Huia Water Treatment Plant

Shortlist Options Analysis: Ecological Effects Evaluation Report
Prepared for Watercare Ltd

8 May 2017

Document Quality Assurance

Bibliographic reference for citation: Boffa Miskell Limited 2017. *Huia Water Treatment Plant: Shortlist Options Analysis: Ecological Effects Evaluation Report*. Report prepared by Boffa Miskell Limited for Watercare Ltd.		
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Status: Finalised	Revision / version: [1]	Issue date: 8 May 2017

Template revision: 20150331 0000

File ref: A16055_003_Shortlist_Analysis_Ecological_Effects_20170327.docx

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1.0 Introduction

Boffa Miskell ecologists (led by Sarah Flynn) and landscape architects (Rachel de Lambert) have formed part of the project team for the options assessment in respect of the proposed Huia Water Treatment Plant (WTP) replacement project since the stage of evaluation of the longlist site options. We were not involved in initial site identification as sites were identified primarily on technical performance criteria.

This assessment report addresses the Ecological factors associated with the four shortlisted sites being:

i. The existing treatment plant Woodlands Park Road;

ii. Manuka Road;

iii. Parker Road South, Oratia; and

iv. Parker Road North, Oratia.

The assessment is based on the now proposed 160 MLD capacity facility and the related drawing sets prepared and provide by GHD. The assessment is further informed by the "Watercare Services Limited, Huia WTP Site Selection Study, Draft Shortlist Site Development Report" (July 2016) prepared by GHD.

It is noted that the GHD design layouts are preliminary and are intended to test the potential configuration of a water treatment plant with a capacity of 160 MLD with room for future expansion. The process to secure a new site for the Huia WTP, on land not already owned by Watercare, would require a Notice of Requirement (NOR) which rather than specifying a particular treatment plant layout would establish the development parameters for a future treatment plant – such as maximum building heights, extent of site coverage, buffer areas and the like. The GHD potential layouts are therefore indicative.

2.0 Methodology

Ecological values were assessed following walkovers of the four alternative sites, during which vegetation was described and fauna habitat values were identified and assessed. This report also draws on the findings of a previous vegetation survey (Tonkin & Taylor 2012) of the Woodlands Park and Manuka Road sites.

This report is structured to address the sites in order as listed above.

The evaluation of each site is tabulated and scored with respect to adverse effects on terrestrial ecological values (particularly indigenous vegetation which is nationally, regionally or locally significant in terms of habitat values and presence of known species), and on freshwater receiving environments (including from operational discharges, and any works within or in proximity to a stream or wetland). Scores range from 1 (very significant adverse effects) to 5 (limited or benign / neutral effects). The basis for assigning scores is as follows:

1 Very significant impact, including widespread impacts. On-site mitigation is not achievable.

2 High impact. Areas of significance may be affected. Mitigation is not readily available or would be very costly.

3 Moderate impact. Effects cannot be completely avoided, but mitigation is achievable at moderate cost.

4 Slight impact which is localised and minor, taking into account reasonably (on-site) mitigation.

5 Straightforward with positive or neutral impacts, taking into account reasonable (on-site) mitigation.

3.0 Ecological Features

3.1 Existing Treatment Plant Site: Woodlands Park Road

3.1.1 Vegetation

The existing WTP facility on Woodlands Park Road, Titirangi is closely surrounded by approximately 2.5 ha of mature indigenous forest (excluding portions in the adjacent road reserve). Vegetation surrounding the treatment plant includes a range of early to late successional forest types.

The proposed development footprint (Fig. 1) also includes two reservoirs to be located within an area of existing kanuka forest (portions of which have been cleared or substantially modified) on the northern side of Woodlands Park Road.

The most abundant forest cover comprises mature kanuka forest, which occurs in patches surrounding the existing treatment facility and is the dominant vegetation type north of Woodlands Park Road. Kanuka forest (an early successional stage of WF11 kauri-podocarp-broadleaved forest; Singers et al 2017) consists of a primarily kanuka canopy interspersed with emergent kauri, totara, kahikatea, rimu, rewarewa and pohutukawa, and a subcanopy of broadleaved trees and shrubs (mahoe, nikau, pigeonwood, kawakawa, ponga, tree fuchsia and pate).

