DESKTOP GEOTECHNICAL ASSESSMENT FOR BALMATTUM RESERVE MOUNTAIN BIKE TRAIL NETWORK

Euroa, VIC 3666

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GEOTECHNICAL INVESTIGATION FOR (RESIDENTIAL/INDUSTRIAL/COMMERCIAL) SUBDIVISION
STRATHBOGIE SHIRE COUNCIL

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1.0 INTRODUCTION

Stantec Australia was engaged by Strathbogie Shire Council with regards to development of Mountain Bike (MB) trails arounds Balmattum Reserve on the eastern fringe of the Euroa township. The proposed development is adjacent to Hume highway and located on east outskirts of Euroa.

According to the Balmattum Concept plan, the proposed trail network is approximately 10km in total length on top of the existing walking trails. The Balmattum Reserve has 1.8km of existing dual direction access road along the western boundary that connects the proposed northern trail heads to the existing walking trail carpark, 1.3km of existing main walking trail and 2.1km of existing secondary walking trail. Further, a trailhead carpark and related infrastructure, and trailhead information and warning signage are proposed to be constructed.

The geotechnical desktop assessment includes the following:

- Geological setting and likely sub-surface profile;
- A discussion of the current features along the mountain bike trails;
- A discussion of the potential presence of groundwater and vegetation in Balmattum Reserve;
- The likely issues relating to the design and construction of the mountain bike trails;
- Geotechnical issues that may impact on the access road; and
- Recommendations for future intrusive geotechnical investigations required to characterise the geotechnical conditions and inform the functional design.

This geotechnical desktop assessment was undertaken in accordance with Balmattum Concept Plan prepared by Natural Trails dated 18th August 2023 and includes an interpretation of likely subsurface and groundwater conditions based on publicly available information.

2.0 LIMITATIONS OF THE REPORT

The report is limited to a geotechnical desktop assessment of the proposed Mountain Bike trails and specifically covers the issues discussed in the project scope identified in Section 1.0.

This report does not include geotechnical investigation results or provide any design recommendations for any roads, below or above-ground services, buildings or other infrastructure. No environmental conclusions or recommendations are made in this report.

The limitations of the geotechnical reports are contained in Appendix A.

3.0 SITE DESCRIPTION

The site for the proposed trail network is located to the east direction of Euroa. The indicative trail paths are shown in Figure 3-1. Figure 3-2 shows that the surface elevation of the site ranges from approximately 350 mAHD along the eastern edge down to 200 mAHD along the western edge (along the Hume Freeway). The crest of Balmattum Hill lies to the east of the site. The northern half of the

site falls towards the north-west away from the crest while the southern half of the site generally falls to the west away from the hill..

Figure 3-1 shows a cross section of the site, which indicates that the slopes in the central to eastern portion of the site are typically have a gradient of greater than 15%.

