


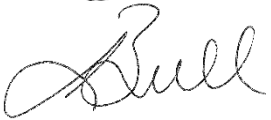
Prince of Wales / Omāroro Reservoir

Preliminary design Ecological Impact Assessment
Prepared for Wellington Water

18 April 2017



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Cover Photo: Looking south to the knoll from the upper playing field across a mosaic of planted native and exotic plant communities © BML 2017

Executive Summary

This assessment considers the potential effects of constructing a water storage reservoir at Prince of Wales Park, within the Wellington City Town Belt.

Project Description

- Council is proposing to build a new 35 million litre buried reservoir above Prince of Wales Park. This will serve Wellington City's Low Level Water Supply Zone, including the CBD, Mount Cook, Newtown and Thorndon. Subject to obtaining required approvals, consents and funding, it is anticipated that work to develop the reservoir could commence in 2018/19. The reservoir will be buried to limit modification to the landscape. It will sit on the ridge above the sportsfield adjacent to Rolleston Street in Mt Cook. The temporary construction site for the reservoir is anticipated to encompass the full extent of the buried reservoir site including a 10m working buffer area, and Prince of Wales Park's upper and lower playing field areas.
- The proposed design includes a range of features intended to avoid or minimise effects on the local ecology. Further design refinement will occur following consultation.

Method

- A range of methods were used to map and describe the vegetation, birdlife, streams and instream fauna.
- Once described, the significance of each ecological element was determined and its ecological values described. An assessment of effects was then carried out using the EIANZ methodology. A range of measures to avoid, remedy and mitigate effects is then provided.
- Finally, the proposed design and proposed remedy and mitigation is checked against the objectives and policies in the Wellington Town Belt Management Plan (WTBMP), and against Policy 47 of the Regional Policy Statement (RPS).

Land Use and Modification

- The site would have been forested prior to human settlement. The forests would have been dominated by abundant kohekohe and frequent tawa, with occasional tītoki, māhoe, porokaiwhiri and nīkau, and scattered emergent rimu, pukatea and northern rātā.
- The land has been historically cleared and all vegetation that is present today has either regenerated since clearance, or has been planted. The plantings include both indigenous vegetation and vegetation dominated by a range of introduced species.

Existing Environment

- The current vegetation patterns on the site are complex and include lawns and playing fields, stands of pines, areas dominated by large eucalypts, plantings of pohutukawa, native plantings, and areas of natural regenerating native forest in gullies or as an understorey beneath pines.
- The avifauna, which a few decades ago would have been limited in diversity, is now enriched by species released within the Karori Wildlife Sanctuary, or which have arrived naturally assisted by council's pest control operations. Most notable arrivals or increases are kaka, tui and kereru.
- Two streams, Waitangi Tributary and Papawai Stream, have perennial flows and aquatic fauna. Papawai Stream has the most diverse habitat and contains native fish. These are some of the last fragments of the original Waitangi Stream. The remainder of Waitangi Stream is culverted beneath the city and suburbs.

Determination of Significance

- We consider that one element of the local ecology, the indigenous seral forest found in several locations within the site, meets the test for significant under Policy 23 of the RPS.
- There is no other aspect of the sites vegetation, streams or habitat that we consider to be significant under Section 6(c) of the RMA.

Assessment of Value

- We consider that the indigenous seral forest is both significant under the criteria of Policy 23, and also has moderate ecological value.
- In addition, we consider that other communities and habitats have ecological value, in particular, the winter flowering eucalyptus, some of which will be lost.
- In addition, the two small streams, which despite having relatively limited habitat values, are some of the last remaining fragments of the original Waitangi Stream catchment. For this reason, we consider that they have moderate and high ecological value.
- We consider that each of these four elements (the seral forest, winter flowering eucalyptus, and the two small streams) require avoidance, remedy or mitigation where effects occur.

Assessment of Effects

- We have considered the magnitude of effects for each element identified above and conclude that the overall level of effects is low to very low. This assumes:
 - Loss of seral forest is limited to the extents shown, and opportunities to further reduce the extent of loss are explored;
 - Both Papawai Stream and the Waitangi Tributary are avoided by physical works, and riparian planting is replaced where lost;
 - Papawai Stream, its flows and habitat, are not adversely affected by the proposal to raise the lower playing field;
 - Robust sediment and erosion management during construction prevent significant discharges of sediment to Waitangi Stream and Wellington Harbour; and

Recommendations

Avoid / Minimise

- Some measures to avoid effects are built into the design, specifically avoidance of the two perennial waterways.
- A number of further design refinements are discussed where additional avoidance may be possible during detailed design. This includes confirmation of areas within the 10m buffer which can also be avoided or where effects can be minimised. These refinements can form part of stakeholder consultation.

Remedy

- We believe all effects on indigenous flora, fauna and habitats will be remedied by the proposed revegetation of works which are detailed in the Landscape and Visual assessment. A number of recommendations for planting specific to remedy of ecology effects have been made and are incorporated into the planting design.

Mitigate

- We conclude that no additional mitigation is required.

Monitor

- Monitoring of avoidance measures, potential effects, and the success of remedial planting are identified. All are standard measures expected on a construction site.

Conclusions

- Overall we find that despite some small areas of habitat loss, the effects of the project as currently designed are not significant, or sufficiently adverse to the local ecology to suggest this project cannot proceed.
- Further, and assuming the recommendations in Section 8 are carried out, we conclude that the effects of this activity will be low to very low in the short term, can be fully remedied within the site, and the proposed revegetation will result in medium to long term ecological benefits for the site.
- We conclude that the works as proposed, and including the remedial measures described, are consistent with the objectives and policies of the WTBMP.

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1 Introduction

Wellington Water has commissioned Boffa Miskell to prepare an ecological effects assessment for a proposal to construct a new reservoir within Prince of Wales Park (POWP) which forms part of the Wellington Town Belt ('Town Belt').

The site occupies part of the Wellington Town Belt within POWP and is part of the Brooklyn Hills Sector (see Figure 1). This sector of the Town Belt combines four nearly contiguous Wellington City Council (WCC) reserves that share many similarities in terms of indigenous and exotic vegetation mixes.

The proposed reservoir has been anticipated at this location by the Wellington Town Belt Management Plan (Section 8.4.3 of the WTBMP).

"The Council is proposing to build a new 35 million litre reservoir above Prince of Wales Park. This will serve Wellington Hospital's emergency needs and provide bulk water supply for the city's growing inner city population. Work is planned to begin in 2015/2016. The reservoir will be buried to limit modification to the landscape. It will sit on the ridge above the sportsfield adjacent to Rolleston Street in Mt Cook."

The project is now moving to the consenting phase. The objectives of this current study and assessment are therefore to:

- Describe the ecological environment and features.
- Determine significance and ecological value.
- Identify the location and scale of potential adverse effects.
- Identify opportunities and methods available to avoid, minimise or remedy potential effects.
- Confirm the sensitivity of the site to any potential unavoidable adverse effects.
- Determine what additional mitigation is required and provide recommendations.

This assessment begins by describing the project and design process (Section 1.1), the assessment methodology (Section 2), the results of the desktop research (Section 3), the results of additional site investigations (Section 4), a summary of the significance and values of the site (Section 5 & 6) and an assessment of effects (Section 7). It finishes with recommendations and conclusion (Sections 8 and 9).

1.1 Project Description

The scope of works provided to us were as follows:

- The site of works includes an elevated spur and the well-known and used look-out knoll with views up Wellington Harbour to the Tararuas. The spur and knoll rise to the south of an existing playing field accessed off Rolleston Street (Upper Park) and north-west of a lower playing field accessed off Salisbury Terrace (Lower Park).
- The proposed reservoir holds a total volume of 35,000m³ of water, which is the equivalent of 14 Olympic size swimming pools. A proposed tunnel structure extends to the north of the reservoir and connects with the existing water network at Hargreaves Street through inlet and outlet pipes constructed beneath the adjoining playing field within POWP.
- The proposal will include measures to integrate the reservoir with the existing spur landform, including covering the structure with soil, planting and reinstating recreation access, as well as temporary and permanent alterations to the levels of adjoining playing fields (collectively hereinafter referred to as "the site"). Planting will be designed to provide both landscape and ecological mitigation.

- A range of scenarios could apply to how the adjacent playing fields are used and developed in conjunction with the reservoir development. For the purpose of this assessment it has been assumed that the reservoir development will involve both upper and lower playing fields being raised by up to 1.5m, with both fields also being used during the course of the reservoir development for the temporary storage of excavated material that will be used to backfill the reservoir site once constructed.
- The design has sought to avoid the two tributaries of Waitangi Stream and minimise effects on riparian vegetation.
- The design has sought to minimise loss of indigenous seral vegetation¹.
- This assessment has assumed that a working buffer of up to 10m will be required around the provided design footprint of the Reservoir, which may be necessary to facilitate access to earthworks, for vegetation management, and to install, operate and remove any required erosion and sediment control measures. Vegetation removal may be required within all or parts of this buffer area. This assessment provides some options for detailed design to avoid or minimise effects within this buffer and recommendations for managing this area during construction.
- However, no buffer is provided for the two playing fields where we have been assured that all works can be contained within the design footprint provided.
- A number of actions will be taken to capture and treat sediment from works and prevent or minimise its discharge to local streams and the harbour. The details of this are contained within a separate report, the draft erosion and sediment control plan.

1.2 Consultation and Project Shaping

This preliminary assessment has been prepared for the internal approval process required by Wellington City Council (WCC). Once approval to proceed has been gained from WCC, the project will move into a consultation phase and from that further design refinement will be considered and a final Ecological Impact Assessment prepared.

¹ Seral vegetation: one of a succession of transitory plant communities in a given habitat that develops during an ecological succession from bare ground to a climax state.

2 Methodology

2.1 Desktop Review

A desktop exercise was carried out to review current ecological knowledge of the site and to understand the proposed scope of works. The review included standard site inventories, management plans, other scientific studies, aerial photography at different times (years) and GIS data sets.

Prior to the site visit a vegetation map was prepared using aerial photography (Source WCC 2013). These maps formed the basis of the field investigations and descriptions of vegetation and habitat. In late January the project sourced high resolution aerial photographs using a drone, the vegetation mapping was refined, and any changes ground truthed. The base aerals and resulting maps are therefore current.

2.2 Site Investigations

The site was first visited on 20 November 2016 by the project Ecologist with members of the project team as part of an introduction to the project and to determine subsequent requirements for further ecological field investigation. It was visited again on 20 December 2016 with the Landscape architects and a representative of WCC Parks to consider Council's requirements for ongoing use-ability and integrity of the park, integration of landscape restoration, ecological requirements for mitigation and ongoing and future requirements for recreational access within that design. Various subsequent visits were made for specialist analysis as follows:

- **Vegetation Community Mapping:** A simple vegetation map was prepared from aerial photographs, with plant communities delineation based on colour, texture and height of vegetation. This map was then tested in the field during a site visit on 24 January 2017; each mapped plant community was visited, boundaries refined, and vegetation descriptions produced. On 30 January 2017 a drone was used to gather imagery of the site which was current to the date of survey. The vegetation map was updated using these high resolution aerals and final ground-truthing was carried out on a follow up site visit on 1 March 2017. On both visits (24 Jan and 1 Mar) the weather was mild and sunny.

A decision was made on the November 2016 site visit that quantitative sampling (plots) were not required as part of vegetation mapping or description because:

- the patterns of vegetation were easily observed and relatively 'simple'; and
 - the great majority of potentially affected vegetation was planted, pioneer or early successional.
- **Rare Plants:** Prior to the site visit on 24 January 2017, locally and nationally rare plants that could be present were identified and listed from several sources (de Lange et al., 2013; New Zealand Plant Conservation Network, 2013). During the mapping of vegetation, the botanist present observed any habitats where these species were likely to occur, as well as any other observation of rare or threatened plants.
 - **Mosses and Lichens:** Surveys were not carried out for mosses and lichens on the assumption that the areas of vegetation within the study area are all planted or are young seral forests that have regenerated following clearance. The likelihood of rare lichens or mosses persisting from original communities was considered low. Any present within the area of clearance are considered to have colonised from other nearby local populations.
 - **Herpetofauna:** The desktop study identified that a recent survey within POWP did not detect lizards, but recorded high levels of predator activity. We note that failure to detect does not necessarily equate to absence, however, it does indicate any remaining populations are at levels that cannot be detected by standard methods. We saw no benefit in repeating this work.

We have assumed that ground-active skinks may be present and the quality of habitat restoration will be considered as a mitigating factor for any loss.

- **Avifauna:** Considerable information on birdlife within the town belt is available as part of ongoing bird monitoring in Wellington parks, reserves and the wider city carried out by WCC staff and volunteers. However, none of the ongoing sampling is occurring within the Brooklyn Hills sector of the inner town belt. Therefore 5-minute bird counts were conducted during early morning and evening at three sites (see Map 4, page 44) on two consecutive days (10 February and 11 February 2017). The three sites were (i) the lower playing field, (ii) upper playing field, and (iii) knoll. Standard methods were used (Hartley, 2012). We also reviewed crowd sourced data on *Ibird* and *Inaturalist*.

We note that the bird counts were only conducted over one season, being summer. Typically, counts are done seasonally for 12 months for a new site. However, with the information already available on bird occupancy of council reserves, we decided the purpose of the counts at this time would be to confirm presence and understand relative abundance of the most common species. Incidental observations were also recorded during the site visits on 23 January and 1 March.

