

Memo

Date	20 th February 2018
To	Waimakariri Water Zone Committee
CC	
From	Jarred Arthur and Alastair Picken

Instream ecosystems recommendations

Purpose

The aim of this workshop is for the Waimakariri Water Zone Committee (WWZC) to agree a set of draft recommendations for protecting and enhancing stream ecosystems. These will be included in a working draft of the Committee's Zone Implementation Plan Addendum (ZIPA).

The suggested recommendations in this memo have been produced by technical team staff based on the Committee's discussion and feedback to a set of questions at an earlier workshop in November 2017. The Committee is asked to:

- Confirm that the broad intent of each recommendation reflects the Committee's position
- Agree draft recommendations for inclusion in a working draft ZIPA
- Identify any major gaps (if any) in the recommendations.

The draft recommendations do not have to be word perfect at this stage. You will have the opportunity to fine tune and rephrase the recommendations in June 2018.

Background

The WWZC was presented with a list of 26 questions highlighting instream ecosystem health issues within the Waimakariri Zone (refer to "Instream Ecosystems Management Options" memo by J. Arthur and A. Picken). At a briefing workshop held on 27th November 2017, Committee members discussed these questions and provided feedback to the Waimakariri Zone Technical Team. Some feedback resulted in clear outcomes for how the Zone Committee wants to manage waterways in the Waimakariri Zone. Other feedback requested additional information to enable greater Committee confidence when responding to particular questions. These questions related specifically to prospective stock exclusion rules, protection of springheads, riparian management, drain management, salmon spawning habitats, stream realignment, and forestry regulations.

The Zone Committee's question-related feedback has been repackaged into suggested ZIPA recommendations intended for the draft ZIPA. This format reflects the technical team's interpretation of the Committee's stance on water management issues in the Waimakariri Zone. All recommendations are detailed under different sub-headings and are specific to protecting instream ecosystem, recreational and, to some degree, cultural values. Further information relating to zone issues will be presented to the Zone Committee in the coming months. Specifically, catchment based workshops will be held to discuss cultural values, stream depleting groundwater, surface water flows and nitrates. There will be the opportunity for the Zone Committee to moderate the instream ecosystem recommendations in this memo according to any new information in June 2018.

Recommendations

Catchment Management Plans (non-statutory)

The WWZC had identified priority sub-catchments where action is needed to improve waterway health. The WWZC has stated that catchment-scale management plans are its preferred vehicle for delivering practical on-the-ground actions in its ZIPA. The Committee also view them as an effective tool for long-term engagement with the community after the ZIPA is published towards the end of 2018.

Several suggested ZIPA recommendations that follow in the memo reference **Catchment Management Plans**. Catchment Management Plans are non-statutory action plans that the WWZC could develop with support from the Zone Delivery Team and through working with landowners, Ngāi Tahu, Waimakariri District Council, farming organisations, Fish and Game, and others. The plans would leverage off existing initiatives such as the "Big Rocks" projects and Dr. Henry Hudson's report "*Scoping strategy for the Three Brooks and channel enhancements in the middle Cam River and Tuahiwi Drain*". They could also identify new actions, lead partners, timeframes and funding.

Zone Committee feedback

- Requests a catchment-based approach to implementation of its solutions programme
- Zone Implementation Programme recommends that Catchment Management Plans are developed for all waterways in the zone (recommendation 1.4)

Suggestion for draft ZIPA

1. The Waimakariri Water Zone Committee will prioritise catchments and develop two Catchment Management Plans per year ~~for 5 years~~ following production of its final Zone Implementation Plan Addendum.

Committee Feedback 1

- Terminology – catchment or sub-catchment mgmt. plans? Greg: stay at catchment level. Use a template approach to each catchment mgmt. plan. OK.
- These are not a pre-requisite for getting on with actions.
Cut for 5 years as we don't know the final numbers of catchments at this stage.

Supporting Good Management Practice

The Waimakariri Zone contains a number of waterways with high nutrient levels and deposited sediment, particularly spring-fed streams on the plains. The cornerstone to managing contaminant losses from land is the development of **good** Farm Environment Plans (FEPs). The education of landowners to improve land-use practices and develop an astute awareness of and interest in catchment-scale aquatic values will strengthen FEP function and compliance. However, FEPs only cover rural sector properties greater than 10 ha in size. Implementing management plans for smaller land holdings will help reduce lifestyle block contaminant losses, which may collectively be significant. Community- and industry-wide education and awareness programmes on waterway values will help inform and encourage public involvement in local waterway enhancement projects.

Zone Committee feedback

- The implementation of Good Management Practice (GMP) is key to protecting waterways.
- GMP is an opportunity to support biodiversity and ecological values through awareness and education programmes.

Suggestions for draft ZIPA

2. Regional council **and Zone Committee support** industry groups **to** provide sector- and catchment-specific support to landowners implementing Good Management Practice (GMP), including:
 - a. sub-catchment groups working to reduce contaminant losses.
 - b. increasing education and awareness of Farm Environment Plan (FEP) audit and accreditation process amongst wider community.
 - c. educating and empowering landowners to protect catchment-specific ecological, biodiversity and cultural values by:
 - i. **constructing** **Preparing** catchment management plans to implement on-the-ground waterway remediation projects at sites identified as priorities by the Waimakariri Water Zone Committee¹.

¹ This recommendation provides scope for the Zone Committee to identify, map and prioritise non-statutory sub-catchment-scale projects within stream catchments. The Zone Committee may also wish to put goal-orientated timelines around the completion of such projects.

- ii. FEPs and Management Plans identifying any areas of “significant indigenous biodiversity” mapped by district councils and methods of complying with any district plan rules.
- iii. providing workshops in vulnerable hotspot (i.e. high value or high contaminant loss) areas.

Committee Feedback 2

- In narrative – take out ‘good’, as above.
- Under ii) Identifying or including?
- What about inclusion of mahinga kai? Does it extend to wetlands planted on farm for sediment control (i.e. as a mitigation)?
- WDC has 150 significant sites and this is being reviewed again now.
- Should all biodiversity on farm be in the FEP?
- What incentives are in place to improve biodiversity (e.g. IMS).
- How will FEP process evolve re: biodiversity (e.g. having a biodiversity advisor assisting farmers on options)?
- Developing more educational options for landowners re: biodiversity / mahinga kai
- Doing a stocktake of current biodiversity.
- Incentives...

3. Promote the use of Lifestyle Block Management Plans and provide workshops to educate and incentivise small land owners to minimise contaminant losses and enhance waterways on their properties.

Committee Feedback 3

- In addition a simpler tool/resources to inform Lifestyle Block owners on the above.
- What mechanism could be introduced to address a group of block holders who are impacting on a waterway?
- Building local landowner groups to share learning and implementation.
- Link to horses – education.

Improving environmental monitoring

State of the environment (SOE) monitoring is key to understanding the state and trends of water quality and ecosystem health in Waimakariri Zone waterways. A component of a successful monitoring programme is the establishment of a robust and representative network of monitoring sites across a variety of catchment types and areas. As it stands, the Regional Council’s capacity to monitor sites is limited. This has been evident throughout the Waimakariri Water Zone planning process which has shown that many catchments lack robust scientific data. Monitoring sites must also be positioned to help quantify plan change effectiveness in the form of measurable water quality and ecosystem health outcomes. Sediment is likely the most significant contributor to degraded habitat quality in spring-fed streams and coastal waterbodies, and there is a large gap in knowledge about the extent and character of sediment deposition in the zone. Likewise, knowledge of the state and distribution of fish and mahinga kai communities is poor.

