

PRR Interim Strategic Plan 2020 - 2023



PRR Report 2020/03

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1. Preface

PRR is a braided river and wetland ecosystem restoration programme located in the upper Waitaki Basin. It is run by the Department of Conservation (DOC) and funded by Meridian Energy and Genesis Energy under a compensatory agreement that recognises the impacts of hydroelectric power development on these rivers and wetlands.

This strategic plan is a guiding document that follows and builds on previous PRR strategic plans (1998-2005, 2005-2012, 2012-2019). Its main purpose is to describe the long-term vision, guiding principles, and strategic approach the project will take however this plan will cover an interim period while a new compensatory agreement is reached as part of the renewal of resource consents that Meridian Energy and Genesis Energy are about to apply for. Once that process is complete and a new agreement is reached, a new seven-year strategic plan will be produced, hopefully by 2023 at the latest.

This interim strategic plan follows the strategic direction of previous plans and is in accordance with findings of an independent external review of PRR's efficiency, performance and strategic effectiveness and more recent science advice on strategic direction. It also provides an overview of PRR's origins and achievements to date, and describes the Project's relationship with Meridian Energy, Genesis Energy, other administering agencies, and other partnerships projects such as Te Manahuna Aoraki. The strategic plan does not prescribe detailed workplans and actions; these are listed in other documents which are already completed or will be prepared during this strategy.

There were some subtle changes in focus and approach over the latter period of the 2012-2019 strategic plan, including the following which have been adopted in this new interim plan:

1. Moving to a "whole river, whole ecosystem approach" which includes the riverbanks, lower terraces, terrace risers and terrace edges, and especially all associated wetlands.
2. More emphasis on indigenous non-migratory fish species, especially bignose (*Galaxias macronasus*) and lowland longjaw galaxias *Galaxias* aff. *cobitinis* ("Waitaki River"), which suffer from habitat degradation of wetlands (including springs), water quantity/flow issues and from trout predation. Several isolated populations of galaxiids need urgent protection. This may include further fish survey work to determine the current distribution of these species and the physical protection of key sites, using trout exclusion fish barriers of some springs and headwaters.
3. PRR is injecting new life into the establishment of effective partnerships with universities and will financially and logistically support students carrying out applied research in the upper Waitaki Basin on relevant topics.

4. More attention is being given to fauna monitoring, especially with regards to annual bird surveys of braided rivers, a repeat of the comprehensive 1991-1994 (base-line) surveys.

In 2016 PRR celebrated its 25th anniversary by publishing a book written by Neville Peat with Brian Patrick and Aalbert Rebergen.

2. Summary

- PRR (PRR) is a Department of Conservation programme that aims to maintain and enhance river, adjacent river terrace and wetland habitat, ecological communities and populations of indigenous animals and plants that use these habitats in the upper Waitaki Basin.
- PRR is funded by Meridian Energy and Genesis Energy under a compensatory agreement that recognises the adverse effects of hydroelectric power development on upper Waitaki Basin rivers and wetlands.
- The agreement was signed in November 1990, amended in May 2011, and is tied to the term of the power providers' consents to take and use water, which expire on 30 April 2025. PRR began operations in late 1991.
- PRR's agreed role is to undertake ecological management and research programmes focused on maintaining, restoring and enhancing habitat and ecological communities in the river, adjacent river terrace and wetland ecosystems of the upper Waitaki basin, with further direction and objectives for work set out in seven-year strategic plans.
- Department of Conservation, Meridian Energy and Genesis Energy review PRR's funding and direction every seven years when strategic plans are renewed.
- The fourth seven-year period ended on 30 June 2019, however as Meridian Energy and Genesis Energy are entering the process of renewal of the water resource consents, they have agreed that this strategic plan will essentially follow the strategic focus of the previous plan while a new compensatory agreement is reached. Regardless of the outcomes of that process, the Department of Conservation, Meridian Energy and Genesis Energy aim to maintain and build on their constructive, mutually beneficial relationship.
- When implementing PRR, Department of Conservation will continue to maintain close working relationships with Environment Canterbury, Land Information New Zealand, local territorial authorities, iwi, and private landholders.
- This strategic plan outlines PRR's origins and achievements to date, describes its long-term vision, guiding principles and objectives.
- PRR's key objectives for its fifth (interim) phase of operation are to:
 1. Maintain indigenous biodiversity and protect and restore terrestrial and aquatic river and wetland habitat and the ecological communities within it by controlling and where possible eradicating invasive weeds.
 2. Continue to test the effectiveness of, and implement, large-scale experimental predator control for population recovery of braided river and wetland fauna.
 3. Increase awareness of braided rivers and wetlands within a changing environment.
 4. Continue to gain ecosystem knowledge in upper Waitaki rivers and wetlands through research and monitoring and attract and facilitate research by external agencies, especially universities, to improve our understanding of the complex ecology of braided river systems, contributing to better habitat and biodiversity management. This includes the financial and logistical support of students who carry out applied research in the upper Waitaki Basin on relevant topics.
 5. There will be additional focus on a "whole river, whole ecosystem approach", which also includes the riverbanks, lower terraces, terrace risers and terrace

edges, and especially associated wetlands such as springs, streams, ponds and backwaters, for the benefit of birds, plants, invertebrates, lizards and fish. Waitaki endemic non-migratory fish species; bignose, lowland longjaw and upland longjaw galaxias, are highly threatened and need urgent action of protection and management, including survey and monitoring and the physical protection of some key sites.

3. Project Background

Water in the Waitaki catchment has been used to generate electricity for the national grid since 1935. The Waitaki power scheme was developed between 1935 and 1985 and currently comprises eight power stations producing 7600 GWh on average each year, depending on inflows. Collectively, the Waitaki power scheme is the largest hydroelectric generating system in New Zealand generating 18 % of New Zealand's annual electricity requirements, with Lakes Tekapo and Pukaki providing approximately 60% of the country's hydro storage capacity.

