Blackpool Stormwater Improvements

Wetland and Watercourse Assessment

Prepared for Auckland Council
Prepared by Beca Limited

24 June 2024

Contents

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
1	Kimberley DSouza	Draft for Client Review	24/06/2024

Document Acceptance

Action	Name	Signed	Date
Prepared by	Kimberley DSouza		24/06/2024
Reviewed by	Connor Whiteley		18/06/2024
Approved by	Jenny Vince		21/06/2024
on behalf of	Beca Limited		

1 Introduction

1.1 Scope and Purpose

Beca Limited (Beca) has been engaged by Auckland Council Healthy Waters (ACHW) to delineate the watercourses and wetland features at several sites in the Blackpool area on Waiheke Island. This is due to ACHW planning to upgrade the stormwater infrastructure in this area. The ecological assessments undertaken involved carrying out wetland and watercourse delineations to classify the features present within the site boundary.

The scope of tasks includes:

- A site visit to the area of where stormwater upgrades are proposed to undertake wetland and watercourse delineations.
- The preparation of a Wetland and Watercourse Assessment which classifies any *natural inland wetlands* and watercourses identified during the site visit
- An assessment of the ecological value of the watercourses and wetlands identified.
- Recommendations for next steps.

The field work undertaken is limited to the sections of daylighted watercourses across the project site where the channel is currently proposed to be both widened and deepened[1]. This report provides a description and classification of the wetlands/watercourses identified, however, does not provide an assessment of ecological effects.

1.2 Site Location and Background Information

The site is located in the suburb of Blackpool on Waiheke Island, with the works primarily taking place across Nikau Road, Tui Street, Rata Street, Manuka Road and Moa Avenue. For ease of understanding, the site is split into eight sections of open watercourse channels that were surveyed during the site walkover:

- Site 1: The watercourse on Tui Street adjacent to the Blackpool Cemetery
- Site 2: The watercourse on Tui Street adjacent to 11 Rata Road
- Site 3: The watercourse adjacent to 30 Tui Street
- Site 4: The watercourse at bottom end of Ridge Road
- Site 5: The watercourse opposite 26 Tui Street
- Site 6: The watercourse in Waeroa Reserve
- Site 7: The watercourse adjacent to 17 Moa Avenue
- Site 8: Drains along Nikau Road

At this stage, the proposed works are understood to include the improvement of the stormwater network within this area. This includes installing new or enlarging existing culverts and pipes along the network, installing grated stormwater inlets and underground pipes in several location, as well as widening and deepening existing open water channels and planting the banks with wetland plants. Refer to the Blackpool Stormwater Improvements Overview Plan for further details.

[1] Auckland Council Healthy Waters. (2024). Blackpool Stormwater Improvements – Overview Plan.

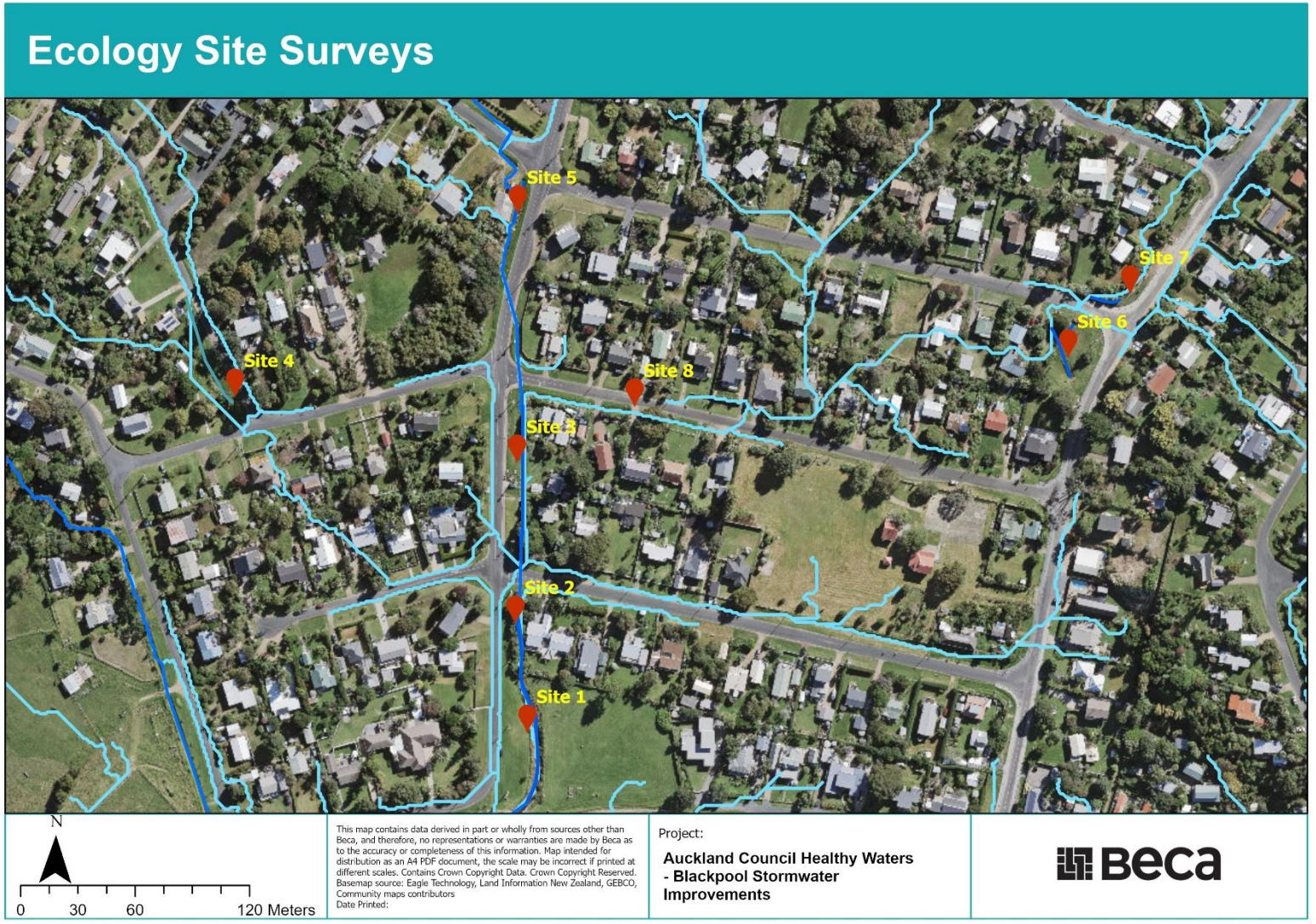

Figure 1. Location of the ecology surveys at Blackpool in relation to the Auckland Council mapped permanent streams (dark blue) and overland flow channels (light blue).