Zone Committee feedback

- A common theme throughout the WWZC meetings and workshops has been ongoing requests for more information.
- Zone Committee members unanimously agree that environmental monitoring in the Waimakariri Zone is not sufficient.
- More monitoring sites are required to provide better zone coverage and provide additional information for priority sites.
- Further ecosystem, biodiversity and cultural health metrics need to be measured.
- Measuring sediment extent and character should be integrated into monitoring plans.
- Recreation sites probably do not need adding to Schedule 6 of the Land and Water Regional Plan (LWRP) **for the purpose of improved stock exclusion provisions**. But further monitoring of additional recreation sites may be desired.
- Greater information sharing should be encouraged, as well as increased involvement in monitoring from community.

Suggestions for draft ZIPA

4. Implement a comprehensive waterway monitoring plan for the Waimakariri Water Zone, including:
 - a. monitoring sites for water quality and ecological health at **key** waterways including, **but not limited to**:
 - i. Kaiapoi River and Silverstream catchments
 - ii. Cam River
 - iii. ~~Ohoka River~~ **Stream**
 - iv. Cust River
 - v. Taranaki Creek
 - vi. ~~Lees Valley waterways~~ **Ashley/Rakahuri River gorge**
 - vii. **Saltwater Creek**
 - b. State of the Takiwā monitoring, specifically the health and wellbeing of mahinga kai species including:
 - viii. Tuna (freshwater eels)
 - ix. Inanga (whitebait species)
 - x. Kākahi (freshwater mussels)
 - xi. Kanakana (lamprey)
 - xii. Kōura (freshwater crayfish)
 - c. measuring freshwater fish, **invertebrates and aquatic vegetation** diversity and distributions throughout the zone.
 - d. measuring deposited sediment extent and character, particularly in spring-fed plains streams and the Ashley River / Rakahuri – Saltwater Creek Estuary.

Committee Feedback 4

Greg – better to have sites noted rather than a statement without a level of detail.
- editions as above

5. Include important bathing sites in Schedule 6 of the LWRP and assess primary recreational water quality at²:
- xiii. Ashley River at Gorge
 - xiv. Ashley River at Rangiora-Loburn Bridge
 - xv. Ashley River at State Highway 1
 - xvi. Kaiapoi River at near Kaiapoi Township

Committee Feedback 5

- Does this list exclude 'local significant' bathing sites? How do we ID other local bathing sites?
- Option: ask through Draft ZIPA – have we got this list right?
- Other sites e.g. Mt Thomas

6. Increase information sharing and integrate monitoring programmes between organisations, and promote community-based monitoring of waterways (citizen science) and education initiatives.

Committee Feedback 6

All good.

Protecting aquatic biodiversity

The Waimakariri Water Zone contains numerous aquatic species of high ecological, cultural and recreational value. However, many years of land use development has resulted in many species or populations becoming lost or threatened. At risk species in the zone include the threatened Canterbury mudfish, lamprey, freshwater mussels, longfin eel and kōura. A key factor contributing to the loss of these species has been habitat loss or degradation. Habitat loss and degradation has resulted from stream channel and bank alterations, sediment deposition, riparian vegetation removal, invasive species, and land-based contaminant inputs. Reduced stream flows can also reduce the amount of available habitat and compounds the effect of other water quality and habitat-related issues³.

² This provides the opportunity for the Zone Committee to suggest primary recreation (e.g. swimming) sites that are important to the local community. The suggested list is those sites that are already monitored. Community members have also mentioned a site along the Cust River. The Zone Committee previously expressed that there is no need for additional sites to be included in Schedule 6. However, this decision related to stock exclusion whereas there are other benefits to including sites e.g., a requirement detailed in the National Policy Statement for Freshwater Management for Environment Canterbury to monitor these sites.

³ Recommendations about surface water flows will be discussed in the coming months in line with the Surface Water Flows key decision-making area (KDA).

Many fish species in the Waimakariri Water Zone are diadromous, meaning that they must pass to and from the sea to complete life-cycles. Stream surveys and investigations have identified numerous barriers to migratory fish passage throughout the zone. These include flood and tide gates, weirs, and culverts. The remediation of such barriers is important to ensuring that the recruitment of individuals into the middle and upper reaches of catchments is allowed. Sufficient fish recruitment is important to maintaining or improving the health of fish communities. Appendix 1 outlines known fish barriers, endangered fish habitat locations, and salmonid spawning sites in the zone.

At the 27th November workshop, the WWZC was asked whether they believed that the additional protection of salmon spawning sites is necessary in the Waimakariri Zone. Their response was that they do not believe the Ashley River / Rakahuri or Silverstream catchments to be significant salmon fisheries. For this reason, the Zone Committee consider it inappropriate to add zone-specific sites to the list of regionally significant salmon spawning sites in Schedule 17 of the LWRP. Further correspondence with Fish and Game New Zealand (FGNZ) confirms that the salmon spawning run in the Ashley River / Rakahuri is very small (Appendix 2).

Zone Committee feedback

- Barriers to fish passage should be removed or mitigated, but be site and species dependent to separate indigenous and recreational fisheries.
- Fish barrier removal should relate to cultural mapping and reports, and prioritise the removal of specific barrier types e.g., flood gates.
- Canterbury mudfish habitat requires specific rules and regulations and management plans to ensure their protection.
- The regulatory protection of lamprey, kōura and freshwater mussels should be investigated.
- Catchment management plans should incorporate projects that rehabilitate the habitat of threatened indigenous species and species of high cultural importance.

Suggestions for draft ZIPA

7. Remove or retrofit barriers to fish passage where:
 - a. barriers are not important for protecting vulnerable non-migratory native fish populations from predation by introduced fish species, **and**
 - ~~b. tide-and flood-gates impede fish migration (including the maintenance and operation of gates), and/or in~~
 - c. ~~catchments are of high ecological and/or cultural value, including~~ the priority catchments of:
 - i. Taranaki Creek
 - ii. Silverstream
 - iii. Cam River
 - iv. Waikuku Stream
 - ~~v. Leggits Creek~~
 - vi. Courtenay Stream

vii. Kairaki Creek

Committee Feedback 7

Greg – national guidelines are coming for this area.

- Is it and/or for the above?
- Fish screening – is this relevant to this section? A CWMS RC WG looking at this.
- Who decides what are high ecological catchments
- Will recreation impacts be considered and do we need to reference this?

8. Identify the types of activities and controls needed to protect the aquatic habitat of the threatened Canterbury mudfish and amend plan provisions to ensure protection

~~at~~ **including** the following sites:

- i. Tutaepatu Lagoon
- ii. Taranaki Creek
- iii. Eyre River tributaries
- iv. Coopers Creek tributaries
- v. Mounseys Stream tributaries

Committee Feedback 8

- Is it amend or introduce. It's amend.
- OK

9. Identify the habitat locations and types of activities and controls needed to protect the habitat of important indigenous species including:

- a. Freshwater crayfish / kōura
- b. Freshwater mussels / kākahi
- c. Lamprey / kanakana

Committee Feedback 9

- Should we add the longfin eel?
- ID sites through catchment mgmt. plans
- OK

10. Resource and support catchment management plans that implement on the ground projects targeted at rehabilitating the habitats of threatened species or species of high cultural importance.

Committee Feedback 10

- Discussion on catchment mgmt. plans being a vehicle for bidding for resources via LTP/Annual plan processes.
- OK.

Protecting natural waterbody character and ecosystem function

Many waterways in the Waimakariri Water Zone have been extensively modified. Spring-fed plains streams have been affected by stream realignments, channel straightening, bank

modifications and more. Restoring natural character to streams can have multiple long-term aesthetic and ecosystem benefits. For example, sinuous stream channels with gentle sloping and well-planted banks promote stream bed shading, bank stability and higher quality instream habitats with improved water quality. Likewise, it is well known that farm stock can cause damage to the beds and streams of rivers. This applies not only to natural watercourses, but also drains and other modified or artificial watercourses that convey contaminants to natural waterbodies. Springheads are not immune from such effects and are the primary source of water for streams on the plains. Both on the ground and regulatory approaches can promote the effective protection of waterways. Appendix 3 provides supplementary information about options for protecting modified watercourses and springheads from stock access.

