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Alpine Resorts Victoria

Mount Buller Water Storage Project

Hydrological and Ecological Monitoring and Adaptive Management Program: Impact Year 6

29 August 2025

VICTORIA State Government

Acknowledgement

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.

EXECUTIVE SUMMARY

Background

From October 2019 to May 2020, the Mount Buller and Mount Stirling Alpine Resort Management Board (the RMB) constructed a 100-megalitre off-stream water storage and ancillary infrastructure (the project) on Mount Buller, within a 10.347-hectare Project Construction Footprint (PCF) between the summit and the Mount Buller Village. As part of the project, Alpine Resorts Victoria (ARV) is implementing an ongoing Hydrological and Ecological Monitoring and Adaptive Management Program (HEMAMP), with an objective of maintaining the extent and condition of Alpine Bogs that are within the Boggy Creek catchment, downslope of the water storage.

Two years of baseline hydrological and ecological monitoring data (Baseline Years 1 and 2 or BY1 and BY2) were collected as part of the HEMAMP in 2018 and 2019. This was followed by hydrological and ecological monitoring during construction in 2020 (Impact Year 1 or IY1) and post-construction hydrological and ecological monitoring from 2021 to 2025 (Impact Years 2 to 6 or IY2 to IY6). This cover report summarises the results of hydrological and ecological monitoring from Impact Year 6, compares the results with baseline data and provides an assessment of these results against the HEMAMP's performance criteria and triggers for adaptive management.

Performance Criteria

The HEMAMP's performance criteria are as follows:

- The 'extent' criterion – there will be no more than a 10% reduction in the total combined area of the impact sites, determined by on-ground or remote (aerial) monitoring and taking into account natural variation based on extent observations averaged across control sites.
- The 'composition' criterion – there will be no more than a 10% reduction in the total 'bog-dependent' native flora species richness of the impact sites, taking into account natural variation based on species richness observations averaged across control sites.
- The 'encroachment' criteria:
  - Atypical species – there will be no more than a 10% increase in the cover of 'non-bog-dependent' species within the impact sites, taking into account natural variation based on observations averaged across control sites.
  - Weeds – the total cover of weeds (introduced flora species) within the impact sites will not exceed 5%.
- The 'structure' criterion – there will be no more than a 10% reduction in the average cover of Peat Moss within the impact sites, taking into account natural variation based on Peat Moss cover averaged across control sites.

Performance criteria are expressed in terms of all impact sites collectively, relative to all control sites collectively (except for the weed encroachment criterion, which is defined in absolute rather than relative terms). All impact sites are at Mount Buller and have catchment areas that are at least partially within the footprint of the water storage. Control sites are split between Mount Buller (with catchment areas outside the footprint of the water storage) and Mount Stirling (approximately 6 kilometres north-east of Mount Buller). Mount Buller and Mount Stirling control sites have been analysed collectively and separately to better understand the potential causes of differences between impact sites and control sites.

Adaptive Management Triggers

The HEMAMP's ecological triggers for adaptive management are related to the above performance criteria. Hydrological triggers have been set with reference to hydrological models for the Boggy Creek catchment, which are designed to provide an early warning system for pre-empting ecological change at the impact sites. The adaptive management trigger thresholds follow a 'traffic light' approach, where the level of management intervention is escalated as the risk of adverse impacts on the ecological values of the impact sites increases. Risks of adverse impacts increase as trigger levels move from green, to amber, to red.

Trigger	Parameter	'Green' Threshold	'Amber' Threshold	'Red' Threshold
Alpine Bog Extent	Reduction in area of Alpine Bogs at impact sites relative to control sites.	≤5%	>5% but ≤10%	>10%
Alpine Bog Composition	Reduction in bog-dependent species richness at impact sites relative to control sites.	≤5%	>5% but ≤10%	>10%
Encroachment by Atypical Species	Increase in cover of non-bog-dependent native flora at impact sites relative to control sites.	≤5%	>5% but ≤10%	>10%
Encroachment by Weeds	Increase in cover of weeds at impact sites.	≤2.5%	>2.5% but ≤5%	>5%
Alpine Bog Structure	Reduction in cover of Peat Moss at impact sites relative to control sites.	≤5%	>5% but ≤10%	>10%

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Trigger	Parameter	'Green' Threshold	'Amber' Threshold	'Red' Threshold
Surface Water Flows	Reduction in mean annual surface water flows to Boggy Creek over two consecutive years, relative to model.	≤10%	>10% but ≤50%	>50%
Groundwater Levels	Reduction in mean annual groundwater levels over two consecutive years, relative to model.	≤10%	>10% but ≤50%	>50%
Surface Water Quality	Change in various surface water quality parameters, relative to baseline.	<1.5 x IQR*	≥1.5 x IQR* and ≤3 x IQR*	>3 x IQR*
Groundwater Quality	Change in various groundwater quality parameters, relative to baseline.	<1.5 x IQR*	≥1.5 x IQR* and ≤3 x IQR*	>3 x IQR*

*IQR = Interquartile Range

Results

Alpine Bog Extent

Comparison	IY6 Result	Compliant?	Action Req'd?	Comments
Mount Buller Impact Sites v All Control Sites	-3.8%	Yes	Yes	Artificial watering (via the environmental watering system), an increased weed control effort in IY5-IY6 and ongoing revegetation works have resulted in an increase in the collective area of impact sites and a return to the 'green' trigger threshold. Some impact sites (e.g. Bog 6) remain highly fragmented and increased deer activity threatens to reverse improvements. Continued weed control, revegetation and monitoring will be required, along with increased deer control/deterrence at Mount Buller.
Mount Buller Impact Sites v Mount Buller Control Sites	+2.6%	Yes	Yes	

Alpine Bog Composition

Comparison	IY6 Result	Compliant?	Action Req'd?	Comments
Mount Buller Impact Sites v All Control Sites	-5.3%	Yes	Yes	Silver Astelia was incidentally observed at impact sites again in IY6, but not along transects or in quadrats. Propagation of Silver Astelia commenced in IY4 and 9 plants were planted at five locations in/around Bog 4.2 in IY5 (autumn 2024). These 9 plants were not located during IY6 monitoring and may have been lost to deer browsing and/or flooding. A further 15 Silver Astelia plants are over-wintering at Mount Buller and will be planted in IY7.
Mount Buller Impact Sites v Mount Buller Control Sites	-5.3%	Yes	Yes	

Encroachment by Atypical Species

Comparison	IY6 Result	Compliant?	Action Req'd?	Comments
Mount Buller Impact Sites v All Control Sites	+5.7%	Yes	No	The cover of non-bog-dependent flora species has increased by 5.7% at impact sites relative to control sites. However, the absolute cover of non-bog-dependent flora has declined to below baseline levels. No intervention required. Continue monitoring in IY7.
Mount Buller Impact Sites v Mount Buller Control Sites	+2.8%	Yes	No	

Encroachment by Weeds

Comparison	IY6 Result*	Compliant?	Action Req'd?	Comments
Cover of weeds inside and outside of Alpine Bog impact sites	6.3%	No	Yes	Weed cover across entire transects (inside and outside of Alpine Bogs) was 6.3% in IY6 and has been greater than 5% since monitoring started. Weed cover within impact sites (inside Alpine Bogs only) was 3.6% in IY5 and therefore compliant. However, weed control is still needed, especially in and around Bog 6.
Cover of weeds inside Alpine Bog impact sites only	3.7%	Yes	Yes	

*Note: The result for cover of weeds is expressed as an absolute percentage cover. All other results are expressed as a relative change from the Baseline Mean (BM) to Impact Year 6 (IY6).

Alpine Bog Structure

Comparison	IY6 Result	Compliant?	Action Req'd?	Comments
Mount Buller Impact Sites v All Control Sites	+5.7%	Yes	No	Peat Moss cover has increased by 5.7% at impact sites relative to control sites. Overall, Peat Moss cover and health at impact sites is good e.g. the proportion of Peat Moss recorded as dead at impact sites is lower than the baseline mean. No intervention is required. Continue monitoring in IY7.
Mount Buller Impact Sites v Mount Buller Control Sites	+2.8%	Yes	No	

Surface Water Flows

Comparison*	IY5 Result**	IY6 Result	Action Req'd?	Comments
Boggy Creek Weir 1 Pickup 2 v Modelled Surface Water Flows	+38%	-10%	No	In IY6, surface water flows were considerably (84%) below model-predicted flows at Boggy Creek Weir 2 but only 10% below model-predicted flows at Boggy Creek Weir 1 Pickup 2. Further monitoring and analysis is recommended in IY7 to assess whether results in IY6 were influenced by water storage liner repair works or water extraction (upslope of Weir 2 but downslope of Weir 1) to refill the water storage. A general check and validation of recorded flow data at Weir 2 is also recommended.
Boggy Creek Weir 2 v Modelled Surface Water Flows	-75%	-84%	Yes	

*Note: As outlined in the HEMAMP protocol, no reliable comparison is currently possible between Boggy Creek Weir 1 Pickup 1 and modelled surface water flows, so it has been excluded from this table.

**Note: Surface water flow data capture was amended for Boggy Creek Weir 2 in December 2023, meaning that only an incomplete dataset (from December 2023 onwards) was available for Weir 2 in IY5. IY6 is therefore the first year with monitoring data available for the full assessment period for all surface water flow monitoring locations (Weir 2 and Weir 1 Pickups 1 and 2).

Groundwater Levels

Comparison	IY5 Result	IY6 Result	Action Req'd?	Comments
All Boreholes v Modelled Groundwater Levels	+4%	-5%	No	Groundwater levels did not depart considerably from expected levels in IY5 or IY6. Results for individual bores were also checked against the model predictions. BH17 was the only bore in IY6 to show higher actual groundwater levels compared with the model, possibly due to additional watering from the EWS* near this bore. Monitoring must continue but no further intervention is needed.

*EWS = Environmental Watering System

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Surface Water Quality

Parameter	IY6 Result	Action Req'd?	Comments
Electrical Conductivity	No outliers detected.	No	The concentrations of most parameters are very low, particularly for major ions. Some parameters are therefore particularly sensitive to the IQR. Other than TDS and turbidity, surface water quality parameters were mostly within the green threshold range of 1.5 x IQR, with an occasional outlier. In contrast, multiple outliers were detected for TDS and turbidity. A review of the catchment area for potential sources of TDS and turbidity is needed, starting with sediment impact from weed control areas and deer impacts. In response, sediment controls may need adding/adjusting to achieve water quality objectives. Repairs were made to the water storage dam liner in late 2024 and early 2025 in response to identified leakage. It is recommended that monitoring continue in IY7 to identify whether changes in TDS, turbidity and other parameters are observed following repair of the dam liner.
Total Dissolved Solids (TDS)	From a total of 12 samples in IY6, five 'red' outliers detected, ranging from 47 mg/L (Weir 1 Pickup 2) to 64 mg/L (Weir 2). These outliers are elevated compared to IY5 'red' outliers.	Yes	
pH	No outliers detected.	No	
Nutrients (Nitrate)	Minor outliers detected. Very low values (0.03 to 0.09 mg/L) recorded in IY6.	No	
Major Ions (Calcium, Magnesium, Potassium, Sodium, Chloride, Sulfate)	From a total of 12 samples in IY6 for each ion, outliers were: two 'red' and one 'amber' for sodium; one 'red' for potassium; and, one 'red' and one 'amber' for chloride.	Yes	
Turbidity	From a total of 12 samples in IY6, one 'red' outlier was detected at Weir 1 Pickup 1 and one 'amber' outlier at Weir 2. EWS East showed all 'red' outliers in both IY5 and IY6.	Yes	
Suspended Solids	From a total of 12 samples in IY6, one 'red' outlier was noted at EWS East.	Yes	

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Groundwater Quality

Parameter	IY6 Result	Action Req'd?	Comments
Electrical Conductivity	No outliers detected.	No	The concentrations of most parameters are very low, particularly for major ions. Some parameters are therefore particularly sensitive to the IQR. Groundwater quality parameters were mostly within the green threshold range of 1.5 x IQR, with some exceptions for TDS and major ions. Further monitoring is required in IY7 to identify whether changes in TDS, major ions and other parameters are observed following repair of the water storage liner. Nitrate at BH06 was outside the overall catchment range but within the IQR threshold for BH06 specifically. It is noted that BH06 has consistently reported nitrate above the range of the other bores, including during the baseline period. Based on this, no adaptive management response is considered necessary, particularly as downgradient bores are not indicating impacts.
Total Dissolved Solids (TDS)	From a total of 12 samples in IY6, one 'red' and four 'amber' outliers detected, ranging from 53 mg/L to 79 mg/L. TDS values at BH17 remain elevated as they were in IY5.	Yes	
pH	No outliers detected.	No	
Nutrients (Nitrate)	From a total of 12 samples in IY6, one 'red' outlier detected at BH06. Similarly, one 'red' and two 'amber' outliers detected at BH06 in IY5.	Yes	
Major Ions (Calcium, Magnesium, Potassium, Sodium, Chloride, Sulfate)	From a total of 12 samples in IY6 for each ion, outliers were: four 'amber' outliers for magnesium and one 'red' outlier for potassium, sulfate and chloride each. Chloride and sulfate outliers at BH16 were particularly elevated in IY6.	Yes	
Turbidity	No outliers detected.	No	
Alkalinity (Bicarbonate)	No outliers detected in IY6. Two 'amber' outliers (at BH17 and BH18) detected in IY5.	No	

Conclusions and Recommendations

The benefits of ARV's ongoing implementation of the HEMAMP (including recommendations of annual monitoring reports), Ecological Rehabilitation Plan (ERP) and ERP Addendum are reflected in monitoring results for IY6, which suggest that there have been recent improvements in the ecological condition of impact sites. However, IY6 monitoring results also indicate that certain adaptive management trigger thresholds have been met. Most notably, the performance criteria for bog composition (bog-dependent species richness) and encroachment (weed cover within impact sites) have been within the 'amber' trigger threshold for at least three consecutive years, meaning that management actions to address these performance criteria will need to be scaled up in IY7. Similarly, despite a water storage leak occurring in IY6 and discharging water into the headwaters of Boggy Creek, the 'red' trigger threshold for surface water flows at Boggy Creek Weir 2 has now been met for two consecutive years, which requires an adaptive management response. Suggested actions to address the adaptive management triggers are provided in the recommendations of the monitoring reports (collated below).

Ecological Recommendations

Most ecological recommendations from IY5 monitoring were implemented in IY6. One recommendation (IY5 Ecological Recommendation 13 relating to dead Peat Moss) was not pursued because it was no longer relevant. Another recommendation (IY5 Ecological Recommendation 8 relating to increased efforts to re-introduce Silver Astelia) was postponed until IY7 and has been re-iterated in IY6 recommendations. The action was put on hold because of sub-optimal planting conditions in autumn 2025 (water was still being discharged from the environmental watering system, causing waterlogging/flooding at the recipient site). Other recommendations from IY5 have been partially implemented but are ongoing and have therefore been incorporated into the list of recommendations from IY6 monitoring.

The recommendations of the IY6 ecological monitoring report are as follows:

1. Despite positive trends since IY3 and a return to the 'green' trigger level threshold in IY6, ongoing management actions and effort at impact sites will be required. In particular, weed control and revegetation should continue at Bog 6.
2. Areas of Spreading Rope-rush dieback at Mount Buller control sites should be re-visited in IY7 and potential causes investigated.
3. Now that artificial watering of Mount Buller's eastern control sites has reduced, ecological monitoring should be alert to a potential decline in the area of these sites and adapt analysis of results accordingly. Analysis of results from Borehole 18 (BH18) may assist.
4. Dieback locations must continue to be re-visited in future years to track vegetation recovery or succession and to plan any necessary management interventions e.g. weed control and revegetation.
5. The status of Bog 11.1 as a control site should be reviewed, based on observed hydrological changes and dieback. This would be assisted by a hydrological review of the Boggy Creek catchment, with updated modelling of Alpine Bog catchment areas and investigation of the role of the aqueduct in water dispersal.
6. Consider periodically revisiting newly mapped Alpine Bogs to note any catchment level changes that may be occurring. Consider allocating newly mapped Alpine Bogs and Alpine Bogs previously mapped in BY2 to either impact sites or control sites, based on further hydrological analysis of the catchment (e.g. updated modelling of the catchment areas of Alpine Bogs).
7. When the HEMAMP Protocol (Biosis 2022b) is next updated, it should be updated with additional details on Alpine Bog mapping, including the following:
    a. The updated HEMAMP Protocol should provide information on any Alpine Bogs that have been newly mapped since baseline monitoring, regardless of whether these new Alpine Bogs are formally incorporated into the long-term monitoring program.

   b. The updated HEMAMP Protocol should confirm that the cover of canopy trees greater than 3 metres tall is disregarded when assessing the dominance of bog-dependent species and therefore defining Alpine Bog extent.
   c. The updated HEMAMP Protocol should clarify that, unlike new Alpine Bogs, Alpine Bog fragments (e.g. at Bog 6) are mapped and included in bog extent regardless of the number of bog-dependent species in the fragment. Bog fragments exist in areas that were previously mapped as Alpine Bog and are important to document for tracking management actions, such as weed control.
8. At locations where informal management tracks are forming through sensitive Alpine Bogs, ARV should provide alternative formalised tracks or coir log 'stepping stones' to minimise the risk of fragmentation of the Alpine Bogs. If coir logs are used, they should be preferentially placed on weed species or within main drainage channels.
9. When the HEMAMP Protocol (Biosis 2022b) is next updated, it should be updated to clarify that organic litter includes mulch, coir logs and jute mat that may have been placed for management purposes.
10. ARV should extend its Mount Stirling deer control program (currently a component of the Mount Stirling Offset Site management) to Mount Buller in response to the observed increase in deer impacts within Mount Buller Alpine Bogs in IY6.
11. Bog-dependent species richness at impact sites relative to control sites has remained 5.3% lower than the baseline mean (i.e. at the 'amber' trigger level) for three consecutive years, meaning that efforts to re-introduce Silver Astelia to impact sites must be increased in IY7 e.g. by planting a greater number of Silver Astelia plants or by better protecting Silver Astelia plants from deer.
12. ARV should plant all available and suitable Silver Astelia plants in spring 2025 or autumn 2026. New planting locations may need to be chosen, as the original locations may no longer be suitable. Planting locations should be recorded with a DGPS to assist with relocation, to monitor survivorship and to plan follow-up management actions, such as weed control or herbivore management. If any of the planted Silver Astelia die, they should be replaced either at the same location (if conditions for re-introduction are still suitable at this location) or at a new location (if conditions for re-introduction are no longer suitable at the original location or better elsewhere).
13. As more Silver Astelia plants become available, ARV should consider planting them into Bog 6 and Bog 12, given that the species has been previously recorded at these impact sites.
14. As the weed cover within impact sites has remained within the 'amber' trigger level for three consecutive years, ARV should increase weed control effort within impact sites in IY7 compared with IY6.
15. ARV should increase weed control effort in vegetation surrounding impact sites and within the Project Construction Footprint of the water storage, as this will reduce weed propagule loads within the impact sites themselves.

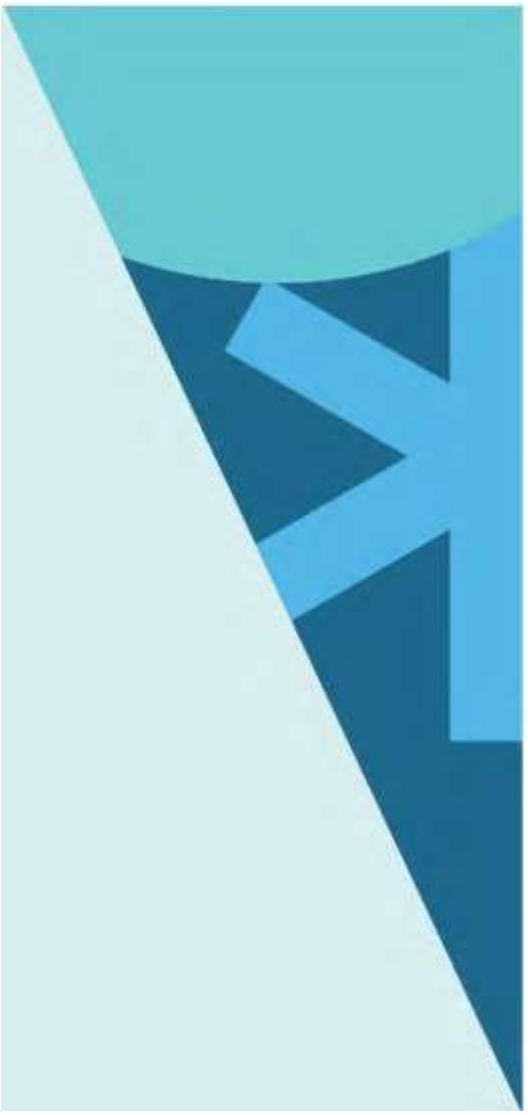
Hydrological Recommendations

Most hydrological recommendations from IY5 monitoring were fully or partially implemented in IY6. One recommendation (IY5 Hydrological Recommendation 6 regarding the manual bailing of BH07 and BH10) was postponed to IY7. All other recommendations were fully or partially completed. Where relevant, partially completed recommendations have been incorporated into the list of recommendations from IY6 monitoring.

The recommendations of the IY6 hydrological monitoring report are as follows:

1. Adaptive management responses are recommended to investigate TDS and turbidity outliers in surface water, similarly to IY5 recommendations:
   a. Areas of weed removal and track grading should be inspected to determine if sediment controls need to be adjusted or added to avoid runoff.

   b. If inspection indicates no or limited sediment runoff, additional sources of TDS could be investigated including the sewage pipeline that traverses the base of the Summit Nature Walk.
   c. Turbidity in the EWS outlet should be investigated as to its source and whether it is entering the distribution pipeline (as turbidity may be settling in the EWS collection pit).
2. Groundwater levels, surface flow levels and EWS flow should continue to be monitored in accordance with the current HEMAMP program methodology, particularly in response to recent water storage repairs. Reference should also be made to the monitoring and risk control measures in the Mount Buller Boggy Creek Reservoir Dam Safety Geotechnical Assessment and Landslide Risk Assessment (GHD 2025).
3. BH07 and BH10 should be manually bailed in the next monitoring round to reduce sediment load.
4. The HEMAMP protocol contains adaptive management triggers for underwatering of the Alpine Sphagnum Bogs. It is now evident that potential overwatering has occurred or there are changes in the flow regimes to the downstream environment. It is recommended that either the HEMAMP or a separate monitoring program (potentially related to the dam safety plans) also considers the prospect of overwatering or these changes to the flow regime through the design of the EWS.
5. Water quality sampling could be removed from the April monitoring period in future years, due to the prevalence of dry groundwater bores and the absence of significant seasonal variation in water quality. Groundwater level and surface flow data should still be collected over this period.
6. The Boggy Creek and EWS flow data should continue to be improved and evaluated with regard to:
   a. Collation of data from the new SCADA system with historical data.
   b. Responsiveness to monitoring instrument failures or system failures.
   c. Calibration of flow meters to verify data records.
7. The control measures outlined in GHD 2025 need to be managed alongside the HEMAMP and Dam Safety monitoring programs. In respect to this report and the hydrogeological and surface water monitoring program, the following improvements and gaps need to be addressed:
   a. Efforts to avoid overwatering of the bogs by ensuring ongoing flows to/through EWS are reduced to levels similar to pre-construction. This is expected to reduce the likelihood of landslide hazard occurrence.
   b. Monitoring the effectiveness of the repairs completed to date as the performance of the liner is assessed as critical to ongoing good slope performance. Monitoring includes visual observations as well as measuring flow meter/groundwater levels.
   c. Review construction details on the aqueduct (and the potential for an updated catchment and hydrological review) and assess function and suitability for required purposes including emergency intake of increased flows because of overwatering from EWS.



Alpine Resorts
Victoria

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APEM Group

Mount Buller Water Storage Project

Hydrological and Ecological Monitoring and Adaptive Management Program

Impact Year 6 Monitoring

FINAL REPORT

Prepared for Alpine Resorts Victoria

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Biosis offices

New South Wales

Albury

Phone: (02) 6069 9200
Email: albury@biosis.com.au

Gosford

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

Newcastle

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

Sydney

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

Western Sydney

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

Wollongong

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

Victoria

Ballarat

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

Melbourne

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

Wangaratta

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

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Summary

Background

From October 2019 to May 2020, the Mount Buller and Mount Stirling Alpine Resort Management Board (now Alpine Resorts Victoria or ARV) constructed a 100-megalitre off-stream water storage and ancillary infrastructure (the project) on Mount Buller, within a 10.347-hectare Project Construction Footprint (PCF) between the summit and the Mount Buller Village. As part of the project, ARV is implementing an ongoing Hydrological and Ecological Monitoring and Adaptive Management Program (HEMAMP), with an objective of maintaining the extent and condition of Alpine Bogs that are downslope of the water storage.

Two years of baseline ecological monitoring data (Baseline Years 1 and 2 or BY1 and BY2) were collected as part of the HEMAMP in 2018 and 2019. This was followed by ecological monitoring during construction in 2020 (Impact Year 1 or IY1) and post-construction ecological monitoring in 2021, 2022, 2023, 2024 and 2025 (Impact Years 2, 3, 4, 5 and 6 or IY2, IY3, IY4, IY5 and IY6). This report summarises the results of ecological monitoring from Impact Year 6, compares the results with baseline data and provides an assessment of these results against the HEMAMP's performance criteria and ecological triggers for adaptive management.

The HEMAMP's performance criteria are as follows:

- The 'extent' criterion – there will be no more than a 10% reduction in the total combined area of the impact sites, determined by on-ground or remote (aerial) monitoring and taking into account natural variation based on extent observations averaged across control sites.
- The 'composition' criterion – there will be no more than a 10% reduction in the total 'bog-dependent' native flora species richness of the impact sites, taking into account natural variation based on species richness observations averaged across control sites.
- The 'encroachment' criteria:
  - Atypical species – there will be no more than a 10% increase in the cover of 'non-bog-dependent' species within the impact sites, taking into account natural variation based on observations averaged across control sites.
  - Weeds – the total cover of weeds (naturalised exotic flora species) within the impact sites will not exceed 5%.
- The 'structure' criterion – there will be no more than a 10% reduction in the average cover of Peat Moss *Sphagnum* spp. within the impact sites, taking into account natural variation based on Peat Moss cover averaged across control sites.

The HEMAMP's ecological triggers for adaptive management are directly related to the above performance criteria.

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Results

Bog extent

Comparison	Threshold	IY6 Result	Compliant?	Action Req'd?	Comments
Mount Buller Impact Sites v All Control Sites	-10.0%	-3.8%	Yes	Yes	Artificial watering (via the environmental watering system), an increased weed control effort in IY5-IY6 and ongoing revegetation works have resulted in an increase in the collective area of impact sites and a return to the 'green' trigger threshold. Some impact sites (e.g. Bog 6) remain highly fragmented and increased deer activity threatens to reverse improvements. Continued weed control, revegetation and monitoring will be required, along with increased deer control/deterrence at Mount Buller.
Mount Buller Impact Sites v Mount Buller Control Sites	-10.0%	+2.6%	Yes	Yes	

Bog composition

Comparison	Threshold	IY6 Result	Compliant?	Action Req'd?	Comments
Mount Buller Impact Sites v All Control Sites	-10.0%	-5.3%	Yes	Yes	Silver Astelia was incidentally observed at impact sites again in IY6, but not along transects or in quadrats. Propagation of Silver Astelia commenced in IY4 and 9 plants were planted at five locations in/around Bog 4.2 in IY5 (autumn 2024). These 9 plants were not located during IY6 monitoring and may have been lost to deer browsing and/or flooding. A further 15 Silver Astelia plants are over-wintering at Mount Buller and will be planted in IY7 (spring 2025 or autumn 2026).
Mount Buller Impact Sites v Mount Buller Control Sites	-10.0%	-5.3%	Yes	Yes	

Encroachment by atypical species

Comparison	Threshold	IY6 Result	Compliant?	Action Req'd?	Comments
Mount Buller Impact Sites v All Control Sites	+10.0%	+5.7%	Yes	No	The cover of non-bog-dependent flora species has increased by 5.7% at impact sites relative to control sites. However, the absolute cover of non-bog-dependent flora has declined to below baseline levels. No intervention required. Continue monitoring in IY7.
Mount Buller Impact Sites v Mount Buller Control Sites	+10.0%	+2.8%	Yes	No	

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Encroachment by weeds

Parameter	Threshold	IY6 Result *	Compliant?	Action Req'd?	Comments
Cover of weeds inside and outside of Alpine Bog impact sites (across entire transects)	5%	6.3%	No	Yes	Weed cover along entire transects (inside and outside of Alpine Bogs) was 6.3% in IY6 and has been greater than 5% since monitoring started. Weed cover within impact sites
Cover of weeds across inside Alpine Bog impact sites only	5%	3.7%	Yes	Yes	(inside Alpine Bogs only) was 3.7% in IY6 and therefore compliant. However, weed control is still needed, especially in Bog 6.

*Note: The result for cover of weeds is expressed as an absolute percentage cover. All other results are expressed as a relative change from the Baseline Mean (BM) to Impact Year 6 (IY6).

Bog structure

Comparison	Threshold	IY6 Result	Compliant?	Action Req'd?	Comments
Mount Buller Impact Sites v All Control Sites	-10.0%	+5.7%	Yes	No	Peat Moss cover has increased by 5.7% at impact sites relative to control sites. Overall, Peat Moss cover and health at impact sites is good e.g.
Mount Buller Impact Sites v Mount Buller Control Sites	-10.0%	+2.8%	Yes	No	the proportion of Peat Moss recorded as dead at impact sites is lower than the baseline mean. No intervention is required. Continue monitoring in IY7.

Conclusion and recommendations

The following observations and conclusions were made from Impact Year 6 ecological monitoring:

- ARV undertook the following management actions in IY6 to implement recommendations of previous monitoring reports, the Ecological Rehabilitation Plan Addendum and associated management plans:
  - Sediment control, involving installation and maintenance of existing sediment socks and sediment fences.
  - 753 hours of weed control at Mount Buller, 50 hours of weed control at Mount Stirling and removal of 2.4 tonnes of weed material.
  - Culling of eight Sambar Deer from the Mount Stirling resort.
  - Planting of 2,372 tubestock in the Alpine Bogs.
- Benefits of the above management actions and those undertaken in previous years are reflected in monitoring results and are expected to continue to materialise in future monitoring years. In particular, bog extent has returned to the 'green' trigger threshold in IY6.
- However, the weed cover and bog composition performance criteria have been within the 'red' and 'amber' trigger level respectively for at least three consecutive years, meaning that management actions to address these performance criteria will need to be scaled up in IY6. This is reflected in the recommendations of this report.

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The recommendations of this monitoring report are as follows:

1. Despite positive trends since IY3 and a return to the 'green' trigger level threshold in IY6, ongoing management actions and effort at impact sites will be required. In particular, weed control and revegetation should continue at Bog 6.
2. Areas of Spreading Rope-rush dieback at Mount Buller control sites should be re-visited in IY7 and potential causes investigated.
3. Now that artificial watering of Mount Buller's eastern control sites has reduced, ecological monitoring should be alert to a potential decline in the area of these sites and adapt analysis of results accordingly. Analysis of results from Borehole 18 (BH18) may assist.
4. Dieback locations must continue to be re-visited in future years to track vegetation recovery or succession and to plan any necessary management interventions e.g. weed control and revegetation.
5. The status of Bog 11.1 as a control site should be reviewed, based on observed hydrological changes and dieback. This would be assisted by a hydrological review of the Boggy Creek catchment, with updated modelling of Alpine Bog catchment areas and investigation of the role of the aqueduct in water dispersal.
6. Consider periodically revisiting newly mapped Alpine Bogs to note any catchment level changes that may be occurring. Consider allocating newly mapped Alpine Bogs and Alpine Bogs previously mapped in BY2 to either impact sites or control sites, based on further hydrological analysis of the catchment (e.g. updated modelling of the catchment areas of Alpine Bogs).
7. When the HEMAMP Protocol (Biosis 2022b) is next updated, it should be updated with additional details on Alpine Bog mapping, including the following:
    a. The updated HEMAMP Protocol should provide information on any Alpine Bogs that have been newly mapped since baseline monitoring, regardless of whether these new Alpine Bogs are formally incorporated into the long-term monitoring program.
    b. The updated HEMAMP Protocol should confirm that the cover of canopy trees greater than 3 metres tall is disregarded when assessing the dominance of bog-dependent species and therefore defining Alpine Bog extent.
    c. The updated HEMAMP Protocol should clarify that, unlike new Alpine Bogs, Alpine Bog fragments (e.g. at Bog 6) are mapped and included in bog extent regardless of the number of bog-dependent species in the fragment. Bog fragments exist in areas that were previously mapped as Alpine Bog and are important to document for tracking management actions, such as weed control.
8. At locations where informal management tracks are forming through sensitive Alpine Bogs, ARV should provide alternative formalised tracks or coir log 'stepping stones' to minimise the risk of fragmentation of the Alpine Bogs. If coir logs are used, they should be preferentially placed on weed species or within main drainage channels.
9. When the HEMAMP Protocol (Biosis 2022b) is next updated, it should be updated to clarify that organic litter includes mulch, coir logs and jute mat that may have been placed for management purposes.
10. ARV should extend its Mount Stirling deer control program (currently a component of the Mount Stirling Offset Site management) to Mount Buller in response to the observed increase in deer impacts within Mount Buller Alpine Bogs in IY6.
11. Bog-dependent species richness at impact sites relative to control sites has remained 5.3% lower than the baseline mean (i.e. at the 'amber' trigger level) for three consecutive years, meaning that efforts to re-introduce Silver Astelia to impact sites must be increased in IY7 e.g. by planting a greater number of Silver Astelia plants or by better protecting Silver Astelia plants from deer.
12. ARV should plant all available and suitable Silver Astelia plants in spring 2025 or autumn 2026. New planting locations may need to be chosen, as the original locations may no longer be suitable. Planting locations should be recorded with a DGPS to assist with relocation, to monitor survivorship

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and to plan follow-up management actions, such as weed control or herbivore management. If any of the planted Silver Astelia die, they should be replaced either at the same location (if conditions for re-introduction are still suitable at this location) or at a new location (if conditions for re-introduction are no longer suitable at the original location or better elsewhere).

13. As more Silver Astelia plants become available, ARV should consider planting them into Bog 6 and Bog 12, given that the species has been previously recorded at these impact sites.
14. As the weed cover within impact sites has remained within the 'amber' trigger level for three consecutive years, ARV should increase weed control effort within impact sites in IY7 compared with IY6.
15. ARV should increase weed control effort in vegetation surrounding impact sites and within the Project Construction Footprint of the water storage, as this will reduce weed propagule loads within the impact sites themselves.

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1. Introduction

1.1 Project background

Alpine Bogs are groundwater dependent ecosystems with a scattered distribution in alpine, sub-alpine and montane environments across the Australian Alps (DEWHA 2009; FFG Act Scientific Advisory Committee 2013). They are generally characterised by the presence of Peat Moss *Sphagnum* spp. and are particularly susceptible to climate change, given that they have a fragmented distribution and are already at their environmental tolerance limit (DEWHA 2009; Macdonald 2009).

Alpine Bogs are listed as threatened ecological communities under Commonwealth and State legislation. The Alpine Sphagnum Bogs and Associated Fens (ASBAF) ecological community is listed as endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Alpine Bog Community is listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act). Throughout this document, the term 'Alpine Bogs' refers to both ASBAF and the Alpine Bog Community.

In October 2019, the Mount Buller and Mount Stirling Alpine Resort Management Board (the RMB, now Alpine Resorts Victoria or ARV and hereafter referred to as such) started construction of a 100-megalitre off-stream water storage and ancillary infrastructure (the project) on Mount Buller between the summit and the Mount Buller Village. Construction of the project finished in May 2020, although there is ongoing rehabilitation of the Project Construction Footprint (PCF) and areas of unauthorised disturbance outside the PCF. ARV continues to implement agreed compliance tasks to manage the impacts of the unauthorised disturbance outside the PCF, in consultation with and under supervision of the Victorian Government Department of Energy, Environment and Climate Action (DEECA), Victorian Government Department of Transport and Planning (DTP) and the Australian Government Department of Climate Change, Environment, Energy and Water (DCCEEW). Note that until 2023, the responsibilities of DEECA and DTP came under the former Victorian Government Department of Environment, Land, Water and Planning (DELWP).

More than 3 hectares of the Alpine Bog community is known to exist at Mount Buller. Most of the known extent of the Alpine Bog community at Mount Buller is located downslope of the PCF and the project has the potential to affect the hydrology of these Alpine Bogs (Biosis and GHD 2016). In accordance with approvals for the project (EPBC Act Approval 2014/7303 and Planning Permit PA1600138), ARV is implementing a Hydrological and Ecological Monitoring and Adaptive Management Program (HEMAMP), with the objective of maintaining the extent and condition of Alpine Bogs that are downslope of the proposed water storage (Biosis 2019). Those Alpine Bogs with catchment areas affected by the water storage are known as impact sites and are monitored annually as part of the HEMAMP. The annual monitoring also includes control sites, which are Alpine Bogs with catchment areas that are unaffected by the water storage.

The HEMAMP aims to meet the following performance criteria:

- The 'extent' criterion – there will be no more than a 10% reduction in the total combined area of the impact sites, determined by on-ground or remote (aerial) monitoring and taking into account natural variation based on extent observations averaged across control sites.
- The 'composition' criterion – there will be no more than a 10% reduction in the total 'bog-dependent' native flora species richness of the impact sites, taking into account natural variation based on species richness observations averaged across control sites.

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- The 'encroachment' criteria:
  - Atypical species – there will be no more than a 10% increase in the cover of 'non-bog-dependent' species within the impact sites, taking into account natural variation based on observations averaged across control sites.
  - Weeds – the total cover of weeds (naturalised exotic flora species) within the impact sites will not exceed 5%.
- The 'structure' criterion – there will be no more than a 10% reduction in the average cover of Peat Moss within the impact sites, taking into account natural variation based on Peat Moss cover averaged across control sites.

1.2 Scope of this report

The HEMAMP is a monitoring and management regime for selected Alpine Bogs on Mount Buller and Mount Stirling (Figure 1). The methods for this monitoring and management regime are outlined in the HEMAMP Protocol (Biosis 2022b). The Protocol is regularly updated and improved in consultation with DEECA and DCCEEW.

Between 2014 and 2018, ARV, assisted by Biosis Pty Ltd (Biosis) and GHD Pty Ltd (GHD), established climatological and hydrological monitoring infrastructure and commenced collecting climate, groundwater and surface water observations as part of the HEMAMP. In January and February 2018, ARV commissioned Biosis to establish the HEMAMP's ecological monitoring components and collect the first year of baseline ecological monitoring data. In total, two years of baseline (pre-construction) monitoring were undertaken (Baseline Years 1 and 2 or BY1 and BY2), one year of monitoring was completed during construction (Impact Year 1 or IY1) and five years of post-construction monitoring have been completed (Impact Years 2, 3, 4, 5 and 6 or IY2, IY3, IY4, IY5 and IY6).

This monitoring report:

- Provides a summary of the ecological monitoring data collected in IY6.
- Compares ecological data collected in IY6 with the baseline data collected over BY1 and BY2.
- Provides an assessment of these results against the HEMAMP's performance criteria and ecological triggers for adaptive management.
- Recommends appropriate management actions.

Throughout this report, recommendations are highlighted in text boxes as shown below.

Recommendations

All recommendations arising from IY6 monitoring are highlighted in this fashion throughout this monitoring report.

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2. Methods

Monitoring methods followed the HEMAMP Protocol (Biosis 2022b), except where explicitly noted. Mount Buller and Mount Stirling monitoring sites are shown on Figure 2 and Figure 3 respectively.

2.1 Monitoring effort, frequency and timing

HEMAMP monitoring years run from the start of June (winter) to the end of May (autumn) each year. The ecological monitoring components of the HEMAMP were established in January and February 2018 (BY1). Since 2018, Biosis has conducted ecological monitoring, with assistance from ARV, at six impact sites and seven control sites (Table 1). Each year, transect monitoring has been undertaken from late January until mid-February, while mapping has been undertaken from late January until mid-March (Table 2). The timing and completeness of the ecological datasets are further outlined in Appendix 1.

Slight differences in timing of ecological monitoring (particularly the monitoring end date) are generally associated with weather conditions and the need to maintain consistency in the quality of the data (e.g. mapping under clear skies to maximise spatial accuracy). Slight differences in the timing of ecological monitoring from year to year are unlikely to affect an assessment against the performance criteria or ecological triggers for adaptive management.

Table 1 Annual ecological monitoring effort as part of the HEMAMP

Monitoring effort	Impact sites	Control sites (Mt Buller:Mt Stirling)	Total
Number of sites* (Alpine Bogs)	6	7 (4 : 3)	13
Number of transects	24	23 (14 : 9)	47
Average length of transect (m)	18.5	21.6 (22.3 : 20.4)	20
Number of point intersections (20-cm intervals)	2196	2457 (1546 : 911)	4653
Number of quadrats	87	101 (64 : 37)	188
Number of photo points	48	46 (28 : 18)	94

*Note: The data presented in this table relate to the sites at which line and belt transects have been established. Additional sites are mapped but not subject to monitoring with line and belt transects.

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Table 2 Timing of ecological monitoring

Monitoring year	Transect monitoring period	Mapping period
Baseline Year 1	26 Jan 2018 to 9 Feb 2018	26 Jan 2018 to 9 Feb 2018
Baseline Year 2	29 Jan 2019 to 14 Feb 2019	29 Jan 2019 to 23 Feb 2019
Impact Year 1	28 Jan 2020 to 20 Feb 2020	30 Jan 2020 to 14 Mar 2020
Impact Year 2	25 Jan 2021 to 4 Feb 2021	2 Feb 2021 to 26 Feb 2021
Impact Year 3	31 Jan 2022 to 9 Feb 2022	2 Feb 2022 to 22 Feb 2022
Impact Year 4	23 Jan 2023 to 2 Feb 2023	20 Feb 2023 to 28 Feb 2023
Impact Year 5	29 Jan 2024 to 8 Feb 2024	30 Jan 2024 to 26 Feb 2024
Impact Year 6	29 Jan 2025 to 6 Feb 2025	29 Jan 2025 to 13 Feb 2025

2.2 Monitoring parameters and data collection

The HEMAMP Protocol (Biosis 2022b) requires that the following ecological parameters are monitored annually:

- Bog extent
- Bog composition
- Encroachment by weeds and other atypical species
- Bog structure.

These parameters allow for the current extent and condition of the Alpine Bogs to be directly assessed against the performance criteria and triggers for adaptive management. Data relating to these ecological parameters are collected using established line transects, belt transects, photo points and on-ground mapping techniques. These data collection methods are outlined in detail in the Standard Operating Procedure (SOP) for ecological monitoring, which is appended to the HEMAMP Protocol (Biosis 2022b).

2.2.1 Bog extent

Bog extent refers to the area of the Alpine Bogs, which is calculated by mapping the boundary of each Alpine Bog on foot using a Differential Global Positioning System (DGPS). Until IY3, boundaries were mapped using a Samsung Galaxy Tab A6, which was paired with a Trimble R1 Global Navigation Satellite System (GNSS) receiver to provide DGPS functionality. From IY3 onwards, boundaries have been mapped using newer DGPS technology, consisting of a tablet or mobile phone paired with an Emlid Reach RS2, RS2+ or RS+ receiver.

Ongoing improvements to DGPS technology have allowed for more accurate mapping since monitoring was first undertaken. In BY1 and BY2, mapping was to an accuracy of 3 metres or better in most instances, but accuracy was reduced to up to 5 metres in some areas with an overhanging tree canopy, particularly at Mount Stirling. In IY1 and IY2, improvements to DGPS technology (e.g. satellite availability and satellite-delivered correction services) allowed for sub-2-metre accuracy in most instances (especially at Mount Buller sites) and generally no worse than 3-metre accuracy (e.g. at Mount Stirling sites with overhanging tree canopies). From IY3 to IY6, use of the Emlid Reach RS2, RS2+ and RS+ GNSS receivers allowed for access to a greater number of satellites and sub-metre accuracy at all locations. In IY6, DGPS accuracy was generally at 1 centimetre, but up to 20 centimetres below tree canopies at both Mount Buller and Mount Stirling.

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In addition to mapping the boundaries of Alpine Bogs, further analysis of bog extent is undertaken using data collected from the permanent monitoring transects. The dimensions of the Alpine Bogs are estimated by determining the start and end of Alpine Bog vegetation along the transects. The edge of the Alpine Bog vegetation is taken to be the point at which bog-dependent flora species richness is equal to non-bog-dependent flora species richness (similar to the on-ground boundary mapping, which records the boundary of the Alpine Bog at the point where bog-dependent flora transition from at least 50% of vegetative cover to less than 50% of vegetative cover). In addition, the transects allow for the cover and cause of bare ground to be analysed, which informs management actions (e.g. revegetation or pest animal control) that may be required to maintain bog extent.

2.2.2 Bog composition

Bog composition refers to the species richness of bog-dependent flora, which is determined using line transects (point intersection sampling) and belt transects (quadrat sampling) in accordance with the SOP for ecological monitoring (Biosis 2022b). The list of bog-dependent species is provided in Appendix 2 of this report and in the HEMAMP Protocol (Biosis 2022b).

The IY2 monitoring report documented the difficulty in distinguishing between Mountain Baeckea *Baeckea utilis s.s.* and Subalpine Baeckea *Baeckea latifolia*, which are two bog-dependent species that co-occur at Mount Buller and Mount Stirling and that are suspected of hybridising or forming intermediates (Biosis 2021). For this reason and following a recommendation of the IY2 monitoring report, the HEMAMP Protocol was updated in 2022 so that the list of bog-dependent flora species aggregated these two species into one taxon, known as Mountain Baeckea *Baeckea utilis s.l.* (Biosis 2022b). While efforts were still made in the field to distinguish the two species, their records are aggregated for the purposes of assessing bog composition. This species aggregation was first included in bog composition analysis in IY5 and it has been included again in IY6.

In addition to bog-dependent species richness, line transects also provide an estimate of the cover of bog-dependent flora. This analysis provides an indication of underlying trends in bog composition and allows for pre-emptive management actions to be taken, if needed.

2.2.3 Encroachment by weeds and other atypical species

Encroachment is assessed by estimating the cover of weeds and other atypical species, using line transects (point intersection sampling) in accordance with the SOP for ecological monitoring (Biosis 2022b).

It is important to note that weed cover is assessed as an absolute cover. This is unlike all other ecological monitoring parameters, which are assessed at impact sites relative to control sites. Since BY1, weed cover is assessed across the entire length of the monitoring transects, not only within the Alpine Bogs themselves. The permanent monitoring transects were set up to pass through the Alpine Bogs, starting and ending 1.5-4 metres outside of the Alpine Bog boundary (when first established in BY1). This means that some weed cover may be attributable to areas immediately outside the Alpine Bogs. Since IY5, further analysis has been undertaken to estimate weed covers within Alpine Bogs only, given that this is strictly what the performance criteria require and where weed control effort has been concentrated. This further analysis only considers weeds that are encountered at or between the baseline mean start and end points of Alpine Bog vegetation along each transect. The baseline mean start and end points are estimated using the same method used to estimate the dimensions of the Alpine Bogs.

In an effort to scale up weed management, ARV and Biosis conducted some weed control concurrently with monitoring in IY3, IY4, IY5 and IY6. Where we encountered isolated occurrences of a weed species, these isolated plants were removed by hand and placed in plastic bags for solarisation and disposal, immediately after recording any required monitoring data (e.g. point intersection or quadrat results). Where relevant, these plants will have contributed to weed cover results in IY3, IY4, IY5 and IY6 but will not contribute to results in future years, assuming the immediate weed control actions have been effective. As always, a

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concerted effort was made to identify and map any novel weed species in the Alpine Bogs, whether encountered during mapping or transect monitoring.

2.2.4 Bog structure

Bog structure refers to the total cover of Peat Moss, whether dead or alive. The proportion of Peat Moss recorded as dead is also analysed to provide an indication of underlying trends in bog structure and pre-empt management actions that may be required (e.g. to avert the future loss of Peat Moss). The cover of Peat Moss, both alive and dead, is estimated using line transects (point intersection sampling) in accordance with the SOP for ecological monitoring (Biosis 2022b).

2.2.5 Other data collection considerations

In accordance with the SOP for ecological monitoring (Biosis 2022b), standardised photos were taken from the permanent photo points at the start and end of transects. These photos provide a visual documentation of gross vegetation changes, when compared with the same photos from previous monitoring years.

In addition, on-ground mapping provided an opportunity to inspect the full extent of the Alpine Bogs and to note any management issues that may not have been detected by transect monitoring (e.g. sedimentation, weed invasion or deer activity). Mapping data and notes from previous years were made available in the field for comparison, so that the cause of any changes could be investigated on the ground and past observations re-visited.

2.3 Data management

The following ecological datasets are being maintained for monitoring consistency and repeatability in future years:

- Herbarium of plant samples.
- An electronic data collection spreadsheet for transect monitoring.
- A spreadsheet of all observations from all transect monitoring conducted to date.
- Spatial dataset of Alpine Bog boundaries from each year, photo point locations and transect locations.
- Database of all photo points taken to date.
- A collection of on-ground observations (e.g. potential management issues) made while walking the Alpine Bog boundaries.

As required by the HEMAMP Protocol (Biosis 2022b), the electronic datasets are stored on ARV's servers and on a third-party cloud-based backup.

2.4 Data analysis

The ecological monitoring program follows a 'Beyond BACI' (Before-After-Control-Impact) design and data analysis has been set up accordingly (Underwood 1992 and 1994). Linear Mixed-effects Models (LMMs) and Analysis of Variance (ANOVA) were used to test the statistical significance of the effect of the period (before/after) and treatment (control/impact) on a given response variable (e.g. area of Alpine Bogs or cover of weeds).

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LMMs were fitted using the 'lme4' package in the R statistical and graphical environment (R Development Core Team 2025) using the Restricted Maximum Likelihood (REML) method. The models were in the following form:

*Response ~ Period * Site Class + (1|Year) + (1|Sample)*

The various components of the models are explained as follows:

- Response:
  - The response variable is the ecological monitoring parameter of interest, such as the area of Alpine Bogs or cover of weeds, non-bog-dependent flora, bog-dependent flora or Peat Moss.
  - We are interested in detecting whether or not there has been a statistically significant change in the response variable at impact sites relative to control sites in the period after the impact commenced.
- Period and Site Class:
  - Period refers to the time before (i.e. BY1 and BY2) or after (i.e. IY1 and IY2) the potential impact commenced (i.e. before or after construction of the water storage started).
  - Site Class refers to the 'treatment' that the Alpine Bogs have received. The Alpine Bogs belong to one of two Site Classes – control sites or impact sites.
  - Period and Site Class are the fixed effects in the model. They are the BACI effect that we are monitoring.
  - Where relevant, a third fixed effect is added to the model to investigate differences between responses at Mount Buller and Mount Stirling. This fixed effect is known as Site, as opposed to Site Class.
- 1|Year and 1|Sample:
  - The model also includes Year (BY1, BY2, IY1 etc.) and Sample (Bog 1, Bog 2, Bog 4.1/5/7 etc.) as random effects (i.e. random temporal and spatial variables).
  - The Sample-to-Sample variation represents localised spatial variability within each Site Class (e.g. the variation between Bog 1 and Bog 2 represents some of the random effect within Control sites).
  - The Year-to-Year variation represents temporal variability that applies to all Samples, regardless of Site Class (i.e. the random temporal effect that applies equally to Control and Impact sites, causing the same fluctuations at both Site Classes from year-to-year).

We are interested in determining whether or not there is a statistically significant interaction between Period and Site Class (sometimes called a BA*CI interaction or BACI contrast). If the coefficient for the BA*CI interaction (i.e. the estimate of the BACI contrast) is statistically significant, it suggests that there is a significant difference in the response of control and impact sites to the impact. In other words, there is a statistically significant difference between the control and impact sites after the impact, compared with the control and impact sites before the impact.

The statistical significance of the BA*CI interaction (BACI contrast) was determined by two-way ANOVA using Type III Sums of Squares and the Kenward-Roger approximation for Degrees of Freedom (DF). Estimated Marginal Means (EMMs) provided an estimate of the BACI contrast and an indication of the variability or Standard Error (SE) in the dataset.

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Examining SE is important and requires an ecological understanding of the dataset. If ANOVA suggests that the BA*CI interaction is not statistically significant, this may be because construction of the water storage has genuinely had no detectable effect on impact sites or it may be because the datasets are too variable (SE is too high) for an effect to be detectable.

Statistical tests were undertaken in the R statistical and graphical environment (R Development Core Team 2025) with a 5% statistical significance threshold ($\alpha = 0.05$). LMMs were fitted and ANOVA conducted using the 'lmerTest' package, while EMMs were computed and analysed using the 'emmeans' package.

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3. Results

Where results have reached the HEMAMP Protocol's 'amber' or 'red' thresholds for adaptive management actions (Biosis 2022b), the results are presented here in greater detail by contrasting Mount Buller control sites and Mount Stirling control sites. This allows for more detailed investigation of potential causes and is consistent with the recommendations of previous monitoring reports (e.g. Biosis 2022c) and independent peer reviews (e.g. SE Botanical 2023).

3.1 Bog extent

3.1.1 Area of Alpine Bogs

Alpine Bog areas were mapped using DGPS. The results of this mapping are summarised in Chart 1 and depicted in Figure 4 (raw results for each Alpine Bog are available in Appendix 5). The total combined area of all Alpine Bogs at impact sites was 1.4037 hectares in IY6, which is greater than the baseline mean of 1.3666 hectares (an increase of 0.0370 hectares or 2.7%). The total combined area of all Alpine Bogs at control sites was 2.2162 hectares in IY6, which is greater than the baseline mean of 2.0812 hectares (an increase of 0.1350 hectares or 6.5%, almost entirely at Mount Stirling control sites). The relative change in the area of impact sites in IY6 was therefore a decrease of 3.8% and this change was statistically significant (BACI contrast = 0.0147; SE = 0.0073; F-statistic = 4.0348; numerator DF = 1; denominator DF = 83; P = 0.0478).

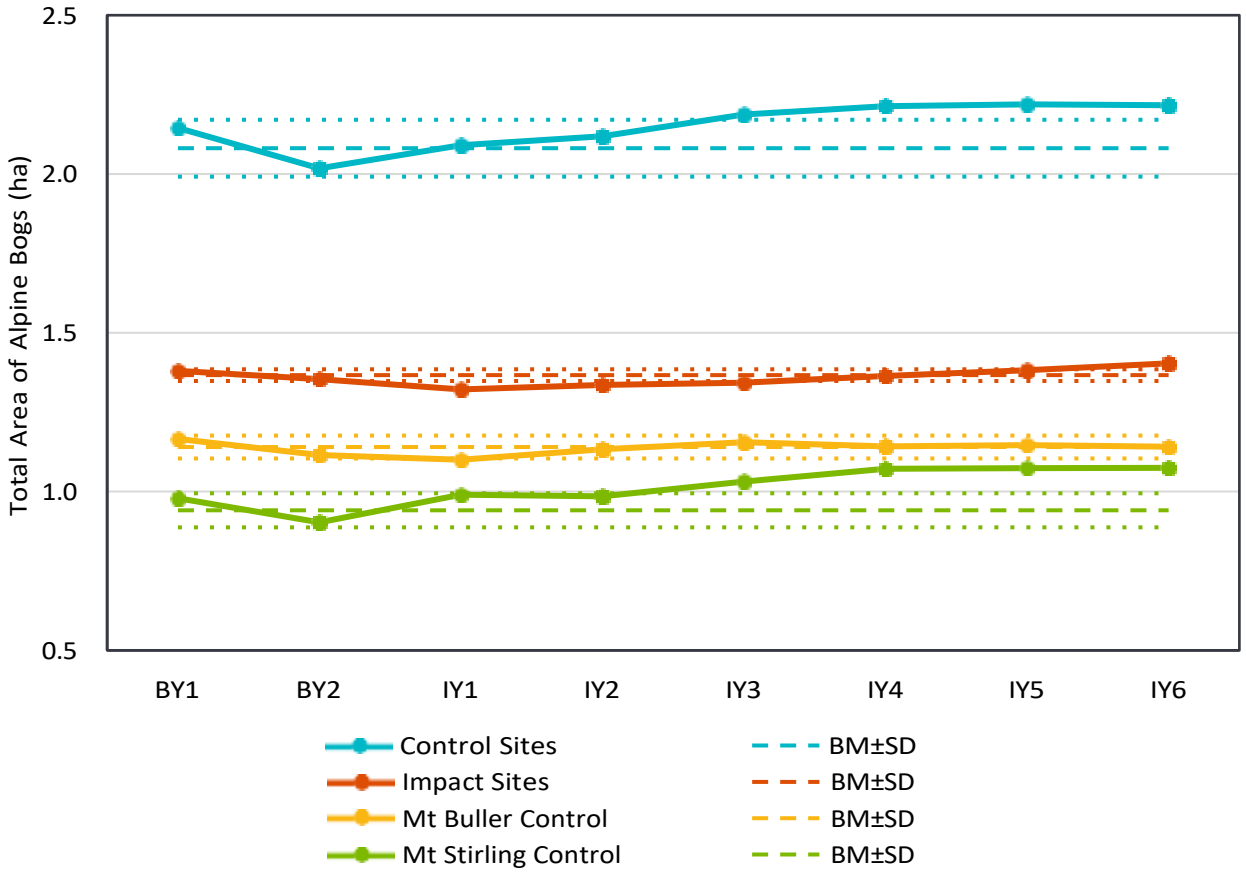

Chart 1 Total area (hectares) of Alpine Bogs over time relative to the baseline mean ± one standard deviation (BM±SD)

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3.1.2 Dimensions of Alpine Bogs

The dimensions of each Alpine Bog were estimated using line transects and the Diagnostic Key to Alpine Bogs (Appendix 3). The results of these estimates are presented in Chart 2 (raw results for each Alpine Bog are available in Appendix 5). The sum of dimensions at impact sites was 353.4 metres in IY6, which is less than the baseline mean of 354.7 metres (a decrease of 1.3 metres or 0.4%). The sum of dimensions at control sites was 438.4 metres in IY6, which is less than the baseline mean of 438.8 metres (a decrease of 0.4 metres or 0.1%). The relative change in the dimensions of the impact sites was therefore a decrease of 0.3%, although this change was not statistically significant (BACI contrast = 0.4830; SE = 0.6200; F-statistic = 0.6053; numerator DF = 1; denominator DF = 83; P = 0.4388).

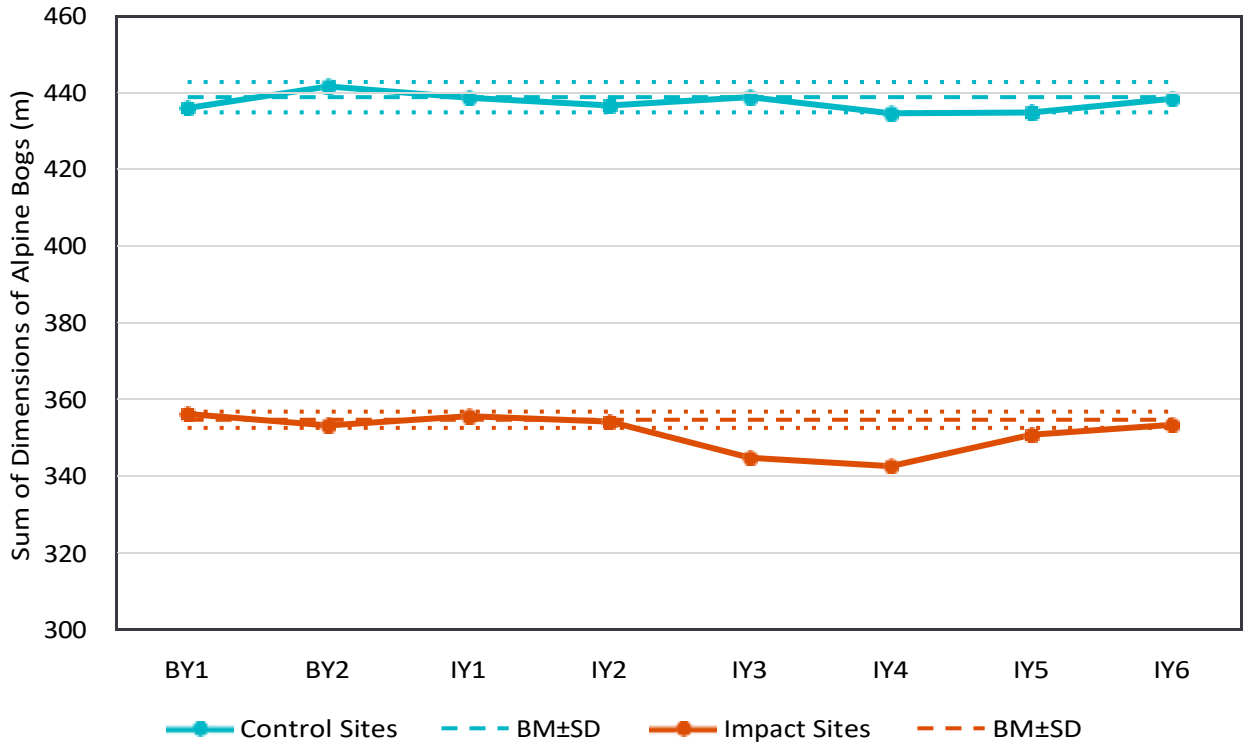

Chart 2 Sum of dimensions (metres) of Alpine Bogs over time relative to the baseline mean ± one standard deviation (BM±SD)

3.1.3 Bare ground

Line transects (point intersections) were also used to estimate the cover of bare ground. These estimates are displayed in Chart 3 (raw results for each Alpine Bog are available in Appendix 5). The cover of bare ground increased at impact sites and decreased at control sites from IY5 to IY6. The cover of bare ground in IY6 was greater than baseline levels but less than levels recorded in IY1, IY2 and IY3 at impact sites and control sites. In IY6, the cover of bare ground was 1.9% at impact sites and 1.3% at control sites, compared with baseline mean covers of 1.0% and 0.5% respectively. However, the changes in bare ground at impact sites relative to control sites have not been statistically significant (BACI contrast = 0.0085; SE = 0.0122; F-statistic = 0.5656; numerator DF = 1; denominator DF = 83; P = 0.4541).

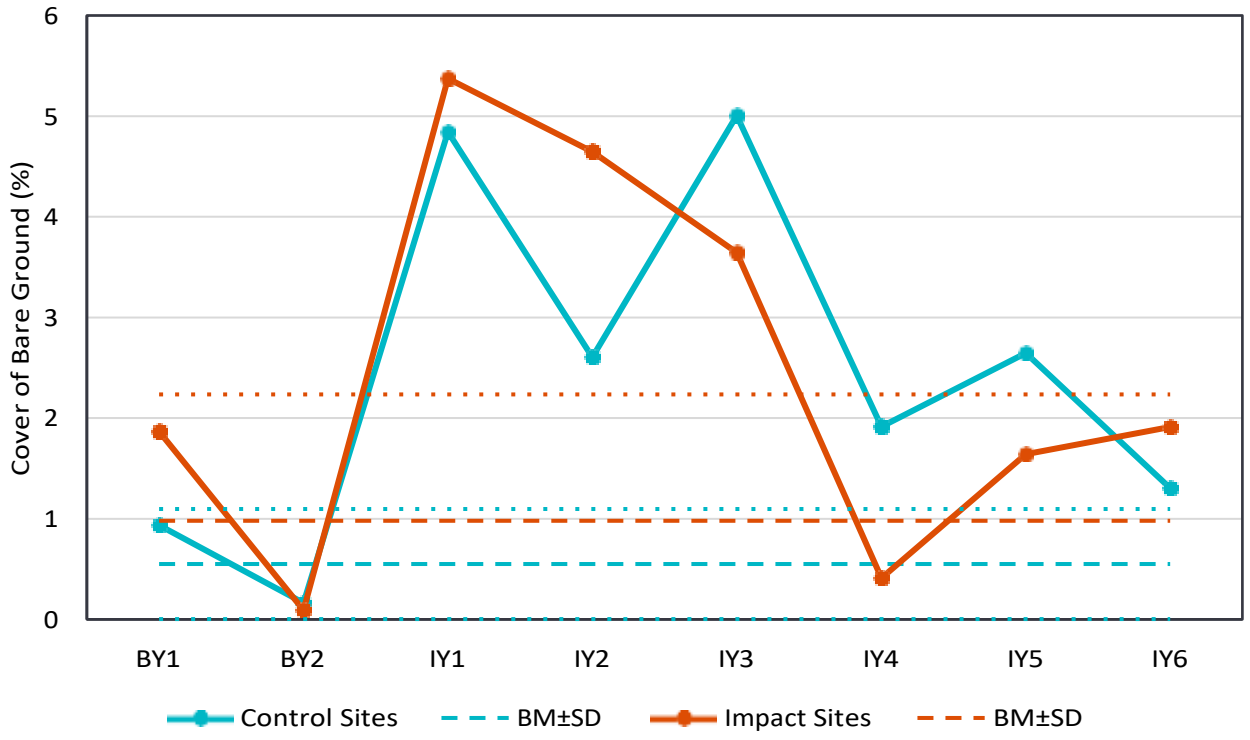

Chart 3 Percentage cover of total bare ground at Alpine Bogs over time relative to the baseline mean ± one standard deviation (BM±SD)

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The main causes of bare ground were the same at impact sites and control sites in IY6, as shown in Chart 4 (note that the cause or type of bare ground was not recorded prior to IY2). At impact sites in IY6, 78.9% of bare ground was considered natural and the remaining 21.1% was attributed to deer activity. The absolute cover of bare ground increased from 1.6% in IY5 to 1.9% in IY6 at impact sites, but this was largely driven by natural bare ground. In comparison with IY5, no bare ground attributable to sediment was recorded at impact sites in IY6. At control sites in IY6, 46.2% of bare ground was attributed to deer activity (entirely at Mount Stirling) and the remainder was considered natural. The absolute cover of natural bare ground at control sites decreased from 2.0% in IY5 to 0.7% in IY6, but the absolute cover of bare ground attributable to deer only decreased by 0.1%.

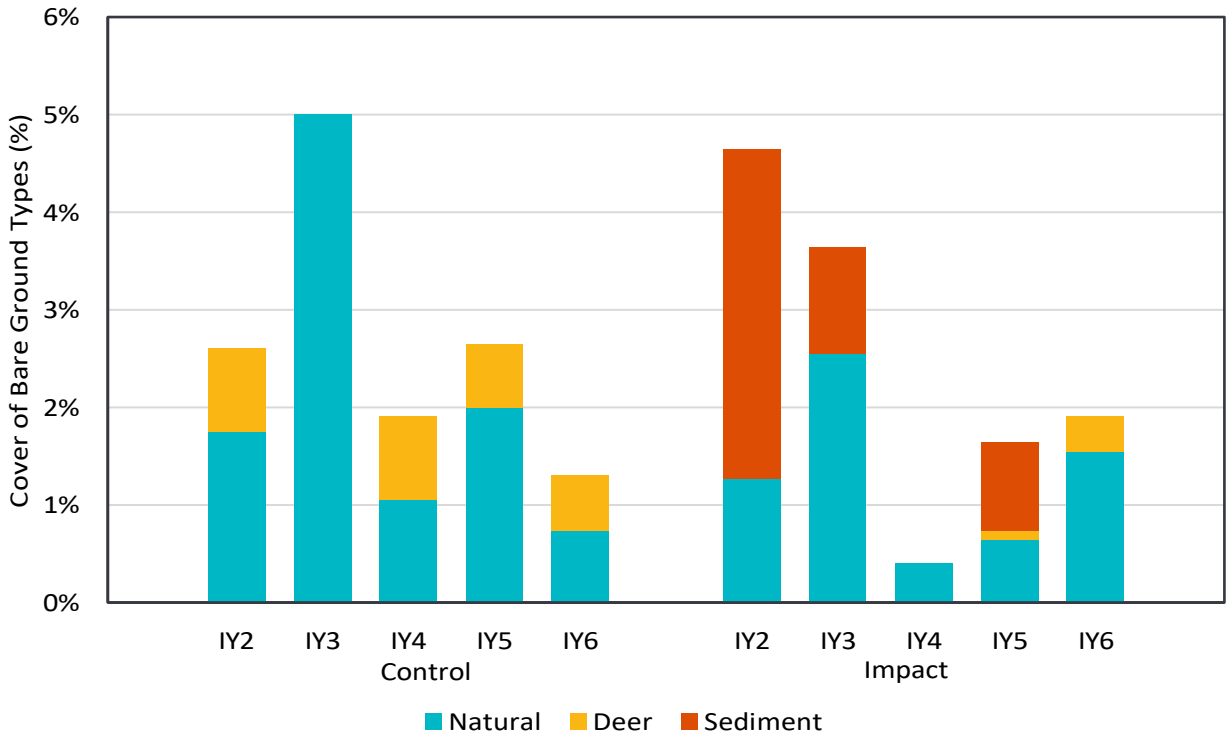

Chart 4 Percentage cover of bare ground types recorded at control and impact sites

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3.2 Bog composition

3.2.1 Species richness

Using line transects (point intersections) and belt transects (quadrats), a total of 11 distinct bog-dependent flora species have been recorded at impact and control sites since monitoring started (Appendix 2; Appendix 5). In accordance with the HEMAMP Protocol (Biosis 2022b), one of the 11 species is an aggregate of two other species that cannot be reliably distinguished in the field at Mount Buller (Mountain Baeckea *Baeckea utilis s.l.* includes Subalpine Baeckea *Baeckea latifolia* and Mountain Baeckea *Baeckea utilis s.s.*). Baseline monitoring detected 9-10 bog-dependent species across all impact sites and 10 bog-dependent species across all control sites (Chart 5). This means that the baseline mean bog-dependent species richness was 9.5 at impact sites and 10 at control sites. In IY6, 9 bog-dependent flora species were recorded along transects at impact sites (a 5.3% reduction in species richness from the baseline mean) and 10 bog-dependent flora species were recorded along transects at control sites (no change in species richness compared with the baseline mean). The relative decrease in species richness at impact sites compared with control sites in IY6 was therefore 5.3%. However, the change in species richness since construction of the water storage has not been statistically significant (BACI contrast = 0.4400; SE = 0.2900; F-statistic = 2.3128; numerator DF = 1; denominator DF = 83; P = 0.1321).

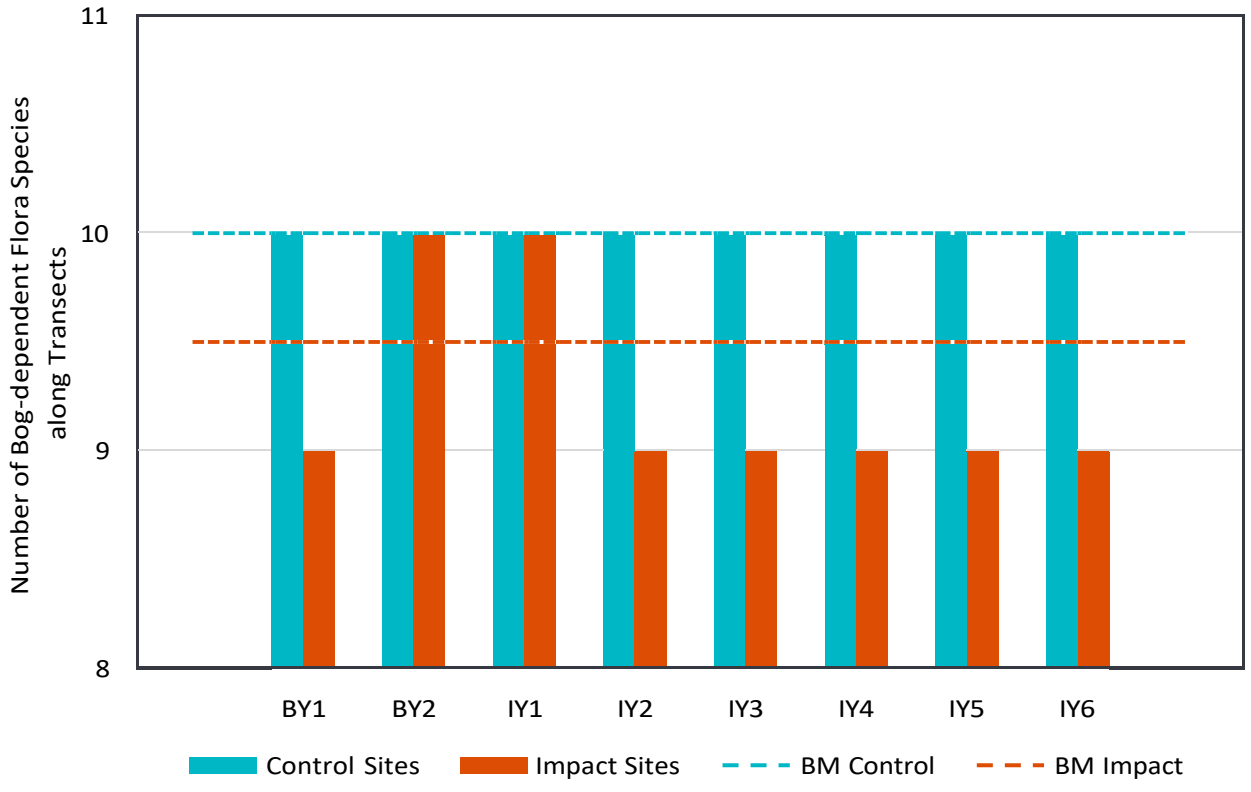

Chart 5 Bog-dependent flora species richness along transect at control and impact sites relative to the baseline mean

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3.2.2 Cover of bog-dependent flora

Line transects (point intersections) were also used to estimate the cover of bog-dependent flora species. Chart 6 shows these covers (raw results for each Alpine Bog are available in Appendix 5). The cover of bog-dependent flora species has decreased at impact sites from a baseline mean of 78.2% to 77.1% in IY6 (a proportional decrease of 1.1%). The cover of bog-dependent flora species at control sites has increased from a baseline mean of 87.9% to 88.3% in IY6 (a proportional increase of 0.4%). The change in the cover of bog-dependent species at impact sites relative to control sites was therefore a decrease in 1.9%, but changes to absolute covers have not been statistically significant (BACI contrast = -0.0156; SE = 0.0120; F-statistic = 1.6837; numerator DF = 1; denominator DF = 83; P = 0.1980).

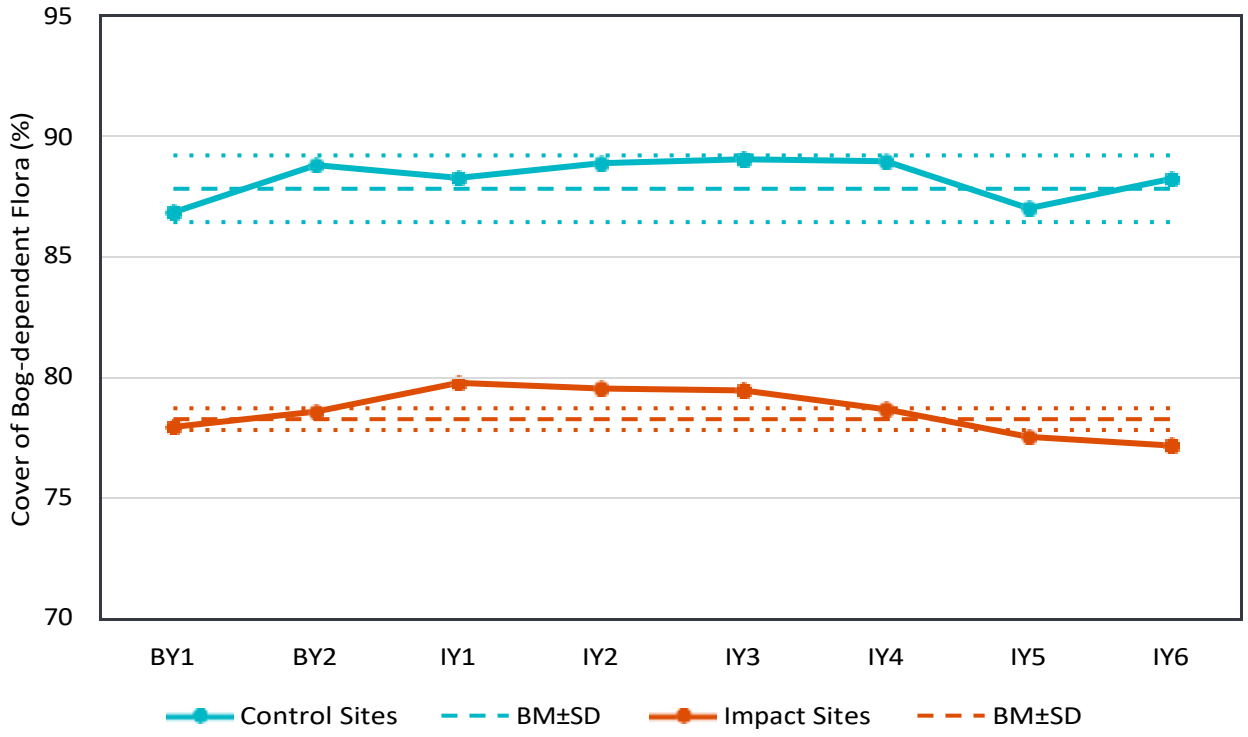

Chart 6 Percentage cover of bog-dependent flora at Alpine Bogs over time relative to the baseline mean ± one standard deviation (BM±SD)

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3.3 Encroachment by weeds and other atypical species

Line transects (point intersections) were used to estimate the covers of native non-bog-dependent flora species and introduced flora species (weeds) at each Alpine Bog (Appendix 5).

3.3.1 Cover of native non-bog-dependent flora

The cover of native non-bog-dependent flora species is shown in Chart 7. The cover of native non-bog-dependent flora has decreased at impact sites from a baseline mean of 45.2% to 41.5% in IY6 and has decreased at control sites from a baseline mean of 45.1% to 38.9% in IY6. This represents a relative increase of 5.7% in the cover of native non-bog-dependent flora species at impact sites relative to control sites in IY6. However, the relative increase in cover of native non-bog-dependent flora at impact sites relative to control sites since construction of the water storage is not statistically significant (BACI contrast = -0.0232; SE = 0.0160; F-statistic = 2.1050; numerator DF = 1; denominator DF = 83; P = 0.1506).

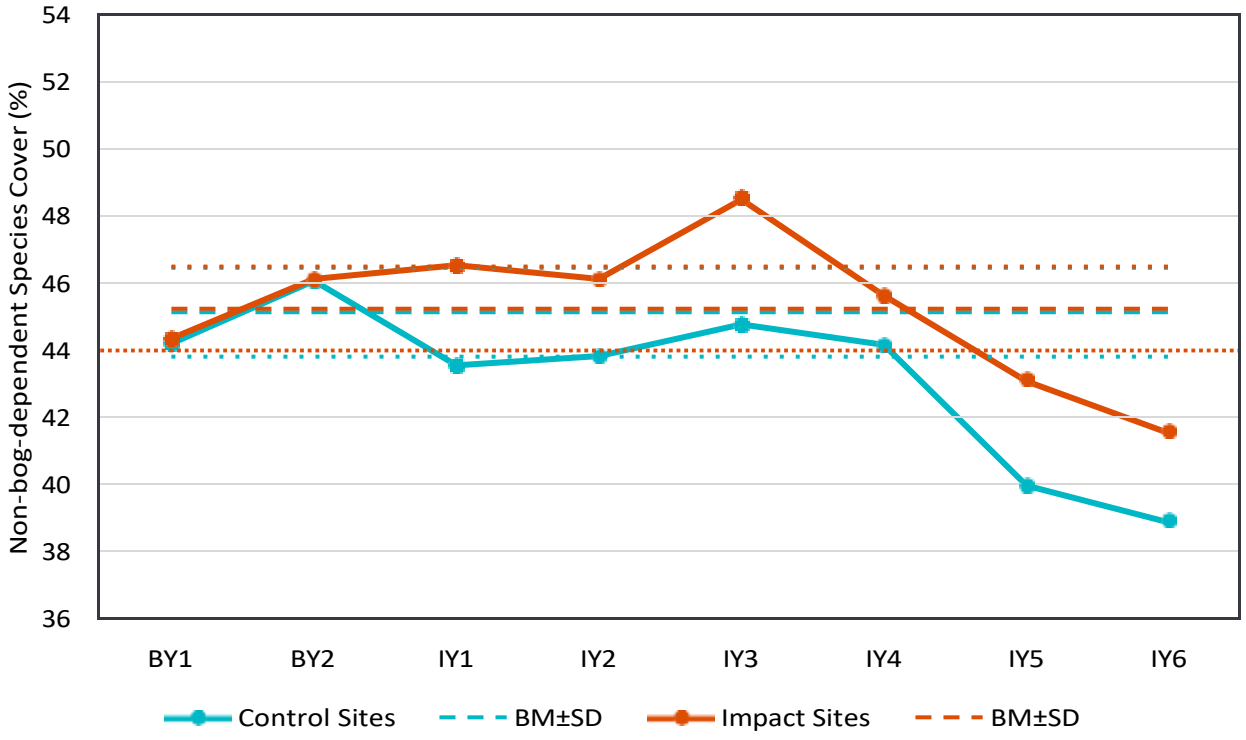

Chart 7 Percentage cover of native non-bog-dependent flora at Alpine Bogs over time relative to the baseline mean ± one standard deviation (BM±SD)

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3.3.2 Cover of weeds

Weed covers across entire transects (inside and outside of Alpine Bogs) are shown in Chart 8. Weed covers have increased along transects at impact sites from a baseline mean of 5.9% to 6.3% in IY6 and increased along transects at control sites from a baseline mean of 4.3% to 4.6% in IY6. While the increase in weed covers along transects at impact sites has been statistically significant in previous impact years, it is no longer statistically significant (BACI contrast = -0.0144; SE = 0.0083; F-statistic = 3.0345; numerator DF = 1; denominator DF = 83; P = 0.0852).

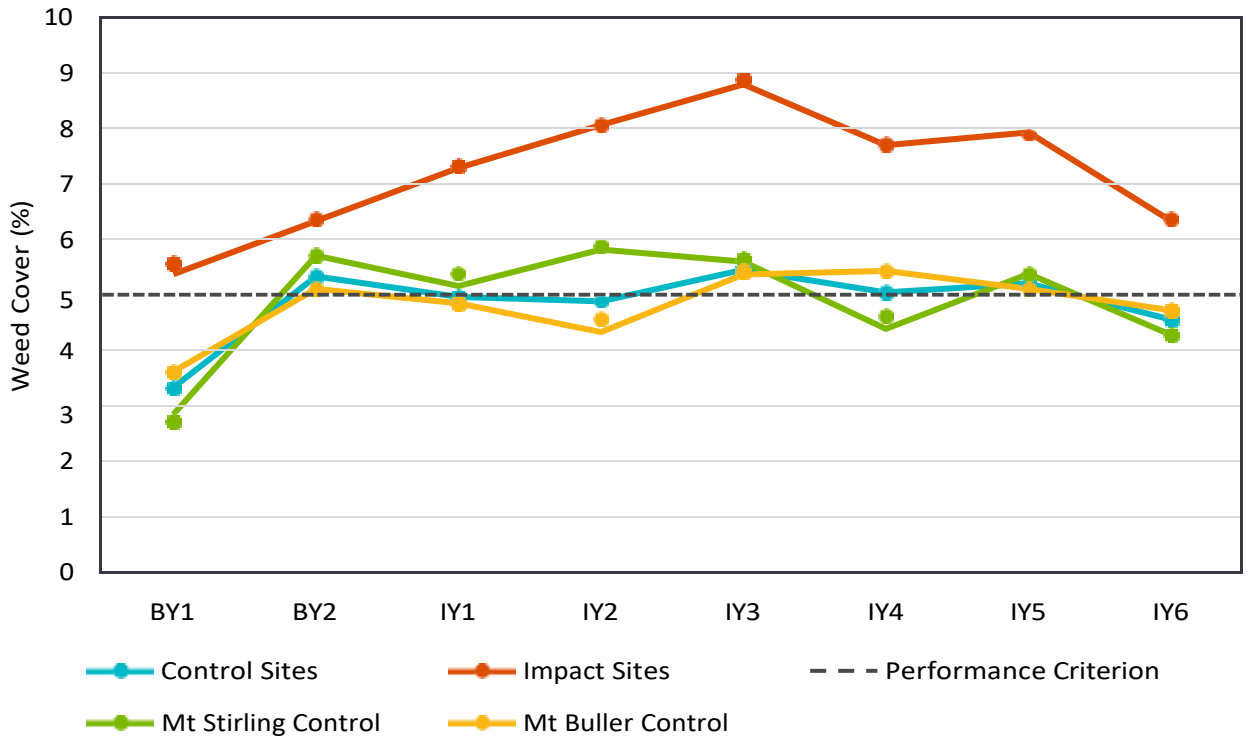

Chart 8 Percentage weed cover across entire transects inside and outside of Alpine Bogs over time relative to the 5% performance criterion

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Weed covers within Alpine Bogs only (i.e. only along those parts of transects that are within the baseline mean dimensions of the Alpine Bogs) are shown in Chart 9. The baseline mean weed cover within impact sites and control sites was 2.2%. Weed covers within impact sites increased from the baseline mean of 2.2% to 5.1% in IY3, but have since returned to below the 5% performance criterion threshold and were 3.7% in IY6. In contrast, weed covers within control sites have remained below the 5% performance criterion threshold since monitoring commenced and were 2.9% in IY6. The change in weed covers within impact sites since baseline monitoring is not statistically significant (BACI contrast = -0.0062; SE = 0.0104; F-statistic = 0.3527; numerator DF = 1; denominator DF = 83; P = 0.5542).

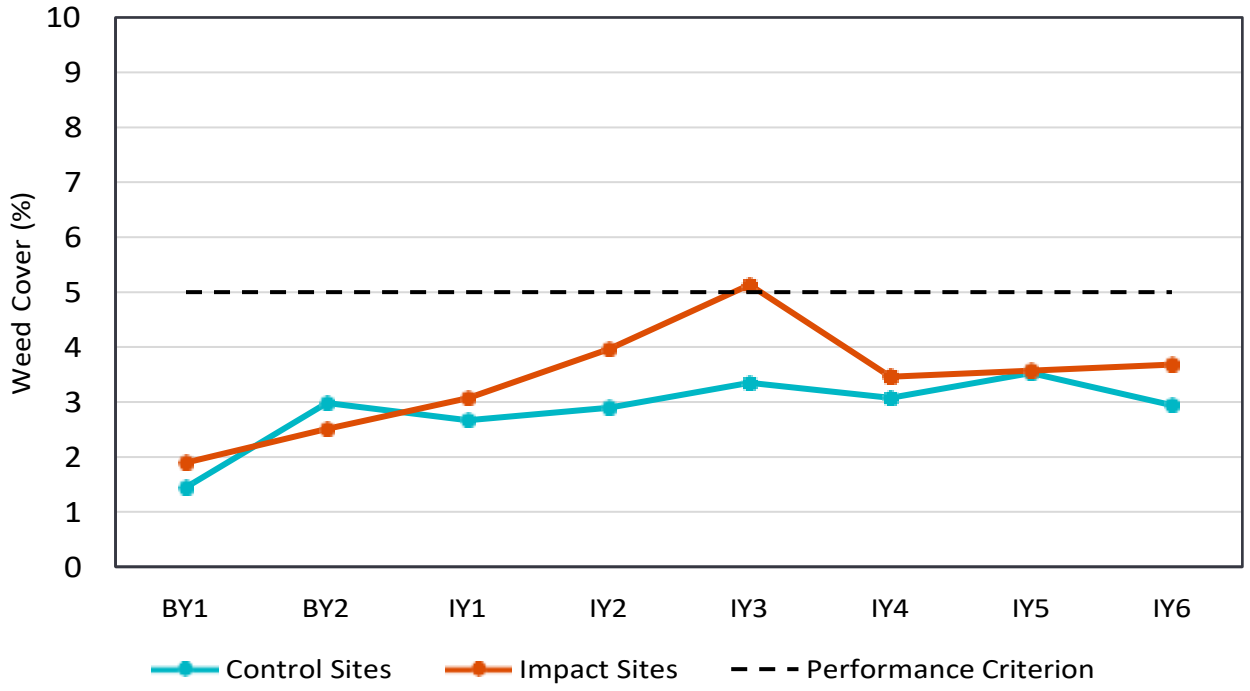

Chart 9 Percentage weed cover within Alpine Bogs over time relative to the 5% performance criterion

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3.4 Bog structure

3.4.1 Cover of Peat Moss

Line transects (point intersections) were used to estimate the cover of Peat Moss *Sphagnum* spp. at impact sites and control sites. These estimates are displayed in Chart 10 (raw results for each Alpine Bog are available in Appendix 5). At impact sites, the cover of Peat Moss has increased from a baseline mean cover of 5.4% to a cover of 6.0% in IY6, which represents a 11.9% proportional increase. At control sites, the cover of Peat Moss has increased from a baseline mean cover of 16.4% to a cover of 16.8% in IY6, which represents a 2.7% proportional increase. In real terms, this means that Peat Moss cover has increased by 9.1% at impact sites relative to control sites. However, the relative increase in Peat Moss cover at impact sites compared with control sites is not statistically significant (BACI contrast = -0.0120; SE = 0.0091; F-statistic = 1.7306; numerator DF = 1; denominator DF = 83; P = 0.1920).

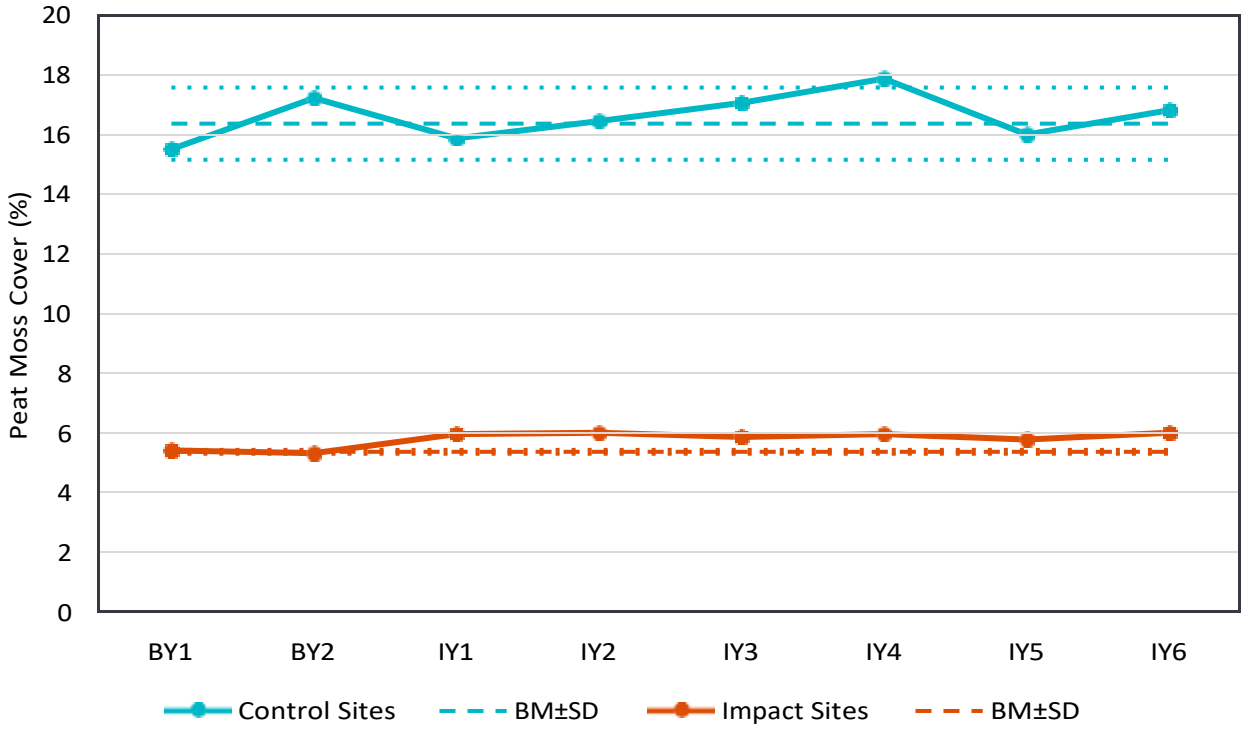

Chart 10 Percentage cover of Peat Moss at Alpine Bogs over time relative to the baseline mean ± one standard deviation (BM±SD)

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3.4.2 Dead Peat Moss

The proportion of dead Peat Moss at impact sites and control sites is shown in Chart 11. The baseline mean proportion of dead Peat Moss at impact sites was 0.8%. A substantial (albeit statistically insignificant) increase in dead Peat Moss (to an overall proportion of 8.4%) was observed at impact sites in IY1. Such an increase in dead Peat Moss has not been observed since. The proportion of dead Peat Moss at impact sites returned to baseline levels (or lower) in IY2, IY3 and IY4, before increasing to above baseline levels in IY5. In IY6, no dead Peat Moss was recorded at impact sites, but the proportion of dead Peat Moss at control sites was 3.9%. Changes in the proportion of dead Peat Moss at impact sites compared with control sites before and after construction have not been statistically significant (BACI contrast = 0.0063; SE = 0.0102; F-statistic = 0.3824; numerator DF = 1; denominator DF = 83; P = 0.5380).

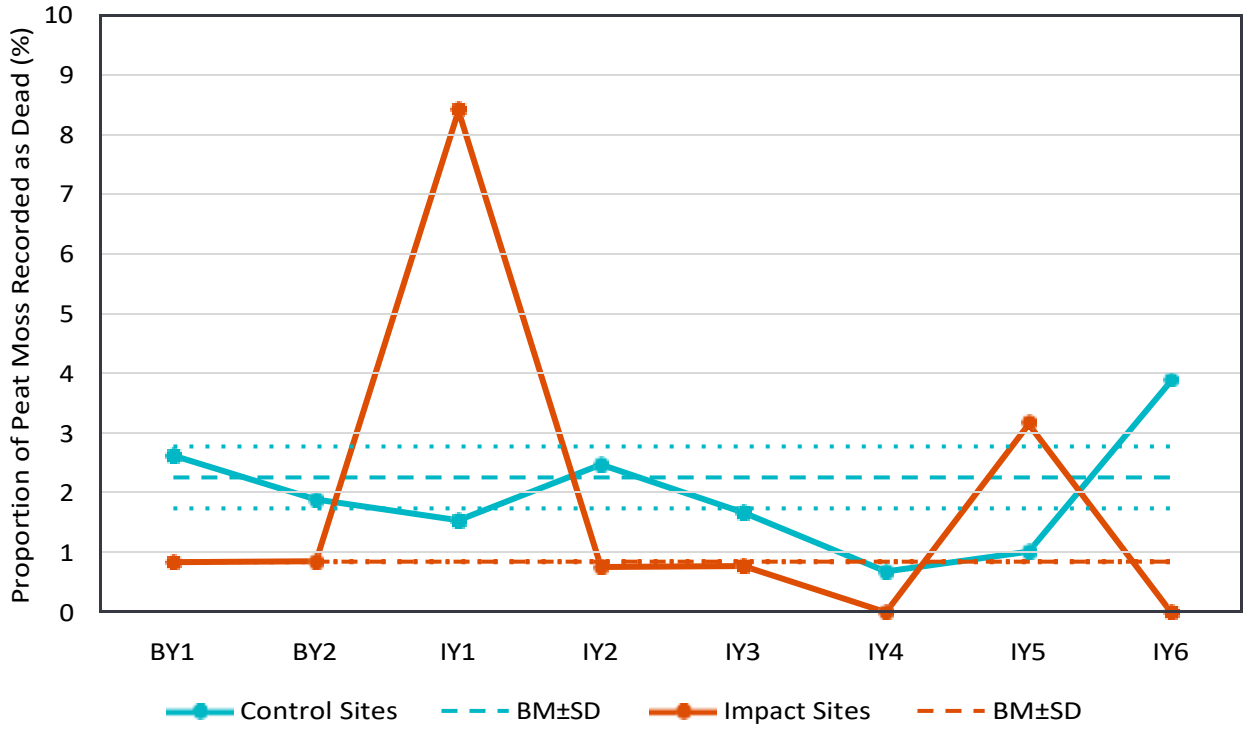

Chart 11 Proportion of Peat Moss recorded as dead relative to the baseline mean ± one standard deviation (BM±SD)

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3.5 Summary of ecological monitoring results

Table 3 summarises the results of the HEMAMP IY6 monitoring in terms of the four performance criteria.

Table 3 Summary of ecological monitoring results in Impact Year 6

Parameter	Site	Baseline Mean (BM) ±Standard Deviation	IY6	Change (BM to IY6)	% Change (BM to IY6)
Extent					
Area (ha)	Impact sites	1.3667 ±0.0185	1.4037	+0.0370	+2.7%
	Control sites	2.0812 ±0.0897	2.2162	+0.1350	+6.5%
Sum of dimensions (m)	Impact sites	354.7 ±2.1	353.4	-1.3	-0.4%
	Control sites	438.8 ±4.0	438.4	-0.4	-0.1%
Composition					
Bog-dependent species richness	Impact sites	9.5 ±0.7	9	-0.5	-5.3%
	Control sites	10.0 ±0.0	10	0.0	0.0%
Cover of bog-dependent flora (%)	Impact sites	78.2 ±0.4	77.1	-1.1	-1.4%
	Control sites	87.9 ±1.3	88.3	+0.4	+0.5%
Encroachment					
Cover of non-bog-dependent native flora (%)	Impact sites	45.2 ±1.2	41.5	-3.7	-8.1%
	Control sites	45.1 ±1.3	38.9	-6.2	-13.8%
Cover of weeds across entire transects (%)	Impact sites	5.9 ±0.6	6.3	+0.5	+8.2%
	Control sites	4.3 ±1.4	4.6	+0.2	+5.2%
Cover of weeds within Alpine Bogs (%)	Impact sites	2.5 ±0.6	3.7	+1.1	+45.1%
	Control sites	2.5 ±1.3	2.9	+0.4	+16.1%
Structure					
Cover of Peat Moss (%)	Impact sites	5.4 ±0.1	6.0	+0.6	+11.9%
	Control sites	16.4 ±1.2	16.8	+0.4	+2.7%

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4. Discussion

Construction of the water storage project started in October 2019 (midway through IY1) and finished in May 2020 (at the end of IY1). Monitoring in IY1 and IY2 detected that construction of the water storage and ancillary infrastructure had caused noticeable impacts on several downslope Alpine Bogs at Mount Buller, particularly Bogs 4.2, 6, 11.2 and 12 (all impact sites). Impacts on Alpine Bogs were documented in the IY1 and IY2 monitoring reports (Biosis 2020b and Biosis 2021) and included:

- Movement of sediment, large rocks and boulders into and through Alpine Bogs from the Project Construction Footprint (PCF) located upslope.
- Direct removal of approximately 8 square metres of Bog 4.2 along approximately 16 metres of its south-eastern boundary.
- Proliferation of weeds as a result of the above impacts, but particularly in areas affected by sedimentation.

In response to these impacts, ARV prepared an Addendum to the Ecological Rehabilitation Plan (ERP; Biosis 2022a). The ERP Addendum aims to rehabilitate the Alpine Bogs through sediment control, weed management, pest animal control and revegetation. It was officially endorsed by DELWP and DCCEEW in March 2022. However, with consent from DELWP and DCCEEW, ARV began early implementation of parts of the ERP Addendum in December 2021 (i.e. midway through IY3).

A range of management actions started in IY3 and were documented in the IY3 monitoring report (Biosis 2022c). Most of these same management actions continued in IY4, IY5 and again in IY6 as part of the ERP Addendum and/or associated management plans. In IY6, management actions included the following (A. Kirkwood and K. Johnson, ARV, pers. comm., 3 July 2025, 4 July 2025 and 7 August 2025):

- Sediment control, involving installation and maintenance of existing sediment socks and fences.
- Weed control, involving:
  - 753 hours of weed control at Mount Buller and 50 hours of weed control at Mount Stirling, with more than 12 personnel from various organisations (ARV, Biosis, Graduate Gardeners and Buller Ski Lifts).
  - Mostly manual weed removal, but with isolated herbicide treatment (e.g. for woody weeds).
  - Removal of 2.4 tonnes of weed material from Mount Buller and Mount Stirling (Photo 1).
- Pest animal control, including:
  - Authorised deer control (shooting) from late September 2024 to mid-May 2025, involving the culling of eight Sambar Deer *Cervus unicolor*.
  - Opportunistic shooting of European Rabbit *Oryctolagus cuniculus* by contracted cat-trappers.
- Revegetation, involving infill planting of 2,372 tubestock from March 2025 to May 2025, concentrating on areas in which weed control was undertaken within and adjacent to the Alpine Bogs (Photo 2, Photo 3 and Photo 4).

