

APPENDIX 5 - Ecological Report by Boffa Miskell Limited

Ecological patterns and processes

A description of the ecological patterns and processes within and between habitat types in the Cone Burn area of The Remarkables near Queenstown.

1.0 Patterns – habitat types

Patterns or habitat types are described on a landscape scale, rather than at a detailed micro-habitat scale. They relate to the flora and fauna on landforms, and are described broadly by dominant and important features, not details. The habitats are described below and their extent and location(s) represented on an attached map.

2.0 Processes – interactions and ecological functions

Processes described here range from landscape wide interactions between habitat types, to processes occurring within habitats on a meso- or micro- scale. Only those observed or expected to be occurring from a reconnaissance survey, rather than in-depth studies are described.

Ecological information is presented here that can be used by developers, the local authority and landowners to develop their land-use strategies for one the most iconic landscapes of the Wakatipu Basin.

Such information can be used to identify:

- areas of particular ecological value
- areas with ecological sensitivity to particular land-uses
- areas where land-uses are compatible with ecological values
- areas with potential for ecological enhancement
- risks and threats to ecological values posed by land-uses or processes

3.0 Cone Burn Study Area – a description

The Cone Burn Study area encompasses all land between Lake Wakatipu and the ridge of The Remarkables. To the north and south respectively the bounds are Wye Creek, and a line between Peninsula Hill and Peak 1520 on The Remarkables ridge.

The study area is composed of schist rock that has been strongly influenced by glacial activity. Steep faces with rock tors and dissected by numerous streams stretch from approximately 600m to the peaks on the ridge at over 2000m (a.s.l.). Below 600m colluvial toe slopes and fluvial fans meet a lakeshore terrace. To the south the lakeshore terrace is very small or non-existent, and the toe slopes drop directly into Lake Wakatipu (300m a.s.l.). To the north the lakeshore terrace merges with three roches moutonnées (isolated mountains ground smooth and gradual-sloping by glacier bound rocks on the leading edge and plucked to steep cliffs on the trailing edge – e.g. Peninsula Hill). A generally steep escarpment from the lake to the lake terrace is between 20 and 100m high around the entire study area.

Habitat types with significant indigenous components, or issues have been identified and mapped. Ecological values, processes and threats, and recommendations have been described for each

of the habitats.

Developed land – pasture on the moraine and lake edge terraces, and outwash fans - have not been described. These, and the weed infested land identified, do not contain high indigenous ecological value. They are less ecologically sensitive, but the types of land-uses should first consider any effects. Plantation forestry would further exacerbate weed infestations, and nearby residential development would introduce additional predators. General pet and weed control provisions should apply here too. There may also be other constraints or limitations (landscape and social issues) to development in these areas.

Habitat Type and key to the map:

Recommendations

1. Snow Tussockland on Steep Mountain Slopes	- development impractical - control exotic weeds - exclude grazing
2. Remnant Beech Forest	- development impractical - create linkages - lowland revegetation
3. High Energy Ephemeral Streams	- development on lowland only - create linkages - weed control
4. Bracken Fernland <i>i. on mid altitude mountain slopes</i> <i>ii. on moraine and fluvial outwash fans and terraces</i>	- sensitive development only - reduce disturbance
5. Grey Shrubland <i>i. on mid altitude mountain slopes</i> <i>ii. on moraine and fluvial outwash fans and terraces</i> <i>iii. on roches moutonnées</i>	- sensitive development only - create more shrub diversity - control weeds
6. Schist Rock Tors and Scarps <i>i. on high and mid altitude mountain slopes</i> <i>ii. on roches moutonnées</i>	- development nearby - control skink predators - introduce skink food plants - link to other habitats - add threatened plants
7. Wetlands	- sensitive development nearby - enhance wetlands - link wetlands
8. Broadleaf Forest on Lakeshore Escarpments	- sensitive development nearby - create links to other habitats - introduce rata - control weeds and pests

Notes:

This is an initial scoping document identifying potential for enhancement within and between habitat types. These ideas have not been developed in detail because enhancement in specific locations requires site-specific considerations.

