Prince of Wales / Omāroro Reservoir

Ecological Impact Assessment

Prepared for Wellington Water

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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

- Wellington City Council is proposing to build a new 35 million litre buried water storage 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 and 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 10 m 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, avifauna, streams and instream fauna.
- Once described, the significance of each ecological element was determined against policy 23 of the RPS, and its ecological values were described based on EIANZ guidelines. An assessment of ecological effects was then carried out using the EIANZ methodology.
- The assessment of ecological effects considered the terrestrial flora and fauna in the context of the Brooklyn Hills Sector of the Wellington Town Belt, within which the project site is located. The streams assessment considered the waterways in the context of the wider Waitangi Stream Catchment.
- A range of measures to avoid, remedy and mitigate effects is then described.
- Finally, the proposed reservoir design and recommended 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 forest canopy would have been dominated by abundant kohekohe and tawa, with tītoki, māhoe, porokaiwhiri and nīkau. Large rimu, miro, pukatea and northern rātā would have been emergent.
- 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 native 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 native avifauna, which two decades ago would have been limited in diversity, is now enriched by species released within, and spreading out of, the Karori Wildlife Sanctuary, and/or which have increased in abundance in the town belt with the aid of ongoing council pest control operations. The most notable arrivals or increases within the Brooklyn Hills Reserves are North Island kaka, bush falcon, bellbird, kereru, red crowned parakeet, and whitehead. Several of these have been recorded within the project area.

- Two streams, Waitangi Tributary and Papawai Stream, have perennial flows and aquatic fauna. Papawai Stream has the most diverse habitat and contains indigenous 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

- The indigenous seral forest is both significant under the criteria of Policy 23, and also has moderate ecological value.
- Other vegetation communities and habitats have ecological value, in particular, the winter flowering eucalyptus, some of which will be lost.
- There are five species of bird with a national threat status which are present or likely to be present within the study area. All are recovering within the Wellington Ecological District. They are whitehead, bush falcon, NI kaka, pied shag, and red crowned parakeet.
- 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.

Assessment of Effects

- Each of these valued elements (seral forest, winter flowering eucalyptus, avifauna, and the two small streams) require avoidance, remedy or mitigation where effects occur. We have considered the magnitude of effects for each element identified above and conclude that after mitigation the overall level of effects is low to very low in the short term and the revegetation will lead to long term benefits. This assumes:
  - There will be a loss of seral forest (natural and planted). We have assumed clearance will be limited to the extents shown in the plans provided (refer to Maps 2 and 3), noting that the predicted clearance includes a 10 m buffer to ensure the assessed magnitude of effects and requirements for remedial works are precautionary.
  - There is a risk of impact on native fauna if felling of tall trees occurs during the breeding season of cavity nesting native birds. This risk can be managed to avoid these effects.
  - There is a risk of impact to both Papawai Stream and the Waitangi Tributary from adjacent excavations related to the reservoir construction. The current design seeks to avoid these potential effects, and the design also includes replacement of existing riparian vegetation where it is lost.
  - There is a risk of impact on Papawai Stream, from raising the lower playing field. This has been taken into account in the design of this playing field so that the stream is avoided and flood flows will be managed.
  - Sediment discharges in to Waitangi Stream and Wellington Harbour during construction could impact on the health of Waitangi Stream and result in effects on Lambton Harbour at the point Waitangi Stream discharges.

Recommendations

Avoid / Minimise

- Some measures to avoid effects are built into the design, specifically avoidance of the two perennial waterways.
- Recommendations are provided for management of tree clearance to minimise or avoid effects on native birds, specifically cavity breeders, and to minimise effects on adjacent vegetation.
- A number of further design refinements are discussed where additional avoidance may be possible during detailed design. This includes confirmation of areas within the 10 m buffer which can also be avoided, or where effects can be minimised.

Remedy

- We believe all effects on indigenous flora, fauna and habitats can 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 water storage reservoir within Prince of Wales Park (POWP), which forms part of the Wellington Town Belt ('Town Belt').

POWP and is part of the Brooklyn Hills Sector (see Figure 1) of the Town Belt, and this sector combines four nearly contiguous Wellington City Council (WCC) reserves that share many similarities in terms of native 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 of that environment and features.
- 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 35,000 m^3 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 with both fields also being used during the course of the reservoir development for a range of temporary activities including the storage of excavated material that will be used to backfill the reservoir site once constructed. Following completion of the reservoir both fields will be reconstructed and permanently raised. The upper field will be raised by approximately 1.0 m. The lower field will be raised by a smaller amount to ensure its crown lies below the Papawai Stream bund. This will ensure the field continues to provide attenuation of excess flood flows.
- The design avoids the two tributaries of Waitangi Stream and has sought to minimise effects on riparian vegetation.
- The design has sought to minimise loss of indigenous seral vegetation[1].
- This assessment has assumed that a working buffer of up to 10 m 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] 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 2017 the project sourced high resolution aerial photographs using a drone, the vegetation mapping was refined, and any changes ground-truthed. The base aerials and resulting maps are therefore current.

Finally, the methodology for site investigations was discussed with technical experts in freshwater ecology, avifauna and herpetology.

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 aerials and final ground-truthing was carried out on a follow up site visit on 1 March 2017. On both visits (24 January and 1 March) 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 carried out by WCC staff and volunteers in Wellington parks, reserves and the wider city. 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 48) 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 *eBird* and *Inaturalist*.

  We note that the bird counts were only conducted over one season, being summer. Ideally, counts are done seasonally for 12 months for a new site where *Threatened* or *At Risk* species may be present. However, with the information already available on bird occupancy of council reserves, we determined that the objective 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 24 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.

  At the time of survey, the waterways were too small for effective electric fishing, as can be seen in the appended photographs. Fish surveys were therefore carried out by spotlighting which 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 48.

2.3 Consultation

Consultation with local residents and community groups was carried out as part of the Wellington City Councils' Town Belt Process. A public meeting was attended on 17 June 2017, and several matters relating to the sites ecology were raised and discussed. Also, public submissions provided to Council as part of the consultation process were viewed.

Following consultation, the assessment was expanded in several areas including:

- Providing greater discussion and analysis with regard to avifauna, including the addition of morepork/ruru on to the species list which had not been recorded by the day time sampling;
- Additional discussion to confirm the avoidance of streams by physical works; and
- Additional detail on management measures that are to be carried out during construction to ensure the application of recommended measures to avoid, minimise or remedy effects.

2.4 Project Shaping

In developing this assessment, we have consulted with, and viewed the maps and documentation prepared by the project engineers regarding the construction scope, extent and methodology. This included two site visits with the project engineers, planners, and landscape architects.

