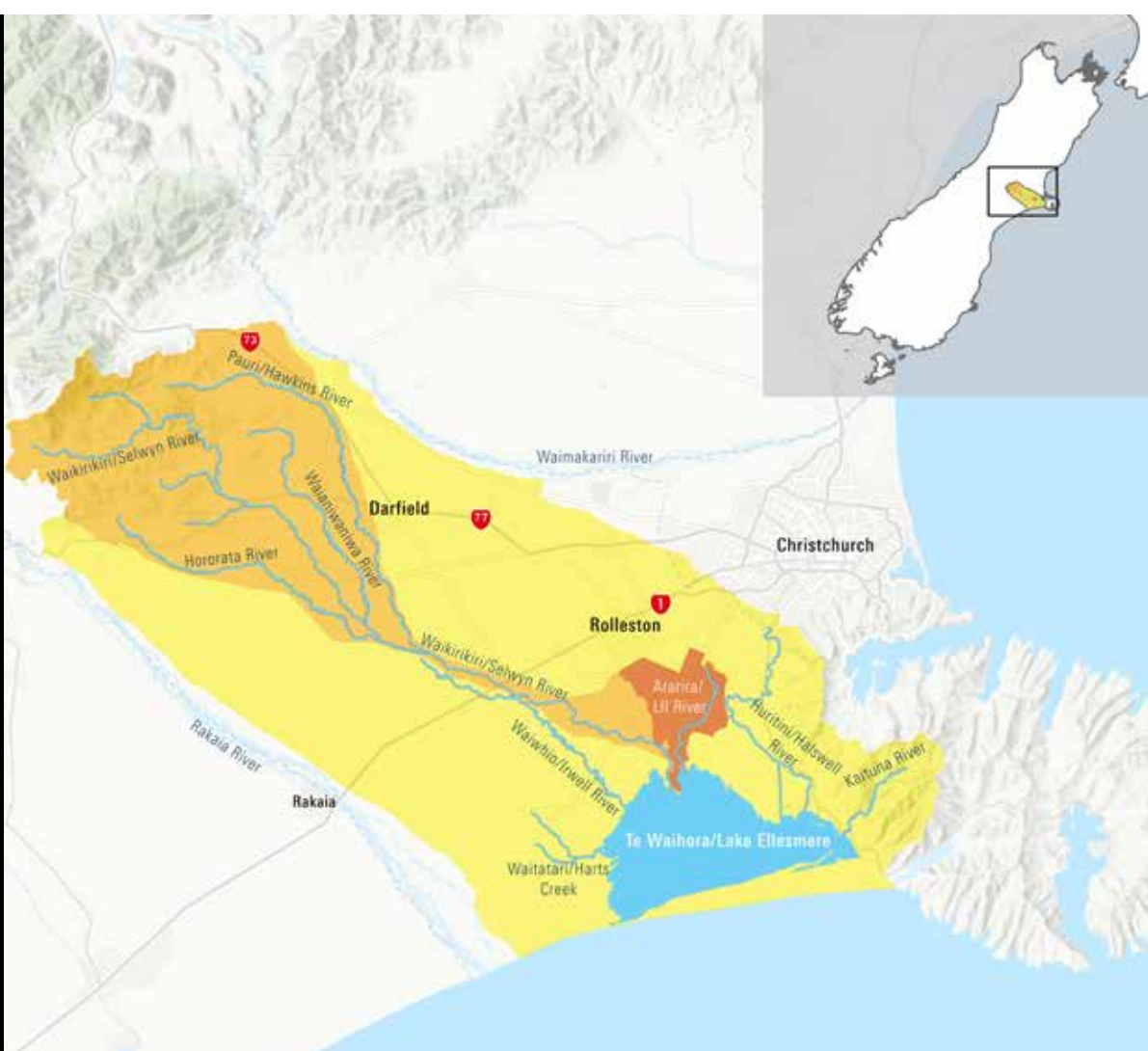
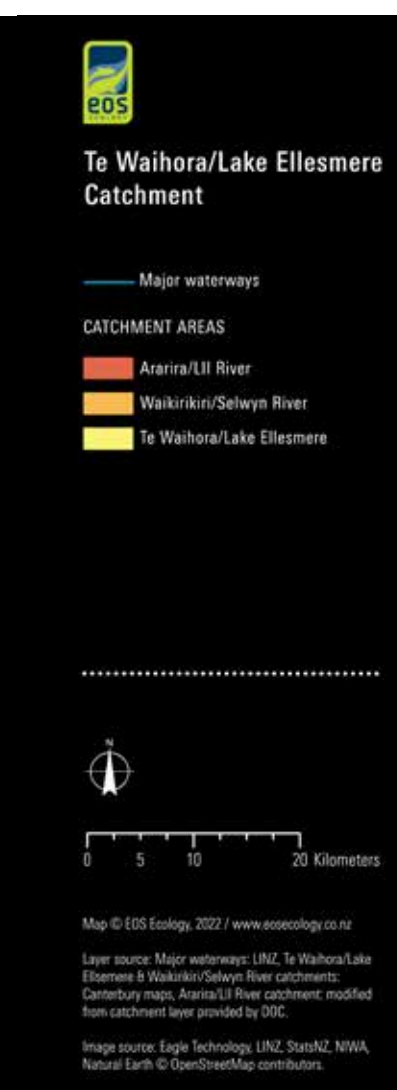


IG CITATION:

Aqualinc, Learning for Sustainability & EOS Ecology 2023. Transforming Lowland Waterway Networks – An Implementation Guide for Reimagining the Ararira/LII. Prepared in co-design with the Ararira Catchment Management Plan Project Team (Selwyn District Council, Te Taumutu Runanga, LII Drainage Committee, Living Water (Fonterra, Department of Conservation), Environment Canterbury, Cawthron). 78 p. <https://bit.ly/3AlVwFI>

1 The Ararira/LII Catchment

The Ararira/LII catchment is a 6,760 ha surface water catchment in coastal mid Canterbury. The waterways of the catchment flow through the heart of the Lincoln township and through rural land before discharging into Te Waihora/Lake Ellesmere, the coastal hāpua (lake-lagoon) (as per map below). The catchment is the second largest contributor of water to Te Waihora/Lake Ellesmere, second only to the Waikirikiri/Selwyn River catchment (Hamilton *et al.*, 2017). At 198 km², Te Waihora is Canterbury's largest and New Zealand's fifth largest coastal lagoon. As one of the most polluted coastal hāpua in New Zealand (ranked as NZ's third worst lake for water quality), Te Waihora receives nitrogen and phosphorus loads two to four orders of magnitude greater than all other monitored lakes. With most of the catchment used for intensive agriculture, and the lake level artificially controlled, the lake is now excessively enriched with excess nutrients, high algal biomass, and poor water clarity. Improving the health of Te Waihora is crucial to the long-term health and wellbeing of all those who interact with the lake, and it is expected that improving the health of the waterways of the Ararira catchment will contribute to the greater challenge of improving the health of Te Waihora.



2 Vision & Engagement/Co-design

Team (including partners Department of Conservation (DOC), Fonterra, Te Taumutu Rūnanga, SDC, Environment Canterbury (ECan), and the LII Drainage Committee) worked together with the Consultant Team (EOS Ecology, Aqualinc Research and Cawthron Institute) to find workable solutions for the Ararira catchment.

The Project Team developed a vision and mission statement, to define the purpose and anticipated outcomes of the project. These statements were developed during a values mapping workshop and were aligned with the Te Waihora Co-Governance indicator framework. The framework was developed to help Co-Governors track overall progress towards achieving their vision and strategic priorities for the restoration of the mauri of Te Waihora. Key outcomes that would result from a transformative approach to catchment management were grouped under four key value ‘baskets’.