3.1 Snow Tussockland on Steep Mountain Slopes

Description - Tall snow tussockland supports a range of fauna from birds such as pipit, breeding black-backed gulls and kea to a rich invertebrate fauna. These include local endemics and a mixture of Western and Central Otago species in moth, beetle, weevil (many associated with speargrass) and stonefly families. Skinks and geckos, potentially including two of New Zealand's most uncommon (Grand and Otago skinks), utilise tussocklands in the study area.

Tussocklands are extensive and extend down to the lower colluvial slopes where they merge with bracken fernland or grey shrubland.

Recommendations - This habitat type is only suited for conservation, development is impractical due to steep terrain. Most of this habitat type here is retired from agricultural use and is administered by the Department of Conservation. The management of this habitat type is best left to natural, non-interventionist regenerative processes. Most is fenced for stock exclusion; fencing any remaining areas would further enhance the tussocklands.

Threats - Invasion of wilding pine and elder from plantings lower in the study area has occurred and further spread is likely. Control of existing infestations is possible, but if left will be more costly and tussockland quality will be reduced.

3.2 Remnant Beech Forest

Description - A few, small remnant mountain beech forest fragments lie in a number of gullies within the high altitude portions of the study area. All but the lowest and most accessible in Wye Creek are isolated from other woody vegetation, being surrounded by tussockland and scree.

At Wye Creek a broadleaved dominated forest in and above the creek bed merges with beech forest. It links with forest containing similar elements around the lakeshore (see; Broadleaf Forest on Lakeshore Escarpments) and is the only part of the study area where there is no intensive development between alpine areas and the lake. These linkages assist the movement of fauna, particularly birds like fantail, grey warbler and others between habitat types and altitudinal zones. This is potential kea breeding habitat, and bellbirds utilise the range of nectar resources in both the beech forest (honeydew) and the lower broadleaf forest (flax and yellow mistletoe).

Only Wye Creek and one other remnant appear to be expanding. Small remnants, slow regeneration rates of beech trees and their location in a montane area with unstable substrate are an impediment to them increasing in size.

Recommendations - This habitat type is only suited for conservation, development here being impractical due to the steep terrain and lack of access.

Beech spreads slowly and to re-introduce it to other areas, particularly on lowland parts of the study area in conjunction with development, requires revegetation. Beech revegetation projects are often slow to establish and faster results can often be achieved by using other species that ameliorate the environment so that beech can re-establish, or invade easier.

Beech roots have a fungal association that assists them to gain nutrients, introducing this association in beech revegetation projects is important for success.

Threats - Senescence of the beech forest in existing fragments, and the lack of replacement individuals presents potential for these remnants to disappear. There is likely to be some regeneration, so that these remnants will persist in the medium-term. However, predation of seeds by rodents and the likelihood of mass movements of rock could destroy some or all of these remnants except Wye Creek; which is big enough to be resilient to such disturbances.

3.3 High Energy Ephemeral Streams

Description - Flowing off the steep high altitude faces of The Remarkables are a series of ephemeral streams, which flow swiftly after rain or during snow melt. The streambeds are un-vegetated boulders and rocks, but on their margins lower down is a mosaic of bracken with emergent and grey and broadleaved shrubs. At about the altitudinal zone where these streams flow onto fluvial fans and colluvial toe slopes exotic buddleja, elder and sycamore trees are common. In at least one of these streams is a small, riparian kowhai woodland.

Recommendations - Development of these streams is impractical. Adjacent to them in pastureland and grey scrub on easy country in the north of the study area it is acceptable if recommendations for developing grey shrubland are followed.

These streams have the ability to create ecological links between high altitude portions of the study area and the lowland portions in the same way as Wye Creek (see Remnant Beech Forest) does. Only the few streams south of Lumberbox Creek contain significant indigenous vegetation components directly to the lake edge. Others are infested with exotic trees and shrubs, which limit the potential for transit of some fauna and flora. The creation of indigenous dominated riparian strips from The Remarkables could significantly enhance these corridors for birds, reptiles and plants. To achieve this weed control and revegetation with locally sourced native species would be desirable.

