RAVENSWORTH
OPEN CUT

GLENCORE

Ravensworth Complex

Annual Review 2022

Name of Operation	Ravensworth Complex
Name of Operator	Ravensworth Operations Pty Limited
Development Consent/ Project Approval #	PA 09_0176 and DA 104/96
Holder of Development Consent/ Project Approval	Ravensworth Operations Pty Limited
ROC Titles/ Mining Leases	ML1325, ML 1357, ML1393, ML1484, ML 1485, ML1502, ML 1576, ML 1669, ML 1683, CL 378, CL 380, CL 580, CCL 723, CCL 739, A385
RUM Titles/ Mining Leases	ML 1348, ML 1349, ML 1398, ML 1416, ML 1477, ML 1495, ML 1506, ML 1564, ML 1580, ML 1581, ML 1591, ML 1595, ML 1625, ML 1667, ML 1668
Name of holder of Mining Lease	Ravensworth Operations Pty Ltd (primary authorisation holder), Cumnock No.1 Colliery Pty Limited, Resource Pacific Pty Limited, AGL Macquarie Pty Limited, Glencore Newpac Pty Limited.
Water Licence #	WAL #: 9049; 9050; 41496; 41505; 41554; 1046; 1325; 8964; 13102; 41529; 10771; 816; 41507; 41530; 41531
Name of holder of Water Licence #	Ravensworth Operations Pty Ltd / Cumnock No1 Colliery Pty Ltd / Resource Pacific Pty Ltd
RMP previous revision date:	1 July 2022 (Ravensworth Open Cut Mine and Ravensworth Underground Mine)
Annual Review start date	1 January 2022
Annual Review end date	31 December 2022

I, Klay Marchant, certify that this audit report is a true and accurate record of the compliance status of Ravensworth Complex for the period 1 January 2022 to 31 December 2022 and that I am authorised to make this statement on behalf of Ravensworth Complex.

Note.

a) *The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.*

b) *The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or $22,000, or both).*

Name of authorise reporting officer	Klay Marchant
Title of authorise reporting officer	Environment and Community Manager
Signature of authorised reporting officer	
Date	31 March 2023

Table of Contents

1. Statement of Compliance

A summary of compliance at Ravensworth Complex is provided in ***Table 1-1***.

Table 1-1 – Statement of Compliance

Document	Compliant
Approvals	
PA 09_0176 (MOD 3)	NO
DA 104/96 (MOD 10)	YES
EPBC 2010_5839	YES
Licences	
EPL 2652	NO
Water Licences	YES
Leases	
ML# 1325	YES
ML# 1348	YES
ML# 1349	YES
ML# 1357	YES
ML# 1393	YES
ML# 1398	YES
ML# 1416	YES
ML# 1477	YES
ML# 1484	YES
ML# 1485	YES
ML# 1495	YES
ML# 1502	YES
ML# 1506	YES
ML# 1564	YES
ML# 1576	YES
ML# 1580	YES

Document	Compliant
ML# 1581	YES
ML# 1591	YES
ML# 1595	YES
ML# 1625	YES
ML# 1667	YES
ML# 1668	YES
ML# 1669	YES
ML# 1683	YES
CL# 380	YES
CL# 378	YES
CL# 580	YES
CCL# 723	YES
CCL# 739	YES

The non-compliances during the 2022 reporting period are discussed further in ***Section 11***. The non-compliances categories are described in ***Table 1-2***. A summary of the non-compliances with Project Approval 09_0176, EPL 2652 and relevant mining leases during the reporting period have been summarised in ***Table 1-3***.

Table 1-2 – Statement of Compliance Key

Risk Level	Colour code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless for the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: Potential for serious environmental consequences, but it is unlikely to occur; or Potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: Potential for moderate environmental consequences, but it is unlikely to occur; or Potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

Table 1-3 – Summary of Non-Compliances

Relevant approval	Condition #	Condition description	Compliance Status	Comment	Where addressed in the Annual Review
PA 09_0176	Schedule 3, Condition 10	The Proponent shall ensure that blasts on site do not cause exceedances of the criteria in Table 8 (of the Project Approval).	Non-compliant	A fault with the REA86 blast monitor caused a missed blast recording on 17/03/22 at 13:13:46, event code RTH615	Section 6.2.2.1 and Section 11
	Schedule 3, Condition 10A	The Proponent shall ensure that blasts on site do not cause any exceedance of the following incremental ground vibration limits at the Aboriginal axe grinding groove site (REA86):	Non-compliant		
PA 09_0176	Schedule 3, Condition 20	All reasonable and feasible avoidance and mitigation measures are undertaken so that particulate matter emissions generated by the Ravensworth mine complex do not exceed the criteria listed in Table 10 (short term PM10 criterion) at any residence on privately-owned land or on more than 25 percent of any privately-owned land.	Non-compliant	PM_{10} 24 hour criterion of 50 µg/m^3 was exceeded once at TEOM D1 on 19/2/2022. The exceedance was notified to the relevant authority on 21/2/2022 and 25/2/2022.	Section 6.3.2.1 and Section 11
EPL 2652	M2.2	Continuously monitor PM10 at Point 9 and 10 (TEOM D1 and D2)	Non-compliant	Continuous PM_{10} data was not acquired due to insufficient data capture. Machine faults were caused by adverse weather.	Section 6.3.2.1 and Section 11
EPL2652	E1.3	The licensee must not exceed the hourly volume discharge limit calculated using the following formula, at Point 2 of this licence. H = V / RRT	Non-compliant	Hourly discharge rate was exceeded on 40 x one hour occasions spread across 22 days where HRSTS discharge block had been published.	Section 7.3 and Section 11
EPL2652	M2.3	Collect grab sample from EPL3 and EPL4 daily during discharge	Non-compliant	Failure to collect 9x grab samples from EPL3 and 4x grab samples from EPL4 as a result of inability to safely access monitoring point due	Section 7.4 and Section 11

Relevant approval	Condition #	Condition description	Compliance Status	Comment	Where addressed in the Annual Review
				to localised and regional flooding events. Samples were collected from EPL2 on all occasions ensuring discharge water remained compliant with EPL2652 water quality requirements.	
EPL2652	M5.1	Continuous monitoring from weather station EPL13.	Non-compliant	Software and hardware issues at EPL13 resulted in lost data on 2 occasions.	Section 6.8 and Section 11

2. Introduction

The Ravensworth Complex comprises the following operations:

- Ravensworth Open Cut (ROC) (PA 09_0176 (MOD 3));
- Ravensworth Underground Mine (RUM) (DA 104/96 (MOD 10)); and
- Ravensworth Coal Handling and Preparation Plant (RCHPP) (PA 09_0176).

Figure 2.1 shows the layout of the Ravensworth Complex and ***Figure 2.2*** shows the regional context.

This Annual Review is for the reporting period 1 January 2022 to 31 December 2022. It includes PA 09_0176 (ROC), DA104/96 (RUM), various mining leases, and associated environmental management plans for the Ravensworth Complex. The project approval and mining lease boundaries are shown on ***Figure 2.3***.

2.1.1 Ravensworth Open Cut (ROC)

ROC is owned and operated by Ravensworth Operations Pty Limited, which is managed by Glencore. An Environmental Assessment (EA) was submitted for the Ravensworth Operations Project in February 2010. The EA was approved by the former Department of Planning, Infrastructure and Environment (DPIE) on 11 February 2011 (PA 09_0176). The approval granted the expansion of existing approved mining operations at ROC and enabled the consolidation of existing approvals for open cut mining and infrastructure. The single project approval has enabled the amalgamation of operational aspects of the mining operations, which has facilitated a consistent and integrated approach to environmental management and mine planning. Details of modifications to PA 09_0176 are included in ***Section 3.1***.

2.1.2 Ravensworth Underground Mine (RUM)

RUM is owned by Resource Pacific Pty Limited and Glencore Coal Assets Australia (GCAA) oversees the management.

The area of land within the approved RUM development consent boundaries is owned by RUM, AGL Macquarie, Daracon, Ravensworth Operations Pty Limited, Glendell, and I. Bowman Pty Ltd. Where necessary, RUM undertakes consultation with the relevant parties, including consultation during the preparation of EA modifications and Subsidence Management Plan (SMP) applications.

RUM operates under development consent DA 104/96 dated 20 November 1996.

The original 1996 development application was supported by an EA for the construction and operation of an underground coal mine. Through subsequent EA modifications, RUM has an approved maximum production of 7 Mtpa of run of mine (ROM) coal.

RUM was placed in Care and Maintenance in October 2014.

The RUM and Ashton Underground Mine share a common mining lease boundary and are approved to extract coal from similar coal seams. During 2021, a tenth modification (DA 104/96 MOD10) was submitted and approved by DPE on 6 July 2022 with the purpose of allowing Ashton Coal Operations Limited (ACOL - who operate Ashton Underground Mine) to access and extract approved but unmined

coal resources at RUM and integrate part of the approved RUM with the Ashton Coal Project. Further details are included in **Section 3.1**.

2.1.3 Ravensworth Coal Handing and Preparation Plant (RCHPP)

The RCHPP is located adjacent to the RUM pit top and is managed under PA 09_0176.

Once the coal from ROC or RUM reaches the ROM stockpile it is required to be managed by RCHPP. Coal is either fed directly into one of the three modules (20 Mt/year) at a rate of up to 3,600 tonnes per hour prior to being loaded onto trains, or bypassed directly to domestic customers.

The RCHPP also receives product coal from Muswellbrook Coal Company.

2.2 Mine Contacts

Mine contact details for ROC, RUM and the RCHPP are shown in **Table 2-1**.

Table 2-1 - Mine Contacts

Name	Title	Contact Details
ROC	General Enquiries	Phone: 1800 620 553 Phone: (02) 6570 0700 Address: Lemington Road, Off New England Highway Ravensworth, via Singleton, NSW 2330 Postal: PO Box 294, Muswellbrook, NSW 2333 *https://www.glencore.com.au/operations-and-projects/coal/current-operations/ravensworth-operations*
RUM / RCHPP	General Enquiries	Phone: 1800 620 553 Address: Liddell Station Rd, Ravensworth NSW 2330 Postal: P.O Box 528 Singleton 2330 *https://www.glencore.com.au/operations-and-projects/coal/past-operations/ravensworth-underground*
Thomas Hubert	Operations Manager	Phone: (02) 6570 0736 E-mail: *thomas.hubert@glencore.com.au*
Klay Marchant	Environment and Community Manager	Phone: (02) 6570 0700 Email: *Klay.Marchant@glencore.com.au*

Figure 2-1 – Ravensworth Complex Layout

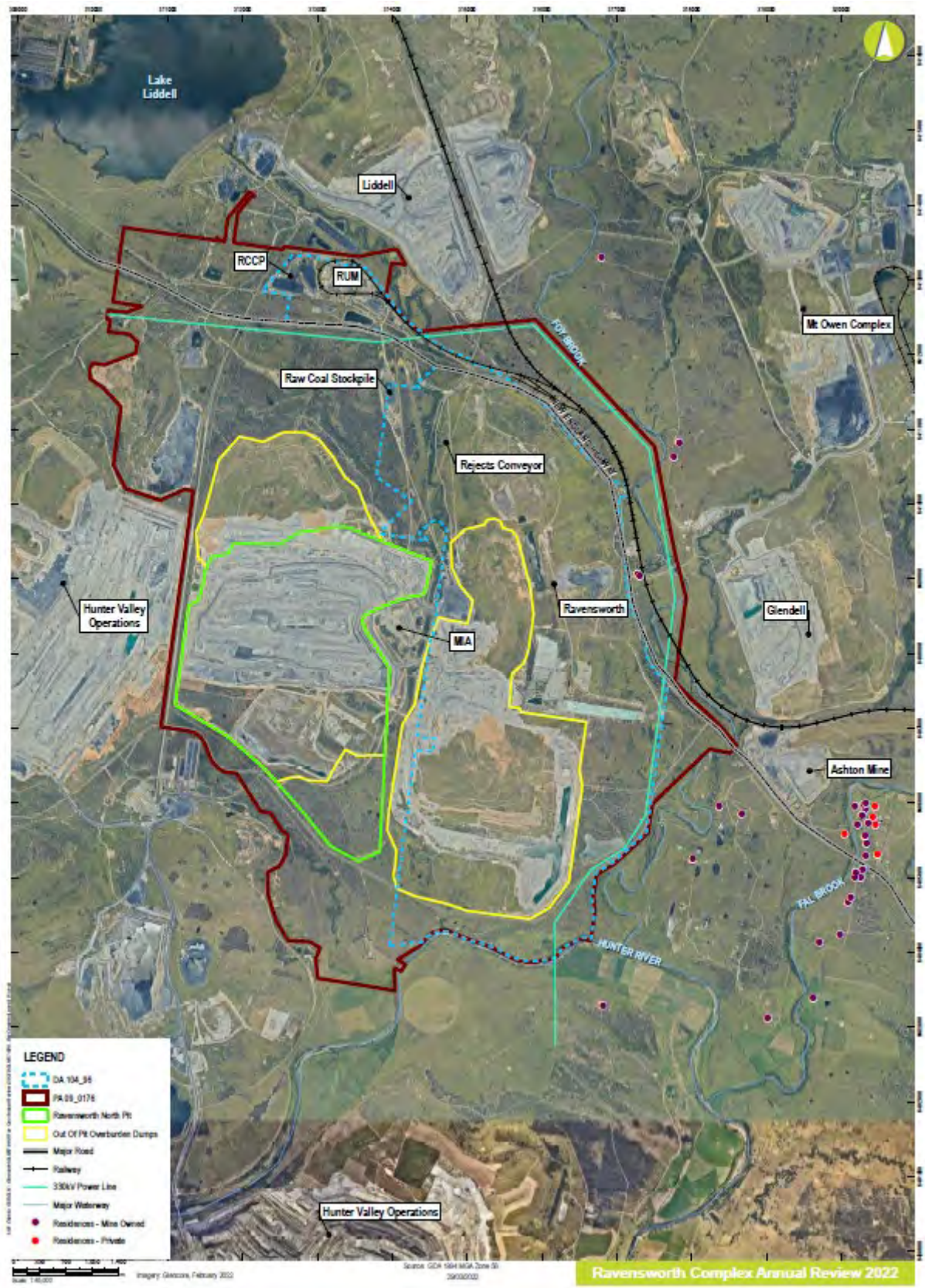


Figure 2-2 – Regional Context

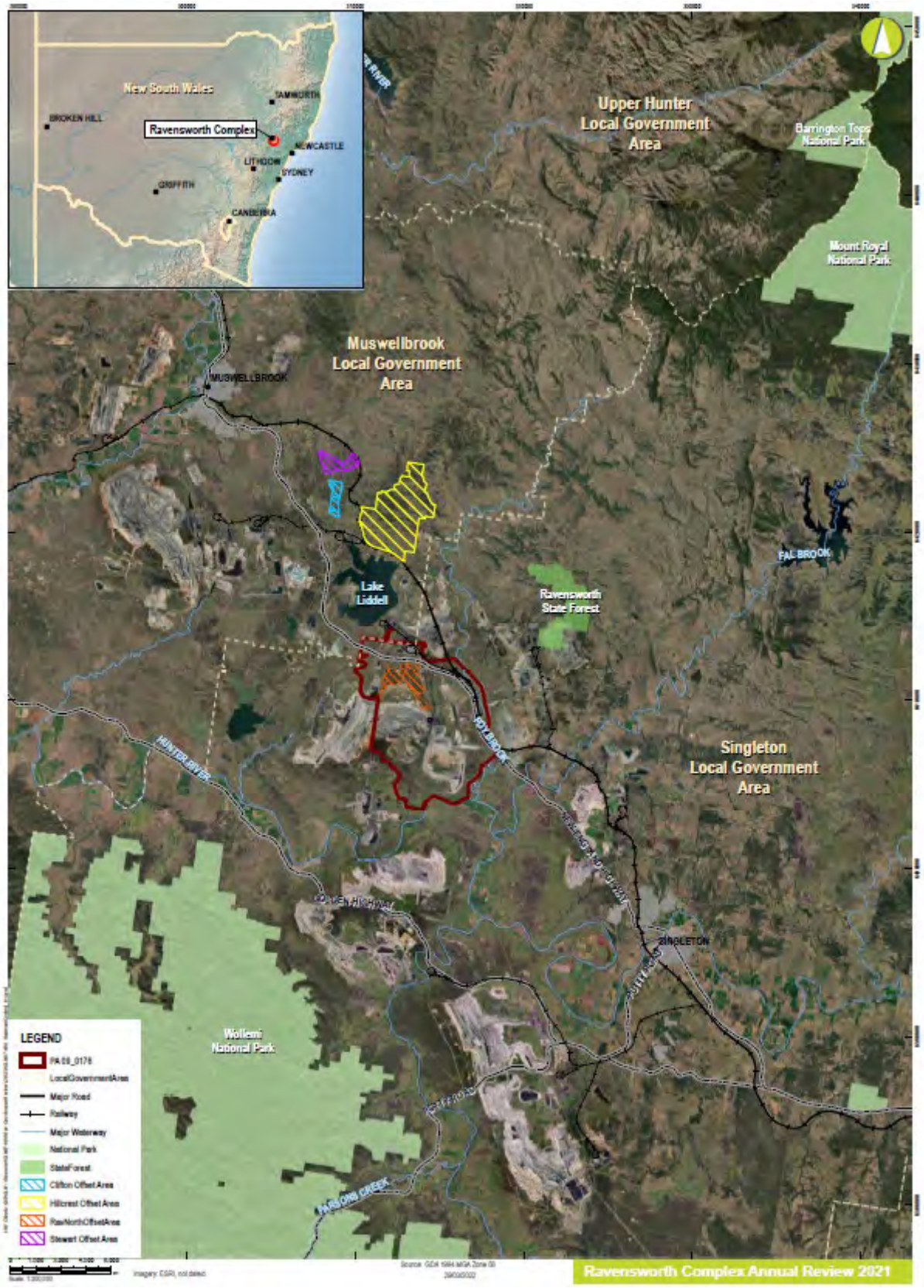


Figure 2-3 – Mining Lease Boundaries

3. Approvals

Operations at Ravensworth Complex are regulated by a range of leases, licences and approvals which are summarised below.

3.1 Project Approval

ROC and the RCHPP operate under Project Approval PA 09_0176 (PA 09_0176 MOD 3, granted on 11 February 2011). A separate approval applies to RUM; Development Consent (DA 104/96 MOD 10).

This Annual Review has been completed to fulfil the requirements of Schedule 5, Condition 3 of PA 09_0176 and Schedule 4, Condition 2 of DA 104/96. ***Table 3-1*** below outlines the project approvals relevant to Ravensworth Complex.

Table 3-1 – Ravensworth Complex Approvals and Modifications

Approval	Title	Date Granted
ROC		
09_0176	Original Approval	11 February 2011
09_0176 Mod 1	Extraction of approximately 2.7 million tonnes of coal in the Narama West mining area.	16 August 2013
09_0176 Mod 2	Allow for an increase in final landform heights to accommodate a more stable free flowing natural landform.	19 December 2014
09_0176 Mod 3	Construction and operation of a tailings pipeline from the RCHPP at Ravensworth Operations to the Mount Owen West Pit Void.	16 February 2016
RUM		
104/96	Original Approval	20 November 1999
104/96 Mod 1	Modification to road haulage conditions	6 January 1998
104/96 Mod 2	Reject emplacement and water management system changes	5 March 2001
104/96 Mod 3	Installation of Substation	11 February 2007
104/96 Mod 4	Solcenic Borehole and Storage Tanks	11 February 2007
104/96 Mod 5	Ventilation Shaft, electricity supply and underground workings	4 July 2007
104/96 Mod 6	Tailings Water Recovery Dam	21 May 2008
104/96 Mod 7	Mining method, water and waste management	3 July 2009
104/96 Mod 8	Extension to LWs 6 to 10 and additional gas management infrastructure	5 January 2011
104/96 Mod 9	Liddell Seam Project	20 June 2013
104/96 Mod 10	Ravensworth Ashton Integration	6 July 2022

The RUM Ashton Coal Project (104/96 MOD 10) involves:

- Allowing access for Ashton to extract a portion of the Ravensworth Underground Mine (RUM) coal reserves;
- Connection of the existing Ashton and Ravensworth underground workings;
- Transfer of ROM coal from RUM to the Ashton CHPP;
- Minor changes to the configuration of the Pikes Gully and Middle Liddell Seam Longwalls;
- Extension of mining operations until 31 December 2032; and
- Other administrative changes to facilitate ACOL management and responsibility for a portion of the RUM consent area.

3.2 Licences

The following sections discuss Licences relevant to the Ravensworth Complex Annual Report.

3.2.1 Environment Protection Licence

Ravensworth Complex operate under Environment Protection Licence (EPL) 2652, with an anniversary date of 12 January. Monitoring results are reported to the EPA as part of Ravensworth Complex Annual Review and monitoring data is available on the Ravensworth website.

During the reporting period Ravensworth Complex EPL was varied once, on 2 August 2022. The following variations were made to EPL 2652:

- Condition A2.1 – Premises description updated to reflect new premises plan which does not include areas within the AGL Macquarie Pty Limited licensed area (EPL 779).
- Condition A2.2 - Premises map removed.
- Condition M2.3 – Monitoring point 3 and 4 monitoring frequency has been changed from Special Frequency 1 to daily during any discharge.
- Condition M2.4 – Definition of Special Frequency 1 has been removed.

The environmental reporting and monitoring activities undertaken at the Ravensworth Complex as required under EPL 2652, are discussed in **Section 6**.

3.2.2 Surface and Groundwater Licences

Ravensworth holds several surface and groundwater licences, which allow for surface and groundwater extraction and monitoring. Further details regarding these licences are provided in ***Section 7.4*** and ***7.5.***

3.3 Other Approvals

3.3.1 Management Plans

The status of site Management Plans as of 31 December 2022 are summarised in ***Table 3-2***. In accordance with Schedule 5, Condition 4 of PA 09_0176, Ravensworth will review, and if necessary,

revise, the strategies, plans and programs required under the consent within three months of this Annual Review, to the satisfaction of the Secretary of the Department of Planning and Environment (DPE).

Table 3-2 – Management Plan Status

Document	Reference	Revision Date
ROC		
Ravensworth Complex Environmental Management Strategy (EMS)	PA 09_0176 Schedule 5, Condition 1	15 June 2022
Pollution Incident Response Management Plan (PIRMP)	Pollution Incident Response Management Plan	31 October 2022
Ravensworth Complex Noise Management Plan (NMP)	PA 09_0176 Schedule 3 Condition 9	10 September 2018
Ravensworth Complex Blast Management Plan (BMP)	PA 09_0176 Schedule 3 Condition 17	20 December 2022
Ravensworth Complex Air Quality and Greenhouse Gas Management Plan (AQGGMP)	PA 09_0176 Schedule 3 Condition 24	21 March 2022
Ravensworth Complex Water Management Plan (WMP)	PA 09_0176 Schedule 3 Condition 31	9 June 2022
Ravensworth Complex Biodiversity Management Plan (BioMP)	PA 09_0176 Schedule 3 Condition 31	28 November 2022
Ravensworth Open Cut Rehabilitation Management Plan (RMP)	PA 09_0176 Schedule 3 Condition 41	1 August 2022
Ravensworth Complex Heritage Management Plan (HMP)	PA 09_0176 Schedule 3 Condition 42	5 August 2022
Aboriginal Cultural Heritage Management Plan (ACHMP)	PA 09_0176 Schedule 3 Condition 42	28 November 2022
RUM		
Ravensworth Underground Air Quality and Greenhouse Gas Management Plan	DA 104/96, Schedule 2, Condition 14	Covered under the Complex Plans.
Biodiversity, Rehabilitation and Land Management Plan	DA 104/96, Schedule 2, Conditions 4, 7. Mining leases	Covered under the Complex Plans.
Lighting Management Plan	DA 104/96, Schedule 2, Condition 5.	Covered under the Complex Plans.
Bushfire Risk Hazard Reduction Management Plan	DA 104/96, Schedule 2, Condition 6.	Covered under the Complex Plans.
Ravensworth Underground Mine RMP	DA 104/96	1 August 2022

3.3.2 Rehabilitation Management Plan

As of 1 July 2022, Ravensworth Complex operates under two *Rehabilitation Management Plans* (RMP) in accordance with the Resources Regulator guidelines. The RMP covers aspects including mine closure planning and execution, stakeholder consultation, environmental management, post mining

land use, status of closure, performance indicators and rehabilitation objectives, criteria, and implementation. Separate RMPs have been prepared for ROC and RUM.

In addition to the RMPs, Annual Rehabilitation Reports and Forward Programs for the two sites will be submitted to Resources Regulator in March 2023.

4. Operations During the Reporting Period

4.1 Mining Operations

Schedule 2, Condition 6 of PA 09_0176 stipulates that no more than 16 Mt of ROM coal will be produced through open cut mining in a calendar year and no more than 21 Mt of ROM coal will be produced by Ravensworth Complex per calendar year.

During the reporting period, 63.8 million bank cubic metres (Mbcm) of overburden was mined in Ravensworth North Pit to allow the extraction of 13.5 million tonnes (Mt) of Run of Mine (ROM) coal which is within the annual limits. A summary for the Ravensworth Complex is outlined in ***Table 4-1***.

Table 4-1 – Complex Production and Waste Summary

Material	Approval Limit	Previous Reporting Period (2021)	This reporting period (2022)	Next reporting period (2023 budget)
Ravensworth North				
Prime Overburden (kbcm)	n/a	61,200	58,846	63,833
ROM coal (Mt)	16[1]	12.9	12.8	13.5
Saleable Product (Mt)	20[2]	8.7	8.4	8.6
RUM				
ROM Coal (Mt)	21[1]	0	0	0
Product Coal (Mt)	0	0	0	0
RCHPP				
Coarse Waste Reject (Mt)	n/a	2.5	2.6	3.2
Fine Waste Reject (Mt) (dry)	n/a	1.6	1.7	1.7

[1]Approval limit of 16 Mt applies to ROC mining operations. A combined limit of 21 Mt applies to the complex. As per schedule 2 condition 6 of PA09_0176.
[2]Restricted product coal transport to/from RCHPP/RCT to a maximum of 20 Mt as per schedule 2 condition 7b of PA09_0176

RUM has remained in care and maintenance from October 2014.

4.2 Exploration

During 2022 the following exploration activities were carried out at ROC:

- Drilling of 5 exploration holes were completed in 2022;
- Purpose of exploration holes were coal quality, geotechnical analysis and the installation of 4 piezometers;
- Samples were taken from 4 holes to sample to complete geochemical analysis in 2023; and
- 4 of 5 holes will be mined through in coming years, 1 piezometer to remain in place.

No exploration was carried out at RUM in 2022.

4.3 Construction

During 2022 the following construction was undertaken at ROC

- Construction of the new Mine Access Road. Construction will continue into 2023;
- Completed construction of new magazine yard ahead of progression of mining.

No construction was carried out at RUM in 2022.

4.4 Land Preperation

Land clearing is undertaken in accordance with the Ravensworth Complex Environmental Management System (EMS). Areas are assessed prior to clearing to minimise potential ecological, water management, sediment and erosion and cultural heritage impacts in accordance with the pre-clearing requirements.

Land disturbed in preparation for rehabilitation is discussed in **Section 8**.

No land preparation was carried out at RUM in 2022.

4.5 Mineral Processing

The following subsections discuss mineral processing activities at Ravensworth Complex.

4.5.1 Rejects Emplacement and Tailings

Coarse Rejects

Rejects are conveyed from the RCHPP to a reject bin, where they are collected by haul trucks. The haul trucks transport rejects via internal haul roads for co-disposing in the overburden emplacement areas in accordance with regulatory approvals. During this reporting period 2.6Mt of coarse rejects produced by the RCHPP (refer ***Table 4-1***).

Tailings

During 2022, tailings were emplaced into both the Mount Owen West Pit Void through the Greater Ravensworth Area Water and Tailings Strategy (GRAWTS) and the Ravensworth Cumnock Tailings storage facility. During this reporting period 1.7Mt of fine tailings reject produced by the RCHPP (refer ***Table 4-1***).

4.5.2 Train and Conveyor Movements

Product coal is transported to the port of Newcastle by rail only. RCHPP train movements are summarised in ***Table 4-2*** below. All levels are compliant with the conditions set out in Schedule 2, Condition 7 of PA 09_0176, which specify that no more than 18 train movements (average) will occur each day, and no more than 20 million tonnes of product coal will be transported to/ from the RCHPP/RCT. Records of all train movements are provided in ***Appendix A*** -**.**

Table 4-2 - RCHPP Train Movements 2022 **Train Movements**	**Total**
Annual Average Daily Train Movements	3.0 movements per day
Max Daily Train Movements	7 max movements per day
Total Train Movements	1,059 total train movements
Average Train Tonnage	8,847.8 tonnes
Total product coal loaded from RCHPP	9,369,836.09 tonnes

4.6 Waste Management

Waste is managed in accordance with the Ravensworth Complex EMS and EPL 2652. The EMS has been developed in accordance with the requirements of the Protection of the Environment Operations Act 1997 (POEO Act).

4.6.1 Waste Management and Reporting

The disposal of waste generated on the site is undertaken in accordance with existing regulatory guidelines and established site procedures. Ravensworth Complex reviews its waste minimisation strategies on an as needs basis**.** The total amount of waste produced at Ravensworth Complex during 2022 was 3,228 tonnes (t). Waste disposed of (offsite) and recycled at the Ravensworth Complex in 2022 was 464t and 2,763t respectively. ***Table 4-3*** provides waste generation for the Ravensworth Complex since 2019.

Table 4-3 – Waste Disposal and Recycling at the Ravensworth Complex

Site	Waste Disposed offsite (t)	Waste recycled (t)	Total waste produced (t)	Waste Recycled (%)
ROC 2022	362	2,529	2,892	87
ROC 2021	397	2,659	3,055	87
ROC 2020	559	2,983	3,542	84
RUM 2022	6	1	7	15
RUM 2021	4	10	13	73
RUM 2020	5	39	44	89
RCHPP 2022	96	233	329	71
RCHPP 2021	126	424	549	77
RCHPP 2020	157	263	420	63

4.7 Product Coal

A total of 9.4 Mt of product coal was transported to the Port of Newcastle from the RCHPP in 2022.

4.8 Decomissioning

There was no decommissioning undertaken at ROC in 2022.

Decommissioning work has commenced at RUM which comprises the sealing of the mine portal and vent shafts (Vent Shaft 1, Vent Shaft 2 and Vent Shaft 3).

4.9 Next Reporting Period

4.9.1 Mining

During 2023, coal extraction will continue in the Ravensworth North Pit. Forecast production for 2023 is predicted as 13.5Mt of ROM coal and 8.6Mt of product coal. Mining in 2023 will remain the same as in 2022 with the equivalent mining equipment, personnel and mining techniques to be utilised in-pit. Ravensworth North will continue progressing in accordance with the mine plan (and RMP) with rehabilitation expected to reach RMP predictions.

4.9.2 Exploration

Samples collected during 2022 are scheduled for geochemical analysis in 2023.

There is no proposed exploration activity in 2023.

4.9.3 Construction

Construction of the new Mine Access Road commenced in the reporting period, construction will continue into 2023.

4.9.4 Coarse Rejects and Tailings Disposal

During 2023 coarse rejects will continue to be co-disposed of in overburden emplacement waste areas in accordance with current statutory approval. Tailings will be disposed of in onsite tailings storage facilities or disposed of via the Greater Ravensworth Area Water and Tailings Scheme (GRAWTS) network.

5. Actions Required from Previous Annual Review

5.1 DPE Actions from Previous Annual Review

A letter was received from the DPE dated 18 July 2022 stating the Annual Review for the period 1 January 2021 to 31 December 2021 satisfied the reporting requirements of PA09_0176 and DA 104/96. No further action or information was requested.

6. Environmental Management and Performance

6.1 Noise

6.1.1 Environmental Management

Noise monitoring and management is outlined in the Ravensworth Complex *Noise Management Plan* which is available on the Ravensworth website.

Noise monitoring consists of both attended and unattended monitoring to meet the requirements of the PA 09_0176, DA 104/96 and EPL 2652. Noise monitoring locations, as discussed in the *Noise Management Plan* are shown on ***Figure 6.1***.

In addition to conducting noise monitoring, Ravensworth continues to implement a number of mitigation strategies with regard to the management of noise to minimise potential noise impact on nearby receivers, and to comply with the relevant conditions of the Project Approvals.

6.1.2 Environmental Monitoring Results

Results from the Reporting Period

Noise monitoring results for the reporting period are provided in ***Appendix B*** **-**(Table B.1-B.12).Relevant noise criteria, as outlined in PA 09_0176 Schedule 3 Conditions 2, 3 and 4, DA 104/96 Condition 12 and EPL 2652 Condition L5 are combined in ***Table 6-1*** and ***Table 6-2.***

The 2022 attended noise monitoring program was conducted on a monthly basis; there were no exceedances (non-compliances) of noise approval criteria at any location during the reporting period. Site 7/R7 is monitored on a quarterly basis for RUM and there were no exceedances during 2022 monitoring.

Table 6-1 - Noise Criteria dB(A) and performance for 2022 reporting period

Monitoring Location	Receiver Location	Receiver	Day (LAeq (15min))	Evening (LAeq (15min))	Night (LAeq (15min))	Night (LA1 (1min))	Performance during Reporting Period (*Appendix B*)
-	R1	34 – Stapleton[1]	48	48	48	49	Not applicable as owned by Ravensworth
Site 2	R2	3 – A Bowman	35	35	35	45	Compliant
		13 – A Bowman	38	38	38	45	Compliant
Site 3	R3	Camberwell Village Central 12 – Yates, 21 – Miller, 27 Chisholm	37	37	37	45	Compliant
Site 5		38 - Ninness	36	36	36	45	Compliant

Monitoring Location	Receiver Location	Receiver	Day (LAeq (15min))	Evening (LAeq (15min))	Night (LAeq (15min))	Night (LA1 (1min))	Performance during Reporting Period (*Appendix B*)
Site 6	R4	Camberwell Village North	35	35	35	45	Compliant
Site 7	R7	Spiteri	35	35	35	45	Compliant
-	-	All other privately-owned land	35	35	35	45	Compliant

[1] Property purchased by Ravensworth Complex

In relation to cumulative noise impacts, the Ravensworth Complex implement all reasonable and feasible measures to ensure that the noise generated by the Ravensworth Complex combined with the noise generated by other mines does not exceed the criteria shown in ***Table 6-1***, at any residence on privately-owned land or on more than 25% of any privately-owned land.

