Significant Natural Areas

Programme

Punakaiki Ecological District **PUN - W034**

Grey District Council

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Grey District
Significant Natural Area assessment

Punakaiki Ecological District

PUN-W034

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Report prepared for the **Grey District Council** by

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1. Introduction

This report presents the findings of a visit to a site that was identified as a possibly Significant Natural Area (PUN-W034) on the Barrytown Flats.

As part of their Resource Management Act 1991 (RMA) obligations, the Grey District Council must provide for the protection of Significant Natural Areas (SNAs). The Council has already undertaken an initial study (stage one) to determine which sites are most likely to be considered as significant. This report constitutes part of the follow up study (stage two) that seeks to determine the actual ecological values present at specific sites. In order to do this, several criteria are applied to each site in order to make the assessment of ecological significance as objective as possible.

The full process and the criteria used to determine significance are explained in detail in the following section.

1.1. The process

The Significant Natural Areas (SNA) process was initiated by the Grey District Council to fulfil their obligations outlined in Part II Section 6(c) of the Resource Management Act (RMA) 1991. This section provides that:

"In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the following matters of national importance:

(c) The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna."

In the first instance, this Grey District Council has recognised that their obligation requires that areas of significant indigenous vegetation and significant habitats of indigenous fauna within the District be identified. This requires the classification of native vegetation or habitats of native fauna into either significant or not significant categories and is achieved by applying significance criteria. Land administered by the Department of Conservation is typically exempt from this classification because such areas are already formally protected. For the Grey District SNA process, the significance criteria used are as follows:

- Representativeness – a measure of how modified an ecosystem (sometimes described as forest types) is when compared to its pre-human extent. This is assessed at different nested spatial scales including local (ecological districts), regional (ecological regions) and national. Ecosystems are considered under-represented if they have been reduced to less than 20 % of their former cover. The use of multiple spatial scales means that an ecosystem could be under-represented at a local scale and adequately-represented at a national scale, or vice versa. In any event, ecosystems are termed as under-represented overall if they are under-represented at any scale. This criterion is used to ensure that the full range of ecosystem types is protected within a geographic area. Clearly, the ecosystems most impacted by humans (i.e. cleared, disturbed, fragmented etc) are the most in need for protection as they are often threatened with local elimination. An important feature if this criterion is that representativeness values are not static and will change over time. As such, currently adequately-represented ecosystems may in time become under-represented or, alternatively, under-represented ecosystem types may become adequately-represented following restoration or natural regeneration. This means that representativeness analysis must be undertaken at regular intervals to allow the protection of ecosystem types that have fallen below the 20% threshold.

- Rarity and distinctiveness – an assessment of whether threatened species or distinct species and distinct species assemblages occur at a site. Distinct species can be those at their known geographical limit or an assemblage of species that are common nationally but rare locally. This criterion is used to ensure that locally occurring threatened species or distinct species and assemblages are not adversely affected by habitat destruction or direct removal.

- Ecological context – a measure of how important an area is to the wider landscape in terms of providing connectivity between otherwise unconnected large areas of native vegetation, buffering of important native vegetation or aquatic habitats and providing critical habitat for native species that use the wider landscape. These features are often most important for species with low dispersal ability or an aversion to crossing large open areas, but also relate to sites that have seasonally important food sources for species with high dispersal ability. This criterion is used to ensure that areas of habitat or food sources for native species that are critical to the maintenance of native species in the wider landscape are retained. It also ensures the protection of areas of native vegetation that buffer more important areas from disturbance.

The process undertaken to identify SNAs consists of two stages. The first stage involved the analysis of ecological patterns of the wider area (using Geographic Information Systems and spatial databases[1]) to identify the most highly modified ecosystem types and the areas most likely to provide important ecological service to the wider area. In addition, ecologists with extensive field knowledge of the West Coast were consulted to identify sites containing threatened species or distinct species assemblages. Investigation of the location, size and shape of forest areas using the land cover database version two (LCDB2) and aerial photographs assisted the identification of the most important sites with respect to ecological context.

Once these analyses had been performed, site inspections carried out from public roads (at no time was private land crossed) and from the air (fixed wing aircraft) were undertaken to help verify the values of sites identified from the remotely performed analysis and also to identify sites that the analyses had missed. Sites were excluded and different sites were included as a result of these observations.

Following the analyses and the quick site inspections, a list of 'possibly' Significant Natural Areas was constructed and was submitted to the Grey District Council in the form of a report with simple descriptions and location maps for each listed site.

