Thredbo Golf Course Development
Aquatic and Riparian Ecology Impact Assessment

Kosciuszko Thredbo Pty Ltd

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1300 646 131
www.ecoaus.com.au

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Project Manager	Kathrine Pellowe
Prepared by	Ian Dixon, Erin Hodgkin and Lily Tonks
Reviewed by	Ian Dixon
Approved by	Richard Cresswell
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Template 2.8.1

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Abbreviations

Abbreviation	Description
APZ	Asset Protection Zone
BC Act	NSW *Biodiversity Conservation Act 2016*
CEMP	Construction Environmental Management Plan
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DPIRD	NSW Department of Primary Industries and Regional Development
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	NSW *Fisheries Management Act 1994*
KFH	Key fish habitat
KT	Kosciuszko Thredbo Pty Ltd
MNES	Matters of National and Environmental Significance
SEPP	State Environmental Planning Policy
SRLEP	Snowy River Local Environmental Plan 2013
SWMP	Stormwater Management Plan
VRZ	Vegetated Riparian Zone
WM Act	NSW *Water Management Act 2000*
WM Regulation	NSW Water Management (General) Regulation 2025

Executive summary

Eco Logical Australia was engaged by Kosciuszko Thredbo Pty Ltd to prepare an Aquatic and Riparian Ecology Impact Assessment to support their Development Application relating to the subdivision and development of Thredbo Golf Course, located within Kosciuszko National Park. This assessment addresses threatened fish species, populations and communities, policies and guidelines, and development controls relevant to the area, especially:

- Matters of National Environmental Significance (MNES) listed under *the Environment Protection and Biodiversity Conservation Act* (EPBC Act)
- Riparian guidelines under the *Water Management Act 2000*
- Threatened species, populations and communities listed under the *Fisheries Management Act 1994* (FM Act), and consideration of the NSW Department of Primary Industries and Regional Development (DPIRD) Fisheries Policy and Guidelines for Fish Habitat Conservation and Management (2013 update).

An assessment of significance for *Austropetalia tonyana* (alpine redspot dragonfly) and the Endangered Ecological Community, *Aquatic Ecological Community in the Catchment of the Snowy River in NSW* concluded no significant impact would result from the proposed development. No other threatened fish species, populations or communities occur, or are likely to occur, in or adjacent to the site.

The proposed works involve dredging and reclamation for stormwater outlets. There are no other instream works or obstruction to fish passage required. Authorisation for dredging and reclamation under the FM Act would be achieved through a Controlled Activity Approval under the WM Act, where notification under s.199 of the FM Act is required. Besides the small area of bank excavated for the outlets, there would be no net loss of key fish habitat, as defined under the FM Act.

The proposed footprint encroaches the inner 50% vegetated riparian zone (VRZ) of the riparian corridor. However, the majority of VRZ encroachment is on existing cleared land on the golf course. An Integrated Development Application is required for a merit-based assessment by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) Water Group for works on waterfront land.

In order to prevent any adverse effects to Thredbo River's water quality, the development must implement the mitigation measures outlined in the Stormwater Management Plan and Construction Environmental Management Plan.

1. Introduction

This report has been prepared by Eco Logical Australia Pty Ltd (ELA) for Kosciuszko Thredbo Proprietary Limited (KT). KT require an Aquatic and Riparian Impact Assessment for the proposed subdivision and development at Thredbo Golf Course, located in Kosciuszko National Park NSW. The existing golf course is located within the Thredbo Alpine Resort boundary, and the study area is shown in Figure 1.

Specific aims and objectives of this report are to:

- Identify riparian buffers triggered by the *Water Management Act 2000* (WM Act)
- Review existing literature and site data to determine the potential impacts of the development on the aquatic ecology of Thredbo River adjacent to the site
- Provide recommendations to mitigate impact during construction and operation.

Consideration has been given to DCCEEW *Controlled activities - Guidelines for riparian corridors on waterfront land* (DCCEEW, 2025b) and DPI Fisheries' *Policy and Guidelines for Fish Habitat Conservation and Management* (2013 update, Fairfull, 2013).

1.1 Proposed work

In proximity to the riparian and aquatic environment, the proposal comprises:

- Provision of Asset Protection Zones (APZs) for 18 subdivided lots
- Construction of a public road from Crackenback Drive and associated batters
- Construction of new golf course tees and greens and associated batters and mounds
- Realignment of a 40 m section of the existing riverside path for user safety
- New gravel pathway
- New concrete pathway with one (1) m high packed rock retaining wall
- Four bioretention basins for capturing sediments and pollutants prior to discharge into Thredbo River
- Three stormwater outlets designed in accordance with the DCCEEW Controlled activities - Guidelines for outlet structures on waterfront land (DCCEEW 2025a)
- Riparian vegetation removal, including:
    - A five (5) m x ~37 m strip of low heath for the construction of the new 2nd green
    - Removal of four trees to create clear shot line along the new 4th green.

The proposed civil, landscape, stormwater and drainage designs are shown in Appendix A.

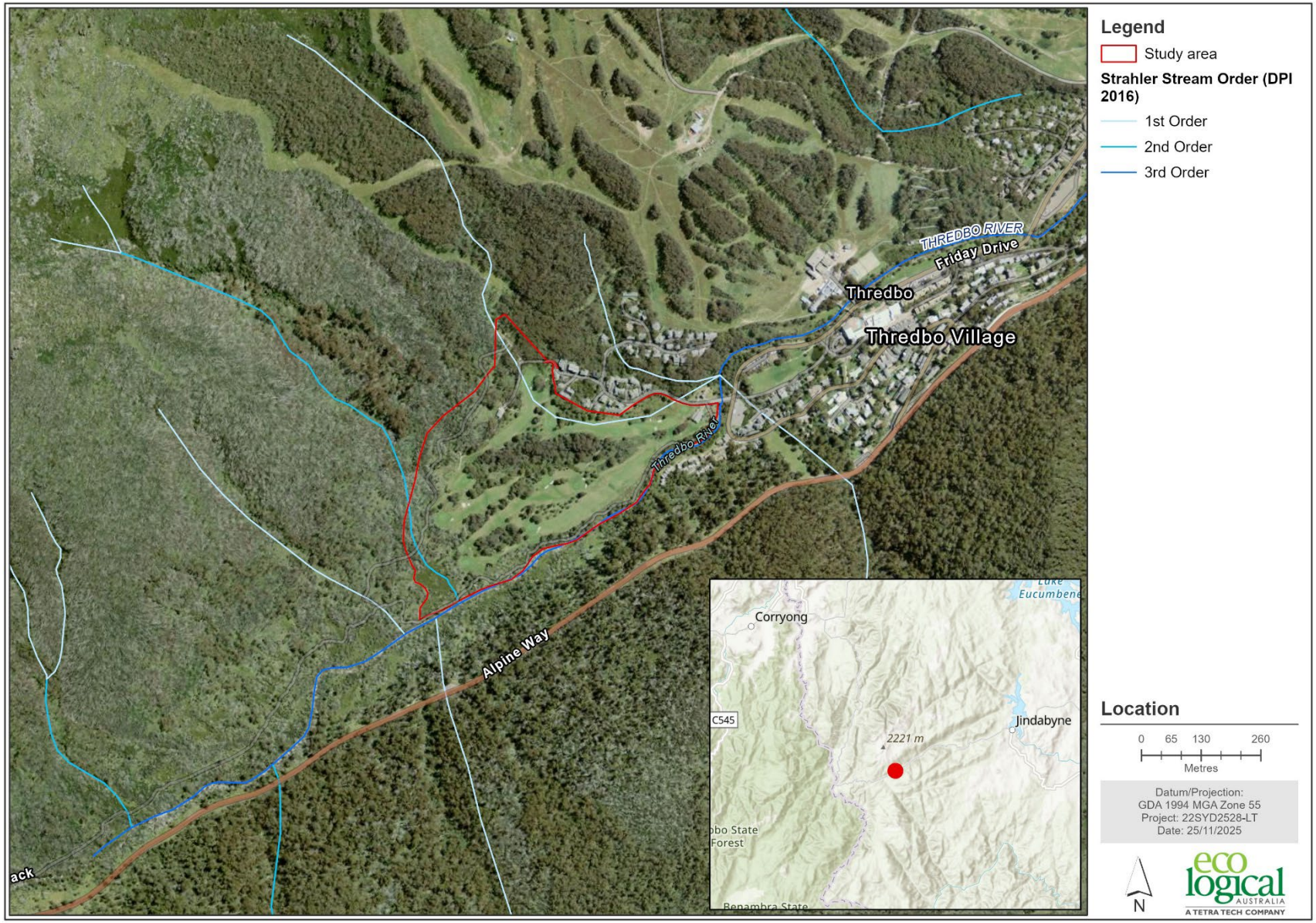

Figure 1: Location of the proposed development

2. Regulatory context

Various legislation, policies and guidelines apply to the assessment, planning and management of waterways and riparian land within the study area. Items reviewed include:

- *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act)
- *Water Management Act 2000* (WM Act)
- Wetlands Management Policy 2010
- *Fisheries Management Act 1994* (FM Act)
- Policy and guidelines for fish habitat conservation and management (Fairfull, 2013)
- State of Environmental Planning Policy (Precincts – Regional) 2021 – Chapter 4 (Alpine SEPP)

2.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EBPC Act is the Australian Government's central piece of environmental legislation. Under the EPBC Act, the Commonwealth Environment Minister needs to approve any development that is likely to have a significant impact on Matters of National Environmental Significance (MNES). Should such an impact, as defined in the EPBC Act *Policy Statement 1.1 – Significant Impact Guidelines* (Department of the Environment 2013), be likely, the preparation and submission of a Referral is required. MNES relevant to this study includes threatened ecological communities, flora and fauna species and migratory species that are listed under the Act. The proposed work would not cause a significant impact to aquatic species, and therefore a Referral is not recommended for impacts to aquatic species

2.2 Water Management Act 2000

The main objective of the WM Act is to manage NSW water in a sustainable and integrated manner that will benefit current generations without compromising future generations' ability to meet their needs. The WM Act is administered by DCCEEW – Water Group and establishes an approval regime for activities within waterfront land, defined as the land 40 m from the highest bank of a river, lake or estuary.

The relevant objects and principles of the WM Act are set out clause 3 and 5 of the WM Act.

3 Objects

The objects of this Act are to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations and, in particular—

a. *to apply the principles of ecologically sustainable development, and*
b. *to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality*
c. *to recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including:*
    i. benefits to the environment
    ii. benefits to urban communities, agriculture, fisheries, industry and recreation
    iii. benefits to culture and heritage
    iv. benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water

d. to recognise the role of the community, as a partner with government, in resolving issues relating to the management of water sources,
e. to provide for the orderly, efficient and equitable sharing of water from water sources,
f. to integrate the management of water sources with the management of other aspects of the environment, including the land, its soil, its native vegetation and its native fauna,
g. to encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users,
h. to encourage best practice in the management and use of water.

5 Water management principles
(2) Generally—
a. water sources, floodplains and dependent ecosystems (including groundwater and wetlands) should be protected and restored and, where possible, land should not be degraded, and
b. habitats, animals and plants that benefit from water or are potentially affected by managed activities should be protected and (in the case of habitats) restored, and
c. the water quality of all water sources should be protected and, wherever possible, enhanced, and
d. the cumulative impacts of water management licences and approvals and other activities on water sources and their dependent ecosystems, should be considered and minimised, and
e. geographical and other features of Aboriginal significance should be protected, and
f. geographical and other features of major cultural, heritage or spiritual significance should be protected, and
g. the social and economic benefits to the community should be maximised, and
h. the principles of adaptive management should be applied, which should be responsive to monitoring and improvements in understanding of ecological water requirements.

Under the WM Act framework, activities and works proposed on waterfront land are regulated. These activities include:

- the construction of buildings or carrying out of works
- the removal of material or vegetation from land by excavation or any other means
- the deposition of material on land by landfill or otherwise
- any activity that affects the quantity or flow of water in a water source.

2.2.1 Guidelines for riparian corridors on waterfront land

The DCCEEW *Controlled activities - Guidelines for riparian corridors on waterfront land* (DCCEEW, 2025b) ('DCCEEW riparian guidelines') outlines the need for a Vegetated Riparian Zone (VRZ) adjacent to the channel to provide a transition zone between the terrestrial environment and watercourse. This vegetated zone helps maintain and improve the ecological functions of a watercourse whilst providing habitat for terrestrial flora and fauna. The VRZ plus the channel (bed and banks of the watercourse to the highest bank) constitute the 'riparian corridor' (Figure 2). To be consistent with the guidelines, VRZ widths should be based on watercourse order as classified under the Strahler system of ordering watercourses and using Hydro Line Spatial Data (the 'hydroline') which is published on the department's website (Table 1).

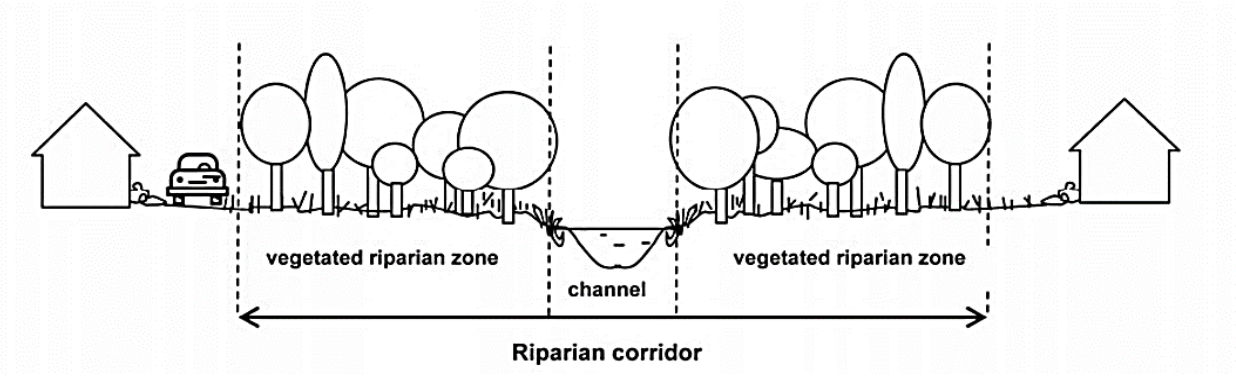

Figure 2: Vegetated riparian zone and watercourse channel comprising the riparian corridor (DCCEEW, 2025b).