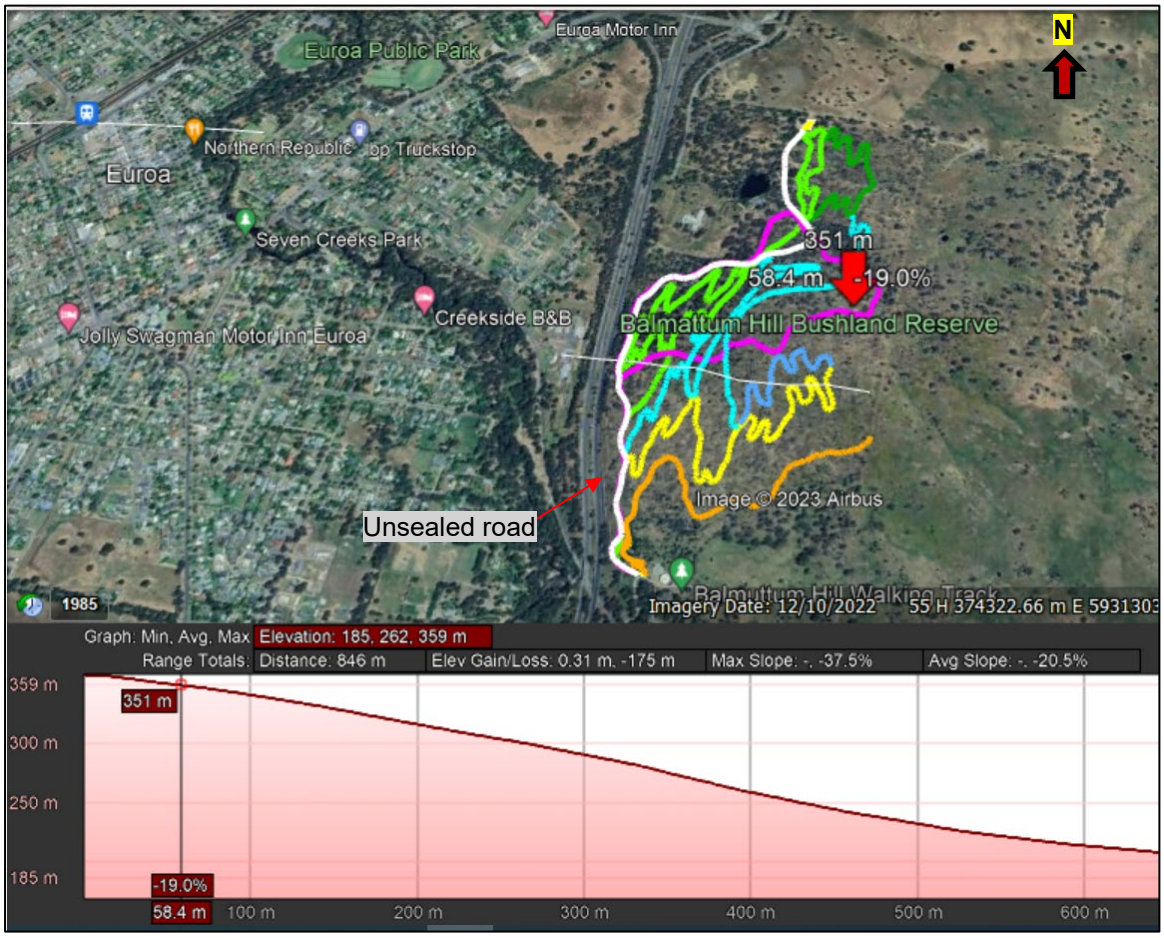


Figure 3-1:Indicative Bike Tracks and East-to-west Topographic Cross Section

According to Vegetation map supplied by Forests Commission Victoria (1972), Figure 3-3 indicates that the vegetation across the Balmattum Hill Bushland Reserve consists of open forest with understorey grasses and scrub.