Table 6-2 - Cumulative noise criteria dB(A) LAeq (period) from PA 09_0176 and performance for 2022 reporting period

Receiver Location	Day	Evening	Night	Performance during Reporting Period. (*Appendix B*)
R3 and R4 – Camberwell Village	55	45	40	Compliant
All other privately owned land	50	45	40	Compliant

Comparison with Predictions

As indicated by the results in ***Appendix B***, all noise monitoring results were within predicted levels for the reporting period.

Long Term Trend Analysis

The results are generally consistent with prior years. Noise results over the last five years have been reported within approved noise criteria.

6.1.3 Key Performance and Management Issues

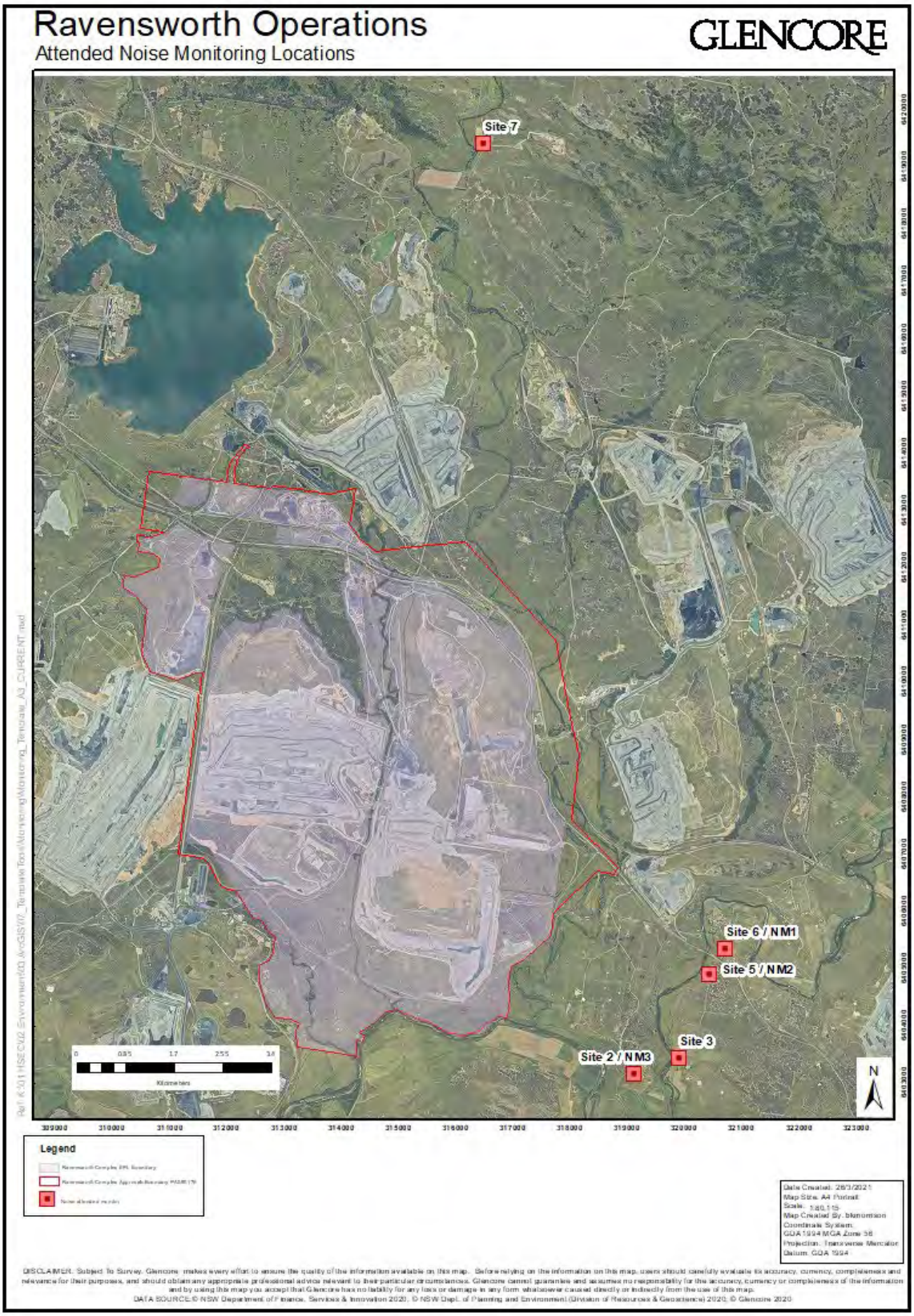
There were no performance or management issues in relation to noise during the reporting period. This included no noise complaints.

6.1.4 Proposed Improvements

Ravensworth will continue to use site procedures, processes and systems to manage noise.

The *Noise Management Plan* was be updated on 31 August 2022 to reflect the changes to EPL 2652 noise monitoring conditions.

Figure 6-1 – Monthly Attended Noise Monitoring Locations, Spectrum Acoustics 2022



6.2 Blasting and Vibration

6.2.1 Environmental Management

Blasting at Ravensworth is undertaken in accordance with the Ravensworth Complex *Blast Management Plan* (BMP) (2022), which was developed in accordance with Schedule 3, Condition 17 of PA 09_0176 and is available on the website. ROC has a number of procedures in place to manage the impacts of blasting including overpressure, vibration, fume and dust.

6.2.2 Environmental Monitoring Results

Results from the Reporting Period

A summary of blasting results obtained during the reporting period is provided as ***Table 6-3*** (below) and ***Appendix C -*** (Table C.1).

During the reporting period there were 221 blasts. No blasts exceeded the overpressure or vibration approval criteria outlined within Schedule 3, Condition 10 of PA 09_0176 or the BMP.

It should be noted however, that a fault with the REA86 blast monitor caused a missed blast recording on 17/03/22 at 13:13:46, event code RTH615. This is classed as a non-compliance as this event failed to be recorded.

Table 6-3 – Blasting Criteria and Performance for 2022 Reporting Period

Location	**Approval Criteria** Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance	**Environmental Performance in this Reporting Period.**
Residence[a] on privately owned land and Camberwell church	120	10	0%	Compliant
	115	5	5% of the total number of blasts over a period of 12 months	Compliant
Ravensworth Public School and Chain of Ponds Hotel	133	10	0%	Compliant
Ravensworth Homestead	126	10	0%	Compliant
Aboriginal axe grinding groove site (REA86)	-	[c] 175	0%	[d] Non-compliance
1,000ML dam wall and proposed dam wall	-	[b] 25	0%	NA
Conveyors, including the Hunter Valley Operations conveyor	-	[b] 100	0%	Compliant
Main Northern Railway culverts and bridges	-	[b] 25	0%	NA
Transmission lines	-	[b] 50	0%	NA
Ashton underground mine	-	[b] 6	0%	NA

Location	Approval Criteria			Environmental Performance in this Reporting Period.
	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance	
a Unless otherwise agreed with the relevant owner/s of the residence, and the Proponent has advised the Department in writing of the terms of this agreement. B Unless otherwise agreed with relevant infrastructure provider, owner or the regulator (in relation to the dams), and the Proponent has advised the Department in writing of the terms of this agreement. C Subject to meeting incremental limits under condition 10A (PA_0176). D Non-compliance due to a missed blast recording on 17/3/2022.				

Comparison with Predictions

The Ravensworth Operations Project Environmental Assessment (Umwelt, 2010) assessed the impacts of blasting. The assessment determined vibration and airblast (overpressure) criteria that applied to infrastructure and heritage sites that may be affected by the operations. These criteria are provided in the blast result tables, included in ***Appendix C***.

During the reporting period both blast vibration and overpressure were generally consistent with EA predictions.

Long Term Trend Analysis

Since 2014, there have been no blast exceedances.

6.2.3 Key Performance and Management Issues

Two blasting complaints were received during the reporting period. Further details of these complaints are included in ***Section 9.2***.

6.2.4 Proposed Improvements

Ravensworth will continue to use site procedures, processes and systems to manage blast impacts.

6.3 Air Quality

6.3.1 Environmental Management

Ravensworth operates in accordance with the approved *Air Quality and Greenhouse Gas Management Plan* (AQGGMP), which is available on the Ravensworth website, and describes air quality management and monitoring requirements associated with the mine.

Figure 6-2 – Air Quality Monitoring Locations

6.3.2 Environmental Monitoring Results

Results from the Reporting Period

An overview of environmental performance for air quality based on TSP, PM_{10}, and depositional dust monitoring data is provided in ***Tables 6.4*** – ***6.6***. See ***Appendix D*** -for further detail on exceedance dates and results. The air quality criteria and notes can be found in Schedule 3, Condition 20 of PA 09_0176. Note that no dates within 2022 were declared as extraordinary events.

Table 6-4 – Long term criteria for particulate matter

Pollutant	Averaging period	Approval Criteria Criterion	Environmental Performance this Reporting Period
Total suspended particulate (TSP) matter	Annual	90 µg/m^3	Compliant
Particulate matter < 10 µm (PM_{10})	Annual	30 µg/m^3	Compliant

Note: TSP and PM_{10} performance based on HVAS data

Table 6-5 – Short term criterion for particulate matter

Pollutant	Averaging period	Approval Criteria *Criterion	Environmental Performance this Reporting Period
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m^3	Compliant

Note: PM_{10} performance based on TEOM data

The rolling annual average for PM_{10} was below the 30 µg/m^3 PA09_0176 criteria, with a result of 13.81 µg/m^3 (refer to results from monitor HVAS19).

The PM_{10} 24 hour criterion of 50 µg/m^3 was exceeded once at TEOM D1 on 19/2/2022. The exceedance was notified to the relevant authority (DPE) on 21/2/2022. A letter reporting and explaining the causes for this exceedance was sent to DPE on 25/2/2022. The TEOM D2 PM_{10} 24 hour criterion of 50 µg/m^3 was not exceeded during the 2022 reporting period. The D1 and D2 24-hour average PM_{10} data for 2022 is provided in ***Appendix D*** -

Table 6-6 – Long term criteria for deposited dust

Pollutant	Averaging period	Approval Criteria		Environmental Performance this reporting period
		Maximum increase in deposited dust level	Maximum total deposited dust level	
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month	Non - Compliant

Note: Deposited dust results are used for internal management purposes only.

Annual average deposited dust results were below 4 g/m^2/month at every offsite monitoring location during 2022. Results are summarised below:

- The 2022 annual average was lower than the 2021 annual average at D9 and D13 (2.2 and 2.31 g/m^2/month respectively);
- The 2022 annual average was higher than that 2021 annual average at D12 and D27 (2.3 and 3.32 g/m^2/month respectively); and
- Annual depositional dust averages for the 2022 period did not exceed the PA09_0176 maximum increase in deposited dust level criteria of 2 g/m^2/month.

Comparison with Predictions

Air quality predictions against the 2010 EA are outlined in ***Table 6.7 - 6.9***. Cumulative predictions consider the contribution of other mines in the area as well as other local sources of dust.

Dust Deposition

Comparisons of dust deposition levels (Year 10) predicted in the 2010 EA and 2022 measured averages are shown for privately owned and mine owned offsite residences in ***Table 6-7***.

All 2022 annual results are greater than the EA predicted values for dust depositional gauges but are within the 4 g/m^2/month criteria with exception of D27 which reported exceedances in April, February and May and is discussed below.

Table 6-7 - ROC Dust Deposition EA Prediction Comparison - Privately Owned and Mine Owned Residences

Monitor	EA Residence ID	Year 10 Prediction		2022 Results
		Ravensworth Contribution	Cumulative	
D9	40B	0.3	0.7	1.9
D12[1]	34	0.3	0.9	2.5
D13	3	0.4	0.8	1.9
D27	5Z / 12	0.2	0.7	4.4

[1]Mine owned residence.

A review of the 2022 deposited dust levels at D27 was undertaken by an external consultant as a result of elevated results for the months of February, April, and May causing a non-compliance of the annual maximum deposited dust. The report stated that the Ravensworth Complex was estimated to have contributed no more than 1.1 g/m^2/month to the measurements in 2022. When results recorded at D27 were compared to relative locations, it was determined the Ravensworth Complex could not have caused the exceedance of the 4 g/m^2/month criterion at D27. The most likely explanation for the

elevated result at D27 is a localised source. The result of 4.4 g/m^2/month at D27 was recorded as an exceedance however, following the independent review it has been downgraded to compliant in this Annual Review.

HVAS TSP and PM_{10}

Comparisons of HVAS TSP and PM_{10} levels (Year 10) predicted in the 2010 EA and 2022 measured averages are shown for privately owned and mine owned residences in ***Table 6.8*** and ***Table 6.9***, respectively.

All 2022 annual results are greater than the predicted values for both PM_{10} and TSP at privately owned residences.

Table 6-8 - ROC HVAS TSP and PM_{10} EA Prediction Comparison - Privately Owned Residences

Monitor	EA ID	Year 10 Prediction				2022 Results	
		Ravensworth Contribution (PM_{10})	Cumulative (PM_{10})	Ravensworth Contribution (TSP)	Cumulative (TSP)	PM_{10}	TSP
HVAS 2 / HVAS 19	45	6	14	5	41	13.81	38.74

Table 6-9 - ROC HVAS TSP EA Prediction Comparison - Mine Owned Residence

Monitor	EA ID	Year 10 Prediction		2022 Results
		Ravensworth Contribution (TSP)	Cumulative (TSP)	
HVAS 4	29P	27	63	36.81
HVAS 5	34	22	56	48.8

Long Term Trend Analysis

2022 experienced significantly higher rainfall than in previous years resulting in a reduction in dust levels across the region. There was one reportable exceedance of PM_{10} 24 hour criterion of 58.40µg/m^3 in 2022, compared with five exceedances in 2021, 22 exceedances in 2020 and 31 exceedances in 2019.

The TEOM D1 PM_{10} annual average of 13.21µg/m^3 was lower than the 2021 average result of 17.88µg/m^3.

The TEOM D2 PM_{10} annual average of 13.29µg/m^3 was lower than the 2021 average results of 15.76µg/m^3.

6.3.3 Key Performance and Management Issues

There were no complaints related to air quality in the 2022 reporting period.

6.3.4 Proposed Improvements

The sites will continue to use site procedures, processes and systems to manage dust.

6.4 Biodiversity

6.4.1 Environmental Management

Biodiversity is managed in accordance with the *Ravensworth Complex Biodiversity Offset Management Plan* which has been developed and approved in accordance with Schedule 3, Condition 24 of PA09_0176. The *Biodiversity Offset Management Plan* covers the management of biodiversity at the Ravensworth Complex and biodiversity offset areas (BOAs), and is available on the website.

The Ravensworth Complex aims to mitigate effects of mining activities on native vegetation communities, fauna habitat and fauna species by planning and implementing programmes to maintain and improve the biological value of land. The programs are not only for rehabilitation areas but include other potentially degraded sites across the Ravensworth Complex holdings.

A large area has been offset as part of the establishment of Ravensworth North. This has involved the establishment, protection and enhancement of Offset Areas by an Implementation Program, which was approved in 2013. This will provide for the long-term conservation of a range of significant ecological features.

6.4.2 Biodiversity Offset Areas – Overview

Ravensworth Operations owns and manages four BOAs required under NSW Project Approval (PA 09_0176) and the Federal EPBC Approval (2010/5389). The offset areas are managed in accordance with the Ravensworth Complex Offset Area Management Programme (OAMP). A spatial summary of these offset areas is described in **Table 6-10** and shown in ***Figure 6-3***.

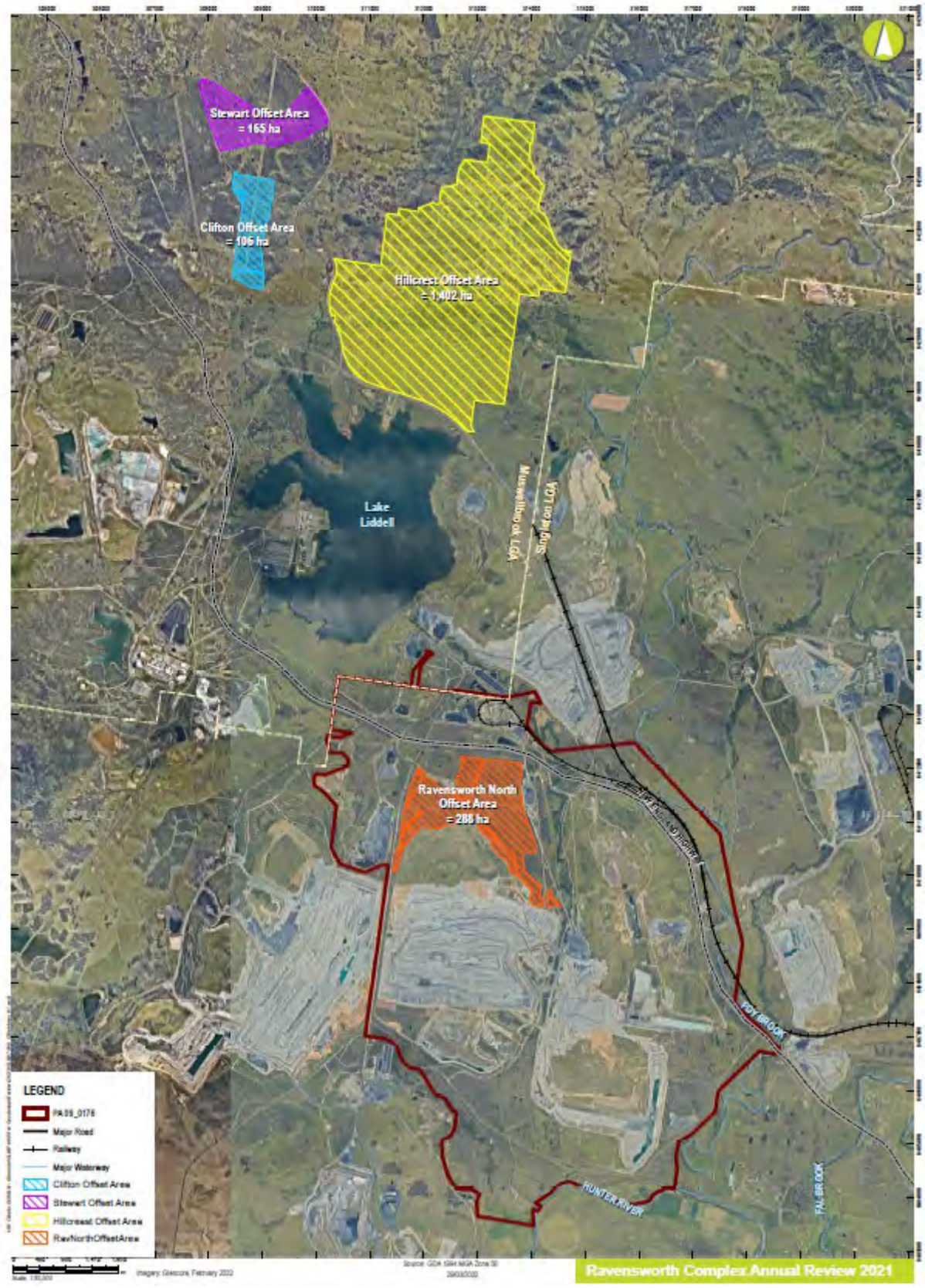
Table 6-10 - Location and size of Ravensworth Operations Offset Areas

Name	Size (ha)	Location Description
Ravensworth North Offset Area (RNOA)	288	Immediately North of Ravensworth North Open Cut Disturbance Area
Hillcrest Offset Area (HOA)	1402	Approx. 6km North of Ravensworth Complex
Clifton Offset Area (COA)	106	Approx. 7.5km North of Ravensworth Complex
Stewart Offset Area	165	Approx. 10km North of Ravensworth Complex

In accordance with the BOMP (Ravensworth Open Cut, 2022), and the OAMP (Ravensworth Open Cut, 2019) Ravensworth Operations utilises suitably qualified and accredited ecologists to undertake an annual biodiversity monitoring program across all BOAs.

Biodiversity monitoring is undertaken at the BOAs on an annual basis. Monitoring involves vegetation condition assessments and fauna monitoring at twenty-eight permanent monitoring locations across all Biodiversity Offset Areas (BOAs). The results of the 2022 monitoring program are discussed in the following section.

Figure 6-3 – Biodiversity Offset Areas



BOA Monitoring Results

Monitoring events are typically completed during early Summer to maintain consistency in data comparisons; monitoring was undertaken during the 4th to the 9th of December 2022. In accordance with the Conservation Agreements, an annual monitoring event must be conducted, and reporting submitted by the 30 December of that year. There were no limitations to completing the conservation agreement monitoring during 2022.

Fauna

One threatened species was recorded across the offset areas during the surveys. The white-throated needle-tail (*Hirundapus caudacutus*) was recorded in the airspace above monitoring site HC9. The white-throated needle-tail is listed as vulnerable under the Environmental Protection and Biodiversity Conservation Act 1999.

The grey-crowned babbler (*Pomatostomus temporalis temporalis*) was also observed foraging in vegetation along the access road to the Ravensworth mine office. The species is listed as vulnerable under the Biodiversity Conservation Act 2016 due to the ongoing loss and degradation of suitable habitat (OEH 2022b). Despite being recorded outside of the BOAs it is however frequently recorded within offset areas during monitoring surveys.

Flora

There was no active revegetation carried out during 2022 with direct seeding postponed until 2023. Vertebrate pest and vegetation management was carried out with some success. Exotic plants were noted to have decreased in most overall BOAs.

Competition with native grasses and groundcover likely aided the reduction in exotic species. It was noted is some areas that more targeted weed treatment had occurred with spot spraying of exotic species.

6.4.3 Key Performance and Management Issues

Weeds and pests continue to be a focus of management within the BOAs. **Section 6.10** discusses the weed and pest management undertaken during 2022 both within the mining lease boundaries and in the BOAs.

No incidents occurred in the BOAs during the reporting period.

Appendix H outlines the compliance of the 2022 monitoring results with the biodiversity objectives and target criteria outlined within the OAMP.

6.4.4 Proposed Improvements

The site's biodiversity and offset areas will continue to be managed consistent with Ravensworth Complex Biodiversity Management Plan. Pest and weed management will continue to be undertaken at the BOAs during 2022, as discussed in ***Section 6.10***.

The continued use of methods such as direct seeding, brush-matting, planting of fast-growing pioneer species and soil amelioration will be undertaken (where possible) to speed up the recovery of vegetation communities within the BOAs and enhance regeneration success of grassland areas.

6.5 Erosion and Sediment Control

6.5.1 Environmental Management

Ravensworth Complex manages erosion and sediment control on site in accordance with the approved Erosion and Sediment Control Plan (ESCP), which is included in the Water Management Plan (WMP). The Water Management Plan was updated and approved in 2022 and is available on the Ravensworth Complex website.

6.5.2 Environmental Monitoring Results and Works Undertaken

During the reporting period there were minor upgrades to erosion and sediment controls at site and maintenance of existing erosion and sediment control measures (e.g. desilting of dams).

6.5.3 Key Performance and Management Issues

Erosion and sediment is actively managed with erosion and sediment controls in place, erosion monitoring undertaken and maintenance works undertaken on an annual basis.

6.5.4 Proposed Improvements

Erosion monitoring will continue to be undertaken during 2022, along with maintenance and upgrades to erosion and sediment controls, as required.

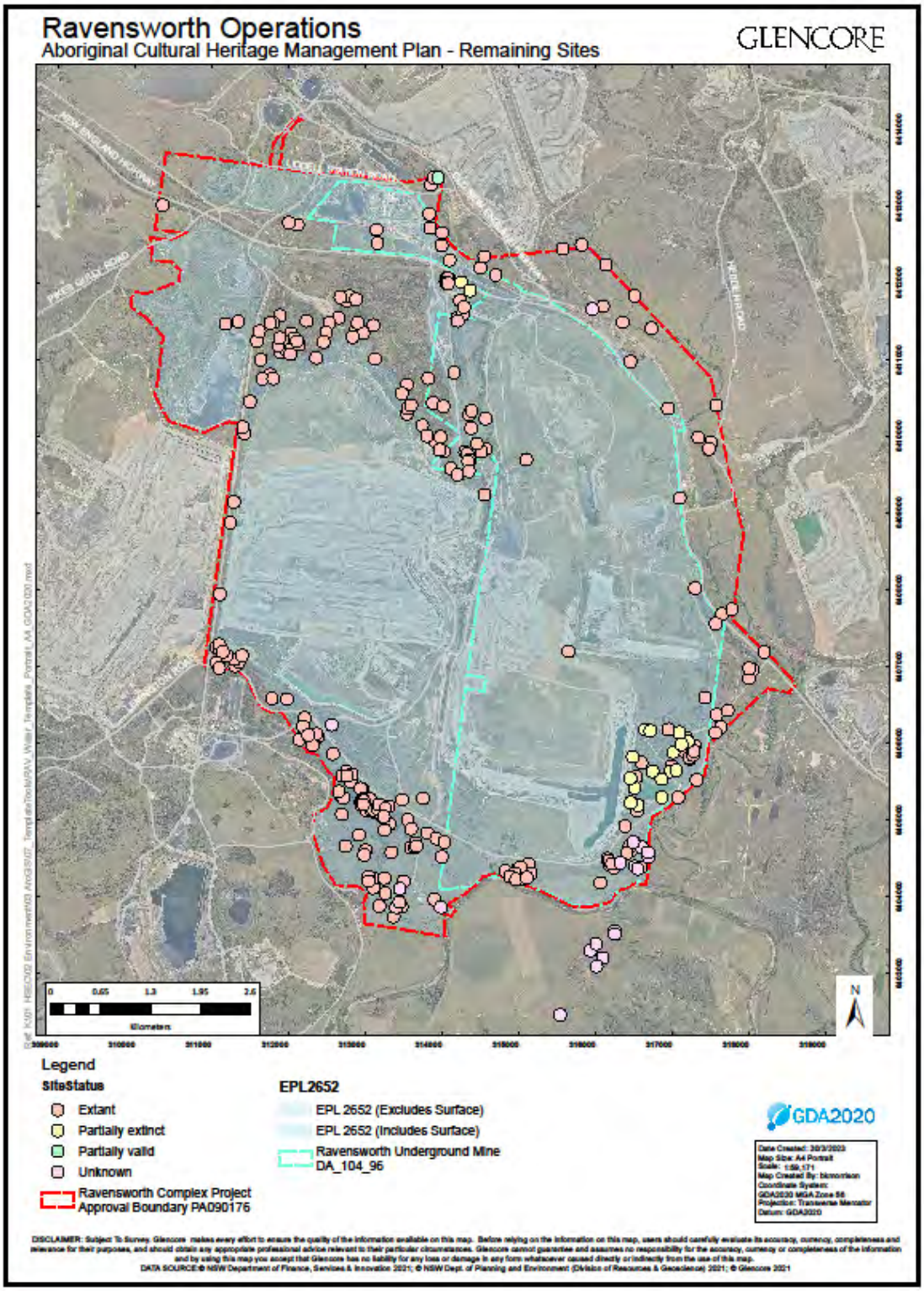
6.6 Aboriginal Heritage

6.6.1 Environmental Management

Aboriginal and Cultural Heritage at the Ravensworth Complex is managed in accordance with the *Aboriginal Cultural Heritage Management Plan* (ACHMP). Remaining archaeological (Aboriginal heritage) sites within the Ravensworth Complex Approval boundary (PA 09_0176) are shown on ***Figure 6-4***.

A monitoring program is undertaken for Aboriginal heritage sites that are not directly impacted by approved mining activities, in accordance with the Ravensworth Complex ACHMP. Monitoring is conducted annually. Results from the monitoring program are discussed below.

Figure 6-4 – Archaeological Sites Monitored Oz Ark Environment and Heritage, 2022



6.6.2 Environmental Monitoring Results

The Aboriginal monitoring program for 2022 was undertaken in November 2022. The 2022 monitoring program was attended by Registered Aboriginal Parties (RAPs) .

In total 20 sites were monitored for site condition, as well as the grinding groove site REA86 (where photographic monitoring is undertaken annually).

The 2022 program managed to visually inspect the condition of all monitoring sites. With exception of REA86, only site condition monitoring was undertaken in 2022 as the last photographic monitoring took place in 2020. The next photograph monitoring is due to occur in 2023.

The 2022 monitoring program demonstrated that:

- Most sites at Ravensworth have been impacted by erosion: most commonly sheet wash erosion. A small number of sites have on-going impacts from extensive gully erosion.
- No sites have been impacted by non-natural activities.
- Natural revegetation is occurring at many sites and this will slow or halt erosion, particularly sheet wash erosion. However, due to the lack of topsoil at many areas of erosion, this revegetation will take time to establish itself naturally across eroded areas.
- At sites where hay bales have been installed there is clear evidence of a build-up of sediment on the upslope side that encourages vegetation growth. This demonstrates that hay bales are an effective, non-invasive method to control worsening erosion. However, the hay bales require replacement periodically.

Aboriginal sites at ROC are fenced and signed. No impacts other than natural deterioration were noted at any of the monitored sites and it is noted that the fencing program has aided the lack of inadvertent impacts to sites.

6.6.3 Key Performance and Management Issues

During the reporting period there was no salvage of Aboriginal heritage items. There were no complaints or incidents involving Aboriginal heritage sites.

The Ravensworth Complex will continue to manage erosion as recommended for the 2023 monitoring program.

During the annual inspection it was reported that site (Ravensworth Open Cut OS-1) is neither fenced nor signed and that the vegetation is overgrown. It was recommended that fencing and signage be installed, however, no maintenance is required as erosion is stable.

It was noted however, that many sites at ROC are not monitored and changing the monitoring sites will allow a broader range of sites to be appropriately managed.

All photographic monitoring sites will remain in the program and substitution of sites will only be among the site condition monitoring group of sites.

6.6.4 Proposed Improvements

Ravensworth Complex will continue to hold the monitoring program site inspections annually in accordance with the project ACHMP.

6.7 European Heritage

The Oaklands homestead is located adjacent to the Ravensworth Complex. Ravensworth Complex has committed to the following heritage management measures in the *Heritage Management Plan,* which is available on the website:

- Manage blasting practices to meet relevant blast impact assessment criteria at listed heritage sites / items within the vicinity of the Project Area;
- Structural assessment of the Oakland's complex buildings at key stages of the mining process, this complex is to be removed from further monitoring; and
- An annual inspection of the Oaklands homestead for pests and the ingress of pest is undertaken.

6.7.1 Environmental Monitoring Results

A structural assessment inspection of the Oaklands homestead site was undertaken on the 27 November 2019. The site is included in 6 monthly inspections.

6.7.2 Key Performance and Management Issues

There were no management issues related to European heritage at the Ravensworth Complex during 2022.

6.7.3 Proposed Improvements

European heritage will continue to be managed in accordance with the *Heritage Management Plan* in 2023.

6.8 Meteorological Monitoring

The Ravensworth Complex has a weather station onsite to measure atmospheric conditions, including wind speed, wind direction, sigma-theta, humidity, rainfall and temperature in accordance with EPL 2652. This allows up to date predictions to be made on the impact of weather conditions on mining operations.

A summary of results is provided in ***Appendix E -***.

6.8.1 Average Temperature and Wind Speed

Throughout the reporting period the average mean wind speed was 2.3 m/s.

The average mean air temperature (at 10m) was 17.4 degrees Celsius. The hottest temperature recorded was 35.4 degrees Celsius, and this was experienced in February 2022.

6.8.2 Rainfall

During the reporting period a total rainfall of 1153 mm was received. This was more than the previous year when 1042.4 mm of rain was received. March 2022 was the wettest month with 312.8 mm, followed by July 2022 with 193.4 mm.

6.9 Weed and Pest Management

6.9.1 Environmental Management Activities and Monitoring Results

Weed Management Activities

Monthly environmental inspections at Ravensworth Complex are used to identify areas of weed infestations as well as review the success of previous weed control programs.

A summary of weed control activities undertaken at Ravensworth Complex and BOAs in 2022 is presented in ***Table 6-11***. Weed control was predominantly conducted in rehabilitation pasture areas, buffer lands and BOA's. Methods included:

- Application of herbicides via spraying;
- Cut and paste;
- Selective culling; and
- Mechanical removal.

Weed infestations were recorded in the sites GIS database.

Table 6-11 - Weed Control at the Ravensworth Complex and in BOAs during the Reporting Period

Location	Target Species
Western Emplacement Area Rehabilitation	• Galenia • Saffron Thistle • Coolatai Grass • Pampass Grass
Eastern Emplacement Area Rehabilitation	• Galenia • African Boxthorn • Acacia Saligna
Cumnock Rehabilitation	• Acacia Saligna • Coolatai Grass • Rhodes Grass • Setaria
Ravensworth North Offset	• Common Pear • African Olive • Coolatai Grass
Clifton Offset	• Coolatai Grass • African Love Grass • Blue Heliotrope
Stewart Offset	• Lantana • Coolatai Grass • African Love Grass
Hillcrest Offset	• Blackberry • Lantana • Coolatai Grass

Location	Target Species
	• African Love Grass

Feral and Pest Animal Management

Wild Dogs and Foxes

The management strategy for feral animals continued with baiting program conducted during the reporting period. The program was carried out by an experienced consultant and adhered to all best practice guidelines set by NSW Environment, Energy and Science and the Local Land Service.

Feral animal control continued to focus on fox and wild dog eradication across all the BOAs. A single wild dog was recorded on Stewart Offset Area (SOA). Although fox and wild dog management has been a recommendation in the past, given there are not significant numbers of threatened species (such as koalas) that need to be protected, continued management of wild dogs is not discussed in the recommendations. Similar recommendations made previously, fox and cat management may be a more beneficial to fauna populations within all BOAs. An opportunistic cull within the vicinity of the Cumnock area reported 7 wild dogs.

Other Animals

A pig poison baiting program was implemented during 2022 which trapped 54 pigs.

6.9.2 Key Performance and Management Issues

No reportable incidents, performance or management issues regarding weeds and feral animal management occurred during the reporting period.

6.9.3 Proposed Improvements

Throughout 2023 weed monitoring will continue to be undertaken, as well as weed and pest management as required.

6.10 Visual and Lighting

6.10.1 Environmental Management

The Ravensworth Complex employs various management strategies for mitigating and minimising its impacts on the visual amenity from community locations and public roads.