Table 1: Recommended riparian corridor widths relative to Strahler stream order (DCCEEW, 2025b).

Watercourse type	VRZ width (each side of watercourse)	Total riparian corridor width
1st order	10 m	20 m + channel width
2nd order	20 m	40 m + channel width
3rd order	30 m	60 m + channel width
4th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 m	80 m + channel width

Note: Where a watercourse does not exhibit the features of a defined channel with bed and banks, the department may determine that the watercourse is not waterfront land for the purpose of the WM Act.

Certain works are permissible within the riparian zone if specific design criteria are met (Table 2 and key). Non-riparian uses in the outer 50% of the VRZ are permitted as long as compensation (1:1 offset) is achieved within the site using the 'averaging rule' (Figure 3).

Table 2: Riparian corridor (RC) matrix of permissible use with key (DPE, 2022).

Stream order	Vegetated Riparian Zone (VRZ)	RC offsetting for non RC uses	Cycleways and paths	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st	10 m	●	●	●	●	●	●	●		
2nd	20 m	●	●	●	●	●		●		
3rd	30 m	●	●	●		●			●	●
4th +	40 m	●	●	●		●			●	●

Key to riparian corridor matrix

Stream order*: The watercourse order as classified under the Strahler system based on Hydro Line Spatial Data published on the Department's website[1] when zoomed in at 1:25,000, 1:50,000 or 1:100,000, whichever is the smallest scale available. A stream may separate and then converge—this is called a 'braided stream'. A braided stream retains the same stream order throughout the braid, as though it were a single stream. For the riparian guidelines, stream order is fixed and is not to be altered if an upstream hydroline is not considered waterfront land.*

Vegetated riparian zone (VRZ)*: The required width of the VRZ measured from the top of the high bank on each side of the watercourse.*

Riparian corridor (RC) off-setting for non RC uses*: Non-riparian uses, such as bushfire Asset Protection Zones, roads and urban development are allowed within the outer 50% of the VRZ, so long as offsets are provided in accordance with the averaging rule as seen in Figure 3.*

Cycleways and paths*: Cycleways or paths no wider than four metres total disturbance footprint can be built in the outer 50% of the VRZ.*

Detention basins*: Detention basins can be built in the outer 50% of the VRZ or online where indicated. Offline detention basins do not need to be offset so long as there is an equivalent VRZ for the corresponding watercourse and they are built in compliance with the department's Guidelines for watercourse crossings and Guidelines for in-stream works. If a proposed basin will not have an equivalent VRZ for the corresponding watercourse, it may still be built in the outer 50% of the VRZ but must be offset. Online basins must:*

- *be dry and vegetated*
- *be for temporary flood detention only with no permanent water holding*
- *have an equivalent VRZ for the corresponding watercourse order*
- *not be used for water quality treatment purposes.*

Stormwater outlet structures and essential services*: Stormwater outlets or essential services are allowed in the RC. Works for essential services on a fourth order or greater stream are to be undertaken by directional drilling or tied to existing crossings.*

Stream realignment*: Indicates that a watercourse may be realigned.*

Road crossings*: Indicates permitted road crossing methods. Also refer to DPIRD Fisheries policy and guidelines for fish friendly waterway crossings (Fairfull 2013, discussed below in section 2.4).*

[1]https://www.water.dcceew.nsw.gov.au/our-work/licensing-and-approvals/controlled-activity-approvals/development-activities-waterfront-0

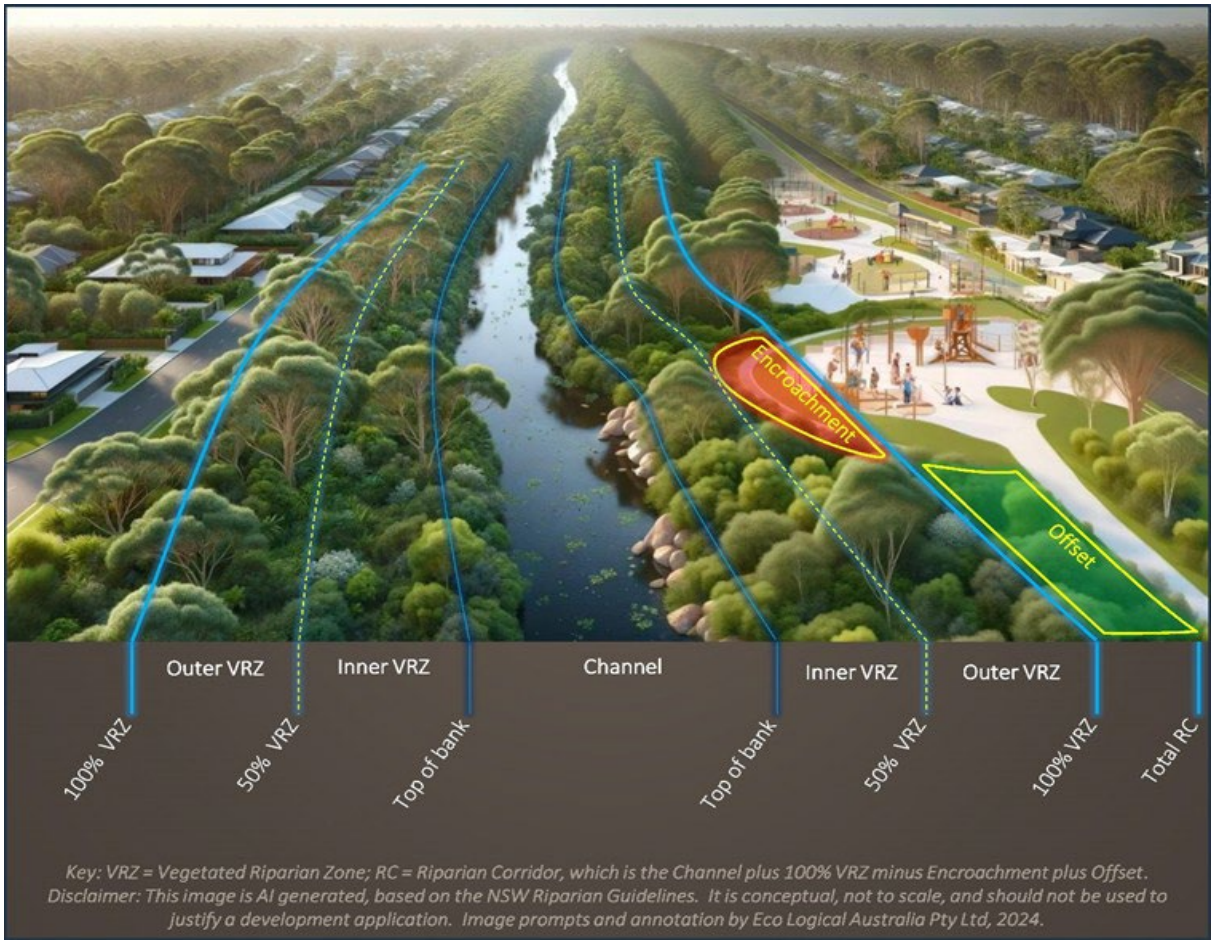

Figure 3: Riparian 'averaging rule' for offsetting encroachment into the outer 50% of the VRZ (Adapted from DCCEEW 2025b)

Exemptions for obtaining Controlled Activity Approvals for works on waterfront land may apply under Schedule 4, Part 6 of the Water Management (General) Regulation 2025 (WM Regulation).

The DCCEEW *Controlled activities- Guidelines for outlet structures on waterfront land* (DCCEEW, 2025a) outlines directions for the construction and maintenance of outlet structures within and leading to water bodies. The purpose of the guidelines is to ensure outlet infrastructure is built and operates in a way that protects water resources and the geomorphology of the catchment. The following considerations for the design and construction of outlet structures are outlined in the guidelines:

- Route and location of discharge regarding riparian vegetation and stream path
- Hydrology and associated impacts of discharge
- Bed and bank stability
- Construction and materials including scour protection
- Rehabilitation methods after works have been completed.

2.3 Wetlands Management Policy 2010

The NSW Wetlands Management Policy (DECCW, 2010) aims to provide for the protection, ecologically sustainable use and management of NSW wetlands. Wetlands include lakes, lagoons, estuaries, rivers, floodplains, swamps, bogs, billabongs, marshes, coral reefs and seagrass beds. This policy provides 12

principles that guide the way in which wetlands should be looked after and preserved. Upland wetlands and rivers occur within the study area and are considered in this report and in a Biodiversity Development Assessment Report (ELA, 2025).

2.4 Fisheries Management Act 1994

The FM Act aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. The FM Act defines 'fish' as any marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history. This includes insects, molluscs (e.g. oysters), crustaceans, echinoderms, and aquatic polychaetes (e.g. beachworms), but does not include whales, mammals, reptiles, birds, amphibians or species specifically excluded (e.g. some dragonflies are protected under the *Biodiversity Conservation Act 2016* (BC Act) instead of the FM Act). If any activity occurs on key fish habitat and will obstruct fish passage, involve dredging or reclamation of channel bed or banks or involve use of explosives in the waterway, then Part 7 of the FM Act applies (notification and/or permits).

Additionally, the objects of this Act are to conserve threatened species, populations and ecological communities of fish and marine vegetation, which are determined as threatened by the Fisheries Scientific Committee. Vulnerable, endangered and critically endangered species, populations and ecological communities are at risk of extinction due to one or more of the following key threatening processes:

- Degradation of native riparian vegetation along New South Wales water courses
- Hook and line fishing in areas important for the survival of threatened fish species
- Human-caused climate change
- Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams
- Introduction of fish to waters within a river catchment outside their natural range
- Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales
- Removal of large woody debris from New South Wales rivers and streams
- The current shark meshing program in New South Wales waters.

Riches et al. (2016) model vulnerable species *Austropetalia tonyana* (alpine redspot dragonfly) as expected to occur within the study area. Additionally, the development is located within the distribution of the Endangered Ecological Community (EEC), *Aquatic Ecological Community in the Catchment of the Snowy River in NSW*, which includes all native fish and aquatic invertebrates within all rivers, creeks and streams of the Snowy River catchment.

2.4.1 Policy and guidelines for fish habitat conservation and management

The *Policy and guidelines for fish habitat conservation and management* (Fairfull, 2013) ('DPIRD Fisheries guidelines') is a supplementary document that outlines the requirements and obligations under the FM Act and the *Fisheries Management (General) Regulation 2019* and were developed to maintain and enhance fish habitat and assist in the protection of threatened species. The Policy provides a definition of key fish habitat and provides guidance for assigning a classification of waterways for fish passage, which informs the types of infrastructure suitable for the creekline (Table 3) and sensitivity of the key

fish habitat present, which determines the potential disturbance and offsetting required for development (Table 4).

Table 3: Classification of waterways for fish passage and crossing type (Fairfull 2013)

Classification	Characteristics of waterway class and preferred crossing type
CLASS 1 Major key fish habitat	Marine or estuarine waterway or permanently flowing or flooded freshwater waterway (e.g. river or major creek), habitat of a threatened or protected fish species or 'critical habitat'. Bridge, arch structure or tunnel. Bridges are preferred to arch structures.
CLASS 2 Moderate key fish habitat	Non-permanently flowing (intermittent) stream, creek or waterway (generally named) with clearly defined bed and banks with semi-permanent to permanent waters in pool or in connected wetland areas. Freshwater aquatic vegetation is present. TYPE 1 and 2 habitats present. Bridge, arch structure, culvert[1] or ford. Bridges are preferred to arch structures, box culverts and fords (in that order).
CLASS 3 Minimal key fish habitat	Named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or other CLASS 1-3 fish habitats. Culvert[2] or ford. Box culverts are preferred to fords and pipe culverts (in that order).
CLASS 4 Unlikely key fish habitat	Waterway (generally unnamed) with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or freestanding water or pools post rain events (e.g. dry gullies or shallow floodplain depressions with no aquatic flora present). Culvert[3], causeway or ford. Culverts and fords are preferred to causeways (in that order).

[1] High priority given to the 'High Flow Design' procedures presented for the design of these culverts—refer to the "Design Considerations" section of Fairfull and Witheridge 2003.

[2] Minimum culvert design using the 'Low Flow Design' procedures; however, 'High Flow Design' and 'Medium Flow Design' should be given priority where affordable—refer to the "Design Considerations" section of Fairfull and Witheridge (2003).

[3] Fish friendly waterway crossing designs possibly unwarranted. Fish passage requirements should be confirmed with NSW DPIRD.

As noted in Fairfull and Witheridge 2003, there are additional factors that must be taken into consideration by those involved in waterway crossing design and construction, including public safety, social and budgetary constraints. Each crossing is therefore assessed by NSW DPIRD on a case-by-case basis.