Groups of kauri are present around the existing treatment plant (Fig. 1, 2) and in the south-western quarter of the Watercare property to the north of Woodlands Park Road. Most kauri trees within the Watercare property are within the “ricker” stage, though numerous trees are greater than 60cm dbh, with a spreading crown characteristic of ‘mature phase’ kauri. Associated canopy and subcanopy species include rimu, kahikatea and kanuka, with occasional totara, rewarewa, kohekohe. Younger kauri and podocarps are also interspersed through the surrounding kanuka forest, both within the canopy and as occasional emergents.

Kauri forest (WF10) is recognised as an endangered ecosystem type (Singers et al 2017), as historic forest clearance has restricted its distribution to Northland hill country, and small patches throughout western Auckland, the Coromandel Ranges and Great Barrier Island. *Phytophthora agathidicida* - induced dieback also poses a significant threat to the viability of kauri forest where this disease occurs.

The site of the proposed reservoirs are is on a fairly level terrace on the northern side of Woodlands Park Road, much of which is vegetated in tall, senescing kanuka. A few mature kahikatea, kauri and totara are present amongst this vegetation, while the subcanopy contains dense broadleaved scrub, treeferns and nikau. Numerous seedlings of broadleaved canopy

Figure 1: Indicative WRP footprint for existing WTP site.

Figure 2: Kauri forest (WF10) on eastern side of existing WTP site.

Figure 3: Kauri forest understorey in southwestern corner of existing WTP site.

species (particularly kohekohe) were noted. Kauri is a significant component of the canopy in forest southwest of the indicative Reservoir 1 footprint. Kohekohe is a common canopy component on the steep slope above the terrace.

Patches of kahikatea-pukatea forest (WF8, a critically endangered ecosystem type; Singers et al 2013), are also present in the vicinity of the proposed reservoirs, principally along the toe of the escarpment and surrounding the small watercourse. Kahikatea swamp forest is also present to the west of the proposed reservoirs, grading into kauri forest on the western property margin.

Old tracks and clearings intersect kanuka forest and scrub in the vicinity of the accessway and existing water reservoir on the Watercare property on the northern side of Woodlands Park Road (generally within the indicative Reservoir 2 footprint). These areas have largely become overgrown with rank grass and herbaceous weeds, while remnant clumps of broadleaved shrubs and small trees (pate, kanuka, tree fuchsia, mahoe) are heavily overgrown with jasmine. A watercourse intersects the partially cleared area, and areas of marshy ground are present, though

these are modified by bush clearance and are mainly vegetated with exotic rushes and sedges (*Cyperus eragrostis, Juncus effusus*), creeping buttercup and rank grass.

The vegetation surrounding the existing WTP is contiguous with and forms part of a wider significant Ecological Area (SEA) as identified in the Auckland Unitary Plan (AUP) part operative. Stands of mature kauri and podocarps immediately adjacent to the existing plant are not included in the SEA overlay. A further area of SEA is located across Woodlands Park Road in the area proposed for the two reservoirs. A small part of the property north of Woodlands Park Road is not included in the SEA.

3.1.2 Fauna habitat

All forest and scrub-covered parts of the existing WTP site and adjacent property north of Woodlands Park Road are likely to support skinks and geckos. Herpetofauna records derived from the NZ lizard database indicate forest geckos (not threatened) have been found in the immediate vicinity, while Pacific gecko (At Risk), Auckland green gecko (At Risk), striped skink (At Risk) and copper skink (not threatened) have all been found in relatively contiguous habitat of comparable type and quality within 1 km of the site. Habitat present is also suitable for ornate skink (At Risk), the nearest records of which are in coastal forest within 5 km of the site.

Hochstetter's frogs (At Risk) have been recorded in the catchment surrounding the Nihotupu Reservoir and in forested headwater streams throughout the Waitakere foothills, and typically favour the margins of stony bottomed streams in native forest. Habitat within the headwaters of Armstrong Gully is somewhat modified but could potentially support a Hochstetter's frog population.

The tall forest components of the site in particular are of value to avifauna, as tall trees provide diverse habitat and food resources, and the best protection from predators during breeding.

