Ecological Impact Assessment

McPherson Quarry

Prepared for McPherson Resources Ltd

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ECOLOGY NEW ZEALAND

Document Sign-Off

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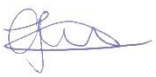
	Connor Whiteley Senior Ecologist Ecology New Zealand Limited	
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1. INTRODUCTION

This report[1], prepared by Ecology New Zealand Limited (ENZL) for McPherson Resources Ltd ('the client'), presents the results of an Ecological Impact Assessment (EIA) undertaken at McPherson Quarry, 47 McPherson Road, Pokeno, Waikato ('the site')[2]. It provides an assessment of the current terrestrial fauna and aquatic values found within 'Stages 1, 2 & 3' of the proposed quarry expansion and overburden storage areas at the site.

1.1. Background[3]

McPherson Resources Limited proposes to expand its operation at the McPherson's Quarry to extract aggregate from a greater area to meet the increasing demand within the district. The quarry is operating with existing use rights and will require a resource consent to continue future operations and to provide storage areas for overburden removed from the quarry site. Most of the quarry expansion footprint and overburden storage areas impact upon vegetation of negligible value (pasture and gorse). However, the expansion footprint also impacts upon relatively small areas of regenerating native forest located within the boundary of a Significant Natural Feature (SNF) identified in Operative Waikato District Plan. Therefore, an assessment of the effects of the impact of the future quarrying operations on ecological values is considered necessary to support resource consent applications.

1.2. Purpose and Scope

This report is intended to be read as supplementary information to support the *McPherson Quarry Vegetation Assessment Report prepared by WSP-Opus, 2018*. The purpose of this report is to evaluate the current terrestrial fauna and aquatic values within the site, which have yet to be assessed in detail.

The scope of this report comprises the following:

- A description of the terrestrial fauna and aquatic values;
- An assessment of effects on terrestrial fauna and aquatic values; and
- Recommendations to avoid, remedy, mitigate or offset adverse ecological effects.

1.3. Site Location, Description and Ecological Context

McPherson Quarry is located at 47 McPherson Road (Property 3480373) on the eastern border of the Manukau Ecological District of the Auckland Ecological Region. It is identified as the south-western most extent of near contiguous ecological linkage to the Hunua Ranges. At present the quarry bisects two large tracts of native forest located to the east and west of the site; these have been classified as Significant Natural Areas by the Waikato District Council (Figure 1). The majority of the existing vegetation onsite is comprised of pasture grass and gorse-dominated scrub.

[1] This report is subject to the Report Limitations provided in Appendix A.
2 Defined as the proposed excavation areas (Stages 1,2,3 and overburden area)
[3] Background information as detailed within Bridge, D., Turner, J., and Yungnickel M. (2018). McPherson Quarry Vegetation Assessment. Expansion Stages 1 to 3. WSPOpus.

Legend

- Stage 1
- Stage 2
- Stage 3
- Overburden storage area
- Significant Natural Area

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N

0 50 100 150 200 250 m

1:3,500 @ A3

Projection: NZGD2000/NZTM2000
Sources: Map data-Waikato District Council Proposed Plan (Legal Effect)

Mcpherson Quarry, Mangatawhiri
Significant Natural Area

Date: 08 March2019 | Revision : 1

Plan prepared for McPherson Resources Limited by Ecology New Zealand Limited
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2. METHODOLOGY

2.1. Terrestrial Assessment

Site investigations were carried out by ENZL ecologists on 16 January 2019, 28 February 2019 and 1 March 2019. Terrestrial habitat assessments were undertaken to investigate the potential presence of a range of terrestrial fauna including indigenous avifauna (birds), chiropteran fauna (bats) and herpetofauna (reptiles and amphibians). Specific onsite surveys for indigenous fauna populations are described in detail below. In addition, a desktop review of relevant fauna databases allowed a full analysis of potential fauna values onsite. The fauna databases that were consulted include the DOC herpetofauna and bat distribution databases and Auckland Council's herpetofauna database.

Site plans provided by WSP-Opus (Job No. 3-39019.00, dated 09/03/18) (Appendix B) were used to determine the extent of the vegetation clearance and degree of ecological impact as a result of the project.

2.1.1. Avifauna

- A record of all bird species encountered (heard and/or seen) across the site, and within the immediate vicinity of the site, was documented during each site visit.
- Call playbacks targeting wetland bird species[4] were undertaken across the most suitable pond edge habitat in the Stage 3 area (Appendix C).

2.1.2. Chiropteran fauna

- A bioacoustic survey for native bats was conducted using four AR-4 model Automatic Bat Monitors (ABMs), which were set from January 16th to February 8th 2019. These were set during favourable summer bat conditions with average low temperatures of 15°C[5]. Placement of the ABMs targeted potential bat roost trees (DBH >80cm) and linear commuting and foraging areas across the site (Appendix C).

2.1.3. Herpetofauna

Herpetofauna surveys included manual habitat searches, deployment of Artificial Cover Objects (ACOs), and nocturnal surveys.

Potential lizard habitats were surveyed using methods outlined by Whitaker (1994)[6] by two ecologists under the supervision of an experienced and permitted herpetologist. The lizard survey was aimed at surveying the habitats with the greatest potential for supporting herpetofauna. As potential frog habitat was identified adjacent to the site, nocturnal spotlighting was likewise conducted targeting Hochstetter's frog (*Leiopelma hochstetteri*).

- Manual habitat searches were carried out to establish the presence of terrestrial lizards across the site. This method involved systematically searching through

[4] Fernbird, Australasian bittern, Marsh crake, Spotless crake, and Banded rail.
[5] Metservice historical data from Jan 27th-Febuary 7th 2019.
[6] Whitaker, T. 1994.Survey methods for lizards. Ecological Management (2): 8-16.

potential microhabitats on site, including clumps of vegetation, under logs, and large rocks.

- A total of 45 ACOs were installed across the site (Appendix C). The monitoring devices were established with a focus on edge habitat, where skinks were likely to be attracted to the warmth and refuge of the ACOs. The ACOs were left for six weeks to allow naturalisation and herpetofauna to become accustomed to them.
- Six person-hours of nocturnal spotlighting occurred over two nights during suitable weather conditions (no precipitation, low windspeed, temperature ~18-19°C). This method involves scanning potential habitat for lizards and frogs, using high-powered head torches and binoculars. Where appropriate, manual searches were undertaken in microhabitats (e.g. terrestrial fern skirts and, loose bark, and aquatic/riparian flat rocks, cracks, and crevices) during spotlighting. These surveys primarily focused on arboreal lizard habitat along bush edges, composed primarily of kānuka (*Kunzea robusta)* scrub, and potential native frog habitat within the hard-bottom stream to the east of the site.

2.2. Freshwater Assessment

2.2.1. Watercourse Assessment

A team of two freshwater ecologist assessed the sites watercourses and waterbodies between 16 - 17 January 2019. All watercourses to be impacted both directly and indirectly were photographed and classified as either permanent, intermittent or ephemeral. Classification guidelines were derived from Auckland Unitary Plan definitions; these were used as they provides definitive criteria to classify stream types. Watercourse physical parameters were assessed with four key ecological function groups:

- Hydraulic functions (processes associated with water storage, conveyance, flood flow retention and sediment transport);
- Biogeochemical functions (processes associated with the processing of minerals, particulates and water chemistry);
- Habitat provision functions (the type, amount and quality of habitat for flora and fauna); and
- Native biodiversity functions (the occurrence of diverse populations of indigenous native plants and animals).

The assessment of the waterbodies examined the key physical parameters including, but not limited to: hydrological connectivity, thermal regulation, vegetation composition both aquatic and marginal vegetation. Given the artificial nature of all waterbodies on the site, no official guidelines were used to assess the ponds.

2.2.2. Fish

In order to sample the fish population, passive sampling methods were used including placement of both fyke nets and Gee Minnow traps throughout the site's watercourses and waterbodies. A total of eight gee minnow trap and two fyke nets were placed throughout the site. The intention of this survey effort was to confirm presence and absence as opposed to population estimation.

Nocturnal spotlighting was undertaken through stream reaches within proximity to potential gecko habitat.

Electric fishing was not possible in the impact stream Tributary 1 due to shallow water depth and excessive macrophyte growth. Electrofishing was considered outside the scope of this

assessment in Stream 1. Pond 1 and Pond 2 were considered inappropriate for active methods of fishing such as electric fishing due to their size and depth.