Zone Committee feedback

- Stream realignment for the purpose of new land development isn't being managed effectively e.g., Ravenswood development.
- Bank stabilisation projects to reduce sediment inputs should focus on lowland waterways.
- Advice on drain clearing activities is required but a recommendation is needed about managing drain clearing practices.
- Stock exclusion provisions in the LWRP should be (provisionally) extended.
- Intensively farmed stock should be excluded from permanently flowing lowland springheads and drains.
- Consider also excluding stock from other lowland artificial waterbodies connected to streams, rivers and lakes.
- Consider also excluding heavy stock from small land holdings, including horses.
- The width sufficiency of a vegetated riparian strip is site dependent and guidance and support is necessary to build awareness in landowners.

Suggestions for draft ZIPA

11. Support further work on the issue of lost ecological and cultural values resulting from waterway realignment and in the event of any regulatory shortcomings, advise changes for a future region-wide plan change.

Committee Feedback 11

- Educating contractors re: GMP/best practice.
- Not recommending a change now but informing a larger region-wide piece of work.
- OK

12. Support catchment management plans that promote bank stabilisation and reduce sediment inputs to spring-fed plains waterways **particularly in including, but not limited to**, the priority catchments of:
 - a. Cam River

- b. Taranaki Creek
- c. Silverstream

Committee Feedback 12

- Edit as above
- OK

13. Ensure **waterway** and drain clearing management activities follow best practice guidelines to minimise contaminant losses to downstream waterbodies and avoid loss of aquatic life in drains **while maintaining flood carrying capacity**.

Committee Feedback 13

- Edits as above.
- OK

14. Rules excluding intensively farmed stock⁴ from waterbodies are extended to include all **open** drains and other artificial watercourses that have surface water in them and directly discharge to a stream, river or lake.

Committee Feedback 14

- Disc on intensively farmed stock definition, e.g. exclusion of non-dairy cattle. Can we extend this definition through this process, i.e. catchment basis?
- Edit as above.
- OK

15. Rules excluding intensively farmed stock from waterbodies are extended to include all plains springheads that permanently or intermittently contain water or connect to a river or surface waterbody⁵.

Committee Feedback 15

- Option to split this into two recommendations – one focused on intermittent, the other on permanent. Greg/Adrian – concern with this given protection challenges to intermittent.
- Can we get clarification on the definition of intermittent, including clarification of the ephemerals.

⁴ Intensively farmed stock means: cattle or deer grazed on irrigated land or contained for break-feeding of winter crops; dairy cattle of any class, including cows, whether dry or milking, and whether on irrigated land or not; or farmed pigs.

⁵ WWZC feedback referred to excluding stock from permanently flowing springs. However, intermittently flowing springs are also culturally and ecologically important even at times when flowing just below the surface. For this reason, the suggested recommendation includes the word 'intermittent' for the Zone Committee to consider.

16. Landowners are supported with education and guidance on appropriate riparian set back distances and plantings for different situations.

Committee Feedback 16

- OK

17. Guidance is developed on access to rivers by horses and used to support landowners in the development of Lifestyle Block Management Plans that the Committee is actively promoting within the zone.

Committee Feedback 17

- Advice is that horses are captured by the current rules. Clarify does this cover recreational riders, e.g. next to waterways. Add reference to education under 3.
- OK.

Coastal waterbodies

Coastal waterbodies are highly valued ecosystems. They are culturally important and serve as nursery, feeding and resting grounds for a variety of migratory fish species and birds. Located at the bottom of river catchments, they serve as basins capturing upstream contaminant inputs. The Ashley River / Rakahuri – Saltwater Creek Estuary and tidal reaches of spring-fed plains streams have been particularly affected by habitat degradation associated with excessive sediment deposition. Managing upstream contaminant losses with the foresight to protect coastal waterbodies downstream is a critical component of any good Catchment Management Plan. Developing a robust monitoring programme for tidal-freshwater and estuarine waterbodies will improve the currently poor understanding of ecosystem state and trends. The extent and characteristics of tidally influenced waterbodies are expected to shift with climate change and rising sea levels.

Zone Committee feedback

- Understanding and controlling contaminant inputs, particularly sediment, in wider catchments is important to improving coastal waterbody health.
- Monitoring of coastal waterbodies is poor and should be integrated into wider full catchment-wide monitoring plans.
- Important to understand and protect the Kaiapoi River, Saltwater Creek (east of State Highway 1) and Taranaki Creek as priority waterways.
- Climate-related aquatic habitat shifts (e.g., inanga spawning areas) should be monitored to inform a forward-thinking approach to habitat protection.

Suggestions for draft ZIPA

18. Integrate the monitoring of tidal waterbodies into comprehensive catchment-wide management plans, and support the increased monitoring of:
 - a. sediment deposition in:
 - i. Ashley River / Rakahuri – Saltwater Creek Estuary.
 - ii. Tidal reaches of Kaiapoi River, Saltwater Creek and Taranaki Creek.
 - b. aquatic habitat shifts associated with climate change and sea level rise, including changes in inanga spawning areas.

Committee Feedback 18

- Discussion on wording addressing accommodating future habitat requirements.
- How to incorporate climate change predictions into catchment mgmt. plans.
- OK

Ashley River / Rakahuri and Saltwater Creek catchment

The WWZC identifies the Ashley River / Rakahuri as an important natural landscape feature. As such, the committee believes that it should be safeguarded in its upper-catchment above the gorge, which is an area that has undergone less land use intensification relative to downstream. The Ashley River / Rakahuri (and to a lesser extent the Okuku River) affords many characteristics of an alpine braided river as defined under the LWRP. The Zone Committee has therefore expressed interest that its braided river values are protected.

Below the gorge, the Ashley River / Rakahuri is highly valued for its recreational use. Cyanobacteria (or blue-green algae) growths proliferate on the bed of the Ashley River at times of warm and stable weather, posing health risks to recreational users and dogs. Cyanobacteria issues were not discussed in the 27th November 2017 workshop, but supplementary information on the issue is detailed in Appendix 4.

The braided nature of the Ashley River / Rakahuri channel becomes constrained by terrestrial weed (e.g. gorse and broom) growth in the mid-catchment and requires extensive weed control to protect braided river bird nesting habitat. The effects of forestry practices in the upper hill-fed catchments of the Okuku and Makerikeri Rivers has caused concern amongst community members, however poor monitoring records are unable to determine the real effects of such practices downstream. The introduction of new National Environmental Standards for Production Forestry (NES-PF) aim to specifically manage the environmental footprint of forestry practices (Appendix 5).

Spring-fed tributaries of the lower Ashley River / Rakahuri catchment are highly valued by both iwi and local community. The degradation of these streams is typical of that displayed by most spring-fed waterways in the Waimakariri Zone containing excessive deposited sediment and poor habitat quality. Water quality in these streams have flow-on effects to downstream aquatic environments, especially the Ashley River / Rakahuri – Saltwater Creek Estuary.

Zone Committee feedback

- Active riverbed and bankside weed control in the Ashley River / Rakahuri should be supported and also extended to the Okuku River.
- The Ashley River / Rakahuri should be considered as a priority braided river in Canterbury.
- Taranaki Creek is a priority area for investigating and implementing waterway enhancement opportunities.
- The impact of production forestry activities on hill-fed streams and rivers needs investigating and better management, particularly in regards to sediment runoff and deposition.
- Lees Valley requires special protection due to its importance as a natural landscape feature and contribution to the middle and lower reaches of the Ashley River / Rakahuri.