6.10.2 Environmental Monitoring Results

No lighting surveys were undertaken during the reporting period as there was no change to visual impacts at the site.

6.10.3 Key Performance and Management Issues

There were no performance or management issues regarding visual mitigation or lighting during the reporting period.

6.10.4 Proposed Improvements

There are no proposed visual and lighting improvements for 2023.

6.11 Spontaneous Combustion, Methane Drainage and Ventilation

6.11.1 Environmental Management

ROC/RCHPP

Management of spontaneous combustion is undertaken in accordance with the Ravensworth Complex Spontaneous Combustion Principal Hazard Management Plan. The plan addresses the placement of carbonaceous materials to ensure the potential for spontaneous combustion is minimised. The document identifies potential sources of carbonaceous material at the mine and details methods to be used when handling and disposing. A specific training module has been developed to communicate the requirements of this procedure to appropriate personnel.

RUM

Methane drainage and ventilation is undertaken by RUM in accordance with the approved Monitoring Arrangements Management Plan (RAVUG-1057118485-4445). The plan documents and the management strategies associated with mine ventilation.

6.11.2 Environmental Monitoring Results

Monitoring is conducted as per the requirements of the *Spontaneous Combustion Principal Hazard Management Plan*. No significant spontaneous combustion events occurred during the reporting period.

6.11.3 Key Performance and Management Issues

No significant spontaneous combustion events occurred during the reporting period.

6.11.4 Proposed Improvements

Improvements to spontaneous combustion, methane drainage and ventilation are not proposed for the 2023 period. Current management activities are deemed sufficient.

6.12 Bushfire Management

6.12.1 Environmental Management

Slashing of grasses is conducted on a regular basis, such as road verges, infrastructure areas, and sensitive and high-risk growth areas to reduce excessive fuels.

The *Ravensworth Complex Bushfire Management Plan* outlines the key mitigation measures for managing bushfire risk at ROC and the RCHPP.

6.12.2 Environmental Monitoring Results

There were no bushfire events onsite or in BOAs during 2022. The annual bushfire inspection of bushfire management in the offset areas was undertaken in September by BEMC (2022).

6.12.3 Key Performance and Management Issues

The Ravensworth Complex Bushfire Management Plan is reviewed annually.

6.12.4 Proposed Improvements

The Ravensworth Offset Area Management Program specifies various bushfire management strategies and monitoring requirements. A review of the Bush fire Management documentation has been completed to inform an annual review that included:

- Visually inspect all areas to ensure fuel levels are at or below the recommended level. This will include the designated SFAZs.
- Inspection of all roads and trials to ensure adequate fire fighter access is maintained.
- Identification of any other bushfire hazards or matters affecting bushfire management for the sites.

The following recommendations are provided to response to fire fuel load assessment:

The recent weather conditions have resulted in an increase in fire fuels loads in consideration of previous drought years. The fuel load increase is consistent across all offsets resulting in an increased the bushfire risk especially within grassland environments.

6.13 Mine Subsidence

6.13.1 Environmental Management

RUM have a Subsidence Management Plan to ensure adequate management of any subsidence impacts associated with surface cracking, erosion, slope instability, land degradation and spontaneous combustion due to longwall mining.

Visual subsidence monitoring is undertaken and subsidence repairs are completed in accordance with the SMP.

Key ongoing subsidence management measures include:

- Six monthly subsidence inspections;
- Repair of subsidence damage and filling of subsidence cracks if required;
- Subsidence reporting to the Resource Regulator, if new subsidence impacts are identified through the visual; and
- Inspection process. An update on subsidence inspections is completed in the Annual Review.

6.13.2 Environmental Monitoring Results

RUM was in care and maintenance during the reporting period and no underground mining activities occurred. Visual subsidence inspections were undertaken as part of the ongoing Environmental Monitoring Inspections in 2022.

Monitoring did not identify any subsidence related issues.

6.13.3 Key Performance and Management Issues

No remedial repair works were required during the reporting period.

6.13.4 Proposed Improvements

Bi-annual inspections will continue and any maintenance required will be completed in accordance with the SMP during 2023.

6.14 Hydrocarbon and Chemical Management

6.14.1 Environmental Management

Bulk fuel facilities are managed in accordance with *AS1940-2017 The Storage and Handling of Flammable and Combustible liquids.* All permanent fuel facilities are bunded, with measures in place to manage spills.

All hydrocarbon contaminated waste material within pit, hardstand and truck wash areas is bio remediated and disposed onsite in a bioremediation area. The site has been designed to prevent contamination and the storage and handling of chemicals is undertaken in accordance with Australian Standards and relevant guidelines.

Hydrocarbon contaminated water is contained and separated in the site's industrial oil water separators where treated water is recycled for reuse and separated oil is disposed of offsite by the licensed waste contractor. In the event of accidental contamination of onsite dams, contaminated water is contained and transported offsite for treatment by a licensed waste contractor.

6.14.2 Environmental Monitoring Results

The bioremediation area is tested once cells are full and dry or inspection deems testing necessary. The required cells were tested in both April and October 2022.

6.14.3 Key Performance and Management Issues

Minor spills (Category 1 and below) occurred during the reporting period. There were no Category 2 spills. Contaminated material was taken to the onsite bioremediation area.

There were no significant issues regarding the storage of chemicals throughout the reporting period.

6.14.4 Proposed Improvements

Hydrocarbon spills will continue to be managed appropriately, with any spills cleaned up and contaminated material sent to the bioremediation area.

6.15 Greenhouse Gas and Energy

6.15.1 GHG Environmental Management

The Ravensworth Complex is committed to reducing GHG emissions from its operation. The *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (Cth) provides methods and criteria for calculating GHG emissions and energy data under the NGER Act. Each reporting year technical guidelines based on the Determination are developed, reflecting improvements in estimation methods and in response to industry feedback. On the 14 May 2021 the Commonwealth Clean Energy Regulator issued new Transitional Safeguard Baselines for the Ravensworth Open Cut and the Ravensworth Underground.

6.15.2 GHG Environmental Monitoring Results

Results from the Reporting Period

Ravensworth Complex reports greenhouse gas emissions (GHG) in accordance with National Energy and Greenhouse Gases (NGER) legislation. Each financial year Ravensworth Complex is required to submit to the federal government the emissions from their NGERs registered facility. Also, because Ravensworth Complex emits over 100kt of CO2e- each year, Ravensworth Complex is registered as a Safeguard facility and therefore also had a Safeguard baseline. Emissions above the baseline for that year need to be offset by retiring Australian Carbon credit Units (ACCUs). The NGERs reporting year is based on a financial year, not a calendar year such as this Annual Review. In order to prevent incompatible public reporting, the values in this report also cover a financial year. The following table contains the Scope 1 (direct emissions from the mining activities during the year), and Scope 2 emissions (electricity consumption by the mine during the year).

Scope 1 and Scope 2 emissions during the FY22 reporting period are presented in **Table 6-12**.

Table 6-12 - GHG Emissions Summary 2022

Emission Source	T CO_2 -e
Ravensworth Open Cut	
Scope 1 Emissions	268,698
Scope 2 Emissions	10,017
Ravensworth UG	
Scope 1 Emissions	126, 640
Scope 2 Emissions	3,966
RCHPP (including Cumnock)	
Scope 1 Emissions	3,294
Scope 2 Emissions	70,348
TOTAL	**482,963**

Comparison with Predictions

The combined Ravensworth Open Cut and Ravensworth Underground Safeguard Baselines is 519,058 T CO2 -e. Actual GHG emissions for 2022 were 409,321T CO2-e.

This is a reduction from the 2021 emissions of 495,798T C02-e.

6.15.3 Key Performance and Management Issues

There were no significant issues regarding GHG throughout the reporting period.

6.15.4 Proposed Improvements

Ravensworth Complex is a part of the wider coal assets held by Glencore across Australia. Glencore Coal Assets Australia (GCAA) are themselves a part of the global Glencore mining portfolio. In line with the ambitions of the 1.5^{o}C scenarios set out by the IPCC, Glencore target a short-term reduction of 15% by 2026 and a medium-term 50% reduction of our total (Scope 1, 2 and 3) emissions by 2035 on 2019 levels. Post 2035, Glencore's ambition is to achieve, with a supportive policy environment, net zero total emissions by 2050.

Glencore incorporates energy costs and our carbon footprint into our annual planning process. Commodity departments, such as Glencore Coal Assets Australia, are required to provide energy and GHG emissions forecasts for each asset over the forward planning period and provide details of emissions reduction projects.

In the case of Ravensworth Complex this includes involvement with GCAA when considering available GHG abatement technology and mine planning to optimise efficiency (which usually translates into reduced fuel consumption).

7. Water Management

7.1 Water Balance

The overall water balance for the Ravensworth Complex in 2022, presented below in ***Table 7-1***, saw a surplus of 3,300 ML which was above the predicted deficit included in the Ravensworth Operations Project (ROP) water balance (Umwelt, 2010) in a 90th percentile rainfall year in 2022. At the time the ROP water balance was prepared, the current GRAWTS scheme was not anticipated and therefore not incorporated into the water balance model calculations. Water imports from other mining operations under the GRAWTS are significant and are likely to account for a significant portion of the discrepancy between the ROP water balance predictions and the observed 2022 site water balance.

Table 7-1 – Ravensworth Complex 2022 Water Balance

Item	Volume (ML)
Inflows	
Rainfall Runoff	8,450
Groundwater Inflow	1,512
ROM Coal Moisture	965
From Mount Owen Complex (MOC)	1,585
From Liddell Coal Operations (LOC)	3,872
Potable Supply	5
From Hunter River	116
Total Inflows	**15,539**
Outflows	
Evaporation	1,126
Dust Suppression / Washbay	20
CHPP Supply	2,362
Product Coal Moisture	1,898
Coarse Rejects Moisture	
Tailings Water	
To MOC	0
To LOC	0
Other Third-party supply (to HVO, Oaklands Property)	0
HRSTS Discharges to the Hunter River	5,498
Uncontrolled Release	34.7
Total Outflows	**10,939**
Inflow – Outflow	**4,600**
Recorded Stored on Site at Start of Annual Review Period	9,539
Recorded Stored on Site and End of Annual Review Period	12,839
Change in Storage	**3,300**
Error	**4.9%**

7.2 Water Take

Ravensworth Complex holds water access licences (WALs) WAL 9049, WAL 10771, WAL 1046, WAL 13102, WAL 9050, WAL 8964, WAL 816, and WAL 1325 that allow for extraction of water from the Hunter River and Glennies Creek.

Ravensworth Complex 2022 surface water extraction and licence entitlement is recorded in ***Table 7-2.*** The extraction of surface water was undertaken in compliance with the conditions of the relevant licences.

Table 7-2 – Licenced surface water usage for the 2022

WAL / Reference Number	Water Source / Management Zone	Category	Entitlement (ML)	Extracted Volume (ML)	Linked to
WAL 9049 / 20AL200743	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	High Security	0	0	20WA200745
WAL 10771 / 20AL200462	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	High Security	25	0	20WA200463
WAL 1046 / 20AL201444	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	High Security	3	0	20CA203133
WAL 13102 / 20AL203412	Hunter River Regulated/Zone 1a (Hunter River from Glenbawn Dam to Goulburn River Junction)	High Security	15	0	20CA203133
WAL 9050 / 20AL200744	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	General Security	500	104.4	20WA200745 20WA200463
WAL 8964 / 20AL203224	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to	General Security	1,590	1200[1]	20CA203133

	Glennies Creek Junction)				
WAL 816 / 20AL200890	Hunter River Regulated/ Management Zone 3a (Glennies Creek)	General Security	20	0	20WA200891
WAL 1325 / 20AL203042	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	Supplementary	13	13[2]	20CA203133

1. Water allocation transferred to another licence.

2. Water extracted under 20CA203133, not operated, or used by Ravensworth.

Ravensworth Complex currently holds six water licences that allow the extraction of groundwater WAL 41496, WAL 41505, WAL 41554, WAL 41507, WAL 41530, and WAL 41531.

Ravensworth Complex groundwater extraction and licence entitlements are recorded in ***Table 7-3***. A total of 1,271.7 ML of groundwater was extracted in 2022 in accordance with the conditions of all relevant licences.

Table 7-3 - Licenced groundwater usage for 2022

WAL / Reference Number	Water Source	Entitlement (ML)	Reported Usage (ML)	Linked to
WAL 41496 20AL216920	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	2520	1118.5	20MW065021
WAL 41505 20AL217052	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	300	0	20MW065021
WAL 41554 20AL219016	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	50	0	20MW065021
[1]WAL41529 20AL218991	*SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE*	*400*	*0*	*20MW065014*
WAL 41507 20AL217068	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	576	7.2	20MW065021

WAL 41530 20AL218992	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	100	0	20MW065014
WAL 41531 20AL218993	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	150	146	20MW065014
1. No longer owned by Ravensworth				

7.3 Water Supply, Use and Discharges

7.3.1 ROC

The ROC water management system comprises a range of infrastructure including water storages, pipes, and pumps for water transfers (within the mine complex and between external water sources and sinks) and instrumentation for flow and level measurement.

Surplus surface water at ROC is transferred to the RCHPP or discharged from the Narama In-pit Storage Dam to the Hunter River via Bowmans Creek under the conditions of ROC EPL No. 2652 and the Hunter River Salinity Trading Scheme (HRSTS) or transferred to other Glencore mine sites under the Greater Ravensworth Water and Tailings Scheme (GRAWTS). The GRAWTS between other Glencore sites transfers water to the Narama Void, which can then be transferred via pipeline to Narama In pit Storage Dam and is the primary discharge point for the Complex.

In 2022, ROC discharged 5,498.76 ML from the Narama In-pit Storage Dam under the conditions of the HRSTS and EPL 2652, more than 4 times the amount discharged in 2021 due to the increase in rainfall (Hunter River flow) events in 2022.

7.4 Surface Water Monitoring

The following sections discuss surface water monitoring for the reporting period with results presented in ***Appendix F -***.

7.4.1 Environmental Management

Surface water management across the Ravensworth Complex is undertaken in accordance with the Ravensworth Complex *Water Management Plan*. This plan has been developed and approved by the DPE in accordance with *Schedule 3, Condition 31* of PA 09_0176.

The Ravensworth Complex *Water Management Plan* outlines the interactions of the water management system across the sites that form part of the Ravensworth Complex.

Water quality sampling is undertaken monthly in Bowmans Creek, Bayswater Creek, and Emu Creek. Water quality monitoring is undertaken in Davis Creek and Pikes Creek every second month.

Ravensworth Complex undertakes stream health and channel stability monitoring in Bayswater Creek, Emu Creek, Bowmans Creek, Davis Creek, and Pikes Creek. This monitoring involves site inspections and stability assessments, macro invertebrate sampling and water quality monitoring at seven sites

across the Complex. The results are compared to reference sites located in the Stewart and Clifton Offset Areas (control sites).

7.4.2 Environmental Monitoring Results

Surface Water Quality Monitoring Results

Water quality results (pH, EC, TDS and TSS) for the Ravensworth Complex sampling program reported by Glencore 2022 are presented in ***Appendix F - (Table F 1 - Table F 16)*** along with analysis (mean and standard deviation) and time-series charts. Monitoring locations are shown on ***Figure 7-1***.

Impact assessment criteria (IAC), also referred to as 'trigger values', for pH, EC, TSS and TDS have been determined for specific receiving water monitoring locations as part of the *Ravensworth Complex Water Management Plan*. All surface water quality data collected as part of the monitoring program were assessed against the IAC (specific to each monitoring location) to identify deviations from the baseline water quality conditions, as shown in ***Appendix F -*** (***Table F 13*** to ***Table F 16***). Exceedances of IAC value were investigated in accordance with the *Water Management Plan.*

Conclusions drawn from internal investigations were related to the ephemeral nature of the creeks, with samples being taken from pooled water which are unrepresentative of normal water quality. No further mitigation measures were required for any surface water quality result in 2022.

Channel Stability

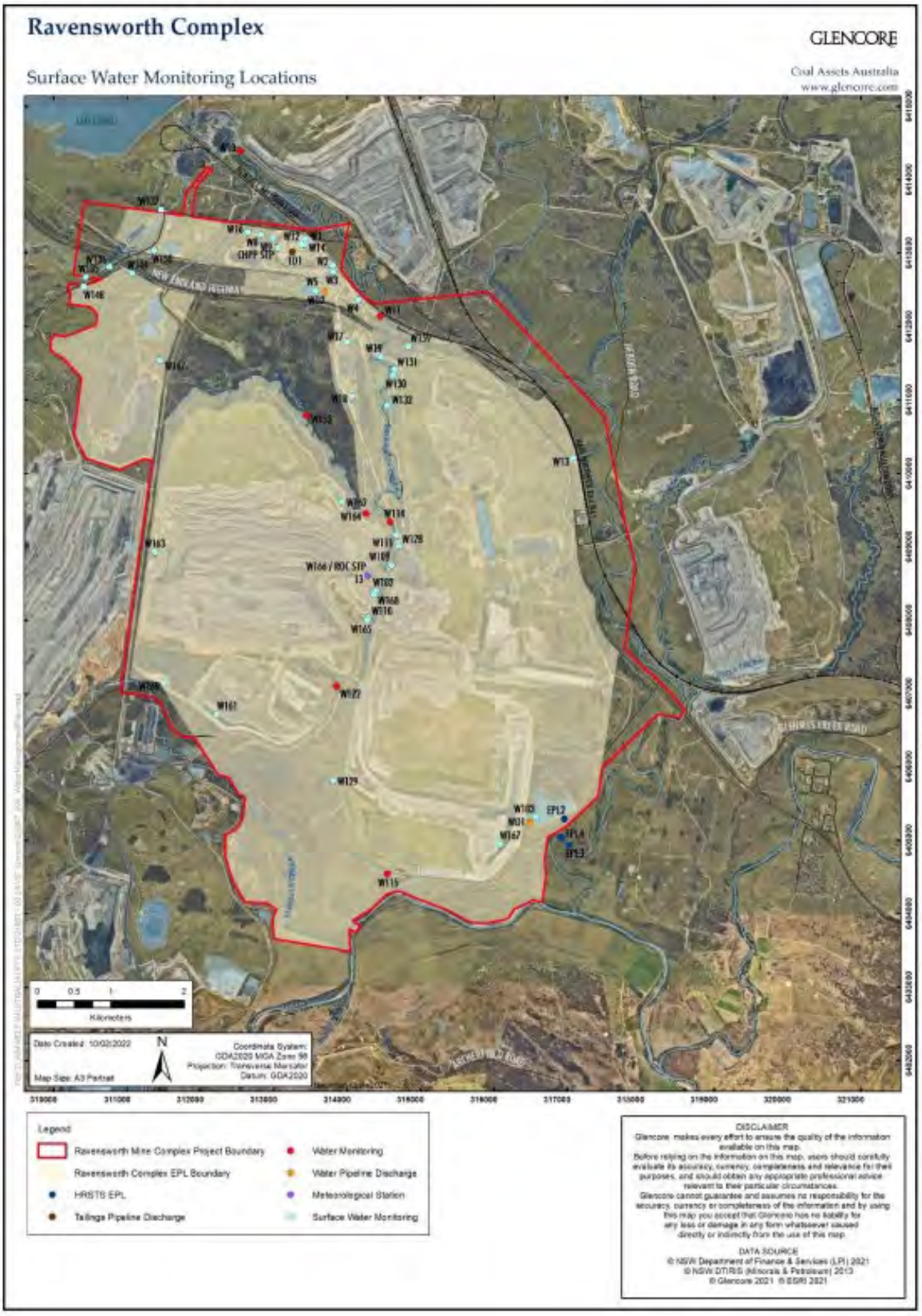
An annual report on stream flow events occurring in Davis and Bayswater Creeks was prepared for the 2022 reporting period. Originally three flow monitoring stations comprised this investigation, but Emu Creek was decommissioned in March 2022 due to the incorporation into the mining activity area with the installation of a flood levee. Stream height and theoretical flows were recorded for the two monitoring stations, Davis, and Bayswater Creek, along with Bowman's and Pike Creek.

Flow events were recorded by each of the stations in the flow monitoring network during 2022. The volume and frequency of rainfall during the monitoring period is reflected in the size, number and when the recorded flow events occurred along each creek. Increased flow events for Davis Creek recorded in the monitoring period was discussed with reason attributed to size of each catchment, under representation of Davis Creek in rainfall data, silting of lower Davis Creek allowing for increased impact of minimal rainfall events due to increased water retainment.

Regarding stream stability, the photographic record suggests that the streams have remained relatively stable over the monitored period, similar to the 2021 period. This is due to significant rainfall in the first and fourth quarters. Subsequent flow events along Bayswater Creek have caused degradation to the drop structure located downstream, which has been included in the photographic record to monitor damage since 2015.

Cross section and long surveys for Bayswater Creek and Davis Creek are recommended to be confirmed again (AECOM, 2023).

Figure 7-1- Surface Water Monitoring Locations



Stream Health Monitoring

Stream health and channel stability monitoring for ROC is undertaken as detailed in the *Ravensworth Open Cut Stream Health Monitoring Program Autumn and Spring 2022* (10/02/2023 FINAL). The monitoring plan enables ROC to monitor stream health, channel stability and identify changes that may be attributable to the mining activities, to fulfil the requirements of Section 6.1.2 (Channel Stability and Stream Health) of the *Plan for Ravensworth Complex Water Management* (Glencore 2020). This plan was developed to facilitate the compliance of ROC with the instrument of approval (09_0176) which was granted on 11 February 2011, as well as the Environmental Protection Licence associated with the mine's operation. Monitoring is undertaken at Bayswater Creek, Bowman's Creek, Pikes Creek, Davis Creek, and Emu Creek on a biannual basis. Additionally, control sites are monitored across four waterways located within the Glencore Coal offset areas; Cuan Creek, Wybong Creek, Unnamed Creek 1, and Unnamed Creek 2, to differentiate potential impacts from environmentally driven variations. The monitoring program assesses macroinvertebrate community assemblages, water quality and overall catchment-riparian health using NSW Australian River Assessment System (AUSRIVAS) and Stream Invertebrate Grade Number Average Level version 2 (SIGNAL 2) sampling and analyses, HABSCORE assessments, and physicochemical surface water quality testing.

The Habscore provides a relative indicator of stream health at dry and wet sites. The AUSRIVAS (Signal2) provides an indication of the macroinvertebrate community's overall tolerance to pollution or disturbance. The physiochemical results recorded several values outside of the adopted IAC guidelines, with sites generally displaying low oxygen saturation, high electrical conductivity values and pH values (Biosis, 2023). Biosis (2023) states that sites have been in poor condition since the commencement of baseline monitoring, although with some improvements in the last two monitoring surveys attributed to sustained rainfall throughout 2021 and 2022. The results of the monitoring program; Habscores, Signal2 and erosion and stability observations are provided in *Ravensworth Open Cut Stream Health Monitoring Program Autumn and Spring 2022* (10/02/2023 FINAL).

No significant difference has been observed between monitoring sites and the control sites regarding water quality or macroinvertebrate assemblage health in 2022. All 2022 recorded Band scores and SIGNAL 2 scores for monitoring sites occurred within the range of previous results. Historical fluctuations in these metrics are observed across both monitoring and control sites, and aligned with changes in water availability, therefore attributed to environmental conditions rather than mining impacts. This was most obvious during the most intense period of the recent drought in 2019 and the high rainfall period in 2021-2022.

The stream health monitoring program concluded that all sites in 2022 are still in the same (poor) condition observed at the commencement of the stream-health monitoring project in 2012. The report concluded that no impacts to stream health associated with mine operations have occurred in 2022 (Biosis, 2023).

Comparison of Stream Health

Water quality parameters recorded at the monitoring sites during autumn and spring 2022 sampling were compared against the Ravensworth Complex adopted impact assessment criteria (Umwelt, 2014) listed in ***Table 7-4***.

Table 7-4 - Adopted Impact Assessment Criteria

Site	pH	Oxygen % saturation	Maximum Conductivity (µs/cm)
Bayswater Creek (BWC) sites	6.5 – 8.0 (all conditions)	85 – 110 (all conditions)	2100 (all conditions)
Other monitoring sites	6.5 – 8.0 (flow) 6.5 – 8.4 (no flow)	85 – 110 (all conditions)	2100 (flow) 6100 (no flow)

The report concluded monitoring and control sites received levels of dissolved oxygen recorded below IAC thresholds yet, consistent with previous monitoring years. Control sites in 2022 (and previous years) displayed increased turbidity which may have contributed to the lower dissolved oxygen at these sites. The increased water flow observed in parts of 2022 likely resulted in two monitoring and control sites recording optimal dissolved oxygen levels.

Overall, the results were consistent with those of previous monitoring years, with no significant impacts from mining observed.

Table 7-5 - Stream Health at Ravensworth Complex for 2021 and 2022

Site		2022 Erosion / Stability Observations	HABSCORE		Signal2		HABSCORE		Signal2	
			Autumn 2021	Spring 2021	Autumn 2022	Spring 2022	Autumn 2021	Spring 2021	Autumn 2022	Spring 2022
BWC-AQ2	Bayswater Creek Mid 1	Minor bank erosion upstream. Recovering with groundcover vegetation cover improving.	47 (M)	29 (M)	3.06	Dry	49	79	3.67	3.81
BWC-AQ3	Bayswater Creek Mid 2	Significant erosion at points where ephemeral tributaries join with Bayswater Creek.	36 (M)	26 (M)	3.55	Dry	36	70	3.92	3.56
BWC-AQ4	Bayswater Creek D/S	Minor erosion of channel edges around the gabion and rip-rap erosion prevention structures.	46 (M)	20 (P)	3.47	Dry	43	51	3.47	3.94
DAC-AQ1	Davis Creek U/S	Moderate undercutting and general erosion of banks, somewhat stabilised with vegetation.	23 (P)	34 (M)	3.59	Dry	54	72	2.92	3.69
DAC-AQ2	Davis Creek D/S	Significant erosion where ephemeral tributaries meet Davis Creek.	26 (M)	25 (P)	Dry	Dry	43	49	*	*
EMC-AQ2	Emu Creek D/S	Significant erosion and undercutting of the left bank.	26 (M)	30 (M)	Dry	Dry	31	61	*	3.29

O=optimal; S=suboptimal; M=marginal; P=poor. * insufficient water to collect macroinvertebrate sample, sites were inaccessible or AUSRIVAS error.

Long Term Trend Analysis

Despite environmental fluctuations in water availability, monitoring sites and control sites overall have remained in a relatively stable but poor condition since the stream health monitoring program incorporated control sites in autumn 2013. No significant difference has been observed between monitoring sites and the control sites in stream health and stability. Stream health at all sites are still in the same poor condition observed at the commencement of the stream-health monitoring project in 2012. From historical records, based on the parameters recorded at monitoring and control sites, it appears that mining activities have minimal impact on stream health within the Ravensworth Complex area.

7.4.3 Key Performance and Management Issues

Biosis (2023) concluded that the 2022 monitoring results are considered normal for the locality and no impacts to stream health because of mine operations have been detected.

AECOM (2023) concluded that the size, number and when the recorded flow events occurred along each creek in 2022 reflected the volume and frequency of rainfall experienced. Photographic record suggests that the streams have remained relatively stable over the monitored period from the significant rainfall in the first and fourth quarters (AECOM, 2023).

Monitoring of surface water will continue to ensure stream health, stability, and flow, and further the reliability of the dataset for accurate conclusion on mining impacts.

7.4.4 Proposed Improvements

Stream health and stream flow/channel stability will continue to be monitored during the 2023 reporting period.

7.5 Groundwater Management

The following sections discuss groundwater management, monitoring and compliance for the 2022 reporting period with results presented in ***Appendix G -***.

7.5.1 Environmental Management

The Ravensworth Complex *Water Management Plan* was prepared to satisfy the requirements of the Project Approval PA 09_0176 *Schedule 3, Condition 31*.

During 2022 a formal review of the depressurisation of coal measures and comparison of responses with the aquifer model predictions was undertaken by AGE (2022) as required by *Condition 6.8.4* of PA 09_0176 Statement of Commitments. It was concluded that the model continues to provide a relatively conservative prediction of impact for the Ravensworth operations. Further calibration of the groundwater model is not considered to be necessary at this stage to establish the level of impact due to Ravensworth Operations.

7.5.2 Environmental Monitoring Results

Results from the Reporting Period

During the 2022 monitoring period, the groundwater management monitoring report included review of monthly monitoring of water levels, quarterly monitoring of pH and EC, and annual monitoring of inorganic species (speciation data). The results are provided in ***Appendix F -Table G1*** to ***Table G5*** and monitoring locations shown on ***Figure 7-2***.

All monitoring data collected as part of this program is assessed against established IAC to:

- Determine whether groundwater extraction volumes are within WAL limits and are comparable with modelled predictions;
- Identify deviations from the baseline water quality conditions; and
- Identify deviations from the baseline groundwater level trends.

Groundwater Quality

Results for pH, EC and speciation 2022 data for all current and decommissioned monitoring bores are presented in ***Appendix G*** -(***Table G3*** to ***Table G5, Figure G1*** to ***Figure G32***) with the exceedances of IAC ranges identified in red text.

Overall, groundwater quality results of 2022 were within historical ranges and the adopted IAC, with observed exceedances being minor in nature and consistent with historical trends. It is recommended that IAC trigger values be reviewed to capture the water quality parameters of the site more accurately.

Groundwater Levels

Groundwater levels are included in ***Appendix G - Figure G33***.

Alluvium and Underlying Weather Coal Measures

Monthly groundwater level monitoring occurs in the Bayswater Creek Alluvium at NPZ5B P2 and the Hunter River Alluvium at NPZ7 Small. The following observations were made:

- NPZ5B P2 (Bayswater Creek Alluvium) recorded groundwater levels remained relatively constant throughout the 2022 monitoring period, averaging 66.8 mAHD, with a minimum of 66.5 mAHD (February) and a maximum of 67.0 mAHD (October).
- NPZ7 Small (Hunter River Alluvium) recorded groundwater levels fluctuated slightly throughout the year, on average RL was 40.4 mAHD, with a minimum 37.1 mAHD (November) and a maximum of 43.8 mAHD (October). Groundwater levels increased throughout the first half of 2022 monitoring period from 40.5 mAHD (January) to 42.0 mAHD (June). Groundwater levels recorded in the second half of the year ranged from 37.1 mAHD (November) to 43.8 mAHD (October).

Bayswater Seam

Monthly groundwater level monitoring in the Bayswater Seam was undertaken at NPZ1 Mid and NPZ7 Tall. NPZ1 Mid was blocked throughout 2022 and therefore has no monitoring results.

The recorded groundwater levels in NPZ7 Tall continued to increase during 2022, rising from 41.1 mAHD in February to 46.1 mAHD in December, which is likely a result of increased rainfall events throughout the water catchment in 2022.

Broonies Seam

Monthly monitoring of groundwater levels in the Broonies Seam was undertaken at NPZ7 Mid, NPZ6 Tall and NPZ5B P1. Bore NPZ7 Mid has been blocked since 2019, therefore no monitoring results have been recorded for 2022. Observations in groundwater levels as follows:

- The recorded levels in NPZ6 Tall and NPZ5B P1 remained relatively constant throughout 2022.
- NPZ6 Tall averaged 64.5 mAHD throughout 2022, with a minimum of 64.2 mAHD (May) and a maximum of 65.2 mAHD (November).
- NPZ5B P1 which increased by approximately 2.13 m between January and December 2022. Averaging 63.0 mAHD throughout 2022, with a minimum of 61.7 mAHD (February) and a maximum of 63.8 mAHD (November).

Lemington Seam

Monthly monitoring of groundwater levels in the Lemington Seam occurred at NPZ1 Tall and NPZ2 Tall. The following observations were made:

- NPZ1 Tall groundwater levels averaged 37.1 mAHD, with a minimum of 34.7 mAHD (September) to maximum of 39.3 mAHD (October and December).
- NPZ2 Tall remained relatively constant throughout 2022, averaging 33.8 mAHD, with a minimum of 32.5 mAHD and a maximum of 34.3 mAHD.

Pikes Gully Seams

Monthly monitoring of groundwater levels in the Pikes Gully Seam was undertaken at CS4641C, which lies within the Lower Pikes Gully Seam. Recorded water levels at CS4641C were relatively stable for the 2022 period, averaging -19.7 mAHD (RL), with a minimum of -20.0 mAHD (September) and a maximum of -19.44 mAHD (January).

Historical groundwater level data shows a decrease in groundwater levels from 2013 to 2015 due to dewatering of the former Cumnock underground workings to allow mining in the Ravensworth North Pit, as previously captured by reviews (Engeny 2021; Umwelt 2020). However, groundwater levels at Pikes Gully appear relatively stable since 2020.

Liddell Seam

Monthly monitoring of groundwater levels within the Liddell Seam was undertaken at the Coffey Dam Borehole in 2022. Recorded results at the Coffey Dam Borehole were relatively stable throughout 2022, with an average of 56.81 mAHD and maximum change of 1.67 m over the year.