North pond and south pond (and other sediment treatment ponds) were not sampled due to their functionality as primarily sediment treatment facilities, the poor ecological function and the low likelihood of them housing any populations of native fish not found within the other site's waterbodies and watercourse.

2.2.3. Aquatic Macroinvertebrates

Macroinvertebrates were sampled from instream habitats to obtain semi-quantitative data in accordance with the Ministry for the Environment's current "Protocols for Sampling Macroinvertebrates in Wadeable Streams". Sampling was undertaken from a representative reach of Stream 1 and Tributary 1 using C1 protocols for hard-bottom streams. Sampling was also undertaken from both Pond 1 and Pond 2 using C2 protocols (soft-bottomed, semi-quantitative). The samples were preserved in isopropyl alcohol and sent to Environment Impact Assessments Ltd who processed samples using a total count method to the lowest practical macroinvertebrate taxonomical level. Several biotic indices were calculated from the results including the number of taxa, Ephemeroptera- Plecoptera-Trichoptera (EPT) scores, Macroinvertebrate Community Index (MCI) and MCI adjusted for soft-bottomed systems (SBMCI). EPT are three orders of macroinvertebrates that are generally sensitive to organic or nutrient enrichment, and a high percentage indicates good stream health; insects in the genera *Oxyethira* and *Paroxyethira* were excluded as these taxa are not sensitive and can proliferate in degraded habitats. The MCI is based on the average sensitivity score for individual taxa recorded within a sample. MCI scores of >120 are indicative of excellent habitat quality, 100 - 119 are indicative of good habitat quality, 80 – 99 are indicative of fair habitat quality and < 80 are indicative of poor habitat quality[7].

[7] Stark JD, Maxted JR 2007. *A user guide for the Macroinvertebrate Community Index*. Prepared for the Ministry for the Environment. Cawthron Report No.1166. 58 p.

3. ECOLOGICAL ASSESSMENT

3.1. Terrestrial Ecological Values

3.1.1. Avifauna

A total of 13 bird species were documented during the assessment (Table 1). Of these species, six were identified as native and the remaining seven were exotic. Notable species recorded onsite and adjacent to the site included a shag (*Phalacrocorax* sp.) and a pair of New Zealand dabchick (*Poliocephalus rufopectus*), respectively; both species have threat status of At Risk.

Most of the site was assessed as low-quality habitat for birds; however, the bush blocks provided moderate habitat, which also provide an ecological corridor to the Hunua Ranges to the east, and Mt. William Reserve to the west.

Table 1: Bird species recorded during ENZL field assessment and their threat status

Common Name	Latin Name	Threat status
Dabchick	*Poliocephalus rufopectus*	At Risk – Recovering
Black / Little Black Shag	*Phalacrocorax sulcirostris or carbo novaehollandiae*	At Risk - Naturally Uncommon
Kingfisher	*Todiramphus sanctus vagans*	Not Threatened
Morepork	*Ninox novaeseelandiae novaeseelandiae*	Not Threatened
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened
Swamp harrier	*Circus approximans*	Not Threatened
Tui	*Prosthemadera novaeseelandiae novaeseelandiae*	Not Threatened
Welcome Swallow	*Hirundo neoxena neoxena*	Not Threatened
Grey teal	*Anas gracilis*	Not Threatened
Australian Magpie	*Gymnorhina tibicen*	Introduced and Naturalised
California Quail	*Callipepla californica*	Introduced and Naturalised
Common Pheasant	*Phasianus colchicus*	Introduced and Naturalised
Myna	*Acridotheres tristis*	Introduced and Naturalised
Yellowhammer	*Emberiza citrinella*	Introduced and Naturalised
Skylark	*Alauda arvensis*	Introduced and Naturalised
Peafowl	*Pavo cristatus*	Introduced and Naturalised

3.1.2. Chiropteran fauna

A possible long-tailed bat (*Chalinolobus tuberculatus*, Threatened – Nationally Critical[8]) pass was detected on one of the ABMs during the three-week monitoring period (Figure 2). A review of the Department of Conservation's bat distribution database verified the presence of long-tailed bats approximately 12km east of the site in the Hunua Ranges, 15km north of the site, and 18 km east of the site in remnant forest patches.

Potential bat roosting habitat was noted in the form of scattered large senescing pine trees (*Pinus* spp.), kahikatea (*Dacrycarpus dacrydiodes*), rimu (*Dacrydium cupressinum*) and totara (*Podocarpus totara*), all with diameters at breast height measured at greater than 80cm and containing potential roosting features (Plate 1). Foraging sites were observed along linear bush

[8] O'Donnell, C.F.J.; Borkin, K.M.; Christie, J.E.; Lloyd, B.; Parsons, S.; Hitchmough, R.A. 2018: Conservation status of New Zealand bats, 2017. New Zealand Threat Classification Series 21. Department of Conservation, Wellington. 4 p.

edges and across small ponds within the site. Potential bat flightpaths were also noted along the site perimeter, haul roads and streams.

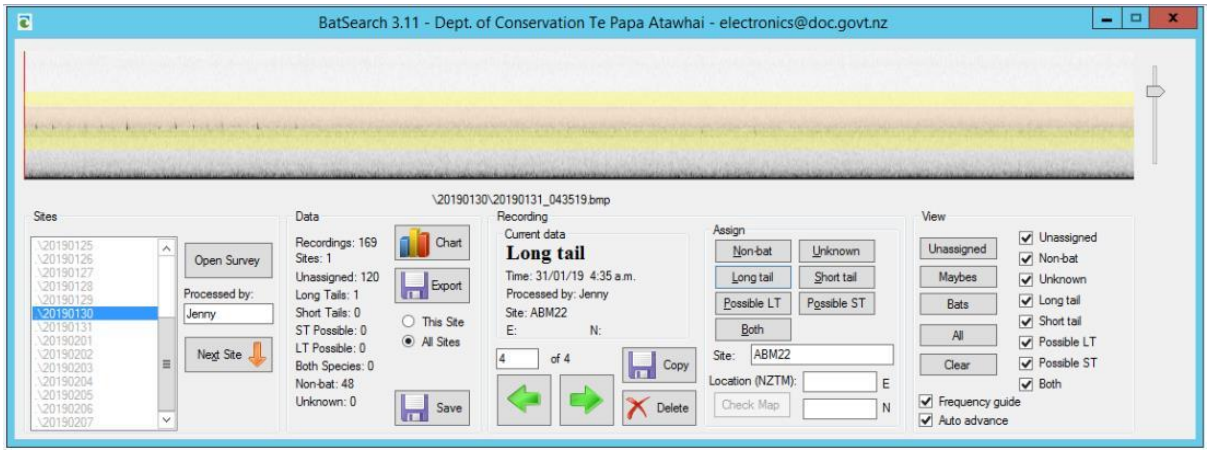

Figure 2 Possible long-tailed bat pass.

Plate 1 Scattered specimen trees representing bat roosting habitat.

3.1.3. Herpetofauna

Arboreal lizard habitat on-site appeared to be suitable within the kānuka-dominant bush blocks onsite (Plate 2); however, the majority of the site presented low-quality habitat through pasture grasses. Ground-dwelling skink habitat was assessed as low - moderate quality due to the sparse leaf litter layer within the bush fragments, and lack of logs and other preferred habitat items within the ground layer. Grazed pasture grasses across the site provided a homogenous novel habitat for ground-dwelling skinks; however, an apparent lack of microhabitat features (e.g. logs or debris items) was noted.

Lizard records are limited in this area with the closest record being a copper skink (*Oligosoma aeneum*) 12km from the site[9]; additionally, there are records of elegant gecko (*Naultinus elegans*) 15km in bush fragments to the north and 17km northeast within the Hunua Ranges[10]. Based on the habitat onsite and the contiguity with native bush, the herpetofauna species that may be present are outlined in Table 2 below. Lizard surveys did not indicate the presence of any native species, with only one plague skink (*Lampropholis delicata, Introduced and Naturalised*) observed under an ACO. Though the species detailed in Table 2 may still be present on-site, it is considered that they may not be at high enough population numbers to allow detectability.

Plate 2 Kānuka-dominant bush block on eastern boundary of site.

Overall, Hochstetter's frog (*Leiopelma hochstetteri*) habitat within the site was considered low quality. The Stream 1 and, to a lesser extent Stream 2, did provide hard-bottom characteristics,

[9] Department of Conservation Database, 2013.
[10] Auckland Council Fauna Database, 2018.

however, poor shading and stock access diminished habitat suitability. The stream reach within the bush block directly east of the Stage 1 area presented moderate – high frog habitat (Plate 3); however, manual searches and spotlighting did not indicate the presence of frogs. A significant population of Hochstetter's frog is known from within the Hunua Ranges to the northeast, with the closest record being 17km from the site. Though they are sometimes detected outside of areas with high levels of shading and water quality, the likelihood of their presence decreases with increasing distance from known populations.

