Wetland ecosystems of national importance for biodiversity: Criteria, methods and candidate list of nationally important inland wetlands

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DISCUSSION DOCUMENT

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Executive Summary

The Department of Conservation (DOC) is developing a series of systematic conservation planning and reporting tools for terrestrial, freshwater, and marine ecosystems under the banner of its Natural Heritage Management System (NHMS: see Stephens et al. 2002 for principles). The NHMS initiative seeks to provide resource managers with a set of decision support tools to maximize efficient use of limited conservation resources. It aims to help managers prioritise, plan, and report on conservation outcomes at a range of geographical and organisational scales. The approach is based on systematic conservation planning principles (Margules & Pressey 2000) using data, transparent criteria, and testable models and explicit assumptions (Chadderton et al. 2004, Stephens et al. 2002). The report arises from the Waters of National Importance (WONI) project, which is part of the Sustainable Development Programme of Action for Freshwaters. The project goal required DOC to identify a list of water bodies (lakes, rivers, wetlands) that would protect a full range of freshwater biodiversity. This report deals with nationally important inland wetlands.

Previous attempts to identify nationally important wetlands for biodiversity (e.g. Cromarty and Scott 1996) were based on an expert panel approach, and were hampered by scant biological data and lack of national wetland maps. Classification tools to define units of the full range of New Zealand's wetland biodiversity were also absent. This meant that the concep of complementarity and representation of a full range of habitats were poorly reflected when identifying nationally important wetlands for biodiversity.

This assessment has four objectives:

- Delineate the historic and current extent of all New Zealand wetlands including those on large inshore islands. Inland wetlands were mapped to a minimum size of 0.5 ha, on North, South, and Stewart islands, and all large inshore islands where useable geo-spatial data were available. The Chatham, Kermadec, and New Zealand sub-Antarctic islands were not mapped because there were no relevant geospatial data.
- Implement a spatially explicit classification based on the Johnson and Gerbeaux (2004) framework.
- Develop measures of anthropogenic pressure to indicate the intensity of various human induced disturbances potentially affecting the ecological integrity of native wetland biota based on the approach of Stephens et al. (2002).
- Develop a ranked list of wetlands of national importance that would protect a full range of wetland biodiversity and highlight the most immediate conservation management needs.

The assessment process was underlain by a three level spatial hierarchy.

- A biogeographic classification was used to divide New Zealand into a smaller set of regions sharing a common history of large scale disturbance and recolonisation. The approach assumes that to protect a full range of biodiversity a representative range of wetlands must be protected in each biogeographic unit. For consistency and to allow future integration of aquatic assessments we used a catchment-based biogeographic classification that breaks New Zealand into a set of 29 biogeographic units.
- Within each biogeographic unit each wetland formed the unit of analysis.
- A spatial classification was used to assign each wetland to a class as defined by Johnson and Gerbeaux (2004). We assumed that each wetland class represented a distinct biological assemblage.

A map of the historical extent of New Zealand's wetlands was produced using soil information held by the Land Resource Inventory (LRI) (Newsome et al. 2000) and a 15 m digital elevation model to refine soil polygons. The estimated historic extent of freshwater wetlands (including forested and herbaceous wetlands) was 2.4 million ha, over three times greater than previous estimates (672,000 ha). We estimated the current extent of wetlands to be 249,776 ha, or about 10% of historic extent. This is consistent with previous estimates of a 90% loss.

Contemporary wetland cover was defined by combining existing databases including LCDB2 (Land cover database 2), topomaps NZMS 260, existing surveys from the Regional Councils (e.g. polygons and point locations), Queen Elizabeth II (QEII) covenant wetland polygons, DOC surveys (WERI database), and a 15 m digital elevation model (DEM), to define a single set of wetland polygons and centre points. These were then checked from a standardised set of Landsat imagery using the Ecosat mapping technology. Where necessary, new wetland boundaries were delineated. The approach provides a more reliable and consistent national wetland map than provided by other databases (e.g. LCDB2), and it is quicker and less labour intensive than aerial photo and ground survey based approaches. We mapped 7032 individual wetland sites nationally. Most (74%) were smaller than 10 ha, and accounted for 6% of the national wetland area. A small number (77) of large wetlands (>500 ha) accounted for 55% of remaining wetland area; these were predominantly on the West Coast of the South Island, Southland, Otago, Northland, and the Waikato. This geographic bias indicates protection of larger wetlands alone will not protect a full range of wetland biodiversity. Smaller wetlands and remnant fragments, especially in lowland areas where wetland loss has been dramatic, account for most of the remaining wetlands in at least 40% of the 29 biogeographic units. Some wetlands were always naturally rare, but most have been much reduced, with many biogeographic units retaining less than 5% of their former wetland extent. The Palliser-Kidnapper and East Cape areas appear to have suffered the greatest losses with just 0.4% and 2.4% respectively of former wetland remaining.

A simple wetland classification was derived from soil attribute data and a 15 m DEM. Wetlands were classified into seven groups at the hydro-class level using fuzzy expert rules: bog, fen, swamp, marsh, pakihi/gumland, seepage, and inland saline. According to the classification results, swamps and pakihi/gumland are the two most common wetland classes found nationally, making up 36% and 23% respectively of all remaining wetlands. Swamps have undergone the largest loss with only 6 % of their historical extent remaining. Although inland saline wetlands are the rarest wetland type, almost 20% of their former extent remains. A preliminary assessment of the classification's accuracy was completed in the Otago region. On average we found 60% agreement between classification and actual wetland type. Accuracy was generally high for all wetland classes (over 80%) except for marshes (5%), with 93% misclassified as swamps due to soil drainage class inaccuracies. Also, almost half (46%) of fens were misclassified as bogs because of an overlapping range of soil pH; bogs/fens and swamps/marshes have highly similar environmental characteristics. Hence, if a complementarity function is used, the impacts of misclassification may limit the ability of the final site selection rationale to capture a representative range of wetland biodiversity. Moreover, classification limitations vary with the accuracy of the LRI,.which is relatively coarse in Otago and more remote areas of New Zealand; however, in more heavily farmed regions where wetland loss has been greatest, the finer resolution of the LRI should also have lower classification error.

Wetlands are often under pressure from a variety of human induced disturbances, the most common being invasive species, drainage, and incompatible land use. We developed an index of human induced pressure by combining six spatial indicators of human activities known to degrade wetland biodiversity and function, and for which nationally consistent GIS data was available. Pressure measures were applied at three spatial units: the wetland's catchment, a 30m buffer around the wetland, and the wetland itself. Pressure included the amount of natural vegetation cover, human-made impervious cover, number of introduced fish, percent cover woody weeds, artificial drainage, and a surrogate measure of land use intensity (nitrate leaching risk). We assume a direct relationship between human pressure measures and wetland ecological integrity. Pressure measures were transformed into an index of ecological integrity (EI) that ranged between 1 (near pristine, no human induced impacts) and 0 (totally degraded with no remaining ecological integrity, native biodiversity or ecological function). More than 60% of remaining wetlands had ecological integrity measures less than 0.5, indicating moderate to severe degradation with associated loss of native biodiversity. This demonstrates that legal protection alone is unlikely to halt the decline in wetland biodiversity.

To construct a ranked list of wetlands contributing most to extant wetland biodiversity, we used a selection algorithm that combined measures of complementarity, human disturbance pressure, irreplaceability, and a measure of conservation effectiveness (corresponding to the proportional contribution of any given site to the protection of the total remaining area in each wetland class). The highest ranked sites in each biogeographic unit were often the largest wetlands and usually comprised 2–3 wetland classes (commonly swamps, marshes, and fens). A high rank reflects a potential to protect both a diverse range of hydroclasses and a high proportion of what remains of each.

The wetland database underpinning this assessment provides an information resource for planning and managing wetland biodiversity at the regional and national scales, and should enable Territorial Local Authorities (TLA) and central governments agencies (e.g. DOC) to direct limited conservation and restoration resources to some of the most important wetlands. The wetlands that deserve most conservation effort are those with high ranks and threatened by additional or increasing pressures.

This report describes a work in progress and we are acutely aware that underlying methods, data, and resulting products can be improved. Our delineation of the current extent of wetlands is an incomplete inventory because of spatial limitations of satellite imagery and difficulties in depicting ephemeral, plutonic, nival, geothermal, and forested wetlands. Moreover, wetlands under 0.5 ha could not be mapped but are likely to provide important habitats for threatened species (particularly plants). Forested wetlands are also difficult to distinguish using present satellite imagery, so we clearly underestimated the total area of wetlands in Stewart Island, Fiordland, Westland, Buller, and Northwest Nelson. Wetlands associated with estuaries were excluded as these are to be covered in future estuary assessment and subsequently integrated at catchment scale. Finally, the classification scheme did not include vegetation or threatened species data, so we suspect our classification underestimates the full range of wetland biodiversity.

The rankings are a guide for decision making and should be considered within the context of local knowledge on conservation priorities, and other socio-political and ecological drivers not incorporated into our assessment.

Keywords: freshwater wetland, mapping, indicator, biodiversity assessment, prioritisation

1. Introduction

1.1 New Zealand context

Freshwater resources are essential to the long-term prosperity, health, and sustainability of New Zealand (Department of the Prime Minister and Cabinet 2003). Lakes, rivers, wetlands, and estuaries provide important social, economic, cultural, and environmental functions. Wetlands in particular provide many critically important ecosystem services, including flood regulation, water storage, improving water quality, recreation, and habitat for a wide range of native and valued introduced species. They are also an essential food basket for Maori. These services were largely ignored following European settlement; most wetlands were viewed as 'wasted land' and subsequently drained and altered for alternative economic uses, mainly agriculture. Consequently, wetlands are now one of the most nationally threatened and degraded ecosystem types, with only about 10% of former wetlands remaining (Ministry for the Environment, 1997).

New Zealand has a remarkable variety of wetland types, reflecting the country's diverse geography, climate, and geology (Johnson & Gerbeaux, 2004). We used the formal definition of wetlands in the Resource Management Act (1991). Wetlands defined thus include: 'permanently or intermittently wet areas, shallow water or land/water margins that support a natural ecosystem of plants and animals that are adapted to living in wet conditions'. This broad definition includes a range of shallow water environments with disparate biological communities but with shared environmental and ecological features that distinguish wetlands from other terrestrial and freshwater ecosystems (Sorrell & Gerbeaux 2004); these distinguishing features are:

- Shallow standing water and/or waterlogged soils
- Anoxic conditions (the absence of oxygen) in the soil
- Dominance by **emergent** aquatic plants

In this report, we focus on palustrine systems and standing water bodies with a 500m maximum length. We excluded larger, open water bodies (i.e. lakes), estuarine, nival, geothermal, and plutonic wetland hydrosystems that could also fit this definition.

Previous estimates of the original area of freshwater wetlands in New Zealand based on soil maps place the total area at 672,000 ha (Ministry for Environment 1997)[1]. By the mid 1970s only an estimated 100,000 ha or 15% remained. This decline since the mid ninetenth century is one of the most globally dramatic examples. The Wildlife Service documented losses between 1954 and 1976 and found almost 40% of the total national wetland area (263,999 hectares) had been drained, at a rate of nearly 2% (about 12,000 hectares), per year (Ministry for the Environment 1997). Lowland wetlands were the hardest hit, particularly on the drier east coast of the North and South Islands, especially in the Bay of Plenty and North Canterbury. Southland and Westland retained more wetlands in a better state. Some wetland types were more susceptible to loss (e.g. kahikatea swamp forest and ephemeral dune wetlands) than others (e.g. mountain bogs and tarns) (Cromarty & Scott, 1996).

Society is now starting to recognise the role of wetlands in human welfare and sustaining biodiversity, especially since New Zealand became a party to the Ramsar Convention in 1976 (Gerbeaux 2003). However, while the rate of wetland loss has slowed, new technologies and a boom in the dairy industry have led to a new wave of wetland drainage and pollution. Many privately owned wetlands and wetland margins are at risk even in the wetter regions of Southland and Westland as prices for agricultural products increase and more effective drainage methods (e.g. 'humping and hollowing') facilitate wetland destruction.

1.2 Policy context

Concerns about the state and continuing loss of New Zealand wetlands became prominent in the late 1970's and early mid 1980's following the publication of the New Zealand Survey of Peat Resources (NWASCO 1978), the Peatland Policy Study (NWASCO 1982a), a Wetlands Guideline (NWASCO 1982b), and a subsequent report to the Environmental Council (NWASCO 1983). These documents ultimately led to the development of a New Zealand Wetlands Management Policy (Commission for the Environment 1986), a remarkable national and international achievement that represented one of the first such examples ever published. Although the Resource Management Act (RMA: 1991) did not supersede the New Zealand Wetlands Management Policy, it also identified wetlands as nationally important and requiring consideration when powers are exercised and decisions made under the Act (Cromarty and Scott 1996). For example, the RMA requires TLAs to draw up regional and district plans that include rules to protect and prevent further wetland loss, and to designate important wetlands. However, plan development, enforcement, and wetland designation has been patchy, resulting in piecemeal implementation of wetland conservation and management; consequently, substantial areas of wetlands continue to be drained,

[1] Landcare Research scientists estimated the original extent of wetlands based on the selection from the Land Resource Inventory (LRI) of organic soils containing peat, and areas of shallow water containing specially adapted plant communities including rushes, sedges, reeds, flax, and pakihi vegetation.

polluted, and invaded by weeds and animal pests. These points were highlighted in The State of the Environment Report (1997), which noted shortcomings in how the New Zealand Wetland Policy had been implemented.

1.3 Previous wetland inventories

Many remaining wetlands are protected and managed by the DOC. Many more, including parts of Ramsar designated wetlands, are privately owned and grazed by livestock from adjacent farmland (Ministry for the Environment 1997). Protection is biased towards larger wetlands at the expense of smaller wetlands and wetland fragments, especially in lowland environments. In regions where wetland loss has been dramatic, these small wetlands (<10 ha) account for most of what remains. For example, Preece (2000) found that 90% of the remaining wetlands in the Tasman district were smaller than 10 ha and about 75% were smaller than 1 ha; furthermore, only 14% of wetlands under 100 m altitude were legally protected. Inventories in the Manawatu (Benn 1997) show similar patterns.

The absence of an accurate delineation of New Zealand's wetlands has been a major impediment to their protection and any national reporting on their state. Existing national delineations of wetlands (NZMS260, WERI[2], LCDB, LCDB2) have large errors (O'Donnell & Zanders 2006; O'Donnell & Brown pers com.). For example, O'Donnell & Zanders (2006) demonstrated that estimates of freshwater cover in the upper Rangitata Valley and Ashburton Lakes varied considerably between databases, from 0.36% in River Environment Classification (REC) data layers (NIWA) to 12.84% for the NZMS260 vector maps. Similarly, Taranaki Regional Council surveys in the mid 1990's identified 717 surviving wetlands, five times more than the 139 recorded in the Wetlands of Ecological and Representative Importance (WERI) Inventory, with many on private land (Taranaki Regional Council 2001). These studies clearly demonstrate the need for an updated and much improved national inventory of wetlands.

Previous inventories have been collated from a combination of local knowledge, reports on protected areas, and interpretation of aerial photographs (Mitsch & Gosselink 2000), but this approach is often time-consuming. Recent developments in remote sensing and GIS have enabled more rapid and objective production of accurate wetland maps at 0.5 ha resolution. The Bay of Plenty Regional Council was able to construct a regional inventory of 300 wetlands, using standardised satellite images to determine wetland extent at the regional level. Delineation took six weeks, compared with one year if a field based assessment and manual digitisation of aerial photographs had been used. This, and a second application in the Manawatu region, proved such an approach was rapid and cost-effective; moreover, satellite images can be frequently updated at

[2] In the late 1980's: the Biological Resource Centre developed a computer database known as WERI (Wetlands of Ecological and Representative Importance), effectively an inventory of about 3000 wetlands. It was essentially based on information collected during Wildlife Service surveys carried out during the 1970s and 1980s.

national scales to enable repeatable national reporting of the current location and extent of New Zealand's wetlands (Ausseil 2003). Therefore, satellite mapping could be used with field surveys to help designate wetlands with a high priority for further assessment.

1.4 Identifying wetlands of national importance

The Department of Conservation is developing a series of systematic conservation planning and reporting tools for terrestrial, freshwater and marine ecosystems under the banner of its Natural Heritage Management System (NHMS: see Stephens et al. 2002 for principles). The NHMS will provide resource managers with decision support tools to maximize efficient use of limited conservation resources. It will help managers prioritise, plan, and report on conservation outcomes over a range of geographical and organisational scales. The approach is based on systematic conservation planning principles (Margules & Pressey 2000) using data, transparent criteria, testable models, and explicit assumptions (Chadderton et al. 2004, Stephens et al. 2002). This report identifies nationally important inland wetlands needed to protect a full range of wetland biodiversity. It arises from the Waters of National Importance (WONI) project, part of the Sustainable Development Programme of Action for Freshwaters. The project goal required DOC to identify a list of water bodies that would protect a full range of freshwater biodiversity.

The first WONI output was a candidate list of nationally important rivers (Chadderton et al. 2004) reflecting the most immediate requirements of a multi-agency working party. Interest centred around securing the national needs for energy generation, water use, irrigation, natural heritage (bio and geo-diversity), recreation, and tourism at catchment scales. The Chadderton et al. (2004) report was the first attempt to identify nationally important rivers on the basis of their contribution to national or regional biodiversity, and it demonstrated that a quantitative approach using spatial databases could deliver a transparent and reproducible result. The ranking exercise attempted to meet two objectives: (1) maintaining viable populations of all species and (2) protecting the full range of remaining natural freshwater habitats and ecosystems that best represent indigenous biodiversity. The Chadderton et al. (2004) assessment combined information on catchment size (as a surrogate for river environment diversity), ecological integrity with data on presence of special features (threatened species and habitat types), and connectivity or buffering function (defined by the presence of nationally important wetlands and lakes in the catchment unit). The latter wetlands and lakes were largely defined from a preliminary list of wetlands of international significance (Cromarty & Scott 1996) developed from expert opinion as part of a RAMSAR directory initiative**.** However, Chadderton et al. (2004) acknowledged that this list was incomplete and they identified a critical need to develop a comprehensive, systematic, and reproducible list of nationally important wetlands. This report is the first of several steps towards addressing this need.

2. Objectives

Development of a list of nationally important wetlands using a systematic framework requires reliable maps of the current and former extent of wetlands. Moreover, without comprehensive biological inventory data, a spatially explicit classification must also provide a surrogate measure of the variety of life within and between different wetlands. This is fundamental to identifying a set of wetlands representing the full range of extant biodiversity. However, both requirements were lacking at the start of this project.

Therefore, this assessment had 4 objectives:

- Delineate the historic and current extent of all wetlands over 0.5 ha of mainland New Zealand including large inshore islands.
- Develop a spatially explicit classification based on the Johnson and Gerbeaux (2004) framework to classify each wetland into hydroclasses or subclasses.
- Develop measures of anthropogenic pressure to indicate the intensity of various human induced disturbances potentially affecting the ecological integrity of native biota (based on Stephens et al. (2002)).
- Develop a ranked list of wetlands of national importance that would protect a full range of wetland biodiversity and provide guidance on the most immediate conservation management needs.

3. Methods

3.1 Biogeographic framework and scale

Identification of nationally important water bodies for biodiversity must account for variability at both the local and biogeographic scales to capture effects of regional historic processes and local scale ecological processes on biodiversity pattern (Chadderton et al. 2004, Collier et al. 2003, Harding & Winterbourn 1997, McDowall 1996, Stephens et al. 2002, Vinson & Hawkins 1998). A freshwater biogeographic framework was developed for the riverine biodiversity assessment (Leathwick et al. 2008). This was designed to account for historic determinants of contemporary biodiversity patterns, particularly the large-scale disturbance events such as glaciation, sea level change, and volcanic eruptions that have major impacts on community composition at regional spatial scales. Colonisation pathways or barriers (e.g. alpine ridgelines, coastal straits) were also considered (Chadderton et al. 2004), as they affect the ability of surviving taxa to disperse and occupy or recolonise habitable sites. Boundaries were based on catchment units and were primarily derived using data describing riverine biota.

Leathwick et al. (2008) combined four different data sources:

- The distributions of obligate aquatic biota having a limited ability to disperse between catchments. These are thought to best indicate the minimum spatial scale required for conservation of entire freshwater ecosystems (Abell et al. 2000).
- Evidence of genetic similarity between different populations of various related freshwater species and groups (e.g. *Galaxias vulgaris* complex: Allibone et al. 1996),
- The extent of major historic physical disturbances (e.g. last glacial maximum, volcanic impact zones in the central North Island)
- The presence of regional-scale barriers or pathways for aquatic species dispersal.

Wetlands straddle aquatic and terrestrial ecosystems, and while emergent vegetation has been relatively well studied, the rest of the aquatic biota is not well known (especially invertebrates and algae; Sorrell & Gerbeaux 2004, Suren et al. 2008). We assumed the obligate freshwater wetland taxa will be the poorest dispersers and that these provide the best surrogate measures of the minimum spatial scales required for conservation of entire ecosystems. Therefore, the use of freshwater biogeographic units should adequately account for historic variation in wetland biodiversity (terrestrial and freshwater). We recognise the biogeographic framework may over-estimate biological variation for some terrestrial groups, but it is more likely to under-estimate biodiversity spatial patterns driven by historic processes. In particular, some freshwater groups of poor-dispersing species (crustaceans and molluscs) vary at finer scales (first-order catchment units or neighbouring springs within a unit) (Scarsbrook et al. 2007, Ponder et al. 1996).

Using the riverine framework also enables future integration of wetland assessments with those for rivers, and lakes and estuaries, consistent with the goals of identifying Waters of National Importance.

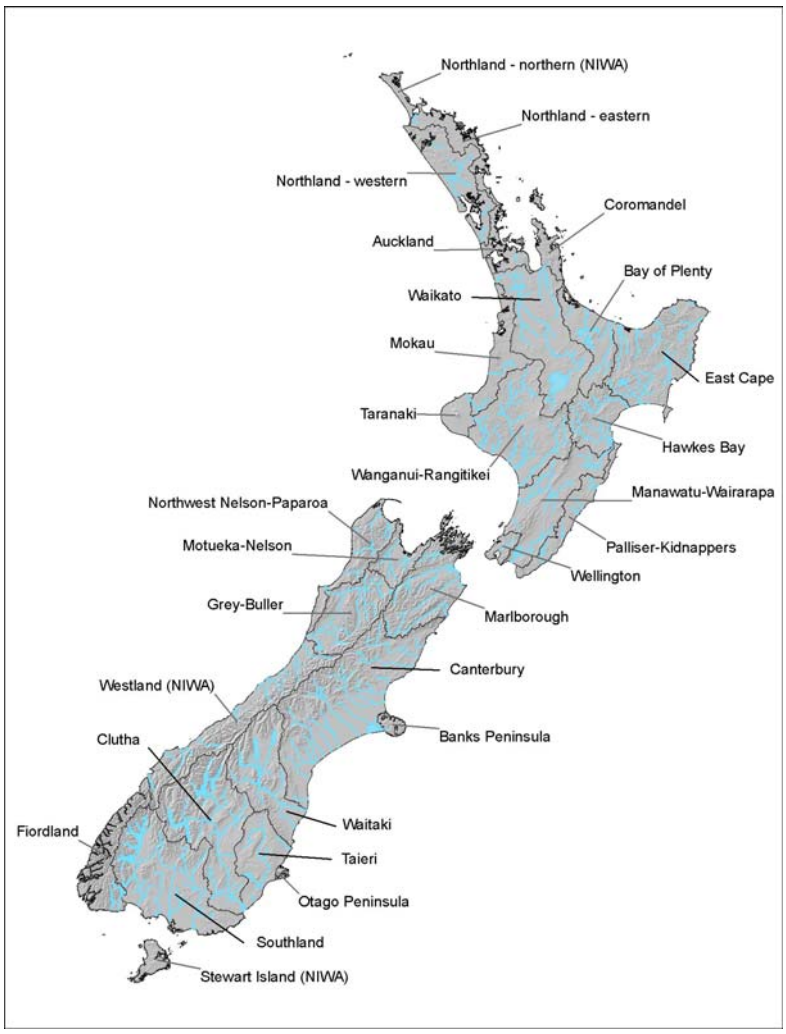

Figure 1 Map of freshwater biogeographic units (Leathwick et al, 2007a).

3.2 Delineation and mapping of wetlands

Pre-human extent

A key objective is to estimate wetland loss since human settlement. Therefore we must estimate both the original (pre-human) extent of freshwater wetlands and the current extent in a way that allows valid comparison. No simple surrogate data can easily be applied but combinations of topographic and soil information (presence of peaty soils, soil wetness, etc.) have commonly been used in various parts of the world. Tests carried out in Australia (Northern Territory) found a strong correlation between a combination of soil and topography information and wetlands (92% similarity) in the study area (Beggs & Lowry 2003).

Several attempts have been made to estimate the extent of New Zealand's wetland loss. Landcare Research estimated that 672,000 ha of freshwater wetlands existed before human settlement (Ministry for the Environment 1997). They used the Land Resource Inventory (LRI) to select land units where the land use capability (LUC) was primarily limited by wetness (e.g. bog, fen, and swamp units on peaty and gleyed soils), and added areas of wetland vegetation. However, the regional LRI manuals also provide data on land units dominated by three other limiting factors: nutrients, climate, and erosion. These land units could contain wetlands (e.g. pakihi, seepages, and alpine bogs) not included in the estimate of historic cover given in the 1997 State of the Environment report.

We used the Fundamental Soil Layers (FSL), coupled with a 15 m Digital Elevation Model (DEM), to develop a more accurate estimate of pre-settlement wetlands. GIS rules were applied to generate 3 levels of certainty: 1 (highly probable—generally units initially identified by the 1997 Landcare Research analysis); 2 (units associated with pakihi and other soils with poor drainage); and 3 (wetlands can be found in this category but soil and landscape features are atypical of wetlands). Only the first two levels of certainty were used in our estimate of pre-settlement wetland extent.

The pre-settlement wetland layer was produced in a two step process: (1) selection of polygons, (2) refinement using a slope threshold.

In the first step, we selected polygons from three databases: NZMS260 topomaps, Land Cover Database 1 (LCDB1), and the LRI. The topomaps gave swamp polygons, indicating the swamp extent in the 1970s and ’80s. The LCDB1 ‘inland wetlands’ category provided evidence of wetland extent in the early ’90s. The LRI provided the main source of pre-settlement soil information. Many features provided clues about wetness of soils:

- The **Land use capability Correlation** (**LCORR**) is the national land use classification based on the regional Land Use Capability (LUC). The hierarchical land use classification identifies the land’s general versatility for productive use, the most limiting factor to production, and a general association of characteristics relevant to productive use (e.g. landform, soil, erosion potential, etc.).
- **GENSOI** is the soil code correlated to the nomenclature of the General Surveys of Soil of North and South Islands (New Zealand Soil Bureau 1954, New Zealand Soil Bureau 1968). A complete set of GENSOI data was available in the South Island, but no GENSOI data was available for the East Cape region.
- The **National New Zealand Soils Classification** (**NZSC**) is intended to replace the New Zealand Genetic Soil Classification (Hewitt 1998) but is not available for all areas of New Zealand. This was the primary layer used to delineate North Island wetlands.
- **DRAINAGE CLASS** is the internal soil drainage. It is divided into five classes from very poorly drained soils (class 1) to well-drained soils (class 5). A class below 3 is considered to have a high probability of being associated with a wetland area.
- **VEGETATION** indicates the vegetative cover derived from aerial photographs (Hunter & Blaschke 1986). This attribute helps confirm whether wetland vegetation is present.

We initially collated a list of suitable LCORR derived from the soil survey books and LUC manuals for the regions for which they were published. Among the selected LCORR polygons, we collated a list of appropriate soil codes, based on the study of the soil survey books. We used GENSOI in the South Island and NZSC in the North Island because of its complete coverage. The NZSC soil list was compiled using the current extent as a training dataset. As such, we selected NZSC soil types where wetland covered 95% of the current area. Drainage classes (drainage class < 3) and presence of wetland vegetation were then used to refine the polygon selection (the full set of GIS rules for selecting LRI polygons in the North and South Island is presented in Appendix 1).

In the second step, the selected polygons were refined by applying a slope threshold derived from a 15 m DEM. This is to counter the lower resolution of the LRI in montane areas, as the mapped units do not always fit the topographic details of the landscape. Polygons were sp on steeper slopes to refine probable wetland boundary limits. Slope thresholds were defined as any slope greater than the maximum in 95% of the current wetlands found in each level 1 environment of Land Environments of New Zealand (LENZ) (Leathwick et al. 2003) (Figure 2). The final layer is a raster layer, based on a 15 m cell grid.

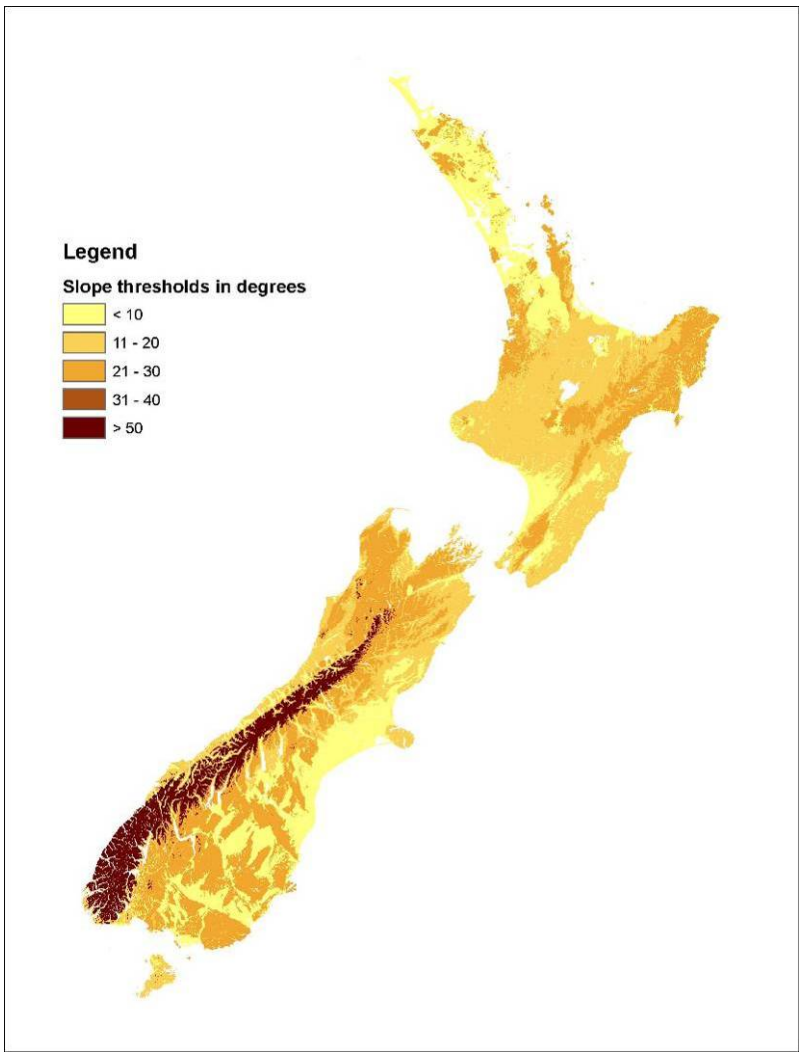

Figure 2 National distribution of Slope thresholds used to refine LRI wetland polygons to define the pre-settlement extent of wetlands. Thresholds are stratified across LENZ level 1 environments (Appendix 1).

Current wetland extent

We used a common framework based on wetland locations and standardised satellite imagery to develop a consistent, contemporary, national wetland layer.

Wetland location

Centre point data and wetland polygon data layers were collated from recent surveys, field work delineation, or photo-interpretation and held by regional councils, DOC conservancies, or Queen Elizabeth II trust (QEII) databases (Table 1). Regional Councils provided polygon or centre point data. The DOC database largely consisted of WERI data. QEII data was a polygon layer derived from all QEII covenants containing freshwater wetlands. Available data varied in standard and spatial extent with some regions having recently completed comprehensive surveys and/or updated inventories (e.g. Auckland, Waikato, Bay of Plenty, Manawatu, Wellington, Tasman, Canterbury). Others relied on old survey information (sometimes dating to the 1980s) or ad hoc updates of WERI, LCDB1 or topo-vectors (e.g. West Coast, Southland, Otago). Three regions, Northland, Hawke's Bay, and East Coast, had no recent inventory data so we used local knowledge to locate wetlands not already identified in NZMS260 or LCDB2.

Table 1 Input information used to delineate boundaries and centre points of current freshwater wetlands.

Region	Initial data source on freshwater wetlands	Data type	Number of sites to check
Northland	DOC collection of points	Polygon	274
Auckland	Auckland Regional Council (ARC) polygon database	Polygon	2225
Waikato	Landcare Research Ltd polygon database	Polygon	874
Bay of Plenty	Environment Bay of Plenty (EBOP) polygon database	Polygon	513
Manawatu–Wanganui	Horizons database	Polygon and point	943
Taranaki	Taranaki Regional Council (TRC) polygon database	Polygon	406
Hawkes Bay – East Cape	DOC local knowledge of points	Point	189
Wellington	Greater Wellington (GW) polygon database	Polygon	236
Tasman	Tasman District Council (TDC) point database	Point	835
Marlborough	Marlborough District Council (MDC) point database	Point	453
West Coast	Estimation by GIS rules using a combination of LRI, LCDB2, and DEM information.	Polygon	5884
Canterbury	Environment Canterbury (ECAN) polygon and point database	Polygon and point	2172
Otago	Otago Regional Council (ORC) polygon database	Polygon	2082
Southland	DOC polygon database	Polygon	1468

Wetlands today are often a combination of fragments of a former larger wetland, and may be represented by several separate polygons. Where these are still within close proximity they should be treated as a single entity, reflecting in part the value a combination of smaller wetland units may have if they could all be reconnected through restoration. Therefore, except where a wetland site was already defined by Regional councils or DOC, we considered all polygons to be the same wetland site if each was within 300 m of its nearest neighbour and historically contiguous. Each fragment was assigned the same identifier code.

Satellite images

Satellite images were used to provide a standardised set of imagery to check and complete delineation. We obtained 26 Landsat Enhanced Thematic Mapper (ETM+) images to provide a national cover of New Zealand. The images were collected between September 1999 and February 2003 (Figure 3). The six 30 m spectral bands of ETM+ were combined with the panchromatic layer to produce 15 m multi-spectral pixels (pan-sharpening). This pan-sharpening enables the data to be used at 1:50 000 scale. The pan-sharpened imagery was ortho-rectified using a digital elevation model (DEM). Ground-control points were derived from coverage of black and white ortho-photographs with 2.5 m pixel resolution. Ortho-rectification was processed with ERDAS IMAGINE 8.40 software to a root mean square mapping error of 20 m.

The ortho-rectified imagery was then standardised to remove the influence of topography, the geometry of satellite and sun position, and atmospheric conditions (Shepherd & Dymond 2003). A

single satellite layer was created from a mosaic of 26 standardised Landsat images that covered both the North and South islands (Figure 3).

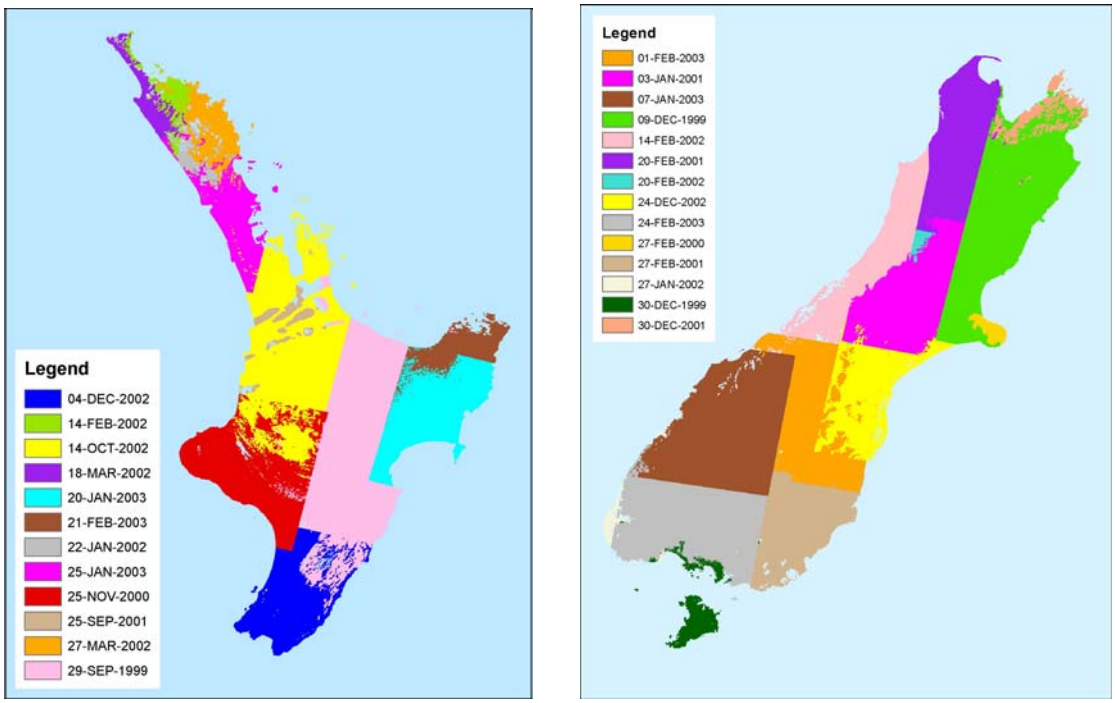

Figure 3 Mosaic of Landsat images for the North Island and South Island.

Data checking method

The method consisted of bringing all of the collected data to the same standard, to achieve a consistent national layer, working by Territorial Local Authorities (TLA) region. A minimum mapping unit of 0.5 ha (i.e. 25 pixels) was adopted to reflect the discrimination limits of the satellite imagery.

For each region, the initial wetland information presented in Table 1 was checked on the satellite imagery using ERDAS IMAGINE. The LCDB1 and 2 (Land Cover Database 1 & 2), NZMS260 topomaps, LRI, FSL, and a 15 m Digital Elevation Model (DEM) were also used during delineation to help refine wetland boundaries. The NZMS260 and LCDB1 and 2 were most helpful for defining larger wetlands where these boundaries were known to be accurate. The DEM was applied to confirm wetland boundaries where existing polygons extended on to steep slopes. Although primarily used for delineating the historic extent of wetlands, LRI (LUC, soil types or vegetation) was also used in some regions where wetlands were covered with tall native vegetation. Soil data enabled determination of wetness status in areas not identified as wetland polygons in NZMS260 or LCDB1 and 2. It also helped in areas corresponding to wetland forests, as wetness in woody vegetation cannot be interpreted from satellite images.

A team of five GIS analysts (Anne Sutherland, Janice Willoughby, Hamish Heke, Terry Conaghan, and Tom Pyatt) used a program developed specifically for this project to check each wetland location. One GIS analyst ran the analysis for a given region to ensure consistency within a biogeographic unit. Two analysts were very familiar with the locations of remaining wetland in their region (Terry Conaghan for Northland and Tom Pyatt for Hawke's Bay). To ensure consistency, all GIS analysts attended a joint training session to ensure they all used the same level of visual interpretation of the satellite image.

For each wetland centre point (location), delineation was performed using one of two possible approaches:

- If the wetland information was a point, a region-grown algorithm was applied on the satellite image to generate a polygon. This algorithm searches around a seeding point and adds neighbouring pixels with a similar spectral signature to the seeding point. This allows an automatic definition of boundaries, but requires the manual setting of a spectral threshold. If the region-growing could not be done, the reason was recorded in the attribute table (presence of cloud, too small, too narrow, etc.).
- If the location consisted of a polygon and:
    - the polygon did not match the satellite image, then the region-growing algorithm was applied to update the boundaries. Other ancillary data (LCDB2, NZMS260, LRI) were used to enhance the delineation. In some cases, the extent was improved by adding new region-grown polygons
    - the polygon matched the image but the region-growing process did not improve the boundaries, then the polygon was kept in the final layer. In some cases, we consulted local experts and aerial photos if we were not certain whether the polygon was valid

In the Auckland, Bay of Plenty, and Manawatu regions, existing regional council data was largely retained as much of this had recently been defined (using ground-truthed data or aerial photos). In the northern North Island and most of the South Island, regional growing of polygons and existing LCDB2 lines were used to define wetland boundaries, reflecting in part limited previous investment in wetland mapping (Table 2). Time and budget constraints prevented a comprehensive check of all wetland locations over large regions in the South Island. Hence, because the number of sites to be checked for the West Coast region was far too large (5,884 sites), we scanned the region from north to south on the satellite images instead of checking each location. For Southland, only sites over 1 ha (1,268 sites) were checked, and for Canterbury and Otago, only sites over 1.5 ha were checked (1,279 sites and 1,346 sites respectively).

Table 2 Sources of information used to define wetland boundaries and checked against satellite imagery.

Region	Region growing	Regional Council polygon	LCDB2 polygon	NZMS260 'swamp' polygon	Manual Drawing	Open water polygon	SNA report polygon	Northland aerial photos	QEII	LRI
Northland	69%	0%	0%	4%	2%	0%	1%	24%	1%	0%
Auckland	8%	91%	0%	0%	0%	0%	0%	0%	0%	0%
Waikato	49%	46%	0%	0%	0%	0%	0%	0%	5%	0%
Bay of Plenty	7%	93%	0%	0%	0%	0%	0%	0%	0%	0%
Manawatu–Wanganui	16%	65%	15%	0%	0%	3%	0%	0%	0%	0%
Taranaki	36%	33%	9%	0%	0%	20%	0%	0%	3%	0%
Hawkes Bay – East Cape	75%	0%	11%	9%	4%	0%	0%	0%	1%	0%
Wellington	53%	45%	0%	0%	0%	0%	0%	0%	2%	0%
Tasman	88%	0%	9%	1%	1%	0%	0%	0%	1%	0%
Marlborough	95%	0%	0%	0%	3%	0%	0%	0%	2%	0%
West Coast	44%	0%	39%	3%	0%	0%	0%	0%	0%	14%
Canterbury	28%	66%	4%	1%	0%	0%	0%	0%	0%	0%
Otago	59%	1%	32%	7%	0%	0%	0%	0%	0%	0%
Southland	46%	2%	46%	5%	0%	0%	0%	0%	1%	0%

The accuracy of current extent estimates was assessed by Ausseil et al. (2007) in the Manawatu region. They found a producer's accuracy—the probability that a ground-truthed sample is correctly mapped—of 65%. Producer's accuracy measures the errors of omission. User accuracy, which indicates the probability that a sample (in this case a polygon mapped by satellite) actually matches reference ground-truth data, was 76%. When comparing wetland areas site by site, the overall correlation coefficient was high (0.96), with a standard deviation of 3.46 hectares, with an uncertainty of ± 138 ha for the total area of palustrine wetlands mapped by satellite for the Manawatu region.

3.3 A Spatial (GIS-based) wetland typology

A spatially referenced wetland classification system was used as a surrogate measure of biological variation across and between wetlands. It is a tool to recognise and delineate the full range of wetland diversity. It also is an essential component of any systematic conservation process that attempts to identify a representative range of wetlands, especially in the absence of an adequate biodiversity inventory. We assumed that if we protect a full range of wetland types, defined by a classification, we will protect a full range of biodiversity (ecosystems, communities, species, genetic variation). The classification we used is based on the hierarchical and semi-hierarchical classification systems described in Johnson and Gerbeaux (2004).

Defining hydrosystems from GIS databases

Of the nine wetland hydrosystems defined by Johnson and Gerbeaux (2004), we included palustrine and inland saline hydrosystems in this assessment. We did not consider estuarine, marine, riverine, lacustrine, plutonic, geothermal, and nival hydrosystems because these are (or will be) the focus of analogous classification and ranking projects.

Inland saline wetlands are those where strong evaporation processes result in high concentrations of soluble salts in soil and groundwater. They can be easily identified from information within the LRI. They are a minor hydrosystem in New Zealand, and now are only located in the basins of inland Otago. Where the salinity class of the LRI exceeded 3 or the GENSOI soil type was type '2' it was classified as an inland saline wetland (Johnson & Gerbeaux 2004).

Palustrine wetlands are defined as all freshwater wetlands fed by rain, groundwater, or surface water, but not directly associated with the open water of estuaries, lakes, or rivers (Johnson & Gerbeaux, 2004). We also excluded wetlands associated with estuary ecosystems as these will be assessed in later iterations.

Defining wetland classes from GIS databases

Johnson and Gerbeaux (2004) recognised ten classes of freshwater wetlands, these being: bog, fen, swamp, marsh, seepage, shallow water, ephemeral wetland, pakihi/gumland, and saltmarsh. We did not consider saltmarshes because they are part of estuarine habitats. Shallow water required information on the depth of standing water but this is not available; therefore, to be consistent with Johnson & Gerbeaux (2004) we simply incorporated all open water bodies less than 500 m long (in any dimension) but did not differentiate these into a separate class. Ephemeral wetlands are season-dependent habitats whose extent varies temporally; they cannot yet be consistently delineated with remote tools. Therefore, we retained seven wetland classes: bog, fen, swamp, marsh, seepage, pakihi, and gumland. Their main environmental features are summarised in Table 3.

Table 3 Distinguishing features of New Zealand wetland classes (from Johnson & Gerbeaux 2004)

Wetland class	Water origin	Water flow	Drainage	Substrate	Nutrient status	pH
Bog	Rain only	Almost nil	Poor	Peat	Low or very low	3–4.8
Fen	Rain + groundwater	Slow to moderate	Poor	Mainly peat	Low to moderate	4–6
Swamp	Mainly surface water + groundwater	Moderate	Poor	Peat and/or mineral	Moderate to high	4.8–6.3
Marsh	Groundwater + surface water	Slow to moderate	Moderate to good	Usually mineral	Moderate to high	6–7
Seepage	Surface water and/or groundwater	Moderate to fast	Moderate to good	Peat, mineral or rock	Low to high	4–7
Pakihi and gumland	Mainly rain	Almost nil	Poor	Mineral or peat	Very low to low	4.1–5

Some key wetland features like pH, fertility, or drainage are defined as attributes in the Fundamental Soils Layer (FSL) (Table 3), but other clues can be found in landscape features. For example, a nearby lake or a river might indicate the dominant source of water; a large upstream sub-catchment area may indicate the wetland receives nutrients from the upper catchment; and wetlands on steep slopes are probably seepages.

The FSL layer was first clipped to the wetland extent, and each polygon was assigned a wetland class. A simple decision tree based upon these properties is inadequate because some features overlap (e.g. range of pH) preventing crisp rule definition. We therefore used a rule-based fuzzy logic system to perform the classification. Rules were manually defined (based on higher level expert knowledge), and used to translate the features described in Table 3 into a probability framework for each wetland polygon.

For each feature *i* and each wetland class *j*, we assigned a degree of membership p_{ij} in [0,1] that the feature *i* describes the wetland type *j*. The p_{ij} are then multiplied together to obtain a probability p_j per wetland type:

$$p_j = \prod_{i=1}^{n} p_{ij}$$

The p_{ij} values are based on empirical expert knowledge and are presented in Appendix 2. The rules show that seepages, pakihi/gumland and inland saline follow a distinct path of rules: seepages are distinguished by the slope angle, pakihi/gumland and inland saline are identified by the soil type. Two groups are then clearly separated: swamp/marsh and bog/fen have a stronger differentation based on the pH class, peat content, fertility, and the nearby presence of a lake or river. Swamp and marsh are then distinguished essentially by the drainage class and bog and fen are distinguished using the pH class, the peat content, and the presence of red tussock (strong indicator of a fen system).

The protocol was slightly different for classifying the historical extent. The rules did not include the presence of a lake, river, and sub-catchment area, as these clues are site-specific and only apply to current extent.

Accuracy assessment

As it was not possible to estimate the accuracy of the GIS classification over the whole country, we checked the validity of the classification using a field investigation in the Otago region. Over two days, a wetland expert (Peter Johnson) visited by helicopter almost half the remaining wetland in the Otago region. The wetland classes he observed were assessed against the GIS classification, assigning the dominant wetland class to the site if the classified wetland contained several classes (Ausseil et al. 2008).

3.4 Determining indicators of human induced pressure and ecological integrity

Anthropogenic pressure measures

Wetlands are sensitive to environmental changes. They are ecotones that support both terrestrial and aquatic biota and so may be affected by a particularly diverse range of human disturbance pressures including alterations of nutrients, hydrology and sedimentation, fire, vegetation clearance, soil disturbance, invasion by aquatic or terrestrial weeds, and animal pests (e.g. livestock grazing, non indigenous fish, invertebrate pests) (Clarkson et al. 2002, Sorrell & Gerbeaux 2004). Over shorter timeframes, human induced disturbances can change biological community structure, composition, and function, thereby eliminating sensitive species, and altering ecological processes. Degradation of this suite of ecological features is described as a decline in ecological integrity (Clarkson et al. 2002).

We developed measures for six important and common pressures on wetland ecosystems. These are: naturalness of catchment cover; artificial impervious cover; nutrient enrichment; introduced fish; woody weeds; and drainage. Some pressures may affect a small component of the wetland community (e.g. invasive fish affect aquatic components), whereas water quality and quantity changes affect the entire wetland community (Table 4).

This does not include the full range of pressures affecting wetlands. For example, we were not able to develop measures of fire impacts because of the absence of a reliable national data layer describing past fires; nor did we explicitly consider mammalian pests, herbaceous weeds, and exotic invertebrates because there are no spatial data describing these; and fragmentation was not considered because of great uncertainty about how this should be measured and nature of its relationship to ecological integrity. Nitrate risk was used as a surrogate measure of land use intensity. We recognise that phosphorus probably plays a more important role in nutrient enrichment (Clarkson B., pers. com.) and in diminishing ecological integrity, but nationally comprehensive GIS data on the risk of phosphorus risk were not available.