Groundwater Depressurisation

In addition to the above, groundwater level is recorded in 8 locations (RNW1, RNW2, RNW3, RNW4, RNW5, RNW6, RNW7 and RNW8) at 12-hour intervals using vibrating wire piezometers to identify the groundwater pressure response to mining operations. Historical water level results are presented in ***Appendix G*** - (***Figure G 33*** to ***Figure G42***) and discussed in detail below. All monitoring bores indicate depressurisation at some depths; however, depressurisation was typically to a lesser degree than

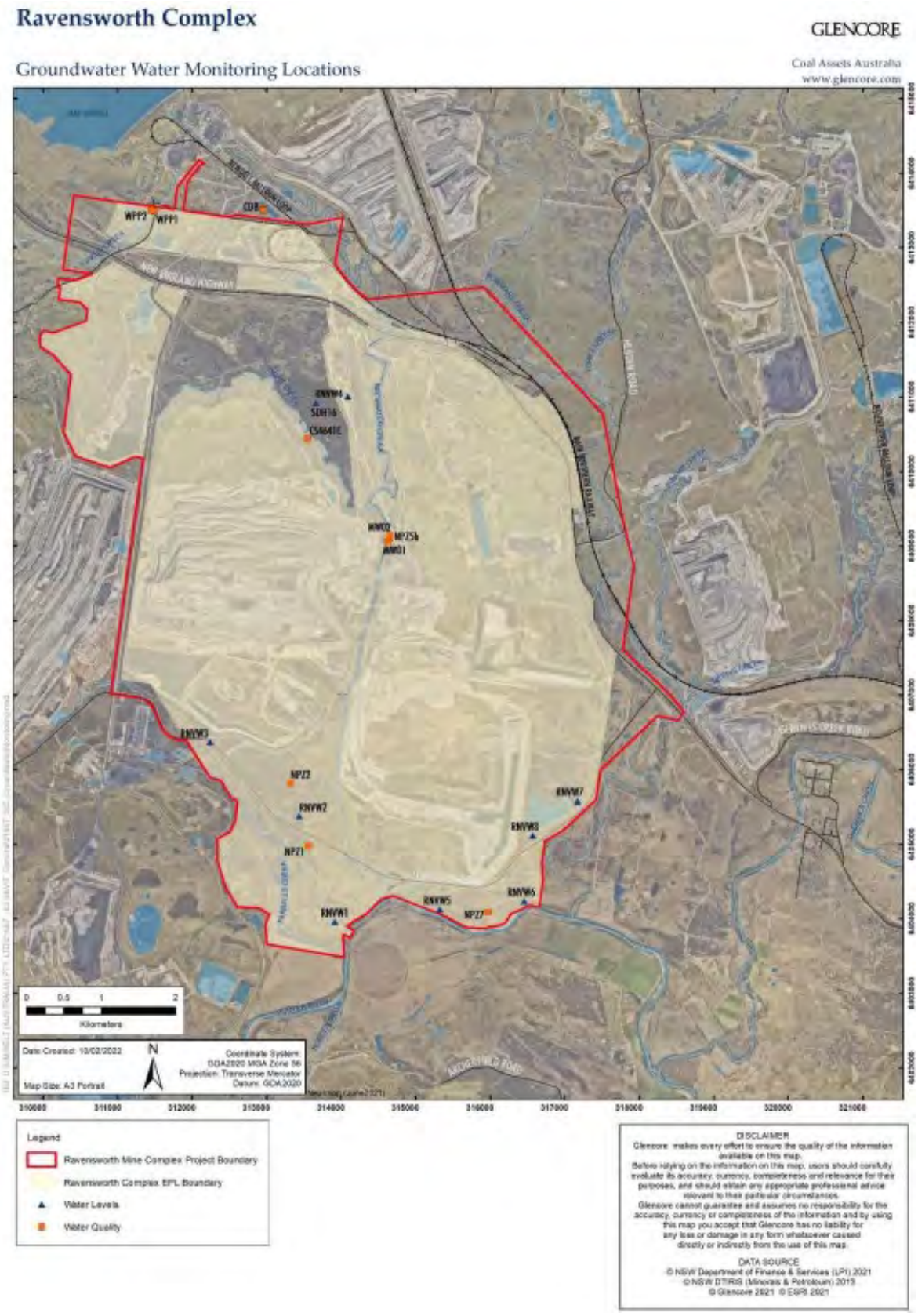
predicted in the Ravensworth Project groundwater model results presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2020). It was. AGE (2022) concluded that the model maintains a relatively conservative prediction of impact for RC operations and determined that additional calibration of the groundwater model is not required at this period to confirm the level of impact due to RC operations.

A review of groundwater pressure results identified the following:

- RNVW1 results show depressurisation at depths of 48 mbgl, 68 mbgl, 150 mbgl, 190 mbgl and 240 mbgl (refer Figure D 2, Appendix D) but to a lesser degree than predicted in the Ravensworth Project groundwater model results as presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2020). Depressurisation at a depth of 109 mbgl was also observed with the degree of depressurisation exceeding that predicted by the groundwater model and this is consistent with observations in previous years. The groundwater model for the Ravensworth Project also predicted depressurisation at a depth of 326 mbgl for RNVW1, however, results over recent years indicate pressure recovery at this depth.
- RNVW2 results show depressurisation at depths of 239 mbgl to 305 mbgl (refer Figure D 3, Appendix D) but to a lesser degree than predicted in the Ravensworth Project groundwater model results as presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2020). The groundwater model for the Ravensworth Project also predicted depressurisation at a depth of 140 mbgl for RNVW2, however, results over recent years indicate pressure recovery at this depth.
- RNVW3 results show continued depressurisation from 2015 onward at all depths (refer Figure D 4, Appendix D). The depressurisation at depths of 103 mbgl, 180 mbgl and 254 mbgl is to a lesser degree than predicted in the Ravensworth Project groundwater model results as reported in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2020).
- RNVW4 results show continued depressurisation at 102 mbgl, 114 mbgl, 163 mbgl, 201 mbgl and 225 mbgl (refer Figure D 5, Appendix D). The depressurisation at depths of 102 mbgl and 163 mbgl is to a lesser degree than predicted in the Ravensworth Project groundwater model results as presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2020).
- RNVW5 results indicate minimal or no depressurisation for the 2022 monitoring period (refer Figure D 6, Appendix D), It is noted that the RNVW5 instrument is outputting zero readings on channels 1 (depth of 19 mbgl), 3 (depth of 87 mbgl) and 6 (depth of 279 mbgl) and therefore no observations of depressurisation at these depths can be made. It also began outputting zero reading at channel 7 (depth of 350 mbgl) in March.
- RNVW6 results have previously indicated depressurisation at depths of 19 mbgl and 66 mbgl (refer Figure D 7, Appendix D) more than those predicted in the Ravensworth Project groundwater model results as presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2022). However, pressures have stabilised at a depth of 19 mbgl, with slight recovery in 2021, and recovered at a depth of 66 mbgl in recent years. Depressurisation at a depth of 265 mbgl was previously observed to a lesser degree than predicted by the groundwater model, however, stabilised over 2020 and 2021. It should be noted that results have not been observed at piezometer RNVW6 since June 2021.

- RNVW7 results show ongoing depressurisation at depths from 121 mbgl to 335 mbgl which is consistent with groundwater model predictions for the Ravensworth Project (refer Figure D 8, Appendix D). However, pressures have stabilised at a depth of 250 mbgl, with slight recovery in 2022. It is noted that channel 1 (depth of 83 mbgl) appears to be outputting erroneous results and therefore no observations of depressurisation at this depth can be made.
- Vibrating wire piezometer for RNVW8 has not been able to be read since 2020, however, historical results are shown in Figure D 9 (Appendix D). The results indicate depressurisation at a depth of 252 mbgl but to a lesser degree than predicted in the Ravensworth Project groundwater model results as reported in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2020; AGE, 2022).

Figure 7-2 – Groundwater Monitoring Locations



8. Rehabilitation

8.1 Rehabilitation Performance

8.1.1 Rehabilitation Status at the End of the Reporting Period

Ravensworth Complex rehabilitation and disturbance areas are summarised in ***Table 8-1***. A total of 57.8 Ha of new disturbance associated with the progression of the Ravensworth North pit occurred during the reporting period. A total of 55 ha was prepared for rehabilitation in 2022 and 20 ha of previously rehabilitated land was re-disturbed.

Figure 8-1 includes a map of areas disturbed and rehabilitated during 2022. Photographs of rehabilitation are also provided.

Table 8-1 - Ravensworth Complex 2022 Rehabilitation and Disturbance

Mine Area Type	Previous Reporting Period (Actual) - 2021	This Reporting Period (Actual) 2022	Next Reporting Period (Forecast) - 2023
Total Mine Footprint (Ha)	2624.9	2697.2	2720.1
Disturbance (Ha)	1617.2	1677.0	1689.9
Land Being Prepared for Rehabilitation (Ha)	30.0	55.0	55.0
Land under Active Rehabilitation (Ha)	956.2	1020.1	1075.1
Completed Rehabilitation (Ha)	0.0	0.0	0.0

Photo 1 – Rehabilitation Progress 2022. Eastern Rehabilitation Area

Photo 2 – Rehabilitation Progress 2022. Eastern Rehabilitation Area

Photo 3 – Rehabilitation Progress 2022. Eastern Rehabilitation Area

Photo 4 – Rehabilitation Progress 2022. Narama Rehabilitation Maintenance

Photo 5 – Rehabilitation Progress 2022. Western Emplacement Area

Photo 6 – Rehabilitation Progress 2022. Western Emplacement Area

Figure 8-1 – 2022 Rehabilitation and Disturbance (ROC)

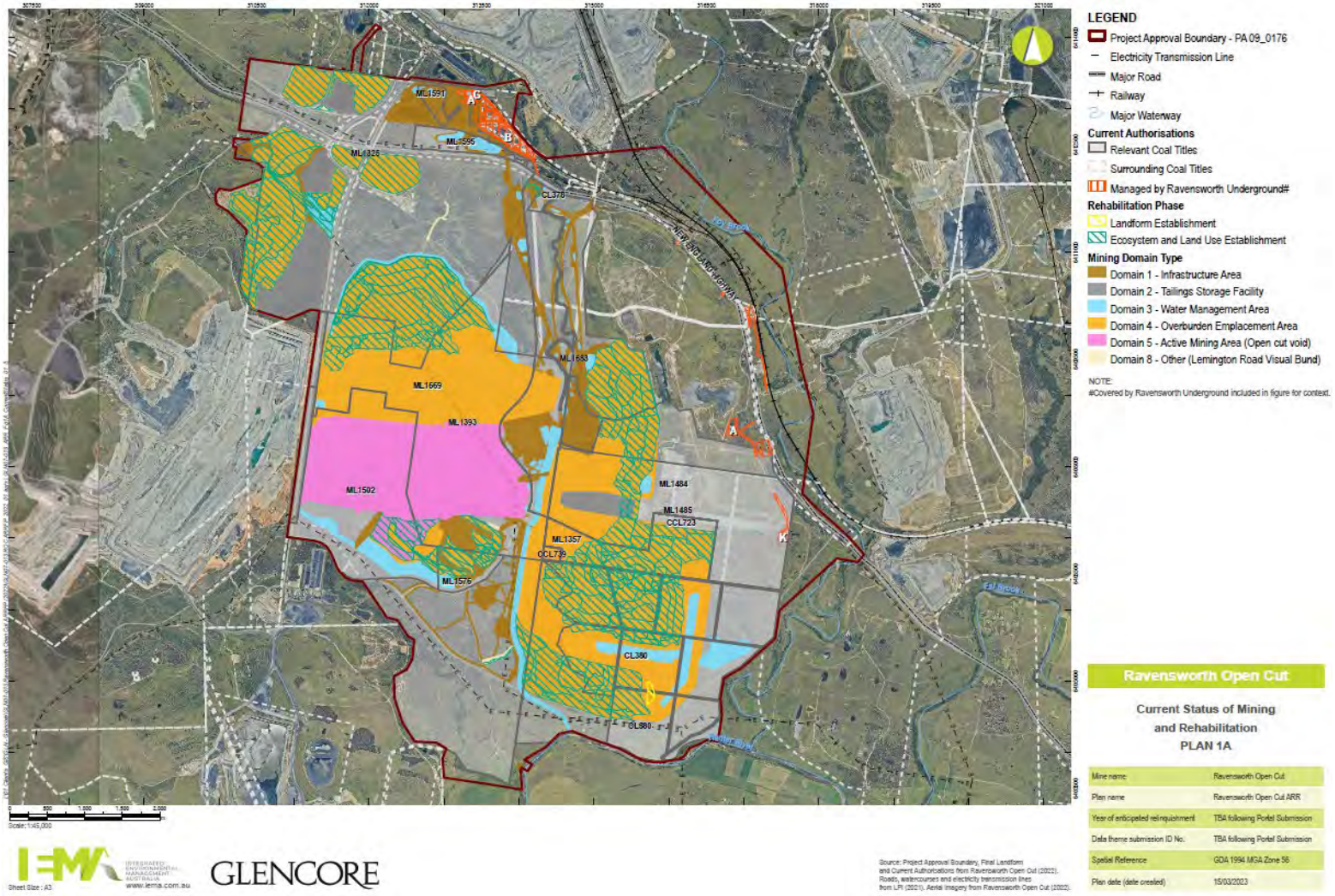
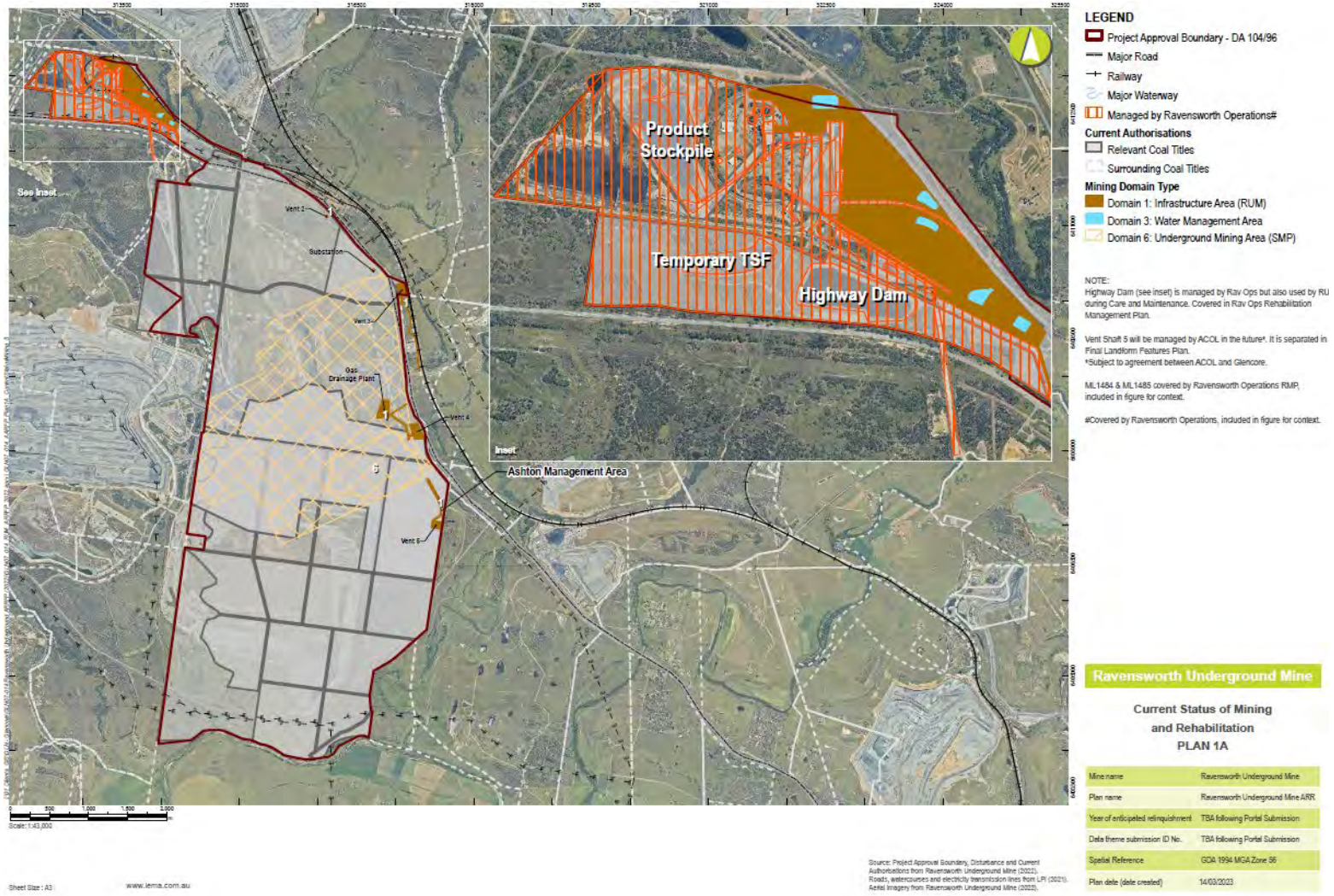


Figure 8-2 – 2022 Rehabilitation and Disturbance (RUM)



8.1.2 Summary of Rehabilitation Monitoring

During the reporting period long-term rehabilitation monitoring and a rehabilitation walkover assessment was conducted to compare current conditions of the rehabilitation with closure criteria outlined in the RMP. This information developed management recommendations to guide the rehabilitation towards targeted Ecological Communities and final landform criteria.

Rehabilitation Monitoring

The Ravensworth Annual Rehabilitation Monitoring Program was completed by a specialist consultant during October and November 2022. This program assessed a total of 14 rehab blocks and 41 transects/plots (including 2 reference monitoring locations), which accounts for an area of approximately 312.1 ha of rehabilitation.

12 initial establishment phase blocks were assessed in 2022. These 12 blocks consisted of 1 block of pasture rehabilitation (16.9 ha, 3 monitoring sites) and 9 native woodland blocks (203.2 ha, 24 monitoring sites).

A total of 4 long-term monitoring blocks were assess in 2022. All 4 long-term blocks were native wood land areas that had been established between 2016 and 2017 and accounted for 92 ha of rehabilitation and 16 monitoring sites.

Fauna Monitoring

Fauna monitoring in rehabilitation is required every three years. Fauna monitoring was previously completed in 2014, 2017, and 2020. Results from the most recent fauna monitoring are reported in the 2020 Annual Review. No monitoring was required in the 2022 reporting period and will be completed in 2023.

Rehabilitation Maintenance

Ongoing maintenance of rehabilitation areas focused on weed management of previously completed rehabilitation.

In addition, approximately 43 ha of rehabilitation maintenance was completed on the south eastern slopes of Narama rehabilitation. Work included removing established stands of acacia saligna, repairing erosion, reconstructing drainage structures, and re-seeding the area with pasture rehabilitation species.

Cumnock

Rehabilitation works at Cumnock were generally undertaken between 2009 and 2011 using a combination of direct seeding and tubestock planting methods, and including a range of understorey, shrub and tree species (including non-endemic species). This included use of Rhodes grass as the rehabilitation status/landform at time of Ravensworth North Project was pasture.

The implementation of the Cumnock Rehabilitation Plan was continued in 2022. Works undertaken in 2022 include:

- Grazing of 32 ha;
- Selective culling of Sugar gums;

- Mulching of 6 ha of Acacia saligna;
- Planting of 9,418 tubestock (native species); and
- preparation and seeding of 32 20x20m plots (native species); and spraying for invasive grasses and weeds.

The progress and success of completed restoration works is monitored.

2023 Rehabilitation Maintenance

During the next reporting period, Ravensworth will continue to develop and implement a rehabilitation maintenance strategy to progress rehabilitation to final landform consistent with final land use objectives. In 2023 Ravensworth will complete ongoing maintenance in previously rehabilitated areas. Priority actions for rehabilitation maintenance include:

- Erosion repairs;
- Control of priority weed species as identified during rehabilitation monitoring and inspections;
- Increasing lower-storey species richness in areas where priority weed grasses are absent (or following weed suppression) through hand seeding or tubestock planting;
- Increasing tree densities of rehabilitated areas through supplementary seeding and or tube stock planting; and
- Increasing habitat potential through adding rocks, logs, woody debris and next boxes to rehabilitation areas for fauna.

A Rehabilitation Maintenance Strategy is currently being developed to address priority areas.

2023 Rehabilitation Maintenance Repairs

During the next reporting period, Ravensworth Complex will continue to develop and implement a rehabilitation maintenance strategy to progress rehabilitation to final landform consistent with final land use objectives. In 2023 Ravensworth Complex will complete ongoing maintenance in previously rehabilitated areas. Priority actions for rehabilitation maintenance include:

- Erosion repairs;
- Control of priority weed species as identified during rehabilitation monitoring and inspections;
- Increasing lower-storey species richness in areas where priority weed grasses are absent (or following weed suppression) through hand seeding or tubestock planting;
- Increasing tree densities of rehabilitated areas through supplementary seeding and or tube stock planting; and
- Increasing habitat potential through adding rocks, logs, woody debris and next boxes to rehabilitation areas for fauna.

A Rehabilitation Maintenance Strategy is currently being developed to address priority areas.

8.2 Rehabilitation Trials and Research

8.2.1 Rehabilitation Trial Results

No rehabilitation trials were undertaken at the Ravensworth Complex in 2022.

8.3 Next Reporting Period

Rehabilitation activities proposed in 2023 include:

- Rehabilitation of 55 Ha;
- Maintenance works as outlined in Section 8.3.3;
- Crash grazing using cattle at Cumnock;
- Ongoing inspections and long-term rehabilitation monitoring; and
- Continued pest and weed management across Ravensworth Complex and in offset areas.

9. Community Relations

9.1 Employment Status

At the end of the reporting period, the Ravensworth Complex had approximately 713 full time employees and contractors.

9.2 Complaints

A complaints register is maintained and available on the Ravensworth Complex Website.

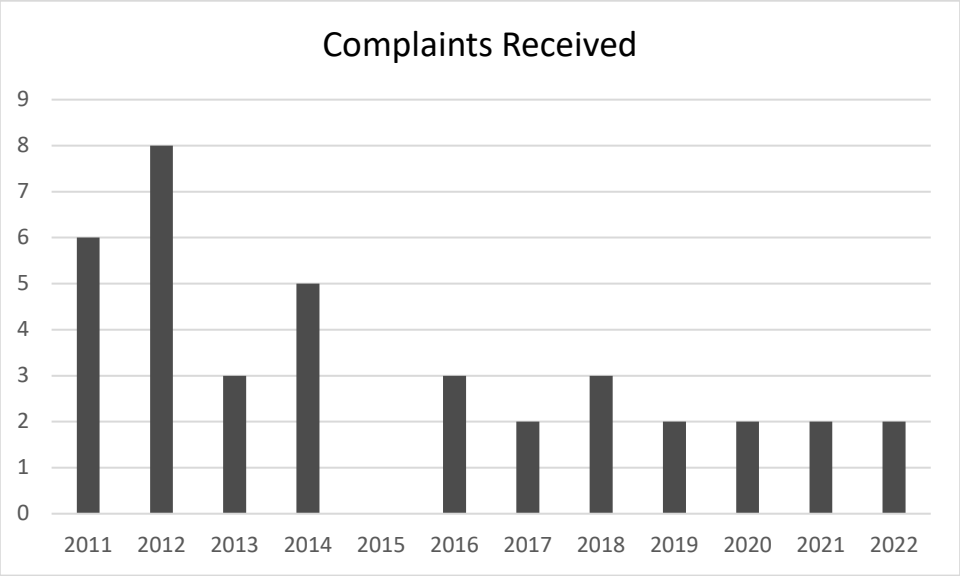
There were two complaints received during the 2022 reporting period for the Ravensworth Complex, both of which related to a singular blast event undertaken at 1.44 pm on 15 June 2022.

The blast was noted to be within acceptable criteria described in PA 09_0176.

9.2.1 Complaint Trend Analysis

Trend analysis on complaints by year since 2011 in ***Figure 9-1*** shows that annual complaints numbers have been stable since 2016.

Figure 9-1 – Complaints Received



9.3 Community Engagement

The Stakeholder Engagement Plan contains a *Community Investment Plan* which outlines key projects to be undertaken by the Ravensworth Complex throughout the year.

Community/stakeholder related activities undertaken during the reporting period include:

- Community Consultative Committee Meetings;
- Distribution of community newsletters;

- Mine tour/career talks with local primary schools and apprentices;
- Active participation in Wild Dog Groups and the LLS; and
- Direct engagement with nearby landholders.

During 2022, the Ravensworth Complex continued to foster positive relationships with the local community through engagement and ongoing financial support provided to a range of community groups and events, including, but not limited to:

- Singleton Touch Football Association;
- Early Links;
- Family Connections Program – Wonnarua Nation Aboriginal Corporation;
- Singleton High School;
- Singleton Primary School;
- Singleton Rotary Club;
- Singleton Theatrical Society;
- Singleton Neighbourhood Centre;
- Hunter River Community School; and
- Upper Hunter Homelessness Support Service.

9.4 Community Consultative Committee

The Ravensworth Complex maintains a close partnership with the local community. The Community Consultative Committee (CCC) includes Glencore representatives and local community members. This provides a formal forum for interaction between the community, mine management and relevant government departments. The Ravensworth Complex CCC held meetings in February, May, August, November 2022. The community representatives may share information from meetings with the rest of the community and relate any items for discussion at the CCC meetings.

The following key topics were discussed at the CCC meetings:

- Discussion of previous meeting minutes;
- Update on mining and processing activities at the Ravensworth Complex;
- Update on key environment and community aspects, including monitoring results and incidents;
- Update on safety performance; and
- Update on community support programs.

Minutes from the CCC meetings are posted on Ravensworth Complex's website: *https://www.glencore.com.au/operations-and-projects/coal/current-operations/ravensworth-operations/community-documents*.

9.5 Community Newsletter

The Ravensworth Complex circulates a community newsletter every six months to neighbouring residents, its employees, CCC members and other stakeholders and are on the Ravensworth Complex website. The newsletter provides information about the operational progress of the Ravensworth Complex, environmental and safety performance, plus other news of community interest.

10. Independent Audit

In accordance with Schedule 5, Condition 8 of PA 09_0176 and Schedule 4, Condition 7 of DA 104/96, an Independent Environmental Audit (IEA) is required every 3 years. An IEA was last undertaken in 2021. The next IEA will be completed in 2024.

11. Environmental Incidents and Non-Compliances

All 2022 incidents, non-compliances and exceedances related to PA 09_0176, DA 104/96 and EPL 2652 are summarised ***Table 11-1.***

Table 11-1 – Incidents, Non-compliances and Exceedances

Date	Details/Location	Non-Compliance	Action/Response
Non-compliances			
17 March 2022	A fault with the REA86 blast monitor caused a missed blast recording on 17/03/22 at 13:13:46, event code RTH615	PA 09_0176	The Proponent shall ensure that blasts on site do not cause exceedances of the criteria in Table 8 (of the Project Approval).
17 March 2022	A fault with the REA86 blast monitor caused a missed blast recording on 17/03/22 at 13:13:46, event code RTH615	PA 09_0176	The Proponent shall ensure that blasts on site do not cause any exceedance of the following incremental ground vibration limits at the Aboriginal axe grinding groove site (REA86):
19 February 2022	Exceedance of the PM_{10} short term criteria occurred once in 2022 (refer to **Section 6.3.2**)	PA 09_0176	Incident reports were provided to the DPE on each occasion.
Throughout the reporting period.	Continuous PM_{10} data was not acquired.	EPL 2652	TEOMs were inspected and repaired.
23 July 2022 and 24 July 2022	Continuous meteorological monitoring from EPL13 was not acquired. Software and hardware issues resulted in lost data.	EPL 2652	Faults were repaired in routine maintenance.
Throughout the reporting period.	Hourly discharge rate was exceeded on 40 x one hour occasions spread across 22 days where HRSTS discharge block had been published. Actual flow rate from the discharge point fluctuated above the calculated hourly rate. Flow rate is dependent primarily on the percentage that the discharge valve is open combined with head pressure (dam level) and thus fluctuations can occur.	EPL 2652	Site personnel monitored flow rate until it returned to an acceptable level. Ravensworth did not exceed the permissible discharge volume for the block (date). During pre-discharge calculations to determine flow rate (and thus ensure compliance with condition E1.3) the Electrical Conductivity (EC) value used is higher (conservative) than the actual EC of the discharge water to account for these fluctuations. Ravensworth have reviewed internal procedures relating to pre discharge calculations and valve operation to ensure conservative approach to this calculation is undertaken to reduce the likelihood of discharge flow rate

Date	Details/Location	Non-Compliance	Action/Response
			fluctuations resulting in exceedances of hourly flow rates.
9 March, 18 April, 6 July, 7 July and 8 July 2022.	Failed to collect nine grab samples from EPL3 and four grab samples from EPL4 as a result of inability to safely access monitoring point due to localised and regional flooding events.	EPL 2652	Sample collected from EPL2 ensuring discharge water quality was known prior to and during discharge events. No action taken to prevent recurrence as event was related to localised flooding preventing safe access. All samples were obtained once access was deemed safe.
Incidents			
Nil to report			

Document Information

11.1 Related Documents

Table 0-1 – Related documents

Number	Title
RAVUG-27619932-35	Ravensworth Underground Mine Rehabilitation Management Plan (2 August 2022)
RAVCX-307024981-8541	Ravensworth Operations Rehabilitation Management Plan (2 August 2022)

11.2 Reference Information

Table 0-2 – Reference information

Reference	Title
NSW Government (2015)	Post-approval requirements for State significant mining developments – Annual Review Guideline
AECOM (2022)	Annual report on stream flow events occurring in Emu, Davis and Bayswater Creeks for the period inclusive of 1 January to 31 December 2021 plus comments on stream stability in relation to the above creeks with the addition of Bowmans and Pikes Creeks
AGE (2022)	Ravensworth Operations – Review of Groundwater Model Predictions
Airon Consulting (2023)	Ravensworth Deposited Dust Levels Review - 2022
Biodiversity Australia (2022)	Ravensworth Annual Conservation Agreement Biodiversity Offset Monitoring Report 2022, Glencore Ravensworth Coal Mine
Biosis (2022)	Ravensworth Open Cut Stream Health Monitoring Program: Autumn and Spring 2021.
BEMC (2022)	Annual Offest Area Bushfire Compliance Report 2022
Engeny Water Management (2022)	Ravensworth Complex 2021 Annual Review Surface Water and Groundwater Management and Monitoring Report
HCBRLM (2023a)	Glencore – Ravensworth Complex RCO 522 – Land Management Contract 1 January to 31 December 2022
HCBRLM (2022b)	Ravensworth Open Cut 1080 Wild Dog and Fox Baiting Program Report, Hillcrest, Stewart and Clifton – Autumn 2021
HCBRLM (2022c)	Ravensworth Open Cut 1080 Wild Dog and Fox Baiting Program Report, Onsite Baiting Program – Autumn 2021
Koru Environmental (2020)	Cumnock Rehabilitation Remediation Plan

Reference	Title
Koru Environmental (2022a)	Rehabilitation Monitoring 2022, Ravensworth Operations
OzArk Environment and Heritage (2022)	2022 Archaeological Monitoring Report, Ravensworth Operations
RPS (2022)	2021 Independent Environmental Audit, Ravensworth Complex
Spectrum Acoustics (2022)	Attended Noise Monitoring (12 separate reports)
Umwelt (2010)	The Ravensworth Operations Project Environmental Assessment

Appendix A - Train Movements

Table A.1 Records of all Train Movements, Ravensworth 2022

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
1	1/01/2022	4:49:26 PM	9390.19
2	2/01/2022	5:37:21 AM	9399.80
3	2/01/2022	12:13:17 PM	9411.96
4	2/01/2022	10:28:20 PM	9406.28
5	3/01/2022	8:18:32 AM	9447.68
6	3/01/2022	3:42:36 PM	9383.04
7	6/01/2022	9:57:25 AM	9254.24
8	6/01/2022	7:13:41 PM	9355.57
9	7/01/2022	3:33:37 AM	9386.79
10	7/01/2022	10:34:26 AM	9418.68
11	7/01/2022	5:02:48 PM	8806.07
12	9/01/2022	11:38:48 PM	9389.00
13	11/01/2022	8:52:08 PM	9551.24
14	12/01/2022	5:19:15 AM	9432.00
15	13/01/2022	3:18:51 AM	9340.56
16	13/01/2022	5:55:49 PM	9591.79
17	13/01/2022	9:38:50 PM	9349.72
18	14/01/2022	1:39:09 AM	9543.08
19	14/01/2022	4:57:12 AM	8617.80
20	14/01/2022	9:51:50 AM	9533.80
21	14/01/2022	2:29:06 PM	9440.88
22	14/01/2022	6:56:04 PM	9474.59
23	14/01/2022	9:46:06 PM	9568.67
24	15/01/2022	1:10:45 AM	9440.88
25	15/01/2022	5:09:44 AM	9467.44
26	15/01/2022	9:01:38 AM	9408.56
27	15/01/2022	1:09:51 PM	9490.74
28	15/01/2022	4:54:17 PM	9314.04
29	15/01/2022	9:29:37 PM	9292.12
30	16/01/2022	2:27:04 AM	9307.16
31	16/01/2022	5:41:24 AM	9352.80
32	16/01/2022	8:57:26 AM	9309.00
33	16/01/2022	12:59:51 PM	9443.16
34	16/01/2022	4:43:39 PM	9248.40
35	16/01/2022	10:30:12 PM	9400.74

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
36	17/01/2022	3:28:45 AM	9366.50
37	17/01/2022	12:52:12 PM	9372.91
38	17/01/2022	4:12:56 PM	9648.40
39	18/01/2022	2:47:23 AM	9462.14
40	18/01/2022	9:42:56 AM	9268.79
41	18/01/2022	5:37:52 PM	9421.68
42	18/01/2022	10:48:54 PM	9399.86
43	19/01/2022	5:06:20 AM	9493.59
44	19/01/2022	1:21:06 PM	9568.14
45	19/01/2022	5:19:49 PM	8692.00
46	20/01/2022	3:21:53 AM	9595.20
47	20/01/2022	3:28:13 PM	9248.79
48	21/01/2022	3:16:06 AM	9367.76
49	21/01/2022	3:10:16 PM	9239.88
50	23/01/2022	11:01:30 AM	9473.41
51	23/01/2022	1:47:09 PM	9512.54
52	23/01/2022	7:16:59 PM	8811.53
53	24/01/2022	4:15:19 AM	9526.30
54	24/01/2022	8:35:56 AM	9327.80
55	24/01/2022	12:41:16 PM	9393.40
56	24/01/2022	4:35:23 PM	9352.40
57	24/01/2022	7:58:10 PM	9395.50
58	25/01/2022	12:42:34 AM	8764.40
59	25/01/2022	7:31:04 AM	9468.80
60	25/01/2022	12:11:28 PM	9356.80
61	25/01/2022	3:12:00 PM	8607.40
62	25/01/2022	7:27:01 PM	8793.40
63	26/01/2022	12:43:39 AM	9368.60
64	26/01/2022	5:34:38 AM	9244.60
65	26/01/2022	1:46:14 PM	8952.49
66	26/01/2022	5:45:45 PM	8949.25
67	26/01/2022	9:55:25 PM	9371.40
68	27/01/2022	6:18:58 AM	9191.06
69	28/01/2022	6:17:51 AM	9121.70
70	28/01/2022	9:11:57 AM	9246.86
71	29/01/2022	12:00:00 AM	8742.80
72	29/01/2022	3:58:12 AM	9401.60
73	29/01/2022	7:33:48 AM	9209.58
74	29/01/2022	10:34:09 AM	9231.47
75	29/01/2022	2:56:23 PM	9225.26
76	29/01/2022	7:32:12 PM	9332.28

