Christchurch District Plan
Site of Ecological Significance

Site Significance Statement

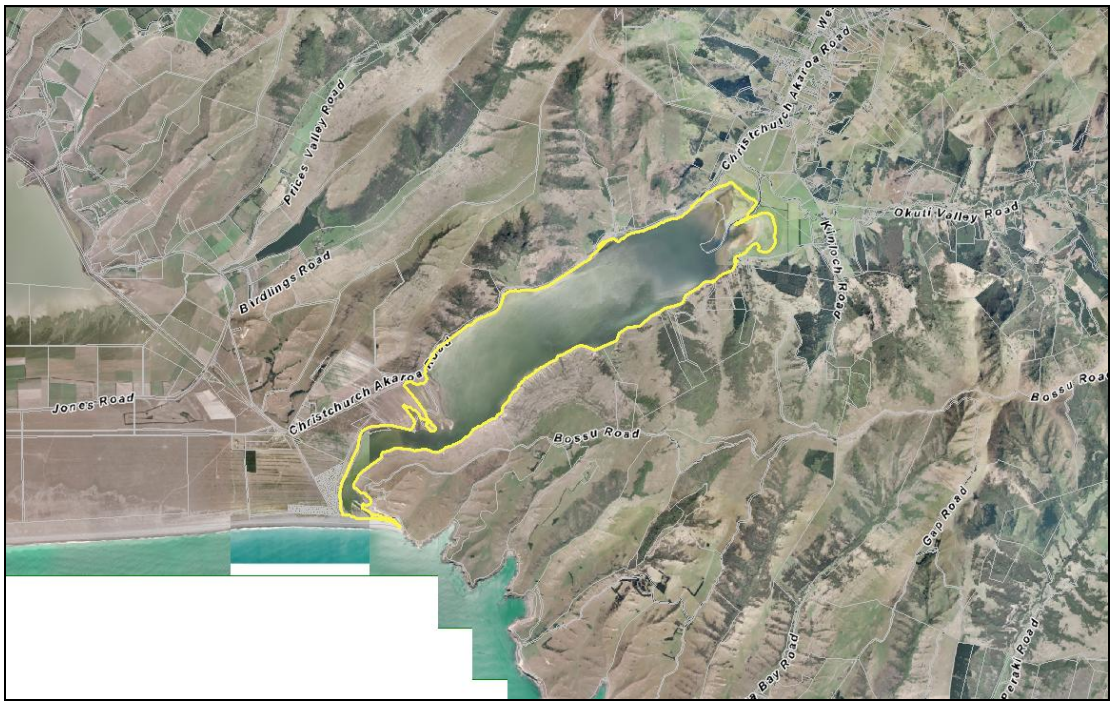
Site name: Lake Forsyth/Wairewa

Site number: SES/H/6

Summary of Significance:

Lake Forsyth/Wairewa is significant as a large example of a coastal lake with extensive and representative saltmarsh and freshwater wetlands. The lake margins are an originally rare ecosystem that supports distinctive vegetation communities. The lake and its margins support a large number of indigenous plant, bird and fish species that are nationally Threatened and At Risk and uncommon within the ecological districts or region. The site also provides habitat for a very diverse, representative assemblage of birds and is a nationally and regionally significant habitat for a large number of species. It is an important ecological corridor for fauna, including several migratory freshwater fish and is ecologically linked to other surrounding areas of high ecological value.

Site Map



Additional Site Information

Ecological District: Herbert and Akaroa[1]

Area of SES (ha): 715.42

Central point (NZTM): E1578845, N5149699

Site Description

Lake Forsyth/Wairewa is a narrow lake (approximately 7.6 km long by 1 km wide) (Cromarty and Scott 1995) at the eastern end of Kaitorete Spit and within the steep sides of Little River Valley. The Christchurch - Akaroa Road passes along the lake's northwestern edge. The boundary between the Herbert and Akaroa Ecological Districts runs through the centre of the lake.

Curved beach ridges at the base of Kaitorete Spit impound the lake. A short man-made channel leads to the sea, but surface discharge is usually blocked by a gravel beach ridge. This barrier is mechanically opened when lake levels are high. The lake is near sea level, approximately 2 m deep, slightly brackish and highly eutrophic (Cromarty and Scott 1995).

