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ASSESSMENT OF EFFECTS ON RIVER BIRDS OF INCREASING THE HEIGHT OF FALLS DAM, MANUHERIKIA RIVER, CENTRAL OTAGO



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Assessment of effects on river birds of increasing the height of Falls Dam, Manuherikia River, Central Otago



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1. INTRODUCTION

The Manuherikia River is a tributary of the Clutha River/Mata-Au, which it joins at Alexandra. The river, hereafter referred to as the Manuherikia, has a braided section in its upper reaches which runs in a southerly direction between the St Bathans Range and the Hawkdun Range. This braided reach, approximately 11 km in length, stops at the lake formed by Falls Dam. The dam was built in 1935 as part of a wider irrigation scheme to provide water to the wider Manuherikia catchment downstream of the dam (LAWA 2014).

Historical reports indicated the presence of a number of threatened bird species within the Manuherikia (McEwen 1987). Recent surveys have confirmed that a number of threatened species breed regularly on the river (Wildland Consultants 2010, 2011, 2012).

Investigations are underway to evaluate various potential projects to increase the irrigation capacity within the Manuherikia catchment. Most of these relate to increasing the height of Falls Dam. Wildland Consultants has been commissioned to undertake a further river bird survey of the Manuherikia, and assess potential effects on the river bird community of increasing the height of Falls Dam by 27 m (the scenario whereby the height of Falls Dam would be raised by the greatest amount).

Under this scenario, modelling indicates that the lake will extend a further 2.64 km upstream from its present maximum extent. This equates to a potential maximum loss of 24.3% of existing riverbed habitat.

2. METHODS

In 2010, three river bird surveys were carried out in the period late October to early November, approximately one week apart: 24 October, and 8 and 19 November. In 2011, flooding postponed surveys, and resulted in only two surveys being undertaken on 14 November and 1 December. In 2012, a single survey was undertaken on 30 October (Wildland Consultants 2012). In 2014, a single survey was undertaken on 17 October.

Approximately 10.5-11.0 km of river was surveyed in each survey, from upstream of Falls Dam to the point where the river valley narrows and the river becomes a single channel. In 2010-2012, only a small section of the river could be walked, due to access issues. The remainder of the river was observed using a spotting scope from the road, which varies from 50 to 400 m from the river. In 2014, the riverbed was able to be accessed but high flow levels permitted only limited river crossings.

Weather during the surveys in 2010, 2011 and 2012 was fine and warm, but with heat haze which may have decreased long range visibility. Northwest gales affected the 2014 survey, making the use of binoculars and spotting scope somewhat difficult.

3. SURVEY RESULTS

Overview

In 2010 and 2011 the same fourteen species of birds were seen during surveys (Table 1). In 2012 and 2014, the same species were observed again, except for grey teal and little shag. Three Nationally Threatened species were observed in all surveys (including repeat surveys within the same season): black-billed gull, black-fronted tern, and banded dotterel. Two At Risk species were found in all surveys: pied oystercatcher and pied stilt (counts are provided in Appendix 1).

Table 1: River birds observed during four years of surveys of the Manuherikia River, 2010, 2011, 2012, and 2014, and their national threat status (threat classifications are from Robertson *et al.* 2013).

Species	Scientific Name	Threat Classification
Black-billed gull	<i>Larus bulleri</i>	Threatened-Nationally Critical
Black-fronted tern	<i>Chlidonias albostratus</i>	Threatened-Nationally Endangered
Banded dotterel	<i>Charadrius bicinctus bicinctus</i>	Threatened-Nationally Vulnerable
South Island pied oystercatcher	<i>Haematopus finschi</i>	At Risk-Declining
Pied stilt	<i>Himantopus himantopus leucocephalus</i>	At Risk-Declining
Black shag	<i>Phalacrocorax carbo novaehollandiae</i>	At Risk-Naturally Uncommon
Little shag	<i>Phalacrocorax melanoleucos brevirostris</i>	At Risk-Naturally Uncommon
Black-backed gull	<i>Larus dominicanus dominicanus</i>	Not Threatened
Grey teal	<i>Anas gracilis</i>	Not Threatened
Paradise shelduck	<i>Tadorna variegata</i>	Not Threatened
White-faced heron	<i>Ardea novaehollandiae</i>	Not Threatened
Canada goose	<i>Branta canadensis</i>	Introduced and Naturalised
Mallard	<i>Anas platyrhynchos</i>	Introduced and Naturalised
Spur-winged plover	<i>Vanellus miles novaehollandiae</i>	Introduced and Naturalised

Survey findings for key species of interest are set out below.