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
77	30/01/2022	12:15:11 AM	9347.21
78	30/01/2022	3:38:18 AM	9254.50
79	30/01/2022	8:35:55 AM	9336.60
80	30/01/2022	2:37:08 PM	9282.06
81	30/01/2022	6:00:11 PM	8782.00
82	30/01/2022	9:52:21 PM	9367.20
83	31/01/2022	1:28:39 AM	8506.40
84	31/01/2022	4:40:37 AM	8614.40
85	31/01/2022	8:05:27 AM	9062.40
86	31/01/2022	12:25:23 PM	8684.80
87	31/01/2022	7:31:50 PM	9292.80
88	1/02/2022	3:00:11 AM	9414.50
89	1/02/2022	7:05:43 AM	9022.68
90	1/02/2022	4:23:35 PM	8978.74
91	1/02/2022	8:33:20 PM	8746.92
92	2/02/2022	1:56:33 AM	8468.80
93	2/02/2022	7:08:40 AM	8432.00
94	2/02/2022	11:41:45 AM	9223.40
95	2/02/2022	9:20:37 PM	9227.52
96	3/02/2022	8:23:44 AM	8990.34
97	3/02/2022	6:45:00 PM	9137.70
98	3/02/2022	11:09:07 PM	9280.99
99	4/02/2022	2:02:31 AM	9393.34
100	4/02/2022	5:01:19 AM	9185.88
101	4/02/2022	10:07:16 AM	8687.00
102	4/02/2022	1:22:09 PM	9213.19
103	4/02/2022	5:02:58 PM	9340.42
104	4/02/2022	9:07:00 PM	8870.20
105	5/02/2022	12:51:58 AM	9176.67
106	5/02/2022	5:16:57 AM	9205.50
107	5/02/2022	9:19:15 AM	8694.00
108	5/02/2022	1:18:32 PM	9440.40
109	5/02/2022	9:36:14 PM	8905.60
110	6/02/2022	1:21:00 AM	9436.00
111	6/02/2022	6:44:12 AM	9440.20
112	6/02/2022	10:07:12 AM	9520.66
113	6/02/2022	3:42:33 PM	9335.68
114	7/02/2022	3:01:41 AM	9114.40
115	7/02/2022	11:06:27 AM	9277.20
116	7/02/2022	6:49:07 PM	9559.06
117	7/02/2022	10:14:20 PM	9468.47

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
118	11/02/2022	9:44:18 AM	9493.54
119	11/02/2022	2:03:46 PM	9429.60
120	11/02/2022	10:47:31 PM	8873.19
121	12/02/2022	6:39:45 PM	9291.79
122	13/02/2022	12:27:15 AM	9246.80
123	13/02/2022	5:26:31 AM	9317.39
124	13/02/2022	10:17:04 PM	9198.86
125	14/02/2022	5:26:36 AM	9631.07
126	14/02/2022	9:14:02 AM	9501.21
127	15/02/2022	6:41:58 AM	8977.40
128	15/02/2022	1:59:08 AM	9027.61
129	15/02/2022	11:37:50 AM	9447.40
130	15/02/2022	2:56:47 PM	9429.74
131	15/02/2022	6:17:10 PM	9220.79
132	15/02/2022	9:39:02 PM	9220.07
133	16/02/2022	6:28:52 AM	9472.37
134	16/02/2022	4:34:52 PM	9214.19
135	16/02/2022	8:32:37 PM	9396.69
136	17/02/2022	12:01:38 AM	9256.07
137	17/02/2022	6:21:46 AM	9423.49
138	17/02/2022	5:58:57 PM	9057.99
139	18/02/2022	12:37:12 AM	9359.20
140	18/02/2022	4:25:27 PM	9229.69
141	19/02/2022	8:09:54 PM	9384.02
142	20/02/2022	8:35:46 AM	9676.32
143	21/02/2022	5:36:00 AM	9453.00
144	21/02/2022	10:05:03 AM	9540.20
145	21/02/2022	1:12:47 PM	9026.88
146	21/02/2022	4:27:01 PM	9283.39
147	22/02/2022	1:56:16 AM	9505.34
148	22/02/2022	6:22:13 PM	9520.60
149	23/02/2022	12:42:10 AM	9343.74
150	23/02/2022	6:19:26 AM	9364.35
151	23/02/2022	5:16:33 PM	9380.34
152	24/02/2022	3:39:08 AM	9056.80
153	24/02/2022	8:33:37 AM	9414.82
154	24/02/2022	11:46:43 AM	9577.87
155	24/02/2022	5:03:05 PM	9416.89
156	24/02/2022	9:29:25 PM	9634.84
157	25/02/2022	2:15:21 AM	9384.40
158	25/02/2022	6:10:53 AM	9442.28

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
159	25/02/2022	9:16:20 AM	9293.76
160	25/02/2022	12:08:28 PM	9302.02
161	25/02/2022	3:06:49 PM	9243.47
162	25/02/2022	8:05:27 PM	9391.51
163	26/02/2022	8:16:52 AM	8967.69
164	26/02/2022	1:07:50 PM	9073.48
165	26/02/2022	4:42:22 PM	9359.31
166	26/02/2022	9:32:15 PM	9353.93
167	27/02/2022	2:18:53 AM	9292.94
168	27/02/2022	5:26:43 AM	9302.37
169	27/02/2022	7:21:48 PM	8657.00
170	28/02/2022	2:44:12 AM	8965.00
171	28/02/2022	7:03:21 AM	8670.80
172	1/03/2022	12:31:39 AM	9351.52
173	1/03/2022	3:52:00 AM	9173.40
174	1/03/2022	8:48:24 AM	8596.00
175	1/03/2022	10:22:15 PM	9300.40
176	2/03/2022	1:26:24 AM	9466.46
177	2/03/2022	7:40:23 PM	9035.52
178	3/03/2022	1:30:49 AM	9347.49
179	3/03/2022	10:49:25 PM	9469.37
180	4/03/2022	1:49:50 AM	9005.67
181	4/03/2022	4:26:03 AM	9064.87
182	4/03/2022	10:49:21 PM	8955.13
183	5/03/2022	1:43:07 AM	9040.92
184	5/03/2022	6:11:11 AM	9174.02
185	5/03/2022	11:07:30 AM	9335.21
186	5/03/2022	2:32:40 PM	9346.52
187	5/03/2022	6:30:09 PM	9327.51
188	5/03/2022	9:42:30 PM	9287.62
189	6/03/2022	12:53:00 AM	9338.63
190	6/03/2022	5:28:21 AM	9496.94
191	6/03/2022	12:33:00 PM	9513.55
192	6/03/2022	4:06:04 PM	9483.64
193	6/03/2022	10:15:33 PM	9696.63
194	7/03/2022	12:54:58 AM	9512.19
195	7/03/2022	10:13:47 AM	9441.47
196	7/03/2022	2:58:23 PM	9536.69
197	8/03/2022	4:46:53 PM	8836.40
198	8/03/2022	10:24:24 PM	9376.53
199	9/03/2022	5:59:33 AM	9627.30

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
200	9/03/2022	9:51:09 AM	9538.68
201	9/03/2022	12:33:30 PM	9231.68
202	9/03/2022	5:26:17 PM	9392.91
203	10/03/2022	11:06:51 AM	9313.02
204	10/03/2022	5:52:53 PM	9398.60
205	10/03/2022	9:30:12 PM	9365.72
206	11/03/2022	2:37:27 AM	9412.80
207	11/03/2022	7:30:52 AM	9266.91
208	11/03/2022	11:25:13 AM	9289.46
209	11/03/2022	8:40:07 PM	9313.88
210	11/03/2022	4:58:16 PM	9288.40
211	11/03/2022	11:59:06 PM	9314.59
212	12/03/2022	9:25:51 AM	9456.11
213	12/03/2022	1:18:31 PM	9502.38
214	12/03/2022	5:29:00 PM	9417.14
215	12/03/2022	8:40:16 PM	9514.64
216	13/03/2022	1:04:17 AM	9520.32
217	13/03/2022	5:03:14 AM	8655.20
218	13/03/2022	8:38:35 AM	9474.67
219	13/03/2022	11:38:24 PM	8908.36
220	16/03/2022	12:09:58 AM	9376.59
221	16/03/2022	5:39:26 AM	9413.80
222	16/03/2022	2:16:10 PM	9391.79
223	16/03/2022	5:41:13 PM	9260.31
224	17/03/2022	5:17:55 AM	9524.71
225	17/03/2022	5:54:54 PM	9336.57
226	18/03/2022	2:08:47 AM	9556.79
227	18/03/2022	8:43:56 PM	8987.40
228	19/03/2022	2:05:27 PM	9193.97
229	19/03/2022	8:25:59 PM	9246.72
230	20/03/2022	4:50:39 AM	9396.72
231	20/03/2022	8:48:48 AM	9316.62
232	20/03/2022	11:42:53 AM	9399.31
233	20/03/2022	10:17:23 PM	9417.13
234	21/03/2022	2:38:10 AM	9436.20
235	21/03/2022	7:15:48 AM	9406.03
236	21/03/2022	2:32:56 PM	9433.42
237	21/03/2022	6:17:28 PM	8772.60
238	22/03/2022	8:17:06 AM	9030.20
239	22/03/2022	6:47:32 PM	9365.67
240	23/03/2022	1:57:49 AM	9238.66

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
241	23/03/2022	4:30:00 AM	9277.92
242	23/03/2022	1:00:23 PM	9133.49
243	23/03/2022	4:24:00 PM	9363.80
244	23/03/2022	10:28:00 PM	9252.67
245	24/03/2022	3:59:00 AM	9244.51
246	24/03/2022	7:28:14 PM	9449.80
247	24/03/2022	11:41:45 PM	8666.20
248	25/03/2022	4:09:27 AM	9338.60
249	25/03/2022	8:53:43 AM	9681.51
250	25/03/2022	3:03:00 PM	9429.47
251	25/03/2022	6:37:08 PM	9401.39
252	26/03/2022	11:29:01 PM	9535.51
253	27/03/2022	4:21:42 PM	9035.83
254	28/03/2022	12:59:14 AM	9317.69
255	28/03/2022	4:08:34 AM	9568.83
256	28/03/2022	8:32:12 PM	9496.16
257	28/03/2022	11:32:05 PM	9414.06
258	29/03/2022	2:39:15 AM	9340.09
259	29/03/2022	5:38:30 PM	9546.31
260	30/03/2022	2:42:58 AM	9339.51
261	30/03/2022	2:21:53 PM	9165.87
262	30/03/2022	8:21:47 PM	9422.63
263	31/03/2022	10:14:42 PM	9217.47
264	1/04/2022	5:22:49 AM	9274.40
265	1/04/2022	5:43:39 PM	9411.17
266	2/04/2022	7:34:57 AM	8828.82
267	2/04/2022	11:53:55 AM	9491.46
268	3/04/2022	12:34:55 PM	9392.53
269	3/04/2022	4:29:42 PM	9123.00
270	3/04/2022	7:43:44 PM	9310.77
271	4/04/2022	12:32:20 AM	9433.31
272	4/04/2022	4:31:53 AM	9341.87
273	7/04/2022	8:50:52 PM	9422.89
274	7/04/2022	11:41:33 PM	9502.52
275	8/04/2022	1:47:05 PM	9142.76
276	8/04/2022	4:57:00 PM	9232.82
277	9/04/2022	2:24:14 AM	9437.16
278	9/04/2022	7:00:57 PM	9333.96
279	10/04/2022	11:15:02 AM	9201.56
280	10/04/2022	11:06:07 PM	9026.58
281	11/04/2022	2:00:00 AM	9363.45

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
282	11/04/2022	8:33:13 PM	9200.69
283	12/04/2022	8:02:00 PM	9480.90
284	13/04/2022	4:51:56 PM	8838.20
285	15/04/2022	4:21:59 PM	9287.16
286	17/04/2022	3:34:39 AM	9465.95
287	17/04/2022	10:31:18 AM	9441.63
288	17/04/2022	4:57:08 PM	9323.23
289	19/04/2022	3:27:54 AM	9703.63
290	19/04/2022	8:00:49 PM	9649.87
291	20/04/2022	5:18:21 AM	9069.80
292	20/04/2022	10:06:16 PM	9758.20
293	21/04/2022	2:03:34 AM	9068.39
294	21/04/2022	9:34:25 AM	9187.82
295	21/04/2022	1:39:22 PM	9212.76
296	21/04/2022	7:04:25 PM	9548.63
297	22/04/2022	12:58:38 AM	9048.20
298	22/04/2022	5:04:56 AM	9525.36
299	22/04/2022	9:39:46 AM	9620.23
300	23/04/2022	12:02:52 AM	8731.80
301	23/04/2022	7:27:57 PM	9322.40
302	24/04/2022	9:25:27 AM	9485.80
303	24/04/2022	2:25:46 PM	9179.19
304	24/04/2022	9:09:50 PM	9049.26
305	25/04/2022	5:16:00 AM	9255.68
306	25/04/2022	10:50:40 PM	8971.21
307	26/04/2022	11:52:42 PM	9402.79
308	27/04/2022	3:53:09 AM	9309.90
309	28/04/2022	1:16:18 AM	9074.57
310	28/04/2022	6:40:06 AM	9340.80
311	28/04/2022	3:35:00 PM	9293.68
312	29/04/2022	1:43:58 PM	9185.76
313	30/04/2022	4:09:06 AM	9340.80
314	30/04/2022	7:05:32 PM	9134.66
315	1/05/2022	3:54:10 AM	9099.28
316	1/05/2022	5:24:36 PM	9140.48
317	1/05/2022	9:20:14 PM	9411.99
318	2/05/2022	2:27:21 AM	9066.75
319	2/05/2022	4:07:18 PM	9017.90
320	2/05/2022	8:03:03 PM	9568.39
321	3/05/2022	12:08:00 AM	8992.17
322	3/05/2022	5:03:00 AM	9512.29

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
323	3/05/2022	11:05:31 PM	9407.40
324	4/05/2022	3:39:29 AM	9310.17
325	4/05/2022	10:49:36 AM	9119.66
326	4/05/2022	7:50:00 PM	8951.60
327	5/05/2022	3:27:00 AM	9440.00
328	5/05/2022	8:59:52 AM	9461.80
329	5/05/2022	10:27:54 PM	9456.36
330	6/05/2022	7:54:26 AM	9128.47
331	6/05/2022	12:30:38 PM	9453.94
332	6/05/2022	10:03:24 PM	9375.00
333	7/05/2022	4:43:21 AM	9447.67
334	7/05/2022	10:03:32 AM	9421.45
335	7/05/2022	2:42:03 PM	8913.14
336	8/05/2022	12:09:12 AM	9399.80
337	8/05/2022	11:38:27 AM	9354.00
338	8/05/2022	7:46:18 PM	9390.57
339	8/05/2022	11:06:18 PM	9035.80
340	9/05/2022	2:47:05 AM	9454.45
341	9/05/2022	10:08:48 AM	9043.20
342	9/05/2022	6:50:00 PM	9555.10
343	10/05/2022	8:02:19 PM	8499.40
344	11/05/2022	9:04:40 PM	8968.10
345	12/05/2022	12:59:49 AM	9447.60
346	12/05/2022	4:37:20 AM	9246.65
347	12/05/2022	8:32:55 PM	9360.00
348	13/05/2022	11:37:35 PM	9401.66
349	14/05/2022	5:03:40 PM	8986.56
350	14/05/2022	1:12:45 PM	9424.26
351	14/05/2022	8:30:27 PM	9365.45
352	15/05/2022	9:48:08 AM	9455.46
353	15/05/2022	1:51:00 PM	9453.27
354	15/05/2022	9:40:26 PM	9342.10
355	15/05/2022	6:11:44 PM	9290.60
356	16/05/2022	2:39:32 AM	9425.64
357	16/05/2022	11:02:09 AM	9336.63
358	16/05/2022	1:58:24 PM	9307.51
359	16/05/2022	5:39:52 PM	9400.06
360	17/05/2022	3:35:05 AM	9584.70
361	17/05/2022	6:47:55 AM	9351.26
362	17/05/2022	4:12:15 PM	9054.57
363	17/05/2022	11:33:03 PM	9580.27

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
364	18/05/2022	3:29:00 PM	8940.30
365	18/05/2022	6:33:20 PM	9590.47
366	19/05/2022	2:42:31 AM	9546.50
367	19/05/2022	11:36:09 PM	9613.90
368	20/05/2022	7:21:46 AM	9153.17
369	20/05/2022	1:34:36 PM	8966.40
370	21/05/2022	8:28:39 AM	8938.14
371	21/05/2022	1:12:15 PM	9392.00
372	21/05/2022	4:52:28 PM	8949.81
373	22/05/2022	2:56:05 AM	8930.00
374	22/05/2022	6:08:15 AM	9307.00
375	22/05/2022	1:52:32 PM	8931.10
376	22/05/2022	4:39:14 PM	9040.79
377	22/05/2022	8:18:35 PM	9513.82
378	23/05/2022	1:09:04 AM	8994.77
379	23/05/2022	10:20:21 AM	9478.17
380	23/05/2022	3:03:00 PM	9386.17
381	23/05/2022	5:59:51 PM	9266.19
382	23/05/2022	9:53:03 PM	9179.78
383	26/05/2022	11:37:14 PM	9179.78
384	27/05/2022	5:25:31 AM	9179.78
385	27/05/2022	9:03:39 PM	9346.68
386	28/05/2022	5:16:38 AM	9351.20
387	28/05/2022	10:15:01 AM	9379.62
388	29/05/2022	12:51:15 AM	9302.20
389	29/05/2022	9:44:52 AM	9374.00
390	29/05/2022	2:14:15 PM	9396.60
391	30/05/2022	1:28:47 AM	9425.48
392	30/05/2022	7:11:33 AM	9259.60
393	30/05/2022	2:46:52 PM	9374.80
394	30/05/2022	6:21:38 PM	9459.50
395	31/05/2022	10:09:53 AM	9432.88
396	1/06/2022	1:08:40 PM	9434.08
397	2/06/2022	3:51:48 AM	9415.40
398	2/06/2022	8:03:51 AM	9200.97
399	2/06/2022	4:29:14 PM	9005.10
400	3/06/2022	3:08:26 AM	9402.70
401	3/06/2022	6:19:37 AM	9138.15
402	3/06/2022	4:08:18 PM	9301.62
403	4/06/2022	8:00:44 AM	9260.43
404	4/06/2022	12:35:00 PM	9492.00

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
405	4/06/2022	4:10:36 PM	9157.02
406	5/06/2022	1:36:39 AM	9414.22
407	5/06/2022	7:30:06 AM	9168.90
408	5/06/2022	5:11:22 PM	9234.60
409	5/06/2022	8:54:09 PM	9031.80
410	6/06/2022	6:09:18 AM	9633.64
411	6/06/2022	9:30:30 AM	9360.60
412	6/06/2022	3:59:40 PM	9388.10
413	6/06/2022	6:55:58 PM	9430.82
414	6/06/2022	9:57:38 PM	9457.90
415	7/06/2022	5:07:49 AM	9393.60
416	8/06/2022	5:13:46 AM	9436.44
417	8/06/2022	3:51:11 PM	9453.68
418	8/06/2022	6:25:32 PM	9324.50
419	8/06/2022	11:50:04 PM	9446.14
420	10/06/2022	12:24:23 AM	9379.68
421	10/06/2022	3:47:47 AM	9516.55
422	10/06/2022	9:31:46 AM	9307.09
423	10/06/2022	12:48:05 PM	9476.48
424	10/06/2022	8:39:48 PM	9376.35
425	10/06/2022	11:38:48 PM	9350.96
426	11/06/2022	9:44:10 AM	9404.63
427	11/06/2022	1:32:15 PM	9516.17
428	11/06/2022	8:20:56 PM	9388.76
429	12/06/2022	3:09:30 PM	9253.97
430	12/06/2022	10:46:22 PM	9331.02
431	13/06/2022	5:30:19 AM	9376.00
432	13/06/2022	11:34:46 AM	9373.82
433	13/06/2022	6:54:05 PM	9387.30
434	14/06/2022	12:16:23 AM	9335.42
435	14/06/2022	3:40:50 PM	9366.80
436	14/06/2022	7:05:00 PM	9556.95
437	15/06/2022	2:27:34 AM	9465.88
438	15/06/2022	6:12:48 AM	9427.77
439	15/06/2022	4:55:37 PM	9215.20
440	15/06/2022	9:50:25 PM	9395.57
441	17/06/2022	6:59:57 AM	9444.40
442	17/06/2022	1:12:45 PM	9398.20
443	18/06/2022	10:49:50 AM	9345.60
444	18/06/2022	11:27:38 PM	9345.60
445	18/06/2022	6:27:26 PM	9435.16

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
446	19/06/2022	2:50:00 AM	9447.97
447	19/06/2022	6:16:01 AM	9489.06
448	19/06/2022	11:28:02 AM	9317.40
449	19/06/2022	3:03:44 PM	9455.57
450	19/06/2022	7:05:30 PM	9476.66
451	19/06/2022	9:54:20 PM	9415.88
452	20/06/2022	1:29:47 AM	9450.45
453	20/06/2022	5:26:58 AM	9457.46
454	21/06/2022	8:45:00 AM	5222.20
455	21/06/2022	12:37:00 PM	9359.86
456	21/06/2022	6:25:21 PM	9500.96
457	22/06/2022	5:17:28 AM	9284.86
458	22/06/2022	10:56:26 AM	9433.60
459	23/06/2022	10:03:18 AM	9544.78
460	24/06/2022	5:24:55 PM	9521.61
461	25/06/2022	12:42:43 AM	8937.57
462	25/06/2022	5:37:50 AM	9270.62
463	25/06/2022	9:10:21 AM	9445.28
464	25/06/2022	5:39:02 PM	9501.22
465	26/06/2022	1:15:51 AM	9193.16
466	26/06/2022	4:44:00 AM	9404.98
467	26/06/2022	8:54:58 AM	9475.23
468	27/06/2022	4:59:20 AM	9334.80
469	28/06/2022	6:51:02 AM	9360.22
470	28/06/2022	6:05:08 PM	9265.55
471	28/06/2022	10:11:59 PM	9163.26
472	29/06/2022	1:56:54 AM	9589.75
473	29/06/2022	5:24:05 AM	9019.75
474	30/06/2022	12:38:24 AM	8957.06
475	30/06/2022	6:29:50 AM	9028.61
476	30/06/2022	5:43:38 PM	9434.19
477	1/07/2022	6:56:47 AM	9310.35
478	1/07/2022	10:20:03 AM	9241.80
479	1/07/2022	1:59:00 PM	9296.76
480	1/07/2022	7:45:07 PM	9473.79
481	2/07/2022	4:48:06 AM	8992.20
482	2/07/2022	12:33:03 AM	9270.96
483	2/07/2022	8:23:38 AM	9273.76
484	2/07/2022	11:58:25 AM	9074.76
485	2/07/2022	4:01:29 PM	9492.46
486	2/07/2022	9:17:08 PM	9047.75

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
487	3/07/2022	3:37:41 AM	9058.70
488	3/07/2022	6:34:07 AM	9226.80
489	3/07/2022	5:14:12 PM	9415.48
490	3/07/2022	10:55:21 PM	9443.16
491	4/07/2022	2:09:26 AM	9624.80
492	4/07/2022	5:48:20 AM	9494.70
493	4/07/2022	7:07:10 PM	9255.68
494	4/07/2022	10:46:13 PM	9333.06
495	5/07/2022	3:36:52 AM	9723.80
496	5/07/2022	12:42:35 PM	9210.40
497	5/07/2022	7:35:30 AM	9297.39
498	5/07/2022	9:51:25 PM	9436.28
499	18/07/2022	5:40:47 AM	8966.40
500	18/07/2022	9:22:42 AM	9109.48
501	18/07/2022	12:24:57 PM	9373.68
502	18/07/2022	4:25:26 PM	9375.94
503	19/07/2022	1:14:40 AM	9371.18
504	19/07/2022	4:55:20 AM	9410.80
505	19/07/2022	11:57:33 AM	9361.60
506	19/07/2022	3:27:14 PM	9418.79
507	19/07/2022	6:37:55 PM	9547.46
508	19/07/2022	11:14:10 PM	9504.94
509	20/07/2022	2:34:13 AM	9522.77
510	20/07/2022	2:58:00 PM	9296.76
511	20/07/2022	11:32:00 PM	5752.96
512	21/07/2022	3:32:44 AM	9403.40
513	21/07/2022	10:52:49 AM	9457.48
514	21/07/2022	7:03:20 PM	9401.88
515	22/07/2022	2:07:00 PM	9012.40
516	22/07/2022	6:17:20 PM	9367.74
517	22/07/2022	9:24:17 PM	9359.60
518	23/07/2022	6:33:37 AM	9407.78
519	23/07/2022	11:04:00 AM	8840.65
520	23/07/2022	3:09:08 PM	9287.76
521	23/07/2022	6:51:47 PM	9341.52
522	23/07/2022	11:11:47 PM	9203.17
523	24/07/2022	2:53:41 AM	9329.56
524	24/07/2022	6:56:21 AM	9303.20
525	24/07/2022	10:25:25 AM	9251.39
526	24/07/2022	1:34:27 PM	9224.06
527	24/07/2022	4:53:00 PM	9326.40

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
528	25/07/2022	7:44:08 AM	9355.40
529	25/07/2022	12:19:11 PM	9162.45
530	25/07/2022	4:18:40 PM	9214.66
531	25/07/2022	8:38:43 PM	9273.60
532	26/07/2022	6:35:51 AM	9373.86
533	26/07/2022	10:31:41 AM	9376.30
534	26/07/2022	1:53:22 PM	9294.00
535	26/07/2022	5:31:06 PM	9464.12
536	27/07/2022	4:01:10 AM	9516.14
537	27/07/2022	7:14:08 AM	9336.17
538	27/07/2022	1:55:13 PM	9347.60
539	27/07/2022	5:26:00 PM	9418.94
540	27/07/2022	10:46:39 PM	9385.99
541	28/07/2022	5:58:19 AM	8820.80
542	28/07/2022	10:06:26 AM	9475.30
543	29/07/2022	1:58:46 AM	9326.60
544	29/07/2022	5:30:34 AM	9395.41
545	29/07/2022	9:23:23 AM	9418.05
546	29/07/2022	4:43:55 PM	9454.00
547	30/07/2022	3:31:11 AM	9419.10
548	30/07/2022	8:14:59 AM	9426.57
549	30/07/2022	1:35:00 PM	9440.00
550	30/07/2022	7:07:11 PM	9408.30
551	31/07/2022	3:21:10 AM	9431.10
552	31/07/2022	10:44:48 AM	9391.95
553	31/07/2022	2:51:47 PM	9429.39
554	1/08/2022	1:13:47 AM	9396.46
555	1/08/2022	7:46:31 AM	9501.61
556	1/08/2022	11:06:15 AM	9385.76
557	1/08/2022	2:49:48 PM	9251.52
558	1/08/2022	10:27:37 PM	9434.30
559	2/08/2022	8:46:51 AM	9158.55
560	2/08/2022	1:58:49 PM	9318.60
561	2/08/2022	7:30:41 PM	9335.50
562	3/08/2022	5:23:21 AM	9093.41
563	3/08/2022	10:32:50 AM	9237.35
564	3/08/2022	7:39:53 PM	9174.77
565	4/08/2022	5:05:27 AM	9491.40
566	4/08/2022	1:32:19 AM	9230.00
567	4/08/2022	9:00:37 AM	9438.98
568	4/08/2022	11:01:19 PM	9367.15

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
569	5/08/2022	3:56:16 PM	9435.57
570	6/08/2022	8:33:12 AM	9522.54
571	6/08/2022	12:38:00 PM	9293.55
572	6/08/2022	3:54:13 PM	9293.18
573	6/08/2022	6:35:43 PM	9345.00
574	7/08/2022	12:32:43 AM	9387.35
575	7/08/2022	3:53:24 AM	9295.21
576	7/08/2022	12:21:50 PM	9354.19
577	7/08/2022	3:28:33 PM	9108.34
578	7/08/2022	6:38:37 PM	9338.17
579	7/08/2022	9:46:52 PM	9328.26
580	8/08/2022	5:27:02 PM	9469.99
581	9/08/2022	1:56:50 AM	9130.17
582	9/08/2022	5:20:16 AM	9244.59
583	9/08/2022	10:44:00 AM	9323.06
584	10/08/2022	5:54:08 AM	9341.46
585	10/08/2022	8:31:03 PM	9097.70
586	11/08/2022	2:38:18 AM	9295.46
587	11/08/2022	8:36:12 AM	9367.70
588	11/08/2022	11:49:10 AM	9440.28
589	12/08/2022	12:10:29 AM	9444.48
590	12/08/2022	5:05:55 AM	9098.95
591	12/08/2022	9:54:35 AM	9146.97
592	12/08/2022	2:12:21 PM	9348.86
593	13/08/2022	1:10:54 AM	9438.26
594	13/08/2022	4:13:13 AM	9367.70
595	13/08/2022	6:34:09 PM	9231.55
596	14/08/2022	3:15:19 AM	9446.10
597	14/08/2022	1:32:48 PM	9275.96
598	15/08/2022	12:12:00 AM	9420.30
599	16/08/2022	12:17:34 AM	9355.99
600	16/08/2022	4:51:14 AM	9506.93
601	17/08/2022	12:49:05 AM	9350.31
602	17/08/2022	2:30:02 AM	4299.46
603	17/08/2022	9:03:52 PM	4283.60
604	18/08/2022	12:51:16 AM	9434.08
605	18/08/2022	5:41:27 AM	9189.34
606	18/08/2022	11:12:09 PM	9311.81
607	19/08/2022	1:54:29 AM	4337.77
608	19/08/2022	6:35:54 AM	9072.00
609	19/08/2022	9:04:30 PM	4376.97

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
610	20/08/2022	1:47:32 AM	9492.81
611	20/08/2022	7:24:08 AM	4293.17
612	20/08/2022	10:18:41 AM	9362.93
613	21/08/2022	2:28:57 AM	9279.68
614	21/08/2022	11:22:31 AM	9282.06
615	21/08/2022	2:49:13 PM	9395.34
616	21/08/2022	4:53:21 PM	4322.77
617	21/08/2022	10:45:12 PM	9124.68
618	22/08/2022	2:11:05 AM	9352.01
619	22/08/2022	8:33:54 AM	9428.96
620	22/08/2022	12:59:31 PM	9092.03
621	22/08/2022	4:25:13 PM	9031.34
622	22/08/2022	8:26:52 PM	9477.08
623	23/08/2022	3:41:20 AM	9154.01
624	23/08/2022	12:10:06 PM	9311.54
625	23/08/2022	5:21:20 PM	8862.36
626	23/08/2022	8:53:43 PM	9429.90
627	24/08/2022	12:07:34 AM	9376.08
628	24/08/2022	3:04:51 AM	9132.94
629	24/08/2022	7:58:00 AM	9351.50
630	24/08/2022	12:21:08 PM	9238.94
631	24/08/2022	8:38:06 PM	9409.93
632	25/08/2022	12:39:13 AM	9369.90
633	25/08/2022	3:30:53 AM	9317.34
634	25/08/2022	6:48:14 AM	9519.41
635	25/08/2022	9:37:15 AM	9413.41
636	26/08/2022	2:10:02 AM	9390.08
637	26/08/2022	5:07:25 AM	9361.14
638	26/08/2022	9:33:52 AM	9463.08
639	26/08/2022	1:49:20 PM	9423.60
640	26/08/2022	6:10:13 PM	9222.13
641	26/08/2022	9:27:17 PM	9148.88
642	27/08/2022	12:22:35 AM	9324.82
643	27/08/2022	3:07:07 AM	9411.50
644	27/08/2022	5:53:39 AM	9331.21
645	27/08/2022	9:31:26 AM	9474.56
646	27/08/2022	2:14:02 PM	9405.70
647	27/08/2022	5:30:13 PM	9304.41
648	27/08/2022	8:23:16 PM	9286.74
649	27/08/2022	11:06:39 PM	9348.00
650	28/08/2022	2:59:54 AM	9329.01

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
651	28/08/2022	10:36:27 AM	9365.46
652	28/08/2022	3:05:02 PM	9247.68
653	28/08/2022	7:11:23 PM	9388.28
654	28/08/2022	11:03:32 PM	9407.90
655	29/08/2022	2:09:57 AM	9458.76
656	29/08/2022	5:13:01 AM	9294.06
657	29/08/2022	2:49:00 PM	9134.22
658	29/08/2022	6:10:35 PM	8968.41
659	29/08/2022	9:31:09 PM	8984.08
660	30/08/2022	3:47:13 AM	9050.10
661	30/08/2022	7:28:27 AM	9160.94
662	30/08/2022	10:47:47 AM	9095.61
663	30/08/2022	2:19:45 PM	9464.63
664	30/08/2022	5:31:14 PM	9509.06
665	31/08/2022	1:23:18 AM	9455.08
666	31/08/2022	4:38:24 AM	9428.56
667	31/08/2022	5:26:28 PM	9208.86
668	31/08/2022	9:55:07 PM	9244.81
669	1/09/2022	1:57:08 AM	9334.40
670	1/09/2022	6:39:01 AM	9412.68
671	1/09/2022	10:22:32 AM	9215.21
672	1/09/2022	4:12:07 PM	9383.70
673	1/09/2022	7:25:07 PM	9642.81
674	1/09/2022	11:08:02 PM	9344.74
675	2/09/2022	1:03:00 AM	4290.96
676	2/09/2022	8:31:00 PM	4332.16
677	3/09/2022	12:02:50 AM	9454.96
678	3/09/2022	3:05:57 AM	9404.40
679	3/09/2022	8:37:21 AM	4326.96
680	3/09/2022	6:51:33 AM	9377.10
681	3/09/2022	4:19:56 PM	9074.14
682	4/09/2022	10:28:35 AM	4379.40
683	4/09/2022	12:42:40 AM	9282.08
684	4/09/2022	4:19:20 AM	9475.10
685	4/09/2022	9:35:56 PM	4292.96
686	4/09/2022	2:19:51 PM	9051.42
687	5/09/2022	7:29:14 AM	4331.00
688	6/09/2022	9:27:35 AM	4244.30
689	6/09/2022	8:25:56 PM	9529.68
690	7/09/2022	7:49:00 AM	4212.90
691	7/09/2022	2:45:38 AM	9336.70