A sizeable resident population of long-tailed bats is present in the Nihotupu Reservoir catchment, well within flying distance of the Woodlands Park site. Forest margins, sheltered areas of tall forest intersected by roads (such as that present along Manuka and Woodlands Park Roads), and steep escarpments (such as the one above the proposed location for water reservoirs) are particularly favoured foraging habitats, while mature kauri and podocarps are likely to offer roosting habitat.

3.1.3 Watercourses

The headwaters of the Armstrong Gully are piped from north of Woodlands Park Road to the southern boundary of the site, where controlled discharges from the existing WTP also occur. Another headwater branch originating east of Manuka Road contains short section of steam but also appears to be piped to the same place. These sections of stream are limited in extent but probably contain a natural assemblage of macroinvertebrates. Fish are likely to be rare or absent.

North of Woodlands Park Road, the upper Armstrong Stream runs through the western side of the site before turning south and passing under Woodlands Park Road and the treatment plant via a culvert (Fig. 4) The stream is largely permanent but as flows decrease up the catchment it is likely to become intermittent or ephemeral. The stream is in good condition, and is likely to support an assemblage of pollution-sensitive macroinvertebrates, but few or no fish as the culvert is likely to impair fish passage. An ephemeral watercourse branches off to the east. Tracks established for drilling have created some disturbance in the riparian zone but little if any effect on the stream.

Figure 4: Watercourses – Woodlands Park Road and Manuka Road sites.

In general, this stream is Permanent[1] and is in good condition, but values are slightly reduced by disturbance from access tracks around the stream and by the discontinuity created by the culvert below Woodlands Park Road.

Due to site constraints, no substantive attenuation storage is available on site for the Woodlands Park Road WPT option, and overflow events would discharge directly to Little Muddy Creek via a pipeline. This discharge is assessed as having no adverse effect on the watercourse, as it is to be piped. There is potential for erosion and scouring effects at the estuary in the vicinity of the outfall, but appropriate design and volume restrictions would avoid adverse effects.

3.1.4 Mitigation Options

Loss of old-growth forest cannot be mitigated in a fully like-for-like replacement through restoration as kauri and podocarp forests develop through a series of successional forest types, and time is a key factor in the formation of forest structure and habitat complexity. Some on-site mitigation to address impacts on localised fauna populations (e.g., lizards) could be undertaken in the remaining bush north of Woodlands Park Rd and in the adjacent Manuka Road site, by way of weed control, infill planting, fauna translocations and predator control. However, due to site constraints there is minimal scope for undertaking mitigation planting on-site.

A suitable offset could theoretically be derived to compensate for the proposed forest clearance. This would require a substantial multiplier to account for the reduction in area of old-growth forest and already-depleted ecosystem types. The extent of any offset would also depend on the existing condition and ecological values of the site proposed for enhancement and/or restoration and its proximity to the impact site.

The location of the proposed reservoirs encompasses a reach of permanent stream that comprises the headwaters of the Armstrong Gully stream. The Auckland Unitary Plan requires that any adverse effects on lakes, rivers, streams and wetlands are avoided, remedied or mitigated. Where those effects cannot be avoided, remedied or mitigated, it is desirable that offsetting of any adverse effects be provided. There is insufficient stream length available for restoration on-site, hence stream restoration at an alternative location would be required to offset adverse ecological effects. As noted on the PAUP: The methodology for calculating a sufficient offset is specified in Auckland Council TR2011/009, the Stream Ecological Valuation manual. A score for ecological value is calculated using the SEV method. An Environmental Compensation Ratio (ECR) is then calculated, based on the loss of values at the impact site and the gain at the mitigation site. The regional average ECR is 3:1, i.e. for each metre of stream reclamation, three metres are restored by riparian planting or other methods. However, the specific extent of restoration required is determined by evaluating the respective quality of the impact site and identified mitigation site.

[1] The stream classification criteria for Permanent, Intermittent and Ephemeral streams are in the Auckland Unitary Plan. In summary, activities in Ephemeral Streams are permitted, while adverse effects on Permanent and Intermittent Stream must be avoided or mitigated.

3.1.5 Summary

The summary of ecological effects in respect of the Woodlands Park Road WPT site is set out below.