These meetings and discussions contributed to an iterative process of project design which led to, or supported several design decisions including:

- Agreement that a 10 m buffer surrounding the physical footprint of works would be sufficient for all ancillary works and realistically set the maximum extent of vegetation clearance.
- Identification of the large trees that needed to be cleared, and those that could be retained; and
- Consideration of potential effects associated with raising of the lower playing field and agreement on measures needed to protect Papawai Stream and its hydrology from these works.

2.5 Assessing Significance

One requirement of an ecological impact assessment is to carry out an assessment of significance under Section 6(c) of the RMA. The criteria used for this assessment, 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: (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:

	(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.

2.6 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 ecosystem and species 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).

2.6.1 Assessing ecological value

For plant communities and habitats we have applied the criteria as described in the EIANZ (2015) guidance (note that 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

With regard to species, all New Zealand biota have been assessed by DOC against a standard set of criteria and lists published for each taxonomic group[4]. This provides a consistent basis on which to assign ecological value for individual species (refer to Table 3).

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
Not Threatened, locally uncommon/rare	Moderate
Not Threatened, common locally	Low

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

[3] Refer to Holdaway et al. (2012).

[4] Goodman et al. (2014) for freshwater fish; Robertson et al. (2017) for birds; de Lange et al. (2013) for plants; Hitchmough et al. (2016) for lizards.

We note that the Consultation Draft of this report (Ver. 4, 18 April 2017) relied on the 2013 NZ Threat Classification Series 4, Conservation status of New Zealand birds (Robertson et al., 2013). In May 2017 the Department of Conservation released an updated version of this classification (Robertson et al., 2017) which included a number of classification changes. This assessment has been revised in line with these changes.

2.6.2 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	• 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	• 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	• 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	• 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	• 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

2.6.3 Assessing level of effect

Combining ecological value with effect magnitude provides an assessment of the overall 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.

2.7 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:

- **Native or Indigenous**: In its broadest sense, a species is defined as native or indigenous if it has originated or occurs in New Zealand as the result of natural process (without human involvement). A species which is native to NZ may also be native to other countries (e.g. kingfisher, inanga).
- **Endemic**: This can be considered a subset of native. A species is defined as endemic if it has evolved and occurs and breeds naturally only in New Zealand (e.g. tui, red beech, long tailed bat).
- **Introduced**: A species that has been introduced accidentally or deliberately by human activity outside its natural range.
- **Naturalised**: A species that has been introduced accidentally or deliberately by human activity, or has self-introduced outside its natural 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.
- **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.
- **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.

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 *(Equivalent to D12 type of Nicholls (1976). Bayfield & Benson (1986), Bussell (1988), Wardle (1991) and McGlone & Neall (1994)).*	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. 49) 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

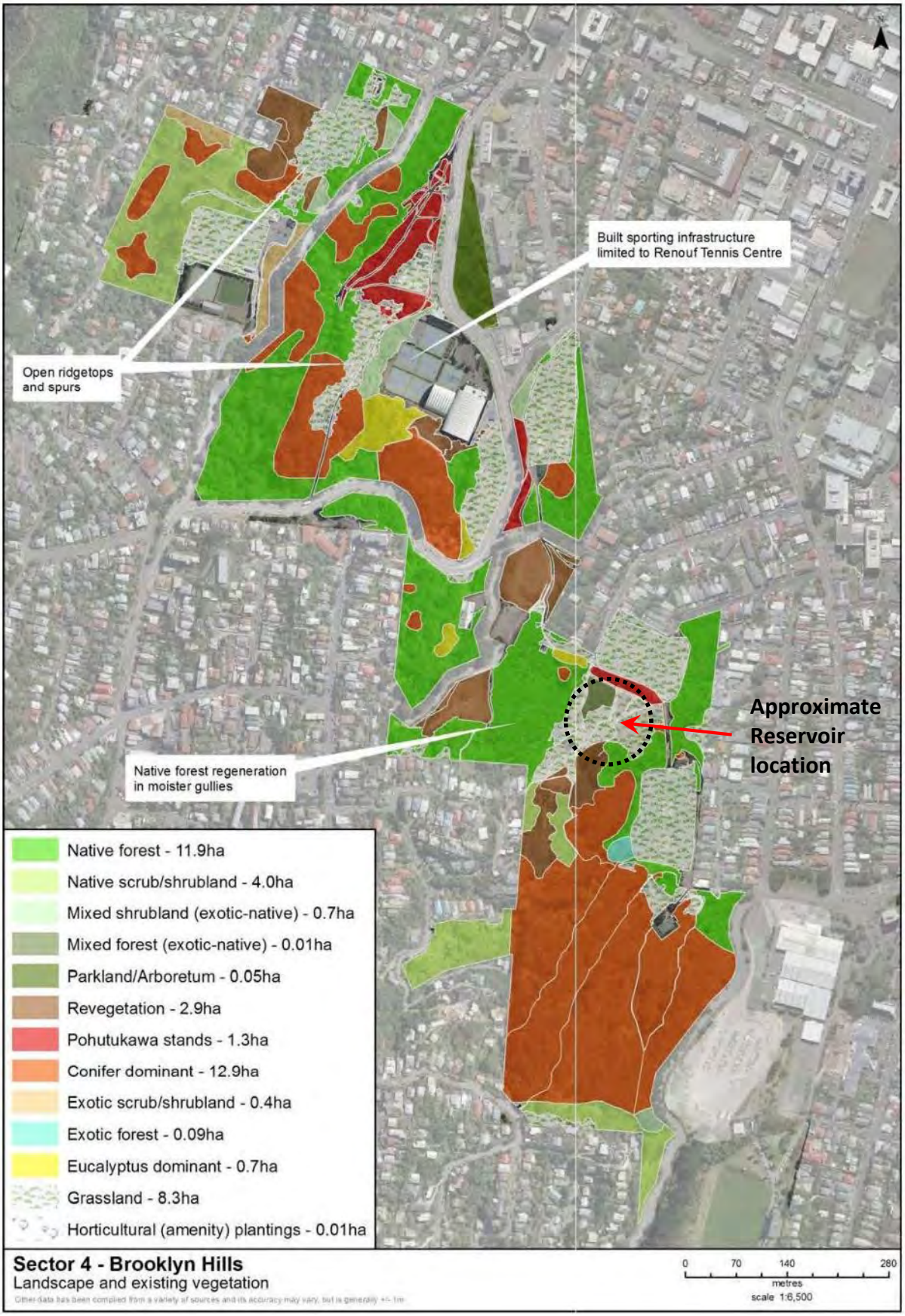
POWP is the southern end the Brooklyn Hills Sector (Sector 4) of the town belt, a continuum of vegetated open space which extends from Mortimer Terrace to Hutchison Road containing Tanera Park, Central Park, Brooklyn Hills, and POWP. These parks have a similar mosaic of vegetation including indigenous 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 12) 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