Some of the positive effects of the above management actions are reflected in IY6 monitoring results and are discussed in the following sub-sections of this report.

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4.1 Bog extent

4.1.1 Extent of impact sites relative to all control sites

The performance criterion related to bog extent requires that there be no more than a 10% reduction in the total combined area of impact sites, relative to control sites. Further to this, Condition 2b of EPBC Act Approval 2014/7303 requires that there is no more than a 0.0900-hectare reduction in the total combined area of 'indirectly affected areas of Alpine Bog', relative to baseline monitoring and control sites. The approval defines 'indirectly affected areas of Alpine Bog' as Bogs 4.2, 6, 8, 9, 10, 11.2 and 12 (i.e. all impact sites except Bog 13).

As at IY6, neither of the performance thresholds (10% or 0.0900-hectare reduction) have been reached. There has been a 3.8% reduction in the total combined area of impact sites relative to control sites and the total combined area of 'indirectly affected areas of Alpine Bog' is 0.0364 hectares greater than the baseline mean. Artificial watering (via the environmental watering system), increased weed control efforts in IY5 and IY6 and ongoing revegetation works have resulted in an increase in the collective area of impact sites and a return to the 'green' trigger level threshold for adaptive management, as described in the HEMAMP Protocol (Biosis 2022b). The 'green' threshold is met when there is less than or equal to a 5% reduction in the area of impact sites relative to control sites (Biosis 2022b).

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Despite positive trends since IY3 and a return to the 'green' trigger level threshold in IY6, ongoing management actions and effort at impact sites will be required. In particular, weed control and revegetation should continue at Bog 6.

4.1.2 Extent of impact sites relative to Mount Buller control sites

The relative decline in area of impact sites has been driven by a greater increase in the area of control sites compared to the increase in area of impact sites. The increase in area of control sites has occurred almost entirely at Mount Stirling, in Bogs S2 and S3 (Chart 1; Appendix 5). Mount Stirling control sites were 0.1337 hectares (14.2%) larger in IY6 compared with their baseline mean. In contrast, the area of Mount Buller control sites has remained relatively stable, at only 0.0013 hectares (0.1%) greater in IY6 than the baseline mean. Similarly, the absolute area (as opposed to relative area) of impact sites in IY6 was 0.0370 hectares (2.7%) greater than the baseline mean (Table 4).

Table 4 Change in Alpine Bog area from baseline mean to Impact Year 6

Site	Area (ha)		
	Baseline Mean (BM) ±Standard Deviation	Impact Year 6	Change (BM to IY6)
All impact sites	**1.3666 ±0.0184**	**1.4037**	**+0.0370 (+2.7%)**
All control sites	**2.0812 ±0.0896**	**2.2162**	**+0.1350 (+6.5%)**
Mount Buller control sites	1.1403 ±0.0360	1.1416	+0.0013 (+0.1%)
Mount Stirling control sites	0.9410 ±0.0536	1.0747	+0.1337 (+14.2%)

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For reasons outlined in the IY3 and IY4 monitoring reports (Biosis 2022c; Biosis 2023), a comparison of impact sites and Mount Buller control sites is likely to be more appropriate for assessing bog extent than a comparison of impact sites with all control sites (Mount Buller and Mount Stirling). When compared with Mount Buller control sites, there has been a 2.6% relative increase in the extent of impact sites as at IY6.

Both results (i.e. comparison with all control sites and comparison with only Mount Buller control sites) are within the 'green' trigger level threshold for adaptive management as at IY6 (Biosis 2022b). However, as documented in IY5, adaptive management actions should continue at impact sites for the following reasons:

- While effective rehabilitation actions have limited and started to reverse some of the construction-related impacts, the direct and indirect effects of construction (e.g. increased weed cover) are still evident at impact sites. The ERP Addendum requires that these impacts be rehabilitated (Biosis 2022a).
- Construction-related impacts may continue to materialise at impact sites in the coming years. For example, despite there now being effective control of sediment movement into Alpine Bogs, sediment that is already present continues to move through the Alpine Bogs, providing opportunities for weeds to colonise.
- The ecological integrity of impact sites has been compromised in some areas, making them more vulnerable to future impacts (whether construction-related or not). For example, Bog 6 now exists as multiple fragments, rather than the single patch that was mapped in baseline monitoring years. Fragmentation was initially caused by sedimentation and weed invasion, but there has been an increase in the number of patches since IY3 because successful weed control and revegetation has 're-established' some of the original areas of Bog 6. This progress towards full rehabilitation must continue.

4.1.3 Further considerations when assessing bog extent

Artificial watering of Mount Buller control sites

In IY3, it was reported that Mount Buller's eastern control sites (Bogs 1, 2 and 11.1) may have benefitted from artificial watering due to accidental but repeated discharge of 20-30 kilolitres of drinking water per week from Baldy Turret tank, located upslope of these control sites. The eastern control sites increased in area in IY3, while the western control site (Bog 4.1/5/7) decreased in area (Biosis 2022c; Table 5). It is unknown when this regular bulk discharge of water from Baldy Turret tank commenced, but the divergence in the areas of eastern and western control sites in IY3 would suggest that the discharge may have commenced in IY1 or IY2 (Biosis 2024).

The discharge of water from Baldy Turret tank ceased in November 2021, midway through IY3. However, this discharge from the tank was replaced by a constant but unquantified discharge of water from the nearby high level water treatment plant (also upslope of the eastern control sites) in around April 2023, towards the end of IY4. This new discharge of water was measured at a rate of approximately 20 kilolitres per week in January and February 2024. Modifications to the water treatment plant in April 2024, towards the end of IY5, stopped the discharge from the water treatment plan for some period (Biosis 2024).

However, in IY6, the water treatment plant was again observed to be discharging water upslope of the eastern control sites. The rate of discharge was approximately 10 kilolitres per week (M. Goddard, Biosis, pers. obs., 31 January 2025) but the discharge was only observed on one of two occasions. When the water treatment plant was re-visited two weeks later, no water was being discharged (M. Goddard, Biosis, pers. obs., 11 February 2025). While the artificial watering of eastern control sites at Mount Buller has not entirely ceased, it appears to have greatly reduced as at IY6.

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The probable reduction in artificial watering of eastern control sites at Mount Buller in IY6 is reflected in monitoring results for bog extent. In IY6, the eastern control sites (Bogs 1, 2 and 11.1) experienced their first reduction in combined area since IY1, after four years of sustained growth. In contrast, the western control site (Bog 4.1/5/7) remained relatively stable in IY6 (a reduction of 1 square metre was recorded), after experiencing an overall loss in area since IY1 (Table 5). It is possible that a recent reduction in artificial watering of eastern control sites has contributed to a reduction in their combined area.

Table 5 Change in area of Mount Buller control sites from baseline mean to Impact Year 6

Mount Buller control sites	Area (ha) Baseline Mean (BM)	IY1 (change from BM)	IY2 (change from IY1)	IY3 (change from IY2)	IY4 (change from IY3)	IY5 (change from IY4)	IY6 (change from IY5)
Eastern sites (Bogs 1, 2 and 11.1)	0.5893	0.5521 (-0.0372)	0.5735 (+0.0214)	0.6037 (+0.0302)	0.6084 (+0.0047)	0.6110 (+0.0026)	0.6069 (-0.0041)
Western site (Bog 4.1/5/7)	0.5509	0.5480 (-0.0029)	0.5597 (+0.0117)	0.5519 (-0.0078)	0.5340 (-0.0180)	0.5348 (+0.0009)	0.5347 (-0.0001)

The decline in the combined area of eastern control sites in IY6 was mostly (but not entirely) attributable to a decline in the extent of Bog 2. The decline in extent of Bog 2 was largely due to recent widespread dieback of Spreading Rope-rush *Empodisma minus*, a bog-dependent species, along the eastern boundary of this control site and colonisation of the dead Spreading Rope-rush by native Snow Grasses *Poa* spp., which are not bog-dependent (Photo 5). The dieback of Spreading Rope-rush is suggestive of a drying substrate and may be linked to the reduction in artificial watering at eastern control sites. For example, less extensive areas of Spreading Rope-rush dieback have been observed in past years when there has been channelisation of water flows through Alpine Bog monitoring sites (e.g. Bog 6). However, recent extensive dieback of Spreading Rope-rush and consequent localised loss of bog extent was also observed in IY6 at the southern end of Bog 4.1/5/7, the western control site, which is not known to have received artificial watering (Photo 6). The cause and permanency of Spreading Rope-rush dieback at Mount Buller control sites is therefore uncertain and warrants further investigation.

Impact Year 6 – Recommendation 2

Areas of Spreading Rope-rush dieback at Mount Buller control sites should be re-visited in IY7 and potential causes investigated.

As noted in previous monitoring reports, Bog 4.1/5/7 may be the most reliable control site for comparison with impact sites, due to the prolonged artificial watering of eastern control sites (Bogs 1, 2 and 11.1). This will potentially continue to be the case for several years, while Bogs 1, 2 and 11.1 continue to respond to the reduction in artificial watering. Bog 4.1/5/7 was 0.0162 hectares (2.9%) smaller in IY6 compared with its baseline mean. If Bog 4.1/5/7 were used as the control against which impact sites were assessed, the relative change in area of impact sites from their baseline mean would be a 5.6% increase as at IY6.

Impact Year 6 – Recommendation 3

Now that artificial watering of Mount Buller's eastern control sites has reduced, ecological monitoring should be alert to a potential decline in the area of these sites and adapt analysis of results accordingly. Analysis of results from Borehole 18 (BH18) may assist.

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Artificial watering of impact sites and consequent dieback

In IY2, small areas of localised dieback of non-bog-dependent species were observed in areas bordering the Alpine Bogs downslope of the PCF (Biosis 2021). In IY3, it was noted that the extent and distribution of this dieback had expanded, so an effort was made to document the locations and estimate the extent of dieback (Biosis 2022c). Most dieback locations were directly downslope of the Environmental Watering System (EWS) and were characterised by waterlogged soils. The IY3 monitoring report therefore recommended that ARV investigate whether the EWS may be contributing to the dieback (Biosis 2022c). An investigation of the EWS by endoscope in IY4 suggested that the EWS was likely contributing to localised hydrological changes (waterlogging) and therefore dieback in non-bog-dependent species bordering impact sites downslope of the PCF (Biosis 2023).

Areas of dieback were re-visited and mapped in IY4, IY5 and IY6. The results of this mapping are summarised in Table 6 and shown in Figure 5. There was a substantial increase in the area of dieback in IY6 compared with IY5 in areas associated with both impact and control sites (Table 6; Photo 7 and Photo 8). The extent of dieback of non-bog-dependent vegetation at Mount Buller remained relatively stable from IY4 to IY5, but increased by more than 80% from IY5 to IY6. It should be noted that the dieback is affecting non-bog-dependent species in both the understorey (e.g. Alpine Leionema *Leionema phylicifolium*) and canopy (i.e. Snow Gum *Eucalyptus pauciflora*; Photo 9). Many areas of dieback continue to be colonised by bog-dependent flora, leading to an expansion in the extent of Alpine Bogs at Mount Buller (mostly impact sites). Some areas of dieback are being colonised by introduced flora, which may necessitate weed control in the near future.

Impact Year 6 – Recommendation 4

Dieback locations must continue to be re-visited in future years to track vegetation recovery or succession and to plan any necessary management interventions e.g. weed control and revegetation.

Table 6 Observations of dieback of non-bog-dependent species near or within Alpine Bogs

Location	Area of dieback of non-bog-dependent species (sq. m)			
	IY3 (estimated)	IY4 (change from IY3)	IY5 (change from IY4)	IY6 (change from IY5)
Associated with impact sites	115	222.8 (+107.8)	230.3 (+7.5)	365.0 (+134.7)
Associated with control sites	29	45.7 (+16.7)	48.2 (+2.5)	140.8 (+92.6)

In October 2024, discharge from the water storage drainage system started to increase, raising concerns of a water storage leak. Dam safety engineers were immediately engaged and a safety plan enacted (A. Kirkwood, ARV, pers. comm., 31 October 2024). Damage to the water storage liner was located on 24 October 2024 and temporarily repaired from 2 to 4 November 2024. The water storage was emptied from 9 to 28 December 2024 and the leak more comprehensively repaired from 15 to 20 January 2025 (A. Kirkwood, ARV, pers. comm., 25 June 2025). The water storage was emptied with the help of snowmaking infrastructure, which allowed for the water storage to be emptied more quickly, for water to be dispersed more broadly across ski slopes and for potential impacts on Alpine Bogs to be minimised. In addition, temporary pipes/hoses were installed in early November 2024 to divert some water from the EWS, around or over Alpine Bogs (e.g. Bog 11.2) and directly into the aqueduct (Photo 10; A. Kirkwood, ARV, pers. comm., 7 November 2024 and 10 January 2025). After the repair works, these pipes were no longer needed and removed on 30 January 2025.

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It is likely that the water storage leak has contributed to the substantial increase in extent of dieback of non-bog-dependent species observed in IY6 (Table 6; Figure 5). Furthermore, it appears that the aqueduct may be dispersing hydrological changes laterally across the slopes below the water storage, meaning that the effects of hydrological changes are not just limited to downslope Alpine Bog impact sites. Of the total dieback area observed at Mount Buller in IY6, more than 70% is associated with impact sites. However, dieback is not restricted to areas directly downslope of the EWS. In IY6, dieback was observed downslope of the eastern half of Bog 11.1 (a control site; Photo 8), in addition to dieback downslope of the western half of control Bog 11.1, which has been recorded since IY3 (Figure 5). These results suggest that the western half of Bog 11.1 may no longer represent a true control site, possibly because the aqueduct is distributing water from the EWS more widely than previously thought (potentially within culverts that are now buried below Alpine Bog vegetation). As suggested in the hydrological monitoring report for IY6 (GHD 2025), a hydrological review of the Boggy Creek catchment may be warranted and would assist in interpreting ecological results.

Impact Year 6 – Recommendation 5

The status of Bog 11.1 as a control site should be reviewed, based on observed hydrological changes and dieback. This would be assisted by a hydrological review of the Boggy Creek catchment, with updated modelling of Alpine Bog catchment areas and investigation of the role of the aqueduct in water dispersal.

Regeneration of Alpine Bog vegetation on northern slopes of Mount Buller

In response to Recommendation 4 of the IY5 monitoring report (Biosis 2024), ARV commissioned Biosis to map new Alpine Bog vegetation within the Boggy Creek catchment (so-called 'new sites', downslope of the water storage and upslope of Bog 13) and to re-visit Alpine Bogs that were newly identified and mapped in BY2 (so-called 'other sites', as they have not been assigned as control or impact sites). A total of 36 Alpine Bogs were mapped, totalling 0.8846 hectares (Table 7; Figure 2) and summarised as follows:

- One Alpine Bog that has been mapped annually (Bog 3). This Alpine Bog is small, upslope of the western control site and it has decreased in area by almost 50% since baseline monitoring (from a baseline mean of 0.0134 hectares to 0.0071 hectares in IY6).
- Seven Alpine Bogs that were first identified and previously mapped in BY2 (Bogs 18 to 24; Photo 11). These Alpine Bogs are mostly downslope of the eastern control sites and have increased in area by approximately 12% since baseline monitoring (from 0.3466 hectares in BY2 to 0.3888 hectares in IY6).
- Twenty-eight Alpine Bogs that have never been previously mapped (Bogs 25 to 52). The total combined area of Bogs 25 to 52 is 0.4887 hectares. Their locations are as follows (Figure 2):
  - One Alpine Bog (Bog 30) is immediately downslope of the western control site (Photo 12).
  - Thirteen Alpine Bogs (Bogs 32, 33, 34, 36, 38, 40, 42, 44, 46, 47, 48, 49 and 51) are immediately downslope of impact sites (e.g. Photo 13).
  - Fourteen Alpine Bogs (Bogs 25, 26, 27, 28, 29, 31, 35, 37, 39, 41, 43, 45, 50 and 52) are immediately downslope of the eastern control sites and many are closely associated with the seven Alpine Bogs first identified in BY2 (e.g. Photo 14).

Two main factors are likely to have contributed to the regeneration of Alpine Bog vegetation on the northern slopes of Mount Buller. First, Buller Ski Lifts began implementing a vegetation management plan across the Mount Buller ski field in 2011 (Biosis Research 2011), which has reduced the frequency and intensity of vegetation grooming on ski trails in the Boggy Creek catchment (compare Photo 15 and Photo 16). Second, recent hydrological changes within the Boggy Creek catchment (as documented by HEMAMP monitoring) are likely to have made conditions more favourable for growth and proliferation of Alpine Bog vegetation.

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Table 7 Additional Alpine Bogs (new sites and other sites) mapped at Mount Buller in IY6

Bog ID	Years Mapped	IY6 Area (ha)	Bog ID	Years Mapped	Area (ha)
3	All Years	0.0071	**35**	IY6	0.0009
18	BY2, IY6	0.0511	**36**	IY6	0.0607
19	BY2, IY6	0.0072	**37**	IY6	0.0019
20	BY2, IY6	0.0126	**38**	IY6	0.0009
21	BY2, IY6	0.0046	**39**	IY6	0.0008
22	BY2, IY6	0.0026	**40**	IY6	0.0384
23	BY2, IY6	0.0964	**41**	IY6	0.0007
24	BY2, IY6	0.2144	**42**	IY6	0.0368
25	IY6	0.0020	**43**	IY6	0.0018
26	IY6	0.0035	**44**	IY6	0.0025
27	IY6	0.0027	**45**	IY6	0.0004
28	IY6	0.0031	**46**	IY6	0.0057
29	IY6	0.0069	**47**	IY6	0.0016
30	IY6	0.0422	**48**	IY6	0.0013
31	IY6	0.0017	**49**	IY6	0.2491
32	IY6	0.0003	**50**	IY6	0.0070
33	IY6	0.0044	**51**	IY6	0.0022
34	IY6	0.0052	**52**	IY6	0.0043
Total for Other Sites in IY6	**IY6**	**0.8846**	**Total for Newly Mapped in IY6**	**IY6**	**0.4887**

It is possible that regular vegetation grooming (slashing) meant that scattered Alpine Bog plants persisted in a supressed state, below or in conjunction with non-bog-dependent species. Reduced grooming frequency and intensity has likely given Alpine Bog plants greater opportunity to grow, reproduce and out-compete non-bog-dependent species, becoming more connected and dominant. Connectivity is important because there is a minimum number of bog-dependent species that must be present within a patch for the Alpine Bog community to be considered present (Appendix 3).

Regeneration of Alpine Bog vegetation may have also been promoted by the same hydrological changes (increased and more widespread waterlogging) that appear to have caused vegetation changes further upslope, such as dieback of non-bog-dependent species and expansion of most impact sites and eastern control sites since baseline monitoring. Indeed, some newly mapped areas of dieback in IY6 (e.g. Location D20) are linked directly or indirectly to newly mapped Alpine Bogs (Figure 5; Photo 8). Moreover, most of the Alpine Bogs that were first mapped in BY2 (Bogs 18 to 24) have since expanded in area and there are now several newly mapped Alpine Bogs in close association.

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Finally, there appears to have also been an interaction (positive feedback loop) between reduced vegetation grooming and hydrological change. Many of the new sites and other sites are associated in some way with artificial drainage infrastructure (e.g. ditches and culverts) that was historically installed for maintenance of the ski slopes. However, reduced vegetation grooming has resulted in greater accumulation of organic matter, which has impeded the flow of water through the drainage infrastructure and provided conditions that are conducive to growth of Alpine Bog vegetation (DoE 2015). This interaction between reduced vegetation grooming and hydrological change may explain why so many additional Alpine Bogs were mapped in IY6 (new sites) and why the Alpine Bogs that were first mapped in BY2 (other sites) have had a more pronounced overall expansion in area than any of the impact sites or control sites at Mount Buller.

Impact Year 6 – Recommendation 6

Consider periodically revisiting newly mapped Alpine Bogs to note any catchment level changes that may be occurring. Consider allocating newly mapped Alpine Bogs and Alpine Bogs previously mapped in BY2 to either impact sites or control sites, based on further hydrological analysis of the catchment (e.g. updated modelling of the catchment areas of Alpine Bogs).

Impact Year 6 – Recommendation 7

When the HEMAMP Protocol (Biosis 2022b) is next updated, it should be updated with additional details on Alpine Bog mapping, including the following:

- The updated HEMAMP Protocol should provide information on any Alpine Bogs that have been newly mapped since baseline monitoring, regardless of whether these new Alpine Bogs are formally incorporated into the long-term monitoring program.
- The updated HEMAMP Protocol should confirm that the cover of canopy trees greater than 3 metres tall is disregarded when assessing the dominance of bog-dependent species and therefore defining Alpine Bog extent.
- The updated HEMAMP Protocol should clarify that, unlike new Alpine Bogs, Alpine Bog fragments (e.g. at Bog 6) are mapped and included in bog extent regardless of the number of bog-dependent species in the fragment. Bog fragments exist in areas that were previously mapped as Alpine Bog and are important to document for tracking management actions, such as weed control.

Damage caused by monitoring and management

Ecological monitoring methods have been carefully designed to minimise the potential impacts that monitoring itself may have on Alpine Bogs, such as impacts from trampling (Biosis 2022b). Nevertheless, the effects of trampling have been noted in some locations, primarily at the start and/or end of some monitoring transects at Mount Stirling (e.g. Photo Point S2AS and Photo 17). In IY6, it was noticed that a growing and more prominent issue was inadvertent damage caused by the intensive management of Alpine Bogs that has taken place since IY3.

Management of Alpine Bogs will often involve teams of two or three personnel visiting a particular Alpine Bog location over many days during the active growth seasons to remove weeds, install sediment controls and revegetate with native species. Several follow-up visits may be needed each year and there may be times when crews of approximately ten personnel are needed. Implementing management actions often requires heavy equipment and materials, such as rolls of jute mat or large bags of weeds, which need to be carried in or out on foot. This contrasts with ecological monitoring, which typically involves up to five or six personnel visiting an Alpine Bog once per year, with relatively lightweight equipment and minimal ground disturbance.

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For the most part, personnel involved in monitoring and management aim to use existing tracks, to walk through vegetation that is already disturbed (e.g. along the aqueduct at Mount Buller) or to take varied routes so as not to concentrate any trampling on a single area of Alpine Bog. However, there are locations where these techniques are not feasible, meaning that the intensive management of Alpine Bogs is resulting in the formation of informal tracks through some sensitive Alpine Bog locations, such as Bog 4.1/5/7 (along the aqueduct), Bog 6 (Photo 18) and Bog 8/9/10 (Photo 19). If these impacts continue, the informal tracks are likely to contribute to the fragmentation of Alpine Bogs, primarily impact and control sites at Mount Buller.

To minimise the risk of fragmentation of Alpine Bogs from monitoring and management damage, formalised tracks that avoid Alpine Bog vegetation may need to be provided in some locations. If this is not feasible, dedicated 'stepping stones' may need to be provided so that connectivity of Alpine Bog vegetation is maintained, while still allowing access on foot. These 'stepping stones' could be made of coir logs, like many of the sediment socks that are already used (Photo 20). If possible, the coir logs should be preferentially placed on weed species to smother them or within the main drainage channel to slow the flow of water. As with sediment socks, the 'stepping stones' would require regular maintenance and replacement.

Impact Year 6 – Recommendation 8

At locations where informal management tracks are forming through sensitive Alpine Bogs, ARV should provide alternative formalised tracks or coir log 'stepping stones' to minimise the risk of fragmentation of the Alpine Bogs. If coir logs are used, they should be preferentially placed on weed species or within main drainage channels.

Impact Year 6 – Recommendation 9

When the HEMAMP Protocol (Biosis 2022b) is next updated, it should be updated to clarify that organic litter includes mulch, coir logs and jute mat that may have been placed for management purposes.

Bare ground and sedimentation

The overall cover of bare ground increased from 1.6% in IY5 to 1.9% in IY6 at impact sites and reduced from 2.6% in IY5 to 1.3% in IY6 at control sites. At impact sites in IY6, 78.9% of bare ground was considered natural and the remaining 21.1% was attributed to deer activity. At control sites in IY6, 46.2% of bare ground was attributed to deer activity, entirely at Mount Stirling (Chart 4).

Bare ground attributable to deer activity at Mount Buller impact sites increased from 0.1% in IY5 to 0.4% in IY6, which correlates with on ground observations of increased deer activity at Mount Buller during IY6 monitoring. Extensive impacts of Sambar Deer (e.g. trampling, wallowing and ring-barking of shrubs) were observed in IY6 within all Mount Buller monitoring sites, except Bogs 11.2 and 13 (Photo 21). In addition, Sambar Deer activity was observed at many of the newly mapped Alpine Bogs in IY6, suggesting that the Mount Stirling deer control and deterrence program should be extended to include Mount Buller.

Hydrological monitoring recorded elevated turbidity and total dissolved solids (TDS) in surface water within the Boggy Creek catchment in IY6 (GHD 2025). However, ecological monitoring recorded no bare ground attributable to sedimentation in IY6 (Chart 4). Through installation and maintenance of sediment socks and fences, it appears that ARV was successful at preventing movement of sediment from the PCF into impact sites. While increased weed control efforts in Alpine Bogs in IY6 may have remobilised sediment that was ultimately detected by hydrological monitoring but not ecological monitoring, it is likely that increased deer activity at Mount Buller is a major cause of increased turbidity and total dissolved solids in IY6.

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Impact Year 6 – Recommendation 10

ARV should extend its Mount Stirling deer control program (currently a component of the Mount Stirling Offset Site management) to Mount Buller in response to the observed increase in deer impacts within Mount Buller Alpine Bogs in IY6.

4.2 Bog composition

The performance criterion relating to the composition of the Alpine Bogs is expressed in terms of bog-dependent species richness (i.e. number of bog-dependent species). It requires that there be no more than a 10% reduction in the total bog-dependent native flora species richness of the impact sites, taking into account natural variation based on species richness observations averaged across control sites. If Mountain Baeckea *Baeckea utilis s.l.* is treated as a single bog-dependent taxon (as opposed to two species), the baseline mean bog-dependent species richness was 9.5 (i.e. an average of nine to ten species) at impact sites and 10 at control sites. In practice, this means that there would need to be a net loss of two bog-dependent species from impact sites relative to control sites for there to be greater than a 10% reduction in bog-dependent species richness at impact sites.

In IY6, nine bog-dependent species were recorded along monitoring transects at impact sites and 10 bog-dependent species were recorded along monitoring transects at control sites. While bog-dependent species richness at control sites in IY6 was equal to the baseline mean, bog-dependent species richness at impact sites in IY6 was 0.5 species (or 5.3%) lower than the baseline mean. This is the same result that has been observed since IY2 (Chart 5). The result is attributable to one bog-dependent species, Silver Astelia *Astelia alpina* var. *novae-hollandiae*, not being detected along monitoring transects at impact sites, despite being detected along monitoring transects during one of the two baseline monitoring years.

Silver Astelia has not been lost from impact sites entirely, as it has been incidentally observed outside of transects at Bogs 4.2, 6 or 12 in BY1, IY4, IY5 and IY6 (Figure 6). The failure of transect monitoring to detect Silver Astelia since IY1 may be due to natural vegetation succession, seasonal conditions or observer error. Alternatively, localised construction-related impacts, such as sedimentation, may have resulted in the loss of this species from along transects.

Nevertheless, propagation of Silver Astelia commenced in 2023 with the aim of re-introducing the species to impact sites in the general areas where it has previously been recorded. Nine plants were planted at five locations in and around Bog 4.2 on 14 May 2024 in or near dieback locations D11/14, D12, D13 and D13.1, which border Bog 4.2 and are within 1-35 metres of Transect 4.2B, where Silver Astelia was previously recorded (Figure 5; Figure 6). Upon revisiting the planted Silver Astelia during IY6, the individuals were not located and were considered to have been lost due to deer browsing, deer trampling and/or flooding. This conclusion was based on observations from the planting locations (e.g. deer prints, deer scats and flowing/pooling water) and observations from the existing Silver Astelia colony within Bog 4.2 (Photo 22).

ARV received a further 15 Silver Astelia plants in autumn 2025. However, it was considered that the plants would benefit from being held over winter and planted into ideal recipient locations in spring 2025 or autumn 2026 (A. Kirkwood, ARV, pers. comm., 7 August 2025). There is still some uncertainty about the hydrological changes in and around Bog 4.2 after the water storage leak. Hydrological conditions in and around Bog 4.2 were still in a state of flux in autumn 2025, with waterlogging and flooding still present in novel areas. These hydrological changes caused extensive dieback of non-bog-dependent flora around Bog 4.2 in IY6 and are suspected to have contributed to the loss of the nine Silver Astelia plants that were planted there in autumn 2024. It was considered best to wait for conditions to stabilise before introducing more Silver Astelia plants.

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Impact Year 6 – Recommendation 11

Bog-dependent species richness at impact sites relative to control sites has remained 5.3% lower than the baseline mean (i.e. at the 'amber' trigger level) for three consecutive years, meaning that efforts to re-introduce Silver Astelia to impact sites must be increased in IY7 e.g. by planting a greater number of Silver Astelia plants or by better protecting Silver Astelia plants from deer.

Impact Year 6 – Recommendation 12

ARV should plant all available and suitable Silver Astelia plants in spring 2025 or autumn 2026. New planting locations may need to be chosen, as the original locations may no longer be suitable. Planting locations should be recorded with a DGPS to assist with relocation, to monitor survivorship and to plan follow-up management actions, such as weed control or herbivore management. If any of the planted Silver Astelia die, they should be replaced either at the same location (if conditions for re-introduction are still suitable at this location) or at a new location (if conditions for re-introduction are no longer suitable at the original location or better elsewhere).

Impact Year 6 – Recommendation 13

As more Silver Astelia plants become available, ARV should consider planting them into Bog 6 and Bog 12, given that the species has been previously recorded at these impact sites.

4.3 Encroachment by weeds and other atypical species

4.3.1 Encroachment by weeds

Types of weed cover

In 2013/2014, Mount Buller's Alpine Bogs were recorded as having less than 5% weed cover (Biosis and GHD 2016). This was based on visual estimates undertaken within Alpine Bogs during vegetation quality assessments. As a result, the HEMAMP's encroachment performance criteria require that the total cover of weeds within impact sites does not exceed 5% (Biosis 2022b). Note that the requirement is for weed cover to not exceed 5% within the Alpine Bogs, not within the Alpine Bogs and surrounding vegetation. Note also that this is the only performance criterion that references absolute cover, rather than relative cover (impact sites relative to control sites).

Historically, weed cover has been assessed and reported along the entire lengths of monitoring transects. This is not an accurate assessment against the relevant performance criterion because each permanent monitoring transect was established during BY1 such that it started and ended 1.5-4 metres outside of the Alpine Bog monitoring site. This means that each monitoring transect potentially passes through 3-8 metres of vegetation surrounding the Alpine Bog. Surrounding vegetation generally has a higher weed cover than the Alpine Bog itself and, in some cases, surrounding vegetation may not even be native vegetation. An estimate of weed cover along the entire lengths of monitoring transects is therefore not a true representation of weed cover within impact sites or of the weed control effort that ARV has been undertaking within impact sites.

A better assessment of weed cover against the relevant performance criterion would be along only those parts of the transects that are within the Alpine Bogs. This analysis was undertaken for the first time in IY5 and again in IY6. However, the Alpine Bog boundaries are dynamic – they fluctuate from year to year and, in a

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few cases, have expanded beyond the ends of transects since baseline monitoring. Limiting weed cover estimates to those parts of transects within the current Alpine Bog boundaries would therefore introduce an additional layer of temporal variability and complexity. Instead, analysis of weed covers within Alpine Bogs focussed on the baseline mean start and end points of the Alpine Bogs along the transects. This provides a fixed length of transect over which comparisons can be made from year to year (a fixed baseline). The fixed baseline approach provides a more accurate assessment against the relevant performance criterion i.e. the requirement that weed cover not exceed 5% within Alpine Bog impact sites.

For consistency with past reporting and to provide a holistic assessment of weed covers, we have continued to report weed cover along entire transects in IY6. However, we have also undertaken more detailed analysis and reported weed covers within Alpine Bogs only, which better assesses the performance of weed control and better informs future management efforts.

Summary of weed covers observed to date

A summary of IY6 results for the two types of weed cover is as follows:

- Weed cover along entire transects inside and outside of Alpine Bog impact sites:
  - Based on IY6 results, the weed cover along entire transects at impact and control sites appears to be reducing, but remains higher than the baseline mean.
  - After increasing each year since monitoring began, weed covers along entire transects at impact sites reached a peak of 8.8% in IY3 and have since declined to 6.3% in IY6 (Chart 8). By comparison, weed covers along entire transects at control sites peaked at 5.5% in IY3 and have since declined to 4.6% in IY6 (Chart 8).
  - If the HEMAMP's performance criterion for weed cover were assessed on the basis of weed cover along entire transects at impact sites, the IY6 results would be non-compliant because weed covers along entire transects at impact sites exceed 5%.
  - However, it should be noted that weed covers along entire transects at impact sites have exceeded 5% since monitoring began (i.e. even during baseline monitoring) and, in IY6, have returned to the same level that was recorded in BY2. It should also be noted that weed covers along entire transects at control sites have also exceeded 5% in the past (in BY2, IY3, IY4 and IY5).
- Weed cover along parts of transects within the baseline mean extent of Alpine Bog impact sites:
  - Based on IY6 results, the weed cover within impact sites appears to have stabilised.
  - After diverging from control sites in IY1 and IY2, weed cover within impact sites reached a peak of 5.1% in IY3, before declining to 3.5% in IY4, 3.6% in IY5 and 3.7% in IY6 and reconverging with control sites (Chart 9; Photo Point 6CE).
  - If the HEMAMP's performance criterion for weed cover were assessed on the basis of weed cover within impact sites (as the wording of the criterion would require), the IY6 results would be compliant because weed cover within impact sites does not exceed 5%.
  - So far, IY3 is the only year in which weed cover within impact sites has exceeded the performance criterion threshold of 5%. While intensive weed management and revegetation action started in IY2, these actions were scaled up in IY3 in response to on-ground observations of weed cover that year, which represented the 'red' trigger level for adaptive management, as per the HEMAMP Protocol (Biosis 2022b).

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- Weed cover within impact sites returned to the 'amber' trigger level in IY4 and has remained within the 'amber' trigger level for three consecutive years (IY4, IY5 and IY6). The 'amber' trigger level corresponds with a weed cover that is greater than 2.5% but less than or equal to 5% (Biosis 2022b). In accordance with the HEMAMP Protocol, as weed cover within impact sites has not return to the 'green' trigger level (i.e. less than or equal to 2.5%) within three years, weed control at impact sites will need to be scaled up in IY7 (Biosis 2022b).

Interpretation of weed cover results

Weed cover results from IY6 reflect the timing, intensity and location of weed control effort that ARV has invested across impact and control sites since IY2. Weed covers across entire transects have remained higher at impact sites relative to control sites throughout the post-construction period, whereas weed covers within the Alpine Bogs have returned to similar levels at impact sites and control sites after a temporary post-construction increase at impact sites. This is likely to be because ARV's weed control effort since IY2 has largely been concentrated within the Alpine Bogs themselves, rather than extending into the vegetation surrounding the Alpine Bogs. Despite most weed control effort since IY2 being concentrated within Bog 6, weed covers within this impact site decreased from 14.2% in IY3 to 8.7% in IY4 but increased to 9.9% in IY5 and 10.2% in IY6 (Appendix 5).

The increased post-construction weed cover in vegetation surrounding impact sites may also be partly due to an increased weed cover upslope within the PCF since construction of the water storage. Monitoring of the ERP implementation and visual analysis of photos taken since baseline monitoring would suggest that weed cover has increased across parts of the PCF in recent years (Creative Lines 2024). This increased weed cover, immediately upslope of many of the impact sites, is likely to be a significant source of weed propagules that may colonise any disturbed ground within and around Alpine Bogs. Monitoring of the ERP implementation within the PCF and HEMAMP monitoring at Alpine Bog impact sites has shown similar trends. Now that ARV has commenced more rigorous monitoring of the PCF in IY6, this will assist in directing targeted control of weeds in the PCF.

Impact Year 6 – Recommendation 14

As the weed cover within impact sites has remained within the 'amber' trigger level for three consecutive years, ARV should increase weed control effort within impact sites in IY7 compared with IY6.

Impact Year 6 – Recommendation 15

ARV should increase weed control effort in vegetation surrounding impact sites and within the Project Construction Footprint of the water storage, as this will reduce weed propagule loads within the impact sites themselves.

4.3.2 Encroachment by native non-bog-dependent species

The performance criterion for atypical species requires that there be no more than a 10% increase in the cover of non-bog-dependent species at impact sites, relative to control sites. A divergence of impact sites from control sites with respect to cover of non-bog-dependent species was detected in IY1 and has persisted since. In BY1, the cover of non-bog-dependent flora was 44.4% at impact sites and 44.2% at control sites. In BY2, the cover of non-bog-dependent flora was 46.1% at impact sites and control sites alike. From IY1 to IY6, the cover of non-bog-dependent flora has been consistently 1.4% to 3.7% higher at impact sites relative to control sites (Chart 7).

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In IY6, the cover of non-bog-dependent flora was 2.7% higher at impact sites relative to control sites, which represents a relative increase of 5.7% in the cover of non-bog-dependent flora at impact sites. While encroachment by native non-bog-dependent species has therefore been within the 'amber' trigger level for adaptive management for two consecutive years, it is not currently cause for concern because the absolute cover of non-bog-dependent species is below baseline mean levels at impact sites (Chart 7). The cover of non-bog-dependent flora at impact sites in IY6 was 8.2% below the baseline mean. This means that there is no evidence that the impact sites are currently transitioning to non-bog-dependent native vegetation.

4.4 Bog structure

The structure criterion requires that there be no more than a 10% reduction in the average cover of Peat Moss at impact sites, relative to control sites. The cover of Peat Moss has remained relatively stable at impact and control sites across monitoring years. The baseline mean cover of Peat Moss at impact sites and control sites was 5.4% and 16.4% respectively. In IY6, the cover of Peat Moss at impact sites and control sites was 6.0% and 16.8% respectively. While this represents a 5.7% increase in the cover of Peat Moss at impact sites relative to control sites, it is not statistically significant.

After a peak in the proportion of dead Peat Moss recorded along transects at impact sites in IY1, the proportion of dead Peat Moss at impact sites returned to baseline levels or lower in IY2, IY3 and IY4. At 3.1%, the proportion of dead Peat Moss was again elevated above baseline levels at impact sites in IY5, but no Peat Moss was recorded as dead at impact sites in IY6 (Chart 11). Bog 4.2 remains the only impact site at which dead Peat Moss has been recorded, apart from in IY1 (i.e. during construction of the water storage), when an increase in the proportion of dead Peat Moss was observed and dead Peat Moss was recorded more widely across impact sites (Appendix 5).

4.5 Triggers for adaptive management

The HEMAMP Protocol uses a 'traffic light' approach to adaptive management triggers, where the level of management intervention is escalated as the risk of adverse impacts on the ecological values of the impact sites increases, from 'green' to 'amber' to 'red' (Biosis 2022b).

The following ecological trigger levels have been reached:

- 'Green' trigger level, on the basis of the following criterion:
  - Bog extent – There has been a 3.8% decrease in the extent of impact sites, relative to control sites. This criterion returned to the 'green' trigger level threshold in IY6, after being 'amber' for three consecutive years. To maintain this result, continued weed control, revegetation and monitoring will be required, along with increased control or deterrence of deer at Mount Buller.
  - Bog structure – There has been a 5.7% increase in Peat Moss cover at impact sites, relative to control sites. No management actions are required to address this result, although HEMAMP monitoring, in-depth analysis and reporting must continue.
- 'Amber' trigger level, on the basis of the following criteria:
  - Bog composition – There has been a 5.3% decrease in bog-dependent species richness at impact sites, relative to control sites, due to Silver Astelia not being observed along monitoring transects at impact sites in IY6. Propagation of this species commenced in IY4 and the first plants were re-introduced to Bog 4.2 in IY5. While these plants were not relocated, more Silver Astelia are planned for planting in spring 2025 or autumn 2026.

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- Encroachment by atypical species – There has been an 5.7% increase in the cover of non-bog-dependent species at impact sites, relative to control sites. No intervention is required at this stage to address this result, given that the absolute cover of non-bog-dependent species has actually declined to below baseline mean levels. However, this performance criterion must continue to be monitored and analysed in future years.
- Encroachment by weeds – Weed cover within impact sites was 3.5% in IY4, 3.6% in IY5 and 3.7% in IY6, meaning this criterion has been within the 'amber' trigger level for three consecutive years. This represents an improvement from IY3, when weed cover within impact sites was 5.1% and therefore within the 'red' trigger level. However, a greater weed control effort will be needed in IY7 than was invested in IY6 in order to meet the 'green' threshold.

In accordance with the HEMAMP Protocol (Biosis 2022b), if performance criteria that are within the 'amber' trigger level do not return to the 'green' trigger level within three years, management actions and effort will need to be increased. The bog composition and weed encroachment performance criteria have been within the 'amber' trigger level for at least three consecutive years, meaning that management actions to address these performance criteria will need to be scaled up in IY7. This is reflected in the recommendations of this report.

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4.6 Key observations and required management actions at each monitoring site

Table 8 summarises the key observations made at each monitoring site in IY6 and recommended management actions.

Table 8 Observations made at monitoring sites in IY6 and management priorities

Bog	Observations in IY6	Priority
Impact sites		
Bog 4.2	This impact site is showing signs of recovery and appears to be expanding into areas of surrounding dieback (Photo 7). However, this site received large volumes of water via the EWS during the water storage leak and deer activity within this site appears to have increased in IY6 (Photo 21). As a result, dieback of surrounding non-bog-dependent flora has increased (Photo 9), there has been localised dieback of some bog-dependent plants (e.g. existing Silver Astelia; Photo 22) and planted Silver Astelia from IY5 have not persisted. Weeds (e.g. Sheep Sorrel) are colonising deer tracks and some areas of dieback. Deer appear to be a vector for some of these weeds. The south-east boundary of Bog 4.2 (where Bog 4.2 meets the PCF) is recovering but would benefit from dense in-fill planting of bog-dependent species (e.g. Carpet Sedge) and herbivore control. Overall, weed control, deer control and revegetation must be scaled up at this location in IY7.	High priority for weed control, deer control, rabbit control and revegetation.
Bog 6	Weed control and revegetation efforts over the last three years (e.g. Photo 4) have meant that this impact site has returned to its baseline mean extent for the first time. However, the recovery of this site is patchy. It is now a highly fragmented system (17 fragments) with a perimeter-to-area ratio that is double what it was in baseline years. This site requires ongoing management, including in-fill plantings to connect fragments and proactive weed control, deer control and deer deterrence. The potential impacts of management activities (e.g. informal tracks) will need to be addressed (e.g. with coir log 'stepping stones').	High priority for weed control, deer control/ deterrence, revegetation and track formalisation.
Bog 8/9/10	The area of this impact site has increased as bog-dependent species have filled the void left by the dieback of surrounding non-bog-dependent species. Weed cover has returned to baseline levels. However, impacts of management activities (e.g. informal tracks) will need to be addressed (e.g. with coir log 'stepping stones').	High priority for track formalisation.
Bog 11.2 and 12	These bogs are immediately upslope (Bog 11.2) and downslope (Bog 12) of each other and have similar management issues. Both sites received large volumes of water via the EWS during the water storage leak. Weed cover is relatively low in both sites, but weeds persist in areas previously affected by sedimentation and deer activity has recently increased (which may increase opportunities for weed dispersal and colonisation).	Moderate priority for weed control and deer control.

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Bog	Observations in IY6	Priority
Bog 13	Despite the small size and isolation of this impact site (it is surrounded by introduced vegetation), it is in relatively good condition. Weed cover at this impact site has returned to below baseline levels for the first time. Peat Moss cover is almost double baseline levels (at 35.9%, it is the highest Peat Moss cover since monitoring started). However, several rocks (approx. 20-30 cm diameter) were observed within this impact site in IY6. These rocks likely originated from the new Grimus Access Trail that was constructed directly upslope in IY4 (the rocks were not observed in IY5). These rocks should be removed by hand.	Moderate priority for sediment control. Low priority for weed control.
Control sites		
Bog 1	This control site has been subject to artificial watering from Baldy Turret tank and/or the high level water treatment plant. The site should be monitored for subsequent drying and consequent incursion of weeds and/or non-bog-dependent species. Soft Rush is present on the northern boundary of this site, along the edge of the Summit Nature Walk. These plants need to be removed or killed. Given the proximity of this location to the walking trail and its sensitivity to erosion, herbicide treatment followed by revegetation may be the most appropriate method. Soft Rush and Sword Rush are also present near the south-eastern extent of this site, near the water treatment plant, which is used as a point of access for management and monitoring purposes. Combined with the presence of high threat weeds, the semi-regular foot traffic at the south-eastern boundary has the potential to fragment this site. ARV should consider installing temporary fencing/flagging to block access and directing personnel to access the area via Pole Line 6.	High priority for track formalisation. Moderate priority for weed control.
Bog 2	This control site has been subject to artificial watering from Baldy Turret tank and/or the high level water treatment plant. The eastern boundary of Bog 2, near Transect 2A, is subject to severe weed pressures due to historic disturbances to the east of this monitoring site. While weed covers are still relatively high (double the baseline mean), they appear to have stabilised. However, extensive dieback of Spreading Rope-rush was observed along the eastern boundary in IY6 (Photo 5). Potential weed incursions into this dieback will need ongoing monitoring and management.	Moderate priority for weed control.
Bog 4.1/5/7	This Alpine Bog complex has been fragmented by weed proliferation along the aqueduct and north of the aqueduct. The main weeds of concern remain Sword Rush, Musk Monkey-flower and Soft Rush. Further weed control will be needed in IY6, particularly downstream of the aqueduct. Damage from management activities (mainly informal tracks) may worsen fragmentation and impede some weed control efforts. Coir log 'stepping stones' should be installed to minimise this damage.	High priority for weed control and track formalisation.

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Bog	Observations in IY6	Priority
Bog 11.1	Bog 11.1 is the only Mount Buller control site to have noticeably increased in area. However, the north-western branch of this control site remains fragmented due to deer activity and weed proliferation. Dieback of non-bog-dependent flora has previously been recorded along the north-western branches. In IY6, this dieback more than doubled in area and dieback of non-bog-dependent species was observed near the north-eastern branches for the first time (Figure 5). Bog-dependent flora and weed species, such as Soft Rush and Monkey Musk, are colonising the void left by dieback of non-bog-dependent native flora.	Moderate priority for weed and deer control.
Bog S1	The north-western end of this Alpine Bog (near Transect S1A) has been dry in recent years, perhaps due to water flow becoming channelised by past deer and horse activity. In IY6, there were early signs that Alpine Bog vegetation was recovering at this location, following various management efforts, including blocking of the main channel with a coir log (the location was noticeably wetter in IY6 as a result), setting up of deer deterrents and weeding (weed covers were lower than the baseline mean). Deer deterrents appear to have reduced activity within the main wallow but there are still active tracks leading upstream into centre of bog and Musk Monkey-flower along these tracks. Continued deer control, weed control and flow management will be needed (e.g. the coir log will likely need replacing in IY7).	Moderate priority for weed control, deer control and flow management.
Bog S2	In IY5, weeds were recorded along monitoring transects within Bog S2 for the first time. In IY6, weeds were again recorded along transects and bare ground attributed to deer was recorded for the first time. This suggests that weeds (primarily Musk Monkey-flower) and deer are now established at the site. The role of deer as weed vectors has previously been documented at this site, so any attempt at weed control should be accompanied by deer control or deterrence. Damage from transect monitoring is evident at this site (Photo 17) and the proportion of dead Peat Moss is higher than the baseline mean. Efforts should be made to minimise the negative effects of monitoring and management on this Alpine Bog.	High priority for weed control, deer control and trail formalisation.
Bog S3	Weed cover has returned to the lowest levels since IY2 (7.6%, but bare ground attributed to deer is still relatively high (3.2%). Most weed cover and deer activity continues to be recorded at Transect S3C, at the southern end of this control site. However, deer activity and associated weed incursions have also been incidentally observed at the northern end of this site.	High priority for weed and deer control.
Other sites		
Bog 3	This Alpine Bog has not changed greatly since IY5, when it contracted to its smallest extent since monitoring began and, for the first time, was mapped as two fragments rather than one. Proliferation of weeds, such as Soft Rush and Musk Monkey-flower, are the main cause of the reduced extent and fragmentation. Bog 3 is at the headwaters of a drainage line that ultimately enters Bog 6, which is also why Bog 3 should be prioritised for weed control.	High priority for weed control.

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5. Conclusion and recommendations

Eight years of ecological monitoring, including two years of baseline monitoring, have now been completed. The monitoring results allow for an assessment against the HEMAMP's performance criteria. Table 9 presents the results of the compliance assessment as at IY6.

Table 9 Compliance with the HEMAMP performance criteria

Performance criterion	Compliant?	Action required?	Comments
Extent			
No more than a 10% reduction in the total combined area of impact sites, relative to control sites.	Yes	Yes	Total combined area of impact sites, relative to control sites, has decreased by 3.8% (although true value is likely to be closer to 0%). To maintain this result, continued weed control, revegetation and monitoring will be required, along with increased control or deterrence of deer at Mount Buller.
Composition			
No more than a 10% reduction in the total 'bog-dependent' native flora species richness of impact sites, relative to control sites.	Yes	Yes	Silver Astelia was once again not recorded along transects in IY6, resulting in a 5.3% relative decline in bog-dependent species richness at impact sites. More Silver Astelia plants will be re-introduced in IY7.
Encroachment			
No more than a 10% increase in the cover of 'non-bog-dependent' species within impact sites, relative to control sites.	Yes	No	The cover of non-bog-dependent flora species has increased by 5.7% at impact sites relative to control sites. However, the absolute cover of non-bog-dependent flora has declined to below baseline levels.
Weed cover not to exceed 5% within impact sites.	No (for entire transects) Yes (for impact sites only)	Yes	Weed cover along entire transects (inside and outside of Alpine Bogs) was 6.3% in IY6 and has been non-compliant since monitoring started. Weed cover along parts of transects within impact sites (inside Alpine Bogs only) was 3.7% in IY6 and compliant. Weed control is still needed, especially in Bog 6.
Structure			
No more than a 10% reduction in the average cover of Peat Moss within impact sites, relative to control sites.	Yes	No	Peat Moss cover has increased by 5.7% at impact sites relative to control sites. Overall, Peat Moss cover and health is good, with no dead Peat Moss recorded at impact sites in IY6.

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The recommendations of this monitoring report are as follows:

1. Despite positive trends since IY3 and a return to the 'green' trigger level threshold in IY6, ongoing management actions and effort at impact sites will be required. In particular, weed control and revegetation should continue at Bog 6.
2. Areas of Spreading Rope-rush dieback at Mount Buller control sites should be re-visited in IY7 and potential causes investigated.
3. Now that artificial watering of Mount Buller's eastern control sites has reduced, ecological monitoring should be alert to a potential decline in the area of these sites and adapt analysis of results accordingly. Analysis of results from Borehole 18 (BH18) may assist.
4. Dieback locations must continue to be re-visited in future years to track vegetation recovery or succession and to plan any necessary management interventions e.g. weed control and revegetation.
5. The status of Bog 11.1 as a control site should be reviewed, based on observed hydrological changes and dieback. This would be assisted by a hydrological review of the Boggy Creek catchment, with updated modelling of Alpine Bog catchment areas and investigation of the role of the aqueduct in water dispersal.
6. Consider periodically revisiting newly mapped Alpine Bogs to note any catchment level changes that may be occurring. Consider allocating newly mapped Alpine Bogs and Alpine Bogs previously mapped in BY2 to either impact sites or control sites, based on further hydrological analysis of the catchment (e.g. updated modelling of the catchment areas of Alpine Bogs).
7. When the HEMAMP Protocol (Biosis 2022b) is next updated, it should be updated with additional details on Alpine Bog mapping, including the following:
    a. The updated HEMAMP Protocol should provide information on any Alpine Bogs that have been newly mapped since baseline monitoring, regardless of whether these new Alpine Bogs are formally incorporated into the long-term monitoring program.
    b. The updated HEMAMP Protocol should confirm that the cover of canopy trees greater than 3 metres tall is disregarded when assessing the dominance of bog-dependent species and therefore defining Alpine Bog extent.
    c. The updated HEMAMP Protocol should clarify that, unlike new Alpine Bogs, Alpine Bog fragments (e.g. at Bog 6) are mapped and included in bog extent regardless of the number of bog-dependent species in the fragment. Bog fragments exist in areas that were previously mapped as Alpine Bog and are important to document for tracking management actions, such as weed control.
8. At locations where informal management tracks are forming through sensitive Alpine Bogs, ARV should provide alternative formalised tracks or coir log 'stepping stones' to minimise the risk of fragmentation of the Alpine Bogs. If coir logs are used, they should be preferentially placed on weed species or within main drainage channels.
9. When the HEMAMP Protocol (Biosis 2022b) is next updated, it should be updated to clarify that organic litter includes mulch, coir logs and jute mat that may have been placed for management purposes.
10. ARV should extend its Mount Stirling deer control program (currently a component of the Mount Stirling Offset Site management) to Mount Buller in response to the observed increase in deer impacts within Mount Buller Alpine Bogs in IY6.
11. Bog-dependent species richness at impact sites relative to control sites has remained 5.3% lower than the baseline mean (i.e. at the 'amber' trigger level) for three consecutive years, meaning that efforts to re-introduce Silver Astelia to impact sites must be increased in IY7 e.g. by planting a greater number of Silver Astelia plants or by better protecting Silver Astelia plants from deer.
12. ARV should plant all available and suitable Silver Astelia plants in spring 2025 or autumn 2026. New planting locations may need to be chosen, as the original locations may no longer be suitable. Planting locations should be recorded with a DGPS to assist with relocation, to monitor survivorship

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and to plan follow-up management actions, such as weed control or herbivore management. If any of the planted Silver Astelia die, they should be replaced either at the same location (if conditions for re-introduction are still suitable at this location) or at a new location (if conditions for re-introduction are no longer suitable at the original location or better elsewhere).

13. As more Silver Astelia plants become available, ARV should consider planting them into Bog 6 and Bog 12, given that the species has been previously recorded at these impact sites.
14. As the weed cover within impact sites has remained within the 'amber' trigger level for three consecutive years, ARV should increase weed control effort within impact sites in IY7 compared with IY6.
15. ARV should increase weed control effort in vegetation surrounding impact sites and within the Project Construction Footprint of the water storage, as this will reduce weed propagule loads within the impact sites themselves.

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Figures

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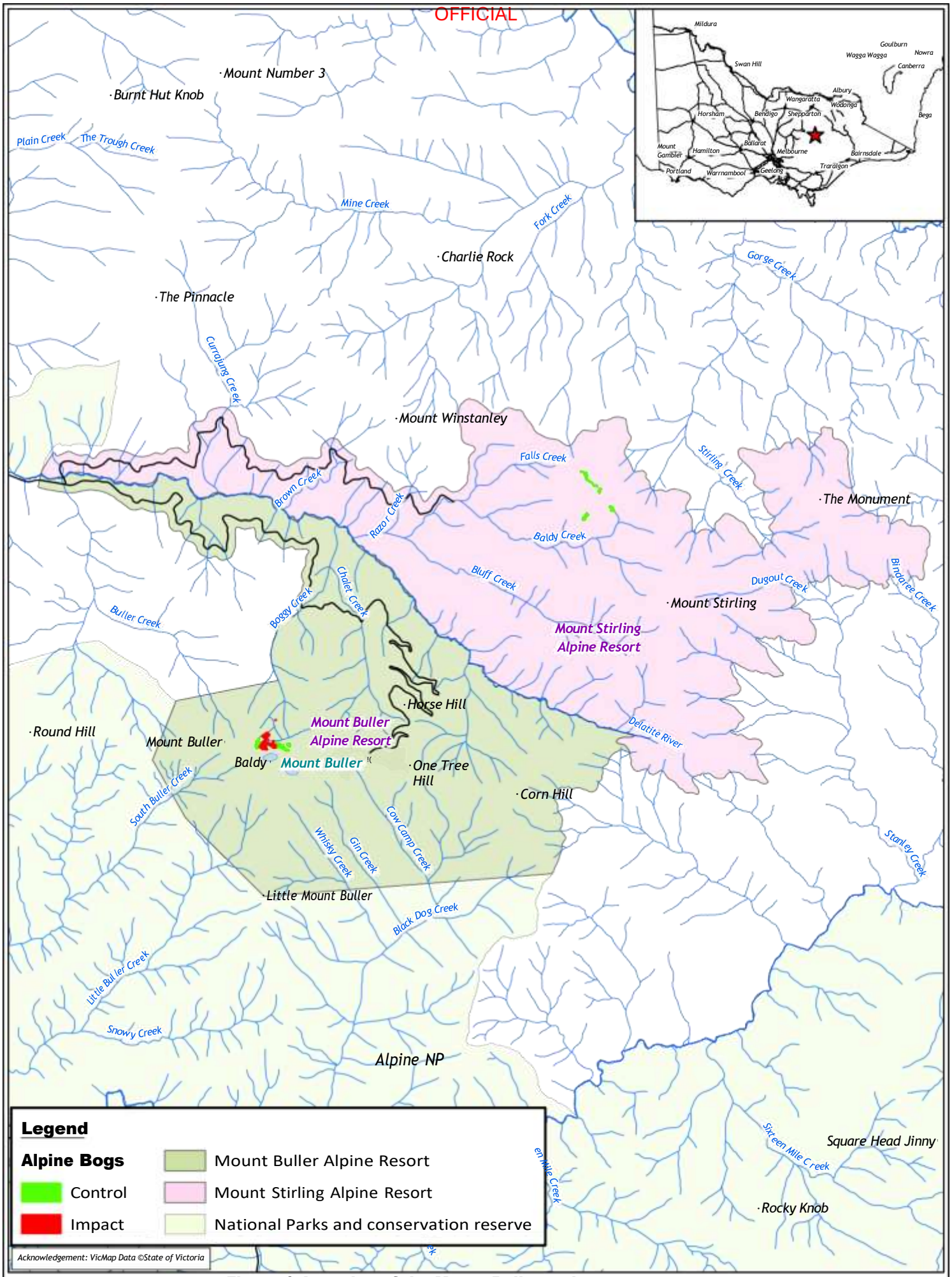

Figure 1 Location of the Mount Buller and Mount Stirling Alpine Resorts, Victoria

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Date: 27 August 2025 ,
Prepared for: MG, Prepared by: SKM, Last edited by: smitchell
Layout: 41703_F1_Locality
Project: P:\41700s\41703\Mapping\41703_MtBuller_WSP_LEMAMXD.aprx

0 700 1,400 2,100 2,800
Metres

Scale: 1:70,000 @ A4
Coordinate System GDA2020 MGA Zone 55

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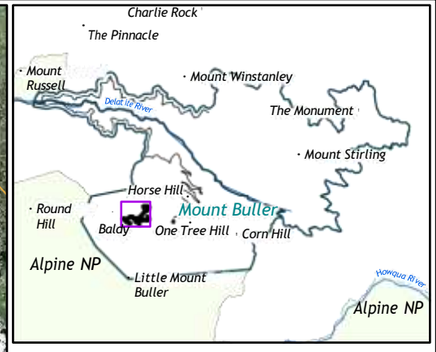

Legend

- Project Construction Footprint (PCF)

Ecological monitoring

Alpine Bogs (IY6)

- Control site
- Impact site
- Other site - first mapped in BY2 (Bog 3 first mapped BY1)
- New site - first mapped in IY6

Climatological monitoring

- Snow gauge
- Weather station

Hydrological monitoring

- Groundwater bore
- Surface water monitoring location

BY = Baseline Year, IY = Impact Year

Figure 2 Location of Alpine Bogs subject to monitoring at Mount Buller Alpine Resort

0 20 40 60 80 100

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA2020 MGA Zone 55

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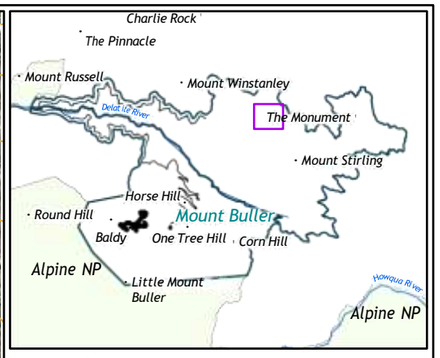
Matter: 41703,
Date: 27 August 2025 ,
Prepared for: MG, Prepared by: SKM, Last edited by: smitchell
Layout: 41703_F2_Alpine_Bogs_Buller
Project: P:\41700s\41703\Mapping\
41703_MtBuller_WSP_HEMAMPYr6.aprx



Acknowledgements: VicMap BaseMap©State of Victoria, Imagery Mt Buller and Mt Stirling Alpine Resort December 2021

Legend

Ecological monitoring

Alpine Bogs (IY6)

Control site

Climatological monitoring

Weather station

IY = Impact Year

Figure 3 Location of Alpine Bogs subject to monitoring at Mount Stirling Alpine Resort

0 20 40 60 80 100

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA2020 MGA Zone 55

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Matter: 41703,
Date: 27 August 2025 ,
Prepared for: JK/MG, Prepared by: SKM, Last edited by: smitchell
Layout: 41703_F3_Alpine_Bogs_Stirling
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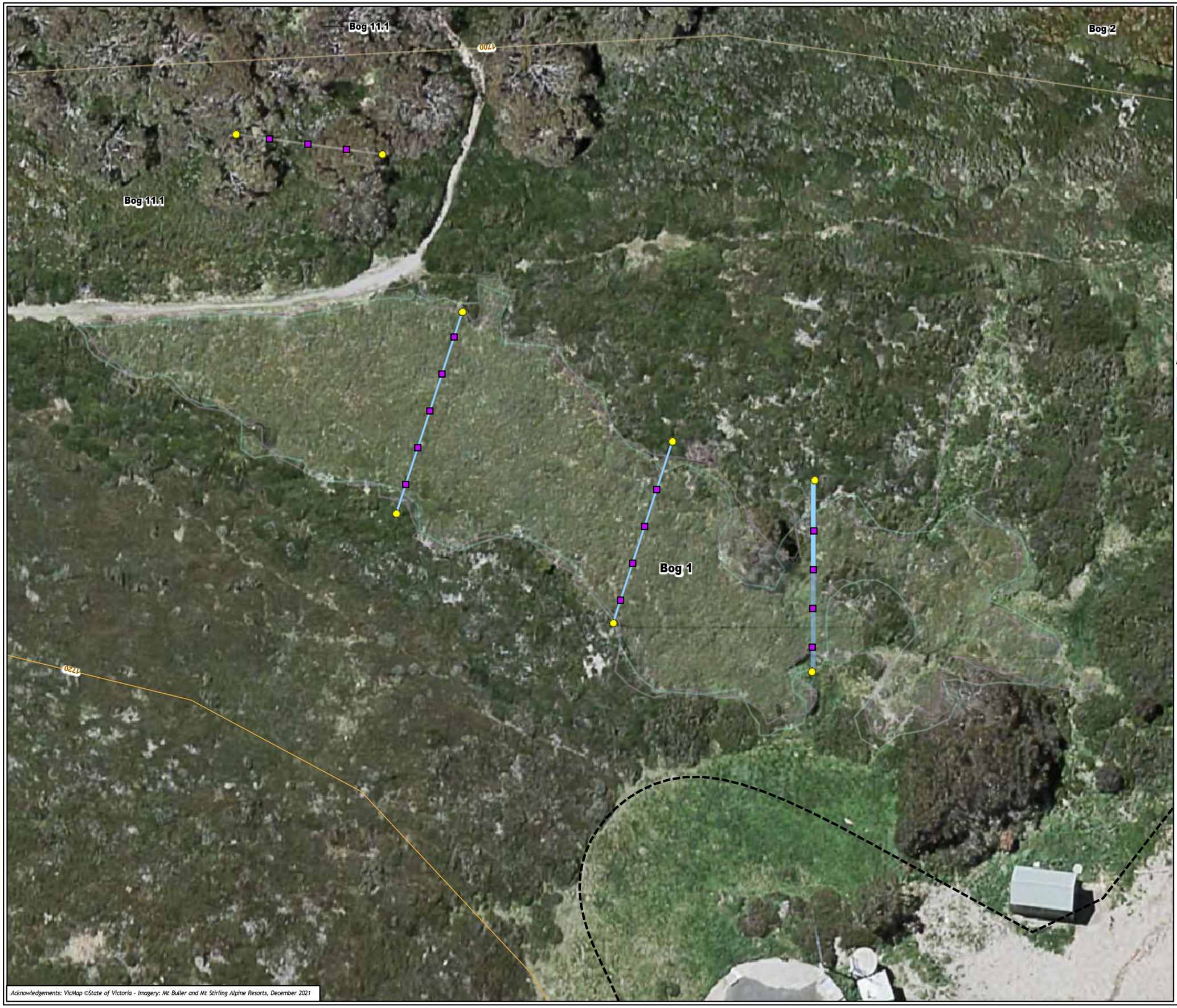
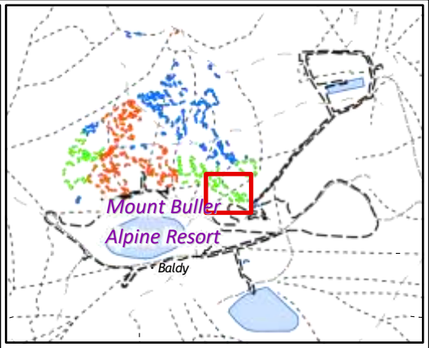
41703_MtBuller_WSP_HEMAMPYr6.aprx





Legend

- Project Construction Footprint
- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Control site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 1 (control site)

0 2.5 5 7.5 10 12.5

Metres

Scale: 1:360 @ A3

Coordinate System: GDA2020 MGA Zone 55

Acknowledgements: VicMap ©State of Victoria - Imagery: Mt Buller and Mt Stirling Alpine Resorts, December 2021

Matter: 41703,
Date: 27 August 2025 ,
Prepared for: JK/MG, Prepared by: SKM, Last edited by: smitchell
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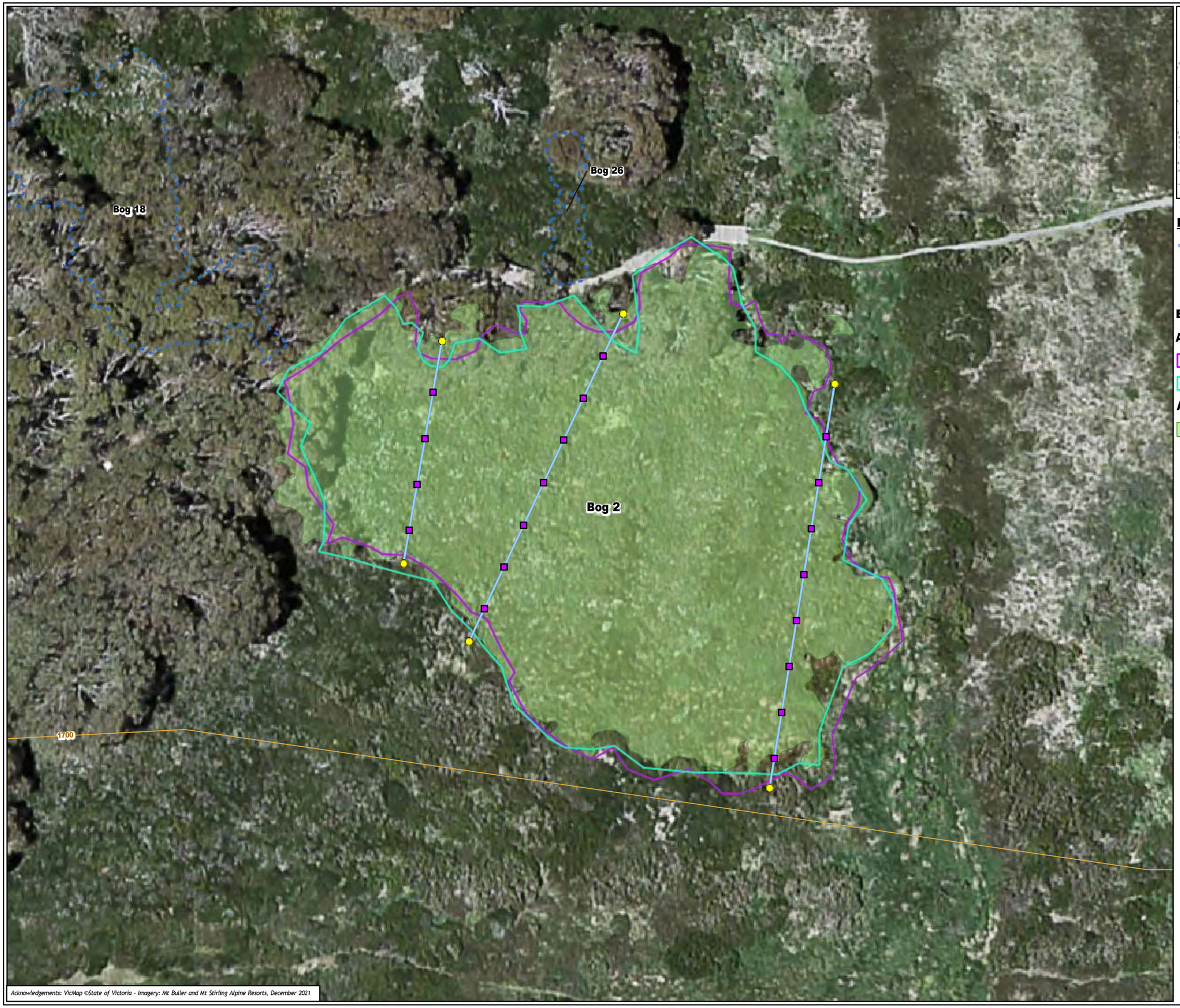

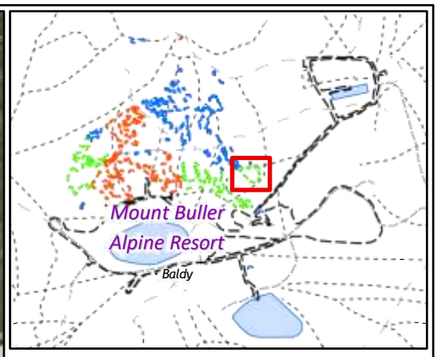

Legend

- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Control site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 2 (control site)

0 2 4 6 8 10

Metres

Scale: 1:300 @ A3

Coordinate System: GDA2020 MGA Zone 55

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Matter: 41703,
Date: 27 August 2025 ,
Prepared for: JK/MG, Prepared by: SKM, Last edited by: smitchell
Layout: 41703_F4_Bogs_Impact area
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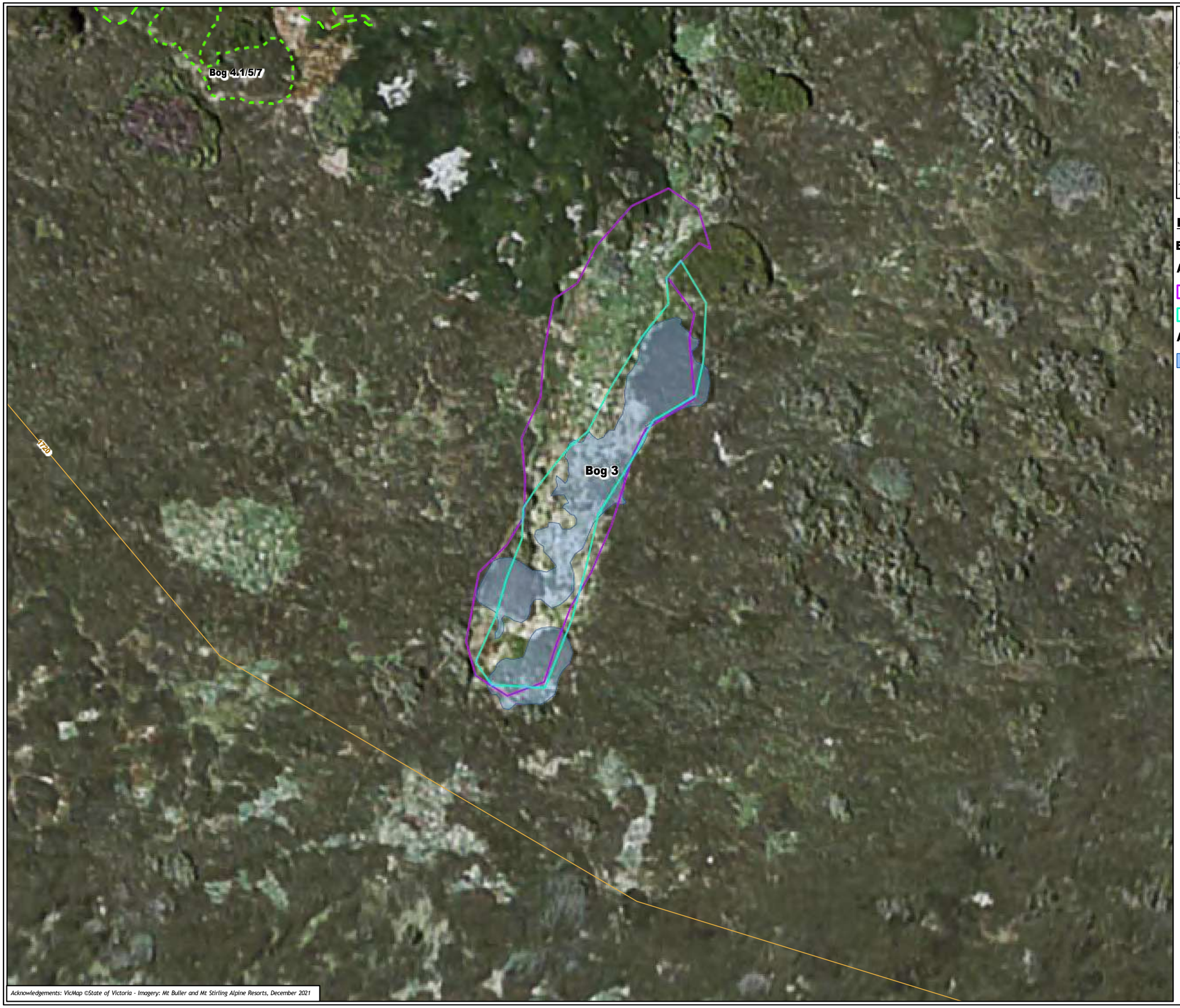
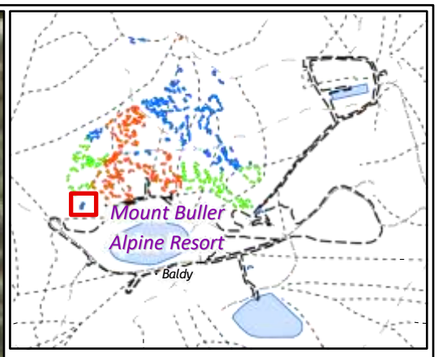
Acknowledgements: VicMap ©State of Victoria - Imagery: Mt Buller and Mt Stirling Alpine Resorts, December 2021





Legend

Ecological monitoring

Alpine Bogs (BY1 and BY2)

Baseline Year 1

Baseline Year 2

Alpine Bogs (IY6)

Other site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 3 (other site)

0 1.5 3 4.5 6 7.5

Metres

Scale: 1:200 @ A3

Coordinate System: GDA2020 MGA Zone 55

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Date: 27 August 2025 ,
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Project: P:\41700s\41703\Mapping\
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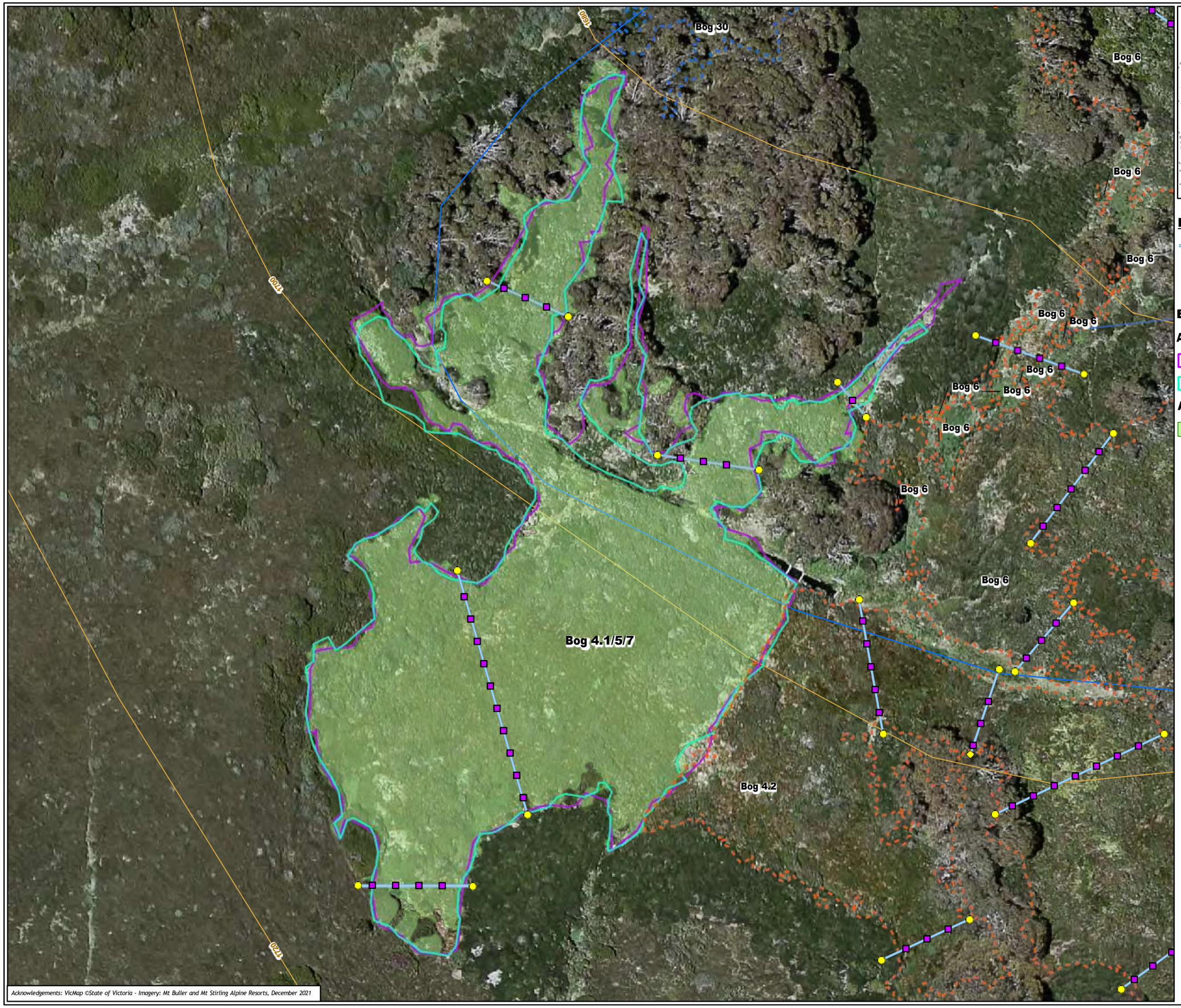

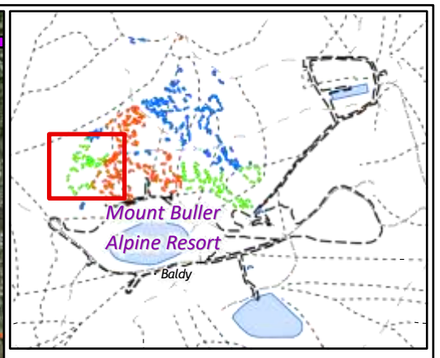

Legend

- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Control site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 4.1/5/7 (control site)

0 4.5 9 13.5 18 22.5

Metres

Scale: 1:600 @ A3

Coordinate System: GDA2020 MGA Zone 55

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Date: 27 August 2025 ,
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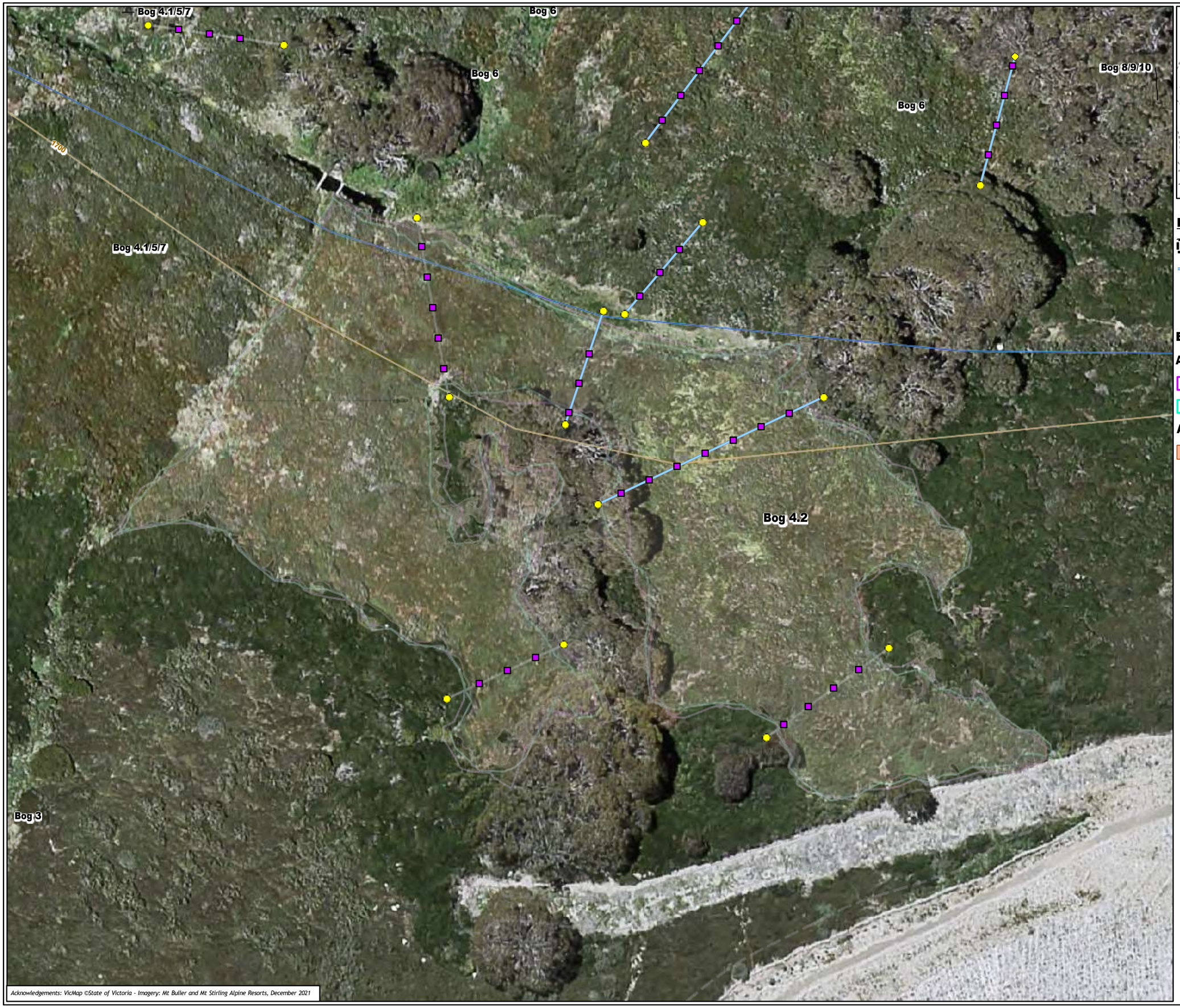

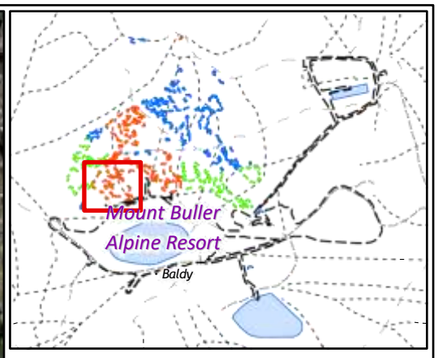

Legend

- Project Construction Footprint
- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Impact site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 4.2 (impact site)

0 3.5 7 10.5 14 17.5

Metres

Scale: 1:450 @ A3

Coordinate System: GDA2020 MGA Zone 55

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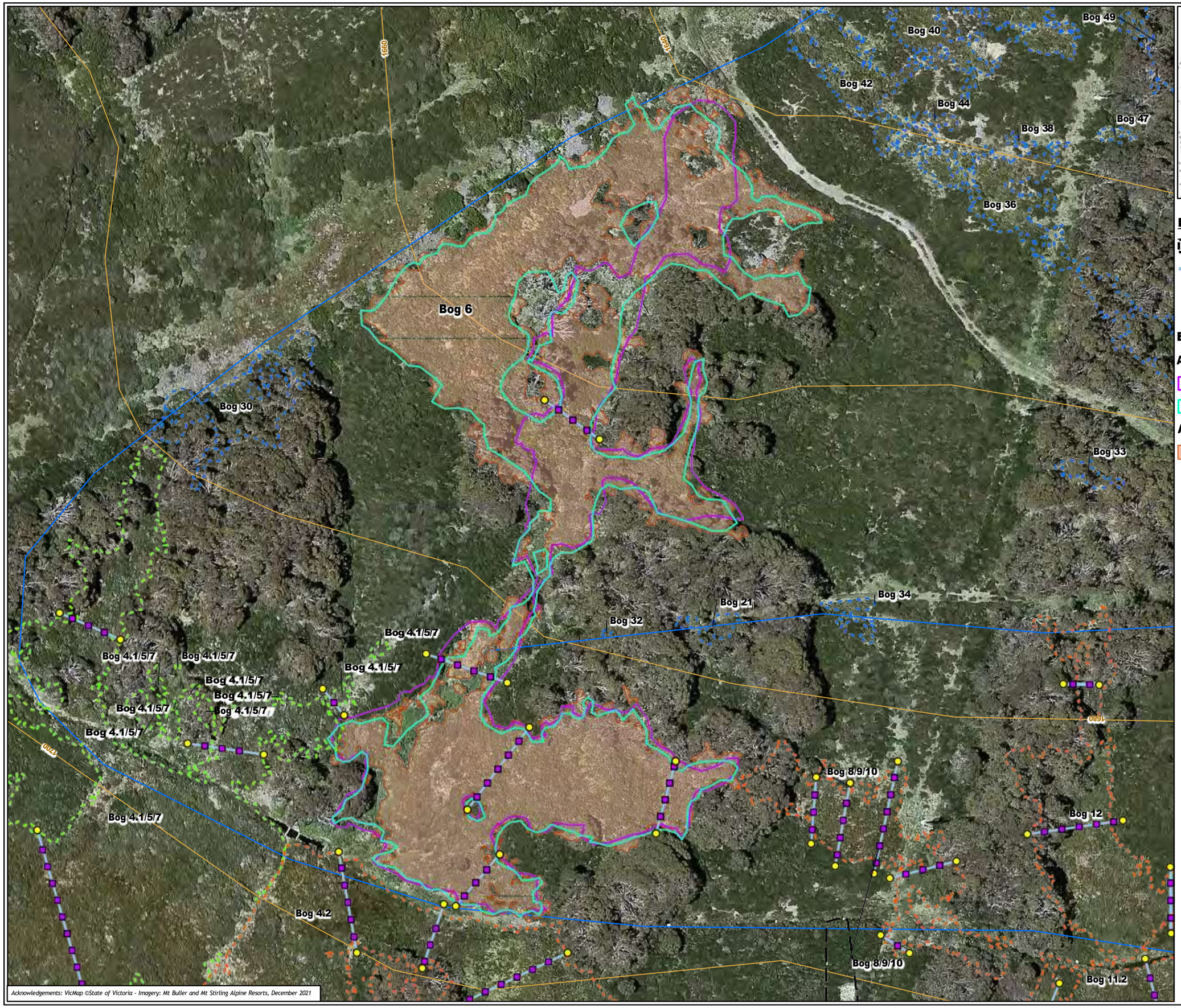

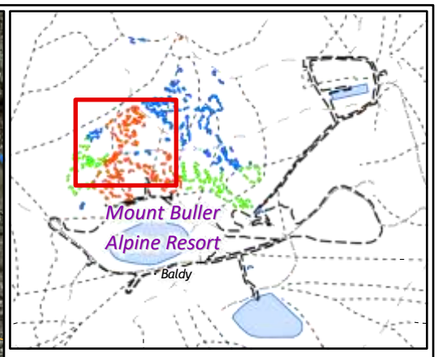

Legend

- Project Construction Footprint
- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Impact site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 6 (impact site)

0 6 12 18 24 30

Metres

Scale: 1:800 @ A3

Coordinate System: GDA2020 MGA Zone 55

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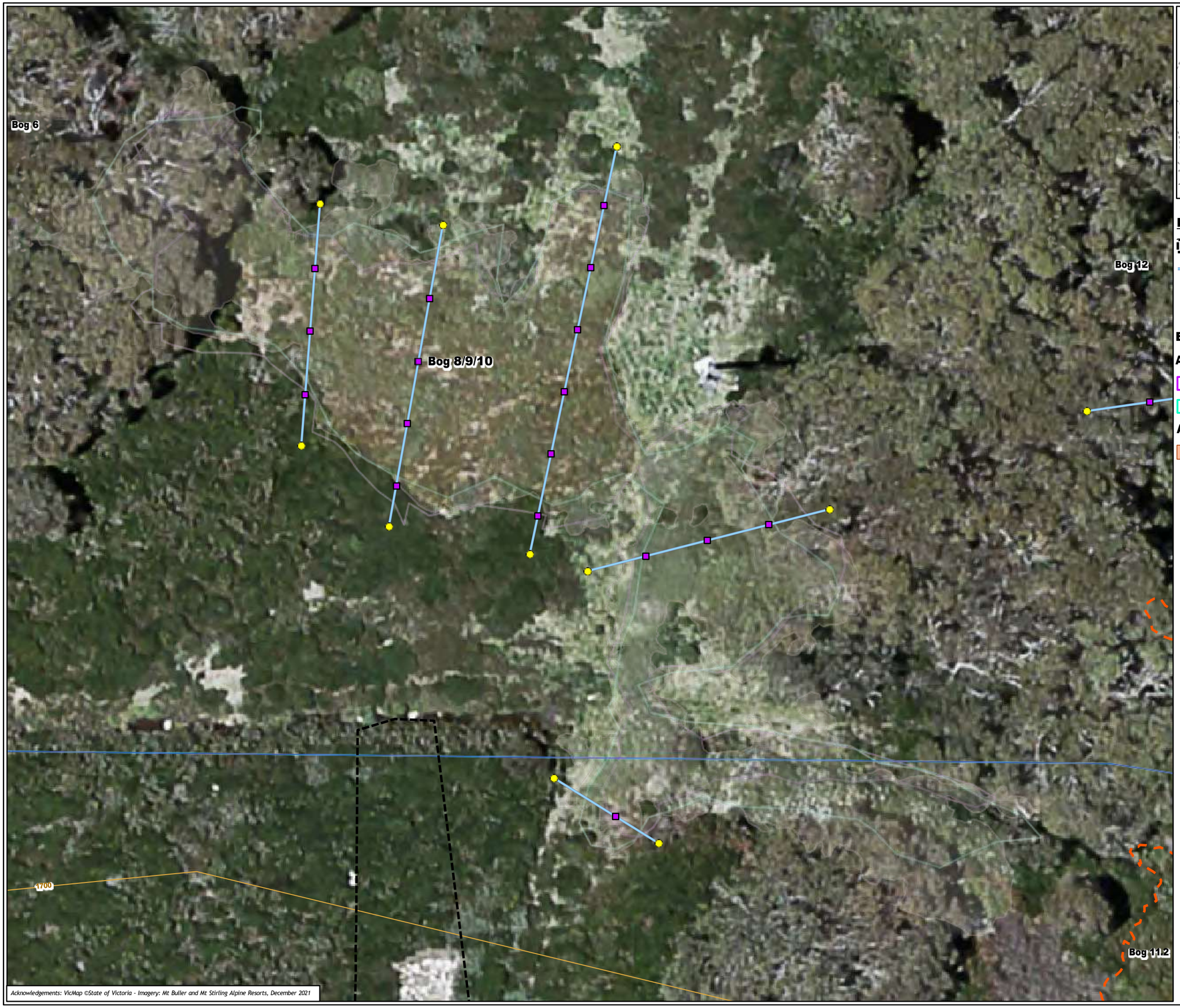

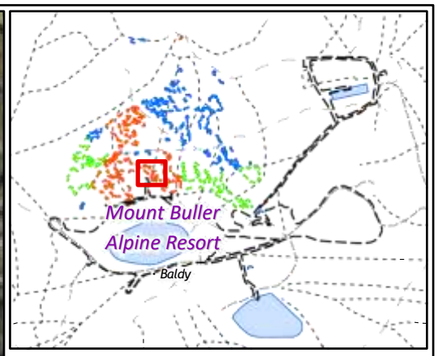

Legend

- Project Construction Footprint
- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Impact site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 8/9/10 (impact site)

0 1.5 3 4.5 6 7.5

Metres

Scale: 1:220 @ A3

Coordinate System: GDA2020 MGA Zone 55

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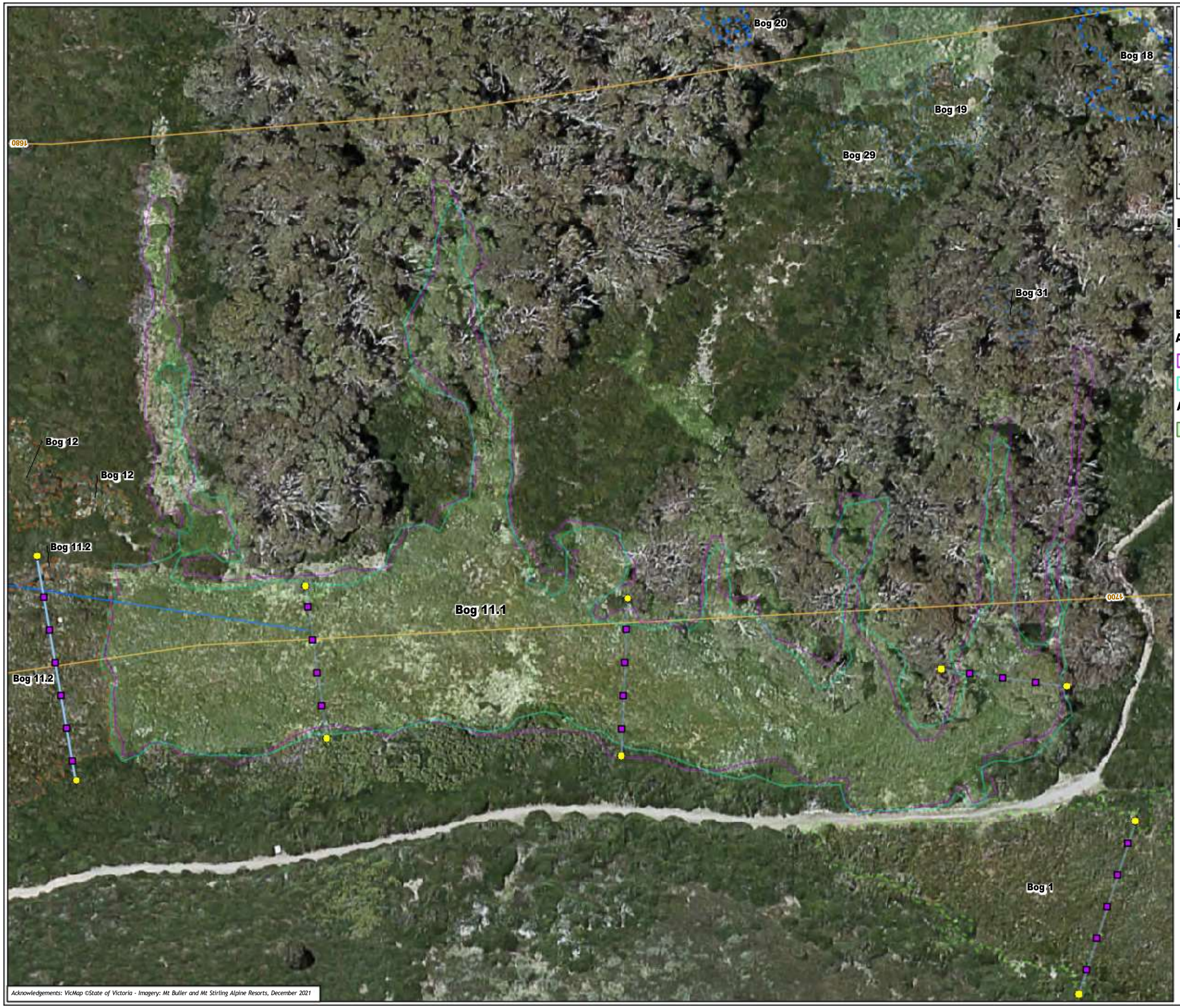

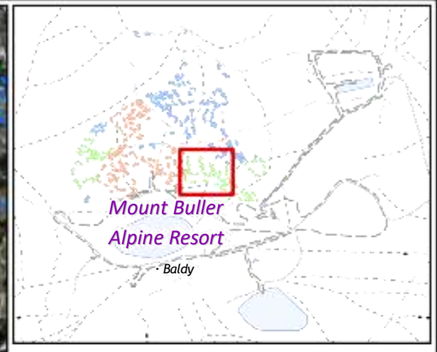

Legend

- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Control site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 11.1 (control site)

0 3 6 9 12 15

Metres

Scale: 1:420 @ A3

Coordinate System: GDA2020 MGA Zone 55

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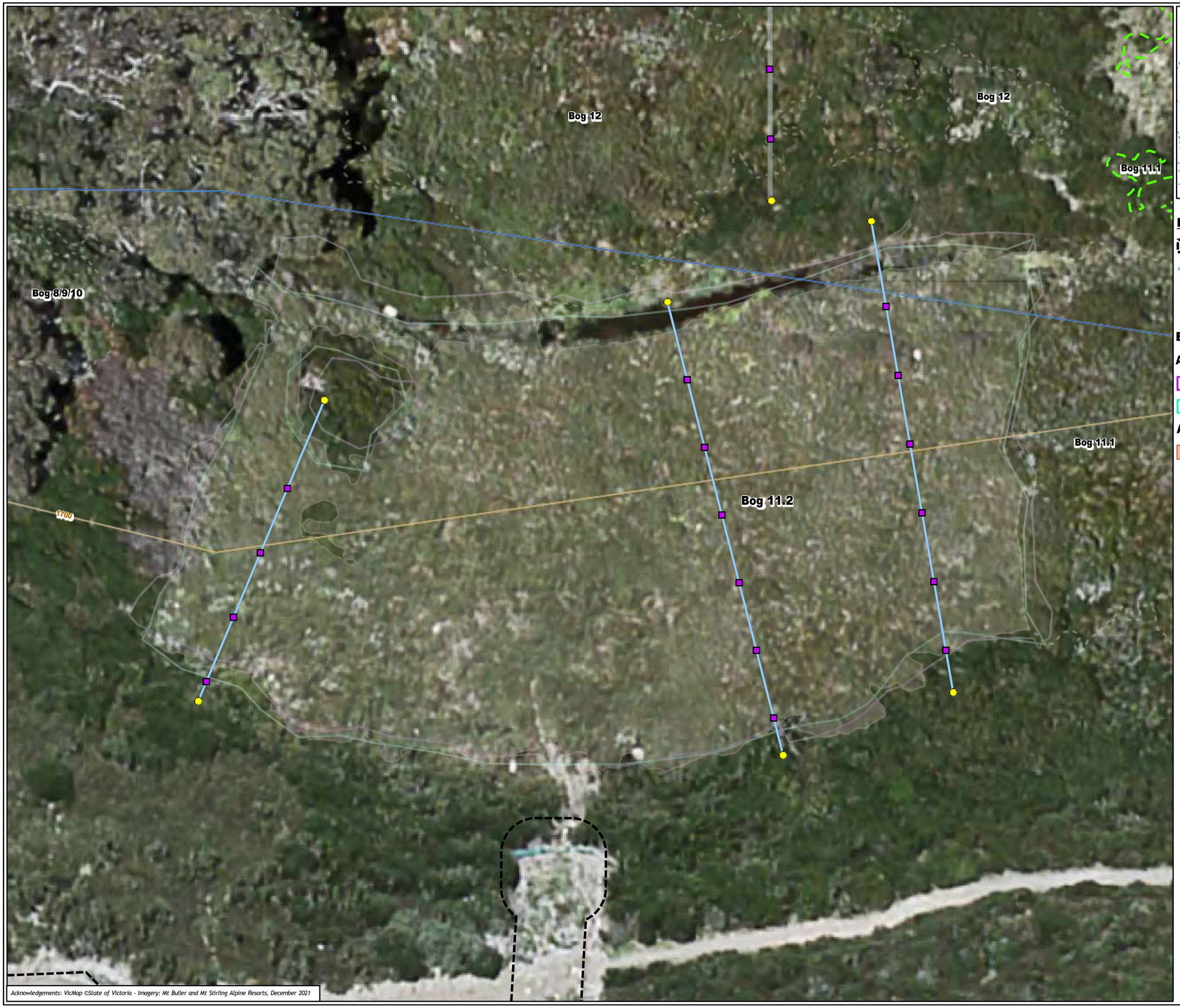