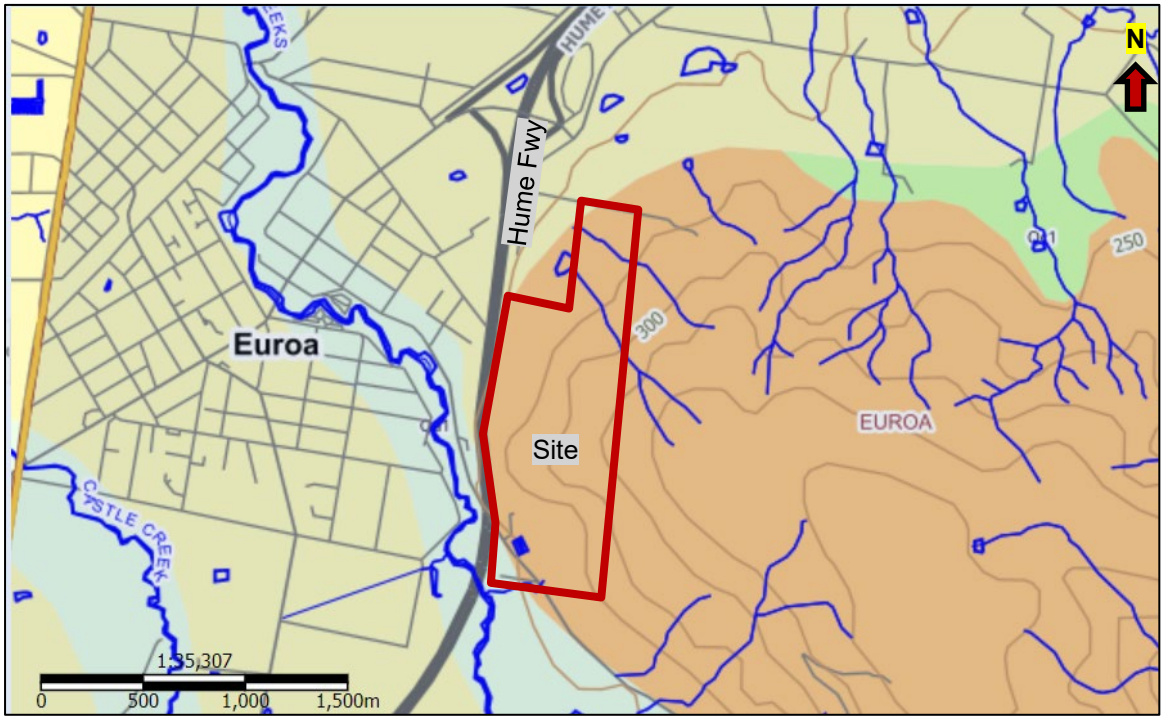


Figure 3-2: Topography and Surface Geology

Map Symbol	Typical Structural Form(s) (at Maturity)	Major Tree Species (Common Name of Unit)	Associated Tree Species	Major Understorey Species
1	Open forest I	Candlebark gum : snow gum.	Broad-leaf peppermint	Snow grass, button everlasting, eyebright; dwarf geebung, gorse bitter-pea; silver wattle.
2 r—Regrowth m—Mature	Open forest IV	Alpine ash	Candlebark gum, narrow-leaf peppermint.	Snow grass; bracken fern; mother shield fern, hop bitter-pea; mountain tea-tree, austral mulberry, musk daisy-bush, soft treefern.
3	Open forest III and IV	Messmate stringybark	Manna gum, victorian blue gum, narrow-leaf peppermint, candlebark gum.	Bracken fern, fishbone water-fern, hard water-fern; silver wattle, musk daisy-bush; blackwood.
4	Open forest III	Narrow-leaf peppermint	Candlebark gum, manna gum, victorian blue gum, broad-leaf peppermint, brittle gum, red stringybark.	Tussock grass, cut-leaf crane's bill, violets, pennyworts; bracken fern, fishbone water-fern; silver wattle, common cassinia, austral king fern, soft treefern, hazel pomaderris, musk daisy-bush, austral mulberry; black-wood.
5a	Open forest II	Broad-leaf peppermint: candlebark gum	Brittle gum, victorian blue gum, narrow-leaf peppermint.	Tussock grass, pink-bells, guinea flower; spiny-headed mat-rush, handsome flat-pea, gorse bitter-pea, narrow-leaf bitter-pea, common beard-heath, mountain grevillea, small grasstree.
5b	Open forest II	Broad-leaf peppermint : red stringybark	Long-leaf box, red box, brittle gum.	Tussock grass, wallaby and spear grasses, violets, pennyworts, austral bugle, austral bear's ear, honey pots; common beard-heath, varnish wattle, handsome flat-pea, bracken fern.
6	Open forest II Open forest I	Red stringybark : long-leaf box : red box	White box, yellow box, grey box.	Tussock grass, wallaby and spear grasses, small grasstree, silky guinea flower, digger's speedwell, daphne heath, grey bush-pea, mountain grevillea, box-leaf wattle, golden wattle, woolly wattle.

Figure 3-3:Vegetation Types (Item 6)

4.0 SITE GEOLOGY AND GROUNDWATER

4.1 SURFACE GEOLOGY

Surface geology across the site and surrounding areas is presented on Figure 4-1. Devonian volcanic rhyodacite generally underlies the site except for a small portion along the unsealed road that runs along the northern portion of the site, which is situated on Quaternary Shepparton Formation. The proposed bike tracks would be constructed predominantly on the residual soils weathered from the volcanic rock.