Existing WTP Site: Woodlands Park Road	
Terrestrial Ecological Effects	
Expansion of the existing WTP footprint will impact identified SEA, including clearance of approximately 1.5 - 2 ha of kauri and kahikatea–pukatea forest (endangered and critically endangered ecosystem types anticipated to have high flora and fauna habitat values) surrounding the existing WTP site. Approximately 0.5 ha of mature kanuka forest would also be cleared. Construction of the reservoirs will impact a further estimated ~2ha of identified SEA, most of which is currently vegetated in mature kanuka forest (a common forest type), though several large trees including mature kahikatea, kauri and totara are also likely to be lost.	
Score: 1 High adverse terrestrial ecological effects generated	
Aquatic Habitat Effects	
Stream classification	Roughly ~100 m of a permanent reach of Armstrong Gully stream headwaters (and a similar length of ephemeral watercourse) is situated within the reservoir footprint north of Woodlands Park Rd (piped beneath the road and existing WTP), and will require piping or diversion (note that the stream could be avoided if the tanks were moved eastward within the site).
Instream habitat	Armstrong Gully stream is in good condition within the proposed reservoir site and below the existing WTP, notwithstanding the piped section. Offsite mitigation for the loss of the permanent stream reach would be required at a high ECR (Environmental Compensation Ratio) given relatively high instream and riparian values.
Score: 3 Moderate adverse aquatic ecological effects generated	

3.2 Manuka Road Site

3.2.1 Vegetation

The Manuka Road site is owned by Watercare, and lies directly across Manuka Road to the east of the existing WTP site ("Woodlands Park Road" site). The extent of the 160 MLD indicative plant layout is shown on Figure 5. Note that the proposed reservoir location (not shown on Fig. 5) is the same as described above for the Woodlands Park Road site. Clearance of a group of mature kauri in the middle of the existing WTP site would also be required to provide for an enlarged overflow basin. The Manuka Road site is largely vegetated in native forest and scrub, and the whole of the Manuka Road property is identified in the AUP as an SEA, other than an area of approximately 0.2ha at the northern margin adjacent to Woodlands Park Road.

A walking track ("Clarks Bush track") intersects the Manuka Road property approximately east – west, descending towards the south-eastern corner of the site. Northwards of the track, the site has been modified by partial historic clearance (dwellings were once present in this part of the site; refer Fig. 6) and subsequent weed encroachment. Vegetation comprises a mosaic of stands of mature kanuka with scattered kahikatea and rimu (an early successional stage of WF11 kauri-podocarp-broadleaved forest; Singers et al 2017); patches of secondary scrub containing mahoe, kanuka and associated native trees and shrubs (cabbage trees, nikau, tree fuchsia, matipo, treeferns, etc); and weedy exotics (gorse, pampas, wattle, shrubby garden escapes; Fig. 7). Occasional mature podocarps (Fig. 8a, b) and saplings of canopy trees (rimu, kahikatea, kauri,

Figure 5: Indicative WTP footprint for Manuka Rd site.

kohekohe) are patchily interspersed throughout. A large specimen of northern rata (regionally uncommon) is also present within the proposed footprint, visible from Woodlands Park Road. A small patch of kahikatea-pukatea forest (WF8) surrounds the ephemeral stream headwaters.

Mature to senescent kanuka forest covers the southern half of the Manuka Road property, with a stand of old-growth kauri - podocarp forest (WF11) in the south-western corner.