Threats - The exotic tree and shrub species mentioned above are a significant threat to these riparian strips and to other land in the study area. In places these trees form woodlands that further exacerbate their spread.

3.4 Bracken Fernland

Description - There are two main locations containing bracken fernland, mid altitude mountain slopes and on moraine and fluvial outwash fans and terraces. In these locations bracken has colonised previously forested areas disturbed by fire. Bracken provides quick and effective ground cover and acts as a nursery for the establishment of other species. On the mid-altitude slopes near Wye Creek native broadleaved species are regenerating through the dense bracken fernland. In other areas, particularly lower down on colluvial fans and terraces the exotic shrub sweet brier is the dominant emergent. In this latter situation it is uncertain whether sweet brier is invading the bracken fernland or bracken is invading sweet brier, evidence for both is present.

Recommendations - Development in some of these areas is acceptable if clearance of bracken and garden plantings are minimised. Any development will likely only occur on

easy land where sweet brier occurs. Control of this species is desirable in conjunction with development.

Whatever the nature of the process of regeneration among bracken it's ability to ameliorate the micro-environment to allow regeneration of native shrubs is a significant asset. To speed, up or increase this native shrubland regeneration process the retention of existing bracken is important. Areas near existing native shrubland or forest will regenerate into natives sooner than those further away.

Threats - The continual disturbance to bracken fernland will impede regeneration of native shrubland. If such processes are desired then a lack of disturbance (burning and vegetation clearance) to both the bracken fernland and nearby native shrubland and forest is important.

3.5 Grey Shrublands

Description - From a distance this habitat type is grey in colour, hence the name. It can range from open scrub to closed shrubland and is comprised of a number of small-leaved, often divaricating shrub species. The dominant ones are matagouri and mingimingi (*Coprosma propinqua*). They are found in three general locations; on mid altitude mountain slopes below and around rock tors, on moraine and fluvial outwash fans and terraces, and on roches moutonnées.

Generally they are low in diversity with matagouri being the most common. However in some locations, particularly on roches moutonnées there is more diversity with other *Coprosma* species (*Coprosma rugosa*, *C. crassifolia*) a tree daisy (*Olearia odorata*), porcupine scrub (*Melicactus alpinus*) and a native broom (*Carmichaelia petrei*) present.

Shrublands such as these are ecologically valuable, and not just for the plant species. There is a rich and diverse fauna of insects that live in association with many of them. One, *Olearia odorata*, hosts up to 27 species of moth, many specific to this shrub. Most of these shrubs produce small fruits, which native skinks utilise for food. The diversity of plant species producing fruit and hosting insects provides an important year-round supply of food for generally omnivorous skinks.

Recommendations - Sensitive residential development within grey shrubland is possible without impinging on the values contained here (see Schist Rock Tors and Scarps). Restrictions on clearing shrubland, garden size, species in gardens, prohibitions on cats and dogs are some of the recommended measures to introduce ecological sustainability into these developments.

Clearance of exotic vegetation, particularly in and around the more diverse grey shrubland areas provides an opportunity to enhance these areas. There are considerable areas of grey shrubland infested with sycamore, buddleja, elder, brier and barberry. In some areas these exotic species are dominant.

There is also considerable opportunity to add greater diversity to these shrublands through the planting of additional plant species. Some of the plantings could include some uncommon species including *Olearia hectorii*, *O. fragrantissima* and *Carmichaelia compacta* plus common ones that are not present here, like korokio.

Threats - Clearance of this vegetation, which is often not regarded as valuable is the greatest threat. The invasion of exotic species into these shrublands is also a threat. In the study area sweet brier, elder, sycamore, buddleja, barberry, crack willow, poplar, pine and other species planted in conjunction with landscape enhancements and plantations are already present. All of these species pose a serious threat to biodiversity values and already most have spread well beyond the sites of their initial plantings. Elder, sycamore and pine, due to their efficient dispersal mechanisms, have spread well up the mid-altitude slopes of The Remarkables.

