A wide-angle photograph of a grassy hillside at the Falls Creek Altitude Training Centre. The foreground shows a dirt path curving through green grass. In the middle ground, there are several trees and a small wooden structure. The background features a dense forest of trees on a hillside under a clear blue sky. The image is partially covered by a large blue and green graphic overlay at the bottom.

Falls Creek Altitude Training Centre: Terrestrial and aquatic flora and fauna assessment

Prepared for Falls Creek Resort Management

15 September 2016

Biosis offices

AUSTRALIAN CAPITAL TERRITORY

Canberra

Floor 1, Unit 3, 38 Essington Street
Mitchell ACT 2911

Phone: (02) 6102 1200
Email: canberra@biosis.com.au

NEW SOUTH WALES

Newcastle

39 Platt Street
Waratah NSW 2298

Phone: (02) 4911 4040
Email: newcastle@biosis.com.au

Sydney

Unit 14 17-27 Power Avenue
Alexandria NSW 2015

Phone: (02) 9101 8700
Email: sydney@biosis.com.au

Wollongong

8 Tate Street
Wollongong NSW 2500

Phone: (02) 4201 1090
Email: wollongong@biosis.com.au

QUEENSLAND

Brisbane

Suite 4 First Floor, 72 Wickham Street
Fortitude Valley QLD 4006

Phone: (07) 3014 1110
Email: brisbane@biosis.com.au

VICTORIA

Ballarat

506 Macarthur Street
Ballarat VIC 3350

Phone: (03) 5304 4250
Email: ballarat@biosis.com.au

Melbourne (Head Office)

38 Bertie Street
Port Melbourne VIC 3207

Phone: (03) 8686 4800
Fax: (03) 9646 9242
Email: melbourne@biosis.com.au

Wangaratta

16 Templeton Street
Wangaratta VIC 3677

Phone: (03) 5718 6900
Email: wangaratta@biosis.com.au

Document information

Report to: Falls Creek Resort Management

Prepared by: Matt Looby
Daniel Gilmore
Anthony Steelcable
Claire Hollier

Biosis project no.: 20424

File name: 20424.Altitude.Training.Nordic.FFA.FIN02.20160915.docx

Citation: Biosis 2016. Falls Creek Altitude Training Centre, Terrestrial and Aquatic Flora and Fauna Assessment. Report for Falls Creek Resort Management. Authors: Looby M, Gilmore D, Steelcable A and Hollier C. Biosis Pty Ltd, Wangaratta. Project no. 20424

Document control

Version	Internal reviewer	Date issued
Version 01	RJS	12/01/2016
Version 02	MJAL	09/02/2016
Version 03	MJAL	15/09/2016

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- Callum Brown and Ben Derrick, FCRM
- John Traikos Architects
- Grant Jones and Bernie Dowsley, GHD
- Department of Environment, Land, Water and Planning for access to the Victorian Biodiversity Atlas and Native Vegetation Information Tools

Biosis staff involved in this project:

- Dan Lim, Martin Lee and James Shepherd for data entry and mapping

© Biosis Pty Ltd

This document is and shall remain the property of Biosis Pty Ltd. The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of the Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Disclaimer:

Biosis Pty Ltd has completed this assessment in accordance with the relevant federal, state and local legislation and current industry best practice. The company accepts no liability for any damages or loss incurred as a result of reliance placed upon the report content or for any purpose other than that for which it was intended.

Contents

Summary	IV
1. Introduction	1
1.1 Project background	1
1.2 Scope of assessment	1
1.3 Location of the study area	1
2. Methods	4
2.1 Database review	4
2.2 Definitions of significance	5
2.3 Determining likelihood of occurrence of significant species	5
2.4 Site investigation	5
2.4.1 Flora assessment	5
2.4.2 Fauna assessment	6
2.4.3 Biosis permits	7
2.5 Qualifications	7
2.6 Legislation and policy	7
2.7 Mapping	8
3. Results	9
3.1 Vegetation & fauna habitat	9
3.2 Landscape context	9
3.3 Significant species and ecological communities	13
3.3.1 EPBC Act and FFG Act listed species	13
3.3.2 DELWP advisory list of rare and threatened species	13
3.3.3 Significant ecological communities	14
3.4 Baseline surface water quality	14
3.5 Further survey recommendations	15
4. Biodiversity legislation and government policy	19
4.1 Commonwealth	19
4.1.1 Environment Protection and Biodiversity Conservation Act 1999	19
4.2 State	20
4.2.1 Flora and Fauna Guarantee Act 1988 (FFG Act)	20
4.2.2 Catchment and Land Protection Act 1994 (CaLP Act)	20
4.2.3 Planning and Environment Act 1987 (incl. Planning Schemes)	21
4.2.4 Fisheries Act 1995	22
4.2.5 Water Act 1989	22
4.2.6 Environment Protection Act 1970: State Environmental Protection Policy (Waters of Victoria) 2003	22

5. Victoria's biodiversity assessment guidelines	24
5.1 Proposed removal of native vegetation	25
5.1.1 Habitat hectares.....	25
5.2 Determining the risk-based pathway.....	26
5.3 Offset requirements	26
5.4 Proposed offset strategy	27
6. Key ecological values and recommendations.....	31
6.1 Values and potential impacts	31
6.2 Mitigation measures.....	31
References and Bibliography	34
Appendices	36
Appendix 1: Survey methods.....	37
Appendix 2: Flora.....	40
Appendix 3: Fauna	47
Appendix 4: Photos of the study area	58
Appendix 5: Vegetation impact assessment results.....	65
Appendix 6: Glossary – Biodiversity assessment guidelines	66
Appendix 7: Biodiversity impact and offset requirements report	73