Black-billed gull

Black-billed gull is classified as Nationally Critical, and is the most threatened species found on the Manuherikia. In 2010, a large breeding colony (highest number counted = 285 birds) was found breeding just above the lake (Figure 1). In 2011, the colony was in the same location, but was significantly smaller (maximum counted = 40); in 2012, the colony was also in the same place and numbered 275 birds, but colony behaviour indicated that breeding was not occurring (birds may have commenced breeding after this survey). In 2014, only very small numbers were observed (total = 18 birds), and no breeding was observed, although small numbers were seen on the ground within the river, about mid-way up the reach.

Black-fronted tern

Black-fronted tern is classified as Nationally Endangered. Tern colonies have been found throughout the Manuherikia. Three colony locations are shown on Figure 1. Numbers present at colony sites were approximately 30 terns in 2010, and 15 and 12 terns in 2014. In 2010, three additional pairs were thought to be holding territories

above the bridge, but no breeding was seen. In 2011, 5-6 nests were observed downstream of the black-backed gull colony. In 2012, approximately 20 birds and five nests were observed above and below the bridge. A further colony was also observed approximately 4 km upstream of the lake.

Numbers observed in association with colonies is generally significantly less than the number of terns observed overall along the length of the river. For example, in 2014, 27 birds were seen in association with two colonies, but 111 birds were sighted flying and foraging along and adjacent to the river. Foraging terns were regularly sighted feeding over adjacent rough pasture. Observations made in 2011 and 2012 indicated that some food items consisted of lizards.