Suggestions for draft ZIPA

19. Increase support for riverbed and bankside weed control programmes that protect/enhance the braided river characteristics and nesting bird habitat in the Ashley / Rakahuri and Okuku rivers.

Committee Feedback 19

- Is this too vague? Do we need a whole of waterway approach/plan for weed mgmt., from the gorge down and including the Okuku River? Integrating with a whole of waterway approach for the Ashley/Rakahuri.
- Do we need more information on options
- Given this, do we rewrite the recommendation to describe what the ZC wants to see.
- Edit as above.

20. Recognise the Ashley River / Rakahuri for its important natural landscape values and provide improved regulatory protection of its braided river characteristics and encroachment consistent with other braided rivers in the region.

Committee Feedback 20

- Can we define it as outstanding, rather than important? Would this give it more weight under the RMA?
- Disc based on the catchment being reasonably highly modified.
- Conclude important is OK.

21. Prioritise on the ground projects to enhance Taranaki Creek, particularly projects related to:
 - a. reducing and removing sources and legacies of deposited fine sediment.
 - b. improving the quality of habitat for mahinga kai species.
 - c. removing barriers to native fish passage.

Committee Feedback 21

- Clarification of Taranaki Creek as culturally important. Add this to the description / wording re: Ngāi Tahu values. Add reference to proximity to Kaiapoi Pa
- Stormwater impact – does WDC do any WQ monitoring around Taranaki Creek?

22. Investigate the impact of forestry practices on downstream freshwater ecosystems by monitoring streams and rivers with production forestry in their catchments.

Committee Feedback 22

- OK

23. Environment Canterbury works with the forestry sector and the Waimakariri District Council to identify high risk periods over the next 5 years when and where earthworks and harvesting is likely to take place within the zone so that resources can be targeted at ensuring potential environmental effects are mitigated.

Committee Feedback 23

- OK

24. Support further research into factors that influence and/or control toxic cyanobacteria growth in the Ashley River / Rakahuri.

Committee Feedback 24

- OK.

25. Recognise **the upper Ashley catchment, including** Lees Valley, for its high natural landscape and ecosystem values, and protect its waterways from degradation by:
- avoiding any **further** land use development that results in increased contaminant losses to waterways.
 - preventing the removal or degradation of any existing wetlands.

Committee Feedback 25

- Edit as above
- Concern over **b.** and wording of 'any' existing wetlands.
- How does the LWRP address the protection of wetlands?
- Can we turn **b.** into an 'enhance existing' wetlands type of recommendation?
- How does **a.** translate into a plan rule?
- Possibly drop 'further' from **a.** as above
- Park for the Ashley/Rakahuri briefing workshop

Northern Waimakariri River tributaries

Many issues in the Waimakariri Zone are centred around the spring-fed tributaries that flow into the lower Kaiapoi River and eventually the mainstem of the Waimakariri River. Unlike other catchments in the zone, the Cam and Kaiapoi Rivers are sourced or flow through substantial urban populations. For this reason, these waterways receive stormwater inputs that can greatly affect instream water quality. Northern Waimakariri Tributaries are highly valued for their amenity and recreation values and there is significant scope to rehabilitate streams. The Cam catchment has received a considerable amount of time and effort investigated into on the ground projects aimed at restoring the ecological health of the river. Being centred amongst a growing and increasingly sprawling urban population, community education and environmental awareness programmes would benefit catchment-specific management plans.

Zone Committee feedback

- The urban environment is growing and increased waterway awareness amongst urban communities is required.
- A monitoring plan that measures stormwater effects in urban waterways needs implementing.
- Reinvigorating the Courtenay Lakes is an important project for the zone.
- Establishing an Eyre River recreation area will help reduce destructive recreational activities in more ecologically sensitive areas e.g., four-wheel driving in the Ashley River / Rakahuri.
- The Cam River and Silverstream are priority areas for investigating and implementing waterway enhancement opportunities.

Suggestions for draft ZIPA

26. ~~Ensure the life-supporting capacity of the Waimakariri River is maintained or improved by minimising contaminant losses from land use practices in the Waimakariri Zone.~~

Committee Feedback 26

- Is this too vague. Does this need to be more specific?
- We can delete this.

27. (1) Support public education and awareness initiatives aimed at improving the water quality and health of urban waterways and
(2) **Work with** WDC **to improve** stormwater infrastructure and management **strategy**.

Committee Feedback 27

- Split this into two recommendations as noted above.

- 2: Work with WDC to improve stormwater infrastructure and management strategy
- 27 & 28 move to add to Zone wide recommendations

28. Support a robust monitoring programme that measures water quality in urban streams and rivers.

Committee Feedback 28

- OK.
- 27 & 28 move to add to Zone wide recommendations

~~29.~~ Support projects that have enduring benefits for instream ecosystem and cultural values, and create recreational opportunities. ~~Projects include:~~
~~a. development of recreational area for four wheel driving in the Eyre River.~~
~~b. reinvigorating the Courtenay Lakes.~~