This report is a component of the second stage of the SNA process and involves the on-site assessment of ecological values (i.e. a site visit) and a more critical application of the significance criteria to the listed 'possible' SNAs. The site assessments seek to characterise the ecological patterns of the site, while considering the effects of past land uses. Due to the limited time available, the

[1] See Appendix two for a more detailed account of the analysis approach.

assessments are focused on vegetation and do not involve concerted searches or surveys for native fauna. However, the role of sites in providing habitat for native fauna is considered in terms of connectivity issues and the presence of major food species and nesting trees. Searches for threatened species are made for species known to exist in the Grey District, but searches are generally restricted to the habitats that these species are known to occur in.

This stage provides landowners with an opportunity to raise concerns and to help establish an adequate balance between farm operation and biodiversity management. Landowner's knowledge of their land and the wider landscape is an invaluable resource and they are encouraged to give their perspective on the major patterns and importance of biodiversity in the region. Ultimately, the classification of the significance of the site is made on pure ecological grounds and is necessarily rigid in this respect. However, boundary locations are often, but not always, more flexible and the delineation of these boundaries will be achieved with input from landowners. For example, this provides an opportunity for farmers to retain key stock movement routes and to make fencing more efficient and robust (fencing is strongly encouraged to protect or enhance ecological values, but is not a requirement).

This report deals specifically with the 'possibly' significant site listed as PUN-W034. This site will be described in context with the local setting and in finer detail and will have the significance criteria re-applied in a more rigorous fashion than was done in stage one.

2. The site and its setting

The site is located on the Barrytown Flats within the Punakaiki Ecological District. Within this general area the places that have experienced the greatest degree of forest clearance are the fertile low surfaces of the river terraces, the coastal plains and some of the post-glacial outwash terraces. This pattern of modification is consistent throughout the West Coast; most of this forest clearance was initially for the purposes of timber harvesting or mining, but clearing or draining for conversion to farmland often followed. The vegetation types that formerly occupied these surfaces were matai/totara-dominated associations on the most fertile, well drained surfaces, kahikatea and fertile wetland associations on the poorly drained surfaces and mixed forests of the coastal plains. In many places the remaining native vegetation on these surfaces is highly modified; often it has been logged, is fragmented and has experienced some stock damage due to its proximity to farmland. These fragmentation effects have caused disruptions in the ecological functioning of forest fragments, with increased weed abundance, more frequent disturbance[2] and some species loss.

2.2. Site description

This moderate sized (c. 40 ha) site occurs to the south of Burke Road and to the north of Canoe Creek (Figure 1). The site occurs within the Barrytown Flats, which are formed of a complex sequence of old dune ridges and outwash deposits from the surrounding streams. Consequently, the soils of the area tend to comprise relatively

[2] Disturbance includes, amongst other things, physical damage from climatic exposure and also damage from pests and diseases.

infertile sand derived soils of the old dune ridges, more fertile silt derived soils of the better-drained inter-dune depressions and moderately fertile mixed peat and silt derived soils of the most poorly drained inter-dune depressions. However, this sequence of soils has been altered by past activities such as mining, logging and drainage.

The site is comprised of an old lagoon of Canoe Creek that has been modified by 20th century gold sluicing operations. The two-part lagoon was probably smaller in extent prior to sluicing operations, with the sluicing cutting into the dune ridge that backed onto the lagoon in the east. This has created a series of bays and banks on the eastern shore of the southern of the two main lagoon areas. The northern lagoon area has generally gentle slopes leading into the water, but the vestiges of an old dune are present in the northernmost shore, which creates a steeper edge. In general the lagoons do not appear to be very deep, although some moderately deep areas occur in the southernmost lagoon area.

Another open area of water occurs to the immediate east of the northern lagoon area, but this appears to be completely man-made.

Deverys and Collins Creeks run into the lagoon from the north and south, respectively, and Canoe Creek occasionally flows through from behind the beach during flood events. The two creeks that permanently flow into the lagoon are deep and slow moving where they enter the lagoon (Photo 1). The banks of Deverys Creek are particularly unstable and are actively eroding through mass slumping. During high tides and stormy conditions the sea breaches the lagoon and leads to saltwater intrusions.

To the west the lagoon is impounded behind the beach. This shoreline tends to be relatively sparsely vegetated, but common species include oioi, giant umbrella sedge, shore bindweed and *Muehlenbeckia axillaris*. Areas with silt tend to support dense flax and raupo.