- **Terrestrial Invertebrates:** Surveys were not conducted for terrestrial invertebrates on the assumption that the areas of vegetation to be affected are all planted or are young seral forests that have regenerated following historic clearance. The likelihood of rare invertebrates persisting from original communities was considered low. Any present within the area of clearance are considered to have colonised from other nearby local populations.
- **Waterways:** Waterways were identified from WCC streams GIS layer and were visited over two days (15 and 16 February 2017). On the first day the waterways were located, reaches with distinct morphologies identified, and fish surveys conducted in that evening for those reaches with flows.

The waterways were revisited and described in more detail on the following day, by walking both up and down stream to understand diversity and completing a simple Physical Habitat Assessment (Maxted, John R., n.d.) to determine relative habitat quality. We considered and rejected the use of Stream Ecological Valuation (SEV) as this method is not recommended for waterways of the small size found at this site. In addition, SEV was developed to calculate compensation ratios for stream loss, in particular in association with culverting; the current design does not propose any direct effects on streams.

Spotlighting was carried out on the evening of 15 February 2017. The PHA survey was carried out on the morning of 16 February 2017. There had not been significant rainfall for two weeks prior to the survey.

- **Aquatic Fauna:** The waterways to be fished were too shallow to net, and generally too shallow to easily conduct a fish survey using an electric fishing machine (EFM). The fish survey was therefore done by spotlighting using the standard methods (Allibone, n.d.), modified as necessary to account for the small channel size and overhanging vegetation (i.e. some sections were crawled). Results were recorded on the standard NIWA freshwater fish database template.

A decision was made not to carry out macro-invertebrate surveys. Observations made during both the day and night visits confirmed a preponderance of midge larvae in the sections dominated by muds. Slightly more diversity was apparent in the more bouldery sections. The values of these streams are evident and we were satisfied that additional macro-invertebrate data would not alter our assessment of significance.

All sample sites are shown in Map 4, page 44.

2.3 Other Disciplines

In developing this assessment, we have consulted with, and viewed the maps and documentation prepared by the project engineer regarding the construction scope, extent and methodology.

We have visited the site and discussed the proposal with the project engineers, planners and landscape architects.

The methodology and assessment was discussed with the technical experts in freshwater ecology, avifauna and herpetology.

2.4 Assessing Significance

The criteria used under Policy 23 of the Wellington RPS are:

Table 1: Assessment Criteria for assessing significance (Policy 23)

| Policy 23: Identifying indigenous ecosystems and habitats with significant indigenous biodiversity values – district and regional plans | |
|--|--|
| District and regional plans shall identify and evaluate indigenous ecosystems and habitats with significant indigenous biodiversity values; these ecosystems and habitats will be considered significant if they meet one or more of the following criteria: | |
| a) | Representativeness: the ecosystems or habitats that are typical and characteristic examples of the full range of the original or current natural diversity of ecosystem and habitat types in a district or in the region, and: <ul style="list-style-type: none"> (i) are no longer commonplace (less than about 30% remaining); or (ii) are poorly represented in existing protected areas (less than about 20% legally protected). |
| b) | Rarity: the ecosystem or habitat has biological or physical features that are scarce or threatened in a local, regional or national context. This can include individual species, rare and distinctive biological communities and physical features that are unusual or rare. |
| c) | Diversity: the ecosystem or habitat has a natural diversity of ecological units, ecosystems, species and physical features within an area. |
| d) | Ecological context of an area: the ecosystem or habitat: <ul style="list-style-type: none"> (i) enhances connectivity or otherwise buffers representative, rare or diverse indigenous ecosystems and habitats; or (ii) provides seasonal or core habitat for protected or threatened indigenous species. |
| e) | Tāngata whenua values: the ecosystem or habitat contains characteristics of special spiritual, historical or cultural significance to tāngata whenua, identified in accordance with tikanga Māori. |

Note that we have not assessed Tangata whenua values which is outside our area of expertise. We understand that Tangata Whenua have been consulted with and this is reported separately within the AEE.

2.5 Evaluation of the level of effects

The methodology for assessing the level of the ecological effects associated with the proposals follows that in the EIANZ (2015) guidance Ecological Impact Assessment. In summary, this method requires:

- An assessment of biodiversity significance as per Policy 23 of the Regional Policy Statement for the Wellington Region (Greater Wellington Regional Council, 2013) as presented in Table 1.
- An assessment of ecosystem value as presented in Table 2 and Table 3;
- An assessment of the magnitude of the impact based on criteria listed in Table 4;
- The application of a matrix which determines the level of effect based on the site or species assessed value and the assessed magnitude of impact (Table 5).

2.5.1 Assessing ecological value

For plant communities and habitats we have applied the criteria as described in the EIANZ (2015) guidance (Note these criteria are similar, but not identical, to those in Policy 23). Each of the four criteria are subjectively scored “high”, “moderate”, “low” or “nil”, based on the assessor’s experience and knowledge of the site. The four scores are then combined to provide a single site score which ranges from “Very High” to “Low” based on the following system (refer to Table 2).

Table 2: Assigning value to vegetation or habitat for assessment purposes (from EIANZ (2015))

| Determining Factors | Value |
|--|-----------|
| Supporting more than one national priority type ² | Very High |
| Supporting one national priority type or naturally uncommon ecosystem ³ | High |
| Locally rare or Threatened, supporting no Threatened or At-Risk species | Moderate |
| Nationally and locally common, supporting no Threatened or At-Risk species | Low |

For individual species of flora and fauna their threat status guides scoring of ecological value as follows:

Table 3: Assigning value to species for assessment purposes (from EIANZ (2015))

| Threat category (from Townsend et al (2008)) | Assigned Value |
|---|-----------------|
| Threatened – Nationally Critical, Endangered or Vulnerable | Very High |
| Nationally At-Risk – Declining | High |
| Nationally At-Risk – Recovering, Relict or Naturally Uncommon | Moderate - High |
| Not Threatened, locally uncommon/rare | Moderate |
| Not Threatened, common locally | Low |

2.5.2 Assessing magnitude of impact

Once the value of the ecosystem components has been determined, the magnitude of the impact is assessed. Magnitude of effect is a measure of the extent or scale of the impact, its duration, and the degree of change that it will cause. A typical scale of magnitude ranges from very high/severe to negligible as follows:

Table 4: Criteria for describing magnitude of effect (from EIANZ (2015))

| MAGNITUDE | DESCRIPTION |
|------------|---|
| Very High | <ul style="list-style-type: none"> Total loss of, or very major alteration to, key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature |
| High | <ul style="list-style-type: none"> Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature |
| Moderate | <ul style="list-style-type: none"> Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature |
| Low | <ul style="list-style-type: none"> Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature |
| Negligible | <ul style="list-style-type: none"> Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature |

² Refer MFE & DOC (2007a, 2007b): Protecting Our Places and Chapter 5.

³ Refer to Holdaway et al. (2012).

2.5.3 Assessing level of effect

Combining ecological value with effect magnitude provides an assessment of the level of the effect as per Table 5.

Table 5: Criteria for describing level of effect (from EIANZ 2015)

| | | ECOLOGICAL VALUE | | | |
|-----------|------------|------------------|-----------|----------|----------|
| | | Very High | High | Moderate | Low |
| MAGNITUDE | Very High | Very High | Very High | High | Moderate |
| | High | Very High | Very High | Moderate | Low |
| | Moderate | Very High | High | Moderate | Very Low |
| | Low | Moderate | Low | Low | Very Low |
| | Negligible | Low | Very Low | Very Low | Very Low |

EIANZ (2015) note that the level of effect can then be used as a guide to the extent and nature of ecological response required (including the need for biodiversity offsetting). For example:

- ‘Very high’ and ‘High’ represent a high level of effect on ecological or conservation values and warrant avoidance and/or extremely high intensity mitigation and remediation actions. Biodiversity offsetting should be considered where these adverse effects cannot be avoided.
- ‘Moderate’ represents a level of effect that requires careful assessment and analysis of the individual case. Such an effect could be mitigated through avoidance, design, or extensive appropriate mitigation actions.
- ‘Low’ and ‘Very low’ should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects. If effects are assessed taking mitigation into consideration, then it is essential that prescribed mitigation is carried out to ensure Low or Very low level effects.
- ‘Very low’ level effects can generally be considered to be classed as ‘not more than minor’ effects.

2.6 Definitions

For the purpose of this report:

- **“Project footprint”** refers to the earthworks extent including both the reservoir excavations, subsequent covering fills, laydown and stockpile area which include the upper and lower playing fields and the access track connecting the two fields. For this project the project footprint includes a 10m buffer around the reservoir excavations and associated covering fills, to allow for land necessary for management of erosion and sediment control devices, construction access and necessary tree trimming or removal.
- **“Study area”** refers to all land, water bodies and receiving environments that could be potentially affected by the Project (also called Zone of Influence). For this project we consider that the project footprint lies within the contiguous forests and parklands of the Brooklyn Hills Reserves through which mobile fauna move. The study area also extends to Wellington Harbour, the project’s receiving environment in relation to stormwater.

Because there is a gradation of naturalness of vegetation from seral forest to weedlands, the following descriptors are used within this document:

- **Indigenous:** A species is defined as indigenous to a given region or ecosystem if its presence in that region is the result of only natural process, with no human intervention. The term is equivalent to "native" in less scientific usage.
- **Adventive:** A species that has arrived outside its native range, but its population is not self-sustaining. Population numbers are only increased through re-introduction.
- **Introduced:** A species that has been introduced accidentally or deliberately by human activity outside its native range and is able to sustain itself in this new environment.
- **Naturalised:** A species that has been introduced accidentally or deliberately by human activity, or has self-introduced, outside its native range and is able to sustain itself in the new environment.
- **Invasive:** A plant, fungus, or animal species that is not native to a specific location (an introduced species), and which has a tendency to spread to a degree believed to cause damage to the environment, human economy or human health.
- **Induced:** in the context of this assessment, a community that is described as induced is one that exists, or has been directed to its current state, by human action.
- **Seral:** one of a succession of transitory plant communities in a given habitat that develops during an ecological succession from bare ground to a climax state.

Watercourses are defined as follows (Greater Wellington Regional Council, 2015):

- **Ephemeral flow path:** A "river" that: (a) does not have an active bed, or (b) has a bed that is predominantly vegetated, and (c) only conveys water during or immediately following heavy rainfall events, and (d) does not convey or retain water at other times.
- **River or stream:**
 - (a) means—
 - (i) a continuously or intermittently flowing body of fresh water, including a modified watercourse; and
 - (ii) the bed of the river or stream; but
 - (b) does not include—
 - (i) a part of the bed of the river or stream that is not owned by the Crown; or
 - (ii) land that the waters of the river or stream do not cover at its fullest flow without overlapping its banks; or
 - (iii) an artificial watercourse; or
 - (iv) a tributary flowing into the river or stream.
- **Active bed (rivers and streams):** For the purpose of determining stream width of permanently or intermittently flowing rivers and streams in Category 2 surface water bodies, the active bed is the area that is subject to at least frequent flows and is predominately un-vegetated and made up of silt, sand, gravel, boulders or similar material.

3 Site Description - Desktop Results

3.1 History of Land Use & Modification

The history of the inner town belt generally, and the Brooklyn Hills sector specifically, is well described in the WTBMP (Wellington City Council, 2013).

3.2 Geology and soils

The geomorphology and soils of the site are described in Table 6 (Note that the land use classification (6e6) is an extrapolation from nearby equivalent hill country, as the current NZLRI dataset shows the study area as “town”). Of note is the relatively shallow soil, stable slopes and low susceptibility to erosion, although moderate potential. This suggests that sediment and stormwater runoff during development can be managed with appropriate sediment control measures and good site management. Along the POWP spur, the existing landform proposed to accommodate the reservoir reaches a maximum elevation of 95 metres above sea level (m.a.s.l.).

Table 6: Geomorphology of the site (Heine, 1975; Page, 1995)

| | | | |
|---------------------|---------------------------|-------------------------------|---|
| Inland Hill Country | 6e6 (6e80) | (Lo)/GW; E + D – 0 N6p2 | Inland greywacke hill country in areas of moderate rainfall (1140-1270 mm p.a.) and with seasonal soil moisture deficiencies. Typically occurs below 400m a.s.l. Slopes are moderately steep, to steep (21° – 35°). The rock type is shallow patchy loess over slightly weathered greywacke and related slope deposits. |
| | KoH = Korokoro Hill Soils | | Soils are well drained Korokoro Hill soils formed from shallow patchy loess over slightly weathered greywacke and related slope deposits. Pre European forests would have been rimu – rata / tawa - kohekohe forest. Erosion is negligible but with the potential for moderate soil slip, scree and sheet erosion where forest cover is removed. Maintenance of a complete vegetation cover is necessary. Pastures are prone to scrub reversion. |

3.3 Historical Vegetation

There is general agreement between Heine (1975) and Singers & Rogers (2014), supported by our own knowledge of the local vegetation, as to the historic vegetation. Table 7 identifies vegetation unit MF6 described in Singers & Rogers (2014):

Table 7: Potential vegetation

| Ecosystem Unit Code and Name | Description: |
|---|---|
| MF6: Kohekohe, tawa forest <i>(Equivalent to D12 type of Nicholls (1976). Bayfield & Benson (1986), Bussell (1988), Wardle (1991) and McGlone & Neall (1994)).</i> | Podocarp, broadleaved forest of abundant kohekohe and frequent tawa, with occasional tītoki, māhoe, porokaiwhiri and nīkau, and scattered emergent rimu, pukatea and northern rātā. |

Before human settlement, the vegetation would have consisted of large emergent rimu and rata over a tawa dominated canopy with varying amounts of rewarewa, hinau, totara, matai, kohekohe and miro. Moist gullies (such as the one within the site) would also have contained kahikatea, pukatea, nikau, and treeferns. Drier sites would have seen totara, matai and titoki enter the canopies. Lianes would have been important, particularly kiekie and supplejack.