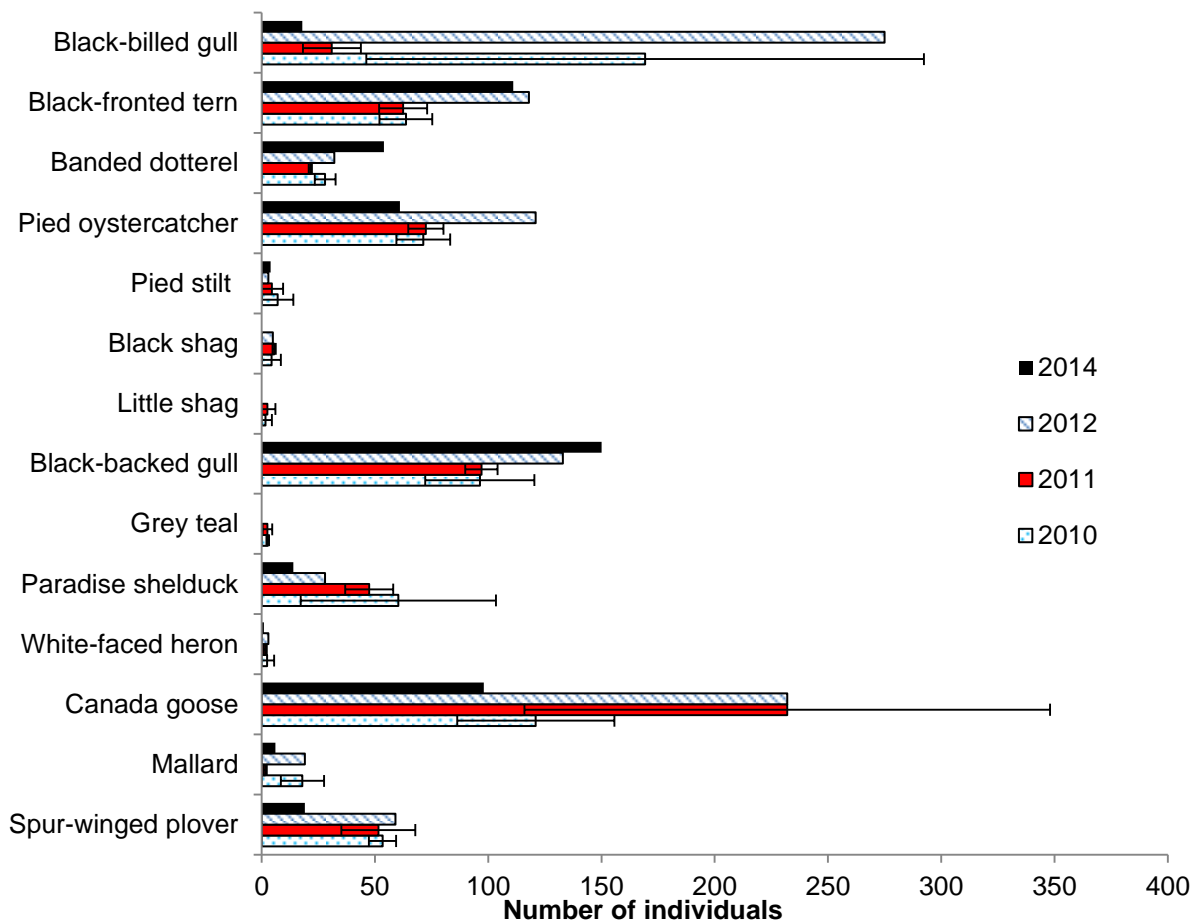
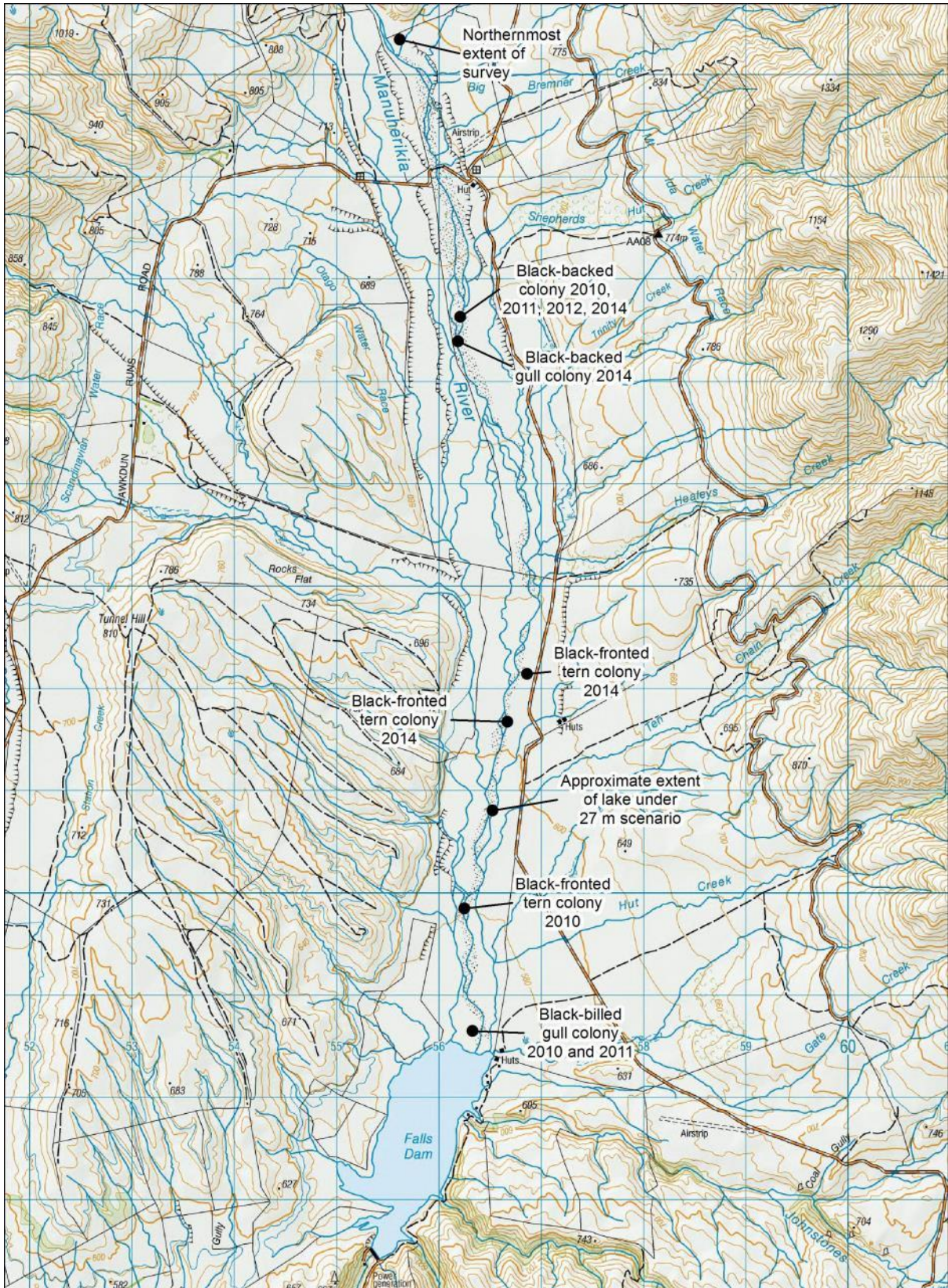