Vision Statement

The life force of the Ararira catchment is enhanced by the thriving communities who live within it, and their relationship to land and water, now and in the future.

Mission Statement

We will work together to reimagine the Ararira so that it continues to support thriving and resilient communities while enhancing the mauri of the catchment.

Key Value Baskets

The Mauri & Ecosystem Health of the Lake

- Taonga species returned.
- Native biodiversity.
- A healthy Te Waihora.
- Restore mauri of Ararira LII.
- Ki uta ki tai – mountains to the sea approach to management of all waterways.
- Waipuna health – protecting & valuing springs & natural landscapes.

Thriving Communities – Providing for Current & Future Generations

- Resilient communities.
- Te Waihora lake management.
- Embracing innovation.
- Partnership approaches.
- Community engagement & participation.
- Common ‘terminology’ reflects values of environment & culture.
- Clear & agreed management strategy for catchment.

A Healthy Lake Supports Healthy People

- Recognising our social history.
- Connected people to land.
- Can swim in LII.
- Recreation & educational opportunities.
- Well-monitored & integrated water quality monitoring.
- Ahi kā – recognising people – past, present & future.

A Prosperous Land- & Water-based Economy is Maintained

- Drainage system that supports social resilience.
- Land use supports people/communities.
- Regenerative practices for all land use.
- Sustainable economy – includes research farms, etc.
- Reliable rural & urban drainage – protecting productive soils, farms & houses.
- Avoiding flooding & groundwater flooding.



3 Past & Present State

PAST STATE



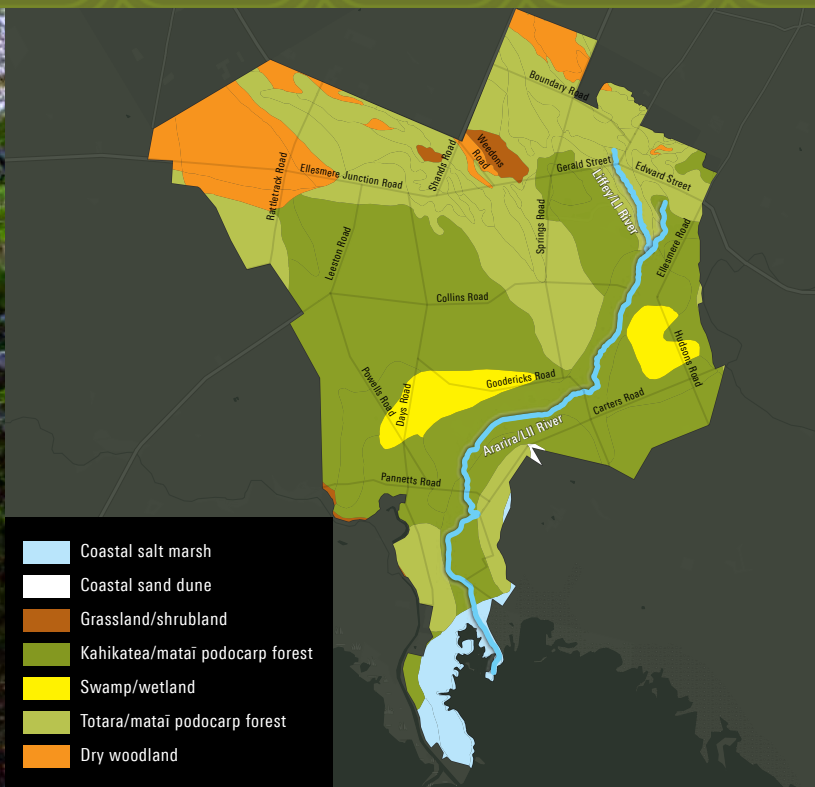
The 6,500 ha Ararira/LII catchment with the townships of Lincoln and Springston in the north, is vastly different to what it once was.

- Prior to human arrival the catchment was mostly forested in a kahikatea/matai/totara podocarp forest, with only small pockets of grassland.
- Following Māori arrival and settlement, the catchment was gradually transformed to vast areas of wetland.

This pattern was repeated right round Te Waihora where swamp forest and then wetlands were sustained by groundwater upwelling as springs.

- European settlement in the catchment from the mid 1800's brought further significant changes. Wetlands were drained and waterways channelised to make way for arable farming and crop production and Lincoln township was established in the headwaters. From the mid 1980's urban growth and farming intensified.

Past State: Vegetation



Past State: Development of the Landscape

1800^{ONWARDS} European Settlement



The wetlands of Ararira were drained and the waterways channelised to make way for arable farming and crop production.

Image: Men digging a drainage ditch in the Kaitiā swamp. Northwood brothers. Photographs of Northland. Source: Ref: 1/1-010652-G. Alexander Turnbull Library, Wellington, New Zealand. /records/22913942

1860^S Urban Creation



The township of Lincoln was established in the headwaters of the catchment in the 1860s and urban expansion continued at a relatively slow pace through to the 1980s.

Image: The LI River in the newly formed Lincoln township, ca 1880s. Source: Lincoln & Districts Historical Society.

1980^{S ONWARDS} Urban Growth & Farming Intensification



In recent decades the catchment has seen an intensification of farmland and further urban expansion.

Images: both © Robin Smith, DOC

An Overview of the STATE OF THE WATERWAYS in the Ararira Catchment

Water Quality

- Variable and is strongly influenced by groundwater arising as springs, urban landuse within the surface water catchment, and rural landuse within and outside of the surface water catchment.
- **E. coli bacteria:** generally higher in the mainstem than the drain network and higher in the farmed areas of the catchment compared to the urban areas.
- **Water clarity:** good during base flow periods. During rainfall drains are major sources of suspended sediment.
- **Phosphorus:** generally high and sufficient to promote excessive algae and macrophyte growth. However, concentrations have been slightly lower for the last decade, implying some improvement.
- **Nitrate:** varies across the catchment, highest in the western headwaters and higher than the national bottom line of 2.4 mg/litre for nitrate toxicity. Likely principal source is nitrate-rich groundwater sourced from up-gradient areas of the Plains beyond the Ararira surface water catchment.



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Freshwater Ecology

- **Fish:** thirteen species (ten native, three introduced) found in the catchment. Includes six species with a threatened conservation status – īnanga and longfin eel are commonly recorded, whilst torrentfish, bluegill bully, giant bully and lamprey are uncommon species. The mainstem and perennial drains support more fish species than the intermittent and ephemeral drains. Four of the thirteen species – longfin and shortfin eel, common and upland bully – are found across all waterway types in the catchment.
- **Freshwater invertebrates:** 37 taxa have been recorded in the catchment. The dominant taxa are those that can tolerate poor water quality and low habitat diversity indicating that the catchment waterways are in a degraded condition.



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Cultural Values

- To Ngai Tahu, Te Waihora represents a major mahinga kai and important source of mana. As a key tributary of Te Waihora, the Ararira was a traditional travelling route and food gathering area. Of particular significance were headwater springs, former open water wetlands near Lincoln and Tarerekautuku, a settlement and food gathering site for many of the species shown here.
- Despite protest from Ngai Tahu in the late 1800's and early 1900's, wetland drainage continued with major impacts on the cultural health of the catchment.



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Waterway Types

The current Council managed waterway network in the catchment is comprised of a mixture of perennial, permanently flowing tributary drains together with intermittently flowing and ephemeral drains. These feed into the main stem of the Ararira/LII River. The abundance of springs in the Ararira catchment, combined with surface run-off, make it the second largest contributor of water to the lake (the Waikirikiri/Selwyn River contributes the largest flow).