Table 4 Anthropogenic pressure measures used to quantify human induced disturbance as an inverse measure of ecological integrity

Indicator	Impact	Reference
Naturalness of catchment cover	Loss of native vegetation, loss of buffering, increased edge effects (increased risk of invasion, wind throw), increased sedimentation due to soil erosion , change in catchment discharge character and wetland hydrology. Catchment clearance is associated with increased pesticide use, increased nutrient loads, greater extremes in water temperatures in inflowing streams. Impacts both aquatic and terrestrial communities	Sorrell & Gerbeaux (2004), Quinn (2000), Boulton & Brock (1999)
Artificial impervious cover (urbanisation, roading)	Changes in hydrological function, flashier inflows, increased input of fine contaminants, heavy metals, and sediment, potential increased invasion risk. Impacts both aquatic and terrestrial communities	Suren (2000), Suren & Elliot (2004), Boulton & Brock (1999)
Nutrient enrichment	Change in water quality, DO, pH, de-oxygenation, altered plant species composition, Impacts both aquatic and terrestrial communities	Clarkson et al. (2002), Sorrell & Gerbeaux (2004), Parkyn & Wilcock (2004), Boulton & Brock (1999)
Introduced fish	Predation and competition with native communities, trophic cascades, altering physical habitat, and change in water quality. Impacts aquatic communities	Closs et al. (2004), McIntosh (2000), Champion et al. (2002).
Woody weeds	Change in plant composition, competition, increased shading, and chemical inhibition (willows), and altered hydrological function. Impacts both aquatic and terrestrial communities	Sorrell & Gerbeaux (2004)
Drainage and soil disturbance	Loss of wetland habitat, change in plant community and hydrological function, and potential changes for fauna. Impacts both aquatic and terrestrial communities	Clarkson et al. (2002), Sorrell & Gerbeaux (2004), Boulton & Brock (1999)

Source data and scales of influence

For each wetland, pressure was quantified at a range of scales to include any combination of the contributing catchment, a surrounding 30 m buffer zone, and the wetland site (Table 5). The boundaries of contributing catchments were derived using ARCINFO (Ausseil 2003). Information about the upstream catchment provides a measure of probable presence of pollutants and increased nutrient or sediment linked to land clearance and intensification (e.g. urbanisation, pastural farming, forestry). The catchment's influence on nutrient input varies with wetland class; for example, bogs depend entirely on rainfall so are far less sensitive to catchment scale issues. Nutrient enrichment (nitrate risk) was quantified from the upstream catchment for marsh, seepage, inland saline, and wetlands close to rivers, and from the buffer zone for bog, fen, pakihi and gumland. For swamps, we assigned the maximum constraint between the catchment or the buffer zone influence. For simplicity, the other pressures were calculated equally between wetland classes.

Table 5 Format and source data used to produce pressure measures

Indicator	Source data	Format	Scale of influence
Naturalness	LCDB2 natural land cover types (appendix 3), modified with an overlay from Agribase farm type record	Grid cells defined as either 'natural' or 'unnatural' cover	Catchment and buffer
Imperviousness	NZ260 roads, LCDB urban areas, 50k Vectors including roads, SHW, sealed, metalled, un-metalled, Railway, attribute – multiple rails, single rail, tracks, attributes – foot track, vehicle track, tunnels, used to erase sections of road and rail network, and buildings (point).	Grid cells defined as either 'pervious' or 'impervious'	Wetland, catchment, and buffer
Nutrient enrichment	Nitrate risk measure derived from CLUES (Woods et al. 2006)	Grid cells ranging from 1 to 69 (natural to highly enriched)	Catchment and buffer
Introduced fish	New Zealand Freshwater Fish (NZFFD) database records	Point database of introduced fish species	Catchment
Woody weeds	LCDB2 willows and other woody weeds (Appendix 3)	Polygon layer of woody weeds	Wetland and buffer
Drainage	Layer derived from the NZMS 260 river network	Vector line	Wetland and buffer

Relating pressure measures to ecological integrity

Before calculating an overall pressure index, for each pressure factor we calculated transfer functions that indicate our expectations of likely decline in ecological integrity. We assumed a high pressure index indicates low ecological integrity (Table 6) Ecological integrity values ranged from zero to one, where one indicates pristine or complete integrity. Relationships between ecological integrity and human induced pressure are designed to reflect qualitative understanding of likely changes across each anthropogenic disturbance gradient (Figure 4). For most pressures we have assumed that even at extreme levels of human disturbance some wetland function, biodiversity, or restoration potential will remain. Thus, condition indices do not generally decline to zero, except in the extreme case where 100% impervious cover would completely destroy wetland ecological values (Stephens et al. 2002). The shape of the transfer functions from pressure to ecological integrity were derived from expert opinion based on our understanding of these relationships and literature.

Table 6 Transfer functions applied to the pressure indicators (see Appendix 3 for more details)

EI name	Scale of influence	Input variable *x*	Transfer function c = f(x)
Naturalness (c_N)	Catchment	Proportion of non-natural cover (0–1)	$c_N = 0.3 + \frac{0.7}{1 + e^{(10x-4)}}$
	Buffer	Proportion of non-natural cover (0–1)	$c_N = 1 - 0.7x$
Imperviousness (c_{Imp})	Wetland and buffer	Proportion of impervious area (0–1)	$c_{Imp} = \frac{1-x}{1+3x}$
Nutrient enrichment (c_{NL})	Catchment	Nitrate leaching risk mean value	$c_{NL} = 1 - \frac{0.8}{1 + e^{(4-0.2x)}}$
	Buffer	Nitrate leaching risk mean value	$c_{NL} = 1 - 0.0125(1 - \frac{core}{edge}) \times x$
Introduced fish (c_{IF})	Catchment	Number of introduced fish species weighted by pestiness scores	$c_{IF} = \frac{0.05 + 0.75x}{0.05 + x}$
Woody weeds $c_{WW} = \min(c_{gw}, c_o)$	Wetland	$\frac{A_{woodyweed}}{A_{wetland}}$	Grey willows (*S. cinera*) (c_{gw}): $c_{gw} = 1 - 0.75e^{-4(1-x)}$
			For gorse and other (c_o): $c_o = 1 - 0.25e^{-4(1-x)}$
Drainage (c_D)	Wetland and buffer	$\frac{A_{drain}}{A_{wetland}}$	$c_D = 1 - 0.9x$

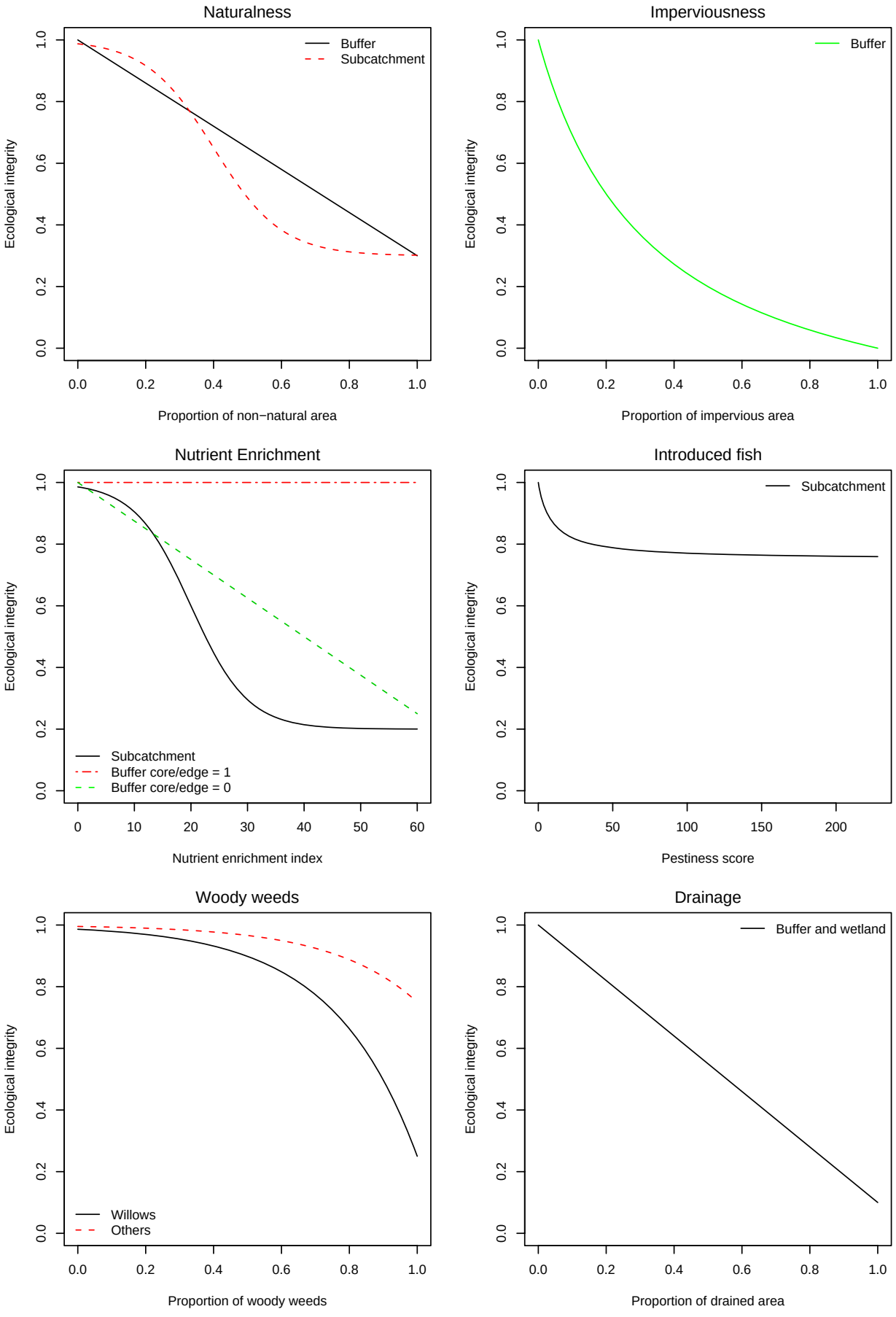

Figure 4 curves used to transform pressure indicators into an Ecological Integrity score

All pressure measures were then integrated into a single pressure index to quantify human induced disturbance. This was used as a weighting function to give less weight to wetlands likely to be already degraded.
Once all the transformations had been applied to each pressure measure, we computed an overall ecological integrity index (*EI*) as follows:

$$c = \min(c_{Imp}, c_{NL}, c_N) \times c_D \times \min(c_{gw}, c_o) \times c_{IF} \quad (1)$$

With
c_{Imp} = EI associated with imperviousness measure
c_{NL} = EI associated with Nitrate Leaching risk measure
c_N = EI associated with Naturalness measure
c_D = EI associated with Drainage measure
c_{gw}, c_o = EI associated with grey willow and other woody weeds respectively
c_{IF} = EI associated with introduced fish measure

We took the smallest of the c_{Imp}, c_N, and c_{NL} values, as this signals the maximum biological constraint. We used *c* as a weighting function to give less weight to wetlands in degraded condition.

Ranking and site selection system

The objective of wetland site selection and ranking was to identify the minimum set of remaining inland wetlands that contribute most towards protecting a representative range of remaining wetland biodiversity. Ranking procedure was akin to that used to identify rivers of national importance (Leathwick et al. 2007b). We accounted for **complementarity** (Vane-Wright et al. 1991) between different wetland types and incorporated a measurement of **conservation effectiveness**, weighted by a measure of **irreplaceability** based on extent of habitat loss.

The **complementarity** measure explicitly accounts for the contribution that protection of one wetland type (e.g. swamp) makes to protection of biodiversity in related wetland types (e.g. fen and marshes). In other words, it takes into account the compositional overlap between wetland types. For this calculation, we needed a similarity matrix based on distances between wetland classes. Palustrine and inland saline hydrosystems were merged to the same level of analysis. Similarity distance measures were defined based on the wetland classification and expert advice (Table 7).

Table 7 Distance measures used for the six palustrine wetland classes and the inland saline hydrosystem

	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage	Saline
Bog	0	0.04	0.18	0.34	0.14	0.38	1
Fen	0.04	0	0.08	0.2	0.1	0.22	1
Swamp	0.18	0.08	0	0.08	0.24	0.4	1
Marsh	0.34	0.2	0.08	0	0.34	0.4	0.96
Pakihi/ gumland	0.14	0.1	0.24	0.34	0	0.42	1
Seepage	0.38	0.22	0.4	0.4	0.42	0	1
Saline	1	1	1	0.96	1	1	0

There is much environmental overlap between wetland classes (Johnson & Gerbeaux 2004), with the exception of inland saline wetlands. Distance measures ranged between 0 (environmentally identical) and 1 with inland saline wetlands considered the most distinctive. Pakihi and gumlands were grouped into a single class. Fen/bog (distance 0.04), and swamp/marsh (distance 0.08) were considered to be environmentally quite similar and so likely to have similar community compositions.

For ranking purposes, we used a similarity measure (*s*) with a negative relationship to the distance measure, ranging from 0 (dissimilar) to 1 (identical), as below:

$$s_{ij} = e^{-kd_{ij}} \quad (2)$$

Where:
s_{ij} is the distance measure between wetland classes *i* and *j*, as given in Table 7.
k is a positive multiplier set at 4

The selection process is based on a measure of **conservation effectiveness (*CE*)**, that seeks to identify the minimum geographic area that will conserve most biodiversity (Leathwick et al. 2007b). The selection algorithm assumes an initial rapid increase in conservation effectiveness with the first sites or examples protected, but this flattens off as larger proportions are protected. It requires a measure of the contribution of a selected wetland to the goal of protecting all remaining wetland biodiversity. We defined *CE* as the sum of wetland class areas weighted by their ecological integrity scores; therefore larger wetlands should rank higher, although their potential contribution to *CE* can be down weighted by their ecological integrity scores.

We then further weight conservation effectiveness with a measure of **irreplaceability**[3]. Irreplaceability reflects the potential of each wetland to be substituted by another for the purpose of protecting a full range of biodiversity (i.e. the conservation goal). If a component of biodiversity (e.g. a wetland class) is represented by a single site, then irreplaceability is maximal because no other site can contribute the biodiversity it contains. If many sites could contribute this component of biodiversity, then irreplaceability is low.

[3] With targets nominated, Pressey et al. (1994) defined the irreplaceability of a site in two ways: (1) the likelihood that it will be required as part of a conservation system that achieves the set of targets; and (2) the extent to which the options for achieving the set of targets are reduced if the area is unavailable for conservation.

The algorithm for estimating the conservation effectiveness (*CE*) of a given selection of wetland sites is as follows:

We calculate the maximum effective wetland area that can be protected ($Pcomp_i$) when taking into account the similarity between wetland classes:

$$Pcomp_i = \sum_{j=1}^{nj} s_{ij} \sum_{k=1}^{n} a_{ik} \quad (3)$$

Where:
n_j is the number of wetland classes.
s_{ij} is the similarity measure between wetland classes *i* and *j*
n the total number of wetland sites
a_{ik} the area of class *i* in site *k*

$\sum_{k=1}^{n} a_{ik}$ is the maximum wetland area available for each class. The sum over the wetland classes n_j accounts for the complementarity. Selection of a similar class to the original will contribute much protection for biological features also present in the original class, whereas selection of a dissimilar wetland class will contribute little to the original class because they share few features. If the similarity of an additional wetland class is low, little is added to $Pcomp_i$.

We can estimate a similar measure ($Pscomp_i$) for any given wetland selection scenario:

$$Pscomp_i = \sum_{j=1}^{nj} s_{ij} \sum_{k=1}^{n} p_k a_{jk} c_k \quad (4)$$

Where:
p_k is a flag set as 0 (non selected) or 1 (selected) for each wetland site *k*.
c_k the ecological integrity index as calculated above (see section 3.5.2) for site *k*

We then calculate $Pprot_i$, the ratio of a particular selection over maximum potential protection:

$$Pprot_i = \frac{Pscomp_i}{Pcomp_i} \quad (5)$$

The conservation effectiveness (*CE*) of any wetland site selection scenario, averaged across all the wetland classes *i* can then be calculated as:

$$CE = \frac{\sum_{i=1}^{N} cf_i * [Pprot_i]^{0.25}}{\sum_{i=1}^{N} cf_i} \quad (6)$$

Where cf_i is a correction factor calculated as:

$$cf_i = \frac{a_i}{\sum_{j=1}^{nj} s_{ij} a_j} \quad (7)$$

cf standardises the area by the similarity measure in the other types (which is a virtually augmented area). As in Ferrier et al. (2004), the ratio $Pprot_i$ was raised to a power of 0.25 to reflect

a diminishing increment to conservation return with subsequent additions of the same class (*i*). This power function reflects the general species:area relationship (Rosenzweig 1995).

Finally, for any given selection, we calculate the benefit/cost ratio (*CEratio*) as follows:

$$CEratio = \frac{CE}{cost * Hleft} \quad (8)$$

Where *Hleft* is defined as:

$$Hleft = \frac{\sum_{i=1}^{N} a_{ik} \left(\frac{Area_{i\_current}}{Area_{i\_historic}} \right)^{0.4}}{\sum_{i=1}^{N} a_{ik}} \quad (9)$$

with

$Area_{i\_current}$ Total current extent in class *i*

$Area_{i\_historic}$ Total historic extent in class *i*

Hleft is a measure of habitat loss for type *i* represented in site *k*. It is high when the site *k* holds a wetland type that has not lost too much extent within the biogeographic unit. *1/Hleft* is an **irreplaceability** measure: the smaller the ratio of current over historic of a wetland type, the higher the irreplaceability and therefore the higher ranking.

cost = 1 at this stage, but it could be set as any measure involving a cost to conservation effectiveness, such as area contribution, land tenure constraint, or land use capability. For example, Leathwick et al. (2007b) used the sum of the river and stream segment lengths as an indicator of cost, assuming that the costs of protection are proportional to the amount of resource protected.

Iterative selection of priority wetlands

Wetlands were ranked and selected within each biogeographic unit by iterating the steps described above. We began by calculating for each wetland site the *CEratio* value, and selecting the wetland that maximises *CEratio* as our first selected priority site. We repeated the procedure, calculating the marginal increase in *CEratio* resulting from selecting each remaining wetland site. Finally, to the selected set we added the wetland site that would result in the highest *CEratio*. This process was repeated until all the wetland sites in the biogeographic unit were selected. In this way a ranked list was created. Note that it could be repeated until a nominated level of CE was achieved, or some total *cost* or *Hleft* threshold was reached.

The relationship between measures of cumulative conservation effectiveness (cumCE) against the cumulative area (CumA) protected reflects the species-area relationship (Figure 5). When a small area is protected, conservation effectiveness increases rapidly, slowing as larger proportions of the biogeographic unit are protected.

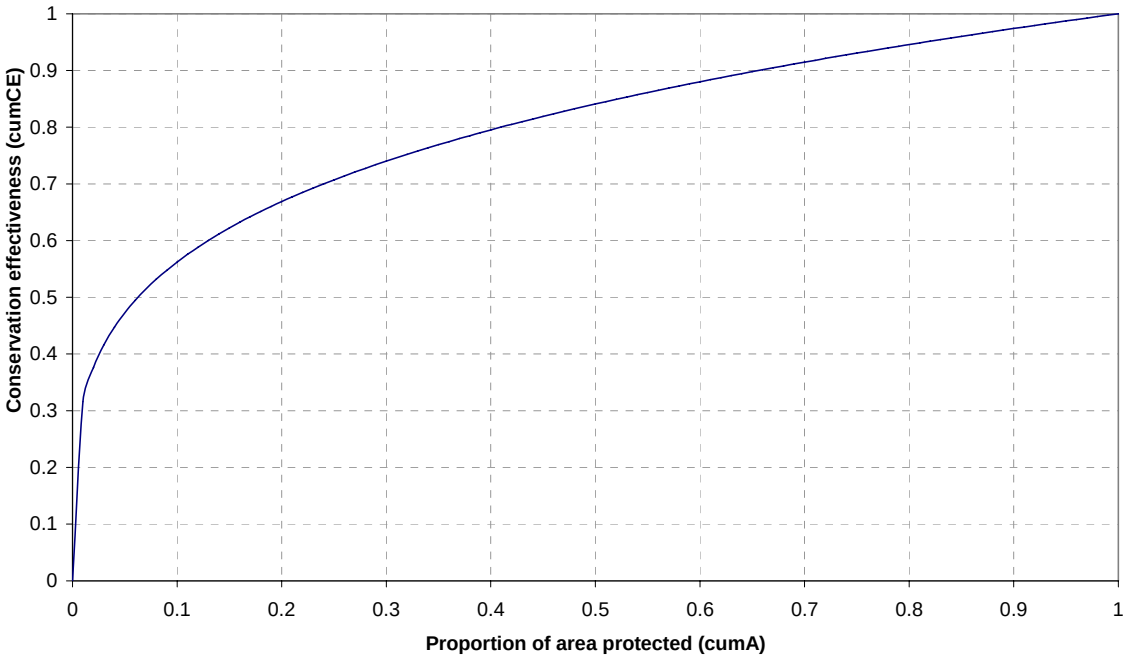

Figure 5 The function used to describe the relationship between conservation effectiveness and the proportion of protection accorded to a wetland class.

4. Results

4.1 Current and historic extent

We estimate the total historic extent of wetlands in New Zealand was 2.4 million ha, nearly three times greater than previous estimates (672,000 ha (Ministry for the Environment 1997)) although the earlier estimate excluded many wetland forests on alluvial flood plains. Our figure suggests almost 9% of the New Zealand mainland area (North Island, South Island, and Stewart Island) was covered by wetland. Current extent is estimated to be 249,776 ha, or 10% of the former extent, consistent with previously cited 90% loss in wetland cover. The loss has been greatest in the North Island, which now retains only 4.9% of its historic extent and contributes about 25% to the national total (Figures 6 & 7; Table 8). Loss has been greatest in the Auckland, Coromandel, East Cape, Manawatu, Hawkes Bay, Northland, and Wellington regions, with wetlands now largely absent from lowland alluvial flood plains. Just over 16% of wetlands area remains in the South Island but this accounts for 75% of the total national area (Figures 6 & 7; Table 8). Wetland cover has survived best on the West Coast of the South Island, on Stewart Island, and in the Otago region (Taeri, Clutha, and Otago Peninsula).

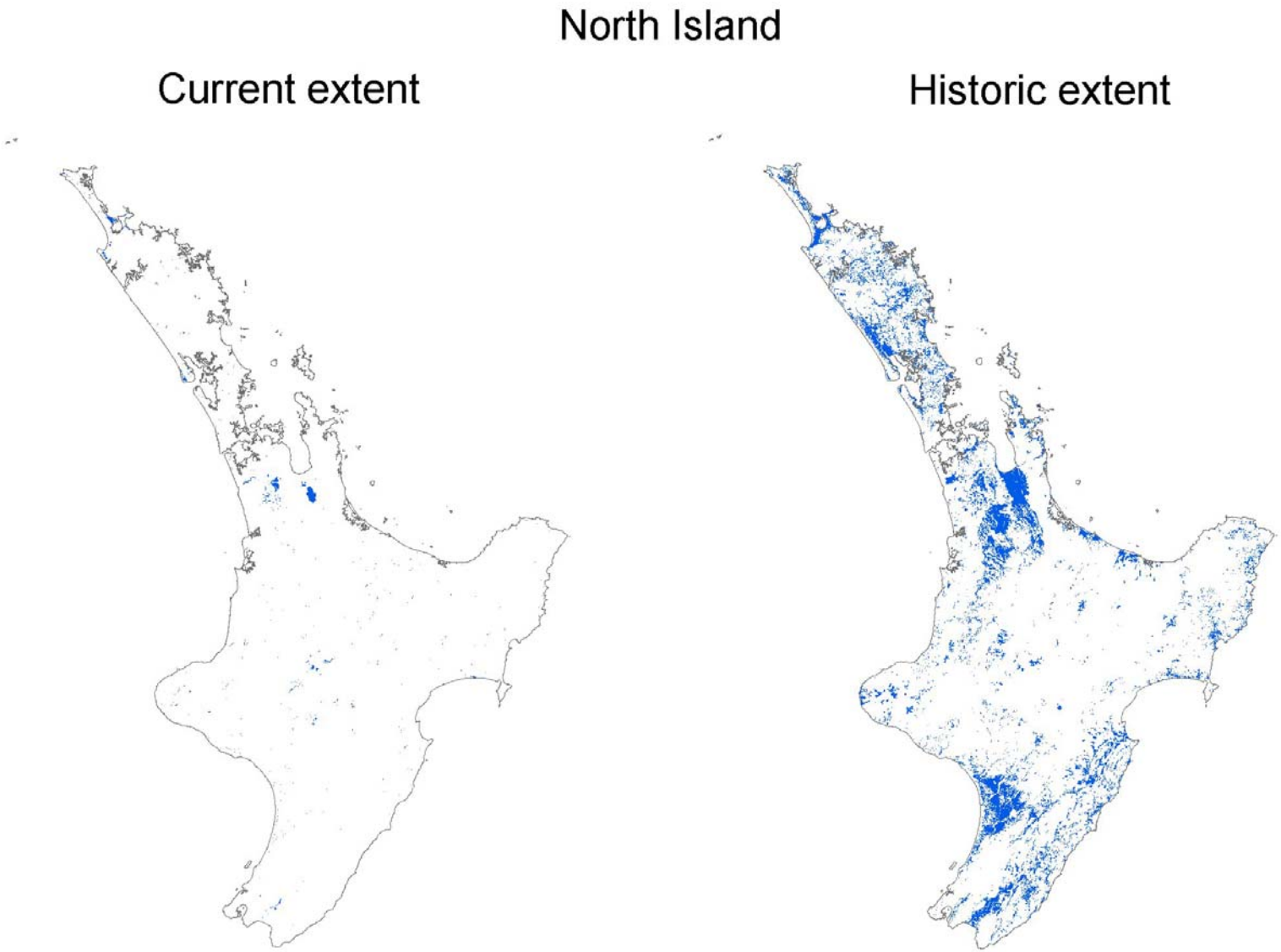

Figure 6 Current and historic extent of freshwater wetlands in the North Island.

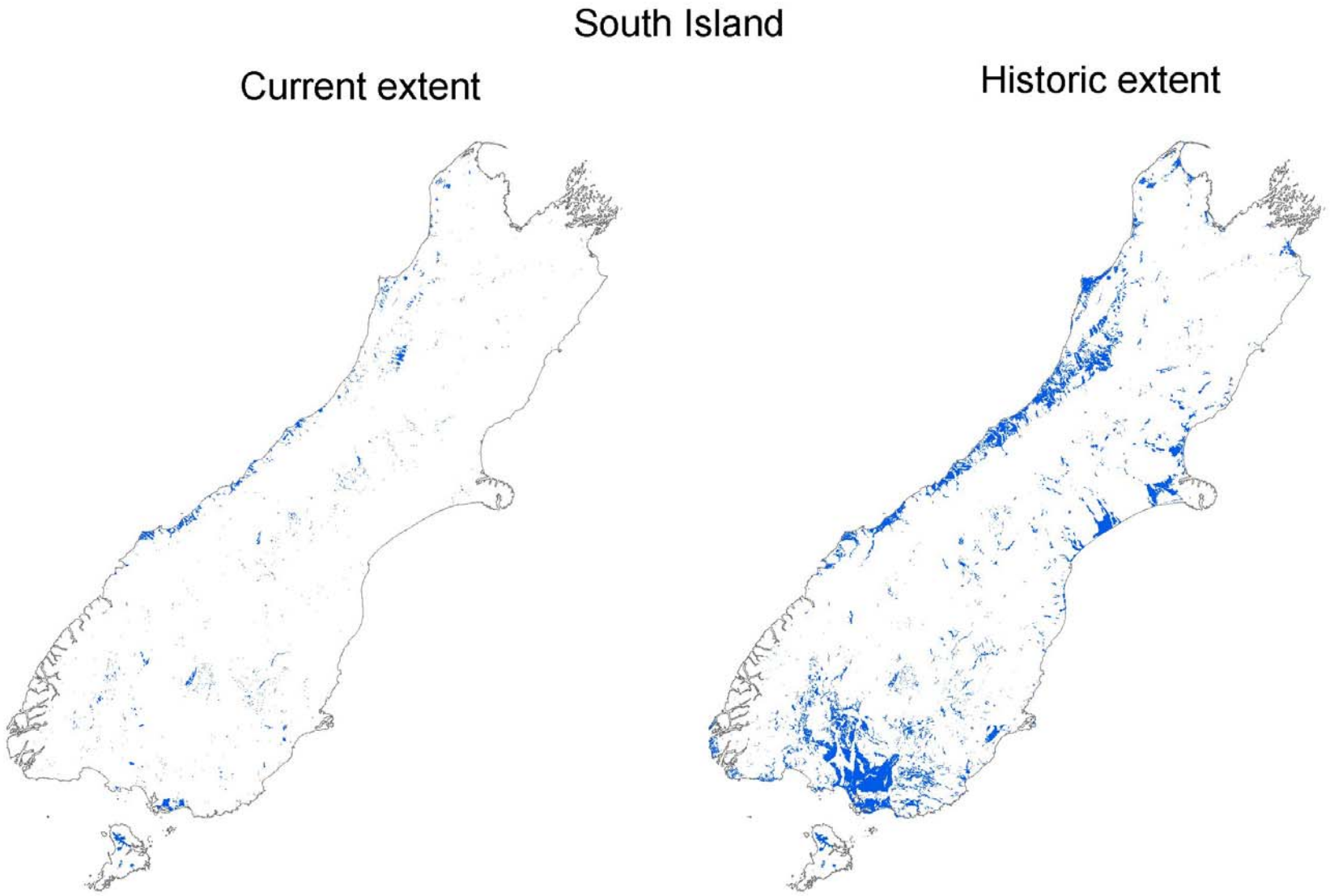

Figure 7 Current and historic extent of freshwater wetlands in the South Island.

At the level of biogeographic units, Westland and Southland have the greatest proportion of national current extent, with 21% and 13% respectively (Table 8). However, despite the presence of large wetland complexes in Southland, this unit has suffered the greatest loss of any South Island region: only 7.9% of its former wetland extent remains, compared to just over 24% in Westland. Twelve of the 29 biogeographic units contain less than 1% of national wetland area, with a percentage loss close to the national average. This reflects that wetlands appear to have been naturally rare in some biogeographic units (e.g. Banks and Otago Peninsulas, Wellington, and Motueka Nelson). On the Otago Peninsula wetlands were uncommon, but a high proportion of their former extent (37%) has been retained. For many other biogeographic units, less than 5% of the former extent remains. Loss seems almost total in Palliser-Kidnappers and East Cape with only 0.4% and 2.4% respectively of former wetlands remaining.

Table 8 Current extent of freshwater wetlands per biogeographic units

Biogeographic unit	Current extent (ha)	Historic extent (ha)	Proportion of national current extent	Proportion remaining of historic extent
Auckland	859	30,381	0.3%	2.8%
Banks Peninsula	34	356	<0.1%	9.6%
Bay of Plenty	3,043	29,136	1.2%	10.4%
Canterbury	11,559	164,869	4.6%	7.0%
Clutha	14,527	58,803	5.8%	24.7%
Coromandel	737	25,984	0.3%	2.8%
East Cape	2,354	97,033	0.9%	2.4%
Fiordland	1,252	28,704	0.5%	4.4%
Grey–Buller	20,196	102,379	8.1%	19.7%
Hawkes Bay	1,019	33,902	0.4%	3.0%
Manawatu–Wairarapa	3,414	254,257	1.4%	1.3%
Marlborough	1,710	14,756	0.7%	11.6%
Mokau	1,208	23,638	0.5%	5.1%
Motueka–Nelson	276	5,802	0.1%	4.8%
Northland – eastern	3,084	79,457	1.2%	3.9%
Northland – northern	5,179	27,973	2.1%	18.5%
Northland – western	6,865	179,120	2.7%	3.8%
Northwest Nelson – Paparoa	18,086	66,461	7.2%	27.2%
Otago Peninsula	344	930	0.1%	37.0%
Palliser–Kidnappers	326	74,009	0.1%	0.4%
Southland	32,970	415,785	13.2%	7.9%
Stewart Island	12,552	12,552	5%	100.0%
Taieri	11,039	36,828	4.4%	30.0%
Taranaki	1,209	23,117	0.5%	5.2%
Waikato	27,601	312,011	11.1%	8.9%
Waitaki	8,183	23,416	3.3%	35.0%

Biogeographic unit	Current extent (ha)	Historic extent (ha)	Proportion of national current extent	Proportion remaining of historic extent
Wanganui–Rangitikei	6,865	127,233	2.7%	5.4%
Wellington	474	5,834	0.2%	8.1%
Westland	52,569	215,164	21%	24.4%
Undefined[4]	242	1,188	0.1%	-
Total	249,776	2,471,080	100%	10.11%

A comparison of wetland loss within Territorial Local Authority boundaries gives a slightly different picture (Table 9). On average less than 5% of wetland area remains in any North Island TLA district, and five have less than 3% of their former extent. In the South Island, all have more than 10% remaining (average 16%). The West Coast and Southland TLA's provide the biggest contributions to national wetland area (contributing 34% and 19% respectively) despite having lost 75–80% of their historic extent.

A comparison of Manawatu and Tasman Districts is telling. Both make a small contribution (2.8% and 2.1%) respectively to the total current extent. However, the proportion of loss differs markedly, with Manawatu (TLA) retaining 2.6% of its former wetland area while 19% of wetlands remain in Tasman (TLA).

[4] Some of the current and historic extent fell outside the WONI biogeographic units because of discrepancies in the coastal boundaries; these were classified as "undefined" and represented 0.1% and 0.05% of the current and historic extent respectively.

Table 9 Current and historic extent of freshwater wetlands per TLA region

	TLA region	Current extent (ha)	% National extent	Historic extent (ha)	% left
North Island	Northland	14,114	5.7%	258,451	5.5%
	Auckland	2,639	1.1%	57,851	4.6%
	Waikato	28,226	11.3%	356,516	7.9%
	BOP	3,304	1.3%	43,089	7.7%
	Manawatu	6,983	2.8%	264,511	2.6%
	Taranaki	3,045	1.2%	40,278	7.6%
	Hawkes Bay	3,394	1.4%	180,371	1.9%
	Wellington	2,774	1.1%	122,804	2.3%
	Total North Island	64,479	25.8%	1,323,871	4.9%
South Island	Tasman	5,224	2.1%	27,339	19.1%
	Marlborough	1,545	0.6%	12,785	12.1%
	West Coast	84,396	33.8%	358,182	23.6%
	Canterbury	19,851	7.9%	187,115	10.6%
	Otago	27,050	10.8%	110,804	24.4%
	Southland	47,231	18.9%	450,985	10.8%
	Total South & Stewart islands	185,297	74.2%	1,147,209	16.3%
	TOTAL	249,776	100%	2,471,080	10.1%

4.2 Wetland types

Results from the GIS classification

Swamps and pakihi/gumland are the two most common wetland classes, making up 36% and 23% respectively of all remaining wetland area (Table 10). However, swamps (being fertile and suitable for agriculture if drained) have undergone most loss with only 6% of their historical extent remaining. Inland saline wetlands were always the rarest form of wetland but today only 292 ha remains, exclusively in Central Otago (Clutha and Taeri biogeographic units). This represents not quite 20% of the former extent. Seepages seem least affected by habitat destruction, with 68% remaining.

Table 10 Current and historic Extent of wetland classes.

	Current extent (ha)	Historic extent (ha)	Proportion of national current extent	Proportion of remaining historic extent
Pakihi/gumland	56,909	339,458	22.8%	16.8%
Bog	40,061	153,116	16.0%	26.2%
Swamp	89,922	1,501,008	36.0%	6.0%
Marsh	23,066	280,828	9.2%	8.2%
Fen	37,009	192,097	14.8%	19.3%
Seepage	2,043	2,990	0.8%	68.3%
Inland Saline	292	1,586	0.1%	18.4%
Undefined[5]	474		0.2%	

At the biogeographic unit level, Westland has the highest proportion of national current extent of swamp (over a third) whereas the Waikato biogeographic unit has the highest proportion of bog (Figure 9). Almost 80% of the total area of bog in the Waikato (13,067 ha), is estimated to reside in two wetland sites, Whangamarino (3398 ha bog area) and Kopuatai peat dome (Bog area; 7186 ha) (Appendix 5). Southland biogeographic unit is the other major stronghold for bogs (32% of national area), most being found within the Awarua wetland complex. Fens are most common in the Clutha and Southland biogeographic unit, accounting for 25% and 23% respectively of the total national area. Small areas of marsh and seepage are present throughout New Zealand, but the inland saline wetland class is found only in the Clutha and Taieri biogeographic units (Figure 8).

[5] "Undefined" corresponds to wetland areas that couldn't be assigned a type because of edge discrepancies with the LRI layer used for the typology rules.

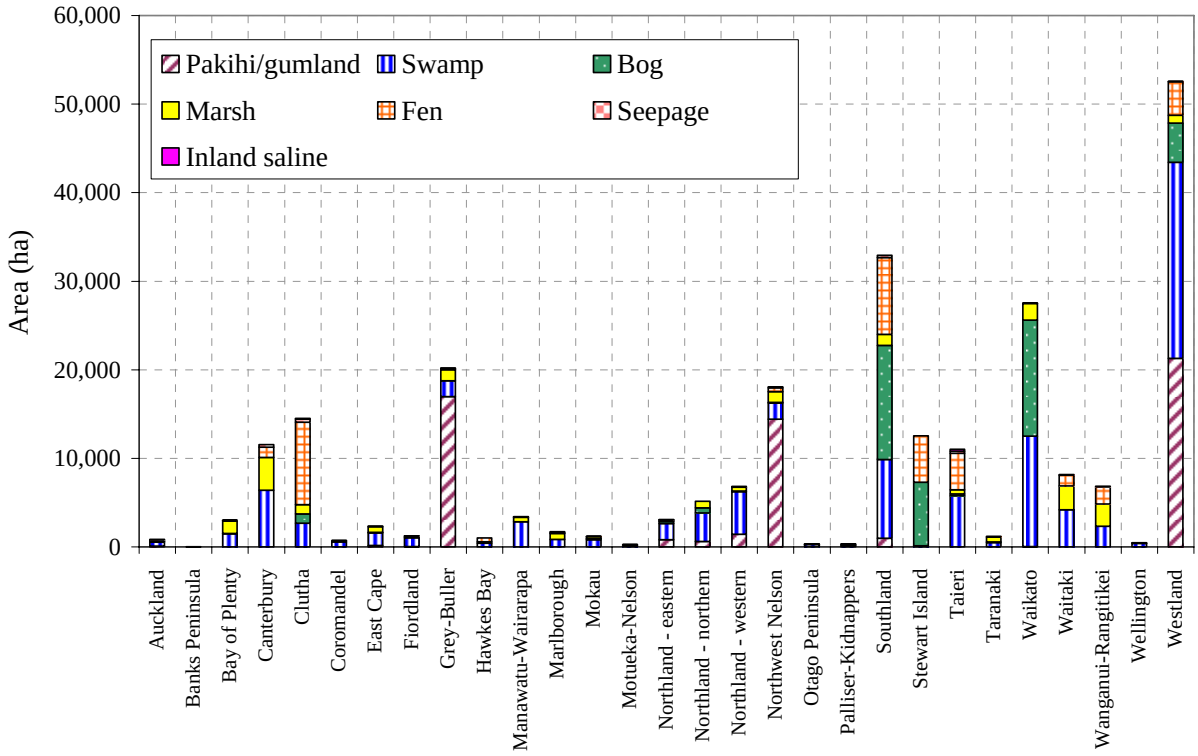

Figure 8 Distribution of wetland classes in each biogeographic unit

Wetland loss varies across wetland classes and between biogeographic units. For example, Pakihi/gumland wetlands have been mostly preserved in the East Cape and Northwest Nelson units (41% and 35% left, respectively), while in the Bay of Plenty and Waikato less than 1% and 3% remain, respectively (Table 11). Furthermore, Waikato is estimated to be a stronghold for bogs (with 19% remaining) but less than 5% of the other wetland classes remains. Southland is similar, retaining almost 36% of its bog area while swamps and marshes shrank to < 5% of former area. A disproportional reduction in the extent of the most common wetland class often drives the high (>90%) overall loss. Thus in Motueka Nelson where overall < 5% of wetlands remain, 2% of swamps remain but 52% of seepages and 26% of marsh wetland classes have survived (Table 11).

Table 11 Proportion of wetland classes remaining in each biogeographic unit (the historical extent in hectares is in brackets)

	Total	Pakihi/ gumland	bog	swamp	marsh	fen	seepage	Inland saline
Auckland	3% (30381)	2% (4393)	4% (1141)	2% (20815)	13% (1541)	0.2% (2478)	100% (12)	
Banks Peninsula	10% (356)			3% (297)	51% (47)		12% (12)	
Bay of Plenty	10% (29136)	0% (513)	3% (888)	7% (21569)	47% (2981)	1% (3184)		
Canterbury	7% (164869)			4% (150249)	31% (12068)	49% (2366)	100% (186)	
Clutha	25% (58803)		47% (2191)	12% (23202)	16% (6635)	38% (24612)	34% (1136)	7% (1027)
Coromandel	3% (25984)		0% (108)	2% (24507)	52% (236)	3% (1128)	42% (5)	

	Total	Pakihi/ gumland	bog	swamp	marsh	fen	seepage	Inland saline
East Cape	2% (97033)	41% (388)	22% (233)	2% (62879)	2% (32036)	0.4% (1443)	97% (54)	
Fiordland	4% (28704)	0% (24587)	0% (40)	100% (653)		5% (3405)	100% (19)	
Grey–Buller	20% (102379)	21% (82521)	1% (437)	18% (10076)	13% (9321)	100% (0)	100% (24)	
Hawkes Bay	3% (33902)			2% (27457)	4% (3714)	15% (2715)	100% (15)	
Manawatu–Wairarapa	1% (254257)		0.3% (1266)	1% (230068)	2% (21631)	1% (1290)	100% (2)	
Marlborough	12% (14756)			8% (11028)	38% (1755)	5% (1863)	91% (109)	
Mokau	5% (23638)		13% (715)	5% (17411)	5% (5126)	2% (371)	100% (15)	
Motueka-Nelson	5% (5802)			2% (5379)	26% (382)		52% (41)	
Northland – eastern	4% (79457)	3% (25812)	3% (6432)	5% (34596)	2% (10296)	1% (2320)		
Northland - northern	18% (27973)	5% (12529)	8% (7705)	47% (6809)	100% (451)	1% (479)		
Northland – western	4% (179120)	5% (31175)	2% (3080)	4% (121376)	2% (18341)	0.3% (5141)	100% (7)	
Northwest Nelson	27% (66461)	35% (41349)	4% (1960)	15% (11702)	11% (11336)	100% (54)	100% (61)	
Otago Peninsula	35% (930)			31% (925)			74% (5)	
Palliser-Kidnappers	0.4% (74009)			0.3% (59544)	1% (14156)	0% (306)	100% (4)	
Southland	8% (415785)	17% (5927)	36% (36209)	4% (250924)	3% (36058)	10% (86264)	67% (404)	
Stewart Island	100% (12552)		100% (7173)	100% (140)		100% (5239)		
Taieri	30% (36828)		21% (1020)	24% (23818)	10% (4701)	67% (6181)	44% (548)	39% (559)
Taranaki	5% (23117)		100% (82)	2% (20166)	29% (1868)	8% (997)	100% (4)	
Waikato	9% (312011)	3% (1321)	19% (69799)	7% (179957)	5% (37811)	0.2% (23123)		
Waitaki	35% (23416)			27% (15275)	50% (5441)	51% (2406)	22% (293)	
Wanganui-Rangitikei	5% (127233)		0% (442)	2% (94548)	9% (27930)	45% (4283)	100% (30)	
Wellington	8% (5834)			16% (2437)	86% (58)	0.3% (3340)		
Westland	24% (215164)	20% (108767)	37% (12162)	31% (72398)	6% (14784)	54% (7051)	100% (2)	

See Appendix 4 for data describing the distribution of wetland classes across TLA boundaries.

Accuracy assessment

An error matrix of the thematic classification was generated (Table 12) from the Otago field assessment. It showed an overall agreement of 60% but this varied greatly between classes. Accuracy was generally higher for all wetland classes (over 80% correct classification) except for marshes (5%) (cf. 'user's accuracy'). Hence, where we found a bog, fen, swamp, or seepage in the field these were usually accurately classified by our GIS rules. However, most marshes observed in the field were misclassified as swamp (93%), although where marshes were identified by the GIS rules they were correctly classified 83% of the time (cf. 'producer's accuracy'). True fens, bogs, and swamps were generally correctly classified in GIS, but the classification suggests the last two were far more abundant than they actually were. For instance, 46% of bogs identified by the GIS rules were actually fens, and 59% of GIS swamps were marshes. Seepages were also overestimated, and only 11% of the real seepages were correctly classified.

Table 12 Error matrix of the wetland classification in the Otago region

Area (ha)		Wetland class observed							Producer's accuracy
		Bog	Fen	Marsh	Swamp	seepage	Inland saline	Total	
GIS classification	Bog	351	319	22	0	0	0	692	51%
	Fen	4	2283	1	58	0	0	2345	97%
	Marsh	0	0	93	13		6	112	83%
	Swamp	9	248	1747	940	0	0	2943	32%
	Seepage	0		12	36	6	3	58	11%
	Total	363	2850	1874	1046	6	10	6149	
	User's accuracy	96%	80%	5%	90%	100%			60%

4.3 Size distribution

Of a total of 7032 individual wetlands mapped nationally, most (74%) are smaller than 10 ha and represent 6% of the national wetland area (Figure 9). There are 77 wetlands over 500 ha which in total cover 54.6% of remaining wetland area (Table 13). These large wetlands (>500ha) are swamp, bog, or pakihis (2), and are mostly on the West Coast (45%), or in Southland, Otago, and Waikato. New Zealand's largest wetland (Kopuatai: 10542 ha) is classified as a bog and located in the Waikato biogeographic unit. Almost half of all biogeographic units contain no wetland over 500 ha.

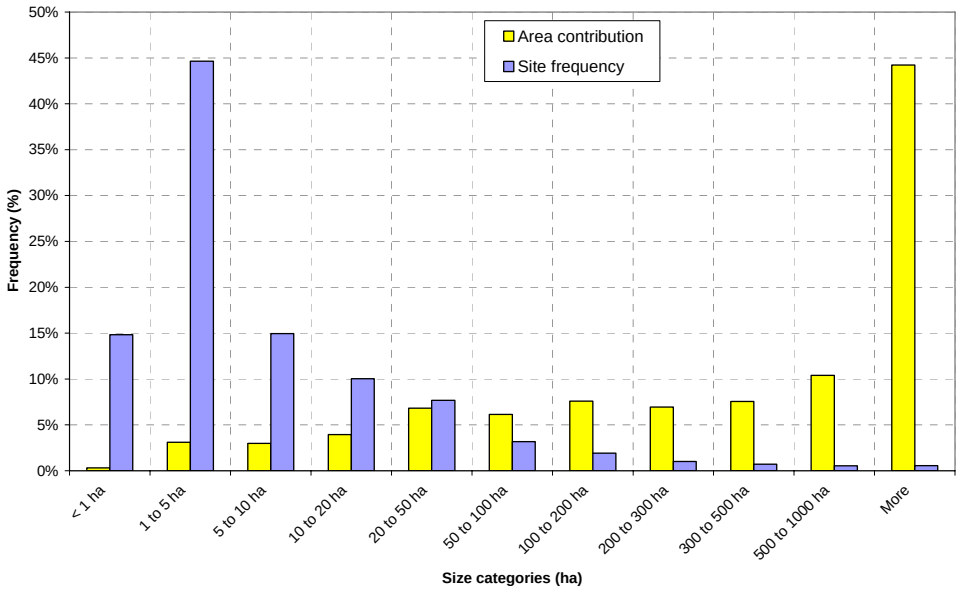

Figure 9 Size frequency and proportional contribution to total area of wetlands nationally (7032 sites)

Table 13 Number, total area, and wetland classes in the 77 remaining wetlands over 500 ha in each biogeographic unit

Biogeographic unit	Number of wetland sites over 500 ha	Total area (ha)	Bog	Swamp	Marsh	Fen	Inland saline	Pakihi/ Gumland
Canterbury	2	2086	0	1868	202	16	0	0
Clutha	4	7648	330	877	207	6235	0	0
East Cape	1	651	0	637	14	0	0	0
Grey–Buller	8	12476	0	241	160	13	0	12062
Northland – eastern	1	827	106	239	0	0	0	481
Northland – northern	2	2932	136	1533	436	0	0	827
Northland – western	2	2460	0	2105	45	0	0	310
Northwest Nelson	7	6051	0	275	231	34	0	5512
Southland	8	15543	9841	3211	86	1770	0	636
Stewart Island	3	12389	7152	0	0	5237	0	0
Taieri	6	6483	0	4306	176	1822	178	0
Waikato	7	20730	12009	8029	674	0	0	17
Waitaki	4	3313	0	1939	418	956	0	0
Wanganui–Rangitikei	2	1535	0	387	1148	0	0	0
Westland	20	39272	3638	16064	172	3042	0	16357
TOTAL	77	134397	33212	41711	3970	19125	178	36202

4.4 Ecological integrity index

Nationally, wetlands represent degraded ecosystems with impaired ecological integrity (Figure 10). More than 60% of sites have an EI < 0.5, and over half the biogeographic units had a mean EI < 0.5, indicating significant human induced disturbance pressures (Figure 11). This potentially represents a substantial loss of biodiversity content. The EI values follow general patterns of agricultural and urban development (Figure 11) with the lowest EI values found in biogeographic units characterized by warm, flat, fertile land favoured for agricultural development. For example, intensive agricultural development (and associated nutrient risks) in the Waikato is associated with a mean EI of 0.35. Regions like Auckland, with widespread urban development, have similar EIs. These EI values contrast with wetlands in Fiordland or Stewart Island; these are typically in good condition, with human disturbance pressures are confined to a few invasive species, and they have a mean EI > 0.9. These wetlands are likely to have retained much of their natural native community composition.

