APPENDIX F

Mitchell Partnerships Limited Terrestrial Ecology Assessment

Peninsula Bay Joint Venture

Peninsula Bay North Plan Change
Terrestrial Ecology Assessment

mitchell partnerships

November 2015

Executive Summary

Peninsula Village Limited and Wanaka Bay Limited propose a private plan change to change the zoning of approximately 6 ha of land they own adjoining Lake Wanaka and northwest of Sticky Forest. The land is currently zoned "Open Space – Landscape Protection" and part of the site is included within an Outstanding Natural Landscape. Indigenous vegetation at the site includes kanuka shrubland and depleted tussock grassland which meets some of the criteria for significance in the District Plan, but the areas are small and degraded and could only be considered significant at the local or district scale.

The proposal would involve removal of up to 4,850 m² of vegetation. The effects of the removal of this vegetation are proposed to be mitigated by approximately 1.1 ha (11,503 m^2) of new planting and enhancement planting within 4,500 m² of kanuka vegetation to be retained as part of the landscape plan for the site. The landscaping proposal has been developed using ecological principles and is expected to result in an increased area of indigenous vegetation overall as well as improved ecological integrity, diversity, function and connection between the patches of habitat. Dense edge plantings are proposed along any newly cut edges to buffer habitats and improve ecotone quality.

The mechanism proposed to ensure the areas of native vegetation are retained and/or enhanced as appropriate is the placing of a covenant on the title.

The proposal is expected to result overall in a positive ecological outcome.

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1. INTRODUCTION

1.1 Background

Peninsula Village Limited and Wanaka Bay Limited ("**Peninsula Bay Joint Venture"**) own land at Peninsula Bay, on the outskirts of Wanaka Township, part of which has been developed by Infinity Investment Group as part of its Peninsula Bay development. The indicative boundary of area affected by the proposed plan change is outlined in red in Plate 1.

Plate 1: Aerial view of the Peninsula Bay site (Taken February 2015).

The land is located northeast of Sticky Forest and is currently zoned "Open Space – Landscape Protection". Furthermore, part of the site is included within an Outstanding Natural Landscape identified in the Queenstown Lakes District Plan (see Plate 2).

Peninsula Bay Joint Venture is seeking a private plan change for part of the joint venture landholdings to amend the zoning from "Open Space" to "Low Density Residential" in order to enable residential development of part of the land (subject to appropriate land use controls). The land to which the plan change relates is shown in the concept scheme for the area provided in Plate 2.

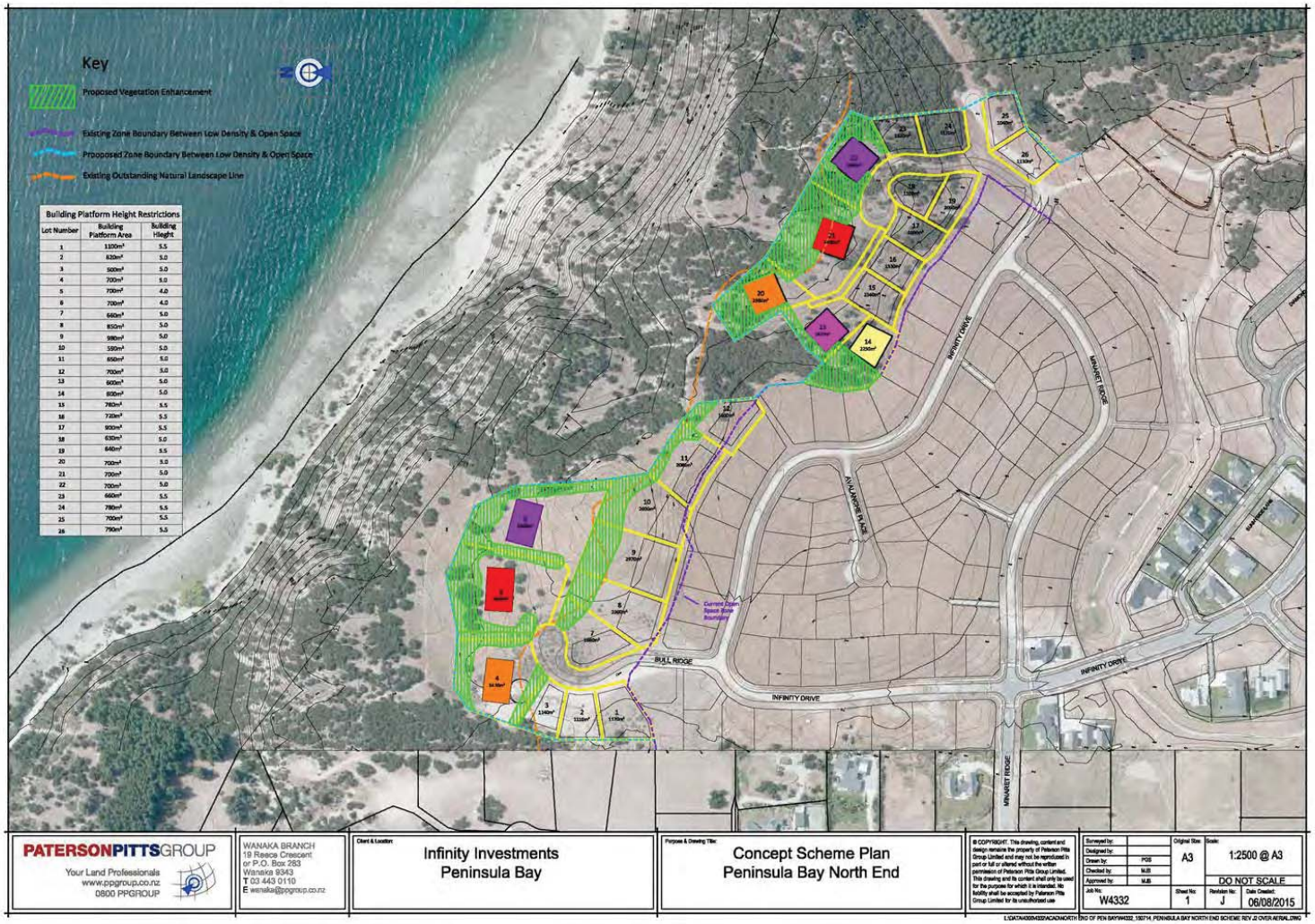

Plate 2: Concept Scheme Plan at Peninsula Bay.

Mitchell Partnerships Limited was retained to identify the ecological values at the site and provide advice as to the location of building platforms so as to reduce the impact on the ecological values present, as well as defining the extent and location of enhancement planting for the site. We defined the goals of the enhancement planting as:

1) Retaining the tussock vegetation where practicable.