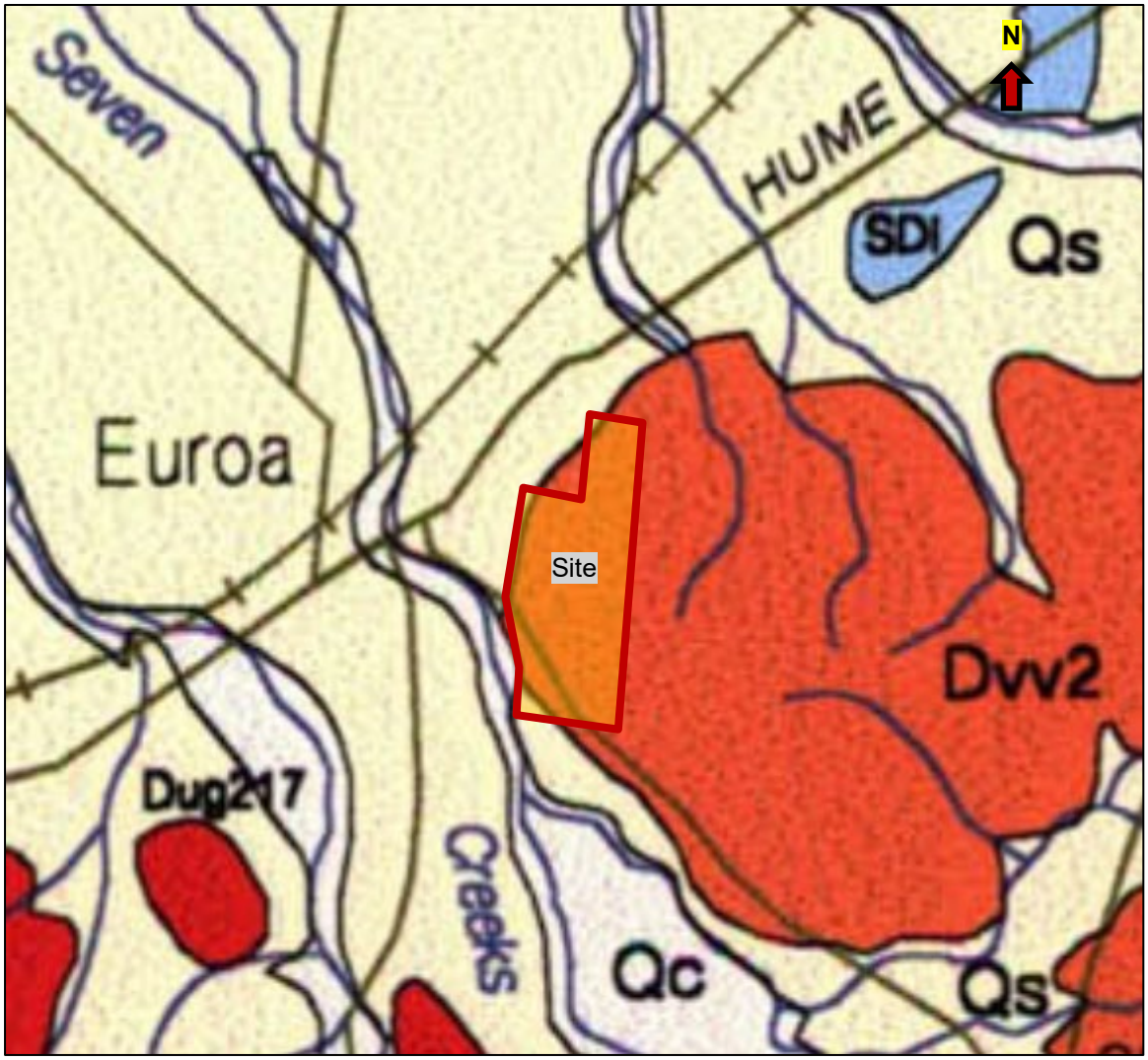


Figure 4-1: Excerpt from Wangaratta (1:250,000) Geological Map

A land capability study covering the site indicates the following:

- Roxby Land Unit.
- Landforms:
  - Drainage lines with various soil types.
  - Gentle slopes (3% to 10%) yellow duplex soils.