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
692	7/09/2022	7:38:51 PM	4250.76
693	7/09/2022	11:02:52 AM	9079.70
694	7/09/2022	5:07:31 PM	9025.76
695	8/09/2022	2:21:00 AM	9303.20
696	8/09/2022	6:43:18 AM	9257.02
697	8/09/2022	11:09:51 PM	4352.56
698	8/09/2022	9:01:32 PM	9247.48
699	9/09/2022	2:48:24 AM	8846.78
700	9/09/2022	12:58:25 PM	9418.61
701	9/09/2022	3:59:43 PM	9385.38
702	13/09/2022	10:13:20 AM	4302.36
703	13/09/2022	10:04:00 PM	4299.16
704	14/09/2022	1:44:49 AM	4333.14
705	14/09/2022	4:31:54 PM	9143.30
706	14/09/2022	8:02:31 PM	8890.80
707	14/09/2022	11:00:04 PM	8999.11
708	15/09/2022	1:09:00 AM	4393.16
709	15/09/2022	6:00:59 AM	9292.40
710	15/09/2022	12:44:41 PM	4410.36
711	16/09/2022	3:28:48 PM	4379.76
712	17/09/2022	9:10:40 PM	4350.76
713	17/09/2022	1:55:01 PM	9447.39
714	17/09/2022	11:42:00 PM	4323.14
715	18/09/2022	8:45:03 PM	9391.68
716	19/09/2022	3:50:57 AM	9068.19
717	19/09/2022	2:15:34 PM	8856.19
718	19/09/2022	6:43:09 PM	8877.79
719	20/09/2022	12:16:00 AM	9528.56
720	20/09/2022	8:56:54 AM	9488.86
721	20/09/2022	2:31:00 PM	8988.16
722	20/09/2022	4:54:00 PM	9379.80
723	20/09/2022	8:54:42 PM	9520.39
724	21/09/2022	7:23:52 AM	9087.56
725	21/09/2022	4:02:15 PM	9280.98
726	21/09/2022	7:17:00 PM	9265.00
727	21/09/2022	10:54:31 PM	9536.20
728	22/09/2022	3:51:24 AM	9457.07
729	22/09/2022	10:44:29 AM	9297.40
730	23/09/2022	5:56:36 AM	9009.20
731	23/09/2022	3:49:13 PM	9332.91
732	24/09/2022	1:23:31 AM	9416.61

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
733	23/09/2022	9:51:36 PM	8630.80
734	24/09/2022	4:36:14 AM	9501.91
735	24/09/2022	8:24:49 AM	8899.67
736	24/09/2022	12:55:33 PM	8820.63
737	24/09/2022	4:43:20 PM	8890.60
738	24/09/2022	9:58:28 PM	8955.46
739	25/09/2022	2:28:00 AM	5576.72
740	25/09/2022	9:18:00 PM	8974.90
741	26/09/2022	5:06:05 AM	9275.52
742	26/09/2022	12:21:43 AM	4317.14
743	26/09/2022	2:09:17 PM	9013.27
744	26/09/2022	7:02:20 PM	8857.16
745	26/09/2022	10:21:47 PM	8855.33
746	27/09/2022	3:19:24 AM	9344.40
747	27/09/2022	9:19:00 AM	9414.83
748	28/09/2022	3:59:57 AM	9009.30
749	28/09/2022	9:02:43 AM	9008.41
750	28/09/2022	3:50:11 PM	9411.77
751	29/09/2022	12:27:00 AM	9452.58
752	29/09/2022	4:19:00 AM	9503.70
753	29/09/2022	8:21:22 AM	9248.26
754	29/09/2022	2:36:16 PM	9414.90
755	29/09/2022	5:46:58 PM	8792.42
756	29/09/2022	11:44:16 PM	9404.99
757	30/09/2022	2:46:56 AM	9418.30
758	30/09/2022	8:16:41 AM	9275.52
759	30/09/2022	11:33:58 AM	9484.19
760	30/09/2022	2:31:05 PM	9167.11
761	30/09/2022	5:33:36 PM	9484.99
762	30/09/2022	10:34:01 PM	9130.38
763	1/10/2022	5:35:51 AM	9562.16
764	1/10/2022	8:45:37 AM	9494.19
765	1/10/2022	12:46:08 PM	9478.39
766	1/10/2022	5:35:31 PM	9439.54
767	2/10/2022	8:36:35 AM	8940.99
768	2/10/2022	1:28:17 PM	9550.99
769	2/10/2022	6:26:31 PM	9275.99
770	3/10/2022	12:31:00 AM	9597.78
771	3/10/2022	3:32:49 AM	8953.30
772	3/10/2022	9:59:59 AM	8807.01
773	3/10/2022	1:42:20 PM	8874.61

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
774	3/10/2022	8:38:38 PM	9240.18
775	4/10/2022	8:09:28 AM	8869.85
776	4/10/2022	8:08:35 PM	8792.42
777	8/10/2022	4:55:00 AM	9031.76
778	8/10/2022	9:11:17 AM	9081.41
779	8/10/2022	11:51:47 AM	8883.54
780	8/10/2022	8:57:00 PM	9440.96
781	9/10/2022	12:52:00 AM	9103.34
782	9/10/2022	3:39:00 PM	9023.14
783	9/10/2022	6:58:53 PM	9395.70
784	10/10/2022	12:09:02 AM	9266.56
785	10/10/2022	4:16:13 AM	9333.58
786	10/10/2022	3:32:30 PM	9312.16
787	11/10/2022	3:58:38 AM	9253.16
788	11/10/2022	4:38:16 PM	9157.99
789	12/10/2022	5:16:00 PM	9009.40
790	14/10/2022	12:15:00 PM	8975.79
791	14/10/2022	7:55:03 PM	9236.30
792	15/10/2022	4:23:53 AM	9262.50
793	15/10/2022	8:31:00 AM	9389.57
794	15/10/2022	11:35:51 AM	9246.30
795	15/10/2022	6:16:39 PM	9147.80
796	15/10/2022	9:40:15 PM	9248.39
797	16/10/2022	1:37:16 AM	9219.69
798	16/10/2022	6:56:29 AM	9276.65
799	16/10/2022	10:29:30 PM	9202.98
800	17/10/2022	3:18:06 AM	8961.50
801	17/10/2022	8:43:00 AM	9164.00
802	17/10/2022	7:37:57 PM	9320.59
803	18/10/2022	12:06:42 AM	9102.20
804	18/10/2022	6:05:56 AM	9343.25
805	18/10/2022	11:10:40 AM	9255.13
806	19/10/2022	6:06:50 PM	4485.70
807	19/10/2022	11:33:46 PM	9283.77
808	20/10/2022	3:32:00 AM	4444.60
809	20/10/2022	7:01:04 AM	9240.00
810	20/10/2022	3:08:35 PM	4480.20
811	20/10/2022	7:37:41 PM	9067.14
812	21/10/2022	6:41:00 AM	4307.00
813	21/10/2022	9:45:57 PM	4455.20
814	22/10/2022	12:30:35 AM	4453.70

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
815	22/10/2022	11:13:33 AM	9297.03
816	22/10/2022	1:34:26 PM	4403.40
817	22/10/2022	9:54:59 PM	4329.00
818	23/10/2022	7:50:34 AM	9424.71
819	23/10/2022	3:32:54 PM	4038.90
820	24/10/2022	4:43:30 AM	4329.00
821	24/10/2022	9:04:00 AM	9293.50
822	25/10/2022	12:49:00 AM	4129.50
823	25/10/2022	10:03:02 PM	4428.70
824	25/10/2022	7:46:29 PM	9176.20
825	25/10/2022	2:33:00 PM	9249.71
826	26/10/2022	3:51:01 AM	4451.00
827	27/10/2022	6:13:00 AM	4533.00
828	27/10/2022	2:17:31 PM	9253.10
829	28/10/2022	12:38:15 AM	9285.60
830	30/10/2022	6:48:00 AM	9212.80
831	30/10/2022	9:53:50 AM	9120.50
832	30/10/2022	10:08:35 PM	9045.30
833	31/10/2022	2:20:37 PM	9038.50
834	31/10/2022	8:57:05 PM	9188.50
835	1/11/2022	3:00:00 PM	9117.00
836	1/11/2022	6:00:35 PM	4211.70
837	2/11/2022	3:32:14 AM	9253.80
838	2/11/2022	5:35:05 AM	4220.50
839	2/11/2022	5:37:00 PM	9220.20
840	3/11/2022	3:34:21 PM	4151.20
841	3/11/2022	7:04:30 PM	9166.90
842	4/11/2022	8:33:05 AM	4168.20
843	4/11/2022	11:49:44 AM	9277.60
844	5/11/2022	7:29:00 AM	4244.40
845	6/11/2022	7:20:36 AM	9221.80
846	6/11/2022	12:11:41 PM	9238.70
847	6/11/2022	7:22:00 PM	4220.40
848	6/11/2022	5:19:26 PM	9300.80
849	7/11/2022	6:36:25 AM	9237.50
850	7/11/2022	9:27:15 PM	4253.30
851	8/11/2022	8:56:50 PM	9225.20
852	9/11/2022	3:07:44 AM	9276.00
853	9/11/2022	6:29:14 AM	9177.80
854	9/11/2022	9:04:00 AM	4204.60
855	9/11/2022	6:05:00 PM	8624.00

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
856	10/11/2022	1:34:31 AM	9125.90
857	10/11/2022	5:30:30 AM	9352.48
858	10/11/2022	5:30:00 AM	8953.00
859	10/11/2022	9:17:07 AM	9171.10
860	10/11/2022	12:31:44 PM	9264.60
861	10/11/2022	4:03:32 PM	9296.00
862	10/11/2022	7:57:00 PM	4226.60
863	11/11/2022	1:28:26 AM	9096.70
864	11/11/2022	4:07:01 AM	9176.40
865	11/11/2022	5:53:08 AM	4273.10
866	11/11/2022	1:30:28 PM	9154.20
867	11/11/2022	5:14:29 PM	9237.90
868	11/11/2022	10:02:59 PM	9121.30
869	12/11/2022	1:02:06 AM	9301.50
870	12/11/2022	5:36:28 AM	9199.90
871	12/11/2022	7:56:57 AM	4221.40
872	12/11/2022	3:57:01 PM	9149.50
873	12/11/2022	10:04:47 PM	9272.00
874	13/11/2022	12:55:11 AM	9239.10
875	13/11/2022	3:57:42 AM	9172.50
876	13/11/2022	9:14:00 AM	9291.80
877	13/11/2022	12:14:09 PM	9215.90
878	13/11/2022	3:16:38 PM	9138.50
879	14/11/2022	12:40:59 AM	4265.50
880	13/11/2022	7:02:58 PM	9208.90
881	13/11/2022	10:38:09 PM	9356.40
882	14/11/2022	12:25:17 PM	4242.50
883	14/11/2022	10:39:50 AM	9245.80
884	14/11/2022	5:23:00 PM	9478.80
885	14/11/2022	9:21:50 PM	9195.10
886	15/11/2022	1:10:17 AM	9250.80
887	15/11/2022	3:00:00 AM	4251.90
888	15/11/2022	6:37:14 AM	9347.00
889	15/11/2022	10:55:48 AM	9337.40
890	15/11/2022	2:49:55 PM	9258.80
891	15/11/2022	9:19:00 PM	4217.10
892	15/11/2022	11:53:52 PM	4451.30
893	16/11/2022	3:08:00 AM	9244.00
894	16/11/2022	5:30:22 AM	4401.20
895	16/11/2022	10:10:16 AM	9268.30
896	16/11/2022	12:31:05 PM	4212.50

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
897	16/11/2022	6:42:47 PM	9237.40
898	16/11/2022	9:41:48 PM	4420.60
899	17/11/2022	3:21:09 AM	9311.30
900	17/11/2022	8:57:05 AM	9304.00
901	17/11/2022	12:07:00 PM	9212.16
902	17/11/2022	5:29:00 PM	9212.16
903	17/11/2022	9:11:06 PM	9216.40
904	18/11/2022	3:29:02 AM	4206.40
905	18/11/2022	11:27:00 AM	9121.50
906	18/11/2022	7:51:04 PM	4382.80
907	18/11/2022	10:53:16 PM	9111.40
908	19/11/2022	2:21:42 AM	4024.60
909	19/11/2022	1:16:28 PM	9083.20
910	21/11/2022	8:20:01 AM	9160.40
911	25/11/2022	12:19:29 PM	9144.00
912	25/11/2022	3:41:00 PM	9109.00
913	26/11/2022	8:00:29 AM	4114.10
914	26/11/2022	2:50:24 PM	9249.10
915	26/11/2022	11:19:00 PM	4416.70
916	27/11/2022	1:56:20 AM	9217.80
917	27/11/2022	5:16:18 AM	9177.90
918	27/11/2022	3:10:50 PM	4462.70
919	27/11/2022	1:07:34 PM	9190.60
920	27/11/2022	8:39:00 PM	9201.10
921	28/11/2022	2:30:32 AM	9264.10
922	28/11/2022	5:24:34 AM	9252.70
923	28/11/2022	12:52:11 PM	4430.70
924	28/11/2022	5:24:00 PM	8584.60
925	28/11/2022	8:44:02 PM	9300.10
926	29/11/2022	3:52:45 AM	9159.70
927	29/11/2022	8:59:25 PM	8893.60
928	30/11/2022	1:42:00 AM	9093.10
929	30/11/2022	4:26:00 AM	9055.00
930	30/11/2022	2:33:01 PM	9159.50
931	30/11/2022	9:28:00 PM	9200.00
932	1/12/2022	12:11:52 AM	9208.20
933	1/12/2022	2:55:33 AM	9205.40
934	1/12/2022	6:50:51 PM	9253.60
935	1/12/2022	10:26:00 PM	9073.50
936	2/12/2022	1:44:08 AM	9256.20
937	2/12/2022	12:53:00 PM	9681.40

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
938	2/12/2022	4:43:00 PM	9320.00
939	2/12/2022	8:19:01 PM	9119.50
940	3/12/2022	12:34:37 AM	9366.50
941	3/12/2022	4:25:00 AM	8559.40
942	3/12/2022	9:02:18 AM	9269.20
943	3/12/2022	12:21:11 PM	9223.40
944	3/12/2022	4:35:23 PM	9034.20
945	3/12/2022	10:52:57 PM	9220.20
946	4/12/2022	4:06:38 AM	9239.60
947	4/12/2022	8:21:22 AM	9178.10
948	4/12/2022	12:06:33 PM	9264.90
949	4/12/2022	8:45:51 PM	9274.00
950	5/12/2022	2:58:25 AM	9285.80
951	5/12/2022	6:15:12 AM	9217.00
952	5/12/2022	9:27:34 AM	9209.50
953	5/12/2022	6:43:00 PM	9252.90
954	5/12/2022	10:10:59 PM	4245.10
955	6/12/2022	3:53:39 AM	9259.30
956	7/12/2022	1:15:47 AM	9060.00
957	7/12/2022	12:08:35 PM	4234.70
958	7/12/2022	5:26:00 AM	9262.30
959	7/12/2022	9:59:01 AM	9184.60
960	7/12/2022	11:05:10 PM	4183.80
961	7/12/2022	3:52:55 PM	9280.90
962	7/12/2022	9:21:50 PM	9170.00
963	8/12/2022	4:21:47 PM	4222.80
964	8/12/2022	3:52:05 AM	9261.20
965	8/12/2022	7:04:05 AM	9250.40
966	8/12/2022	10:52:17 AM	9349.20
967	8/12/2022	2:43:59 PM	9182.00
968	8/12/2022	7:34:10 PM	9244.80
969	9/12/2022	2:09:46 AM	9247.10
970	9/12/2022	7:07:05 PM	4212.60
971	9/12/2022	9:51:27 PM	9281.80
972	10/12/2022	6:02:00 AM	4234.90
973	10/12/2022	4:10:59 AM	9249.00
974	10/12/2022	9:07:53 AM	9273.40
975	10/12/2022	12:02:16 PM	9228.40
976	10/12/2022	3:12:49 PM	9295.40
977	11/12/2022	4:21:41 AM	4249.50
978	11/12/2022	2:33:46 AM	9255.70

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
979	11/12/2022	7:32:52 AM	9250.20
980	11/12/2022	3:10:57 PM	4285.40
981	11/12/2022	12:59:17 PM	9253.70
982	11/12/2022	6:07:13 PM	9134.60
983	11/12/2022	10:05:21 PM	9035.40
984	12/12/2022	12:13:54 AM	4270.60
985	12/12/2022	3:34:58 AM	9252.20
986	12/12/2022	6:54:00 AM	9093.20
987	12/12/2022	11:33:00 AM	9068.80
988	12/12/2022	4:54:00 PM	9265.20
989	13/12/2022	12:40:54 AM	9235.90
990	13/12/2022	3:38:55 AM	9259.20
991	13/12/2022	6:39:00 AM	9156.90
992	13/12/2022	10:39:37 AM	9263.70
993	13/12/2022	1:25:33 PM	4246.30
994	13/12/2022	4:46:01 PM	9331.60
995	13/12/2022	8:49:07 PM	9227.70
996	14/12/2022	12:41:14 AM	9173.50
997	14/12/2022	7:26:23 AM	9214.40
998	14/12/2022	2:34:56 PM	9257.20
999	14/12/2022	8:44:50 PM	9243.70
1000	15/12/2022	8:39:22 AM	9201.10
1001	15/12/2022	7:26:19 PM	9203.20
1002	15/12/2022	10:15:17 PM	9191.30
1003	16/12/2022	1:56:46 AM	9254.90
1004	16/12/2022	7:18:21 AM	9250.50
1005	16/12/2022	11:19:07 AM	9281.90
1006	16/12/2022	2:52:44 PM	8946.20
1007	16/12/2022	7:39:59 PM	8988.60
1008	17/12/2022	2:27:15 AM	9251.60
1009	17/12/2022	7:26:44 AM	9232.10
1010	17/12/2022	1:55:29 PM	9227.90
1011	17/12/2022	5:23:13 PM	9207.90
1012	17/12/2022	11:23:01 PM	9217.70
1013	18/12/2022	3:28:27 AM	9222.20
1014	18/12/2022	8:57:00 AM	4200.00
1015	18/12/2022	4:27:49 PM	9231.50
1016	18/12/2022	7:52:00 PM	9279.77
1017	18/12/2022	10:17:34 PM	4248.80
1018	19/12/2022	1:04:42 AM	9262.70
1019	19/12/2022	4:41:36 AM	9276.80

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
1020	19/12/2022	7:29:24 AM	9262.60
1021	19/12/2022	12:12:56 PM	9284.70
1022	19/12/2022	3:55:40 PM	9261.30
1023	19/12/2022	7:15:01 PM	4220.50
1024	19/12/2022	11:46:20 PM	9206.60
1025	20/12/2022	2:57:36 AM	9328.80
1026	20/12/2022	6:59:40 AM	9208.20
1027	20/12/2022	8:41:48 AM	4230.60
1028	20/12/2022	3:15:03 PM	9250.90
1029	20/12/2022	11:20:56 PM	4281.90
1030	21/12/2022	5:20:01 AM	9135.36
1031	21/12/2022	6:15:57 PM	9200.70
1032	21/12/2022	10:34:50 PM	9003.10
1033	22/12/2022	1:42:12 AM	9043.60
1034	22/12/2022	4:56:32 AM	9240.20
1035	22/12/2022	7:48:00 AM	4212.10
1036	22/12/2022	1:20:00 PM	9166.80
1037	22/12/2022	4:32:10 PM	9061.30
1038	22/12/2022	7:25:18 PM	4116.40
1039	23/12/2022	5:12:35 AM	9063.70
1040	23/12/2022	10:56:50 AM	9436.81
1041	23/12/2022	2:33:50 PM	9336.40
1042	23/12/2022	5:41:58 PM	9394.79
1043	24/12/2022	2:03:30 PM	9282.59
1044	26/12/2022	9:35:35 PM	9289.99
1045	27/12/2022	9:54:54 AM	4321.10
1046	27/12/2022	7:33:52 PM	4307.56
1047	28/12/2022	8:09:28 AM	4260.56
1048	28/12/2022	1:29:15 PM	9211.20
1049	29/12/2022	4:54:14 AM	9144.17
1050	29/12/2022	8:07:31 AM	4288.76
1051	29/12/2022	12:22:10 PM	9125.99
1052	29/12/2022	6:21:27 PM	4330.76
1053	30/12/2022	5:35:54 AM	4342.43
1054	30/12/2022	2:55:00 PM	9086.50
1055	30/12/2022	5:40:00 PM	9068.84
1056	30/12/2022	9:21:08 PM	9397.31
1057	31/12/2022	12:10:03 AM	9284.00
1058	31/12/2022	10:47:00 AM	9184.86
1059	31/12/2022	1:51:00 PM	9012.84

Appendix B - Noise Monitoring Results (Spectrum Acoustics, 2022)

Table B.1 Noise Monitoring Results 27 January 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:14pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	11:07pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:28pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:49pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Table B.2 Noise Monitoring Results 23 and 24 February 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:41pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	11:30pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:51pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	12:11pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R7 (Site 7) Spiteri	10:00pm	<20	N/A	N/A	35	Yes	<20	45	Yes	<20	N/A	N/A

Table B.3 Noise Monitoring Results 21 March 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:20pm	25	<30-33	Yes	35	Yes	25	45	Yes	25	40	Yes
R3 (Site 3) W. Bowman	11:17pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:37pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:59pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Table B.4 Noise Monitoring Results 20 April 2021

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:11pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	11:05pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:29pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:49pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Table B.5 Noise Monitoring Results 26 and 27 May 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:41pm	29	<30-33	Yes	35	Yes	<20	45	Yes	29	40	Yes
R3 (Site 3) W. Bowman	11:32pm	<25	<30-34	Yes	35	Yes	<20	45	Yes	25	40	Yes
R3 (Site 5) Camberwell South	11:53pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	12:13am	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R7 (Site 7) Spiteri	10:02pm	<20	N/A	N/A	35	Yes	<20	45	Yes	<20	N/A	N/A

Table B.6 Noise Monitoring Results 23 and 24 June 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:30pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	29	40	Yes
R3 (Site 3) W. Bowman	11:19pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:53pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:40am	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R7 (Site 7) Spiteri	10:30pm	<20	N/A	N/A	35	Yes	<20	45	Yes	<20	N/A	N/A

Table B.7 Noise Monitoring Results 29 July 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:05pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	10:57pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:18pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:37pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Table B.8 Noise Monitoring Results 29 and 30 August 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:35pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	11:26pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:44pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	12:03am	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R7 (Site 7) Spiteri	10:00pm	<20	N/A	N/A	35	Yes-	<20	45	Yes	<20	N/A	N/A

Table B.9 Noise Monitoring Results 27 September 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:00pm	30	<30-33	Yes	35	Yes	33	45	Yes	30	40	Yes
R3 (Site 3) W. Bowman	10:57pm	31	<30-34	Yes	35	Yes	34	45	Yes	31	40	Yes
R3 (Site 5) Camberwell South	11:17pm	27	<30-34	Yes	35	Yes	30	45	Yes	27	40	Yes
R4 (Site 6) Camberwell North	11:38pm	30	<30-34	Yes	35	Yes	32	45	Yes	<20	40	Yes

Table B.10 Noise Monitoring Results 19 October 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:09pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	10:58pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:20pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:40pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Table B.11 Noise Monitoring Results 24 and 25 November 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:41pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	11:33pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:55pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	12:15am	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R7 (Site 7) Spiteri	10.00pm	<20	N/A	N/A	35	Yes	<20	45	Yes	<20	N/A	N/A

Table B.12 Noise Monitoring Results 5 December 2022

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:06pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	10:57pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:16pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:35pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Appendix C - Blast Monitoring Results

Table C.1 Annual Blast Overpressure Monitoring Results

	Bowmans	Camberwell Village	Camberwell Church	Chain of Ponds Hotel	REA 86 Grinding Grooves	Ravensworth Public School	Ravensworth Homestead
Limit	120	120	120	133	N/A	133	126
Limit 5% up to 120 dBL	115	115	115	N/A	N/A	N/A	N/A
EA Prediction	115	115	N/A	N/A	N/A	N/A	115
Min	67.5	67.5	67.5	87.3	N/A	87.3	76.9
Mean	92.8	92.8	92.8	97.9	N/A	97.9	99.9
Max	113.4	113.4	113.4	113.5	N/A	113.5	125.9
Blast Events Exceeding 120 dBL	0	0	0	N/A	N/A	N/A	N/A
Blast Events Exceeding 115dBL	0	0	0	N/A	N/A	N/A	N/A
% > 115 dBL up to 120 dBL	0	0	0	N/A	N/A	N/A	N/A

Table C.2 Annual Vibration Monitoring Results

	Bowmans	Camberwell Village	Camberwell Church	Chain of Ponds Hotel	REA 86 Grinding Grooves	Ravensworth Public School	Ravensworth Homestead
Limit	10	10	10	10	175	10	10
Limit 5% up to 10mm/s	5	5	5	N/A	N/A	N/A	N/A
EA Prediction	5	5	5	N/A	N/A	N/A	N/A
Min	0	0	0	0	0	0	0
Mean	0.1	0.1	0.1	0.2	0.5	0.2	0.11
Max	0.4	0.4	0.4	2.0	5.0	2.0	0.4
Blast events exceeding 10mm/s	0	0	0	0	N/A	0	0
Blast events exceeding 5mm/s	0	0	0	N/A	N/A	N/A	N/A
%> 5mm/s up to 10mm/s	0	0	0	N/A	N/A	N/A	N/A