3.6 Schist Rock Tors and Scarps

Description - The movement of glaciers across the landscape has left much of the schist bedrock shattered and exposed. Most noticeable are large, steep scarps on high and mid-altitude mountain slopes, but there are also many smaller ones on roches moutonnées.

The steep and shattered faces less prone to grazing, predation and burning are a refuge for plant and animal species. These include blue tussock, a threatened cress *Ischnocarpus novaezealandiae*, uncommon *Gingidia montana*, rock fern, the small mat plant *Scleranthus uniflorus*, porcupine scrub, dwarf heath and crawling over rocks and plants is bush lawyer and two species of pohuehue (*Muehlenbeckia australis* and *M. complexa*).

The latter five plants all produce berries, which (see Grey Shrublands) are important food for skinks. In addition to providing food for skinks this habitat also offers sheltered and safe locations among rocks and under robust and intertwined branches of porcupine scrub. High rock scarps could provide nesting places for falcon – though they tend to occur where human occupation is lower.

Recommendations - Along with grey shrublands, rock tors and scarps are robust enough to withstand ecologically sensitive development in the flatter areas nearby. However, provisions such restrictions on cats and dogs, which predate on skinks, and on garden plants, which can escape to become weeds (see also Grey Shrublands) are necessary.

In most of the Cone Burn study area grey shrubland, and often bracken fernland occurs around rock tors and scarps. Interaction of components in both these habitat types is important, and there is opportunity to increase this by allowing regeneration of grey scrub around the rock tors. Grey shrubland linked with rock tors is especially important to provide invertebrate prey to skinks. Silver tussockland around rock tors, which is currently only infrequent and scattered, would provide additional habitat diversity and invertebrate prey for skinks.

Habitat could be provided for threatened and local plant species; *Ischnocarpus novaezealandiae*, *Gingidia montana* and the threatened brassica, *Lepidium kawarau* all of which live on shattered schist rock scarps in or near the Cone Burn area.

Threats - Intensive stock grazing and trampling around and on rock tors is a common feature because animals to 'camp' in these dry locations. While fencing exclusion to prevent this is impractical measure to prevent 'stock camps' in these locations could be investigated to improve the quality of these habitats.

There is also an opportunity to increase the quality of the habitat for skinks by controlling threatening predators such as cats and stoats and other mustelids, particularly on the lower altitude roches moutonnées.

3.7 Wetlands

Description - All of the wetlands in the Cone Burn study area are located on the lakeshore terraces around, and on, roches moutonnées. Most are ephemeral, and grazed. While some, particularly on the Henley Downs property are linked together, most of the wetlands are discrete and distinct entities fed mostly by rainwater.

Dominant species in the wetlands are purei / pukio and soft rush. Some wetlands contain only these species, but a few are more diverse containing other wetland and aquatic species. Aquatic species only occur in the moist, rarely dry wetlands rather than the strictly ephemeral ones. They provide seasonal habitat, or in the case of one permanent wetland, year-round habitat for waterfowl.

Purei / pukio is noted for having a diverse insect fauna associated with it. The distribution of this species in many of the wetlands adds to the botanical values.

Recommendations - Wetlands in lowland locations like these are among the most threatened habitat types nationally. They are often drained and developed for agricultural and residential land uses. However, development adjacent to wetlands can be compatible with ecological values if carried out sensitively.

Retention of the existing wetlands and creation of new wetlands in conjunction with development enhances wetland values. There is a large wetland on Henley Downs that appears to have been enhanced. It has a diversity of habitat, shallow margins and open water for waterfowl and dense reedland and sedgeland for wetland birds. Wetland enhancements can have direct practical benefits to adjacent developments, for example the retention and treatment of storm water can be achieved in wetlands.