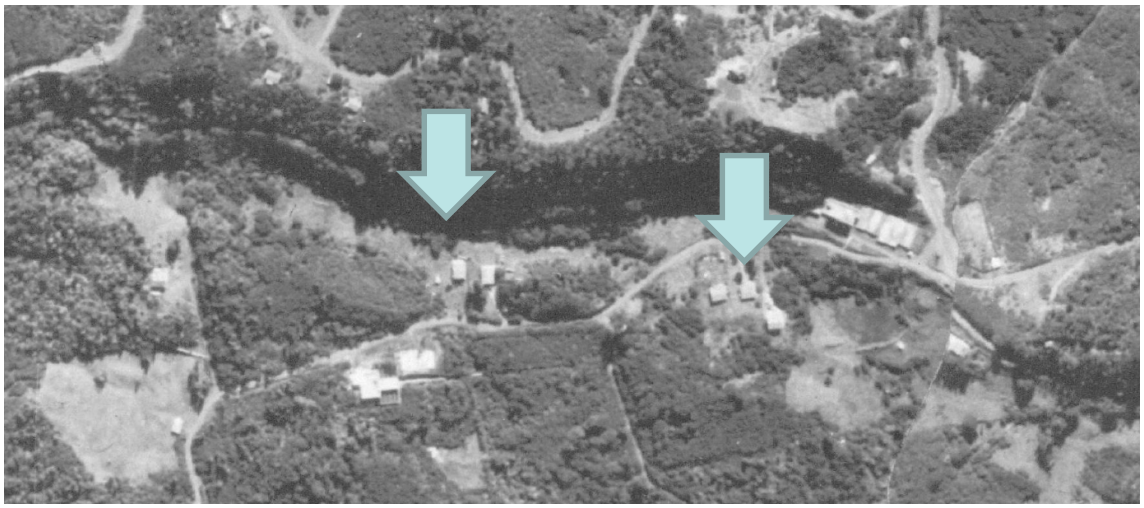

Figure 6: 1940 aerial photograph of Huia WTP and surrounds. Arrows indicate proposed reservoir site (north of Woodlands Park Rd) and Manuka Rd site.

3.2.2 Fauna habitat

Fauna values are similar to those at the Woodlands Park Road site. All forest and scrub-covered parts of the Manuka Road site and the property north of Woodlands Park Road are likely to support native lizards, with forest gecko, Pacific gecko, Auckland green gecko, ornate skink and copper skink most likely to be present. Bats and birds are similarly likely to forage and roost in the area, and mature trees offer high quality nesting habitat.

As with the Woodlands Park Road site, the headwater reach of Armstrong Gully is in good condition and offers potentially suitable habitat for Hochstetter's frog. Watercourses within the affected portion of the Manuka Road site are ephemeral and are unlikely to support Hochstetter's frogs.

Areas of relatively intact, old-growth forest in both sites (approximately 1 ha within the Manuka Rd site, and ~2 ha north of Woodlands Park Rd) is accorded greater ecological value than the portions of the site that contain more recently established vegetation, as the diversity of habitat and biota lost as a result of mature forest clearance is generally greater than from early-successional forest ecosystems, and the recovery period for these habitats is in the order of many decades to hundreds of years.

Figure 7: Modified scrub and weedfield within northern portion of Manuka Rd site.

Figure 8a, b): Mature podocarps within kanuka forest in Manuka Rd site.

3.2.3 Watercourses

The general landform at this site consists of shallow gullies and basins sloping from the west to the southeast, with some steeper slopes near Scenic Drive in the northeast. The streams combine and fall into a steep gully near the southern boundary (refer Fig. 4). Most of the streams in the upper gullies and basins are Ephemeral (only carrying surface runoff). Some Intermittent

sections (with defined channels and occasional pools) occur near the southern boundary. The extent of Permanent Streams on the site is minimal.

The Ephemeral streams have low aquatic biodiversity values but support stream values in the downstream receiving environments, and form and integrated and unmodified hydrological sequence. The Intermittent Streams contain refuge pool in which fauna can survive during low flows, and will probably contain flowing water through the winter months. The macroinvertebrate fauna will be similar to small Permanent Streams in Waitakere, although habitat volume throughout the year will be lower due to intermittent flows. This fauna is likely to have a moderate taxonomic richness and include pollution-sensitive taxa including mayflies and koura (*Paranephrops* sp., freshwater crayfish). Fish are probably absent due to the steepness of the gully to the south and the intermittent flows. Water quality is likely to be high, the only potential source of pollution being road runoff.

In conclusion, the streams on this site have limited extent and aquatic biodiversity value, but form a largely unmodified headwater sequence that supports downstream values.

3.2.4 Mitigation Options

Some on-site mitigation to address impacts on localised fauna populations (e.g., lizards) could be undertaken in the remaining bush on the Manuka Road site and north of Woodlands Park Rd by way of weed control, infill planting, fauna translocations and predator control. However, due to site constraints there is minimal scope for undertaking mitigation planting on-site.