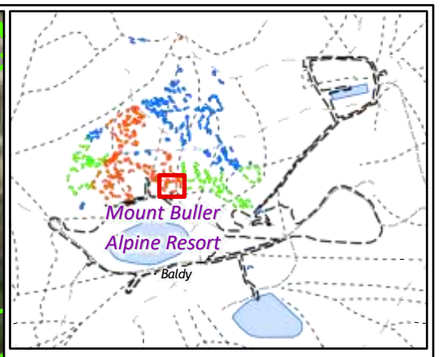

Legend

- Project Construction Footprint
- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Impact site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 11.2 (impact site)

0 1.5 3 4.5 6 7.5

Metres

Scale: 1:200 @ A3

Coordinate System: GDA2020 MGA Zone 55

biosis APEMGroup

Matter: 41703,
Date: 27 August 2025 ,
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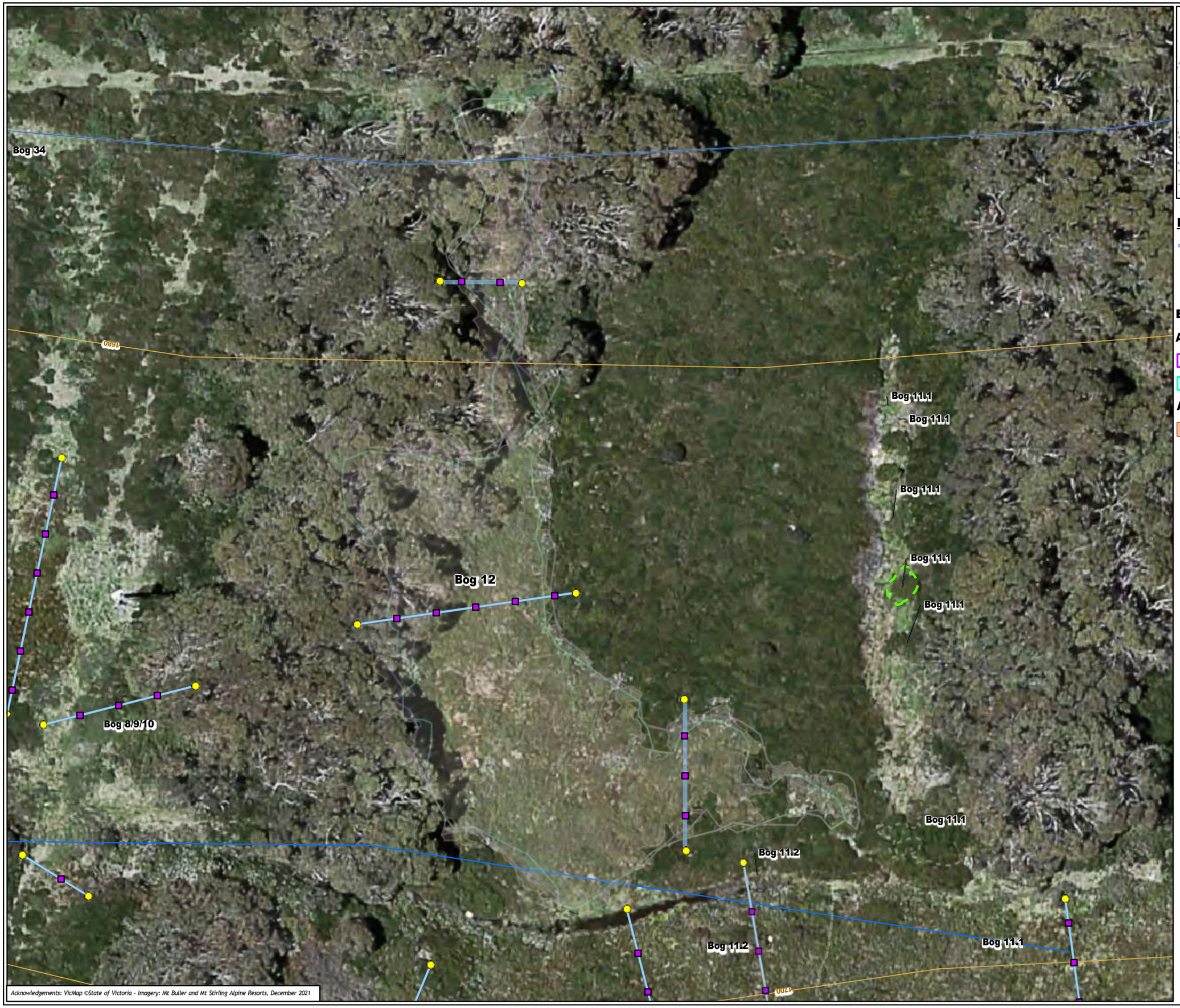

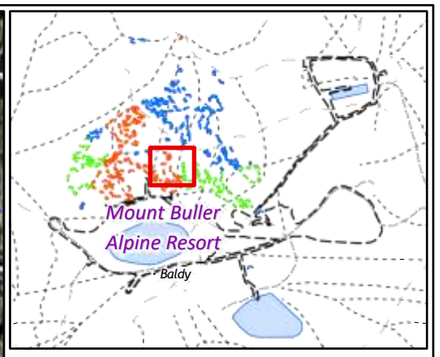

Legend

- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Impact site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 12 (impact site)

0 2.5 5 7.5 10 12.5

Metres

Scale: 1:350 @ A3

Coordinate System: GDA2020 MGA Zone 55

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Prepared for: JK/MG, Prepared by: SKM, Last edited by: smitchell
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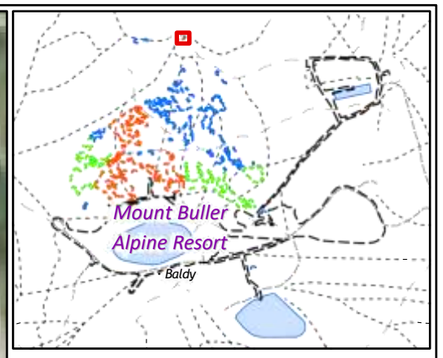

Legend

- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Impact site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog 13 (impact site)

0 0.8 1.6 2.4 3.2 4

Metres

Scale: 1:100 @ A3

Coordinate System: GDA2020 MGA Zone 55

Acknowledgements: VicMap ©State of Victoria - Imagery: Mt Buller and Mt Stirling Alpine Resorts, December 2021

Matter: 41703,
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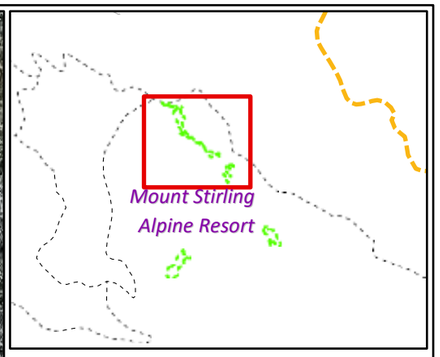

Legend

- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Control site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog S1 (control site)

0 10 20 30 40 50

Metres

Scale: 1:1,300 @ A3

Coordinate System: GDA2020 MGA Zone 55

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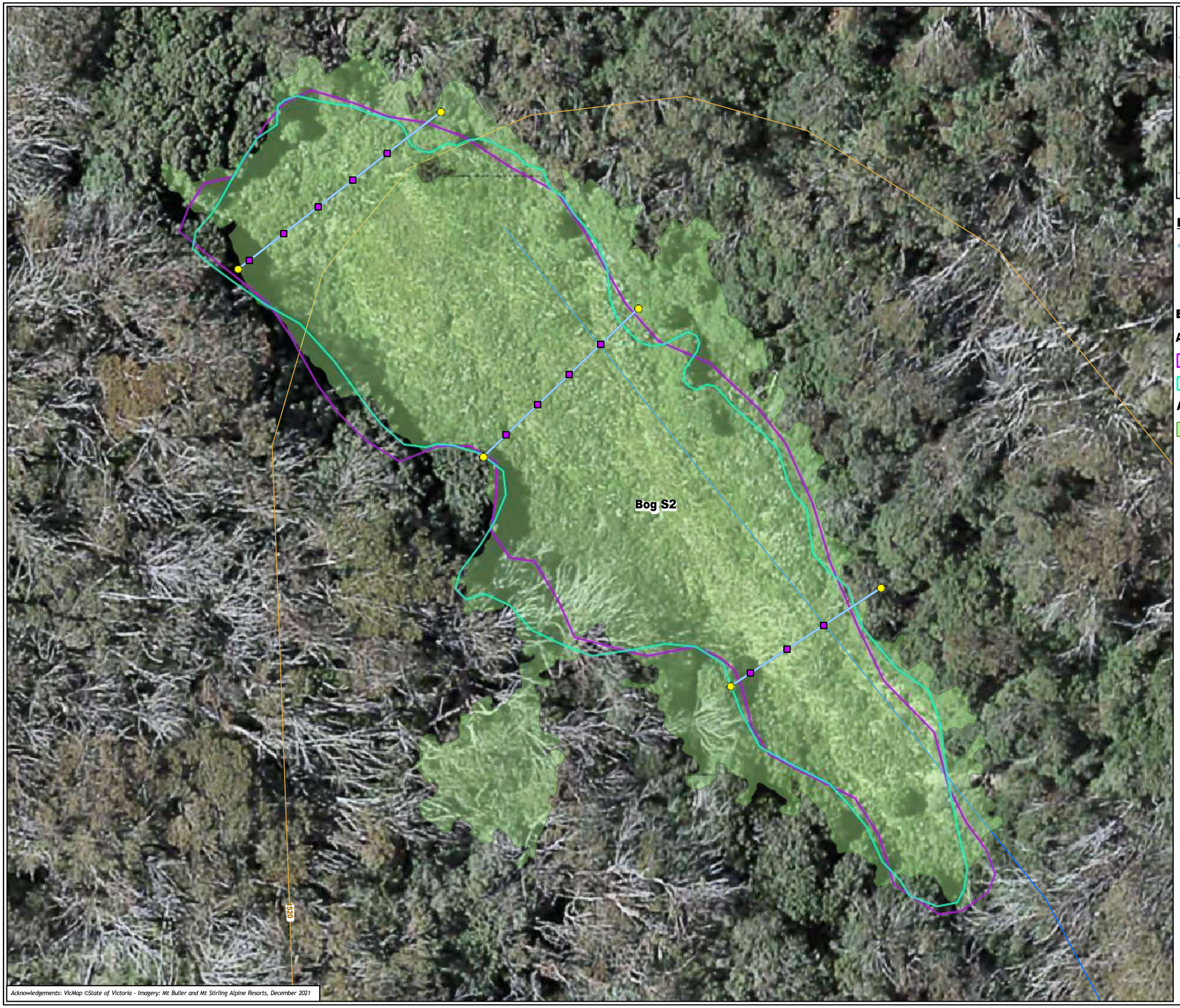

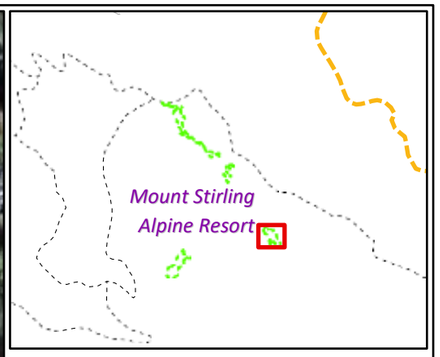

Legend

- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Control site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog S2 (control site)

0 2.5 5 7.5 10 12.5

Metres

Scale: 1:320 @ A3

Coordinate System: GDA2020 MGA Zone 55

Acknowledgements: VicMap ©State of Victoria - Imagery: Mt Buller and Mt Stirling Alpine Resorts, December 2021

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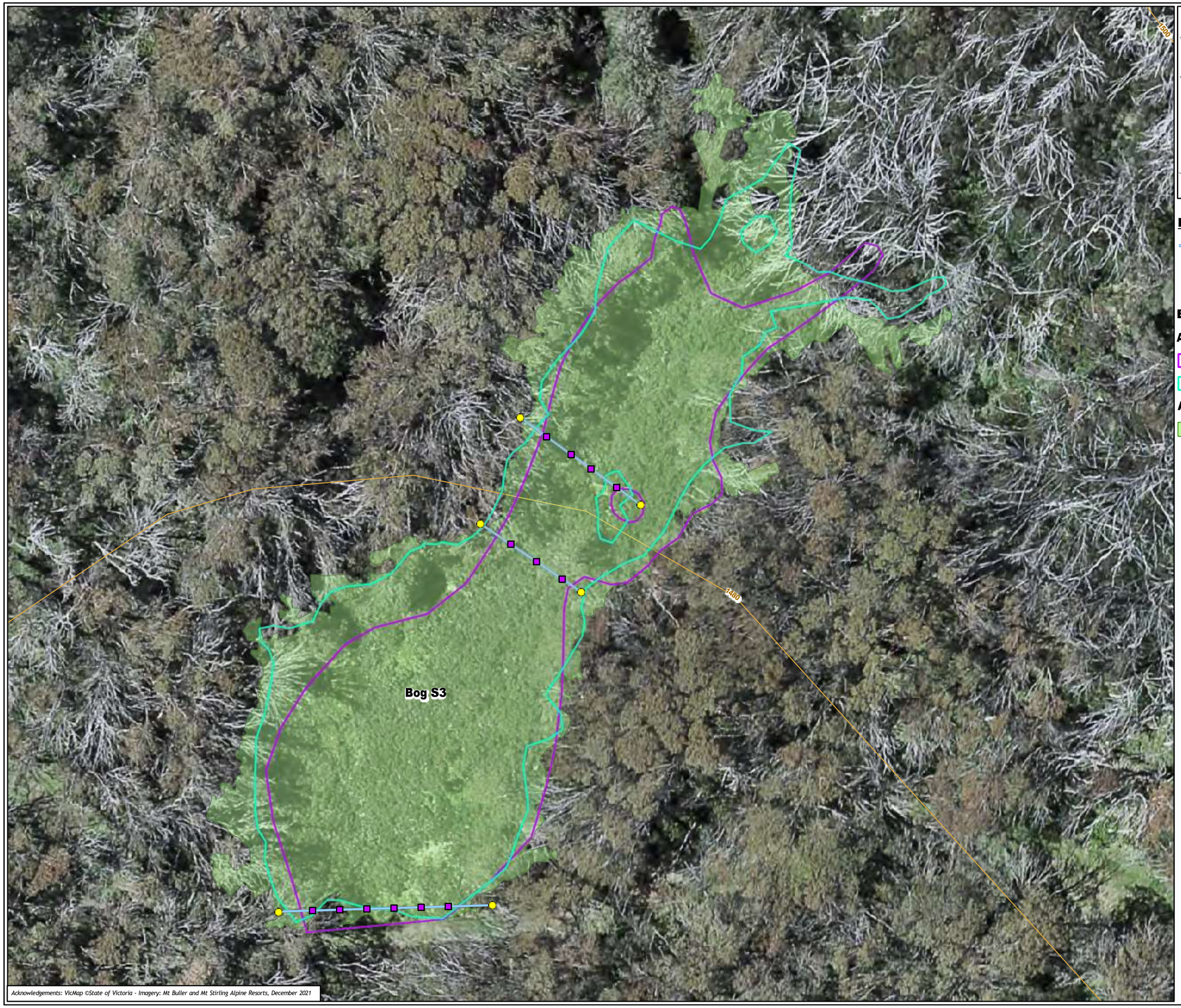
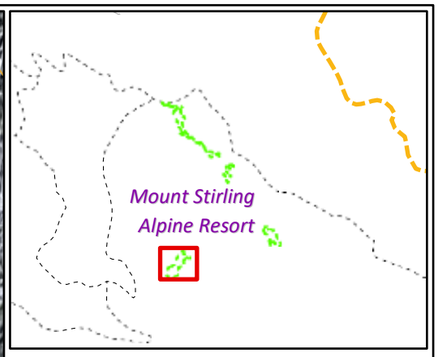




Legend

- Transects
- Quadrat
- Transect photo point

Ecological monitoring

Alpine Bogs (BY1 and BY2)

- Baseline Year 1
- Baseline Year 2

Alpine Bogs (IY6)

- Control site

BY = Baseline Year, IY = Impact Year

Figure 4 Bog S3 (control site)

0 3.5 7 10.5 14 17.5

Metres

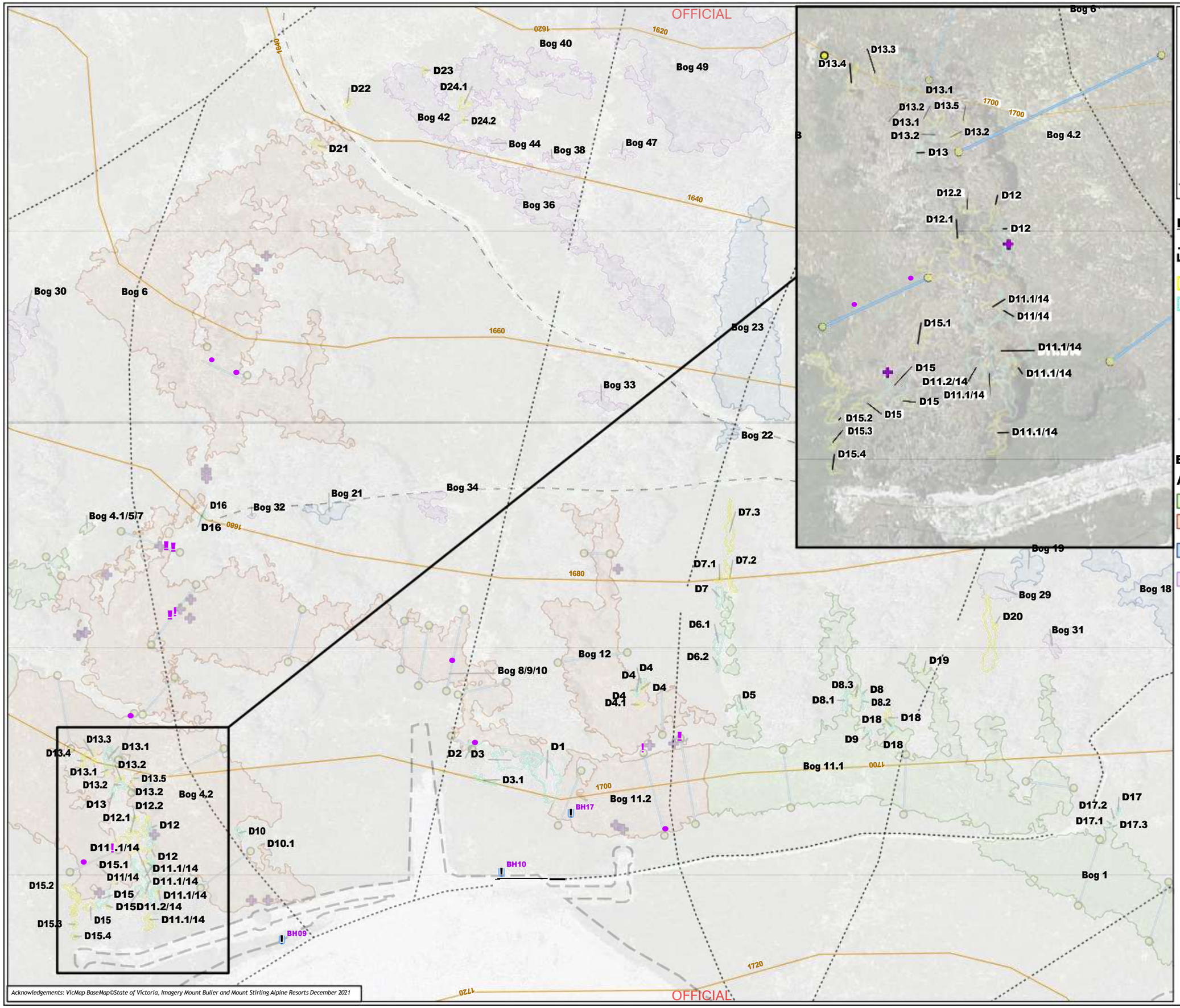
Scale: 1:450 @ A3

Coordinate System: GDA2020 MGA Zone 55

Acknowledgements: VicMap ©State of Victoria - Imagery: Mt Buller and Mt Stirling Alpine Resorts, December 2021

Matter: 41703,
Date: 27 August 2025 ,
Prepared for: JK/MG, Prepared by: SKM, Last edited by: smitchell
Layout: 41703_F4_Bogs_Stirling
Project: P:\41700s\41703\Mapping\
41703_MtBuller_WSP_HEMAMPYr6.aprx

OFFICIAL



Legend

- Project Construction Footprint (PCF)
- New dieback mapped in IY6
- Previously mapped dieback
- Sediment recorded by transect monitoring (IY2)
- Sediment recorded during on-ground mapping (IY2 to IY4)
- Transect photo point
- Transects
- Groundwater bore

Ecological monitoring

Alpine Bogs (IY6)

- Control site
- Impact site
- Other site - first mapped in BY2 (Bog 3 first mapped BY1)
- New site - first mapped in IY6

BY = Baseline Year, IY = Impact Year

Figure 5 Locations of dieback of Alpine Grassy Heathland and Sub-alpine Woodland (non-bog-dependent flora) surrounding Alpine Bog vegetation in Impact Year 6

0 10 20 30 40 50

Metres

Scale: 1:1,100 @ A3

Coordinate System: GDA2020 MGA Zone 55

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Matter: 41703,
Date: 27 August 2025 ,
Prepared for: JK/MG, Prepared by: SKM, Last edited by: smitchell
Layout: 41703_F5_Dieback_IY6
Project: P:\41700s\41703\Mapping\
41703_MtBuller_WSP_HEMAMPYr6.aprx

Acknowledgements: VicMap BaseMap©State of Victoria, Imagery Mount Buller and Mount Stirling Alpine Resorts December 2021

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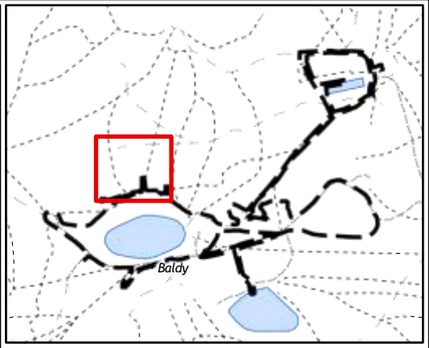

Legend

Silver Astelia records from BY1 to IY6

- Recorded as an incidental observation
- Recorded by transect monitoring
- Silver Astelia planting locations - May 2024 (IY5, ARV supplied)
- Project Construction Footprint (PCF)

Areas of dieback

- New dieback mapped in IY6
- Previously mapped dieback
- Photo point
- Transect

Ecological monitoring

Alpine Bogs (IY6)

- Control site
- Impact site
- Other site

BY = Baseline Year, IY = Impact Year

Figure 6 Locations of Silver Astelia recorded from Baseline Year 1 (BY1) to Impact Year 6 (IY6)

0 6 12 18 24 30

Metres

Scale: 1:600 @ A3

Coordinate System: GDA2020 MGA Zone 55

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Matter: 41703,
Date: 28 August 2025 ,
Prepared for: JK/MG, Prepared by: SKM, Last edited by: smitchell
Layout: 41703_F6_Astelia
Project: P:\41700s\41703\Mapping\
41703_MtBuller_WSP_HEMAMPYr6.aprx

Acknowledgements: VicMap BaseMap©State of Victoria, Imagery Mount Buller and Mount Stirling Alpine Resorts December 2021

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Photos

Photo 1 **Example of weed material removed from Bogs 6 and 4.1/5/7, bagged for solarisation and removal (IY6; 12 February 2025)**

Photo 2 **Tubestock reading for planting into and around Bog 6 following weed control (IY6; 6 May 2025)**

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Photo 3 **Area of Bog 6 immediately upslope of Transect 6C before major weed control and revegetation works (IY6; 12 February 2025; compare with Photo 4)**

Photo 4 **Area of Bog 6 immediately upslope of Transect 6C after major weed control and revegetation works (IY6; 6 May 2025; compare with Photo 3)**

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Photo 5 **Recent and extensive dieback of Spreading Rope-rush and colonisation by non-bog-dependent species along the eastern boundary of Bog 2 (IY6; 31 January 2025)**

Photo 6 **Recent and extensive dieback of Spreading Rope-rush and colonisation by non-bog-dependent species along the southern boundary of Bog 4.1/5/7 (IY6; 28 January 2025)**

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Photo 7 **Dieback of non-bog-dependent species (centre and right) and colonisation by bog-dependent species (centre and left) at the eastern boundary of Bog 4.2, an impact site (Location D10; IY6; 28 January 2025)**

Photo 8 **New area of dieback of non-bog-dependent species north of Bog 11.1, a control site, leading to the boundary of newly mapped Bog 29 (Location D20; IY6; 14 February 2025)**

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Photo 9 **Dieback of Snow Gum within waterlogged Sub-alpine Woodland near Bog 4.2, including dieback of epicormic regrowth from IY5 (Location D12; IY6; 14 February 2025)**

Photo 10 **Temporary pipe used to divert excess water leaking from the end of the environmental watering system, over Bog 11.2 and directly to the aqueduct (IY6; 29 January 2025)**

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Photo 11 **Part of Bog 18, previously mapped in BY2, showing vigorous growth of Carpet Sedge and evidence of deer activity (IY6; 11 February 2025)**

Photo 12 **Part of Bog 30, newly mapped in IY6 at the edge of Summit Slide Trail, downslope of the western control site (IY6; 12 February 2025)**

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Photo 13 **Part of Bog 42, newly mapped in IY6 on Boggy Creek Trail, showing dieback of Alpine Leionema and vigorous growth of Spreading Rope-rush (IY6; 13 February 2025)**

Photo 14 **Part of Bog 29, newly mapped in IY6 on Vista Trail, downslope of the eastern control sites and associated with dieback of non-bog-dependent species at Location D20 (IY6; 11 February 2025)**

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Photo 15 **Results of pre-construction vegetation grooming on Wenzel's Weave Trail (centre background), between Bog 6 (left) and Sub-Alpine Woodland (right) below the aqueduct (BY2; 21 February 2019; compare with Photo 16)**

Photo 16 **Results of reduced post-construction vegetation grooming on Wenzel's Weave Trail (centre background), between Bog 6 (left) and Sub-Alpine Woodland (right) below the aqueduct (IY6; 14 February 2025; compare with Photo 15)**

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Photo 17 **Damage to bog-dependent and non-bog-dependent species caused by transect monitoring activities at the start of Transect S2A (wooden monitoring peg in bottom left; IY6; 5 February 2025)**

Photo 18 **Informal management track through Spreading Rope-rush along the main drainage line at the south-western extent of Bog 6 (IY6; 12 February 2025)**

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Photo 19 **Informal management track (centre) through Alpine Bog vegetation, causing near fragmentation of Bog 8/9/10 (IY6; 30 January 2025)**

Photo 20 **Examples of coir logs placed into the main drainage line of Bog 6 to slow flow of water and act as 'stepping stones' for management access on foot (IY6; 11 February 2025)**

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Photo 21 **Example of the impacts of deer at Bog 4.2, including trampling, pugging and ring-barking of shrubs (IY6; 14 February 2025)**

Photo 22 **An existing Silver Astelia colony in Bog 4.2, with evidence of recent dieback, possibly due to trampling by deer and/or flooding from the water storage leak (IY6; 28 January 2025)**

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Appendices

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Appendix 1 HEMAMP monitoring calendar

Table A1.1 summarises the frequency and timing of the ecological monitoring and highlights where datasets may be incomplete. The following codes are used in Table A1.1:

Code	Meaning
Yes	Complete dataset for given month
Part	Partially complete dataset for given month
No	Missing dataset for given month

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Table A1.1 Timing, frequency and completeness of the HEMAMP's ecological datasets

			Baseline Year 1											
			Jun	Jul	Aug	Sep 2017	Oct	Nov	Dec	Jan	Feb	Mar 2018	Apr	May
Ecology	Transect monitoring	Control sites									Yes			
		Impact sites								Yes	Yes			
	Mapping	Control sites								Yes	Yes			
		Impact sites								Yes	Yes			

			Baseline Year 2											
			Jun	Jul	Aug	Sep 2018	Oct	Nov	Dec	Jan	Feb	Mar 2019	Apr	May
Ecology	Transect monitoring	Control sites								Yes	Yes			
		Impact sites								Yes	Yes			
	Mapping	Control sites									Yes			
		Impact sites									Yes			

			Impact Year 1											
			Jun	Jul	Aug	Sep 2019	Oct	Nov	Dec	Jan	Feb	Mar 2020	Apr	May
Ecology	Transect monitoring	Control sites								Yes	Yes			
		Impact sites									Yes			
	Mapping	Control sites								Yes	Yes	Yes		
		Impact sites								Yes	Yes	Yes		

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			Impact Year 2											
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
						2020						2021		
Ecology	Transect monitoring	Control sites								Yes	Yes			
		Impact sites								Yes	Yes			
	Mapping	Control sites									Yes			
		Impact sites									Yes			

			Impact Year 3											
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
						2021						2022		
Ecology	Transect monitoring	Control sites								Yes	Yes			
		Impact sites								Yes	Yes			
	Mapping	Control sites									Yes			
		Impact sites									Yes			

			Impact Year 4											
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
						2022						2023		
Ecology	Transect monitoring	Control sites								Yes	Yes			
		Impact sites								Yes	Yes			
	Mapping	Control sites									Yes			
		Impact sites									Yes			

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			Impact Year 5										
			Jun	Jul	Aug	Sep 2023	Oct	Nov	Dec	Jan	Feb	Mar 2024	Apr	May
Ecology	Transect monitoring	Control sites								Yes	Yes			
		Impact sites								Yes	Yes			
	Mapping	Control sites								Yes	Yes			
		Impact sites								Yes	Yes			

			Impact Year 6										
			Jun	Jul	Aug	Sep 2024	Oct	Nov	Dec	Jan	Feb	Mar 2025	Apr	May
Ecology	Transect monitoring	Control sites								Yes	Yes			
		Impact sites								Yes	Yes			
	Mapping	Control sites								Yes	Yes			
		Impact sites								Yes	Yes			

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Appendix 2 Flora species lists

The following status codes are used in this Appendix:

Code	Meaning	Notes
National significance		
CR	Critically endangered	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
EN	Endangered	
VU	Vulnerable	
State significance		
cr	Critically endangered	Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act)
e	Endangered	
v	Vulnerable	
P	Protected species (public land only)	
RU	Restricted use (public land only)	
Noxious weed status		
SP	State prohibited species	Victorian *Catchment and Land Protection Act 1994* (CaLP Act) statuses within the Goulburn Broken/North East catchments
RP	Regionally prohibited species	
RC	Regionally controlled species	
R	Restricted species	
Other		
^	Bog-dependent species	Refer to Diagnostic Key to Alpine Bogs (Appendix 3)

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Table A2.1 Flora species list for all Alpine Bogs

Status	Scientific Name	Common Name
Indigenous species		
	Acaena novae-zelandiae	Bidgee-widgee
	Achrophyllum dentatum	Toothed Mitre-moss
e P	*Aciphylla glacialis*	Snow Aciphyll
e P	*Acrothamnus montanus*	Snow Beard-heath
	Agrostis parviflora s.s.	Hair Bent
	Anthosachne scabra s.s.	Common Wheat-grass
e P	*Argyrotegium poliochlorum*	Grey-green Cudweed
	Asperula conferta	Common Woodruff
	Asperula gunnii	Mountain Woodruff
^	*Astelia alpina* var. *novae-hollandiae*	Silver Astelia
RU ^	*Baeckea gunniana*	Alpine Baeckea
e P ^	*Baeckea latifolia* (as *Baeckea utilis s.l.*)	Subalpine Baeckea
RU ^	*Baeckea utilis s.s.* (as *Baeckea utilis s.l.*)	Mountain Baeckea
	Bartramia robusta	Common Apple-moss
RU	*Blechnum penna-marina* subsp. *alpina*	Alpine Water-fern
RU	*Brachyscome scapigera*	Tufted Daisy
RU	*Brachyscome spathulata*	Spoon Daisy
	Brachythecium paradoxum	Feather Moss
	Brachythecium rutabulum	Rough-stalked Feather-moss
	Brachythecium salebrosum	Smooth-stalk Feather-moss
	Brachythecium spp.	Feather Moss
^	*Callistemon pityoides*	Alpine Bottlebrush
	Campylopus introflexus	Heath Star Moss
	Carex appressa	Tall Sedge
	Carex breviculmis	Common Grass-sedge
	Carex flaccida (syn. *Carex austroflaccida*)	Mountain Hook-sedge
	Carex hebes	Mountain Sedge
e P ^	*Carex jackiana*	Carpet Sedge
	Carex spp.	Sedge
	Catagonium nitens subsp. *nitens*	Feather-tail Moss
e P	*Celmisia latifolia*	Victorian Snow-daisy
RU	*Celmisia* spp.	Snow Daisy
v P	*Celmisia tomentella*	Silver Snow-daisy
P	*Chiloglottis cornuta*	Green Bird-orchid
P	*Chiloglottis* spp.	Bird Orchid
	Chiloscyphus semiteres var. *semiteres*	Common Crestwort
	Chiloscyphus trialatus (syn. *Chiloscyphus pallidus*)	Greasy Crestwort
	Clematis aristata	Mountain Clematis
RU	*Coronidium monticola*	Mountain Everlasting
	Cotula alpina	Alpine Cotula
e P	*Craspedia adenophora*	Sticky Billy-buttons
RU	*Craspedia aurantia s.l.*	Orange/Green Billy-buttons

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Status	Scientific Name	Common Name
e P	*Craspedia lamicola*	Bog Billy-buttons
RU	*Craspedia spp.*	Billy Buttons
e P	*Craspedia sylvestris*	Mountain Forest Billy-buttons
RU ^	*Dracophyllum continentis* (syn. *Richea continentis*)	Candle Heath
^	*Empodisma minus*	Spreading Rope-rush
RU ^	*Epacris paludosa*	Swamp Heath
	Epilobium billardiereanum subsp. *billardiereanum*	Smooth Willow-herb
	Epilobium billardiereanum subsp. *hydrophilum*	Robust Willow-herb
v P	*Epilobium sarmentaceum*	Mountain Willow-herb
	Epilobium spp.	Willow Herb
	Eucalyptus pauciflora	Snow Gum
	Euchiton involucratus s.s.	Star Cudweed
	Euchiton sphaericus	Annual Cudweed
	Euchiton spp.	Cudweed
	Exocarpos nanus	Alpine Ballart
	Gemmabryum sauteri	Sauter's Thread-moss
	Gentianella cunninghamii subsp. *major*	Tall Snow-gentian
v P	*Gentianella muelleriana* subsp. *willisiana*	Mt Buller Snow-gentian
	Geranium potentilloides var. *1*	Soft Crane's-bill
	Geranium sp. *7*	Alpine Swamp Crane's-bill
	Gonocarpus micranthus	Creeping Raspwort
	Gonocarpus montanus	Mat Raspwort
	Gonocarpus tetragynus	Common Raspwort
	Goodenia hederacea	Ivy Goodenia
RU	*Grevillea australis*	Alpine Grevillea
	Grimmia pulvinata var. *africana*	Blunt-beak Grimmia
^	*Hierochloe redolens*	Sweet Holy-grass
	Hovea montana	Alpine Rusty-pods
e P	*Huperzia australiana*	Fir Clubmoss
	Hydrocotyle hirta	Hairy Pennywort
	Hydrocotyle spp.	Pennywort
	Hygrolembidium acrocladum	Fingerwort
	Hymenodontopsis mnioides (syn. *Pyrrhobryum mnioides*)	Woolly-stem Thyme-moss
	Hypericum japonicum	Matted St John's Wort
	Isolepis aucklandica	New Zealand Club-sedge
	Isolepis habra	Wispy Club-sedge
e P	*Isolepis montivaga*	Fog Club-sedge
	Isolepis spp.	Club Sedge
	Isolepis subtilissima	Mountain Club-sedge
	Lagenophora montana	Mountain Bottle-daisy
	Lagenophora stipitata s.s.	Blue Bottle-daisy
	Leionema phylicifolium	Alpine Leionema
	Leptospermum grandifolium	Mountain Tea-tree

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Status	Scientific Name	Common Name
	Leptostigma breviflorum	Mountain Nertera
RU	*Leucopogon gelidus*	Drooping Beard-heath
	Libertia pulchella	Pretty Grass-flag
	Luzula modesta	Southern Woodrush
	Luzula spp.	Woodrush
RU	*Lycopodium fastigiatum*	Mountain Clubmoss
cr P	*Lycopodium scariosum*	Spreading Clubmoss
	Marchantia berteroana	Common Marchantia
	Melicytus sp. aff. *dentatus* (snowfields variant)	Alpine Shrub-violet
	Mentha laxiflora	Forest Mint
RU	*Microseris lanceolata*	Alpine Yam-daisy
RU ^	*Olearia algida*	Mountain Daisy-bush
e P	*Olearia phlogopappa* subsp. *flavescens*	Dusty Daisy-bush
	Oreobolus distichus	Fan Tuft-rush
	Oreomyrrhis eriopoda	Australian Caraway
	Orites lancifolius	Alpine Orites
	Orthodontium lineare	Cape Thread-moss
	Ozothamnus cupressoides	Kerosene Bush
e P	*Phebalium squamulosum* subsp. *alpinum*	Alpine Phebalium
	Picris angustifolia subsp. *merxmuelleri*	Highland Picris
	Pimelea alpina	Alpine Rice-flower
	Pimelea ligustrina	Tall Rice-flower
	Pimelea spp.	Rice Flower
	Plantago euryphylla	Broad Plantain
	Poa costiniana	Bog Snow-grass
	Poa ensiformis	Sword Tussock-grass
	Poa fawcettiae	Horny Snow-grass
	Poa hiemata	Soft Snow-grass
	Poa hothamensis	Ledge Grass
	Poaceae spp.	Grass
	Podocarpus lawrencei	Mountain Plum-pine
RU	*Podolepis robusta*	Alpine Podolepis
RU	*Podolepis* spp.	Podolepis
	Podolobium alpestre	Alpine Shaggy-pea
RU	*Polystichum proliferum*	Mother Shield-fern
	Polytrichum commune	Common Haircap
	Polytrichum spp.	Haircap
P	*Prasophyllum* spp.	Leek Orchid
P	*Prasophyllum suttonii* (syn. *Prasophyllum alpestre*)	Mauve Leek-orchid
RU	*Pteris tremula*	Tender Brake
	Ptychostomum pseudotriquetrum	Bog Bryum
	Ranunculus graniticola	Granite Buttercup
e P	*Ranunculus gunnianus*	Gunn's Alpine Buttercup
	Ranunculus lappaceus	Australian Buttercup
	Ranunculus pimpinellifolius	Bog Buttercup

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Status	Scientific Name	Common Name
	Ranunculus scapiger	Hairy Buttercup
	Ranunculus spp.	Buttercup
	Rhaphidorrhynchium amoenum	Common Signal-moss
	Rosulabryum capillare	Capillary Thread-moss
	Rubus parvifolius	Small-leaf Bramble
	Rumex brownii	Slender Dock
	Rytidosperma nudiflorum	Alpine Wallaby-grass
	Rytidosperma penicillatum	Weeping Wallaby-grass
	Rytidosperma spp.	Wallaby Grass
	Sanionia uncinata	Sickle-leaved Hook-moss
	Schoenus calyptratus	Alpine Bog-sedge
e P	*Scleranthus brockiei*	Brock Knawel
	Senecio gunnii	Mountain Fireweed
e P	*Senecio pinnatifolius* var. *alpinus*	Snowfield Groundsel
	Senecio spp.	Groundsel
RU ^	*Sphagnum cristatum*	Peat Moss
	Stellaria pungens	Prickly Starwort
RU	*Stylidium armeria* subsp. *armeria*	Common Triggerplant
e P	*Stylidium montanum*	Alpine Triggerplant
RU	*Stylidium* spp.	Trigger Plant
	Tasmannia xerophila subsp. *xerophila*	Alpine Pepper
P	*Thelymitra spp.*	Sun Orchid
e P	*Trochocarpa clarkei*	Lilac Berry
	Veronica serpyllifolia	Thyme Speedwell
	Viola betonicifolia	Showy Violet
	Wahlenbergia ceracea	Waxy Bluebell
	Wahlenbergia gloriosa	Royal Bluebell
RU	*Xerochrysum subundulatum*	Orange Everlasting
	Zoopsis leitgebiana	Glass Centipede
Introduced species		
	Acetosella vulgaris	Sheep Sorrel
	Achillea millefolium	Milfoil
	Agrostis capillaris	Brown-top Bent
	Anthoxanthum odoratum	Sweet Vernal-grass
	Cerastium glomeratum s.s.	Sticky Mouse-ear Chickweed
	Cerastium spp.	Mouse-ear Chickweed
	Cerastium vulgare	Common Mouse-ear Chickweed
RC	*Cirsium vulgare*	Spear Thistle
	Dactylis glomerata	Cocksfoot
	Erythranthe guttata	Monkey Musk
	Erythranthe moschata	Musk Monkey-flower
	Festuca rubra s.s.	Creeping Fescue
	Glyceria declinata	Manna Grass
	Holcus lanatus	Yorkshire Fog
	Hypochaeris radicata	Flatweed

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Status	Scientific Name	Common Name
	Juncus articulatus subsp. *articulatus*	Jointed Rush
	Juncus effusus subsp. *effusus*	Soft Rush
	Juncus ensifolius	Sword Rush
	Malus pumila	Apple
	Phleum pratense	Timothy Grass
	Ranunculus repens	Creeping Buttercup
RC	*Rubus anglocandicans*	Common Blackberry
	Rumex conglomeratus	Clustered Dock
	Sonchus asper s.s.	Rough Sow-thistle
	Sonchus spp.	Sow Thistle
	Taraxacum officinale spp. agg.	Garden Dandelion
	Trifolium repens var. *repens*	White Clover
	Viola arvensis	Field Pansy

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Table A2.2 Bog-dependent flora species list

Status	Scientific Name	Common Name
^	*Astelia alpina* var. *novae-hollandiae*	Silver Astelia
RU ^	*Baeckea gunniana*	Alpine Baeckea
e P ^	*Baeckea utilis s.l.**	Mountain Baeckea*
^	*Callistemon pityoides*	Alpine Bottlebrush
e P ^	*Carex jackiana*	Carpet Sedge
RU ^	*Dracophyllum continentis* (syn. *Richea continentis*)	Candle Heath
^	*Empodisma minus*	Spreading Rope-rush
RU ^	*Epacris paludosa*	Swamp Heath
^	*Hierochloe redolens*	Sweet Holy-grass
RU ^	*Olearia algida*	Mountain Daisy-bush
RU ^	*Sphagnum cristatum*	Peat Moss

Note: Mountain Baeckea *Baeckea utilis s.l.* includes Subalpine Baeckea *Baeckea latifolia*, which is listed as endangered under the FFG Act, and Mountain Baeckea *Baeckea utilis s.s.*, which is not listed as threatened under the FFG Act. These species are aggregated for the purposes of assessing HEMAMP performance criteria because they cannot be reliably distinguished in the field at Mount Buller.

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Appendix 3 Diagnostic Key to Alpine Bogs

This diagnostic key has been reproduced from the key to the EPBC Act listed Alpine Sphagnum Bogs and Associated Fens ecological community on the Australian mainland, prepared by the Australian Government Department of the Environment (DoE 2013). The key appeared in early draft versions of the National Recovery Plan but does not appear in the final version, although the final version does make reference to the key (DoE 2015; A. Tolsma, ARI, pers. comm., February 2019).

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Key to the listed Alpine *Sphagnum* bogs and Associated Fens ecological community on the Australian mainland

The listed ecological community comprises two main components, *Sphagnum* bogs and their associated fens. Fens, or fen pools, are species-poor communities typically linked to bogs. They are dominated by sedges and frequently inundated. The bogs which surround or link to fens generally display greater species diversity, and it is this diversity which in part guides the following key.

1. Are you above 1000m in elevation and in the Australian Alps bioregion?
Yes – go to 2 — No – Unlikely to be the listed community

2. Is live, hummock-forming *Sphagnum* present and abundant, or if burnt[1], can abundant pre-fire *Sphagnum* be inferred from burnt remnants?
Yes – Is the listed community — No, *Sphagnum* is minor or absent – go to 3

3. Does the site have a peat substrate evident?
Yes, or unsure – go to 4 — No – Unlikely to be the listed community

4. Is *Sphagnum* present?
Yes – go to 5 — No – go to 6

5. Is most of the non-*Sphagnum* vegetation cover composed of two or more of the diagnostic species listed below?
Yes – Is the listed community. — No – Not the listed community, but may be transitional or a degraded version[2]

6. Is most of the vegetation cover composed of 3 or more of the diagnostic species?
Yes – Is the listed community, possibly degraded. — No – Not the listed community, but may be transitional or a degraded version[2]

Diagnostic species other than *Sphagnum*:

- *Empodisma minus*
- *Epacris* spp (usually *E. paludosa, E. glacialis, E. celata or E. breviflora*)
- *Richea* spp (*R. continentis or R. victoriana*)
- *Baeckea* spp (usually *B. gunniana, B. latifolia or B.utilis*)
- *Astelia alpina*
- *Carpha nivicola*
- *Baloskion australe*
- *Carex gaudichaudiana*
- *Callistemon pityoides*
- *Hakea microcarpa*
- *Carex jackiana*[3]
- *Hierochloe redolens*[3]
- *Olearia algida*[3]

[1] If a site has been recently and severely burnt, *Sphagnum* and other key diagnostic species may be temporarily absent (live hummock-forming *Sphagnum* would normally comprise at least 20-30% cover).In this case, assessment of the site for the listed community should be delayed for at least 24 months. However, the presence of burnt hummocks over peat indicates the community is present.

[2] Clarification: no need to refer.

[3] This key originally appeared in a draft version of the National Recovery Plan for the Alpine Sphagnum Bogs and Associated Fens. The key has been left unchanged except for the addition of these three species and this footnote. These species have been added by Biosis for the purposes of monitoring Alpine Bogs at Mount Buller and Mount Stirling, Victoria. At these locations, Carex jackiana, Hierochloe redolens and Olearia algida are restricted to Alpine Bogs and are therefore amongst the diagnostic species.

Appendix 4 Photo points

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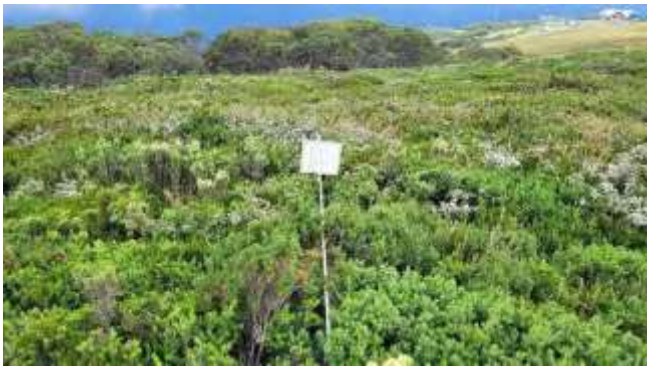
Bog 1 (Control Site), Photo Point 1AS

Baseline Year 1, 9 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 31 January 2020

Impact Year 2, 2 February 2021



Impact Year 3, 31 January 2022

Impact Year 4, 2 February 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 1 (Control Site), Photo Point 1AE

Baseline Year 1, 9 February 2018

Baseline Year 2, 31 January 2019

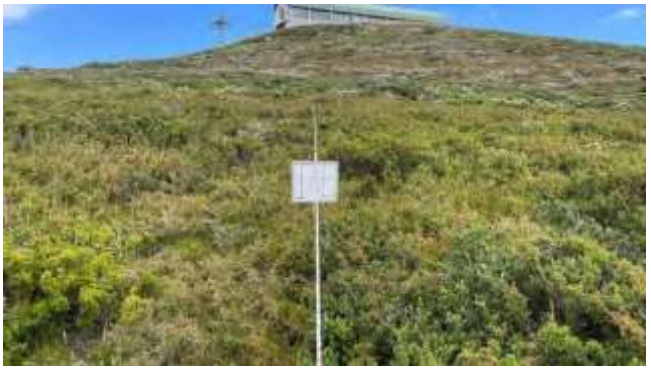
Impact Year 1, 31 January 2020

Impact Year 2, 2 February 2021

Impact Year 3, 31 January 2022

Impact Year 4, 2 February 2023

Impact Year 5, 29 January 2024



Impact Year 6, 6 February 2025

Bog 1 (Control Site), Photo Point 1BS

Baseline Year 1, 9 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 31 January 2020

Impact Year 2, 2 February 2021

Impact Year 3, 31 January 2022

Impact Year 4, 23 January 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 1 (Control Site), Photo Point 1BE

Baseline Year 1, 9 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 31 January 2020

Impact Year 2, 2 February 2021

Impact Year 3, 31 January 2022

Impact Year 4, 23 January 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 1 (Control Site), Photo Point 1CS

Baseline Year 1, 9 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 31 January 2020

Impact Year 2, 2 February 2021

Impact Year 3, 31 January 2022

Impact Year 4, 23 January 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 1 (Control Site), Photo Point 1CE

Baseline Year 1, 9 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 31 January 2020

Impact Year 2, 2 February 2021

Impact Year 3, 31 January 2022

Impact Year 4, 23 January 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 2 (Control Site), Photo Point 2AS

Baseline Year 1, 9 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 3 February 2020

Impact Year 2, 26 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 26 January 2023

Impact Year 5, 8 February 2024

Impact Year 6, 6 February 2025

Bog 2 (Control Site), Photo Point 2AE

Baseline Year 1, 9 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 3 February 2020

Impact Year 2, 26 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 26 January 2023

Impact Year 5, 8 February 2024

Impact Year 6, 6 February 2025

Bog 2 (Control Site), Photo Point 2BS

Baseline Year 1, 9 February 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 3 February 2020

Impact Year 2, 25 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 26 January 2023

Impact Year 5, 8 February 2024

Impact Year 6, 6 February 2025

Bog 2 (Control Site), Photo Point 2BE

Baseline Year 1, 9 February 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 3 February 2020

Impact Year 2, 25 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 26 January 2023

Impact Year 5, 8 February 2024

Impact Year 6, 6 February 2025

Bog 2 (Control Site), Photo Point 2CS

Baseline Year 1, 9 February 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 3 February 2020

Impact Year 2, 25 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 2 February 2023

Impact Year 5, 2 February 2024

Impact Year 6, 6 February 2025

Bog 2 (Control Site), Photo Point 2CE

Baseline Year 1, 9 February 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 3 February 2020

Impact Year 2, 26 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 2 February 2023

Impact Year 5, 2 February 2024

Impact Year 6, 6 February 2025

Bog 4.1/5/7 (Control Site), Photo Point 4.1AS

Baseline Year 1, 8 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 2 February 2021

Impact Year 3, 9 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 5 February 2024

Impact Year 6, 3 February 2025

Bog 4.1/5/7 (Control Site), Photo Point 4.1AE

Baseline Year 1, 8 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 2 February 2021

Impact Year 3, 9 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 31 January 2024

Impact Year 6, 3 February 2025

Bog 4.1/5/7 (Control Site), Photo Point 4.1BS

Baseline Year 1, 8 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 1 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 31 January 2024

Impact Year 6, 3 February 2025

Bog 4.1/5/7 (Control Site), Photo Point 4.1BE

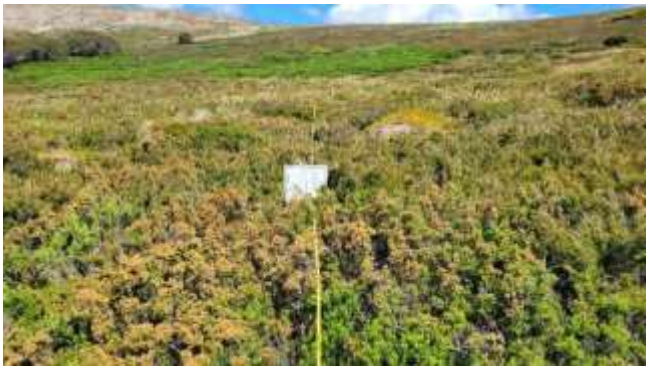
Baseline Year 1, 8 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 4 February 2020

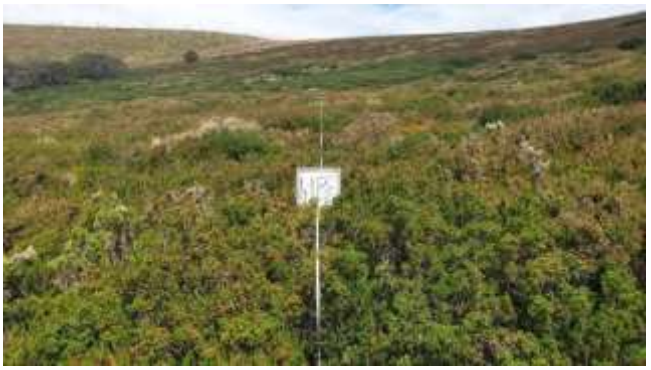
Impact Year 2, 1 February 2021

Impact Year 3, 8 February 2022



Impact Year 4, 25 January 2023

Impact Year 5, 31 January 2024



Impact Year 6, 3 February 2025

Bog 4.1/5/7 (Control Site), Photo Point 4.1CS

Baseline Year 1, 8 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 8 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 31 January 2024

Impact Year 6, 29 January 2025

Bog 4.1/5/7 (Control Site), Photo Point 4.1CE

Baseline Year 1, 8 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 8 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 31 January 2024

Impact Year 6, 29 January 2025

Bog 4.1/5/7 (Control Site), Photo Point 5AS

Baseline Year 1, 8 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 6 February 2020

Impact Year 2, 1 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 31 January 2024

Impact Year 6, 29 January 2025

Bog 4.1/5/7 (Control Site), Photo Point 5AE

Baseline Year 1, 8 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 6 February 2020

Impact Year 2, 1 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 31 January 2024

Impact Year 6, 29 January 2025

Bog 4.1/5/7 (Control Site), Photo Point 7AS

Baseline Year 1, 1 February 2018

Baseline Year 2, 11 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 8 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 31 January 2024

Impact Year 6, 29 January 2025

Bog 4.1/5/7 (Control Site), Photo Point 7AE

Baseline Year 1, 1 February 2018

Baseline Year 2, 11 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 8 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 31 January 2024

Impact Year 6, 29 January 2025

Bog 4.2 (Impact Site), Photo Point 4.2AS

Baseline Year 1, 30 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 1 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 24 January 2023

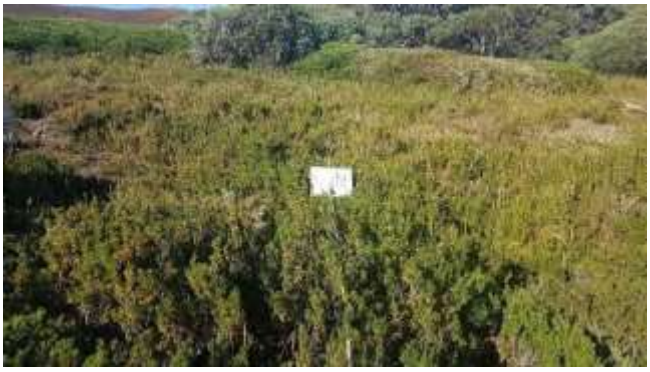
Impact Year 5, 30 January 2024

Impact Year 6, 27 January 2025

Bog 4.2 (Impact Site), Photo Point 4.2AE

Baseline Year 1, 30 January 2018

Baseline Year 2, 1 February 2019



Impact Year 1, 5 February 2020

Impact Year 2, 1 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 30 January 2024

Impact Year 6, 27 January 2025

Bog 4.2 (Impact Site), Photo Point 4.2BS

Baseline Year 1, 30 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 1 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 1 February 2023

Impact Year 5, 30 January 2024

Impact Year 6, 28 January 2025

Bog 4.2 (Impact Site), Photo Point 4.2BE

Baseline Year 1, 30 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 1 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 28 January 2025

Bog 4.2 (Impact Site), Photo Point 4.2CS

Baseline Year 1, 31 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 2 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 31 January 2024

Impact Year 6, 28 January 2025

Bog 4.2 (Impact Site), Photo Point 4.2CE

Baseline Year 1, 31 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 2 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 31 January 2024

Impact Year 6, 28 January 2025

Bog 4.2 (Impact Site), Photo Point 4.2DS

Baseline Year 1, 31 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 1 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 30 January 2024

Impact Year 6, 28 January 2025

Bog 4.2 (Impact Site), Photo Point 4.2DE

Baseline Year 1, 31 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 1 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 30 January 2024

Impact Year 6, 28 January 2025

Bog 4.2 (Impact Site), Photo Point 4.2ES

Baseline Year 1, 31 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 2 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 30 January 2024

Impact Year 6, 28 January 2025

Bog 4.2 (Impact Site), Photo Point 4.2EE

Baseline Year 1, 31 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 4 February 2020

Impact Year 2, 2 February 2021

Impact Year 3, 8 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 30 January 2024

Impact Year 6, 28 January 2025

Bog 6 (Impact Site), Photo Point 6AS

Baseline Year 1, 31 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 7 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 8 February 2024

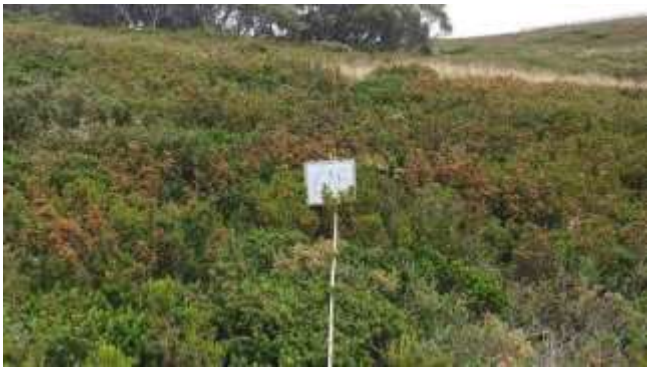
Impact Year 6, 28 January 2025

Bog 6 (Impact Site), Photo Point 6AE

Baseline Year 1, 31 January 2018

Baseline Year 2, 1 February 2019

Impact Year 1, 5 February 2020



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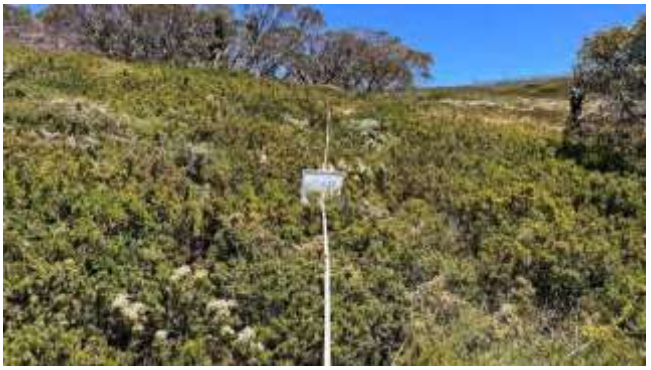
Impact Year 3, 7 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 8 February 2024



Impact Year 6, 28 January 2025

Bog 6 (Impact Site), Photo Point 6BS

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Baseline Year 2, 14 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 7 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 5 February 2024

Impact Year 6, 30 January 2025

Bog 6 (Impact Site), Photo Point 6BE

Baseline Year 1, 31 January 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 7 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 30 January 2025

Bog 6 (Impact Site), Photo Point 6CS

Baseline Year 1, 1 February 2018

Baseline Year 2, 11 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 7 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 8 February 2024

Impact Year 6, 29 January 2025

Bog 6 (Impact Site), Photo Point 6CE

Baseline Year 1, 1 February 2018

Baseline Year 2, 11 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 7 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 1 February 2024

Impact Year 6, 29 January 2025

Bog 6 (Impact Site), Photo Point 6DS

Baseline Year 1, 1 February 2018

Baseline Year 2, 11 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 7 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 8 February 2024

Impact Year 6, 29 January 2025

Bog 6 (Impact Site), Photo Point 6DE

Baseline Year 1, 1 February 2018

Baseline Year 2, 11 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 7 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 8 February 2024

Impact Year 6, 29 January 2025

Bog 6 (Impact Site), Photo Point 6ES

Baseline Year 1, 1 February 2018

Baseline Year 2, 11 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 7 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 8 February 2024

Impact Year 6, 28 January 2025

Bog 6 (Impact Site), Photo Point 6EE

Baseline Year 1, 1 February 2018

Baseline Year 2, 11 February 2019

Impact Year 1, 5 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 7 February 2022

Impact Year 4, 25 January 2023

Impact Year 5, 8 February 2024

Impact Year 6, 28 January 2025

Bog 8/9/10 (Impact Site), Photo Point 8AS

Baseline Year 1, 26 January 2018

Baseline Year 2, 29 January 2019

Impact Year 1, 18 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 1 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 30 January 2025

Bog 8/9/10 (Impact Site), Photo Point 8AE

Baseline Year 1, 26 January 2018

Baseline Year 2, 29 January 2019

Impact Year 1, 18 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 1 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 30 January 2025

Bog 8/9/10 (Impact Site), Photo Point 8BS

Baseline Year 1, 26 January 2018

Baseline Year 2, 29 January 2019

Impact Year 1, 18 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 1 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 30 January 2024

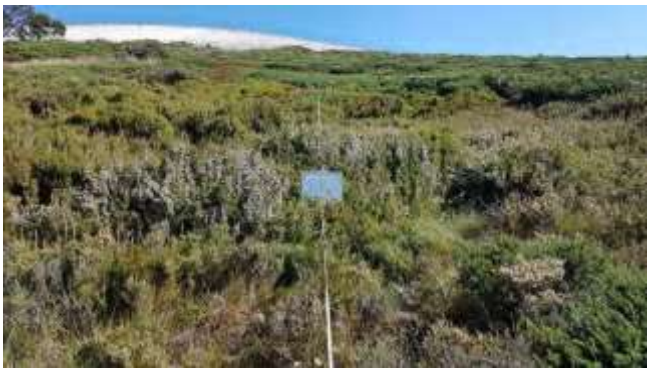
Impact Year 6, 30 January 2025

Bog 8/9/10 (Impact Site), Photo Point 8BE

Baseline Year 1, 26 January 2018

Baseline Year 2, 29 January 2019

Impact Year 1, 18 February 2020



Impact Year 2, 27 January 2021

Impact Year 3, 1 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 30 January 2024

Impact Year 6, 30 January 2025

Bog 8/9/10 (Impact Site), Photo Point 8CS

Baseline Year 1, 26 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 20 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 3 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 30 January 2025

Bog 8/9/10 (Impact Site), Photo Point 8CE

Baseline Year 1, 26 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 20 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 3 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 30 January 2025

Bog 8/9/10 (Impact Site), Photo Point 9AS

Baseline Year 1, 27 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 7 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 1 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 30 January 2025

Bog 8/9/10 (Impact Site), Photo Point 9AE

Baseline Year 1, 27 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 7 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 1 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 30 January 2025

Bog 8/9/10 (Impact Site), Photo Point 10AS

Baseline Year 1, 27 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 7 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 3 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 30 January 2025

Bog 8/9/10 (Impact Site), Photo Point 10AE

Baseline Year 1, 27 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 7 February 2020

Impact Year 2, 28 January 2021

Impact Year 3, 3 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 30 January 2025

Bog 11.1 (Control Site), Photo Point 11.1AS

Baseline Year 1, 8 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 3 February 2020

Impact Year 2, 25 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 2 February 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 11.1 (Control Site), Photo Point 11.1AE

Baseline Year 1, 8 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 3 February 2020

Impact Year 2, 25 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 2 February 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 11.1 (Control Site), Photo Point 11.1BS

Baseline Year 1, 8 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 3 February 2020

Impact Year 2, 25 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 23 January 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 11.1 (Control Site), Photo Point 11.1BE

Baseline Year 1, 8 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 3 February 2020

Impact Year 2, 25 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 23 January 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 11.1 (Control Site), Photo Point 11.1CS

Baseline Year 1, 8 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 4 February 2020

Impact Year 2, 25 January 2021

Impact Year 3, 31 January 2022

Impact Year 4, 23 January 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 11.1 (Control Site), Photo Point 11.1CE

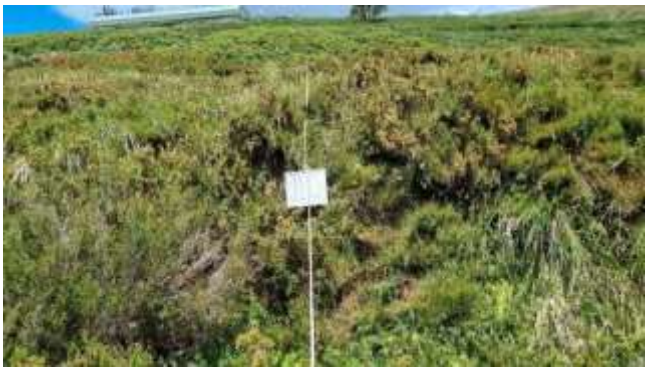
Baseline Year 1, 8 February 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 4 February 2020

Impact Year 2, 25 January 2021

Impact Year 3, 31 January 2022



Impact Year 4, 23 January 2023

Impact Year 5, 29 January 2024

Impact Year 6, 6 February 2025

Bog 11.2 (Impact Site), Photo Point 11.2AS

Baseline Year 1, 28 January 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 7 February 2020

Impact Year 2, 26 January 2021

Impact Year 3, 1 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 29 January 2024

Impact Year 6, 31 January 2025

Bog 11.2 (Impact Site), Photo Point 11.2AE

Baseline Year 1, 28 January 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 7 February 2020

Impact Year 2, 26 January 2021

Impact Year 3, 1 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 29 January 2024

Impact Year 6, 31 January 2025

Bog 11.2 (Impact Site), Photo Point 11.2BS

Baseline Year 1, 28 January 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 20 February 2020

Impact Year 2, 26 January 2021

Impact Year 3, 1 February 2022

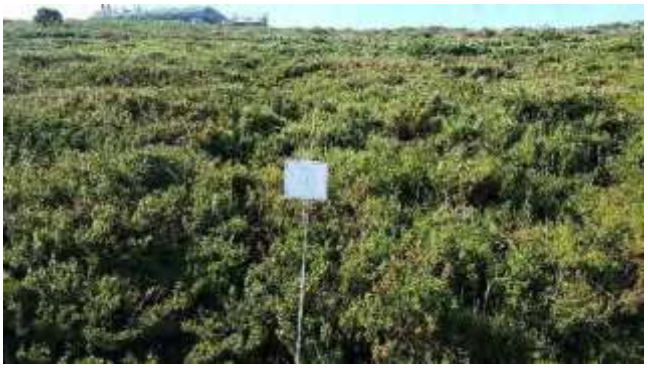
Impact Year 4, 23 January 2023

Impact Year 5, 29 January 2024

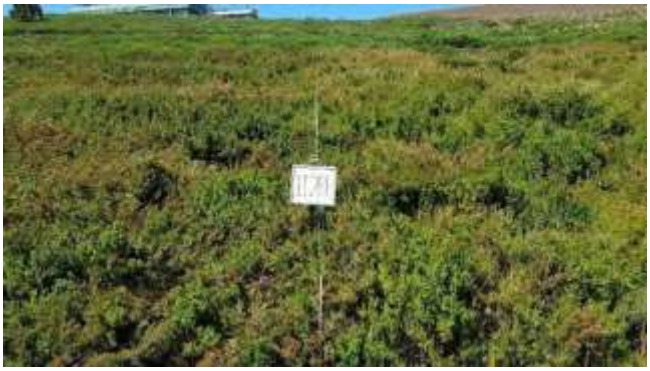
Impact Year 6, 31 January 2025

Bog 11.2 (Impact Site), Photo Point 11.2BE

Baseline Year 1, 28 January 2018



Baseline Year 2, 31 January 2019

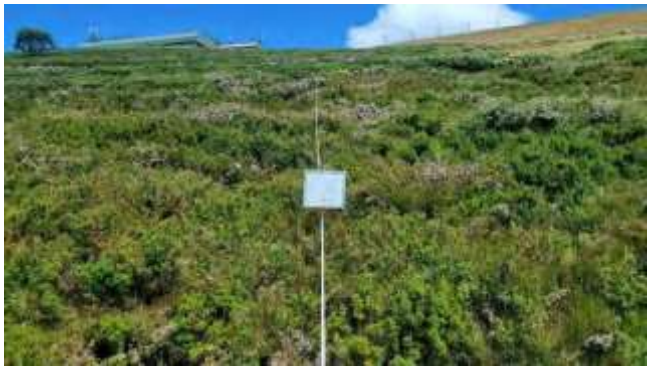


Impact Year 1, 20 February 2020

Impact Year 2, 26 January 2021

Impact Year 3, 1 February 2022

Impact Year 4, 23 January 2023



Impact Year 5, 29 January 2024

Impact Year 6, 31 January 2025

Bog 11.2 (Impact Site), Photo Point 11.2CS

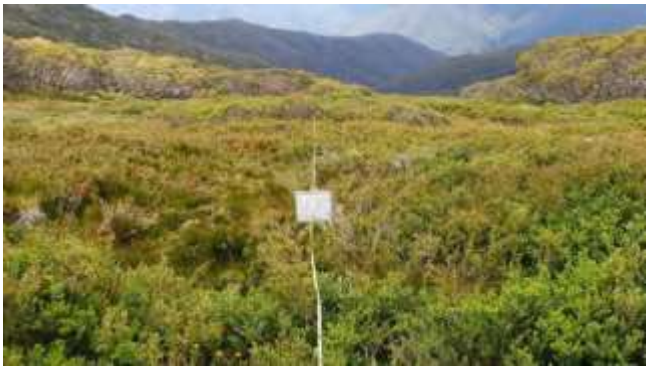
Baseline Year 1, 28 January 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 6 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 1 February 2022



Impact Year 4, 2 February 2023

Impact Year 5, 8 February 2024

Impact Year 6, 31 January 2025

Bog 11.2 (Impact Site), Photo Point 11.2CE

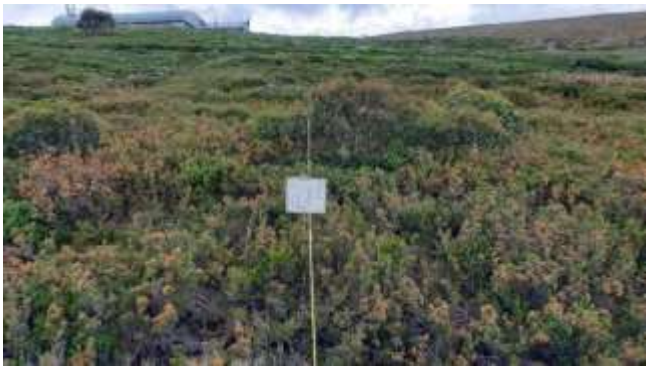
Baseline Year 1, 28 January 2018

Baseline Year 2, 31 January 2019

Impact Year 1, 6 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 1 February 2022



Impact Year 4, 2 February 2023

Impact Year 5, 29 January 2024

Impact Year 6, 31 January 2025

Bog 12 (Impact Site), Photo Point 12AS

Baseline Year 1, 27 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 7 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 3 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 29 January 2024

Impact Year 6, 31 January 2025

Bog 12 (Impact Site), Photo Point 12AE

Baseline Year 1, 27 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 7 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 3 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 31 January 2025

Bog 12 (Impact Site), Photo Point 12BS

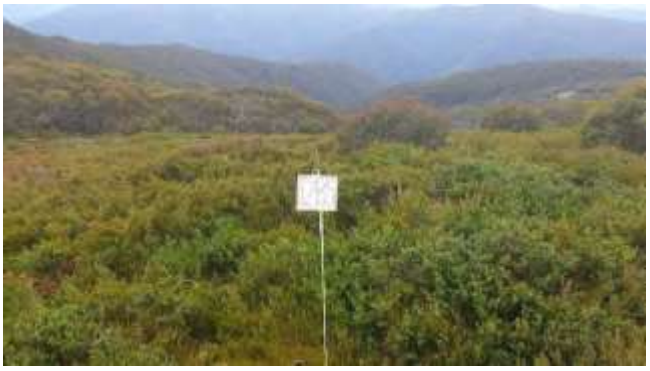
Baseline Year 1, 29 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 6 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 1 February 2022



Impact Year 4, 2 February 2023

Impact Year 5, 30 January 2024

Impact Year 6, 31 January 2025

Bog 12 (Impact Site), Photo Point 12BE

Baseline Year 1, 29 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 6 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 1 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 30 January 2024

Impact Year 6, 31 January 2025

Bog 12 (Impact Site), Photo Point 12CS

Baseline Year 1, 29 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 7 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 3 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 31 January 2025

Bog 12 (Impact Site), Photo Point 12CE

Baseline Year 1, 29 January 2018

Baseline Year 2, 30 January 2019

Impact Year 1, 7 February 2020

Impact Year 2, 27 January 2021

Impact Year 3, 3 February 2022

Impact Year 4, 24 January 2023

Impact Year 5, 30 January 2024

Impact Year 6, 31 January 2025

Bog 13 (Impact Site), Photo Point 13AS

Baseline Year 1, 2 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 31 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 9 February 2022

Impact Year 4, 30 January 2023

Impact Year 5, 5 February 2024

Impact Year 6, 6 February 2025

Bog 13 (Impact Site), Photo Point 13AE

Baseline Year 1, 2 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 31 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 9 February 2022

Impact Year 4, 30 January 2023

Impact Year 5, 5 February 2024

Impact Year 6, 6 February 2025

Bog 13 (Impact Site), Photo Point 13BS

Baseline Year 1, 2 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 31 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 9 February 2022

Impact Year 4, 30 January 2023

Impact Year 5, 5 February 2024

Impact Year 6, 6 February 2025

Bog 13 (Impact Site), Photo Point 13BE

Baseline Year 1, 2 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 31 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 9 February 2022

Impact Year 4, 30 January 2023

Impact Year 5, 5 February 2024

Impact Year 6, 6 February 2025

Bog 13 (Impact Site), Photo Point 13CS

Baseline Year 1, 2 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 31 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 9 February 2022

Impact Year 4, 30 January 2023

Impact Year 5, 5 February 2024

Impact Year 6, 6 February 2025

Bog 13 (Impact Site), Photo Point 13CE

Baseline Year 1, 2 February 2018

Baseline Year 2, 14 February 2019

Impact Year 1, 31 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 9 February 2022

Impact Year 4, 30 January 2023

Impact Year 5, 5 February 2024

Impact Year 6, 6 February 2025

Bog S1 (Control Site), Photo Point S1AS

Baseline Year 1, 6 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 28 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 2 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 6 February 2024

Impact Year 6, 4 February 2025

Bog S1 (Control Site), Photo Point S1AE

Baseline Year 1, 6 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 28 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 2 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 6 February 2024

Impact Year 6, 4 February 2025

Bog S1 (Control Site), Photo Point S1BS

Baseline Year 1, 6 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 28 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 2 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 6 February 2024

Impact Year 6, 4 February 2025

Bog S1 (Control Site), Photo Point S1BE

Baseline Year 1, 6 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 28 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 2 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 6 February 2024

Impact Year 6, 4 February 2025

Bog S1 (Control Site), Photo Point S1CS

Baseline Year 1, 6 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 28 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 2 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 6 February 2024

Impact Year 6, 4 February 2025

Bog S1 (Control Site), Photo Point S1CE

Baseline Year 1, 6 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 28 January 2020

Impact Year 2, 4 February 2021

Impact Year 3, 2 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 6 February 2024

Impact Year 6, 4 February 2025

Bog S2 (Control Site), Photo Point S2AS

Baseline Year 1, 6 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 29 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 3 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 7 February 2024

Impact Year 6, 5 February 2025

Bog S2 (Control Site), Photo Point S2AE

Baseline Year 1, 6 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 29 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 3 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 7 February 2024

Impact Year 6, 5 February 2025

Bog S2 (Control Site), Photo Point S2BS

Baseline Year 1, 7 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 29 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 3 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 7 February 2024

Impact Year 6, 5 February 2025

Bog S2 (Control Site), Photo Point S2BE

Baseline Year 1, 7 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 29 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 3 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 7 February 2024

Impact Year 6, 5 February 2025

Bog S2 (Control Site), Photo Point S2CS

Baseline Year 1, 7 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 30 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 3 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 7 February 2024

Impact Year 6, 5 February 2025

Bog S2 (Control Site), Photo Point S2CE

Baseline Year 1, 7 February 2018

Baseline Year 2, 13 February 2019

Impact Year 1, 30 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 3 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 7 February 2024

Impact Year 6, 5 February 2025

Bog S3 (Control Site), Photo Point S3AS

Baseline Year 1, 7 February 2018

Baseline Year 2, 12 February 2019

Impact Year 1, 29 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 3 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 6 February 2024

Impact Year 6, 4 February 2025

Bog S3 (Control Site), Photo Point S3AE

Baseline Year 1, 7 February 2018

Baseline Year 2, 12 February 2019

Impact Year 1, 29 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 3 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 6 February 2024

Impact Year 6, 4 February 2025

Bog S3 (Control Site), Photo Point S3BS

Baseline Year 1, 7 February 2018

Baseline Year 2, 12 February 2019

Impact Year 1, 29 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 3 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 7 February 2024

Impact Year 6, 4 February 2025

Bog S3 (Control Site), Photo Point S3BE

Baseline Year 1, 7 February 2018

Baseline Year 2, 12 February 2019

Impact Year 1, 29 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 3 February 2022

Impact Year 4, 2 February 2023

Impact Year 5, 7 February 2024

Impact Year 6, 4 February 2025

Bog S3 (Control Site), Photo Point S3CS

Baseline Year 1, 7 February 2018

Baseline Year 2, 12 February 2019

Impact Year 1, 29 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 2 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 6 February 2024

Impact Year 6, 4 February 2025

Bog S3 (Control Site), Photo Point S3CE

Baseline Year 1, 7 February 2018

Baseline Year 2, 12 February 2019

Impact Year 1, 29 January 2020

Impact Year 2, 3 February 2021

Impact Year 3, 2 February 2022

Impact Year 4, 31 January 2023

Impact Year 5, 6 February 2024

Impact Year 6, 4 February 2025

Appendix 5 Ecology data

Table A5.1 Area of Alpine Bogs as determined by DGPS mapping

Site	Area (ha)										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**1.3797***	**1.3536**	**1.3666**	**1.3217**	**1.3353**	**1.3423**	**1.3636**	**1.3824**	**1.4037**		
Bog 4.2	0.4014	0.3842	0.3928	0.3912	0.3823	0.3866	0.3882	0.3957	0.4016		
Bog 6	0.4914*	0.6723	0.6723*	0.6380	0.6473	0.6359	0.6492	0.6584	0.6737		
Bog 8/9/10	0.0667	0.0718	0.0692	0.0704	0.0762	0.0798	0.0838	0.0839	0.0861		
Bog 11.2	0.1195	0.1120	0.1157	0.1094	0.1083	0.1094	0.1089	0.1099	0.1081		
Bog 12	0.1145	0.1071	0.1108	0.1076	0.1157	0.1249	0.1275	0.1282	0.1278		
Bog 13	0.0051	0.0063	0.0057	0.0051	0.0055	0.0058	0.0060	0.0063	0.0064		
All control	**2.1446**	**2.0178**	**2.0812**	**2.0902**	**2.1183**	**2.1875**	**2.2136**	**2.2193**	**2.2162**		
Bog 1	0.1781	0.1620	0.1700	0.1491	0.1595	0.1626	0.1641	0.1652	0.1659		
Bog 2	0.1516	0.1481	0.1499	0.1459	0.1464	0.1521	0.1519	0.1530	0.1503		
Bog 4.1/5/7	0.5562	0.5457	0.5509	0.5480	0.5597	0.5519	0.5340	0.5348	0.5347		
Bog 11.1	0.2798	0.2590	0.2694	0.2571	0.2676	0.2890	0.2923	0.2928	0.2907		
Bog S1	0.5712	0.4584	0.5148	0.5126	0.4992	0.5009	0.5145	0.5111	0.5053		
Bog S2	0.1805	0.1778	0.1791	0.1785	0.1846	0.2108	0.2306	0.2340	0.2391		
Bog S3	0.2271	0.2669	0.2470	0.2989	0.3013	0.3201	0.3261	0.3284	0.3303		

*Note: As discussed in the IY1 monitoring report, mapping of Bog 6 in BY1 is unlikely to have captured the full extent of the Bog 6 entity as recognised in subsequent years and is therefore unreliable. The BY2 area for Bog 6 has therefore been used as the baseline mean and BY1 total for all impact sites.

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Table A5.2 Dimensions of Alpine Bogs as estimated by line transects

Site	Sum of dimensions (m)										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**356.2**	**353.2**	**354.7**	**355.6**	**354.2**	**344.8**	**342.6**	**350.8**	**353.4**		
Bog 4.2	92.2	92.6	92.4	92.2	92.6	89.8	93	92.2	90.6		
Bog 6	79.6	75.8	77.7	77.4	78.2	74.2	69.8	75	74.4		
Bog 8/9/10	66.4	67.8	67.1	65.2	65	61.4	60.8	64.2	66.4		
Bog 11.2	67.2	66.4	66.8	66.8	67.2	67.2	66	67	67.6		
Bog 12	40.6	41.0	40.8	41.4	40.6	40.6	40.4	40	40.6		
Bog 13	10.2	9.6	9.9	12.6	10.6	11.6	12.6	12.4	13.8		
All control	**436.0**	**441.6**	**438.8**	**438.6**	**436.6**	**438.8**	**434.6**	**434.8**	**438.4**		
Bog 1	55.8	57.2	56.5	57.0	56.6	55.8	55	57	55.8		
Bog 2	78.8	79.6	79.2	77.2	79	79.4	79.2	78	78.4		
Bog 4.1/5/7	81.6	84.2	82.9	85.2	83.8	86	83.4	83.4	87.4		
Bog 11.1	48.6	48.4	48.5	48.0	47.4	47.6	48	47	47.4		
Bog S1	52.6	52.4	52.5	52.0	51.2	50.8	51.2	50.6	51.2		
Bog S2	57.4	58.2	57.8	58.2	57	57	57.8	58.4	56.4		
Bog S3	61.2	61.6	61.4	61.0	61.6	62.2	60	60.4	61.8		

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Table A5.3 Cover of all bare ground as estimated by line transects

Site	Cover of all bare ground										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**1.9%**	**0.1%**	**1.0%**	**5.4%**	**4.6%***	**3.6%***	**0.4%***	**1.6%***	**1.9%***		
Bog 4.2	3.4%	0.0%	1.7%	5.8%	5.2%	1.9%	0.0%	1.9%	2.4%		
Bog 6	3.8%	0.0%	1.9%	8.2%	5.3%	4.0%	1.5%	3.2%	4.8%		
Bog 8/9/10	0.7%	0.0%	0.3%	6.0%	3.7%	2.8%	0.5%	0.5%	0.9%		
Bog 11.2	0.0%	0.0%	0.0%	3.7%	8.0%	5.6%	0.0%	0.0%	0.0%		
Bog 12	0.8%	0.8%	0.8%	3.1%	0.4%	5.4%	0.0%	2.7%	0.8%		
Bog 13	0.0%	0.0%	0.0%	0.0%	1.7%	3.4%	0.0%	1.7%	0.0%		
All control	**0.9%**	**0.2%**	**0.5%**	**4.8%**	**2.6%***	**5.0%***	**1.9%***	**2.6%***	**1.3%***		
Bog 1	0.6%	0.0%	0.3%	3.5%	0.3%	1.9%	0.0%	0.6%	0.0%		
Bog 2	1.1%	0.0%	0.6%	10.3%	0.7%	2.7%	0.0%	0.2%	0.7%		
Bog 4.1/5/7	0.4%	0.0%	0.2%	0.8%	0.6%	0.6%	0.4%	0.6%	0.6%		
Bog 11.1	0.7%	0.4%	0.5%	3.6%	0.0%	3.2%	0.4%	0.7%	0.0%		
Bog S1	3.0%	0.3%	1.7%	2.4%	7.1%	4.7%	6.4%	6.4%	1.3%		
Bog S2	0.0%	0.0%	0.0%	5.7%	0.7%	1.0%	1.3%	3.7%	2.0%		
Bog S3	0.9%	0.9%	0.8%	7.9%	10.7%	24.0%	6.6%	8.5%	5.0%		

*Note: From IY2 onwards, the type of bare ground was also recorded. Results presented here are for all bare ground, regardless of type.

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Table A5.4 Cover of bare ground attributed to natural causes as estimated by line transects

Site	Cover of bare ground attributed to natural causes										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	-	-	-	-	1.3%	2.6%	0.4%	0.6%	1.5%		
Bog 4.2	-	-	-	-	2.2%	1.7%	0.0%	0.2%	2.4%		
Bog 6	-	-	-	-	1.1%	3.4%	1.5%	1.1%	3.4%		
Bog 8/9/10	-	-	-	-	1.1%	2.3%	0.5%	0.5%	0.9%		
Bog 11.2	-	-	-	-	0.8%	0.8%	0.0%	0.0%	0.0%		
Bog 12	-	-	-	-	0.4%	5.4%	0.0%	1.6%	0.4%		
Bog 13	-	-	-	-	1.7%	3.4%	0.0%	1.7%	0.0%		
All control	-	-	-	-	1.8%	5.0%	1.1%	2.0%	0.7%		
Bog 1	-	-	-	-	0.3%	1.9%	0.0%	0.6%	0.0%		
Bog 2	-	-	-	-	0.7%	2.7%	0.0%	0.2%	0.7%		
Bog 4.1/5/7	-	-	-	-	0.0%	0.6%	0.4%	0.6%	0.6%		
Bog 11.1	-	-	-	-	0.0%	3.2%	0.4%	0.7%	0.0%		
Bog S1	-	-	-	-	3.4%	4.7%	1.3%	4.7%	1.0%		
Bog S2	-	-	-	-	0.7%	1.0%	1.3%	3.7%	1.0%		
Bog S3	-	-	-	-	8.5%	24.0%	4.7%	5.0%	1.9%		

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Table A5.5 Cover of bare ground attributed to deer activity as estimated by line transects

Site	Cover of bare ground attributed to deer activity										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	-	-	-	-	0.0%	0.0%	0.0%	0.1%	0.4%		
Bog 4.2	-	-	-	-	0.0%	0.0%	0.0%	0.2%	0.0%		
Bog 6	-	-	-	-	0.0%	0.0%	0.0%	0.0%	1.5%		
Bog 8/9/10	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 11.2	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 12	-	-	-	-	0.0%	0.0%	0.0%	0.4%	0.4%		
Bog 13	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
All control	-	-	-	-	0.9%	0.0%	0.9%	0.7%	0.6%		
Bog 1	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 2	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 4.1/5/7	-	-	-	-	0.6%	0.0%	0.0%	0.0%	0.0%		
Bog 11.1	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog S1	-	-	-	-	3.7%	0.0%	5.1%	1.7%	0.3%		
Bog S2	-	-	-	-	0.0%	0.0%	0.0%	0.0%	1.0%		
Bog S3	-	-	-	-	2.2%	0.0%	1.9%	3.5%	3.2%		

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Table A5.6 Cover of bare ground attributed to sedimentation as estimated by line transects

Site	Cover of bare ground attributed to sedimentation										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**-**	**-**	**-**	**-**	**3.4%**	**1.1%**	**0.0%**	**0.9%**	**0.0%**		
Bog 4.2	-	-	-	-	3.0%	0.2%	0.0%	1.5%	0.0%		
Bog 6	-	-	-	-	4.2%	0.6%	0.0%	2.1%	0.0%		
Bog 8/9/10	-	-	-	-	2.5%	0.5%	0.0%	0.0%	0.0%		
Bog 11.2	-	-	-	-	7.2%	4.8%	0.0%	0.0%	0.0%		
Bog 12	-	-	-	-	0.0%	0.0%	0.0%	0.8%	0.0%		
Bog 13	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
All control	**-**	**-**	**-**	**-**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**		
Bog 1	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 2	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 4.1/5/7	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 11.1	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog S1	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog S2	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog S3	-	-	-	-	0.0%	0.0%	0.0%	0.0%	0.0%		

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Table A5.7 Bog-dependent flora species richness as determined by line and belt transects

Site	Number of bog-dependent flora species*										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**9**	**10**	**9.5**	**10**	**9**	**9**	**9***	**9***	**9***		
Bog 4.2	8	9	8.5	8	8	8	8*	8*	8*		
Bog 6	8	8	8	9	8	8	8	8	8		
Bog 8/9/10	8	5	6.5	8	6	7	7	7	6		
Bog 11.2	6	6	6	6	5	6	5	5	5		
Bog 12	7	7	7	6	6	6	6	7	6		
Bog 13	3	5	4	6	3	4	3	4	4		
All control	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**		
Bog 1	5	5	5	5	6	6	5	6	6		
Bog 2	6	6	6	5	5	6	6	6	6		
Bog 4.1/5/7	8	8	8	7	8	7	8	8	7		
Bog 11.1	8	7	7.5	8	8	7	7	8	8		
Bog S1	6	6	6	7	7	6	7	7	7		
Bog S2	6	6	6	6	7	5	6	5	6		
Bog S3	6	8	7	8	7	8	8	7	8		

*Note: Subalpine Baeckea *Baeckea latifolia* and Mountain Baeckea *Baeckea utilis s.s.* have been aggregated into one taxon (Mountain Baeckea *Baeckea utilis s.l.*) for the purposes of this table and analysis of bog-dependent species richness. While Silver Astelia was not recorded along line and belt transects at impact sites in IY4, IY5 or IY6, it was incidentally recorded beside Transect 4.2B in Bog 4.2. The results presented in this table do not include incidental observations.

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Table A5.8 Cover of bog-dependent flora species as estimated by line transects

Site	Cover of bog-dependent flora species										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**77.9%**	**78.5%**	**78.2%**	**79.7%**	**79.5%**	**79.4%**	**78.6%**	**77.5%**	**77.1%**		
Bog 4.2	87.5%	87.3%	87.4%	87.3%	87.7%	86.0%	87.9%	86.7%	86.0%		
Bog 6	72.2%	72.4%	72.3%	72.6%	74.1%	74.3%	70.7%	69.1%	67.4%		
Bog 8/9/10	75.6%	75.6%	75.6%	77.5%	74.9%	77.5%	74.5%	73.8%	73.8%		
Bog 11.2	88.1%	90.5%	89.3%	91.0%	91.0%	88.9%	89.4%	87.8%	88.6%		
Bog 12	72.8%	72.4%	72.6%	73.5%	75.1%	73.9%	73.2%	70.0%	70.0%		
Bog 13	43.6%	48.7%	46.2%	59.0%	53.0%	58.1%	60.7%	65.8%	66.7%		
All control	**86.9%**	**88.8%**	**87.9%**	**88.3%**	**88.9%**	**89.1%**	**89.0%**	**87.1%**	**88.3%**		
Bog 1	88.0%	90.5%	89.3%	90.2%	90.2%	88.6%	89.0%	89.9%	88.0%		
Bog 2	89.0%	91.1%	90.0%	91.3%	90.4%	91.5%	91.5%	89.2%	90.8%		
Bog 4.1/5/7	81.2%	83.9%	82.5%	83.7%	83.7%	81.7%	81.6%	81.7%	84.5%		
Bog 11.1	87.4%	87.7%	87.5%	88.1%	88.4%	88.4%	89.9%	87.4%	87.7%		
Bog S1	84.8%	86.9%	85.9%	86.9%	89.2%	88.2%	89.2%	84.5%	84.8%		
Bog S2	97.0%	99.3%	98.1%	98.0%	98.7%	98.3%	97.6%	96.3%	97.3%		
Bog S3	84.2%	85.2%	84.7%	82.3%	85.2%	90.9%	88.6%	83.3%	86.4%		

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Table A5.9 Cover of native non-bog-dependent flora species as estimated by line transects

Site	Cover of native non-bog-dependent flora species										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**44.4%**	**46.1%**	**45.2%**	**46.5%**	**46.1%**	**48.5%**	**45.6%**	**43.1%**	**41.5%**		
Bog 4.2	24.7%	26.9%	25.8%	27.1%	29.5%	27.5%	26.4%	23.9%	24.9%		
Bog 6	62.5%	65.7%	64.1%	61.5%	65.7%	66.9%	66.7%	63.4%	55.8%		
Bog 8/9/10	49.4%	51.7%	50.6%	53.3%	50.6%	56.1%	50.1%	49.7%	51.7%		
Bog 11.2	24.9%	23.6%	24.3%	25.7%	24.7%	27.6%	25.7%	23.6%	22.8%		
Bog 12	61.5%	61.5%	61.5%	63.4%	56.4%	62.6%	56.4%	57.6%	56.8%		
Bog 13	66.7%	72.6%	69.7%	79.5%	72.6%	77.8%	71.8%	54.7%	48.7%		
All control	**44.2%**	**46.1%**	**45.1%**	**43.5%**	**43.8%**	**44.8%**	**44.2%**	**40.0%**	**38.9%**		
Bog 1	42.9%	44.2%	43.5%	45.4%	44.8%	49.2%	51.1%	43.8%	40.4%		
Bog 2	41.6%	41.4%	41.5%	41.2%	40.5%	42.1%	38.7%	34.6%	33.4%		
Bog 4.1/5/7	39.2%	42.3%	40.8%	39.8%	39.0%	40.2%	41.4%	39.6%	39.2%		
Bog 11.1	41.2%	44.4%	42.8%	40.4%	43.0%	44.0%	44.0%	40.8%	36.5%		
Bog S1	54.5%	57.9%	56.2%	46.8%	47.1%	44.4%	46.8%	42.8%	46.1%		
Bog S2	32.3%	32.3%	32.3%	33.0%	34.7%	34.3%	33.3%	29.3%	30.0%		
Bog S3	61.2%	63.7%	62.5%	60.6%	61.5%	62.1%	57.1%	50.8%	47.9%		

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Table A5.10 Cover of weed species as estimated by entire line transects inside and outside of Alpine Bogs

Site	Cover of weed species inside and outside of Alpine Bogs										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**5.4%**	**6.3%**	**5.9%**	**7.3%**	**8.1%**	**8.8%**	**7.7%**	**7.9%**	**6.3%**		
Bog 4.2	4.5%	4.7%	4.6%	4.3%	4.5%	4.3%	4.7%	4.7%	3.6%		
Bog 6	4.4%	6.9%	5.7%	7.8%	9.7%	14.5%	9.7%	10.5%	10.1%		
Bog 8/9/10	6.0%	9.0%	7.5%	11.0%	11.5%	10.3%	12.4%	10.1%	6.7%		
Bog 11.2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.0%		
Bog 12	0.0%	0.4%	0.2%	0.8%	0.8%	1.6%	0.0%	0.4%	0.0%		
Bog 13	40.2%	35.0%	37.6%	42.7%	47.0%	44.4%	37.6%	43.6%	36.8%		
All control	**3.3%**	**5.3%**	**4.3%**	**5.0%**	**4.9%**	**5.5%**	**5.0%**	**5.2%**	**4.6%**		
Bog 1	3.2%	3.5%	3.3%	3.5%	3.8%	3.8%	3.8%	1.3%	2.5%		
Bog 2	3.9%	4.6%	4.2%	5.5%	4.8%	7.8%	6.9%	8.7%	8.5%		
Bog 4.1/5/7	4.9%	7.6%	6.2%	5.4%	5.0%	6.0%	7.4%	6.8%	4.7%		
Bog 11.1	1.4%	3.2%	2.3%	4.3%	2.9%	2.2%	1.4%	0.7%	1.4%		
Bog S1	6.4%	7.4%	6.9%	6.7%	9.8%	6.7%	5.1%	3.7%	4.4%		
Bog S2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.7%		
Bog S3	2.2%	9.5%	5.8%	8.5%	7.6%	9.8%	7.9%	11.7%	7.6%		

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Table A5.11 Cover of weed species as estimated by the parts of line transects within the baseline dimensions of Alpine Bogs

Site	Cover of weed species within Alpine Bogs										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**1.9%**	**2.5%**	**2.2%**	**3.1%**	**4.0%**	**5.1%**	**3.5%**	**3.6%**	**3.7%**		
Bog 4.2	1.1%	0.4%	0.8%	0.9%	1.1%	1.3%	1.5%	1.3%	1.1%		
Bog 6	3.6%	5.9%	4.7%	6.4%	8.7%	14.2%	8.7%	9.9%	10.2%		
Bog 8/9/10	1.5%	3.8%	2.6%	4.1%	5.0%	4.1%	4.7%	3.5%	5.0%		
Bog 11.2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 12	0.0%	0.5%	0.2%	1.0%	0.5%	1.9%	0.0%	0.0%	0.0%		
Bog 13	19.2%	11.5%	15.4%	19.2%	26.9%	23.1%	9.6%	13.5%	7.7%		
All control	**1.4%**	**3.0%**	**2.2%**	**2.7%**	**2.9%**	**3.3%**	**3.1%**	**3.5%**	**2.9%**		
Bog 1	0.0%	0.4%	0.2%	0.4%	0.4%	0.7%	0.7%	0.0%	0.4%		
Bog 2	0.8%	2.3%	1.5%	1.5%	1.5%	1.8%	1.8%	4.3%	4.5%		
Bog 4.1/5/7	3.1%	4.3%	3.7%	3.3%	3.6%	4.8%	5.7%	4.1%	3.3%		
Bog 11.1	0.4%	0.4%	0.4%	1.2%	2.0%	2.0%	1.2%	0.0%	0.8%		
Bog S1	3.0%	2.6%	2.8%	3.0%	4.9%	3.4%	2.6%	2.3%	1.5%		
Bog S2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.7%		
Bog S3	2.3%	9.7%	6.0%	8.7%	7.8%	10.0%	8.1%	12.0%	7.8%		

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Table A5.12 Cover of Peat Moss *Sphagnum* spp. as estimated by line transects

Site	Cover of Peat Moss *Sphagnum* spp.										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**5.4%**	**5.3%**	**5.4%**	**6.0%**	**6.0%**	**5.9%**	**6.0%**	**5.8%**	**6.0%**		
Bog 4.2	15.9%	15.1%	15.5%	15.1%	16.8%	16.8%	15.3%	14.8%	15.0%		
Bog 6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 8/9/10	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 11.2	3.2%	2.7%	2.9%	2.1%	2.9%	2.1%	4.0%	3.2%	2.7%		
Bog 12	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 13	18.8%	22.2%	20.5%	28.2%	26.5%	26.5%	29.1%	30.8%	35.9%		
All control	**15.5%**	**17.2%**	**16.4%**	**15.9%**	**16.4%**	**17.1%**	**17.9%**	**16.0%**	**16.8%**		
Bog 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 2	3.4%	3.0%	3.2%	2.1%	3.4%	2.5%	3.7%	1.8%	1.1%		
Bog 4.1/5/7	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 11.1	5.4%	11.9%	8.7%	7.6%	6.1%	4.7%	6.5%	6.5%	5.8%		
Bog S1	33.7%	39.4%	36.5%	38.7%	37.7%	40.7%	43.4%	35.4%	37.7%		
Bog S2	62.0%	65.0%	63.5%	59.3%	61.6%	65.0%	64.6%	60.6%	65.7%		
Bog S3	21.1%	21.1%	21.1%	21.8%	24.3%	25.6%	26.5%	25.9%	26.8%		

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Table A5.13 Proportion of Peat Moss *Sphagnum* spp. recorded as dead along line transects

Site	Proportion of Peat Moss *Sphagnum* spp. recorded as dead										
	BY1	BY2	BM	IY1	IY2	IY3	IY4	IY5	IY6	IY7	IY8
All impact sites	**0.8%**	**0.9%**	**0.8%**	**8.4%**	**0.8%**	**0.8%**	**0.0%**	**3.1%**	**0.0%**		
Bog 4.2	1.2%	1.2%	1.2%	2.5%	1.1%	1.1%	0.0%	5.1%	0.0%		
Bog 6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 8/9/10	0.0%	0.0%	0.0%	66.7%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 11.2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 12	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 13	0.0%	0.0%	0.0%	9.1%	0.0%	0.0%	0.0%	0.0%	0.0%		
All control	**2.6%**	**1.9%**	**2.2%**	**1.5%**	**2.5%**	**1.7%**	**0.7%**	**1.0%**	**3.9%**		
Bog 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 4.1/5/7	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
Bog 11.1	0.0%	15.2%	10.4%	0.0%	0.0%	0.0%	0.0%	11.1%	18.8%		
Bog S1	7.0%	0.0%	3.2%	1.7%	5.4%	0.8%	0.0%	0.0%	8.0%		
Bog S2	1.6%	1.6%	1.6%	2.3%	0.5%	0.5%	1.6%	0.6%	2.1%		
Bog S3	0.0%	0.0%	0.0%	0.0%	3.9%	6.2%	0.0%	1.2%	0.0%		

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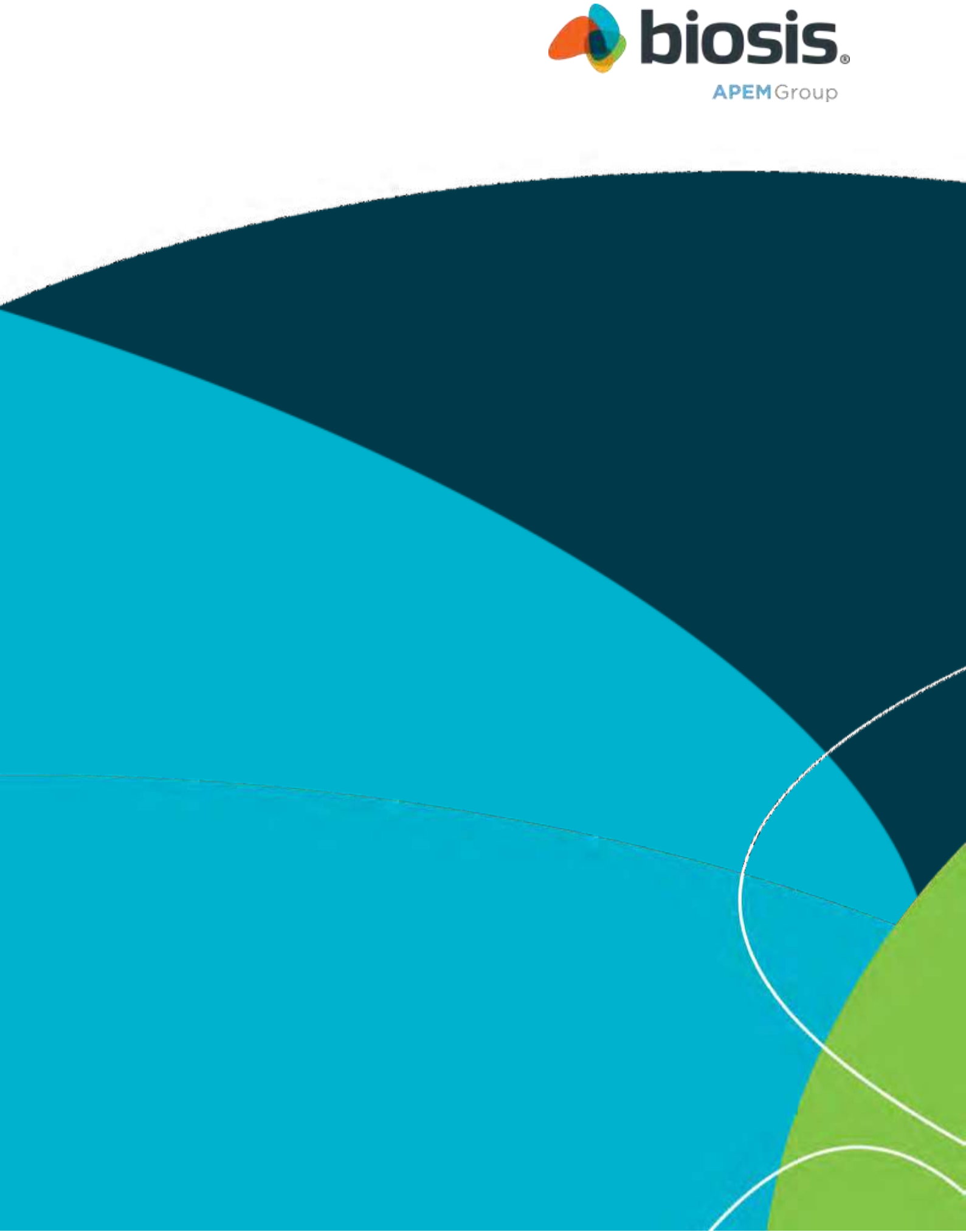
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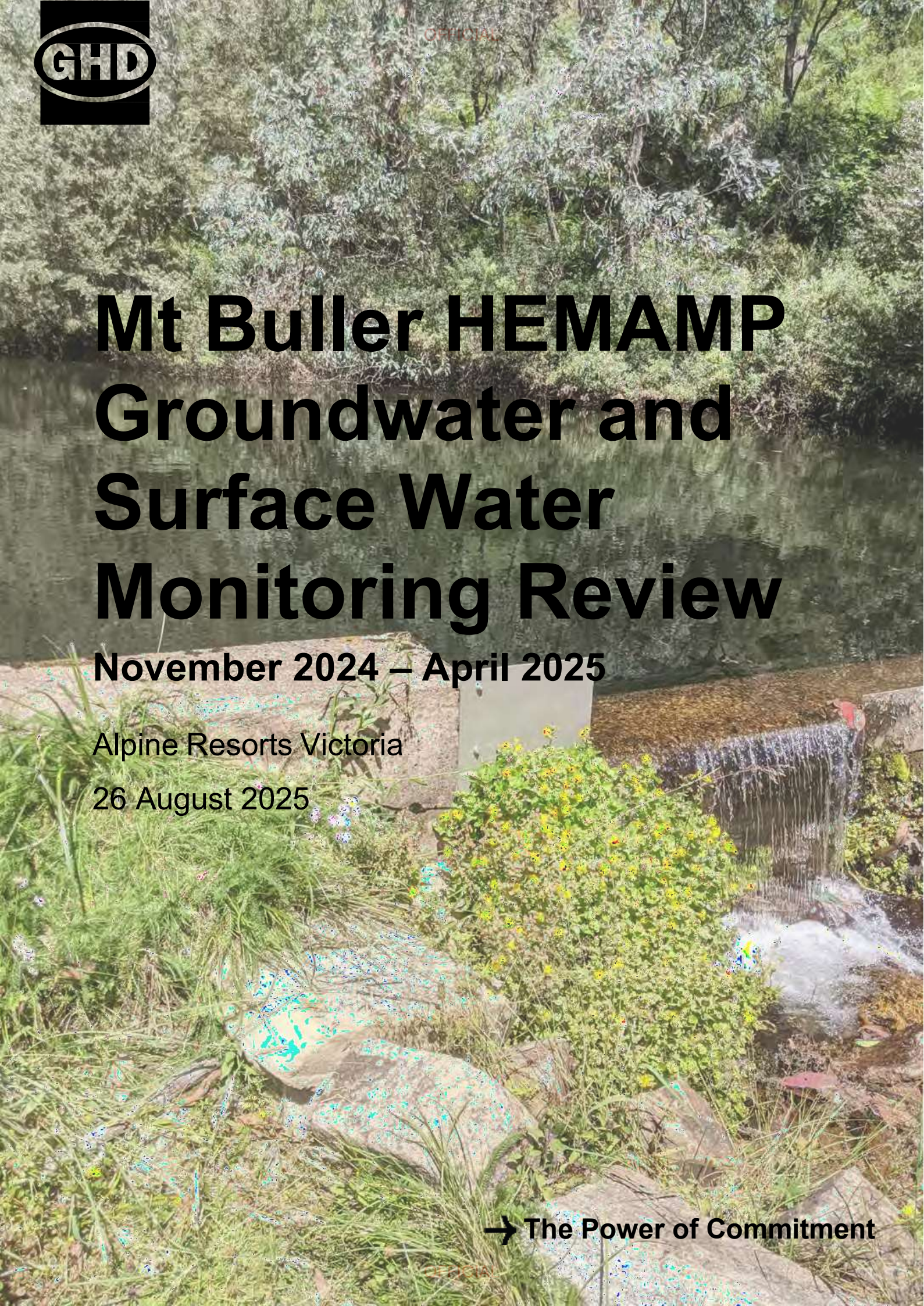

Mt Buller HEMAMP Groundwater and Surface Water Monitoring Review

November 2024 – April 2025

Alpine Resorts Victoria

26 August 2025

→ The Power of Commitment

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GHD Pty Ltd | ABN 39 008 488 373
Contact: Meg Turner, Environmental Scientist | GHD
105 Hume Street, Suite 5
Wodonga, Victoria 3690, Australia
T +61 2 6043 8700 | **F** +61 2 6043 8711 | **E** abxmail@ghd.com | **ghd.com**

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Acknowledgement of Country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.