List of Figures

Figure 1: Location of the study area, Falls Creek, Victoria	3
Figure 2: Ecological features of the study area, Falls Creek, Victoria	16
Figure 3: Proposed native vegetation removal and habitat zones.....	28
Figure 4: Aquatic fauna survey locations, Falls Creek, Victoria	39

List of Table

Table 1: Criteria for determining significance of species & ecological communities.....	5
Table 2: Summary of vegetation and habitat types within the study area	10
Table 3: Summary of EPBC and FFG Act listed species most likely to occur in the study area	13
Table 4: Baseline physico-chemical surface water quality parameters (see Appendix 1, Figure 4).....	14
Table 5: Baseline Macroinvertebrate indices (see Appendix 1, Figure 4)	15
Table 6: Assessment of project in relation to the EPBC Act	19
Table 7: Summary of DELWP Biodiversity Impacts and Offset Requirements report	26

Summary

Biosis Pty Ltd was commissioned by Falls Creek Resort Management to undertake a flora and fauna assessment of infrastructure and services proposed for construction of an Altitude Training Centre ('the centre'). The centre is centred on the existing Nordic Bowl precinct to the south of the village and will involve construction of a sports oval, multi-use building, services, drainage, an upgrade to the Bogong High Plains Road from Windy Corner and improving access along the Aqueduct Trail from Wombat's Ramble ski-run.

Ecological values

The study area supports a mosaic of native sub-alpine vegetation and disturbed areas dominated by introduced vegetation. This mosaic pattern is typical of historically disturbed areas and the developed ski field at Falls Creek. Key ecological values identified within the study area are as follows:

- 0.413 Habitat hectares of native vegetation with a strategic biodiversity score of 0.967.
- Examples of one significant ecological community, Alpine Sphagnum Bogs and Associated Fens Community, which is listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. This community is synonymous with the Alpine Bog Community which is listed under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act).
- Habitat for the Alpine Stonefly *Thaumatoperla alpina* and Broad-toothed Rat *Mastacomys fuscus mordicus*, both of which are listed under the *Environment Protection and Biodiversity Conservation Act 1999*. Alpine Stonefly may occur in sedgeland, minor tributaries, created waterways and gullies surrounding, and downstream of, the study area. Indirect evidence of Broad-toothed Rat was recorded in woodland and heathland vegetation.
- Habitat for four fauna species listed as threatened under the *Flora and Fauna Guarantee Act 1988*: Alpine Bog Skink *Pseudemoia cryodroma*, Dingo *Canis lupus dingo*, Alpine Water Skink *Eulamprus kosciuskoi* and Alpine Spiny Crayfish *Euastacus crassus*.
- Modelled habitat for 58 species listed as rare or threatened on a Victorian Advisory List by the Department of Environment, Land, Water and Planning.

Government legislation and policy

An assessment of the project in relation to key biodiversity legislation and policy is provided and summarised below.

Legislation / policy	Relevant ecological feature on site	Permit / approval required	Notes
EPBC Act	The site supports one listed threatened ecological community and habitat for two listed species.	Referral recommended	Potential for significant impacts on matters of national environmental significance can be reduced if appropriate mitigation measures and design responses are implemented. A referral is recommended to provide legal certainty for FCRM and the project.

Legislation / policy	Relevant ecological feature on site	Permit / approval required	Notes
FFG Act	Protected flora and listed ecological community occur, or are likely to occur, in the study area on public land.	A Protected Flora Permit will be required. Actions required to avoid and minimise impacts on listed species.	Study area occurs on Alpine Resort Crown land.
Planning & Environment Act	All indigenous vegetation to be cleared.	Planning permit required, including permission to remove, destroy or lop native vegetation. Permit application needs to address provisions of the Alpine Resorts Planning Scheme.	An assessment against Victoria's biodiversity assessment guidelines has been undertaken for the project.
CaLP Act	Four noxious weeds and three pest animals present.	None.	
Water Act	Rocky Valley Creek and the Aqueduct (Frying Pan Raceline)	North East CMA Works on Waterways will be required.	Consult with North East CMA to verify requirements to prepare a works on waterway permit.
Fisheries Act	-	-	No permit required
SEPP (WoV)	Aqueduct and tributary of Rocky Valley Creek.	No permit required.	Comply with policy to ensure objectives of SEPP are achieved.

Permitted clearing of native vegetation: Biodiversity assessment guidelines (the Guidelines)

Based on the current design, the proposed development will require the removal of 0.615 hectares of native vegetation from within an area identified as location C. Therefore, the planning permit application will be assessed in the high risk-based pathway. The strategic biodiversity score of the native vegetation to be removed is 0.967.

If a permit is granted, the offset requirements would be a total of 3.199 specific biodiversity equivalence units (SBEU) consisting of:

- 0.524 SBEU for White Billy-buttons
- 0.666 SBEU for Alpine Stork's Bill
- 0.801 SBEU for Rusty Daisy-bush
- 0.728 SBEU for Alpine Bootlace Bush
- 0.056 SBEU for Bogong Sally
- 0.424 SBEU for Snowfield Groundsel.

An offset strategy has been drafted by FCRM for various development projects in the resort. The capacity of this strategy to meet the offset requirements of the current project will be verified and the strategy will need to accompany the planning permit application as required by the Alpine Resorts Planning Scheme. The

strategy in its current draft form demonstrates that no net loss can be achieved for other projects in the resort, including Stages 3 and 4 of the recently approved mountain bike project, by protecting and managing vegetation at a number of locations within the resort. An offset site on Frying Pan Spur has mapped important habitat for many species for which specific offsets are required and can therefore yield SBEU gains. FCRM has commissioned a detailed offset plan to be completed for the resort by April 2016 and SBEU credits will be registered and traded through the Native Vegetation Credit Register.