Table 4: Key fish habitat types (Fairfull 2013)

Key fish habitat and associated sensitivity classification scheme (for assessing potential impacts of certain activities and developments on key fish habitat types)
TYPE 1 – Highly sensitive key fish habitat:
Posidonia australis (strapweed)
Zostera, Heterozostera, Halophila and *Ruppia* species of seagrass beds >5 m^2 in area
Coastal saltmarsh >5 m^2 in area
Coral communities
Coastal lakes and lagoons that have a natural opening and closing regime (i.e. are not permanently open or artificially opened or are subject to one off unauthorised openings)
Marine park, an aquatic reserve or intertidal protected area
SEPP 14* coastal wetlands, wetlands recognised under international agreements (e.g. Ramsar, JAMBA, CAMBA, ROKAMBA wetlands), wetlands listed in the Directory of Important Wetlands of Australia
Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants
Any known or expected protected or threatened species habitat or area of declared 'critical habitat' under the FM Act
Mound springs
TYPE 2 – Moderately sensitive key fish habitat:
Zostera, Heterozostera, Halophila and *Ruppia* species of seagrass beds <5 m^2 in area
Mangroves
Coastal saltmarsh <5 m^2 in area
Marine macroalgae such as *Ecklonia* and *Sargassum* species
Estuarine and marine rocky reefs
Coastal lakes and lagoons that are permanently open or subject to artificial opening via agreed management arrangements (e.g. managed in line with an entrance management program)
Aquatic habitat within 100 m of a marine park, an aquatic reserve or intertidal protected area
Stable intertidal sand/mud flats, coastal and estuarine sandy beaches with large populations of in-fauna
Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in TYPE 1
Weir pools and dams up to full supply level where the weir or dam is across a natural waterway
TYPE 3 – Minimally sensitive key fish habitat may include:
Unstable or unvegetated sand or mud substrate, coastal and estuarine sandy beaches with minimal or no in-fauna
Coastal and freshwater habitats not included in TYPES 1 or 2
Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation

**SEPP 14 coastal wetlands are not Resilience and Hazards SEPP coastal wetlands*

2.5 State of Environmental Planning Policy (Precincts – Regional) 2021 – Chapter 4 (Alpine SEPP)

Chapter 4 of the State Environmental Planning Policy (Precincts – Regional) 2021 (Alpine SEPP) governs alpine resort development assessments. The aim of the Alpine SEPP is to protect the natural and cultural heritage of the land within alpine resorts. As outlined in Section 4.6 of the SEPP, this Chapter prevails over the Snowy River Local Environmental Plan 2013.

Under this SEPP, all developments are subject to the assessment of environmental impacts and geotechnical and land stability issues. This SEPP requires all development proposals to be advertised, and those located within Kosciuszko National Park are to be referred to the NSW Office of Environment and Heritage for comment and to be authorised under the *National Parks and Wildlife Act 1974*.

3. Methods

3.1 Literature review and desktop assessment

Online database searches were used to confirm the presence of watercourses and threatened species, populations and communities in the region. Results were used to infer what may be present in the study area. Databases accessed include:

- 1:25,000 Water Management (General) Regulation Hydro Line spatial data and the corresponding stream order using the Strahler classification system
- EPBC Act – Protected Matters Search Tool (5 km radius) (April 2023)
- FM Act – Fisheries Portal, key fish habitat, listed protected and threatened species and populations, including species profiles, 'Primefact' publications and expected distribution maps (Riches et al 2016)
- Online Zoological Collections of Australian Museums (OZCAM) and Atlas of Living Australia (ALA) – individual species searches to determine likelihood of occurrence of threatened species (Thredbo River sub-catchment).

Additionally, previous studies provided by KT were reviewed to determine past and recent aquatic conditions of Thredbo River, and the surrounding Snowy River Catchment.

3.2 Riparian assessment

A 'river', as termed in the WM Act, is a watercourse shown on the state hydroline map and one that has a defined bed, bank and evidence of geomorphic processes (erosion and deposition). A river may generally have some aquatic habitat features, either ephemeral or permanent, and may be discontinuous along its length. A watercourse may have portions of its length that do not display evidence of a river but if there are defining features upstream of that reach, then it must be classed as a river for its full length (as measured down from the uppermost part that has defining characteristics). Under the DCCEEW riparian guidelines, should a watercourse not be defined as a river, then the downstream Strahler stream order cannot be altered. That is, the Strahler stream order is a fixed calculation from the state hydroline map, regardless of whether the river exists, or has been engineered, or is proposed to be engineered (i.e. piped or filled for development).

3.2.1 Top of bank mapping

Top of bank was initially mapped on ArcMap using one (1) m LiDAR-derived contours and high-resolution aerial photography. A brief opportunistic field survey was conducted by ELA Aquatic Ecologist Ian Dixon in 2023 to verify the desktop mapping and confirm piping of one stream. Surveyed top of bank for the northern bank of Thredbo River was supplied by CLM Civil (2025).

Once the field-validated top of bank linework was finalised, a riparian buffer (VRZ width) was applied to its corresponding stream order in accordance with the DCCEEW riparian guidelines (Table 1), as well the Snowy River Local Environmental Plan 2013 (SRLEP) riparian land guidelines. The SRLEP riparian guidelines require a 40 m buffer from top of bank, which matches the 40 m waterfront land buffer required by the WM Act. Therefore, the SRLEP buffer is represented by the waterfront land buffer,

highlighted in Section 4.2. A 50% VRZ line was added to show the limit of permitted encroachment if offsetting is possible, as per DCCEEW's averaging rule (Figure 3).

4. Results

4.1 Literature review and database search

The study area intersects with the riparian corridors of two 1st order streams, one 2nd order stream, and one 3rd order stream (Thredbo River), forming part of the Snowy River Catchment (Figure 4). DPIRD Fisheries identify three types of key fish habitat (KFH) in their Policy and Guidelines for Fish Habitat Conservation and Management (Table 4). As a 3rd order stream, Thredbo River is mapped as KFH by DPIRD Fisheries (Figure 5). Thredbo River and the unnamed 2nd order tributary along the southwestern edge of the study area are modelled as part of the indicative distribution of *Austropetalia tonyana* (alpine redspot dragonfly), which is listed as a Vulnerable species under the FM Act. Smaller streams can also be classed as KFH is they are known to support a threatened species. Therefore, the 2nd order stream along the western edge of the study area is also defined as KFH (Figure 5). Thredbo River and the 2nd order tributary can be further described as Type 1 highly sensitive KFH and Class 1 major KFH due to the modelled distribution of alpine redspot dragonfly.

4.1.1 Presence or likelihood of threatened and protected species, populations and communities

The OZCAM database shows only a small number of species records in the Thredbo River catchment: the native *Galaxias olidus* (mountain galaxias) and introduced *Salmo trutta* (brown trout). These species are common in alpine and subalpine streams of NSW and are not listed as threatened.

Threatened fish species, populations or communities listed under the FM Act and EPBC Act that are known or expected to occur in the region are listed in Appendix B. Two are known or predicted to occur in the study area:

- *Austropetalia tonyana (*alpine redspot dragonfly) is modelled to occur in Thredbo River and the 2nd order tributary bordering the study area, as seen in Figure 5 (Riches et al 2016). Alpine redspot dragonfly have an aquatic phase of their lifecycle, with extremely specific habitat requirements, in that they only occur amongst rocks, logs and moss within the splash zone of waterfalls or in the nearby stream edge. Their flight period is thought to occur between October and January. An assessment of significance under the FM Act is provided in Appendix C.
- *Aquatic Ecological Community in the Catchment of the Snowy River in NSW* is an endangered ecological community (EEC) that includes all native fish and aquatic invertebrates in all rivers, creeks and streams within the entire NSW portion of the Snowy River catchment. An assessment of significance for this EEC under the FM Act is provided in Appendix D.

4.2 Riparian assessment

The study area intersects with the riparian corridors of two 1st order streams, one 2nd order stream and one 3rd order stream (Thredbo River) (Figure 6). All streams within the study area met the definition of a river under the WM Act, except for a 106 m piped section across the golf course (Reach 1B). Concrete-lined and piped sections are exempt from obtaining approvals for works on waterfront land (Schedule 4, Section 63 of the WM Regulation). Part of the development is separated from Reach 1A by an existing public road, therefore, that portion of land is also exempt (Schedule 4, Section 62 of the WM Regulation).

Final top of bank mapping and corresponding riparian corridors triggered by the riparian guidelines are shown in Figure 6.

4.2.1 Riparian and aquatic condition

The Snowy River catchment is typically the poorest in condition within the Southern Rivers CMA region and coastal catchments in NSW. Habitat degradation and modification, flow alteration due to the Snowy Mountains Hydro-electric Scheme (SMS) and climate change are all examples of factors that have led to the catchment's poor condition (Fisheries Scientific Committee, 2011). Thredbo River, within the study area, remains upstream of the SMS and therefore remains in a relatively natural condition, with the exception of the migration barrier caused by Jindabyne Dam.

Quarterly water quality monitoring surveys have been carried out since 1989, as well as numerous studies, all carried out by the University of Canberra under various denominations, originally known as the Cooperative Research Centre for Freshwater Ecology. The current iteration, since 2016, known as Centre for Applied Water Science, undertake routine water quality monitoring and biological assessments of Thredbo River for KT (Ugyen et al., 2016; 2022).

Those studies aim to test effects of run-off from Thredbo Village, golf course and sewerage treatment plant by analysing macroinvertebrate assemblages. Between 2016 and 2022, all sites tested downstream of the golf course and Thredbo Village were, on average, given a band B score (significantly impaired), interpreted to mean that compared to the undisturbed reference site, there is potential impact on either water quality or habitat quality (or both) from development and run-off.

For the proposed development to produce no adverse effects to the water quality of Thredbo River, sufficient erosion and sedimentation measures must be put into place, as well as water sensitive urban design (WSUD) measures to treat stormwater. Recommendations for these are outlined in the Stormwater Management Plan (SWMP) produced by ELA (2023).

All channels within the study area were assessed as poor to good condition, generally driven by width of existing riparian vegetation, with representative photos shown in Figure 7 to Figure 9.