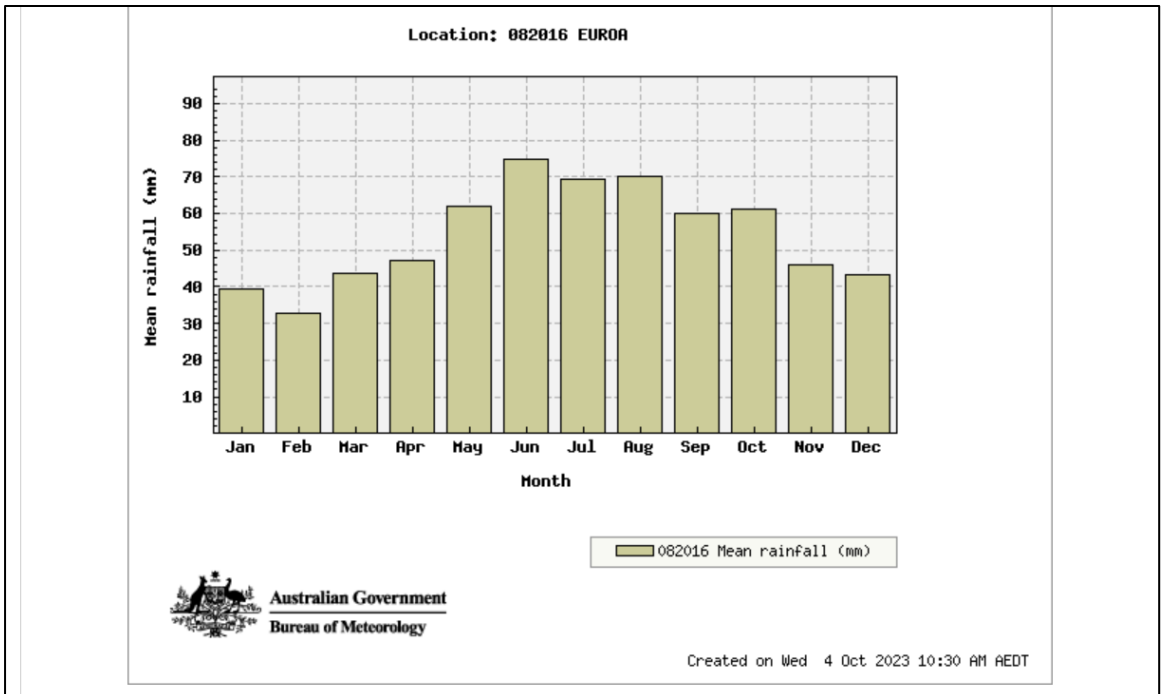
- Hilly (15% to 25% slopes) red duplex soils and uniform stony loams.
- Moderate colluvial slopes (8% to 15%) yellow duplex soils.
- Steep slopes (25% to 30%) with uniform stony loams and occasional red duplex soils.

4.2 GROUNDWATER

The depth to the regional water table is anticipated to be in excess of 10 m. Some ephemeral perched groundwater and localised springs may develop along the toe of the slopes during periods of high rainfall.

As shown on Figure 3-2, two ephemeral creeks are present in the northern portion of the site and one ephemeral creek is present in the southwest corner of the site.

Average annual rainfall at Euroa is approximately 650 mm with the 10%ile annual rainfall of approximately 440 mm and the 90%ile of approximately 890 mm. As shown on Figure 4-2, mean monthly rainfall ranges between approximately 33 mm (February) and 75 mm (June). However, heavy localised rainfall associated with summer thunderstorms occurs in the area.



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean rainfall (mm) for years 1883 to 2023	39.3	32.9	43.7	47.1	61.8	74.8	69.3	70.3	60.0	61.3	46.1	43.2	649.1	137

Figure 4-2: Mean Monthly Rainfall – Euroa, Victoria

5.0 DISCUSSION

5.1 GEOLOGICAL CONSIDERATIONS

The proposed alignment of the mountain bike trails will be located on Devonian volcanic rocks, which are geologically old and likely to be consolidated. This rock unit is likely to be composed of high strength competent rock. Figure 4-1 indicates that a small portion of the unsealed road running along the northern side of the site is underlain by Quaternary Shepparton Formation.

Figure 5-1 shows a contour map of the proposed site, with gullies identified along the trail alignments. These gullies may have been formed by slow erosional processes or minor landslips. No significant evidence of deep-seated landslides was visible in the contour maps. However, the soil within the gullies are likely to have a higher moisture content than other areas, which could lead to increased degradation of the bike paths and potentially localised minor landslip instability.