There are extensive wetlands located around the perimeter of the lake. Those nearer the coast are non-tidal estuarine habitats that are comprised mostly of native sea rush rushland and marsh ribbonwood shrubland with smaller areas of native reedland and mixed saltmarsh herbfield. Remaining perimeter wetlands, including extensive wetland areas at the head of the lake, are freshwater lacustrine marsh, and palustrine marsh and swamp habitats. The vegetation of the palustrine wetlands is mainly wet pasture with *Juncus edgariae* rushland and smaller areas of raupo reedland and willow treeland and forest. The lacustrine habitats are mainly indigenous lakeshore turf/herbfields with a high diversity of species. Stands of raupo also occur at intervals in shallow water around the lake margin (Grove and Parker 2013). A comprehensive plant species list (Jensen 2009) is provided in Appendix 1.

The lake was identified by the Department of Conservation as a Recommended Area for Protection (Herbert RAP 17 – Wairewa) Wilson (1992).

Extent of Site of Ecological Significance

The site includes the lake and margins, including its wetlands and the wet pasture at the head of the lake which provide important habitat for birds (Crossland 2008).

[1] The boundary between the Herbert and Akaroa Ecological Districts following Wilson (1992) runs approximately through the centre of Lake Forsyth/Wairewa.

Assessment Summary

The Lake Forsyth/Wairewa Site has been evaluated against the criteria for determining significant indigenous vegetation and significant habitats of indigenous fauna listed in Appendix 3 of the Canterbury Regional Policy Statement (Environment Canterbury, 2013) (see below) referring also to the Wildland Consultants (2013) Guidelines and advice from the relevant Specialist Ecologist Groups. Under these criteria the site is ecologically significant because it meets the representativeness (criteria 1 and 2), rarity/distinctiveness (criteria 3, 4 and 6), diversity and pattern (criterion 7) and ecological context criteria (criteria 8, 9 and 10).

Assessment against Significance Criteria

Representativeness

1. ***Indigenous vegetation or habitat of indigenous fauna that is representative, typical or characteristic of the natural diversity of the relevant ecological district. This can include degraded examples where they are some of the best remaining examples of their type, or represent all that remains of indigenous biodiversity in some areas.***

   The site is significant under this criterion.

   Although the lake has a very high nutrient status and some of the vegetation on the margins has been modified by dryland plant invasion (ECan 2010) it supports moderately representative examples of both freshwater palustrine and lacustine wetland vegetation and diverse and representative indigenous lakeshore turfland and herbfield communities. The site still retains the key wetland functions of a coastal lake/lagoon habitat.

   The lake has an international significance ranking for bird habitat (Cromarty and Scott 2005, O'Donnell 2000) and supports a diverse and representative assemblage of water birds. A very high proportion of the species in the "Banks Peninsula estuaries/coastal wetlands bird species assemblage" (Crossland unpubl. data 2014) occur at the site (Appendix 2). A full list of the species recorded by Council staff at the site (Crossland unpubl. data 2014) is provided in Appendix 3.

2. ***Indigenous vegetation or habitat of indigenous fauna that is a relatively large example of its type within the relevant ecological district.***

   The site is significant under this criterion.

   Lake Forsyth/Wairewa is the largest lake in both the Herbert and Akaroa Ecological Districts. It supports the most extensive non-tidal saltmarshes and freshwater marshes in the Banks Ecological Region.

Rarity/Distinctiveness

3. Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent in the Region, or relevant land environment, ecological district, or freshwater environment.

The wetlands within the site are significant under this criterion.

Wetland ecosystems have been reduced to less than 20% of their former extent at the ecological district, regional and freshwater biogeographic unit scales. Ausseil et al. (2008) estimate that wetlands have been reduced to 10.6% of their original extent in the Canterbury Region and 7.0% in the Canterbury freshwater biogeographic unit.

The site is also significant at the Level 4 land environment scale. Much of the indigenous freshwater wetland vegetation on the margins of the lake is on Acutely and Chronically Threatened land environments (predominantly J2.2b, F3.1a and J2.1d,) where 4.5, 9.9 and 10.6% indigenous vegetation, respectively, is left on these land environments nationally (Walker et al. 2007).

4. Indigenous vegetation or habitat of indigenous fauna that supports an indigenous species that is threatened, at risk, or uncommon, nationally or within the relevant ecological district.

The site is significant under this criterion.

Lake Forsyth/Wairewa supports a large number of indigenous plant, bird and fish species that are nationally Threatened and At Risk and plant and bird species that are uncommon within the ecological district or region.