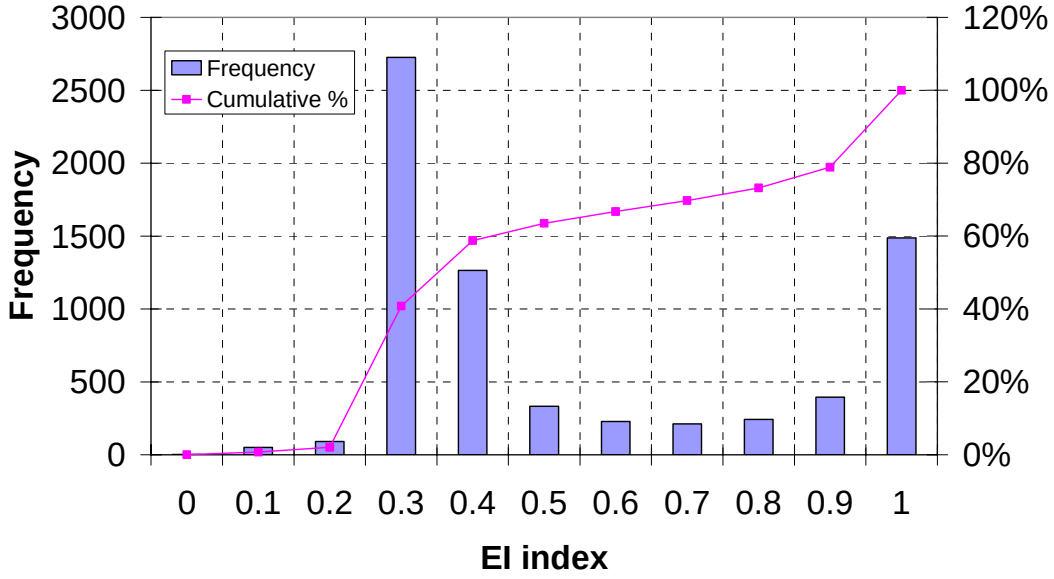

Figure 10 Histogram of the ecological integrity index for all 7032 wetland sites

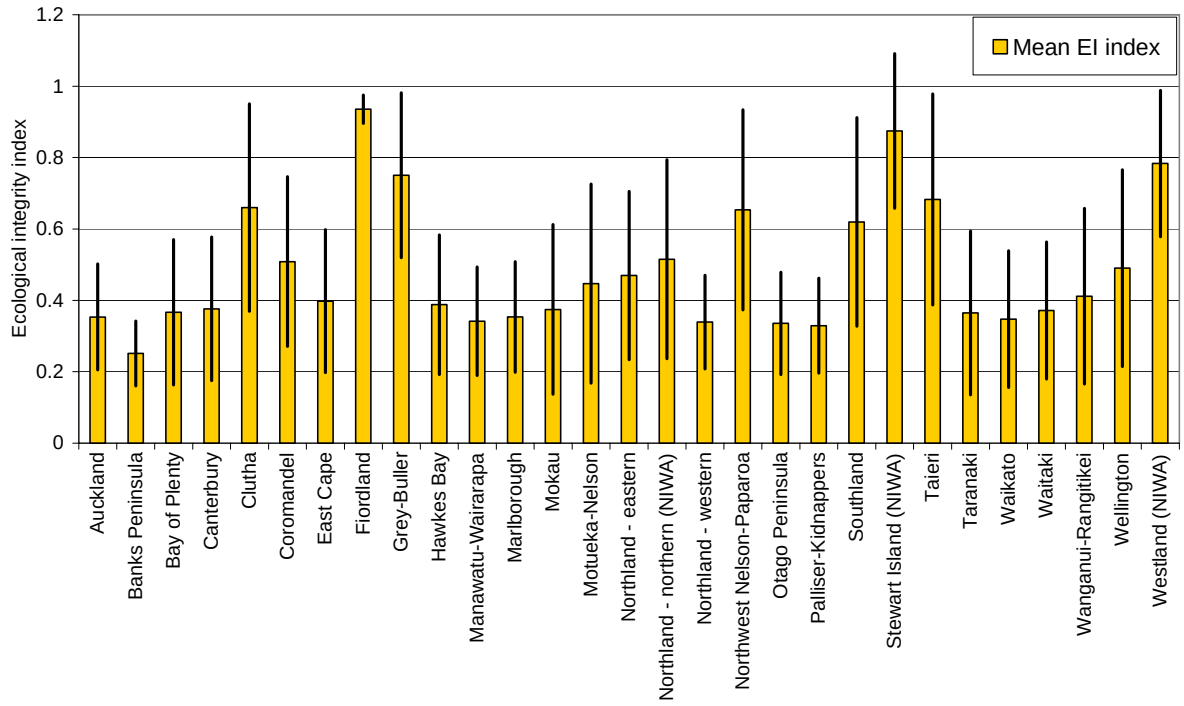

Figure 11 Mean and one standard deviation for the ecological integrity index in all 29 biogeographic units

4.5 Candidate list of nationally important wetlands

The highest ranked sites in each biogeographic unit were often the largest remaining wetlands. This reflects their potential to protect several wetland classes and a high proportion of what remains of these classes (Table 14, Figure 12). For example, Kopuatai peat dome is the largest wetland in the Waikato biogeographic unit, and accounts for 55% of remaining bog and 27% of remaining swamp. The top ranked site in each biogeographic unit typically contained two or three wetland classes and most commonly included swamps, marshes and fens. Smaller wetlands were ranked highly if they contained rare hydroclasses, and/or had high ecological integrity, Maymorn ridge in the Wellington region and Grebe in the Southland being two examples.

The 5 ha Maymorn ridge wetland in Wellington contains 41% (by area) of fen habitat left in Wellington. When this is coupled with its high ecological integrity (0.97) it also has a high irreplaceability score because there are no comparable options for protecting this type of wetland biodiversity. Other fens in the Wellington biogeographic unit are smaller, and/or have lower ecological integrity. Thus, the ranking algorithm places more importance on this site, as it assumes it is critical for protecting a full range of biodiversity in the Wellington biogeographic unit.

In Southland, the Grebe was selected before either the Waituna or Toetoe wetlands, two components of the Awarua wetland (New Zealand's largest wetland complex). This appears to reflect the promotion of a smaller wetland because it has a higher ecological integrity (EI = 0.95) and the demotion of larger wetlands in poorer condition (EI = 0.41; Appendix 5). In part, this may also reflect the relationship between area and conservation effectiveness derived from the species area curve (Figure 5). Hence, with the existing function, conservation effectiveness increases extremely rapidly over the first 1–3% of the area protected before levelling off. Thus, the Grebe, a small wetland in good condition, contributes 30% of the overall CE even though Waituna Lagoon is almost 30 times larger and

Toetoe 10 times larger, and despite the wider range of wetland classes in Waituna and Toetoe, the second and third highest ranked wetlands in Southland. In contrast, selection of the Upper Taieri Wetlands Complex reflects both the richness of wetlands classes (3) and its high irreplaceability due to the presence of distinctive and rare saline wetlands (Table 14); these make up for the somewhat reduced ecological integrity.

Figure 12 Location of the highest ranked wetland site in each biogeographic unit.

Table 14 Ecological integrity value, Extent and proportion (in brackets) of wetland classes in the first site selected in each biogeographic unit

Biogeographic unit	Names	EI index	Area (ha)	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Inland saline
Auckland	Awhitu_tram gully rd	0.49	87			87 (15%)			
Banks Peninsula	Wairewa	0.23	11			6 (100%)	5 (29%)		
Bay of Plenty	Whirinaki (Hautapu) Bog	0.30	37		30 (69%)	7 (0.5%)			
Canterbury	Lake Stream – Cameron Fan Wetland	0.45	1405		16 (1%)	1290 (20%)	100 (3%)		
Clutha	Von Valley Wetland Management Area	0.68	2492		1408 (15%)	877 (33%)	207 (20%)		
Coromandel	Kaitoke swamp	0.93	222			199 (35%)	23 (18%)		
East Cape	Whakaki lagoon	0.27	651			637 (44%)	14 (2%)		
Fiordland	Lake Hauroko – Lillburn valley rd	0.96	15					15 (28%)	
Grey–Buller	Lake Hochstetter pakihi	0.74	5391			158 (9%)		5233 (31%)	
Hawkes Bay	Poukawa stream	0.21	116			113 (28%)	3 (2%)		
Manawatu–Wairarapa	JK Donald Reserve	0.24	410			337 (12%)	73 (13%)		
Marlborough	Edwards- Muntz	0.83	131		28 (32%)	102 (12%)			
Mokau	Hutiwai Wetland	0.97	240			199 (24%)	41 (16%)		
Motueka–Nelson	Tonga Swamp	0.97	18			18 (19%)			
Northland – eastern	Lake Ohia wetlands	0.28	827	106 (43%)		239 (13%)		481 (57%)	
Northland – northern	Waihuahua swamp	0.78	1589	136 (21%)		518 (18%)	108 (19%)	827 (76%)	
Northland – western	Kaipara Head wetland	0.37	1928			1883 (38%)	45 (11%)		
Northwest Nelson	Denniston plateau	0.68	1138		13 (3%)			1125 (8%)	
Otago Peninsula	Swampy Summit Wetland	0.78	122			122 (34%)			
Palliser–Kidnappers	Wanstead	0.25	27			27 (15%)			
Southland	Grebe	0.95	312		7 (0.1%)	305 (3%)			
Stewart Island	Ruggedy Flats	0.97	10148	4912 (68%)	5237 (100%)				

Biogeographic unit	Names	EI index	Area (ha)	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Inland saline
Taieri	Upper Taieri Wetlands Complex	0.31	2349			1995 (35%)	176 (37%)		178 (80%)
Taranaki	Norfolk Road	0.75	199			199 (41%)			
Waikato	Kopuatai wetland	0.23	10542	7188 (55%)		3354 (27%)			
Waitaki	Braemar Road Tussock	0.85	1570		956 (78%)	437 (10%)	177 (7%)		
Wanganui–Rangitikei	Waitotara and Hawken's Lagoon	0.37	213			213 (9%)			
Wellington	Maymorn Ridge	0.97	5		5 (41%)				
Westland	Haast wetland	0.80	3569			816 (4%)	8 (1%)	2745 (13%)	

The top 20 ranked wetlands in each biogeographic unit are listed in Appendix 5, as well as any additional sites required to provide full representation of wetland classes. The omission of a fully representative range of wetlands classes in the top 20 wetlands results from the complementarity function, which assumes protection of similar wetland classes will capture some of the biodiversity present in absent classes.

If the selection algorithm continues until one example of each wetland class in each biogeographic unit has been selected, conservation effectiveness exceeds 67% for each unit (Table 15). In other words, if the goal is to select the minimum number of sites that protect a full range of wetland classes, then selecting at least one example of each wetland class would protect more than 67% of overall wetland biodiversity. But, in some biogeographic units, over 200 wetlands must be selected to capture a full range of wetland classes (e.g. Bay of Plenty)— not particularly effective for allocating resources. In areas of high ecological integrity, fewer wetlands are required to protect close to 100% of the full range of biodiversity (high conservation effectiveness). Thus, on Stewart Island, 99% of wetland biodiversity can be effectively conserved by protecting 27% of the sites (4 sites out of 15) and in Fiordland 97% (CE) is achieved by selecting 68% of remaining wetland area. In areas of high human pressure (e.g. Banks Peninsula and Bay of Plenty) protecting 99% of wetland area may effectively conserve just over 70% of remaining biodiversity.

Table 15 Number of wetland sites required to select at least one example of each wetland class per biogeographic unit, and cumulative conservation effectiveness and area that results from this selection.

Biogeographic unit	Number of wetland classes present	Number of sites before all wetland classes are selected	Total number of sites	% CE reached	% Area covered
Auckland	6	20	204	73%	62%
Banks Peninsula	3	5	6	70%	99%
Bay of Plenty	6	215	249	74%	99%
Canterbury	4	46	843	72%	58%
Clutha	6	29	606	90%	75%
Coromandel	4	23	27	93%	99%
East Cape	5	23	227	71%	63%
Fiordland	4	98	144	97%	95%
Grey–Buller	5	36	259	90%	85%
Hawkes Bay	4	50	78	83%	96%
Manawatu–Wairarapa	5	56	352	70%	73%
Marlborough	4	24	216	72%	61%
Mokau	5	30	66	88%	93%
Motueka–Nelson	4	34	66	89%	84%
Northland – eastern	6	46	218	75%	84%
Northland – northern	5	22	159	85%	83%
Northland – western	6	41	466	82%	84%

Biogeographic unit	Number of wetland classes present	Number of sites before all wetland classes are selected	Total number of sites	% CE reached	% Area covered
Northwest Nelson	6	55	272	92%	91%
Otago Peninsula	4	7	11	82%	99%
Palliser–Kidnappers	3	5	82	67%	29%
Southland	6	173	863	83%	85%
Stewart Island	3	4	15	99%	99%
Taieri	6	60	427	81%	85%
Taranaki	5	50	70	88%	97%
Waikato	6	73	179	71%	97%
Waitaki	4	60	221	86%	92%
Wanganui–Rangitikei	4	127	377	83%	91%
Wellington	4	4	59	82%	46%
Westland	6	120	270	95%	98%

An alternative way to examine the rankings is to consider the first set of wetland sites that reaches a threshold of conservation effectiveness (Table 16). For example, if we want to protect enough wetlands to achieve 70% CE in each biogeographic unit, we would need to conserve 328 wetland sites. This would account for 66% of all possible combinations of wetland classes/biogeographic units and 43% of the remaining area. In Southland, 70% CE is achieved from the first nine wetlands that make up about 45% of the remaining area and it captures all wetlands classes except seepages.

Table 16 Number of wetland sites required to reach a minimum of 70% conservation effectiveness in each biogeographic unit

Biogeographic unit	Number of wetland sites selected	Number of wetland classes represented	Total no of wetland classes	Wetland class not represented	Cumulative area as percent of total area in the biogeographic unit
Auckland	10	6	6		49%
Banks Peninsula	4	3	3		89%
Bay of Plenty	61	4	6	Seepage, gumland	77%
Canterbury	33	3	4	Seepage	53%
Clutha	1	3	6	Bog, seepage, saline	17%
Coromandel	1	2	4	Fen, seepage	30%
East Cape	15	4	5	Fen	57%
Fiordland	1	1	4	Fen, swamp, bog	1%
Grey-Buller	1	2	5	Fen, marsh, bog	27%
Hawkes Bay	1	2	4	seepage, fen	11%
Manawatu-Wairarapa	59	5	5		74%
Marlborough	16	3	4	Seepage	55%
Mokau	1	2	5	Bog, fen, seepage	20%
Motueka-Nelson	2	3	4	Seepage	24%
Northland - eastern	15	4	6	Fen, seepage	69%
Northland – northern	1	4	5	Fen	31%
Northland – western	3	3	6	Bog, fen, seepage	43%
Northwest Nelson	3	4	6	Bog, seepage	26%
Otago Peninsula	1	1	4	Fen, marsh, seepage	31%
Palliser-Kidnappers	31	3	3		75%
Southland	9	5	6	Seepage	45%

Biogeographic unit	Number of wetland sites selected	Number of wetland classes represented	Total no of wetland classes	Wetland class not represented	Cumulative area as percent of total area in the biogeographic unit
Stewart Island	1	2	3	Swamp	81%
Taieri	3	4	6	Bog., seepage	38%
Taranaki	2	1	5	Bog, fen, marsh, seepage	28%
Waikato	38	5	6	Seepage	92%
Waitaki	2	3	4	Seepage	28%
Wanganui-Rangitikei	7	3	4	Seepage	44%
Wellington	3	3	4	Marsh	41%
Westland	3	5	6	Seepage	23%
Total	328	93	139		43%

5. Discussion

5.1 Strengths of the WONI wetland approach

This project has achieved two firsts: the first national scale inventory of New Zealand's inland wetlands and the first quantitative listing of wetlands contributing most to what remains of our remaining wetland biodiversity. Previous inventories have either been focused at the regional scale (Janssen et al. 2005), or adopted more qualitative expert panel approaches (e.g. Oceania list of wetlands, (Cromarty and Scott 1996)) that assessed a wider range of freshwater ecosystems (lakes, rivers, estuaries and wetlands).

We have improved on previous estimates of the current and former wetland extent by incorporating a more complete range of data from existing databases, and by using nationally consistent digital elevation models and satellite imagery. By considering all Land Use Capability classes in the LRI that could contain wetlands we increased the estimate of probable historic extent from 672,000 ha to 2,471,080 ha. However, some of this increase reflects a broader definition of wetlands. In the Waikato, Leathwick et al. (1995) reported 25% of the wetland vegetation remained whereas we estimated it to be 7.9% (Table 12) because our measure of historic extent was greater due to the inclusion of wet alluvial plains. Leathwick et al. (1995) used a narrower, essentially herbaceous, definition of wetlands. Former historic kahikatea-dominated alluvial forests (i.e. the estimated extent of secondary scrub on alluvial in 1840) adds another 200,000+ ha to our wider definition, and thus confirms a similar loss of extent. Satellite imagery and regional growing provide a consistent and repeatable approach to wetland delineation; these techniques can generate regular, cost-effective, national updates to measure changes in extent. Thus, this work could provide a baseline for monitoring progress towards NZBS and wetland policy goals.

There is increasing evidence that species disappear quickly once the area of remaining ecosystem, habitat, or community falls below 30% of its original area, and the biodiversity loss associated with the destruction of each additional hectare increases rapidly (Rosenzweig 1995; Seabloom et al. 2002; Fahrig 2003). The rate of wetland habitat loss in New Zealand has been dramatic; we have confirmed that losses are about 90%. Destruction has been greatest in the North Island (>95% loss), with 80–85% loss in many parts of the South Island. These figures describe only a part of the loss—the area lost component. Our data indicate New Zealand's wetland ecological integrity is severely depleted and what remains is threatened, with some ecosystem types, communities, and species facing extinction. Clearly, to achieve New Zealand Biodiversity Strategy Goal Three[1], all remaining

[1] Goal Three of the Biodiversity Strategy is: "Halt the decline in New Zealand's indigenous biodiversity. Maintain and restore a full range of remaining natural habitats and ecosystems to a healthy functioning state, enhance critically scarce habitats, and sustain the more modified ecosystems in production and urban environments; and do what else is

wetlands must be protected from drainage, clearance, pollution, and invasion by exotic species.

We have improved upon earlier freshwater prioritisation exercises (Chadderton et al. 2004, Leathwick et al. 2007b) by incorporating measures of irreplaceability and complementarity. The selection ranking and underlying wetland attributes provide a consistent, transparent, objective, and repeatable framework that is not fraught with the geographic, taxonomic, and sampling biases implicit in expert-panel-based approaches (Chadderton et al 2004).

These data provide strong quantitative support for recent national policy statements that identify the need to protect all remaining natural wetlands. They reinforce the need to consider wetlands as nationally significant habitats for indigenous species (Ministry for the Environment 2007). These guidelines, the 1986 National Wetland policy, and provisions in the Resource Management Act (1992) are designed to prevent further loss of wetlands through habitat destruction, and if enforced by Territorial Local Authorities (TLA) would provide some legal protection to all remaining wetlands. However, wetland drainage, ploughing, burning, and spraying continue (Sorrell & Gerbeaux, 2004), apparently unconstrained by legislation and policy. Most (74%) of the 7032 wetlands identified in this study are smaller than 10 ha. This result is consistent with previous regional assessments (Preece 2000 & 2001) that show the highly fragmented state of remaining wetlands. These small wetlands account for most of what remains in the 12 biogeographic units that now contain less than 1% of the total national wetland area. Most are located on private land, and it is questionable whether the current regulatory framework, and its reliance on national guidance to regional policies, will prevent or even slow further loss.

Legal protection alone will not prevent further loss of wetland biodiversity. Effective conservation will require active management and restoration to mitigate impacts of invasive species, fire, sedimentation and nutrient enrichment, and altered hydrology (Sorrell & Gerbeaux, 2004). Lowland coastal wetlands are particularly important as they contribute much to remaining biological diversity and are important refuges for threatened species in these regions (de Lange et al 2004). But, they have suffered the greatest levels of loss from drainage and habitat destruction, and are also under increasing pressure from intensification of surrounding land uses. This is illustrated by the state of wetlands in the Manawatu, Hawkes Bay, and Palliser–Kidnappers biogeographic units. Over 97% of wetlands have been lost and the few remaining examples in the lowland areas have low ecological integrity. Even the highest ranked sites (Table 13) have an ecological integrity score of less than 0.25, suggesting much of their biodiversity has already been lost.
The approach lends itself to further learning, improvement, and exploration of alternate assumption. The ranking system is a guide for decision makers, as it provides some, but not all, the information required to prioritise and allocate scarce conservation resources. In particular, it is important to identify the sites at most imminent risk. Some of the highest ranked sites are well protected on high protection status conservation land (e.g. National Park, Scientific Reserve) and may be at negligible

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necessary to maintain and restore viable populations of all indigenous species and subspecies across their natural range and maintain their genetic diversity."

risk of degradation (except from impacts of invasive species). However, the highest ranked sites also at most risk of loss must be top priority for conservation effort. The opportunity costs of spending scarce conservation resources on important but secure biodiversity are large (Margules and Pressey 2000, Stephens et al 2002). Further relevant considerations are tenure, cost, feasibility, and effectiveness of the required action. In short, it is the conservation work rather than the site that should be prioritised to achieve greatest efficiency.

This database and ranking provides managers with information to help identify sites for conservation. For example, by overlaying wetland ranks with information on land status regional site protection priorities (for land acquisition, covenants etc) could be identified. Alternatively, animal or plant pest management priorities could be informed by considering wetlands ranks, the presence of existing populations of invasive species, and the relative impact sustained control or eradication versus further spread would have upon the sites ecological integrity and ranking.

It might be tempting to focus protection efforts on the 77 wetlands larger than 500 ha because these capture over 50% of remaining wetland extent. However, this strategy would not meet representativeness goals because the 77 wetlands are located in just 16 of the 29 biogeographic units (predominantly West coast, Southland, Northland, Waikato, and Stewart Island). Many of the larger wetlands (>500 ha) are less vulnerable to the most pressing anthropogenic threats other than fire or invasive species (e.g. Stewart Island Ruggedy flats) and are therefore less threatened than the many smaller wetlands in agricultural landscapes. Systematic conservation planning principles (Margules and Pressey 2000) state that these smaller, typically highly irreplaceable and more vulnerable wetlands deserve the most immediate conservation investment. Threats to their persistence mean options for their conservation are rapidly retreating, and it is important to conserve them while this is still possible.

To meet the policy goal of protecting a fully representative range of wetlands, it is important that when TLAs devise biodiversity policies and report conservation performance these should use biogeographic units rather than political boundaries, which do not reflect biodiversity pattern. For example, in the Tasman region, the TLA summary suggests that almost 20% of wetlands remain. But, the biogeographic unit analysis in this region reveals that North West Nelson biogeographic unit has retained over 27% of its former wetland extent compared with less than 5% remaining in the Motueka/Nelson biogeographic unit (Table 8). Intervention priorities must also recognise the full range of wetland classes. Thus, although swamps are the most extensive wetland class remaining in New Zealand they have also suffered the greatest losses (<6% remaining); in the Motueka –Nelson Biogeographic unit swamps, with just 2% of their former extent, are the most threatened wetland class.

5.2 Limitations and future improvements

Wetland Delineation

Efforts to delineate historic extent are limited by the accuracy of information on potential land capability (soil Land Use Capability maps). Soils data are sparse and patchy; remote and steep areas of New Zealand have low resolution; and soil alteration by 'improvements', infilling, and landscaping are not detectable in the data. These limitations mean our estimates of historic wetland extent are probably underestimates.

Our delineation of the current extent of wetlands improves on existing national maps (e.g. LCDB2) but is nevertheless an incomplete inventory as we were unable to depict ephemeral, plutonic, nival, and geothermal wetlands. This is a major gap in our assessment and results in failure to represent the full range of wetland biodiversity. Satellite imagery favours depiction of wetlands with low-stature vegetation like rushes or sedges, whereas forested wetlands are difficult to separate from dry forests. Hence, our results for Fiordland (New Zealand's largest national park and an area retaining most of its wetland) wrongly suggest a significant loss in cover. The error is a consequence of scant centre point data for Fiordland, poor resolution of soils data (perhaps overestimating former extent), and the inability of satellite imagery to differentiate wetlands through canopy trees. Moreover, some discrepancies probably reflect the absence of good centre point data for some remote parts of New Zealand. Thus, estimates of current and former extent in remote forested regions of New Zealand (e.g. West Coast, Westland, Fiordland, and Stewart Island) should be treated with caution, being likely underestimates of the total area. We also probably missed many small wetlands because centre point locations were absent and spatial limitations of remote satellite imagery prevented recognition of wetlands < 0.5 ha. These small wetlands are likely to be abundant (Preece, 2000 & 2001) and are probably important sites for sustaining some threatened species, particularly in some seriously depleted biogeographic units. For most of these sites, ground-truthing will improve delineation, especially where margins vary seasonally. Region-growing from satellite imagery is most suitable for regional and national assessments and should not replace delineation from aerial photos or ground-truthed polygons.

Defining wetland sites was also problematic in fragmented landscapes. In the absence of local information we used a GIS rule (polygons within 300 m of a nearest neighbour are in the same site) to combine wetland fragments into a single site, or wetland complex. However, whether this is appropriate can only be assessed on a site by site basis.

Delineation could be improved by using local experts to map these wetlands or possibly by using radar imagery or LIDAR (Light Detection and Ranging remote sensing systems) for small wetlands. S-map, a current soil mapping project (Hewitt 2005), has good potential to refine delineation because it seeks to standardise and improve landscape descriptors (slopes, ridges, spurs) and soil information based on a combination of ground survey and topographic modelling techniques (Rutledge and Ausseil 2006). However, to improve delineation of small wetland types in local depressions, field work is still necessary. Some forested wetlands could also be identified and mapped by compiling data from other publications; for example, New Zealand Forest Service forest class maps, PNAP surveys, National Parks Series Maps, and the biological survey of reserves report series all contain forest cover type data that could help locate wet forest areas.

Wetland classification

Our wetland typology was constrained by data and reliance on soil properties. Although the GIS expert rules reflect environmental drivers described by Johnson and Gerbeaux (2004), the ability of these rules to differentiate wetland types is highly dependent on the resolution of the LRI, which is as coarse as 1:250,000 in the montane areas of the South Island. In regions mapped at such coarse resolutions, soils data can not accurately classify wetlands that vary at a much finer scale—in part, the results from the Otago region probably reflect this. The overall wetland classification probably underestimated the marsh extent, overestimated seepages, and confused bog and fen. The underestimation of marsh probably reflects the inability of drainage class data to differentiate marshes form swamps, while the peat content and pH class of bog and fen are too similar to differentiate these wetland types accurately. Thus, parts of the Whangamarino wetland complex are classified as bog when they should be fen (Clarkson pers. comm.), although Cromarty and Scott (1996) classified it as a swamp/bog complex. Marsh and swamp wetland classes are environmentally similar and have much overlap in their species compositions (Brian Sorrell, NIWA, pers. commm). If this this overlap is large then the misclassification of marshes as swamps will have little material impact on the biodiversity representation goal of the site selection process. Clearly this is an issue that deserves further enquiry.

The limited classification level is likely to have under-represented the full range of wetland diversity. For example, the classification rules do not account for climatic variability at regional scales that affect wetland plant community composition (Leathwick et al. 2003). A national classification system that incorporates a wider range of environmental drivers (e.g. temperature, rainfall variation) should better differentiate biotic pattern across wetland ecosystems and would substantially improve the biodiversity assessment and our site rankings. However, progress towards its development depends on the S-Map project, to improve mapping of soil characteristics (drainage, pH, peat, flood return intervals) (Rutledge & Ausseil 2006), and the delineation of critical topographic features defining wetland boundaries. In the near term, the classification could be refined using wetland data derived under the NIWA-Landcare FRST wetland project and information on vegetation and wetland class at various locations.

Wetland pressure indicators

Wetland ecological integrity was defined using a combined index of anthropogenic pressures measures, transformed to scale them according to expert opinions about their impact. We assumed a high pressure index indicates low ecological integrity. Empirical evidence to support this assumption would be correlation between ecological integrity and species occupancy. The proportion of taxa expected to be present naturally (i.e. without pressures) should increase with ecological integrity. A current FRST research project is presently attempting to quantify and describe some of these relationships (B. Clarkson pers. comm.). Outputs from these studies will improve the EI model and remove possible covariates or redundant variables that may presently weight the assessment toward particular pressure measures. For example, we used nitrate risk as a surrogate measure of land use intensification because it is derived from data on farm types, soil, rainfall, and fertiliser application (CLUEs reference). There is likely to be a reasonable correlation between nitrate and phosphorus enrichment (the latter probably the more important nutrient pressure; B. Clarkson, pers. comm.) as they share many of the same drivers. However, a national data set on phosphorus does not yet exist. Further work is needed to create a national layer of phosphorus enrichment risk to assess its relationship with nitrate risk, field measurements, and measures of ecological integrity.

Future research may also enable inclusion of a fragmentation measure. The negative impacts fragmentation has on wetland functioning (especially hydrological processes; (Saunders et al. 1991) were recognised, but without data or even expert consensus to scale its impact on wetland biodiversity, fragmentation could not be included. We were also unable to include a measure of pressure from human induced fire because there is no national inventory of burnt wetlands. Natural fires occurred in the past for most of New Zealand wetlands but are now much more common (Sorrell & Gerbeaux 2004). New Zealand native vegetation is not fire adapted (Basher et al. 1990) and while several wetland native plant species can tolerate infrequent burning, fire has significant impacts on native wetland communities by altering plant communities and making them vulnerable to weed invasion (Timmins 1992).

With the exception of nutrient enrichment, all other pressure measures were applied uniformly across each wetland class. We recognise that some classes are more susceptible to particular pressures than others. The impact of the pressure on ecological integrity depends on the size of the catchment relative to the wetland, the river size and flood frequency, and the wetland edge to core ratio. For example, indicators derived from upstream catchments or that require open water (pest fish) would have little relevance to bogs that depend on rainwater for their wetness. This averaging impact was probably most pronounced in the Waituna wetlands, where the low ecological integrity score is driven by intensive dairy farming in the upstream catchment even though much of the system is composed of bogs that would be minimally affected by such pressures. It seems likely that New Zealand's bogs may not be as heavily disturbed as our data suggests. The relationships will be described quantitatively by the current FRST research.

Site selection methods

Measures of complementarity assume protection of one wetland type protects some of the biodiversity of similar wetland types. By combining complementarity, ecological integrity, and irreplaceability, our selection algorithm defines an overall measure of conservation effectiveness. The trade-off among these factors appears to have prevented selection of some degraded wetland classes where related (but not the same) types with higher ecological integrity were present. This suggests our complementarity variable may overestimate the contribution any one wetland type can make to the full range of available biodiversity. In practice, when choosing between two highly similar wetlands types the algorithm appears to select the least degraded wetland types even where no examples of the other type have been selected. Thus, it seems likely that our process does not always select a full range of wetland biodiversity, but the biotic data are so limited (Suren et al. 2008) that we have no way of assessing bias in the selection.

The relationship between wetland area and our conservation effectiveness metric deserves critical assessment. It suggests that protection of only 1-3% of the remaining area could achieve conservation effectiveness in the order of 30% of what currently remains. The selection of the Grebe system in Southland ahead of two significantly larger wetland complexes (Waituna and Toetoes) illustrates this result. The relationship between extent and conservation effectiveness may be overly optimistic. If there is rapid species loss as the area remaining falls below 30% as indicated by Rosenzweig (1995), Seabloom et al. (2002)and Fahrig (2003), then our CE metric should asymptote at a higher percentage remaining. A more conservative increase in CE with area protected will favour selection of larger wetlands that should generally be more viable.

Finally, wetlands associated with estuaries were excluded because a future estuary assessment is planned. This artificial separation has probably demoted some freshwater wetlands bordering estuaries that together would rank higher because of their greater combined internal diversity. For example, Okarito swamp is a coastal freshwater wetland ranked twelfth highest in the Westland biogeographic unit; however, if estuarine wetland around the Lagoon and other open water habitats had been considered, it would probably have ranked higher. Clearly, there is a more general need to

integrate all classes of biodiversity—rivers, lakes, wetlands, estuaries, and adjacent terrestrial and perhaps also marine ecosystems. Also, there is a strong case for including threatened species as distribution patterns, while presence of macro and or wide-ranging species often does not correspond to wetland classes or ecological integrity (Chadderton et al. 2004). Further work is needed to devise robust ways to include these dimensions into the site selection and conservation work prioritisation processes, developing these methods remains among the core challenges for systematic conservation science.

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Appendix 1: Wetland Maps

1.1 Pre-settlement extent

The Land Resource Inventory (LRI) was the main GIS layer used to select polygons referring to a pre-settlement wetland extent. The rules are shown in Tables 2 and 3 for the North Island and the South Island respectively. The North Island rules use three attributes of the LRI:

- **LCORR**: is an expression of three parts recorded in combination (see Newsome et al (2000) for interpretation). The left-hand number (between 1 and 8) describes the land limitation for arable use (from 1 = no limitation to 8 = severe limitation for cropping, pasture, or forestry). The middle letter corresponds to the polygon susceptibility for four limitations: 'e' = erosion limitation, 'w' = soil wetness limitation (poor drainage), 's' = soil physical or chemical limitation (e.g. shallowness, stoniness, low fertility), and 'c' = climatic limitation (coldness, frost, salt-laden onshore winds). The right-hand number makes the combined LCORR expression unique. It associates polygons on the basis of common landform, productive potential, physical limitation, and management behaviour.
- **NZSC**: is the New Zealand Soil Classification. The nomenclature can be found in Hewitt A. (1998).
- **Drainage Class**: is assessed using criteria of soil depth and chroma. The classes range from 1 (very poor drainage) to 5 (well drained soil).

Table 2 should be read row by row. For example, the first row of Table 2 is equivalent to the GIS rule: if LCORR = '1w1 OR 1w2 OR 1w4 OR 1w5' AND 'NZSC = RFM OR O% OR G%' then certainty = 1.

Table 2 Rules applied on the Land Resource Inventory to select pre-settlement wetland polygons for the North Island[2].

LCORR	NZSC	DRAINAGE class	Certainty
1w 1, 1w2, 1w4, 1w5	RFM, O%, G%		1
1w3, 2w6, 2w7, 2w4, 2w3, 2s4, 3s6, 4e14, 6s11, 6s15, 7e23, 7e24, 7s1		< 3	1
1w3, 2w6, 2w7, 2w4, 2w3, 2s4, 3s6, 4e14, 6s11, 6s15, 7e23, 7e24, 7s2		> 3	3
1w6	BMM, EMM, LOM		1
1w6	not BMM, EMM, LOM		3

[2] N.B. '%' denotes a wildcard character. This can be used as either a prefix or a suffix.

LCORR	NZSC	DRAINAGE class	Certainty
2w1	RFM, GOT, GR%		1
2w1	not RFM, GOT or GR%		3
2w2	O%, G%		1
2w2	not O%, G%		3
2w8	RFM		1
2w8	not RFM		3
2w5, 2w9, 2w14, 2w10, 2w12, 2w13, 2s3, 3s22, 3w%, 4w%, 5w%, 6w%, 6e66, 6e62, 6e65, 7w%, 8w%			1
2s11	not BSA, PPT		1
2s11	BSA, PPT		3
3e17	PJM, PJT, PP%, PIM		1
3e17	not PJM, PJT, PP%, PIM		3
3e20, 3s18	PJM, PPJ	<3	1
3e20, 3s18	not PJM, PPJ		3
Other LCORR not listed above	O%, G%		2
Other LCORR not listed above	UEY, PPX, PIM, UEP, RSM, PJM, UDM, LIT, RFM, WGFU, BSM, NOM, BAM, BFM, UPT, PPJX, LGT, ZGT, XPT, NPA, BLM, LPT, BOM, RFM, MPT, PPT, EMM, NXM, EPT, MOM, RFMA, BMM, PPU	<3	3

The rules for the South Island use four attributes of the LRI:

- **LCORR** (described above)
- **LUC**: Land Use Capability which has the same description as LCORR
- **GENSOI**: is the soil nomenclature corresponding to the General Survey of Soils of the South Island (New Zealand Soil Bureau, 1968).
- **VEGETATION**: is an indication of the vegetative cover of the polygon. The relevant codes for wetland vegetation are:

H1: swamp vegetation
H2: rushes and sedges
H6: pakihi vegetation
P5: red tussock grassland
M1: manuka/kanuka
N7: podocarp forest
N3a: lowland podocarp forest

GENSOI was used instead of NZSC as we had a complete coverage for GENSOI in the South Island. VEGETATION was used in the South Island as a checking attribute because the scale of the polygons is coarse.

Table 3 Rules applied on the Land Resource Inventory to select historical wetland polygons for the South Island

LCORR	GENSOI	LUC	VEGETATION	Certainty
%w%	18d, 18f, 25b, 25c, 25d, 26, 28cH, 28d, 32b, 33, 33a, 33b, 36a, 36aH, 36c, 36cH, 36d, 36dH, 36e, 40, 40aH, 52, 53a, 53aH, 54h, 59, 59a, 59b, 59c, 60, 60a, 60b, 62, 62c, 62d, 63, 63a, 63b, 63cH, 64a, 64e, 64f, 70a, 72, 86, 86a, 86b, 86c, 87, 87a, 88, 89, 89a, 89b, 89c, 89d, 89e, 89f, 89g, 90, 90a, 90b, 90c, 90d, 90e, 90f, 91, 91a, 92			1
	15, 15 H, 17, 18, 18a, 20, 43c, 68, 68a, 68b, 68c, 70, 70b, 70c, 94, 94a, 95, 95a, 95b, 95c, 95d, 97, 98, 98b, 98c, 98e, 98f, 98g, 99, 99a, 99b, 99c, 99d		H 1 H 2	1
	23		P 5 H 1 H 2	1
	25a		H 2	1
	18d, 18f, 25b, 25c, 25d, 26, 28cH, 28d, 32b, 33, 33a, 33b, 36a, 36aH, 36c, 36cH, 36d, 36dH, 36e, 40, 40aH, 52, 53a, 53aH, 54h, 59, 59a, 59b, 59c, 60, 60a, 60b, 62, 62c, 62d, 63, 63a, 63b, 63cH, 64a, 64e, 64f, 70a, 72, 86, 86a, 86b, 86c, 87, 87a, 88, 89, 89a, 89b, 89c, 89d, 89e, 89f, 89g, 90, 90a, 90b, 90c, 90d, 90e, 90f, 91, 91a, 92	%2c2, %2s1, 2s3, 3e4, 3s2, 3s4, 3s8, 3s9, 3s10, 3s11, 3s12, 4c3, 4e16, 4s1, 4s2, 4s5, 4s8, 4s10, 4s11, 4s15, 5c2, 5s5, 5s6, 6c7, 6e8, 6s3, 6s4, 6s5, 6s6, 6s10, 7s1, 7s2, 7s3, 7s6, 7s7, 7s11, 8c1, 8s1		2
	18b, 19b, 21b, 21c, 26a, 29, 29 H, 29aH, 29ch, 29d, 29dH, 35aH, 36, 36 H, 36b, 40a, 41cH, 43d, 44aH, 50 H, 40a, 50b, 50bH, 76 H, 76dH, 80, 80a 53b, 53d, 54e, 54eH, 54f, 54hH		P 5	2
	78, 78 H		H 2 H 6 M 1 P 5	2
	28bH		M 1 P 5	3
	30bH		M 1 H 1	3
	43		H 1 H 2 M 1	3
	59d		P 5 N 7	3
	62a		M 1	3
	77a		N3a	3

Once the polygons from the LRI were selected for the North and South Islands, thresholds on slope stratified across the LENZ level 1 environments were applied. LRI wetland soils polygons were trimmed where the slope exceeded the threshold. Figure 2 in the main body of this report (Section 3.2) shows the spatial map of the slope thresholds, and Table 4 shows the threshold numbers used.

Table 4 Slope thresholds used to refine LRI wetland polygons.

LENZ Level	Slope threshold	Description
A	6	Northern lowlands
B	17	Central dry lowland
C	7	Western and southern North Island lowlands
D	24	Northern hill country
E	18	Central dry foothills
F	19	Central hill country and volcanic plateau
G	6	Northern recent soils
H	9	Central sandy recent soils
I	3	Central poorly-drained recent soils
J	6	Central well-drained recent soils
K	6	central upland recent soils
L	4	Southern lowlands
M	6	Western South Island recent soils
N	9	Eastern South Island plains
O	11	Western South Island foothills & Stewart Island
P	20	Central mountains
Q	21	Southeastern hill country & mountains
R	44	Southern Alps
S	7	Ultramafic soils
T	51	Permanent snow & ice

1.2 Current extent

The GIS wetland data includes a list of attributes associated with each polygon (Table 1) and an associated metadata file; these metadata describe the different information sources used to define the wetland boundaries, including the source of the polygon and further information when a region-growing has been applied (threshold and centre point data). Each wetland has two unique identifier numbers (Idwetland and Idunique) at the region scale and national scale.

Table 1 Description of the attributes associated with each wetland polygon in the current national extent layer (2007).

Attribute name	Definition
Source	Source of information of the polygon
Type	Emergent vegetation or open water type
Name	Name of the wetland
Info	General information known about the wetland
IDunit	Identifier of the biogeographic unit
IDwetland	Identifier of the wetland at the region level
IDregion	Identifier of the political region
IDunique	Identifier of the wetland at the national level (= IDregion x 100000 + IDwetland)
IDinfo	General information on the identifier number IDwetland
Easting	Easting of the centre point used for the region-growing algorithm
Northing	Northing of the centre point used for the region-growing algorithm
Threshold	Spectral threshold used for the region-growing algorithm
Check	Flag to know if a region-growing polygon has been checked or not.

Figure 1 summarises the different sources of information used for each region (TLA boundaries) for creating the current wetland extent.

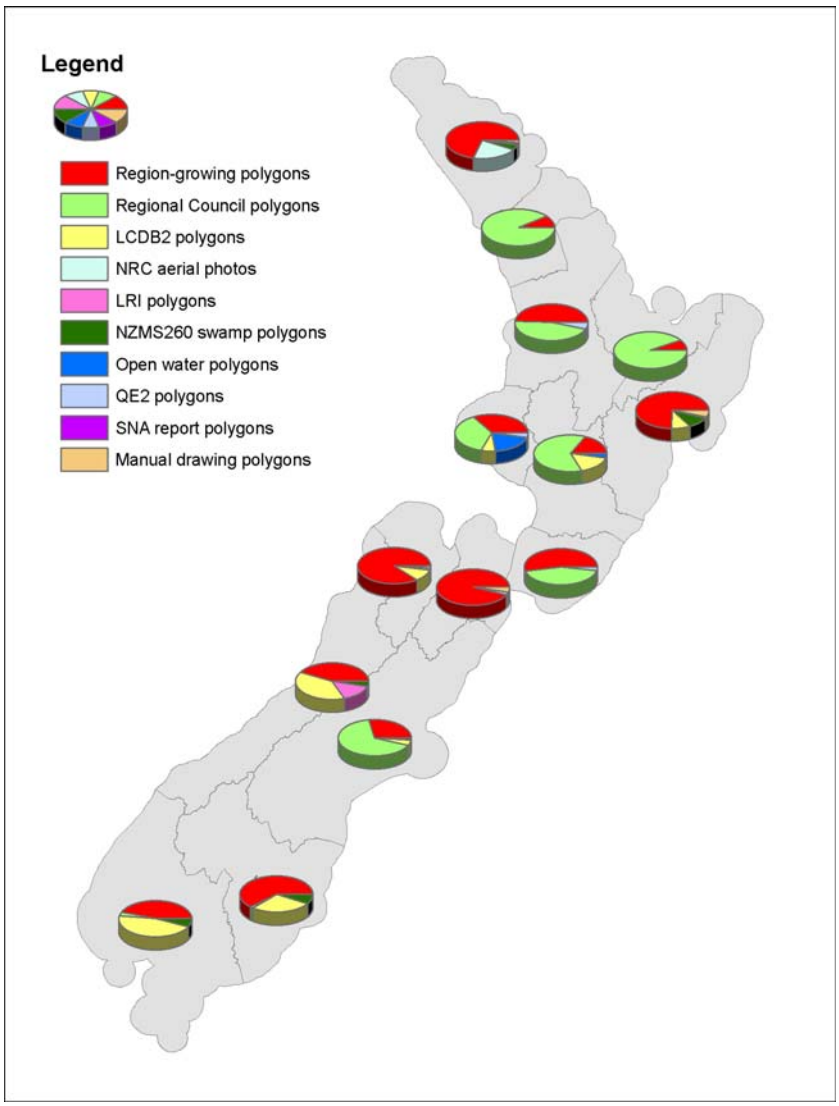


Figure 1 Source of information in each region authority boundaries.

Appendix 2: Typology decision rules

2.1 Wetland classes

Table 5 shows the rules to define the degree of membership of each wetland polygon to each class. For each of the 13 variables (pH class, drainage class, peat content, red tussock, subalpine vegetation, upland, slope, nearby lake, nearby river, subcatchment size, fertility, pakihi soil, and gumland soil), the polygon was assigned a degree of membership p_{ij} in each wetland class (*i* refers to the variable, *j* to the wetland class). For example, a polygon with a pH class of 1 will have a swamp membership of 0.1, a marsh membership of 0.6, etc. The p_{ij} are then multiplied to obtain a probability p_j per wetland class.

Tables 6, 7, and 8 show the rules used to determine the variables **pakihi soils**, **gumland soils**, and **peat content** respectively, as they were not available from the LRI. These variables had to be inferred from GIS rules on the soil types (using the following attributes in the LRI: NZSC, GENSOI, SOIL TYPE, TOP ROCK, and BASE ROCK).

Table 5 Degree of membership for each wetland class per variable.

Variable	description	swamp	marsh	bog	fen	seepage	pakihi	gumland
PH class (from the LRI)	7.6-8.3	0.1	0.6	0	0	0.8		
	6.5-7.5	0.8	1	0	0	1		
	5.8-6.4	1	0.6	0	0.6	1		
	5.5-5.7	0.8	0.2	0.6	0.8	1		
	4.9-5.4	0.5	0	0.8	1	1		
	4.5-4.8	0.1	0	1	0.8	1		
Drainage class (from the LRI)	very poor	1	0	1	1	0		
	poor	1	0.2	1	1	0.2		
	imperfect	0.8	1	0.6	0.6	0.4		
	moderately well	0.3	0.9	0	0.5	1		
	well	0.1	0.9	0	0.1	1		
Peat content	Pure peat		0	1	0.8	0		
	Mneral/peat		0.5	0.8	1	1		
	Pure mineral		1	0	0.1	1		
Red tussock (P5 in LRI)	No red tussock	1	1	1	0.5			
	Red tussock	0	0	0	1			
Subalpine herbfield (H 4 in LRI)	presence	0	0.5		1			
	absence	1	1		1			
Upland	>600m (upland)	0.5						
	< 600m	1						
Slope	< 6 deg (flat)	1				0		
	> 6 deg (steep)	0.5				1		
Lake nearby	presence			0.1	0.1			
	absence			1	1			

Variable	description	swamp	marsh	bog	fen	seepage	pakihi	gumland
River nearby	presence				0.1			
	absence				1			
Subcatchment size	> 1000 ha				0.1	0		
	100-1000 ha				1	0		
	< 100 ha				1	1		
Fertility	low	0.2	0.2	1	1			
	low to medium	0.5	0.5	0.8	1			
	medium	0.8	0.8	0	0.8			
	medium to high	1	1	0	0			
	high	1	1	0	0			
Pakihi soil	High probability						1	
	Low probability						0.5	
	absence						0	
Gumland soil	High and medium probability							1
	low probability							0.2
	absence							0

Table 6 Pakihi soil definition.

	North Island	South Island
High probability	NZSC like ZP ZG ZD ZX except ZXU	GENSOI like 59a,59b, 59c, 59d, 60a, 60b, 62, 62a, 62c, 62d, 63a, 64f, 64fH
Low probability	NZSC like ZO	NZSC like ZO

Table 7 Gumland soil definition (North Island only).

	NZSC classification
High probability	UDP, ZXU, UEP, ZOH, ZOT, UDM
Medium probability	UYT, ZDH, ZGT
Low probability	UEY, GOA, UPS, UEM, UPT, UYM

Table 8 Peat content definition.

	GIS Rule
Pure peat	Top rock or soil type contains ‘Pt’ or NZSC like OH, OM, OF
Peat and mineral substrate	Top rock not Pt and baserock like Pt or peaty or NZSC like LGO, BAO, GUO, GRO, GAO, GOO, ERO, ZPOZ, RXOA
Pure mineral	By default

The protocol was slightly different for classifying the historical extent. The rules did not include the presence of lake, river, and sub-catchment area, as these clues are site-specific and apply to the current extent only.

Table 9 shows an example of wetland classification for a polygon with the following properties: pH class = 1, drainage class = poor, peat content = mineral/peat, no red tussock, no subalpine herbfield, below 600m elevation, slope below 6 degrees, no lake or river nearby, medium subcatchment size (100–1000 ha), medium fertility, no pakihi soil, and no gumland soil. By reading membership values in table 5, and multiplying the membership degrees in each class, we found in this example that the highest p_j is p_{bog} = 0.8, so the polygon will be classified as a bog.

Table 9 Example of wetland class assignment.

Variable	description	swamp	marsh	bog	fen	seepage	pakihi	gumland
PH class	4.5-4.8	0.1	0	1	0.8	1		
Drainage class	poor	1	0.2	1	1	0.2		
Peat content	mineral/peat		0.5	0.8	1	1		
Red tussock	absence	1	1	1	0.5			
Subalpine herbfield	absence	1	1		1			
upland	< 600m	1						
Slope	< 6 deg (flat)	1				0		
Lake nearby	absence			1	1			
River nearby	absence				1			
Subcatchment size	100-1000 ha				1	0		
Fertility	medium	0.8	0.8	0	0.8			
Pakihi soil	absence						0	
Gumland soil	absence							0
Probability p_j		0.08	0	0.8	0.32	0.2	0	0

2.2 Wetland structural vegetation

Wetland vegetation structural classes (Johnson & Gerbeaux 2004) were defined for each wetland based on the natural vegetation cover classes defined in LCDB2 but were not used in the current assessment due to the methodological complexity this would impose (e.g. how to measure complementarity).

Table 10 Natural vegetation structural classes of wetlands as defined in LCDB2.

LCDB2 code	LCDB2 description
41	Low-producing grassland
43	Tall tussock grassland
45	Herbaceous freshwater vegetation
47	Flaxland
50	Fernland
52	Manuka and or kanuka
53	Matagouri
54	Broadleaved indigenous hardwoods
55	Sub alpine shrubland
69	Indigenous forest

Appendix 3. Anthropogenic pressure measures.

3.1 Creating the spatial layers

3.1.1 Naturalness

Spatial variation in native vegetation cover was derived using a combination of LCDB2 cover types considered as 'natural' overlaid with data from an unpublished land use layer held by Landcare Research. The LCDB2 polygons, particularly tussock, were refined by applying a rule based on underlying land use where land defined as farmed was considered as non-natural (Table 11). Gorse and broom, matagouri, and depleted tussock grasslands were considered natural cover as they are likely to provide similar functional protection and indicate early successional recovery following disturbance in natural areas. They were considered when nested within a mosaic of other natural vegetation classes.

Table 11 LCDB2 cover classes representing natural land cover.

LCDB2 code	LCD2 cover types
10	Coastal sand and gravel
11	River and lakeshore gravel and rock
12	Landslide
13	Alpine gravel and rock
14	Permanent snow and ice
15	Alpine grass-/herbfield
20	Lake and pond
21	River
22	Estuarine open water
43	Tall tussock grassland
44	Depleted tussock grassland
45	Herbaceous freshwater vegetation
46	Herbaceous saline vegetation
47	Flaxland
50	Fernland
51	Gorse and broom
52	Manuka and or kanuka
53	Matagouri
54	Broadleaved indigenous hardwoods
55	Subalpine shrubland
56	Mixed exotic
57	Grey scrub
60	Minor shelterbelts
61	Major shelterbelts
62	Afforestation
63	Afforestation
65	Pine forest

LCDB2 code	LCD2 cover types
66	Pine forest
69	Indigenous forest
70	Mangroves

3.1.2 Artificial impervious surfaces

A raster layer describing spatial variation in the cover of impervious surfaces such as roads, car parks, and buildings was provided by Derek Brown (DOC). The layer separates impervious v. pervious areas.

The source layers were LCDB2 and the following 1:50,000 vector layers from LINZ:

- Roads, attributes – SHW, sealed, metalled, un-metalled.
- Railway, attribute – multiple rails, single rail.
- Tracks, attributes – foot track, vehicle track.
- Tunnels, used to erase sections of road and rail network.
- Building point.

The vectors listed above and LCDB2 were gridded to a resolution of 25 m using LENZ level 4 as a template and then merged.