2) Introducing diversity as part of the plantings using eco-sourced plants that are typical of shrubland habitat in the Wanaka area and specifically the Pisa Ecological District, but currently only rarely found at the site. In particular including species that provide seasonal food for birds to assist in seed dispersal in the wider area and species that are not bird or wind dispersed (such as beech, *Fuscospora* spp.).

3) Maintaining or restoring ecological connectivity between patches of similar habitat (kanuka or tussock).

4) Establishing dense edge vegetation along new cut edges to buffer the changes brought about by clearance of kanuka and reduce weed invasion in both tussock and kanuka habitats.

5) Increasing the proportion of green leafy plants (i.e. those that are less flammable than kanuka, Fogarty 2001) to reduce fire hazard closest to the proposed house sites.

6) Locating plants at appropriate microsites with respect to topography, drainage and aspect to positively influence their survival.

The purpose of this report is to describe the existing terrestrial ecological values of the site and assess the nature and magnitude of any effects of the proposed plan change on those values. This report consists of four sections as follows:

- **Section 1** (this Introduction) describes the site, the proposal and its ecological context.
- **Section 2** describes the investigations carried out on site and our findings.
- **Section 3** assesses the significance of the ecological values found at the site.
- **Section 4** provides an assessment of effects with respect to the proposal.

1.2 Ecological Setting

The Wanaka area is located in the north-western corner of the Pisa Ecological District, which is the western-most district in the Central Otago Ecological Region (McEwen 1987, Ward *et al*. 1994). The Pisa Ecological District covers approximately 81,177 ha and includes 17,908 ha (21.9%) of public conservation land administered by the Department of Conservation. The extent and location of this public conservation land is shown in Plate 3.

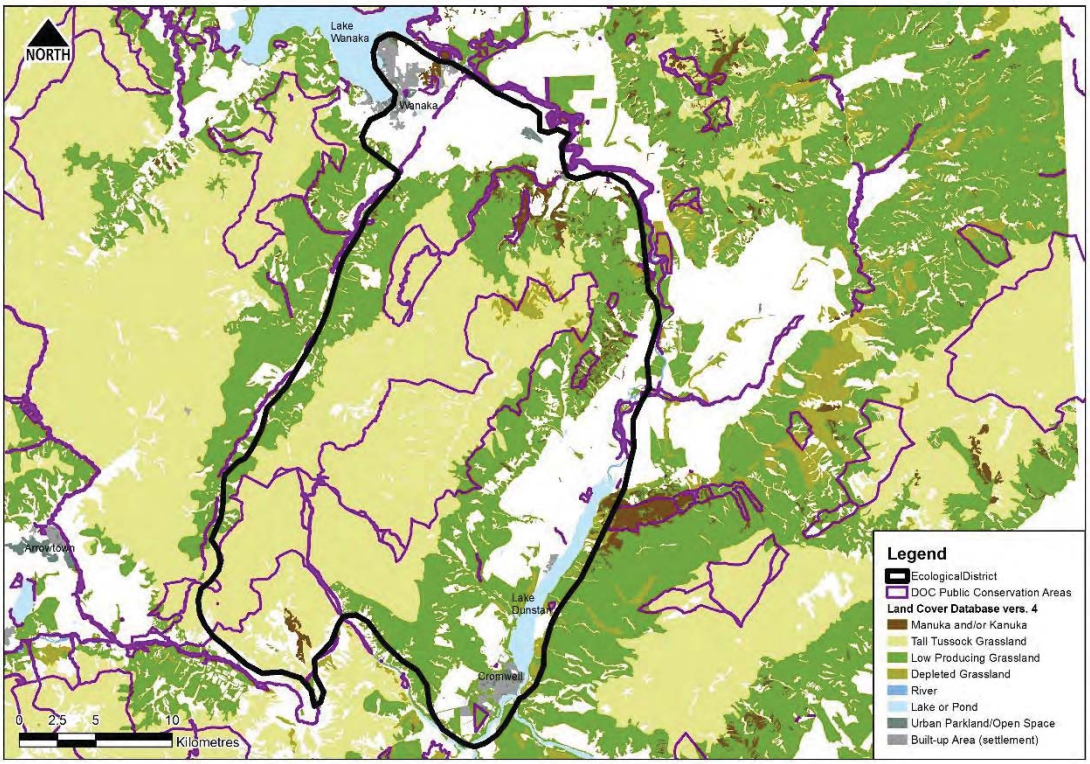

Plate 3: Selected land cover types and public conservation land within the Pisa Ecological District.

In pre-human times the vegetation within the district probably comprised dryland forest dominated by kanuka (*Kunzea robusta*), kowhai (*Sophora microphylla*) and totara (*Podocarpus totara*), but burning by early Māori created a mosaic of scrubland communities of kanuka, matagouri (*Discaria toumatou*), mikimiki (*Coprosma linariifolia*) and porcupine scrub (*Melicytus alpinus*) as well as tussock grassland communities dominated by fescue tussock (*Festuca novae-zelandiae*). This mosaic existed until more recent times, but has been significantly affected by farming and other human activities, particularly where the topography is gentler.

The land affected by the plan change includes two Level IV land environments[1]. Most of the area comprises environment N5.1c, but there are small amounts of N4.1d on the top of the ridge above the lake. Land environment N5.1c occurs on undulating plains with cool temperatures, high annual water deficits and imperfectly drained soils derived from a mixture of colluvium and loess of moderate fertility (Leathwick *et al*. 2002).

Land Environment N5.1c is regarded as Category 1 ("acutely threatened") within the Threatened Environment Classification because only around 2.5% of that land environment remains in indigenous vegetation, and only 0.7% is formally protected[2]. The extent of indigenous vegetation in environment N5.1c has continued to decline since 2002. For that reason any remaining examples of indigenous vegetation within those land environments have an elevated conservation importance.

1 Land Environments of New Zealand (LENZ) is explained in more detail in Appendix 1.

2 Available at www.landcareresearch.co.nz/resources/maps-satellites/threatened-environment-classification/downloads.asp. Accessed 20 July 2015.

Land Environment N4.1d is regarded as Category 2 ("chronically threatened") withn the Threatened Environment Classification because around 18.6% remains in indigenous vegetation and only 2.5% is protected. The amount of indigenous vegetation in environment N4.1d remained constant since 2002, but any remaining examples would still be accorded conservation importance because of the small amount legally protected.

The Land Cover Database (version 4.1) (**"LCDB4"**) shows the vegetation within the area affected by the proposed plan change as "low producing grassland" with areas of "manuka and/or kanuka". 'Low producing grassland' typically includes some completely exotic cover types such as extensive pasture dominated by sweet vernal (*Anthoxanthum odoratum*) and browntop (*Agrostis capillaris*) as well as grasslands of variable native and exotic composition and those dominated by indigenous short tussocks. There is approximately 833 ha of low producing grassland and 261 ha of manuka and kanuka vegetation within the public conservation estate in the Pisa Ecological District.