On other shores the vegetation cover varies considerably. In the areas least accessible to stock (either too wet and boggy or protected by banks or gorse shrubland) are tall and dense stands of raupo (Photo 2). Flax often forms the dominant cover to the landward side of these raupo stands. Swamp kiokio is sometimes present amongst the flax. This is the primary vegetation type fringing the man-made pond, with flax dominant and raupo occurring in patches.

Elsewhere the upper edges of the lagoon support often dense patches of oioi, *Carex sinclarii* and soft rush*, with *Juncus canadensis**, lotus*, *Carex virgata, Isolepis prolifer** and Yorkshire fog* spread throughout. The grazed areas behind the raupo stands tend to support rough exotic pasture species, such as creeping bent and Yorkshire fog, but also moderate abundant are swamp kiokio, *Carex gaudichaudiana,* giant umbrella sedge and oioi. Saltmarsh ribbonwood and cabbage tree are also scattered throughout these areas.

Mixed gorse* and native shrub occur to the north and east of the lagoon, but are less extensive in the south. This vegetation is usually associated with the raised dunes or the steep banks of the southern bays. The most common species present are gorse* (most abundant), mahoe, mikimiki, bracken, pohuehue, wheki and blackberry.

The water levels within the lagoon appear to vary considerably and consequently a broad band of turf vegetation occurs in the more gently sloping areas. This community is relatively diverse and is dominated by native species (Photo 3). These include *Myriophyllum triphyllum, Galium palustre, Potamogeton suboblongus, Centella uniflora, Pratia perpusilla,* bachelors button, spiked sedge, *Crassula helmsii, Glossostigma elatinoides, Lilaeopsis novae-zeelandiae, Limosella lineata, Lobelia anceps,* silverweed and *Hydrocotyle novae-zeelandiae.*

Cattle have access to most of the site and have significantly altered most of the plant communities present through trampling, browsing and introduction of weed species. Grazing has been particularly heavy on the landward edge of the main raupo patches and has lead to a collapse of raupo stands in places.

A few small patches of crack willow* are present in the northeastern areas and these are likely to spread in the future. However, periodic saltwater incursions may slow its spread.

Birds
Native birds observed during the field visit include fantail, fernbird, pukeko, paradise shelduck, pied stilt, white-faced heron, kotuku, western weka, little shag and black shag. One of the landowners commented that Australasian bittern, royal spoonbill and Canada geese* have been sighted here. Other native birds likely to occur are shoveler, grey warbler, tui, bellbird, grey duck, and possibly marsh crake.

In general the site contains a wide diversity of bird habitat types, from shallow edges for wading birds, deeper vegetated edges for waterfowl, moderately deep open water for shags, dense reed beds for bittern and perhaps crake, and dense shrubland for fernbird and other passerines.

Fish
Although no fish surveys were conducted during the site visit, past surveys conducted within the site have indicated that brown trout*, long finned eel, short finned eel, giant kokopu and common bully are common (Bioresearches, 1986). Numerous brown trout* were caught in the open lagoon and the giant kokopu were restricted to the man-made pond to the east of the lagoon.