The attributes recorded in the layer are:

- Impervious – Impervious, Pervious
- Surface – Native, Exotic, Compacted, Metalled, Sealed, Surface modified
- Source – source of data
- Source_Detail – Feature extracted from source data

Grid cells defined as ‘compacted’ in the *surface* column are split between the ‘pervious’ and ‘impervious’ classification in the *impervious* column. Unmetalled roads are classified as impervious whilst foot tracks and vehicle tracks are classed as pervious.

Further investigation is needed to establish if, at a 25 m grid resolution, compaction caused by vehicles and pedestrians on tracks alters the porosity sufficiently to move these classes into the ‘impervious’ grouping.

Where a tunnel vector intersects with a subterranean vector and a surface vector, the two latter vectors are deleted. This effect is minimal as the tunnel and surface vector generally run perpendicular to each other. For example, the Lyttelton road tunnel intersects the Summit Road and affects 2 grid cells.

3.1.3 Nutrient enrichment

Estimates of nitrate leaching risk load from the soil were based on a leaching model implemented within a catchment framework (Woods et al. 2006). The values output from CLUES were expressed in parts per million, i.e. g m-3.

3.1.4 Introduced fish

The New Zealand Freshwater Fish Database (NZFFD) provided point location data on pest fish presence throughout New Zealand. A total introduced fish score was calculated using different impact indices for each species derived from a risk assessment model developed by Wilding & Rowe (2007). The pestiness scores were based on ecological impact, as we removed the life history characteristic scores and invasiveness values used in the original risk assessment model (Table 12).

Table 12 Pestiness score for introduced fish species derived from Wilding and Rowe (2007)

Scientific name	Common name	Pestiness score
Ameiurus nebulosus	Catfish	17
Carassius auratus	Goldfish	12.5
Ctenopharyngodon idella	Grass carp	9
Cyprinus carpio	Koi carp	14
Gambusia affinis	Gambusia	14
Hypophthalmichthys molitrix	Silver carp	7
Leuciscus idus	Orfe	9
Oncorhynchus mykiss	Rainbow trout	18
Oncorhynchus nerka	Sockeye salmon	7
Oncorhynchus tshawytscha	Quinnat salmon	2
Perca fluviatilis	Perch	24
Poecilia latipinna	Sailfin	4.5
Poecilia reticulata	Guppy	7.5
Salmo salar	Atlantic salmon	8
Salmo trutta	Brown trout	17
Salvelinus fontinalis	Brook char	12
Scardinius erythrophthalmus	Rudd	19
Tinca tinca	Tench	8

3.1.5 Woody weeds

LCDB2 provided spatial information for some weeds affecting wetlands. Two categories were considered: willows, and other woody weeds. The willows can be found under a single LCDB2 code (68: deciduous hardwoods). The other woody weeds were a combination of LCDB2 codes (Table 13).

Table 13 LCDB2 codes used to define the extent of woody exotic weeds

LCDB2 code	LCDB2 name
51	Gorse and broom
56	Mixed exotic
57	Grey scrub
60	Minor shelterbelts
61	Major shelterbelts
62	Afforestation
63	Afforestation
65	Pine forest
66	Pine forest
67	Other exotic forest

3.1.6 Drainage

NZMS260 topomap provided the stream line and drain line vector file. We processed the vector layer to retrieve drain parts, thus creating our own drain layer. The GIS rule used retrieved straight lines corresponding to drains by using a criterion on number of vertices and slope for each line segment.

3.2.Relating pressure measures to ecological integrity

Before calculating an overall pressure index, we transformed each pressure measure to provide a measure of ecological integrity. Ecological integrity values ranged from zero to one, with shapes designed to reflect qualitative understanding of likely changes in ecological integrity across the gradient of each pressure. For most pressures we have assumed that even at extreme levels of human disturbance some wetland function, biodiversity content, or restoration potential will remain. Thus, ecological integrity values do not fall to zero except where 100% impervious cover would result in the complete loss of the wetland's biodiversity.

The curves were chosen as follows:

Loss of natural cover: the variable used is the proportion of natural cover. Values were derived in the catchment and in the buffer zone. They were expressed as a proportion (0-1) and transformed using a decreasing line for the buffer and an S-shape curve for the contributing catchment. The linear function decreases to a minimum of 0.3 for no naturalness. The S-shape function initially decreases slowly, then steepens around 0.4 and slows down, also reaching a minimum of 0.3.

- *Imperviousness*: the variable used is the proportion of impervious surface. Values were derived in the wetland and in the buffer zone. A decreasing function started at 1 if there is no impervious area, declining to 0 for 100% impervious surface, with a value of 0.5 for a 20% impervious surface.
- *Nutrient enrichment*: the variable used is the mean value derived from a nitrate leaching index model developed by Landcare Research as part of the CLUEs project. This acts as a surrogate measure of nutrient enrichment associated with land intensification. Values were derived in the catchment and in the buffer zone. The catchment function was S-shaped, becoming steeper around 20 ppm and reaching a minimum at 0.2. The buffer zone function had an extra parameter (the **core to edge** ratio) to account for edge effects. The core to edge ratio was estimated using a 30 m internal buffer. The chosen function decreased from 1, with a slope varying with the core to edge ratio. If the ratio is low (strong edge effect), the slope is steep, reflecting greater loss of EI. If the ratio is 1 or more (core is bigger than the edge), the nitrate risk has no effect, as the wetland has a sufficient buffer strip to deal with local nitrate leaching risk.
- *Introduced fish*: the variable used is the sum of pestiness scores for all the present introduced fish species (the maximum value is the sum of pestiness scores for all introduced species, i.e. 209.5). Values were derived in the catchment. The function started at 1 when no introduced fish species were present, decreasing steeply to reach a 0.8 value for a pestiness score of 50. The curve has an infinite limit set at 0.75.
- *Woody weeds*: the variable used is the proportion of woody weeds (as a fraction). Values were derived in the wetland. Two functions were used to separate willow effects from gorse and other weed effects. For willows, the curve starts at 1 and decreases at an increasing rate to a minimum value of 0.25. For gorse, the curve shape is similar with a final value set at 0.75 as the impact on wetland biota is thought to be less than for willows.
- *Drainage*: the variable used is the proportion of drains based on the drain layer described above. Values were derived in the wetland and in the buffer zone. The curve is a decreasing line reaching a minimum of 0.1 if 100% of the area was affected by drainage.

Appendix 4: Results of wetland type extent per TLA region

Table 14 Current extent (ha) of wetland classes per TLA region

TLA Region	Pakihi/ gumland	Bog	Swamp	Marsh	Fen	Seepage	Inland saline	Undefined	Total
Northland	2729	864	9386	1023	43	24		44	14114
Auckland	242	63	1475	586	42	139		334	2639
Waikato	45	13163	13006	1915	51	6		85	28226
Bay of Plenty	10	51	1556	1595	27	42		23	3304
Manawatu–Wanganui		3	2415	2549	1942	69		5	6983
Taranaki		84	1746	1074	76	45		20	3045
Hawkes Bay – East Cape	150	25	2049	656	445	62		7	3394
Wellington			2384	339	16	27		8	2774
Tasman	3087	24	776	775	428	131		3	5224
Marlborough			731	658	56	100		0	1545
West Coast	49158	4484	24038	2653	3939	111		13	84396
Canterbury			10689	6392	2419	348		3	19851
Otago		1412	9493	1764	13412	642	292	35	27050
Southland	1494	19888	10331	1094	14113	297		14	47231
TOTAL	56628	40061	90075	23073	37009	2043	292	595	249776

Table 15 Historic extent (ha) of wetland classes per TLA region

TLA Region	Pakihi Gumland	Bog	Swamp	Marsh	Fen	Seepage	Inland saline	Total
Northland	66551	15651	141850	26592	7808	0	0	258451
Auckland	7377	2717	40189	4234	3310	24	0	57851
Waikato	1392	70625	220585	40066	23848	0	0	356516
Bay of Plenty	823	1024	31497	5593	4153	0	0	43089
Manawatu–Wanganui	0	1695	221338	37064	4413	1	0	264511
Taranaki	0	82	31018	7562	1568	48	0	40278
Hawkes Bay – East Cape	79	116	136940	39863	3299	75	0	180371
Wellington	0	0	101326	17259	4218	0	0	122804
Tasman	12981	593	6026	7570	44	125	0	27339
Marlborough	0	0	10573	1710	399	102	0	12785
West Coast	216338	13597	92903	28289	7053	2	0	358182
Canterbury	0	0	163100	17514	6046	456	0	187115
Otago	0	4431	62849	11818	28382	1739	1586	110804
Southland	33917	42585	240814	35694	97556	418	0	450985
TOTAL	339458	153116	1501008	280828	192097	2990	1586	2471081

Appendix 5. Priority lists per biogeographic unit.

Biogeographic units are listed in alphabetical order below (for locations, refer to Figure 1 p.14).

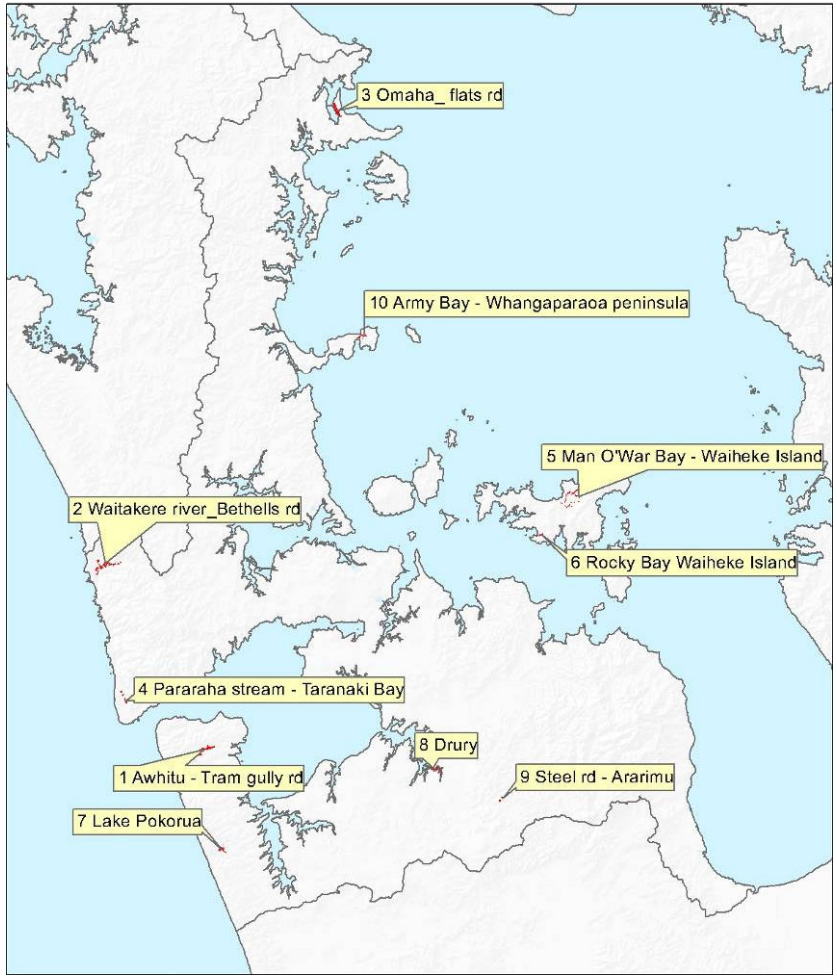
1. Auckland
2. Banks Peninsula
3. Bay of Plenty
4. Canterbury
5. Clutha
6. Coromandel
7. East Cape
8. Fiordland
9. Grey–Buller
10. Hawkes Bay
11. Manawatu–Wairarapa
12. Marlborough
13. Mokau
14. Motueka–Nelson
15. Northland – Eastern
16. Northland – Northern
17. Northland – Western
18. Northwest Nelson – Paparoa
19. Otago Peninsula
20. Palliser–Kidnappers
21. Southland
22. Stewart Island
23. Taieri
24. Taranaki
25. Waikato
26. Waitaki
27. Wanganui–Rangitikei
28. Wellington
29. Westland

For each biogeographic unit, the following information is presented:

- A table summarising the current and historic extent of each wetland class. When the curernt extent is greater than the historic extent, the cell is italicised. This inconsistency is sometimes seen as the extents do not always match spatially.
- A map displaying the biogeographic unit with only the first ten wetland sites, with their rank and name.
- A table displaying the first twenty wetland sites, and any additional wetland site corresponding to a missing wetland class, with the following attributes:
  - Easting, Northing and mapsheet refer to the point location of the wetland site and the map sheet number of the NZMS 260 topomap series.
  - Area (ha) is the total area of the site in hectares,
  - CumCE is the cumulative conservation effectiveness as we go down the list (section 3.4.4).
  - Cum.area is the proportion of cumulative area protected as we go down the list (see section 4.4 for interpretation details).
  - EI index is the Ecological Integrity index of the wetland site, as computed in section 3.4.3
  - HLeft is the irreplaceability measure as computed in section 3.4.4
  - Bog, Fen, Swamp, Marsh, Seepage, Pakihi/Gumland, and Inland Saline present the cumulative percentage of current extent over the total current extent (not in brackets), and the cumulative proportion of current extent over the total historic extent (in brackets). No proportion (-) is shown when the historic extent is greater than the current extent.
- A table displaying the EI index and its components for naturalness (in the subcatchment and the buffer), imperviousness, nitrate leaching risk, pestiness, woody weeds, drainage and the resulting EI index.

The wetland names were derived from the databases given by the Regional Councils. Otherwise, the names of the first ten sites were completed by local experts at DOC (Sjaan Charteris for Canterbury, Natasha Grainger for Westland), or by assigning the closest visible feature on the topomap.

1. Auckland



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Gumland	Seepage
Current (ha)	850.2	40.6	5.1	469.0	196.2	92.1	47.3
Historic (ha)	(30381)	(1141)	(2478)	(20815)	(1541)	(4393)	*(12)*

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi /gumland	Seepage
1	201066	Awhitu_tram gully Rd	R12	2653051	6456763	86.9	0.47	0.09	0.49	0.22			15% (0%)			0% (–)
2	200990	Waitakere River_Bethells Rd	Q11	2640408	6480055	116.4	0.59	0.21	0.66	0.43			16% (0%)	56% (7%)		0% (–)
3	200272	Omaha_ flats Rd	R09	2669874	6537898	56.9	0.62	0.27	0.41	0.22			26% (1%)	56% (7%)		0% (–)
4	201039	Pararaha stream_Taranaki Bay	Q11	2642919	6463447	23.2	0.64	0.29	0.92	0.23			29% (1%)	56% (7%)		0% (–)
5	200926	Man O'War Bay_Waiheke Island	S11	2699706	6488856	73.4	0.66	0.37	0.31	0.27			38% (1%)	64% (9%)	8% (0%)	0% (–)
6	200984	Rocky Bay Waiheke Island	S11	2695697	6483930	13.4	0.67	0.38	0.72	0.22			40% (1%)	64% (9%)	8% (0%)	0% (–)
7	201108	Lake Pokorua	R12	2655315	6444185	39.7	0.68	0.42	0.31	0.26	84% (3%)		41% (1%)	64% (9%)	8% (0%)	0% (–)
8	201086	Drury	R12	2682481	6454359	32.2	0.69	0.45	0.25	0.22	84% (3%)		47% (1%)	64% (9%)	8% (0%)	0% (–)
9	201201	Steel Rd – Ararimu	S12	2690724	6450585	12.5	0.69	0.47	0.42	0.18	84% (3%)	100% (0.2%)	48% (1%)	64% (9%)	8% (0%)	0% (–)
10	200707	Army Bay – Whangaparaoa peninsula	R10	2673049	6509233	22.8	0.70	0.49	0.32	0.21	84% (3%)	100% (0.2%)	49% (1%)	64% (9%)	26% (1%)	0% (–)
11	201077	0	R12	2657260	6455156	24.4	0.70	0.52	0.25	0.22	84% (3%)	100% (0.2%)	53% (1%)	64% (9%)	26% (1%)	0% (–)
12	200532	0	R10	2664043	6519544	19.7	0.71	0.54	0.38	0.31	84% (3%)	100% (0.2%)	55% (2%)	68% (9%)	26% (1%)	0% (–)
13	201040	0	R11	2674890	6462364	13.9	0.71	0.55	0.30	0.22	84% (3%)	100% (0.2%)	57% (2%)	68% (9%)	26% (1%)	0% (–)
14	201060	0	R12	2689958	6457304	13.9	0.71	0.56	0.26	0.22	84% (3%)	100% (0.2%)	60% (2%)	68% (9%)	26% (1%)	0% (–)
15	200704	0	R10	2661100	6509653	12.4	0.72	0.58	0.30	0.22	84% (3%)	100% (0.2%)	61% (2%)	68% (9%)	29% (1%)	0% (–)

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi /gumland	Seepage
16	200583	0	R10	2662713	6516695	5.7	0.72	0.58	0.63	0.22	84% (3%)	100% (0.2%)	62% (2%)	68% (9%)	29% (1%)	0% (–)
17	200340	0	R09	2670886	6534729	8.9	0.72	0.59	0.35	0.22	84% (3%)	100% (0.2%)	64% (2%)	68% (9%)	29% (1%)	0% (–)
18	200689	0	R10	2660761	6510679	10.7	0.72	0.60	0.27	0.22	84% (3%)	100% (0.2%)	66% (2%)	68% (9%)	29% (1%)	0% (–)
19	200717	0	R10	2674459	6508700	11.3	0.73	0.61	0.35	0.25	84% (3%)	100% (0.2%)	66% (2%)	68% (9%)	40% (1%)	0% (–)
20	201111	0	R12	2674173	6443478	9.4	0.73	0.62	0.30	0.22	84% (3%)	100% (0.2%)	68% (2%)	68% (9%)	40% (1%)	2% (–)

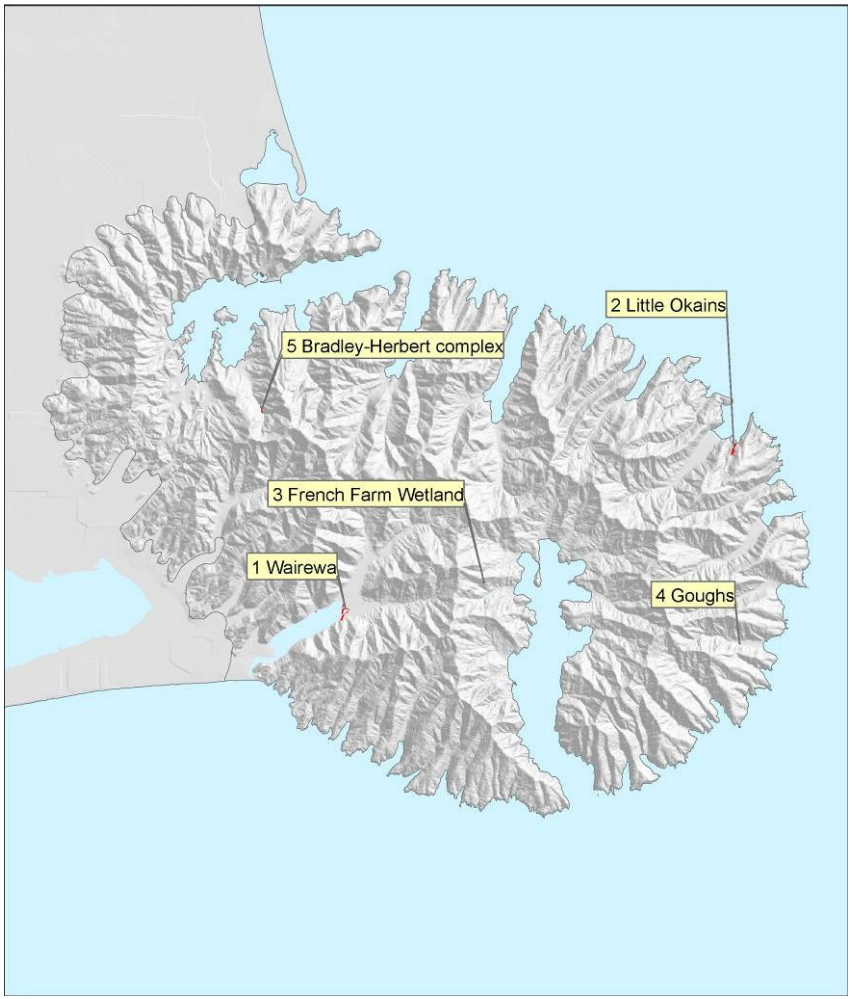
Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcat	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	201066	Awhitu_tram gully Rd	0.50	0.66	0.99	0.95	1	0.99	1	0.49
2	200990	Waitakere River_Bethells Rd	0.87	0.85	0.86	0.98	0.79	0.98	1	0.66
3	200272	Omaha_ flats Rd	0.41	0.71	0.81	0.98	1	0.99	1	0.41
4	201039	Pararaha stream_Taranaki Bay	0.97	0.93	1	0.98	1	0.99	1	0.92
5	200926	Man O'War Bay_Waiheke Island	0.31	0.35	0.87	0.97	1	0.99	1	0.31
6	200984	Rocky Bay Waiheke Island	0.73	0.80	0.85	0.98	1	0.99	1	0.72
7	201108	Lake Pokorua	0.32	0.32	1	0.96	1	0.99	1	0.31
8	201086	Drury	0.30	0.69	0.95	0.92	0.85	0.99	1	0.25
9	201201	Steel Rd – Ararimu	0.42	0.46	0.87	0.96	1	0.99	1	0.42
10	200707	Army Bay – Whangaparaoa peninsula	0.32	0.52	0.54	0.98	1	0.99	1	0.32
11	201077	0	0.30	0.65	0.88	0.90	0.85	0.99	1	0.25
12	200532	0	0.38	0.59	0.98	0.98	1	0.99	1	0.38
13	201040	0	0.30	0.58	1	0.98	1	0.99	1	0.30
14	201060	0	0.31	0.92	1	0.96	0.85	0.99	1	0.26
15	200704	0	0.30	0.44	0.75	0.98	1	0.99	1	0.30
16	200583	0	0.92	0.63	0.91	0.99	1	0.99	1	0.63
17	200340	0	0.35	0.53	1	0.98	1	0.99	1	0.35
18	200689	0	0.33	0.57	0.83	0.98	0.85	0.99	1	0.27
19	200717	0	0.36	0.50	1	0.97	1	0.99	1	0.35
20	201111	0	0.30	0.32	0.65	0.78	1	0.99	1	0.30

2. Banks Peninsula

Current and historic extent (hectares) in each wetland class.

	Total	Swamp	Marsh	Seepage
Current (ha)	34.4	8.6	24.3	1.5
Historic (ha)	(356)	(297)	(47)	(12)

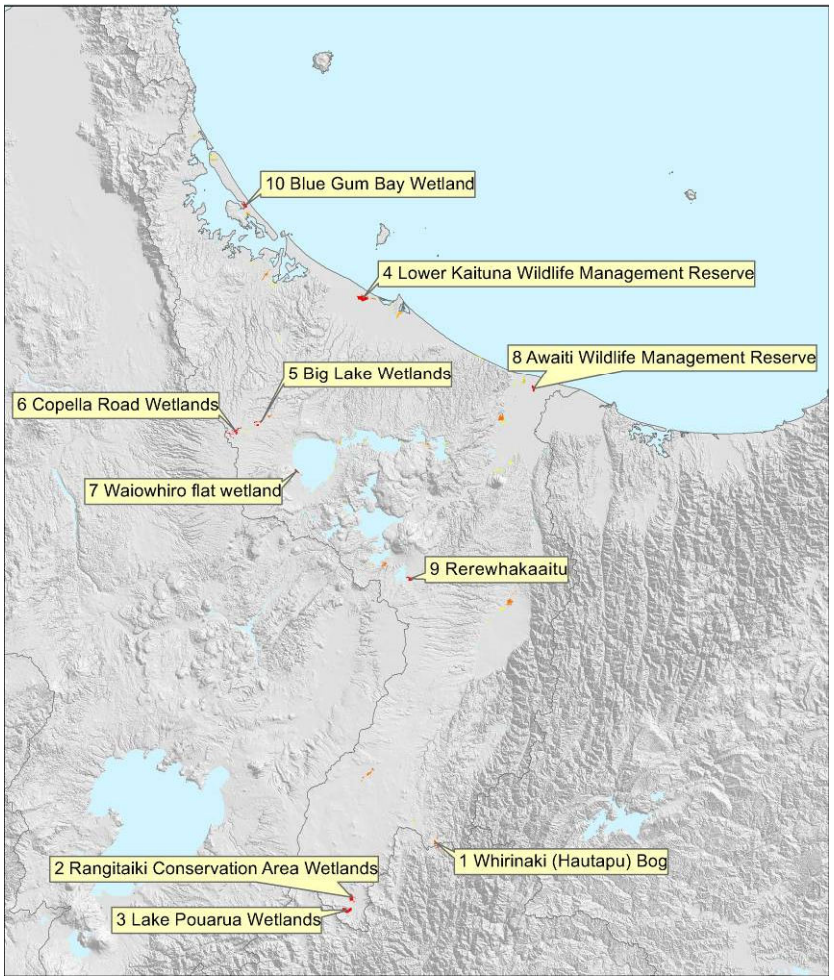


Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	cum. CE	Cum. area	EI index	HLeft	Swamp	Marsh	Seepage
1	1201617	Wairewa	I37	2324378	5689413	11.4	0.56	0.43	0.23	0.49	100% (2%)	29% (11%)	0% (<1%)
2	1201592	Little Okains	H37	2284025	5701812	9.4	0.67	0.79	0.30	0.77	100% (2%)	79% (31%)	0% (<1%)
3	1201615	French Farm Wetland	I37	2308057	5697517	1.5	0.69	0.85	0.30	0.43	100% (2%)	79% (31%)	100% (12%)
4	1201624	Goughs	L37	2419057	5686547	1.1	0.70	0.89	0.30	0.77	100% (2%)	84% (34%)	100% (12%)
5	1201581	Bradley–Herbert complex	N36	2492214	5712958	3.0	0.70	1	0.08	0.77	100% (2%)	100% (40%)	100% (12%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcat	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1201617	Wairewa	0.31	0.77	0.99	0.98	0.78	0.94	1	0.23
2	1201592	Little Okains	0.30	0.47	1	0.97	1	0.99	1	0.30
3	1201615	French Farm Wetland	0.30	0.30	1	0.98	1	0.99	1	0.30
4	1201624	Goughs	0.31	0.40	0.94	0.98	1	0.99	1	0.30
5	1201581	Bradley–Herbert complex	0.30	0.36	1	0.98	1	0.25	1	0.08

3. Bay of Plenty



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Gumland	Seepage
Current (ha)	3020.8	25.1	46.0	1511.2	1413.4	0.3	24.8
Historic (ha)	(29136)	(888)	(3184)	(21569)	(2981)	(513)	*(0)*

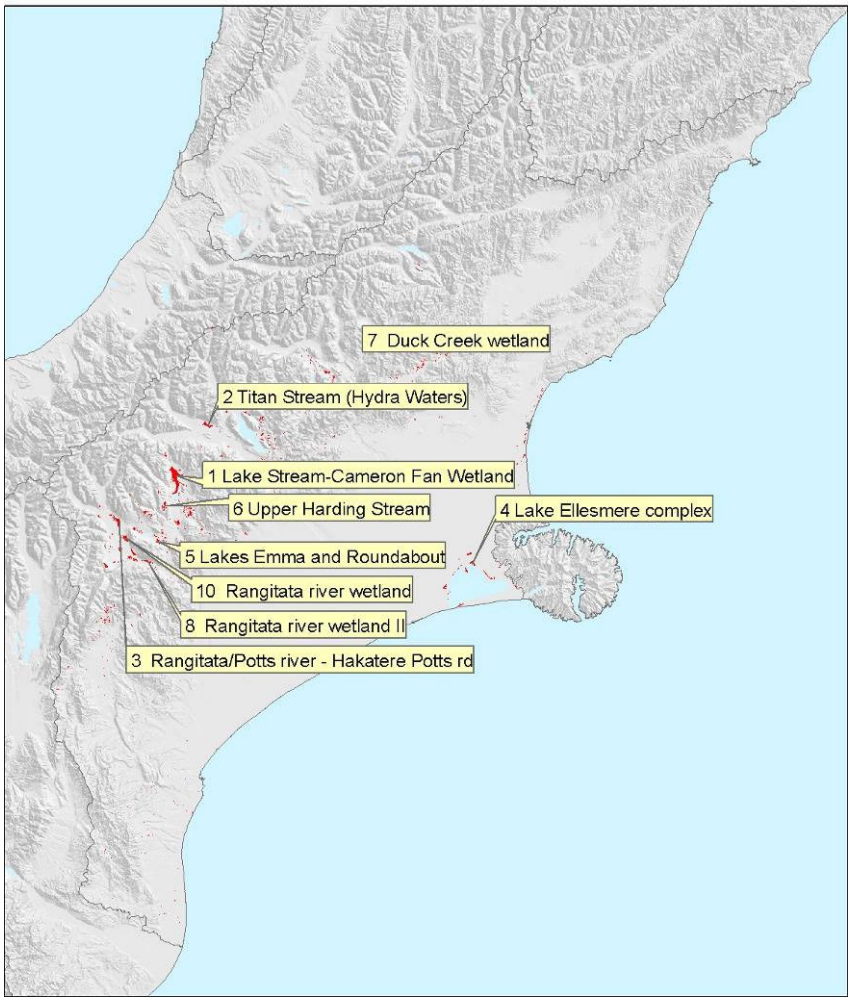
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Seepage
1	400141	Whirinaki (Hautapu) Bog	V18	2823637	6258156	36.7	0.23	0.01	0.30	0.21		69% (1%)	0.5% (0.03%)			
2	400363	Rangitaiki Conservation Area Wetlands	U19	2805064	6246289	145.0	0.37	0.06	0.35	0.35		69% (1%)	10% (1%)			
3	400355	Lake Pouarua Wetlands	U19	2804266	6243299	151.5	0.43	0.11	0.32	0.35		69% (1%)	20% (1%)			
4	400146	Lower Kaituna Wildlife Management Reserve Wetlands	U14	2807679	6377861	190.3	0.46	0.17	0.16	0.35		69% (1%)	32% (2%)			
5	400163	Big Lake Wetlands	U15	2784706	6350262	56.8	0.48	0.19	0.51	0.35		69% (1%)	35% (3%)			
6	400450	Copella Road Wetlands	U15	2779500	6348312	120.9	0.52	0.23	0.51	0.72		69% (1%)	36% (3%)	8% (4%)		
7	400003	Waiowhiro flat Wetland	U16	2793191	6339682	38.4	0.53	0.24	0.49	0.35		69% (1%)	38% (3%)	8% (4%)		
8	400041	Awaiti Wildlife Management Reserve Wetlands	V15	2845261	6357832	60.2	0.54	0.26	0.31	0.35		69% (1%)	42% (3%)	8% (4%)		
9	400625	Rerewhakaaitu F	V16	2818075	6316052	74.6	0.55	0.28	0.24	0.36		69% (1%)	47% (3%)	8% (4%)		
10	400502	Blue Gum Bay Wetland	U14	2781823	6398204	70.5	0.57	0.30	0.51	0.72		69% (1%)	47% (3%)	13% (6%)		
11	701427	0	V18	2823937	6257874	69.0	0.58	0.33	0.30	0.44		69% (1%)	51% (4%)	14% (7%)		
12	400066	Lake Aniwhenua Wetlands	V16	2840237	6311293	131.7	0.59	0.37	0.26	0.74		69% (1%)	51% (4%)	23% (11%)		
13	400352	Kaituna River Wetlands	U14	2809404	6377985	38.7	0.60	0.38	0.36	0.35		69% (1%)	53% (4%)	23% (11%)		
14	400377	Kopurererua Stream Wetland A	U14	2786403	6382985	63.1	0.60	0.40	0.28	0.48		69% (1%)	56% (4%)	24% (12%)		

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Seepage
15	400044	Tumurau (Braemar) Lagoon Wetlands	V15	2838182	6351391	118.6	0.61	0.44	0.10	0.36		69% (1%)	63% (5%)	25% (12%)		
16	400275	Lower Mangatiti Stream Wetlands	U18	2808965	6273213	80.4	0.62	0.47	0.24	0.74		69% (1%)	63% (5%)	30% (15%)		
17	400219	Rotomahana MAH/4/W3	V16	2812378	6319190	62.6	0.62	0.49	0.32	0.74		69% (1%)	63% (5%)	34% (17%)		
18	400127	Roy Road Lagoon	U15	2787282	6351749	25.8	0.63	0.49	0.34	0.35		69% (1%)	65% (5%)	34% (17%)		
19	400032	Lakes Aroarotamahine and Te Paritu Wetlands	U13	2799921	6429395	7.8	0.63	0.50	0.97	0.35		69% (1%)	65% (5%)	34% (17%)		
20	400573	Waitangi Soda spring Wetland	V15	2821416	6345743	37.5	0.63	0.51	0.31	0.74		69% (1%)	65% (5%)	37% (18%)		
46	400380	Poike Wetlands	U14	2788347	6380776	17.2	0.68	0.7	0.31	0.34	51% (2%)	88% (1%)	83% (6%)	37% (18%)		
153	400077	Matamanu Wetlands	v15	2829153	6363695	3.1	0.74	0.96	0.41	0.81	98% (3%)	99% (1%)	99% (7%)	94% (46%)		3% (–)
215	400529	Tahuna Road Wetland	v15	2843969	6341110	1.1	0.74	0.99	0.24	0.58	100% (3%)	100% (1%)	100% (7%)	99% (48%)	100% (<1%)	55% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcat	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	400141	Whirinaki (Hautapu) Bog	0.31	0.68	0.86	0.97	1	0.99	1	0.30
2	400363	Rangitaiki Conservation Area Wetlands	0.35	0.58	1	0.97	1	0.99	1	0.35
3	400355	Lake Pouarua Wetlands	0.32	0.53	0.97	0.94	1	0.99	1	0.32
4	400146	Lower Kaituna Wildlife Management Reserve Wetlands	0.36	0.35	1	0.95	0.78	0.60	1	0.16
5	400163	Big Lake Wetlands	0.51	0.94	1	0.98	1	0.99	1	0.51
6	400450	Copella Road Wetlands	0.51	0.89	0.99	0.83	1	0.99	1	0.51
7	400003	Waiowhiro flat Wetland	0.50	0.78	0.80	0.96	1	0.99	1	0.49
8	400041	Awaiti Wildlife Management Reserve Wetlands	0.33	0.35	0.87	0.95	1	0.94	1	0.31
9	400625	Rerewhakaaitu F	0.31	0.62	1	0.84	0.83	0.92	1	0.24
10	400502	Blue Gum Bay Wetland	0.52	0.86	1	0.98	1	0.99	1	0.51
11	701427	0	0.31	0.60	0.91	0.98	1	0.99	1	0.30
12	400066	Lake Aniwhenua Wetlands	0.33	0.62	0.94	0.97	0.80	0.99	1	0.26
13	400352	Kaituna River Wetlands	0.36	0.74	1	0.97	1	0.99	1	0.36
14	400377	Kopurererua Stream Wetland A	0.36	0.49	0.55	0.95	0.80	0.99	1	0.28
15	400044	Tumurau (Braemar) Lagoon Wetlands	0.30	0.58	0.86	0.80	0.81	0.42	1	0.10
16	400275	Lower Mangatiti Stream Wetlands	0.30	0.60	0.84	0.96	0.80	0.99	1	0.24
17	400219	Rotomahana MAH/4/W3	0.33	0.89	1	0.94	1	0.99	1	0.32
18	400127	Roy Road Lagoon	0.35	0.42	1	0.98	1	0.99	1	0.34
19	400032	Lakes Aroarotamahine and Te Paritu Wetlands	0.99	1	1	0.99	1	0.99	1	0.97
20	400573	Waitangi Soda spring Wetland	0.37	0.59	0.85	0.91	0.83	0.99	1	0.31
46	400380	Poike Wetlands	0.32	0.64	0.59	0.96	1	0.99	1	0.31
153	400077	Matamanu Wetlands	0.41	0.82	1	0.98	1	0.99	1	0.41
215	400529	Tahuna Road Wetland	0.33	0.31	0.98	0.82	0.79	0.99	1	0.24

4. Canterbury



Current and historic extent (hectares) in each wetland class.

	Total	Fen	Swamp	Marsh	Seepage
Current (ha)	11556.0	1169.4	6401.1	3702.6	282.8
Historic (ha)	(164869)	(2366)	(150249)	(12068)	*(186)*

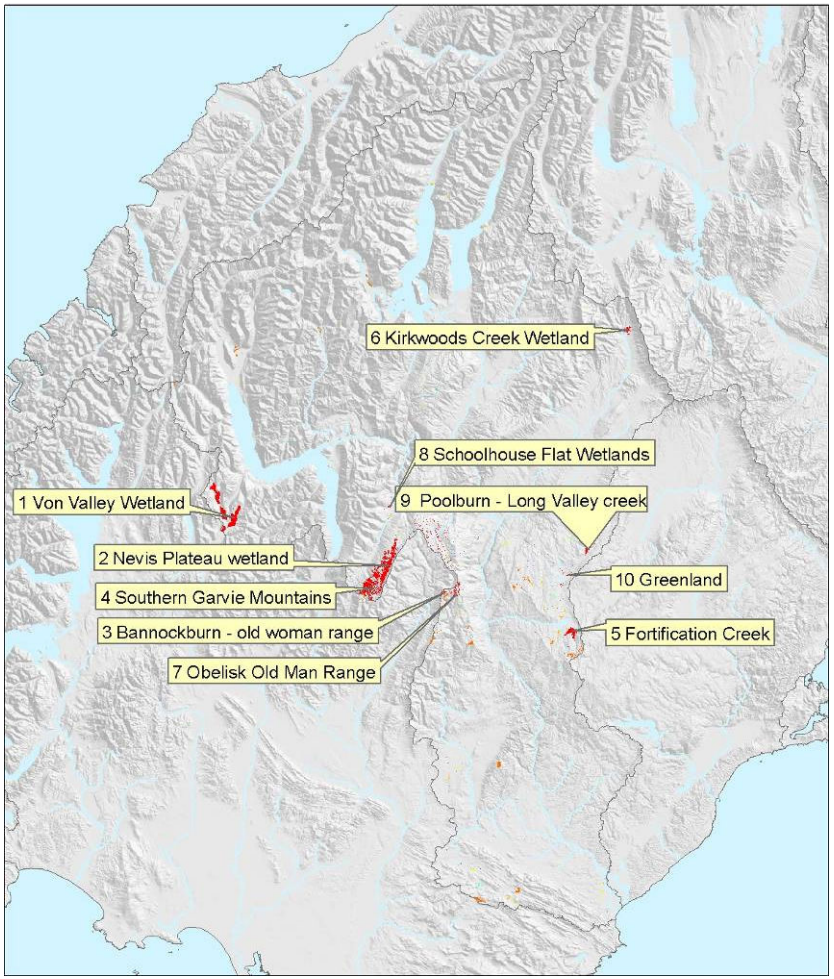
Rank	Idunique	Names	Map sheet	Easting	Northing	area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
1	1200197	Lake Stream – Cameron Fan Wetland	J35	2362945	5743877	1405.4	0.49	0.12	0.45	0.31	1% (1%)	20% (1%)	3% (1%)	
2	1200902	Titan Stream (Hydra Waters?)	K35	2392297	5759664	268.0	0.52	0.14	0.61	0.28	1% (1%)	24% (1%)	3% (1%)	
3	1200528	Rangitata/Potts River Wetland	J35	2348880	5742143	367.1	0.54	0.18	0.44	0.28	1% (1%)	30% (1%)	3% (1%)	
4	1201634	Western Kaitorete Barrier	I37	2306927	5691991	680.4	0.56	0.23	0.23	0.33	1% (1%)	39% (2%)	5% (2%)	
5	1200870	Lakes Emma and Roundabout	J36	2357158	5732495	174.8	0.58	0.25	0.67	0.30	1% (1%)	41% (2%)	6% (2%)	
6	1200262	Upper Harding Stream	J35	2364439	5750728	222.9	0.60	0.27	0.96	0.55	2% (1%)	42% (2%)	10% (3%)	
7	1201127	0	L34	2439822	5786023	247.6	0.61	0.29	0.34	0.29	2% (1%)	46% (2%)	10% (3%)	
8	1200866	0	J36	2358983	5730856	151.2	0.62	0.30	0.48	0.29	2% (1%)	48% (2%)	10% (3%)	
9	1200508	0	J36	2337877	5727854	157.2	0.62	0.32	0.40	0.29	2% (1%)	51% (2%)	10% (3%)	
10	1200896	0	K35	2389645	5762398	217.5	0.63	0.33	0.39	0.46	8% (4%)	53% (2%)	11% (3%)	
11	1200141	Idaburn Swamp	K35	2390454	5766393	132.4	0.63	0.35	0.44	0.34	9% (4%)	55% (2%)	11% (3%)	
12	1201487	0	L35	2435026	5768539	135.3	0.64	0.36	0.96	0.69	14% (7%)	55% (2%)	13% (4%)	
13	1200899	0	K35	2393073	5757345	105.8	0.65	0.37	0.96	0.62	14% (7%)	55% (2%)	16% (5%)	
14	1200477	0	J36	2341859	5723087	110.8	0.65	0.38	0.34	0.28	14% (7%)	56% (2%)	16% (5%)	
15	1200839	Lake Hawdon	L34	2410153	5793427	131.0	0.66	0.39	0.26	0.28	14% (7%)	58% (2%)	16% (5%)	
16	1200539	0	J36	2366265	5724567	68.4	0.66	0.39	0.49	0.28	14% (7%)	59% (3%)	16% (5%)	
17	1200256	Maori Lakes	J35	2360176	5744906	172.3	0.66	0.41	0.26	0.38	14% (7%)	61% (3%)	17% (5%)	
18	1201174	0	J37	2350244	5703056	108.5	0.67	0.42	0.81	0.71	23%	62%	17%	

Rank	Idunique	Names	Map sheet	Easting	Northing	area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen (11%)	Swamp (3%)	Marsh (5%)	Seepage
19	1201154	0	L34	2440405	5782572	89.2	0.67	0.42	0.30	0.31	23% (11%)	63% (3%)	17% (5%)	
20	1200885	Lake Clearwater Complex	J36	2354915	5737848	98.3	0.67	0.43	0.52	0.60	23% (11%)	63% (3%)	19% (6%)	
46	1201485	Cheeseman Huts	l34	2446941	5772613	44.0	0.72	0.58	0.88	0.77	53% (26%)	74% (3%)	35% (11%)	1% (2%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcat	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1200197	Lake Stream – Cameron Fan Wetland	0.90	0.55	0.99	1	0.83	0.99	1	0.45
2	1200902	Titan Stream (Hydra Waters?)	0.77	0.76	1	0.98	0.81	0.99	1	0.61
3	1200528	Rangitata/Potts River Wetland	0.82	0.57	1	0.98	0.79	0.99	1	0.44
4	1201634	Western Kaitorete Barrier	0.30	0.67	0.98	0.96	0.77	0.98	1	0.23
5	1200870	Lakes Emma and Roundabout	0.91	0.83	1	0.98	0.82	0.99	1	0.67
6	1200262	Upper Harding Stream	0.99	1	1	0.99	1	0.99	1	0.96
7	1201127	0	0.36	0.34	1	0.98	1	0.99	1	0.34
8	1200866	0	0.96	0.49	1	0.98	1	0.99	1	0.48
9	1200508	0	0.95	0.52	1	0.97	0.79	0.99	1	0.40
10	1200896	0	0.43	0.40	1	0.99	1	0.99	1	0.39
11	1200141	Idaburn Swamp	0.95	0.56	0.86	0.99	0.80	0.99	1	0.44
12	1201487	0	0.99	1	1	0.98	1	0.99	1	0.96
13	1200899	0	0.99	1	1	0.99	1	0.99	1	0.96
14	1200477	0	0.89	0.35	1	0.97	1	0.99	1	0.34
15	1200839	Lake Hawdon	0.31	0.52	0.79	0.98	0.84	0.99	1	0.26
16	1200539	0	0.69	0.50	1	0.98	1	0.99	1	0.49
17	1200256	Maori Lakes	0.32	0.50	0.96	0.98	0.81	0.98	1	0.26
18	1201174	0	0.91	0.82	1	0.97	1	0.99	1	0.81
19	1201154	0	0.31	0.35	1	0.97	1	0.99	1	0.30
20	1200885	Lake Clearwater Complex	0.80	0.52	0.97	0.98	1	0.99	1	0.52
46	1201485	Cheeseman Huts	0.99	1	0.89	0.99	1	0.99	1	0.88

5. Clutha



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Seepage	Inland saline
Current (ha)	14526.5	1030.9	9291.6	2693.0	1050.5	389.2	71.3
Historic (ha)	(58803)	(2191)	(24612)	(23202)	(6635)	(1136)	(1027)

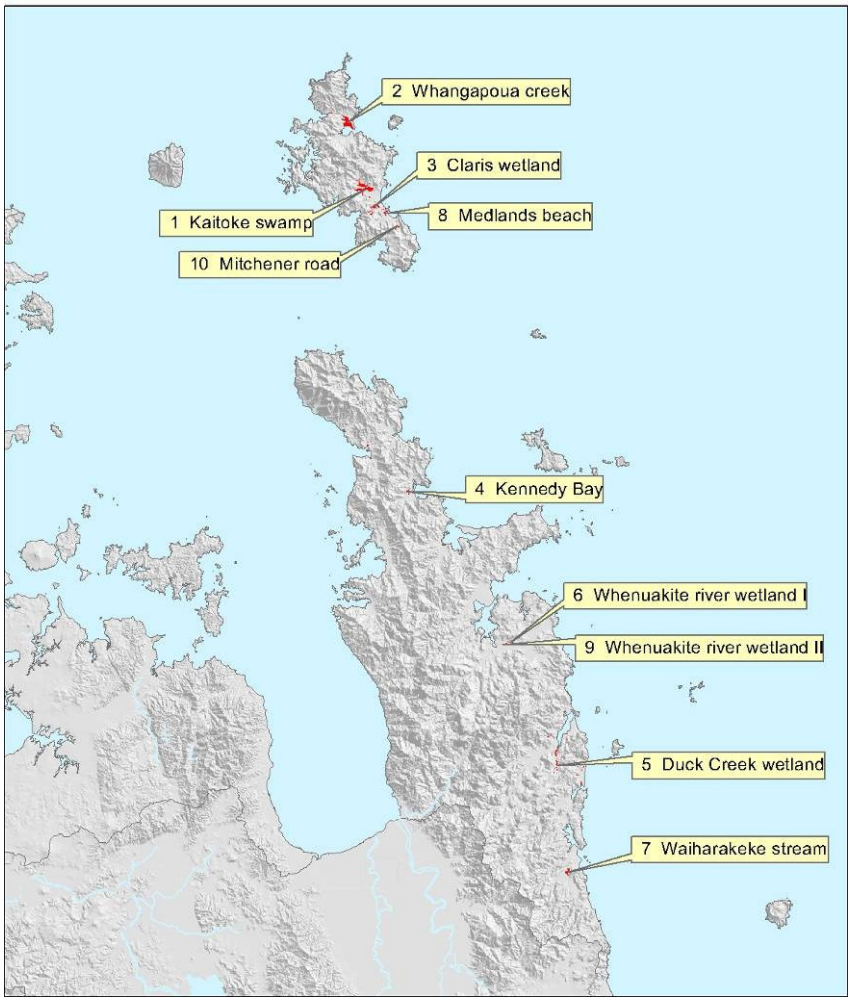
Rank	IDunique	Name	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. Area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Seepage	Inland saline
1	1300073	Von Valley Wetland Management Area	E42	2141809	5547143	2492.4	0.60	0.17	0.68	0.57		15% (6%)	33% (4%)	20% (3%)		
2	1300048	Nevis Plateau Wetland Management Area	F43	2189632	5528100	3953.0	0.79	0.43	0.92	0.68		56% (22%)	33% (4%)	20% (3%)		
3	1300214	Bannockburn – Old woman range	F42	2206669	5536215	669.2	0.81	0.47	0.91	0.68	2% (1%)	62% (24%)	33% (4%)	20% (3%)		
4	1300061	Southern Garvie Mountains Wetland Management Area	F43	2187494	5522453	602.0	0.83	0.51	0.93	0.68	2% (1%)	69% (27%)	33% (4%)	20% (3%)		
5	1300021	Fortification Creek Wetland Management Area	G43	2248788	5509277	533.8	0.84	0.55	0.91	0.71	32% (15%)	71% (28%)	33% (4%)	20% (3%)		
6	1300033	Kirkwoods Creek Wetland Management Area	H40	2266097	5602944	236.5	0.85	0.57	0.73	0.44	32% (15%)	71% (28%)	39% (4%)	27% (4%)		
7	1300251	Obelisk Old Man Range	G43	2213194	5522430	297.2	0.85	0.59	0.94	0.72	53% (25%)	72% (28%)	39% (4%)	27% (4%)		
8	1300059	Schoolhouse Flat Wetlands	F42	2192278	5548035	58.5	0.86	0.59	0.37	0.37	53% (25%)	72% (28%)	39% (4%)	28% (4%)		68% (5%)
9	1301339	Herbaceous Freshwater Vegetation	H42	2253716	5535138	223.5	0.86	0.60	0.59	0.42	53% (25%)	72% (28%)	47% (5%)	28% (4%)		68% (5%)
10	1300248	Greenland	G43	2246554	5526161	114.9	0.86	0.61	0.90	0.43	53% (25%)	72% (28%)	51% (6%)	28% (4%)		68% (5%)
11	1300244	Teviot swamp	G43	2248948	5502110	180.2	0.87	0.62	0.95	0.71	63% (30%)	73% (28%)	51% (6%)	28% (4%)		68% (5%)
12	1300246	Blue Mountain bog	G45	2226313	5468560	193.7	0.87	0.64	0.96	0.74	82% (38%)	73% (28%)	51% (6%)	28% (4%)		68% (5%)