3.4 Recent Changes

Several community planting projects have been established throughout the Brooklyn Hills and contributed to the cover of indigenous vegetation and enhancement of Papawai Stream. There has also been loss of tall exotic trees through removal or windthrow.

Appendix 2 (pg. 45) presents a series of sequential aerial photos which show the changes to the vegetation at POWP over a fourteen-year period from 2002 to 2016, a period during which revegetation efforts have assisted in expanding indigenous vegetation communities and reducing exotic communities.

3.5 Current Vegetation

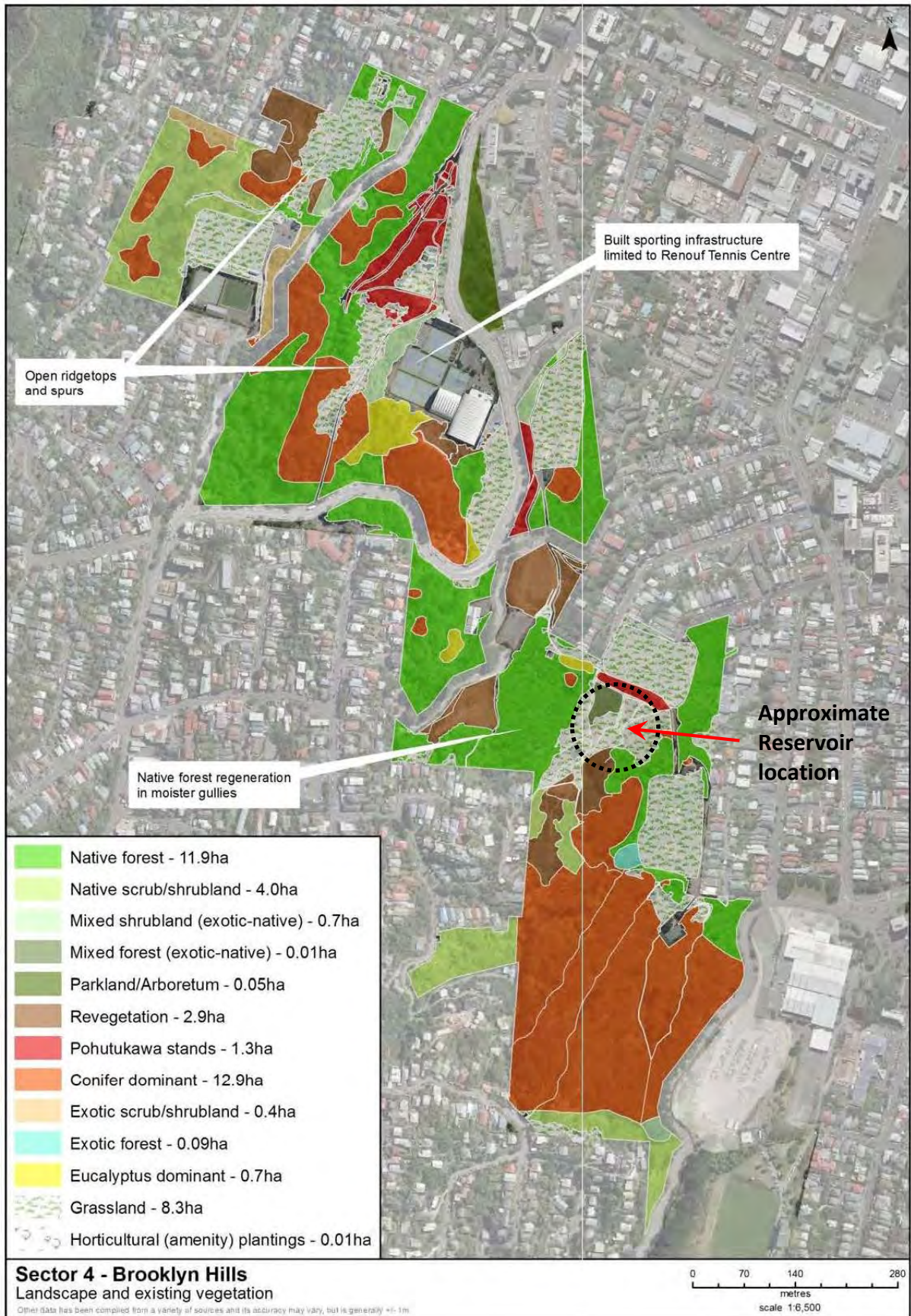
POWP is the southern end the Brooklyn Hills Sector (Sector 4) of the town belt, a continuum of vegetated open space which extends from Mortimer Terrace to Hutchison Road containing Tanera Park, Central Park, Brooklyn Hills, and POWP. These parks have a similar mosaic of vegetation including indigenous forest and scrub, conifer stands, playing fields, pohutukawa and eucalyptus stands, and open grasses tracks and lookouts.

The management plan describes the Brooklyn Hills Sector vegetation as follows:

“The vegetation patterns are complex (Sector 4: landscape and existing vegetation map). Prominent stands of pines and other conifers occur throughout, including a plantation above Hutchison Road. These are often associated with eucalypts. Mixed woodland in Central Park includes pines, eucalypts, deciduous trees such as elms, limes and a native understorey. Amenity plantings occur in Central Park and around some of the sports grounds. Native vegetation is regenerating in gullies or as an understorey beneath pines.”

Figure 1 (page 13) provides a summary of the areas of all vegetation communities within the Brooklyn Hills Sector as listed in the WTBMP. These vegetation communities comprise a total area of 43.26 ha.

Figure 1: Brooklyn Hills Sector 4 (2014 WCC) Study Area, Existing Vegetation mapped and measured. Project footprint outlined.



3.6 Rare Plants

We did not identify any records of naturally occurring plants that are Threatened or At-Risk at the site.

3.7 LENZ Threat

Table 8 shows the categories of the Land Environments of New Zealand (LENZ) threat classification (Walker et al., 2007).

The study area lies on land environment F1.4b which is classified as 'At Risk' 20-30% indigenous cover remaining. One of the criteria within Policy 23 of the RPS for determining significance is that the ecosystem or habitats are "no longer commonplace (less than 30% remaining. This means that any indigenous vegetation within the site will be significant in terms of being underrepresented.

Table 8: Sites by status of Land Environment (LENZ)

| Acutely threatened | Chronically threatened | At risk | Not at risk | Critically under protected | Under protected | Protected |
|---------------------------------|-----------------------------------|-----------------------------------|---------------------------------|---------------------------------|-----------------|----------------|
| <10% indigenous cover remaining | 10–20% indigenous cover remaining | 20–30% indigenous cover remaining | >30% indigenous cover remaining | >30% indigenous cover remaining | | |
| | | | | <10% legally protected | 10–20% | >20% protected |

We would note, however, that the site does not contain a natural priority type (Ministry for the Environment & Department of Conservation, 2007b) or a naturally uncommon ecosystem (Holdaway, Wiser, & Williams, 2012).

3.8 Terrestrial Fauna

3.8.1 Lizards & invertebrates

Several references were checked for any records of the presence of terrestrial fauna (lizards and macro-invertebrates such as land snails) at the location of the proposed works. A recent comprehensive survey of council reserves (EcoGecko Consultants Ltd, 2014) had not recorded any lizard species in POWP.

3.8.2 Avifauna

Bird counts have been carried out in the Council's parks and reserves network annually since 2011 (McArthur, Harvey, & Flux, 2015). This includes both the inner town belt and the outer green belt. The Brooklyn Hills area does not have a sampling site, but the list provided can be seen as a baseline against which we can check observations at the study area. In addition, the report (McArthur et al) includes crowd sourced data from the wider city, which identifies some species as being present in the Brooklyn Hills Sector. The species are: tui, bellbird, fantail, kereru, kaka, whitehead, North Island robin (adjacent to Polehill reserve), kakariki, and NZ falcon.

In Table 9 we list all species recorded within Wellington City's parks and reserves network and their threat status (Columns 1 and 2), and those species recorded within the Brooklyn Hills Sector (Column 3). In Column

4, we consider all species recorded in the Town Belt and determine, based on habitat preference and availability, the likelihood of presence within the project footprint.

Table 9: Bird observations within Wellington parks and reserves and suggested likelihood of presence with the study

| All birds observed in Parks & Reserves | Threat Classification ⁴ | Recorded within Brooklyn Hills ⁵ | Likely presence in the project area |
|--|------------------------------------|---|-------------------------------------|
| North Island kaka | NV | YES | YES |
| New Zealand falcon | NV | | YES |
| Red-billed gull | NV | | Unlikely |
| North Island saddleback | RC | | Unlikely |
| Variable oystercatcher | RC | | Unlikely |
| Red-crowned parakeet | RE | | YES |
| Bellbird | NT | YES | YES |
| Grey warbler | NT | | YES |
| New Zealand fantail | NT | YES | YES |
| New Zealand kingfisher | NT | | YES |
| New Zealand pigeon (kereru) | NT | YES | YES |
| North Island robin | NT | YES | Unlikely |
| Paradise shelduck | NT | | Unlikely |
| Shining cuckoo | NT | | YES |
| Silvereye | NT | | YES |
| Southern black-backed gull | NT | | YES |
| Spur-winged plover | NT | | Unlikely |
| Swamp harrier | NT | | YES |
| Tui | NT | YES | YES |
| Welcome swallow | NT | | YES |
| White-faced heron | NT | | Unlikely |
| Whitehead | NT | YES | YES |
| Australian magpie | I | | YES |
| California quail | I | | YES |
| Chaffinch | I | | YES |
| Common redpoll | I | | YES |
| Common starling | I | | YES |
| Dunnock | I | | YES |
| Eastern rosella | I | | YES |
| Eurasian blackbird | I | | YES |
| Goldfinch | I | | YES |
| Greenfinch | I | | YES |
| House sparrow | I | | YES |
| Skylark | I | | YES |
| Song thrush | I | | YES |
| Yellowhammer | I | | YES |

⁴ Threat classification rankings are as per Robertson et al (2013): NV – Nationally Vulnerable; RC – At Risk, Recovering; RE – At risk, Relict; NT – Not threatened; I – Introduced and Naturalised.

⁵ McArthur et al. (2015)

3.9 Freshwater Habitats

The site contains two small headwaters of Waitangi Stream, a stream largely buried within the piped Wellington stormwater network.

The largest is Papawai Stream, which flows through the site to the east of the knoll, and exits the site into the city stormwater at the top of Papawai Terrace. It has several branches within the site. The second smaller waterway flows down a gully to the west of the knoll and exits the site into the city stormwater at the top of Rolleston Road. It has a single wet channel.

Figure 2 is sourced from “Mapping Wellington’s Unpipied Streams” (Burnett, 2013) which identifies both waterways and the extent of Waitangi Stream that remains unpiped.

3.10 Freshwater Fauna

The various publications reviewed and the NIWA Freshwater Fish Database (National Institute of Water and Atmospheric Research, n.d.) identify one species of indigenous fish (banded kokopu, both adult and juvenile forms) as present within the Papawai Stream extending into POWP. These sources also identify that freshwater crayfish (koura) are common in Papawai Stream.

The database records report:

- Banded kokopu (*Galaxias fasciatus*): Method =Electric fish, 1 pass; Abundance = 6 fish, Length from 70mm to 100mm length, dated 2009; and
- Koura (*Paranephrops planifrons*): Method = Electric fish, 1 pass; abundance = common, dated 2009.

The records do not include effort (i.e. length or area fished). There are no records for Waitangi Stream downstream of POWP.

3.11 Marine Habitat

The ultimate receiving environment for all discharges to Papawai Stream is Wellington Harbour. Wellington Harbour therefore lies within the zone of influence of the project. The discharge point to Wellington Harbour is located at Waitangi Park.

Figure 2: The delighted portions of Papawai Stream and the unnamed tributary of Waitangi Stream, that lie within the study area, are highlighted within the blue dashed box (Burnett, 2013).



4 Site Investigations

4.1 Terrestrial Vegetation & Habitats

A more detailed vegetation map of the section of POWP within the area of works was prepared from aerial photography and site observation. The area potentially affected by works includes a diversity of plant communities including natural seral forest and scrub, planted native vegetation, grass with areas of gorse, and areas of pine, eucalyptus, sycamore and pohutukawa.

Table 10 provides a description of the plant communities found within the project footprint, compared to the total area of those communities within the Brooklyn Hills study area. The communities identified below are shown in Appendix 1 (Map 1, page 41). Photos of each community are presented in Appendix 4, page 49. A detailed description of each community is provided in Appendix 3, page 47.