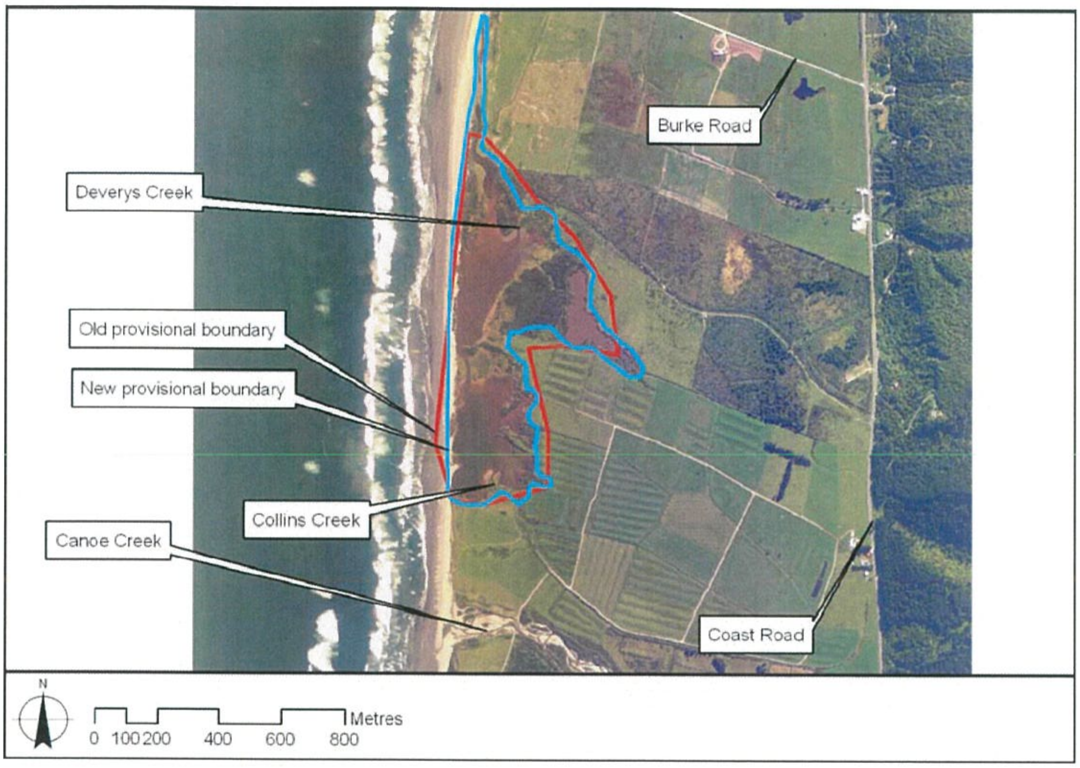

Figure 1. Site location

Photo 1. Deverys Creek is deep, slow moving and sinuous where it enters the lagoon. The riparian areas tend to be dominated by exotic species.

Photo 2. Dense stands of raupo are backed by flax and sedges, and then blackberry* and gorse*.

Photo 3. The fringes of the lagoon support a diverse turf community.

2.2.1. Summary of ecological patterns

In general the lagoon supports a relatively high diversity of vegetation types from submerged aquatic, marginal turfland, tall sedgeland, tall raupo and flax and dense shrubland. Although the site has experienced considerable modification in the past, it still retains a high abundance of well-developed native wetland vegetation and supports many native birds and fish.

2.3. Significance criteria application

2.3.1. Representativeness

The majority of the Barrytown Flats have been cleared for agriculture or mining and very little remains of the coastal forests and wetlands that were previously abundant. The Barrytown Flats are unique within the Punakaiki Ecological District in that they are the only major area of flat coastal land that would have formerly supported a mosaic of forest and wetlands. Although fertile wetlands of the Punakaiki Ecological District and the wider area have been largely cleared and should be considered as under-represented, the brackish coastal wetlands have been less affected by land clearance and drainage because they do not usually yield productive farmland. There is little to suggest that coastal lagoons have been highly modified or cleared within the Punankaiki Ecological District or wider area and, consequently, they should not be considered as under-represented.

2.3.2. Rarity and distinctiveness

Several bird species present within the site are included with the New Zealand threatened species lists (Hitchmough 2002). These include western weka and Australasian bittern. Western weka is listed as serious decline and bittern are listed as nationally endangered.

Generally weka are widespread and abundant in the Grey District and are probably more influenced by predation (and perhaps disease) than they are by habitat loss. There is nothing to suggest that the site is important for the ongoing persistence of this species within the local or wider area and, as such, the presence of this species will not be used to determine significance.

Australasian bittern is much less abundant and widespread, but this species occurs throughout the country in a variety of generally fertile wetlands, often in association with open water. These species will forage in a variety of habitats, but will tend to breed only in areas with dense reeds. Given the abundance of raupo and suitable foraging habitat on the edges of the lagoon the site provides very good bittern habitat for both feeding and breeding. This appears to be the best habitat for this species in the Punakaiki Ecological District and appears to be the most suitable bittern habitat for at least a 70 km stretch of the coastline.

No threatened species of plant were observed during the site visit, but it is possible that *Amphibromus fluitans* (a small wetland grass) may occur, as it has been recorded from the nearby Maher Swamp and is known to occur in the shallow margins of wetlands and other water bodies. This species is listed as nationally threatened and the Maher Swamp record is apparently the only one for the West Coast. A more thorough search for this species may be warranted on the site, but for the purposes of this assessment it will be assumed that this species does not occur on the site.

Giant kokopu and long finned eel are the only threatened species of fish that occur within the site. These species are listed as gradual decline, but are abundant in some areas of the West Coast. Long finned eel are typically widespread and occupy a range of habitats from lowland coastal streams and wetlands to upland rivers and lakes and the site is unlikely to provide important habitat for them. In contrast, giant kokopu are typically restricted to lowland streams and wetlands not far from the coast, although they are known to occur in the Lake Brunner area. Given the restricted nature of giant kokopu populations and their presence in modified lowland landscapes, the man-made pond within site is likely to provide important habitat for this species as it is moderately large, is fringed by dense over-hanging vegetation and is protected from brown trout* by a densely vegetated outlet stream.