Committee Feedback 29

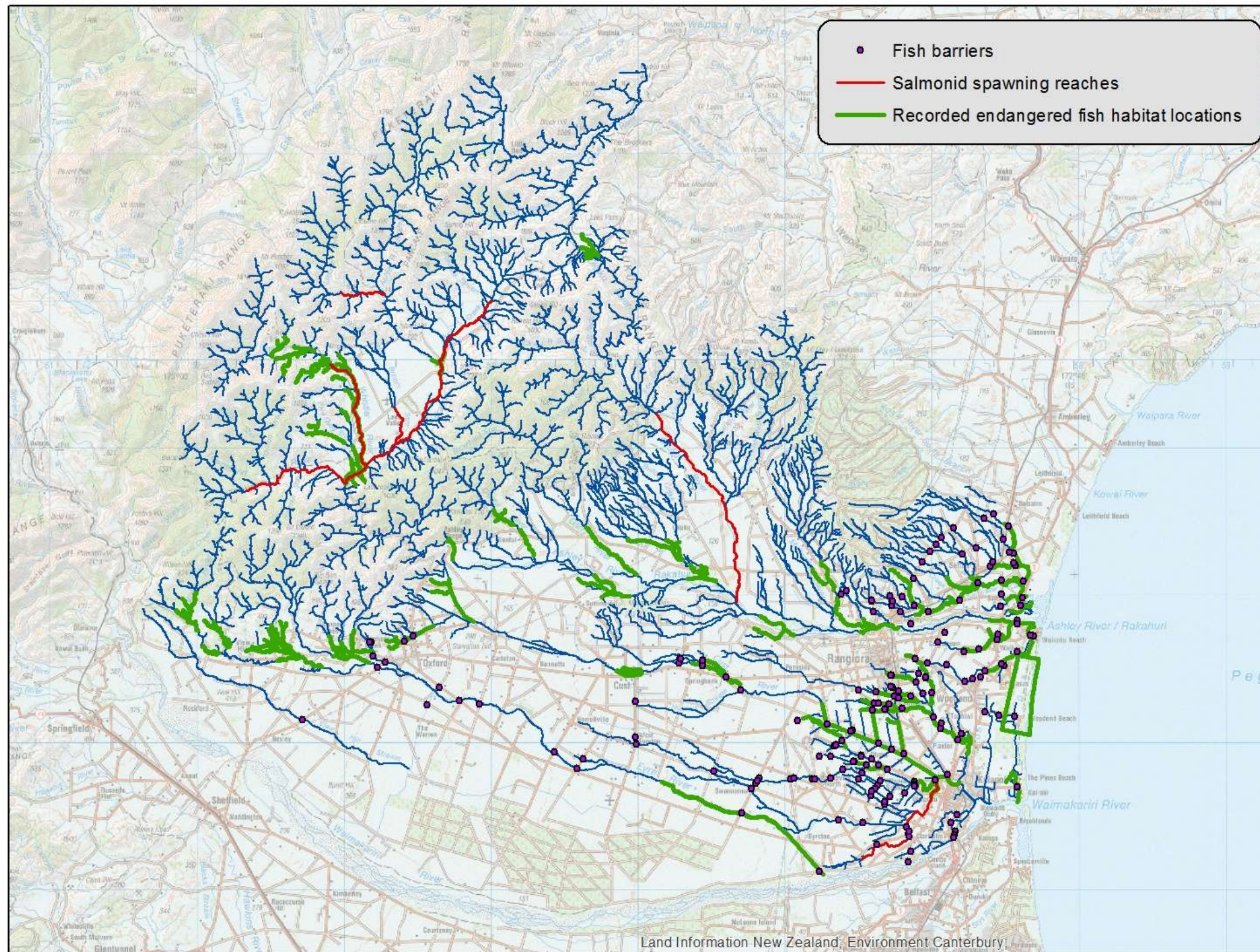
- Edit as above.
- OK

30. Prioritise on the ground projects, **including but not limited to**, the Cam River and Silverstream, related to:
a. reducing and removing sources and legacies of deposited fine sediment.
b. improving the quality of habitat for mahinga kai.
c. removing barriers to native fish passage.

Committee Feedback 30

- Edit as above.
- OK

Appendix 1



Known location of fish barriers, salmonid spawning sites, and endangered fish habitat. Spawning habitat and endangered fish habitat indicative of available data only and distributions are likely to be more extensive.

Appendix 2

Salmon spawning in the Waimakariri Zone

Schedule 17 of the LWRP lists a number of regionally significant salmon spawning sites in Canterbury. These sites are afforded additional protection, particularly during spawning times, through special provisions and rules throughout the LWRP. However, many significant salmon spawning sites remain absent from Schedule 17 including those situated in high-country spring-fed tributaries of the Waimakariri River. Initial consultation between Environment Canterbury and FGNZ staff indicated that salmon also spawn in the mainstem and headwater tributaries of the Ashley River / Rakahuri, and in Silverstream. These sites are also absent from Schedule 17 and the WWZC was asked whether they thought these should receive the added protection from being included.

Since the 27th November workshop, the technical team have been in contact with FGNZ to obtain salmon spawning data for the Waimakariri Zone. This was in response to a Zone Committee request and understanding that the Ashley River / Rakahuri is not a significant salmon fishery. Below outlines the reply received by Environment Canterbury staff from Scott Pearson, Environmental Advisor from North Canterbury Fish and Game.

“Steve (Terry) has said we don’t have any salmon spawning data at present for the Ashley. It is fair to say the salmon spawning run is very small, although at some future date, with improved flows it might again become a more viable salmon fishery.

The sites named also have value as trout spawning areas, with these sites listed as secondary salmonid spawning areas in our Schedule XX. The upper Ashley has been given a hard time, compared to its more pristine condition 20 years ago. I feel the additional protection is warranted, especially if the Waimakariri Zone Committee is serious about improving flows/fish passage in the Ashley and restoring some of the degraded spawning habitat in the Lee’s Valley.”

Appendix 3

Stock exclusion from waterbodies (27 November 2017 workshop Questions 7, 8, 9 and 11)

A summary of the LWRP stock exclusion provisions was provided 27 November in the memo “Instream Ecosystems Management Options” in Appendix 1 and 2.

In summary, the LWRP requires exclusion of non-intensive and intensively farmed cattle, deer and pigs from lakes, wetlands and rivers, and limits access to waterbodies to stock species that prefer to avoid water (sheep). For the purposes of stock exclusion, a river is defined as a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal). This definition does not capture drains or springheads.

Permitted Access to Waterways

Non-intensively farmed stock are allowed access to surface waterbodies provided their access does not result in pugging or de-vegetation that exposes bare earth in the bed or banks, and a conspicuous change in clarity or colour of that waterbody.

Consented Access to Waterways

Intensively farmed stock⁶ (cattle, deer and pigs) must be excluded from waterways that are greater than one metre wide, and 10 centimetres deep, and wetlands. If they are not excluded, a resource consent is required for stock access to that waterway. The LWRP considers stock access of this nature to be inappropriate.

Prohibited Access to Waterways

Any farmed cattle, deer and pigs are **prohibited** from having access to, and must be excluded from:

- a) Waterways with Inanga spawning habitat and salmon spawning sites
- b) Waterways with Community Drinking Water Supply Protection Zones
- c) Waterways 1000m upstream of a freshwater bathing site
- d) The bed or banks of all spring-fed plains rivers

In response to the Committee’s request for further advice on extensions to the stock exclusion rules and riparian setbacks, several options and suggested recommendations are provided below.

Option 1: Strengthening the Stock Exclusion Rules to Include Drains (Ref Q.7 & 8)

⁶ Cattle or deer grazed on irrigated land or contained for break-feeding of winter feed crops; Dairy cattle, including cows, whether dry or milking, and whether on irrigated land or not; Farmed pigs

Commentary

Spring fed streams in the Waimakariri zone generally have poorer health in terms of their ecology and sedimentation, and faecal contamination from stock access to waterways. Open drains, water races and canals can also be a direct conduit for contaminants into these streams. Map 1 shows the indicative extent of drains.

Suggested recommendation for draft ZIPA

- Rules excluding intensively farmed stock from waterbodies are extended to include all drains and other artificial watercourses that have surface water in them and directly discharge to a stream, river or lake.

Option 2: Strengthening the Stock Exclusion Rules to Include Springheads (Ref Q.11)

Commentary

Springheads are upwellings of groundwater that are the source from which the plains streams flow. As well as being important aquatic environments springs (waipuna) are also tapu (sacred) to Te Ngāi Tūāhuriri Rūnanga. Waipuna also have an important role in Māori cosmology and rongoā (Māori medicinal treatments)⁷. Environment Canterbury's Wells database holds information on the location of springs but with varying location accuracy. Map1 shows the indicative location of springheads.

Suggested recommendation for draft ZIPA

- Rules excluding intensively farmed stock from waterbodies are extended to include all springheads that permanently or intermittently contain water or connect to a river or surface waterbody.

Option 3: Riparian setbacks (Ref Q.9)

Commentary

The primary tool for determining if all stock are excluded from waterways with an appropriate setback distance are Farm Environment Plans and Management Plans. An "effective" setback distance for fencing a stream for stock exclusion will depend on the nature of the waterway, how vulnerable it is to contamination due to the surrounding land characteristics and practices, and whether the setback is for bank protection, or nutrient filtering and assimilation. These requirements are determined through the audit of FEPs.

⁷ Addendum Wāhi Tapu me Wāhi Taonga in the Waimakariri and Rakahuri Catchments of the Takiwā of Te Ngāi Te Ngāi Tūāhuriri Rūnanga (MKT October 2017)

The Zone Committee were in general agreement that PC5 Audited FEP and Management Plan requirement that “vegetated margins of **sufficient width** are maintained to minimise nutrient, sediment and microbial pathogen losses to waterbodies” was appropriate because the width could be determined by site specific considerations. However, the Committee wanted to see more education and guidance for farmers.

Note: Plan Change 5 Schedule 7A Management Plan for [permitted] Farming Activities stipulates vegetated buffer strips of at least 5 metres between areas of winter grazing and ant river, lake, drain or wetland.

Suggested recommendation for draft ZIPA

- The Zone Committee recommends that landowners are supported with education and guidance on appropriate set back distances and riparian plantings for different situations.

