



Snowy 2.0 Biodiversity Monitoring Report

Year 5

2024/2025 Annual Report



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Photo Credit: Dr Zak Atkins

Alpine She-oak Skink

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Executive Summary

This report has been prepared under the SHL 2.0 Biodiversity Management Plan (BMP) – Revision M S2-FGJV-ENV-PLN-0008, and the Biodiversity Monitoring Program (Appendix B of the BMP) – revision G S2-FGJV-ENV-PLN-0106.

Consultation with agencies and technical experts following the Year 4 report, and throughout the Year 5 survey period, has been extensive and has identified opportunities for improvement across multiple aspects of the program. Feedback from agencies during previous survey years consistently emphasised the need for engagement with species experts. In response, SHL has progressed beyond consultation and directly engaged species experts, including PhD-qualified conservation biologists, to undertake BMP surveys and assessments.

A further request from agencies was to include a dedicated chapter on Groundwater Dependent Ecosystems (GDEs), incorporating telemetry monitoring in accordance with the Groundwater Management Plan. This has been addressed in this report. In addition, SHL has undertaken floristic surveys of selected GDEs, exceeding approval requirements (refer to Section 11).

Improvements to document structure have also been implemented in response to agency feedback. Survey results are now presented by survey type/species group within consolidated chapters, rather than being separated into introductory, methods, results, discussion, and recommendation sections. This revised structure improves readability and usability. Additionally, the biodiversity report prepared by the principal contractor, previously issued as a standalone document, has been incorporated into this report (refer to Appendix 10).

Recommendations identified through periodic reporting by species experts were proactively discussed with agencies in advance of this reports' release. This early engagement has contributed to positive outcomes for the Year 6 Biodiversity Monitoring Program, including:

- The inclusion of chytrid swabbing during frog surveys.
- An increase in monitoring transects for frogs with the addition of two more control sites to increase statistical relevance.
- An increase in survey effort for the Booroolong frog to include a 3rd survey (making it two surveys in November and one in December).
- Retaining a sediment basin that was to be decommissioned after Ecologists identified successful breeding and species recruitment of Alpine Tree Frog at the basin.
- Supporting the NPWS Board-toothed Rat genetics survey with the collection of scats for their program.
- Increased feral control activities and a user-friendly sighting notification process via a QR-code poster.
- Increased weed control, extending into the Autumn season.

In Year 5 triggers for adaptive management have been identified for some of the surveys including, small mammals (Smoky Mouse only), Alpine she-oak Skink, feral animals, weeds, and soil. Proactive consultation with agencies has been initiated as per the adaptive management processes for each survey/species as per the biodiversity monitoring program. Further details discussing results and recommendations can be found in the relevant chapters.

All other aspects of the monitoring program are tracking within defined trigger thresholds; however, a notable trend has been observed in threatened flora surveys. A decline in *Clover Glycine* and *Kiandra Leek Orchid* has been recorded across both control and impact sites since the commencement of main works. In addition, three sites adjacent to the temporary spoil emplacement area have not recorded a positive detection over multiple monitoring periods. While these observations do not meet the current trigger criteria, SHL has initiated consultation with agencies to further investigate these trends.

Acronyms and Definitions

| | |
|-----------------------|--|
| Approval | Infrastructure Approval for Snowy 2.0 Main Works issued under Section 5.19 of the Environmental Planning and Assessment Act 1979 (Dated: 20th May 2020) (SSI 9687). |
| BCS | Biodiversity Conservation and Science (changed to Conservation Programs, Heritage and Regulation (CPHR) in 2025). |
| BMP | Biodiversity Management Plan. |
| BMPg | Biodiversity Monitoring Program. |
| Construction Envelope | The envelope within which the disturbance area of the development may be located. As detailed design continues, final siting of the infrastructure (i.e. the disturbance area) can move within the assessed Construction Envelope subject to recommended environmental management measures and provided it does not exceed the maximum disturbance area and native vegetation clearing limits. |
| CPHR | Conservation Programs, Heritage and Regulation (formally BCS). |
| CSSI | Critical State Significant Infrastructure. |
| DAWE | Department of Agriculture, Water, and the Environment (changed to DCCEEW and DAFF in July 2022). |
| DCCEEW | Department of Climate Change, Energy, Environment, and Water (formally DAWE). |
| Direct Impact | Areas directly impacted are those areas which are situated within the final disturbance footprint for the project. Direct impacts are characterised as: <ul style="list-style-type: none"> - clearing of areas of native vegetation; - clearing of threatened species habitat; - clearing of threatened ecological communities (TECs); and - disturbance of river/creek beds and banks. |
| Disturbance Area | The area with the construction envelope where development may be carried out; the precise location of the disturbance area will be fixed within the construction envelope following final design. As detailed design continues, final siting of the infrastructure (i.e. the disturbance area) can move within the assessed Construction Envelope subject to recommended environmental management measures and provided it does not exceed the maximum disturbance area and native vegetation clearing limits. |
| DPI | Department of Primary Industries. |
| EP&A Act | <i>Environmental Planning and Assessment Act 1979</i> (NSW). |
| EPBC Act | <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth). |
| FGJV | Future Generation Joint Venture (this is the Principal Contractor employed by Snowy Hydro to complete the 2.0 Project). |
| GDE | Groundwater Dependent Ecosystem. |
| Indirect Impact | Indirect impacts, if unmitigated, are characterised as: <ul style="list-style-type: none"> - Increased noise, vibration and dust levels resulting in disturbance of fauna species, and consequent abandonment of habitat, or changes in behaviour (including breeding behaviour); - Lighting for night works, resulting in disturbance to fauna species and changes in occupancy or behaviour; - Drawdown of groundwater resulting in impacts to groundwater dependant ecosystems; - Increase in weeds and pathogens, resulting in degradation of retained native vegetation and habitat; and - Increase in predatory and pest animal species, resulting in increased predation and competition and a consequent reduction in populations. <p>For the purposes of the BDAR it was assumed that all vegetation within 20 m of the disturbance footprint will experience indirect impacts as a result of the project.</p> |
| KNP | Kosciuszko National Park |

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| LHRR | Lobs Hole Ravine Road. |
| Main Works | Refers to Snowy 2.0 main construction work, which follows the Exploratory phase of the Project. |
| NPW Act | <i>National Parks and Wildlife Act 1974 (NSW).</i> |
| NPW Regulation | <i>National Parks and Wildlife Regulation 2019 (NSW).</i> |
| NPWS | National Parks and Wildlife Service (NSW). |
| PC | Principle Contractor. |
| PCT | Plant Community Type. |
| Program | The Biodiversity Monitoring Program (Appendix B of the BMP also referred to as BMPg). |
| Project area | The project area is the broader region within which Snowy 2.0 will be built and operated, and the extent within which 'direct impacts' from Snowy 2.0 Main Works are anticipated. The Project Area does not represent a footprint for construction works, but rather indicates an area that was investigated during the environmental assessments. |
| Project, the | Snowy 2.0 Main Works Project. |
| SHL | Snowy Hydro Limited |
| TARP | Trigger, Action and Response Plan |

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1. Introduction

The Snowy Hydro Limited (Snowy Hydro or SHL) Biodiversity Monitoring Program (BMPg) S2-FGJV-ENV-PLN-0106, is included under Appendix B of the FGJV Biodiversity Management Plan (BMP) S2-FGJV-ENV-Plan-0008. At the time of preparing this Annual Report (Year 5: 2024–2025), the current version of the BMP was Revision M (20 March 2025), and the BMPg was Revision G (19 December 2024). The BMPg addresses the requirements of Schedule 3, Condition 18(d) of the Infrastructure Approval (SSI 9687).

The purpose of the BMPg is to define the biodiversity monitoring requirements to be implemented during construction of the Project. Specifically, the Program outlines monitoring activities designed to assess indirect impacts associated with construction, as identified in the BMP. These monitoring activities provide feedback on the effectiveness of implemented environmental management measures in mitigating indirect biodiversity impacts.

The Program demonstrates Snowy Hydro's commitment to minimising potential impacts of the Project on biodiversity values.

1.1 Snowy 2.0 Project Overview

Snowy Hydro owns, manages, and maintains the Snowy Mountains Hydroelectric Scheme (the Scheme). The Scheme currently includes 16 major dams, nine power stations, one pumped power station, 145 km of interconnected tunnels and pipelines, and 80 km of aqueducts. The Scheme, principally located within the Kosciuszko National Park (KNP), is one of the largest and most complex hydro-electric schemes in the world. The pumped hydro-electric expansion of the Scheme (Snowy 2.0) will link the existing Tantangara and Talbingo reservoirs via a new underground tunnel and a Pumped Hydro Energy Storage (PHES), see figure 1.1 for an overarching location map. Snowy 2.0 will provide an additional 2,200 MW of dispatchable generating capacity, along with approximately 350,000 MWh of large-scale energy storage that will be available on demand as quick-start electricity generation at critical times of peak demand.

For almost 70 years Snowy Hydro has responsibly operated the Snowy Scheme within KNP. Snowy Hydro is committed to avoiding and minimising potential impacts from Snowy 2.0 as they do for the existing business.

1.2 Snowy 2.0 Project Approval

This project was designated Critical State Significant Infrastructure (CSSI 9687) and assessed under Part 5 of the EP&A Act. Under sections 5.23 and 5.24 of the EP&A Act, certain separate approvals and licences are not required. The project was approved by the NSW Minister for Planning and Public Spaces under Section 5.19 of the EP&A Act on the 20th of May 2020.

A referral (EPBC 2018/8322) was also prepared and lodged with the Federal Minister for the Environment under the EPBC Act and the proposal was subsequently determined to be a controlled action under that Act. The project was approved by the Department of Agriculture Water and the Environment (DAWE), now the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under sections 130(1) and 133(1) of the EPBC Act on the 29th June 2020.

Full details of the project Approval and supporting information can be found at:

<https://www.planningportal.nsw.gov.au/major-projects/project/12891>

1.3 Snowy 2.0 Main Works Overview

Snowy Hydro and its project partner Future Generation Joint Venture (FGJV) are currently undertaking 'Main Works' construction work for Snowy 2.0. The Snowy 2.0 project area is delineated into the Approved Disturbance Footprint and the Approved Construction Envelope (Figure 1-2). The Main Works includes pre-construction activities such as pre-clearing works, pre-construction/site establishment, geotechnical investigation and survey, and implementing environmental mitigation measures. Construction activities include access road and bridge work, excavation and tunnelling, excavated rock management, intake and gate-shaft construction, progressive rehabilitation, fit out, testing and commissioning, and final rehabilitation.

1.4 Biodiversity Monitoring Program (BMPg) Objectives

The objective of this Program is to monitor potential impacts to flora, fauna and habitat arising from indirect hazards associated with Snowy 2.0 construction activities, within defined proximity which were identified during the EIS stage and listed in the BMP.

1.5 BMPg Implementation, Content, and Reporting

Responsibility for the Biodiversity Monitoring Program sits with Snowy Hydro, while the Principal Contractor, FGJV, is responsible for implementing all other BMP activities and requirements.

An annual report is to be prepared each year to report on the variety of biodiversity matters addressed in the BMP. The annual report is to be made available to NPWS, DCCEEW (formally DAWE), and CHPR (formally BCS), and will include:

- Results from the Biodiversity monitoring (as detailed in Appendix B of the BMP):
- Any triggers for adaptive management based on the results:
- Recommendations from Ecologists with respect to any required mitigation plans, or general discussion for overarching monitoring improvements regarding the efficacy of the implements Biodiversity management measures against the performance measures set out in Table 1.1 below;
- A summary of weed and vertebrate pest control activities undertaken since the last annual report (as detailed in Appendix F of the BMP);
- Account of fauna strikes and account of any fauna strike mitigation strategy actions (as detailed in Appendix G of the BMP);
- Account of all clearing activities including tracking against clearing limits and threatened species habitats limits. This includes post-clearing reports since the last annual report (as detailed in Appendix C of the BMP), and:
- Account of any relevant incidents and non-compliances.

Once finalised, this report will be publicly available via Snowy Hydro’s website www.snowyhydro.com.au

Table 1-1: Performance Measure for assessing the efficacy of the implemented management controls (excerpt from the BMP S-6.5.1).

See Appendix 10 for compliance results and control activities performed by the Principal Contractor.

| No. | Performance Measure | Relevant COA |
|-----|--|--|
| 1 | The project will not exceed the maximum native vegetation clearing of 532 Ha. | Schedule 2, Condition 5 |
| 2 | The project will ensure that if the shallow groundwater regime is impacted and results in a measurable change to the ecosystem function of the Alpine Bogs and Fens vegetation community, that appropriate biodiversity offsets will be calculated and paid. | Schedule 3, condition 15 & 16 |
| 3 | Other than where permitted by the Infrastructure Approval, the disturbance area will be restricted to within the approved construction envelope of the project. | Schedule 3, condition 17(a) |
| 4 | Direct impacts to threatened species habitats will be generally in accordance with those quantified in the revised BDAR as summarised in section 4.2.1 of this plan. | Schedule 3, condition 17(b) & (d) |
| 5 | Threatened species impacts resulting from clearing and vehicle strike will be minimised through the implementation of effective controls such as pre-clearing procedures and fauna strike mitigation measures. | Schedule 3, condition 17(d), (e) & (f) |
| 6 | An improvement (e.g. a reduction in weed/pest abundance or distribution) results from the implementation of a regular weed and pest control program. | Schedule 3, condition 17(d) & (i) |



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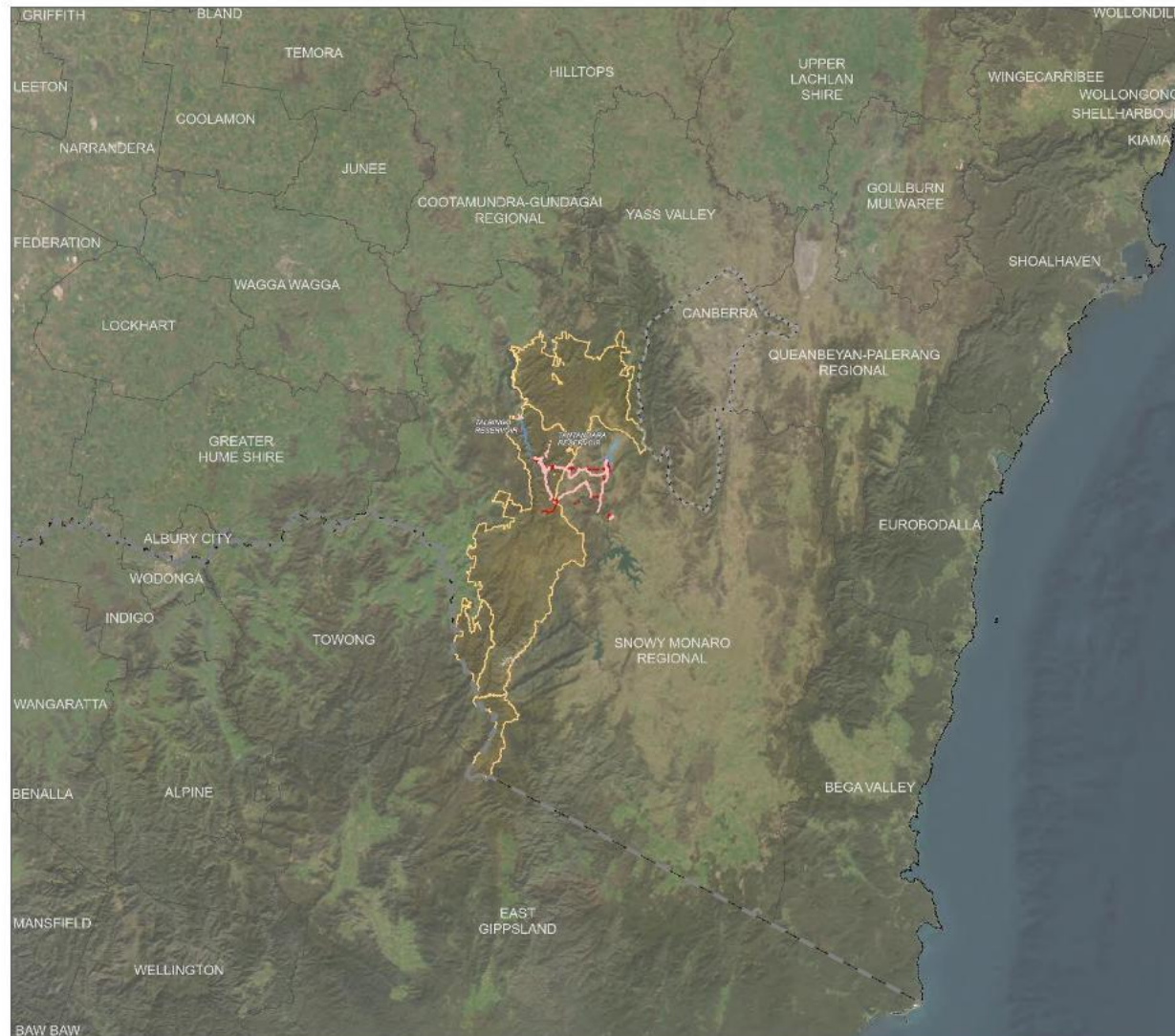
Figure 1 - Site Context

Legend

- Construction Envelope
- Disturbance Boundary
- Reservoirs
- Kosciuszko National Park
- Local Government Area
- State Border



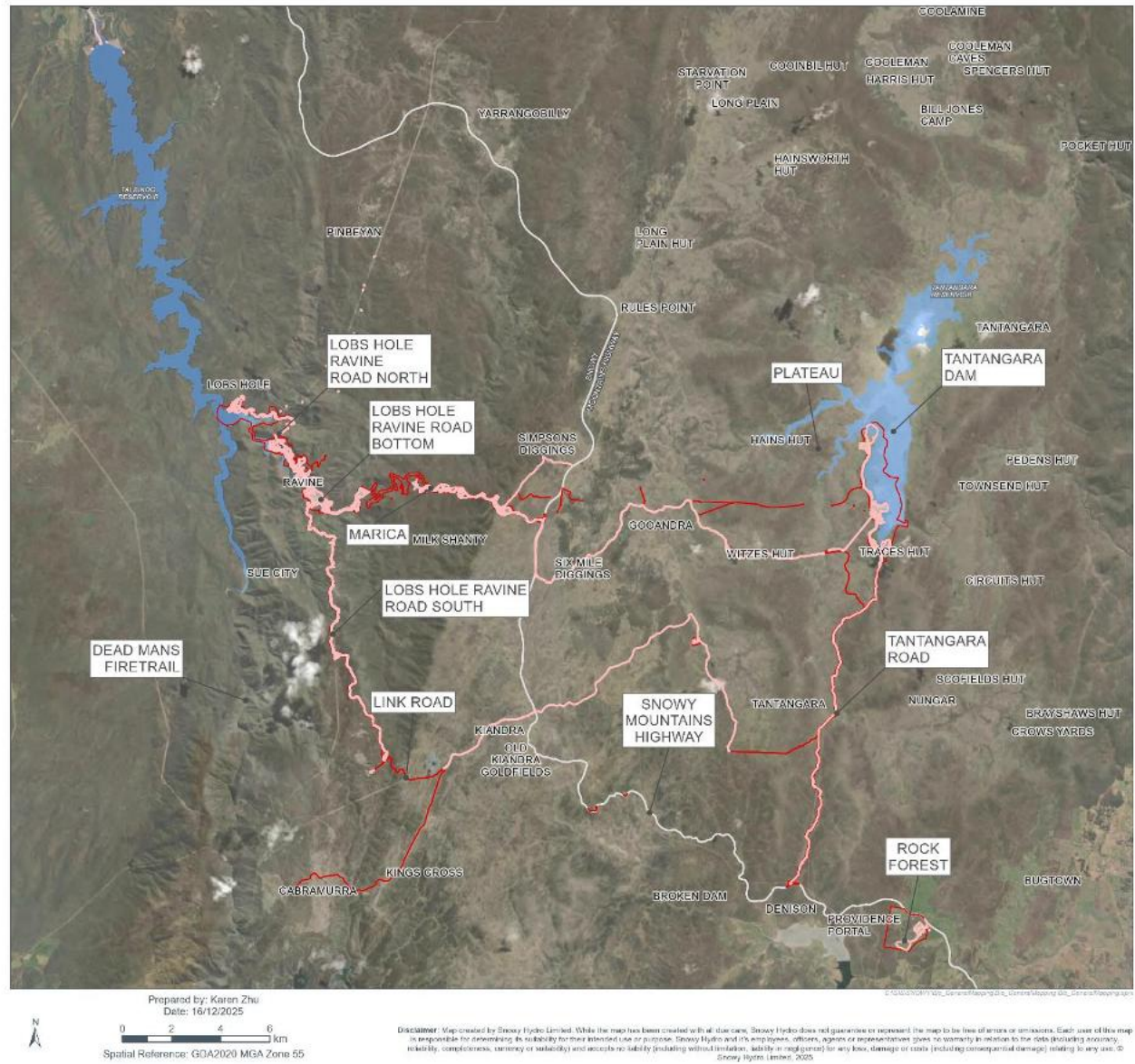
Credits: Data used is owned by Snowy Hydro Limited except as follows:
DCCEEW, Vicmap, Esri, Terraform, Garmin, FAO, NOAA, USGS, Geospatial Cloudsmiths
(All credits / acknowledgements for any other third party sources here)



Prepared by: Karen Zhu
Date: 18/12/2025
Spatial Reference: GDA2020 MGA Zone 55

Disclaimer: Map created by Snowy Hydro Limited. While the map has been created with due care, Snowy Hydro does not guarantee or represent the map to be free of errors or omissions. Each user of this map is responsible for determining its suitability for their intended use or purpose. Snowy Hydro and its employees, officers, agents or representatives gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use. © Snowy Hydro Limited, 2025.

Figure 1.1: Overarching location map.

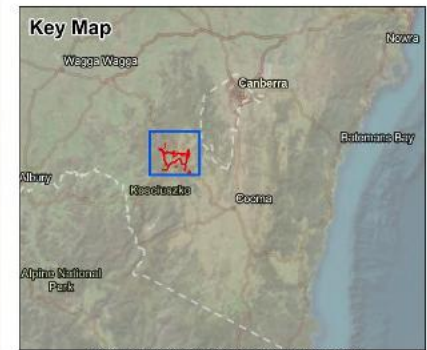


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Figure 1.2 - Snowy 2.0 Main Works Areas

Legend

- ▭ Construction Envelope
- ▭ Disturbance Boundary
- ▭ Reservoirs
- ▭ Major road



Credits: Data used is owned by Snowy Hydro Limited except as follows:
 UICOLEW, © map, ©an, TomTom, Garmin, FAO, KLDAA, UEXIS, Earthstar Geographics
 (Full credits & acknowledgements for any other third party data sources here)

Figure 1.2: Location of Snowy 2.0 Main Works Infrastructure.

1.6 Recommendations from Year 4 and Actions taken

In response to the findings and recommendations of the *Biodiversity Monitoring Program: Year 4 Annual Monitoring Report (2023/2024)* (EMM, 2025), SHL formally addressed areas identified as requiring adaptive management to enhance biodiversity management for the project. Table 1.2 summarises the Year 4 recommendations, relevant consultation undertaken, and provides a statement on the outcome of these adaptive measures.

Table 1-2: Adaptive Management Tracking – Implementation and Outcomes of Year 4 BMP Recommendations.

| Monitoring Component | Year 4 triggers for adaptive management (EMM, 2025), | Summary of Year 4 Recommendation (EMM, 2025), | Action/Consultation undertaken in Year 5 | Resolution/Outcome |
|-----------------------------|--|---|--|---|
| Threatened Flora monitoring | Adaptive management was triggered for Clover Glycine and Kiandra Leek Orchid at TF04 - Tantangara. | <p>Investigation is required to determine the causes of the observed decline and assess whether project activities are contributing factors. This should include dust impact assessments, with dust monitoring set up at Spoil Road (Tantangara) and a control site on Circuits Trail.</p> <p>Following the investigation, a mitigation plan should be developed in consultation with DPIE and DAWE [sic]. The plan should address identified causes of decline and include actions such as targeted weed suppression and assessment of soil and microhabitat conditions.</p> | <p>Investigation Result: TF04 was incorrectly triggered. The adaptive management trigger is defined as a “percentage decline in the number of plants observed within a single monitoring plot, over two consecutive monitoring periods, and outside the standard deviation observed at control sites.”</p> <p>As no individuals were recorded at this site in Year 3, a percentage decline could not be calculated for Year 4. Accordingly, the trigger criteria were not met.</p> | <p>Consultation with NPWS and CHPR resulted in the inclusion of a weed transect through the centre of each threatened flora plot, with weed cover to be quantified as percentage cover from the Year 6 monitoring period onwards. This measure has been introduced to assess whether observed historical declines (as opposed to consecutive declines) may be attributed to a primary impact.</p> <p>Subject matter experts from DCCEEW also recommended revising the survey timing to November–December, in place of the previous December–January window. This change has been implemented for the Year 6 monitoring program to improve detection likelihood (email confirmation of change titled <i>BMP Year 4 Review: Threatened Flora Plots</i> – chain begins on 26.09.2025 and finishes on 17.11.2025)</p> <p>The ecologist also included observations of feral herbivore activity within the plot, including horses and rabbits. The plot is located adjacent to the construction footprint and falls</p> |

| Monitoring Component | Year 4 triggers for adaptive management (EMM, 2025), | Summary of Year 4 Recommendation (EMM, 2025), | Action/Consultation undertaken in Year 5 | Resolution/Outcome |
|--|---|--|---|--|
| | | | | <p>outside the Project’s defined area for feral animal control.</p> <p>Discussions of dust deposition monitoring at flora sites is underway.</p> <p>Consultation with agencies remains ongoing.</p> |
| <p>Small mammal occupancy monitoring</p> | <p>Four impact sites (Ravine Rd: SM05-I, Marica: SM22-I, SM23-I, SM24-I) were triggered for adaptive management in Year 4. One impact site (SM07-I – Ravine Road) remained triggered for adaptive management as the Eastern Pygmy Possum in Year 4.</p> | <p>Investigation is required to determine why Smoky Mouse and Eastern Pygmy Possum were not detected and whether project activities contributed to their decline. Based on the findings, mitigation plan should then be developed with NSW and Commonwealth DCCEEW. It is recommended that a formalised trigger-response pathway be documented and integrated into the mitigation plan.</p> <p>Feral Cats and Red Foxes should be prioritised for control at the four impact sites triggering adaptive management, as both species were detected at nearly all sites</p> <p>Reporting of faecal pellet surveys should show counts by age class instead of combined totals.</p> | <p>Consultation was undertaken with small mammal experts from DCCEEW and external specialists. As the Year 4 report (prepared by EMM in May 2025) was finalised while the Year 5 survey effort was already underway, additional data were available at the time of review. Reassessment of trigger status using the Year 5 dataset resulted in changes to triggered sites, reflecting recent detections. Updated trigger locations have been reported to agencies, and additional targeted survey effort is being progressed.</p> <p>Consultation with NPWS has also been undertaken to inform the development of an effective feral control program, focused on foxes, cats and rabbits.</p> | <p>A review of Year 4 trigger outcomes, in combination with progressively collected and now finalised Year 5 survey data, has resulted in the following trigger determinations for Smoky Mouse only. A conservative approach has been adopted, incorporating both Year 1 and Year 2 datasets as baseline conditions.</p> <p>Using Year 1 data as the baseline, triggered sites are SM05, SM22, SM23, SM24 and SM35. When incorporating Year 2 as an additional baseline, triggered sites extend to include SM10, SM14, SM18 and SM21.</p> <p>For ease of reference, trigger locations are summarised below:</p> <ul style="list-style-type: none"> • Ravine Road: SM05, SM10, SM14 and SM18 • Marica: SM22, SM23, SM24 and SM21 • Offsite: SM35 (Alpine Creek Fire Trail) - Note: the area surrounding SM35 was accessed by project staff only during the exploration stage and remained unaffected by direct or indirect project |

| Monitoring Component | Year 4 triggers for adaptive management (EMM, 2025), | Summary of Year 4 Recommendation (EMM, 2025), | Action/Consultation undertaken in Year 5 | Resolution/Outcome |
|----------------------|--|---|--|---|
| | | | | <p>impacts since then. Therefore, the absence of the species is unlikely to be attributed to the project. Recent discussions with DCCEEW expert Dr F Ford in March 2026 support this.</p> <p>Consultation with agencies is ongoing to inform adaptive management. One option put forward by a species expert is the removal of BTR camera traps (noting that scat surveys provide a more robust indication of population presence and activity), with reallocation of this effort to enhance Smoky Mouse camera trapping.</p> <p>A feral predator control program has been developed in consultation with the NPWS liaison team and Area Rangers. Cage trapping is being undertaken on a routine basis, with deployment locations informed by the BMP Project Coordinator using QR code sighting notifications and camera trap data. Trial deployment of 1080 CPEs by SHL was successful; however, a commercial decision in 2025 transferred responsibility for this program to the Principal Contractor (FGJV). FGJV will engage a suitably qualified feral animal control contractor to undertake this work, with control locations determined in</p> |

| Monitoring Component | Year 4 triggers for adaptive management (EMM, 2025), | Summary of Year 4 Recommendation (EMM, 2025), | Action/Consultation undertaken in Year 5 | Resolution/Outcome |
|---|--|--|--|---|
| | | | | <p>consultation with NPWS Authorised Control Officers.</p> <p>The EMM recommendation regarding changes to the faecal pellet survey was not supported by subject matter experts.</p> |
| <p>Small mammal habitat characteristic monitoring</p> | <p>Observed degradation in native vegetation cover and habitat structure of occupied habitat was recorded in combination with an increase in weed cover at two impact sites (SM20 – Lobs Hole and SM27 - Marica). SM20 and SM27 were triggered for adaptive management</p> | <p>Investigation is required to determine whether project activities contributed to habitat degradation at SM20 and SM27.</p> <p>Based on the findings, a mitigation plan should be developed with NSW and Commonwealth DCCEEW, potentially including targeted weed control or construction-related measures.</p> <p>If these actions are ineffective, presence/absence monitoring will assess whether small terrestrial mammals are being impacted.</p> <p>Weed management should be targeted at nine sites (Ravine Rd: SM01, SM10, SM14, SM15. Lobs Hole: SM19, SM20. Marica: SM27. Alpine Creek Trail: SM35. Tantangara: SM36.), which showed an exotic vegetation cover greater than Year 1 and greater than the average showed at control sites in Year 4.</p> <p>Floristic surveys should be undertaken to identify plant species, understand habitat and food resources for small mammals, and guide targeted weed control.</p> | <p>Both sites were investigated.</p> <p>Based on consultation with agencies and small mammal experts, methodology has been updated from Year 6 onwards to incorporate species richness assessments, dust monitoring, <i>Phytophthora</i> soil testing, weed and scat surveys, as well as general habitat health observations.</p> <p>within updated quadrat surveys.</p> <p>Photo points have also been established at each monitoring site.</p> | <p>At SM27 (Marica), review of transect data provided by EMM identified a reported native vegetation cover of 105%. This is considered a typographical error, as maximum cover cannot exceed 100%.</p> <p>Notwithstanding this discrepancy, a site inspection was undertaken by a qualified ecologist, who reported high biodiversity values—exceeding those of the corresponding control site—and suitable habitat for the Eastern Pygmy Possum and Smoky Mouse. The site comprises a wet soak area supporting riparian and wetland vegetation communities. Recorded species included <i>Arthropodium milleflorum</i>, <i>Brachyscome decipiens</i>, <i>Brachyscome spathulata</i>, <i>Carex appressa</i>, <i>Derwentia derwentiana</i>, <i>Empodisma minus</i>, <i>Epacris microphylla</i>, <i>Eucalyptus pauciflora</i> subsp. <i>debeuzevillei</i>, <i>Eucalyptus stellulata</i>, <i>Grevillea australis</i>, <i>Hakea microcarpa</i>, <i>Juncus australis</i>, <i>Olearia erubescens</i>, <i>Picris angustifolia</i>, <i>Pimelea pauciflora</i>, <i>Podolepis robusta</i>, <i>Sphagnum cristatum</i>, <i>Tasmania lanceolata</i> and</p> |

| Monitoring Component | Year 4 triggers for adaptive management (EMM, 2025), | Summary of Year 4 Recommendation (EMM, 2025), | Action/Consultation undertaken in Year 5 | Resolution/Outcome |
|----------------------|--|--|--|---|
| | | <p>Photopoint monitoring should be established at all impact sites, using consistent methods, to visually track vegetation change, weed invasion and habitat recovery over time.</p> | | <p><i>Xerochrysum subundulatum</i>. Evidence of horse activity (scats and tracks) was also observed.</p> <p>Based on these findings, SM27 did not trigger in Year 5 and no targeted weed management was required. However, the 2025–2026 weed control program included treatment of adjacent roadside areas in accordance with the 50 m buffer requirement specified in Appendix F of the BMP.</p> <p>SM20 (Lobs Hole); upon investigation, it was found that transect SM20-HT1 was not adequately situated. It was located in the disturbance footprint rather than within 0–20 meters of the disturbance area. This misplacement has resulted in a negative bias in the Year 4 dataset. Blackberry (<i>Rubus fruticosus</i> spp. agg.) is the species responsible for the trigger at this site. The presence of Blackberry is a pre-existing condition in the Lobs Hole area, particularly in proximity to watercourses. The site is located near Wallaces Creek, where the corresponding HT2 transect is situated on Park land. Weed occurrence in this area is outside the control of the Project’s weed management program.</p> <p>For all other sites identified in EMM’s recommendations, FGJV engaged Rippers Rural to undertake weed</p> |

| Monitoring Component | Year 4 triggers for adaptive management (EMM, 2025), | Summary of Year 4 Recommendation (EMM, 2025), | Action/Consultation undertaken in Year 5 | Resolution/Outcome |
|--|---|---|---|---|
| | | | | <p>control during the 2025–2026 spring/summer season, in accordance with Appendix F of the BMP. FGJV has provided monthly mapping, photographic records, and progress reports to Snowy Hydro Limited (SHL) and the NSW National Parks and Wildlife Service (NPWS).</p> <p>The program has demonstrated effective implementation, with observed reductions in weed extent and positive feedback received from both SHL and NPWS.</p> |
| <p>Feral animal occupancy and abundance monitoring</p> | <p>Feral animal occupancy and abundance monitoring: Pest control in accordance with the Weed, Pest and Pathogen Management Plan (FGJV, 2024) was triggered to all Feral animal remote camera monitoring sites except sites FC08 – Lobs Hole and FC09 – Lobs Hole.</p> | <p>The BMP requires that any feral animal sightings activate the Weed, Pest and Pathogen Management Plan, with adaptive management actions coordinated by FGJV or Snowy Hydro.</p> <p>Priority control areas include Lobs Hole Ravine Road, Marica, Tantangara Dam and Rock Forest, especially to protect Smoky Mouse, Eastern Pygmy-possum and Broad-toothed Rat habitat from threats such as European Rabbits and feral horses.</p> <p>Monitoring of feral species occupancy and abundance is recommended in Year 5 to assess site-wide trends and relate them to threatened species data. Additional improvements include targeted control of Red Foxes, Feral</p> | <p>Response to EMM Recommendation: Feral Fauna Management</p> <p>Consultation with NPWS has been undertaken to inform the development of an effective feral animal control program, focused on foxes, cats and rabbits, in alignment with the Weed, Pest and Pathogen Management Plan.</p> <p>Analysis of Year 4 Monitoring Results: <i>Occupancy (Presence/Absence)</i></p> <p>Review of EMM Year 4 data (Plate 3.28) indicates a reduction in feral predator detections relative to Year 1, with cat detections approximately halved and rabbit detections reduced by approximately two-thirds. Fox detections remained close to year 1</p> | <p>Trigger Review</p> <p>The current trigger, defined as any sighting of feral animals within proximity to known Smoky Mouse habitat or Project infrastructure, is considered highly sensitive and is likely to be activated under typical background conditions. This limits its utility as a meaningful indicator of Project-related impact. Monitoring results indicate that feral species were present across the landscape as part of baseline environmental conditions. Accordingly, refinement of the trigger is recommended to better distinguish between baseline feral presence and conditions warranting adaptive management response.</p> <p>To better protect native species, SHL has designed and distributed a feral</p> |

| Monitoring Component | Year 4 triggers for adaptive management (EMM, 2025), | Summary of Year 4 Recommendation (EMM, 2025), | Action/Consultation undertaken in Year 5 | Resolution/Outcome |
|----------------------|--|---|--|--|
| | | <p>Cats and European Rabbits before and during their breeding seasons to reduce recruitment and coordinating control programs with regional agencies like NPWS or Local Land Services to improve landscape-scale effectiveness and minimise reinvasion.</p> | <p>baseline, but recorded slightly lower detections.</p> <p>Other feral species (e.g. deer, horses, pigs, and dogs) are outside the scope of the Project’s control program, as defined in consultation with NPWS, and are therefore reported for contextual purposes only.</p> <p><i>Abundance</i></p> <p>The most abundant feral species recorded were rabbits, deer and horses, noting that deer and horses are not within the Project’s control scope.</p> <p>Rabbit abundance was highest at Tantangara and Rock Forest. Rock Forest is located on privately owned land, where the landholder has elected to undertake independent control and has not authorised SHL or FGJV to implement control measures.</p> <p>Recorded observations include:</p> <ul style="list-style-type: none"> • Lobs Hole / Ravine Road: low fox presence (six individuals recorded annually), no cat detections, and moderate rabbit observations • Marica: low rabbit presence (five individuals), no fox or cat detections • Tantangara: higher rabbit abundance (137 individuals recorded), no fox or cat detections, and significant | <p>animal notification poster incorporating a QR code to enable reporting of opportunistic sightings. These notifications, in conjunction with camera trap data, are being used to inform FGJV’s targeted cage trapping efforts.</p> <p>A feral predator control program has been developed in consultation with the NPWS liaison team and Area Rangers. Cage trapping is undertaken on a routine basis, with deployment locations guided by the BMP Project Coordinator using QR code sighting data and camera trap outputs.</p> <p>Trial deployment of 1080 Canid Pest Ejectors (CPEs) by SHL was successful; however, a commercial decision in 2025 transferred responsibility for this program to the Principal Contractor (FGJV). FGJV will engage a suitably qualified feral animal control contractor to undertake this work, with control locations determined in consultation with NPWS Authorised Control Officers.</p> <p>Rabbit control has been undertaken at Tantangara; however, this occurred outside the current monitoring period. FGJV has committed to biannual rabbit monitoring to enable a timely and responsive approach to any increases in population within the construction footprint.</p> |

| Monitoring Component | Year 4 triggers for adaptive management (EMM, 2025), | Summary of Year 4 Recommendation (EMM, 2025), | Action/Consultation undertaken in Year 5 | Resolution/Outcome |
|----------------------|--|---|---|--------------------|
| | | | <p>horse presence (136 individuals)</p> <ul style="list-style-type: none"> • Tantangara Road: low rabbit presence (11 individuals), no fox or cat detections <p>These results indicate that feral predator presence (foxes and cats) is currently low across key monitoring areas, while herbivore pressure, particularly from rabbits and horses, remains more prominent.</p> | |

2. Methodology and Survey Schedule

All surveys were undertaken in accordance with the methodologies detailed in Revision G (S2-FGJV-ENV-PLN-0106) of the BMPg. Detailed descriptions of survey methodologies for each survey type are provided in the relevant species-specific sections of this report.

2.1 Survey Schedule

SHL has amended the annual survey period to run from 1 June to 31 May each year, with references to quarters now aligning with the seasons. This change enables reporting to be undertaken during winter, ensuring adequate time for ecological analysis outside peak fieldwork periods. Monitoring period reports are also requested from ecologists after each event to support progressive assessment and adaptive management of the program. Over time, this approach is intended to facilitate earlier submission of annual reports to agencies.

2.2 Monitoring Period Summary

A summary of the Year 5 BMP monitoring periods referred to throughout this report are provided in Table 2-1.

Please note that this Year 5 Annual Report covers a cross-over of data from the Year 4 Annual Report due to the need to update the reporting schedule as detailed in Section 2.1.1

Table 2-1: Summary of Main Works Monitoring periods and surveys in Year 5.

| Monitoring Period | BMP Surveys | Notes |
|----------------------------------|---|--|
| Q1 – Winter 2024 | Camera Traps | 30-day period reported by EMM |
| | BTR Scat Surveys | Completed by EMM |
| | Spotlighting | Completed by EMM |
| Q2 – Spring 2024 | Camera Traps | 30-day period reported by EMM |
| | BTR Scat Surveys | Completed by EMM |
| | Spotlighting | Completed by EMM |
| | ASOS Skink Tile Monitoring | Completed by Snowline Ecology |
| | Frog Occupancy (Booroolong & ATP) (Nov) | Completed by Snowline Ecology |
| | Frog Habitat Characteristics | Completed Snowline Ecology |
| Q3 – Summer 2025 | Camera Traps | 30-day period reported by Snowline Ecology |
| | BTR Scat Surveys | Completed by Snowline Ecology |
| | Spotlighting | Completed by SHL Env Advisors |
| | ASOS Skink Tile Monitoring | Completed by Snowline Ecology |
| | Frog Occupancy (Booroolong & ATP) (Dec) | Completed by Snowline Ecology |
| | Frog Habitat Characteristics | Completed by Snowline Ecology |
| | Threatened Flora (Dec & Jan) | Completed by Alpine Flora |
| | Weed Monitoring | Completed by Dendra (drone monitoring) |
| | Small Mammal Habitat Characteristics | Completed by Alpine Flora |
| GDE Floristic survey (inaugural) | Completed by Alpine Flora | |
| Q4 – Autumn 2025 | Camera Traps | 30-day period reported by Snowline Ecology |
| | BTR Scat Surveys | Completed by Snowline Ecology |

| | | |
|--|------------------------------|---------------------------------|
| | Spotlighting | Completed by SHL Env Advisors |
| | ASOS Skink Tile Monitoring | Completed by Snowline Ecology |
| | Frog Habitat Characteristics | Completed by Snowline Ecology |
| | GDE Floristic survey | Completed by Alpine Flora |
| | Phytophthora Surveys | Completed by SHL Env Scientists |

2.3 Survey Effort Overview

A summary of the survey effort undertaken for Year 5 is shown in Table 2-2.

Table 2-2: Year 5 biodiversity monitoring survey effort overview

| Target Species | Survey objective | Monitoring methods | Monitoring period | Year 5 total effort |
|--|-------------------------|--|--|---|
| Flora | | | | |
| Clover Glycine | Presence and density | Individual counts within monitoring plots | Dec 2024 | 5 x Impact sites |
| Kiandra Leek Orchid | | | Jan 2025 | 6 x Control sites |
| Fauna | | | | |
| ASOS | Presence | Tile grids | Dec 2024 Apr 2025 | 5 x Impact sites 4 x Control sites 450 tiles (25 x tiles per site per period) |
| Small Mammals | Presence | Camera traps | June-Aug 2024 Sep-Nov 2024 Dec 2024 - Feb 2025 April 2025 | 21 x Impact sites 18 x Control sites 30-day minimum per period* |
| Small Mammals | Habitat Characteristics | Transects | Jan 2025 | 17 x Impact sites 13 x Control sites |
| Broad-tooth Rat (<i>Mastacomys fuscus</i>) faecal search | Presence | BTR faecal counts within 10 m radius of monitoring plots | Jul/Aug 2024 Oct 2024 Jan 2025 April 2025 | 4 x Impact sites 7 x Control sites 390 minutes (10-minute search per site per period*) |
| Alpine Tree Frog (<i>Rawlinsonia verreauxii alpina</i>) | Presence | Individual counts | Nov 2024 Dec 2024 | 4 x Impact sites 4 x Control sites 8 km ground covered (~500 m transects lines per site per period) |
| Booroolong Frog (<i>Rhyaconastes booroolongensis</i>) | | | | 4 x Impact sites 2 x Control sites 6 km ground covered (~500 m transects lines per site per period) |
| Feral Animals | Presence | Camera traps | Jun-Aug 2024 Sep-Nov 2024 Dec-Jan 2025 Mar-Apr 2025 | 19 x Impact sites 30-day minimum per period* |

| | | | | |
|-------------------------|-----------|---------------------|--|---|
| | Abundance | Individual counts | Jun 2024 Sep 2024 Feb 2025 May 2025 | 7 x Impact sites 280 km ground covered (transects with non-standardised lengths*) |
| Weeds | Presence | Infestation records | Dec 2024 | All project areas, drone monitoring. |
| Phytophthora <i>sp.</i> | Presence | Soil testing | Apr 2025 Jun 2025 | 31 x Impact sites |

*Monitoring efforts impacted by limitations described in respective chapters of this report

2.4 Limitations

Increased construction activity in certain areas restricted access to some monitoring sites.

Post-2019/2020 fire regrowth, including an elevated risk of falling trees, created safety risks and limited the ability to survey some locations without causing environmental disturbance.

Terrain steepness and site accessibility also resulted in certain areas being deemed an unacceptable risk.

National Park closures during winter, including those associated with aerial shooting programs, further constrained access to some sites during scheduled survey periods.

Limitations associated with the above factors are addressed in the relevant sections throughout this report.

3. Threatened Flora

3.1 Survey Location Map

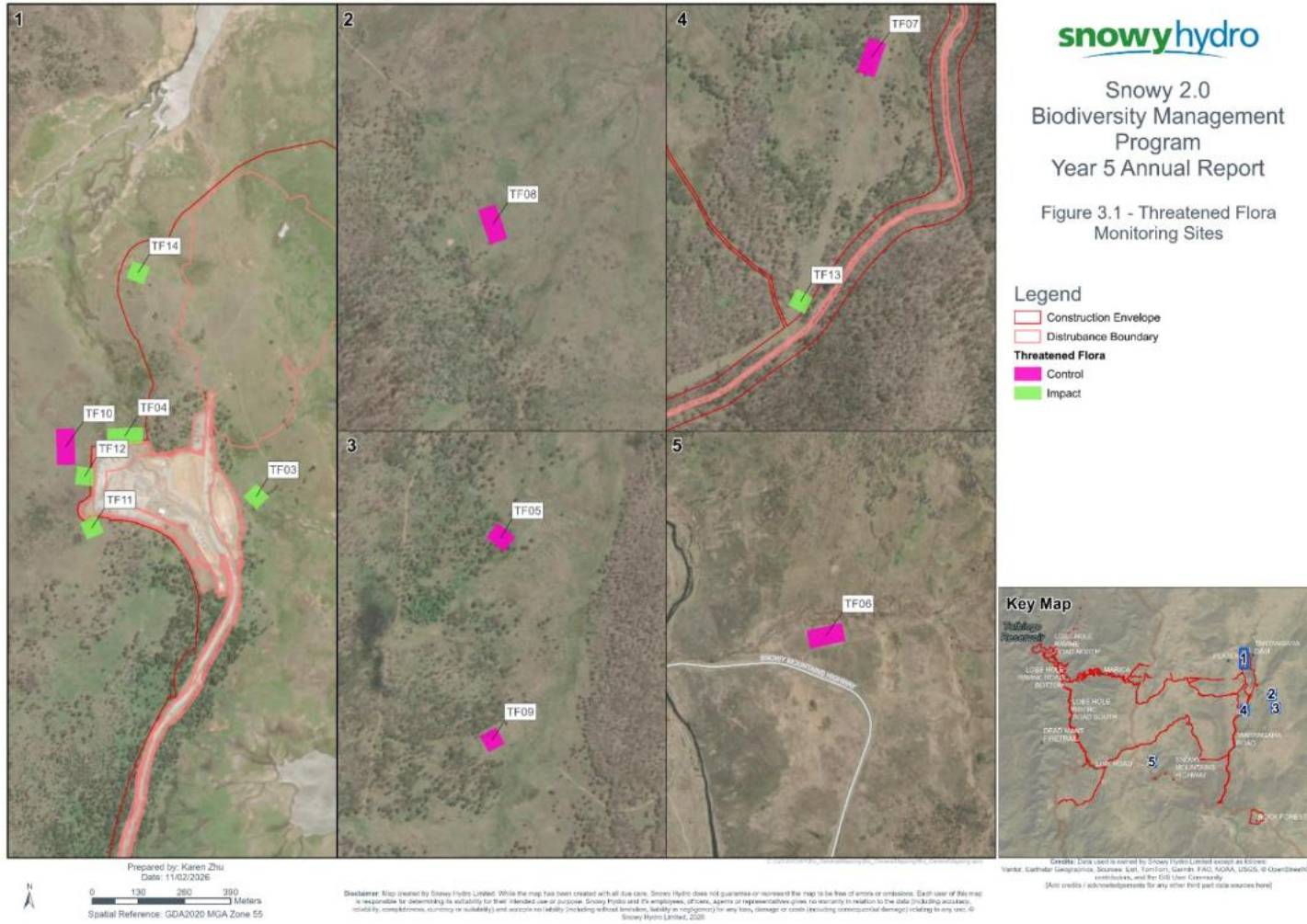


Figure 3.1: Threatened Flora Monitoring Plots. Year 5.

3.2 Objective

According to the BMPg Section 4.2 (Rev G), the objective of the threatened flora monitoring is to determine the health of threatened flora populations of Clover Glycine (*Glycine latrobeana*) and Kiandra Leek Orchid (*Prasophyllum retroflexum*) located adjacent to the disturbance area, to document any changes as a result of the Main Works, and to implement additional controls if necessary.

3.3 Species Description

Clover Glycine (*Glycine latrobeana*) is listed as critically endangered under the NSW BC Act and vulnerable under the EPBC Act. It is a low-growing perennial herb that flowers variably across its range, typically in spring at lower elevations and extending into summer at higher elevations. The species occurs mainly in grassland and grassy woodland habitats, and less frequently in dry forests and heathlands. It is generally found at elevations between 900 and 1,300 m and can persist across a range of soil types.

Little is known about the population size and distribution of Clover Glycine within Kosciuszko National Park. More broadly, the species is distributed across south-eastern Australia, occurring from Port Pirie in South Australia through much of Victoria and into Tasmania near Hobart.

Key threatening processes to Clover Glycine in Kosciuszko National Park include habitat degradation and competition from invasive weeds (such as ox-eye daisy), which can impair recruitment and establishment. This threat is exacerbated by small population sizes and low seed viability. Damage to individual plants and habitat degradation also occur through grazing and trampling by introduced herbivores, including horses and deer, as well as through rooting, digging and trampling by feral pigs (NSW Government, 2025).

Kiandra Leek Orchid (*Prasophyllum retroflexum*) is a small, inconspicuous ground orchid listed as Vulnerable under NSW BC Act and the EPBC Act. All known populations occur within Kosciuszko National Park, primarily in the Long Plain, Kiandra and Tantangara areas. The species inhabits subalpine grasslands and woodlands and flowers between October and December. Following fruiting, plants retreat to subterranean tubers and are not visible above ground outside the flowering period.

Key threats to the Kiandra Leek Orchid include habitat disturbance and direct damage from feral pigs through rooting, browsing and trampling by feral horses, and grazing by rabbits. Competition from invasive weeds, particularly ox-eye daisy, also poses a significant threat, with feral horses contributing to its spread (NSW Government, 2021).

3.4 Methodology

Targeted threatened flora monitoring plots were established adjacent to the Main Works disturbance area during year 1 of the BMPg at all locations where Clover Glycine and/or Kiandra Leek Orchid are known to occur, as described in the BMP. Plots of variable size were permanently marked and aligned with infrastructure where practicable. Monitoring involved systematic transect surveys, photo monitoring from fixed points, and counts of all observable individuals, with annual totals calculated to avoid double counting. Surveys were undertaken twice annually during the flowering period (December 2024 and January 2025), with control sites outside the disturbance area used to account for broader bioclimatic variation. Refer to the BMPg (Rev G) for detailed threatened flora monitoring methods.

3.5 Results

In Year 5, a total of 11 threatened flora monitoring plots were surveyed for Clover Glycine and Kiandra Leek Orchid, comprising five impact sites and six control sites (Figure 3-1). One impact site (TF03) could not be surveyed as phase 1 construction had been initiated at the permanent spoil emplacement area, making it unsafe to access.

Neither species was recorded at four monitoring sites, including three impact sites (TF04, TF11 and TF12) and one control site (TF05). Clover Glycine was detected at one impact site (TF14), where a total of 45 individuals were recorded across Year 5, representing the highest count recorded at any site in this year. Clover Glycine was also recorded at three control sites (TF08, TF09 and TF10).

Kiandra Leek Orchid was recorded at one impact site (TF13) and two control sites (TF06 and TF07), with low overall numbers.

Site descriptions and GPS details of each record are presented in Appendix 1a-c, including photographs from photo points established at each monitoring site.

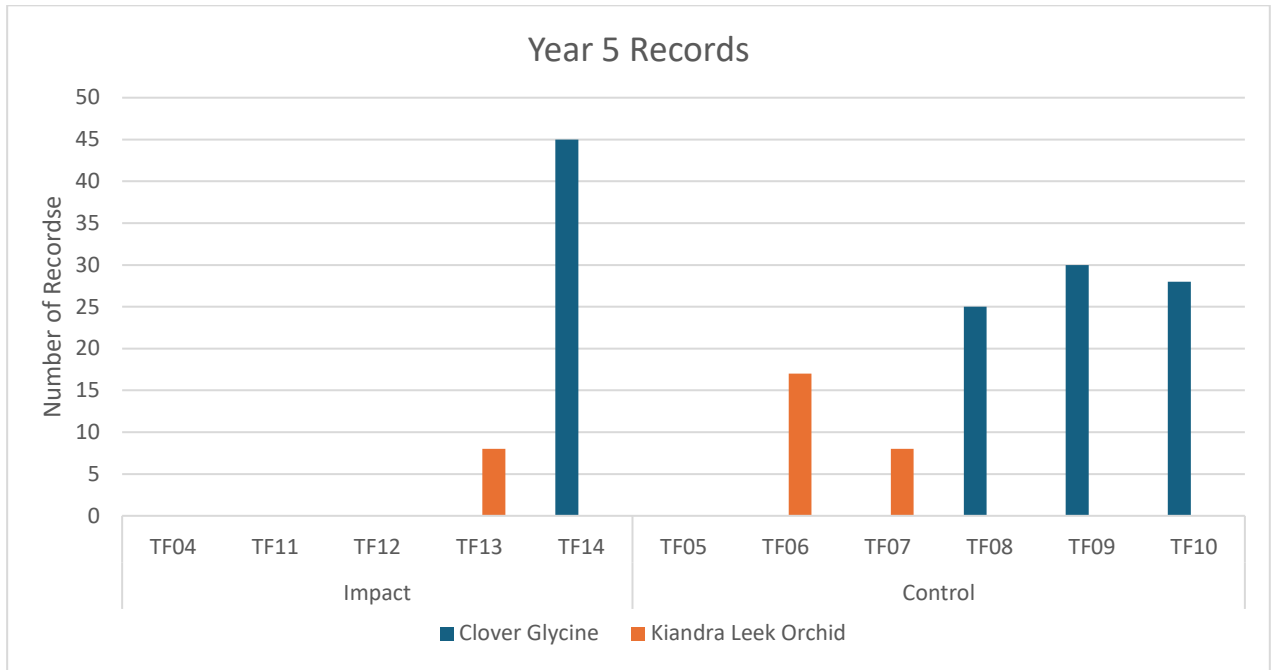


Figure 3.2: Total records of Clover Glycine and Kiandra Leek Orchid across sites in Year 5

Table 3-1: Flora records comparing Yr 4 and Yr 5 monitoring periods.

| Year | Impact | | | | | | Control | | | | | |
|---------------|--------|------|------|------|------|------|---------|------|------|------|------|------|
| | TF03 | TF04 | TF11 | TF12 | TF13 | TF14 | TF05 | TF06 | TF07 | TF08 | TF09 | TF10 |
| Year 4 | | | | | | | | | | | | |
| Dec-23 | | | | | | | | | | | | |
| CG | 4 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 2 | 25 | 29 | 26 |
| KLO | 0 | 0 | 1 | 0 | 8 | 3 | 0 | 25 | 1 | 0 | 8 | 0 |
| Jan-24 | | | | | | | | | | | | |
| CG | 5 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 4 | 18 | 28 | 22 |
| KLO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Year 5 | | | | | | | | | | | | |
| Dec-24 | | | | | | | | | | | | |
| CG | NA | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 |
| KLO | NA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Jan-25 | | | | | | | | | | | | |
| CG | NA | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 0 | 25 | 30 | 28 |
| KLO | NA | 0 | 0 | 0 | 8 | 0 | 0 | 17 | 8 | 0 | 0 | 0 |

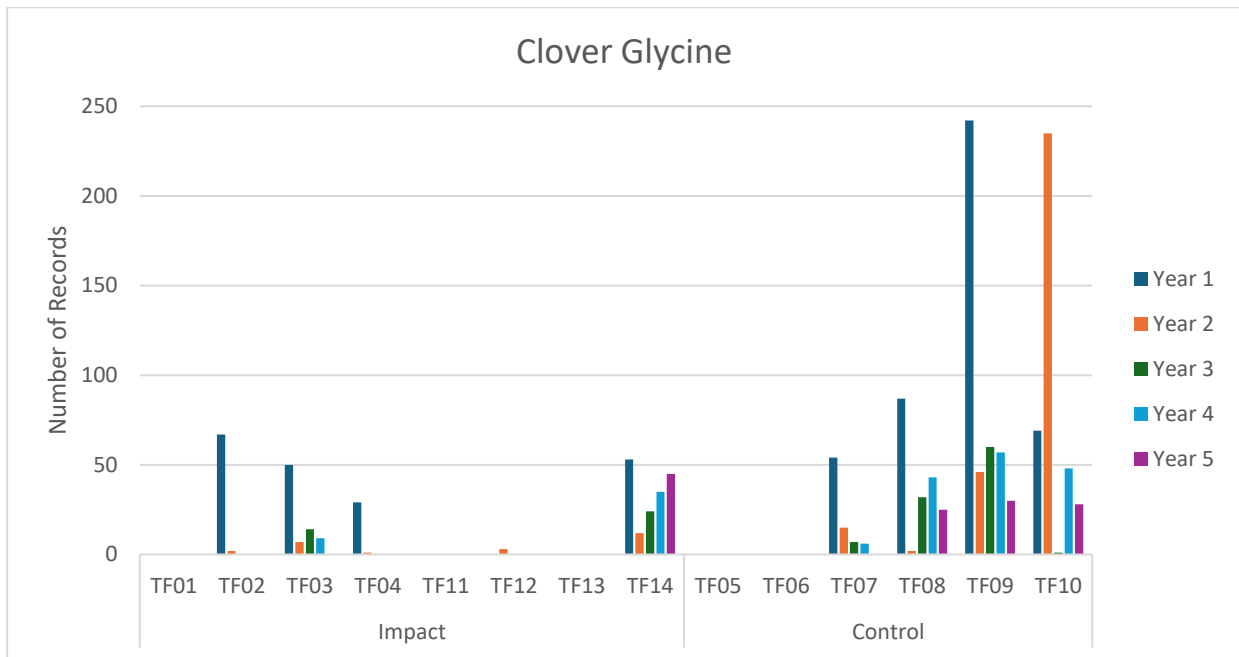


Figure 3.3: Annual records of Clover Glycine at impact and control sites from Year 1 to Year 5.

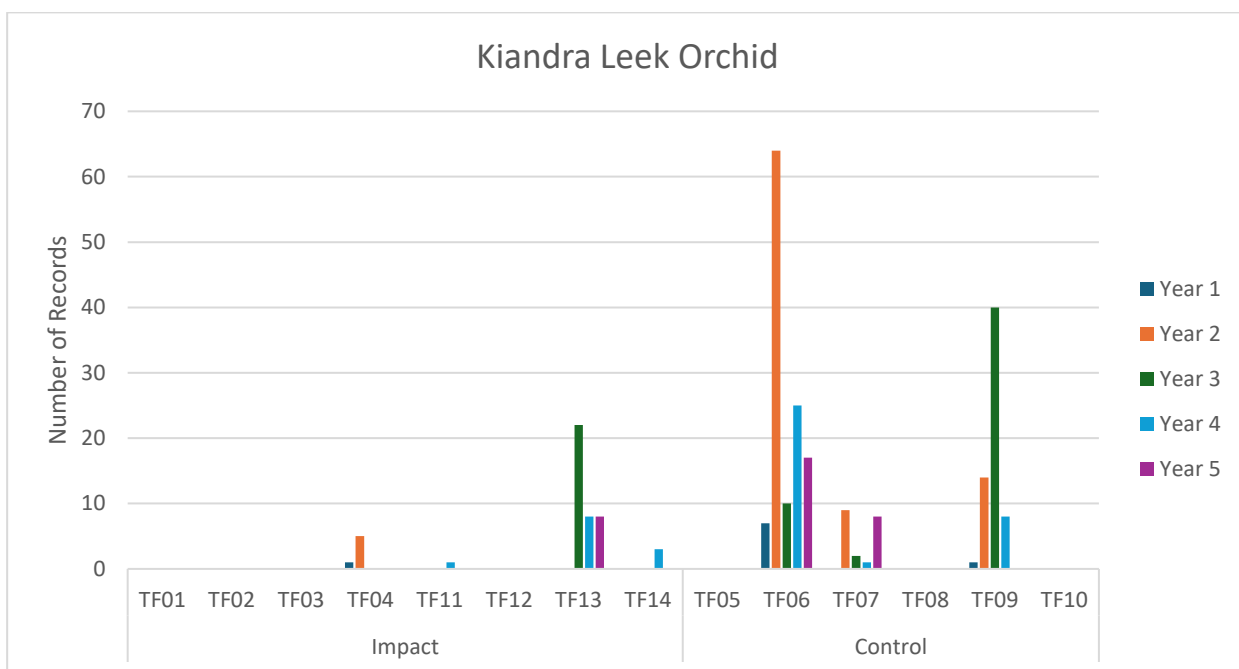


Figure 3.4: Annual records of Kiandra Leek Orchid at impact and control sites from Year 1 to Year 5.

3.6 Discussion

The triggers for adaptive management for threatened flora are:

- percentage decline in the number of plants observed within a single monitoring plot, observed over two consecutive monitoring periods and outside of the standard deviation observed at control sites
- decline must be observed in conjunction with a primary impact (e.g. increase in weed cover).

Year 5 monitoring data indicates that adaptive management has not been triggered for Clover Glycine or Kiandra Leek Orchid. No percentage decline was recorded at any of the impact sites all between consecutive periods being Year 4 and Year 5. However, TF03 was not surveyed in Year 5 due to unsafe conditions near construction activities, leaving its adaptive management requirement undetermined. Due to the timing of this report, and progressive updates, it can be confirmed that TF03 was monitored in Year 6 and results were positive, with 10 clover glycine

located which is an increase by 1 individual from year 4 data. No Kiandra Leek Orchid were located at TF03 which is to be expected as none of this species have ever been located at this site.

Year 5 results showed an increase in Clover Glycine (*Glycine latrobeana*) plants at TF14 (when comparing data between monitoring periods year 4 and year 5). While there was percentage decline of Kiandra Leek Orchid recorded at TF11, TF14 and TF06 this has not been recorded for two consecutive monitoring periods and therefore does not trigger adaptive management for Year 5.

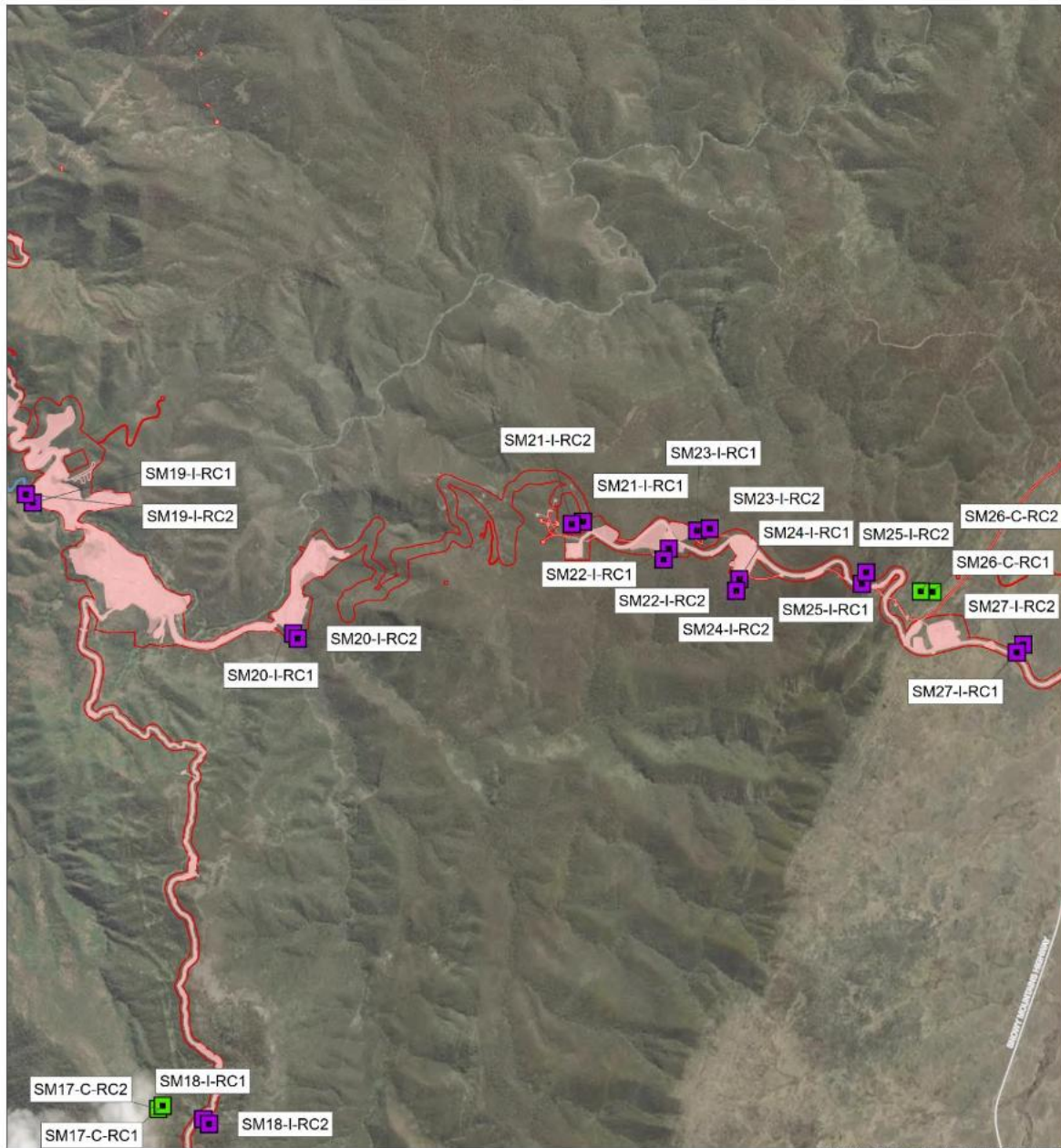
A decrease in species abundance of *Glycine latrobeana* at control sites on Park lands (TF08, TF09, and TF10) between monitoring periods (years 4 and 5) has been documented. These control sites are on National Parks land, scope to mitigate lies outside of the responsibility of SHL or FGJV. Noticeable pressure from grazing animals, particularly rabbits and horses were observed with fresh scats on every site.

3.7 Recommendations

It is proposed that two alternative threatened species could be monitored, which will have fewer confounding results. Both Clover Glycine and Kiandra Leek orchid are highly dependent on low levels of disturbance and favourable climatic conditions to flower. Given the constant grazing pressure and potential trampling, larger more persistent species may be of more use to observe project impacts on threatened species of the area. This will have to be discussed and approved by the relevant regulators.

4. Small Terrestrial Mammals – Presence/Absence Monitoring

4.1 Survey Location Maps



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Program
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Prepared by: Karan Zhu
Date: 11/02/2026

0 0.8 1.1 1.7 km

Spatial Reference: GDA2020 MGA Zone 55

Credits: Data used is owned by Snowy Hydro Limited except as follows:
 Vector, Earthstar, Geographic, DCSEW, Sotmap, Esri, TomTom, Garmin, NGL, UNAGS, USGS
 [Add credits / acknowledgements for any other third party data sources here]

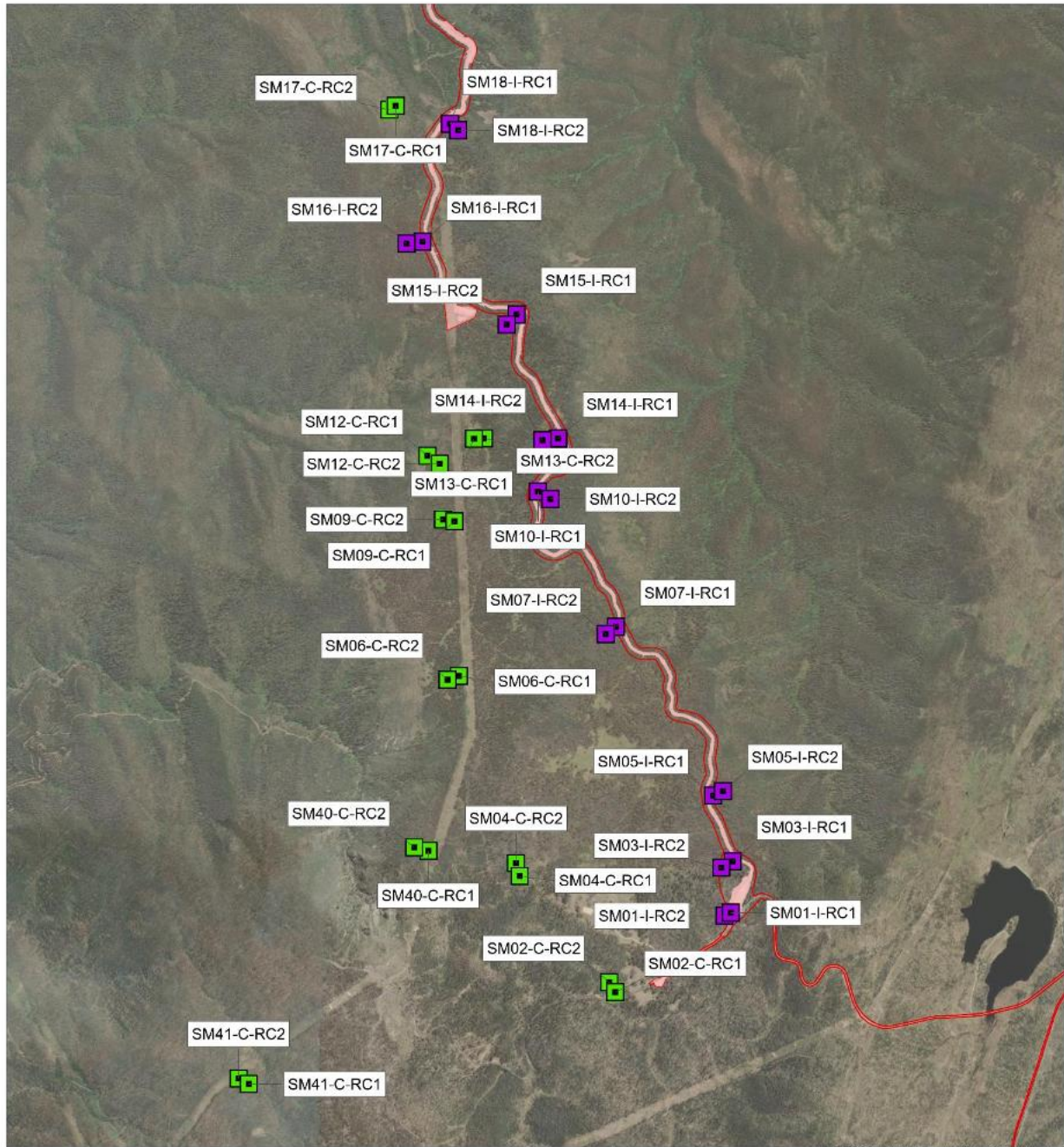
Figure 4.1.Aa: Small Mammal Presence/Absence Camera Monitoring Sites

- Legend**
- Construction Envelope
 - Disturbance Boundary
 - Reservoirs
 - Major road
- Locations - Small Mammal Camera**
- Control
 - Impact

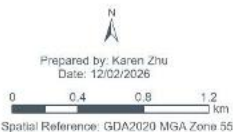


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Figure 4.1: Small Mammal camera monitoring locations - Lower Ravine, Lobs Hole, and Marica.



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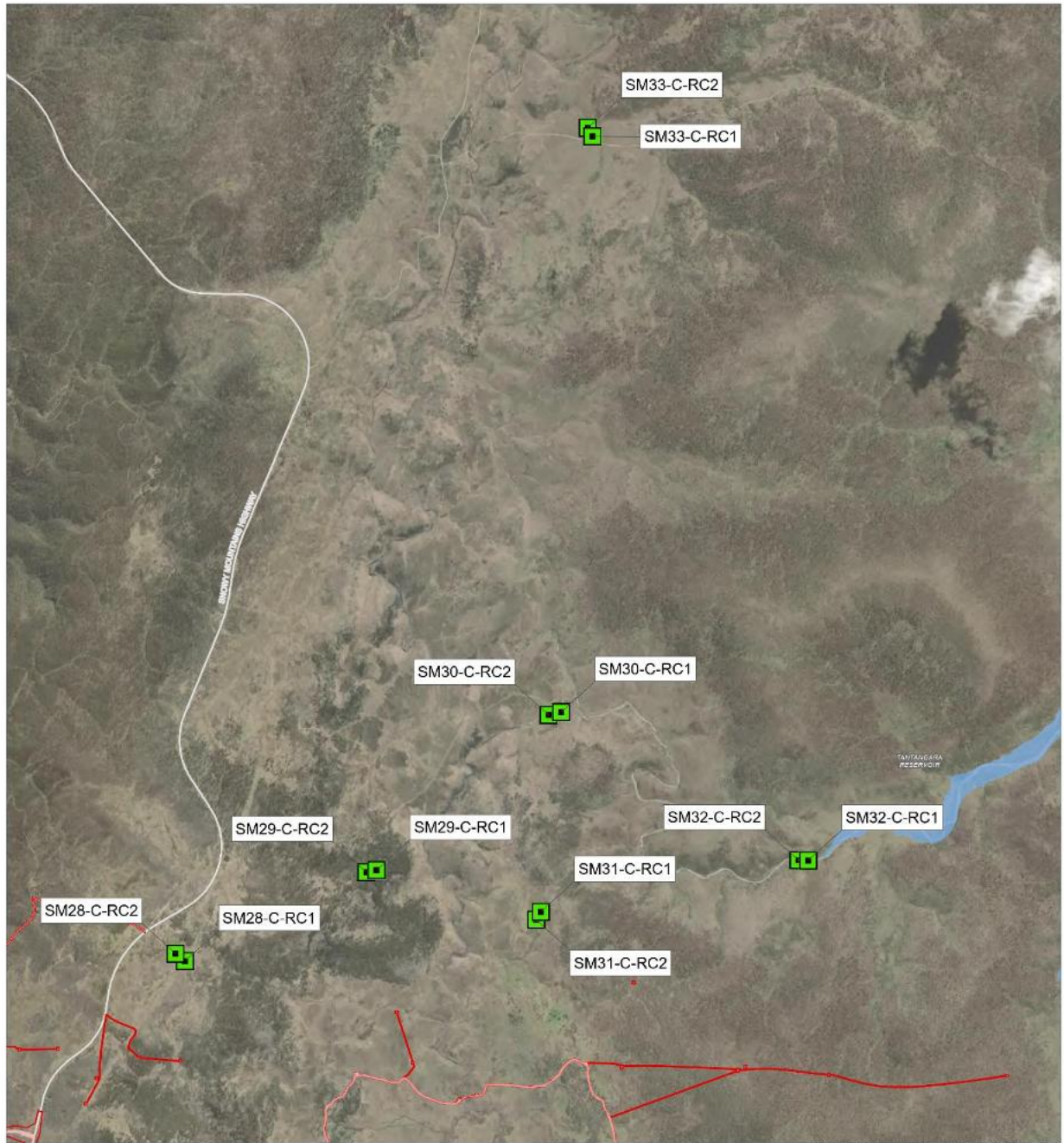
Figure 4.1.Ab: Small Mammal Presence/ Absence Monitoring Sites

- Legend**
- Construction Envelope
 - Disturbance Boundary
 - Locations - Small Mammal Camera**
 - Control
 - Impact



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Figure 4.2: Small Mammal camera monitoring locations - Upper Ravine.



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 Date: 11/02/2026
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Figure 4.1.B: Small Mammal Presence/
 Absence Camera Monitoring Sites

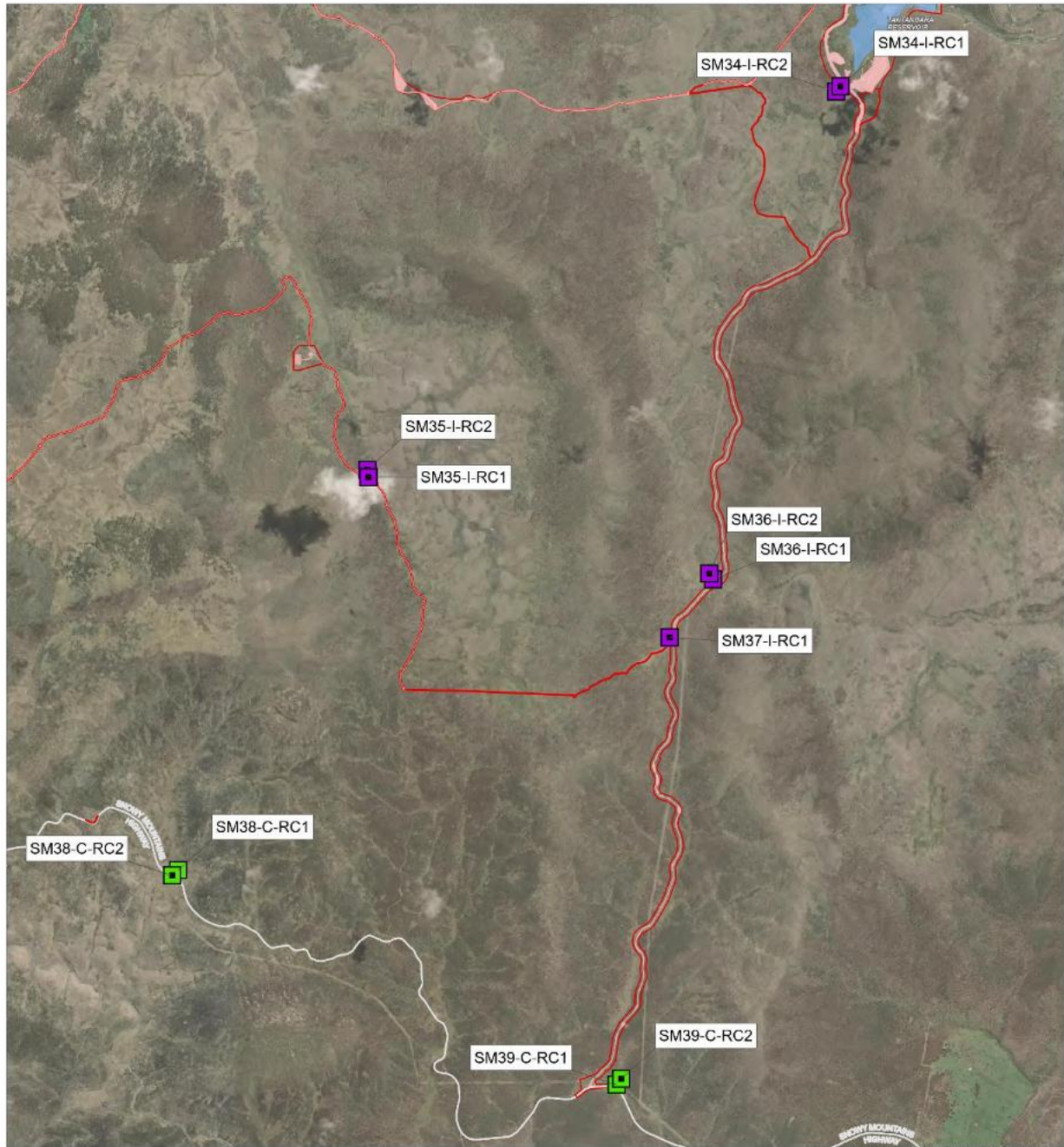
Legend

- Construction Envelope
- Disturbance Boundary
- Reservoirs
- Major road
- Locations - Small Mammal Camera**
- Control



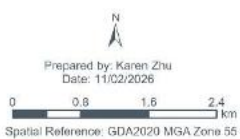
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Figure 4.3: Small Mammal camera monitoring locations: Off Site Controls.



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Figure 4.1.C: Small Mammal Presence/
 Absence Camera Monitoring Sites

Legend

- Construction Envelope
- Disturbance Boundary
- Reservoirs
- Major road
- Locations - Small Mammal Camera**
- Control
- Impact



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Figure 4.4: Small Mammal camera monitoring locations - Offsite control and impact + Impact cameras on Tantangara road.



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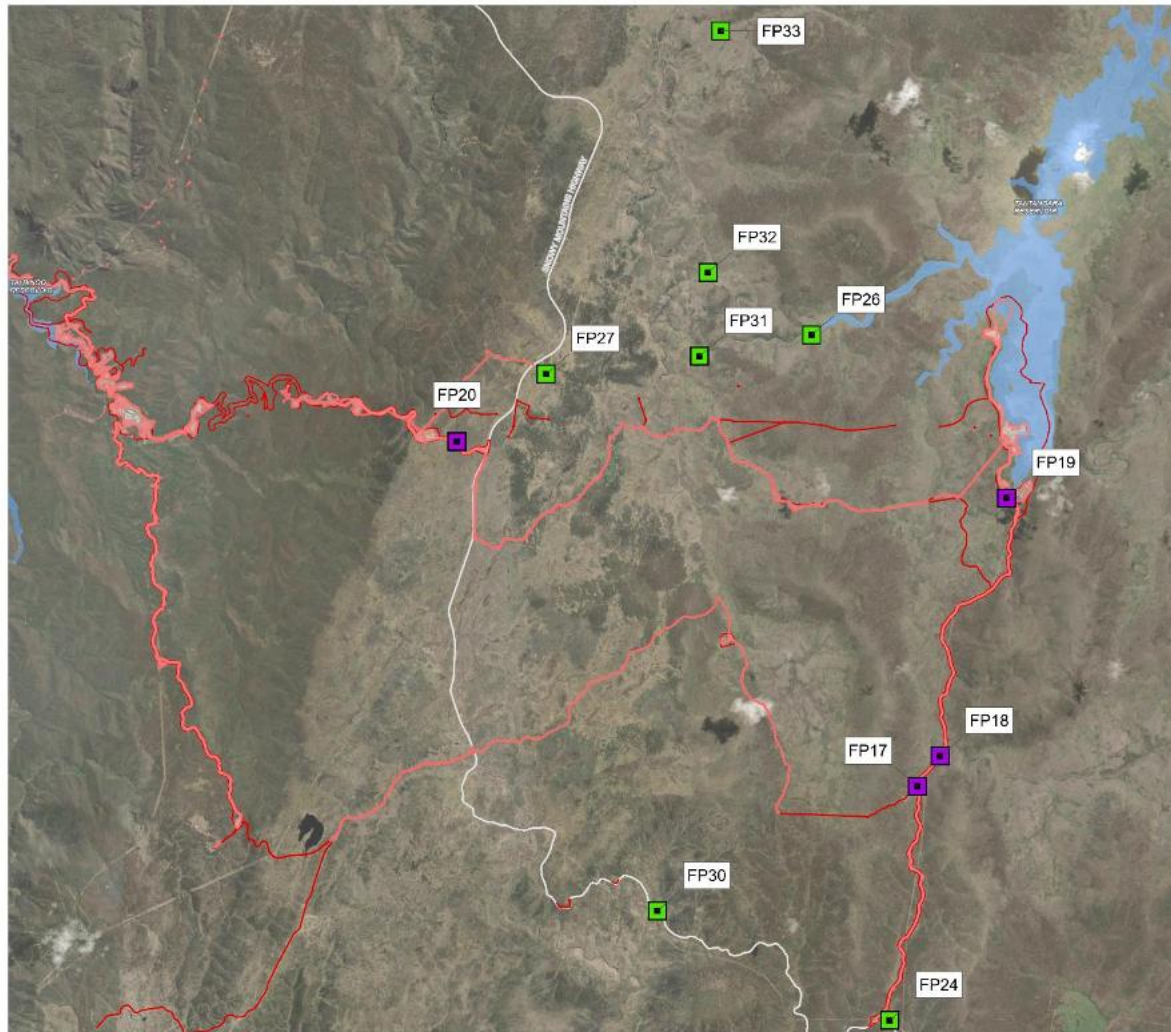
Figure 4.2 : Small Mammal Presence/
 Absence Broad-toothed Rat fecal
 monitoring sites

Legend

- Disturbance Boundary
- Construction Envelope
- Reservoirs
- Major road
- Fecal Pellet BTR**
- Control
- Impact



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 Date: 12/02/2025
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Figure 4.5: BTR Scat Monitoring Sites.



Authors
Dr Phoebe Burns, Matt Clancy & Dr Zak Atkins

Photo Credit
Cover page: Phoebe Burns



4.2 Executive Summary

The small mammal aspect of the BMP aims to determine the small terrestrial mammal occupancy (presence/absence) at known habitat sites within proximity to the Snowy 2.0 Project and document any changes attributable to the Project.

During this reporting period (Year 5: Winter 2024 – Autumn 2025), the Smoky Mouse was detected at two control sites and no impact sites; five sites remain triggered for Smoky Mouse (SM05, SM22, SM23, SM24, SM35). Inclusion of Year 2 detections in 'baseline' data for determination of triggers would lead to an additional four Smoky Mouse sites being triggered (SM10, SM14, SM18, SM21). Eastern Pygmy Possums were detected at eight impact sites and five control sites; despite non-detections of Eastern Pygmy Possums at eight sites in over 12 months, no sites are currently triggered as similar trends have been observed at control sites. Broad-toothed Rats were detected at all control and impact sites during this period; no sites have been triggered.

Camera monitoring of small mammal underpasses (July – December 2024) have recorded underpass use by several species of small mammals, snakes, skinks and birds, however, no Smoky Mice have been detected on the cameras.

4.3 Background

Three small mammal species listed at a State or Federal level were identified for targeted monitoring in the Snowy 2.0 Biodiversity Management Program (BMP; Snowy 2.0 Main works BMP S2-FGJV-ENV-PLN-0008 Rev M, and Appendix B of the BMP, Monitoring Program S2-FGJV_ENV-PLN-0106 Rev G) due to their presence within or adjacent to the planned construction envelopes: Smoky Mouse (*Pseudomys fumeus*; EPBC Act: Endangered; NSW BC Act: Critically Endangered), Broad-toothed Rat (BTR; *Mastacomys fuscus*; EPBC Act: Endangered; NSW BC Act: Vulnerable), and Eastern Pygmy Possum (*Cercartetus nanus*; NSW BC Act: Vulnerable). Smoky Mice were recorded within or adjacent to the construction envelopes for Lobs Hole and Marica, Broad-toothed Rats were recorded in the envelopes for Marica, Plateau and Tantangara, and Eastern Pygmy Possums were recorded in the envelopes for Lobs Hole and Marica.

To deliver the Snowy 2.0 Project, habitat for these three species was cleared and indirect impacts were expected from:

- the introduction and/or exacerbation of weeds and pathogens;
- introduced herbivores and predators (feral animals) – i.e. from increased permeability of landscape and reduced ability to control species around Project sites;
- changes in behaviour to increased activity (including noise, dust, vibrations and artificial light at night);
- decreased connectivity / habitat fragmentation;
- fauna-vehicle strike.

The small mammal camera monitoring aspect of the BMP aims to monitor indirect impacts of the Snowy 2.0 Project in these three species and determine whether timely adaptive management is required to mitigate impacts. Specifically, the small mammal camera monitoring aimed to track changes in occupancy across 41 sites and determine whether potential changes are attributable to indirect impacts of the Snowy 2.0 Project, and provide guidance on mitigation of these impacts.

Additionally, the BMP includes BTR faecal pellet monitoring across 11 sites (four impact, seven control) to track BTR occupancy and relative abundance across time. These 11 sites overlap with the camera monitoring sites. Again, this monitoring seeks to determine whether potential changes are attributable to indirect impacts of the Snowy 2.0 Project, and provide guidance on mitigation of these impacts.

4.3.1. Previous works

Works prior to November 2024 were delivered by EMM Consulting Pty Ltd. Monitoring sites were selected in areas where habitat was not directly cleared, but the indirect Project impacts were expected to still potentially influence species' persistence.

For camera monitoring, a total of 21 impact sites and 18 control sites were selected, with two cameras per site – one positioned 20 m from the nearest road, and the second 120 m from the road. Of these sites, 15 impact and ten control

were considered suitable habitat for Smoky Mice, and 17 impact and 11 control were considered suitable habitat for Eastern Pygmy Possum.

For Broad-toothed Rat, four impact and seven control sites were selected for camera survey and faecal pellet searches. The other camera sites were deemed unsuitable habitat, however, the species has since been detected on camera at an additional nine sites (four impact). These additional camera sites are included in the data presented in this report but are not included in the thresholds for adaptive management triggers.

Smoky Mice were detected at five impact sites in Year 1 (two control; (EMM, 2022), six in Year 2 (three control; (EMM, 2023) and no sites in Year 3 or Year 4 (two control; (EMM, 2025, 2024). Subsequently, adaptive management actions were triggered for Smoky Mice across five sites.

Eastern Pygmy Possums were detected at 13 impact sites in Year 1, 11 in Year 2, 12 in Year 3, and 9 in Year 4 (EMM, 2025, 2024, 2023, 2022). Adaptive management actions were triggered at one site.

Broad-toothed Rats were detected at one impact site in Year 1, five in Year 2 and Year 3, and six in Year 4 (EMM, 2025, 2024, 2023, 2022). No actions have been triggered for BTRs.

4.3.2. Current works and change in delivery

In November 2024, delivery of the small mammal monitoring program transitioned from EMM and was split between Snowy 2.0 and Snowline Ecology. Snowy 2.0 biodiversity staff took on the on-ground maintenance of camera trap sites and collection of data, providing images for identification to Snowline Ecology through the online Wildlife Insights portal. Snowline Ecology deliver the on-ground BTR faecal pellet surveys.

The timing for Year 5 has shifted, with Year 4 Q3 and Q4 now considered Year 5 Q1 and Q2. Full data for Year 4 Q3 / Year 5 Q1 and Year 4 Q4 / Year 5 Q2 is available in the EMM report for Year 4 (EMM, 2025), however, these data are also considered here in the interpretation of triggers for adaptive management. In this report, we provide detail on camera data for Summer and Autumn 2025 (Year 5, Q3 & Q4) and BTR faecal pellet surveys for January and April 2025 (Year 5, Q3 & Q4).

4.4 Methods

Survey methods detailed here are taken directly from the BMP (Appendix B: Monitoring Program) with notes added to highlight changes over the course of the program.

Initial site selection

- Remote Camera Monitoring Sites (RCMS) will be established adjacent to key infrastructure areas, such as key access roads, construction areas, camps etc.
- Monitoring locations will be focussed on sections of higher quality habitat or at sites of previous records of the target species. Subsequent monitoring events should return to the same site for consistency.
- Monitoring of control sites, located outside of the disturbance area and construction envelope, will be incorporated into the small terrestrial mammal monitoring to ensure any observed changes are not a result of bioclimatic factors unrelated to construction.