The construction and commissioning of the upper Waitaki section of this network in the 1970s was authorised by the Government of the day. In 1988 the Waitaki Catchment Commission initiated discussion around ECNZ obtaining water rights to replace the more general Government authorisation. Consultation was undertaken by forming the ECNZ Waitaki Water Rights Working Party, which comprised a range of water users: ECNZ, Upper Waitaki District Council, Waitaki Catchment Commission, MAF Fisheries, Department of Conservation, Omarama and Upper Waitaki Federated Farmers, Ngäi Tahu, Otago Canoe and Kayak Club, Transit New Zealand, Royal Forest and Bird Protection Society, New Zealand Salmon Anglers Association, Waitaki Valley and South Canterbury Acclimatisation Societies, Opihi Augmentation Society, Ministry for the Environment, and DSIR Hydrology Centre. The working party assessed the concerns and proposals of water users during 18 months of consultation. As a result of the working party process, several compensatory agreements between ECNZ and individual user groups were drawn up.

One such compensatory agreement was the Compensatory Funding Agreement between ECNZ and Department of Conservation which explicitly recognised the impacts of hydro electric power generation on braided river wading birds and established PRR. An alternative habitat enhancement proposal - to release four cumecs of water down the Pukaki River - was rejected by ECNZ and DOC as it was more costly and would have provided a smaller conservation gain. All members of the working party endorsed the ECNZ-DOC agreement.

Department of Conservation and ECNZ signed the agreement in November 1990, and PRR began operations in late 1991. Meridian Energy took over responsibility for this agreement from ECNZ on 1 April 1999 and in September 2006 it was rewritten to reflect the changes in objectives and priorities that occur over time as new information and different management approaches develop. The new agreement confirms PRR's role as an *"...ecological management and research programme focused on maintaining and*

enhancing habitat and ecological communities in the riverbed and wetland ecosystems of the upper Waitaki basin...” with the focus and objectives of work to be undertaken set out in successive seven-year strategic plans. PRR’s funding and direction is reviewed every seven years through development of these strategic plans.

In May 2011 responsibility for the agreement was further shared with Genesis Energy when this company acquired Tekapo A and B Power Stations from Meridian Energy in the upper Waitaki at Lake Tekapo, including the Tekapo/Pukaki Canal. The term of the agreement is tied to resource consents held by the power generation companies to take and use water in the upper Waitaki, which expire in 2025.

This strategic plan covers the fifth (interim) period of operation for PRR. Meridian Energy and Genesis Energy are currently funding PRR at nearly \$567,000 per annum (excluding GST) with future annual adjustments tied to the consumer price index.

4. Strategic context

The project has been operating for nearly thirty years now and is close to the end of the consenting period for upper Waitaki hydro power resource consents. Provision was made under the current funding agreement between the Department of Conservation, Meridian Energy and Genesis Energy for an independent review of the project to be commissioned assessing the effectiveness, efficiency and ecological significance of PRR’s operations, including an assessment of the project’s strategic planning approach. The review was completed in 2012 (Innes and Saunders 2012), finding PRR has been a highly effective braided river restoration agency since its inception, has been very resource-efficient at achieving its outcomes and endorsed the project’s strategic direction as outlined in its 2005-2012 Strategic Plan (Woolmore and Sanders 2005). Reviewers did not see a need for major changes to how PRR operates in terms of effectiveness, outcome delivery, strategic direction or stakeholder communication. They did however alert to a growing number of pressures on our rivers, from land intensification, water allocation and recreational use of rivers and surrounding environments. Review recommendations were incorporated into the 2012-2019 strategic plan.

In early 2020, science advice was sought to consider any changes to strategic focus and research priorities for this interim plan and some aspects of this advice have been incorporated into the plan.

5. Project achievements 2012-2019

In the period 2012-2019 PRR has achieved some outstanding results. The project has maintained focus on the preservation and restoration of braided river and wetland habitat, increasing knowledge, understanding and better management of key ecosystems and passing this knowledge on to community, stakeholders, schools and universities. Specific achievements include:

- Maintaining over 23,000 hectares of natural braided river habitat by targeted removal of problem weeds before they become widespread, concentrating on protecting high quality habitats.

- Undertaking weed management of selected sections of modified habitat to restore habitat quality over a further 7000 hectares of braided riverbed.
- On average, over 3500 hours of spraying carried out by staff and contractors every year.
- Cover and size of lupins on the Tasman River are steadily decreasing each year. Costs have gone from over \$70,000 spent on contractor time annually to less than \$20,000.
- Sites with yellow tree lupin and buddleia have been mapped and continue to be controlled annually. This work has achieved a reduction in the presence of these weeds in the basin with a decline in the number and size of plants.
- Establishment of a comprehensive weed surveillance system to detect and deal with new incursions of weeds. One weed that was picked up was false tamarisk and it has been maintained at extremely low levels in the Tasman, Cass and Godley Rivers.
- Running weed identification workshops and producing and distributing pocket sized weed ID booklets to staff and contractors.
- Raising awareness about invasive weeds and reporting by staff, contractors, general public, of new weed incursions on our rivers and wetlands.
- Contributing to our understanding of braided river and wetland ecosystem composition, structure and functioning by undertaking and facilitating research.
- Funding a large-scale predator control operation in the Tasman River to benefit multiple wader bird species. This was the first intensively managed, catchment scale predator control operation attempted for multiple predator species in a braided river environment. It is a joint initiative between the Kaki recovery programme, PRR and more recently Te Manahuna Aoraki (TMA).
 - During the seven years (of the last plan) of continuous predator trapping, large numbers of predators have been removed from the Tasman River: 4146 hedgehogs, 2599 stoats, 1385 feral cats, 287 ferrets, 231 possums, 158 weasels, and 64 rats.
- Continuing a localised, intensive predator control programme centred on an island in the upper Ohau River (known as Tern Island) to test an alternative approach to protecting colonial nesting birds (black-fronted tern/tarapirohe) from mammalian predation. This approach started with both direct predator control methods and indirect methods (rabbit control and the 'island/moat effect'). However following a review in 2016, rabbit control was discontinued, and the radius of the area being targeted was reduced from one km to 500 metres.
 - During the seven years (of the last plan) of continuous predator trapping, large numbers of predators have been removed from the Tern Island area: 1030 hedgehogs, 119 stoats, 475 feral cats, 737 ferrets, 30 weasels, and 135 rats.
 - Breeding success of black-fronted tern/tarapirohe is monitored each year as a measure of the success of the trapping programme. Results have been highly variable, ranging from 43% - 90% hatching success and of the nests to hatch chicks, 0% to 69% fledging success over the first five years of the plan. However in the last two years, despite large numbers of terns attempting to breed, mass abandonment of

the colony occurred due to predator disturbance in 2017/18 and predator disturbance and flooding in 2018/19.

