Ohineangaanga Stream

Ecological Assessment
Prepared for David Marshall

27 May 2022

Document Quality Assurance

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Appendices

1.0 Introduction

1.1 Background and scope

Boffa Miskell Ltd (BML) undertook an ecological assessment along the Ohineangaanga Stream, Te Puke adjacent to proposed Structure Plan (Washer Road, District Plan Change 94) (Figure 1), to identify the values within the waterway. The purpose of this report is to describe and assess existing ecological values along Ohineangaanga Stream adjacent to the proposed Structure Plan Change 94 and interpret the ecological effects of the proposed plan change with respect to stream water quality and stream ecology.

Figure 1: Proposed structure plan site

1.2 Site description

Ohineangaanga Stream is located in the Western Bay of Plenty region. The headwaters of the stream begin approximately 10km south west of Te Puke township within an area of mixed land use including agriculture, pine plantation and native forest. The main stem of the stream flows north towards Te Puke along a natural flow path with native vegetation dominant in the riparian margin. The stream continues to flow north, first through horticultural land use, then through the Te Puke town centre, before following a mostly straightened channel through agricultural land and discharging into Raparapahoe Canal.

The site is low lying and prone to flooding. However, flooding is not considered a significant constraint for development of the site given the existing site elevation and location adjacent to a large flood plain (section 3.0 LCL Engineering Services Report).

1.3 Literature Review

1.3.1 Bay of Plenty Regional Council, 2016

Bay of Plenty Regional Council (BOPRC) undertook a freshwater fish survey throughout waterways in the Kaituna-Maketū and Pongakawa-Waitahanui Water Management Area (WMA) in May 2016 to fill knowledge gaps identified in early work by BOPRC. The survey involved electric-fishing in shallow, hard-bottom stream, whereas fyke nets were deployed in deep, slow-flowing streams or streams with fine benthic sediment.

The BOPRC survey of Ohineangaanga revealed the presence of shortjaw kokopu (*Galaxias postvectis)* (Threatened – Nationally Vulnerable (Dunn et al., 2018)) not previously identified in this stream and not detected in subsequent fish surveys. Additional freshwater fish species detected included shortfin eel (*Anguilla australis)* (Not Threatened) and longfin eel (*Anguilla dieffenbachii*) (At Risk – Declining (Dunn et al., 2018)), galaxias species and redfin bully (*Gobiomorphus huttoni)* (Not Threatened).

1.3.2 Boffa Miskell Ltd, 2018

The upper and middle reaches of the stream (beyond the Structure Plan project site) has high quality ecological values with intact habitats and a healthy functioning ecosystem (Boffa Miskell Ltd, 2018). The 2018 assessment classified the Ohineangaanga Stream as being of national importance based on the stream meeting at least four criteria of the Bay of Plenty Regional Policy Statement's Criteria for assessing matters of national importance in the Bay of Plenty region (Set 3) (Momentum Planning and Design, 2021).

The BML 2018 survey indicated that nutrient levels were high across all three sampling sites, with the highest concentrations recorded at the most downstream site. The downstream site also had high turbidity levels and total suspended solids. Macroinvertebrate indices were indicative of fair water and/or habitat quality and probable moderate pollution (although the upstream QMCI score suggested poor water and/or habitat quality and probable severe pollution). The interpretation of these macroinvertebrate scores was that they were likely reflective of the high nutrient levels found within the stream.

The 2018 BML survey indicated fish diversity was greatest at the downstream sampling site (8 species detected), with only longfin eel recorded from the midstream and upstream sampling sites[1]. Freshwater fish database records also show there is a diverse range of fish species present within the Ohineangaanga Stream, including *At Risk* and *Threatened* species.

The Ohineangaanga Stream, as a whole, was recorded (BML, 2018) as having high ecological values due to:

- The high-quality habitat in the upper and middle reaches of the stream with intact habitats and a healthy functioning ecosystem;

[1] The upstream, midstream and downstream sites surveyed in 2018 are distant from the project sites surveyed and are shown in Appendix 1.

- The assemblage of native fish species present within the waterway, including *At Risk* and *Threatened* species;
- The natural state of the stream in the upper and middle reaches; and
- The waterway and forested riparian margins provide an important ecological linkage for freshwater and terrestrial native fauna.

1.3.3 Freshwater Fish Database

There are over 20 records for this stream in the freshwater fish database[2]. Fish species recorded, which were not found during the current 2022 fish surveys (nor during the 2018 BML nor 2016 BOPRC fish surveys), included grey mullet (*Mugil cephalus*), common bully (*Gobiomorphus cotidianus*) and torrentfish (*Cheimarrichthys fosteri*).

1.4 Proposed Structure Plan 94

The proposal is to for a plan change to rezone approximately 7.012ha of land at 66 Washer Road, Te Puke from Rural to Industrial to establish the Washer Road Business Park (Figure 1). This comprises a wedge shape piece of pastural land, bordered by Washer Road and the East Pack industrial buildings to the east, and Ohineangaanga Stream along the western boundary. To the north of the proposed structure plan site is more pastural land. To the south-east is existing residential properties, separated from the site by the Ohineangaanga Stream and a proposed 10 m minimum vegetation buffer, which will be implemented for the length of the eastern boundary as part of the plan change. The site narrows to a point on to Washer Road/Station Rd. Access from Washer Rd is flat, however the site falls steeply into the Ohineangaanga Stream along the eastern boundary (summarised from the application for plan change, (Momentum 2021).

1.5 Proposed Stormwater Treatment

Lysaght Consulting propose treating stormwater generated onsite by way of an extended detention pond, treatment wetland, swales and raingardens (Figure 2).

Currently, the runoff from the proposed Plan Change area (pastoral land use) disperses evenly across the site to the eastern part of the site to the Ohineangaanga Stream.

[2] https://nzffdms.niwa.co.nz

Figure 2: Excerpt from Lysaght Consulting Report (Lysaght Consultants Ltd, 2021) regarding stormwater

There is no reticulated stormwater network available to the site. A new discharge point will need to be created into the Ohineangaanga Stream adjacent to the site boundary. This will most likely consist of a culvert with headwall and stabilised discharge channel. The existing site is pastural, with discharge dispersed relatively evenly across the eastern boundary into the Ohineangaanga Stream. Existing site flows are in the order of 0.4-0.5m^3/s, hence any new concentrated discharge point is likely to exceed BOPRC's 125 L/s permitted discharge rate, requiring BOPRC consents for the culvert structure and discharge rate.