Appendix D - Air Quality Monitoring Results

Table D.1 Daily PM10 Averages 2022

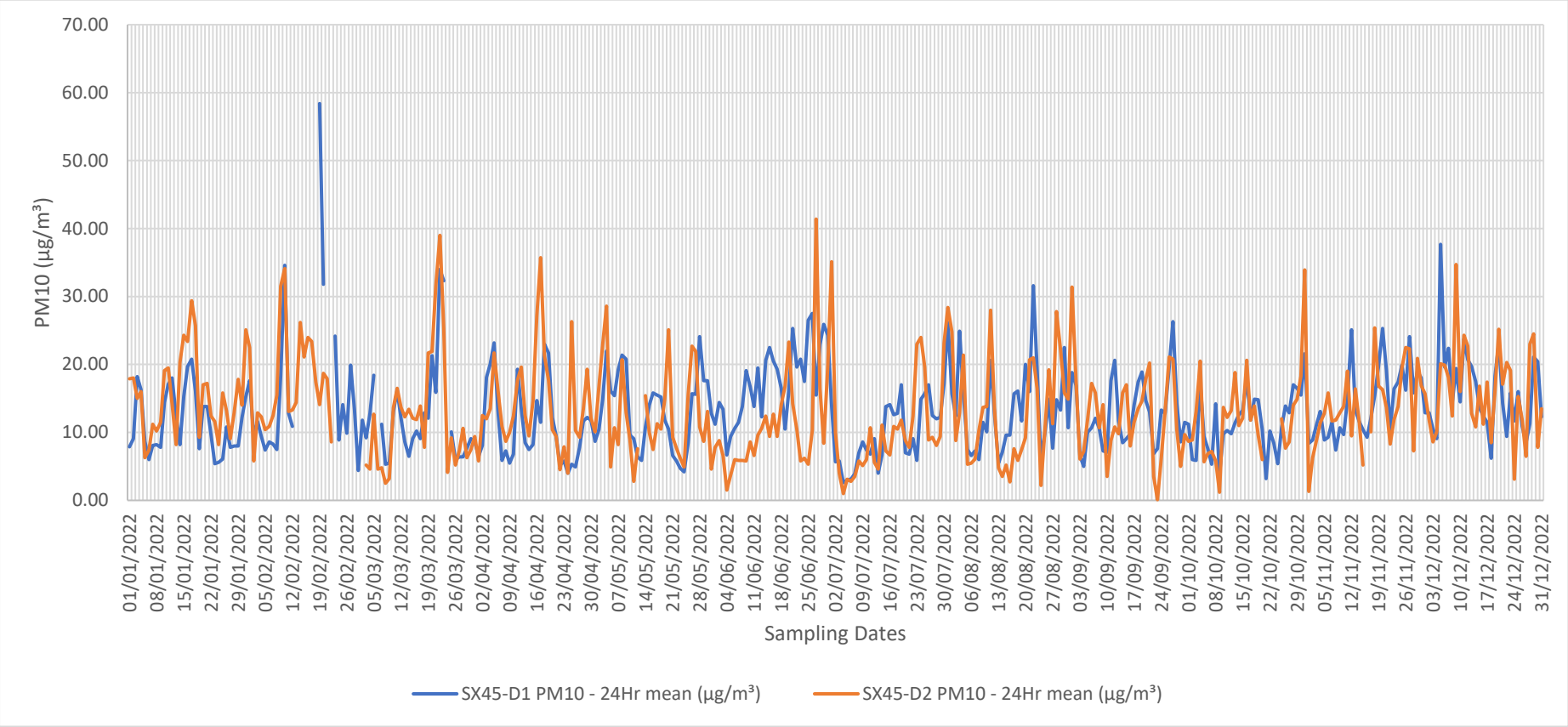


Table D.2 Total Suspended Particulates HVA (Church) 2022 Results

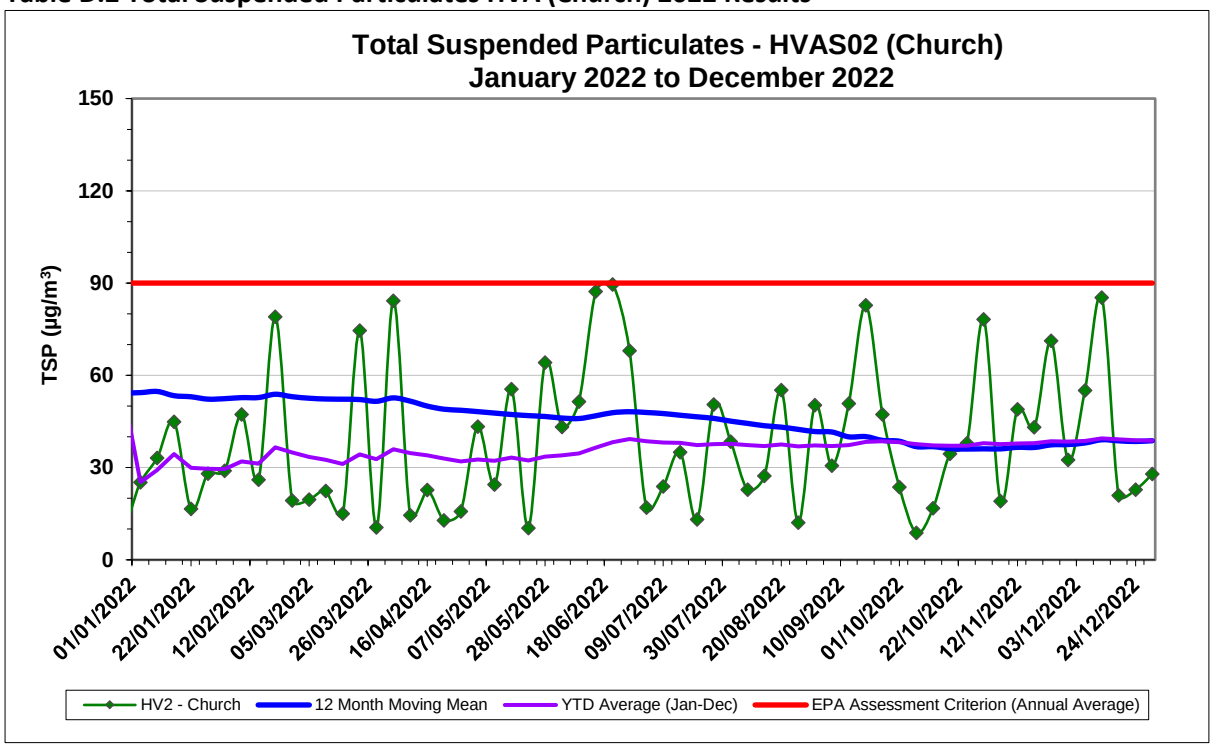


Table D.3 Total Suspended Particulates HVAS04 (Oaklands) 2022 Results

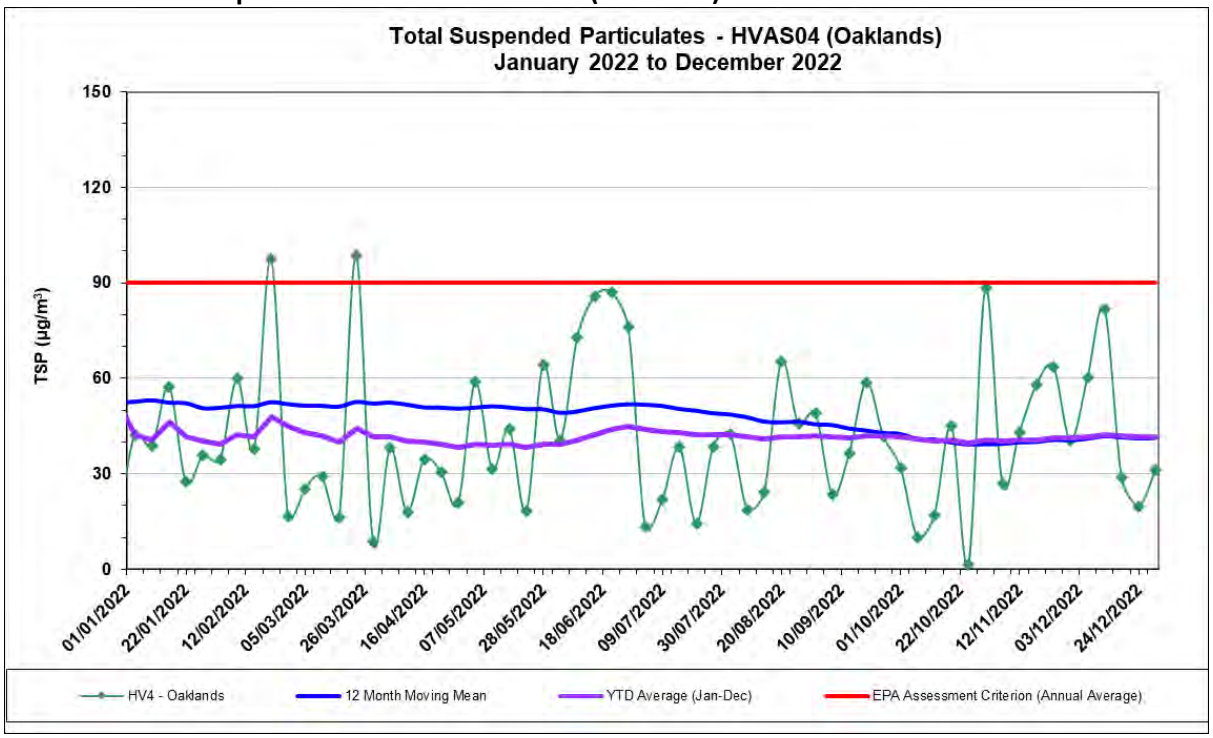


Table D.4 Total Suspended Particulates HVA S05 (Stapleton) 2022 Results

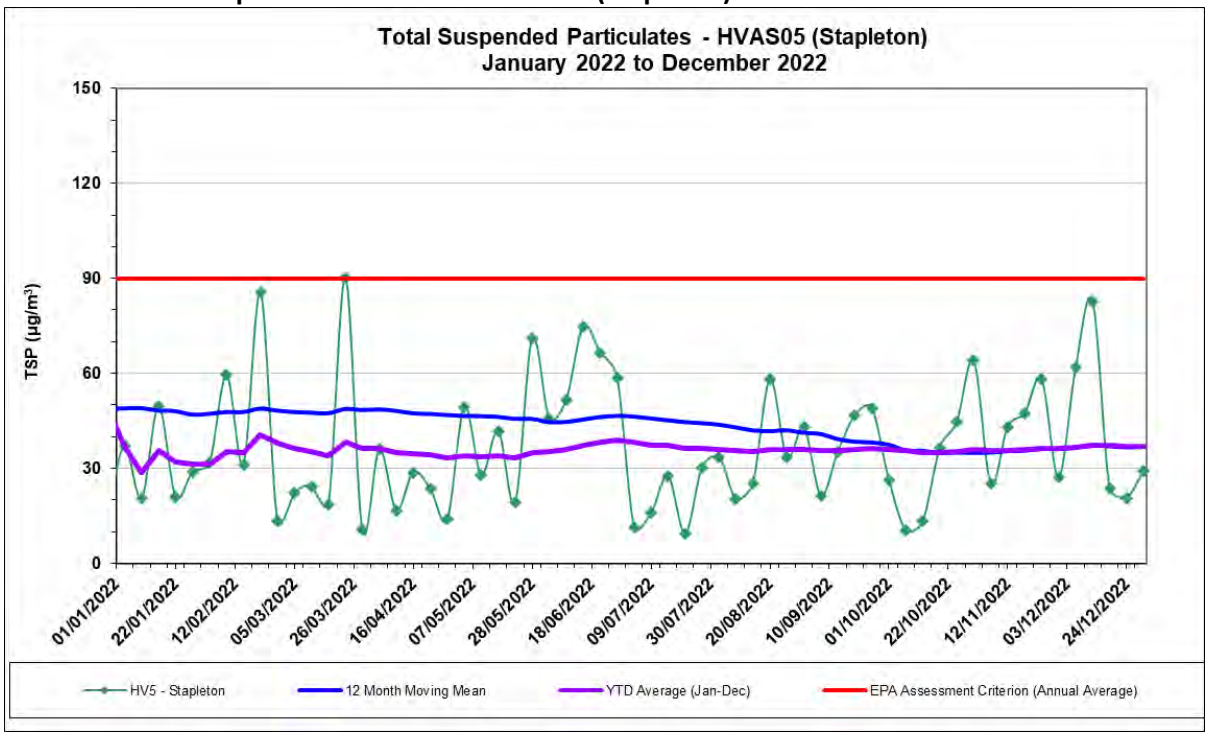


Table D.5 PM10 – HVAS19 (Church) 2022 Results

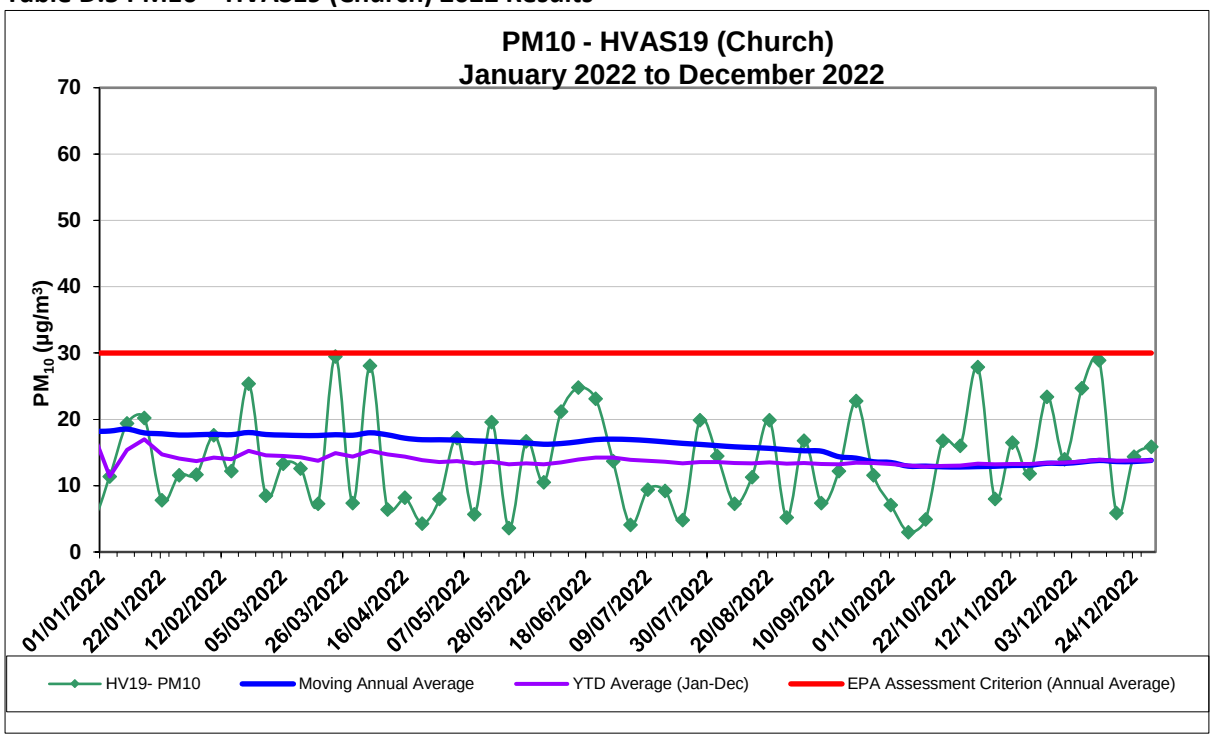


Table D.6 PM_{10} 24 hr Exceedances above 50 µg/m^3 during 2022

Date	TEOM Unit	Result (µg/m^3)
19/2/2022	TEOM D1	58.4

Appendix E - Meteorological Monitoring Results

Table F.1 Meteorological Results 2022

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
01-Jan-22	67.1	23.2	1.8	103.0	0.0	24.6
02-Jan-22	64.5	24.6	2.1	102.0	0.0	22.6
03-Jan-22	65.8	23.6	3.7	118.0	0.0	17.6
04-Jan-22	70.4	23.4	3.7	115.0	0.0	14.9
05-Jan-22	91.9	22.9	3.2	139.0	11.4	15.3
06-Jan-22	78.2	25.1	4.2	116.0	0.2	13.7
07-Jan-22	74.2	26.3	3.1	128.0	0.2	17.7
08-Jan-22	74.4	25.4	0.7	210.0	24.6	23.9
09-Jan-22	79.6	24.6	3.2	126.0	0.2	16.2
10-Jan-22	82.9	25.4	2.0	131.0	0.0	20.1
11-Jan-22	84.5	24.4	1.5	141.0	3.0	25.2
12-Jan-22	76.3	23.4	2.4	119.0	0.2	19.3
13-Jan-22	74.7	23.5	3.2	118.0	0.0	17.5
14-Jan-22	78.8	23.6	1.1	90.0	0.0	28.5
15-Jan-22	74.9	24.9	0.5	307.0	0.6	30.9
16-Jan-22	78.7	24.9	1.9	128.0	0.0	22.2
17-Jan-22	71.3	26.7	1.8	122.0	0.2	26.9
18-Jan-22	89.7	24.0	1.7	124.0	1.4	17.0
19-Jan-22	93.2	20.1	3.4	138.0	19.0	14.4
20-Jan-22	73.8	20.3	4.5	129.0	1.4	14.5

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
21-Jan-22	67.0	21.0	4.0	117.0	0.0	16.2
22-Jan-22	72.9	20.8	2.5	112.0	0.0	17.4
23-Jan-22	71.1	21.4	2.4	112.0	0.0	21.2
24-Jan-22	78.1	21.9	2.9	124.0	0.2	15.7
25-Jan-22	74.1	22.4	1.4	126.0	0.0	29.3
26-Jan-22	69.6	22.5	3.2	113.0	0.0	15.2
27-Jan-22	65.8	23.0	3.0	120.0	0.0	17.9
28-Jan-22	66.9	25.2	2.2	124.0	0.0	23.8
29-Jan-22	69.0	25.4	2.1	132.0	0.0	24.0
30-Jan-22	71.9	24.8	3.4	129.0	0.0	17.6
31-Jan-22	72.9	25.3	1.2	122.0	0.0	30.3
01-Feb-22	71.1	27.2	1.1	247	0	21.6
02-Feb-22	85.5	23.3	1.1	173	4.4	17.5
03-Feb-22	75.2	19.8	2.9	142	0.6	17.0
04-Feb-22	75.9	18.4	3.7	134	5	15.4
05-Feb-22	76.8	19	4	130	6.6	15.9
06-Feb-22	78	19.3	3.8	126	2.2	15.5
07-Feb-22	75.5	19.5	3.2	134	0.4	17.5
08-Feb-22	73.6	20.2	1.7	138	2.8	26.8
09-Feb-22	60.5	23.1	0.9	302	0	29.8
10-Feb-22	52	25.5	0.4	105	0	24.8
11-Feb-22	81.9	21.7	2.6	129	12.8	19.6
12-Feb-22	74.7	21	3.2	118	0.2	15.0

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
13-Feb-22	67.5	21.3	3	120	0	16.9
14-Feb-22	66.9	21.8	1.8	118	0	27.3
15-Feb-22	68.5	22.6	2.1	114	0	23.2
16-Feb-22	69.9	22.4	1.6	113	0	25.5
17-Feb-22	62.6	25.3	1.5	268	0.4	23.0
18-Feb-22	67.6	25.3	0.6	129	2.2	25.9
19-Feb-22	71	21.9	4.2	119	18.6	14.0
20-Feb-22	68.1	23.4	0.7	62	0	30.7
21-Feb-22	58.9	25.9	1.4	255	5.2	23.2
22-Feb-22	85.5	22.5	2.8	134	3.4	18.5
23-Feb-22	83.6	23.1	4.3	112	0	13.0
24-Feb-22	93	23	3.5	123	9.6	13.8
25-Feb-22	84.3	23.5	3.2	123	3.6	14.3
26-Feb-22	85.9	21.7	3.7	128	1.2	13.9
27-Feb-22	87.1	22.1	3.6	127	1.4	14.6
28-Feb-22	84.3	21.9	3.8	120	0	15.4
01-Mar-22	93.6	21	3.5	132	2	14.9
02-Mar-22	87.5	21.8	3.3	133	0.4	14.9
03-Mar-22	93.6	21.4	2.8	167	13.6	15.1
04-Mar-22	91.6	23.3	3.4	144	6	14.4
05-Mar-22	82.2	24.2	1.5	126	0	24.1
06-Mar-22	80.2	22.1	2.2	147	75	21.6
07-Mar-22	82.8	22	2.5	136	42	17.2

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
08-Mar-22	55.1	20.3	0.9	204	72.2	21.4
09-Mar-22	82.1	20.9	0.5	123	7.4	24.6
10-Mar-22	66.4	19.3	2.7	122	0	16.0
11-Mar-22	72.4	19.5	2.5	115	0	17.6
12-Mar-22	71.7	19.8	2.5	113	0	18.7
13-Mar-22	76.8	19.2	1.9	108	0	18.0
14-Mar-22	77.6	20.2	2.2	116	0	18.6
15-Mar-22	76.5	20.6	2.8	120	0.2	17.0
16-Mar-22	77.2	21.4	2.7	117	0	18.0
17-Mar-22	79.4	22.1	1.3	125	0	22.3
18-Mar-22	78.6	22.5	2.2	115	0	20.2
19-Mar-22	85.2	20	2	120	1.4	17.8
20-Mar-22	72.1	20.3	0.8	95	0.2	24.8
21-Mar-22	73.4	20.1	1.6	108	0	20.7
22-Mar-22	70.4	21.8	0.8	352	0	30.7
23-Mar-22	71.1	23.1	0.3	47	13.8	18.5
24-Mar-22	96.7	18.7	3.3	139	24.8	15.5
25-Mar-22	91.8	18.8	2	116	2.4	14.8
26-Mar-22	90.6	18.6	2.5	121	14.4	15.8
27-Mar-22	96.7	18.8	2.3	138	4.2	14.6
28-Mar-22	82.2	20.6	0.8	116	1.2	22.4
29-Mar-22	95.7	20.2	2.3	139	19.6	15.8
30-Mar-22	89.7	20.7	3.2	148	10.2	14.1

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
31-Mar-22	77.8	19.1	3.9	157	1.8	14.7
01-Apr-22	67.3	17.4	2.6	169	0	18.9
02-Apr-22	68.9	17.8	0.8	294	0	26.8
03-Apr-22	64.3	18.9	1.6	275	0	20.4
04-Apr-22	68.8	20.3	1.2	283	0	19.2
05-Apr-22	69.2	20.1	0.8	144	0	23.2
06-Apr-22	80.2	19.9	2.4	114	0	18.7
07-Apr-22	94.5	18.9	3.1	139	8.4	15.7
08-Apr-22	84.8	19.7	3.8	122	1.2	14.1
09-Apr-22	80.9	20.1	3.4	124	0	15.1
10-Apr-22	79.6	20.5	1.1	135	0	27.2
11-Apr-22	75.9	21.6	0.5	286	0	20.7
12-Apr-22	81	19.8	2	130	0	17.4
13-Apr-22	85.6	17.4	3.3	141	2.4	14.5
14-Apr-22	82.5	17.7	2.3	115	0.4	17.6
15-Apr-22	78.5	17.7	0.9	95	0	25.4
16-Apr-22	79.4	17.3	0.8	91	0	23.0
17-Apr-22	76.2	17.4	0.4	32	0	24.6
18-Apr-22	74.5	18.6	0.4	340	0.2	20.3
19-Apr-22	72.4	20	1.4	308	2.8	22.5
20-Apr-22	65.9	18.3	4.1	289	0.2	16.5
21-Apr-22	67.8	17.3	1.3	130	0	22.0
22-Apr-22	94.8	16.1	2.9	138	3.2	14.3

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
23-Apr-22	86.9	16.7	2.8	113	0.2	13.5
24-Apr-22	87.2	16.7	2.1	112	0	16.4
25-Apr-22	83	16.3	1.9	109	0	16.9
26-Apr-22	90.8	16.8	2	120	0	17.6
27-Apr-22	97.3	16.9	0.7	128	4.8	20.5
28-Apr-22	96.5	18.8	0.1	89	1.6	22.6
29-Apr-22	78.1	20.8	0.6	281	0	22.3
30-Apr-22	89.8	18.4	1.9	303	4.8	22.0
01-May-22	84.1	15	0.8	140	0.4	19.4
02-May-22	81.7	15.5	0.9	110	0	20.6
03-May-22	81.9	15.4	0.9	7	0.2	26.3
04-May-22	75.2	17.5	0.6	311	0	20.8
05-May-22	79.2	18.4	1.5	296	2.8	27.8
06-May-22	56.2	15	1.8	272	0	24.2
07-May-22	54.4	13.2	2.8	282	0	21.5
08-May-22	63.5	12.5	1.1	294	0	27.7
09-May-22	81.5	13	1.6	121	0	18.2
10-May-22	84.8	16.8	3.3	123	0	15.3
11-May-22	87.8	17	3.3	135	2.2	14.7
12-May-22	96.3	17.6	2.5	153	5.6	17.2
13-May-22	53.5	18.3	1	118	7	12.7
14-May-22	49.2	19.9	0.7	360	0.4	19.6
15-May-22	66.6	19.8	2.2	317	0	20.9

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
16-May-22	64.9	19.3	2.4	275	0.2	22.0
17-May-22	65.9	16	1.4	294	0	27.2
18-May-22	60.2	14.2	3.4	290	0	16.9
19-May-22	65.2	12.4	0.3	58	0	24.0
20-May-22	90.4	11.5	1.1	86	0.8	19.4
21-May-22	92	14.3	2.2	128	2.2	16.6
22-May-22	96.9	13.8	1.7	130	8.8	17.5
23-May-22	87.5	14.4	1.9	123	0.2	16.2
24-May-22	90.6	14.3	1.7	121	0	19.9
25-May-22	87.5	13.6	0.6	84	0	19.5
26-May-22	89.2	14.6	0.7	48	0	23.3
27-May-22	86.1	14.7	0.5	9	0	24.5
28-May-22	84.3	15.3	2	309	0	26.4
29-May-22	67.9	13	3.3	284	0	22.6
30-May-22	69.7	12.7	3.9	289	6	17.2
31-May-22	69.9	12.5	7.4	276	2.8	12.5
01-Jun-22	60.1	10.3	6.1	282	0	12.3
02-Jun-22	74.5	8.9	1.4	310	0	21.8
03-Jun-22	91.2	8.5	1.1	289	7.8	19.2
04-Jun-22	73.9	11.5	4.8	288	0.2	12.6
05-Jun-22	68.6	11.9	3.7	288	0	15.5
06-Jun-22	61.9	12.2	7.1	283	0.8	12.2
07-Jun-22	62.9	11.3	5	282	0	12.8

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
08-Jun-22	62.7	9.6	5	290	0	11.7
09-Jun-22	57.1	10.3	5.3	286	0	12.1
10-Jun-22	61.3	11.8	4.9	287	0	12.5
11-Jun-22	62.5	11.3	4.8	290	0	12.0
12-Jun-22	56.8	11	5.8	287	0	11.9
13-Jun-22	72.1	9.5	1.1	328	0	23.3
14-Jun-22	81.9	8.8	0.7	319	0	18.2
15-Jun-22	66.9	11.9	1.5	284	0	21.0
16-Jun-22	60.9	14.2	2.1	279	0	22.0
17-Jun-22	72.9	12.7	1.5	307	0	24.2
18-Jun-22	77.5	12.5	0.3	356	0	24.2
19-Jun-22	84.7	13.5	0.9	85	0.2	18.9
20-Jun-22	88.5	12.4	0.7	51	0.8	23.6
21-Jun-22	77.3	12.9	1.7	305	0.2	22.1
22-Jun-22	69.6	12.3	1.1	312	0	24.8
23-Jun-22	66.3	11.6	2.1	293	0	23.5
24-Jun-22	60.8	13.4	4.2	292	0	16.1
25-Jun-22	63.6	13.5	1.7	300	0	23.5
26-Jun-22	67.9	13	1.5	313	0	24.4
27-Jun-22	63.3	12	0.1	125	0	24.3
28-Jun-22	78.6	9.6	0.8	78	0	21.2
29-Jun-22	81.7	11.4	1.1	321	0	22.2
30-Jun-22	71.1	13.4	0.3	349	0	20.9

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
01-Jul-22	82.3	11.6	1.6	122	0	16.4
02-Jul-22	98.2	12.2	0.5	33	8.2	14.6
03-Jul-22	91.9	12.8	2.1	291	55.6	20.2
04-Jul-22	98.7	12.2	2.6	310	39.2	23.9
05-Jul-22	90.6	14.2	3.4	135	47.8	15.9
06-Jul-22	99.7	14.2	3.9	163	23.2	12.8
07-Jul-22	90.2	14.1	1.2	287	4.6	15.6
08-Jul-22	69.1	10.1	4.2	291	0	17.6
09-Jul-22	69.5	10.5	2.3	293	0	21.4
10-Jul-22	88.6	9.5	1.3	308	5.4	21.9
11-Jul-22	88.5	10.7	0.6	48	0.2	22.9
12-Jul-22	91	9.3	0.8	323	3	24.2
13-Jul-22	75.9	10.7	1.4	268	0.2	27.8
14-Jul-22	73.4	10.7	1	177	0	22.7
15-Jul-22	82.8	8.8	1	325	0.2	18.4
16-Jul-22	67.6	10.4	1.1	307	0	20.9
17-Jul-22	52.7	15.3	4.9	293	0	13.3
18-Jul-22	54.1	12.7	3.9	282	0	16.7
19-Jul-22	83.9	8.5	1.4	104	0.8	16.2
20-Jul-22	83.6	11.1	2.4	112	0.2	15.2
21-Jul-22	77.4	12.8	3.5	119	0	14.0
22-Jul-22	81.3	13.6	2.9	121	0.4	15.5
23-Jul-22			NaN	NaN	NaN	13.3

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
24-Jul-22			NaN	NaN	NaN	
25-Jul-22	83.2	11.6	0.9	352	0.2	13.6
26-Jul-22	76.1	11.9	3.2	277	4.2	17.9
27-Jul-22	59.3	11.3	3.8	294	0	17.6
28-Jul-22	64	12.1	2	295	0	28.3
29-Jul-22	64.3	11.6	0.2	318	0	29.8
30-Jul-22	76.1	8.5	0.6	59	0	21.7
31-Jul-22	79.6	9.7	0.7	27	0	25.6
01-Aug-22	85.4	12.5	2.4	299	4.8	17.3
02-Aug-22	67.3	12.1	1.1	297	0	21.8
03-Aug-22	74	14.9	1.6	311	0	24.3
04-Aug-22	87.3	16.3	1.5	292	31.8	22.3
05-Aug-22	74.2	17.5	4	283	0	14.9
06-Aug-22	60.3	14.7	4.5	277	1.4	12.9
07-Aug-22	70.8	11.6	1.5	292	3	28.8
08-Aug-22	80.1	10.8	0.5	2	0	25.8
09-Aug-22	80.1	10.8	0.5	147	0	20.8
10-Aug-22	78.1	12.1	1.1	97	0	25.9
11-Aug-22	87.8	12	0.5	68	0	23.8
12-Aug-22	94.5	12.7	0.8	314	14.8	24.7
13-Aug-22	78.5	13.1	2.5	279	5.4	19.5
14-Aug-22	68.1	11.8	4.7	283	0	12.9
15-Aug-22	63.2	12.9	4.8	279	0	13.1

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
16-Aug-22	66.8	12.1	2.6	282	0	17.1
17-Aug-22	70.9	12	1.1	333	0	28.4
18-Aug-22	59.7	14.6	2.9	294	0	16.5
19-Aug-22	55.9	15.4	3.1	268	0	20.27
20-Aug-22	58.6	12.8	3.3	285	0	20.8
21-Aug-22	70.2	12.6	0.5	84	0	30.1
22-Aug-22	68.6	13.2	2.7	299	0	19.5
23-Aug-22	70.8	13.9	3.1	285	7.2	22.2
24-Aug-22	62.8	10.8	2.6	284	3.2	23.9
25-Aug-22	63.3	12.1	2.4	299	0	17.2
26-Aug-22	84.7	12.2	1.2	71	0	18.8
27-Aug-22	79	13.9	1.6	116	0	21.9
28-Aug-22	77.6	15.1	1.1	109	0	24.9
29-Aug-22	84.5	14.3	0.3	54	0.4	23.4
30-Aug-22	80	16.5	2.3	313	0	22.6
31-Aug-22	74.8	14.9	1.8	120	0	23.6
01-Sep-22	78.5	15.2	0.3	2	0	26.2
02-Sep-22	86.3	13.7	0.5	122	5.4	26.7
03-Sep-22	88.9	11.6	4.1	157	10.4	13.3
04-Sep-22	81.5	12.6	3.3	148	1.6	15.4
05-Sep-22	73.5	12.6	1.1	91	0.2	22.4
06-Sep-22	76.8	12.5	1.8	117	0	20.1
07-Sep-22	79.5	12.6	1.2	101	0	25.3

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
08-Sep-22	76.5	15.2	0.7	97	0.2	26.7
09-Sep-22	81.9	15.3	0.7	270	2.8	28.3
10-Sep-22	70.8	15.7	4.5	269	2.4	13.7
11-Sep-22	59.6	15.1	3.9	272	0	14.5
12-Sep-22	52.6	14.6	3.3	271	0	16.5
13-Sep-22	60.5	13.7	0.8	99	0	25.5
14-Sep-22	69.3	13.5	2.1	108	0	22.9
15-Sep-22	88.8	13	0.6	154	19.4	31.0
16-Sep-22	62.4	17	4	274	11.4	14.6
17-Sep-22	49.8	17.8	3.6	261	0.2	18.5
18-Sep-22	46.6	17.1	5.6	267	0	13.3
19-Sep-22	49	17.1	3.5	262	0	17.0
20-Sep-22	69.7	14.7	1.4	120	0	27.1
21-Sep-22	87.4	15.2	0.6	101	7.8	26.4
22-Sep-22	84.6	15.8	3.4	109	17	15.6
23-Sep-22	88.7	16.8	2.2	120	0.2	19.1
24-Sep-22	83.6	16.9	1.1	293	0.8	24.4
25-Sep-22	62.4	16.5	1.9	278	0.2	25.2
26-Sep-22	71.5	15.1	0.5	277	0	29.9
27-Sep-22	75.8	16.2	0.4	131	0.2	25.9
28-Sep-22	64.7	16.7	2.4	256	2	25.3
29-Sep-22	74.7	15.2	1.1	189	2.8	25.6
30-Sep-22	80.5	15.2	3.6	142	7	16.9

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
01-Oct-22	77.3	14.1	3.2	122	0.2	15.6
02-Oct-22	76.3	13.6	1.2	108	0.6	29.8
03-Oct-22	73	13.1	1.2	86	0.2	23.7
04-Oct-22	64.4	15.7	0.8	102	0	28.1
05-Oct-22	89.1	14.8	3.5	121	11.8	14.6
06-Oct-22	89.6	15.9	1.5	138	1	21.7
07-Oct-22	62.7	15.6	0.3	162	23.4	28.1
08-Oct-22	61.7	18.7	0.2	184	19.8	26.3
09-Oct-22	79	14.7	2	117	3.2	19.1
10-Oct-22	75.2	14.8	3.3	110	0	16.7
11-Oct-22	71	15.9	3	110	0	15.9
12-Oct-22	76.3	15.7	2.6	116	0	20.3
13-Oct-22	71.5	17.6	1.4	135	0	27.6
14-Oct-22	67.9	18.8	3.5	255	3.6	20.3
15-Oct-22	57.5	17.5	0.2	219	0	36.7
16-Oct-22	69.2	17.6	0.3	164	0	32.9
17-Oct-22	73.4	17.4	3.7	133	0	16.3
18-Oct-22	78.9	18.3	2.8	118	0	18.2
19-Oct-22	90.5	18.9	0.8	115	8.2	25.4
20-Oct-22	99	18.9	2.6	132	16.6	16.2
21-Oct-22	92.1	19.4	1.5	112	9.6	24.1
22-Oct-22	87.8	19.9	0.7	120	12.2	27.4
23-Oct-22	83.6	19.9	1.8	111	3.4	20.4

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
24-Oct-22	86.8	19.5	2.3	125	0	19.9
25-Oct-22	78.5	20.7	2.9	291	2.6	19.6
26-Oct-22	54.1	23.1	5.1	272	0.2	12.3
27-Oct-22	60.7	22.1	3.2	271	8.6	17.2
28-Oct-22	49.9	19.6	5.5	268	0.2	14.3
29-Oct-22	43.4	19.5	4.9	271	0	13.5
30-Oct-22	52.4	19	1.4	267	0	25.5
31-Oct-22	74.4	20.4	3.1	282	13	20.7
01-Nov-22	61.7	18.1	6.6	266	34.8	13.4
02-Nov-22	52.3	13.4	7	260	0.2	13.3
03-Nov-22	55.9	15.2	1.2	263	0	19.2
04-Nov-22	72.7	16.3	3	107	0	16.8
05-Nov-22	69	16.9	2.8	108	0	19.9
06-Nov-22	71.4	17.8	1.6	108	0	28.2
07-Nov-22	74.8	18.2	1.9	91	0	22.1
08-Nov-22	71.5	18	1.9	93	0	25.6
09-Nov-22	67.9	18	2.8	99	0	19.8
10-Nov-22	64.6	18.1	2.4	100	0	23.5
11-Nov-22	74.6	18	0.5	238	0	29.3
12-Nov-22	77.3	20.9	0.2	84	3.8	37.9
13-Nov-22	81.1	19.2	0.6	317	25.4	28.9
14-Nov-22	53	22.9	5.3	264	17.8	16.6
15-Nov-22	52.6	20.5	3.3	254	0	19.1

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
16-Nov-22	44.3	16.4	3.1	226	0	23.9
17-Nov-22	52.1	15.2	0.6	80	0	33.2
18-Nov-22	64	16.2	1.5	94	0	28.8
19-Nov-22	61.2	19.9	0.8	303	0	28.0
20-Nov-22	45.5	22.9	4.9	253	0	19.5
21-Nov-22	36.1	20.4	5.6	255	0	14.9
22-Nov-22	37.3	17.5	5	253	0	15.6
23-Nov-22	44.1	20.4	3.9	268	0	18.2
24-Nov-22	54.4	21	0.7	190	0	23.5
25-Nov-22	60	21.9	0.9	238	0	29.4
26-Nov-22	69.9	19.7	1.4	94	0	27.4
27-Nov-22	57.5	23.2	1.7	297	4.6	24.2
28-Nov-22	74.9	21.7	1.9	128	0.2	26.1
29-Nov-22	65.3	20.7	1.9	98	0	27.9
30-Nov-22	62.9	18.8	3.8	105	0	16.9
01-Dec-22	66.7	17.9	3.3	108	0	16.5
02-Dec-22	68.1	18.6	3.7	105	0	16.1
03-Dec-22	65.9	19.4	2.6	99	0	20.2
04-Dec-22	64.9	19.2	1.9	89	0	24.6
05-Dec-22	53.8	24.3	2.6	269	0	21.9
06-Dec-22	63.1	22.8	2.4	106	0.2	24.4
07-Dec-22	64.9	20.5	2.9	266	0.6	20.2
08-Dec-22	54.9	20.2	1.9	237	0.2	17.2

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
09-Dec-22	59.4	17.2	2.5	100	0	22.5
10-Dec-22	63.8	18.1	3.7	107	0	16.2
11-Dec-22	57.3	23	1	295	0	26.0
12-Dec-22	52.6	23.8	3.9	266	21.4	18.5
13-Dec-22	35.5	20.9	3.2	257	0	21.8
14-Dec-22	37.4	19.9	3.3	239	0	20.6
15-Dec-22	43.5	18.2	0	91	0	30.9
16-Dec-22	55.2	17	3.3	102	0	18.5
17-Dec-22	58.9	17.5	3.2	101	0	16.7
18-Dec-22	74.2	16.3	2.7	106	0.4	17.9
19-Dec-22	62.1	16.8	3	109	1.2	19.3
20-Dec-22	59.7	17.1	2.5	103	0	20.1
21-Dec-22	60.8	18	2.3	103	0	25.2
22-Dec-22	68	19	1.5	116	2.4	24.7
23-Dec-22	57.8	21.7	1	270	0.2	22.5
24-Dec-22	65.4	24.6	1	257	8	23.5
25-Dec-22	63.7	25.8	1.3	103	0	24.9
26-Dec-22	54.4	26.1	2.6	88	0	21.1
27-Dec-22	64.2	24	3.3	103	0	21.6
28-Dec-22	60.6	25.2	1.4	127	0	31.8
29-Dec-22	70.7	23.1	3.2	129	0	18.5
30-Dec-22	70.6	23.4	4.2	111	0	16.9
31-Dec-22	72	23.4	3.4	117	0	20.4

Appendix F - Surface Water Monitoring Results

A summary of water quality results (pH, EC, TDS and TSS) for the Ravensworth Complex sampling program reported by Glencore 2022 are presented in Tables F1 – F13 along with analysis (minimum, maximum and average) and time-series charts.