Table 10: Quantity of loss of plant communities

| | Plant communities | Brooklyn Hills Study Area (ha) | Project Footprint (ha) |
|-----|--|--------------------------------|------------------------|
| 1. | Grassland / lawn and rank grasses (Photo 1) | 8.30 | 2.25 |
| 2. | Gorse shrublands over rank grasses (Photo 2) | 0.70 | 0.29 |
| 3. | Residential margins with scattered trees and weedlands (Photo 3) | - | 0.07 |
| 4. | Recent native plantings in gorse and exotic grasslands (c. 2012) (Photo 4 & Photo 5) | - | 0.36 |
| 5. | Maturing native planting (c. 2002 or earlier) (Photo 6 & Photo 7) | 2.90 | 0.15 |
| 6. | Seral native broadleaved forest and scrub communities (Photo 4 & Photo 5) | 15.90 | 0.18 |
| 7. | Pohutukawa forest and treeland (Photo 6 & Photo 7) | 1.30 | 0.23 |
| 8. | Forest and treeland dominated by invasive trees and weeds (Photo 13) | 0.50 | 0.07 |
| 9. | Pine trees and Pine Plantations (Photo 14) | 12.90 | 0.17 |
| 10. | Eucalyptus Treelands (Photo 15 and Photo 16) | 0.70 | 0.17 |
| 11. | Other Parkland / Arboretum and Horticultural plantings. | 0.10 | 0 |
| 12. | TOTAL | 43.30 | 3.94 |

For the purpose of the following assessment the 11 communities described above are combined into three groups, naturally occurring indigenous vegetation, planted native communities, and exotic communities, as shown in Table 11.

Table 11: Extent of vegetation clearance (excluding grasslands) within Sector 4: Brooklyn Hills.

| Plant Groups (excluding grasslands / fields) | Brooklyn Hills Area (ha) | Project Footprint Area (ha) |
|--|--------------------------|-----------------------------|
| Indigenous forest / scrub / shrubland | 15.90 | 0.18 |
| Planted native communities | 2.90 | 0.51 |
| Exotic communities (including fields) | 23.20 | 3.25 |
| Combined | 43.30 | 3.94 |

Pohutukawa plantings are included in the category “exotic communities”. Pohutukawa (*Metrosideros excelsa*) is not naturally found within the Wellington Region, but has naturalised since being introduced. Also, another

native plant (karo or *Pittosporum crassifolium*) is included as an invasive tree. Like pohutukawa, karo is not naturally found within the Wellington Region, but has naturalised since being introduced and was often used in planting due to its rapid growth. There are mixed views regarding the appropriateness of use of these species in the Wellington region, and in some areas they have been treated as a weed and removed. For the purpose of this assessment we have chosen not to include plantings of these species as indigenous plant communities.

4.1.1 Threatened, At-Risk or locally uncommon plants

One plant of *Pomaderris apetala* subsp. *maritima* (Nationally Critical; de Lange *et al.* (2013)) was seen beneath pine canopy outside of the project footprint. A wider search was conducted to determine if this species is more widespread but no other individuals were identified within the study area. It is possible that this plant is a garden escape, or has been historically planted.

No other threatened, at-risk, or locally uncommon species were seen during the site visit. This is anticipated given the history of the site. The native plants present are common, robust species that, following land retirement, have arrived by wind or bird dispersal, or have been planted.

4.2 Avifauna

Table 12 lists bird species observed on site based on both 5-minute bird counts and incidental observations recorded while traversing the site. The 5-minute counts provide a relative abundance estimate for the bird commonly seen. The five most commonly seen or heard birds during 5-min counts were goldfinch, magpie, tui, black-backed gull and starling. Note that two species were recorded (incidental observations) that were not recorded on the WCC surveys; pied shag and rock pigeon. The last column of Table 12 lists those birds potentially present (See Section 3.8.2) but not seen or heard during this survey.

Table 12: Observations of birds seen on site (5-minute bird counts and incidental observations), summer 2016/17.

| Birds likely present in project area (See table xx) | Threat Classification | 5-Min Counts | | Incidental Observations | Not seen or heard |
|---|-----------------------|--------------|-------|-------------------------|-------------------|
| | | Seen | Heard | | |
| New Zealand falcon | NV | | | | X |
| North Island kaka | NV | 0 | 4 | yes | |
| Pied Shag | NV | | | yes | |
| Red-crowned parakeet | RE | | | | X |
| Bellbird | NT | | | | X |
| Grey warbler | NT | 0 | 4 | yes | |
| New Zealand fantail | NT | 2 | 3 | yes | |
| New Zealand kingfisher | NT | | | yes | |
| New Zealand pigeon (kereru) | NT | | | yes | |
| Shining cuckoo | NT | | | | X |
| Silvereye | NT | 5 | 5 | yes | |
| Southern black-backed gull | NT | 11 | 1 | yes | |
| Swamp harrier | NT | 1 | 0 | yes | |
| Tui | NT | 10 | 3 | yes | |
| Welcome swallow | NT | | | | X |
| Whitehead | NT | | | | X |
| Australian magpie | I | 9 | 5 | yes | |
| California quail | I | | | | X |

| Birds likely present in project area (See table xx) | Threat Classification | 5-Min Counts | | Incidental Observations | Not seen or heard |
|---|-----------------------|--------------|-------|-------------------------|-------------------|
| | | Seen | Heard | | |
| Chaffinch | I | | | yes | |
| Common redpoll | I | | | | X |
| Common starling | I | 7 | 3 | yes | |
| Dunnock | I | | | | X |
| Eastern rosella | I | 3 | 0 | yes | |
| Eurasian blackbird | I | 1 | 3 | yes | |
| Goldfinch | I | 14 | 15 | yes | |
| Greenfinch | I | | | yes | |
| House sparrow | I | 2 | 1 | yes | |
| Rock Pigeon | I | | | yes | |
| Skylark | I | | | | X |
| Song thrush | I | | | yes | |
| Yellowhammer | I | | | | X |

NV – Threatened, Nationally Vulnerable; RC – At Risk, Recovering; RE – At Risk, Relict; NT – Not Threatened; I – Introduced and Naturalised.

Two native species with a threat status were recorded on site:

- **North Island kaka** (Nationally Vulnerable), which are spreading throughout Wellington City utilising flowering trees for nectars during spring, conifers and eucalyptus species for sap feeding, and utilising nest sites. At least one successful nesting has occurred in trees to the north of the site in 2013⁶. The potential nesting of this species needs to be considered as part of any tree felling conditions.
- **Pied shag** (Nationally Vulnerable) have not been recorded in previous WCC surveys. A single bird was seen traversing the site, most likely commuting to the colony at the Karori Wildlife Sanctuary. There is no habitat within the site for this species to utilise and no nest sites were observed. This species is therefore not considered to be a resident.

Two native species with a threat status and which are present within Council's parks and reserves were not recorded:

- **New Zealand falcon** (Nationally Vulnerable) were not seen during 5-minute counts or incidental observations, but have been observed in the wider study area (Brooklyn Hills reserves) and within the project footprint in citizen science records. The potential presence and nesting of this species needs to be considered as part of any tree felling conditions.
- **Red crowned parakeet** (At Risk). Like kaka, this species is spreading out from the Zealandia where they were recently released. They were not seen during 5-minute counts or incidental observations, but have been observed within the wider study area (Brooklyn Hills reserves) in citizen science records. The potential presence and nesting of this species needs to be considered as part of any tree felling conditions.

4.3 Herpetofauna

No targeted sampling was carried out on the site for herpetofauna (reptiles and amphibians). None have been recorded during previous site investigations.

⁶ WCC 2012: <http://wellington.govt.nz/your-council/news/2012/12/kaka-nest-found-in-prince-of-wales-park>

4.4 Freshwater Habitats

There are two waterways that are potentially affected by works; the Papawai stream and its tributaries, and a small tributary of Waitangi Stream. For the purpose of these descriptions, Papawai Stream was divided into five discrete sections: three within the main stem and two small tributaries (see Map 4). The Waitangi Stream tributary was treated as a single body.

Six sections of waterway were visited and described (Table 13). The sample sites can be seen in Map 4 (page 44). A simple physical habitat assessment (PHA) was carried out at each, the result given in the final column of Table 13 (the maximum possible score for this method is 140). Photos are presented in Appendix 5, page 57.

Table 13: Description and habitat quality of streams observed within the study area.

| Reach | Description | PHA Score |
|---|--|--------------|
| Papawai Stream | | |
| Reach 1 (Lower) (Photo 17 & Photo 18. Also Photo 28) | <ul style="list-style-type: none"> A major blowout was caused by recent flooding and only a short section of this reach was described, a narrow channel beside a park building leading up to a pool below the culvert separating this reach from reach two. The flood damage and channelization explain the low PHA score. All fish seen in this reach were within the small pool at the culvert outlet. | 61 (44%) |
| Reach 2 (Field drain) (Photo 19 & Photo 20) | <ul style="list-style-type: none"> Over this reach Papawai stream has been placed into a linear channel of relatively uniform width and depth. However, despite this the stream has good shade provided by a bund separating the waterway from the playing field and due to the planting of a variety of grasses along the bund and stream edge which provide cover and organic matter. It also has low velocity flows and stills ideal for some aquatic fauna. The channelization and low diversity explains the low PHA score, however, this is mitigated to a degree by the riparian cover and shading provided. The stream averages 550mm in width and 20mm in depth with a maximum depth of 150mm. It has a diverse substrate dominated by muds, sands and fine gravels, areas with large cobbles and boulders. | 71 (51%) |
| Reach 3 (Main stem upper) (Photo 21 & Photo 22) | <ul style="list-style-type: none"> This reach of Papawai stream is the most natural with only a little obvious channelization in its lower length, elsewhere flowing within a natural bed along an unmodified valley floor. Like reach 1 there is evidence of flood induced erosion and stream bank collapse, but it is not as severe in this section of the stream. The stream averages 400mm in width and 30mm in depth with a maximum depth of around 250mm in the lower section and 80mm in the upper. It has a diverse substrate dominated by muds, sands and fine gravels, areas with large cobbles and boulders. It flows through a catchment area dominated by pine, but there is a native canopy above much of the valley floor. The lack of modification and native riparian cover give this reach the highest PHA score. It is moderated by effects of stream bed erosion and bank collapse, and the pine dominated catchment. | 105 (75%) |
| Reach 4 (southern tributary) (Photo 23) | <ul style="list-style-type: none"> A small waterway, intermittent in its lower reach, reducing to an ephemeral waterway and then to a watershed. This waterway does not extend into the footprint of the project but sediment could flow into it during heavy rain. | 0 (0%) |
| Reach 5 (eastern headwater) (Photo 24) | <ul style="list-style-type: none"> This is the only waterway that enters the construction site. It is a dry watershed without flows, persistent pools, or aquatic habitat. There is some channel formation toward the bottom due to flood flow scouring but no defined bed or banks. | 0 (0%) |

| Reach | Description | PHA Score |
|--|---|-------------|
| Waitangi Tributary | | |
| Reach 6 (Photo 25, Photo 26 & Photo 27) | <ul style="list-style-type: none"> A small waterway, perennial in its lower reach, reducing to intermittent pools and then an ephemeral waterway. The lower section flows through a dense weedland dominated by <i>Tradescantia</i>, rank grass and other vine weeds. Where it enters native vegetation, the weeds disappear and a bed of muds, cobbles, occasional boulders and bedrock is exposed. The stream has a diversity of widths from 300mm to 800mm. Water sheets over the muds and bedrock with an average depth of less than 5mm, or disappears into boulders and cobbles at times. There are no pools or other fish habitat. There is abundant organic debris where koura shelter. | 87 (62%) |

4.4.1 Freshwater Fauna

Spotlighting for fish was conducted in both waterways. For Papawai Stream, the results were reported according to each of the six distinct reaches. Fish were only seen within three reaches of Papawai Stream (Table 14). The two small tributaries of this stream that approach the design footprint are headwaters without active bed or banks. Only koura (North Island species – *Paranephrops planifrons*) was seen in the Waitangi Stream Tributary; this species is classified Not Threatened (Grainger et al., 2014).

One species of fish was identified, banded kokopu (*Galaxias fasciatus*) within the lower three reaches of Papawai Stream. While spotlighting does not provide an accurate census of fish numbers, the numbers of banded kokopu observed (24 fish within 137 m² of perennial habitat or one fish for every 5.7 m² of stream bed) suggest a low abundance. This species is classified as 'Not Threatened' (Goodman et al., 2014)

Two elvers (approx. 80mm and 90mm) were seen in the lowest reach of Papawai Stream. They could not be identified to species level. No elver were seen above reach 1 of Papawai Stream or the unnamed Waitangi tributary (reach 6), and no adult eel were seen anywhere in the site.

Table 14: Summary of freshwater fish observations recorded during spotlighting, summer 2016/17.

| Study Reach (Map 4) | Length and area | Banded Kokopu | Whitebait | Elver | Koura |
|----------------------------------|---|-----------------------|-----------|-------|--------|
| Papawai Stream | | | | | |
| Reach 1 (Lower) | • 55 m from blow out upstream to outlet of culvert (30.25 m ²) | 4 | 1 | 2 | rare |
| Reach 2 (Field drain) | • 125m from inlet of culvert upstream to end of playing field drain (68.75 m ²) | 12 | 4 | - | common |
| Reach 3 (Main stem upper) | • 95m upstream of playing field (38 m ²) | 8 | - | 1 | rare |
| Reach 4 (southern trib) | • 65m (upstream of confluence to upper extent of flow) (26 m ²) | - | - | - | nil |
| Reach 5 (eastern headwater) | • 40 m (from headwater to Reach 3) | Dry - Not spotlighted | | | |
| Waitangi Stream Tributary | | | | | |
| Reach 6 | • 140m (to upper extent of flow) (56 m ²) | - | - | - | common |

5 Determination of Significance

5.1 Terrestrial Ecosystems and Habitat

Policy 23 of the Regional Policy Statement (GWRC 2013) has been developed in response to the RMA section 6 (c) which requires “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” including “The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna”.