Executive summary

A 100 ML water storage dam was constructed on the Mt Buller summit, between October 2019 and May 2020, as part of the Mt Buller Sustainable Water Security Project. A Hydrological and Ecological Monitoring and Adaptive Management Program (HEMAMP) was developed to enable monitoring of the condition of Alpine Sphagnum Bogs which are hydraulically down-gradient of the dam construction footprint. The hydrological component of the HEMAMP involves tri-annual groundwater and surface water monitoring and sampling, undertaken by Alpine Resorts Victoria (ARV). The annual monitoring period includes one monitoring event in spring (typically November), one in late summer (typically February) and autumn (typically April). Monitoring has been undertaken prior to dam construction (Baseline monitoring) and after dam construction (Impact monitoring).

Based upon the monitoring completed in late 2024 and early 2025 (Impact Year 6), the following conclusions are made regarding the construction of the water storage dam:

– No obvious hydrochemical differences in the surface water and groundwater have been identified between the Baseline and Impact periods
– No major exceedances of the ANZG (2018) water quality objectives are identified. The water quality objectives are met at all locations with the exception of minor exceedances of nitrate (as N) and ammonia (as N) at bore BH06, noting these were observed in the baseline monitoring prior to dam construction
– There is no obvious influence upon groundwater levels at most locations. However, two bores (BH09 and BH17), directly down-gradient of the water storage have shown a change in water level behaviour. The strong seasonal water level trend identified historically has been replaced with a more stable water level, albeit with a slight reduction in water level highs
    - This change in groundwater level response is in part due to changes in the upgradient groundwater catchment due to the footprint of the water storage and associated earthworks. It is noted, however, that groundwater seepage beneath the storage is captured via a drainage blanket, then concentrated and redirected to Alpine bogs further downslope (north) via the Environmental Watering System (EWS). The EWS has likely been contributing additional flows to the bogs and groundwater bores below the water storage footprint as described in the dot point below
– In October 2024, ARV staff observed that the water storage appeared to be leaking. Inspections identified damage to the dam liner in multiple tears. The water storage was dewatered in December 2024 and the liner was repaired in January 2025
– Surface water flows from Boggy Creek Weir 1 pickup 1 and Weir 2 indicate that flows are highly responsive to rainfall all year-round and may be increased by snowmelt for several weeks in late spring. Boggy flows also appeared to be highly influenced by flows from the EWS in 2024, however this is noted to have been a period of high flows from the EWS due to leakage of the water storage. Continued monitoring is required to assess the influence of EWS flows post-repair of the dam liner

HEMAMP recommendations

Recommendations from the Impact Year 6 hydrogeological assessment are as follows:

– Adaptive management responses are recommended to investigate TDS and turbidity outliers in surface water, similarly to IY5 recommendations (see Section 8.2.1.2):
    - Areas of weed removal and track grading should be inspected to determine if sediment controls need to be adjusted or added to avoid runoff
    - If inspection indicates no or limited sediment runoff, additional sources of TDS could be investigated including the sewage pipeline that traverses the base of the Summit Nature Walk
    - Turbidity in the EWS outlet should be investigated as to its source and whether it is entering the distribution pipeline (as turbidity may be settling in the EWS collection pit)
– Groundwater levels, surface flow levels and EWS flow should continue to be monitored in accordance with the current HEMAMP program methodology, particularly in response to recent water storage repairs. Reference should also be made to the monitoring and risk control measures in GHD 2025

- BH07 and BH10 should be manually bailed in the next monitoring round to reduce sediment load
- The HEMAMP protocol contains adaptive management triggers for underwatering of the Alpine Sphagnum Bogs. It is now evident that potential overwatering has occurred or there are changes in the flow regimes to the downstream environment. It is recommended that either the HEMAMP or a separate monitoring program (potentially related to the dam safety plans) also considers the prospect of overwatering or these changes to the flow regime through the design of the EWS. Implications of overwatering or changes to flow regime may include:
  - The encroachment of the Alpine Sphagnum Bogs on other vegetation communities (as has been indicated by the ecological monitoring), or
  - Potential influences or impact to geotechnical hazards, including slope stability and dam safety
- Water quality sampling could be removed from the April monitoring period in future years, due to the prevalence of dry groundwater bores and the absence of significant seasonal variation in water quality. Groundwater level and surface flow data should still be collected over this period
- The Boggy Creek and EWS flow data should continue to be improved and evaluated with regard to:
  - Collation of data from the new SCADA system with historical data
  - Responsiveness to monitoring instrument failures or system failures
  - Calibration of flow meters to verify data records

Other recommendations

- As outlined in GHD 2025 (*Mt Buller Boggy Creek Reservoir Dam Safety Geotechnical Assessment and Landslide Risk Assessment*) Low to Moderate risks were evaluated for the qualitative risk assessment (risk to property) and “acceptable” risks were evaluated for the qualitative risk assessment (risk to life). As a result of inherent uncertainties and the known historical site conditions, a number of risk control measures are outlined to reduce the risks to as low as reasonably practicable. GHD recommend these control measures need to be managed alongside the HEMAMP as well as the Dam Safety monitoring programs. In respect to this report and the hydrogeological and surface water monitoring program, the following improvements and gaps need to be addressed:
  - On-going monitoring/operation:
    - Efforts to avoid overwatering of the bogs by ensuring ongoing flows to/through EWS are reduced to levels similar to pre-construction. This is expected to reduce the likelihood of landslide hazard occurrence
    - Monitoring the effectiveness of the repairs completed to date as the performance of the liner is assessed as critical to ongoing good slope performance. Monitoring includes visual observations as well as measuring flow meter/groundwater levels
  - Data gaps:
    - Review construction details on the aqueduct (and the potential for an updated catchment and hydrological review) and assess function and suitability for required purposes including emergency intake of increased flows because of overwatering from EWS

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.4 and the assumptions and qualifications contained throughout the Report.

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1. Introduction

Mt Buller and Mt Stirling Resort Management Board, now incorporated into Alpine Resorts Victoria (ARV) determined the need for a 100 ML water storage as part of the Mt Buller Sustainable Water Security Project. This project aimed to provide a reliable water supply to the resort, capable of meeting future demand. The water storage was constructed between October 2019 and May 2020 and had a 10.3 ha construction footprint. The footprint of the storage is adjacent to sensitive alpine ecosystems, particularly native vegetation and habitat for significant species, that are immediately down-gradient of the storage construction footprint, with some of these sensitive alpine ecosystems also corresponding to historical landslide features.

A Hydrological and Ecological Monitoring and Adaptive Management Program (HEMAMP) was developed to monitor the condition of the ecosystems, notably Alpine Sphagnum Bogs. The HEMAMP was implemented prior to the commencement of construction to obtain a baseline of information on surface water, groundwater and ecological conditions. Monitoring has continued post-construction. These pre-construction and post-construction monitoring periods have been referred to as baseline and impact periods in data reporting.

The hydrological component of the HEMAMP has involved bi-annual groundwater and surface water monitoring and sampling, undertaken by ARV. The annual monitoring period has included one monitoring event in spring (typically November) and one in late summer (typically February). In 2023, an additional monitoring round was added in April. This was added in response to a peer review of the monitoring program by Monash University as well as recommendations from the former Department of Environment, Land, Water and Planning (DELWP)[1].

This Impact Year 6 report presents the findings of the 2024-2025 monitoring events. The data analysis in this report incorporates changes to the adaptive management triggers in the HEMAMP Version 5 (Biosis 2022).

1.1 Impact Year 5 report recommendations

The impact year 5 (IY5) assessment recommended further investigations and infrastructure improvements as summarised in Table 1. The recommendations have largely been addressed.

Table 1 Key recommendations from IY5

Recommendation	Works completed	Resolved?
Adaptive management responses are recommended to investigate TDS and turbidity outliers in surface water	Areas of weed removal and track-grading were inspected to adjust sediment controls if needed. Additional potential sources of sediment were investigated including the aqueducts in the bog catchment area. The EWS collection pit was flushed to clear sediment build-up.	Ongoing due to similar results in IY6
Repair Bore 10 headworks and decommission bores BH04 and BH04A.	A permit to decommission Bore BH04 and BH04A was obtained and a drilling contractor engaged for these works, however the contractor withdrew from the works. The works will be rescheduled for IY7.	Partially
An interim surface flow analysis should be conducted in December 2024 or January 2025 following the collection of six months of flow data from the EWS.	Partially addressed in this report, noting interim flow analysis was not conducted prior to preparation of this report, potentially leading to some data gaps as identified in the assessment.	Partially Addressed in this report
Groundwater levels should continue to be monitored in accordance with the current HEMAMP program methodology	Continued monitoring completed.	Yes
It is recommended that either the HEMAMP or a separate monitoring program also considers the prospect of overwatering which may be occurring from the EWS or from changes to the subsurface within the dam footprint.	Some investigation undertaken in response to leakages identified from the water storage dam. This included a geotechnical slope stability assessment (GHD 2025).	Partially

[1] Now the Department of Energy, Environment and Climate Action (DEECA)

Recommendation	Works completed	Resolved?
ARV should consider opportunities to utilise the HEMAMP hydrological monitoring to inform ongoing water supply assessments and decisions, including to capture data to assist with water security and demand assessments	ARV has been creating an Integrated Water Management Plan to document water use and distribution on site.	Partially
BH07 and BH10 should be manually bailed in the next monitoring round to reduce sediment load	Not completed	No
Note: EWS = Environmental Watering System		

1.2 Water storage repair works in IY6

In October 2024, concerns were raised that the water storage was leaking. Visual observations of the water storage levels as well as SCADA flow data interpretation led ARV to initiate an investigative response and action plan, with subsequent repair works undertaken in November 2024 and replacement works in January 2025. A timeline of events is presented below. The implications of the water loss from the water storage and changes in pumping regimes in response to investigations and repairs have been discussed in the relevant result analysis sections in this report.

- **8 October 2024:** ARV Enviro staff observe unusual water activity while conducting routine HEMAMP related site monitoring.
- **17 Oct 2024:** ARV Water Operations confirm an anomaly in data that indicated a potential leak
- **18 Oct 2024:** ARV initiated response plans
- **23 Oct 2024:** Divers inspected reservoir and identified a number of holes
- **4 Nov 2024:** Temporary repairs carried out
- **9 Dec 2024:** Dewatering of reservoir commenced
- **6 to 20 Jan 2025:** Permanent repairs carried out
- **21 Jan 2025:** Refilling of storage commenced

1.3 Purpose of this report

The purpose of this report is to present the data obtained from the annual groundwater and surface water monitoring at Mt Buller in the Impact Year 6 (IY6) 2024-2025 hydrological monitoring period (i.e. November 2024, February 2025 and April 2025 monitoring events).

1.4 Scope and limitations

This report: has been prepared by GHD Pty Ltd (GHD) for Alpine Resorts Victoria and may only be used and relied on by Alpine Resorts Victoria for the purpose agreed between GHD and Alpine Resorts Victoria as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Alpine Resorts Victoria arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Alpine Resorts Victoria and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

1.5 Assumptions

The following assumptions have been used to prepare this report:

– GHD has relied upon data collected and/or provided by the ARV, including climate and water flow data (evapotranspiration, surface flows, pump data and EWS flows). This data is assumed to be accurate and reflect the conditions and have been collected with the required instrumentation calibration and data collection quality assurance requirements. GHD has not completed any independent verification of the data supplied

– A climatological model was produced by Biosis as part of the endorsed HEMAMP for the purpose of reviewing data against the HEMAMP adaptive management triggers. GHD has input surface flow data and groundwater flow data into the HEMAMP model and included the model outputs in this report. GHD has not undertaken an independent review or verification of the HEMAMP climatological model and assumes that the model is accurate and fit-for-purpose

2. Overview of monitoring program

2.1 Objectives

The objectives of the water monitoring program are to measure results of water quality and flow monitoring against the adaptive management triggers of the HEMAMP, to identify potential implications on surface water and groundwater levels and quality caused by the construction and operation of the water storage.

2.2 Monitoring network

2.2.1 Surface water

2.2.1.1 Boggy Creek

Prior to 2018, there were two surface water sampling locations at weirs referred to as Boggy Creek 1 and Boggy Creek 2. Following a site inspection and sampling event in February 2018, a third location was added, at a weir downstream of the existing sampling locations.

The surface water sampling locations since 2018 include:

- Boggy Creek 1
  - Pick up Location 1 (Boggy 1 p/u 1) west of the shed and tank
  - Pick up Location 2 (Boggy 1 p/u 2), south of the shed and tank
- Boggy Creek 2
  - At a weir downstream of the two Boggy Creek 1 sites

It is noted that limited flow data has previously been provided for surface water. Therefore, surface water flow analysis has been limited in previous years. IY6 is the first year in which complete flow records have been obtained for all Boggy Creek Weirs. ARV installed new flow gauges at Boggy Creek weir 1 pickup 1 and pickup 2 in January and May 2022 and Boggy Weir 2 in December 2023.

2.2.1.2 Environmental watering system

In addition to the Boggy Creek sampling locations, a fourth sampling location was added to the monitoring program in 2022-2023 following recommendation from DELWP. The fourth sampling location is the Leakage Collection Pipeline, which is the eastern pipeline feeding into the EWS located at the toe of the storage embankment.

To prevent excessive hydrostatic pressures on the storage lining system, the storage was constructed with an under-drainage system. The design drawings in Appendix A show the drainage system as comprising bedding sand with a network of DN100 collection pipes. The pipes terminate at central point beneath the storage, and then gravity feed to a ‘distribution pit’ located at the toe of the northern embankment. Groundwater collecting beneath the storage can then be directed to the north and discharged over the landscape.

Two pipelines feed into the EWS pit:

- Leakage Collection Pipeline (referred to as EWS East), which captures leakage of surface water from the dam
- Groundwater Collection Pipeline (referred to as EWS West), which is intended to capture groundwater build-up beneath the dam which would naturally flow to the sphagnum bogs

From the EWS pit, here are two (0.6 m deep) soakage trenches extending to the east (~58 m) and west (~107 m) of the distribution pit which spread the discharge across the northern slopes of Mount Buller, downstream of the dam. The pipe comprises both slotted and non-slotted intervals so that EWS water is mostly redirected to the Alpine Bog areas and avoids discharge at snow-gum stands.

Sampling of the EWS is completed using the same methodology as that applied to the Boggy Creek locations. The distribution pit is metered, however, at the time of assessment, no data was available. Flow gauges with automatic logging have since been installed as described in Section 1.1.

2.2.1.3 Summary

The surface water sampling sites are shown in Figure 1 and are summarised in Table 2.

Table 2 Surface water monitoring network

Location Name	UTM Zone 55 Coordinates		Location
	Easting	Northing	
Boggy Creek 1 p/u 1	449,781	5,889,496	Collection point is behind the shed off to the right up the hill, away from the tank pick up 1
Boggy Creek 1 p/u 2	449,857	5,889,488	Collection point is by the weir located on this hill behind the shed called Boggy Creek 1, pick up 2
Boggy Creek 2	449,677.79	5,890,310.05	Collection point is by the weir at Boggy Creek 2
EWS East	449,656	5,888,881	Collection point is the eastern pipe of the EWS distribution pit, located on the northern wall of the dam. (western pipe is the groundwater collection drain, eastern pipe is the leakage collection drain)
Note: Coordinates presented above are handheld GPS coordinates			

Data Disclaimer

© 2024. Whilst every care has been taken to prepare this map, GHD, VICMAP, and Nearmap make no representations or warranties about its accuracy reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Paper Size ISO A3

50 100 150 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GOA 1994
Grid: GOA 1994 MGA Zone 55

N

Mt Buller Resort Management Board
Mt Buller HEMAMP Monitoring
Groundwater and Surface Water

Monitoring Network

Project No. **12565989**
Revision No. **B**
Date **20/08/2024**

FIGURE 1

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Printdate: 20Aug 2024-13:39

Data source: GHD: Surface Water Monitoring, Dam footprint, Monitoring Bore Locations (2024). VICMAP Roads and Cadastre (2021) Vicmap Basemap-VicGrid94-Aerial: Imagery (Date Extracted: 20/08/2024). Created by: eiunn

2.2.2 Groundwater

2.2.2.1 Bore locations

The groundwater monitoring network originally comprised 14 bores which were installed as part of the initial geotechnical investigations. The original monitoring network is shown Figure 1 and these bores were gauged multiple times during the preconstruction period to establish baseline conditions.

Additional bores were installed to target Alpine Bog areas e.g. BH16, BH17 and BH18. A review of the program by GHD (2018) recommended that water quality sampling continue at bores BH06, BH09, BH16, BH17 and BH18 during the construction period. The remaining bores (BH07 and BH10) are to be manually gauged for the standing water level during sampling rounds (refer Table 3).

Table 3 Groundwater monitoring network

Bore ID	Automatic Standing Water Level (SWL) data logger	Manual gauging	Groundwater Sampling
BH04	**Scheduled for decommission**		
BH04A	**Scheduled for decommission**		
BH06	✓	✓	✓
BH07		✓	✓
BH09	✓	✓	✓
BH10		✓	
BH16	✓	✓	✓
BH17	✓	✓	✓
BH18	✓	✓	✓
Environmental Watering System – collected from beneath the dam and discharged at EWS pit			
EWS West	Flow meter installed for IY6	NA	✓

Many of the original bores were located within the storage construction footprint and were destroyed in-situ during the construction program. During a site inspection by GHD in late 2021, bore BH09 could not be identified and was suspected as being hidden by fill material. Bore BH10 was sampled in place of the 'missing' bore BH09.

Bore BH09 was subsequently identified using a metal detector in March 2022. The bore condition was reviewed and as it appeared to be sound and operational, it was re-incorporated into the monitoring program.

2.2.2.2 Monitoring bore construction

The construction details for each groundwater monitoring bore are given in Table 4. The bores which are no longer operational have been shaded grey.

Table 4 Groundwater monitoring bores construction details

Bore ID	Zone 55 Coordinates		Total Depth (m bgl)	Screen (m bgl)		
	Easting	Northing		Top	Bottom	Screened Lithology
BH04	449,692.8	5,888,663	15.68	8.68	14.68	Carbonaceous Mudstone
BH04A	449,692.6	5,888,663	2.56	1.56	2.56	Basalt
BH05	449,547.4	5,888,727	19.8	14	19.8	Granitic Soils
BH05A	449,546.6	5,888,727	2.5	1.5	2.5	Colluvium
BH06	449,429.0	5,888,787	9	6	9	Granite
BH07	449,658.3	5,888,915	1	0	1	Bog/Granitic Soil

Bore ID	Zone 55 Coordinates		Total Depth (m bgl)	Screen (m bgl)		
	Easting	Northing		Top	Bottom	Screened Lithology
BH09	449,611.8	5,888,835	6	3	6	Granite
BH10	449,679.9	5,888,856	9	6	9	Granite
BH13	449,580.0	5,888,729	9	6	9	Colluvium
BH14	449,683.5	5,888,724	19.5	16.5	19.5	Granite
BH14A	449,683.9	5,888,725	15	12	15	Granite
BH14B	449,684.4	5,888,725	9.5	6.5	9.5	Granitic Soils
BH15	449,626.7	5,888,695	23	20	23	Granitic Soils
BH15A	449,629.6	5,888,696	6	3	6	Colluvium
BH16	449,459	5,888,860	2.1	1.1	2.1	Granitic Soils
BH17	449,701	5,888,866	2.2	1	2.2	Granitic Soils
BH18	449,922	5,888,830	2.15	1.15	2.15	Granitic Soils
Note: grey shading denotes bores which are no longer operational						

2.3 Sampling and analytical program

The monitoring is conducted tri-annually (previously bi-annually), in the months of February, November and April each year. The April monitoring round was introduced in 2023 and was recommended to continue for two years. The reporting period follows the financial year, i.e. this report documents results of the monitoring period November 2024 – April 2025.

2.3.1 Surface water

2.3.1.1 Sampling method

A Standard Operating Procedure (SOP) has been prepared for the hydrological monitoring program to help to maintain consistency in the instance that a change in ARV staff should take place. Sampling for the 2024-2025 monitoring events was undertaken in accordance with this procedure.

Photographs of the sampling points were taken at each site and are attached in Appendix B. Samples were taken on the inside of the weir wall from the nearest access point at each weir:

– the western corner at Boggy Creek 1 p/u 1 and Boggy Creek 2
– the eastern corner at Boggy Creek 1 p/u 2
– the eastern pipe within the EWS distribution pit

One duplicate and one split sample is required for each surface water monitoring event, as summarised in Table 5. This can be taken at either of the primary sample locations, making sure that the location of the duplicate sample is noted on the field sheet.

Table 5 Number of surface water samples required per monitoring event

Sample Type	Number
Primary sample	4
Primary laboratory duplicate (Duplicate) sample	1
Inter-laboratory duplicate (Split) sample	1

2.3.1.2 Analytical program

Table 6 lists the analytes requested for each surface water sample. Prior to taking a sample, a calibrated field water quality meter was used to measure in-field water quality parameters. The field and laboratory parameters are summarised in Table 6.

In addition to the analytes in Table 6, a suite of metals were also analysed in November 2023 for comparison with metal results obtained in 2015. Incorporating metal results in April 2023 evened this to one impact year and one baseline year.

Table 6 Surface water analytes

Suite	Locations	Analytes
In-situ field measurements	Boggy Creek p/u 1 Boggy Creek p/u 2 Boggy Creek 2 EWS East	Temperature pH Dissolved oxygen Oxidation – Reduction Potential (Redox) Electrical Conductivity (µS/cm)
SW1 (laboratory analysis)	Boggy Creek p/u 1 Boggy Creek p/u 2 Boggy Creek 2 EWS East	Electrical conductivity (EC) Total Dissolved Solids (TDS) pH (field) Nutrients (Total P, N), Total Kjeldahl Nitrogen (TKN) Major ions (Ca, Mg, Na, K, Cl, SO4, HCO3, CO3 and NO3) Turbidity Suspended Solids

2.3.2 Groundwater

2.3.2.1 Sampling method

Samples were collected from the five groundwater monitoring bores and the western outlet pipe of the EWS pit.

Samples were collected in accordance with the SOP described in Section 2.3.1.1.

Groundwater sampling was consistent with EPA Publication 669.1 (2022).

One duplicate and one split sample is required for each groundwater monitoring event, as shown in Table 7. This can be taken at either of the primary sample locations, making sure that the location of the duplicate sample is noted on the field sheet.

Table 7 Number of groundwater samples required per monitoring event

Sample Type	Number
Primary sample	6
Primary laboratory duplicate (Duplicate) sample	1
Inter-laboratory duplicate (Split) sample	1

Monitoring bores were purged of standing water (minimum three casing volumes, where possible) prior to sampling using a dedicated, disposable bailer to eliminate cross contamination. Field parameters were monitored throughout the purging process using a calibrated field water quality meter. The bore was considered ready for sampling when the field indicators stabilised, in accordance with EPA Victoria (2022). Some bores were sampled without purging when there was insufficient recharge to purge three casing volumes of water or where recharge rates were very low.

The volume of water purged, and comments on observed characteristics of the water, were recorded on the field sheet for each bore (refer Appendix B).

2.3.2.2 Analytical program

Table 8 summarises the analytes requested for each groundwater sample, and the field measured water quality parameters.

Table 8 Groundwater analytes

Suite	Bore ID/Locations	Analytes
In-situ field measurements	BH06, BH09, BH16, BH17, BH18, EWS West	Temperature pH Dissolved oxygen Oxidation – Reduction Potential (Redox) Electrical Conductivity (µS/cm)
GW1 (Laboratory analysis)	BH06, BH09, BH16, BH17, BH18, EWS West	Electrical conductivity, Total Dissolved Solids and pH Nitrate (as N), Nitrite (as N), Nitrogen (Total Oxidised) and Phosphorus (Total) Alkalinity (total) as CaCO3, Alkalinity (Bicarbonate as CaCO3), Alkalinity (Carbonate as CaCO3) Calcium, Magnesium, Potassium, Sodium, Chloride, sulphate

2.3.3 Laboratory

Samples were placed in an esky and chilled during the field sampling. Samples were refrigerated until they were ready for dispatch to the analytical laboratory in chilled eskies.

The samples were submitted to Eurofins Scientific (Eurofins) as the primary laboratory and Environmental Laboratories Pty Ltd (ALS) as the independent, secondary laboratory for QA/QC analysis.

A completed chain of custody form was submitted with the samples. Eurofins and ALS are both registered with NATA[2] for the nominated analyses.

2.4 Water quality objectives

The *Environment Protection Act 2017* commenced on 1 July 2021 and specifies new objectives of the EPA and consequential amendments to the former act *Environment Protection Act 1970*. The Act changes Victoria's focus to a prevention based approach, rather than preventing waste and pollution impacts and managing these after they have occurred. Central to the Act is the General Environmental Duty (GED) which requires Victorians to reduce the risk of their activities potentially harming the environment or human health through waste and pollution.

The Act introduces two subordinate instruments:

– Environment Protection Regulations (EPR)
– Environment Reference Standard (ERS)

Under section 93 of the new Environment Protection Act 2017, an Environmental Reference Standard (ERS) is used to assess and report on the environmental conditions throughout Victoria. The ERS:

– Identifies environmental values (human health and the environment) to be achieved or maintained in Victoria
– Specifies indicators and objectives used to measure, determine or assess whether those environmental values are being achieved, maintained, or threatened

The ERS is not meant to represent a compliance standard, but rather has a primary function to provide an environmental assessment and reporting benchmark. The ERS contains environmental values for each element of the environment in separate parts, i.e. air, land, water (surface and groundwater), however, the different elements of the environment can impact each other and the interactions between them need to be considered.

[2] NATA – National Association of Testing Authorities

The ERS classifies the waters of Victoria (surface water and groundwater) into segments, with each segment having particular identified environmental values. For the surface and groundwater at the water storage, the protection of water dependent ecosystems and species is most relevant.

The ERS also sets indicators and objectives for the environmental value of the water, which for water dependent ecosystem and species are the Australian and New Zealand Guidelines for Fresh and Marine Water quality (ANZG 2018, updated July 2021). The ANZG (2018) guideline allows for water quality objectives to be selected based on different levels of species protection sought.

The results of the IY6 monitoring program have been compared to the criteria of ANZG (2018, updated July 2021) for 95% Freshwater species protection. Of the analytes included in the laboratory program, a water quality objective criterion exists for nitrate (2.4 mg/L as N) and ammonia (0.32mg/L as N).

A discussion of the surface and groundwater quality against relevant water quality objectives has been included in Section 8.3.

3. Monitoring results - Climate

3.1 Rainfall

The Bureau of Meteorology (BOM) maintains an active climate station at Mt Buller (Station No. 083024). The automated station is located approximately 500 m from the water storage dam at Tirol flat and monitors temperature (highs and lows) and rainfall (amongst other climate parameters) twice daily (am and pm). The monthly rainfall for the 2024 – 2025 monitoring period has been summarised in Table 9.

Table 9 Monthly rainfall over the 2024-25 monitoring period

Month	2024-2025 Monitoring period rainfall (mm)
April 2024	76.4
May 2024	98.4
June 2024	99
July 2024	161.2
August 2024	108.2
September 2024	143
October 2024	59.4
November 2024	176.8
December 2024	116.6
January 2025	59.4
February 2025	25.8
March 2025	118
April 2025	3.2
Year Total (Apr 24 – Mar 25)	1242.2

Table 10 presents the monthly rainfall for the previous three years as well as the mean monthly rainfall during the baseline years and 1889 to 2018. From the table it can be seen that total rainfall over the recent years is higher than the historical range. The annual total for 2024 was 56.9 mm above the long-term average (1990-present), and 309 mm below the mean recorded during the baseline years 2012-2018.

Rainfall trends are shown in Figure 2 for the years 2014 to 2024. To assess the variability of the climate, a rainfall deviation graph has also been included in Figure 2. This has been prepared to identify long term rainfall trends for the period 1990 to 2024 to characterise the influence of climate on groundwater levels. The absolute value of the residual mass curve is not important, but rather the slope:

– A positive slope indicates a wetter than average period
– A negative slope indicates a drier than average period
– A section of both negative and positive indicates a period of generally average rainfall
– The grade of the slope indicates how much wetter or drier than average the climate is

Note that the cumulative deviation from mean monthly rainfall has been calculated from 1990 to present, and so on the graph starts at a negative value based on previous years of rainfall. The residual mass curve indicates that rainfall has been close to average between 2018 and the present, except for a short period of above average rainfall in 2022.

Table 10 Monthly rainfall during impact years and historical mean rainfall

Month	Mean monthly rainfall (mm)		Monthly rainfall (mm)		
	1990 - 2018	2012 - 2018	2022	2023	2024
January	75.7	101.5	136.6	35.2	253.2
February	75.1	84.6	19.4	63.8	20.2
March	76.9	107.8	100.8	185.4	33.8
April	97.1	100.7	165.6	110	76.4
May	125.1	184.6	122.0	159.8	98.4
June	146.1	166.3	202.0	284	99
July	163.6	213.0	96.4	181.2	161.2
August	167.0	215.7	260.4	119.6	108.2
September	148.5	143.9	231.4	88.4	88.4
October	108.4	111.2	490.0	258.2	59.4
November	109.1	91.2	290.0	86.4	176.8
December	95.1	134.6	126.6	130.8	116.6
Year Total	**1280**	**1,655**	**2,241**	**1703**	**1346**

3.2 Temperature

The BoM station at Mt Buller (Station No. 083024) was also used to extract temperature data. The monthly mean maximum temperature for the 2024 – 2025 monitoring period has been summarised in Table 11.

Table 11 Mean monthly maximum temperature over the 2024-25 monitoring period

Month	2024-2025 Monitoring period mean maximum temperature (°C)
April 2024	9.71
May 2024	8.50
June 2024	2.91
July 2024	1.65
August 2024	4.12
September 2024	5.50
October 2024	10.9
November 2024	14.4
December 2024	16.1
January 2025	18.7
February 2025	18.7
March 2025	17.7
April 2025	12.6
Year Average (Apr 24 – Mar 25)	**10.7**

Table 12 presents the monthly mean of daily maximum temperatures for the previous three years as well as monthly mean of daily maximum temperatures during the baseline years and 1889 to 2018. From the table, it can be seen that recent years include both lower and higher maximum temperatures compared to the historical range.

The average mean of daily maximum temperatures in 2024 was 9.93 °C , which is 0.7 °C above the long-term average (1990-present) of 9.28 °C, and 1.03 °C below the mean recorded during the baseline years 2012-2018.

Temperature trends are shown in Figure 3 for the years 2014 to 2024. This has been prepared to identify long term rainfall trends for the period 1990 to 2024 to characterise the influence of climate on groundwater levels.

Table 12 Monthly mean maximum temperature during impact years and historical mean maximum temperature

Month	Mean maximum temperature (°C)		Mean maximum temperature (°C)		
	1990 - 2018	2012 - 2018	2022	2023	2024
January	17.6	18.2	18.3	17.3	16.8
February	17.2	17.8	16.0	16.4	18.1
March	14.2	14.8	14.6	13.6	16.9
April	9.86	10.4	9.72	9.38	9.71
May	6.18	5.68	5.11	2.24	8.49
June	3.36	3.42	0.83	1.97	2.91
July	1.34	0.91	2.03	3.09	1.65
August	2.03	1.32	2.46	4.67	4.12
September	4.91	5.21	3.57	9.24	5.50
October	8.95	10.12	7.76	8.19	10.9
November	12.6	13.2	8.19	14.4	14.8
December	15.0	15.9	12.6	15.6	16.1
Year Total	**8.90**	**8.98**	**7.53**	**8.98**	**9.93**

Evapotranspiration data collected from June 2024 through to the present closely mirrors the seasonal temperature trend observed at Mt Buller. Rates were lowest during the winter months, consistent with reduced solar radiation and cooler temperatures in June (0.60 mm in June 2024), and gradually increased through spring and summer, peaking alongside the highest recorded temperatures in January (5.06 mm in January 2025). The data illustrates a predictable seasonal cycle in evapotranspiration.

3.3 Snow depth

As the water storage and the associated groundwater monitoring bore network are above the snow line, they become inundated with snow during the winter period. Snow is another form of precipitation that can recharge the aquifers underlying the summit.

Mt Buller Ski Lifts (Ski Patrol) undertakes snow gauging at three (3) locations across the resort:

– Tirol flat
– Boggy Creek
– Family Run

These sites have been in use continuously since 1987 and are considered to be reasonably close to the study site to provide an indication of snow depths. Of the three sites, the Tirol and Boggy Creek gauges are considered most reflective of the conditions at the water storage site and are described below based on historical records:

Tirol flat

The gauge is located near BoM automated weather station 083024. The monitoring site is located above the tree line and generally receives the least amount of snow, has sunlight all day, is prone to scouring from wind effect and in spring will lose all its snow first, in line with the north side of the mountain. It is not unusual during a significant snowfall for the Tirol Gauge to have nothing on it due to wind. Although the Tirol Gauge has the least amount of snow due to exposure, all the gauges are well above the lowest skiable point of 1,375 m AHD, therefore average depths are recorded and helps reflect snow across the whole resort.

Boggy Creek

The gauge is located at the top of the Boggy Creek T-Bar. The gauge is above the tree line and receives sunlight all day and has little or no wind affect. It receives considerably more snow than the Tirol Gauge.

The snow depths, averaged across the three gauges, have been shown in Figure 4. The graph has two snow depths reflecting the natural snow depth and that resulting from snow making activities. Snow depths have been relatively low in the past 2 years.

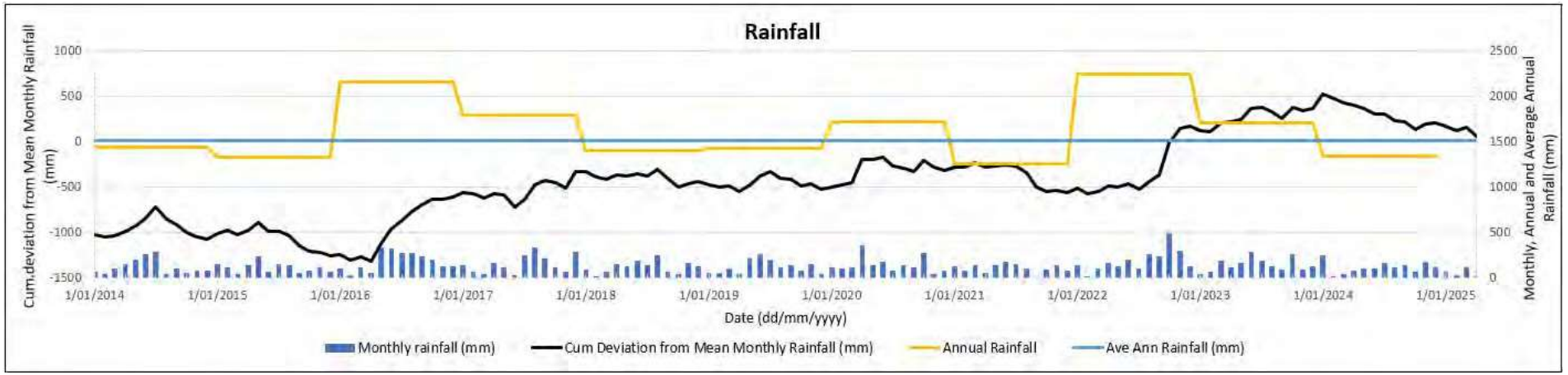

Figure 2 *Rainfall trends January 2014 - April 2025*

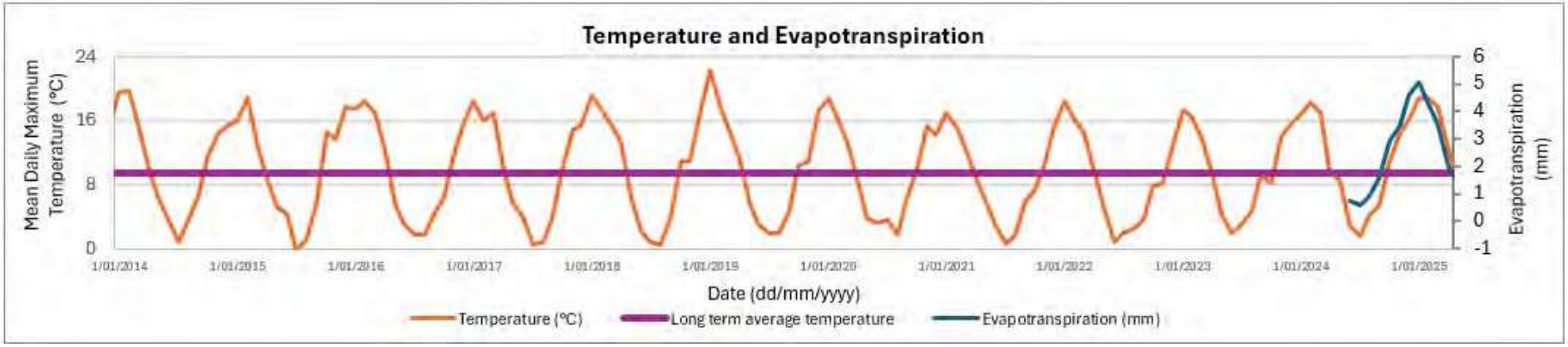

Figure 3 *Temperature and Evapotranspiration trends January 2014 - April 2025*

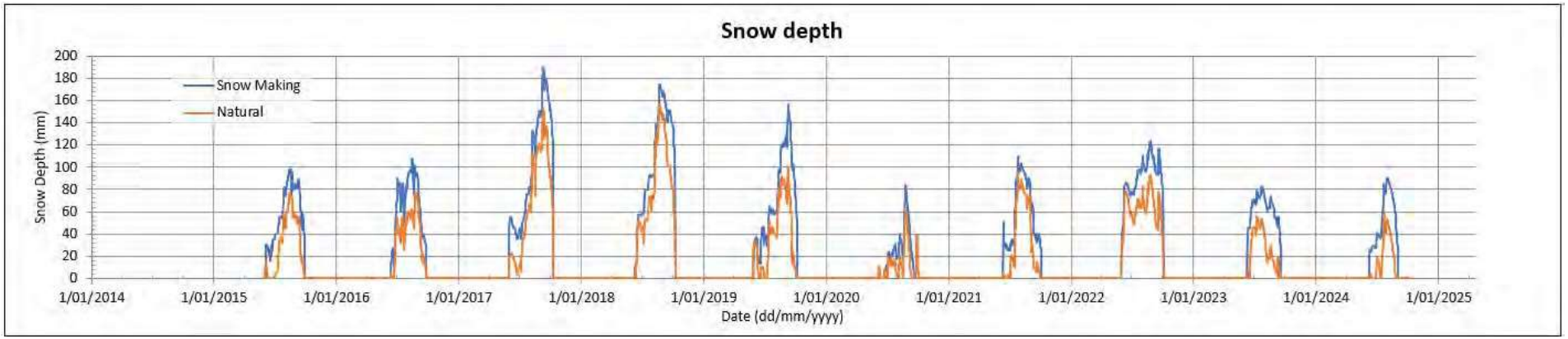

Figure 4 *Snow depth data January 2014 – April 2025*

4. Monitoring results – network condition

4.1 Surface water

The surface water monitoring sites remain easily accessible for sampling. The weirs at each sampling site appeared to be in a similar condition to previous monitoring rounds, and water was at similar levels.

4.2 Groundwater

All but two of the groundwater monitoring bores are in a sound condition i.e. there was no obvious damage to the casing or headworks, they were secure and operational. Bore BH10 was not open over its full depth, however, access into the screen interval was possible.

All of the monitoring bores designated for sampling (bores BH06, BH09, BH16, BH17 and BH18) are in operable condition. Minor differences in bore depths were measured in all bores compared to original depths, potentially indicating minor sediment build up in the bores. This was most notable in bores BH07 and BH10 which are not sampled. These bores should be manually bailed in the next monitoring round to reduce sediment load.

A summary of the groundwater monitoring network condition is presented in Table 13.

Table 13 Summary of monitoring bore condition

Bore ID	HEMAMP Water Quality Site	Status	Datalogger installed? (Y/N)	Condition
BH06	Yes	Identified	Y	Operational and secure
BH07	Yes	Identified	N	Bore depth has reduced to 0.87 m from an original depth of 1 m. Bentonite is protruding at the top of the well around the J plug. Headworks are operational and secure.
BH09	Yes	Identified	Y	Operational and secure
BH10	No	Identified	N	Headwork has been damaged and positioned loosely atop the well opening. Bore depth has reduced to 8.55 from an original depth of 9 m.
BH16	Yes	Identified	Y	Operational and secure
BH17	Yes	Identified	Y	Operational and secure
BH18	Yes	Identified	Y	Operational and secure
Note: Monitoring bore network condition as of 23/04/2024				

5. Monitoring results – surface flows

Flow meters were installed by ARV at Boggy Creek 1 and Boggy Creek 2 in January 2022 (Boggy 1 p/u 1), May 2022 (Boggy 1 p/u 2) and December 2023 (Boggy Creek 2). There is no flow gauging data for earlier impact periods.

Goulburn Valley Water have been assisting ARV to complete a number of upgrade works to the Boggy weir monitoring. The following works are noted to have occurred in the IY6 period:

– Flow monitoring system upgraded to Geo SCADA in May 2025
– Siphon installed at Boggy 2 on 26/02/2025 to permanently meet passing flow of 250KL/Day
– Siphons installed at Boggy 1 on 01/07/2024 to permanently meet passing flow of 100KL/Day (on pickup 1 & 2)
– The radar sensor at Boggy 2 weir is reported to have failed on 27/11/2024 and was not replaced until 2025

EWS flow monitoring data was provided from September 2024. Prior to this, flow rates from the EWS had been manually monitored.

Average daily flow rates have been calculated from the Boggy and EWS flow data and have been incorporated into Figure 5 to Figure 7 below. Surface flow timeseries have been plotted against rainfall and snow depth to allow a comparison of seasonal trends.

The timeseries generally show a high level of responsiveness to rainfall at each of the Boggy 1 and Boggy 2 weirs. Surface flows appear to respond to rainfall immediately (i.e. surface flows increase on the day that rainfall occurs).

Snowmelt may also contribute to higher baseline surface flows in November-December. For example, in November 2022 the minimum surface flow rates at Boggy 1 remain higher than other periods of the year, suggesting another source may be topping up surface flows between rain events (noting that there were 10 days with < 1 mm of rain). Figure 5 suggests that unlike the influence of rainfall, surface flows may have a delayed and longer lasting response to snowmelt.

EWS impacts

It was identified in September 2024 that the water storage dam was leaking. Evidence of this can be observed in the EWS East (leakage collection pit) flow rate data. Note that flow data for the EWS wasn't available prior to September 2024, therefore the period of leakage is unknown but estimated to have been occurring to some extent for at least 12 months prior.

There are some periods in IY6 where emergency dam response activities may have impacted flow responsiveness to rainfall, though not at the same rate, generally falling between October 2024 and January 2025. It can be seen in the flow charts that flows from the EWS East reduced considerably after December 2024 as a result of dam repair works during this time. The response to rainfall observed at all Boggy Creek weirs is also greatly reduced following December 2024.

The change in response to rainfall following December 2024 indicates that flows from the EWS may have been contributing additional surface water flows in Boggy Creek. It is noted however that water was pumped from Boggy Creek to refill the water storage following repairs, which may also be contributing to the reduced response to rainfall in early 2025. The refilling of the water storage in early 2025 was outside of the normal pumping regime for Boggy Creek, whereby the water extraction licence usually does not permit water extraction during summer. An emergency licence exemption was obtained from Goulburn-Murray Water (GMW) for the additional pumping and this exemption outlined the requirement to maintain minimum flows of 100,000 litres per day at Boggy 1 and 250,000 litres per day at Boggy 2.

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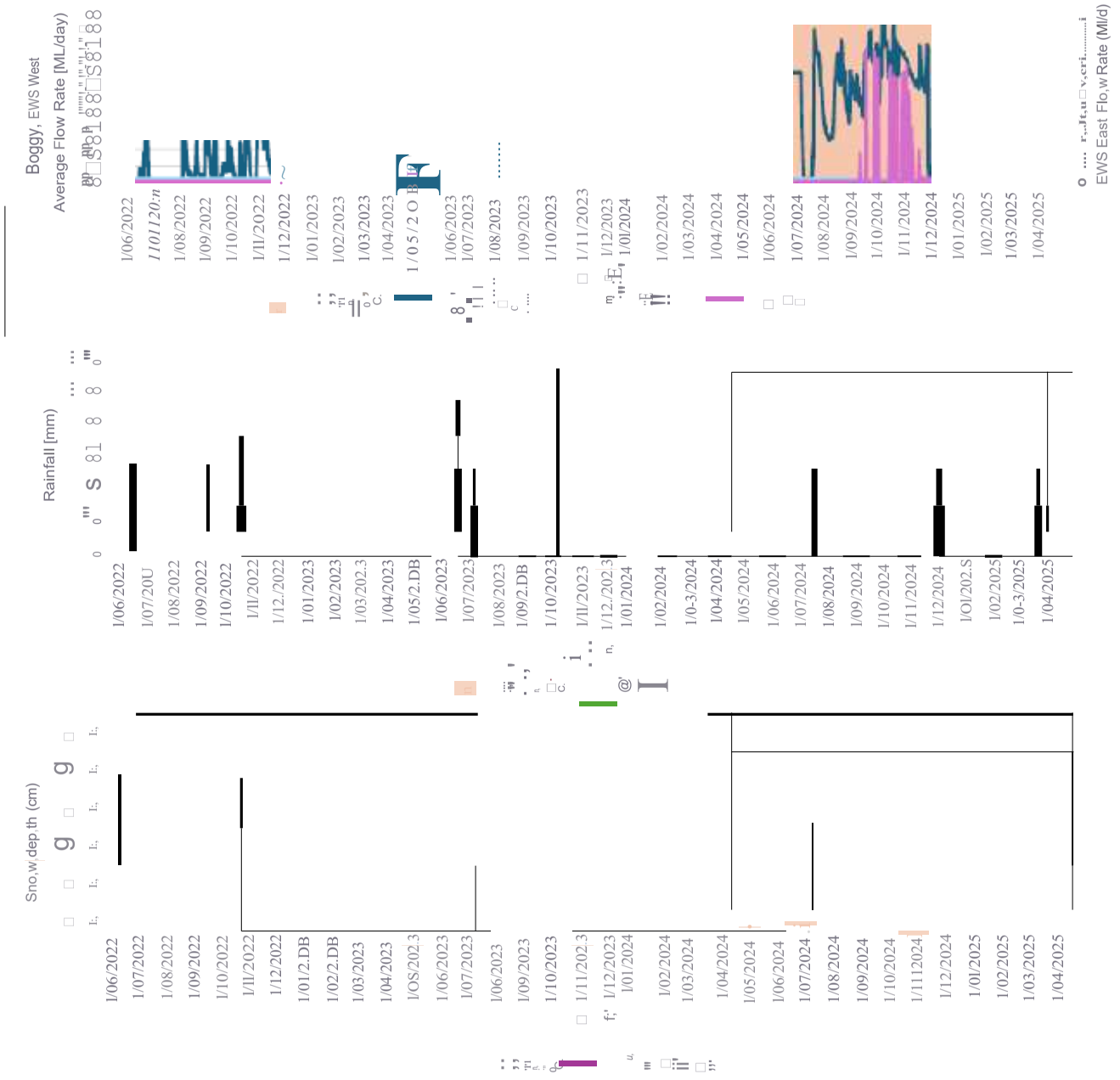

Figure 5 **Boggy 1 p/u 1 surface flows**

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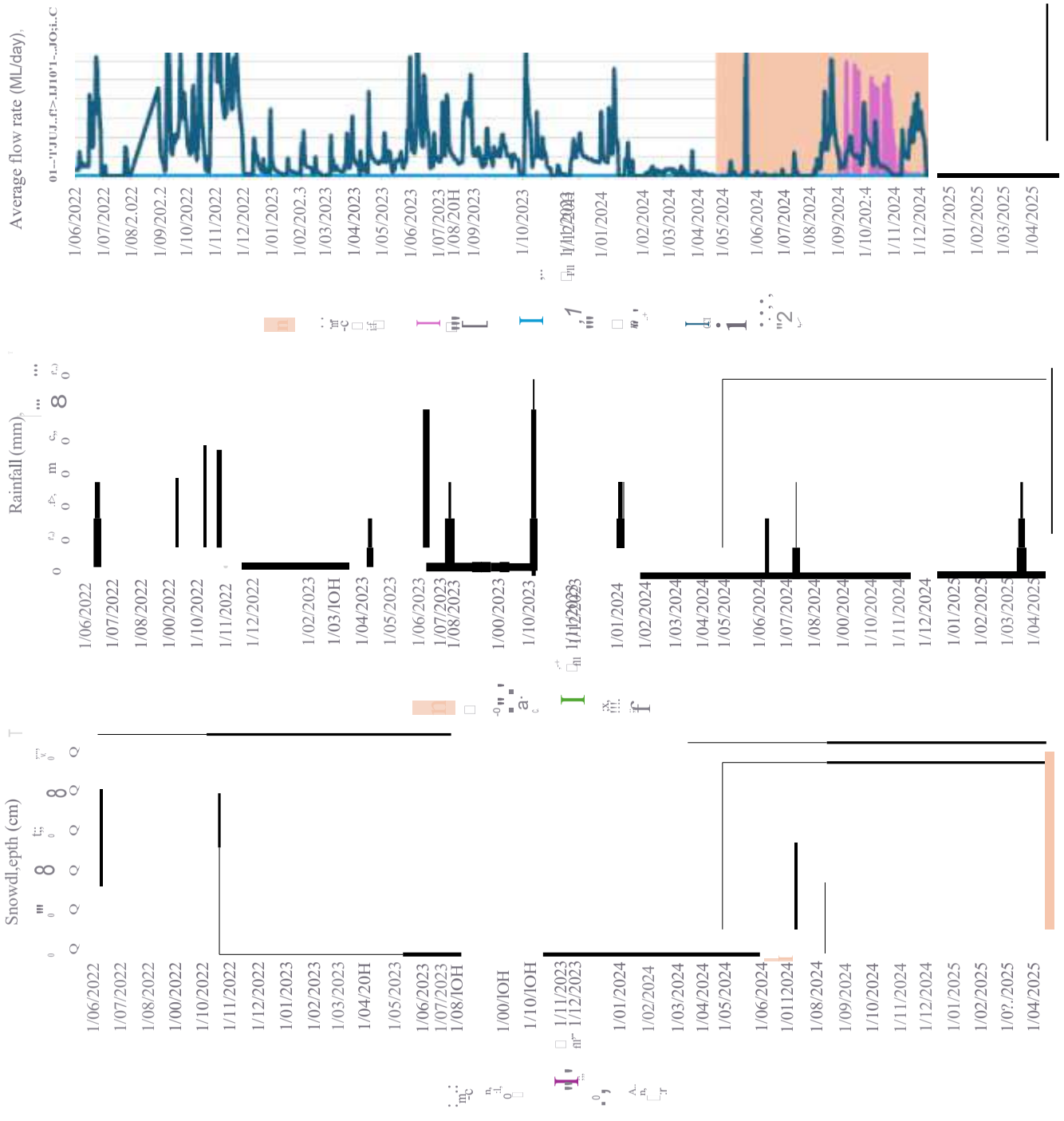

Figure 6 *Boggy 1 p/u 2 surface flows*

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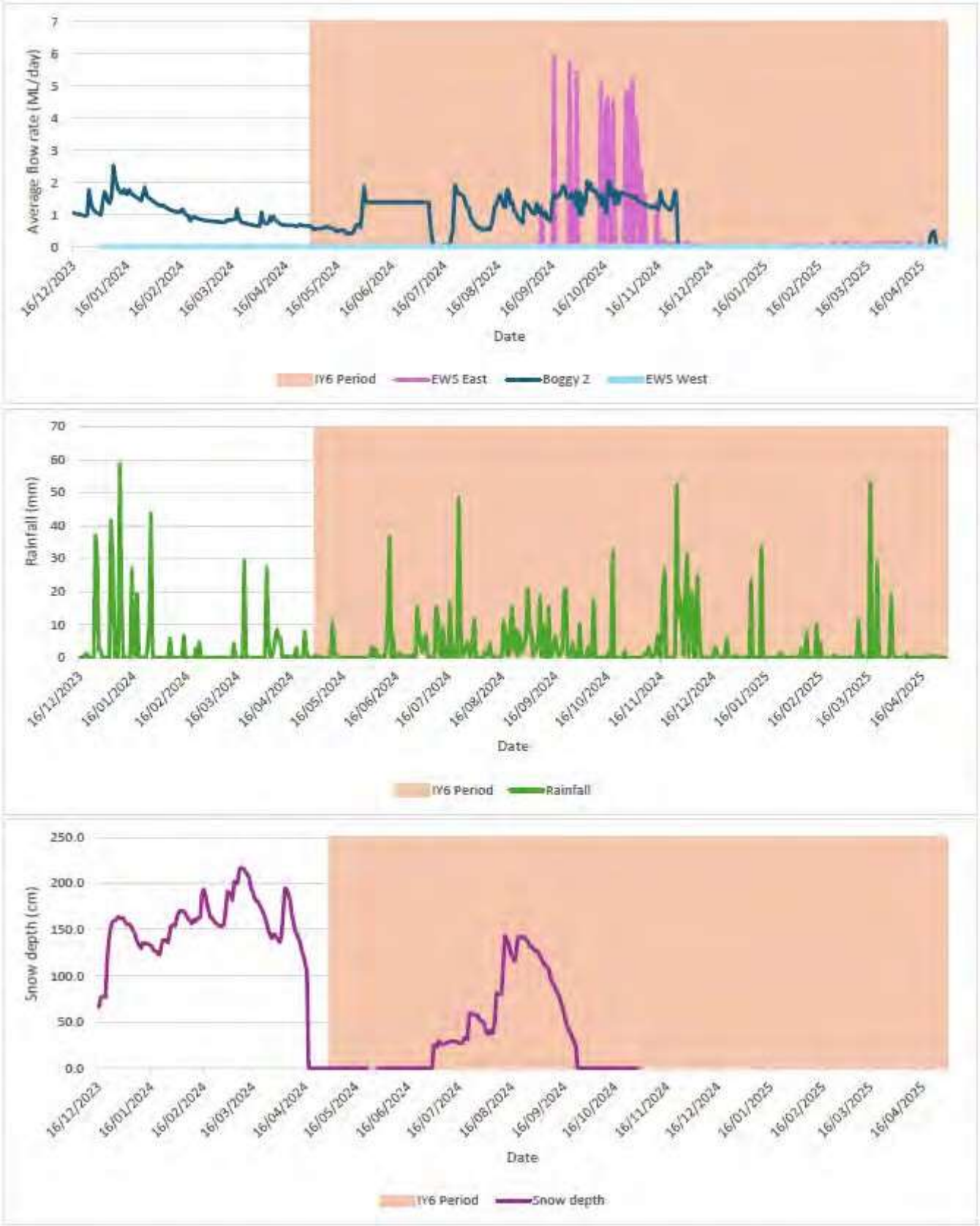


Figure 7 ***Boggy 2 surface flows***

6. Monitoring results – groundwater level

6.1 Groundwater data collection

Automated water level dataloggers were installed in bores BH06, BH09, BH16, BH17 and BH18 prior to and after dam construction. The dataloggers (Insitu® LevelTROLL™) were non vented units and therefore barometric pressure datalogging was completed by installing an Insitu® BaroTROLL™ in bore BH06. The barometric logging enabled water level correction in the non-vented units. The dataloggers were removed, inspected, and downloaded during each monitoring round.

A manual measurement of the standing water level (SWL) was also taken for all monitoring bores (refer Appendix B for field notes) during each sampling round. For bores containing dataloggers, the SWL was manually taken before and after removing the datalogger. Standing water levels were manually measured using a hand held electronic water level probe. Manual SWL data is added to the hydrographs in Appendix C as a way of quality checking and “calibrating” the logger data.

In previous impact years, there have been some issues identified with the water level logging data in terms of reference datums being incorrectly set and loggers moved. These included an incorrect logger setting when the loggers were re-installed after dam construction in June 2018 (recording “Depth” with no reference, instead of depth to water), and a swap of the Leveltroll and Barrotroll in BH06 in February 2023.

This has required GHD to undertake some post processing of data, and the manual correction of barometric response for one annual period. In some cases, there are data gaps in the time series monitoring record (e.g. during dam construction). No corrections have been required for the logger data since June 2023, with the exception of a standard correction using manual readings.

6.2 Hydrographs

The Hydrographs for each monitoring bore are presented in Appendix C. The following is noted regarding the format of the hydrographs:

– The approximate construction period of the water storage has been indicated on the SWL graph
– The approximate period of dam repair works has been indicated on the graphs from October 2024 to January 2025
– Snow depth and rainfall has been appended to each graph
– A rainfall cumulative deviation has been included in the rainfall chart, based upon rainfall data since 1990

6.2.1 Evidence of bore failure

Anomalous water levels can be taken as circumstantial evidence of bore failure. Anomalous water levels were not identified in any of the monitoring bores.

6.2.2 Summary

Interpretations of the hydrographs for each monitoring bore are included in Table 14. Bores which are manually gauged have also been included in this table.

The water level response in most monitoring bores is strongly dependent upon the prevailing climate. From the review of the hydrographs, bores BH06 and BH18 exhibit similar responses to rainfall during the water storage construction period compared to the preconstruction or baseline monitoring period. These bores are situated cross-gradient from the water storage and are not expected to be impacted by the water storage construction or operation. Conversely, bores BH09, BH17 and to a lesser extent BH16 exhibit some change in SWL patterns after the construction of the water storage.

Interpretation of the water level response in the manually monitored bores is more uncertain owing to the limited frequency of the water level gauging.

Table 14 Summary of hydrograph and other water level data responses

Bore ID	Aquifer	Monitoring method	Comment
BH06	Granite (weathered)	Datalogger + Manual	Bore BH06 is upgradient of mapped bogs near BH16. The hydrograph suggests that this bore is responsive to rainfall. A notable seasonality in this bore is evident during both the baseline and impact periods, suggesting that the bore is behaving in the same way as it was prior to the water storage construction. Water levels are generally greater than 5 m below the surface, however during the snow season and spring, water can be within 2 m of the surface during years with higher rainfall. After recharge during the Winter and Spring periods, water levels exhibit a slow decline over the Summer. Declines in some cases have continued below the base of the bore (9 m), i.e. there have been periods when the bore is dry. Water levels recover relatively rapidly, with the most rapid rises occurring during the onset of the snow season. The significant variation in water levels potentially suggests that storage in the weathered granites may form a significant contribution to down-gradient seeps and spring flows. In IY6, the bore recorded it's lowest maximum SWL over an annual monitoring period to date. In April 2025 the bore was dry. The decline in SWL is consistent with a decline in rainfall in IY6.
BH07	Granitic soil (bog)	Manual only (Datalogger prior to 2018)	This is a shallow bore (1.0 m depth) with water levels responding to rainfall events. It is located within a mapped bog area immediately north of the water storage dam. In late summer, water levels fall below the base of the monitoring bore. The bore indicates that for the majority of the year, water levels are within 1 m of the surface or shallower, however, there are small periods in the late Summer through Autumn where water levels become deeper than 1 m. SWL declined in BH07 over IY6. In April 2025 the bore was dry.
BH09	Granite (sandy clay/clayey sands)	Datalogger + Manual	There is an obvious change in the water level response in this monitoring bore since the construction of the storage. During the baseline period, the hydrograph exhibits a strong season response, with water level lows typically between 2.5 m and 3 m bgl and water levels becoming artesian, i.e. water levels above current ground surface, in late Winter and Spring. Prior to storage construction, water levels would fall over the summer period, resulting in a pronounced seasonal response. Towards the end of the construction period the water level response changed, noting that this bore is directly down-gradient of the storage. Water levels no longer become artesian, and the seasonal drainage has stopped, with rapid water levels frequently responding between 1 m and 2.5 m bgl. The groundwater catchment supplying water to the zone monitored by this bore has been disturbed by the storage construction. There is additional storage of infiltrating rainfall into the embankment materials (immediately north of the bore), and changes in recharge due to the storage itself. The bore is located marginally up-gradient of the western arm of the EWS, which is understood to have been flowing continuously since installation. In summary the bore is indicating that the water table is getting more frequent recharge events, but the total volume of recharge is lower than the baseline period. A similar pattern of SWLs was observed in IY6 to that in IY5, with an increase in SWL between from winter to spring, followed by a decline over summer. There is slightly less noise/variability in the water levels in IY6.

Bore ID	Aquifer	Monitoring method	Comment
BH10	Granite (extremely weathered – moderately weathered)	Manual only	The response of monitoring bore BH10 was similar to bore BH09 in the baseline period monitoring. Manual gauging results indicate that the SWL is continuing to respond to seasonal trends and remains within the baseline range. The hydrograph exhibits a strong season response, with water levels typically deeper than 2 m bgl, but become within 0.5 m of the ground surface in the peak of the snow season. Water levels exhibit a steady decline over the summer period and fall to around 6 m below the surface. Water level recovery is rapid, rising over 5 m with rainfall and the commencement of the snow season. Smaller rainfall events in early Autumn do not seem to have a significant influence in terms of arresting the rate of water decline during the Summer/Autumn period. The significant variation in water levels, and slow drainage from the Winter/Spring highs potentially suggests that storage in the granites may form a significant contribution to down-gradient seeps and spring flows. Water levels were slightly higher in IY6 compared with IY5, particularly in April 2025.
BH16	Clayey gravelly SAND and Silty GRAVEL	Datalogger + Manual	Bore BH16 is located cross slope from the storage, and within the margins of a bog. Water levels typically exhibit a strong season response and fall during the Summer and late Autumn periods. At times during Winter, water levels can become artesian. As per other monitoring bores, there is a gradual decline in water levels following winter as groundwater drains from storage, however, water level recovery can be rapid. Larger rainfall events are, however, evident in the water level monitoring response. In this bog, there seems to be tendency for water levels to remain more stable (generally within 1 m variation between seasons), with groundwater storage taking more time to deplete, and recharge. The trend in water levels at BH16 in IY6 was similar to the annual trend in other impact years. However, water levels were slightly lower in IY6.
BH17	Clayey SAND	Datalogger + Manual	BH17 is a shallow bore located within the margins of a bog. In the baseline years the bore shows similar features to that of bore BH16, i.e. an obvious seasonal response. At times the groundwater level has been artesian, and in some cases water levels remained artesian throughout the year. Since the construction of the storage the seasonal response of the water level has not been as pronounced. This bore is located directly down-gradient of the storage, and it would seem that the construction of the storage has modified aquifer recharge in this area. The bog in this area is receiving water from the EWS. It is noted that groundwater levels are tending to remain more stable (generally within 0.5 m of the ground surface, and 0.5 m variation between seasons), with groundwater storage taking more time to deplete, and recharge. Groundwater levels have frequently been artesian or very close to surface in IY5. A seasonal trend was more apparent in IY6 compared with other impact years, with the exception of an additional rise in water levels in late summer.
BH18	Clayey SAND	Datalogger + Manual	This bore is located further to the east of the water storage. Bore BH18 appears to be experiencing similar trends and ranges in SWL in the impact years and baseline years. This indicates that the bore is not being impacted by the water storage. Water levels exhibit a strong season response and fall during the Summer and late Autumn periods. Water levels are reactive to rainfall events. At times during late Summer/Autumn water levels can fall below the base of the bore, however, they can quickly respond following a rainfall event. BH18 was dry in February and April 2025 and generally exhibited lower water levels in IY6.

7. Monitoring results – water quality

7.1 Surface water

7.1.1 Field parameters

Field monitoring sheets have been attached as Appendix B. Measurements were taken in the field using a Water Quality Meter (WQM) prior to sampling for each site. The final measurements (taken immediately prior to sampling) are displayed in both graphical and tabulated format alongside previous years in Appendix D, to allow comparison between baseline and construction periods.

From Appendix D, the field parameters appear to remain within the same range between the baseline and water storage construction periods at each location. No obvious change in the water quality has been identified from the field water quality parameter monitoring.

Typically, the field parameter results demonstrate:

- Temperature averages are approximately 8°C to 9°C at each location
- At all locations, pH ranges from slightly acidic to neutral, with the exception of October 2015 at Boggy Creek 1 with a pH of 9 to 10
- Dissolved Oxygen values range between 7 mg/L and 13 mg/L with the exception of a low reading of 0.5 mg/L in January 2014 at Boggy Creek 1 p/u 1
- The average oxidation reduction potential (Redox) during the impact period is between 55 % to 673 % of that of the baseline period at all locations and conditions are typically oxidising. Negative ORP results indicated reducing conditions in the November 2022 monitoring round at all locations. Results from IY6 returned mostly positive ORP values, with February 2025 showing the lowest reported values, including a negative value of -6.3 mV at Boggy Creek 1 p/u 1
- Electrical conductivity (EC) reduced at Boggy locations during both the IY4 and IY5 monitoring periods, to approximately half of the baseline average. In the IY6 period EC at Boggy locations increased toward baseline values in February and April 2025
- Field parameters for EWS East are typically within the range of the Boggy locations. pH is slightly acidic to neutral similarly to the Boggy locations. In IY5 and IY6, DO for EWS East was about half the concentration of the Boggy Creek locations. Fluctuations in Redox and EC followed similar patterns to Boggy Creek locations in IY6

7.1.2 Analytical results

Analytical results are presented in summary tables in Appendix E. The certified laboratory reports are attached in Appendix F. The discussion below focuses on differences between the baseline and water storage construction periods.

Inorganics

For all monitoring locations, laboratory measurements of pH, and EC were typically within the same range during both the baseline and post construction impact monitoring periods. These parameters are typically within the same range as the field measurements.

New TDS maximums were recorded for all locations in IY6, similarly to IY5 and IY4 increases. TDS levels remained either steady or increased in IY6. The EWS East reported inorganics within the range of all Boggy Creek monitoring locations, with the exception of elevated turbidity recorded in February and April 2025.

Acidity and Alkalinity

Bicarbonate concentrations were similar to previous years in IY6, with the exception of one relatively high result at EWS East in November 2024. It is noted that the laboratory limit of reporting (LOR) was higher in IY6 compared with previous impact years despite the same analysis being requested from the laboratory. This is not deemed to materially impact the results analysis given this LOR has been used in the baseline period.

Major Ions

At all locations, major ions such as calcium, magnesium and potassium ions were within a similar range across the monitoring record, with some exceptions for sodium and potassium. New maximums were recorded in IY6 for sodium at Boggy 1 p/u 1, Boggy 2 and EWS East between 3.1 mg/L and 3.7 mg/L. The maximum prior to IY6 was 3.0 mg/L recorded in IY5 and the baseline period. A new maximum of 1.6 mg/L was recorded at EWS East.

Nutrients

Nitrate ranges in IY6 were similar in all wells and showed a mild decrease compared to IY4 and IY5 monitoring periods. Concentrations of phosphorus (Total) were low and mostly below the limit of reporting (<0.1 mg/L).

7.1.3 Summary tables

Results for key analytes are summarised in Table 15. Table 16 summarises any notable differences in surface water quality between the construction and baseline monitoring periods.

Table 15 Key analyte results for surface water

Key analyte	Boggy Creek 1 p/u 1	Boggy Creek 1 p/u 2	Boggy Creek 2	EWS East
pH	Appears to be consistent between baseline and impact periods. Typically slightly acidic to neutral.	Appears to be consistent between baseline and impact periods. Typically slightly acidic to neutral.	Appears to be consistent between baseline and impact periods. Typically slightly acidic to neutral.	Appears to be consistent with other Boggy Creek locations. Typically slightly acidic to neutral.
Electrical conductivity	Appears to be consistent between baseline and impact periods. Concentration ranges from 9.3 µS to 27.5 µS/cm	Appears to be consistent between baseline and impact periods. Concentration ranges from 17.3 µS to 28.7 µS/cm	Appears to be consistent between baseline and impact periods. Concentration ranges from 10.8 µS to 30.6 µS/cm	Appears to be consistent with other Boggy Creek locations. Concentration ranges from 14.7 µS to 24 µS/cm.
Turbidity	Appears to be consistent between baseline and impact periods. Typically < 2 NTU	Appears to be consistent between baseline and impact periods. Typically < 1 NTU	Appears to be consistent between baseline and impact periods. Typically < 1 NTU	Appears slightly elevated compared to the other Boggy Creek locations. Concentration ranges from 3 NTU to 7.7 NTU.
Bicarbonate	Appears to be consistent between baseline and impact periods. Concentrations range from 7 mg/L to 15 mg/L except for Feb 2022 at 37 mg/L.	Appears to be consistent between baseline and impact periods with slightly increased values recorded in IY6. Concentrations range from 6 mg/L to 33 mg/L.	Appears to be consistent between baseline and impact periods with all samples noted as <20 laboratory LOR. Concentrations range from 13 mg/L to 16 mg/L.	Appears to be consistent with other Boggy Creek locations. Concentrations range from 8 mg/L to 20 mg/L.
Carbonate	Consistent between baseline and impact periods. Concentrations below detection limit.	Consistent between baseline and impact periods. Concentrations below detection limit.	Consistent between baseline and impact periods. Concentrations below detection limit.	Appears to be consistent with other Boggy Creek locations. Concentrations below detection limit.

Key analyte	Boggy Creek 1 p/u 1	Boggy Creek 1 p/u 2	Boggy Creek 2	EWS East
Calcium, Magnesium, Potassium, Chloride	Appears to be consistent between baseline and impact periods. Ion concentrations typically < 3 mg/L.	Appears to be consistent between baseline and impact periods. Ion concentrations typically < 3 mg/L	Appears to be consistent between baseline and impact periods. Ion concentrations typically < 3 mg/L. With only Chloride returning at 6.3 mg/L in April 2025.	Appears to be consistent with other Boggy Creek locations. Ion concentrations typically < 3 mg/L.
Nitrogen and nitrate	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent with other Boggy Creek locations. Concentrations < 0.5 mg/L.
Sodium	Appears to be consistent between baseline and impact periods. Concentrations between 1.5 mg/L and 3.7 mg/L.	Appears to be consistent between baseline and impact periods. Concentrations between 1.3 mg/L and 2.9 mg/L.	Appears to be consistent between baseline and impact periods. Concentrations between 1.5 mg/L and 3.1 mg/L.	Appears to be consistent with other Boggy Creek locations. Concentrations range from 1 mg/L to 3.7 mg/L.
Phosphorus and phosphate	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent with other Boggy Creek locations. Concentrations are <1 mg/L.

Table 16 Summary of surface water differences

Key analyte	Notable difference in construction period compared to baseline years?		
	Boggy Creek 1 p/u 1	Boggy Creek 1 p/u 1	Boggy Creek 2
pH	No	No	No
Electrical conductivity	No	No	No
Turbidity	No	No	No
Bicarbonate	No	No	No
Carbonate	No	No	No
Calcium, Magnesium, Potassium, Sodium Chloride	No	No	No
Nitrogen and nitrate	No	No	No
Phosphorus and phosphate	No	No	No

7.2 Groundwater

7.2.1 Field parameters

Measurements were taken in the field using a calibrated WQM prior to sampling for each site. The final measurements (taken immediately prior to sampling) are displayed in both graph and table form alongside previous years in Appendix D, to allow comparison between baseline and construction periods.

From Appendix D, the field parameters appeared to remain within the same range between baseline and construction periods at each groundwater monitoring location. This indicates that water quality has not obviously changed. BH18 did not produce enough water to collect a sample, and was recorded dry during both the February and April 2025 monitoring events, while BH06 was dry in April 2025. Typically, the field parameter results demonstrate:

- Temperature averaged between approximately 6°C to 10°C at each location, with bore BH18 previously exhibiting the widest variation in temperature
- At all locations, pH ranged from acidic to neutral. Bore BH16 continued to return a slight drop in average pH of 6.26 in the baseline period to 5.21 post construction
- Dissolved Oxygen values were generally within 6 mg/L to 10mg/L, with a slight reduction compared to baseline year values. BH17 and BH18 exhibited the lowest DO levels when compared to baseline. BH18 recorded 2.83 mg/L in November 2024 and was found dry in February and April 2025. Note that DO measurements are less reliable than other parameters due to the sampling method (bailer)
- Oxidation Reduction Potential continued its trend of being lower (less oxidising) in the impact years compared to baseline years. February 2025 returned the lowest ORP values with monitoring locations ranging from -5.7 mV to 18.5 mV
- Electrical conductivity in impact years appeared either similar or slightly lower than the baseline year values, with the exception of a slight increase in BH18. Furthermore, conductivity values in IY6 remained within similar ranges of other impact years

7.2.2 Analytical results

Analytical results are included in Appendix E. The following summary relates to monitoring bores BH06, BH10, BH16, BH17 and BH18 as well as EWS West.

Inorganics

The electrical conductivity (EC) remained low, typically < 50 µS/cm. Bore BH06 was typically highest in EC, recording a maximum of 58 µS/cm in Apr 2024, and lower values in 2025. The EWS West EC was similar to bores BH09 and BH16.

Salinity remained low at all locations (< 100 mg/L TDS), however IY4, IY5 and IY6 TDS values were markedly higher in all bores compared to previous years, with 2023 to 2025 BH17 and BH18 locations approximately double the baseline TDS ranges.

Acidity and Alkalinity

Bicarbonate concentrations remained similar between the baseline and impact period. BH17 in IY6 returned the highest concentrations of bicarbonate (maximum of 48 mg/L), which is almost double the IY5 maximum (26 mg/L). The remaining bores typically had concentrations of bicarbonate <10 mg/L.

At all locations, the carbonate alkalinity has not been above the laboratory LOR.

Major Ions

Major ions (unfiltered calcium, magnesium. potassium and sodium) were generally within a similar range between the baseline and impact periods for all bores. Bores BH06, BH10, BH16 and BH17 all typically average < 3 mg/L for calcium, magnesium, sodium and potassium, with BH18 reporting highest values in IY2 and IY3 and reduced concentrations in subsequent impact years. Chloride and sulfate were relatively consistent for all bores in both baseline and construction periods, at typically < 2 mg/L.

EWS West did not deviate from the rest of the bores with the recorded values generally lower than the other groundwater locations.

Nutrients

Nutrient concentrations were reasonably consistent across the groundwater bore locations, during both baseline and impact periods. Nutrient concentrations at EWS West reported no outstanding values when compared to other bores.

BH06 continued to record the highest nitrate by an order of magnitude with concentrations reaching 4.91 mg/L in IY6. Nitrate concentrations in bores BH16 and BH17 appear consistently elevated compared to other locations in both baseline and impact periods. A minor exceedance of the water quality objective (1.1 mg/L) was identified at BH16 in IY6. Furthermore, minor ammonia exceedance (0.49 mg/L) was also recorded at BH16 in February 2025, which is the highest ammonia concentration recorded across all bores in baseline and impact years. These are further discussed in Section 8.3.

Phosphate and phosphorus are typically below the LOR or very low (< 1 mg/L) at all locations in both baseline and impact periods, with the exception of bore BH16 in 2022 which has a total phosphorus concentration of 3.6 mg/L.

7.2.3 Summary table

Results are summarised in Table 17.

Table 17 Key analyte results for groundwater

Key analyte	BH06	BH10	BH16	BH17	BH18	EWS West
pH	Appears to be consistent between baseline and impact periods. Typically slightly acidic to neutral.	Appears to be consistent between baseline and impact periods. Typically slightly acidic to neutral.	Appears to be consistent between baseline and impact periods. Typically slightly acidic to neutral.	Appears to be consistent between baseline and impact periods. Typically slightly acidic to neutral.	Appears to be consistent between baseline and impact periods. Typically slightly acidic to neutral.	Appears to be consistent with the other monitoring locations. Typically slightly acidic to neutral.

Key analyte	BH06	BH10	BH16	BH17	BH18	EWS West
Electrical conductivity	Appears to be consistent between baseline and impact periods. Typically < 50 µS/cm.	Appears to be consistent between baseline and impact periods. Typically < 50 µS/cm.	Appears to be consistent between baseline and impact periods. Typically < 50 µS/cm.	Appears to be consistent between baseline and impact periods. Typically < 50 µS/cm.	Appears to be consistent between baseline and impact periods. Typically < 50 µS/cm.	Appears to be consistent with the other monitoring locations. < 50 µS/cm since recording started.
Bicarbonate	Appears to be consistent between baseline and impact periods. Range typically < 10 mg/L.	Appears to be consistent between baseline and impact periods. Range typically < 10 mg/L.	Appears to be consistent between baseline and impact periods. Range typically < 10 mg/L.	Impact periods appear slightly elevated compared to baseline. Range from 10-50 mg/L.	Appears to be consistent between baseline and impact periods. Range from 10-20 mg/L.	Appears to be consistent with the other monitoring locations. Slightly elevated in IY6. Range from 6 – 40 mg/L.
Carbonate	Appears to be consistent between baseline and impact periods. Concentrations below detection limit.	Appears to be consistent between baseline and impact periods. Concentrations below detection limit.	Appears to be consistent between baseline and impact periods. Concentrations below detection limit.	Appears to be consistent between baseline and impact periods. Concentrations below detection limit.	Appears to be consistent between baseline and impact periods. Concentrations below detection limit.	Appears to be consistent with the other monitoring locations. Concentrations below detection limit.
Calcium, Magnesium, Potassium, Sodium, Chloride	Appears to be consistent between baseline and impact periods. Typically < 3 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 3 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 3 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 3 mg/L.	Increases in calcium, magnesium, potassium. Concentrations < 10 mg/L.	Appears to be consistent to with the other monitoring locations. < 3 mg/L since recording started.
Nitrogen and nitrate	Appears to be consistent between baseline and impact periods. Typically < 5 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 1.5 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 1.5 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent to with the other monitoring locations. < 0.5 mg/L since recording started.
Phosphorus and phosphate	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	One higher total phosphorus result in 2022 (3.6 mg/L).	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent between baseline and impact periods. Typically < 1 mg/L.	Appears to be consistent to with the other monitoring locations. < 1 mg since recording started.

Salinity remains low throughout baseline and impact years, indicating an ongoing strong connection with infiltrating rainfall and snow melt. The low salinity also suggests short residence times of water in each aquifer throughout baseline and construction periods. A summary of the key differences is provided in Table 18.

Table 18 Groundwater: Differences in key analytes between baseline and impact monitoring periods

Key analyte	Notable difference in impact period compared to baseline years?				
	BH06	BH10	BH16	BH17	BH18
pH	No	No	No	No	No
Electrical conductivity	No	No	No	No	No
Bicarbonate	No	No	No	No	No
Carbonate	No	No	No	No	No
Calcium, Magnesium, Potassium, Sodium Chloride	No	No	No	No	No
Nitrogen and nitrate	No	No	No	No	No
Phosphorus and phosphate	No	No	No **One higher result in 2022**	No	No

7.3 Water type comparison – piper plot

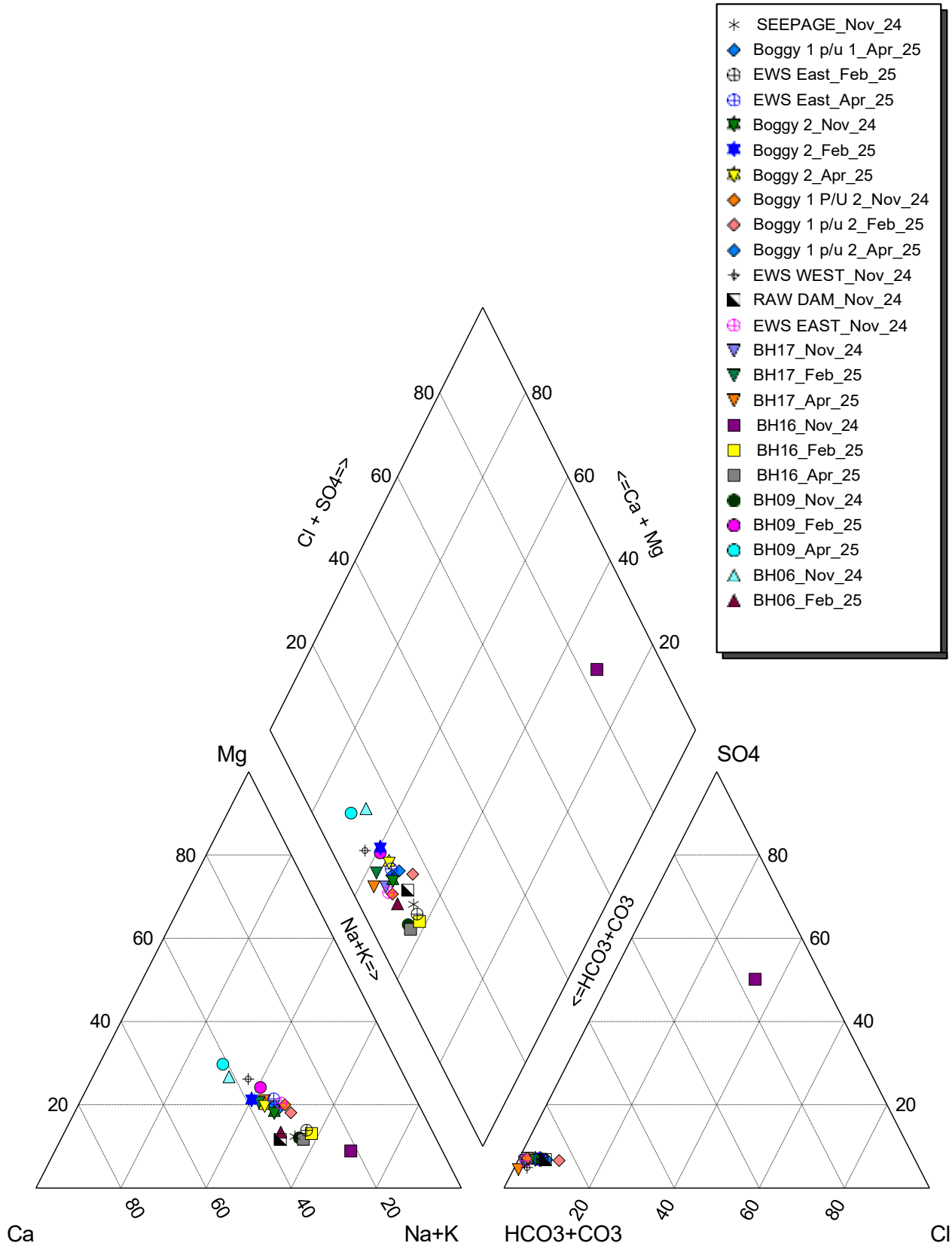
It has been mentioned in each hydrological report that the concentrations of major ions are typically very close to or below the LOR and therefore sensitive to some on the measures used in the HEMAMP. To aid in further assessment of water quality, piper plots were produced for IY6 to demonstrate the closeness in water types between each of the sample locations.

A Piper plot or Piper diagram is a trilinear chart that displays the relative abundance of major cations and anions within a water sample. Rather than plotting concentration, the diagrams show the composition of ions in a standardised unit called milliequivalents per litre (%meq/L). This allows the ions to be compared as a percentage of the total cation or anion makeup, to determine the dominant ions. The diagram consists of two triangles, one presenting cations and one presenting anions, and a diamond that effectively combines the data from the two triangles.

From Figure 8, it can be seen that most of the water samples from IY6 sit closely together on the chart and typically straddle a mixed water type between magnesium-bicarbonate and sodium-bicarbonate type. There are a few outliers on the chart for isolated samples from BH16.

In addition to the HEMAMP monitoring locations, additional samples were taken in November 2024 from the water storage (Raw Dam) and seepage from the pipe below the summit nature walk near BH17 (Seepage). The composition of the raw dam water is similar to that of the seepage water and EWS East, while the EWS West is higher in calcium.

The comparison suggests that all monitoring locations exhibit similar ionic compositions, including between groundwater and surface water. This is likely due to the shallow groundwater bores being strongly influenced by surface water interactions.



DESCRIPTION: Mt Buller Piper Plot		
	PROJECT: Mt Buller Water Storage	PROJECT NO: 12565989
	CLIENT: Alpine Resorts Victoria	DATE:

7.4 QAQC Program

An assessment of the QAQC program is presented in Appendix G. Based on the completion and results of the QAQC program, there is an acceptable level of confidence in the field and analytical results for IY6.

8. Discussion

8.1 Independent review recommendations

An independent review is conducted of the HEMAMP Hydrological and Ecological Monitoring Reports each year. In October 2024, Southeast Botanical Consulting (SE Botanical) provided an independent review of the IY5 reports. The following recommendations were made in relation to the hydrological monitoring and reporting:

1. “Temperature data may be obtained from the Bureau of Meteorology and plotted with rainfall data for further interpretation of how climate influences hydrology and vegetation changes over time. Alpine Resorts Victoria may review the need for evapotranspiration data and whether this climate variables is essential for the HEMAMP reporting.”
2. “Continue surface water flow monitoring until there is sufficient data to determine whether adjustments are needed for the EWS.”
3. “Locate water extraction data from Boggy Creek 2 and include in Y6 annual reporting.”
4. “Review and report EWS drainage and discharge data in Y6 once enough data has been collected.”

The recommendations above has been addressed in this report by the following actions:

1. Temperature data has been added to the discussion in Section 3.
2. Surface flow monitoring has been included in the report, however a need remains for continued review and validation of flow data.
3. High-level pumping data has been provided, however a need remains for continued review and validation of the data to make this suitable for incorporation into the report.
4. EWS flows have been plotted against the Boggy flow data in the surface flow analysis.

In IY4, Mann Kendall analysis was included in the reporting in response to the previous year’s independent review. Based on discussions with Biosis and ARV, and the recommendations in the most recent independent review, Mann Kendall analysis has been omitted from the IY5 and IY6 assessment (and will continue to be omitted) for the following reasons:

– Concentrations of the analytes in the monitoring program are typically close to or below the LOR, which increases the sensitivity of Mann Kendall analysis and creates a tendency to identify false or negligible trends which do not materially impact the HEMAMP objectives
– Mann Kendall is analysed on a continuous time series and does not analyse individual results against a standard range. It therefore does not meet the HEMAMP objective to respond to recent changes in water quality against the baseline range

April monitoring period

The April monitoring round was introduced in 2023 in response to a previous independent review which recommended the monitoring period be added for at least two years. Following the IY5 and IY6 monitoring, it is suggested that water quality monitoring could be removed from the April monitoring round moving forward, for the following reasons:

– The water quality results in April do not appear to differ significantly from the November and February periods
– Groundwater bores are more likely to be dry in the April monitoring period, decreasing the availability of groundwater for sampling and decreasing the opportunity for comparison between bores

8.2 HEMAMP adaptive management triggers

Hydrological triggers have been set with reference to hydrological models for the Boggy Creek catchment, which are designed to provide an early warning system for pre-empting ecological change at the impact sites (Table 19). The adaptive management trigger thresholds follow a ‘traffic light’ approach, where the level of management intervention is escalated as the risk of adverse impacts on the ecological values of the impact sites increases. Risks of adverse impacts increase as trigger levels move from green, to amber, to red.

Inter-Quartile Range (IQR) methodology

The concentrations of most parameters are very low, particularly for major ions (i.e. typically < LOR or < 2 mg/L). Some parameters are therefore particularly sensitive to the IQR as a measure for adaptive management. An acceptable 'green' range was determined by applying 1.5 times the baseline IQR to either side of the baseline first quartile (Q1) and third quartile (Q3); i.e. below baseline Q1 and above baseline Q3. This produced a range for each analyte which was representative of the baseline period.

The adaptive management triggers for water quality are based on comparison of individual impact year results against a baseline period IQR statistic. It is noted that there are two distinct groundwater catchments apparent in the monitoring data with slightly different chemical compositions. Alpine bogs are located among each of these catchments, indicating these ecosystems are capable of existing within the water quality range of each. A combined baseline IQR (i.e. for groundwater, a bicarbonate IQR calculated from all monitoring bores) allows for a 'big picture' analysis. This method minimises the risk of creating a sensitive trigger whereby a value for one monitoring bore may be outside of the typical range for that bore yet within the range of the alpine bog habitat as a whole.

Table 19 HEMAMP adaptive management triggers

Trigger	Parameter	'Green' Threshold	'Amber' Threshold	'Red' Threshold
Surface Water Flows	Reduction in mean annual surface water flows to Boggy Creek over two consecutive years, relative to model	≤10%	>10% but ≤50%	>50%
Groundwater Levels	Reduction in mean annual groundwater levels over two consecutive years, relative to model	≤10%	>10% but ≤50%	>50%
Surface Water Quality	Change in various surface water quality parameters, relative to baseline.	<1.5 x IQR*	≥1.5 x IQR* and ≤3 x IQR*	>3 x IQR*
Groundwater Quality	Change in various groundwater quality parameters, relative to baseline.	<1.5 x IQR*	≥1.5 x IQR* and ≤3 x IQR*	>3 x IQR*

* The Inter-quartile range (IQR) has been calculated for surface water and groundwater for each analyte using the baseline range for all monitoring locations. This gives a representative IQR which accounts for variability in the catchments across which the alpine bogs occur.

8.2.1 Surface water

8.2.1.1 Surface water flow

Surface water flow data capture was amended for Boggy Creek Weir 2 in December 2023, therefore IY6 is the first year with monitoring data available for the full assessment period. A full year of flow data was also available for Boggy Creek Weir 1 p/u 1 and Boggy Creek Weir 1 p/u 2, as per IY5.

A hydrological model was created by Biosis for comparison to recorded surface water flow as described in the HEMAMP Version 5 (Biosis, 2022). GHD did not contribute to the development of the hydrological model and has not reviewed or verified the model. The model was created for Boggy 1 p/u 2 and Boggy 2 only, due to insufficient modelling data for Boggy 1 p/u 1.

Annual averages were calculated for the predicted and actual mean daily flow rates for the two Boggy weirs. The differences are presented in Table 20 with an assessment against the HEMAMP criteria.

The actual surface water flow rates differed from the model predictions at both locations. Actual mean daily flow rates at Boggy 1 p/u 2 were 10% lower than predicted flow rates in IY6. Conversely, actual mean daily flow rates at Boggy 2 were 84% lower than predicted values for IY6.

Charts plotting predicted vs actual flows for each weir are provided in Appendix C. From the charts, it can be seen that the flow rates at Boggy 1 p/u 2 fluctuate between higher and lower than the model prediction, while Boggy 2 flow rates are consistently below the model prediction.

Water Storage repair works

It is noted that additional pumping to the water storage was undertaken in the summer of IY6 following emptying of the water storage in spring 2024 for liner repair works. The changes in pumping regime and Boggy flows are likely to be impacting the comparison with the model, therefore further monitoring and analysis is recommended in IY7 rather than immediate actions to be implemented in the interim.

Table 20 Results of Surface flow analysis

Comparison*	IY5 Result	IY6 Result	Action Req'd?	Comments
Boggy Creek Weir 1 Pickup 2 v Modelled Surface Water Flows	+ 38%	- 10%	No	A complete dataset was available for Boggy 1 p/u 2 and an incomplete dataset was available for Boggy 2 in IY5. Mean surface flows were analysed for Boggy 2 for the period December 2023 to April 2024. A complete dataset was available for Boggy 1 p/u 2 and Boggy 2 in IY6. Results for IY6 were considerably below the model predicted flows at Boggy 2 - 84% but only 10% below the model predicted flows at Boggy 1 p/u 2. Further monitoring and analysis is recommended in IY7 to assess whether results in IY6 were influenced by liner repair works and the general check and validation of recent Boggy 2 recorded flow data.
Boggy Creek Weir 2 v Modelled Surface Water Flows	- 75%	- 84%	Yes	

8.2.1.2 Surface water quality

Most analytical results were within the 'green' threshold of 1.5 times the IQR, with some exceptions as shown in Table 21. The concentrations of most parameters are very low, particularly for major ions (i.e. typically < LOR or < 2 mg/L). Some parameters are therefore particularly sensitive to the IQR as a measure for adaptive management.