Plate 3 High-quality potential frog habitat in a stream directly east of the site.

Table 2 Summary of herpetofauna found within the region.

Common Name	Latin Name	Threat status[11]
Auckland green gecko	*Naultinus elegans*	At Risk-Declining
Copper skink	*Oligosoma aeneum*	Not Threatened
Forest gecko	*Mokopiriakau granulatus*	At Risk-Declining
Green and Gold Bell Frog	*Ranoidea aurea*	Introduced and Naturalised
Hochstetter's frog	*Leiopelma hochstetteri*	At-Risk-Declining
Ornate skink	*Oligosoma ornatum*	At Risk-Declining
Pacific gecko	*Dactylocnemis pacificus*	At Risk-Relict
Plague skink	*Lampropholis delicata*	Introduced and Naturalised
Southern Bell Frog	*Ranoidea raniformis*	Introduced and Naturalised

[11] Hitchmough, R.; Barr, B.; Lettink, M.; Monks, J.; Reardon, J.; Tocher, M.; van Winkel, D.; Rolfe, J. 2016: Conservation status of New Zealand reptiles, 2015. New Zealand Threat Classification Series 17. Department of Conservation, Wellington. 14 p

3.1.4. Pest Animals

Pest animals observed onsite included both hedgehogs (*Erinaceus europaeus occidentalis*) and mice (*Mus musculus*). Given the habitat and rural landscape setting of the site, additional pest animal species that are likely present onsite include possum (*Trichosurus vulpecula*), rats (*Rattus* spp.), mustelids and occasional goats (*Capra hircus*) and pigs (*Sus scrofa*).

3.2. Freshwater Ecology

3.2.1. Watercourse Assessment

All watercourses to be impacted both directly and indirectly within the site were assessed; a section of the "Waipunga Stream" (noted within the Opus report and hence identified as Stream 1) was also assessed, which is noted as the downstream receiving environment. A single tributary was found to be located within the south-western end of the site and is referred to as Tributary 1 for the purposes of this report. Four ponds were assessed and are referred to as north pond, south pond (as labelled on the concept plan by Opus, 3/9/2018 sheet C21), Pond 1, Pond 2 and Pond 3 (Appendix D).

"Stream 1"

Stream 1 is a section of the Waipunga stream which is a tributary of the Mangatawhiri River, which in turn flows into the Waikato River around 8km to the south-west of the site. It is not expected to be directly impacted by expansion of the McPherson Quarry, however it is the receiving environment for the watercourses within the site. This stream also provided valuable habitat for fish and macroinvertebrate surveys to give an indication of the potential species that could inhabit the directly impacted streams and ponds.

Stream 1 presented as a permanent, hard-bottomed stream which formed the southern border of the site, meandering for approximately 1km through the property at 93 Irish Rd, roughly north-west to south-east. Based on NZ Topomaps, the stream can be classified as a third order stream (at least) with a relatively large catchment. The upper catchment flows through native bush up most of the tributaries. The assessment was focused on the lowland portion of Stream 1 where there is the potential for impacts from the proposed quarry expansion.

Stream 1 had well-defined banks, steeply incised in places and ranging from around 0.3m to several metres in height with channel widths varying between about 3m and 6m. Evidence of scouring from flood flows was noted in places with bank undercuts and slumpage present. Stock had direct access to the water in most places including two fords for vehicle crossing where sheep were seen crossing the stream. Riparian vegetation in the assessed section was patchy and consisted predominantly of grazed and rank grass and exotic species such as hawthorn (*Crataegus monogyna*), gum trees (*Eucalyptus* sp.), gorse (*Ulex europaeus*) and occasional mānuka (*Leptospermum scoparium*). At the eastern end of the site, a fallen gum tree was accumulating debris and organic foam, as well as facilitating notable scouring of the true right bank (TRB).

Stream 1 exhibited high variation in hydrology with pool-riffle-run sequences present throughout and cascades present where the stream flowed off the hillside through the bush. Channel morphology was also varied with a meandering channel, undercut banks and noticeable variations in depth throughout. Instream habitat provision was high with fine gravels and sand ranging up to large cobbles and (in the upper reaches at the bottom of the hill) boulders. Woody debris was present in places. No macrophytes were present within the

channel; however, there was substantial growth of filamentous brown algae which appeared to increase as the stream flowed east across the site. This algal growth was noticeably higher on stones that were subject to low shade, aside from the upstream extent of the assessed section where there was very little shade but little algal growth. Water clarity was measured as 78cm using a water clarity tube.

Two tributaries were noted flowing into Stream 1 along the assessed reach within the site – one from the TRB flowing from a neighbouring property, and one on the true left bank (TLB) through a culvert which is the impact stream.

Considering the moderate level of shading throughout the reach, the diverse instream habitat range, stock access, sparse riparian vegetation, lack of significant instream anthropogenic modification, the ecological function of Stream 1 would be considering moderate to high.

Plate 4 Photo of Stream 1 within a shaded section of the reach. Just above the Gee Minnow where inanga where caught

Plate 5 Photo of Stream 1 flowing through the farm site, showing the ease of stock access.

Tributary 1

Tributary 1 was classified as a permanent stream which appeared to flow out of the native bush at the bottom the hill below Pond 2. The stream appeared as two or three small channels before flowing through a wetland area then forming one single channel. This channel then flowed for approximately 380m in a south-easterly direction before its confluence with Stream 1 via a culvert.

Tributary 1 exhibited both hard and soft-bottomed characteristics, and displayed soft-bottomed characteristics where flow was slowed and sediment was deposited (especially in the ~10m upstream from the culvert), and reverted to hard-bottomed characteristics in areas of more rapid flow. Substrate, therefore, varied from silt/mud to gravel and small to medium cobbles. Macrophytes were abundant within the channel, and were comprised of mainly water pepper (*Persicaria hydropiper*), water cress (*Nasturtium microphyllum*) and *Juncus* sp. Riparian vegetation consisted predominantly of rank pasture grass with a narrow margin of *Juncus* sp. and thistles.

Shading varied from low to high, and was provided mainly by the vegetation within the channel. Stock access was unimpeded along the length of the stream. Streambed morphology showed little variation with only slow runs and small pools present along the reach. Channel morphology exhibited some variation with narrow meanders present in some places. There was also evidence of some in-flow from Pond E as marked on the concept designs by WSP-Opus (3/9/18, project number 3-39019.00).

Considering the degree of shading, the general average variation within the instream habitat, the direct stock access and the poor-quality riparian vegetation, this reach of Tributary 1 would be considered to have low to moderate ecological value.

Plate 6 Photo of MCI being undertaken within Tributary 1. Grazing of rushes by stock is clear from the photo.

Plate 7 Photo of outfall drain showing the clearly defined and excavated channel.

Outfall Drain

This artificial channel is included within the WRC's online mapping system as a watercourse, however, the channel present at the time of assessment, was artificially managed, with steep sides, no meandering and piles of clay on top of the banks from excavation. It was almost impossible to tell whether this was originally a natural stream due to length of time the quarry has been established. Given the direct nature of the channel, it is expected that this channel has likely been constructed around the time of the North and South Ponds.

The drain was soft-bottom (clay) with virtually no variation in channel morphology but some variation in streambed morphology, with runs and riffles present (which would provide oxygenation). Watercress, *Juncus* sp. and curly pondweed (*Potamogeton crispus*) were present within the channel. Water depth was fairly uniform at around 0.2m and although the water still retained some of the lime-green cloudy appearance as seen in the ponds, the clarity was 0.42m. Shading was relatively poor, as it was mostly provided by the steep banks. Direct stock access was possible along the length of the channel with pugging of the banks evident, and it flowed for approximately 80m before exiting the site into the neighbouring property. The confluence with Stream 1 was not visible from the site.

3.2.2. Waterbody Assessment

North pond & South pond

The north pond and the south pond are sediment treatment ponds located at the south-eastern corner of the quarry. These ponds were included in the assessment due to being in the region of a watercourse marked on Waikato Regional Council's online mapping system.