A suitable offset could theoretically be derived to compensate for the proposed forest clearance but this would require a substantial multiplier to account for the loss of an estimated 1 ha of old-growth forest and already-depleted ecosystem types, with a lesser multiplier for the loss of ~ 2 ha of more modified, recent ecosystem types within the Manuka Road site, and ~2 ha of kanuka forest in the proposed reservoir location. The extent of any offset would also depend on the existing condition and ecological values of the site proposed for enhancement and/or restoration and its proximity to the impact site, recognising that the loss of old-growth forest cannot be mitigated in a fully like-for-like replacement through restoration as kauri and podocarp forests develop through a series of successional forest types, and time is a key factor in the formation of forest structure and habitat complexity.

As with the Woodlands Park Road site, the loss of a reach of permanent headwater stream within the site proposed for reservoirs would require mitigation or offset compensation under Auckland Unitary Plan provisions. There is insufficient stream length available for restoration on-site, hence stream restoration at an alternative location would be required to offset adverse ecological effects. As noted on the PAUP, the regional average ECR is 3:1, i.e. for each metre of stream reclamation, three metres are restored by riparian planting or other methods. However, the specific extent of restoration required is determined by evaluating the respective quality of the impact site and identified mitigation site. Watercourses within the Manuka Road site are ephemeral, and therefore specific mitigation for the loss of these watercourses is not required under AUP provisions.

3.2.5 Summary

The summary of ecological effects in respect of the Manuka Road WPT site is set out below.

Manuka Road WTP	
Terrestrial Ecological Effects	
Both main WTP and reservoirs sites are almost entirely identified as terrestrial vegetation SEA; comprises both intact and modified secondary native vegetation, with remnants of old growth forest. Vegetation is contiguous with extensive bush areas in Waitakere Ranges / Scenic Reserves. The footprint of the operational plant and associated construction zone would encompass approximately 3 ha, most of which is currently vegetated in native forest. More than half of this vegetation has been modified by previous partial clearance and disturbance, but some stands containing large (>50 cm diameter) kauri and podocarp would be lost.	
Score: 2 Moderate high / high adverse ecological effects generated	
Aquatic Habitat Effects	
Stream classification	Mainly Ephemeral within the Manuka Rd site, with a short reach of Intermittent stream on the periphery of the development footprint. A Permanent reach north of Woodlands Park Rd, as for the existing WTP site evaluation.
Instream habitat	No mitigation for the loss of ephemeral stream reaches is required in the Auckland Unitary Plan. Offsite mitigation for the loss of the permanent Armstrong Gully stream each would be required at a high ECR (Environmental Compensation Ratio) given relatively high instream and riparian values. Note that although this option has minimal stream length within its footprint, it would affect a largely intact headwater basin and therefore disrupt stream processes, and this effect would need to be mitigated locally.
Score: 3 Moderate adverse ecological effects generated	

3.3 Parker Road South

3.3.1 Vegetation

The Parker Road South site is set well back from the road in an area of large-lot residential development. Several patches of mature native forest are present, generally surrounding watercourses and largely comprising intact kahikatea-pukatea forest (WF8; critically endangered) remnants primarily along the stream/ gully areas (Fig. 9), grading into mixed kauri-podocarp-broadleaved forest (WF11) on surrounding gully slopes above the water table. Much (though not all) of the mature indigenous forest present is identified as SEA, and all meets SEA significance criteria.

Figure 9a - c: Kahikatea-pukatea (WF8) forest understorey

Figure 9: Parker Road South WTP footprint

The indicative footprint of the proposed WTP (Figure 10) is situated to largely avoid forested areas but encroaches on areas of WF8 forest, while construction of the accessway and treatment plant would extend beyond the envelope shown, resulting in the loss or degradation of an estimated ~1.5 - 2 ha of WF11 and WF8 forest, along with some areas of planted and naturally regenerated native scrub.

Areas of mixed native scrub also occur throughout the site (partly planted and of varying age and quality), and provide buffering and connectivity to mature forest areas. Several large, mature pine trees are scattered around the forest margins. There are also extensive areas without intact native vegetation that have a more fragmented pattern of residential and amenity land use.