Five extreme/red outliers were identified for total dissolved solids (TDS) across the surface water monitoring locations in IY6. This consisted of two outliers at Boggy 1 p/u 1 and one outlier at each other location. Five amber outliers also occurred across the locations.

TDS could be impacted by a range of sources containing inorganic or organic constituents, such as sewage, water treatment, soil, rock, algal and plant decomposition. Weed control works upstream of Boggy Creek were noted as a potential source of TDS in IY5, which largely involved the up-rooting of weeds to avoid herbicide spraying. It is noted that weed mats and other sediment control measures have been implemented in IY6, therefore TDS may be related to ongoing impacts from previous sedimentation or a different source. It is noted that TDS was high at EWS East, therefore a source other than weed control could be attributing to TDS concentrations (for example, sediment from the water storage dam and EWS pipe).

In contrast to TDS, increased turbidity would indicate impact from non-dissolved solids in water such as suspended sediment runoff. Turbidity results were variable in IY6, including red outliers at EWS East (three outliers) and Boggy 1 p/u 1 (one outlier), and one amber outlier at Boggy 2. The lack of increased turbidity compared to TDS could indicate that sediment is settling below the surface at the weir monitoring locations, or that the source of increased TDS may be from another source.

Management actions

The HEMAMP Version 5 specifies the requirement for management action when one or more parameters report extreme (red) outliers. The management action is dependent on the parameter(s) exceeding the threshold. Where one or more parameters report mild (amber) outliers, further investigation is required to determine pre-emptive management actions. Responses for water quality are described in section 8.3.6 of the HEMAMP Version 5.

The following adaptive management responses are recommended for TDS and turbidity:

– Areas of weed removal and track grading should be inspected to determine if sediment controls need to be adjusted or added to avoid runoff
– If inspection indicates no or limited sediment runoff, additional sources of TDS could be investigated including the sewage pipeline that traverses the base of the Summit Nature Walk
– Turbidity in the EWS outlet should be investigated as to its source and whether it is entering the distribution pipeline (as turbidity may be settling in the EWS collection pit)

Water Storage repair works

Table 21 Results of IQR analysis – Surface water quality

Parameter	IY6 Result	Action Required	Comments
Electrical Conductivity	No outliers detected.	No	Review catchment area for potential sources of TDS and Turbidity, starting with sediment impact from weed control areas. Adjust/add sediment control if necessary to achieve water quality objectives. Other parameters were mostly within the green threshold range of 1.5 x IQR. Repairs were made to the water storage dam liner in late 2024 in response to identified leakage. EWS flow data indicates significant water loss through the dam leakage collection pit and EWS East prior to December 2024. It is recommended that monitoring continue in IY7 to identify whether changes in TDS, turbidity and other parameters are observed following repair of the dam liner.
Total Dissolved Solids	Five 'red' outliers detected in IY6 in all sampling periods, ranging from 47 mg/L (Boggy 1 p/u 2) to 64 mg/L (Boggy 2). These outliers are slightly elevated compared to IY5 'red' outlier values.	Yes	
pH	No outliers detected.	No	
Nutrients (Nitrate)	Minor outliers detected. Very low values (0.03 to 0.09 mg/L) recorded in IY6	No	
Major Ions (Calcium, Magnesium, Potassium, Sodium, Chloride, Sulfate)	Two 'red', one 'amber' outlier recorded for sodium, one 'red' for potassium, one 'red' and one 'amber' for chloride in IY6	Yes	
Turbidity	One 'red' outlier detected at Boggy 1 p/u 1 and one 'amber' outlier at Boggy 2 in IY6. EWS East showed all 'red' outliers in both IY5 and IY6.	Yes	
Alkalinity (Bicarbonate)	One 'red' outlier was noted at EWS East in IY6, with the rest being below LoR	Yes	

8.2.2 Groundwater

8.2.2.1 Groundwater flow

A hydrological model was created for comparison to recorded groundwater levels as described in the HEMAMP Version 5 (Biosis, 2022). GHD did not contribute to the development of the hydrological model and has not reviewed or verified the model.

Annual averages were calculated for the predicted and actual SWLs for the two Boggy weirs. The differences are presented in Table 22 with an assessment against the HEMAMP criteria.

The recorded mean annual groundwater level for all bores in IY5 was approximately 4% lower than the annual mean predicted by the model in IY5. Similarly, in IY6 the recorded mean annual groundwater level for all bores in was approximately 5% lower than the annual mean predicted by the model.

Charts plotting predicted vs actual SWL for each bore are provided in Appendix C and demonstrate that monthly fluctuations from the predicted mean SWL are typically variable for each bore. BH17 was the only bore in IY6 to show a higher actual groundwater levels compared to the model, possibly due to additional watering from the EWS at this bore.

Table 22 Results of Groundwater Level analysis

Comparison	IY5 Result	IY6 Result	Action Req'd?	Comments
All boreholes v Modelled Groundwater Levels	- 4%	- 5%	No	Groundwater levels did not depart considerably from expected levels in IY5 or IY6. Monitoring must continue but no further intervention is needed.

8.2.2.2 Groundwater quality

Most analytical results were within the 'green' threshold of 1.5 times the IQR. The concentrations of most parameters are very low, particularly for major ions (i.e. typically < LOR or < 2 mg/L). Some parameters are therefore particularly sensitive to the IQR as a measure for adaptive management.

The HEMAMP Version 5 specifies the requirement for management action when one or more parameters report extreme (red) outliers. The exact management action is dependent on the parameter(s) exceeding the threshold. Where one or more parameters report mild (amber) outliers, further investigation is required to determine pre-emptive management actions.

One extreme/red outlier was identified for nitrate at the 'control' bore BH06 in IY6 (refer Table 23). All other values were within the 'green' threshold. It is noted that BH06 has consistently reported nitrate above the range of the other bores, including during the baseline period. When calculating an IQR for BH06 specifically, the results are within the 'green' threshold for this bore. Based on this, it is recommended that the red exceedance should not trigger an adaptive management response in this scenario, as downgradient bores are not indicating impacts.

Similarly, isolated outliers of major ions are not recommended to trigger an active response due to the consistency of other results across the IY6 monitoring period. Rather, further monitoring is required in IY7 to identify whether changes in TDS, major ions and other parameters are observed following repair of the dam liner.

Table 23 Results of IRQ analysis – Groundwater quality

Parameter	IY6 Result	Action Req'd?	Comments
Electrical Conductivity	No outliers detected.	No	Nitrate at BH06 was outside the overall catchment range but within the IQR threshold for BH06 specifically. Other parameters were mostly within the green threshold range of 1.5 x IQR, with some exceptions for major ions and TDS. Further monitoring is required in IY7 to identify whether changes in TDS, major ions and other parameters are observed following repair of the dam liner.
Total Dissolved Solids	One 'red' and four 'amber' outliers detected in IY6 with values ranging 53 mg/L to 79 mg/L. TDS values at BH17 remain elevated as they were in IY5.	Yes	
pH	No outliers detected.	No	
Nutrients (Nitrate)	One 'red' outlier detected in IY6 and BH06. With one 'red' outlier and two 'amber' outliers detected at BH06 in IY5.	Yes	

Parameter	IY6 Result	Action Req'd?	Comments
Major Ions (Calcium, Magnesium, Potassium, Sodium, Chloride, Sulfate)	Four 'amber' outliers were detected for magnesium, one 'red' outlier for potassium, sulfate and chloride each. Chloride and sulfate outliers at BH16 were particularly elevated in IY6.	Yes	
Turbidity	No outliers detected.	No	
Alkalinity (Bicarbonate)	No outliers detected in IY6. Two 'amber' outliers (BH17 and BH18) detected in IY5.	No	

8.3 Comparison with water quality objectives

Of the analytes included in the laboratory program, a water quality objective exists for nitrate (1 mg/L as N) and ammonia (0.32mg/L as N).

Bore BH06 continued to recorded nitrate (as N) exceedances in IY6. The maximum nitrate concentration in IY6 (4.6 mg/L) was similar to the baseline period (maximum of 4.9 mg/L) and recorded in February 2025. This well was dry for the April 2025 monitoring period. Three exceedances of the nitrate as N criteria occurred for bore BH06 during the baseline period.

Bore BH16 and BH17 exceeded the nitrate as N criteria during the baseline period (bores BH16 in 2015 and BH17 in 2015 and 2018). BH16 recorded a nitrate exceedance (1.1 mg/L) in Nov 2024, with further values of 0.93 mg/L and 0.82 mg/L in February and April 2025 respectively.

Results collected also identified an ammonia (as N) exceedance (0.49 mg/L) in BH16, with no ammonia exceedances previously recorded in baseline or impact years.

The results suggest that the water quality objectives are met at all locations with the exception of minor exceedances at bore BH06, BH16 and BH17 with regard to nitrate (as N) and ammonia (as N) at BH16. Bore BH06 appears to have naturally high background concentrations of nitrate (as N), which have fallen slightly during the impact period but remain above the criteria. Bores BH16 and BH17 showed slight increases in nitrate concentration from IY5, however within baseline year ranges (1.1 mg/L to 1.2 mg/L). The elevated ammonia (as N) concentrations at BH16 may indicate changes to the groundwater chemistry, however further monitoring at BH16 is required to establish significance of the elevated levels.

9. Conclusion and recommendations

9.1 Conclusions

9.1.1 Surface flow

The surface flow analysis is based on a limited time series only and currently indicates a strong influence from rainfall on the flow rates at Boggy Creek 1 and Boggy Creek 2, however this influence declines following dam repair works on the water storage in late 2024. It is noted that increased pumping from Boggy Creek occurred in early 2025 to refill the water storage, which may be influencing the change in rainfall response. In addition, Boggy flows reduce following a reduction in EWS flows following dam liner repair. Therefore, the influence of rainfall versus EWS flows in Boggy Creek is ambiguous and may be influencing Boggy Creek in combination. Snowmelt may also contribute to higher baseline flow rates in the late spring to early summer (November to December).

9.1.2 Groundwater levels

Bores BH06 and BH18 exhibit similar responses to rainfall during the water storage construction period compared to the preconstruction or baseline monitoring period. These bores are situated cross-gradient from the water storage and are expected to not be impacted by the water storage construction or operation.

Conversely, bores BH09, BH17 and to a lesser extent bore BH16 exhibit some change in SWL patterns after the construction of the water storage. Bores BH09 and BH17 are adjacent to the EWS, which is understood to have been flowing continuously (i.e. not manually controlled) since the water storage construction, with increased flows from the EWS East due to leakage from the water storage. Bores BH09 and BH17 exhibit less seasonality in the impact years and do not decline to the depths observed in the baseline monitoring period.

9.1.3 Water quality

Baseline water quality data is limited, making it difficult to draw robust conclusions. However, there does not appear to be any obvious, significant change to water quality (surface and groundwater) as a result of the water storage construction based upon the analytical program undertaken to date.

9.1.4 QA/QC program

The frequency of field duplicate and field split samples is deemed sufficient for the adopted monitoring program.

9.2 Recommendations

HEMAMP responses

- Adaptive management responses are recommended to investigate TDS and turbidity outliers in surface water, similarly to IY5 recommendations (see Section 8.2.1.2):
  - Areas of weed removal and track grading should be inspected to determine if sediment controls need to be adjusted or added to avoid runoff
  - If inspection indicates no or limited sediment runoff, additional sources of TDS could be investigated including the sewage pipeline that traverses the base of the Summit Nature Walk
  - Turbidity in the EWS outlet should be investigated as to its source and whether it is entering the distribution pipeline (as turbidity may be settling in the EWS collection pit)
- Groundwater levels, surface flow levels and EWS flow should continue to be monitored in accordance with the current HEMAMP program methodology, particularly in response to recent water storage repairs. Reference should also be made to the monitoring and risk control measures in GHD 2025
- BH07 and BH10 should be manually bailed in the next monitoring round to reduce sediment load

- The HEMAMP protocol contains adaptive management triggers for underwatering of the Alpine Sphagnum Bogs. It is now evident that potential overwatering has occurred or there are changes in the flow regimes to the downstream environment. It is recommended that either the HEMAMP or a separate monitoring program (potentially related to the dam safety plans) also considers the prospect of overwatering or these changes to the flow regime through the design of the EWS. Implications of overwatering or changes to flow regime may include:
  - The encroachment of the Alpine Sphagnum Bogs on other vegetation communities (as has been indicated by the ecological monitoring), or
  - Potential influences or impact to geotechnical hazards, including slope stability and dam safety
- Water quality sampling could be removed from the April monitoring period in future years, due to the prevalence of dry groundwater bores and the absence of significant seasonal variation in water quality. Groundwater level and surface flow data should still be collected over this period
- The Boggy Creek and EWS flow data should continue to be improved and evaluated with regard to:
  - Collation of data from the new SCADA system with historical data
  - Responsiveness to monitoring instrument failures or system failures
  - Calibration of flow meters to verify data records

Integrated dam safety and HEMAMP operations

- As outlined in GHD 2025 (*Mt Buller Boggy Creek Reservoir Dam Safety Geotechnical Assessment and Landslide Risk Assessment*) Low to Moderate risks were evaluated for the qualitative risk assessment (risk to property) and “acceptable” risks were evaluated for the qualitative risk assessment (risk to life). As a result of inherent uncertainties and the known historical site conditions, a number of risk control measures are outlined to reduce the risks to as low as reasonably practicable. GHD recommend these control measures need to be incorporated and managed within the HEMAMP as well as the Dam Safety monitoring programs. In respect to this report and the hydrogeological and surface water monitoring program, the following improvements and gaps need to be addressed:
  - On-going monitoring/operation:
    - Efforts to avoid overwatering of the bogs by ensuring ongoing flows to/through EWS are reduced to levels similar to pre-construction. This is expected to reduce the likelihood of landslide hazard occurrence
    - Monitoring the effectiveness of the repairs completed to date as the performance of the liner is assessed as critical to ongoing good slope performance. Monitoring includes visual observations as well as measuring flow meter/groundwater levels
  - Data gaps:
    - Review construction details on the aqueduct (and the potential for an updated catchment and hydrological review) and assess function and suitability for required purposes including emergency intake of increased flows because of overwatering from EWS

10. References

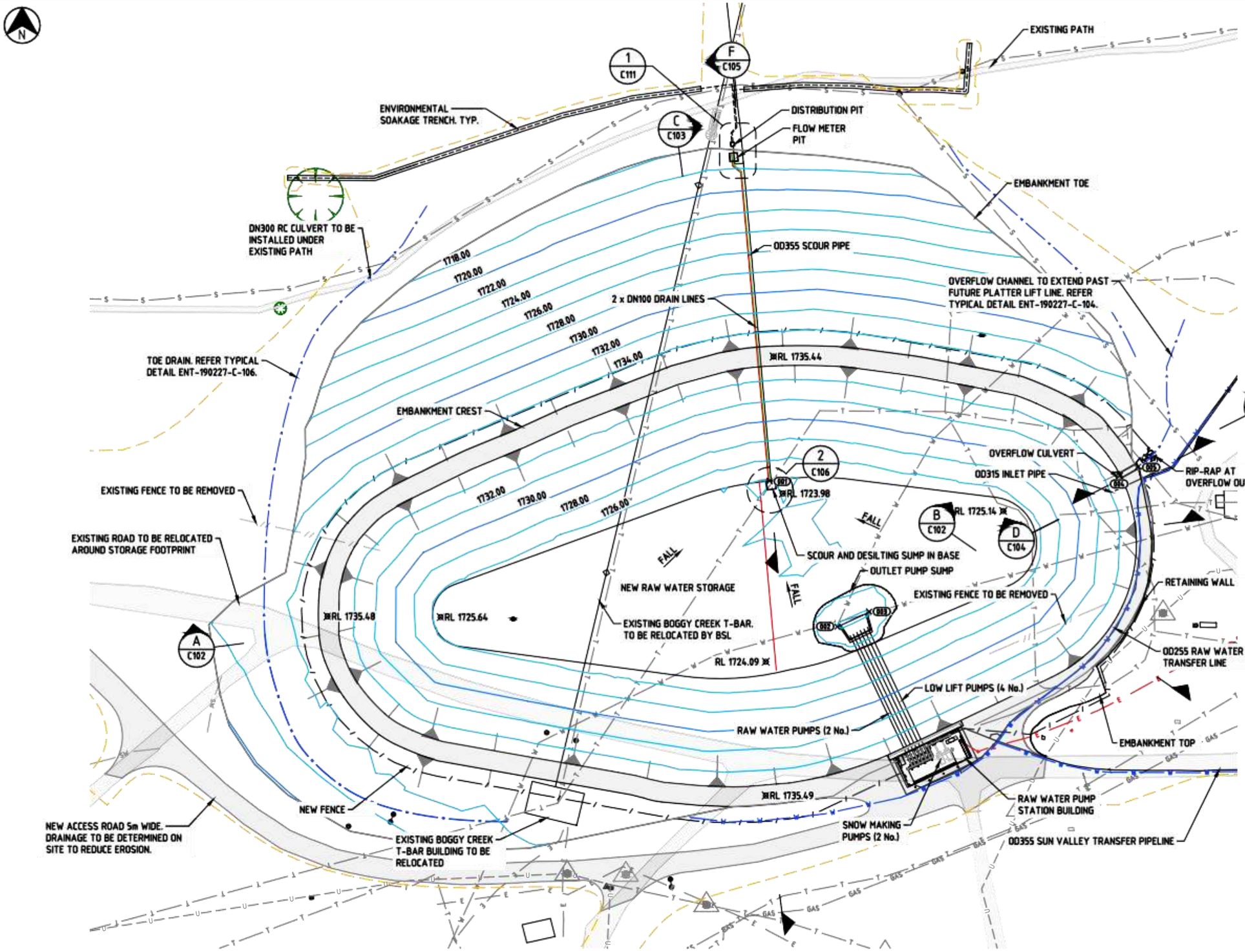
- Australian and New Zealand Environment Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000: '*National Water Quality Management Strategy. Australian and New Zealand Guidelines for Fresh and Marine Water Quality*'
- ANZG, 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines
- Biosis, 2022. *Mount Buller Sustainable Water Security Project – Off-stream Storage: Hydrological and Ecological Monitoring and Adaptive Management Program: Version 5*. 29 July 2022. Reference 34410
- Bureau of Meteorology, 2025, *Monthly Rainfall, Mount Buller,* Australian Government, accessed 23/07/2025, Monthly Rainfall - 083024 - Bureau of Meteorology (bom.gov.au)
- EPA Victoria, 2022: *Groundwater sampling guidelines*. Publication 669.1
- EPA Victoria, 2022: *Environment Reference Standard*. No.S245 Gazette 26 May 2021
- GHD, 2018. *Mt Buller Water Storage 2015-2018 Monitoring Report*, document reference 313073318
- GHD, 2024. Mt Buller Water Storage 2023-2024 *Mt Buller HEMAMP Groundwater and Surface Water Monitoring Review*, document reference 12565989
- GHD, 2025. Mt Buller Boggy Creek Reservoir Dam Safety *Geotechnical Assessment and Landslide Risk Assessment*, document reference 12655947, dated June 2025
- Southeast Botanical Consulting, 2024. *Mt Buller Water Security Off-Stream Storage Project: Hydrological and Ecological Monitoring and Adaptive Management Program (HEMAMP) Year 5 Planning Permit Condition 8 Independent Review.* 23 October 2024. Reference number: ARV0724

Appendices

Appendix A

Dam design drawings

OFFICIAL



WATER STORAGE VOLUME VS DEPTH:

WATER LEVEL (mRL)	VOLUME (ML)
1724.4	0.2
1724.8	0.7
1725.0	0.8
1726.0	6.2
1727.0	12.8
1728.0	20.2
1729.0	28.6
1730.0	37.9
1731.0	48.2
1732.0	59.6
1733.0	72.1
1734.0	85.8
1735.0	102.7

WATER STORAGE KEY DETAILS:

LINER EXTENT OF COVERAGE	16978.31m²
(TWL) TOP WATER LEVEL	1735mRL
(BWL) BOTTOM WATER LEVEL	1724.8 mRL
MINIMUM CREST LEVEL	1735.55mRL
APPROXIMATE USABLE VOLUME	102ML
FREEBOARD	500mm

NOTES ON LINER EXTENT:

1. LINER EXTENT IS APPROXIMATE ONLY AND DOES NOT ALLOW FOR OVERLAPS, FIXING DETAILS, PENETRATIONS OR ADDITIONAL LENGTH REQUIRED FOR ANCHOR TRENCH

NOTES:

1. ALL COORDINATES ARE TO MGA.
2. ALL LEVELS IN METRES TO AHD.
3. ALL DIMENSIONS IN mm UNLESS NOTED OTHERWISE.
4. REFER TO ENT-190227-C-002 FOR LEGEND.
5. REFER TO ENT-190227-C-107 FOR CUT FILL VOLUMES.
6. REFER TO ENT-190227-C-006 FOR SET OUT POINTS.

WARNING
ALL SERVICES SHOWN ON THE DRAWINGS ARE APPROXIMATE ONLY. EXACT LOCATION IS TO BE CONFIRMED ON SITE BY CONTRACTOR PRIOR TO COMMENCEMENT OF ANY WORKS.

0 5 10 15 20 25m
SCALE IN METRES 1:500 AT A1

RAW WATER STORAGE PLAN
SCALE 1:500

AS CONSTRUCTED DETAILS BASED ON INFORMATION PROVIDED BY ENTRACON PTY LTD

AS CONSTRUCTED

REV.	ZONE	REVISION	DATE	CHK'D	APP'D
1		AS CONSTRUCTED	6/05/20	SMM	SMM
0		ISSUED FOR CONSTRUCTION	3/10/19	JL	SMM

CMP CONSULTING GROUP
Level 1, 700 Springvale Rd, Mulgrave VIC 3170
Tel : 61 3 9002 0710
Email: info@cmpgroup.com.au
Web: www.cmpgroup.com.au

DESIGNED W. DARLING Jun-19	DRAWN L. JACOB Jun-19	PROJECT MANAGER N. SINCLAIR
DESIGN CHECK J. LOUW Oct-19	DRAFT CHECK P. WOJCIECHOWSKI Oct-19	ASSET/ENG. MANAGER K. ALEXANDER
APPROVED S.MORRIS Oct-19		

ENTRACON

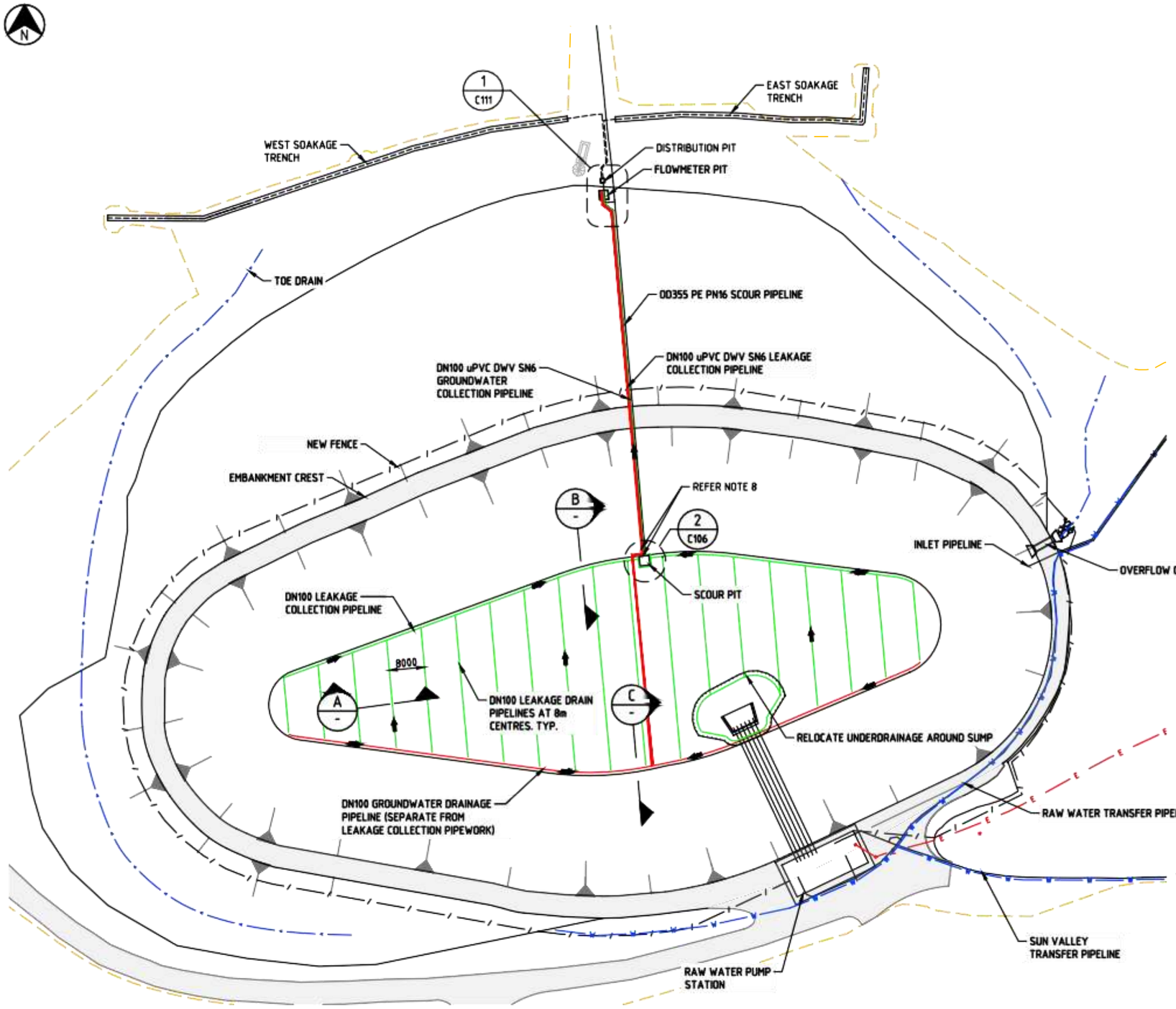
MT BULLER AND MT STIRLING RESORT MANAGEMENT
MT BULLER WATER STORAGE UPGRADE
RAW WATER STORAGE
GENERAL ARRANGEMENT - PLAN

DO NOT SCALE
SCALE: AS SHOWN
DRAWING NUMBER
ENT-190227-C-100 | 1
NUMERAL | REV

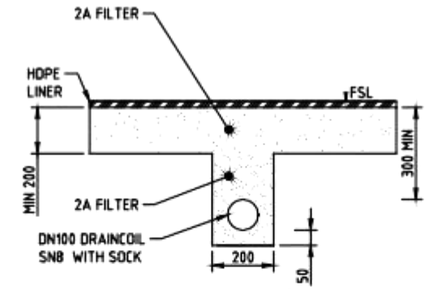
DATE PLOTTED: 6 May 2020 8:40 AM BY: WILL DARLING
S:\Projects\ENT-190227 - Mt Buller Water Storage\6 CAD\6.1 Working Drawings\ent-190227-c-100.dwg

OFFICIAL

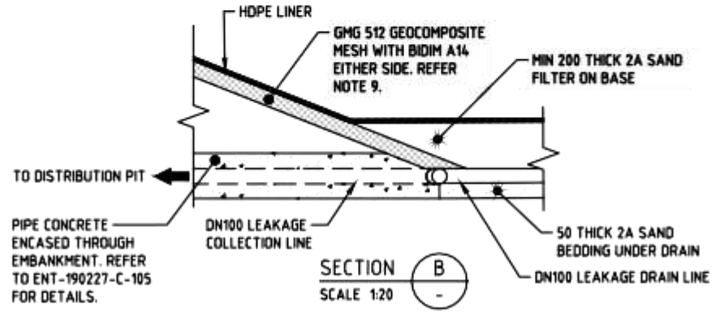
OFFICIAL



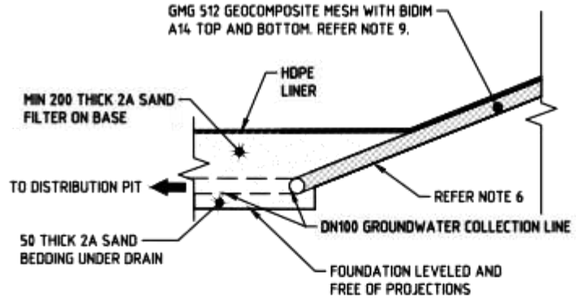
RAW WATER STORAGE PLAN
SCALE 1:500



SECTION A
SCALE 1:10



SECTION B
SCALE 1:20



SECTION C
SCALE 1:20

NOTES:

1. ALL COORDINATES ARE TO MGA.
2. ALL LEVELS IN METRES TO AHD.
3. ALL DIMENSIONS IN mm UNLESS NOTED OTHERWISE.
4. ENSURE DRAINAGE PIPE IS PROTECTED DURING COMPACTION WORKS.
5. IF REQUIRED OVER-EXCAVATION REPLACE WITH 2A IN CUT FACE AND FLOOR AS PER ENGINEERS DIRECTION.
6. IF REQUIRED 2A TO REPLACE GEOCOMPOSITE AS PER ENGINEERS DIRECTION TO INTERCEPT SEEPAGE BELOW GEODRAIN ON CUT FACE ONLY.
7. REFER TO ENT-190227-C-002 FOR LEGEND.
8. GROUNDWATER AND LEAKAGE COLLECTION PIPELINES TO BE RELOCATED AROUND SCOUR SUMP AND SCOUR PIPELINE ON SITE. ENSURE PIPELINES ARE CONTINUOUSLY GRADED TOWARDS OUTLET.
9. DURING EXCAVATION WORKS DAM ENGINEER TO ADVISE ON SUITABILITY OF BOTTOM BIDIM LAYER PRIOR TO ORDERING MATERIALS.

WARNING
ALL SERVICES SHOWN ON THE DRAWINGS ARE APPROXIMATE ONLY. EXACT LOCATION IS TO BE CONFIRMED ON SITE BY CONTRACTOR PRIOR TO COMMENCEMENT OF ANY WORKS.

0 5 10 15 20 25m
SCALE IN METRES (1:500 AT A1)

AS CONSTRUCTED DETAILS BASED ON INFORMATION PROVIDED BY ENTRACON PTY LTD

AS CONSTRUCTED

REV.	ZONE	REVISION	DATE	CHK'D	APP'D
1		AS CONSTRUCTED	6/05/20	SMM	SMM
0		ISSUED FOR CONSTRUCTION	4/10/19	JL	SMM

CMP CONSULTING GROUP
Level 1, 700 Springvale Rd, Mulgrave VIC 3170
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Email: info@cmpgroup.com.au
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DESIGNED	DRAWN	PROJECT MANAGER
W. DARLING Jun-19	L. JACOB Jun-19	N. SINCLAIR
DESIGN CHECK	DRAFT CHECK	ASSET/ENG. MANAGER
J. LOUW Oct-19	P. WOJCIECHOWSKI Oct-19	K. ALEXANDER
APPROVED		
S.MORRIS Oct-19		

ENTRACON

MT BULLER AND MT STIRLING RESORT MANAGEMENT
MT BULLER WATER STORAGE UPGRADE
RAW WATER STORAGE UNDER DRAINAGE - PLAN

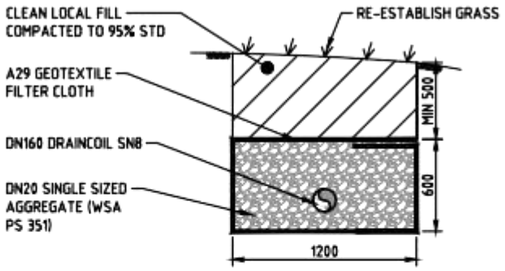
DO NOT SCALE
SCALE: AS SHOWN
DRAWING NUMBER
ENT-190227-C-101 | 1
NUMERAL | REV

A1

DATE PLOTTED: 5 May 2020 5:32 PM BY: WILL DARLING
S:\Projects\ENT-190227 - Mt Buller Water Storage\6 CAD\6.1 Working Drawings\ENT-190227-C-101.dwg

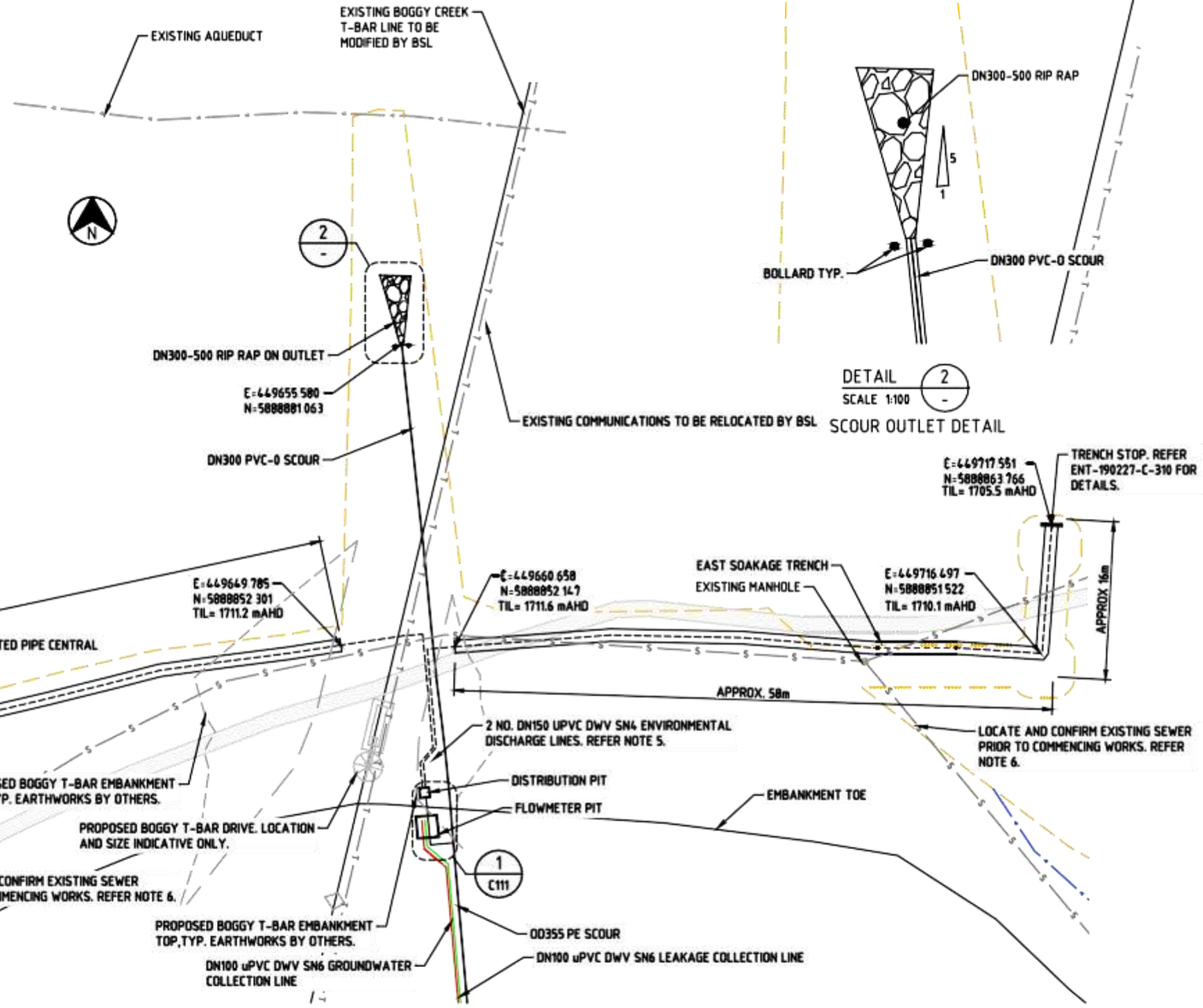
OFFICIAL

OFFICIAL



SECTION A / SCALE 1:20

TYPICAL SOAKAGE TRENCH SECTION



ENVIRONMENTAL DISCHARGE SYSTEM PLAN

SCALE 1:250

NOTES:

1. ALL COORDINATES ARE TO MGA.
2. ALL LEVELS IN METRES TO AHD.
3. ALL DIMENSIONS IN mm UNLESS NOTED OTHERWISE.
4. TRENCH SURFACE TO BE MOUNDED TO ALLOW FOR SETTLEMENT
5. ENVIRONMENTAL DISCHARGE LINES TO BE RUN IN THE SAME TRENCH AS THE SCOUR LINE. REFER ENT-190227-C-105 FOR TRENCH DETAILS. PIPE EMBEDMENT TO HAVE A MINIMUM MODULUS OF 5 MPa.
6. EXISTING SEWER TO BE PROTECTED DURING WORKS.
7. TIL-REFERS TO THE APPROX. TRENCH INVERT LEVEL.

1100 BEFORE YOU DIG AUSTRALIA

WARNING
ALL SERVICES SHOWN ON THE DRAWINGS ARE APPROXIMATE ONLY. EXACT LOCATION IS TO BE CONFIRMED ON SITE BY CONTRACTOR PRIOR TO COMMENCEMENT OF ANY WORKS.

AS CONSTRUCTED

0 0.2 0.4 0.6 0.8 1m — SCALE IN METERS (1:20 AT A1)

0 2.5 5 7.5 10 12.5m — SCALE IN METRES (1:250 AT A1)

AS CONSTRUCTED DETAILS BASED ON INFORMATION PROVIDED BY ENTRACON PTY LTD

REV.	ZONE	REVISION	DATE	CHK'D	APP'D
1		AS CONSTRUCTED	6/05/20	SMM	SMM
C		FOR PLANNING ENDORSEMENT-ENV. DISCHARGE AREA	21/02/20	SMM	WD
0		ISSUED FOR CONSTRUCTION	4/10/19	JL	SMM

CMP CONSULTING GROUP
Level 1, 700 Springvale Rd, Mulgrave VIC 3170
Tel : 61 3 9002 0710
Email: info@cmpgroup.com.au
Web: www.cmpgroup.com.au

DESIGNED	DRAWN	PROJECT MANAGER
W. DARLING Jul-19	A. DANA Jul-19	N. SINCLAIR
DESIGN CHECK	DRAFT CHECK	ASSET/ENG. MANAGER
J. LOUW Oct-19	P. WOJCIECHOWSKI Oct-19	K. ALEXANDER
APPROVED		
S.MORRIS Oct-19		

ENTRACON

MT BULLER AND MT STIRLING RESORT MANAGEMENT

MT BULLER WATER STORAGE UPGRADE

RAW WATER STORAGE

ENVIRONMENTAL DISCHARGE - PLAN

DO NOT SCALE

SCALE: AS SHOWN

DRAWING NUMBER

ENT-190227-C-110 — 1

NUMERAL — REV

DATE PLOTTED: 5 May 2020 5:10 PM BY: WILL DARLING
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Appendix B

Photolog and field sheets

Photographic Log

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
EWS – Environmental Watering System	Outside bog		

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
Boggy Creek 1 Pickup Weir 1	Outside bog		
Boggy Creek 1 Pickup Weir 2	Outside bog		

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
Boggy Creek 2	Outside bog		

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
BH06	**Coordinates (UTM, Zone 55)** 449,429.0 5,888,787		Bore BH06 is upgradient of mapped bogs near BH16.

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
BH07	Within bog **Coordinates (UTM, Zone 55)** 449,658.3 5,888,915		BH07 is located within a mapped bog area north of the water storage dam

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
BH09	**Coordinates (UTM, Zone 55)** 449,611.8 5,888,835		BH09 is directly down-gradient of the storage and marginally up-gradient of the western arm of the EWS.

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
BH10	**Coordinates (UTM, Zone 55)** 449,679.9 5,888,856		BH10 is directly downgradient of the water storage, located on the northern side of the summit nature trail footpath.

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
BH16	Within bog **Coordinates (UTM, Zone 55)** 449,459 – 5,888,860		BH16 is located cross slope from the storage, and within the margins of a bog.

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
BH17	Within bog **Coordinates (UTM, Zone 55)** 449,701 5,888,866		BH17 is a shallow bore located within the margins of a bog

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
BH18	**Coordinates (UTM, Zone 55)** 449,922 5,888,830		This bore is located further to the east of the water storage.

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
Pipe east of BH17, below Summit Nature Walk	Above bog		

Location	Description (Within bog/ Outside bog)	Collection point / Headworks	Site location
Dam water sampling point	Sample taken from black pipe		

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Purging and Sampling Record

Bore ID: B.rf (b

Job Information

Client: AJs.V.:
Project: .rb.>..6.29..□1. 12
Proj. No.: . . . □ .s;;-1j,A_tJ.P....\i.□.....
Sampler: nT
Date: 22-l'I 12-s
Round AP.□;..\.....3:-:'?

Samp□·g In(f!rmation

Purge Method: □□--\□."C
Sample Method:
WQ Meter Type: 1.?.\...□.1.:'.□!Q.f.J/C?.:
Flow Cell: Y / **N** Pump Depth.....m
WLevel Meter Tvoe: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC): o,(□/q:I□.9. m Logic Check:
Screen: Fmo :.....to..... m Stick Up..... m
NAPL Check: A Bore Diam.: ...5..0 mm
Ref.datum: Well Cap Secure?... .)(.....
Bore Depth: ...4.:1. m

Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	(.....).	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
								o · 83i	w(c,.A (oqq.J.
.1,'-10	l L-	-:,-.°J	'S.:2i,	14·'5	(t.□l	{)bo , '2-	0-832-		0du>JV""(-e.S□v'=Pn;v□ 01<.o..i,,.. 0v 0.,v,A +;.,.._q..e._
									i ,...w -IAJ crl "T\JrGi. 0CAML.g1J\<.- □_,_J • \J
									lvo.,v.<.;;hOM ;'" □1oJ& - ih_ iir□d
:2 ·-rt	4L	l□-o	5:□c	13 ·8	lt-SO	l□D,8"	o.ig 1		□-,:0 ,,\ASLJ.;\+ In,,c.o u 1/\..G IAJ"v L :SQJ.,"4U • J V
I-'5:)	6L.	-=,-.q-	5 30	l I • <=t	10-i2.	J..oS-1	o.i4s		As cJJo...n

Field QA Checks:

Air bubbles in vials? Y / **N** Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / **N**

Paor'3f'TJl!Cet"S	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	ITot.Mctoll	IJiol.1
Presen,ati-									

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

I,_.,.:,□□□i.)J □-\ iL\-·30 •
I 9 VI w i15° 06 ·
JJ

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (Lim of casing)	2.0	7.9	17.7

*Double for gravel pack

OFFICIAL

OFFICIAL

Purging and Sampling Record

Bore ID: [□S

Job Information

Client: ij..A□V.....
Project: .../. tnAt:\P.....lY..□....
Proj. No.: ...l.b'::?.½?.5.3..□ 1.....
Sampler: .....t:rf/. .....
Date: ••••••1-:b;;,1=..1/:./□□---·····
Round ..... :£□J.. .. 1-:?.....

Sampling Information k.

Purge Method:....%--f:9...b... 50.:":.].j?.....
Sample Method:.....
WQ Meter Type:.....
Flow Cell: Y / N Pump Depth: ..... m
Wlevel Meter Type: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC}: ..... m Logic Check: .....
Screen: From:.....to..... m Stick Up: ..... m
NAPL Check:..... Bore Diam..... mm
Ref.datum: ..... Well Cap Secure?.....Y. ....
Bore Depth:..... m

Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (±mV)	SWL (mTOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readinos):		-	*+/. 0.05pH*	*+/-3%*	*+/-10%*	*+/- 10mV*	*stable*		
									CWS £a._□
llf□o3		(o.:,	t;:,50	2'7,6	,' '!:-□-	'2.l7,7			Cl-e.o....--<, colo□k.9; . oJ.ou."□□ □□
									t-tAYbJ□+<_A
									1::-.1 . JS L-J□t-
									– f'--lo Fl□LA/'

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / **N**
C0C updated? Y / **N**

Paor□s	BTE□	TPH	PAli	CHC	PCO	OCP	OPP	Tot.Met.ii	Iliol.				
Preser-uaiti□													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

• Double for gravel pack

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Purging and Sampling Record

Bore ID:

Job Information

Client: A.R.:V...

Project: !±.f□.Ar.P.J1.G.

Proj. No.: I?5..(?,5□$.r.

Sampler'. ••i•a)j_t

Date:

Round A.r,□□L..!::?.....

Sampling Informalicfh

Purge Method:

Sample Method:

w□o□Y□□=□ □ ·;:e□□□=

Wlevel Meter Type: <Dip/ Fox/ Int.Fee/ Gge

Field Filtered? Y / **N** (filter vessel, disposable filter/syringe)

Bore Information

SWL(mbTOC): m Logic Check:

Screen: From: to m Stick Up m

NAPL C'J_.eck□ BoreJ)iam. mm

Ref.datum: □ap Secure?

Bore Depth m

Time ( )	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond ().	Dis.Oxygen ( )	Ox-Red Pt. {± mV)	SWL (mTOC)	( )
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/-3%*	*+/-10%*	*+/- 10 mV*	*stable*	
\ ; II-			-=,-.2..75	;2.,0 • 9	i:)• 5	I't>°"6		
'·, ?.._,':>.		f).6	*1-llf-*	11-. 6	\□ . \\	\G\:,.7-		
\I:f>1		9.9	'f.O\	2-□-C\	\4.?S4-	r=r-3 . '1>		

Comment:
Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?

[illegible] D (CA t□

Co\0□1'\□") O□OU.<\e,:.:,S. fiCI ,\-v\<b1c\1h((lo <secu ..-nerl□

tb--□.□ / ol CA... 2

rn\Ou-<□---;:?Ao,.,1.v-\e□-=-. rv, +wbid,t \'t,\ ,\110 6ecl;MeAf

c,\e.o,..,- *D • - • 'I'Y\ \r□Jr-' r;.C..□\,"Y\P{'It o-,e""t->;/l-\::.

!□ccu 2

1ro\ouv\□.□o □,n,clir½, vtc :5ed;□, odol.M'/U)

we,..{ CIA\\,(,CUl\t □e.□ -te ()---,''' bo,-¾-OM

Field QA Checks:

Air bubbles in vials? Y / **N** Any violent reactions? Y / N

Decontamination as per GHD procedure? Y / N

Was sampling equipment pre-cleaned? Y / **N**

COC updated? Y / **N**

Pa.r:arneter,s Prese.-uatiue!;	BTE□	TPH	PAH	CHC	PCB	OCP	OPP	ITot.Mctol	Biol.

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Sp\I-\-Dvp ct_□ 8□) 9-

Purge Volumes

Casing Int.Dia(mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID: Js\-.\0.b.....

I

Jov *Information*

Client: .8.R.....

Project: M.."□M.□.t\.P...i.if.?.....

Proj. No.: .J.b□.¢...□.9.□□.....

Sampler: .M..I.....

Date: ..□.?.J.<?□..!.'?-:-.?.....

Round ...A..□'0.\..□?.....

Sampling Information

Purge Method:.....::-:-.....

Sample Method:.....:::":.....

WQ Meter Type:.....:::-.....

Flow Cell: Y / N Pump Depth:.....m

Wlevel Meter Type: Dip/ Fox/ Int.Fee/ Gge

Field Filtered? Y / **N** (filter vessel, disposable filter/syringe)

Bore Information

SWL(mbTOC):□.:□?..□.....q:.0.4.;?. m Logic Check: .....

Screen: From:.....6....to ... 9..'.... m Stick Up..... m

NAPL Check:..... Bore Diam. ..... mm

Ref.datum: ..... Well Cap Secure?.....Y.....

Bore Depth: .9.:.0.7.-:..... m

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	(.....)
Stab/a when (3consecutive readings):		–	+/- 0.05p H	+/- 3%	+/- 10%	+/- 10 mV	s t b/e a	

Comment:
Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?

C\•04S

W { Ovit- \OQf\eY

No NO.\-ev- -;-o □mo\.e

Field QA Checks:

Air bubbles in vials? y / N, Any violent reactions? y / **N**

Decontamination as per GHD procedure? Y / N

Was sampling equipment pre-cleaned? Y / N

COC updated? Y / N

Pair□ - **BTEX** TPH **PAli** CHC PCO OCP **OPP** **Tot.Met.ii** **Biol.**

Preser-uatiie

-1- |

J J

Comment.· Dupl˙icate samples collected, bottles used, access, con[d]1·l"lon o[f h] ea[d] wor[k] setc

\._Qc,.CA,-€,v O\At" - *1:* 54-

Lo°'o..-e,v \,1"1 - °o: IJ c:

CasingInt. PDuirag(emVmolumes
50 100 150
Vol(Umofcasing) 2.0 7.9 17.7
*Double for gravel pack

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Purging and Sampling Record

Bore ID: .B.M.g.i .....

Job Information

Client: ...A?:-::'I.....
Project: ..H□Ar.!f...J.7.''□.....
Proj. No.: ..\□$6.?.□.f/i .....
Sampler: .....m: .....
Date: ... □ f'f.[□.....
Round ....A.?.0..\..R. .....

Sam:t;·g Information

Purge Method:.•.•.•.□□J□□-.....
Sample Method:.....
WQ Meter Type:... Y.?..\...\..□□/.Q□.3f.t:?.....
Flow Cell: Y / **N** Pump Depth:...--::..... m
Wlevel Meter Type: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC):J.:j.'{?:.l/:.j.'5.? .....m Logic Check: .....
Screen: From:..2...to ..□..... m Stick Up .....m
NAPL Check:..... Bore Diam.: ...□..... mm
Ref.datum: ..... Well Cap Secure?...(- .....
Bore Depth: .....□ ...5·.88 ... m

Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (oC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecuttve readinos):		.	*+/. 0.0SpH*	*+/-3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
							2.950		u.,{o dd-o.. (oqqQJt
1'5: 2'b	.°2)L	9.0	5 *2...lo*	LL{· 7	9·1tf	25i·7	'3-tS		C" *loo..ir* (' □.1 OAJ.,... l-e <;□ *t•-</o.:u* rl-e:...s□ □GV-,.0..□
,5.3□	□1 L	'6·4-	S",3 l	14 .z_	9.2_0	'2<-J2.-5"	q ·'3l		cuA,d 00 □dj
i5-4 l	9t-	X·'3	5-2..□	14. (	'1· *v?*	*24-h.o*	?J-40		A1'. n1AUQ
i□,4cy	*("1* L-	f$. W	S-'?,S	*14.* 2.	7- '63	?u:-3 -l..f	□ ,y 12,		

Field QA Checks:
Airbubbles in vials? Y / N Any violent reactions? Y / **N**
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / **N**

Paor□en.	BTEX:	TPH	PAH	CHC	PCO	OCP	OPP	iTot.Mctol	13iol.				
Presel'uatiues		1											

Comment: Duplicatesamples collected,ottles used, access, condition of headworks etc
L..033..w Ov .- 15-1,o
/.-oOfQ{l)/ ("'- - , 5'-55.

/-'urge vo,umes
Casing Int. Dia (mm) 50 100 150
Vol (Um of casing) 2.0 7.9 17.7
*Doublefor gravel pack 1'2... L

--:JJ

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Purging and Sampling Record

Bore ID: ..□.\-.\\...1.-.....

Job Information

Client: .A.RY.....
Project: .H.□.MAM.P.J.ib.....
Proj. No.: !?:-:-:-'?..9..?.'3..□q.....
Sampler: .Mr .....
Date: .'?:-.';?/9..'f../?:?.....
Round A?.0.\..;?;..'$.....

Sampling Information

Purge Method:.....8.9.-:-□'-\□:-C.:-.....
Sample Method:.....
WQ Meter Type:... Y□\..J□.□)O.':f..?.□□...
Flow Cell: Y / N Pump Depth:..... m
WLevel Meter Tvoe: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC): .O.. □ ..Q.□i ..... m Logic Check: .....
Screen: From:....□. .....to..□:.f.7. m Stick Up:..... m
NAPL Check:..... Bore Diam.: ...?.C?. mm
Ref.datum: ..... Well Cap Secure?.... Y.....
Bore Depth: ....i..□.<?..;>. .....m

Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (oC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. {± mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05pH*	*+/-3%*	*+/-10%*	*+/- 10mV*	*stable*		
							0 -06'5		w{ou.t \ooao<
□: 49	?:>	"c • \	:>.""6'D	?:£) • -+-	?:>. b?-	2-35.'b	I '7!5		C.,\.ea..'(" □ rit).··d-es.s, ocf cu:rl-ech, V70 5ed
q□o□	'5	□ro	G.o??	2.'9..7	5,□	7n,:;, I	I. 7';7		Loc,u +· 1-r□-.J.□□ CKO-Y\a.,.o --?r,oc.J,/YI +-□e-
									c._,..,VV'le 0 □V\.O :π'(""O-..'Y\\ □tr -C U S e:f,:- 1.□YI t -
									dlou...<l□
									Slow -<ec.1-,o...ro....e v-Jo..□+ IO J1V1IY/ '+ti(q: l5"
q·, /?							L'f-3		
q□'27							Loq		Sa...Y11o1e Q-\--- q', ?0

Field QA Checks:

Air bubbles in vials? YIN Any violent reactions? Y/ N
Decontamination as per GHD procedure? Y/ **N**
Was sampling equipment pre-cleaned? Y / **N**
COC updated? Y / **N**

Pairaametef'S	BTEX	TPH	PA.lt	CHC	PCB	OCP	OPP	Tot.t,tct.11	Biol.				
Preser-uati11e1													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

LO□?:-,0-r 01.A.Jr - 1.): 4-4

Dctp □ 5p\J

L Qc\0 0x W\ = 9: -+-5

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

•ooube for gravel pack

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Purging and Sampling Record

Bore ID: .oH.Q."J.□.....

Information | *Sampling Information* | *Bore Information*

Client: A.□Y.....
Project: 0.□M.f\Mf...\':f?.....
Proj. No.: *J.i5..□.?.□..f{f.....*
Sampler: .M1.....
Date: .?:-.'?..□.<?.□.L□?.....
Round .A.9.□>....□?.....

Purge Method:.....:-:::-.....
Sample Method:.....:=.....
WQ Meter Type:.....□.....
Flow Cell: Y / N
Pump Depth ..... m
Wlevel Meter Type: Dip, Fox /Int.Fee, Gge
Field Filtered? Y / N (filter vessel, disposable filter/syringe)

SWL(mbTOC): .....9-:f.-§..... m
Screen: From:.....O...to...\..... m
NAPL Check:.....
Ref.datum: .....
Bore Depth: .o.□.1.1 ..... m

Logic Check: .....
Stick Up .....m
Bore Diam .....mm
Well Cap Secure?.....?.:':...

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+L 0.05 pH*	*+L J%*	*I - 10%*	*I - 10 mV*	*t sa b',e*		

Ov-I,\ d (\0 NO..□E?,v'

Field QA Checks:

Air bubbles in vials? y / N Any violent reactions? y / N

Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / **N**

Pair□!BTEX L TPH PA,ti CHC PCO OCP OPP Tot.Mctol OioL

P re: □ □ ru at iues!---', --'!_ _.___ .L....._ __._ _,___---"------'-----_,_--...,_____--._____-_____.._ _.__ _,

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

I'u:gevot),umes

Casing Int. Ota (mm	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID: B \-\ \

Job Information

Client: A'R.'J

Project: k\£.Mfi P \i.P

Proj. No.: \i;,.f?9. -

Sampler: M.

Date: 1.)104- /2S

Round AP. I :z S

Sampling Information

Purge Method:

Sample Method:

WQ Meter Type:

Flow Cell: *YIN* Pump Depth m

Wlevel Meter Tvoe: Dip/Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC): 2-0\ S m Logic Check:

Screen: From: J.:I.> to .'.?.-::.!?. m Stick Up m

NAPL Check: Bore Diam mm

Ref.datum: Well Cap Secure? 7

Bore Depth: 2 -02 m

Field Filtered? *YIN* (filter vessel, dis posable filter/syringe)

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (±mV)	SWL (mTOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecuhve readings):		-	*+/- 0.0SpH*	*+/-3%*	*+/- 10%*	*+/-10mV*	*stable*		
							2,0 \"6		w/ *nw* \ooqe,,r
									\.)·rU \/'JQ,\\ ı (\0 □VY')()\€,

Field QA Checks:

Air bubbles in vials? Y / **N** Any violent reactions? Y / N

Decontamination as per GHD procedure? Y / N

Was sampling equipment pre-cleaned? Y / **N**

COC updated? Y / **N**

Pair□en.	BTEX	TPH	PAH	CHC	PCO	OCP	OPP	Tot.Metal	Diol.				
Preseruatne													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

L.o□e,r *ow* - 1O·,o<S

\ *C'1ClrtON* '1/\ – 10;14-

Purge Volumes

Casing Int. Dia (mm) 50 100 150

Vol (Um of casing) 2.0 7.9 17.7

•Double for gravel pack

u"7J'

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GHD

www.ghd.com.au
Tel. (03) 8687 8000 Fax. (03) 8687 8111
180 Lonsdale Street Melbourne Vic 3000

Bore Id	Date	Time	SWL (m)	Bore depth (m)	Comment	Construction Depth (m)
BH04						15.68
BH04A						2.56
BH96 OCf	!Uli/.25	i6·2-0	..1_. °f'51)	5-88		□b
BH07						1
BH(}S' 0(,..,						/9.
BH10	1:?:>/04 / 2.5	9,:c,'b	□.0":f3	□-155		9
BH16						2.1
BH17						2.2
BH18						2.15

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GHD

www.ghd.com.au
Tel. (03) 8687 8000 Fax. (03) 8687 8111
180 Lonsdale Street Melbourne Vic 3000

Bore Id	Date	Time	SWL (m)	Bore depth (m)	Comment	Construction Depth (m)
BH04						15.68
BH04A						2.56
BH0S	\q /2_ /9 5	l 0 -:..'?0	□- "?'-75	q .'2.1		9
BH07	1'6/01.,/ -;L':i	l. .,: ')..,,b	0, 62.,3	o. '56		1
BH09	\q /'7.../""2. "5	q•,';;O	'2_50::z..	.i;_q l		6
BH10	\"6 / 01. / 2.5	?-,!15	2,965	'i3, 5 IJ.		9
BH16	1q /-i_ 1'2. 5	\\ ·-".2-.;:,	o.t.f-7	'2_.o		2.1
BH17	\q,/--i..l?..... ZS	1□ ·-'7---r)	V,O£/O	'2 ,'2.		2.2
BH18	'-q l"J. /1-.'5	<2,-_ \IS	1--□cr	'2.o'J....		2.15

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Purging and Sampling Record

Bore ID: …□\-\D6……

Job Information

Client: …ARV……
Project: …Mt Buller HEMAMP IVG…
Proj. No.: ……12565989……
Sampler: **…MT**……
Date: …\□.f.q_;Y□5……
Round ……FebIVG……

Sampling Information

Purge Method:……Bailer……
Sample Method:……Bailer……
WQMeter Type:.Y.?..\ ……:2.."bG:-\9□□7.
Flow Cell: V / **N** Pump Depth……m
WLevel Meter Type: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC): ..J?.:..?..t/…… m Logic Check: ……
Screen: From:….G……to ..□ ….. m Stick Up ……m
NAPL Check:…… Bore Diam……mm
Ref.datum: …… Well Cap Secure? …. Y……
Bore Depth: …..37.!':.\……m

Field Filtered? V / **N** (filter vessel, disposable filter/syringe)

Time (……)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (……)	Dis.Oxygen (……).	**Ox-Red Pt.** (± mV)	**SWL** (mTOC)	(……).	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/-0.05pH*	,, ;+/-3%	*+/-10%*	*+/- 10 mV*	*stable*		
" ,w. -		-- -	- ,-,\	J -	- -	/.::_ I	't>·36 '6·'55:,	wl \ooC\Q\ !,,,,I()IA.\– \n-::,,i	
\0•.41	\	1-S	s.o'b	□4-2	'o-t) 2	15.I	</:;./J.6	VI.)	c,o\01Av\-eos ,MO\,H\et>':::>, Y\o W(b\di:\-U., ro 6e.G\I.ft\ e,v'\.\:;-
									\es'$.\ho..v-, \ Y"""\ w°'-.+e<"" co lu.v--i Y",I
									I.Ji'7".:X- '<"€c.ho..-m.e . So.....,.....,r.>\e □""""
									I0□55 +-o 0-.□□J_ J-("...R.. u.Jel{ (□k..-e V GHI?,.

Field QA Checks:

Air bubbles in vials? Y / **N** Any violent reactions? Y / **N**
Decontamination as per GHD procedure? Y / **N**
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / N

Pairaani,etel"S	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	IT ot.	Ml:tol	Biol.
Pres:eruatiue!;										

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc
LO□W out \O;·b()
Lo<?.':\ ex \Y\ t \ : c,4

Purge Volumes

Casing Int. Dia(mm)	50	100	150
Vol (Um of casing)	·2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID: Bnq

Job Information

Client: ...ARV.....
Project: ...Mt Buller HEMAMP IY6...
Proj. No.: .....12565989.....
Sampler: ...MT.....
Date: \C{ /01/ VS
Round .....□..... f□□-□1.□.

Sampling Information

Purge Method:.....Bailer.....
Sample Method:.....Bailer.....
WQMeter Type: YS\ '2.".2.G0:;;,267
Flow Cell: Y / N Pump Depth: .....m
Wlevel Meter Type: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC)*. 2#4CfO ..... m Logic Check: .....
Screen: From:.....?.....to ...□ ..... m Stick Up: ..... m
NAPL Check:..... Bore Diam..... mm
Ref.datum: ..... Well Cap Secure?... Y.....
Bore Depth: . . .□ ...□.:..<?.\.\.....m

Field Filtered? Y / **N** (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (DC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (±mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readinas):		-	*+/-0.0SpH*	*+/. 3%*	*+/-10%*	*+/. 10 mV*	*stable*		
							1.-502. 11□dm,l...\ \or o		
9;3q	□	'b,"D	5-7-b	ib-\	6-60	□□"1	'J...□SC/		
9□43	b	'b-6	S.S\	1'5 •0	6-Cfd	{J..,,/	1.b":1		CO\()\AY\e!:>□1 odoLAr\□'&. ('\(1 ti,\Y-b\d,\-v\,()Q □I,me□
G\ '., *Lft"*	9	□-b	S-42.	li-l--9	6-1-1.t	\1•"1>	10135		A'::> aoove.
q: 51.	I '2..	,S. 6	s.□o	14:. 9	b.66	\'D· 'a	?...,,113		AS o'ooVe
q□5b	\o	'6':>	S.42.	14.<a	7-.20	C\-2	1.1-'14		-o0Me. c (\e, sediMeX\I .nt\ierw,"->e. a.□ CJIiocve
G{ : 59	\ 'D	I). \	5.45	\4."1-	6. <o'b	10 . 9	2..'8'3S		A. □ above
\0□03	?-..|	<o• \	s.4S	jl.\-. 6	r-\b	C\-O	:i_.□5		IA.□ r.1.oave
									□mo\ed a-\- \0□04
									r:,___n □ o.... □
									-

Field QA Checks:

Air bubbles in vials? Y / **N** Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / **N**

Pair,am,eilef'Sl BTEX	TPH	PA.II	CHC	PCO	OCP	OPP	Tot.M::tol	Biol.
Pres:eruatiuesj					7	7		

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

LO □□ -e>v OlA"'t" q:30
LO<;\(Ae,N', n lo;;t6

Purge Volumes

Casing Int.Dia (mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID: .:..:-\..\1.....

JobInformation	Sampling Information	Bore Information
Client: ... ARV.....	Purge Method:.....Bailer.....	SWL(mbTOC): .0.-..QJ⇒..... m
Project: ...Mt Buller HEMAMP IY6...	Sample Method:.....Bailer.....	Logic Check: .....
Proj. No.: .....12565989.....	WQ Meter Type:.. Y.S..\ '?,;□_½\9?...1-:§?.	Screen: From:....J.....to .. '.7.::6 m
Sampler: ...MT.....	Flow Cell: Y / **N** Pump Depth .....m	Stick Up: ..... m
Date: .\':6../.9.1.f.?::□.....	Wlevel Meter Tvoe: Dip/ Fox/ Int.Fee/ Gge	NAPL Check:..... Bore Diam. ..... mm
Round .....FebIY6.....	Field Filtered? Y / **N** {filter vessel, disposable filter/syringe)	Ref.datum: ..... Well Cap Secure?... Y.....
		Bore Depth:) ..:..-?:-:..... m

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (mTOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		.	*+/. 0.0SpH*	*+/. 3%*	*+/-10%*	*+/- 10 mV*	*stable*		
							0.01s	w/ Io'?-. C:\e.{	
							n.o4n	W/ov\t lo□<	
1 : 4-□	::,	9 . 0	6.to	3\.2	4.2:>	Lt□\	\-410		Cr-,\01..AY□.... odri0K'l@□□, Yin ffi<k>i<""1\tt• r"O •:e::::H□
2:os	5	ll- 6	6-7-2	:,2.'D	/...J... t>3	- \\. 6			.:iC>""e c-□.,..o h..-n,□,o("\"E,eGf1• □- ,,. O:;,..\t"l-<fuv-.I>'S,e.. 0.5 or -ve \:x:\.i dr-□ (i.iQ -rmrw
\9/0□							0 .Q').,'5	lw/ \ooge.v	n. 0Lt- W /OlAt \oo..ge.x-
9 :0 5	1-	'6,3	6.01	1,q.q	Lt.:w	\□·s			:: ornP □()e ":·)PA· ('()e{')□. ..."lou-.\o 5□C'.Jdouv-\e..:1'.:> rn tt.lV'bic.L/'1./
									R.nmo\Pd o.t q: iO
									fk □"e, Vl0UAV\.a □:C-oV'l'l di.DO bel-•,
									□ '("""\□ ""o.1--u:,~e'' □ I b,_ r'.:o.□),.
									□□ --c--ec..\ □-UK€-

Field QA Checks:
Air bubbles in vials? Y / **N** Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / **N**

Pair,ameie11S	BTE□	TPH	PAH	CHC	PCB	OCP	OPP	Tot.Metal	Iliol. j
Preset"uaitiie;									

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc
□01□eiro□t: \:o \'6/0l \ \.._oo'?-.!□e.;r o\..A.-t; q□oo 1c1/Q;-
1,..OQ..9-,ev ,f1·. '2.05 LO *fN* 1'1'\ ·, qn□

\)□ b:1□ □5-1
U□d MQMO□ \<&1•

l'urge volumes
Casing Int.Dia (mm) 50 100 150
Vol (Urn of casing) 2.0 7.9 17.7
*Double for gravel pack

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Purging and Sampling Record

Bore ID: B\-\ \<b

Job Information

Client: .AB.Y.....,.....

Project: .1:-1□□.□□.J:.'.□_q".l.i.t_qf\".1.9.....

Proj. No.: .1□□?.?.□□□.....

Sampler: .□!.....

Date: \q{0?...,/2,5

Round□□\1.□□□□.-:-.-... I□□..□'?.....

Sampling Information

Purge Method:.....□□i!□r .....

Sample Method·.....B a i l e r .....

WQ Meter Type:.....

Flow Cell: Y / **N** Pump Depth:..... m

Wlevel Meter Type: Dip/ Fox/ Int.Fee / Gge

Bore Information

SWL(mbTOC): ..... 2 - 0 11.. m Logic Check: .....

Screen: From:.....to..... m Stick Up: ..... m

NAPL Check:..... Bore Diam. ..... mm

Ref.datum: ..... Well Cap Secure?... Y.....

Bore Depth: ...:.2..0.i..... m

Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Time (.....····..)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (mTOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable *when (3 consacutive readings):*		-	*+/-0.05pH*	*+/. 3%*	*+/- 10%*	*+/. 10mV*	*stable*		
&: 15							1 .Ol'l	W / \oor1<2.4	"
							2_.009	1\,..\t'.)t.,\..\ \()QC	ex

Field QA Checks:

Air bubbles in vials? Yl **N** Any violent reactions? Yl N

Decontamination as per GHD procedure? Yl **N**

Was sampling equipment pre-cleaned? Y / **N**

COC updated? Yl **N**

Pair;irneiter,s	BTEX	TPH	PAIi	CHC	PCB	OCP	OPP	Tot.Mctol	Biol.				
Preseruatiues													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Lo□'J-ev Ov\\- - '6:\□ LO?J°JU \Y'\ - "b□35

\.)6ec\ \:-,o.t\-e□- t) □ .,'

\be.d Me.VV\O'<Y) - '1.⤵

Purge Volumes

Casing Int Dia(mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

·ooub1e for gravel pack

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Purging and Sampling Record

Bore ID: ..\.3..\-.;.\...\..b.....

Job Information

Client: ... ARV.....

Project: ...Mt Buller HEMAMP IY6...

Proj. No.: .....12565989.....

Sampler: ... MT.....

Date: 19/02../7-5

Round .....FebIY6.....

Sampling Information

Purge Method:.....Bailer.....

Sample Method:.....Bailer.....

WQ Meter Type:.Y.?..\. . □ ..□.□?.'?.G7.

Flow Cell: Y / N Pump Depth: ..... m

WLevel Meter Type: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC): .. Q..□.4:.9..... m Logic Check: .....

Screen: From:...\.:..\ ....to..?.::.L. m Stick Up:..... m

NAPL Check:..... Bore Diam. ..... mm

Ref.datum: ..... Well Cap Secure?....Y.....

Bore Depth: ....?::,.□.Q..... m

Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (±mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, **flow** rate, purged dry?
Stable when (3 consecutive readinas):		-	*+/-0.0SpH*	*+/-3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
							O.Lt-6	WI \nMe.,'{	
							0•41"	Iw' O\At \OIYH	hr
\I: 2..9	·3	1> -1--	6•45	14.,i	7-.7-s	- 0.2	n . 4 1-		,1,.,\'()w - b(OV\11\' hv'\OH>. {YIn.401(0\-e. hAvh□d;:o.u od.0U-<le?.>:i
U□·7:;5	0,	'T)..O	'5o"r)'o	l4-.::>	-=f.9t	'3.0	Q.4'r)		A.c.. *n"rovP*
t I : 4\	9	*f-* Cfj	'5.C\ \	\4-,2	"b,O\	- /4..,.7--	0-4<6		A□ *n 00,1-P*
11 : 4-9	\2.	*1-?;*	15. 1-:>	\4n S	't).\"1-	–$. 1			Ar:.., oJQove..,

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N

Decontamination as per GHD procedure? Y / N

Was sampling equipment pre-cleaned? Y / N

C0C updated? Y / **N**

Pair□	BTEIC	TPH	PAH	CHC	PCB	OCP	OPP	Tot.Mc:tol	Dial.		
Pres:eruati□											

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

\...Oi'zj€N OW I\□1.-3 c_vv-02

LO%\'<-< 1v"i 11.;, (}□ c..w- $"L.

l)::,e.di (v'\Qv'\11-0 "<'6 \ □/(0

Us<2..o ◆◆'{◆ "t:>5·/□

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID: □.W>..□□;,.t./.....

Job Information

Client: ...ARV.....
Project: ...Mt Buller HEMAMP IY6...
Proj. No.: .....12565989.....
Sampler: ...MT.....
Date: .\I?.f 9.?-:JJ.?.....
Round .....FebIY6.....

Sampling Information

Purge Method:.....Bailer.....
Sample Method:.....Bailer.....
WQ Meter Type:..Y.?..L..2.?. Y:-:-□.9..?.□.?
Flow Cell: YI N Pump Depth:.....m
Wlevel Meter Type: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC): ..... m Logic Check: .....
Screen: From:.....to..... m Stick Up:.....m
NAPL Check:..... Bore Diam.....mm
Ref.datum: ..... Well Cap Secure?.....
Bore Depth:.....m

Field Filtered? YIN (filter vessel, disposable filter/syringe)

Time (....·••·..)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (±mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05pH*	*+/-3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
I! 19		\::,.4	6.62	14-0	6.2\	I'S,2.		(WS fq<:st	r o\0th,\e,□5 ,Oc;l.Ar--lv'\P<..<.,.(\f'l ,tiAvlnirt□\-1,,\ ,of'\n <.c:>rl. 1{V)e.vtt.
								£W5We<c;	D'("u.. . no <?l O<.v
									{:"(C'.!)uJ Ccoyv, E,W>, E,0...<;.+ S.WO□ v

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / N

Paraameeersl	BTEX	TPH	P AH	CHC	PCO	OCP	OPP	Tot.Mctol	Biol.				
Preser-uatiuesl													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID: e.o.%□i•-□--.....

Job Information	Sampling Information	Bore Information
Client: ...ARV.....	Purge Method:.....Btriter.....	SWL(mbTOC): ..... m Logic Check: .....
Project: ...Mt Buller HEMAMP IY6...	Sample Method:.....□	Screen: From:.....to..... m Stick Up: ..... m
Proj. No.: .....12565989.....	WQ Meter Type:... Y?..\...□ ?-:-9-Lq_?.%..7	NAPL Check:..... Bore Diam..... mm
Sampler: ...MT.....	Flow Cell: Y / N Pump Depth: ..... m	Ref.datum: ..... Well Cap Secure?.....
Date: .l:tdO.□./..□':.?.....	Wlevel Meter Type: Dip / Fox/ Int.Fee / Gge	Bore Depth: ..... m
Round .....FebIY6.....	Field Filtered? Y / N (filter vessel, disposable filter/syringe)	

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/-0.0SpH*	*+/-3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
I\ !39	—	°1-3	*1-.'f52.*	*W•r-*	9.·"t-z..	- 6-3		*Plc..t 1*	*od.ovU'\e,□'5.1 \m...1 -w-,0o\ch□u,* cofOUKle:i,. 1>01"\-\e -::.ed.,,"\"\ o□·'-
\\·,:,S	-	1-0	-=f,'50	\b • 1-	9.1-z.	7-5		*Plu.* 2..	A□ *oe:(* 8- *olwJ..*
									wok."\:::"""-e-0€-kw u..)e..□y □ls 0uJ-
									Clo,5:.:rat □V'\□ □\e+ *P\c,,p□*

Field QA Checks:

Air bubbles in vials? YI **N** Any violent reactions? YI N
Decontamination as per GHD procedure? YI **N**
Was sampling equipment pre-cleaned? YI **N**
COC updated? Y / **N**

Paor□s	BTE:C	TPH	PAH	CHC	PCO	OCP	OPP	Tot.Metal	Diol.				
Preseruatiues													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Purge Volumes
Casing Int. Dia (mm) 50 100 150
Vol (Um of casing) 2.0 7.9 17.7
•ooUble for gravel pack

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Purging and Sampling Record

Bore ID: --□□...t

Job Information

Client: ...ARV.....
Project: ...Mt Buller HEMAMP IYG...
Proj. No.: .....12565989.....
Sampler: ...MT.....
Date: ...J□./'.?-:-./J $.....
Round .....FebIYG.....

Sampling Information

Purge Method:.....:Mttm.....
Sample Method:.... .Bail..- .....
WQMeter Type:..Y'7..\....2..□□.:\9.?.h.P..7...
Flow Cell: Y / N Pump Depth:..... m
Wlevel Meter Type: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC): :.....:-:-.. m Logic Check: .....
Screen: From:.....to..... m Stick Up: ....▬....▬....m
NAPL Check:..... ▬ Bore Diam.: □..... mm
Ref.datum: ..... ▪..... Well Cap Secure?□ ..
Bore Depth: .....m

Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (oC)	pH (pH units)	Elec.Cond tu.WQ.':!J	Di;□-Oxgen (..... k)	Ox-Red Pt. {± mV)	SWL {m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05pH*	*+I-3%*	*+/-10%*	*+I-10mV*	*stable*		
/0□'5□	▬	9.?..	i. 2.3	2,\,7	10.10	4-:,.. 6			,..\CC\✓ ("'o □A,MPV"It, onCi\!r\ec<s, C.O\Ql 1.crlP□:-,,

Field QA Checks:

Air bubbles in vials? YIN Any violent reactions? YIN
Decontamination as per GHD procedure? *YI* N
Was sampling equipment pre-cleaned? ***YI*** **N**
COC updated? Y / N

Pair□	BTEX	TPtt	rAH	CHC	PCB	OCP	OPP	iTot.Mctol	Diol.
Pres:er-uatiues									

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID·. .....

Job Information

Ch•en!: A.P. . .-.V.....
Project: J.2.S.□.'5.':\%.':L.....
Proj. No.: .....
Sampler: .Mr.....
Date: i':I./!□/2,.*-·····
Round .....

Sampling Information

Purge Method:..... .....
Sample Method:.....
WQ Meter Type:1/.'.2.\.. J'P.'"'i'.5.:□0.?.?::6.:2.
Flow Cell: Y / **N** Pump Depth: .....m
Wlevel Meter Tvne: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC): ..... m Logic Check: .....
Screen: From:.....to..... m Stick Up: ..... m
NAPL Check:..... **Bore Diam. ..... mm**
Ref.datum: ..... Well Cap Secure?.....
Bore Deoth: .....m

Field Filtered? Y / **N** (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp ("C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (±mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
iShIJU□□□□-:.		.	Bill	□ □ _	I i_□_□	if_:¥1-:rl.om□	□	_4#E@tS□Jtt□	□ftttttt:t;-:-:-I□J{11J;□ll"□d-t□'□¼□·□□1□□"1;11□1-:-t-1-1>l22,1
,:voo		i.o	i-.4$	IS.I	(0.1\	:1..01.2..,			' (I n/u_ I OdOl,lf\t-;:,'.:I, G\eA'<'
									";1 se.....- -, ...,0o. co\01.1.-loc...._
\?-.'. IS		fi.q	f.□□	f2..7-	10.·11	2..09.O			(□n--,n I Pill I f\rl,.,lArlet>S , Cle.cu.,
									1"11\ "::>er:I I +-uro. ('1'1\0\A'fle:,,.':)' v-Jq□ 0:l\ □low,Nl
									ove,r Wei< "-"Cl"" n(1 <,r,,i:c,.,-p
I'.£-/-6		I\. 3	7. 2.7	,c:.q	5. 12	2?<f, 'o			p_o.u..J l)....:,_-.-, Taj)
									Cl□. 0J,.,,,-<le.□. no sedifY!ert u<""
									../.-. ,.,1":J'k<J1 , r= IOL,{_d-ess

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? YIN

Par.a111Bite1□	BTEK	TPH	PAH	CHC	PCB	OCP	OPP	Tot.Mctt:111	Biol.				
Presei'uatiues													

Comment: Duplicate **samples** collected, bottles used, access, condition of headworks etc Dt--□,*cc.*\-e '\. ":)'"; \- 1.

Purge VolUmes

Casing Int. Dia (mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID:

Job Information

Client:

Project:

Proj. No.

Sampler:

Date:

Round

Sampling Information

Purge Method:

Sample Method:

Water Meter Type:

Flow Cell fitted? N

Pump Depth: m

Water Level Meter Type:

Dip/ Fox(int.Fee) Gge

Bore Information

SWL (mbTOC): m Logic Check:

Screen: From: to: m Stick Up: m

NAPL Check: Bore Diam. mm

Ref. datum: Well Cap Secure?

Bore Depth: m

Field **Filtered? Y N** (filter vessel, disposable filter/syringe)

Time (.....)	**Volume** (L)	Temp (OC)	pH (pH units)	Elec.Cond (c.61)	**Dis.Oxi** (□,□/h)	**Ox-Red Pt.** (± mV)	**SWL** (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/-3%*	*+/- 10%*	*+/-10mV*	*stable*		
□---ZO		:=t.0	;'.f-io4	,s.1o	\"Q·°i'\	145\			Ode-.Jr le..c;-:, cJ□ ,,.□l sn:l ,/to□ Gil0.0 rl□$':::, -
,t-1:15 □		iO S	(,., '77	15, I	,5'-1-3	'2.37.i			t:.WS ,C:-□.J- Col,,.,u.'<"b,,o&b□ess,, no □ □ □ ·h.,t.,b□□+co□ u
[lf-:□		q,□	0.').J	\q .6	G.55	l<B<3-1			E'vJS Wt::,'f>T Coloo'([□ =1/00\,_'\bS "'lo sJf ,!. v\o +lA.,t,□□+t.O _)

Field QA Checks:

Air bubbles in vials? Y / **N** Any violent reactions? Y / N

Decontamination as per GHD procedure? Y / **N**

Was sampling equipment pre-cleaned? *Y/N*

COC updated? Y / **N**

Pu&1111B1tete Preseruatiues	**BTEIC**	**TPH**	**PAH**	CHC	**PCB**	**OCP**	**OPP**	**Tot.Metal**	Biol.

Comment: Duplicate samples collected, bottles used. access, condition of headworks etc

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (Lim of casing)	2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID.·

Job Information | **Sampling Information** | **Bore Information**

Client: ..ARY..... Purge Method:.....G.□,\□..... SWL(mbTOC) .....m Logic Check: ..

Project: ..... Sample Method:.....I.?..□□·□..... Screen: From:....P....to ... q_..... m Stick Up: m

Proj. No.: 1'2.:-56..5.:.t.%fL..... WQ Meter Type:.. Y.?..L)1?.v..,<:X!..?!?./.. NAPL Check:..... Bore Diam. ..... mm

Sampler: ••••□T\····r□··.:.:_:j_o/Jt/2 FlowCell:Y / N P□mp Depth:••••••••m Ref.datum'. •••9.:·;·□·····½ Well Cap Secure?.....>.:.'....

Date: ..J.../ ....|.,.....¥.:..... '21.f WLevel Meter T e: Dip/ Fox/ Int.Fee / Gge Bore Depth.....m

Round ....Nr:>::-1.....?.--:·-.tf..... Field Filtered? Y / **N** (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (±mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, s_lleen_,_ odour, flow rate, purged dry?
Stable when (3 consecutive readings):			*+/- 0.05pH*	*+/-3%*	*+/-10%*	*+/- 10 mV*	*stable*		
15.oo							1 ot0		w,+1.--. l.o3Jv/"
							1-=f. 08 l		vvfo lo□i2_V
1'5·2-::>	'3	1 4 l	5 · 2.. l	1□- '3	'8•b 1	2.SD • 1			ul0>'-"---<l ., cJloc.□l□.,.no --h.J...-<""6□J--u. ...
									Y'O '?eJ.:Yr-c-€r¾..
2dit!Jl-tf									S\o» '"□□□: a;_,W], □
i>•.::,o	l	J--.t-t	14.95	11□.o	q,Niuz	IV-i-3-3	17--,oqs		W10 loo_□e,<,.
									r,,.)oc.efl-87 / □t·d□ -tJ.'<bCJlct-:g, v.e)
									set!□
									Sa...r'V! pl-e&_ □e< \ 6-:..((c) '3>·.4-5
									10/11/z.£1-

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N

Decontamination as per GHD procedure? Y / N

Was sampling equipment pre-cleaned? Y / N

COC updated? Y / N

Par,arneters	BTE:<	TPH	PAIi	CI·IC	rCD	OCP	OPP	Tot.Mctol	Biol.				
Preseruatiues													

Comment D"Olloate sa::·i,□·7;;·rr:;;□·:;t'"·:·•;07□"

5-:,Q

Lo□C;\Oi Ql.A\- - □·.--60(2.,0/1\)

\...OC\0iU \-C\ - C\·.oO (1..0 / \\J

Purge Volumes

Casing Int. Dia(mm) 50 100 150

Vol (Um of casing) 2.0 7.9 17.7

Double for gravel pack

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Purging and Sampling Record

Bore ID: 8-f/G

Job Information

Client: A.□V
Project: Jl□tJAM./?..Jy.G
Proj. No.: ./2'5.G.5.1.□:C
Sampler: t"1-t
Date: □/u./?!f
Round N□f.....?:!.f

Sam!.J,ng /IJformation

Purge Method: g
Sample Method:
WQMeter Type: YS\ t't>:5 IC:02..63
Flow Cell: Y / **N** Pump Depth..... m
WLevel Meter Type: Dip/ Fox / Int.Fee / Gge

Bore Information

SWL(mbTOC): m Logic Check:
Screen: From: L...f....to.. h.1.\. m Stick Up..... m
NAPL Check: Bore Diam ..... mm
Ref.datum: Well Cap Secure?
Bore Depth: ...&:.◊.\5- m

Field Filtered? Y / **N** (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (±mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05pH*	*+/-3%*	*+/-10%*	*+/- 10 mV*	*stable*		..
q;z□							□		Ilir,,.,e,.<: 0. 2.2. \
q:bo	4	6,:>	□.2S	11.., *b*	q.35	?,\L\.:>		0 .1..1.	wYo 10/""lnex • o. □\ 1
9·=,'5	't)	;,q	s.20	\'J_•1.	q,736	z_q4. "c	-	0.°:)	'5hr,\-\\- v"".,la-rO\□(\Qe' odou.....\es::, loV\I rv.'(biciih,\.
c1·.4:>	I 2..,	5.1	S.\4-	\'l .7-	q.9 S	1..iS5-0			SOrY'e □""e □di·fY\elfYt
q:49	t. I£+	£.9	5.2'3	I?.. 3	9_·30	1-75.2.			A-:, nbove.
									□Q.Mo\ed Ctt q;55

Field QA Checks:
Air bubbles in vials? Y / **N** **Any** violent reactions? Y / **N**
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / **N**
COC updated? Y / N

P'anirneter'!.'	BTE>C	TPH	PAli	CHC	PCD	OCP	OPP	Tot.Mctol	Biol.				
Preset"uati□													

Comment: Duplicate samples collected, bottles used, access, condition of headworks *etc*

\roj□< ov-..\- 9.·.W _D□□ "" :,o:oo

\)IA□\\CCt\-{.. c._w-D\

S□\, \- □C..w-S\

Purge Volumes
Casing Int. Dia (mm) 50 100 150
Vol (Um of casing) 2.0 7.9 17.7
*Double for gravel pack

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Purging and Sampling Record

Bore ID: @1-tlB

Job Information

Client: .f:..f:Y.....
Project: !1.□.':'\□tW...Jj g.....
Proj. No.: \?...:i6Sq□9
Sampler: M£
Date: W/ll/1.4-
Round ..NO.□..1-4

Sam□Information

PurgeMethod: ••••••g·□□.....
Sample Method: .....□>..□ .....
WQ Meter Type:.. Y.'?.L..\□□.l-G.9.□2.
Flow Cell: Y / **N** Pump Depth .....m
WLevel Meter Tvpe: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC): ..... m Logic Check: .....
Screen: From:..\.,J.>..to..'?..,l.□ m Stick Up:..... m
N/ PL Check:..... Bore Diam..... mm
Ref.datum:..... Well Cap Secure?.... Y....
Bore Depth: . -:z_. 03 ..... m

Field Filtered? Y / **N** (filter vessel, disposable filter/syrin ge)

Time (.....)	Volume (L}	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readingsl:		-	*+/- 0.05pH*	*+/-3%*	*+/-10%*	*+/- 10 mV*	*stable*		
to;'J...							0,66		w/ \00-0.*ex*
			S.4-4				*o.br*		*w{O \noo(2){*
1n:ss	33	7-.Cf	□	2.,'5, 6	□-IC\	179.0	□	o.4\Sci	Wo.\-€.v \,\□□v\,Q\-\t \o<O\.,□/\ -hneie., \o\l\J - mod
10:4-2.	6	1·5	15..is\	2-s.o	2·41	\'o'z.. 4	c).q7		tt-trb,ouh1, □:,:*Xe seoFmevit,* o□our/£.)5
10 ', Sl	q	7,q	5.61	;Z.,/4 •"V	}...-bo	15,.5	O.C\l		A□ a b::>VG
n-00	MI'L	7.q	5.61	2...S-o	'L-'53	tsLt.o			

Field QA Checks:
Air bubbles in vials? Y / N Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / **N**
COC updated? Y / **N**

Pa,r,arneter-s	BTE□	TPH	PAIi	CMC	PCB	OCP	OPP	Tot.Metal	Biol.				
PreseruatilfeS													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

□f Bcci- *10 :"Le!>* Lai□Q,-, \(\·\\:06

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID: .P\:\.9.9.....

Job Information

Client: A□Y.....

Project: \\£t'\.A\'1?.....\:'f.0.....

Proj'. No .: 11.56 59 *i'l*.....

Sampler: tr\.....

Date'... ?.. .. .0 /\\ / 7 .. .„4;.....

Round .□□□--... 1:-4.....

Sampling !(!formation

Purge Method:.....f

Sample Method:.....□□-.□ 'f.....

WQ Meter Type:...1.7..\...l□□..\□.1:-:R9...

Flow Cell: Y / **N**

WLevel Meter Type:

Field Filtered? Y / **N** (filter vessel, disposable filter/syringe)

Bore Information

SWL(mbTOC): ..... m

Screen: From:... ';:?.....to ...□... m

NAPL Check:.....

Pump Depth:.....m

Dip / Fox/ Int.Fee/ Gge

Logic Check: .....

Stick Up: ..... m

Bore Diam..... mm

Ref.datum: .....

Bore Depth: ..:□.:.□.?..... m

Well Cap Secure?..Y.....

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (±mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/-0.05pH*	*+/-3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
\'L'.J.J)							\·r4		v-1I \oao.e;r
							\'7-6		W r O \or.in.eJ(
1i:30	1:)	6-r	5-□S	\4-, 3	1.S. /\-□	2..,6). 0	\. i:2i		*1* r1w +uYb. ndol,\Y\e::,s. *CO\Ou'*<\-*e.,*<:> ,..\-vc(cQ<) *rf:..*
n..:35	*'v*	6-7-	□-□	\□. □	'o. l?:>	*1..L;* 5 - l			f 11 esec\ i -(v/eni:'" A□ n'oove
\□:/.{'	\ ?-,	b-6	S-□'D	\□ -□	9'D	2...69 -'3	\---t1		A-::, 0.'-oove...
\1--; *i+b*	\6	(.,.5	5.42	lU-• 0	'3.12	1A1·l			l\\ri \--\A'{'"\ d.\-\u.
11.□□ 1	*1.D*	*b-4-*	5-41	14,0	'6, *fJb*	Vtl. c>	\-°*tb*		A5 o.hOVE:-
11:56	.,_4	h-0	S-3?	\4-0	/· 2.□	:L39□ 9			oamp\e....Q\:lr \□: 5S

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N

Decontamination as per GHD procedure? Y / **N**

Was sampling equipment pre-cleaned? Y / **N**

COC updated? Y / **N**

Par,am,elter-s	BTEl<	TPH	PA.II	CHC	PCB	OCP	OPP	Tot.Metal	Biol.
Preseruatii,es									

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc \ £. *Xf□f(* Q\At \1.'. 2..3

\....0 ?f.\'o/" \v\

Purge volumes

Casing Int.Dia (mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID: [Y·-\()s J□ \0

Job Information

Client: /J□'Y.....

Project: tlEMAt\f.J□l.6.....

Proj. No.: 1'l.,56 Sq ‹s°i

Sampler: .\.\'.....

Date: W /\\ / 7,.,4-.....

Round NOV Vf.....

Sampling Information

Purge Method:...□ □ □ r.....

Sample Method:.....'?.-:-';-.□ .....

WQ Meter Type:... Y.□-?J...\5.Q.l0.0.1-:□2....

Flow Cell: Y / N Pump Depth:.....m

Wlevel Meter Type: Dip/ Fox/ Int.Fee/ Gge

Bore Information

SWL(mbTOC): ..... m Logic Check: .....

Screen: From:....9.....to ... \ ..... m Stick Up:.....m

NAPL Check:..... Bore Diam.....mm

Ref.datum: ..... Well Cap Secure?..>".'.....

Bore Depth: .....o. ..□.-□□..... m

Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (mTOC)	Comment: (.....) Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05pH*	*+/-3%*	*+/-10%*	*+/- 10 mV*	*stable*	
\ : '.)6							0,42_	t2,\-\or /3o-{e &Et□h - o,□5
;2..,:05							'.2..:2.,\0	'B'\-\10 □□ dQ,o-\-Y'l - '3,59

Field QA Checks:

Air bubbles in vials? Y / **N** Any violent reactions? Y / **N**

Decontamination as per GHD procedure? Y / N

Was sampling equipment pre-cleaned? Y / N

COC updated? Y / **N**

Par□IBYE□ **TPI1** **PAIi** CHC PCD OCP **OPP** **Tot.Mctol** **Diol.**

Pres:eruatille!Sj

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Purge Volumes

Casing Int. Dia (mm) 50100 150

Vol (Lim of casing) 2.0 7.9 17.7

*Double for gravel pack

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Purging and Sampling Record

Bore ID: Pw£ 5EA\>AuE

Job Information

Client: .MJ.
Project: r.1:6.M.A M .r□y□
Proj. No.: 1?/?.□.fl11{f.....--
Sampler: .Mr
Date: ?-:P././.1 /[.f.,.. .....
Round ./J.Q.□. ?:!./.f .-. ..-:.'''..

Sampling Information

Purge Method:.....t-?_A.f
Sample Method: Q;:{□-------
WQ Meter Type:..Y?L..Ji□Jc.9.?.:-□-·
Flow Cell: Y / N
Pump Depth:... ,-- ···· m
Wlevel Meter Type:
Dip/ Fox /Int.Fee/ Gge

Bore Information

SWL(mbTOC): ·· ..... m
Logic Check:_ .....
Screen: From: _·····--to..... m
Stick Up:·····--·-- m
NAPL Check:_ .....
Bore Diam.: ·-·-·····-·-- mm
Ref.datum: ·····--·····-·····-·····--··
Well Cap Secure?..N.A.
Bore Depth: ..... m

Field Filtered? Y / **N** (filter vessel, disposable filter/syringe)

Time (-·-· -·-·-·)	Volume (L)	Temp (OC)	pH (pH units)	Elec-Cond (·-·-)	Dis.Oxygen (----------)	Ox-Red Pt. (± mV)	SWL (mTOC)	(·····_·_)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		·	*+/-0_0SpH*	*+/-3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
2: 43		10,T	*6-01*	15. 6	7--23	*1..,Jq.* 3			
□:,11		\0-:Z	D-9S	15- 0	7-. *be+*	1-rs□.b			

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / **N**
Was sampling equipment pre-cleaned? Y / **N**
COC updated? Y / **N**

Par□E!f'G	BTEIC	TPH	PA.II	CHC	PCB	OCP	OPP	Tot.Metal	Diol.				
Preset"ualilfe!													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Purge Volumes

Casing Int. Dia (mm) 50 100 150
Vol (Um of casing) 2.0 7.9 17.7
*Double for *gravel* pack

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Purging and Sampling Record

Bore ID: .6...\-.\\1.....

Job Information

Client: .A□Y.....

Project: l1□t\A□?.....\J.6.....

Proj. No.:).?:-.?.□.□□..'f?:1.....

Sampler: .M.J.....

Date: 1 ..P/\\1 □ 4 -.....

Round NOV...J/:t.....

Sampling Information

Purge Method:.....□□..... "

Sample Method:.....

WQ Meter Type:.Y.□.\..J.'fi0..\□.....

Flow Cell: Y / **N** Pump Depth: .....m

Wlevel Meter Type: Dip/ Fox/ Int.Fee / Gge

Bore Information

SWL(mbTOC): ..... m Logic Check: .....

Screen: From:..J.....to .. 1□.□ m Stick Up:..... m

NAPL Check:..... Bore Diam. ..... mm

Ref.datum: ..... Well Cap Secure?.... Y.....

Bore Depth: ...?-:-.:..<?.';?..... m

F.ield Filtered? Y / **N** (filter vessel, disposable filter/syringe)

Time (.....)	Volume (L)	Temp (OC)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05pH*	*+/-3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
							AW<O)□ n.0		wl \oo.C\e){"
							A□ (;\½'1-...e		w/0 \oo.o.u
?, ;1)-	4	-:,-.b	I,. J_::,	'J_,1.O	S-65	;._,\□. 0	\-16		co\ouy\Jk,. od.r,I,,U[\e=>S' \JO -\iA(bio\;+tA no oeo/
									□ Recri □/
									sal')\nled oJ- 2·. 35

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N

Decontamination as per GHD procedure? Y / N

Was sampling equipment pre-cleaned? Y / N

COC updated? Y / **N**

Pa.nirnl!tef'-6	BTEX	TPH	PA.II	CHC	PCB	OCP	OPP	Tot.Metal	Biol,			
Preseruatiue!												