Specifically, the purpose of Policy 23 is to provide criteria for the identification and protection of indigenous ecosystems and habitats with significant indigenous biodiversity values, which are therefore significant under Section 6(c) of the RMA⁷. Note that determining significance under this policy does not require an ecological assessment. If any one of five criteria (Representativeness, Rarity, Diversity, Context and Tangata Whenua⁸) are met, the ecosystem or habitat is considered to be significant, irrespective of any other factors.

5.1.1 Native forest / scrub / shrubland

- Policy 23 determines that any indigenous vegetation that occurs on a Land Environment classified as ‘At-Risk’ (20-30% indigenous cover remaining) is significant (see Section 3.7). The areas of seral native forest and scrub are therefore significant. No further consideration is required.
- We conclude that, using the RPS criteria, these communities are “areas of significant indigenous vegetation, and significant habitats of indigenous fauna”. The location of these areas is shown in Map 3.

5.1.2 Native planted communities

- These communities, despite being dominated by indigenous plant species, are planted, of mixed quality, and recent in origin.
- Policy 23 does not provide specific guidance for induced communities. If assessed under 6(c) of the RMA we would determine that these communities are not significant in terms of representativeness, rarity, diversity, or context. We therefore conclude they are not “areas of significant indigenous vegetation” or “significant habitats of indigenous fauna”. Nor do we consider that their protection is a matter of national importance.
- We therefore conclude that; these communities are not significant. The location of these areas is shown in Map 3.

5.1.3 Exotic communities – introduced (but including pohutukawa)

- These communities are induced and dominated by introduced species a number of which are naturalised and invasive.
- We conclude that, using the RPS criteria, these are not “areas of significant indigenous vegetation, and significant habitats of indigenous fauna”. The location of these areas is shown in Map 3.

⁷ We note that the words used in Policy 23 of the RPS are not consistent with those used in Section 6(c) of the RMA. However, the guide to Policy 23 (Greater Wellington Regional Council, 2016) states: “The criteria in RPS Policy 23 assist with applying RMA section 6(c) for the Wellington region by describing a process for identifying these significant values”.

⁸ We have not assessed Tangata whenua values which is outside our area of expertise. We understand consultation with Tangata Whenua is occurring, and will be reported on in the AEE.

5.2 Avifauna

- In developing an approach to determining significance for coastal and wetland avifauna habitat in the Wellington Region, McArthur & Lawson (2013) applied three of Policy 23 significance criteria; rarity, diversity and ecological context (See Schedule F2 of the Proposed Natural Resources Plan ('NRP')).
- McArthur & Lawson only looked at coastal and wetland habitats and there is no equivalent Schedule in the NRP for inland bird habitats. However, we consider it appropriate to apply their interpretation and application of the Policy 23 criteria to this terrestrial environment. Using their method, we assess the study area as a Category 3 site, i.e. sites that do not meet the RPS criteria for significance, as follows:

Table 15: From "McArthur & Lawson, Table 3.1: Initial translation criteria developed by the expert panel to score candidate sites according to their indigenous bird values".

| Policy 23 criteria | b) Rarity | c) diversity | d) Ecological context |
|---|---|--|---|
| Category 3 site (Does not meet the RPS Policy 23 criteria) | The site provides habitat for >5% of the regional population of a threatened or at risk species | Less than 4 threatened or at risk species know to be resident at or regularly using the site | The site provides seasonal or core habitat for <33% of the regional population of a protected (but not threatened or at risk) species |

- In support of this, we have identified one threatened species (kaka) and several birds appear to regularly utilise the habitat at this site. However, the site will not provide habitat for > 5% of the regional population of this species. Two other Threatened or At-Risk species have been recorded in the town belt but not at this site.
- We conclude that the site is not a significant habitat of indigenous avifauna.

5.3 Lizards

- No lizards have been recorded by surveys at this site.
- We conclude that the site is not a significant habitat of indigenous herpetofauna.

5.4 Freshwater Habitat & Fauna

- Streams and rivers in the Wellington Region have been assessed for significance by GWRC against four criteria, and significant waterways are listed in Schedule F1 of the Proposed NRP.
 - *Habitat for indigenous threatened/at risk fish species;*
 - *Habitat for six or more migratory indigenous fish species;*
 - *Inanga spawning habitat (Reach of tidal influence); and*
 - *High macroinvertebrate community health.*
- Waitangi Stream and the Papawai Stream tributary have not been identified in Schedule F1 as Rivers and lakes with significant indigenous ecosystems. Our results support this.
- While two elver were observed in the lower reach of Papawai Stream, no elvers or adult eel were observed in the middle or upper reaches of this stream which suggests there is not a resident population of eel within the site.
- One migratory indigenous fish species, banded kokopu, has been recorded in this site; this species is classified as Not Threatened (Goodman et al., 2014).

- Koura are present throughout the waterways; this Crustacea species is classified as At Risk - Declining (Grainger et al., 2014).
- The macro-invertebrates seen over most reaches were dominated by dipteran species, habituated to muds. Some *Deleatidium* were present in more cobbled reaches but based on experience of similar streams we conclude that these waterways will have a low macro-invertebrate community index.
- We conclude that these waterways are not significant habitats under the Proposed NRP.

5.5 Marine Habitat

Wellington Harbour, and in particular the coastal habitat at the outfall of Waitangi Stream is not listed in Schedule F1b (parts of the coastal marine area with inanga spawning habitat), Schedule F2c (habitat for indigenous birds in the coastal marine area), Schedule F4 (sites with significant indigenous biodiversity values in the coastal marine area) or Schedule F5 (habitats with significant indigenous biodiversity values in the Coastal Marine Area) of the PNRP.

However, Policy P.23 of the PNRP (Restoring Te Awarua-o-Porirua Harbour, Wellington Harbour (Port Nicholson) and Lake Wairarapa) states that:

The ecological health and significant values of Te Awarua-o-Porirua Harbour, Wellington Harbour (Port Nicholson) and Lake Wairarapa will be restored overtime by:

- managing activities to reduce sedimentation rates and pollutant inputs, and*
- managing erosion-prone land and riparian margins in their catchments, and*

5.6 Summary of significance

Table 17 summarises our assessment of significance as defined in Policy 23 (terrestrial communities) and the Proposed NRP (aquatic and marine communities and habitats).

Table 16: Summary of significance indigenous ecosystems and habitats within the zone of influence.

| Ecosystem Component | Representative | Rarity | Diversity | Context | Conclusion |
|--|---|--------|-----------|---------|-----------------|
| Terrestrial Vegetation (Policy 23) | | | | | |
| • Native forest / scrub / shrubland | Yes | No | No | No | Significant |
| • Planted native communities | No | No | No | No | Not significant |
| • Exotic communities | No | No | No | No | Not significant |
| Habitats of Significant Terrestrial Fauna | | | | | |
| • Avifauna habitat | Does not meet criteria for significance under Schedule F2 | | | | Not significant |
| • Lizards habitat | None recorded | | | | Not significant |
| Aquatic Ecosystems and Habitats | | | | | |
| • Papawai Stream habitat | Does not meet criteria for significance under Schedule F1 | | | | Not significant |
| • Tributary of Waitangi Stream | Does not meet criteria for significance under Schedule F1 | | | | Not significant |
| Marine Ecosystems and Habitats | | | | | |
| • Wellington Harbour | PNRP Schedule F1b, F2c, F4, F5 | | | | Not significant |

6 Assessing Ecological Value

Determination of 'significance' under Policy 23 is not a measure of ecological value, and therefore a determination of 'significance' under Policy 23 does not mean it is necessarily of high ecological value. Similarly, sites which are not considered significant under the Policy 23 criteria, may have ecological values worthy of further consideration. For this reason, an assessment of ecological value is required.

This assessment of ecological value guides our consideration of site sensitivity to change, the magnitude and importance of ecological effects, and the need for, and quantum of required mitigation. Following the EIANZ guidelines (2015) we use the same four criteria (representativeness, rarity, diversity, context) but unlike Policy 23, we provide a score of ecological value (nil, low, moderate, high or very high) against each criteria.

This assessment is carried out for all vegetation communities and habitats within the site, whether or not they are significant according to Policy 23 criteria.

6.1 Terrestrial Habitat

Native forest / scrub / shrubland

- This seral vegetation is young, in areas lacks diversity of structure and species and is missing the next tier of canopy species such as tawa, kohekohe, ngaio and podocarps except where these have been planted. Also most areas that have regenerated naturally still contain exotic trees such as sycamore, prunus, eucalyptus and cherry laurel. We therefore consider that these communities score low for representativeness and diversity.
- We did not identify any naturally occurring threatened, rare or locally uncommon plant species so these communities score nil for rarity.
- These communities do however, provide habitat and seasonal food supplies for a diversity of indigenous bird species including kaka and so score moderate for context.
- Overall we conclude these communities have moderate ecological value.

Native planted communities

- These communities vary. Earlier and more mature plantings are dominated by species that are not representative of a natural succession, they have very low diversity and often contain species such as karo which we now consider to be an invasive species. More recent plantings have better diversity of planted species, however, they still lack structure, including understorey and floor species and typically lack mid seral species and so will require further enrichment.
- There are no naturally occurring threatened or rare species.
- The older sites provide poor habitat for fauna due to the lack of diversity, and the recent plantings are still too young to provide diverse habitat opportunities.
- Overall we conclude these communities have low ecological value.

Exotic communities

- While these communities are not native, they provide vertical structure which is not yet present in the young naturally occurring and induced indigenous plant communities present on site. This structure expands the 3-D volume of habitat available to birds to display, forage, and nest.
- In addition, several species, particularly eucalyptus, provide abundant nectar during winter and early spring for native birds, at a time when the current seral forests around much of the Wellington Peninsula are not producing fruit or flowers. They therefore contribute to the supply

of seasonal habitat for indigenous fauna available within the town belt. The location of trees potentially affected is shown in Map 3 (Page 43).

- In summary; we consider that these plantings are not representative, have no rarity, and have low indigenous diversity, but have moderate value in terms of ecological context. Overall we conclude they have moderate ecological value.

6.2 Threatened or At-Risk Species

- North Island kaka is the only Threatened resident or commonly seen bird species at this site. It has a threat status of Nationally Vulnerable (Criteria: C (1/1), 1000-5000 mature individuals, Decreasing: 10-50 %. Qualifiers: Conservation Dependent, Partial Decline, Recruitment Failure).
- North Island kaka are therefore considered to be of very high ecological value

6.3 Freshwater Habitat

Papawai Stream and Tributaries

- Papawai Stream is a modified waterway with a relatively low PHA score for much of its length, and is subject to flood damage. It also only contains one species of resident fish (banded kokopu) which is a common species in Wellington and classified as Not Threatened.
- However, it is also one of only a very few fragments of the Waitangi Stream that remain un-piped. Day-lighted tributaries of Waitangi Stream are therefore extremely underrepresented. On this basis we find that the stream has high ecological value as a remnant of a once much larger system.

Unnamed tributary

- This is a small waterway with only intermittent habitat over most of the potentially affected length. We did not record any fish. It is perhaps most valuable for the koura which are relatively abundant in the absence of fish. The waterway also has a very low PHA score.
- However, it is also one of only a very few fragments of the Waitangi Stream that remain un-piped. Day-lighted tributaries of Waitangi Stream are therefore extremely underrepresented. On this basis we find that the stream has moderate ecological value as a remnant of a once much larger system.

The location of these valued waterways, in relation to the extent of works, is shown in Map 3 (Page 43).

6.4 Marine Habitat

We identified in Section 3.11 that at the point of discharge of Waitangi Stream the harbour is not significant in terms of birds, fish spawning, indigenous sites or indigenous habitat. This part of the harbour is highly modified, with hardened edges, marinas, stormwater discharges. We consider it to currently have low ecological value.

6.5 Summary of Ecological Values

Table 17 summarises our assessment of ecological value based on the EIANZ (2015) methodology. See

Table 17: Summary of ecological and biodiversity values assigned to flora and fauna communities within the site.

| Ecosystem Component | Representative | Rarity | Diversity | Context | Conclusion |
|--|---|--------|----------------|----------|------------|
| Terrestrial Vegetation and Habitats (Policy 23) | | | | | |
| • Seral forest and scrub | Low | Nil | Low | Moderate | Moderate |
| • Native planted communities | Low | Nil | Low - Moderate | Low | Low |
| • Exotic communities | Nil | Nil | Nil | Moderate | Moderate |
| Threatened & At Risk species | | | | | |
| • Kaka | Nationally Vulnerable | | | | Very High |
| Aquatic Habitat | | | | | |
| • Papawai Stream | Perennial stream. One species of native fish. One of the last fragments of a larger stream system. | | | | High |
| • Tributary of Waitangi Stream | Largely intermittent waterway. No native fish species One of the last fragments of a larger stream system. | | | | Moderate |
| Marine Habitat | | | | | |
| • Wellington Harbour at Waitangi Park | Not significant. Highly modified. Subject to discharges. | | | | Low |

7 Assessment of Effects

Once the value of the ecosystem components has been determined (Section 6) the magnitude of the effect is assessed. Magnitude of effect is a measure of the extent or scale of the impact, its duration, and the degree of change that it will cause (Table 4). A typical scale of magnitude ranges from very high/severe to negligible. The overall level of effect is then assessed below (Section 7.5) having regard to both the magnitude of the effect and the ecological value of the area or community affected.