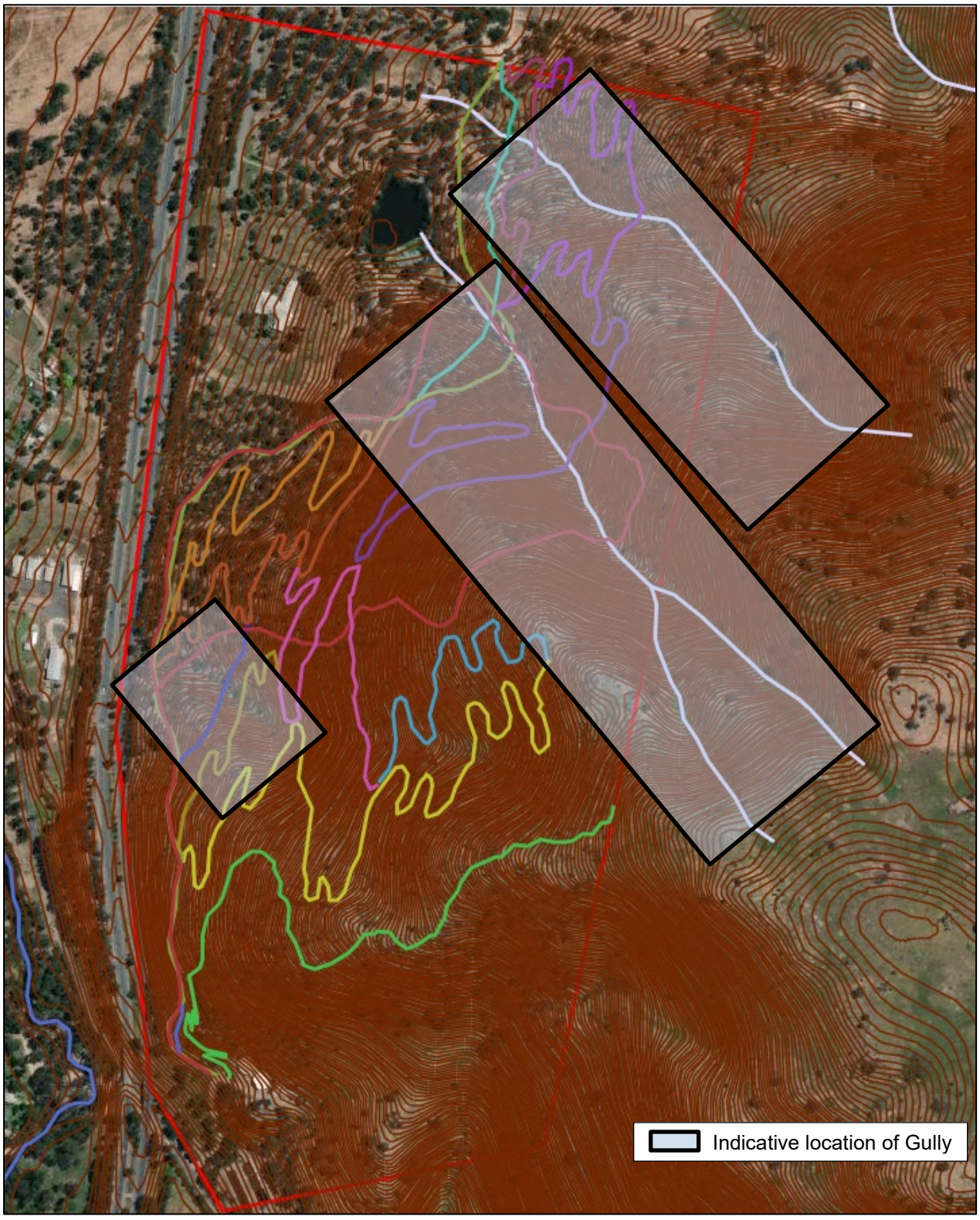


Figure 5-1: Contour map of the site

5.2 CONSIDERATIONS FOR THE ACCESS ROAD

The proposed pavement alignment for the access road is likely to be generally suitable, provided that there is appropriate allowance for potential subgrade conditions and drainage issues. In order to minimise the potential impacts of softened subgrade conditions due to run-off from up slope it is recommended that the road is built up above the existing surface level using an embankment rather than being boxed below subsurface level. The embankment should be conducted after stripping of any topsoil and silts down to the natural clays. The embankment should be constructed out of a Type A fill material with low erodibility.

Swale drains should be installed on both sides of the road to capture surface runoff and appropriately divert it away from the road. Culverts will be required where the road crosses gullies and depressions to minimise ponding of water on the high side of the road embankment.

An unsealed gravel pavement for the access track is likely to be suitable for the volume of traffic anticipated for the site, provided that there is appropriate maintenance grading conducted at regular intervals. Should a lower maintenance pavement be required then the use of a thin asphalt wearing course or spray seal wearing course could be considered.

For the turning lanes and entrance to the access road it is recommended that a sealed pavement be adopted. Usually, for turning lanes where there will be braking heavy vehicles it is recommended that a deep asphalt pavement provide be adopted. However, if the traffic will generally be limited to cars and recreational vehicles then adopting a granular pavement with a thin asphalt wearing course could be considered.