Plants

Nationally Threatened and At Risk plant species (de Lange et al. 2013) that occur in the lake or on the margins of the lake (Jensen 2009, Wilson 1992) include:

- *Muehlenbeckia astonii* (Threatened - Nationally Endangered) (Jensen 2009)
- *Isolepis basillaris* (Threatened - Nationally Vulnerable) (Jensen 2009, Wilson 1992) – this is probably the best site for this species in Canterbury (Jensen 2009)
- *Lepilaena bilocularis* (Threatened – Nationally Vulnerable) (Wilson 1992)
- *Eryngium vesiculosum* (At Risk – Declining) (Jensen 2009, Wilson 1992)
- *Coprosma virescens* (At Risk – Declining) (Jensen 2009)
- *Chenopodium allanii* (At Risk – Naturally Uncommon) (Jensen 2009)
- *Hebe strictissima* (At Risk – Naturally Uncommon) (Jensen 2009)
- *Mimulus repens* (At Risk – Naturally Uncommon) (Jensen 2009, Wilson 1992)
- *Stuckenia pectinata* (At Risk – Naturally Uncommon) (Wilson 1992)

Plant species (Jensen 2009) that are “uncommon to rare or very local” on Banks Peninsula (Wilson 2013) are:

- *Alternanthera nahui*
- *Bolboschoenus caldwellii*
- *Carex buchananii*
- *Chenopodium glaucum*
- *Crassula sinclairii*
- *Isolepis cernua*
- *Juncus krausii*
- *Limosella lineata*
- *Myriophyllum triphyllum*
- *Potamogeton cheesemanii*
- *Pratia perpusilla*
- *Ranunculus limosella*
- *Ruppia polycarpa*
- *Selliera radicans*
- *Typha orientalis*
- *Zannichellia palustris*

Birds

Nationally Threatened bird species (Robertson et al. 2012) that use the lake and its margins (Crossland unpubl. data 2014) are:

- White heron (Threatened - Nationally Critical)
- Black-billed gull (Threatened - Nationally Critical)
- Black-fronted tern (Threatened - Nationally Endangered)
- Australasian crested grebe (Threatened - Nationally Vulnerable)
- Banded dotterel (Threatened - Nationally Vulnerable)
- Caspian tern (Threatened - Nationally Vulnerable)
- Pied cormorant (Threatened - Nationally Vulnerable)
- Red-billed gull (Threatened - Nationally Vulnerable)

The site is also known to provide habitat for Australasian bittern (Threatened - Nationally Endangered, and threatened and uncommon in the ecological district), marsh crake (At Risk – Relict, and threatened and uncommon in the ecological district) but due to the cryptic nature of these species they are not recorded during formal Council surveys (Andrew Crossland *pers.comm* 2015).

Nationally At Risk (Robertson et al. 2012) bird species[2] that use the lake its margins are:

- Eastern bar-tailed godwit (At Risk - Declining)
- Pied stilt (At Risk - Declining)
- South Island pied oystercatcher (At Risk - Declining)
- White-fronted tern (At Risk - Declining)
- Black cormorant (At Risk - Naturally Uncommon)
- Little black cormorant (At Risk - Naturally Uncommon)
- Royal spoonbill (At Risk - Naturally Uncommon)
- Variable oystercatcher (At Risk- Recovering)

[2] Although for mobile fauna such as birds, species classified as nationally At Risk do not meet the threshold for significance (Wildland Consultants 2013).

Fish

A number of nationally Threatened and At Risk (Goodman et al. 2014) fish species are found in, or migrate through the site between the marine environment and the rivers and streams above the lake (Gray 2013):

- Lamprey (Threatened – Nationally Vulnerable)
- Longfin eel (At Risk - Declining)
- Torrentfish (At Risk - Declining)
- Bluegill bully (At Risk - Declining)
- Koaro (At Risk - Declining)
- Inanga (At Risk - Declining)
- Redfin bully (At Risk - Declining)

5. ***The site contains indigenous vegetation or an indigenous species at its distribution limit within Canterbury Region or nationally.***

The site is not significant under this criterion. There are no indigenous vegetation communities or indigenous species at their distributional limit within Canterbury Region or nationally.

6. ***Indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, occurs within an originally rare ecosystem, or has developed as a result of an unusual environmental factor or combinations of factors.***

The site is significant under this criterion.

Lake margins are originally rare ecosystems Williams et al. (2007). The lake and its margins also support a distinctive assemblage of salt marsh turf species and a distinctive assemblage of indigenous birds.