7.1 Vegetation Loss

Section 4.1 and Map 2 (page 42) show that the affected area is a complex mosaic of grasslands, weedlands, tall exotic trees, planted native and exotic vegetation and seral native vegetation. Table 18 summarises these 10 communities into three basic groups for both the project footprint and Brooklyn Hills and this assessment considers the potential effects on each group.

It assumes the project footprint will be the project footprint provided by the design team plus a 10m buffer which accounts for uncertainty regarding construction methodology and the space needed to tie in the works to the existing landscape, provide access for construction machinery, and enable erosion and sediment management.

Table 18: Extent of vegetation clearance (excluding grasslands) within Sector 4: Brooklyn Hills.

| Plant Groups (excluding grasslands / fields) | Brooklyn Hills Area (ha) | Project Footprint Area (ha) | Proportional loss (%) |
|--|--------------------------|-----------------------------|-----------------------|
| Native forest / scrub / shrubland | 15.9 | 0.18 | 1.1% |
| Planted native communities | 2.9 | 0.51 | 17.6% |
| Exotic communities (including fields) | 24.5 | 3.25 | 13.3% |
| Combined | 43.3 | 3.94 | 9.1% |

Native forest and scrub

- A small area of regenerating native forest and scrub will be affected by works (0.18 ha) in a small gully to the south east of the knoll, and riparian vegetation adjacent to Waitangi Stream Tributary. The magnitude of this loss in relation to the extent of this plant community within the Brooklyn Hills reserves is 1.1%. The magnitude of effect is therefore considered to be negligible (*Very slight change from the existing baseline condition*).

Planted native communities

- An area of planted natives will be affected by works (0.51 ha). This is approximately 17.6% of planted native vegetation within the Brooklyn Hills reserves. The magnitude of effect is therefore considered to be moderate (*Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed;*).

Exotic communities

- An area of exotic vegetation (grassland, shrublands, scrub and treeland) will be affected by works (3.25 ha), however, if the pasture that makes up the playing fields is removed, the loss is reduced to 1.0 ha as a proportion of 16.2 ha within the Brooklyn Hills Reserves. The magnitude of this loss (excluding pasture) is 4.1%.

- The main value of this vegetation is the provision of vertical structure for bird life, and in the case of eucalyptus, as seasonal food. We do not consider that the loss of these small areas of trees will limit any bird populations given the extensive exotic forest which occurs within the inner and outer town belt.
- The magnitude of effect is therefore considered to be negligible (*Very slight change from the existing baseline condition*).

7.2 Threatened or At-Risk Species

- Kaka are seen almost daily at this site and have historically nested in this park near to the proposed works in a large pine. Several large pines and eucalypts will be cleared to make way for works. We do not consider that the loss of these trees will impact on kaka within the area given the extensive exotic forest which occurs within the inner and outer town belt.
- The magnitude of effect is therefore considered to be negligible (*Very slight change from the existing baseline condition*).

7.3 Freshwater

Papawai Stream

- With the proposed design there will not be any direct effects on this stream or its tributaries from works.
- Part of the design includes a proposal to raise the lower playing field by up to 1.5m. Currently, during a large flood event Papawai Stream is able to overtop the recently constructed bund and flood onto the playing field. Raising the playing field could constrain Papawai Stream to a narrow corridor, increasing flow volumes and velocities during heavy rainfall, and increase scouring and erosion of the channel with associated effects on freshwater fauna. This risk has been taken account in design by:
 - ensuring that the raised playing field at its highest point remains 100 mm lower than the crest of the bund, thereby allowing flood flows to still overtop the bund;
 - providing a swale next to the bund to drain flood flows away; and
 - During detailed design, investigating the effect of the bund on flood flows, and considering formation of a managed crossing point tailored to best maintain the stream hydrology.
- Assuming the change to the field does not increase the volumes or velocities of flood flows within the Papawai Stream, we consider that any effects will be negligible (*Very slight change from the existing baseline condition*).
- Another potential indirect effect is sediment discharge to the stream. With good sediment management we consider that any effects will also be negligible (*Very slight change from the existing baseline condition*).

Tributary of Waitangi Stream

- With the proposed design there will not be any direct effects on this stream, however, the toe of the batter slope comes into close proximity and the construction methodology will need to allow for protection of this waterway. Other than this the only other potential effect is sediment discharge to the streams. With good sediment management we consider that any effects will be negligible (*Very slight change from the existing baseline condition*).

7.4 Marine

In order to meet Policy P23 of the PNRP (*managing activities to reduce sedimentation rates and pollutant inputs & c) managing erosion-prone land and riparian margins in their catchments*) a high level of site management will be required to protect stream margins and minimise sediment discharge to the tributaries of Waitangi Stream.

Assuming high levels of management, our expectation is that the magnitude of effect to the harbour will be negligible (Very slight change from the existing baseline condition).

7.5 Summary of Assessment of Effects

Combining ecological value with effect magnitude provides an assessment of the level or seriousness of the effect as per Table 5. Table 19 summarises the two key criteria (value and magnitude) applied to each of the ecological components in the process of the assessment of the level of effects of the proposal assuming no mitigation.

Table 19: Assessment of level of effect without mitigation

| Ecosystem Component | Ecological value | Magnitude of effect | Level of Effect |
|--|------------------|---------------------|-----------------|
| Terrestrial Vegetation and Habitats | | | |
| • Native forest / scrub / shrubland | Moderate | Negligible | Very Low |
| • Planted native communities | Low | Moderate | Very Low |
| • Exotic communities (including fields) | Moderate | Negligible | Very Low |
| Threatened and At-Risk Species | | | |
| • Kaka | Very High | Negligible | Low |
| Aquatic Habitat | | | |
| • Papawai Stream | High | Negligible | Very Low |
| • Tributary of Waitangi Stream | Moderate | Negligible | Very Low |
| Marine Habitat | | | |
| • Wellington Harbour | Low | Negligible | Very Low |

EIANZ (2015) guidelines note that the level of effect can then be used as a guide to the extent and nature of ecological response required (including the need for biodiversity offsetting). For example:

‘Low’ and ‘Very low’ should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects. If effects are assessed taking mitigation into consideration, then it is essential that prescribed mitigation is carried out to ensure Low or Very low level effects.

‘Very low’ level effects can generally be considered to be classed as ‘not more than minor’ effects.

Overall we find that despite some small areas of habitat loss, the effects of the project as currently designed are not significant, or sufficiently adverse to the local ecology to suggest this project cannot proceed.

8 Recommendations

In summary, the following actions are recommended to avoid, remedy or mitigate for any potential adverse effects of works on habitats, flora and fauna.

Avoid & Minimise

- Current project design has sought to minimise effects, or contain effects to low value areas such as lawns, exotic vegetation and planted native vegetation as much as possible. However, six elements of design still require further development and as part of this process we can confirm where avoidance is possible, or if avoidance cannot be achieved, to confirm the methods necessary for minimising effects.
 1. **Seral Forest Area B Loss:** Because of the requirement to bury the reservoir (Town Belt Manager Plan) a large fill is proposed to the south of the reservoir which will fill the valley containing Seral Forest B (Map 3). We recommend further discussion with council and community groups to explore the need for this area of fill, and if possible enable retention of this vegetation.
 2. **Waitangi Stream Tributary Works Extent:** The design shows that this stream is avoided, however, the stream location being used is based on aerial mapping and we recommend stream location be confirmed by site survey. In addition, we recommend a series of cross sections be survey perpendicular to the stream so that the relationship between works at the toe of the proposed batter slope and the riparian zone of the stream are better able to be detailed and the construction methodology described.
 3. **Papawai Stream Works Extent:** As for the Waitangi Stream Tributary, the design shows that this stream is avoided. However, we recommend a series of cross sections perpendicular to the stream and up the slopes to the west to confirm the relationship between works at the toe of the batter slope and the riparian zone of the stream. Note, this work will not be required if the fill in this site can be avoided, as discussed in 1 above.
 4. **Papawai Stream Field Raising:** The design for raising of the lower playing field has taken account of the risk of affecting flows and velocities. On that basis we consider that direct effects have been avoided. We have, however, identified the potential for indirect effects depending on the design of the playing field fill and associated stormwater management. A commitment has been made to ensure detailed design takes this into account and ensures that the playing field fill and associated stormwater management will not alter flood volumes and velocities within the stream and thereby avoid indirect effects on the streams ecology.
 5. **Access Track:** The access track between the upper and lower playing fields may need to be widened, and some trees along its margins will need to be removed or pruned. to allow for movement of large vehicles. The extent of tree works needs to be confirmed.
 6. **Stormwater:** Comprehensive management of sediment and erosion management is required to minimise discharge of sediment to Wellington Harbour, and ensure effects are negligible.

Remedy

- There is a requirement to plant most of the finished site upon completion and stabilisation of the reservoir cover and fill batter slopes. A planting design has been developed taking into account both ecological and landscape requirements, and a preliminary design is provided in the Landscape and Visual Assessment. Most areas of planting will deliver ecological benefit and in total will remedy the effects of vegetation clearance. Specific requirements for remedy of ecological effects are:
 - **Remedy for loss of Seral Forest:** This requires revegetation of the fill batter to the west of the reservoir above the Waitangi Stream tributary, and revegetation of fill batters to the south and east of the reservoir, where naturally occurring seral forest will be lost.

On previous projects in the Wellington Region, a 3:1 ratio of planting for loss of seral forest communities has been recommended by BML where planting is the preferred mitigation method. This recognises that the adverse effect may extend beyond the edge of cut vegetation, and that there is a time lag between planting and the return of the ecological functions that were lost.

For this site, and assuming all seral forest within the project footprint is lost (including the 10m buffer), 0.54 ha of remedial planting will be required for the loss of 0.18 ha of seral forest. Currently 0.55 ha of planting is proposed in these locations, which will result in a small surplus.

The planting is to include winter and spring flowering and fruiting natives such as kowhai and kotukutuku to increase seasonal food for nectar and fruit feeders. Final planting details to be confirmed following consultation.

- **Remedy for Loss of existing Native Planting:** It is proposed to remedy the loss of areas of native planting, with equivalent areas of similar planting.
- **Remedy of Potential Effects on Papawai Stream:** We recommended enhancement of riparian vegetation to both sides of Papawai Stream, in concert with any proposal to raise the lower playing field, to buffer the stream, and maintain stream function.
- **Avifauna:** We have recommended inclusion of winter flowering eucalyptus within the landscape planting treatment to the north of the reservoir where they currently occur but will be removed. This will replace the current seasonal food supply for native birds in the short to medium term while native revegetation develops.

Mitigation

- We consider that all ecological effects can be remedied within the project footprint by the proposed measures described above. No additional mitigation is required. This conclusion is based on the following assumptions regarding magnitude of effect:
 - Both Papawai Stream and the Waitangi Tributary are avoided by physical works, and riparian planting is replaced where lost.
 - Papawai Stream, its flows and habitat, will not be adversely affected by the proposal to raise the lower playing field.
 - Robust sediment and erosion management during construction prevent significant discharges of sediment to Waitangi Stream and Wellington Harbour.
 - Loss of seral forest will not exceed the areas shown (footprint plus 10m buffer) and may be reduced.

8.1 Monitoring

- Monitoring of vegetation clearance will be required to ensure clearance zones are limited to the areas shown on the attached maps. Use of an arborist is also required to minimise the impact of felling large trees on adjacent native vegetation.
- Monitoring of revegetation will be needed for a sufficient maintenance period. Five years has been recommended at this exposed site.
- We understand normal monitoring of stormwater devices and of any discharges will occur, following accepted good practice. The details of this are covered elsewhere in the draft Erosion and Sediment Control Plan.
- Monitoring of streams may be needed in the event of discharges from stormwater devices which affect aquatic health.

Positive Effects

- The majority of vegetation clearance within the project footprint (excluding grasslands) will be exotic vegetation including gorse shrubland and scrub, areas dominated by invasive tree species such as sycamore and karo, and larger exotic trees including pine and eucalyptus. The proposed planting of the finished site with carefully selected native species will extend indigenous planting across these areas leading to an overall increase in native vegetation at this park, and an overall reduction in weediness.
- Some landscape planting will be of low growing indigenous vegetation which, while designed for amenity purposes and the retention of views, will also provide habitat for lizards in the event of expansion of local populations.

9 Assessment against Town Belt Management Plan

Section 5 and 8 of the WTBM provide objectives and policies that relate to ecology. Section 5 has five objectives as follows:

5.1 Objectives

5.1.1 To protect indigenous biodiversity and indigenous ecosystems on the Town Belt, including freshwater ecosystems.

- We have avoided or minimised most areas of natural successional forest present on site, and where avoidance has not been possible believe recommended revegetation will remedy this loss.
- We have also avoided both small streams that lie in close proximity to the works and have identified where design needs to further protect these waterways from stormwater discharges.