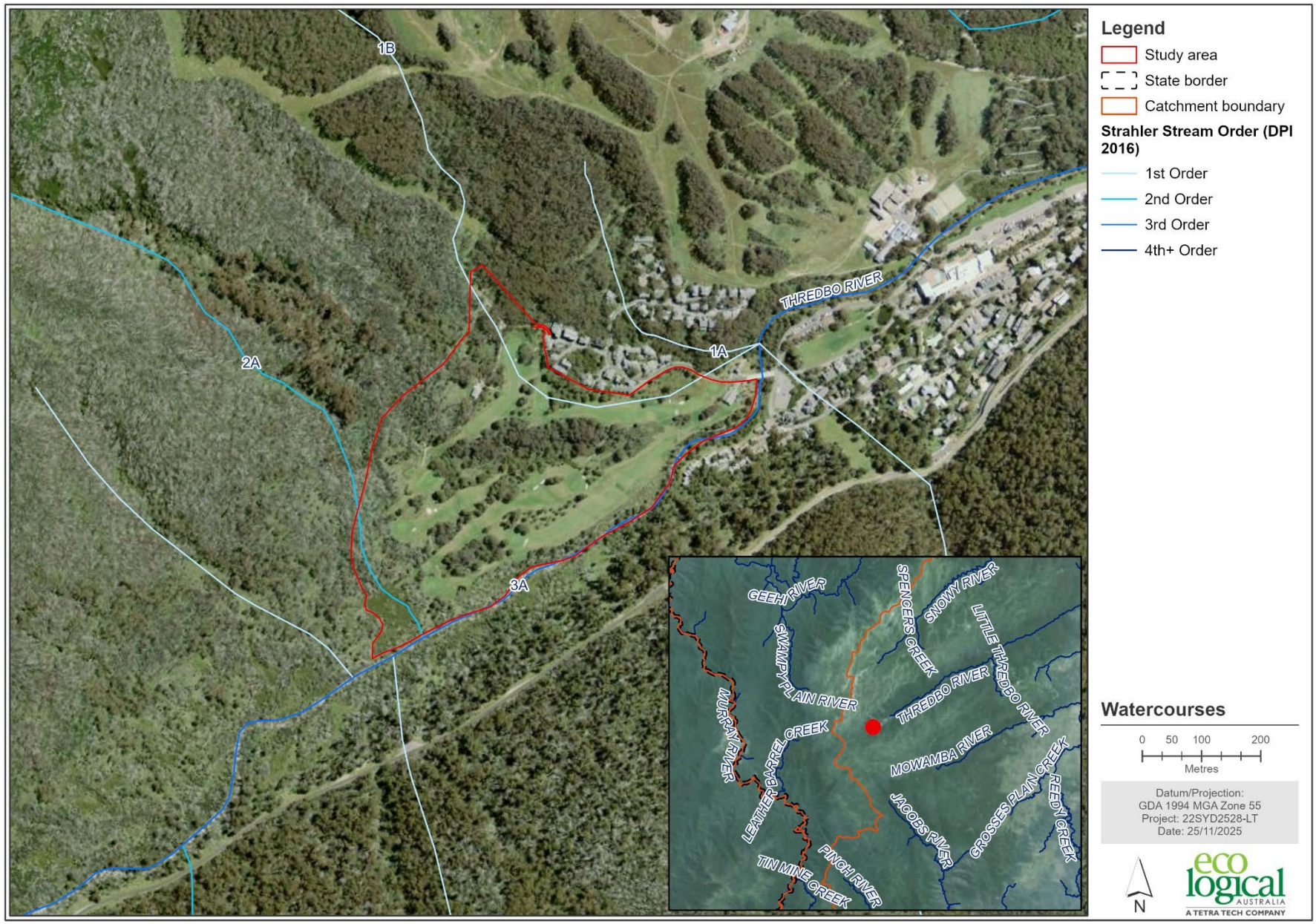

Figure 4: Hydrological context of the study area

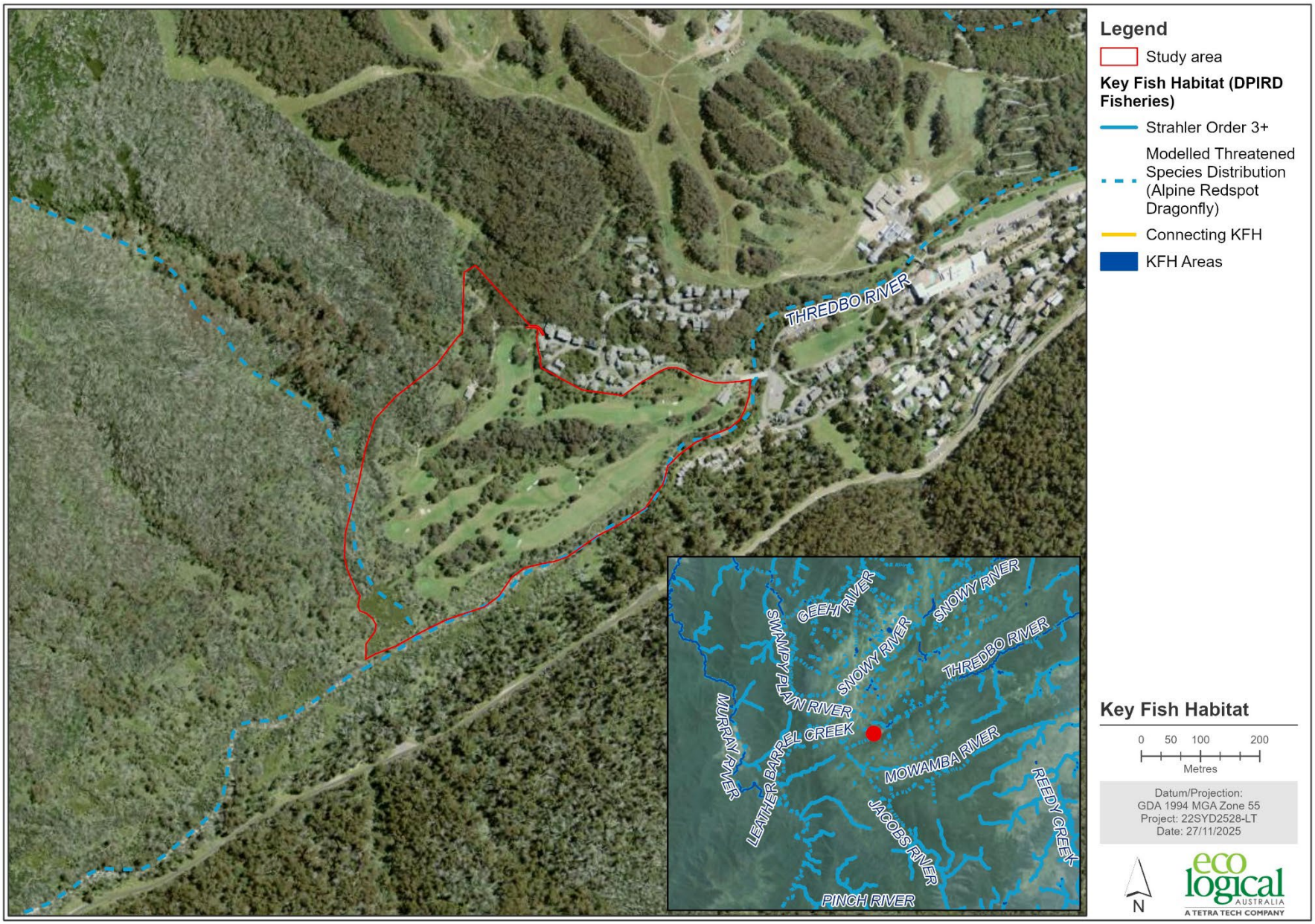

Figure 5: Key fish habitat within the study area

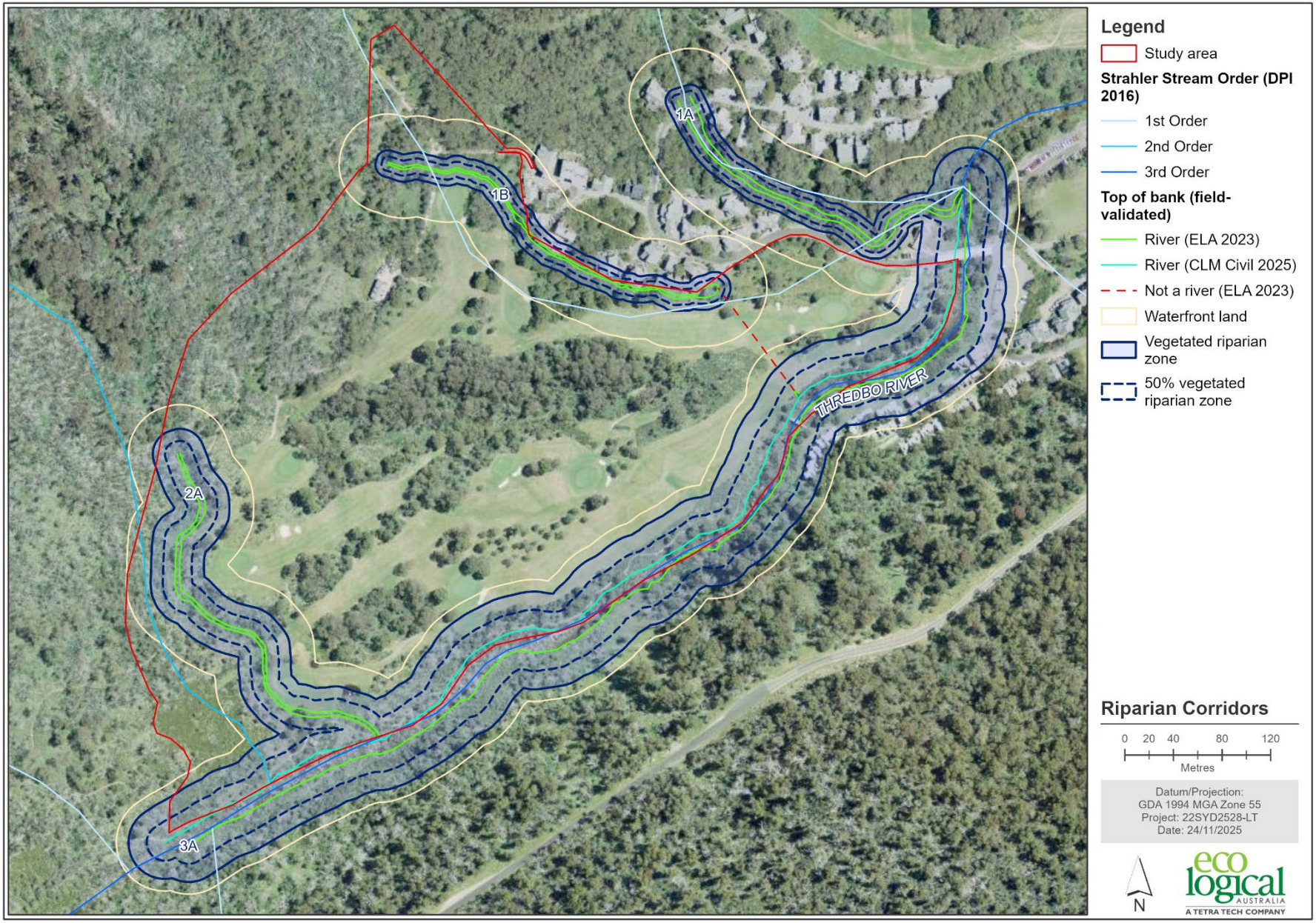

Figure 6: Field-validated top of bank mapping and vegetated riparian zones required under DCCEEW riparian guidelines (2025)

Figure 7: Representative photographs of Reach 1B: Left – facing downstream from fire trail; Right – facing upstream near existing housing

Figure 8: Representative photographs of Reach 2A: Left – facing downstream from fairway footbridge; Right – facing upstream near confluence with Thredbo River.

Figure 9: Representative photos of Reach 3A (Thredbo River): Top left – facing upstream looking across to golf course; Top right – facing downstream from footbridge (gully and small bridge on left is pipe outlet from Reach 1B); Bottom left – typical riparian zone facing downstream; Bottom right – existing walking track (mixed boardwalk and gravel).

5. Impact assessment and mitigation

This section considers the potential impact of the proposed development described in Section 1.1.

5.1 Threatened species impact assessment

A likelihood of occurrence assessment is provided in Appendix B. Of the species, populations and communities gathered in database searches, the Vulnerable species *Austropetalia tonyana (*alpine redspot dragonfly) and the EEC *Aquatic Ecological Community in the Catchment of the Snowy River in NSW* trigger further assessment of significance under the FM Act. Threatened aquatic species, populations or communities listed under the EPBC Act are considered unlikely to occur within the study area, and therefore, do not trigger further assessment. Given the proposed development is mainly situated on existing cleared and managed land, and does not include in stream works besides three small outlets, the main concern are indirect impacts from factors, such as run-off during construction and operation.

The tests, conducted in Appendix C and Appendix D, conclude no significant impacts to either species or EEC. In summary, alpine redspot dragonfly is currently threatened due to habitat degradation caused by climate change, natural disasters, reduced stream flow associated with forestry development and the capture of dragonflies by humans. The proposal sees no direct or indirect links to any of these factors and given no substantial instream works are proposed (outlets only), there will be no modification or removal of important habitat, particularly splash zones of waterfalls, or equivalent habitat around large boulder riffles.

Where possible, stormwater outlet structures should be located in pools away from riffles to minimise potential impact to alpine redspot dragonfly habitat.

The *Aquatic Ecological Community in the Catchment of the Snowy River in NSW* is currently threatened due to the indirect impacts to biological cues (spawning, migration etc), largely caused by the SMS. Erection of the SMS has resulted in reduced flows, affecting water quality, thermal pollution and fish barriers in the form of dam and weirs. The proposal sees no substantial direct impact to the EEC, and with sufficient mitigation measures in place to minimise factors such as construction run-off and stormwater filtration, indirect impacts will also not modify or degrade the existing condition of the habitat supporting the aquatic community.

As per the SWMP (ELA 2023), stormwater infrastructure is proposed to manage runoff surrounding impervious areas including the subdivided lots, buildings and access road. The drainage infrastructure will be connected to four stormwater retention devices (e.g. Puraceptor brand or similar) to treat stormwater prior to discharge to Thredbo River. If effective and adequately maintained, the treatment system would mitigate indirect impacts to the river.

5.2 Riparian impact assessment

The proposed development encroaches on a total of 0.48 ha of the VRZ, including 0.04 ha of inner 50% VRZ encroachment, for reconfiguration of the golf course on existing fairways/greens (Figure 10). APZs are located on fairways near the river, and it is assumed they would not be an additional impact to riparian vegetation or require thinning of riparian trees. Due to ongoing existing use and limited space provided by the golf course, no potential offset areas have been provided for, as would typically be recommended in the DCCEEW riparian guidelines averaging rule for new development (Figure 3). As such, the proposal would be subject to a merit assessment by DCCEEW – Water Group.

Encroachment of the proposed development within the outer 50% VRZ includes APZs (0.19 ha), the proposed road (<0.01 ha) and associated batters (0.08 ha), riparian vegetation removal (0.03 ha) and landscaping associated with new greens, batters and mounds (0.10 ha). Encroachment of the inner 50% VRZ comprises road batter (<0.01 ha), riparian vegetation removal (0.01 ha), a small section of the new gravel footpath, existing riverside footpath realignment (<0.01 ha), and landscaping associated with new greens, batters and mounds (0.01 ha).

Encroachment which involves impact to riparian vegetation includes realignment of the existing riverside footpath and removal of riparian vegetation for the construction of the new 2nd green and creation of a clear shot line along the new 4th green. Additionally, the removal of two trees, <0.01 ha of vegetation along the 2nd green and realignment of the riverside footpath are within the inner 50% VRZ, which is not permitted under the DCCEEW riparian guidelines. Other inner 50% VRZ encroachment includes batters and mounds for the road, golf course and realignment of drainage/swales. However, these areas are unvegetated and part of the existing golf course. Riparian averaging within the study area is not possible due to the ongoing use as a golf course in the VRZ.

Outlet structures are permitted within the riparian corridor, provided they meet the DCCEEW *Controlled activities - Guidelines for outlet structures on waterfront land* (DCCEEW, 2025a). The proposed typical sections of the outlet structures are presented in Appendix A, which would be designed in line with the guidelines. Assessment of the outlet structures against the guidelines would be undertaken at the detailed design stage. As in Section 5.3, it is recommended that the outlet structures are positioned to avoid impacts to the habitat of the alpine redspot dragonfly.

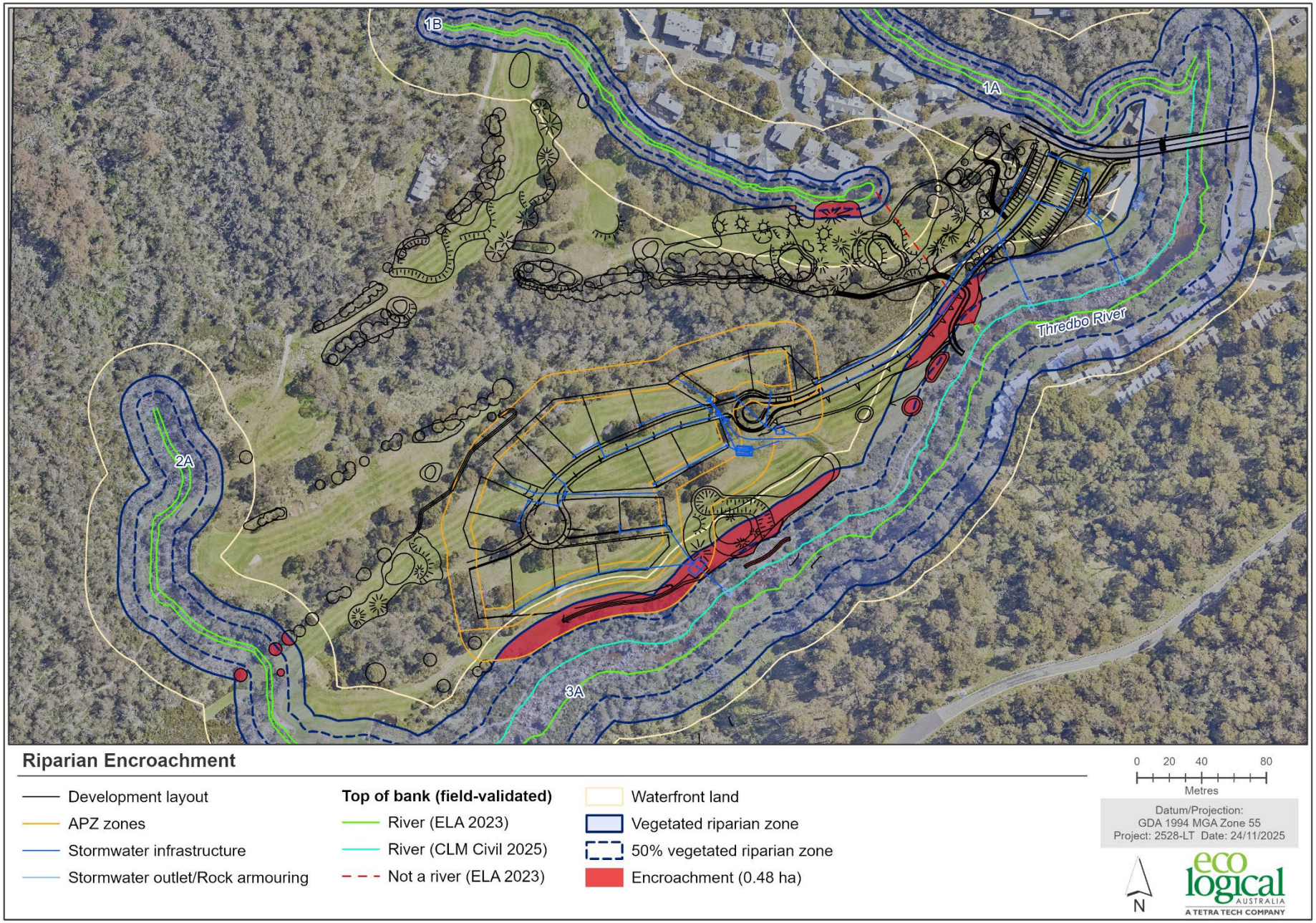

Figure 10: Riparian encroachment of the proposed development

5.3 Recommendations

The following measures are recommended for the mitigation of potential impacts during construction and operation. At a minimum, KT should:

- Develop a Construction Environmental Management Plan (CEMP) to address pollution, contamination and unnecessary disturbance which could arise during construction, including:
  - Erosion and Sediment Control Plan
  - oil/fuel/chemical storage and spill management
  - machinery and engine maintenance schedule to reduce oil/fuel leakage
  - biological hygiene (e.g. prevent spread of noxious flora species on and off the site)
  - other measures outlined in the SWMP (ELA, 2023).
- Seek the following:
  - Merit-based assessment by DCCEEW – Water Group when lodging an Integrated Development Application. A merit-based assessment is required because the proposal does not meet the DCCEEW Riparian Guidelines 2025b (i.e. encroachment of the inner 50% VRZ and no application of the averaging rule). If DCCEEW – Water Group issue General Terms of Approval, this will lead to an application for a Controlled Activity Approval (CAA) for works on waterfront land (40 m from top of bank).
- The CAA will likely require development of a Vegetation Management Plan (VMP) to protect and enhance riparian vegetation using native riparian species endemic to the area. If required, the VMP should form part of the Rehabilitation and Landscape Plan, to be prepared during detailed design.
- Under the VMP, urban plantings should avoid using deciduous trees within 40 m of a watercourse, or in areas where excessive leaf drop cannot be contained from stormwater runoff.

6. Conclusion

This Aquatic and Riparian Ecology Impact Assessment concludes that the proposed subdivision and construction work and golf course reconfiguration:

- Would not have a significant impact on any threatened fish species or aquatic communities listed under the FM Act or EPBC Act
- Would not trigger the need for a Species Impact Statement, nor referral to a Commonwealth body in relation to fish
- Would not require dredging, reclamation, obstruction of fish passage or permits under Part 7 of the FM Act (outlets would be covered under a Controlled Activity Approval)
- Would not degrade watercourse condition by proposed VRZ encroachments, due to existing cleared use for the golf course
- Would require an Integrated Development Application for a merit-based assessment by DCCEEW – Water Group for works on waterfront land
- Would require the implementation of mitigation measures as outlined in the SWMP to prevent adverse effects to Thredbo River's water quality
- Would require detailed designs of outlets to meet DCCEEW standards
- Would meet environmental protection requirements of Chapter 7.3 – Snowy River LEP 2013.

7. References

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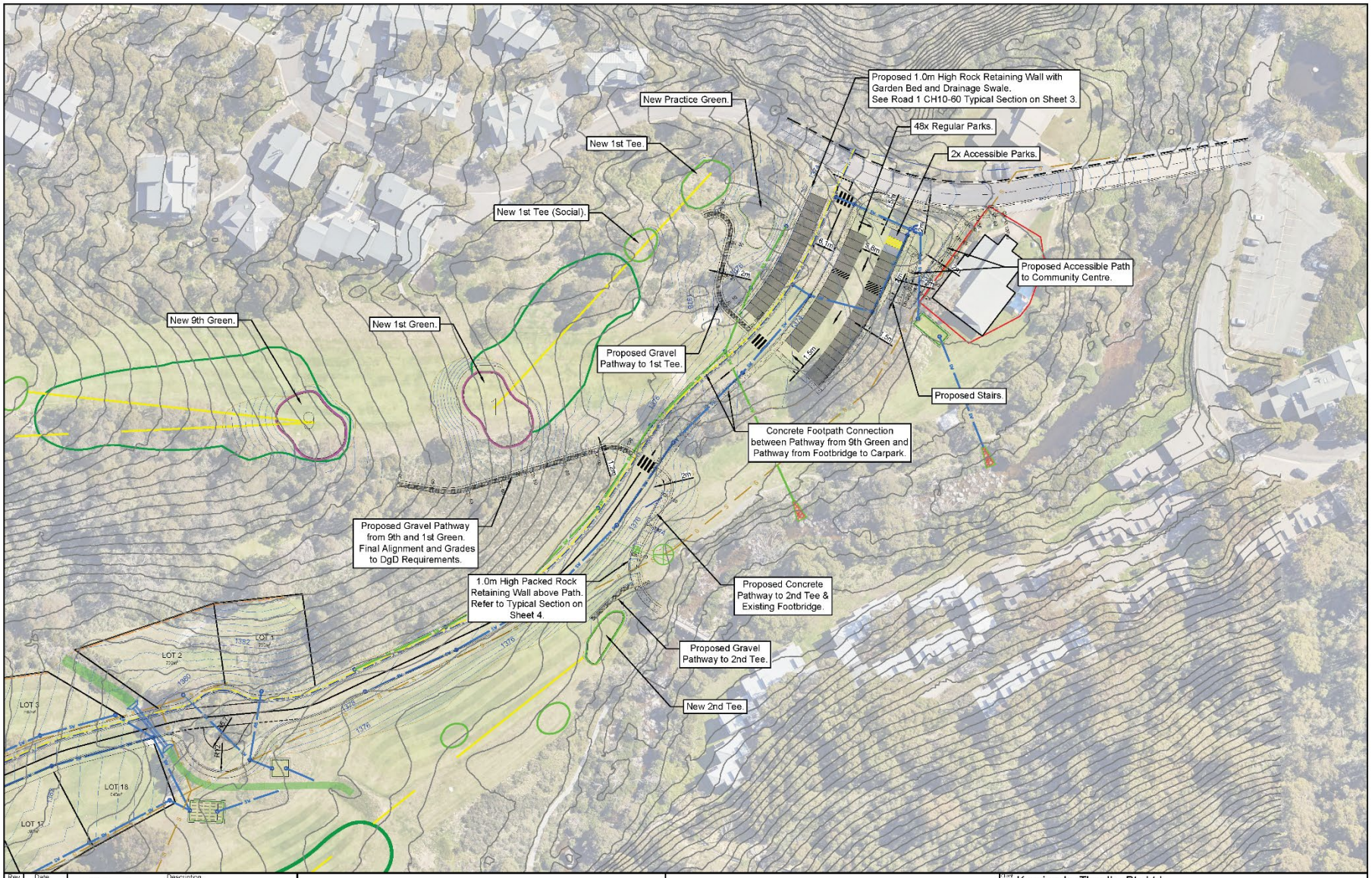
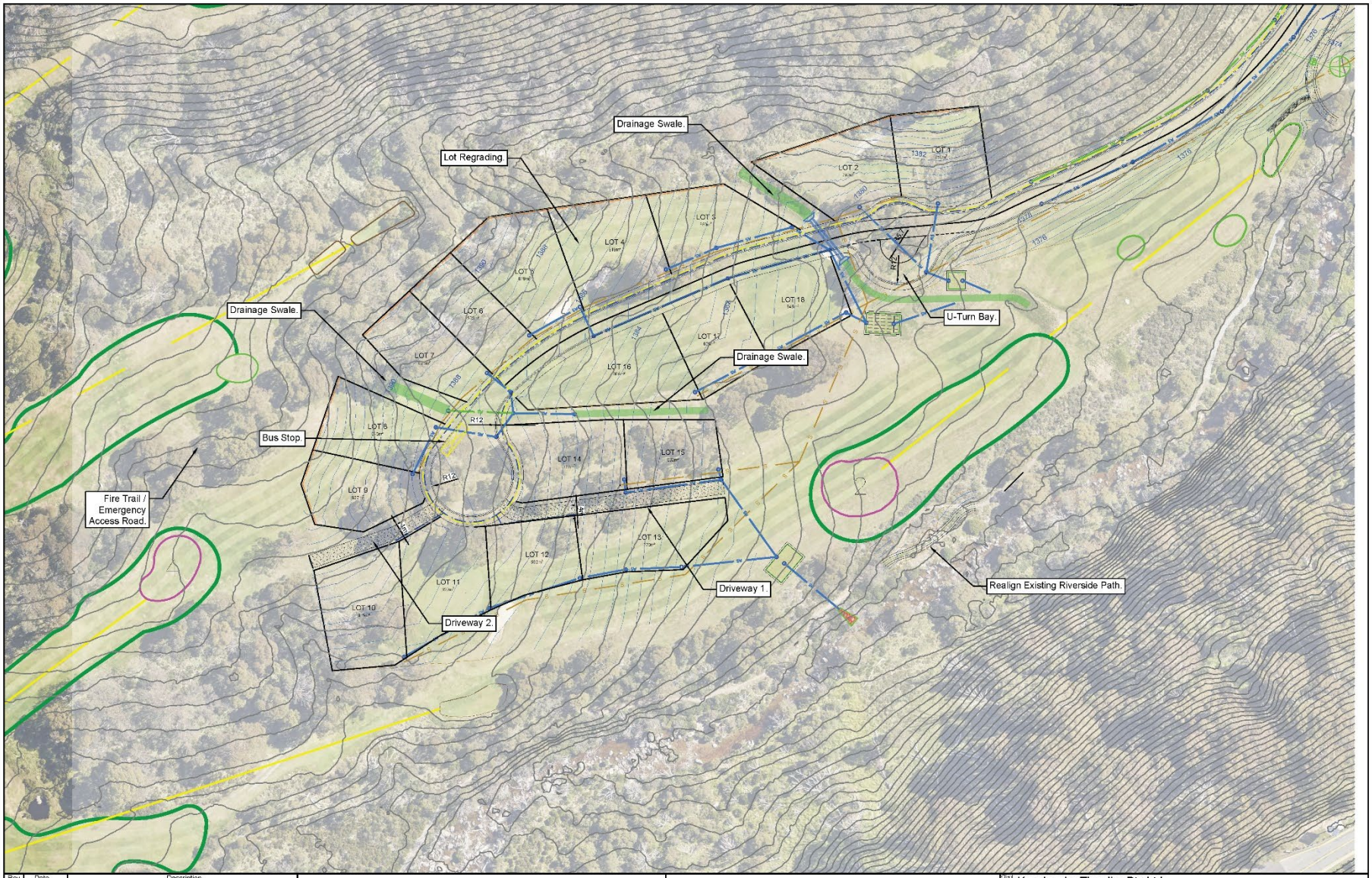
Appendix A – Proposed Design





Rev	Date	Description
K	8/9/25	Revised Lot Layout
J	7/02/25	Amended as per Kosciuszko Thredbo Comments 31/1/25
I	22/01/25	Amended as per Kosciuszko Thredbo Comments
H	28/08/24	Amended as per DPE Requirements (100% Issue)
G	30/07/24	Amended as per DPE Requirements (80% Issue)
F	04/07/24	Amended as per DPE Requirements (50% Issue)

Thredbo Golf Course Subdivision
Thredbo Village NSW

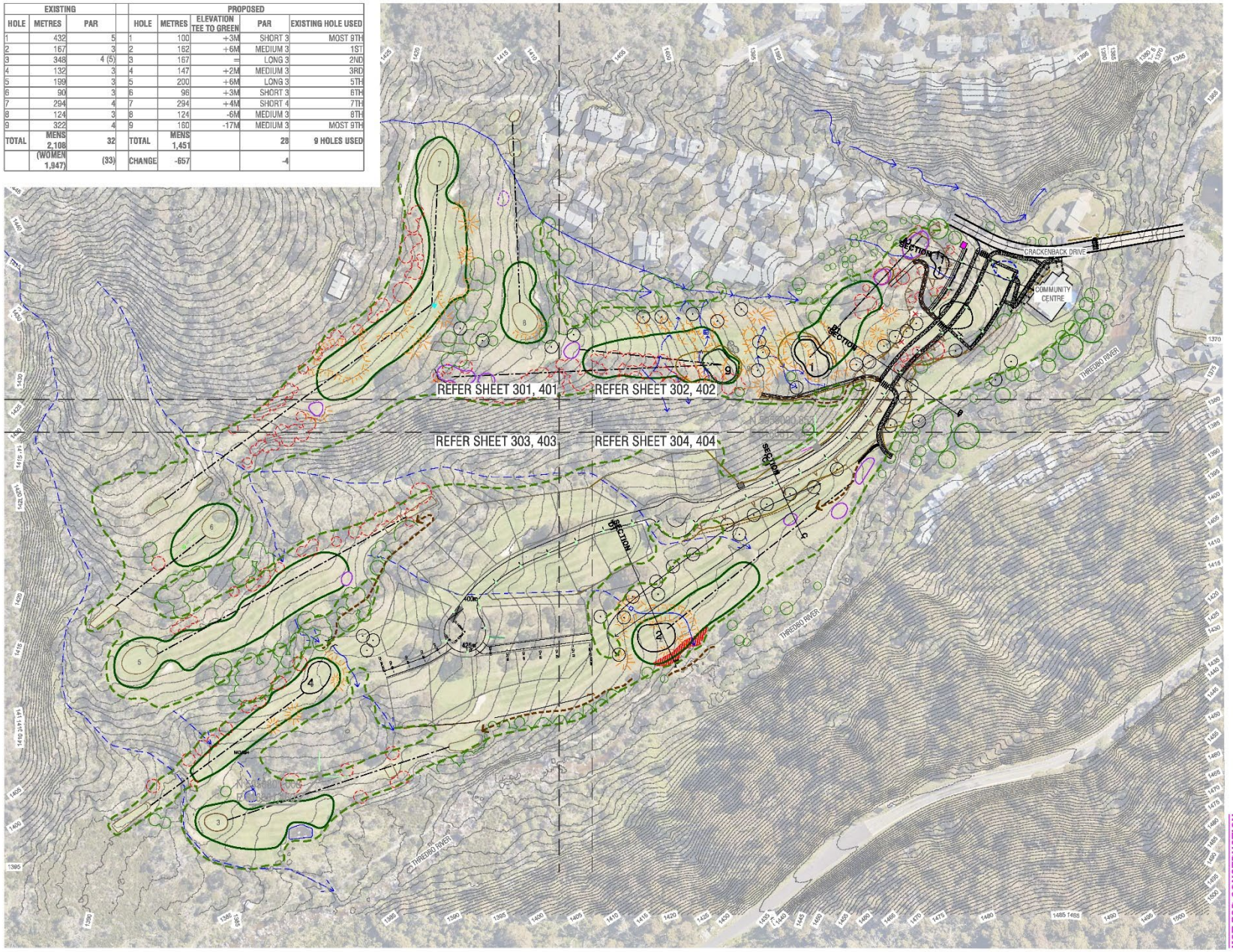
CLM CiViL Engineering
205 Bobundara Road
BERRIDALE NSW 2628
PH: 0427 886 623
www.clmcivil.com.au