Option 4: Explicitly managing access to waterways by horses

Commentary

The Zone Committee sought that horses be explicitly referenced in the LWRP stock exclusion rules.

The extent to which that horses accessing rivers is a significant issue for water quality in the Waimakariri Zone is unclear.

We recommend that the region-wide stock exclusion rules are not amended to make specific reference to horses. This is unnecessary as horses are captured under the existing rules alongside other stock that are not intensively farmed, such as sheep. Stock that are not intensively farmed are only permitted to access rivers, lakes and wetlands without resource consent provided they do not cause pugging, de-vegetation that exposes bare earth or a conspicuous change in water clarity or colour.

However, the Committee may wish to manage access to rivers by horses by developing advice as a component of completing non-statutory Lifestyle Block Management Plans which it is actively promoting within the zone. While small holdings are not significant contributors to water quality issues individually, collectively they can contribute to issues given the large number in the Waimakariri Zone.

A Lifestyle Block Management Plan⁸ is a user friendly simplified version of Farm Environment Plan for small holdings less than 10 ha to help owners understand and take actions to manage the environmental risks associated with their land.

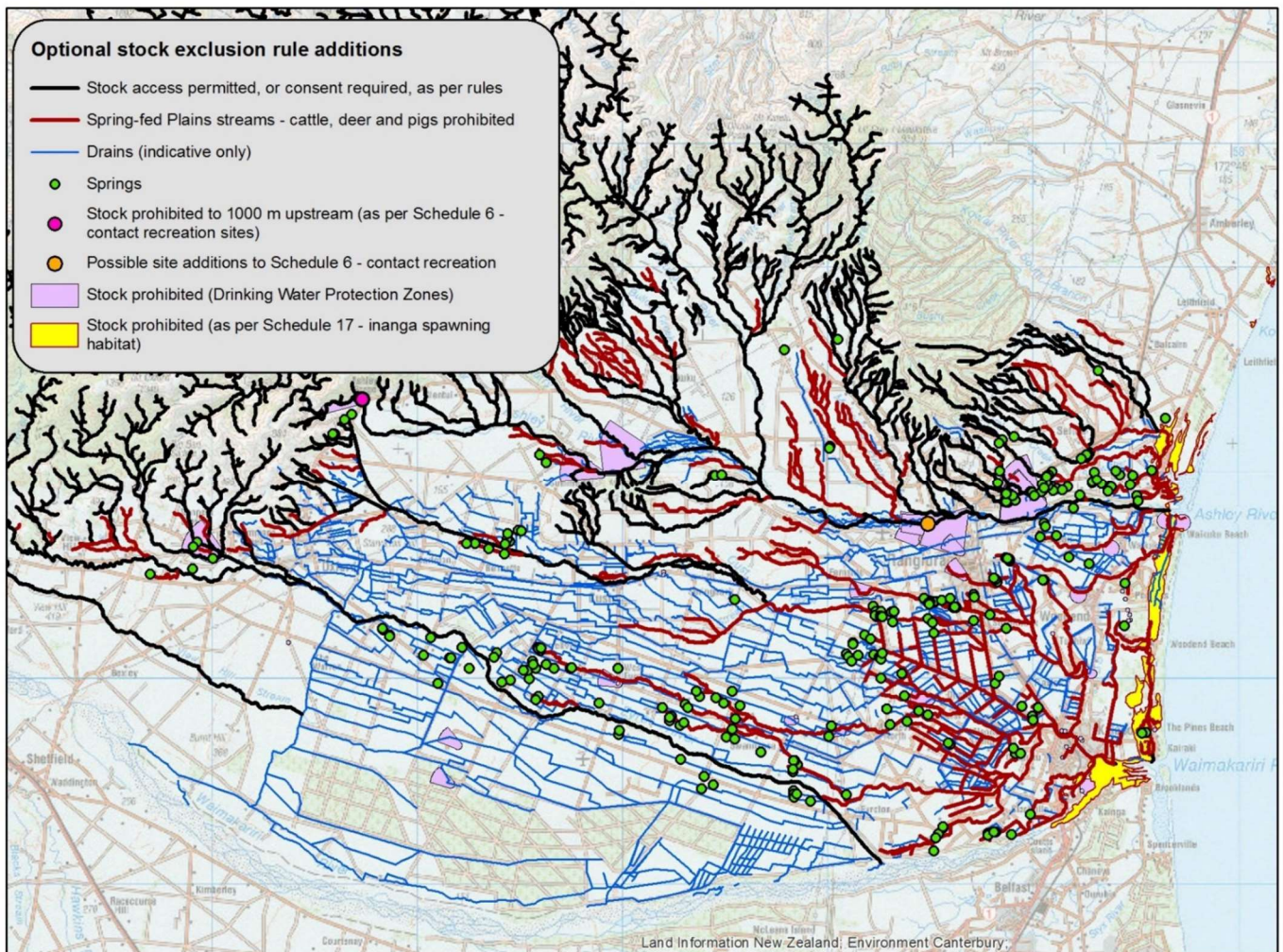
Suggested recommendation for draft ZIPA

- The Zone Committee recommends that guidance is developed on access to rivers by horses and used to support landowners in the development of Lifestyle Block Management Plans that the Committee is actively promoting within the zone.

Advisory Note: If, and when national regulations on stock access to waterbodies may come forward Environment Canterbury will be required to review the stock access provisions in the LWRP to ensure alignment with the regulations.

⁸ Lifestyle Block Management Plan Template:
<https://www.canterburywater.farm/assets/Uploads/PU8C-6023-Lifestyle-Block-Management-Plan-October-20152.pdf>

Map 1 - Surface water bodies where stock would be excluded if drains and springheads were included in the rules (indicative)



Appendix 4

Cyanobacteria in the Ashley River / Rakahuri

The 27th November 2017 workshop discussed many issues affecting instream ecosystem health and recreation in the Waimakariri Zone. One issue that was failed to be mentioned was cyanobacteria growth in the Ashley River / Rakahuri. Below provides a brief summary of the issue and implications for managing it. A more in-depth review of the subject is detailed by McAllister et. al. (2016)⁹.

What is cyanobacteria?

Cyanobacteria is more commonly known as blue-green algae. Cyanobacteria species belonging to the genus *Phormidium* grow in river environments, forming dark green-to-black mats on the surface of rocks (Figure 1). These mats consist of a slimy texture and can give off a musty odour. Cyanobacteria grows naturally in even very clean water environments, however over the past decade the alga has received growing attention as recorded blooms have become more prevalent in Canterbury rivers as well as in other regions throughout New Zealand. Since 2009, at least 103 rivers across New Zealand have been reported to have prolific growths (i.e. over 20% cover of the river bed) of *Phormidium*.



Figure 1: *Phormidium* mat growing on a river cobble.

⁹ https://www.parliament.nz/resource/en-NZ/51SCLGE_EVI_51DBHOH_PET68761_1_A535144/2b5eba855a108ce943aeca8c075f634e92d297a1

Why does it matter?

Species belonging to the genus *Phormidium* can produce a range of neuromuscular-blocking toxins. These can be harmful to both humans and animals with the first documented case of dog death resulting from cyanobacteria consumption occurring in 1998 in the Waikinae River (lower North Island). Since then, numerous confirmed cases have been reported throughout New Zealand including the Maitai River in 1999 and 2000, and Hutt River in 2005. Toxin levels can fluctuate dramatically both geographically (between *Phormidium* populations or rivers) and periodically (within the same population over time). For example, sampling in the Makakahi River in February 2012 found that anatoxin concentrations became 80 times higher within a week. When *Phormidium* growths proliferate, they can form filaments that eventually detach and deposit themselves along the banks of streams and rivers. At this point they are particularly vulnerable to consumption by dogs. Ingestion by humans can have a variety of symptoms including tingling sensations, stomach cramps and vomiting. There have been no known cases of human death related to toxic cyanobacteria contact in New Zealand.