The industrial nature of any future development will significantly increase site impervious area, resulting in increased runoff and generating contaminants such as sediment, metals and hydrocarbons. It is proposed to manage runoff treatment by utilising stormwater wetlands, swales, raingardens or other approved treatment devices. Indicative wetland calculations based on the BOPRC sizing requirement of 2% of catchment area (7 ha) equates to a 1400m^2 wetland.

The discharge to the Ohineangaanga Stream will require provision of extended detention (ED) to ensure frequent flows are attenuated to minimise downstream scour. Preliminary calculations indicate an ED volume of 2287m^3 will be required for the site based on a water quality volume of 1906m^3 and water quality storm of 33mm (to be confirmed at preliminary design).

New developments generally require the inclusion of onsite stormwater detention to attenuate flows in larger storm events (up to and including the 50-year event), however Section 7.1.3 of BOPRC's *Stormwater Management Guidelines for the Bay of Plenty Region 2012/01* states that this is only required in the top half of a catchment where coincidence of hydrograph peaks can occur. The subject site is located within the bottom half of the catchment within the low-lying flood plain. Flooding in the location of the site is likely to be of a long duration, probably measured in days. Therefore, provision of detention storage, measured in hours, is unlikely to provide any significant downstream benefits. Our initial recommendation is that the provision of detention storage, other than ED, is not required for the site.

The site is likely to be reticulated for events up to and including the 10-year Annual Return Interval (ARI) using a standard pipe and pit network directing flows to a wetland/ED pond located at the north eastern corner (to utilise existing site grade), prior to discharge into the Ohineangaanga Stream. Overland flow in events greater than the 10-year ARI is likely to surcharge the pipe network and be directed to the stream in overland flow paths (roads/reserves).

1.6 BOPRC Submission

The submissions received from BOPRC relating to Stormwater Management and Stormwater Mitigation are copied in Appendix 1. BOPRC opposes Plan Change 94 on the basis of not giving effect to the relevant provisions of the National Policy Statement Freshwater (NPS-FM) and the relevant provisions of the Bay of Plenty Regional Natural Resources Plan (RNRP) to manage the incremental degradation of water quality on receiving environments arising from urban stormwater.

BOPRC seeks that methods to ensure a treatment approach to water sensitive urban design is required and the methods to ensure proposed treatment devices are located outside of the flood plain.

National Policy Statement Freshwater

3.21 Definitions relating to wetlands and rivers

Loss of value, in relation to a natural inland wetland or river, means the wetland or river is less able to provide for the following existing or potential values: (a) any value identified for it under the National Objectives Framework (NOF) process; or (b) any of the following, whether or not they are identified under the NOF process: (i) ecosystem health (ii) indigenous biodiversity (iii) hydrological functioning (iv) Māori freshwater values (v) amenity.

Policy IM P1A Regional Natural Resources Plan (RNRP)

The loss of river extent and values is avoided, unless the council is satisfied: (a) that there is a functional need for the activity in that location; and (b) the effects of the activity are managed by applying the effects management hierarchy. For the purposes of this policy, effects management hierarchy and loss of value have the meaning given by the National Policy Statement for Freshwater Management 2020.

2.0 Methods

We conducted fieldwork on the 18th and 19th of March 2022. Weather conditions during the fieldwork were generally clear with minimal cloud cover and wind and no rain in the preceding three days.

Aquatic ecological values were assessed at three locations along the Ohineangaanga Stream. Figure 1 (Appendix 2) shows the locations of the three sampling sites. The assessment included recording riparian vegetation, waterway channel morphology and habitat diversity, sampling macroinvertebrates and fish assemblages, collecting spot water quality measurements, water quality samples and sediment samples for laboratory analyses. Habitat values were assessed following the methods described in (Harding et al., 2009) were modified to suit the current assessment.

Spot water quality measurements (dissolved oxygen, temperature, pH, conductivity) were taken using a calibrated YSI ProPlus multiparameter. Water and sediment quality samples were collected, kept chilled and sent to Hill Laboratories for analysis of nutrient, heavy metal concentrations and total suspended solids.

Macroinvertebrate samples were collected from each site using a 500-micron net following Protocol C2 for the downstream site (Ministry for the Environment 2001), preserved in ethanol and analysed according to Protocol P3: full count. Soft-bottom indices were calculated for the three sites (Stark & Maxted 2007) as well as species richness and number of EPT[3] taxa.

The fish survey involved setting three unbaited fyke nets and six unbaited Gee minnow traps at each of the three sites and recording any fish species observed during the site visit. Nets were set during the afternoon and retrieved the following morning. All native fish caught were identified, measured, and released, while pest fish were euthanized humanely. The fishing

[3] Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxa.

survey was based on modified methodology outlined in Joy *et al*. 2013 and considered to be adequate to provide an overview of the fish species present within the waterways.

The fish survey was supplemented with records from the freshwater fish database, a previous survey in 2017 for Bay of Plenty Regional Council (Boffa Miskell Ltd, 2018) as well as a previous fish survey conducted by Bay of Plenty Regional Council (Bay of Plenty Regional Council, 2016).

3.0 Results

3.1 Stream morphology

3.1.1 Upstream site

The sampling site is located in an area predominantly reserve (Donovan Park). Stream width varies over the assessed reach from approximately 1 m to 5 m, following a predominantly natural but straightened flow path. The stream consists of optimal fish and macroinvertebrate habitat with an array of habitats (i.e. woody debris, riffles and gravel/sand benthic sediment) and a mixture of hydrologic conditions (i.e. riffles, runs and pools of varying size).

The substrate consists of bedrock in faster flowing areas, as well as large cobbles, ranging in size. Depths vary over the assessed stream reach between 0.2 m to 0.5 m.

Riparian vegetation is largely dominated by exotic species (Table 1), with some flax (*Phormium tenax*) present. Sparse rooted emergent and rare rooted submergent macrophytes were evident. Images 1 and 2 show the upstream sampling reach.

Image 1: Upstream sampling site.

Image 2: Upstream sampling site with exotic riparian vegetation.