The Arariria catchment waterways have been mapped and categorised into eight types. This provides the basis for defining suitable interventions to be implemented in each waterway type. This spatial approach to the implementation of site-specific solutions allows for the time to engage with landowners and asset owners directly regarding specific placement within those waterway types.

Present State: Waterway Types



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4 Pressures & Challenges

An Overview of the PRESSURES in the Ararira Catchment

Land Use Change & Intensification

Increasing urban areas and planned urban development in areas of high spring activity. Potential changes include increased stormwater runoff and stormwater contamination, changed surface water hydrology, and possible changes to/loss of springheads.

Intensification of rural landuse. Potential changes include further decline in water quality (increased nutrients and sediment).

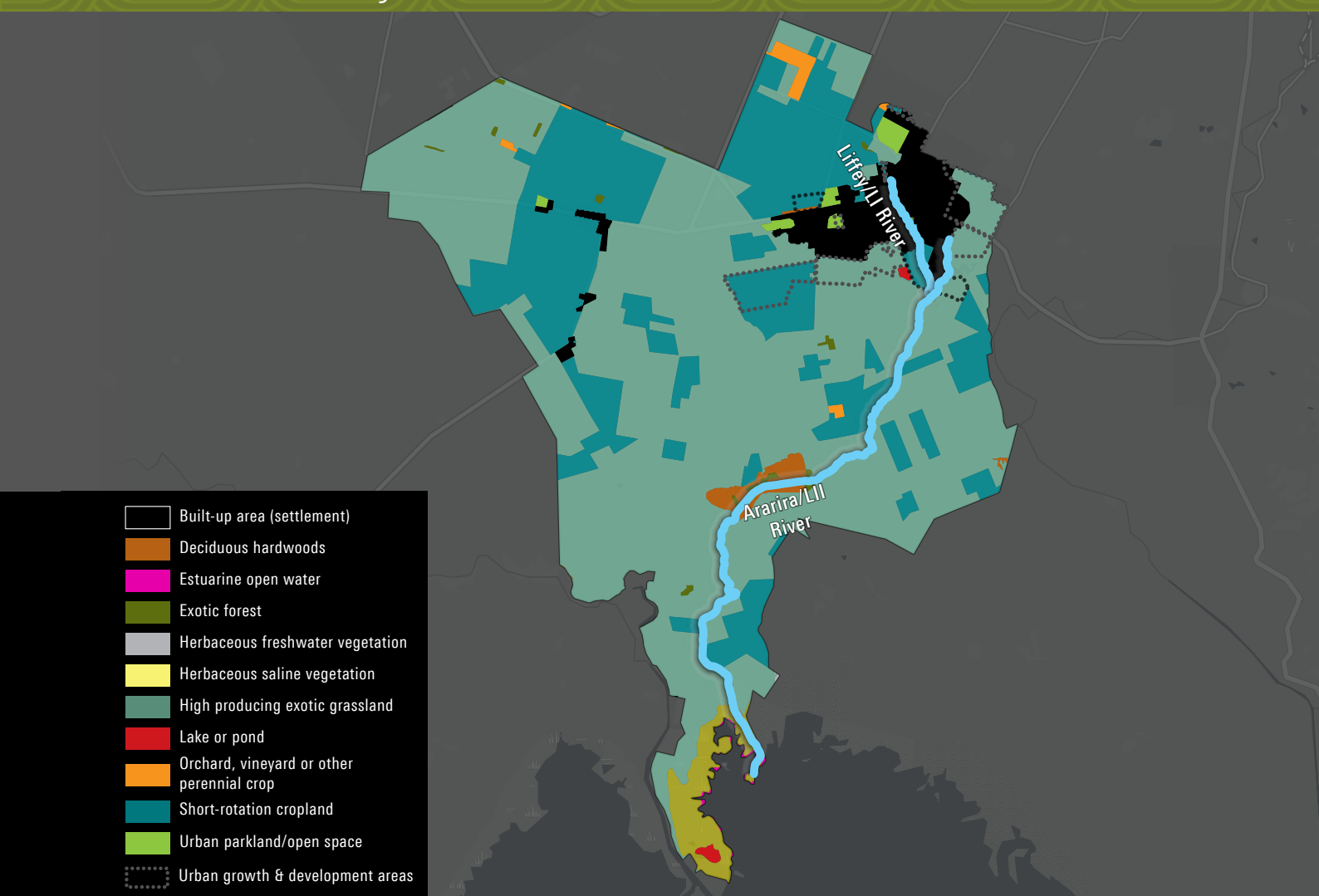
Complexity of Catchment flows

The hydrology of the Ararira catchment is complex and sometimes counter-intuitive. Flows are provided by ground-water springs as well as a water race network. The low gradient of the catchment means that in addition to catchment flooding, water levels are also influenced by the opening and closing of Te Waihora and macrophyte growth in the Ararira/LII mainstem.

Climate Change

Climate change and sea level rise will increase the potential for flooding and complicate when Te Waihora is able to be opened, with resulting management challenges.

Pressures & Challenges: Catchment Land Use & Intensification



An Overview of the CHALLENGES in the Ararira Catchment

Macrophytes

- Excessive macrophyte growth due to plentiful sunlight and nutrients to support growth of exotic species.
- Requires ongoing removal of growth to maintain drainage, which is costly and damaging to the ecology of the system.

Finding a better way to manage this problem is a key goal.



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Sediment

- The majority of the waterway network has a soft sediment substrate, either overlying gravel habitat or naturally soft-sediment.
- Sediment sourced from overland flow during rain events or from bank collapse (exacerbated by drainage maintenance to control macrophyte growth).
- Some sediment inputs settle out along the drainage network and are redistributed whenever flows increase. Other sediment remains in suspension, discharging to and impacting on receiving environments including Te Waihora.

Finding a better way to manage this problem is a key goal.



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Lack of Space

- Often little space between drains and roads or powerlines, limiting space available to implement interventions.
- Tensions between maximising productive land and leaving more space for fencing off waterways/drainage channels, to be able to implement interventions.

Looking at opportunities for maximising space is a key goal in order to realise the full range of toolbox interventions/solutions.



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Flooding & Wet Ground

Poorly drained soils and shallow groundwater mean that flooding and wet ground are ongoing challenges. Flooding in the lower catchment is affected by lake levels in Te Waihora and macrophyte growth in the catchment's waterways. Prolonged rain results in flooding in the upper catchment.

Water race input: the upper portion of the catchment has flow contributed by the Paparua water race network; future changes to that network could alter flow periodicity in some locations.