2 Desktop and Field Investigations

2.1 Desktop Investigations

A desk-based study was undertaken using ecological information from the following sources:

- New Zealand Freshwater Fish Database (NZFFD)
- Auckland Council geospatial layers including aerial imagery, catchment hydrology, potential and current ecosystem extents
- Google Earth and LINZ aerial imagery
- Retrolens
- Other publicly available reports

2.1.1 Identification of Potential Watercourses

Watercourses within the project area were first identified on the site concept plan[2] produced by Auckland Council, which provided an outline of the water channels where works were proposed to occur. From there watercourses were further investigated using the hydrology and catchment layers on the Auckland Council Geomaps database. This layer was reviewed for permanent and intermittent streams, as well as overland flow pathways. Following this, a closer inspection of the geospatial data was undertaken to determine the actual location and presence of the watercourses. The modelled overland flow data can also be used to provide catchment information that can be utilised to provide classifications for watercourses.

Then aerial imagery from 1961 was visually inspected to confirm the presence of these watercourse features and to identify any modifications that may have occurred overtime. This imagery was compared to Google Earth imagery to determine the current existence and extent of these watercourses, and which have retained natural features.

In order to determine and confirm the classification of artificial watercourses within the site, an assessment of the upstream reaches of the watercourses (within the site) was conducted. As stated in the Practice and Guidance Note for River/Stream classifications (Auckland Council, 2021), once an upstream section of a watercourse has been determined to be permanent or intermittent, then all downstream sections from that point are also considered to be permanent or intermittent, even if modification of the reach has occurred.

2.2 Field Investigations

A site visit was undertaken on 17 May 2024. The weather at the time of the site visit varied considerably with periods of overcast and light rain, changing to sunny with a moderate breeze. There had been moderate rainfall in the previous 48 hours with approximately 6 mm recorded near Matiatia.

2.2.1 Wetland Delineations

During the site visit, an assessment of any potential wetlands within 10 m of the proposed stormwater upgrade works was undertaken in accordance with the New Zealand Wetland Delineation Protocols and current Ministry for the Environment guidance in order to classify *natural inland wetlands* and delineate extents where necessary in accordance with the National Policy Statement for Freshwater Management (NPS-FM) (Clarkson, 2018; Ministry for the Environment, 2022) (see Appendix A). Given that a majority of the stormwater improvements will be undertaken within the road reserve, as well as existing drain systems,

[2] Auckland Council Healthy Waters. (2024). Blackpool Stormwater Improvements – Overview Plan.

wetland surveys were only undertaken at areas where wetland vegetation covered an area greater than 1 m x 1 m and where other landscape clues were present that could suggest wetland hydrology would be present.

2.2.2 Watercourse Delineations

Watercourse delineations were undertaken across the sections where improvement works are being undertaken (as shown in Figure 1). The delineation and classifications were undertaken in accordance with the AUP:OP guidelines (Appendix A). It should be noted that watercourse classification assessments are best undertaken between July and October due to seasonal variability in groundwater and surface water hydrosystems. Given that these surveys were required to be undertaken outside of this timeframe to inform the consenting process, professional judgement, based on desktop information and the field results, has been applied here.

2.2.3 eDNA Surveys

Three eDNA samples was several locations along the existing stormwater network at Blackpool at Sites 1, 4, and 6. Mini eDNA kits with 1.2 µm and 5 µm CA filters. Multi-species analyses by DNA metabarcoding were undertaken on eDNA samples by Wilderlab Ltd to produce a list of all DNA sequences detected within a broad taxonomic group (e.g., fish, insects, birds, mammals) and the number of times each appears in the sample. These DNA sequences are then compared against a reference database to assign species names and characterise the community as a whole.

2.3 Assessment Criteria

A desktop assessment of ecological values was undertaken in accordance with Ecological Impact Assessment (EcIA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems (Roper-Lindsay et al., 2018).

The EIANZ guidelines set out a methodology to assign ecological value to species and ecosystems based on four assessment criteria which are consistent with significance assessment criteria set out in the National Policy Statement for Indigenous Biodiversity (2023) Appendix 1: Criteria for identifying significant indigenous vegetation and significant habitat of indigenous fauna. In summary:

- Particular attributes are considered when considering ecological value or importance. These relate to matters such as representativeness, the rarity and distinctiveness, diversity and patterns, and the broader ecological context;
- Determining factors for valuing any terrestrial species present; span a continuum of very high to negligible, depending on aspects such as whether species are native or exotic, have threatened status, and their abundance and commonality at the site impacted;
- Ecological Values are scored based on an expert judgement, and qualitative and quantitative data collected. The freshwater features assessment has additionally been guided by an adaption to the EIANZ methodology to provide linkage to some of the common stream ecological value assessment methodology.

3 Ecological Context and Site History

The site is located in the Blackpool area on Waiheke Island, which is located in the Inner Gulf Islands Ecological District (ED). This ED comprises a group of inshore islands in the Hauraki Gulf, with Waiheke being the largest island. Original vegetation on most of the islands would have been coastal forests comprising primarily pōhutukawa, with some kauri, and on Waiheke Island hard beech, rimu, miro, and tawa were also common. A majority of the historic ecosystems have been lost, with the island having gone significant modifications and is now farmed with cattle and sheep, as well as a permanent and holiday settlements (McEwen, 1987).

Historical aerial imagery identifies the presence of these channels since as early as 1961 and it is very likely that while these channels were modified (bank cut and deepened), that they are located within natural flow pathways. This is supported by contour data which clearly indicates hydrological driven erosion sloping downgradient towards the Blackpool Beach. Furthermore, Sites 1 - 5 originate upstream near Alison Park, where the permanent stream retains natural meandering characteristics as it flows through residential housing, under several culverts, before flowing through modified open channels along Tui Road and discharges into Huruhi Bay/ Blackpool Beach.

Figure 2. Aerial imagery from 1961 of Site 4 (yellow) and Sites 1, 2, 3, 5, and 8 (in red) from 1961.

Figure 3. Aerial imagery from 1961 of Site 6 (red) and Site 7 (yellow).

4 Wetland and Watercourse Delineations and Ecological Value

The following provides the results of the wetland and watercourse delineations and ecological value at each of the site locations (Site 1 – Site 8). All eDNA results can be found in Appendix B, and the location of delineated wetlands and watercourses is displayed on Figure 14 and Figure 15.

4.1 Site 1

Overall, the site visit and desktop investigations undertaken support the classification of a permanent stream channel with wetland riverine margins that meet the definitions of a *natural inland wetland* under the NPS-FM.