Enhancing wetland habitat attracts waterfowl and wetland birds such as scaup, white-faced heron and pied stilts. Suitable habitat with appropriate plants and invertebrate communities, and safe from predators such as cats, dogs and mustelids increases the success of wetland enhancements. Threatened plant species such as *Carex tenunculmis* and *Deschampsia cespitosa*, both rare in the Wakatipu Basin, can provide additional conservation benefits to wetland enhancements here.

Reducing the grazing regime in wetlands will increase the quality and diversity of vegetation. Linking them with other habitat types like grey shrublands and lakeshore escarpments will add further diversity and corridors for insect, plant, reptile and bird species.

Threats - Reduction in wetland area through intensive grazing and trampling, drainage and other developments is a threat. Here there is also the potential for exotic crack willow trees to spread from the currently small infestations in one wetland on Henley Downs and on the land east of the highway into other wetlands. Crack willow is a serious threat to biodiversity values in wetlands.

3.8 Broadleaf Forest on Lakeshore Escarpments

Description - Forest dominated by kohuhu and broadleaf occurs along the lakeshore escarpment. Except for one section the entire escarpment through the study area is forested. Botanically this is the highest diversity habitat; kowhai, lancewood, yellow mistletoe, koromiko and wineberry are found here.

Closer to the lakeshore are wetland plant species such as rushes, sedges and turfs on the frequently inundated lake margins. Within the lake itself are aquatic plants such as water milfoil and pondweed. This lake margin to forest area provides habitat for a large number of plants and insects that provide much of the food that is important for aquatic and terrestrial species like fish (eel, bully, koaro) and birdlife (scaup), and for processes in and around the lake.

Recommendations - Development in these areas is largely impractical due to the steep terrain. Sensitive development in adjacent areas can be undertaken with the following recommendations.

Creating ecological linkages between other habitats close to the lakeshore escarpment (wetlands, grey scrubland and high-energy streams) and the lake is useful. Only the high-energy streams in the south of the study area currently link to the lakeshore escarpment with quality indigenous riparian habitat. Excluding grazing from small areas between wetlands and the lakeshore escarpments can provide links. There is an existing example of a revegetation project associated with a residential subdivision that when mature will provide a stronger link between the upper Wye Creek beech and broadleaved forest area and the lakeshore escarpment.

The use of specific plants that strengthen and speed up ecological processes is recommended in any revegetation and enhancement projects here. For example nectar-producing plants like flax encourage bellbirds, which in turn pollinate and distribute yellow mistletoe and introduce seeds of other plants.

The re-introduction of rata to this section of the lakeshore escarpment is possible. It currently occurs on the lakeshore escarpment to the south of the study area.

Threats - Weeds such as Himalayan honeysuckle buddleja, gum trees and poplar that have spread from enhancement plantings are present here. The location of lifestyle subdivisions immediately above this habitat type exacerbates this problem unless species planted here are compatible (natives or non-invasive exotic species).

Domestic pets such as cats and dogs predate upon forest birds (bellbird, fantail and grey warbler). Their presence near this habitat will reduce bird numbers and diversity. Goats grazing in this area reduce native plant diversity.

Water discharges containing sediment and organic pollutants reduce the water quality in Lake Wakatipu. Measures to reduce these effects such as reduced land clearance, effective sewerage disposal, storm water treatment and reduced use of herbicides, pesticides and fertilisers are recommended.