Table 1: Riparian vegetation species

Native vegetation	Species name	Upstream	Midstream	Downstream
Cabbage tree	*Cordyline australis*			✓
Wetland cutty grass	*Carex geminata*			✓
Harekeke	*Phormium tenax*	✓		
	Isolepis lenticularis			✓
Exotic vegetation	**Species name**	**Upstream**	**Midstream**	**Downstream**
Castor oil plant	*Ricinus communis*			✓
Purple top verbain	*Verbena bonariensis,*		✓	✓
Jerusalem artichoke	*Helianthus tuerosus*			✓
Convulvulus - bindweed	*Convululus sp.*		✓	✓
Blackberry	*Rubus fruticosus*		✓	✓
Artemism verlotiorum	*Artemism verlotiorum*			✓
Pampas	*Cortaderia sp.*		✓	✓
Willow weed	*Persicaria maculosa*	✓	✓	✓
Rank grass		✓	✓	✓
Woolly nightshade	*Solanum mauritianum*		✓	
Wild ginger	*Hedychium gardnerianum*		✓	
Gorse	*Ulex europaeus*		✓	
Water cress	*Nasturtium officinale*	✓	✓	
Wattle	*Acacia dealbata*	✓	✓	

Black nightshade	*Solanum Nigrum*		✓	
Grey willow	*Salix cinerea*	✓		
Nasturtium	*Nasturtium sp.*	✓		
Buttercup	*Ranunculus repens*	✓		
Daucus carrot	*Daucus carota*		✓	✓
Oak	*Quercus*	✓		
Wandering Jew	*Tradescantia sp.*	✓		
Maple	*Acer sp.*	✓		
Lotus	*Lotus sp.*	✓		

3.1.2 Midstream site

The midstream sampling site was located approximately midway adjacent to the proposed industrial area/structure plan area. The sampling site is located in an area with predominantly agricultural land use. Stream width varies over the assessed reach between approximately 0.5 m to 1 m and follows a straightened alignment. The stream consists of a wide variety of aquatic habitat types including woody debris, riffles, undercut banks, sand/gravel benthic sediment and a variety of hydrologic conditions.

Riparian vegetation is dominated by exotic vegetation (Table 1), with no indigenous species. Sparse rooted emergent and rare rooted submergent macrophytes are present within the sampling site. Images 3 and 4 show the midstream sampling reach.

Image 3: Midstream sampling site with stream reach surrounded by steep banks and exotic vegetation.

Image 2: Midstream sampling site with stream reach surrounded by steep banks and exotic vegetation.

3.1.3 Downstream site

The downstream sampling site was located adjacent to the upstream extent of the proposed industrial area/structure plan area. Similar to the two sampling sites further upstream, this sampling site is located in an area with predominantly agricultural land use.

Stream width is mostly uniform over the assessed reach (around 1-2 m) and follows a straightened channel path. Habitat consists of some undercut banks with over-hanging vegetation. Hydrologic conditions are uniform, with no pools or riffle habitat present and unvarying depth and velocity. The substrate consists of sand and gravel sediment along the entire assessed stream reach.

Riparian vegetation is minimal, consisting predominantly of rank pasture grasses, low stature exotic weeds and occasional indigenous species (cabbage tree, *Carex geminata* and *Isolepis* sp.) (Table 1). Images 5 and 6 show the stream reach.

Image 5: Downstream site showing exotic riparian vegetation.

Image 6: Downstream sampling site with straightened stream channel through agricultural land use.

3.2 Water and sediment quality

A summary of the water quality results, both spot water quality parameters and analysed water samples, are presented in Table 2. Results are compared against ANZG, which provide guidelines provide standards for chronic exposure of aquatic organisms to contaminants. Laboratory transcripts are provided in Appendix 2.

Spot water quality parameters across the three sampling sites showed neutral pH levels as well as mostly high dissolved oxygen levels. Temperature and dissolved oxygen are likely to fluctuate daily and with seasons.

Total suspended solids were very low at all three sites. Water quality sample results indicated below laboratory detection limits for all heavy metals apart from zinc, which was detected but at very low concentrations. Ammoniacal nitrogen, nitrate and dissolved reactive phosphorus (DRP) in stream water were above ANZG DGV values at the downstream site (cells highlighted orange in Table 2). Nitrate and nitrogen were also above ANZG DGV values (cells highlighted orange in Table 2) at the upstream and midstream sites. Instream sediment samples revealed very low concentrations of heavy metals and petroleum hydrocarbons across all three sites (Table 2).

These results indicate high water and sediment quality at the three sites within Ohineangaanga Stream adjacent to the industrial/structure plan site. Elevated nitrate and nitrogen in stream water may encourage the growth of periphyton and macroalgae, but excessive growth was not evident in the field survey.

Table 2: Water and sediment quality results

Parameters	Units	Upstream	Midstream	Downstream	ANZG (2018)
Water					
Field measurements					
Temperature	ºC	15.2	14.7	13.7	-
Dissolved oxygen	%	100.5	106.3	6.8	92 - 103[4]
pH	pH units	6.66	6.72	6.8	7.26 - 7.7[5]
Laboratory results					
Total suspended solids	g/m	<3	<3	<3	8.8[6]
Dissolved Heavy metals (ANZG DGV values for protection of 95% of species)					
Arsenic	g/m^3	< 0.0011	< 0.0011	<0.000053	0.013
Cadmium	g/m^3	<0.000053	<0.000053	<0.00053	0.0002
Chromium	g/m^3	<0.00053	<0.00053	<0.00053	0.001
Copper	g/m^3	<0.00053	<0.00053	<0.00011	0.0014
Lead	g/m^3	<0.00011	<0.00011	<0.00053	0.0034
Nickel	g/m^3	<0.00053	<0.00053	0.0023	0.011
Zinc	g/m^3	0.0042	0.0018	0.0023	0.008
Nutrient profile (ANZG DGV values are 80th percentile)					
Total ammoniacal-N	g/m^3	< 0.010	< 0.010	0.003	0.01 g/m^3
Nitrite-N	g/m^3	0.002	0.002	1.59	-
Nitrate-N	g/m^3	1.57	1.62	1.6	0.065 g/m^3
Nitrite + Nitrate	g/m^3	1.58	1.63	< 0.010	-
Total kjeldahl nitrogen	g/m^3	< 0.010	< 0.010	1.7	-
Total nitrogen	g/m^3	1.63	1.72	0.004	0.292 g/m^3
Dissolved reactive phosphorus	g/m^3	0.009	0.005	0.014	0.014 g/m^3
Total phosphorus	g/m^3	0.017	0.016	0.014	0.024 g/m^3
Sediment (ANZG DGV for sediment)					
Heavy metals and hydrocarbons (total)					**DGV**
Arsenic	mg/kg	<2	<2	<2	20
Cadmium	mg/kg	<0.10	<0.10	<0.10	1.5
Chromium	mg/kg	<2	<2	<2	80