No species or communities that occur within the site can be considered as distinctive within the Punakaiki Ecological District or the wider area.

Given that the site may to provide important habitat for bittern feeding and breeding and also provides good habitat for giant kokopu, it should be considered as significant in terms of the rarity and distinctiveness criterion.

2.3.3. Ecological context

Moderately large lagoons with dense native riparian vegetation are very uncommon within the Punakaiki Ecological District, largely for natural landform reasons, and the site comprises one of the few examples of such lagoons for a long stretch of coastline (at least 70 km). As such, the site is likely to form an important breeding and feeding area for many species of wetland birds that travel along the West Coast. As such, the site should be considered as significant in this respect.

2.3.4. Summary of significance

Given the assessment of the above criteria, the site should be regarded as significant in terms of Section 6(c) of the Resource Management Act 1991; the site supports threatened species and provides significant ecological service to the wider area.

2.4. Boundary issues

The boundary should encapsulate all areas within the site that form a relatively contiguous area of wetland and shrubland. However, it is acknowledged that large areas of gorse are included and this may not be deemed appropriate given that it is not a native species dominated cover in all areas. Final boundary designations will need to be determined in consultation with the landowner and other stakeholders.

2.5. *Management*

Given that the site is classified as significant, it should be managed to maintain its ecological values. Particular focus should be placed on the values that determine the site's significance. As such, vegetation clearance should be seen as contrary to protection of the site.

2.5.1. Stock

Stock have had full access to the site in the past and have had considerable impact on the lagoon margins. The site would benefit from stock exclusion, which could be achieved by fencing.

2.5.2. Pest control

Pest control would be of great benefit to the site, with focus placed on the control of possums*, stoats* and ferrets*. Currently these species preferentially browse palatable native species, altering species composition, and also prey on native birds and their eggs and chicks.

2.5.3. Weeds

Although numerous weeds occur on site, most of them are not considered as problematic. However, crack willow* is a known problem weed in wetland environments and has the potential to dominate the site if not controlled. This species does not spread by seed so a combination of manual and herbicide control of the small population will be very effective at removing it from the site. Some surveillance and control may be beneficial to prevent new weeds becoming established on site and may be especially useful if stock are removed from the area, as they may have been suppressing potentially problematic weeds.

2.5.4. Vegetation modification

In general, vegetation clearance should be seen as inconsistent with the purpose of the site. However, the Council may deem it appropriate to grant consent for activities that may involve some vegetation clearance. Any such activity should involve mitigation that is sufficient to compensate for the loss of specific values relating to the site's significance.

2.5.5. Restoration

The site is somewhat fragmented by areas of rough grassland and weedy wet areas, largely created by stock browsing and trampling. Targeted restoration activities aimed at reducing this fragmentation and improving the continuity of the native vegetation around the entire periphery of the lagoon would be very beneficial.

2.5.6. Drainage

Given the low relative level of the lagoon (when compared to sea level) it is likely to be resilient to drainage activities. However, activities such as artificial opening to the sea or diversion of feeder streams could be detrimental to the long-term ecological functioning of the lagoon and should be avoided.

3. Conclusions

The lagoon area, while heavily influenced by past mining activities retains a diverse array of native vegetation types that are uncommon elsewhere in the Punakaiki Ecological District, such as dense patches of raupo and marginal turf vegetation. This in turn supports a diverse array of bird species, including the threatened Australasian bittern, which typically depends on dense raupo for breeding. Also present are several species of fish including the threatened giant kokopu. The man-made pond within the site provides good habitat for this species, while the densely vegetated outlet prevents predatory brown trout* from reaching the pond.

The lagoon should be regarded as significant in terms of providing important habitat for threatened species and an important coastal feeding and breeding area for wetland birds on a stretch of coastline that has few examples of similar habitats.

Ecological values could be improved with targeted restoration of the lagoon margins, especially in the south, predator control and exclusion of stock from the area.

4. References

Bioresearches. 1986. Barrytown Flat – baseline biological survey 1985-86. Unpublished report prepared for Grampian Mining Company.

Hitchmough, R. 2002. New Zealand Threat Classification System lists 2002. Threatened Species Occasional Publication 23. Department of Conservation, Wellington.

Appendix one

Scientific and common names of species mentioned in text.