Where is it monitored?

Cyanobacteria growth is monitored at popular primary and secondary recreation sites throughout Canterbury. Monitoring procedures follow national guidelines (MfE & MoH 2009), and occurs during the peak recreation season between mid-November and early-March. In the Waimakariri Zone, monitoring sites are located at:

- Ashley River at Gorge;
- Ashley River at Rangiora-Loburn Bridge;
- Ashley River at State Highway 1, and;
- Cust Main Drain at Skewbridge Rd

Alerts are issued for each site when bed cover exceeds 20 percent or when there is a large abundance of mats detaching. Following this, monitoring frequencies are increased, Community and Public Health and the Waimakariri District council are notified, media releases are issued, and warning signs are erected at affected sites.

All sites in the Waimakariri Zone have a history of cyanobacteria related health warnings being issued. At the time of writing this memo, the Ashley River at Rangiora-Loburn Bridge and State Highway 1 had both experienced cyanobacteria blooms and had health warnings issued for the 2017/18 summer. The Cust Main Drain at Skewbridge Rd was the only site to receive a warning over the 2016/17 recreation season, however it is not regarded as a primary contact recreation site.

What causes it?

Periphyton (or algae) accrual cycles describe the initial colonisation or development of a periphyton community, its subsequent growth, and the process that removes the periphyton (thus beginning the cycle again). The accrual rate of periphyton is typically determined by a suite of factors, most notably light, temperature, nutrient levels (nitrogen and phosphorus), stream flows and animal grazing. *Phormidium* mats differ from most other periphyton types (e.g. filamentous green algae and diatoms) due to their very thick and dense growth form. As such, the biochemical characteristics and functioning of *Phormidium* mats appear to differ markedly, as do the complex way that environmental factors affect their accrual rates.

The first part of the *Phormidium* accrual cycle (the colonisation of *Phormidium* cells) is poorly understood. However, studies suggest that *Phormidium* grows preferably on large stable substrates such as cobbles and boulders. It is also found on riverbeds with a high variety of substrate sizes, which may be because these habitats provide many refuges in the form of crevices, cracks and gaps that allow cells to “hide” and persist during and after flushing flows that have removed prior growths. Several studies have also suggested that water column nutrient concentrations can be a strong determinant.

The environmental factors influencing the growth rate of *Phormidium* are better understood but their interactions remain highly complex. Past studies have found that temperature is the most important variable affecting many periphyton accrual rates. However, the role of temperature in determining *Phormidium* accrual rates have been contradictory, with the most recent research finding no relationship between the two. Unlike many periphyton species which thrive under high nutrient environments, *Phormidium* mats grow well in environments where water column dissolved reactive phosphorus (DRP) levels are low (< 0.01 mg/L) and dissolved inorganic nitrogen (DIN) levels are moderate-to-high (> 0.2 mg/L, although proliferations have been found in Canterbury Rivers at lower DIN concentrations). As previously noted, the biogeochemical characteristics and functioning of *Phormidium* mats differ to that of other periphyton species, and studies suggest that the presence of nitrogen-fixing bacteria in *Phormidium* mats allow it to persist in water columns with lower DIN levels. Fine sediments suspended in the water column also adhere to *Phormidium* mats and are retained within its mucilaginous layer. It is thought that DRP bound to these sediments could be a nutrient source when water column DRP is low.

Grazing of periphyton by stream invertebrates such as snails and mayflies is known to control periphyton growth. While little research has studied the impacts of grazing on *Phormidium*, grazing insects have been found in amongst mats. The most influential factor known to reduce or remove *Phormidium* growths is high stream flows. Studies have found that water velocity and flow impacts differ between rivers. The level of flow required to remove a *Phormidium* bloom also depends on what stage during the accrual cycle the bloom is in.

How can we control it?

Effective mitigation strategies for removing/reducing growths of *Phormidium* are not well-known. Further research is required to better understand the environmental variables that regulate, and therefore control, *Phormidium* proliferations. It is suggested that nitrogen and sediment-bound phosphorus are two important contributors to growth, therefore reducing the input of such land-based contaminants may protect recreational users from risks associated with potentially toxic mats. Flushing flows have been used, in flow-regulated rivers, to remove nuisance periphyton growths in rivers. The Ashley River / Rakahuri is not flow-regulated and therefore this is not an option. It is important, however, to ensure that sufficient flows are retained in the river so that flushing provisions are retained for the removal of mats. Sufficient flows will also reduce the potential effect that increasing water temperatures may have on *Phormidium* accrual rates. Continued monitoring at recreation sites during summer, and robust warning protocols will help ensure that the public is protected.

References

- McAllister, T.G., Wood, S.A, and Hawes, I., 2016. *The rise of toxic benthic Phormidium proliferations: A review of their taxonomy, distribution, toxin content and factors regulating prevalence and increased severity*. Harmful Algae **55**: 282-294.
- Ministry for the Environment and Ministry of Health, 2009. *New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters – Interim Guidelines*. Prepared for the Ministry for the Environment and the Ministry of Health by SA Wood, DP Hamilton, WJ Paul, KA Safi and WM Williamson. Wellington: Ministry for the Environment.

Appendix 5

Plantation Forestry (Question 21 - 27 November 2017 workshop)

Background

The Zone Committee asked for further information on the potential erosion and sediment risks from plantation forestry activities in the hill-fed catchment of the Ashley River.

This memo summarises the current rules relating to plantation forestry in the LWRP and the anticipated benefits of nationally consistent regulation under the NES-PF and what it means for us.