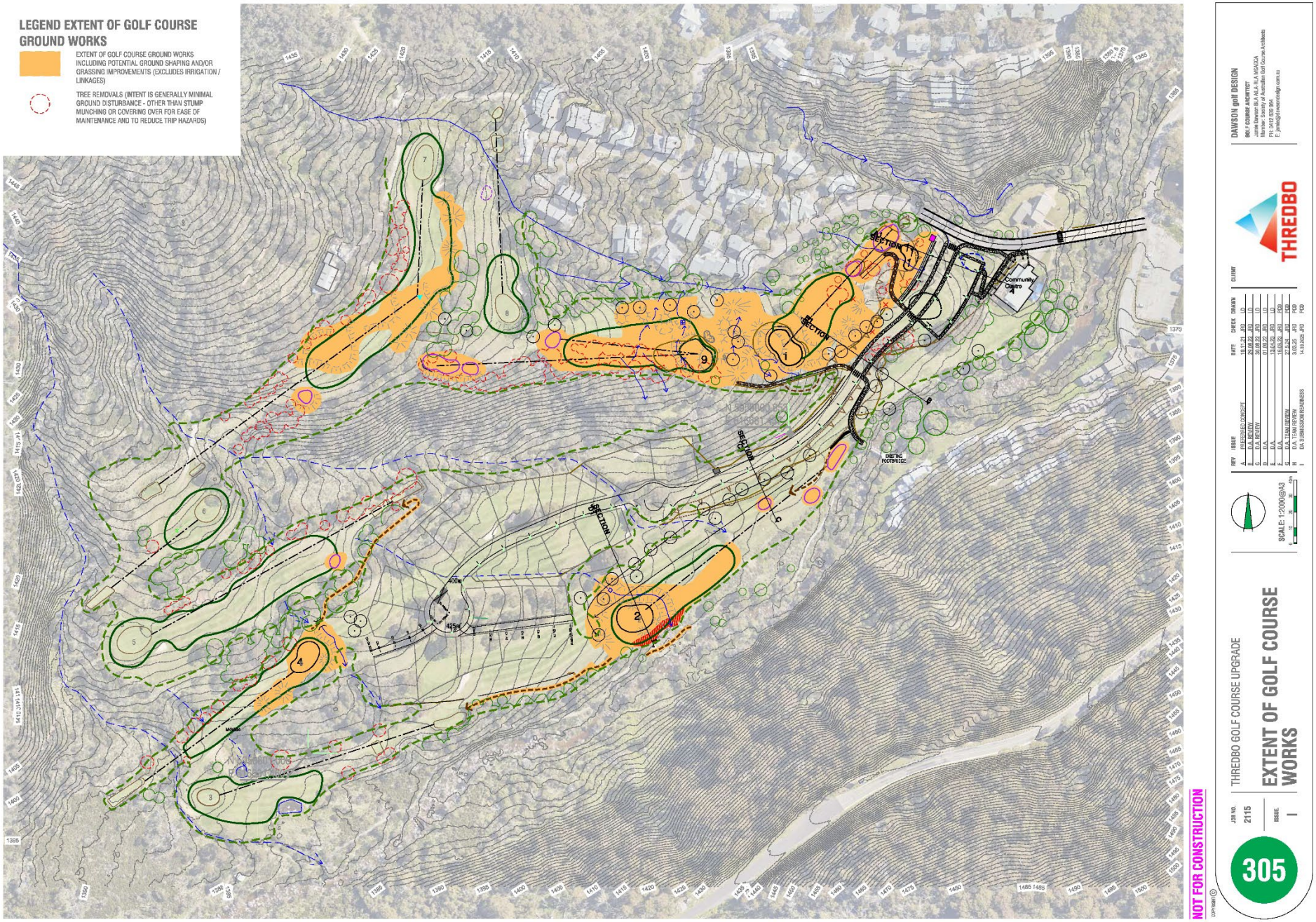
Client: Kosciuszko Thredbo Pty Ltd

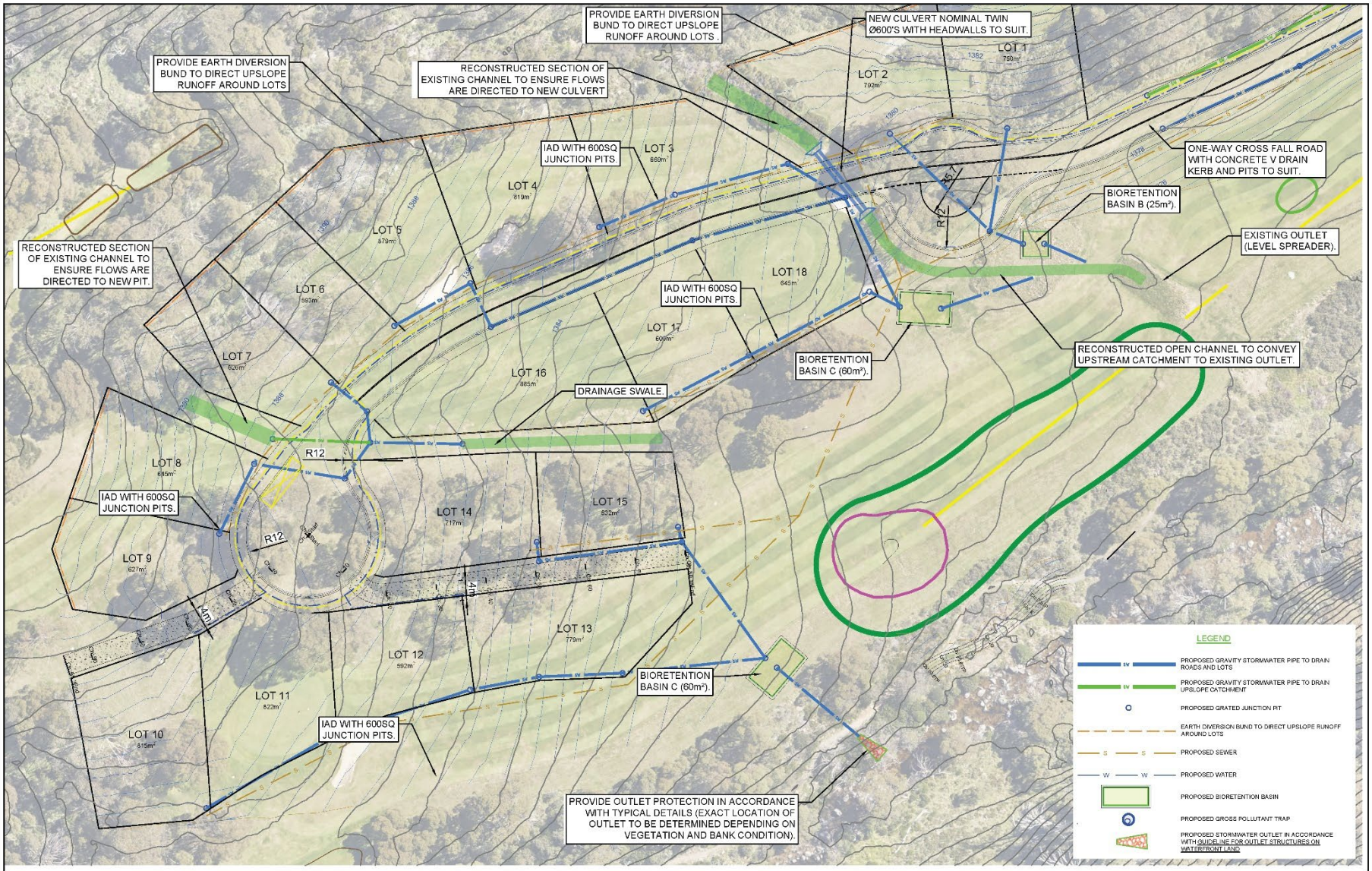
Subdivision Plan

Status: For Development Approval
Datum: GDA94 / AHD | Scale: 1:1000 | Size: A3
Drawing No: U-183 | Sheet No: 6 of 45 | Revision: K

EXISTING				PROPOSED				
HOLE	METRES	PAR		HOLE	METRES	ELEVATION TEE TO GREEN	PAR	EXISTING HOLE USED
1	432	5		1	100	+3M	SHORT 3	MOST 9TH
2	167	3		2	162	+6M	MEDIUM 3	1ST
3	348	4 (5)		3	167	=	LONG 3	2ND
4	132	3		4	147	+2M	MEDIUM 3	3RD
5	199	3		5	200	+6M	LONG 3	5TH
6	90	3		6	96	+3M	SHORT 3	6TH
7	294	4		7	294	+4M	SHORT 4	7TH
8	124	3		8	124	-6M	MEDIUM 3	8TH
9	322	4		9	160	-17M	MEDIUM 3	MOST 9TH
TOTAL	MENS 2,108	32		TOTAL	MENS 1,451		28	9 HOLES USED
	(WOMEN 1,947)	(33)		CHANGE	-657		-4	




LEGEND EXTENT OF GOLF COURSE GROUND WORKS
EXTENT OF GOLF COURSE GROUND WORKS INCLUDING POTENTIAL GROUND SHAPING AND/OR GRASSING IMPROVEMENTS (EXCLUDES IRRIGATION / LINKAGES)
TREE REMOVALS (INTENT IS GENERALLY MINIMAL GROUND DISTURBANCE - OTHER THAN STUMP MUNCHING OR COVERING OVER FOR EASE OF MAINTENANCE AND TO REDUCE TRIP HAZARDS)
SECTION
Community Centre
EXISTING FOOTBRIDGE
NOT FOR CONSTRUCTION
DAWSON golf DESIGN
GOLF COURSE ARCHITECT
THREDBO
THREDBO GOLF COURSE UPGRADE
EXTENT OF GOLF COURSE WORKS
JOB NO. 2115
ISSUE I
305



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Thredbo Village NSW

CLM CIVIL
CLM CIVIL Engineering
205 Bolaro Road
BERRIDALE NSW 2628
PH: 0427 886 623
www.clmcivil.com.au

southeast
engineering + environmental
SOUTHEAST ENGINEERING + ENVIRONMENTAL
PO Box 98
MORUYA NSW 2537
PH: 0427 886 623

Client: Kosciuszko Thredbo Pty Ltd

Stormwater Management
General Arrangement (1 of 2)