The north pond was relatively narrow (approximately 3m at the northern end and approximately 10m wide at the downstream end) and around 40m in length. The pond was lime green in colour at the time of assessment, presumed to be as a result of treatment with a flocculant such as alum to aid in sediment removal. There was a small amount of shading provided by a single gum tree at the northern end, but otherwise, very little shading was present. Riparian vegetation was dominated by rank grass with a few juncus plants. There was very little macrophyte growth within the pond, leaving it mainly open water. The presence of floculant treatment has likely resulted in the reduce macrophyte growth due to potentially unfavourable pH level.

The south pond was fed by water from north pond flowing through a concrete culvert. Water flowing out of the culvert flowed into an area of waterlogged rank grass, then into a more open area, around a separation barrier (dirt, cabbage trees and pampas) and finally into an area of lime green open water. Both ponds had mosquitofish (*Gambusia affinis*) present with the south pond also having present a brown teal (*Anas chlorotis*) and a single domesticated mallard (*Anas platyrhynchos domesticus*).

A second culvert was noted entering the south pond at the north-western edge but no flow was visible at time of assessment. A small amount of shading was provided by the rank grass at the northern end and a row of manuka at the southern end. Given the minimal shading across both ponds and the relatively shallow depth, it is expected that thermo regulation of both ponds is poor.

Given the artificial nature of both these waterbodies, the lack of shading, highly turbid water, continual sediment treatments and lack of any diverse habitat features, it is expected the ponds are in a state of poor ecological function.

Plate 8 Photo of North Pond clearly showing the lack of any macrophyte growth.

Plate 9 Photo of Pond 2 from the southern bank.

Pond 1

Pond 1 was located above the current quarry extent and appeared to have virtually no connectivity either above or below it at the time of assessment. It presented as a relatively narrow pond varying between approximately 6-25m with an approximate area of 1,800m^2. The pond consisted of predominantly open water, with some marginal vegetation including bamboo spike sedge (*Eleocharis sphacelata*) and several juncus species. At the northern extent of the pond, there was a manuka scrubland all of which was dead or dying, along with a few patches of gorse. There was very little if any shading resulting in poor thermo regulation of the pond. Maximum depth was not attainable but it was well over 1m within 3m of the pond margin. It is highly unlikely that the pond will reach sufficient depth to establish a thermocline; this will ensure that there is a constant mixing within the ponds water column.

There were no macrophytes present and only a small amount of algal growth. The pond was visibly artificial in nature likely created for recreational use. The physical features and lack of connectivity of the pond presented marginal aquatic habitat. Given the lack of any notable connectivity to the wider catchment, it is unlikely that there will be significant migration of fish species into the pond, although eels are likely to enter the pond by overland migration.

Pond 2

Pond 2 was significantly larger than Pond 1 having a length of roughly 130m and covering an area of approximately 6,500m2. A large maimai on stilts was present on the eastern bank for duck shooting. The pond was also noted to be an artificial pond, possibly formed by damming a waterway historically, however, given the length of time of this pond has been establish it is impossible to determine the historical features. Unlike Pond 1, there is connectivity to the wider catchment, a discharge was noted at the southern end discharging into the native bush below. It is expected that this discharge forms part of the source of Tributary 1. At the time of the assessment, there was no flow visible leaving the pond.

Pond 2 was divided into two distinct sections. The south section was characterised as a larger open water area with small areas of marginal rushes and macrophyte growth (curly pondweed). The northern section of the Pond 2 was significantly narrower within shading provided by the surrounding mānuka and raupō (*Typha orientalis*). Algae growth appeared to be low, indicating that the ponds did not appear to be within a state of eutrophication, this was further supported with visibility of 0.5 m.

The pond was noted to be relatively deep >3m, as indicated by the client. Like Pond 1, this pond water column is likely to be well mixed throughout the summer. Filtration activity provided by the riparian vegetation was considered poor with the pond mainly surrounded by pasture grasses with patchy gorse. There was direct stock access, however there were no stock present at the time of assessment and based on the current state of the pasture, it appeared to not have been subjected to grazing for an extended period.

Pond 3

Pond 3 was the smallest of the three ponds, only 800 m^2 occurring within the proposed quarry area. The pond is located directly above the quarry. The southern edge of the pond was lined by bare earth, due to the current quarry traffic using this as an access way. There was significant amount of bare earth entering the Pond. The pond presents a lime green colouration similar to the North and South Ponds. The vegetation around the margin was

limited to a few rush species and predominately rank grass. No fish species were noted at the time of the assessment.

Pond Overview

The three ponds within the proposed quarry area present very similar characteristic each with slight variations. Given the artificial nature of the ponds and the relative isolation of all three ponds, the ecological function of the ponds is expected to be low, with Pond 2 providing the highest ecological function followed by Pond 1, with Pond 3 providing the lowest ecological function.

Wetlands

There were two highly degraded wetlands occurring along Tributary 1. The upper wetland occurs around the confluence of several intermittent and permanent streams before these confluence into Tributary 1. The lower wetland occurs just up from a culvert before Tributary 1 drains into Stream 1. Both wetlands can be currently classified as riverine marshes. This classification could change should stock access be restricted and the wetlands are able to recover.

The current wetlands are significantly degraded due to the stock having direct access to the wetlands. Only scattered clumps of rushes (*Juncus* sp.) are the only current wetland adapted vegetation within the area. The identification of these wetlands occurred due to the high-water content within the surface soil and the presence of surface water when pressure was applied to the soils strongly indicating the likely hold of hydric soils beneath the vegetation. In their current state, these riverine marshes are highly degraded due to stock access and are providing lower ecological functions of filtration, water retention, habitat diversity which could be recovered with stock exclusion and restoration works. Given the location of the wetlands, there is no expected effect on these wetlands.

3.2.3. Fish

A total of six native species and one pest species were documented onsite. Overall, 13 individual fish were captured, which included common bully (*Gobiomorphus cotidianus*), inanga (*Galaxias maculatus*), shortfin eel (*Anguilla australis*) and a single longfin eel (*Anguilla dieffenbachia*) with banded kōkopu (*Galaxias fasciatus*) and kōura (*Panaphrops planifrons*) being observed during spotlighting. The eels were all found within the two ponds at the top of the site, whilst the bullies and inanga were within Stream 1, which will be subject to indirect impacts only. Banded kōkopu where noted in a tributary east of the existing quarry, outside of the main channel, however directly connected to Stream 1 and are assumed to be present within Stream 1. No native fish were found within the impact stream Tributary 1, however it is highly likely that this tributary function as potential migratory pathway for native species, given the presence of eels within Pond 2 which is identified as a headwater feature. While the common bully and shortfin eel are listed as not threatened, the longfin eel and inanga are listed as 'At Risk – Declining' in the New Zealand threat classification system 12. Details of fish caught across the site are outlined in Table 3 below.

A wider catchment search of the New Zealand Freshwater Fish Database (NZFFD) revealed that the presence of 13 native species (Table 4) within the Mangatawhiri River. This search revealed a relatively diverse native freshwater fish population within the wider catchment. While survey efforts only revealed five native species within the impact site, the potential

[12] Goodman, J.M.; Dun, N.R; Ravenscroft, P.J; Allibone, R.M; Boubee, J.A.T.; David, B.O.; Griffiths, M.; Ling, N.; Hitchmough, R.A.; Rolfe, J.R. (2013) *Conservation status of New Zealand freshwater fish.* New Zealand Threat Classification Series 7

presence of these native species cannot be ruled out from especially the lower reaches of the site.

Table 3: Fish caught on site (Appendix D shows trap locations).