Recommendations

Key recommendations and the next steps for this project are:

- Minimise the removal of Alpine Sphagnum Bog vegetation and Broad-toothed Rat habitat through design and construction responses. Consider use of retaining walls and other engineering solutions to minimise the need for large cut and fill batters.
- Develop a storm water management system that minimises any changes to the flow regime and quality of existing run-off from the Nordic Bowl site. This is critical for minimising impacts on the gully below (east) of the Nordic Bowl that drains directly to Rocky Valley Creek.
- Finalise the design for the Bogong High Plains Road upgrade and maximise the use of existing disturbed areas adjacent to the road for all upgrade and drainage works.
- Retain native vegetation cover on the upslope area of the proposed Aqueduct upgrade.
- Prior to construction develop project specific protocols in the Site Environmental Management Plan that cover:
 - Mitigation of impacts on Alpine Stonefly, Broad-toothed Rat and Alpine Sphagnum Bogs during and after construction.
 - Stabilisation of all disturbed areas and a revegetation plan.
 - Ongoing monitoring of stormwater flows, including water volume and quality.
- Once the Falls Creek offset strategy and plan is finalised, implement native vegetation offsets.

1. Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by Falls Creek Resort Management (FCRM) to undertake a flora and fauna assessment of the Nordic Bowl area south of the Falls Creek village. Falls Creek Resort Management is investigating the potential to develop the Nordic Bowl area as a multi-use summer training centre and to improve winter sports opportunities and access. The project is referred to as the Altitude Training Centre and involves construction of a sports field, development of new multi-use building, car parking, installation of services, drainage works, safety upgrades to the Bogong High Plains Road from Windy Corner and improving access along the Aqueduct Trail from Wombat's Ramble ski-run.

1.2 Scope of assessment

The objectives of this investigation are to:

- Describe the vascular flora (ferns, conifers, flowering plants), vertebrate fauna (mammals, birds, reptiles, frogs, fishes) and decapod crustacea (e.g. crayfish).
- Map native vegetation and other habitat features.
- Conduct a vegetation quality assessment.
- Review the implications of relevant biodiversity legislation and policy, including Victoria's Permitted clearing of native vegetation: Biodiversity assessment guidelines ('the Guidelines').
- Identify potential implications of the proposed development and provide recommendations to assist with development design.
- Recommend any further assessments of the site that may be required (such as a vegetation impact assessment or targeted searches for significant species).

1.3 Location of the study area

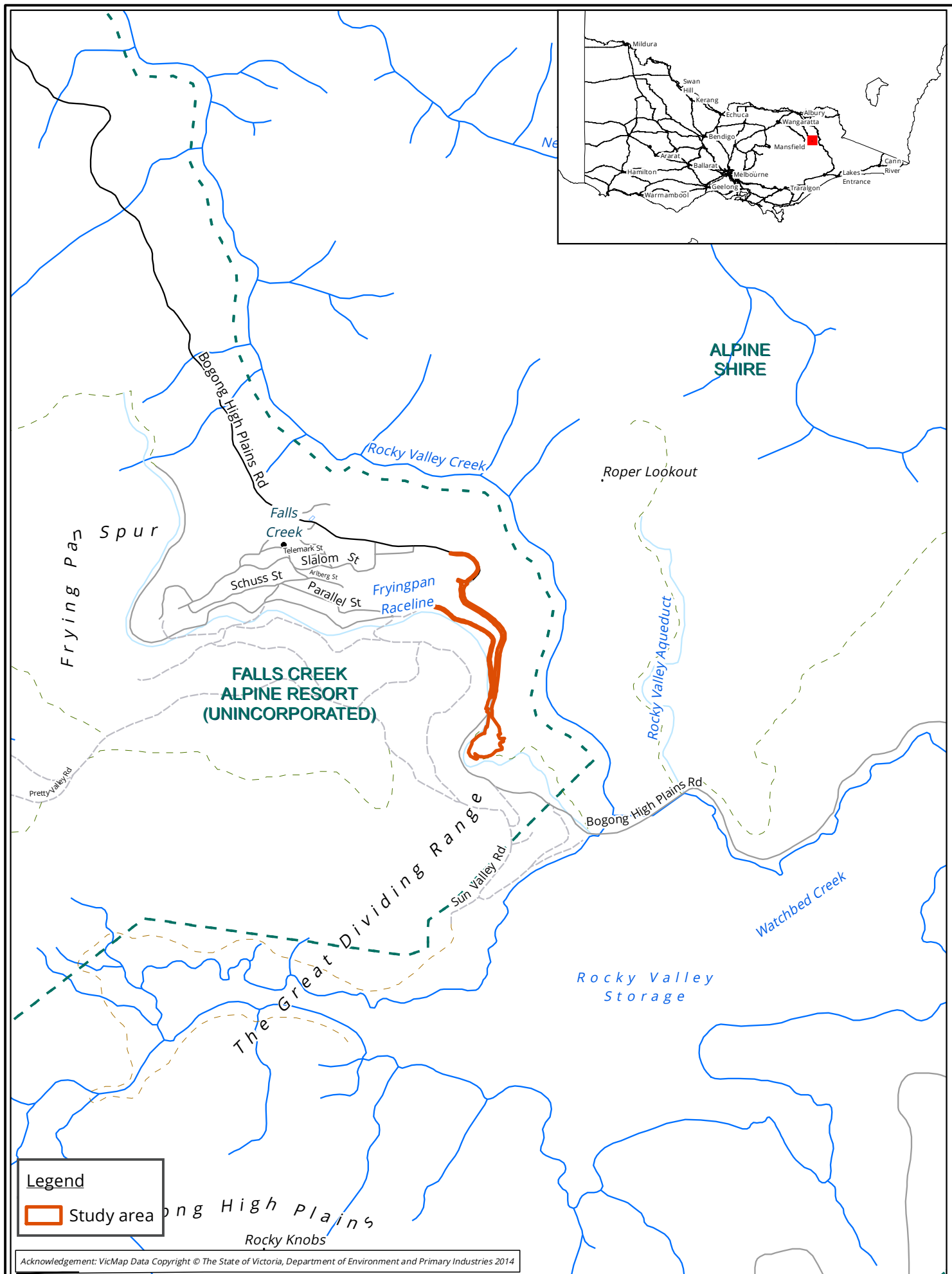
The study area, which consists of the Nordic Bowl and land adjacent to the Bogong High Plains Road and Aqueduct, is located within the Falls Creek Alpine Resort in northeast Victoria. Specifically, the study area includes (Figure 1):