5.1.2 To restore and connect indigenous ecosystems on the Town Belt.

- The majority of planting will be of native vegetation appropriate to the site, and it will be located to extent and connect other areas of native vegetation.

5.1.3 To improve the city's ecological resilience by gradually increasing the indigenous vegetation cover on the Town Belt and its connectivity within a region-wide ecological network.

- Once complete, there will be an increase in native vegetation at this site, and a reduction of vegetation dominated by exotic tree and weed species.

5.1.4 To gradually increase the indigenous proportion of the Town Belt's total vegetation cover to 65 percent by 2065.

- There will be an increase in the proportion of indigenous vegetation cover at this site.

5.1.5 To work in partnership with iwi, communities, researchers and businesses in restoring, learning about and celebrating the Town Belt's ecology.

- The next phase of development of this assessment will involve community consultation.

Section 8 of the WTBM lists policies that relate specifically to the Brooklyn Hills Sector:

8.4.3.1 Extend the existing native forest to form a consistent vegetation cover based around the moister gullies and south-facing slopes.

- The proposed planting will replace existing riparian planting along the Waitangi Tributary, and create a larger area of native forest to the south and east of the water reservoir where a mix of native and exotic vegetation currently occurs.

8.4.3.4 Ensure the proposed water reservoir is buried and remedial planting done to mitigate its impact on the Town Belt.

- At one location burying the reservoir will have the adverse outcome of destroying an area of seral native forest and several very large pohutukawa. At this one location we seek reconsideration of this policy so that this native forest can be retained. The landscape simulations suggest that the loss of this seral forest will increase visibility of the water reservoir. Retaining it will increase visual screening.

8.4.3.6 Continue with animal pest control and the control of weeds.

- Pest control will occur for the maintenance period of the planting (5 years) and will focus on browsing animals (possums, rabbits).

10 Assessment against RPS Policy 47

Where areas of vegetation or habitats are present which trigger significance under Policy 23 of the RPS the project must then be assessed against Policy 47 of the RPS as follows:

When considering an application . . . a determination shall be made as to whether an activity may affect indigenous ecosystems and habitats with significant indigenous biodiversity values, and in determining whether the proposed activity is inappropriate particular regard shall be given to:

The following analysis relates to the seral forest found to be significant under Policy 23 (Section 5). It refers to the listed matters (a) to (h) in Policy 47.

- a) Maintaining connections within, or corridors between, habitats of indigenous flora and fauna, and/or enhancing the connectivity between fragmented indigenous habitats;

Conclusion:

- With the proposed landscape and ecological mitigation planting, the works will enhance connections, particularly to the south and east of the site, between indigenous habitats.

- b) Providing adequate buffering around areas of significant indigenous ecosystems and habitats from other land uses;

Conclusion:

- Some indigenous vegetation will be removed. Proposed revegetation will replace and extend that vegetation which will buffer and restore any margins left exposed.

- c) Managing wetlands for the purpose of aquatic ecosystem health;

Conclusion:

- There are no wetlands within the study area.

- d) Avoiding the cumulative adverse effects of the incremental loss of indigenous ecosystems and habitats;

Conclusion:

- With the proposed mitigation there will not be incremental loss of indigenous ecosystems or habitats. The total area of native vegetation will be increased.

- e) Providing seasonal or core habitat for indigenous species;

Conclusion:

- Some seasonal habitat will be affected (loss of winter flowing eucalyptus and riparian plants adjacent to Waitangi Tributary). This has been taken into account in the proposed design of the proposed landscape and ecological mitigation planting and will be remedied within the site once works are complete through revegetation using appropriate species.

- f) Protecting the life supporting capacity of indigenous ecosystems and habitats;

Conclusion:

- We conclude that the potential effects will not be of a sufficient scale to impact on the life supporting capacity of any indigenous terrestrial or freshwater ecosystem or habitat.

- g) Remedying or mitigating adverse effects on the indigenous biodiversity values where avoiding adverse effects is not practicably achievable; and

Conclusion:

- We consider that all opportunities to avoid or minimise adverse effects have been explored. Remedial of most effects can be achieved by the proposed revegetation of the completed surface.

If additional mitigation is required, it will require a minor increase in planting or other restoration activities which can be readily provided for within the wider Prince of Wales site.

- h) The need for a precautionary approach when assessing the potential for adverse effects on indigenous ecosystems and habitats.

Conclusion:

- We do not consider that a precautionary approach is needed in these circumstances. The values of plant communities are clear, and the scale of effects has been detailed. There is no real uncertainty as to the effects, or the nature of the habitat affected, that would necessitate a precautionary approach.

In summary, and assuming the recommendations in Section 8 are carried out, and sediment discharge to the harbour is as predicted, we conclude that the effects of this activity will be low to very low in the short term, and will lead in the mid to long term, to ecological benefits.

11 References

- Allibone, R. (n.d.). *Spotlighting: Spotfishing* (Inventory and Monitoring Toolbox: Freshwater Fish No. DOCDM-770406). Wellington: Department of Conservation.
- Burnett, M. (2013). *Mapping Wellington's Unpipied Streams*. (p. 18). Victoria University Summer Scholarship 2012/2013.
- de Lange, P. J., Rolfe, J. R., Champion, P. D., Courtney, S. P., Heenan, P. B., Barkla, J. W., ... Hitchmough, R. A. (2013). *Conservation status of New Zealand indigenous vascular plants, 2012* (New Zealand Threat Classification Series No. 3). Wellington: Department of Conservation.
- EcoGecko Consultants Ltd. (2014). *Lizard survey of Wellington City Council - Administered Parks & Reserves: Final Report*. Report prepared for the Wellington City Council.
- EIANZ. (2015). *Ecological impact assessment (EclA): EIANZ guidelines for use in New Zealand: Terrestrial and freshwater ecosystems*. Melbourne: Environment Institute of Australia and New Zealand.
- Goodman, J. M., Dunn, N. R., Ravenscroft, P. J., Allibone, R. M., Boubee, J. A. T., David, B. O., ... Rolfe, J. R. (2014). *Conservation status of New Zealand freshwater fish, 2013* (New Zealand Threat Classification Series No. 7). Wellington: Department of Conservation.
- Grainger, N., Collier, K., Hitchmough, R., Harding, J., Smith, B., & Sutherland, D. (2014). *Conservation status of New Zealand freshwater invertebrates, 2013* (New Zealand Threat Classification Series No. 8). Wellington: Department of Conservation.
- Greater Wellington Regional Council. (2013). *Regional policy statement for the Wellington Region* (Greater Wellington Publication No. GW/EP-G-13/21). Wellington: Greater Wellington Regional Council.
- Greater Wellington Regional Council. (2015). *Proposed Natural Resources Plan for the Wellington Region*. Greater Wellington Regional Council.
- Greater Wellington Regional Council. (2016). *Identifying and protecting significant indigenous biodiversity in the Wellington Region, A guide to interpreting criteria in the Regional Policy Statement*. (No. GW/BD-G-16/51) (p. 32).
- Hartley, L. (2012). Five-minute bird counts in New Zealand. *New Zealand Journal of Ecology*, 36(3).
- Heine, J. C. (1975). *Interim report on soils of Wellington Region, New Zealand* (N.Z. Soil Bureau Record No. 39). Wellington: DSIR Soil Bureau.
- Holdaway, R. J., Wiser, S. K., & Williams, P. A. (2012). Status assessment of New Zealand's naturally uncommon ecosystems. *Conservation Biology*, 26(4), 619–629.
- Maxted, John R. (n.d.). Physical Habitat Assessment - Field Data Sheets. Prepared for Auckland Regional Council.
- McArthur, N.; Harvey, A. and Flux, I. (2015). *State and trends in the diversity, abundance and distribution of birds in the Wellington City* (p. 38). Prepared for Greater Wellington Regional Council. Wildlife Management International Ltd, Blenheim.
- McArthur, N., Harvey, A., & Flux, I. (2015). *State and trends in the diversity, abundance and distribution of birds in Wellington City*. Report prepared by Wildlife Management International Limited for Greater Wellington Regional Council.
- McArthur, N., & Lawson, J. (2013). *Coastal and freshwater sites of significance for indigenous birds in the Wellington region*. Greater Wellington Regional Council.
- Ministry for the Environment, & Department of Conservation. (2007a). *National priorities for protecting rare & threatened native biodiversity on private land* (ME No. 799). Wellington: Ministry for the Environment & Department of Conservation.
- Ministry for the Environment, & Department of Conservation. (2007b). *Protecting our places: Information about the Statement of National Priorities for Protecting Rare and Threatened Biodiversity on Private Land* (ME No. 805). Wellington: Ministry for the Environment & Department of Conservation.
- National Institute of Water and Atmospheric Research. (n.d.). New Zealand Freshwater Fish Database (NZFFD). Retrieved July 25, 2013, from <http://dataversity.org.nz/guide/systems/nzffd>
- New Zealand Plant Conservation Network. (2013). New Zealand Plant Conservation Network. Retrieved August 5, 2013, from <http://www.nzpcn.org.nz/>
- Page, M. J. (1995). *Land use capability classification of the Wellington Region: A report to accompany the second edition, New Zealand land resource inventory*. Lincoln: Manaaki Whenua Press.

- Robertson, H. A., Dowding, J. E., Elliott, G. P., Hitchmough, R. A., Miskelly, C. M., O'Donnell, C. F. J., ... Taylor, G. A. (2013). *Conservation status of New Zealand birds, 2012* (New Zealand Threat Classification Series No. 4). Wellington: Department of Conservation.
- Singers, N. J. D., & Rogers, G. M. (2014). *A classification of New Zealand's terrestrial ecosystems* (Science for Conservation No. 325). Wellington: Department of Conservation.
- Townsend, A. J., de Lange, P. J., Duffy, C. A. J., Miskelly, C. M., Molloy, J., & Norton, D. A. (2008). *New Zealand threat classification system manual*. Wellington: Department of Conservation.
- Walker, S., Cieraad, E., Grove, P., Lloyd, K., Myers, S., Park, T., & Porteous, T. (2007). *Guide for users of the threatened environment classification* (Ver 1.1).
- Wellington City Council. (2013). *Wellington Town Belt Management Plan*. Wellington City Council.

12 Appendices

Appendix 1: Site Maps

- ▭ Extent of study area
- ▭ Vegetation extent

Vegetation Type

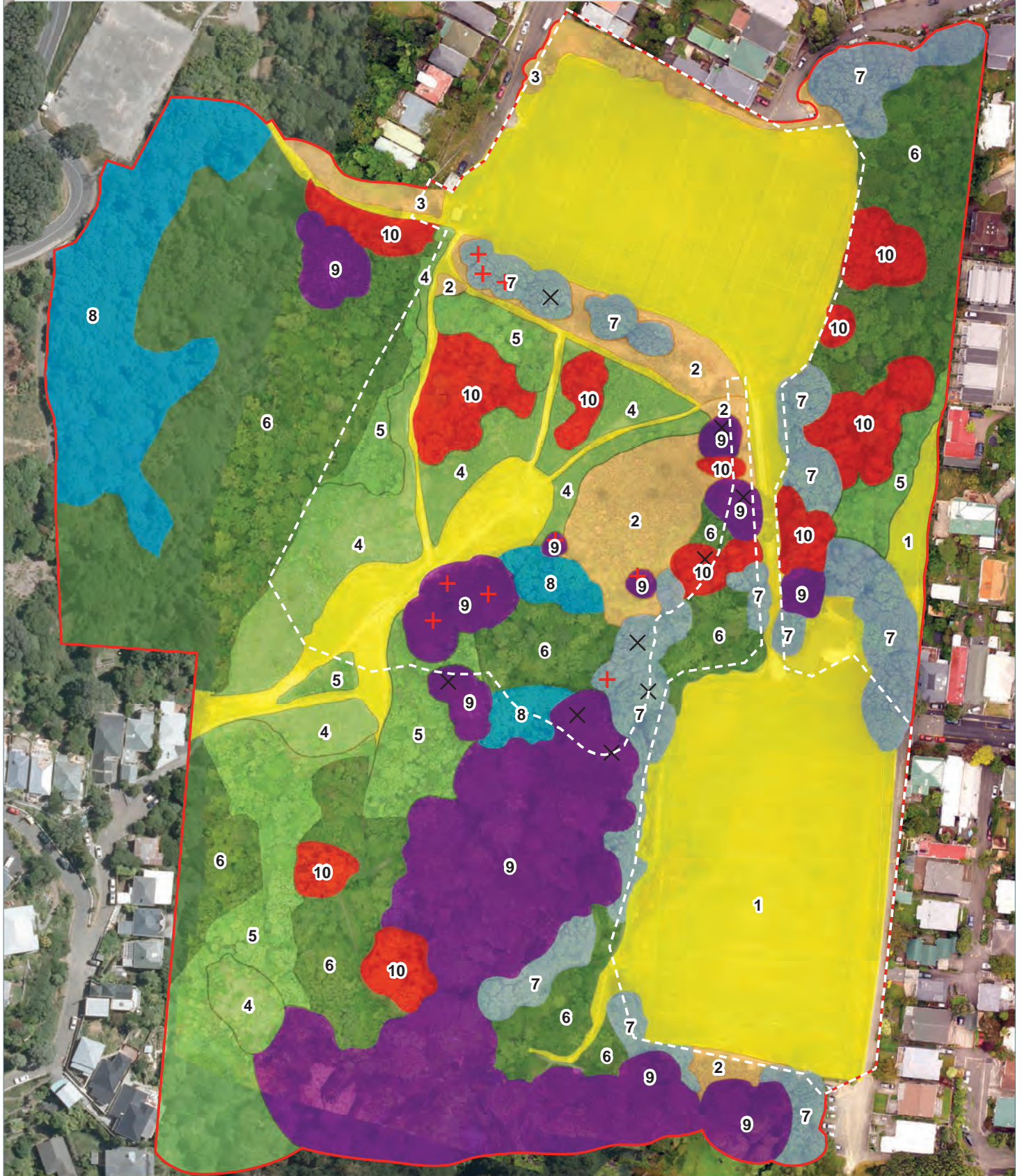
- 1: Grassland / Lawn & rank grasses
- 2: Gorse shrubland over rank grasses
- 3: Residential margin with scattered trees and weedlands
- 4: Recent native planting in gorse and exotic grasslands (c. 2014)
- 5: Maturing native planting (c. 2002)
- 6: Seral native broadleaved scrub and forest communities
- 7: Pohutukawa forest and treeland
- 8: Forest and treelands dominated by invasive trees
- 9: Pine trees and pine plantation
- 10: Eucalyptus trees



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- ✕ Potential need for removal
- ✚ To be removed
- ▭ Extent of study area





Extent of study area
+ Large trees (introduced)
Vegetation Type
 Exotic communities
 Native planting
 Seral native vegetation



Data Sources: LINZ, Boffa Miskell Ltd.