Site	Species	Common name	Number	Size Range
Stream 1 – Gee 2	*Gobiomorphus cotidianus*	Common bully	1	50mm
Stream 1 – Gees 3 & 4	*Gobiomorphus cotidianus*	Common bully	4	50-65mm
	Galaxias maculatus	Inanga	3	80mm
Tributary 1 - Gees	Nothing caught			
Pond 1 - fyke net	*Anguilla australis*	Shortfin eel	1	600mm
Pond 2 - fyke net	*Anguilla australis*	Shortfin eel	3	320-500mm
	Anguilla dieffenbachii	Longfin eel	1	600mm

Table 4: Fish species found within the wider Mangatawhiri River catchment based on NZFFD

Species	Common Name	Caught on site	Native/non-native	National Threat Status
Anguilla australis	Shortfin eel	Yes	Native	Not Threatened
Anguilla dieffenbachii	Longfin eel	Yes	Native	At Risk- Declining
Cheimarrichthys fosteri	Torrentfish	No	Native	At Risk- Declining
Galaxias fasiculatus	Banded kōkopu	Yes	Native	Not Threatened
Galaxias brevipinnis	Kōaro	No	Native	At Risk- Declining
Galaxias maculatus	Inanga	Yes	Native	At Risk- Declining
Galaxias postvectis	Shortjaw kōkopu	No	Native	Threatened - Nationally Vulnerable
Geotria australis	Lamprey	No	Native	Threatened - Nationally Vulnerable
Gobiomorphus basalis	Crans Bully	No	Native	Not Threatened
Gobiomorphus cotidianus	Common bully	Yes	Native	Not Threatened
Mugil cephalus	Grey mullet	No	Native	Not Threatened
Neochanna diversus	Black mudfish	No	Native	At Risk- Declining
Retropinna retropinna	Common smelt	No	Native	Not Threatened
Ameiurus nebulosus	Catfish	No	Non-native	Naturalised Introduced
Carassius auratus	Goldfish	No	Non-native	Naturalised Introduced
Cyprinus carpio	Koi carp	No	Non-native	Naturalised Introduced
Salmo trutta	Brown Trout	No	Non-native	Naturalised Introduced
Scardinius erythrophthalmus	Rudd	No	Non-native	Naturalised Introduced

3.2.4. Aquatic Macroinvertebrates

Macroinvertebrate samples were taken from Pond 1, Pond 2, Tributary 1 and Stream 1. Results varied as was expected due to on site observations and habitat availability. The highest MCI score was recorded for the main channel, Stream 1 with a score of 103.48 indicating "good" habitat quality. This stream also recorded an EPT score of 10 with almost half of the macroinvertebrates found being of the EPT group.

The remaining three sites were all sampled using a soft-bottomed methodology and as such the MCI score corrected for soft-bottomed systems (SBMCI) will be used. This score accounts for the fact the certain macroinvertebrates have higher tolerances for poorer habitat conditions in soft-bottomed streams and as such their rating is lower. The impact reach, Tributary 1, had an SBMCI score of 86, indicating "fair" habitat quality whilst both ponds had much lower scores (63.5 and 47.43) indicating "poor" habitat quality which was expected for artificial pond systems within agricultural settings.

Table 5: Results of macroinvertebrate sampling at four sites, McPherson Quarry

Parameter	Pond 1	Pond 2	Tributary 1	Stream 1
Number of Taxa	12	7	17	23
EPT Value	0	0	3	10
Number of Individuals	12	7	17	23
% EPT	0.00	0.00	17.65	43.48
% EPT Taxa	0.00	0.00	17.65	43.48
Sum of recorded scores	49.00	30.00	71.00	119.00
MCI Value	81.67	85.71	83.53	103.48
Sum of abundance load	49.00	30.00	71.00	119.00
QMCI Value	4.08	4.29	4.18	5.17
SBMCI Value	63.50	47.43	86.00	116.52

4. ASSESSMENT OF ECOLOGICAL EFFECTS

4.1. Terrestrial

4.1.1. Assessment of Values (EIANZ)

The majority of the proposed quarry expansion area is comprised of pasture grasses and gorse-dominated scrub towards the north of the site (Appendix F). Table 6 evaluates the ecological value of native fauna within the habitat types presented across the site. The kānuka-dominant forest areas provide the highest valued habitat for native herpetofauna, specifically arboreal geckos, although none were observed during nocturnal spotlighting efforts onsite. This habitat type also provides moderate-high value habitat for native avifauna, specifically because it is part of a large tract of contiguous bush to the east and west. The kānuka-dominant forest does not provide high- quality roosting habitat for native bats; however, the specimen trees scattered throughout the site provide adequate habitat. The habitat type provided by the kānuka-dominant forest is considered representative; nonetheless is identified as a Least Concern ecosystem type[13].

Large specimen trees scattered throughout Stage 2 and 3 areas of the site provide potentially suitable roosting habitat for long-tailed bats. However, with only one possible bat pass on the east of Stage 1, the site is not likely a key area for long-tailed bats. The pasture/exotic scrub which comprises most of the site is considered to provide low-quality habitat for native fauna.

Table 6 Assignment of habitat values onsite.

Habitat Type	Area	Percentage of site area	Habitat Value	Comments
Existing quarry	10.3	20%	Negligible	Provides no habitat
Kānuka-dominant forest	3.1	6%	High	Provides high-quality habitat for herpetofauna and avifauna.
Specimen trees (DBH>80cm)	0.4	2%	Moderate	Provides moderate-high quality habitat for bats.
Gorse-dominated scrub	4.2	11%	Low	Provides low-quality habitat for native bats, birds and herpetofauna
Waterbodies	0.8	2%	Moderate	Provides moderate habitat for avifauna
Pasture	34.2	59%	Low	Provides little habitat for native bats,

[13] Singers, N.; Osborne, B.; Lovegrove, T.; Jamieson, A.; Boow, J.; Sawyer, J.; Hill, K.; Andrews, J.; Hill, S.; Webb, C. (2017) Indigenous terrestrial and wetland ecosystems of Auckland. Auckland Council

				birds and herpetofauna

4.1.2 Assessment of values (Regional Criteria)

Based on the Waikato Regional Council Criteria for determining significance of indigenous biodiversity, the site is classed as significant (Appendix E). This is due to it having a designated SNA which provides an ecological corridor between the Hunua Ranges and Mt William Walkway. Furthermore, there were At Risk and Threatened species observed onsite. However, the areas that classify the site as significant are a small percentage of the overall proposed expansion area and overburden site, and the At Risk and Threatened species were observed in low numbers.

Overall, the main effect on indigenous terrestrial fauna is the direct loss of habitat that will result from future quarry expansion. Additional effects include the reduction of a nearly contiguous habitat corridor from the Hunua Ranges to Mt. William Reserve, both rich in biodiversity. Given the small amount of high-value habitat within the site, overall the quarry expansion will have a low and localised impact on terrestrial fauna.

4.1.2. Magnitude of Effects

Out of the three delineated areas, Stage 1 had the most notable area of fauna habitat, which is proposed for removal for the future quarry expansion. The kānuka dominant bush block was adjacent to a large tract of existing forest (bisected by a haul road), leading to the Hunua Ranges in the northeast. This bush block is approximately 1.3ha of the demarcated SNA block (Figure 1), and is noted as a least concern ecosystem type. Based on the fauna surveys described in Section 3.1, this bush block did not contain notable populations of herpetofauna, bats or threatened bird species. The site is largely composed of low-quality habitat for avifauna, chiropteran fauna and herpetofauna; therefore, the magnitude of effects for the site is assessed as low (Table 6).

Table 7 Summary of magnitude of effects.

Fauna type in relation to overall habitat types described above	Magnitude	Comments
Effects on herpetofauna	Low	Loss of a small high-quality habitat area (6% of site), with no native herpetofauna presence observed.
Effects on bats	Low	Loss of potential roost trees and vegetation which provides foraging sources for long-tailed bats, with very low presence observed.
Effects on birds	Low	Loss of moderate nesting and foraging habitat for native avifauna, mostly within the kānuka-dominant forest (6% of site) and waterbodies (2% of site).

4.1.3. Overall Level of Effects Rating

The table below provides an overall level of effects rating. The ecological values are based on Table 6. The magnitude of effect ratings refer to Table 7. The potential impacts were

assessed as having a low magnitude of effect on all three fauna taxa considered, therefore 'low' has been used as an average for the magnitude of effect column below.

The rating of low for all habitat types reflects the lack of high-quality habitat within the site.

Table 8 Overall level of effects rating (EIANZ, 2018).

Habitat Type	Ecological Value	Magnitude of Effect	Level of Effect
Existing quarry	Low	Low	Low
Kānuka-dominant forest	High	Low	Low
Specimen trees (DBH>80cm)	Moderate	Low	Low
Gorse-dominant scrub	Low	Low	Low
Waterbodies	Moderate	Low	Low

4.2. Freshwater

The proposed quarry expansion will result in the loss of Ponds 1, 2 and 3, the reclamation piping of Tributary 1 and the discharge of water from four sediment retention ponds into Stream 1. Given the difference in type and magnitude of effects at each location, each of these water bodies will be considered separately in order to assess the effects of the proposed activities.

4.2.1. Ponds

The loss of ponds will result in the loss of 9,100 m^2 of poor quality artificial aquatic habitat. There is very little, if any connectivity to waterways either upstream or downstream so there is zero-to-minimal foreseeable effect on either of these environments. The primary effects will be the injury or death of fish species, the loss of aquatic habitat and the loss of habitat and food sources for bird and insect species.