Diversity and Pattern

7. ***Indigenous vegetation or habitat of indigenous fauna that contains a high diversity of indigenous ecosystem or habitat types, indigenous taxa, or has changes in species composition reflecting the existence of diverse natural features or ecological gradients.***

The site is significant under this criterion.

The lake supports a diverse range of indigenous wetland plant communities. The composition of the wetland communities change in response to differences in salinity between the mouth and the head of the lake. Wetlands at the head of the lake are freshwater palustrine and lacustrine wetlands while those nearer the coast are comprised mostly of species more tolerant to higher salinity including native sea rush rushland and marsh ribbonwood shrubland with areas of native reedland and saltmarsh herbfield (Grove and Parker 2013).

Indigenous lakeshore vegetation communities support turfland and herbfield vegetation communites that are notable for their diversity (Wilson 1992, Jensen 2009, Grove and Parker 2013).

The lake also provides habitat for a very diverse assemblage of birds. With 93 bird species recorded since 1840 (including 51 resident species, 14 seasonal visitors, 17 vagrants and 11 locally extinct species) the lake and its environs has a comparable or higher species diversity than most other New Zealand coastal wetland and estuarine systems and the seventh highest ranking in Canterbury behind Lake Ellesmere, the Avon-Heathcote Estuary/Bromley Oxidation Ponds, Lake Ki-Wainono, Ashley-Saltwater Creek Estuary, Brooklands Lagoon and Washdyke Lagoon. Fifty-three species are wetland and coastal birds (Crossland 2008).

Ecological Context

8. Vegetation or habitat of indigenous fauna that provides or contributes to an important ecological linkage or network, or provides an important buffering function.

The site is significant under this criterion.

Lake Forsyth/Wairewa is ecologically linked to other areas of high ecological value including the indigenous shrublands of Birdlings Flat, diverse shrublands and forest on the north-western side of the lake, dryland vegetation communities on the south eastern side of the lake, the shingle beach and dune ecosytems of Kaitorete Spit, and the Takiritawai River and its upstream tributaries.

The lake provides an important ecological corridor for a number of migratory fish species including large numbers of long- and shortfin eel. The ecological linkage between the coast and the rivers and the streams via the lake is essential for these fish.

The lake and its margins are also part of an ecological network of coastal habitats along the South Island's east coast that provide habitat for water and wetland birds. It provides important additional habitat in close proximity to Lake Ellesmere/Te Waihora. When habitat conditions in Lake Ellesmere are unsuitable for the feeding requirements of a range of wetland bird species (e.g. pied stilt, banded dotterel, grey teal, New Zealand shoveler and black swan) there is a substantial movement of birds from Lake Ellesmere/Te Waihora to Lake Forsyth/Wairewa (Crossland *pers. comm*. 2015).

9. A wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal system.

The site is significant under this criterion.

Its large size and high species richness mean the site plays an important role in maintaining the genetic and ecological diversity of the region. The wetlands on the lakes margin are also significant under this criterion. They retain their key hydrological functions and are hydrologically connected to the lake.

10. ***Indigenous vegetation or habitat of indigenous fauna that provides important habitat (including refuges from predation, or key habitat for feeding, breeding, or resting) for indigenous species, either seasonally or permanently.***

The site is significant under this criterion.

Lake Forsyth/Wairewa has an international significance ranking for bird habitat (Cromarty and Scott 1995, O'Donnell 2000). It supports large numbers and a high diversity of wetland and coastal birds including large numbers of nationally Threatened and At Risk species (Robertson et al. 2012) (refer to Criterion 4, above).

Fifty-three bird wetland and coastal bird species have been recorded on the lake and numbers of birds peak at 10,000+ in late summer/autumn (Crossland 2008). Twenty-one of these species use the lake and its margins in numbers of national, regional or local significance (Appendix 2). The key bird species of conservation importance at Lake Forsyth are Australasian crested grebe (year round); white heron (autumn-winter); paradise shelduck (summer-autumn); New Zealand shoveler (summer-autumn); Grey teal (summer-winter); New Zealand scaup (autumn-winter) and Pied stilt (spring-summer) (Crossland 2008).

The lake is of special value as a wintering site for up to 70% (up to 269 birds) of the entire New Zealand population of Australasian crested grebe (Crossland 2008, unpubl. data 2014).