4.0 References and further reading

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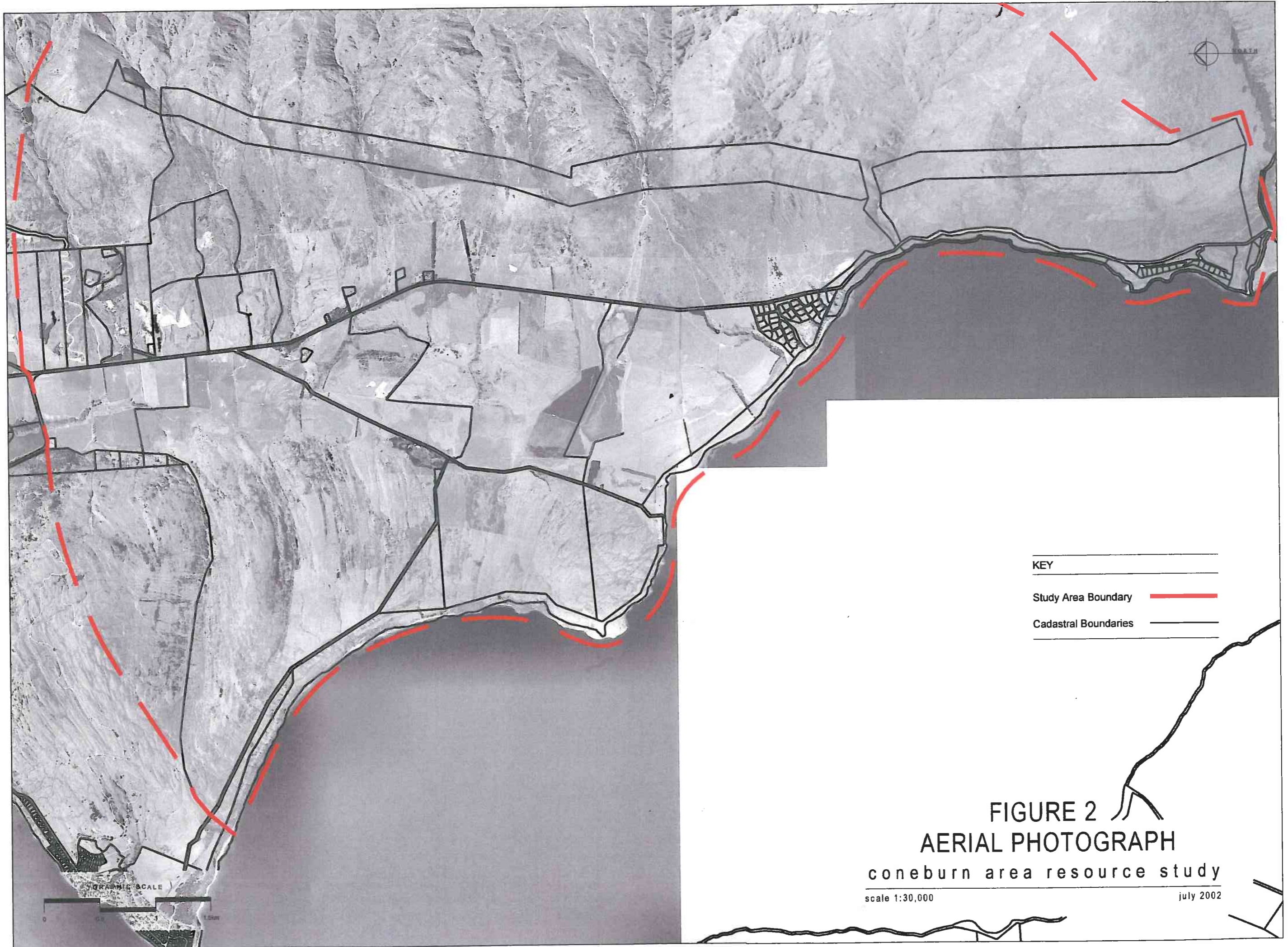
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