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc LCJ□Q,'(Ov\t 1..! \ S

LO□eJ< ,(\ 2·, Lf-tJ

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (Um of casing)	2.0	7.9	17.7

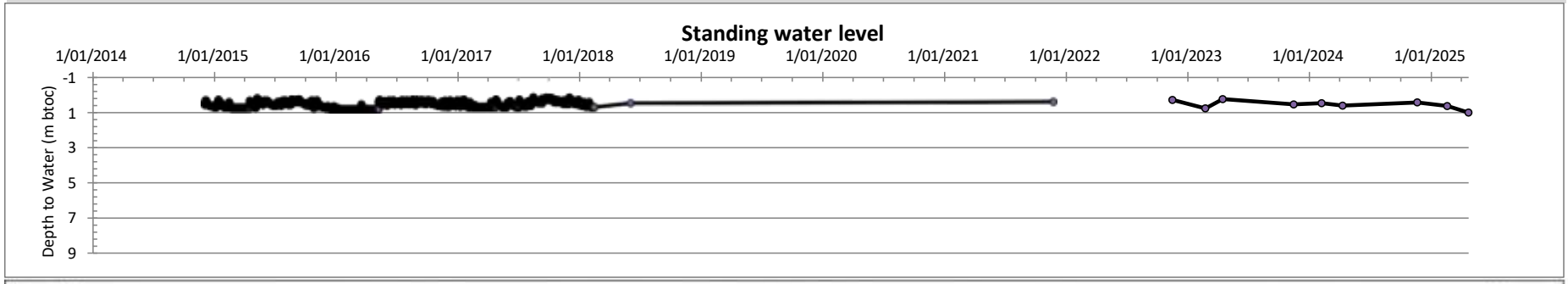
*Double for gravel pack

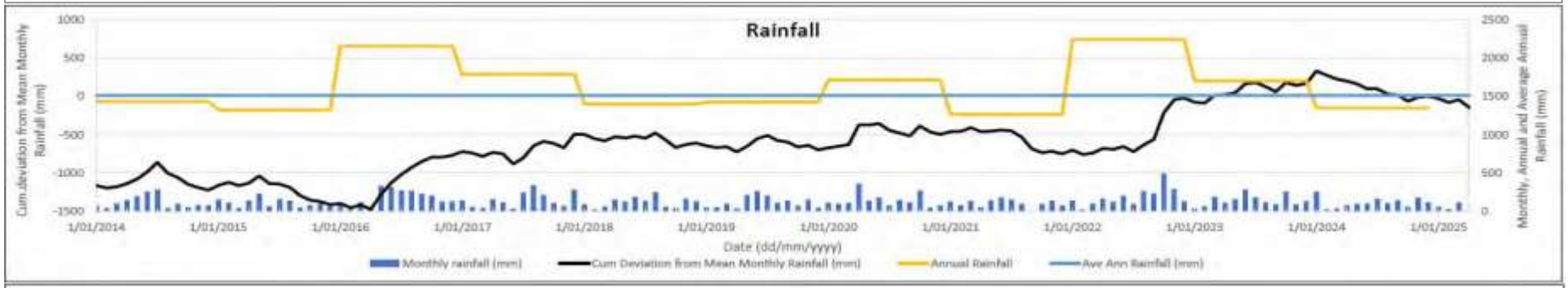
OFFICIAL

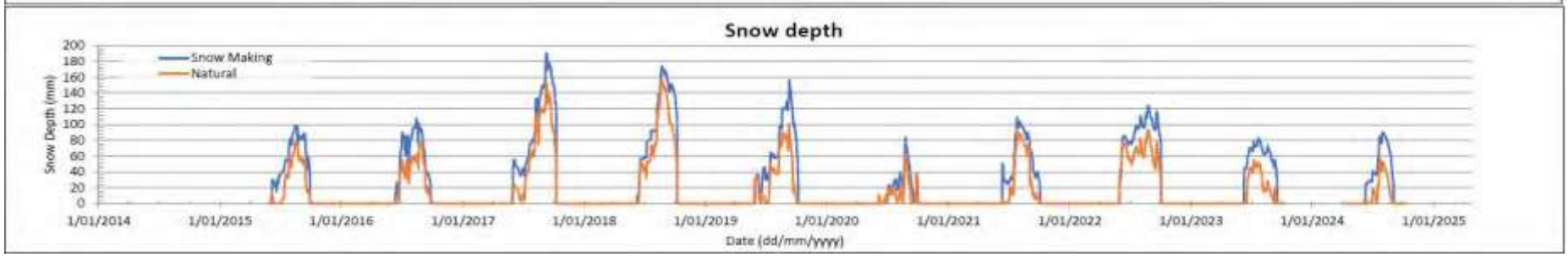
Appendix C

Hydrographs

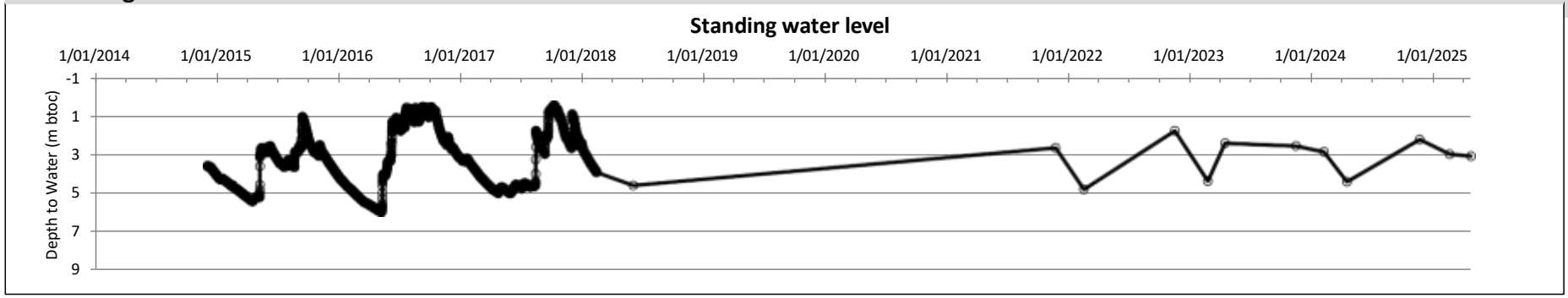
Monitoring Bore BH07

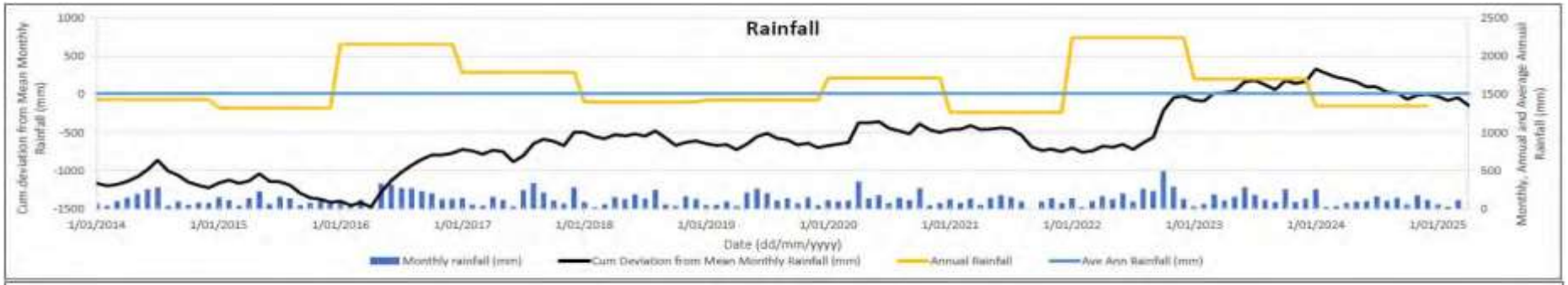


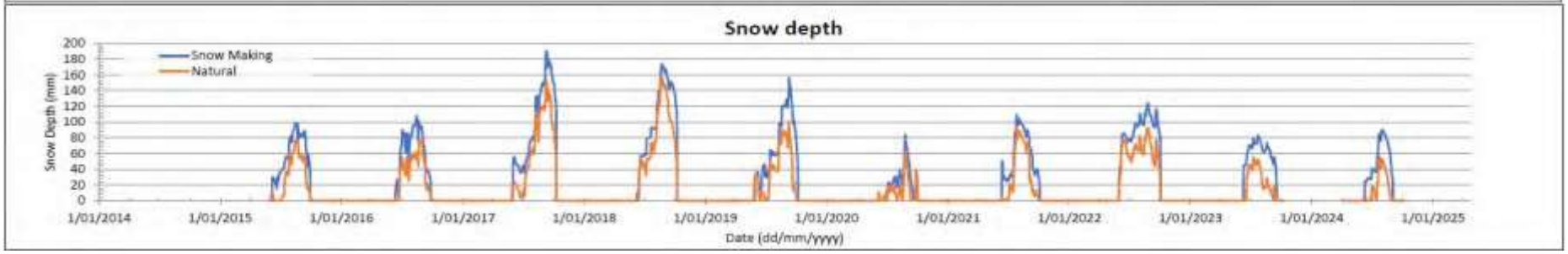




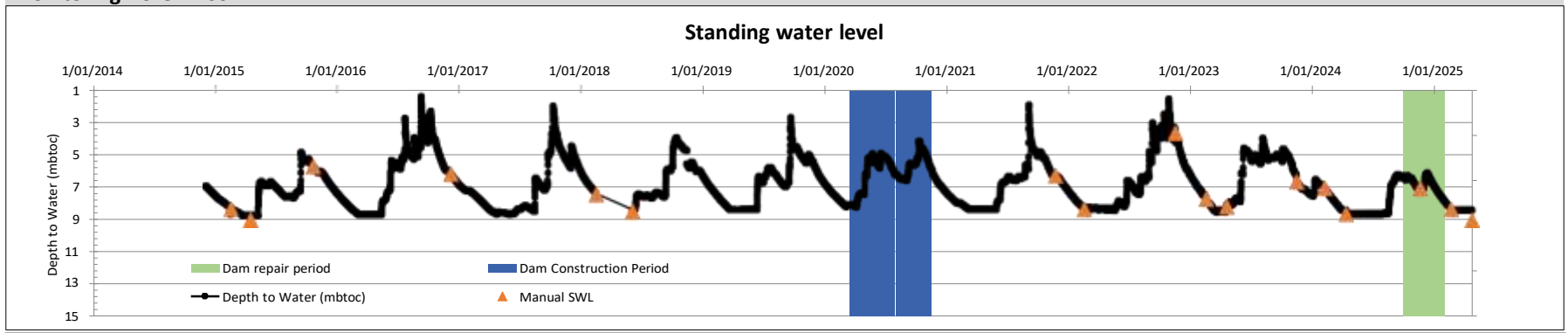
Monitoring Bore BH10

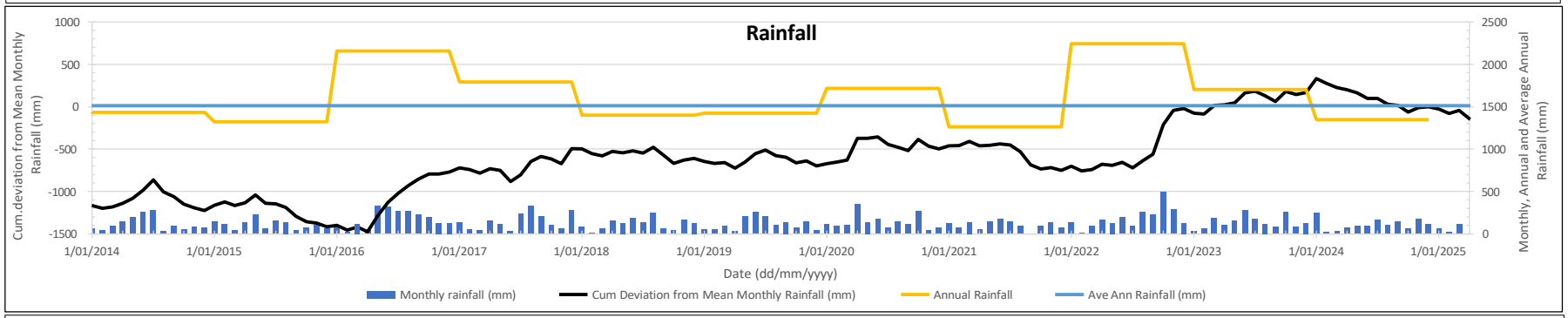


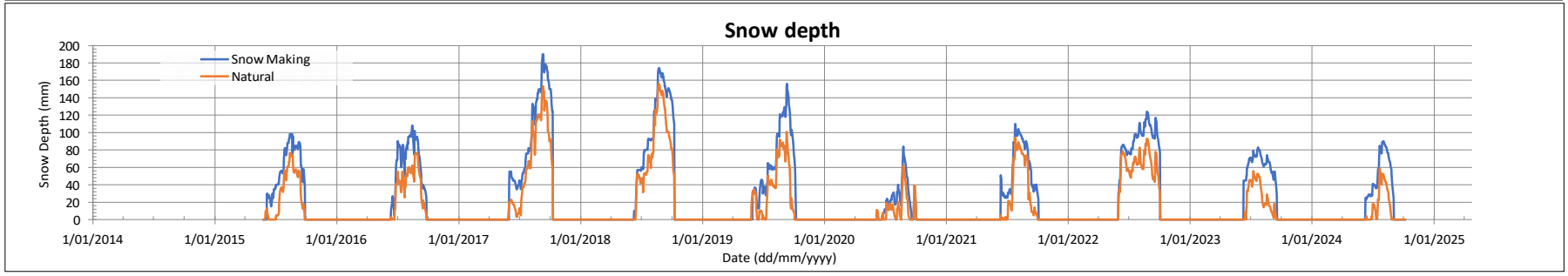




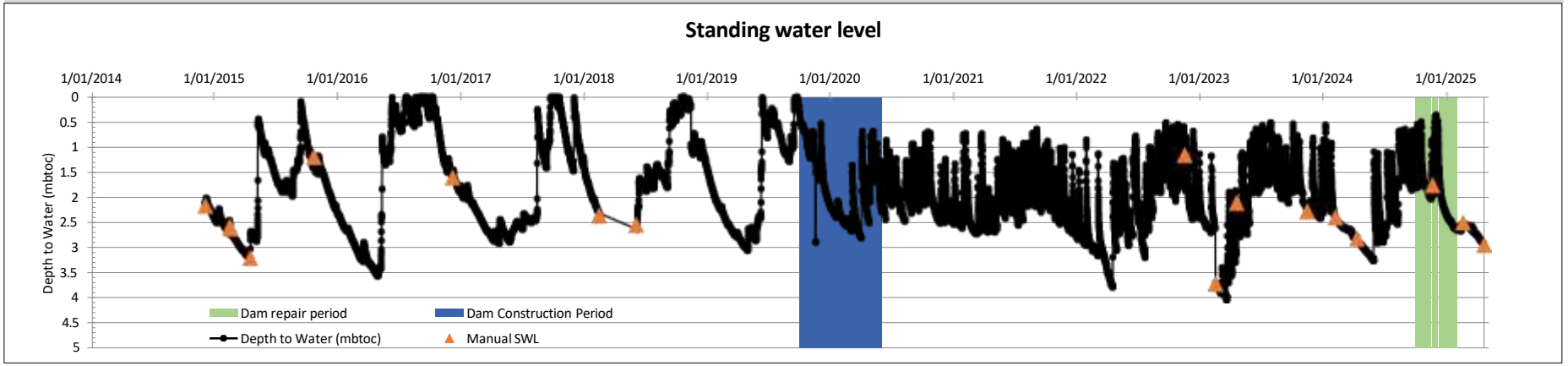
Monitoring Bore BH06

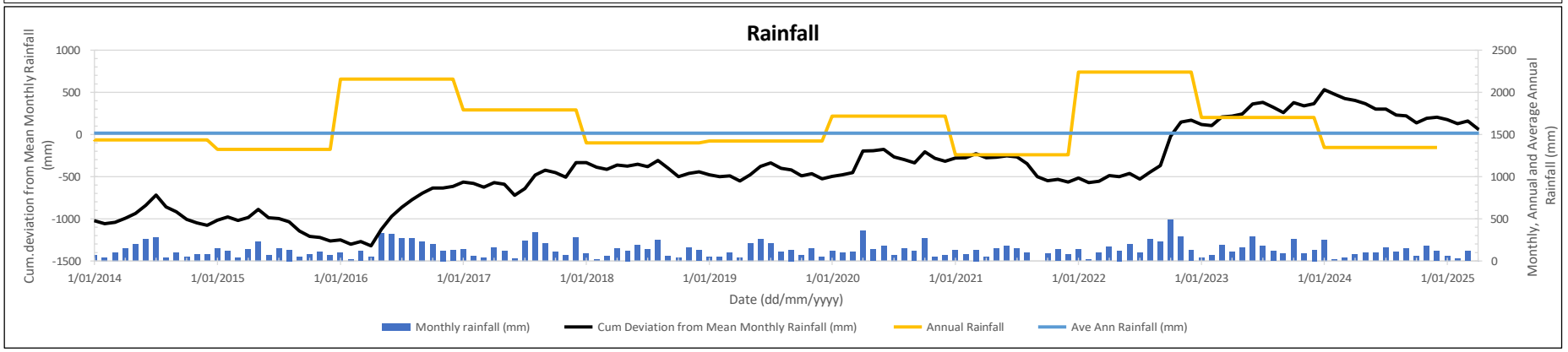


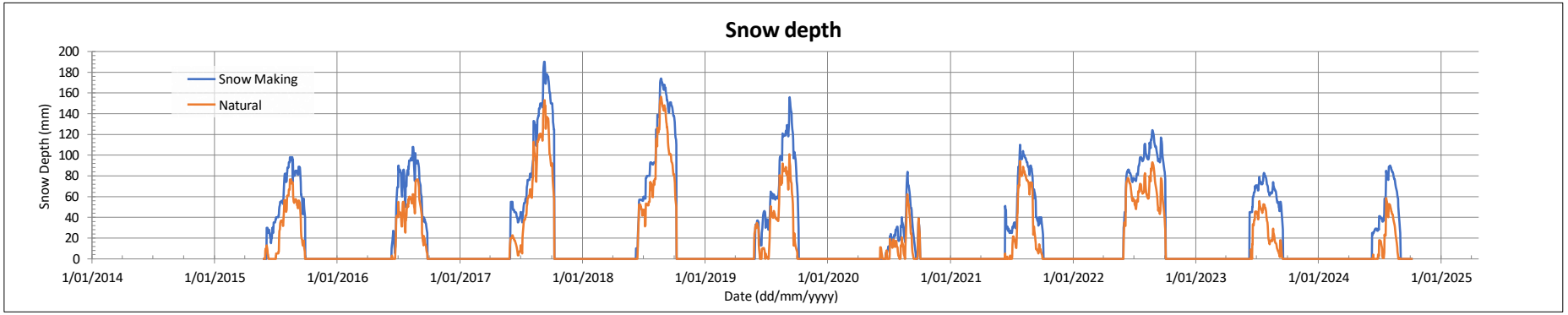




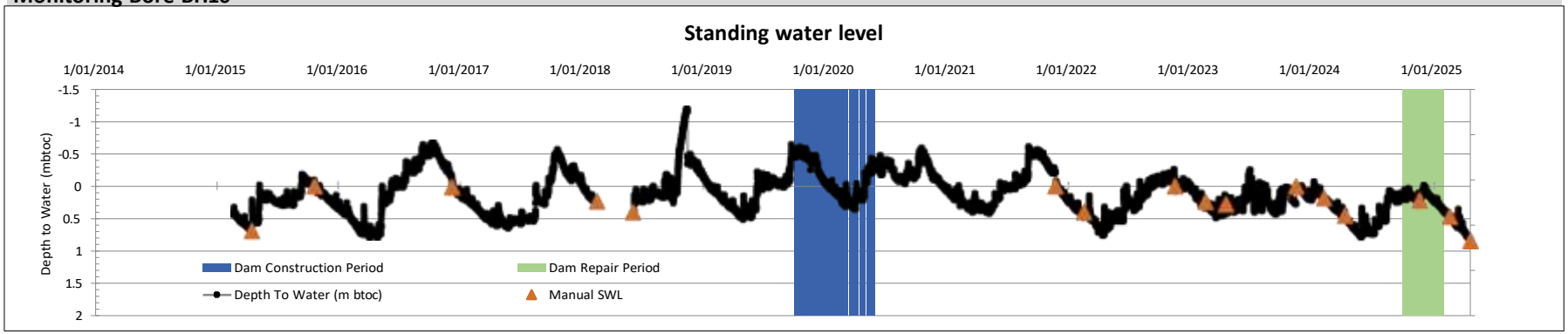
Monitoring Bore BH09

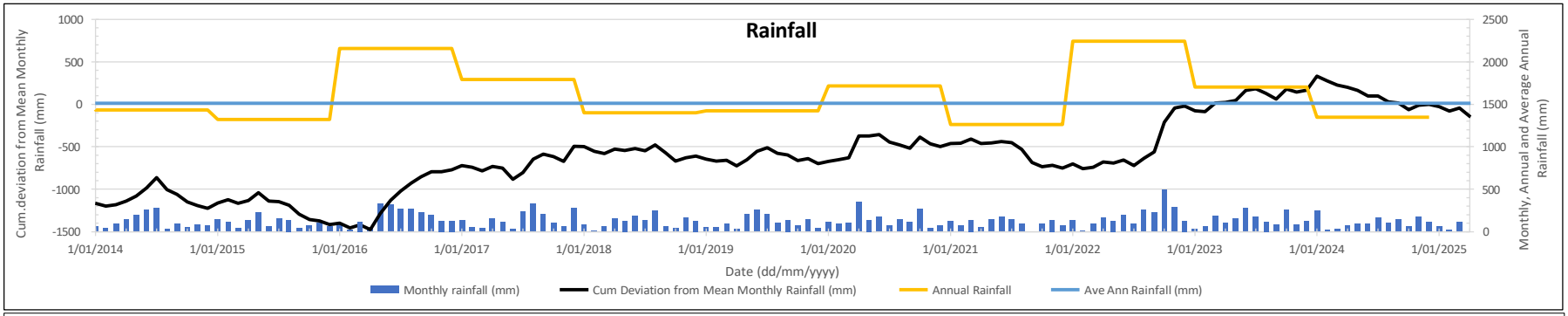


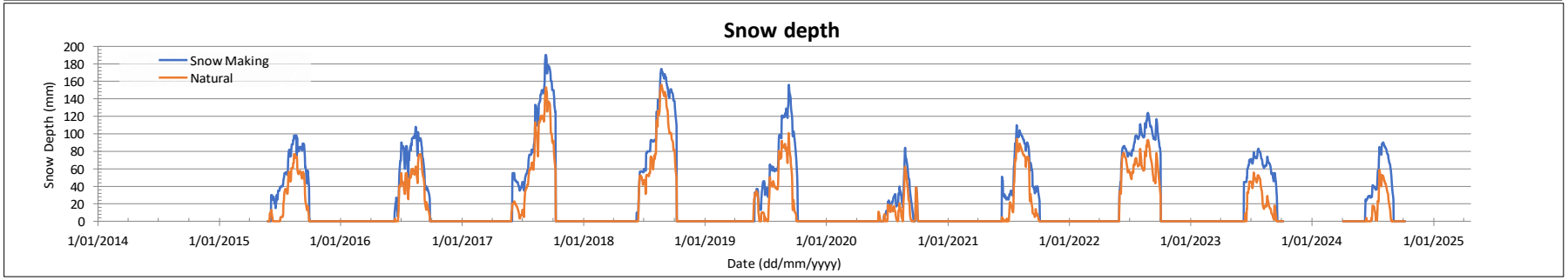




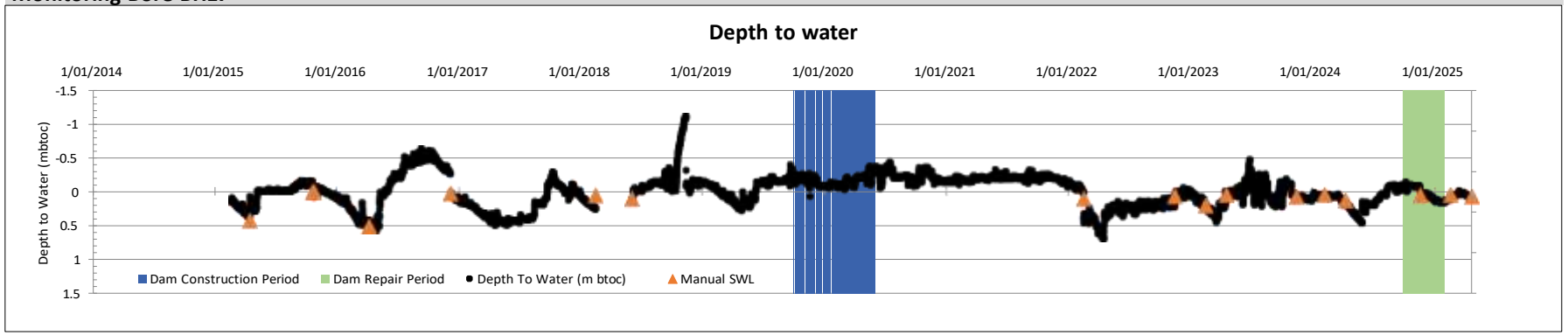
Monitoring Bore BH16

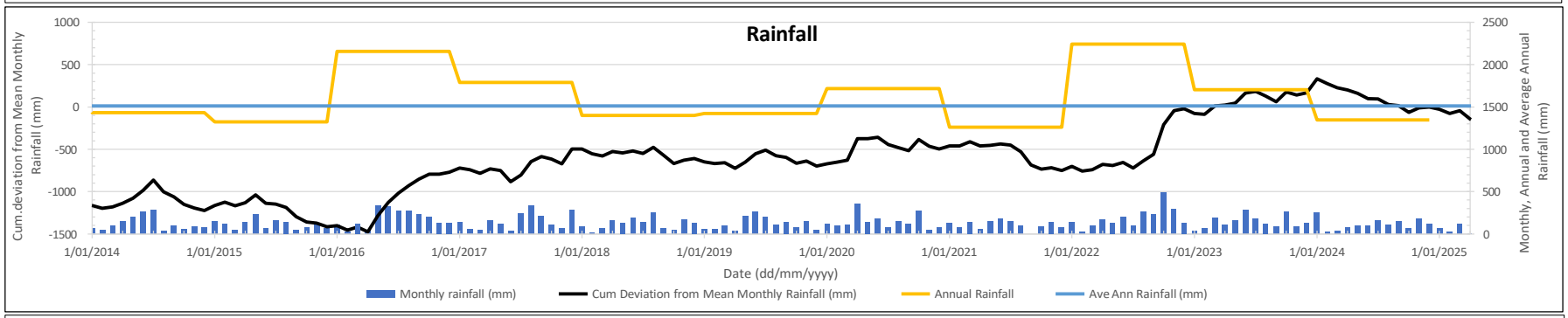


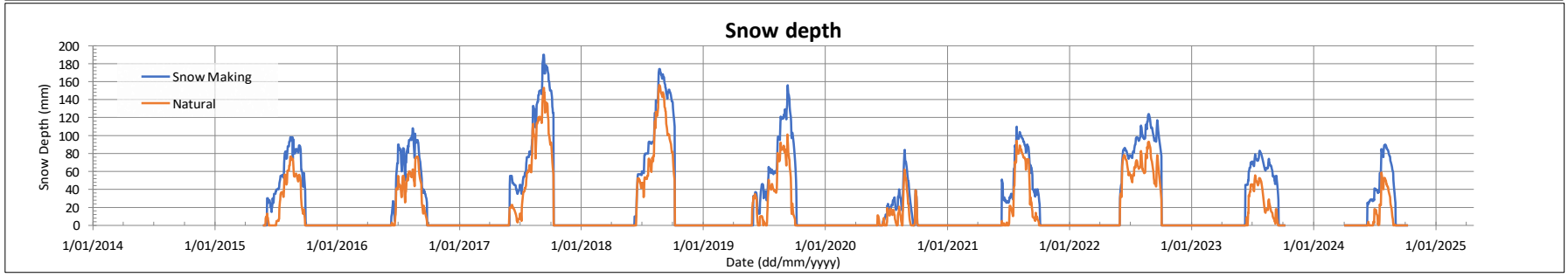




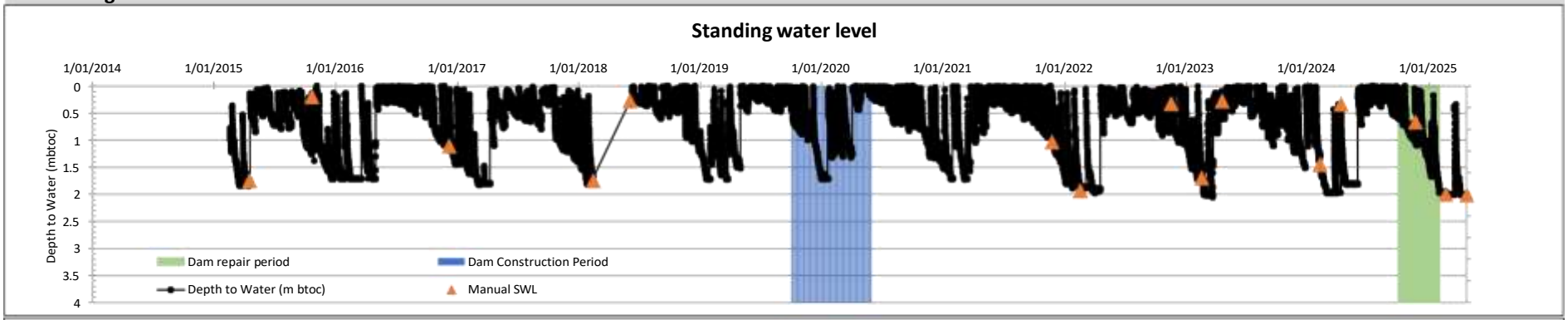
Monitoring Bore BH17

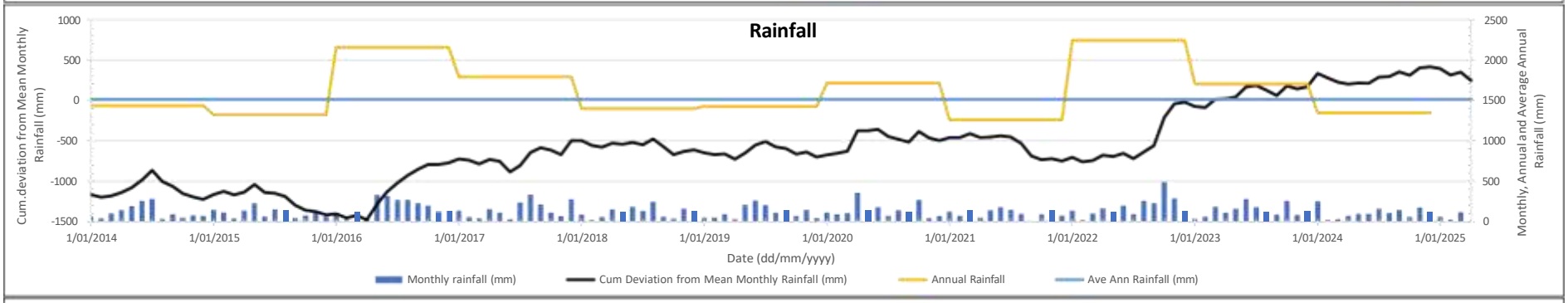


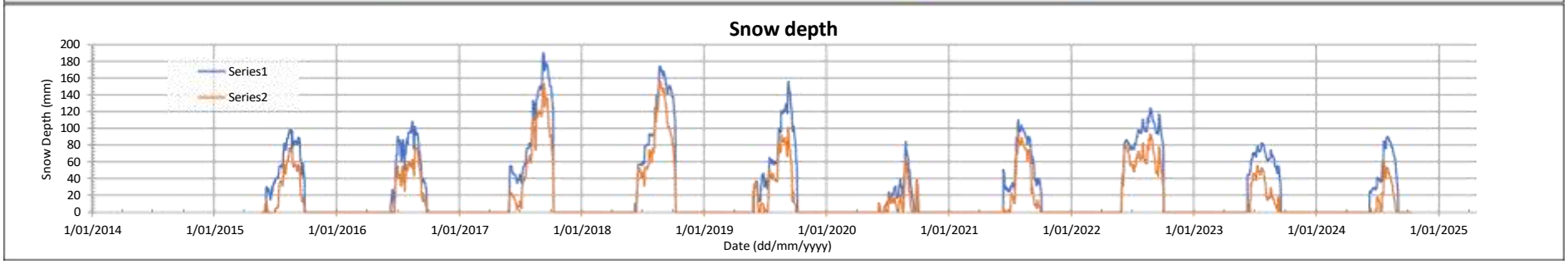




Monitoring Bore BH18







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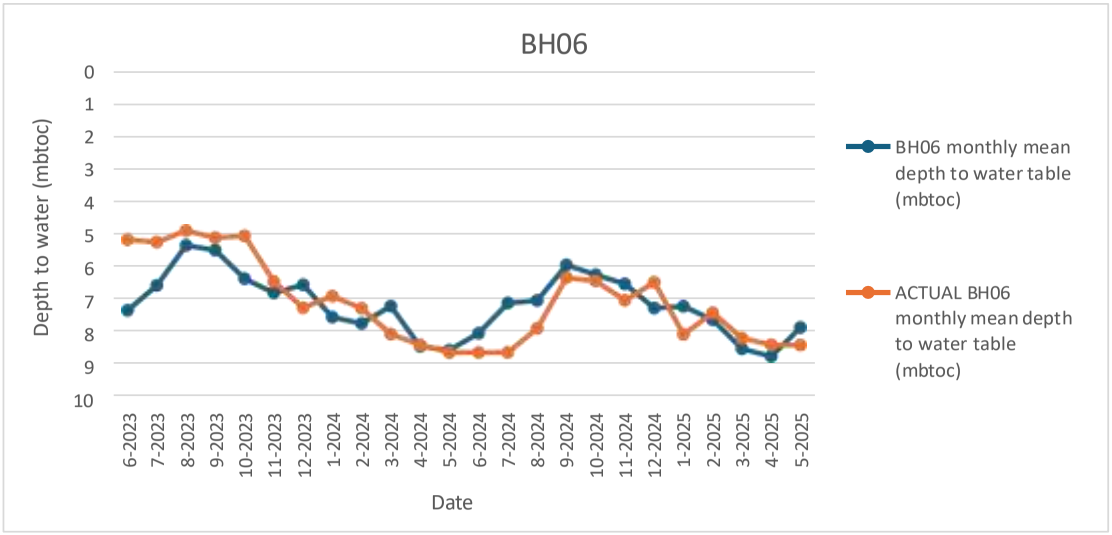
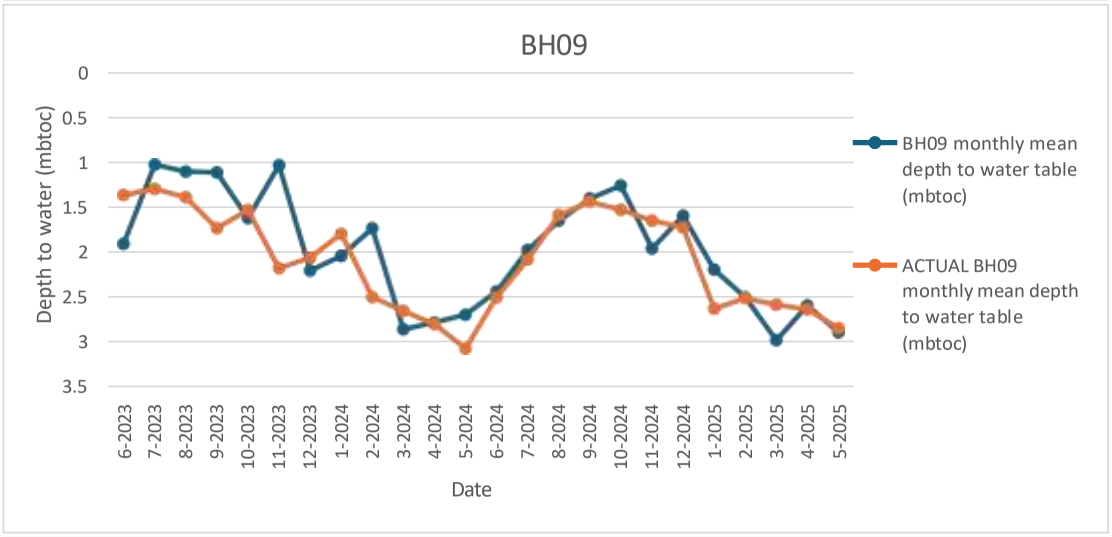
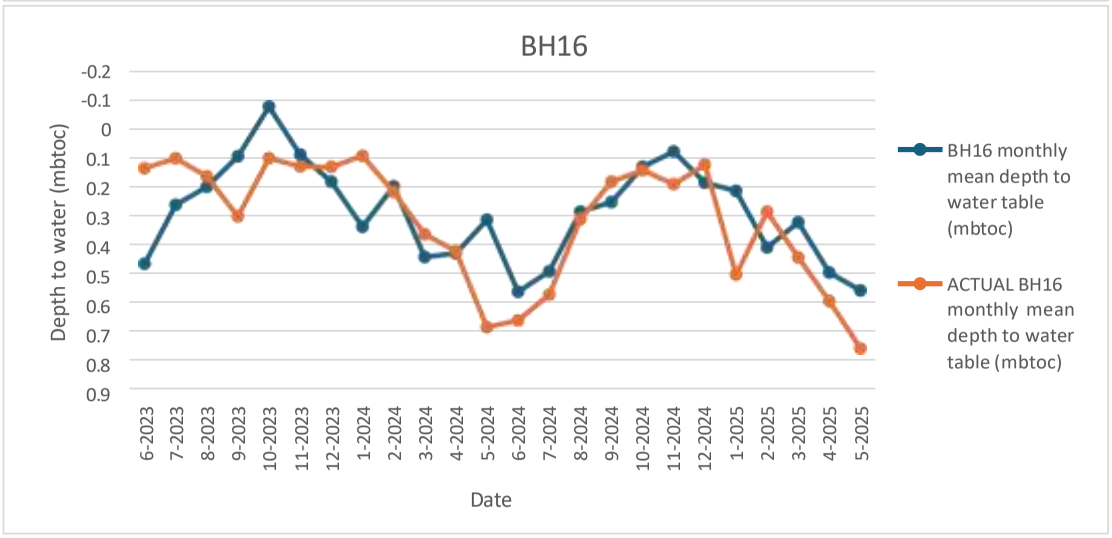
HEMAMP Model predicted depth to water vs Actual depth to water







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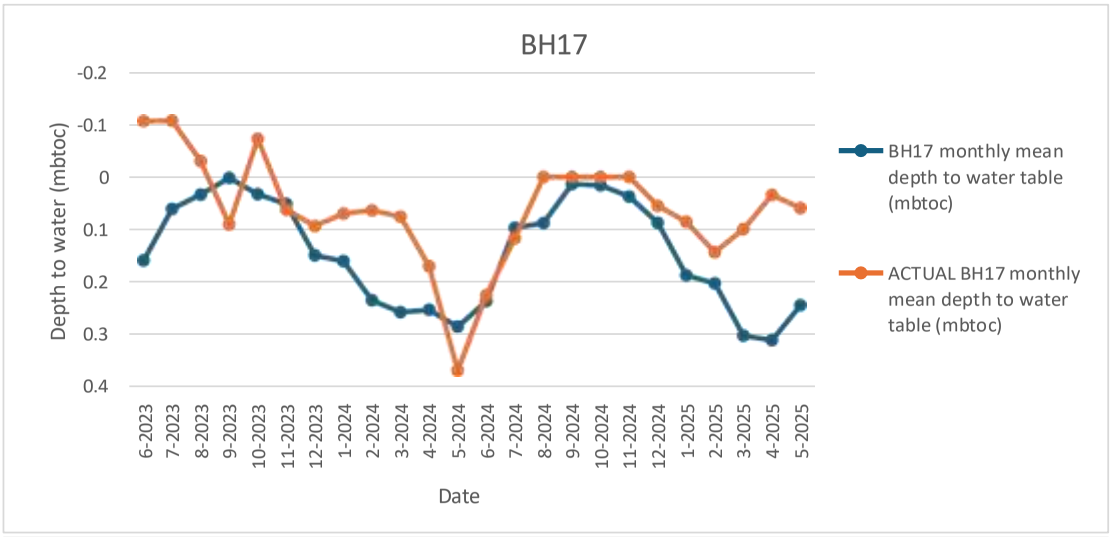

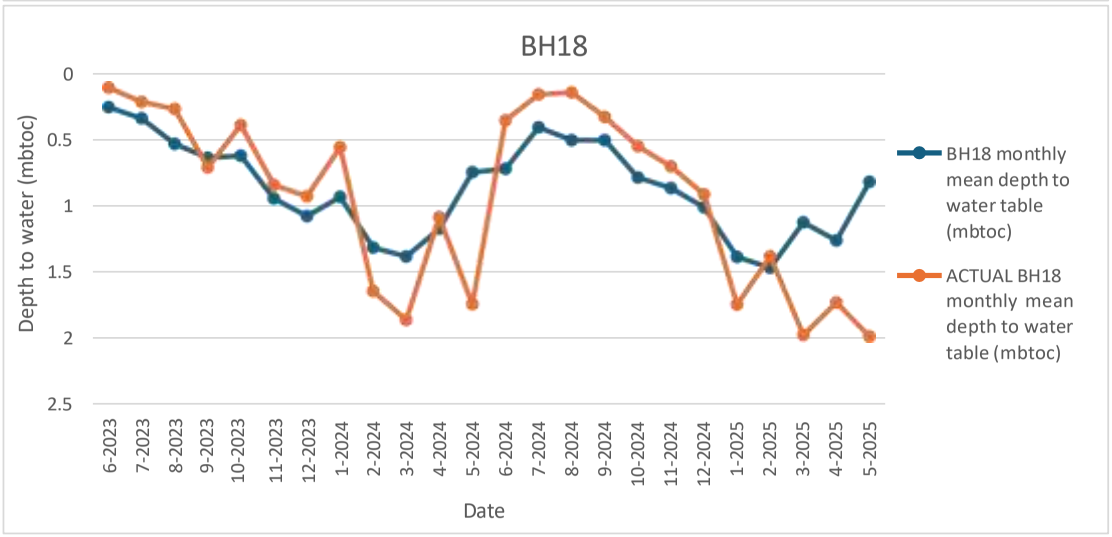

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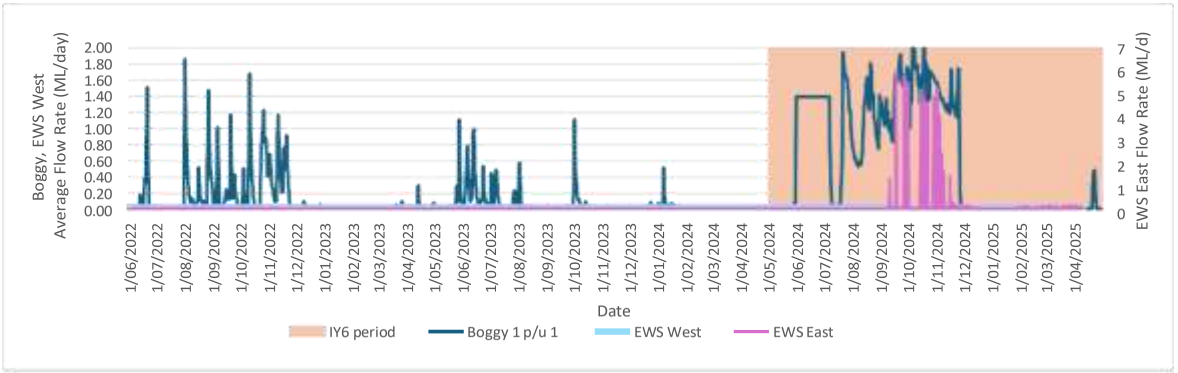
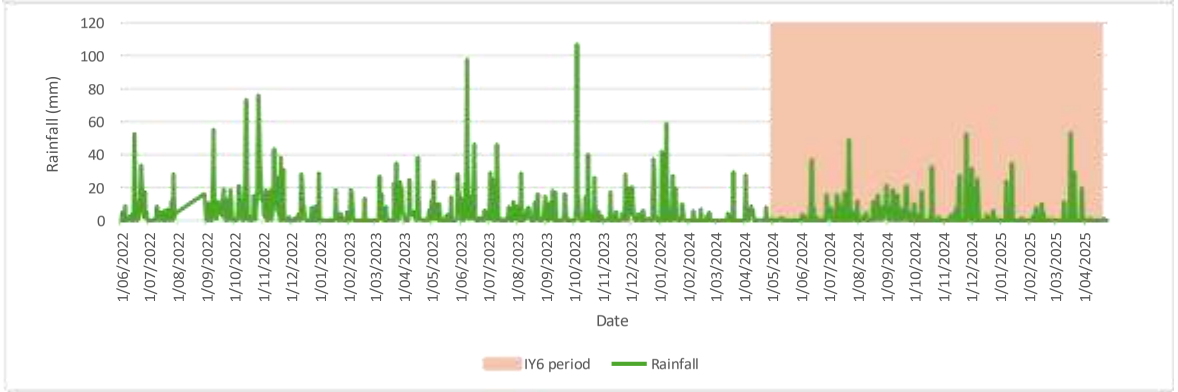
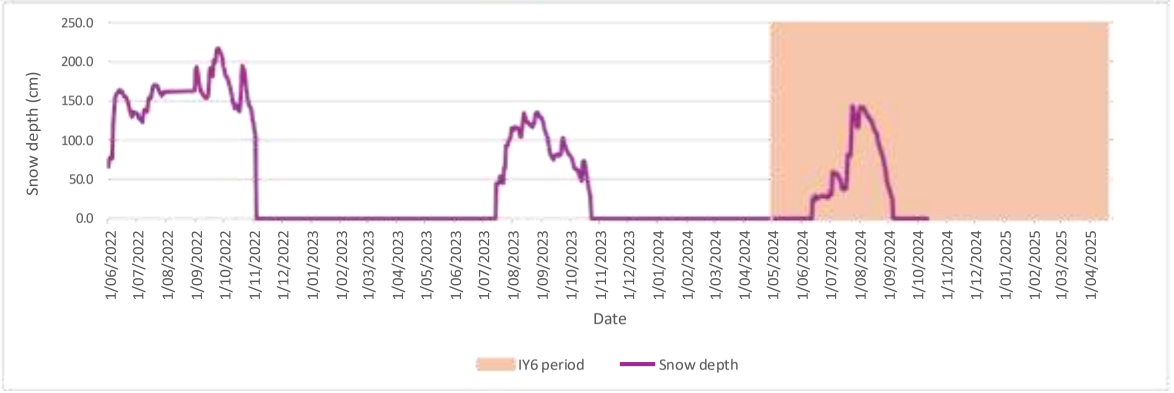
Boggy 1 p/u 1 Flow Chart







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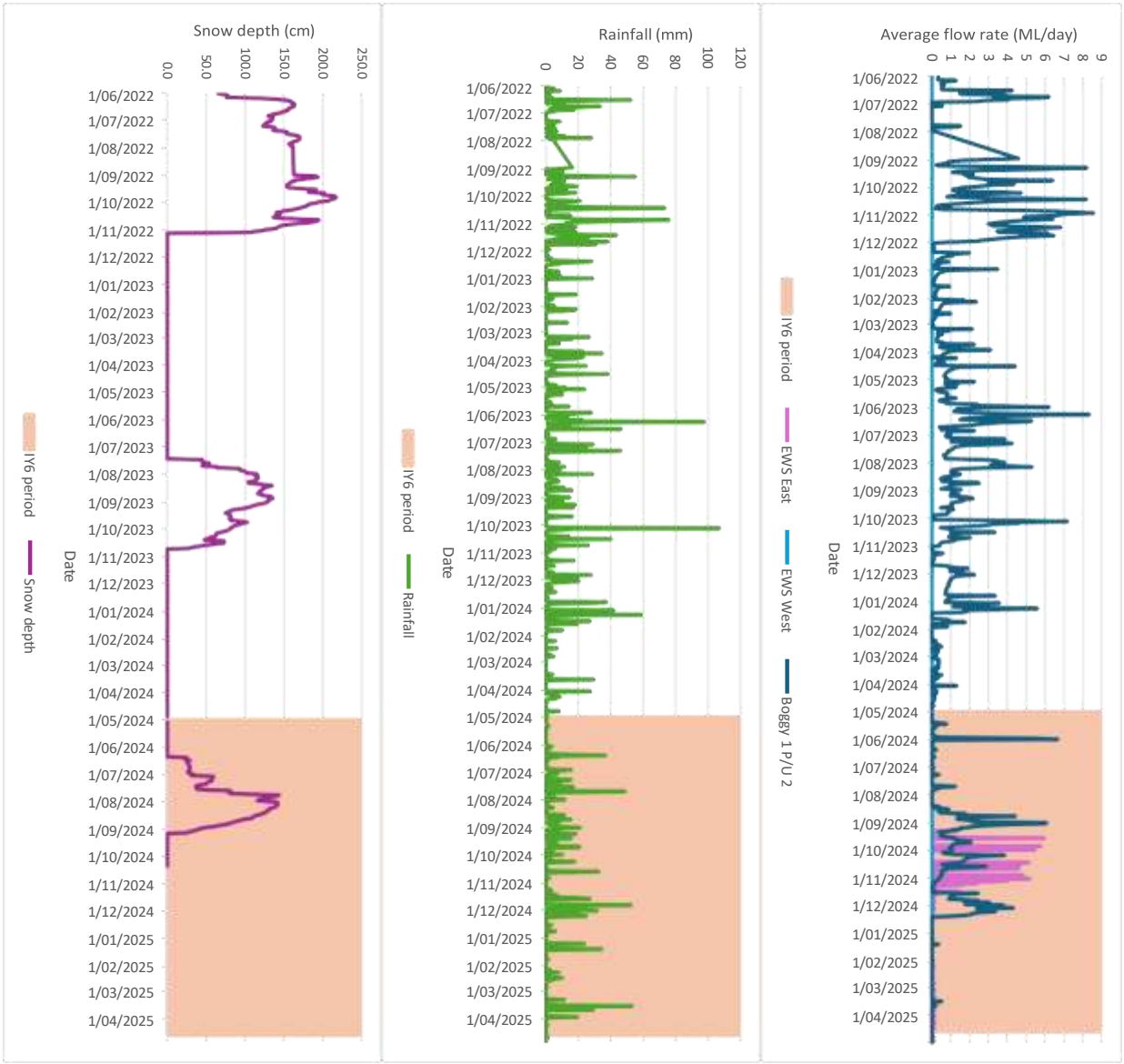
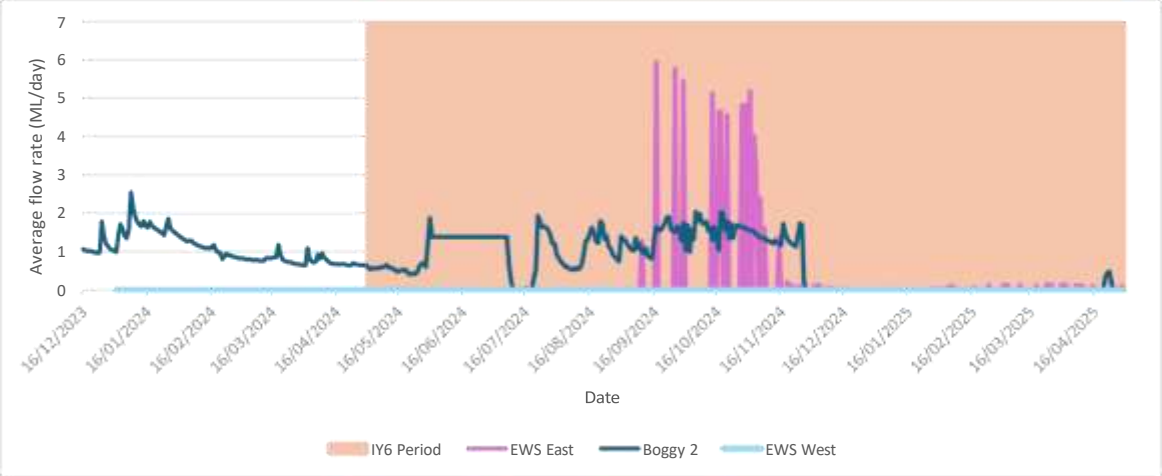
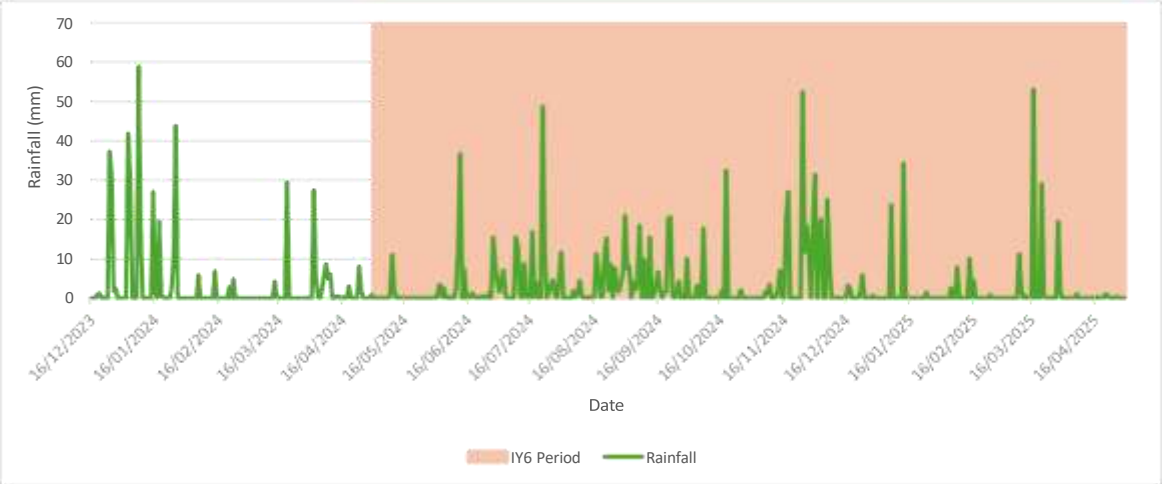
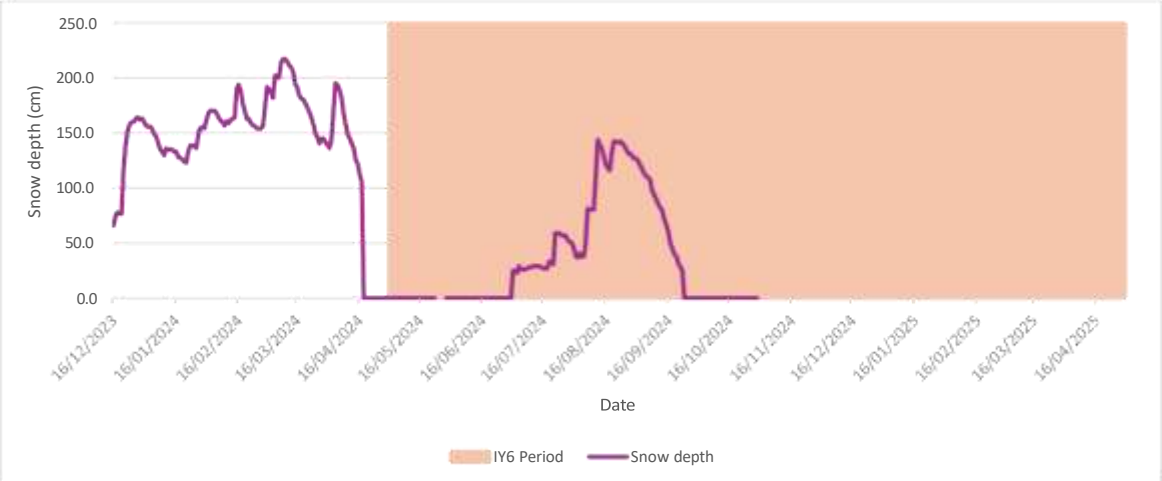
Boggy 1 p/u 2 Flow Chart



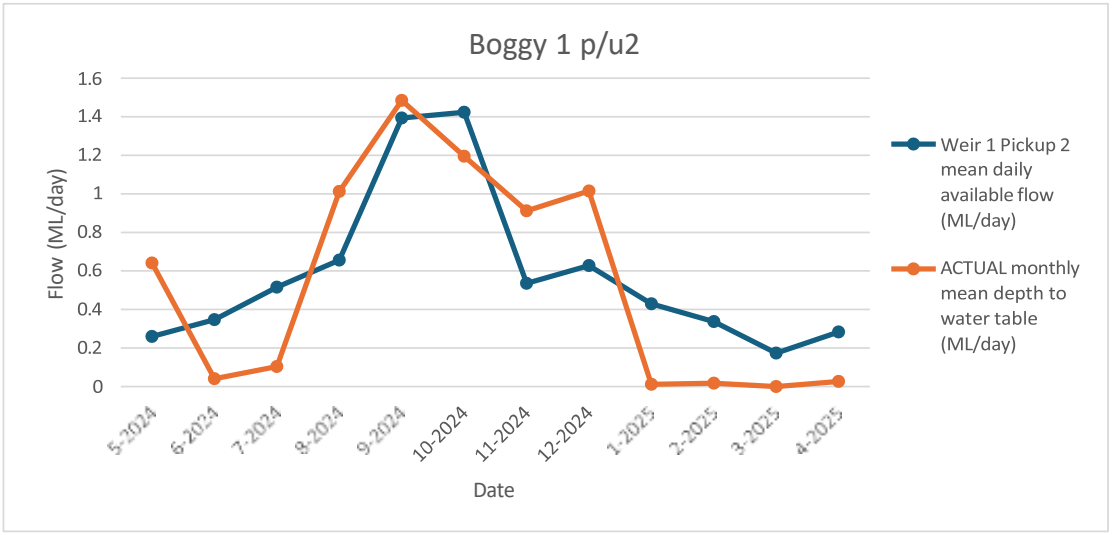
Boggy 2 Flow Chart

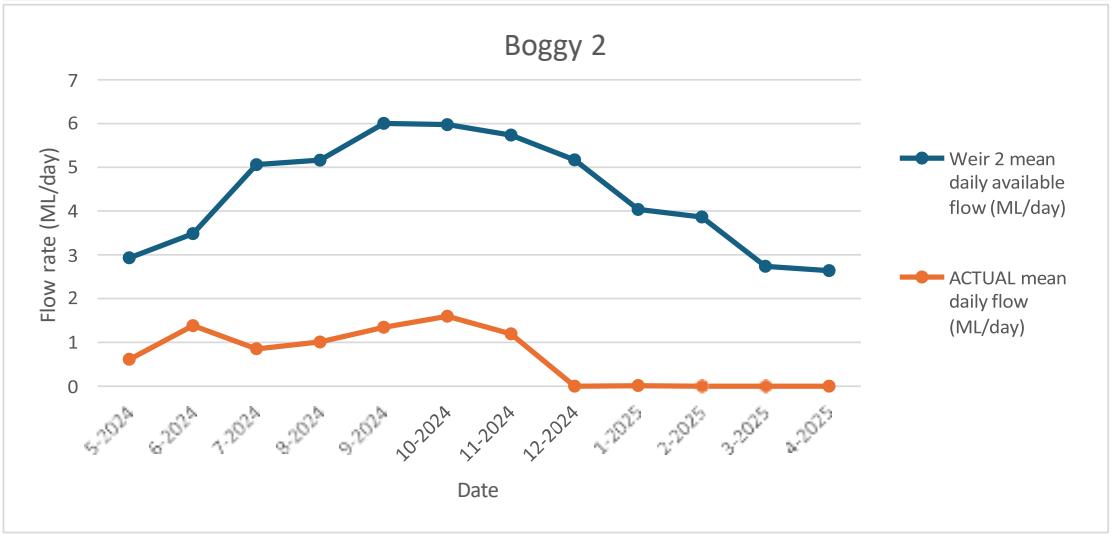






HEMAMP Model predicted flow rates vs Actual flow rates



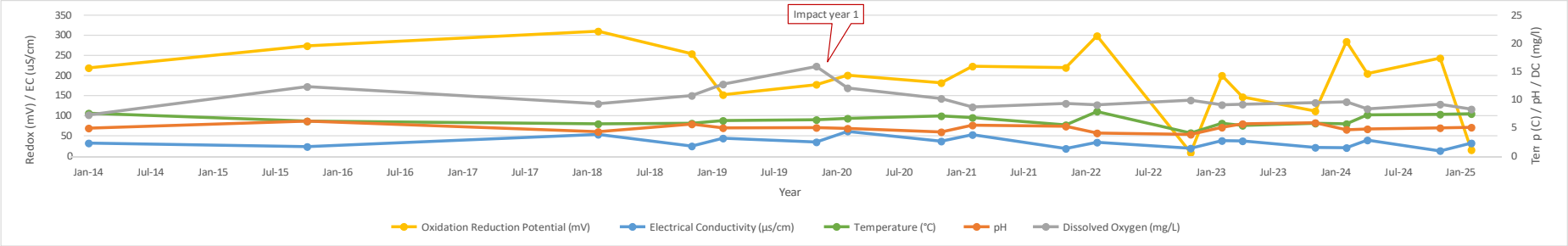


Appendix D

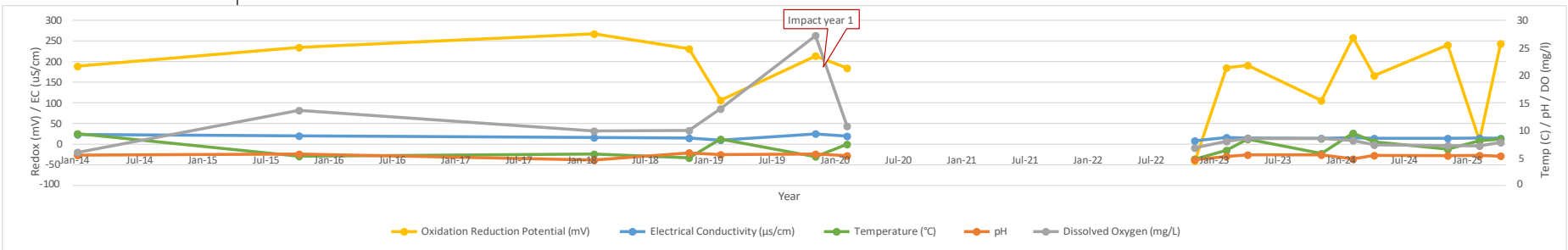
Field parameter data

Appendix D
Purging Field Parameters

	Baseline					Impact													
	Jan-14	Oct-15	Feb-18	Nov-18	Feb-19	Nov-19	Feb-20	Nov-20	Feb-21	Nov-21	Feb-22	Nov-22	Feb-23	Apr-23	Nov-23	Feb-24	Apr-24	Nov-24	Feb-25	Apr-25
BH06																				
Temperature (°C)	7.6	6.2	5.7	5.8	6.3	6.43	6.67	7.1	6.8	5.5	7.9	4.1	5.8	5.4	5.8	5.7	7.3	7.4	7.5	
pH	4.92	6.2	4.32	5.65	4.97	5.04	4.9	4.24	5.48	5.26	4.09	3.85	5.07	5.7	5.9	4.67	4.77	4.98	5.08	
Dissolved Oxygen (mg/L)	7.31	12.31	9.29	10.7	**12.76**	**15.9**	**12.05**	10.21	8.71	9.3	9.09	9.92	9.06	9.18	9.47	**9.6128**	8.36	9.16	8.32	
Oxidation Reduction Potential (mV)	219	273.4	310	254	152	177.37	200.67	181.5	222.73	219.5	298.4	8.7	199.9	146.9	111.5	284.5	204.5	243.3	15.1	
Electrical Conductivity (µs/cm)	32.3	23	53.3	24.4	44.4	34.97	61.63	36.53	53.23	18.5	34.2	19.1	38.2	37.2	20.9	20.4	39.7	13	32.2	



BH09																				
Temperature (°C)	9.4	5.3	5.7	5	8.4	5.23	7.47					4.8	6.4	8.4	5.8	9.5	7.9	6.6	8.1	8.4
pH	5.52	5.72	4.63	5.94	5.61	5.71	5.42					4.68	5.28	5.54	5.53	4.81	5.43	5.39	5.45	5.33
Dissolved Oxygen (mg/L)	6.03	13.62	9.89	10	**13.9**	**27.2**	10.78					6.83	8	8.53	8.49	**8.1699**	7.38	7.23	7.16	7.83
Oxidation Reduction Potential (mV)	189	234.3	267	231	106	213.33	184.2					-40.4	184.5	190.5	105.1	257.6	166	239.9	9	243.4
Electrical Conductivity (µs/cm)	23	20	16.1	15	9.8	25.07	19.47					8.2	15.8	14.8	14.1	15.2	14	14	14.6	14.2



Note - Bold indicates value converted from ppm to mg/L

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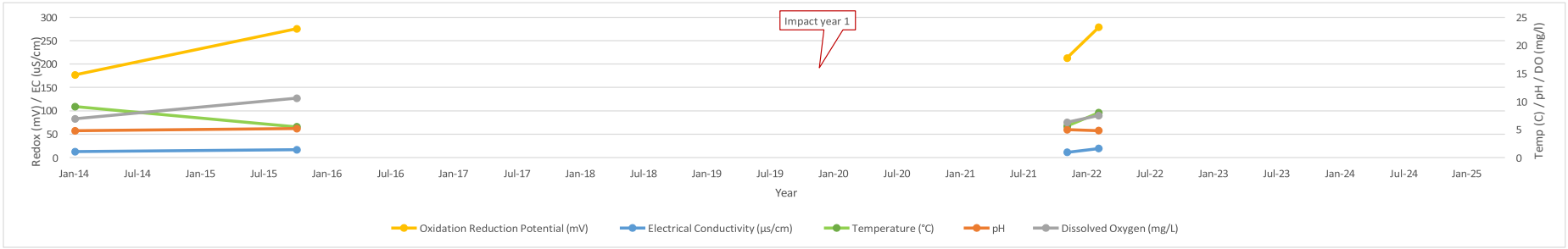
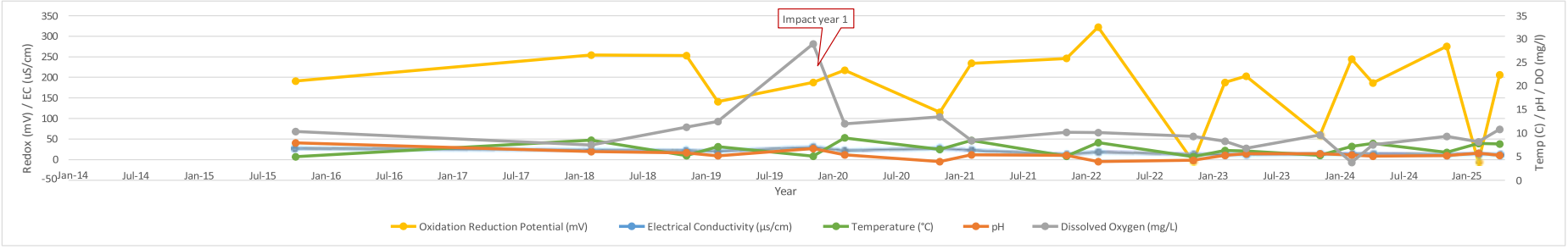
Appendix D
Purging Field Parameters

	Baseline					Impact														
	Jan-14	Oct-15	Feb-18	Nov-18	Feb-19	Nov-19	Feb-20	Nov-20	Feb-21	Nov-21	Feb-22	Nov-22	Feb-23	Apr-23	Nov-23	Feb-24	Apr-24	Nov-24	Feb-25	Apr-25
BH10																				
Temperature (°C)	9.1	5.5								5.6	8									
pH	4.79	5.18								5	4.81									
Dissolved Oxygen (mg/L)	6.91	10.59								6.3	7.48									
Oxidation Reduction Potential (mV)	177	275.5								212.7	278.9									
Electrical Conductivity (µs/cm)	12.6	17								11.5	19.6									



BH16																				
Temperature (°C)		5	8.5	5.2	7.1	5.13	9	6.57	8.46	5.1	8	5	6.3	6.2	5.3	7.2	7.8	5.9	7.8	7.7
pH		7.93	6.09	5.83	5.19	6.73	5.38	3.95	5.37	5.3	3.96	4.24	5.26	5.63	5.6	5.33	5.12	5.23	5.73	5.3
Dissolved Oxygen (mg/L)		10.38	7.5	11.3	**12.5**	**29**	**12**	13.45	8.44	10.2	10.11	9.34	8.3	6.76	9.63	**3.7888**	7.53	9.3	8.17	10.82
Oxidation Reduction Potential (mV)		191	254	253	141	187.67	217.6	114.97	234.13	246	322.1	-4.5	187.5	203.1	58.3	244.3	186.5	275.2	-5.7	205.9
Electrical Conductivity (µs/cm)		27	23.1	21.6	20.1	29.97	21.5	26.67	22.56	12.4	18.1	12.4	12.7	12.4	13.5	13.5	13.9	12.3	14.3	11.9



Note - Bold indicates value converted from ppm to mg/L

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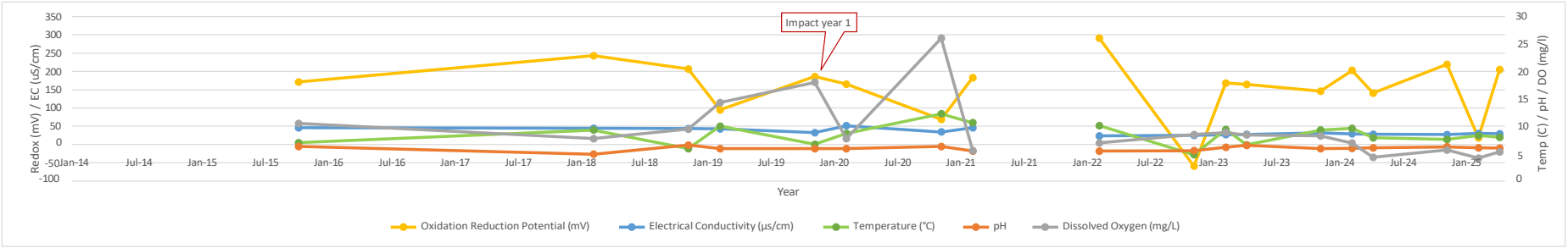
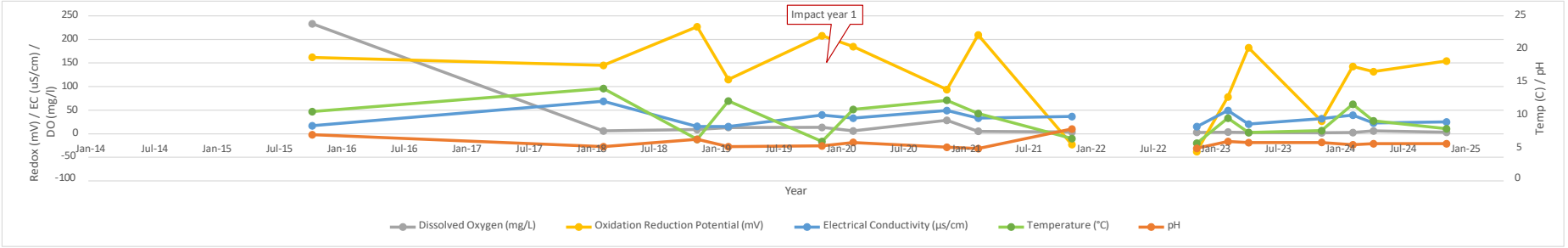
Appendix D
Purging Field Parameters

	Baseline					Impact														
	Jan-14	Oct-15	Feb-18	Nov-18	Feb-19	Nov-19	Feb-20	Nov-20	Feb-21	Nov-21	Feb-22	Nov-22	Feb-23	Apr-23	Nov-23	Feb-24	Apr-24	Nov-24	Feb-25	Apr-25
BH17																				
Temperature (°C)		7	9.3	5.9	10	6.7	8.67	12.27	10.63		10.1	4.8	9.4	6.6	9.3	9.6	7.9	7.6	8.3	8
pH		6.3	4.91	6.57	5.89	5.9	5.9	6.3	5.48		5.46	5.54	6.16	6.49	5.92	5.96	6.06	6.23	6.07	6.03
Dissolved Oxygen (mg/L)		10.52	7.76	9.47	**14.3**	**18**	7.73	26.06	5.58		6.93	8.5	8.85	8.41	8.22	**6.9269**	4.34	5.65	4.2	5.3
Oxidation Reduction Potential (mV)		171	243	207	95	186	165.07	68.67	182.86		291.5	-59	168.1	164.3	145.8	202.6	140.6	219	18.5	205.1
Electrical Conductivity (µs/cm)		46	44.4	43.3	43.1	32.7	51.3	34.23	45.46		23.6	25.3	26.8	27.6	31.8	29.1	28.1	27	29.9	29.7



BH18																				
Temperature (°C)		10.5	14	6.3	12.1	5.97	10.83	12.2	10.2	6.4		5.7	9.5	7.3	7.6	11.6	9.1	7.9		
pH		6.97	5.16	6.3	5.18	5.3	5.81	5.1	4.9	7.86		4.94	5.96	5.78	5.81	5.46	5.61	5.62		
Dissolved Oxygen (mg/L)		233.1	5.99	**8.6**	**13.1**	**13.6**	5.76	28.6	4.97	3.51		2.7	3.32	2.38	1.82	**2.4747**	5.93	2.83		
Oxidation Reduction Potential (mV)		161.9	145	227	115	207.67	184.9	93.7	209.7	-23.1		-37.8	77.9	182.6	26.8	142.8	131.4	154		
Electrical Conductivity (µs/cm)		17	68.8	15.4	15.3	39.67	33.07	49.3	33	36.4		14.95	49	20.1	31.8	39.3	22.4	25		



Note - Bold indicates value converted from ppm to mg/L

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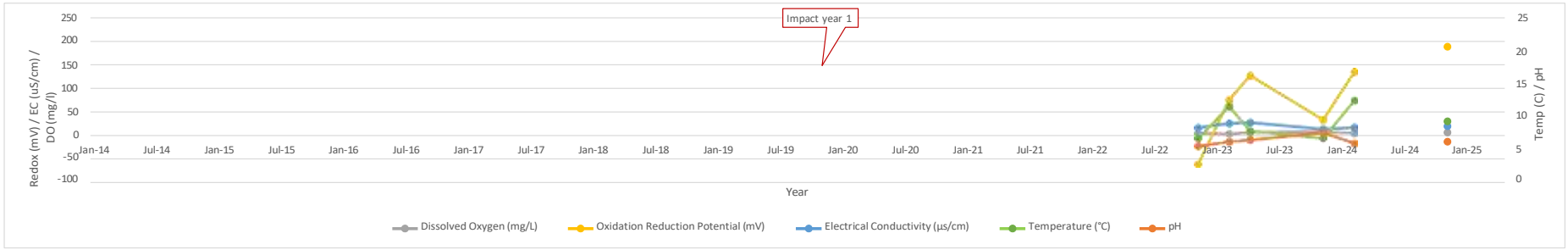
Appendix D
Purging Field Parameters

	Baseline					Impact														
	Jan-14	Oct-15	Feb-18	Nov-18	Feb-19	Nov-19	Feb-20	Nov-20	Feb-21	Nov-21	Feb-22	Nov-22	Feb-23	Apr-23	Nov-23	Feb-24	Apr-24	Nov-24	Feb-25	Apr-25
EWS West																				
Temperature (°C)												6.8	11.6	7.9	6.8	12.5		9.3		
pH												5.61	6.27	6.55	7.65	6.04		6.21		
Dissolved Oxygen (mg/L)												5.59	4.45	7.45	9.04	**5.7743**		6.55		
Oxidation Reduction Potential (mV)												-59.2	76.4	127.5	34.1	135.3		188.7		
Electrical Conductivity (µs/cm)												17.5	26.6	28.6	14.7	18.2		19.6		



Note - Bold indicates value converted from ppm to mg/L

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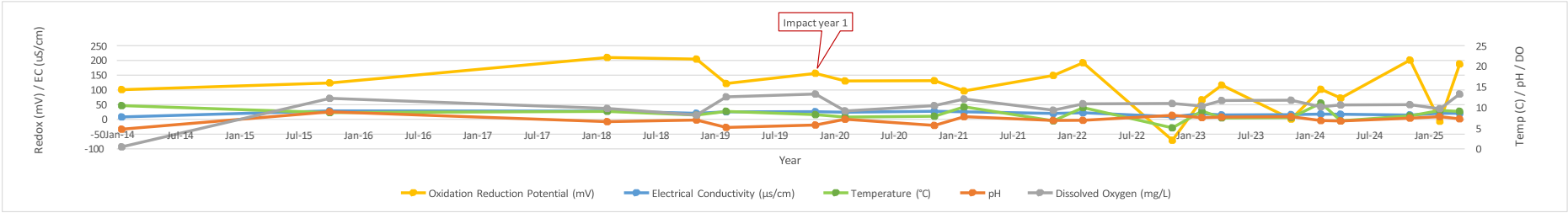
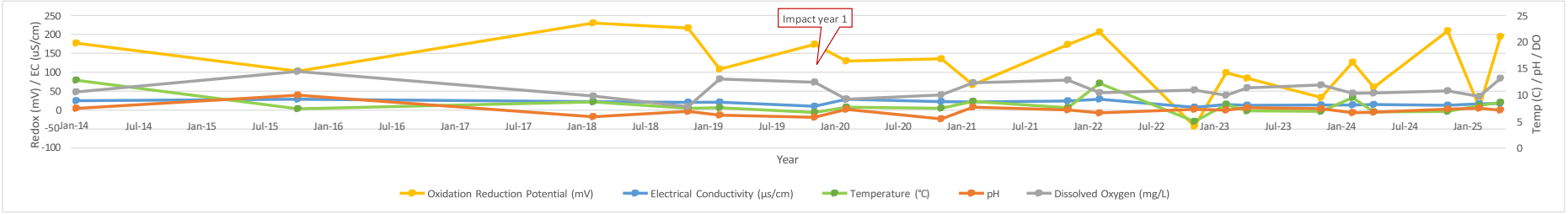
Appendix D
Surface Water
Field Parameters

	Baseline					Impact														
	Jan-14	Oct-15	Feb-18	Nov-18	Feb-19	Nov-19	Feb-20	Nov-20	Feb-21	Nov-21	Feb-22	Nov-22	Feb-23	Apr-23	Nov-23	Feb-24	Apr-24	Nov-24	Feb-25	Apr-25
Boggy Creek 1 p/u 1																				
Temperature (°C)	10.5	8.8	9.1	8.2	9.1	8.3	7.7	7.9	10.2	6.8	10	5.1	9.2	7.5	7.6	11.1	6.8	8	9.3	9.1
pH	4.79	9	6.6	7	5.2	5.8	7.2	5.7	7.8	6.9	6.92	8.15	7.57	7.7	7.8	6.86	6.78	7.45	7.82	7.28
Dissolved Oxygen (mg/L)	0.51	12.24	9.8	8.2	**12.6**	**13.3**	9.2	10.5	12.1	9.37	10.93	11	10.4	11.73	11.79	**10.1926**	10.64	10.71	9.72	13.3
Oxidation Reduction Potential (mV)	101	123.8	210	204.5	121.8	156.3	130.5	131.2	96.7	149	192	-70.8	66.3	116.2	1.3	102.2	72.4	201.2	-6.3	188
Electrical Conductivity (µs/cm)	8.5	29	28.3	20.6	25.8	26.3	24.6	27.5	25.9	20.2	22.8	9.3	19.5	15.2	16.2	18.3	17.4	15.1	20.7	20.9



Boggy Creek 1 p/u 2																				
Temperature (°C)	12.8	7.4	8.7	7.5	7.6	6.7	7.7	7.5	8.8	7.6	12.2	5	8.2	7	6.9	9.5	6.8	6.9	8	8.6
pH	7.47	9.97	5.9	6.9	6.2	5.8	7.3	5.5	7.7	7.2	6.62	7.3	7.14	7.59	7.41	6.65	6.76	7.33	7.5	7.14
Dissolved Oxygen (mg/L)	10.57	14.45	9.8	7.8	**13**	**12.4**	9.2	10	12.3	12.81	10.42	10.92	9.93	11.34	11.88	**10.3169**	10.36	10.77	9.72	13.11
Oxidation Reduction Potential (mV)	177	102.8	230	216.6	108.1	173.7	129.4	135.4	66.8	173	206	-42.6	98.6	84.4	33.3	126.4	60.2	209	7.5	193.7
Electrical Conductivity (µs/cm)	24.7	29	22.4	20.5	21	10.1	28.6	22.5	21.7	24.1	28.7	7.6	15	12.8	13.4	13.6	14.7	12.7	16.7	17.6



Note - Bold indicates value converted from ppm to mg/L

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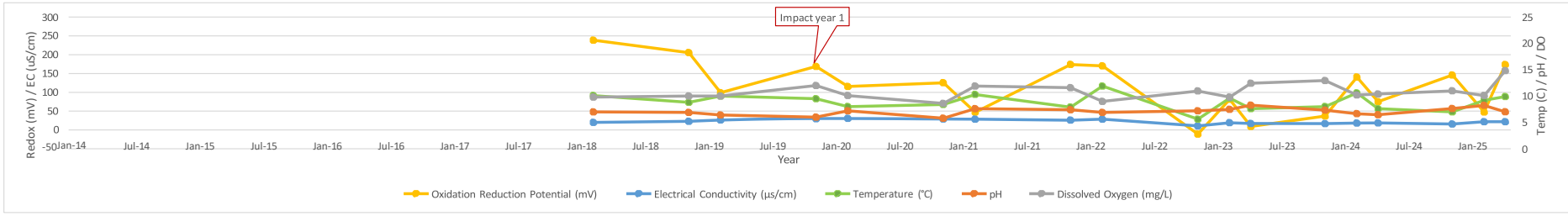
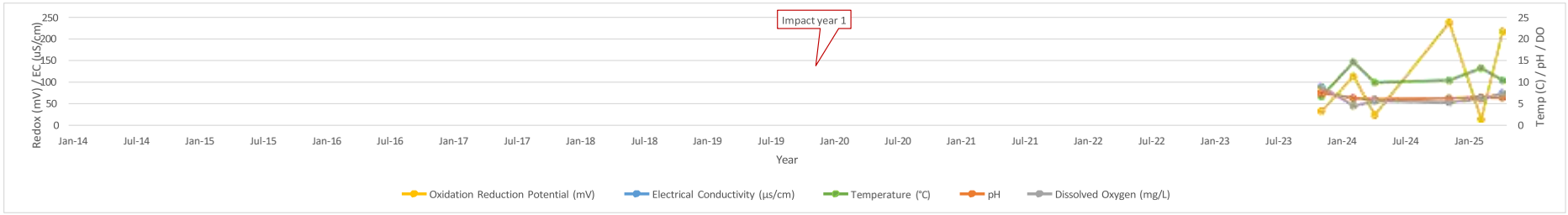
Appendix D
Surface Water
Field Parameters

	Baseline					Impact														
	Jan-14	Oct-15	Feb-18	Nov-18	Feb-19	Nov-19	Feb-20	Nov-20	Feb-21	Nov-21	Feb-22	Nov-22	Feb-23	Apr-23	Nov-23	Feb-24	Apr-24	Nov-24	Feb-25	Apr-25
Boggy Creek 2																				
Temperature (°C)			10.1	8.8	10	9.5	8	8.4	10.3	7.9	11.9	5.6	9.6	7.6	8	10.6	7.6	7	9.2	9.9
pH			7	6.9	6.4	6	7.2	5.8	7.6	7.4	6.9	7.19	7.47	8.27	7.33	6.65	6.46	7.64	8.23	7.01
Dissolved Oxygen (mg/L)			9.8	10	**10**	**12**	10.1	8.6	11.9	11.6	8.99	10.97	9.8	12.43	12.94	**10.2039**	10.39	10.99	10.1	14.84
Oxidation Reduction Potential (mV)			238.6	205.5	99.1	168.7	115.4	125.4	47	174	170.2	-11.1	81.4	9.3	36.7	140.4	75	145.9	47.5	173.8
Electrical Conductivity (µs/cm)			20	23	26.4	29.6	30.6	28.9	28.7	25.9	28.5	10.8	19.1	17.1	16.8	18.2	18.5	15.6	21.7	21.9



EWS East																				
Temperature (°C)															6.8	14.7	10	10.5	13.3	10.5
pH															7.65	6.4	6.13	6.37	6.62	6.5
Dissolved Oxygen (mg/L)															9.04	**4.6206**	5.69	5.43	6.21	7.55
Oxidation Reduction Potential (mV)															34.1	114.2	25.5	237.4	15.2	217.3
Electrical Conductivity (µs/cm)															14.7	22.1	16.5	15.1	24	23.6



Note - Bold indicates value converted from ppm to mg/L

Appendix E

Laboratory results

Appendix E
Table 1
Analytical Results

ARV

Location Code				**BH06**						
Period (Baseline/Impact)				**Baseline**				**Impact**		
Date /Time				12/02/2014	27/10/2015	27/10/2015	15/02/2018	25/11/2020	09/02/2021	23/11/2021	15/02/2022	17/11/2022
Lab Report Number				EM1401293	477470	479595	18-09444	870256	893814	933545	956224	EM2222893
Sample Code				EM1401293004	M15-Oc20501	M15-No11474	18-09444_5546157	6787594	6877651	7249146	7353389	EM2222893005
Date /Time				41682.625	42304	42304	43146	44160	44236	44523	44607	44882.625
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	-	-	4.980	-	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	-	10.4
Inorganics												
pH (Lab)	pH units	0.01		7.05	5.6	-	-	4.1	6	5.26	4.09	6.02
pH Redox	pH units	0.01		-	-	-	-	-	-	-	-	5.79
Electrical conductivity (lab)	µS/cm	1		45	24	-	51	36.5	53.2	18.5	34.2	32
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	10.25	8.72	9.3	9.09	-
Redox (Lab)	mV	0.1		-	-	-	-	-	225.1	219.5	298.4	256
Temperature	°C			-	-	-	-	7.1	6.8	5.5	7.9	-
Turbidity	NTU	0.1		-	650	-	-	-	-	160	210	7.9
Total Dissolved Solids	mg/L	5		33	16	-	42	-	-	-	-	27
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	12	36	15	38	-
Total Suspended Solids	mg/L	1		-	700	-	-	-	-	-	-	-
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<10	-	<2	<2	<2	<2	<2	<1
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	<20	-	2	-	-	-	-	2
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	5	3	4	<2	-
Alkalinity (total as CaCO3)	mg/L	1		4	<20	-	-	-	-	-	-	2
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	0.1		-	1.5	-	3.0	2.2	3.5	1.3	3.2	-
Calcium (filtered)	mg/L	0.1		1	-	-	-	-	-	-	-	2
Magnesium	mg/L	0.1		-	0.6	-	1.2	2.2	5.4	0.5	1.3	-
Magnesium (filtered)	mg/L	0.1		<1	-	-	-	-	-	-	-	<1
Potassium	mg/L	0.1		-	0.5	-	0.4	1.8	3.8	0.3	0.5	-
Potassium (filtered)	mg/L	0.1		<1	-	-	-	-	-	-	-	<1
Sodium	mg/L	0.1		-	2.1	-	2.1	2.3	2.8	1.5	2.1	-
Sodium (filtered)	mg/L	0.1		4	-	-	-	-	-	-	-	2
Chloride	mg/L	1		2	1.3	-	2	1	2	<1	2	1
Sulfate	mg/L	1		-	-	-	<1	-	-	-	-	-
Sulfate (filtered)	mg/L	1		<1	-	-	-	-	-	-	-	<1
Sulfate as S	mg/L	5		-	<5	-	-	<1	<1	<1	<1	-
Cations Total	meq/L	0.01		0.22	-	-	-	-	-	-	-	0.19
Anions Total	meq/L	0.01		0.14	-	-	-	-	-	-	-	0.07
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	1.2	-	4.9	-	-	-	-	2.13
Nitrite (as N)	mg/L	0.01		<0.01	<0.02	-	-	-	-	-	-	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	1.2	-	4.9	1.9	5.1	1.2	5.6	2.13
Nitrogen (Total)	mg/L	0.1		-	1.4	-	5.3	2.3	5.4	1.4	6.2	2.9
Kjeldahl Nitrogen Total	mg/L	0.1		-	<0.2	-	0.5	0.4	0.3	0.2	0.6	0.8
Phosphate total (P)	mg/L	0.05		-	0.49	-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	-	-	<0.05	<0.05	<0.05	<0.05	0.2	<0.01

Appendix E
Table 1
Analytical Results

Location Code				**BH06**						
Period (Baseline/Impact)				**Impact**						
Date /Time				12/02/2014	16/02/2023	19/04/2023	15/11/2023	06/02/2024	10/04/2024	20/11/2024	19/02/2025
Lab Report Number				EM1401293	23-14906	EM2306987	EM2320487	EM2401890	EM2405745	1163576	1190470
Sample Code				EM1401293004	23-14906_8321066	EM2306987006	EM2320487001	EM2401890005	EM2405745009	M24-No0064669	M25-Fe0053822
Date /Time				41682.625	44973	45035.625	45245.625	45328.625	45392.625	45616	45707
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26								
Field Parameters											
pH (Field)	pH units			-	-	-	-	-	-	-	-
NA											
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	-
Inorganics											
pH (Lab)	pH units	0.01		7.05	-	5.07	5.78	-	-	-	-
pH Redox	pH units	0.01		-	-	-	-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	57	53	31	29	58	19	43
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	-	-	-
Temperature	°C			-	-	-	-	-	-	-	-
Turbidity	NTU	0.1		-	29	-	19.4	40.5	4.8	8.8	1.3
Total Dissolved Solids	mg/L	5		33	35	80	15	45	53	55	52[#4]
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	1		-	-	<5	-	-	-	-	-
Acidity & Alkalinity											
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<2	<1	<1	<1	<1	<10	<10
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	<2	<1	3	3	2	<20	<20
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	<2	<1	3	3	2	<20	<20
Hardness as CaCO3	mg/L	1		-	-	14	-	-	-	-	-
Major Ions											
Calcium	mg/L	0.1		-	2.1	-	-	-	-	-	2.8
Calcium (filtered)	mg/L	0.1		1	-	4	2	2	3	1.1	-
Magnesium	mg/L	0.1		-	0.8	-	-	-	-	-	1.1
Magnesium (filtered)	mg/L	0.1		<1	-	1	<1	<1	1	<0.5	-
Potassium	mg/L	0.1		-	0.4	-	-	-	-	-	0.5
Potassium (filtered)	mg/L	0.1		<1	-	<1	<1	<1	<1	<0.5	-
Sodium	mg/L	0.1		-	1.5	-	-	-	-	-	2.2
Sodium (filtered)	mg/L	0.1		4	-	2	2	2	2	1.5	-
Chloride	mg/L	1		2	2	2	1	1	2	<1	1.7
Sulfate	mg/L	1		-	<1	-	-	-	-	<5	<5
Sulfate (filtered)	mg/L	1		<1	-	7	<1	<1	<1	-	-
Sulfate as S	mg/L	5		-	-	-	-	-	-	-	-
Cations Total	meq/L	0.01		0.22	-	0.37	0.19	0.19	0.32	-	-
Anions Total	meq/L	0.01		0.14	-	0.20	0.09	0.09	0.10	-	-
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-
Nutrients											
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	0.04	-	<0.01	0.28	0.09	<0.01
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	5.1	4.69	2.55	2.26	4.91	1.3	4.6
Nitrite (as N)	mg/L	0.01		<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.02	<0.02
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	5.1	4.69	2.55	2.26	4.91	1.3	4.6
Nitrogen (Total)	mg/L	0.1		-	5.7	5.3	2.8	2.5	5.3	1.3	5.1
Kjeldahl Nitrogen Total	mg/L	0.1		-	0.6	0.6	0.2	0.2	0.4	<0.2	0.5
Phosphate total (P)	mg/L	0.05		-	-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	<0.05	0.03	0.02	0.08	<0.01	<0.01	<0.01

Appendix E
Table 1
Analytical Results

ARV

Location Code				**BH09**							
Period (Baseline/Impact)				**Baseline**					**Impact**			
Date /Time				12/02/2014	12/02/2014	27/10/2015	27/10/2015	14/02/2018	16/11/2022	16/02/2023	19/04/2023	15/11/2023
Lab Report Number				EM1401293	EM1401293	477470	479595	18-09453	EM2222893	23-14906	EM2306987	EM2320487
Sample Code				EM1401293004	EM1401293005	M15-Oc20500	M15-No11471	18-09453_5546205	EM2222893006	23-14906_8321067	EM2306987007	EM2320487002
Date /Time				41682.625	41682.625	42304	42304	43145	44881.625	44973	45035.625	45245.625
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	-	-	-	5.693	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	10.1	-	-	-
Inorganics												
pH (Lab)	pH units	0.01		7.05	7.15	6	-	-	6.22	-	5.94	5.58
pH Redox	pH units	0.01		-	-	-	-	-	5.90	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	34	-	19	16	14	23	20	18
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	2,600	-	-	-
Temperature	°C			-	-	-	-	-	-	-	-	-
Turbidity	NTU	0.1		-	-	-	-	-	4.8	53	-	5.3
Total Dissolved Solids	mg/L	5		33	30	-	12	12	11	12	44	<10
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	1		-	-	-	-	-	-	-	39	-
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<1	-	<10	<2	<1	<2	<1	<1
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	11	-	<20	4	3	4	3	2
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	11	<20	<20	-	3	4	3	2
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-	-	2	-
Major Ions												
Calcium	mg/L	0.1		-	-	-	1.3	0.7	-	0.9	-	-
Calcium (filtered)	mg/L	0.1		1	1	-	-	-	<1	-	1	1
Magnesium	mg/L	0.1		-	-	-	<0.5	0.3	-	0.4	-	-
Magnesium (filtered)	mg/L	0.1		<1	<1	-	-	-	<1	-	<1	<1
Potassium	mg/L	0.1		-	-	-	<0.5	0.1	-	0.1	-	-
Potassium (filtered)	mg/L	0.1		<1	<1	-	-	-	<1	-	<1	<1
Sodium	mg/L	0.1		-	-	-	1.4	1.2	-	0.8	-	-
Sodium (filtered)	mg/L	0.1		4	5	-	-	-	<1	-	1	1
Chloride	mg/L	1		2	2	-	<1	1	<1	1	1	1
Sulfate	mg/L	1		-	-	-	-	<1	-	<1	-	-
Sulfate (filtered)	mg/L	1		<1	1	-	-	-	1	-	<1	1
Sulfate as S	mg/L	5		-	-	-	<5	-	-	-	-	-
Cations Total	meq/L	0.01		0.22	0.27	-	-	-	<0.01	-	0.09	0.09
Anions Total	meq/L	0.01		0.14	0.3	-	-	-	0.08	-	0.09	0.09
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	-	-	-	-	-	<0.02[#5]	-
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.27	-	0.57	0.50	0.23	0.84	0.84	0.65
Nitrite (as N)	mg/L	0.01		<0.01	<0.01	-	<0.02	-	<0.01	-	<0.01	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.27	-	0.57	0.51	0.23	0.84	0.84	0.65
Nitrogen (Total)	mg/L	0.1		-	-	-	-	0.7	0.4	1.0	0.9	0.8
Kjeldahl Nitrogen Total	mg/L	0.1		-	-	-	-	0.2	0.2	0.2	0.1	0.1
Phosphate total (P)	mg/L	0.05		-	-	-	<0.05	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	-	-	-	0.07	<0.01	0.05	0.04	0.02

Appendix E
Table 1
Analytical Results

Location Code				**BH09**					
Period (Baseline/Impact)				**Impact**					
Date /Time				12/02/2014	06/02/2024	10/04/2024	20/11/2024	19/02/2025	22/04/2025
Lab Report Number				EM1401293	EM2401890	EM2405745	1163576	1190470	1213018
Sample Code				EM1401293004	EM2401890006	EM2405745007	M24-No0064670	M25-Fe0053823	M25-Ap0065761
Date /Time				41682.625	45328.625	45392.625	45616	45707	45769
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26						
Field Parameters									
pH (Field)	pH units			-	-	-	-	-	-
NA									
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-
Inorganics									
pH (Lab)	pH units	0.01		7.05	-	-	-	-	-
pH Redox	pH units	0.01		-	-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	19	21	21	18	19
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	-
Temperature	°C			-	-	-	-	-	-
Turbidity	NTU	0.1		-	12.0	39.5	<1	14	39
Total Dissolved Solids	mg/L	5		33	72	27	57	34[#4]	48
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-	-
Total Suspended Solids	mg/L	1		-	-	-	-	-	-
Acidity & Alkalinity									
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<1	<1	<10	<10	<10
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	5	6	<20	<20	<20
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	5	6	<20	<20	<20
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-
Major Ions									
Calcium	mg/L	0.1		-	-	-	-	1.2	1.1
Calcium (filtered)	mg/L	0.1		1	1	1	1.6	-	-
Magnesium	mg/L	0.1		-	-	-	-	0.5	<0.5
Magnesium (filtered)	mg/L	0.1		<1	<1	<1	0.7	-	-
Potassium	mg/L	0.1		-	-	-	-	<0.5	<0.5
Potassium (filtered)	mg/L	0.1		<1	<1	<1	<0.5	-	-
Sodium	mg/L	0.1		-	-	-	-	1.3	1.9
Sodium (filtered)	mg/L	0.1		4	1	1	1.0	-	-
Chloride	mg/L	1		2	1	1	<1	1.1	<1
Sulfate	mg/L	1		-	-	-	<5	<5	<5
Sulfate (filtered)	mg/L	1		<1	<1	<1	-	-	-
Sulfate as S	mg/L	5		-	-	-	-	-	-
Cations Total	meq/L	0.01		0.22	0.09	0.09	-	-	-
Anions Total	meq/L	0.01		0.14	0.13	0.15	-	-	-
Ionic Balance	%	0.01		-	-	-	-	-	-
Nutrients									
Ammonia as N	mg/L	0.01	0.32[#1]	-	<0.01	0.04	<0.01	<0.01	<0.01
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.54	0.56	0.87	0.67	0.61
Nitrite (as N)	mg/L	0.01		<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.54	0.56	0.87	0.67	0.62
Nitrogen (Total)	mg/L	0.1		-	0.5	0.6	1.2	1.0	1.2
Kjeldahl Nitrogen Total	mg/L	0.1		-	<0.1	<0.1	0.3	0.3	0.6
Phosphate total (P)	mg/L	0.05		-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	<0.01	0.03	<0.01	<0.01	<0.01

Appendix E
Table 1
Analytical Results

ARV

Location Code				BH16						
Period (Baseline/Impact)				Baseline				Impact		
Date /Time				12/02/2014	27/10/2015	27/10/2015	15/02/2018	25/11/2020	09/02/2021	23/11/2021	15/02/2022	17/11/2022
Lab Report Number				EM1401293	477470	479595	18-09455	870535	893780	933560	956224	EM2222893
Sample Code				EM1401293004	M15-Oc20497	M15-No11485	18-09455_5546208	6787665	6877669	7249186	7353388	EM2222893007
Date /Time				41682.625	42304	42304	43146	44160	44236	44523	44607	44882.625
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	-	-	6.09	-	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	-	10.2
Inorganics												
pH (Lab)	pH units	0.01		7.05	5.8	-	-	3.9	5.4	5.3	3.96	6.48
pH Redox	pH units	0.01		-	-	-	-	-	-	-	-	5.83
Electrical conductivity (lab)	µS/cm	1		45	21	-	21	26.6	22.6	24.6	18.1	22
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	13.54	8.4	10.2	10.11	-
Redox (Lab)	mV	0.1		-	-	-	-	-	232.2	246	322.1	270
Temperature	°C			-	-	-	-	6.4	8.5	5.1	8	-
Turbidity	NTU	0.1		-	5.8	-	-	-	-	130	1,200	20.1
Total Dissolved Solids	mg/L	5		33	14	-	15	-	-	-	-	26
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	15	11	12	12	-
Total Suspended Solids	mg/L	1		-	2.7	-	-	-	-	-	-	-
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<10	-	<2	<2	<2	<2	<2	<1
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	<20	-	5	-	-	-	-	6
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	6	6	4	4	-
Alkalinity (total as CaCO3)	mg/L	1		4	<20	-	-	-	-	-	-	6
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	0.1		-	1.4	-	0.8	3.1	1.9	0.9	0.8	-
Calcium (filtered)	mg/L	0.1		1	-	-	-	-	-	-	-	1
Magnesium	mg/L	0.1		-	<0.5	-	0.3	9.3	4.8	0.2	0.2	-
Magnesium (filtered)	mg/L	0.1		<1	-	-	-	-	-	-	-	<1
Potassium	mg/L	0.1		-	<0.5	-	0.1	2.6	1.5	0.2	0.1	-
Potassium (filtered)	mg/L	0.1		<1	-	-	-	-	-	-	-	<1
Sodium	mg/L	0.1		-	1.9	-	1.6	2.8	2.2	2.1	1.6	-
Sodium (filtered)	mg/L	0.1		4	-	-	-	-	-	-	-	2
Chloride	mg/L	1		2	1.1	-	1	1	2	1	1	1
Sulfate	mg/L	1		-	-	-	<1	-	-	-	-	-
Sulfate (filtered)	mg/L	1		<1	-	-	-	-	-	-	-	<1
Sulfate as S	mg/L	5		-	<5	-	-	<1	<1	<1	<1	-
Cations Total	meq/L	0.01		0.22	-	-	-	-	-	-	-	0.14
Anions Total	meq/L	0.01		0.14	-	-	-	-	-	-	-	0.15
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	1.1	-	0.83	-	-	-	-	0.84
Nitrite (as N)	mg/L	0.01		<0.01	<0.02	-	-	-	-	-	-	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	1.1	-	0.84	0.98	0.81	0.84	0.7	0.84
Nitrogen (Total)	mg/L	0.1		-	1.2	-	1.1	1.5	1.2	0.8	2.1	1.1
Kjeldahl Nitrogen Total	mg/L	0.1		-	<0.2	-	0.3	0.5	0.3	<0.1	1.5	0.3
Phosphate total (P)	mg/L	0.05		-	<0.05	-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	-	-	<0.05	<0.05	0.06	<0.05	3.6	<0.01

Appendix E
Table 1
Analytical Results

ARV

Location Code				**BH16**							
Period (Baseline/Impact)				**Impact**							
Date /Time				12/02/2014	16/02/2023	19/04/2023	15/11/2023	07/02/2024	10/04/2024	20/11/2024	19/02/2025	22/04/2025
Lab Report Number				EM1401293	23-14906	EM2306987	EM2320487	EM2401890	EM2405745	1163576	1190470	1213018
Sample Code				EM1401293004	23-14906_8321068	EM2306987008	EM2320487003	EM2401890007	EM2405745010	M24-No0064671	M25-Fe0053824	M25-Ap0065762
Date /Time				41682.625	44973	45035.625	45245.625	45329.625	45392.625	45616	45707	45769
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	-	-	-	-	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	-	-
Inorganics												
pH (Lab)	pH units	0.01		7.05	-	6.00	5.78	-	-	-	-	-
pH Redox	pH units	0.01		-	-	-	-	-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	18	17	17	17	19	19	19	18
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	-	-	-	-
Temperature	°C			-	-	-	-	-	-	-	-	-
Turbidity	NTU	0.1		-	36	-	23.7	158	89.8	14	3.5	180
Total Dissolved Solids	mg/L	5		33	10	42	<10	66	25	13	<10	64
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	1		-	-	61	-	-	-	-	-	-
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<2	<1	<1	<1	<1	<10	<10	<10
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	3	3	2	4	4	<20	<20	<20
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	3	3	2	4	4	<20	<20	<20
Hardness as CaCO3	mg/L	1		-	-	<1	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	0.1		-	0.5	-	-	-	-	-	0.9	1.0
Calcium (filtered)	mg/L	0.1		1	-	<1	1	<1	<1	1.1	-	-
Magnesium	mg/L	0.1		-	0.2	-	-	-	-	-	<0.5	<0.5
Magnesium (filtered)	mg/L	0.1		<1	-	<1	<1	<1	<1	<0.5	-	-
Potassium	mg/L	0.1		-	<0.1	-	-	-	-	-	<0.5	<0.5
Potassium (filtered)	mg/L	0.1		<1	-	<1	<1	<1	<1	<0.5	-	-
Sodium	mg/L	0.1		-	1.3	-	-	-	-	-	1.8	3.4
Sodium (filtered)	mg/L	0.1		4	-	2	2	2	2	2.0	-	-
Chloride	mg/L	1		2	1	1	1	1	1	<1	1.4	50
Sulfate	mg/L	1		-	<1	-	-	-	-	<5	<5	100
Sulfate (filtered)	mg/L	1		<1	-	<1	<1	<1	<1	-	-	-
Sulfate as S	mg/L	5		-	-	-	-	-	-	-	-	-
Cations Total	meq/L	0.01		0.22	-	0.09	0.14	0.09	0.09	-	-	-
Anions Total	meq/L	0.01		0.14	-	0.09	0.07	0.11	0.11	-	-	-
Ionic Balance	%	0.01		-	-	0.66	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	0.10	-	<0.01	<0.01	0.06	0.49	<0.01
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.72	0.74	0.92	0.89	0.92	1.1	0.93	0.82
Nitrite (as N)	mg/L	0.01		<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.73	0.74	0.92	0.89	0.92	1.1	0.93	0.82
Nitrogen (Total)	mg/L	0.1		-	0.7	0.9	0.9	1.5	1.1	1.4	1.4	1.0
Kjeldahl Nitrogen Total	mg/L	0.1		-	<0.1	0.2	<0.1	0.6	0.2	0.3	0.5	0.2
Phosphate total (P)	mg/L	0.05		-	-	-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	0.07	0.08	0.03	0.38	0.19	<0.01	<0.01	0.11