- Land and areas of remnant native vegetation below the Aqueduct (Frying Pan Raceline) at the Nordic Bowl south of the village
- An assessment corridor of 3 metres either side of the Bogong High Plains Road between the Nordic Bowl and Windy Corner car park
- The Aqueduct Trail and Aqueduct waterway between the Bogong High Plains Road crossing at the Nordic Bowl and the Wombat's Ramble ski-run.

The study area is within the:

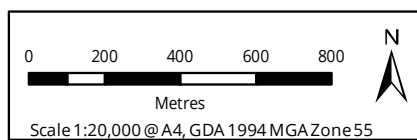
- Victorian Alps Bioregion
- Kiewa River Basin

-
- Management area of the North East Catchment Management Authority
 - Falls Creek Alpine Resort Planning Scheme.



Biosis Pty Ltd
Ballarat, Brisbane, Canberra, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 20424,
Date: 04 February 2016,
Checked by: MJAL, Drawn by: JMS, Last edited by: jshepherd
Location: P:\20400s\20424\Mapping\



2. Methods

2.1 Database review

In order to provide a context for the study area, information about flora and fauna from within 5 kilometres of the study area (the 'local area') was obtained from relevant biodiversity databases. Aquatic fauna records were searched from the sub-catchments of Pretty Valley Creek and Rocky Valley Creek of the Kiewa River Basin. Records from the following databases were collated and reviewed:

- Flora Information System (FIS) which includes records from the Victorian Biodiversity Atlas 'VBA_FLORA25, FLORA100 & FLORA Restricted' August 2015 © The State of Victoria, Department of Environment, Land, Water and Planning (DELWP).
- Victorian Biodiversity Atlas 'VBA_FAUNA25, FAUNA100 & FAUNA Restricted' August 2015 © The State of Victoria
- DELWP Biodiversity Interactive Map (BIM)
- DELWP Habitat Importance Models
- Protected Matters Search Tool of the Australian Government Department of the Environment and Energy for matters protected by the EPBC Act.

Other sources of biodiversity information were examined including:

- DELWP Native Vegetation Information Management (NVIM) system
- DELWP's native vegetation support team was provided with site-based spatial information in order to generate a Biodiversity Impact Offset Requirement (BIOR) report for the study area.

The following reports from previous Biosis surveys at Falls Creek were also reviewed:

- Proposed altitude training facilities, Falls Creek, Flora, Fauna and Habitat Hectare (Biosis 2010)
- Falls Creek Stage 3 Mountain Bike Trail Project Flora and Fauna Assessment, Biosis (2014)
- Falls Creek Stage 4 Mountain Bike Trail Project Flora and Fauna Assessment, Biosis (2015a)
- Falls Creek Water Security Project Flora and Fauna Assessment, proposed groundwater bore, Biosis (2015b).

2.2 Definitions of significance

The significance of a species or ecological community is determined by its listing status under Commonwealth or State legislation or policy (Table 1).

Table 1: Criteria for determining significance of species & ecological communities

Significance	
National	Listed as critically endangered, endangered or vulnerable under the <i>Environment Protection and Biodiversity Conservation Act 1999</i>
State	Listed as critically endangered, endangered, vulnerable or rare in Victoria on a DELWP Advisory List (DSE 2013a; DEPI 2014a) Listed as threatened under the <i>Flora and Fauna Guarantee Act 1988</i>

Lists of significant species generated from the databases are provided in Appendix 2 (flora) and Appendix 3 (fauna) and the species have been assessed to determine their likelihood of occurrence based on the process outlined below. These species are not discussed further in this report unless they:

- have a medium or greater likelihood of occurrence
- are flora species listed as threatened under the FFG Act with a medium or greater likelihood of occurrence
- have habitat on the site according to the Habitat Importance Modelling prepared by DELWP.

2.3 Determining likelihood of occurrence of significant species

Likelihood of occurrence indicates the potential for a species or ecological community to occur regularly within the study area. It is based on expert opinion, information in relevant biodiversity databases and reports, and an assessment of the habitats on site. Likelihood of occurrence is ranked as negligible, low, medium, high or recorded. Those species for which there is little or no suitable habitat within the study area are assigned a likelihood of low or negligible and are not considered further.

Species which have at least medium likelihood of occurrence are given further consideration in this report. The need for targeted survey for these species is also considered.

2.4 Site investigation

2.4.1 Flora assessment

A preliminary site inspection was undertaken on 28 October 2015 and the detailed flora assessment was completed from 11-13 November 2015. The proposed Aqueduct Trail upgrade was further investigated on 21 January 2016. A list of flora species was collected (# U4094600) and will be submitted to DELWP for incorporation into the Victorian Biodiversity Atlas. Planted species have not been recorded unless they are naturalised.

Native vegetation is defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses' (Clause 72).

The Guidelines classify native vegetation into two categories (DEPI 2013a):

- A **remnant patch** of native vegetation (measured in hectares) is either:
 - An area of native vegetation, with or without trees, where at least 25 per cent of the total perennial understorey cover is native plants.
 - An area with three or more indigenous canopy trees where the tree canopy cover is at least 20 per cent.