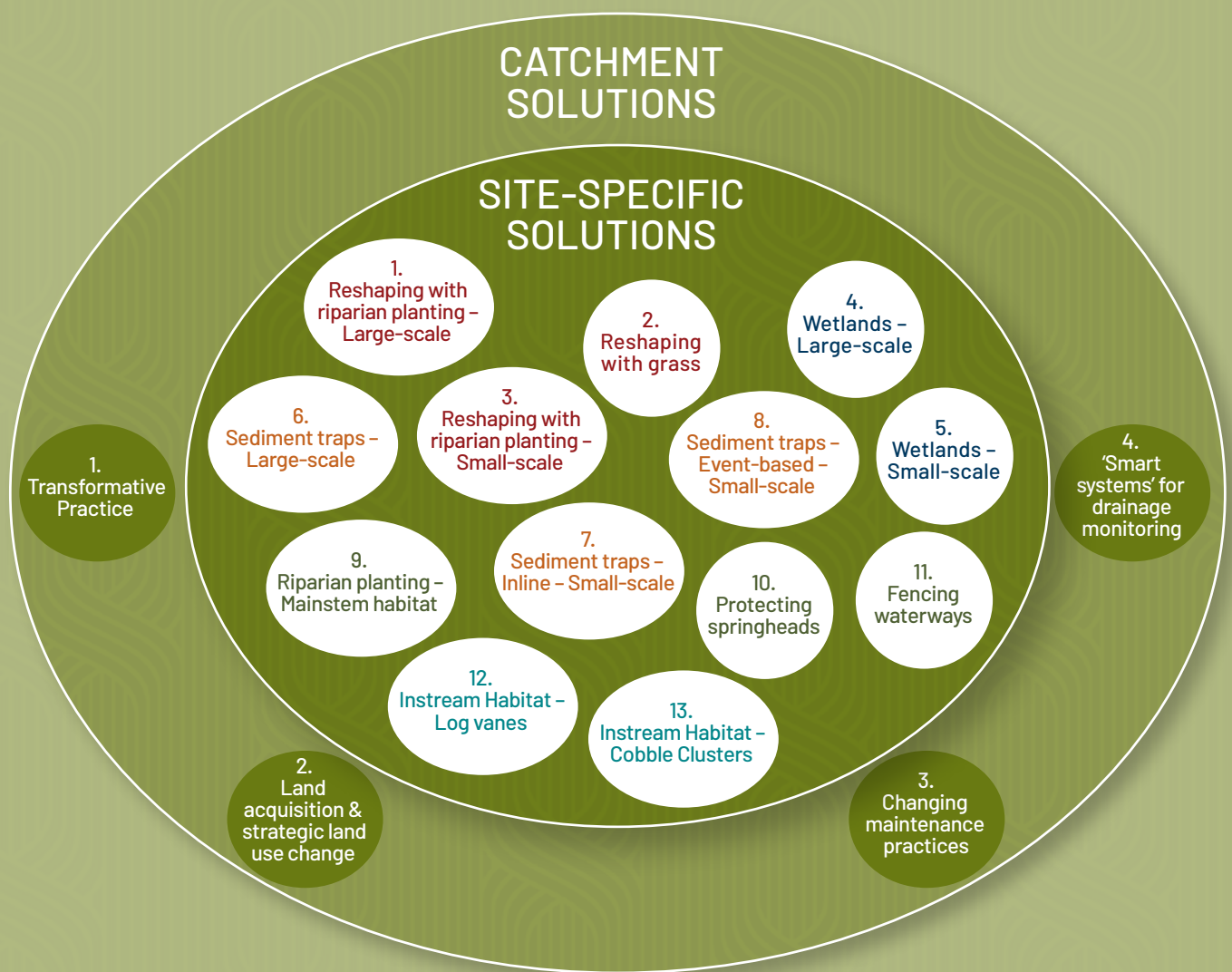


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5 Solutions

With the goal of reimagining how the Ararira catchment could be managed – to continue to maintain adequate drainage function for productive land uses, while also improving biodiversity, water quality, cultural, and ecological values – it is anticipated that a combination of catchment-scale changes in land and drain management, along with the implementation of reach-scale interventions to improve the existing condition of waterways will be needed.

Ararira Solutions: Catchment vs Site-specific



An Overview of the CATCHMENT-SCALE (i.e., overarching) SOLUTIONS in the Ararira Catchment

1. Transformative Practice

- Current 'Good Management Practices' provide farmers with guidance on how they can manage their land to improve water quality. But to transform this catchment we need to be striving for 'better than good practice'.
- Several examples of this are provided in the CMP document, along with the relevant tools and where to use them – meaning the CMP is not only relevant to local government, but also to the community and individuals.



© DDC

2. Land Aquisition & Strategic Land Use Change

- In some cases, the strategic purchase, retirement, or lease of land will be a viable way of achieving improved values on a catchment wide basis.
- Changing land use or retiring areas of land adjacent to waterways can help with securing land needed to implement some of the proposed tools and solutions.
- Some examples include setting aside areas for controlled flooding – to reduce the flooding risk in other areas of the catchment; during urban development protecting areas of significant spring activity by sequestering them within springhead reserves.



© DDC

3. Lack of Space

- As tools and solutions are implemented to deal with some of the key challenges facing the catchment, it's anticipated that the approach to maintenance will also need to change. This change will not be immediate –there will be a period of transition between the full implementation of the proposed toolbox solutions and the eventual phasing out of some of the current maintenance practices.
- Once the toolbox interventions are established in the catchment, there will be a shift away from a reactionary maintenance approach to proactive maintenance. This will also improve the ability to deal with the uncertainty and extreme events that climate change will bring.



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4. Flooding & Wet Ground

- A key component of a proactive maintenance regime is knowing when and where assets have been maintained and when and where they need to be maintained. The use of 'smart' technology such as GIS-based systems can provide immediate data on monitoring and maintenance needs.
- This is not only useful for a proactive maintenance approach but also to those implementing and managing catchment solutions, and to mapping and monitoring ecological and cultural improvements as a result.
- Ultimately this should help to optimise and target drain maintenance activities, streamlining maintenance and targeting when and where it is needed.



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SITE-SPECIFIC TOOLBOX INTERVENTION SOLUTIONS

Thirteen different interventions have been identified and developed in the toolbox of site-specific solutions. Guidance is provided on the types of waterways that would be suitable for each intervention, and where these interventions should have the greatest impact. This will allow for further stakeholder and landowner engagement to select specific locations for implementation.

Implementing both the overarching catchment wide approaches and the 13 site-based interventions will help to achieve a healthier and more resilient Ararira catchment and drainage network, and to recognise Te Mana O Te Wai when managing

		WATERWAY TYPES							
Interventions		Informal Flow Paths	Springs	Water Races	Drains		Mainstem		
					Ephemeral/ Intermittent	Perennial	Headwaters	Mid Reaches	Lower Reaches
1	CHANNEL/BANKS			1		1			
2				2 for dry sections of water race	2				
3								3	3
4	WETLANDS						4 already implemented with urban development	4 e.g., Yarr's Lagoon area	4
5			5		5	5			
6	SEDIMENT TRAPS					6 at the downstream limit, in combination with large-scale wetlands		6	6
7				7 where still flowing as they enter drainage network		7			
8					8				
9	RIPARIAN PLANTING – Mainstem Habitat						9	9	9
10	PROTECTING SPRINGHEADS		10						
11	FENCING WATERWAYS where there is stock access	11	11	11	11	11	11	11	11
12	LOG VANES – Large-scale & Small-scale					12 small-scale	12 small-scale	12 large-scale	12 large-scale
13	Cobble clusters					13 where coarse substrate	13 where coarse substrate		

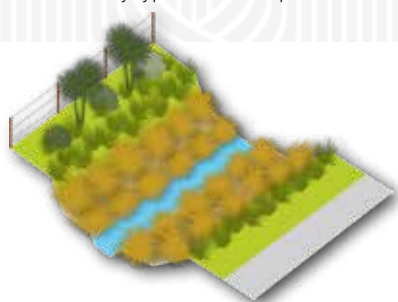
An Overview of CHANNEL/BANK INTERVENTIONS for the Ararira Catchment

Two-stage channels are artificially created floodplains/benches that are established by reshaping the banks of existing drains to create a lower bench before battering back the bank to the existing ground level. It is less prone to erosion and collapse, and provides greater flood flow capacity, and some water quality improvements. There are different options available for the types and size of the system.