Built sporting infrastructure limited to Renouf Tennis Centre
Open ridgetops and spurs
Native forest regeneration in moister gullies
Approximate Reservoir location
Native forest - 11.9ha
Native scrub/shrubland - 4.0ha
Mixed shrubland (exotic-native) - 0.7ha
Mixed forest (exotic-native) - 0.01ha
Parkland/Arboretum - 0.05ha
Revegetation - 2.9ha
Pohutukawa stands - 1.3ha
Conifer dominant - 12.9ha
Exotic scrub/shrubland - 0.4ha
Exotic forest - 0.09ha
Eucalyptus dominant - 0.7ha
Grassland - 8.3ha
Horticultural (amenity) plantings - 0.01ha
Sector 4 - Brooklyn Hills
Landscape and existing vegetation
0 70 140 280
metres
scale 1:6,500

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 national 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. 2015) includes crowd sourced data from the wider city, which identifies some native 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 bush 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 just 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 Area. Sorted by native / introduced and by threat status (Robertson et al., 2017).

All birds observed in Parks & Reserves	Relative Abundance (Nationally)[5]	Threat Classification[6]	Recorded in Brooklyn Hills[7]	Likely in project footprint
Whitehead	Uncommon endemic	At Risk, Dec	YES	YES
Bush falcon	Abundant native	At Risk, Rec	YES	YES
North Island kaka	Locally common endemic	At Risk, Rec	YES	YES
Red-billed gull	Uncommon endemic	At Risk, Rec		Unlikely
North Island saddleback	Locally common endemic	At Risk, Rec		Unlikely
Variable oystercatcher	Rare endemic	At Risk, Rec		Unlikely
Red-crowned parakeet	Uncommon endemic	At Risk, Rel	YES	YES
Bellbird	Locally common native	NT	YES	YES
Grey warbler	Common endemic	NT	YES	YES
Morepork / Ruru	Abundant endemic	NT	YES	YES
New Zealand fantail	Common native	NT	YES	YES
New Zealand kingfisher	Abundant native	NT	YES	YES
New Zealand pigeon (kereru)	Abundant native	NT	YES	YES
North Island robin	Common endemic	NT	YES	Unlikely
Paradise shelduck	Common endemic	NT		Unlikely
Shining cuckoo	Common native	NT		YES
Silvereye	Abundant native	NT	YES	YES
Southern black-backed gull	Abundant native	NT		YES
Spur-winged plover	Abundant native	NT		Unlikely
Swamp harrier	Abundant native	NT		YES
Tui	Common endemic	NT	YES	YES
Welcome swallow	Abundant native	NT		YES
White-faced heron	Abundant native	NT		Unlikely
Australian magpie	Introduced	-		YES
California quail	Introduced	-		YES
Chaffinch	Introduced	-		YES
Common redpoll	Introduced	-		YES
Common starling	Introduced	-		YES
Dunnock	Introduced	-		YES
Eastern rosella	Introduced	-		YES
Eurasian blackbird	Introduced	-		YES
Goldfinch	Introduced	-		YES
Greenfinch	Introduced	-		YES
House sparrow	Introduced	-		YES
Skylark	Introduced	-		YES
Song thrush	Introduced	-		YES
Yellowhammer	Introduced	-		YES

[5] From The field guide to the birds of New Zealand (Heather & Robertson, 2005)

[6] From Robertson et al. (2017). Dec = declining; Rec = recovering; Rel = Relict; NT = Not Threatened.

[7] From McArthur et al. (2015) including crowd sourced records, and observations provided during consultation.

In summary, the avifauna within the Wellington Town Belt, which two decades ago would have been very limited in diversity, is now enriched by species which have been released within, and are spreading out of, the Karori Wildlife Sanctuary, and/or resident species which have increased in abundance in the town belt with the aid of ongoing council pest control operations and enhancement of habitat by councils and community care groups.

The five most common, widespread and secure native species recorded in the town belt are fantail, silvereye, grey warbler, tui, and shining cuckoo. Bush falcon, morepork and kingfisher are also widespread but are either relatively rare or inconspicuous (McArthur, N.; Harvey, A. and Flux, I., 2015).

Looking specifically at the Brooklyn Hills, the most notable arrivals or increases within these reserves are NI kaka, red crowned parakeet, bellbird, kereru, and whitehead. Of these kaka, kereru and whitehead have shown the greatest expansion, bellbird and parakeet the least. All other native or endemic species recorded in the Brooklyn Hills Sector are widespread and common or abundant nationally.

In summary, council bird surveys within the town belt have identified 23 native birds and 14 introduced species. Of the 23 native species, 13 have been observed in the Brooklyn Hills Reserves, extending from Tanera Park in the north (adjacent to Polehill reserve), to MacAlister Park in the south. Based on habitat availability, another four species are likely to be present. Seven native species recorded in the town belt are considered unlikely to occur within the project footprint due to lack of appropriate habitat, or in the case of the NI Robin and NI Saddleback, the low likelihood of these species expanding their range from Polehill Reserve south to POW.

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 Unpiped 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.) identified one species of native fish (banded kokopu, both adult and juvenile forms) as present within the Papawai Stream extending into POWP. These sources also identified 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 highlighted 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 45). Photos of each community are presented in Appendix 5, page 54. A detailed description of each community is provided in Appendix 3, page 51.

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)
Seral native broadleaved forest and scrub communities	15.90	0.18
Planted native communities	2.90	0.51
Exotic communities (including playing fields)	23.20	3.25
Combined	43.30	3.94

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

reasons, karo (*Pittosporum crassifolium*) is another native species included in this category. 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 planted native 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

The following analysis is based on Table 9 (Section 3.8.2) which lists all birds recorded by Council survey within the Wellington Town Belt. Table 12 then adds the results of 5-minute bird counts at three locations within the project footprint, and incidental observations recorded while traversing the site on several site visits.

The 5-minute counts provide a relative abundance estimate for the species which are most visible or vocal at the time of survey. The five most commonly seen or heard birds during 5-minute counts (both native and exotic) were goldfinch, magpie, tui, black-backed gull and starling. The five most frequently seen or heard native species were tui, black-backed gull, silvereye, and fantail, with grey warbler and kaka fifth equal.