- In the 2016/17 year, monitoring of Lakes skinks in the trapped area was started. This Nationally Vulnerable species was initially going to be compared to skinks at an adjacent non-trapped site however Lakes skinks could not be found elsewhere nearby.
- A pilot survey of terrestrial invertebrate fauna in the Tasman River was designed and implemented to provide information on braided river invertebrate species assemblages and refine survey methodology for wider scale assessments in the future. Species identification (152,509 specimens collected) and compilation of results was time consuming, however a final report has now been written. A total of 919 unique recognisable taxonomic units were identified from these specimens, representing 165 arthropod families, 21 orders and five classes (Murray, 2019).
- Repeat surveys over three consecutive years of riverbed birds in the Godley Macaulay and Cass Rivers in the early part of the period and then switching to the Tekapo and Ahuriri Rivers. This is part of an ongoing long-term programme of monitoring bird population trends in upper Waitaki braided riverbeds.
- Ongoing management of over 80 hectares of constructed wetlands which have been highly successful in attracting a variety of wading birds, waterfowl and other wetland birds and have important botanical values.
- Maintaining a close relationship with the University of Otago Wildlife Management course by providing practical exercises and introducing students to braided river and wetland management concepts as part of their annual field trip to the Mackenzie basin.
- Supporting PhD research to investigate how flood-induced processes affect lupin mortality and determine the correlating flood events that drive these processes. This work will help make informed decisions about management of herbaceous weeds in braided rivers.
- Supporting research by a University of Canterbury student into the Nationally Endangered Robust Grasshopper. This included determining the best ways of monitoring the grasshopper and training PRR/DOC staff for future monitoring.
- Supporting research into mouse densities in the Mackenzie Basin by a University of Otago student.
- Using various methods to raise the profile of braided rivers as unique and valuable ecosystems: among policy-makers, ecologists, conservation groups, the general public, and various stakeholders.

6. Natural values of braided rivers

Braided rivers are defining features of the eastern side of the South Island. Following the end of the last glaciation some ten thousand years ago, retreating glaciers deposited gravels and boulders and large rivers carried gravels and silts down the mountain valleys of the east coast to form the flat inter-montane basins and coastal plains we see today. Locally, rivers of the Lake Tekapo, Lake Pukaki, Lake Ohau, and Ahuriri catchments have

deposited sediments and created relic channels that crisscross the floor of the upper Waitaki Basin. The processes of geological uplift, erosion, and alluvial transport continue today to create our familiar braided rivers – rivers characterised by their wide gravel beds, numerous sinuous channels, and highly variable flows. World-wide, only Alaska, Canada and the Himalayas have similar, extensive braided rivers.

While braided rivers are internationally unusual, their plant and animal communities in New Zealand are unique. Numerous plants, birds, invertebrates, fish and lizards have specialised to varying degrees for life in New Zealand braided rivers and some are found nowhere else in the world. Many of the plants and animals that are reliant on braided river habitats are declining in numbers, with more than fifty species currently classified as threatened. Perhaps most specialised is wrybill/ngutu pare, which migrates inland and breeds only on uniformly sorted, un-vegetated, flat gravel expanses of braided rivers. Black-fronted tern/tarapirohe, banded dotterel/turiwhatu, black stilt/kaki, South Island pied oystercatcher and black-billed gull/taräpuka also depend on braided riverbeds for specialised breeding requirements.

At least sixteen other bird species, including Australasian bittern, marsh crake, pied stilt, various cormorants (shags), Caspian tern, and herons, breed and forage in Canterbury's braided rivers and adjacent wetlands. Occasionally, uncommon Asian migrants such as the white-winged black tern are sighted in Canterbury rivers and have even bred here.

Under the classification system which ranks New Zealand plants and animals according to their threat of extinction (Townsend et al., 2008) a number of birds associated with braided rivers and wetlands have been assessed as being Threatened: kaki, Australasian bittern and black-billed gull (Nationally Critical); black-fronted tern (Nationally Endangered); wrybill, banded dotterel, Caspian tern and Southern crested grebe (Nationally Vulnerable) (Robertson et al, 2013). Other birds assessed as being At Risk are: South Island pied oystercatcher and marsh crake (Declining) (Robertson et al, 2016). The rivers and wetlands of the upper Waitaki Basin are a stronghold for many of these bird species.

Braided rivers and their adjoining environments are also important habitat for numerous other endemic animals. McCann's skink, Southern grass skink, long-toed skink, , scree skink, Mackenzie skink, Lakes skink, jewelled gecko and Southern Alps gecko have all been recorded at various locations throughout the upper Waitaki Basin, making use of dry rocky areas, boulder-field and shrubland habitat in or alongside riverbeds. Long-toed skink and scree skink, Mackenzie skink and the Lakes skink (the latter species is taxonomically indeterminate) are all assessed as being Threatened: Nationally Vulnerable and jewelled gecko and Southern grass skink (the latter taxonomically indeterminate) are At Risk: Declining (Hitchmough et al. 2015).

Two migratory and eight non-migratory native freshwater fish species are found in upper Waitaki rivers and streams. Two of the non-migratory fish are recently described species with very localised distributions, and recent work indicates that some species are genetically divergent from similar species living outside the Waitaki catchment (Waters and Craw 2008). Bignose galaxias are only found in upper Waitaki tributaries, lowland longjaw galaxias (Waitaki River) are known from a limited number of sites in the upper Waitaki catchment and upland longjaw galaxias (Waitaki River) are associated with the

large upper Waitaki braided rivers. Populations of all these fish are all declining (Dunn et al. 2017) and are recognised as being Nationally Endangered (lowland long-jaw) or Nationally Vulnerable (upland long-jaw, bignose galaxias) . Other non-migratory fish include upland and common bullies, Canterbury galaxias and alpine galaxias. Longfin eel, lamprey and koaro (a whitebait species) are the only native fish in the upper Waitaki which normally migrate to the sea to complete part of their life cycle, although historical records of lamprey penetrating inland to upper Waitaki rivers are sparse. All these species have been inhibited in their ability to migrate by the presence of major dams on the Waitaki River. Longfin eel are entirely dependent on passage to the sea to breed and lamprey migrate to sea during adult development. On the other hand, koaro are known to be more flexible in their spawning requirements, breeding in small tributaries entering inland lakes. Lamprey is classified as Threatened: Nationally Vulnerable and Koaro and longfin eel are classified as At Risk: Declining.