Assessment using EIANZ guidelines

Longfin eels (At Risk – Declining) were recorded within Pond 2 and while not recorded within Pond 1 or Pond 3, they cannot be excluded, given the presence of shortfin eels and for the purpose of this assessment have been assumed to be present. The habitat is not a unique or a threatened habitat type, has small catchment areas and is artificial in nature, providing poor quality aquatic habitat. Species diversity was low as evidenced by on-site observations, fish surveys and macroinvertebrate survey. It is not contiguous with high-quality terrestrial ecosystems and the minimal riparian vegetation was also considered of poor quality.

The magnitude of effect of filling in these ponds and expanding the quarry is considered moderate. This has been reached due to the majority the onsite eel habitat being lost, and while this is a significant loss of habitat within the site, it is not a significant loss through the wider Mangatawhiri River and therefore can only be considered moderate at most. The time scale is considered permanent due to this habitat being lost.

With the ecological value considered low and magnitude considered moderate, the overall level of effects under EIANZ guidelines is considered very low.

While the overall effect is very low under EIANZ assessment guidelines, the presence of longfin eels and dabchicks utilizing these ponds triggers habitat significance under the Waikato Regional Policy Statement Ecological Assessment Section 11A. Therefore, these effects require some form of ecological offsetting.

4.2.2. Tributary 1

The proposed activity would see the piping of Tributary 1 from below the wetland area to the confluence with Stream 1, approximately 250m in length. The piping of this stream would reduce some hydrological connectivity, remove instream habitat and reduce migration pathways. This work also has the potential for death of or injury to native fish (although none were found during surveys and habitat available is minimal).

Assessment using EIANZ guidelines

The impact reach of Tributary 1 presents a degraded system offering minimal aquatic habitat. It did not contain any threatened species, however, is a migratory corridor for an At-Risk species. The MCI score was indicative of poor water quality. It does have connectivity to both upstream and downstream water bodies but does not provide a riparian corridor. It is not representative of any unique or threatened ecosystems and exhibits a low level of diversity and ecological complexity. The ecological value of the impact reach is considered low. The magnitude of effect of the piping of this length of stream is considered low in the context of the further reduction of a degraded stream system, affecting approximately 15% of stream length within the site and minimal stream effect within the wider Mangatawhiri River catchment. The timeframe is permanent given the piping of the stream reach is to be maintained for the foreseeable future.

With the ecological value considered low and magnitude considered low, the overall level of effects under EIANZ guidelines is considered very low. While the effect is very low under EIANZ assessment guidelines, the presence of longfin eel throughout the site's catchment results in the habitat being considered as significant under Waikato Regional Policy Statement Ecological Assessment Section 11A. Therefore, these effects require some form of mitigation. In addition to the Waikato Regional Policy Statement Ecological Assessment Section 11A, it is a tributary of the Mangatawhiri River which flows into the Waikato River, and as such is subject to the requirements of the Vision and Strategy for the Waikato River partially Objective H.

4.2.3. Stream 1

Stream 1 will be the receiving environment for the outflow of four additional proposed sediment ponds related to the construction of a new overburden storage area. It is also at the bottom of the catchment where any stormwater runoff from the quarry or additional sediment generated by the increase in cleared land on the site will eventually flow to. Therefore, the direct impacts will be a potential increase in flow due to the sediment pond inputs and a potential increase in sediment or contaminants entering the waterway via the same route. Potential indirect impacts would include increased sediment accumulation from greater areas of exposed land causing run-off during rain events. Potential positive effects may include reduction in nutrient input by converting what is currently stock-grazed land in the greater riparian zone, into the overburden storage area on the true left of the stream.

Assessment using EIANZ guidelines

Stream 1 is typical of a hard-bottomed stream flowing out of a steep, forested catchment. It is a third order stream and has a large catchment size, providing habitat for a variety of fish and invertebrates year-round. Although it has been degraded by riparian zone alteration and nutrient inputs, it still supports the At Risk inanga, as well as multiple macroinvertebrate species that inhabit only high-quality water bodies. It is a tributary of the Mangatawhiri River, which flows into the Waikato River, and as such is subject to the requirements of the Vision and Strategy for the Waikato River. The ecological value of Stream 1 is considered to be high.

The magnitude of effect of the discharge of treated stormwater can only be estimated and depends on correct management and maintenance of the overburden storage areas and the treatment ponds. For the purposes of this report, it is assumed that this will be done correctly and therefore the magnitude of effect is considered to be low. The timeframe is considered to be permanent as the proposed expansion stages of the quarry will continue for several decades.

With the ecological value considered high and magnitude considered low, the overall level of effects under EIANZ guidelines is considered low While the effect is low under EIANZ assessment guidelines, the presence of longfin eels and inanga throughout Stream 1 catchment results in the habitat being considered as significant under Waikato Regional Policy Statement Ecological Assessment Section 11A; therefore, these effects require some form of mitigation. In addition to the Waikato Regional Policy Statement Ecological Assessment Section 11A, it is a tributary of the Mangatawhiri River which flows into the Waikato River, and as such is subject to the requirements of the Vision and Strategy for the Waikato River partially Objective H.

4.2.4. Overall Level of Effects Rating

The table below provides an overall level of effects rating. The ecological values are based on Section 3. The magnitude of effects refers to Section 4.2; the potential impacts was assessed as having a very low to low on the three freshwater ecosystems, therefore 'very low' has been used as an average for the magnitude of effect column below.

Table 9 Overall level of effects rating (EIANZ, 2018).

Habitat Type	Ecological Value	Magnitude of Effect	Level of Effect
Ponds	Low	Moderate	Very Low
Tributary 1	Low	Low	Very Low
Stream 1	High	Low	Low

5. MANAGEMENT OF EFFECTS

5.1. Terrestrial

Though the overall level of effects for terrestrial fauna has been assessed as low, it is considered appropriate for fauna management to occur as native birds, bats and lizards are protected under the Wildlife Act 1953.

To effectively manage the potential direct injury/mortality threats on native birds and their eggs, mitigation is recommended by means of seasonal constraints for vegetation clearance activities across the higher quality kānuka-dominant forest areas. The removal of native woody trees and large shrubs should be removed outside of the peak bird breeding season (November to January inclusive). If this isn't possible, then those areas should be checked by an appropriately qualified ecologist for nesting birds immediately prior to vegetation removal and, if detected, vegetation removal should be put on hold until the area is deemed by an appropriately qualified ecologist to be clear of native nesting birds and fledglings.

Overall, potential habitat for native lizards was limited across the proposed footprint. As described in Section 3.1.3 of this report, the kānuka-dominant areas hold the greatest potential for providing habitat for native lizards. Although no native lizards were found during surveying efforts, it is recommended that prior to any works within the kānuka-dominant areas, an appropriately qualified and experienced herpetologist should resurvey these areas through a minimum of two nights of nocturnal spotlighting and checking previously installed closed-cell foam covers at least three times. This proposed effort will increase the confidence that can be placed in presence/absence results. If native lizards are found to be present, then a project-specific Lizard Management Plan should be prepared and implemented for the kānuka-dominant forest areas.

Although only one potential bat pass was observed over the surveying period, the site provided potential roosting and foraging habitat for bats. Based on the proximity of confirmed bat records relatively close by, and the relatively large home range of long-tailed bats, it is appropriate to undertake further acoustic surveys prior to vegetation clearance of the specimen trees indicated in Appendix F. If bats are found to be present, a bat management plan should be completed and implemented.

A planted corridor north of the site is recommended in the Effects Management section of the vegetation assessment written by WSP-Opus. The reestablishment of an ecological corridor between the eastern and western forest areas adjacent to the site would provide necessary offsetting for the clearance of native fauna habitat. To ensure the ecological quality of this corridor, it is recommended that pest animal control is undertaken within the newly planted corridor and also along bush edges the east and west of the site. This should be detailed in a Pest Management Plan and should be implemented for the lifetime of the quarry.

5.2. Freshwater

The proposed extension of the quarry will see the total loss of 9,100 m^2 of low ecological value artificial ponds that under Waikato Regional Council criteria are classed as significant due to the presence of At Risk species. Given the ecological significance of this habitat, any removal should be mitigated/offset accordingly. To offset the loss of habitat provision, it is recommended that a raupō and rushland wetland with open water areas be created within the site. Given the level of effect being below the level that would require mitigation/offset under EIANZ guidelines; the artificial nature of the ponds and the expectation that the new wetland will provide a habitat with greater ecological function than the current ponds, the proposed area ratio would need be 1:0.5 ratio to ensure that any ecological effect will be

offset. It is envisioned that the creation of this offset wetland habitat will occur in stages in conjunction with the loss of the identified habitat. Additionally, this wetland area could provide further ecosystem services by also providing polishing treatment to any water discharged from the existing and future sediment ponds as indicated within the cultural assessment, by Ngāti Tamaoho Ngāti Te Ata, 2019.