Figure 2: Mean number of birds observed on the braided section of the Manuherikia River, 2010-2014. Error bars indicate one standard deviation (only single counts were completed in 2012 and 2014).



Data Acknowledgment
 Map contains data sourced from LINZ
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Report:
 Client: GOLDER
 Ref: 07 0098
 Path: E:\gis\Manuherikia_River.mxd
 File: Manuherikia River.mxd

**Colony locations 2010-2012, 2014,
 Manuherikia River, Central Otago**

0 1,000 2,000 Meters

Wildlands
 www.wildlands.co.nz, 0508 WILDNZ

Scale: 1:50,000
 Date: 01/12/2014
 Cartographer: RPB
 Format: A4

Banded dotterel

Observations of banded dotterels made in 2010, 2011, and 2012 were mostly undertaken from the adjacent road, and as such, were thought to be an under-estimation. In 2012, the survey was carried out along the river itself, and recorded the most dotterel to date. In this survey, dotterel territories were found to be very evenly distributed throughout the entire river.

Pied oystercatcher

Like banded dotterel, pied oystercatcher are also found throughout the river, at slightly higher densities than the dotterel. The higher numbers recorded in 2012 appear to have been bolstered by a group of 40 birds feeding in a paddock above the lake.

Black-backed gull

The species is highlighted due to its predatory nature on other braided river birds. Black-backed gulls appear to have nested in exactly the same location in all four years, although in 2014, a second colony (or sub-colony) was located immediately south of the usual location. Numbers have been relatively consistent from year to year.

Other species

Other At Risk species - pied stilt, black shag and little shag - are uncommon on the Manuherikia. Pied stilt breed on the river in small numbers. In 2010-2012, the only birds observed were immediately above the lake. In 2014, the only pied stilts observed were within the mid reaches of the river.

4. ECOLOGICAL SIGNIFICANCE FOR BRAIDED RIVER BIRDS

Black-billed gull

The national population of black-billed gulls has been estimated at 90,000 mature individuals (McClellan 2009) and, as such, numbers on the Manuherikia are not internationally or nationally significant¹. Stronghold rivers for the species are largely restricted to Southland, but also include the Ashburton River, in south Canterbury. Otago rivers are not known to have historically supported significant numbers of black-billed gulls.

The South Island aerial survey of black-billed gulls is presently underway, and the Otago flight has been completed. This survey has obtained the most comprehensive, synchronised coverage of Otago Region to date (completed within one day). Rivers covered were the Clutha, Taieri, Kye Burn, Manuherikia, Shotover, Dart, Rees, Matukituki, Wilkin, Makarora, Hunter, Ahuriri, Hopkins, and Dobson. Only one

¹ This estimate of the national population is likely to be revised after a comprehensive South Island survey that was completed by the end of November 2014.

colony, numbering c.150 gulls, was found, located on the Clutha/Mata-Au. Observers noted black-billed gulls on the wing in the Manuherikia but, like the survey described in this report, observed no colonies. This regional survey suggests an extremely small population of black-billed gulls in the Otago region. However, it should be noted that numbers of black-billed gulls can show significant regional fluctuations between years (pers. obs.), and further consecutive surveys within Otago and the South Island are tentatively planned to examine this possible variation, and may detect greater numbers in following years. Nevertheless, given the Manuherikia has supported up to 280 gulls in previous years, it is likely to be regionally significant for this species.