Our braided rivers also support a diverse but poorly known terrestrial invertebrate community. Several notable macro-invertebrates have been described and many others require further taxonomic work. Of those that we know about, robust grasshopper was rediscovered in the early 1980s and is known from limited sites in and near the Ohau, Pukaki, and Tekapo Rivers and Fork Stream. It has a threat classification of Threatened: Nationally Endangered. Another short-horned grasshopper, *Sigaus minutus*, is also endemic to upper Waitaki Basin riverbeds and has a threat classification of At Risk: Declining.

Despite the apparent sparseness of riverbeds, over 300 native plant species, 35 mosses and liverworts and 41 lichens form mosaics of distinctive communities in the riverbeds and adjoining wetlands of the upper Waitaki rivers. Although not rare, many of these communities are best represented in riverbed environments. Typical early pioneer species include various encrusting lichens, mosses, tiny cushion plants, willow herbs and wispy native grasses. With time, these plants form blankets of plant cover and tussocks, and woody shrubs slowly establish, in turn becoming the dominant plants. The whole process is dynamic, often being disrupted by changing river channels and scouring floods resulting in the mosaic of vegetation development typical of braided riverbeds. Some eye-catching species include the prostrate shrub, *Helichrysum depressum*, with its cryptic grey foliage and contrasting white fluffy seed heads, *Pimelia prostrata* a native daphne with a profusion of small white scented flowers and the cushion plant *Myosotis uniflora* with tight cushions of delicate white or lemon flowers. Twenty two plants classified as Threatened or At Risk have been recorded in upper Waitaki riverbeds; two are Nationally Critical, two are Nationally Endangered, one Nationally Vulnerable, seven Declining, and ten Naturally Uncommon (De Lange et al. 2017).

7. Pressures facing braided rivers and wetlands

Braided rivers of the upper Waitaki Basin and the plants and animals they support are facing a variety of influences and impacts from external, usually human induced sources. Many of these pressures have been operating consistently over long time frames while others have developed or increased significantly over the last seven years.

Water control for hydro-electric power generation has caused a major reduction in the amount and quality of braided river habitat and associated stable side channels and wetlands in upper Waitaki braided rivers. Diversion of water into canals has severely modified flows in the Tekapo, Pukaki and Ohau Rivers reducing the size and frequency of floods, changing the timing of floods, reducing substrate disturbance, and allowing vegetation to establish more quickly. Raising natural lake levels or creating artificial lakes has inundated a further 7400 hectares of braided riverbed and 3900 hectares of wetlands (Wilson, 2000). Dam construction has affected the ability of long finned eel and koaro to move freely between inland rivers and the coast where they spawn. Long-finned eels have become uncommon in the upper catchment, whereas koaro have adapted to the changes and formed land-locked breeding populations.

A suite of introduced mammals (cats, ferrets, stoats, hedgehogs, and rats) prey on riverbed fauna. Large invertebrates, lizards, nesting birds, eggs and chicks are all part of the diet of these predators. For many species the level of sustained predation is affecting population viability as rates of adult mortality exceed replacement by juveniles.

River engineering works are commonly used to protect important structures or economically productive land uses within or adjoining braided riverbeds. The effect of these works is to constrain the river, either by stabilising banks through planting exotic trees or narrowing the floodplain available for peak flows to spread across. This can affect river flows, changing the way braid channels erode and form, or altering the floodplain sediment supply. The planting of exotic trees such as willow and alder in engineering works has acted as a source for further spread of problem plants into the floodplain. These actions reduce the amount and quality of braided river habitat.

Land use intensification and pastoral development have resulted in an estimated loss of 90% of wetlands in Canterbury, a process which continues as wetlands are drained, damaged by stock or the natural hydrology impacted by groundwater abstraction and vegetation clearance. Similarly, pastoral development has displaced whole sections of alluvial riverbed succession sequences. Of particular concern are the displacement of indigenous communities by pasture grasses on more fertile alluvial surfaces and the trampling effects of stock in wetlands.

Thousands of exotic plant species have been introduced to New Zealand for ornamental or productive use or arrived as accidental immigrants with imported goods. Currently, 33% of plant species found on upper Waitaki river beds are exotics (Woolmore 2011). In riverbeds the diversity and percentage cover of exotic vegetation is thought to increase, especially because of the intensification of the river margins. Many exotic plant species are colonising weeds that can out-compete native plants and occupy a wide range of river floodplain environments. They can displace whole natural plant communities and adversely affect the quality and quantity of habitat available for native plants and animals, especially those that are adapted to open, bare or sparsely vegetated riverbeds.

The adverse effects of multiple threats are often inter-related, complex and more than additive in their cumulative impact. For example, a reduction in river flow can reduce quantity and quality of feeding habitat for wading birds, as well as allowing predators access to islands previously safe for fauna. Lower flows also lead to increases in vegetation

cover which in turn destroys open gravel bird nesting habitat and provides better cover for predators.

In the past decade land-use in the upper Waitaki basin has undergone rapid change. Pastoral practices are moving away from extensive grazing to more intensive farm management systems dependent on a reliable water supply for irrigation. Water abstraction from rivers, streams and groundwater can adversely affect the quality and quantity of habitat available for plants and animals as well as the physical functioning of braided river systems. Stock intensification can affect quality of habitat by increasing the levels of nutrients entering waterways and groundwater from fertilisers or animal effluent. Small, spring-fed tributaries are important reservoirs of freshwater biodiversity and are particularly vulnerable to changes in shallow groundwater water quality and quantity, as well as the effects of trampling stock.

An increasing number of people choose to visit or live in the upper Waitaki with a clear focus on outdoor recreational pursuits. Recreational activities in riverbeds can have unintended impacts on the fragile vegetation or disturb nesting birds and other fauna, especially as demand for these activities are increasing. The proliferating use of four-wheel drive vehicles and motorbikes in riverbeds is of particular concern.

Climate change is expected to significantly alter the climate and hydrology of Canterbury with warmer temperatures and less rainfall predicted in the east and more rainfall, less snow and fewer frosts in the west. Rivers in the upper Waitaki headwaters are fed from deep within the Southern Alps and may experience increased flows and larger floods during the bird nesting season. On the other hand increased spring moisture will encourage spring vegetation growth and this could result in increased rabbit and predator populations. Drier summer conditions and more frequent droughts in eastern Canterbury may further increase pressures on rivers due to water abstraction and irrigation.