Site 1 is assessed as having **Moderate** ecological value, and the reasons for this are outlined in the below table.

Table 1. Justification for assigned ecological value to Site 1.

Matter	Rating	Justification
Representativeness	Low	Permanent estuarine channel from a first order channel Channel has been modified to convey stormwater flows.
Rarity/Distinctiveness	Moderate	Grey mangroves (*Avicennia marina;* Not Threatened) present within the channel. eDNA sample detected shortfin eel and banded kōkopu within the channel (both Not Threatened), and a benthic community largely comprised by tolerant taxa. WL10 (oioi,m restiad rushland/reedland) ecosystem mapped, and the site visit confirmed the dominance of dominated by *Bolboschoenus fluviatilis,* a diagnostic species of this ecosystem type.
Diversity and Pattern	Low	Includes coastal vegetation that potentially supports native fish, invertebrates, and birds. Overall low level of diversity and complexity.
Ecological context	Moderate	Provides limited habitat and foraging for native/endemic bird species. Habitat for intertidal invertebrates. Pūkeko (*Porphyrio melanotus*) and one oystercatcher (*Haematopus unicolor;* At Risk – Recovering) observed adjacent Blackpool Cemetery Reserve. This section of the channel provides suitable pathway for migratory native fish, with no barriers identified. Limited riparian vegetation, providing low shading for the channel. Limited provisioning of natural coastal processes including shoreline protection and trapping sediment.
		Overall value: **Moderate**

Figure 4. Site 1 taken at the downstream end, looking upstream.

4.2 Site 2

Overall, the site visit and desktop investigations undertaken support the classification of a permanent stream, channel that meet the definitions under the AUP:OP.

The ecological value of Site 2 has been assessed as **Low**, and the reasons for this are outlined in the table below.

Table 2. Justification for assigned ecological value to Site 2.

Matter	Rating	Justification
Representativeness	Low	First order permanent stream channel Stream channel and morphology has undergone significant modifications including channel straightening, installation of culverts, and artificial lining and base.
Rarity/Distinctiveness	Low	Benthic community is expected to comprise of taxa predominantly tolerant to environmental changes and pollution.
Diversity and Pattern	Low	Low diversity and complexity.
Ecological context	Moderate	Provides limited habitat for native fish. This section of the channel provides limited fish passage, and likely only for species with suitable climbing abilities – especially during lower flow periods. Riparian vegetation dominated by karo (*Pittosporum crassifolium*) in a well-established closed canopy, providing high shading and organic debris input into the channel. Channel forms part of the wider stormwater network, which retains nature characteristics, however, has been highly modified to convey stormwater flows.

Matter	Rating	Justification
		Overall value: **Low**

Figure 5. Site 2 taken at the downstream end, looking upstream.

4.3 Site 3

Overall, the site visit and desktop investigations undertaken support the classification of a permanent stream, channel that meet the definitions under the AUP:OP.

The ecological value of Site 3 has been assessed as **Low**, and the reasons for this are outlined in the table below.

Table 3. Justification for assigned ecological value to Site 4.

Matter	Rating	Justification
Representativeness	Low	First order permanent stream channel – represents the upstream section of Sites 1 and 2. Stream channel and morphology has undergone significant modifications including channel straightening and deepening.
Rarity/Distinctiveness	Low	Benthic community is expected to comprise of taxa predominantly tolerant to environmental changes and pollution. Vegetation is only present along the true left bank and includes karo, scattered patches of woolly nightshade (*Solanum mauritianum*), flax (*Phorium tenax*), Chinese privet (*Ligustrum sinense*), a large blue jacaranda (*Jacaranda mimosifolia*) and red mapou (*Myrsine australis*). The understorey comprises *Agapanthus praecox*, *Acanthus mollis*, arum lily (*Zantedeschia aethiopica*), and exotic grasses.

Matter	Rating	Justification
		Native fish community are expected to be typically low diversity, due to limited habitat availability.
Diversity and Pattern	Low	Low diversity and complexity.
Ecological context	Low	Provides limited habitat for native fish and invertebrates including some overhanging and instream vegetation. Riparian vegetation is limited to mixed native and exotic species, that does not form a closed canopy as such, provides limited shading to the stream channel. Channel forms part of the wider stormwater network, which retains nature characteristics, however, has been highly modified to convey stormwater flows.
		Overall value: **Low**

Figure 6. Representative photo of Site 3.

4.4 Site 4

Overall, the site visit and desktop investigations undertaken support the classification of an intermittent stream channel that meet the definitions under the AUP:OP.

The ecological value of Site 4 has been assessed as **Low**, and the reasons for this are outlined in the table below.

Table 4. Justification for assigned ecological value to Site 4.

Matter	Rating	Justification
Representativeness	Low	The channel is mapped as an overland flow pathway. Stream channel and morphology has undergone significant modifications including channel widening (at the downstream end), straightening and deepening.
Rarity/Distinctiveness	Low	Benthic community is expected to comprise of taxa predominantly tolerant to environmental changes and pollution. eDNA detected only banded kōkopu, therefore the fish community is considered to be of low diversity. Riparian vegetation on the true right comprised several larger willows, one cabbage tree, one ngaio, and flax. Ground cover vegetation comprised primarily exotic grasses and some creeping buttercup.
Diversity and Pattern	Low	Low diversity and complexity.
Ecological context	Low	Channel is piped upstream, therefore is no expected to provide any linkages to suitable upstream habitat. Provides limited habitat for native fish and invertebrates, and the channel is expected to be periodically dry. Riparian vegetation is limited to mixed native and exotic species, that does not form a closed canopy as such, provides limited shading to the stream channel. Deeper pooled section was highly turbid at the time of the site visit, and it is likely that the downstream end of the culvert may be blocked. Channel forms part of the wider stormwater network, which retains nature characteristics, however, has been highly modified to convey stormwater flows.
		Overall value: **Low**

Figure 7. Site 4, looking downstream towards the deeper pooled section by the culvert.

4.5 Site 5

Overall, the site visit and desktop investigations undertaken support the classification of a permanent stream channel with wetland riverine margins that meet the definitions of a *natural inland wetland* under the NPS-FM and AUP:OP.

The ecological value of Site 5 has been assessed as **Low**, and the reasons for this are outlined in the table below.

Table 5. Justification for assigned ecological value to Site 5.