Specifically, sites were selected within patches of associated PCT or at sites of previous records of target species along the three main access roads and adjacent to key infrastructure (Fig 4.5, Fig 4.6), including:

- 21 impact sites, including:
 - Lobs Hole Ravine Road between Link Road and Lobs Hole (Eastern Pygmy Possum and Smoky Mouse)
 - Lobs Hole construction areas (Eastern Pygmy Possum)
 - Marica Trail between MAT portal and Snowy Mountains Highway (Eastern Pygmy Possum and Smoky Mouse)
 - Tantangara Road between Snowy Mountains Highway and Tantangara Reservoir (Broad-toothed Rat)

- Tantangara construction area at Kellys Plain (Broad-toothed Rat)
- 18 control sites, to be established outside of the construction envelope

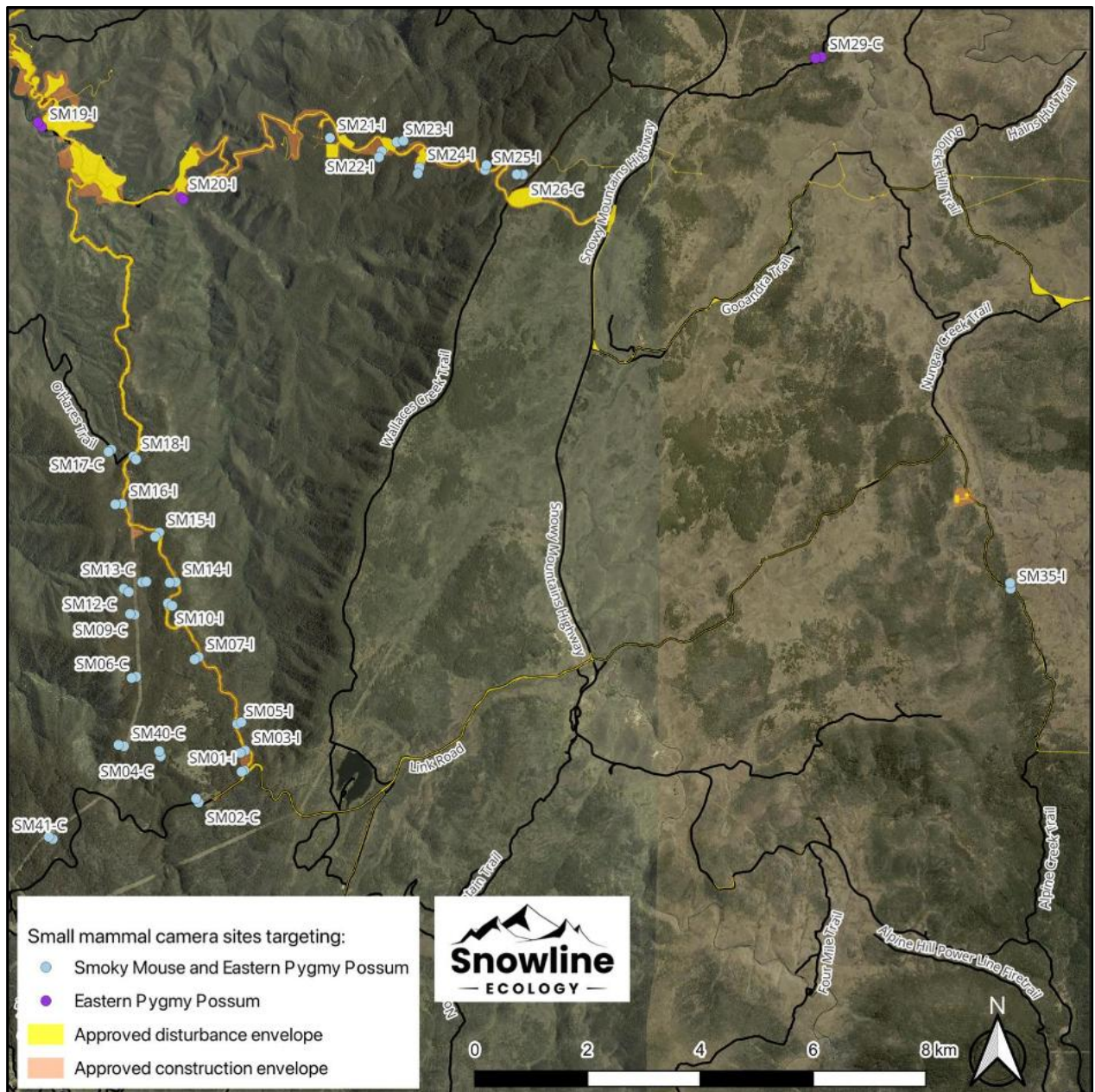


Figure 4.6: Smoky Mouse and Eastern Pygmy Possum camera monitoring sites.

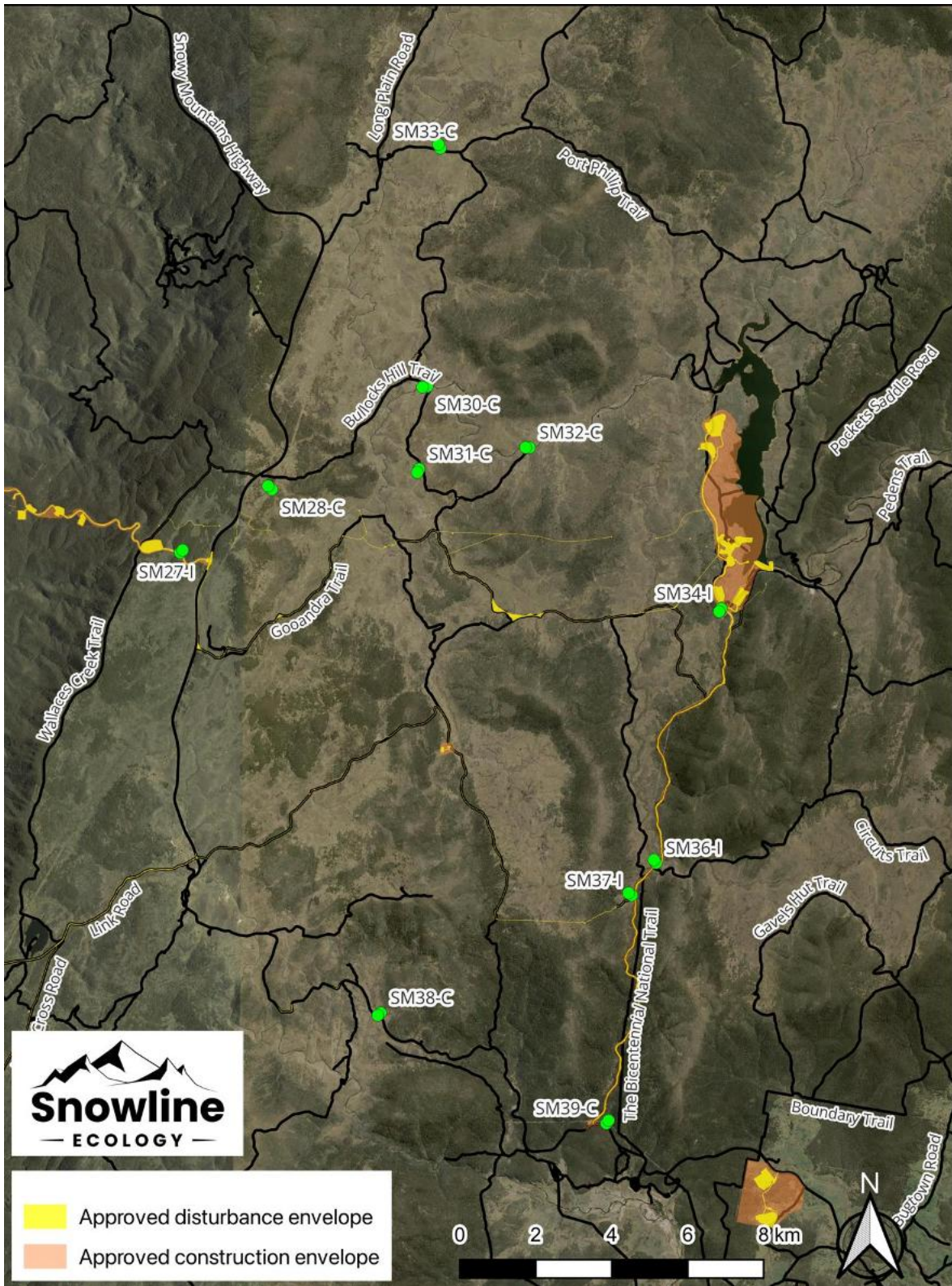


Figure 4.7: Broad-toothed Rat camera monitoring and faecal pellet survey sites.

Changes to camera monitoring sites

Several camera sites have been moved, replaced, or dropped from the monitoring program over the five years since the BMP commenced in October 2020. These have variously been due to expansion of the construction envelope (the BMP aims to monitor indirect impacts rather than direct impacts), theft of cameras, and inaccessibility of sites as habitat has regrown post-fire.

In Year 1 Q2, two control sites (SM08 and SM11) were replaced (with SM40 and SM41) due to access issues. In Year 1 Q3, SM01-I-RC1 was moved to outside the construction envelope.

The cameras for SM33-C-R2 and SM38-C-RC1 were lost after Year 1 Q1 and replaced in Year 2 Q3. The cameras for SM37-I were lost prior to Q1 Year 3 (February 2023) and have not been replaced. The camera for SM32-C-RC2 was stolen prior to Q3 Year 5 and has not been replaced. As both SM37 and SM32 are in tussock grasslands in heavily frequented areas, replacement cameras would be at high risk of being stolen again.

Nine cameras across three impact sites (SM18-I-RC1, SM18-I-RC2, SM22-I-RC1, SM25-I-RC1, SM25-I-RC2) and two control sites (SM17-C-RC1, SM17-C-RC2, SM41-C-RC1, SM41-C-RC2) have been discontinued due to reasons other than theft. SM22-I-RC1 was lost in the excavation for Amendment 3 and the hill on which the site was situated no longer exists. SM17 and SM18 have been discontinued due to track inaccessibility following post-fire regrowth. SM25 and SM41 were discontinued due to safety concerns issues (steep terrain or high risk of treefall). SM22-I-RC2 is now 30 m from a cleared area for Amendment 3. SM24-I-RC1 is now within 5 m of new disturbance. A full list of camera sites, localities, and camera status is available in Appendix 2a.

Table 4-1: Camera monitoring sites in program at start of Year 5.

| Target Species | Year 1 Impact sites (cameras) | Year 1 Control sites (cameras) | Year 5 Impact sites (cameras) | Year 5 Control sites (cameras) |
|----------------------|-------------------------------|--------------------------------|-------------------------------|--------------------------------|
| Smoky Mouse | 15 (30) | 10 (20) | 13 (25) | 8 (16) |
| Eastern Pygmy Possum | 17 (34) | 11 (22) | 15 (29) | 9 (18) |
| Broad-toothed Rat | 4 (8) | 7 (14) | 3 (6) | 7 (13) |

Timing

Small terrestrial mammal presence/absence monitoring will comprise four monitoring events per year during construction (one per season). A monitoring event is defined as:

- minimum 30-day deployment of all camera traps as per the layout explained in methods; and
- one faecal search per event.

Where possible monitoring will be undertaken prior to construction activities occurring, during construction and for a period of two years following construction.

Camera setting

- At each camera survey site, a pair of cameras will be placed out, with one camera placed approximately 20 m from the road verge and one placed approximately 120 m from the road verge.
- White flash cameras will be attached to a tree or stake and positioned approximately 25 cm above ground with bait stations placed 1.5 m away.
- Bait station to be baited with walnuts or universal mammal bait as required.
- The remote cameras should be positioned to face suitable small mammal habitat (e.g. logs, coarse woody debris, leaf litter, dense understorey cover and key flora feed species).
- Trimming of vegetation with hand-held shearers directly between the camera and bait station may be required to avoid vegetation from obscuring the view of an animal investigating the bait or that might cause the camera to false trigger.
- Cameras are to be deployed for 30 days per survey and will be set to trigger over the entire 24-hour cycle for the duration.
- Coordinates to be recorded at each camera location, such that the same sites can be setup for subsequent monitoring events.

Faecal pellet surveys

- A timed 10-minute search will be conducted at each site in an approximately 10 m radius to search for Broad-toothed Rat scats.
- The observer will record:

- an estimate of abundance will be recorded after the 10-minute search
 - Abundant >200 scats
 - Common = 100-200 scats
 - Uncommon = 50-100 scats
 - Rare <50 scats
 - Not Present = no scats recorded
- scat age
 - Old – completely dry
 - Fresh – bright olive green
 - Intermediate
- feral animal impacts.

4.5 Results

Camera trap surveys: Summer 2025 – Year 5 Q3

Summer camera trap data was provided for 53 cameras for 9-47 days (mean = 28) between 1 December 2024 and 7 February 2025. This comprised a total of 8412 non-blank images from animal triggers. Camera setup and image quality (e.g. bait visible in image; non-obstructed of field of view) was adequate for small mammal detection for 25 of the cameras for the duration of deployment.

No Smoky Mice were detected during this period (Table 4.2). Eastern Pygmy Possums were detected on six cameras across five impact sites and one camera at a control site (Fig. 4.7 a-g; Table 4.3). Broad-toothed Rats were detected on two cameras across two impact sites, five cameras across four control sites, and an additional two cameras at two control sites not targeting the species (Fig 4.8 a-i; Table 4.4). Overall, 46 species were identified across 39 cameras at 28 sites (Appendix 2b).

Table 4-2: Smoky Mouse (*Pseudomys fumeus*) detections on camera traps across survey sites.

Prior records refers to year/s of detection within 150 m of either camera prior to 2021 based on records from NSW BioNet. Year 1 Q1 to Year 4 Q4/Year 5 Q2 data were collected by EMM Consulting and derived from annual reports.

| | | Year 1 | | | | Year 2 | | | | Year 3 | | | | Year 4 | | | | Year 5 | | |
|-------------------------|-------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------------|-----------------|-----------|-----------|-----|
| Site | Prior records | Q1 Summer | Q2 Autumn | Q3 Winter | Q4 Spring | Q1 Summer | Q2 Autumn | Q3 Winter | Q4 Spring | Q1 Summer | Q2 Autumn | Q3 Winter | Q4 Spring | Q1 Summer | Q2 Autumn | Q3 Winter Y5 Q1 | Q4 Spring Y5 Q2 | Q3 Summer | Q4 Autumn | |
| Impact | SM01-I | nil | | | | | | | | NA | | | | NA | | | | NA | NA | |
| | SM03-I | nil | | | | | NA | | | NA | | | | | | NA | NA | | | |
| | SM05-I | nil | 1 | 1, 2 | 2 | 2 | | | | | | | | | | | | | NA | |
| | SM07-I | 2017 | | | | | NA | | | | | | | | | | | | NA | |
| | SM10-I | nil | | | | | 1 | | | | NA | | | | | | | | NA | |
| | SM14-I | nil | | | | | 1 | 1 | | | | | | | | NA | | | | |
| | SM15-I | nil | | NA | | | | | | | | | | | | | NA | | | |
| | SM16-I | 2018 | | | | | | | | | | | | | | NA | | NA | | |
| | SM18-I | 2018 | | | | | 1 | | 1 | | | | | | | | | | NIL | NIL |
| | SM21-I | nil | | | | | | 1 | | NA | | | | | | | | | | |
| | SM22-I | nil | | 1, 2 | 1, 2 | 1, 2 | 1, 2 | | | | | | | | | | | | | |
| | SM23-I | nil | | | | 2 | 2 | 2 | | NA | | | | | | NA | | | | |
| | SM24-I | nil | | | 2 | | | NA | | | | | | | | | | | | |
| | SM25-I | nil | | | | | | | | | | | | | | | | | NIL | NIL |
| | SM35-I | nil | | | 1 | | | NA | | | | | | | | NA | NA | | | |
| | # impact sites surveyed | | 15 | 14 | 15 | 15 | 14 | 12 | 15 | 13 | 12 | 15 | 15 | 15 | 14 | 11 | 12 | 13 | 9 | 12 |
| # impact sites detected | | 1 | 2 | 4 | 3 | 5 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

| | | % impact sites detected | 7% | 14% | 27% | 20% | 36% | 25% | 7% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | |
|---------|--------------------------|-------------------------|----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|-----|-----|-----|-----|-----|
| Control | SM02-C | nil | | | | | | | | | | | | | | | NA | | | |
| | SM04-C | 2018, 2020 | | | | | | | | NA | | | | | NA | | | NA | | |
| | SM06-C | 2018 | | | | NA | NA | | NA | NA | | | | | NA | | | | | |
| | SM09-C | 2018, 2020 | | 1 | | 1 | NA | 2 | | | | | | | | 2 | 1 | 2 | | |
| | SM12-C | 2020 | | | | | NA | 2 | | | NA | | | | | | NA | 1 | | 2 |
| | SM13-C | 2018, 2020 | | | | | | NA | | | | | | | | NA | | | | |
| | SM17-C | nil | | | | 2 | | | 1 | | NA | | | | | | | NA | NIL | NIL |
| | SM26-C | nil | | | NA | | | | | | | | | | | NA | | | | |
| | SM40-C | nil | NA | | | | | | | | | | | | | | | | | |
| | SM41-C | nil | NA | | | | | | | | | | | | | | | | NIL | NIL |
| | # control sites surveyed | | 8 | 10 | 9 | 9 | 7 | 9 | 9 | 9 | 7 | 10 | 10 | 10 | 7 | 9 | 8 | 9 | 7 | 8 |
| | # control sites detected | | 0 | 1 | 0 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 1 |
| | % control sites detected | | 0% | 10% | 0% | 22% | 0% | 22% | 11% | 0% | 0% | 0% | 0% | 0% | 0% | 11% | 13% | 22% | 0% | 13% |

LEGEND:

- NIL = camera site discontinued or camera stolen
- NA = one or both cameras non-functional for survey period
- = periods of non-detection > 1 year

- 1 = species detected on camera 1
- 2 = species detected on camera 2
- 1, 2 = species detected on camera 1 & camera 2

Table 4-3: Eastern Pygmy Possum (*Cercartetus nanus*) detections on camera traps across survey sites.

Prior records refers to records from NSW BioNet prior to 2021 within 150 m of either camera. Year 1 Q1 to Year 4 Q4/Year 5 Q2 data were collected by EMM Consulting and derived from annual reports.

| | | Year 1 | | | | Year 2 | | | | Year 3 | | | | Year 4 | | | | Year 5 | | |
|-------------------------|---------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------------|-----------------|-----------|-----------|-----|
| Site | Prior records | Q1 Summer | Q2 Autumn | Q3 Winter | Q4 Spring | Q1 Summer | Q2 Autumn | Q3 Winter | Q4 Spring | Q1 Summer | Q2 Autumn | Q3 Winter | Q4 Spring | Q1 Summer | Q2 Autumn | Q3 Winter Y5 Q1 | Q4 Spring Y5 Q2 | Q3 Summer | Q4 Autumn | |
| Impact | SM01-I | nil | | | | 1 | | | | NA | | | | | | | | NA | NA | |
| | SM03-I | nil | 2 | 2 | | 2 | NA | | | NA | | | 1 | 2 | 2 | NA | NA | 2 | 2 | |
| | SM05-I | nil | | 2 | 1 | | | | | | 2 | | | | | | | NA | 2 | |
| | SM07-I | nil | | 2 | | | NA | | | | | | | | | | | NA | | |
| | SM10-I | nil | 2 | | | | | | | NA | | | 2 | | | | | NA | | |
| | SM14-I | nil | 1 | | | 2 | | 1 | | | 2 | | | | 2 | | | | 2 | |
| | SM15-I | 2018 | | 1 | | | | 1 | | | 1 | 1 | | | 1, 2 | | NA | | 1 | 1 |
| | SM16-I | nil | 2 | 2 | | | | 1 | | | 1 | 2 | | | 1 | NA | | NA | | |
| | SM18-I | nil | 1 | | | | | | | | | | | | 1 | | | 2 | NIL | NIL |
| | SM19-I | 2018 | | | | | | 1 | | | | | | | NA | | NA | | | |
| | SM20-I | 2017, 2018 | 2 | 2 | | | | | | NA | | | | 1 | | | | | 1, 2 | 1 |
| | SM21-I | nil | 1, 2 | 2 | | 1, 2 | 1 | | | NA | 1 | 1, 2 | | 1, 2 | 1, 2 | 1 | | | 1 | |
| | SM22-I | 2017 | | 1 | | | | | | | 2 | | | 2 | | | | | | |
| | SM23-I | 2018 | | 2 | | 1, 2 | 1 | 1, 2 | | NA | 1 | 1 | | | 1 | NA | | | | |
| | SM24-I | nil | | 1, 2 | | | 1 | 1 | | | 2 | 2 | | 1, 2 | 1 | | | | 2 | |
| | SM25-I | nil | | | | | 2 | | | 2 | 2 | 2 | | 1 | 1 | | | | NIL | NIL |
| SM35-I | nil | | | | | | 2 | | | | | | | | NA | NA | | | | |
| # impact sites surveyed | | 17 | 17 | 17 | 17 | 16 | 16 | 17 | 14 | 14 | 17 | 17 | 17 | 16 | 14 | 13 | 15 | 11 | 14 | |
| # impact sites detected | | 7 | 10 | 1 | 3 | 6 | 7 | 0 | 1 | 7 | 8 | 0 | 7 | 8 | 3 | 0 | 1 | 5 | 5 | |

| % impact sites detected | | 41% | 59% | 6% | 18% | 38% | 44% | 0% | 7% | 50% | 47% | 0% | 41% | 50% | 21% | 0% | 7% | 45% | 36% | |
|--------------------------|--------|------|------|------|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|----|-----|-----|------|
| Control | SM02-C | nil | 1, 2 | 1 | 2 | | | | | | | | | 1 | | NA | | 2 | | |
| | SM04-C | nil | 1 | 1, 2 | | | | | | NA | | | 1 | NA | | | | NA | | |
| | SM06-C | 2018 | 1, 2 | 1 | | NA | 1 | 1 | NA | 1 | 1, 2 | 1, 2 | | 1, 2 | 1 | 1, 2 | | | | 1 |
| | SM09-C | nil | 1 | 1 | | 1 | 1 | 2 | | | 1 | | 1 | 1, 2 | 1, 2 | | | | | 2 |
| | SM12-C | nil | | | | | NA | 2 | 2 | | NA | | 1, 2 | | | NA | | | | 1, 2 |
| | SM13-C | 2018 | | | | | | 2 | | | | 1 | | 1 | | | | | | |
| | SM17-C | nil | 1 | 1, 2 | | | | 2 | | | 1, 2 | | | | 1, 2 | 1, 2 | | NA | NIL | NIL |
| | SM26-I | nil | | | NA | | | | | | | | | | 2 | | | | | |
| | SM29-C | 2018 | | | | | | 2 | | NA | | | | | | NA | NA | | | |
| | SM40-C | nil | NA | | | 2 | | | | | | 1 | | 1, 2 | | | | | | 2 |
| | SM41-C | nil | NA | | | | | 2 | | | | 2 | | | | | | | NIL | NIL |
| # control sites surveyed | | 9 | 11 | 10 | 10 | 10 | 11 | 10 | 10 | 9 | 11 | 11 | 11 | 10 | 10 | 8 | 10 | 8 | 9 | |
| # control sites detected | | 5 | 4 | 1 | 3 | 2 | 7 | 1 | 1 | 2 | 5 | 0 | 6 | 5 | 3 | 0 | 0 | 1 | 4 | |
| % control sites detected | | 56% | 36% | 10% | 30% | 20% | 64% | 10% | 10% | 22% | 45% | 0% | 55% | 50% | 30% | 0% | 0% | 13% | 44% | |

LEGEND:

| | |
|-----|--|
| NIL | = camera site discontinued or camera stolen |
| NA | = one or both cameras non-functional for survey period |
| | = periods of non-detection > 1 year |

| | |
|------|---|
| 1 | = species detected on camera 1 |
| 2 | = species detected on camera 2 |
| 1, 2 | = species detected on camera 1 & camera 2 |

Table 4-4: Broad-toothed Rat (*Mastacomys fuscus*) detections on camera traps and faecal pellet surveys across survey sites.

Prior records refers to records from NSW BioNet prior to 2021 within 150 m of either camera. Year 1 Q1 to Year 4 Q4/Year 5 Q2 data were collected by EMM Consulting and derived from annual reports.

| | | Year 1 | | | | Year 2 | | | | Year 3 | | | | Year 4 | | | | Year 5 | | |
|---------------------------|-----------------|------------|--------|--------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|---------|-------------|-------------|---------|------------|---------|
| Site | Prior records | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 Y5 Q1 | Q4 Y5 Q2 | Q3 | Q4 | |
| Faecal pellet survey date | | Jan-21 | Apr-21 | Sep-21 | Oct-21 | Jan-Feb 22 | Apr-22 | Aug-Sep 22 | Oct-Nov 22 | Feb-23 | Apr-May 23 | Jul-Aug 23 | Oct-Nov 23 | Feb-24 | May-24 | Jul-Aug 24 | Oct-Nov 24 | Jan-25 | Apr-25 | |
| Impact | SM27-I (camera) | | | NA | | | NA | | | NA | | | | NA | | | | NA | 2 | |
| | FP20 (scat) | 2017 | | | | | | | | | Rare & old | | | Rare & old | | | | | | |
| | SM34-I (camera) | | | | | | | | | NA | 1 | 1 | NA | NA | 2 | 2 | 1, 2 | 2 | | |
| | FP19 (scat) | 2016, 2017 | | | | | Rare & old | | | Rare & old | Present | Present | Present | Present | Present | Present | Present | | Rare & old | |
| | SM36-I (camera) | | | | | | 1 | | NA | NA | | | | NA | | | NA | 2 | 2 | |
| | FP18 (scat) | 2017 | | | | | Rare & old | Rare & old | | Rare & old | | | | Present | Present | Present | Present | Present | Present | |
| | SM37-I (camera) | | | | | | NA | | NA | NA | NA | NA | NA | NA | NIL | NIL | NIL | NIL | NIL | |
| | FP17 (scat) | 2016 | | | Rare & old | | | | Rare & old | | Present | Present | Present | Present | Present | Present | Present | Present | Rare & old | Present |
| | SM01-I | | | | | | | | 2 | | NA | | 1 | | NA | | | | NA | NA |
| | SM07-I | | | | | | | | 1 | | | | | | | | | | NA | |
| | SM14-I | | | | | | | | | | | | | | NA | | | 1 | | |
| SM18-I | | | | | | | | | | | | | | 1 | | | | NIL | NIL | |
| # impact sites surveyed | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| # impact sites detected | | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | |
| % impact sites detected | | 0% | 0% | 0% | 0% | 0% | 25% | 0% | 0% | 25% | 50% | 50% | 50% | 75% | 75% | 75% | 75% | 50% | 75% | |
| Contr | SM28-C (camera) | | 1 | 1 | 1 | | NA | | NA | | | 1 | 1 | 1 | NA | NA | 1 | NA | NA | |

| | | | | | | | | | | | | | | | | | | | |
|--------------------------|------------|-----|------------|------------|------------|------------|------------|---------|------------|------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| FP27 (scat) | 2017 | | | | | | | | Rare & old | | | | Present | Present | NA | NA | Present | | Present |
| SM30-C (camera) | | 2 | 2 | 1,2 | 2 | 2 | 1,2 | 1,2 | 1 | 1,2 | 1,2 | 1,2 | 2 | 2 | NA | NA | 2 | 2 | 2 |
| FP32 (scat) | 2016, 2017 | | Present | Present | Rare & old | Rare & old | Present | Present | Present | Present | Present | Present | Present | Present | NA | NA | Present | Present | Present |
| SM31-C (camera) | | | | | | | 1 | | 2 | NA | | 1 | 1 | 1,2 | NA | NA | | NA | |
| FP31 (scat) | 2017 | | | | | | | Present | Present | Present | Present | Present | Present | Present | NA | NA | Present | | Present |
| SM32-C (camera) | | | 1,2 | 1,2 | 1,2 | 1 | 1 | 1,2 | | 2 | 1,2 | 1,2 | 1,2 | 1,2 | NA | NA | 2 | NA | 1 |
| FP26 (scat) | 2017 | | | Rare & old | Rare & old | Rare & old | Present | Present | Present | Present | Present | Present | Present | Present | NA | NA | Present | Present | Present |
| SM33-C (camera) | | 1,2 | 1,2 | NA | NA | 1 | NA | | 1,2 | NA | 2 | 1,2 | 1 | 1,2 | NA | NA | NA | 2 | 1,2 |
| FP33 (scat) | 2017, 2018 | | | Rare & old | | | Rare & old | Present | Present | Rare & old | Present | Present | Present | Present | NA | NA | Present | Present | Present |
| SM38-C (camera) | | | 2 | NA | NA | NA | NA | 1 | | NA | | | NA | NA | | | | 2 | |
| FP30 (scat) | 2009 | | Rare & old | | | | | | Rare & old | | | Present | Present | Present | Present | Present | Present | Present | Present |
| SM39-C (camera) | | | | NA | 2 | 1,2 | NA | 1,2 | 1,2 | 2 | 2 | 1,2 | 1,2 | 2 | 1,2 | 2 | 2 | 1,2 | 1 |
| FP24 (scat) | nil | | | | | | Rare & old | Present | Present | Present | Present | Present | Present | Present | Present | Present | Present | Present | Present |
| SM02-C | | | | | | | | | | | 2 | 1,2 | 2 | 2 | 2 | NA | | 1 | 1 |
| SM04-C | | | | | | | | | | NA | | 2 | 2 | 1 | 1 | | | NA | |
| SM09-C | | | | | | NA | | | | | | | | | | | | 2 | |
| SM17-C | | | | | | | | | | NA | | | | 2 | 2 | | | NIL | NIL |
| SM40-C | | NA | | | | | | | | | | | | | | | 1 | | |
| # control sites surveyed | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 2 | 7 | 7 | 7 |

| | | | | | | | | | | | | | | | | | | |
|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-----|-----|------|-----|------|
| # control sites detected | 3 | 5 | 3 | 3 | 4 | 3 | 6 | 5 | 4 | 6 | 7 | 7 | 7 | 2 | 2 | 7 | 5 | 7 |
| % control sites detected | 43% | 71% | 43% | 43% | 57% | 43% | 86% | 71% | 57% | 86% | 100% | 100% | 100% | 29% | 29% | 100% | 71% | 100% |

LEGEND:

| | |
|-----|--|
| NIL | = camera site discontinued or camera stolen |
| NA | = one or both cameras non-functional for survey period |
| | = periods of non-detection > 1 year |
| | = camera sites not targeting BTRs |

| | |
|------------|---|
| 1 | = species detected on camera 1 |
| 2 | = species detected on camera 2 |
| 1, 2 | = species detected on camera 1 & camera 2 |
| Rare & old | = scat was detected but scarcity and age mean species may not have been present |









Figure 4.8: Eastern Pygmy Possum (*Cercartetus nanus*) detected in Year 5 Q3 (Summer) on camera a) SM03-I-RC2; b) SM15-I-RC1; c) SM20-I-RC1; d) SM20-I-RC2; e) SM21-I-RC1; f) SM24-I-RC2; and g) SM02-C-RC2.











Figure 4.9: Broad-toothed Rat (*Mastacomys fuscus*) detected in Year 5 Q3 (Summer) on camera a) SM34-I-RC2; b) SM36-I-RC2; c) SM30-C-RC2; d) SM33-C-RC2; e) SM38-C-RC2; f) SM39-C-RC1; g) SM39-C-RC2; h) SM02-C-RC1 (non-target); and i) SM09-C-RC2 (non-target).

Camera trap surveys: Autumn 2025 – Year 5 Q4

Autumn camera trap data was provided for 63 cameras for 18-34 (mean = 29) days between 14 March 2025 and 7 May 2025. Eight cameras are no longer part of the monitoring program and three cameras failed to produce images. Camera setup and image quality (e.g. bait visible in image; non-obstructed of field of view) was adequate for small mammal detection for 39 of the cameras for the duration of deployment. Camera images provided totalled 25,869 non-blank images from animal triggers.

Smoky Mice were detected on one camera at control site SM12 over three visits to the bait in one night (Fig. 4.9; Table 4.2). Eastern Pygmy Possums were detected on five cameras at five impact sites and five cameras across four control sites (Fig 4.10a-j; Table 4.3). Broad-toothed Rats were detected on two cameras across two impact sites, five cameras across four control sites, and one camera at a control site not targeting the species (Fig 4.11a-h; Table 4.4). Overall, 35 species were detected across 50 cameras at 33 sites (Appendix 2c).



Figure 4.10: Smoky Mouse (*Pseudomys fumeus*) detected in Year 5 Q4 (Autumn) on camera SM12-C-RC2.











Figure 4.11: Eastern Pygmy Possum (*Cercartetus nanus*) detected in Year 5 Q4 (Autumn) on camera a) SM03-I-RC2; b) SM05-I-RC2; b) SM14-I-RC2; d) SM15-I-RC1; e) SM20-I-RC1; f) SM06-C-RC1; g) SM09-C-RC2; h) SM12-C-RC1; i) SM12-C-RC2; and j) SM40-C-RC2.









Figure 4.12: Broad-toothed Rat (*Mastacomys fuscus*) detected in Year 5 Q4 (Autumn) on camera a) SM27-I-RC2; b) SM36-I-RC2; c) SM30-C-RC2; d) SM32-C-RC1; e) SM33-C-RC1; f) SM33-C-RC2; g) SM39-C-RC1; and h) SM02-C-RC1 (non-target).

Feral predators

Red foxes (*Vulpes vulpes*) were detected on eight small mammal cameras across two control and five impact sites in Year 5 Q3 Summer and 21 cameras across eight control and eight impact sites in Year 5 Q4 Autumn (Table 4.5). Feral cats (*Felis catus*) were detected on nine small mammal cameras across five control and four impact sites in Year 5 Q3 Summer and 11 cameras across four control and seven impact sites in Year 5 Q4 Autumn (Table 4.5). Due to camera setup targeting small mammals these detections may underrepresent the presence of feral predators in the landscape. It is understood that SHL and FGJV will be undertaking targeted 1080 CPE control; the small mammal camera data will help to inform this program in addition to the targeted feral predator cameras.

Table 4-5: Feral predator detections on small mammal cameras in Year 5 Q3 Summer and Q4 Autumn 2025.

| | Site | Cat detected 2025 | Fox detected 2025 |
|---------|------|-------------------|-------------------|
| Impact | SM01 | Y | |
| | SM03 | Y | |
| | SM05 | Y | |
| | SM07 | Y | |
| | SM10 | | Y |
| | SM14 | | Y |
| | SM19 | Y | Y |
| | SM20 | Y | Y |
| | SM21 | Y | |
| | SM22 | Y | Y |
| | SM23 | Y | Y |
| | SM24 | | Y |
| | SM27 | | Y |
| | SM34 | | Y |
| | SM35 | | Y |
| Control | SM02 | Y | |
| | SM04 | Y | |
| | SM06 | Y | Y |
| | SM12 | Y | Y |
| | SM26 | Y | Y |
| | SM28 | | Y |
| | SM39 | Y | Y |
| | SM40 | Y | Y |

Faecal pellet surveys: Summer – Year 5 Q3

Summer surveys were conducted 6-7 January 2025. Broad-toothed Rat scat was detected at two of four impact sites and five of seven control sites (Table 4.6). It was noted that site FP31 is inappropriately located in a sphagnum bog and the recommendation was made in the survey report that the site be shifted to prevent trampling of sensitive habitat and more appropriately target BTR habitat (i.e. no standing water).

Faecal pellet surveys: Autumn- Year 5 Q4

Autumn surveys were conducted 14-15 April 2025. Broad-toothed Rat scat was detected at three of four impact sites and seven of seven control sites (Table 4.3). Site FP31 was shifted 15 m north out of sphagnum bog, as recommended in January.

Table 4-6: Broad-toothed Rat faecal pellet survey results, January and April, 2025.

| | Site | January 2025 | April 2025 |
|----------------|------|--|--|
| Impact | FP17 | Rare, mostly old Common nearby | Abundant, fresh |
| | FP18 | Abundant, fresh Juvenile scat present | Abundant, fresh |
| | FP19 | Not present Heavily degraded habitat, high horse sign | Rare, all old |
| | FP20 | Not present Heavily grazed habitat, high horse sign | Not present Heavily grazed habitat, high horse sign |
| Control | FP24 | Common, fresh Juvenile scat present | Abundant, mostly old |
| | FP26 | Abundant, fresh Very high-quality habitat | Abundant, fresh Very high-quality habitat |
| | FP27 | Not present Heavily grazed habitat, high horse sign | Uncommon, fresh |
| | FP30 | Common, fresh | Common, fresh |
| | FP31 | Not present Inappropriate locat on – needs to be moved out of bog | Common, fresh |
| | FP32 | Abundant, fresh Very high level of rabbit sign | Abundant, fresh Very high level of rabbit sign |
| | FP33 | Common, fresh Patchy habitat | Common, fresh |

4.6 Triggers for adaptive management

Adaptive management for Smoky Mouse has previously been triggered for five sites. In Year 2, SM05, SM24, SM35 were triggered. No adaptive management for Smoky Mouse was triggered in Year 3 as the species was not recorded at any impact or control sites. In Year 4, adaptive management was triggered for SM05, SM22, SM23, SM24 and SM35. Based on absence in the past 12 months and occurrence at two control sites, the following sites remain triggered for Year 5: SM05, SM22, SM24, SM35 (Table 4.7). SM10, SM14, SM18, and SM21 have not previously been triggered despite absences greater than 12 months; this is because the species was not detected at these sites in Year 1 surveys, however, the species was detected at these four sites in Year 2 surveys.

Adaptive management for Eastern Pygmy Possum has previously been triggered for six sites in Year 2 (SM05, SM07, SM10, SM18, SM20 and SM22), two remained triggered in Year 3 (SM07 and SM18), and only SM07 remained triggered in Year 4. While there are eight sites at which the species has not been detected in over 12 months for Year 5, there have been similar detection patterns at the control sites and therefore no sites are triggered for Eastern Pygmy Possum in Year 5 (Table 4.7).

Adaptive management has not been triggered for Broad-toothed Rats at any sites and no triggers require activation based on the past 12-months survey data (Table 4.7).

Table 4-7: Triggers for adaptive management: Small mammals.

| | Smoky Mouse | Broad-toothed Rat (BTR) | Eastern Pygmy Possum (EPP) |
|--|--|--|---|
| Summary | Triggered sites: SM05, SM22, SM23, SM24, SM35 | No sites have been triggered as the species has been detected at all impact sites in the past 12 months. | No sites are triggered as there have been similar detect on pat erns across control and impact sites in the past 12 months. |
| Trigger | | | |
| Absence from a site during construct on and operat onal monitoring, where the species was recorded during pre-construct on / baseline surveys | Smoky Mice were not detected at any impact sites in the past 12 months. | No BTR were detected in Year 1 (baseline) surveys, except rare and old scat at FP17. | Of the 13 impact sites where EPP were detected in Year 1, they have not been detected at eight in the past 12 months. |
| No changes in presence / absence at control sites | In the past 12 months, Smoky Mice have been detected at two of three control sites where they were detected in Year 1 or Year 2 and the other has been decommissioned. | BTR were detected at all control sites in the past 12 months. | In the past 12 months, EPP have been detected at f ve of the ten control sites where the species was detected in Year 1 or Year 2, and one has been decommissioned. |
| Absence recorded for greater than one year | No Smoky Mice have been detected in over 12 months at the following sites where they were detected in Year 1: <ul style="list-style-type: none"> ▪ SM05 – last detected Y1-Q4 ▪ SM22 – last detected Y2-Q1 ▪ SM23 – last detected Y2-Q2 | BTR were detected at all impact sites in the past 12 months. | No EPP have been detected in over 12 months at the following sites where they were detected in Year 1: <ul style="list-style-type: none"> ▪ SM07 – last detected Y1-Q2 ▪ SM10 – last detected Y4-Q4 ▪ SM16 – last detected Y4-Q1 ▪ SM22 – last detected Y3-Q4 |

| | | | |
|--|---|------------|--|
| | <ul style="list-style-type: none"> ▪ SM24 – last detected Y1-Q3 ▪ SM35 – last detected Y1-Q3 <p>Addit onally, no Smoky Mice have been detected in over 12 months at the following sites where they were detected in Year 2:</p> <ul style="list-style-type: none"> ▪ SM10 – last detected Y2-Q1 ▪ SM14 – last detected Y2-Q2 ▪ SM18 – last detected Y2-Q3 – inaccessible ▪ SM21 – last detected Y2-Q2 | | <ul style="list-style-type: none"> ▪ SM23 – last detected Y1-Q1 <p>No EPP have been detected in over 12 months at the following sites where they were detected in Year 2:</p> <ul style="list-style-type: none"> ▪ SM01 – last detected Y2-Q1 ▪ SM19 – last detected Y2-Q2 ▪ SM35 – last detected Y2-Q2 ▪ SM25 – last detected Y4-Q1, however, cameras at the site were decommissioned at some point in the past 12 months. |
| <p>Absence is combined with an observed increase or new occurrence of a primary impact (decline in habitat complexity, weeds, pathogens, or feral herbivores / predators)</p> | <ul style="list-style-type: none"> ▪ SM05 – potential ▪ SM22 – Yes – the hillside on which RC1 occurred has been excavated, RC2 is now 30 m from a cleared area with extensive construct on act vity. ▪ SM23 – Yes – situated within a few hundred meters of two areas of signif cant new disturbance and drilling. ▪ SM24 – Yes – RC1 very close to new shaf with noise, drilling and vibrat on. ▪ SM35 – no new primary impacts observed at site | <p>N/A</p> | <ul style="list-style-type: none"> ▪ SM07 – uncertain ▪ SM10 – uncertain ▪ SM16 – uncertain ▪ SM22 – Yes – the hillside on which RC1 occurred has been excavated, RC2 is now 30 m from a cleared area with extensive construct on act vity. ▪ SM23 – Yes – situated within a few hundred meters of two areas of signif cant new disturbance and drilling. |

4.7 Recommendations

Overview

Key recommended amendments for BMP Year 6 Small Mammal monitoring include:

- Allow flexibility in survey site centroid location in BTR faecal monitoring (up to 30 m) to account for changes in hydrology among survey seasons;
- Winter BTR scat surveys to be removed. Three BTR scat surveys to occur annually – Spring, Summer and Autumn;
- Collection of faecal pellets during surveys for use by NPWS in genetic analyses;
- Remove cameras from BTR sites and redeploy to new locations targeting Smoky Mouse. This will also address issues of some BTR-targeted cameras having been placed in bogs; and
- Snowline Ecology to provide on-ground training to Snowy 2.0 staff to improve small mammal camera trap setup and maintenance.

Details: BTR faecal pellet surveys

Site centroid flexibility

Some BTR faecal pellet survey site centroids have been located close to or within creek lines and bogs, rendering the majority of some sites (10 m radius from centroid) unsuitable habitat during survey events. Allowing a 30 m tolerance in the location of the site survey centroid among survey events will enable field biologists to target seasonally appropriate habitat within the bounds of the site without impacting control/impact status of the site. For example, moving FP31 out of a bog and allowing flexibility for FP27 which is sometimes in a creek.

Timing

Data from winter BTR scat surveys has been inconsistent due to site access issues. Winter is a poor time to survey for BTR due to potential snow cover impeding visibility of scat and runways. For Year 6, the number of BTR surveys per year will be reduced from four to three and no survey will be conducted in winter. Spring, summer and autumn surveys will be maintained.

Genetics

NSW NPWS have a project underway using BTR faecal pellets to assess population genetics in across Kosciuszko. Some sites surveyed in the BMP are not accessible to NPWS staff, thus collection of faecal pellets during BMP surveys may provide valuable additional data for the project with a negligible time impacts on BMP surveys. Faecal pellets will be collected and stored in line with NSW NPWS protocols and provided to NSW NPWS. These samples and resultant genetic data will not be reported through the BMP process.

Small mammal camera trapping surveys - detailed

Inclusion of Year 2 detection sites in 'baseline' for triggers

Four Smoky Mouse camera sites (SM10, SM14, SM18, SM21) recorded the species in Year 2, but not Year 1, precluding the sites from being triggered after periods of non-detection for 12 months or more. Similarly, four EPP camera sites (SM01, SM19, SM25, SM35) recorded the species in Year 2, but not Year 1. Depending on timelines for disturbance at the sites, Year 2 detections could be included in identifying baseline presences, enabling the sites to be triggered after periods of non-detection for 12 months or more, and justifying continued monitoring of the sites. Without this change, SM01, SM19, SM25, SM35 can never be triggered for any species and the purpose of continued monitoring of these sites is uncertain. SM25 has already been discontinued due to site access issues.

BTR camera sites transitioning to Smoky Mouse

No BTR were detected on camera in Year 1, precluding BTR sites from being triggered based on camera data. All sites selected for camera trapping to target BTR are also surveyed in the faecal pellet surveys. The faecal pellet surveys provide greater detail about the species abundance and occupancy at a site than the camera monitoring data. At least

eight cameras originally targeting the Smoky Mouse are no longer included in the monitoring program and sites have not been replaced.

We recommended that in Year 6, the 22 BTR-targeted cameras are relocated to sites that provide additional information about the occurrence of the Smoky Mouse, which has been very poorly detected since Year 2. Site selection would be conducted in collaboration with Dr Fred Ford (NSW DCCEE) and target locations where the species was detected between 2017 – 2021 or where further data are required to assess potential impacts of SHL works.

Camera trap set-up and image quality

Camera trap set-up (angling and alignment of field of view, visibility of bait holder, clearing of obstructive vegetation), site access (safety issues, snowfall, active construction), and camera theft resulted in some data gaps in Year 5.

In Year 6, Snowline Ecology will provide Snowy 2.0 staff with on-ground training in camera deployment, set-up and maintenance. Baits must be deployed at the beginning and collected at the end of each 30-day monitoring period. Camera setup, alignment and functionality must be checked at the beginning of each 30-day monitoring period.

4.8 Fauna underpass monitoring

4.8.1. Overview

Vehicle strike was identified as a risk to fauna in the biodiversity assessment undertaken for Snowy 2.0 Main Works. As a result, the Snowy 2.0 Main Works Fauna Strike Mitigation Strategy involved the installation of six small mammal road crossing underpasses, developed and installed by Snowy 2.0 along Ravine Road in the Lobs Hole area (Snowy 2.0, 2022).

For Year 5, five small mammal species were recorded using the underpasses: Eastern Pygmy Possum, Bush Rat (*Rattus fuscipes*), Agile Antechinus (*Antechinus agilis*), Dusky Antechinus (*A. mimetes*) and the non-native House Mouse (*Mus musculus*), with crossings recorded for all except Dusky Antechinus. Ten lizard species, four snake species and two bird species were also recorded using the underpasses.

4.8.2. Methods

Camera deployment and servicing is managed by Snowy 2.0 staff. Underpasses have a vertically aligned Reconyx camera at each end to capture fauna entering or exiting the underpass. Cameras were set to collect 10 images per trigger and operate 24 hours per day.

Images are provided to Snowline Ecology via the Wildlife Insights online portal. Where possible, images were identified to species-level. A crossing was considered as the detection of the same species on both cameras at a given underpass within a 30-minute window.

4.8.3. Results

Camera trap data was provided for the twelve cameras between 1 June 2024 – 31 May 2025. This comprised a total of 13,628 non-blank images from animal triggers; 12,285 of these images could be identified to species level. Nine skink, five small mammal, four snake, two bird, and one dragon species were recorded on the underpass cameras (Table 4.8). Some skinks from the genera *Lampropholis* and *Pseudomoia* cannot be reliably identified on camera trap images, so are not represented in the data below. No Smoky Mice were detected. Eastern Pygmy Possums were detected at two underpasses – on 2 nights in Underpass 3 and 16 nights in Underpass 4.

Table 4-8: Species detected on underpass cameras, Ravine Rd, Lobs Hole.

| | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | |
|----------|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | East | West | East | West | East | West | East | West | East | West | East | West |
| Mammals | Agile Antechinus | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| | Bush Rat | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| | Dusky Antechinus | | Y | | | | | | | | | | |
| | Eastern Pygmy Possum | | | | | Y | Y | Y | Y | | | | |
| | House Mouse | Y | Y | | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Reptiles | Black Rock skink | | | Y | Y | Y | Y | | | | Y | | |
| | Blotched Blue-tongued Lizard | Y | Y | | | | | | | | | | |
| | Coventry's Skink | Y | | Y | Y | Y | Y | | | Y | | | |
| | Dreeite Water Skink | | Y | | Y | Y | Y | | | | Y | | |
| | Southern Water Skink | | Y | | | | | | | | | | |
| | Eastern Brown Snake | | Y | Y | Y | Y | Y | | | | | Y | Y |
| | Eastern Three-lined Skink | | Y | Y | Y | Y | Y | | Y | | Y | Y | Y |

| | | | | | | | | | | | | | |
|-------|-------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| | Highland Copperhead | Y | Y | Y | Y | Y | Y | Y | Y | | | Y | Y |
| | Jacky Lizard | | | | | Y | Y | Y | | Y | Y | | |
| | Pale-flecked Garden Sun Skink | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| | Rainbow Skink | | | | | | Y | | | | | | |
| | Spencer's Skink | | Y | | | | Y | | | | | | |
| | Tiger Snake | Y | | Y | Y | | Y | | | Y | | | |
| | White-lipped Snake | | Y | | | | Y | | | | | | |
| Birds | Flame Robin | | | | | | Y | | | | | | |
| | White-browed Scrubwren | Y | | Y | Y | Y | Y | | Y | Y | Y | | |

Three small mammal species, two snake species and three skink species were confirmed crossing through the underpasses (Table 4.9). However, the target species – Smoky Mouse – was not detected on any underpass cameras, nor was it detected in previous reporting periods (Abel Ecology, 2024). The greatest number of confirmed crossings were by the Agile Antechinus (125 crossings at five underpasses), followed by the Highland Copperhead (40 crossings across four underpasses), followed by the Bush Rat (28 crossings across four underpasses).

Table 4-9: Number of crossings in Year 5 by species on underpass cameras, Ravine Rd, Lobs Hole. Crossings are determined by detection of the species on both cameras within a 30-minute window.

| | | 1 | 2 | 3 | 4 | 5 | 6 |
|----------|-------------------------------|----|----|----|----|---|----|
| Mammals | Agile Antechinus | 28 | | 32 | 20 | 4 | 41 |
| | Bush Rat | 8 | 14 | 1 | | | 5 |
| | Eastern Pygmy Possum | | | | 5 | | |
| | House Mouse | | | 4 | 2 | 8 | 3 |
| Reptiles | Black Rock skink | | | 3 | | | |
| | Blotched Blue-tongued Lizard | 1 | | | | | |
| | Eastern Brown Snake | | 3 | | | | 3 |
| | Highland Copperhead | 29 | | 2 | 3 | | 6 |
| | Pale-flecked Garden Sun Skink | 1 | 1 | 12 | 1 | | |

5. Small Mammals – Habitat Characteristics Surveys

5.1 Survey Location Maps



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Prepared by: Karen Zhu
 Date: 12/02/2026
 0 0.3 0.7 1 km
 Spatial Reference: GDA2020 MGA Zone 55

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Figure 5.1 - Small Mammal Habitat Characteristics Transects - Ravine Road

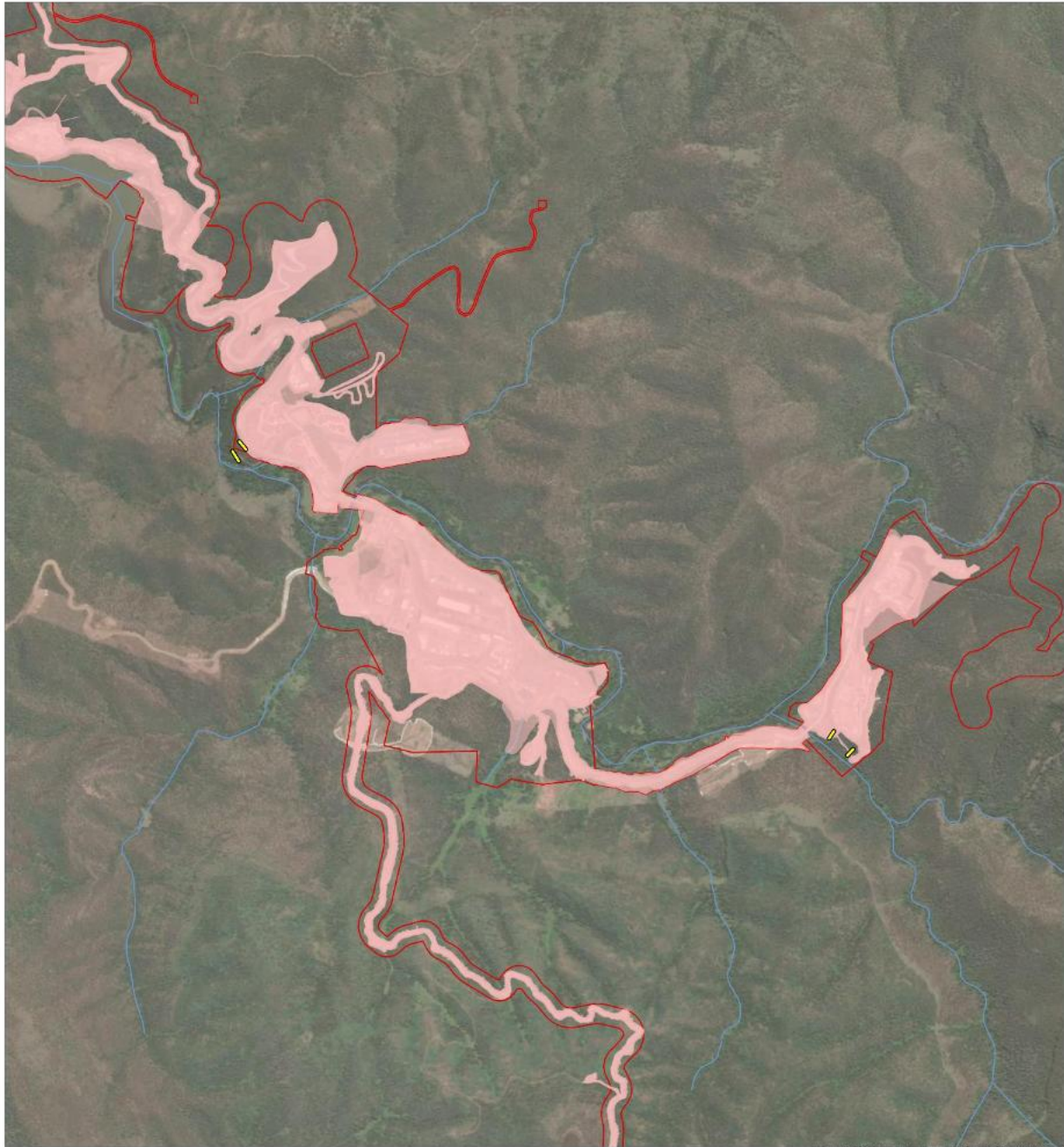
Legend

- Construction Envelope
- Disturbance Boundary
- Transects - Small Mammal
- Major road
- Watercourse



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Figure 5.1: Small mammal habitat characteristics transects – Ravine Road.



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Prepared by: Karen Zhu
 Date: 7/04/2026
 0 0.2 0.4 0.6 km

Spatial Reference: GDA2020 MGA Zone 55

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Figure 5.1 - Small Mammal Habitat Characteristics Transects - Lobs Hole

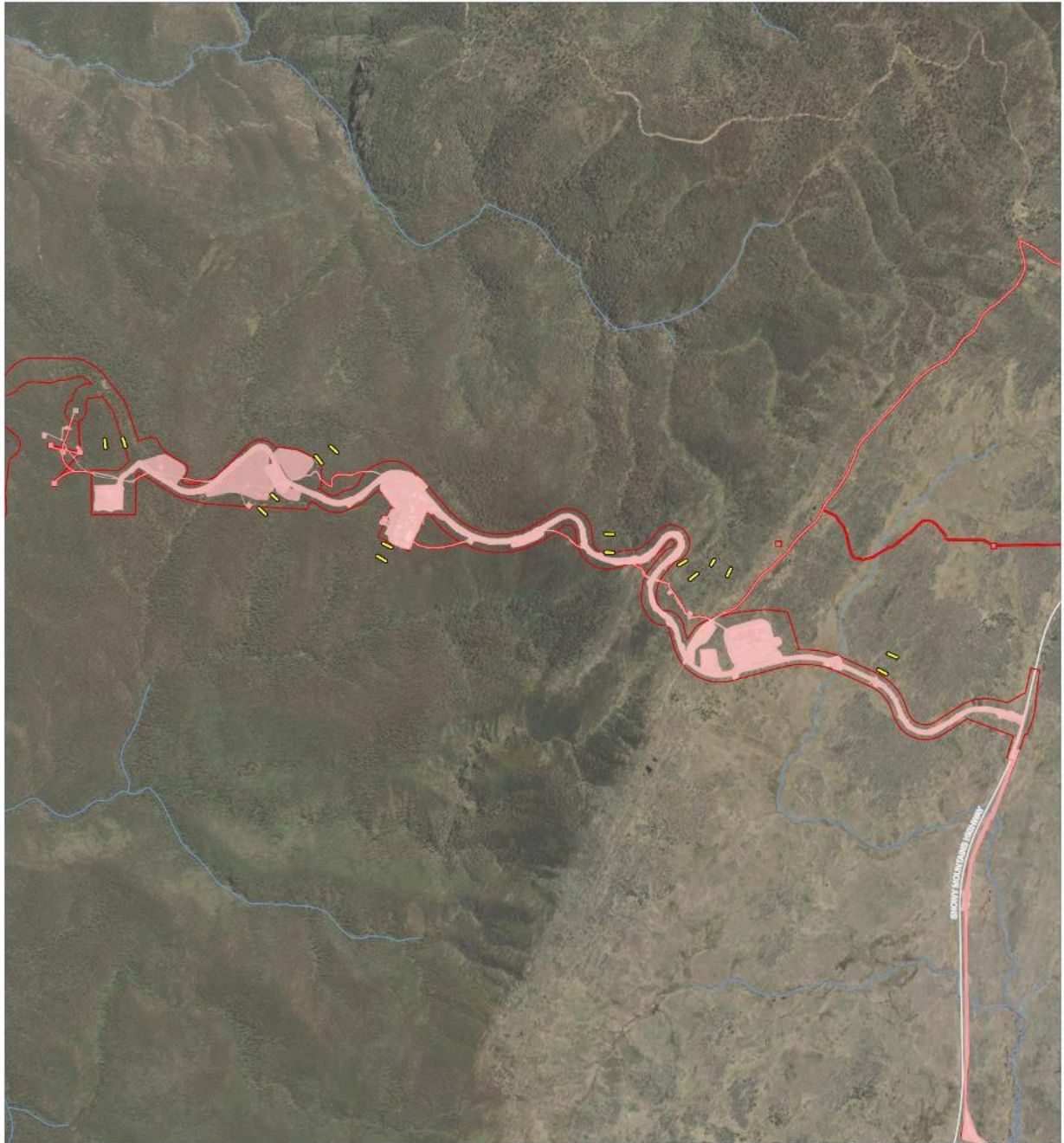
Legend

- Construction Envelope
- Disturbance Boundary
- Transects - Small Mammal
- Watercourse



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Figure 5.2: Small mammal habitat characteristics transects – Lobs Hole.



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Figure 5.1 - Small Mammal Habitat Characteristics Transects - Marica

- Legend**
- Construction Envelope
 - Disturbance Boundary
 - Transects - Small Mammal
 - Major road
 - Watercourse



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Figure 5.3: Small mammal habitat characteristics transects – Marica.



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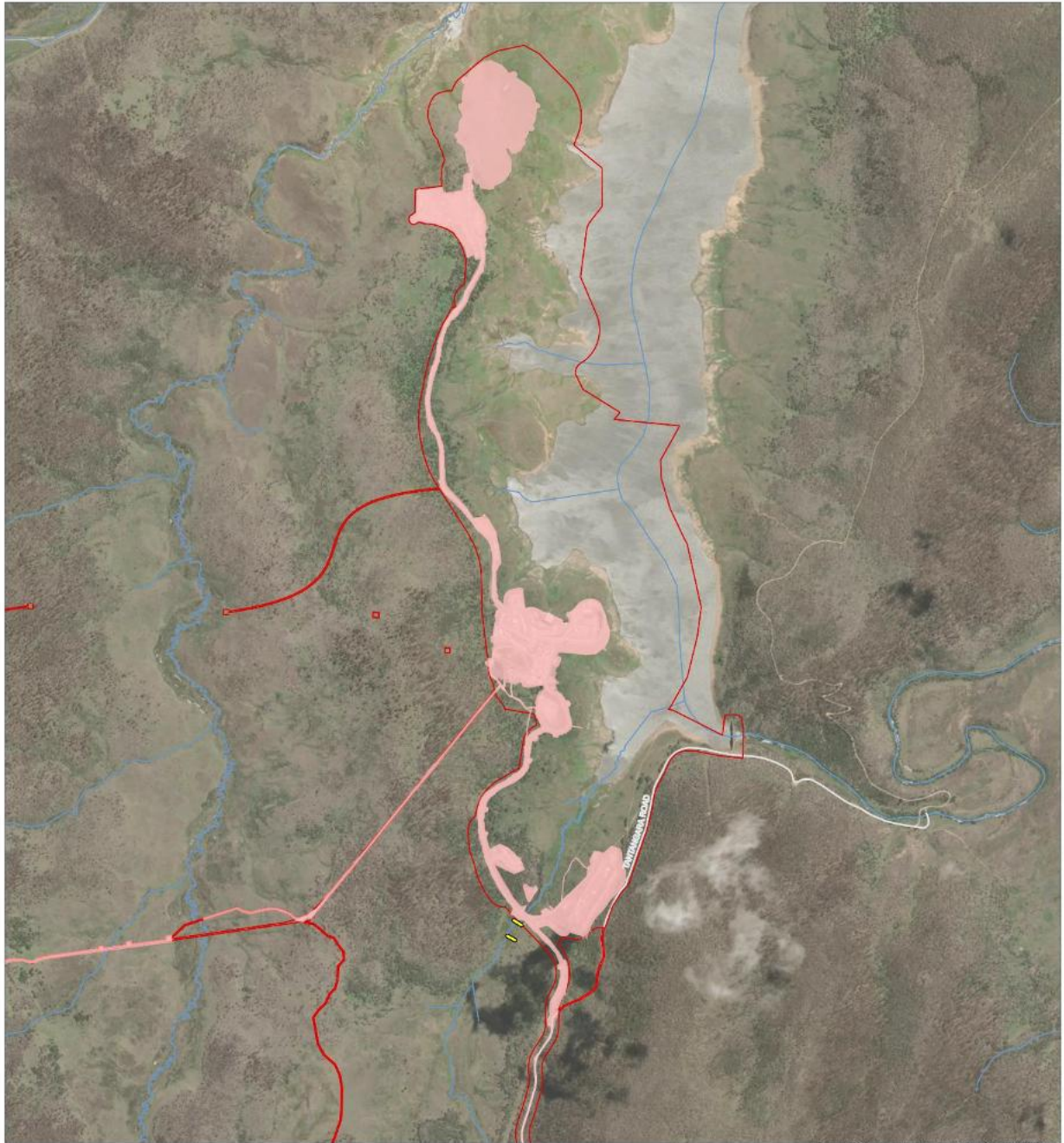
Figure 5.1 - Small Mammal Habitat Characteristics Transects - Offsite

- Legend**
- Construction Envelope
 - Disturbance Boundary
 - Transects - Small Mammal
 - Major road
 - Watercourse



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Figure 5.4: Small mammal habitat characteristics transects – Off site.



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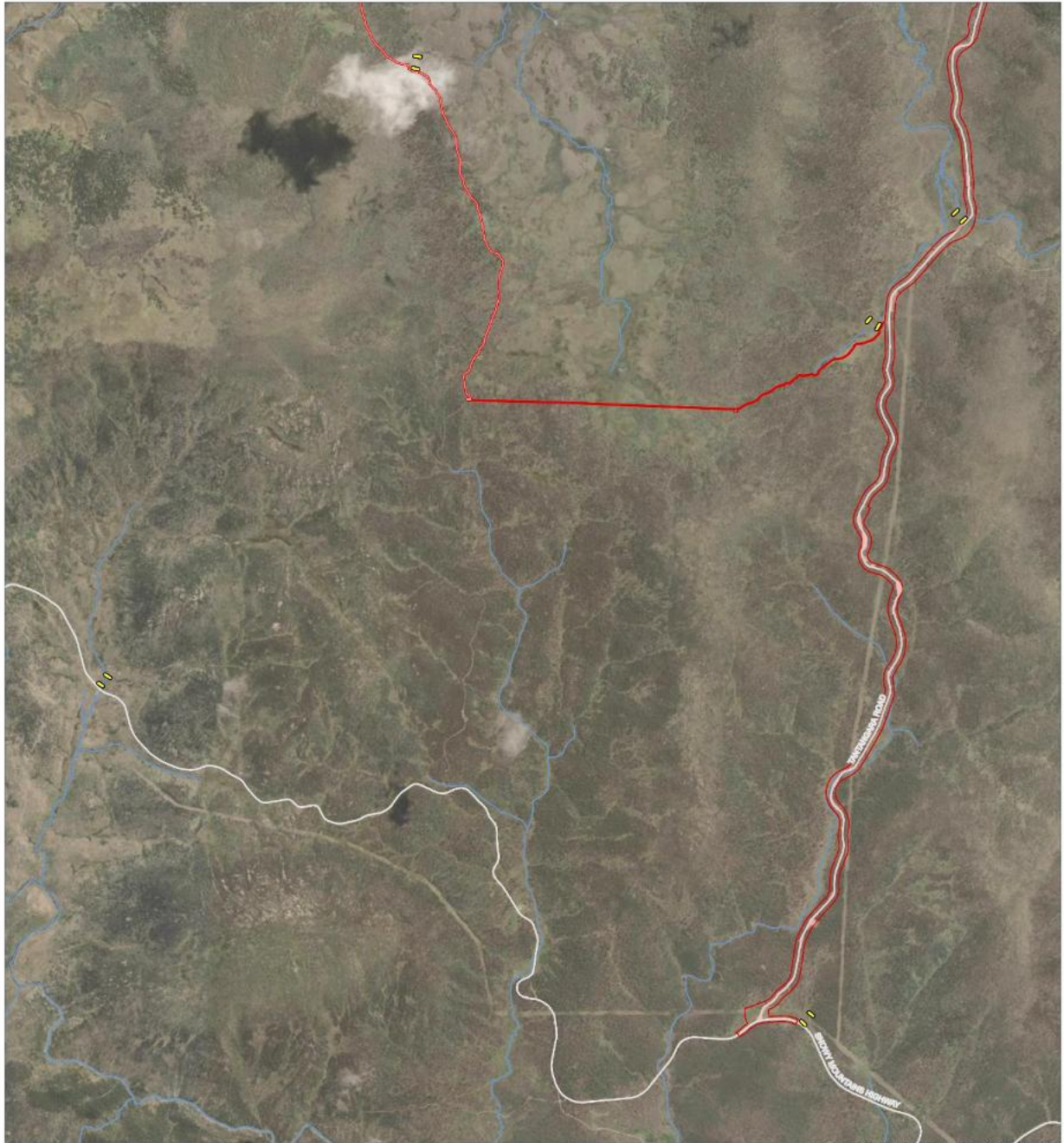
Figure 5.1 - Small Mammal Habitat Characteristics Transects - Tantangara

- Legend**
- Construction Envelope
 - Disturbance Boundary
 - Transects - Small Mammal
 - Major road
 - Watercourse



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Figure 5.5: Small mammal habitat characteristics transects – Tantangara.



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 0 0.5 1 1.5 km
 Spatial Reference: GDA2020 MGA Zone 55

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Figure 5.1 - Small Mammal Habitat Characteristics Transects - Tantangara Road

- Legend**
- Construction Envelope
 - Disturbance Boundary
 - Transects - Small Mammal
 - Major road
 - Watercourse



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Figure 5.6: Small mammal habitat characteristics transects – Tantangara Road.

5.2 Executive Summary

The purpose of the Small Mammal Habitat Characteristics survey is to track changes in habitat structure and to determine if any changes arise due to indirect project related impacts. When comparing the monitoring periods, no significant differences can be ascertained between Year 4 and Year 5, at impact or control sites at any height range, with the exception of SM32, a control site at Hains Hut. SM32 results returned significantly more native cover than in the previous year. In wooded areas trends reflect native habitat predominately increasing in the upper height ranges 0.5-1m and 1-1.5m. It has been observed that the current methodology employed is likely to be tracking post fire regrowth after the 2019/2020 fires, rather than providing any insight into potential project related indirect impacts. It is noted that the paired transects have been set-up incorrectly, with pairs being impact and impact, rather than impact and control. This is discussed further in the Methodology section.

It is recommended to consult with species experts to design methodology that targets the specific habitat requirements of each target species and concentrates on indirect impacts that could have potential to be exasperated by the project (such as weed incursion, dust, and Phytophthora) and which are impacts known to negatively impact habitat of the target species. Location maps are provided in section 5.1 above; figures 5.1 to 5.6.

5.3 Methodology

The methodology utilised is a line-point intercept method as described in Projects' Biodiversity Monitoring Program (Appendix B - Rev G) of the Biodiversity Management Plan (Rev M), completed in January 2025. However, it is recommended to consult with species experts to design methodology that targets the specific habitat requirements of each target species and focus on the indirect impacts that could have potential to be exasperated by the project (such as weed incursion, dust, and Phytophthora) and which are impacts known to negatively impact the habitat of the target species. As noted in the Executive summary, in a post-fire landscape, the current line-point methodology employed is tracking post fire regrowth after the 2019/2020 fires, rather than providing any insight into potential project related indirect impacts.

It is also noted that there is a flaw in the methodology design, the pairings, HC1 and HC2, should have been set up as impact and control pairs (given their relative distance to the project construction footprint). Instead, sites have been paired impact/impact and control/control. As such, in previous years HC1 and HC2 results have been combined to produce the overall percentage of cover type at each site, when they should have been compared to each other as impact and control. The original methodology has been continued for the purposes of this report, however, it should be noted, that due to the density of post fire regrowth and other safety factors, some sites were either completely inaccessible, or only one of the pairings were able to be accessed. Following from previous years, scores have been depicted as percentages. Additionally, as comparisons with control sites are not utilised in the triggers for adaptive management, it is confounding as to why they have been included in this survey.

5.4 Results

Vegetation cover percentages by height and component for year 5 are presented in Table 5.1. Comparisons across monitoring periods are presented in Table 5.2. General site descriptions and flora species lists have been included Appendix 3(a).

Table 5-1: Cover percentage by height range and class, Year 5.

| Component | | <0.5 m | | | 0.5 – 1 m | | | 1 – 1.5 m | | |
|-------------------|---------|---------|--------|------------|-----------|--------|------------|-----------|--------|------------|
| | | Control | Impact | Difference | Control | Impact | Difference | Control | Impact | Difference |
| Native | Minimum | 56% | 53% | -3% | 0% | 7% | 7% | 0% | 0% | 0% |
| | Maximum | 96% | 98% | 2% | 62% | 86% | 24% | 62% | 52% | -10% |
| | Average | 74% | 76% | 2% | 27% | 57% | 29% | 13% | 24% | 11% |
| Exotic | Minimum | 2% | 0% | -2% | 0% | 0% | 0% | 0% | 0% | 0% |
| | Maximum | 44% | 94% | 50% | 1% | 40% | 39% | 0% | 12% | 12% |
| | Average | 17% | 15% | -3% | 0% | 5% | 5% | 0% | 1% | 1% |
| Habitat structure | Minimum | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| | Maximum | 24% | 44% | 20% | 5% | 29% | 24% | 0% | 2% | 2% |
| | Average | 5% | 15% | 10% | 1% | 5% | 5% | 0% | 0% | 0% |

Table 5-2: Cover average percentages; comparison across all monitoring periods.

| | | <0.5 meter | | 0.5 - 1 meter | | 1-1.5 meter | |
|------------------|--------|------------|----------|---------------|----------|-------------|----------|
| | | Control % | Impact % | Control % | Impact % | Control % | Impact % |
| Native | Year 1 | 74 | 74 | 15 | 17 | 2 | 3 |
| | Year 2 | 90 | 90 | 18 | 19 | 4 | 9 |
| | Year 3 | 78 | 72 | 16 | 18 | 9 | 16 |
| | Year 4 | 70 | 70 | 30 | 52 | 15 | 22 |
| | Year 5 | 74 | 76 | 27 | 57 | 13 | 24 |
| Exotic | Year 1 | 18 | 14 | 1 | 2 | 0 | 0 |
| | Year 2 | 9 | 19 | 0 | 1 | 0 | 0 |
| | Year 3 | 8 | 12 | 1 | 1 | 0 | 2 |
| | Year 4 | 15 | 17 | 0 | 7 | 0 | 1 |
| | Year 5 | 17 | 15 | 0 | 5 | 0 | 1 |
| Structure | Year 1 | 18 | 18 | 0 | 1 | 0 | 0 |
| | Year 2 | 27 | 25 | 1 | 1 | 0 | 0 |
| | Year 3 | 8 | 15 | 1 | 2 | 0 | 1 |
| | Year 4 | 7 | 19 | 0 | 7 | 0 | 1 |
| | Year 5 | 5 | 15 | 1 | 5 | 0 | 0 |

5.5 Discussion

Average Native Cover: The average percentage of native coverage is recorded as being higher at impacts sites across all height ranges; the 0.5 to 1 m and 1 to 1.5 m height class ranges have seen the biggest increases. Compared to previous monitoring periods, both native and control sites have seen an increase in native cover. SM32 (control) returned a result of significantly more native cover than in the previous year and a decrease in weeds, this may be due to a good year for rainfall, increasing the predominately Poa biomass and out competing the weeds.

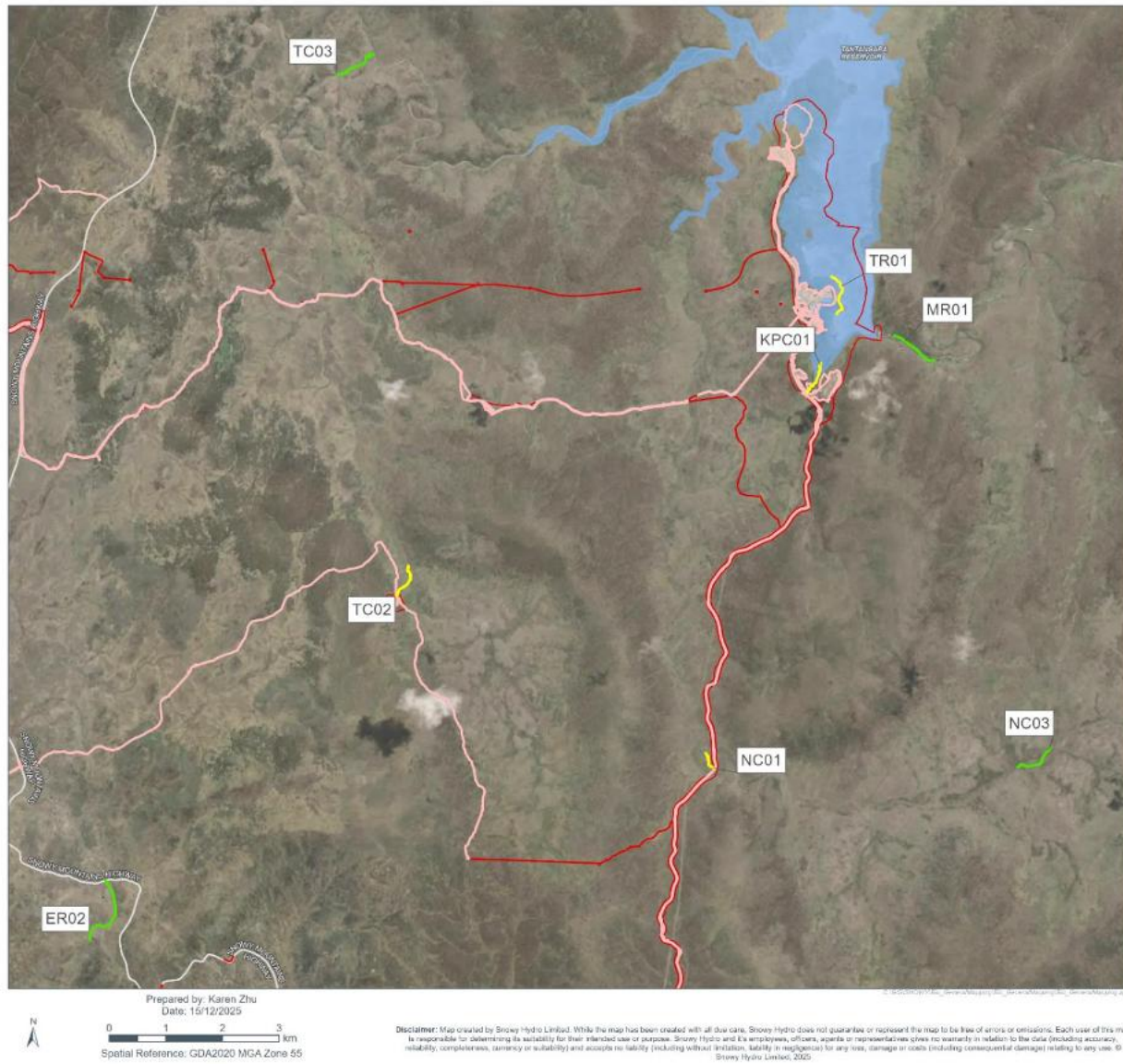
Average Exotic Cover: the <0.5 m height class has seen a minor decrease in exotic cover when comparing impacts and controls. In the 0.5 to 1 m and the 1 to 1.5 m range the exotic cover has a slightly higher percentage cover. Exotic percentages in these height ranges can predominately be attributed to blackberry at some sites. As mentioned previously, "Impact" HT2 transects are located on Park land, and therefore weeds cannot be controlled by the 'Project' making it hard to improve these figures. It was noted that some control sites are experiencing slight increases in weed (SM28 and SM37), these are both located near horse riding camps, this activity is likely introducing weeds. SM20 has relatively high weed cover in the 0.5 to 1 m height class, albeit decreasing in cover from the year before. This is due to the populations of thistle and blackberry at both sites. SM19 also has a high percentage of weed cover (albeit less in year 5 compared to year 4), this is due to height of the blackberry. Although there has been a slight decrease in weed abundance between monitoring in year 4 and 5, it must be noted that in both locations, the HT2 transect is situated on National Parks land, and therefore the weed population that is causing the data to trend high, is outside of the 'Projects' control.

Habitat Structure: has varied little between monitoring periods year 4 and year 5, and represents no significant variations between control and impacts sites.

When comparing the last two consecutive monitoring periods, no significant differences can be ascertained between Year 4 and Year 5, at impact or control sites, at any height or class range. In wooded areas, trends reflect native habitat predominately increasing in the upper ranges 0.5-1m and 1-1.5m, which is expected in a post fire landscape. It is hypothesised that the methodology of this survey type is simply tracking post fire regrowth, rather than habitat characteristics attributed to any of the target species.

5.6 Conclusion and Recommendations

It is recommended to consult with species experts to design methodology that focuses on the specific habitat requirements of each target species with respect to indirect impacts that could have potential to be exasperated by the project (such as weed incursion, dust, and *Phytophthora*) and which are known impacts that negatively impact habitat of the target species. It has been observed that the current methodology employed is likely to be tracking post fire regrowth after the 2019/2020 fires, rather than providing any insight into adverse effects of potential project related impacts. Triggers for adaptive management should also state that the degradation must be assessed relative to control sites. Overall, a review of the methodology is recommended.



Snowy 2.0
 Biodiversity Management
 Program
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Figure 6.1: Frog Occupancy Monitoring Sites – Alpine Tree Frog

- Legend**
- Construction Envelope
 - Disturbance Boundary
 - Reservoirs
 - Major road
 - Transects - Alpine Tree Frog**
 - Control
 - Impact



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Figure 6.2: Alpine Tree frog occupancy monitoring sites.

Frog Monitoring

Year 5 Annual Monitoring Report (2024/2025)

Snowy 2.0 Main Works

September 2025



6.2 Executive Summary

The frog monitoring aspect of the BMP aims to assess the status of the Alpine Tree Frog (*Rawlinsonia verreauxii alpina*, ATF) and the Booroolong Frog (*Rhyaconastes booroolongensis*) and document any changes attributable to the project.

During this reporting period, ATF and Booroolong Frog were detected at all sites; not triggering adaptive management. However, interventions were undertaken at multiple locations to protect occupied species habitat within the works area.

Future refinements to survey protocols, including increased metadata collection and survey effort, coupled with habitat protection and more rigorous data analysis will improve interpretations, management efficacy and overall species outcomes.

6.3 Introduction

6.3.1. Acknowledgment

This research was conducted for Snowy Hydro Limited under the Department of Climate Change, Energy, the Environment and Water (DCCEEW) scientific licence (SL102962) and with the approval of the University of Melbourne Animal Ethics Committee (2024-30681-58139-3).

This report has been prepared in accordance with the brief provided by Snowy Hydro Limited and, in its preparation, Snowline Ecology has relied upon the information provided by Snowy Hydro and its contractors, and data collected at the times and under the conditions specified in this report. All findings, conclusions or recommendations contained in this report are based on those aforementioned circumstances. Except where expressly agreed to by Snowline Ecology in writing, and to the extent permitted by law, Snowline Ecology will have no liability (and assumes no duty of care) to any person in relation to this document, other than to Snowy Hydro Limited (and subject to the terms of Snowline Ecology's agreement with Snowy Hydro Limited).

Photo Credit

Cover page - Matt Clancy: Kosciuszko National Park (right landscape), Alpine Tree Frog and Booroolong Frogs (inset). Zak Atkins: Namadgi National Park (left landscape).

6.3.2. Overview

The primary objective of frog occupancy monitoring is to assess the status of two threatened target species; the Alpine Tree Frog (*Rawlinsonia verreauxii alpina*, ATF) and the Booroolong Frog (*Rhyaconastes booroolongensis*) and to document any changes associated with the hydroelectric Snowy 2.0 development. These works involve habitat loss and fragmentation throughout known populations of ATF and Booroolong Frog, notably in the Tantangara and Lobs Hole works areas. We deploy multiple survey techniques to evaluate frog populations. We use calling to approximate numbers of ATFs (as they are small, often hidden whilst calling, and can be difficult to detect via spotlighting) and spotlighting to observe and record numbers for Booroolong Frogs (as they are easily detected via eyeshine, and often perch in exposed positions). To better understand drivers of observed population trends, we assess both control and impact sites during peak frog activity periods. Data collected from frog monitoring will be compared to previous survey years and be used to guide land management decisions aimed at improving outcomes for threatened frog populations.

6.3.3. Previous Works

Works prior to November 2024 were delivered by EMM Consulting Pty Ltd. Their frog surveys began in 2021 with eight ATF and six Booroolong Frog transects established at control and impact sites. These surveys included counts of total frogs (seen and heard, presumably) present, but did not record demographic (sex, age class) or breeding (tadpole) data. While two survey events during peak breeding periods were required per year, some monitoring events were undertaken outside of key species activity times or not conducted at all. This, in combination with small sample sizes has led to low levels of confidence in results from this previous monitoring (for Booroolong Frog), and difficulties in our ability to compare current results to past results.

6.3.4. Current Works

In November 2024 (Year 5), delivery of frog surveys transitioned from EMM to Snowline Ecology. Snowline Ecology immediately increased metadata collection across both Year 5 surveys, and will implement further changes in Year Six to better understand the health of both ATF and Booroolong Frog populations within Kosciuszko National Park (KNP). Overall, the current survey and analysis has shown that both frog populations are persisting, with all sites recording adult frogs (and several supporting high numbers), and breeding documented at many locations. Therefore, adaptive management was not triggered. Comparisons between monitoring years show that ATF numbers have increased (marginally) recently, as have Booroolong Frog (albeit not significantly), likely attributed to previous La Niña weather patterns increasing frog recruitment, suitable environmental conditions during 2024 monitoring and observer experience. Data collected over the past five years highlights that significantly higher numbers of ATF are present at control sites, suggesting greater habitat quality is present at undisturbed locations.

6.3.5. Future Adaptations - Management recommendations

- Retain sediment basin CH805 post-construction to preserve ATF breeding habitat. Note, this recommendation was approved and actioned in early 2025;
- Establish “no-go zone” at identified ATF habitat on Schofields Track to prevent vehicle access;
- Increase invasive species management at ATF impact sites;
- Control invasive Poplars and Willows in the Yarrangobilly River;
- Prevent sedimentation from the works area entering Booroolong Frog habitat, as documented in November 2024. Note, the basin/s were drained and re-lined following advice to resolve this issue;
- Undertake genetic (tissue samples) and disease (chytrid) assessments to better understand the health of ATF and Booroolong Frog populations within KNP;
- Further refine habitat characteristics monitoring, including key areas of breeding microhabitat (e.g. cobble and bedrock pools) and linear length of key species habitat per 500 m stream transect;
- Additional control sites further from impacted areas (e.g. Yarrangobilly caves area) should be considered for more appropriate comparisons and statistical power;
- Increase Booroolong Frog survey effort from two to three surveys per season (November-December).

6.4 Alpine Tree Frog Monitoring

6.4.1. Introduction

The Alpine Tree Frog (ATF) *Rawlinsonia verreauxii alpina* (Figure 6.3) is a threatened species inhabiting small streams, rivulets, ponds and bogs within montane forest and alpine grassland plains above 1000m elevation in the Australian Alps. These waterbodies may be permeant but are often ephemeral, especially in wet years or after heavy spring or summer rainfall. ATFs breed from October through to February, with peak breeding activity occurring from October to November; hence this is when our surveys are conducted to maximise detection. ATFs were once distributed throughout the alpine regions of Victoria and New South Wales (NSW), but populations have declined significantly, particularly in Victoria. Declines have been caused by the deadly amphibian disease chytridiomycosis, in combination with a range of anthropogenic influences such as habitat clearing for alpine resort infrastructure and native forest logging (Clemann and Swan 2023; Clemann and Cook 2025).

Note: Recent taxonomic revision of Australo-Papuan Tree Frogs

A recent revision of Australo-Papuan tree frogs (Anura: Pelodyadidae) has reclassified several species ‘groups’ into new genera. The “Whistling Tree Frogs,” part of the *Litoria ewingii* complex and comprising ten species, are now placed in the genus *Rawlinsonia*. As a result, the ATF, formerly known as *Litoria verreauxii alpina*, is now recognised as *Rawlinsonia verreauxii alpina* (Donnellan *et al.* 2025).



Figure 6.3: Adult female Alpine Tree Frog photographed during surveys at impact site TC02, December 2024. Photo by M. Clancy.

6.4.2. Methods

Survey Design and Timing

Surveys targeting ATF were conducted in late spring (November) and early summer (December) of 2024, prioritising the time of year when this species is most active and detectable during breeding season.

Occupancy monitoring was conducted using ~500 m nocturnal stream transects targeting known or potential breeding habitats for ATF (e.g. river, stream, rivulet or alpine bogs and flooded areas). Surveys were undertaken at night under suitable conditions (low rainfall during survey, light winds and air temperature >10 °C). Each transect was surveyed once in November 2024 and repeated in December 2024. For statistical purposes, both surveys pooled into a single annual effort, as they were considered to target a single generation.

Survey Methodology

Each survey began with a 5-minute listening period to detect calling males. Transects approximately 500 m in length were then walked by two observers using spotlights and headtorches to detect eye-shine and visually search for frogs. Key microhabitats such as sedges, grasses and pond-edge environments were targeted along rivulets, off-stream pools, ditches and flooded areas.

The geospatial location of observational data including number of individuals, sex (when identifiable), and habitat descriptors were recorded on a hand-help GPS (Garmin Rhino 750) and data entry app using the datum UTM GDA94. General survey metadata were recorded, including the date, time, site and the names of the observers present. Weather conditions (air temperature, humidity, wind) were measured with a Kestrel weather unit (model 5000). All surveys followed established hygiene protocols to minimise the risk of spreading chytrid fungus. Surveys were conducted by qualified herpetologists with prior experience working with Alpine Tree Frogs.

Survey Locations

Alpine Tree Frog monitoring locations included:

- Four impact transects at Kellys Plain Creek, Tantangara Creek, Nungar Creek, and Tantangara Reservoir
- Four proposed control transects on the Eucumbene River, Murrumbidgee River, Nungar Creek, and Tantangara Creek.

See Figure 6.2 for overview of all ATF survey sites across the plateau.

Data Analysis

All data were compiled and tracked in a spreadsheet to identify trends in frog occupancy across sites and breeding seasons. Comparison between impact and upstream control transects was used to distinguish project-related effects from broader environmental variability.

Analysis of Variance (ANOVA; repeated measures) was performed in Systat v13.0 to investigate whether frog observations (count) differed due to treatment (impact/control site) and/or year that the observation was recorded (five years, 2021–2025) – the data met the required normality assumption for this analysis and had no extreme outliers. When a significant effect was recorded, post-hoc tests were used to determine the source of within-factor variance (for example, if observation year was broadly deemed to be significant, post-hoc tests investigated which year(s) differed in a pairwise manner).

Given the absence of tadpole data from years 1-4, no statistical analysis on tadpole observations were conducted. Detailed tadpole data is presented in Appendix 2 and will be an additional monitoring metric going forward.

Note, the number of frog survey sites and subsequent monitoring data are low. As such, results and analyses are preliminary, and will be best if refined over time.

6.4.3. Adaptive Management Triggers

Adaptive management actions will be considered if a biologically significant decline in relative abundance is observed at impact sites during construction or operation phases, and this decline is not mirrored at control sites. Species experts will review such changes to determine significance.

6.4.4. Results

Approximately 400 ATFs (excluding tadpoles) were recorded across all eight monitoring sites during late spring surveys in November 2024 in KNP, NSW (Table 6.1, Figures 6.5-6.7; Appendix 4a). Eggs and tadpoles were recorded at six sites, confirming recent breeding activity (Figure 6, 7; Appendix 2). Two other frog species; Common Eastern Froglet (*Crinia signifera*) and Eastern Banjo Frog (*Limnodynastes dumerilii*) were also recorded during the November surveys, and were a common occurrence at most sites.

Table 6-1: Alpine Tree Frog survey results – Survey 1 (November 2024)

| Site name | Site type | Survey date | Approx. heard | Observed adult | Observed sub-adult | Observed metamorph | Approx. tadpoles |
|-----------|-----------|-------------|---------------|----------------|--------------------|--------------------|------------------|
| TR01 | Impact | 15/11/24 | 10 | 3 | 7 | 0 | 0 |
| TC02 | Impact | 15/11/24 | 40 | 5 | 2 | 0 | 1900 |
| NC01 | Impact | 17/11/24 | 5 | 1 | 0 | 0 | 1300 |
| KPC01 | Impact | 14/11/24 | 26 | 1 | 1 | 0 | 1000 |
| TC03 | Control | 16/11/24 | 5 | 0 | 0 | 0 | 0 |
| ER02 | Control | 17/11/24 | 20 | 0 | 0 | 0 | 1750 |

| | | | | | | | |
|-------------|---------|----------|-----|---|---|---|-----|
| MR01 | Control | 17/11/24 | 220 | 1 | 0 | 0 | 750 |
| NC03 | Control | 16/11/24 | 100 | 3 | 7 | 0 | 250 |

Approximately 300 ATFs (excluding tadpoles) were recorded across all eight monitoring sites during early summer surveys in December 2024 in KNP, NSW (Table 6.2, Figures 6.5-6.7; Appendix 4a). Eggs and tadpoles were recorded at six sites, confirming breeding activity (Figure 6, 7; Appendix 2). Notably >150 metamorphs were observed across three sites (KPC01, TC02 and ER02) confirming breeding success and recruitment (Table 6.2, Appendix 4b).