The proposed piping of Tributary 1 will result in the loss of approximately 250m of in stream habitat and reduce the hydrological function of the stream. Under the EIANZ guideline assessment the level effect would normally require no mitigation/offset/compensation, however due to significance under Waikato Regional Council criteria the loss of some ecological functionality will require offsetting. To offset the loss of these functions it is recommended that the riparian restoration of Stream 1 is undertake. The major form of degradation on Stream 1 is the significant lack of riparian margin and direct stock access. It is recommended that a 7.5m margin be planted on both sides of Stream 1 and fenced off to prevent stock access (Appendix D). It is recommended that a ratio of 1:3 of stream length should be sufficient to ensure that all ecological effects associated with the piping of Tributary 1 are offset and there will be a minimal ecological gain to the wider catchment, through riparian connectivity. The current potential area along Stream 1 have been indicated within Appendix D, only 750 m of stream will be required and should be confirmed within a planting plan.

Vegetation removal and earthworks associated with the project have the potential to generate sediment which, if unmitigated, may enter the catchment's freshwater ecosystems and cause significant ecological effects downstream including Stream 1. The implementation of stringent erosion and sediment control measures should be adequate to avoid adverse effects on the catchment's freshwater ecological values. It is recommended that a project specific sediment and erosion control plan is prepared by a suitably qualified and experienced professional.

Native fish are present within the ponds and potentially present within Tributary 1. Removal of the ponds and piping of Tributary 1 has the potential to cause injury/death of native fish. To minimise the risk to native fish it is recommended that prior to any works within the site's aquatic environment an appropriately qualified and experienced freshwater ecologist should prepare and implement a project-specific Fish Management Plan (FMP). Any fish found with the site should be relocated to a suitable release site identified within the FMP.

5.3. Recommendations:

The following ecological management is recommended to ensure that any foreseeable ecological effects associated with the works are adequately managed and mitigated:

- **Lizard Management –** As detailed above, additional lizard surveys should be undertaken prior to clearance of the kānuka-dominant forest within the site. If lizards are found to be present, a lizard management plan should be prepared by a Department of Conservation-recognised herpetologist and implemented across the high-valued habitat to ensure native lizards are relocated into retained vegetation of equal or greater quality on-site. Lizard management should be undertaken before and during vegetation removal by an appropriately qualified and experienced ecologist. The suitability of remaining vegetation for lizards will likely be improved with pest animal control.

- **Bat Management –** Additional acoustic bat monitoring surveys should be undertaken before clearance of the specimen trees highlighted in Appendix F. If bats are found to be present, then a bat management plan should be completed and implemented by a Department of Conservation-recognised bat ecologist.

- **Bird Management** – Vegetation removal should take place outside of the peak bird breeding season (October to January inclusive). If vegetation clearance cannot be achieved outside of these dates, then those areas should be checked by an appropriately qualified ecologist for nesting birds immediately prior to vegetation removal. If active nests are detected, vegetation removal should be put on hold until the area is deemed by an appropriately qualified ecologist to be clear of nesting birds.

- A site-specific Ecological Management Plan (EMP) should be prepared for the site which aims to mitigate and manage foreseeable ecological impacts associated with the removal of protected habitat and enhance retained areas of indigenous biodiversity. This EMP should be approved by Waikato Regional Council for implementation and cover the following:

  - **Planting Plan** – This plan should be prepared by a suitably qualified and experienced ecologist and outline the planting to take place 7.5m either side of the bank along an identified area of Stream 1, and also for the corridor north of the site proposed by WSP-Opus[14]. Details should include plant species and size, site preparation, timing of planting and maintenance for five years from the time of planting. It is envisaged that natural regeneration will complement this planting.

  - **Pest Animal Management Plan**-– This plan will detail appropriate pest animal control across the newly planted corridor and existing bush edges for the lifetime of the quarry. This plan shall specify control measures, methods, timings and placements of traps/bait stations.

  - **Fish Management Plan** (FMP)- This should be produced by an appropriately qualified and experienced freshwater ecologist and should detail fish salvage and exclusion methodologies. The FMP should be implemented before any work on the site's aquatic environment is undertaken.

- **Sediment and Erosion Control Plan**: Appropriate erosion, sediment and containment controls should be installed prior to the commencement of the proposed quarry extensions to reduce the risk of any sediment and/or containments entering the wider Mangatawhiri River catchment. This should be guided by a plan prepared by a suitably experienced professional.

[14] Bridge, D., Turner, J., and Yungnickel M. (2018). McPherson Quarry Vegetation Assessment. Expansion Stages 1 to 3. WSPOpus.

6. CONCLUSION

This report addresses the actual and potential impacts of proposed quarry extension at McPherson Quarry. While the ecological effects were assessed as low under the EIANZ assessment guidelines, recommendations to avoid, remedy or mitigate these effects have been made due to the local and regional ecological significance of various ecological features on the site. Recommendations for various ecological management plans have been detailed in order to guide the management of any potential adverse effects ensure an outcome of no-net ecological loss.

APPENDIX A

Report Limitations

This Report/Document has been provided by Ecology New Zealand Limited (ENZL) subject to the following limitations:

i) This Report/Document has been prepared for the particular purpose outlined in ENZL's proposal and no responsibility is accepted for the use of this Report/Document, in whole or in part, in other contexts or for any other purpose.

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iii) Conditions may exist which were undetectable given the limited nature of the enquiry ENZL was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Report/Document. Accordingly, if information in addition to that contained in this report is sought, additional studies and actions may be required.

iv) The passage of time affects the information and assessment provided in this Report/Document. ENZL's opinions are based upon information that existed at the time of the production of the Report/Document. The Services provided allowed ENZL to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

v) Any assessments, designs and advice made in this Report/Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Report/Document.

vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by ENZL for incomplete or inaccurate data supplied by others.

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ix) Where lengths or other measurements have not been provided by a surveyor, ENZL has used basic GIS mapping and measurement systems to estimate these numbers. These should not be taken as surveyor-level accuracy for the purposes of decision making.

Appendix B

Site plans (WSP-Opus)

FUTURE STAGE 4
(EXCLUDED FROM CONSENT)

STAGE 2

STAGE 3

STAGE 1
(REFER DRAWING C20)

2-4b
2-4a
2-3
2-2
2-1
2-5
2-6
2-7
3-8
3-10
3-7
3-9
3-6
3-5
3-1
3-3
3-2
3-4
14
15a
15
14a
POND E
NORTH POND
SOUTH POND

N

300 mm
200
100
50
10 mm
0

KEY

- SEDIMENT RETENTION POND
- SILT FENCE
- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- HAUL ROUTE
- SRP OUTLET
- WATER COURSE
- LEVEL SPREADER

1:2000 @ A1
1:4000 @ A3
0 20 40 60 80 100 120 140 160 180 200 m

DRAWING IN PROGRESS

PLOTTED ON 2018-9-3 AT 9:54 AM

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Designed	Approved	Approved Date

Drawn	Scales

Project
McPHERSON RESOURCES LTD
McPHERSON QUARRY
POKENO

Sheet
ESCP
STAGE 2 & 3 - CONCEPT

Project No.	Sheet. No.	Revision
3-39019.00	C21	----

Original Sheet Size A1 [841x594] Plot Date 2018-09-03 at 9:54:51 AM Path O:\env\heavy_industry\mcpherson_quarry\dwgs\3-39019.00 quarry\(C) Civil\+Civil3D\3-39019.00-C01_ESCP.dwg C21

Appendix C

Terrestrial Surveying Efforts

Legend

- Stage 1
- Stage 2
- Stage 3
- Overburden storage area
- Artificial Cover Objects
- Spotlighting efforts
- Automatic Bat Monitors
- Call playback survey
- Bat Pass
- Dabchick
- Shag