The braided section of the Manuherikia runs between the St Bathans Ecological District and the Hawkdun Ecological District. It is unlikely that any other waterway in these Ecological Districts supports gulls, and therefore the Manuherikia is significant for its black-billed gull population within these Ecological Districts.

Black-fronted tern

The national population of black-fronted terns has been estimated at less than 5,000 mature individuals (Robertson *et al.* 2013), but also up to 10,000 (O'Donnell and Hoare 2011). Numbers on the Manuherikia have varied between 51-118 birds (mean = 88.8). Criterion 6 of the Ramsar Convention (Convention on Wetlands of International Importance, Ramsar, Iran, 1971) states that “a wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird” (Ramsar 2011). The most recent international publication providing an authoritative basis for Criterion 6 levels is Wetlands International (2006). This report gives the 1% level for black-fronted tern as 60 birds, based on an analysis by BirdLife International. On this basis, the braided section of the Manuherikia is internationally significant for black-fronted terns.

Additionally, O'Donnell and Hoare (2011) provide the most recent counts of black-fronted terns for 84 South Island rivers in which surveys have been undertaken. An analysis of these counts gives a mean of 99.1 terns per river (standard deviation = 227.7, indicating high variability between rivers)¹. No terns were found on 33 of the rivers, compared to the largest count of 1,617 on the Wairau. The highly skewed nature of the data means that a more useful analysis of the data is to separate the data into quartiles. The third quartile is 87.5 terns, that is, only 25% of the 84 rivers supported more than 88 terns during the most recent count. These data suggest that the Manuherikia River can be considered nationally important for black-fronted tern.

The river is also likely to be significant for black-fronted tern within both the St Bathans and Hawkdun Ecological Districts.

Banded dotterel

The national population of banded dotterel is estimated to be approximately 50,000 birds, though this may be a significant overestimate (Southey 2009). The Manuherikia River does not, therefore, meet the international 1% criterion for wetland

¹ Appendix 1 of O'Donnell and Hoare 2011 separates three of the largest rivers into reaches. These have been combined for this analysis.

significance, and is unlikely to be regionally or nationally significant. However, as the main waterway within the St Bathans and Hawkdun Ecological Districts, the river is significant within these Ecological Districts for this species.

South Island pied oystercatcher

The national population of South Island pied oystercatcher has varied markedly over the last few decades. In 1970, the population was estimated at *c.*49,000 birds (Baker 1973). However, by 1983-1994, the population was estimated to number *c.*112,000 individuals (Sagar *et al.* 1999), representing a major increase since their formal protection in 1940. Further counts from 1994 to 2003 indicated a somewhat mixed picture of slight declines, increases, and stabilisations at key sites; the conclusion being that a continuing increase was no longer clear (Southey 2009). However, the species is now considered to be in general decline (Robertson *et al.* 2013) and Sagar (2014) contends that the species is now at levels recorded in 1988.

The Manuherikia population has varied between 61 and 121 since 2010; while this is a sizeable population, it is not nationally significant and is unlikely to be regionally significant. However, it will likely be significant within the St Bathans and Hawkdun Ecological Districts.

5. POTENTIAL EFFECTS ON BRAIDED RIVER BIRDS

Increasing the height of Falls Dam by 27 m has been modelled to result in the loss of approximately a quarter of the braided river habitat of the Manuherikia when the dam is at its most full. The lake is likely to reach its maximum during spring when the snow melt increases water flow within the river, coinciding with the start of the breeding season for braided river birds. The primary effect of the increase will be the loss of breeding habitat for all braided river species that breed on the river. The impact of this loss may vary between species.