Table 6-2: Alpine Tree Frog survey results – Survey 2 (December 2024)

| Site name | Site type | Survey date | Approx. heard | Observed adult | Observed sub-adult | Observed metamorph | Approx. tadpoles |
|--------------|-----------|-------------|---------------|----------------|--------------------|--------------------|------------------|
| TR01 | Impact | 13/12/24 | 30 | 6 | 0 | 0 | 0 |
| TC02 | Impact | 15/12/24 | 12 | 5 | 0 | 100 | 1700 |
| NC01 | Impact | 15/12/24 | 2 | 1 | 0 | 0 | 120 |
| KPC01 | Impact | 13/12/24 | 10 | 1 | 0 | 50 | 100 |
| TC03 | Control | 16/12/24 | 10 | 1 | 0 | 0 | 0 |
| ER02 | Control | 16/12/24 | 12 | 5 | 0 | 1 | 320 |
| MR01 | Control | 14/12/24 | 100 | 2 | 0 | 0 | 1000 |
| NC03 | Control | 14/12/24 | 80 | 7 | 17 | 0 | 1500 |

Collectively, November and December 2024 surveys recorded calling ATF at all sites in year 5, with the greatest number of calling males were detected at control sites MR01 and NC03 (Figure 6.5).

There was a significant effect of treatment ($F=13.319$, $df=1$, $p=0.004$), showing that total ATF frog observations were significantly higher in control sites than impact sites (Figure 6.4). We found a trend between survey year and observation number - a marginal effect of year was recorded ($F=4$, $df=4$, $p<0.01$, $G-G=0.056$, $H-F=0.047$). There was no significant interaction between year and treatment ($F=2.3$, $df=4$, $p>0.05$), meaning that the effects of treatment did not differ over five years (i.e., they were consistently non-significant) (Figure 6.6).

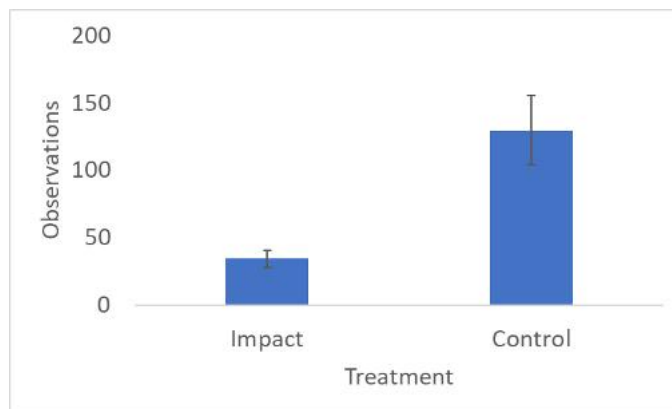


Figure 6.4: Mean frog observations at ‘impact’ and ‘control’ sites over five years (2021–2025) (± standard error).

Post-hoc tests revealed that the number of ATF frogs recorded in Year 5 were significantly greater than those observed in years one and four. All other pairwise comparisons between years were not significant (Figure 6.5).

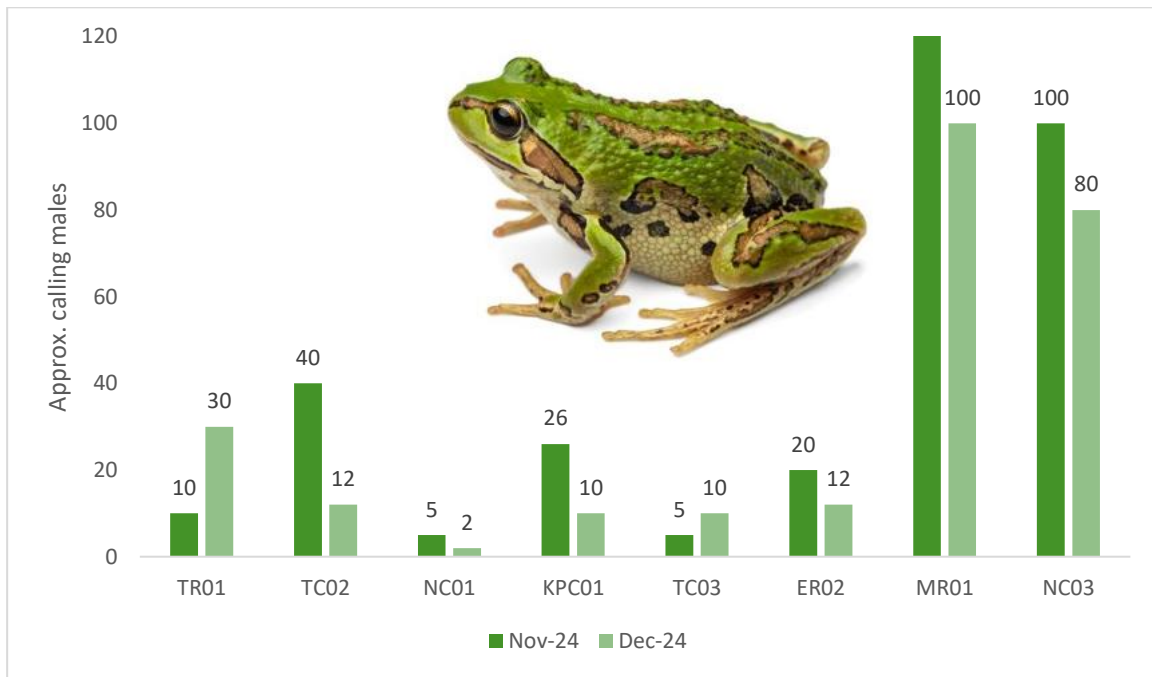


Figure 6.5: Approximate numbers of calling male Alpine Tree Frogs recorded during 2024 surveys in KNP, NSW.

Note: we use approximate numbers of calling males as a proxy for presence (rather than observed no. of individuals) as calling is the best detection method for this species. Photo by M. Clancy.

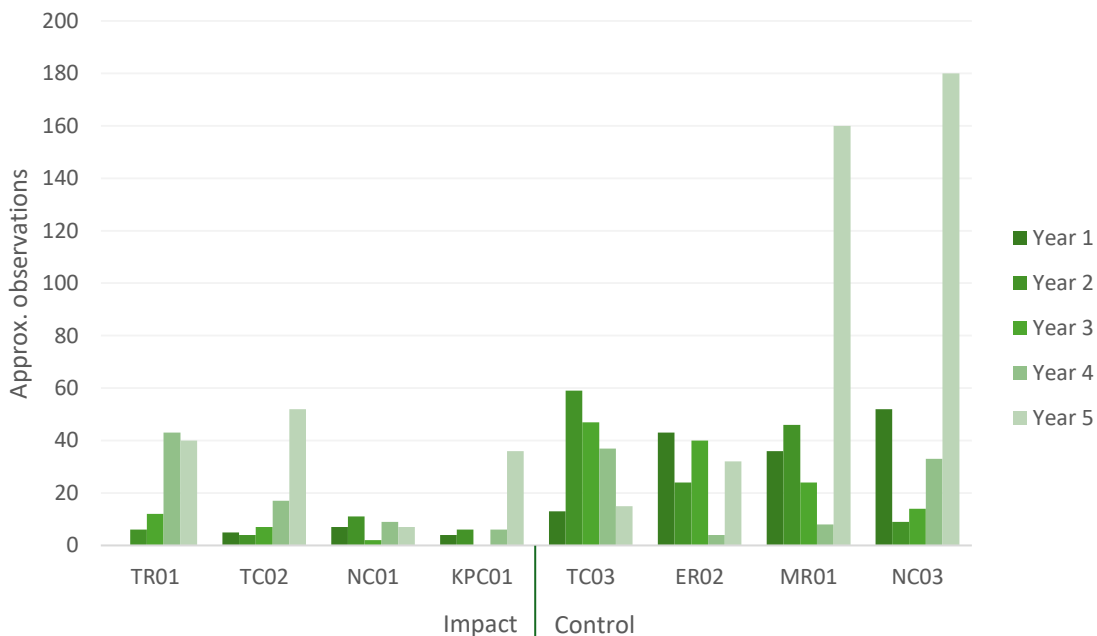


Figure 6.6: Comparison of observations of Alpine Tree Frogs records from years 1-5 in KNP, NSW.

Note: we (Snowline Ecology – year five) have used approximate numbers of calling males as a proxy for presence (rather than observed no. of individuals) as calling is the best detection method for this species. It is unknown whether surveys during years 1-4 recorded observations of observed individuals or calling males, though we assume previous consultants also recorded numbers of calling individuals.

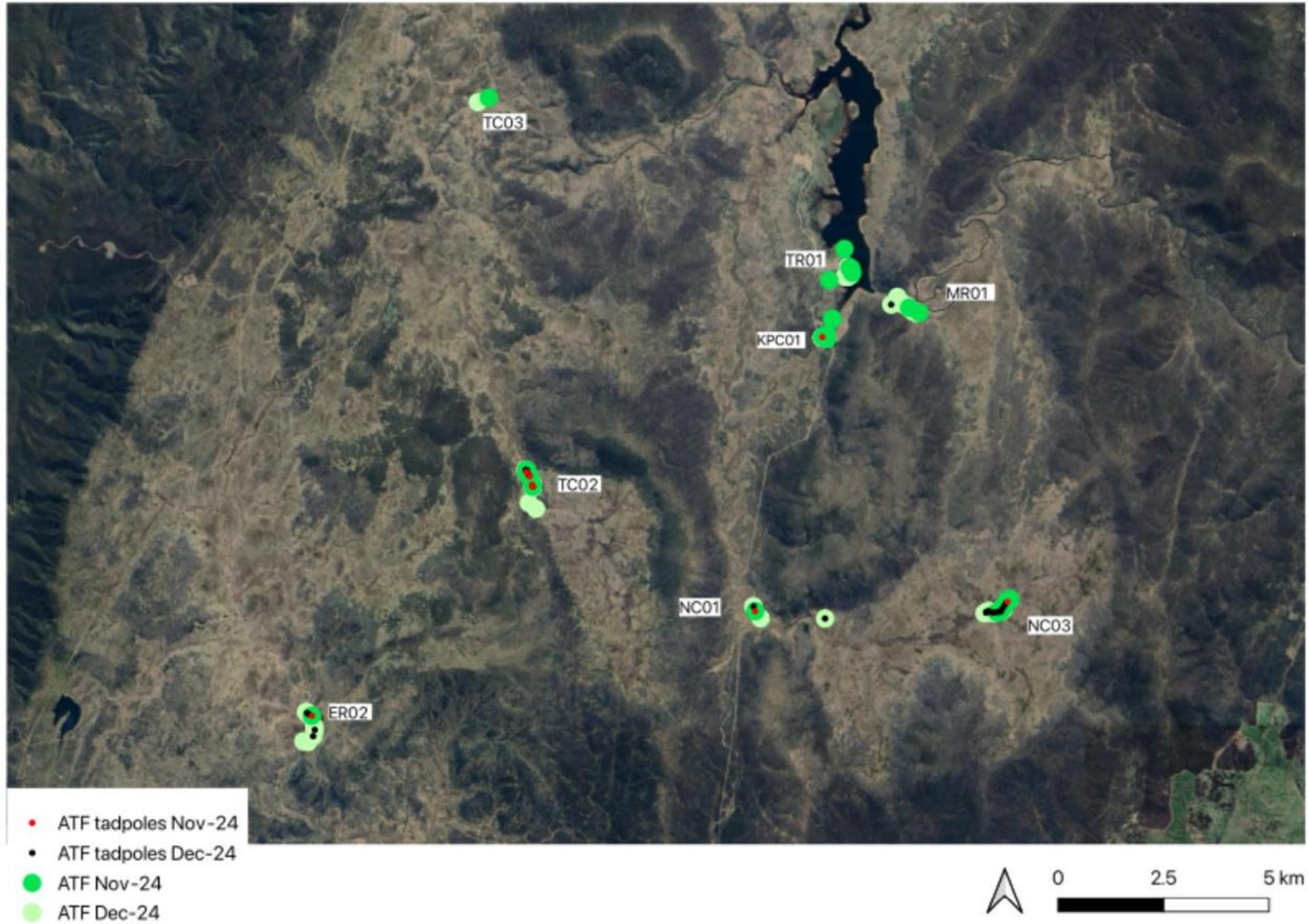


Figure 6.7: Alpine Tree Frog detections at all sites during year five - 2024 surveys, including tadpole detections.

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ATF Tadpoles were recorded at 75% of impact and control sites during November and December surveys in 2024 (Figure 6.8). No tadpoles were recorded at one impact (TR01) and one control site (TC03) during year 5.

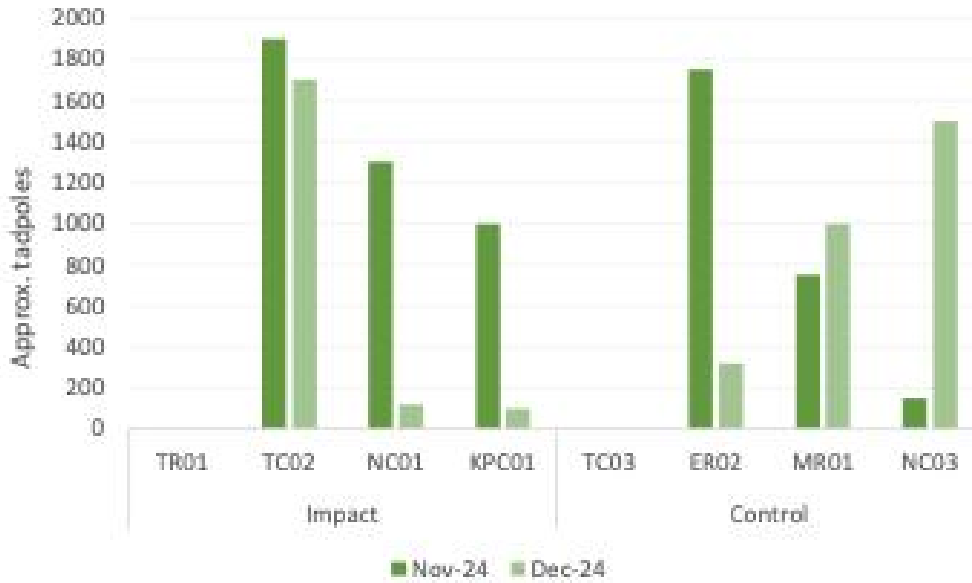


Figure 6.8: Approximate numbers of Alpine Tree Frog tadpoles recorded at surveys sites during Year 5 monitoring in KNP, NSW.



Figure 6.9: Alpine Tree Frog tadpoles and Alpine Spiny Crayfish (*Euastacus sp.*) recorded during Year 5 monitoring in KNP, NSW.

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Sympatric threatened species highlights the importance of protecting these sites for conserving broader alpine biodiversity. Photo by Z. Atkins

6.4.5. Discussion

Year 5 frog occupancy and count surveys recorded ATF at all eight sites (four impact, four control) in KNP, NSW. ATF were persisting at all monitored areas across this region, with all survey sites recording at least some individuals and several supporting high numbers. Further, successful breeding was documented at 75% of sites between November and December 2024.

However, the raw data suggests some fluctuation in the populations at sites. Therefore, understanding if population change is occurring at these sites - and what factors influence this - will be a focus of future survey and analysis. Data collected over the past five years highlights that significantly higher numbers of ATF are present at control sites, suggesting greater habitat quality is present at undisturbed locations. Comparisons between monitoring years suggests that ATF numbers have increased (marginally) recently, likely a result of recent consecutive La Niña summers, which brought higher-than-average rainfall and likely enhanced species activity and recruitment. However, it's important to highlight factors that may have increased frog detections, including potentially more suitable environmental conditions during surveys and observer differences in Year Five.

Future data analysis approaches will be incorporated to disentangle these issues. Monitoring also identified important ATF breeding habitat that will now be maintained to assist ATF recruitment within the works area. Future surveys should prioritise both genetic and disease assessments to better understand the health of ATF populations within KNP; data that will assist current conservation programs aimed at securing the species across its range.

6.4.6. Survey results

Notable variation in ATF numbers across monitoring years may be a result of considerable changes in weather patterns during this time. Surveys in years 1-3 occurred during La Niña seasons that prevailed over south-eastern Australia between 2021 and 2023, resulting in cooler alpine temperatures and higher rainfall (Huang *et al.* 2024). This will have likely increased the availability of ATF breeding habitat and subsequent species recruitment, which may explain the increase in records at control sites during this period. Consequently; cooler conditions may also result in higher frog mortality from increased chytrid presence and susceptibility (e.g. Berger *et al.* 2004). Chytrid-driven population declines of some alpine frog species in KNP have been documented during recent La Niña seasons. Data collected at Victorian monitoring sites indicate a dramatic decline in the abundance and site occupancy of ATF over the last 15 years (West 2021, 2023, 2025). Disease caused by chytrid fungus, habitat disturbance by Sambar Deer and high intensity bushfire are all contributing to the population declines in Victoria (West 2021, 2023, 2025). While the chytrid status of ATF across the SHL monitoring sites is currently unknown, it's potentially profound impacts on the species warrants it being assessed during future surveys. This, in combination with genetic analysis, will provide a more robust understanding of status of ATF populations more than just observational data alone.

Year 5 detections of ATF were particularly high across sites where optimal ATF breeding habitat was present, including both control (e.g. MR01, NC03) and impact (e.g. TC02) sites. Significantly higher numbers of ATF at control sites across monitoring years is unsurprising, given improved habitat quality associated with undisturbed locations; habitat modification is a key threatening process associated with declines in 50% of threatened Australian frogs (Hero and Morrison 2003). We note that impact site TC02, which recorded many ATF, is a remote site that would be more appropriately considered a control site. High numbers of frogs (both calling and tadpoles) in Year 5 may be a result of increased recruitment in previous seasons, noting the faster life history of many frog species (Scheele *et al.* 2017) and their subsequent ability to more rapidly respond to suitable environmental conditions unlike some other sympatric fauna (e.g. Brannelly *et al.* 2015; Brannelly *et al.* 2016; Scheele *et al.* 2017; Atkins *et al.* 2019). Future field survey and genetic data will help to clarify the status of the

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populations at control and impact sites. Consistent collection of site metadata and environmental conditions during surveys, key water quality parameters, and threats including chytrid status of frogs will help to verify factors that influence population changes at sites. Additionally, increased detections at these sites likely also result from a combination of surveying during optimal time of year, during optimal weather conditions for frog activity and utilising observers with extensive experience surveying the target species.

6.4.7. Breeding observations

Tadpole data (e.g. numbers, sites, Gosner stage etc.) were not recorded by previous consultants in monitoring years 1-4. Therefore, this important metric was unable to be compared between seasons. This caveat must be considered when interpreting ATF occupancy at treatments between seasons, as successful recruitment is an indicator of population health (e.g. Boyce 1992). However, year five tadpole observations suggest that ATF breeding activity is highly variable across the Kosciuszko plateau during Spring and Summer, and influenced by local temperature and rainfall patterns. While large rain events can increase the availability of breeding habitat, ephemeral ponds may dry quickly, potentially leading to breeding failure. Additionally, specific site features (e.g. topography, waterbody type etc.) dictate breeding habitat suitability, as evident at sites TR01 and TC03, that failed to record tadpoles due to high water flows and absence of suitable breeding pools (see Appendix 2). Tadpole metamorphosis was staggered across sites, with early breeding producing earlier metamorphosis. Later breeding may result in overwintering tadpoles. Interestingly, albino tadpoles were discovered at ER02 during both November and December surveys and may be the first record of wild albinism in ATF.

6.4.8. Adaptive management recommendations – Alpine Tree Frog

Year 5 monitoring identified ATF persisting at all sites, not triggering adaptive management actions. However, interventions were undertaken at multiple locations to improve species outcomes within the works area. Surveys have identified threats to ATF habitat condition, including those posed by invasive herbivores like horses and deer. We recommend ongoing monitoring, including collection of key metadata (e.g. genetics, chytrid status, habitat data etc.) and more rigorous data analysis to clarify the status of ATF at control and impact sites, determine if the observed differences in numbers of frogs represent population change and to determine if any population changes are driven by natural fluctuations or other processes. Ultimately, future project inclusions will ensure ATF populations are better understood and most effectively managed to improve species outcomes.

While ATF were recorded at all Tantangara impact sites (in moderate numbers) during year five surveys (not triggering adaptive management), multiple actions were identified to improve ATF habitat condition and breeding opportunities. Despite successful breeding identified at three impact sites (TC02, NC01, KPC01), no tadpoles were recorded at TR01. TR01 is on the sloped banks of the Tantangara Reservoir, which is a very large waterbody and does not represent typical ATF breeding habitat. Although tadpoles were not observed, this does not mean they are not present, but likely difficult to detect. The vast area of deep water may have increased predators such as Trout, reducing likelihood of tadpole survival. The sloped banks of the reservoir do not provide breeding habitat, apart from a few small rivulets which have been severely damaged by horses and no tadpoles were observed within them. Calling male frogs observed here are likely moving along the waterline on the edge of the reservoir having dispersed from nearby sediment basins where breeding is occurring. The site also experiences a high level of disturbance (be that light, noise or dust pollution and ground disturbances from people, horses and light vehicles) being directly adjacent to or within the Main Works area. Maintaining and protecting ATF breeding habitat to support population persistence is vital, particularly given the scale and proximity of works impacting occupied ATF habitat. This is important, as our analyses indicate that impact sites had significantly fewer (3.8 × less) frog observations, (impact=274; control=1036).

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At KPC01, very few ATF individuals were observed along the original stream transect. This is likely a result of extensive vegetation damage and stream-bank erosion, caused by the large population of feral horses currently present on-site. Reducing the impacts of feral species, particularly heavy-hooved ungulates like horses and deer that are destroying sensitive alpine habitats and threatening native biodiversity, is an urgent priority (e.g. Driscoll *et al.* 2019). While more targeted research is required, the effects of horses on impact site condition (and subsequent population status of target species therein) may threaten data interpretations, making it difficult to distinguish between development-related impacts and those driven by feral species (which are in greater abundance at impact sites). Mitigating the impacts of horses and deer, which have the potential to disturb ATF habitat, will remain a key conservation priority. These invasive herbivores will remain a significant issue for alpine biodiversity until appropriately controlled.

Year 5 ATF surveys have resulted in the approval to maintain an existing sediment basin; an action that will assist species recruitment within the works area. Toward the upstream end of the KPC01 transect, two small sediment basins (CH805 and CH615) are present. CH805 was initially scheduled for decommissioning (Figure 8). During early surveys, many ATF males were heard calling around this basin. Later surveys confirmed successful breeding and recruitment at CH805, with thousands of tadpoles and numerous metamorph frogs observed (Figure 9). In contrast, CH615, which is regularly drained, supported only a few calling males and did not show evidence of successful breeding - likely due to regular de-watering preventing tadpole development. As a result of our findings, we recommended that sediment basin CH805 be retained post-construction to preserve its value as breeding habitat for ATF. Based on this recommendation, the basin will no longer be decommissioned and is now protected as habitat for this threatened species. An exclusion zone has been established around CH805 using roping and signage, ensuring the basin will not be de-watered or de-silted (Figure 6.10).

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Figure 6.10: Exclusion zone established around sediment basin CH805.

This basin was soon to be decommissioned, but as a result of our findings has been protected as breeding habitat for the threatened Alpine Tree Frog. This case highlights the importance of small, artificial waterbodies such as ponds, dams, and sediment basins in providing critical breeding habitat for ATF, particularly where natural habitats have been degraded or lost due to the impacts of feral horses or infrastructure.

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Figure 6.11: Alpine Tree Frog eggs at TC02 (A - M. Clancy) and Alpine Tree Frog metamorphs (Gosner stage 42) at KPC01 sediment basin CH805 (B - M. Clancy, C and D - J. Leman).

Another example of adaptive management implemented in year five was the identification of an additional ATF breeding site; tadpoles were discovered incidentally, (though outside the main works area but nearby impact site NC01) whilst driving on Schofields Track (Figure 6.12). A flooded wheel-rut had been used as a recent ATF breeding site, with hundreds of tadpoles present. It was advised that this small ditch be flagged to prevent vehicle access. In this instance, establishing a small “no-go zone” around the ditch would suffice to protect the site from disturbance.



Figure 6.12: A flooded wheel-rut on Schofields Track (UTM 648954.96, 6029730.80) with many Alpine Tree Frog tadpoles present. This is a great example of a highly ephemeral breeding site. Photo by M. Clancy.

6.5 Booroolong Frog Monitoring

6.5.1. Introduction

The Booroolong Frog *Rhyaconastes booroolongensis* (Figure 6.13) is a small to medium-sized riverine frog native to south-eastern Australia (Clemann and Swan 2023). Once widespread across parts of NSW and north-eastern Victoria, the species has experienced significant population declines and is now listed as *Endangered* under both state and federal conservation legislation (Anstis 2017) and Critically Endangered globally under the IUCN Red List for Threatened Species. This frog typically inhabits rocky streams and rivers in forested and woodland areas, often at mid to high elevations. It relies on clean, permanent watercourses for breeding, laying eggs in still or slow-flowing pools amongst cobble banks on the river edge (Clemann and Swan 2023). The species is primarily nocturnal and is most active during the warmer months, particularly after rain.

Major threats to the Booroolong Frog include habitat degradation due to human development, altered flow regimes, establishment of invasive weeds (e.g. willows), erosion and siltation of streams from bushfire or flooding events, as well as chytridiomycosis caused by the Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis*, predation by introduced species (such as fish and feral animals) and drought (Clemann and Swan 2023). Conservation efforts are focused on habitat protection and restoration, monitoring known populations, and controlling threats. Ex-situ conservation efforts are also underway to protect this species in the north if its range in the New England Tablelands (Rowley and Cutajar 2018).

Note: Recent taxonomic revision of Australo-Papuan Tree Frogs.

A recent revision of Australo-Papuan tree frogs (Anura: Pelodryadidae) has resulted in the reclassification of several species groups into newly established genera. The "Rocky River Frogs," part of the *Litoria lesueuri* complex and comprising four species, are now placed in the genus *Rhyaconastes*. As a result, the species formerly known as *Litoria booroolongensis* is now recognised as *Rhyaconastes booroolongensis* (Donnellan *et al.* 2025).



Figure 6.13: A male Booroolong Frog photographed during surveys on the Yarrangobilly River near site YR06, in December 2024. Photo by M. Clancy.

6.5.2. Methods

Survey Design and Timing

Surveys targeting Booroolong Frog were conducted in late spring (November) and early summer (December) of 2024, prioritising the time of year when this species is most active and detectable during breeding season. Surveys were conducted at a known population occurring along the Yarrangobilly River in KNP, NSW.

Occupancy monitoring was conducted during the peak breeding season (November to mid-December) under suitable environmental conditions - low rainfall, moderate to low stream flows, light wind, and air temperature $>10^{\circ}\text{C}$. Each transect was surveyed once in November 2024 and repeated in December 2024.

Surveys commenced at dusk and were conducted by experienced herpetologists familiar with *Booroolong Frog*. Habitat assessments were undertaken ahead of each survey to assess stream flow and ensure safe survey conditions. Due to frequent thunderstorms during the survey period, river levels were monitored closely. Surveys were delayed or cancelled in the event of lightning or heavy rainfall.

Survey Methodology

A total of six ~ 500 m transects were surveyed via spotlighting at night: five along the Yarrangobilly River and one on Wallace's Creek, a tributary of the Yarrangobilly River which crosses through Lobs Hole works area. Two transects located upstream of the disturbance footprint served as control sites, while the remaining four, positioned adjacent to or within the project area, were considered impact sites.

Each survey began with a five-minute listening period to detect calling males, followed by a systematic search of the river transect by two observers using headtorches. Surveys targeted known and potential microhabitats including cobble banks, log jams, bedrock exfoliations, rocky ledges, and shallow rockpools. Frogs were detected visually (e.g. eye-shine), aurally (calling males), or by observing tadpoles. Each transect was surveyed by walking upstream from the transect start point, as is standard procedure for most stream-frog surveys.

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The geospatial location of observational data including number of individuals, sex (when identifiable), and habitat descriptors were recorded on a hand-help GPS (Garmin Rhino 750) and data entry app using the datum UTM GDA94. General survey metadata were recorded, including the date, time, site and the names of the observers present. Weather conditions (air temperature, humidity, wind) were measured with a Kestrel weather unit (model 5000). All surveys followed established hygiene protocols to minimise the risk of spreading chytrid fungus. Surveys were conducted by qualified herpetologists with prior experience working with *Booroolong Frog*.

Survey Locations

Surveys were conducted at six transects in the Lobs Hole works area (see map figure 6.1 above and 6.20 below):

Impact sites: Three transects along the lower Yarrangobilly River and one along Wallaces Creek near its confluence with the Yarrangobilly River.

Control sites: Two transects on the Yarrangobilly River upstream on the Lobs Hole works area, beyond the influence of the project area.

Data Analysis

Survey data were compiled and tracked using spreadsheets to monitor trends in Booroolong Frog occupancy and relative abundance across years and sites. Comparisons between control and impact transects were used to differentiate potential project-related changes from broader environmental variation.

Analysis of Variance (ANOVA; repeated measures) was performed in Systat v13.0 to investigate whether frog observations (count) differed due to treatment (impact/control site) and/or year that the observation was recorded (five years, 2021–2025). The data met required normality assumption for this analysis and had no extreme outliers; however, homogeneity of variance was violated due to extreme low and high values for some observations. When a significant effect was recorded, post-hoc tests were used to determine the source of within-factor variance.

Note, the number of frog survey sites and subsequent monitoring data are low. As such, results and analyses are preliminary, and will be best if refined over time.

6.5.3. Adaptive Management Triggers

Adaptive management will be initiated if a biologically significant decline in frog abundance is observed at impact sites during construction or operation phases, and that decline is not mirrored at control sites. All changes will be reviewed by species experts to assess their ecological significance and inform management response.

6.5.4. Results

Approximately 59 adult *L. booroolongensis* were recorded across all six monitoring sites during the spring surveys in November 2024 in KNP, NSW (Table 6.3, Figure 6.14). Tadpoles were recorded at three sites, confirming recent breeding activity. Several other frog species; Eastern Banjo Frog (*Limnodynastes dumerilii*); Broad-palmed Rocket Frog (*Litoria latopalmata*) and Whistling Tree Frog (*Rawlinsonia verreauxii verreauxii*) were also recorded during the November surveys, and were a common occurrence in sediment basins throughout the Lobs Hole works area.

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Table 6-3: Booroolong Frog survey results – Survey 1 (November 2024)

| Site name | Site type | Survey date | Approx. heard | Observed adult | Observed sub-adult | Observed met/juv | Approx. tadpoles |
|-----------|-----------|-------------|---------------|----------------|--------------------|------------------|------------------|
| YR08 | Control | 11/11/24 | 0 | 4 | 1 | 0 | 0 |
| YR09 | Control | 11/11/24 | 10 | 13 | 1 | 0 | 500 |
| YR06 | Impact | 12/11/24 | 0 | 16 | 2 | 0 | 100 |
| WC01 | Impact | 12/11/24 | 0 | 5 | 0 | 0 | 0 |
| YR02 | Impact | 13/11/24 | 0 | 1 | 3 | 0 | 0 |
| YR05 | Impact | 13/11/24 | 0 | 10 | 2 | 1 | 250 |

Approximately 109 adult *L. booroolongensis* were recorded across all six monitoring sites during the summer surveys in December 2024 (Table 6.4, Figure 6.14). Tadpoles were recorded at three sites, confirming recent breeding activity. Tadpoles were also occasionally seen randomly throughout the river, having been washed downstream from initial points of oviposition. Several other frog species; Eastern Banjo Frog (*Limnodynastes dumerilii*); Broad-palmed Rocket Frog (*Litoria latopalmata*) and Whistling Tree Frog (*Rawlinsonia verreauxii verreauxii*) were also recorded during the December surveys, and were a common occurrence. Large numbers of *L. latopalmata* were recorded calling around several sediment basins in the Lobs Hole works area, and, interestingly, represents the most southerly population of this species occurs throughout their broad eastern-Australian distribution.

Table 6-4: Booroolong Frog survey results – Survey 2 (December 2024)

| Site name | Site type | Survey date | Approx. heard | Observed adult | Observed sub-adult | Observed met/juv | Approx. tadpoles |
|-----------|-----------|-------------|---------------|----------------|--------------------|------------------|------------------|
| YR08 | Control | 10/12/24 | 0 | 15 | 1 | 0 | 0 |
| YR09 | Control | 10/12/24 | 0 | 7 | 0 | 0 | 0 |
| YR06 | Impact | 11/12/24 | 15 | 43 | 0 | 0 | 1050 |
| WC01 | Impact | 11/12/24 | 0 | 3 | 0 | 0 | 0 |
| YR02 | Impact | 12/12/24 | 4 | 15 | 0 | 0 | 1 |
| YR05 | Impact | 12/11/24 | 20 | 25 | 0 | 0 | 120 |

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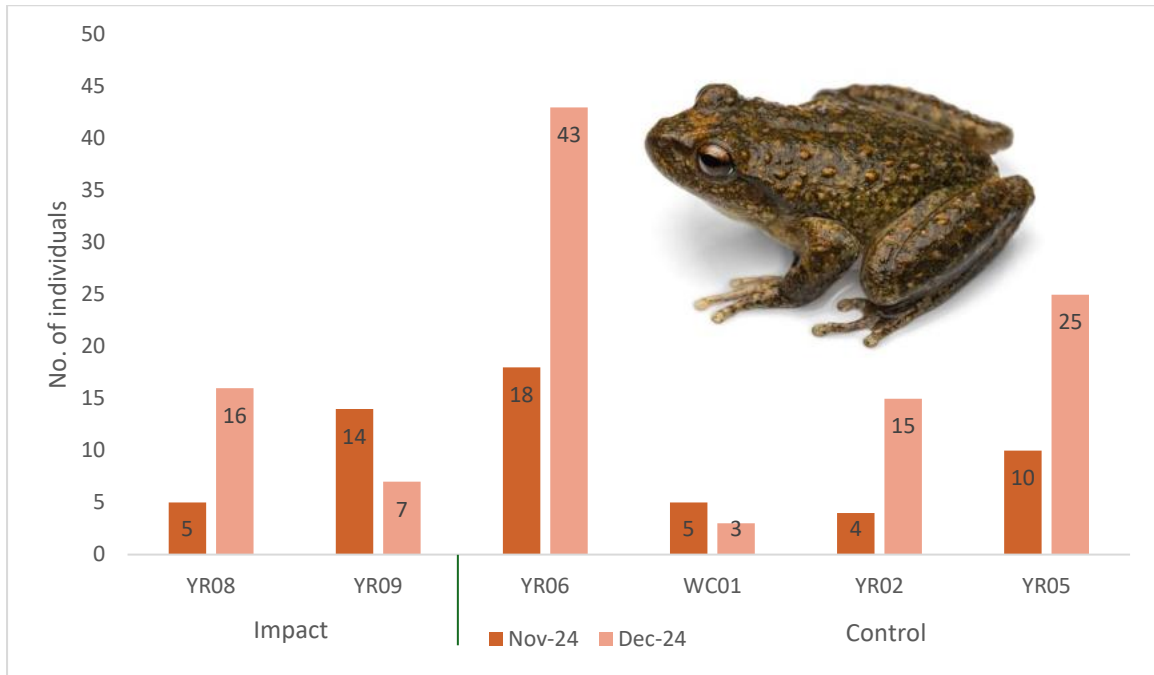


Figure 6.14: Number of individual Booroolong Frogs observed during 2024 surveys (excluding tadpoles). Photo by M. Clancy.

Collectively, November and December 2024 surveys observed Booroolong Frog at all sites in year 5, with the greatest number of individuals detected at control sites YR05 and YR06 (Figure 6.14).

Booroolong frog observations did not differ across the survey year ($F=0.107$, $df=1$, $p=0.8$) or treatment type (control/impact; $F=2.09$, $df=4$, $p>0.05$) (Figure 15). While greater numbers of Booroolong Frog were detected at each site (Figure 6.15) and in total (Figure 6.16) in year five, this difference was not significant.

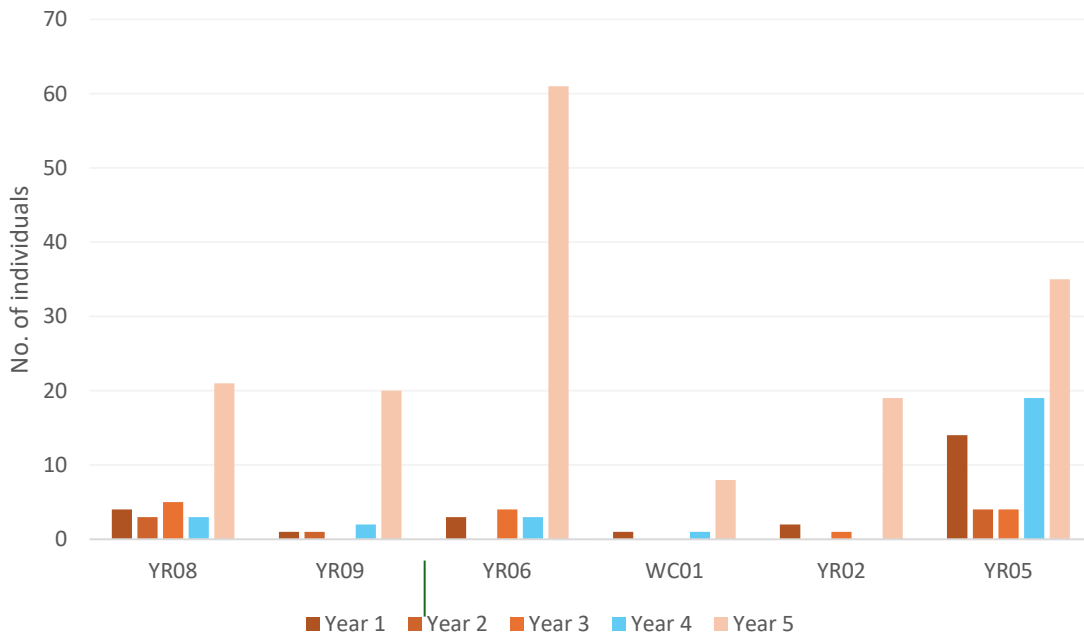


Figure 6.15: Number of individual Booroolong Frogs observed during surveys - Years 1-5.

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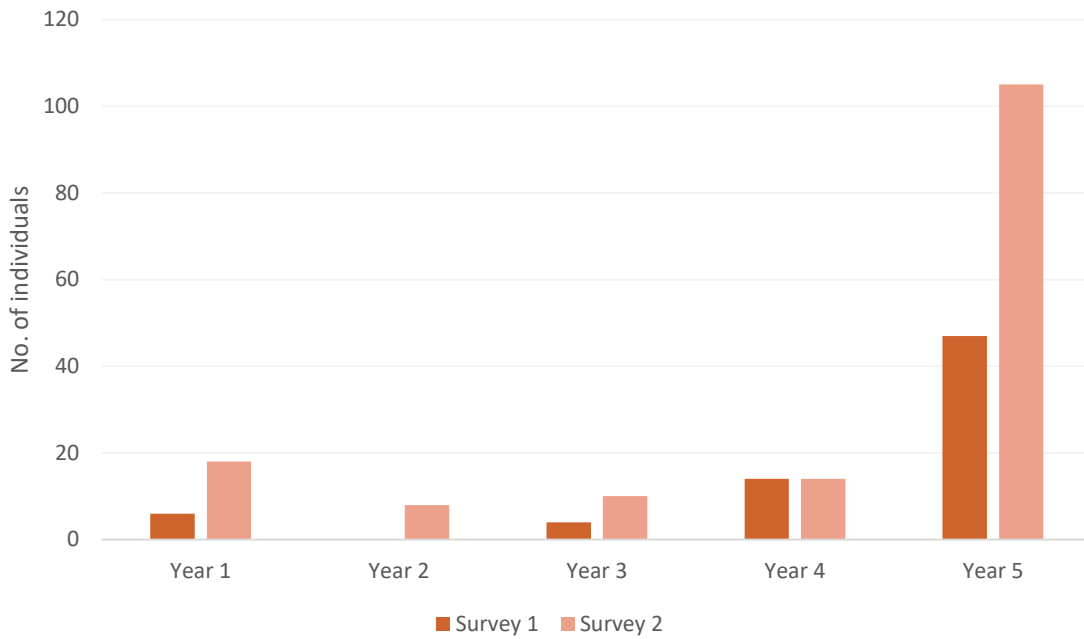


Figure 6.16: Number of individual Booroolong Frogs observed during surveys years 1-5 between first and second survey.

Note: Previous surveys by EMM ecologists were cancelled in December 2023 at YR02 and YR05 due to unsafe weather conditions and was conducted in February 2024.

Booroolong Frog breeding activity was observed during both the November and December 2024 surveys at 66% of monitoring sites: three impact (YR02, YR05, YR06) and one control (YR09) (Table 6.3, 6.4; Figure 6.17-6.19). Observed breeding behaviours included calling males on exposed and partially inundated cobble-banks, one observation of amplexus (Figure 6.17) and many tadpoles in streamside and off-stream rockpools (e.g. Figure 6.21). Only two monitoring sites (YR08 and WC01) failed to record tadpoles during year five monitoring events.



Figure 6.17: Booroolong Frogs in axillary amplexus (mating) at YR06 at the confluence of Wallace's Creek and Yarrangobilly River – an important breeding site for this species. Photo by M. Clancy.

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Figure 6.18: Booroolong Frog (*Rhyaconastes booroolongensis*) tadpole in the Yarrangobilly River, KNP, NSW. Photo by M. Clancy.



Figure 6.19: Booroolong Frog (*Rhyaconastes booroolongensis*) tadpole camouflaged during day at control site YR09 on the Yarrangobilly River, KNP, NSW. Photo by M. Clancy.



Figure 6.20: Booroolong Frog detections across all six transects during year five - 2024 surveys, including tadpole detections.

6.5.5. Discussion

Year 5 frog occupancy monitoring recorded Booroolong Frog at all six sites (four impact, two control) in KNP, NSW. The Booroolong Frog population at Lobs Hole is persisting, with all sites recording adult frogs and several supporting high numbers. Further, successful breeding was documented at 66% of sites (three impact, one control) between November and December 2024. Comparisons between monitoring years show that Booroolong Frog detections were higher in late 2024 (Year 5), albeit not significantly. These increases may be attributed to previous La Niña weather patterns increasing frog recruitment, suitable environmental conditions during 2024 monitoring and observer experience; a nuanced species understanding derived from many years working on the target species is essential to draw robust conclusions. Monitoring also identified threatening processes that required adaptive management interventions (invasive weeds and run-off from sediment basin within works area) necessary to maintain Booroolong Frog habitat condition. Future surveys should prioritise both genetic and disease assessments to better understand the health of Booroolong Frog populations within KNP; data that will assist the species' broader conservation.

Field surveys

Year 5 monitoring results highlighted an increase in Booroolong Frog numbers at all monitoring sites compared to the previous four years, albeit not significant, largely a consequence of small sample size, low F value (statistical power) and high data variance (increased survey effort and site number will improve this in future). However, observed increases in year five may be a result of multiple factors. Firstly, broader environmental conditions during 2024 may have improved stream conditions and subsequently increased frog detections. La Niña weather patterns prevailed over south-eastern Australia between 2021 and 2023, resulting in cooler alpine temperatures, higher rainfall and increased stream flows (Huang et al. 2024). River flow is a critical factor when planning and interpreting Booroolong Frog surveys. High flows not only create unsafe conditions, often resulting in cancellations (as noted during 2022 surveys), but also reduce frog detectability as individuals move away from inundated breeding microhabitats, such as cobble banks.

Secondly, unlike some previous monitoring events, Year 5 surveys were conducted under favourable conditions - specifically, optimal (warm, humid) weather and moderate river flows during the peak breeding season, providing optimal conditions for Booroolong Frog activity and detection. Some monitoring events conducted between years 1-4 (by previous contractors) were undertaken as late as February, when the species' activity is typically lower (EMM 2022-2025). Thus, previously inconsistent survey timing must be considered when interpreting temporal variations in site occupancy.

Thirdly, observer experience is another critical variable that should be considered when interpreting detection data, particularly when conducting active searches on cryptic species. While often identifiable when perched in the open on exposed cobble sections, Booroolong Frogs also utilise complex riparian structure such as mud banks, embedded rocks in steep banks, exposed bedrock, log-jams and in leaf litter, all which can reduce their visibility. Booroolong Frogs also move some distance away from the river's edge during high flows or flood events, and in this situation may move directly into the works area (Figure 6.21). Understanding the nuance in Booroolong frog microhabitats, gained through years of frog dedicated monitoring, greatly increase the efficacy of targeted surveys. Our teams experience with this species may also be contributing to the greater detections recorded during Year 5 monitoring.



Figure 6.21: One of several adult Booroolong Frogs found sheltering around a sediment basin in the Lobs Hole Main Works area, during a period of moderate river flow.

Finally, lower Booroolong detections during years 1-4 may have been influenced by La Niña weather patterns during this time. Cool, wet conditions can increase chytrid fungus presence and lethality, with frogs less capable of shedding the disease. Chytrid-driven population declines of some alpine frog species in KNP have been documented during recent La Niña seasons. While the chytrid status of Booroolong Frog across these monitoring sites is currently unknown, its potentially profound impacts on the species warrants it being assessed during future surveys. This, in combination with genetic analysis, will provide a more robust understanding of status of the Lobs Hole Booroolong Frog population more than just observational data alone. Ultimately, greater sample sizes and consistent survey methods (consistent survey times, no missed surveys, limited observer bias etc.) will provide more meaningful data when considering Snowy 2.0 impacts on Booroolong Frog.

Breeding observations and microhabitat

Observations of several cohorts of Booroolong Frog tadpoles across 66% of sites in Year 5 monitoring is significant and shows clear evidence of recent breeding activity – a key initial metric when considering population viability. Tadpoles also indicate important breeding sites, which are often located in small and isolated sections of slow-flowing water amongst cobble, or in streamside rockpools. Figure 6.22 (below) shows one of these stream-edge cobble breeding sites (YR09) where tadpoles were documented in 2024. Rockpools formed in exposed sections of bedrock also provide suitable points for oviposition and tadpole development, as confirmed by many small tadpoles found in this microhabitat in 2024 (e.g. YG05; Figure 6.23). Year 5 results highlight that the Yarrangobilly River at Lobs Hole contains important Booroolong breeding habitat, critical for the persistence of this Endangered frog population. It is imperative that threatening processes be mitigated in these areas to best ensure population viability.



Figure 6.22: Booroolong Frog (*Rhyaconastes booroolongensis*) breeding habitat at control site YR09 on the Yarrangobilly River, KNP, NSW

The centre image shows an area of slow-flowing, shallow water on the edge of a cobble bank. This was an observed oviposition site, with many subsequent observations of tadpoles here (see Figure 6.19). Note: Blackberry encroaching onto the cobble-bank from the left of the image. Photo by M. Clancy.

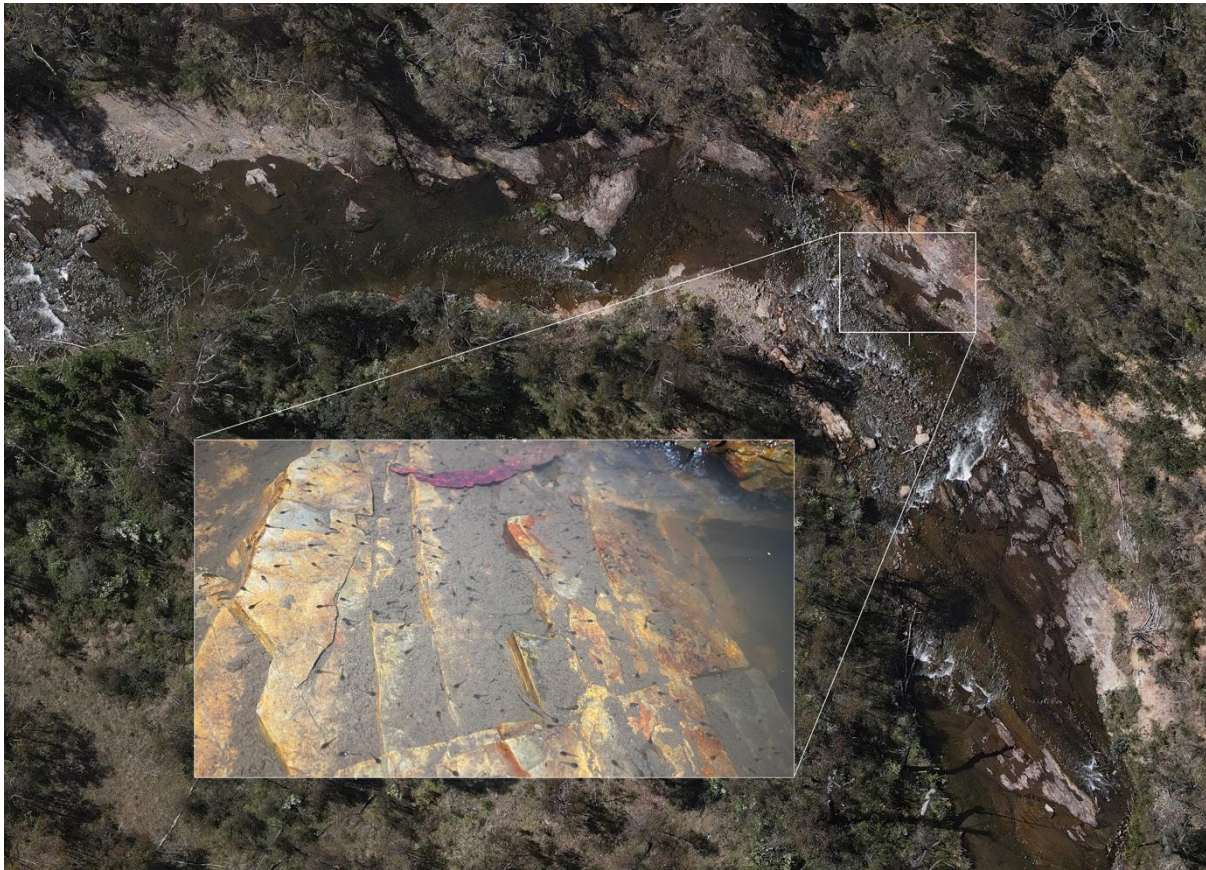


Figure 6.23: Drone imagery showing the location of rockpools on the Yarrangobilly River in which Booroolong Frog (*Rhyaconastes booroolongensis*) tadpoles were observed at impact site YR05.

Approximately 250 very small Booroolong Frog tadpoles were located in these small, shallow bedrock-rockpools (see inset). Tadpoles will develop in these pools until they are washed out during higher flows into the main river to complete development. High-res drone imagery by Snowy 2.0 Surface Surveyors. Tadpole inset photo by M. Clancy.

6.5.6. Adaptive Management recommendations – Booroolong Frog

Woody weeds: Poplars and Willows in the Yarrangobilly River

The Yarrangobilly River supports a significant Booroolong Frog population. Its riparian zone provides ideal habitat for Booroolong Frogs and despite historical and more recent human impacts, is in relatively good condition. However, environmental woody weeds, particularly Willow (*Salix* species, classified as a Weed of National Significance) and Lombardy Poplar (*Populus nigra* 'Italica'), are present and expanding. If left untreated, they pose a threat to the longer-term viability of this Booroolong Frog population.

Willow and Poplar are problematic due to their ability to spread aggressively, primarily by root and fallen branch suckering. Willows can also produce viable seed which can be spread large distances by air and water dispersal. If left untreated, they are highly invasive and can form dense thickets that reduce sunlight penetration, and eventually outcompete and displace native riparian vegetation and habitat preferred by Booroolong Frogs.

Booroolong Frogs prefer habitat consisting of stream-edge and mid-stream cobble banks and other rock structures within stream margins. They bask in the sun on exposed rocks near flowing water during warmer periods and also shelter under rocks or amongst low open native vegetation near the ground on the stream edge. Critically, these environments are where willow and poplar typically germinate, sucker and colonise. Excessive willow and poplar shading of rocky riparian and mid-stream island habitat reduces solar radiation and ambient temperatures in areas of

Booroolong Frog micro and macrohabitat; and in doing so exacerbate their risk of being infected by chytrid fungus (as chytrid is temperature sensitive).

This threat, however, can be effectively managed through an effective, targeted environmental woody-weed control program. We have created a KML/KMZ file highlighting these priority areas which can be obtained through us (and was provided to NPWS by SHL in 2025).

Control of Poplars, Willows and other woody weeds

Eradication of each individual/all Willow and Poplar (and smaller infestations of other woody weed, e.g. blackberry) is recommended along the entire Yarrangobilly reach that supports Booroolong Frogs. The [Bradley Method](#) or Bradley Technique is a recommended weed control approach. This technique is based on the "protect the best areas" first principle i.e. commence work on the smaller, easier to manage weed infestations in otherwise clean, native sections of bush or streamside, then progressively work towards the heaviest and more difficult infestations.

Control of smaller plants is recommended via the cut and paste technique during the active growing season. Larger specimens can be drilled and filled or frilled so that they die on site without having to cut down large green (living) trees. It is not recommended to cut and paste large living, streamside trees as fallen green branchlets will inevitably be carried downstream where they can take root and establish new infestations. If treated, large poplars ultimately pose a fall safety risk in some areas. Poplars can be felled by chainsaw operators once confirmed dead e.g. 12-months post treatment, when they support no living material that could sucker when felled.

Due to the sensitivity of frogs to herbicide exposure, foliar spraying of streamside-based Willow and Poplar (and other environmental weeds, e.g. blackberry) is not recommended.

Cut and paste and frill treatments are not necessarily 100% effective. Treatment success is influenced by many variables including experience and skills of contract staff, due attention being applied to the '10-second' cut and herbicide application rule, herbicide type and climatic/seasonal conditions at the time of treatment. Inevitably, follow up monitoring and re-treatment of a small percentage of treated plants should be incorporated into the control plan to ensure complete eradication in targeted areas.

Environmental Incidences

Run-off and sedimentation pose significant risks to rocky-river species like the Booroolong Frog, as they have the capacity to reduce water quality, pollute waterbodies, choke critical breeding habitats, and ultimately, reduce habitat condition necessary to maintain viable populations. This was observed across multiple frog populations immediately after the 2019/2020 black summer fire (e.g. West and Johnson 2020; Mahony *et al.* 2023). During a Booroolong Frog survey at site YR02 on 14/11/24 at 00:56 hours our team located a seepage of cloudy/milky water seeping into the Yarrangobilly River (UTM 626055.46, 6039030.63; Figure 6.24). The cloudy water, which was white or milky in appearance, appeared to be seeping into the river via runoff directly from a nearby sediment basin (of which the water in these basins is the same colour) in the Lobs Hole works area, approximately 72m south-east and upstream of these coordinates. The incident was reported immediately to the Snowy 2.0 Senior Environmental Advisor, upon which the incident was escalated. Future Generation Joint Venture (FGJV) were instructed to investigate, and found one of the sediment basins was leaking. The basin/s were drained and re-lined. This location will be closely monitored during the 2025-26 season to ensure run-off and sedimentation issues associated with Snowy 2.0 works in this location have not continued.



Figure 6.24: Cloudy water seeping into the Yarrangobilly River from a nearby sediment basin in the Lobs Hole works area.

6.6 Booroolong Frog Habitat Characteristics Monitoring

The aim of Booroolong Frog (*Litoria booroolongensis*) habitat monitoring is to assess the condition and availability of habitat types within transect sections of the Yarrangobilly River and Wallaces Creek that occur within or adjacent to the project area. Monitoring changes in habitat availability, notably the distribution and abundance of available breeding habitat (e.g. cobble and exposed bedrock banks) between impact and control stream sections will provide additional data when considering the impacts of the Snowy 2.0 project on this threatened frog population.

Stream transect monitoring sites:

Impact sites (n = 4): Yarrangobilly River and Wallaces Creek within the project area

Control sites (n = 2): Upstream sections of the Yarrangobilly River above project area (albeit only slightly).

Important Considerations

Interpretation of habitat data must account for natural variation in river flow, which strongly influences the extent, visibility (both by human and drone imagery) and occupancy of breeding habitat. For example:

- **High flows** can inundate cobble banks and obscure exposed rock, reducing the amount of observable breeding habitat and potentially displacing frogs into the riparian zone.
- **Low flows** expose more cobble and shallow pools, increasing observable habitat and potential breeding opportunities.
- Flow-dependent variability can also shift frog breeding activity to different parts of the river across seasons.

River levels and flow rates can change rapidly and unpredictably, particularly in response to localised rainfall or upstream catchment conditions. As such, all habitat assessments should be interpreted in the context of concurrent flow conditions.

Interpretation of these results must also account for difference in observer / contractor when characterising habitat features (contractor change between Year 4 (EMM) and Year 5 (Snowline) surveys). Although our results are broadly similar, these habitat characteristics surveys were conducted using high-resolution drone imagery and qualified frog experts with knowledge of the species and ground-truthing of all sites.

The feature class 'other' (comprising various disturbed areas such as access tracks, and cleared land and existing disturbance footprint) was not included in this analysis as data of this feature class was not reported in year four.

6.6.1. Year 5 survey

Year 5 data was collected in November 2024. Drone imagery was captured for all four impact sites and one of two control sites, due to the drone not being able to operate as far upstream as the furthest control site. As such, there is no 2024 drone imagery for site YR09 and thus habitat features for this site were mapped using google satellite imagery in QGIS.

Habitat types assessed within stream transects included: bedrock bank, cobblebank, mud bank, pool, riffle, riparian vegetation, rocky bank and run (Table 5; Figures 6.25-6.31).

Table 6-5: Stream feature area (ha) in Year 5 at Booroolong Frog monitoring sites in KNP, NSW.

| Transect | | Stream feature area (ha) | | | | | | | |
|----------------|------|--------------------------|-------------|----------|-------|-------|---------------------|------------|-------|
| | | Bedrock bank | Cobble bank | Mud bank | Pool | Rif e | Riparian vegetat on | Rocky bank | Run |
| <i>Control</i> | YR08 | 0.059 | 0.025 | 0.006 | 0.012 | 0.147 | 1.760 | 0.022 | 0.103 |
| | YR09 | 0.070 | 0.072 | 0.006 | 0.000 | 0.166 | 1.784 | 0.029 | 0.175 |
| <i>Impact</i> | YR06 | 0.031 | 0.057 | 0.003 | 0.010 | 0.250 | 3.466 | 0.032 | 0.236 |
| | WC01 | 0.002 | 0.011 | 0.000 | 0.000 | 0.093 | 3.200 | 0.021 | 0.121 |
| | YR02 | 0.021 | 0.071 | 0.002 | 0.003 | 0.342 | 3.944 | 0.000 | 0.276 |
| | YR05 | 0.218 | 0.281 | 0.017 | 0.014 | 0.416 | 4.603 | 0.005 | 0.280 |

Note: Values have been rounded to 3 decimal places.

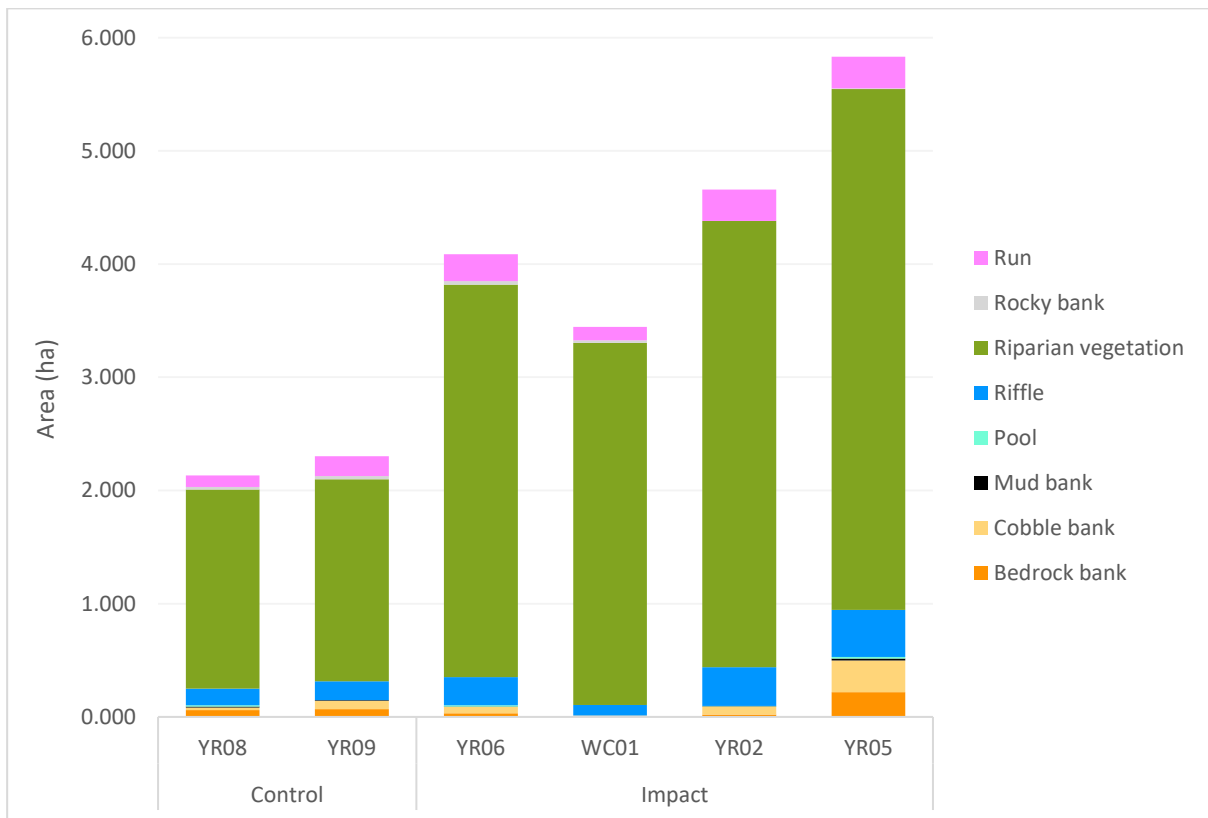


Figure 6.25: Composition of stream features during Year 5 Booroolong Frog habitat characteristics monitoring in KNP, NSW.

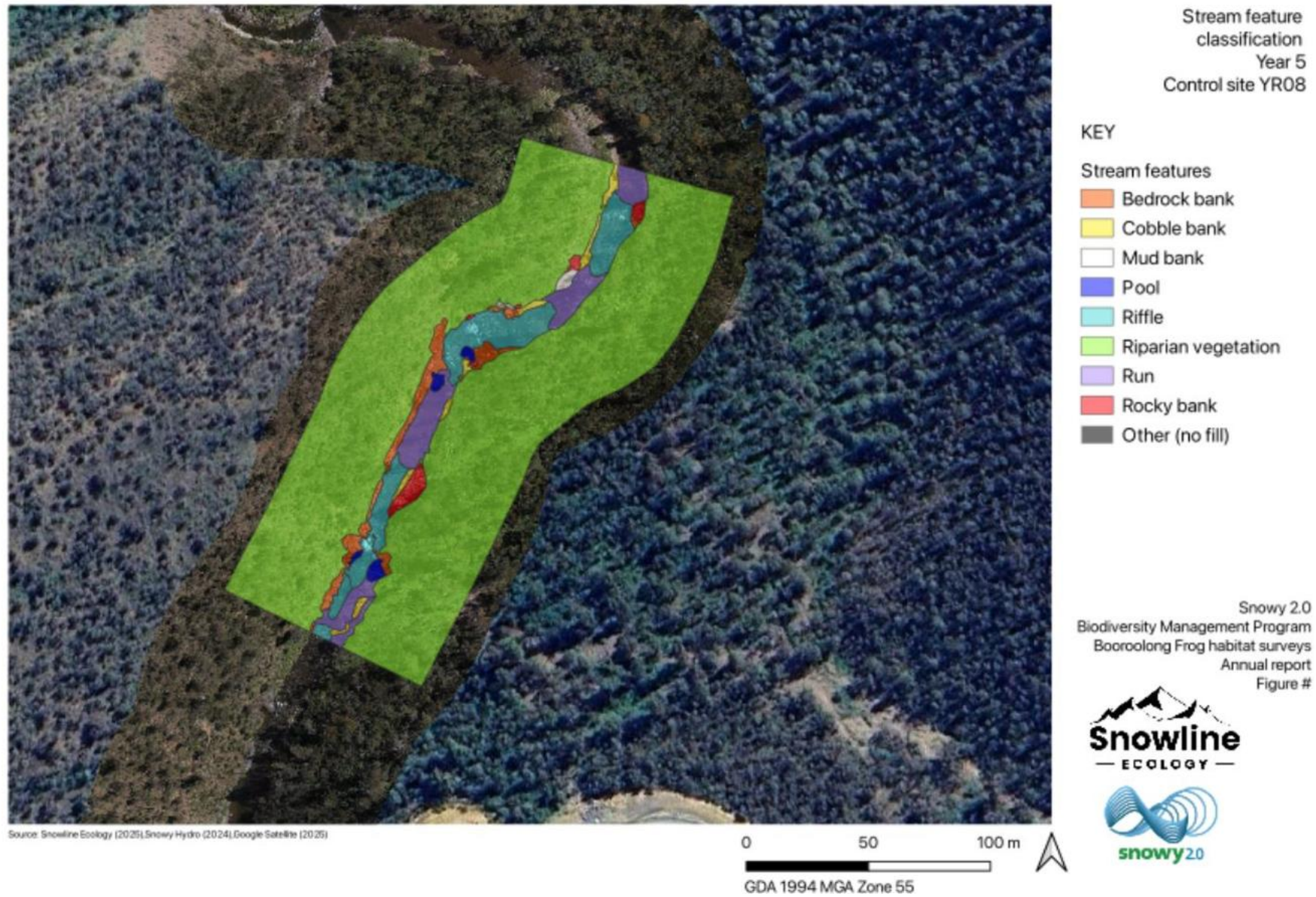


Figure 6.26: Assessment - Habitat types – Booroolong.

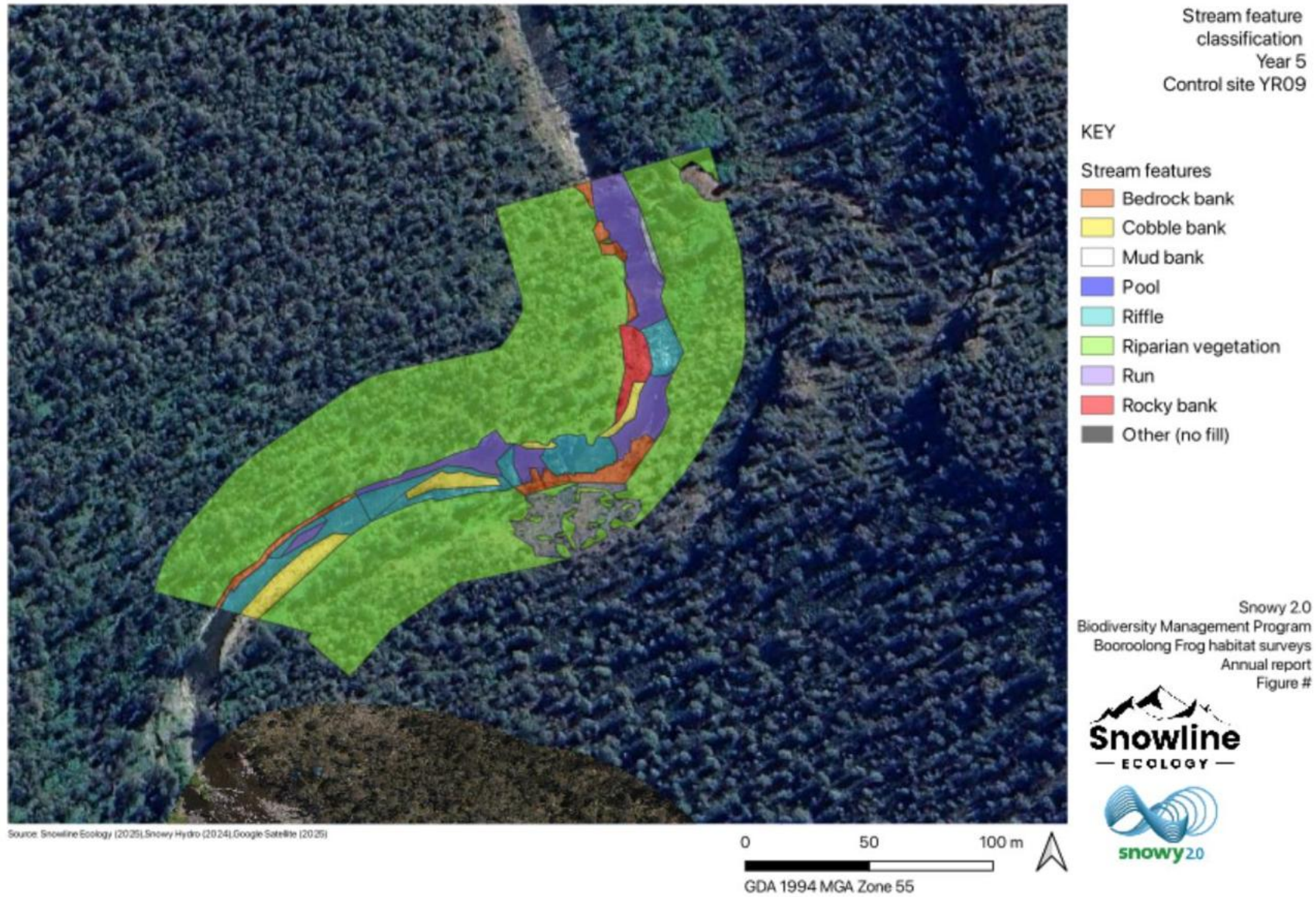


Figure 6.27: Figure 6.28: Assessment - Habitat types – Booroolong.

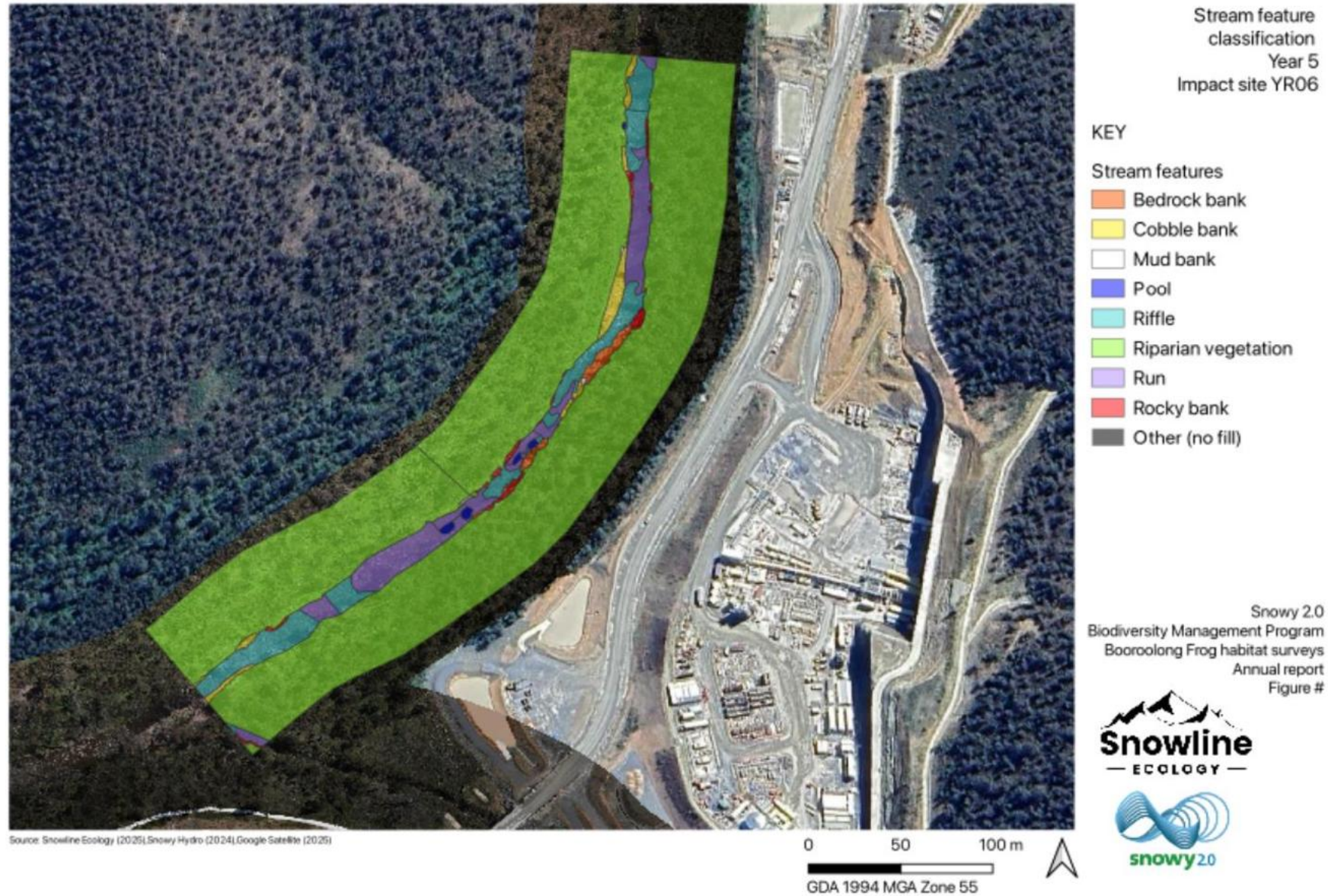


Figure 6.29: Figure 6.30: Assessment - Habitat types – Booroolong.

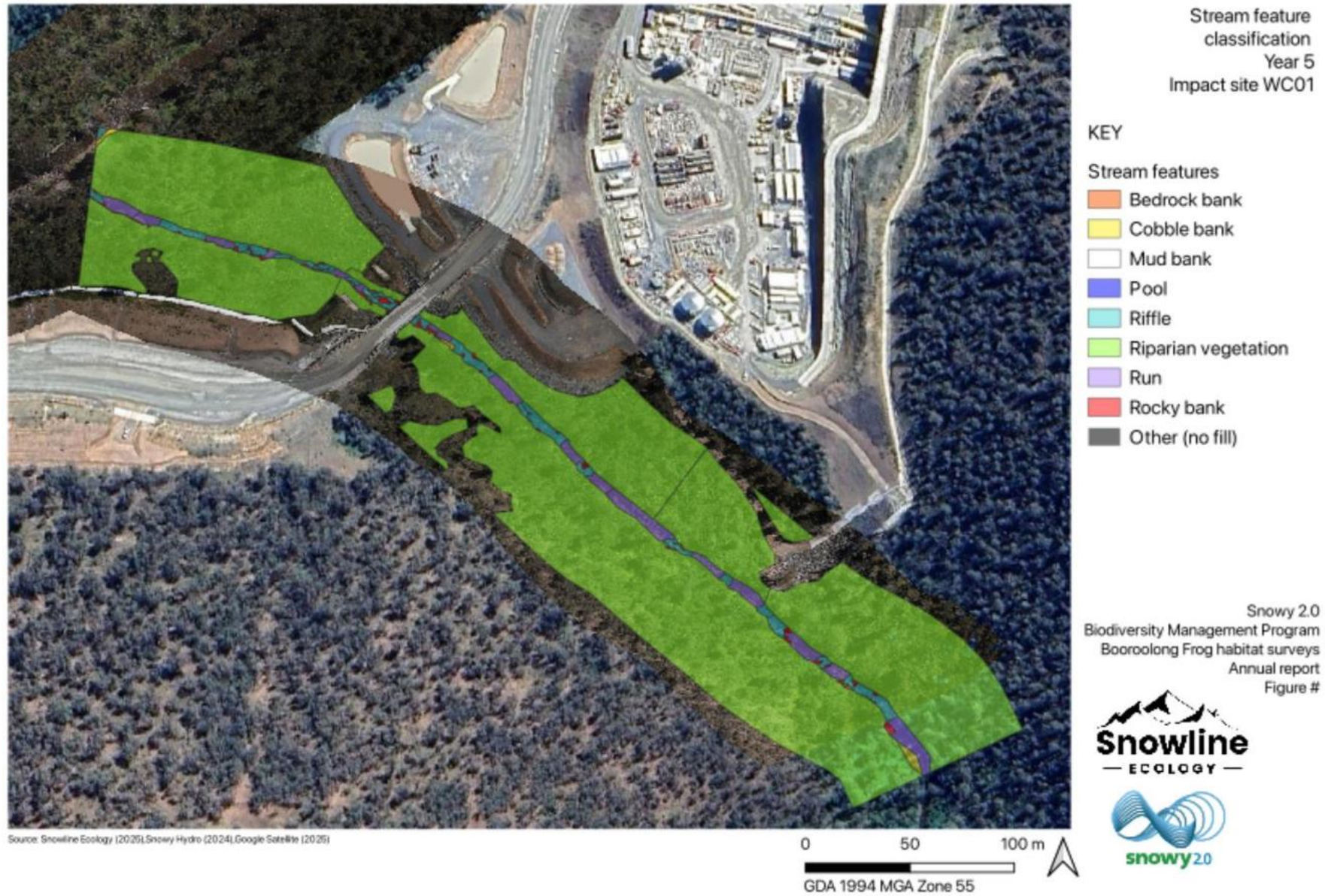


Figure 6.31: Figure 6.32: Assessment - Habitat types – Booroolong.



Figure 6.33: Figure 6.34: Assessment - Habitat types – Booroolong.

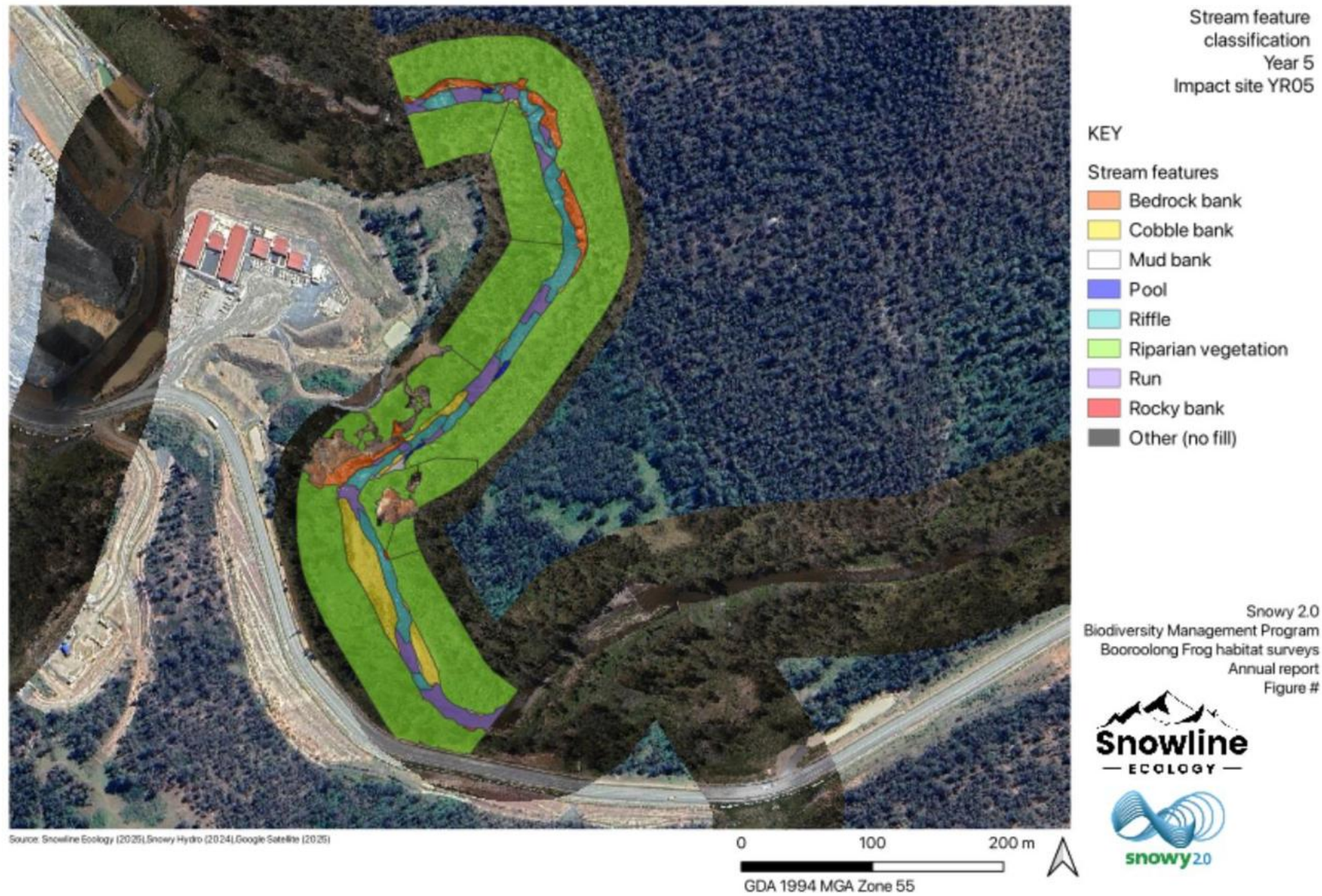


Figure 6.35: Figure 6.36: Assessment - Habitat types – Booroolong.

6.6.2. Habitat characteristics – comparative analysis between Year 4 and Year 5 monitoring

As the total area of each site varied across years, the following analyses were performed on proportional area, to account for the variance in area surveyed.

A series of models were used to evaluate changes in habitat composition across control and impact sites over two years (Year 4 and Year 5). A mixed-effects model of total proportional area (with site as a random effect) found no significant effects of Year, Treatment, or their interaction. As the random effect showed zero variance, a simplified linear model without random effects was fitted, which similarly indicated no significant differences.

When individual habitat classes were analysed using mixed-effects models separately, most habitat types did not differ significantly over time or between treatments (Table 6.6; Figure 6.37). However, rocky bank showed clear differences: it was significantly lower at impact sites than control sites ($p = 0.009$), and it decreased from Year 4 to Year 5 ($p = 0.018$), and the interaction between year and treatment was also significant ($p = 0.022$), suggesting the decline over time was greater at impact sites.

Specifically, rocky bank habitat at control sites increased slightly from 0.031 ha (Year 4) to 0.051 ha (Year 5), while at impact sites it declined from 0.061 ha to 0.014 ha, indicating a 0.047 ha greater loss at impact sites over time. This suggests a potential treatment-related degradation or change in that habitat type (Table 6.6).

The riffle habitat showed a *marginal treatment effect* ($p = 0.088$), with lower average proportional area at impact sites (mean = 0.200 ha) compared to control sites (mean = 0.166 ha), though this difference was not statistically strong. All other habitat classes, including pool, mud bank, run, and riparian vegetation, did not show any meaningful temporal or treatment-related changes (Table 6.6).

Table 6-6: Summary of Results from Linear Mixed Models for Proportional Area by Habitat Class.

| Habitat Class | Year (p) | Treatment (p) | Year × Treatment (p) | Key Patterns |
|---------------------|--------------|---------------|----------------------|--|
| Bed rock bank | 0.365 | 0.881 | 0.637 | No significant effects |
| Cobble bank | 0.974 | 0.516 | 0.571 | No significant effects |
| Mud bank | 0.680 | 0.800 | 0.735 | No significant effects |
| Pool | 0.303 | 0.482 | 0.605 | No significant effects |
| Riffle | 0.108 | 0.088 | 0.128 | <i>Marginal treatment effect – lower at impact sites</i> |
| Riparian vegetation | 0.791 | 0.320 | 0.372 | No significant effects (singular fit) |
| Rocky bank | 0.018 | 0.009 | 0.022 | Significant decline at Impact sites over time |
| Run | 0.312 | 0.787 | 0.736 | No significant effects (singular fit) |

Caution must be taken when interpreting results for highly dynamic habitat features such as riffle or run zones, or large areas of exposed cobble or bedrock banks. Stream and riverine environments are highly dynamic and thus these area values may change on a regular basis – e.g. after rain river levels rise and habitat features such as bedrock and cobble area will decrease, whilst riffle and run will increase. Conversely, when river levels are low, more areas of bedrock and cobble will be exposed, resulting in periodically larger areas of this habitat type. Typically, Booroolong Frogs will be most active during the breeding season at low-moderate stream flows when cobble and bedrock are exposed with shallow cobble (edge pools and bedrock-based rockpools having formed (e.g. Figure 6.22, 6.23)).

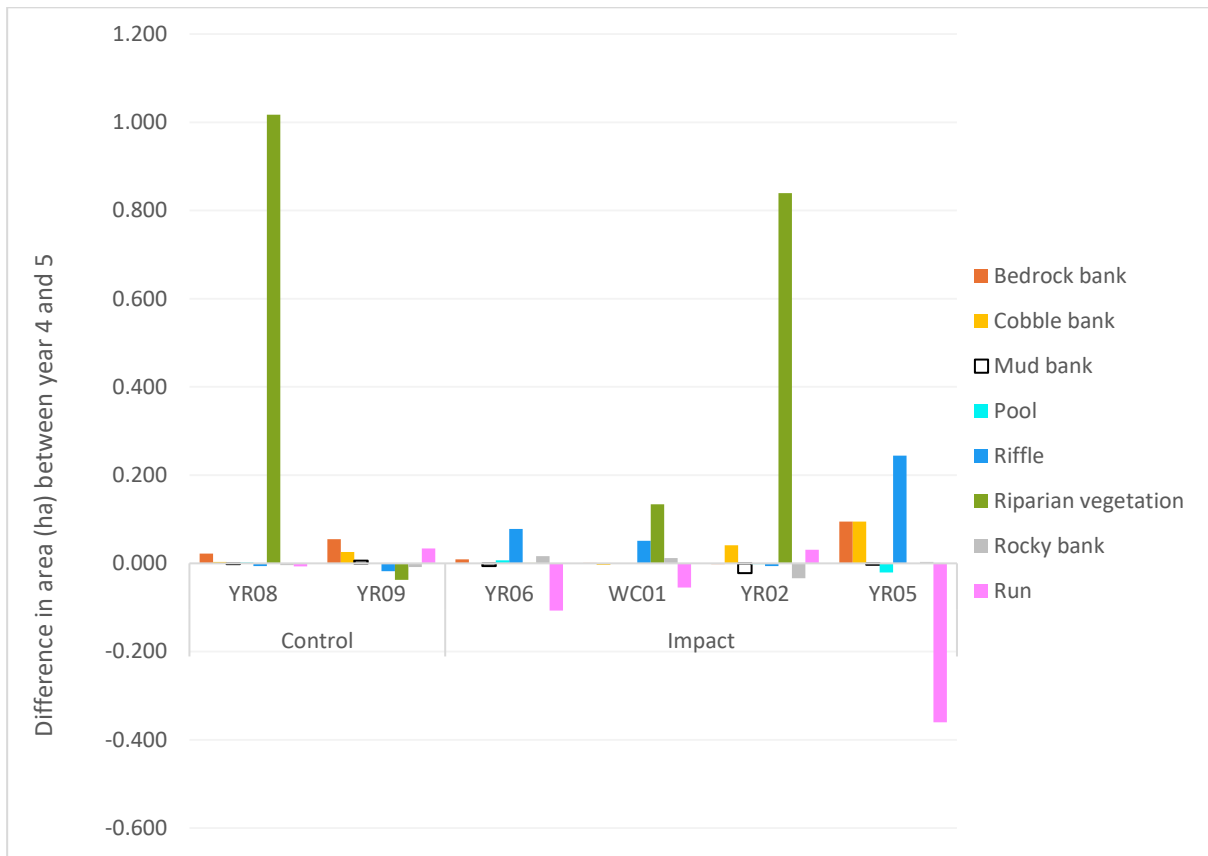


Figure 6.37

Figure 30. Difference in composition of stream features (ha) for each Booroolong Frog transect between Year Four and Year Five in KNP, NSW.

6.6.3. Year 6 recommendations

We suggest including several new (and important) micro-habitat features for the 2025-2026 surveys, such as separating ‘pools’ into ‘deep pools’, ‘bedrock pools’ and ‘cobble pools’. These are important breeding microhabitat features for Booroolong Frogs which have not been recorded during previous surveys, yet are easily visible on drone imagery of the sites (e.g. Figure 6.21). This is more valuable data and would enable us to track and record breeding microhabitats throughout each season as well as the broader habitat characteristics.

In future, we recommend a linear measurement of key Booroolong Frog habitat be reported per 500 m stream transect. This will provide more meaningful information when considering changes in species habitat over monitoring years. Further, additional control sites further from impacted areas (e.g. Yarrangobilly caves area) should be considered for more appropriate comparisons and statistical power.

7. Alpine She-oak Skink – Occupancy

7.1 Survey Location Map



Snowy 2.0
 Biodiversity Management
 Program
 Year 5 Annual Report

Figure 7.1: Alpine She-oak Skink –
 Presence/Absence Monitoring
 Sites

Legend

- ▭ Construction Envelope
- ▭ Disturbance Boundary
- ▭ Reservoirs
- ▭ Major road
- Alpine She-oak Skink**
- Control
- Impact



Prepared by: Karen Zhu
 Date: 11/02/2025
 Spatial Reference: GDA2020 MGA Zone 55

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Alpine She-oak Skink Monitoring
Year 5 Annual Monitoring Report (2024/2025)
Snowy 2.0 Main Works
September 2025



7.2 Executive Summary

This monitoring component of the BMP aims to assess the status of the nationally Endangered Alpine She-oak Skink (*Cyclodomorphus praealtus*; ASOS) and document any changes attributable to the project.

During this reporting period, ASOS were detected at 55% of sites (2/5 impact and 3/4 control); triggering adaptive management. The absence of robust supplementary data and experimental design flaws limit our capacity to confidently ascertain the differences in annual species detection rates. Future refinements to survey protocols, including increased metadata collection and survey effort, will allow more robust interpretation of results. Ensuring future monitoring mimics the approach used in established ASOS recovery programs will allow population health and trends to be monitored in a broader context, and better direct management actions.

7.3 Introduction

7.3.1. Acknowledgment

This research was conducted for Snowy Hydro Limited under the Department of Climate Change, Energy, the Environment and Water (DCCEEW) scientific licence (SL102960) and with the approval of Zoos Victoria's Animal Ethics Committee (ZV24025).

Photo Credit

Cover page: Dr Zak Atkins.

7.3.2. Overview

The primary objective of occupancy monitoring is to assess the status of the nationally Endangered Alpine She-oak Skink (*Cyclodomorphus praealtus*; ASOS) in context of the impacts associated with the hydroelectric Snowy 2.0 development. These works will cause habitat loss and fragmentation throughout known populations of ASOS, notably in the Tantangara works area. To better understand drivers of observed population trends, we survey tile grids across both control and impact sites during the ASOS active season (Nov-April). Data collected from this ASOS monitoring will be compared to data from previous survey years and will be used to guide land management decisions aimed at improving outcomes for this threatened lizard.

7.3.3. Previous Works

Works prior to November 2024 were delivered by EMM Consulting Pty Ltd. Their surveys for ASOS began in 2021 with 12 tile grid arrays established at control and impact sites. Five of these grids were decommissioned and a further two added in 2024, leaving nine grids for Year 5 (2024-25) ASOS monitoring. These surveys included counts of lizards detected but did not control for variables that impact both detectability and number of ASOS that are detected. Under-tile ant density is known to be a significant driver of ASOS presence (Clemann and Atkins unpub. data); while ASOS will use tiles with a small number of ants, once ant presence beneath a tile is substantial, ASOS (and other vertebrate species) will not use that tile. Other influential metadata were not reported (e.g. tile temperature), and methods were not always controlled (i.e., varying tile materials and inconsistent numbers of tiles in grids), or consistent with long-term data collected by ASOS species experts. These issues have resulted in low levels of confidence in the results from this previous monitoring, and difficulties when comparing current results to past results.

7.3.4. Current Works

In November 2024 (Year 5), delivery of ASOS surveys transitioned from EMM to Snowline Ecology. Snowline Ecology immediately increased metadata collection across all Year 5 surveys, and will implement further changes in Year Six to bring surveys in line with national ASOS monitoring programs. Year 5 monitoring detected ASOS at 55% of sites (2/5 impact and 3/4 control); triggering adaptive management. The current survey and analysis show a decrease in total ASOS detections since Year Three (2023), although this decrease does not appear to be related to changes in control and impact sites. While changes in apparent ASOS detection rates may be a result of numerous factors, these results highlight the need for both methods that are consistent with established programs for the ASOS, and

management interventions to better understand and protect ASOS within areas of Kosciuszko National Park (KNP) impacted by Snowy 2.0.