Projection: NZGD 2000 New Zealand Transverse Mercator

DRAFT

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Clients use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Appendix 2: Vegetation Change (2002 – 2016)



Figure 3: December 2002 – Grass and gorse dominate most of the knoll. Some planting visible. Gorse east and north of knoll appears young.



Figure 4: December 2004. Plantings south and west of knoll clearly visible.



Figure 5: February 2009. Planting areas from c. 2002 are maturing and the canopy is closing. Gorse is densely established on eastern slopes of knoll.



Figure 6: May 2016

Appendix 3: Detailed vegetation descriptions

See Map 1 (Page 41) and Site Photo 1 (Page 49) to Photo 16 (Page 56)

| | Site characteristics |
|----|--|
| 1. | <p>Grassland / Lawn & rank grasses</p> <ul style="list-style-type: none"> • Two playing fields which are mown and maintained. • The managed grasslands on the knoll and the margins of connecting tracks. |
| 2. | <p>Gorse shrublands over rank grasses</p> <ul style="list-style-type: none"> • Found in two situations <ul style="list-style-type: none"> – Gorse dominated shrublands which have regenerated through managed lawns on the north and eastern slopes below the knoll; and – Gorse regenerating on clay/rock cut bank exposures above the two playing fields. With <i>Montbretia</i>, karo, pine (young), broom, patches of rank grass, and young mahoe. |
| 3. | <p>Residential margins with scattered trees and weedlands</p> <ul style="list-style-type: none"> • Weedy margins adjacent to residential areas, dominate by vine weeds (blackberry, German ivy, common ivy, Old man's beard), broom, acacia seedlings, rank pasture grasses (over York fog, cocksfoot, fescue), nasturtium, phenyl, thistle, yarrow, inkweed, gorse, dock, buddleia, and self-sown shrubs of fivefinger, kanono, rangiora. Karo common. • Some areas have been planted with natives including kohuhu, tarata, mahoe, taupata, kapuka, five finger, kawakawa. Often hounds tongue fern and rank grass floor. |
| 4. | <p>Recent native plantings in gorse and exotic grasslands (c. 2012)</p> <ul style="list-style-type: none"> • In a number of areas around the knoll recent planting has been carried out in either pasture or managed gorse. <ul style="list-style-type: none"> – Where planted in pasture species includes koromiko, kohuhu, mapou, koromiko. – Where planted into managed gorse, the planting is predominantly manuka / kanuka. There are also other existing weeds, such as Spanish heath, and pine seedlings. |
| 5. | <p>Maturing native planting (c. 2002)</p> <ul style="list-style-type: none"> • Native plantings that are 10 years old or older. They are predominantly native but where the plantings were not maintained they sometimes include sycamore, eucalypt, karo, prunus, planted ornamentals, wattle and purple ake ake. • The planted species diversity is typically low, with mahoe, ngaio, ake ake, kohuhu, and tarata dominating a simple canopy. Other native species have regenerated within these areas such as five finger, occasional karamu, however the understoreys are generally open with little regeneration. • In some places where a dense canopy has not established a weedland has come to dominate the floor covered with rank grasses, and species such as tradescantia, montbretia, and amaranth. • These older plantings are generally poor in condition and low in diversity, although where the plantings had higher diversity and good canopy closure they are in better condition. |
| 6. | <p>Seral native broadleaved forest and scrub communities</p> <ul style="list-style-type: none"> • Areas of natural regeneration dominated by mahoe with five finger, ngaio, karaka, mamaku, cabbage tree, occasional kohekohe, mapou, puka, karo, and fuchsia. • The margins are often very weedy and have poplars, pohutukawa, cherry laurel and sycamore present. • Tree fern is often abundant in gullies. The presence of large tree ferns is a good indicator of natural regeneration in aerial photos. • The larger trees are typically 200 – 400 mm dbh and are up to 8 metre tall. • The understorey is generally more diverse than in planted areas and includes silver tree fern, young mamaku, kawakawa, hangehange, young mahoe, kanono. • The floor may have relatively deep litter and a variety of scattered ferns. Seedlings of kohekohe can be found. • Tradescantia is relatively ubiquitous in wet gullies. |

| Site characteristics | |
|----------------------|---|
| 7. | <p>Pohutukawa forest and treeland</p> <ul style="list-style-type: none"> • A combination of pohutukawa planted as a stand, or planted in a row along a linear feature, or self-sown on exposed banks. • Pohutukawa vary from small young trees to large multi stem trees 200 – 400 in diameters and up to 10 metres in height. • Often has a broadleaved shrub understorey of karo, mahoe, hangehange, pit ten, five finger, mamaku, gully fern • On the clay banks rank grass, gorse, bone seed, pine seedlings, broom are common with occasional ngaio seedlings, small taupata, agapanthus, common ivy and cape ivy. |
| 8. | <p>Forest and treeland dominated by invasive species</p> <ul style="list-style-type: none"> • There are three plant communities that are noted: <ul style="list-style-type: none"> – On the upper western slopes adjacent to Bell Road Reservoir is a large area of low forest, tree land dominated by a canopy of cherry laurel over mixed weedlands. Some cherry laurel trees are dying (poisoned). Beneath the canopy are rank grasses, Muehlenbeckia, ivy, convolvulus, tradescantia, montbretia, young rangiora, kanono, mahoe, privet, karamu, young ngaio, wineberry, and occasional young tree fern. – On the southern slopes of the knoll is an area of sycamore forest. This blends into gorse scrub to the north and east, pine to the west, native seral broadleaved forest to the south. Elsewhere sycamore is present in a number of areas of vegetation, often on margins of stands where it has self-seeded. – Finally, there is a stand of karo. Karo is present throughout the site, sometimes in historical planting, elsewhere as a self-sown weed. At this site it forms a continuous canopy between an area of seral native forest to the north and pine forest to the south. |
| 9. | <p>Pine trees and Pine Plantations</p> <ul style="list-style-type: none"> • Plantation pine, with a mix of tall and single stem plantation growth, intermingled with a few very large multi stem old growth trees. • Typically, the understory has a tall shrub layer of natives dominated by mahoe, rangiora, lemonwood, fivefinger, karamu, hangehange, with wineberry and mamaku in gullies • In some areas exotics are common. Karo is dominant in some areas. Prunus and sycamore occur as saplings, Japanese honeysuckle occurs under canopy gaps, with cotoneaster, broom, and cherry laurel. Gorse is common on drier spurs. • The floor cover it typically sparse with areas of meadow rice grass, Asplenium and Microsorium, occasional areas dominated by montbretia and tradescantia, with blackberry often present in moist gullies or under treefalls. |
| 10. | <p>Eucalyptus Treelands</p> <ul style="list-style-type: none"> • Present as three forms. <ul style="list-style-type: none"> – As single or a few very large isolated trees within pine plantation or on the forest margins. Species are likely to be southern blue gum (<i>Eucalyptus bicostata</i>). Flowers are needed to confirm. The species is winter flowering. – Occasionally blue gum is seen as a smaller self-sown tree over gorse or broadleaved scrub. Scrub may include mahoe, ngaio, rangiora, five finger, pohuehue. Other exotics may include karo, acacia, prunus, and sycamore. – On the knoll are two areas of recently planted eucalypt tree land over rank grass, with gorse, broom, blackberry, and with some karo and young pine. The species is likely to be yellow gum (<i>Eucalyptus leucoxydon</i> var.). Flowers needed to confirm. This species is winter flowering. |

Appendix 4: Site Photos - Terrestrial



Photo 1: Plant Community 1 – retained grasslands on the knoll which is the location of the proposed reservoir. Note low growing eucalyptus to the left and to north of knoll which will be removed and replanted. The large pines to the right will be lost and replaced with native vegetation. Most of the grasslands on the knoll will be replaced following works.



Photo 2: Plant Community 2 – Gorse shrublands over rank grass on the knoll. This will be lost to works. In some areas it will be replaced with a managed treeland, in others with native plantings.



Photo 3: Plant Community 3 - Residential margins with scattered native and introduced trees and weedlands.



Photo 4: Plant Community 4 - Recent native plantings (C. 2012) on sunny, north facing slopes. Broadleaved species into rank grass and gorse on the knoll. Any of the visible plantings that are lost will be replaced. The 2 large pines on the left of frame will be lost.



Photo 5: Plant Community 4 -Recent native plantings (C. 2012). Manuka into gorse on the knoll. This planting will be lost, but replaced following works.



Photo 6: Plant Community 5 – Maturing native plantings (c. 2002). Common species used at this time were akeake, karo, kohuhu, tarata, mahoe. Also seen is rewarewa enrichment. Diversity of early plantings was often low and some inappropriate species occasionally used (e.g. karo, akeake cultivars).



Photo 7: Plant Community 5 – Maturing native plantings (c. 2002). Gully planting with lemonwood, mahoe, fivefinger, karamu, fuchsia, toetoe, dominant. This area of planting will be lost to the proposed works, but replaced.



Photo 8: Plant Community 6 -Seral native broadleaved forest and scrub. Very large cabbage tree. Mamaku treeferns in moist gullies. The presence of tree ferns in the canopy is an identifier of these more natural successions. Some areas of enrichment planting can be found within this vegetation. This area will be avoided by the proposed works.



Photo 9: Photo 10: Plant Community 6 -Seral native broadleaved forest and scrub with mamaku. A gully to the south east of the knoll. This area may be lost to the proposed works in order to provide a covering fill for the reservoir.



Photo 11: Plant Community 7 - Pohutukawa forest and treelands with the knoll behind. Two or three pohutukawa on the right of this photo, will be lost to the proposed works.



Photo 12: Plant Community 7 - Pohutukawa forest and treelands. Forming a discontinuous canopy surrounding the lower playing field. The knoll sits behind the trees in the centre of frame.



Photo 13: Plant Community 8 – Cherry laurel (*Prunus laurocerasus*) forest and trees over weedlands. These lie outside the design footprint on the top of the western slopes.



Photo 14: Plant Community 9 - Pine trees and plantations. These plantations will be avoided by works.



Photo 15: Plant Community 10 -Very large eucalyptus trees and treelands. The species is likely to be southern blue gum (*Eucalyptus bicostata*). These trees will not be affected.



Photo 16: Plant Community 10 -low growing eucalyptus trees and treelands over gorse on the knoll. These trees will be removed, but replacement trees located in this same general locations. The species is likely to be yellow gum (*Eucalyptus leucoxylon* var.).

Appendix 5: Site Photos – Freshwater



Photo 17: Papawai Stream – Reach 1 showing erosion from flooding.



Photo 18: Papawai Stream – Reach 1, pool at toe of culvert where banded kokopu and elvers were recorded.



Photo 19: Papawai Stream – Reach 2, playing field drain showing the bund and riparian planting.



Photo 20: Papawai Stream – Reach 2, showing the muds, aquatic macrophytes and sedges that provide cover for banded kokopu and koura



Photo 21: Papawai Stream – Reach 3 showing the open channel beneath natives and pines.



Photo 22: Papawai Stream – Reach 3 showing recent flood damage to bank and beds.



Photo 23: Papawai Stream – Reach 4 – a small southern tributary with intermittent sheet flows through dense litter and across clays and bedrock.



Photo 24: Papawai Stream – Reach 5 – a dry headwater. A fill batter extends down this gully and will be the nearest approach to Papawai Stream at a point adjacent to the Lower playing field (See Photo 19 above)



Photo 25: Unnamed tributary of Waitangi Stream showing persistent shallow flows over deep muds and abundant organic debris and tradescantia infestations.



Photo 26: Unnamed tributary of Waitangi Stream further upstream of Photo 25, showing cobble and boulder cascades with intermittent flows.



Photo 27: Unnamed tributary of Waitangi Stream where it passes through weedlands above Rolleston Road.



Photo 28: The scruffy dome at the bottom of Papawai Stream. The stream can be heard beneath the deep gravels which were deposited during flooding in May 2015.