3.3.2 Fauna

The site has good connectivity to the Waitākere Ranges and there is potential for bats to commute and forage along the tall forest margins and hedgerows. The presence of large, mature trees (including podocarps and the mature pine trees established around the site) offer excellent habitat for communal bat roosts, and local residents report bat activity around these features. Oratia Stream has been previously surveyed for bats, as part of Project Twin Streams and during annual long-tailed bat surveys conducted on behalf of Auckland Council, but no bats have been recorded during these surveys (Bioresearches, 2014; Envirologic Ltd., 2007). Bats are resident at Nihotupu Reservoir and known to use the Opanuku Stream approximately 2.5 km away from the site, well within range of long-tailed bat foraging paths. Local residents report regular sightings of bats foraging around forest margins during summer months.

Hochstetter's frogs occur in forested headwater streams throughout the Waitakere foothills, and could potentially be present within the Parker Road South site (though known populations are generally found in more remote hinterland sites).

The Lizard Database does not contain any herpetofauna records for Oratia, however the mosaic of intact forest, scrub, old orchard remnants and hedgerows and open grassland offers excellent habitat for native skinks and geckos, and local residents report encounters with both Pacific green geckos (At Risk) and forest geckos.

This habitat is also likely to support a healthy and diverse avifauna assemblage, with sizeable patches of tall forest which provide diverse habitat and food resources, and well-elevated nest sites which offer protection from predators during breeding.

3.3.3 Watercourses

Most watercourses follow forested gullies (Fig. 11), and within the native forest the streams are in excellent condition. The steams are modified where stream crossings occur, and in at least one area a stream has been straightened to improve drainage through an old orchard.

The streams in the native forest have intact habitats and are likely to support a range of native macroinvertebrates and fish, and have high ecological values. The modified stream reaches have lower values, but good potential for restoration as the modification is of limited extent.

Watercourses within the Parker Rd South site are situated in the upper reaches of Cochrane's Stream (a tributary of Oratia Stream), and comprise a largely unmodified headwater sequence that supports downstream values.

Figure 11: Watercourses within Parker Road sites.

3.3.4 Mitigation Options

Some on-site mitigation to address impacts on localised fauna populations (e.g., lizards) could be undertaken in surrounding bush areas (e.g., in the forested portion of 130 Parker Road, and on adjacent private land with the permission of landowners) by way of weed control, infill planting, fauna translocations and predator control. There is also modest scope for undertaking restoration planting on-site, though this would not be of sufficient scale to mitigate adverse effects arising from forest clearance.

Deriving suitable offset for the removal of WF8 poses an additional challenge to forest restoration *per se*, because WF8 is a high quality example of a wetland forest type which is heavily depleted in the region. Therefore, an extensive area with a similar high water table environment would be required to adequately compensate its loss. The extent of any offset would also depend on the existing condition and ecological values of the site proposed for enhancement and/or restoration and its proximity to the impact site.

The loss of a reach of permanent headwater stream within the site proposed for reservoirs would require mitigation or offset compensation under Auckland Unitary Plan provisions. There is insufficient stream length available for restoration on-site, hence stream restoration at an alternative location would be required to offset adverse ecological effects. As noted on the PAUP, the regional average ECR is 3:1, i.e. for each metre of stream reclamation, three metres are restored by riparian planting or other methods. However, the specific extent of restoration required is determined by evaluating the respective quality of the impact site and identified mitigation site. Furthermore, the scale and severity of effects depends on the flexibility available to reconfigure/ design around streams within the site.

3.3.5 Summary

The summary of ecological effects in respect of the Parker Road south WTP site is set out below.

Parker Road South WTP: Oratia	
Terrestrial Ecological Effects	
The indicative WTP footprint encroaches into areas of kahikatea-pukatea forest, a critically endangered ecosystem type; and would result in the loss of areas of high value flora and fauna habitat. Scoring assumes additional impacts from construction of an accessway in addition to the indicative footprint. Scoring also recognises that loss of old-growth forest cannot be mitigated in a fully like-for-like replacement as time is a key factor in the formation of forest structure and habitat complexity. Furthermore, there are limited opportunities to reinstate wetland forest communities because the substrate and drainage patterns are integral to the character of this ecosystem.	
Score: 1 High adverse ecological effects generated	
Aquatic Habitat Effects	
Stream classification	Permanent
Instream habitat	The indicative layout shows reservoirs located in a watercourse. About 100 m of stream length would be piped or diverted and riparian connectivity disrupted.