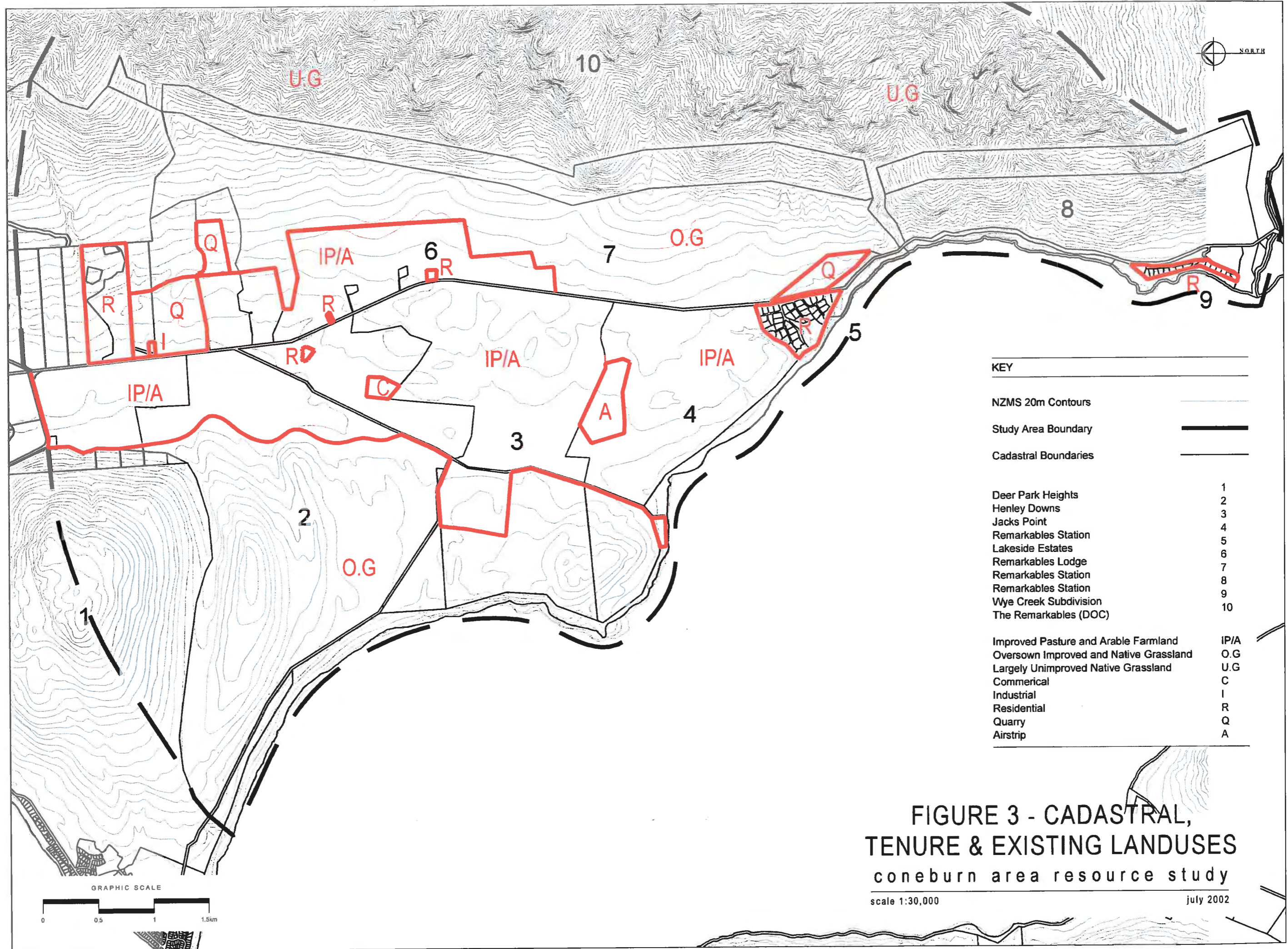
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APPENDIX 6 – Planning Bibliography (accompanying document)