Matter	Rating	Justification
Representativeness	Low	The channel is identified as a first order permanent stream. Stream channel and morphology has undergone significant modifications including channel straightening and deepening, and the installation of culverts at both the upstream and downstream end.
Rarity/Distinctiveness	Low	Benthic community is expected to comprise of taxa predominantly tolerant to environmental changes and pollution. Site 4 is expected to support a low diversity of native fish, given the modified nature of the downstream reaches. Instream vegetation comprising watercress and *Persicaria maculosa* were noted within the channel that exceeded 1 m^2 in size. Both species are regularly found in slow flowing and still waterbodies and are obligate and facultative wetland species, respectively.
Diversity and Pattern	Low	Low diversity and complexity.
Ecological context	Low	Provides limited habitat for native fish and invertebrates. No riparian vegetation present. Channel forms part of the wider stormwater network, which retains nature characteristics, however, has been highly modified to convey stormwater flows.
		Overall value: **Low**

Figure 8. Representative photos of Site 5 looking upstream (left) and downstream (right).

4.6 Site 6

Overall, the site visit and desktop investigations undertaken support the classification of a permanent stream channel with wetland riverine margins that meet the definitions of a *natural inland wetland* under the NPS-FM and AUP:OP.

The ecological value of Site 6 has been assessed as **Low**, and the reasons for this are outlined in the table below.

Table 6. Justification for assigned ecological value to Site 6.

Matter	Rating	Justification
Representativeness	Low	The channel is mapped as an overland flow pathway. Site 5 is expected to support a low diversity of native fish only, given the modified nature of the system and the perched culverts present.
Rarity/Distinctiveness	Low	Benthic community is expected to comprise of taxa predominantly tolerant to environmental changes and pollution. Current ecosystem mapping also indicates this area is WL19 ecosystem type. This is representative of a raupō reedland ecosystem (Endangered), which often occur alongside rivers and lakes and are widespread in the Auckland region (Singers et al., 2017). This was verified during the site visit, where hydrophytic vegetation present included scattered patches of *B. fluviatilis,* fool's watercress (*Helosciadium nodiflorum*), flax, and small areas of *Persicaria* sp. The presence of other rafted aquatic species (e.g., watercress) and flax

Matter	Rating	Justification
		indicates that this area is only partially representative of an WL19 ecosystem type.
Diversity and Pattern	Low	Low diversity and complexity.
Ecological context	Low	Site 6 comprises four separate culverts entering the system from the north, southeast, south, and southwest Provides limited habitat for native fish and invertebrates. Riparian vegetation limited to patches of flax, and a few large willows and a pōhutukawa tree – which provides some shading to the channel. Channel forms part of the wider stormwater network, which retains nature characteristics, however, has been highly modified to convey stormwater flows. The soil plot identified the top 10 cm of soil is moist topsoil and below that is a layer of clay with some large gravels. This is potentially from fill material historically place at the site.
		Overall value: **Low**

Figure 9. Representative photo of Site 6 looking downstream.

Figure 10. Site 6 looking upstream (left) where there is a doubled perched culvert, and the results of the soil plot (right).

4.7 Site 7

4.7.1 Overall Classification

Overall, the site visit and desktop investigations undertaken support the classification of an intermittent watercourse, that meet the definitions under the AUP:OP.

The ecological value of Site 7 has been assessed as **Low**, and the reasons for this are outlined in the table below.

Table 7. Justification for assigned ecological value to Site 7.

Matter	Rating	Justification
Representativeness	Low	The channel is mapped as an overland flow pathway but is more likely intermittent. Located within a highly modified catchment. Site 7 is expected to support a low diversity of native fish only, given the modified nature of the system and the piped upstream end, and the perched culvert downstream. Channel has been modified with the installation of a culvert at the upstream and downstream end.
Rarity/Distinctiveness	Low	Benthic community is expected to comprise of taxa predominantly tolerant to environmental changes and pollution The blocked culvert has allowed for water pooling, which has enabled the establishment of watercress, an obligate wetland species often found in shallow water ponds and drains. Given this, the establishment

Matter	Rating	Justification
		of watercress is considered to have established around an artificial structure (the culvert), and is excluded as a *natural inland wetland* under the NPS-FM (see Appendix A
Diversity and Pattern	Low	Low diversity and complexity.
Ecological context	Low	Channel provides no linkages to upstream suitable habitat. Provides very limited habitat for native fish and invertebrates. Riparian vegetation limited to primarily exotic species. Channel forms part of the wider stormwater network, which retains very limited nature characteristics and has been highly modified to convey stormwater flows.
		Overall value: **Low**

Figure 11. Site 7 with overgrowth of kikuyu within the “channel” (left), and the overgrowth of watercress at the entrance of the blocked culvert (right).

4.8 Site 8

Overall, the site visit and desktop investigations undertaken support the classification of an artificial watercourse at the upstream end, flowing into a permanent watercourse, that meet the definitions of an artificial watercourse under the AUP:OP. Information on the stormwater network sourced from Auckland Council Geomaps indicates that this reach of watercourse is not connected to Sites 6 and 7, as indicated within the Overland flow pathway overlay. The current catchment systems form two distinct hydrological catchments (see Figure 12). It may have historically been plausible that a single catchment existed prior to

modification, however, it could also be plausible that several small discrete catchments existed prior to modification. Therefore, historical analysis provides limited clarification on the nature of the watercourse of Site 8. Therefore, given the channel typifies a constructed swale channel alongside the road, directed slightly against contour gradient's the watercourse has been classified as artificial and therefore has not been assessed for ecological value.