7.3.5. Future adaptive management recommendations

- Make methods consistent with other ASOS monitoring programs in NSW and Victoria. Changes required include: grid arrangement, tile type (change to concrete tiles), and tile number (25 per grid);
- Increase the number of grids in the landscape and re-position some existing grids to improve ASOS detectability and statistical power;
- Collect additional metadata at sites (e.g. percent cover of weeds, feral herbivore sign);
- Collect genetic samples from all captured ASOS;
- Increase invasive species management, particularly at impact sites;
- Consider including the sympatric Mountain Skink and Alpine Water Skink in Snowy 2.0 threatened reptile monitoring.

7.3.6. Species Description

The ASOS is listed as Endangered nationally under the *EPBC Act 1999* and Endangered in New South Wales under the *Biodiversity Conservation Act 2016*. The species is restricted to predominantly treeless grassland and heathland vegetation communities of the alpine and subalpine regions of mainland Australia (Robertson and Coventry 2019; Figure 7.1). Populations occur on a series of disjunct peaks and plateaux above 1250 m from the Wellington Plains (Victoria) in the south, to KNP (NSW) in the north. Habitat specialisation, fragmented populations and worsening threatening processes throughout the range of ASOS make this species susceptible to extinction (e.g. Hartley *et al.* 2023a).



Figure 7.1: Alpine She-oak Skink (*Cyclodomorphus praealtus*) found during tile surveys at site TG11, Kosciuszko National Park, NSW. Photo by M. Clancy.

Many ASOS populations throughout their Victorian and NSW range have been severely impacted by disturbance, which threatens population viability and persistence (Atkins and Clemann 2023a; Hartley *et al.* 2023a, b). Large areas of ASOS habitat were severely affected by the 2019-20 'Black Summer' fires, leading to broad-scale and rapid changes to the complex vegetation structure required by the species (Figure 7.2). This significant disturbance is exacerbated by multiple other threatening processes occurring simultaneously, including habitat loss and degradation by invasive species (notably horses, pigs, rabbits and deer), expanding human infrastructure, and climate change (Clemann, 2015). Protecting all extant ASOS habitat is essential to avoid further fragmentation and prevent extinction.



Figure 7.2: An Alpine She-oak Skink monitoring site (tile transect visible in background) burned during the 2019-20 Black Summer fires within Kosciuszko National Park, NSW. Photo by Renèe Hartley.

7.4 Methods

Tile Grid Monitoring

Monitoring of ASOS involved the use of artificial cover (tile grids) surveys established at impact (adjacent to the Snowy 2.0 Main Works disturbance footprint) and control (undisturbed areas not impacted by Snowy 2.0) sites where the species was known or presumed to occur.

Each grid consisted of 25 tiles deployed in a 5 x 5 array, with 10 m spacing between each tile. Grid arrangement for years 1-5 (10 x 10 m spacing) will be amended in 2025 to match the arrangement (5 x 5 m) undertaken across the Victorian (Zoos Victoria) and NSW (NPWS 'Saving Our Species') ASOS conservation programs.

Grids were checked under suitable weather conditions, as determined by species experts (e.g. early in the morning on warm days before air and tile temperatures reached levels that meant that reptiles were unlikely to be under tiles or late afternoon/early evening once temperatures had fallen; or any time during the day under mild conditions). At every grid check, weather parameters were recorded (sun exposure, cloud cover, wind speed, relative humidity, current or recent rain), as well as under tile temperature (°C) and ant score (0-3) for each tile (see Appendix). A coarse measure of ant densities, where 0 = no ants, 1 = < 20% ants, 2 = 20-80%, 3 = >80% ants, is consistently recorded during

ASOS long-term monitoring programs. Both under tile temperature and ant densities are key variables influencing ASOS detectability, and must be considered when interpreting survey data.

Captured ASOS were weighed (g), measured (snout-vent length ;SVL), and tail condition was assessed (complete, lost, regenerating). Where possible, individuals were sexed, and females gently palpated to detect developing embryos (November to February). Standardised head photographs were also taken to facilitate identification of recaptured lizards (based on unique scale markings, patterns and features; Figure 7.5). The geospatial location of each individual (including tile number within grid) was recorded on a hand-held GPS (Garmin Rino 750) using the datum UTM GDA94. All reptiles found beneath tiles were identified to species.

In addition to individual lizard data, general survey data were recorded, including the date, time, site and grid number, and the names of the observers present. Habitat descriptors were documented, noting any changes between surveys (e.g. evidence of invasive species, human impacts etc.).

Timing, Effort, and Frequency

Monitoring was undertaken between December 2024 and April 2025. Each tile grid was surveyed six times (approximately monthly) over the ASOS active season. Monitoring was conducted by species experts with more than a decade of dedicated ASOS monitoring experience.

Survey Locations

Nine tile grids were monitored: five at impact sites and four at control sites (Figure 7.3).

- Impact Sites:
 - Tantangara Road (TG02, TG12)
 - Tantangara construction area (TG03, TG05, TG13)
- Control Sites:
 - Gooandra (TG11)
 - Bullocks trail (TG07, TG08)
 - Long Plain (TG06)

Tile grids were established in 2021, except for two grids (TG12 and TG13) that were deployed in 2024. Grids were established in areas of associated Plant Community Type (PCT) or in proximity to previous ASOS records. Note, all sites were selected by previous contractors and setup differently to long-term monitoring projects run by ASOS experts. Necessary changes will be made in Year Six to ensure the most suitable habitats are assessed, and to make data comparable to current ASOS recovery programs.

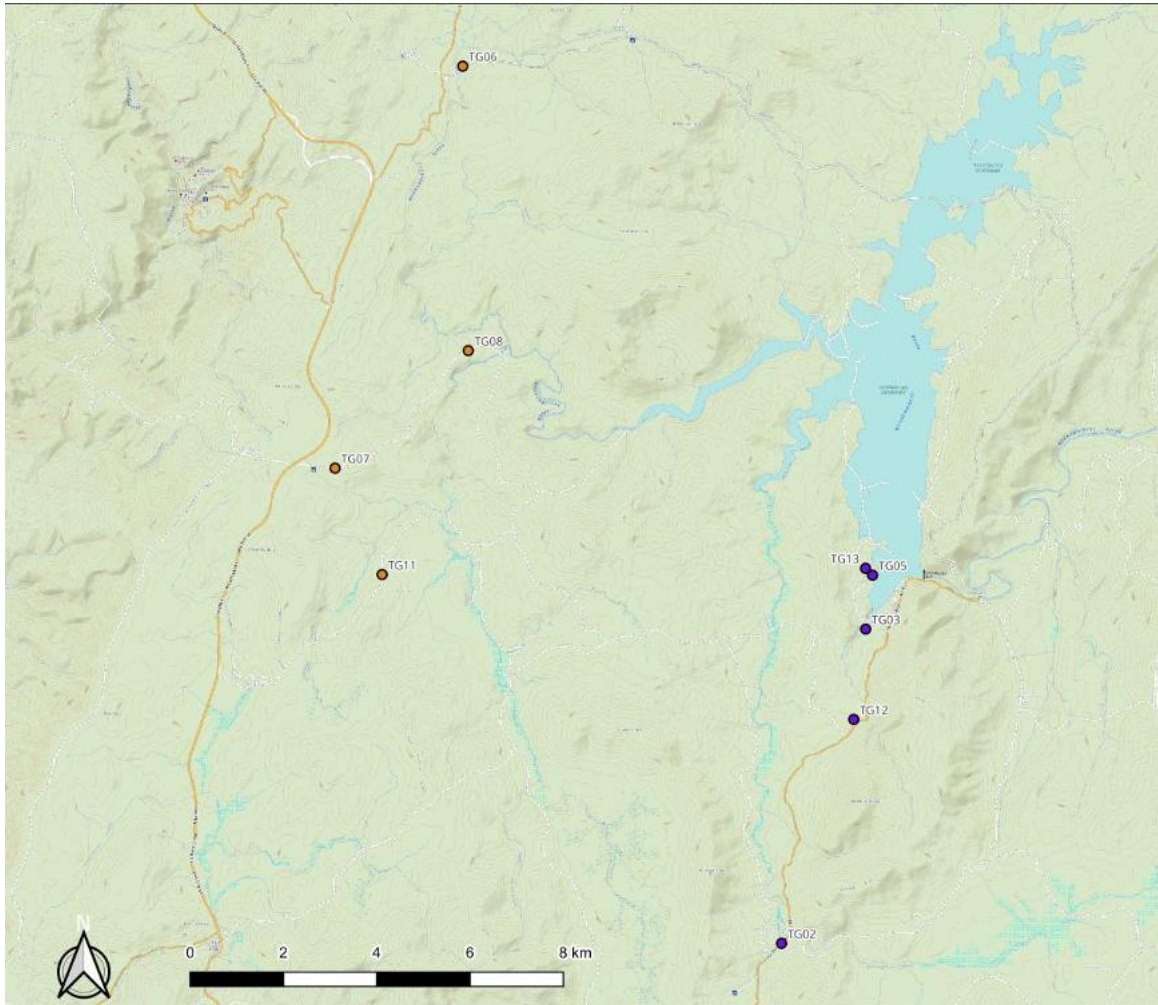


Figure 7.3: Alpine She-oak Skink (*Cyclodomorphus praealtus*) tile grid locations at impact (purple circles) and control (orange circles) sites in Kosciuszko National Park, NSW.

Data Analysis

All monitoring data were entered into a central database to assess trends in ASOS occupancy across sites and survey years. Data were analysed to identify any significant changes in detection, particularly where changes may be related to construction activities.

Analysis of Variance (repeated measures ANOVA) was performed in Systat v13.0 to investigate whether ASOS observations (count) differed due to treatment (impact/control site) and/or year the observation was recorded (five years, 2021–2025)—the data met the required normality assumption for this analysis and had no extreme outliers. When a significant effect was recorded, post-hoc tests were used to determine the source of within-factor variance.

Under-tile ant scores and tile temperatures were not recorded in years 1-4. Therefore, this important metric was unable to be compared between seasons. This caveat was considered when interpreting ASOS occupancy between seasons. Moreover, the number of tile grids and subsequent monitoring data are low. As such, results and analyses are preliminary, and will be best if refined over time.

7.5 Adaptive Management

Adaptive management actions will be considered if any of the following occur:

- Non-detection of the species from an impact site where it was previously recorded during baseline surveys

- Non-detection at an impact site persists for more than one year
- Continued detection at all control sites
- Non-detection coincides with a known impact driver (e.g. soil disturbance/weed incursion)

Should a trigger be met, an investigation will be initiated to identify potential causes of decline (e.g. weed invasion, feral predators, site disturbance). In consultation with DCCEEW and NPWS, a mitigation plan will be developed, which may include:

- More intensive monitoring
- Weed and/or feral animal control
- Additional mitigation measures during construction

If these actions prove ineffective, implementation of additional offsets may be required.

7.6 Results

In Year 5 of the ASOS monitoring program nine tile grids (five impact, four control) were assessed over six separate monitoring events between December 2024 and April 2025. Eight ASOS were captured: two at impact sites (TG02, TG12), and five at control sites (TG07, TG08, TG11) (Figure 7.4). Of these, five were males, one was a gravid female, and two were juveniles (Table 7.1). No ASOS recorded in Year 5 were recaptured during subsequent surveys (Figure 7.5). Seven additional reptile species were documented during surveys, including: Southern Grass Skink (*Pseudemoia entrecasteauxii*), Tussock Skink (*Pseudemoia pagenstecheri*), Eastern Three-lines Skink (*Acritoscincus duperreyi*), Red-throated Skink (*Acritoscincus platynotus*), Blotched Blue-tongued Lizard (*Tiliqua nigrolutea*), White-lipped Snake (*Drysdalia coronoides*) and Highland Copperhead (*Austrelaps ramsayi*).

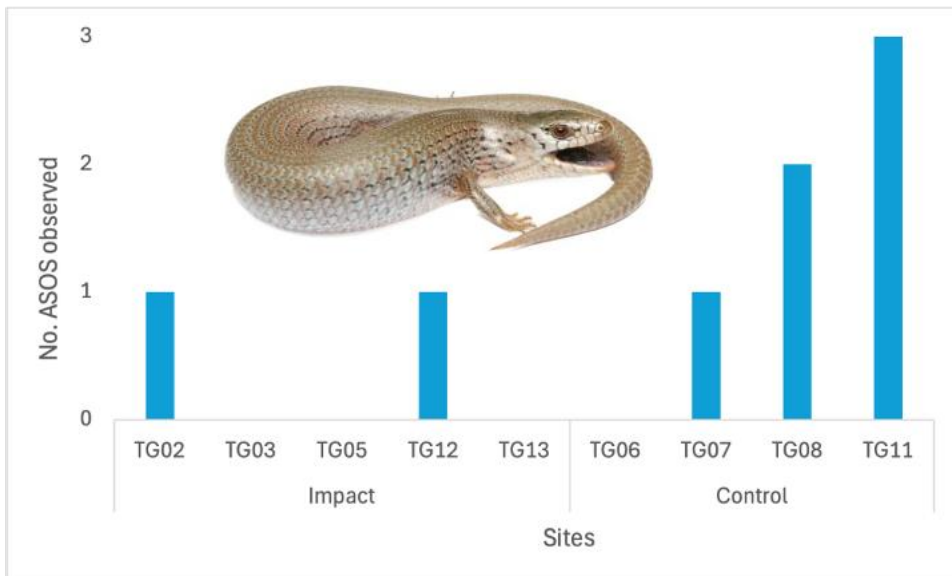


Figure 7.4: Alpine She-oak Skink detections at impact and control sites during Year 5 monitoring in Kosciuszko National Park, NSW.

Table 7-1: Alpine She-oak Skink captured at tile grids during Year 5 monitoring in Kosciuszko National Park, NSW.

| Grid | Location | Lizard # | Ambient T | Tile T | Tile # | Sex | SVL | Weight | Tail |
|------|----------|----------|-----------|--------|--------|-----|------|--------|------|
| TG12 | Impact | SHL01 | 13.9 | 16 | B1 | M | 89 | 9.1 | TC |
| TG11 | Control | SHL02 | 25 | 26.1 | D5 | FG | 93 | 12.2 | TR |
| TG11 | Control | SHL03 | 25 | 27.4 | E3 | M | 73 | 9.1 | TC |
| TG08 | Control | SHL04 | 21.3 | 27.9 | B2 | J | 68.3 | 4.3 | TC |
| TG11 | Control | SHL05 | 25.5 | 28.4 | E4 | J | 59.4 | 3.2 | TC |
| TG07 | Control | SHL06 | 11.6 | 25.9 | A2 | M | 78.4 | 7.6 | TC |
| TG02 | Impact | SHL07 | 12.5 | 11.1 | E1 | M | 104 | 11.4 | TC |
| TG08 | Control | SHL08 | 19.7 | 24.8 | A5 | M | 70 | 7.1 | TC |

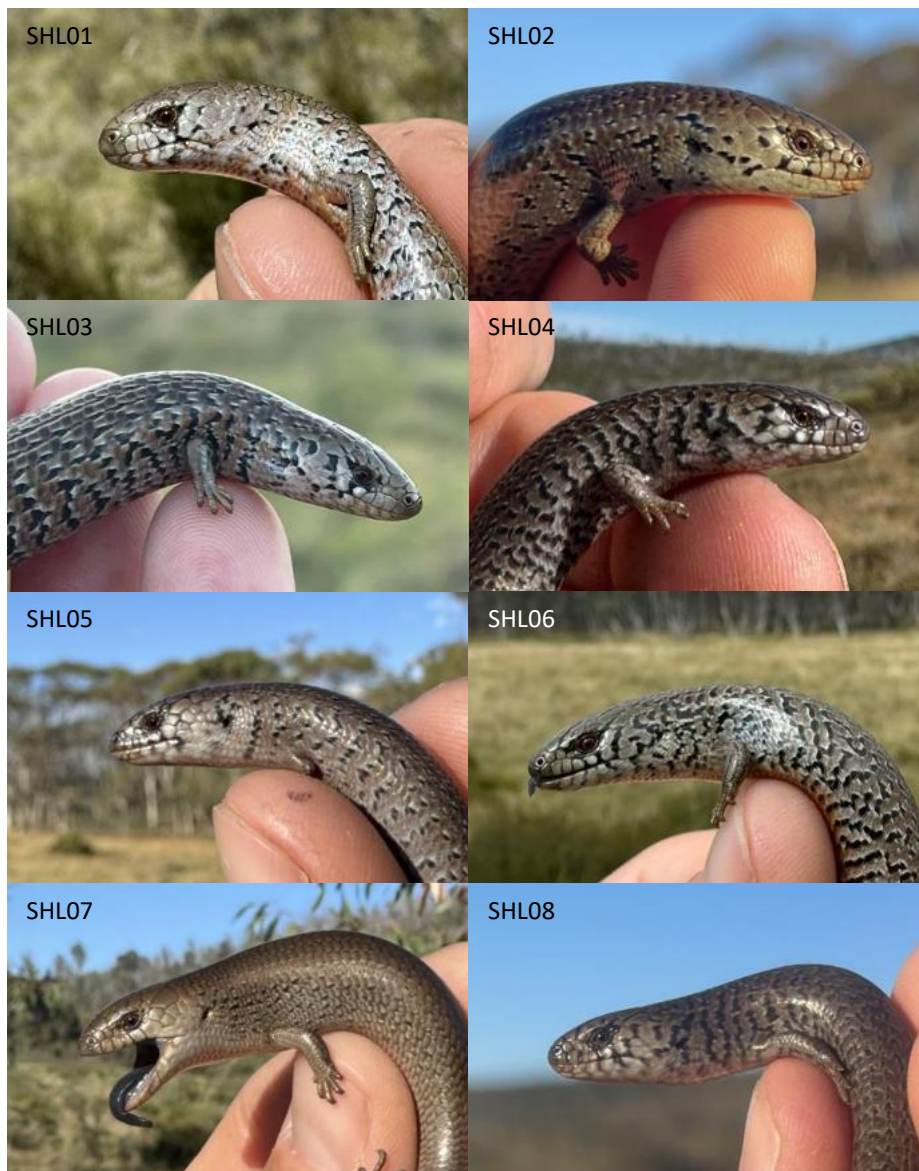


Figure 7.5: Alpine She-oak Skinks (SHL01-08) captured during Year 5 tile grid surveys in Kosciuszko National Park, NSW. Note, unique scale markings, patterns and features (scars, limb loss etc.) allow individual identification.

In Year 5, ASOS were detected at 2/5 impact sites and 3/4 control sites, comparable to Year 4, when the species was recorded at 3/5 and 3/4 sites, respectively (Figure 7.6). However, the number of individuals captured differed between years. For impact sites, ASOS were recorded at TG02 and TG12, but not documented at TG03, TG05 and TG13. ASOS had been previously recorded at both TG03 (years 1, 2, 4) and TG05 (years 2, 3, 4), while no individuals have been detected at TG13 since establishment in August 2024 (Figure 7.6). There was no significant effect of treatment ($F=1.017$, $df=1$, $p>0.37$). That is, ASOS observations did not differ between ‘control’ and ‘impact’ areas. There was no significant interaction between year and treatment ($F=1.2$, $df=4$, $p=0.34$), meaning that the effects of treatment (control and impact) did not differ over five years (i.e., they were consistently non-significant).

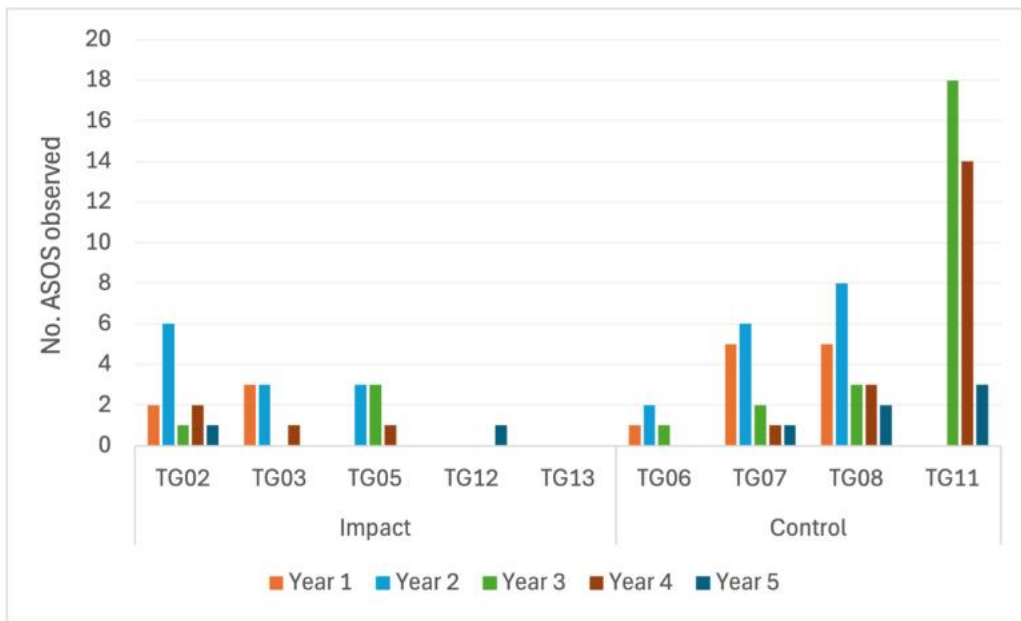


Figure 7.6: Comparison of Alpine She-oak Skink detections from monitoring years 1-5 in Kosciuszko National Park, NSW.

Note, previous contractors deployed tiles grids at differing periods, meaning not all grids were surveyed annually from 2021.

There was a significant effect of year on total ASOS observations ($F=23.1$, $df=4$, $p<0.001$), meaning that detection of ASOS varied significantly across each of the five years (Figure 7.7). Post-hoc tests revealed that the number of ASOS recorded each year differed significantly, with one exception—years one and four had statistically similar ASOS detections.

Total ASOS detections increased significantly from years 1-3 but decreased significantly from years 3-5. Monitoring in Year 5 returned the lowest number of ASOS detections ($n = 8$) of any year and differed significantly from all other years (Figure 7.7).

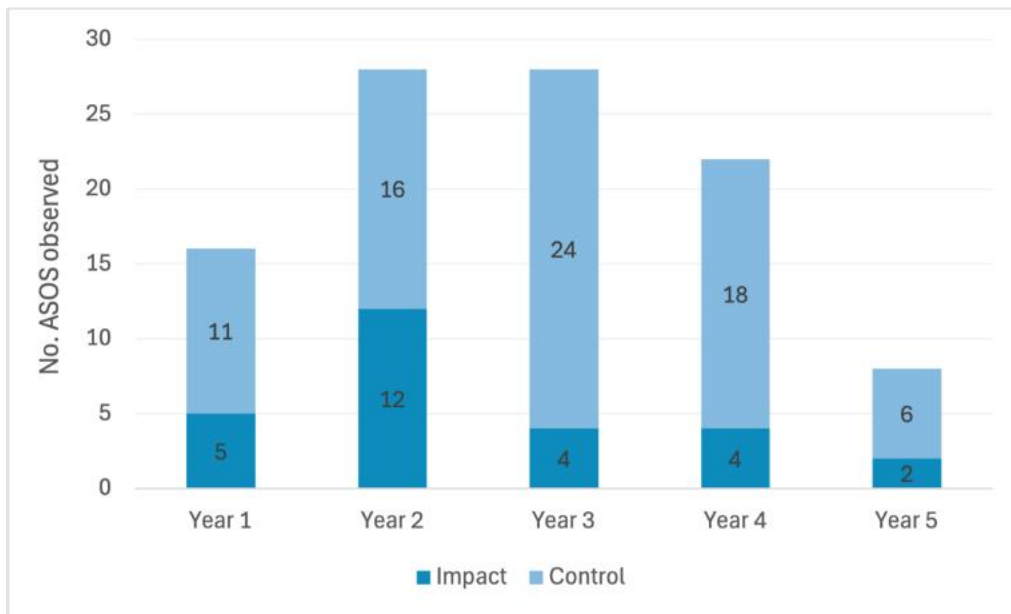


Figure 7.7: Total Alpine She-oak Skink detections over monitoring years 1-5 in Kosciuszko National Park, NSW.

Observations within impact (dark blue) and control (light blue) sites are presented

7.7 Discussion

During Year 5 monitoring ASOS were detected at 55% of sites (2/5 impact and 3/4 control) in Kosciuszko National Park. Detections of ASOS at these sites have been variable over the five years of monitoring. The trend of fewer detections and a lack of recaptures over this time suggests that populations may be declining (significantly reducing since Year 3 surveys; 2023), but more data is required to be certain about trends, and to determine drivers of any changes. Year 5 (2025) recorded the lowest ASOS detections of any monitoring year, with only eight individuals. However, these declines were attributed to significant changes in overall ASOS detections (i.e., lower detections overall, not between control and impact sites). Reductions in ASOS detections may be a result of fluctuations in environmental conditions, inherent variability in the species' detectability, changes in habitat quality (e.g. impacts from construction activities and/or feral herbivores) and declining grid efficacy (smashed/missing tiles, vegetation succession, increased ant occupancy etc.). Although the absence of robust supplementary data (notably ant scores) and experimental design flaws (e.g. grid placement/arrangement, inconsistent tile type) limit our capacity to confidently ascertain the reasons for the differences in detections between years. Furthermore, genetic data would help with our understanding of whether gene flow occurring between control and impact areas. We have suggested improvements to the methods (e.g. tile grid modifications, adding more monitoring sites) that will improve data collection and allow more robust interpretation of results. Ensuring future monitoring mimics the approach used in established ASOS recovery programs in Victoria and NSW will allow population health and trends to be monitored in a broader context, and better direct management actions. These results underscore the importance of engaging genuine species experts when undertaking threatened species monitoring programs, especially when interpretations affect land management (e.g. Burns *et al.* 2020). Improved methods for future ASOS monitoring will improve our understanding of how ASOS respond to disturbance, at a time when continued human-induced impacts threaten the persistence of ASOS populations across their range.

Field Survey

Year 5 monitoring results indicated a significant decrease in ASOS detection on these tile grids, which may be a result of one or more factors. Firstly, broader environmental conditions over the past year may have reduced ASOS detectability. During the Year 5 active season (Nov 2024–April 2025), drought conditions were evident throughout the mainland Australian Alpine region, with 2024 recording the lowest rainfall since 2010 and unusually high temperatures (Australian Bureau of Meteorology 2025). Most of the season was characterised by these sub-optimal survey conditions - a stark contrast to the cold and wet La Niña weather patterns that prevailed over south-eastern

Australia between 2021 and 2023 (Huang *et al.* 2024). While warm conditions typically increase reptile activity (e.g. Huey 1982), the method used for assessing ASOS occupancy here (roof tiles) may have been less effective under these conditions. Roof tiles are effective conductors of heat and rapidly increase in temperature when exposed to solar radiation. Some reptiles, including ASOS, utilise differential temperatures under tiles as a means of thermoregulating; this is a major reason this method is so effective under the right conditions. However, on warm, sunny days, under-tile temperatures can rapidly exceed critical thermal maximum of lizards. Once beneath-tile temperatures exceed the thermal tolerances of reptiles, reptiles will either move away from the tile, or, if the tile is sitting on vegetation, the reptiles may move lower through the vegetation to access lower temperatures (N. Clemann and Z. Atkins unpub. data). During Year 5 surveys we experienced extensive periods of warm and sunny days that limited suitable survey windows and typically necessitated ASOS monitoring be conducted only in early mornings and late evenings. Needing to survey at these times limits how much monitoring can be conducted under suitable conditions. While tiles are also used by ASOS for shelter, the need to utilise tiles for thermoregulation may have declined during these warmer conditions during Year 5, or meant that the lizards were detectable for shorter periods of the day at these times. Higher temperatures also appear to be correlated with ant activity under tiles, an additional environmental variable that is vital when interpreting ASOS survey results.

Under-tile temperatures and ant scores were not documented in years 1-4, leaving key drivers of ASOS detectability unknown. First implemented by N. Clemann over two decades ago (Clemann, 2002), concrete roof tiles are an effective method for detecting alpine reptiles but vary temporarily in their efficacy given their conductivity of heat and propensity to be colonised by ants. ASOS are typically detected under tiles when under-tile temperatures are below 30°C and ant scores are less than 20% (Hartley *et al.* 2023b; Clemann and Atkins unpub data). While ant occupancy under tiles is both temporally and spatially variable, reptile detectability under tiles is negatively correlated with ant density (Hartley *et al.* 2023b; N. Clemann and Z. Atkins unpub data). For example, in Year 5, were reduced ASOS numbers at monitoring sites a genuine reflection of ASOS occupancy, or was the species just less detectable at sites due to higher ant densities? During Year 5 monitoring, TG11 – the most productive ASOS control site during previous years – had the highest mean ant score.

Our long-term data clearly shows higher under-tile ant densities lowers ASOS detectability (N. Clemann and Z. Atkins unpub. data). Year 4 monitoring returned most ASOS in December 2023 at TG11 (n = 7). Only two ASOS were recorded at the site in Year 5, in December 2024. However, ant scores help explain the significant reduction in lizard detections. Only 4/25 tiles had no ants, while 17 of the tiles had an ant score of 3, completely precluding lizard occupancy at 68% of the grid (see Appendix 5). Ultimately, the absence of ant data between years 1-4 greatly limits our capacity to compare and interpret ASOS occupancy results.

Consistent survey effort (e.g. the number of tiles in each grid) across sites is essential to ensure lizard detectability measures are comparable between treatments and years. However, almost every grid had missing or smashed tiles, reducing the overall survey effort in Year 5. The incidence of broken or lost tiles increases with time since deployment. This can be a result of snow compaction, trampling (e.g. Horses), vehicles (when sites are close to tracks), and displacement by the public (hikers often mistake tiles for rubbish). Ultimately, the fewer surveyable tiles in the landscape, the lower the lizard detection probability. Ensuring grids have the appropriate number of tiles will be a priority for Year 6 ASOS surveys. Consistent tile numbers in each grid also facilitates comparisons of ant activity between grids.

Habitat condition must be considered when assessing ASOS occupancy. Habitat destruction by humans is the most pronounced driver of biodiversity loss globally (e.g. Hogue and Broen 2022) and a major driver of reptile declines in south-eastern Australia (Clemann 2015). Snowy 2.0 involves the destruction of an estimated 532 hectares of native vegetation (Snowy 2.0 Main Works BMP; Figure 7.8), including areas of ASOS habitat. Our long-term monitoring data from a Victorian ASOS population at Mt Hotham highlights that current human disturbance (land clearing for resort infrastructure) is significantly harming this ASOS population, with declines observed in recent seasons. In this current study, deteriorating habitat condition has been noted as an issue at impact sites from previous survey years (EMM Consulting Pty Ltd 2025). However, 'impact' sites within this study include tile grids within the broader construction area, not occupied habitat that has been destroyed during construction works. As such, human disturbance being monitored in this instance is largely increased road traffic and associated dust. Ultimately, if survey sites also included

ASOS areas being actively cleared during construction works, the difference between treatments would be far more pronounced, and our ability to ascertain the impacts of construction far clearer. Simply put, destruction of ASOS habitat has obvious ramifications for the species; but degradation and/or fragmentation are also clear drivers of decline for the ASOS.



Figure 7.8: Lobs Hole works area that forms part of the Snowy 2.0 project within Kosciuszko National Park, NSW. Photo by Z. Atkins.

During Year 5 ASOS surveys we noted that habitat condition for ASOS was degraded at some sites as a consequence of abundant exotic weeds (e.g. TG05, TG13) and feral herbivores, notably rabbits and feral horses (e.g. TG02, TG03, TG12; Figure 9). Both disturbances can reduce the structural complexity of ASOS habits and impact a site's carrying capacity (Hartley *et al.* 2023b; N. Clemann and Z. Atkins unpub. data; Figure 7.9). Deteriorating habitat quality because of horses, which remain abundant in the Tantangara impact area, can confound data interpretations, making it difficult to distinguish between development-related impacts and those driven by feral species. Despite declines at other monitored locations, both horse and rabbit numbers have remained high in the Tantangara Dam region over previous survey years (EMM Consulting Pty Ltd 2025; Figure 7.10). Horse impacts were evident throughout the Year 5 monitoring, with extensive grazing, roll pits and dung piles consistently present within impact grids (e.g. Figure 7.9, 7.11). Mitigating the impacts of feral species, notably horses, on ASOS habitat within the works area must become a conservation priority. Horses will remain a significant driver of loss of alpine biodiversity until they are completely removed (e.g. Driscoll *et al.* 2019; Pulsford and Darlington 2025). Increased feral species control within the Tantangara works area is advised to prevent further decline in habitat condition that threatens local ASOS population persistence.



Figure 7.9: Alpine She-oak Skink tile grid at impact site TG12 in Tantangara, Kosciuszko National Park, NSW. Note the weeds, low vegetation structure and piles of horse dung.



Figure 7.10: An abundance of feral horses within the Tantangara works area in Kosciuszko National Park. Note, Alpine She-oak Skink impact site TG03 is directly behind this location pictured. Photo by Z. Atkins.

There is significant variation in ASOS data collected over the past five monitoring years. While long-term monitoring of ASOS in NSW (conducted by NPWS ‘AIS’ (Assets of Intergenerational Significance) program) only shifted to the 20 x 20 m grid survey methods three years ago, preliminary data shows there has been a reduction in ASOS detections in some locations in Northern Kosciuszko since 2022-23 (McInerney *et al.* unpub. data). Such trends align with our

control sites in this study, notably TG06 at Long Plain, where ASOS has not been detected for the past two years. We note the limited sampling period of NSW long-term monitoring data (three seasons) when drawing comparisons, but generally low detection rates, elevated summer temperatures, changes in feral herbivore and pig density densities, and abundant ants are potential drivers of the lower observed ASOS detections in this simultaneous monitoring program.

Analyses of ASOS data across monitoring years has been compromised by experimental design changes and subsequent missing data. Multiple grids were decommissioned despite some recording ASOS (TG04, TG10), following only 1-2 years of species 'absence'. The ASOS is highly cryptic and can take years to detect, even in areas where the species is known to occur. It took seven years of dedicated survey for Clemann and Atkins (in prep) to detect ASOS at a long-term monitoring site in Victoria. Since detection, the site now consistently records multiple ASOS. While this location always had ASOS present, multiple factors can greatly influence detectability, and therefore it is critical that a nuanced species understanding derived from many years working on cryptic species such as ASOS is essential to drawing robust conclusions. A more appropriate response to low ASOS detection rates during earlier Snowy 2.0 surveys would have been 1) to increase (and not decrease) the number of tile grids in the landscape, and 2) consult species experts when establishing tile grid monitoring sites. In some cases, tile grids have been placed in marginal ASOS habitat when more appropriate options are available nearby in almost every instance. Further, tile type in this study is not consistent, it is typically a mix of both concrete and terracotta tiles. While both detect ASOS, terracotta roof tiles erode faster in the landscape (due to breakage from water expansion within terracotta over winter), making them less effective at detecting ASOS over time. And, importantly, tiles made from different materials may have different properties (including how rapidly they warm up and cool down), which could confound results. Rectifying methodological inconsistencies, re-positioning tiles, and adding additional tile grids in suitable habitat will improve sample sizes and provide the experimental power needed to draw more accurate conclusions.

7.8 Adaptive management

Triggers for Adaptive Management

Adaptive management actions will be considered if all of the following occur:

- *Non-detection of the species from an impact site where it was previously recorded during baseline surveys*

Triggered: ASOS were not recorded at impact sites TG03 and TG05 during Year 5 monitoring. However, the species was recorded at these sites during previous surveys. ASOS were detected in years 1, 2, 4 at TG03 and years 2, 3, 4 at TG05. No ASOS were detected at TG13, although this grid was only established in August 2024.

- *Absence at an impact site persists for more than one year*

Not triggered: While ASOS were not detected at 3/5 impact sites, non-detection at these three grids has only been documented for a single year.

- *Continued detection at all control sites*

Triggered: ASOS were recorded at all but one control site (TG06). While ASOS was detected at this site in years 1-3, the species has not been detected at this site for two consecutive years. TG06 consists of heathy grassland habitat, dominated by *Bossiaea foliosa* and *Poa* spp. While this area is ASOS habitat, the current location of the tile grid is sub-optimal. The grid is positioned extremely close to the road (< 30 cm) and many tiles are within dense *B. foliosa*. While heathy vegetation growth at this site has likely increased in recent years (similar to vegetation succession noted elsewhere in the alps), the current grid position within this tall heath is completely shading many tiles. However, suitable ASOS habitat surrounds this grid. To give an accurate indication of ASOS presence at this site, tiles need to be moved to nearby habitat where ASOS are more likely to be detected. Repositioning this grid to ensure the highest quality habitat is surveyed will better

reflect the species' status in this location. Additionally, rabbit abundance at this site is also reducing habitat quality, which could be contributing to lower ASOS detections, therefore, increased pest management is also advised.

- *Non-detection coincides with a known impact driver (e.g. soil disturbance/weed incursion)*

As described above, the absence of detections of ASOS may be explained by several factors, including changes in broader environmental conditions, inherent variability in the species' detectability, changes in habitat quality, and/or declining grid efficacy.

Adaptive Management Actions

As triggers have been met, further investigations are required to better understand populations trends. If apparent ASOS declines are confirmed, proactive actions will be required to stop and hopefully reverse declines. We recommend amending methods to improve ASOS detectability and ensure that data is comparable to long-term programs underway across the species' range. Similarly, collecting genetic material (tissue samples) will provide insights into population health, while also assisting broader conservation priorities, and again aligning this monitoring with the recovery programs for ASOS in Victoria and NSW. Finally, increasing targeted invasive species management strategies (weeds and feral herbivores) will improve habitat quality and likely assist ASOS recovery in impacted areas.

7.9 Recommendations for Year 6

Key recommended amendments for BMP Year 6 ASOS monitoring include:

- Make methods consistent with other ASOS monitoring programs in NSW and Victoria. Changes required include: grid arrangement, tile type (change to concrete tiles), and tile number (25 per grid);
- Increase the number of grids in the landscape and re-position some existing grids to improve ASOS detectability and statistical power. Proposed Year 6 grid totals: 16 (eight impact and eight control).
- Collect ASOS genetics.
- Including weed, dust, and herbivore monitoring at ASOS grids.
- Increase invasive species monitoring.
- Include sympatric endangered reptiles in BMP monitoring.

Field Survey

Ensuring survey methods are consistent across long-term monitoring programs is paramount to ensure comparable data that can be interpreted in a broader context. In this instance, the ASOS tile grid experimental design, including grid arrangement and key detectability drivers, did not match that of the long-term programs undertaken by species experts across Victoria and NSW. Firstly, tile grids deployed in this study were in a 40 x 40m arrangement (10m tile spacing) and not the standard 20 x 20m arrangement (5m tile spacing) (as developed by N. Clemann), doubling the survey area. In many instances, the large grid sizes in this project resulted in tiles being deployed in suboptimal habitat (e.g. tall heath or exposed areas with little vegetation cover). While habitat composition may have changed since initial tile deployments (e.g. shrub densities increased [as seen at other KNP reptile sites; Z. Atkins pers obs], sites become more exposed due to feral herbivore impacts etc.), current tile placement is reducing ASOS detectability at multiple monitoring sites. We advise tile grids be altered to ensure the arrangement matches that of our long-term programs, and in some instances, repositioned to target the most suitable ASOS habitat within the site. Additionally, broken or missing tiles should be replaced, and grids should comprise 25 concrete tiles for consistency. Ultimately, comparable survey methods will improve statistical power when considering population trends habitat, and threats, thereby increasing confidence and directing the most appropriate management actions.

Including a subjective score of percentage cover of weeds and feral herbivore sign within ASOS grids and collecting under-tile ant scores for detectability, will help determine whether these issues are (i) more common in impact sites, (ii) more problematic in impact sites, and by adding them as a covariate in future analyses, (iii) how much they influence ASOS occupancy. This, coupled with annual aerial (drone) photos of ASOS sites (as taken during our other alpine reptile monitoring programs) would also allow key habitat features to be more accurately tracked over time.

Collect genetic samples during ASOS monitoring

Conservation genetics is a key element of our team's threatened species recovery programs (e.g. Atkins *et al.* 2019; Amor *et al.* 2024; Amor *et al.* 2025), including the ASOS (Hartley *et al.* 2023a). Measures of genetic diversity provide a reliable indication of the health of a population. High genetic diversity is correlated with large population sizes and is a reliable indicator that the species or population has healthy adaptive potential and is resilient to stress (i.e., it has high fitness and is likely to persist). Conversely, low genetic diversity limits adaptive potential and resilience. Low diversity is also correlated with small population sizes, which is a very reliable indicator of extinction risk. Ultimately, to be successful conservation programs must preserve genetic diversity. Such programs must identify and mitigate sources of disturbance and stress. If possible, they may also promote or even facilitate dispersal among isolated populations. Our current threatened species programs prioritise habitat protection, are actively rehabilitating disturbed areas, and are implementing genetic rescue initiatives to best ensure the long-term viability of populations (e.g. Atkins and Clemann 2023c). These principles could be incorporated into the current monitoring program by using genetic data to determine whether control sites are connected to impact sites sufficiently to allow gene exchange.

Dedicated ASOS survey and monitoring work results in continuing collection of genetic samples across KNP to inform species management (NPWS SoS Program; Atkins and Clemann 2023a). Collection of genetic samples from previously unsampled tile grids will improve our understanding of the health of ASOS in KNP. This will not only directly complement the data being collected by NSW NPWS 'Saving our Species' ASOS long-term monitoring program, it will also inform priority recovery actions planned for the species in Victoria (e.g. Koumoundouros *et al.* 2009; Clemann and Atkins 2023). We recommend that all new ASOS captured during Snowy 2.0 monitoring be sampled for genetic analyses to assist the broader conservation objectives of the ASOS.

Invasive species control

Invasive species (weeds and feral herbivores) are a notable threat across ASOS sites in KNP, particularly in impact areas. While feral horse numbers have declined across the park in recent years following aerial culling (Invasive Species Council, 2024), thousands remain, including throughout the Tantangara area (Pulsford and Darlington 2025; Figure 10). As such, this significant threatening process has remained (and likely worsened) at ASOS impact sites during this five-year study. A similar trend has been noted with rabbits (EMM Consulting Pty Ltd 2025), which too persist in the Tantangara region in high abundance. The damage to native habitats as result of these feral herbivores (e.g. reduced vegetation cover, increased bare ground, elevated erosion) also increases weed incursion (both actively (from the animals themselves) and passively (via wind etc.) (e.g. Driscoll *et al.* 2019). Collectively, these threatening processes reduce the structural complexity of ASOS habits and impact the site's carrying capacity (Hartley *et al.* 2023b; Z. Atkins pers. obs.). Horse impacts are evident across all ASOS impact grids (e.g. Figure 9, 11), while rabbit and weeds are problematic at all impact sites excluding TG12. At control sites, rabbit damage is most pronounced at TG06. Increased feral species control within the Tantangara works area and Long Plain is advised to prevent further decline in habitat condition that threatens local ASOS population persistence.



Figure 7.11: Evidence of feral horse presence (dung piles) in Alpine she-oak Skink impact sites in Tantangara, Kosciuszko National Park, NSW.

Sympatric threatened reptile surveys

Adaptive management, by definition, is an iterative approach to decision making that prioritises learning and adapting to new information and changing conditions. The Mountain Skink, *Liopholis montana*, is a nationally Endangered montane lizard that occurs in disjunct, high elevation areas of south-eastern Australia's Great Dividing Range, including Kosciuszko National Park (Donnellan *et al.* 2002; Robertson and Coventry 2019; Figure 7.12). Despite the species being present within the Snowy 2 disturbance footprint, including the Tantangara works area, it was overlooked as its listing was in review at the time. Our team leads the recovery program for the Mountain Skink, and despite raising the failure of initial assessments to account for the species, no allowances were made. Of course, our team understood the status of the Mountain Skink, the risks this and simultaneous disturbances (e.g. logging, extensive bushfires etc.) posed to the species' persistence, and that state, federal and global listing as Endangered were a formality (Atkins and Clemann 2023; Amor *et al.* 2025). The lack of deep herpetological knowledge of KNP during the initial assessment process has undoubtedly compromised conservation outcomes for the Mountain Skink. However, as new information arises, and the species status is recognised, there is now support from government (ACT Parks, NSW NPWS) and community groups (e.g. Wombat Forestcare) to ensure Mountain Skink populations are protected (Atkins and Clemann 2023b; Atkins and Clancy 2024; Amor *et al.* 2025). Gaining further understanding of Mountain Skink in Kosciuszko National Park remains a high conservation priority (Atkins and Clemann 2023b; Atkins *et al.* unpub. data).

Mountain Skink were known to occur in the Tantangara works area pre-construction, as well as the Long Plain region outside of the disturbance footprint, mirroring the impact and control regions for the current Snowy 2 ASOS monitoring program. We recommend that Mountain Skink be included in future monitoring works. While we do not have year 1-5 data like other monitoring programs, understanding the status of a known Mountain Skink population within a disturbed works area will provide insights into the species' susceptibility to disturbance. Additionally, ecological and genetic data collected from extant populations will improve our understanding of the Mountain Skink; valuable information as we continue to build a robust conservation program for this threatened lizard. Because of our existing range-wide survey, monitoring, and genetic analyses of Mountain Skink, we are in a position to immediately interpret survey and monitoring data from Snowy 2 in the context of the species' wider distribution, genetic health, and population trends.



Figure 7.12: Adult Mountain Skink (*Liopholis montana*) photographed in Wombat State Forest, Victoria. Photo by Z. Atkins.

Similarly, the Alpine Water Skink (*Eulamprus kosciuskoi*; AWS), recently listed as nationally Endangered, also occurs within both control and impact regions of Snowy 2.0. This lizard occupies sphagnum bogs and adjacent wet heath and habitats in disjunct regions of the mainland Australia Alps (Robertson and Coventry 2019; Figure 13). Given its specialisation to alpine bogs, the AWS habitat is subject to significant degradation from introduced herbivores, including feral horses, pigs and deer (Robertson and Coventry 2019; Z. Atkins pers. obs). These threats, coupled with increased drought and fire associated with climate change and human development, are threatening the persistence of this alpine endemic lizard. Our long-term alpine reptile program has identified many areas where AWS and ASOS are sympatric, and AWS can be detected using the same tile grid survey method, as well as active searching. Better understanding AWS distribution and status across their range is a current conservation priority (e.g. Victoria: Zoos Victoria and Snowline Ecology, ACT: Snowline Ecology). Collecting additional species data in KNP will complement this research (and that planned by NSW NPWS) aimed at preserving this species.



Figure 7.13: Adult Alpine Water Skink (*Eulamprus kosciuskoi*) photographed on the Bogong High Plains, Victoria. Photo by Z. Atkins.

8. Feral Monitoring

8.1 Occupancy Monitoring - Survey Location Maps

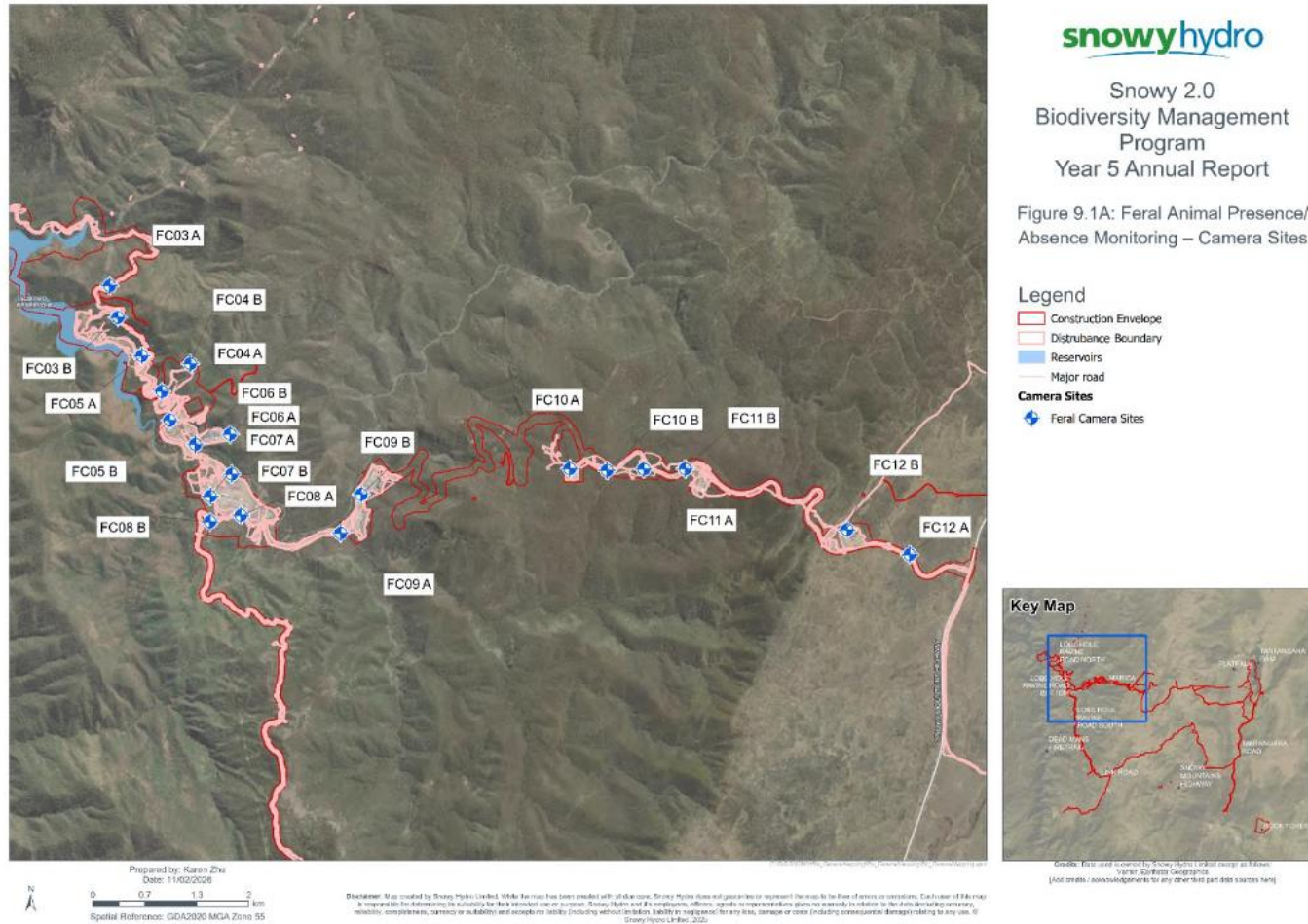


Figure 8.1: Camera sites for feral presence/absence monitoring – Lobs Hole and Marica.



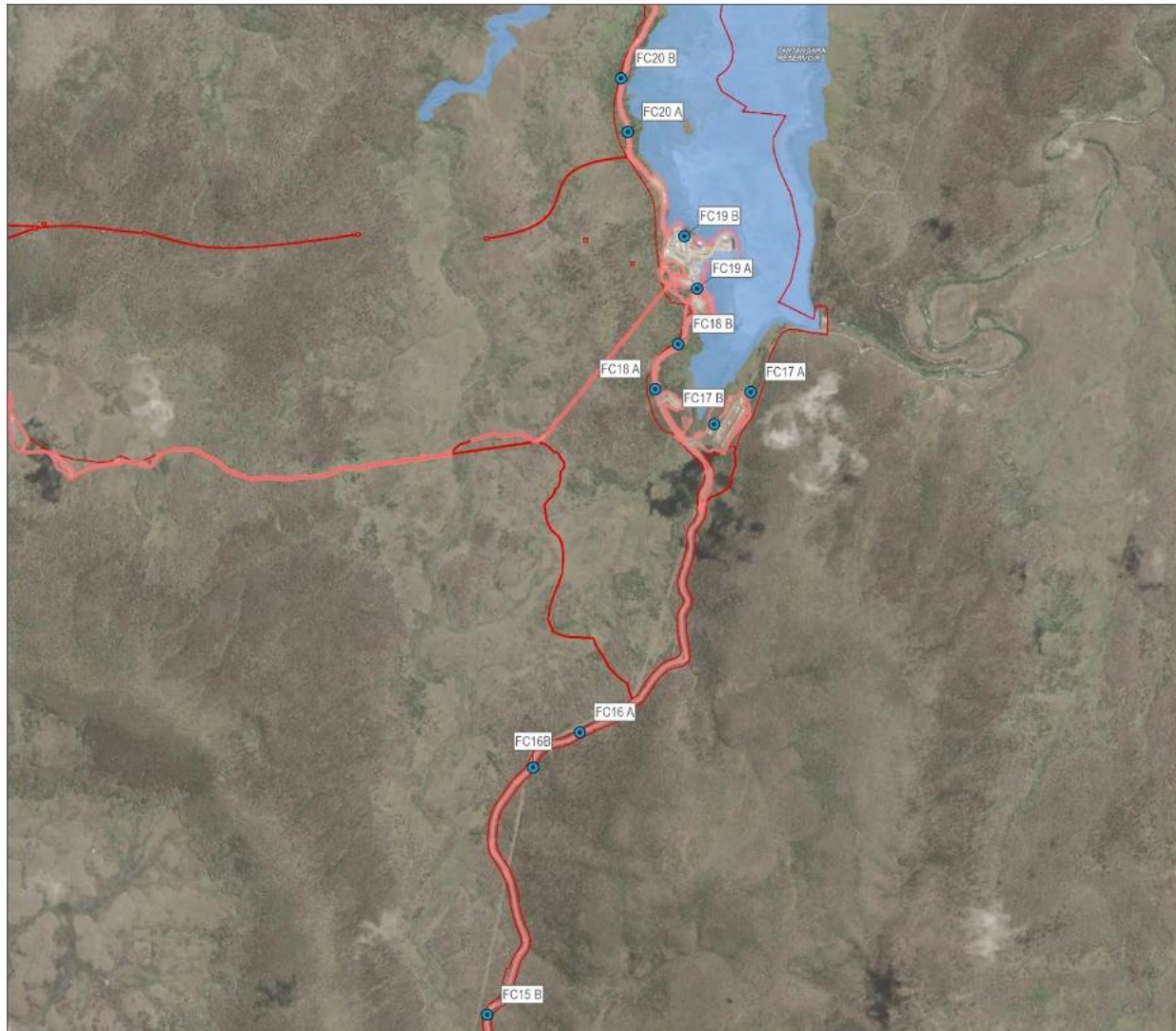
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Figure 9.1B: Feral Animal Presence/
 Absence Monitoring – Camera Sites

- Legend
- Disturbance Boundary
 - Construction Envelope
 - Reservoirs
 - Feral Camera Sites



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Prepared by: Karen Zhu
 Date: 17/02/2026
 Spatial Reference: GDA2020 MGA Zone 55

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Figure 8.2: Camera sites for feral presence/absence monitoring – Tantangara.



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Figure 9.1C: Feral Animal Presence/
 Absence Monitoring – Camera Sites

- Legend**
- Construction Envelope
 - Disturbance Boundary
 - Major road
 - Camera Sites**
 - + Feral Camera Sites



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Figure 8.3: Camera sites for feral presence/absence monitoring – Tantangara and Rock Forest.

8.1.1. Objective

The objective of feral animal monitoring is to determine presence/absence of feral animals within proximity to the project for control.

8.1.2. Methodology

Feral animal occupancy was monitored using targeted remote camera traps, as described in the BMPg (Revision G). Cameras were placed, un-baited, at locations adjacent to key project infrastructure areas and roads and within Smoky Mouse habitat (Figure 8.1-8.3). Cameras were set for four monitoring events per year, with each event comprising a 30-day minimum deployment of all cameras. Camera traps established for small mammal monitoring were also utilised to inform feral presence. For more information refer to the BMPg. Due to changes in the monitoring schedule, as mentioned in Section 2.1, the results in the feral monitoring chapter are inclusive of data previously present in the Year 4 Annual Report, specifically from Q3 and Q4 of the 2023/2024 monitoring period.

8.1.3. Results

During Year 5, 34 targeted feral animal cameras were deployed across 19 sites. Typically, two camera replicates were installed at each site; however, some sites had fewer cameras due to various factors, which are discussed in Section 8.3.

Feral animal detections were widespread across the camera sites during Year 5 consisting of eight feral species, these results are summarised in 8.1, detailed results can be found in Appendix 6(a).

Across the 19 monitored sites, red foxes and wild dogs were the most widespread species, each being recorded at 47.4% of sites. Deer were also commonly detected, occurring at 42.1% of sites, followed by feral horses, which were present at 36.8% of locations. European rabbits were observed at 26.3% of sites, while feral cats were recorded at 21.1%. In contrast, European hares and feral pigs were detected only rarely, each occurring at 5.3% of sites. The number of monitoring sites where each feral species was recorded is displayed in 8.4.

Feral animal detections varied across the project area, with each region showing a different mix of species:

- **Lobs Hole Ravine Road:** Seven feral camera sites (FC03-FC09) recorded six feral species including red fox, deer, wild dog, feral pig, feral cat and rabbit. One site (FC08) did not detect any feral species.
- **Marica:** Three feral camera sites (FC10-FC12) recorded feral horse, red fox, deer and wild dog. One site (FC11) did not detect any feral species.
- **Tantangara:** Eight feral camera sites (FC13–FC20) showed the highest diversity of invasive species, detecting feral cat, rabbit, feral horse, red fox, deer and wild dog. Feral horse and wild dog were detected in all but one monitoring event at this location.
- **Rock forest:** One camera site (FC21) recorded two species, European rabbit and hare.

Opportunistic records from the small mammal cameras detected notably more feral cats than the dedicated feral camera traps. Feral cats were recorded at 21 small mammal camera sites, compared with detections at only four of the feral camera sites. Similarly, red foxes were recorded frequently across the monitoring events at 24 of the small mammal sites. Both predator species were recorded at SM12 on Dead Mans Fire Trail which is a control site, where Smoky Mouse were also detected in Year 5. However, neither predator was recorded at SM09, another Smoky Mouse site along the same trail. Opportunistic feral animal records are summarised in Table 8-2.2.

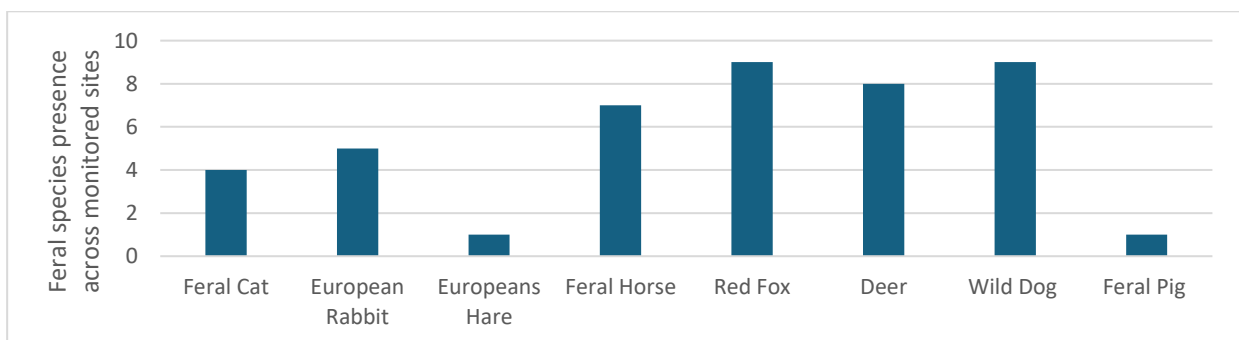


Figure 8.4: Number of monitoring sites where each feral species was recorded during Year 5

Table 8-1: Feral animal occupancy - camera trap presence Year 5

| Site Name | Location | Feral Cat | | | | European Rabbit | | | | European Hare | | | | Feral Horse | | | | Red Fox | | | | Deer* | | | | Wild Dog | | | | Feral Pig | | | |
|-----------|----------------|-----------|----|----|----|-----------------|----|----|----|---------------|----|----|----|-------------|----|----|----|---------|----|----|----|-------|----|----|----|----------|----|----|----|-----------|----|----|----|
| | | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| FC03 | LHRR North | | | | | | | | | | | | | | | | | 1 | | | | | | | | 1 | | | | | | | |
| FC04 | LHRR North | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | | | 1 | |
| FC05 | LHRR Bottom | 1 | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | |
| FC06 | LHRR Bottom | | | | | 1 | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| FC07 | LHRR Bottom | | | | | 1 | | | | | | | | | | | | 1 | 1 | 1 | | 1 | | | | | | | | | | | |
| FC08 | LHRR Bottom | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FC09 | LHRR Bottom | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | |
| FC10 | Marica | | | | | | | | | | | | | | | | | 1 | | | | | | 1 | | 1 | | | | | | | |
| FC11 | Marica | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FC12 | Marica | | | | | | | | | 1 | 1 | 1 | 1 | | | | | | | 1 | | | | | | | | 1 | 1 | | | | |
| FC13 | Tantangara Rd | 1 | 1 | | | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | |
| FC14 | Tantangara Rd | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | | | | |
| FC15 | Tantangara Rd | | | | | | | | | 1 | 1 | | 1 | | | | | 1 | | | | | | | | 1 | 1 | | 1 | | | | |
| FC16 | Tantangara Rd | | | | | | | | | 1 | 1 | | | | | | | 1 | | | | | | | | 1 | 1 | | | | | | |
| FC17 | Tantangara Rd | 1 | | | | 1 | | | | | 1 | | 1 | | | | | | | | | | | 1 | | | | | 1 | | | | |
| FC18 | Tantangara Dam | | | | | | | | | 1 | 1 | | 1 | | | | | | | | | | | 1 | | 1 | | | | | | | |
| FC19 | Tantangara Dam | 1 | | | | | | | 1 | | | | | 1 | 1 | | 1 | | | | | 1 | | | | | | | | | | | |
| FC20 | Tantangara Dam | | | | | | | | | 1 | 1 | | 1 | | | | | | | | | 1 | | | | | 1 | | | | | | |
| FC21 | Rock Forest | | | | | 1 | 1 | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |

Notes:

*Deer includes all deer species recorded during monitoring.

Highlighted cells in light grey represent sites in proximity to Smokey Mouse habitat.

Blank cells represent no detection of species or missing data.

Table 8-2: Opportunistic feral animal occupancy – camera trap presence Year 5

| Site Name | Location | Feral Cat | | | | European Rabbit | | | | European Hare | | | | Feral Horse | | | | Red Fox | | | | Deer* | | | | Wild Dog | | | | Feral Pig | | | | |
|-----------|--------------------------|-----------|----|----|----|-----------------|----|----|----|---------------|----|----|----|-------------|----|----|----|---------|----|----|----|-------|----|----|----|----------|----|----|----|-----------|----|----|----|--|
| | | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | |
| SM01 | Ravine Road Gatehouse | 1 | 1 | | | | | | | | | | | | | | | 1 | 1 | | | | | 1 | | | | 1 | | | | | | |
| SM02 | Ravine Road Gatehouse | | | 1 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | |
| SM03 | Ravine Road Gatehouse | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SM04 | Ravine Road | 1 | 1 | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | |
| SM05 | Ravine Road | | | 1 | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | |
| SM06 | Dead Mans Fire Trail | | 1 | 1 | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | |
| SM07 | Ravine Road | 1 | | 1 | | | | | | | | | | 1 | | | | 1 | | 1 | 1 | | | | | | | | | | | | | |
| SM09^ | Dead Mans Fire Trail | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SM10 | Ravine Road | 1 | 1 | | | | | 1 | | | | | | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | |
| SM12^ | Dead Mans Fire Trail | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | | | | | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | |
| SM13 | Dead Mans Fire Trail | 1 | | | | | | 1 | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | |
| SM14 | Ravine Road | 1 | | | | | | | | | | | | 1 | 1 | | 1 | | | | | | | 1 | | | | | | | | | | |
| SM15 | Ravine Road | | | | | | | 1 | | | | | | | | 1 | | | | 1 | 1 | | | | | | | | | | | | | |
| SM16 | Ravine Road | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | 1 | | | | | | |
| SM19 | Lobs Hole Main Camp | | | 1 | | | | | | | | | | 1 | 1 | | 1 | | | 1 | 1 | | | | | | | | | | | | | |
| SM20 | Lobs Hole ECVT | 1 | | 1 | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | |
| SM21 | Marica HDD | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SM22 | Marica | 1 | 1 | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | |
| SM23 | Marica | 1 | 1 | | 1 | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | |
| SM24 | Marica Surge Shaft | 1 | | | | | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | | | | | | | |
| SM25 | Marica | | | | | | | | | | | | | 1 | | | | 1 | | | | | | 1 | | | | | | | | | | |
| SM26 | Marica | | | 1 | | | | | | | | | | | | 1 | 1 | | | | | | | 1 | 1 | | | | 1 | | | | | |
| SM27 | Marica | 1 | | | | | | | | | | | 1 | 1 | | 1 | | | | 1 | | | | | | | | | | | | | | |
| SM28 | Bullocks Hill Fire Trail | | | | | | | | | | | | 1 | | | | | | | | 1 | | | | | | | | | | | | | |
| SM29 | Bullocks Hill Fire Trail | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SM30 | Bullocks Hill Fire Trail | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Site Name | Location | Feral Cat | | | | European Rabbit | | | | European Hare | | | | Feral Horse | | | | Red Fox | | | | Deer* | | | | Wild Dog | | | | Feral Pig | | | |
|-----------|--------------------------|-----------|----|----|----|-----------------|----|----|----|---------------|----|----|----|-------------|----|----|----|---------|----|----|----|-------|----|----|----|----------|----|----|----|-----------|----|----|----|
| | | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| SM31 | Bullocks Hill Fire Trail | | | | | | | | | | | | | 1 | | | | | | | | | | | | 1 | | | | | | | |
| SM34 | Tantangara | | | | | 1 | | | 1 | | | | | 1 | 1 | | 1 | 1 | 1 | | 1 | 1 | | | | | | | | | | | |
| SM35 | Alpine Creek Fire Trail | | | | | | | | | | | | | 1 | | | | 1 | 1 | | | | | | | | | | | 1 | | | |
| SM36 | Nungar Creek | | | | | 1 | | | | | | | | 1 | | | 1 | 1 | | | | | | | | | | | | | | | |
| SM38 | Snowy Mountains Hwy | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| SM39 | Tantangara Road | | | 1 | | | | 1 | | | | | | | | | | | | | 1 | | | | | 1 | | | | 1 | | | |
| SM40 | Ravine Road | | | | 1 | | | | | | | | | | | | | | | | 1 | | | | 1 | | | | | | | | |
| SM41 | Link Road | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |

Notes:

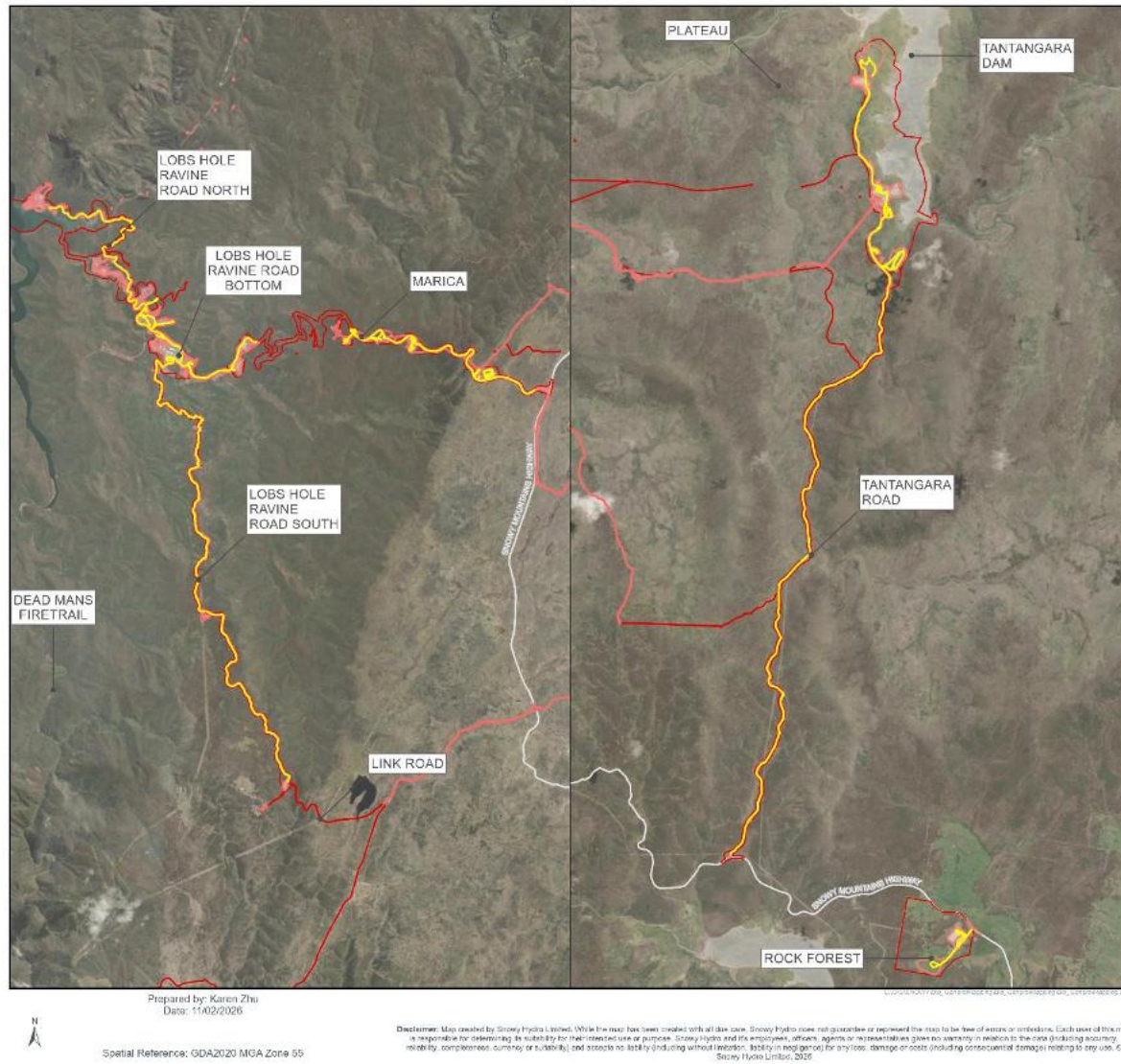
*Deer includes all deer species recorded during monitoring.

Cells highlighted in light grey indicate sites where both threatened small mammals and feral predators were recorded in Year 5.

^ Indicates sites where Smoky Mouse, specifically, were recorded in Year 5.

Blank cells represent no detection of species or missing data.

8.2 Feral Abundance Monitoring – Survey Location map



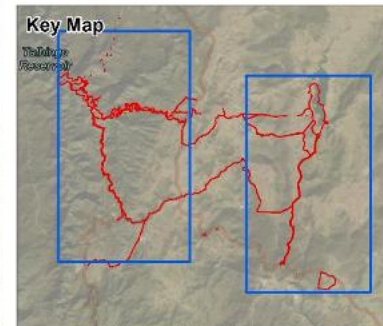
snowyhydro

Snowy 2.0 Biodiversity Management Program Year 5 Annual Report

Figure 9.2 - Feral Animal Abundance Monitoring – Spotlighting Transects

Legend

- ▭ Construction Envelope
- ▭ Disturbance Boundary
- ▭ Feral Abundance Year 5 GPS Tracks
- ▭ Major road



Created: Data used is owned by Snowy Hydro. Snowy Hydro is the owner.
 Contributor: Geographers. Sources: Esri, TomTom, Garmin, FMO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community.
 (Additional / Acknowledgements for any other data providers here)

Figure 8.5: Spotlighting survey transects.

8.2.1. Objective

The objective of the feral animal abundance monitoring is to determine feral animal abundance within proximity to the project for control.

8.2.2. Methodology

Feral animal abundance was monitored using Vehicle-based Spotlight Transects, as described in the BMPg (Rev G). Abundance monitoring was undertaken at seven sites across Snowy 2.0: Lobs Hole Ravine Road Bottom; Lobs Hole Ravine Road North; Lobs Hole Ravine Road South; Marica; Rock Forest; Tantangara Dam; Tantangara Road. These areas have been predefined in previous monitoring years. Surveys comprised four separate monitoring events within each monitoring year, one in each season. Due to changes in the monitoring schedule, as mentioned in Section 2.1, this the chapter is inclusive of data previously presented in the Year 4 Annual Report specifically from Q3 and Q4 of the 2023/2024 monitoring period.

After completion of each monitoring event, the raw data is used to calculate a Simple Index of Abundance as described in the BMPg (rev G). Whereby the sum of animals is divided by the transect length (animals/km) for each species at each survey site. The Year 5 Feral spotlighting transect tracks are displayed in Figure 8.5. For more information refer to the BMPg.

8.2.3. Results

In Year 5, all monitoring sites were surveyed across the four monitoring periods, excluding Lobs Hole Ravine Road North in Q3 due to access issues. A total of nine feral animal species were recorded during Year 5 spotlighting surveys. Feral species presence and abundance for each monitoring event and survey site are summarised in 8.3 and displayed in Figure 8.68.6, detailed results can be found in Appendix 6(b).

In Year 5, the overall feral abundance indices were highest at Tantangara Dam (5.1 animals/km) and Rock Forest (5.0 animals/km) transect sites. In contrast, the lowest total abundance was recorded at Lobs Hole Ravine Road South (0.1 animals/km) followed by Tantangara Road and Lobs Hole Ravine Road Bottom (both 0.3 animals/km).

Rabbit was the most abundant species, accounting for almost half of all observations in Year 5. The highest concentrations of Rabbit were recorded at Rock Forest (4.97 animals/km) and Tantangara Dam (3.00 animals/km). The second and third most abundant species were Feral Horse and Sambar Deer, respectively. Highest Feral Horse abundance was recorded at Tantangara Dam (1.99 animals/km) and Marica (1.67 animals/km). Sambar Deer's highest annual abundance was recorded at Lobs Hole Ravine Road North (0.64 animals/km).

Feral predators such as the Red Fox and Feral cat were recorded in low abundances in Year 5. Specifically, the Red Fox was recorded twice at Lobs Hole Ravine Road Bottom and twice at Lobs Hole Ravine Road South in Year 5. While the Feral Cat was recorded once at Tantangara Dam during the Year 5 period.

Overall, the five-year abundance monitoring data displays noticeable inter-annual variation in abundance of feral animals across the seven survey sites (Figure 8.7). Rock Forest and Tantangara Dam are consistently identified as the sites with the highest overall abundance rates throughout the years. The three Lobs Hole Ravine Road sites and Tantangara Road show consistently low abundance rates, generally remaining below 1.0 animal/km across all five years.

Table 8-3: Number of individuals and abundance per km recorded within each monitoring sites

| Species | LHRR Bottom individuals (abundance) | LHRR North individuals (abundance) | LHRR South individuals (abundance) | Marica individuals (abundance) | Rock Forest individuals (abundance) | Tantangara Dam individuals (abundance) | Tantangara Road individuals (abundance) |
|---|-------------------------------------|------------------------------------|------------------------------------|--------------------------------|-------------------------------------|--|---|
| First Monitoring Event - Q1 - Winter (June 2024) (EMM) | | | | | | | |
| Distance (km) | 11.07 | 2.2 | 14.28 | 11.79 | 1.53 | 14.87 | 15.36 |
| Red Fox | 1 (0.1) | 0 | 0 | 0 | 0 | 0 | 0 |
| Sambar Deer | 0 | 0 | 0 | 0 | 0 | 2 (0.1) | 0 |
| Feral Horse | 0 | 0 | 0 | 55 (4.7) | 0 | 15 (1.0) | 0 |

| Species | LHRR Bottom individuals (abundance) | LHRR North individuals (abundance) | LHRR South individuals (abundance) | Marica individuals (abundance) | Rock Forest individuals (abundance) | Tantangara Dam individuals (abundance) | Tantangara Road individuals (abundance) |
|---|-------------------------------------|------------------------------------|------------------------------------|--------------------------------|-------------------------------------|--|---|
| Rusa Deer | 1 (0.1) | 0 | 0 | 0 | 0 | 1 (0.1) | 0 |
| European Hare | 0 | 0 | 0 | 0 | 0 | 0 | 2 (0.1) |
| Rabbit | 4 (0.4) | 0 | 0 | 0 | 8 (5.2) | 47 (3.2) | 3 (0.2) |
| Second Monitoring Event - Q2 - Spring (September 2024) (EMM) | | | | | | | |
| Distance (km) | 11.32 | 3.16 | 13.54 | 14.56 | 1.59 | 13.55 | 15.79 |
| Sambar Deer | 0 | 5 (1.6) | 0 | 0 | 0 | 0 | 0 |
| Feral Horse | 0 | 0 | 0 | 0 | 0 | 81 (6.0) | 0 |
| European Hare | 0 | 0 | 0 | 0 | 0 | 0 | 3 (0.2) |
| Rabbit | 0 | 2 (0.6) | 1 (0.1) | 4 (0.3) | 14 (8.8) | 76 (5.6) | 5 (0.3) |
| Third Monitoring Event - Q3 - Summer (February 2025) (SHL) | | | | | | | |
| Distance (km) | 10.46 | N/A | 14.81 | 10.92 | 3.31 | 9.99 | 15.69 |
| Red Fox | 1(0.1) | N/A | 2(0.1) | 0 | 0 | 0 | 0 |
| Wild Dog | 0 | | 0 | 0 | 0 | 1(0.1) | 0 |
| Red Deer | 0 | | 1(0.1) | 0 | 0 | 0 | 0 |
| Feral Horse | 0 | | 0 | 4(0.4) | 0 | 0 | 0 |
| Rabbit | 4(0.4) | | 0 | 3(0.3) | 11(3.3) | 9(0.9) | 4(0.3) |
| Fourth Monitoring Event - Q4 - Autumn (May 2025) (SHL) | | | | | | | |
| Distance (km) | 11.49 | 7.1 | 14.78 | 9.35 | 1.42 | 10.94 | 15.63 |
| Feral Cat | 0 | 0 | 0 | 0 | 0 | 1(0.1) | 0 |
| Wild Dog | 0 | 0 | 0 | 0 | 0 | 1(0.1) | 0 |
| Red Deer | 2(0.2) | 0 | 3(0.2) | 0 | 0 | 0 | 0 |
| Sambar Deer | 0 | 3(0.4) | 0 | 0 | 0 | 0 | 0 |
| Feral Horse | 0 | 0 | 0 | 19(2.0) | 0 | 2(0.2) | 0 |
| Rabbit | 2(0.2) | 0 | 0 | 0 | 6(4.22) | 16(1.5) | 3(0.2) |
| Total Year 5 Distance Surveyed (km) | 44.34 | 12.46 | 57.41 | 46.62 | 7.85 | 49.35 | 62.47 |
| Total Year 5 Individuals (abundance) | 15(0.3) | 10(0.8) | 7(0.1) | 85(1.8) | 39(5.0) | 252(5.1) | 20(0.3) |

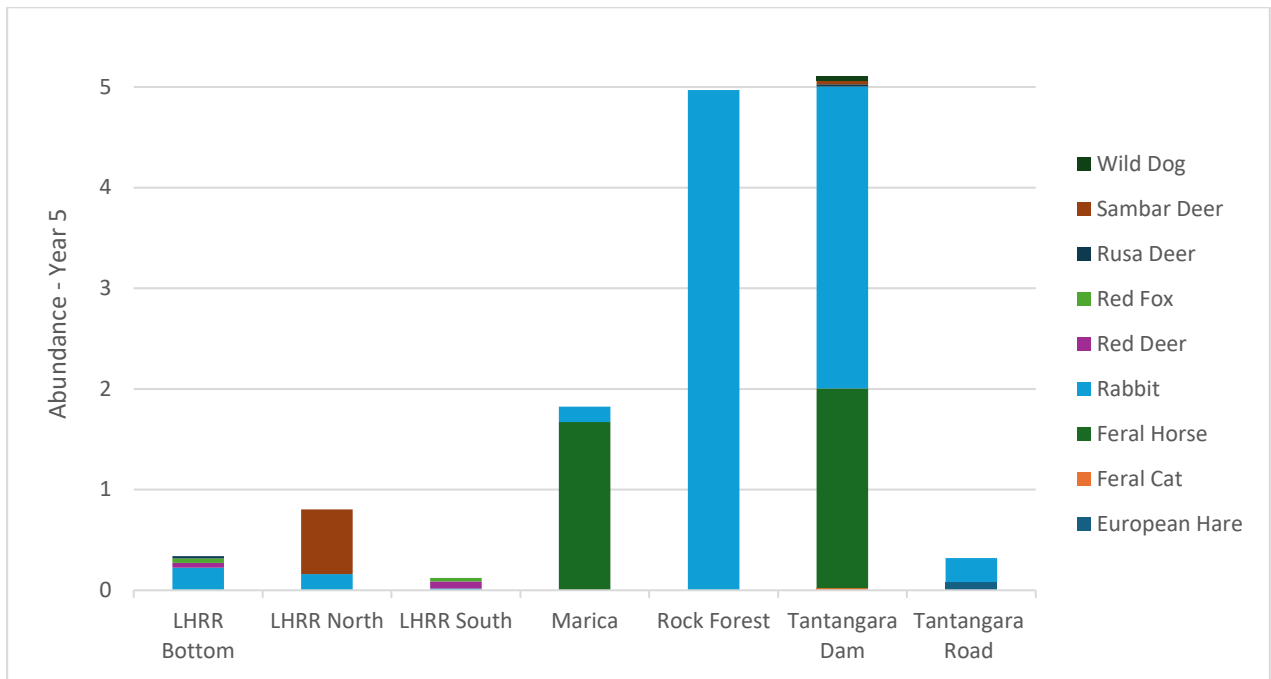


Figure 8.6: Abundance of feral animals recorded per km at each survey site during Year 5

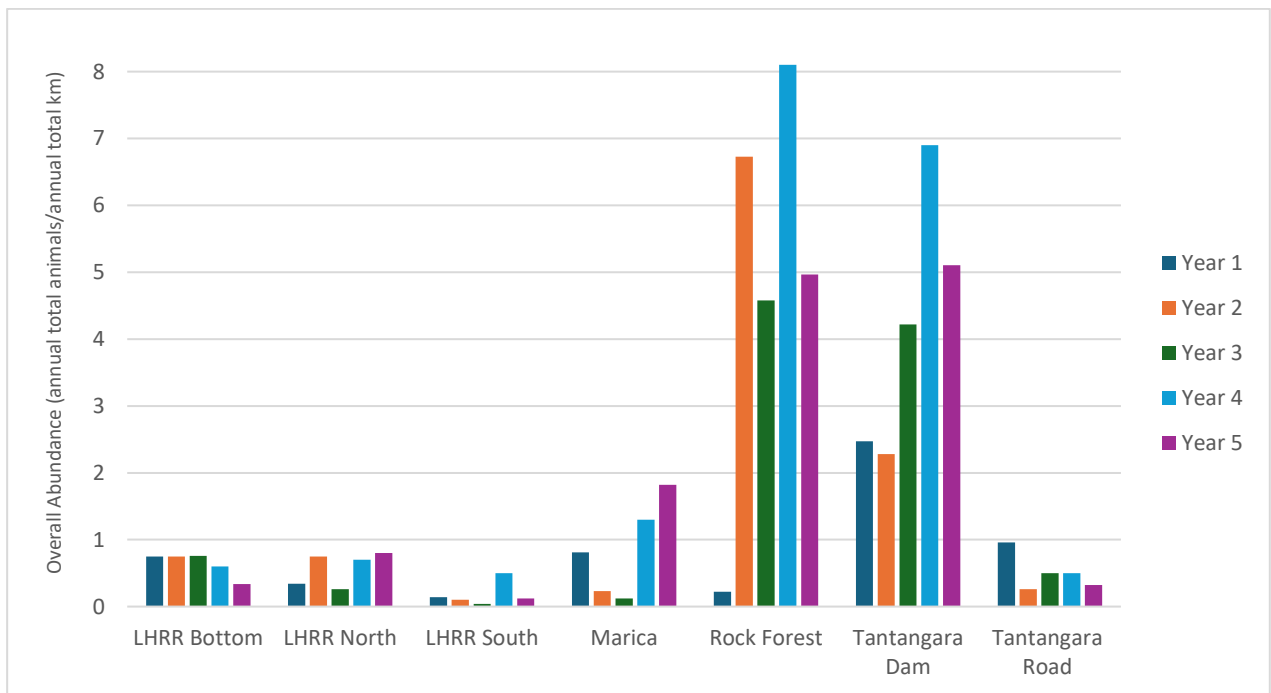


Figure 8.7: Comparison of feral animal abundance (annual total animals/annual total km) across monitoring sites: Year 1 to Year 5

8.3 Feral Monitoring Discussion

Review of feral animal occupancy and abundance monitoring data for Years 4 and 5 indicates that feral animal presence across the project area has generally remained stable, with some evidence of minor localised improvement. Occupancy monitoring identified no increase in the distribution of any feral species between years, with several species, including feral cat, red fox and European hare, recorded at fewer monitoring sites in Year 5. Occupancy of wild dogs, deer and rabbits remained broadly consistent across both years. Abundance monitoring results are consistent with the occupancy findings. Spotlighting indices indicate stable to declining abundance at most monitoring transects, including historically higher-abundance sites such as Rock Forest and Tantangara Dam. Monitoring sites with consistently low abundance, including the Lobs Hole Ravine Road sites and Tantangara Road, remained below 1.0 animal/km in both years. A localised increase in abundance at Marica, primarily associated with feral horse detections.

Feral cats and foxes were recorded at three fewer feral camera sites between Year 4 and Year 5. However, this decline does not necessarily indicate reduced presence the project, as feral cats, and to a lesser extent red foxes, were detected far more frequently on small mammal cameras than on the targeted feral camera network. This pattern suggests that feral predators may be more active within small mammal habitat than around infrastructure focused camera locations and is the opposite of what is typically expected, where increased human activity and infrastructure tend to be associated with higher feral predator presence. It may also indicate that the present location of dedicated 'feral' cameras may need to be reviewed for adequacy.

Feral predators (feral cat and red fox) were detected at SM12 (Dead Mans Fire Trail – control site), a confirmed Smoky Mouse site, reinforcing the ongoing risk to threatened small mammal species. In contrast, no predators were recorded at SM09, another Smoky Mouse site along the same trail, indicating spatial variability in predator activity. Consistent with this pattern, feral cats and red foxes were also recorded near Smoky Mouse habitat in Years 3 and 4. Across the project, fifteen small mammal camera sites recorded both feral predators and a threatened small mammal species (EPP/BTR). Although spotlighting results suggest low overall predator abundance across the Project, feral cats are known to be difficult to survey reliably due to their elusive behaviour (Stokeld, et al., 2015), likely contributing to an under representation in abundance estimates. These results highlight the ongoing threat feral predators pose to small mammal species across the project area.

Predation by feral cats and red foxes is listed as a key threatening process under the EPBC Act (DCCEE, 2024; DCCEE, 2008) and is an ongoing issue within the Kosciuszko National Park region (NSW NPWS, 2024). Effective control of feral predators within small mammal habitat is inherently difficult, and the challenge is compounded when surrounding landholders do not undertake concurrent feral animal management. This increases the likelihood of ongoing recolonisation from neighbouring areas. However, management efforts within more accessible, urbanised project areas, where control measures are easier to implement, should therefore focus on reducing the movement of predatory species into surrounding habitat. Reducing predator access to these areas will help alleviate pressure on vulnerable species and support the broader protection and recovery of small mammal populations (AWC, 2025)

European rabbits were infrequently detected on feral camera traps in Year 4 and Year 5, yet they remain the most abundant species recorded during spotlighting across the five years of monitoring. Rock Forest and Tantangara Dam consistently show the highest concentrations of rabbits, likely due to favourable habitat conditions. At Rock Forest in particular, storage and logistics activities create open, disturbed spaces and structural refuges that provide suitable foraging areas and shelter. However, the landholder of this site has declined to allow SHL or FGJV to engage in feral control at the property, preferring to undertake this responsibility themselves.

Feral horses remain another consistently detected and locally abundant species in the Project area. In Year 4 and Year 5, the Tantangara region showed the highest and most consistent activity horses as they were detected in nearly every monitoring event at these sites. Spotlighting results support this pattern, with horses recorded as the second most abundant feral species, particularly at Tantangara Dam and Marica. Feral horses are another ongoing challenge within Kosciuszko National Park and are known to cause damage to the fragile environments within the Park (NPWS Wild Horse Team, 2024). A population survey undertaken in 2023 estimated between 12,797 to 21,760 wild horses in the park, by law, the NPWS must reduce the population to 3,000 wild horses by June 2027 (NPWS Wild Horse Team, 2024).

There are several limitations to the Year 5 feral abundance and occupancy data. Abundance monitoring at Ravine Road North could not be completed in Q3 due to restricted access requirements. Additionally, some feral cameras were inactive during some monitoring events across the year due to various issues such as theft, safety-related access issues, high traffic interference, workforce interference, or hardware faults. Reduced camera coverage

during some monitoring periods may have resulted in limited detection rates and reduced the completeness of species records at affected sites.

8.4 Triggers for Adaptive Management

The current trigger for adaptive management relating to feral animal occupancy and abundance is defined as:

- Sighting of feral animals within proximity to known Smoky Mouse habitat or project infrastructure.

Feral animals have been detected in proximity to both Smoky Mouse habitat and project infrastructure at all monitored sites, with the exception of FC08 and FC11. Accordingly, adaptive management requirements have been triggered at these locations. In accordance with the BMP, any feral animal detection initiates the implementation of control measures consistent with the Weed, Pest and Pathogen Management Plan (Appendix F). It is noted that this trigger is quite sensitive given the Project's location within a National Park. It would be better phrased to only include those feral animals that are under the Project's direct control (being foxes, cats, and rabbits).

Adaptive management actions should prioritise feral predators, particularly feral cats and red foxes, where detections occur within or adjacent to small mammal habitat, given the elevated risk these species pose to threatened fauna. It is noted that, within leased land, the Project is authorised to control only cats, foxes, and rabbits.

The landholder at Rock Forest has confirmed that they would prefer to undertake control activities on the property themselves, as they are experienced and licenced and presently maintain the rest of the property. Therefore, as effective feral animal management cannot be implemented at this location, continued monitoring does not provide a meaningful adaptive management outcome. It is suggested that Rock Forest be removed from the feral animal monitoring program, including both camera trapping and spotlighting surveys.