Rank	IDunique	Name	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. Area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Seepage	Inland saline
13	1300016	Diamond Lake/Earnslaw Burn Wetland Management Area	E40	2145049	5596628	120.3	0.87	0.65	0.64	0.42	82% (38%)	73% (28%)	56% (6%)	28% (4%)		68% (5%)
14	1300226	Pinelheugh	G43	2234581	5525155	115.1	0.87	0.65	0.95	0.68	82% (38%)	74% (29%)	56% (6%)	28% (4%)		68% (5%)
15	1300225	Mt Benger	G43	2217692	5505960	141.6	0.88	0.66	0.78	0.68	82% (38%)	75% (29%)	56% (6%)	28% (4%)		68% (5%)
16	1301611	Herbaceous Freshwater Vegetation	F43	2209744	5520556	103.3	0.88	0.67	0.95	0.68	82% (38%)	76% (30%)	56% (6%)	28% (4%)		68% (5%)
17	1300219	Whitcoomb – Gem Lake	F43	2206186	5508064	105.7	0.88	0.68	0.84	0.68	82% (38%)	77% (30%)	56% (6%)	28% (4%)		68% (5%)
18	1400263	Mt Tennyson string bog	F43	2184464	5520242	88.6	0.88	0.68	0.93	0.68	82% (38%)	78% (31%)	56% (6%)	28% (4%)		68% (5%)
19	1300111	Cairn Road Swamp	G46	2220278	5426771	221.0	0.89	0.70	0.31	0.58	82% (38%)	80% (31%)	59% (7%)	28% (4%)		68% (5%)
20	1301851	Herbaceous Freshwater Vegetation	H43	2251869	5504112	82.2	0.89	0.70	0.90	0.68	82% (38%)	81% (32%)	59% (7%)	28% (4%)		68% (5%)
29	1400273	Whitecoombe Range Wetland	F43	2205820	5507036	105.5	0.90	0.75	0.51	0.65	82% (38%)	83% (33%)	68% (8%)	37% (6%)	20% (9%)	68% (5%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcat	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1300073	Von Valley Wetland Management Area	0.96	0.83	0.99	1	0.83	0.99	1	0.68
2	1300048	Nevis Plateau Wetland Management Area	0.99	1	1	0.97	1	0.99	1	0.92
3	1300214	Bannockburn – Old woman range	0.98	0.95	1	0.93	1	0.99	1	0.91
4	1300061	Southern Garvie Mountains Wetland Management Area	0.99	0.99	1	0.96	1	0.99	1	0.93
5	1300021	Fortification Creek Wetland Management Area	0.99	0.98	1	0.96	1	0.99	1	0.91
6	1300033	Kirkwoods Creek Wetland Management Area	0.99	1	0.92	0.98	0.81	0.99	1	0.73
7	1300251	Obelisk Old Man Range	0.99	1	0.98	0.95	1	0.99	1	0.94
8	1300059	Schoolhouse Flat Wetlands	0.95	0.38	1	0.92	1	0.99	1	0.37
9	1301339	Herbaceous Freshwater Vegetation	0.63	0.60	1	0.96	1	0.99	1	0.59
10	1300248	Greenland	0.92	1	1	0.97	1	0.99	1	0.90
11	1300244	Teviot swamp	0.99	1	1	0.96	1	0.99	1	0.95
12	1300246	Blue Mountain bog	0.99	1	1	1	1	0.99	1	0.96
13	1300016	Diamond Lake/Earnslaw Burn Wetland Management Area	0.95	0.65	0.87	0.96	1	0.99	1	0.64
14	1300226	Pinelheugh	0.99	1	1	0.96	1	0.99	1	0.95
15	1300225	Mt Benger	0.99	1	0.79	0.99	1	0.99	1	0.78
16	1301611	Herbaceous Freshwater Vegetation	0.99	1	1	0.97	1	0.99	1	0.95
17	1300219	Whitcoomb – Gem Lake	0.86	0.87	1	0.91	1	0.99	1	0.84
18	1400263	Mt Tennyson string bog	0.99	1	1	0.94	1	0.99	1	0.93
19	1300111	Cairn Road Swamp	0.32	0.41	0.92	0.99	1	0.99	1	0.31
20	1301851	Herbaceous Freshwater Vegetation	0.99	1	0.99	0.92	1	0.99	1	0.90
29	1400273	Whitecoombe Range Wetland	0.52	0.77	1	0.90	1	0.99	1	0.51

6. Coromandel



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Seepage
Current (ha)	737.4	0	36.5	575.1	123.6	2.2
Historic (ha)	(25984)	(108)	(1128)	(24507)	(236)	(5)

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum.CE	Cum.area	EIindex	HLeft	Fen	Swamp	Marsh	Seepage
1	200053	Kaitoka swamp	T09	2730361	6549818	222.0	0.73	0.30	0.93	0.28		35% (1%)	18% (10%)	
2	200002	Whangapoua creek	S08	2727657	6560641	173.8	0.82	0.54	0.71	0.33		60% (1%)	44% (24%)	
3	200108	Claris Wetland	T09	2731999	6546372	72.3	0.85	0.64	0.82	0.26	100% (3%)	66% (2%)	46% (25%)	
4	300003	Kennedy Bay	T10	2737756	6499379	24.4	0.87	0.67	0.88	0.22	100% (3%)	70% (2%)	46% (25%)	
5	300010	Duck Creek Wetland	T12	2762193	6455041	65.5	0.88	0.76	0.30	0.22	100% (3%)	82% (2%)	46% (25%)	
6	300006	Whenuakite River Wetland I	T11	2754525	6474515	15.7	0.88	0.78	0.71	0.26	100% (3%)	84% (2%)	47% (25%)	
7	300021	Waiharakeke stream	T12	2764027	6436496	34.1	0.90	0.83	0.86	0.66	100% (3%)	85% (2%)	68% (37%)	
8	200117	Medlands beach	T09	2733849	6545849	29.9	0.90	0.87	0.57	0.45	100% (3%)	89% (2%)	78% (42%)	
9	300007	Whenuakite River Wetland II	T11	2753512	6474154	12.9	0.91	0.89	0.51	0.22	100% (3%)	91% (2%)	78% (42%)	
10	200186	Mitchener road	T09	2735840	6543358	18.6	0.91	0.91	0.94	0.60	100% (3%)	92% (2%)	88% (48%)	
11	200001	0	S08	2724831	6562094	5.5	0.92	0.92	0.81	0.23	100% (3%)	93% (2%)	88% (48%)	
12	300001	0	T10	2730980	6507027	6.8	0.92	0.93	0.60	0.22	100% (3%)	94% (2%)	88% (48%)	
13	300009	0	T12	2760862	6458862	8.0	0.92	0.94	0.30	0.22	100% (3%)	95% (2%)	88% (48%)	
14	300008	0	T12	2763871	6459379	5.9	0.92	0.95	0.31	0.22	100% (3%)	97% (2%)	88% (48%)	
15	300002	0	T10	2731641	6506185	2.1	0.92	0.95	0.83	0.22	100% (3%)	97% (2%)	88% (48%)	
16	300011	0	T12	2763049	6455367	4.4	0.92	0.96	0.30	0.22	100%	98%	88%	

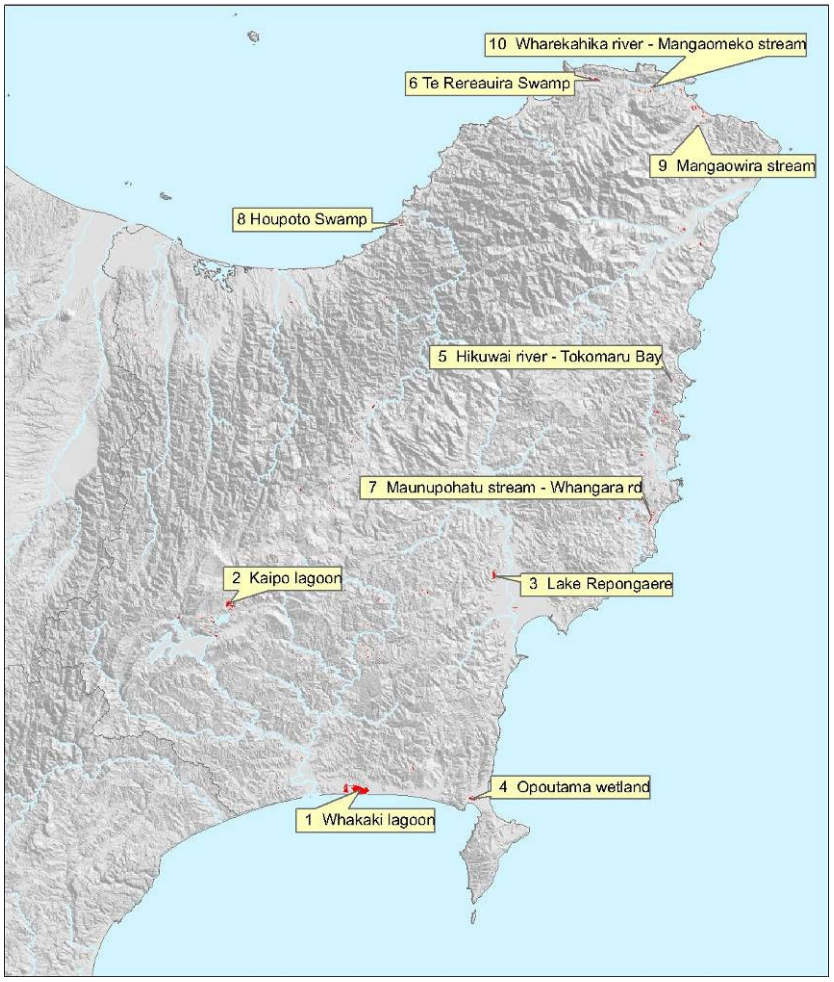
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum.CE	Cum.area	EIindex	HLeft	Fen (3%)	Swamp (2%)	Marsh (48%)	Seepage
17	300012	0	T12	2755561	6455161	2.7	0.92	0.96	0.56	0.22	100% (3%)	98% (2%)	88% (48%)	
18	200098	0	T09	2731323	6548224	4.7	0.92	0.97	0.66	0.77	100% (3%)	98% (2%)	91% (50%)	
19	300015	0	T12	2765720	6452531	4.3	0.92	0.97	0.26	0.34	100% (3%)	99% (2%)	92% (50%)	
20	300016	0	T12	2766317	6451288	6.4	0.92	0.98	0.31	0.58	100% (3%)	99% (2%)	95% (52%)	
23	200215	0	t09	2733895	6541580	4.5	0.93	0.99	0.36	0.77	100% (3%)	100% (2%)	99% (53%)	21% (9%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcat	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	200053	Kaitoka swamp	0.98	0.96	0.94	0.98	1	0.99	1	0.93
2	200002	Whangapoua creek	0.92	0.72	0.98	0.98	1	0.99	1	0.71
3	200108	Claris Wetland	0.95	0.83	1	0.98	1	0.99	1	0.82
4	300003	Kennedy Bay	0.98	0.89	1	0.98	1	0.99	1	0.88
5	300010	Duck Creek Wetland	0.31	0.73	0.88	0.98	1	0.99	1	0.30
6	300006	Whenuakite River Wetland I	0.96	0.72	1	0.97	1	0.99	1	0.71
7	300021	Waiharakeke stream	0.87	0.91	1	0.97	1	0.99	1	0.86
8	200117	Medlands beach	0.94	0.67	0.58	0.97	1	0.99	1	0.57
9	300007	Whenuakite River Wetland II	0.51	0.76	1	0.95	1	0.99	1	0.51
10	200186	Mitchener road	0.99	0.96	1	0.98	1	0.99	1	0.94
11	200001	0	0.99	0.82	1	0.98	1	0.99	1	0.81
12	300001	0	0.72	0.73	0.61	0.92	1	0.99	1	0.60
13	300009	0	0.31	0.52	1	0.98	1	0.99	1	0.30
14	300008	0	0.31	0.84	0.77	0.97	1	0.99	1	0.31
15	300002	0	0.98	1	0.88	0.95	1	0.99	1	0.83
16	300011	0	0.30	0.66	0.70	0.98	1	0.99	1	0.30
17	300012	0	0.95	0.69	0.98	0.98	0.83	0.99	1	0.56
18	200098	0	0.67	1	0.84	0.97	1	0.99	1	0.66
19	300015	0	0.30	0.30	1	0.98	1	0.85	1	0.26
20	300016	0	0.31	0.69	0.67	0.95	1	0.99	1	0.31
23	200215	0	0.90	0.38	0.37	0.97	1	0.96	1	0.36

7. East Cape

East Cape



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Seepage
Current (ha)	2347.0	50.5	5.4	1441.8	637.4	159.6	52.1
Historic (ha)	(97033)	(233)	(1443)	(62879)	(32036)	(388)	(54)

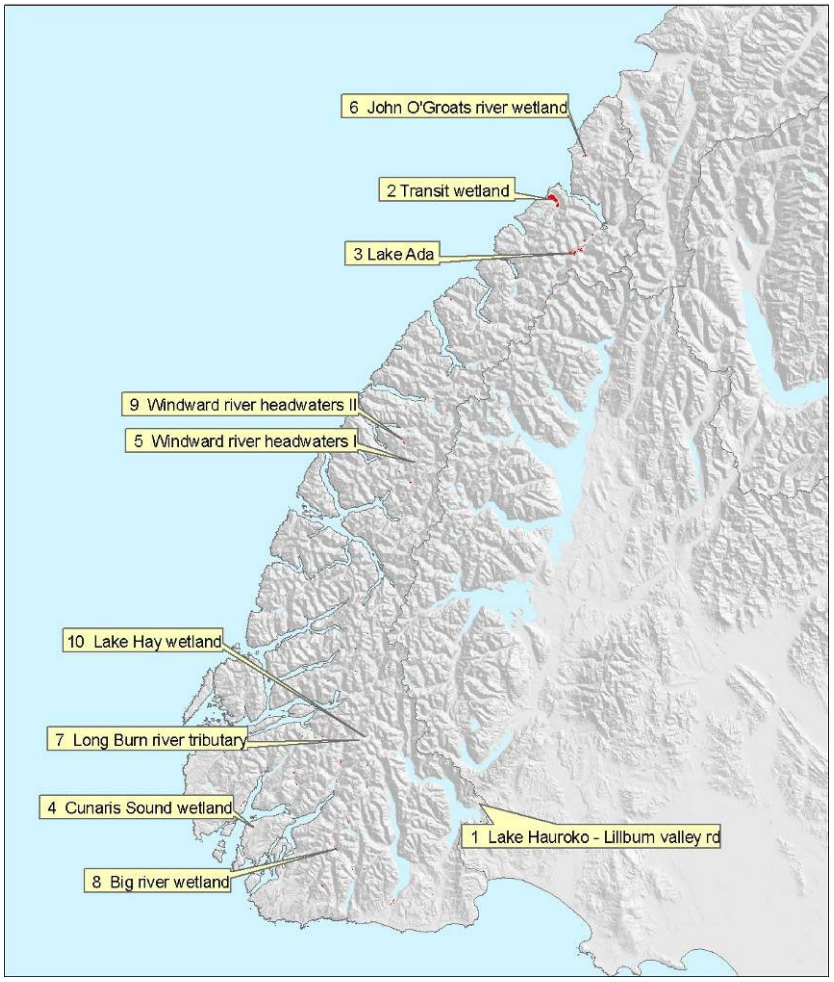
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland
1	701366	Wakaki lagoon	X19	2903395	6229891	650.9	0.53	0.28	0.27	0.22			44% (1%)	2% (<1%)	
2	700110	Kaipo lagoon	W18	2874584	6271914	147.3	0.61	0.34	0.96	0.38			51% (1%)	2% (<1%)	30% (12%)
3	700091	Lake Repongaere	Y18	2934391	6278418	104.3	0.62	0.38	0.30	0.22			58% (1%)	2% (<1%)	30% (12%)
4	701358	Opoutama Wetland	X19	2929360	6227924	68.9	0.63	0.41	0.36	0.21			58% (1%)	13% (<1%)	30% (12%)
5	701537	Hikuwai River Tokomaru Bay	Z16	2974686	6322388	20.3	0.64	0.42	0.97	0.22			59% (1%)	14% (<1%)	30% (12%)
6	400034	Te Rereauira Swamp	Y14	2957565	6390751	66.7	0.65	0.45	0.52	0.34	50% (11%)		60% (1%)	18% (<1%)	30% (12%)
7	700059	Maunupohatu stream – Whangara Rd	Z17	2970170	6291416	61.7	0.66	0.48	0.30	0.22	50% (11%)		64% (1%)	20% (<1%)	30% (12%)
8	400082	Houpoto Swamp	X15	2912781	6358139	47.2	0.67	0.50	0.32	0.21	50% (11%)		64% (1%)	27% (1%)	30% (12%)
9	700019	Mangaowira stream	Z14	2980679	6380394	14.6	0.67	0.50	0.96	0.22	50% (11%)		65% (1%)	27% (1%)	30% (12%)
10	701575	Wharekahika River – Mangaomeko stream	Z14	2970214	6389076	12.9	0.68	0.51	0.86	0.22	50% (11%)		65% (2%)	27% (1%)	30% (12%)
11	701532	0	Z16	2972993	6313549	29.6	0.68	0.52	0.33	0.22	50% (11%)		67% (2%)	29% (1%)	30% (12%)
12	700534	0	Y14	2969918	6388114	9.8	0.68	0.52	0.95	0.22	50% (11%)		67% (2%)	29% (1%)	30% (12%)
13	701560	0	Z14	2979601	6384366	31.1	0.69	0.54	0.42	0.29	62% (13%)		69% (2%)	29% (1%)	30% (12%)
14	700082	0	W18	2869334	6267771	41.6	0.70	0.55	0.97	0.70	62% (13%)		69% (2%)	29% (1%)	56% (23%)
15	701472	0	X18	2918356	6274390	27.8	0.70	0.57	0.30	0.21	62% (13%)		69% (2%)	33% (1%)	56% (23%)
16	701534	0	X16	2907033	6316484	25.3	0.70	0.58	0.30	0.22	62% (13%)		71% (2%)	33% (1%)	56% (23%)
17	701533	0	Z16	2971138	6315148	24.3	0.70	0.59	0.31	0.22	62% (13%)		72% (2%)	35% (1%)	56% (23%)

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland
18	700038	0	Z15	2981293	6353608	20.4	0.71	0.60	0.35	0.22	62% (13%)		73% (2%)	35% (1%)	56% (23%)
19	701428	0	W18	2867144	6258249	9.8	0.71	0.60	0.69	0.21	62% (13%)		73% (2%)	36% (1%)	56% (23%)
20	400140	Owhakatoro Road Swamp	W16	2853040	6332929	14.5	0.71	0.61	0.45	0.21	62% (13%)		73% (2%)	39% (1%)	56% (23%)
23	701547	0	Z14	2996053	6370856	4.1	0.71	0.63	0.80	0.12	62% (13%)	69% (<1%)	76% (2%)	39% (1%)	56% (23%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate Leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	701366	Wakaki lagoon	0.32	0.78	1	0.97	0.85	0.99	1	0.27
2	700110	Kaipo lagoon	0.99	1	1	0.99	1	0.99	1	0.96
3	700091	Lake Repongaere	0.31	0.36	0.96	0.98	1	0.98	1	0.30
4	701358	Opoutama Wetland	0.36	0.37	0.89	0.98	1	0.99	1	0.36
5	701537	Hikuwai River Tokomaru Bay	0.99	1	1	0.98	1	0.99	1	0.97
6	400034	Te Rereauira Swamp	0.53	0.69	0.78	0.99	1	0.99	1	0.52
7	700059	Maunupohatu stream – Whangara Rd	0.31	0.40	0.71	0.98	1	0.98	1	0.30
8	400082	Houpoto Swamp	0.32	0.49	1	0.98	1	0.99	1	0.32
9	700019	Mangaowira stream	0.98	1	1	0.98	1	0.99	1	0.96
10	701575	Wharekahika River – Mangaomeko stream	0.99	0.87	1	0.97	1	0.99	1	0.86
11	701532	0	0.33	0.46	0.80	0.97	1	0.99	1	0.33
12	700534	0	0.97	1	1	0.98	1	0.99	1	0.95
13	701560	0	0.44	0.42	0.98	0.98	1	0.99	1	0.42
14	700082	0	0.99	1	1	0.99	1	0.99	1	0.97
15	701472	0	0.30	0.63	0.84	0.97	1	0.99	1	0.30
16	701534	0	0.35	0.30	0.98	0.96	1	0.99	1	0.30
17	701533	0	0.32	0.48	1	0.97	1	0.99	1	0.31
18	700038	0	0.35	0.65	0.87	0.97	1	0.99	1	0.35
19	701428	0	0.99	0.83	1	0.98	0.84	0.99	1	0.69
20	400140	Owhakatoro Road Swamp	0.90	0.46	0.92	0.98	1	0.99	1	0.45
23	701547	0	0.91	0.81	1	0.99	1	0.99	1	0.80

8. Fiordland



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Pakihi/ Gumland	Seepage
Current (ha)	1252.4	0	180.4	983.4	54	34.3
Historic (ha)	(28704)	(40)	(3405)	*(653)*	(24587)	*(19)*

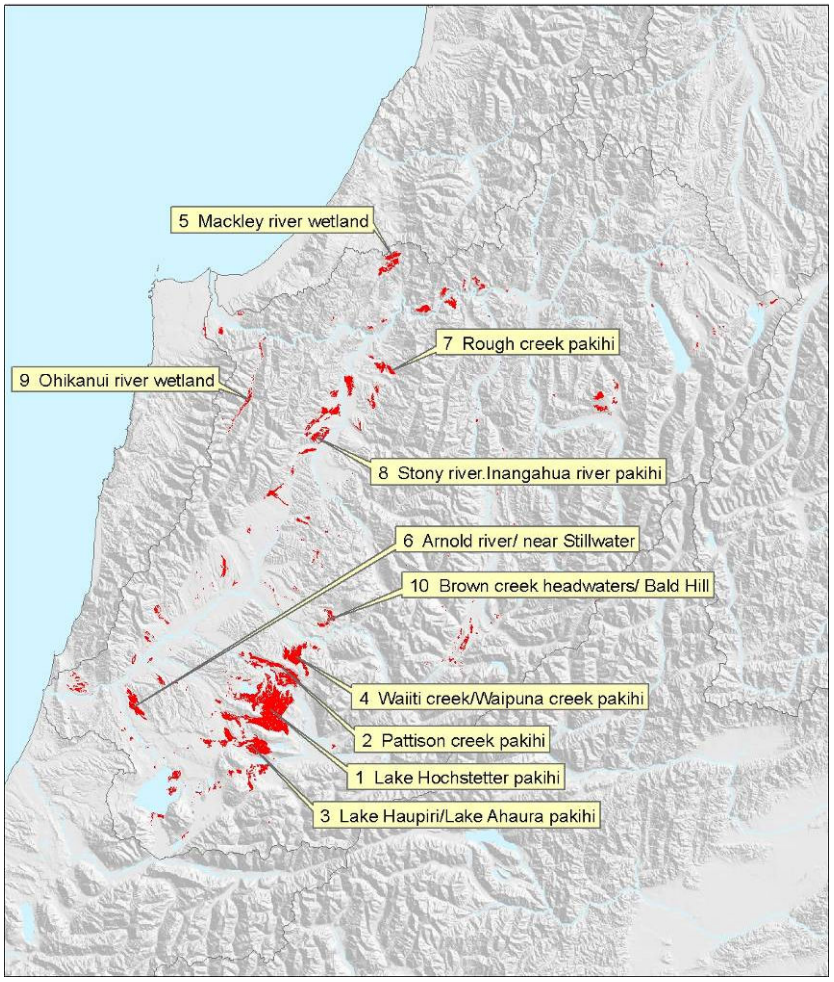
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum.CE	Cum.area	EI index	HLeft	Fen	Swamp	Pakihi/ gumland	Seepage
1	1410764	Lake Hauroko – Lillburn valley Rd	c45	2075746	5455266	15.3	0.29	0.01	0.96	0.09			28% (<1%)	
2	1400304	Transit Wetland (Lower and mid	d40	2094545	5608768	327.1	0.71	0.27	0.96	0.95		31% (–)	61% (<1%)	
3	1400275	Lake Ada	d40	2100546	5596033	245.0	0.81	0.47	0.79	0.99	1% (<1%)	56% (–)	61% (<1%)	
4	1410784	Cunaris sound Wetland	a45	2018044	5449308	8.9	0.81	0.48	0.96	0.09	1% (<1%)	56% (–)	77% (<1%)	
5	1410150	Windward River headwaters	c42	2059192	5541928	13.7	0.81	0.49	0.91	0.31	9% (<1%)	56% (–)	77% (<1%)	
6	1410006	John O'Groats River Wetland	d40	2102475	5619893	42.4	0.83	0.52	0.97	1	9% (<1%)	60% (–)	77% (<1%)	
7	1410722	Long Burn River tributary	b44	2045024	5471510	13.6	0.83	0.53	0.90	0.31	17% (1%)	60% (–)	77% (<1%)	
8	1410804	Big River Wetland	b45	2039075	5443886	30.0	0.84	0.56	0.95	0.96	18% (1%)	63% (–)	77% (<1%)	
9	1410114	Windward River headwaters II	c42	2055769	5547695	8.3	0.84	0.56	0.93	0.31	22% (1%)	63% (–)	77% (<1%)	
10	1410720	Lake Hay Wetland	b44	2046687	5472162	8.5	0.85	0.57	0.92	0.31	27% (1%)	63% (–)	77% (<1%)	
11	1410828	Herbaceous Freshwater Vegetat	b46	2043343	5438850	7.6	0.85	0.57	0.96	0.31	31% (2%)	63% (–)	77% (<1%)	
12	1410733	Herbaceous Freshwater Vegetat	b45	2040315	5465825	23.1	0.86	0.59	0.94	1	31% (2%)	66% (–)	77% (<1%)	
13	1410864	Herbaceous Freshwater Vegetat	b46	2024182	5432914	3.5	0.86	0.60	0.88	0.09	31% (2%)	66% (–)	84% (<1%)	
14	1410615	Herbaceous Freshwater Vegetat	b44	2047308	5498352	7.2	0.86	0.60	0.89	0.31	35% (2%)	66% (–)	84% (<1%)	
15	1410056	Herbaceous Freshwater Vegetat	c41	2071293	5561922	6.6	0.86	0.61	0.96	0.31	39% (2%)	66% (–)	84% (<1%)	
16	1410117	Herbaceous Freshwater Vegetat	c42	2056895	5547457	6.8	0.86	0.61	0.94	0.31	43% (2%)	66% (–)	84% (<1%)	
17	1410629	Herbaceous Freshwater Vegetat	b44	2040794	5494755	6.7	0.87	0.62	0.96	0.31	46% (2%)	66% (–)	84% (<1%)	

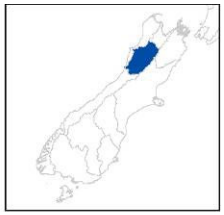
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum.CE	Cum.area	EI index	HLeft	Fen	Swamp	Pakihi/ gumland	Seepage
18	1410386	Herbaceous Freshwater Vegetat	c43	2057911	5523553	6.7	0.87	0.62	0.92	0.31	50% (3%)	66% (–)	84% (<1%)	
19	1410895	Herbaceous Freshwater Vegetat	b46	2035721	5434308	20.4	0.87	0.64	0.95	1	50% (3%)	68% (–)	84% (<1%)	
20	1410071	Herbaceous Freshwater Vegetat	c42	2067327	5554698	6.2	0.88	0.64	0.93	0.31	54% (3%)	68% (–)	84% (<1%)	
98	1410022	Herbaceous Freshwater Vegetat	c41	2079316	5582332	4.3	0.97	0.95	0.97	1	99% (5%)	97% (–)	100% (<1%)	13% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1410764	Lake Hauroko – Lillburn valley Rd	0.99	1	1	0.98	1	0.99	1	0.96
2	1400304	Transit Wetland (Lower and mid	0.99	1	1	1	1	0.99	1	0.96
3	1400275	Lake Ada	0.99	0.98	1	0.98	0.84	0.99	1	0.79
4	1410784	Cunaris sound Wetland	0.99	1	1	0.99	1	0.99	1	0.96
5	1410150	Windward River headwaters	0.99	1	1	0.98	1	0.99	1	0.91
6	1410006	John O'Groats River Wetland	0.99	0.98	1	0.98	1	0.99	1	0.97
7	1410722	Long Burn River tributary	0.99	1	1	0.98	1	0.99	1	0.90
8	1410804	Big River Wetland	0.99	1	1	0.99	1	0.99	1	0.95
9	1410114	Windward River headwaters II	0.99	1	1	0.98	1	0.99	1	0.93
10	1410720	Lake Hay Wetland	0.99	1	1	0.98	1	0.99	1	0.92
11	1410828	Herbaceous Freshwater Vegetat	0.99	1	1	0.98	1	0.99	1	0.96
12	1410733	Herbaceous Freshwater Vegetat	0.99	1	1	0.95	1	0.99	1	0.94
13	1410864	Herbaceous Freshwater Vegetat	0.99	1	1	0.91	1	0.99	1	0.88
14	1410615	Herbaceous Freshwater Vegetat	0.99	1	1	0.97	1	0.99	1	0.89
15	1410056	Herbaceous Freshwater Vegetat	0.99	1	1	0.98	1	0.99	1	0.96
16	1410117	Herbaceous Freshwater Vegetat	0.99	1	1	0.98	1	0.99	1	0.94
17	1410629	Herbaceous Freshwater Vegetat	0.99	1	1	0.98	1	0.99	1	0.96
18	1410386	Herbaceous Freshwater Vegetat	0.99	1	1	0.93	1	0.99	1	0.92
19	1410895	Herbaceous Freshwater Vegetat	0.99	1	1	0.97	1	0.99	1	0.95
20	1410071	Herbaceous Freshwater Vegetat	0.99	1	1	0.95	1	0.99	1	0.93
98	1410022	Herbaceous Freshwater Vegetat	0.99	1	1	0.98	1	0.99	1	0.97

9. Grey–Buller





Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Seepage
Current (ha)	20196.4	4.5	106.0	1806.9	1234.8	16963	81.5
Historic (ha)	(102379)	(437)	*(0)*	(10076)	(9321)	(82521)	*(24)*

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
1	1100331	Lake Hochstetter pakihi	k31	2397472	5860421	5390.9	0.67	0.27	0.74	0.53		9% (2%)		31% (6%)	
2	1100360	Pattison creek pakihi	l31	2412603	5869438	1531.9	0.71	0.34	0.76	0.53		9% (2%)		40% (8%)	
3	1100330	Lake Haupiri/Lake Ahaura pakihi	k32	2403351	5857969	1451.5	0.75	0.42	0.75	0.53		9% (2%)		48% (10%)	
4	1101083	Waiiti creek / Waipuna creek pakihi	k31	2409096	5867787	1093.5	0.78	0.47	0.94	0.53		10% (2%)		55% (11%)	
5	1100519	Mackley River Wetland	l29	2433298	5933381	631.9	0.79	0.50	0.96	0.51		11% (2%)	13% (2%)	58% (12%)	
6	1100305	Arnold River / near Stillwater	k32	2386107	5849598	653.6	0.80	0.53	0.60	0.53		11% (2%)	13% (2%)	61% (13%)	
7	1100528	Rough creek pakihi	l30	2424479	5919259	375.4	0.81	0.55	0.96	0.53		11% (2%)	13% (2%)	64% (13%)	
8	1100549	Stony River Inangahua River pakihi	l30	2414997	5912553	336.4	0.82	0.57	0.96	0.53		15% (3%)	13% (2%)	65% (13%)	
9	1100438	Ohikanui River Wetland	k29	2381296	5920955	403.0	0.83	0.59	0.80	0.53		15% (3%)	13% (2%)	68% (14%)	
10	1101086	Brown creek headwaters / Bald Hill	l31	2415064	5874805	311.1	0.83	0.60	0.81	0.53		17% (3%)	13% (2%)	69% (14%)	
11	1100375	0	k30	2408420	5902695	264.8	0.84	0.62	0.95	0.53		17% (3%)	13% (2%)	71% (15%)	
12	1100551	0	l30	2416321	5917232	584.8	0.84	0.65	0.41	0.53		19% (3%)	13% (2%)	74% (15%)	
13	900122	Deepdale Terrace Wetland	l29	2438502	5934546	216.9	0.85	0.66	0.97	0.53		19% (3%)	13% (2%)	75% (15%)	
14	1100329	Added polygon from satellite image	k32	2400580	5851260	291.5	0.85	0.67	0.71	0.52		24% (4%)	13% (2%)	76% (16%)	
15	1100520	0	l29	2416008	5931452	244.0	0.86	0.68	0.84	0.53		24% (4%)	13% (2%)	78% (16%)	
16	1100316	0	k32	2402776	5846626	235.4	0.86	0.70	0.81	0.51		24% (4%)	17% (2%)	79% (16%)	
17	1100317	Added polygon from satellite image	k32	2404867	5848435	241.0	0.86	0.71	0.71	0.50		37% (7%)	18% (2%)	79% (16%)	

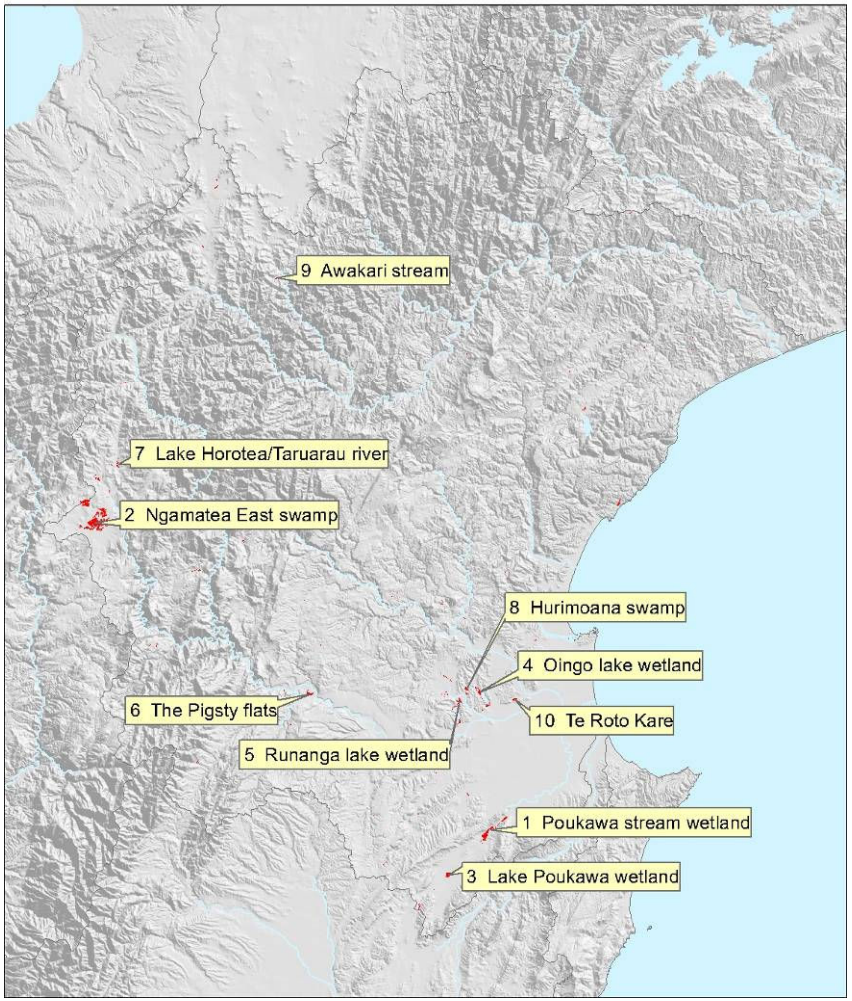
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
18	900770	Tutaki West Branch Headwater Wetlands 1	m30	2466362	5916740	180.8	0.87	0.72	0.96	0.55	8% (–)	37% (7%)	18% (2%)	80% (16%)	
19	1100395	0	l31	2442220	5872906	170.2	0.87	0.72	0.83	0.46	8% (–)	39% (7%)	30% (4%)	80% (16%)	
20	1100535	0	l29	2430099	5925963	171.0	0.87	0.73	0.87	0.53	8% (–)	40% (7%)	30% (4%)	81% (17%)	
36	1100488	Added polygon from satellite image	k29	2398590	5932520	83.6	0.90	0.85	0.96	0.55	8% (–)	65% (12%)	33% (4%)	92% (19%)	5% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1100331	Lake Hochstetter pakihi	0.92	0.90	0.96	0.99	0.84	0.99	1	0.74
2	1100360	Pattison creek pakihi	0.98	0.92	0.93	1	0.84	0.99	1	0.76
3	1100330	Lake Haupiri/Lake Ahaura pakihi	0.91	1	0.96	0.99	0.84	0.99	1	0.75
4	1101083	Waiiti creek / Waipuna creek pakihi	0.99	1	0.95	1	1	0.99	1	0.94
5	1100519	Mackley River Wetland	0.99	1	1	0.99	1	0.99	1	0.96
6	1100305	Arnold River / near Stillwater	0.61	1	0.97	1	1	0.99	1	0.60
7	1100528	Rough creek pakihi	0.99	1	1	0.99	1	0.99	1	0.96
8	1100549	Stony River Inangahua River pakihi	0.99	0.98	1	0.99	1	0.99	1	0.96
9	1100438	Ohikanui River Wetland	0.99	0.99	1	0.97	0.84	0.99	1	0.80
10	1101086	Brown creek headwaters / Bald Hill	0.99	1	1	0.99	0.84	0.99	1	0.81
11	1100375	0	0.99	1	0.96	0.99	1	0.99	1	0.95
12	1100551	0	0.99	0.50	0.94	0.95	0.84	0.99	1	0.41
13	900122	Deepdale Terrace Wetland	0.99	1	1	0.99	1	0.99	1	0.97
14	1100329	Added polygon from satellite image	0.86	1	0.95	0.99	0.84	0.98	1	0.71
15	1100520	0	0.99	0.98	1	1	1	0.99	1	0.84
16	1100316	0	0.99	0.82	1	0.99	1	0.99	1	0.81
17	1100317	Added polygon from satellite image	0.86	0.96	1	0.91	0.84	0.99	1	0.71
18	900770	Tutaki West Branch Headwater Wetlands 1	0.99	1	1	1	1	0.99	1	0.96
19	1100395	0	0.94	0.84	1	0.97	1	0.99	1	0.83
20	1100535	0	0.99	0.88	1	0.91	1	0.99	1	0.87
36	1100488	Added polygon from satellite image	0.99	1	1	0.99	1	0.99	1	0.96

10. Hawkes Bay

Hawkes Bay



Current and historic extent (hectares) in each wetland class.

	Total	Fen	Swamp	Marsh	Seepage
Current (ha)	1019.2	420.6	429.2	152.9	16.4
Historic (ha)	(33902)	(2715)	(27457)	(3714)	*(15)*

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
1	701158	Poukawa stream	v22	2832896	6157701	116.0	0.39	0.11	0.21	0.19		28% (<1%)	2% (<1%)	
2	700159	Ngamatea East Swamp	u20	2779147	6200149	438.7	0.74	0.54	0.65	0.44	87% (14%)	28% (<1%)	41% (2%)	
3	701149	Lake Poukawa Wetland	v22	2827189	6151760	34.8	0.75	0.58	0.47	0.19	87% (14%)	36% (1%)	41% (2%)	
4	701210	Oingo lake Wetland	v21	2831801	6176091	56.2	0.76	0.63	0.26	0.19	87% (14%)	50% (1%)	41% (2%)	
5	701200	Runanga lake Wetland	v21	2828522	6174869	36.5	0.77	0.67	0.30	0.19	87% (14%)	59% (1%)	42% (2%)	
6	701220	The Pigsty flats	u21	2808308	6176343	30.5	0.77	0.70	0.30	0.19	87% (14%)	66% (1%)	42% (2%)	
7	700158	Lake Horotea / Taruarau River	u20	2782035	6207401	21.4	0.78	0.72	0.95	0.47	92% (14%)	66% (1%)	42% (2%)	
8	701226	Hurimoana swamp	v21	2829642	6176837	20.4	0.78	0.74	0.30	0.19	92% (14%)	71% (1%)	42% (2%)	
9	700139	Awakari stream	u19	2803921	6232915	7.1	0.79	0.74	0.87	0.20	92% (14%)	73% (1%)	42% (2%)	
10	701215	Te Roto Kare	v21	2836252	6175602	15.0	0.79	0.76	0.31	0.19	92% (14%)	76% (1%)	42% (2%)	
11	700164	0	u20	2779570	6205438	10.2	0.80	0.77	0.96	0.47	95% (15%)	76% (1%)	42% (2%)	
12	701230	0	v21	2827041	6178455	12.1	0.80	0.78	0.30	0.19	95% (15%)	79% (1%)	42% (2%)	
13	702000	0	v22	2823269	6147464	11.8	0.80	0.79	0.30	0.19	95% (15%)	82% (1%)	42% (2%)	
14	701285	0	u20	2792941	6193029	11.0	0.80	0.80	0.55	0.28	95% (15%)	82% (1%)	49% (2%)	
15	701250	0	u21	2787436	6182907	7.1	0.80	0.81	0.43	0.19	95% (15%)	84% (1%)	49% (2%)	
16	701201	0	v21	2828680	6172571	15.2	0.80	0.82	0.19	0.19	95% (15%)	87% (1%)	49% (2%)	
17	701308	0	u20	2779224	6205757	7.6	0.81	0.83	0.95	0.47	97% (15%)	87% (1%)	49% (2%)	
18	701240	0	u21	2786501	6182849	3.5	0.81	0.83	0.71	0.19	97% (15%)	88% (1%)	49% (2%)	

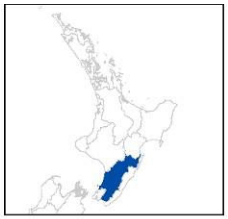
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
19	701408	0	u19	2795632	6245284	8.0	0.81	0.84	0.30	0.19	97% (15%)	90% (1%)	49% (2%)	
20	700325	0	w20	2850414	6202188	12.9	0.81	0.85	0.30	0.28	97% (15%)	90% (1%)	56% (3%)	
50	701343	0	v19	2829741	6222546	3.2	0.83	0.96	0.30	0.42	99% (15%)	99% (1%)	89% (4%)	4% (–)

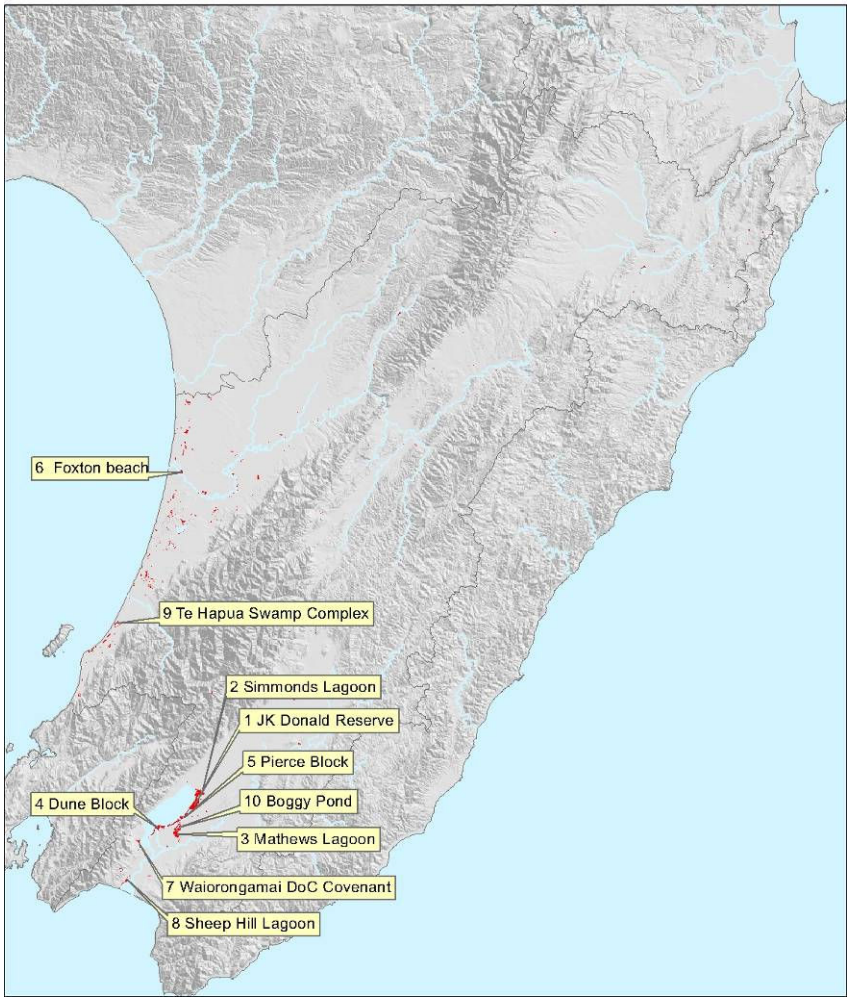
Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	701158	Poukawa stream	0.30	0.31	0.59	0.96	0.85	0.80	1	0.21
2	700159	Ngamatea East Swamp	0.66	0.99	1	0.98	1	0.99	1	0.65
3	701149	Lake Poukawa Wetland	0.48	1	1	0.97	1	0.99	1	0.47
4	701210	Oingo lake Wetland	0.31	0.64	1	0.97	0.85	0.99	1	0.26
5	701200	Runanga lake Wetland	0.31	0.68	1	0.97	1	0.99	1	0.30
6	701220	The Pigsty flats	0.30	0.42	1	0.94	1	0.99	1	0.30
7	700158	Lake Horotea / Taruarau River	0.99	1	1	0.97	1	0.99	1	0.95
8	701226	Hurimoana swamp	0.30	0.49	1	0.98	1	0.99	1	0.30
9	700139	Awakari stream	0.99	1	1	0.98	1	0.89	1	0.87
10	701215	Te Roto Kare	0.31	0.68	1	0.98	1	0.99	1	0.31
11	700164	0	0.99	1	1	0.98	1	0.99	1	0.96
12	701230	0	0.30	0.30	1	0.97	1	0.99	1	0.30
13	702000	0	0.30	0.44	0.79	0.96	1	0.98	1	0.30
14	701285	0	0.97	1	0.56	0.98	1	0.99	1	0.55
15	701250	0	0.44	0.74	1	0.98	1	0.99	1	0.43
16	701201	0	0.31	0.40	1	0.97	1	0.62	1	0.19
17	701308	0	0.99	1	1	0.96	1	0.99	1	0.95
18	701240	0	0.72	0.99	1	0.98	1	0.99	1	0.71
19	701408	0	0.30	0.36	0.91	0.39	1	0.99	1	0.30
20	700325	0	0.30	0.30	0.99	0.98	1	0.99	1	0.30
50	701343	0	0.31	0.44	1	0.97	1	0.99	1	0.30

11. Manawatu–Wairarapa

Manawatu - Wairarapa





Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Seepage
Current (ha)	3407.8	3.4	18.5	2855.6	499.4	31
Historic (ha)	(254257)	(1266)	(1290)	(230068)	(21631)	*(2)*

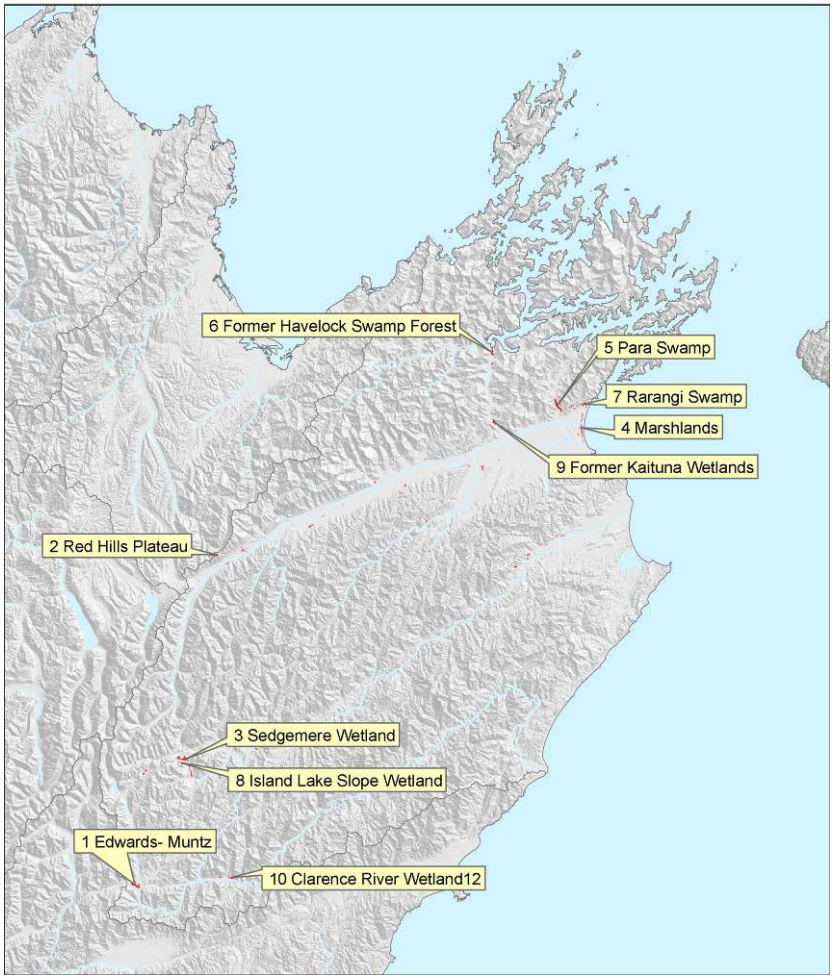
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Seepage
1	800175	JK Donald Reserve	s27	2703769	5998041	410.1	0.41	0.12	0.24	0.18			12% (<1%)	13% (<1%)	
2	800167	Simmonds Lagoon	s27	2704840	6000823	213.6	0.48	0.18	0.37	0.17			20% (<1%)	13% (<1%)	
3	800197	Mathews Lagoon	s27	2699541	5991473	218.2	0.51	0.25	0.24	0.17			27% (<1%)	13% (<1%)	
4	800189	Dune Block	s27	2696077	5992880	206.6	0.54	0.31	0.25	0.17			34% (<1%)	14% (<1%)	
5	800186	Pierce Block	s27	2700852	5995013	166.7	0.56	0.36	0.30	0.17			40% (<1%)	15% (<1%)	
6	509685	Foxton beach	s24	2700570	6077342	53.7	0.58	0.37	0.58	0.17			42% (1%)	15% (<1%)	
7	800204	Waiorongamai DoC Covenant	s27	2690533	5988925	74.9	0.59	0.39	0.42	0.17			45% (1%)	15% (<1%)	
8	800227	Sheep Hill Lagoon	r27	2687634	5980329	49.2	0.60	0.41	0.54	0.17			47% (1%)	15% (<1%)	
9	800038	Te Hapua Swamp Complex	r25	2685307	6041154	59.6	0.61	0.43	0.40	0.18			48% (1%)	16% (<1%)	
10	800194	Boggy Pond	s27	2699915	5992818	60.2	0.61	0.44	0.34	0.17			51% (1%)	16% (<1%)	
11	800166	Lake Wairarapa	s27	2696792	5993226	79.7	0.62	0.47	0.25	0.17			53% (1%)	17% (<1%)	
12	800223	Lake Pounui	r27	2686335	5982575	21.4	0.62	0.47	0.78	0.17			54% (1%)	17% (<1%)	
13	517648	Moutoa Flax Reserve	s24	2705860	6072401	38.1	0.63	0.48	0.41	0.17			55% (1%)	17% (<1%)	
14	800103	Allen/Lowes bush	s26	2728238	6019980	50.8	0.63	0.50	0.28	0.17			57% (1%)	17% (<1%)	
15	500976	Lake Horowhenua	s25	2701080	6065112	43.6	0.64	0.51	0.30	0.17	8% (<1%)		59% (1%)	17% (<1%)	
16	500939	Makuera Swamp Wildlife Management Reserve	s24	2718942	6076003	45.7	0.64	0.52	0.25	0.17	8% (<1%)		60% (1%)	17% (<1%)	
17	701100	0	v23	2810651	6125847	44.9	0.64	0.54	0.25	0.17	8% (<1%)		62% (1%)	17% (<1%)	

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Seepage
18	500904	pukepuke	s24	2702275	6093876	42.7	0.65	0.55	0.25	0.17	8% (<1%)		63% (1%)	17% (<1%)	
19	800047	Te Harakeke Swamp	r26	2682261	6037053	33.4	0.65	0.56	0.32	0.18	8% (<1%)		65% (1%)	17% (<1%)	
20	501071	Lake Papaitonga	s25	2698247	6060109	29.8	0.65	0.57	0.31	0.17	8% (<1%)		66% (1%)	17% (<1%)	
29	800089	Mt Cone	s26	2707838	6024749	10.8	0.67	0.63	0.93	0.25	8% (<1%)		71% (1%)	29% (1%)	1% (–)
56	501005	Koputaroa Scientific (snail) Reserve	s25	2708572	6068122	11.7	0.70	0.73	0.29	0.18	8% (<1%)	30% (<1%)	79% (1%)	51% (1%)	1% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	800175	JK Donald Reserve	0.30	0.53	1	0.93	0.82	0.99	1	0.24
2	800167	Simmonds Lagoon	0.90	0.51	0.99	0.97	0.78	0.93	1	0.37
3	800197	Mathews Lagoon	0.32	0.70	1	0.96	0.77	0.99	1	0.24
4	800189	Dune Block	0.33	0.91	1	0.96	0.77	0.99	1	0.25
5	800186	Pierce Block	0.30	0.73	1	0.94	1	0.99	1	0.30
6	509685	Foxton beach	0.93	0.59	1	0.98	1	0.99	1	0.58
7	800204	Waiorongamai DoC Covenant	0.72	0.44	0.97	0.97	1	0.94	1	0.42
8	800227	Sheep Hill Lagoon	0.67	0.81	1	0.96	0.82	0.99	1	0.54
9	800038	Te Hapua Swamp Complex	0.41	0.50	0.95	0.97	1	0.99	1	0.40
10	800194	Boggy Pond	0.35	0.79	0.95	0.96	1	0.99	1	0.34
11	800166	Lake Wairarapa	0.33	0.98	1	0.96	0.77	0.99	1	0.25
12	800223	Lake Pounui	0.97	0.97	1	0.98	0.82	0.98	1	0.78
13	517648	Moutoa Flax Reserve	0.42	0.46	1	0.96	1	0.99	1	0.41
14	800103	Allen/Lowes bush	0.30	0.30	0.99	0.95	1	0.94	1	0.28
15	500976	Lake Horowhenua	0.30	0.58	0.96	0.99	1	0.99	1	0.30
16	500939	Makuera Swamp Wildlife Management Reserve	0.30	0.30	1	0.89	1	0.82	1	0.25
17	701100	0	0.30	0.83	1	0.96	0.85	0.99	1	0.25
18	500904	pukepuke	0.30	0.73	1	0.94	0.85	0.99	1	0.25
19	800047	Te Harakeke Swamp	0.32	0.79	0.94	0.97	1	0.99	1	0.32
20	501071	Lake Papaitonga	0.36	0.83	1	0.96	0.85	0.99	1	0.31
29	800089	Mt Cone	0.99	1	1	0.94	1	0.99	1	0.93
56	501005	Koputaroa Scientific (snail) Reserve	0.31	0.43	0.67	0.93	1	0.95	1	0.29

12. Marlborough



Current and historic extent (hectares) in each wetland class.