4 20th percentile 92 % and 80th percentile 103% (ANZG DGV)

5 20th percentile of 7.26 and 80th percentile 7.7 (ANZG DGV)

6 80th percentile (ANZG DGV)

Copper	mg/kg	<2	<2	<2	65
Lead	mg/kg	3.9	1.8	6.3	50
Nickel	mg/kg	<2	<2	<2	21
Zinc	mg/kg	36	20	22	200
Total hydrocarbons	mg/kg	<80	<80	<80	280

3.3 Macroinvertebrate community

Full macroinvertebrate results are provided in Appendix 3 and the summary table is shown below (Table 2)[7].

Table 3: Macroinvertebrate sample analysis (2022 sites plus BML 2018 site)

Metric	Upstream (2022)	Midstream (2022)	Downstream (2022)	BML monitoring site (2018)
Total abundance	227	216	182	700
Taxa richness	21	10	13	21
No. of EPT taxa	4	0.33	1	5
MCI	78	77	83	86
QMCI	2	3.4	3.2	4.67

Macroinvertebrate abundance was similar across all three sites in the 2022 survey, but significantly lower compared to the adjacent 2018 survey (Boffa Miskell Ltd, 2018). The upstream site had the highest taxa richness (21), with downstream having 13 taxa and midland having lowest taxa number of 10. EPT taxa were highest at the upstream site, slightly lower than that detected in the 2018 survey (Boffa Miskell Ltd, 2018).

Macroinvertebrate communities at three sites were dominated by oligochaete worms, diptera and the freshwater snail *Potamoprygus.* The upstream site also included a high proportion of caddisflies (predominantly *Oxyethira*[8]).

Macroinvertebrate Community Index (MCI) scores across all sites (including the BOPRC monitoring site) were indicative of fair water and/or habitat quality and probable moderate pollution. QMCI scores[9] was highest at the midstream site (3.4) and lowest at the upstream site (2) indicating fair water and/or habitat quality and probable moderate pollution, while the upstream site had a lower score indicating poor water and/or habitat quality and probable severe pollution (Stark & Maxted 2007; Boothroyd & Stark 2000).

[7] All three sites surveyed in 2022 used soft-bottom MCI and SQMCI methodologies.

[8] Oxyethira is a hydroptilid, which are not considered as sensitive taxa. These are also algal-piercing taxa so often associated with poor(er) quality conditions.

[9] The QMCI score considers the relative abundance of each taxa in the sample and is calculated using the proportional abundance of each scoring taxa. It is thus a better index of a community's composition, whereas the MCI is strongly influenced by rare taxa which contribute to the MCI score disproportionally to their abundance.

3.4 Fish survey

Fish survey results are provided in the table below (Table 3). Sampling sites are displayed on Figure 1 (Appendix 1).

Table 3: Fish species recorded from 2022 survey

Fish species	**Number (size range in mm)**		
	Up-stream	**Mid-stream**	**Down-stream**
Longfin eel *Anguilla dieffenbachii*	5 (600, 300, 500, 350, 400)		2 (500, 800)
Shortfin eel *Anguilla australis*	4 (350, 350, 600, 400)		
Inanga *Galaxias maculatus*		4 (30,40, 50, 50)	2 (60, 50
Smelt *Retropinna retropinna*		2 (60,40, plus 13 dead)	
Redfin bully *Gobiomorphus huttoni*		1 (70)	1 (50)
Bully sp. *Gobiomorphus* sp.	3 (20, 20,15)		1 (20)
Common bully *Gobiomorphus cotidianas*			1 (50)

A total of sevennative fish species were recorded across the three sampling sites. Of the six species, two species have a conservation status of *At risk* (declining) including longfin eel and inanga (Dunn et al., 2018). Longfin eel were found at upstream and downstream sites in 2022, while inanga were found at the midstream and downstream sites.

Fish diversity was greatest at the downstream sampling site, with only longfin eel recorded from the midstream and upstream sampling sites. Fish location data can be related to the migratory nature of native fish species found and habitat connectivity (which can be interrupted by physical and chemical barriers).

4.0 Summary of ecological values

The lower reaches of the Ohineangaanga Stream adjacent to the proposed industrial/structure plan area follows a straightened channel through pastoral farmland with moderate quality habitat for instream fauna and reduced hydrologic heterogeneity.

Some nutrients were elevated above DGV across the three sampling sites. Macroinvertebrate indices were indicative of fair water and/or habitat quality and probable moderate pollution (although the upstream QMCI score suggested poor water and/or habitat quality and probable severe pollution). The MCI and QMCI scores are likely reflective of the elevated nutrient levels and habitat conditions (highly mobile substrates and absence of instream cover in parts) found within the stream. Heavy metals and TPH concentrations were low in water and sediment at all sites.

Fish diversity was greatest at the downstream sampling site, with only longfin eel recorded from the midstream and upstream sampling sites. Fish records show there is a diverse range of fish species present within the Ohineangaanga Stream including *At Risk* and *Threatened* species.

Overall, the entire length of the Ohineangaanga Stream has generally high ecological values due to:

- The high-quality habitat in the upper and middle reaches of the stream (upstream of the industrial/structure plan area) with intact habitats and a healthy functioning ecosystem;
- The assemblage of native fish species present within the waterway, including *At Risk* and *Threatened* species;
- The natural state of the stream in the upper and middle reaches upstream of the industrial/structure plan area; and

In addition, the whole stream is assessed as being of national importance in the Bay of Plenty region as it meets at least four criteria of the Bay of Plenty Regional Policy Statement's Criteria for assessing matters of national importance in the Bay of Plenty region (Set 3) (Bay of Plenty Regional Council 2014).