Reshaping with Riparian Planting

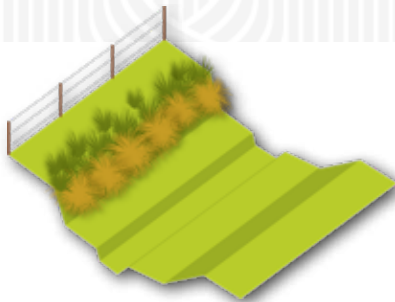
1 ...for Low Cover

- **Suitable for:** water races, drains – perennial
- Planting of *Carex secta* along the bank edge to effectively shade out the problematic emergent macrophytes that grow from the channel margins; preventing them from being able to establish.
- Preventing emergent macrophyte growth will greatly reduce the need for macrophyte removal that can damage banks and disrupt systems.
- To be effective on a catchment scale, this should be used in the specified waterway types wherever possible.



2 ...with Grass Only

- **Suitable for:** water races, drains – ephemeral/intermittent
- Grassed on both sides or only planted on one side; due to variation in flow, low ground cover planting will not be able to control macrophyte growth.
- Function is more similar to a grassed swale which provides some water quality treatment.
- Ongoing maintenance likely to be needed.



3 ...for Large-scale

- **Suitable for:** mainstem – mid reaches, lower reaches
- No macrophyte control possible due to the size of the channel. But much greater flood flow capacity, helping to reduce flooding in other parts of the catchment.
- Reconnects the river with its natural floodplain, whilst the flood plain vegetation helps to trap sediment and uptake nutrients during inundation.
- Obvious recreational and biodiversity benefits.
- Key location: Yarrs Lagoon

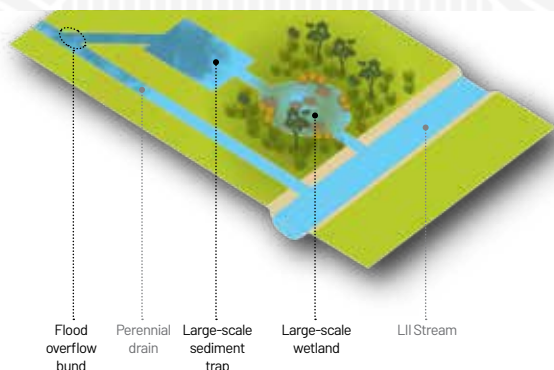


An Overview of WETLAND INTERVENTIONS for the Ararira Catchment

Wetlands offer benefits for flood management, sediment control and water quality improvement, while providing increased habitat for biodiversity. They can be sized for use in on-farm drains or larger integrated wetlands used in downstream habitats to treat water on a much larger-scale.

4 Large-scale Wetlands

- **Suitable for:** mainstem – headwaters, mid reaches, lower reaches
- To increase longevity, large-scale wetlands should be bundled with large-scale sediment traps upstream.
- Key location: channels feeding into Yarrs Lagoon.



5 Small-scale Wetlands

- **Suitable for:** informal flow paths, springheads, drains – ephemeral/intermittent, perennial
- Likely to be an on-farm opportunity, that individual landowners may implement as part of their farm development.



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An Overview of SEDIMENT INTERVENTIONS for the Ararira Catchment

Sediment traps provide a location for targeted accumulation and removal of sediment from waterways. By trapping sediment in specific locations, the environmental impacts and financial costs of widespread sediment removal across the drainage scheme will be reduced and the quantity of sediment entering the downstream receiving environment reduced.

Sediment traps may be created at either a large or small scale, depending on the space available and the quantity of sediment anticipated. To be effective on a catchment scale, considerable numbers of sediment traps would be required. Sediment traps require ongoing monitoring and maintenance to ensure that they function effectively.

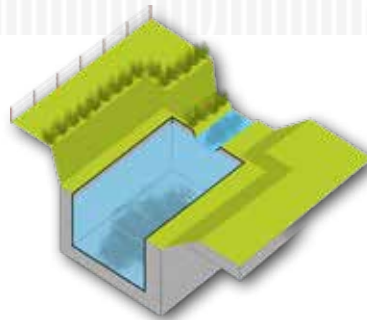
6 Large-scale Sediment Trap

- **Suitable for:** drains – perennial (downstream reach), mainstem – mid reaches, lower reaches
- Bespoke design required to meet the local conditions of the site.
- Best to be located upstream of large-scale wetlands.



7 In-line Sediment Trap

- **Suitable for:** water races, drains – perennial
- A widened and deepened area of channel, ideally with a concrete structure as a more robust and long-lasting structure for maintenance.



8 Event-based In-line Sediment Trap

- **Suitable for:** drains – ephemeral/intermittent
- Design is based on a peak control structure, that allows the normal intermittent flow to pass through, but holds back additional water during high flows, allowing time for sediment to settle out.
- As this creates a fish passage barrier they are only recommended for ephemeral/intermittent drains, where there are low/no habitat values for fish upstream.



An Overview of PLANTING & PROTECTIVE INTERVENTIONS for the Ararira Catchment

9 Other Riparian Planting

- **Suitable for:** mainstem – headwaters, mid reaches, lower reaches
- In addition to planting associated with the proposed interventions – there is the opportunity for infill planting in other areas (the mainstem river in particular).
- Provides the opportunity to boost the habitat values along the river corridor, by establishing a connected corridor of vegetation along the mainstem. In some cases, this will be infill planting among existing vegetation, but there are also many places where riparian vegetation is absent at present.



10 Protecting Springheads

- **Suitable for:** springs
- In rural areas: fencing off and planting of the springhead area. Will reduce sediment input to the system by keeping out stock from these wet/puggy areas and improve water quality.
- In urban areas: sequester springs from the stormwater network – keeping stormwater out of these systems retains the stable flow and high water quality needed to support the spring fauna that inhabit them. Other benefits from creating reserves where people can interact with and celebrate clear water spring systems.



11 Fencing Waterways

- **Suitable for:** all waterway types where there is stock access
- An opportunity for landowners to support a “better than best practice” approach. This would entail fencing off not just waterways of a certain size, but to also look at fencing options for smaller channels, and ephemeral/intermittent drains that are also a source of sediment. As well as to look at opportunities for where there could be a greater setback of fences from those channels.



An Overview of INSTREAM HABITAT INTERVENTIONS for the Ararira Catchment

These instream interventions are intended to enhance instream habitat, to better support the fish and invertebrate communities of the catchment.

12 Log Vanes

- **Large-scale - suitable for:** mainstem – mid reaches, lower reaches
- **Small-scale - suitable for:** drains – perennial, mainstem – headwaters
- Reduces erosion along the bank edge by directing the main force of the flow into the middle of the channel.
- Creates stable central channel pools for fish. When offset from each other can create a wee meander and thus varied habitat in an otherwise straight channel.
- When installed correctly should not create debris jams or erosion issues in floods.
- Especially useful for soft sediment areas where they can create high value habitat for biota in these otherwise homogenous habitats.



13 Cobble Clusters

- **Suitable for:** drains – perennial, mainstem – headwaters
- Added as individual rocks or in clusters.
- Provide a stable place for both fish and invertebrates to lay their eggs.
- Varies near-bed water velocity – creating small areas of faster and slower flow that can mean that habitat is created for a much wider range of species.
- A low cost option to improve habitat in sections of gravel-bottomed channels.