2. VEGETATION AND FAUNA

2.1 Methods

We visited the site and undertook a walk through survey on 2 June 2015. Plant species and associations were recorded, along with any birds seen or heard during our visit. Vegetation at the site comprised a mixture of predominantly exotic pasture, depleted tussock grassland and kanuka shrubland. A list of plant species recorded is provided in Appendix 2.

2.2 Vegetation

Kanuka shrubland and isolated kanuka trees were common across the site reaching a height of approximately 4 – 5 m and with diameters at breast height of up to 15 cm, although some trees had multiple leaders. The canopy of these shrublands was almost exclusively kanuka and even in the understorey layers, other species were only occasionally encountered and usually limited to canopy gaps or edges. These other species included matagouri, *Coprosoma propinqua*, porcupine scrub and bracken (*Pteridium esculentum*). The ground layer often consisted of mosses and lichens or bare soil and litter. Lower tiers and epiphytes were mostly absent from the shrublands. Examples of the shrubland vegetation are shown in Plates 4 and 5.

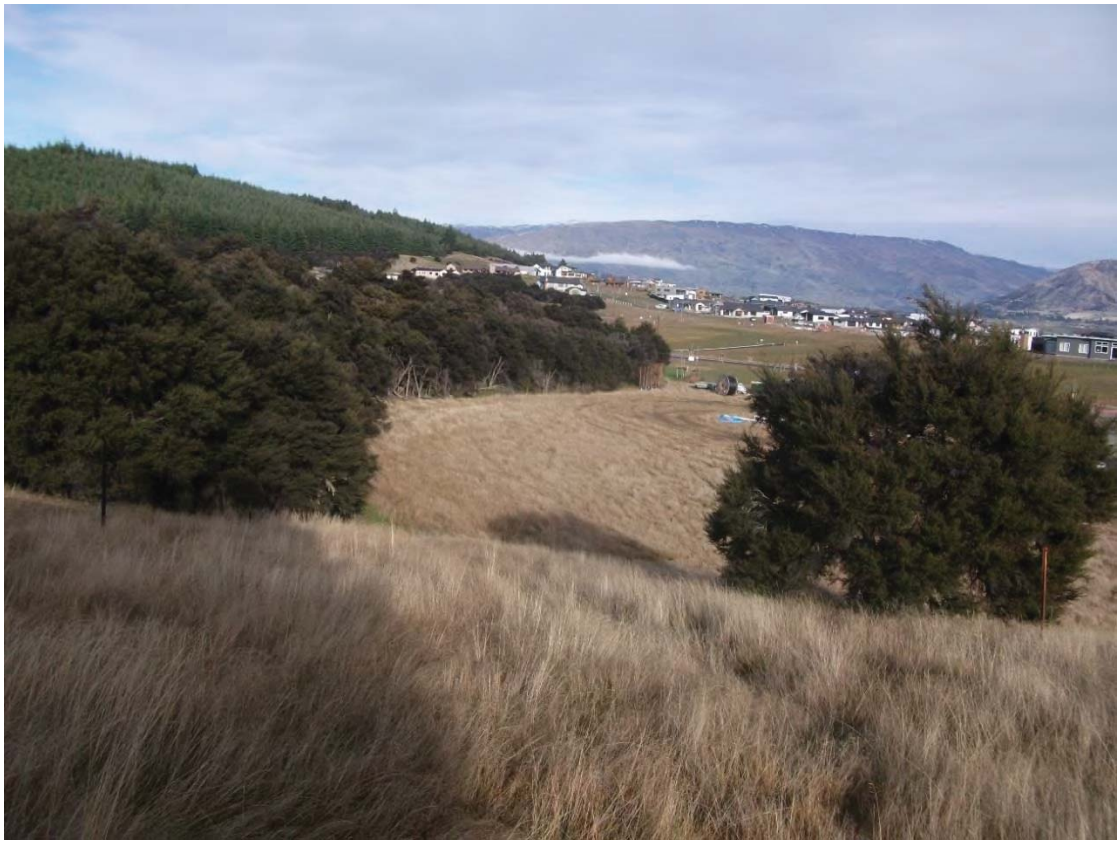

Plate 4: Kanuka shrubland within a grassland mosaic.

Plate 5: Kanuka shrubland.

Within the larger canopy gaps, particularly near the ridgeline at the south-eastern end of the site (nearest Sticky Forest), small areas of depleted tussock grassland occurred. These were dominated by fescue tussock (*Festuca novae-zelandiae*) and included a limited range of other native species such as patotara (*Leucopogon fraseri*), turfy coprosma (*Coprosma petriei*), scab weed (*Raoulia hookeri* var. *hookeri*), blue tussock (*Poa colensoi*), *Kelleria dieffenbachii* and native wheat grass (*Anthosacne solandri*) as well as exotic species typical of such grasslands including tussock hawkweed (*Hieracium lepidulum*), yarrow (*Achillea millefolium*), nipplewort (*Lapsana communis*) and moth mullein (*Verbascum virgatum*). Native shrubs such as desert broom (*Carmichaelia petriei*) and kanuka were occasionally encountered in the grassland. Wilding conifers had been removed at some locations. Two examples of this tussock grassland vegetation are shown in Plates 6 and 7.

Plate 6: Depleted tussock grassland dominated by *Festuca novae-zelandiae*.

Plate 7: Fescue tussock grassland surrounded by kanuka.

At the north-western end of the site (nearest the new road known as Bull Ridge) there was an expanse of exotic grassland dominated by browntop (*Agrostis capillaris*) with occasional isolated kanuka trees and common pasture weeds such as briar (*Rosa rubiginosa*), yarrow, Californian thistle (*Cirsium arvense*) and the like. An example of this vegetation is shown in Plate 8.

Plate 8: Exotic grassland.

The continued spread of kanuka and other native shrubs into these grassland areas (both exotic and introduced) is to be expected because of the local source of seed and the good germination conditions for kanuka there.

2.3 Fauna

Review of Robertson *et al*. (2007) indicates that 53 species of birds have been recorded within the 4 km^2 centred on Wanaka Township, although only ten were encountered during our site visit (see Appendix 2).

Of the 53 species identified by Robertson *et al*. (2007), 12 are waterbirds that would not be affected by the proposal.

Many (17) of the remaining species identified by Robertson *et al*. (2007) are exotic species such as finches (goldfinch (*Carduelis carduelis*), green finch (*C. chloris*), redpoll (*C. flammea*), chaffinch (*Fringilla coelobs*)) and Californian quail (*Callipepla californica*). Common self-introduced natives such as welcome swallow (*Hirundo tahitica*) or spur-winged plover (*Vanellus miles novaehollandiae*) and common native species such as grey warbler (*Gerygone igata*) or tui (*Prosthemadera novaeseelandiae*) which have adapted to highly modified habitats make up the remainder, along with species such as oystercatchers and gulls which may use areas of pasture or cultivated soil for feeding and loafing.