The Ohineangaanaga Stream adjacent to the proposed Structure Plan area has moderate to high ecological values (based on water and sediment quality, macroinvertebrate assemblages, and fish communities present). Stormwater collected on site will need to be treated to a high standard prior to discharge to the Ohineangaanga Stream to protect the ecological values.

5.0 Recommendations

In response to the moderate to high ecological values present adjacent to the proposed structure plan area, we have recommended additional stormwater treatment over and above the standard approach. The following stormwater treatment has been developed by Lysaght Consultants in response to the recommendations based on ecological values and also reflects BOPRC submission requests.

5.1 Revised Stormwater Treatment Approach

The following revised stormwater treatment is now proposed, which provides for enhanced stormwater treatment prior to discharge to the Ohineangaanga Stream.

- All roof, cladding, gutters, downpipes and external plant and fixtures on buildings to be colourbond/non-leach materials to ensure dissolved metals are minimised.
- All high pollution activities (e.g. wreckers, galvanising etc) shall have site specific plans and treatment systems and operate under cover to minimise runoff of pollutants into the reticulated system.

- Stormwater shall be collected from all hardstand areas and reticulated to trunk drainage mains and directed to the stormwater treatment system.
- The water quality flow shall be directed through a gross pollutant trap (e.g. VortCapture) for removal the bulk of pollutants/sediments > 5mm in size. The system will also remove free-floating grease and oil and litter. This pre-filter system will provide significant reductions in maintenance costs and extend the periods between maintenance of the downstream treatment devices.
- Water quality flows will then be directed through a finer mechanical filtration system e.g. Jellyfish or Stormfilter) for removal of particles down to 2 microns, which will remove a high percentage of particle bound pollutants, including phosphorus, nitrogen, metals and hydrocarbons.
- Finally, the stormwater will be directed through a planted wetland or other approved biological/chemical device to provide polishing, particularly for the removal of nutrients in plant uptake and aerobic/anaerobic processes.
- The stormwater would discharge from the wetland directly into the stream via a pipe, swale or spillway.
- Higher flows up to and including the extended detention flowrate will bypass the gross pollutant trap into the wetland where it will be stored and detained, releasing slowly over 24 hours into the stream to reduce velocity erosion of the stream.
- Flows in excess of the treatment and extended detention flows will surcharge the bypass system and be directed as a combination of piped and overland flow (over the road and in swales) to the stream.

6.0 Conclusions on BOPRC Submission

BOPRC seek for the industrial/structure plan area that a stormwater treatment approach to water sensitive urban design is required and the methods to ensure proposed treatment devices are located outside of the flood plain. This is provided for in the revised stormwater treatment detailed in section 5.1 above.

7.0 References

Bay of Plenty Regional Council 2016. Fisheries assessment of waterways throughout the Kaituna-Maketu & Pongakawa-Waitahanui WMA. Report prepared for Bay of Plenty Regional Council.

Bay of Plenty Regional Council 2014. Bay of Plenty Regional Policy Statement. Report prepared for Bay of Plenty Regional Council.

Boothroyd IG, Stark JD 2000. Use of invertebrates in monitoring. Chapter 14 in Collier KJ and Winterbourn MJ eds. New Zealand stream invertebrates: ecology and implications for management. New Zealand Limnological Society, Christchurch. Pp. 334-373.

Boffa Miskell Ltd. (2018). *Ohineangaanga Stream ecological assessment* (Report No. T17167). Prepared by Boffa Miskell Ltd for Bay of Plenty Regional Council.

Dunn, N. R., Allibone, R. M., Closs, G. P., Crow, S. K., David, B. O., Goodman, J. M., Griffiths, M., Jack, D. C., Ling, N., Waters, J. M., & Rolfe, J. R. (2018). *Conservation status of New Zealand freshwater fishes, 2017* (New Zealand Threat Classification Series No. 24). Department of Conservation.

Goodman JM, Dunn ND, Ravenscroft PJ, Allibone RM, Boubee JAT, David BO, Griffiths M, Ling N, Hitchmough RA, Rolfe JR 2014. Conservation status of New Zealand freshwater fish, 2013. Report prepared for the Department of Conservation.

Harding, J. S., Clapcott, J., Quinn, J., Hayes, J. W., Joy, M. K., Storey, R. G., Greig, H., Hay, J., James, T., Beech, M., Ozane, R., Meredith, A., & Boothroyd, I. (2009). *Stream habitat: Assessment protocols for wadeable rivers and streams of New Zealand*. School of Biological Sciences, University of Canterbury.

Joy M, David B, Lake M 2013. New Zealand freshwater fish sampling protocols. Massey University. Palmerston North, New Zealand.

Lysaght Consultants Ltd. (2021). *Propose private plan change engineering servicing report: 66 Washer Road, Te Puke*. Prepared by Lysaght Consultants Ltd for David Marshall.