Remnant patch vegetation is classified into ecological vegetation classes (EVCs). An EVC contains one or more floristic (plant) communities, and represents a grouping of broadly similar environments. Definitions of EVCs and benchmarks (condition against which vegetation quality at the site can be compared) are determined by DELWP.

- A **scattered tree** is defined as (extent measured by number of trees):
 - An indigenous canopy tree that does not form part of a remnant patch of native vegetation.

A canopy tree is a mature tree that is greater than 3 metres in height and is normally found in the upper layer of a vegetation type. Ecological vegetation class descriptions provide a list of the typical canopy species. A condition score and extent is applied to each scattered tree based on information provided by DELWP's NVIM.

A Vegetation Quality Assessment was undertaken for all remnant patch native vegetation identified in the study area. This assessment is consistent with DELWP's Habitat hectare method (DSE 2004) and the Guidelines (DEPI 2013a). For the purposes of this assessment the limit of the resolution for the Habitat hectare assessment process is taken to be 0.001 Habitat hectares (Hha). That is, if native vegetation is present with sufficient cover but its condition and extent would not result in the identification of at least 0.001 Habitat hectares then that vegetation will not be mapped or assessed as a separate habitat zone.

It should be noted that EVC typology and benchmarking remains unresolved for parts of the Victorian Alps bioregion, especially EVC 44 (Treeless Vegetation aggregate). On this basis, draft EVC benchmarks have been used in assessments where appropriate and available.

Species nomenclature for flora follows the Flora Information System (FIS).

2.4.2 Fauna assessment

The study area was investigated on 21-22 October 2015 (aquatic) and 11-13 November 2015 (terrestrial) to determine its values for fauna. These values were determined primarily on the basis of the types and qualities of habitat(s) present. All species of fauna observed during the assessment were noted and active searching for fauna was undertaken. This included direct observation, searching under rocks and logs, examination of tracks and scats and identifying calls. Particular attention was given to searching for significant species and their habitats. Fauna species were recorded with a view to characterising the values of the site and the investigation was not intended to provide a comprehensive survey of all fauna that has potential to utilise the site over time.

The investigation of fauna incorporated aquatic habitat assessment (including *in situ* water quality measurement) at eight sites and aquatic fauna survey at five sites located on Rocky Valley Creek in the vicinity and downstream of the study area. Standard fish and invertebrate sampling techniques including dip netting, electrofishing and bait traps were utilised. The details of each site surveyed and the methods utilised are outlined in Appendix 1, Figure 4. Fauna records will be submitted to DELWP for incorporation into the Victorian Biodiversity Atlas.

As a component of the aquatic assessment, baseline assessments of water quality were undertaken to support future monitoring requirements. Baseline water quality parameters included macroinvertebrate indices and physico-chemical water quality.

Biosis Standard Operating Procedures provide a comprehensive outline of methods used for fauna survey and are available on request.

2.4.3 Biosis permits

Biosis undertakes flora and fauna assessments under the following permits and approvals:

- Research Permit/Management Authorisation and Permit to Take Protected Flora & Protected Fish issued by DELWP under the *Wildlife Act 1975*, *Flora and Fauna Guarantee Act 1988* and *National Parks Act 1975* (Permit number 10007569).
- Approvals 07.15 and 14.12 from the Wildlife and Small Institutions Animal Ethics Committee.
- Permit RP1220 issued by DELWP (Fisheries Victoria) under the *Fisheries Act 1995*.

2.5 Qualifications

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are a number of reasons why not all species will be detected at a site during survey, such as low abundance, patchy distribution, species dormancy, seasonal conditions, and migration and breeding behaviours. In many cases these factors do not present a significant limitation to assessing the overall biodiversity values of a site.

The terrestrial flora and fauna assessment was conducted in spring and the site was revisited in summer, which are considered appropriate times for survey in alpine environments. The weather conditions were cool and wet during the spring fauna survey period. Observations on 11, 12 and 13 November from Falls Creek automatic weather station (station 083084) indicate that temperatures ranged between 6.9°C and 14.7°C and winds were light to moderate from the west to north-west. A total of 47.6 millimetres of rain was recorded over the three days. The heavy rain and cloudy conditions are likely to have limited reptile activity, meaning these animals were less likely to be detected. Nevertheless, the survey effort was sufficient to assess the ecological values of the study area.

Biodiversity Assessment Reports (BAR) and Biodiversity Impact Offset Requirement (BIOR) reports are prepared through DELWP's NVIM system or requested through DELWP's Native Vegetation Transitional Guidance team. Biosis supplies relevant site-based spatial information as inputs to DELWP and we are entirely reliant on DELWP's output reports for moderate and high risk pathway applications. Biosis makes every effort to ensure site and spatial information entered into the NVIM, or supplied to DELWP, is an accurate reflection of proposed native vegetation removal.

2.6 Legislation and policy

The implications for the project were assessed in relation to key biodiversity legislation and policy including:

- Matters listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), associated policy statements, significant impacts guidelines, listing advice and key threatening processes.
- Threatened taxa, communities and threatening processes listed under Section 10 of the *Flora & Fauna Guarantee Act 1988* (FFG Act); associated action statements and listing advice.
- Permitted clearing of native vegetation: Biodiversity assessment guidelines (DEPI 2013a).

- *Planning and Environment Act 1987* – specifically Clauses 12.01-2, 52.17 and 66.02 and Overlays in the Alpine Resorts Planning Scheme.
- Noxious weeds and pest animals lists under the *Catchment and Land Protection Act 1994* (CaLP Act)
- *Fisheries Act 1995*.
- *Water Act 1989*.
- *Environment Protection Act 1971*: State Environmental Protection Policy (Waters of Victoria) 2003.

2.7 Mapping

Spatial data for the study area and the development footprint were provided by FCRM, GHD and John Traikos Architects.