	Total	Fen	Swamp	Marsh	Seepage
Current (ha)	1709.5	87.9	852.1	669.4	100.1
Historic (ha)	(14756)	(1863)	(11028)	(1755)	(109)

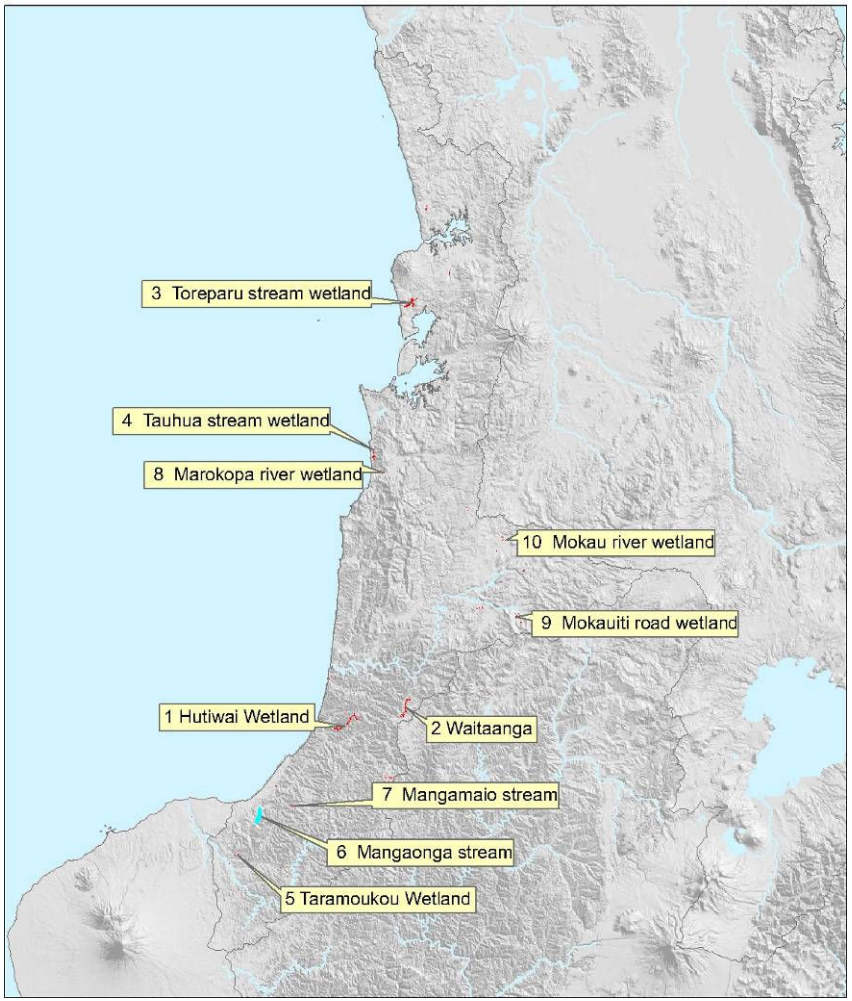
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
1	1201413	Edwards–Muntz	n32	2510419	5851417	130.6	0.50	0.08	0.83	0.35	32% (2%)	12% (1%)		
2	900613	Red Hills Plateau	n29	2510919	5943215	52.7	0.55	0.11	0.96	0.36	32% (2%)	18% (1%)		
3	1000876	Sedgemere Wetland	n30	2502465	5897193	132.7	0.59	0.18	0.35	0.47	40% (2%)	27% (2%)	7% (3%)	
4	1000658	Marshlands	p26	2608095	6017599	93.9	0.61	0.24	0.31	0.40	40% (2%)	37% (3%)	9% (3%)	
5	1000754	Para Swamp	o29	2556507	5921446	128.3	0.62	0.31	0.18	0.36	40% (2%)	52% (4%)	9% (3%)	
6	1000433	Former Havelock Swamp Forest	p28	2575441	5973748	47.8	0.64	0.34	0.42	0.36	40% (2%)	58% (4%)	9% (3%)	
7	1000795	Rarangi Swamp	o29	2561746	5925030	62.9	0.65	0.38	0.34	0.40	40% (2%)	64% (5%)	10% (4%)	
8	1000562	Island Lake Slope Wetland	n30	2505164	5892928	25.8	0.65	0.39	0.46	0.33	57% (3%)	65% (5%)	10% (4%)	
9	1000434	Former Kaituna Wetlands	p27	2574678	5987591	73.6	0.67	0.44	0.30	0.68	57% (3%)	65% (5%)	21% (8%)	
10	1000325	Clarence River Wetland12	o31	2534167	5881658	55.6	0.68	0.47	0.36	0.68	57% (3%)	65% (5%)	29% (11%)	
11	1000563	Island Lake Stream Wetland	p27	2575261	5989884	41.5	0.68	0.49	0.33	0.66	58% (3%)	65% (5%)	35% (13%)	
12	1001202	Riparian forest remnant Wetland	p27	2584243	5990768	16.0	0.69	0.50	0.78	0.66	58% (3%)	66% (5%)	37% (14%)	
13	1000780	Pukaka Swamp	o27	2559684	5995151	20.5	0.69	0.51	0.38	0.44	58% (3%)	67% (5%)	38% (14%)	
14	1000245	Cabbage Tree Gully Swamp	o28	2536193	5952346	23.9	0.69	0.53	0.30	0.45	58% (3%)	69% (5%)	39% (15%)	
15	1000241	Brown River Forest	n30	2518162	5911030	21.8	0.70	0.54	0.25	0.36	58% (3%)	72% (6%)	39% (15%)	
16	1000560	Island Gully Wetland3	n30	2502903	5895059	11.2	0.70	0.55	0.43	0.30	69% (3%)	72% (6%)	39% (15%)	
17	1000403	Eves Stream Wetlands3	o28	2547402	5953405	17.9	0.70	0.56	0.30	0.45	69% (3%)	74% (6%)	40% (15%)	
18	1000531	Hillersden Stream Wetland	n30	2494815	5893338	15.4	0.70	0.57	0.30	0.40	69% (3%)	75% (6%)	40% (15%)	

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
19	1001063	Two Bay Swamp	o29	2554860	5920212	13.7	0.70	0.58	0.30	0.36	69% (3%)	77% (6%)	40% (15%)	
20	1000558	Island Gully Wetland1	n30	2494245	5892641	12.1	0.71	0.58	0.30	0.29	83% (4%)	77% (6%)	40% (15%)	
24	1001200	lowland swamp Wetland	p28	2597196	5965056	18.1	0.72	0.61	0.44	0.76	87% (4%)	78% (6%)	44% (17%)	5% (5%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1201413	Edwards–Muntz	0.96	0.84	0.94	0.99	1	0.99	1	0.83
2	900613	Red Hills Plateau	0.99	1	1	0.97	1	0.99	1	0.96
3	1000876	Sedgemere Wetland	0.35	0.36	1	0.98	1	0.99	1	0.35
4	1000658	Marshlands	0.32	0.32	0.98	0.97	1	0.99	1	0.31
5	1000754	Para Swamp	0.37	0.81	0.65	0.97	1	0.48	1	0.18
6	1000433	Former Havelock Swamp Forest	0.43	0.49	0.82	0.97	1	0.99	1	0.42
7	1000795	Rarangi Swamp	0.56	0.37	0.97	0.97	1	0.92	1	0.34
8	1000562	Island Lake Slope Wetland	0.47	0.52	1	0.97	1	0.99	1	0.46
9	1000434	Former Kaituna Wetlands	0.31	0.53	0.88	0.97	1	0.99	1	0.30
10	1000325	Clarence River Wetland12	0.78	0.44	1	0.98	0.83	0.99	1	0.36
11	1000563	Island Lake Stream Wetland	0.33	0.52	1	0.98	1	0.99	1	0.33
12	1001202	Riparian forest remnant Wetland	0.79	1	0.84	0.97	1	0.99	1	0.78
13	1000780	Pukaka Swamp	0.55	0.68	0.77	0.98	0.84	0.84	1	0.38
14	1000245	Cabbage Tree Gully Swamp	0.30	0.45	0.99	0.98	1	0.99	1	0.30
15	1000241	Brown River Forest	0.73	0.30	0.99	0.97	0.84	0.99	1	0.25
16	1000560	Island Gully Wetland3	0.97	0.44	1	0.97	1	0.99	1	0.43
17	1000403	Eves Stream Wetlands3	0.97	0.30	1	0.97	1	0.99	1	0.30
18	1000531	Hillersden Stream Wetland	0.30	0.30	1	0.98	1	0.99	1	0.30
19	1001063	Two Bay Swamp	0.91	0.30	1	0.98	1	0.99	1	0.30
20	1000558	Island Gully Wetland1	0.94	0.30	0.90	0.97	1	0.99	1	0.30
24	1001200	lowland swamp Wetland	0.45	1	1	0.98	1	0.99	1	0.44

13. Mokau



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Seepage
Current (ha)	1208.3	96.1	5.6	836.7	253.5	16.4
Historic (ha)	(23638)	(715)	(371)	(17411)	(5126)	*(15)*

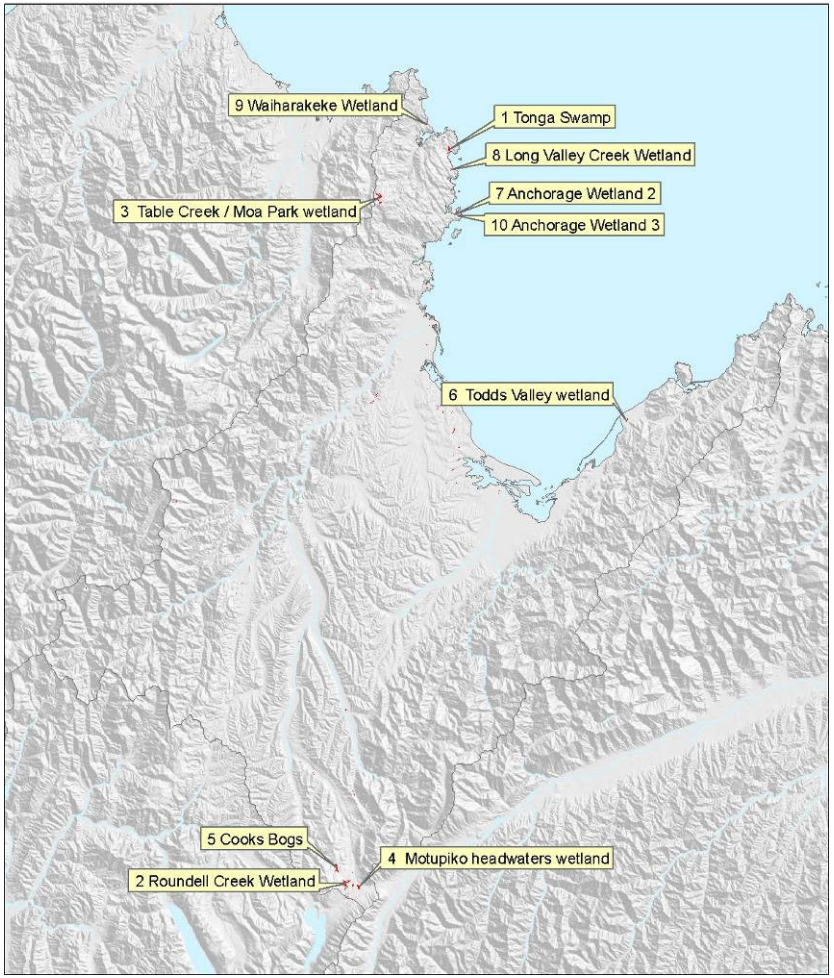
Rank	Idunique	Names	Map sheet	Easting	Northing	area	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Seepage
1	600844	Hutiwai Wetland	r18	2654309	6263464	239.6	0.67	0.20	0.97	0.30			24% (1%)	16% (1%)	
2	509498	Waitaanga	r18	2668214	6267017	158.2	0.76	0.33	0.97	0.30			42% (2%)	20% (1%)	
3	300117	Toreparu stream Wetland	r15	2669542	6361852	224.0	0.79	0.52	0.29	0.30			66% (3%)	31% (2%)	
4	300129	Tauhua stream Wetland	r16	2660773	6326197	76.6	0.81	0.58	0.75	0.41	57% (8%)		68% (3%)	35% (2%)	
5	600881	Taramoukou Wetland	q19	2628777	6232530	33.9	0.82	0.61	0.85	0.30	57% (8%)		72% (3%)	35% (2%)	
6	600210	Mangaonga stream	q19	2633833	6241838	33.9	0.83	0.64	0.81	0.30	57% (8%)		76% (4%)	35% (2%)	
7	600205	Mangamaio stream	q19	2641707	6244024	21.8	0.84	0.66	0.77	0.30	57% (8%)		79% (4%)	35% (2%)	
8	300135	Marokopa River Wetland	r16	2662767	6322241	32.9	0.85	0.69	0.78	0.43	88% (12%)		79% (4%)	36% (2%)	
9	300180	Mokauiti road Wetland	s17	2694342	6288485	20.9	0.85	0.70	0.42	0.30	88% (12%)		81% (4%)	37% (2%)	
10	300152	Mokau River Wetland	s17	2691315	6306564	36.6	0.85	0.74	0.22	0.30	88% (12%)		85% (4%)	40% (2%)	
11	300105	0	r14	2673042	6383959	28.1	0.86	0.76	0.31	0.30	88% (12%)		86% (4%)	45% (2%)	
12	300113	0	r15	2678545	6368850	23.6	0.86	0.78	0.30	0.30	88% (12%)		88% (4%)	48% (2%)	
13	600184	Herbaceous Freshwater Vegetation	r18	2663847	6250907	24.6	0.86	0.80	0.30	0.30	88% (12%)		88% (4%)	58% (3%)	
14	300502	lowland podocarp hardwood swamp forest remnant	s17	2695903	6299107	19.2	0.86	0.82	0.35	0.30	88% (12%)		88% (4%)	65% (3%)	
15	300176	0	r17	2686220	6290419	14.0	0.87	0.83	0.34	0.30	88% (12%)		90% (4%)	65% (3%)	
16	300182	0	s17	2695262	6287162	12.6	0.87	0.84	0.35	0.30	88% (12%)		91% (4%)	68% (3%)	
17	600843	Mohakatino Swamp	r18	2650313	6273842	6.6	0.87	0.84	0.50	0.30	88% (12%)		91% (4%)	68% (3%)	
18	500217	0	r18	2665521	6250209	12.9	0.87	0.85	0.31	0.30	88%		91%	73%	

Rank	Idunique	Names	Map sheet	Easting	Northing	area	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Seepage
											(12%)		(4%)	(4%)	
19	600212	Herbaceous Freshwater Vegetation	q19	2635132	6242866	5.0	0.87	0.86	0.58	0.30	88% (12%)		92% (4%)	73% (4%)	
20	300130	0	r16	2670155	6325994	7.8	0.87	0.86	0.36	0.30	88% (12%)		93% (4%)	73% (4%)	
28	300143	0	r16	2682553	6313593	10.6	0.88	0.92	0.30	0.37	95% (13%)	42% (1%)	96% (4%)	86% (4%)	
30	600267	0	q19	2637640	6223074	3.0	0.88	0.93	0.73	0.33	95% (13%)	42% (1%)	96% (4%)	90% (5%)	1% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	600844	Hutiwai Wetland	0.99	1	1	0.98	1	0.99	1	0.97
2	509498	Waitaanga	0.98	1	1	0.98	1	0.99	1	0.97
3	300117	Toreparu stream Wetland	0.31	0.54	1	0.94	1	0.95	1	0.29
4	300129	Tauhua stream Wetland	0.94	0.76	1	0.98	1	0.99	1	0.75
5	600881	Taramoukou Wetland	0.99	1	0.86	0.98	1	0.99	1	0.85
6	600210	Mangaonga stream	0.89	0.83	0.99	0.97	1	0.99	1	0.81
7	600205	Mangamaio stream	0.81	0.79	0.99	0.97	1	0.99	1	0.77
8	300135	Marokopa River Wetland	0.99	0.98	1	0.95	0.84	0.99	1	0.78
9	300180	Mokauiti road Wetland	0.43	0.56	1	0.97	1	0.99	1	0.42
10	300152	Mokau River Wetland	0.31	0.31	0.96	0.95	0.80	0.89	1	0.22
11	300105	0	0.32	0.59	1	0.95	1	0.99	1	0.31
12	300113	0	0.30	0.32	1	0.91	1	0.99	1	0.30
13	600184	Herbaceous Freshwater Vegetation	0.31	0.47	1	0.88	1	0.99	1	0.30
14	300502	lowland podocarp hardwood swamp forest remnant	0.35	0.41	0.99	0.96	1	0.99	1	0.35
15	300176	0	0.35	0.47	0.85	0.91	1	0.98	1	0.34
16	300182	0	0.91	0.35	1	0.98	1	0.99	1	0.35
17	600843	Mohakatino Swamp	0.75	0.51	0.92	0.98	1	0.99	1	0.50
18	500217	0	0.31	0.37	0.94	0.91	1	0.99	1	0.31
19	600212	Herbaceous Freshwater Vegetation	0.92	0.59	0.99	0.98	1	0.99	1	0.58
20	300130	0	0.48	0.66	0.46	0.96	0.80	0.98	1	0.36
28	300143	0	0.30	0.50	1	0.94	1	0.99	1	0.30
30	600267	0	0.87	0.74	1	0.95	1	0.99	1	0.73

14. Motueka–Nelson



Current and historic extent (hectares) in each wetland class.

	Total	Fen	Swamp	Marsh	Seepage
Current (ha)	272.8	58.6	95.2	97.8	21.1
Historic (ha)	(5802)	*(0)*	(5379)	(382)	(41)

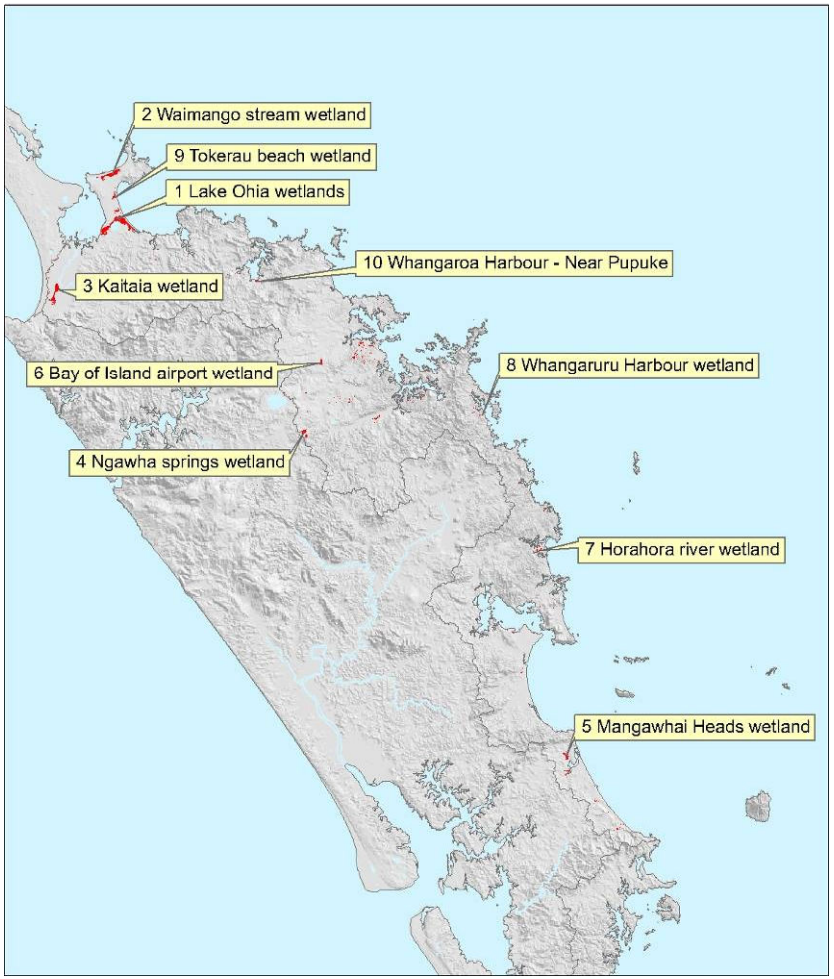
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
1	900752	Tonga Swamp	n26	2514192	6036421	18.3	0.51	0.07	0.97	0.20		19% (<1%)		
2	900637	Roundell Creek Wetland	n29	2500342	5937423	45.7	0.68	0.24	0.88	0.63	9% (–)	19% (<1%)	42% (11%)	
3	900851	Table Creek/ Moa park Wetland	n26	2504733	6029953	34.7	0.76	0.36	0.97	1	68% (–)	19% (<1%)	42% (11%)	
4	900861	Motupiko headwaters Wetland	n29	2501975	5936979	15.9	0.79	0.42	0.91	0.58	68% (–)	19% (<1%)	58% (15%)	
5	900107	Cooks Bogs	n29	2499016	5939579	23.8	0.83	0.51	0.90	0.90	99% (–)	19% (<1%)	64% (16%)	
6	900853	Todds Vally Wetland	o27	2538152	5999839	4.0	0.83	0.52	0.88	0.20	99% (–)	24% (<1%)	64% (16%)	
7	900008	Anchorage Wetland 2	n26	2514777	6027629	3.6	0.84	0.54	0.97	0.20	99% (–)	27% (<1%)	64% (16%)	
8	900483	Long Valley Creek Wetland	n26	2514393	6033733	3.5	0.85	0.55	0.96	0.20	99% (–)	31% (1%)	64% (16%)	
9	900787	Waiharakeke Wetland	n26	2511136	6039706	3.5	0.85	0.56	0.96	0.20	99% (–)	35% (1%)	64% (16%)	
10	900009	Anchorage Wetland 3	n26	2515362	6027505	2.6	0.85	0.57	0.97	0.20	99% (–)	38% (1%)	64% (16%)	
11	900051	Blue Glen Stream	n29	2501319	5949582	3.2	0.86	0.58	0.61	0.20	99% (–)	41% (1%)	64% (16%)	
12	900582	Porters Hut Wetland	n28	2509099	5950355	2.0	0.86	0.59	0.97	0.20	99% (–)	43% (1%)	64% (16%)	
13	900485	Luna Lake	m28	2465177	5977216	1.9	0.86	0.60	0.94	0.20	99% (–)	45% (1%)	64% (16%)	
14	900413	Motueka State Forest Swamp	n26	2510345	6020162	5.2	0.87	0.62	0.27	0.20	99% (–)	51% (1%)	64% (16%)	
15	900447	Nile Road Wetland	n27	2515478	5994504	4.2	0.87	0.63	0.30	0.20	99% (–)	55% (1%)	64% (16%)	
16	900754	Trafalgar Road Wetland	n27	2514728	5993114	5.0	0.87	0.65	0.26	0.20	99% (–)	60% (1%)	64% (16%)	
17	900638	Ruby Bay Wetland	n27	2514742	5998367	8.5	0.87	0.68	0.12	0.20	99% (–)	69% (1%)	64% (16%)	

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
18	900215	Ex Waiwhero Forest Wetland	n27	2503791	6002232	5.1	0.87	0.70	0.18	0.20	99% (–)	75% (1%)	64% (16%)	
19	900870	Added polygon from satellite image	m27	2477251	5988824	5.4	0.87	0.72	0.45	0.58	99% (–)	75% (1%)	69% (18%)	
20	900032	Awaroa Swamp	n26	2513551	6038045	2.5	0.88	0.73	0.96	0.58	99% (–)	75% (1%)	72% (18%)	
34	900649	Sanctuary Basin Sinkhole	m28	2472661	5965630	1.7	0.89	0.84	0.90	0.77	99% (–)	92% (2%)	83% (21%)	8% (4%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	900752	Tonga Swamp	0.99	0.99	1	0.98	1	0.99	1	0.97
2	900637	Roundell Creek Wetland	0.96	0.89	1	0.96	1	0.99	1	0.88
3	900851	Table Creek/ Moa park Wetland	0.99	1	0.99	0.99	1	0.99	1	0.97
4	900861	Motupiko headwaters Wetland	0.95	0.92	1	0.97	1	0.99	1	0.91
5	900107	Cooks Bogs	0.91	0.94	1	0.95	1	0.99	1	0.90
6	900853	Todds Vally Wetland	0.99	0.90	1	0.99	1	0.99	1	0.88
7	900008	Anchorage Wetland 2	0.99	1	1	0.98	1	0.99	1	0.97
8	900483	Long Valley Creek Wetland	0.99	1	1	0.98	1	0.99	1	0.96
9	900787	Waiharakeke Wetland	0.99	1	1	0.98	1	0.97	1	0.96
10	900009	Anchorage Wetland 3	0.99	1	1	0.98	1	0.99	1	0.97
11	900051	Blue Glen Stream	0.94	0.62	0.86	0.98	1	0.99	1	0.61
12	900582	Porters Hut Wetland	0.99	1	1	0.98	1	0.99	1	0.97
13	900485	Luna Lake	0.99	1	1	0.95	1	0.99	1	0.94
14	900413	Motueka State Forest Swamp	0.30	0.41	0.68	0.98	1	0.89	1	0.27
15	900447	Nile Road Wetland	0.30	0.38	0.85	0.98	1	0.99	1	0.30
16	900754	Trafalgar Road Wetland	0.30	0.41	0.74	0.98	1	0.85	1	0.26
17	900638	Ruby Bay Wetland	0.30	0.35	0.12	0.98	1	0.99	1	0.12
18	900215	Ex Waiwhero Forest Wetland	0.30	0.40	0.67	0.96	0.81	0.73	1	0.18
19	900870	Added polygon from satellite image	0.99	0.46	1	0.99	1	0.99	1	0.45
20	900032	Awaroa Swamp	0.99	1	0.98	0.98	1	0.99	1	0.96
34	900649	Sanctuary Basin Sinkhole	0.99	1	1	0.91	1	0.99	1	0.90

15. Northland – Eastern



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Pakihi/Gumland	Seepage
Current (ha)	3083.8	224.3	21.2	1810.5	169.3	834	24.1
Historic (ha)	(79457)	(6432)	(2320)	(34596)	(10296)	(25812)	*(0)*

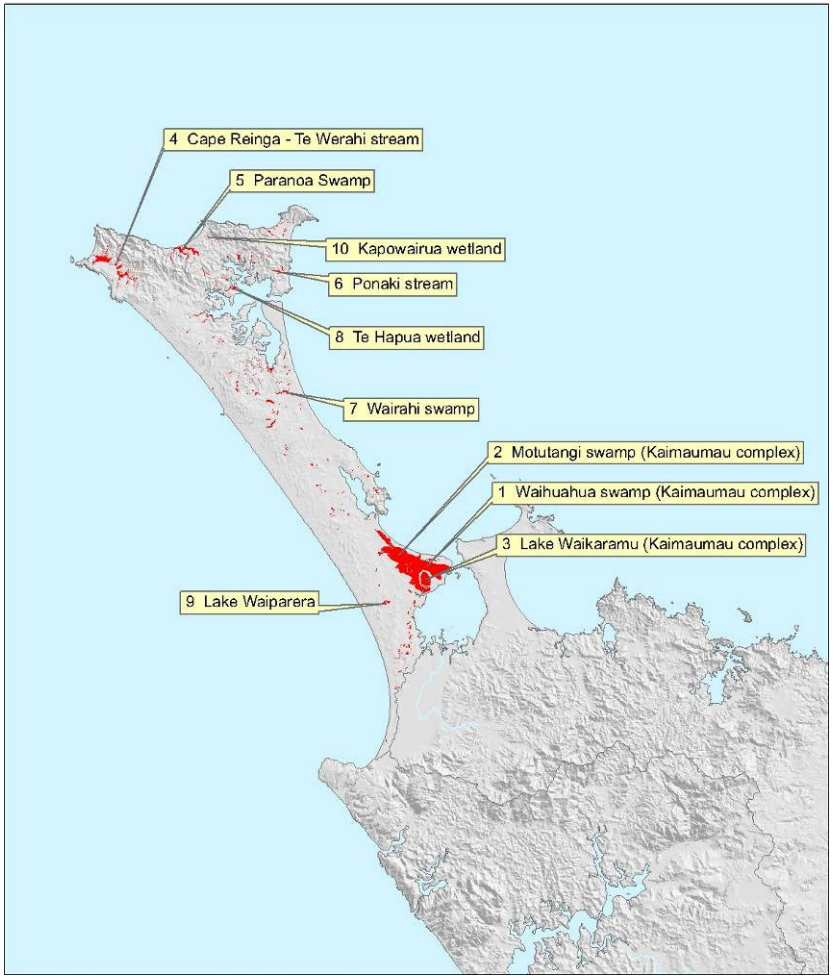
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
1	100594	Lake Ohia Wetlands (Karikari peninsula)	o04	2544694	6692372	826.9	0.52	0.26	0.28	0.27	43% (2%)		13% (1%)	0.2% (<1%)	57% (2%)	
2	100603	Waimango stream Wetland (Karikari peninsula)	o03	2543374	6704401	328.4	0.57	0.37	0.29	0.30	43% (2%)		28% (2%)	0.2% (<1%)	62% (2%)	
3	100601	Kaitaia Wetland	n04	2529950	6675920	327.0	0.60	0.47	0.26	0.31	43% (2%)		46% (2%)	0.2% (<1%)	62% (2%)	
4	100903	Ngawha springs Wetlands	p05	2589305	6642752	89.1	0.62	0.50	0.62	0.29	43% (2%)		50% (3%)	0.2% (<1%)	65% (2%)	
5	102034	Mangawhai Heads Wetland	r08	2651924	6565648	116.6	0.64	0.53	0.37	0.28	43% (2%)		53% (3%)	0.2% (<1%)	71% (2%)	
6	100041	Bay of Island airport Wetland	p05	2593459	6659586	74.3	0.65	0.56	0.47	0.29	43% (2%)		56% (3%)	5% (<1%)	71% (2%)	
7	100116	Horahora River Wetland	q06	2645900	6614636	32.5	0.66	0.57	0.97	0.30	43% (2%)		58% (3%)	5% (<1%)	72% (2%)	
8	100198	Whangaruru Harbour Wetland	q05	2631794	6646978	28.7	0.66	0.58	0.90	0.31	43% (2%)		60% (3%)	5% (<1%)	72% (2%)	
9	102206	Tokerau beach Wetland	o04	2543969	6699129	74.4	0.67	0.60	0.31	0.29	43% (2%)		63% (3%)	9% (<1%)	73% (2%)	
10	100012	Whangaroa Harbour – Pupuke	p04	2578119	6678907	38.6	0.68	0.61	0.59	0.31	43% (2%)		65% (3%)	9% (<1%)	73% (2%)	
11	100212	0	q06	2644854	6615555	21.9	0.68	0.62	0.90	0.30	43% (2%)		66% (4%)	9% (<1%)	73% (2%)	
12	100155	0	p05	2601545	6661027	63.2	0.69	0.64	0.31	0.26	59% (2%)		66% (4%)	12% (<1%)	75% (2%)	
13	102035	0	r08	2652075	6561578	57.1	0.69	0.66	0.30	0.29	59% (2%)		68% (4%)	12% (<1%)	77% (3%)	
14	102209	0	o04	2544683	6695649	57.4	0.70	0.68	0.31	0.30	59% (2%)		71% (4%)	12% (<1%)	78% (3%)	
15	100161	0	p05	2602836	6663906	54.1	0.70	0.69	0.26	0.29	59% (2%)		73% (4%)	17% (<1%)	78% (3%)	
16	102013	0	n03	2508679	6722964	17.1	0.70	0.70	0.86	0.26	66% (3%)		73% (4%)	17% (<1%)	78% (3%)	

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
17	100106	0	p05	2606654	6646092	50.1	0.70	0.71	0.28	0.30	66% (3%)		76% (4%)	18% (<1%)	78% (3%)	
18	100102	0	q05	2614604	6650139	13.4	0.71	0.72	0.92	0.27	66% (3%)		76% (4%)	21% (<1%)	78% (3%)	
19	100274	0	p05	2589870	6641798	32.1	0.71	0.73	0.38	0.30	66% (3%)		78% (4%)	21% (<1%)	79% (3%)	
20	100062	0	q05	2616422	6655709	14.9	0.71	0.73	0.74	0.30	66% (3%)		78% (4%)	21% (<1%)	79% (3%)	
45	100252	0	p05	2605286	6659955	8.6	0.75	0.84	0.29	0.15	77% (3%)	40% (<1%)	87% (5%)	52% (1%)	89% (3%)	
46	100253	0	p05	2606141	6660143	9.4	0.75	0.84	0.30	0.20	77% (3%)	66% (1%)	87% (5%)	52% (1%)	89% (3%)	0.4% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	100594	Lake Ohia Wetlands (Karikari peninsula)	0.35	0.92	0.97	0.99	0.81	0.99	1	0.28
2	100603	Waimango stream Wetland (Karikari peninsula)	0.34	0.78	0.98	1	0.85	0.99	1	0.29
3	100601	Kaitaia Wetland	0.31	0.50	1	0.96	0.85	0.99	1	0.26
4	100903	Ngawha springs Wetlands	0.63	0.83	0.81	0.98	1	0.99	1	0.62
5	102034	Mangawhai Heads Wetland	0.37	0.66	0.93	0.99	1	0.99	1	0.37
6	100041	Bay of Island airport Wetland	0.78	0.47	0.74	0.94	1	0.99	1	0.47
7	100116	Horahora River Wetland	0.98	1	1	0.99	1	0.99	1	0.97
8	100198	Whangaruru Harbour Wetland	0.92	0.96	1	0.98	1	0.99	1	0.90
9	102206	Tokerau beach Wetland	0.32	0.73	0.99	0.99	1	0.97	1	0.31
10	100012	Whangaroa Harbour – Pupuke	0.75	0.71	0.83	0.70	0.85	0.99	1	0.59
11	100212	0	0.97	0.93	0.91	0.99	1	0.99	1	0.90
12	100155	0	0.31	0.48	0.86	0.99	1	0.99	1	0.31
13	102035	0	0.31	0.51	0.96	0.97	1	0.99	1	0.30
14	102209	0	0.31	0.60	0.97	0.99	1	0.99	1	0.31
15	100161	0	0.31	0.67	0.89	0.97	0.85	0.99	1	0.26
16	102013	0	0.92	0.87	1	0.95	1	0.99	1	0.86
17	100106	0	0.34	0.47	0.79	0.96	0.85	0.98	1	0.28
18	100102	0	0.98	0.93	1	0.98	1	0.99	1	0.92
19	100274	0	0.39	0.72	0.96	0.98	1	0.99	1	0.38
20	100062	0	0.96	0.88	0.90	0.98	0.85	0.99	1	0.74
45	100252	0	0.30	0.42	1	0.99	1	0.96	1	0.29
46	100253	0	0.31	0.34	1	0.99	1	0.98	1	0.30

16. Northland – Northern



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Pakihi/Gumland
Current (ha)	5161.6	586.7	7.1	3223.7	735.9	608
Historic (ha)	(27973)	(7705)	(479)	(6809)	*(451)*	(12529)

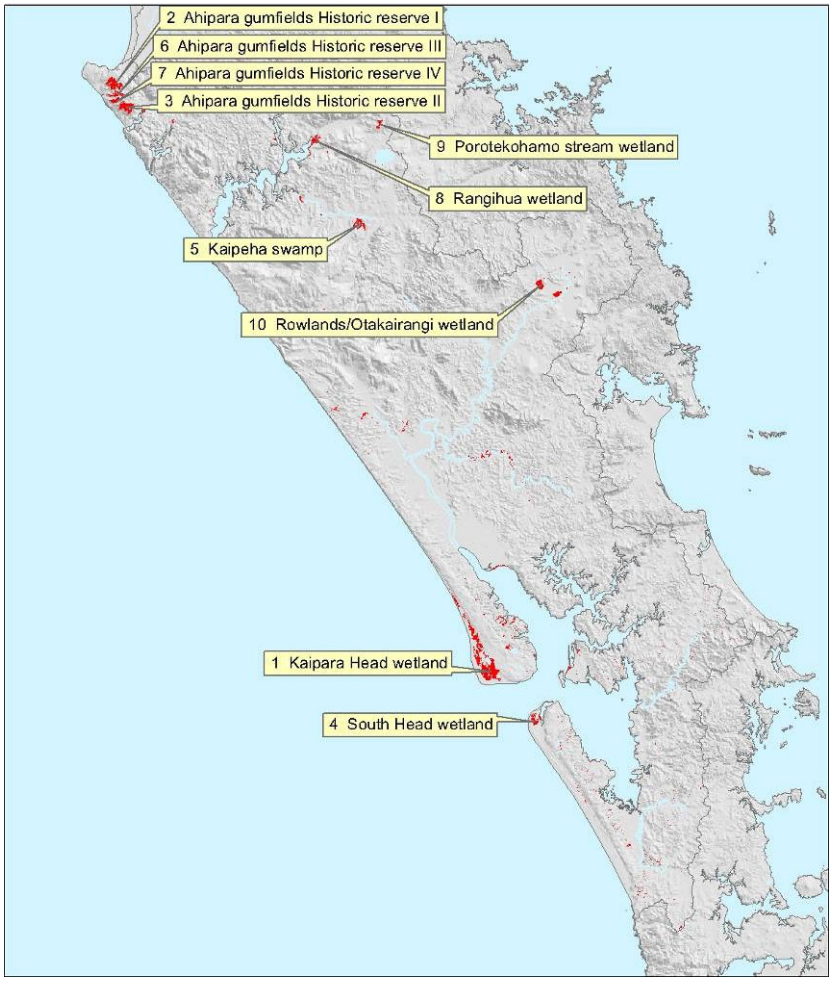
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland
1	100617	Waihuahua swamp (Kaimaumau complex)	o04	2532412	6699571	1588.8	0.69	0.31	0.78	0.50	21% (2%)		18% (8%)	19% (–)	76% (7%)
2	100579	Motutangi swamp (Kaimaumau complex)	n03	2528203	6702203	1343.3	0.76	0.57	0.39	0.80	21% (2%)		54% (23%)	76% (–)	76% (7%)
3	100616	Lake Waikaramu Wetland (Kaimaumau complex)	o04	2532452	6698405	267.1	0.78	0.62	0.72	0.36	61% (5%)		54% (23%)	76% (–)	76% (7%)
4	102108	Cape Reinga – Te Werahi stream	m02	2484061	6747059	458.2	0.81	0.71	0.60	0.72	61% (5%)		69% (29%)	76% (–)	78% (7%)
5	100690	Paranoa Swamp	n02	2495303	6749257	229.0	0.83	0.75	0.95	0.73	61% (5%)		77% (32%)	76% (–)	78% (7%)
6	100661	Ponaki stream Wetland	n02	2509619	6746089	38.3	0.83	0.76	0.97	0.74	61% (5%)		79% (33%)	76% (–)	78% (7%)
7	100566	Wairahi Swamp	n03	2510949	6727253	67.3	0.84	0.77	0.40	0.70	61% (5%)		81% (34%)	76% (–)	79% (7%)
8	100676	Te Hapua Wetland	n02	2502820	6743528	28.5	0.84	0.78	0.92	0.74	61% (5%)		82% (34%)	76% (–)	79% (7%)
9	100503	Lake Waiparera	n04	2526258	6694800	43.7	0.84	0.79	0.44	0.46	67% (6%)		82% (34%)	77% (–)	79% (7%)
10	100672	Kapowairua Wetland	n02	2498897	6751529	13.5	0.84	0.79	0.78	0.30	67% (6%)		82% (34%)	77% (–)	80% (7%)
11	100643	0	n02	2510565	6752159	13.6	0.84	0.79	0.88	0.36	69% (6%)		82% (34%)	77% (–)	80% (7%)
12	100666	0	n02	2508371	6752146	23.8	0.84	0.80	0.74	0.71	69% (6%)		82% (34%)	77% (–)	80% (7%)
13	100626	0	n03	2508658	6722365	42.0	0.84	0.80	0.31	0.43	74% (6%)		83% (35%)	78% (–)	80% (7%)
14	100434	0	n03	2524808	6712007	31.8	0.84	0.81	0.30	0.35	74% (6%)		83% (35%)	78% (–)	83% (7%)
15	100656	0	n02	2505550	6748563	10.1	0.84	0.81	0.97	0.35	75% (6%)		83% (35%)	78% (–)	83% (7%)
16	102020	0	o04	2530747	6694691	20.1	0.85	0.82	0.50	0.36	78% (7%)		83% (35%)	78% (–)	83% (7%)
17	102116	0	n02	2508143	6748874	8.0	0.85	0.82	0.97	0.30	78% (7%)		83% (35%)	78% (–)	84% (7%)

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLef t	Bog	Fen	Swamp	Marsh	Pakihi/ gumland
18	100678	0	n02	2501538	6744936	17.2	0.85	0.82	0.97	0.72	78% (7%)		83% (35%)	78% (–)	84% (7%)
19	100560	0	o04	2530055	6690989	13.0	0.85	0.82	0.60	0.31	78% (7%)		83% (35%)	78% (–)	85% (7%)
20	100677	0	n02	2502003	6743495	16.1	0.85	0.83	0.97	0.72	78% (7%)		84% (35%)	78% (–)	85% (7%)
22	100471	0	n03	2509567	6724144	9.6	0.85	0.83	0.93	0.39	80% (7%)	100% (1%)	84% (35%)	78% (–)	85% (7%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	100617	Waihuahua swamp (Kaimaumau complex)	0.98	0.94	0.99	1	0.85	0.99	1	0.78
2	100579	Motutangi swamp (Kaimaumau complex)	0.47	0.87	1	0.98	0.85	0.99	1	0.39
3	100616	Lake Waikaramu Wetland (Kaimaumau complex)	0.97	0.86	1	0.99	0.85	0.99	1	0.72
4	102108	Cape Reinga – Te Werahi stream	0.61	0.61	0.99	0.99	1	0.99	1	0.60
5	100690	Paranoa Swamp	0.99	0.96	1	1	1	0.99	1	0.95
6	100661	Ponaki stream Wetland	0.99	1	1	1	1	0.99	1	0.97
7	100566	Wairahi Swamp	0.41	0.74	1	0.99	1	0.99	1	0.40
8	100676	Te Hapua Wetland	0.94	1	1	0.98	1	0.99	1	0.92
9	100503	Lake Waiparera	0.45	0.55	1	0.99	1	0.99	1	0.44
10	100672	Kapowairua Wetland	0.85	0.79	0.92	0.99	1	0.99	1	0.78
11	100643		0.97	0.89	1	0.99	1	0.99	1	0.88
12	100666		0.75	0.79	1	0.99	1	0.99	1	0.74
13	100626	0	0.32	0.76	1	0.99	1	0.99	1	0.31
14	100434	0	0.31	0.55	1	0.98	1	0.99	1	0.30
15	100656	0	0.99	1	1	0.99	1	0.99	1	0.97
16	102020	0	0.50	0.76	1	0.99	1	0.99	1	0.50
17	102116	0	0.99	1	1	0.99	1	0.99	1	0.97
18	100678	0	0.99	1	1	0.99	1	0.99	1	0.97
19	100560	0	0.61	0.75	1	0.98	1	0.99	1	0.60
20	100677	0	0.98	1	1	0.99	1	0.99	1	0.97
21	102148	0	0.98	1	1	1	1	0.99	1	0.96
22	100471	0	0.97	0.94	1	0.98	1	0.99	1	0.93

17. Northland – Western



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Seepage
Current (ha)	6847.4	74.6	14.6	4824.0	414.1	1431	89.2
Historic (ha)	(179120)	(3080)	(5141)	(121376)	(18341)	(31175)	(7)

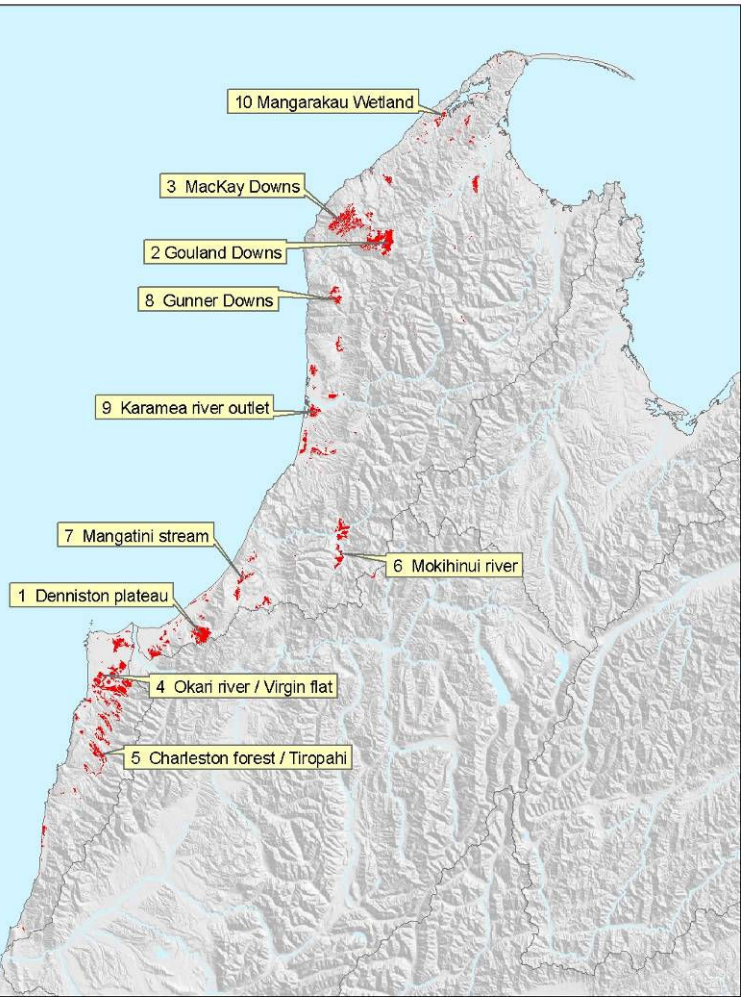
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
1	100827	Kaipara Head Wetland	p09	2604939	6538824	1928.5	0.57	0.28	0.37	0.27			38% (2%)	11% (<1%)		
2	100837	Ahipara gumfields Historic reserve I	n05	2523008	6666139	531.9	0.64	0.35	0.87	0.28			43% (2%)	11% (<1%)	22% (1%)	
3	100840	Ahipara gumfields Historic reserve II	n05	2525821	6660981	493.7	0.69	0.43	0.95	0.29			44% (2%)	11% (<1%)	53% (2%)	
4	200442	South Head Wetland	q09	2616085	6525604	200.0	0.72	0.45	0.95	0.28			48% (2%)	11% (<1%)	53% (2%)	
5	100296	Kaipeha Swamp	p06	2577399	6635163	268.0	0.73	0.49	0.64	0.28			53% (2%)	11% (<1%)	53% (2%)	
6	100838	Ahipara gumfields Historic reserve III	n05	2523672	6663807	214.2	0.75	0.52	0.96	0.29			54% (2%)	11% (<1%)	65% (3%)	
7	100839	Ahipara gumfields Historic reserve IV	n05	2523522	6662571	174.8	0.76	0.55	0.96	0.29			55% (2%)	11% (<1%)	75% (3%)	
8	100742	Rangihua Wetland	o05	2566591	6653333	257.8	0.77	0.59	0.41	0.27			60% (2%)	13% (<1%)	75% (3%)	
9	100923	Porotekohamo stream Wetland	p05	2581759	6657217	105.1	0.78	0.60	0.89	0.29			60% (2%)	13% (<1%)	83% (4%)	
10	100316	Rowlands/Otakairangi Wetland	q06	2617274	6621814	239.7	0.78	0.64	0.24	0.28			65% (3%)	13% (<1%)	83% (4%)	
11	100709	0	n05	2529587	6660340	80.7	0.79	0.65	0.68	0.28			66% (3%)	13% (<1%)	83% (4%)	
12	200445	0	q09	2617204	6526109	44.8	0.79	0.65	0.96	0.28			67% (3%)	13% (<1%)	83% (4%)	
13	100344	0	q06	2621093	6619719	155.5	0.79	0.68	0.24	0.27			70% (3%)	15% (<1%)	83% (4%)	
14	100432	0	p07	2604234	6583736	131.8	0.80	0.69	0.24	0.28			73% (3%)	15% (<1%)	83% (4%)	
15	100408	0	o06	2557358	6612749	77.6	0.80	0.71	0.34	0.28			74% (3%)	15% (<1%)	83% (4%)	
16	100791	0	p07	2578377	6592731	63.3	0.80	0.71	0.39	0.28			76% (3%)	15% (<1%)	83% (4%)	
17	100888	0	p08	2598836	6551532	79.9	0.80	0.73	0.30	0.28			77% (3%)	15% (<1%)	83% (4%)	