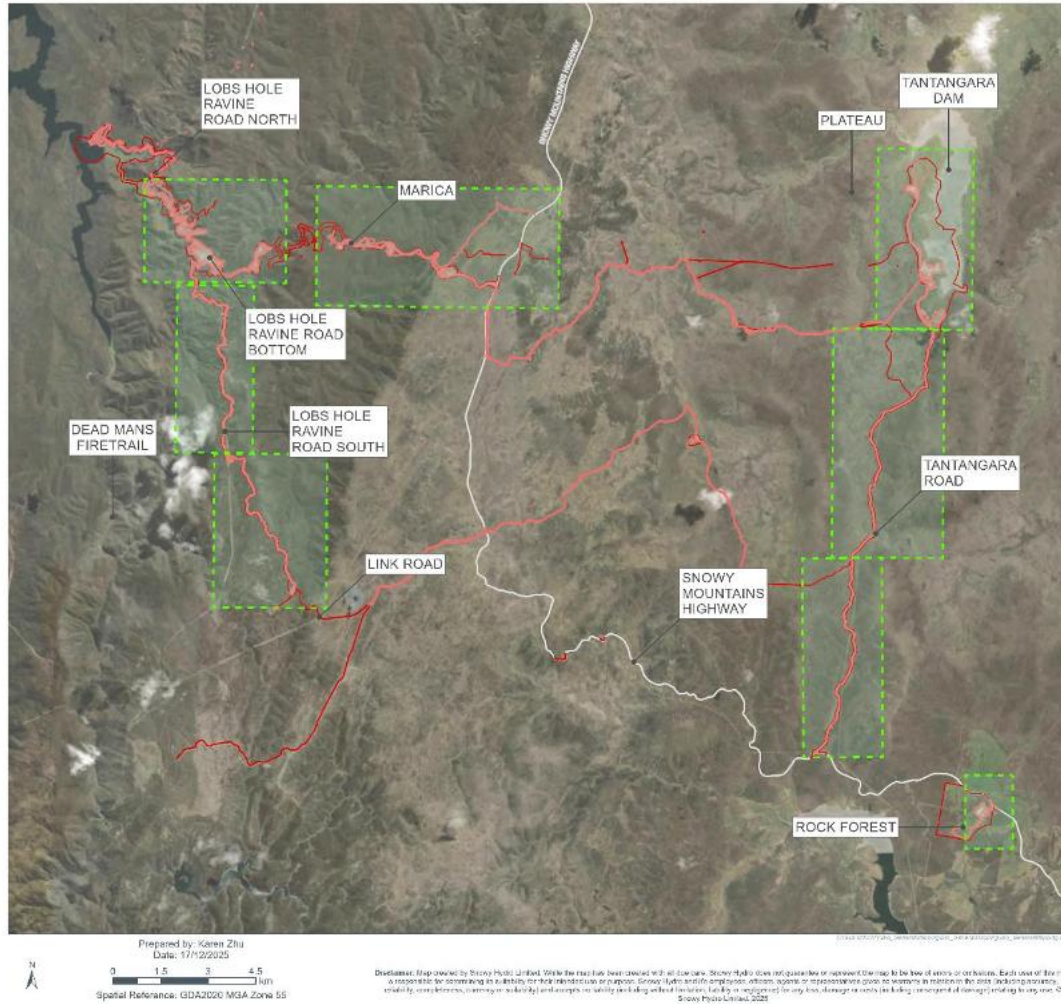
8.5 Recommendations

It is recommended that the adaptive management trigger be refined to explicitly apply to these target species. In addition, the current reference to "known Smoky Mouse habitat" is overly broad, as extensive areas of the surrounding national park—particularly in the Marica and Lobs Hole areas—constitute known habitat. As a result, the trigger is effectively perpetually activated and does not provide a meaningful or actionable threshold. Refinement of this trigger to a more spatially or operationally relevant definition is recommended to ensure it supports effective and proportionate management responses.

It is further recommended that monitoring and adaptive management efforts focus on species within SHL's operational capacity to manage, specifically feral cats, red foxes, and European rabbits. These species represent the greatest manageable risk to local biodiversity and are amenable to targeted, site-based control consistent with the BMP. In contrast, species such as feral horses, wild dogs, and deer are subject to broader, landscape-scale management programs and fall outside SHL's direct operational control. While detections of these species should continue to be recorded to inform regional context, performance assessment and adaptive management should prioritise species for which effective control can be implemented.

9. Weed Monitoring

9.1 Management zones



Snowy 2.0 Biodiversity Management Program Year 5 Annual Report

Figure 15.1 - Weed Management Zones

- Legend**
- Disturbance Boundary
 - Construction Envelope
 - Weed Management Zones
 - Major road



Credits: Data used to create this Snowy Hydro Limited report follows:
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Figure 9.1: Weed management zones Snowy 2.0

9.2 Objective

The objective of the weed presence/absence monitoring is to determine presence/absence and abundance of priority weeds within proximity of the project (roads and key project infrastructure) for routine control in accordance with the Weed, Pest and Pathogen Management Plan (Appendix F of the BMPg).

9.3 Methodology

Weed mapping was undertaken within the Weed Management Zones (Figure 9-1) at selected locations adjacent to project access roads, key infrastructure areas, and threatened flora monitoring sites, generally within a 50 m buffer of disturbance. Priority weed species were recorded in accordance with BMPg (Rev G Appendix F).

Year 4 weed surveys were completed using on-ground surveys recorded with GPS using polygons and qualitative analysis. During Year 4 and Year 5 weed monitoring was undertaken using UAV imagery with machine-assisted species detection. In Year 5, only UAV monitoring was employed. This represents a methodological shift from the on-foot observational surveys undertaken in Years 1-4.

To ensure defensible longitudinal comparison, the 2023 UAV dataset (Year 4 UAV trial) is used as the primary baseline for comparison against the 2024 UAV survey. The 2023 detections have been redistributed by management zone to ensure that spatial allocations align as closely as practicable with 2024 boundaries. Minor residual discrepancies do not materially influence zone-scale interpretation.

Although the two survey methods measure different attributes, a qualitative triangulation of Year 4 outputs was undertaken to confirm directional consistency at the management-zone scale. This step establishes contextual confidence in the UAV dataset as a reliable quantitative continuation of the monitoring program for species within the model detection scope.

Key Methodology Differences

Field-Based Monitoring (Years 1-4)

- Ground-level species identification.
- Presence/absence and anecdotal abundance.
- Survey route and access dependent.
- Density extrapolated from observed patches.
- Species breadth wider than UAV model.
- Absence in record ≠ ecological absence.

UAV + Machine Detection (Years 4-5)

- Wall-to-wall coverage within flown extents.
- Spatially consistent and repeatable.
- Detection limited to model-trained species.
- Quantified outputs (1 detection unit = 3.764 m²).
- Sensitive to lighting, season and capture conditions.
- Non-detection ≠ absence.

The UAV approach provides spatial precision and quantification at the expense of species breadth and ground-level nuance.

Triangulation with Year 4 Foot Monitoring

Although UAV machine detection outputs are not directly comparable to foot-based abundance estimates, a qualitative triangulation was undertaken for Year 4 to assess whether both approaches describe a broadly consistent weed pattern at the management-zone scale.

The triangulation considered:

- Presence of overlapping priority species between datasets
- Whether zones described as supporting dense infestations in the foot survey exhibit elevated UAV detection intensity for the same species

Species Within UAV Detection Model (Year 4)

The following priority species were detected by the UAV model in Year 4 and therefore form the basis of comparison:

- European blackberry (*Rubus fruticosus*)
- Spear thistle (*Cirsium vulgare*)
- Great mullein (*Verbascum thapsus*)
- St John's wort (*Hypericum perforatum*)
- Sweet briar (*Rosa rubiginosa*)
- Oxeye daisy (*Leucanthemum vulgare*)
- Common hawthorn (*Crataegus monogyna*)

Priority Species Recorded in Foot Monitoring but Not Included in UAV Model

The following species were identified in Year 4 foot monitoring but are not included within the current UAV detection model:

- Sweet Vernal Grass (*Anthoxanthum odoratum*)
- Yorkshire Fog (*Holcus lanatus*)
- Browntop Bent (*Agrostis capillaris*)
- Cocksfoot (*Dactylis glomerata*)
- Musk Monkey Flower (*Mimulus moschatus*)

These species of grasses and low-structural herbaceous weeds, are potentially outside the trained detection scope of the UAV model.

9.4 Results

A total of 62515 weed records were recorded for Year 5 across the project, these are detailed in Table 9.1. One of the recorded weed species is a Weeds of National Significance (WoNS), European Blackberry, it is also a declared weed in NSW. Two other recorded species are declared in NSW, St. John's Wort and Sweet Briar.

The highest numbers of records were recorded at Tantangara Dam and Tantangara Road, particularly for Oxeye Daisy, Spear Thistle, and St John's Wort. European Blackberry was recorded in high numbers at Lobs Hole Ravine Road Bottom and Lobs Hole Ravine Road South, with lower records elsewhere. Hawthorn (*Crataegus monogyna*), Sweet Briar, and Great Mullein were recorded at comparatively lower levels and were unevenly distributed across the management zones.

Table 9-1: Number of species records for each management zone

| Scientific Name | Common Name | Management Zone | | | | | |
|-------------------------------|---------------------|-----------------|------------|--------|----------------|-----------------|-------------|
| | | LHRR Bottom | LHRR South | Marica | Tantangara Dam | Tantangara Road | Rock Forest |
| <i>Cirsium vulgare</i> | Spear Thistle | 939 | 437 | 239 | 5264 | 974 | |
| <i>Crataegus monogyna</i> | Hawthorn | 59 | 0 | 1 | 0 | 0 | |
| <i>Hypericum perforatum</i> * | St. John's Wort | 4170 | 1266 | 28 | 2449 | 592 | |
| <i>Leucanthemum vulgare</i> | Oxeye Daisy | 0 | 0 | 15 | 4133 | 9329 | |
| <i>Rosa rubiginosa</i> * | Sweet Briar | 185 | 375 | 2 | 266 | 0 | |
| <i>Rubus fruticosus</i> *^ | European Blackberry | 8519 | 9026 | 491 | 3803 | 14 | |
| <i>Verbascum thapsus</i> | Great Mullein | 767 | 460 | 88 | 419 | 84 | |

Notes: *Species is declared in NSW, ^Species is a WoNS.

Results between monitoring periods and methodologies

Directional agreement is observed for key broadleaf and woody priority weeds, notably:

- European blackberry
- St John’s wort

Zones identified in the Year 4 foot survey as supporting notable infestations (Talbingo/Bottom of Lobs Hole, Ravine Road, Tantangara) also exhibit elevated UAV detection intensity for these species.

Compositional overlap exists in corresponding areas for:

- Spear thistle
- Mullein
- Sweet briar

Zones historically identified as supporting infestations (Talbingo, Ravine Road, Tantangara) exhibit elevated UAV detection intensity for these species. Divergence is expected where foot monitoring emphasises grass-dominated infestations not included in the UAV species set. No contradictory patterns were observed where UAV data indicated absence in zones described as strongly infested for overlapping species.

Methodological Boundary

- Absence in UAV dataset = “not detected by model”.
- UAV outputs represent a quantified subset of priority weeds.
- Detection intensity is an index of detection frequency, not percent cover.

This triangulation provides strong qualitative confidence that the UAV dataset is capturing dominant broadleaf and woody weed patterns evident to field surveyors in Year 4, while recognising the structural limitation of species scope within the machine detection model.

Management Zone Rationalisation

UAV zones were aligned to historical Management Zones as per the following table 9.2.

Table 9-2: Naming convention of management zones. Aligning year 5 with previous years.

| Field Management Zone | UAV Zone |
|----------------------------|--------------------|
| Bottom of Lobs Hole | Talbingo |
| Lobs Hole Ravine Rd Bottom | Ravine Rd |
| Lob Hole Ravine Rd Top | Ravine Rd |
| Marica | Marica |
| Rock Forest | Not flown (Year 5) |
| Tantangara Dam | Tantangara |
| Tantangara Rd Bottom | Tantangara Rd |
| Tantangara Rd Top | Tantangara Rd |

Additional UAV-only zones: Plateau and Ravine Bay (previously not included in the weed monitoring zones of the BMP - Ravine Bay has been included in Year 5 Monitoring). Rock Forest was not flown in Year 5 and is excluded from UAV comparison.

Survey Extent Comparison

Before interpreting detection totals, spatial coverage differences between survey years must be considered. Variations in flown extent directly influence raw detection counts and, if not accounted for, may distort apparent year-to-year change.

Although survey extents are broadly comparable in most zones, notable differences occur at Marica and Talbingo due to deliberate scope adjustments in Year 5. Redistribution aligns historical detections to updated zone boundaries; it does not change the underlying detection geometries. These changes increase the total surveyed area and therefore have the potential to elevate raw detection totals independent of actual density shifts.

To ensure a defensible comparison, spatial extent differences are explicitly identified below and incorporated into subsequent analysis. Table 9.3 depicts area-normalised metrics (detections per hectare) to account for these variations and allow meaningful comparison between years and across management zones. This approach ensures that observed changes reflect relative detection intensity rather than artefacts of expanded or reduced survey footprint.

Table 9-3: Detections per hectare.

| Field Management Zone | Year 4 Area (ha) | Year 5 Area (ha) | % Change |
|-----------------------|------------------|------------------|----------|
| Marica | 88.03 | 126.62 | + 44% |
| Ravine Bay | 68.96 | 86.66 | + 26% |
| Ravine Road | 166.35 | 170.59 | + 3% |
| Talbingo | 117.69 | 175.72 | + 49% |
| Tantangara | 119.51 | 119.51 | 0% |
| Tantangara Road | 185.41 | 192.06 | + 4% |
| Total Area: | 972.42 | 1129.54 | |

Notable extent changes:

- Talbingo and Marica expanded substantially to pick up additional area within the site and also further beyond the site limits.
- Ravine Bay expanded moderately to include the access road.
- Tantangara remained effectively identical.
- Ravine Road and Tantangara Road changed marginally.

All year-to-year comparisons are normalised by area using detection intensity (det/ha).

Detection Density Metric (det/ha) - Explainer

Detection intensity (det/ha) represents the number of machine-detected units per hectare within a management zone. This metric provides a standardised measure that allows comparison between zones and between survey years, independent of differences in survey footprint.

$$\text{Detection Intensity} = \text{Total Aggregated Detections} / \text{Zone Area (ha)}$$

Where:

- 1 hectare = 10,000 m²
- 1 detection unit = 3.764 m²

Raw detection totals alone are influenced by survey extent. Larger flown areas will, by definition, tend to yield higher total detections even if underlying weed density remains unchanged. By expressing detections per hectare, variation attributable solely to footprint size is removed, allowing for more meaningful spatial and temporal comparison.

Detection intensity is used as a relative comparison metric only. It does not represent exclusive ground coverage. Multiple species detections may occur within the same spatial footprint and therefore summed detections may exceed physical area coverage. For example, co-occurring species or vertically stratified vegetation may generate multiple detections within overlapping ground areas.

Accordingly, detection intensity should not be interpreted as percent cover or infestation extent. Rather, it functions as an index of detection frequency within a defined area.

While not a direct measure of ground cover, elevated detection intensity can reasonably be interpreted as an indicator of relative abundance and/or spatial concentration of detectable species within a management zone. Sustained increases in detection intensity between survey years may therefore reflect expansion, densification, or increased detectability of priority weeds, subject to model and environmental constraints.

The use of this normalised metric provides a structured and defensible framework for longitudinal UAV-based monitoring, particularly where minor differences in survey extent occur between years. When interpreted alongside species-level density tables, detection intensity supports robust assessment of compositional and spatial change across the project footprint.

Year 5 Detection Density by Zone

Year 5 UAV monitoring provides quantified detection intensity across all flown management zones. Detection intensity (det/ha) reflects the number of model detections per hectare and allows comparison between zones independent of survey extent.

It is important to reiterate that detection intensity does not represent exclusive ground coverage. Species may co-occur spatially, and multiple detections may occupy overlapping footprints. As such, this metric is best interpreted as an indicator of relative weed presence and concentration within a zone rather than percent cover. Table 9.4 below summarises total detection units and detection intensity for Year 5 across all zones.

Table 9-4: Summary of total detection units and detection intensity for year 5 across all zones.

| Field Management Zone | Area (ha) | Total Units | Det/ha |
|-----------------------|-----------|-------------|--------|
| Tantangara | 119.51 | 8869 | 74.21 |
| Talbingo | 175.72 | 10192 | 58.00 |
| Ravine Road | 170.59 | 7490 | 43.91 |
| Ravine Bay | 86.66 | 2187 | 25.18 |
| Tantangara Road | 192.06 | 2242 | 11.67 |
| Marica | 126.62 | 283 | 2.24 |

Several patterns emerge from the Year 5 detection intensity results:

- Tantangara records the highest detection intensity, indicating the greatest relative concentration of detectable priority weeds within the flown extent.

- Talbingo and Ravine Road also exhibit elevated intensity, forming a secondary tier of higher-density zones.
- Ravine Bay presents moderate intensity, suggesting established but less concentrated distribution relative to the leading zones.
- Plateau and Tantangara Road show comparatively lower intensity levels, though still measurable across substantial spatial footprints.
- Marica records the lowest detection intensity despite expanded survey extent, indicating comparatively lower density of model-detected species within the broader footprint.

Overall, detection intensity in Year 5 demonstrates clear spatial variability across management zones, with a distinct concentration gradient between the Tantangara/Talbingo/Ravine Road cluster and the lower-density Plateau, Tantangara Road, and Marica zones. This spatial differentiation provides a structured baseline for longitudinal UAV-based comparison moving forward.

Year 4 vs Year 5 Density Comparison

This comparison uses identical methodology (UAV + machine detection) for both years. Where extents differ materially (Marica, Talbingo), interpretation considers density rather than raw totals (table 9.5).

Table 9-5: Summarises comparisons for both years using identical UAV methodology.

| Field Management Zone | Year 4 Det/ha | Year 5 Det/ha | Trend |
|-----------------------|---------------|---------------|-------|
| Marica | 4.31 | 2.24 | ↓↓ |
| Ravine Bay | 13.92 | 25.18 | ↑↑ |
| Ravine Road | 26.13 | 43.91 | ↑↑ |
| Talbingo | 35.47 | 58.00 | ↑↑ |
| Tantangara | 54.98 | 74.21 | ↑↑ |
| Tantangara Road | 23.74 | 11.67 | ↓↓ |

Interpretation of Detection Intensity Change:

- Detection intensity increased strongly in 4 zones: Ravine Bay, Ravine Road, Talbingo, Tantangara.
- Tantangara is the cleanest like-for-like signal (area unchanged) and shows a genuine uplift.
- Detection intensity declined strongly in 3 zones: Marica, Plateau, Tantangara Road.
- Because Talbingo expanded ~49%, the det/ha increase indicates more than “just more area”, the concentration signal rises as well.

Detection intensity is a comparative signal of machine-detected occurrence within each management zone.

- It is suitable for longitudinal UAV comparison.
- Does not represent exclusive percent ground cover.
- May include spatial overlap between species detections.
- Should not be interpreted as a cumulative physical infestation area.

Species-level density tables (Appendix 7) provide the most robust view of compositional change.

Species-Level Totals (All Zones Combined)

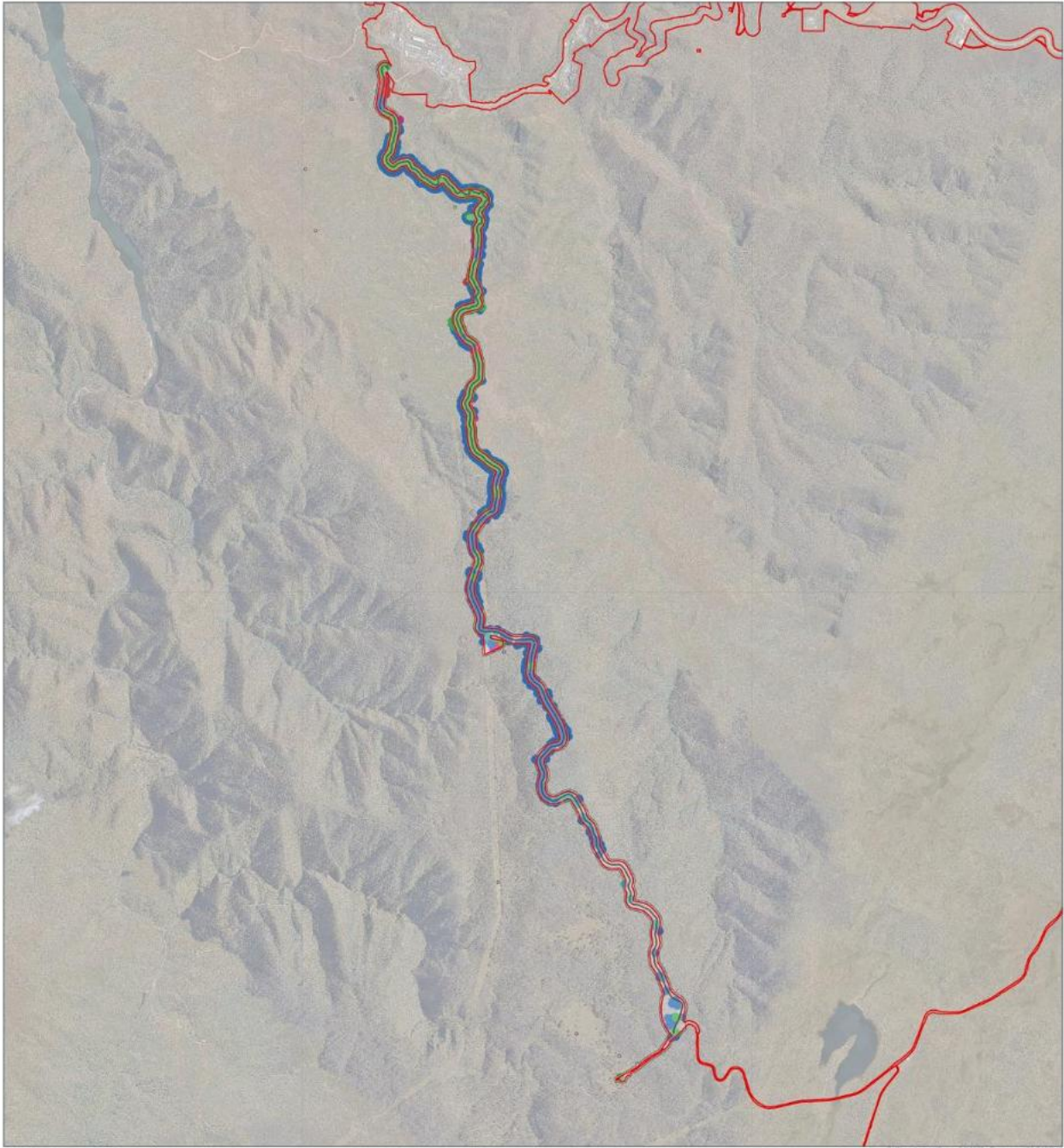
| Species | Y4 units | Yr 4 Det/ha | Yr 5 Units | Yr 5 Det/ha | Trend |
|----------------|----------|-------------|------------|-------------|-------|
| Blackberry | 9346 | 9.61 | 14808 | 13.11 | ↑ |
| St John’s wort | 2628 | 2.70 | 6314 | 5.59 | ↑↑ |

| Species | Y4 units | Yr 4 Det/ha | Yr 5 Units | Yr 5 Det/ha | Trend |
|---------------|----------|-------------|------------|-------------|-------|
| Spear thistle | 2955 | 3.04 | 6243 | 5.53 | ↑↑ |
| Oxeye daisy | 12356 | 12.71 | 4871 | 4.31 | ↓↓ |
| Great mullein | 573 | 0.59 | 1488 | 1.32 | ↑↑ |
| Sweet briar | 388 | 0.40 | 485 | 0.43 | - |
| Hawthorn | 14 | 0.01 | 46 | 0.04 | ↑↑ |



After accounting for total flown area:

- Blackberry, spear thistle, mullein and St John's wort all increased in detection intensity.
- Oxeye daisy shows a substantial reduction in detection intensity.
- Sweet briar remains broadly stable.
- Hawthorn remains very low density but has increased slightly.

While whole-of-zone detection intensity provides a broad signal, the species-level density tables offer the most reliable insight into compositional shifts between survey years (Appendix 7). UAV results detections can be seen in figures 9.2 to 9.8.



BMP Weed Survey - Year 5
 Ravine Road

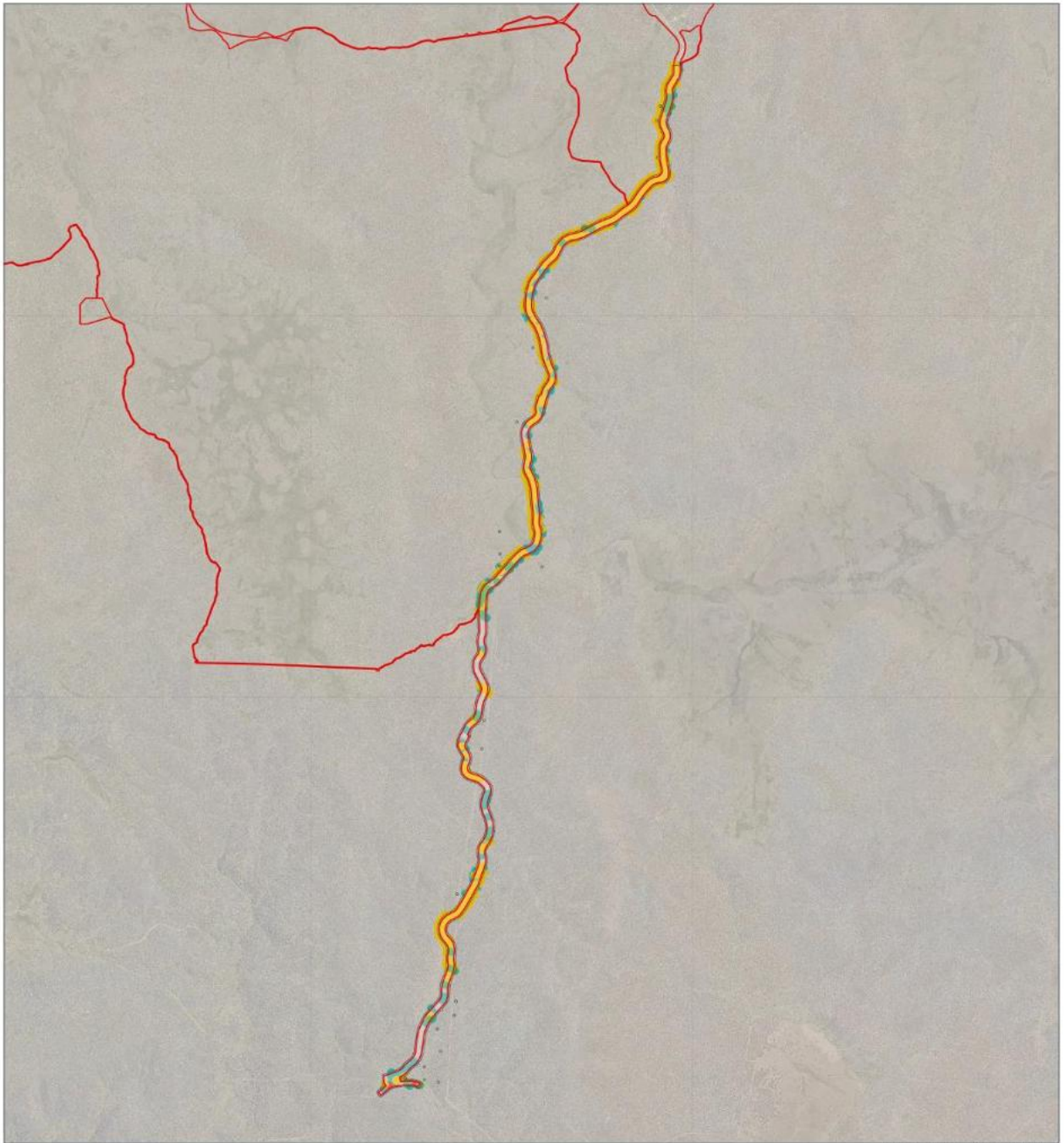

 Prepared by: RG
 Date: 3/03/2026

 Spatial Reference: GDA2020 MGA
 Zone 55

Credits: Data used is owned by Snowy Hydro Limited except as follows:
 Imagery sourced from NearMap, Feb 2025


- Cirsium vulgare (spear thistle)
- Hypericum perforatum (St Johns-wort)
- Rosa rubiginosa (sweet briar)
- Rubus fruticosus (European Blackberry)
- Verbascum thapsus (great mullien)
- UAV Scanned Area
- Construction Envelope (May 2021)

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Figure 9.2: UAV detections Ravine Rd.



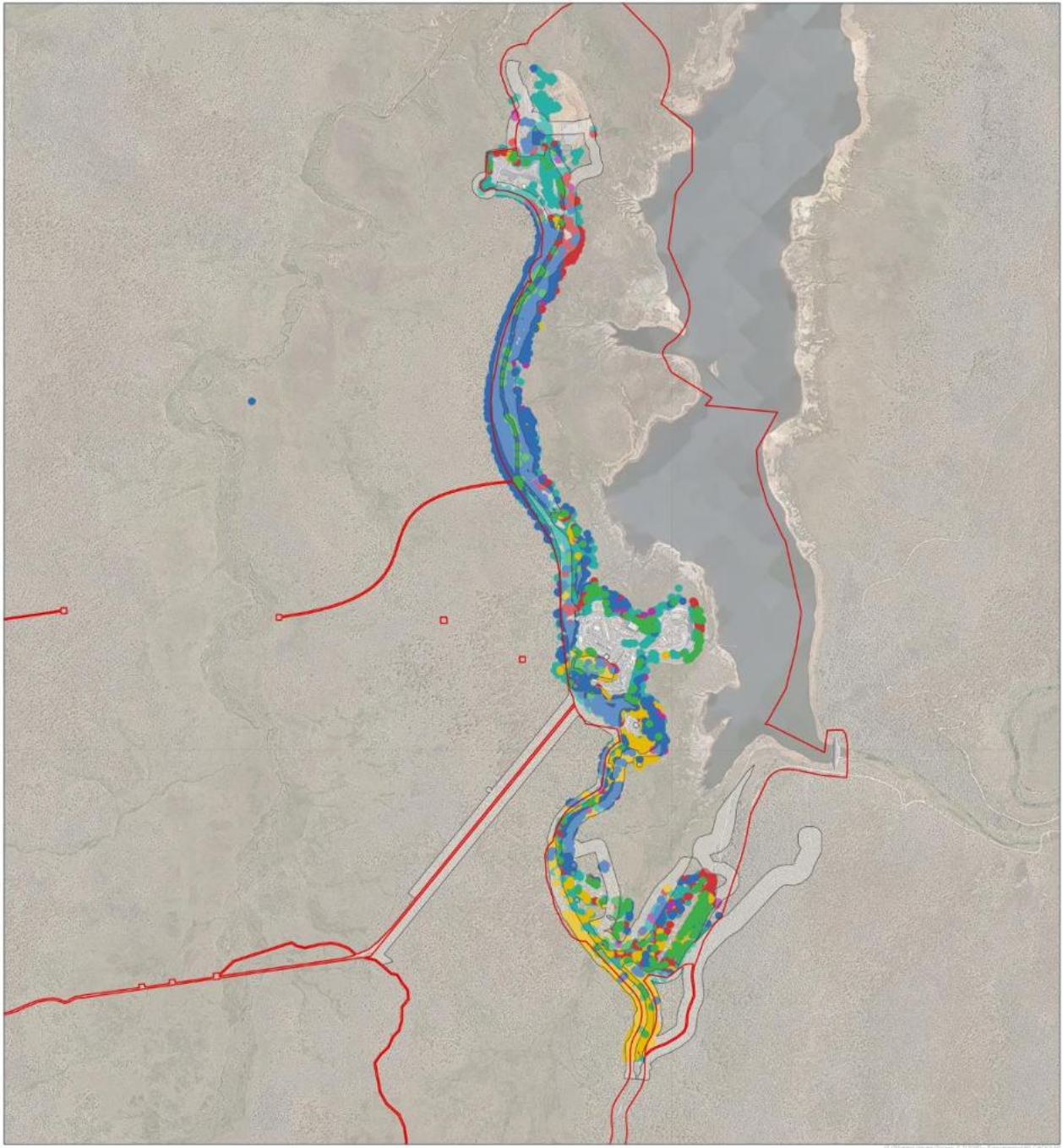
BMP Weed Survey - Year 5 Tantangara Road


 Prepared by: RG
 Date: 3/03/2026
 0 0.8 1.5 2.3 km
 Spatial Reference: GDA2020 MGA
 Zone 55
Credits: Data used is owned by Snowy Hydro Limited except as follows:
 Imagery sourced from NearMap, Feb 2025



- *Cirsium vulgare* (spear thistle)
- *Hypericum perforatum* (St John's-wort)
- *Leucanthemum vulgare* Leucanthemum vulgare
- *Verbascum thapsus* (great mullen)
- UAV Scanned Area
- Construction Envelope (May 2021)

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Figure 9.3: UAV detections Tantangara Rd.



BMP Weed Survey - Year 5
 Tantangara


 Prepared by: RG
 Date: 3/03/2026

 Spatial Reference: GDA2020 MGA
 Zone 55
Credits: Data used is owned by Snowy Hydro Limited except as follows:
 Imagery sourced from NearMap, Feb 2025

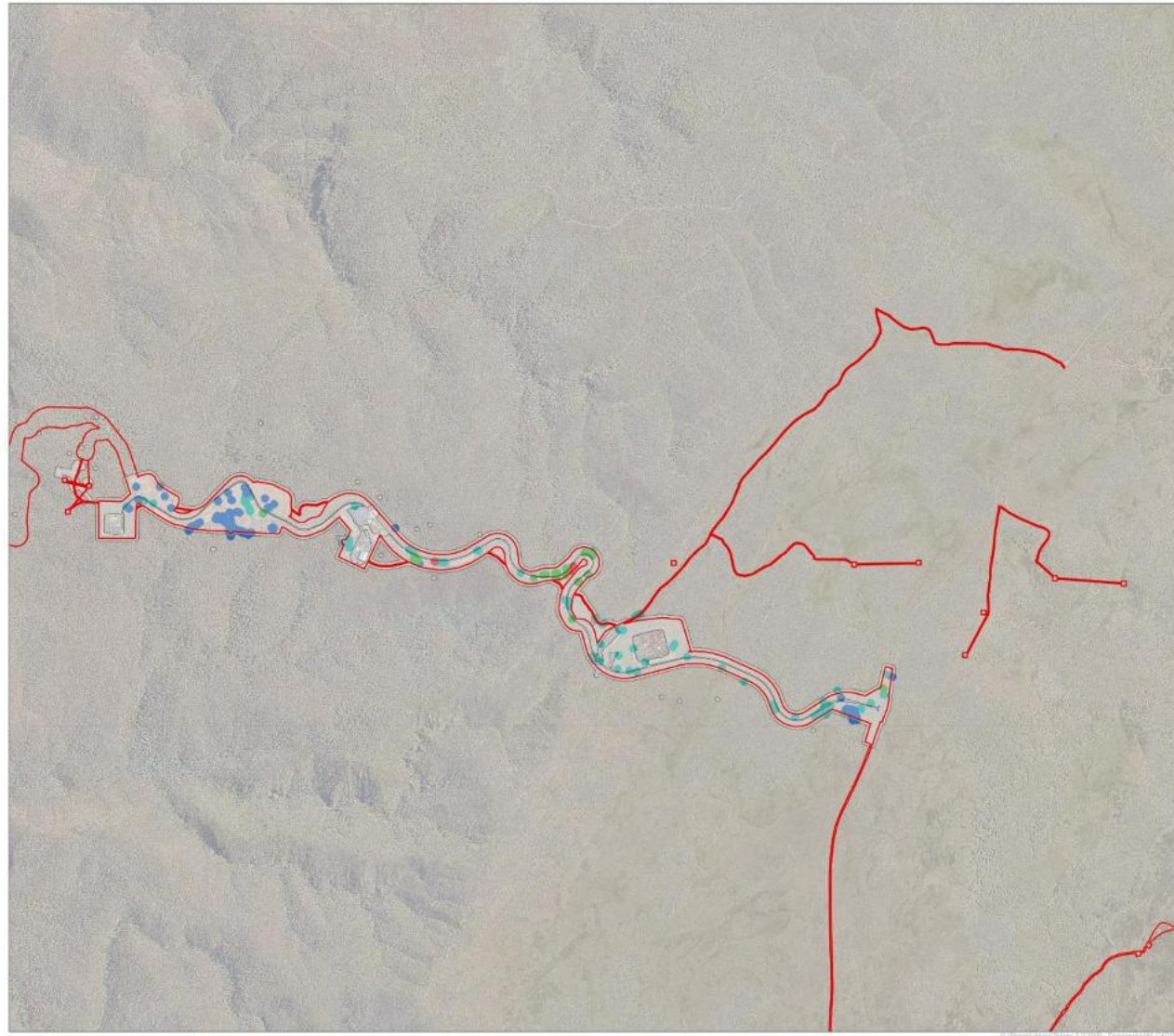
- *Cirsium vulgare* (spear thistle)
- *Hypericum perforatum* (St John's-wort)
- *Leucanthemum vulgare* Leucanthemum vulgare
- *Rosa rubiginosa* (sweet briar)
- *Rubus fruticosus* (European Blackberry)
- *Verbascum thapsus* (great mullien)
- UAV Scanned Area
- Construction Envelope (May 2021)

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Figure 9.4: UAV detections Tantangara.



BMP Weed Survey - Year 5
 Marica



- Cirsium vulgare (spoor thistle)
- Hypericum perforatum (St. John's-wort)
- Rosa rubiginosa (sweet briar)
- Rubus fruticosus (European Blackberry)
- Verbasicum thapsus (great mullien)
- UAV Scanned Area
- Construction Envelope (May 2021)

Credits: Data used is owned by Snowy Hydro Limited except as follows:
 Imagery sourced from NearMap, Feb 2025

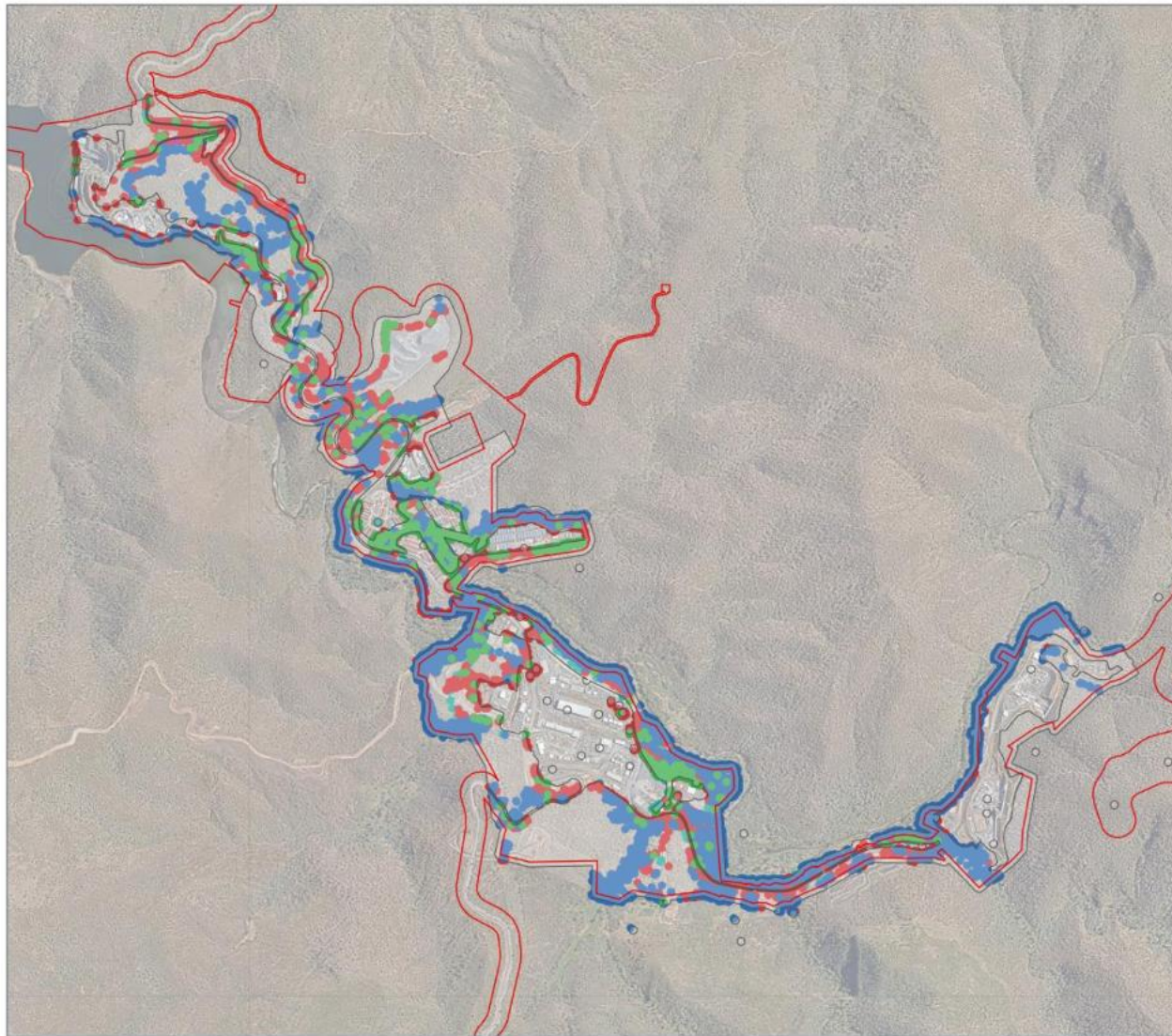
Prepared by: RG
 Date: 3/03/2025
 Spatial Reference: GDA2020 MGA Zone 55

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Figure 9.5: UAV detections Marica.



BMP Weed Survey - Year 5 Talbingo



- *Cirsium vulgare* (spear thistle)
- *Crataegus monogyna* (common hawthorn)
- *Hypericum perforatum* (St John's-wort)
- *Rosa rubiginosa* (sweet briar)
- *Rubus fruticosus* (European Blackberry)
- *Verbascum thapsus* (great mullein)
- UAV Scanned Area
- Construction Envelope (May 2021)

Credits: Data used is owned by Snowy Hydro Limited except as follows:
Imagery sourced from NearMap, Feb 2025.

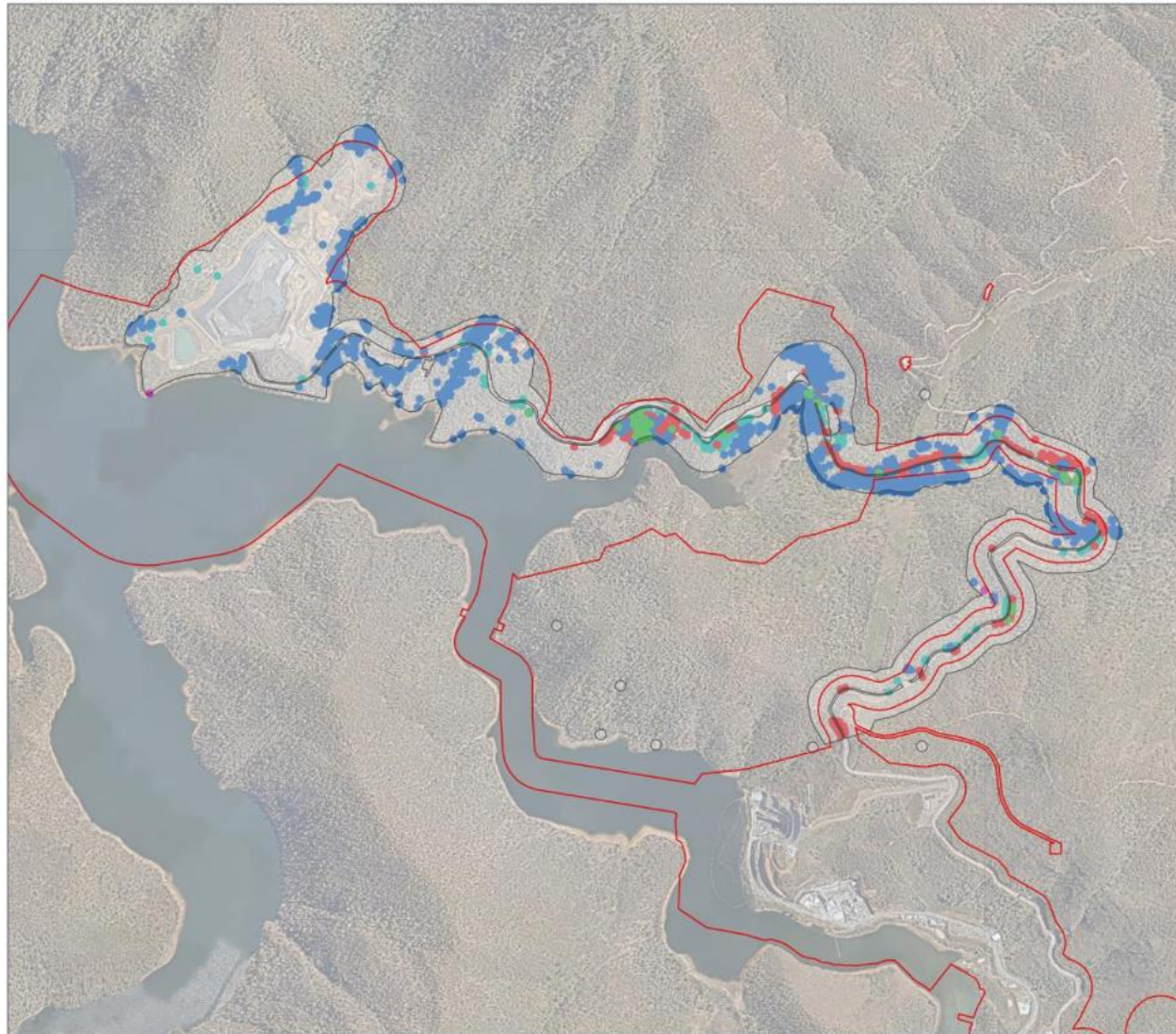
Prepared by: RG
Date: 3/03/2026
0 0.2 0.4 0.6 km
Spatial Reference: GDA2020 MGA Zone 55

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Figure 9.6: UAV detections Talbingo.



BMP Weed Survey - Year 5 Ravine Bay



- *Cirsium vulgare* (spear thistle)
- *Hypericum perforatum* (St. John's wort)
- *Rosa rubiginosa* (sweet briar)
- *Rubus fruticosus* (European Blackberry)
- *Verbascum thapsus* (great mullein)
- UAV Scanned Area
- Construction Envelope (May 2021)

Credits: Data used is owned by Snowy Hydro Limited except as follows:
Imagery sourced from NearMap, Feb 2025

Prepared by: RG
Date: 3/03/2026
0 0.1 0.3 0.4 km
Spatial Reference: GDA2020 MGA Zone 55

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Figure 9.7: UAV detections Ravine Bay.

9.5 Discussion

After accounting for spatial extent and using density normalisation:

- Tintangara remains the area with the highest concentration zone and surveys reflect increases in species; Blackberry, Spear thistle, and Great mullein with sweet briar also being picked up in year 5.
- Talbingo and Ravine Road show strong increases in detection intensity in Year 5 of Blackberry, Spear thistle, St John's wort, and Great mullein.
- Ravine Bay surveys reflect increases in species; Blackberry, Spear thistle, and Great mullein.
- Tintangara Road shows a substantial reduction, largely related to reduced numbers of oxeye daisy and St John's wort, however increases in Spear thistle have been observed.
- Marica depicts declines in intensity after redistribution/area correction despite having more area in Year 5 with a small increase in Blackberry.
- Spear thistle, blackberry, mullein and St John's wort show consistent increases across multiple zones.
- Oxeye daisy shows the strongest overall decline.

Year 5 provides quantifiable, spatially consistent monitoring suitable for ongoing longitudinal UAV comparison. Interpretation remains bounded by model scope and detection sensitivity.

Limitations: changes in project personnel and contracted monitoring providers has provided challenges to data comparisons between years. Gaps in data collection at Rock Forest mean that we cannot assess that area.

Additionally, the inability of the UAV to pick up grass species make it difficult to completely assess changes across all species throughout the whole project and at all at that particular property.

9.6 Triggers for Adaptive Management

Triggers for adaptive management of weed monitoring are:

- New occurrence of weeds within proximity to project infrastructure.
- Monitoring results are identifying increases in density of high priority weeds.

During the Year 5 Spring/Summer season (Sept 2024 to Feb 2025) the weed control program was delayed, not beginning until early January 2025 when it was supposed to start in October. This non-compliance was reported to agencies at that time.

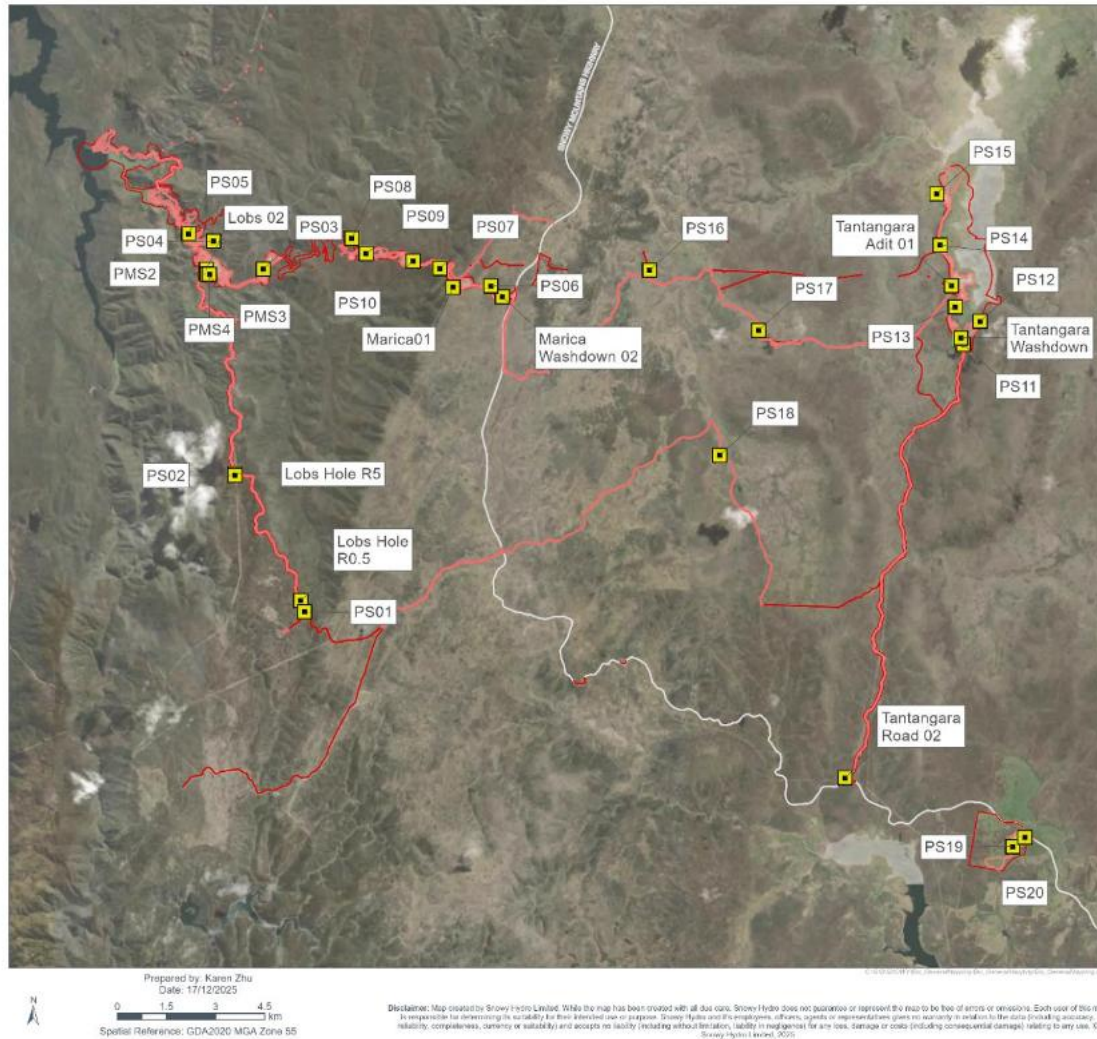
Areas triggered are: Marica, Tintangara, Tintangara Rd, Talbingo, Ravine Rd, and Ravine Bay. This has been addressed by Snowy Hydro with the Principal Contractor and the Year 6 Control program has been intensified as a result.

9.7 Recommendations

It is recommended to perform the control program without fail in Spring and Summer, with regular reporting to ensure compliance.

10. Pathogen Monitoring

10.1 Survey Locations



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Figure 11.1 - Phytosphthora Monitoring Sites

- Legend**
- Disturbance Boundary
 - Construction Envelope
 - Major road
 - Phytosphthora Monitoring Sites



Credits: Data used is derived by Snowy Hydro Limited except as follows:
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 (Add credits / acknowledgements for any other third party data sources here)

Figure 10.1: Pathogen Monitoring sites across the whole project.

10.2 Objective

The objective of pathogen monitoring is to undertake soil sampling in order to assess pathogens, particularly *Phytophthora spp.*, within proximity to project roads and key project infrastructure, to inform the location and extent of controls if required.

10.3 Methodology

Pathogen monitoring is undertaken by collecting several small sub-samples and combining them into a single representative sample for that sampling location, as per the BMPg (appendix B Rev G). The combined representative sample was between 100-250 grams of soils which consisted primarily of living plant roots from within 10 cm of the surface. Pathogen monitoring was undertaken in April 2025. A total of 31 soil samples were collected in Year 5. All samples were sent to suitable laboratory to analyse for *Phytophthora spp.* Positive results were also subject to secondary testing in June 2025 to validate the initial results. For more information refer to the BMPg.

10.4 Results

During Year 5, one of the 31 routine soil samples tested positive for *Phytophthora cinnamomi*. This positive result was recorded at site PS05, located within the Main Camp at Lobs Hole. Laboratory analysis of the remaining soil samples confirmed that no additional sites tested positive for *Phytophthora spp.*, however, in the first round of testing a positive result was returned at site named Tantangara Road 02. The second round of testing confirmed a true positive at site PS05 and a negative result at Tantangara Road 02. The results of all soil samples and site coordinates, are provided Table 10-1.1. Laboratory results are attached in Appendix 8a-b.

Table 10-1: Final Soil Sampling *Phytophthora* analysis results

| Monitoring Site ID | Date Sampled | Positive/Negative | Phytophthora Species | Easting | Northing |
|--------------------|--------------|-------------------|-------------------------------|-----------|------------|
| Lobs Hole | | | | | |
| Lobs 02 | April 2025 | Negative | - | 626120.46 | 6038401.48 |
| Lobs Hole R0.5 | April 2025 | Negative | - | 628995.21 | 6028300.12 |
| Lobs Hole R5 | April 2025 | Negative | - | 626988.78 | 6032170.28 |
| PMS2 | April 2025 | Negative | - | 626106.08 | 6038269.54 |
| PMS3 | April 2025 | Negative | - | 626149.10 | 6038244.68 |
| PMS4 | April 2025 | Negative | - | 626208.07 | 6038247.71 |
| PS01 | April 2025 | Negative | - | 629109.39 | 6027956.31 |
| PS02 | April 2025 | Negative | - | 626987.60 | 6032117.81 |
| PS03 | April 2025 | Negative | - | 627855.79 | 6038412.52 |
| PS04 | April 2025 | Negative | - | 626333.60 | 6039263.27 |
| PS05 | June 2025 | Positive | <i>Phytophthora cinnamomi</i> | 625578.40 | 6039483.15 |
| Marica | | | | | |
| Marica Washdown 02 | April 2025 | Negative | - | 635151.84 | 6037565.24 |
| Marica01 | April 2025 | Negative | - | 633641.82 | 6037854.98 |
| PS06 | April 2025 | Negative | - | 634797.41 | 6037894.79 |
| PS07 | April 2025 | Negative | - | 633242.40 | 6038430.06 |
| PS08 | April 2025 | Negative | - | 630555.24 | 6039344.24 |
| PS09 | April 2025 | Negative | - | 630989.77 | 6038885.17 |
| PS10 | April 2025 | Negative | - | 632421.96 | 6038653.34 |
| Tantangara | | | | | |
| PS11 | April 2025 | Negative | - | 649215.33 | 6036114.04 |

| | | | | | |
|---------------------|------------|----------|---|-----------|------------|
| PS12 | April 2025 | Negative | - | 649728.74 | 6036816.06 |
| PS13 | April 2025 | Negative | - | 648972.26 | 6037253.03 |
| PS14 | April 2025 | Negative | - | 648507.40 | 6039138.52 |
| PS15 | April 2025 | Negative | - | 648403.21 | 6040707.47 |
| Tantangara Adit 01 | April 2025 | Negative | - | 648853.33 | 6037899.98 |
| Tantangara Road 02 | June 2025 | Negative | - | 645604.97 | 6022889.99 |
| Tantangara Washdown | April 2025 | Negative | - | 649139.20 | 6036308.04 |
| Rock Forest | | | | | |
| PS19 | April 2025 | Negative | - | 650724.46 | 6020789.50 |
| PS20 | April 2025 | Negative | - | 651091.47 | 6021075.78 |
| Off-Site | | | | | |
| PS16 | April 2025 | Negative | - | 639640.94 | 6038375.87 |
| PS17 | April 2025 | Negative | - | 642967.19 | 6036540.31 |
| PS18 | April 2025 | Negative | - | 641781.46 | 6032730.97 |

10.5 Discussion

Pathogen monitoring across the project site has revealed a mixed pattern of *Phytophthora* presence over the five years of monitoring. Sites PS05 has not returned positive *Phytophthora* results in previous monitoring periods. In Year 3, one Lobs Hole site (PS03) tested positive for *Phytophthora cinnamomic*, then in Year 4, all sites tested negative for *Phytophthora* species. Indicating a temporary period of clearance or effective management. The Year 5 results, however, indicates the re-emergence of *Phytophthora cinnamomi* in the Lobs Hole area (PS05). *Phytophthora cinnamomi* spreads through soil, water and organic matter, any activity that moves this material can spread the disease, including soil on tools, footwear and vehicles. Hygiene measures across the project have been reviewed, with additional controls placed near the PS05 site to reduce the potential risk of pathogen transfer.

10.6 Triggers for Adaptive Management

The trigger for adaptive management of pathogen monitoring is:

- A soil sample returns a positive result for *Phytophthora* species of concern such as *Phytophthora cinnamomi* or *Phytophthora gregata*.

In Year 5, one site (PS05) has been triggered for adaptive management as it recorded the presence of *Phytophthora cinnamomi*. Adaptive management for *Phytophthora* includes:

- Conducting additional soil sample testing within suspected infection area to document extent; and
- Ensure anthropogenic spread from infected areas is eliminated by modifying site activities in the vicinity, controlling access, and revising hygiene procedures.

Adaptive management for the positive detection has been actioned; additional testing was conducted at 14 sites within the area of PS05. The adaptive management response was managed by FGJV. Due to the timing of the knowledge of this positive result, the management will be ongoing into the Year 6 program and will also be discussed there.

10.7 Recommendations

It is recommended that an internal biosecurity audit be undertaken to assess whether current hygiene practices are meeting the controls and requirements outlined in BMP Appendix F - Weed, Pest and Pathogen Management Plan. FGJV have been instructed by Snowy Hydro to engage a Dieback Specialist to review the results, assess current controls, and inform ongoing management strategies.

11. Groundwater Dependent Ecosystems

11.1 Survey Locations

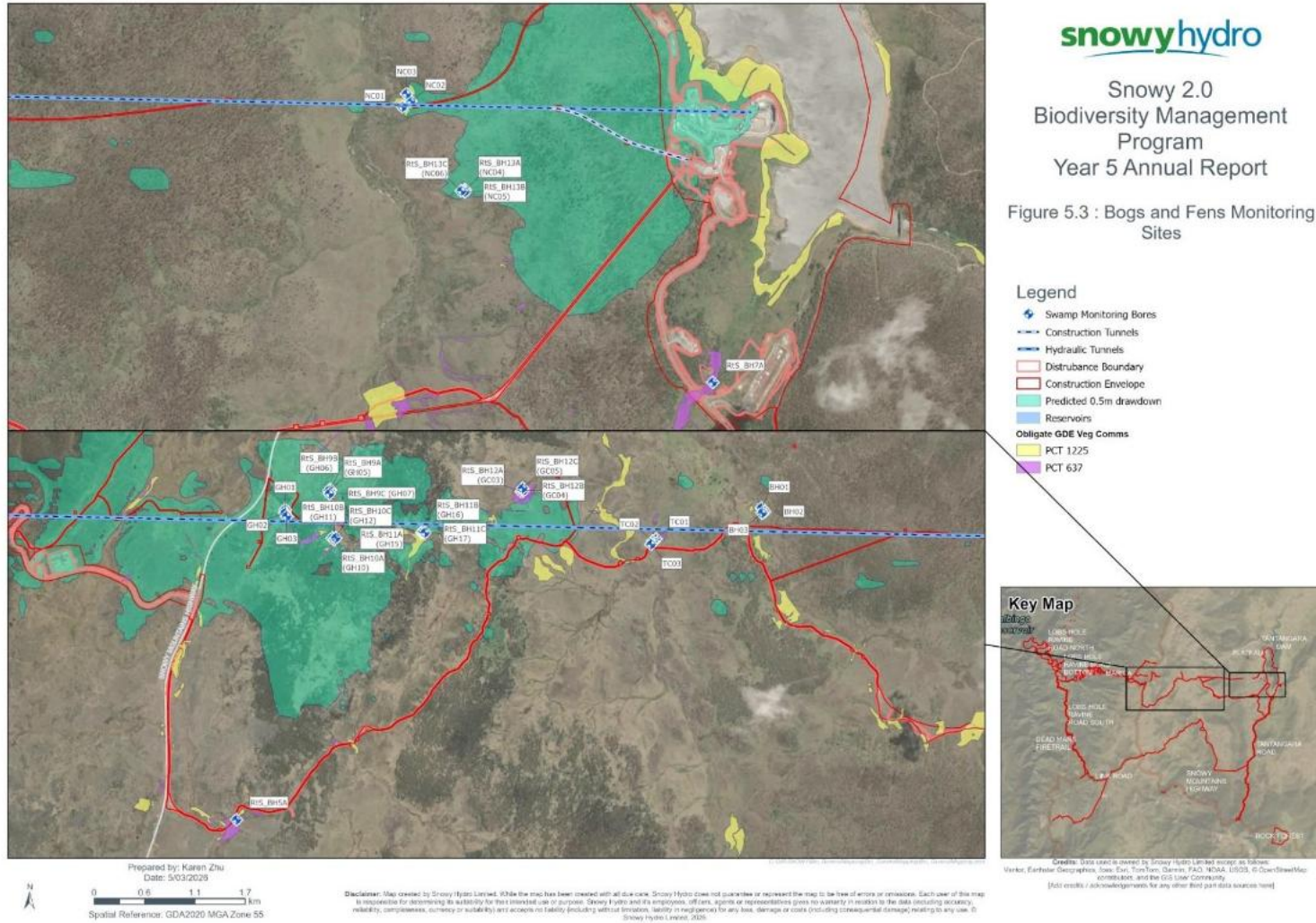
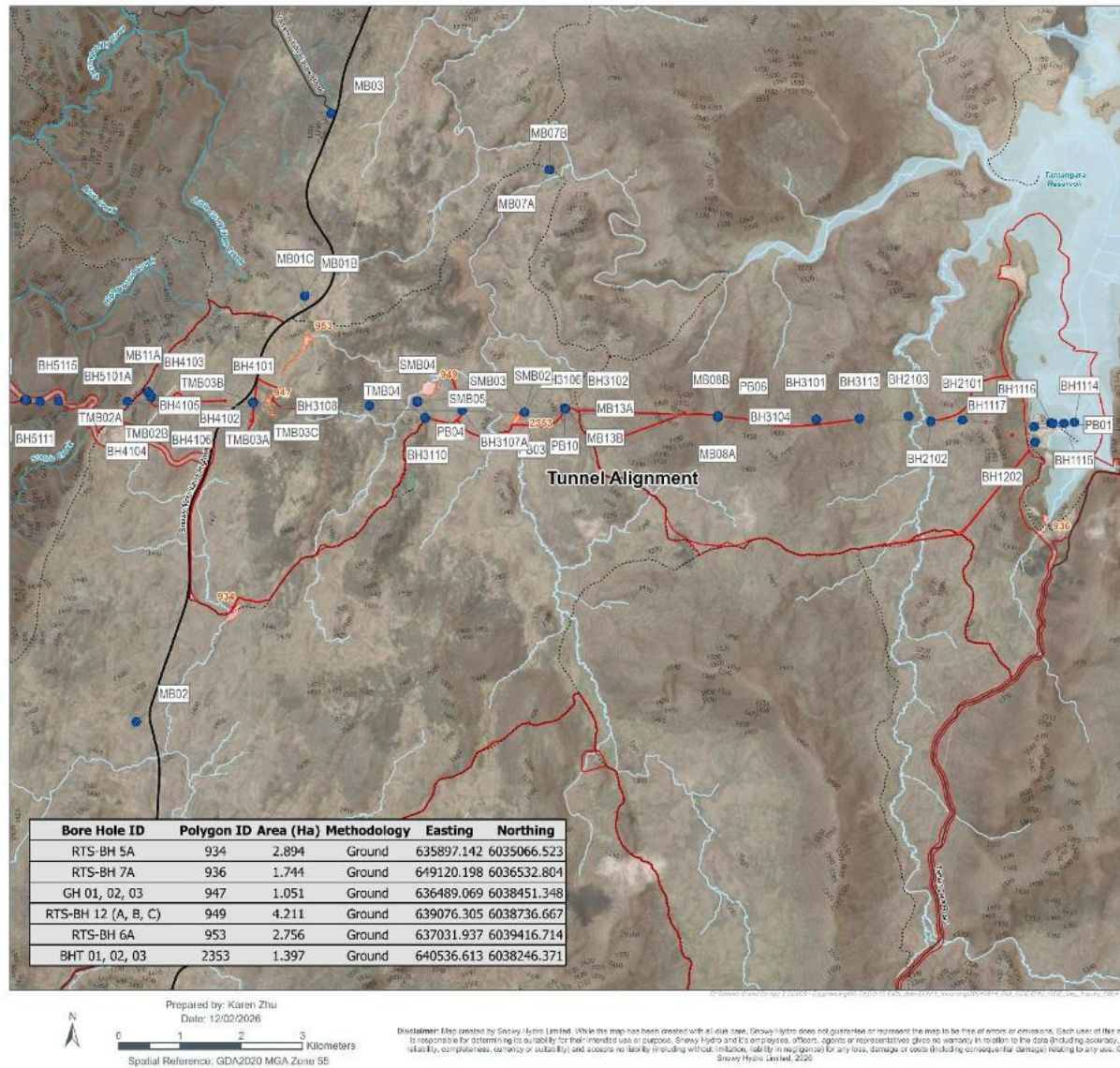


Figure 11.1: Bog and Fen monitoring network.



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Figure 11.2 - GDE Ground Surveys



Legend

- Borehole Location
- Headrace Tunnels
- Highway
- Main road
- Minor and local roads
- Track
- Creek
- Drainage
- RIVER
- Contour (10m)
- Waterbody
- Construction Envelope
- Monitoring Methods
- Ground

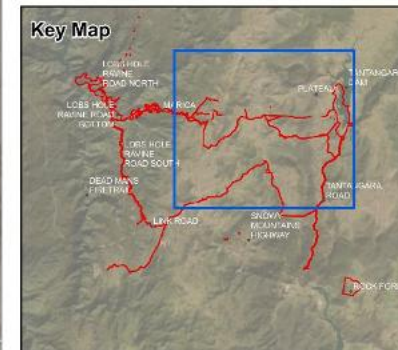


Figure 11.2: GDE ground floristic survey sites.

11.2 Background

Groundwater dependent ecosystem monitoring does not come under the BMPg, rather the results of the monitoring network are reported as per the Ground Water Management Plan (FGJV, 2020; document reference S2-FGJV-ENV-PLN-0012, GMP). The inclusion of this chapter was requested by agencies.

From December 2025, Snowy Hydro has begun to include seasonal floristic studies of selected GDE's (see figure 11.2), which goes beyond compliance requirements as the BMP states that *"No additional biometric monitoring, such as floristics or vegetation condition, is proposed to assess the impact on ecosystem function as a result of drawdown. This is because, functional impacts can take a substantial amount of time to present and be detected. Instead, shallow groundwater levels will be used as a proxy for ecosystem function in the GDE patches."*

As groundwater levels in the shallow groundwater monitoring network are used as a proxy for ecosystem function in the GDE patches, confirmed groundwater drawdown will trigger potential ameliorative actions where practicable, otherwise a loss of ecological function will be assumed, and offsets will be sought.

11.3 Baseline Data Collection

The existing GDE shallow groundwater monitoring network includes 30 sites that co-locate with recognised GDEs. These sites have been used to define baseline conditions for bogs and associated fens across the Plateau region. The full shallow groundwater monitoring network is shown in Figure 11.1.

Floristic studies began in December 2025. For the survey period applicable to this Year 5 report, a summer and autumn report have been supplied (see Appendix 9b-c).

11.4 Floristic survey methodology

A range of qualitative and quantitative techniques will be used to assess the health and changes to the GDE's that may be impacted by the Snowy 2.0 project. Control sites, that are not on the tunnel alignment, will be used to compare the GDEs that are directly aligned with the Snowy 2.0 tunnel excavation.

1. Field mapping will involve the following survey techniques:
 - Random meander surveys on foot to ground-truth Plant Community Type (PCT) boundaries.
 - 10m x 10 m quadrats will be marked out within the GDE sites with an assessment of vegetation/litter/rocks/bare ground/pools/channels at 1m intervals. Quadrats will be GPS'd and marked with flagged corner posts for future monitoring ease.
2. Photo points will use a corner post of the 10m x 10m quadrat. These will be taken every quarter during the monitoring period from the same post.
3. Surface level rods will be inserted into the monitoring area to assess any changes in peat depth over time. Surface level rods essentially act as markers to track how the peatland is evolving by recording the height of the peat surface relative to a fixed point. Surface level rods will be marked with flagging tape and GPS'd for ease of future monitoring.
4. PCTs will be assessed into vegetation zones based on the broad condition of the vegetation according to PCT floristic biodiversity as poor, moderate or high.

A qualitative assessment of the general ecological health of the GDE's and the surrounding area will also be done. GDE's in KNP have been exposed to significant ecological threatening processes due to the high numbers of ungulates, introduced herbivores and weed invasion in the past and present and must be noted.

11.5 GDE Monitoring Results

Groundwater network

Groundwater hydrographs for each shallow groundwater monitoring site are presented in Appendix 9a and discussed in detail in the Groundwater Monitoring Report provided to agencies through the NSW Planning Portal.

To date, construction has remained outside recognised GDEs, except for TBM 3, which excavated the headrace tunnel under Nungar Creek from November 2024 to January 2025. Groundwater levels at monitoring sites NC02 and NC03, which are installed in the Nungar Creek Bog, have shown recharge consistent with baseline data. Recharge patterns are also aligned with broader regional patterns when compared to control sites RtS_BH13A, B and C. The remaining GDE groundwater monitoring locations continue to collect baseline data.

Floristic surveys

As baseline data was collected in the year 5 survey period, at this stage, no comparisons can be made yet. All areas monitored appear to be in good health, with the exception of the control site at Tantangara Reservoir (ID 936) due to overwhelming damage by feral horses. For full results of each site, including photo points, see Appendix 9b-c.

11.6 Triggers for Adaptive Management

In accordance with the Groundwater Management Plan (FGJV, 2020; document reference S2-FGJV-ENV-PLN-0012, GMP), groundwater levels at GDE sites are evaluated against trigger values from autumn through spring (May to October). Baseline assessments have shown that drying during summer is a normal occurrence and part of the natural ecosystem function. Additionally, monitoring results from the GDE bores indicate that no 80th percentile triggers were met during the reporting period.

Since no GDE triggers were met, no adverse impacts on ecological function due to impacts from the project are predicted at this time. Consequently, the conditional actions outlined in the BMP for offset payments are not required for Year 5. Ground water monitoring will continue as per the GMP to re-assess trigger values and ensure ongoing management of GDE patches.

12. Conclusion – Summary of Yr 5 Recommendations

The results of the Year 5 Biodiversity Monitoring Program for the Snowy 2.0 Main Works have identified adaptive management requirements. These are summarised in **Error! Reference source not found.**, along with recommendations for incorporation into the Year 6 monitoring period (2025/2026). SHL will aim to implement these recommendations to enhance project biodiversity outcomes and minimise impacts on local ecosystems.

Table 12-1: Triggers for adaptive management and recommendations for project boundary and the Year 6 monitoring program.

| Monitoring component | Adaptive management triggered in Year 5? | Recommendations for Year 6 | Consultation to date |
|---|---|--|---|
| Threatened Flora Monitoring (Section 3) | Not Triggered. However historical decline is persisting at both control and impact sites | It is proposed that two alternative threatened species could be monitored, which will have fewer confounding results. Both Clover Glycine and Kiandra Leek orchid are highly dependent on low levels of disturbance and favourable climatic conditions to flower. Given the constant grazing pressure and potential trampling, larger more persistent species may be of more use to observe project impacts on threatened species of the area. | Result: A draft monitoring proposal was presented to NPWS and CHPR to include two threatened species that are perennials (<i>Pimelea Bracteata</i> and <i>Rutidosis leiolepis</i>) Suggested measures to assess health and impacts were; new growth, leaf morphology, etiolation, chlorosis, evidence of grazing and trampling, flowering, germinates, dust, and percentage cover of weeds. At the time, the recommendation was not supported. Instead DCCEEW species experts recommended that SHL amended the survey timing to November and December, rather than December and January. The rationale for this was that we may be seeing a decline due to the fact that the survey timing needs adjusting to better suit flowering and therefore capacity to find the plants. NPWS and DCCEEW also recommended that a weed transect be included through the centre transect of each quadrat. Both recommendations have been included in the Year 6 survey methodology. |

| Monitoring component | Adaptive management triggered in Year 5? | Recommendations for Year 6 | Consultation to date |
|--|--|--|---|
| Small Mammal Occupancy Monitoring (Section 4) | Triggered. Smoky mouse sites at Marica and Ravine Rd | <ol style="list-style-type: none"> 1. Allow flexibility in survey site centroid location in BTR faecal monitoring (up to 30 m) to account for changes in hydrology among survey seasons; 2. Winter BTR scat surveys to be removed. Three BTR scat surveys to occur annually – Spring, Summer and Autumn; 3. Collection of faecal pellets during surveys for use by NPWS in genetic analyses; 4. Remove cameras from BTR sites and redeploy to new locations targeting Smoky Mouse. This will also address issues of some BTR-targeted cameras having been placed in bogs; and 5. Snowline Ecology to provide on-ground training to Snowy 2.0 staff to improve small mammal camera trap setup and maintenance. | <p>Result: Recommendations 1-4 were discussed with NPWS and CPHR who have confirmed their consensus. SHL has implemented them. Recommendation 3 assists in contributing to the broader body of scientific knowledge for this species. Rec 5 was agreed to between SHL and Snowline Ecology, the training was provided during the year 6 survey period. Recs 1-3 were implemented during the year 6 survey effort. Rec 4 will be implemented in consultation with DCCEEW’s Smoky Mouse expert (with respect to on site location selection).</p> <p>SHL and NPWS are also in discussions regarding updating the camera trap settings in order to have a better chance of capturing images of EPP and SM, such as continuous monitoring, rather than 30-day periods, and setting up to only capture night-time images as the species is active at night.</p> |
| Small Mammal Habitat Characteristic Monitoring (Section 5) | Not Triggered. However recommendations based on the effectiveness of the methodology were made. | It is recommended to consult with species experts to design methodology that focuses on the specific habitat requirements of each target species with respect to indirect impacts that could have potential to be exasperated by the project (such as weed incursion, dust, and <i>Phytophthora</i>) and which are known impacts that negatively impact habitat of the target species. It has been observed that the current methodology employed is likely to be tracking post fire regrowth after the 2019/2020 fires, rather than providing any insight into adverse effects of potential project related impacts. Triggers for adaptive management should also state that the degradation must be assessed relative to | Consultations with NPWS and DCCEEW were undertaken. It was decided that a new survey methodology would be implemented that focuses on measuring indirect impacts and monitoring for any changes. SHL has implemented the updated methodology in the year 6 survey period. The details of the updated methodology will be detailed in the BMP revision. This includes creating quadrats at known target species locations (site were selected by the species experts, locations were based on most recent sighting data), transects are |

| Monitoring component | Adaptive management triggered in Year 5? | Recommendations for Year 6 | Consultation to date |
|--|--|---|--|
| | | control sites. Overall, a review of the methodology is recommended. | performed within the quadrats to measure habitat structure, species richness, herbivore impact, dust, weed incursions, and phytosphora. |
| <p>Frogs: Alpine Tree Frog occupancy monitoring. Booroolong Frog occupancy monitoring. Booroolong Frog habitat characteristic monitoring. (all in Section 6)</p> | Not Triggered. | <ol style="list-style-type: none"> 1. Retain sediment basin CH805 post-construction to preserve ATF breeding habitat. Note, this recommendation was approved and actioned in early 2025; 2. Establish “no-go zone” at identified ATF habitat on Schofields Track to prevent vehicle access; 3. Increase invasive species management at ATF impact sites; 4. Control invasive Poplars and Willows in the Yarrangobilly River; 5. Prevent sedimentation from the works area entering Booroolong Frog habitat, as documented in November 2024. Note, the basin/s were drained and re-lined following advice to resolve this issue; 6. Undertake genetic (tissue samples) and disease (chytrid) assessments to better understand the health of ATF and Booroolong Frog populations within KNP; 7. Further refine habitat characteristics monitoring, including key areas of breeding microhabitat (e.g. cobble and bedrock pools) and linear length of key species habitat per 500 m stream transect; 8. Additional control sites further from impacted areas (e.g. Yarrangobilly caves area) should be considered for more appropriate comparisons and statistical power; 9. Increase Booroolong Frog survey effort from two to three surveys per season (November-December). | <ol style="list-style-type: none"> 1. Was completed by FGJV to save the basin for breeding grounds rather than decommissioning. A real win for the species. 2. This is an ‘on Park’ site, therefore SHL sent the details to NPWS to see if they were able to prevent impact. 3. Section 6 speaks to ungulates as being the most damaging, these species do not come under the Project’s control. However, FGJV has increased trapping efforts for feral predator species. 4. Woody weeds (Poplars and Willows) were mapped. The GIS data was given to NPWS as this area is outside of the Construction boundary. 5. This refers to a specific incident that was raised by Snowline (details in section 6), this was resolved and the basin was drained to be fully lined. 6. Snowline is now completing this work. 7. Snowline will include this in the year 6 survey period. 8. This recommendation went to NPWS and DCCEEW amphibian experts for consultation. This is now included in the year 6 surveys. 9. This recommendation went to NPWS and DCCEEW amphibian experts for consultation. This is now included in the year 6 surveys. |

| Monitoring component | Adaptive management triggered in Year 5? | Recommendations for Year 6 | Consultation to date |
|---|--|---|---|
| Alpine She-oak Skink occupancy monitoring (Section 7) | Triggered. | <ol style="list-style-type: none"> 1. Make methods consistent with other ASOS monitoring programs in NSW and Victoria. Changes required include: grid arrangement, tile type (change to concrete tiles), and tile number (25 per grid); 2. Increase the number of grids in the landscape and re-position some existing grids to improve ASOS detectability and statistical power. Proposed Year 6 grid totals: 16 (eight impact and eight control). 3. Collect ASOS genetics. 4. Including weed, dust, and herbivore monitoring at ASOS grids. 5. Increase invasive species monitoring. 6. Include sympatric endangered reptiles in BMP monitoring. | <ol style="list-style-type: none"> 1. This was discussed in consultation with NPWS, and experts from DCCEEW. These recommendations have been actioned in the Year 6 survey period. 2. As above. 3. As above. 4. Observational data is now collected for these impacts at each site. 5. There are over 20 dedicated feral cameras monitoring feral species and a total of 138 camera traps across the project. SHL has also introduced an easy to use notification poster with a QR code, making it convenient for anyone to provide incidental observations, which means FGJV can act quickly to deploy traps. 6. |
| Feral animal occupancy and abundance monitoring (Section 8) | Triggered. | <p>It is recommended that the adaptive management trigger be refined to explicitly apply to the target species that the Project is responsible for controlling. Namely, feral cats, foxes, and rabbits.</p> <p>It is further recommended that monitoring and adaptive management efforts focus on species within SHL’s operational capacity to manage, specifically feral cats, red foxes, and European rabbits.</p> | <p>This recommendation can only be enacted in consultation with NPWS and CHPR.</p> <p>The current trigger for adaptive management is; “Sighting of feral animals within proximity to known Smoky Mouse habitat or project infrastructure”.</p> <p>The Project is only responsible for the control of feral cats, foxes, and rabbits, however, due to the sensitivity of this trigger being related to all ferals, and the location of the project within the National Park and the presence of horses, pigs, dogs, and deer that are outside of the Projects responsibility to manage, that the trigger is essentially always triggered.</p> |

| Monitoring component | Adaptive management triggered in Year 5? | Recommendations for Year 6 | Consultation to date |
|---|---|--|--|
| | | | FG and SHL have worked together to bolster the control program, this has been quite successful, with regular updates being provided to NPWS. |
| Weed presence monitoring (Section 9) | Triggered. | It is recommended to perform the control program without fail in Spring and Summer, with regular reporting to ensure compliance. | The weed control program covering the 2025-2026 Summer and Spring season has been effectively implemented, with regular monthly reports being sent to NPWS for review. The program was also extended into Autumn which goes beyond the minimum requirements. |
| Phytophthora spp. Monitoring (Section 10) | Triggered. PS05 recorded the presence of <i>Phytophthora cinnamomi</i> | It is recommended that an internal biosecurity audit be undertaken to assess whether current hygiene practices are meeting the controls and requirements outlined in BMP Appendix F - Weed, Pest and Pathogen Management Plan. | FGJV have been instructed by Snowy Hydro to engage a Dieback Specialist to review the results, assess current controls, and inform ongoing management strategies. |

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14. Appendices

Appendix 1(a) - Threatened Flora GPS locations

| Monitoring Site | Common Name | Number of Individuals | Lat Long |
|-----------------|---------------------|-----------------------|------------------------|
| TF14 | Clover Glycine | 3 | 35.761993 148.642691 |
| | | 3 | 35.762012 148.642700 |
| | | 2 | 35.761879 148.643020 |
| | | 2 | 35.762013 148.643002 |
| | | 3 | 35.761875 148.643195 |
| | | 2 | 35.761907 148.643216 |
| | | 6 | 35.761931 148.643212 |
| | | 8 | 35.761915 148.643179 |
| | | 5 | 35.761936 148.643176 |
| | | 5 | 35.761935 148.643182 |
| | | 6 | 35.761929 148.643184 |
| TF06 | Kiandra Leek Orchid | 1 | 35.883761 148.519867 |
| | | 1 | 35.883752 148.519841 |
| | | 1 | 35.883759 148.519822 |
| | | 14 | 35.883779 148.519792 |
| TF13 | Kiandra Leek Orchid | 1 | 35.826091 148.645547 |
| | | 1 | 35.826045 148.645380 |
| | | 3 | 35.826007 148.645403 |
| | | 1 | 35.825961 148.645257 |
| | | 2 | 35.825959 148.645234 |
| TF07 | Kiandra Leek Orchid | 3 | 35.819482 148.647745 |
| | | 3 | 35.820020 148.647506 |
| | | 2 | 35.820018 148.647510 |
| TF10 | Clover Glycine | 4 | 35.766243 148.641049 |
| | | 3 | 35.766246 148.641010 |
| | | 2 | 35.766252 148.640975 |
| | | 1 | 35.766133 148.640540 |
| | | 2 | 35.766126 148.640836 |
| | | 5 | 35.766075 148.640887 |
| | | 1 | 35.766058 148.640825 |
| | | 3 | 35.766013 148.640889 |
| | | 2 | 35.766128 148.640842 |
| | | 4 | 35.766081 148.640851 |
| TF09 | Clover Glycine | 1 | 35.823769 148.689327 |
| | | 3 | 35.823533 148.689042 |
| | | 2 | 35.823641 148.689245 |
| | | 3 | 35.823532 148.689051 |
| | | 1 | 35.823529 148.689260 |
| | | 3 | 35.823520 148.689109 |



| Monitoring Site | Common Name | Number of Individuals | Lat Long |
|-----------------|----------------|-----------------------|------------------------|
| | | 1 | 35.823597 148.689060 |
| | | 1 | 35.823555 148.689014 |
| | | 2 | 35.823566 148.689021 |
| | | 2 | 35.823674 148.689302 |
| | | 3 | 35.823687 148.689173 |
| | | 1 | 35.823623 148.689169 |
| | | 3 | 35.823624 148.689172 |
| | | 4 | 35.823623 148.689168 |
| TF08 | Clover Glycine | 5 | 35.806511 148.684473 |
| | | 7 | 35.806508 148.684467 |
| | | 3 | 35.806498 148.684455 |
| | | 2 | 35.806515 148.684482 |
| | | 6 | 35.806510 148.684571 |
| | | 4 | 35.806512 148.684481 |
| | | 3 | 35.806514 148.684501 |



Appendix 1(b) – Threatened Flora Site Descriptions



| Site ID | Site description |
|-----------------------|---|
| Impact 1 Sites | |
| TF03 | Location: East of the haul road. May be cleared in the future for the new TT PSE. Unable to survey due to location being within the PSE – unsafe due to interactions with heavy vehicles for the development of the new permanent spoil area. |
| TF04 | Location: Adjacent to the Tantangara Temporary Spoil Emplacement (TSE) area. Adjacent to the temporary spoil emplacement area. Poorly maintained batters of the TSE area are increasing weed and weed seed in the area. Highly disturbed sub-alpine grassland. Evidence of feral rabbits: burrows and excrement. Weed % cover approximately 80%. High numbers of <i>Hakea microcarpa</i> Indicate previous disturbance such as wildfire or heavy grazing. |
| TF11 | Location: Adjacent to the Tantangara Temporary Spoil Emplacement (TSE) area. This site is a highly disturbed sub-alpine grassland. Horse tracks, scats and grazing were observed in addition to rabbit burrows and excrement. Invasive grasses such as <i>Anthoxanthum odoratum</i> and <i>Agrostis capillaris</i> were observed. The site had at least 30% exotic species present. |
| TF12 | Location: Adjacent to the Tantangara Temporary Spoil Emplacement (TSE) area. This site is a highly disturbed subalpine grassland, including some <i>Hakea microcarpa</i> shrubs. There is an approximate weed cover of 30% (mostly exotic grasses with some St John’s Wort). High level of disturbance were observed as horse tracks and excrement. Rabbit burrows, digging and rabbit scats were also recorded. |
| TF13 | Location: Corner of Tantangara road and Tantangara dam fire trail, under the transmission lines. This site has a dense weed cover of <i>Hypericum perforatum</i> and <i>Leucanthemum vulgare</i> , both very invasive weeds. The site has 50:50 weed to native cover. Most native species were short alpine herbfield species, with some colonising shrubs and Eucalypts. It is a highly disturbed sub-alpine grassland located under powerlines with both horse and rabbit scats present. |
| TF14 | Location: Furthest monitoring quadrat on the peninsular. May be cleared in the future for the new TT PSE. |



| | |
|-----------------------------|--|
| | <p>This site is a highly disturbed subalpine grassland with multiple exotic grasses present. Weedy grasses observed were: <i>Anthoxanthum odoratum</i>, <i>Agrostis capillaris</i>, <i>Dactylis glomerata</i> and <i>Phleum pratense</i>. High levels of disturbance were observed with horse tracks, scats and grazing monitored. Rabbit burrows, digging and scats were also present. There was evidence that someone has driven on this site despite it being outside of the construction area. The aspect of this site varies to the TF 10, 11, 12, and 14 and is situated in a slight valley. The aspect and protection from prevailing winds may account for the presence of <i>Glycine</i> at this site respective of the other four in the area.</p> |
| <p>Control Sites</p> | |
| TF05 | <p>Location: a remote control site, on National Parks land at the Circuits Hut.</p> <p>This site is a long way from the Snowy 2.0 area and is located at the back of a bush hut. It is completely disturbed site that has evidence of human and feral animal disturbance, particularly horses. The only native species recorded was <i>Eucalyptus stellulata</i> – Black Sallee. The understorey was nearly completely dominated by <i>Anthoxanthum odoratum</i> – Sweet Vernal Grass.</p> <p>This site needs to be reassessed as a control site as it has very low natural values and biodiversity.</p> |
| TF06 | <p>Location: parallel to the Snowy Mountains Highway at Kiandra, adjacent to the ‘Tantangara Mtn’ walking trail.</p> <p>This site is within short alpine herbifield vegetation in the Kiandra area. It has evidence of disturbance with horse scats, trampling, rabbit scats and digging and weeds. Weed species recorded were <i>Agrostis capillaris</i>, <i>Hypericum perforatum</i>, <i>Hypochaeris radicata</i> and <i>Rumex acetosella</i>.</p> |
| TF07 | <p>Location: Parallel to Tantangara road, over the creek, and under the transmission lines.</p> <p>This site has a high presence of exotic grasses, particularly <i>Anthoxanthum odoratum</i> and <i>Agrostis capillaris</i>. Historical fire disturbance from 2009. Horse grazing, trampling and scats were observed. Rabbit scats and digging were also observed. There is a dense population of Ox-eye Daisy – <i>Leucanthemum vulgare</i>. It is semi-degraded sub alpine woodland with over 50% invasive weed cover.</p> |
| TF08 | <p>Location: a remote control site, on National Parks land along Circuits Fire Trail. A decline in observed numbers at this site from previous years. Noted much pressure from grazing, rabbits and horses, along side native grazing also.</p> <p>This site is located in a subalpine grassland with approximately 50% weed cover, mostly <i>Anthoxanthum odoratum</i> and <i>Holcus lanatus</i>. There is evidence of human disturbance (the site had been driven through) and high levels of feral disturbance, with horse tracks and excrement, rabbit burrows and excrement observed. This site needs to be reassessed as a control site as it has very low natural values and biodiversity.</p> |
| TF09 | <p>Located at the edge of a Black Sallee open woodland. Weed cover approximately 40% with no obvious evidence of feral animal disturbances.</p> <p>Many species of clover were found at this location; including white clover and clover <i>Mycrophilla</i>. Without flowers at the time of the survey (Dec) it was not possible to positively ID the target clover species. It was decided to flag and investigate in the January survey.</p> <p>Many more clover individuals exists near this site, however they were just outside of the quadrant.</p> |
| TF10 | <p>Location: Control located outside of the construction boundary, parallel to the TSE.</p> <p>Sub-alpine area dominated by <i>Hakea microcarpa</i>. The high density of <i>Hakea</i> indicates previous disturbance as it’s a pioneer species. Multiple disturbances were observed: horse tracks and excrement, rabbit burrows and excrement.</p> |



Appendix 1(c) – Threatened Flora Photo Points


| Site | Image |
|---|--|
| <p>TF04</p> <p>Impact</p> |  <p>TF04 Jan 2025</p> |
| <p>TF05</p> <p>Control</p> <p>Circuits Hut</p> |  <p>TF05 Jan 2025</p> |

| Site | Image |
|---|---|
| <p>TF06</p> <p>Control</p> <p>Kiandra</p> |  <p>TF06 Jan 2025</p> |
| <p>TF07</p> <p>Control</p> <p>Across creek, under powerline</p> |  <p>TF07 Jan 2025</p> |

| Site | Image |
|---|--|
| <p>TF08</p> <p>Control</p> <p>Circuits</p> <p>FT</p> |  <p>TF08 Dec 2024</p> |
| <p>TF09</p> <p>Control</p> <p>Gulf</p> <p>Creek FT</p> |  <p>TF09 Dec 2024</p> |

| Site | Image |
|--|--|
| <p>TF10</p> <p>Control</p> <p>Adjacent to temp spoil site</p> |  <p>TF10 Jan 2025</p> |
| <p>TF11</p> <p>Impact</p> |  <p>TF11 Jan 2025</p> |

| Site | Image |
|---|--|
| <p>TF12</p> <p>Impact</p> |  <p>TF12 Jan 2025</p> |
| <p>TF13</p> <p>Impact</p> <p>Corner of TT Dam FT and TT Road</p> |  <p>TF13 Dec 2024</p> |

| Site | Image |
|------------------------------|--|
| TF14 Impact |  A wide-angle photograph of a grassy field under a clear blue sky. In the foreground, there are several large, grey rocks. A person wearing a purple jacket and a hat is visible in the middle ground, standing near some bushes. A black vertical marker is placed in the grass on the right side of the frame. The text "TF14 Dec 2024" is overlaid in white in the center of the image. In the background, there are rolling hills and a small body of water under a bright blue sky with a few wispy clouds. |