Woody species	
Aristotelia serrata	wineberry
Coprosma propinqua	mikimiki
Cordyline australis	Cabbage tree
Dacrycarpus dacrydioides	Kahikatea
Melicytus ramiflorus	Mahoe
Muehlenbeckia australis	pohuehue
Muehlenbeckia axillaris	
*Rubus fruticosus**	Blackberry*
Plagianthus divaricatus	Saltmarsh ribbonwood
Podocarpus totara	totara
Prumnopitys taxifolia	Matai
*Salix fragilis**	Crack willow*
*Ulex europaeus**	Gorse*
Ferns	
Blechnum minus	Swamp kiokio
Pteridium esculentum	bracken fern
Herbaceous species	
Apodasmia similis	Oioi
Calystegia soldanella	Shore bindweed
Carex gaudichaudiana	
Carex sinclairii	
Carex virgata	
Centella uniflora	
Cotula coronopifolia	bachelors button
Crassula helmsii	
Cyperus ustulatus	Giant umbrella sedge
Eleocharis acuta	Spiked sedge
Galium palustre	
Glossostigma elatinoides	
Hydrocotyle novae-zelandiae	
*Isolepis prolifer**	
*Juncus canadensis**	Canadian rush*
*Juncus effusus**	soft rush*
Lilaeopsis novae-zeelandiae	
Limosella lineata	
Lobelia anceps	
*Lotus pedunculatus**	lotus*
Myriophyllum triphyllum	
Phormium tenax	flax
Potamogeton suboblongus	
Potentilla anserinoides	silverweed
Pratia perpusilla	
Typha orientalis	raupo
Uncinia ferruginea	

Birds

Anas rhynchotis	Shoveler
Anas superciliosa superciliosa	Grey duck
Anthornis melanura melanura	bellbird
Ardea novaehollandiae	White faced heron
Botaurus poiciloptilus	Australasian bittern
Bowdleria punctata punctata	fernbird
Chrysococcyx lucidus lucidus	Shining cuckoo
Egretta alba modesta	Kotuku
Gallirallus australis australis	weka
Gerygone igata	Grey warbler
Hemiphaga novaeseelandiae	kereru
Himantopus himantopus leucocephalus	Pied stilt
Petroica macrocephala macrocephala	South Island tomtit
Phalacrocorax carbo novaehollandiae	Black shag
Phalacrocorax melanoleucos brevirostris	Little shag
Porphyrio melanotus	Pukeko
Porzana pusilla affinis	Marsh crake
Prosthemadera novaeseelandiae novaeseelandiae	tui
Rhipidura fuliginosa fuliginosa	fantail
Tadorna variegata	Paradise shelduck

Fish

Anguilla dieffenbachii	Long finned eel
Galaxias argenteus	Giant kokopu
Galaxias fasciatus	Banded kokopu
Galaxias maculatus	Inanga
Gobiomorphus cotidianus	Common bully
*Salmo trutta**	Brown trout*

Mammals

*Mustela erminea**	Stoat*
*Mustela furo**	Ferret*
Rattus spp.*	Rat*
*Trichosurus vulpecula**	Possum*

Appendix two

As a basis for assessing the natural values of the Grey District, and hence to determine the location of possible SNAs in terms of RMA Section 6(c), an analysis of the past and present distribution of native ecosystems within the area was undertaken to:

(1) Identify how much of the district still retains a predominantly native cover, and where this is located;
(2) Compare the current extent of native cover to past extent in order to evaluate the level of representation of ecosystem types.
(3) Identify areas of native cover on private land that represent under-represented ecosystems.

For the study area the following spatial information was obtained:

1. LENZ classification of ecosystem types (level 4 classification).
2. LCDB classification of current vegetation cover (version 2).
3. Extent of public conservation lands (land tenure).
4. Ecological District boundaries.

Traditional approaches to assessing representativeness (and hence identifying under-represented ecosystem types) have involved detailed field surveys and subsequent analyses of ecological patterns on and off public conservation land. However, use of LENZ and LCDB2 provides a much quicker method to obtain similar information. LENZ provides a classification of areas of New Zealand with similar ecosystem character. Land environments are modelled from information on climate (e.g. radiation, temperature and rainfall deficit) landform (slope) and soil (e.g. drainage, fertility and parent material). The LENZ classification is given at four different levels that correspond to different spatial scales of its intended use. The range is from level I with 20 different land environments (best used at the 1:2-5,000,000 map scale) to level IV with 500 land environments (best used at the 1:50,000 map scale). The 15 environmental variables used to define the land environments were chosen because of their known correlations with distributions of the most common native tree species. Because of this the LENZ provides a map of potential ecosystem types for an area irrespective of current land use. The code used to name land environments (LE) is hierarchical so that each land environment can be related to the group to which it belongs. For example, the O1.4a LE (level IV) belongs to the O1.4 LE group (level III), which belongs to the O1 LE group (level II), which in turn belongs to the O LE group. The differences between individual LEs within a group become subtler with increasing level. For example, the difference between the O1 and O2 LEs is much greater than the difference between the O1.4a and O1.4b LEs in terms of the 15 climate, landform and soil attributes that define them.