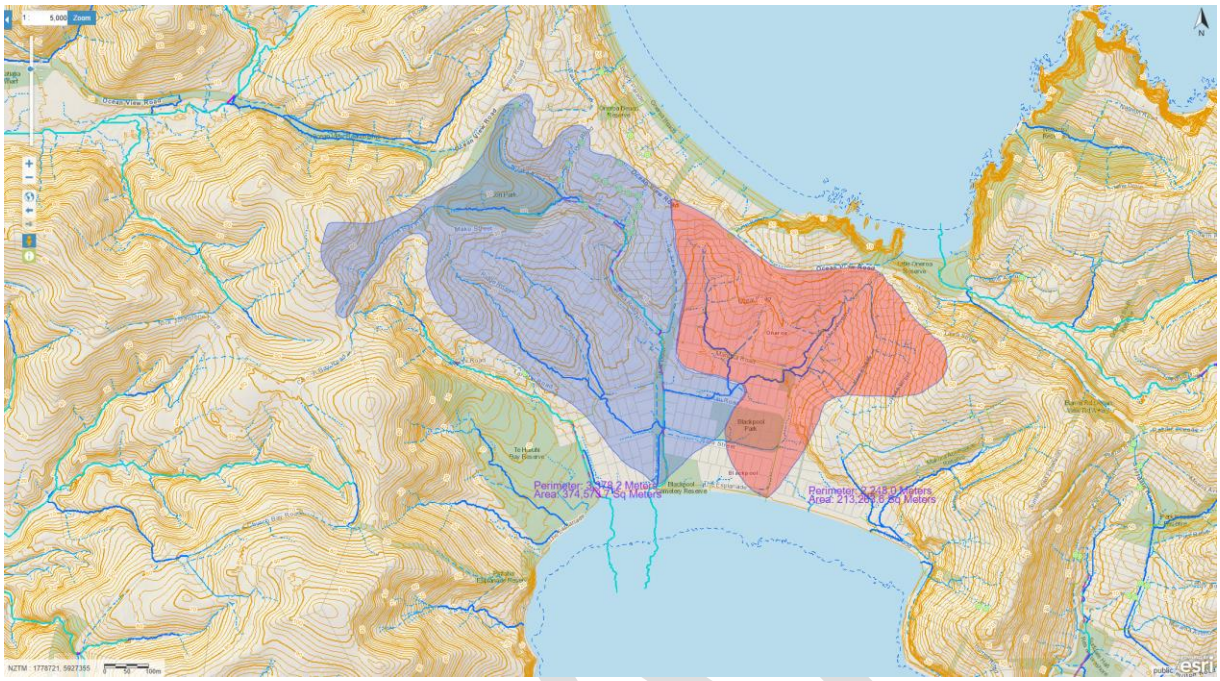

Figure 12 High level current catchment analysis based on both flow pathway and stormwater infrastructure (Source: Auckland Council Geomaps).

Figure 13. Overview of the drain channels along Nikau Road

4.9 Summary

Table 8 provides a summary of the results for each site. The watercourses and wetland delineations are shown on Figure 14 and 15.

Table 8. AUP:OP Stream Classification Criteria for Sites 1 – 8 at Blackpool, Waiheke.

Criteria 1: Evidence of natural pools, Criteria 2: Presence of a well-defined channel where the banks and bed are distinguishable, Criteria 3: Surface water is present (more than 48 hours after a rainfall event). Criteria 4: Rooted terrestrial vegetation is not present across the entire cross, Criteria 5: Evidence of organic debris in the floodplain. Criteria 6: Evidence of substrate sorting and scour.

AUP:OP Criteria	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Is there continually flowing freshwater (if yes is a permanent stream)?	Very Likely	Very likely	Very likely	Uncertain	Likely	Likely	Unlikely	Unlikely
Criteria #1:	Yes	Yes	Yes	Uncertain	Yes	Yes	No	No
Criteria #2:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Criteria #3:	Yes	Yes	Yes	Yes.	Yes	Yes	Yes	No
Criteria #4:	Yes	Yes	Yes	Yes	Yes	Yes	Yes .	Yes
Criteria #5:	No	No	No	No	No	No	No	No
Criteria #6:	Yes	No (not assessable)	Yes	Uncertain	Yes	No	No	No
Does the watercourse meet 3 of the 6 (above) criteria?	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Stream type (permanent, intermittent or ephemeral)	Permanent channel	Permanent channel	Permanent channel	More likely an intermittent stream.	Permanent channel	Permanent channel	Intermittent Channel	Artificial watercourse

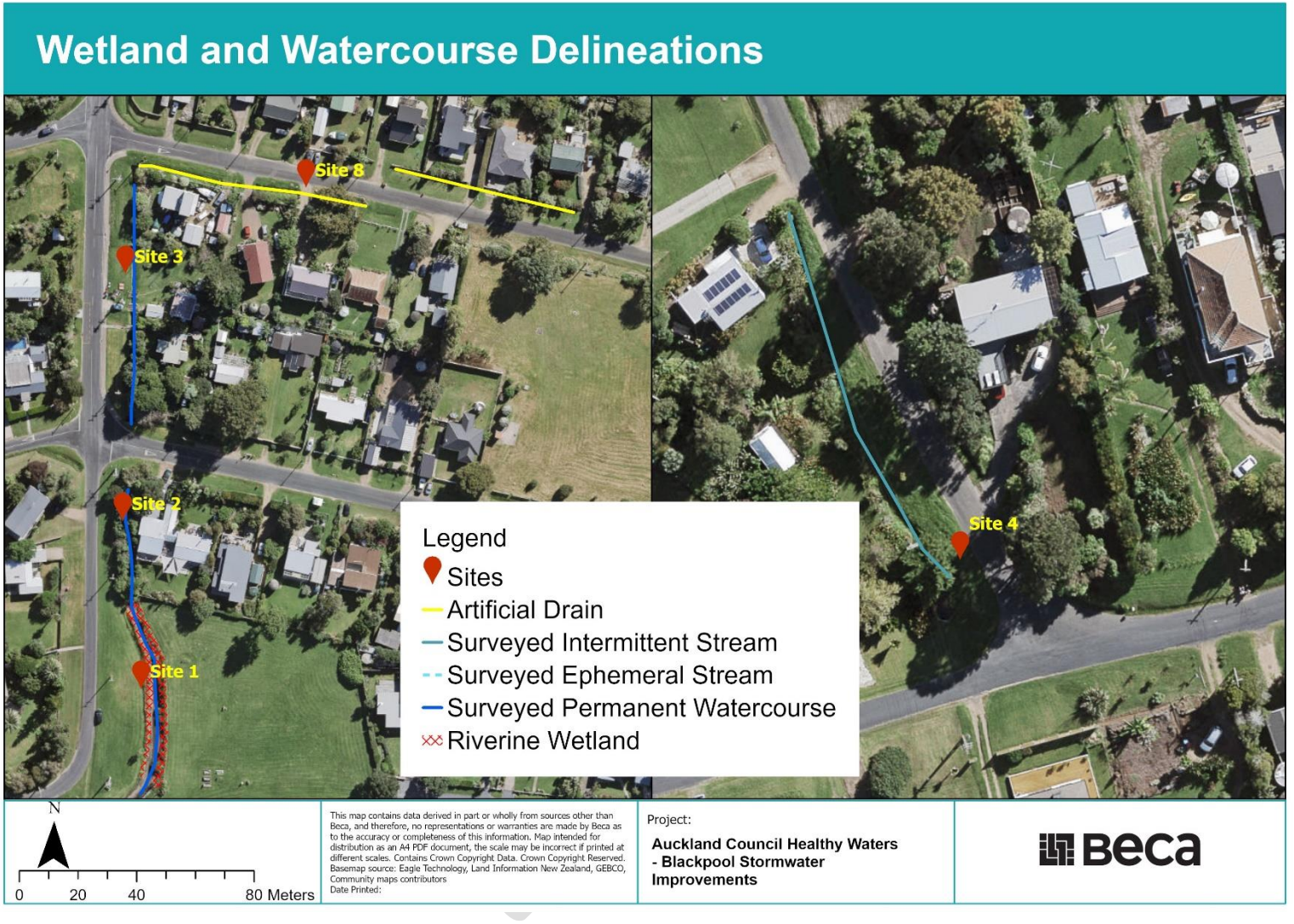

Figure 14. Results of the site survey – the delineated permanent streams and wetlands at Sites 1 – 4, and 8.