For Development Approval

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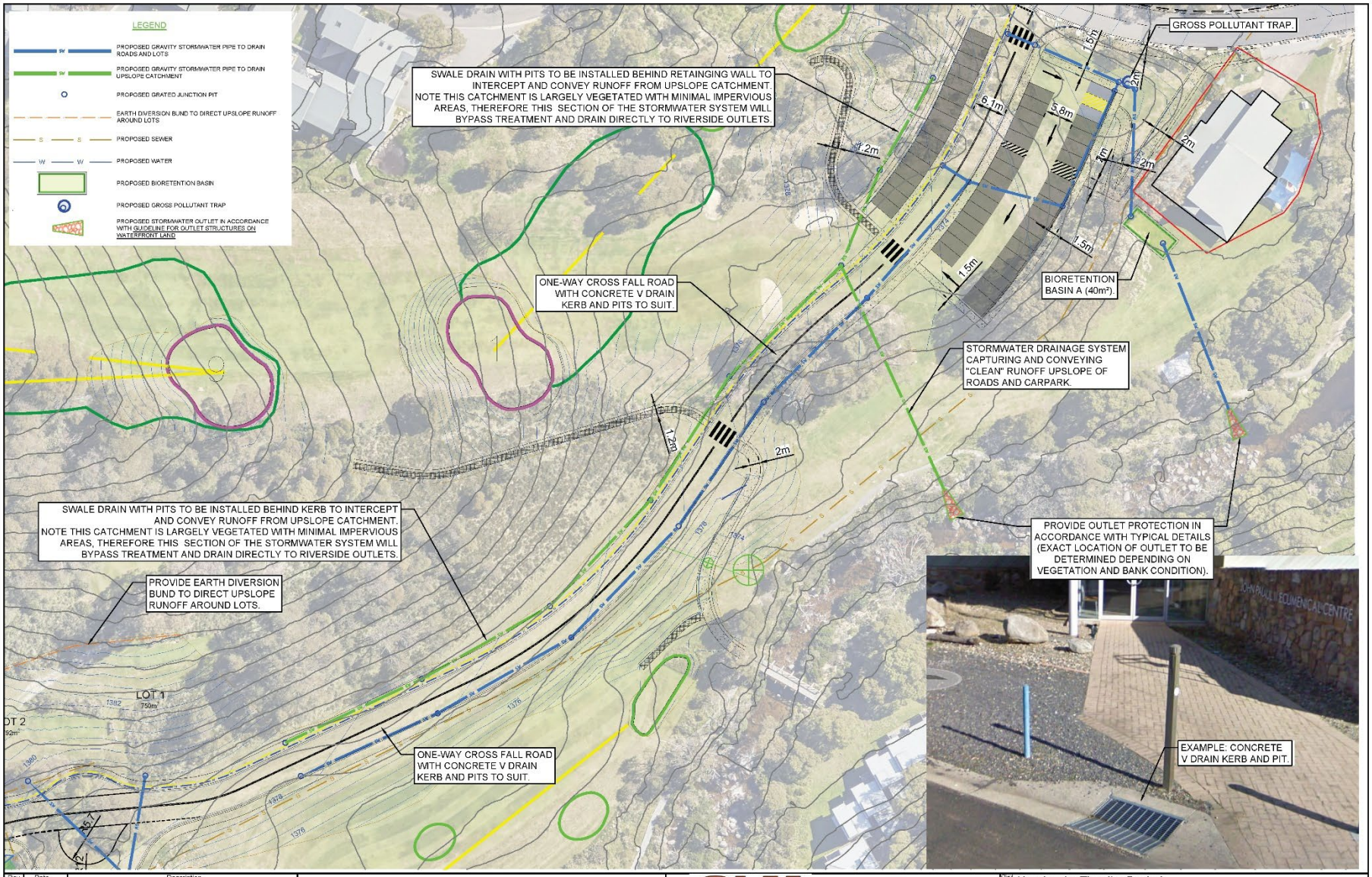
Drawing Number: U-183 | Sheet: 40 of 45 | Revision: K



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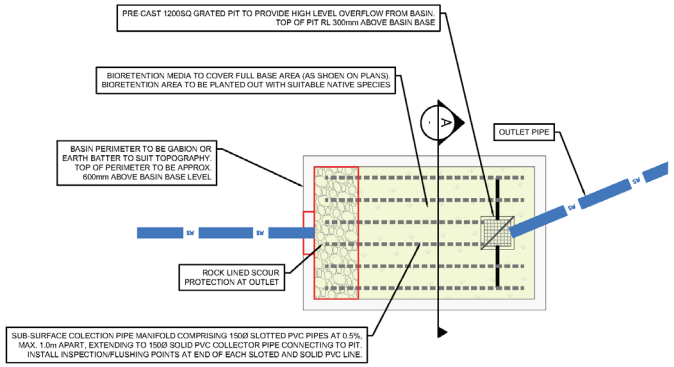
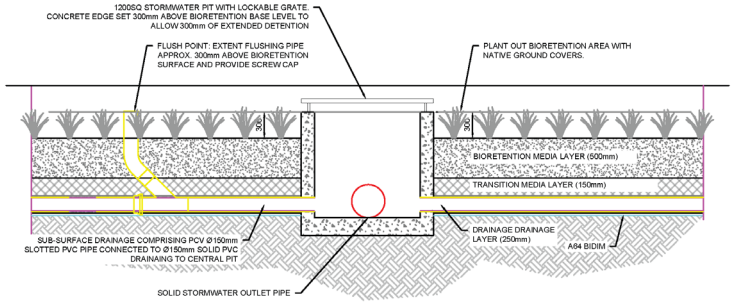


BIORETENTION BASIN (TYP.)

NOT TO SCALE



BIORETENTION BASIN (TYPICAL CROSS SECTION.)

NOT TO SCALE

CONSTRUCTION SEQUENCING

CONSTRUCTION SEQUENCING INCLUDES THE FOLLOWING:

1. DIVERT EXTERNAL CATCHMENT RUNOFF AROUND THE STAGE BEING CONSTRUCTED THROUGH THE PROVISION OF STABLE FLOW PATHS;
2. CONSTRUCT SEDIMENT BASIN/S AT LOW POINTS OF SITE (THIS MAY INCLUDE THE BIORETENTION BASIN FOOTPRINTS IN THE BULKED OUT PHASE);
3. CONSTRUCT TRUNK DRAINAGE;
4. ONCE TRUNK DRAINAGE IS COMPLETE DIVERT FLOWS FROM UPSTREAM INTO NEW TRUNK DRAINAGE;
5. COMMENCE ACCESS ROAD CONSTRUCTION AND BULK EARTHWORKS;
6. FOLLOWING 80% COMPLETION OF CONSTRUCTION (INCLUDING BULK EARTHWORKS, ROADS AND LOT SHAPING) BIORETENTION SYSTEM CAN BE FORMALISED WITH FILTER MEDIA AND VEGETATION AS REQUIRED.
7. FINALISE ROAD CONSTRUCTION AND BULK EARTHWORKS AND MAKE GOOD.

BIORETENTION SYSTEM

THE PROPOSED BIORETENTION SYSTEM FORMS A FUNDAMENTAL PART OF THE TREATMENT TRAIN THAT IMPROVES THE WATER QUALITY OF STORMWATER RUNOFF FROM THE SITE. THE BIORETENTION SYSTEM – CONSISTS OF VEGETATION, A SOIL FILTRATION MEDIA AND SUB-SURFACE DRAINAGE SYSTEM . THERE WILL BE A SMALL DEPTH OF PONDING AT THE SURFACE FOR A NUMBER OF HOURS FOLLOWING RAINFALL HOWEVER THE BIORETENTION SYSTEM WILL APPEAR DRY MOST OF THE TIME.

THE DESIGN OF THE BIORETENTION SYSTEM INCLUDES THE FOLLOWING:

- MINIMUM SURFACE AREA AS SHOWN
- EXTENDED DETENTION = 300mm
- FILTER MEDIUM DEPTH = 0.5m
- TRANSITION LAYER DEPTH = 0.15m
- DRAINAGE LAYER DEPTH = 0.25m

BIORETENTION-DRAINAGE PIPE SPECIFICATION

SLOTTED DRAINAGE PIPES (NO FILTER SOCK AND NOT AG LINE) ARE TO BE Ø150mm SLOTTED PVC-U PIPES WITH MINIMUM INLET AREA TO LENGTH RATIO OF 1000sqmm/m OF PIPE

SLOTTED DRAINAGE PIPES ARE TO HAVE A MAXIMUM SPACING OF 1.5 METRE. SLOTTED DRAINAGE PIPES ARE TO BE FITTED WITH STANDARD UNDER-DRAINAGE INSPECTION/CLEANOUT FITTINGS (REFER FLUSHING POINTS BELOW) AT THE END OF PIPES AND AT JUNCTIONS TO ALLOW FOR THE REMOVAL OF ACCUMULATED FINES WITHIN THE SYSTEM.

CONNECT SLOTTED DRAINAGE PIPES TO THE APPROPRIATE Ø150mm SOLID PVC-U COLLECTION LINE AND DRAIN TO PIT AS SHOWN.

JOINTING: PROVIDE TEES, COUPLINGS OR ADAPTORS AT JUNCTIONS TO AS 2439.1.
ALL SLOTTED DRAINAGE PIPES ARE TO BE EMBEDDED IN THE MEDIA AS SHOWN ON DRAWINGS. ALL JUNCTIONS AND CONNECTIONS ARE TO BE SEALED TO PREVENT SOIL MATERIAL ENTERING THE PIPE NETWORK.

FLUSHING POINTS: FLUSHING POINTS ARE TO BE PROVIDED AS SHOWN ON THE DRAWINGS. THE FLUSHING POINTS ARE TO BE CONSTRUCTED OF SOLID Ø100mm PVC-U PIPE. THE 90 DEGREE BEND IS TO BE CONSTRUCTED OF TWO 45 DEGREE BENDS SEPARATED BY A MINIMUM OF 300MM OF SOLID PVC-U.

PROVIDE PVC-U SCREW CAP FOR EACH FLUSH POINT. TOP OF FLUSH POINT TO FINISH MIN. 300mm ABOVE BIORETENTION FINISHED SURFACE LEVEL

BIORETENTION-PLANTING SPECIFICATION

PLANT OUT BIORETENTION AREA WITH NATIVE GROUND COVERS.

BIORETENTION-FILTER MATERIAL SPECIFICATION

FILTER MEDIA HYDRAULIC PROPERTIES
THE FILTER MATERIAL SHALL PREFERABLY BE A "WASHED SAND' OF SILICEOUS OR CALCAREOUS ORIGIN, ONE THAT HAS BEEN MINED AND PROCESSED. NATURAL SOILS OR TOPSOILS ARE NOT USUALLY SUITABLE.
SOILS SHALL HAVE THE FOLLOWING MECHANICAL AND PHYSICAL PROPERTIES:

1. SATURATED HYDRAULIC CONDUCTIVITY IN THE RANGE OF 100 - 200mm/H. THIS CRITICAL ELEMENT IS TO BE DEMONSTRATED THROUGH LAB TESTING (ASTM-F1815-06).
2. PARTICLE SIZE DISTRIBUTION/COMPOSITION REQUIREMENTS:

DESCRIPTION	PROPORTION	GRADING
CLAY AND SILT	<3%	<0.05mm
VERY FINE SAND	5-30%	0.05-0.15mm
FINE SAND	10-30%	0.15-0.25mm
MEDIUM TO COARSE SAND	40-60%	0.25-1.0mm
COARSE SAND	7-10%	1.0-2.0mm
FINE GRAVEL	<3%	2.0-3.4mm

3. PH - 6.2-6.8 BEFORE DELIVERY - ADD DOLOMITE AS REQUIRED
4. ELECTRICAL CONDUCTIVITY (EC) < 12ds/m

NOTE: FILTER MEDIA SHALL ALSO CONTAIN A SMALL AMOUNT OF ORGANIC MATERIAL (NOT EXCEEDING 5%) TO SUPPORT VEGETATION GROWTH. THE SOURCE OF THE ORGANIC MATERIAL SHALL BE PROVIDED TO COUNCIL FOT APPROVAL AND MUST BE FROM A CLEAN SOURCE, NOT COMPOST.

TRANSITION LAYER
A TRANSITION LAYER IS REQUIRED WHEN THE DRAINAGE LAYER IS FINE GRAVEL. IT IS RECOMMENDED WHEN THE DRAINAGE LAYER IS COARSE SAND. THE TRANSITION LAYER SHOULD BE A SAND/COARSE SAND MATERIAL CONFORMING TO THE GRADING BELOW AND IS GENERALLY APPLIED IN A 100-200mm LAYER.

SIEVE SIZE AS (mm)	% PASSING
0.075	0-3
0.15	0-4
0.3	0-16
0.6	12-40
1.18	40-65
2.36	70-100
4.75	90-100
9.5	100

DRAINAGE LAYER
THE DRAINAGE LAYER IS NORMALLY BETWEEN 200-250mm THICK. SUITABLE MATERIALS INCLUDE A HARD DURABLE AGGREGATE, EG. BASALT, MAY BE IMPORTED WITH MAXIMUM DIAMETER OF 10MM OR FINE GRAVEL IN THE RANGE 4mm - 7mm.

SIEVE SIZE	% RETAINED
>10mm	0
6.0-10.0mm	>70%
2.0-6.0mm	<20%
<2.0mm	0

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K	8/9/25	Revised Lot Layout
J	7/02/25	Amended as per Kosciuszko Thredbo Comments 31/1/25
I	22/01/25	Amended as per Kosciuszko Thredbo Comments
H	28/08/24	Amended as per DPE Requirements (100% Issue)
G	30/07/24	Amended as per DPE Requirements (80% Issue)
F	04/07/24	Amended as per DPE Requirements (50% Issue)

Thredbo Golf Course Subdivision
Thredbo Village NSW

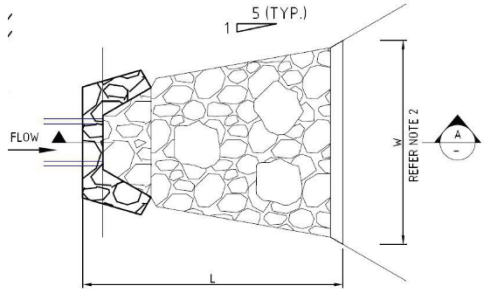
CLM CIVIL Engineering
205 Bobundara Road
BERRIDALE NSW 2628
PH: 0427 886 623
www.clmcivil.com.au

SOUTHEAST ENGINEERING + ENVIRONMENTAL
PO Box 96
MORUYA NSW 2537
PH: 0427 886 623

Client: Kosciuszko Thredbo Pty Ltd

Stormwater - Typical Details
(1 of 2)

Status: For Development Approval
Datum: GDA94 / AHD | Scale: 1:1000 | Size: A3
Drawing Number: U-183 | Sheet: 42 of 45 | Revision: K