Important habitats for birds at the site are:

- Lower Okana River and delta
- Lowland wet grassland at the head of the lake
- Mudflats at the head of the lake
- Mudflats at the southern end of the lake
- Freshwater wetlands adjacent to the western shoreline
- East and west lake margins
- Short grassland, saltmeadow and saltmarsh habitats at the southern end of the lake
- The lake outlet channel
- The lake mouth at Birdlings Flat

These habitats and the bird guilds that use them are described in more detail in Crossland (2008).

Site Management

Existing Protection Status

The majority of the site is within the Wairewa Conservation Area (conservation unit no. N36135 and M37017, M37018, M37019 and M37020). This areas are administered by the Department of Conservation. Areas at the head (north-eastern end) of the lake are in private ownership and are not legally protected. The site is a Maori Fishing Reserve under Fisheries Regulations (1986). Ngai Tahu and local runanga are responsible for the management of The Wairewa Maori Fisheries Reserve (Cromarty and Scott 1995).

Threats and risks	Management recommendations	Support package options
• Water quality issues: high nutrient levels sedimentation. The lake is in a highly eutrophic state and experiences frequent algal blooms.	• The Banks Peninsula Zone Committee has prepared an action plan to address freshwater quality (and flooding issues) in the catchment. The plan will be incorporated into a sub-regional section (section 10) of the proposed Land & Water Regional Plan.	• N/A
• Stock, particularly cattle at the head of the lake (Jensen 2009).	• Consider fencing the alluvial flats at the head of the lake and working with landowner(s) to remove grazing from areas of high botanical and/or habitat value. • Consider fencing the wetland margin around the Christchurch City Council's Birdlings Flat Regional Park (Reserve 3185) to keep sheep out of the wetland communities. • Consider fencing other un-fenced parts of the lake.	• Discussion with landowners about the benefits to biodiversity of stock control and of the options available. • Collaboration with other agencies and groups to assist landowners as appropriate.
• Passage for eels and other indigenous diadromous fish species through the mouth of the lake.	• Continue to open the lake at key upstream and downstream migration periods to allow the passage of indigenous migratory fish.	• N/A
• Prolonged heightened lake levels affecting saltmarsh and turfland vegetation, bird breeding, feeding,	• Consider the ecological requirements of indigenous fauna and saltmarsh and turfland vegetation in decisions regarding the	• N/A

roosting habitat and the condition of buffering vegetation on the lake margins.	management of lake levels, particularly in relation to extended periods of extremely low or high lake levels.	
• Vehicle damage to turfland in front of the powerboat clubhouse house (Jensen 2009).	• Consider signage and fencing or bollards to limit vehicle access at this location. Consider the feasibility of constructing a boat ramp to discourage people driving over the turfland to launch boats.	• N/A
• Power boats disturbing wildlife on the lake.	• Consider options for controlling or prohibiting the use of power boats on the lake.	• N/A
• Model planes disturbing wildlife on the lake	• Consider options for restricting the use of model planes in the air space over areas with high wildlife values.	• N/A
• Gamebird hunting disturbing non-target waterfowl, particularly species such as Australasian crested grebe.	• Consider identifying sensitive locations where hunting is best prohibited and identifying appropriate locations for gamebird hunting. This is considered to be particularly important now that Canada geese can be hunted year round. The hunting window now extends through the breeding season, the moulting season and the period of peak occupancy of indigenous bird species (including threatened and at risk species).	• N/A
• Biodiversity pest plants. Many exotic plants are present on the lake margins (e.g. grey and crack willows and horned poppy near Birdlings Flat).	• Consider implementing a programme (in partnership with DOC?) to control grey willows (as a priority) and crack willows (where they are not providing important roosting/nesting habitat for birds). • Consider controlling other biodiversity pest plants within site.	• N/A

References

Ausseil, A-G.; Gerbeaux, P.; Chadderton, W.L.; Stephens, T.; Brown, D.; and Leathwick, J. (2008). *Wetland ecosystems of national importance for biodiversity: Criteria, methods and candidate list of nationally important inland wetlands.* Landcare Research Contract Report: LC0708/158. 174pp.

Cromarty, P. and D. Scott (1995). *A Directory of Wetlands in New Zealand*. Department of Conservation, Wellington.

Crossland, A. (2008). Lake Forsyth (Wairewa) *Wetlands: An overview of the site's importance to birdlife with habitat management recommendations.* Unpublished Report. Christchurch City Council. (Trim: 10/190712).