Appendix E
Table 1
Analytical Results

ARV

Location Code					**BH17**						
Period (Baseline/Impact)					**Baseline**				**Impact**		
Date /Time				12/02/2014	27/10/2015	27/10/2015	14/02/2018	25/11/2020	09/02/2021	15/02/2022	16/11/2022	16/02/2023
Lab Report Number				EM1401293	477470	479595	18-09454	870535	893780	956224	EM2222893	23-14906
Sample Code				EM1401293004	M15-Oc20499	M15-No11470	18-09454_5546207	6787666	6877670	7353387	EM2222893008	23-14906_8321069
Date /Time				41682.625	42304	42304	43145	44160	44236	44607	44881.625	44973
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	-	-	4.91	-	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	9.7	-
Inorganics												
pH (Lab)	pH units	0.01		7.05	6.4	-	-	7.64	5.48	5.46	6.79	-
pH Redox	pH units	0.01		-	-	-	-	-	-	-	6.70	-
Electrical conductivity (lab)	µS/cm	1		45	-	46	43	33.3	45.5	23.6	45	44
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	25.78	5.56	6.93	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	181.7	291.5	272	-
Temperature	°C			-	-	-	-	12.2	10.6	10.1	-	-
Turbidity	NTU	0.1		-	-	-	-	-	-	340	140	21
Total Dissolved Solids	mg/L	5		33	-	30	30	-	-	-	44	22
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	30	34	32	-	-
Total Suspended Solids	mg/L	1		-	-	-	-	-	-	-	-	-
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	-	<10	<2	<2	<2	<2	<1	<2
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	-	<20	15	-	-	-	15	16
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	20	20	21	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	<20	<20	-	-	-	-	15	16
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	0.1		-	-	3.2	2.3	3.8	3	2.5	-	3.1
Calcium (filtered)	mg/L	0.1		1	-	-	-	-	-	-	3	-
Magnesium	mg/L	0.1		-	-	0.9	0.8	1.7	1.3	0.9	-	1.1
Magnesium (filtered)	mg/L	0.1		<1	-	-	-	-	-	-	1	-
Potassium	mg/L	0.1		-	-	<0.5	0.3	1.3	0.8	0.3	-	0.5
Potassium (filtered)	mg/L	0.1		<1	-	-	-	-	-	-	<1	-
Sodium	mg/L	0.1		-	-	3.2	2.8	4.3	3.6	3.1	-	3.8
Sodium (filtered)	mg/L	0.1		4	-	-	-	-	-	-	4	-
Chloride	mg/L	1		2	-	1.0	1	2	1	1	1	2
Sulfate	mg/L	1		-	-	-	<1	-	-	-	-	<1
Sulfate (filtered)	mg/L	1		<1	-	-	-	-	-	-	<1	-
Sulfate as S	mg/L	5		-	-	<5	-	<1	<1	<1	-	-
Cations Total	meq/L	0.01		0.22	-	-	-	-	-	-	0.40	-
Anions Total	meq/L	0.01		0.14	-	-	-	-	-	-	0.33	-
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	-	1.1	1.2	-	-	-	1.11	0.64
Nitrite (as N)	mg/L	0.01		<0.01	-	<0.02	-	-	-	-	<0.01	-
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	-	1.1	1.2	1.1	0.9	0.46	1.11	0.65
Nitrogen (Total)	mg/L	0.1		-	-	-	1.5	2	1.1	1	1.4	0.8
Kjeldahl Nitrogen Total	mg/L	0.1		-	-	-	0.3	0.8	0.2	0.5	0.3	0.1
Phosphate total (P)	mg/L	0.05		-	-	<0.05	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	-	-	0.05	<0.05	0.06	0.51	0.05	0.10

Appendix E
Table 1
Analytical Results

Location Code				**BH17**						
Period (Baseline/Impact)				**Impact**						
Date /Time				12/02/2014	19/04/2023	15/11/2023	07/02/2024	10/04/2024	20/11/2024	19/02/2025	23/04/2025
Lab Report Number				EM1401293	EM2306987	EM2320487	EM2401890	EM2405745	1163576	1190470	1213018
Sample Code				EM1401293004	EM2306987009	EM2320487004	EM2401890008	EM2405745008	M24-No0064672	M25-Fe0053825	M25-Ap0065763
Date /Time				41682.625	45035.625	45245.625	45329.625	45392.625	45616	45707	45770
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26								
Field Parameters											
pH (Field)	pH units			-	-	-	-	-	-	-	-
NA											
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	-
Inorganics											
pH (Lab)	pH units	0.01		7.05	6.36	6.13	-	-	-	-	-
pH Redox	pH units	0.01		-	-	-	-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	40	38	38	42	41	40	39
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	-	-	-
Temperature	°C			-	-	-	-	-	-	-	-
Turbidity	NTU	0.1		-	-	3.0	16.3	33.5	160	<1	100
Total Dissolved Solids	mg/L	5		33	52	20	59	55	79	64[#4]	40
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	1		-	88	-	-	-	-	-	-
Acidity & Alkalinity											
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<1	<1	<1	<1	<10	<10	<10
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	26	13	16	18	48	27	24
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	26	13	16	18	48	27	24
Hardness as CaCO3	mg/L	1		-	7	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	0.1		-	-	-	-	-	-	3.0	3.2
Calcium (filtered)	mg/L	0.1		1	3	3	4	3	3.1	-	-
Magnesium	mg/L	0.1		-	-	-	-	-	-	1.0	1.1
Magnesium (filtered)	mg/L	0.1		<1	<1	1	1	1	1.1	-	-
Potassium	mg/L	0.1		-	-	-	-	-	-	<0.5	1.2
Potassium (filtered)	mg/L	0.1		<1	<1	<1	<1	<1	<0.5	-	-
Sodium	mg/L	0.1		-	-	-	-	-	-	3.6	4.2
Sodium (filtered)	mg/L	0.1		4	4	4	4	4	4.0	-	-
Chloride	mg/L	1		2	1	1	1	2	<1	<1	<1
Sulfate	mg/L	1		-	-	-	-	-	<5	<5	<5
Sulfate (filtered)	mg/L	1		<1	<1	<1	<1	<1	-	-	-
Sulfate as S	mg/L	5		-	-	-	-	-	-	-	-
Cations Total	meq/L	0.01		0.22	0.32	0.40	0.46	0.40	-	-	-
Anions Total	meq/L	0.01		0.14	0.55	0.29	0.35	0.42	-	-	-
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-
Nutrients											
Ammonia as N	mg/L	0.01	0.32[#1]	-	0.16	-	<0.01	0.03	<0.01	<0.01	0.02
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.55	<0.01	0.52	0.32	0.07	0.58	0.17
Nitrite (as N)	mg/L	0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.55	<0.01	0.52	0.32	<0.05	0.58	0.17
Nitrogen (Total)	mg/L	0.1		-	0.8	<0.1	0.8	0.3	<0.2	0.8	1.0
Kjeldahl Nitrogen Total	mg/L	0.1		-	0.2	<0.1	0.3	<0.1	<0.2	0.2	0.8
Phosphate total (P)	mg/L	0.05		-	-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	0.13	0.03	0.10	0.02	0.02	<0.01	0.06

Appendix E
Table 1
Analytical Results

ARV

Location Code				BH18						
Period (Baseline/Impact)				Baseline				Impact		
Date /Time				12/02/2014	27/10/2015	27/10/2015	15/02/2018	25/11/2020	09/02/2021	23/11/2021	16/11/2022	16/02/2023
Lab Report Number				EM1401293	477470	479595	18-09462	870535	893780	933560	EM2222893	23-14906
Sample Code				EM1401293004	M15-Oc20513	M15-No11484	18-09462_5546351	6787667	6877671	7249188	EM2222893009	23-14906_8321070
Date /Time				41682.625	42304	42304	43146	44160	44236	44523	44881.625	44973
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	-	-	-	-	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	9.3	-
Inorganics												
pH (Lab)	pH units	0.01		7.05	5.9	-	-	5.1	4.85	7.86	6.49	-
pH Redox	pH units	0.01		-	-	-	-	-	-	-	5.95	-
Electrical conductivity (lab)	µS/cm	1		45	29	-	25	49.3	33.3	36.4	25	38
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	28.32	5.12	3.51	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	211.5	-23.1	279	-
Temperature	°C			-	-	-	-	12.1	10.2	6.4	-	-
Turbidity	NTU	0.1		-	120	-	-	-	-	2,500	36.3	190
Total Dissolved Solids	mg/L	5		33	19	-	18	-	-	-	25	22
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	20	21	20	-	-
Total Suspended Solids	mg/L	1		-	120	-	-	-	-	-	-	-
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<10	-	<2	<2	<2	<2	<1	<2
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	<20	-	12	-	-	-	9	16
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	18	15	13	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	<20	-	-	-	-	-	9	16
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	0.1		-	1.8	-	1.5	7	3.6	5.3	-	1.6
Calcium (filtered)	mg/L	0.1		1	-	-	-	-	-	-	2	-
Magnesium	mg/L	0.1		-	0.6	-	0.5	10	3.6	9.6	-	0.6
Magnesium (filtered)	mg/L	0.1		<1	-	-	-	-	-	-	<1	-
Potassium	mg/L	0.1		-	<0.5	-	0.1	4.8	2.2	3.6	-	0.2
Potassium (filtered)	mg/L	0.1		<1	-	-	-	-	-	-	<1	-
Sodium	mg/L	0.1		-	3.9	-	3.2	4.8	3.3	3.4	-	2.4
Sodium (filtered)	mg/L	0.1		4	-	-	-	-	-	-	2	-
Chloride	mg/L	1		2	1.9	-	1	2	2	2	1	2
Sulfate	mg/L	1		-	-	-	1	-	-	-	-	<1
Sulfate (filtered)	mg/L	1		<1	-	-	-	-	-	-	<1	-
Sulfate as S	mg/L	5		-	<5	-	-	<1	<1	<1	-	-
Cations Total	meq/L	0.01		0.22	-	-	-	-	-	-	0.19	-
Anions Total	meq/L	0.01		0.14	-	-	-	-	-	-	0.21	-
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	<0.02	-	0.06	-	-	-	<0.01	0.01
Nitrite (as N)	mg/L	0.01		<0.01	<0.02	-	-	-	-	-	<0.01	-
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	<0.05	-	0.06	0.02	0.01	<0.01	<0.01	0.02
Nitrogen (Total)	mg/L	0.1		-	<0.2	-	1.1	0.8	0.3	0.5	0.3	0.2
Kjeldahl Nitrogen Total	mg/L	0.1		-	<0.2	-	1.1	0.8	0.3	0.5	0.3	0.2
Phosphate total (P)	mg/L	0.05		-	0.1	-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	-	-	0.63	0.15	0.07	0.1	0.02	0.06

Appendix E
Table 1
Analytical Results

Location Code				**BH18**				
Period (Baseline/Impact)				**Impact**				
Date /Time				12/02/2014	19/04/2023	15/11/2023	07/02/2024	09/04/2024
Lab Report Number				EM1401293	EM2306987	EM2320487	EM2401890	EM2405745
Sample Code				EM1401293004	EM2306987010	EM2320487005	EM2401890009	EM2405745006
Date /Time				41682.625	45035.625	45245.625	45329.625	45391.625
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26					
Field Parameters								
pH (Field)	pH units			-	-	-	-	-
NA								
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-
Inorganics								
pH (Lab)	pH units	0.01		7.05	6.22	6.15	-	-
pH Redox	pH units	0.01		-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	29	41	46	33
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-
Temperature	°C			-	-	-	-	-
Turbidity	NTU	0.1		-	-	55.8	51.7	476
Total Dissolved Solids	mg/L	5		33	42	25	50	70
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-
Total Suspended Solids	mg/L	1		-	119	-	-	-
Acidity & Alkalinity								
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<1	<1	<1	<1
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	13	14	20	12
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	13	14	20	12
Hardness as CaCO3	mg/L	1		-	5	-	-	-
Major Ions								
Calcium	mg/L	0.1		-	-	-	-	-
Calcium (filtered)	mg/L	0.1		1	2	4	4	2
Magnesium	mg/L	0.1		-	-	-	-	-
Magnesium (filtered)	mg/L	0.1		<1	<1	1	1	<1
Potassium	mg/L	0.1		-	-	-	-	-
Potassium (filtered)	mg/L	0.1		<1	<1	<1	<1	<1
Sodium	mg/L	0.1		-	-	-	-	-
Sodium (filtered)	mg/L	0.1		4	2	4	4	3
Chloride	mg/L	1		2	1	2	1	2
Sulfate	mg/L	1		-	-	-	-	-
Sulfate (filtered)	mg/L	1		<1	<1	<1	<1	<1
Sulfate as S	mg/L	5		-	-	-	-	-
Cations Total	meq/L	0.01		0.22	0.19	0.46	0.46	0.23
Anions Total	meq/L	0.01		0.14	0.29	0.34	0.43	0.30
Ionic Balance	%	0.01		-	-	-	-	-
Nutrients								
Ammonia as N	mg/L	0.01	0.32[#1]	-	0.19	-	0.01	<0.01
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	<0.01	0.84	<0.01	0.06
Nitrite (as N)	mg/L	0.01		<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	<0.01	0.84	<0.01	0.06
Nitrogen (Total)	mg/L	0.1		-	0.3	1.0	0.4	1.0
Kjeldahl Nitrogen Total	mg/L	0.1		-	0.3	0.2	0.4	0.9
Phosphate total (P)	mg/L	0.05		-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	0.16	0.04	0.25	0.51

Appendix E
Table 1
Analytical Results

ARV

Location Code					**Boggy 1 p/u 1**					
Period (Baseline/Impact)					**Baseline**				**Impact**				
Date /Time				12/02/2014	13/02/2014	26/10/2015	14/02/2018	25/11/2020	09/02/2021	23/11/2021	15/02/2022	15/11/2022
Lab Report Number				EM1401293	EM1401293	477470	18-09219	870279	893808	933587	956223	EM2222893
Sample Code				EM1401293004	EM1401293015	M15-Oc20494	18-09219_5544481	6787599	6877707	7252501	7353374	EM2222893001
Date /Time				41682.625	41683.625	42303	43145	44160	44236	44523	44607	44880.625
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	-	-	7.184	-	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	-	=CD6:C+CH15P6
Inorganics												
pH (Lab)	pH units	0.01		7.05	6.42	6.8	-	5.74	7.78	6.9	6.92	6.58
pH Redox	pH units	0.01		-	-	-	-	-	-	-	-	6.89
Electrical conductivity (lab)	µS/cm	1		45	28	21	26	27.5	25.9	20.2	22.8	18
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	10.51	12.05	9.37	10.93	-
Redox (Lab)	mV	0.1		-	-	-	-	-	97.5	149	192	224
Temperature	°C			-	-	-	-	7.9	10.2	6.8	10	-
Turbidity	NTU	0.1		-	-	1.8	0.8	0.5	0.4	0.2	0.3	3.7
Total Dissolved Solids	mg/L	5		33	15	14	22	-	-	-	-	36
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	12	14	12	8	-
Total Suspended Solids	mg/L	1		-	-	4.7	<2	<2	<2	<2	<2	-
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<1	<10	<2	<2	<2	<2	<2	<1
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	12	<20	-	-	-	-	-	5
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	15	13	13	12	37	-
Alkalinity (total as CaCO3)	mg/L	1		4	12	<20	-	-	-	-	-	5
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	0.1		-	-	1.4	2.0	1.6	1.8	0.9	1.4	-
Calcium (filtered)	mg/L	0.1		1	2	-	-	-	-	-	-	1
Magnesium	mg/L	0.1		-	-	0.6	0.6	0.5	0.6	0.4	0.5	-
Magnesium (filtered)	mg/L	0.1		<1	<1	-	-	-	-	-	-	<1
Potassium	mg/L	0.1		-	-	<0.5	0.2	0.2	0.2	0.1	0.1	-
Potassium (filtered)	mg/L	0.1		<1	<1	-	-	-	-	-	-	<1
Sodium	mg/L	0.1		-	-	2.4	2.6	2.1	2.4	1.5	2	-
Sodium (filtered)	mg/L	0.1		4	2	-	-	-	-	-	-	2
Chloride	mg/L	1		2	<1	1.1	1	<1	1	1	1	1
Sulfate	mg/L	1		-	-	-	<1	-	-	-	-	-
Sulfate (filtered)	mg/L	1		<1	<1	-	-	-	-	-	-	<1
Sulfate as S	mg/L	5		-	-	<5	-	<1	<1	<1	<1	-
Cations Total	meq/L	0.01		0.22	0.19	-	-	-	-	-	-	0.14
Anions Total	meq/L	0.01		0.14	0.24	-	-	-	-	-	-	0.13
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.03	0.14	0.16	-	-	-	-	0.22
Nitrite (as N)	mg/L	0.01		<0.01	<0.01	-	-	-	-	-	-	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.03	0.14	0.16	0.16	0.14	0.09	0.15	0.22
Nitrogen (Total)	mg/L	0.1		-	-	0.7	0.3	0.2	0.1	0.2	0.2	0.2
Kjeldahl Nitrogen Total	mg/L	0.1		-	-	0.5	0.2	<0.1	<0.1	0.2	<0.1	<0.1
Phosphate total (P)	mg/L	0.05		-	-	0.06	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	-	-	<0.05	<0.05	0.06	0.08	<0.05	<0.01

Appendix E
Table 1
Analytical Results

ARV

Location Code				**Boggy 1 p/u 1**								
Period (Baseline/Impact)				**Impact**								
Date /Time				12/02/2014	15/02/2023	18/04/2023	14/11/2023	06/02/2024	09/04/2024	19/11/2024	18/02/2025	22/04/2025
Lab Report Number				EM1401293	23-14906	EM2306987	EM2320487	EM2401890	EM2405745	1163576	1190470	1213018
Sample Code				EM1401293004	23-14906_8320917	EM2306987001	EM2320487009	EM2401890001	EM2405745001	M24-No0064663	M25-Fe0053817	M25-Ap0065757
Date /Time				41682.625	44972	45034.625	45244.625	45328.625	45391.625	45615	45706	45769
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	-	-	-	-	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	-	-
Inorganics												
pH (Lab)	pH units	0.01		7.05	-	6.27	6.12	-	-	-	-	-
pH Redox	pH units	0.01		-	-	-	-	-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	27	23	19	22	30	36	28	28
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	-	-	-	-
Temperature	°C			-	-	-	-	-	-	-	-	-
Turbidity	NTU	0.1		-	0.3	-	1.7	1.6	2.0	1.5	3.6	<1
Total Dissolved Solids	mg/L	5		33	15	38	23	54	44	51	55[#4]	37[#4]
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	1		-	-	<5	-	-	-	-	-	-
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<2	<1	<1	<1	<1	<10	<10	<10
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	9	13	7	11	13	<20	<20	<20
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	9	13	7	11	13	<20	<20	<20
Hardness as CaCO3	mg/L	1		-	-	2	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	0.1		-	1.9	-	-	-	-	-	2.0	2.1
Calcium (filtered)	mg/L	0.1		1	-	1	1	2	2	1.6	-	-
Magnesium	mg/L	0.1		-	0.6	-	-	-	-	-	0.7	0.6
Magnesium (filtered)	mg/L	0.1		<1	-	<1	<1	<1	<1	0.6	-	-
Potassium	mg/L	0.1		-	0.2	-	-	-	-	-	<0.5	<0.5
Potassium (filtered)	mg/L	0.1		<1	-	<1	<1	<1	<1	<0.5	-	-
Sodium	mg/L	0.1		-	2.7	-	-	-	-	-	2.8	3.7
Sodium (filtered)	mg/L	0.1		4	-	2	2	2	3	2.4	-	-
Chloride	mg/L	1		2	1	3	<1	1	2	<1	1.1	<1
Sulfate	mg/L	1		-	<1	-	-	-	-	<5	<5	<5
Sulfate (filtered)	mg/L	1		<1	-	3	<1	<1	<1	-	-	-
Sulfate as S	mg/L	5		-	-	-	-	-	-	-	-	-
Cations Total	meq/L	0.01		0.22	-	0.14	0.14	0.19	0.23	-	-	-
Anions Total	meq/L	0.01		0.14	-	0.41	0.14	0.25	0.32	-	-	-
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	<0.01	-	<0.01	<0.01	0.04	<0.01	<0.01
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.18	0.26	0.14	0.14	0.12	0.13	0.07	0.09
Nitrite (as N)	mg/L	0.01		<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.19	0.26	0.14	0.14	0.12	0.13	0.08	0.09
Nitrogen (Total)	mg/L	0.1		-	0.2	0.5	0.1	0.1	0.3	0.7	<0.2	0.3
Kjeldahl Nitrogen Total	mg/L	0.1		-	<0.1	0.2	<0.1	<0.1	0.2	0.6	<0.2	0.2
Phosphate total (P)	mg/L	0.05		-	-	-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	<0.05	0.01	0.04	0.04	<0.01	<0.01	<0.01	<0.01

Appendix E
Table 1
Analytical Results

ARV

Location Code				**Boggy 1 p/u 2**						
Period (Baseline/Impact)				**Baseline**				**Impact**		
Date /Time				12/02/2014	13/02/2014	26/10/2015	14/02/2018	25/11/2020	09/02/2021	23/11/2021	15/02/2022	15/11/2022
Lab Report Number				EM1401293	EM1401293	477470	18-09219	870279	893808	933587	956223	EM2222893
Sample Code				EM1401293004	EM1401293016	M15-Oc20495	18-09219_5544482	6787600	6877708	7252502	7353375	EM2222893002
Date /Time				41682.625	41683.625	42303	43145	44160	44236	44523	44607	44880.625
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	-	-	7.03	-	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	-	10.2
Inorganics												
pH (Lab)	pH units	0.01		7.05	6.16	6.9	-	5.52	7.72	7.2	6.62	6.56
pH Redox	pH units	0.01		-	-	-	-	-	-	-	-	6.83
Electrical conductivity (lab)	µS/cm	1		45	51	22	20	22.5	22.2	24.1	28.7	15
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	9.91	12.19	12.81	10.42	-
Redox (Lab)	mV	0.1		-	-	-	-	-	66.7	173	206	233
Temperature	°C			-	-	-	-	7.5	8.8	7.6	12.2	-
Turbidity	NTU	0.1		-	-	<1	0.2	0.1	0.1	0.6	0.5	1.7
Total Dissolved Solids	mg/L	5		33	29	14	18	-	-	-	-	<10
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	10	14	10	12	-
Total Suspended Solids	mg/L	1		-	-	9.3	<2	<2	<2	<2	4	-
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<1	<10	<2	<2	<2	<2	<2	<1
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	24	<20	-	-	-	-	-	4
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	11	10	11	13	15	-
Alkalinity (total as CaCO3)	mg/L	1		4	24	<20	-	-	-	-	-	4
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	0.1		-	-	1.9	1.5	1.2	1.4	1.2	1.8	-
Calcium (filtered)	mg/L	0.1		1	4	-	-	-	-	-	-	<1
Magnesium	mg/L	0.1		-	-	0.7	0.5	0.5	0.5	0.4	0.6	-
Magnesium (filtered)	mg/L	0.1		<1	2	-	-	-	-	-	-	<1
Potassium	mg/L	0.1		-	-	<0.5	0.1	0.1	0.2	0.2	0.2	-
Potassium (filtered)	mg/L	0.1		<1	<1	-	-	-	-	-	-	<1
Sodium	mg/L	0.1		-	-	2.3	2.0	1.6	1.8	2	2.6	-
Sodium (filtered)	mg/L	0.1		4	3	-	-	-	-	-	-	1
Chloride	mg/L	1		2	<1	1.2	1	<1	1	1	1	<1
Sulfate	mg/L	1		-	-	-	<1	-	-	-	-	-
Sulfate (filtered)	mg/L	1		<1	<1	-	-	-	-	-	-	<1
Sulfate as S	mg/L	5		-	-	<5	-	<1	<1	<1	<1	-
Cations Total	meq/L	0.01		0.22	0.49	-	-	-	-	-	-	0.04
Anions Total	meq/L	0.01		0.14	0.48	-	-	-	-	-	-	0.08
Ionic Balance	%	0.01		-	1.54	-	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.14	0.12	0.12	-	-	-	-	0.09
Nitrite (as N)	mg/L	0.01		<0.01	<0.01	-	-	-	-	-	-	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.14	0.12	0.12	0.09	0.09	0.18	0.46	0.09
Nitrogen (Total)	mg/L	0.1		-	-	0.4	0.1	<0.1	0.3	0.4	0.5	0.3
Kjeldahl Nitrogen Total	mg/L	0.1		-	-	0.3	<0.1	<0.1	0.2	0.2	<0.1	0.2
Phosphate total (P)	mg/L	0.05		-	-	<0.05	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	-	-	<0.05	<0.05	<0.05	0.07	<0.05	<0.01

Appendix E
Table 1
Analytical Results

ARV

Location Code				**Boggy 1 p/u 2**								
Period (Baseline/Impact)				**Impact**								
Date /Time				12/02/2014	15/02/2023	18/04/2023	14/11/2023	06/02/2024	09/04/2024	19/11/2024	18/02/2025	22/04/2025
Lab Report Number				EM1401293	23-14906	EM2306987	EM2320487	EM2401890	EM2405745	1163576	1190470	1213018
Sample Code				EM1401293004	23-14906_8320918	EM2306987002	EM2320487010	EM2401890002	EM2405745002	M24-No0064664	M25-Fe0053818	M25-Ap0065758
Date /Time				41682.625	44972	45034.625	45244.625	45328.625	45391.625	45615	45706	45769
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	-	-	-	-	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-	-	-
Inorganics												
pH (Lab)	pH units	0.01		7.05	-	6.24	6.09	-	-	-	-	-
pH Redox	pH units	0.01		-	-	-	-	-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	21	19	16	18	22	22	24	25
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	-	-	-	-
Temperature	°C			-	-	-	-	-	-	-	-	-
Turbidity	NTU	0.1		-	<0.1	-	0.6	1.2	0.9	<1	<1	<1
Total Dissolved Solids	mg/L	5		33	12	27	15	42	27	47	35[#4]	37
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	1		-	-	<5	-	-	-	-	-	-
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<2	<1	<1	<1	<1	<10	<10	<10
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	7	12	6	7	8	<20	<20	<20
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	7	12	6	7	8	<20	<20	<20
Hardness as CaCO3	mg/L	1		-	-	5	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	0.1		-	0.9	-	-	-	-	-	1.5	1.7
Calcium (filtered)	mg/L	0.1		1	-	2	1	1	2	1.3	-	-
Magnesium	mg/L	0.1		-	0.3	-	-	-	-	-	0.5	0.6
Magnesium (filtered)	mg/L	0.1		<1	-	<1	<1	<1	<1	0.5	-	-
Potassium	mg/L	0.1		-	<0.1	-	-	-	-	-	<0.5	<0.5
Potassium (filtered)	mg/L	0.1		<1	-	<1	<1	<1	<1	<0.5	-	-
Sodium	mg/L	0.1		-	1.3	-	-	-	-	-	2.1	2.9
Sodium (filtered)	mg/L	0.1		4	-	2	2	2	2	2.0	-	-
Chloride	mg/L	1		2	1	<1	<1	1	1	<1	1.8	2.7
Sulfate	mg/L	1		-	<1	-	-	-	-	<5	<5	<5
Sulfate (filtered)	mg/L	1		<1	-	<1	<1	<1	<1	-	-	-
Sulfate as S	mg/L	5		-	-	-	-	-	-	-	-	-
Cations Total	meq/L	0.01		0.22	-	0.19	0.14	0.14	0.19	-	-	-
Anions Total	meq/L	0.01		0.14	-	0.24	0.12	0.17	0.19	-	-	-
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	0.07	-	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.13	0.12	0.11	0.10	0.12	0.13	0.06	0.09
Nitrite (as N)	mg/L	0.01		<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.13	0.12	0.11	0.10	0.12	0.13	0.07	0.09
Nitrogen (Total)	mg/L	0.1		-	0.1	0.4	0.1	0.1	0.2	<0.2	0.3	<0.2
Kjeldahl Nitrogen Total	mg/L	0.1		-	<0.1	0.3	<0.1	<0.1	0.1	<0.2	0.2	<0.2
Phosphate total (P)	mg/L	0.05		-	-	-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	0.06	0.01	0.03	0.03	<0.01	<0.01	<0.01	<0.01

Appendix E
Table 1
Analytical Results

ARV

Location Code				**Boggy 2**								
Period (Baseline/Impact)				**Baseline**		**Impact**						
Date /Time				12/02/2014	14/02/2018	25/11/2020	09/02/2021	23/11/2021	15/02/2022	15/11/2022	15/02/2023	18/04/2023
Lab Report Number				EM1401293	18-09131	870279	893808	933587	956223	EM2222893	23-14906	EM2306987
Sample Code				EM1401293004	18-09131_5543403	6787601	6877709	7252503	7353376	EM2222893003	23-14906_8320919	EM2306987003
Date /Time				41682.625	43145	44160	44236	44523	44607	44880.625	44972	45034.625
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26									
Field Parameters												
pH (Field)	pH units			-	6.69	-	-	-	-	-	-	-
NA												
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	10.2	-	-
Inorganics												
pH (Lab)	pH units	0.01		7.05	-	5.79	7.58	7.4	6.9	6.68	-	6.36
pH Redox	pH units	0.01		-	-	-	-	-	-	6.99	-	-
Electrical conductivity (lab)	µS/cm	1		45	27	29	28.7	25.9	28.5	20	26	25
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	8.52	11.91	11.6	8.99	-	-	-
Redox (Lab)	mV	0.1		-	-	-	47.1	174	170.2	237	-	-
Temperature	°C			-	-	8.4	10.3	7.9	11.9	-	-	-
Turbidity	NTU	0.1		-	0.1	0.1	0.1	0.3	0.1	1.5	<0.1	-
Total Dissolved Solids	mg/L	5		33	20	-	-	-	-	41	12	19
Total Dissolved Solids (filtered)	mg/L	5		-	-	12	16	10	12	-	-	-
Total Suspended Solids	mg/L	1		-	<2	<2	<2	<2	<2	-	-	<5
Acidity & Alkalinity												
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<2	<2	<2	<2	<2	<1	<2	<1
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	-	-	-	-	-	6	10	14
Alkalinity (Bicarbonate)	mg/L	2		-	15	13	14	16	13	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	-	-	-	-	-	6	10	14
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-	-	-	5
Major Ions												
Calcium	mg/L	0.1		-	2.0	1.9	2.2	1.4	1.9	-	1.3	-
Calcium (filtered)	mg/L	0.1		1	-	-	-	-	-	1	-	2
Magnesium	mg/L	0.1		-	0.6	0.7	0.7	0.5	0.6	-	0.4	-
Magnesium (filtered)	mg/L	0.1		<1	-	-	-	-	-	<1	-	<1
Potassium	mg/L	0.1		-	0.2	0.2	0.2	0.2	0.2	-	0.1	-
Potassium (filtered)	mg/L	0.1		<1	-	-	-	-	-	<1	-	<1
Sodium	mg/L	0.1		-	2.3	2	2.2	1.8	2.3	-	1.5	-
Sodium (filtered)	mg/L	0.1		4	-	-	-	-	-	2	-	2
Chloride	mg/L	1		2	1	<1	1	1	1	1	2	2
Sulfate	mg/L	1		-	<1	-	-	-	-	-	<1	-
Sulfate (filtered)	mg/L	1		<1	-	-	-	-	-	<1	-	1
Sulfate as S	mg/L	5		-	-	<1	<1	<1	<1	-	-	-
Cations Total	meq/L	0.01		0.22	-	-	-	-	-	0.14	-	0.19
Anions Total	meq/L	0.01		0.14	-	-	-	-	-	0.15	-	0.36
Ionic Balance	%	0.01		-	-	-	-	-	-	-	-	-
Nutrients												
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	-	-	-	-	-	-	<0.01
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.09	-	-	-	-	0.14	0.09	0.22
Nitrite (as N)	mg/L	0.01		<0.01	-	-	-	-	-	<0.01	-	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.09	0.08	0.07	0.1	0.09	0.14	0.10	0.22
Nitrogen (Total)	mg/L	0.1		-	0.2	<0.1	0.2	0.3	<0.1	0.2	<0.1	0.4
Kjeldahl Nitrogen Total	mg/L	0.1		-	0.1	<0.1	0.2	0.2	<0.1	0.1	<0.1	0.2
Phosphate total (P)	mg/L	0.05		-	-	-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	<0.05	<0.05	0.05	0.05	<0.05	<0.01	0.08	0.01

Appendix E
Table 1
Analytical Results

Location Code				**Boggy 2**						
Period (Baseline/Impact)				**Impact**						
Date /Time				12/02/2014	14/11/2023	06/02/2024	09/04/2024	19/11/2024	18/02/2025	22/04/2025
Lab Report Number				EM1401293	EM2320487	EM2401890	EM2405745	1163576	1190470	1213018
Sample Code				EM1401293004	EM2320487011	EM2401890003	EM2405745003	M24-No0064665	M25-Fe0053819	M25-Ap0065759
Date /Time				41682.625	45244.625	45328.625	45391.625	45615	45706	45769
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26							
Field Parameters										
pH (Field)	pH units			-	-	-	-	-	-	-
NA										
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-
Inorganics										
pH (Lab)	pH units	0.01		7.05	6.14	-	-	-	-	-
pH Redox	pH units	0.01		-	-	-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	21	23	28	26	28	28
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	-	-
Temperature	°C			-	-	-	-	-	-	-
Turbidity	NTU	0.1		-	0.1	0.5	0.6	1.7	<1	2.4
Total Dissolved Solids	mg/L	5		33	20	30	49	20	37[#4]	64
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-	-	-
Total Suspended Solids	mg/L	1		-	-	-	-	-	-	-
Acidity & Alkalinity										
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<1	<1	<1	<10	<10	<10
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	8	9	10	<20	<20	<20
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	8	9	10	<20	<20	<20
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	0.1		-	-	-	-	-	2.1	2.2
Calcium (filtered)	mg/L	0.1		1	2	2	2	1.8	-	-
Magnesium	mg/L	0.1		-	-	-	-	-	0.7	0.7
Magnesium (filtered)	mg/L	0.1		<1	<1	<1	<1	0.6	-	-
Potassium	mg/L	0.1		-	-	-	-	-	<0.5	<0.5
Potassium (filtered)	mg/L	0.1		<1	<1	<1	<1	<0.5	-	-
Sodium	mg/L	0.1		-	-	-	-	-	2.2	3.1
Sodium (filtered)	mg/L	0.1		4	2	2	2	2.2	-	-
Chloride	mg/L	1		2	1	<1	2	1.4	1.3	1.0
Sulfate	mg/L	1		-	-	-	-	<5	<5	<5
Sulfate (filtered)	mg/L	1		<1	<1	<1	<1	-	-	-
Sulfate as S	mg/L	5		-	-	-	-	-	-	-
Cations Total	meq/L	0.01		0.22	0.19	0.19	0.19	-	-	-
Anions Total	meq/L	0.01		0.14	0.19	0.18	0.26	-	-	-
Ionic Balance	%	0.01		-	-	-	-	-	-	-
Nutrients										
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.10	0.09	0.10	0.12	0.03	0.06
Nitrite (as N)	mg/L	0.01		<0.01	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.10	0.09	0.10	0.12	<0.05	0.06
Nitrogen (Total)	mg/L	0.1		-	0.1	0.4	0.2	<0.2	<0.2	0.4
Kjeldahl Nitrogen Total	mg/L	0.1		-	<0.1	0.3	0.1	<0.2	<0.2	0.3
Phosphate total (P)	mg/L	0.05		-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	0.03	0.02	<0.01	<0.01	<0.01	<0.01

Appendix E
Table 1
Analytical Results

Location Code				**EWS East**						
Period (Baseline/Impact)					**Impact**					
Date /Time				12/02/2014	14/11/2023	06/02/2024	09/04/2024	19/11/2024	18/02/2025	22/04/2025
Lab Report Number				EM1401293	EM2320487	EM2401890	EM2405745	1163576	1190470	1213018
Sample Code				EM1401293004	EM2320487013	EM2401890012	EM2405745005	M24-No0064667	M25-Fe0053820	M25-Ap0065832
Date /Time				41682.625	45244.625	45328.625	45391.625	45615	45706	45769
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26							
Field Parameters										
pH (Field)	pH units			-	-	-	-	-	-	-
NA										
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-	-	-
Inorganics										
pH (Lab)	pH units	0.01		7.05	6.06	-	-	-	-	-
pH Redox	pH units	0.01		-	-	-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	18	19	24	21	27	28
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-	-	-
Temperature	°C			-	-	-	-	-	-	-
Turbidity	NTU	0.1		-	4.6	7.7	3.8	6.1	6.8	3.0
Total Dissolved Solids	mg/L	5		33	15	26	43	37	63[#4]	26
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-	-	-
Total Suspended Solids	mg/L	1		-	-	-	-	-	-	-
Acidity & Alkalinity										
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<1	<1	<1	<10	<10	<10
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	6	6	8	24	<20	<20
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	6	6	8	24	<20	<20
Hardness as CaCO3	mg/L	1		-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	0.1		-	-	-	-	-	1.8	2.1
Calcium (filtered)	mg/L	0.1		1	1	1	2	1.3	-	-
Magnesium	mg/L	0.1		-	-	-	-	-	0.7	0.6
Magnesium (filtered)	mg/L	0.1		<1	<1	<1	<1	0.5	-	-
Potassium	mg/L	0.1		-	-	-	-	-	<0.5	1.6
Potassium (filtered)	mg/L	0.1		<1	<1	<1	<1	<0.5	-	-
Sodium	mg/L	0.1		-	-	-	-	-	2.5	3.7
Sodium (filtered)	mg/L	0.1		4	2	2	2	1.9	-	-
Chloride	mg/L	1		2	1	1	1	<1	1.3	1.5
Sulfate	mg/L	1		-	-	-	-	<5	<5	<5
Sulfate (filtered)	mg/L	1		<1	3	<1	2	-	-	-
Sulfate as S	mg/L	5		-	-	-	-	-	-	-
Cations Total	meq/L	0.01		0.22	0.14	0.14	0.19	-	-	-
Anions Total	meq/L	0.01		0.14	0.21	0.15	0.23	-	-	-
Ionic Balance	%	0.01		-	-	-	-	-	-	-
Nutrients										
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	<0.01	<0.01	0.05	<0.01	<0.01
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.14	0.11	0.03	0.20	0.14	0.10
Nitrite (as N)	mg/L	0.01		<0.01	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.14	0.11	0.03	0.20	0.14	0.10
Nitrogen (Total)	mg/L	0.1		-	0.1	0.1	0.1	0.2	<0.2	0.7
Kjeldahl Nitrogen Total	mg/L	0.1		-	<0.1	<0.1	0.1	<0.2	<0.2	0.6
Phosphate total (P)	mg/L	0.05		-	-	-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	0.02	0.02	<0.01	<0.01	<0.01	<0.01

Appendix E
Table 1
Analytical Results

Location Code				**EWS West**				
Period (Baseline/Impact)				**Impact**				
Date /Time				12/02/2014	15/02/2023	14/11/2023	06/02/2024	19/11/2024
Lab Report Number				EM1401293	23-14906	EM2320487	EM2401890	1163576
Sample Code				EM1401293004	23-14906_8320922	EM2320487012	EM2401890013	M24-No0064668
Date /Time				41682.625	44972	45244.625	45328.625	45615
	Unit	EQL	ANZG (2018) - FW - 99% (updated 26					
Field Parameters								
pH (Field)	pH units			-	-	-	-	-
NA								
Dissolved Oxygen	mg/L	0.1		-	-	-	-	-
Inorganics								
pH (Lab)	pH units	0.01		7.05	-	6.09	-	-
pH Redox	pH units	0.01		-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1		45	34	19	21	29
Dissolved Oxygen (Lab) (filtered)	mg/L			-	-	-	-	-
Redox (Lab)	mV	0.1		-	-	-	-	-
Temperature	°C			-	-	-	-	-
Turbidity	NTU	0.1		-	2.3	4.6	8.9	4.3
Total Dissolved Solids	mg/L	5		33	18	16	34	12
Total Dissolved Solids (filtered)	mg/L	5		-	-	-	-	-
Total Suspended Solids	mg/L	1		-	-	-	-	-
Acidity & Alkalinity								
Alkalinity (Carbonate as CaCO3)	mg/L	1		<1	<2	<1	<1	<10
Alkalinity (Bicarbonate as CaCO3)	mg/L	1		4	11	6	8	39
Alkalinity (Bicarbonate)	mg/L	2		-	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	1		4	11	6	8	39
Hardness as CaCO3	mg/L	1		-	-	-	-	-
Major Ions								
Calcium	mg/L	0.1		-	1.8	-	-	-
Calcium (filtered)	mg/L	0.1		1	-	1	2	2.1
Magnesium	mg/L	0.1		-	0.6	-	-	-
Magnesium (filtered)	mg/L	0.1		<1	-	<1	<1	0.9
Potassium	mg/L	0.1		-	0.4	-	-	-
Potassium (filtered)	mg/L	0.1		<1	-	<1	<1	<0.5
Sodium	mg/L	0.1		-	1.0	-	-	-
Sodium (filtered)	mg/L	0.1		4	-	2	2	2.1
Chloride	mg/L	1		2	1	1	<1	1.1
Sulfate	mg/L	1		-	1	-	-	<5
Sulfate (filtered)	mg/L	1		<1	-	<1	<1	-
Sulfate as S	mg/L	5		-	-	-	-	-
Cations Total	meq/L	0.01		0.22	-	0.14	0.19	-
Anions Total	meq/L	0.01		0.14	-	0.15	0.16	-
Ionic Balance	%	0.01		-	-	-	-	-
Nutrients								
Ammonia as N	mg/L	0.01	0.32[#1]	-	-	-	<0.01	<0.01
Nitrate (as N)	mg/L	0.01	1[#2]	3.12	0.23	0.13	0.14	0.30
Nitrite (as N)	mg/L	0.01		<0.01	-	<0.01	<0.01	<0.02
Nitrogen (Total Oxidised) (as N)	mg/L	0.01		3.12	0.23	0.13	0.14	0.30
Nitrogen (Total)	mg/L	0.1		-	0.2	0.1	0.1	0.3
Kjeldahl Nitrogen Total	mg/L	0.1		-	<0.1	<0.1	<0.1	<0.2
Phosphate total (P)	mg/L	0.05		-	-	-	-	-
Phosphorus (Total)	mg/L	0.01		-	<0.05	0.04	0.02	<0.01

Appendix F

Laboratory reports

OFFICIAL

ALS (2) FH

CHAIN OF CUSTODY RECORD

GHO Melboymo Office Address
1BOLonsdale Street. MelDourne 3000
Tel•phonoc 613 8687 8000
Fn 61386876111

Completion Date/TUmaf'ound
5 Day TAT

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ProjectNumber
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Project Name
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Labo r a tory AddrG.$-5

GHD Project M•o•gtr
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TOTAL NUMBER OF SAMPLES

TOTAL NUMBER OF ESKIES

CUSTODY DETAILS

SAMPLER:

COURIER:

LABORATORY:

COMMENTS:

Environmental Division
Melbourne
Work Order Reference
EM□□507

Telephone : +61•3·864!1 9600

Received: 29/4 Carrier:
C/note:
Temp: 6 C Seal: Y N
Ice / Ice Bricks X NA

OFFICIAL

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2507122**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Contact	: Peter Ravlic
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: meg.turner@ghd.com	E-mail	: peter.ravlic@alsglobal.com
Telephone	: ----	Telephone	: +6138549 9645
Facsimile	: ----	Facsimile	: +61-3-8549 9626
Project	: 12565989	Page	: 1 of 3
Order number	: ----	Quote number	: EB2020GHDSER0038 (EN/000)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	:		
Sampler	:		

Dates

Date Samples Received	: 29-Apr-2025 11:55	Issue Date	: 29-Apr-2025
Client Requested Due Date	: 06-May-2025	Scheduled Reporting Date	: **06-May-2025**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 6.7°C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 2 / 2

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- Unless otherwise stated, analytical work for this work order will be conducted at ALS Melbourne, NATA accreditation no. 825, site no. 13778.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Issue Date	:	29-Apr-2025
Page	:	2 of 3
Work Order	:	EM2507122 Amendment 0
Client	:	GHD PTY LTD

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EA010P Electrical Conductivity (Auto Titrator)	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EA045 Turbidity	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity	WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P
EM2507122-001	22-Apr-2025 00:00	SW-Split	✓	✓	✓	✓	✓
EM2507122-002	23-Apr-2025 00:00	GW-Split	✓	✓	✓	✓	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EA045: Turbidity							
GW-Split	Clear Plastic Bottle - Natural	----	25-Apr-2025	29-Apr-2025	×	----	----
SW-Split	Clear Plastic Bottle - Natural	----	24-Apr-2025	29-Apr-2025	×	----	----
EK057G: Nitrite as N by Discrete Analyser							
GW-Split	Clear Plastic Bottle - Natural	----	25-Apr-2025	29-Apr-2025	×	----	----
SW-Split	Clear Plastic Bottle - Natural	----	24-Apr-2025	29-Apr-2025	×	----	----

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com

Accounts Payable Australia

- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com

GHD LAB REPORTS

- *AU Certificate of Analysis - NATA (COA)	Email	ghdlabreports@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ghdlabreports@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ghdlabreports@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ghdlabreports@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	ghdlabreports@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	ghdlabreports@ghd.com

Meg Turner

- *AU Certificate of Analysis - NATA (COA)	Email	meg.turner@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	meg.turner@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	meg.turner@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	meg.turner@ghd.com
- A4 - AU Tax Invoice (INV)	Email	meg.turner@ghd.com
- Chain of Custody (CoC) (COC)	Email	meg.turner@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	meg.turner@ghd.com
- EDI Format - XTab (XTAB)	Email	meg.turner@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	meg.turner@ghd.com

CERTIFICATE OF ANALYSIS

Work Order	: **EM2507122**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Contact	: Peter Ravlic
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +6138549 9645
Project	: 12565989	Date Samples Received	: 29-Apr-2025 11:55
Order number	: ----	Date Analysis Commenced	: 29-Apr-2025
C-O-C number	: ----	Issue Date	: 05-May-2025 17:38
Sampler	: ----		
Site	:		
Quote number	: EN/000		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Eric Chau	Metals Team Leader	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA015H: EM2507122 #1-2: TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Page	: 3 of 4
Work Order	: EM2507122
Client	: GHD PTY LTD
Project	: 12565989

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SW-Split	GW-Split	----	----	----
				Sampling date / time	22-Apr-2025 00:00	23-Apr-2025 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM2507122-001	EM2507122-002	--------	--------	--------
					Result	Result	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**30**	**42**	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**46**	**50**	----	----	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		**0.4**	**171**	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**15**	**25**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**15**	**25**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	<1	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**1**	**1**	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**2**	**3**	----	----	----
Magnesium	7439-95-4	1	mg/L		<1	**1**	----	----	----
Sodium	7440-23-5	1	mg/L		**3**	**4**	----	----	----
Potassium	7440-09-7	1	mg/L		<1	<1	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		<0.01	<0.01	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.08**	**0.18**	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ana yser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.08**	**0.18**	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SW-Split	GW-Split	----	----	----
				Sampling date / time	22-Apr-2025 00:00	23-Apr-2025 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM2507122-001	EM2507122-002	--------	--------	--------
					Result	Result	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser - Continued									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.1	**0.2**	**----**	**----**	**----**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Ar alyser									
^ Total Nitrogen as N	----	0.1	mg/L		<0.1	**0.4**	**----**	**----**	**----**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.01**	**0.16**	**----**	**----**	**----**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**0.33**	**0.53**	**----**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**0.23**	**0.40**	**----**	**----**	**----**

QUALITY CONTROL REPORT

Work Order	: **EM2507122**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Contact	: Peter Ravlic
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +6138549 9645
Project	: 12565989	Date Samples Received	: 29-Apr-2025
Order number	: ----	Date Analysis Commenced	: 29-Apr-2025
C-O-C number	: ----	Issue Date	: 05-May-2025
Sampler	: ----		
Site	:		
Quote number	: EN/000		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Eric Chau	Metals Team Leader	Melbourne Inorganics, Springvale, VIC

Page	:	2 of 5
Work Order	:	EM2507122
Client	:	GHD PTY LTD
Project	:	12565989

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA010P: Conductivity by PC Titrator (QC Lot: 6541188)									
EM2507088-002	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	1090	1080	0.8	0% - 20%
EM2507109-003	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	15900	16000	0.9	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 6541767)									
EM2506897-093	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	181	175	3.0	0% - 50%
EM2507104-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	9100	9260	1.8	0% - 20%
EM2507109-004	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	7110	6960	2.2	0% - 20%
EM2507122-002	GW-Split	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	50	65	24.7	No Limit
EA045: Turbidity (QC Lot: 6539866)									
EM2507117-001	Anonymous	EA045: Turbidity	----	0.1	NTU	2.0	2.1	0.0	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 6541191)									
EM2507116-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	580	583	0.6	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	580	583	0.6	0% - 20%
EM2507181-005	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	20	20	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	20	20	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 6541340)									
EM2507042-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	287	288	0.0	0% - 20%
EM2507104-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2210	2280	3.1	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 6541339)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED045G: Chloride by Discrete Analyser (QC Lot: 6541339) - continued									
EM2507042-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	1470	1470	0.3	0% - 20%
EM2507104-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	4000	4000	0.1	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 6540318)									
EM2507109-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	42	42	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	90	89	1.7	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	586	586	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EM2507115-011	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	84	85	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	356	351	1.5	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	1830	1820	0.6	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	50	51	0.0	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 6542351)									
EM2507116-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EM2507130-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 6541341)									
EM2507122-001	SW-Split	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 6542352)									
EM2507116-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.02	0.02	0.0	No Limit
EM2507130-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.06	0.02	87.9	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 6541520)									
EM2507102-003	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	48.6	44.8	8.2	0% - 20%
EM2507122-002	GW-Split	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.2	0.2	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 6541519)									
EM2507102-003	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	1.15	1.11	3.8	0% - 20%
EM2507122-002	GW-Split	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.16	0.17	7.5	0% - 50%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report		Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA010P: Conductivity by PC Titrator (QCLot: 6541188)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	100	85.0	119
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 6541767)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	91.4	91.0	110
				<10	2340 mg/L	108	80.8	119
				<10	293 mg/L	109	91.0	110
EA045: Turbidity (QCLot: 6539866)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	100	88.1	110
ED037P: Alkalinity by PC Titrator (QCLot: 6541191)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	104	85.0	116
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6541340)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	500 mg/L	99.1	90.0	110
				<1	25 mg/L	102	90.0	110
ED045G: Chloride by Discrete Analyser (QCLot: 6541339)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	105	90.0	110
				<1	10 mg/L	104	90.0	110
ED093F: Dissolved Major Cations (QCLot: 6540318)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	111	80.0	120
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	101	80.0	120
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	100	80.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	97.3	80.0	120
EK055G: Ammonia as N by Discrete Analyser (QCLot: 6542351)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	101	90.0	110
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6541341)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	94.8	90.0	110
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6542352)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	90.0	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6541520)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	5 mg/L	97.4	70.0	117
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6541519)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	2.21 mg/L	95.2	71.9	114

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Work Order	:	EM2507122
Client	:	GHD PTY LTD
Project	:	12565989

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6541340)							
EM2507042-003	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 6541339)							
EM2507042-003	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	# Not Determined	70.0	142
EK055G: Ammonia as N by Discrete Analyser (QCLot: 6542351)							
EM2507116-002	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	96.9	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6541341)							
EM2507122-002	GW-Split	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	82.7	80.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6542352)							
EM2507116-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	106	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6541520)							
EM2507102-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	93.5	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6541519)							
EM2507102-004	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	97.0	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2507122**	Page	: 1 of 8
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Telephone	: +6138549 9645
Project	: 12565989	Date Samples Received	: 29-Apr-2025
Site	:	Issue Date	: 05-May-2025
Sampler	: ----	No. of samples received	: 2
Order number	: ----	No. of samples analysed	: 2

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, where applicable to the methodology, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

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Work Order	: EM2507122
Client	: GHD PTY LTD
Project	: 12565989

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EM2507042--003	Anonymous	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED045G: Chloride by Discrete Analyser	EM2507042--003	Anonymous	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA015: Total Dissolved Solids dried at 180 ± 5 °C						
Clear Plastic Bottle - Natural / SW-Split	----	----	----	30-Apr-2025	29-Apr-2025	**1**
EA045: Turbidity						
Clear Plastic Bottle - Natural / SW-Split	----	----	----	29-Apr-2025	24-Apr-2025	**5**
Clear Plastic Bottle - Natural / GW-Split	----	----	----	29-Apr-2025	25-Apr-2025	**4**
EK057G: Nitrite as N by Discrete Analyser						
Clear Plastic Bottle - Natural / SW-Split	----	----	----	30-Apr-2025	24-Apr-2025	**6**
Clear Plastic Bottle - Natural / GW-Split	----	----	----	30-Apr-2025	25-Apr-2025	**5**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: ☒ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation

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Work Order : EM2507122
Client : GHD PTY LTD
Project : 12565989

Matrix: **WATER**

Evaluation: ☒ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P) SW-Split	**22-Apr-2025**	----	----	----	**01-May-2025**	20-May-2025	✓
Clear Plastic Bottle - Natural (EA010-P) GW-Split	**23-Apr-2025**	----	----	----	**01-May-2025**	21-May-2025	✓
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H) SW-Split	**22-Apr-2025**	----	----	----	**30-Apr-2025**	29-Apr-2025	☒
Clear Plastic Bottle - Natural (EA015H) GW-Split	**23-Apr-2025**	----	----	----	**30-Apr-2025**	30-Apr-2025	✓
EA045: Turbidity							
Clear Plastic Bottle - Natural (EA045) SW-Split	**22-Apr-2025**	----	----	----	**29-Apr-2025**	24-Apr-2025	☒
Clear Plastic Bottle - Natural (EA045) GW-Split	**23-Apr-2025**	----	----	----	**29-Apr-2025**	25-Apr-2025	☒
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) SW-Split	**22-Apr-2025**	----	----	----	**01-May-2025**	06-May-2025	✓
Clear Plastic Bottle - Natural (ED037-P) GW-Split	**23-Apr-2025**	----	----	----	**01-May-2025**	07-May-2025	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) SW-Split	**22-Apr-2025**	----	----	----	**30-Apr-2025**	20-May-2025	✓
Clear Plastic Bottle - Natural (ED041G) GW-Split	**23-Apr-2025**	----	----	----	**30-Apr-2025**	21-May-2025	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) SW-Split	**22-Apr-2025**	----	----	----	**30-Apr-2025**	20-May-2025	✓
Clear Plastic Bottle - Natural (ED045G) GW-Split	**23-Apr-2025**	----	----	----	**30-Apr-2025**	21-May-2025	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) SW-Split	**22-Apr-2025**	----	----	----	**29-Apr-2025**	20-May-2025	✓
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) GW-Split	**23-Apr-2025**	----	----	----	**29-Apr-2025**	21-May-2025	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G) SW-Split	**22-Apr-2025**	----	----	----	**30-Apr-2025**	20-May-2025	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) GW-Split	**23-Apr-2025**	----	----	----	**30-Apr-2025**	21-May-2025	✓

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Work Order : EM2507122
Client : GHD PTY LTD
Project : 12565989

Matrix: **WATER**

Evaluation: ☒ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) SW-Split	**22-Apr-2025**	**----**	----	**----**	**30-Apr-2025**	24-Apr-2025	☒
Clear Plastic Bottle - Natural (EK057G) GW-Split	**23-Apr-2025**	**----**	----	**----**	**30-Apr-2025**	25-Apr-2025	☒
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G) SW-Split	**22-Apr-2025**	**----**	----	**----**	**03-May-2025**	20-May-2025	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) GW-Split	**23-Apr-2025**	**----**	----	**----**	**03-May-2025**	21-May-2025	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G) SW-Split	**22-Apr-2025**	**01-May-2025**	20-May-2025	✓	**01-May-2025**	20-May-2025	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) GW-Split	**23-Apr-2025**	**01-May-2025**	21-May-2025	✓	**01-May-2025**	21-May-2025	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G) SW-Split	**22-Apr-2025**	**01-May-2025**	20-May-2025	✓	**01-May-2025**	20-May-2025	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) GW-Split	**23-Apr-2025**	**01-May-2025**	21-May-2025	✓	**01-May-2025**	21-May-2025	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ☒ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	4	33	**12.12**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	3	33	**9.09**	**7.50**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	3	**33.33**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ☒ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Turbidity	EA045	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030E. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)

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CHAIN OF CUSTODY RECORD

GHD Melbourne Office Address
180 Lonsdare Strcel. Melbourne 3000
Teleol,ono 613 8687 8000
F8>L 6i 3 8687 8111

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1. Samples are to be delivered to the laboratory address shown

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LaDorato,v Address
2 - 4 Wostall Roaa, S"""va!e 3171

GHO Projec1Manager
Meg Turner

labarnrary Contact
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Mca Turner

GHD PM email
MCIQ TumOf@mc a.m

GHD Contact email
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Environm,□ntal Division
Melbourne Order REiference
EM□□502990 r

Telophono: •61·3•854!19600

| Sample I.D. | | |

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2502990**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Contact	: Peter Ravlic
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: meg.turner@ghd.com	E-mail	: peter.ravlic@alsglobal.com
Telephone	: ----	Telephone	: +6138549 9645
Facsimile	: ----	Facsimile	: +61-3-8549 9626
Project	: 12565989	Page	: 1 of 3
Order number	: ----	Quote number	: EB2020GHDSER0038 (EN/000)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	:		
Sampler	:		

Dates

Date Samples Received	: 24-Feb-2025 11:30	Issue Date	: 24-Feb-2025
Client Requested Due Date	: 03-Mar-2025	Scheduled Reporting Date	: **03-Mar-2025**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 2	Temperature	: 8.2°C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 2 / 2

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- Unless otherwise stated, analytical work for this work order will be conducted at ALS Melbourne, NATA accreditation no. 825, site no. 13778.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Issue Date	:	24-Feb-2025
Page	:	2 of 3
Work Order	:	EM2502990 Amendment 0
Client	:	GHD PTY LTD

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EA005P pH (Auto Titrator)	WATER - EA010P Electrical Conductivity (Auto Titrator)	WATER - EA045 Turbidity	WATER - EK058G Nitrate as N by Discrete Analyser	WATER - EK062G Total Nitrogen as N (TKN + NOx reported) By	WATER - EK067G Total Phosphorus as P By Discrete Analyser	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EM2502990-001	18-Feb-2025 00:00	SW-S2	✓	✓	✓	✓	✓	✓	✓
EM2502990-002	19-Feb-2025 00:00	GW-S2	✓	✓	✓	✓	✓	✓	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EA005-P: pH by Auto Titrator							
GW-S2	Clear Plastic Bottle - Natural	----	19-Feb-2025	24-Feb-2025	×	----	----
SW-S2	Clear Plastic Bottle - Natural	----	18-Feb-2025	24-Feb-2025	×	----	----
EA045: Turbidity							
GW-S2	Clear Plastic Bottle - Natural	----	21-Feb-2025	24-Feb-2025	×	----	----
SW-S2	Clear Plastic Bottle - Natural	----	20-Feb-2025	24-Feb-2025	×	----	----
EK057G: Nitrite as N by Discrete Analyser							
GW-S2	Clear Plastic Bottle - Natural	----	21-Feb-2025	24-Feb-2025	×	----	----
SW-S2	Clear Plastic Bottle - Natural	----	20-Feb-2025	24-Feb-2025	×	----	----

Issue Date	:	24-Feb-2025
Page	:	3 of 3
Work Order	:	EM2502990 Amendment 0
Client	:	GHD PTY LTD

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com

Accounts Payable Australia

- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com

GHD LAB REPORTS

- *AU Certificate of Analysis - NATA (COA)	Email	ghdlabreports@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ghdlabreports@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ghdlabreports@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ghdlabreports@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	ghdlabreports@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	ghdlabreports@ghd.com

Meg Turner

- *AU Certificate of Analysis - NATA (COA)	Email	meg.turner@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	meg.turner@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	meg.turner@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	meg.turner@ghd.com
- A4 - AU Tax Invoice (INV)	Email	meg.turner@ghd.com
- Chain of Custody (CoC) (COC)	Email	meg.turner@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	meg.turner@ghd.com
- EDI Format - XTab (XTAB)	Email	meg.turner@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	meg.turner@ghd.com

CERTIFICATE OF ANALYSIS

Work Order	: **EM2502990**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Contact	: Peter Ravlic
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +6138549 9645
Project	: 12565989	Date Samples Received	: 24-Feb-2025 11:30
Order number	: ----	Date Analysis Commenced	: 25-Feb-2025
C-O-C number	: ----	Issue Date	: 03-Mar-2025 15:02
Sampler	: ----		
Site	:		
Quote number	: EN/000		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)			Sample ID	GW-S2	-----	-----	-----	-----
			Sampling date / time	19-Feb-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM2502990-002	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.99**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**16**	----	----	----	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	**124**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**3**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**3**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**2**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	**2**	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.94**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ana yser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.94**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.3**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Ar alyser								

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Sample ID	GW-S2	-----	-----	-----	-----
				Sampling date / time	19-Feb-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2502990-002	--------	--------	--------	--------
					Result	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser - Continued									
^ Total Nitrogen as N	----	0.1	mg/L		**1.2**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.28**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**0.12**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**0.09**	----	----	----	----

Page	: 5 of 6
Work Order	: EM2502990
Client	: GHD PTY LTD
Project	: 12565989

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	SW-S2	-----	-----	-----	-----
			Sampling date / time	18-Feb-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM2502990-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.35**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**28**	----	----	----	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	**1.2**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**12**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**12**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**1**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**1**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**2**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	**3**	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.08**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ana yser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.08**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.1**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Ar alyser								

Page	: 6 of 6
Work Order	: EM2502990
Client	: GHD PTY LTD
Project	: 12565989

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SW-S2	----	----	----	----
				Sampling date / time	18-Feb-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2502990-001	--------	--------	--------	--------
					Result	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser - Continued									
^ Total Nitrogen as N	----	0.1	mg/L		**0.2**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.09**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**0.29**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**0.23**	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: **EM2502990**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Contact	: Peter Ravlic
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +6138549 9645
Project	: 12565989	Date Samples Received	: 24-Feb-2025
Order number	: ----	Date Analysis Commenced	: 25-Feb-2025
C-O-C number	: ----	Issue Date	: 03-Mar-2025
Sampler	: ----		
Site	:		
Quote number	: EN/000		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC

Page	:	2 of 5
Work Order	:	EM2502990
Client	:	GHD PTY LTD
Project	:	12565989

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC
* = The final LOR has been raised due to dilution or other sample specific cause; adjusted LOR is shown in brackets. The duplicate ranges for Acceptable RPD% are applied to the final LOR where applicable.

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA005P: pH by PC Titrator (QC Lot: 6398530)									
EM2502969-009	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.84	7.89	0.6	0% - 20%
EM2502995-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.12	7.15	0.4	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 6398529)									
EM2502964-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	14500	14600	0.8	0% - 20%
EM2502969-009	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	3510	3520	0.3	0% - 20%
EA045: Turbidity (QC Lot: 6399861)									
EM2502973-001	Anonymous	EA045: Turbidity	----	0.1	NTU	1.6	1.6	0.0	0% - 50%
EM2502990-002	GW-S2	EA045: Turbidity	----	0.1	NTU	124	127	2.4	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 6398531)									
EM2502979-004	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	1040	1080	4.4	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	1040	1080	4.4	0% - 20%
EM2502995-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	226	228	1.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	226	228	1.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 6399117)									
EM2502964-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	913	898	1.6	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 6399116)									

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED045G: Chloride by Discrete Analyser (QC Lot: 6399116) - continued									
EM2502820-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	3760	3610	4.1	0% - 20%
EM2502964-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	4620	4680	1.2	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 6404924)									
EM2502869-004	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	6	6	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	2	2	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	7	6	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	7	7	0.0	No Limit
EM2502969-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	47	47	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	93	93	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	602	598	0.7	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 6399114)									
EM2502979-003	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.08	0.08	0.0	No Limit
EM2502812-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 6401120)									
EM2502969-007	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	1.65	1.69	2.6	0% - 20%
EM2503057-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 6405028)									
EM2502979-003	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1 (0.5)*	mg/L	5.4	4.5	18.1	0% - 50%
EM2502607-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	56.9	56.6	0.5	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 6405027)									
EM2502607-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	6.08	6.17	1.5	0% - 20%
EM2503071-004	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.04	0.03	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report		Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 6398530)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	99.5	98.8	101
				----	7 pH Unit	100	99.3	101
EA010P: Conductivity by PC Titrator (QCLot: 6398529)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	97.6	85.0	119
EA045: Turbidity (QCLot: 6399861)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	102	88.1	110
ED037P: Alkalinity by PC Titrator (QCLot: 6398531)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	108	85.0	116
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6399117)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	500 mg/L	107	90.0	110
				<1	25 mg/L	110	90.0	110
ED045G: Chloride by Discrete Analyser (QCLot: 6399116)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	104	90.0	110
				<1	10 mg/L	103	90.0	110
ED093F: Dissolved Major Cations (QCLot: 6404924)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	107	80.0	120
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	103	80.0	120
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	98.4	80.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	98.5	80.0	120
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6399114)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	106	90.0	110
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6401120)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	109	90.0	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6405028)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	5 mg/L	102	70.0	117
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6405027)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	2.21 mg/L	94.7	71.9	114

Matrix Spike (MS) Report

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Work Order	:	EM2502990
Client	:	GHD PTY LTD
Project	:	12565989

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6399117)							
EM2502967-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	2000 mg/L	78.3	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 6399116)							
EM2502869-001	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	114	70.0	142
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6399114)							
EM2502812-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	88.0	80.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6401120)							
EM2502969-008	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	109	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6405028)							
EM2502607-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	50 mg/L	94.8	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6405027)							
EM2502607-004	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	# Not Determined	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2502990**	Page	: 1 of 8
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Telephone	: +6138549 9645
Project	: 12565989	Date Samples Received	: 24-Feb-2025
Site	:	Issue Date	: 03-Mar-2025
Sampler	: ----	No. of samples received	: 2
Order number	: ----	No. of samples analysed	: 2

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, where applicable to the methodology, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK067G: Total Phosphorus as P by Discrete Analyser	EM2502607--004	Anonymous	**Total Phosphorus as P**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
SW-S2	----	----	----	26-Feb-2025	18-Feb-2025	**8**
Clear Plastic Bottle - Natural						
GW-S2	----	----	----	26-Feb-2025	19-Feb-2025	**7**
EA045: Turbidity						
Clear Plastic Bottle - Natural						
SW-S2	----	----	----	25-Feb-2025	20-Feb-2025	**5**
Clear Plastic Bottle - Natural						
GW-S2	----	----	----	25-Feb-2025	21-Feb-2025	**4**
EK057G: Nitrite as N by Discrete Analyser						
Clear Plastic Bottle - Natural						
SW-S2	----	----	----	25-Feb-2025	20-Feb-2025	**5**
Clear Plastic Bottle - Natural						
GW-S2	----	----	----	25-Feb-2025	21-Feb-2025	**4**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: ☒ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation

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Work Order : EM2502990
Client : GHD PTY LTD
Project : 12565989

Matrix: **WATER**

Evaluation: ☒ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P) SW-S2	18-Feb-2025	----	----	----	26-Feb-2025	18-Feb-2025	☒
Clear Plastic Bottle - Natural (EA005-P) GW-S2	19-Feb-2025	----	----	----	26-Feb-2025	19-Feb-2025	☒
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P) SW-S2	18-Feb-2025	----	----	----	26-Feb-2025	18-Mar-2025	✓
Clear Plastic Bottle - Natural (EA010-P) GW-S2	19-Feb-2025	----	----	----	26-Feb-2025	19-Mar-2025	✓
EA045: Turbidity							
Clear Plastic Bottle - Natural (EA045) SW-S2	18-Feb-2025	----	----	----	25-Feb-2025	20-Feb-2025	☒
Clear Plastic Bottle - Natural (EA045) GW-S2	19-Feb-2025	----	----	----	25-Feb-2025	21-Feb-2025	☒
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) SW-S2	18-Feb-2025	----	----	----	26-Feb-2025	04-Mar-2025	✓
Clear Plastic Bottle - Natural (ED037-P) GW-S2	19-Feb-2025	----	----	----	26-Feb-2025	05-Mar-2025	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) SW-S2	18-Feb-2025	----	----	----	26-Feb-2025	18-Mar-2025	✓
Clear Plastic Bottle - Natural (ED041G) GW-S2	19-Feb-2025	----	----	----	26-Feb-2025	19-Mar-2025	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) SW-S2	18-Feb-2025	----	----	----	26-Feb-2025	18-Mar-2025	✓
Clear Plastic Bottle - Natural (ED045G) GW-S2	19-Feb-2025	----	----	----	26-Feb-2025	19-Mar-2025	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) SW-S2	18-Feb-2025	----	----	----	27-Feb-2025	18-Mar-2025	✓
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) GW-S2	19-Feb-2025	----	----	----	27-Feb-2025	19-Mar-2025	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) SW-S2	18-Feb-2025	----	----	----	25-Feb-2025	20-Feb-2025	☒
Clear Plastic Bottle - Natural (EK057G) GW-S2	19-Feb-2025	----	----	----	25-Feb-2025	21-Feb-2025	☒

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Work Order	: EM2502990
Client	: GHD PTY LTD
Project	: 12565989

Matrix: **WATER**

Evaluation: ☒ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G) SW-S2	**18-Feb-2025**	**----**	----	**----**	**28-Feb-2025**	18-Mar-2025	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) GW-S2	**19-Feb-2025**	**----**	----	**----**	**28-Feb-2025**	19-Mar-2025	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G) SW-S2	**18-Feb-2025**	**28-Feb-2025**	18-Mar-2025	✓	**28-Feb-2025**	18-Mar-2025	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) GW-S2	**19-Feb-2025**	**28-Feb-2025**	19-Mar-2025	✓	**28-Feb-2025**	19-Mar-2025	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G) SW-S2	**18-Feb-2025**	**28-Feb-2025**	18-Mar-2025	✓	**28-Feb-2025**	18-Mar-2025	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) GW-S2	**19-Feb-2025**	**28-Feb-2025**	19-Mar-2025	✓	**28-Feb-2025**	19-Mar-2025	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ☒ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	6	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	9	**22.22**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ☒ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
Nitrite as N by Discrete Analyser	EK057G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH by Auto Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030E. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)

OFFICIAL

n Date / T

Environmental Division..
Melbourne
Work Order Reference
EM,□420600

CHAIN OF CUSTODY RECORD

GHO Melbourno Office Addross
180 Lonsdale Street. Melbourne 3000
Tetephono: 613 8687 8000
Fax 61388878111

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5 Day TAT

Project Number
12565989

Laboratory
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Laboratory Address

GHDProject **Monogor**
Meg Turner

Laboratory Contact
Rhonda Chouman

GHD Contact
MA<. Turner

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GHO **PM** email
□UJ!l0r@ghd.COl!J

GHD Contact omall
f!l.'!Sl.<HJJO•@ohd.c0111

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Scott Huett

Subject: RE: GHDSER - SRN for ALS Workorder: EM2420600 | Overall Description: Mount Buller Water Storage Ongoing Monitoring Program

From: Meg Turner <meg.turner@ghd.com>
Sent: Tuesday, November 26, 2024 9:13 AM
To: ALS Enviro Melbourne <ALSEnviroMelbourne@ALSGlobal.com>
Cc: Brad Snibson <Brad.Snibson@alsglobal.com>
Subject: [EXTERNAL] - FW: SRN for ALS Workorder : EM2420600 | Overall Description: Mount Buller Water Storage Ongoing Monitoring Program

CAUTION: This email originated from outside of ALS. Do not click links or open attachments unless you recognize the sender and are sure content is relevant to you.

Hi,

Could the attached sample batch please be analysed for the following:

Electrical conductivity (EC)
Total Dissolved Solids (TDS)
Turbidity
Nutrients (Total P, Total N, Nitrate and Nitrite), Total Kjeldahl Nitrogen (TKN)
Major ions (Ca, Mg, Na, K, Cl, SO4, HCO3, CO3 and NO3)
Alkalinity (total) as CaCO3, Alkalinity (Bicarbonate as CaCO3), Alkalinity (Carbonate as CaCO3)

Kind regards,

Meg Turner (she/her)
B. Env Sci
Environmental Scientist - Victoria Environmental Management
GHD
Proudly employee-owned | ghd.com
105 Hume Street, Wodonga, Victoria, 3690, Australia
D +61 3 8687 8862 **(primary phone) M** +61 477 513 431 **(if work phone is unattended) E** meg.turner@ghd.com

➔ **The Power of Commitment**
Connect

Please consider the environment before printing this email

From: angel-no-reply@alsglobal.com <angel-no-reply@alsglobal.com>
Sent: Monday, 25 November 2024 4:31 PM
To: Meg Turner <meg.turner@ghd.com>
Subject: SRN for ALS Workorder: EM2420600 | Overall Description: Mount Buller Water Storage Ongoing Monitoring Program

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2420600**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Contact	: Peter Ravlic
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: meg.turner@ghd.com	E-mail	: peter.ravlic@alsglobal.com
Telephone	: ----	Telephone	: +6138549 9645
Facsimile	: ----	Facsimile	: +61-3-8549 9626
Project	: 12565989	Page	: 1 of 2
Order number	: ----	Quote number	: EB2020GHDSER0038 (EN/000)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	:		
Sampler	:		

Dates

Date Samples Received	: 25-Nov-2024 11:26	Issue Date	: 25-Nov-2024
Client Requested Due Date	: 09-Dec-2024	Scheduled Reporting Date	: **09-Dec-2024**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 2	Temperature	: 11.8°C
Receipt Detail	:	No. of samples received / analysed	: 2 / 0

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please be advised, that no analysis has been requested on the provided Chain of Custody (COC). The ANALYSIS-TBA task has been logged as a place holder until analysis instructions have been supplied by the client. Standard disposal timeframes apply from receipt of samples. Administrative fee plus applicable freight fees will be charged on the shown due date. If you would like to discuss this please contact Client Services.**
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- Unless otherwise stated, analytical work for this work order will be conducted at ALS Melbourne, NATA accreditation no. 825, site no. 13778.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Issue Date	:	25-Nov-2024
Page	:	2 of 2
Work Order	:	EM2420600 Amendment 0
Client	:	GHD PTY LTD

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - ANALYSIS-TBA Analysis not yet defined (Water)
EM2420600-001	19-Nov-2024 00:00	SW-51	✓
EM2420600-002	20-Nov-2024 00:00	GW-51	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com

Accounts Payable Australia

- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com

GHD LAB REPORTS

- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ghdlabreports@ghd.com

Meg Turner

- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	meg.turner@ghd.com
- A4 - AU Tax Invoice (INV)	Email	meg.turner@ghd.com
- Chain of Custody (CoC) (COC)	Email	meg.turner@ghd.com

CERTIFICATE OF ANALYSIS

Work Order	: **EM2420600**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Contact	: Peter Ravlic
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +6138549 9645
Project	: 12565989	Date Samples Received	: 25-Nov-2024 11:26
Order number	: ----	Date Analysis Commenced	: 30-Nov-2024
C-O-C number	: ----	Issue Date	: 03-Dec-2024 18:46
Sampler	: ----		
Site	:		
Quote number	: EN/000		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Eric Chau	Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA015H: EM2420600 #1-2 : Sample has been confirmed for total dissolved solids analysis through re-preparation and re-analysis.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SW-S1	GW-S1	----	----	----
				Sampling date / time	19-Nov-2024 00:00	20-Nov-2024 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM2420600-001	EM2420600-002	--------	--------	--------
					Result	Result	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**24**	**20**	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**47**	**49**	----	----	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		**0.4**	**26.2**	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**10**	**5**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**10**	**5**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	<1	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**1**	**1**	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**2**	**1**	----	----	----
Magnesium	7439-95-4	1	mg/L		<1	<1	----	----	----
Sodium	7440-23-5	1	mg/L		**2**	**2**	----	----	----
Potassium	7440-09-7	1	mg/L		<1	<1	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.13**	**0.89**	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ana yser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.13**	**0.89**	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.1	**0.2**	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Ar alyser									

Page	: 4 of 4
Work Order	: EM2420600
Client	: GHD PTY LTD
Project	: 12565989

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SW-S1	GW-S1	----	----	----
				Sampling date / time	19-Nov-2024 00:00	20-Nov-2024 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM2420600-001	EM2420600-002	--------	--------	--------
					Result	Result	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser - Continued									
^ Total Nitrogen as N	----	0.1	mg/L		**0.1**	**1.1**	**----**	**----**	**----**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.01	**0.11**	**----**	**----**	**----**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**0.23**	**0.13**	**----**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**0.19**	**0.14**	**----**	**----**	**----**

QUALITY CONTROL REPORT

Work Order	: **EM2420600**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Contact	: Peter Ravlic
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +6138549 9645
Project	: 12565989	Date Samples Received	: 25-Nov-2024
Order number	: ----	Date Analysis Commenced	: 30-Nov-2024
C-O-C number	: ----	Issue Date	: 03-Dec-2024
Sampler	: ----		
Site	:		
Quote number	: EN/000		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Eric Chau	Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC

Page	:	2 of 5
Work Order	:	EM2420600
Client	:	GHD PTY LTD
Project	:	12565989

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA010P: Conductivity by PC Titrator (QC Lot: 6226694)									
EM2420600-001	SW-S1	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	24	23	4.7	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 6226535)									
EM2420600-001	SW-S1	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	47	59	22.5	No Limit
EA045: Turbidity (QC Lot: 6225712)									
EM2420600-001	SW-S1	EA045: Turbidity	----	0.1	NTU	0.4	0.4	0.0	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 6226693)									
EM2420600-001	SW-S1	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	10	10	0.0	0% - 50%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	10	10	0.0	0% - 50%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 6225725)									
EM2420600-001	SW-S1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
EM2420972-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	526	518	1.5	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 6225726)									
EM2420600-001	SW-S1	ED045G: Chloride	16887-00-6	1	mg/L	1	1	0.0	No Limit
EM2420972-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	2150	2100	2.4	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 6227878)									
EM2420600-002	GW-S1	ED093F: Calcium	7440-70-2	1	mg/L	1	1	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	2	2	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EM2420748-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	20	20	0.0	0% - 50%

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Work Order : EM2420600
Client : GHD PTY LTD
Project : 12565989

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED093F: Dissolved Major Cations (QC Lot: 6227878) - continued									
EM2420748-002	Anonymous	ED093F: Magnesium	7439-95-4	1	mg/L	18	18	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	49	49	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	4	4	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 6225727)									
EM2420600-001	SW-S1	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EM2420972-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.04	0.04	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 6226868)									
EM2420896-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	16.2	16.9	4.4	0% - 20%
EM2420772-014	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.05	0.05	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 6226845)									
EM2420600-001	SW-S1	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	<0.1	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 6226846)									
EM2420600-001	SW-S1	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA010P: Conductivity by PC Titrator (QCLot: 6226694)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	100	85.0	119
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 6226535)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	101	91.0	110
				<10	2340 mg/L	103	80.8	119
EA045: Turbidity (QCLot: 6225712)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	102	88.1	110
ED037P: Alkalinity by PC Titrator (QCLot: 6226693)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	95.5	85.0	116
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6225725)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	500 mg/L	106	90.0	110
				<1	25 mg/L	105	90.0	110
ED045G: Chloride by Discrete Analyser (QCLot: 6225726)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	109	90.0	110
				<1	10 mg/L	110	90.0	110
ED093F: Dissolved Major Cations (QCLot: 6227878)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	107	80.0	120
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	97.2	80.0	120
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	95.7	80.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	95.7	80.0	120
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6225727)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	110	90.0	110
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6226868)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	104	90.0	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6226845)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	5 mg/L	87.5	70.0	117
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6226846)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	2.21 mg/L	93.1	71.9	114

Matrix Spike (MS) Report

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The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6225725)							
EM2420600-002	GW-S1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	94.0	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 6225726)							
EM2420600-002	GW-S1	ED045G: Chloride	16887-00-6	400 mg/L	72.4	70.0	142
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6225727)							
EM2420600-002	GW-S1	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	81.5	80.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6226868)							
EM2420777-003	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6226845)							
EM2420600-002	GW-S1	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	95.0	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6226846)							
EM2420600-002	GW-S1	EK067G: Total Phosphorus as P	----	1 mg/L	115	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2420600**	Page	: 1 of 8
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: Meg Turner	Telephone	: +6138549 9645
Project	: 12565989	Date Samples Received	: 25-Nov-2024
Site	:	Issue Date	: 03-Dec-2024
Sampler	: ----	No. of samples received	: 2
Order number	: ----	No. of samples analysed	: 2

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, where applicable to the methodology, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

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Work Order	: EM2420600
Client	: GHD PTY LTD
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Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete An	EM2420777--003	Anonymous	**Nitrite + Nitrate as N**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Due for extraction	Days overdue	Analysis: Date analysed	Due for analysis	Days overdue
EA015: Total Dissolved Solids dried at 180 ± 5 °C						
Clear Plastic Bottle - Natural						
SW-S1	----	----	----	02-Dec-2024	26-Nov-2024	**6**
Clear Plastic Bottle - Natural						
GW-S1	----	----	----	02-Dec-2024	27-Nov-2024	**5**
EA045: Turbidity						
Clear Plastic Bottle - Natural						
SW-S1	----	----	----	30-Nov-2024	21-Nov-2024	**9**
Clear Plastic Bottle - Natural						
GW-S1	----	----	----	30-Nov-2024	22-Nov-2024	**8**
EK057G: Nitrite as N by Discrete Analyser						
Clear Plastic Bottle - Natural						
SW-S1	----	----	----	02-Dec-2024	21-Nov-2024	**11**
Clear Plastic Bottle - Natural						
GW-S1	----	----	----	02-Dec-2024	22-Nov-2024	**10**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: ☒ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation

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Client : GHD PTY LTD
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Matrix: **WATER**

Evaluation: ☒ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P) SW-S1	19-Nov-2024	----	----	----	02-Dec-2024	17-Dec-2024	✓
Clear Plastic Bottle - Natural (EA010-P) GW-S1	20-Nov-2024	----	----	----	02-Dec-2024	18-Dec-2024	✓
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H) SW-S1	19-Nov-2024	----	----	----	02-Dec-2024	26-Nov-2024	☒
Clear Plastic Bottle - Natural (EA015H) GW-S1	20-Nov-2024	----	----	----	02-Dec-2024	27-Nov-2024	☒
EA045: Turbidity							
Clear Plastic Bottle - Natural (EA045) SW-S1	19-Nov-2024	----	----	----	30-Nov-2024	21-Nov-2024	☒
Clear Plastic Bottle - Natural (EA045) GW-S1	20-Nov-2024	----	----	----	30-Nov-2024	22-Nov-2024	☒
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) SW-S1	19-Nov-2024	----	----	----	02-Dec-2024	03-Dec-2024	✓
Clear Plastic Bottle - Natural (ED037-P) GW-S1	20-Nov-2024	----	----	----	02-Dec-2024	04-Dec-2024	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) SW-S1	19-Nov-2024	----	----	----	02-Dec-2024	17-Dec-2024	✓
Clear Plastic Bottle - Natural (ED041G) GW-S1	20-Nov-2024	----	----	----	02-Dec-2024	18-Dec-2024	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) SW-S1	19-Nov-2024	----	----	----	02-Dec-2024	17-Dec-2024	✓
Clear Plastic Bottle - Natural (ED045G) GW-S1	20-Nov-2024	----	----	----	02-Dec-2024	18-Dec-2024	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) SW-S1	19-Nov-2024	----	----	----	02-Dec-2024	17-Dec-2024	✓
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) GW-S1	20-Nov-2024	----	----	----	02-Dec-2024	18-Dec-2024	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) SW-S1	19-Nov-2024	----	----	----	02-Dec-2024	21-Nov-2024	☒
Clear Plastic Bottle - Natural (EK057G) GW-S1	20-Nov-2024	----	----	----	02-Dec-2024	22-Nov-2024	☒

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Client	: GHD PTY LTD
Project	: 12565989

Matrix: **WATER**

Evaluation: ☒ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G) SW-S1	**19-Nov-2024**	**----**	----	**----**	**02-Dec-2024**	17-Dec-2024	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) GW-S1	**20-Nov-2024**	**----**	----	**----**	**02-Dec-2024**	18-Dec-2024	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G) SW-S1	**19-Nov-2024**	**03-Dec-2024**	17-Dec-2024	✓	**03-Dec-2024**	17-Dec-2024	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) GW-S1	**20-Nov-2024**	**03-Dec-2024**	18-Dec-2024	✓	**03-Dec-2024**	18-Dec-2024	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G) SW-S1	**19-Nov-2024**	**03-Dec-2024**	17-Dec-2024	✓	**03-Dec-2024**	17-Dec-2024	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) GW-S1	**20-Nov-2024**	**03-Dec-2024**	18-Dec-2024	✓	**03-Dec-2024**	18-Dec-2024	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ☒ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	2	**100.00**	**7.50**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ☒ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030E. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)

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1213018

CHAIN OF CUSTODY RECORD

180 Lonsdale Str.,...,. Melbcerne 3000
Telephone:51386878000
Fax: 613 8687 8111

5 Day TAT

Quote ALS

Project Number

Laboratory 71

COURIER AND LABORATORY INSTRUCTIONS:

Project Name

Laboratory Addres;

GHD Project Manager

Laboratory Contact

GHD Contact
Meo Turner

Containers

Anal□sesRet11lire<f

GHD PM email

GHD Contact email

meg.turner@ghd.com

Meg.Turner@ghd.com

SampleLD	O.te and Time	Composite Sample	Sample Matrix S: Soil SL: Sludg W: Water A: Air GW:	Preservative Type J: soil jar B: bag V: vial G: glass bottle P: plastic bottle	Number	Volume (ml)					SAMPLE COMMENTS
Boao_1 o/U1	22/4/25		W	p	3		✓	✓	✓	X	
Boao_1 o/U2	"										
	"										
EWS Easl	//										
EWS Wo/ul											
SW-D'•"											Please rename to SW-D3
sw-split										X	Please Forward to ALS
BH09	11										
BH16	/.I										
BH17	22/4/25										
BH18	ft										
GW-D□J..r.	//										Please rename to GW
gw-split to R2			IAJ	:/			✓	✓	✓	X	Forwared to ALS
TOTAL **NUMBER** OF SAMPLES											
TOTAL **NUMBER** OF **ESKIES**											

CUSTODY DETAILS

SAMPLER:	M Turner	IDate/Time I 7.2./,/-- /"7L	IRelinqu1shea by;	IDate/Time 22/4/25
COURIER:		Date/Time	Relinquished by:	IDate/Time
LABORATORY:		Date/Time I		
COMMENTS:	Samples stored on ice in esky			

OFFICIAL

ra Outlook

RE: Scan Data from FF-1C7D225E68C7

From Hany Bacalis <Harry.Bacalis@eurofinsanz.com>
Date Mon 28/4/25 9:26 AM
To Meg Turner <meg.turner@ghd.com>; EnviroSampleVic <EnviroSampleVic@eurofins.com>
Cc Harry Bacalis .:harrybacalis@eurofins.com>; SH_AU_CAU001_EnviroSampleVic .:EnviroSampleVic@eurofinsanz.com>

fl 1 attachment (432 KB)
28042025073939-0001.pdf;

Verified Sender: This email is from an internal and/or verified domain which passed security verifications. Remember to still be cautious with personal data and follow company policies.

Thanks Meg

Vinay - COC attached

Kind regards,

Harry Bacalis
Phone: +61 3 8564 5064
Mobile: +61 438 858 924
Email: Harry.Bacalis@eurofinsanz.com

** Our Adelaide office is on the move**

This e-mail including its attachments may contain confidential and proprietary information. Any unauthorized disclosure or use of this e-mail including its attachments is prohibited and may be prosecuted. If you are not the intended recipient, please inform the sender by an e-mail reply and delete the message.
Transmission by e-mail is not secure and can result in errors or omissions in the content of the message.
Despite state-of-the-art precautions we cannot guarantee that e-mails and attachments are free from viruses. We accept no liability for viruses or any transmission-related errors and omissions. You need to always virus-check any e-mails and attachments.
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-----Original Message----
From: Meg Turner <meg.turner@ghd.com>
Sent: Monday, 28 April 2025 8:06 AM
To: EnviroSampleVic <EnviroSampleVic@eurofins.com>
Cc: Harry Bacalis <harrybacalis@eurofins.com>
Subject: FW: Scan Data from FF-IC7D225E68C7

Unverified Sender: The sender of this email bas not been verified. Review the content of the message carefully and verify the identity of the sender before acting on this email: replying, opening attachments or clicking links.

Hi Enviro team,

Please see COC attached for eskies delivered for PO 12565989 late last week.

Kind regards,

Meg Turner (she/her)
B. Env Sci
Environmental Scientist - Victoria Environmental Management GHD Proudly employee-owned ı ghd.com
105 Hurne Street, Wodonga, Victoria, 3690,Australia D +61386878862 (primary phone) M +61 477 513 431 (if work phone is unattended) E meg.tumer@ghd.com

Toe Power of Commitment
Connect

Please consider the environment before printing this email

-----Original Message---
From: Apeos C3570 <ABX_FB3570@ghd.com.au>
Sent: Monday, 28 April 2025 7:40 AM
To: Meg Turner <meg.tumer@ghd.com>
Subject: Scan Data from FF-IC7D225E68C7

Number of Images: I
Attachment File Type: PDF

Device Name: Apcos C3570
Device Location:

CONFIDENTIALITYNOTICE: This email, including any attachments, is confidential and may be privileged. If you are not the intended recipient please notify the sender immediately, and please delete it; you should not copy it or use it for any purpose or disclose its contents to any other person. GHD and its affiliates reserve the right to monitor and modify all email communications through their networks.

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PROJECT INFORMATION

Date & Time Received: iy / 4 IO·. j 1-

Company: GH D N v c{a n c-.

Contact Details: 0411 $\· -/+ ɣ 4 3./

Project Name/site:

Project Number: 1 b 5q 9

Sample IDs:

Sampling Date/s: 1]u4

COC:

Attached ☐
E-mailed ☐
Not received ☐

Courier C:{'

Temperature: I 3 I c.

Attempt to chill:@/ N

Custody Seal: /\'61 s-=,6 I

Number of Eskies: 1

Last modified on: 03 January 2025	Approved on: PENDING	Version: QS1039_R3-DRAFT
Last modified by: N. Richardson	Approver: PENDING	Page 1 of 1
Edttorial Committee: N. Richardson, V. Heredia, T. Lakeland		Next required review date: XX January 2029

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AU ② FH

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CHAIN OF CUSTODY RECORD

GHD Melbourne Office Address
160 Lonsdale Street Melbourne 3000
Telep□one: 613 6667 ll000
Fax .613 6667 8111

Completion Date , Turnaround
5 Day TAT

Quote#
Page_{._._or
Quote **ALS**

Project Number
125659B8

Project Name
Mounl Buller Water Storaoe on1101n□Monitorinll Proaram

Laboratory□'"--<,J_)
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Laboratory Addres□
'— 1,ll.-.a-,..tte:> "

GHD Project Manager
MegTumer

Laboratory Contact
-

GHD Contact
MeoTumer

Containers | **Analvsis ReQUlred**

GHD **PM email**
Meg.Tumer@ghd_com

GHD Contact email
meg.tumer@ahd.com

COURIER AND LABORATORY INSTRUCTIONS:

- &3nchain Dl' cus>lXly document on r.e:::rflpC ;ma rdc..sc 0r sa-nple5. -oeiw6!!n oach party

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TOTAL **NUMBER** OF **SAMPLES**	
TOTAL NUMBER OF ESKIES	

CUSTODY DETAILS

SAMPLER:	r---r -r ".r-o,r	Dale/Time	-<.::/l <,p 1'·1 c..	Relinau1shea bu:	Dateffime
COURIER:		Dale/Time		Relinau1shed bv·	Date/Time
LABORATORY:		Datemme			
COMMENTS:	Samples s1ored on ice in esky				

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www.eurofins.com.au EnviroSales@eurofinsanz.com

Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	+61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794 & 2780	Site# 25079

Eurofins ARL Pty Ltd

ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370 & 2554

Eurofins Environment Testing NZ Ltd

NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise	43 Detroit Drive	1277 Cameron Road
Penrose	Mount Wellington	Rolleston	Gate Pa
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

Sample Receipt Advice

Company name:	GHD PTY LTD
Contact name:	Meg Turner
Project name:	Mount Buller Water Storage Ongoing Monitoring Program
Project ID:	12565989
Turnaround time:	10 Day
Date/Time received	Apr 28, 2025 8:06 AM
Eurofins reference	1213018

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
×	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✓	Split sample sent to requested external lab.
×	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

BH18 not received

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Savini Suduweli on phone : +61 3 8564 5051 or by email: Savini.Suduwelikondage@eurofinsanz.com

Results will be delivered electronically via email to Meg Turner - meg.turner@ghd.com.

Note: A copy of these results will also be delivered to the general GHD PTY LTD email address.