Vegetation polygon mapping was conducted using a Trimble DGPS with data post-processed to sub 1 metre accuracy. Mapping has been produced using a Geographic Information System (GIS). Electronic GIS files which contain our flora and fauna spatial data are available to incorporate into design concept plans.

Point data for survey sites was collected using hand-held (uncorrected) GPS units (WGS84) and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration.

3. Results

The ecological features of the study area are described below and mapped in Figure 2.

Species recorded during the flora and fauna assessment are listed in Appendix 2 (flora) and Appendix 3 (fauna). Unless of particular note, these species are not discussed further.

Those species recorded or predicted to occur in the local area is also provided in those appendices, along with an assessment of the likelihood of the species occurring within the study area.

3.1 Vegetation & fauna habitat

The study area supports a mosaic of native alpine vegetation and disturbed areas dominated by introduced vegetation. This pattern is typical of the developed ski field areas at Falls Creek or areas subject to historical disturbance for the Kiewa Hydroelectricity Scheme and road construction. A water race (the Aqueduct) has been constructed and runs along the contour above the Nordic Bowl. This feature effectively provides a hydrological barrier between gullies upstream and downstream of the study area. A multi-use trail follows the water race and gives access to the Nordic Bowl site.

Vegetation and habitat quality is a function of prevailing environmental factors and ongoing land uses. Vegetation patterns in the study area are typical of the sub-alpine environment at Falls Creek with woodland growing in lower elevation sheltered positions with deeper soils, heathlands on exposed rocky substrates and wetland vegetation in drainage lines subject to permanent waterlogging. These vegetation types are commonly subjected to persistent winter snow cover. Fauna habitats that occur within and adjacent to the study area can be characterised according to vegetation communities and other features such as surface rock density or presence of fallen timber.

The vegetation and habitat types in the study area are described in Table 2 and mapped in Figure 2. Photos of site features, vegetation types and habitats are provided in Appendix 4.

3.2 Landscape context

The study area lies within the alpine resort and comprises a mosaic of native vegetation and disturbed areas. Habitats within the alpine resort are mostly contiguous with the adjacent Alpine National Park. Previous disturbances to the study area are mostly concerning engineering works for hydroelectricity infrastructure and water control, ski field development and road making.

Table 2: Summary of vegetation and habitat types within the study area

EVC, condition state	Location, structure, floristics and status	Fauna habitat features and values
<p>Sub-alpine Woodland EVC 43</p> <p>See photos in Appendix 4</p>	<p>Location: Patches within the Nordic Bowl and along the BHP Road, including areas burnt in 2003 bushfire.</p> <p>Structure: Open woodland to 8 m grading to shrubland (where canopy trees have been historically removed) with a shrubby to grassy understorey.</p> <p>Character species: Overstorey of Bogong Sallee <i>Eucalyptus pauciflora</i> subsp. <i>hedraia</i> with a very dense to sparse understorey dominated by Alpine Orites <i>Orites lancifolia</i>, Leafy Bossiaea <i>Bossiaea foliosa</i>, Alpine Mint-bush <i>Prostanthera cuneata</i>, Dusty Daisy-bush <i>Olearia phlogopappa</i> var. <i>flavescens</i> and Alpine Pepper <i>Tasmannia xerophila</i>. The dense shrub layer results in a sparse ground layer of Ledge Grass <i>Poa hothamensis</i>, Common Grass-sedge <i>Carex breviculmis</i>, Mountain Pennywort <i>Hydrocotyle algida</i>, Pale Everlasting <i>Coronidium monticola</i> and Mother Shield-fern <i>Polystichum proliferum</i>.</p> <p>Weeds: Moderate weed cover of Sheep Sorrel <i>Acetosella vulgare</i>, Greater Bird's-foot Trefoil <i>Lotus uliginosus</i>, Brown-top Bent <i>Agrostis capillaris</i>, Timothy Grass <i>Phleum pratense</i> and Flatweed <i>Hypochaeris radicata</i>.</p> <p>Listed ecological community: No</p>	<p>Description: Sub-alpine Woodland provides a diversity of niches for fauna, including foraging resources for birds such as Flame Robin <i>Petroica phoenicea</i>, Gang-gang Cockatoo <i>Callocephalon fimbriatum</i> and Crescent Honeyeater <i>Phylidonyris pyrrhopterus</i>. The dense shrubby ground-layer provides protective cover for locally common small mammals including Dusky Antechinus <i>Antechinus swainsonii</i> and Bush Rat <i>Rattus fuscipes</i>.</p> <p>Threatened fauna: Good quality habitat present for the nationally significant Broad-toothed Rat <i>Mastacomys fuscus</i> throughout this vegetation type. Threatened reptiles including Alpine Bog Skink <i>Pseudemoia cryodroma</i> are also likely to be present, and may make use of increased foraging and basking opportunities along disturbed edges.</p>
<p>Sub-alpine Shrubland EVC 42</p> <p>See photos in Appendix 4</p>	<p>Location: Patches within the Nordic Bowl and along the BHP Road.</p> <p>Structure: Closed heathland to 2 m tall.</p> <p>Character species: Shrubs including Alpine Orites, Alpine Mint-bush, Showy Bossiaea, Alpine Grevillea <i>Grevillea australis</i> and Alpine Pepper. Low graminoid and herb cover consisting of Common Grass-sedge, Ledge Grass, Horny Snow-grass <i>Poa fawcettiae</i>, Pale Everlasting and Mountain Pennywort.</p> <p>Weeds: Low to moderate cover of Red Fescue, Brown-top Bent and Sheep Sorrel.</p> <p>Listed ecological community: No</p>	<p>Description: Sub-alpine Shrubland provides protective cover for small ground-dwelling mammals. Reptiles may also be present, particularly where boulders and breaks in the shrub layer provide opportunities for thermoregulation.</p> <p>Threatened fauna: good quality habitat for Broad-toothed Rat.</p>