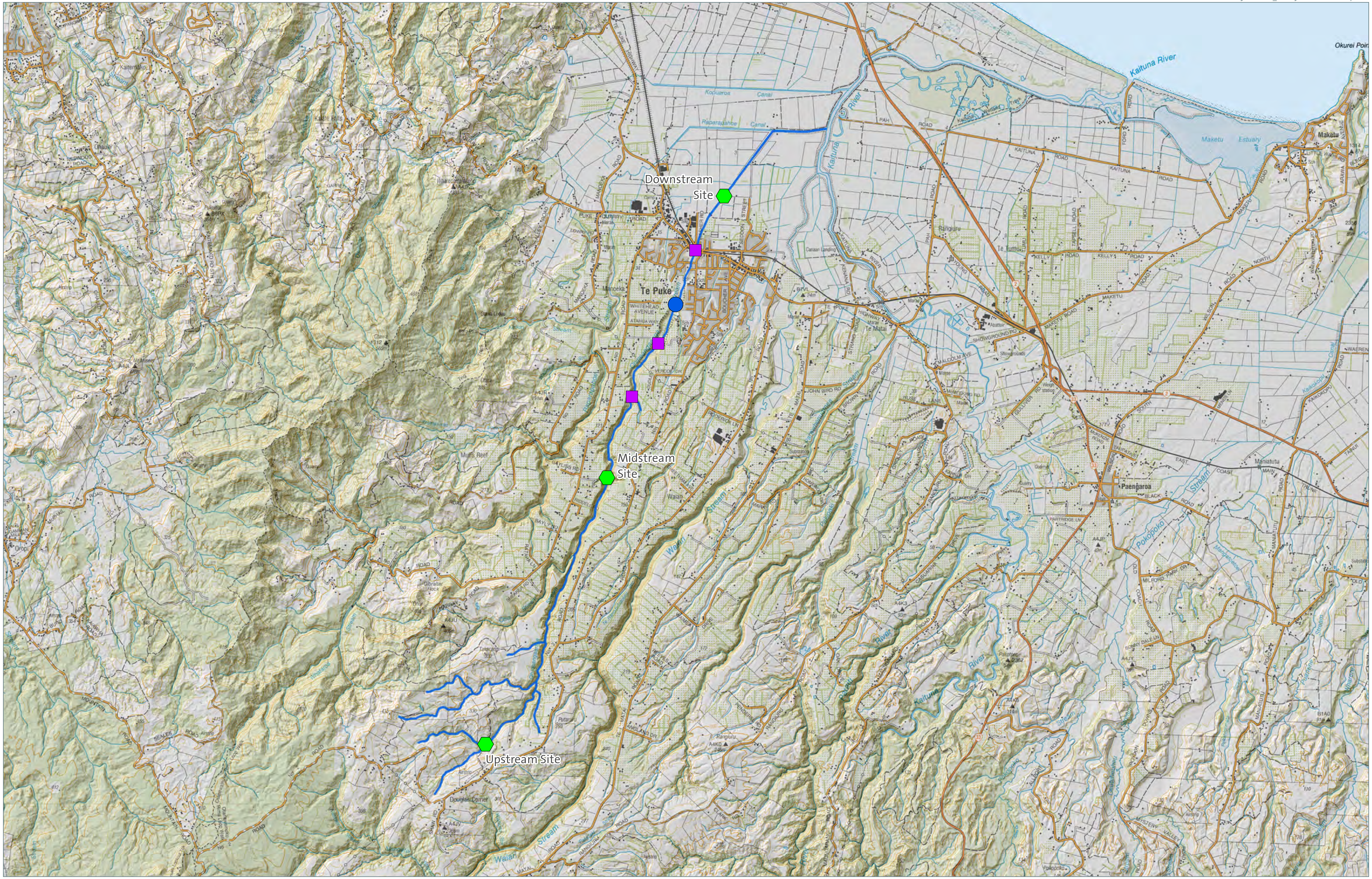
Ministry for the Environment 2001. Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103.

Momentum Planning and Design. (2021). *Application for plan change: Washer Road business park*. Prepared by Momentum Planning and Design for David Marshall.

Stark J.D., Maxted J.R. 2007. A biotic index for New Zealand's soft-bottomed streams. New Zealand Journal of Marine and Freshwater Research. Vol. 41: 43-61.

Appendix 1: Survey Sites for BML 2018 Assessment

File Ref: T17167_SurveySiteLocationMap.mxd



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0 1,400 m
1:70,000 @ A3

Data Sources: Land Infomration New Zealand, Crown Copyright Reserved. BOPLASS Limited.

Projection: NZGD 2000 New Zealand Transverse Mercator

Legend

- BML Fish Survey Site
- BOPRC Fish Survey Site
- BOPRC Water Quality Survey Site
- Ohineangaanga Stream and Tributaries