The incidental observations recorded two species that have not previously been recorded during WCC surveys of the Town Belt; the pied shag and rock pigeon. Six species, red crowned parakeet, bellbird, shining cuckoo, welcome swallow, whitehead and ruru, were not recorded during this study, but there is suitable habitat for them, they are present in nearby reserves, and so are likely visitors from time to time.

Table 12: Observations of birds seen on site (5-minute bird counts and incidental observations), summer 2016/17. Sorted by native / exotic and by threat status (Robertson et al., 2017)

Birds likely present in project area	Threat Classification	Table 9 WCC Surveys	5-Min Counts		Incidental Observations
			Seen	Heard	
Whitehead	At Risk – Dec.	Y			
Bush falcon	At Risk – Rec.	Y			
North Island kaka	At Risk – Rec.	Y		4	yes
Pied Shag	At Risk – Rec.	-			yes
Red-crowned parakeet	At Risk – Rel.	Y			
Bellbird	NT	Y			
Grey warbler	NT	Y		4	yes
Morepork / ruru	NT	Y			
New Zealand fantail	NT	Y	2	3	yes
New Zealand kingfisher	NT	Y			yes
New Zealand pigeon (kereru)	NT	Y			yes
Shining cuckoo	NT	Y			
Silvereye	NT	Y	5	5	yes
Southern black-backed gull	NT	Y	11	1	yes

Birds likely present in project area	Threat Classification	Table 9 WCC Surveys	5-Min Counts		Incidental Observations
			Seen	Heard	
Swamp harrier	NT	Y	1		yes
Tui	NT	Y	10	3	yes
Welcome swallow	NT	Y			
Australian magpie	I	Y	9	5	yes
California quail	I	Y			
Chaffinch	I	Y			yes
Common redpoll	I	Y			
Common starling	I	Y	7	3	yes
Dunnock	I	Y			
Eastern rosella	I	Y	3	-	yes
Eurasian blackbird	I	Y	1	3	yes
Goldfinch	I	Y	14	15	yes
Greenfinch	I	Y			yes
House sparrow	I	Y	2	1	yes
Rock Pigeon	I	-			yes
Skylark	I	Y			
Song thrush	I	Y			yes
Yellowhammer	I	Y			

Threat classification rankings are as per Robertson et al (2017): **Dec** *= Declining;* **Rec** *= Recovering;* **Rel** *= Relict;* **NT** *= Not Threatened;* **I** *= Introduced and Naturalised.*

4.2.1 Summary

In summary, Council bird surveys, crowd-sourced records, and our surveys (summer only) have identified 17 native and 15 introduced bird species that occur or potentially occur within the POWP study area.

Of the 17 native bird species, nine species are likely to be resident and breed within POWP and therefore utilise habitat within the project footprint. They are: kaka, grey warbler, morepork, fantail, kingfisher, kereru, shining cuckoo, silvereye, and tui. The remaining eight species may only traverse across the site, or may occasionally roost on the playing fields, or may visit from time to time but are not resident.

The eight species likely to visit at least infrequently and utilise habitat within the project footprint but which are less likely to be resident and breed within POWP are bush falcon, red crowned parakeet, bellbird, black backed gull, pied shag, swamp harrier, welcome swallow and whitehead.

4.2.2 Threatened or At-Risk birds

Of the 17 species described above (i.e. recorded or considered likely to occur within the POWP), five have a national threat status, the whitehead, bush falcon, North Island kaka, pied shag, and red-crowned parakeet (See also Appendix 4). Their threat status and relevant ecology are:

- **Whitehead** are classified as “At Risk; Declining C(1/1), DP”. While this species has a very large population nationally, it is predicted to face ongoing or predicted decline in the order of 10 to 70% in the next 10 years.

  They have not been recorded at POW, but are dispersing into forests adjacent to the Karori Wildlife Sanctuary where they were released. Gregarious during breeding, outside the breeding season this species disperses to increase its foraging area and could move along the Brooklyn Hills to POW.

Whitehead are not strong flyers, running through the vegetation rather than flying from site to site. They build a conventional cup shaped nest either in the canopy of the forest, or lower down in smaller trees or shrubs.

- **Bush falcon** are classified as "At Risk: Recovering (A): DP". Nationally, this species has undergone a documented decline but now has an ongoing or predicted increase of > 10% in the total population or area of occupancy over the next 10 years.

  Bush falcon were not seen during 5-minute counts or incidental observations, but have been recorded in WCC surveys in the wider study area (Brooklyn Hills reserves) and noted traversing POWP "reasonably regularly" in citizen science records.

  This species has a very large home range, e.g. in the order of 900 ha in pine forest (Seaton, R., 2007). Therefore, POWP, and the habitat within the project footprint, would constitute a small part of the home range of any bird seen traversing the site. The bush falcon typically nests on the ground but may also nest in epiphytic plants in tall podocarps.

- **North Island kaka** are classified as "At Risk: Recovering (B): CD, PD". Nationally, this species is recovering both in terms of population and area of occupancy. Of note is that this recovery remains dependent on conservation activity, and is not nationally consistent. Historic decline has been due primarily to recruitment failure (nest predation).

  However, in Wellington City kaka has increased dramatically in the last decade, spreading through the town belt from the Karori Sanctuary. It utilises flowering trees for nectar during spring, conifers and eucalyptus species for sap feeding, and utilises large exotic trees for nest sites.

  Kaka are now a continuous presence at POW, and during site visits were typically seen in gregarious flocks of three to eight. There has been at least one successful nesting at POW, in trees to the north of the project footprint in 2013[8] They generally nests in tree cavities over 5 metres above the ground, but can also nest near ground level.

- **Pied shag** are classified as "At Risk: Recovering (B)". Nationally, this species is recovering and is expected to have a 10% increase in population or area of occupancy over the next 10 years.

  This species has 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.

- **Red crowned parakeet** are classified as "At Risk – Relict – B"; Nationally the species is stable or increasing slightly due to conservation activities. In Wellington, like kaka, this species is spreading out from the Zealandia and Matiu/Somes Island where they were recently released.

  This species was 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 and by BML staff. This bird is a strong flyer, and can travel large distances daily and seasonally to locate food. Again, like kaka, this parrot generally nests in tree cavities.

4.2.3 Other species of note

In addition to bush falcon a second bird of prey, the morepork or ruru, is present on site. This species is *Not Threatened*. Like falcon, this top predator has a relatively large home range which may be 3.5 to 7 ha in native forests (Pryde & Greene, 2016). They generally breed in bush habitat and pine forests, both habitats found within POWP and within the project footprint. Like kaka and falcon, where available they nest in cavities in trees, but will also nest on the ground.