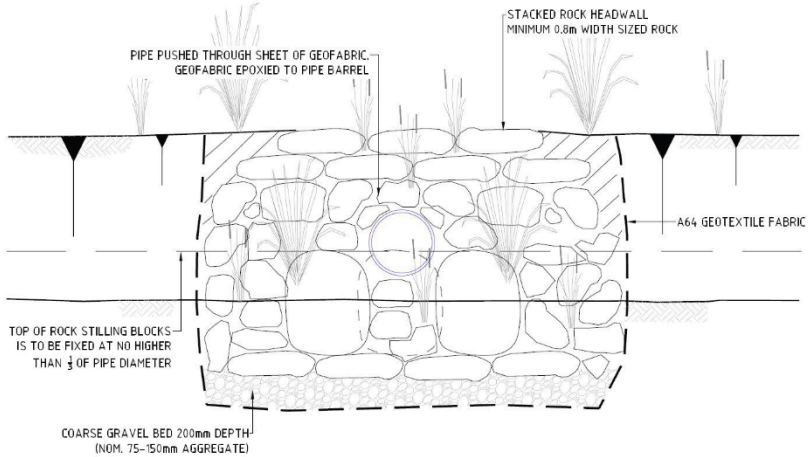


TYPICAL STORMWATER OUTLET LAYOUT IN ACCORDANCE WITH GUIDELINE FOR OUTLET STRUCTURES ON WATERFRONT LAND

NOT TO SCALE

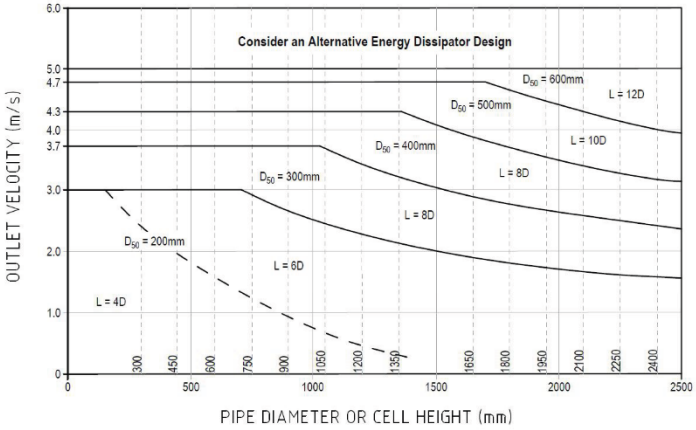
NOTES:

1. READ 'L' FROM CHART 1, LEFT.
2. W = 3 TIMES PIPE DIAMETER 'D'.
3. THE MEDIAN ROCK SIZE D_{50} AND LENGTH (L) OF ROCK SCOUR PROTECTION DOWNSTREAM OF STORMWATER OUTLETS IS TO BE DETERMINED USING CHART 1. MIN. D_{50} = 200mm
4. ROCK IS TO BE GRADED IN ACCORDANCE WITH THE ROCK SIZE DISTRIBUTION TABLE AS SHOWN BELOW
5. IN THE EVENT THE WIDTH OF THE OUTLET CHANNEL IS LESS THAN THE DESIGN WIDTH OF THE ROCK APRON, THE ROCK SCOUR PROTECTION SHALL EXTEND UP TO THE BANK TO EITHER THE HEIGHT OF THE OBVERT OF PIPE OR CULVERT OR TO THE DESIGN TAILWATER LEVEL.



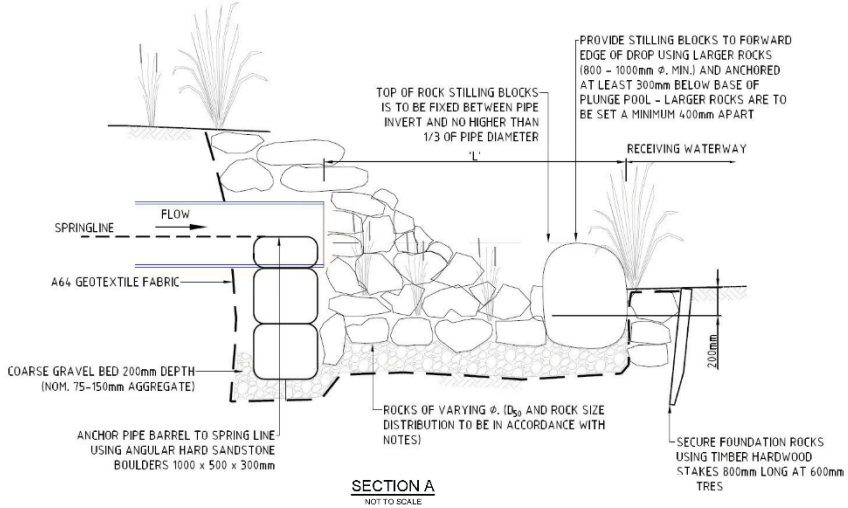
TYPICAL ROCK STACK HEADWALL AROUND STORMWATER OUTLET PIPE

NOT TO SCALE



SIZING OF STORMWATER OUTLET SCOUR PROTECTION

NOT TO SCALE



SECTION A

NOT TO SCALE

Rev	Date	Description
K	6/9/25	Revised Lot Layout
J	7/02/25	Amended as per Kosciuszko Thredbo Comments 31/1/25
I	22/01/25	Amended as per Kosciuszko Thredbo Comments
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Thredbo Village NSW

CLM CIVIL
CLM CIVIL Engineering
209 Bolaro Road
BERRIDALE NSW 2628
PH: 0427 886 623
www.clmcivil.com.au

southeast
engineering + environmental
SOUTHEAST ENGINEERING + ENVIRONMENTAL
PO Box 98
MORUYA NSW 2537
PH: 0427 886 623

Client: Kosciuszko Thredbo Pty Ltd

Stormwater - Typical Details
(2 of 2)

For Development Approval

Datum: GDA94 / AHD | Scale: 1:1000 | Size: A3

Drawing No: U-183 | Sheet No: 43 of 45 | Revision: K

Appendix B – Threatened species likelihood of occurrence and impact

If a species has suitable habitat present on site **AND** is likely to use this habitat **AND** the species or its habitat would be directly or indirect impacted, **THEN** an Assessment of Significance is required. Such species, if any, are highlighted yellow in the table below and are assessed further in Appendix C and Appendix D.

Type	Scientific name	Common name	FM Act Status	EPBC Act Status	Use of site	Is an impact assessment required?
Fish	*Galaxias supremus*	Kosciuszko galaxias		CE	Only known to occur in small area in an adjacent catchment to the north	No
	Galaxias terenasus	Roundsnout galaxias		E	Not known to occur upstream of Jindabyne Dam	No
	Maccullochella peelii	Murray cod		V	Only known to occur in an adjacent catchment flowing west to the Murray River	No
	Macquaria australasica	Macquarie perch	E	E	Only known to occur in an adjacent catchment flowing west to the Murray River	No
	Prototroctes maraena	Australian grayling	E	V	Jindabyne Dam prohibits connectivity to its preferred adult habitat that connects to the ocean where larvae migrate.	No
	Austropetalia tonyana	Alpine redspot dragonfly	V		Suitable habitat is within splash zones of waterfalls and rocks, logs and moss within these areas or nearby stream edges. None were observed during field survey, however, may still frequent the site or follow the river. No preferred habitat would be removed, modified or fragmented as a result of development.	Yes
	Aquatic Ecological Community in the Catchment of the Snowy River in NSW	Snowy River Endangered Ecological Community (EEC)	E		This EEC comprises all fish and aquatic invertebrates within the Snowy River catchment. This EEC is typically in poor condition, and with appropriate mitigation measures in place, the development would not exacerbate the factors causing this community to be endangered.	Yes

FM Act: E = Endangered, V = Vulnerable
EPBC Act: CE = Critically Endangered, E = Endangered, V = Vulnerable

Appendix C – Assessment of Significance: Alpine Redspot Dragonfly

An Assessment of Significance for *Austropetalia tonyana* (alpine redspot dragonfly) has been conducted below against criteria listed in Section 221ZV of the FM Act (C1).

***Austropetalia tonyana* (alpine redspot dragonfly)**

November 2014, Primefact 1356, First edition, DPI Fisheries – Aquatic Ecosystems Unit

The alpine redspot dragonfly is a moderate-sized dragonfly. The larvae grow to 32-35 mm long and adults grow to 70-80 mm long. Restricted to mountainous regions below 35°S that reach above 600-1,800 metres above sea level, the species has extremely specific habitat requirements. Nymphs are only known to occur among rocks, logs and moss in the spray zone of waterfalls, while adults are found to perch in a territorial area within the waterfall splash zone. Their flight period is thought to occur between October and January. The species is listed as threatened as they are highly sensitive to habitat disturbance, climate change and reduced stream flow. Although no waterfalls occur within or near the study area, the watercourse provide similar habitat in the form of large boulder riffles and spray.

C1 *Fisheries Management Act 1994* Assessment of Significance

***Austropetalia tonyana* (alpine redspot dragonfly) – Vulnerable Species (FM Act)**

FM Act	Question	Response
221ZV a)	In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	The majority of the proposed works are to occur on existing cleared and managed land within the golf course. Installation of stormwater outlets within the channel would not be located in the preferred species habitat such as splash zones or waterfalls. Water quality would be protected by mitigation measures during construction and operation. No modification to flow is expected. Therefore, the development is unlikely to have an impact on the habitat that this species uses during its aquatic life cycle phase, and there is negligible risk to its viability.
221ZV b)	In the case of an endangered population, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	Not applicable
221ZV c)	In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) Is likely to have an adverse effect on the extent of the ecological community such that its local	Not applicable

FM Act	Question	Response
	occurrence is likely to be placed at risk of extinction, or (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	
221ZV d)	In relation to the habitat of a threatened species, population or ecological community: (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the threatened species, population or ecological community in the locality.	(i) Outlets are located on the bank, and would not be located in the species' preferred habitats., therefore, no habitat will be removed or modified. (ii) Alpine redspot dragonflies live in waterfall splash zones, which will not be fragmented by the proposed development. (iii) Not applicable, no habitat to be modified or removed.
221ZV e)	Whether the proposed development or activity is likely to have an adverse effect on any critical habitat (either directly or indirectly).	The site is not declared critical habitat.
221ZV f)	Whether the proposed development or activity is consistent with a Priorities Action Statement.	Consultation with DPIRD Fisheries is consistent with the High Priority action for DPIRD to: *Provide information on the distribution of the alpine redspot dragonfly to local councils and determining authorities to ensure appropriate consideration during development assessment processes.*
221ZV g)	Whether the proposed development constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	One key threatening process is involved in the proposal due to removal or pruning of riparian trees to improve sight lines on the golf course: *Degradation of native riparian vegetation*. This impact would be compensated by managing the existing native vegetation (e.g. weed and erosion control). Therefore, the removal or pruning of a small number of trees is unlikely to significantly contribute to this key threatening process.
Conclusion	**Is there likely to be a significant impact?**	**No, because no habitat would be directly or indirectly modified**

Appendix D – Assessment of Significance: Aquatic Ecological Community in the Catchment of the Snowy River in NSW

An Assessment of Significance for the Aquatic Ecological Community in the Catchment of the Snowy River in NSW has been conducted below against criteria listed in Section 221ZV of the FM Act (D1).

Aquatic Ecological Community in the Catchment of the Snowy River in NSW

May 2012, Primefact 1204, First edition, DPI Fisheries – Fisheries Ecosystems Unit

Located in the Australian Alps in southeastern NSW, the Snowy River is known for its snowmelt and flood flows during Spring, and other features such as deep channels, pools and cascades. The aquatic ecological community of the Snowy River catchment has been listed as an endangered ecological community, as the community is likely to become extinct unless threatening factors cease to hinder evolutionary development. The community includes all native fish and aquatic invertebrates within all rivers, creeks and streams, and includes 19 native fish species and hundreds of native invertebrate species.

Processes threatening this community vary depending on the position of the waterway within the catchment. Within the NSW portion of the catchment, 44% of watercourses are located within national parks and reserves, although due to the connected nature of the catchment, these waterways are affected by factors outside of these areas. The largest key threatening process affecting the community is reduced/altered flow caused by the construction of major dams, as well as adverse effects such as thermal pollution and in stream structure barriers. Additionally, introduced fish species such as Eastern Gambusia and Brown Trout, and clearing of riparian vegetation have a range of detrimental impacts to the community.

D1 Fisheries Management Act 1994 Assessment of Significance

Aquatic Ecological Community in the Catchment of the Snowy River in NSW – Endangered Ecological Community (FM Act)

FM Act	Question	Response
221ZV a)	In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Not applicable
221ZV b)	In the case of an endangered population, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	Not applicable
221ZV c)	In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:	(i) The majority of the proposed works are to occur on existing cleared and managed land within the golf course. Minor areas of proposed landscaping works encroaching VRZs will be mitigated with sufficient

FM Act	Question	Response
	(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	erosion and sediment control measures in order to prevent pollution or debris run off. Indirect impacts such as run-off will be accounted for by the stormwater drainage design, and four Puraceptors will treat any stormwater prior to discharge to Thredbo River. Therefore, the extent of the community will not be placed at risk of extinction by the proposed works. (ii) As above, the majority of the proposed works are to occur on existing cleared and land managed as a golf course. The composition of the ecological community would not be modified by the proposed works as no fringing or aquatic vegetation would be being removed and no aquatic fauna would be added or removed as a part of the development.
221ZV d)	In relation to the habitat of a threatened species, population or ecological community: (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the threatened species, population or ecological community in the locality.	(i) The proposed stormwater outlets on the river bank are minor in scale compared to the unimpacted river (i.e. several metres versus kilometres). (ii) The proposed works would not remove, realign or modify habitat and, therefore, would not become fragmented. (iii) Not applicable, as no habitat would be modified or removed.
221ZV e)	Whether the proposed development or activity is likely to have an adverse effect on any critical habitat (either directly or indirectly).	The site is not declared critical habitat
221ZV f)	Whether the proposed development or activity is consistent with a Priorities Action Statement.	Consultation with DPIRD Fisheries is consistent with the Medium Priority action for DPIRD to: *Provide local councils, government agencies and Local Land Service's with resource materials and training regarding habitat protection and threatened species provisions of the NSW Fisheries Management Act 1994 to support planning, determination, impact assessment and concurrence decision making processes. This may include impact assessment guidelines, mitigating prescriptions, offsets, and generic consent conditions.*
221ZV g)	Whether the proposed development constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	One key threatening process is involved in the proposal due to removal or pruning of riparian trees to improve sight lines on the golf course: *Degradation of native riparian vegetation*. This impact would be compensated by managing the existing native vegetation (e.g. weed and erosion control). Therefore, the removal or pruning of a small number of trees is unlikely to significantly contribute to this key threatening process.

FM Act	Question	Response
Conclusion	**Is there likely to be a significant impact?**	**No, because no habitat would be modified, and the works would not exacerbate the factors causing this community to be endangered.**

ecological AUSTRALIA
A TETRA TECH COMPANY

1300 646 131
www.ecoaus.com.au