The braided rivers and associated wetlands of the upper Waitaki Basin have a unique flora and fauna and are an important part of New Zealand's natural heritage that deserves protection. The challenge is to retain this distinctive habitat and landscape while accommodating the varied uses and economic demands society places on braided river systems.

8. Opportunities in braided river and wetland management

Alongside the increasing and competing demands for use of water from Canterbury rivers and aquifers, there has developed a greater awareness and recognition of the national and international importance of the natural values of braided river systems. The Canterbury Water Management Strategy has led to the recognition of braided rivers as important environmental features in the management of water quality and quantity by regulatory authorities in Canterbury. Implementing the Strategy through the Upper Waitaki Zone Implementation Programme supports PRR and seeks to achieve other measures for braided river protection. Working with the Zone Committee in the implementation of this programme will provide opportunities for complementing and enhancing PRR's existing work.

Similarly, the first region-wide, collaborative vision for maintaining and enhancing natural heritage in Canterbury has been developed by a multi interest Advisory Group and adopted by many regulatory authorities. The Department of Conservation recognises the significance of braided rivers as naturally rare ecosystems and the role of braided rivers in supporting rare and endangered plants and animals (Holdaway et al. 2012).

Both of these initiatives have raised the public profile of braided river values, issues and management in Canterbury and PRR is well placed to build on this momentum through contributing to statutory planning and consenting processes, networking with community groups, obtaining supplementary funding sources and exploring new collaborative initiatives.

9. A vision for the future

Our vision for the future sees New Zealanders valuing and enjoying braided river ecosystems and wetlands as a unique and integral part of their natural heritage. In the upper Waitaki Basin people will have some general knowledge of the plants and animals in their braided rivers, and local and regional communities will support demonstrably successful, ongoing and sustainable conservation programmes. Braided rivers and wetlands are recognised as key elements in the expansive and iconic landscape of the upper Waitaki.

Braided rivers above the upper Waitaki glacial lakes will remain in essentially pristine condition because problem exotic plants such as lupins, gorse, broom, wilding conifers and willows are being maintained at near zero densities. Below the lakes, weeds in large sections of the Ahuriri, Tekapo and Ohau Rivers will be managed in an economically and ecologically sustainable manner. These rivers will be augmented by a network of carefully managed and highly prolific natural and constructed wetlands. Indigenous plant communities will flourish and form high quality habitats for native fauna as we maintain weed-free and weed-controlled ecosystems. The survival and productivity of birds, lizards and invertebrates will be high as a result of ongoing, cost-effective predator management at key sites. Native freshwater fish will thrive in safe and healthy habitats.

As a result of active and ongoing research programmes, there will be a good understanding of the ecology of braided river and wetland ecosystems. Findings of this research will have been published in peer reviewed scientific literature and disseminated in accessible styles and formats to a range of audiences. PRR's work in braided rivers and wetlands will be valued for its contribution to science and education, as well as nature conservation.

People will visit these rivers and wetlands to experience pristine braided river ecosystems with large populations of wading birds, invertebrates, lizards and other fauna. Ecotourism will contribute to the local economy by bringing visitors to share enjoyment of these places in an ecologically sensitive and responsible manner.

While achieving these outcomes we will gain from strong and mutually beneficial working relationships with Meridian Energy and Genesis Energy, the community of the upper Waitaki Basin, private landholders, iwi, Environment Canterbury, Land Information New Zealand, New Zealand Defence Force, and research institutions. We will have expanded our knowledge of wetland and braided river ecosystems, and PRR will be recognised regionally, nationally, and internationally as a highly successful conservation management and research programme.

10. Our focus

During the seven year term of the previous strategic plan (2012-2019), PRR consolidated its focus to concentrate on the key objectives. These objectives underpin the core contributions already made by the project through habitat protection, predator research and raising community awareness of braided river ecosystems. Much of this work relies on incremental progress over long time-frames to achieve long term outcomes and is dependent on continued inputs to be effective. For example, control of weed species with seeds that can last decades in buried seedbanks (gorse, broom, Russell lupin, yellow tree lupin) relies on annual removal of mature plants prior to seed set. Discontinuing or delaying such programmes as a result of changes in strategic direction could result in rapid loss of previous progress with density reduction of target plants, further contributions to the seedbank and effective loss of prior financial investment.

The new interim Strategic Plan recognises the importance of strategic continuity in braided river management. Our key objectives during the interim period of 2020 and beyond will remain largely unchanged from the previous planning period with core work continuing to consolidate and improve on previous habitat enhancement initiatives, develop effective multispecies predator control in riverbeds, and improve public awareness of natural values and pressures in braided river ecosystems. We will continue to expand our knowledge of braided river ecology, foster relevant research in braided river ecosystems and explore new initiatives to enhance wetland conservation.

11. Objectives of our Work:

1. *Maintain indigenous biodiversity; protect and restore terrestrial and aquatic river and wetland habitat and the ecological communities within it, by controlling and where possible eradicating invasive weeds.*

Explanation: Invasive exotic plants can have severe, adverse impacts on the composition and extent of indigenous plant communities and quality and quantity of habitat for fauna. PRR has adopted four key approaches when dealing with weeds. First approach is early detection and removal of new problem weeds arriving in the upper Waitaki Basin before they become established (e.g. false tamarisk). Second approach is eradication or containment of established problem weeds which are present in very low numbers in the upper Waitaki Basin (e.g. yellow tree lupin, buddleia). Third approach is to remove widespread problem weeds from selected sites with important natural heritage values (e.g. main river headwaters, Cass River and parts of Tekapo and Ohau Rivers) and fourth approach is to remove problem tree species (willow and alder) from selected wetland sites that they are invading.

Focus for 2020 and beyond: PRR will continue with the above outlined strategic approach to weed control, concentrating on consolidating gains made over previous years. New weed control initiatives may be undertaken if they can be fully resourced and are sustainable, but the benefits of such work will need to be weighed against other strategic opportunities. Direction for existing and future weed control is provided by the *PRR Weed Control Plan* (Woolmore 2004) which will be updated in 2021.