The only species recorded by Robertson *et al*. (2007) which might be affected by the proposal to intensively develop the site and which are of conservation concern is the New Zealand pipit (*Anthus novaeseelandiae*). Pipits have a conservation ranking of "at risk (declining)" (Robertson *et al*. 2013). Pipits are commonly found in rough farmland, coastal, wetland and forested habitats throughout the country with notable gaps in the most developed farming or urban areas (Auckland, Waikato, Manawatu and Canterbury). They are also only sparsely present in the Wanaka and Cromwell area (Robertson *et al*. 2007). We did not record pipits during our visit to the site, although the grassland habitats present are suitable for pipits. We do not consider the proposal will have any adverse effects on local pipit populations because of the very small size of the site, the availability of other rough pasture habits outside Wanaka itself, the site's proximity to residential areas and the paucity of pipits in the area.

The Wanaka and Central Otago area, including some islands within Lake Wanaka, are home to a variety of gecko and skink species. Given the proximity of residential housing and accompanying pets, the site is not expected to provide valuable habitat for native lizard species of conservation concern. Common native species may occur there, however these are unlikely to make extensive use of the exotic grassland areas.

3. SIGNIFICANCE ASSESSMENT

3.1 Introduction

Criteria for assessing ecological significance are provided in Appendix 5 of the operative Queenstown Lakes District Council District Plan. Our assessment of the site's values against these criteria is set out below.

a) **The Ecological Values of the Area**

(i) *Representativeness – Whether the area contains one of the best examples of an indigenous vegetation type, habitat or ecological process which is typical of its Ecological District.*

Although the areas of tussock grassland are small, and likely to be undergoing a natural successional progression to shrubland, they could be considered representative of the natural ecological values (and processes) of the Wanaka area. Kanuka vegetation is also representative of shrubland within the district. Neither vegetation type is "one of the best" examples of an indigenous vegetation type, therefore this criterion is not met.

(ii) *Rarity – Whether the area supports or is important for the recovery of, an indigenous species, habitat or community of species which is rare or threatened within the Ecological District or is threatened nationally.*

The vegetation includes common species and provides habitat for only common birds such as fantails and grey warbler. There are no outcrops of schist or other rock piles that would provide good lizard habitat, although common lizard species may be present. Tussock grassland as a habitat type is generally substantially reduced in extent and becoming increasingly rare. Kanuka habitats are also rare in the Pisa Ecological

District. The area is important for recovery of indigenous species at the local scale therefore this criterion is met.

(iii) *Diversity and Pattern – the degree of diversity exhibited by the area in:*
- *vegetation,*
- *habitat types,*
- *ecotones,*
- *species,*
- *ecological processes.*

The vegetation does not meet the diversity and pattern criteria since it is substantially modified, although ecological processes of succession are clearly at play.

(iv) *Distinctiveness/Special ecological character – the type and range of unusual features of the area itself and the role of the area in relationship to other areas locally, regionally and nationally, including:*

- *presence of indigenous species at their distribution limit,*
- *levels of endemism, e.g. the presence of endemic species,*
- *supporting protected indigenous fauna for some part of their life cycle (e.g. breeding, feeding, moulting, roosting), whether on a regular or infrequent basis,*
- *Playing a role in the life cycle of migratory indigenous fauna,*
- *containing one of the best examples of an intact sequence, or substantial part of an intact sequence of ecological features or gradients,*
- *supporting predominantly intact habitats with evidence of healthy natural ecosystem functioning*

Neither the tussock grassland nor the kanuka vegetation meet the distinctiveness criteria.

b) The Ecological Context of the Area

(v) *Size and Shape – the degree to which the size and shape of an existing area is conducive to it being, or becoming ecologically self-sustaining.*

(vi) Connectivity – the extent to which the area has ecological value due to its location and functioning in relation to its surroundings. An area may be ecologically significant because of its connections to a neighbouring area, or as part of a network of areas of fauna habitat. For example an area may act as a corridor or stepping stone for movement/migration of species between or to areas of important habitat.

The vegetation patches are small and have a high amount of edge. In the case of the tussock vegetation, this reduces the chance of it being ecologically self-sustaining. The vegetation is part of a larger swathe of vegetation which has good connectivity values between the edge of Lake Wanaka generally, Beacon Point, and the banks of the Clutha River, the nearby Hikuwai Conservation Area and the Mt Iron Scenic Reserve. The site meets this criterion.

c) The Future Ecological Value of the Area

(vii) *Long Term Sustainability – the degree to which an area is likely to maintain itself, taking into consideration:*

- *extent to which criteria in paragraphs A and B above are met*
- *degree of historic modification to the area and its surroundings which affects its future*
- *degree of resilience of species and habitats present*
- *the effects of current management on identified ecological values*
- *the extent to which the area has achievable potential, with management input, for restoration of ecological values which are significant in the Ecological District.*

In terms of sustainability it is unlikely that the current vegetation mix will be maintained in the longer term without management. Tussock grassland in particular is unlikely to be self-sustaining because of invasion of kanuka from the adjacent shrubland. It is most likely that kanuka shrubland would develop across the whole site in the medium – longer term. The area has been highly modified in the past. The vegetation at the site does not meet this criterion.

We conclude that the indigenous vegetation, both the tussock grassland and the kanuka shrubland, would trigger the significance criteria articulated in Appendix 5 of the District Plan (particularly rarity and ecological context) but because of the small extent and the highly modified nature it can only be regarded as significant at a local or at best a district scale.

The District Plan notes that the fact that a particular area satisfies one or more of the above criteria does not necessarily mean the area is significant in the District Plan. In order to determine whether an area should be included as significant in the District Plan the Council will also have regard to the following:

(a) *Existing land use and the degree of modification associated with the site.*
We note that the area is privately owned land adjacent to residential housing and has been substantially modified in the past, including when it was formerly farmland.

(b) *Any views of the landowner and occupier including development costs and lost development potential and the support or otherwise for the proposal.*
The landowner's views are reflected in this proposal. The landowner is supportive of the additional planting and protection proposed.

(c) *The views of the Department of Conservation and other interested parties.*
The views of the Department of Conservation and others have not been sought as part of this report. The landowner is carrying out consultation, and interested parties will also have the opportunity to contribute to the plan change process.

(d) *Consideration of non-regulatory and regulatory methods which ensure the identified values and their needs are recognised and protected.*
The proposed covenants would ensure the remaining values and the areas of new planting are recognised and protected.

(e) *Presence and level of animal pests and weeds*.

The presence of both is high. During our site visit evidence of rabbits (*Oryctolagus cuniculus*) was commonly encountered, as were weeds at some locations, particularly within the grassland areas.

(f) *Resources required to implement effective protection.*
Implementing protection via covenanting and planting is proposed as part of the plan change process. The need for ongoing weed and pest control will vary.