[8] WCC 2012: http://wellington.govt.nz/your-council/news/2012/12/kaka-nest-found-in-prince-of-wales-park

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 (EcoGecko Consultants Ltd, 2014).

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); sample sites are shown on Map 4 (page 48). 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 6, page 62.

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)	• 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)	• 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)	• 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)	• 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	Description	PHA Score
Reach 5 (eastern headwater) (Photo 24)	• 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%)
Waitangi Tributary		
Reach 6 (Photo 25, Photo 26 & Photo 27)	• 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 *Tradescantia*, 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 *as At Risk Declining (C(1/1))* (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 m^2 of perennial habitat or one fish for every 5.7 m^2 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 observations recorded during spotlighting, summer 2016/17.

Study Reach (Map 4)	Length and area	Banded Kokopu	Whitebait	Elver	Koura[9]
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 (small 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

[9] Koura = freshwater crayfish. Relative Abundance scores based on ACFOR.

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 RMA[10]. 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 Whenua[11]) 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.

[10] 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".*

[11] 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 Habitat

- 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, of the five bird species which have an At-Risk classification, only the kaka regularly utilises the habitat within the POWP. And despite their visibility at POWP, kaka are much more prevalent in other parts of the inner and outer town belts (McArthur, Govella, Walter, & Small, 2015). Therefore, the area of potentially affected habitat within the project footprint will not provide habitat for > 5% of the regional population of this species.
- We conclude that the site is not a significant habitat of indigenous avifauna.

5.3 Lizard Habitat

- 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

- 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:*
>
> *a) managing activities to reduce sedimentation rates and pollutant inputs, and*
>
> *b) 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	Represent-ative	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 47).

- 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 Avifauna

Threatened or At Risk Species

- the whitehead, bush falcon, North Island kaka, pied shag, and red-crowned parakeet are classified as "At Risk" species nationally, and are therefore considered to be of high ecological value (At Risk – Declining) or moderate (At Risk – Recovering, Relict). That is, an activity at a site which adversely effects a number of individuals can have an impact on the local or national population.

Other species

- The common, widespread and secure species within the town belt; fantail, silvereye, grey warbler, tui, kingfisher, morepork, and shining cuckoo are considered to have a low relative ecological value with respect to an effects assessment, that is, an activity at a site which adversely affects a number of individuals, is unlikely to impact the local population.
- The remaining non-threatened bird species (bellbird, kereru) have been released back into the city (bellbird, whitehead) or are naturally recovering (kereru) and so are still relatively uncommon. Their recovery within the city is currently most visible in the larger native forest remnants in the northern suburbs (bellbird, kereru), or in forest reserves immediately adjacent to the Karori Wildlife Sanctuary (whitehead), where there is better indigenous habitat. To date neither bellbird or whitehead have been recorded in POWP. Overall, while these species are uncommon locally, they are not threatened nationally, and are recovering and dispersing in Wellington. For that reason, we consider them to have low ecological value with respect to an effects assessment, that is, an activity at a site which affects a number of individuals, is unlikely to impact on the local population, or its recovery.

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 47).

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					
• Whitehead	At Risk - Declining				High
• bush falcon, North Island kaka, pied shag, red-crowned parakeet	At Risk – Recovering or Relict				Moderate
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 46) 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 (%)
Seral native broadleaved forest and scrub communities	15.9	0.18	1.1%
Planted native communities	2.9	0.51	17.6%
Exotic communities (including playing 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 loss equates to 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 this 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 Avifauna

There are three potential effects on avifauna which are considered; habitat loss, displacement resulting from disturbance, and impacts on breeding birds.

Habitat loss

All bird species recorded at the site are mobile and able to utilise habitat over relatively large areas for food and breeding (home range). It is therefore considered highly unlikely that any native bird species which utilise the potentially affected habitat, are restricted to just that affected area. The vegetation and habitat being cleared (0.9 ha) is a small percentage of the seral native forest and tall exotic forest, which makes up the vegetation of the Brooklyn Hills Reserves (±35 ha). In addition, there are many fingers of mature native and exotic trees and vegetation that extend into residential gardens and which also make up the matrix of habitat available to potentially affected species.

It is also unlikely that any of the native species likely to utilise the site, are currently limited by habitat availability. The main limit to abundance of native bird species is likely to be predation. This means that birds are unlikely to be competing for habitat to the extent that the loss of a small proportion of vegetation will detrimentally affect any individual birds, or the local population.

Therefore, it is concluded that the loss of small areas of seral vegetation and the few large exotic trees is unlikely to have an adverse impact on local populations of any birds that currently include the affected footprint within their home range.

- The magnitude of effect is therefore assessed to be negligible (*Very slight change from the existing baseline condition*) for all species.

Disturbance

In terms of disturbance, we conclude that any species currently resident or regularly visiting POWP is already experiencing high levels of human disturbance common to any urban park, and so are habituated to activities including vehicle movements, mowers, team sport, walking groups, vegetation management, house and street lights, fireworks, and so on.

There is space adjacent to works and within surrounding parks for any species to move away from construction activity, and based on experience on other projects some species will be attracted to works, and will utilise the new habitat provided by disturbed land and vegetation clearance.

We conclude that construction noise and human activity is unlikely to have an adverse impact on local populations of any birds currently resident or regularly visiting the site.

- The magnitude of effect is therefore assessed to be negligible (*Very slight change from the existing baseline condition*) for all species.

Breeding

The greater risk to some species relates to vegetation clearance if this activity occurs during breeding. In particular kaka, parakeet and ruru are cavity breeders; and bush falcon can breed in epiphytes in large trees or in cover on the ground.

The clearance of old growth pine and eucalyptus is therefore the project activity of most risk to avifauna. This risk can be readily avoided by clearing vegetation outside the breeding season. If clearance occurs within the breeding season, a more comprehensive management response is required. The following species are considered to be at risk.

Threatened Species

Four bird species with a threat status, kaka, bush falcon, pied shag, and red-crowed parakeet have been recorded or are potentially present at the site. For this analysis we have assumed a worst case which is that clearance of habitat suitable for nesting by these species occurs during the breeding season, and without any management actions to minimise effects.

- **Whitehead**: this species has not been recorded at POW and there is no evidence of past breeding at this site. It is expanding slowly out from the Karori Sanctuary, but is a poor flyer and so is extending its range slowly. We consider it unlikely that whitehead will nest within the project footprint in coming years based on the current expansion beyond the Karori Sanctuary. Even then, its nesting behaviour suggests it will not be at risk. Unlike the other species discussed below, whitehead is not a cavity breeder, but build a conventional cup shaped nest either in the canopy of a closed forest, rather than in the low scrub which makes up much of the project footprint.