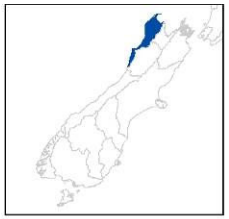
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
18	100775	0	p09	2608141	6548001	39.4	0.80	0.73	0.77	0.26	23% (1%)		77% (3%)	15% (<1%)	85% (4%)	
19	100825	0	p09	2607011	6534896	21.4	0.80	0.73	0.97	0.28	23% (1%)		78% (3%)	15% (<1%)	85% (4%)	
20	100804	0	p07	2571941	6594040	56.2	0.81	0.74	0.31	0.28	23% (1%)		79% (3%)	15% (<1%)	85% (4%)	
41	100776	0	p09	2608811	6547475	19.7	0.82	0.84	0.33	0.26	73% (2%)	79% (<1%)	88% (4%)	38% (1%)	88% (4%)	4% (55%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	100827	Kaipara Head Wetland	0.38	0.82	1	0.98	1	0.99	1	0.37
2	100837	Ahipara gumfields Historic reserve I	0.99	1	0.88	1	1	0.99	1	0.87
3	100840	Ahipara gumfields Historic reserve II	0.99	0.99	1	0.99	1	0.99	1	0.95
4	200442	South Head Wetland	0.97	1	1	0.99	1	0.99	1	0.95
5	100296	Kaipeha Swamp	0.76	0.82	1	0.99	0.85	0.99	1	0.64
6	100838	Ahipara gumfields Historic reserve III	0.99	1	1	0.99	1	0.99	1	0.96
7	100839	Ahipara gumfields Historic reserve IV	0.99	1	1	0.99	1	0.99	1	0.96
8	100742	Rangihua Wetland	0.54	0.90	0.95	0.98	0.78	0.99	1	0.41
9	100923	Porotekohamo stream Wetland	0.98	0.90	1	0.99	1	0.99	1	0.89
10	100316	Rowlands/Otakairangi Wetland	0.31	0.67	1	0.82	0.79	0.99	1	0.24
11	100709	0	0.73	0.69	0.83	0.97	1	0.99	1	0.68
12	200445	0	0.97	1	1	0.99	1	0.99	1	0.96
13	100344	0	0.31	0.69	1	0.74	0.79	0.99	1	0.24
14	100432	0	0.31	0.69	1	0.96	0.79	0.99	1	0.24
15	100408	0	0.34	0.60	1	0.96	1	0.99	1	0.34
16	100791	0	0.47	0.99	1	0.99	0.85	0.99	1	0.39
17	100888	0	0.30	0.58	1	0.98	1	0.99	1	0.30
18	100775	0	0.78	1	0.94	0.99	1	0.99	1	0.77
19	100825	0	0.99	1	1	0.99	1	0.99	1	0.97
20	100804	0	0.31	0.78	0.94	0.89	1	0.99	1	0.31
41	100776	0	0.34	0.79	0.94	0.99	1	0.99	1	0.33

18. Northwest Nelson – Paparoa





Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Seepage
Current (ha)	18073.9	73.2	425.9	1805.9	1219.1	14440	110
Historic (ha)	(66461)	(1960)	(54)	(11702)	(11336)	(41349)	*(61)*

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
1	1100501	Denniston plateau	l29	2410683	5946396	1138.3	0.46	0.06	0.68	0.54		3% (24%)			8% (3%)	
2	900252	Gouland Downs	m26	2452975	6033050	1819.1	0.61	0.16	0.95	0.66		10% (87%)	1% (<1%)	0.27% (<1%)	20% (7%)	
3	1100597	MacKay Downs	k29	2401227	5939618	1714.5	0.69	0.26	0.96	0.66		20% (100%)	1% (<1%)	0.27% (<1%)	32% (11%)	
4	1100464	Okari River / Virgin flat	k29	2385508	5931646	1081.5	0.72	0.32	0.68	0.63		20% (100%)	10% (2%)	0.5% (<1%)	38% (13%)	
5	1100430	Charleston forest / Tiropahi	k30	2380620	5914680	678.3	0.75	0.35	0.96	0.64		20% (100%)	10% (2%)	5% (1%)	42% (15%)	
6	1100558	Mokihinui River	l28	2438117	5977566	1138.2	0.76	0.42	0.53	0.62		20% (100%)	10% (2%)	17% (2%)	49% (17%)	
7	1100517	Mangatini stream	l29	2424596	5946065	516.3	0.78	0.44	0.93	0.65		20% (100%)	11% (2%)	18% (2%)	52% (18%)	
8	1100587	Gunner Downs	m27	2462233	5980542	494.3	0.79	0.47	0.92	0.66		23% (100%)	12% (2%)	18% (2%)	56% (19%)	
9	1100573	Karamea River outlet	l27	2438453	5994089	391.3	0.80	0.49	0.91	0.64		23% (100%)	12% (2%)	20% (2%)	58% (20%)	
10	900501	Mangarakau Wetland	m25	2466983	6062416	270.4	0.81	0.51	0.93	0.47	1% (<1%)	23% (100%)	26% (4%)	20% (2%)	58% (20%)	
11	900016	Aorere Peneplain Pakihi	m25	2475367	6046802	336.0	0.82	0.53	0.95	0.63	1% (<1%)	23% (100%)	26% (4%)	23% (3%)	60% (21%)	
12	1100491	0	k29	2399204	5935003	358.2	0.82	0.55	0.70	0.52	1% (<1%)	23% (100%)	27% (4%)	26% (3%)	62% (22%)	
13	1100518	0	l29	2426862	5942142	265.3	0.83	0.56	0.96	0.53	1% (<1%)	23% (100%)	27% (4%)	27% (3%)	64% (22%)	
14	1100432	0	k30	2379422	5918325	381.4	0.83	0.58	0.59	0.59	1% (<1%)	23% (100%)	27% (4%)	35% (4%)	66% (23%)	
15	1100595	Added polygon from satellite image	l26	2449787	6036060	244.6	0.84	0.59	0.96	0.66	1% (<1%)	24% (100%)	28% (4%)	35% (4%)	68% (24%)	
16	1100457	0	k29	2388299	5928236	298.7	0.85	0.61	0.75	0.65	1% (<1%)	24% (100%)	28% (4%)	35% (4%)	70% (24%)	
17	1100441	0	k30	2386677	5919031	222.8	0.85	0.62	0.96	0.66	1% (<1%)	24% (100%)	28% (4%)	36% (4%)	71% (25%)	

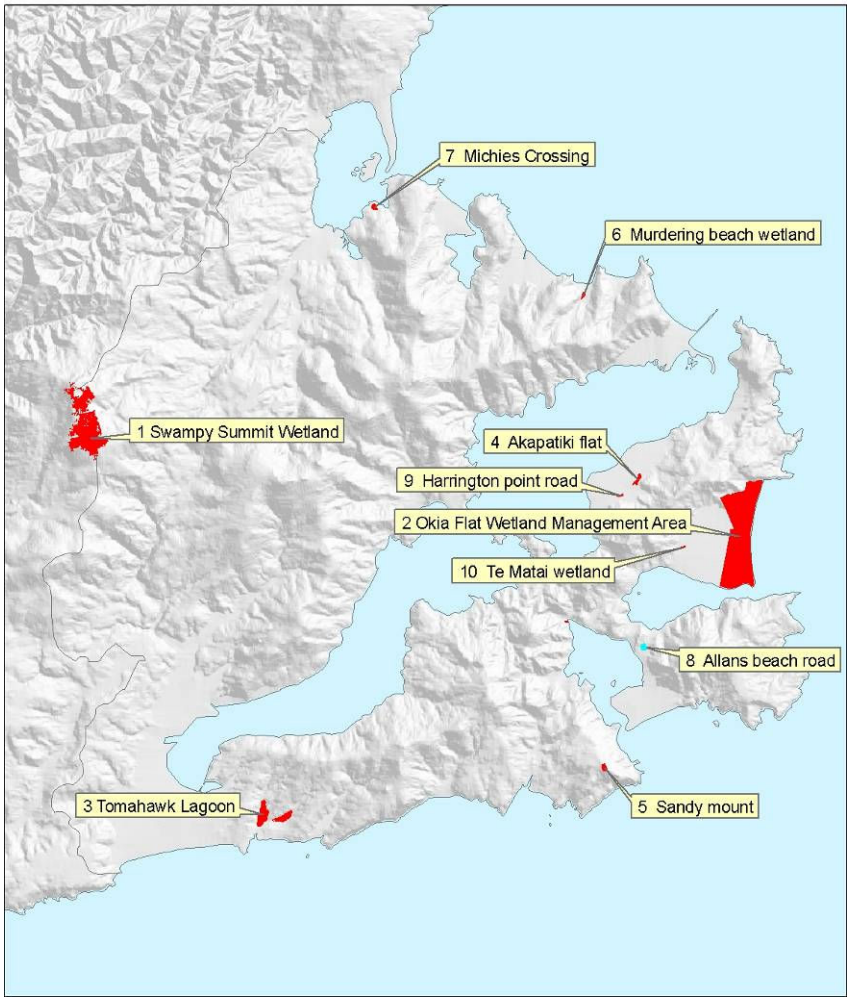
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
18	900488	MacKay Downs 2	l26	2446107	6038622	227.6	0.86	0.64	0.95	0.66	1% (<1%)	24% (100%)	28% (4%)	36% (4%)	73% (25%)	
19	1100577	0	l27	2436469	6002538	144.6	0.86	0.64	0.90	0.42	1% (<1%)	24% (100%)	29% (5%)	46% (5%)	73% (25%)	
20	1100563	Kongahu Swamp	l27	2436685	5987801	363.7	0.86	0.66	0.35	0.45	67% (3%)	24% (100%)	45% (7%)	46% (5%)	73% (25%)	
55	900842	0	m25	2469589	6057389	39.9	0.92	0.91	0.96	0.65	93% (3%)	63% (100%)	70% (11%)	67% (8%)	97% (34%)	4% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1100501	Denniston plateau	0.69	0.76	0.92	0.90	1	0.99	1	0.68
2	900252	Gouland Downs	0.99	1	1	0.99	1	0.99	1	0.95
3	1100597	MacKay Downs	0.99	1	1	0.99	1	0.99	1	0.96
4	1100464	Okari River / Virgin flat	0.77	0.93	0.93	0.99	1	0.99	1	0.68
5	1100430	Charleston forest / Tiropahi	0.99	0.99	1	0.99	1	0.99	1	0.96
6	1100558	Mokihinui River	0.99	0.53	1	0.82	1	0.99	1	0.53
7	1100517	Mangatini stream	0.97	1	0.95	0.96	1	0.99	1	0.93
8	1100587	Gunner Downs	0.99	0.96	1	0.99	1	0.99	1	0.92
9	1100573	Karamea River outlet	0.98	1	1	0.99	1	0.99	1	0.91
10	900501	Mangarakau Wetland	0.98	0.99	0.94	0.98	1	0.99	1	0.93
11	900016	Aorere Peneplain Pakihi	0.99	1	1	0.98	1	0.99	1	0.95
12	1100491	0	0.99	0.71	1	0.92	1	0.99	1	0.70
13	1100518	0	0.99	1	1	0.99	1	0.99	1	0.96
14	1100432	0	0.99	0.60	1	0.96	1	0.99	1	0.59
15	1100595	Added polygon from satellite image	0.99	1	1	0.97	1	0.99	1	0.96
16	1100457	0	0.99	0.76	0.99	0.97	1	0.99	1	0.75
17	1100441	0	0.99	1	1	0.99	1	0.99	1	0.96
18	900488	MacKay Downs 2	0.99	1	1	0.97	1	0.99	1	0.95
19	1100577	0	0.91	1	0.95	0.99	1	0.99	1	0.90
20	1100563	Kongahu Swamp	0.83	1	0.97	0.99	1	0.99	1	0.35
55	900842	0	0.99	1	1	0.99	1	0.99	1	0.96

19. Otago Peninsula

Otago peninsula



Current and historic extent (hectares) in each wetland class.

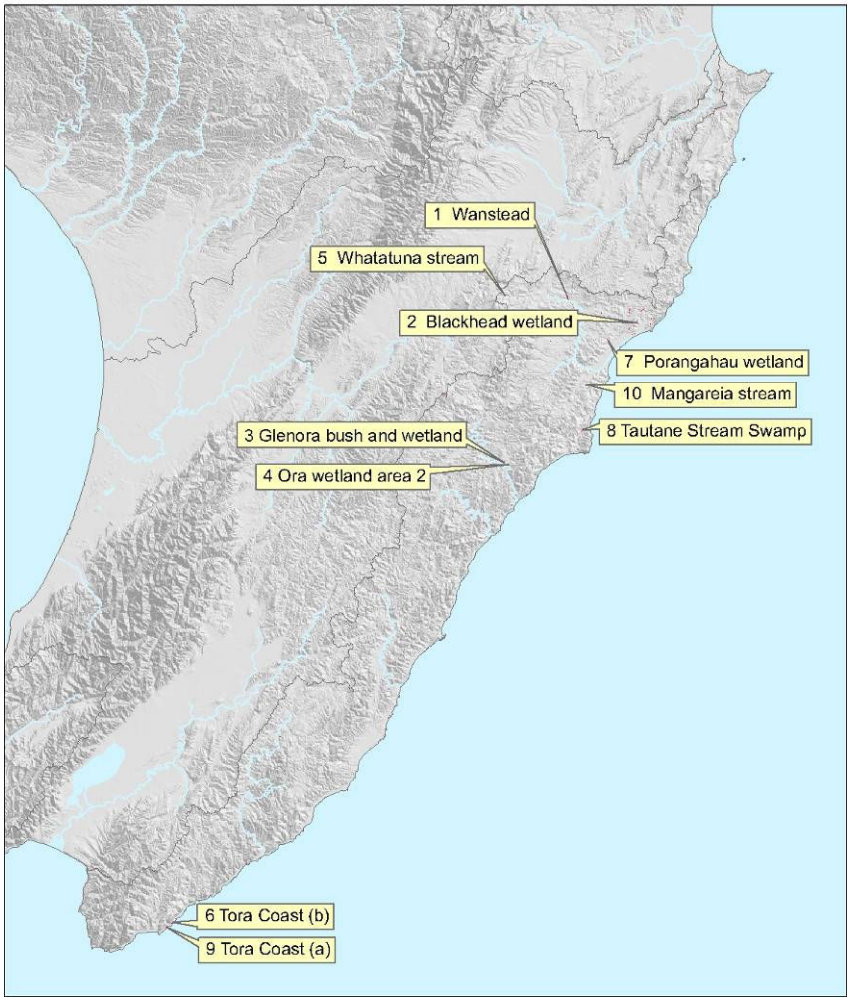
	Total	Fen	Swamp	Marsh	Seepage
Current (ha)	322.1	2.7	283.5	32.1	3.7
Historic (ha)	(930)	*(0)*	(925)	*(0)*	(5)

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
1	1300063	Swampy Summit Wetland	i44	2313992	5487123	121.8	0.70	0.31	0.78	0.62		34% (13%)		
2	1300049	Okia Flat Wetland Management Area	j44	2333171	5483859	236.1	0.80	0.90	0.29	0.63		98% (38%)	21% (–)	
3	1300069	Tomahawk Lagoon	i44	2319402	5475697	26.0	0.81	0.96	0.25	1		98% (38%)	100% (–)	
4	1301975	Akapatiki flat	j44	2330170	5485513	3.8	0.81	0.97	0.30	0.62		99% (38%)	100% (–)	
5	1301997	Sandy mount	i44	2329197	5477094	3.1	0.81	0.98	0.76	0.88		99% (38%)	100% (–)	82% (61%)
6	1303000	Murdering beach Wetland	i44	2328583	5490946	1.8	0.81	0.98	0.30	0.64		99% (39%)	100% (–)	82% (61%)
7	1301940	Michies Crossing	i44	2322455	5493529	2.7	0.82	0.99	0.30	1	100% (–)	99% (39%)	100% (–)	82% (61%)
8	1301996	Allans beach road	j44	2330341	5480625	1.1	0.82	0.99	0.30	0.62	100% (–)	100% (39%)	100% (–)	82% (61%)
9	1301978	Harrington point road	i44	2329666	5485052	1.0	0.82	1	0.30	0.62	100% (–)	100% (39%)	100% (–)	82% (61%)
10	1301981	Te Matai Wetland	j44	2331515	5483549	0.7	0.82	1	0.30	0.65	100% (–)	100% (39%)	100% (–)	82% (61%)
11	1301993	Herbaceous Freshwater Vegetation	i44	2328094	5481361	0.7	0.82	1	0.36	0.88	100% (–)	100% (39%)	100% (–)	100% (74%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1300063	Swampy Summit Wetland	0.98	0.92	0.79	0.97	1	0.99	1	0.78
2	1300049	Okia Flat Wetland Management Area	0.31	0.65	0.99	0.98	1	0.95	1	0.29
3	1300069	Tomahawk Lagoon	0.31	0.61	0.82	0.97	0.82	0.99	1	0.25
4	1301975	Akapatiki flat	0.30	0.33	0.60	0.98	1	0.99	1	0.30
5	1301997	Sandy mount	0.99	0.77	1	0.97	1	0.99	1	0.76
6	1303000	Murdering beach Wetland	0.30	0.30	1	0.98	1	0.99	1	0.30
7	1301940	Michies Crossing	0.69	0.30	1	0.99	1	0.99	1	0.30
8	1301996	Allans beach road	0.35	0.30	0.49	0.98	1	0.99	1	0.30
9	1301978	Harrington point road	0.31	0.30	0.70	0.98	1	0.99	1	0.30
10	1301981	Te Matai Wetland	0.87	0.30	0.67	0.97	1	0.99	1	0.30
11	1301993	Herbaceous Freshwater Vegetation	0.40	0.43	0.37	0.98	1	0.99	1	0.36

20. Palliser–Kidnappers



Current and historic extent (hectares) in each wetland class.

	Total	Fen	Swamp	Marsh	Seepage
Current (ha)	321.2	0	182.6	126.6	12.0
Historic (ha)	(74009)	(306)	(59544)	(14156)	*(4)*

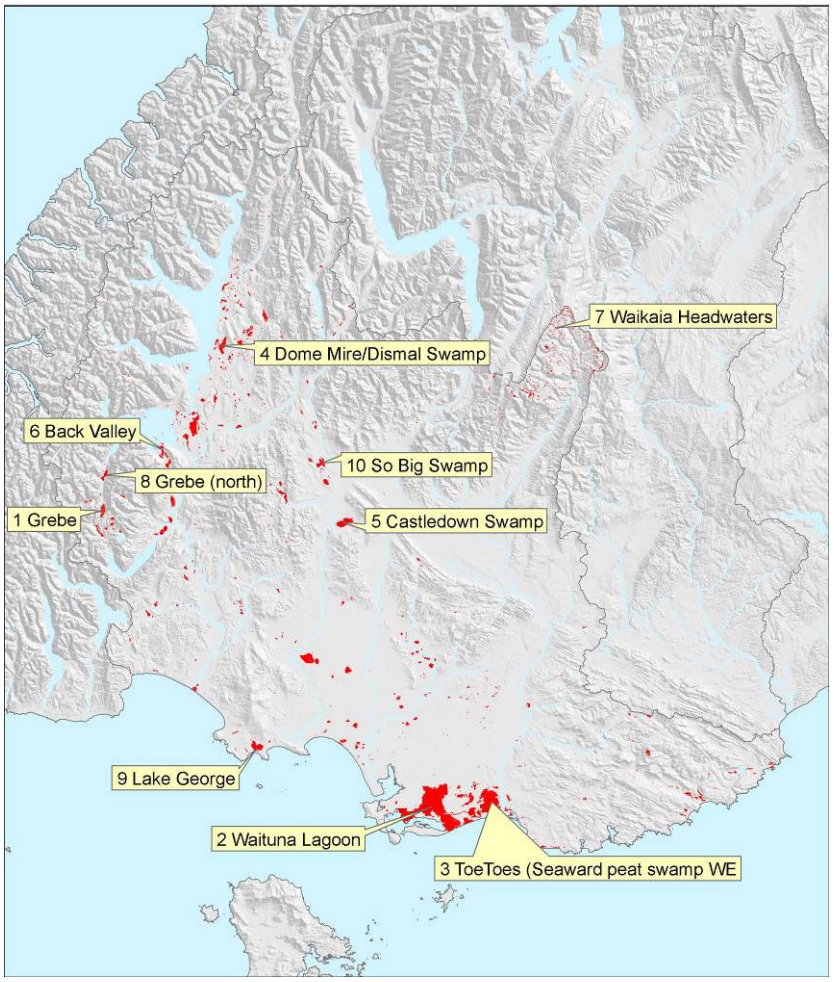
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum.CE	Cum.area	EI index	HLeft	Swamp	Marsh	Seepage
1	701066	Wanstead	v23	2811875	6111018	27.4	0.38	0.08	0.25	0.10	15% (<1%)		
2	702005	Blackhead Wetland	v23	2828029	6105959	27.1	0.46	0.17	0.29	0.12	24% (<1%)	8% (<1%)	
3	503030	Glenora bush and Wetland	u24	2796537	6070790	18.5	0.50	0.22	0.25	0.10	33% (<1%)	9% (<1%)	
4	503031	Ora Wetland area 2	u24	2797386	6070317	10.9	0.52	0.26	0.31	0.10	39% (<1%)	9% (<1%)	
5	509666	Whatatuna stream	u23	2796722	6111451	9.3	0.56	0.29	0.97	0.27	39% (<1%)	16% (<1%)	11% (–)
6	800312	Tora Coast (b)	s28	2716013	5959480	12.5	0.57	0.32	0.30	0.14	41% (<1%)	23% (<1%)	11% (–)
7	701017	Porangahau Wetland	v23	2821727	6100541	8.3	0.58	0.35	0.30	0.10	45% (<1%)	23% (<1%)	11% (–)
8	509097	Tautane Stream Swamp	v24	2815406	6078659	7.6	0.59	0.37	0.30	0.10	49% (<1%)	23% (<1%)	11% (–)
9	800311	Tora Coast (a)	s28	2714529	5958302	12.5	0.61	0.41	0.30	0.15	49% (<1%)	32% (<1%)	11% (–)
10	701003	Mangareia stream	v24	2816250	6089785	7.6	0.61	0.43	0.30	0.10	54% (<1%)	32% (<1%)	11% (–)
11	701024	0	v23	2828010	6102127	9.3	0.62	0.46	0.30	0.15	54% (<1%)	40% (<1%)	11% (–)
12	701059	0	v23	2813237	6109077	5.8	0.63	0.48	0.30	0.10	57% (<1%)	40% (<1%)	11% (–)
13	701179	0	v21	2849802	6165114	5.7	0.63	0.50	0.30	0.10	60% (<1%)	40% (<1%)	11% (–)
14	701002	0	v24	2816890	6088598	5.2	0.64	0.51	0.30	0.10	63% (<1%)	40% (<1%)	11% (–)
15	701156	0	v22	2848138	6156579	6.1	0.64	0.53	0.25	0.10	66% (<1%)	40% (<1%)	11% (–)
16	701051	0	v23	2830141	6107961	6.4	0.65	0.55	0.30	0.13	68% (<1%)	42% (<1%)	11% (–)
17	800293	Owahanga Coast (Chimnes)	u25	2787477	6044148	4.9	0.65	0.57	0.30	0.10	70% (<1%)	42% (<1%)	11% (–)
18	509086	Oporae Wetland Complex	u24	2782364	6086546	10.9	0.66	0.60	0.30	0.21	70% (<1%)	50% (<1%)	16% (–)

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum.CE	Cum.area	EI index	HLeft	Swamp	Marsh	Seepage
19	800247	HOOSON	s28	2717683	5974867	4.8	0.67	0.62	0.30	0.10	73% (<1%)	50% (<1%)	16% (–)
20	701133	0	w22	2851560	6147626	4.7	0.67	0.63	0.36	0.14	73% (<1%)	53% (<1%)	16% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	701066	Wanstead	0.30	0.46	0.64	0.97	1	0.82	1	0.25
2	702005	Blackhead Wetland	0.30	0.30	1	0.98	1	0.97	1	0.29
3	503030	Glenora bush and Wetland	0.30	0.43	1	0.97	0.85	0.99	1	0.25
4	503031	Ora Wetland area 2	0.31	0.55	1	0.98	1	0.99	1	0.31
5	509666	Whatatuna stream	0.99	1	1	0.99	1	0.99	1	0.97
6	800312	Tora Coast (b)	0.34	0.30	1	0.99	1	0.99	1	0.30
7	701017	Porangahau Wetland	0.30	0.43	1	0.99	1	0.99	1	0.30
8	509097	Tautane Stream Swamp	0.31	0.37	1	0.97	1	0.99	1	0.30
9	800311	Tora Coast (a)	0.34	0.30	1	0.99	1	0.99	1	0.30
10	701003	Mangareia stream	0.30	0.30	1	0.97	1	0.99	1	0.30
11	701024	0	0.30	0.38	1	0.98	1	0.99	1	0.30
12	701059	0	0.30	0.62	0.98	0.97	1	0.99	1	0.30
13	701179	0	0.30	0.48	1	0.95	1	0.99	1	0.30
14	701002	0	0.30	0.30	1	0.97	1	0.99	1	0.30
15	701156	0	0.30	0.53	0.94	0.97	0.84	0.99	1	0.25
16	701051	0	0.30	0.30	1	0.98	1	0.99	1	0.30
17	800293	Owahanga Coast (Chimnes)	0.30	0.30	1	0.97	1	0.99	1	0.30
18	509086	Oporae Wetland Complex	0.30	0.39	1	0.96	1	0.99	1	0.30
19	800247	HOOSON	0.30	0.44	1	0.98	1	0.97	1	0.30
20	701133	0	0.37	0.45	0.71	0.98	1	0.98	1	0.36

21. Southland



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Seepage
Current (ha)	32943.4	12868.6	8673.4	8887.4	1258.4	984	272
Historic (ha)	(415785)	(36209)	(86264)	(250924)	(36058)	(5927)	(404)

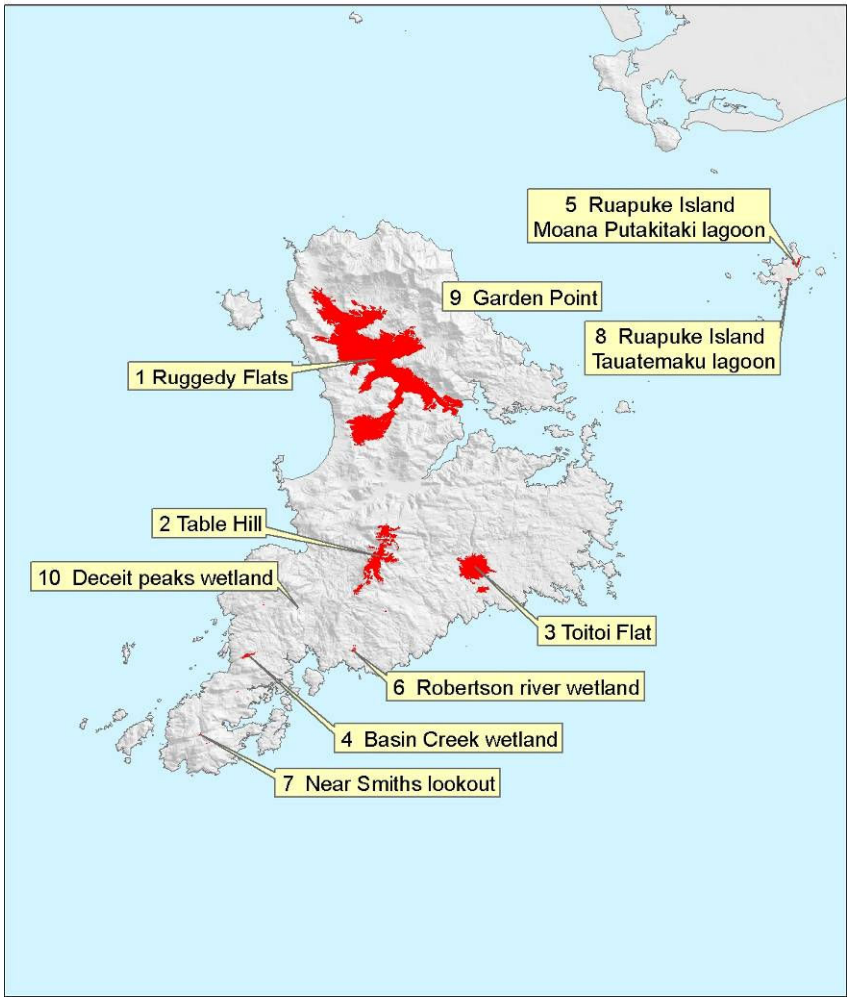
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
1	1400255	Grebe	c44	2069291	5482840	311.6	0.30	0.01	0.95	0.27		0.1% (<1%)	3% (<1%)			
2	1400237	Waituna Lagoon	e47	2163947	5398336	8608.0	0.58	0.27	0.41	0.58	50% (18%)	10% (1%)	16% (1%)	6% (<1%)	10% (2%)	
3	1400239	ToeToes (Seaward peat swamp WE	f47	2179699	5400022	2717.1	0.65	0.36	0.72	0.61	68% (24%)	10% (1%)	19% (1%)	6% (<1%)	25% (4%)	
4	1400010	Dome Mire/Dismal Swamp	d42	2103524	5530014	492.7	0.66	0.37	0.79	0.34	68% (24%)	14% (1%)	21% (1%)	6% (<1%)	25% (4%)	
5	1400227	Castledown Swamp	e44	2138540	5479380	831.9	0.67	0.40	0.46	0.40	68% (24%)	23% (2%)	22% (1%)	6% (<1%)	25% (4%)	
6	1400048	Back Valley	c44	2086991	5498229	523.0	0.68	0.41	0.95	0.41	68% (24%)	23% (2%)	23% (1%)	6% (<1%)	62% (10%)	
7	1400202	Waikaia Headwaters	f42	2199914	5537477	372.7	0.69	0.42	0.91	0.40	68% (24%)	28% (3%)	23% (1%)	6% (<1%)	62% (10%)	
8	1400298	Grebe (north)	c44	2069881	5492913	243.4	0.69	0.43	0.95	0.26	68% (24%)	28% (3%)	26% (1%)	6% (<1%)	62% (10%)	
9	1400110	Lake George	d46	2113224	5415756	574.3	0.70	0.45	0.39	0.26	68% (24%)	28% (3%)	33% (1%)	7% (<1%)	62% (10%)	
10	1400248	So Big Swamp	e44	2131574	5496314	339.3	0.70	0.46	0.71	0.40	68% (24%)	32% (3%)	33% (1%)	7% (<1%)	62% (10%)	
11	1400028	Kepler Mire	d43	2095372	5506976	912.7	0.71	0.49	0.30	0.43	70% (25%)	33% (3%)	38% (1%)	7% (<1%)	62% (10%)	
12	1400335	Waghorn Wetland NHF	f47	2174231	5397056	483.4	0.71	0.50	0.37	0.29	70% (25%)	33% (3%)	43% (2%)	7% (<1%)	67% (11%)	
13	1400270	Blue Lakes Wetlands	f43	2191260	5516486	227.3	0.72	0.51	0.91	0.40	70% (25%)	36% (3%)	43% (2%)	7% (<1%)	67% (11%)	
14	1410673	Herbaceous Freshwater Vegetat	c44	2068290	5476948	175.0	0.72	0.51	0.94	0.28	70% (25%)	36% (3%)	45% (2%)	7% (<1%)	68% (11%)	
15	1400007	Dunton Swamp	d42	2115576	5538422	240.6	0.73	0.52	0.84	0.39	70% (25%)	39% (4%)	45% (2%)	7% (<1%)	68% (11%)	
16	1400157	Bayswater Swamp	d45	2128185	5440652	892.9	0.73	0.55	0.38	0.59	76% (27%)	39% (4%)	46% (2%)	7% (<1%)	68% (11%)	
17	1400374	Obrien NHF Acquisition (north)	c44	2089261	5485447	264.8	0.74	0.56	0.68	0.35	76% (27%)	41% (4%)	48% (2%)	7% (<1%)	68% (11%)	

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
18	1400009	Southern Snowdon Wetland	d42	2108586	5530794	192.8	0.74	0.56	0.96	0.38	76% (27%)	43% (4%)	48% (2%)	7% (<1%)	68% (11%)	
19	1400297	Braxton Burn Bog	e44	2132995	5490935	178.2	0.74	0.57	0.92	0.40	76% (27%)	45% (4%)	48% (2%)	7% (<1%)	68% (11%)	
20	1400137	Mistake Block Takitimu Mountai	d44	2120952	5487136	276.2	0.75	0.58	0.52	0.32	76% (27%)	46% (4%)	49% (2%)	14% (1%)	68% (11%)	
173	1410484	Herbaceous Freshwater Vegetat	f43	2185973	5516525	21.2	0.83	0.85	0.92	0.50	93% (33%)	85% (8%)	79% (3%)	65% (2%)	86% (14%)	2% (1%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1400255	Grebe	0.99	1	1	0.99	1	0.99	1	0.95
2	1400237	Waituna Lagoon	0.49	0.87	0.99	1	0.84	0.99	1	0.41
3	1400239	ToeToes (Seaward peat swamp WE	0.96	0.74	1	1	1	0.99	1	0.72
4	1400010	Dome Mire/Dismal Swamp	0.80	0.92	1	0.99	1	0.99	1	0.79
5	1400227	Castledown Swamp	0.56	0.94	1	1	0.84	0.99	1	0.46
6	1400048	Back Valley	0.99	1	1	1	1	0.99	1	0.95
7	1400202	Waikaia Headwaters	0.99	1	1	0.92	1	0.99	1	0.91
8	1400298	Grebe (north)	0.99	0.98	0.97	0.96	1	0.99	1	0.95
9	1400110	Lake George	0.82	0.48	0.94	0.97	0.82	0.98	1	0.39
10	1400248	So Big Swamp	0.89	0.86	1	0.99	0.84	0.99	1	0.71
11	1400028	Kepler Mire	0.37	0.61	1	1	0.84	0.99	1	0.30
12	1400335	Waghorn Wetland NHF	0.44	0.73	0.98	1	0.84	0.99	1	0.37
13	1400270	Blue Lakes Wetlands	0.99	1	1	0.95	1	0.99	1	0.91
14	1410673	Herbaceous Freshwater Vegetat	0.99	1	1	0.99	1	0.99	1	0.94
15	1400007	Dunton Swamp	0.98	0.85	1	0.99	1	0.99	1	0.84
16	1400157	Bayswater Swamp	0.38	0.62	1	0.99	1	0.99	1	0.38
17	1400374	Obrien NHF Acquisition (north)	0.97	0.69	1	0.99	1	0.99	1	0.68
18	1400009	Southern Snowdon Wetland	0.99	0.97	1	1	1	0.99	1	0.96
19	1400297	Braxton Burn Bog	0.95	0.94	1	0.99	1	0.99	1	0.92
20	1400137	Mistake Block Takitimu Mountai	0.96	0.63	1	0.98	0.84	0.99	1	0.52
173	1410484	Herbaceous Freshwater Vegetat	0.99	1	1	0.93	1	0.99	1	0.92

22. Stewart Island



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp
Current (ha)	12552	7173	5238.9	140
Historic (ha)	(12552)	(7173)	(5238.9)	(140)

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp
1	1400174	Ruggedy Flats	d48	2116592	5361486	10148.5	0.94	0.81	0.97	1	68% (68%)	100% (100%)	
2	1400261	Table Hill	d49	2116948	5337529	1213.6	0.97	0.91	0.97	1	85% (85%)	100% (100%)	
3	1400196	Toitoi Flat	d49	2128805	5335894	1026.8	0.99	0.99	0.97	1	100% (100%)	100% (100%)	
4	1411017	Basin Creek	d49	2100601	5325206	46.0	0.99	0.99	0.97	1	100% (100%)	100% (100%)	33% (33%)
5	1411004	Ruapuke Island / Moana Putakitaki lagoon	e48	2168793	5373992	49.0	0.99	0.99	0.72	1	100% (100%)	100% (100%)	68% (68%)
6	1411016	Robertson River Wetland	d49	2113765	5325986	31.7	0.99	1	0.97	1	100% (100%)	100% (100%)	90% (90%)
7	1411019	Near Smiths lookout	d50	2094622	5315441	6.4	0.99	1	0.97	1	100% (100%)	100% (100%)	90% (100%)
8	1411006	Ruapuke Island / Tauatemaku lagoon	e48	2167755	5371971	13.4	0.99	1	0.43	1	100% (100%)	100% (100%)	100% (100%)
9	1411007	Garden point	d48	2127815	5369038	2.1	0.99	1	0.97	1	100% (100%)	100% (100%)	100% (100%)
10	1411013	Deceit peaks Wetland	d49	2106814	5331088	3.7	0.99	1	0.97	1	100% (100%)	100% (100%)	100% (100%)
11	1411008	Herbaceous Freshwater Vegetat	d48	2119954	5360852	1.5	0.99	1	0.97	1	100% (100%)	100% (100%)	100% (100%)
12	1411011	Herbaceous Freshwater Vegetat	d49	2102519	5331536	1.9	0.99	1	0.97	1	100% (100%)	100% (100%)	100% (100%)
13	1411015	Herbaceous Freshwater Vegetat	d49	2117707	5330697	2.9	0.99	1	0.97	1	100% (100%)	100% (100%)	100% (100%)
14	1411018	Herbaceous Freshwater Vegetat	d49	2099292	5320697	2.3	0.99	1	0.97	1	100% (100%)	100% (100%)	100% (100%)
15	1411021	Herbaceous Freshwater Vegetat	d50	2095622	5314361	2.3	0.99	1	0.97	1	100% (100%)	100% (100%)	100% (100%)

Ecological integrity index

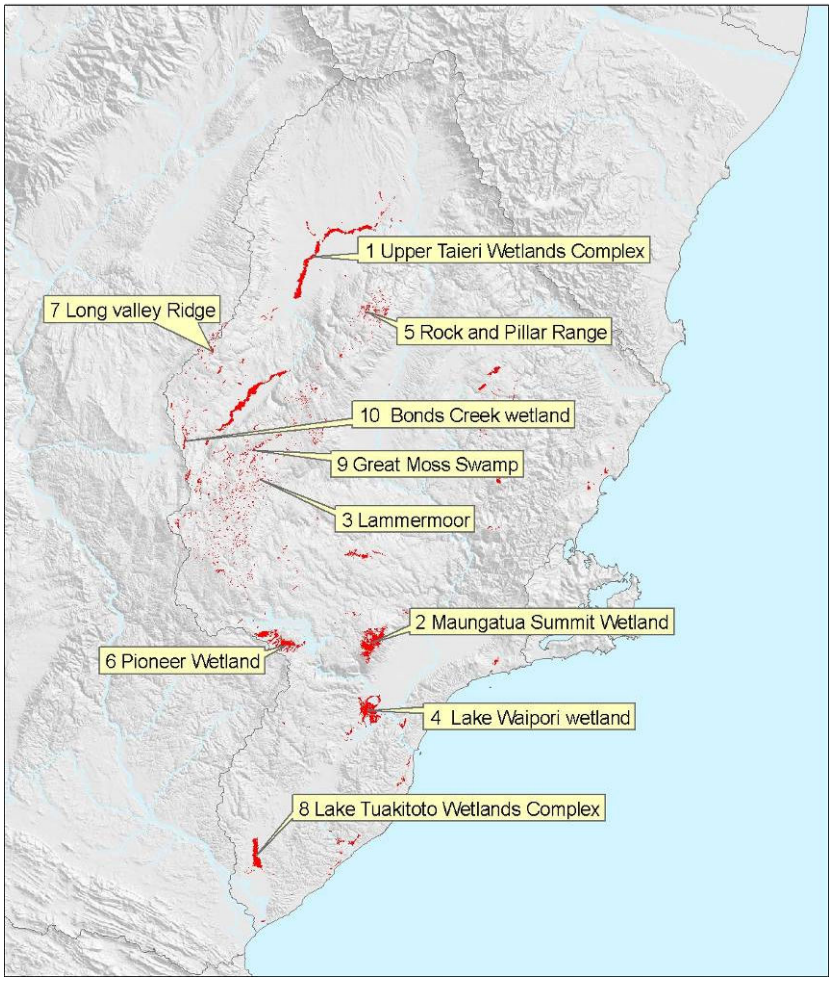
Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1400174	Ruggedy Flats	0.99	1	1	1	1	0.99	1	0.97
2	1400261	Table Hill	0.99	1	1	1	1	0.99	1	0.97
3	1400196	Toitoi Flat	0.99	1	1	1	1	0.99	1	0.97
4	1411017	Basin Creek	0.99	1	1	0.99	1	0.99	1	0.97
5	1411004	Ruapuke Island / Moana Putakitaki lagoon	0.75	0.73	1	0.99	1	0.99	1	0.72
6	1411016	Robertson River Wetland	0.99	1	1	0.99	1	0.99	1	0.97
7	1411019	Near Smiths lookout	0.99	1	1	1	1	0.99	1	0.97
8	1411006	Ruapuke Island / Tauatemaku lagoon	0.79	0.44	1	0.99	1	0.99	1	0.43
9	1411007	Garden point	0.99	1	1	1	1	0.99	1	0.97
10	1411013	Deceit peaks Wetland	0.99	1	1	1	1	0.99	1	0.97
11	1411008	Herbaceous Freshwater Vegetat	0.99	1	1	1	1	0.99	1	0.97
12	1411011	Herbaceous Freshwater Vegetat	0.99	1	1	1	1	0.99	1	0.97
13	1411015	Herbaceous Freshwater Vegetat	0.99	1	1	1	1	0.99	1	0.97
14	1411018	Herbaceous Freshwater Vegetat	0.99	1	1	1	1	0.99	1	0.97
15	1411021	Herbaceous Freshwater Vegetat	0.99	1	1	1	1	0.99	1	0.97

23. Taieri

Taieri

Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Seepage	Inland saline
Current (ha)	11038.6	209.2	4112.4	5784.5	473.8	238.5	220.2
Historic (ha)	(36828)	(1020)	(6181)	(23818)	(4701)	(548)	(559)



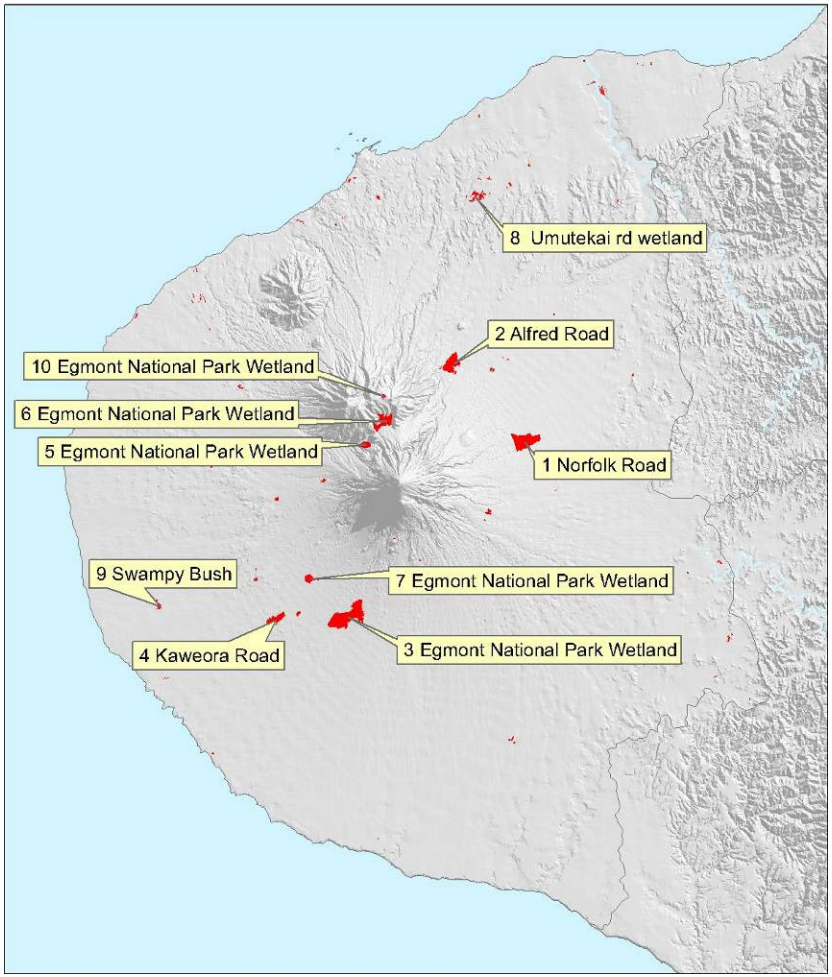
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Seepage	Inland Saline
1	1300072	Upper Taieri Wetlands Complex	h42	2270526	5536776	2349.1	0.54	0.21	0.31	0.56			35% (8%)	37% (4%)		80% (32%)
2	1300043	Maungatua Summit Wetland Management Area	h44	2285712	5477726	1179.9	0.65	0.32	0.91	0.78		21% (14%)	40% (10%)	37% (4%)		80% (32%)
3	1300232	Lammermoor	h43	2260068	5501328	650.0	0.69	0.38	0.87	0.85		37% (25%)	40% (10%)	37% (4%)		80% (32%)
4	1300076	Lake Waipori Wetland	h45	2285053	5464919	967.7	0.70	0.47	0.29	0.57		37% (25%)	57% (14%)	37% (4%)		80% (32%)
5	1300252	Rock and Pillar Range	h42	2285917	5537838	357.6	0.72	0.50	0.95	0.85		45% (30%)	57% (14%)	37% (4%)		80% (32%)
6	1300055	Pioneer Wetland Management Area	h44	2268637	5478035	815.1	0.73	0.58	0.27	0.67		53% (35%)	66% (16%)	37% (4%)		80% (32%)
7	1300249	Long valley Ridge	h42	2256443	5532540	203.2	0.74	0.59	0.93	0.85		58% (39%)	66% (16%)	37% (4%)		80% (32%)
8	1300035	Lake Tuakitoto Wetlands Complex	h46	2264504	5438938	520.8	0.75	0.64	0.22	0.57		58% (39%)	75% (18%)	37% (4%)		80% (32%)
9	1300027	Great Moss Swamp	h43	2263946	5511681	122.3	0.75	0.65	0.93	0.61	43% (9%)	59% (39%)	75% (18%)	37% (4%)		80% (32%)
10	1301693	Bonds Creek Wetland	h43	2251403	5515083	129.9	0.76	0.66	0.88	0.85	43% (9%)	62% (41%)	75% (18%)	37% (4%)		80% (32%)
11	1300057	Red Bank Wetland Management Area	i43	2308189	5527404	140.3	0.76	0.68	0.49	0.57	43% (9%)	62% (41%)	78% (19%)	37% (4%)		80% (32%)
12	1301946	Lammerlaw Range	h44	2257703	5491169	83.1	0.76	0.69	0.96	0.85	43% (9%)	64% (43%)	78% (19%)	37% (4%)		80% (32%)
13	1300117	Clark's Junction Swamp	h44	2283194	5493646	215.6	0.77	0.70	0.31	0.75	43% (9%)	67% (45%)	79% (19%)	38% (4%)		80% (32%)
14	1300243	Red swamp	h43	2252044	5508130	69.6	0.77	0.71	0.95	0.65	63% (13%)	68% (45%)	79% (19%)	38% (4%)		80% (32%)
15	1301768	Herbaceous Freshwater Vegetation	h43	2259392	5511290	59.2	0.77	0.72	0.92	0.85	63% (13%)	69% (46%)	79% (19%)	38% (4%)		80% (32%)
16	1300047	Nenthorn Ridge Wetland Management Area	i43	2305928	5524384	73.1	0.77	0.72	0.48	0.57	63% (13%)	69% (46%)	80% (19%)	38% (4%)		80% (32%)
17	1301686	Herbaceous Freshwater Vegetation	h43	2276419	5516437	52.7	0.78	0.73	0.96	0.85	63% (13%)	71% (47%)	80% (19%)	38% (4%)		80% (32%)

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Seepage	Inland Saline
18	1301337	Herbaceous Freshwater Vegetation	h42	2266073	5537317	22.7	0.78	0.73	0.36	0.56	63% (13%)	71% (47%)	81% (19%)	39% (4%)		83% (33%)
19	1300068	Tokomairiro River Swamp	h45	2280770	5441376	125.5	0.78	0.74	0.24	0.57	63% (13%)	71% (47%)	83% (20%)	39% (4%)		83% (33%)
20	1301738	Herbaceous Freshwater Vegetation	h43	2265208	5513698	40.8	0.78	0.75	0.94	0.69	73% (15%)	71% (47%)	83% (20%)	39% (4%)		83% (33%)
60	1301792	Herbaceous Freshwater Vegetation	i43	2306326	5510019	21.5	0.81	0.85	0.79	0.80	88% (18%)	85% (57%)	90% (22%)	60% (6%)	4% (2%)	99% (39%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1300072	Upper Taieri Wetlands Complex	0.38	0.58	0.98	0.97	0.81	0.98	1	0.31
2	1300043	Maungatua Summit Wetland Management Area	0.98	0.92	1	0.99	1	0.99	1	0.91
3	1300232	Lammermoor	0.98	0.98	0.99	0.88	1	0.99	1	0.87
4	1300076	Lake Waipori Wetland	0.38	0.69	0.94	0.96	0.78	0.97	1	0.29
5	1300252	Rock and Pillar Range	0.99	1	1	0.96	1	0.99	1	0.95
6	1300055	Pioneer Wetland Management Area	0.34	0.55	0.95	0.95	0.80	0.99	1	0.27
7	1300249	Long valley Ridge	0.99	1	0.97	0.94	1	0.99	1	0.93
8	1300035	Lake Tuakitoto Wetlands Complex	0.31	0.39	0.93	0.96	0.80	0.89	1	0.22
9	1300027	Great Moss Swamp	0.99	1	0.99	0.95	1	0.99	1	0.93
10	1301693	Bonds Creek Wetland	0.99	1	1	0.91	1	0.99	1	0.88
11	1300057	Red Bank Wetland Management Area	0.50	0.79	0.94	0.98	1	0.99	1	0.49
12	1301946	Lammerlaw Range	0.99	1	1	0.97	1	0.99	1	0.96
13	1300117	Clark's Junction Swamp	0.31	0.43	1	0.98	1	0.99	1	0.31
14	1300243	Red swamp	0.99	1	1	0.96	1	0.99	1	0.95
15	1301768	Herbaceous Freshwater Vegetation	0.99	0.99	0.95	0.93	1	0.99	1	0.92
16	1300047	Nenthorn Ridge Wetland Management Area	0.49	0.59	1	0.98	1	0.99	1	0.48
17	1301686	Herbaceous Freshwater Vegetation	0.99	1	1	0.97	1	0.99	1	0.96
18	1301337	Herbaceous Freshwater Vegetation	0.57	0.36	1	0.96	1	0.99	1	0.36
19	1300068	Tokomairiro River Swamp	0.30	0.65	0.95	0.97	0.80	0.99	1	0.24
20	1301738	Herbaceous Freshwater Vegetation	0.99	1	1	0.96	1	0.99	1	0.94
60	1301792	Herbaceous Freshwater Vegetation	0.80	0.87	1	0.97	1	0.99	1	0.79