(g) *Whether or not identified values are under threat.*
In general terms the values are under threat, with particularly depleted tussock grassland becoming increasingly rare. In the absence of the plan change proposal the natural regeneration of the site is expected to be slower and more uncertain as to outcome.

(h) *The extent to which values are or are not protected elsewhere.*
Reference to LCDB4 shows that within the Pisa Ecological District, public conservation land includes 494 ha of depleted grassland, 833 ha of low producing grassland and 261 ha of kanuka or manuka. The extent of the same vegetation types located on private land is 871 ha, 20,474 ha and 1,577 ha respectively. On that basis, depleted grassland of the type found at the site is very rare and the degree of protection is generally low and manuka or kanuka is rare and moderately poorly protected elsewhere. Indigenous vegetation within the specific land environment is regarded as acutely threatened.

(i) *Any other relevant factor.*
The use of the area for recreation (cycling, walking) may be a relevant consideration. We are unaware of any other relevant matters.

4. ASSESSMENT OF EFFECTS

4.1 Vegetation Removal and Planting Proposed

The proposal would involve removal of up to 4,850 m² of vegetation to allow for construction of building platforms. Some of the vegetation which might be removed (dependent on individual site plans) is locally significant. The area proposed for new enhancement planting (hatched green in Plate 2) is 14,600 m². Within that hatched area, there is around 4,500 m² of kanuka to be retained. This results in slightly more than 1.1 ha (11,503 m^2) of new planting as described and shown in the Landscape Concept Plan prepared by Rachael Stanford Landscape Design and attached as Appendix 3. Overall the amount of indigenous vegetation at the site will increase.

The policies and objectives of the Queenstown Lakes District Plan seek to encourage the retention of existing indigenous vegetation in gullies and along watercourses as well as the maintenance of tussock grass-lands and other natural ecosystems[3] in outstanding natural landscapes as part of subdivision developments. As such the incorporation of existing significant vegetation into developments and enhancement of native vegetation along with increased connectivity/ecological linkages is a preferred outcome of subdivision articulated in the district plan.

[3] See Section 4.1.

Slightly less than half of the indigenous vegetation at the site would be retained, and the quality of the vegetation remaining would be improved and the area of indigenous vegetation overall increased by planting as part of this proposal. This is consistent with the direction of the policies and objectives of the District Plan.

With regard to this proposal we have participated in locating the building platforms so as to minimise the amount of vegetation removal and in planning the enhancement planting to maximise its ecological benefits. We have recommended that the new planting use locally sourced plants which would have been or are typical of shrublands in the Pisa Ecological District, but are not found currently at the site, as well as kanuka and other species already present. The purpose of this approach is to aid in the functional restoration of the site and to assist in revegetation in the wider vicinity which is currently limited by the lack of suitable seed sources for many species which could otherwise be expected to be present.

In particular we propose the use of the species listed in Table 1 where appropriate microsites can be found to suit their growth habits.

Table 1: Species proposed for planting at Peninsula Bay.

Latin Name	Common Name	Threat Ranking
Trees, shrubs and climbers		
Aristotelia serrata	wineberry	Not threatened
Carmichaelia petriei	desert broom	Not threatened
Coprosma intertexta		At Risk - declining
Coprosma lucida	karamu	Not threatened
Coprosma rugosa		Not threatened
Corokia cotoneaster	korokio	Not threatened
Fuchsia excorticata	tree fuchsia	Not threatened
Fuscospora cliffortioides	mountain beech	Not threatened
Fuscospora fusca	red beech	Not threatened
Griselinia littoralis	broadleaf	Not threatened
Hebe salicifolia	koromiko	Not threatened
Hebe subalpina	hebe	Not threatened
Hoheria glabrata	mountain lacebark	Not threatened
Kunzea robusta	kanuka	Not threatened
Leonohebe cupressoides	cypress hebe	Threatened - nationally endangered
Melicytus alpinus	porcupine scrub	Not threatened
Muehlenbeckia axillaris	creeping pohuehue	Not threatened
Olearia avicenniifolia	mountain akeake	Not threatened
Olearia hectorii	Hector's tree daisy	Threatened – nationally endangered
Phyllocladus alpinus	toatoa	Not threatened
Pittosporum tenuifolium	kohuhu	Not threatened
Plagianthus regius	ribbonwood	Not threatened
Podocarpus laetus	Hall's totara	Not threatened
Pseudopanax colensoi var. *ternatus*		Not threatened
Teucridium parvifolium	Teucridium	At risk - declining

Latin Name	Common Name	Threat Ranking
Monocots (grasses and sedges)		
Chionochloa macra	slim snow tussock	Not threatened
Chionochloa rigida	narrow leaved snow tussock	Not threatened
Phormium cookianum subsp. *cookianum*	Mountain flax	Not threatened

In areas where there are isolated kanuka trees or small stands, these would be incorporated into the proposed planting. Some species such as wineberry (*Aristotelia serrata*), tree fuchsia (*Fuchsia excorticata*) and the like would do best sheltered under a canopy, and these species will be used in areas where such a canopy is available. Species such as slim snow tussock (*Chionochloa macra*) and creeping pohuehue (*Muehlenbeckia axillaris*) are suitable for using at the interface of tussock and kanuka to buffer the edges of these habitats and reduce weeds.

Covenants on the new titles are proposed to ensure the areas of native vegetation would be retained and/or enhanced as appropriate in accordance with the landscape concept for the site.

The overall benefits of the proposed enhancement planting, include:

- Increased diversity of both plant species and habitats present;
- Opportunity to include threatened and at risk plants to assist in their conservation;
- Improved ecological connection between habitats;
- Enhanced ecological function with respect to buffering of habitats, seed dispersal, successional progress and seasonal food sources;
- Reduced edge effects and improved ecotone quality; and
- Contribution to improved ecological integrity as a result of the enhancement planting.

After taking into account the extent of vegetation removal proposed, the nature of the existing vegetation and the enhancement plantings proposed, we consider that the proposed plan change will have an overall positive effect on the terrestrial ecology of the site and is consistent with the direction of the district plan with regard to incorporation of existing significant vegetation into developments and enhancement of native vegetation and increased connectivity and ecological linkages.

4.2 Response to Request for Further Information

On 27 October 2015 Queenstown Lakes District Council (**"the Council"**) requested further information in order to better understand the nature of the proposed plan change. The following section provides a response to the eight ecological matters raised by the Council's Ecological Advisor in relation to the request for further information.

Issue 1: The proposal to increase the proportion of green leafy species into the landscape planting to reduce the fire hazard closest to the proposed house sites.

One of the identified goals for enhancement planting (as described in section 1.1) is to increase the proportion of green leafy species to reduce fire hazard closest to the proposed building platforms.