  Overall, we conclude that there is a low likelihood of a nest occurring within the project footprint, and, the potential magnitude of effect on the local population if a nest was lost is negligible (*Very slight change from the existing baseline condition*) for this species due to its increasing population locally.

- **Bush falcon:** is present in the town belt in low numbers. It's a highly mobile species with a very large home range that can be tens of square km in size, making a large area available for the selection of a nest site. It nests in scrapes on the ground or occasionally in epiphytes in tall trees and like most predators' falcon have a low reproductive rate, and so a local population can take some time to recover from losses.

  There have been records of nest mortalities due to forestry operations due to disturbance of the brooding adult or physical destruction of the nest (Seaton, Holland, Minot, & Springett, 2009). However, there are no records of adults being lost.

  At worst, due to territory size, only one nest could potentially be affected if falcon chose to nest within the project footprint. However, if clearance led to loss of a nest and any chicks in it, it could have a moderate short to medium term effect on recruitment of falcon in the wider area given low productivity rates for this species.

  Overall, we conclude that there is a very low likelihood of a nest occurring within the project footprint, but, the potential magnitude of effect on the local population if a nest was lost is moderate (*Loss of a moderate proportion of the known population or range of the element/feature*) for this species.

- **North Island kaka:** Of the species considered here only kaka is present in the town belt in moderate numbers, seen almost daily at this site in boisterous flocks ranging from a couple to 8 birds (T. Roberts pers. comm.). They have also historically nested in this park very near to the proposed works. They are a cavity breeder and so restricted to nests in old growth trees.

  If clearance led to loss of a nest, the effect on the local population would be relatively small given the secure population within the Karori Wildlife Sanctuary, and the increasing expansion and abundance and of this species through Wellingtons parks.

  Overall, we conclude that there is a low likelihood of a nest occurring within the project footprint, and, the potential magnitude of effect on the local population if a nest was lost is negligible (*Very slight change from the existing baseline condition*) for this species due to its increasing population and distribution locally.

- **Pied Shag:** One bird was seen traversing but it is not resident on site. No breeding habitat is present. This species will not be adversely affected.
- **Red-crowned parakeet:** This species has been observed at POWP, but breeding has not been recorded. Like kaka, it is a cavity breeder and so restricted to nests in old growth trees. Like whitehead this species is expanding slowly out from the Karori Sanctuary, but unlike whitehead, kakariki is a strong flyer and is able to move throughout the town belt. Nesting within the POWR and potentially the project footprint is a possibility.

  If clearance led to loss of a nest, we consider that the effect on the local population would be moderate, given the current low numbers and limited distribution of this species in Wellington.

  Overall we conclude that there is a very low likelihood of a nest occurring within the project footprint, but the potential magnitude of effect on the local population if a nest was lost is moderate (*Loss of a moderate proportion of the known population or range of the element/feature*) for this species given the low numbers present locally.

Non Threatened Species

The only non-threatened species that we consider potentially affected is the morepork. This species is widespread within the town belt. It is a mobile species with a relatively large home range, making a large area available for the selection of a nest site. It is also a cavity breeder and so restricted to nests in old growth trees.

At worst, due to territory size, only one nest could potentially be affected if morepork chose to nest within the project footprint. And, like other species discussed, the nesting adult is likely to leave the nest if there is disturbance to the tree. If a nest was lost, we consider that there would be a small but short term effect on recruitment of ruru in the wider area.

Overall, we conclude there is a very low likelihood of a nest occurring within the project footprint, but, the potential magnitude of effect on the local population if a nest was lost is low (*Having a minor effect on the known population or range of the element/feature*) for this species.

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. Currently, during a large flood event Papawai Stream is able to overtop the recently constructed bund and flood onto the playing field. The design for the raised playing field has taken this into account. Specifically, the design ensures:
  - 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;
  - A swale next to the bund will drain flood flows away; and
  - The design entirely avoids the bund and so will not alter the current stream flows and velocities.
- 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
Avifuana			
• Habitat Loss	Very High to Low	Negligible	Low to Very Low
• Disturbance	Very High to Low	Negligible	Low to Very Low
• Whitehead	High	Negligible	Very Low
• Breeding (cavity nesters)			
– Bush falcon	Moderate	Moderate	Moderate
– Kaka	Moderate	Negligible	Very Low
– Pied Shag	Moderate	Nil	Very Low
– Red crowned parakeet	Moderate	Moderate	Moderate
– Ruru	Low	Low	Very 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.

Vegetation Clearance

1. **Retained Vegetation:** Prior to vegetation clearance the maximum extent of clearance is to be clearly marked by flagging tape, and inspected by the project ecologist. Any large trees that are to be retained also need to be clearly identified.
2. **Arborist:** Large trees are to be dismantled by an arborist, rather than simply felled. This is to minimise effects on adjacent vegetation that is to be retained.
3. **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 all practicable efforts to minimise the extent of this loss.
4. **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.

Avifauna

5. Where possible, clearance of vegetation or large trees that may contain nests of bush falcon, kaka, kakariki or ruru, should occur outside breeding season, i.e. before 1 September or after 31 March. This would very simply avoid effects to these species.
6. If clearance must occur during breeding season, avoidance of effects will rely on surveys of these trees by an ornithologist which will need to be carried out immediately prior to felling. If a nest of any of the species listed in above is located, clearance is to be put on hold until a suitably qualified ornithologist can provide recommendations. Potentially this may require a halt to works until chicks have fledged.
7. Prior to felling, a number of nest boxes for kaka and ruru, could be installed on appropriate trees at locations some distance away from the works area. Both of the species are known to, or are likely to nest locally. None of the other at risk species are likely to be nesting in the POWP. The presence of nest boxes might minimise the risk of kaka nesting within the project footprint, and would provide alternative nest sites to both species if trees with suitable cavities are removed. If this recommendation is adopted installation at least a year in advance is also recommended. Responsibility for maintenance would fall to the applicant until completion of the project.

Streams

8. **Waitangi Stream Tributary Works Extent: T**he 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 surveyed 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.

9. **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 be surveyed 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.

10. **Papawai Stream Field Raising:** The design for raising of the lower playing field has taken account of the risk of affecting flows and velocities. 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 stream's ecology.

Stormwater

11. **Stormwater:** Comprehensive management of sediment and erosion is required to minimise discharge of sediment to Wellington Harbour, and ensure effects are negligible. A sediment and erosion management plan is appended to the application.