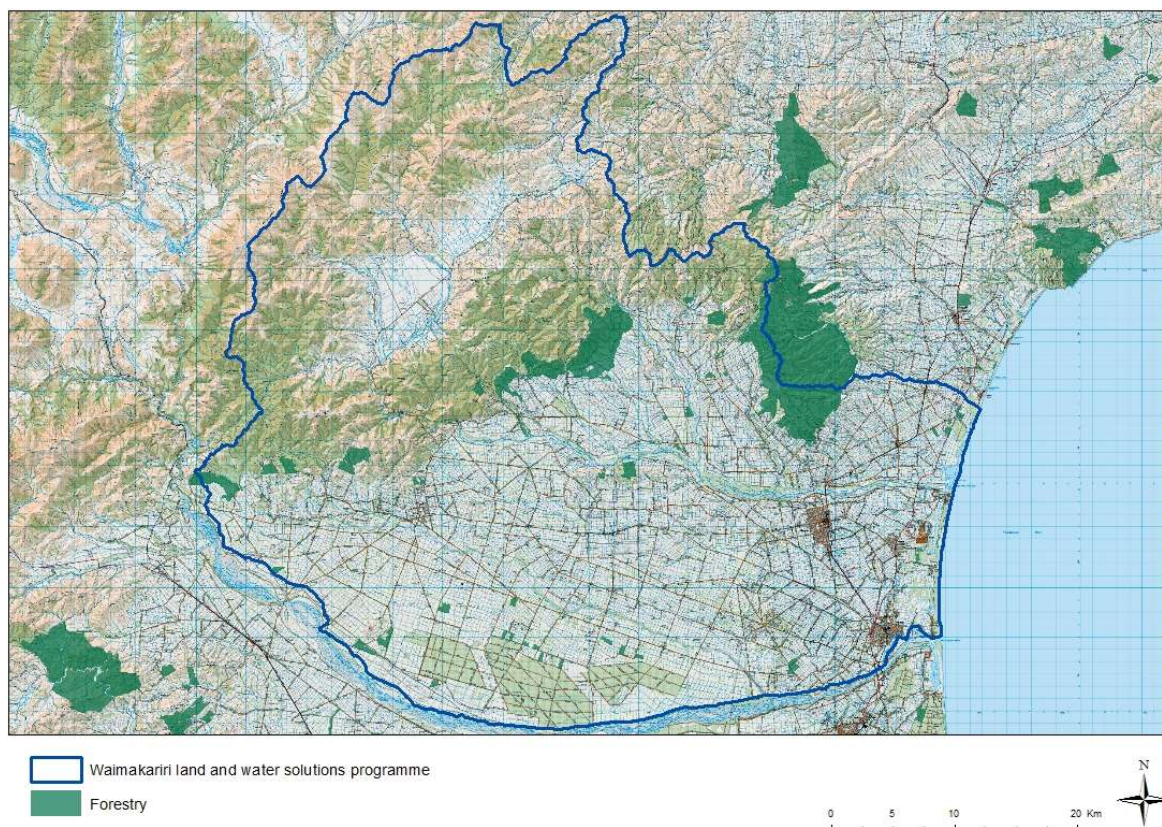
Canterbury Land and Water Regional Plan

There is no suite of rules solely for the plantation forestry sector in the LWRP. Rather, the environmental effects are controlled through more general rules relating to earthworks and vegetation clearance in riparian and erosion-prone areas. The rules do require that plantation forestry activities are undertaken in accordance with the Environmental Code for Plantation Forestry (2007) and Forestry Road Engineering Manual (2012).

National Environmental Standard Plantation Forestry (NES-PF)

The new NES-PF will come into force in May 2018. It is relevant to the zone because in most cases it will replace or prevail over any district plan and regional plan rules controlling forestry.

Plantation forestry is New Zealand's third largest primary sector. The map below shows the area of forestry in the Waimakariri sub-region which is around 7966 ha.



Plantation forestry can provide environmental benefits for water quality and controlling erosion whilst trees are growing. However, forestry can also have adverse effects on water quality and stream ecology with the greatest risks being during earthworks and harvesting are when soil is exposed.

To date, rules governing forestry activities and its environmental effects have been in district and regional council plans. These have varied across the country adding uncertainty and complexity for the forestry sector. The NES-PF aims to maintain or improve the environmental outcomes associated with plantation forestry activities and increase certainty and consistency in management and regulation of forestry.

What activities does the NES-PF cover?

The regulations apply to any forest larger than one hectare that has been planted specifically for commercial purposes and harvest. The NES-PF covers nearly all aspects of forestry including:

- afforestation
- pruning and thinning-to-waste
- earthworks
- river crossings
- forest quarrying

- harvesting
- mechanical land preparation
- replanting.

Key features to manage environmental effects

Most forestry activities are permitted by the NES-PF if conditions are met to prevent environmental effects. Conditions include:

- Setbacks for tree planting from rivers, lakes, wetlands and coastal areas
- A harvest plan identifying environmental risks including erosion susceptibility (using an Erosion Susceptibility Classification tool) and identifying mitigations to be used
- A forestry earthworks management plan that includes the installation and maintenance of storm water and sediment control measures so discharges do not cause a change in colour or visual clarity, make water unsuitable for farm animals or have a significant effect on aquatic life.
- Controls to protect fish from disturbance during spawning using a fish spawning indicator which lists 33 fish species, where they are present and spawning times.
- Measures to control the spread of wilding trees using a wilding tree risk calculator to assess the risk
- Requirement to give councils written notice of (amongst other things) when and where earthworks and harvesting are to be carried out.

Forest operators must apply for resource consent if permitted activity conditions cannot be met. Overall, the NES-PF is expected to raise environmental standards for most effects when compared to existing council rules.

What does it mean for Environment Canterbury and the Zone Committee?

We will need to implement the new regulations from May 2018.

The NES-PF requirements to give councils prior notice of activities including earthworks and harvesting and to produce earthworks and harvest management plans means we will receive much more information about forestry activities in the zone than in the past. The NES-PF also allows local authorities to charge for monitoring certain permitted activities including earthworks, river crossings, forestry quarrying and harvesting. This will mean we should be better placed to monitor compliance and manage the environmental risks from forestry.

Consideration is being given to expanding Environment Canterbury's Sediment and Erosion Toolkit to cover forestry activities and support implementation of the NES-PF in the region.

Overall, the NES-PF requirements are expected to lift the bar for managing environmental risks from plantation forestry in the zone. The NES-PF also provides an opportunity for Zone Delivery teams to build beneficial new relationships with the forestry sector which has largely been "off the radar" until now.

Plan Alignment with the NES-PF

WDC and Environment Canterbury will no longer need to develop forestry-specific rules in their regional and district plans for the eight activities covered by the NES-PF. The NES-PF will prevail over regional and district plan rules for plantation forestry because plan rules cannot be more lenient than a NES (in terms of activity status and/or conditions).

However, the NES-PF does allow for plan rules to be more stringent in specific circumstances. This includes to give effect to the NPSFM, the NZCPS, matters of national importance or to manage specific unique and sensitive environments detailed in the regulations.

Environment Canterbury will need to review the provisions in the LWRP to remove any duplication or conflict with the NES-PF and consider where more stringent rules may be required.

What is not covered by the NES-PF?

Some forestry related activities and effects are excluded from the regulations. For these, regional and district plan rules will continue to apply. Two potential effects in our zone are the effect of plantation forestry on cultural sites (such as wāhi tapu) and on stream flows (water yield) from the interception of rainfall.

The MKT report¹⁰ identifies areas and features of cultural significance within the Waimakariri and Ashley River/Rakahuri catchments. Further analysis is needed to determine culturally sensitive areas or sites where a level of protection may be required over and above the environmental effects managed by the NES-PF.

The effect of plantation forestry on water yield will continue to be managed by provisions relating to “flow sensitive catchments” in the LWRP. A flow sensitive catchment is:

“the catchment of a river which is dependent on rainfall as its main source of flow, has limited ability to store water, and where evapotranspiration can be expected to exceed precipitation between December and April resulting in very low flows in summer and autumn compared with mean flows”

The Okuku River upstream from the Fox Creek confluence is the only river identified as flow sensitive catchment in section 8 (Waimakariri) of the LWRP and subject to specific provisions.¹¹

In flow sensitive catchments, rules permit replanting of an existing plantation forest if it was harvested within the last five years. New areas of plantation forest require resource consent provided that:

¹⁰ Addendum. Wāhi Tapu me Wāhi Taonga in the Waimakariri & Rakahuri Catchments of the Takiwā of Te Ngāi Tūāhuriri Rūnanga (Makaanui Kuritaiao Ltd, October 2017)

¹¹ LWRP Section 8, Policy 4.75, Rules 5.72 -5.74

- The total area of planted forest does not exceed 20 percent of a small flow sensitive catchment or sub-catchment (less than 50 km²); or
- For larger catchments, new plantings do not reduce the 7 day MALF by more than 5 percent and / or the mean flow by 10 percent

Suggested recommendation for draft ZIPA

- Environment Canterbury works with the forestry sector and the Waimakariri District Council to identify high risk periods over the next 5 years when and where earthworks and harvesting is likely to take place within the zone so that resources can be targeted at ensuring potential environmental effects are mitigated.

References:

- Ministry for Primary Industries web pages on National Environmental Standards for Plantation Forestry. <https://www.mpi.govt.nz/growing-and-harvesting/forestry/national-environmental-standards-for-plantation-forestry/>
- Resource Management (National Environmental Standards for Plantation Forestry) Regulations 2017. <http://www.legislation.govt.nz/regulation/public/2017/0174/latest/whole.html>