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N

0 50 100 150 200 250 m

1:4,000 @ A3

Projection: NZGD2000/NZTM2000
Sources: Map data Google 2019

Mcpherson Quarry, Mangatawhiri

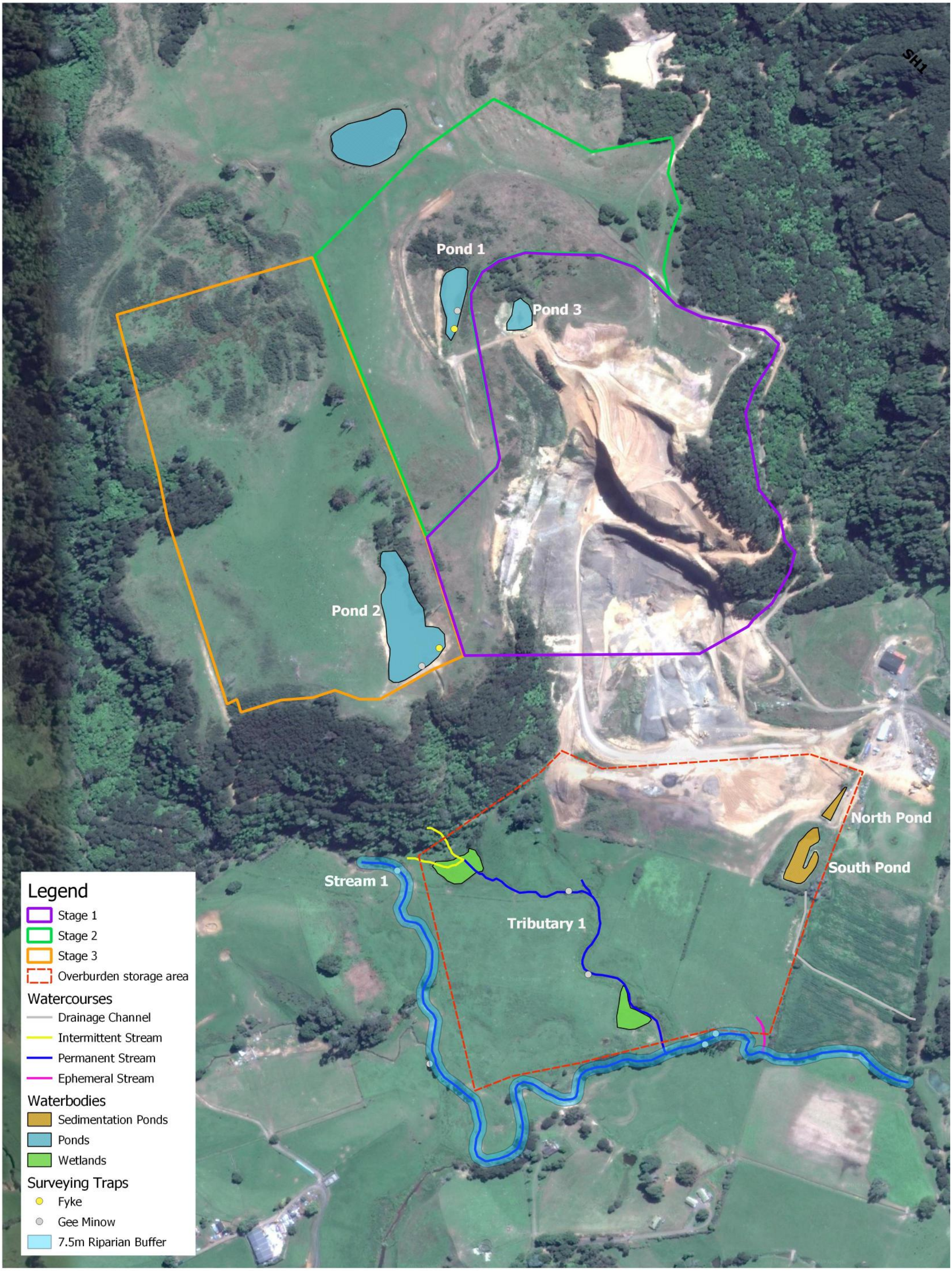
Terrestrial surveying efforts

Date: 08 March2019 | Revision : 1

Plan prepared for McPherson Resources Limited by Ecology New Zealand Limited
Author: stephanie.angove-emery@ecologynz.nz |

Appendix D

Freshwater features and surveying efforts



ECOLOGY NEW ZEALAND

N

0 50 100 150 200 250 m

1:4,000 @ A3

Projection: NZGD2000/NZTM2000
Sources: Map data sourced from Google (2019)

McPherson Quarry

Aquatic Features and Surveying Effort
Date: 19 March 2019 | Revision : 2

Plan prepared for McPherson Resources Limited by Ecology New Zealand Limited
Author: stephanie.angove-emery@ecologynz.nz

Appendix E

Regional Policy Statement Ecological Assessment Section 11A

Previously assessed site			Does criteria apply
1.	*It is indigenous vegetation or habitat for indigenous fauna that is currently, or is recommended to be, set aside by statute or covenant or by the Nature Heritage Fund, or Ngā Whenua Rāhui committees, or the Queen Elizabeth the Second National Trust Board of Directors, specifically for the protection of biodiversity, and meets at least one of criteria 3-11.*	A small portion of the vegetation onsite is classed as a Significant Natural Area by the Waikato Regional Council.	Yes
Ecological values			
2	*In the Coastal Marine Area, it is indigenous vegetation or habitat for indigenous fauna that has reduced in extent or degraded due to historic or present anthropogenic activity to a level where the **ecological sustainability** of the ecosystem is threatened.*	Not applicable	No
3.	*It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are:* • *classed as threatened or at risk, or* • ***endemic** to the Waikato region, or* o *at the limit of their natural range.*	Threatened (long-tailed bat) and At Risk (shag, long fin eel and inanga) species were noted onsite.	Yes
4.	*It is indigenous vegetation, habitat or ecosystem type that is under-represented (20% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally.*	The impacted site	No
5.	*It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon such as geothermal, chenier plain, or karst ecosystems, hydrothermal vents or cold seeps.*	Not applicable	No

6.	*It is wetland habitat for indigenous plant communities and/or indigenous fauna communities (excluding exotic rush/pasture communities) that has not been created and subsequently maintained for or in connection with:* • *waste treatment;* • *wastewater renovation;* • *hydroelectric power lakes (excluding Lake Taupō);* • *water storage for irrigation; or* • *water supply storage;* *unless in those instances they meet the criteria in Whaley et al. (1995).*	The wetlands areas are degraded and only contain exotic and pastural species, as such do not fall within this criteria.	No
7.	*It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type. Note this criterion is not intended to select the largest example only in the Waikato region of any habitat type.*	The indigenous vegetation within the site composes a small percentage of the vegetation overall.	No
8.	*It is aquatic habitat (excluding artificial water bodies, except for those created for the maintenance and enhancement of biodiversity or as mitigation as part of a consented activity) that is within a stream, river, lake, groundwater system, wetland, intertidal mudflat or estuary, or any other part of the coastal marine area and their margins, that is critical to the self-sustainability of an indigenous species within a catchment of the Waikato region, or within the coastal marine area. In this context "critical" means essential for a specific component of the life cycle and includes breeding and spawning grounds, juvenile nursery areas, important feeding areas and migratory and dispersal pathways of an indigenous species. This includes areas that maintain connectivity between habitats.*	Yes, the stream reaches provide habitat and migratory and dispersal pathways of indigenous species.	Yes
9.	*It is an area of indigenous vegetation or habitat that is a healthy and*	The two small bush blocks that are in the site have slightly degraded	No

	representative example of its type because: • *its structure, composition, and ecological processes are largely intact; and* • *if protected from the adverse effects of plant and animal pests and of adjacent land and water use (e.g. **stock**, discharges, erosion, sediment disturbance), can maintain its ecological sustainability over time.*	understories and pest plant impacts.	
10.	*It is an area of indigenous vegetation or habitat that forms part of an **ecological sequence**, that is either not common in the Waikato region or an ecological district, or is an exceptional, representative example of its type.*	The majority of the vegetation onsite is composed of pasture grasses and gorse.	No
Role in protecting ecologically significant area			
11.	*It is an area of indigenous vegetation or habitat for indigenous species (which habitat is either naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor and which is necessary to protect any site identified as significant under criteria 1-10 from external adverse effects.*	The bush blocks on the eastern and western boundaries of the site are part of an ecological corridor running from the Hunua Ranges.	Yes

Appendix F

Terrestrial habitat features (all unmarked areas classified as grazed pasture)

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N

0 50 100 150 200 250 m

1:3,500 @ A3

Projection: NZGD2000/NZTM2000
Sources: Map data Google 2019

Mcpherson Quarry, Mangatawhiri

Terrestrial habitat features

Date: 08 March2019 | Revision : 1

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