Birds that breed on braided riverbeds must be adaptable to a changing environment, particularly, breeding sites that are modified between seasons by floods or encroaching vegetation. These species are often forced to change nesting sites from year-to-year because previous nesting sites are no longer suitable. The availability of nearby food sources may also influence nest site selection, as may other factors. However, the relative influence of such factors including the physical characteristics of nest sites on nest site selection is poorly understood.

The most mobile of these species is probably black-billed gull, meaning that this species may be the least affected by loss of breeding habitat. In Southland, the stronghold for black-billed gull, colonies were rarely found to re-establish in previously-used colony sites over a three-year period (McClellan 2009; unpublished data). However, there are also anecdotal, unpublished observations of colonies establishing, irregularly, in the same site for decades (a recent and relatively well-known example is the colony that regularly establishes near the State Highway 1 road bridge on the Ashburton River, Ashburton).

Interestingly, a black-billed gull colony was observed at the same location on the Manuherikia in 2010 and 2011, and in 2012 breeding may also have commenced at the same site after the survey was completed. However, in 2014, no black-billed gulls were seen close to the lake; the small numbers observed were all in the mid reaches of the river. Breeding habitat suitable for black-billed gulls consists of areas of relatively vegetation-free gravel. On this basis, breeding habitat is not limiting, as habitat sufficient for numerous black-billed gull colonies is clearly available on the Manuherikia (although the river supported extensive areas of vegetation in 2014). Black-billed gulls can travel tens of kilometres to feed, and therefore there is no obvious reason why a gull colony could not establish successfully further up the river. However, one or more factors are leading to relatively regular colony establishment immediately upstream of the lake, and it is possible that the ‘delta’ above the lake provides more attractive breeding habitat for black-billed gulls. The loss of it could therefore reduce the chance of the birds using the river to breed. However, presumably a delta will re-form above the new lake level, so this loss may not be permanent.

Black-fronted terns are also a relatively mobile species that require only small areas of clear gravel to establish colonies (see Plate 1). Colony sites can change between years, and surveys on the Manuherikia have shown that tern colonies can establish throughout the river. Like black-billed gull, the availability of breeding habitat is unlikely to be a limiting factor on the Manuherikia, and therefore the species is likely to nest elsewhere on the river once the lower section has been inundated.



Plate 1: Black-fronted tern colony site, 2014. Arrow indicates location of colony (4-5 nests).

Banded dotterels and pied oystercatchers are solitary, territorial breeders. On the Manuherikia, their nesting sites are spread relatively evenly throughout the river, from its upper reaches above the bridge downstream to the delta. The effect of the loss of approximately one quarter of the available nesting habitat is difficult to predict; a conservative assessment is that the permanent loss of nesting habitat would result in an equivalent, proportional loss in the breeding populations of both species.

However, the population trends of both species in the Manuherikia are not known, but could be assumed to be in decline given their respective national population trends. Therefore it is possible that the carrying capacity of the river for both species is not met, and the unaffected reach of the river can support a greater number of breeding dotterels and oystercatchers than has been observed in recent years.

Nesting densities of both species in certain habitats/locations have been examined e.g. Hughey (1998); Maloney *et al.* (1997); Morgan (2001). However, insufficient information exists to be able to predict with confidence whether the remaining c.75% of the Manuherikia will be able to support the existing dotterel and oystercatcher populations (combined possibly with weed control). Because of this, it is appropriate to consider the nesting habitat loss as resulting in a reduction in the breeding population of both species.

An increase in the height of the dam will also affect the availability of foraging habitat: river habitat will be significantly reduced, lake habitat will be increased, and there will also be a loss of terrestrial habitat through inundation by the extension of the lake. The lack of in-depth studies about the foraging behaviour of black-billed gulls, black-fronted terns (in particular, the amount of time birds spend foraging over terrestrial habitats versus aquatic habitats), and pied oystercatchers in inland habitats makes it difficult to evaluate the possible effects of the loss of terrestrial and river habitat and the increase in lake habitat. All four key species are known to forage in terrestrial habitats; this habitat can be very important for black-billed gulls (pers. obs., unpublished data) and black-fronted terns (e.g. O'Donnell and Hoare 2009). For example, O'Donnell and Hoare (2009) showed that terns made extensive use of adjacent valley floor grasslands for feeding on skinks and this behaviour has been observed elsewhere, including the Manuherikia.