Ohineangaanga Stream Assessment

Ohineangaanga Stream Survey Site Locations

Date: 7 March 2018 | Revision: 0

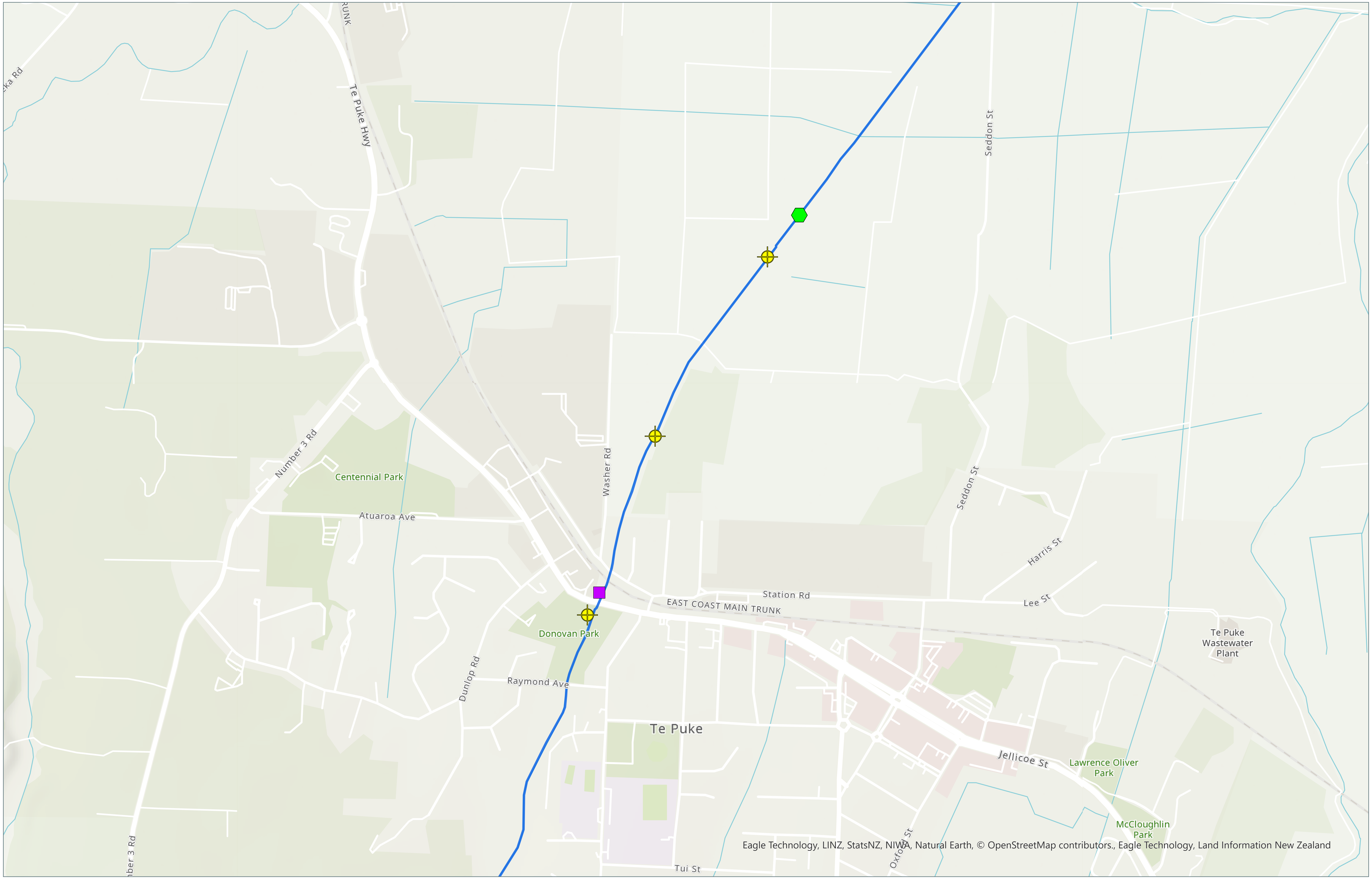
Plan prepared by Boffa Miskell Limited

Project Manager: **Kieran.Miller@boffamiskell.co.nz** | *Drawn:* JWa | *Checked:* KMi

Figure 1

Appendix 2: Survey Sites 2022

File Ref: BM220154.mxd



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Projection: NZGD 2000 New Zealand Transverse Mercator

- BML Survey Site 2022
- BML Survey Site 2017
- BOPRC Fish Survey Site
- Ohineangaanga Stream

OHINEANGAANGA STREAM ASSESSMENT

Ohineangaanga Stream Survey Site Locations

Date: 29 March 2022 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: **Sharon.DeLuca@boffamiskell.co.nz** | *Drawn:* JWa | *Checked:* SDe

Appendix 3: BOPRC Submission relating to Stormwater Management and Mitigation

PC 93 (3)	Stormwater Management	**Oppose**	The council's database has identified a water course[2] within the Plan Change area in addition to the other waterbodies (streams/wetlands) including a spring on the site. For this reason, BOPRC seek that an ecological assessment is prepared to identify the values of this stream as required by Policy IMP1A in the Regional Natural Resources Plan (RNRP) which seeks to avoid losses in extent and values of streams. Guidance for appropriate matters to consider when addressing loss of value[3] are provided for in the NPS-FM (2020). The assessment should be prepared by Suitably Experienced and Qualified Persons have particular regard to the potential cumulative effects arising from the:	**Oppose** the proposal or elements of it, in so far as it would not give effect to the relevant provisions of the NPS-FM and the RPS and would be inconsistent with the relevant freshwater provisions of the Bay of Plenty RNRP to manage incremental degradation of water quality on receiving environments arising from urban stormwater.

://qis.boprc.govt.nz/BayMaps/?appid=8c543e1d68a34940bef0f3c8e844a589)

- definition for 'loss of value' page 23 of the NPS-FM

3

			• scale and intensity of the land uses and development expected in the commercial zone high imperviousness for the subject site; and • potential increases in contaminants as a result of forming a new access from the lay-by adjoining SH 2 into the plan change area. Further, the applicant is advised to engage with tāngata whenua as kaitiaki as required by RPS Policy 1W 2B with regards to the potential loss of cultural values associated with the stream as well as any other relevant resource management issues relating to the plan change.	
PC 93 (4)	Stormwater mitigation	**Oppose**	Subject to the completion of an ecological assessment to identify the specific values of the stream, BOPRC raise the following concerns with regards to the proposed stormwater mitigation. • While peak flows are being controlled by attenuation, the PC does not provide for methods to manage run-off control/run-off reductions such as water sensitive urban options (at source controls, rain gardens and swales etc.) to manage stormwater quality and volume from the plan change into the receiving environment; and • The proposed access off the lay-by adjoining SH 2 would be located upstream of the identified stream. Accordingly, the proposed location of the access in this location will likely increase contaminants into the stream network overtime, particularly during large flood events. • The proposed treatment ponds will be inundated during a large event and are highly likely to re-suspend metals into the downstream environment. BOPRC seek that the treatment ponds are located outside of the 1% AEP flood plain/overland flow path.	**Oppose** - the proposal would not give effect to the relevant provisions of the NPS-FM and the RPS and would be inconsistent with the relevant freshwater provisions of the Bay of Plenty RNRP to manage incremental degradation of water quality on receiving environments arising from urban stormwater. Subject to ecological assessment of the proposed stream, the following relief in the Structure Plan is sought: • Oppose the commercial zone on parts of the plan change area that include rivers/streams and or wetlands: appropriate buffers should also be provided;
				• Relocate or design the 'Structure Plan Stormwater Pond', in particular the proposed treatment ponds, so that the loss of extent and values of any river/stream is avoided as required by Policy IMP 1A of the RNRP and NPS-FM; and • Control design matters to ensure the proposed access off the lay-by adjoining SH2 does not result in the loss of values of any

4

				river/stream is avoided as required by Policy IMP 1A of the RNRP; BOPRC seek that the plan change includes (but not limited to) methods to manage water quality): • Methods to ensure a treatment approach to water sensitive urban design is required at structure plan stage; and • Methods to ensure that the proposed treatment devices are located outside of the flood plain.

Appendix 4: Water quality and sediment quality laboratory transcripts

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

SPv1

Client:	Boffa Miskell Limited	**Lab No:**	2925832
Contact:	S De Luca	**Date Received:**	22-Mar-2022
	C/- Boffa Miskell Limited	**Date Reported:**	29-Mar-2022
	PO Box 13373	**Quote No:**	116862
	Tauranga 3141	**Order No:**	BM220154
		Client Reference:	BM220154
		Submitted By:	S De Luca

Sample Type: Sediment

Sample Name:		US (sediment) 17-Mar-2022 1:15 pm	MS (sediment) 17-Mar-2022 12:00 pm	DS (sediment) 17-Mar-2022 10:15 am		
Lab Number:		2925832.4	2925832.5	2925832.6		
Individual Tests						
Dry Matter	g/100g as rcvd	74	76	72	-	-
Heavy metals screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	< 2	< 2	< 2	-	-
Total Recoverable Copper	mg/kg dry wt	< 2	< 2	< 2	-	-
Total Recoverable Lead	mg/kg dry wt	3.9	1.8	6.3	-	-
Total Recoverable Nickel	mg/kg dry wt	< 2	< 2	< 2	-	-
Total Recoverable Zinc	mg/kg dry wt	36	20	22	-	-
Total Petroleum Hydrocarbons in Solids						
C7 - C9	mg/kg dry wt	< 20	< 20	< 20	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	< 80	< 80	-	-