Appendix 2(a) – Small mammal camera monitoring sites

| | Camera | Longitude | Latitude | Area | Target Species | Summer - Year 5 Q3 | | | | | | Autumn - Year 5 Q4 | | | | | |
|------------|------------|-----------|----------------|-----------------------------|----------------|---|------------|--------|-----------------|--------------|------------|---|------------|--------|-----------------|--------------|------------|
| | | | | | | Start | End | Nights | # animal images | Bait in view | Visibility | Start | End | Nights | # animal images | Bait in view | Visibility |
| Impact | SM01-I-RC1 | 148.4292 | -35.8853 | Ravine Road Gatehouse | SM, EPP | 1/12/2024 | 18/12/2024 | 17 | 31 | Y | ok | Camera failure | | | | | |
| | SM01-I-RC2 | 148.4287 | -35.8855 | Ravine Road Gatehouse | SM, EPP | Camera failure | | | | | | 1/04/2025 | 30/04/2025 | 29 | 32 | Y | ok |
| | SM03-I-RC1 | 148.4293 | -35.8821 | Ravine Road Gatehouse | SM, EPP | 8/01/2025 | 6/02/2025 | 29 | 29 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 61 | Y | poor |
| | SM03-I-RC2 | 148.4284 | -35.8825 | Ravine Road Gatehouse | SM, EPP | 1/1/2025 | 29/1/2025 | 28 | 239 | Y | poor | 2/4/2025 | 30/4/2025 | 28 | 799 | Y | poor |
| | SM05-I-RC1 | 148.4277 | -35.8779 | Ravine Road | SM, EPP | Camera failure | | | | | | 1/04/2025 | 30/04/2025 | 29 | 500 | Y | ok |
| | SM05-I-RC2 | 148.4285 | -35.8776 | Ravine Road | SM, EPP | 8/01/2025 | 5/02/2025 | 28 | 110 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 115 | Y | ok |
| | SM07-I-RC1 | 148.4199 | -35.8673 | Ravine Road | SM, EPP | Camera failure | | | | | | 2/04/2025 | 1/05/2025 | 29 | 408 | N | ok |
| | SM07-I-RC2 | 148.4191 | -35.8677 | Ravine Road | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 493 | N | poor | 2/04/2025 | 1/05/2025 | 29 | 1088 | N | poor |
| | SM10-I-RC1 | 148.4137 | -35.8588 | Ravine Road | SM, EPP | Camera failure | | | | | | 1/04/2025 | 30/04/2025 | 29 | 133 | Y | ok |
| | SM10-I-RC2 | 148.4146 | -35.8592 | Ravine Road | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 274 | N | poor | 2/04/2025 | 1/05/2025 | 29 | 1592 | From 19 Apr | ok |
| | SM14-I-RC1 | 148.4152 | -35.8554 | Ravine Road | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 126 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 215 | Y | ok |
| | SM14-I-RC2 | 148.4140 | -35.8555 | Ravine Road | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 328 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 607 | Y | ok |
| | SM15-I-RC1 | 148.4118 | -35.8475 | Ravine Road | SM, EPP | 1/12/2024 | 30/12/2024 | 29 | 100 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 616 | Y | ok |
| | SM15-I-RC2 | 148.4110 | -35.8482 | Ravine Road | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 190 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 488 | Y | poor |
| | SM16-I-RC1 | 148.4044 | -35.8430 | Ravine Road | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 68 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 141 | Y | poor |
| | SM16-I-RC2 | 148.4031 | -35.8431 | Ravine Road | SM, EPP | 1/12/2024 | 30/12/2024 | 29 | 286 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 470 | Y | ok |
| | SM18-I-RC1 | 148.4065 | -35.8354 | Lobs Hole Ravine Road North | SM, EPP | Discontinued due to post fire regrowth making site inaccessible | | | | | | Discontinued due to post fire regrowth making site inaccessible | | | | | |
| | SM18-I-RC2 | 148.4070 | -35.8359 | Lobs Hole Ravine Road North | SM, EPP | Discontinued due to post fire regrowth making site inaccessible | | | | | | Discontinued due to post fire regrowth making site inaccessible | | | | | |
| | SM19-I-RC1 | 148.3876 | -35.7830 | Lobs Hole Main Camp | EPP | 1/01/2025 | 30/01/2025 | 29 | 57 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 156 | Y | poor |
| | SM19-I-RC2 | 148.3869 | -35.7823 | Lobs Hole Main Camp | EPP | 1/01/2025 | 31/01/2025 | 30 | 53 | N | poor | 1/04/2025 | 30/04/2025 | 29 | 396 | Y | poor |
| SM20-I-RC1 | 148.4151 | -35.7939 | Lobs Hole ECVT | EPP | 8/01/2025 | 6/02/2025 | 29 | 445 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 301 | Y | ok | |
| SM20-I-RC2 | 148.4156 | -35.7943 | Lobs Hole ECVT | EPP | 8/01/2025 | 6/02/2025 | 29 | 409 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 341 | Y | ok | |
| SM21-I-RC1 | 148.4442 | -35.7841 | Marica HDD | SM, EPP | 2/12/2024 | 1/01/2025 | 30 | 64 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 619 | Y | ok | |



| | | | | | | | | | | | | | | | | | |
|------------|------------|----------|-----------------------|-------------------------|----------------|--|------------|-----|-----|--------------|-----------|--|------------|-----|------|-------------|--------------|
| Control | SM21-I-RC2 | 148.4442 | -35.7841 | Marica HDD | SM, EPP | 8/01/2025 | 6/02/2025 | 29 | 85 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 265 | Y | ok |
| | SM22-I-RC1 | 148.4544 | -35.7861 | Marica | SM, EPP | Camera lost and site destroyed during new construction | | | | | | Camera lost and site destroyed during new construction | | | | | |
| | SM22-I-RC2 | 148.4539 | -35.7871 | Marica | SM, EPP | 1/1/2025 | 31/1/2025 | 30 | 331 | Y | ok | 1/4/2025 | 1/5/2025 | 30 | 182 | Y | ok |
| | SM23-I-RC1 | 148.4573 | -35.7846 | Marica | SM, EPP | 8/01/2025 | 7/02/2025 | 30 | 144 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 176 | Y | poor |
| | SM23-I-RC2 | 148.4586 | -35.7844 | Marica | SM, EPP | 8/01/2025 | 6/02/2025 | 29 | 143 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 726 | Y | ok |
| | SM24-I-RC1 | 148.4618 | -35.7886 | Marica Surge Shaft | SM, EPP | 8/01/2025 | 6/02/2025 | 29 | 31 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 183 | N | poor |
| | SM24-I-RC2 | 148.4615 | -35.7896 | Marica Surge Shaft | SM, EPP | 8/01/2025 | 6/02/2025 | 29 | 300 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 746 | Y | ok |
| | SM25-I-RC1 | 148.4747 | -35.7889 | Marica | SM, EPP | Discontinued due to steep terrain | | | | | | Discontinued due to steep terrain | | | | | |
| | SM25-I-RC2 | 148.4749 | -35.7881 | Marica | SM, EPP | Discontinued due to steep terrain | | | | | | Discontinued due to steep terrain | | | | | |
| | SM27-I-RC1 | 148.4910 | -35.7945 | Marica | BTR | Camera failure | | | | | | 1/04/2025 | 30/04/2025 | 29 | 347 | From 27 Apr | poor |
| | SM27-I-RC2 | 148.4917 | -35.7939 | Marica | BTR | Camera failure | | | | | | 1/04/2025 | 30/04/2025 | 29 | 39 | Y | poor |
| | SM34-I-RC1 | 148.6489 | -35.8057 | Tantangara | BTR | 1/12/2024 | 30/12/2024 | 29 | 6 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 231 | N | poor |
| | SM34-I-RC2 | 148.6483 | -35.8064 | Tantangara | BTR | 1/12/2024 | 30/12/2024 | 29 | 17 | Y | poor | 4/04/2025 | 30/04/2025 | 26 | 42 | N | poor |
| | SM35-I-RC1 | 148.5791 | -35.8544 | Alpine Creek Fire Trail | SM, EPP | 8/01/2025 | 6/02/2025 | 29 | 74 | Y | ok | 14/3/2025 | 13/4/2025 | 30 | 656 | Y | ok til 7-Apr |
| | SM35-I-RC2 | 148.5790 | -35.8535 | Alpine Creek Fire Trail | SM, EPP | 8/01/2025 | 6/02/2025 | 29 | 383 | Until 12 Jan | ok | 14/3/2025 | 14/4/2025 | 31 | 2057 | Y | ok |
| | SM36-I-RC1 | 148.6311 | -35.8662 | Nungar Creek | BTR | 1/01/2025 | 30/01/2025 | 29 | 40 | N | poor | 1/04/2025 | 30/04/2025 | 29 | 43 | N | poor |
| | SM36-I-RC2 | 148.6305 | -35.8655 | Nungar Creek | BTR | 1/01/2025 | 30/01/2025 | 29 | 156 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 189 | Y | ok |
| | SM37-I-RC1 | 148.6242 | -35.8740 | Tantangara Road | BTR | Camera stolen - high risk of replacements being taken | | | | | | Camera stolen - high risk of replacements being taken | | | | | |
| | SM37-I-RC2 | 148.6232 | -35.8735 | Tantangara Road | BTR | Camera stolen - high risk of replacements being taken | | | | | | Camera stolen - high risk of replacements being taken | | | | | |
| | SM02-C-RC1 | 148.4203 | -35.8905 | Ravine Road Gatehouse | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 261 | Until 25 Jan | ok | 1/04/2025 | 30/04/2025 | 29 | 92 | N | poor |
| SM02-C-RC2 | 148.4198 | -35.8899 | Ravine Road Gatehouse | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 186 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 497 | Y | ok | |
| SM04-C-RC1 | 148.4127 | -35.8832 | Ravine Road | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 259 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 543 | Y | ok | |
| SM04-C-RC2 | 148.4124 | -35.8824 | Ravine Road | SM, EPP | Camera failure | | | | | | 1/04/2025 | 30/04/2025 | 29 | 800 | Y | ok | |
| SM06-C-RC1 | 148.4077 | -35.8706 | Dead Mans Fire Trail | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 59 | N | poor | 1/04/2025 | 30/04/2025 | 29 | 189 | Y | ok | |
| SM06-C-RC2 | 148.4068 | -35.8708 | Dead Mans Fire Trail | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 313 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 631 | Y | ok | |
| SM09-C-RC1 | 148.4072 | -35.8607 | Dead Mans Fire Trail | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 157 | N | poor | 1/04/2025 | 30/04/2025 | 29 | 236 | Y | ok | |
| SM09-C-RC2 | 148.4063 | -35.8606 | Dead Mans Fire Trail | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 74 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 446 | Y | ok | |
| SM12-C-RC1 | 148.4050 | -35.8566 | Dead Mans Fire Trail | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 261 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 241 | Y | ok | |

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| | | | | | | | | | | | | | | | | |
|------------|----------|----------|-----------------------------|---------|---|------------|----|-----|----|------|---|------------|----|------|----|------|
| SM12-C-RC2 | 148.4060 | -35.8571 | Dead Mans Fire Trail | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 400 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 350 | Y | ok |
| SM13-C-RC1 | 148.4086 | -35.8555 | Dead Mans Fire Trail | SM, EPP | 1/12/2024 | 15/12/2024 | 14 | 10 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 136 | Y | ok |
| SM13-C-RC2 | 148.4094 | -35.8554 | Dead Mans Fire Trail | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 47 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 104 | Y | ok |
| SM17-C-RC1 | 148.4021 | -35.8344 | Lobs Hole Ravine Road North | SM, EPP | Discontinued due to post fire regrowth making site inaccessible | | | | | | Discontinued due to post fire regrowth making site inaccessible | | | | | |
| SM17-C-RC2 | 148.4016 | -35.8347 | Lobs Hole Ravine Road North | SM, EPP | Discontinued due to post fire regrowth making site inaccessible | | | | | | Discontinued due to post fire regrowth making site inaccessible | | | | | |
| SM26-C-RC1 | 148.4821 | -35.7895 | Marica | SM, EPP | 8/01/2025 | 6/02/2025 | 29 | 62 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 426 | Y | poor |
| SM26-C-RC2 | 148.4809 | -35.7895 | Marica | SM, EPP | 8/01/2025 | 6/02/2025 | 29 | 296 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 2216 | N | poor |
| SM28-C-RC1 | 148.5174 | -35.7792 | Bullocks Hill Fire Trail | BTR | Excessive false triggers - no animal triggers | | | | | | 1/04/2025 | 30/04/2025 | 29 | 21 | Y | ok |
| SM28-C-RC2 | 148.5163 | -35.7784 | Bullocks Hill Fire Trail | BTR | Excessive false triggers - no animal triggers | | | | | | 1/04/2025 | 30/04/2025 | 29 | 32 | Y | poor |
| SM29-C-RC1 | 148.5403 | -35.7700 | Bullocks Hill Fire Trail | EPP | 2/12/2024 | 18/1/2025 | 47 | 27 | Y | poor | 8/4/2025 | 28/4/2025 | 20 | 5 | Y | ok |
| SM29-C-RC2 | 148.5391 | -35.7702 | Bullocks Hill Fire Trail | EPP | 30/12/2024 | 27/01/2025 | 28 | 47 | Y | poor | 1/4/2025 | 30/4/2025 | 29 | 464 | Y | ok |
| SM30-C-RC1 | 148.5622 | -35.7542 | Bullocks Hill Fire Trail | BTR | Camera failure | | | | | | 19/4/2025 | 7/5/2025 | 18 | 66 | Y | ok |
| SM30-C-RC2 | 148.5608 | -35.7544 | Bullocks Hill Fire Trail | BTR | 23/12/2024 | 1/01/2025 | 9 | 341 | Y | ok | 14/3/2025 | 14/4/2025 | 31 | 2860 | Y | ok |
| SM31-C-RC1 | 148.5602 | -35.7738 | Bullocks Hill Fire Trail | BTR | 8/01/2025 | 6/02/2025 | 29 | 28 | Y | poor | 17/3/2025 | 20/4/2025 | 34 | 0 | Y | poor |
| SM31-C-RC2 | 148.5597 | -35.7746 | Bullocks Hill Fire Trail | BTR | 8/01/2025 | 6/02/2025 | 29 | 0 | NA | NA | 14/3/2025 | 13/4/2025 | 30 | 70 | Y | poor |
| SM32-C-RC1 | 148.5923 | -35.7683 | Hains Hut Trail | BTR | No data - unknown cause | | | | | | 1/4/2025 | 30/4/2025 | 29 | 162 | Y | ok |
| SM32-C-RC2 | 148.5911 | -35.7683 | Hains Hut Trail | BTR | Camera stolen - high risk of replacements being taken | | | | | | Camera stolen - high risk of replacements being taken | | | | | |
| SM33-C-RC1 | 148.5649 | -35.6977 | Long Plain Road | BTR | Excessive false triggers - no animal triggers | | | | | | 1/4/2025 | 22/4/2025 | 21 | 26 | N | poor |
| SM33-C-RC2 | 148.5643 | -35.6968 | Long Plain Road | BTR | 1/01/2025 | 30/01/2025 | 29 | 39 | Y | poor | 1/4/2025 | 24/4/2025 | 23 | 41 | Y | poor |
| SM38-C-RC1 | 148.5515 | -35.9028 | Snowy Mountains Hwy | BTR | 1/12/2024 | 30/12/2024 | 29 | 0 | NA | NA | 6/04/2025 | 5/05/2025 | 29 | 0 | NA | NA |
| SM38-C-RC2 | 148.5507 | -35.9034 | Snowy Mountains Hwy | BTR | 1/01/2025 | 30/01/2025 | 29 | 8 | Y | poor | 10/04/2025 | 10/05/2025 | 30 | 11 | N | poor |
| SM39-C-RC1 | 148.6179 | -35.9281 | Tantangara Road | BTR | 1/12/2024 | 20/12/2024 | 19 | 56 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 99 | Y | ok |
| SM39-C-RC2 | 148.6185 | -35.9274 | Tantangara Road | BTR | 8/01/2025 | 6/02/2025 | 29 | 248 | Y | poor | Camera failure | | | | | |
| SM40-C-RC1 | 148.4055 | -35.8817 | Ravine Road | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 204 | Y | ok | 1/04/2025 | 30/04/2025 | 29 | 645 | Y | ok |
| SM40-C-RC2 | 148.4044 | -35.8815 | Ravine Road | SM, EPP | 1/01/2025 | 30/01/2025 | 29 | 30 | Y | poor | 1/04/2025 | 30/04/2025 | 29 | 606 | Y | ok |
| SM41-C-RC1 | 148.3918 | -35.8967 | Link Road | SM, EPP | Discontinued - unsafe access | | | | | | Discontinued - unsafe access | | | | | |
| SM41-C-RC2 | 148.3910 | -35.8963 | Link Road | SM, EPP | Discontinued - unsafe access | | | | | | Discontinued - unsafe access | | | | | |

Appendix 3(a) – Habitat site descriptions and species list



Sites: General Location - Lobs and Ravine Road.

| Site ID | | Transect ID | Complete Y/N | Review |
|--------------------|--|-------------|--------------|--|
| SM01 Impact |  | HT1 | Y | Very difficult to survey due to post fire Alpine Ash regrowth. Hundreds of stems per square metre. Only species noted were <i>E. delegatensis</i> and <i>Poa fawcettiae</i> . No low growing flowering species or <i>Poa</i> swards suitable for small mammal habitat. |
| | | HT2 | N | Too dangerous to access through forest, risk of falling trees. |
| SM03 Impact | Lobs – Ravine Rd  | HT1 | Y | Very difficult to survey due to post fire Alpine Ash regrowth and dangerous due to tall stands of deadwood. Species noted were <i>E. delegatensis</i> , <i>Lomandra longifolia</i> and <i>Poa helmsii</i> . Weeds observed were Black Thistle and Blackberry. No low growing flowering species or <i>Poa</i> swards suitable for small mammal habitat. |
| | | HT2 | Y | As above. Forest composition uniform throughout the survey quadrat to HT1. |
| SM05 Impact | Lobs – Ravine Rd | HT1 | N | Unsafe to survey. Observation from the road: lots of standing deadwood with potential to fall and mass Alpine Ash regrowth. Species recorded from the site edge were <i>Eucalyptus delegatensis</i> , <i>Poa helmsii</i> and <i>Podolobium alpestre</i> . |
| | | HT2 | N | Too dangerous to access through forest. |



Sites: General Location - Lobs and Ravine Road.

| Site ID | | Transect ID | Complete Y/N | Review |
|--------------------|--|-------------|--------------|---|
| |  | | | |
| SM07 Impact | Lobs – Ravine Rd  | HT1 | Y | Mass post fire Alpine Ash regrowth and very hard to survey. Dominated by Eucalyptus delegatensis saplings. Other species recorded were Coprosma hirtella, Daveisia latifolia, Lomandra ficifolia, Lomatia arborescens and Poa sieberiana. Many plants of Glycine microphylla were noted on the edge of the forest regrowth, but not within the Alpine Ash seedlings. Poor habitat values due to lack of biodiversity in flowering species and an insignificant presence of Poa. |
| | | HT2 | N | Unable to access - Too dangerous to access through the dense forest. |
| SM10 Impact | Lobs – Ravine Rd | HT1 | N | Unsafe to survey. Observations from the road - Lots of standing dead wood with potential to fall (tree fell while we were observing entry from the edge) and mass Alpine Ash regrowth, with the only species recorded being Acacia dealbata, Eucalyptus delegatensis and Poa helmsii. A lot of Blackberry was growing between the Alpine Ash saplings which further inhibited access. No habitat values for all three small mammals. |



Sites: General Location - Lobs and Ravine Road.

| Site ID | | Transect ID | Complete Y/N | Review |
|--------------------|--|-------------|--------------|--|
| | | HT2 | N | Too dangerous to access through dense forest. |
| SM14 Impact | Lobs – Ravine Rd  | HT1 | Y | Mass Eucalyptus delegatensis regrowth post fire germination with multiple stems per square metre. Other species noted were Acacia dealbata, Lomatia arborescens, Eucalyptus rubida, Cassinia longifolia and Poa sieberiana but were only seen around the edges of the forest regrowth. Poor habitat values due to lack of biodiversity in flowering species and an insignificant presence of Poa. |
| | | HT2 | Y | Forest composition uniform throughout the survey quadrat to HT1. |
| SM15 Impact | Lobs – Ravine Rd  | HT1 | Y | Mass Alpine Ash (E. delegatensis) post fire germination with multiple stems per square metre. Very hard to survey. Other species recorded were Acacia melanoxylon, Cassinia aculeata, Eucalyptus rubida and Geranium potentilloides. Site is also dominated by Rubus fruticosus – Blackberry. Poor habitat values due to lack of biodiversity in flowering species and an insignificant presence of Poa. |
| | | HT2 | N | Access too difficult and dangerous. |
| SM16 Impact | Lobs – Ravine Rd | HT1 | Y | A mixed forest with Alpine Ash and Snow Gum regrowth with multiple stems per square metre. However, there was more open areas than other post fire Alpine Ash Forest surveyed. Hard to access, but other species observed were Bossiaea foliosa, Cassinia aculeata, Daveisia mimosoides, Dianella tasmannica, Lomandra ficifolia and Poa sieberiana. Some Poa sward |



Sites: General Location - Lobs and Ravine Road.

| Site ID | | Transect ID | Complete Y/N | Review |
|------------------------|--|-------------|--------------|---|
| |  | | | suitable for Broad Tooth Rat habitat, but very low to low habitat values for the eastern Pygmy Possum and Smokey Mouse. |
| | | HT2 | Y | As above. Forest composition uniform throughout the survey quadrat to HT1. |
| SM17 Control | Lobs – O’Hares FT | HT1 | N | Not surveyed due to safety reasons – inaccessible due to the condition of the fire trail. |
| |  | HT2 | N | Not surveyed due to safety reasons – inaccessible due to the condition of the fire trail. |
| SM18 Impact | Lobs – Ravine Rd | HT1 | N | Not surveyed due to safety reasons – inaccessible due to slope and access. |
| | | HT2 | N | Not surveyed due to safety reasons – inaccessible due to slope and access. |
| SM19 Impact | Lobs – Across from Main Camp | HT1 | Y | This survey area was dominated by Blackberry and was difficult to access. Other species occurring were <i>Acacia dealbata</i> , <i>Acacia pravissima</i> , <i>Euc. delegantensis</i> , <i>Euc. viminalis</i> , <i>Cassinia aculeata</i> , <i>Poa helmsii</i> . Low biodiversity, low <i>Poa</i> sward and no low flowering species. Minimal habitat values for small mammals. |
| | | HT2 | N | Not surveyed due to safety reasons – inaccessible due to Blackberry. |



Sites: General Location - Lobs and Ravine Road.

| Site ID | | Transect ID | Complete Y/N | Review |
|------------------------|--|-------------|--------------|---|
| |  | | | suitable for Broad Tooth Rat habitat, but very low to low habitat values for the eastern Pygmy Possum and Smokey Mouse. |
| | | HT2 | Y | As above. Forest composition uniform throughout the survey quadrat to HT1. |
| SM17 Control | Lobs – O’Hares FT | HT1 | N | Not surveyed due to safety reasons – inaccessible due to the condition of the fire trail. |
| |  | HT2 | N | Not surveyed due to safety reasons – inaccessible due to the condition of the fire trail. |
| SM18 Impact | Lobs – Ravine Rd | HT1 | N | Not surveyed due to safety reasons – inaccessible due to slope and access. |
| | | HT2 | N | Not surveyed due to safety reasons – inaccessible due to slope and access. |
| SM19 Impact | Lobs – Across from Main Camp | HT1 | Y | This survey area was dominated by Blackberry and was difficult to access. Other species occurring were <i>Acacia dealbata</i> , <i>Acacia pravissima</i> , <i>Euc. delegantensis</i> , <i>Euc. viminalis</i> , <i>Cassinia aculeata</i> , <i>Poa helmsii</i> . Low biodiversity, low <i>Poa</i> sward and no low flowering species. Minimal habitat values for small mammals. |
| | | HT2 | N | Not surveyed due to safety reasons – inaccessible due to Blackberry. |


Sites: General Location - Lobs and Ravine Road.

| Site ID | | Transect ID | Complete Y/N | Review |
|--------------------|--|-------------|---|--|
| |  | | | |
| SM20 Impact | Near MAT potal  | HT1 | Y | This transect is located within the construction footprint, this does not meet the criteria for being placed within the indirect impact zone of 0-20m. It is within the disturbance area and has been taken over by site activities. |
| | | HT2 | Y This survey site was in a highly disturbed area near to Wallaces Ck down a small track. It is a recovering post fire dry sclerophyll forest dominated by regrowing Eucalyptus dives and Eucalyptus mannifera. Other species observed were Acacia pravissima, Banksia canei, Bursaria spinosa, Cassinia longifolia, Lomandra longifolia, Poa sieberiana and Pteridium esculentum. The area was inundated with Blackberry and Fleabane, with the weedy species intergrown through the forest. No low flowering species were observed, nor any built up Poa biomass. This site has low to zero habitat values for the three target small mammals. | |


Sites: General Location - Tantangara

| Site ID | Location | Transect ID | Complete Y/N | Review |
|--------------------|---|-------------|--------------|---|
| SM34 Impact | TT Rd – Across from old Quarry site  | HT1 | Y | This site is located in a wetland/riparian area adjacent to a creek. Lots of grazing observed, trampling of vegetation, incisions into the edges of the area with active water loss. Horse scats observed. Poor habitat values for all target small mammals. Species observed were: <i>Agrostis capillaris</i> *, <i>Anthoxanthum odoratum</i> *, <i>Carex guadichaudiana</i> , <i>Cassinia uncata</i> , <i>Cirsium vulgare</i> * <i>Empodisma minus</i> , <i>Epacris microphylla</i> , <i>Hakea microcarpa</i> , <i>Hypochaeris radicata</i> *, <i>Holcus lanatus</i> *, <i>Juncus australis</i> , <i>Juncus effusus</i> *, <i>Leucanthemum vulgare</i> , <i>Phalaris arundinacea</i> *, <i>Pimelea ligustrina</i> , <i>Pimelea pauciflora</i> , <i>Poa costiniana</i> and <i>Senecio gunnii</i> . |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM36 Impact | TT Rd  | HT1 | Y | This site is located on the edge and in part of a fen near to Nungar creek. It has a range of low flowering species, a robust <i>Poa</i> sward, but also containing <i>Anthoxanthum odoratum</i> . Species observed were: <i>Aciphylla simplicifolia</i> , <i>Arthropodium milliflorum</i> , <i>Carex guadichaudiana</i> , <i>Cassinia uncata</i> , <i>Empodisma minus</i> , <i>Holcus lanatus</i> * <i>Leptorhynchus squamatus</i> , <i>Ozothamnus hookeri</i> , <i>Picris angustifolia</i> , <i>Pimelea ligustrina</i> , <i>Poa fawcettiae</i> and <i>Poa labillardierei</i> . This are having moderate to good habitat values for Broad Tooth Rat. Due to the absence of a tree canopy, it is likely to have low habitat value for both the Smoky Mouse and the Eastern Pygmy Possum. |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM37 Impact | TT Rd – Wares Yard FT | HT1 | Y | This site is highly disturbed, mostly from pig damage and horse grazing. Dominated by <i>Anthoxanthum odoratum</i> , <i>Hypericum perforatum</i> and <i>Hypochaeris radicata</i> . Native species observed were: <i>Grevillea australis</i> , <i>Hakea microcarpa</i> , <i>Hovea montana</i> , <i>Leptospermum myrtifolium</i> , <i>Leucopogon montanus</i> , <i>Olearia erubescens</i> , <i>Pimelea ligustrina</i> , <i>Pimelea</i> |



Sites: General Location - Tantangara

| Site ID | Location | Transect ID | Complete Y/N | Review |
|---------|---|-------------|--------------|---|
| |  | | | pauciflora, <i>Poa sieberiana</i> and <i>Xerochrysum subundulatum</i> . These are all medium to tall shrubs with little habitat values for the Smokey Mouse and Eastern Pygmy Possum. Limited <i>Poa</i> biomass for Broad Tooth Rat habitat. |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |



Sites: General Location - Marica

| Site ID | Location | Transect ID | Complete Y/N | Review |
|--------------------|---|-------------|--------------|--|
| SM21 Impact | Marica – Bottom of the Rd  | HT1 | Y | This site is a burnt Snow Gum/Mountain Gum recovering forest. It is dominated by <i>Daveisia mimosoides</i> and <i>Cassinia longifolia</i> , which are colonising shrubs after significant disturbance, such as wildfire. It has a low to average amount of litter, some hollows and very few nectar plants. It has low habitat quality for the Eastern Pygmy Possum and very low to zero habitat values for the Smokey Mouse and Broad Tooth Rat. |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM22 Impact | Marica - Pad 3 | HT1 | Y | This site is very close and similar to SM21 with a recovering Snow Gum and Mountain Gum Forest. The shrubs occurring in this area are <i>Daveisia mimosoides</i> , <i>Olearia erubescens</i> and <i>Personnia rigida</i> , which are colonising shrubs. There are some <i>Arthropodium milliflorum</i> , <i>Dianella revoluta</i> , <i>Coprosma hirtella</i> and <i>Lomandra longifolia</i> . There are some hollows and |



Sites: General Location - Marica

| Site ID | Location | Transect ID | Complete Y/N | Review |
|------------------------|--|-------------|--------------|---|
| |  | | | average depths of leaf litter. It has low habitat quality for the Eastern Pygmy Possum and very low habitat values for the Smokey Mouse and no habitat values for Broad Tooth Rat. |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM23 Impact | Marica - Pad 3  | HT1 | Y | This site is also in a recovering post fire Snow Gum and Mountain Gum Forest, with some Eucalyptus robertsonii within the survey area. It has some Poa sieberiana and Poa helmsii, but with little old biomass. The shrubs present are Cassinia longifolia, Daveisia mimosoides, Daveisia ulicifolia and Platylobium formosum, all of which are colonising shrubs. There are small amounts of Lomandra longifolia, but no low flowering shrubs or forbs. Poor habitat values for all three small mammals. |
| | | HT2 | Y | As above. Survey area is consistent throughout. |
| SM24 Impact | Marica – Behind Surge Shaft | HT1 | Y | This site is very close and similar to SM21, SM22 and SM23. It is a recovering Snow Gum and Mountain Gum Forest with lots of post fire regrowth. The shrubs occurring in this area are Daveisia mimosoides and Pimelea pauciflora, which are colonising shrubs. Another species on site is Lomandra longifolia. There are some hollows and a good depth of leaf litter. It has low habitat quality for the Eastern Pygmy Possum and very low habitat values for the Smokey Mouse and Broad Tooth Rat. |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |


Sites: General Location - Marica

| Site ID | Location | Transect ID | Complete Y/N | Review |
|-------------------------------|--|-------------|--------------|---|
| |  | | | |
| SM25 Impact | Marica  | HT1 | Y | This site has post fire regrowth, particularly in the upper strata. The tree species on site is <i>Eucalyptus pauciflora</i> subsp. <i>debeuzevillei</i> , but all stems are small and recovering from fire. It had high levels of biodiversity in the middle and lower strata and moderate to good habitat values for the Eastern Pygmy Possum and Smokey Mouse. The <i>Poa</i> biomass was very low, so poor habitat value for the Broad Tooth Rat. Species observed on site were: <i>Bossiaea foliosa</i> , <i>Daveisia ulicifolia</i> , <i>Goodenia hederaceae</i> , <i>Helichrysum rutidolepis</i> , <i>Leucopogon montanus</i> , <i>Lomandra ficifolia</i> , <i>Olearia erubescens</i> , <i>Persoonia rigida</i> , <i>Poa sieberiana</i> , <i>Podolobium alpestre</i> , <i>Polyscias sumbucifolia</i> and <i>Stylidium graminifolium</i> . |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM26 Control | Marica | HT1 | Y | This site is similar to all the Marica sites, which has post fire regrowth, particularly the upper strata species. The tree species on site is <i>Eucalyptus pauciflora</i> subsp. <i>debeuzevillei</i> , but all are small and recovering from fire. It had moderate levels of biodiversity in the middle and lower strata and moderate habitat values for the Eastern Pygmy Possum and Smokey Mouse. The <i>Poa</i> biomass wasn't intense but better than other Marica sites so some habitat value for the Broad Tooth Rat. Species observed on site were: <i>Arthropodium milliflorum</i> , <i>Bossiaea foliosa</i> , <i>Daveisia ulicifolia</i> , <i>Helichrysum rutidolepis</i> , <i>Leucopogon montanus</i> , <i>Lomandra ficifolia</i> , <i>Olearia erubescens</i> , <i>Poa phillipsiana</i> , <i>Poa sieberiana</i> , <i>Podolobium alpestre</i> , <i>Polyscias sumbucifolia</i> , <i>Stellaria pungens</i> and <i>Stylidium graminifolium</i> . |



Sites: General Location - Marica

| Site ID | Location | Transect ID | Complete Y/N | Review |
|--------------------|--|-------------|--------------|--|
| |  | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM27 Impact | Marica  | HT1 | Y | Triggered in year 4. Assessment: this site has no evidence of any Snowy 2 impacts and is very similar to SM26, the control site. It had very high levels of biodiversity (better than the control site) and good habitat values for the eastern Pygmy Possum and Smokey Mouse. It is a wet soak area with lots of riparian and wetland species present. There was some Poa biomass on site, but not continuous, so virtually no habitat value for the Broad Tooth Rat. Species observed were: <i>Arthropodium milliflorum</i> , <i>Brachyscome dicipiens</i> , <i>B. spathulata</i> , <i>Carex appressa</i> , <i>Derwentia derwentiana</i> , <i>Empodisma minus</i> , <i>Epacris microphylla</i> , <i>Eucalyptus pauciflora</i> subsp. <i>debeuzevillei</i> , <i>Eucalyptus stellulata</i> , <i>Grevillea australis</i> , <i>Hakea microcarpa</i> , <i>Juncus australis</i> , <i>Olearia erubescens</i> , <i>Picris angustifolia</i> , <i>Pimelea pauciflora</i> , <i>Podolepis robusta</i> , <i>Sphagnum cristatum</i> , <i>Tasmania lanceolata</i> and <i>Xerochrysum subundulatum</i> . Horse scats and tracks were observed. |
| | | HT2 | Y | As above. Survey area is consistent throughout, with HT1. |



Sites: General Location – Off site

| Site ID | Location | Transect ID | Complete Y/N | Review |
|------------------------|---|-------------|--------------|--|
| SM02 Control |  | HT1 | Y | This site, like all in the upper Ravine Rd is dominated by Alpine Ash post fire regrowth with multiple stems per square metre. The species observed were from the first transect as it was unsafe and impossible to access the second transect. There were some lower flowering species observed and lots of coarse woody debris, so possibly good habitat for the Eastern Pygmy Possum, very low for Smokey Mouse and no habitat value for Broad Tooth Rat. Species observed from the first transect were: <i>Acacia obliquinervia</i> , <i>Callistemon pityoides</i> , <i>Cassina longifolia</i> , <i>Eucalyptus delegatensis</i> , <i>Ozothamnus secundiflorus</i> , <i>Pos helmsii</i> , <i>Polyscias sumbucifolia</i> and <i>Rumex parvifolia</i> . |
| | | HT2 | N | Very hard to access site due to Alpine Ash post fire regrowth. Unsafe, risk of falling trees. |
| SM04 Control | Disused Trail just past Lobs turn off | HT1 | N | Not surveyed due to accessibility issues – trees fallen over roads |
| | | HT2 | N | Not surveyed due to accessibility issues – trees fallen over roads |
| SM06 Control | Off Ravine past lay down area – disused Rd | HT1 | Y | This site has mass germination of post fire species, particularly <i>Daveisia latifolia</i> and <i>Eucalyptus delegatensis</i> . Other species observed were: <i>Acacia pravissima</i> , <i>Eucalyptus pauciflora</i> , <i>Eucalyptus rubida</i> , <i>Derwentia derwentiana</i> , <i>Lomandra ficifolia</i> , <i>Poa sieberiana</i> and <i>Poa labillardierei</i> . Weeds observed were: <i>Hypericum perforatum</i> , <i>Rubus fruticosus</i> and <i>Rosa rubignosa</i> . The <i>Poa</i> biomass was not continuous or thick, so no habitat values for the Broad Tooth Rat. Minimal habitat values for the Smokey Mouse and Eastern Pygmy Possum as not enough low growing flowering species. Some habitat provided in the coarse woody debris on site for these two species. |
| | | HT2 | Y | As above, survey area consistent throughout site with HT1. |



Sites: General Location – Off site

| Site ID | Location | Transect ID | Complete Y/N | Review |
|------------------------|--|-------------|--------------|---|
| |  | | | |
| SM09 Control | Off Ravine past lay down area – disused Rd  | HT1 | Y | This site is very similar and very close to SM06 with a lot of <i>Daveisia latifolia</i> and <i>Eucalyptus delegatensis</i> post fire germination, with masses of stems per square metre. Other species observed were <i>Daveisia ulicifolia</i> , <i>Eucalyptus pauciflora</i> and <i>E.rubida</i> , <i>Cassinia longifolia</i> , <i>Derwentia perfoliata</i> , <i>Lomandra ficifolia</i> , <i>Platylobium formosum</i> , <i>Pimelea pauciflora</i> , <i>Poa sieberiana</i> and <i>Themeda australis</i> . Weeds observed were: <i>Hypericum perforatum</i> , <i>Rubus fruticosus</i> and <i>Rosa rubiginosa</i> . There was minimal <i>Poa</i> biomass, so poor habitat for the Broad Tooth Rat. Slightly improved habitat for the Smokey Mouse and Eastern Pygmy Possum with some lower flowering and fruiting species for foraging. |
| | | HT2 | N | Too dangerous to access fully onto site, unsafe, risk of falling trees. |
| SM12 Control | Off Ravine past lay down area – disused Rd | HT1 | Y | This site is very similar and very close to SM09 with a lot of <i>Daveisia latifolia</i> and <i>Eucalyptus delegatensis</i> post fire germination, with masses of stems per square metre. Other species observed were: <i>Bossiaea foliosa</i> , <i>Daveisia ulicifolia</i> , <i>Eucalyptus pauciflora</i> , <i>Cassinia longifolia</i> , <i>Derwentia derwentiana</i> , <i>Leptospermum myrtifolium</i> , <i>Lomandra ficifolia</i> , <i>Platylobium formosum</i> , <i>Pimelea pauciflora</i> , <i>Poa labillardierei</i> and <i>Poa sieberiana</i> . Weeds observed were: <i>Hypericum perforatum</i> , <i>Rubus fruticosus</i> and <i>Rosa rubiginosa</i> . |



Sites: General Location – Off site

| Site ID | Location | Transect ID | Complete Y/N | Review |
|-------------------------------|---|-------------|--------------|--|
| |  | | | There was minimal Poa biomass, so poor habitat for the Broad Tooth Rat. Slightly improved habitat for the Smokey Mouse and Eastern Pygmy Possum with some lower flowering and fruiting species for foraging. |
| | | HT2 | Y | As above, survey area consistent throughout site with HT1. |
| SM13 Control | Off Ravine past lay down area – disused Rd | HT1 | N | Many duplicate controls in close proximity to each other. Unable to survey due to track access issues. |
| | | HT2 | N | Many duplicate controls in close proximity to each other. Unable to survey due to track access issues. |
| SM28 Control | Bullocks Hill FT – Horse Camp  | HT1 | Y | This site is located adjacent to a well-used horse camp and is in the middle of a fen. It is a site dominated by <i>Carex guadichaudiana</i> . A low biodiversity site, with no nectar species, seeds or Poa biomass to support any of the target small mammals. It has small amounts of introduced species, mostly Yorkshire Fog and Brown Top Bent Grass. Due to the fen location, this site is not a good control site for the habitat characteristics for small mammals. |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1 |


Sites: General Location – Off site

| Site ID | Location | Transect ID | Complete Y/N | Review |
|------------------------|---|-------------|--------------|--|
| SM29 Control |  | HT1 | Y | This site is an open woodland, there are average habitat values for Smokey Mouse and the Eastern Pygmy Possum as few low flowering species exist. Moderate Poa biomass, so moderate habitat value for Broad Tooth Rats. Lots of coarse woody debris. Species occurring on this site are <i>Acacia obliquinervia</i> , <i>Acaena novae-zelandiae</i> , <i>Arthropodium milliflorum</i> , <i>Eucalyptus nortonii</i> , <i>Eucalyptus robertsonii</i> , <i>Lomatia arborescens</i> , <i>Pimelea pauciflora</i> , <i>Poa phillipsiana</i> , <i>Poa sieberiana</i> , <i>Polystichum proliferum</i> , <i>Stellaria pungens</i> and <i>Tasmania lanceolata</i> . |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM30 Control | Bullocks Hill FT – Creek Crossing  | HT1 | Y | Close to a complete coverage of <i>Poa labillardierei</i> , however, Very low biodiversity. No tall strata. Good Broad Tooth Rat habitat dominated by <i>Poa labillardierei</i> . Poor habitat values for the Smokey Mouse and Eastern Pygmy Possum. Species observed were: <i>Carex hebes</i> , <i>Empodisma minus</i> , <i>Epacris microphylla</i> , <i>Juncus australis</i> , <i>Pimelea ligustrina</i> , <i>Poa labillardierei</i> , <i>Poa sieberiana</i> and <i>Pratia pedunculata</i> . |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM31 Control | Bullocks Hill FT | HT1 | Y | Located near to Bullocks Hill Trail. Very low habitat values for Broad Tooth Rat habitat as little Poa biomass. Some forb and shrub species with potential food for Smokey Mice and low habitat value. No habitat value for the Eastern Pygmy Possum. Species observed were: <i>Aciphylla simplicifolia</i> , <i>Anthoxanthum odoratum*</i> , <i>Craspedia lamicola/maxgreyii</i> , <i>Holcus lanatus*</i> , <i>Hovea montana</i> , <i>Leucopogon montanus</i> , <i>Oreomyrrhis eriopoda</i> , <i>Ozothamnus secundiflorus</i> , <i>Pimelea pauciflora</i> , <i>Poa sieberiana</i> , <i>Rhodanthe anthemoides</i> and <i>Stellaria pungens</i> . Some coarse woody debris on site. |


Sites: General Location – Off site

| Site ID | Location | Transect ID | Complete Y/N | Review |
|------------------------|--|-------------|--------------|---|
| |  | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM32 Control | Bullocks Hill FT – Hains Hut  | HT1 | Y | This site is located on the Murrumbidgee Rive. Significant <i>Poa labillardierei</i> biomass providing excellent Broad Tooth Rat habitat. Low levels of biodiversity and very few low flowering species, so poor habitat for the Eastern Pygmy Possum and Smokey Mouse. Mix of shrubs and grasses. Species observed were: <i>Acaena novae-zelandiae</i> , <i>Carex hebes</i> , <i>Cassinia aculeata</i> , <i>Hakea microcarpa</i> , <i>Poa labillardierei</i> , <i>Rumex acetosella</i> (weed) and <i>Verbascum thapsus</i> (weed). |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM33 Control | Port Phillip FT – Long Plain | HT1 | Y | This site is composed mostly of native species and mostly grasses and a few forbs. <i>Poa labillardierei</i> is the dominant grass species. It has excellent <i>Poa</i> biomass suitable for Broad Tooth Rat habitat, but poor habitat quality for the Smokey Mouse and Eastern Pygmy Possum as few low flowering species exist. Species observed on site were: <i>Carex guadichaudiana</i> , <i>Cassinia uncata</i> , <i>Empodisma minus</i> , <i>Hypochaeris radicata</i> *, <i>Holcus</i> |

Sites: General Location – Off site

| Site ID | Location | Transect ID | Complete Y/N | Review |
|-------------------------------|---|-------------|--------------|--|
| |  | | | lanatus*, Juncus australis, Pimelea ligustrina, Poa helmsii, Poa labillardierei and Wahlenbergia gloriosa. |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM35 Impact | Alpine Creek FT | HT1 | N | Alpine Creek FT – no longer active in Main works, associated with borehole work in the Exploration Phase. |
| | | HT2 | N | Alpine Creek FT – no longer active in Main works, associated with borehole work in the Exploration Phase. |
| SM38 Control | Snowy Mtns Hwy | HT1 | Y | This site is mostly native species composed of a mix of grasses, forbs, shrubs and small trees. It has significant Poa biomass suitable for Broad Tooth Rats. There are a range of flowering forbs which have good habitat value for Smokey Mouse. Species observed were: Arthropodium milliflorum, Asperula gunnii, Brachyscome nivalis, Brachyscome spathulate, Carex appressa, Cassinia uncata, Empodisma minus, Epacris microphylla, Eucalyptus pauciflora, Grevillea australis, Hakea microcarpa, Juncus australis, Picris angustifolia, Pimelea ligustrina, Plantago antarctica, Poa helmsii, Poa sieberiana, Rununculus graniticola, Senecio gunnii, Viola betonicifolia and Wahlenbergia gloriosa. |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM39 Control | Cnr of Snowy Mtns Hwy and TT Rd | HT1 | Y | This site is composed of mostly native species, a mix of grasses, forbs, shrubs and small trees. There is significant Poa biomass suitable for Broad Tooth Rats. There are some low fruits and flowers on shrubs and forbs that could support Smokey Mouse. Species observed were: Agrostis capillaris (weed), Callistemon pityoides, Carex appressa, Derwentia derwentiana, Empodisma minus, Epacris microphylla, Eucalyptus |

Sites: General Location – Off site

| Site ID | Location | Transect ID | Complete Y/N | Review |
|-------------------------------|---|-------------|--------------|--|
| |  | | | stellulata, Grevillea lanigerum, Hakea microcarpa, Hypochaeris radicata (weed), Juncus australis, Leptospermum grandifolium, Pimelea ligustrina, Poa helmsii, Poa sieberiana, Viola betonicifolia and Wahlenbergia gloriosa. |
| | | HT2 | Y | As above. Survey area is consistent throughout with HT1. |
| SM40 Control | Off Ravine past lay down area – disused Rd | HT1 | N | Not surveyed, too dangerous to access. Very close to other very similar and multiple control sites in this survey areas. |
| | | HT2 | N | Not surveyed, too dangerous to access. Very close to other very similar and multiple control sites in this survey areas. |
| SM41 Control | Link Rd – Halfway to Cabra | HT1 | N | Not surveyed due to safety reasons, risk of falling trees. |
| | | HT2 | N | Not surveyed due to safety reasons, risk of falling trees. |

Appendix 3(b) – Habitat percentage counts by site.

| | | Year 5 | | | | | | | | |
|---------|------|------------|------------|-----------------------|------------|------------|-----------------------|------------|------------|-----------------------|
| | | <0.5 m | | | 0.5-1 m | | | 1-1.5 m | | |
| Site | | Native (%) | Exotic (%) | Habitat Structure (%) | Native (%) | Exotic (%) | Habitat Structure (%) | Native (%) | Exotic (%) | Habitat Structure (%) |
| Control | SM02 | 56% | 4% | 24% | 62% | 0% | 0% | 62% | 0% | 0% |
| | SM06 | 60% | 7% | 16% | 31% | 1% | 5% | 25% | 0% | 0% |
| | SM09 | 96% | 2% | 2% | 28% | 0% | 0% | 16% | 0% | 0% |
| | SM12 | 82% | 2% | 5% | 59% | 0% | 2% | 40% | 0% | 0% |
| | SM26 | 96% | 3% | 1% | 29% | 0% | 0% | 11% | 0% | 0% |
| | SM28 | 76% | 23% | 0% | 0% | 1% | 0% | 0% | 0% | 0% |
| | SM29 | 70% | 18% | 8% | 19% | 0% | 0% | 4% | 0% | 0% |
| | SM30 | 95% | 5% | 0% | 11% | 0% | 0% | 0% | 0% | 0% |
| | SM31 | 67% | 30% | 3% | 3% | 0% | 0% | 0% | 0% | 0% |
| | SM32 | 64% | 33% | 0% | 55% | 0% | 0% | 0% | 0% | 0% |
| | SM33 | 71% | 29% | 0% | 13% | 0% | 0% | 0% | 0% | 0% |
| | SM38 | 67% | 24% | 2% | 16% | 0% | 0% | 0% | 0% | 0% |
| | SM39 | 58% | 44% | 2% | 27% | 1% | 0% | 13% | 0% | 0% |
| Impact | SM01 | 76% | 6% | 24% | 86% | 4% | 8% | 16% | 0% | 0% |
| | SM03 | 53% | 0% | 44% | 83% | 0% | 29% | 43% | 0% | 2% |
| | SM07 | 80% | 8% | 32% | 78% | 0% | 10% | 32% | 0% | 0% |
| | SM14 | 58% | 4% | 39% | 66% | 4% | 8% | 36% | 0% | 0% |
| | SM15 | 92% | 22% | 20% | 68% | 2% | 8% | 22% | 0% | 2% |
| | SM16 | 85% | 6% | 14% | 70% | 0% | 6% | 30% | 0% | 0% |
| | SM19 | 54% | 94% | 8% | 34% | 40% | 10% | 32% | 12% | 0% |
| | SM20 | 60% | 32% | 8% | 42% | 28% | 2% | 10% | 0% | 0% |
| | SM21 | 84% | 3% | 6% | 41% | 0% | 0% | 15% | 0% | 0% |
| | SM22 | 76% | 5% | 8% | 39% | 1% | 1% | 38% | 0% | 0% |
| | SM23 | 57% | 1% | 7% | 56% | 0% | 1% | 52% | 0% | 0% |
| | SM24 | 63% | 3% | 10% | 47% | 0% | 1% | 38% | 0% | 1% |
| | SM25 | 71% | 3% | 7% | 61% | 1% | 0% | 41% | 0% | 0% |
| | SM27 | 91% | 14% | 0% | 7% | 0% | 0% | 0% | 0% | 0% |
| | SM34 | 98% | 17% | 21% | 66% | 5% | 5% | 0% | 0% | 0% |
| | SM36 | 97% | 8% | 1% | 61% | 5% | 0% | 0% | 0% | 0% |
| SM37 | 95% | 23% | 2% | 58% | 1% | 1% | 2% | 0% | 0% | |

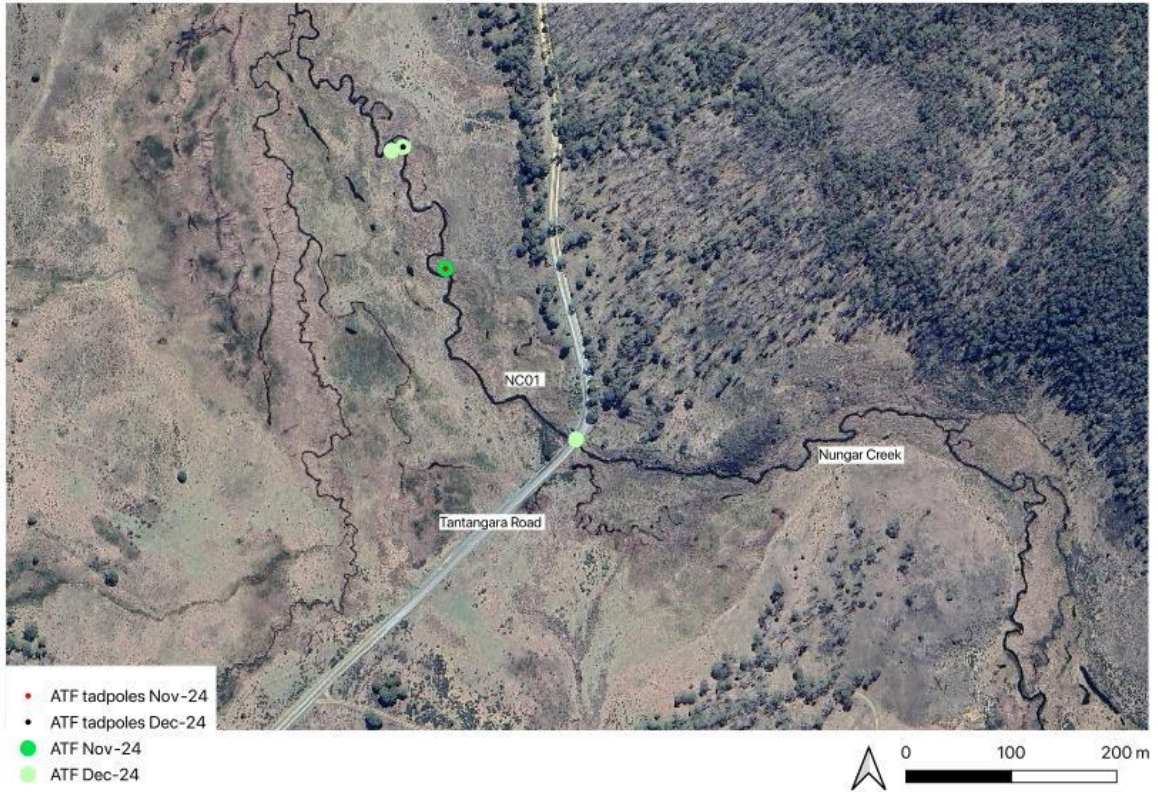
Appendix 4(a) – Year 5 ATF detections at impact and control sites



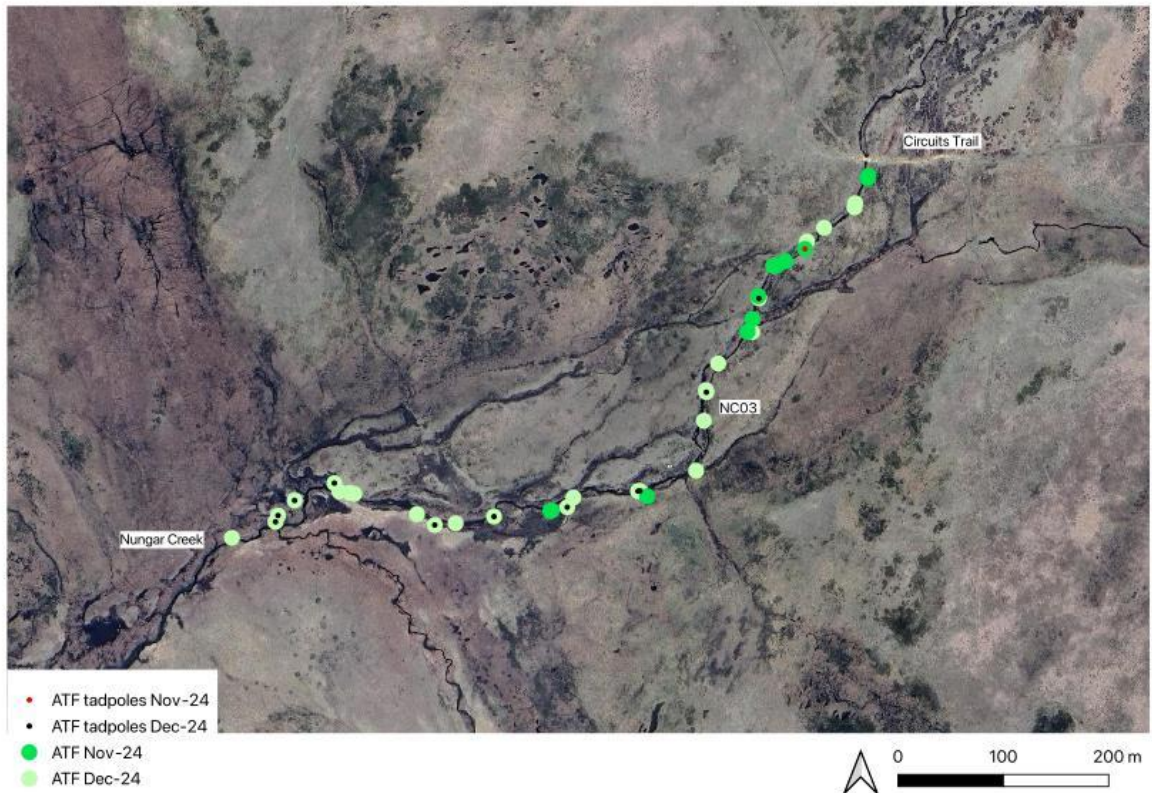
Alpine Tree Frog detections at impact sites TC01, MR01 and KPC01 during 2024 surveys, including tadpole detections. Note: sediment basin CH805 at the end of transect KPC01 protected for breeding habitat.



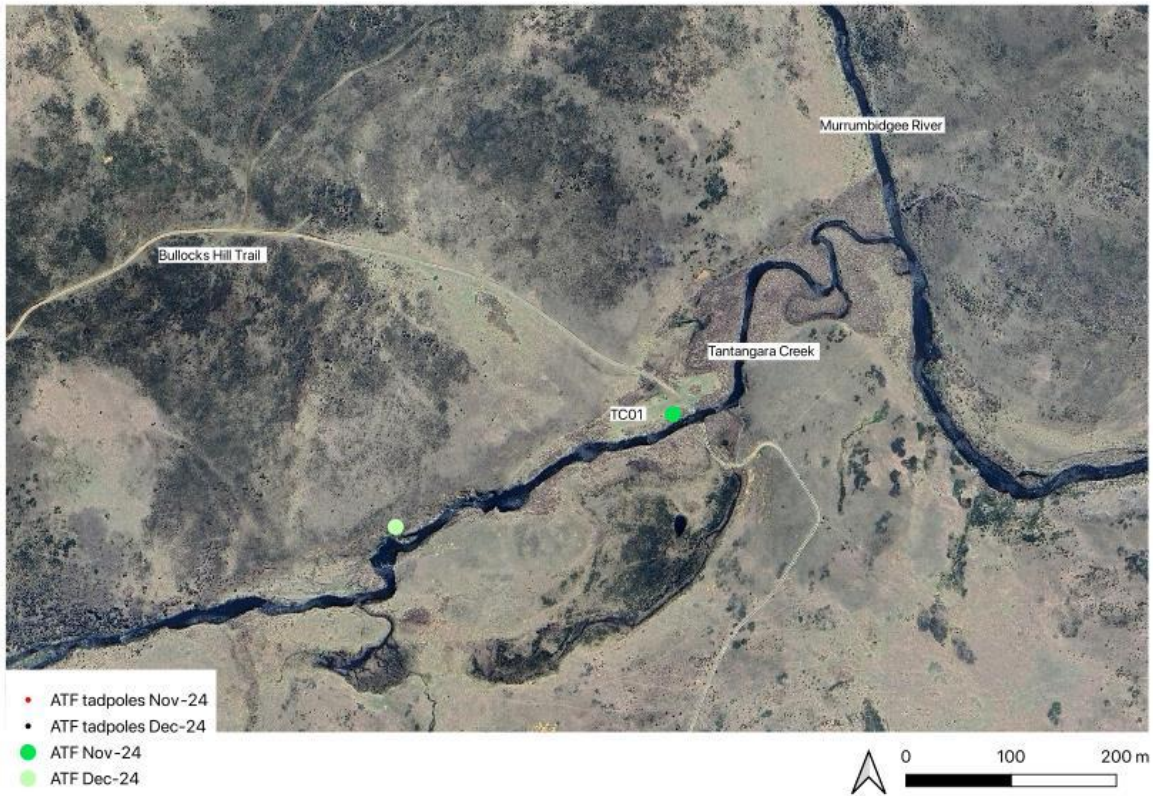
Alpine Tree Frog detections at control site ER02 during 2024 surveys, including tadpole detections.



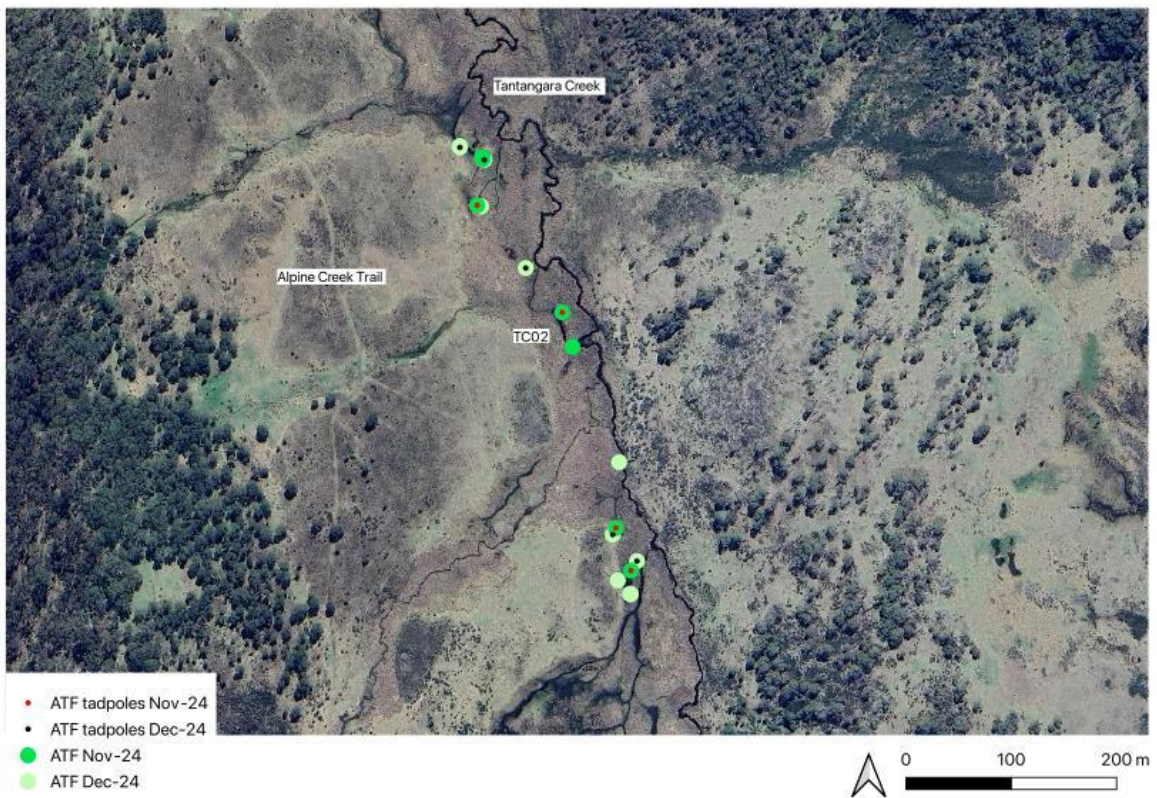
Alpine Tree Frog detections at impact site NC01 during 2024 surveys, including tadpole detections.



Alpine Tree Frog detections at control site NC03 during 2024 surveys, including tadpole detections. Note: many tadpoles observations during December survey.



Alpine Tree Frog detections at control site TC01 during 2024 surveys, including tadpole detections. Note: no tadpoles observations during 2024 surveys.



Alpine Tree Frog detections at impact site TC02 during 2024 surveys, including tadpole detections. Note: many frog and tadpole observations during both surveys.

Appendix 4(b) – Year 5 ATF tadpole observational data

NC01 (Impact site) and ER02 (Control site)

Tadpole numbers declined at both NC01 and ER02, which are highly ephemeral sites consisting of shallow, rain-filled pools. Many of these ponds dried out during late November and early December, leading to tadpole desiccation and consequently fewer observations during the second survey.

TC02 (Impact site)

At TC02, tadpole numbers decreased as many individuals had either begun metamorphosis during the second survey or had already completed metamorphosis and left the water.

KPC01 (Impact site)

Tadpole numbers at KPC01 were significantly lower in December compared to November. This decline is attributed to many tadpoles already having metamorphosed and dispersed (Figure 12). Approximately 100 remaining tadpoles were observed at Gosner stage 41 and 42, indicating they were close to completing metamorphosis.

MR01 and NC03 (Control sites)

At both MR01 and NC03, tadpole numbers increased between the November and December surveys. MR01 is a deep, off-stream fire dam where many small tadpoles were recorded in November. By December, these tadpoles had grown and increased in number, likely due to further breeding events. The site is partially shaded, which may result in slower development compared to more exposed, sunlit sites like KPC01. No tadpoles were observed in the adjacent Murrumbidgee River, though detection in such a deep, fast-flowing system is inherently difficult. At NC03, tadpole numbers increased markedly. This small, permanent stream contains deep pools, and the sharp rise in detections is likely a result of a breeding explosion noted during the November survey.

TR01 (Impact site) and TC03 (Control site)

No tadpoles were recorded at either TR01 or TC03, likely due to high water flows and the absence of suitable breeding pools.

Appendix 5 – Year 5 ASOS additional data – Ants and other reptiles

Ant scores (0-3) and reptiles detected during Year 5 Alpine She-oak Skink tile grid surveys (n=6) in Kosciuszko National Park, NSW.

| Site | Survey | Ant Score | | | | Reptile detections | |
|-------------|--------|-----------|------|------|------|--------------------|------|
| | | 0 | 1 | 2 | 3 | Other species | ASOS |
| Impact TG02 | 1 | 7 | 2 | 4 | 12 | 2 | 0 |
| | 2 | 15 | 4 | 6 | 0 | 2 | 0 |
| | 3 | 20 | 1 | 4 | 0 | 2 | 0 |
| | 4 | 22 | 0 | 2 | 1 | 0 | 1 |
| | 5 | 25 | 0 | 0 | 0 | 0 | 0 |
| | 6 | 20 | 3 | 1 | 1 | 0 | 0 |
| | mean | 18.17 | 1.67 | 2.83 | 2.33 | Total | 6 |
| TG03 | 1 | 5 | 7 | 3 | 10 | 2 | 0 |
| | 2 | 22 | 1 | 2 | 0 | 0 | 0 |
| | 3 | 12 | 3 | 9 | 1 | 1 | 0 |
| | 4 | 13 | 0 | 7 | 5 | 3 | 0 |
| | 5 | 16 | 5 | 4 | 0 | 1 | 0 |
| | 6 | 20 | 2 | 1 | 2 | 1 | 0 |
| | mean | 14.67 | 3.00 | 4.33 | 3.00 | Total | 8 |
| TG05 | 1 | 13 | 6 | 4 | 2 | 0 | 0 |
| | 2 | 19 | 4 | 2 | 0 | 0 | 0 |
| | 3 | 14 | 4 | 5 | 2 | 1 | 0 |

| Site | Survey | Ant Score | | | | Reptile detections | |
|--------------|--------|-----------|------|------|------|--------------------|------|
| | | 0 | 1 | 2 | 3 | Other species | ASOS |
| | 4 | 14 | 1 | 4 | 6 | 0 | 0 |
| | 5 | 20 | 3 | 2 | 0 | 1 | 0 |
| | 6 | 19 | 5 | 0 | 1 | 0 | 0 |
| | mean | 16.50 | 3.83 | 2.83 | 1.83 | Total | 2 |
| TG12 | 1 | 16 | 7 | 1 | 1 | 0 | 0 |
| | 2 | 22 | 3 | 0 | 0 | 0 | 1 |
| | 3 | 21 | 2 | 2 | 0 | 0 | 0 |
| | 4 | 23 | 0 | 1 | 1 | 1 | 0 |
| | 5 | 24 | 1 | 0 | 0 | 0 | 0 |
| | 6 | 24 | 1 | 0 | 0 | 1 | 0 |
| | mean | 21.67 | 2.33 | 0.67 | 0.33 | Total | 2 |
| TG13 | 1 | 15 | 8 | 1 | 1 | 9 | 0 |
| | 2 | 24 | 1 | 0 | 0 | 1 | 0 |
| | 3 | 20 | 1 | 3 | 1 | 4 | 0 |
| | 4 | 20 | 1 | 1 | 3 | 2 | 0 |
| | 5 | 20 | 4 | 0 | 1 | 2 | 0 |
| | 6 | 23 | 1 | 1 | 0 | 0 | 0 |
| | mean | 20.33 | 2.67 | 1.00 | 1.00 | Total | 18 |
| Control TG06 | 1 | 21 | 2 | 0 | 2 | 0 | 0 |
| | 2 | 24 | 1 | 0 | 0 | 1 | 0 |

| Site | Survey | Ant Score | | | | Reptile detections | |
|------|--------|-----------|------|------|------|--------------------|------|
| | | 0 | 1 | 2 | 3 | Other species | ASOS |
| | 3 | 18 | 7 | 0 | 0 | 0 | 0 |
| | 4 | 19 | 0 | 1 | 5 | 2 | 0 |
| | 5 | 19 | 6 | 0 | 0 | 0 | 0 |
| | 6 | 23 | 2 | 0 | 0 | 1 | 0 |
| | mean | 20.67 | 3.00 | 0.17 | 1.17 | Total | 4 |
| TG07 | 1 | 18 | 4 | 0 | 3 | 0 | 0 |
| | 2 | 12 | 4 | 9 | 0 | 0 | 0 |
| | 3 | 11 | 5 | 9 | 0 | 1 | 0 |
| | 4 | 8 | 2 | 11 | 4 | 3 | 1 |
| | 5 | 23 | 2 | 0 | 0 | 0 | 0 |
| | 6 | 24 | 1 | 0 | 0 | 0 | 0 |
| | mean | 16.00 | 3.00 | 4.83 | 1.17 | Total | 4 |
| TG08 | 1 | 15 | 3 | 6 | 1 | 0 | 0 |
| | 2 | 19 | 2 | 4 | 0 | 1 | 1 |
| | 3 | 13 | 3 | 8 | 1 | 0 | 0 |
| | 4 | 12 | 2 | 8 | 3 | 0 | 0 |
| | 5 | 20 | 2 | 3 | 0 | 0 | 1 |
| | 6 | 24 | 1 | 0 | 0 | 0 | 0 |
| | mean | 17.17 | 2.17 | 4.83 | 0.83 | Total | 1 |
| TG11 | 1 | 4 | 3 | 1 | 17 | 0 | 2 |

| Site | Survey | Ant Score | | | | Reptile detections | |
|------|--------|-----------|------|------|------|--------------------|------|
| | | 0 | 1 | 2 | 3 | Other species | ASOS |
| | 2 | 15 | 3 | 6 | 1 | 0 | 0 |
| | 3 | 8 | 7 | 9 | 1 | 2 | 1 |
| | 4 | 8 | 2 | 11 | 4 | 2 | 0 |
| | 5 | 23 | 1 | 1 | 0 | 0 | 0 |
| | 6 | 23 | 0 | 1 | 1 | 0 | 0 |
| | mean | 13.50 | 2.67 | 4.83 | 4.00 | Total 4 | 3 |

Appendix 6(b) – Feral Animal Abundance Data – Spotlighting

Feral Animal Abundance Data (sum of animals/km) – Year 5

| Species | LHRR Bottom individuals(abundance) | LHRR North individuals(abundance) | LHRR South individuals(abundance) | Maricia individuals(abundance) | Rock Forest individuals(abundance) | Tantangara Dam individuals(abundance) | Tantangara Road individuals(abundance) |
|---|------------------------------------|-----------------------------------|-----------------------------------|--------------------------------|------------------------------------|---------------------------------------|--|
| First Monitoring Event - Q1 - Winter (June 2024) (EMM) | | | | | | | |
| Transect Distance (km) | 11.07 | 2.2 | 14.28 | 11.79 | 1.53 | 14.87 | 15.36 |
| Red Fox | 1 (0.1) | 0 | 0 | 0 | 0 | 0 | 0 |
| Feral Cat | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wild Dog | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Red Deer | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sambar Deer | 0 | 0 | 0 | 0 | 0 | 2 (0.1) | 0 |
| Fallow Deer | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feral Pig | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feral Horse | 0 | 0 | 0 | 55 (4.7) | 0 | 15 (1.0) | 0 |
| Rusa Deer | 1 (0.1) | 0 | 0 | 0 | 0 | 1 (0.1) | 0 |
| European Hare | 0 | 0 | 0 | 0 | 0 | 0 | 2 (0.1) |
| Rabbit | 4 (0.4) | 0 | 0 | 0 | 8 (5.2) | 47 (3.2) | 3 (0.2) |
| Second Monitoring Event - Q2 - Spring (September 2024) (EMM) | | | | | | | |
| Transect Distance (km) | 11.32 | 3.16 | 13.54 | 14.56 | 1.59 | 13.55 | 15.79 |
| Red Fox | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feral Cat | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wild Dog | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Red Deer | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sambar Deer | 0 | 5 (1.6) | 0 | 0 | 0 | 0 | 0 |

| Species | LHRR Bottom individuals(abundance) | LHRR North individuals(abundance) | LHRR South individuals(abundance) | Maricia individuals(abundance) | Rock Forest individuals(abundance) | Tantangara Dam individuals(abundance) | Tantangara Road individuals(abundance) |
|---|------------------------------------|-----------------------------------|-----------------------------------|--------------------------------|------------------------------------|---------------------------------------|--|
| Fallow Deer | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feral Pig | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feral Horse | 0 | 0 | 0 | 0 | 0 | 81 (6.0) | 0 |
| Rusa Deer | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| European Hare | 0 | 0 | 0 | 0 | 0 | 0 | 3 (0.2) |
| Rabbit | 0 | 2 (0.6) | 1 (0.1) | 4 (0.3) | 14 (8.8) | 76 (5.6) | 5 (0.3) |
| Third Monitoring Event - Q3 - Summer (February 2025) (SHL) | | | | | | | |
| Transect Distance (km) | 10.46 | N/A* | 14.81 | 10.92 | 3.31 | 9.99 | 15.69 |
| Red Fox | 1 (0.1) | N/A | 2 (0.1) | 0 | 0 | 0 | 0 |
| Feral Cat | 0 | N/A | 0 | 0 | 0 | 0 | 0 |
| Wild Dog | 0 | N/A | 0 | 0 | 0 | 1 (0.1) | 0 |
| Red Deer | 0 | N/A | 1 (0.1) | 0 | 0 | 0 | 0 |
| Sambar Deer | 0 | N/A | 0 | 0 | 0 | 0 | 0 |
| Fallow Deer | 0 | N/A | 0 | 0 | 0 | 0 | 0 |
| Feral Pig | 0 | N/A | 0 | 0 | 0 | 0 | 0 |
| Feral Horse | 0 | N/A | 0 | 4 (0.4) | 0 | 0 | 0 |
| Rabbit | 4 (0.4) | N/A | 0 | 3 (0.3) | 11 (3.3) | 9 (0.9) | 4 (0.3) |
| Fourth Monitoring Event - Q4 - Autumn (May 2025) (SHL) | | | | | | | |
| Transect Distance (km) | 11.49 | 7.1 | 14.78 | 9.35 | 1.42 | 10.94 | 15.63 |
| Red Fox | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feral Cat | 0 | 0 | 0 | 0 | 0 | 1 (0.1) | 0 |
| Wild Dog | 0 | 0 | 0 | 0 | 0 | 1 (0.1) | 0 |
| Red Deer | 2 (0.2) | 0 | 3 (0.2) | 0 | 0 | 0 | 0 |

| Species | LHRR Bottom individuals(abundance) | LHRR North individuals(abundance) | LHRR South individuals(abundance) | Maricia individuals(abundance) | Rock Forest individuals(abundance) | Tantangara Dam individuals(abundance) | Tantangara Road individuals(abundance) |
|-------------|------------------------------------|-----------------------------------|-----------------------------------|--------------------------------|------------------------------------|---------------------------------------|--|
| Sambar Deer | 0 | 3 (0.4) | 0 | 0 | 0 | 0 | 0 |
| Fallow Deer | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feral Pig | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feral Horse | 0 | 0 | 0 | 19 (2.0) | 0 | 2 (0.2) | 0 |
| Rabbit | 2 (0.2) | 0 | 0 | 0 | 6 (4.22) | 16 (1.5) | 3 (0.2) |

*Not surveyed during this period due to access issues.

Appendix 7 – Weed compositional shifts between survey years.

A1. Talbingo

| Species | Y4 Units | Y4 det/ha | Y5 Units | Y5 det/ha | Trend |
|----------------|-----------------|------------------|-----------------|------------------|--------------|
| Blackberry | 3246 | 27.58 | 5097 | 29.01 | - |
| Spear thistle | 335 | 2.85 | 587 | 3.34 | ↑ |
| Great mullein | 147 | 1.25 | 602 | 3.43 | ↑↑ |
| St John's wort | 293 | 2.49 | 3819 | 21.73 | ↑↑ |
| Sweet briar | 144 | 1.22 | 41 | 0.23 | ↓↓ |
| Oxeye daisy | 0 | - | 0 | - | - |
| Hawthorn | 9 | 0.08 | 46 | 0.26 | ↑↑ |

A2. Ravine Road

| Species | Y4 Units | Y4 det/ha | Y5 Units | Y5 det/ha | Trend |
|----------------|-----------------|------------------|-----------------|------------------|--------------|
| Blackberry | 3761 | 23.11 | 5358 | 31.41 | ↑ |
| Spear thistle | 162 | 0.97 | 292 | 1.71 | ↑↑ |
| Great mullein | 105 | 0.63 | 373 | 2.19 | ↑↑ |
| St John's wort | 29 | 0.17 | 1295 | 7.59 | ↑↑ |
| Sweet briar | 203 | 1.282 | 172 | 1.01 | ↓ |
| Oxeye daisy | 0 | - | 0 | - | - |
| Hawthorn | 4 | 0.02 | 0 | - | ND |

A3. Marica

| Species | Y4 Units | Y4 det/ha | Y5 Units | Y5 det/ha | Trend |
|----------------|-----------------|------------------|-----------------|------------------|--------------|
| Blackberry | 83 | 0.94 | 152 | 1.20 | ↑ |
| Spear thistle | 86 | 0.98 | 96 | 0.76 | ↓ |
| Great mullein | 35 | 0.40 | 31 | 0.24 | ↓↓ |
| St John's wort | 25 | 0.28 | 3 | 0.02 | ↓↓ |
| Sweet briar | 3 | 0.03 | 1 | 0.01 | ↓↓ |
| Oxeye daisy | 146 | 1.66 | 0 | - | ND |
| Hawthorn | 1 | 0.01 | 0 | - | ND |

A4. Tantangara

| Species | Y4 Units | Y4 det/ha | Y5 Units | Y5 det/ha | Trend |
|----------------|-----------------|------------------|-----------------|------------------|--------------|
| Blackberry | 1352 | 11.31 | 2409 | 20.16 | ↑↑ |
| Spear thistle | 1551 | 12.98 | 3646 | 30.51 | ↑↑ |
| Great mullein | 70 | 0.59 | 339 | 2.84 | ↑↑ |
| St John's wort | 1608 | 13.46 | 822 | 6.88 | ↓↓ |
| Sweet briar | 0 | - | 266 | 2.23 | New |
| Oxeye daisy | 1989 | 16.64 | 1387 | 11.61 | ↓ |
| Hawthorn | 0 | - | 0 | - | - |

A5. Tantangara Road

| Species | Y4 Units | Y4 det/ha | Y5 Units | Y5 det/ha | Trend |
|----------------|-----------------|------------------|-----------------|------------------|--------------|
| Blackberry | 1 | 0.01 | 0 | - | ND |
| Spear thistle | 373 | 2.01 | 504 | 2.62 | ↑ |
| Great mullein | 37 | 0.20 | 41 | 0.21 | - |
| St John's wort | 476 | 2.57 | 6 | 0.03 | ↓↓ |
| Sweet briar | 0 | - | 0 | - | - |
| Oxeye daisy | 3508 | 18.95 | 1837 | 8.80 | ↓↓ |
| Hawthorn | 0 | - | 0 | - | - |

A7. Ravine Bay

| Species | Y4 Units | Y4 det/ha | Y5 Units | Y5 det/ha | Trend |
|----------------|-----------------|------------------|-----------------|------------------|--------------|
| Blackberry | 772 | 11.20 | 1446 | 16.69 | ↑ |
| Spear thistle | 47 | 0.68 | 314 | 3.62 | ↑↑ |
| Great mullein | 46 | 0.67 | 49 | 0.57 | - |
| St John's wort | 57 | 0.83 | 369 | 4.26 | ↑↑ |
| Sweet briar | 38 | 0.55 | 4 | 0.05 | ↓↓ |
| Oxeye daisy | - | - | - | - | - |
| Hawthorn | - | - | - | - | - |

Appendix 8(a) – Laboratory Results, pathogen monitoring – All sites.

Date Issued: 23 Jun 2025

Final Report

Report Number: M25-05670-F-V1



Department of
Primary Industries

Elizabeth Macarthur Agricultural Institute
Woodbridge Rd Menangle

Our Ref: M25-05670
Your Ref: PO: T70380 - ATT: DIEGO
AVI

Prev. Ref:
Laboratory Enquires: 1800 675 623
Invoice Enquires: 1300 720 773

LABORATORY REPORT

To: SNOWY HYDRO LIMITED
1 MONARO HIGHWAY
COOMA

2630 NSW AU
Attn: DIEGO AVI

Owner: SNOWY HYDRO - 2.0 PROJECT
Property: SAMPLE LOCATIONS:
LOBS HOLE, MARICA, TANTANGARA,
ROCK FOREST

Job Type: Media
Soil

Job Manager: Stacy Cavanagh
Date Sampled:
Date Sent: 15 Apr 2025
Date Received: 24 Apr 2025

Submitter Subject: PHYTOPHTHORA / SPECIES IDENTIFICATION
Samples Received: 31 X SOIL SAMPLES

| Analysis Method | Method ID | Date of Test |
|---|-----------|--------------|
| Baiting of Media and Water Samples for Pythium & Phytophthora spp | MPLA-004 | 23 Jun 2025 |
| *Sequence | | 23 Jun 2025 |

Conclusion

Soil from Sample ID's PS05 and Tantangara Road 02 were found positive for *Phytophthora*.
Sequence results determined the PS05 isolate as *P. cinnamomi* and the Tangangara Road 02 isolate as *P. gregata*.

Andrew Daly
Plant Pathologist



NATA Accreditation Numbers

14173 Environmental Laboratory Wollongbar
14488 Orange Agricultural Institute
14495 Elizabeth Macarthur Agricultural Institute
14949 Wagga Wagga Chemistry Services Laboratory

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EMAI Plant Health

Baiting of Media and Water Samples for Pythium & Phytophthora spp

| | | Analysis | Phytophthora sp |
|--------|---------------------|-------------|-----------------|
| Lab.No | Sample ID | Sample Desc | |
| 0001 | PS05 | Soil 1 | Detected |
| 0002 | PS04 | Soil 2 | Not Detected |
| 0003 | Lobs 02 | Soil 3 | Not Detected |
| 0004 | PMS2 | Soil 4 | Not Detected |
| 0005 | PMS3 | Soil 5 | Not Detected |
| 0006 | PMS4 | Soil 6 | Not Detected |
| 0007 | PS03 | Soil 7 | Not Detected |
| 0008 | PS02 | Soil 8 | Not Detected |
| 0009 | Lobs Hole R5 | Soil 9 | Not Detected |
| 0010 | Lobs Hole R0.5 | Soil 10 | Not Detected |
| 0011 | PS01 | Soil 11 | Not Detected |
| 0012 | Marica Washdown02 | Soil 12 | Not Detected |
| 0013 | PS06 | Soil 13 | Not Detected |
| 0014 | Marica01 | Soil 14 | Not Detected |
| 0015 | PS07 | Soil 15 | Not Detected |
| 0016 | PS10 | Soil 16 | Not Detected |
| 0017 | PS09 | Soil 17 | Not Detected |
| 0018 | PS08 | Soil 18 | Not Detected |
| 0019 | PS16 | Soil 19 | Not Detected |
| 0020 | PS17 | Soil 20 | Not Detected |
| 0021 | PS18 | Soil 21 | Not Detected |
| 0022 | Tantangara Road 02 | Soil 22 | Detected |
| 0023 | PS20 | Soil 23 | Not Detected |
| 0024 | PS19 | Soil 24 | Not Detected |
| 0025 | PS11 | Soil 25 | Not Detected |
| 0026 | Tantangara Washdown | Soil 26 | Not Detected |
| 0027 | PS12 | Soil 27 | Not Detected |
| 0028 | PS13 | Soil 28 | Not Detected |
| 0029 | Tantangara Adit 01 | Soil 29 | Not Detected |
| 0030 | PS14 | Soil 30 | Not Detected |
| 0031 | PS15 | Soil 31 | Not Detected |

Comment(s):

Date Issued: **23 Jun 2025**

Final Report

Report Number: **M25-05670-F-V1**

***Sequence**

| | | Analysis | Sequence Result | Details |
|--------|-----------------------|-------------|---------------------------|------------------------------|
| Lab.No | Sample ID | Sample Desc | | |
| 0001 | PS05 | Soil 1 | Phytophthora cinnamomi | Oomycete ITS DNA amplicon |
| 0022 | Tantangara Road 02 | Soil 22 | Phytophthora gregata | Oomycete ITS DNA amplicon |

Comment(s):

Please note that a sample may be affected by a range of factors prior to presentation at the Plant Health Diagnostic Service (PHDS). For example the processes used to obtain the sample, the time taken to transport the sample and the conditions of transportation may all have an effect on the sample. The results presented in this report only apply to the sample(s) as presented to the PHDS and described on the submission form. No representation is made as to the applicability of the results to any other sample(s).

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DIEGO AVI (email: diego.avi@snowyhydro.com.au)

CPPO - Plant Pathology (email: cppo.labresults@dpi.nsw.gov.au)

Appendix 8(a)– Laboratory Results, pathogen monitoring – Secondary testing.

Date Issued: **29 Jul 2025**

Final Report

Report Number: **M25-08289-F-V1**



**Department of
Primary Industries**

Elizabeth Macarthur Agricultural Institute
Woodbridge Rd Menangle

Our Ref: **M25-08289**

Your Ref: **T70380**

Prev. Ref:

Laboratory Enquires: **1800 675 623**

Invoice Enquires: **1300 720 773**

LABORATORY REPORT

To: SNOWY HYDRO LIMITED
1 MONARO HIGHWAY
COOMA
2630 NSW AU
Attn: RHIA MARTIN

Owner: NOT SPECIFIED

Property: SAMPLE SITES:

LOBS HOLE

TANTANGARA

Job Type: Media
Soil

Job Manager: Stacy Cavanagh

Date Sampled:

Date Sent:

Date Received: 16 Jun 2025

Submitter Subject: PHYTOPHTHORA PRESENCE / ABSENCE

Samples Received: SOIL (2 SAMPLES)

| Analysis Method | Method ID | Date of Test |
|---|-----------|--------------|
| Baiting of Media and Water Samples for Pythium & Phytophthora spp | MPLA-004 | 14 Jul 2025 |
| *Sequence | | 28 Jul 2025 |

Conclusion

Soil sample 'PS05' was found to be positive for the presence of Phytophthora. Sequencing of the oomycete ITS region identified the Phytophthora isolate from soil sample 'PS05' to share highest similarity to *Phytophthora cinnamomi*. Phytophthora was not detected from the 'Tantangara Road 02' soil sample.

Ossie Wildman
Diagnostic Plant Pathologist



NATA Accreditation Numbers

14173 Environmental Laboratory Wollongbar

14488 Orange Agricultural Institute

14495 Elizabeth Macarthur Agricultural Institute

14949 Wagga Wagga Chemistry Services Laboratory

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Date Issued: **29 Jul 2025**

Final Report

Report Number: **M25-08289-F-V1**

EMAI Plant Health

Baiting of Media and Water Samples for Pythium & Phytophthora spp

| | | Analysis | Phytophthora sp |
|--------|--------------------|-------------|-----------------|
| Lab.No | Sample ID | Sample Desc | |
| 0001 | PS05 | Soil 1 | Detected |
| 0002 | TANTANGARA ROAD 02 | Soil 2 | Not Detected |

Comment(s):

***Sequence**

| | | Analysis | Sequence Result | Details |
|--------|-----------|-------------|------------------------|---------------------------|
| Lab.No | Sample ID | Sample Desc | | |
| 0001 | PS05 | Soil 1 | Phytophthora cinnamomi | Oomycete ITS DNA amplicon |

Comment(s):

Please note that a sample may be affected by a range of factors prior to presentation at the Plant Health Diagnostic Service (PHDS). For example the processes used to obtain the sample, the time taken to transport the sample and the conditions of transportation may all have an effect on the sample. The results presented in this report only apply to the sample(s) as presented to the PHDS and described on the submission form. No representation is made as to the applicability of the results to any other sample(s).