	Scoring is based on a worst-case scenario (i.e., limited scope to avoid streams and additional impacts from construction), scale and severity of effects on watercourses depends on the flexibility available to reconfigure/ design around streams within the site.
Score: **1** High adverse ecological effects generated	

3.4 Parker Road North: Oratia

3.4.1 Vegetation

The north site is located further down Parker Road also on the east side of the ridge with Carter Road away to the east. The eastern third of the site is covered with intact second growth native vegetation, an identified SEA the potential WTP footprint does not extend into this area.

The western side of the property is primarily grass covered and was historically an orchard, while the eastern side contains native forest known as Allen's Swamp. A low-lying area has been patchily planted in wetland species (Fig. 12a), and scattered native trees (mainly cabbage trees, with a few karamu, matipo, manuka, etc) are sparsely scattered across the site (Fig. 12b).

The proposed development footprint is easily accommodated within open areas of the site (grassland and residential areas) and does not encroach into any native bush, though amenity trees are affected.

Figure 12a,b: Grassland with intermittent plantings across Parker North site. '

3.4.2 Fauna

The Lizard Database does not contain any herpetofauna records for Oratia, however the adjacent intact forest and scrub offers excellent habitat for geckos, while native skinks may occupy areas of dense grassland and patchy plantings. Local residents report encounters with both Pacific green geckos (At Risk) and forest geckos, generally around dwellings and on bush margins. An exotic rainbow skink was found in a recessed water tank surrounded by grassland during the site walkover. No other notable fauna habitat is present within the indicative development footprint.

3.4.3 Watercourses

There are no streams on the western side of the site, although a planted wetland is present in a low-lying area.

A branch of the Cochrane Stream runs near the edge of the native forest area. This is a Permanent Stream with instream habitats including pools and stony riffles, and is likely to support a range of macroinvertebrates and fish. Riparian vegetation occurs along both banks of the stream except a section near the northern boundary on the western side. There appears to be a historical dam or road crossing here, and some streambank erosion has recently occurred.

The stream is part of a wider network characterised by low modification, and has high ecological values.

3.4.4 Mitigation Options

No substantive ecological mitigation is required for this site option. The site has good capacity for ecological enhancement through protection and maintenance of the forested area within Watercare's property at 130 Parker Road, and revegetation of a native buffer to along the bush margin and associated watercourse.

A lizard salvage and relocation plan is recommended as part of preparatory site works to minimise the risk of mortality as a result of earthworks.

3.4.5 Summary

The summary of ecological effects in respect of the Parker Road North WTP site is set out below.

Parker Road North WTP: Oratia	
Terrestrial Ecological Effects	
No significant vegetation or fauna habitat will be adversely affected as a consequence of development under the Parker North option.	
Score: 5 No adverse terrestrial ecological effects generated	
Aquatic Habitat Effects	
Stream classification	None.
Instream habitat	None.
Score: 5 No significant adverse aquatic ecological effects generated	

3.5 Mackie's Rest

In additional to the main WTP site ancillary works are required to connect the proposed plant with the water supply contained in the Waitakere catchment dams. The majority of these works involve tunnelled pipe networks. At Mackies Rest an existing above ground pump location an additional shaft will be required for the construction and operation of the pipe network. Very limited vegetation clearance, comprising recent predominantly Manuka / kanuka regrowth, or excavation beyond the shaft itself will be required in this location. Given the bush-covered surrounds of Mackies Rest and the small scale of works any potential adverse ecological effects are considered to be negligible.

4.0 Summary and Conclusions

Three of the four shortlisted WTP sites identified to replace the existing Huia WTP have the potential to generate significant adverse ecological effects, and mitigation of these effects would require substantial offsite mitigation in every case. Ecological effects arising as a result of the Manuka Road option is assessed as being a marginally less severe than the Woodlands Park or Parker Road South options, as a fair portion of this site comprises a more modified, recent vegetation type. In contrast, development of the Parker Road North site would have no substantive adverse ecological effects.