EVC, condition state	Location, structure, floristics and status	Fauna habitat features and values
<p>Sub-alpine Wet Heathland EVC 210</p> <p>See photos in Appendix 4</p>	<p>Location: Along low to moderate gradient drainage lines on waterlogged soils on the western side of the Nordic Bowl.</p> <p>Structure: Closed heathland/sedgeland to 1 m tall Occurs as a mosaic with EVC 42 and Sub-alpine Wet Sedgeland EVC 917 below the tree-line. Peat Moss cover is variable as a result of drainage gradient, disturbance and possible loss during severe fires in 2003.</p> <p>Character species: Tall Sedge <i>Carex appressa</i>, Swamp Heath <i>Epacris paludosa</i>, Alpine Bottlebrush <i>Callistemon pityoides</i>, Alpine Baeckea <i>Baeckea gunniana</i>, Silver Snow-daisy <i>Celmisia tomentella</i>, Alpine Water-fern <i>Blechnum penna-marina</i> subsp. <i>alpina</i>, Spreading Rope-rush <i>Empodisma minus</i>, Willow-herbs <i>Epilobium</i> spp., Shining Pennywort <i>Hydrocotyle sibthorpioides</i>, Peat Moss <i>Sphagnum</i> sp., Candle Heath <i>Richea continentis</i>, Carpet Sedge <i>Carex jackiana</i> and Bog Snow-grass <i>Poa costiniana</i>.</p> <p>Weeds: Moderate to high cover of Soft Rush <i>Juncus effusus</i>, Red Fescue <i>Festuca rubra</i> and Brown-top Bent.</p> <p>Listed ecological community: Yes, meets community description for Nationally-listed Alpine Sphagnum Bogs and Associated Fens and State-listed Alpine Bog Community.</p>	<p>Description: Wet heathland and sedgeland habitat located within natural drainage lines below the aqueduct, and surrounded by Sub-alpine Woodland.</p> <p>Threatened fauna: Good quality habitat for Broad-toothed Rat and Alpine Bog Skink. Some potential for the state significant Alpine Water Skink <i>Eulamprus kosciuskoi</i> to occur in these areas, however the species is more likely to be associated with sphagnum bogs located elsewhere.</p>
<p>Sub-alpine Wet Sedgeland EVC 917</p> <p>See photos in Appendix 4</p>	<p>Location: Below the Nordic Bowl in gully that drains to Rocky Valley Creek.</p> <p>Structure: Dense sedgeland growing along low to moderate gradient drainage lines with scattered shrubs to 1.5 m tall.</p> <p>Character species: Dominated by Tall Sedge with scattered Tussock-grasses <i>Poa</i> spp. Sparse cover of other species including Alpine Bottlebrush, Alpine Water-fern, Mother Shield-fern, Spreading Rope-rush, Willow-herbs. A low cover of Peat Moss <i>Sphagnum</i> sp. occurs in this EVC.</p> <p>Weeds: Moderate to high cover of Soft Rush, Grey Sallow <i>Salix cinerea</i> and Greater Bird's-foot Trefoil.</p> <p>Listed ecological community: partially representative of Nationally-listed Alpine Sphagnum Bogs and Associated Fens and State-listed Alpine Bog Community.</p>	<p>Description: Wet sedgeland habitat located within natural drainage lines. Rocks and coarse woody debris are usually present. Common reptiles such as Highland Copperhead <i>Austrelaps ramsayi</i> and Southern Water Skink <i>Eulamprus tympanum</i> are likely to be present and make use of these areas.</p> <p>Threatened fauna: Good quality habitat for Broad-toothed Rat and Alpine Bog Skink. .</p>

EVC, condition state	Location, structure, floristics and status	Fauna habitat features and values
<p>Predominately introduced vegetation (no EVC).</p> <p>See photos in Appendix 4</p>	<p>Structure: Grassland-herbland and disturbed areas including existing tracks and roads dominated by modified substrates or introduced grasses with generally less than 25% cover of indigenous species. Occurs in a variety of landscape settings subject to significant historical and ongoing modification.</p> <p>Character species: Various introduced grasses and herbs.</p> <p>Listed ecological community: Not applicable</p>	<p>Description: Highly modified areas that provide limited resources for fauna. Existing tracks and roads are likely to be regularly utilised by introduced predators such as Red Fox <i>Vulpes vulpes</i>.</p> <p>Threatened fauna: Limited opportunities for threatened fauna species due to the highly modified and disturbed nature of these areas, and lack of vegetative cover.</p>
<p>Waterways within and immediately downstream of the study area.</p>	<p>Location: Frying Pan Race line (Aqueduct) flows adjacent to and within the study area. A tributary of Rocky Valley Creek occurs downslope of the study area to the east.</p> <p>Structure: Frying Pan Race line is an engineered channel/pipeline that contains limited aquatic habitat components. Dominant native species include Willow herbs <i>Epilobium</i> spp. and Club-sedges <i>Isolepis</i> spp. Introduced species dominate areas of disturbed soil along the edge and in the water including Yorkshire Fog <i>Holcus lanatus</i>, Browntop Bent, Jointed Rush <i>Juncus articulatus</i>, Soft Rush, Greater Bird's-foot Trefoil, White Clover <i>Trifolium repens</i> and Sweet Vernal-grass <i>Anthoxanthum odoratum</i>.</p> <p>The tributary of Rocky Valley Creek below the Nordic Bowl is a fast flowing incised gully with a series of riffles and terraces interspersed with glides, which are fringed by overhanging vegetation.</p> <p>Listed ecological community: Sections of the Aqueduct have been colonised by Peat Moss <i>Sphagnum cristatum</i>. These areas are not considered to represent the EPBC Act listed ecological community as they are not a naturally-occurring features of the landscape and are an artefact of the permanently wet environment created by the human-made Aqueduct.</p>	<p>Description: Frying Pan Race line contains limited value for aquatic fauna due to high introduced fish numbers. The tributary of Rocky Valley Creek contains a diverse range of high quality aquatic habitat components.</p> <p>Threatened fauna: No threatened species habitat is present within Frying Pan Race line. The Alpine Stonefly <i>Thaumatoperla alpina</i> is considered likely to occur within the tributary of Rocky Valley Creek. Habitat is also considered suitable for the Alpine Spiny Crayfish <i>Euastacus crassus</i> within the Rocky Valley Creek tributary</p>