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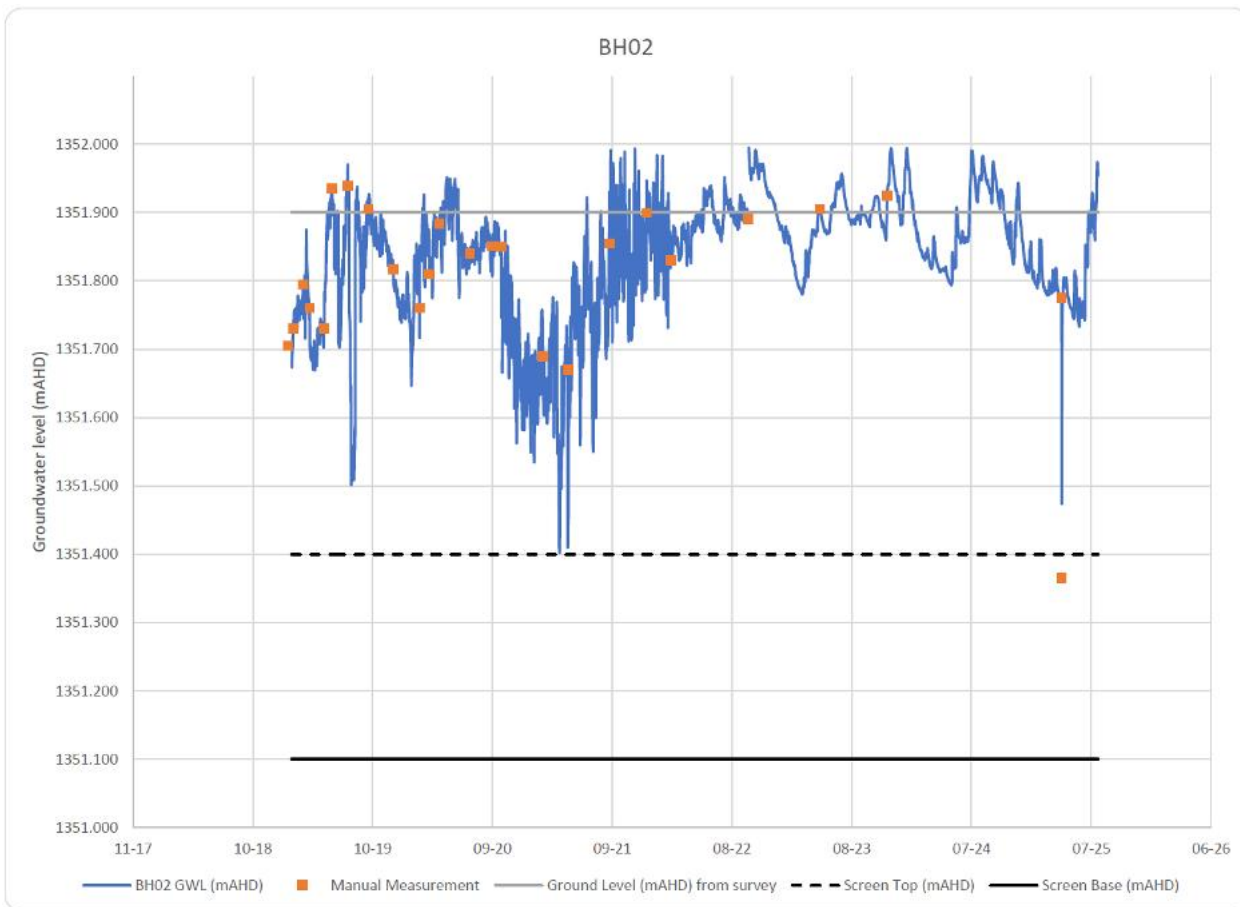
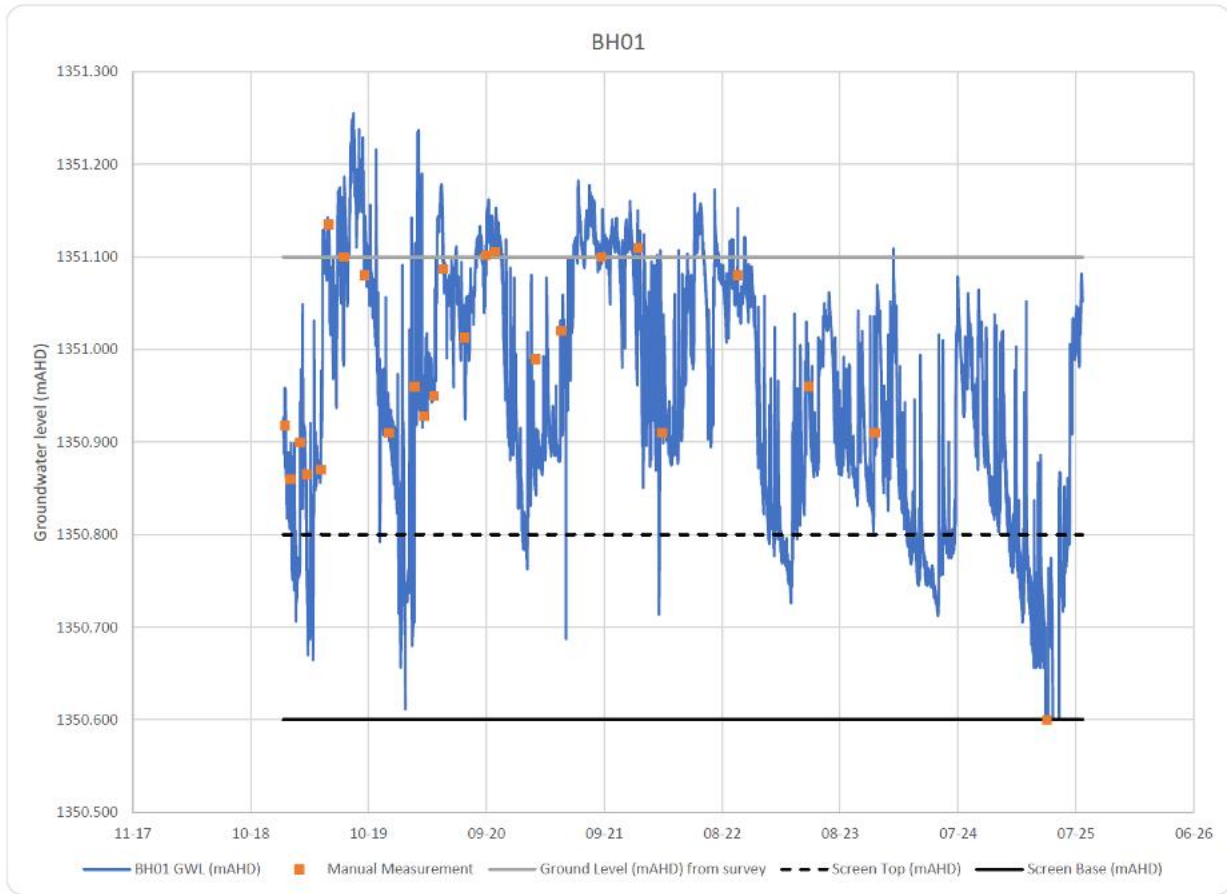
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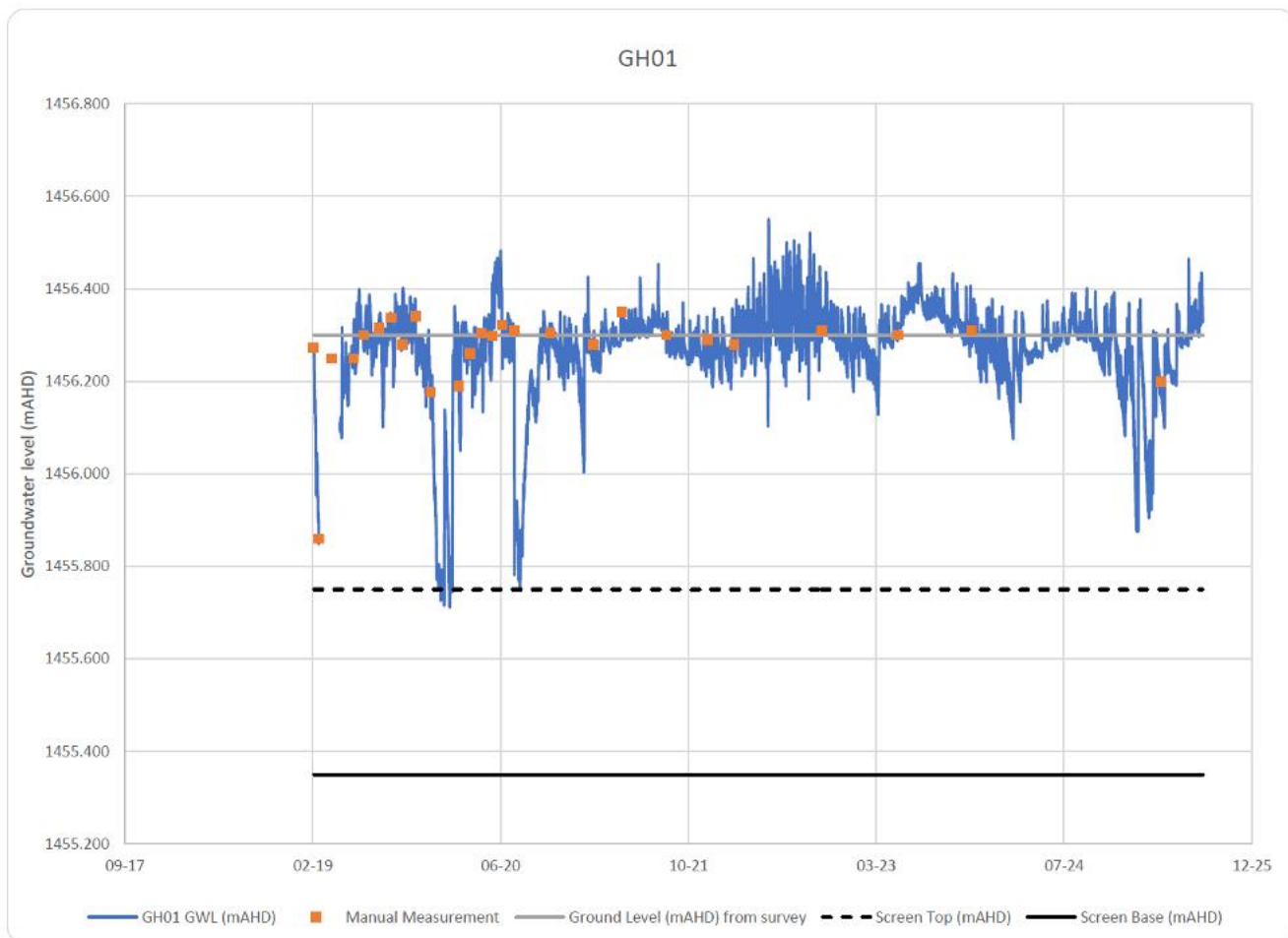
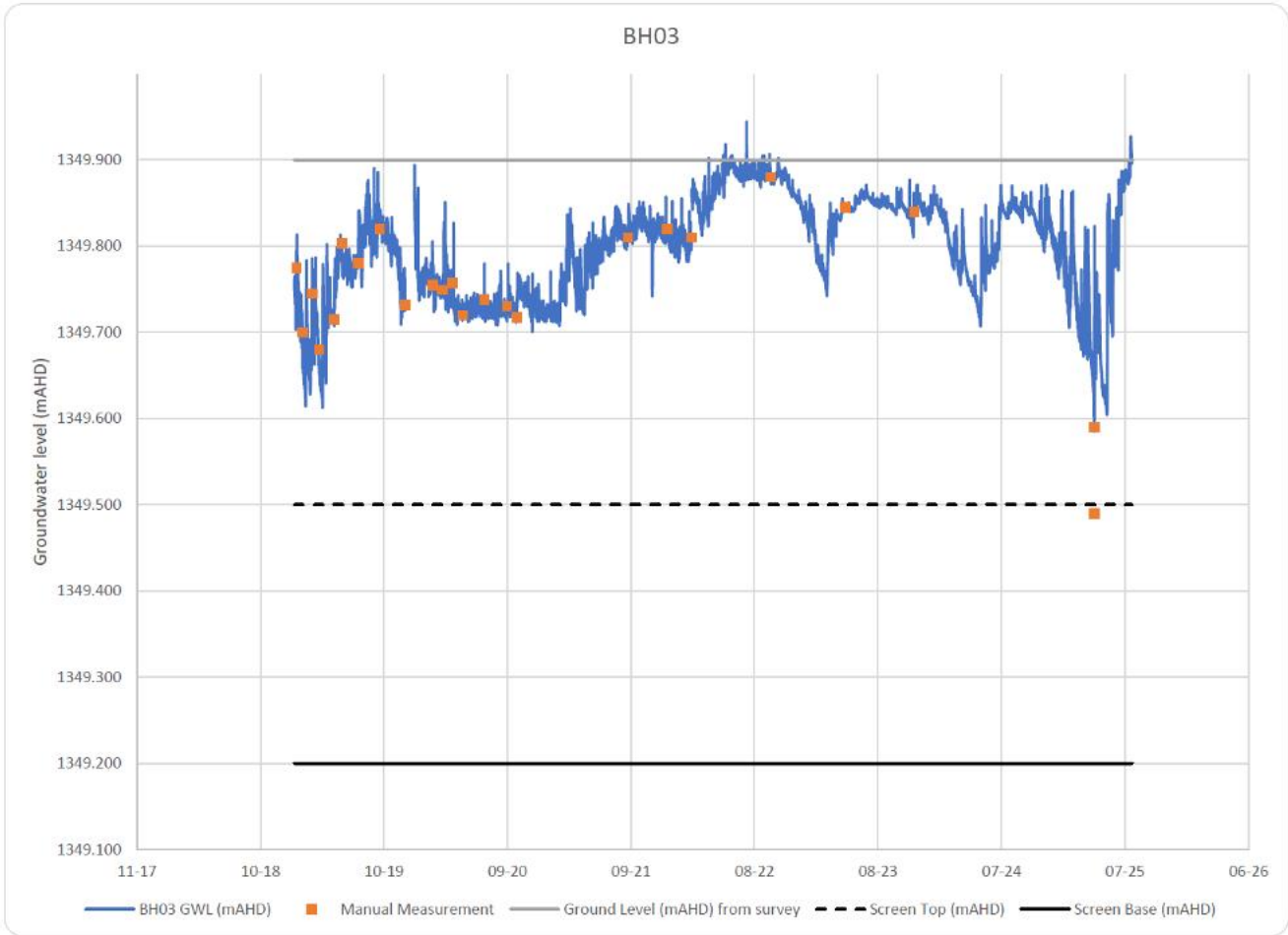
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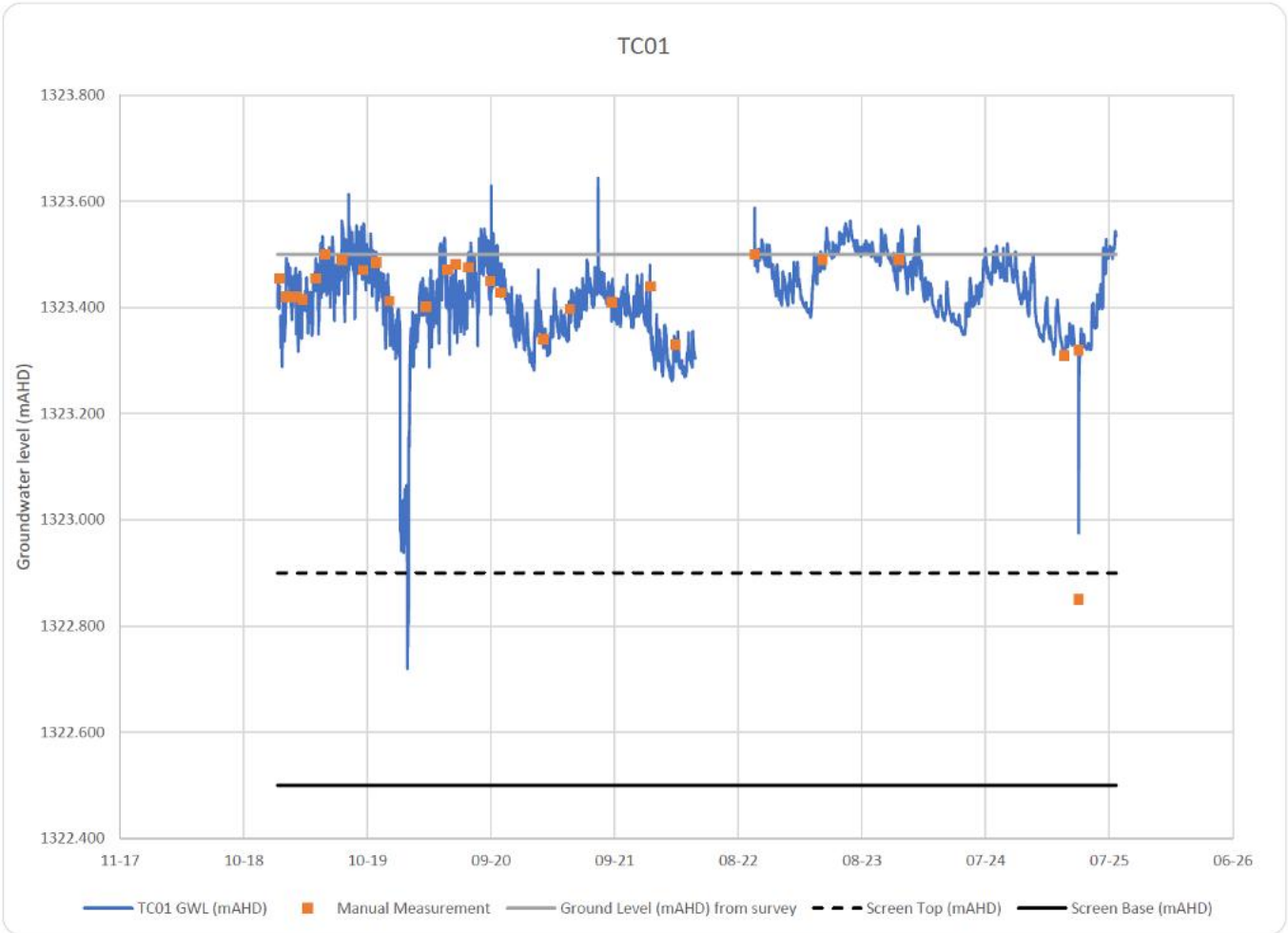
RHIA MARTIN (email: rhia.martin@snowyhydro.com.au)

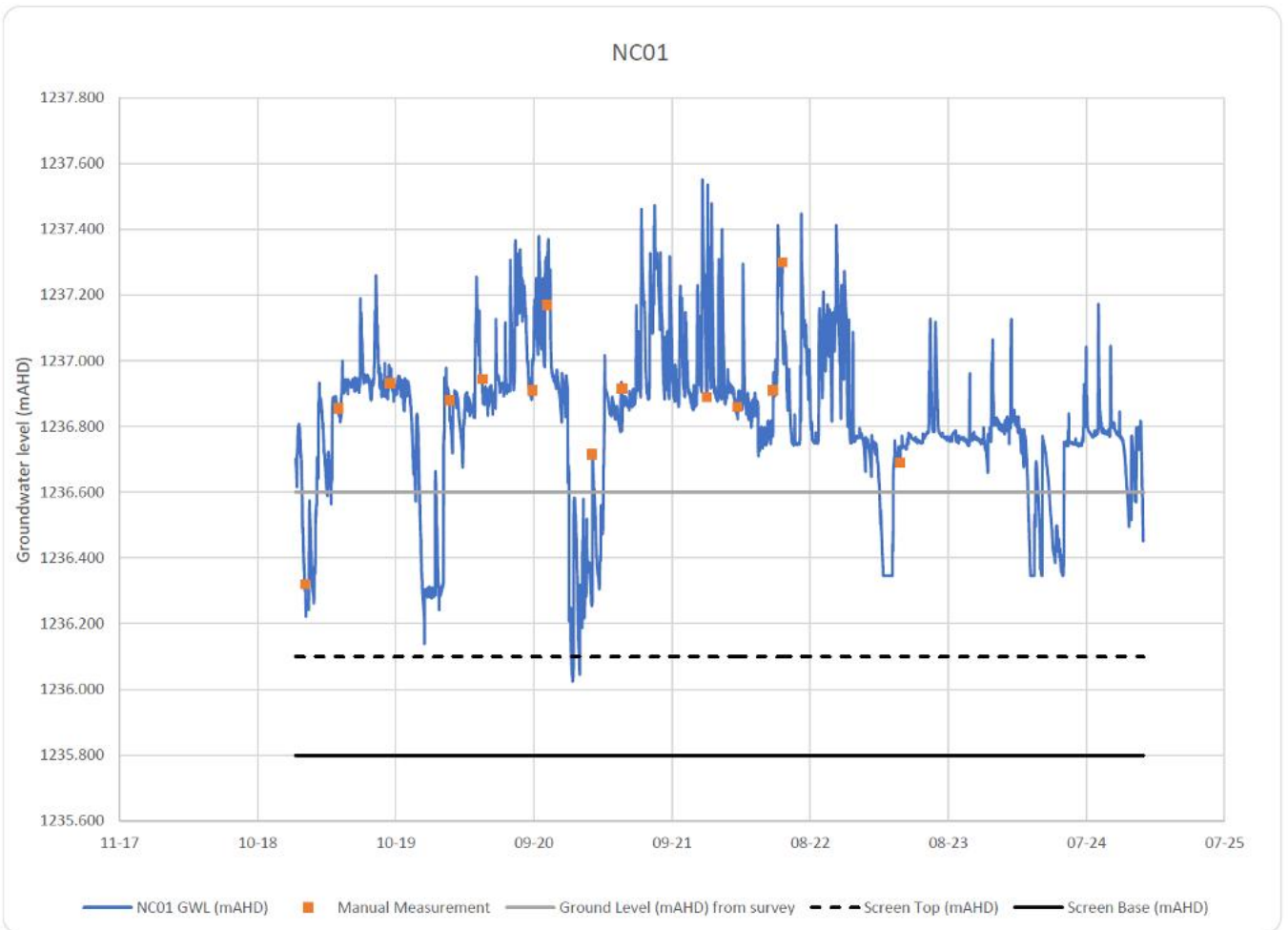
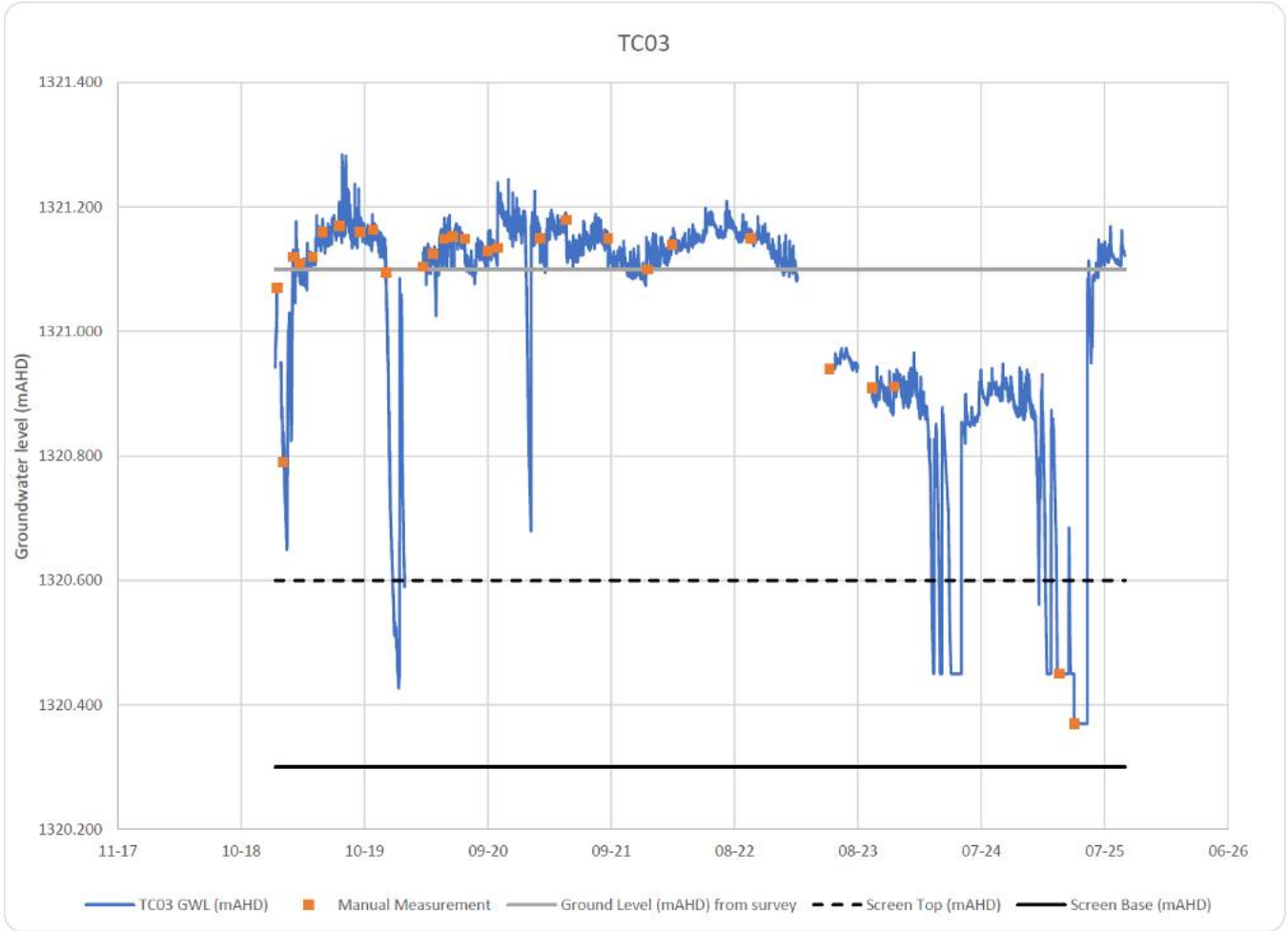
Appendix 9a – GDE telemetry – hydrographs

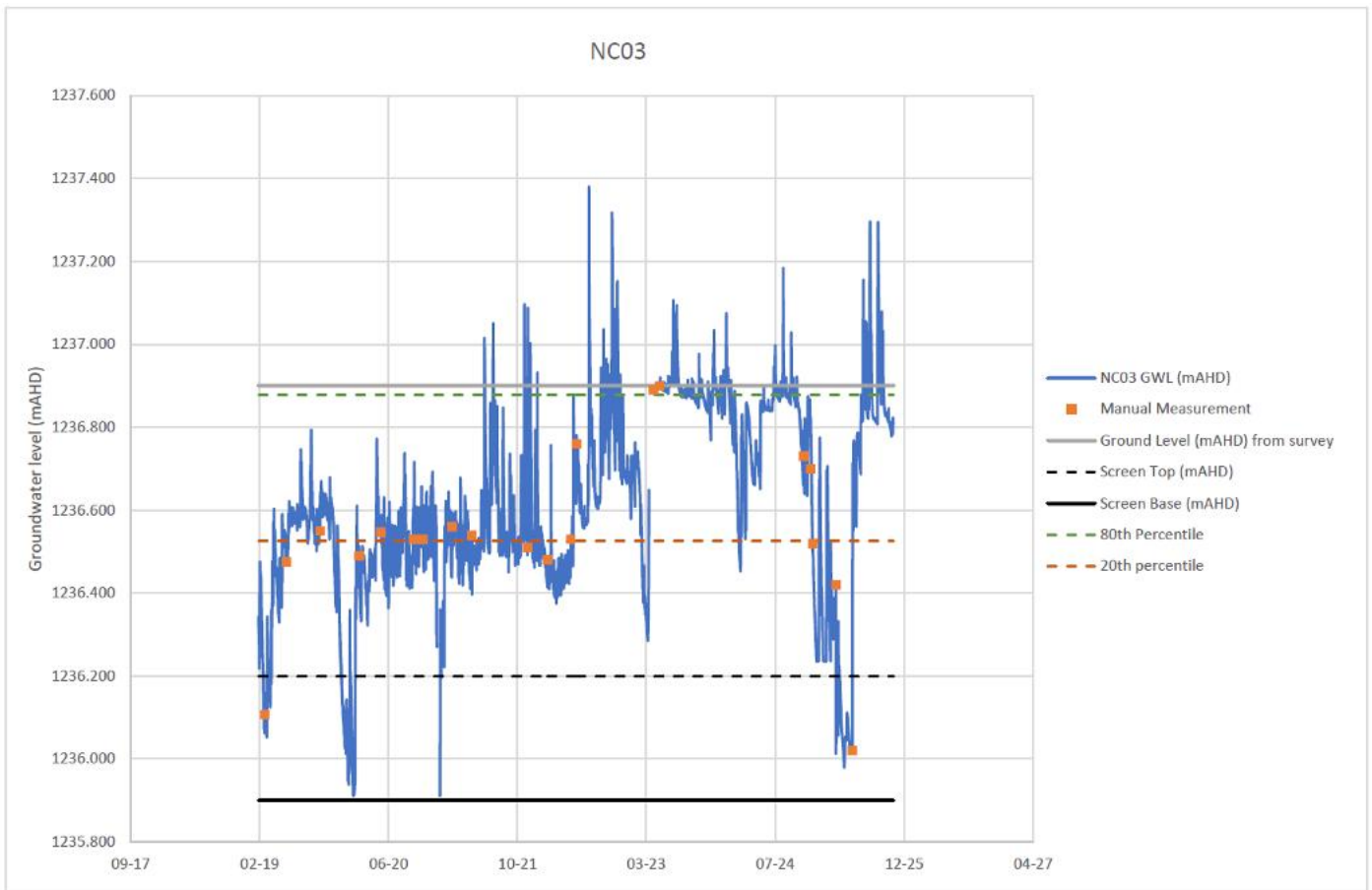
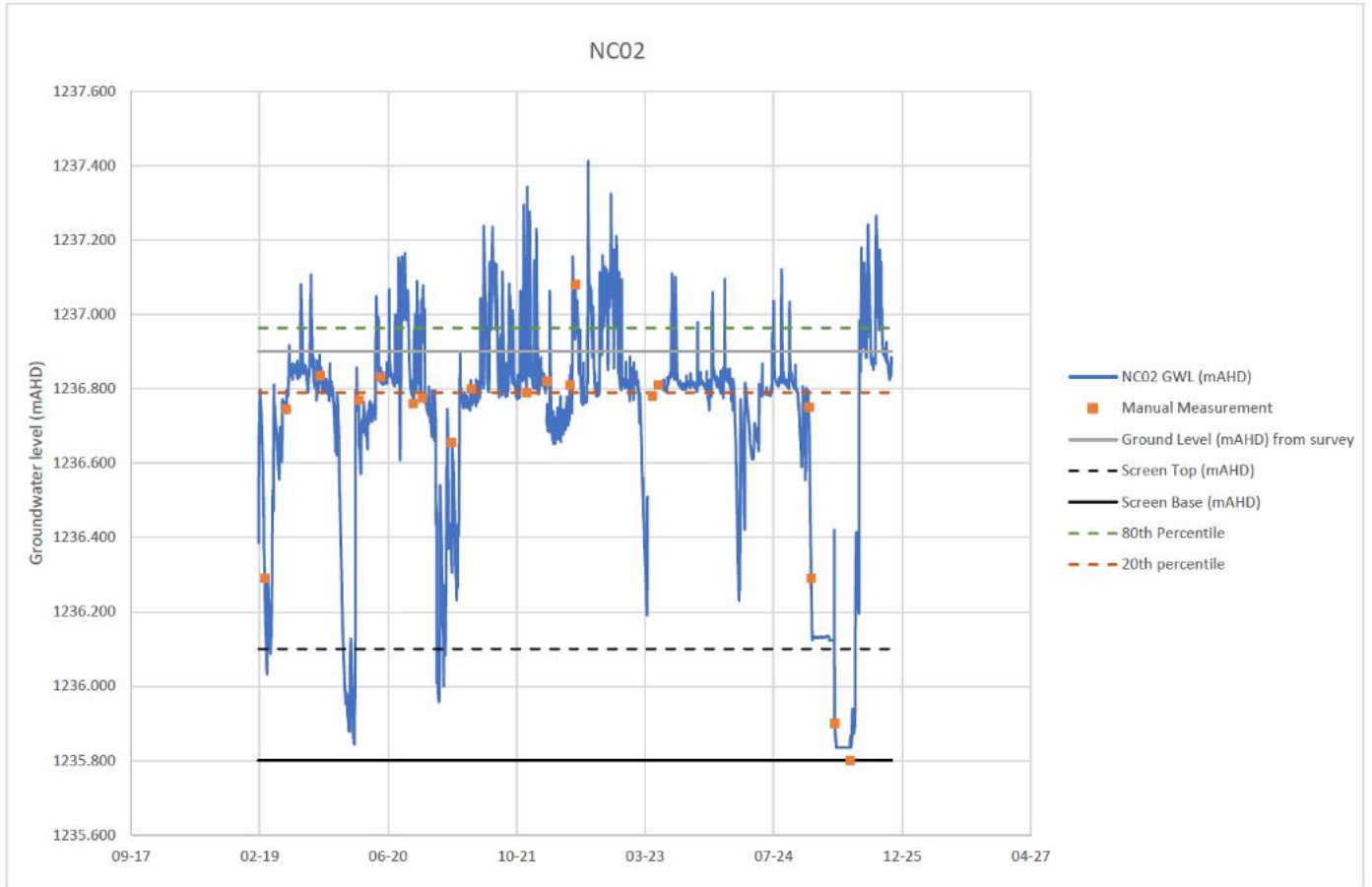


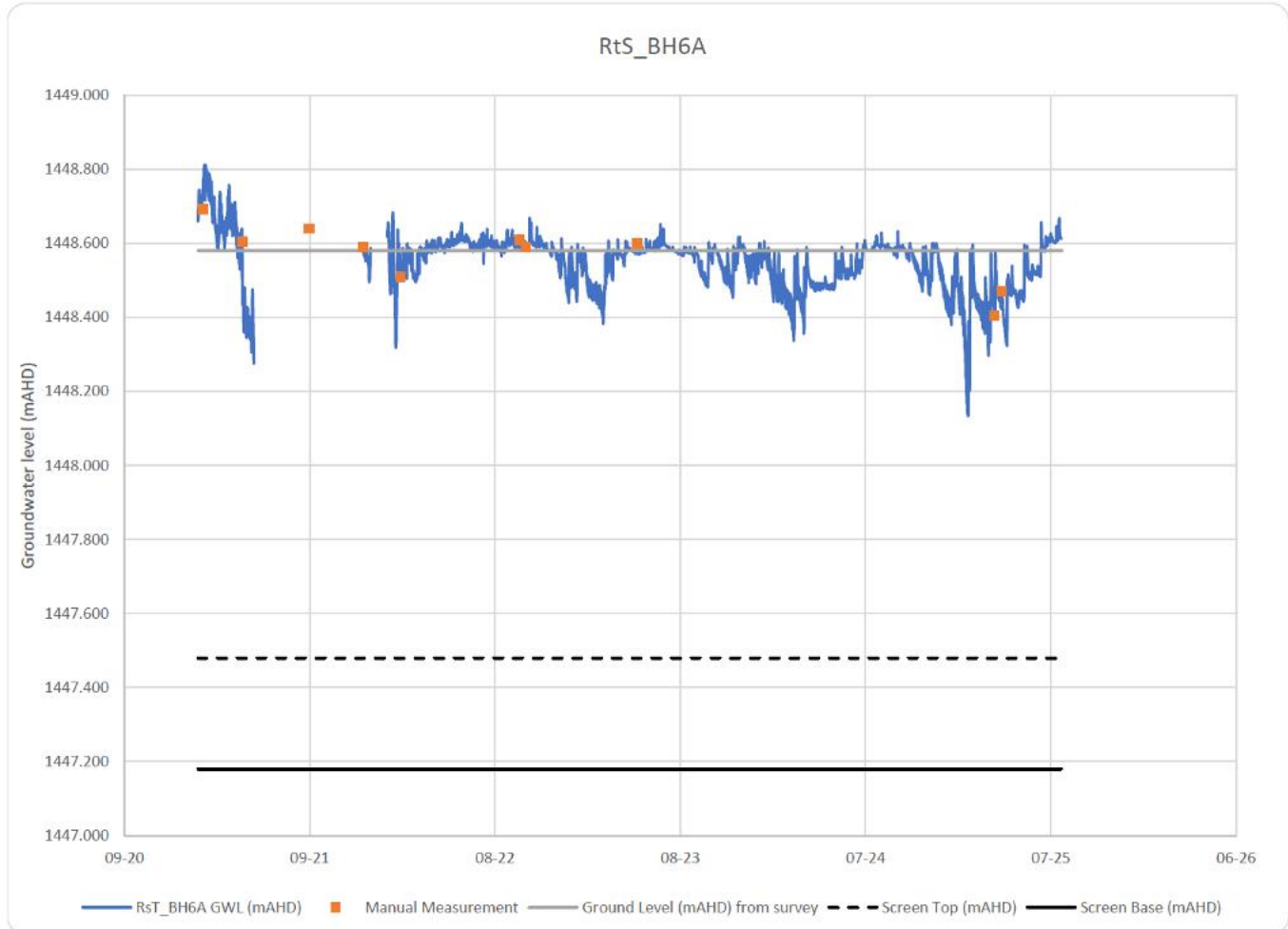
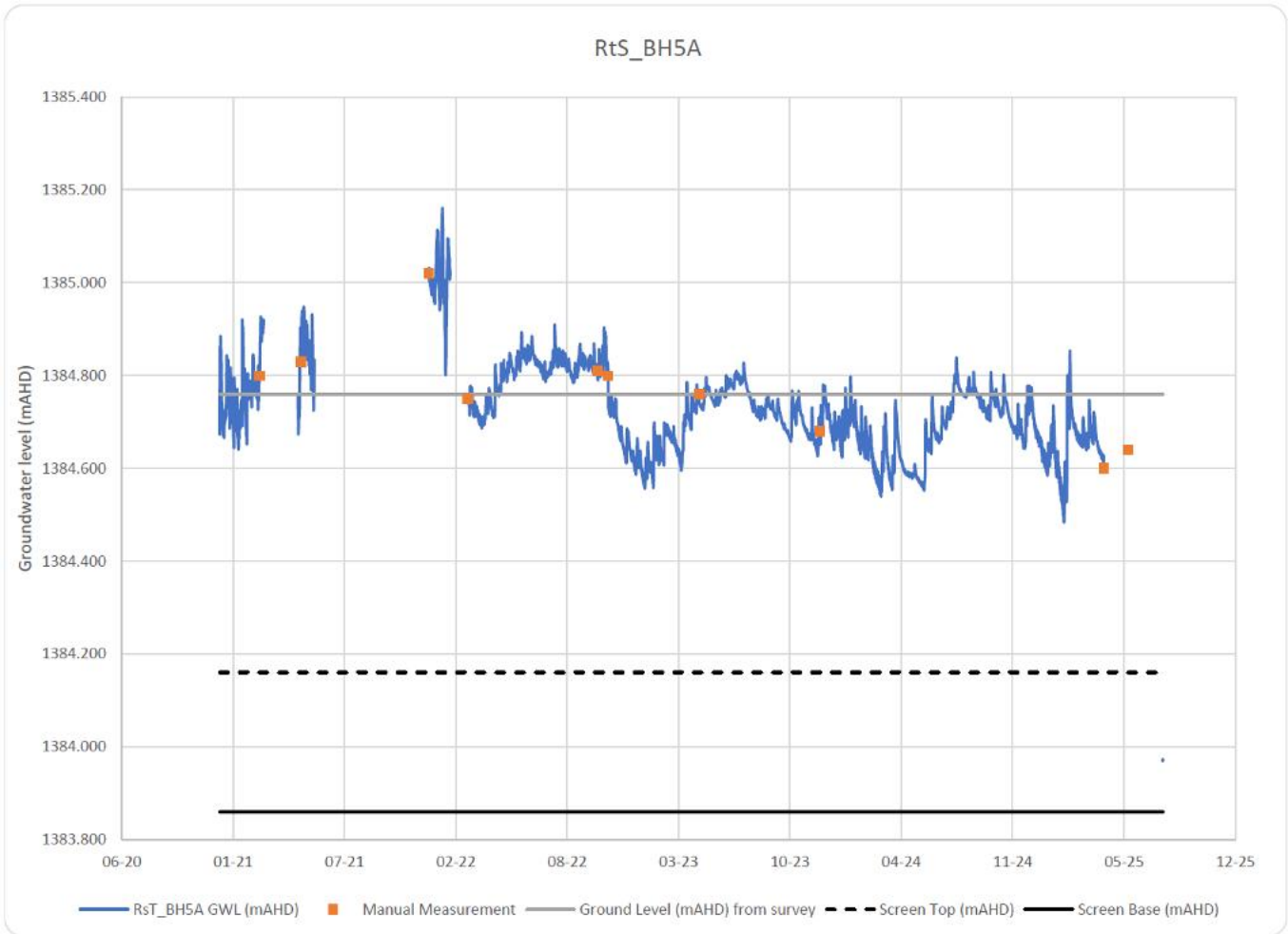


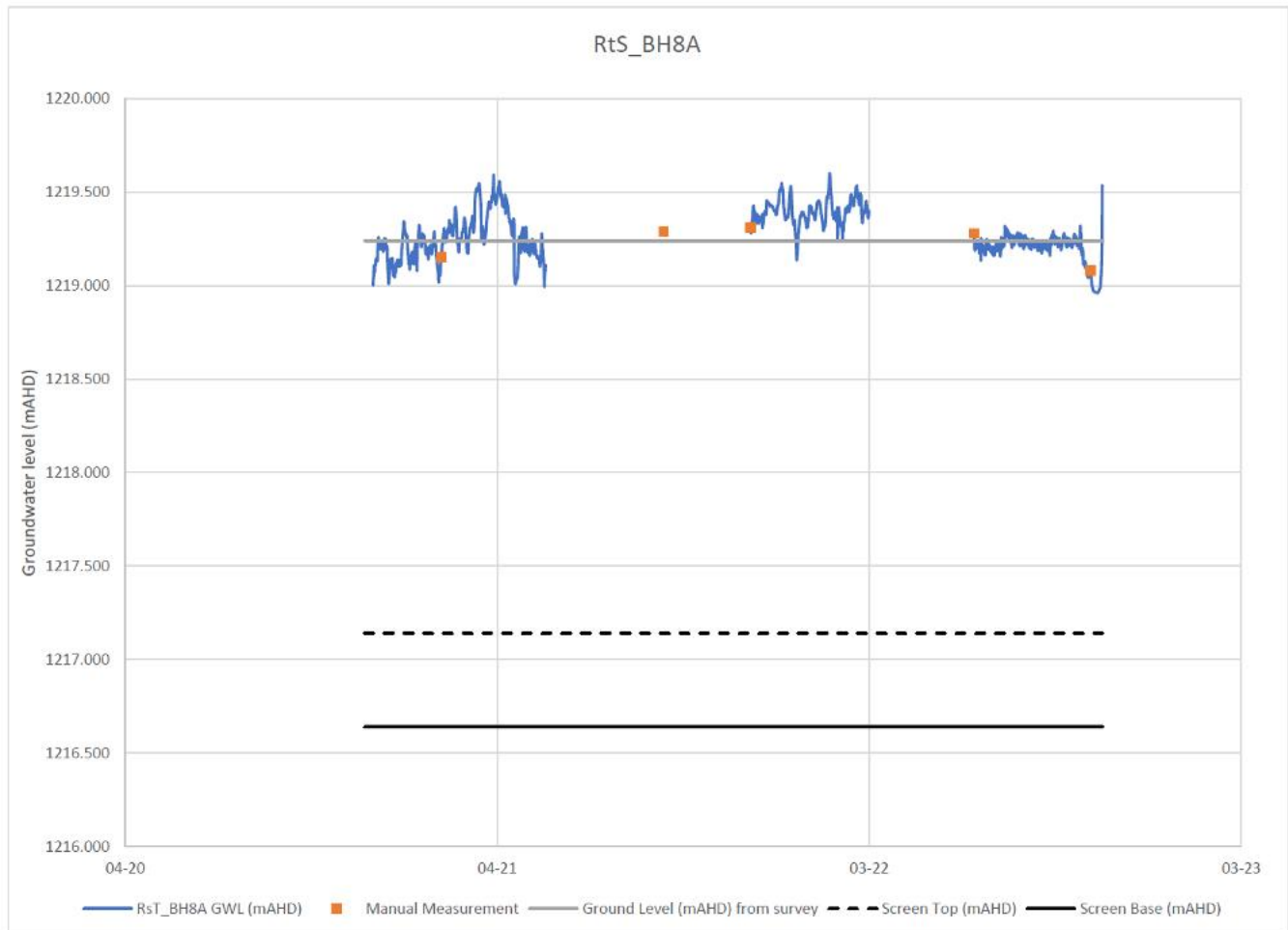
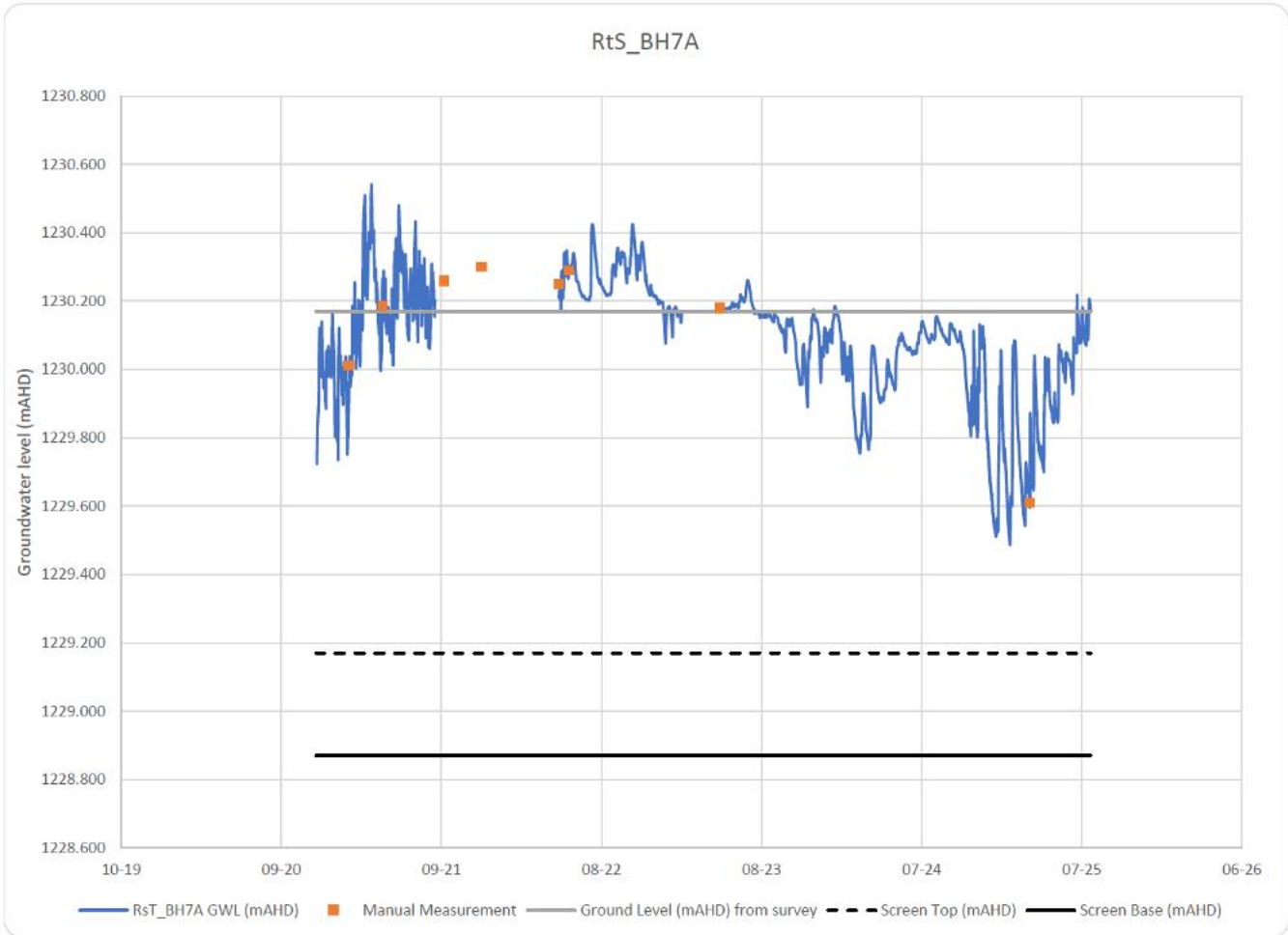


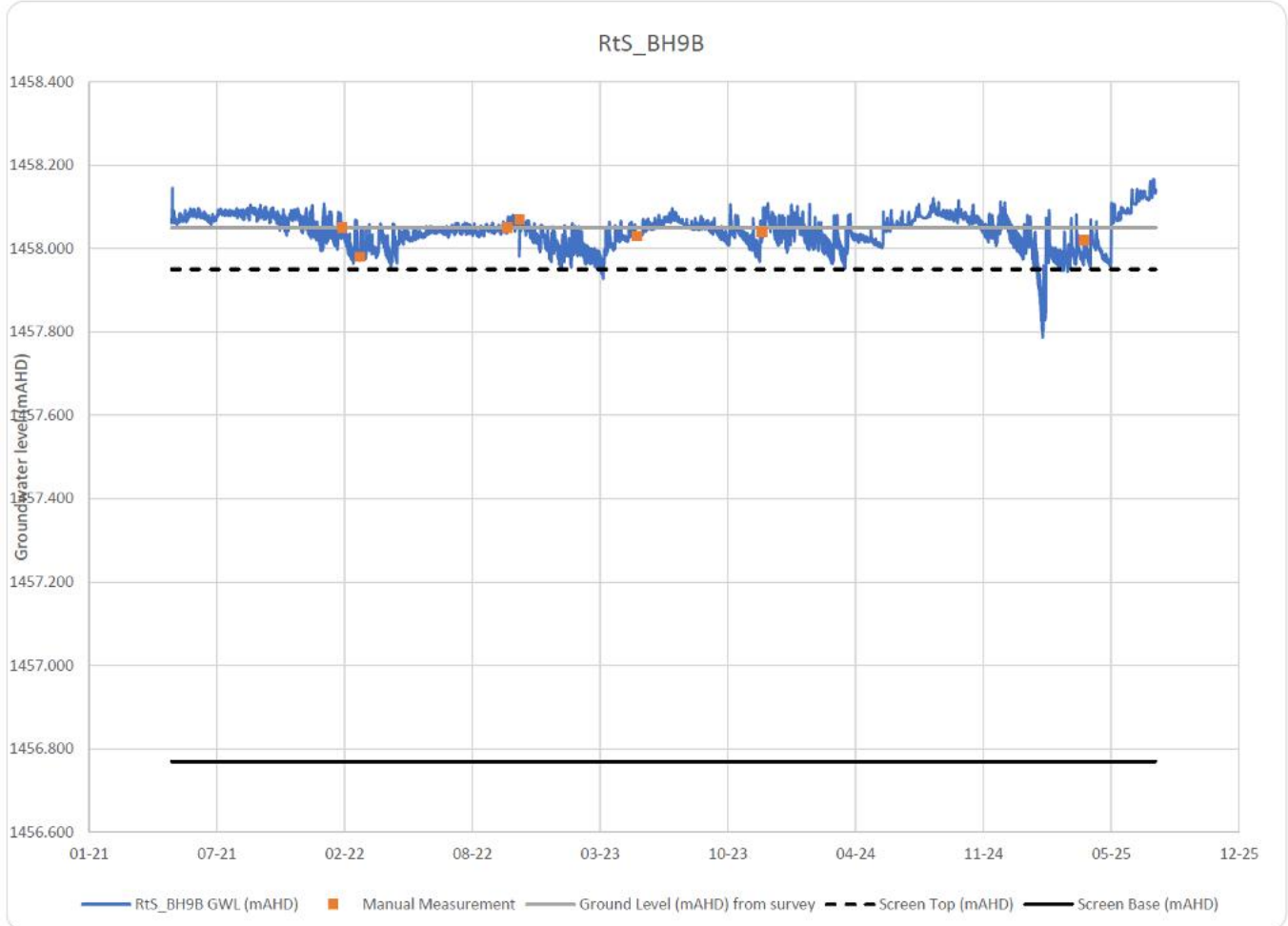
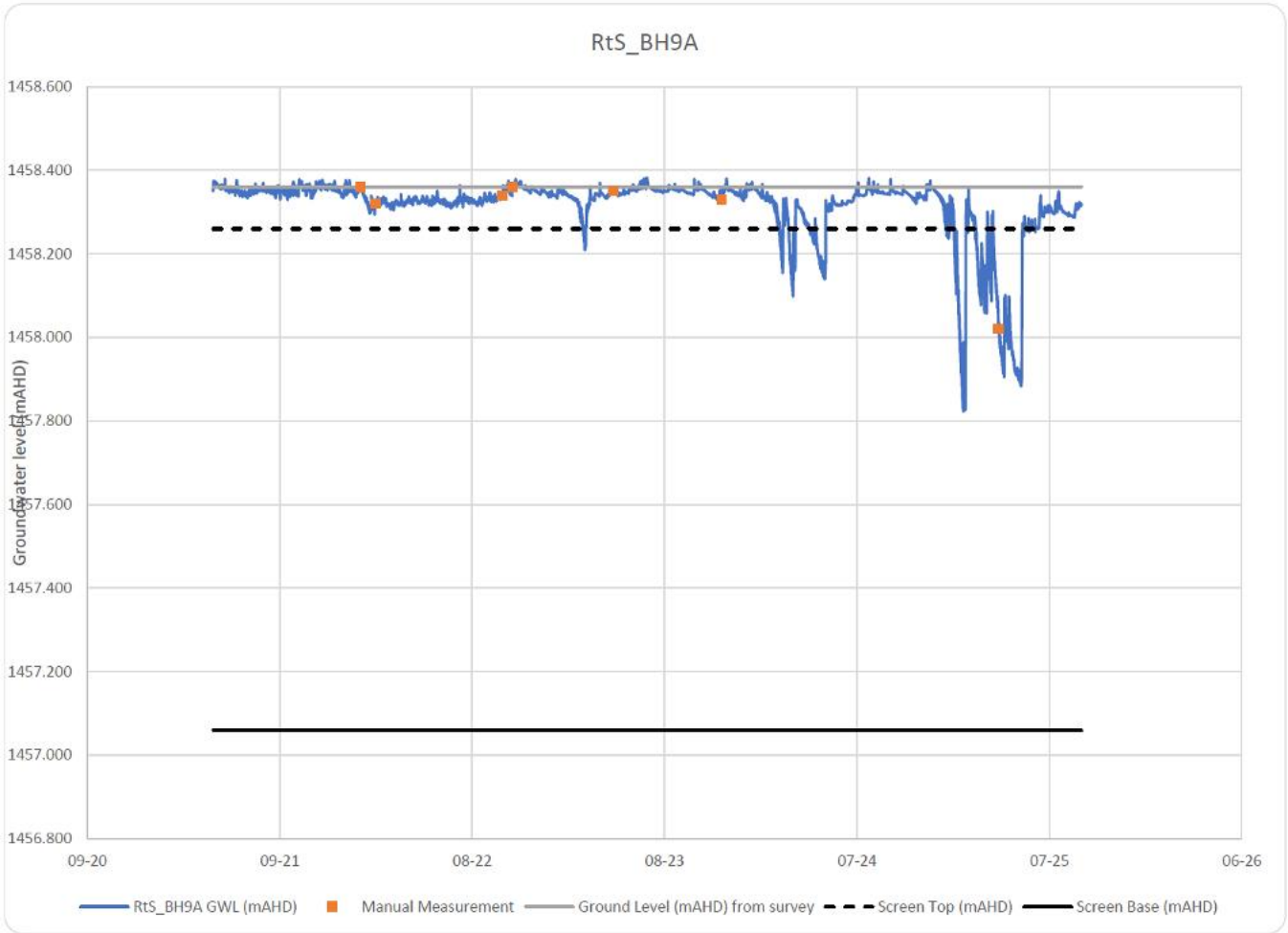


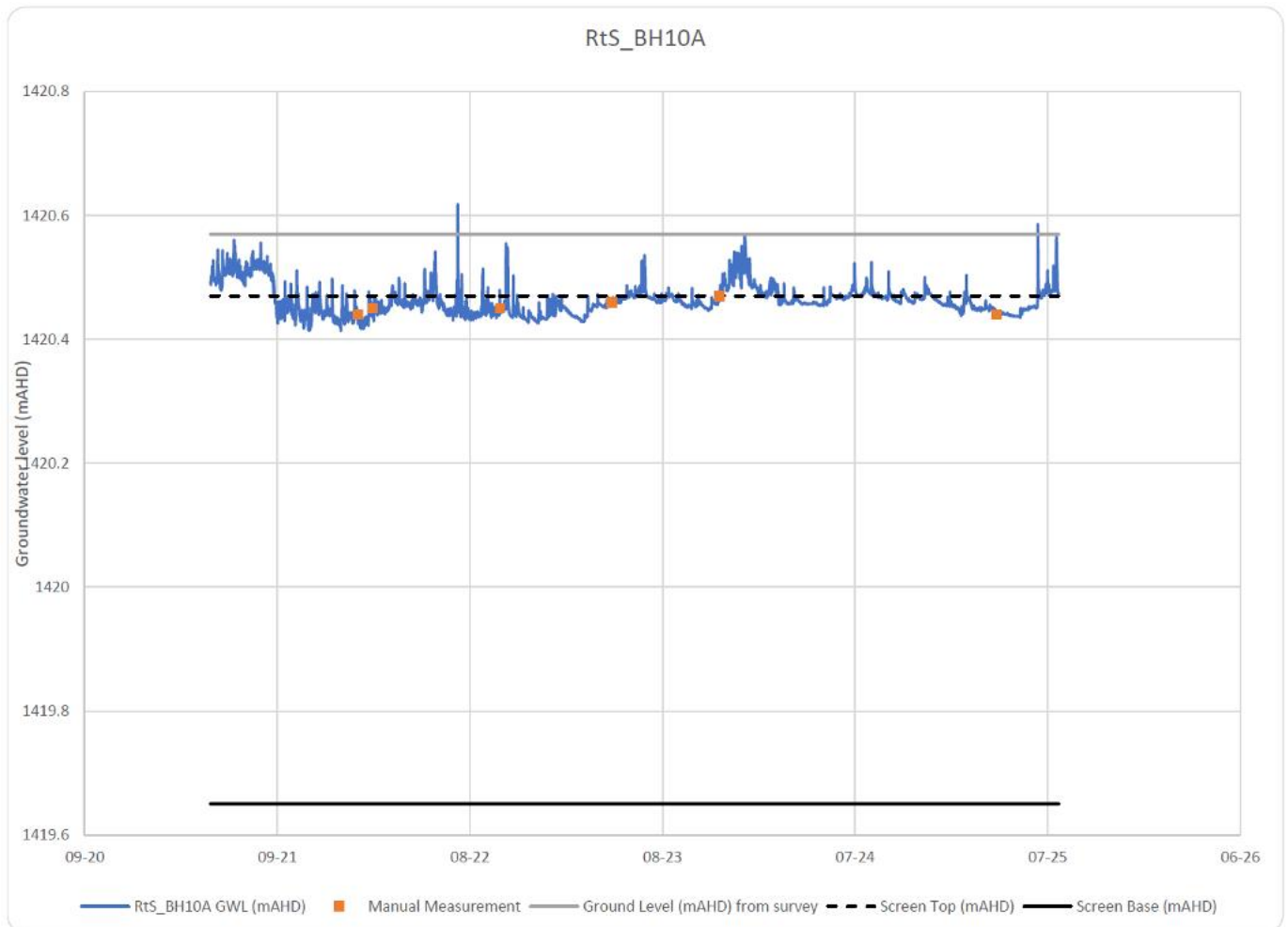
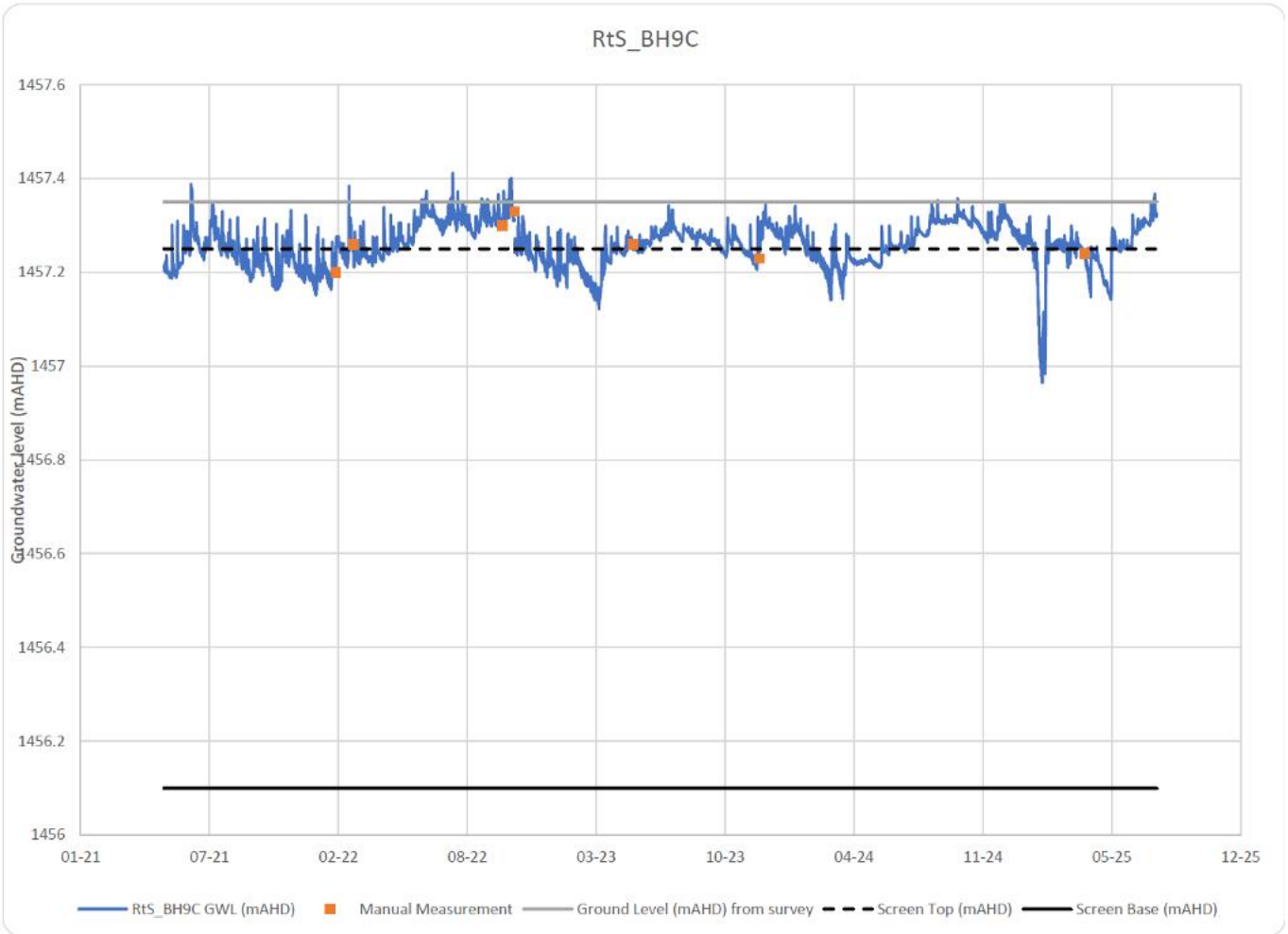


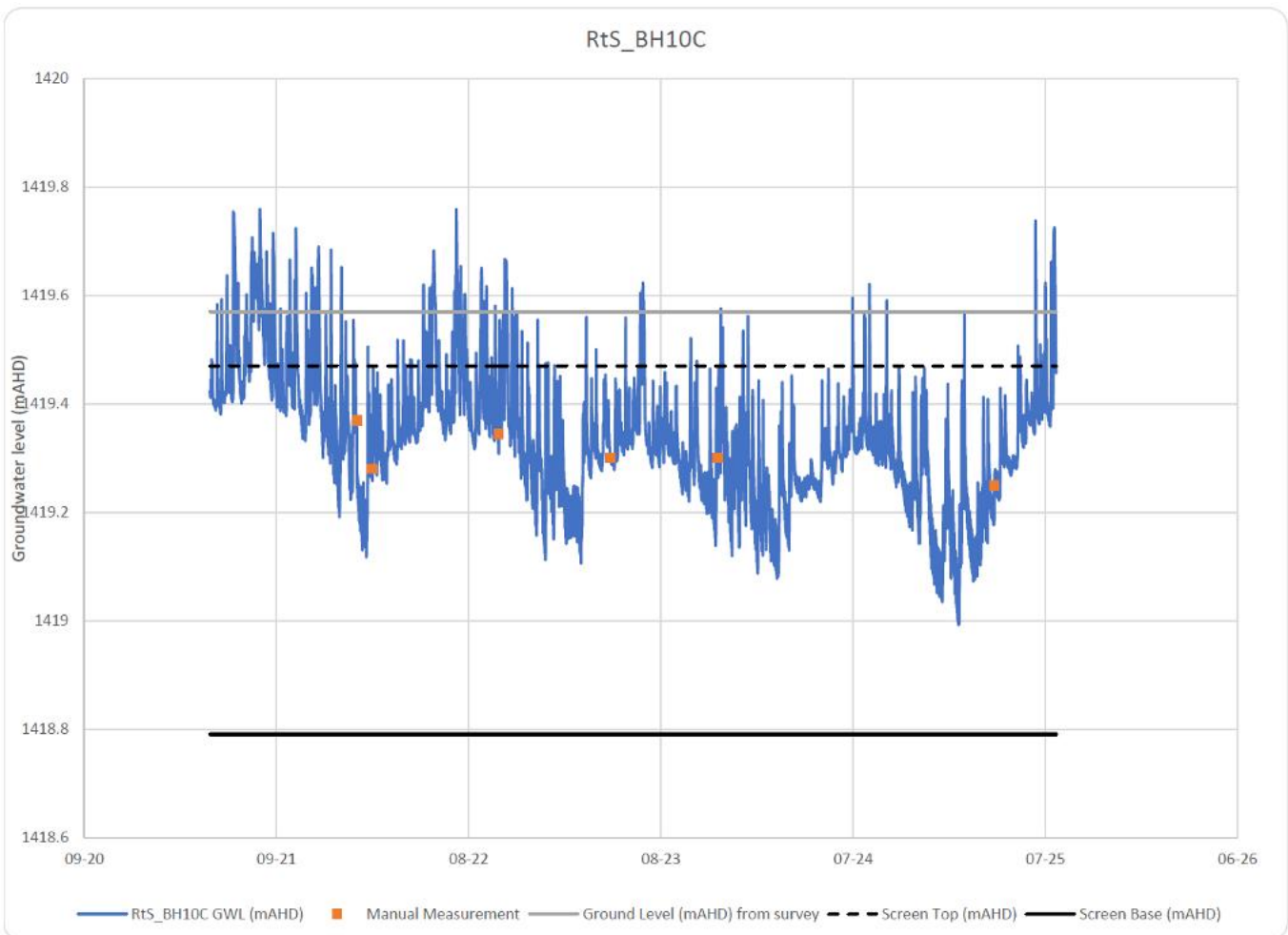
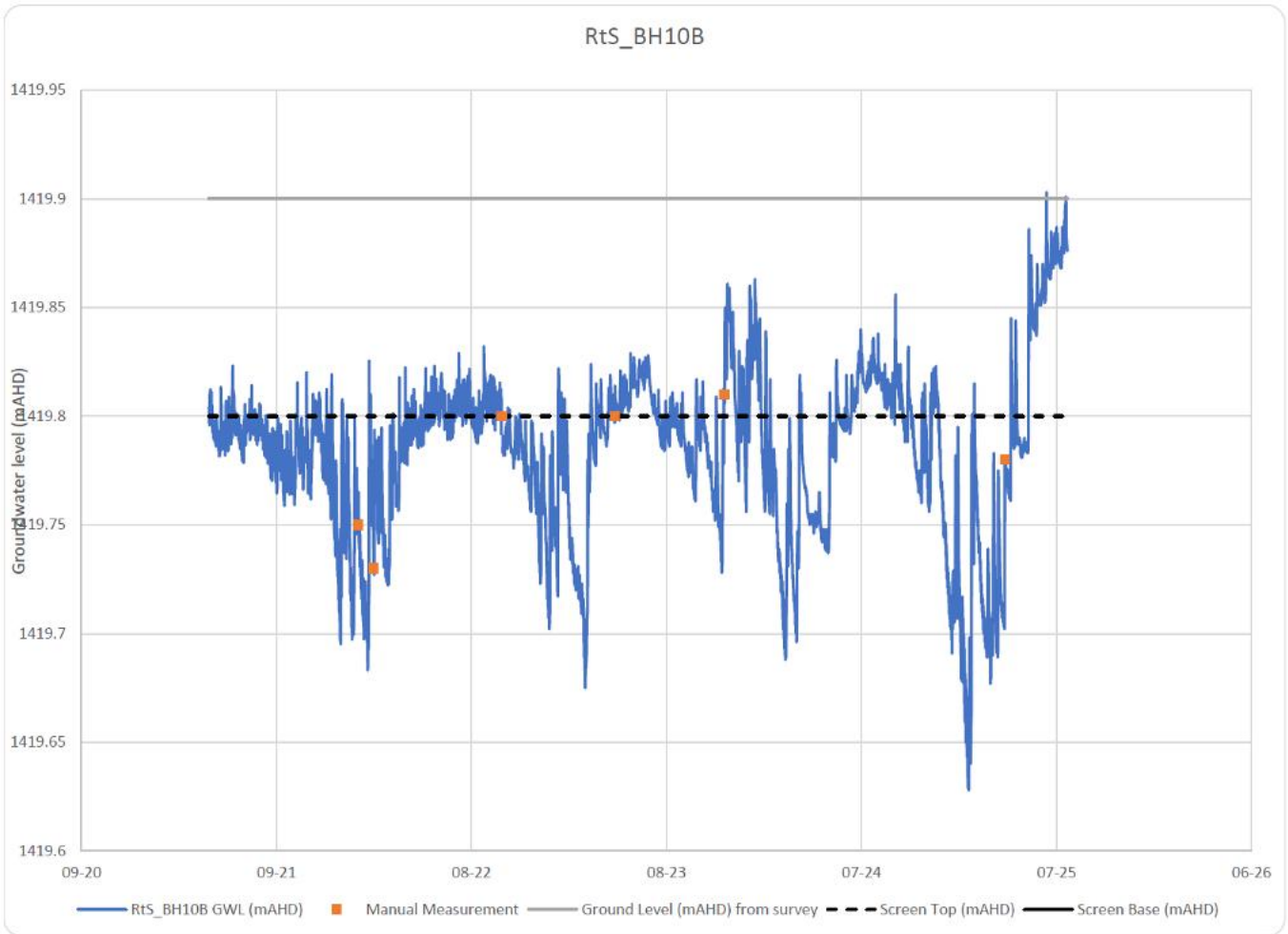


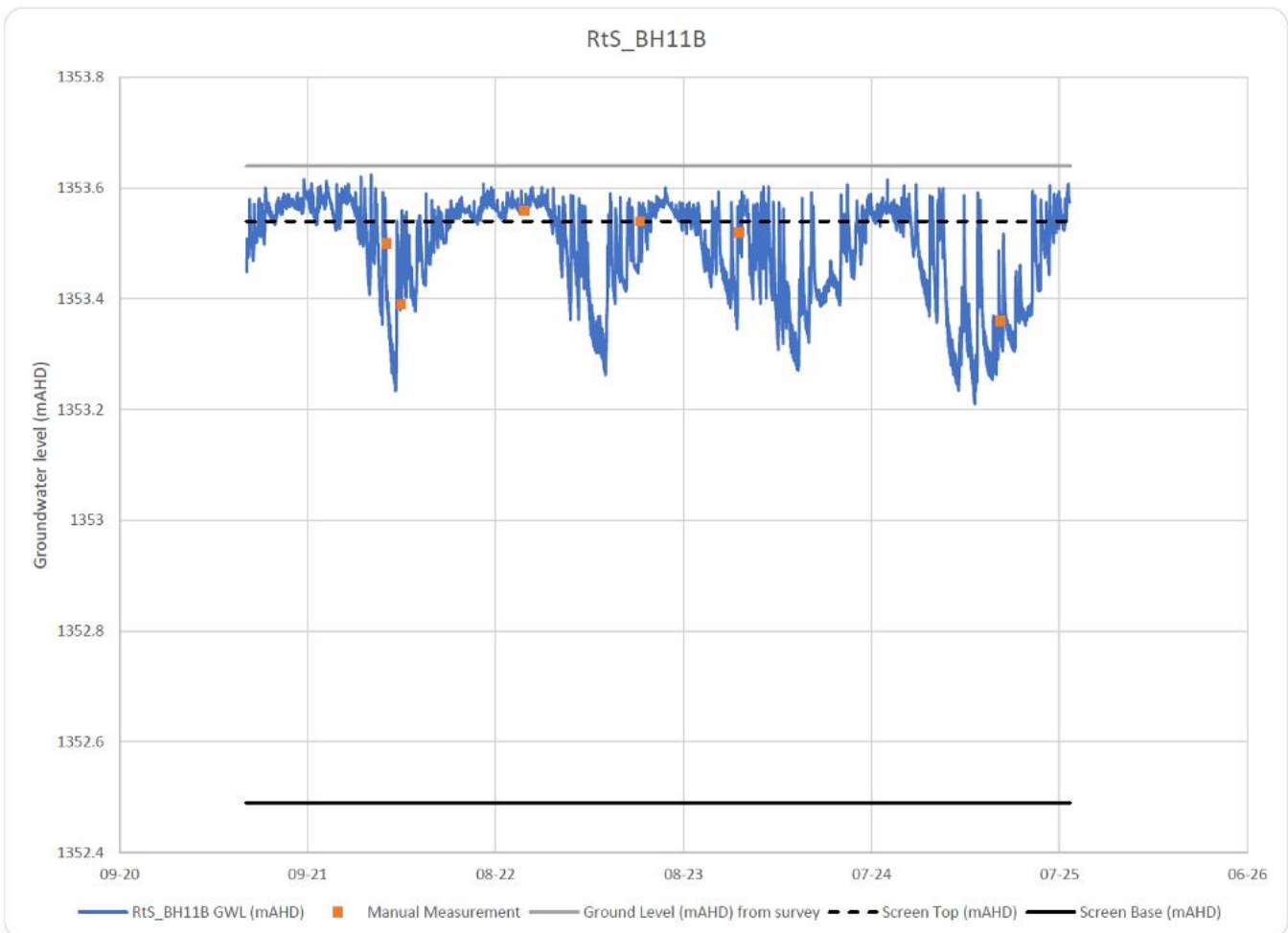
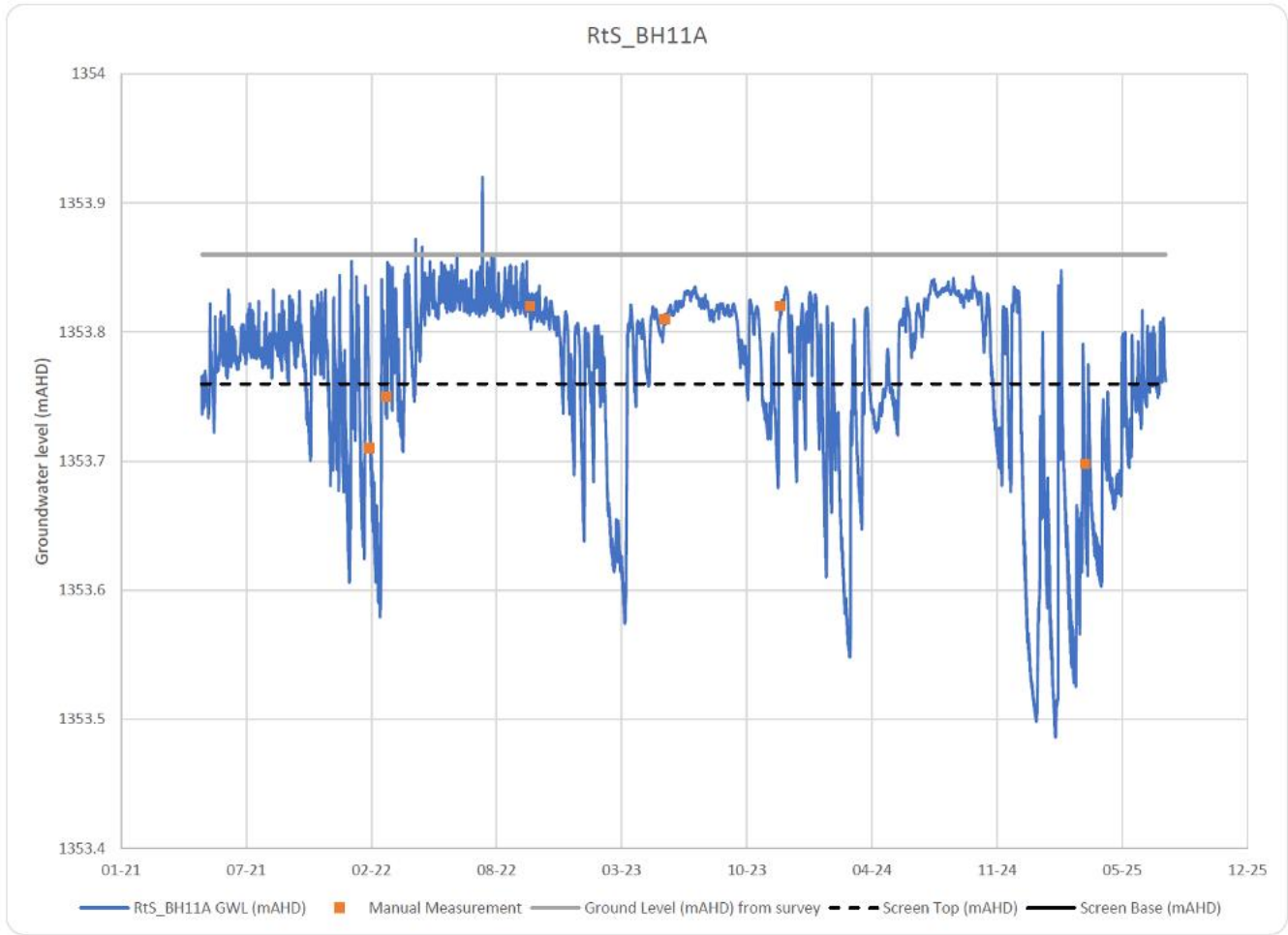


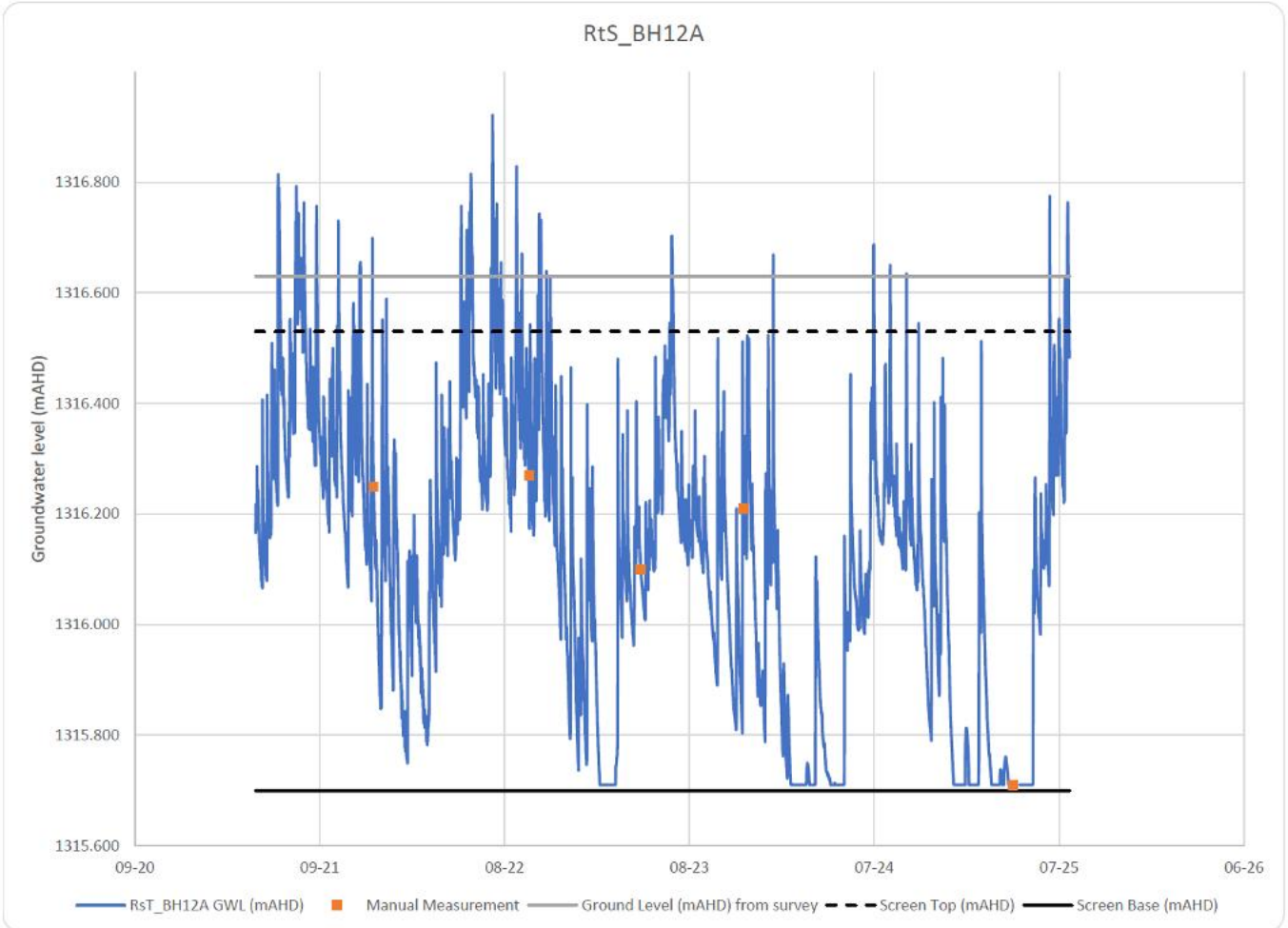
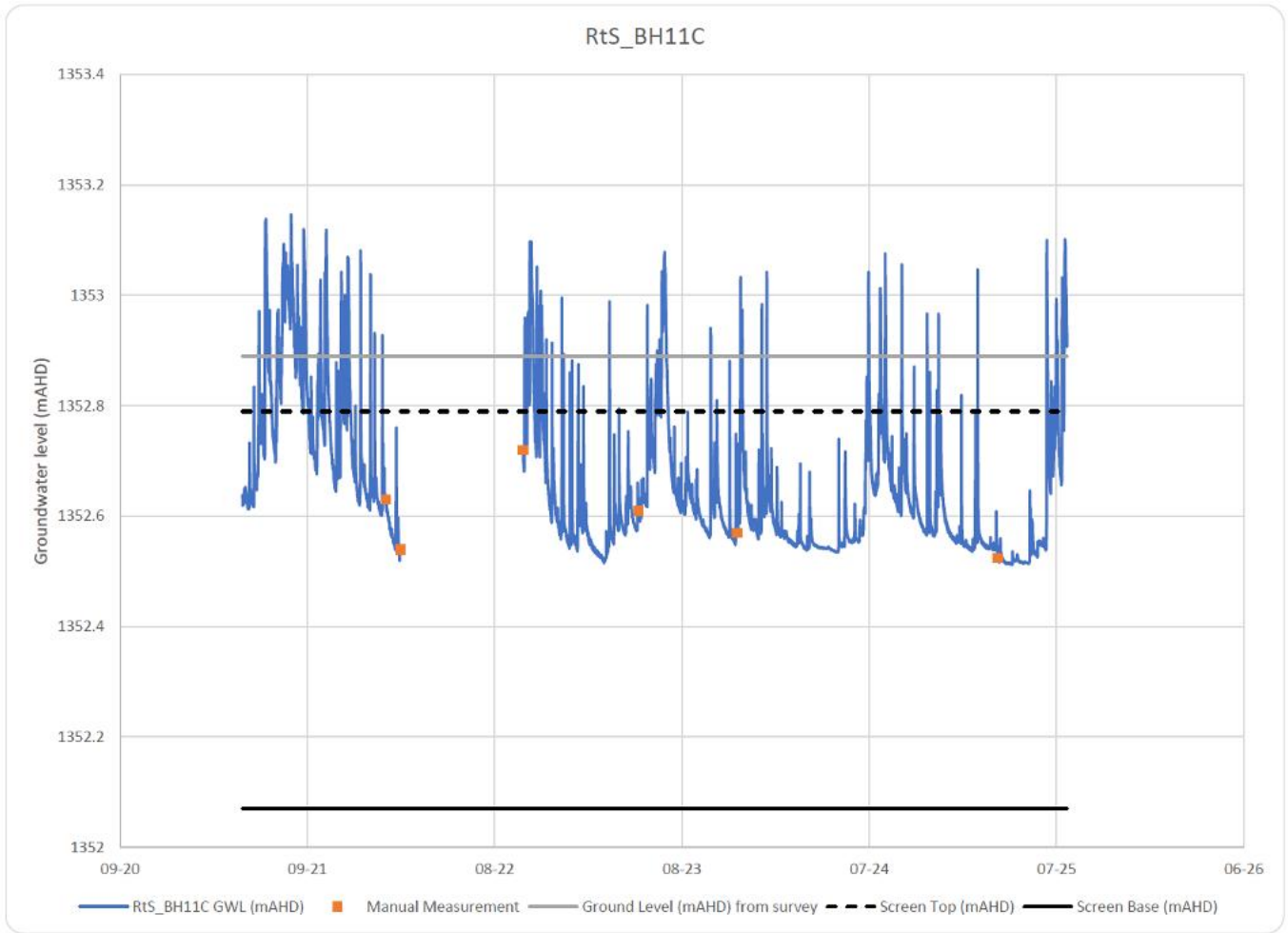


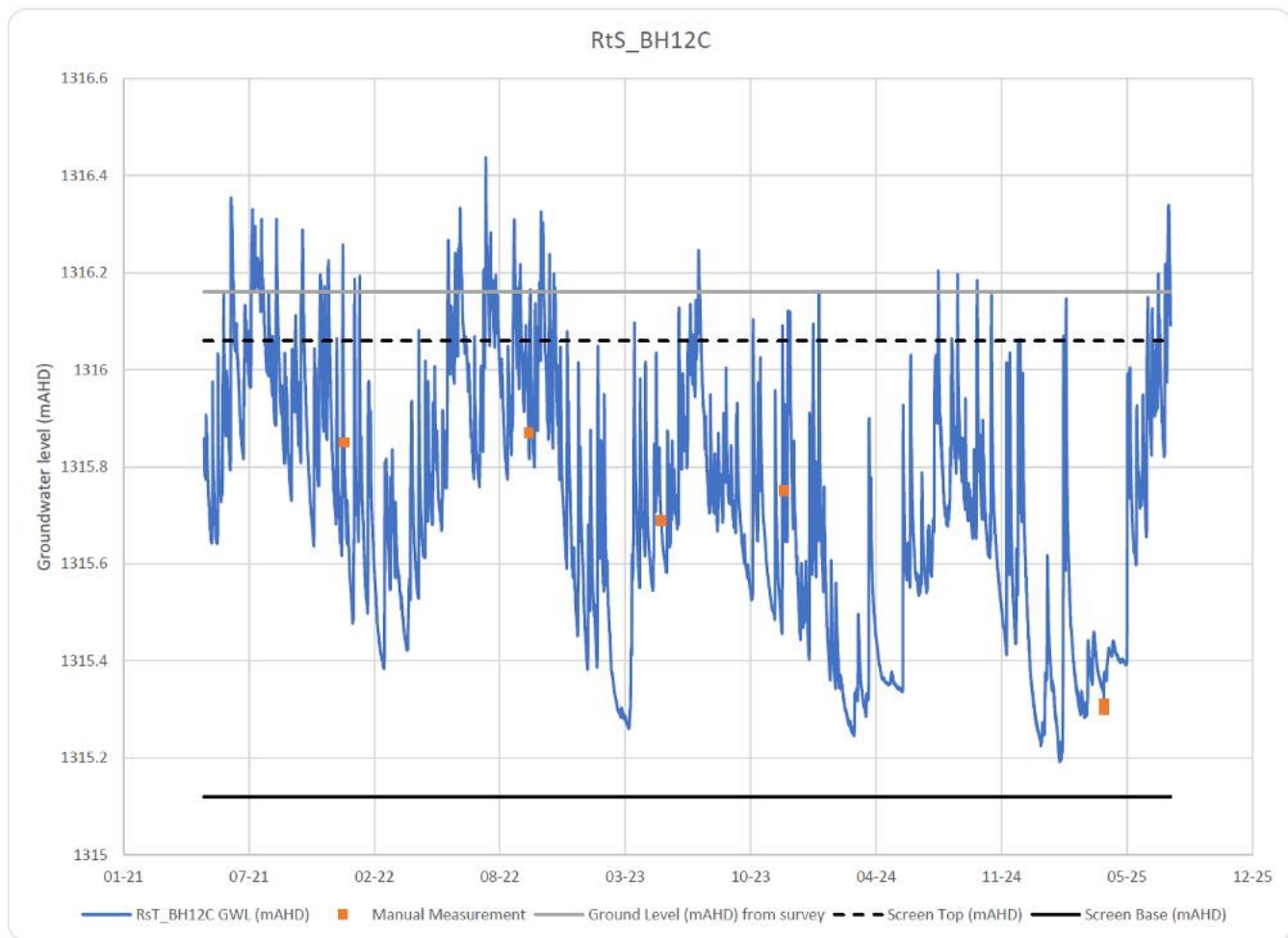
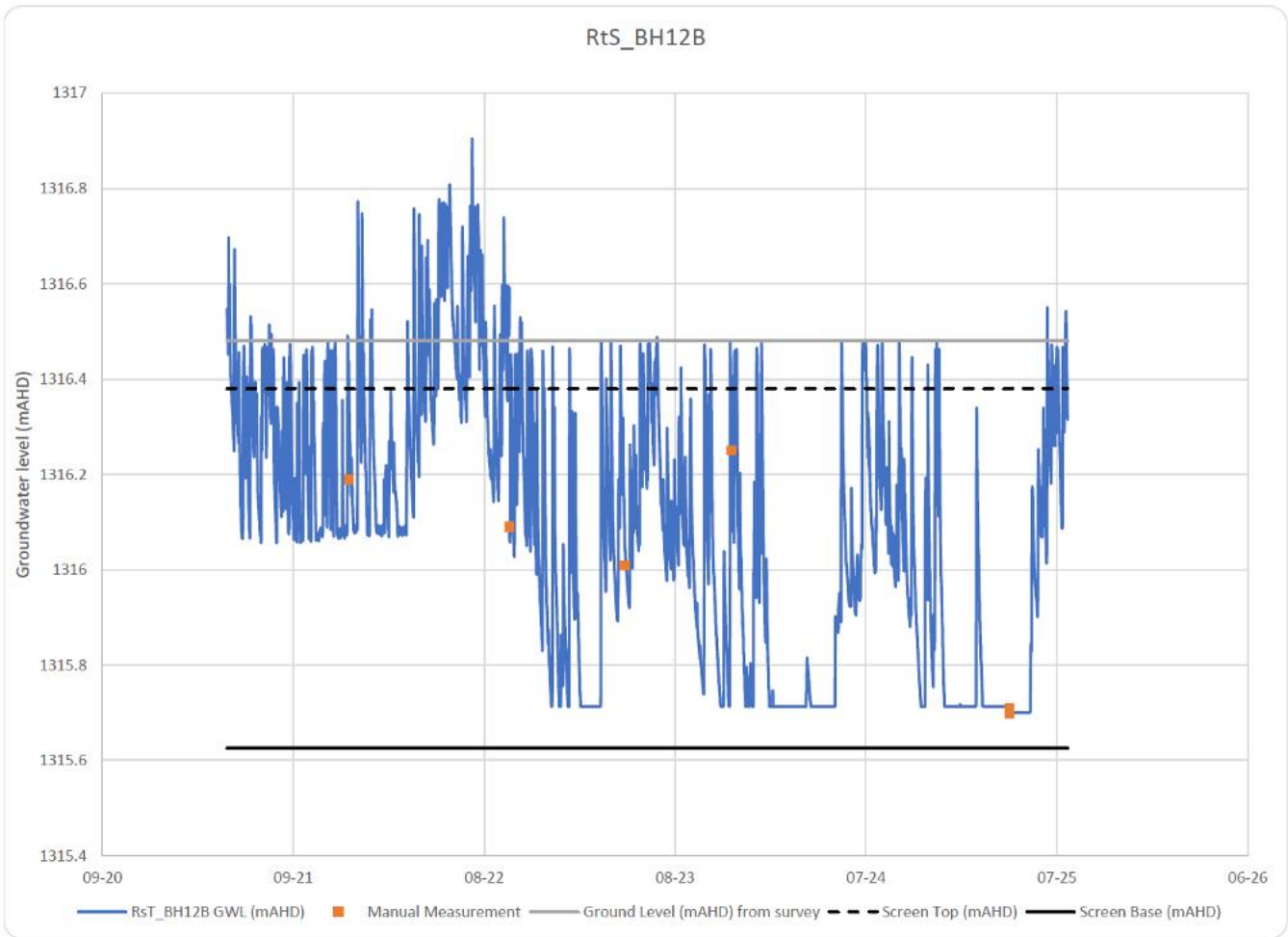


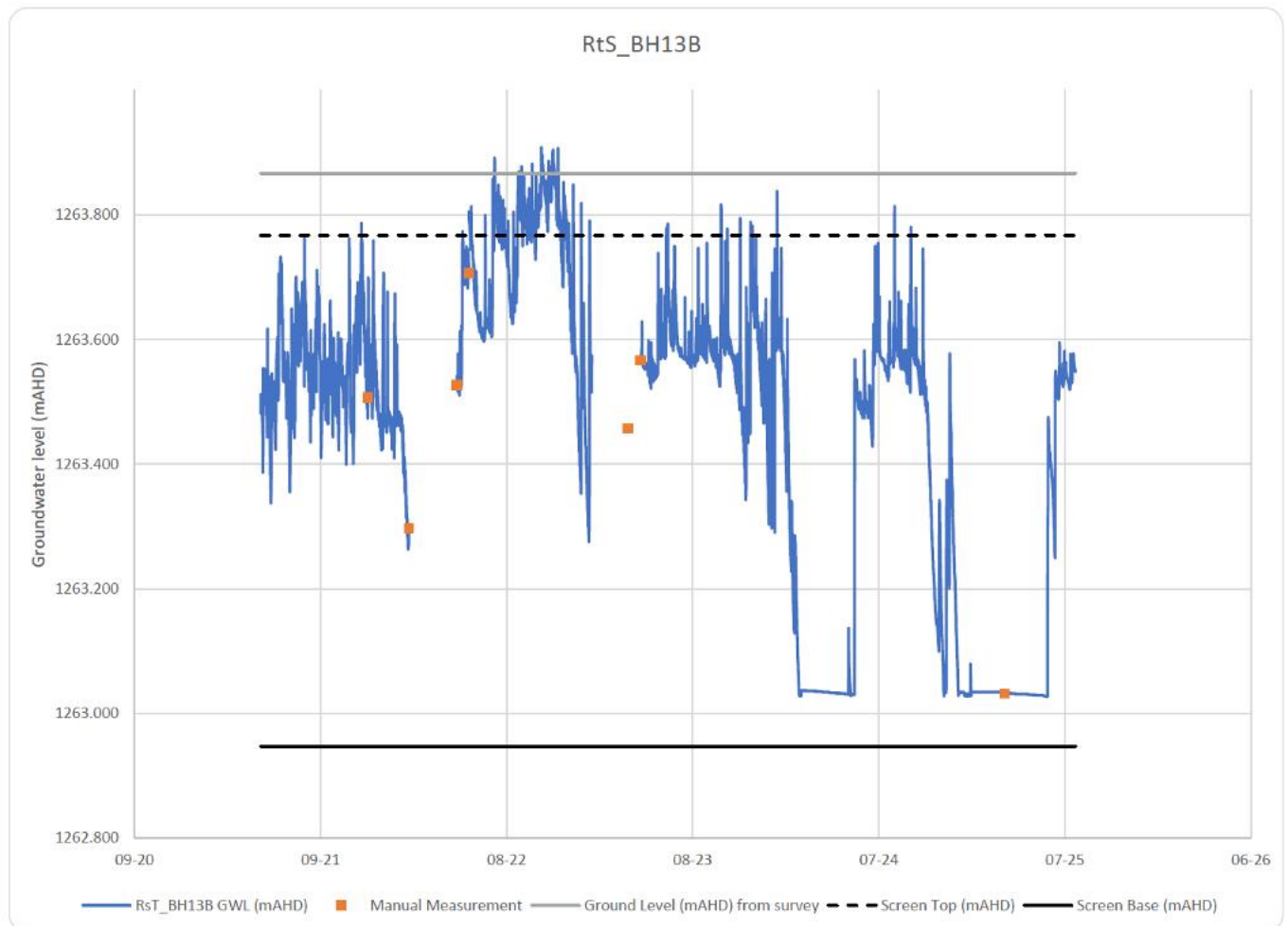
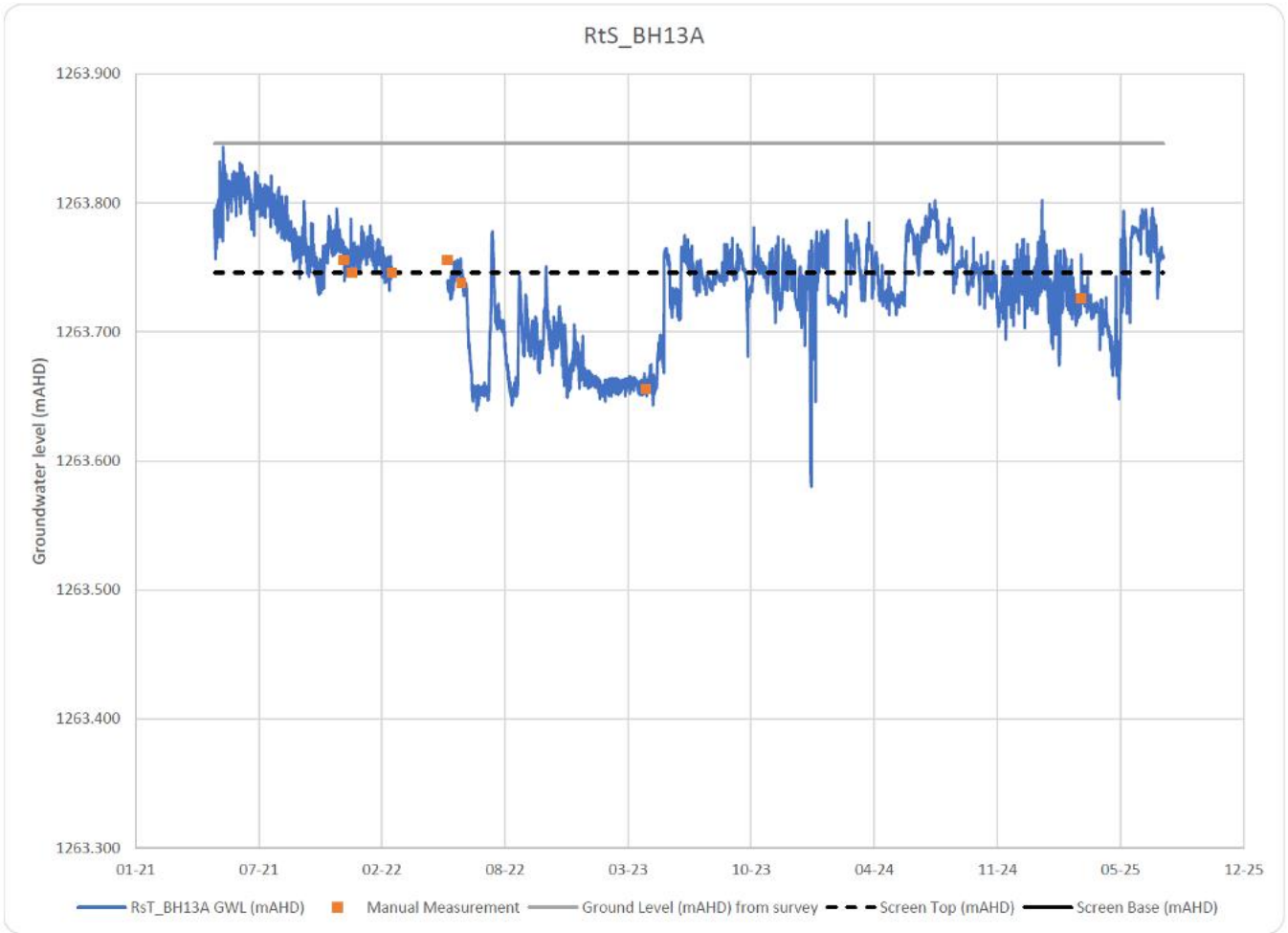


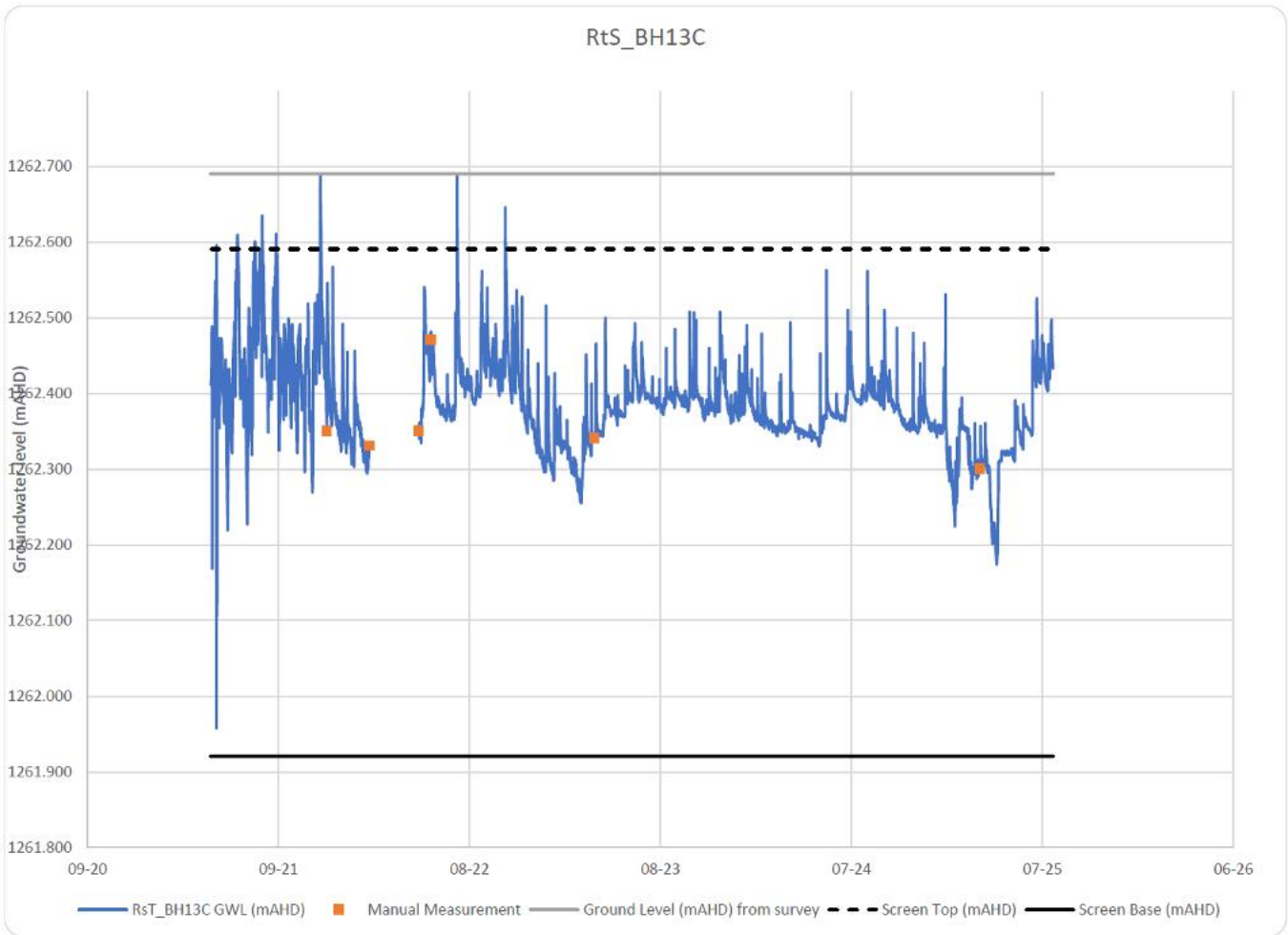












Appendix 9b – GDE floristic report – Summer 24/25



Alpine Flora

Snowy Hydro 2.0

Groundwater Dependent Ecosystem Vegetation Survey Monitoring

Summer 2025

Contents

| | | |
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1. Introduction – Project Background

Snowy Hydro Limited (SHL) is the proponent of the Snowy Mountains Hydro-electric Scheme which operates within a catchment of approximately 5,100 square kilometres (km²), most of which is located within Kosciuszko National Park (KNP). The purpose of the Snowy Scheme was to collect water from the alpine areas of the Great Dividing Range and send it to farms and communities in the west. There has been close to 65 years of continuous operation since construction, with sustained water and environmental management allowing the Snowy Scheme's assets to operate within the natural and recreational areas of KNP.