Figure 15. Results of the site survey – the delineated permanent streams and wetlands at Sites 5 - 7

5 Summary and Next Steps

5.1 Summary of Findings

In summary, and as set out in Section 4:

- Intermittent and permanent streams have been identified in and adjacent to the proposed works at Sites 1, 2, 3, 5 and 6.
- One artificial watercourse has been identified at Site 8.
- Three natural inland (riverine) wetlands have been identified in and adjacent to the proposed works at Sites 1, 5, and 6.
- Site 1 has been assigned as having **Moderate** ecological value, and the remaining sites are assigned as having **Low** ecological value.
- Freshwater native fish diversity within the watercourses are expected to be low, with shortfin eel (*Anguilla australis*) and banded kōkopu (*Galaxias fasciatus*), both Not Threatened, detected across this watercourse network.

5.2 Next Steps

Given the location of the works in and adjacent to intermittent and permanent streams (as defined by the AUP:OP), and natural inland wetlands (as defined under the NPSFM), consent is likely to be required for some or all of the proposed works.

Once the project works and construction methodology for instream works has been confirmed, an Ecological Impact Assessment (EcIA) is recommended to provide an assessment of the current ecological values of the site(s) and identify the types and level of ecological effects of the proposed works. To complete this, there may be a requirement to undertake Stream Ecological Valuations (SEVs) at each of these sites.

6 References

Auckland Council. (2021). *Auckland Unitary Plan - Practice and Guidance note for River / Stream Classification*. *17*(July), 1–23.

Clarkson, B. (2018). *Wetland Delineation Protocols. Contract Report: LC3354.*

McEwen, W. M. (1987). *Ecological Regions and Districts of New Zealand*. Department of Conservation.

Ministry for the Environment. (2022). National Policy Statement for Freshwater Management 2022 (NPS-FM). In *Publication reference ME 1155 34p*.

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. In *Auckland Council*.

A

Appendix A – Wetland and Watercourse Definitions

Wetland and Watercourse Definitions

Watercourse Classification

A desktop assessment of hydrology, watercourse and catchment characteristics was undertaken to determine watercourse classification in accordance with Auckland Unitary Plan definitions for rivers, streams, overland flow paths, and artificial watercourses[3].

Definition 1: Artificial Watercourse

“Constructed watercourses that contain no natural portions from their confluence with a river or stream to their headwaters. Includes: canals that supply water to electricity power generation plants; farm drainage canals; irrigation canals; and water supply races. Excludes: naturally occurring watercourses.”

Definition 2. Rivers or streams

“A continually or intermittently flowing body of fresh water, excluding ephemeral streams, and includes a stream or modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal except where it is a modified element of a natural drainage system).”

Definition 3. Ephemeral stream

“Stream reaches with a bed above the water table at all times, with water only flowing during and shortly after rain events. This category is defined as those stream reaches that do not meet the definition of a permanent river or stream or intermittent stream.”

Definition 4. Intermittent stream.

“Stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of permanent river or stream and meet at least three of the following criteria: it has natural pools; it has a well-defined channel, such that the bed and banks can be distinguished; it contains surface water more than 48 hours after a rain event which results in stream flow; rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel; organic debris resulting from flood can be seen on the floodplain; or there is evidence of substrate sorting process, including scour and deposition.”

Definition 5. Overland flow path.

“Low point in terrain, excluding a permanent watercourse or intermittent river or stream, where surface runoff will flow, with an upstream contributing catchment exceeding 4,000 m². Excludes the following areas: Constructed depressions and pits within Special Purpose - Quarry Zone.”

Definition 6. Permanent river or stream.

“The continually flowing reaches of any river or stream.”

[3] Auckland Unitary Plan: Operative in Part. Chapter J: Definitions. Retrieved from https://unitaryplan.aucklandcouncil.govt.nz/Images/Auckland%20Unitary%20Plan%20Operative/Chapter%20J%20Definitions/Chapter%20J%20-%20Definitions.pdf

Wetland Assessment

The Resource Management Act 1991 (RMA) defines wetlands as, "*permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions".*

The NPS-FM (2022) defines a natural inland wetland as (Ministry for the Environment, 2022):

natural inland wetland means a wetland (as defined in the Act) that is not:

(a) in the coastal marine area; or

(b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or

(c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or (d) a geothermal wetland; or

(e) a wetland that: (i) is within an area of pasture used for grazing; and

(ii) has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless

(iii) the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply

B

Appendix B – eDNA results

eDNA Results

Scientific Name	Rank	TaxID	Common Name	Group	Site 1	Site 6	Site 4
Anas platyrhynchos	species	8839	Mallard duck; rakiraki	Birds	2025	4119	0
Anguilla australis	species	7940	Shortfin eel; tuna; hao; aopori; hikumutu	Fish	4415	0	223
Galaxias fasciatus	species	89555	Banded kokopu; kokōpu	Fish	1899	0	0
Potamothrix bavaricus	species	745771	Aquatic oligochaete worm	Worms	1678	0	0
Orthonychiurus folsomi	species	2581074	Springtail	Springtails	54	1011	319
Eukerria saltensis	species	169929	Worm	Worms	174	1090	32
Lumbricus rubellus	species	35632	Red earthworm	Worms	163	927	189
Limnodrilus hoffmeisteri	species	76587	Redworm	Worms	124	987	72
Isotomidae sp. BIOUG15211-F03	species	2101463	Springtail	Springtails	25	983	84
Megascolex laingii	species	914218	Worm	Worms	34	844	132
Octolasion lacteum	species	334871	Worm	Worms	18	450	506
Eiseniella tetraedra	species	1302610	Squaretail worm	Worms	34	740	123
Tubifex tubifex	species	6386	Sludge worm	Worms	146	665	29
Aulodrilus pluriseta	species	76585	Aquatic oligochaete worm	Worms	229	515	32
Amynthas corticis	species	351238	Snake worm	Worms	72	493	71
Sus scrofa	species	9823	Pig	Mammals	0	525	0
Lumbriculus variegatus	species	61662	Blackworm	Worms	77	240	71
Acanthocyclops robustus	species	415614	Copepod	Crustaceans	16	25	290
Oryctolagus cuniculus	species	9986	European Rabbit; rāpeti	Mammals	0	248	0