3.3 Significant species and ecological communities

3.3.1 EPBC Act and FFG Act listed species

Lists of EPBC Act and FFG Act listed species recorded or predicted to occur within 5 kilometres of the study area or from the relevant catchment (aquatic species) are provided in Appendix 2 (flora) and Appendix 3 (fauna). An assessment of the likelihood of these species occurring in the study area and an indication of where within the site (i.e. which habitats or features of relevance to the species) is included. A summary of those species recorded or with a medium or higher likelihood of occurring in the study area is provided in Table 3.

Table 3: Summary of EPBC and FFG Act listed species most likely to occur in the study area

Species	Listing status	Area of value within the study area
Alpine Stonefly	Listed under EPBC Act	This species was collected in the McKay Creek, but not recorded within Rocky Valley Creek. Suitable habitat present within Rocky Valley Creek and this species is considered likely to be present.
Broad-toothed Rat	Listed under EPBC Act Listed under FFG Act	Evidence of this species was recorded in patches of Sub-alpine Woodland but likely to also occur in Sub-alpine Wet Heathland and sedgeland.
Dingo	Listed under FFG Act	The study area does not support habitat of high value to this species but it is likely to use the study area occasionally
Alpine Bog Skink	Listed under FFG Act	This species may be present in various habitat types.
Alpine Water Skink	Listed under FFG Act	This species may be present in areas of Sub-alpine Wet Heathland.
Alpine Spiny Crayfish	Listed under FFG Act	The species is considered likely to occur within Rocky Valley Creek; however no individuals were collected during surveys.

3.3.2 DELWP advisory list of rare and threatened species

To support decision making under the Guidelines, DELWP has produced models for Victoria describing the extent of habitat for most listed rare or threatened species. These models are called 'habitat importance models' and they assign a 'habitat importance score' to a location based on the importance of that location in the landscape as habitat for a particular rare or threatened species, in relation to other suitable habitat for that species (DEPI 2013a).

Under the Guidelines, these models form the basis for determining the impact of potential native vegetation clearing on rare and threatened species. The models only apply where a clearing proposal is considered on the moderate or high risk-based application pathways. The habitat importance scores are used to calculate the type and extent of biodiversity offsets required for native vegetation removal that impacts on individual rare or threatened species habitat for moderate or high risk application pathways.

A list of the species for which habitat is modelled in the study area is provided in the BIOR (Appendix 7). Of the species with modelled habitat, 12 were recorded during the current survey.

Determination of the requirement for a specific offset based on the extent of impact to one or more rare or threatened species is addressed in Section 5.

Sixteen rare flora species and one endangered mammal species listed on the DELWP Advisory list were recorded during the site assessment (Appendix 2 and 3).

3.3.3 Significant ecological communities

Sub-alpine Wet Heathland and Sub-alpine Wet Sedgeland EVC 917 are representative of the EPBC Act threatened ecological community 'Alpine Sphagnum Bogs and Associated Fens' and the FFG Act 'Alpine Bog community'. Most examples of these two listed communities are at their lower elevation limit and only sporadically contain Peat Moss *Sphagnum* spp., which is a defining characteristic of this community. Furthermore, examples of these communities close to the Falls Creek Village are generally modified as a result of alterations to hydrology (mainly storm water input) and weed invasion.

No other threatened ecological communities were recorded in the study area.

3.4 Baseline surface water quality

The collection of water quality parameters was undertaken to establish the baseline condition of waterways subject to potential impacts associated with the proposal. These baseline measurements will underpin future and ongoing monitoring of surface water quality, pending project approval. These baseline surface water quality parameters are presented in Table 4 and Table 5.

Table 4: Baseline physico-chemical surface water quality parameters (see Appendix 1, Figure 4)

Site code	pH	Total Nitrogen (mg N/L)	Total Phosphorous (mg P/L)	Total Kjeldahl Nitrogen (mg/L)	Nitrogen (mg N/L)	Turbidity	Dissolved Oxygen (mg/L)	Electrical Conductivity (mS/ cm ²)
RVC-US1	6.9	0.29	0.008	0.14	0.150	0	7.19	0.025
RVC-DS1	7.2	0.17	< 0.005	0.06	0.110	0	6.53	0.022
RVT-DS1	6.7	0.47	0.011	0.13	0.350	0	8.35	0.008
MCC-US1	6.2	0.16	0.014	0.11	0.048	0	9.86	0.004
MCC-DS1	4.7	0.90	0.120	0.21	0.690	0	9.14	0.053
FPR-US1	5.6	0.45	0.005	0.12	0.330	0	10.96	0.005
FPR-DS1	6.2	0.18	< 0.005	0.10	0.087	0	10.35	0.005
RVD	6.5	0.26	0.008	0.16	0.100	0	10.79	0.005

Table 5: Baseline Macroinvertebrate indices (see Appendix 1, Figure 4)

Site code	Signal2 score	Number of taxa	EPT score
RVC-US1	6.59	18	8
RVC-DS1	5.8	18	8
RVT-DS1	7.21	21	12
MCC-US1	6.93	16	8
MCC-DS1	6.94	20	11

3.5 Further survey recommendations

The current survey work for terrestrial flora and fauna is considered sufficient to identify significant species and ecological communities. No further surveys are recommended based on the current project design.