Sample Type: Aqueous

Sample Name:		US (water) 17-Mar-2022 1:15 pm	MS (water) 17-Mar-2022 12:00 pm	DS (water) 17-Mar-2022 10:15 am		
Lab Number:		2925832.1	2925832.2	2925832.3		
Individual Tests						
Total Suspended Solids	g/m^3	< 3	< 3	< 3	-	-
Total Nitrogen	g/m^3	1.63	1.72	1.70	-	-
Total Ammoniacal-N	g/m^3	< 0.010	< 0.010	< 0.010	-	-
Nitrite-N	g/m^3	0.002	0.002	0.003	-	-
Nitrate-N	g/m^3	1.57	1.62	1.59	-	-
Nitrate-N + Nitrite-N	g/m^3	1.58	1.63	1.60	-	-
Total Kjeldahl Nitrogen (TKN)	g/m^3	< 0.10	< 0.10	< 0.10	-	-
Dissolved Reactive Phosphorus	g/m^3	0.009	0.005	0.004	-	-
Total Phosphorus	g/m^3	0.017	0.016	0.014	-	-
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m^3	< 0.0011	< 0.0011	< 0.0011	-	-
Total Cadmium	g/m^3	< 0.000053	< 0.000053	< 0.000053	-	-
Total Chromium	g/m^3	< 0.00053	< 0.00053	< 0.00053	-	-
Total Copper	g/m^3	< 0.00053	< 0.00053	< 0.00053	-	-
Total Lead	g/m^3	< 0.00011	< 0.00011	< 0.00011	-	-
Total Nickel	g/m^3	< 0.00053	< 0.00053	< 0.00053	-	-
Total Zinc	g/m^3	0.0042	0.0018	0.0023	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Sediment

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	4-6
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	4-6
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	4-6
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4-6
Heavy metals screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	4-6
Total Petroleum Hydrocarbons in Solids			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	4-6
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	4-6
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	4-6
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	4-6

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1-3
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m^3	1-3
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m^3 is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m^3, the Default Detection Limit for Total Nitrogen will be 0.11 g/m^3. In-house calculation.	0.05 g/m^3	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH_4-N = NH_4^+-N + NH_3-N). APHA 4500-NH_3 H (modified) 23rd ed. 2017.	0.010 g/m^3	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m^3	1-3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m^3	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m^3	1-3
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N_{org} D (modified) 4500 NH_3 F (modified) 23rd ed. 2017.	0.10 g/m^3	1-3
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) 23rd ed. 2017.	0.004 g/m^3	1-3
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H 23rd ed. 2017.	0.002 g/m^3	1-3
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.000053 - 0.0011 g/m^3	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 23-Mar-2022 and 29-Mar-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Appendix 5: Macroinvertebrate results

Group	Species	Ohineangaanga Stream March 2022 DS1-3 1	Ohineangaanga Stream March 2022 DS1-3 2	Ohineangaanga Stream March 2022 DS1-3 3	Ohineangaanga Stream March 2022 MS1-3 1	Ohineangaanga Stream March 2022 MS1-3 2	Ohineangaanga Stream March 2022 MS1-3 3	Ohineangaanga Stream March 2022 US1-3 1	Ohineangaanga Stream March 2022 US1-3 2	Ohineangaanga Stream March 2022 US1-3 3
	1 Total	201	225	120	240	203	204	257	219	206
	2 Number of	12	19	9	9	8	13	21	22	19
	3 Number of	0	3	0	0	0	1	4	5	3
	4 MCI score	79.2	96.5	74.2	82.2	74	73.8	77.5	84.9	71.6
	5 QMCI	3.1	3.5	3	3.5	3.4	3.5	2.9	3.5	2.9
	6 Full count=1,Cod	4	4	4	2	2	2	2	2	2
ACARINA	ACARINA	2	1					5	8	3
ANNELIDA	HIRUDINEA						1			
ANNELIDA	OLIGOCHAET	31	86	43	144	118	88	81	28	77
CNIDARIA	Hydra							4	3	2
Coleoptera	Elmidae	4	5	3	4	1	2	1		
Coleoptera	Hydrophilida	1					2	1		
COLLEMBOLA	COLLEMBOL		4					1	4	
CRUSTACEA	Cladocera							9	3	2
CRUSTACEA	Copepoda		1					8	4	2
CRUSTACEA	Isopoda, excl.			1						
CRUSTACEA	Ostracoda	1					1	13	7	3
Diptera	Austrosimuli		1					1	2	
Diptera	Chironomida		3							
Diptera	Chironomus	11	26		8	4	3	10		9
Diptera	Corynoneura								4	
Diptera	Eriopterini,		1							
Diptera	Mischoderus				1					
Diptera	Muscidae					1	2			
Diptera	Orthocladiina	53	13	6	30	34	56	5	3	2
Diptera	Paradixa								13	2
Diptera	Polypedilum		3						6	
Diptera	Tanypodinae	9	10	3	5	3	13	5	8	1
Diptera	Tanytarsini	6	1					10		3
Ephemeropte	Zephlebia							1	6	
Hemiptera	Microvelia								3	
MOLLUSCA	Gundlachia =									1
MOLLUSCA	Lymnaeidae			1						
MOLLUSCA	Potamopyrgu	81	62	55	41	37	28	53	39	39
MOLLUSCA	Sphaeriidae	1					1			1
NEMATODA	NEMATODA		1	1	1			3		1

NEMATOMOR	NEMATOMO								23	
NEMERTEA	NEMERTEA	1	4	7	6	5	6	18		39
PLATYHELMIN	PLATYHELMI NTHES, excl.								1	
Plecoptera	Zelandiobius						1			
Trichoptera	Hydrobiosis		1							
Trichoptera	Hydropsyche-								1	
Trichoptera	Oxyethira							26	48	15
Trichoptera	Pycnocentria								2	
Trichoptera	Pycnocentro							1		
Trichoptera	Triplectides		1					1	3	3
Trichoptera	Zelandoptila		1							1