Council's Ecological Advisor considers that fires approaching the building platforms would likely run out of fuel before significantly endangering property or human life. The Council's advisor also noted that broad-leaved communities of the type proposed (to reduce fire hazard) are more common west of the Peninsula Bay site in the vicinity of Glendhu Bay.

When preparing planting plans for shrubland (mainly Manuka) subdivisions in the Far North District, the use of less flammable species (such as those proposed) is accepted and expected by Council's on the basis of advice provided by the New Zealand Fire Service. It is on this basis that the leafy green species were proposed in close proximity to the building platforms.

Issue 2: The inclusion of species which would alter the character of the community composition such that it may appear incongruent with the surrounding kanuka shrubland that characterises the N5.1c Land Environment and northern Peninsula escarpment.

The Council's Ecological Advisor considers that the species proposed to reduce fire hazard would alter the character of the community composition such that it may appear incongruent with the surrounding kanuka shrubland that characterises the N5.1c Land Environment and the northern Peninsula escarpment.

While it is acknowledged that the species proposed to manage fire hazard would change the character of the vegetation, that was partly the intention in order to reduce the likelihood, intensity and scale of future accidental fires at the site.

One of the factors considered when developing the landscaping planting plan was that the kanuka at the site is very uniform in terms of size (and presumably age). There is no obvious regeneration of the understory in most places. This suggests that the vegetation succession at the site may be limited in future as the existing kanuka age and senesce as a cohort. The species proposed were selected in part as temporary place fillers to draw frugivorous birds to the site to assist in promoting succession with locally derived species from the wider area.

Issue 3: Consider modifying the application to better provide for the presence and significance of (degraded) fescue tussock grassland, noting that the Landscape Concept Plan (Revision E) does not include any areas where the remaining community would be protected, maintained or enhanced.

Council's Ecological Advisor considers that the application could be modified to better provide for the presence and significance of degraded fescue tussock grassland.

The protection and maintenance of depleted tussock grassland was intentionally excluded from the landscape planting as historically the tussock grassland at the site would have been maintained by grazing and other human activity. If left alone, the kanuka would likely continue to expand and come to dominate the tussock areas, replacing the existing species. In other words, retention of tussock grassland at the site would require active management in perpetuity, whilst succession to kanuka would require less intervention in the longer term. Kanuka therefore represents a more sustainable ecological community at the site, although in the longer term succession will also replace the kanuka with a different forest association. The form of that association will depend on the seed sources available.

The presence of hares, the thick thatch of exotic grass, and the regular influx of kanuka seed (which may also be limited by the exotic grasses) creates difficulties when seeking to protect and enhance the tussock grassland community at the site and expand the area of tussock occupation.

Issue 4: Consider removal of woody weeds from the open space area.

The Council's Ecological Advisor considers that there may be benefits arising from the removal of wood weeds from the Open Space area.

Removal of woody weeds from the open space areas is technically feasible, but much of the open space is currently dominated by exotic grasses, with only occasional herbs and woody weeds. Although this situation may change in future, woody weeds are not considered to be the greatest threat to the tussock vegetation at the site. On this basis, the control of woody weeds is not considered necessary.

In the areas proposed for enhancement planting, woody weeds would be controlled as part of the planting plan for the site.

Issue 5: Consider creating a more gradual transition from the planted areas to the existing vegetation which would remain as open space on public land.

The Council's Ecological Advisor recommends that consideration be given to the gradual transition from the planted areas to the existing vegetation areas remaining as open space.

The space available within the private boundaries to carry out the recommended transition is relatively limited. The proposed edges however, will be well buffered with densely growing species to reduce edge effects on the habitats created.

Issue 6: All shrubland plantings should include the species Kunzea ericoides rather than Kunzea robusta.

The Council's Ecological Advisor considers that the plantings proposed in Sections E, S and K should include the species *Kunzea ericoides*.

The distribution of kanuka was relied upon to assign the species after the site visit. *K. ericoides* is a "common tree of the northern South Island only with its distribution

recorded as north of the Buller and Wairau Rivers[4]" and that species is "most common in North West Nelson". *K. robusta* is recorded as a "widespread, common tree of North and South Islands.[5]" On that basis the trees in Wanaka are most unlikely to be *K. ericoides*. It is accepted however, that they may not be *K. robusta*.

Due to the recent revision of the taxonomy of the genus *Kunzea,* samples were not collected to confirm the species present.

The planting plan specifies that trees for planting must be ecosourced from the same ecological district according to best practice. The actual species currently present makes little practical difference.

Issue 7: The recommendation that species identified for planting within the Landscape Concept planting plan for Section S should be short tussock grassland and/ or shrubland species including Coprosma propinqua, Coprosma intertexta, Coprosma crassifolia, Coprosma virescens, Carmichaelia petriei, Olearia lineata, Sophora microphylla, Teucridium parvifolium, Podocarpus laetus and kanuka.

It has been recommended by the Council's Ecological Advisor that some of the species included in the Section S area are likely to be difficult to establish at the site and that alternative short tussock grassland and/or shrubland species should be used.

As noted above with respect to Issue 2, some of the species proposed were intended to attract birds to the site to assist in natural spread of bird-dispersed species like totara, but are early successional species so would be unlikely to persist in the longer term, although they may spread throughout the area. While the species proposed are appropriate and could be included in the proposed planting, the short tussock grassland proposed would not provide adequate screening and is therefore (on balance with landscape considerations) inappropriate for Section S.

Issue 8: The recommendation that similar species to those above be included in the Section E plantings with the addition of Plagianthus regius and Fuscospora cliffortioides as a sheltering/ screening landscaping tree.

The Council's Ecological Advisor considers that similar species to those proposed for Section S of the planting plan should also be used for Section E. If such an approach is adopted, Council's Advisor considers that short tussock grassland could then merge more gradually into the open grassland surrounding the allotments and would also compensate for the loss of grassland habitat by enhancing the habitat for McCanns skink.

The landscaping plan for the proposal has been updated to account for some of the recommendations with respect to species plantings. As per the discussion with respect to Issue 7, low level tussock would not be appropriate due to the implications for visual landscape effects.

Muehlenbeckia was included on the planting list to provide habitat for lizards, as well as food for small frugivorous birds (such as waxeyes) which would assist in dispersing seed, and because a dense mounded ground cover such as *Muehlenbeckia* provides would assist in reducing edge effects as well as softening the look of the taller vegetation.

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4 http://www.nzpcn.org.nz/flora_details.aspx?ID=885

5 http://www.nzpcn.org.nz/flora_details.aspx?ID=7644

4.3 Conclusion

The vegetation within the area affected by the proposed Peninsula Bay North End plan change includes both kanuka shrubland and depleted tussock grassland which can be considered locally significant using the criteria in the Queenstown Lakes District Plan.

The grassland habitat comprises small areas and is likely to be undergoing succession to shrubland. The shrubland is poorly diverse and natural seed sources to address this are rare in the near vicinity.