Snowy 2.0 is a pumped hydro-electric project that will link the existing Tantangara and Talbingo reservoirs through a series of new underground tunnels and a hydro-electric power station. Snowy 2.0 will increase the generation capacity of the Snowy Scheme by an additional 2,200 megawatts (MW), and at full capacity, provide approximately 350,000 megawatt hours (MWh) of large-scale energy storage to the National Electricity Market (NEM).

2. GDE Monitoring

2.1. Overview

Groundwater Dependent Ecosystems occur in all wetland areas on terrestrial Earth. Wetlands are vital for environmental health acting as natural filters, flood buffers and biodiversity hotspots. They contribute to clean water, climate regulation and support a wide range of plant and animal species. GDE's are intrinsic to water quality and supply, biodiversity and habitat, Climate Change mitigation, recreation and tourism, economic value and cultural significance.

Groundwater Dependent Ecosystems (GDE's) that could potentially be affected by the construction of the Snowy 2.0 project in Kosciuszko National Park (KNP) were initially monitored in February 2025. As the monitoring of GDE's has not been done since the commencement of work on the Snowy 2.0 project, the February 2025 assessment will be used as baseline data to monitor the changes to both floristic composition and peat depth in the future. Monitoring of GDE's will be done every quarter henceforth. This report is for Autumn 2025. Monitoring of the GDE's was done on the 29th of May 2025.

The Groundwater Management Plan for Snowy 2.0 identifies a Plant Community Types (PCT) that is characterised as entirely obligate Terrestrial Groundwater Dependent Ecosystems (GDE). This PCT requires ongoing monitoring, adaptive management and potentially offsetting if impacted. The PCT of relevance is:

- PCT 637 – Alpine and sub-alpine peatland, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion.

2.2. Methodology

Ground Survey Methodology

A range of qualitative and quantitative techniques will be used to assess the health and changes to the GDE's that may be impacted by the Snowy 2.0 project. Control sites, that are not on the tunnel alignment, will be used to compare the GDE's that are directly aligned with the Snowy 2.0 tunnel excavation.

1. Field mapping will involve the following survey techniques:
 - Random meander surveys on foot to ground-truth Plant Community Type (PCT) boundaries.
 - 10m x 10 m quadrats will be marked out within the GDE sites with an assessment of vegetation/litter/rocks/bare ground/pools/channels at 1m intervals. Quadrats will be GPS'd and marked with flagged corner posts for future monitoring ease.
2. Photo points will use a corner post of the 10m x 10m quadrat. These will be taken every quarter during the monitoring period from the same post.
3. Surface level rods will be inserted into the monitoring area to assess any changes in peat depth over time. Surface level rods essentially act as markers to track how the peatland is evolving by recording the height

of the peat surface relative to a fixed point. Surface level rods will be marked with flagging tape and GPS'd for ease of future monitoring.

- PCTs will be assessed into vegetation zones based on the broad condition of the vegetation according to PCT floristic biodiversity as poor, moderate or high.

A qualitative assessment of the general ecological health of the GDE's and the surrounding area will also be done. GDE's in KNP have been exposed to significant ecological threatening processes due to the high numbers of ungulates, introduced herbivores and weed invasion in the past and present and must be noted.

Factors outside of the Snowy 2.0 tunnel excavation that could be underlying any changes in hydrology and GDE's within KNP include:

- Increased erosion and channelling
- Trenching and flow redirection
- Altered drainage
- Hydrophobic soils
- Bare and exposed peat
- Previous fire impacts
- Trampling or peat compaction
- Presence of wallows
- Presence and abundance of weeds
- Changes in precipitation and subsequent effects on groundwater recharge
- Temperature, evapotranspiration and altered snow cover with climate change.

2.3. Location Map

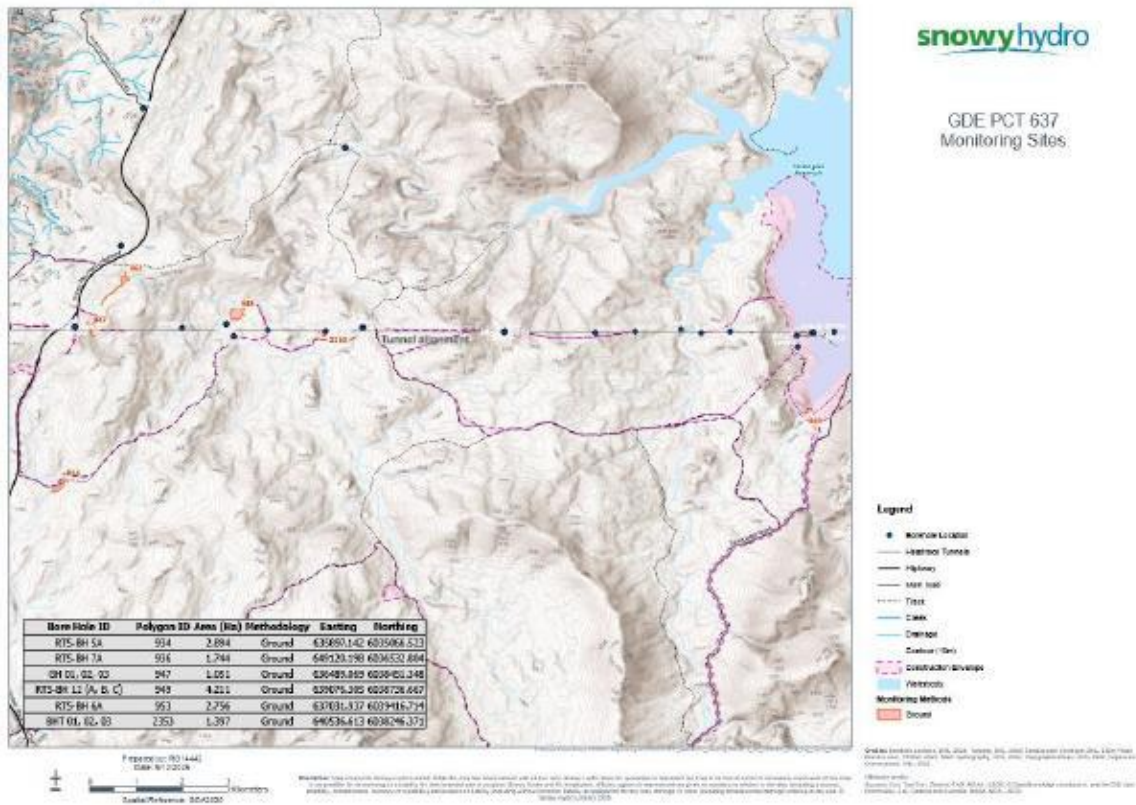


Figure 1: Location of GDE's and Control Sites within the Snowy 2.0 area.

3. Results

Table 3.1: GDE Assessment - Summer 2025

Note: All GDE’s monitored for this project are within PCT 637.

| Project Area | Method | Site Type | Description and Condition Report |
|----------------|------------------------|--------------------------|--|
| <i>Site ID</i> | <i>Ground or Drone</i> | <i>Control or Impact</i> | |
| GDE 934 | Ground | Control | This site is a fen dominated by <i>Carex gaudichaudiana</i> with <i>Poa labillardierei</i> var. <i>labillardierei</i> on the edges of the fen, which is common in GDE’s in KNP. There was free water noted above the plants on the soil surface and is 3mm higher than in the summer. The marked 10m x 10m quadrat was 100% <i>Carex gaudichaudiana</i> , with no pools or bare ground. <i>Carex</i> was in a senescent phase. The vegetation was healthy and showed no signs of water stress. Peat depth was recorded as 1.2m. Whilst biodiversity of the site is low, the overall health of this GDE is high. |
| GDE 936 | Ground | Control | This site, whilst a control site is a highly disturbed area near to Tantangara quarry. There is a lot of horse damage with native and introduced plants being chewed and trampled. There were incisions created by horses accessing the fen and water draining out of the GDE due to the incisions. The site had about 50% weed species and areas of exposed peat. Native species observed were: <i>Carex gaudichaudiana</i> , <i>Epacris microphylla</i> , <i>Myosotis australis</i> subsp. <i>australis</i> , <i>Pratia pedunculata</i> and a species of <i>Myriophyllum</i> in the pooled water. Introduced species were: <i>Hypericum perforatum</i> , <i>Holcus lanatus</i> , <i>Juncus effusus</i> , <i>Phalaris arundinacea</i> and <i>Trifolium repens</i> . The 10m x10m quadrat had a mix of the <i>Carex</i> , <i>Pratia pedunculata</i> , <i>Juncus effusus</i> , <i>Hypericum perforatum</i> and <i>Trifolium repens</i> . There was also some pools and areas of exposed peat. Surface water was recorded at the base of the vegetation. Peat depth was recorded as 0.2m. Overall, the broad condition of the vegetation based on PCT 637 is poor. |
| GDE 947 | Ground | Impact | This site is an intact fen with minimal signs of disturbance and no presence of introduced species. The 10m x 10m quadrat species recorded were: <i>Carex gaudichaudiana</i> , <i>Empodisma minus</i> , <i>Geranium potentilloides</i> , <i>Senecio gunnii</i> and <i>Picris angustifolia</i> . The <i>Carex</i> was the most dominant species within the quadrat with around 95% cover. The <i>Carex</i> was in a senescent phase due to cold autumnal temperatures. There were faint and possibly old tracks of a vehicle, a distinctive horse track and some horse scats. Surface water was recorded at the base of the vegetation and was 2mm higher than the summer reading. Peat depth was recorded as 1m. Overall, the broad condition of the vegetation based on PCT 637 is high. |
| GDE 949 | Ground | Impact | This site is a mix of both fen and sphagnum bog vegetation. No introduced species were observed. The native species observed within the 10m x 10m quadrat were: <i>Carex gaudichaudiana</i> , <i>Carex jackiana</i> , <i>Empodisma minus</i> , <i>Epacris paludosa</i> , <i>Epilobium gunnianum</i> , <i>Poa costiniana</i> , <i>Poa</i> |

| | | | |
|----------|--------|---------|---|
| | | | labillardierei var. labillardierei, <i>Pratia pedunculata</i> , <i>Richea continentis</i> , <i>Sphagnum cristatum</i> . Surface water was observed at the base of the vegetation and had not changed since summer. There was a well-formed horse track through the GDE and horse scats, but little evidence of grazing. There were a few exposed water pools, but no exposed peat. Peat depth was recorded as 1.4m deep. Overall, the broad condition of the vegetation based on PCT 637 is moderate to high. |
| GDE 953 | Ground | Control | This site is an intact fen with no signs of disturbance. The 10m x 10m quadrat was dominated by 99% <i>Carex gaudichaudiana</i> . Other species recorded were <i>Craspedia</i> spp., <i>Empodisma minus</i> , <i>Epilobium gunnianum</i> , <i>Luzula novae cambriae</i> , <i>Poa labillardierei</i> var. <i>labillardierei</i> , <i>Plantago antarctica</i> , <i>Pratia pedunculata</i> , <i>Ranunculus graniticola</i> and <i>Wahlenbergia gloriosa</i> . One plant of <i>Juncus effusus</i> was noted. A native orchid, <i>Spiranthes australis</i> was also recorded. All plants were in a senescent phase due to low temperatures leading up to winter. No bare peat, pools or tracks were recorded. There was exposed water at the bottom of the vegetation recorded and was 5mm higher than the summer reading. Peat depth was recorded as 1.6m. Overall, the broad condition of the vegetation based on PCT 637 is high. |
| GDE 2353 | Ground | Impact | This site is an intact fen with minimal signs of disturbance. The 10m x 10m quadrat was dominated by 99% <i>Carex gaudichaudiana</i> . Other species recorded were <i>Holcus lanatus</i> (weed) and <i>Poa labillardierei</i> var. <i>labillardierei</i> . No bare peat, pools or tracks were recorded. Horse scats within the fen were observed. There was no exposed water at the bottom of the vegetation recorded. Peat depth was recorded as X. Overall, the broad condition of the vegetation based on PCT 637 is high. |

4. Climate Effects on GDE’s

Climate, as in rainfall, daily temperature, diurnal fluctuation, snow depth and humidity levels all affect GDE’s and the groundwater that they are dependent on. It is important than when assessing the health of the target GDE’s that this data is included. For example, a prolonged and severe drought will deplete the water table and will stress some of the water dependent floral species in GDE’s. Changes to the water table and drought, in particular, are relatively common in the Australian Alps and GDE floral species have some capacity to cope with dry conditions. In prolonged droughts, GDE species will become stressed and show signs of senescence. However, it is highly unlikely that a drought will result in the mass death of plants in a GDE.

Therefore, within this context, only mass change and death of large areas of GDE vegetation will trigger a response to investigate the water table in the surrounding area and ascertain whether it is directly related to the Snowy 2.0 tunnelling process.

Climate data for each annual quarter can be viewed in

5. Appendix

5.1. Coordinates of GDEs

Table 5.1: Coordinates by Location

| ID # | Longitude | Latitude |
|----------|------------|-------------|
| GDE 934 | 635897.142 | 6036532.804 |
| GDE 936 | 649120.198 | 6036532.804 |
| GDE 947 | 636489.069 | 6038451.348 |
| GDE 948 | 636975.874 | 6038715.801 |
| GDE 949 | 639076.305 | 6038736.667 |
| GDE 953 | 637031.937 | 6039416.714 |
| GDE 2353 | 640536.613 | 6038246.371 |

5.2. Climate Data - Summer 2024/25

Weather Stations near the Snowy 2.0 alignment

Please note that this report uses preliminary rainfall and temperature data that has not yet been officially quality controlled.

There are a number of Automatic Weather Stations (AWS), in the immediate vicinity of the Lob's Hole to Tantangara region that report real-time data. These include:

- "Ravine" station (precipitation only), located near the streamflow gauge on the Yarrangobilly River upstream of Talbingo Reservoir;
- "Tantangara" station (full AWS), located at the southern end of the reservoir near the Snowy 2.0 depot ;
- "Murrumbidgee", located near the stream flow gauge on the upper Murrumbidgee river 2.7km north of the alignment and about 8.2 km WNW from Tantangara;
- "Cabramurra" a full AWS located near the township,
- "Cabramurra (BOM)," a full AWS operated by the Bureau of Meteorology, located above the Cabramurra township (used for comparison to our own data)

Summary of weather data collected in the Snowy 2.0 regions from January 1 2024 to February 1 2025

Rainfall

Raw rainfall data

The cumulative rainfall data over this period, with the automatic and manual preliminary quality control, is shown in the figure below. The Snowy Hydro gauge at Ravine (Lobs Hole) was destroyed in the bushfires on 4 Jan 2020 and has not yet been returned to service.

We noted that the precipitation reported by the Snowy Hydro gauge at Cabramurra was anomalously low during winter, and previewing the spring data it appears that the under-reporting issues persist. We have therefore excluded the Snowy Hydro Cabramurra gauge from the remainder of this report and will rely on the BOM Cabramurra gauge and/or Tooma Dam to characterise precipitation at higher elevations.

Heaviest rain days of the season

Rainfall during summer of 2024-25 was characterised by a handful of moderate rainfall events. December had only one or two substantial rain days. January had a period of rainy days in the second week of the month, and there were a few rainy periods in February that especially impacted the Murrumbidgee and Lobs Hole (Ravine) areas.

Daily Maximum Precipitation:

| | Date | Rainfall (mm) |
|--------------|------------|---------------|
| Ravine | 2025-02-14 | 51.600 |
| Cabramurra | 2025-01-15 | 23.978 |
| Tantangara | 2025-02-14 | 24.000 |
| Murrumbidgee | 2025-02-10 | 67.000 |

On the five day time scale, the heaviest precipitation amounts occurred during different events than the daily maximums. These events occurred in September or early October, and had more "wintertime" characteristics, with colder weather and multi-day westerly winds, rather than convective thunderstorms.

Five-Day Maximum Precipitation:

| | Date | Rainfall |
|--------------|------------|----------|
| Ravine | 2025-02-14 | 85.600 |
| Cabramurra | 2024-12-07 | 48.924 |
| Tantangara | 2025-01-15 | 50.600 |
| Murrumbidgee | 2025-02-14 | 118.500 |

Monthly rainfall amounts compared to long-term (1995-2024) averages for rainfall during this period

During DJF 2024-25 the tropical Pacific Oceans was in a weak La Nina like phase, with no discernible influence from the Indian Ocean. When there is weak forcing like this, other influences can dominate the weather in south eastern Australia. This summer, rainfall was generally near to below average, though isolated heavy showers appear to have brought February totals above average at some locations.

Monthly rainfall during this period:

| Date | Ravine (mm) | Cabramurra (mm) | Tantangara (mm) | Murrumbidgee (mm) |
|--------|-------------|-----------------|-----------------|-------------------|
| Dec 24 | 77.4 | 54.5 | 41.2 | 62.5 |
| Jan 25 | 42.4 | 68.3 | 73.0 | 137.5 |
| Feb 25 | 129.4 | 52.1 | 70.4 | 59.2 |

Long-term (1995-2024) average monthly rainfall for this period:

| Date | Ravine (mm) | Cabramurra (mm) | Tantangara (mm) | Murrumbidgee (mm) |
|------|-------------|-----------------|-----------------|-------------------|
| Dec | 78.7 | 109.1 | 85.1 | 94.2 |
| Jan | 60.1 | 92.5 | 76.6 | 84.8 |
| Feb | 61.0 | 86.4 | 66.4 | 87.0 |

Temperature data in Dec-Feb 2024-25

Raw temperature data

The following figure shows the raw temperature data recorded at the Tantangara, Ravine, and BOM Cabramurra automatic weather stations.

Statistics for Talbingo temperature in this period

Daily maximum and minimum temperatures were calculated from this period using the 00:00-23:59 definition of a day.

The column headings in the table below are described as follows:

- maxmax is the hottest temperature for that month
- meanmax is the average of the daily maximum temperatures for that month
- meanmin is the average of the daily minimum temperatures for that month
- minmin is the lowest temperature for that month

Talbingo, the nearest reporting weather station to Lob's Hole, reported above average values for both maximum and minimum temperatures, for each month during spring 2020. Despite the significant heatwave towards the end of November, the daily maximum temperatures were well short of the highest November values since 1995.

| Date | Highest Max | Average Max | Lowest Min | Average Min |
|----------|-------------|-------------|------------|-------------|
| Dec 2024 | 29.1 | 23.0 | -2.1 | 5.2 |
| Jan 2025 | 29.3 | 24.2 | 1.5 | 8.2 |
| Feb 2025 | 30.9 | 24.1 | -2.8 | 6.4 |

The climatological values from the period 1995-2024 are shown in the table below for reference:

| Date | Highest Max | Average Max | Lowest Min | Average Min |
|----------|-------------|-------------|------------|-------------|
| Dec 2024 | 32.9 | 21.0 | -6.6 | 4.3 |
| Jan 2025 | 35.3 | 23.6 | -4.4 | 7.0 |
| Feb 2025 | 34.3 | 22.6 | -4.9 | 6.4 |

5.3. Photo Points

All GDE photos were taken on the 12th and 13th of February 2025.

GDE 934 – Control Site



GDE 936 – Control Site







GDE 947 – Impact Site





GDE 949 – Impact Site





GDE 953 – Control Site





GDE 2353 – Impact Site





Appendix 9c – GDE floristic report – Autumn 2025



Alpine Flora

Snowy Hydro 2.0

Groundwater Dependent Ecosystem Vegetation Survey Monitoring

Autumn 2025

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1. Introduction – Project Background

Snowy Hydro Limited (SHL) is the proponent of the Snowy Mountains Hydro-electric Scheme which operates within a catchment of approximately 5,100 square kilometres (km²), most of which is located within Kosciuszko National Park (KNP). The purpose of the Snowy Scheme was to collect water from the alpine areas of the Great Dividing Range and send it to farms and communities in the west. There has been close to 65 years of continuous operation since construction, with sustained water and environmental management allowing the Snowy Scheme's assets to operate within the natural and recreational areas of KNP.

Snowy 2.0 is a pumped hydro-electric project that will link the existing Tantangara and Talbingo reservoirs through a series of new underground tunnels and a hydro-electric power station. Snowy 2.0 will increase the generation capacity of the Snowy Scheme by an additional 2,200 megawatts (MW), and at full capacity, provide approximately 350,000 megawatt hours (MWh) of large-scale energy storage to the National Electricity Market (NEM).

2. GDE Monitoring

2.1. Overview

Groundwater Dependent Ecosystems occur in all wetland areas on terrestrial Earth. Wetlands are vital for environmental health acting as natural filters, flood buffers and biodiversity hotspots. They contribute to clean water, climate regulation and support a wide range of plant and animal species. GDE's are intrinsic to water quality and supply, biodiversity and habitat, Climate Change mitigation, recreation and tourism, economic value and cultural significance.

Groundwater Dependent Ecosystems (GDE's) that could potentially be affected by the construction of the Snowy 2.0 project in Kosciuszko National Park (KNP) were initially monitored in February 2025. As the monitoring of GDE's has not been done since the commencement of work on the Snowy 2.0 project, the February 2025 assessment will be used as baseline data to monitor the changes to both floristic composition and peat depth in the future. Monitoring of GDE's will be done every quarter henceforth. This report is for Autumn 2025. Monitoring of the GDE's was done on the 29th of May 2025.

The Groundwater Management Plan for Snowy 2.0 identifies a Plant Community Types (PCT) that is characterised as entirely obligate Terrestrial Groundwater Dependent Ecosystems (GDE). This PCT requires ongoing monitoring, adaptive management and potentially offsetting if impacted. The PCT of relevance is:

- PCT 637 – Alpine and sub-alpine peatland, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion.

2.2. Methodology

Ground Survey Methodology

A range of qualitative and quantitative techniques will be used to assess the health and changes to the GDE's that may be impacted by the Snowy 2.0 project. Control sites, that are not on the tunnel alignment, will be used to compare the GDE's that are directly aligned with the Snowy 2.0 tunnel excavation.

1. Field mapping will involve the following survey techniques:
 - Random meander surveys on foot to ground-truth Plant Community Type (PCT) boundaries.
 - 10m x 10 m quadrats will be marked out within the GDE sites with an assessment of vegetation/litter/rocks/bare ground/pools/channels at 1m intervals. Quadrats will be GPS'd and marked with flagged corner posts for future monitoring ease.
2. Photo points will use a corner post of the 10m x 10m quadrat. These will be taken every quarter during the monitoring period from the same post.
3. Surface level rods will be inserted into the monitoring area to assess any changes in peat depth over time. Surface level rods essentially act as markers to track how the peatland is evolving by recording the height

of the peat surface relative to a fixed point. Surface level rods will be marked with flagging tape and GPS'd for ease of future monitoring.

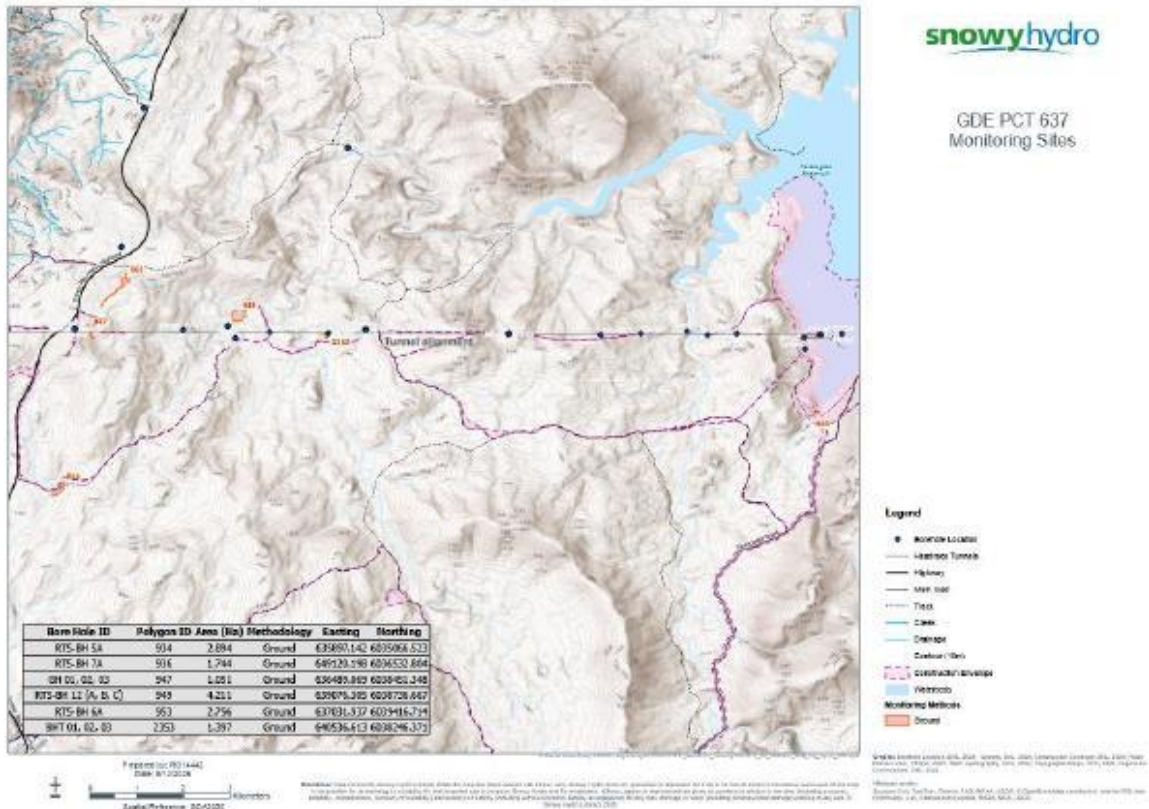
- PCTs will be assessed into vegetation zones based on the broad condition of the vegetation according to PCT floristic biodiversity as poor, moderate or high.

A qualitative assessment of the general ecological health of the GDE's and the surrounding area will also be done. GDE's in KNP have been exposed to significant ecological threatening processes due to the high numbers of ungulates, introduced herbivores and weed invasion in the past and present and must be noted.

Factors outside of the Snowy 2.0 tunnel excavation that could be underlying any changes in hydrology and GDE's within KNP include:

- Increased erosion and channelling
- Trenching and flow redirection
- Altered drainage
- Hydrophobic soils
- Bare and exposed peat
- Previous fire impacts
- Trampling or peat compaction
- Presence of wallows
- Presence and abundance of weeds
- Changes in precipitation and subsequent effects on groundwater recharge
- Temperature, evapotranspiration and altered snow cover with climate change.

2.3. Location Map



3. Results

Table 3.1: GDE Assessment - Autumn 2025

Note 1: All GDE's monitored for this project are within PCT 637.

| Project Area | Method | Site Type | Description and Condition Report |
|----------------|------------------------|--------------------------|--|
| <i>Site ID</i> | <i>Ground or Drone</i> | <i>Control or Impact</i> | |
| GDE 934 | Ground | Control | This site is a fen dominated by <i>Carex gaudichaudiana</i> with <i>Poa labillardierei</i> var. <i>labillardierei</i> on the edges of the fen, which is common in GDE's in KNP. There was free water noted above the plants on the soil surface and is 3mm higher than in the summer. The marked 10m x 10m quadrat was 100% <i>Carex gaudichaudiana</i> , with no pools or bare ground. <i>Carex</i> was in a senescent phase. The vegetation was healthy and showed no signs of water stress. Peat depth was recorded as 1.2m. Whilst biodiversity of the site is low, the overall health of this GDE is high. |
| GDE 936 | Ground | Control | This site, whilst a control site is a highly disturbed area near to Tantangara quarry. There is a lot of horse damage with native and introduced plants being chewed and trampled. There were incisions created by horses accessing the fen and water draining out of the GDE due to the incisions. The site had about 50% weed species and areas of exposed peat. Native species observed were: <i>Carex gaudichaudiana</i> , <i>Epacris microphylla</i> , <i>Myosotis australis</i> subsp. <i>australis</i> , <i>Pratia pedunculata</i> and a species of <i>Myriophyllum</i> in the pooled water. Introduced species were: <i>Hypericum perforatum</i> , <i>Holcus lanatus</i> , <i>Juncus effusus</i> , <i>Phalaris arundinacea</i> and <i>Trifolium repens</i> . The 10m x10m quadrat had a mix of the <i>Carex</i> , <i>Pratia pedunculata</i> , <i>Juncus effusus</i> , <i>Hypericum perforatum</i> and <i>Trifolium repens</i> . There was also some pools and areas of exposed peat. Surface water was recorded at the base of the vegetation. Peat depth was recorded as 0.2m. Overall, the broad condition of the vegetation based on PCT 637 is poor. |
| GDE 947 | Ground | Impact | This site is an intact fen with minimal signs of disturbance and no presence of introduced species. The 10m x 10m quadrat species recorded were: <i>Carex gaudichaudiana</i> , <i>Empodisma minus</i> , <i>Geranium potentilloides</i> , <i>Senecio gunnii</i> and <i>Picris angustifolia</i> . The <i>Carex</i> was the most dominant species within the quadrat with around 95% cover. The <i>Carex</i> was in a senescent phase due to cold autumnal temperatures. There were faint and possibly old tracks of a vehicle, a distinctive horse track and some horse scats. Surface water was recorded at the base of the vegetation and was 2mm higher than the summer reading. Peat depth was recorded as 1m. Overall, the broad condition of the vegetation based on PCT 637 is high. |
| GDE 949 | Ground | Impact | This site is a mix of both fen and sphagnum bog vegetation. No introduced species were observed. The native species observed within the 10m x 10m quadrat were: <i>Carex gaudichaudiana</i> , <i>Carex jackiana</i> , <i>Empodisma minus</i> , <i>Epacris paludosa</i> , <i>Epilobium gunnianum</i> , <i>Poa costiniana</i> , <i>Poa</i> |

5

| | | | |
|----------|--------|---------|---|
| | | | labillardierei var. labillardierei, <i>Pratia pedunculata</i> , <i>Richea continentis</i> , <i>Sphagnum cristatum</i> . Surface water was observed at the base of the vegetation, but not at the monitoring stake. Given the very dry autumn it is likely that this is a natural event. There was a well-formed horse track through the GDE and horse scats, but little evidence of grazing. There were a few exposed water pools, but no exposed peat. Peat depth was recorded as 1.4m deep. Overall, the broad condition of the vegetation based on PCT 637 is moderate to high. |
| GDE 953 | Ground | Control | This site is an intact fen with no signs of disturbance. The 10m x 10m quadrat was dominated by 99% <i>Carex gaudichaudiana</i> . Other species recorded were <i>Craspedia</i> spp., <i>Empodisma minus</i> , <i>Epilobium gunnianum</i> , <i>Luzula novae cambriae</i> , <i>Poa labillardierei</i> var. <i>labillardierei</i> , <i>Plantago antarctica</i> , <i>Pratia pedunculata</i> , <i>Ranunculus graniticola</i> and <i>Wahlenbergia gloriosa</i> . One plant of <i>Juncus effusus</i> was noted. A native orchid, <i>Spiranthes australis</i> was also recorded. All plants were in a senescent phase due to low temperatures leading up to winter. No bare peat, pools or tracks were recorded. There was exposed water at the bottom of the vegetation recorded and was 5mm higher than the summer reading. Peat depth was recorded as 1.6m. Overall, the broad condition of the vegetation based on PCT 637 is high. |
| GDE 2353 | Ground | Impact | This site is an intact fen with minimal signs of disturbance. The 10m x 10m quadrat was dominated by 99% <i>Carex gaudichaudiana</i> . Other species recorded were <i>Holcus lanatus</i> (weed) and <i>Poa labillardierei</i> var. <i>labillardierei</i> . No bare peat, pools or tracks were recorded. Horse scats within the fen were observed. There was no exposed water at the bottom of the vegetation recorded. Peat depth was recorded as 1.2m. Overall, the broad condition of the vegetation based on PCT 637 is high. |

4. Climate Effects on GDE’s

Climate, as in rainfall, daily temperature, diurnal fluctuation, snow depth and humidity levels all affect GDE’s and the groundwater that they are dependent on. It is important than when assessing the health of the target GDE’s that this data is included. For example, a prolonged and severe drought will deplete the water table and will stress some of the water dependent floral species in GDE’s. Changes to the water table and drought, in particular, are relatively common in the Australian Alps and GDE floral species have some capacity to cope with dry conditions. In prolonged droughts, GDE species will become stressed and show signs of senescence. However, it is highly unlikely that a drought will result in the mass death of plants in a GDE.

Therefore, within this context, only mass change and death of large areas of GDE vegetation will trigger a response to investigate the water table in the surrounding area and ascertain whether it is directly related to the Snowy 2.0 tunnelling process.

Climate data for the autumn 2025 quarter can be viewed in Section 5: Appendix - 5.2.

Autumn 2025, in the areas around the Snowy 2.0 construction footprint and all of Southern NSW was particularly dry as can be seen in the data and graphs in Section 5.2. However, there was little change in the recorded groundwater present within the monitored GDE’s. This indicates that groundwater has not been affected by any gross drawdowns or subterranean losses and that baseline groundwater is sustained. It is likely that after winter with snow fall and winter rains that any minor losses to groundwater will be replenished.

5. Appendix

5.1. Coordinates of GDEs

Table 5.1: Coordinates by Location

| ID # | Longitude | Latitude |
|----------|------------|-------------|
| GDE 934 | 635897.142 | 6036532.804 |
| GDE 936 | 649120.198 | 6036532.804 |
| GDE 947 | 636489.069 | 6038451.348 |
| GDE 949 | 639076.305 | 6038736.667 |
| GDE 953 | 637031.937 | 6039416.714 |
| GDE 2353 | 640536.613 | 6038246.371 |

5.2. Climate Data – Autumn 2025

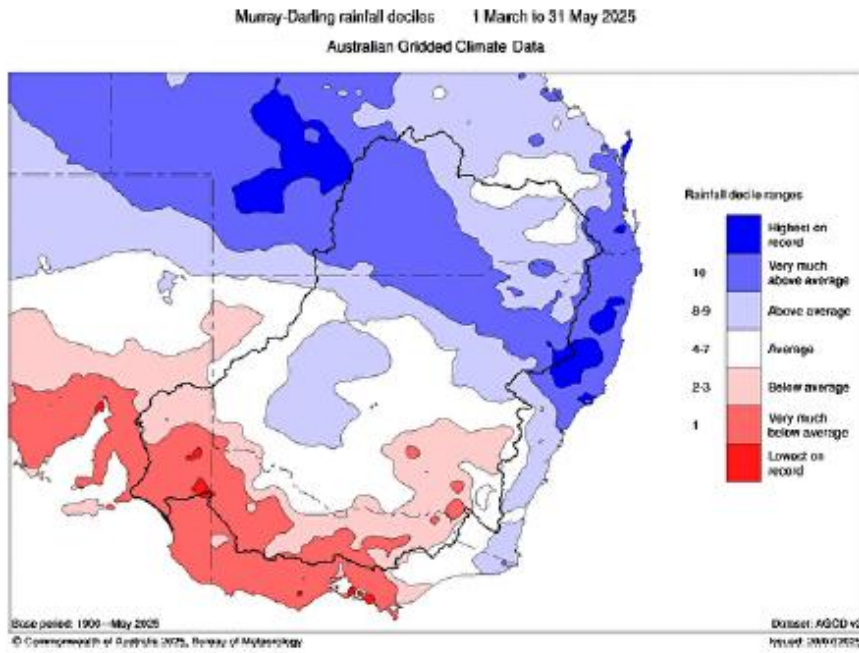
There are a number of Automatic Weather Stations (AWS), in the immediate vicinity of the Lob's Hole to Tantangara region that report real-time data. These include:

- "Ravine" station (precipitation only), located near the streamflow gauge on the Yarrangobilly River upstream of Talbingo Reservoir;
- "Tantangara" station (full AWS), located at the southern end of the reservoir near the Snowy 2.0 depot ;
- "Murrumbidgee", located near the stream flow gauge on the upper Murrumbidgee River 2.7km north of the alignment and about 8.2 km WNW from Tantangara;
- "Cabramurra" a full AWS located near the township,
- "Cabramurra (BOM)," a full AWS operated by the Bureau of Meteorology, located above the Cabramurra township (used for comparison to our own data)

Rainfall

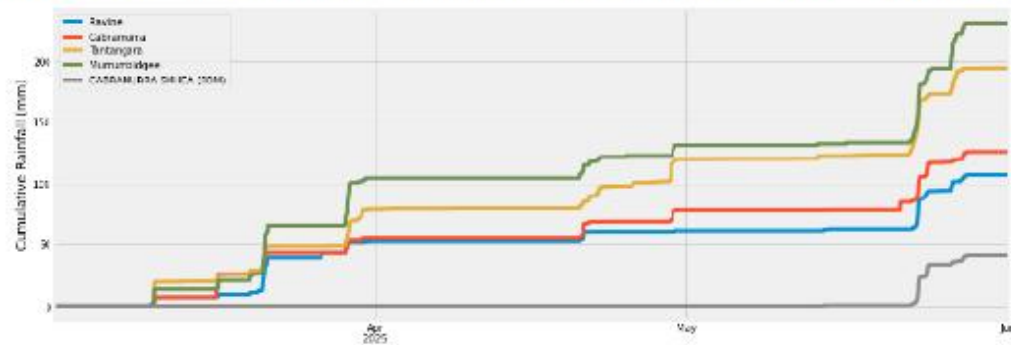
Large scale rainfall anomalies

As shown in the image below (courtesy BOM), there were widespread rainfall deficiencies in the three-month period of interest. Although deficiencies were more severe in the southernmost part of the continent, the Riverina and South West Slopes were also very much below average. These regions have high correlation with Snowy Mountains rainfall.



Raw rainfall data

The cumulative rainfall data over this period, with the automatic and manual preliminary quality control, is shown in the figure below. It appears that the BOM gauge at Cabramurra was out of service to most of this period.



Heaviest rain days of the season

Rainfall during autumn of 2025 was characterised by remarkably dry conditions overall. There were a handful of precipitation events that brought in excess of about 20mm to the region.

Daily Maximum Precipitation:

| | Date | Rainfall |
|--------------|------------|----------|
| Ravine | 2025-03-21 | 27.000 |
| Cabramurra | 2025-05-23 | 19.618 |
| Tantangara | 2025-05-23 | 34.800 |
| Murrumbidgee | 2025-05-23 | 41.000 |

Monthly rainfall during this period:

| | Ravine | Cabramurra | Tantangara | Murrumbidgee | CABRAMURRA SMHEA (BOM) |
|----------|--------|------------|------------|--------------|------------------------|
| Mar-2025 | 52.4 | 54.7 | 78.8 | 104.5 | 0.0 |
| Apr-2025 | 9.4 | 23.3 | 40.8 | 27.0 | 0.0 |
| May-2025 | 45.0 | 48.2 | 75.0 | 99.5 | 41.2 |
| Totals | 106.8 | 126.2 | 194.6 | 231.0 | 41.2 |

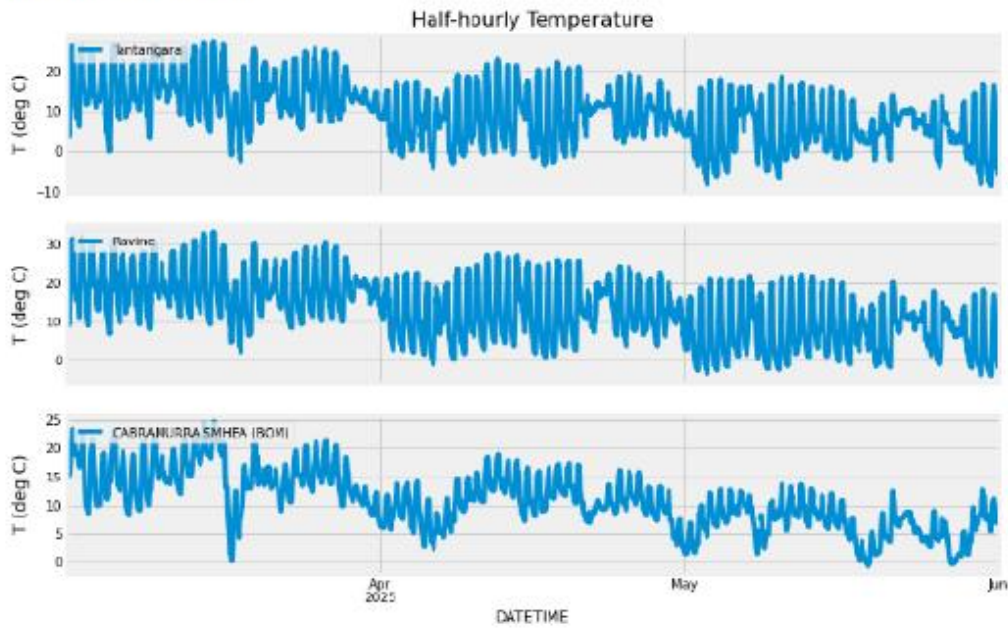
Long-term (1995-2024) average monthly rainfall for this period:

| | Ravine | Cabramurra | Tantangara | Murrumbidgee | CABRAMURRA SMHEA (BOM) |
|--------|--------|------------|------------|--------------|------------------------|
| Mar | 49.6 | 94.0 | 65.1 | 76.1 | 82.6 |
| Apr | 54.8 | 85.4 | 54.5 | 79.2 | 77.1 |
| May | 67.3 | 114.3 | 67.6 | 87.5 | 88.6 |
| Totals | 171.7 | 293.7 | 187.2 | 242.8 | 248.3 |

Temperature data in Mar-May 2025

Raw temperature data

The following figure shows the raw temperature data recorded at the Tantangara, Ravine, and BOM Cabramurra automatic weather stations.



| | Highest Max | Average Max | Lowest Min | Average Min |
|----------|-------------|-------------|------------|-------------|
| Mar-2025 | 27.3 | 22.9 | -2.9 | 7.0 |
| Apr-2025 | 22.7 | 17.6 | -4.4 | 1.0 |
| May-2025 | 18.6 | 13.7 | -8.6 | -1.8 |

The climatological values from the period 1995-2024 are shown in the table below for reference:

| | Highest Max | Average Max | Lowest Min | Average Min |
|-----|-------------|-------------|------------|-------------|
| Mar | 30.8 | 19.9 | -5.4 | 3.9 |
| Apr | 25.0 | 15.5 | -10.8 | 0.2 |
| May | 20.1 | 11.4 | -11.6 | -2.0 |

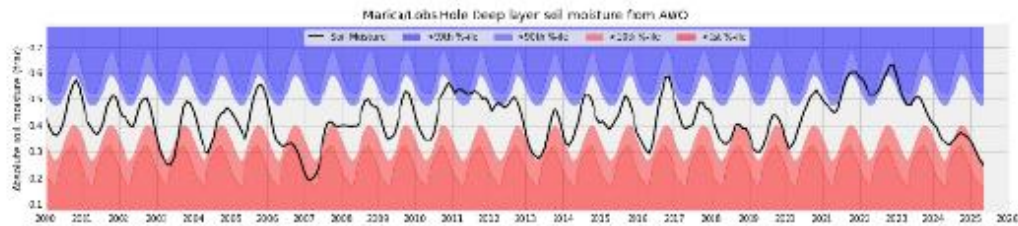
AWO data extraction

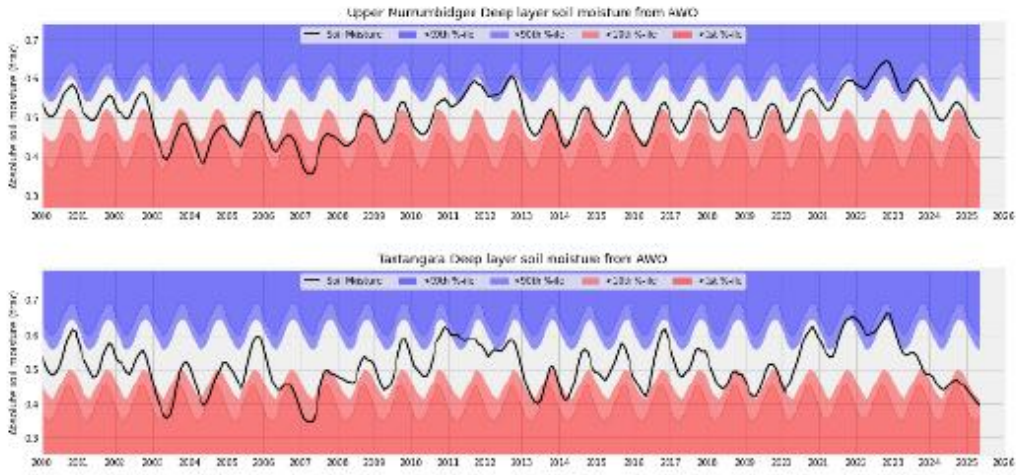
Layers available:

- Root zone - percentage of available water content in the top 1 m of the soil profile
- Upper layer - percentage of available water content in the top 10 cm of the soil profile
- Lower layer - percentage of available water content between 10 cm and 100 cm in the soil profile
- Deep layer - percentage of available water content between 1 m and 6 m in the soil profile
- Time series of soil moisture at three locations

The graph below shows the time series of deep layer soil moisture at three locations along the Snowy 2.0 alignment. The data are based on the Australian Water Outlook (AWO)'s AWRA model, which uses rainfall and geological data to drive a hydrological model. The colours show the climatological bounds for deep layer soil moisture, with 10-90%ile values in the white area.

The current values (as of Jun 1 2025) are rather dry, even for the time of year. Lobs Hole and Tantangara are both in the driest 10% of values for the season, while Upper Murrumbidgee is at about the 15th percentile. This follows a trend of generally drying conditions that has persisted for the previous two years or so.





This table shows precise values of the current soil moisture value in the context of the climatological median, and the current values percentile compared to all previous values from the same season.

| | <i>Modelled soil moisture</i> | <i>Median for this season</i> | <i>%-ile of this value</i> |
|---------------------------|-------------------------------|-------------------------------|----------------------------|
| <i>Marica/Lobs Hole</i> | 26.749 | 37.302 | 9.649 |
| <i>Upper Murrumbidgee</i> | 45.597 | 49.341 | 15.789 |
| <i>Tantangara</i> | 40.575 | 49.588 | 5.263 |

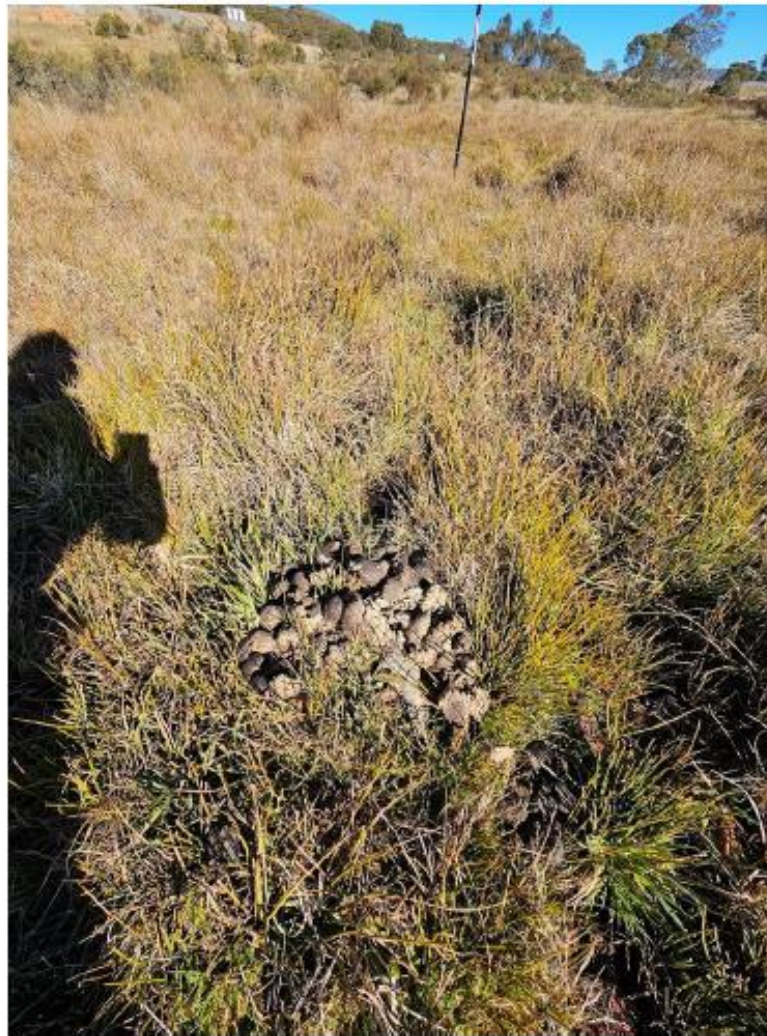
5.3. Photo Gallery - Autumn 2025

GDE 934 – Control Site





GDE 936 – Control Site





GDE 947 – Impact Site



GDE 949 – Impact Site



GDE 953 – Control Site



GDE 2353 – Impact Site





Appendix 10 – FGJVs Annual Biodiversity Report Year 5



webuild | clough | lane

REPORT

ANNUAL BIODIVERSITY REPORT

S2-ENV-BI-GEN-REP-FGJV0150

REV A

APRIL 2026

ABSTRACT




This report provides an overview of operational biodiversity matters as part of the Biodiversity Management Plan reporting requirements.

Revision Record

| | | | | | |
|------|------------|------------------|-------------|-------------|-------------|
| A | 07/04/2026 | Compliance | C. Pedraza | E. Porter | D. Drummond |
| Rev. | Date | Reason for Issue | Responsible | Accountable | Endorsed |

Document Verification

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| <p>Responsible:</p> | <p>Name: Carolina Pedraza Job Title: Environmental Approvals Coordinator Signed:  <small>Signed by: Carolina Pedraza 30352BF52C9B441...</small> Date: 09 April 2026</p> |
| <p>Accountable:</p> | <p>Name: Ellen Porter Job Title: Environmental Manager Signed:  <small>Signed by: Ellen Porter 4EDE3ABC971F416...</small> Date: 10 April 2026</p> |
| <p>Consulted:</p> | <p>See distribution list on Page 3.</p> |
| <p>Informed:</p> | <p>See distribution list on Page 3.</p> |
| <p>Endorsed:</p> | <p>Name: Dave Drummond Job Title: QHSE Director Signed:  <small>Signed by: David Drummond 5374F7DA03A54C2...</small> Date: 10 April 2026</p> |

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1. INTRODUCTION

1.1. Purpose and Scope

This annual report provides an overview of the biodiversity matters addressed in the Biodiversity Management Plan (BMP) for the reporting period **June 2024 to May 2025**. This report addresses the following matters for which FGJV is responsible for:

- summary of weed and vertebrate pest control activities undertaken since last report (as detailed in Appendix F of the BMP) - Section 2.
- account of all clearing activities including tracking against clearing limits and threatened species habitat limits – Section 3.
- post-clearing ecology reports since last report (as detailed in Appendix C of the BMP) – Section 3.
- account of fauna strike mitigation strategy management actions (as detailed in Appendix G of the BMP) – Section 4.
- account of any relevant incidents and non-compliances – Section 5.

The efficacy of the implemented biodiversity management measures against the performance measures will be reported by SHL in the Year 5 Annual Biodiversity Monitoring report for the same time period (June 2024 to May 2025). This report (S2-FGJV-ENV-REP-0114) forms an appendix to the full BMP Report.

The results of threatened species, groundwater-dependant ecosystem, weed and pest monitoring (as detailed in Appendix B of the BMP) are also detailed in [SHL's Annual Biodiversity Monitoring](#) for the reporting period.

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2. WEED, PATHOGEN, AND VERTEBRATE PEST, CONTROL

Appendix F of the Biodiversity Management Plan is the Weed, Pest and Pathogen Management Plan outlines the management measures to be implemented to ensure that the spread of weeds, pest animals and pathogens are minimised. Section 6.1 of the plan outlines the reporting requirements including:

- Details on the weed control actions undertaken since the last report including:
 - A list of the control activities undertaken;
 - Map of areas where control activities were undertaken;
 - Efficacy of the control measures in relation to the objective of minimising weed, pest and pathogen distribution and/or abundance in the project area (reported by SHL);
 - Recommendations for future control activities.
- Details on the vertebrate pest control activities undertaken since the last report including:
 - A list of the control activities undertaken;
 - Cage trapping results;
 - Baiting and shooting results (where undertaken);
 - Recommendations for future control activities.
- Summary of the efficacy of other control measures outlined in this plan and recommendations for revisions to controls (reported by SHL).

2.1. Weed Control Actions

2.1.1. Target Weeds

As identified by SHL during the monitoring period of the Project Area during (EMM 2021), there were locations of infestations of weeds. In March 2022, Narla Environmental (Narla), developed a weed spraying program (WSP) for Future Generation Joint Venture (FGJV) in accordance with the following documents, detailing the methods of control for all 'Priority Weeds for Control' and 'Weeds of Concern' outlined within:

- Appendix F of the Biodiversity Management Plan (BMP; FGJV 2020);
- Appendix B of the BMP (FGJV 2020); and
- Weed Spraying Programme (Narla 2021).

The following weed species were a priority for mapping, monitoring, and control, in accordance with Appendix F of the BMP (FGJV 2020) and the Regional Pest Management Strategy 2012-2017: Southern Ranges Region (OEH 2012):

- *Achillea millefolium* (Milfoil/Yarrow);
- *Barbarea verna* (Winter Cress);
- *Carduus nutans* (Nodding Thistle);
- *Cytisus scoparius* (Scotch Broom);
- *Echium vulgare* (Vipers Bugloss);
- *Eragrostis curvula* (African Love Grass);

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- *Hypericum perforatum* (St John's Wort);
- *Juncus effusus* (Large Rush);
- *Lupinus polyphyllus* (Russel Lupins);
- *Marrubium vulgare* (Horsehound);
- *Nasella trichotoma* (Serrated Tussock);
- *Onopordum acanthium* (Scotch Thistle);
- *Rosa rubiginosa* (Sweet Briar);
- *Rubus fruticosus sp. agg.* (Blackberry);
- *Ulex nutans* (Gorse);
- *Xanthium spp.* (Bathurst Burr); and
- *Leucanthemum vulgare* (Ox-eye Daisy).

The weed program is adapted each year based on monitoring results, and seasonal changes to weed growth.

2.1.2. Weed Spraying

Weed spraying works were scheduled in accordance with priority areas, species, and weather conditions. Species targeted in the spring / summer 2024 / 2025 program included:

- *Carduus nutans* (Nodding Thistle);
- *Hypericum perforatum* (St John's Wort);
- *Onopordum acanthium* (Scotch Thistle);
- *Rosa rubiginosa* (Sweet Briar);
- *Rubus fruticosus sp. agg.* (Blackberry); and
- *Leucanthemum vulgare* (Ox-eye Daisy).

Chemicals used as part of the weed spraying included a mix of Herbi Dye, Grazon, MCPA, and Glyphosate. The following maps outline the locations of weed spraying activities carried out in spring / summer 2024/2025, noting that weed control responsibilities were transferred to FGJV in late Spring of 2024, creating an unintended delay to that start of the control program. The FGJV sub-contractor engaged was Ripper's Rural, a report of the annual spraying efforts was provided to agencies on May 26th, 2025, by email, subject *Comms: SHL-NPWS: FGJV Weed control update*.

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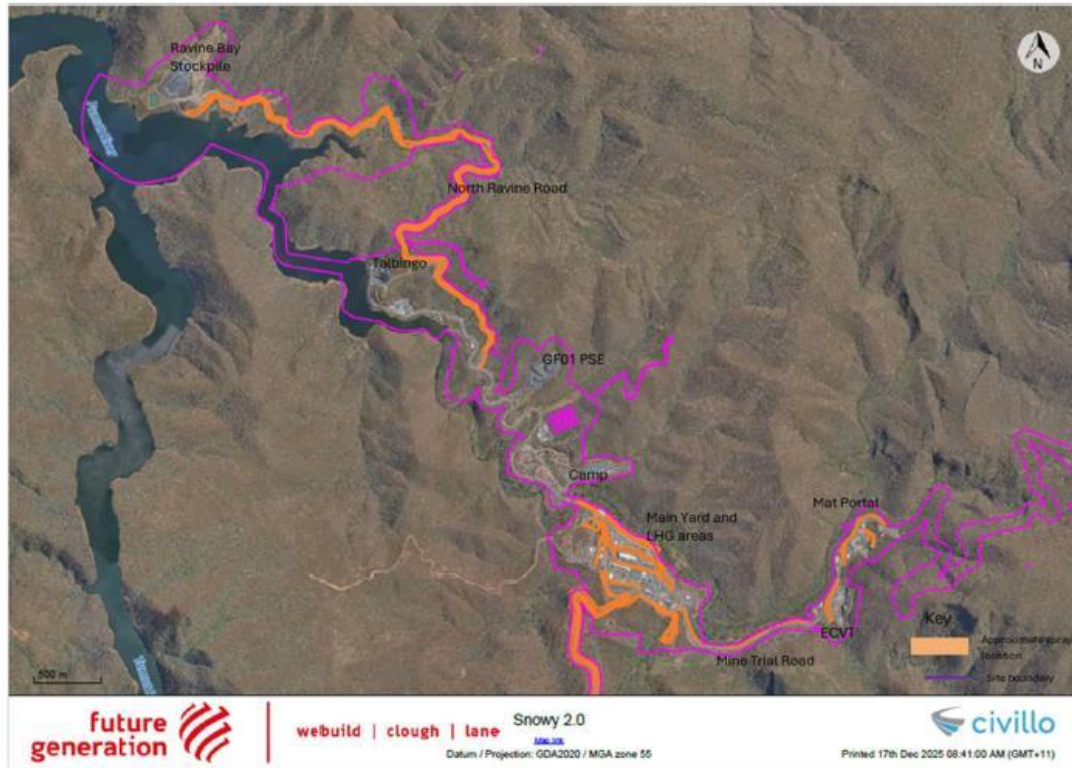


Figure 2-1: Lobs Hole Weed Spraying Areas

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Figure 2-2: South Ravine Road Weed Spraying Areas

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TANTANGARA



Figure 2-3: Tantangara Weed Spraying Areas

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MARICA



Figure 2-4: Marica Weed Spraying Areas

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Figure 2-5: Gooandra Trail Weed Spraying Areas

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2.1.3. Hygiene Certificates

All suppliers are required to complete the Hygiene Declaration Form prior to entry to site (Annexure A of Appendix F of the BMP: Weed, Pest and Pathogen Plan). All suppliers of plant and equipment are also informed of their obligation under the *Biosecurity Act 2015* to prevent the introduction and spread of pests, diseases, weeds and contaminants. The suppliers when arriving on site are required to present their equipment clean and free of dirt, mud, seed and biological materials including weeds, seeds, pathogen and other organisms. Any plant or equipment arriving from an external site that fails hygiene standards will be rejected and returned to the supplier. Equipment transferring between project sites (e.g., Tantangara to Lobs Hole) that fails inspection will be returned to its point of origin for decontamination before re-inspection.

During the reporting period 2024 - 2025 SHL completed the annual soil monitoring program, during which one site returned a positive test for *P.cinnamomi* (PS05). Subsequent testing was undertaken in the area (insert map), with further positive results being identified (list). This management of this matter is part of an ongoing consultation with NPWS. Reporting the conclusion of this issue is expected in the Year 6 Annual BMP Report.



Figure 2-6. Phytophthora sampling sites

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Table 2-1: Phytophthora samples by location

| Sample Location | Easting | Northing |
|-----------------|-----------|------------|
| S1 | 625647.27 | 6039423.29 |
| S2 | 625601.61 | 6039412.28 |
| S3 | 625580.40 | 6039430.26 |
| S4 | 625552.11 | 6039483.71 |
| S5 | 625609.49 | 6039503.52 |
| S6 | 625681.11 | 6039478.54 |
| S7 | 625722.22 | 6039479.72 |
| S8 | 625769.30 | 6039461.31 |
| S9 | 625866.44 | 6039511.44 |
| S10 | 625925.28 | 6039543.26 |
| S11 | 625983.04 | 6039622.08 |
| S12 | 625959.26 | 6039539.31 |
| S13 | 625943.31 | 6039448.51 |
| S14 | 625899.53 | 6039497.61 |
| S15 | 625885.79 | 6039422.12 |
| S16 | 625852.81 | 6039461.67 |
| S17 | 625803.85 | 6039443.08 |

2.1.4. Washdown Areas

Washdown stations, including wheel wash stations, have been established at the following locations:

- Entry to Lobs Hole Ravine Road (near Link Road).
- Quarry Trail Road, exit from Tantangara site to Tantangara Road.
- Entry to Marica Trail from Snowy Mountains Highway.
- Trunk Services, exit point from Gooandra Trail to Snowy Mountains Highway at Marica.
- Trunk Services, access point from the eastern side of Gooandra Trail towards Marica. *

***Note:** Washdown station on the Eastern side of Gooandra Trail towards Marica was moved to Rock Forest in April 2025.

The Environmental Team performed a wheel wash audit on the 17/11/2024. The Team has found improvements in comparison to the last review which are listed below:

- To control the freezing in the water tanks, the Team has added isolation equipment to the tanks and pipes' surfaces. This equipment controls the temperature, avoiding freezing and promoting their optimal function.
- A wheel wash procedure was written and implemented across sites, including the wheel wash operation and maintenance.
- A traffic light was installed in the wheel wash at Tantangara, which increased the time cars spend in the wheel wash, therefore improving the efficiency of removing mud and dirt from the vehicle.

Overall, the wheel washes were observed to be operational, and it was also noted that the Security and Transport teams were aware of the importance of their functionality. The Security Teams inform the respective Environmental Teams when it is not working. A recommendation at Lobs Hole is that the sensors be wiped when it rains.

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2.1.1. Efficiency

The effectiveness of weed spraying, wheel washes, and weed control measures is provided in monitoring results independently carried out by Dendra on behalf of SHL in the main body of the BMP Year 5 Annual Report.

2.1.2. Feral Animal Control Actions

Feral animal control is limited to those animals that are most likely to be attracted to increased human occupation and have the greatest environmental impact, such as the Feral Cat, Red Fox, and Rabbit.

A coordinated baiting strategy has been developed in consultation with NPWS to reduce feral predation and minimise the impact of the Project. However, for the period covered in this report. The methodology employed was opportunistic cage trapping based on reports of sightings.

2.1.3. Observations

Table 2-2 outlines the feral species that were observed and reported during the construction period. This data excludes vehicle strikes.

Table 2-2: Feral Sightings

| Date of Encounter | Site | Location | Chainage | Species Recorded |
|-------------------|------------|-----------------|-------------|------------------|
| 18-Jun-24 | Lobs Hole | Ravine Road | N/A | Fox |
| 07-Sep-24 | Lobs Hole | Ravine Bay | N/A | Fox |
| 21-Sep-24 | Lobs Hole | Office Pad | N/A | Brown Rat |
| 18-Dec-24 | Tantangara | Spoil Road | TSE | Fox |
| 25-Feb-25 | Lobs Hole | Main Yard | N/A | Fox |
| 02-Mar-25 | Lobs Hole | Office Pad | N/A | Red Fox |
| 19-Mar-25 | Lobs Hole | Main Yard | N/A | Red Fox |
| 19-Apr-25 | Tantangara | Tantangara Road | Call up 0-1 | Sambar Deer |
| 22-Apr-25 | Tantangara | Tantangara Road | T2-T13 | Wild Dogs |
| 24-Apr-25 | Tantangara | Tantangara PSE | N/A | Fox |
| 03-May-25 | Lobs Hole | Ravine Road | Call up 2-3 | Cat |
| 17-May-25 | Lobs Hole | Batch Plant | N/A | Fox |
| 17-May-25 | Lobs Hole | Office Pad | N/A | Fox |
| 18-May-25 | Tantangara | Tantangara Road | T10-T9 | Sambar Deer |

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| | | | | |
|-----------|------------|------------|------|-------|
| 18-May-25 | Tantangara | Spoil Road | S1-2 | Dingo |
| 21-May-25 | Tantangara | Fill 3 | N/A | Fox |
| 21-May-25 | Tantangara | Fill 3 | N/A | Fox |

2.1.4. Cage Traps

Cage traps were again deployed, however with little to negligible impact on controlling feral species. See Table 2-3 for evidence of cage trapping deployment.

There were no recordings of animals caught in cage traps for the reporting period.

Table 2-3: Cage Trapping Deployment

| Date of Deployed | Site | Comments | Photos |
|------------------|------------|---|--|
| 17/12/2024 | Tantangara | Batch Plant Storage Container | - |
| 11/03/2025 | Tantangara | Recreation Room - Maintenance Office | - |
| 1/05/2025 | Tantangara | Generator Pad Office - Under first desk | - |
| 20/05/2025 | Lobs Hole | Main office – Fox trap |  |

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Figure 2-6: Tantangara cage trap locations



Figure 2-7: Lobshole cage trap locations

2.1.1. Efficiency

The success of the feral animal control actions is provided in monitoring results independently carried out by SHL. Monitoring results are provided in the main body of the Year 5 Annual Report.

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3. CLEARING ACTIVITIES

3.1. Pre-clearing surveys

Pre-clearing surveys are completed as a measure of preventing impact to fauna during clearing activities and are completed by a suitably qualified ecologist along the proposed clearing areas prior to the commencement of clearing. The ecologist completes the following in the pre-clearing survey:

- Identify and flag/demarcate key habitat features that are suspected to accommodate fauna, these features may include:
 - nests;
 - hollow bearing trees;
 - large logs, rock piles and woody debris;
 - heath, sedges, and soaks/swamps;
 - dense understorey shrubs;
 - burrows below groundcover vegetation, runways and other established fauna routes;
 - evidence of fresh scat; and
 - other habitat features for local fauna as determined by the ecologist;
- Check for the presence of threatened flora and fauna species by thorough visual inspection of potential habitat features. Refer to the unexpected finds procedure for species with potential to occur in the area;
- The ecologist must consider the threatened species likely to occur in the disturbance area when flagging and identifying habitat features. GPS coordinates for all identified habitat features will be recorded during the pre-clearing survey;
- Confirm nearby habitat suitable for the release of any fauna that may be encountered during clearing works;
- Where works are to be undertaken within 50 m of watercourses, all vegetation, rocks, logs and other shelter are to be carefully inspected for frog species;
- Where possible and safe to do so collect available seed from native vegetation in the disturbance area to be used for rehabilitation works.

Pre-clearing inspections/surveys have been completed to the above criteria throughout the reporting period (June 2024 – May 2025). A suitably qualified ecologist was present for all clearing activities during Exploratory Works and Main Works, within all areas across the project.

All contracted ecologists held a Scientific Licence under Part 2 of the BC Act (including Animal Ethics Approval under the *Animal Research Act 1985*) for fauna handling/rescue and survey work.

3.2. Clearing and Grubbing Permits

Significant clearing areas for this reporting period were associated with Modification 3; included Rock Forest and Tantangara PSEs, and Marica Adit for TBM 4. The cumulative clearing totals are presented in Table 2.

3.3. Post Clearing Ecology Reports

Post clearing reports are prepared following all clearing activities across the project and include the below details as per the BMP:

- The name and qualifications of the ecologist or wildlife carer present during clearing;
- An assessment of the habitat and handling of fauna;
- Information on clearing operations, dates, procedure, areas;

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- Live animal sightings, captures, any releases or injured/shocked wildlife;
- Fauna that died as a result of clearing; and
- Photographs of rescued fauna

During the reporting period, vegetation clearing and habitat removal activities were conducted across several key project areas, including but not limited to the Tantangara Spoil Road, Lobs Hole Main Accommodation Camp, and the Tantangara Camp sites. All clearing works were executed under the supervision of qualified ecologists in accordance with the project's Biodiversity Management Plan. Pre-clearing surveys identified specific fauna habitat features, such as hollow-bearing trees, burrows, and nests, which were inspected during felling to minimize impacts on native wildlife. While most of the fauna were successfully excluded or relocated, a small number of mortalities were recorded. The following table provides a consolidated summary of habitat features removed, fauna species relocated, and recorded mortality across these work fronts.

Table 3-1: Cage Trapping Deployment

| Project Area | Habitat features | Species relocated | Fauna Mortality |
|------------------------------|---|--|---|
| Tantangara Spoil Road | 63 Habitat trees; 15 Burrows; 9 Nests; 4 Rock/Log features | Bougainville's Skink (6), McCoy's Skink (5), Southern Grass Skink (2), Highland Copperhead (1) | 3 (McCoy's Skink, Bougainville's Skink, Southern Grass Skink) |
| Lobs Hole Main Camp | 20 Habitat trees (salvaged); 16 Burrows; 4 Nests; 1 Log feature | None recorded | 0 |
| Tantangara Camp | 14 Habitat trees; 5 Burrows; 1 Nest | McCoy's Skink (2), Mountain Log Skink (1), Woodlands Skink (1) | 1 (McCoy's Skink) |
| Marica | 8 Habitat trees/features | None recorded | 0 |
| Tantangara | None | None recorded | 0 |
| Camp Extensions | None (Features damaged during felling) | None recorded | 0 |
| TOTALS | 105 Habitat Trees; 55 Other Features | 18 Individuals | 4 Individuals |

3.4. Clearing Limits

A condition of consent from the Main Works Infrastructure Approval (SSI 9687) which relates clearing limits is (Schedule 3, Condition 13) that within 3 years of the commencement of construction, the Proponent must submit a report via the Major Projects Portal that identifies the final disturbance area of the Main Works and calculates the difference between the maximum disturbance area and the final disturbance area.

For the reporting period, table 3.2 outlines the approval clearing limits and threatened species habitat limits, / disturbance totals as of 31 May 2025, the percentage of the project clearing / disturbance against the approved limits, and the balance/budget of hectares remaining.

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Table 3-2: Clearing totals as at 31 May 2025



This has been back-calculated to approximately May 2025. Note that this calculation is based on permits which may not completely reflect the actual chronology of clearing on site.

Date & time of calculation 25-Mar-2026 14:48

| Clearing Totals Submission S2-FGJV-ENV-LST- | | State Approval and EPBC Clearing Limits | Estimated total current clearing based on submitted permits | Updated Disturbance | Percentage of Approval Clearing Limits | Budget remaining |
|--|--|--|---|------------------------|--|---------------------|
| S2-FGJV-ENV-PER-0008-0288 AR02 Marica west | | <i>ha</i> | <i>ha</i> | <i>ha</i> | % | <i>ha</i> |
| Vegetation Totals | Total Disturbance | 630 | 361.96 | 363.84 | 58% | 266.16 |
| | Total Native Vegetation | 532 | 307.72 | 309.60 | 58% | 222.40 |
| | Exploratory Works ONLY Disturbance | 126 | 90.20 | 90.20 | 72% | 35.80 |
| | Exploratory Works ONLY Native Vegetation | 107 | 71.00 | 71.00 | 66% | 36.00 |
| | Main Works ONLY Disturbance | 504 | 271.76 | 273.64 | 54% | 230.36 |
| | Main Works ONLY Native Vegetation | 425 | 236.72 | 238.60 | 56% | 186.40 |
| Species Habitats Main Works ONLY | Alpine Bogs and Fens | 1.03 | 0.52 | 0.52 | 50% | 0.51 |
| | Alpine She-oak Skink | 80.83 | 55.62 | 55.62 | 69% | 25.21 |
| | Alpine Tree Frog | 22.87 | 18.06 | 18.06 | 79% | 4.81 |
| | Broad-toothed Rat | 61.47 | 37.00 | 37.00 | 60% | 24.47 |
| | Eastern Pygmy-possum | 197.95 | 133.42 | 135.30 | 68% | 62.65 |
| | Latham's Snipe | 81.86 | 2.01 | 2.01 | 2% | 79.85 |
| | Smoky Mouse | 84.29 | 51.40 | 51.40 | 61% | 32.89 |

Note: Estimated total current clearing is determined from historical data entry of prior submitted permits and represents an upper bound estimate. This assessment does not fully account for potential sources of error including overlapping permits, unused permits, overclearing, unpermitted clearing, or data entry error. While some of these sources of error may increase this estimate, it is assessed that errors reducing the estimated clearing total are likely to outweigh those increasing it. These figures are therefore subject to change due to permit revalidation, or revision of permitted cleared areas with actual where significant difference has occurred. However, FGJV remain confident that this represents an upper bound estimate. Reasonable steps have been taken to ensure completeness of the permit record and the elimination of the greatest sources of error.

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4. FAUNA STRIKE

4.1. Unauthorised/accidental death or injury of native fauna

An analysis of fauna strike records for the reporting period is provided in the graphs below. There were 55 incidents involving fauna between June 2024 and May 2025 with a peak occurring during the summer predominantly at Lobs Hole. The number of fauna strikes increased by 6 for this reporting period. The major groups of fauna impacted were snakes and marsupials (kangaroos, wallabies and wombats).



Figure 4-1: Distribution of Fauna Strikes by Site Location

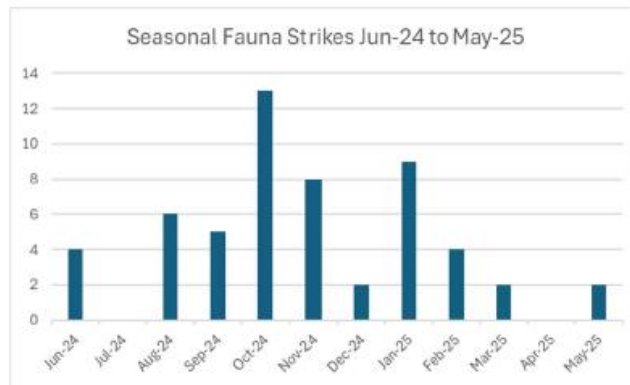


Figure 4-2 Monthly Fauna Strikes from June 2024 to May 2025

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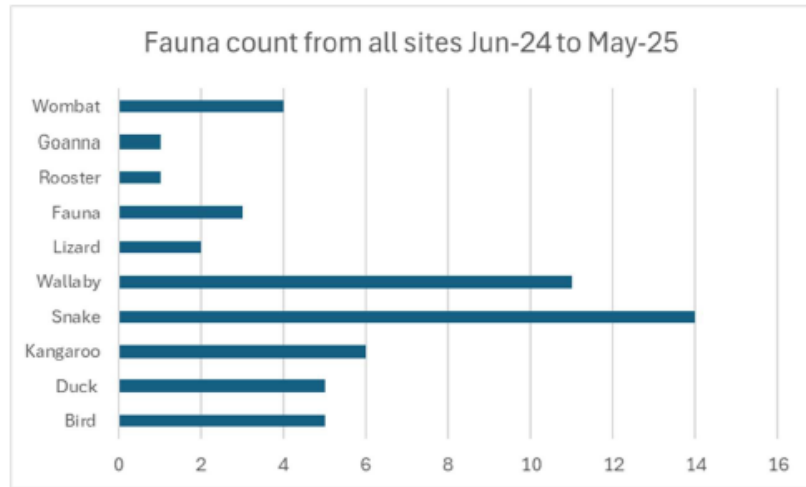


Figure 4-3 Fauna Strikes Counts by Species Across All Sites (June 2024-May 2025)

4.2. MITIGATION ACTIONS

Fauna strike mitigation strategy management actions were implemented in accordance with Appendix G of the Biodiversity Management Plan. The following strategies were implemented during the reporting period:

- In Vehicle Monitoring Systems (IVMS)
- Speed Limits
- Training and awareness
- Fauna Underpasses (6 on Ravine Road, and 3 at Marica)

During the reporting period, toolbox talks on fauna strike mitigation were rolled out across the project as well as multiple notices in pre-starts providing awareness and training on fauna. Additionally large posters with QR codes have been distributed around the project depicting images of local threatened species. QR codes allow the workforce to complete an observation form for any of the identified species, creating additional awareness of the sensitivity of the surrounding environment.

4.3. IVMS

The IVMS allows for automated data collection and regular reports on vehicle speeds, traffic volumes and incidents. Vehicle movement management is beneficial in avoiding fragmentation of fauna populations and reducing the likelihood of fauna strike.

Speed limit alarms are triggered in the vehicle if drivers exceed the nominated speed limit in an area. There is a point system in place to enforce driver compliance with the standards of the project. Reports are generated through the IVMS to ensure drivers remain compliant to the code of conduct and management measures. If required, the management team can make enquiries with relevant drivers which can ensure that incidents of fauna strike or near-misses are reported and appropriately dealt with through the incident reporting process.

From a biodiversity perspective, they are an effective means of ensuring the reduced speed limits on site (e.g. 30kms on roads and 10kms at active works areas) are adhered to in the absence of police enforcement. IVMS performance is internally monitored on a monthly basis and enforced across all FGJV vehicles in addition to a Driver Code of Conduct.

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4.4. Speed Limits

Restrictions on vehicle movements within the project are limited to speeds of 30km/h between dusk and dawn (Traffic Management Plan Section 5.1.1).

4.5. Relocations

Table 4-1 below shows the fauna interactions at each site during the reporting period and were relocated back into the surrounding environment.

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Table 4-1: Fauna Relocations as a result of sightings

| Date of Encounter | Site | Location | Chainage | Species Recorded |
|-------------------|------------|----------------------|--|------------------------------------|
| 09-Oct-24 | Tantangara | Quarry Road | Tantangara Camp | Mountain Dragon |
| 18-Oct-24 | Tantangara | Tantangara Road | TBM Tag Hut | Lesser Long-Eared Bat |
| 25-Oct-24 | Marica | Marica Camp | Bus stop at admin office | Unknown (suspected Brown Songlark) |
| 26-Oct-24 | Marica | Marica Trail | Approx. 400m uphill from Marica Site Offices on Marica Trail | Red-necked Wallaby |
| 31-Oct-24 | Marica | Surge Shaft | Behind Water Treatment Plant | Australian Wood Duck |
| 07-Nov-24 | Tantangara | Tantangara Camp | N/A | Copperhead Snake |
| 22-Dec-24 | Marica | Pad 1 | N/A | Feathertail Glider |
| 11-Feb-25 | Tantangara | Tantangara Road | Callup 3-2 | Red-necked Wallaby |
| 22-Feb-25 | Tantangara | Tantangara Reservoir | N/A | Microbat |
| 27-Feb-25 | Lobs Hole | Main Camp | Callup 14 | Red-browed Finch |
| 04-Apr-25 | Lobs Hole | Exploratory Camp | N/A | Silvereye |
| 24-Apr-25 | Tantangara | Spoil Road | S3-4 | Blotched Blue-Tongue Lizard |

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5. INCIDENTS AND NON-COMPLIANCES

The BMP requires details on environmental incidents (Section 7 of the EMS) relating to biodiversity may include:

- clearing or damage to vegetation outside of the designated clearing areas;
- unauthorised damage or interference to threatened species, endangered ecological communities, or critical habitat; or
- unauthorised/accidental death or injury of native fauna within the project site.

Environmental incidents and non-compliances relating to the Annual Biodiversity Report for the reporting period include fauna strikes, damage to threatened flora monitoring plots and clearing outside the approved area. There was no reported unauthorised damage or interference to threatened species, endangered ecological communities, or critical habitat.

5.1. Disturbances beyond the Project Boundary

Table 5 outlines construction disturbances beyond the Project boundary, resulting in a non-compliance against the project approvals.

Table 5-1: Disturbances outside the Project Boundary

| Date of Incident | Site | Location | Description | Incident Type |
|------------------|------------|------------------------------|--------------------------------------|-------------------------|
| 02-Jun-24 | Tantangara | Magazine Pad | Breach of clearing boundary | ENV - Procedural Breach |
| 29-Jul-24 | Lobs Hole | Pad F | Encroachment of cadastral boundary | ENV - Procedural Breach |
| 07-Sep-24 | Tantangara | Tantangara Road | Breach of EIS boundary by water cart | ENV - Procedural Breach |
| 27-Sep-24 | Marica | SPLB01 Leachate Basin | EIS boundary encroachment | ENV - Procedural Breach |
| 02-Jan-25 | Tantangara | Chainage 1250 Sediment Basin | Clearing boundary breach | ENV - Procedural Breach |

The incidents were reported to NSW Government and SHL as required under contractual, lease and licence conditions.

5.2. Weed Identification

For the reporting period, one incident was reported to NPWS relating to the BMP:

1. *Leucanthemum vulgare* (Ox-eye Daisy) was identified along an existing trail within Marica Pad 4 extension proposed clearing area on 14/01/2025, and an investigation was conducted. Actions taken are mentioned below:
 - Wheel wash inspection records were assessed and identified that tank levels were full, and the wheel wash was functional over the month prior to sighting of invasive species.
 - Immediate inspection and removal of Ox-eye Daisy plants by hand, effectively controlling the spread.

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6. PERFORMANCE MEASURES

Performance measures have been derived from relevant conditions of approval and are outlined in section 6.5.1 of the BMP. These performance measures are used as a guide to measure the efficacy of the management plan controls and will aid in the refinement of management measures where required.

Table 6-1: Performance measures

| Item | Performance Measure | Compliance |
|------|--|---|
| 1 | The project will not exceed the maximum native vegetation clearing of 532 Ha. | Compliant as per clearing table in Section 3 above. |
| 2 | The project will ensure that if the shallow groundwater regime is impacted and results in a measurable change to the ecosystem function of the Alpine Bogs and Fens vegetation community, that appropriate biodiversity offsets will be calculated and paid. | No impacts to Alpine Bogs and Fens during the reporting period. |
| 3 | Other than where permitted by the Infrastructure Approval, the disturbance area will be restricted to within the approved construction envelope of the project. | Non-compliant. See Section 5 disturbances in Table 5. |
| 4 | Direct impacts to threatened species habitats will be generally in accordance with those quantified in the revised BDAR as summarised in section 4.2.1 of this plan. | Compliant as per clearing table in Section 3. |
| 5 | Threatened species impacts resulting from clearing and vehicle strike will be minimised through the implementation of effective controls such as pre-clearing procedures and fauna strike mitigation measures. | As outlined in Section 4. |
| 6 | An improvement (e.g. a reduction in weed/pest abundance or distribution) results from the implementation of a regular weed and pest control program. | Partially non-compliant. Pest: review of feral animal occupancy and abundance monitoring data for year 4 and 5 indicates that feral presence across the project area has generally remained stable, with some evidence of minor localised improvement. Weeds: Due to limitations in survey collection methodology, improvements are difficult to quantify. |

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