This significance assessment exercise used land environments to provide a map of potential ecosystem cover at level IV (it is assumed that all areas, except wetland and alpine, were forested in pre-human times) and then intersected this in a Geographic Information System (GIS) with the LCDB2. The LCDB2 two is based on high-resolution satellite images of New Zealand taken over the 2001-2002 summer. These images have been classified into 43 land cover types that depict the current land cover (eg, native forest, plantation forest, and pasture). By using the LCDB information, the land environments can be analysed to determine how much of each land environment (ie, potential ecosystem type) still retains native vegetation (eg, native forest as opposed to pasture or plantation forest) and from this to identify which land environments have been most impacted by human activities. Information on land tenure can then be used to determine how much of the remaining area of each land environment that carries native vegetation occurs on different land tenures (eg, public conservation land versus private land) to show what is already protected through conservation legislation.

The spatial relationships between land LENZ, LCDB2 and tenure data were analysed in ArcGIS 8 using the Spatial Analyst extension to determine the following:

1. The extent of each ecosystem type (from LENZ) within the study area by ecological district (ED) and overall.
2. The proportion of each ecosystem type that still supports native vegetation by ecological district and overall.
3. The proportion of each ecosystem type with native vegetation that is within public conservation lands by ecological district and overall.

The LCDB2 classes of 'alpine grass/herbfield' (15), 'herbaceous freshwater vegetation' (45), 'herbaceous saline vegetation' (46), 'flaxland' (47), 'fernland' (50), 'manuka and or kanuka' (52), 'broadleaved indigenous hardwoods' (54), 'sub alpine shrubland' (55), 'grey scrub' (57) and 'indigenous forest' (69) were used to define the area of predominantly native vegetation cover. All other classes were taken to represent modified areas (e.g., pasture and plantation forest). Some of these classes, such as coastal sand and gravel, could be taken as native cover, but LENZ represents these areas as 'null' because they do not contain soil and inclusion of such areas would create a discrepancy in the analysis. LCDB2, land tenure and ecological districts were all converted to raster format to simplify calculations and to avoid errors associated with analysis of very large vector data sets.

<u>Limitations associated with using LENZ</u>

LENZ provides a useful tool for describing the past or potential ecosystem types present within a region at four scales. It does this by combining ecosystem drivers (climate, landform and soil) in a spatially explicit manner. However, it must be recognised that LENZ is limited by the quality of its inputs, especially so at its finest scale (level IV).

At LENZ level IV the boundaries between land environments are largely driven by the underlying soil type distributions. In the case of the West Coast, these soil type distributions used in the LENZ classification were very coarse-scale, except for the soils of the Inangahua Valley. As such, there are errors in the actual allocation of sites to specific LENZ types. In some places, terraces of markedly different age and fertility are assigned to the same land environment, yet they supported markedly different vegetation types. Conversely, many examples were observed in the field of different land environments supporting the same vegetation type, especially in areas dominated by beech.

This highlights the importance of using LENZ as a *guide* not as a determinant. LENZ is best applied to categorise a large amount of information and to provide guidelines for those ecosystem types that are under-represented in the region. Once these types are identified, LENZ can indicate where they are likely to reside but its spatial and classification accuracy needs to be questioned at finer scales.

<u>Assessment of wetlands</u>

Wetlands can be viewed as separate subsystems within more generalised ecosystems and, as such, present a special case for representative analysis. Whereas a more general ecosystem can have its historical extent well approximated by LENZ, wetlands suffer from a more simplified approximation; LENZ can indicate the land environments within which wetlands occur, but it cannot indicate their extent within said environments.

Soils provide a basis for the estimation of historical wetland extent, as their appearance and chemistry reflect hydrology (gleying and cemented pans), fertility (cation status) and past vegetative cover (organic material). All of these factors have implications for past and present wetland occurrence and character. For the purposes of this study, the historical extent of wetlands within ecological districts on the West Coast was estimated using soil data (NZLRI), wetland cover (LCDB2) and land tenure in an approach outlined as follows:

Historical wetland occupancy levels on different soil types were estimated by calculating the proportion of area covered by wetlands, as defined by LCDB2 (includes 'herbaceous freshwater vegetation' [45], 'herbaceous saline vegetation' [46], 'flaxland' [47] and cover classes with wetland character), on soil types within public conservation land (PCL)[3] of the entire West Coast Region. These occupancy levels were then extrapolated to the entire study area to obtain an estimate of historical wetland extent on all land described in the NZLRI. Presently occurring wetland area within different soil types were then compared to estimates of past extent in order to obtain an estimate of representativeness, given as a percentage.