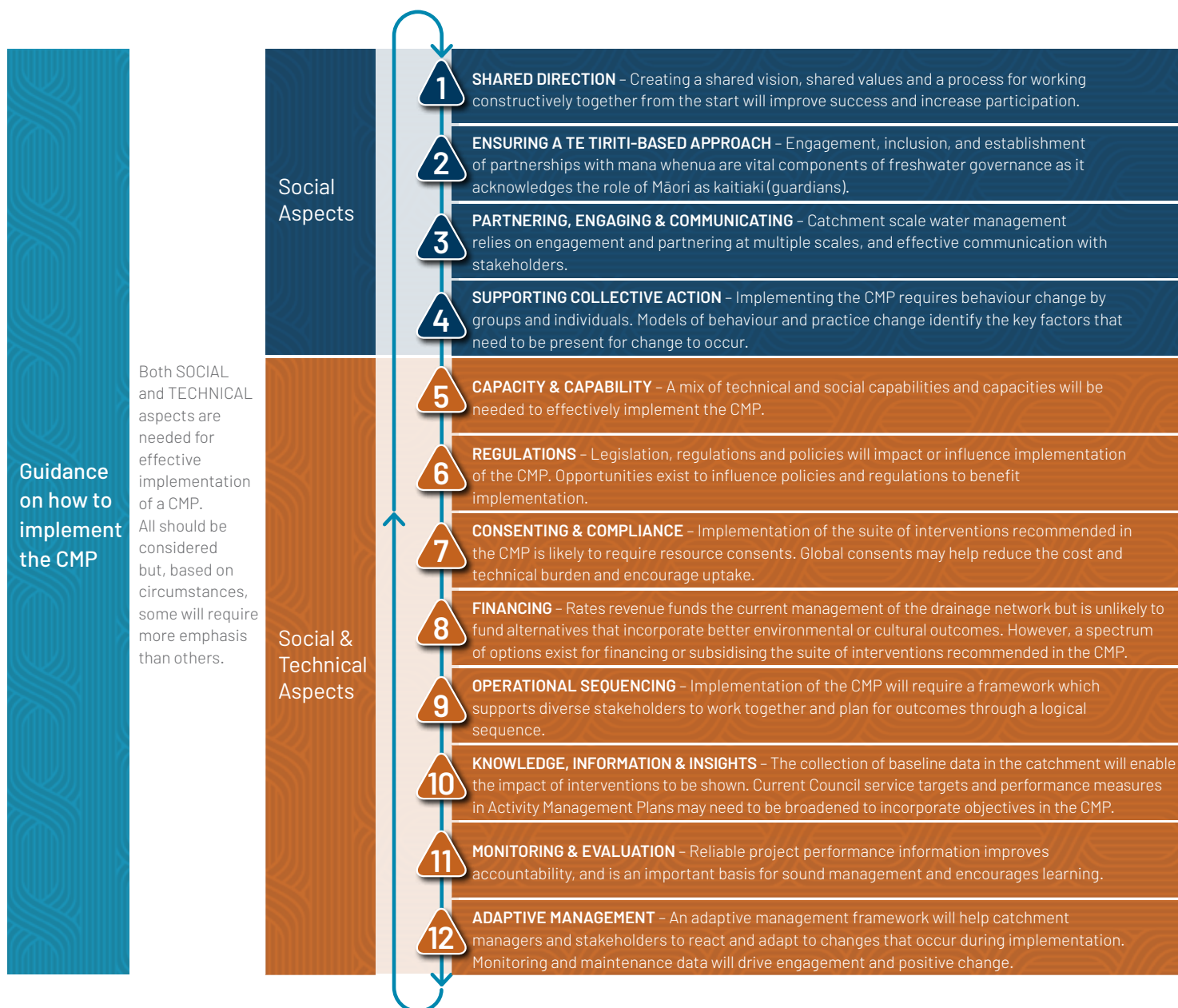


6 Implementation

The Implementation Guide (IG) is designed to complement the Catchment Management Plan 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. While this has been written specifically for the Ararira catchment, there is a secondary aim of it being transferrable to other catchments, both within the Selwyn District, and more broadly to other lowland catchments with similar land drainage issues elsewhere in Aotearoa.

The IG is based on a framework of 12 activity areas that support water system change. These principles have been developed from the Ararira team discussions, the wider Living Water work and projects, and are informed by water governance information produced by the OECD.

Each section of the IG provides 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 is included to provide a process to look across the range of activity areas and 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 activity areas.



SHARED DIRECTION



Creating a shared vision is an important process for supporting transformative projects. A shared vision serves to amplify success, increase participation, and makes it easier to bridge the 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 organizational decision-making and also provide a kind of ethical compass for organizational action. Implementation of the CMP will need to be consistent with the vision and values that have been developed as part of the CMP process.

ENSURING A TE TIRITI-BASED APPROACH



Engagement and inclusion of Māori/iwi 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, SDC has partnered with mana whenua to bring multiple values into land drainage management. There are strong 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.

PARTNERING, ENGAGING & COMMUNICATING



Catchment-scale water management relies on engagement at a number of 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.

SUPPORTING COLLECTIVE ACTION



Implementing the Ararira CMP will require behaviour change by groups and individuals. Focussing on what drives or hinders behaviour change, alongside more traditional methods of changing behaviour, can potentially be used to support successful implementation. Existing models of behaviour and practice change identify the key factors that need to be present for change to occur. 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.

CAPABILITY & CAPACITY



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

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, such as the Canterbury Water Management Strategy and the Mahaanui Iwi Management Plan.

SDC delegates responsibility for managing drainage networks to Drainage Committees. Te Komiti Waiora – District Land Drainage and Waterway Committee was established in November 2021 to help facilitate a growing focus on the environmental performance of the land drainage schemes.

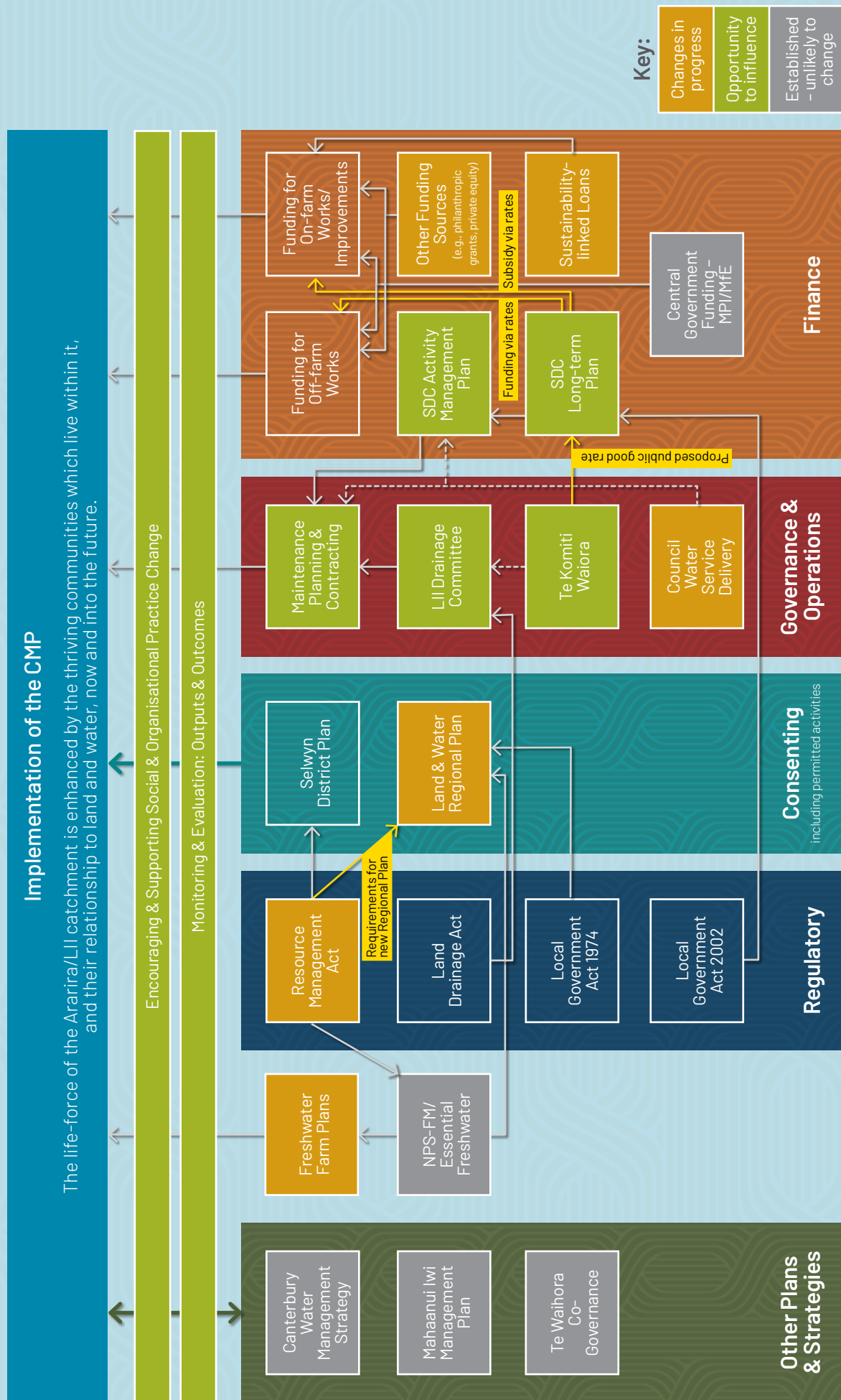
The system changes required to implement the CMP can be helped or hindered by various factors, some of which are unlikely to change, and some of which may be able to be influenced, as shown in the following diagram.