2. *Test and where possible improve the effectiveness of, and implement experimental predator control for population recovery of braided river and wetland fauna.*

Explanation: Introduced and some native predators are known to adversely affect the population viability of many braided river birds and will have a similar impact on other indigenous fauna, including invertebrates, lizards and non-migratory fish. Relationships between predators, prey and habitat are complex in braided rivers and are not fully understood. More in depth research on predator ecology, the inter-relationships among the different predator species, habitat type and quality, and the range of available prey would benefit decision making processes. The population dynamics, movements and impacts of some indigenous predatory species, especially black-backed gull, are poorly understood but they can and are known to have serious impact on some river fauna, especially on nesting black-fronted terns. Such detailed research is beyond the immediate capacity of PRR, but research from other agencies, especially universities can and will be supported financially and logistically by PRR.

Unlike forest systems where knowledge of relationships between predators, prey and fauna recovery is well developed and improved outcomes for fauna can be clearly demonstrated as a result of predator management, predator control in braided rivers has historically met with limited success.

Over the previous seven-year Strategic Plan period PRR has either led or supported the implementation of intensive multi-species predator management in braided rivers at two locations. Firstly, through a collaborative investment with the Kaki (black stilt) Recovery Programme and more latterly with Te Manahuna Aoraki, in catchment-scale predator management at the Tasman River, designed to provide benefits to a wide range of braided riverbed fauna. Secondly, through small-scale intensive management of predators in the upper Ohau River for the benefit of the seriously threatened black-fronted tern, which nests in colonies at discrete locations. Additionally, this predator control appears to be having a beneficial effect on a nearby Lakes skink population.

Both initiatives have shown some measure of success. Due to the complex nature of predator prey relationships and scale of operations undertaken, the true value of these initiatives will require operation over long time frames to fully understand and evaluate. However, the results of the black-fronted tern focussed pest control operation are such that the technique can already be successfully applied elsewhere.

Focus for 2020 and beyond: PRR will continue to evaluate and improve the effectiveness and efficiency of different predator control scenarios and their benefit to indigenous fauna. Key deliverables will include:

- Annual operational report for the Ohau River project

- Analysis and formal reporting of all of the results in the Ohau River project from its beginning in 2010.
- Annual application of the adaptive management principles of monitor, review, revise to project delivery.
- In conjunction with Te Manahuna Aoraki, extend aerial and ground-based Southern black-backed gull control into more breeding locations within the Mackenzie basin.

3. Increase public awareness of braided rivers and associated wetlands within a changing environment.

Explanation: The aim of PRR's public awareness programmes is to encourage appreciation of the characteristic plants and animals of braided river ecosystems and increase awareness of the pressures they are facing. Better understanding and appreciation of braided rivers and wetlands will lead to regional and national public support for the protection and management of our rivers and wetlands. PRR has put a large amount of effort into producing written material, community consultation and incorporating resource material into school curricula. Whilst this work has been well received there is further scope to increase our public awareness effort, both within the project and with external partners. Key opportunities for public awareness work include:

- Develop an understanding and appreciation of the natural values and pressures impacting on braided river ecosystems through:
 - Articles in social media, utilising Meridian media staff and Facebook page
 - Articles in interest/user group magazines
 - An up to date PRR page on the DOC website
 - Assessing the value of current educational resources to the senior secondary school curricula and if relevant, providing support to active education programmes in braided rivers and wetlands in the Upper Waitaki basin
 - Widespread circulation of an up to date "Braided river care code"
- Take active steps to reduce immediate impacts of human disturbance where important values are at risk (signage, marking of tracks and river crossings).
- Identify and engage in new communication and education opportunities to foster awareness and good outcomes for braided river ecosystems
- Build and maintain positive relationships with key agencies, landowners and community groups involved in the management of braided river and associated wetlands, as well as the areas bordering and potentially impacting on those river and wetland systems
- Engage early to achieve good outcomes in RMA consenting processes which affect PRR's investment in braided river and wetland management.
- Share knowledge gained within the project by providing technical advice and support within DOC and to other organisations involved in braided river management.

- Make new knowledge, research and management results available through internal reports and formal peer reviewed scientific publications.

Focus for 2020 and beyond: PRR will continue to improve resource material that has been developed over the last 20 years. Particular attention will be given to improving braided river resource material in collaboration with Department of Conservation technical advisors, promoting the programme's achievements through a range of different media and explaining the benefits of ecological management of braided rivers to the wider community.

4. Gain ecosystem knowledge in upper Waitaki rivers and wetlands through research and monitoring.

Explanation: PRR has collected detailed information about the distribution and abundance of braided river birds in the upper Waitaki Basin. Most of this knowledge was gathered during the 1990s and continues to be updated.

During the previous strategic plan period our knowledge of threatened plants and plant communities on braided rivers, and the distribution of indigenous non-migratory fish in upper Waitaki Rivers, streams and wetlands has significantly improved. Our understanding of the other fauna present and the ways in which they are making use of braided river and associated wetland habitat is less certain. In particular, there is still limited knowledge of the invertebrate and lizard fauna and their habitat requirements in braided rivers. We need to expand our knowledge of the plants and animals inhabiting and using braided rivers to be able to make informed management decisions and enable us to evaluate changes as a result of our actions. Invertebrates on the Tasman River have been sampled as part of an extensive study during the previous strategic plan period. Most of the data from the study have been analysed and published, with involvement from taxonomic experts. We also need a better understanding of the long term status of significant threatened plant populations and riverbed plant communities.

Focus for 2020 and beyond: Consolidate existing knowledge base by monitoring changes in riverbed bird populations; expand our understanding of factors influencing the composition of plant communities and distribution of threatened plants and problem weeds in riverbeds; explore improved methods for rapid assessment of terrestrial invertebrate fauna; improve our understanding of non-migratory galaxiid distribution and threats and fill gaps in knowledge of reptile riverbed distributions.

Key deliverables will include:

- Continue annual survey of braided river birds on a three yearly, rotational basis throughout upper Waitaki braided rivers
- Assisting with DOC's freshwater fish distributional surveys and ongoing monitoring of key non-migratory galaxias populations
- Publication of key aspects of our research and monitoring in internal reports and peer reviewed papers.