The limitations of this analysis are largely attributable to the types of soils within PCL and the accuracy of the underlying soil data, yet other anomalies occurred that were independent of the soil data limitations.

The most common soils in PCL are infertile ones, as most of the recent soils have been cleared for farming purposes (Wardle, 1991). As such, it is likely that the modelling of the extent of wetlands on infertile soils is much more robust than the modelling of those on low alluvial surfaces and coastal plains, which are typically pastoral landscapes.

Furthermore, the soil information used for the wetlands representativeness analysis is very general; it does not account for fine-scale variation in parent material and slope, and does not always represent coastal areas accurately (DSIR, 1968). The accuracy of this information is likely to be poorest in forested and inaccessible areas. This limitation probably resulted in wetlands being ascribed to incorrect soil types in analysis in some cases. However, provided soil units are relatively consistent throughout the region, this error is unlikely to adversely affect estimates of wetland extent.

A special limitation concerns the soils on which saltmarsh wetlands occur. The NZLRI often excludes soils in estuarine areas, which weakens the implications of analysis for these wetland types. However, it is unlikely that such soils have been highly modified, as their high salinity makes them difficult to covert for farming purposes (DSIR, 1968).

Independent of the limitations of the soil data, these analyses presented one major anomaly for interpretation; many wetlands occurring on private land were more extensive than predicted by estimates of historical extent. This can be primarily explained by the creation or expansion of wetlands by logging on some types of soil.

[3] It is acknowledged that PCL includes areas that have been modified in the past, yet as a general rule PCL provides a good approximation of historical land cover.

In part, this relates to the fact that wetland edges are difficult to delineate, as hydrological properties may change gradually across wetland/forest boundaries. When forest is cleared near a wetland the boundaries (as identified by LCDB2[4]) of the wetland can expand outward, effectively increasing the wetland area. In other cases forest may exist on soils with high water tables and the removal of forest in these situations can lead to a raised water table and establishment of wetland vegetation. Essentially, these problems occur because LCDB2 cannot effectively differentiate between wet forest and dry forest. A better representation of the distribution of wet forest (effectively wetland) would improve the estimation of the extent of true wetland change by reduction the error component attributable to "induced" wetlands.

When all of these examples are considered together it is apparent that the most dominant effect is the "inducement" or expansion of wetlands following logging or clearing of forest or scrub. There is a general tendency for this analysis to underestimate the level of wetland removal because this 'inducement' of wetland often does not create wetland; it simply converts forested or woody wetland into wetland dominated by herbaceous species.

It is recognised that soil data used in this analysis is a source of weakness, yet more accurate soil information was not available in a spatially explicit format. Analysis using land environments (LENZ) would have suffered from the same problems as it uses the NZLRI soil data.

Given the limitations of this method for assessing wetland representativeness, a conservative threshold of 50% was set to define wetland representativeness for this study. This is supported by several arguments:

- There is uncertainty surrounding the estimation of past wetland extent, especially for wetlands that occur on recent soils.
- LCDB2 may misclassify wetlands and does not always accurately portray their true extent.
- The use of NZLRI soil data excludes many areas that contain saltmarsh wetland.
- Wetlands are one of the most nationally threatened ecosystem types, with an estimated 10% remaining.
- Threatened species information lacks detail and completeness, which may lead to the exclusion of important habitats of threatened species through the lack of information at a site.

This conservative approach led to a large number of possibly significant wetlands being identified, given the criteria specified. However, subsequent surveys and analysis will refine the list of wetlands as new information regarding threatened species, hydrology, and sustainability is obtained.

References

DSIR, 1968. Soil Bureau Bulletin 27. General survey of the soils of South Island, New Zealand. New Zealand Department of Scientific and Industrial Research, Wellington.

Wardle, P. 1991. Vegetation of New Zealand. Cambridge University Press, Cambridge.

[4] It should be noted that the minimum mapping unit for LCDB2 is one hectare.

Road Reserve | Legal Riverbed (LINZ) | Confirmed SNA Boundary | QEII Covenant | WCRC Wetlands

8/7/14