CONSENTING & COMPLIANCE



Implementation of the suite of interventions recommended in the CMP is likely to require resource consents from both Selwyn District Council and Environment Canterbury. 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 land-owners. This approach may make implementation on private land more straightforward for landowners.



FINANCING



Rates revenue collected by SDC is primarily allocated to the current maintenance regime. A transition to lower-intervention maintenance will reduce costs, 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.

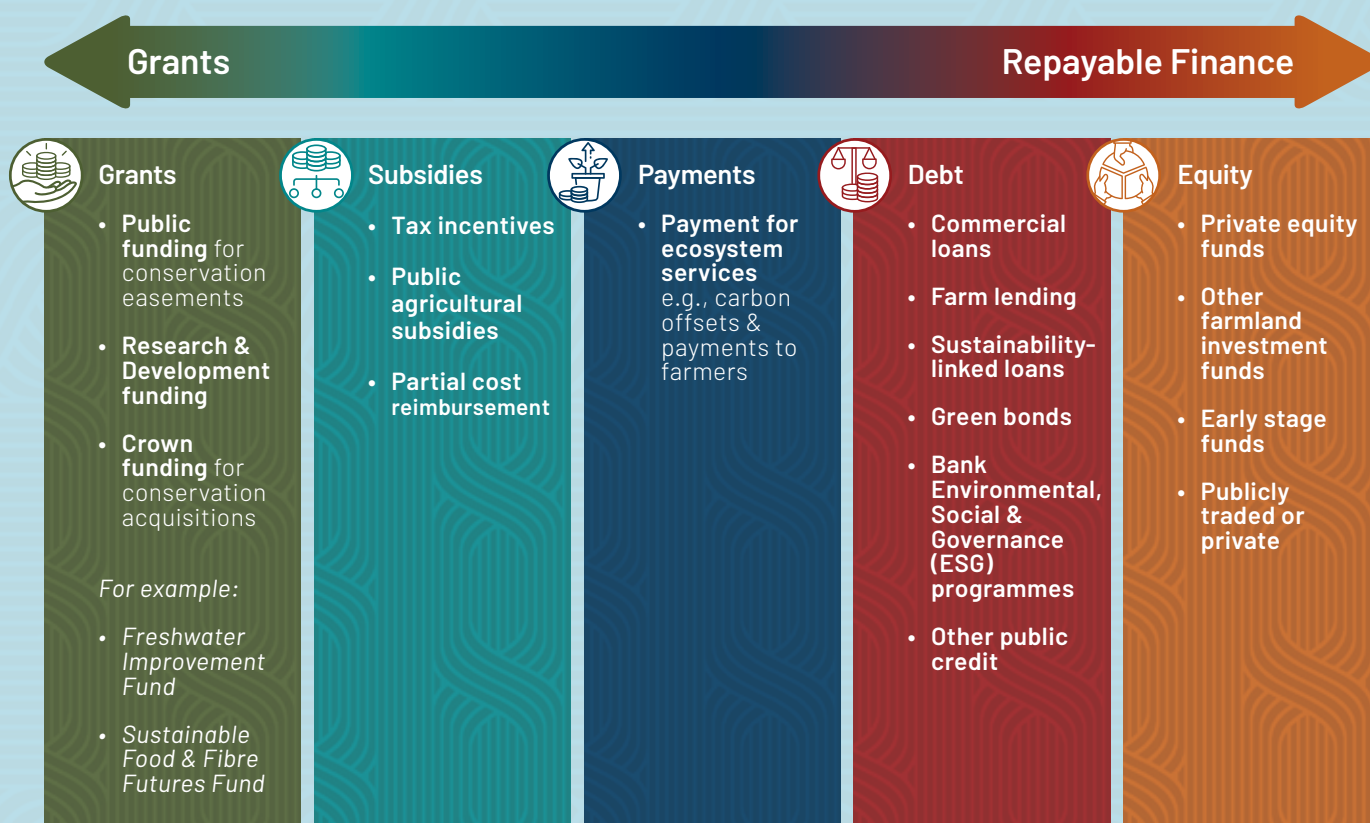
OPERATIONAL SEQUENCING



Implementation of the CMP will require a number of actions in order to achieve the vision as set out in the CMP. 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) – in the Ararira context these include the changes to maintenance practices – and long-term: the cultural, environmental, social, and economic aspects of the catchment that need to change or be retained to achieve the vision from the CMP.

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/private-owned drains, and interventions on public land/infrastructure at a network utility scale.

Funding Mechanisms



Indicative phasing of work for interventions on PRIVATE LAND

Inputs:	Resourcing to support engagement, advice to landowners, consenting & compliance			
Activities:			Assist securing funding	
		Identify & document suitable properties where landowners are willing to participate	Provide advice on implementation of specific tools/solutions	
	Development of an M&E Plan		Incorporate on-farm actions into catchment monitoring	Ongoing advice on implementation & monitoring of tools & solutions
	Communicate how the catchment plan relates to freshwater Farm Plans (as information becomes available)	Obtain global consent for specific tools & solutions on private land	Feedback information into freshwater Farm Plan audits	Adjustments to improve effectiveness of tools/solutions based on evaluation of monitoring data
		Provide design & compliance guidance	Provide advice on maintenance practices	
	Engagement with landowners & other stakeholders			
	M&E & adaptive management			
	Phase 1	Phase 2	Phase 3	Phase 4 & onwards
Outputs:	Guidance material for landowners	Global consents Design documentation Guidance on compliance monitoring .	Guidance material for landowners	Spatial data on specific tools & solutions Monitoring data
Outcomes:	Landowners are aware of the available options, & how these fit into their freshwater Farm Plan obligations	Landowners are well-informed on the design & consenting requirements for implementing solutions on their land	Change of practice on private land	Reduced sediment & nutrient input from private land, contributing to enhancement of catchment values.