5.3 CONSIDERATIONS FOR EROSION AND LANDSLIDES

As indicated earlier in this report, based on a desktop assessment, the site does not appear to be significantly prone to large scale deep seated landslides. However, due to the steepness of the site and likely increased moisture content in the gullies there is potential for smaller scale landslides within these gullies.

The potential for debris flows also should be considered. Debris flows can be instigated by relatively small landslides occurring in the upper parts of a gully in combination with a build up of water. Once started, debris flows can result in the movement of large volumes of soil, water and debris a significant distance downslope. Debris flows can pose a significant risk to downstream life and infrastructure. While there is no clear evidence of past debris flow activity, based on the geological maps, it is recommended that during the design phase an experienced geotechnical engineer inspect the site to look for evidence of the potential for debris flows, and if required conduct a risk assessment based on Australian Geomechanics Society guidelines.

Care will be required during the design of the track network to minimise the use of large cuts and fill as these have the potential to induce instability issues. Preferably cuts and fills should be limited to less than 1m in height, especially within the gullies or on the steeper slopes. Where greater than 1m in height is required, it is recommended that a detailed geotechnical assessment be conducted to assess the impacts of the works on the stability of the slope.

Due to the significant slope on the site, the potential for erosion of the upper soils needs to be considered, especially in the vicinity of the existing gullies. While ongoing erosion may only have a

gradual impact on the amenity of the bike trails, there is potential that areas of high water flow may result in localised washouts of the tracks and gully crossings and other areas of increased surface flow.

For the access track, as previously indicated, it is recommended that the road embankment be constructed out of low erodibility materials to minimise the potential for scouring of the subgrade due to water flow through the pavement.

5.4 GEOTECHNICAL INVESTIGATION

It is recommended that a geotechnical investigation be conducted to inform the design of the project. The investigation should be targeted to assess the conditions that are most likely to impact on the design and performance of the project. These issues include:

- The subgrade conditions along the alignment of the access track and entrance
- The foundation conditions for any structures (such as jumps and elevated platforms)
- The foundation conditions for culverts
- The potential for landslides, debris flows and erosion

It is recommended that the scope for the investigation includes the following:

- Boreholes at approximately 200m intervals along the alignment of the access track with two boreholes conducted at the entrance for the widenings of the main road
- Boreholes / hand auger holes at the locations of structures
- A borehole at the location of each of the culverts under the access track
- A walkover assessment by an experienced geotechnical engineer to assess the site for the potential impacts of landslides, debris flows and erosion

6.0 REFERENCES

Vegetation Map, Forests Commission, Victoria, 1972.

Geological Map of Wangaratta (1:250,000).

Visualising Victoria's Groundwater website

AS 1726 - 2011 *Geotechnical Site Investigations*

APPENDIX

Appendix A LIMITATIONS OF THE REPORT

LIMITATIONS OF GEOTECHNICAL REPORTS

The purpose of this report is to provide a geotechnical assessment of the sites examined. The information provided herein will reduce the exposure to risks, but no geotechnical assessment can eliminate them. Nonetheless, even a rigorous assessment may fail to detect all of the geotechnical conditions on a site. Site variations may have occurred in areas not investigated or sampled.

This geotechnical report should not be used when the nature of the proposed site usage changes, when the size, layout, or location of the development is modified, when the site ownership changes nor should it be applied to a nearby area. No environmental assessment has been undertaken nor is implied.

This site geotechnical assessment identifies actual subsurface conditions where the samples were taken and at the time they were taken. The laboratory tests are carried out by external NATA accredited laboratories and any liability with regards to the testing is solely this laboratory's responsibility. Geotechnical engineers then interpreted the laboratory results and field data and rendered an opinion about the overall subsurface conditions, including the soil type, extent of the soil layers, and their likely impact on the proposed development, with a discussion of the implications considered likely. The actual conditions may differ from the inferred conditions, as no person (no matter how qualified) or even the most detailed subsurface investigation can predict with confidence what may be hidden by soil or water or may have altered with time. Often the interface between different geotechnical areas may be more abrupt or gradual than anticipated. The actual conditions in an area may differ from those predicted.

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Finally, geotechnical reports are based extensively on opinion and judgment and are less exact than other sciences. The report may contain a number of explanatory clauses or limitations on the results to inform the client about the restrictions of the report. These clauses are not meant to be exculpatory clauses to foist liability onto another person, but to identify where Stantec's and the client's responsibilities start and finish. Their use is to clarify where individual responsibilities lie and to allow the individual to take appropriate actions.