Enhancement planting is proposed and would be based on ecological considerations of the species likely to occur there in the past. This approach of retaining vegetation and enhancing it will both reduce the area of exotic grassland and supplement the diversity of the existing shrubland. As well as increasing diversity this approach has other local ecological benefits such as improved connectivity and ecological functioning. Such an approach is appropriate and is expected to result in a better overall ecological outcome than allowing natural succession at the site.

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APPENDICES

APPENDIX 1

Explanation of the Land Environments of New Zealand (LENZ) and New Zealand Land Cover Databases

Explanation of LENZ and LCDB

The Land Environments of New Zealand ("LENZ") database is an attempt to objectively define ecological units at multiple spatial scales (Leathwick et al. 2002, 2003). The database uses 15 environmental variables (such as climate and soil type) that correlate strongly with species distribution to classify New Zealand into discrete environment types. The environment types are nested within a hierarchy, with the first level at the widest scale being given an alphabetic description (Environments A-T). At each increasing level the classification becomes finer scale and differences between the environments become less, for example there is more difference between Environments D3 and D4 than there is between D4.1 and D4.2 and even less difference between D4.1a and D4.1b. This results in a series of maps showing the geographical distribution of units ("land environments") having similar ecosystem characters. LENZ can be used to identify the type of land environment and thus the vegetation expected at a particular site. LENZ mapping is based on potential rather than current habitat with respect to what species are found in a particular environment type and provides an indication of the species that could potentially be found in a particular environment if the vegetation was successionally mature. The advantage of LENZ is that it provides an objective measure of the extent and significance of environments in a regional, national and, at least potentially, global context. This measure can be used for a wide range of purposes including management. LENZ has some limitations due to the accuracy and resolution of the data (particularly the soil data) from which it was derived and slight local variations in some factors (e.g. topography) can give rise to quite major changes in vegetation composition and structure that are not detected in the LENZ framework. This makes habitats that are not predicted by LENZ hard to assess in terms of their representativeness within the LENZ framework and a more subjective assessment is required. Furthermore the scale at which LENZ was developed does not recognise naturally rare ecosystem types which are by definition limited in their extent (Williams et al. 2007).

The New Zealand Land Cover Database ("LCDB") is a spatial dataset which maps vegetation cover types across the country based on satellite imagery, aerial photography and other sources. The first version of LCDB was compiled based on images taken in summer 1996/7, this was updated with images from summer 2001/2 (the second version "LCDB2"), summer 2008/2009 (LCDB3) and summer 2012/13 (LCDB4). Version 4.1 was issued in July 2015 and includes improvements to the mapping. Different vegetation types recognisable on the satellite images are both delineated and classified. The current version, LCDB4 (and its predecessor LCDB3), contains 33 vegetation classes.

The Land Cover Database is limited by resolution accuracy and the lack of systematic and statistically robust field sampling, but the information is useful for understanding how land cover has changed over time, and particularly for determining which land cover is now found (rather than that predicted by LENZ). This can then be verified by field survey. LCDB is also useful for determining which types of land cover (or habitat) are becoming more rare and should therefore be considered threatened (Walker et al. 2006, Brockerhoff et al. 2008, Cieraad *et al*. 2015).

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Williams, P.A., Wiser, S., Clarkson, B. and Stanley, M.C. 2007. New Zealand‟s historically rare terrestrial ecosystems set in a physical and physiognomic framework. New Zealand Journal of Ecology (2007) 31(2): 119-128.Plant species

APPENDIX 2

Plant and Bird Species Recorded

Plant Species Recorded

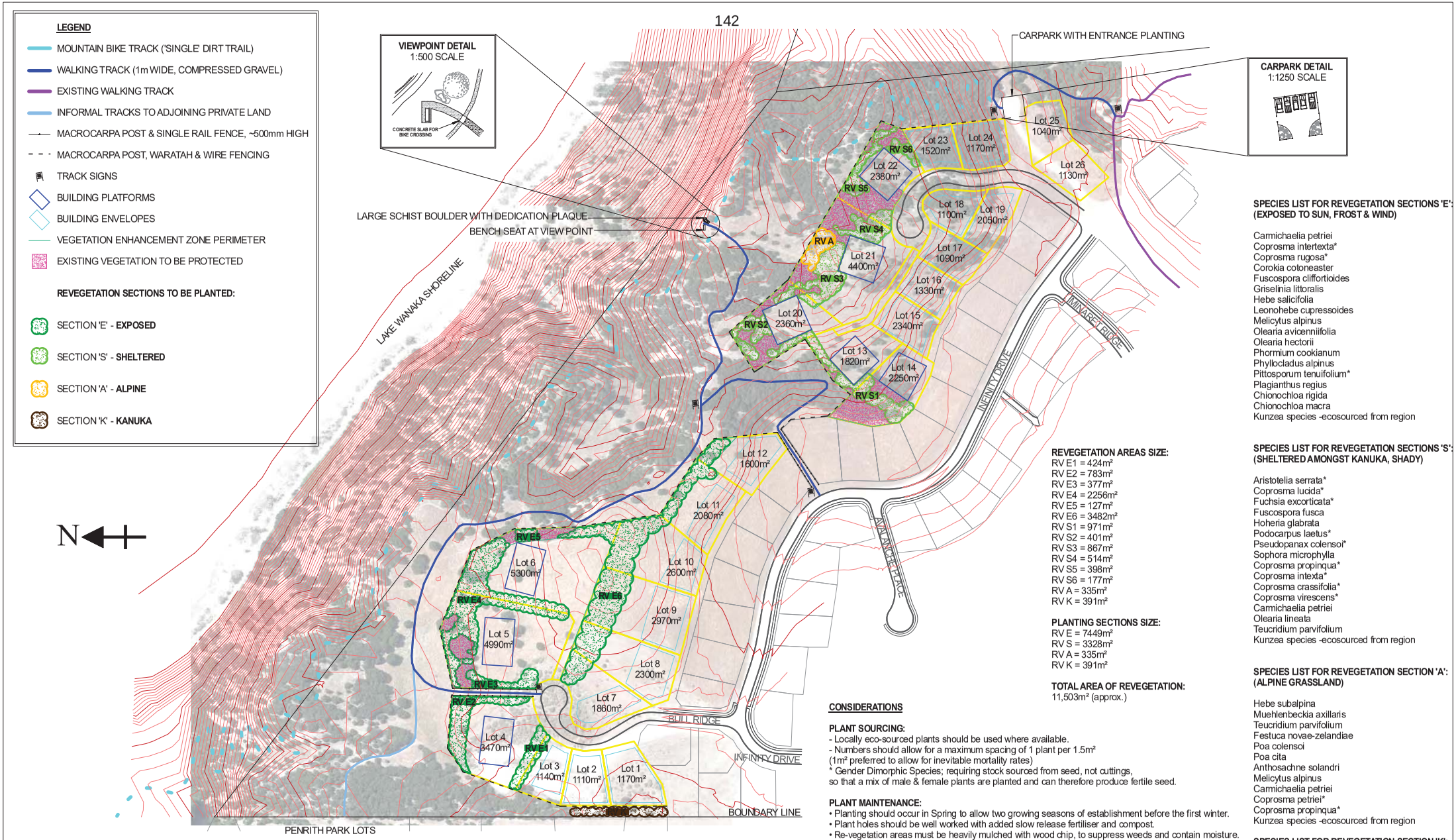
Species (*denotes exotic)	**Common name**
Dicot herbs	
*Achillea millefolium**	yarrow
*Alchemilla mollis**	
Anisotome aromatica	aromatic aniseed
*Cirsium arvense**	Californian thistle
*Cirsium vulgare**	Scotch thistle
*Geranium molle**	doves foot cranesbill
*Hieracium lepidulum**	tussock hawkweed
Kelleria dieffenbachii	
*Lapsana communis**	nipplewort
*Leontodon taraxicoides**	hawkbit
Raoulia hookeri var. *hookeri*	scabweed
*Rumex acetosella**	sheep's sorrel
*Rumex obtusifolius**	broad-leaved dock
*Trifolium arvense**	haresfoot trefoil
*Trifolium repens**	White clover
*Verbascum virgatum**	moth mullein
Sedges, Rushes and Grasses	
*Agrostis capillaris**	browntop
Anthosacne solandri	native wheat grass
*Anthoxanthum odoratum**	sweet vernal
*Dactylis glomerata**	cocksfoot
*Lolium perenne**	perennial ryegrass
Poa colensoi	blue tussock
Woody Shrubs and Trees	
Carmichaelia petriei	desert broom
Coprosma propinqua	mingimingi
Coprosma petriei	turfy coprosma
*Cytisus scoparius**	wild broom
Discaria toumatou	matagouri
Kunzea robusta	kanuka
*Larix decidua**	European larch
Leucopogon fraseri	patotara
*Lupinus polyphyllus**	Russell lupin
Melicytus alpinus	porcupine scrub
*Pseudotsuga menziesii**	Douglas fir
*Rosa rubiginosa**	briar
Climbers and Vines	
Muehlenbeckia complexa var. *complexa*	small leaved pohuehue
Ferns and Tree ferns	
Pteridium esculentum	bracken