5. Protect and manage upper Waitaki wetlands

Explanation: Wetlands have greatly diminished in extent in Canterbury since European settlement. They support specialised plant communities and fauna and are often closely linked with the floodplains and tributaries of braided rivers in the upper Waitaki Basin. Many of the remaining wetlands face a range of ongoing threats such as drainage, weed invasion and incremental clearance for economic use. Although PRR has been successful in constructing and managing artificial wetlands, it is more cost effective to conserve existing natural wetlands.

Focus for 2020 and beyond: PRR will contribute to the protection and management of significant wetlands and is well placed to:

- Manage weed control in priority wetlands administered by the Department;
- Assist with freshwater fish protection through construction of barriers, distributional surveys and ongoing monitoring of population trends;
- Assist with distributional survey and population monitoring of threatened wetland fauna and flora;
- Identify opportunities for wetland protection outside public conservation land and help implement mechanisms for their protection.

The constructed wetlands at Ruataniwha and Waterwheel will be maintained and managed for their ecological values, but there are currently no plans to build new artificial wetlands of this size. However, there is some thought around development of small ponds in the Dead Horse wetland (Tasman Valley) to facilitate provision of kaki feeding habitat in shallow water. PRR could use its expertise to lead this work.

6. Facilitate research by external agencies, including universities, to improve our understanding of the ecology of braided river systems.

A. *Explanation:* Research carried out or supported by PRR in the upper Waitaki Basin has helped to understand fauna ecology and distribution, predator-prey interactions and has tested the effectiveness of some management actions. Whilst this research has been beneficial, many research issues are so complex or of such scale that they are beyond the capacity of PRR to address. Developing and maintaining close working relationships and partnerships with academic and research institutions is a mutually beneficial way of addressing key research issues. Wherever possible, PRR resources (operating dollars and/or staff) should be used to leverage investment from others. This will include using student projects to undertake and write up research questions, with modest grants and logistic support coming from the PRR team. It can also include co-funding projects run by others in DOC) where they line up with PRR strategic priorities.

An analysis of management and research priorities for conserving biodiversity in braided rivers (O'Donnell et al. 2106) has been completed and a summary of key research opportunities which are relevant to the work in the upper Waitaki is listed in Appendix 1.

Focus for 2012-2019: Establish and maintain effective partnerships with academic and research institutions and foster and support development of mutually beneficial research with them, with a focus on the key research opportunities as listed in Appendix 1.

12. Guiding principles

For PRR to succeed in its quest to protect and manage braided river and wetland habitat, ecological communities and the populations of indigenous plants and animals within it the following guiding principles have been adopted:

1. Integrated habitat, ecological community and species management

Braided river and wetland ecosystems comprise plants and animals, including invertebrates, lizards, fish and birds that interact with each other and with the physical environment. PRR takes a whole system approach to the ecological management of braided rivers by maintaining and enhancing high quality riverine and wetland habitat, filling gaps in our knowledge of the plants and animals characterising braided rivers and wetlands, and by managing indigenous plants and animals that are known to be threatened, endangered or declining in range or abundance.

2. Science-informed work

We know much about the ecology of wetlands and braided rivers and the threats that they face. Even so, our ability to manage these ecosystems is still limited by gaps in our knowledge of the ecosystems, and the effectiveness of different management options. To manage wetlands and braided rivers while improving our understanding of the system we will adopt an adaptive management approach, using conventional ecological science to fill knowledge gaps and monitor management outcomes to inform future decisions.

3. Monitoring to enable cost-benefit analysis

Monitoring key ecological components allows PRR to answer critical questions about the populations we manage. For example, are black-fronted tern populations increasing, remaining static or decreasing in number and why? Monitoring also allows us to measure operational efficiency (e.g. what percentage of weeds were removed), financial costs (e.g. how much did weed control cost) and conservation gains (e.g. how did weed control affect bird productivity).

4. Close liaison with the community

Protection and enhancement of our wetlands and braided rivers will depend, to a large extent, on the support and co-operation of the local community. We will foster this support and co-operation by involving the community in PRR and by keeping them well informed of our work. In particular, we will consult with the community early in the planning stages of major work.

5. Excellence

PRR has a key role to play in the protection and restoration of New Zealand braided rivers. We relish the opportunity to lead in braided river restoration management and

development of best practice. In achieving this goal we will aim for excellence in every aspect of our work – planning, community relations, staff management, research, and most importantly, achieving results ‘on the ground’.

13. PRR’s relationship with energy providers

We wish to maintain and build on our constructive and mutually beneficial relationships with Meridian Energy and Genesis Energy. We believe that public awareness of braided river conservation can be greatly enhanced by promoting braided river issues with both companies. Furthermore, we believe PRR has clearly established an enduring and successful model for delivering agreed compensatory management arising from the Upper Waitaki Power Scheme and will work with Meridian Energy and Genesis Energy to promote the success of this approach.

In maintaining our ongoing working relationship, we will formally meet with Meridian Energy and Genesis Energy annually to jointly agree on the annual work programme and to review progress. Additional meetings will be held on an “as required” basis as opportunities arise. Liaison group meetings (including all key stakeholders) will also provide an opportunity to review progress and discuss issues with Meridian Energy and Genesis Energy.

14. PRR’s relationship with other organisations

PRR has also developed close working relationships with other organisations over the last 20+ years. Much of the work we undertake is situated in riverbeds administered by Land Information New Zealand (LINZ), but other agencies also have a regulatory or management interest in riverbed activities. Environment Canterbury (ECAN) river engineers manage fairways of the Tekapo, Ohau and Pukaki Rivers to mitigate risk of flooding and Mackenzie District Council has an interest in the management of legal roads in or adjoining riverbeds. The Tekapo-Pukaki-Ohau Working Group has been set up to allow annual meetings among LINZ, ECAN, Meridian Energy and Mackenzie District Council staff to discuss and review work programmes in the Tekapo, Ohau and Pukaki riverbeds. PRR also meets annually with LINZ agents to discuss and review weed control programmes in other upper Waitaki rivers.

Several other agencies or groups are taking an active role in Canterbury braided river management. BRAID is a community initiative developed to coordinate, encourage and inform those working in braided river management, with a special focus on community led programmes. Environment Canterbury and other local authorities are making significant investments in braided river management through their commitment to the Canterbury Water Management Strategy, Regional Plans and Zone Implementation Programmes. The Upper Waitaki Zone Committee recognises braided rivers as important natural features and PRR as a key partner in upper Waitaki braided river management. We will continue to develop and improve working relationships with these agencies.