While the terrestrial area that will be inundated is a small percentage of what is available to braided river birds, the lower valley floor habitats may provide relatively better quality foraging habitat than hill slope habitats. However, the terrestrial foraging behaviours of these species are insufficiently known to be able to predict the impact of this loss. The overall effect is a decrease in the availability of foraging habitat, which may affect the carrying capacity of the environment.

6. POTENTIAL OPTIONS FOR MITIGATION/COMPENSATION

6.1 Predator control

Predation is almost certainly the greatest threat to successful nesting for black-billed gull, black-fronted tern, banded dotterel, and pied oystercatcher on the Manuherikia. Predation by introduced mammals such as cats, stoats, ferrets, rats, and hedgehogs has been well documented e.g. Keedwell and Sanders (2002); McClellan (2009); Murphy *et al.* (2004); Sanders and Maloney (2002).

Predation by indigenous aerial predators such as Australasian harrier (*Circus approximans*) and southern black-backed gull may also be a key threat. Human activities have allowed black-backed gull numbers to increase well beyond levels known at European settlement and, as such, they now present a largely novel threat to

braided river birds. The gulls are known to prey on eggs and chicks of a number of threatened bird species, including black-billed gull and black-fronted tern. However, the extent of their impact on braided river bird species is largely unstudied. Nevertheless, the regular presence of a substantial colony of black-backed gulls on the braided section of the Manuherikia may be a threat to bird species nesting in this location.

Harriers have also increased in numbers since the arrival of humans in New Zealand, having benefitted from the increase in open habitats resulting from deforestation. They have been shown to have significant impacts on braided river birds in parts of the country; e.g. black-fronted terns on the Wairau River, Marlborough (Steffens *et al.* 2012).

Predator control has the potential to improve productivity of all four key species (including others such as pied stilt), and to reduce deaths of adult birds. However, there are serious limitations in our understanding of predator control regimes on braided rivers, and few examples of successful management programmes that have benefited a range of species. As such, the development of cost-effective, efficient strategies for predator control is considered to be the highest priority for braided river research (O'Donnell *et al.* in prep.). Because of the unknowns, a predator control operation focused on the upper Manuherikia valley to protect braided river bird populations could not be guaranteed to improve productivity of any of the key bird species present.

Nevertheless, recent adaptive management focused on a single, large black-fronted tern colony in the Ohau River, in the upper Waitaki, has had excellent, consistent results; but at great financial cost. In contrast, some species such as black-billed gulls have never been the focus of intensive management. Any proposal for predator control within the upper Manuherikia would need to be very well designed, and developed within an adaptive management framework, requiring thorough monitoring and expert involvement.

An additional benefit of intensive pest control (for example, a regime that would also enhance local lizard populations), would likely be a significant increase in food sources for black-fronted terns. O'Donnell and Hoare (2009) noted that the extensive, long-term pest control in the Eglinton Valley combined with stock removal had resulted in significant increases in the lizard fauna, and that this was being utilised by the terns; they estimated that the black-fronted tern colony was taking approximately 800 skinks every 12 hours.

6.2 Stock exclusion

The river is unfenced, and cattle can roam across the riverbed. Cattle will enter noisy black-billed gull colonies (R. McClellan, pers. obs.), and were observed within the black-billed gull colony on the Manuherikia on 14 November 2011. The animals can trample nests containing eggs and chicks of any species breeding on the riverbed. Cattle waste lowers water quality, and banks can be damaged by cattle movement.

Fencing of the riverbed will reduce the risk of trampling of nests, and may increase water quality. Alternative water sources would have to be provided for stock, however.

6.3 Weed control

Many braided river bird species tend to nest in areas with very low vegetation coverage, particularly black-billed gulls and black-fronted terns. In 2014, the Manuherikia had significant levels of vegetation (compared to *c.*20 rivers surveyed in Canterbury by the author in the same season). Weeds were present on the riverbed, but also indigenous plant species. Weed control can create further areas of clear gravel suitable for nesting by the four key bird species. Such control should be focused on island habitats within the river; this is likely to reduce access by terrestrial predators (see McClellan 2009). The creation of additional nesting habitat will help to offset the loss of nesting habitat resulting from increasing the height of Falls Dam.