Bird Species Recorded

Bird Species (*denotes exotic)	**Common name**
*Carduelis carduelis**	goldfinch
Circus approximans	harrier
*Cracticus tibicen**	Australian magpie
*Emberiza citronella**	yellowhammer
*Fringilla coelobs**	chaffinch
Gerygone igata	grey warbler
*Passer domesticus**	house sparrow
Rhipidura fuliginosa	fantail
Tadorna variegata	paradise shelduck
*Turdus merula**	blackbird

APPENDIX 3

Landscape Concept Plan prepared by Rachael Stanford Landscape Design



REVEGETATION AREAS SIZE:
RV E1 = 424m²
RV E2 = 783m²
RV E3 = 377m²
RV E4 = 2256m²
RV E5 = 127m²
RV E6 = 3482m²
RV S1 = 971m²
RV S2 = 401m²
RV S3 = 867m²
RV S4 = 514m²
RV S5 = 398m²
RV S6 = 177m²
RV A = 335m²
RV K = 391m²

PLANTING SECTIONS SIZE:
RV E = 7449m²
RV S = 3328m²
RV A = 335m²
RV K = 391m²

TOTAL AREA OF REVEGETATION:
11,503m² (approx.)

CONSIDERATIONS

PLANT SOURCING:
- Locally eco-sourced plants should be used where available.
- Numbers should allow for a maximum spacing of 1 plant per 1.5m² (1m² preferred to allow for inevitable mortality rates)
* Gender Dimorphic Species; requiring stock sourced from seed, not cuttings, so that a mix of male & female plants are planted and can therefore produce fertile seed.

PLANT MAINTENANCE:
• Planting should occur in Spring to allow two growing seasons of establishment before the first winter.
• Plant holes should be well worked with added slow release fertiliser and compost.
• Re-vegetation areas must be heavily mulched with wood chip, to suppress weeds and contain moisture.
• Deep irrigation should be provided for at least the first five years to allow for strong plant establishment.
• Necessary rabbbit protection must be applied to all planted *and protected* areas; in the form of rabbit proof fencing, individual plastic sleeves around plants and poision programs.

NOTE: ALL PINUS, PSEUDOTSUGA & CYTISUS ON SITE TO BE REMOVED.

SPECIES LIST FOR REVEGETATION SECTIONS 'E':
(EXPOSED TO SUN, FROST & WIND)

Carmichaelia petriei
Coprosma intertexta*
Coprosma rugosa*
Corokia cotoneaster
Fuscospora cliffortioides
Griselinia littoralis
Hebe salicifolia
Leonohebe cupressoides
Melicytus alpinus
Olearia avicenniifolia
Olearia hectorii
Phormium cookianum
Phyllocladus alpinus
Pittosporum tenuifolium*
Plagianthus regius
Chionochloa rigida
Chionochloa macra
Kunzea species -ecosourced from region

SPECIES LIST FOR REVEGETATION SECTIONS 'S':
(SHELTERED AMONGST KANUKA, SHADY)

Aristotelia serrata*
Coprosma lucida*
Fuchsia excorticata*
Fuscospora fusca
Hoheria glabrata
Podocarpus laetus*
Pseudopanax colensoi*
Sophora microphylla
Coprosma propinqua*
Coprosma intexta*
Coprosma crassifolia*
Coprosma virescens*
Carmichaelia petriei
Olearia lineata
Teucridium parvifolium
Kunzea species -ecosourced from region

SPECIES LIST FOR REVEGETATION SECTION 'A':
(ALPINE GRASSLAND)

Hebe subalpina
Muehlenbeckia axillaris
Teucridium parvifolium
Festuca novae-zelandiae
Poa colensoi
Poa cita
Anthosachne solandri
Melicytus alpinus
Carmichaelia petriei
Coprosma petriei*
Coprosma propinqua*
Kunzea species -ecosourced from region

SPECIES LIST FOR REVEGETATION SECTION 'K':
(KANUKA)

Kunzea species -ecosourced from region

design@rachaelstanford.co.nz
Mobile: (021) 115 6269
Studio: (03) 443 8392
7 Islington Place, Wanaka

SITE:	PLAN:		
PENINSULA BAY NORTH END PROPOSED PLAN CHANGE	**LANDSCAPE CONCEPT**	**5 NOVEMBER 2015**	**1:2500**
	FOR: **INFINITY INVESTMENTS**	**01/017 - 15/16**	0 50m 100m
		REVISION: **F**	*Drawing to scale when printed on A3 sheet*