15. PRR’s relationship to other DOC work

The Department of Conservation's vision is that "New Zealand is the greatest living space on earth", supported by an outcome statement in which "New Zealanders gain environmental, social and economic benefits from healthy functioning ecosystems, from recreation opportunities and from living our history." These statements are given effect through high level objectives (Department of Conservation Statement of Intent 2013-2017), national decision making support tools (e.g. Natural Heritage Management System) and at a regional level, through Conservation Management Strategies.

In achieving these outcomes the Department has developed an approach that focuses on the key values of Performance, Collaboration, Innovation, Trust and Guardianship. Collaborating with iwi, councils, business and communities building conservation partnerships and achieving better value in species and ecosystem management are all areas in which PRR can actively contribute to the Departments priority outcomes.

There is also a linkage with the Arawai Kakariki programme at O Tu Wharekai, upper Rangitata and Ashburton basin. Given the similar nature of these sites O Tu Wharekai will begin a wide-scale predator control programme in 2015 to help protect wrybill, black-fronted tern and other braided river birds, and is undertaking research into the impacts of land-use change on wetland ecosystems. Sharing information will help improve conservation management at both sites.

PRR's work complements many of the outcomes identified in the Statement of Intent for departmental work over the 2013-2017 period, in particular, "conserving a full range of ecosystems to a healthy functioning state", "conserving nationally threatened species" and "maintaining or restoring locally treasured natural heritage through partnerships".

PRR has an ecosystem approach, aiming to benefit a wide range of indigenous plants and animals in braided river systems and associated wetlands with a clear focus on the upper Waitaki Basin. PRR liaises closely with a range of Department of Conservation programmes in the upper Waitaki Basin and contributes directly to others. Examples include: the ongoing work in the Tasman River over the last twenty years and more recent collaborative initiatives in predator management now directly contribute to management outcomes in a Priority Ecosystem Management unit under the Department's new Natural Heritage Management Programme. Similarly, a species recovery programme focused on managing the critically endangered black stilt/kaki undoubtedly benefits from PRR's braided river habitat restoration work, however the two projects have different goals, are managed separately and are financially independent. Looking into the future, there will be many more opportunities for collaborative work as the Department's priority work in riverbed ecosystems becomes more aligned with PRR's programme objectives.

13 Acknowledgements

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Appendix 1 – some research topics

- Identify opportunities to integrate braided river and wetland management with research initiatives
- Development and testing of new cost effective predator control methods and improvement of existing methods
 - Mustelid, cat, hedgehog, harrier and rat control methods using kill traps and a range of baits and lures.
 - Specifically, the best tools for hedgehog control and what their impact is on lizards/invertebrates
 - Black-backed gull control to low levels using ground application of toxins (alphachloralose) or other techniques.
 - Utilising and/or supporting research into new technology such as self-resetting traps, new toxins and delivery methods (such as PAPP and the “spitfire” delivery system, new rat specific toxins like the Diphacinone/Cholecalciferol mix).
- Test the effectiveness of indirect management techniques to reduce predator risk to riverbed fauna (e.g. rabbit control, islands)
 - Sustained rabbit and hare control to low levels by ground hunting and ground application of toxic baits to reduce food supplies for predators.
 - Physical manipulation of islands and channels in rivers to maintain a protective moat around bird breeding sites (and potentially reduce flood-vulnerability)
- Build knowledge of predator ecology and use of the landscape
 - What is the relative importance of different predator species and predator guilds?
 - What ecological factors drive variation in predator numbers and risk?
 - How does predation risk vary in space and time and what is the influence of predator dynamics in the adjacent catchments?
 - How are predation impacts affected by variation in flow regimes, weed encroachment and their interactions?
 - How do various predators use the environment, and how is their behaviour influenced by flow and weeds?
 - What is driving stoat irruptions in river headwaters (e.g., tussock seeding or beech masting)?
 - How important are the effects of interactions between causes of mortality (e.g., predation and flow or vegetation encroachment and nest flooding interactions).
 - What are the longer term impacts of predation on population viability both for individual populations and species as a whole? Good population models are needed so we know when we achieve predator control targets (i.e. threatened species recover).

- What is the impact of indigenous avian predators such as black-backed gull and Australasian harrier on nesting colonies of black-fronted tern and black-billed gull?
 - What is the population dynamics of the black-backed gull in the South Island high country; does each river-system has its own sub-population of black-backed gulls and would any control work on a single river result in lasting reduced numbers, without movement in from gulls from other river systems?
- Build knowledge and improve effectiveness of weed management interventions in braided rivers
 - How much weed control do we need to do to sustain natural geomorphic processes in braided rivers
 - What are the effects of altered flow regimes on weed encroachment?
 - How much weed control do we need to do (spatial and temporal scales) to increase breeding success of threatened species?
 - Are there more effective weed control methods available?
 - Is remote sensing of weeds an effective tool for detecting and monitoring key weed species, and for auditing weed management?
 - To what extent is habitat a limiting factor for threatened species?
 - How does weed invasion alter the community composition of terrestrial invertebrates and lizards?
 - How do weeds influence predation risk, e.g. by providing habitat or supporting prey such as rabbits?
- Understand the impacts of recreational use on braided river ecosystems
 - What are the impacts (or benefits) of recreation activity (and specifically jet boating) on the viability of populations of threatened species?
 - How do changes in flow regimes – particularly reduction in flow – affect recreational use of rivers, and how does this affect river birds? (E.g. do lower flows make river islands more accessible?)
 - Does education and advocacy result in changes in behaviour?
- Build knowledge of braided river ecosystem ecology
 - How do mobile threatened species use habitat at a macro scale? Are rivers acting as networks for some species? Are birds nesting on one river in one year the same as those on another the next?
 - What are the relative impacts of the different causes of mortality in threatened braided river fauna?
 - Understand the importance of constructed wetland management regimes for threatened plants around ephemeral water bodies.
 - Analyse braided river bird surveys to determine whether single or groups of sections reflect counts over the whole system. Undertake further research to understand observer variation in counts, and relationship between total count and actual number of birds present.

- Fill distributional and habitat knowledge gaps around key threatened species e.g. Australasian bittern, robust grasshopper, Tekapo weta, Mackenzie skink, dryland cress (*Lepidium solandri*).

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