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:

Vegetation Clearance

- 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 10 m 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 and must be both designed and signed off in consultation with a suitability experienced and qualified ecologist, according to international standards as outlined in (McDonald, Gann, Jonson, & Dixon, 2016)

- **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.

Terrestrial Habitat

- Following felling of large trees, the logs and debris can be relocated to revegetation sites or existing mitigation sites to add to diversity of habitat on the forest floor. Some logs can be disc'ed, the disks stacked along the edge of the site to provide lizard habitat. Surplus timber can be mulched for planting.

Avifauna

- **Habitat Restoration:** 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.
- **Nest Box's:** The presence of quality nest boxes would provide alternative nest sites to both species if trees with suitable cavities were removed, thereby remedying this loss.

Potential Effects on Papawai Stream:

- We recommended enhancement of riparian vegetation of Papawai Stream, in concert with any proposal to raise the lower playing field. This planting will help to shade and buffer the stream, and maintain stream function.
- Planting can fill gaps on the hill side of the stream and provide a thin barrier along the bund. We note that a wide strip of riparian planting on the bunded side of the stream is not possible given the design requirements for the playing field and associated drainage. However, if planting of grasses such as carex can achieve a closed canopy over the stream most of the possible benefits or riparian planting can still be achieved.

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

Revegetation

- Monitoring of vegetation clearance will be required to ensure clearance zones are limited to the areas shown on the attached maps.
- In addition, where vegetation clearance creates the potential for effects along the margins of vegetation that is being retained, we recommend annual spring monitoring and management of weed and vegetation condition (dieback surveys). Reporting is to include recommendations for timing and method of weed management.
- Monitoring of revegetation will be needed for a sufficient maintenance period to ensure plant survival, and good growth rates. Five years has been recommended at this exposed site.

Avifauna

- Annual checks of nest boxes will be required prior to each breeding season to confirm they are present and undamaged, and to clean them if necessary.

Streams

- 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. This monitoring should include baseline and seasonal measurements of sediment in both waterways, and of fish populations in the Papawai. It will also need to include monitoring of erosion in Papawai Stream, upstream of works. Reporting is to include recommendations for remedial actions where adverse effects are recorded.

Positive Ecological 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 WTBMP 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, includes flowering and fruiting species that will attract native birds, and will be located to extent and connect other areas of native vegetation within the site.

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.

- Processes for ongoing community involvement in the design and implementation of site restoration are proposed.

Section 8 of the WTBMP lists polices 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, exotic and invasive 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 location we believe there may be opportunities to minimise the effects of the proposed fill. This will be explored further during detailed design.

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 extent that vegetation which will buffer and restore any margins left exposed. Weed surveys of exposed margins are proposed during construction to assist in protection until planting is established.

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 habits. 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 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.
- Some potential nest sites in old growth trees may be lost. The installation of nest boxes is recommended to provide alternative nest sites to both species potentially affected.

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.

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12 Appendices

Appendix 1: Site Maps

Boffa Miskell
www.boffamiskell.co.nz

0 20 m
1:1,250 @ A3

Data Sources: LINZ, Boffa Miskell Ltd.

Projection: NZGD 2000 New Zealand Transverse Mercator

DRAFT

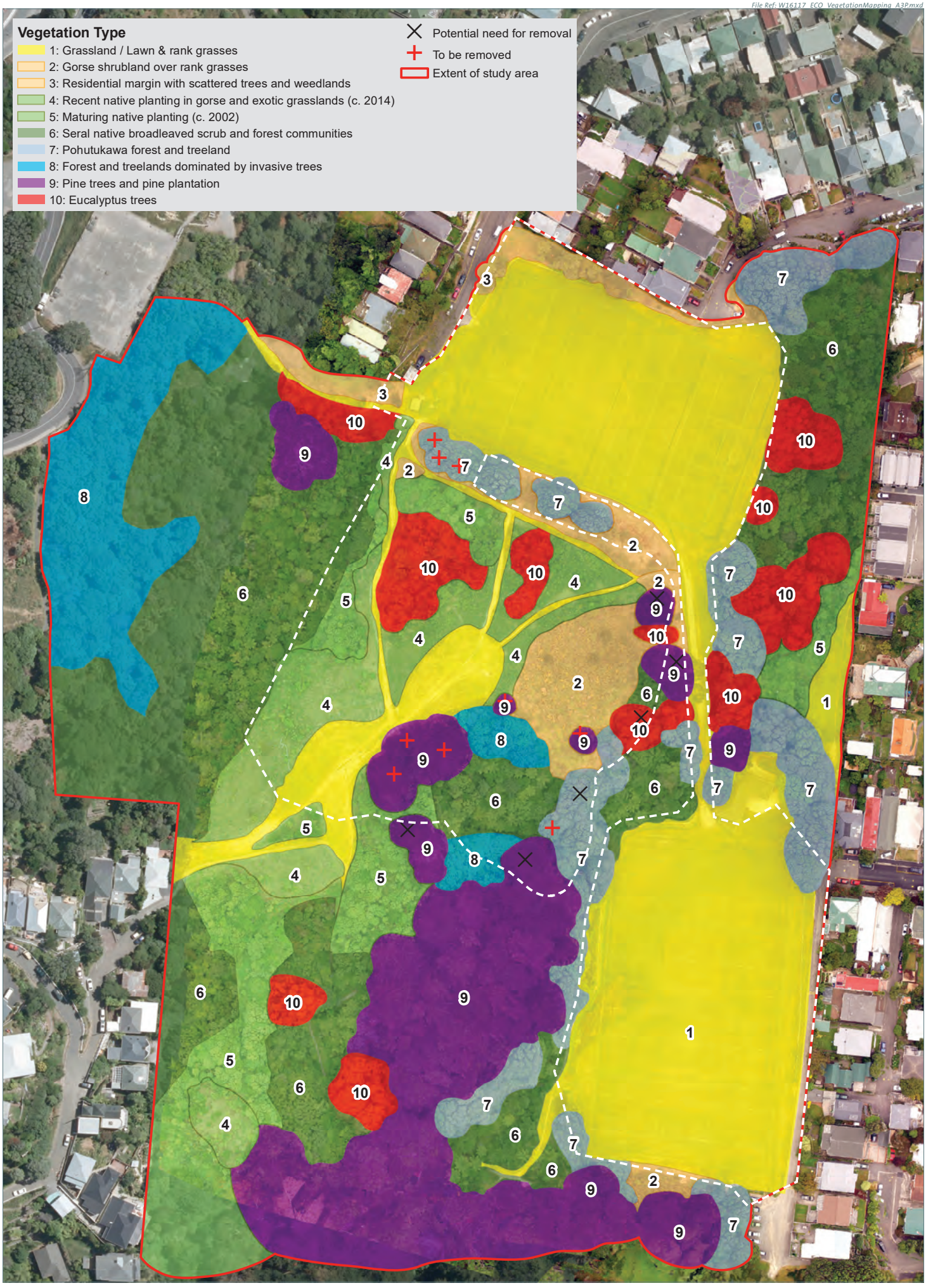
PRINCE OF WALES PARK

Map 1: Vegetation Extents (Existing)

Date: 07 March 2017 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: **Stephen.Fuller@boffamiskell.co.nz** | *Drawn:* MDu | *Checked:* SFu



Boffa Miskell
www.boffamiskell.co.nz

0 20 m
1:1,250 @ A3

Data Sources: LINZ, Boffa Miskell Ltd.