Indicative phasing of work for interventions on PUBLIC LAND/INFRASTRUCTURE

Inputs:	Resourcing to support engagement, design, financing, consenting & compliance			
	Catchment-scale monitoring systems			
Activities:	Development of an M&E Plan	Identify steps of site selection & land acquisition.	Construction phased as funding allows.	
	Design of baseline monitoring requirements	Detailed design & consenting phased as funding allows.	Transition maintenance regime	Ongoing monitoring
	Continued investigation of funding options	Establish baseline monitoring	Monitoring of maintenance & the effectiveness of new tools & solutions.	Adjustments to improve effectiveness of tools/solutions based on evaluation of monitoring data
	Influencing the new Regional Plan with respect to consenting of environmental infrastructure			
	Engagement with landowners & other stakeholders			
	M&E & adaptive management			
	Phase 1	Phase 2	Phase 3	Phase 4 & onwards
Outputs:	Business case for funding options	Resource consents Detailed design documentation Land access/acquisition agreement	Completion of specific interventions Monitoring data	Information on the effectiveness of interventions
Outcomes:	SDC have a clear plan for funding network-scale interventions	SDC, landowners & other stakeholders have a clear idea of where interventions will be sited	Changes in drain maintenance practices	Reduced sediment & nutrients within the rated drainage network, contributing to enhancement of catchment values

KNOWLEDGE, INFORMATION & INSIGHTS

IG Section 10

Taking account of science, Mātauranga Māori and culture, 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.

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.

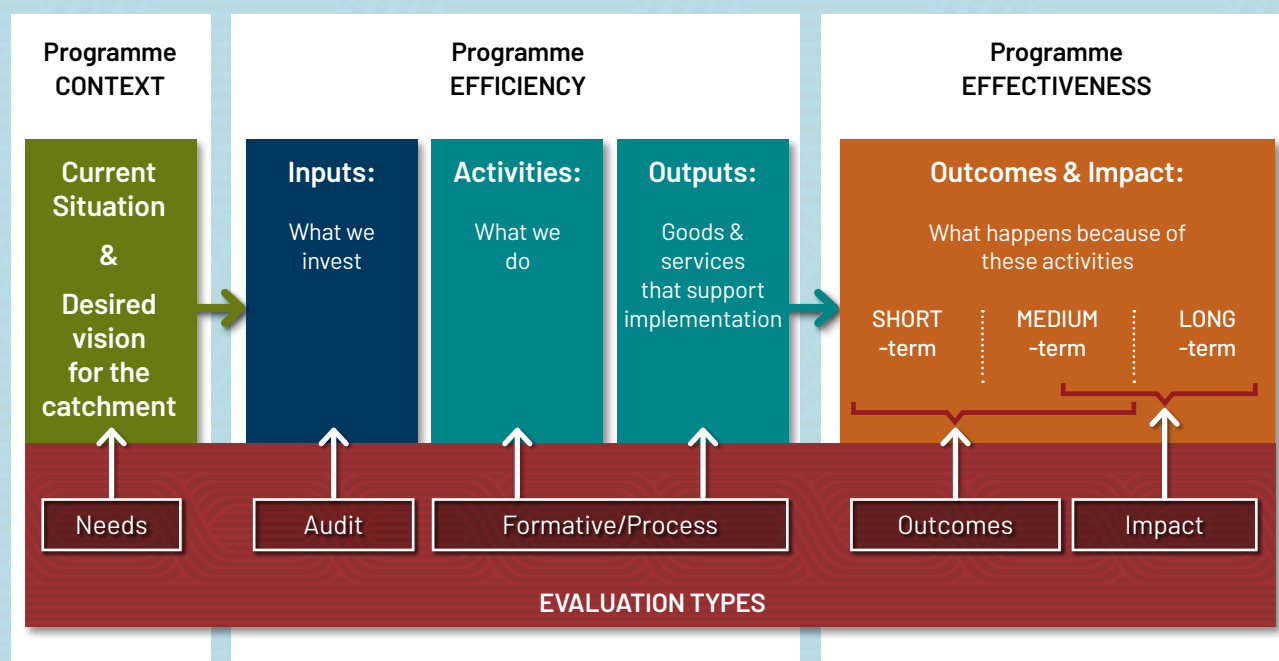
We recommend that M&E data be stored and accessed via an online platform that is accessible to all, and supported by the 'smart systems' proposed in the CMP. By having all information readily available through an interactive site-based web portal will allow the entire Ararira community to learn about what is being implemented in their catchment and how these are improving the condition of their waterways.

MONITORING & EVALUATION

IG Section 11

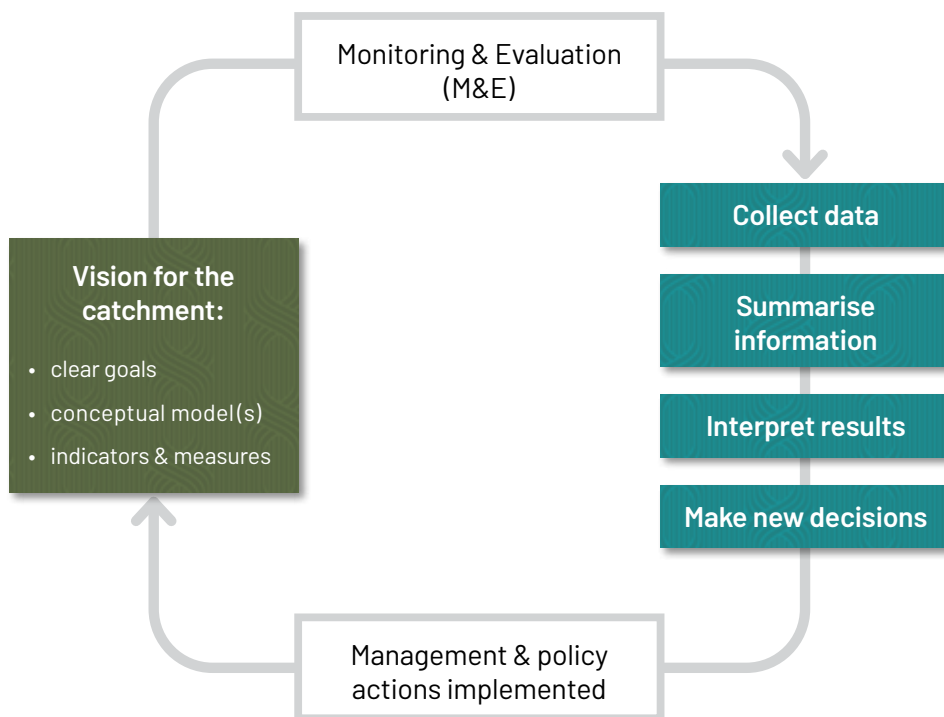
Monitoring and Evaluation (M&E) is necessary to check that efforts to implement the CMP are producing the desired outcomes. The outcomes that require monitoring include both the intermediate and long-term outcomes set out in the indicative phasing logic model for implementation. Different types of M&E 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: if monitoring shows that progress is not being made towards achieving outcomes, then the approach can be modified.

Evaluation Types & Approaches



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 Sustainability).

Adaptive management will help catchment managers and stakeholders to 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.



7 Future Values

The CMP and IG provide the roadmap for a transformative approach to waterway management in the Ararira. The tools and solutions proposed will not only deal with the existing challenges of ongoing drainage, but will also enhance the biodiversity, cultural, and recreational opportunities of the catchment.

As this transformative approach to managing the Ararira is put into practice, and demonstrated to be effective, the catchment will provide an exemplar of modern lowland waterbody management in Aotearoa. Implementing the CMP will move beyond managing the Ararira as a network of drains, towards creating a biodiverse cultural and recreational asset for the community, embodying both the local catchment vision and the national direction of Te Mana o Te Wai.





Image source: Fish & Game NZ



Image source: Robin Smith, DOC



Image source: SDC



Image source: EOS Ecology



Image source: SDC



Image source: EOS Ecology