Global Leader - Results you can trust

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofinsanz.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	+61 7 3902 4600	+61 2 4968 8448
NATA# 1261 Site# 1254	NATA# 1261 Site# 25403	NATA# 1261 Site# 18217	NATA# 1261 Site# 25466	NATA# 1261 Site# 20794 & 2780	NATA# 1261 Site# 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377 Site# 2370 & 2554

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise	43 Detroit Drive	1277 Cameron Road
Penrose	Mount Wellington	Rolleston	Gate Pa
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

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Company Name: GHD PTY LTD
Address: Level 8, 180 Lonsdale St
Melbourne
VIC 3000

Project Name: Mount Buller Water Storage Ongoing Monitoring Program
Project ID: 12565989

Order No.:
Report #: 1213018
Phone: 8687 8000
Fax: 8687 8111

Received: Apr 28, 2025 8:06 AM
Due: May 12, 2025
Priority: 10 Day
Contact Name: Meg Turner

Eurofins Analytical Services Manager : Savini Suduweli

Sample Detail						Conductivity (at 25 °C)	Phosphate total (as P)	Turbidity	Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P	Eurofins Suite B11E: Cl/SO4/Alkalinity	Eurofins Suite B11C: Na/K/Ca/Mg	Total Dissolved Solids Dried at 180 °C ± 2 °C
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	Boggy 1 p/u 1	Apr 22, 2025		Water	M25-Ap0065757	X	X	X	X	X	X	X
2	Boggy 1 p/u 2	Apr 22, 2025		Water	M25-Ap0065758	X	X	X	X	X	X	X
3	Boggy 2	Apr 22, 2025		Water	M25-Ap0065759	X	X	X	X	X	X	X
4	SW-D3	Apr 22, 2025		Water	M25-Ap0065760	X	X	X	X	X	X	X
5	BH09	Apr 22, 2025		Water	M25-Ap0065761	X	X	X	X	X	X	X
6	BH16	Apr 22, 2025		Water	M25-Ap0065762	X	X	X	X	X	X	X
7	BH17	Apr 23, 2025		Water	M25-Ap0065763	X	X	X	X	X	X	X
8	GW-D3	Apr 23, 2025		Water	M25-Ap0065764	X	X	X	X	X	X	X
9	R3	Apr 23, 2025		Water	M25-Ap0065765	X	X	X	X	X	X	X
10	EWS East	Apr 22, 2025		Water	M25-Ap0065832	X	X	X	X	X	X	X
Test Counts						19	10	10	10	10	10	10

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Certificate of Analysis

GHD PTY LTD
Level 8, 180 Lonsdale St
Melbourne
VIC 3000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Meg Turner**

Report **1213018-W**
Project name Mount Buller Water Storage Ongoing Monitoring Program
Project ID 12565989
Received Date Apr 28, 2025

Client Sample ID **Sample Matrix** **Eurofins Sample No.** **Date Sampled** Test/Reference	LOR	Unit	**Boggy 1 p/u 1** **Water** **M25-Ap0065757** **Apr 22, 2025**	**Boggy 1 p/u 2** **Water** **M25-Ap0065758** **Apr 22, 2025**	**Boggy 2** **Water** **M25-Ap0065759** **Apr 22, 2025**	**SW-D3** **Water** **M25-Ap0065760** **Apr 22, 2025**
Ammonia (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Chloride	1	mg/L	< 1	2.7	1.0	6.3
Conductivity (at 25 °C)	10	uS/cm	28	25	28	28
Nitrate & Nitrite (as N)	0.05	mg/L	0.09	0.09	0.06	< 0.05
Nitrate (as N)	0.02	mg/L	0.09	0.09	0.06	0.04
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)*	0.2	mg/L	0.2	< 0.2	0.3	0.2
Sulphate (as SO4)	5	mg/L	< 5	< 5	< 5	< 5
Total Dissolved Solids Dried at 180 °C ± 2 °C	10	mg/L	[Q19]37	[Q19]37	[Q19]64	[Q19]44
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	0.2	< 0.2	0.3	0.2
Total Nitrogen (as N)*	0.2	mg/L	0.3	< 0.2	0.4	0.2
Turbidity	1	NTU	< 1	< 1	2.4	< 1
Phosphate total (as P)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Alkali Metals						
Calcium	0.5	mg/L	2.1	1.7	2.2	2.1
Magnesium	0.5	mg/L	0.6	0.6	0.7	0.7
Potassium	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5
Sodium	0.5	mg/L	3.7	2.9	3.1	3.1

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Client Sample ID			BH09	BH16	BH17	GW-D3
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M25-Ap0065761	M25-Ap0065762	M25-Ap0065763	M25-Ap0065764
Date Sampled			Apr 22, 2025	Apr 22, 2025	Apr 23, 2025	Apr 23, 2025
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	< 0.01	< 0.01	0.02	0.02
Chloride	1	mg/L	< 1	50	< 1	1.4
Conductivity (at 25 °C)	10	uS/cm	19	18	39	39
Nitrate & Nitrite (as N)	0.05	mg/L	0.62	0.82	0.17	0.18
Nitrate (as N)	0.02	mg/L	0.61	0.82	0.17	0.17
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)*	0.2	mg/L	0.6	0.2	0.78	0.28
Sulphate (as SO4)	5	mg/L	< 5	100	< 5	< 5
Total Dissolved Solids Dried at 180 °C ± 2 °C	10	mg/L	Q19 48	Q19 64	Q19 40	Q19 42
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	0.6	0.2	0.8	0.3
Total Nitrogen (as N)*	0.2	mg/L	1.2	1.0	1.0	0.5
Turbidity	1	NTU	39	180	100	200
Phosphate total (as P)	0.01	mg/L	< 0.01	0.11	0.06	0.06
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	24	23
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	24	23
Alkali Metals						
Calcium	0.5	mg/L	1.1	1.0	3.2	3.1
Magnesium	0.5	mg/L	< 0.5	< 0.5	1.1	1.2
Potassium	0.5	mg/L	< 0.5	< 0.5	1.2	1.1
Sodium	0.5	mg/L	1.9	3.4	4.2	4.2

Client Sample ID			R3	EWS East
Sample Matrix			Water	Water
Eurofins Sample No.			M25-Ap0065765	M25-Ap0065832
Date Sampled			Apr 23, 2025	Apr 22, 2025
Test/Reference	LOR	Unit		
Ammonia (as N)	0.01	mg/L	< 0.01	< 0.01
Chloride	1	mg/L	< 1	1.5
Conductivity (at 25 °C)	10	uS/cm	< 10	28
Nitrate & Nitrite (as N)	0.05	mg/L	< 0.05	0.10
Nitrate (as N)	0.02	mg/L	< 0.02	0.10
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02
Organic Nitrogen (as N)*	0.2	mg/L	< 0.2	0.6
Sulphate (as SO4)	5	mg/L	< 5	< 5
Total Dissolved Solids Dried at 180 °C ± 2 °C	10	mg/L	< 10	Q19 26
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	< 0.2	0.6
Total Nitrogen (as N)*	0.2	mg/L	< 0.2	0.7
Turbidity	1	NTU	< 1	3.0
Phosphate total (as P)	0.01	mg/L	< 0.01	< 0.01
Alkalinity (speciated)				
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	< 20	< 20
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	< 20	< 20

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Client Sample ID			R3	EWS East
Sample Matrix			Water	Water
Eurofins Sample No.			M25-Ap0065765	M25-Ap0065832
Date Sampled			Apr 23, 2025	Apr 22, 2025
Test/Reference	LOR	Unit		
Alkali Metals				
Calcium	0.5	mg/L	< 0.5	2.1
Magnesium	0.5	mg/L	< 0.5	0.6
Potassium	0.5	mg/L	< 0.5	1.6
Sodium	0.5	mg/L	< 0.5	3.7

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Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P			
Ammonia (as N)	Melbourne	Apr 28, 2025	28 Days
- Method: APHA 4500-NH3 Ammonia Nitrogen by FIA			
Nitrate & Nitrite (as N)	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Nitrate (as N)	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Nitrite (as N)	Melbourne	Apr 28, 2025	2 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Organic Nitrogen (as N)*	Melbourne	Apr 28, 2025	7 Days
- Method: APHA 4500 Organic Nitrogen (N)			
Total Kjeldahl Nitrogen (as N)	Melbourne	Apr 28, 2025	28 Days
- Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA			
Eurofins Suite B11E: Cl/SO4/Alkalinity			
Chloride	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Sulphate (as SO4)	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Alkalinity (speciated)	Melbourne	Apr 28, 2025	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Conductivity (at 25 °C)	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-INO-4030 Conductivity			
Turbidity	Melbourne	May 02, 2025	2 Days
- Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)			
Phosphate total (as P)	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Melbourne	Apr 28, 2025	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Dissolved Solids Dried at 180 °C ± 2 °C	Melbourne	May 05, 2025	28 Days
- Method: LTM-INO-4170 Total Dissolved Solids in Water			

Repeat Samples

Description	Testing Site	Extracted	Holding Time
Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P			
Ammonia (as N)	Melbourne	Apr 28, 2025	28 Days
- Method: APHA 4500-NH3 Ammonia Nitrogen by FIA			
Nitrate & Nitrite (as N)	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Nitrate (as N)	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Nitrite (as N)	Melbourne	Apr 28, 2025	2 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Organic Nitrogen (as N)*	Melbourne	Apr 28, 2025	7 Days
- Method: APHA 4500 Organic Nitrogen (N)			
Total Kjeldahl Nitrogen (as N)	Melbourne	Apr 28, 2025	28 Days
- Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA			
Eurofins Suite B11E: Cl/SO4/Alkalinity			
Chloride	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Sulphate (as SO4)	Melbourne	Apr 28, 2025	28 Days

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Description	Testing Site	Extracted	Holding Time
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Alkalinity (speciated)	Melbourne	Apr 28, 2025	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Conductivity (at 25 °C)	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-INO-4030 Conductivity			
Turbidity	Melbourne	May 02, 2025	2 Days
- Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)			
Phosphate total (as P)	Melbourne	Apr 28, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Melbourne	Apr 28, 2025	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Dissolved Solids Dried at 180 °C ± 2 °C	Melbourne	May 05, 2025	28 Days
- Method: LTM-INO-4170 Total Dissolved Solids in Water			

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web: www.eurofins.com.au
email: EnviroSales@eurofinsanz.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	+61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794 & 2780	Site# 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370 & 2554

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise	43 Detroit Drive	1277 Cameron Road
Penrose	Mount Wellington	Rolleston	Gate Pa
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

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Company Name: GHD PTY LTD
Address: Level 8, 180 Lonsdale St
Melbourne
VIC 3000

Project Name: Mount Buller Water Storage Ongoing Monitoring Program
Project ID: 12565989

Order No.:
Report #: 1213018
Phone: 8687 8000
Fax: 8687 8111

Received: Apr 28, 2025 8:06 AM
Due: May 12, 2025
Priority: 10 Day
Contact Name: Meg Turner

Eurofins Analytical Services Manager : Savini Suduweli

Sample Detail						Conductivity (at 25 °C)	Phosphate total (as P)	Turbidity	Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P	Eurofins Suite B11E: Cl/SO4/Alkalinity	Eurofins Suite B11C: Na/K/Ca/Mg	Total Dissolved Solids Dried at 180 °C ± 2 °C
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	Boggy 1 p/u 1	Apr 22, 2025		Water	M25-Ap0065757	X	X	X	X	X	X	X
2	Boggy 1 p/u 2	Apr 22, 2025		Water	M25-Ap0065758	X	X	X	X	X	X	X
3	Boggy 2	Apr 22, 2025		Water	M25-Ap0065759	X	X	X	X	X	X	X
4	SW-D3	Apr 22, 2025		Water	M25-Ap0065760	X	X	X	X	X	X	X
5	BH09	Apr 22, 2025		Water	M25-Ap0065761	X	X	X	X	X	X	X
6	BH16	Apr 22, 2025		Water	M25-Ap0065762	X	X	X	X	X	X	X
7	BH17	Apr 23, 2025		Water	M25-Ap0065763	X	X	X	X	X	X	X
8	GW-D3	Apr 23, 2025		Water	M25-Ap0065764	X	X	X	X	X	X	X
9	R3	Apr 23, 2025		Water	M25-Ap0065765	X	X	X	X	X	X	X
10	EWS East	Apr 22, 2025		Water	M25-Ap0065832	X	X	X	X	X	X	X
Test Counts						19	10	10	10	10	10	10

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
ppm: parts per million
µg/L: micrograms per litre
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit
Colour: Pt-Co Units (CU)

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Conductivity (at 25 °C)	uS/cm	< 10			10	Pass	
Sulphate (as SO4)	mg/L	< 5			5	Pass	
Total Dissolved Solids Dried at 180 °C ± 2 °C	mg/L	< 10			10	Pass	
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
Method Blank							
Sulphate (as SO4)	mg/L	< 5			5	Pass	
Turbidity	NTU	< 1			1	Pass	
Method Blank							
Phosphate total (as P)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Sulphate (as SO4)	mg/L	< 5			5	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Nitrate (as N)	mg/L	< 0.02			0.02	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Method Blank							
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Method Blank							
Nitrate & Nitrite (as N)	mg/L	< 0.05			0.05	Pass	
LCS - % Recovery							
Ammonia (as N)	%	75			70-130	Pass	
Conductivity (at 25 °C)	%	87			70-130	Pass	
Nitrite (as N)	%	82			70-130	Pass	
Sulphate (as SO4)	%	120			70-130	Pass	
Total Dissolved Solids Dried at 180 °C ± 2 °C	%	97			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	%	97			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Carbonate Alkalinity (as CaCO3)	%	78			70-130	Pass	
Total Alkalinity (as CaCO3)	%	81			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	96			70-130	Pass	
Sulphate (as SO4)	%	111			70-130	Pass	
Turbidity	%	96			70-130	Pass	
LCS - % Recovery							
Sulphate (as SO4)	%	119			70-130	Pass	
Phosphate total (as P)	%	94			70-130	Pass	
LCS - % Recovery							
Chloride	%	111			70-130	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium	%	96			80-120	Pass	
Magnesium	%	102			80-120	Pass	

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Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Potassium			%	103			80-120	Pass	
Sodium			%	102			80-120	Pass	
LCS - % Recovery									
Ammonia (as N)			%	97			70-130	Pass	
Chloride			%	101			70-130	Pass	
LCS - % Recovery									
Alkali Metals									
Calcium			%	92			80-120	Pass	
Magnesium			%	100			80-120	Pass	
Potassium			%	97			80-120	Pass	
Sodium			%	99			80-120	Pass	
LCS - % Recovery									
Ammonia (as N)			%	94			70-130	Pass	
LCS - % Recovery									
Nitrate & Nitrite (as N)			%	118			70-130	Pass	
LCS - % Recovery									
Nitrate & Nitrite (as N)			%	97			70-130	Pass	
LCS - % Recovery									
Nitrate & Nitrite (as N)			%	95			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Ammonia (as N)	M25-Ap0063061	NCP	%	94			70-130	Pass	
Chloride	M25-Ap0063322	NCP	%	89			70-130	Pass	
Nitrate & Nitrite (as N)	M25-Ap0063061	NCP	%	82			70-130	Pass	
Nitrite (as N)	M25-Ap0063061	NCP	%	90			70-130	Pass	
Sulphate (as SO4)	M25-Ap0063322	NCP	%	76			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	M25-Ap0063062	NCP	%	92			70-130	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Calcium	M25-Ap0060025	NCP	%	108			75-125	Pass	
Magnesium	M25-Ap0063061	NCP	%	122			75-125	Pass	
Potassium	M25-Ap0067541	NCP	%	92			75-125	Pass	
Spike - % Recovery									
				Result 1					
Phosphate total (as P)	M25-Ap0065759	CP	%	93			70-130	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Sodium	M25-Ap0065762	CP	%	106			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Total Kjeldahl Nitrogen (as N)	M25-Ap0065769	NCP	mg/L	18	19	7.0	30%	Pass	
Turbidity	M25-Ap0069139	NCP	NTU	< 1	< 1	<1	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium	M25-Ap0062733	NCP	mg/L	310	310	1.0	30%	Pass	
Magnesium	M25-Ap0063061	NCP	mg/L	23	22	4.0	30%	Pass	
Potassium	M25-Ap0067541	NCP	mg/L	2.0	1.9	5.0	30%	Pass	

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Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M25-Ap0065760	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Nitrate & Nitrite (as N)	M25-Ap0065760	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Nitrite (as N)	M25-Ap0065760	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Phosphate total (as P)	M25-Ap0065760	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M25-Ap0065761	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Chloride	M25-Ap0065761	CP	mg/L	< 1	1.0	11	30%	Pass	
Nitrate & Nitrite (as N)	M25-Ap0065761	CP	mg/L	0.62	0.55	11	30%	Pass	
Nitrite (as N)	M25-Ap0065761	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Sulphate (as SO4)	M25-Ap0065761	CP	mg/L	< 5	< 5	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M25-Ap0065762	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Nitrate & Nitrite (as N)	M25-Ap0065762	CP	mg/L	0.82	0.80	2.0	30%	Pass	
Nitrite (as N)	M25-Ap0065762	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Sodium	M25-Ap0065762	CP	mg/L	3.4	3.0	13	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chloride	M25-Ap0065764	CP	mg/L	1.4	1.2	11	30%	Pass	
Sulphate (as SO4)	M25-Ap0065764	CP	mg/L	< 5	< 5	<1	30%	Pass	
Duplicate									
Alkalinity (speciated)				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	M25-Ap0065832	CP	mg/L	< 20	< 20	<1	30%	Pass	
Carbonate Alkalinity (as CaCO3)	M25-Ap0065832	CP	mg/L	< 10	< 10	<1	30%	Pass	
Hydroxide Alkalinity (as CaCO3)	M25-Ap0065832	CP	mg/L	< 20	< 20	<1	30%	Pass	
Total Alkalinity (as CaCO3)	M25-Ap0065832	CP	mg/L	< 20	< 20	<1	30%	Pass	

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Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q19	TDS may bias high due to the presence of fine particulate or colloidal matter that may pass through the filter paper.

Authorised by:

Catherine Wilson	Analytical Services Manager
Caitlin Breeze	Senior Analyst-Inorganic
Caitlin Breeze	Senior Analyst-Metal
Luke Holt	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Metal

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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CHAIN OF CUSTODY RECORD

GHD Melbourne Office Address
180 Lonsdale Street, Melbourne 3000
Telephone: 613 8687 8000
Fax:61386878111

Completion Date/ Turnaround: 5 Day TAT

Quote#

Page 1 of 1

Quote ALS

Project Number

Project Name
Mount Buller Water Storage Opposing Monitoring Program

GHD Project Manager
Mea Turner

GHD Contact
MeaTurner

GHD PM email
Meg.Turner@ghd.com

GHD Contact email
meg.turner@ghd.com

Laboratory

Laboratory Address
2-4 Westall Road, Springvale 3171

Laboratory Contact
Shirley Le Comu

COURIER AND LABORATORY INSTRUCTIONS:

- Sign eha1n of custody document on reciept and release of samples. between each party.
- Samples are to be delivered to the laboratory address shown
- Laboratory contact should sign the COC and send a copy (via email) to the GHO Project Manager and GHD Contact. along With a sample receipt notice, tNIthin 24 hows of reciept
- A signed copy ofthe coc shotld be returned to the GH> Project Mariager and GHO contact with the results via email at tne completion of analysis as requested.
- All results should reference tlie JobNumber and Project Name.
- All resultsshou d be provided in NATA accredited pelf format and ESDAT format

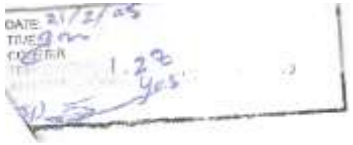
SAMPLE COMMENTS

SIlmpleI.D.	Date and Time	Sample Matrix: S: Soil W: Water GW: Groundwater A: Air	Preservative	Containers: Type: Jar, Bottle, Bag V: VOA G: glass bottle P: Plastic bottle	Analyses Required: Major Anions (Cl, SO4 Alkalinity, Total)	Nutrients: Nitrogen as	EC, TDS, Turbid
Booov 1 o/u 1	8/2/25	W	p		X	X	X
Boonv 1 p/u 2							
Bno..iv 2							
EWSWest							
SW-D2							
SW-S2	19/2/25	GW					
BH06							
BH09							
BH16							
BH17							
GW-D2							
GW-S2							
R2				V		V	
TOTAL NUMBER OF SAMPLES							
TOTAL NUMBER OF ESKIES							

#1190470

CUSTODY DETAILS

SAMPLER:		Date/Time	Relinquished by:	Date/Time
COURIER:	Type	Date/Time	Relinquished by:	Date/Time
LABORATORY:		Date/Time		
COMMENTS:	Samples stored on ice in esky			



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CHAIN OF CUSTODY RECORD

GHD Melbourne Office Address
180 Lonsdale Street, Melbourne 3000
Telephone: 613 8687 8000
Fax: 613 8687 8111

Completion Date / Turnaround

Quote#

Quote ALS

Project Number 12565989	**Laboratory** ALS
Project Name Mount Buller Water Storage Ongoing Monitoring Program	**Laboratory Address** 2-4 Westall Road, Springvale 3171
GHD Project Manager MeaTurner	**Laboratory Contact** Shirley Le.Comu
GHD Contact Meo Turner	
GHD PM email Meg.turner@ghd.com	**GHD Contact email** meg.turner@ghd.com

COURIER AND LABORATORY INSTRUCTIONS:

- Sign cha.in of custody document on reciept and release of samples, between each party.
- Samples are to be delivered to lhe laboratory address shown.
- Laboratory contact should sign the COG and send a copy (via email) to the GHD Proje□t Manager and GH0 Contact, along with a sample receipt notice, within 24 hours of reciept
- A signed copy of the C0C should be returned to lhe GH0 Project Manager and GHD Contact with the results via email at the completion of analysis as requested
- .- All results should reference the Job Number and ProjeCt Name
- All results should be pro'llded in NATA accredited pdf format and ESDAT format

Containers

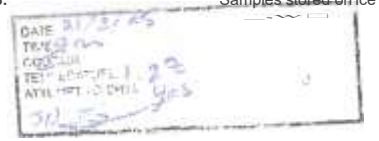
Ana'"esos Reauired

Samflel.D.	Date and Time	SAMPLE COMMENTS
□-1...E&.L	\□ / 2/□	
8Mm, 1o/u 2		
lloqa,2		
EWSWest		
SW-D2		
SW-$2	,lo"	)(e…,"<□I A'-"…>
BH06	l9 /'7 /'2.S	
BH09		
BH16		
BH17		
GW-D2		
GW-S2		'/. □□ ..□di +o AL-S
R2		

TOTAL NUMBER OF SAMPLES

TOTAL NUMBER OF ESKIES

CUSTODY DETAILS							
SAMPLER:		DateTime		Relinquished by:		Datemme	
COURIER:		Datemme		Relinquished by:		DateTime	
LABORATORY:		DateTime					
COMMENTS:	Samples stored on Ice in esky						



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www.eurofins.com.au EnviroSales@eurofinsanz.com

Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	+61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794 & 2780	Site# 25079

Eurofins ARL Pty Ltd

ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370 & 2554

Eurofins Environment Testing NZ Ltd

NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise	43 Detroit Drive	1277 Cameron Road
Penrose	Mount Wellington	Rolleston	Gate Pa
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

Sample Receipt Advice

Company name:	GHD PTY LTD
Contact name:	Meg Turner
Project name:	Mount Buller Water Storage Ongoing Monitoring Program
Project ID:	12565989
Turnaround time:	6 Day
Date/Time received	Feb 21, 2025 9:00 AM
Eurofins reference	1190470

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✓	Split sample sent to requested external lab.
×	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

EWC East recieved instead of EWC West.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Savini Suduweli on phone : +61 3 8564 5051 or by email: Savini.Suduwelikondage@eurofinsanz.com

Results will be delivered electronically via email to Meg Turner - meg.turner@ghd.com.

Note: A copy of these results will also be delivered to the general GHD PTY LTD email address.

Global Leader - Results you can trust

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofinsanz.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	+61 7 3902 4600	+61 2 4968 8448
NATA# 1261 Site# 1254	NATA# 1261 Site# 25403	NATA# 1261 Site# 18217	NATA# 1261 Site# 25466	NATA# 1261 Site# 20794 & 2780	NATA# 1261 Site# 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377 Site# 2370 & 2554

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise	43 Detroit Drive	1277 Cameron Road
Penrose	Mount Wellington	Rolleston	Gate Pa
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

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Company Name: GHD PTY LTD
Address: Level 8, 180 Lonsdale St
Melbourne
VIC 3000

Project Name: Mount Buller Water Storage Ongoing Monitoring Program
Project ID: 12565989

Order No.:
Report #: 1190470
Phone: 8687 8000
Fax: 8687 8111

Received: Feb 21, 2025 9:00 AM
Due: Mar 3, 2025
Priority: 6 Day
Contact Name: Meg Turner

Eurofins Analytical Services Manager : Savini Suduweli

Sample Detail						Conductivity (at 25 °C)	Phosphate total (as P)	Turbidity	Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P	Eurofins Suite B11E: Cl/SO4/Alkalinity	Eurofins Suite B11C: Na/K/Ca/Mg	Total Dissolved Solids Dried at 180 °C ± 2 °C
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	Boggy 1 p/u 1	Feb 18, 2025		Water	M25-Fe0053817	X	X	X	X	X	X	X
2	Boggy 1 p/u 2	Feb 18, 2025		Water	M25-Fe0053818	X	X	X	X	X	X	X
3	Boggy 2	Feb 18, 2025		Water	M25-Fe0053819	X	X	X	X	X	X	X
4	EWS East	Feb 18, 2025		Water	M25-Fe0053820	X	X	X	X	X	X	X
5	SW-D2	Feb 18, 2025		Water	M25-Fe0053821	X	X	X	X	X	X	X
6	BH06	Feb 19, 2025		Water	M25-Fe0053822	X	X	X	X	X	X	X
7	BH09	Feb 19, 2025		Water	M25-Fe0053823	X	X	X	X	X	X	X
8	BH16	Feb 19, 2025		Water	M25-Fe0053824	X	X	X	X	X	X	X
9	BH17	Feb 19, 2025		Water	M25-Fe0053825	X	X	X	X	X	X	X
10	GW-D2	Feb 19, 2025		Water	M25-Fe0053826	X	X	X	X	X	X	X
11	R2	Feb 19, 2025		Water	M25-Fe0053827	X	X	X	X	X	X	X
Test Counts						21	11	11	11	11	11	11

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Certificate of Analysis

GHD PTY LTD
Level 8, 180 Lonsdale St
Melbourne
VIC 3000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Meg Turner**

Report **1190470-W**
Project name Mount Buller Water Storage Ongoing Monitoring Program
Project ID 12565989
Received Date Feb 21, 2025

Client Sample ID			**Boggy 1 p/u 1**	**Boggy 1 p/u 2**	**Boggy 2**	**EWS East**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**M25-Fe0053817**	**M25-Fe0053818**	**M25-Fe0053819**	**M25-Fe0053820**
Date Sampled			**Feb 18, 2025**	**Feb 18, 2025**	**Feb 18, 2025**	**Feb 18, 2025**
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Chloride	1	mg/L	1.1	1.8	1.3	1.3
Conductivity (at 25 °C)	10	uS/cm	28	24	28	27
Nitrate & Nitrite (as N)	0.05	mg/L	0.08	0.07	< 0.05	0.14
Nitrate (as N)	0.02	mg/L	0.07	0.06	0.03	0.14
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)*	0.2	mg/L	< 0.2	0.2	< 0.2	< 0.2
Sulphate (as SO4)	5	mg/L	< 5	< 5	< 5	< 5
Total Dissolved Solids Dried at 180 °C ± 2 °C	10	mg/L	[Q19]55	[Q19]35	[Q19]37	[Q19]63
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	< 0.2	0.2	< 0.2	< 0.2
Total Nitrogen (as N)*	0.2	mg/L	< 0.2	0.3	< 0.2	< 0.2
Turbidity	1	NTU	3.6	< 1	< 1	6.8
Phosphate total (as P)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Alkali Metals						
Calcium	0.5	mg/L	2.0	1.5	2.1	1.8
Magnesium	0.5	mg/L	0.7	0.5	0.7	0.7
Potassium	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5
Sodium	0.5	mg/L	2.8	2.1	2.2	2.5

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Client Sample ID			SW-D2	BH06	BH09	BH16
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M25-Fe0053821	M25-Fe0053822	M25-Fe0053823	M25-Fe0053824
Date Sampled			Feb 18, 2025	Feb 19, 2025	Feb 19, 2025	Feb 19, 2025
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01	0.49
Chloride	1	mg/L	1.2	1.7	1.1	1.4
Conductivity (at 25 °C)	10	uS/cm	28	43	18	19
Nitrate & Nitrite (as N)	0.05	mg/L	< 0.05	4.6	0.67	0.93
Nitrate (as N)	0.02	mg/L	0.04	4.6	0.67	0.93
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)*	0.2	mg/L	< 0.2	0.5	0.3	< 0.2
Sulphate (as SO4)	5	mg/L	< 5	< 5	< 5	< 5
Total Dissolved Solids Dried at 180 °C ± 2 °C	10	mg/L	[Q19]62	[Q19]52	[Q19]34	< 10
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	< 0.2	0.5	0.3	0.5
Total Nitrogen (as N)*	0.2	mg/L	< 0.2	5.1	1.0	1.4
Turbidity	1	NTU	< 1	1.3	14	3.5
Phosphate total (as P)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Alkali Metals						
Calcium	0.5	mg/L	2.1	2.8	1.2	0.9
Magnesium	0.5	mg/L	0.8	1.1	0.5	< 0.5
Potassium	0.5	mg/L	< 0.5	0.5	< 0.5	< 0.5
Sodium	0.5	mg/L	2.3	2.2	1.3	1.8

Client Sample ID			BH17	GW-D2	R2
Sample Matrix			Water	Water	Water
Eurofins Sample No.			M25-Fe0053825	M25-Fe0053826	M25-Fe0053827
Date Sampled			Feb 19, 2025	Feb 19, 2025	Feb 19, 2025
Test/Reference	LOR	Unit			
Ammonia (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01
Chloride	1	mg/L	< 1	1.1	< 1
Conductivity (at 25 °C)	10	uS/cm	40	17	< 10
Nitrate & Nitrite (as N)	0.05	mg/L	0.58	0.94	< 0.05
Nitrate (as N)	0.02	mg/L	0.58	0.93	< 0.02
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)*	0.2	mg/L	0.2	0.4	< 0.2
Sulphate (as SO4)	5	mg/L	< 5	< 5	< 5
Total Dissolved Solids Dried at 180 °C ± 2 °C	10	mg/L	[Q19]64	[Q19]35	< 10
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	0.2	0.4	< 0.2
Total Nitrogen (as N)*	0.2	mg/L	0.8	1.3	< 0.2
Turbidity	1	NTU	< 1	2.9	< 1
Phosphate total (as P)	0.01	mg/L	< 0.01	< 0.01	< 0.01
Alkalinity (speciated)					
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	27	< 20	< 20
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	27	< 20	< 20

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Client Sample ID			BH17	GW-D2	R2
Sample Matrix			Water	Water	Water
Eurofins Sample No.			M25-Fe0053825	M25-Fe0053826	M25-Fe0053827
Date Sampled			Feb 19, 2025	Feb 19, 2025	Feb 19, 2025
Test/Reference	LOR	Unit			
Alkali Metals					
Calcium	0.5	mg/L	3.0	1.0	< 0.5
Magnesium	0.5	mg/L	1.0	< 0.5	< 0.5
Potassium	0.5	mg/L	< 0.5	< 0.5	< 0.5
Sodium	0.5	mg/L	3.6	1.9	< 0.5

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Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P			
Ammonia (as N)	Melbourne	Feb 22, 2025	28 Days
- Method: APHA 4500-NH3 Ammonia Nitrogen by FIA			
Nitrate & Nitrite (as N)	Melbourne	Feb 22, 2025	28 Days
- Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA			
Nitrate (as N)	Melbourne	Feb 22, 2025	28 Days
- Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA			
Nitrite (as N)	Melbourne	Feb 22, 2025	2 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Organic Nitrogen (as N)*	Melbourne	Feb 21, 2025	7 Days
- Method: APHA 4500 Organic Nitrogen (N)			
Total Kjeldahl Nitrogen (as N)	Melbourne	Feb 22, 2025	28 Days
- Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA			
Eurofins Suite B11E: Cl/SO4/Alkalinity			
Chloride	Melbourne	Feb 22, 2025	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Sulphate (as SO4)	Melbourne	Feb 22, 2025	28 Days
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Alkalinity (speciated)	Melbourne	Feb 22, 2025	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Conductivity (at 25 °C)	Melbourne	Mar 03, 2025	28 Days
- Method: LTM-INO-4030 Conductivity			
Turbidity	Melbourne	Feb 24, 2025	28 Days
- Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)			
Phosphate total (as P)	Melbourne	Feb 22, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Melbourne	Feb 22, 2025	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Dissolved Solids Dried at 180 °C ± 2 °C	Melbourne	Feb 27, 2025	28 Days
- Method: LTM-INO-4170 Total Dissolved Solids in Water			

Repeat Samples

Description	Testing Site	Extracted	Holding Time
Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P			
Ammonia (as N)	Melbourne	Feb 22, 2025	28 Days
- Method: APHA 4500-NH3 Ammonia Nitrogen by FIA			
Nitrate & Nitrite (as N)	Melbourne	Feb 22, 2025	28 Days
- Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA			
Nitrate (as N)	Melbourne	Feb 22, 2025	28 Days
- Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA			
Nitrite (as N)	Melbourne	Feb 22, 2025	2 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Organic Nitrogen (as N)*	Melbourne	Feb 21, 2025	7 Days
- Method: APHA 4500 Organic Nitrogen (N)			
Total Kjeldahl Nitrogen (as N)	Melbourne	Feb 22, 2025	28 Days
- Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA			
Eurofins Suite B11E: Cl/SO4/Alkalinity			
Chloride	Melbourne	Feb 22, 2025	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Sulphate (as SO4)	Melbourne	Feb 22, 2025	28 Days

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Description	Testing Site	Extracted	Holding Time
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Alkalinity (speciated)	Melbourne	Feb 22, 2025	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Conductivity (at 25 °C)	Melbourne	Mar 03, 2025	28 Days
- Method: LTM-INO-4030 Conductivity			
Turbidity	Melbourne	Feb 24, 2025	28 Days
- Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)			
Phosphate total (as P)	Melbourne	Feb 22, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Melbourne	Feb 22, 2025	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Dissolved Solids Dried at 180 °C ± 2 °C	Melbourne	Feb 27, 2025	28 Days
- Method: LTM-INO-4170 Total Dissolved Solids in Water			

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web: www.eurofins.com.au
email: EnviroSales@eurofinsanz.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	+61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794 & 2780	Site# 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370 & 2554

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise	43 Detroit Drive	1277 Cameron Road
Penrose	Mount Wellington	Rolleston	Gate Pa
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

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Company Name: GHD PTY LTD
Address: Level 8, 180 Lonsdale St
Melbourne
VIC 3000

Project Name: Mount Buller Water Storage Ongoing Monitoring Program
Project ID: 12565989

Order No.:
Report #: 1190470
Phone: 8687 8000
Fax: 8687 8111

Received: Feb 21, 2025 9:00 AM
Due: Mar 3, 2025
Priority: 6 Day
Contact Name: Meg Turner

Eurofins Analytical Services Manager : Savini Suduweli

Sample Detail						Conductivity (at 25 °C)	Phosphate total (as P)	Turbidity	Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P	Eurofins Suite B11E: Cl/SO4/Alkalinity	Eurofins Suite B11C: Na/K/Ca/Mg	Total Dissolved Solids Dried at 180 °C ± 2 °C
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	Boggy 1 p/u 1	Feb 18, 2025		Water	M25-Fe0053817	X	X	X	X	X	X	X
2	Boggy 1 p/u 2	Feb 18, 2025		Water	M25-Fe0053818	X	X	X	X	X	X	X
3	Boggy 2	Feb 18, 2025		Water	M25-Fe0053819	X	X	X	X	X	X	X
4	EWS East	Feb 18, 2025		Water	M25-Fe0053820	X	X	X	X	X	X	X
5	SW-D2	Feb 18, 2025		Water	M25-Fe0053821	X	X	X	X	X	X	X
6	BH06	Feb 19, 2025		Water	M25-Fe0053822	X	X	X	X	X	X	X
7	BH09	Feb 19, 2025		Water	M25-Fe0053823	X	X	X	X	X	X	X
8	BH16	Feb 19, 2025		Water	M25-Fe0053824	X	X	X	X	X	X	X
9	BH17	Feb 19, 2025		Water	M25-Fe0053825	X	X	X	X	X	X	X
10	GW-D2	Feb 19, 2025		Water	M25-Fe0053826	X	X	X	X	X	X	X
11	R2	Feb 19, 2025		Water	M25-Fe0053827	X	X	X	X	X	X	X
Test Counts						21	11	11	11	11	11	11

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
ppm: parts per million
µg/L: micrograms per litre
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit
Colour: Pt-Co Units (CU)

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Conductivity (at 25 °C)	uS/cm	< 10			10	Pass	
Nitrate & Nitrite (as N)	mg/L	< 0.05			0.05	Pass	
Nitrate (as N)	mg/L	< 0.02			0.02	Pass	
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Total Dissolved Solids Dried at 180 °C ± 2 °C	mg/L	< 10			10	Pass	
Method Blank							
Phosphate total (as P)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Sulphate (as SO4)	mg/L	< 5			5	Pass	
Turbidity	NTU	< 1			1	Pass	
Method Blank							
Chloride	mg/L	< 1			1	Pass	
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Conductivity (at 25 °C)	%	100			70-130	Pass	
Nitrate & Nitrite (as N)	%	71			70-130	Pass	
Sulphate (as SO4)	%	112			70-130	Pass	
Total Dissolved Solids Dried at 180 °C ± 2 °C	%	96			70-130	Pass	
LCS - % Recovery							
Phosphate total (as P)	%	83			70-130	Pass	
LCS - % Recovery							
Turbidity	%	101			70-130	Pass	
LCS - % Recovery							
Sulphate (as SO4)	%	98			70-130	Pass	
Turbidity	%	101			70-130	Pass	
LCS - % Recovery							
Chloride	%	107			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	%	91			70-130	Pass	
LCS - % Recovery							
Nitrite (as N)	%	92			70-130	Pass	
Total Dissolved Solids Dried at 180 °C ± 2 °C	%	96			70-130	Pass	
LCS - % Recovery							
Chloride	%	101			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	97			70-130	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium	%	96			80-120	Pass	
Magnesium	%	105			80-120	Pass	
Potassium	%	100			80-120	Pass	
Sodium	%	103			80-120	Pass	
LCS - % Recovery							
Alkalinity (speciated)							

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Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Carbonate Alkalinity (as CaCO3)			%	105			70-130	Pass	
Total Alkalinity (as CaCO3)			%	108			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Ammonia (as N)	M25-Fe0055296	NCP	%	97			70-130	Pass	
Nitrate & Nitrite (as N)	M25-Fe0055296	NCP	%	76			70-130	Pass	
Nitrite (as N)	M25-Fe0055296	NCP	%	98			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	B25-Fe0053399	NCP	%	97			70-130	Pass	
Spike - % Recovery									
				Result 1					
Phosphate total (as P)	M25-Fe0053818	CP	%	90			70-130	Pass	
Spike - % Recovery									
				Result 1					
Chloride	M25-Fe0053822	CP	%	84			70-130	Pass	
Sulphate (as SO4)	M25-Fe0053822	CP	%	79			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Conductivity (at 25 °C)	M25-Fe0047887	NCP	uS/cm	83	82	1.2	30%	Pass	
Total Dissolved Solids Dried at 180 °C ± 2 °C	M25-Fe0054724	NCP	mg/L	2200	2300	3.5	30%	Pass	
Total Kjeldahl Nitrogen (as N)	B25-Fe0053398	NCP	mg/L	1.8	1.7	7.0	30%	Pass	
Phosphate total (as P)	M25-Fe0053817	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
Alkalinity (speciated)				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	M25-Fe0047887	NCP	mg/L	23	24	4.3	30%	Pass	
Carbonate Alkalinity (as CaCO3)	M25-Fe0047887	NCP	mg/L	< 10	< 10	<1	30%	Pass	
Hydroxide Alkalinity (as CaCO3)	M25-Fe0047887	NCP	mg/L	< 20	< 20	<1	30%	Pass	
Total Alkalinity (as CaCO3)	M25-Fe0047887	NCP	mg/L	23	24	4.3	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M25-Fe0053821	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Chloride	M25-Fe0053821	CP	mg/L	1.2	1.5	21	30%	Pass	
Nitrate & Nitrite (as N)	M25-Fe0053821	CP	mg/L	< 0.05	0.05	27	30%	Pass	
Nitrite (as N)	M25-Fe0053821	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Sulphate (as SO4)	M25-Fe0053821	CP	mg/L	< 5	< 5	<1	30%	Pass	
Turbidity	M25-Fe0053821	CP	NTU	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Dissolved Solids Dried at 180 °C ± 2 °C	M25-Fe0053822	CP	mg/L	52	68	27	30%	Pass	

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Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q19	TDS may bias high due to the presence of fine particulate or colloidal matter that may pass through the filter paper.

Authorised by:

Catherine Wilson	Analytical Services Manager
Caitlin Breeze	Senior Analyst-Metal
Luke Holt	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Inorganic

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

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CHAIN OF CUSTODY RECORD

GHD Melbourne Office Address
180 Lonsdale Street, Melbourne 3000
Telephone: 613 8687 8000
Fax: 613 8687 8111

Completion Date/ Turnaround
5 Day TAT

Project Number
12565989

Project Name
Mount Buller Water Storage Ongoing Monitoring Program

GHD Project Manager
Meg Turner

GHD Contact
Meo Turner

GHD PM email
Meg.Turner@ghd.com

GHD Contact email
m!!lJ.lurner@ghd.com

Laboratory
Eurofins

Laboratory Address

Laboratory Contact
Rhonda Chouman

Containers

Analyses Required

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CUSTODY DETAILS

SAMPLER:		Daterrime		Relinquished bv:	
COURIER:		Date/Time		Relinquished by:	
LABORATORY:		Date/Time			
COMMENTS:	Samples stored on ice in esky				

2/11/24 @ 14:2

DAIE:
RIE,.:,J 5.4°c
TEMPERATURE.
ATTEMPT TO CHILL:

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CHAIN OF CUSTODY RECORD

GHD Melbourne Office Address	Completion Date/ Turnaround
180 Lonsdale Street. Melbourne 3000 Telephone: 613 8687 8000 Fax: 613 8687 8111	5 Day TAT

Project Number 12565989	**Laboratory** Eurofins
Project Name- Mount Buller Water Stora11e Onqoinu MonitorinQProoram	Laboratory Address
GHD Project Manager Meg Turner	Laboratory Contact RhOnda Chouman
GHD Contact Mea Turner	
GHD **PM** email Meg.Turner@ghd.com	GHD Contact email m!lQ.turner@ghd.com

SampleI.D.	**Date and Time**	**Containers**						**Anah ses Reouirad**															
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COURIER:		Dale/Time		Relinquished by:	
LABORATORY:		Date/Time			
COMMENTS:	Samples stored on ice in esky				

OFFICIAL

OFFICIAL

C PY

9

CHAIN OF CUSTODY RECORD

GHD Melbourne Office Address	Completion Date/ Turnaround
180 Lonsdale Street. Melbourne 3000 Telephone: 613 8687 8000 Fax: 613 8687 8111	5 Day TAT

Project Number 12565989	**Laboratory** Eurofins
Project Name Mount Buller Water StoraQe Qnooim\ Monitorifl!! PrOQram	**Laboratory Address**
GHD Project Manager Mea Turner	**Laboratory Contact** Rhonda Chouman
GHD Contact M"" Turner	**Containers**
GHD PM email Mea.Turner@ghd.com	GHD Contact email mea.turner@ghd.com

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Sample I.D.	Date and Time	
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CUSTODY DETAILS

SAMPLER:		Date/Time	Relinquished by:
COURIER:		Date/Time	Relinquished by:
LABORATORY:		Date/Time	
COMMENTS:	Samples stored on ice in esky		

22/11/24 @ 14:

DAIE·

□□□□IE□tj

TEMPERATURE. 5.4°c

ATTEMPT TO CHILL: YES NO

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Environment Testing

PROJECT INFORMATION

Date Received: 22/J/ /2tr

Company: GI-! 0

Contact person:

Contact Number:

Contact E-mail:

Project Name/site:

Project Number: l 2£5, gc,

COC: **Attached** ☐

E-mailed ☐

Not received 1:9'

DATE: TIME: TEMPERATURE: ATTEMPT TO CHILL: NO

Last modified on: 16 October 2019	Approved on: 16 October 2019	Version: QS1039_R2
Last modified by: H. Le	Approver: M. Makarios	Page 1 of 1
Editorial Committee: T. Lakeland, F Sanjaya, H. Le, M. Makarios		Next required review date: 16 October 2022

Unverified Sender: The sender of this email has not been verified. Review the content of the message carefully and verify the identity of the sender before acting on this email: replying, opening attachments or clicking links.

Hi,

Could all samples in this batch please be analysed for the following:

Electrical conductivity (EC)
Total Dissolved Solids (TDS)
Turbidity
Nutrients (Total P, Total N, Nitrate and Nitrite), Total Kjeldahl Nitrogen (TKN)
Major ions (Ca, Mg, Na, K, Cl, SO4, HCO3, CO3 and NO3)
Alkalinity (total) as CaCO3, Alkalinity (Bicarbonate as CaCO3), Alkalinity (Carbonate as CaCO3)

Please edit sample IDs as follows:

4 – Boggy 1 P/U 1
5 – Boggy 1 P/U 2
6 – Boggy 2
7 – SW-D1
15 – GW-D1

No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID								
1	RAW DAM	Nov 19, 2024		Water	M24-No0064660	X		X	X	X	X	X	X
2	SEEPAGE	Nov 20, 2024		Water	M24-No0064661	X		X	X	X	X	X	X
3	R1	Nov 20, 2024		Water	M24-No0064662	X		X	X	X	X	X	X
4	Baggy 1 p/up1	Nov 19, 2024		Water	M24-No0064663		X						
5	Baggy 1 p/up2	Nov 19, 2024		Water	M24-No0064664		X						
6	Baggy 2	Nov 19, 2024		Water	M24-No0064665		X						
7	SW-01	Nov 19, 2024		Water	M24-No0064666		X						
8	EWS EAST	Nov 19, 2024		Water	M24-No0064667		X						
9	EWS WEST	Nov 19, 2024		Water	M24-No0064668		X						
10	BH06	Nov 20, 2024		Water	M24-No0064669		X						
11	BH09	Nov 20, 2024		Water	M24-No0064670		X						
12	BH16	Nov 20, 2024		Water	M24-No0064671		X						
13	BH17	Nov 20, 2024		Water	M24-No0064672		X						
14	BH18	Nov 20, 2024		Water	M24-No0064673		X						

Meg Turner (she/her)
B. Env Sci
Environmental Scientist – Victoria Environmental Management
GHD
Proudly employee-owned | ghd.com
105 Hume Street, Wodonga, Victoria, 3690, Australia
D +61 3 8687 8862 **(primary phone) M** +61 477 513 431 **(if work phone is unattended) E** meg.turner@ghd.com
The Power of Commitment
Connect

Please consider the environment before printing this email

From: EnviroSampleVic@eurofins.com <EnviroSampleVic@eurofins.com>
Sent: Friday, 22 November 2024 9:35 PM
To: Meg Turner <meg.turner@ghd.com>
Subject: Eurofins Sample Receipt Advice - Report 1163576 : Site Mount Buller Water Storage Ongoing Monitoring Program (12565989)

Dear Valued Client,

Please find attached a Sample Receipt Advice (SRA), a Summary Sheet and a scanned copy of your Chain-of-Custody (COC). It is important that you check this documentation to ensure that the details are correct such as the Client Job Number, Turn Around Time, any comments in the Notes section and sample numbers as well as the requested analysis. If there are any irregularities then please contact your Eurofins Analytical Services Manager as soon as possible to make certain that they get changed.

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www.eurofins.com.au EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	T: +61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794 & 2780	Site# 25079

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ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370 & 2554

Eurofins Environment Testing NZ Ltd

NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise,	43 Detroit Drive	1277 Cameron Road,
Penrose,	Mount Wellington,	Rolleston,	Gate Pa,
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

Sample Receipt Advice

Company name:	GHD PTY LTD
Contact name:	Meg Turner
Project name:	Mount Buller Water Storage Ongoing Monitoring Program
Project ID:	12565989
Turnaround time:	5 Day
Date/Time received	Nov 22, 2024 2:30 PM
Eurofins reference	1163576

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✓	Split sample sent to requested external lab.
×	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Savini Suduweli on phone : +61 3 8564 5051 or by email: SaviniSuduweli@eurofins.com

Results will be delivered electronically via email to Meg Turner - meg.turner@ghd.com.

Note: A copy of these results will also be delivered to the general GHD PTY LTD email address.

Global Leader - Results you can trust

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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ABN: 50 005 085 521

Melbourne
6 Monterey Road
Dandenong South
VIC 3175
+61 3 8564 5000
NATA# 1261
Site# 1254

Geelong
19/8 Lewalan Street
Grovedale
VIC 3216
+61 3 8564 5000
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Sydney
179 Magowar Road
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NSW 2145
+61 2 9900 8400
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1/21 Smallwood Place
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T: +61 7 3902 4600
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1/2 Frost Drive
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+61 2 4968 8448
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ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
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NZBN: 9429046024954

Auckland
35 O'Rorke Road
Penrose,
Auckland 1061
+64 9 526 4551
IANZ# 1327

Auckland (Focus)
Unit C1/4 Pacific Rise,
Mount Wellington,
Auckland 1061
+64 9 525 0568
IANZ# 1308

Christchurch
43 Detroit Drive
Rolleston,
Christchurch 7675
+64 3 343 5201
IANZ# 1290

Tauranga
1277 Cameron Road,
Gate Pa,
Tauranga 3112
+64 9 525 0568
IANZ# 1402

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Company Name: GHD PTY LTD
Address: Level 8, 180 Lonsdale St
Melbourne
VIC 3000

Project Name: Mount Buller Water Storage Ongoing Monitoring Program
Project ID: 12565989

Order No.:
Report #: 1163576
Phone: 8687 8000
Fax: 8687 8111

Received: Nov 22, 2024 2:30 PM
Due: Nov 29, 2024
Priority: 5 Day
Contact Name: Meg Turner

Eurofins Analytical Services Manager : Savini Suduweli

Sample Detail						Conductivity (at 25 °C)	Phosphate total (as P)	Turbidity	Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P	Eurofins Suite B11F: Cl/SO4/Alkalinity/Total F	Total Dissolved Solids Dried at 180 °C ± 2 °C	Eurofins Suite B11C filtered: Na/K/Ca/Mg
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	RAW DAM	Nov 19, 2024		Water	M24-No0064660	X	X	X	X	X	X	X
2	SEEPAGE	Nov 20, 2024		Water	M24-No0064661	X	X	X	X	X	X	X
3	R1	Nov 20, 2024		Water	M24-No0064662	X	X	X	X	X	X	X
4	Boggy 1 P/U 1	Nov 19, 2024		Water	M24-No0064663	X	X	X	X	X	X	X
5	Boggy 1 P/U 2	Nov 19, 2024		Water	M24-No0064664	X	X	X	X	X	X	X
6	Boggy 2	Nov 19, 2024		Water	M24-No0064665	X	X	X	X	X	X	X
7	SW-D1	Nov 19, 2024		Water	M24-No0064666	X	X	X	X	X	X	X
8	EWS EAST	Nov 19, 2024		Water	M24-No0064667	X	X	X	X	X	X	X
9	EWS WEST	Nov 19, 2024		Water	M24-No0064668	X	X	X	X	X	X	X
10	BH06	Nov 20, 2024		Water	M24-No0064669	X	X	X	X	X	X	X
11	BH09	Nov 20, 2024		Water	M24-No0064670	X	X	X	X	X	X	X
12	BH16	Nov 20, 2024		Water	M24-No0064671	X	X	X	X	X	X	X
13	BH17	Nov 20, 2024		Water	M24-No0064672	X	X	X	X	X	X	X
14	GW-D1	Nov 20, 2024		Water	M24-No0064673	X	X	X	X	X	X	X

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Company Name: GHD PTY LTD
Address: Level 8, 180 Lonsdale St
Melbourne
VIC 3000

Project Name: Mount Buller Water Storage Ongoing Monitoring Program
Project ID: 12565989

Order No.:
Report #: 1163576
Phone: 8687 8000
Fax: 8687 8111

Received: Nov 22, 2024 2:30 PM
Due: Nov 29, 2024
Priority: 5 Day
Contact Name: Meg Turner

Eurofins Analytical Services Manager : Savini Suduweli

Sample Detail						Conductivity (at 25 °C)	Phosphate total (as P)	Turbidity	Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P	Eurofins Suite B11F: Cl/SO4/Alkalinity/Total F	Total Dissolved Solids Dried at 180 °C ± 2 °C	Eurofins Suite B11C filtered: Na/K/Ca/Mg
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X
15	GW-01	Nov 20, 2024		Water	M24-No0064674	X	X	X	X	X	X	X
Test Counts						15	15	15	15	15	15	15

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Certificate of Analysis

GHD PTY LTD
Level 8, 180 Lonsdale St
Melbourne
VIC 3000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Meg Turner**

Report **1163576-W**
Project name Mount Buller Water Storage Ongoing Monitoring Program
Project ID 12565989
Received Date Nov 22, 2024

Client Sample ID			**RAW DAM**	**SEEPAGE**	**R1**	**Boggy 1 P/U 1**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**M24-No0064660**	**M24-No0064661**	**M24-No0064662**	**M24-No0064663**
Date Sampled			**Nov 19, 2024**	**Nov 20, 2024**	**Nov 20, 2024**	**Nov 19, 2024**
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	< 0.01	0.05	< 0.01	0.04
Chloride	1	mg/L	1.7	1.6	< 1	< 1
Conductivity (at 25 °C)	10	uS/cm	21	21	< 10	36
Fluoride	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5
Nitrate & Nitrite (as N)	0.05	mg/L	< 0.05	0.19	< 0.05	0.13
Nitrate (as N)	0.02	mg/L	0.02	0.19	< 0.02	0.13
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)*	0.2	mg/L	< 0.2	0.55	< 0.2	0.56
Sulphate (as SO4)	5	mg/L	< 5	< 5	< 5	< 5
Total Dissolved Solids Dried at 180 °C ± 2 °C	10	mg/L	42	20	< 10	51
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	< 0.2	0.6	< 0.2	0.6
Total Nitrogen (as N)*	0.2	mg/L	< 0.2	0.8	< 0.2	0.7
Turbidity	1	NTU	< 1	4.2	< 1	1.5
Phosphate total (as P)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Alkali Metals						
Calcium (filtered)	0.5	mg/L	1.3	1.1	< 0.5	1.6
Magnesium (filtered)	0.5	mg/L	< 0.5	< 0.5	< 0.5	0.6
Potassium (filtered)	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5
Sodium (filtered)	0.5	mg/L	1.8	1.8	< 0.5	2.4

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Client Sample ID			Boggy 1 P/U 2	Boggy 2	SW-D1	EWS EAST
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M24-No0064664	M24-No0064665	M24-No0064666	M24-No0064667
Date Sampled			Nov 19, 2024	Nov 19, 2024	Nov 19, 2024	Nov 19, 2024
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01	0.05
Chloride	1	mg/L	< 1	1.4	< 1	< 1
Conductivity (at 25 °C)	10	uS/cm	22	26	24	21
Fluoride	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5
Nitrate & Nitrite (as N)	0.05	mg/L	0.13	0.12	0.16	0.20
Nitrate (as N)	0.02	mg/L	0.13	0.12	0.16	0.20
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)*	0.2	mg/L	< 0.2	< 0.2	< 0.2	< 0.2
Sulphate (as SO4)	5	mg/L	< 5	< 5	< 5	< 5
Total Dissolved Solids Dried at 180 °C ± 2 °C	10	mg/L	47	20	41	37
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	< 0.2	< 0.2	< 0.2	< 0.2
Total Nitrogen (as N)*	0.2	mg/L	< 0.2	< 0.2	< 0.2	0.2
Turbidity	1	NTU	< 1	1.7	< 1	6.1
Phosphate total (as P)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	33	24
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	33	24
Alkali Metals						
Calcium (filtered)	0.5	mg/L	1.3	1.8	1.6	1.3
Magnesium (filtered)	0.5	mg/L	0.5	0.6	0.6	0.5
Potassium (filtered)	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5
Sodium (filtered)	0.5	mg/L	2.0	2.2	2.4	1.9

Client Sample ID			EWS WEST	BH06	BH09	BH16
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M24-No0064668	M24-No0064669	M24-No0064670	M24-No0064671
Date Sampled			Nov 19, 2024	Nov 20, 2024	Nov 20, 2024	Nov 20, 2024
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	< 0.01	0.09	< 0.01	0.06
Chloride	1	mg/L	1.1	< 1	< 1	< 1
Conductivity (at 25 °C)	10	uS/cm	29	19	21	19
Fluoride	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5
Nitrate & Nitrite (as N)	0.05	mg/L	0.30	1.3	0.87	1.1
Nitrate (as N)	0.02	mg/L	0.30	1.3	0.87	1.1
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)*	0.2	mg/L	< 0.2	< 0.2	0.3	0.24
Sulphate (as SO4)	5	mg/L	< 5	< 5	< 5	< 5
Total Dissolved Solids Dried at 180 °C ± 2 °C	10	mg/L	12	55	57	13
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	< 0.2	< 0.2	0.3	0.3
Total Nitrogen (as N)*	0.2	mg/L	0.3	1.3	1.2	1.4
Turbidity	1	NTU	4.3	8.8	< 1	14
Phosphate total (as P)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01

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Client Sample ID			EWS WEST	BH06	BH09	BH16
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M24-No0064668	M24-No0064669	M24-No0064670	M24-No0064671
Date Sampled			Nov 19, 2024	Nov 20, 2024	Nov 20, 2024	Nov 20, 2024
Test/Reference	LOR	Unit				
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	39	< 20	< 20	< 20
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	39	< 20	< 20	< 20
Alkali Metals						
Calcium (filtered)	0.5	mg/L	2.1	1.1	1.6	1.1
Magnesium (filtered)	0.5	mg/L	0.9	< 0.5	0.7	< 0.5
Potassium (filtered)	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5
Sodium (filtered)	0.5	mg/L	2.1	1.5	1.0	2.0

Client Sample ID			BH17	GW-D1	GW-01
Sample Matrix			Water	Water	Water
Eurofins Sample No.			M24-No0064672	M24-No0064673	M24-No0064674
Date Sampled			Nov 20, 2024	Nov 20, 2024	Nov 20, 2024
Test/Reference	LOR	Unit			
Ammonia (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01
Chloride	1	mg/L	< 1	< 1	3.3
Conductivity (at 25 °C)	10	uS/cm	41	37	18
Fluoride	0.5	mg/L	< 0.5	< 0.5	< 0.5
Nitrate & Nitrite (as N)	0.05	mg/L	< 0.05	< 0.05	1.1
Nitrate (as N)	0.02	mg/L	0.07	0.04	1.1
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)*	0.2	mg/L	< 0.2	< 0.2	0.3
Sulphate (as SO4)	5	mg/L	< 5	< 5	< 5
Total Dissolved Solids Dried at 180 °C ± 2 °C	10	mg/L	79	75	10
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	< 0.2	< 0.2	0.3
Total Nitrogen (as N)*	0.2	mg/L	< 0.2	< 0.2	1.4
Turbidity	1	NTU	160	190	29
Phosphate total (as P)	0.01	mg/L	0.02	< 0.01	< 0.01
Alkalinity (speciated)					
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	48	48	< 20
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	48	48	< 20
Alkali Metals					
Calcium (filtered)	0.5	mg/L	3.1	2.8	1.0
Magnesium (filtered)	0.5	mg/L	1.1	1.0	< 0.5
Potassium (filtered)	0.5	mg/L	< 0.5	< 0.5	< 0.5
Sodium (filtered)	0.5	mg/L	4.0	3.5	1.9

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Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P			
Ammonia (as N)	Melbourne	Nov 28, 2024	28 Days
- Method: APHA 4500-NH3 Ammonia Nitrogen by FIA			
Nitrate & Nitrite (as N)	Melbourne	Nov 28, 2024	28 Days
- Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA			
Nitrate (as N)	Melbourne	Nov 28, 2024	28 Days
- Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA			
Nitrite (as N)	Melbourne	Nov 28, 2024	2 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Organic Nitrogen (as N)*	Melbourne	Nov 26, 2024	7 Days
- Method: APHA 4500 Organic Nitrogen (N)			
Total Kjeldahl Nitrogen (as N)	Melbourne	Nov 28, 2024	28 Days
- Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA			
Eurofins Suite B11F: Cl/SO4/Alkalinity/Total F			
Chloride	Melbourne	Nov 28, 2024	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Fluoride	Melbourne	Nov 28, 2024	28 Days
- Method: LTM-INO-4270 Anions by Ion Chromatography			
Sulphate (as SO4)	Melbourne	Nov 28, 2024	28 Days
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Alkalinity (speciated)	Melbourne	Nov 28, 2024	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Conductivity (at 25 °C)	Melbourne	Nov 28, 2024	28 Days
- Method: LTM-INO-4030 Conductivity			
Turbidity	Melbourne	Nov 29, 2024	28 Days
- Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)			
Phosphate total (as P)	Melbourne	Nov 28, 2024	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C filtered: Na/K/Ca/Mg	Melbourne	Nov 28, 2024	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Dissolved Solids Dried at 180 °C ± 2 °C	Melbourne	Nov 28, 2024	28 Days
- Method: LTM-INO-4170 Total Dissolved Solids in Water			

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Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne
6 Monterey Road
Dandenong South
VIC 3175
+61 3 8564 5000
NATA# 1261
Site# 1254

Geelong
19/8 Lewalan Street
Grovedale
VIC 3216
+61 3 8564 5000
NATA# 1261
Site# 25403

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Girraween
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Canberra
Unit 1,2 Dacre Street
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ACT 2911
+61 2 6113 8091
NATA# 1261
Site# 25466

Brisbane
1/21 Smallwood Place
Murarrie
QLD 4172
T: +61 7 3902 4600
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Perth
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WA 6106
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Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland
35 O'Rorke Road
Penrose,
Auckland 1061
+64 9 526 4551
IANZ# 1327

Auckland (Focus)
Unit C1/4 Pacific Rise,
Mount Wellington,
Auckland 1061
+64 9 525 0568
IANZ# 1308

Christchurch
43 Detroit Drive
Rolleston,
Christchurch 7675
+64 3 343 5201
IANZ# 1290

Tauranga
1277 Cameron Road,
Gate Pa,
Tauranga 3112
+64 9 525 0568
IANZ# 1402

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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Company Name: GHD PTY LTD
Address: Level 8, 180 Lonsdale St
Melbourne
VIC 3000

Project Name: Mount Buller Water Storage Ongoing Monitoring Program
Project ID: 12565989

Order No.:
Report #: 1163576
Phone: 8687 8000
Fax: 8687 8111

Received: Nov 22, 2024 2:30 PM
Due: Nov 29, 2024
Priority: 5 Day
Contact Name: Meg Turner

Eurofins Analytical Services Manager : Savini Suduweli

Sample Detail						Conductivity (at 25 °C)	Phosphate total (as P)	Turbidity	Eurofins Suite B19D: Total N, TKN, NOx, NO2, NO3, NH3, Total P	Eurofins Suite B11F: Cl/SO4/Alkalinity/Total F	Total Dissolved Solids Dried at 180 °C ± 2 °C	Eurofins Suite B11C filtered: Na/K/Ca/Mg
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	RAW DAM	Nov 19, 2024		Water	M24-No0064660	X	X	X	X	X	X	X
2	SEEPAGE	Nov 20, 2024		Water	M24-No0064661	X	X	X	X	X	X	X
3	R1	Nov 20, 2024		Water	M24-No0064662	X	X	X	X	X	X	X
4	Boggy 1 P/U 1	Nov 19, 2024		Water	M24-No0064663	X	X	X	X	X	X	X
5	Boggy 1 P/U 2	Nov 19, 2024		Water	M24-No0064664	X	X	X	X	X	X	X
6	Boggy 2	Nov 19, 2024		Water	M24-No0064665	X	X	X	X	X	X	X
7	SW-D1	Nov 19, 2024		Water	M24-No0064666	X	X	X	X	X	X	X
8	EWS EAST	Nov 19, 2024		Water	M24-No0064667	X	X	X	X	X	X	X
9	EWS WEST	Nov 19, 2024		Water	M24-No0064668	X	X	X	X	X	X	X
10	BH06	Nov 20, 2024		Water	M24-No0064669	X	X	X	X	X	X	X
11	BH09	Nov 20, 2024		Water	M24-No0064670	X	X	X	X	X	X	X
12	BH16	Nov 20, 2024		Water	M24-No0064671	X	X	X	X	X	X	X
13	BH17	Nov 20, 2024		Water	M24-No0064672	X	X	X	X	X	X	X
14	GW-D1	Nov 20, 2024		Water	M24-No0064673	X	X	X	X	X	X	X

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	T: +61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794 & 2780	Site# 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370 & 2554

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise,	43 Detroit Drive	1277 Cameron Road,
Penrose,	Mount Wellington,	Rolleston,	Gate Pa,
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

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Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X
15	GW-01	Nov 20, 2024		Water	M24-No0064674	X	X	X	X	X	X	X
Test Counts						15	15	15	15	15	15	15

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
ppm: parts per million
µg/L: micrograms per litre
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit
Colour: Pt-Co Units (CU)

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Chloride	mg/L	< 1			1	Pass	
Conductivity (at 25 °C)	uS/cm	< 10			10	Pass	
Nitrate (as N)	mg/L	< 0.02			0.02	Pass	
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Sulphate (as SO4)	mg/L	< 5			5	Pass	
Method Blank							
Alkali Metals							
Calcium (filtered)	mg/L	< 0.5			0.5	Pass	
Magnesium (filtered)	mg/L	< 0.5			0.5	Pass	
Potassium (filtered)	mg/L	< 0.5			0.5	Pass	
Sodium (filtered)	mg/L	< 0.5			0.5	Pass	
Method Blank							
Conductivity (at 25 °C)	uS/cm	< 10			10	Pass	
Fluoride	mg/L	< 0.5			0.5	Pass	
Method Blank							
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
Turbidity	NTU	< 1			1	Pass	
Phosphate total (as P)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Alkali Metals							
Calcium (filtered)	mg/L	< 0.5			0.5	Pass	
Magnesium (filtered)	mg/L	< 0.5			0.5	Pass	
Potassium (filtered)	mg/L	< 0.5			0.5	Pass	
Sodium (filtered)	mg/L	< 0.5			0.5	Pass	
Method Blank							
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
Method Blank							
Conductivity (at 25 °C)	uS/cm	< 10			10	Pass	
Nitrate & Nitrite (as N)	mg/L	< 0.05			0.05	Pass	
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
Method Blank							
Fluoride	mg/L	< 0.5			0.5	Pass	
Method Blank							
Total Dissolved Solids Dried at 180 °C ± 2 °C	mg/L	< 10			10	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Phosphate total (as P)	mg/L	< 0.01			0.01	Pass	
LCS - % Recovery							
Conductivity (at 25 °C)	%	99			70-130	Pass	
Nitrate & Nitrite (as N)	%	111			70-130	Pass	
Nitrite (as N)	%	75			70-130	Pass	
Sulphate (as SO4)	%	106			70-130	Pass	
LCS - % Recovery							
Conductivity (at 25 °C)	%	99			70-130	Pass	
Fluoride	%	106			70-130	Pass	
LCS - % Recovery							
Chloride	%	114			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Carbonate Alkalinity (as CaCO3)	%	90			70-130	Pass	
Total Alkalinity (as CaCO3)	%	95			70-130	Pass	
LCS - % Recovery							

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Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Kjeldahl Nitrogen (as N)	%	104			70-130	Pass	
Turbidity	%	104			70-130	Pass	
Phosphate total (as P)	%	94			70-130	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium (filtered)	%	104			80-120	Pass	
Magnesium (filtered)	%	106			80-120	Pass	
Potassium (filtered)	%	104			80-120	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium (filtered)	%	107			80-120	Pass	
Magnesium (filtered)	%	111			80-120	Pass	
Potassium (filtered)	%	107			80-120	Pass	
LCS - % Recovery							
Ammonia (as N)	%	100			70-130	Pass	
Conductivity (at 25 °C)	%	101			70-130	Pass	
LCS - % Recovery							
Fluoride	%	112			70-130	Pass	
LCS - % Recovery							
Total Dissolved Solids Dried at 180 °C ± 2 °C	%	99			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	100			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	85			70-130	Pass	
Phosphate total (as P)	%	99			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Fluoride	M24-No0057442	NCP	%	98			70-130	Pass	
Phosphate total (as P)	M24-No0061439	NCP	%	98			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	M24-No0064665	CP	%	106			70-130	Pass	
Nitrate & Nitrite (as N)	M24-No0064665	CP	%	100			70-130	Pass	
Nitrite (as N)	M24-No0064665	CP	%	105			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	M24-No0064665	CP	%	96			70-130	Pass	
Spike - % Recovery									
				Result 1					
Chloride	M24-No0064674	CP	%	101			70-130	Pass	
Sulphate (as SO4)	M24-No0064674	CP	%	91			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Total Dissolved Solids Dried at 180 °C ± 2 °C	M24-No0062213	NCP	mg/L	1100	1100	1.1	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium (filtered)	M24-No0064661	CP	mg/L	1.1	1.1	4.0	30%	Pass	
Magnesium (filtered)	M24-No0064661	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Potassium (filtered)	M24-No0064661	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Sodium (filtered)	M24-No0064661	CP	mg/L	1.8	1.8	1.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Fluoride	M24-No0064663	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	

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Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M24-No0064664	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Chloride	M24-No0064664	CP	mg/L	< 1	< 1	<1	30%	Pass	
Fluoride	M24-No0064664	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Nitrate & Nitrite (as N)	M24-No0064664	CP	mg/L	0.13	0.14	8.0	30%	Pass	
Nitrite (as N)	M24-No0064664	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Sulphate (as SO4)	M24-No0064664	CP	mg/L	< 5	< 5	<1	30%	Pass	
Total Kjeldahl Nitrogen (as N)	M24-No0064664	CP	mg/L	< 0.2	< 0.2	<1	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium (filtered)	M24-No0064666	CP	mg/L	1.6	1.5	3.0	30%	Pass	
Magnesium (filtered)	M24-No0064666	CP	mg/L	0.6	0.5	2.0	30%	Pass	
Potassium (filtered)	M24-No0064666	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Sodium (filtered)	M24-No0064666	CP	mg/L	2.4	2.4	2.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Phosphate total (as P)	M24-No0064668	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Turbidity	M24-No0064669	CP	NTU	8.8	8.8	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Conductivity (at 25 °C)	M24-No0064670	CP	uS/cm	21	21	1.9	30%	Pass	
Duplicate									
Alkalinity (speciated)				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	M24-No0064670	CP	mg/L	< 20	< 20	<1	30%	Pass	
Carbonate Alkalinity (as CaCO3)	M24-No0064670	CP	mg/L	< 10	< 10	<1	30%	Pass	
Hydroxide Alkalinity (as CaCO3)	M24-No0064670	CP	mg/L	< 20	< 20	<1	30%	Pass	
Total Alkalinity (as CaCO3)	M24-No0064670	CP	mg/L	< 20	< 20	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chloride	M24-No0064673	CP	mg/L	< 1	< 1	<1	30%	Pass	
Fluoride	M24-No0064673	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Sulphate (as SO4)	M24-No0064673	CP	mg/L	< 5	< 5	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Fluoride	M24-No0064674	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Total Kjeldahl Nitrogen (as N)	M24-No0064674	CP	mg/L	0.3	0.3	21	30%	Pass	

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Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Catherine Wilson	Analytical Services Manager
Caitlin Breeze	Senior Analyst-Inorganic
Emily Rosenberg	Senior Analyst-Metal
Luke Holt	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Metal

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Appendix G

QAQC report

Quality Assurance and Quality Control Assessment Report

1. Background

Quality assurance and quality control (QA/QC) practices were applied to all stages of data gathering and subsequent sample handling procedures and were designed to provide control over both field and laboratory operations. Additionally, the analytical laboratory completed their own internal QA procedures, as required by NATA registration, during the analysis of samples.

The QA/QC program undertaken as part of the assessment by GHD included the following:

- Use of appropriately qualified and trained staff
- Calibration of field instruments
- Preservation of samples with ice during transport from the field to the laboratory
- Transportation of samples with accompanying chain-of-custody (COC) documentation
- Compliance with sample holding times
- Review of results of field quality assurance samples
- Review of results of internal laboratory quality control procedures which included analysis of method blanks, laboratory duplicate samples, laboratory control samples, matrix spike samples and surrogates

Field quality assurance samples provide information that discounts or potentially identifies any errors due to possible sources of cross contamination, inconsistencies in sampling and analytical techniques used. The quality assurance samples collected during the field program included:

- **Field duplicates:** Coded duplicate samples submitted to the primary laboratory for analysis as individual samples without any indication to the laboratory that they have been duplicated.
- **Field splits:** Duplicate samples with one sample being sent to a secondary laboratory for analysis. The same parameters are analysed utilising similar analytical techniques.
- **Rinsate blank:** A sample of deionised water collected from equipment used during sampling to indicate whether cross contamination occurred from equipment.

Field methodologies for sample collection, sample tracking, preservation and storage are summarised in Section 2 in the report.

2. Laboratories and sample batches

Samples were submitted to ALS Environmental (ALS) and Eurofins, both of which are National Association of Testing Authorities (NATA) accredited laboratories, accredited to perform the required analysis.

Sample batches issued during the surface water and groundwater sampling program are summarised in Table 1.

Table 1 Laboratory report summary

Laboratory	Report number	Sample date
Surface water and groundwater samples		
Eurofins (Primary)	1163576	19/11/2024 – 20/11/2024

Laboratory	Report number	Sample date
	1190470	18/02/2025 – 19/02/2025
	1213018	22/04/2025 – 23/04/2025
ALS (Secondary)	EM2420600	19/11/2024 – 20/11/2024
	EM2502990	18/02/2025 – 19/02/2025
	EM2507122	22/04/2025 – 23/04/2025

3. GHD QA/QC

3.1 Calibration of field instruments

Calibrated field instruments were supplied for the field works undertaken. The calibration certificate is provided in Attachment 1

3.2 Sample holding time

All analytes were extracted and analysed within both ALS' and Eurofins' technical holding times, with the exception of those detailed in Table 2.

Table 2 Summary of QA/QC compliance – sample holding time

Matrix	Laboratory Report	Analyte	Extraction / Preparation overdue (days)	Analysis overdue (days)
	EM2420777	Total Dissolved Solids dried at 180 ± 5 °C	-	6
	EM2420777	Turbidity	-	9
	EM2420777	Nitrite as N by Discrete Analyser	-	11
	EM2502990	pH by PC Titrator	-	8
	EM2502990	Turbidity	-	5
	EM2502990	Nitrate as N by Discrete Analyser	-	5
	EM2507122	Total Dissolved Solids dried at 180 ± 5 °C	-	1
	EM2507122	Turbidity	-	5
	EM2507122	Nitrate as N by Discrete Analyser	-	6
Groundwater	EM2420777	Total Dissolved Solids dried at 180 ± 5 °C	-	5
	EM2420777	Turbidity	-	8
	EM2420777	Nitrite as N by Discrete Analyser	-	10
	EM2502990	pH by PC Titrator	-	7
	EM2502990	Turbidity	-	4
	EM2502990	Nitrate as N by Discrete Analyser	-	4
	EM2507122	Nitrate as N by Discrete Analyser	-	6

Matrix	Laboratory Report	Analyte	Extraction / Preparation overdue (days)	Analysis overdue (days)
	EM2507122	Turbidity	-	4

3.3 Field duplicate and split duplicate frequency

Table 3 summaries the total number of primary, field and split duplicate samples collected and analysed for contaminants of potential concern in the groundwater and surface water investigation. The required frequency is one field duplicate and one split duplicate (i.e.. one duplicate pair) sample per twenty (20) primary samples (i.e. 5% frequency). The frequency of duplicate samples for the IY6 monitoring period is above the minimum requirement.

Table 3 Field and split duplicate sampling and analysis frequency

Matrix	No. of primary samples	No. of field duplicate pairs	No of split pairs	Frequency (%)
Surface water	15	3	3	20
Groundwater	12	3	3	25

3.4 Field duplicate and split duplicate RPD results

3.4.1 Relative percentage difference

A quantitative measure of the duplicate sample results was made using calculated relative percentage difference (RPD) values for each chemical. The RPD values were calculated using the following equation.

$$RRRRRR(\%) = \frac{(CC_{oo} - CC_{ss})}{\left[\frac{CC_{oo} + CC_{ss}}{2}\right]} \times 100$$

where C_o = reported concentration of the chemical of interest from the original parent sample

Cs = reported concentration of the chemical of interest from the duplicate sample

All RPD values were within the acceptable range of 0% to 30% with exceptions summarised in . RPD values are displayed in Attachment 2. Several RPD exceedances occurred for concentrations at or close to the limit of reporting (LOR), noting that RPD exceedances are typically considered only where a concentration is greater than 10 times the LOR.

Table 4 Field duplicate and spilt duplicate RPD exceedance summary

Primary Sample	Duplicate Sample	Report Number	Analyte	RPD (%)
Surface Water				
Boggy 1 p/u 2	SW-D1	1163576	Alkalinity (Bicarbonate as CaCO3)	49
Boggy 1 p/u 2	SW-D1	1163576	Alkalinity (Total as CaCO3)	49
Boggy 1 p/u 2	SW-S1	1163576 EM2420600	Calcium (filtered)	42
Boggy 1 p/u 1	SW-D2	1190470	Turbidity	113
Boggy 1 p/u 1	SW-D2	1190470	Nitrate (as N)	55
Boggy 1 p/u 1	SW-D2	1190470	Nitrogen (Total Oxidised) (as N)	46
Boggy 1 p/u 1	SW-S2	1190470 EM2502990	Turbidity	100

Primary Sample	Duplicate Sample	Report Number	Analyte	RPD (%)
Boggy 1 p/u 1	SW-S2	1190470 EM2502990	Phosphorus (Total)	160
Boggy 2	SW–D3	1213018	Turbidity	82
Boggy 2	SW–D3	1213018	TDS	37
Boggy 2	SW–D3	1213018	Chloride	145
Boggy 2	SW–D3	1213018	Nitrite (as N)	40
Boggy 2	SW–D3	1213018	Nitrogen (Total)	67
Boggy 2	SW–D3	1213018	Kjeldahl Nitrogen Total	40
Boggy 2	SW–D3	1213018	Nitrogen (Organic)	40
Boggy 2	SW–Split	1213018 EM2507122	Turbidity	143
Boggy 2	SW–Split	1213018 EM2507122	TDS	33
Boggy 2	SW–Split	1213018 EM2507122	Kjeldahl Nitrogen Total	100
Boggy 2	SW–Split	1213018 EM2507122	Nitrogen (Total)	120
Ground Water				
BH16	GW-D1	1163576	Electrical Conductivity (lab)	64
BH16	GW-D1	1163576	Turbidity	173
BH16	GW-D1	1163576	TDS	141
BH16	GW-D1	1163576	Alkalinity (Bicarbonate as CaCO3)	82
BH16	GW-D1	1163576	Alkalinity (Total as CaCO3)	82
BH16	GW-D1	1163576	Calcium (filtered)	87
BH16	GW-D1	1163576	Magnesium (filtered)	67
BH16	GW-D1	1163576	Sodium (filtered)	55
BH16	GW-D1	1163576	Ammonia (as N)	143
BH16	GW-D1	1163576	Nitrate (as N)	186
BH16	GW-D1	1163576	Nitrogen (Total Oxidised) (as N)	183
BH16	GW-D1	1163576	Nitrogen (Total)	150
BH16	GW-D1	1163576	Kjeldahl Nitrogen Total	40
BH16	GW-01	1163576	Turbidity	70
BH16	GW-01	1163576	Chloride	107
BH16	GW-01	1163576	Ammonia as N	143
BH16	GW-S1	1163576 EM2420600	Turbidity	61
BH16	GW-S1	1163576 EM2420600	TDS	116
BH16	GW-S1	1163576 EM2420600	Kjeldahl Nitrogen Total	40

Primary Sample	Duplicate Sample	Report Number	Analyte	RPD (%)
BH16	GW-S1	1163576 EM2420600	Phosphorus (Total)	167
BH16	GW-D2	1190470	TDS	111
BH16	GW-D2	1190470	Ammonia as N	192
BH16	GW-D2	1190470	Nitrogen (Organic)	67
BH16	GW-S2	1190470 EM2502990	Turbidity	189
BH16	GW-S2	1190470 EM2502990	Sulfate	35
BH16	GW-S2	1190470 EM2502990	Kjeldahl Nitrogen Total	50
BH16	GW-S2	1190470 EM2502990	Phosphorus (Total)	186
BH17	GW-D3	1213018	Turbidity	67
BH17	GW-D3	1213018	Chloride	33
BH17	GW-D3	1213018	Nitrogen (Total)	67
BH17	GW-D3	1213018	Kjeldahl Nitrogen Total	91
BH17	GW-D3	1213018	Nitrogen (Organic)	94
BH17	GW-Split	1213018 EM2507122	Turbidity	52
BH17	GW-Split	1213018 EM2507122	Ammonia as N	67
BH17	GW-Split	1213018 EM2507122	Nitrogen (Total)	86
BH17	GW-Split	1213018 EM2507122	Kjeldahl Nitrogen Total	120
BH17	GW-Split	1213018 EM2507122	Phosphorus (Total)	91

3.5 Rinsate blank samples

One rinsate blank sample was collected at each monitoring event from field (equipment) listed below in Table 5. A total of three rinsate blank samples were collected during the field investigation.

The rinsate blank sample results were reported below the laboratory LOR. Tabulated results for the rinsate samples are provided in Attachment 2.

Overall, based on the results for the monitoring period, GHD considers the decontamination procedures conducted during the soil and groundwater sampling programs to be acceptable.

Table 5 Rinsate sampling equipment

Lab Report Number	Sample date	Equipment
1163576	20/11/2024	Stericup filter
1190470	19/02/2025	Bailer
1213018	23/04/2025	Measuring jug (used to collect EWS samples)

4. Laboratory QA/QC

Results of the internal laboratory quality control programs are included as part of the laboratory reports. Laboratory QA/QC results are summarised in the following sections.

4.1 Laboratory duplicate review

4.1.1 Laboratory control spikes

Laboratory control spike analysis of the analysis of either a reference material or a control matrix fortified with analytes representative of the analyte class. The purpose of laboratory control spike samples is to monitor method precision and accuracy independent of the sample matrix. Typically, the percentage recovery of the laboratory control spike sample is compared to the dynamic recovery limits based on the statistical analysis of the processed laboratory control spike analysis. Recoveries should lie between 70% and 130% for inorganics and metals, and 60% to 140% for organics. Reported results will not include an adjustment for recovery.

No laboratory control spike outliers occurred in the investigation over all three sampling periods.

4.1.2 Surrogate spikes

Surrogate spike samples are samples with known additions of known amounts of compounds, which are similar to analytes of interests in terms of extractability, recovery through clean-up procedures and response to chromatographic or other measurement. Surrogate compounds may be alkylated or halogenated analogues or structural isomers of analytes of interest. The purpose of surrogate spikes, which are added immediately before the sample extraction step, is to provide a check for every analysis that no gross processing errors have occurred.

All reported surrogate spike recoveries were reported within the acceptable limits as specified by the laboratories.

4.1.3 Matrix spikes

Matrix spike samples analysis is the analysis of one or more replicate portions of samples from the batch, after fortifying the additional portion(s) with known quantities of the analyte(s) of interest. The percentage of recovery of target analyte(s) from matrix spike samples is used to determine the bias of the method in the specific sample matrix. Recoveries should typically lie between 70% and 130%, however this varies based on the organic nature of the analyte.

Matrix spike recoveries were generally compliant with data quality objectives, with exceptions shown in Table 6 Non-compliant matrix spike recoveries.

Table 6 Non-compliant matrix spike recoveries

Laboratory Report	Monitoring Round	Sample	Analyte	Data (%)	Limit (%)	Comments
EM2420777	19 November 2024	Anonymous	Nitrite plus Nitrate as N (NOx) by Discrete Analyser	Not Determined	-	MS recovery not determined, background level greater than or equal to 4x spike level.
EM2502990	18 February 2025	Anonymous	Total Phosphorus as P	Not Determined	-	MS recovery not determined, background level greater than or equal to 4x spike level.

Laboratory Report	Monitoring Round	Sample	Analyte	Data (%)	Limit (%)	Comments
EM2507122	22 April 2025	Anonymous	Sulfate as SO4 - Turbidimetric	Not Determined	-	MS recovery not determined, background level greater than or equal to 4x spike level.
EM2507122	22 April 2025	Anonymous	Chloride	Not Determined	-	MS recovery not determined, background level greater than or equal to 4x spike level.

4.1.4 Laboratory control sample

All laboratory control samples were reported within the acceptable range as defined by the laboratories.

4.1.5 Internal duplicates

Laboratory blind duplicates provide data on the analytical precision and reproducibility of the analytical results. The laboratory blind duplicate is created by sub sampling from one of the primary samples submitted for analysis. Laboratory blind duplicates are analysed at a rate equivalent to one in twenty (20) samples per analytical batch, or one sample per batch if less than twenty samples (20) are analysed in a batch.

All reported internal duplicate concentration were within the acceptable RPD ranges.

4.1.6 Method Blanks

Method or analysis blank samples are the analysis of a sample that is as free as possible of the analytes of interest but has been prepared the same way as the samples under investigation. The analysis is to ascertain if laboratory analytical process contributes to the reported concentration of the analyte.

All reported method blank concentrations were less than their respective laboratory LOR and indicates that potential laboratory cross contamination was unlikely to have occurred.

4.1.7 Laboratory quality control sample frequency

No Quality control frequency outliers were identified for laboratory duplicates, matrix spikes and laboratory control samples for both soil and groundwater samples.

5. Discussion and Conclusion

Several non-conformances of RPDs for blind and split duplicates and holding times were recorded. However, as discussed above, these are not considered to have impacted the overall outcome of the investigation.

The results of the QA/QC program are considered to provide an acceptable degree of confidence in the analytical program completed. Overall, the analytical data set is considered to be valid and of acceptable quality upon which to base the assessment.

Attachments

Attachment 1

Calibration Certificates

Multi Parameter Water Meter 152.0 1042025M

Instrument **YSI Pro Plus**
Serial No. **1BJ104343**

airmet
Air-Met Scientific Pty Ltd
1800 000 744

Item	Test	Pass	Comments
Batterv	Charge Condition	✓	
	Fuses	✓	
	Caaacitv	✓	
Switch/kevnad	Oaeration	✓	
Disolav	Intensitv	✓	
	Operation segments)	✓	
Grill Filler	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. aH	✓	
	2.mv	✓	
	3.EC	✓	
	4.D.O	✓	
	5. Terna	✓	
Alarms	Beeaer		
	Settings		
Software	**Version**		
Data lonner	Oaeration		
Download	Oaeration		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. D.O	'	**0%**		391223	**0%**
2. Conductivity		2760uS		401089	2760uS
3. aH7		DH 7		399304	pH?
4.aH4		PH4		399527	aH4
5. Terna °C		18.8°C		MullTherm	18.8°C
6.ORP mV		236.64mV		MullTherm	236.64mV

Calibrated by: Shirly Shen

- ***Calibration date:*** **10- Apr-25**

Next calibration due: **07-Oct-25**

1014/ZS

Oil / Water Interface Meter 3.0 1042025M

Instrument Solinst Interface Meter (30m)
Serial No. 549753

airmet
Air-Met Scientific Pty Ltd
1800 000 744

Item	Test	Pass	Comments
Batterv	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decan.	✓	
	Ooeration	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
	Checked far cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated** by: **Ha"ison Meers

Calibration date: 10/04/2025

Next calibration due: 07/10/2025

11/2125

Oil / Water Interface Meter 3.0 1122025M

Instrument Solinst Interface Meter (30m)
Serial No. 549766

airmet
Air-Met Scientific Pty Ltd
1800 000 744

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: Holly McNaughton

Calibration date: **11/02/2025**

Next calibration due: **10/08/2025**

Multi Parameter Water Meter 44.0 1122025M

Instrument YSI Pro Quatro
Serial No. 22G103267

airmet
Air-Met Scientific Pty Ltd
1800 000 744

Item	Test	Pass	Comments
Batterv	Charqe Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/kevoad	Operation	✓	
Displav	Intensity	✓	
	Operation 'seqments}	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1.pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settinqs		
Software	Version		
Data loaner	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. D.O		0pom		391223	0oom
2. Conductivity		2760µS		401089	2760µS
3.pH?		pH 7		399304	pH 7
4. oH4		oH 4		399527	pH 4
5. Temo °C		19.4•c		MultTherm	19.4•c
6. ORP mV		235.32mV		MultTherm	235.32mV

Calibrated by: ***Rebecca Massoud***

Calibration date: 11- Feb-25

Next calibration due: 10-Aug-25

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 18J100253

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Batterv	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/kevnad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2.mv	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settinas		
Software	Version		
Data lonner	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. D.O		0oom		391223	0.0 ppm
2. Conductivity		2760 uS/cm		396172	2760 uS/cm
3. pH7		pH 7.00		393774	pH 7.00
4.pH4		pH 4.00		399527	pH 4.00
5. ORP mV		233.12		406331/398193	233.12
7. Temp °C		20.4		Multimeter	20.4

Calibrated by: **Nanditha Srinivasan**

Calibration date: **14-Nov-24**

Calibration due: **12- Feb-25**

OFFICIAL

Oil / Water Interface Meter

Instrument Interface Meter (30M)
Serial No. 312444

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Batterv	Comoartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Ooeration	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: Micah Tennent

Calibration date: 13/11/2024

Next calibration due: 12/01/2025

OFFICIAL

Attachment 2

QAQC Result Tables

Appendix G
Table 1
RPD Result

		Loc. Code	Boggy 1 p/u 2	Boggy 1 p/u 2		Boggy 1 p/u 2	Boggy 1 p/u 2		BH16	BH16		BH16	BH16	
		Date	19 Nov 2024	19 Nov 2024		19 Nov 2024	19 Nov 2024		20 Nov 2024	20 Nov 2024		20 Nov 2024	20 Nov 2024	
		Field ID	Boggy 1 P/U 2	SW-D1		Boggy 1 P/U 2	SW-S1		BH16	GW-D1		BH16	GW-01	
		Sample Type	Normal	Field_D		Normal	Interlab_D		Normal	Field_D		Normal	Field_D	
		Lab Report	1163576	1163576	RPD	1163576	EM2420600	RPD	1163576	1163576	RPD	1163576	1163576	RPD
Analyte	**Unit**	**LOR**												
Inorganics														
pH (Lab)	pH units	0.01	-	-	-	-	-	-	-	-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1	22	24	9	22	24	9	19	37	**64**	19	18	5
Turbidity	NTU	0.1	<1	<1	0	<1	0.4	0	14	190	**173**	14	29	**70**
Total Dissolved Solids	mg/L	10	47	41	14	47	47	0	13	75	**141**	13	10	26
Acidity & Alkalinity														
Alkalinity (Carbonate as CaCO3)	mg/L	1	<10	<10	0	<10	<1	0	<10	<10	0	<10	<10	0
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	<20	33	**49**	<20	10	0	<20	48	**82**	<20	<20	0
Alkalinity (Hydroxide as CaCO3)	mg/L	1	<20	<20	0	<20	<1	0	<20	<20	0	<20	<20	0
Alkalinity (total as CaCO3)	mg/L	1	<20	33	**49**	<20	10	0	<20	48	**82**	<20	<20	0
Major Ions														
Calcium	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Calcium (filtered)	mg/L	0.5	1.3	1.6	21	1.3	2	**42**	1.1	2.8	**87**	1.1	1.0	10
Magnesium	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium (filtered)	mg/L	0.5	0.5	0.6	18	0.5	<1	0	<0.5	1.0	**67**	<0.5	<0.5	0
Potassium	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Potassium (filtered)	mg/L	0.5	<0.5	<0.5	0	<0.5	<1	0	<0.5	<0.5	0	<0.5	<0.5	0
Sodium	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Sodium (filtered)	mg/L	0.5	2.0	2.4	18	2.0	2	0	2.0	3.5	**55**	2.0	1.9	5
Chloride	mg/L	1	<1	<1	0	<1	1	0	<1	<1	0	<1	3.3	**107**
Sulfate	mg/L	1	<5	<5	0	<5	-	-	<5	<5	0	<5	<5	0
Sulfate (filtered)	mg/L	1	-	-	-	-	<1	-	-	-	-	-	-	-
Fluoride	mg/L	0.5	<0.5	<0.5	0	<0.5	-	-	<0.5	<0.5	0	<0.5	<0.5	0
Cations Total	meq/L	0.01	-	-	-	-	0.19	-	-	-	-	-	-	-
Anions Total	meq/L	0.01	-	-	-	-	0.23	-	-	-	-	-	-	-
Nutrients														
Ammonia as N	mg/L	0.01	<0.01	<0.01	0	<0.01	-	-	0.06	<0.01	**143**	0.06	<0.01	**143**
Nitrate (as N)	mg/L	0.01	0.13	0.16	21	0.13	0.13	0	1.1	0.04	**186**	1.1	1.1	0
Nitrite (as N)	mg/L	0.01	<0.02	<0.02	0	<0.02	<0.01	0	<0.02	<0.02	0	<0.02	<0.02	0
Nitrogen (Total Oxidised) (as N)	mg/L	0.01	0.13	0.16	21	0.13	0.13	0	1.1	<0.05	**183**	1.1	1.1	0
Nitrogen (Total)	mg/L	0.1	<0.2	<0.2	0	<0.2	0.1	0	1.4	<0.2	**150**	1.4	1.4	0
Kjeldahl Nitrogen Total	mg/L	0.1	<0.2	<0.2	0	<0.2	<0.1	0	0.3	<0.2	**40**	0.3	0.3	0
Nitrogen (Organic)	mg/L	0.2	<0.2	<0.2	0	<0.2	-	-	0.24	<0.2	18	0.24	0.3	22
Phosphorus (Total)	mg/L	0.01	<0.01	<0.01	0	<0.01	<0.01	0	<0.01	<0.01	0	<0.01	<0.01	0

Comments

#1 TDS may bias high due to the presence of fine particulate or colloidal matter that may pass through the filter paper.

RPD Comments

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 30 (1 - 10 x EQL); 30 (10 - 30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Appendix G
Table 1
RPD Result

ARV

Loc. Code			BH16	BH16		Boggy 1 p/u 1	Boggy 1 p/u 1		Boggy 1 p/u 1	Boggy 1 p/u 1		BH16	BH16		BH16	BH16
Date			20 Nov 2024	20 Nov 2024		18 Feb 2025	18 Feb 2025		18 Feb 2025	18 Feb 2025		19 Feb 2025	19 Feb 2025		19 Feb 2025	19 Feb 2025
Field ID			BH16	GW-S1		Boggy 1 p/u 1	SW-D2		Boggy 1 p/u 1	SW-S2		BH16	GW-D2		BH16	GW-S2
Sample Type			Normal	Interlab_D		Normal	Field_D		Normal	Interlab_D		Normal	Field_D		Normal	Interlab_D
Lab Report			1163576	EM2420600	RPD	1190470	1190470	RPD	1190470	EM2502990	RPD	1190470	1190470	RPD	1190470	EM2502990
Analyte	**Unit**	**LOR**														
Inorganics																
pH (Lab)	pH units	0.01	-	-	-	-	-	-	-	6.35	-	-	-	-	-	5.99
Electrical conductivity (lab)	µS/cm	1	19	20	5	28	28	0	28	28	0	19	17	11	19	16
Turbidity	NTU	0.1	14	26.2	**61**	3.6	<1	**113**	3.6	1.2	**100**	3.5	2.9	19	3.5	124
Total Dissolved Solids	mg/L	10	13	49	**116**	55[#1]	62[#1]	12	55[#1]	-	-	<10	35[#1]	**111**	<10	-
Acidity & Alkalinity																
Alkalinity (Carbonate as CaCO3)	mg/L	1	<10	<1	0	<10	<10	0	<10	<1	0	<10	<10	0	<10	<1
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	<20	5	0	<20	<20	0	<20	12	0	<20	<20	0	<20	3
Alkalinity (Hydroxide as CaCO3)	mg/L	1	<20	<1	0	<20	<20	0	<20	<1	0	<20	<20	0	<20	<1
Alkalinity (total as CaCO3)	mg/L	1	<20	5	0	<20	<20	0	<20	12	0	<20	<20	0	<20	3
Major Ions																
Calcium	mg/L	0.5	-	-	-	2.0	2.1	5	2.0	-	-	0.9	1.0	11	0.9	-
Calcium (filtered)	mg/L	0.5	1.1	1	10	-	-	-	-	2	-	-	-	-	-	<1
Magnesium	mg/L	0.5	-	-	-	0.7	0.8	13	0.7	-	-	<0.5	<0.5	0	<0.5	-
Magnesium (filtered)	mg/L	0.5	<0.5	<1	0	-	-	-	-	<1	-	-	-	-	-	<1
Potassium	mg/L	0.5	-	-	-	<0.5	<0.5	0	<0.5	-	-	<0.5	<0.5	0	<0.5	-
Potassium (filtered)	mg/L	0.5	<0.5	<1	0	-	-	-	-	<1	-	-	-	-	-	<1
Sodium	mg/L	0.5	-	-	-	2.8	2.3	20	2.8	-	-	1.8	1.9	5	1.8	-
Sodium (filtered)	mg/L	0.5	2.0	2	0	-	-	-	-	3	-	-	-	-	-	2
Chloride	mg/L	1	<1	1	0	1.1	1.2	9	1.1	1	10	1.4	1.1	24	1.4	2
Sulfate	mg/L	1	<5	-	-	<5	<5	0	<5	-	-	<5	<5	0	<5	-
Sulfate (filtered)	mg/L	1	-	<1	-	-	-	-	-	1	-	-	-	-	-	<1
Fluoride	mg/L	0.5	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Cations Total	meq/L	0.01	-	0.14	-	-	-	-	-	0.23	-	-	-	-	-	0.09
Anions Total	meq/L	0.01	-	0.13	-	-	-	-	-	0.29	-	-	-	-	-	0.12
Nutrients																
Ammonia as N	mg/L	0.01	0.06	-	-	<0.01	<0.01	0	<0.01	-	-	0.49	<0.01	**192**	0.49	-
Nitrate (as N)	mg/L	0.01	1.1	0.89	21	0.07	0.04	**55**	0.07	0.08	13	0.93	0.93	0	0.93	0.94
Nitrite (as N)	mg/L	0.01	<0.02	<0.01	0	<0.02	<0.02	0	<0.02	<0.01	0	<0.02	<0.02	0	<0.02	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01	1.1	0.89	21	0.08	<0.05	**46**	0.08	0.08	0	0.93	0.94	1	0.93	0.94
Nitrogen (Total)	mg/L	0.1	1.4	1.1	24	<0.2	<0.2	0	<0.2	0.2	0	1.4	1.3	7	1.4	1.2
Kjeldahl Nitrogen Total	mg/L	0.1	0.3	0.2	**40**	<0.2	<0.2	0	<0.2	0.1	0	0.5	0.4	22	0.5	0.3
Nitrogen (Organic)	mg/L	0.2	0.24	-	-	<0.2	<0.2	0	<0.2	-	-	<0.2	0.4	**67**	<0.2	-
Phosphorus (Total)	mg/L	0.01	<0.01	0.11	**167**	<0.01	<0.01	0	<0.01	0.09	**160**	<0.01	<0.01	0	<0.01	0.28

Comments

#1 TDS may bias high due to the presence of fine particulate or colloidal matter that may pass through the filter paper.

RPD Comments

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 30 (1 - 10 x EQL); 30 (10 - 30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Appendix G
Table 1
RPD Result

ARV

Loc. Code				Boggy 2	Boggy 2		Boggy 2	Boggy 2		BH17	BH17		BH17	BH17	
Date				22 Apr 2025	22 Apr 2025		22 Apr 2025	22 Apr 2025		23 Apr 2025	23 Apr 2025		23 Apr 2025	23 Apr 2025	
Field ID				Boggy 2	SW-D3		Boggy 2	SW-Split		BH17	GW-D3		BH17	GW-Split	
Sample Type				Normal	Field_D		Normal	Interlab_D		Normal	Field_D		Normal	Interlab_D	
Lab Report			RPD	1213018	1213018	RPD	1213018	EM2507122	RPD	1213018	1213018	RPD	1213018	EM2507122	RPD
Analyte	**Unit**	**LOR**													
Inorganics															
pH (Lab)	pH units	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
Electrical conductivity (lab)	µS/cm	1	17	28	28	0	28	30	7	39	39	0	39	42	7
Turbidity	NTU	0.1	**189**	2.4	<1	**82**	2.4	0.4	**143**	100	200	**67**	100	171	**52**
Total Dissolved Solids	mg/L	10	-	64	44	**37**	64	46	**33**	40	42	5	40	50	22
Acidity & Alkalinity															
Alkalinity (Carbonate as CaCO3)	mg/L	1	0	<10	<10	0	<10	<1	0	<10	<10	0	<10	<1	0
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	0	<20	<20	0	<20	15	0	24	23	4	24	25	4
Alkalinity (Hydroxide as CaCO3)	mg/L	1	0	<20	<20	0	<20	<1	0	<20	<20	0	<20	<1	0
Alkalinity (total as CaCO3)	mg/L	1	0	<20	<20	0	<20	15	0	24	23	4	24	25	4
Major Ions															
Calcium	mg/L	0.5	-	2.2	2.1	5	2.2	-	-	3.2	3.1	3	3.2	-	-
Calcium (filtered)	mg/L	0.5	-	-	-	-	-	2	-	-	-	-	-	3	-
Magnesium	mg/L	0.5	-	0.7	0.7	0	0.7	-	-	1.1	1.2	9	1.1	-	-
Magnesium (filtered)	mg/L	0.5	-	-	-	-	-	<1	-	-	-	-	-	1	-
Potassium	mg/L	0.5	-	<0.5	<0.5	0	<0.5	-	-	1.2	1.1	9	1.2	-	-
Potassium (filtered)	mg/L	0.5	-	-	-	-	-	<1	-	-	-	-	-	<1	-
Sodium	mg/L	0.5	-	3.1	3.1	0	3.1	-	-	4.2	4.2	0	4.2	-	-
Sodium (filtered)	mg/L	0.5	-	-	-	-	-	3	-	-	-	-	-	4	-
Chloride	mg/L	1	**35**	1.0	6.3	**145**	1.0	1	0	<1	1.4	**33**	<1	1	0
Sulfate	mg/L	1	-	<5	<5	0	<5	-	-	<5	<5	0	<5	-	-
Sulfate (filtered)	mg/L	1	-	-	-	-	-	<1	-	-	-	-	-	<1	-
Fluoride	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Cations Total	meq/L	0.01	-	-	-	-	-	0.23	-	-	-	-	-	0.40	-
Anions Total	meq/L	0.01	-	-	-	-	-	0.33	-	-	-	-	-	0.53	-
Nutrients															
Ammonia as N	mg/L	0.01	-	<0.01	<0.01	0	<0.01	<0.01	0	0.02	0.02	0	0.02	<0.01	**67**
Nitrate (as N)	mg/L	0.01	1	0.06	0.04	**40**	0.06	0.08	29	0.17	0.17	0	0.17	0.18	6
Nitrite (as N)	mg/L	0.01	0	<0.02	<0.02	0	<0.02	<0.01	0	<0.02	<0.02	0	<0.02	<0.01	0
Nitrogen (Total Oxidised) (as N)	mg/L	0.01	1	0.06	<0.05	18	0.06	0.08	29	0.17	0.18	6	0.17	0.18	6
Nitrogen (Total)	mg/L	0.1	15	0.4	0.2	**67**	0.4	<0.1	**120**	1.0	0.5	**67**	1.0	0.4	**86**
Kjeldahl Nitrogen Total	mg/L	0.1	**50**	0.3	0.2	**40**	0.3	<0.1	**100**	0.8	0.3	**91**	0.8	0.2	**120**
Nitrogen (Organic)	mg/L	0.2	-	0.3	0.2	**40**	0.3	-	-	0.78	0.28	**94**	0.78	-	-
Phosphorus (Total)	mg/L	0.01	**186**	<0.01	<0.01	0	<0.01	0.01	0	0.06	0.06	0	0.06	0.16	**91**

Comments

#1 TDS may bias high due to the presence of fine particulate or colloidal matter that may pass through the filter paper.

RPD Comments

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 30 (1 - 10 x EQL); 30 (10 - 30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Appendix G
Table 2
Rinsate Result

		Field ID	R1	R2	R3
		Date	20 Nov 2024	19 Feb 2025	23 Apr 2025
		Sample Type	Rinsate	Rinsate	Rinsate
		Lab Report	1163576	1190470	1213018
Analyte	Unit	LOR			
Inorganics					
Electrical conductivity (lab)	µS/cm	10	<10	<10	<10
Turbidity	NTU	1	<1	<1	<1
Total Dissolved Solids	mg/L	10	<10	<10	<10
Acidity & Alkalinity					
Alkalinity (Carbonate as CaCO3)	mg/L	10	<10	<10	<10
Alkalinity (Bicarbonate as CaCO3)	mg/L	20	<20	<20	<20
Alkalinity (Hydroxide as CaCO3)	mg/L	20	<20	<20	<20
Alkalinity (total as CaCO3)	mg/L	20	<20	<20	<20
Major Ions					
Calcium	mg/L	0.5	-	<0.5	<0.5
Calcium (filtered)	mg/L	0.5	<0.5	-	-
Magnesium	mg/L	0.5	-	<0.5	<0.5
Magnesium (filtered)	mg/L	0.5	<0.5	-	-
Potassium	mg/L	0.5	-	<0.5	<0.5
Potassium (filtered)	mg/L	0.5	<0.5	-	-
Sodium	mg/L	0.5	-	<0.5	<0.5
Sodium (filtered)	mg/L	0.5	<0.5	-	-
Chloride	mg/L	1	<1	<1	<1
Sulfate	mg/L	5	<5	<5	<5
Fluoride	mg/L	0.5	<0.5	-	-
Nutrients					
Ammonia as N	mg/L	0.01	<0.01	<0.01	<0.01
Nitrate (as N)	mg/L	0.02	<0.02	<0.02	<0.02
Nitrite (as N)	mg/L	0.02	<0.02	<0.02	<0.02
Nitrogen (Total Oxidised) (as N)	mg/L	0.05	<0.05	<0.05	<0.05
Nitrogen (Total)	mg/L	0.2	<0.2	<0.2	<0.2
Kjeldahl Nitrogen Total	mg/L	0.2	<0.2	<0.2	<0.2
Nitrogen (Organic)	mg/L	0.2	<0.2	<0.2	<0.2
Phosphorus (Total)	mg/L	0.01	<0.01	<0.01	<0.01

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