Rattus rattus	species	10117	Black Rat; hinamoki; inamoki	Mammals	0	240	0
Aporrectodea limicola	species	647717	Worm	Worms	0	133	88
Spilopelia chinensis	species	115700	Spotted dove	Birds	135	34	0
Teleogryllus commodus	species	672150	Black field cricket	Insects	67	102	0
Bos taurus	species	9913	Cattle; kau	Mammals	0	33	131
Clogmia albipunctata	species	85120	Bathroom moth midge; Bathroom moth fly; drain fly	Insects	7	30	119
Octolasion cyaneum	species	302033	Worm	Worms	21	134	0
Mus musculus	species	10090	House mouse	Mammals	0	126	0
Bimastos parvus	species	2025029	Worm	Worms	0	120	0
Canis lupus familiaris	subspecies	9615	Dog; pero	Mammals	81	29	0
Culex quinquefasciatus	species	7176	Southern house mosquito	Insects	26	62	19
Porphyrio melanotus	species	72013	Pukeko; pūkeko	Birds	104	0	0
Passer domesticus	species	48849	House sparrow; tiu	Birds	59	41	0
Nais elinguis	species	74736	Sludgeworm	Worms	96	0	0
Ceratophysella aff. denticulata L3	species	2449137	Mushroom springtail	Springtails	20	73	0
Erinaceus europaeus	species	9365	European hedgehog; hetiheti; tuatete	Mammals	24	56	0
Turdus philomelos	species	127946	Song thrush	Birds	77	0	0
Todiramphus sanctus vagans	subspecies	497867	Sacred kingfisher; kōtare	Birds	71	0	0
Chironomus cloacalis	species	113493	Grey midge	Insects	39	0	24
Aporrectodea trapezoides	species	408844	Southern worm	Worms	0	61	0
Potamopyrgus antipodarum	species	145637	Mud Snail	Molluscs	59	0	0
Arripis trutta	species	270544	Kahawai; kōukauka; kahawai	Fish	0	57	0

Felis catus	species	9685	Cat; ngeru; poti	Mammals	0	51	0
Spumella sp.	species	1955568	Golden-brown alga	Heterokont algae	5	10	36
Cornu aspersum	species	6535	Garden snail	Molluscs	0	50	0
Prosthemadera novaeseelandiae	species	266374	Tui; tūī	Birds	0	50	0
Pseudolycoriella cavatica	species	2664622		Insects	45	0	5
Hyporhamphus ihi	species	2696611	Ihe; piper	Fish	50	0	0
Paranais litoralis	species	74742	Oligochaete worm	Worms	45	0	0
Austrosciara etorutao	species	2664628	Black fungus gnat	Insects	0	43	0
Symplecta pilipes pilipes	subspecies	2676132	Cranefly	Insects	15	0	27
Physella acuta	species	109671	Left handed sinistral snail	Molluscs	5	0	35
Lampropholis delicata	species	316451	Plague skink; rainbow skink	Lizards and snakes	0	39	0
Oligosoma aeneum	species	105716	Copper skink	Lizards and snakes	0	37	0
Ilyodrilus templetoni	species	170993	Aquatic worm	Worms	35	0	0
Mermessus fradeorum	species	1165471		Spiders	26	9	0
Lepidocyrtus pallidus	species	186254	Springtail	Springtails	32	0	0
Phytophthora cf. sp. sylvatica 1	species	2692156	Water mold	Oomycetes	15	17	0
Adineta vaga	species	104782	Rotifer	Rotifers	0	0	28
Sciaridae sp.	species	2909299		Insects	11	14	0
Prostoma eilhardi	species	41366	Freshwater ribbon worm	Ribbon worms	23	0	0
Lumbricus terrestris	species	6398	Common earthworm	Worms	20	0	0
Aphis craccivora	species	307492	Cowpea aphid	Insects	20	0	0
Carpelimus zealandicus	species	1587141		Insects	11	8	0

Rattus norvegicus	species	10116	Norway Rat; pouhawaiki; pou o hawaiki; kaingarua; maungarua	Mammals	0	18	0
Aulacorthum solani	species	202456	Foxglove aphid	Insects	13	5	0
Lumbricus castaneus	species	81491	Worm	Worms	0	0	17
Potamopyrgus estuarinus	species	268618	Mud Snail	Molluscs	17	0	0
Paracyclops fimbriatus	species	1606834	Copepod	Crustaceans	8	9	0
Armadillidium vulgare	species	13347	Common pillbug	Crustaceans	0	0	16
Tetraneura nigriabdominalis	species	1308603	Oriental grass root aphid	Insects	0	0	16
Capua dura	species	1371741		Insects	0	16	0
Casuarinicola nigrimaculatus	species	2218036		Insects	16	0	0
Prostoma graecense	species	324887	Freshwater nemertean	Ribbon worms	10	5	0
Eisenia fetida	species	6396	Tiger worm	Worms	0	14	0
Sminthurinus elegans	species	1190784	Springtail	Springtails	14	0	0
Triozidae sp. 1 FM-2017	species	2044830		Insects	12	0	0
Dero digitata	species	66488	Worm	Worms	11	0	0
Platynothrus peltifer	species	128015	Mite	Mites and ticks	0	11	0
Cryptachaea blattea	species	585892	Cobweb spider	Spiders	0	11	0
Pinnularia sp. 9 CS-2011	species	1089256	Freshwater diatom	Diatoms	0	11	0
Paraphysomonas sp.	species	1955561	Golden-brown alga	Heterokont algae	0	11	0
Chrysomya rufifacies	species	45450	Hairy maggot blow fly	Insects	0	10	0
Linepithema humile	species	83485	Argentine ant	Insects	10	0	0
Cochliopodium kieliense	species	1512276	Amoeba	Amoebae	0	10	0