7. CONCLUSION

The Manuherikia River above Falls Dam regularly supports substantial breeding populations of three Nationally Threatened bird species, black-billed gull, black-fronted tern, and banded dotterel, and one At Risk species, South Island pied oystercatcher. It also supports a substantial population of southern black-backed gull, a species known to prey on the eggs and chicks of braided river birds. Populations of all species, particularly black-billed gulls, demonstrate natural fluctuations in numbers from year-to-year.

The Manuherikia can be considered to be internationally and nationally significant for black-fronted tern, and regionally significant for black-billed gull. The river is the only major waterway of its kind within the St Bathans and Hawkdun Ecological Districts, and the populations of all four breeding species are therefore significant within these Ecological Districts.

Increasing the height of Falls Dam by 27 m will result in the loss of about one quarter of the available breeding habitat for the four key species. Black-billed gull and black-fronted tern are likely to be the least affected by this reduction because they nest in colonies, and therefore require only small areas of suitable habitat, and because they are highly mobile and can shift colony sites between years under normal circumstances. In contrast, banded dotterel and pied oystercatcher are solitary nesters, and a conservative assessment is that the loss of braided river nesting habitat may lead to a similar reduction in the breeding population on the river. This effect will be less if the river can support a greater number of breeding pairs than it does at present, and could potentially be offset by creation of further habitat through weed control, and predator control.

A terrestrial pest control regime and control of black-backed gulls has the potential to offset the loss of productivity of banded dotterel and pied oystercatcher caused through an assumed reduction in the breeding population. Pest control could also be considered to provide compensation for overall effects on braided river birds. This

could be achieved by increasing the productivity of black-billed gull and black-fronted tern (and other species such as pied stilt), which are likely to be less affected by nesting habitat loss. Intensive predator control that augments local lizard populations also has the potential to provide an improved food source for black-fronted terns.

Habitat creation through weed control will assist to offset nesting habitat loss.

The effects of the losses in the availability of riverine and terrestrial foraging habitat on the populations of river birds is difficult to evaluate; but is likely to result in an overall loss. It is not feasible to offset the loss of foraging habitat.

The project, overall, will require very careful evaluation of adverse effects on fauna including braided river birds, and potential mitigation/compensation for those effects. However, it is clear at this stage that a comprehensive package of works would be required to address potential adverse effects on river-breeding birds associated with the scenario evaluated in this assessment.

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APPENDIX 1

SPECIES COUNTS AT THE MANUHERIKIA RIVER, 2010-2012, 2014

Species	2010				2011			2012	2014
	24 Oct	8 Nov	19 Nov	Mean (SD)	14 Nov	1 Dec	Mean (SD)	30 Oct	17 Oct
Black-billed gull	40	183	285	169 (123)	40	22	31 (13)	275	18
Black-fronted tern	51	66	74	64 (12)	55	70	63 (11)	118	111
Banded dotterel	27	33	24	28 (5)	22	21	22 (1)	32	54
Pied oystercatcher	65	64	85	71 (12)	78	67	73 (8)	121	61
Pied stilt	3	3	15	7 (7)	1	8	5 (5)	3	4
Black shag	3	1	9	4 (4)	5	6	6 (1)	5	0
Little shag	0	0	5	2 (3)	5	0	3 (4)	0	0
Black-backed gull	80	85	124	96 (24)	92	102	97 (7)	133	150
Grey teal	2	3	3	3 (1)	4	1	3 (2)	0	0
Paradise shelduck	37	34	110	60 (43)	55	40	48 (11)	28	14
White-faced heron	0	6	1	2 (3)	2	1	2 (1)	3	1
Canada goose	113	91	159	121 (35)	150	314	232 (116)	232	98
Mallard	13	12	29	18 (10)	1	2	2 (1)	19	6
Spur-winged plover	54	47	59	53 (6)	63	40	52 (16)	59	19



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