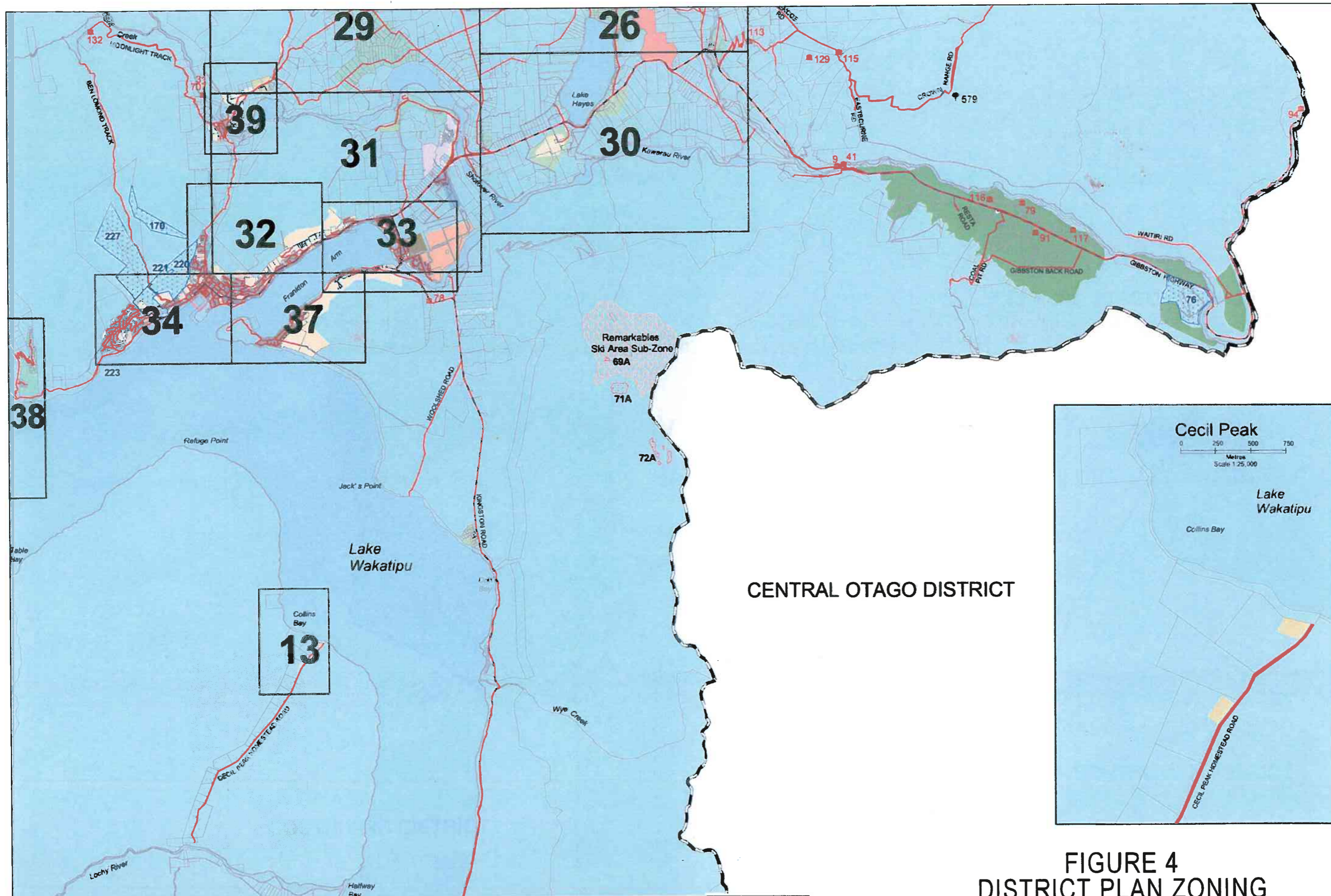
KEY	
NZMS 20m Contours	
Study Area Boundary	
Cadastral Boundaries	
Deer Park Heights	1
Henley Downs	2
Jacks Point	3
Remarkables Station	4
Lakeside Estates	5
Remarkables Lodge	6
Remarkables Station	7
Remarkables Station	8
Remarkables Station	9
Wye Creek Subdivision	10
The Remarkables (DOC)	
Improved Pasture and Arable Farmland	IP/A
Oversown Improved and Native Grassland	O.G
Largely Unimproved Native Grassland	U.G
Commerical	C
Industrial	I
Residential	R
Quarry	Q
Airstrip	A

FIGURE 3 - CADASTRAL, TENURE & EXISTING LANDUSES
 coneburn area resource study

scale 1:30,000

july 2002





CENTRAL OTAGO DISTRICT

FIGURE 4
DISTRICT PLAN ZONING
 coneburn area resource study
 scale 1:30,000
 august 2002



Queenstown Lakes District Council

PROPOSED DISTRICT PLAN MAPS