24. Taranaki



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Seepage
Current (ha)	1207.6	83.7	76.4	486.8	544.7	16.1
Historic (ha)	(23117)	*(82)*	(997)	(20166)	(1868)	*(4)*

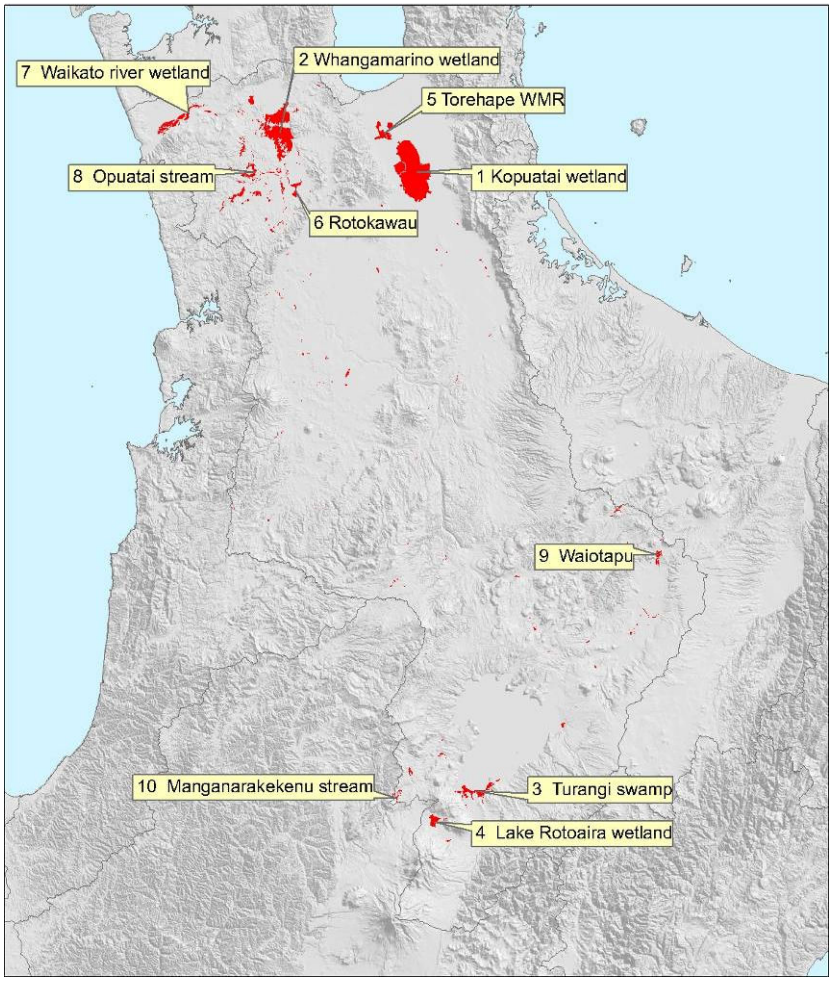
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum CE	Cum.area	EIindex	HLeft	Bog	Fen	Swamp	Marsh	Seepage
1	600927	Norfolk Road	q20	2611768	6214953	199.2	0.60	0.17	0.75	0.23			41% (1%)		
2	600918	Alfred Road	p19	2605941	6221138	133.1	0.69	0.28	0.82	0.23			68% (2%)		
3	600403	Egmont National Park Wetland	p20	2597666	6201022	317.4	0.78	0.54	0.52	0.61			68% (2%)	58% (17%)	
4	600936	Kaweora Road	p20	2591928	6200791	77.5	0.80	0.60	0.55	0.23			84% (2%)	58% (17%)	
5	600410	Egmont National Park Wetland	p20	2599055	6214659	40.7	0.81	0.64	0.95	0.34		50% (4%)	85% (2%)	58% (17%)	
6	600400	Egmont National Park Wetland	p20	2600508	6216505	107.6	0.84	0.73	0.80	0.91	100% (–)	52% (4%)	85% (2%)	62% (18%)	
7	600402	Egmont National Park Wetland	p20	2594687	6204024	42.3	0.85	0.76	0.73	0.61	100% (–)	52% (4%)	85% (2%)	70% (20%)	
8	600914	Herbaceous Freshwater Vegetation	p19	2607972	6234454	45.1	0.85	0.80	0.34	0.38	100% (–)	82% (6%)	88% (2%)	72% (21%)	
9	600935	Swampy Bush	p20	2582605	6201909	18.3	0.86	0.82	0.31	0.23	100% (–)	82% (6%)	92% (2%)	72% (21%)	
10	600401	Egmont National Park Wetland	p20	2600511	6218491	9.5	0.86	0.82	0.95	0.36	100% (–)	95% (7%)	92% (2%)	72% (21%)	
11	600409	Egmont National Park Wetland	p20	2608850	6209248	13.6	0.86	0.84	0.97	0.61	100% (–)	95% (7%)	92% (2%)	75% (22%)	
12	600929	Kahui Road	p20	2592038	6210341	7.0	0.86	0.84	0.52	0.23	100% (–)	95% (7%)	93% (2%)	75% (22%)	
13	600404	Egmont National Park Wetland	p20	2595745	6211806	6.6	0.87	0.85	0.97	0.61	100% (–)	95% (7%)	93% (2%)	76% (22%)	
14	600925	Dudley Road	p19	2609150	6220679	8.3	0.87	0.85	0.24	0.23	100% (–)	95% (7%)	95% (2%)	76% (22%)	
15	600898	Landcorp Looney's Lake	p20	2590348	6203947	5.9	0.87	0.86	0.31	0.23	100% (–)	95% (7%)	96% (2%)	76% (22%)	
16	600890	Herbaceous Freshwater Vegetation	p20	2590547	6217792	4.2	0.87	0.86	0.39	0.23	100% (–)	95% (7%)	97% (2%)	76% (22%)	
17	600211	0	q19	2617871	6242818	15.7	0.87	0.87	0.25	0.61	100% (–)	95% (7%)	97% (2%)	79% (23%)	
18	600932	Mudfish Sites	q20	2628010	6199333	9.0	0.87	0.88	0.33	0.53	100% (–)	95% (7%)	97% (2%)	80% (23%)	

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum CE	Cum.area	EIindex	HLeft	Bog	Fen	Swamp	Marsh	Seepage
19	600956	Wiremu Road	p20	2593749	6201252	7.7	0.87	0.89	0.33	0.59	100% (–)	95% (7%)	97% (2%)	82% (24%)	
20	600911	Lloyds Ponds	p19	2598002	6235803	6.8	0.87	0.89	0.30	0.61	100% (–)	95% (7%)	97% (2%)	83% (24%)	
50	600405	0	p20	2601362	6207204	1.3	0.88	0.97	0.96	1	100% (–)	100% (7%)	100% (2%)	97% (28%)	8% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	600927	Norfolk Road	0.95	0.76	1	0.91	1	0.99	1	0.75
2	600918	Alfred Road	0.98	0.83	0.99	0.98	1	0.99	1	0.82
3	600403	Egmont National Park Wetland	0.96	0.53	0.98	0.97	1	0.99	1	0.52
4	600936	Kaweora Road	0.91	0.56	0.90	0.94	1	0.99	1	0.55
5	600410	Egmont National Park Wetland	0.99	1	1	0.99	1	0.99	1	0.95
6	600400	Egmont National Park Wetland	0.99	1	1	0.99	0.83	0.99	1	0.80
7	600402	Egmont National Park Wetland	0.98	0.75	1	0.98	1	0.99	1	0.73
8	600914	Herbaceous Freshwater Vegetation	0.34	0.38	1	0.79	1	0.99	1	0.34
9	600935	Swampy Bush	0.32	0.52	1	0.94	1	0.99	1	0.31
10	600401	Egmont National Park Wetland	0.99	1	1	0.97	1	0.99	1	0.95
11	600409	Egmont National Park Wetland	0.99	1	0.98	0.98	1	0.99	1	0.97
12	600929	Kahui Road	0.98	0.52	1	0.98	1	0.99	1	0.52
13	600404	Egmont National Park Wetland	0.99	1	1	0.98	1	0.99	1	0.97
14	600925	Dudley Road	0.32	0.39	0.99	0.30	0.84	0.99	1	0.24
15	600898	Landcorp Looney's Lake	0.32	0.48	1	0.95	1	0.99	1	0.31
16	600890	Herbaceous Freshwater Vegetation	0.48	0.47	0.67	0.71	0.83	0.99	1	0.39
17	600211	0	0.38	0.66	0.46	0.85	0.80	0.83	1	0.25
18	600932	Mudfish Sites	0.34	0.46	1	0.62	1	0.99	1	0.33
19	600956	Wiremu Road	0.72	0.40	1	0.57	0.84	0.99	1	0.33
20	600911	Lloyds Ponds	0.31	0.42	0.54	0.98	1	0.99	1	0.30
50	600405	0	0.99	1	0.98	0.98	1	0.99	1	0.96

25. Waikato



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Seepage
Current (ha)	27537.3	13066.9	45.7	12482.8	1890.7	45	5.7
Historic (ha)	(312011)	(69799)	(23123)	(179957)	(37811)	(1321)	*(0)*

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
1	300043	Kopouatai Wetland	t13	2736501	6417295	10541.6	0.55	0.38	0.23	0.46	55% (10%)		27% (2%)			
2	300022	Whangamarino Wetland	s13	2699723	6428580	6137.7	0.61	0.61	0.23	0.44	81% (15%)		48% (3%)	1% (<1%)	38% (1%)	
3	300197	Turangi swamp	t19	2754064	6246272	1115.9	0.64	0.65	0.49	0.34	81% (15%)		56% (4%)	6% (<1%)	38% (1%)	
4	300205	Lake Rotoaira Wetland	t19	2742357	6238181	553.7	0.64	0.67	0.52	0.30	81% (15%)		56% (4%)	35% (2%)	38% (1%)	
5	300034	Torehape WMR	s13	2728180	6427958	882.8	0.65	0.70	0.30	0.51	88% (16%)		56% (4%)	35% (2%)	38% (1%)	
6	300056	Rotokawau	s13	2703917	6413120	499.3	0.66	0.72	0.24	0.36	88% (17%)		60% (4%)	35% (2%)	38% (1%)	
7	300023	Waikato River Wetland	r12	2671774	6431916	837.0	0.66	0.75	0.14	0.34	88% (17%)		67% (5%)	35% (2%)	38% (1%)	
8	300049	Opuatai stream	s13	2691660	6417210	661.0	0.67	0.77	0.23	0.47	92% (17%)		68% (5%)	36% (2%)	38% (1%)	
9	300147	Waiotapu	u16	2804394	6310756	335.5	0.67	0.78	0.25	0.34	92% (17%)		70% (5%)	37% (2%)	38% (1%)	
10	509507	Manganarakekenu stream	t19	2731713	6244666	126.3	0.67	0.79	0.75	0.30	92% (17%)		70% (5%)	44% (2%)	38% (1%)	
11	300065	0	r13	2688194	6410896	398.8	0.67	0.80	0.17	0.34	92% (17%)		74% (5%)	44% (2%)	38% (1%)	
12	300199	0	t19	2749381	6245786	110.9	0.68	0.81	0.60	0.34	92% (17%)		74% (5%)	44% (2%)	38% (1%)	
13	300055	0	s13	2698973	6415914	279.5	0.68	0.82	0.22	0.33	92% (17%)		76% (5%)	49% (2%)	38% (1%)	
14	300042	0	r13	2689457	6424257	278.1	0.68	0.83	0.21	0.37	92% (17%)		78% (5%)	49% (2%)	38% (1%)	
15	300195	0	t18	2735796	6251693	122.8	0.68	0.83	0.44	0.34	92% (17%)		79% (5%)	50% (2%)	38% (1%)	
16	300029	0	r12	2678902	6434674	219.2	0.68	0.84	0.23	0.34	92% (17%)		80% (6%)	50% (2%)	38% (1%)	
17	300198	0	t19	2732882	6246116	72.8	0.68	0.84	0.39	0.19	93% (17%)	86% (<1%)	80% (6%)	52% (3%)	38% (1%)	

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
18	300036	0	t12	2730215	6430056	226.2	0.68	0.85	0.30	0.47	94% (18%)	86% (<1%)	81% (6%)	52% (3%)	38% (1%)	
19	300037	0	r13	2667847	6429134	383.1	0.69	0.86	0.11	0.34	94% (18%)	86% (<1%)	84% (6%)	52% (3%)	38% (1%)	
20	300425	0	r12	2672809	6432583	153.1	0.69	0.87	0.29	0.34	94% (18%)	86% (<1%)	85% (6%)	52% (3%)	38% (1%)	
73	300132	0	s16	2724343	6325137	16.8	0.71	0.97	0.37	0.31	99% (19%)	86% (<1%)	96% (7%)	86% (4%)	100% (3%)	2% (–)

Ecological integrity index

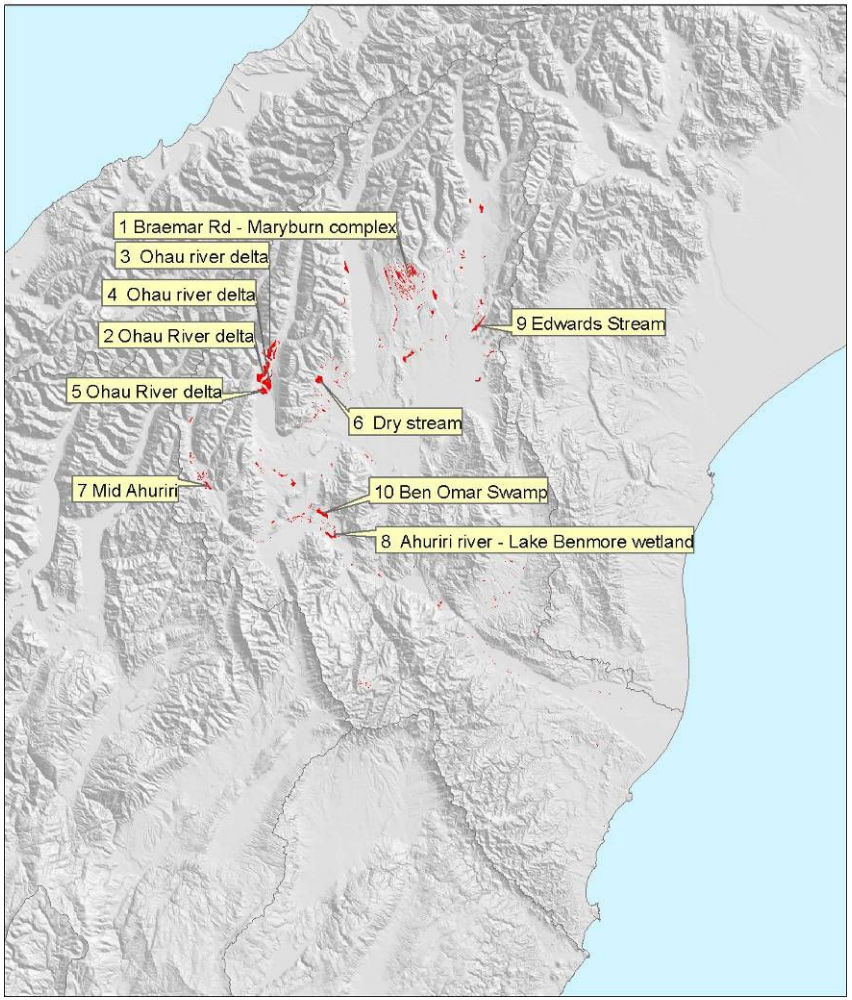
Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	300043	Kopouatai Wetland	0.31	0.50	1	1	0.79	0.97	1	0.23
2	300022	Whangamarino Wetland	0.31	0.47	0.97	0.99	0.77	0.94	1	0.23
3	300197	Turangi swamp	0.90	0.64	0.93	0.98	0.78	0.97	1	0.49
4	300205	Lake Rotoaira Wetland	0.63	0.74	0.89	0.97	0.83	0.99	1	0.52
5	300034	Torehape WMR	0.31	0.60	0.95	0.99	1	0.96	1	0.30
6	300056	Rotokawau	0.31	0.67	0.99	0.99	0.79	0.98	1	0.24
7	300023	Waikato River Wetland	0.31	0.59	0.97	0.93	0.77	0.57	1	0.14
8	300049	Opuatai stream	0.31	0.58	0.97	0.98	0.77	0.98	1	0.23
9	300147	Waiotapu	0.31	0.78	0.78	0.97	0.83	0.99	1	0.25
10	509507	Manganarakekenu stream	0.88	0.76	0.97	0.98	1	0.99	1	0.75
11	300065	0	0.30	0.43	0.99	0.96	0.78	0.73	1	0.17
12	300199	0	0.90	0.79	0.79	0.98	0.78	0.98	1	0.60
13	300055	0	0.31	0.67	0.95	0.88	0.77	0.95	1	0.22
14	300042	0	0.30	0.37	0.95	0.97	0.85	0.80	1	0.21
15	300195	0	0.45	0.57	1	0.97	1	0.99	1	0.44
16	300029	0	0.30	0.58	1	0.92	0.81	0.92	1	0.23
17	300198	0	0.40	0.51	0.80	0.99	1	0.99	1	0.39
18	300036	0	0.30	0.30	1	0.99	1	0.99	1	0.30
19	300037	0	0.31	0.87	0.99	0.93	0.77	0.47	1	0.11
20	300425	0	0.42	0.65	0.99	0.98	1	0.69	1	0.29
73	300132	0	0.38	0.77	1	0.97	1	0.99	1	0.37

26. Waitaki

Waitaki

Current and historic extent (hectares) in each wetland class.

	Total	Fen	Swamp	Marsh	Seepage
Current (ha)	8183.2	1223.8	4198.2	2696.7	64.6
Historic (ha)	(23416)	(2406)	(15275)	(5441)	(293)



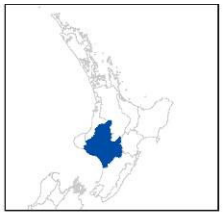
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
1	1201309	Braemar Road Tussock	k34	2406679	5795464	1570.4	0.63	0.19	0.85	0.72	78% (40%)	10% (3%)	7% (3%)	
2	1200681	Ohau River delta	h38	2256674	5672470	685.4	0.67	0.28	0.42	0.60	78% (40%)	27% (7%)	7% (3%)	
3	1200693	Ohau River delta	h38	2272096	5669110	502.7	0.71	0.34	0.71	0.67	78% (40%)	33% (9%)	16% (8%)	
4	1200680	Ohau River delta	h38	2256588	5672660	554.4	0.73	0.41	0.50	0.60	78% (40%)	46% (13%)	16% (8%)	
5	1200679	Ohau River delta	h38	2256207	5672936	283.3	0.74	0.44	0.63	0.60	78% (40%)	53% (15%)	16% (8%)	
6	1200706	Dry stream	h38	2278608	5662620	291.3	0.76	0.48	0.69	0.75	95% (48%)	54% (15%)	18% (9%)	
7	1201763	Mid Ahuriri	h40	2287348	5619607	326.8	0.77	0.52	0.44	0.74	97% (49%)	54% (15%)	29% (14%)	
8	1201765	Ahuriri River – Lake Benmore Wetland	j40	2363583	5603860	341.8	0.78	0.56	0.33	0.65	97% (49%)	60% (16%)	33% (16%)	
9	1201672	Edwards Stream	g38	2239529	5658813	226.6	0.79	0.59	0.49	0.76	97% (49%)	60% (16%)	41% (20%)	
10	1201766	Ben Omar Swamp	j40	2361633	5601490	261.8	0.79	0.62	0.33	0.60	97% (49%)	66% (18%)	42% (20%)	
11	1201655	Forks Wetland	j38	2356141	5674365	158.6	0.80	0.64	0.56	0.76	97% (49%)	66% (18%)	48% (23%)	
12	1201295	Wolds Swamp	i37	2297666	5687799	217.1	0.80	0.67	0.29	0.61	97% (49%)	71% (19%)	48% (24%)	
13	1201540	Godley River	m36	2487317	5725235	178.8	0.81	0.69	0.53	0.76	97% (49%)	71% (19%)	55% (27%)	
14	1201792	Plateau	m36	2462717	5722935	95.0	0.81	0.70	0.96	0.76	97% (49%)	71% (19%)	59% (29%)	
15	1200725	Double Bay	h38	2279249	5670187	96.4	0.82	0.70	0.89	0.77	97% (49%)	71% (19%)	62% (30%)	
16	1200778	0	k35	2380599	5762842	131.5	0.82	0.73	0.43	0.60	97% (49%)	74% (20%)	62% (30%)	
17	1200694	0	h38	2273060	5667755	91.0	0.82	0.74	0.61	0.60	97% (49%)	76% (21%)	63% (30%)	

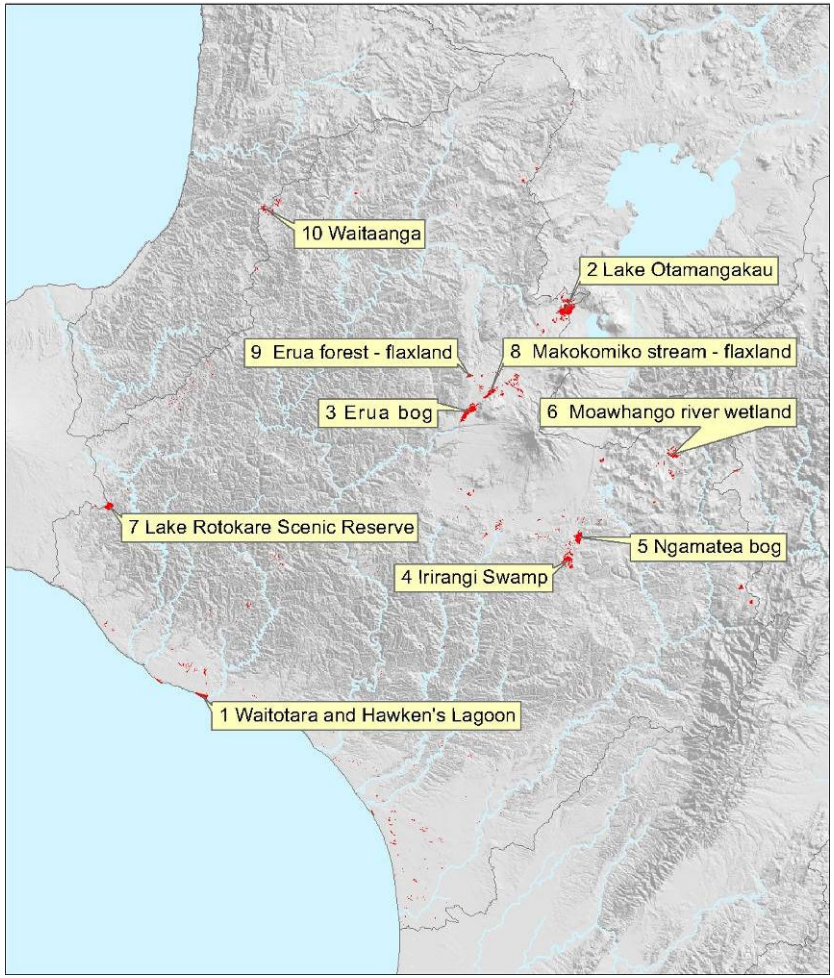
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
18	1201287	Glenburn Swamp	i38	2293469	5677060	128.0	0.83	0.76	0.35	0.60	97% (49%)	79% (22%)	63% (31%)	
19	1201642	Cass River	i37	2313195	5688830	61.4	0.83	0.76	0.53	0.70	97% (49%)	79% (22%)	64% (31%)	
20	1201740	Ribbonwood St Wetland	h39	2265452	5642744	76.7	0.83	0.77	0.54	0.76	98% (50%)	79% (22%)	67% (33%)	
60	1200730	0	h38	2279684	5679320	6.7	0.86	0.92	0.77	0.71	98% (50%)	96% (26%)	85% (41%)	2% (1%)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1201309	Braemar Road Tussock	0.89	0.86	1	0.99	1	0.99	1	0.85
2	1200681	Ohau River delta	0.97	0.54	0.99	0.97	0.79	0.99	1	0.42
3	1200693	Ohau River delta	0.97	0.72	1	0.97	1	0.99	1	0.71
4	1200680	Ohau River delta	0.96	0.63	0.99	0.97	0.79	0.99	1	0.50
5	1200679	Ohau River delta	0.96	0.80	1	0.97	0.79	0.99	1	0.63
6	1200706	Dry stream	0.91	0.70	1	1	1	0.99	1	0.69
7	1201763	Mid Ahuriri	0.94	0.54	0.98	0.99	0.83	0.99	1	0.44
8	1201765	Ahuriri River – Lake Benmore Wetland	0.50	0.65	0.97	0.97	0.79	0.84	1	0.33
9	1201672	Edwards Stream	0.72	0.59	1	0.97	0.83	0.98	1	0.49
10	1201766	Ben Omar Swamp	0.34	0.34	1	0.97	1	0.97	1	0.33
11	1201655	Forks Wetland	0.91	0.69	0.92	0.97	0.83	0.98	1	0.56
12	1201295	Wolds Swamp	0.61	0.35	1	0.98	0.84	0.98	1	0.29
13	1201540	Godley River	0.93	0.54	1	0.97	1	0.99	1	0.53
14	1201792	Plateau	0.99	1	1	0.97	1	0.99	1	0.96
15	1200725	Double Bay	0.96	0.90	0.99	0.98	1	0.99	1	0.89
16	1200778	0	0.61	0.43	0.81	0.95	1	0.99	1	0.43
17	1200694	0	0.71	0.61	0.96	0.97	1	0.99	1	0.61
18	1201287	Glenburn Swamp	0.36	0.41	1	0.98	1	0.99	1	0.35
19	1201642	Cass River	0.96	0.65	1	0.99	0.83	0.97	1	0.53
20	1201740	Ribbonwood St Wetland	0.55	0.88	1	0.99	1	0.99	1	0.54
60	1200730	0	0.78	0.98	1	0.97	1	0.99	1	0.77

27. Wanganui–Rangitikei





Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Seepage
Current (ha)	6849.1	0	1927.2	2337.3	2522.4	62.3
Historic (ha)	(127233)	(442)	(4283)	(94548)	(27930)	*(30)*

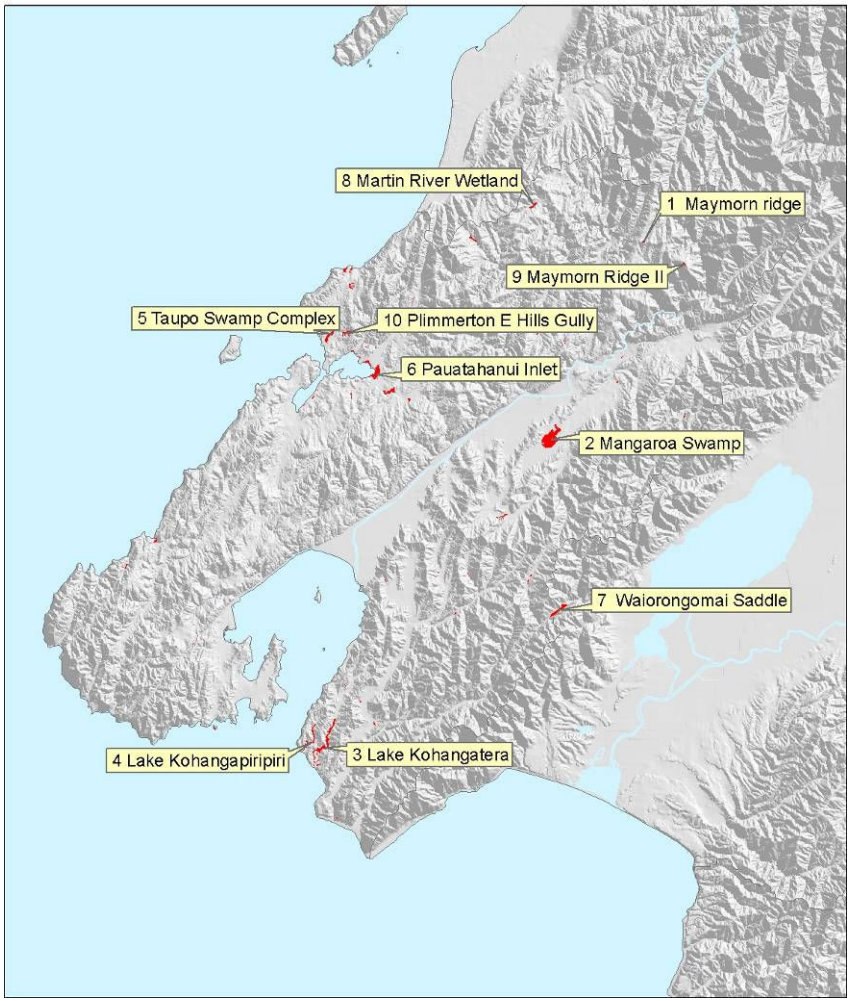
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
1	600910	Waitotara and Hawken's Lagoon	r22	2653314	6150146	213.0	0.33	0.03	0.37	0.23		9% (<1%)		
2	501097	Lake Otamangakau	t19	2737894	6240195	993.9	0.49	0.17	0.32	0.32		25% (1%)	24% (2%)	
3	516141	Erua bog	s20	2715407	6216143	541.2	0.57	0.25	0.68	0.38		25% (1%)	45% (4%)	
4	501124	Irirangi Swamp	t21	2738483	6181773	471.9	0.62	0.32	0.54	0.53	13% (6%)	31% (1%)	48% (4%)	
5	501126	Ngamatea bog	t21	2740972	6186872	339.4	0.66	0.36	0.85	0.72	30% (14%)	31% (1%)	48% (4%)	
6	509572	Moawhango River Wetland	t20	2762940	6206424	283.4	0.69	0.40	0.95	0.73	44% (21%)	31% (1%)	48% (4%)	
7	600900	Lake Rotokare Scenic Reserve	q20	2631602	6194117	241.6	0.70	0.44	0.39	0.32	44% (21%)	35% (1%)	54% (5%)	
8	509561	Makokomiko stream – flaxland	s19	2720552	6220726	363.6	0.72	0.49	0.57	0.70	61% (29%)	35% (1%)	54% (5%)	
9	509539	Erua forest – flaxland	s19	2715582	6224476	70.1	0.72	0.50	0.96	0.27	61% (29%)	37% (1%)	55% (5%)	
10	509037	Waitaanga	r18	2667686	6263547	114.3	0.73	0.52	0.48	0.24	61% (29%)	41% (1%)	55% (5%)	
11	600938	Rotokohu Scenic Reserve	r21	2663704	6186600	54.3	0.73	0.52	0.93	0.23	61% (29%)	44% (1%)	55% (5%)	
12	502999	Taringomoutu bog	s18	2728188	6270159	48.4	0.74	0.53	0.96	0.25	61% (29%)	45% (1%)	55% (5%)	
13	509499	Waitaanga	r18	2670972	6265060	85.5	0.74	0.54	0.49	0.24	61% (29%)	48% (1%)	56% (5%)	
14	509542	Flaxland	s19	2726325	6222427	277.9	0.75	0.58	0.45	0.71	75% (35%)	49% (1%)	56% (5%)	
15	600896	Landcorp and Rayonier	q19	2649022	6220445	115.0	0.76	0.60	0.30	0.25	75% (35%)	53% (1%)	57% (5%)	
16	509111	New site from satellite	t18	2731318	6272862	31.5	0.76	0.60	0.96	0.23	75% (35%)	54% (1%)	57% (5%)	
17	509099	Te Paata Wetland	s21	2722229	6189400	89.1	0.76	0.62	0.42	0.28	75% (35%)	56% (1%)	58% (5%)	

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
18	509577	Herbaceous Freshwater Vegetation	u20	2777671	6202447	33.6	0.76	0.62	0.96	0.27	75% (35%)	58% (1%)	58% (5%)	
19	501107	Moawhango River Head	t20	2761532	6199629	103.0	0.77	0.64	0.94	0.73	80% (38%)	58% (1%)	58% (5%)	
20	500221	Waitaanga Bush Swamp	r18	2669503	6262748	67.2	0.77	0.65	0.44	0.26	80% (38%)	60% (2%)	58% (5%)	
127	517807	Pa Hill Wetland	s21	2718981	6187004	13.4	0.83	0.91	0.31	0.48	97% (46%)	94% (2%)	86% (8%)	3% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	600910	Waitotara and Hawken's Lagoon	0.80	0.48	1	0.98	0.79	0.99	1	0.37
2	501097	Lake Otamangakau	0.41	0.62	0.93	0.97	0.80	0.99	1	0.32
3	516141	Erua bog	0.94	0.87	0.89	0.98	0.80	0.99	1	0.68
4	501124	Irirangi Swamp	0.65	0.55	0.97	0.98	1	0.99	1	0.54
5	501126	Ngamatea bog	0.97	0.86	0.90	0.99	1	0.99	1	0.85
6	509572	Herbaceous Freshwater Vegetation	0.99	1	1	0.98	1	0.99	1	0.95
7	600900	Lake Rotokare Scenic Reserve	0.96	0.49	0.94	0.98	0.82	0.99	1	0.39
8	509561	Makokomiko stream – flaxland	0.96	0.69	0.93	0.99	0.83	0.99	1	0.57
9	509539	Erua forest –Flaxland	0.99	1	1	0.98	1	0.99	1	0.96
10	509037	Waitaanga	0.48	0.90	1	0.96	1	0.99	1	0.48
11	600938	Rotokohu Scenic Reserve	0.98	0.95	1	0.98	1	0.99	1	0.93
12	502999	Taringomoutu bog	0.99	1	1	0.98	1	0.99	1	0.96
13	509499	Waitaanga	0.50	0.66	0.91	0.97	1	0.99	1	0.49
14	509542	Flaxland	0.77	0.55	0.95	0.98	0.83	0.99	1	0.45
15	600896	Landcorp and Rayonier	0.31	0.40	0.73	0.97	1	0.96	1	0.30
16	509111	New site from satellite	0.99	1	1	0.97	1	0.99	1	0.96
17	509099	Te Paata Wetland	0.77	0.50	0.98	0.98	0.84	0.99	1	0.42
18	509577	Herbaceous Freshwater Vegetation	0.99	1	1	0.98	1	0.99	1	0.96
19	501107	Moawhango River Head	0.98	0.98	0.99	0.95	1	0.99	1	0.94
20	500221	Waitaanga Bush Swamp	0.45	0.61	0.92	0.96	1	0.99	1	0.44
127	517807	Pa Hill Wetland	0.31	0.43	0.90	0.97	1	0.99	1	0.31

28. Wellington



Current and historic extent (hectares) in each wetland class.

	Total	Fen	Swamp	Marsh	Seepage
Current (ha)	472.6	11.5	397.3	49.7	14
Historic (ha)	(5834)	(3340)	(2437)	(58)	*(0)*

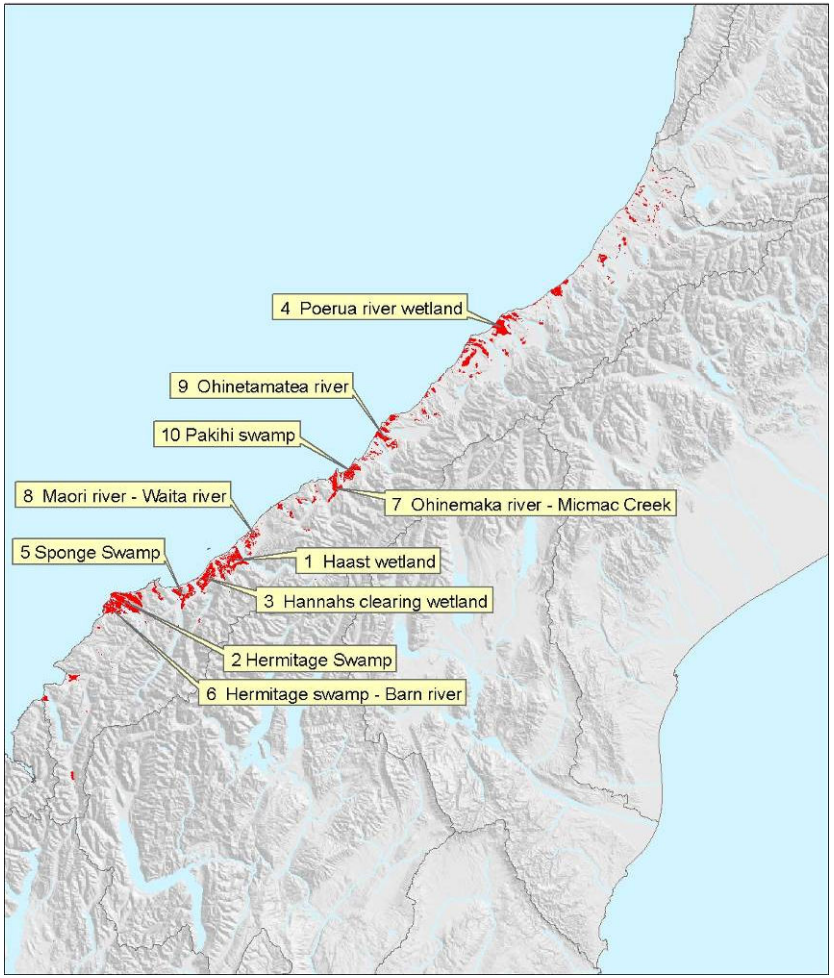
Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
1	801008	Maymorn Ridge	s26	2691335	6020004	4.5	0.29	0.01	0.97	0.12	41% (<1%)			0.4% (–)
2	800155	Mangaroa Swamp	r27	2684200	6004817	131.6	0.60	0.28	0.43	0.48	41% (<1%)	33% (5%)		0.4% (–)
3	800220	Lake Kohangatera	r27	2666787	5981464	66.8	0.69	0.41	0.69	0.48	41% (<!%)	50% (8%)		0.4% (–)
4	800221	Lake Kohangapiripiri	r27	2665743	5981831	22.5	0.71	0.46	0.76	0.49	41% (<1%)	55% (9%)	0.2% (<1%)	0.4% (–)
5	800129	Taupo Swamp Complex	r26	2667359	6013381	41.4	0.73	0.55	0.31	0.48	41% (<1%)	66% (11%)	0.2% (<1%)	0.4% (–)
6	800138	Pauatahanui Inlet Saltmarsh	r26	2670571	6010156	47.9	0.75	0.64	0.26	0.50	41% (<1%)	77% (13%)	3% (3%)	0.4% (–)
7	800201	Waiorongamai Saddle	r27	2688668	5993287	27.7	0.77	0.70	0.87	0.93	41% (<1%)	77% (13%)	44% (50%)	0.4% (–)
8	800097	Martin River Wetland	r26	2682850	6022751	8.6	0.78	0.72	0.95	0.48	41% (<1%)	80% (13%)	44% (50%)	0.4% (–)
9	800111	Maymorn Ridge II	s26	2694477	6018269	4.0	0.79	0.73	0.96	0.23	72% (<1%)	80% (13%)	44% (50%)	4% (–)
10	800125	Plimmerton E Hills Gully	r26	2668540	6012979	14.8	0.79	0.76	0.32	0.49	72% (<1%)	83% (14%)	44% (50%)	6% (–)
11	800143	Judgeford gorge bush	r27	2671814	6008412	18.4	0.80	0.79	0.26	0.56	72% (<1%)	87% (14%)	49% (55%)	6% (–)
12	800114	Raroa Reserve Swamp	r26	2668358	6017812	6.8	0.80	0.81	0.79	0.57	100% (<1%)	87% (14%)	55% (62%)	6% (6%)
13	800105	Whakatikei Headwater Swamp	r26	2678207	6020190	7.4	0.80	0.82	0.46	0.60	100% (<1%)	88% (14%)	57% (65%)	6% (–)
14	800117	Muri Road Wetland	r26	2668818	6016550	7.4	0.81	0.84	0.30	0.48	100% (<1%)	90% (15%)	57% (65%)	6% (–)
15	801011	0	r27	2669536	5984660	1.9	0.81	0.84	0.93	0.48	100% (<1%)	91% (15%)	57% (65%)	6% (–)
16	800190	Gracefield Scrub	r27	2671495	5993866	1.7	0.81	0.84	0.97	0.48	100% (<1%)	91% (15%)	57% (65%)	6% (–)
17	800177	Makara Rvr Mth	r27	2653806	5996966	5.7	0.81	0.86	0.26	0.49	100% (<1%)	93% (15%)	58% (65%)	6% (–)

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Fen	Swamp	Marsh	Seepage
18	800192	Orongorongo swamp	r27	2682462	5993818	3.2	0.81	0.86	0.96	0.94	100% (<1%)	93% (15%)	62% (70%)	6% (–)
19	801004	0	r27	2680623	5998847	4.9	0.82	0.87	0.30	0.54	100% (<1%)	94% (15%)	63% (71%)	6% (–)
20	800113	Wairaka gorge	r26	2668809	6017798	4.1	0.82	0.88	0.31	0.48	100% (<1%)	95% (16%)	63% (71%)	6% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	801008	Maymorn Ridge	0.99	1	1	0.99	1	0.99	1	0.97
2	800155	Mangaroa Swamp	0.44	0.44	1	0.88	1	0.99	1	0.43
3	800220	Lake Kohangatera	0.95	0.83	0.99	0.98	0.84	0.99	1	0.69
4	800221	Lake Kohangapiripiri	0.86	0.77	0.95	0.98	1	0.99	1	0.76
5	800129	Taupo Swamp Complex	0.31	0.74	0.45	0.98	1	0.98	1	0.31
6	800138	Pauatahanui Inlet Saltmarsh	0.32	0.65	0.55	0.97	0.84	0.99	1	0.26
7	800201	Waiorongomai Saddle	0.97	0.89	1	0.98	1	0.99	1	0.87
8	800097	Martin River Wetland	0.99	1	1	0.98	1	0.99	1	0.95
9	800111	Maymorn Ridge II	0.99	1	1	0.98	1	0.99	1	0.96
10	800125	Plimmerton E Hills Gully	0.32	0.49	1	0.96	1	0.99	1	0.32
11	800143	Judgeford gorge bush	0.32	0.52	0.62	0.97	0.84	0.99	1	0.26
12	800114	Raroa Reserve Swamp	0.96	0.88	0.84	0.99	1	0.94	1	0.79
13	800105	Whakatikei Headwater Swamp	0.55	0.73	1	0.98	1	0.85	1	0.46
14	800117	Muri Road Wetland	0.31	0.36	0.74	0.96	1	0.99	1	0.30
15	801011	0	0.99	0.95	1	0.98	1	0.99	1	0.93
16	800190	Gracefield Scrub	0.98	1	1	0.98	1	0.99	1	0.97
17	800177	Makara Rvr Mth	0.32	0.57	0.57	0.97	0.84	0.98	1	0.26
18	800192	Orongorongo swamp	0.99	1	1	0.98	1	0.99	1	0.96
19	801004	0	0.30	0.30	0.99	0.94	1	0.99	1	0.30
20	800113	Wairaka gorge	0.32	0.68	0.35	0.98	1	0.99	1	0.31

29. Westland



Current and historic extent (hectares) in each wetland class.

	Total	Bog	Fen	Swamp	Marsh	Pakihi/ Gumland	Seepage
Current (ha)	52567.1	4449.2	3795.6	22118.0	876.6	21297	30.3
Historic (ha)	(215164)	(12162)	(7051)	(72398)	(14784)	(108767)	*(2)*

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
1	1100031	Haast Wetland	f37	2190910	5699379	3569.4	0.48	0.07	0.80	0.54			4% (1%)	1% (<1%)	13% (3%)	
2	1100602	Hermitage Swamp	e38	2139936	5672602	5265.6	0.63	0.17	0.95	0.70		72% (38%)	15% (5%)	2% (<1%)	13% (3%)	
3	1100025	Hannahs clearing Wetland	f37	2179873	5691453	3501.0	0.68	0.23	0.95	0.59	33% (12%)	72% (38%)	17% (5%)	3% (<1%)	21% (4%)	
4	1100108	Poerua River Wetland	i34	2305267	5785679	2795.1	0.72	0.29	0.96	0.53	34% (12%)	72% (38%)	18% (6%)	3% (<1%)	33% (6%)	
5	1100022	Sponge Swamp	f37	2174576	5680671	2906.3	0.75	0.34	0.80	0.55	34% (12%)	72% (38%)	22% (7%)	7% (<1%)	42% (8%)	
6	1100603	Hermitage swamp – Barn River	l30	2438830	5902435	2557.5	0.77	0.39	0.95	0.64	34% (12%)	81% (43%)	32% (10%)	7% (<1%)	42% (8%)	
7	1100053	Ohinemaka River – Micmac creek	g36	2233564	5727108	2341.2	0.79	0.44	0.79	0.56	34% (12%)	81% (43%)	36% (11%)	8% (<1%)	49% (10%)	
8	1100036	Maori River – Waita River	g38	2218568	5671611	1990.3	0.81	0.47	0.79	0.60	36% (13%)	81% (43%)	43% (13%)	17% (1%)	50% (10%)	
9	1100065	Ohinetamatea River	h35	2251676	5745781	1835.4	0.82	0.51	0.80	0.56	36% (13%)	81% (43%)	47% (14%)	17% (1%)	54% (11%)	
10	1100055	Pakihi swamp – Lake Kini	g36	2244071	5730225	2236.9	0.83	0.55	0.80	0.65	72% (25%)	81% (43%)	50% (15%)	17% (1%)	54% (11%)	
11	1100028	0	f37	2197466	5685929	1701.4	0.84	0.58	0.80	0.56	73% (26%)	81% (43%)	52% (16%)	17% (1%)	60% (12%)	
12	1100099	Added polygon from satellite image	h34	2287792	5784690	1425.3	0.85	0.61	0.79	0.53	73% (26%)	81% (43%)	53% (16%)	17% (1%)	66% (13%)	
13	1100107	0	i34	2299211	5787703	1869.3	0.86	0.65	0.69	0.61	73% (26%)	81% (43%)	60% (19%)	17% (1%)	67% (13%)	
14	1100134	0	i33	2328173	5809415	1286.7	0.87	0.67	0.72	0.58	73% (26%)	81% (43%)	63% (20%)	19% (1%)	69% (14%)	
15	1100019	0	f38	2175297	5667352	807.4	0.87	0.69	0.81	0.52	73% (26%)	81% (43%)	63% (20%)	19% (1%)	73% (14%)	
16	1100068	0	h35	2261261	5752447	617.2	0.88	0.70	0.95	0.53	73% (26%)	81% (43%)	64% (20%)	19% (1%)	75% (15%)	
17	1400214	Waiuna lagoon	d39	2123640	5644092	741.8	0.88	0.71	0.81	0.59	74% (26%)	81% (43%)	66% (20%)	19% (1%)	76% (15%)	
18	1100115	0	i34	2308555	5782645	808.6	0.89	0.73	0.76	0.62	74% (26%)	81% (43%)	70% (21%)	19% (1%)	76% (15%)	

Rank	Idunique	Names	Map sheet	Easting	Northing	Area (ha)	Cum. CE	Cum. area	EI index	HLeft	Bog	Fen	Swamp	Marsh	Pakihi/ gumland	Seepage
19	1100018	Added polygon from satellite image	e38	2157985	5679026	448.7	0.89	0.74	0.96	0.76	74% (26%)	93% (49%)	70% (21%)	22% (1%)	76% (15%)	
20	1400300	Martins Bay	d39	2112055	5635490	405.8	0.89	0.74	0.79	0.57	74% (26%)	93% (49%)	71% (22%)	22% (1%)	77% (15%)	
120	1100037	0	g37	2222802	5684223	20.5	0.95	0.98	0.78	0.81	99% (35%)	96% (51%)	99% (30%)	87% (5%)	99% (19%)	9% (–)

Ecological integrity index

Rank	Idunique	Names	Non-naturalness in subcatchment	Non-naturalness in buffer	Imperviousness	Nitrate leaching risk	Pestiness	Woody weeds	Drainage	EI index
1	1100031	Haast Wetland	0.99	0.99	0.99	0.99	0.84	0.99	1	0.80
2	1100602	Hermitage Swamp	0.98	1	1	0.99	1	0.99	1	0.95
3	1100025	Hannahs clearing Wetland	0.98	0.97	1	0.98	1	0.99	1	0.95
4	1100108	Poerua River Wetland	0.99	1	0.99	1	1	0.99	1	0.96
5	1100022	Sponge Swamp	0.99	0.96	0.97	0.98	0.84	0.99	1	0.80
6	1100603	Hermitage swamp – Barn River	0.98	1	1	0.98	1	0.99	1	0.95
7	1100053	Ohinemaka River – Micmac creek	0.98	1	0.96	1	0.83	0.99	1	0.79
8	1100036	Maori River – Waita River	0.99	1	0.99	0.96	0.84	0.99	1	0.79
9	1100065	Ohinetamatea River	0.97	1	0.99	0.99	0.84	0.99	1	0.80
10	1100055	Pakihi swamp – Lake Kini	0.97	1	0.97	0.99	0.84	0.99	1	0.80
11	1100028	0	0.99	1	0.96	0.99	0.84	0.99	1	0.80
12	1100099	Added polygon from satellite image	0.98	1	1	1	0.83	0.99	1	0.79
13	1100107	0	0.95	0.83	1	0.98	0.84	0.99	1	0.69
14	1100134	0	0.97	0.74	0.96	0.99	1	0.98	1	0.72
15	1100019	0	0.99	1	1	0.99	0.84	0.99	1	0.81
16	1100068	0	0.99	1	0.96	1	1	0.99	1	0.95
17	1400214	Waiuna lagoon	0.99	1	1	1	0.84	0.99	1	0.81
18	1100115	0	0.96	0.98	0.93	0.94	0.84	0.99	1	0.76
19	1100018	Added polygon from satellite image	0.99	1	1	1	1	0.99	1	0.96
20	1400300	Martins Bay	0.99	1	1	0.99	0.83	0.99	1	0.79
120	1100037	0	0.99	1	0.79	0.93	1	0.99	1	0.78