Crossland, A. (2014). *Lake Forsyth Bird Monitoring 1989 to Present.* Unpublished data. (Trim: 14/440366)

de Lange, P. J., Rolfe, J. R., Champion, P. D., Courtney, S. P., Heenan, P. B., Barkla, J. W., Cameron, E.K., Norton, D.A., Hitchmough, R. A. (2013). *Conservation status of New Zealand indigenous vascular plants, 2012* (New Zealand Threat Classification Series No. 3). Department of Conservation, Wellington.

Environment Canterbury. 2010. Lake Forsyth/Wairewa *Wetland Assessment*. Unpublished Report prepared by Environment Canterbury. (Trim: 14/555378).

Environment Canterbury. (2013). *Canterbury Regional Policy Statement 2013*. Environment Canterbury.

Goodman, J.M.; Dunn, N.R.; Ravenscroft, P.J.; Allibone, R.M.; Boubee, J.A.T.; David, B.O.; Griffiths, M.; Ling, N.; Hitchmough, R.A.; Rolfe, J.R. (2014) Conservation status of New Zealand freshwater fish, 2013. *New Zealand Threat Classification Series 7.* Department of Conservation, Wellington. 12 p.

Gray, D. (2013). *Stream Ecology in Tributaries of Wairewa-Lake Forsyth*. Unpublished Report.

Grove, P. and Parker, M. (2013). *Banks Peninsula Wetlands – a discussion paper prepared for the Banks Peninsula Water Management Zone.* Unpublished report prepared for the Banks Peninsula Water Management Zone Committee, May 2013. 6 pp.

Jensen, C. (2009). *Lake Forsyth (Te Wairewa), Banks Peninsula: A botanical survey.* Unpublished Report, April 2009. (Trim: 14/269165).

O'Donnell, C. F. J. (2000). *The significance of river and open water habitats for indigenous birds in Canterbury, New Zealand*. Unpublished Report No. U00/37. Environment Canterbury, Christchurch.

Robertson, H.A.; Dowding, J.E.; Elliott, G.P.; Hitchmough, R.A.; Miskelly, C.M.; O'Donnell, C.F.J.; Powlesland, R.G.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A. 2013: Conservation status of New Zealand birds, 2012. *New Zealand Threat Classification Series 4.* Department of Conservation, Wellington. 22 p.

Walker, S., Cieraad, E., Grove, P., Lloyd, K., Myers, S., Park, T., & Porteous, T. (2007). *Guide for users of the threatened environment classification* (Ver 1.1.).

Williams, P. A., Wiser, S., Clarkson, B. R., & Stanley, M. C. (2007). New Zealand's historically rare terrestrial ecosystems set in a physical and physiognomic framework. *New Zealand Journal of Ecology 31*(2), 119–128.

Wilson, H.D. (1992). Banks Ecological Region: Port Hills, Herbert and Akaroa Ecological Districts. *Protected Natural Areas Programme Survey Report No. 21.* Department of Conservation, Canterbury. 342 pp.

Wilson, H.D. (2013). *Plant Life on Banks Peninsula.* Manuka Press, Cromwell. 412 pp.

Assessment completed by: Scott Hooson
Date: 18 November 2014

Statement completed by: Scott Hooson
Date: 18 November 2014

Statement updated by: XXX
Date: XXX

PLEASE NOTE THIS STATEMENT IS BASED ON INFORMATION AVAILABLE AT THE TIME OF WRITING. DUE TO THE DYNAMIC NATURE OF ECOSYSTEMS, FUTURE REASSESSMENT OF THE SITE MAY BE NECESSARY TO REFLECT ANY CHANGES IN KNOWLEDGE OF ITS ECOLOGICAL SIGNIFICANCE.

Appendix 1: Plant Species List

Sourced from Jensen (2009).