Projection: NZGD 2000 New Zealand Transverse Mercator

DRAFT

PRINCE OF WALES PARK

Map 2: Extent of Works

Date: 31 August 2017 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: **Stephen.Fuller@boffamiskell.co.nz** | *Drawn:* HHu | *Checked:* SFu

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1:1,250 @ A3

Data Sources: LINZ, Boffa Miskell Ltd.

Projection: NZGD 2000 New Zealand Transverse Mercator

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PRINCE OF WALES PARK

Map 3: Significant Vegetation

Date: 31 August 2017 | Revision: 0

Plan prepared by Boffa Miskell Limited
Project Manager: **Stephen.Fuller@boffamiskell.co.nz** | *Drawn:* HHu | *Checked:* SFu

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0 20 m
1:1,250 @ A3

Data Sources: LINZ, Boffa Miskell Ltd.

Projection: NZGD 2000 New Zealand Transverse Mercator

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PRINCE OF WALES PARK

Map 4: Biological Sampling

Date: 07 March 2017 | Revision: 0

Plan prepared by Boffa Miskell Limited
Project Manager: **Stephen.Fuller@boffamiskell.co.nz** | *Drawn:* MDu | *Checked:* SFu

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 45) and Site Photo 1 (Page 54) to Photo 16 (Page 61)

	Site characteristics
1.	**Grassland / Lawn & rank grasses** • Two playing fields which are mown and maintained. • The managed grasslands on the knoll and the margins of connecting tracks.
2.	**Gorse shrublands over rank grasses** • Found in two situations – 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 *Montbretia*, karo, pine (young), broom, patches of rank grass, and young mahoe.
3.	**Residential margins with scattered trees and weedlands** • 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.	**Recent native plantings in gorse and exotic grasslands (c. 2012)** • In a number of areas around the knoll recent planting has been carried out in either pasture or managed gorse. – 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.	**Maturing native planting (c. 2002)** • 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.	**Seral native broadleaved forest and scrub communities** • Areas of natural regeneration dominated by mahoe with five finger, ngaio, karaka, mamaku, cabbage tree, occasional kohekohe, mapou, puka, karo, and fuchsia. • The larger trees are typically 200 – 400 mm dbh and are up to 8 metre tall. • Tree fern is often abundant in gullies. The presence of large tree ferns is a good visual indicator of natural regeneration when viewed in aerial photos. • The face immediately to the west of the Waitangi Stream Tributary ("Bell Road Restoration Area") contains a number (approx. 20) of very large tī kōuka (cabbage trees). • 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. • The margins are often very weedy and have poplars, pohutukawa, cherry laurel and sycamore present.

	Site characteristics
7.	**Pohutukawa forest and treeland** • 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.	**Forest and treeland dominated by invasive species** • There are three plant communities that are noted: – 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 if forms a continuous canopy between an area of seral native forest to the north and pine forest to the south.
9.	**Pine trees and Pine Plantations** • 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 Microsorum, occasional areas dominated by montbretia and tradescantia, with blackberry often present in moist gullies or under treefalls.
10.	**Eucalyptus Treelands** • Present as three forms. – 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 (*Eucalyptus bicostata*). 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 (*Eucalyptus leucoxylon var.*). Flowers needed to confirm. This species is winter flowering.

Appendix 4: Avifauna names and threat status

Birds referenced in Text Common / Maori Name	Latin Name	Threat Classification (Robertson et al., 2017)
Whitehead / popokatea	*Mohoua albicilla*	At Risk; Declining, C (1/1): (DP)
Bush falcon / karearea	*Falco novaeseelandiae ferox*	At Risk: Recovering, A: (DP)
North Island kaka / kaka	*Nestor meridionalis septentrionalis*	At Risk: Recovering, B: (CD, PD)
Pied Shag / karuhiruhi	*Phalacrocorax varius varius*	At Risk: Recovering, B
Red-crowned parakeet / kakariki	*Cyanoramphus novaezelandiae novaezelandiae*	At Risk: Relict, B.
Bellbird / korimako	*Anthornis melanura melanura*	Not threatened
Grey warbler / rironiro	*Gerygone igata*	Not threatened
Morepork / ruru	*Ninox novaeseelandiae novaeseelandiae*	Not threatened
New Zealand kingfisher / kotare	*Todiramphus sanctus vagans*	Not threatened
New Zealand pigeon / kereru	*Hemiphaga novaeseelandiae*	Not threatened: (CD, Inc)
North Island fantail / piwakawaka	*Rhipidura fuliginosa placabilis*	Not threatened: (EF)
Shining cuckoo / pipiwharauroa	*Chrysococcyx lucidus lucidus*	Not threatened: (DP)
Silvereye / tauhou	*Zosterops lateralis lateralis*	Not threatened: (SO)
Southern black-backed gull	*Larus dominicanus dominicanus*	Not threatened: (SO)
Swamp harrier / kahu	*Circus approximans*	Not threatened: (SO)
Tui	*Prosthemadera novaeseelandiae novaeseelandiae*	Not threatened: (Inc)
Welcome swallow / warou	*Hirundo neoxena neoxena*	Not threatened: (SO, St)
Australian magpie	-	Introduced
California quail	-	Introduced
Chaffinch	-	Introduced
Common redpoll	-	Introduced
Common starling	-	Introduced
Dunnock	-	Introduced
Eastern rosella	-	Introduced
Eurasian blackbird	-	Introduced
Goldfinch	-	Introduced
Greenfinch	-	Introduced
House sparrow	-	Introduced
Rock Pigeon	-	Introduced
Skylark	-	Introduced
Song thrush	-	Introduced
Yellowhammer	-	Introduced

CD; Conservation dependent
DP; Data Poor
EF; Extreme Fluctuations
Inc; Increasing
PD: Partial Decline
SO; Secure Overseas
St; Stable

Appendix 5: 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 6: 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.