Xenylla welchi	species	2750919		Springtails	5	5	0
Sturnus vulgaris	species	9172	Common starling; tāringi	Birds	0	9	0
Aporrectodea caliginosa	species	302032	Worm	Worms	0	9	0
Heteronychus sp. NLG-2014	species	1551901		Insects	0	9	0
Porcellionides pruinosus	species	96870	Woodlouse	Crustaceans	7	0	0
Deroceras reticulatum	species	145610	Grey field slug; Grey garden slug	Molluscs	7	0	0
Folsomia candida	species	158441	Springtail	Springtails	7	0	0
Lepidocyrtus lanuginosus	species	186250	Springtail	Springtails	7	0	0
Supraphorura furcifera	species	2041972	Springtail	Springtails	0	7	0
Sarcoptiformes sp.	species	2938510		Mites and ticks	0	7	0
Compsopogon caeruleus	species	31354	Freshwater red alga	Red algae	6	0	0
Haplophthalmus danicus	species	115156	Terrestrial cave isopod	Crustaceans	6	0	0
Naupactus cervinus	species	122851	Fuller rose beetle	Insects	0	6	0
Onychiuridae sp. DPCOL101273	species	676432	Springtail	Springtails	6	0	0
Micromus tasmaniae	species	1137563	Tasmanian brown lacewing	Insects	6	0	0
Theridion gigantipes	species	1227667	Cobweb spider	Spiders	6	0	0
Sericoderus sp. CO953	species	1285982		Insects	0	6	0
Mecyclothorax sp. sc_09291	species	1901309		Insects	0	0	6
Smynthurodes betae	species	196486		Insects	0	5	0

Tornatellides boeningi	species	681099		Molluscs	0	5	0
Limnodrilus hoffmeisteri complex unlabeled lineage	subspecies	1969548	Worm	Worms	0	5	0
Lepidocyrtus fimetarius	species	2583952		Springtails	5	0	0
Psychodidae sp. BOLD:AAU4648	species	2660484		Insects	0	5	0
Derelomus postfasciatus	species	2945069		Insects	0	5	0
Ceratophysella	genus	187617	Mushroom springtail	Springtails	611	410	65
Turdus	genus	9186	Thrush; manu pango	Birds	668	316	0
Bothrioneurum	genus	188203	Worm	Worms	98	230	0
Dero	genus	66487	Worm	Worms	17	149	52
Ilyodrilus	genus	170992	Worm	Worms	129	67	0
Limnodrilus	genus	76586	Worm	Worms	70	0	58
Opogona	genus	236779	Fungus moth	Insects	70	36	6
Gobiomorphus	genus	86236	Bullies	Fish	99	0	0
Arcitalitrus	genus	1238132	Sandhopper	Crustaceans	28	50	11
Potamopyrgus	genus	145636	Mud snails	Molluscs	44	6	25
Culex	subgenus	53527		Insects	24	0	48
Amynthas	genus	195544	Worm	Worms	36	6	11
Nylanderia	genus	710235		Insects	41	12	0
Limnophyes	genus	190098	Non-biting midge	Insects	28	11	0
Tubifex	genus	6385	Worm	Worms	15	9	0
Nais	genus	74730	Sludgeworm	Worms	0	23	0
Sitona	genus	122856		Insects	21	0	0
Phytophthora	genus	4783	Water mold	Oomycetes	0	0	20

Rhopalosiphum	genus	40931	Aphid	Insects	15	0	0
Desoria	genus	281417	Springtail	Springtails	0	5	10
Folsomia	genus	158440	Springtail	Springtails	0	6	8
Psychoda	genus	7201	Drainfly; mothfly	Insects	13	0	0
Iridomyrmex	genus	121506		Insects	0	12	0
Sminthurinus	genus	187717	Springtail	Springtails	11	0	0
Pinnularia	genus	216736	Freshwater diatom	Diatoms	0	6	5
Lipaphis	genus	223994		Insects	0	0	10
Heterocypris	genus	84330		Crustaceans	0	0	9
Lepidocyrtus	genus	49178	Springtail	Springtails	8	0	0
Megascolex	genus	914210	Worm	Worms	0	8	0
Aureococcus	genus	44055	Unicellular alga	Heterokont algae	7	0	0
Spumella	genus	89043	Golden-brown alga	Heterokont algae	0	0	7
Vannella	genus	95228	Amoeba	Amoebae	0	0	7
Macrobiotus	genus	42244		Other	0	5	0
Supraphorura	genus	2041971	Springtail	Springtails	5	0	0
Tubificinae	subfamily	1780203		Worms	0	46	37
Carangidae	family	8157	Jacks	Fish	76	0	0
Phasianinae	subfamily	9072		Birds	76	0	0
Entomobryidae	family	48704	Slender springtails	Springtails	6	17	0
Aphididae	family	27482	Aphids	Insects	14	7	0
Lumbricidae	family	6392		Worms	0	16	0
Isotomidae	family	36141	Smooth springtails	Springtails	9	0	0
Chaetonotidae	family	41372		Other	9	0	0
Psychodidae	family	7197	Sandflies and mothflies	Insects	5	0	0
Helicoidea	superfamily	87862		Molluscs	0	5	0
root	no rank	1	Unidentified	Other	3000	4374	4179
Metazoa	kingdom	33208	Metazoans	Other	1364	702	297

Arthropoda	phylum	6656	Arthropods	Other	216	134	30
Neoptera	infraclass	33340	Winged insects	Insects	137	22	5
Insecta	class	50557	Insects	Other	92	58	7
Lepidoptera	order	7088	Butterflies and moths	Insects	15	79	17
Oligochaeta	subclass	6381		Worms	0	49	25
Diptera	order	7147	Flies	Insects	26	0	48
Passeriformes	order	9126	Song birds	Birds	61	0	0
Eurotatoria	class	2816136		Rotifers	36	18	6
Endopterygota	cohort	33392		Insects	34	0	0
unclassified Paraphysomonas	no rank	2617784		Heterokont algae	0	11	21
unclassified Philodina	no rank	2625787		Rotifers	0	0	28
Oomycota	phylum	4762		Heterokont algae	15	0	12
Nemertea	phylum	6217	Bootlace worms	Other	10	7	0
unclassified Isotomidae	no rank	676298		Springtails	17	0	0
Bacillariophyta	phylum	2836	Diatoms	Heterokont algae	11	0	0
unclassified Spumella	no rank	704139		Heterokont algae	9	0	0
Boreoeutheria	clade	1437010	Placental mammals	Mammals	0	9	0
Orthoptera	order	6993	Grasshoppers locusts and crickets	Insects	8	0	0
Coleoptera	order	7041	Beetles	Insects	0	0	8
unclassified Saccamoeba	no rank	2622403		Amoebae	8	0	0
Hemiptera	order	7524		Insects	0	7	0
Discosea	phylum	555280		Amoebae	0	0	6
unclassified Limnophyes	no rank	2640025		Insects	6	0	0
Ochrophyta	clade	2696291		Heterokont algae	0	6	0
Annelida	phylum	6340	Annelid worms	Other	5	0	0

Collembola	class	30001	Snow fleas	Other	5	0	0