Scientific Name	**Common Name(s)**
Indigenous species	
Acaena novae-zelandiae	piripiri, bidibid
Aira caryophyllea	
Alectryon excelsus	titoki
Alternanthera nahui	
Bolboschoenus caldwellii	
Calystegia soldanella	shore convolvulus
Calystegia tuguriorum	NZ bindweed
Carex buchananii	
Carex secta	pukio
Carex virgata	pukio
Chenopodium allanii	
Chenopodium glaucum	glaucous goosefoot
Clematis afoliata	leafless clematis
Coprosma areolata	
Coprosma crassifolia	mikimiki
Coprosma propinqua	mikimiki
Coprosma repens	taupata
Coprosma robusta	karamu
Coprosma virescens	
Cordyline australis	ti kouka, cabbage tree
Corokia cotoneaster	korokio
Cotula coronopifolia	batchelors button
Crassula sinclairii	
Cristesion marinum	salt barley grass
Dichondra brevifolia	
Disphyma australe	horokaha, NZ ice plant
Eleocharis acuta	sharp spike sedge
Eryngium vesiculosum	
Ficinia nodosa	
Fuchsia excorticata	tree fuchsia, kotukutuku
Hebe strictissima	
Helichrysum lanceolatum	
Hoheria angustifolia	houhere, narrow-leaved lacebark
Hydrocotyle sulcata	
Ileostylus micranthus	
Isolepis basilaris	
Isolepis cernua	slender clubrush
Juncus edgariae	wiwi
Juncus kraussii var.	sea rush
Kunzea ericoides	kanuka
Leptinella dioica	
Lilaeopsis novae-zelandiae	
Limosella lineata	mudwort
Melicytus ramiflorus	mahoe

Mimulus repens	native musk
Muehlenbeckia astonii	pohuehue
Muehlenbeckia australis	pohuehue
Muehlenbeckia axillaris	pohuehue
Muehlenbeckia complexa	pohuehue
Muehlenbeckia ephedroides	pohuehue
Myoporum laetum	ngaio
Myriophyllum triphyllum	water milfoil
Myrsine australis	mapau, red matipo
Olearia paniculata	akiraho, hedge olearia
Oxalis exilis	creeping oxalis
Phormium tenax	harakeke, NZ flax
Pittosporum tenuifolium	kohuhu
Plagianthus divaricatus	marsh ribbonwood
Poa cita	silver tussock, wii
Polystichum richardii	
Pratia perpusilla	
Pseudopanax arboreus	five-finger
Pteridium esculentum	bracken
Ranunculus limosella	
Rubus cissoides	tataramoa, bush lawyer
Schoenoplectus pungens	three-square
Selliera radicans	remuremu, selliera
Sophora microphylla	kowhai
Sophora prostrata	prostrate kowhai
Tetragonia implexicoma	NZ spinach
Triglochin striatum	arrow grass
Typha orientalis	raupo
Exotic species	
Acaena agnipila	Australian sheeps bur
Acer pseudoplatanus	sycamore
Achillea millefolium	yarrow
Agrostis stolonifera	creeping bent
Anagallis arvensis	scarlet pimpernel
Anthoxanthum odoratum	sweet vernal
Atriplex prostrata	orache
Bromus diandrus	ripgut brome
Calystegia silvatica	bindweed
Carpobrotus edulis	ice plant
Centranthus ruber	spur valerian
Chenopodium album	fathen
Cirsium arvense	Californian thistle
Cirsium vulgare	Scotch thistle
Echium candicans	
Echium vulgare	
Elytrigia repens	couch
Erodium cicutarium	common storksbill
Foeniculum vulgare	fennel
Glaucium flavum	
Holcus lanatus	Yorkshire fog
Hypochoeris radicata	catsear

Lolium perenne ryegrass	
Lotus pedunculatus	lotus major
Malus domesticus	Malus sp.
Pittosporum ralphii	
Plantago coronopus	bucks horn plantain
Plantago lanceolata	narrow plantain
Plantago major	broad plantain
Polygonum salicifolium	swamp willow weed
Quercus sp.	oak
Rosa rubiginosa	sweet briar
Rubus fruticosus agg.	blackberry
Rumex acetosella	sheep sorrel
Rumex crispus	curled dock
Rumex obtusifolius	broad dock
Salix cinerea	grey willow
Salix fragilis	crack willow
Sambucus nigra	elder
Schedonorus phoenix	tall fescue
Sedum acre	stonecrop
Solanum nigrum	black nightshade
Spergularia marina	
Trifolium fragiferum	strawberry clover
Trifolium pratense	red clover
Trifolium repens	white clover
Ulex europaeus	gorse
Verbascum thapsus	woolly mullein
Vicia sativa	vetch

Appendix 2: Indigenous Banks Peninsula Estuaries/Coastal Wetlands Bird Species Assemblage

Comparison of bird species recorded at Lake Forsyth/Wairewa (Crossland unpubl. data 2014) (and incidental observations by Council staff) with the "Banks Peninsula Estuaries/Coastal Wetlands Bird Species Assemblage" (Crossland 2014).

Species recorded at the study site are marked with a tick ✓.

	Common name	**Scientific Name**
	Arctic Skua	*Stercorarius parasiticus*
	Australasian Gannet	*Morus serrator*
✓	Australasian Harrier	*Circus approximans*
✓	Black Cormorant	*Phalacrocorax carbo novaehollandiae*
✓	Black Swan	*Cygnus atratus*
✓	Black-backed Gull	*Larus dominicanus dominicanus*
✓	Black-billed Gull	*Larus bulleri*
✓	Black-fronted Tern	*Sterna albostriata*
✓	Caspian Tern	*Sterna caspia*
✓	Eastern Bar-tailed Godwit	*Limosa lapponica baueri*
✓ *	Grey Duck	*Anas superciliosa superciliosa*
✓	Grey Teal	*Anas gracilis*
✓	Little Black Cormorant	*Phalacrocorax sulcirostris*
✓	Little Cormorant	*Phalacrocorax melanoleucos brevirostris*
✓	Marsh Crake	*Porzana pusilla affinis*
✓	New Zealand Kingfisher	*Halcyon sancta vagans*
✓	New Zealand Shoveler	*Anas rhynchotis*
✓	Paradise Shelduck	*Tadorna variegata*
✓	Pied Cormorant	*Phalacrocorax varius varius*
✓	Pied Stilt	*Himantopus himantopus leucocephalus*
	Pomarine Skua	*Stercorarius pomarinus*
✓	Pukeko	*Porphyrio porphyrio melanotus*
✓	Red-billed Gull	*Larus novaehollandiae scopulinus*
	Reef Heron	*Egretta sacra sacra*
✓	South Island Pied Oystercatcher	*Haematopus ostralegus finschi*
✓	Spotted Shag	*Stictocarbo punctatus*
✓	Spur-winged Plover	*Vanellus miles*
✓	Variable Oystercatcher	*Haematopus unicolor*
✓	Welcome Swallow	*Hirundo tahitica neoxena*
✓	White-faced Heron	*Ardea novaehollandiae novaehollandiae*
✓	White-fronted Tern	*Sterna striata*
	New Zealand Pipit	*Anthus novaeseelandiae novaeseelandiae*

* Mallard/grey duck hybrids have been recorded at the site (Crossland unpubl. data 2014).

Appendix 3: Bird Species List

Waterbirds recorded from Lake Forsyth/Wairewa during Council monitoring, July 1989 to July 2014. Sourced from Crossland unpubl. data (2014).

* denotes introduced species

Species
Australasian crested grebe
Australasian harrier
Australian coot
Banded dotterel
Black cormorant
*Black swan
Black-backed gull
Black-billed gull
Black-fronted tern
*Canada goose
Caspian tern
Eastern bar-tailed godwit
*Feral goose
Grey teal
Gull-billed tern
Little black cormorant
Little cormorant
Little egret
Little tern
Mallard/grey duck
*Mute swan
New Zealand shoveler
New Zealand scaup
Paradise shelduck
Pied cormorant
Pied stilt
Pukeko
Red-billed gull
Royal spoonbill
South Island pied oystercatcher
Spotted shag
Spur-winged plover
Variable oystercatcher
Welcome swallow
White heron
White-faced heron
White-fronted tern

Appendix 4: Significance for Bird Species

Bird species that use Lake Forsyth/Wairewa and environs in numbers of national (N), regional (R) or local (L) significance (defined as >5% of local or regional or >1% of national populations; based on lagoon bird monitoring data and best estimates for local/regional/national populations). Peak populations on Lake Forsyth are provided in brackets (from Crossland 2008).

Species	Max count	Significance
Australasian Crested Grebe	(250+)	N
White Heron	(3)	N
Paradise Shelduck	(3400+)	N
New Zealand Shoveler	(3000+)	N
Grey Teal	(3000+)	N
New Zealand Scaup	(4100+)	N
Pied Stilt	(700+)	N
Bar-tailed Godwit	(160)	R
Red-billed Gull	(2450)	R
Pied Cormorant	(20)	L
White-faced Heron	(20)	L
Australasian Bittern	(?)	L
Royal Spoonbill	(10)	L
Variable Oystercatcher	(6)	L
Spur-winged Plover	(210)	L
Banded Dotterel	(80)	L
Black-billed Gull	(320)	L
White-fronted Tern	(300)	L
Black-fronted Tern	(10)	L
Caspian Tern	(10)	L
New Zealand Kingfisher	(?)	L