Table F 1 2022 Bowmans Creek EPL 3 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
7/01/2022	7.93	744	483	13
2/02/2022	7.79	870	516	15
2/03/2022	7.93	874	544	17
6/04/2022	7.84	635	401	13
4/05/2022	7.94	884	568	6
1/06/2022	8.00	929	543	7
13/07/2022	7.78	484	328	10
3/08/2022	8.00	824	474	5
7/09/2022	7.96	478	319	12
12/10/2022	7.88	409	262	22
7/11/2022	7.84	583	363	10
7/12/2022	7.87	834	484	10

Table F 2 2022 Bowmans Creek EPL 4 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
7/01/2022	7.92	762	500	16
2/02/2022	7.81	896	515	15
2/03/2022	7.9	887	521	22
6/04/2022	7.84	644	388	8
4/05/2022	7.94	893	537	7
1/06/2022	8	927	533	8
13/07/2022	8.22	1650	1090	10
3/08/2022	8.38	2010	1170	5
7/09/2022	8.47	1920	1100	20
12/10/2022	8.56	3180	1900	28
7/11/2022	8.49	2910	1800	12
7/12/2022	7.88	838	490	11

Table F 3 2022 Bayswater Creek ROC W114 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
7/01/2022	7.97	3580	2770	10
2/02/2022	8.09	5420	3330	21
2/03/2022	8.18	4980	3480	20
6/04/2022	8.28	2740	2050	5
4/05/2022	7.92	3340	2470	18
1/06/2022	7.63	4200	2790	50
13/07/2022	8.33	2690	1830	6
3/08/2022	8.18	2820	1800	8
7/09/2022	8.07	4120	2540	7
12/10/2022	8.11	2690	1690	14
7/11/2022	8.26	2880	1890	7
7/12/2022	8.19	5420	3500	63

Table F 4 2022 Bayswater Creek ROC W115 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
7/01/2022	8.35	3970	3040	20
2/02/2022	8.48	5800	3720	68
2/03/2022	8.54	5800	3900	33
6/04/2022	8.35	2750	2100	5
4/05/2022	8.44	3360	2380	6
1/06/2022	8.32	3540	2410	10
13/07/2022	8.31	2710	1820	6
3/08/2022	8.24	2840	1820	6
7/09/2022	8.43	3570	2290	5
12/10/2022	8.12	2670	1740	23
7/11/2022	8.28	2880	1930	9
7/12/2022	8.59	5720	3720	12

Table F 5 2022 Bayswater Creek RUM W110 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
12/01/2022	8.5	4850	2910	5
9/02/2022	8.2	6020	4030	5
30/03/2022	8.3	2930	1930	9
20/04/2022	8.4	3140	2230	5
11/05/2022	8.2	4930	3540	5
15/06/2022	8.20	6060	4140	5
13/07/2022	8.50	2860	1800	11
15/08/2022	8.40	3110	1660	8
28/09/2022	8.5	5520	3800	5
12/10/2022	8.1	2650	1920	5
9/11/2022	8.4	2810	1890	5
13/12/2022	8.1	6240	4270	12

Table F 6 2022 Bayswater Creek RUM W111 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
12/01/2022	8	3080	2080	5
9/02/2022	8.5	5790	3680	19
30/03/2022	8.3	2500	1630	21
20/04/2022	8.3	3520	2460	8
11/05/2022	8.2	3940	2560	5
15/06/2022	8.3	3830	2440	5
13/07/2022	8.4	2900	1810	9
15/08/2022	8.4	3110	2000	7
28/09/2022	8.1	5190	3590	5
12/10/2022	8.1	2640	1940	8
9/11/2022	8.4	3000	2020	5
13/12/2022	8.3	5200	3440	70

Table F 7 2022 Davis Creek 152 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
16/02/2022	8.11	8890	5870	5
16/03/2022	7.53	5200	3390	11
27/04/2022	7.55	7310	4720	14
22/06/2022	7.75	7700	4850	5
20/07/2022	7.46	6420	3790	10
24/08/2022	7.45	6240	3480	5
19/10/2022	7.49	6370	3990	17
24/11/2022	7.49	7020	4330	6
19/12/2022	7.72	7530	4790	14

Table F 8 2022 Davis Creek 164 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
16/03/2022	8.09	678	512	93
20/07/2022	7.76	827	521	144
24/08/2022	7.87	685	490	138

Table F 9 2022 Emu Creek W122 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
7/01/2022	7.81	311	266	9
2/02/2022	7.74	351	340	8

Table F 10 2022 Pikes Gully Creek W135 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
16/02/2022	7.79	5230	3880	14
16/03/2022	7.94	2820	2130	5
27/04/2022	7.84	4950	3620	5
22/06/2022	8.03	8540	6960	6
20/07/2022	8.44	6310	4520	5
24/08/2022	8.26	5370	3620	5
19/10/2022	8.08	6400	4360	7
24/11/2022	8.21	7560	5310	12
19/12/2022	8.14	9670	6740	19

Table F 11 2022 Pikes Gully Creek W136 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
16/02/2022	8.17	11500	9110	5
16/03/2022	8.21	8490	6700	5
27/04/2022	8.18	15500	12600	6
22/06/2022	8.26	18400	15800	10
20/07/2022	8.22	9720	7100	11
24/08/2022	8.07	12400	9630	10
19/10/2022	8.08	9210	6360	10
24/11/2022	8.24	7370	5140	5
19/12/2022	8.33	9070	6550	8

Table F 12 2022 Pikes Gully Creek W137 pH, EC, TDS and TSS

Date	pH (pH unit)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
16/03/2022	7.51	14200	12600	20
27/04/2022	7.56	12200	11300	32
22/06/2022	7.5	12100	11700	31
20/07/2022	7.38	11100	9270	20
19/10/2022	7.22	11300	9530	21
24/11/2022	7.35	11700	9420	28

Legend for Tables F.13, 14, 15, 16

	Indicates non-sampling month
Red text	Indicates and exceedance of the IAC range
	Dry/insufficient water or unable to access site

Table F 13 2022 Watercourse pH Monitoring Results

Watercourse pH Monitoring Results for 2022													
Site	IAC Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EPL3 – Bowmans Creek Upstream	7.7 - 8.1	7.93	7.79	7.93	7.84	7.94	8.00	7.78	8.00	7.96	7.88	7.84	7.87
EPL4 – Bowmans Creek Downstream		7.92	7.81	7.90	7.84	7.94	8.00	8.22	8.38	8.47	8.56	8.49	7.88
W114 - Bayswater Creek Upstream	7.7 - 8.5	7.97	8.09	8.18	8.28	7.92	7.63	8.33	8.18	8.07	8.11	8.26	8.19
W115 - Bayswater Creek Downstream		8.35	8.48	8.54	8.35	8.44	8.32	8.31	8.24	8.43	8.12	8.28	8.59
W10 - Bayswater Creek Upstream	6.5 – 8.0	8.50	8.20	8.30	8.40	8.20	8.20	8.50	8.40	8.50	8.10	8.40	8.10
W11 - Bayswater Creek Downstream		8.00	8.50	8.30	8.30	8.20	8.30	8.40	8.40	8.10	8.10	8.40	8.30
W122 - Emu Creek Downstream	7.4 - 8.2	7.81	7.74										
W152 - Davis Creek 2	7.5 – 8.3		8.11	7.53	7.55		7.75	7.46	7.45		7.49	7.49	7.72
W164 - Davis Creek Down				8.09				7.76	7.87				
W135 - Pikes Gully Upstream	7.8 – 8.3		7.79	7.94	7.84		8.03	8.44	8.26		8.08	8.21	8.14
W136 - Pikes Gully @ New England Highway			8.17	8.21	8.18		8.26	8.22	8.07		8.08	8.24	8.33
W137 - Pikes Gully Road @ CHPP Culvert				7.51	7.56		7.50	7.38			7.22	7.35	

Table F 14 2022 Watercourse EC Monitoring Results

Watercourse EC (µS/cm) Monitoring Results for 2022													
Site	IAC Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EPL3 – Bowmans Creek Upstream	1,331	744	870	874	635	884	929	484	824	478	409	583	834
EPL4 – Bowmans Creek Downstream		762	896	887	644	893	927	1,650	2,010	1,920	3,180	2,910	838
W114 - Bayswater Creek Upstream	4,882	3,580	5,420	4,980	2,740	3,340	4,200	2,690	2,820	4,120	2,690	2,880	5,420
W115 - Bayswater Creek Downstream		3,970	5,800	5,800	2,750	3,360	3,540	2,710	2,840	3,570	2,670	2,880	5,720
W10 - Bayswater Creek Upstream	125 – 2,200	4,850	6,020	2,930	3,140	4,930	6,060	2,860	3,110	5,520	2,650	2,810	6,240
W11 - Bayswater Creek Downstream		3,080	5,790	2,500	3,520	3,940	3,830	2,900	3,110	5,190	2,640	3,000	5,200
W122 - Emu Creek Downstream	3,336	311	351										
W152 - Davis Creek 2	7,378		8,890	5,200	7,310		7,700	6,420	6,240		6,370	7,020	7,530
W164 - Davis Creek Down				678				827	685				
W135 - Pikes Gully Upstream	13,832		5,230	2,820	4,950		8,540	6,310	5,370		6,400	7,560	9,670
W136 - Pikes Gully @ New England Highway			11,500	8,490	15,500		18,400	9,720	12,400		9,210	7,370	9,070
W137 - Pikes Gully Road @ CHPP Culvert				14,200	12,200		12,100	11,100			11,300	11,700	

Table F 15 2022 Watercourse TDS Monitoring Results

Watercourse TDS (mg/L) Monitoring Results for 2022													
Site	IAC Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EPL3 – Bowmans Creek Upstream	817	483	516	544	401	568	543	328	474	319	262	363	484
EPL4 – Bowmans Creek Downstream		500	515	521	388	537	533	1,090	1,170	1,100	1,900	1,800	490
W114 - Bayswater Creek Upstream	3,216	2,770	3,330	3,480	2,050	2,470	2,790	1,830	1,800	2,540	1,690	1,890	3,500
W115 - Bayswater Creek Downstream		3,040	3,720	3,900	2,100	2,380	2,410	1,820	1,820	2,290	1,740	1,930	3,720
W10 - Bayswater Creek Upstream	Nil	2,910	4,030	1,930	2,230	3,540	4,140	1,800	1,660	3,800	1,920	1,890	4,270
W11 - Bayswater Creek Downstream		2,080	3,680	1,630	2,460	2,560	2,440	1,810	2,000	3,590	1,940	2,020	3,440
W122 - Emu Creek Downstream	2,014	266	340										
W152 - Davis Creek 2	4,630		5,870	3,390	4,720		4,850	3,790	3,480		3,990	4,330	4,790
W164 - Davis Creek Down				512				521	490				
W135 - Pikes Gully Upstream	10,818		3,880	2,130	3,620		6,960	4,520	3,620		4,360	5,310	6,740
W136 - Pikes Gully @ New England Highway			9,110	6,700	12,600		15,800	7,100	9,630		6,360	5,140	6,550
W137 - Pikes Gully Road @ CHPP Culvert				12,600	11,300		11,700	9,270			9,530	9,420	

Table F 16 2022 Watercourse TSS Monitoring Results

Watercourse TSS (mg/L) Monitoring Results for 2022													
Site	IAC Values	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EPL3 – Bowmans Creek Upstream	18	13.00	15.00	17.00	13.00	6.00	7.00	10.00	5.00	12.00	22	10.00	10.00
EPL4 – Bowmans Creek Downstream		16.00	15.00	22	8.00	7.00	8.00	10.00	5	20	28	12.00	11.00
W114 - Bayswater Creek Upstream	23	10.00	21.00	20.00	<5.00	18.00	50	6.00	8.00	7.00	14.00	7.00	63
W115 - Bayswater Creek Downstream		20.00	68	33	<5.00	6.00	10.00	6.00	6.00	<5.00	23.00	9.00	12.00
W10 - Bayswater Creek Upstream	Nil	<5.00	<5.00	9.00	<5.00	<5.00	<5.00	11.00	8.00	<5.00	5.00	<5.00	12.00
W11 - Bayswater Creek Downstream		<5.00	19.00	21.00	8.00	<5.00	<5.00	9.00	7.00	5.00	8.00	<5.00	70.00
W122 - Emu Creek Downstream	47	9.00	8.00										
W152 - Davis Creek 2	31		<5.00	11.00	14.00		<5.00	10.00	<5.00		17.00	6.00	14.00
W164 - Davis Creek Down				93				144	138				
W135 - Pikes Gully Upstream	32		14.00	<5.00	<5.00		6.00	5.00	<5.00		7.00	12.00	19.00
W136 - Pikes Gully @ New England Highway			<5.00	<5.00	6.00		10.00	11.00	10.00		10.00	<5.00	8.00
W137 - Pikes Gully Road @ CHPP Culvert				20.00	32.00		31.00	20.00			21.00	28.00	

Appendix G - Groundwater Monitoring Results

Table G 1 Site Specific Values for Groundwater pH and EC

Site Specific Criteria Values for pH and EC			
Monitoring Location	**Target**	**Water Quality Parameter**	**IAC**
Coffey Dam Borehole	Liddell	pH	9.2 - 10.0
		EC (µS/cm)	1360
CS4641C	Pikes Gully	pH	8.8 - 11.9
		EC (µS/cm)	8900
NPZ1 Mid	Bayswater	pH	6.6 - 6.8
		EC (µS/cm)	15015
NPZ1 Tall	Lemington	pH	7.0 - 7.3
		EC (µS/cm)	9736
TPZ2 Tall	Lemington	pH	8.3 - 8.4
		EC (µS/cm)	9765
NPZ5B P1	Broonies	pH	7.2 - 7.4
		EC (µS/cm)	6340
NPZ5B P2	Bayswater Creek Alluvium	pH	7.1 - 7.3
		EC (µS/cm)	2193
NPZ6 Tall	Broonies	pH	7.5 - 7.7
		EC (µS/cm)	7120
NPZ7 Small	Hunter River Alluvium	pH	7.3 - 7.4
		EC (µS/cm)	5259
NPZ7 Mid	Broonies	pH	7.3 - 7.7
		EC (µS/cm)	8446
NPZ7 Tall	Bayswater	pH	7.4 - 7.5
		EC (µS/cm)	8678
WPP1	-	pH	7.0 - 7.1
		EC (µS/cm)	8604
WPP2	-	pH	7.0 - 7.3
		EC (µS/cm)	9352

Table G 2 Water Quality Statistics Summary 2022

Groundwater Quality 2022 Statistics Summary								
Monitoring Location	Target	pH			Electrical Conductivity			No. of Samples
		Min	Max	Mean	Min	Max	Mean	
Coffey Dam Borehole	Liddell	7.1	7.5	7.3	6230.0	7070.0	6678.3	6
CS4641C	Pikes Gully	7.7	7.9	7.8	8720.0	8900.0	8810.0	4
NPZ1 Mid	Bayswater	**Blocked**						0
NPZ1 Tall	Lemington	7.1	7.4	7.3	6790.0	7510.0	7310.0	6
NPZ2 Tall	Lemington	7.9	8.1	8.1	9360.0	9770.0	9610.0	6
NPZ5B P1	Broonies	7.1	7.6	7.4	933.0	5570.0	2017.3	12
NPZ5B P2	Bayswater Alluvium	6.7	7.0	6.9	1620.0	2790.0	2148.9	12
NPZ6 Tall	Broonies	7.6	7.8	7.7	3620.0	9220.0	6943.3	12
NPZ7 Small	Bayswater	7.1	7.3	7.3	2890.0	5219.0	4311.7	6
NPZ7 Mid	Broonies	**Blocked**						0
NPZ7 Tall	Hunter River Alluvium	7.3	7.5	7.4	5450.0	5800.0	5558.3	6
WPP1	-	7.0	7.2	7.2	5010.0	6050.0	5375.0	6
WPP2	-	7.2	7.2	7.2	6820.0	8960.0	8366.0	5

Legend for Table G.3, G.4, G.5

	Indicates non-sampling month
Red text	Indicates and exceedance of the IAC range
	Dry/insufficient water or unable to access site

Table G 3 Ravensworth Mining Complex Groundwater pH 2022

Ravensworth Mining Complex Groundwater pH for 2022														
	pH		Monitoring Results											
Target	Borehole	IAC	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Liddell	Coffey Dam Borehole	9.2 - 10.0	0	7.5	0	7.1	0	7.5	0	7.2	0	7.3	0	7.4
Pikes Gully	CS4641C	8.8 - 11.9	0	7.8	0	7.9	0	7.7	0	7.9	0	0	0	0
Bayswater	NPZ1 Mid	6.6 - 6.8	Blocked											
Lemington	NPZ1 Tall	7.0 - 7.3	0	7.3	0	7.4	0	7.1	0	7.3	0	7.3	0	7.3
Lemington	NPZ2 Tall	8.3 - 8.4	0	8.1	0	8.1	0	7.9	0	8.1	0	8	0	8.1
Broonies	NPZ5B P1	7.2 - 7.4	7.1	7.3	7.6	7.4	7.3	7.4	7.6	7.6	7.6	7.5	7.1	7.6
Bayswater Creek Alluvium	NPZ5B P2	7.1 - 7.3	6.9	6.9	6.9	6.8	6.9	6.8	6.8	6.8	7	6.8	6.9	6.7
Broonies	NPZ6 Tall	7.5 - 7.7	7.8	7.8	7.8	7.8	7.8	7.7	7.7	7.7	7.7	7.6	7.7	7.6
Hunter River Alluvium	NPZ7 Small	7.3 - 7.4	0	7.3	0	7.3	0	7.3	0	7.3	0	7.2	0	7.1
Broonies	NPZ7 Mid	7.3 - 7.7	Blocked											
Bayswater	NPZ7 Tall	7.4 - 7.5	0	7.3	0	7.3	0	7.3	0	7.3	0	7.5	0	7.4
-	WPP1	7.0 - 7.1	0	7	0	7.1	0	7.2	0	7.2	0	7.2	0	7.2
-	WPP2	7.0 - 7.3	0	7.2	0	7.2	0	7.2	0	7.2	0	0	0	7.2

Table G 4 Ravensworth Mining Complex Groundwater EC 2022

Ravensworth Mining Complex Groundwater Electrical Conductivity for 2022														
EC (µS/cm)		Monitoring Results												
Target	Borehole	IAC	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Liddell	Coffey Dam Borehole	1360	0	6230	0	7070	0	6260	0	6750	0	6850	0	6910
Pikes Gully	CS4641C	8900	0	8720	0	8900	0	8870	0	8750	0	0	0	0
Bayswater	NPZ1 Mid	15015	Blocked											
Lemington	NPZ1 Tall	9736	0	7300	0	7350	0	6790	0	7440	0	7470	0	7510
Lemington	NPZ2 Tall	9765	0	9770	0	9640	0	9360	0	9700	0	9700	0	9490
Broonies	NPZ5B P1	6340	5570	1950	1020	1051	4270	3180	1798	1036	1003	933	1096	1300
Bayswater Creek Alluvium	NPZ5B P2	2193	1890	1620	1888	1982	2060	2050	2310	2250	2206	2790	2050	2691
Broonies	NPZ6 Tall	7120	7100	3620	7140	6930	7110	6960	7120	7050	7040	9220	7040	6990
Hunter River Alluvium	NPZ7 Small	5259	0	4380	0	4600	0	4390	0	2890	0	5219	0	4391
Broonies	NPZ7 Mid	8446	Blocked											
Bayswater	NPZ7 Tall	8678	0	5650	0	5480	0	5800	0	5520	0	5450	0	5450
-	WPP1	8604	0	6050	0	5810	0	5070	0	5010	0	5160	0	5150
-	WPP2	9352	0	8790	0	8960	0	6820	0	8650	0	0	0	8610

Table G 5 Ravensworth Complex Groundwater Speciation for 2022

Ravensworth Mining Complex Groundwater Speciation for 2022

Analyte	IAC	Liddell Seam		Pikes Gully Seam		Bayswater				Lemington				Broonie						Bayswater Alluvium		Hunter River Alluvium		Colluvial			
		Coffey Dam Bm		C9461C		NP21 MM		NP27 Tail		NP31 Tail		NP32 Tail		NP26 P1		NP26 Tail		NP27 MM		NP228 P1		NP17 Shall		WPP1		WPP2	
		Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22	Apr-22	Oct-22
Field pH	X	7.1	7.0	7.6	0			7.3	7.8	7.4	7.8	8.1	8	7.4	7.3	7.6	7.8			7.8	6.6	7.5	7.2	7.1	7.2	7.2	0
Field Conductivity (µS/cm)	X	7070	6690	8800	0			8480	8480	7050	7070	9840	9700	2050	833	6950	8120			1882	2780	4800	8218	3820	5560	8840	0
Calcium (mg/L)	X	182	139	0	0			60	59	11	11	17	17	60	60	10	11			61	56	48	15	183	139	278	0
Magnesium (mg/L)	X	247	215	0	0			94	92	5	6	6	7	66	62	4	4			61	60	71	12	268	188	448	0
Sodium (mg/L)	500	1270	1190	0	0			1080	1080	1480	1730	2040	2090	124	68	1630	1480			307	338	784	46	479	809	1980	0
Potassium (mg/L)	X	18	17	0	0			12	10	6	7	11	13	4	3	6	7			4	3	18	28	4	4	13	0
Hydroxide Alkalinity as CaCO3	X	<1.00	<1.00	0	0			<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00			<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	0
Carbonate Alkalinity as CaCO3	X	<1.00	<1.00	0	0			<1.00	37	<1.00	<1.00	47	<1.00	<1.00	<1.00	<1.00	<1.00			<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	0
Bicarbonate Alkalinity as CaCO3	X	1180	1070	0	0			775	680	1180	1130	1380	1340	388	338	889	808			278	338	666	134	793	658	883	0
Alkalinity as CaCO3 (mg/L)	X	1180	1070	0	0			775	707	1180	1130	1440	1340	388	338	889	808			278	338	666	134	793	658	883	0
Sulfate (mg/L)	400	1600	1130	0	0			73	69	1	1	1	1	144	100	1	1			388	438	48	17	1980	1710	4180	0
Chloride (mg/L)	400	1260	1190	0	0			1980	1460	1650	1860	2010	2020	108	24	1840	1630			509	518	1170	81	974	699	741	0
Reactive Silica (mg/L)	X	18.3	29.2	0	0			17.8	23.8	24.8	30.4	5.83	6.69	19	16.6	30.1	26.9			61	61.7	15.5	6.6	34.1	36.1	27.4	0
Ammonia as N (mg/L)	X	1.77	1.88	0	0			1.88	2.2	3.27	3.88	1.77	1.83	0.07	0.28	2	1.83			0.23	0.28	2.81	3.8	0.08	0.04	0.3	0
Nitrite as N (mg/L)	1	<0.01	0.01	0	0	BLOCKED		0.02	<0.01	0.01	0.04	<0.01	<0.01	0.14	<0.01	<0.01	<0.01	BLOCKED		<0.01	<0.01	0.01	0.27	<0.01	0.01	<0.01	0
Nitrate as N (mg/L)	10	<0.01	<0.01	0	0			0.09	0.08	0.08	0.11	<0.01	0.01	11.8	0.82	0.08	0.02			0.1	0.08	0.18	0.08	<0.01	0.01	<0.01	0
Nitrite + Nitrate as N (mg/L)	X	<0.01	0.01	0	0			0.09	0.08	0.09	0.18	<0.01	0.01	11.4	0.82	0.08	0.02			0.1	0.08	0.18	0.08	<0.01	0.02	0.08	0
TKN as N (mg/L)	X	2.2	2.2	0	0			3.3	4.3	3.5	3	4.2	5.8	5.2	1.2	4.3	4			2.7	2.6	3.8	8.1	0.2	0.2	0.3	0
Total Nitrogen as N (mg/L)	X	2.2	2.2	0	0			3.4	4.3	3.4	3.2	4.2	5.8	16.6	9.6	4.3	4			2.8	2.7	4.1	8.4	0.2	0.2	0.4	0
Total Cations (meq/L)	X	82.8	78.4	0	0			98.8	94.1	66.3	78.3	90.4	90.4	18.8	10.7	83.3	65.8			18.3	28.3	48.2	8.17	71	61.3	118	0
Total Anions (meq/L)	X	80.4	78.4	0	0			98.1	98.2	70.3	88.3	98.6	101	14.8	8.87	68.8	68.7			22.2	28.8	47.3	3.83	74.6	63.6	128	0
Zinc (mg/L)	8	0.009	0.008	0	0			0.007	0.008	0.009	0.008	0.009	0.008	0.086	0.044	0.008	0.009			0.017	0.008	0.05	0.008	13	11	0.034	0
Silver (mg/L)	0.05	0.001	0.001	0	0			0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001	0
Selenium (mg/L)	0.01	0.01	0.01	0	0			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0
Nickel (mg/L)	0.1	0.008	0.008	0	0			0.001	0.008	0.002	0.001	0.001	0.002	0.007	0.004	0.001	0.001			0.005	0.008	0.002	0.004	0.008	0.002	0.008	0
Mercury (mg/L)	0.002	0.0001	0.0001	0	0			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0
Manganese (mg/L)	0.1	0.368	0.484	0	0			0.058	0.098	0.128	0.117	0.078	0.079	0.098	0.028	0.08	0.081			0.484	0.748	0.068	0.103	0.103	0.098	0.042	0
Lead (mg/L)	0.05	0.001	0.001	0	0			0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001	0
Iron (mg/L)	0.3	0.83	0.26	0	0			0.09	0.12	0.08	1.22	0.08	0.18	0.17	0.08	0.28	0.18			0.12	0.87	0.18	0.81	0.08	0.08	0.08	0
Copper (mg/L)	1	0.001	0.001	0	0			0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.007	0.001	0.001			0.004	0.001	0.001	0.001	0.001	0.001	0.002	0
Cadmium (mg/L)	0.009	0.0001	0.0001	0	0			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001			0.0001	0.0001	0.0001	0.0001	0.0008	0.0001	0.0004	0
Barium (mg/L)	1	0.033	0.029	0	0			0.421	0.038	0.329	0.448	1.29	1.3	0.048	0.068	0.368	0.383			0.088	0.081	0.388	0.003	0.011	0.01	0.018	0
Antimony (µg/L)	X	<1.000	<1.000	0	0			<1.000	<1.000	<1.000	<1.000	4	<1.000	8	6	6	<1.000			<1.000	<1.000	2	2	1	<1.000	<1.000	0
Aluminium (mg/L)	0.2	0.01	0.01	0	0			0.01	0.01	0.01	0.01	0.01	0.01	0.09	0.01	0.01	0.01			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0
Site Specific IAC for pH		6.5 - 10.0		6.8 - 11.8		6.8 - 8.8		7.4 - 7.8		7.0 - 7.8		6.9 - 8.4		7.1 - 7.4		7.5 - 7.7		7.3 - 7.7		7.1 - 7.8		7.0 - 7.4		7.0 - 7.1		7.0 - 7.8	
Site Specific IAC for EC (µS/cm)		1580		8800		18018		8878		9756		9768		4940		7120		8448		2183		9286		8804		8902	
Site Specific IAC for Sodium (mg/L)		N/A		1550		N/A		1603		2088		2178		359		N/A		N/A		N/A		1486		N/A		N/A	
Site Specific IAC for Chloride (mg/L)		N/A		2882		N/A		2842		2364		2888		1030		N/A		N/A		N/A		2480		N/A		N/A	

* WPP2 Oct-22 no data due to wet conditions and unable to access.
* C9461C Oct-22 Insufficient water for water analysis.
* NP21 MM and NP27 MM Piezometers Blocked, hence insufficient data.
Insufficient water to get sample / Unable to access.

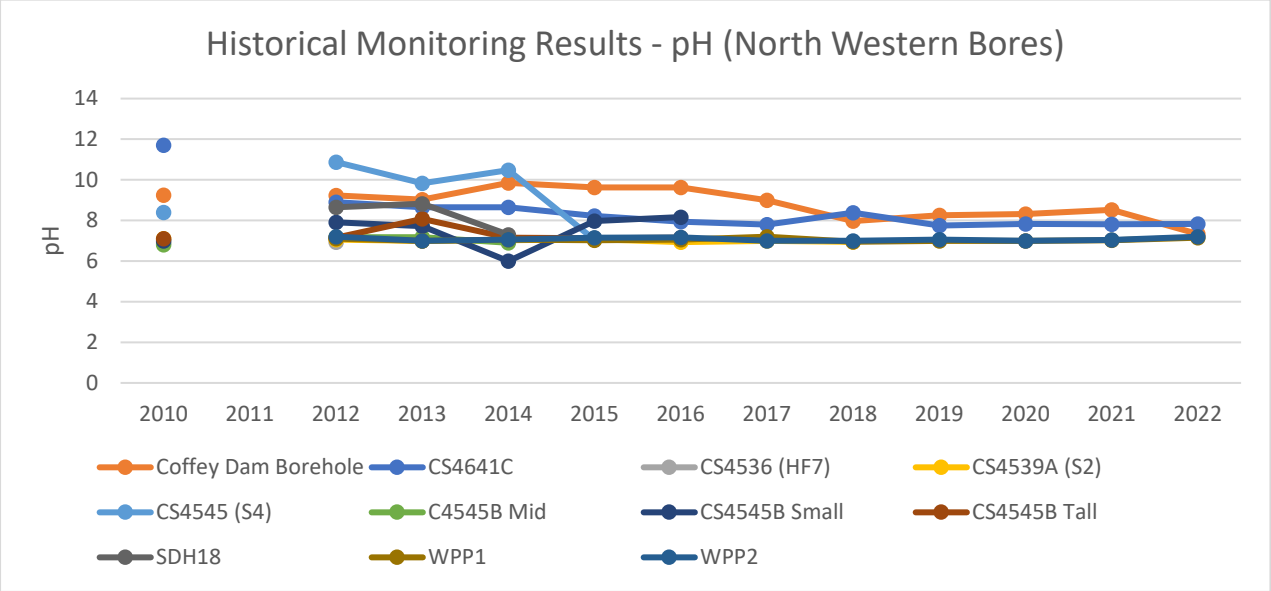


Figure G 1 Historical Monitoring Results pH North Western Bores

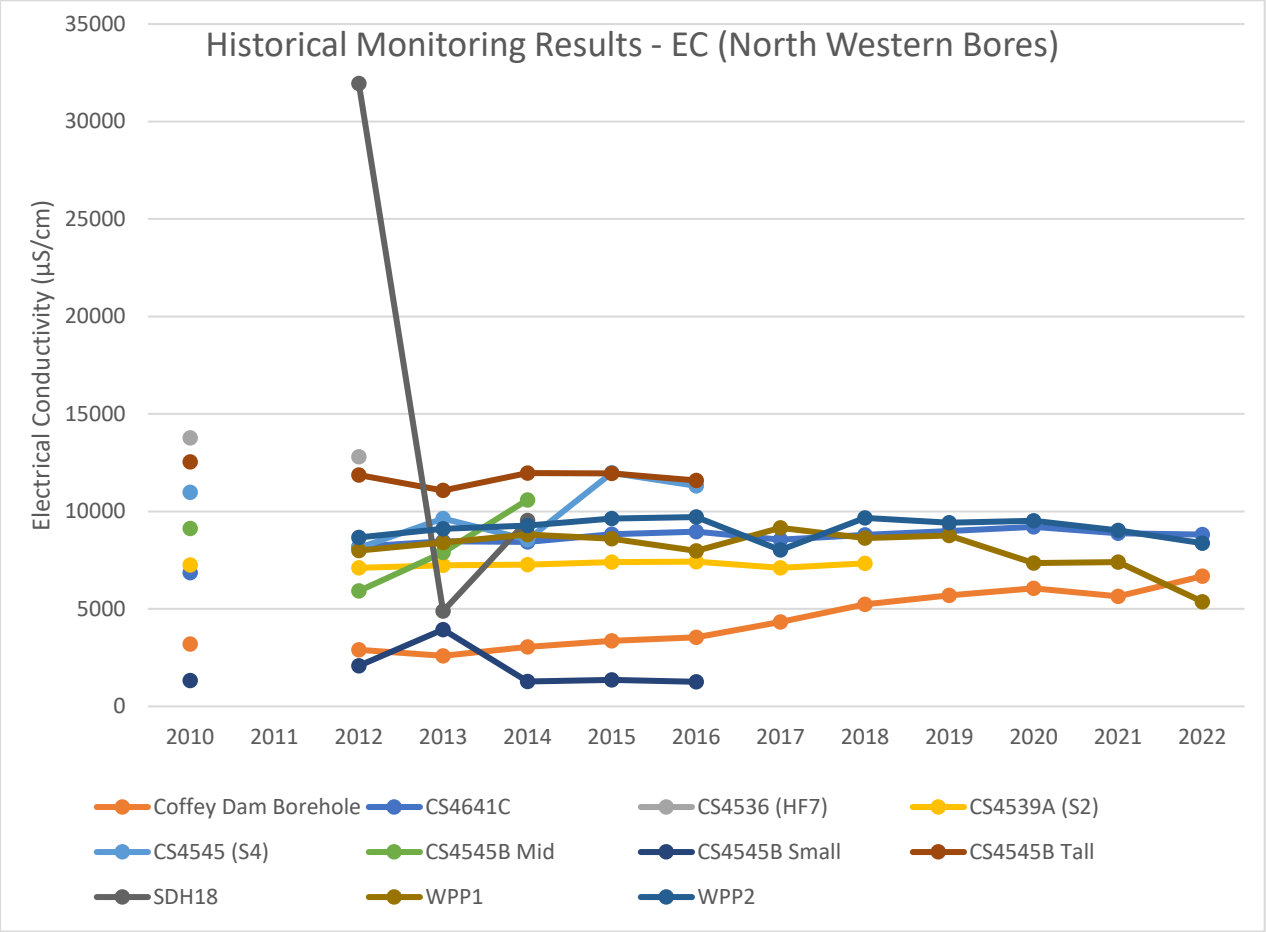


Figure G 2 Historical Monitoring Results EC Northern Western Bores

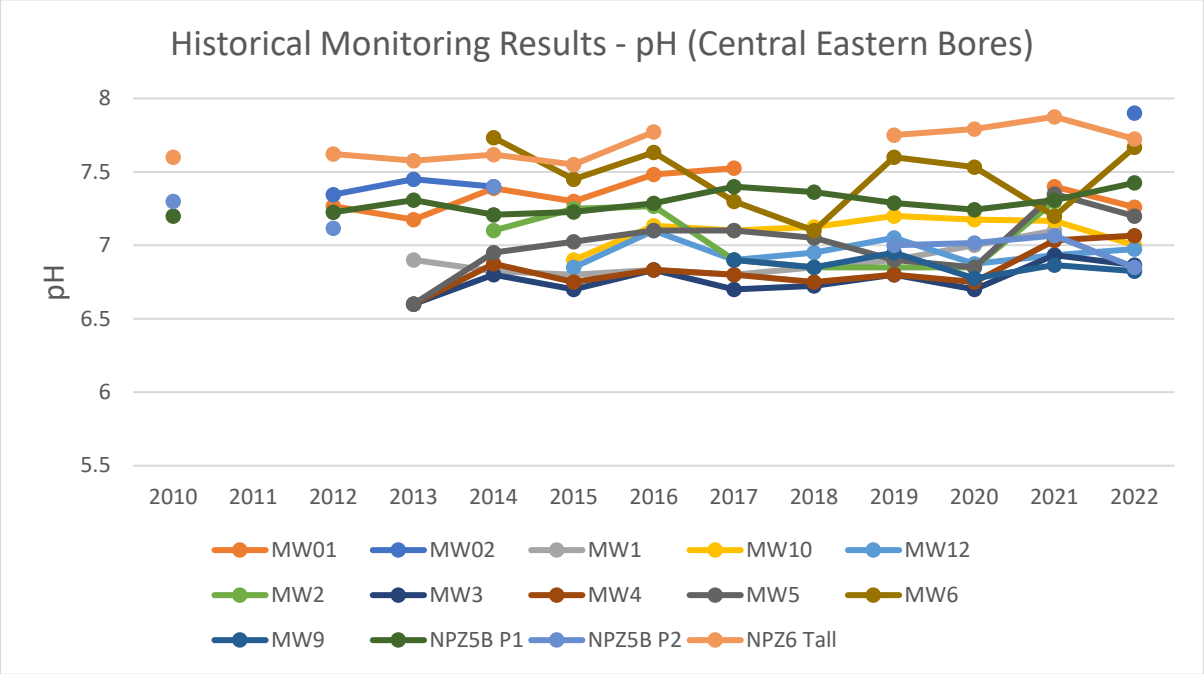


Figure G 3 Historical Monitoring Results pH Central Eastern Bores

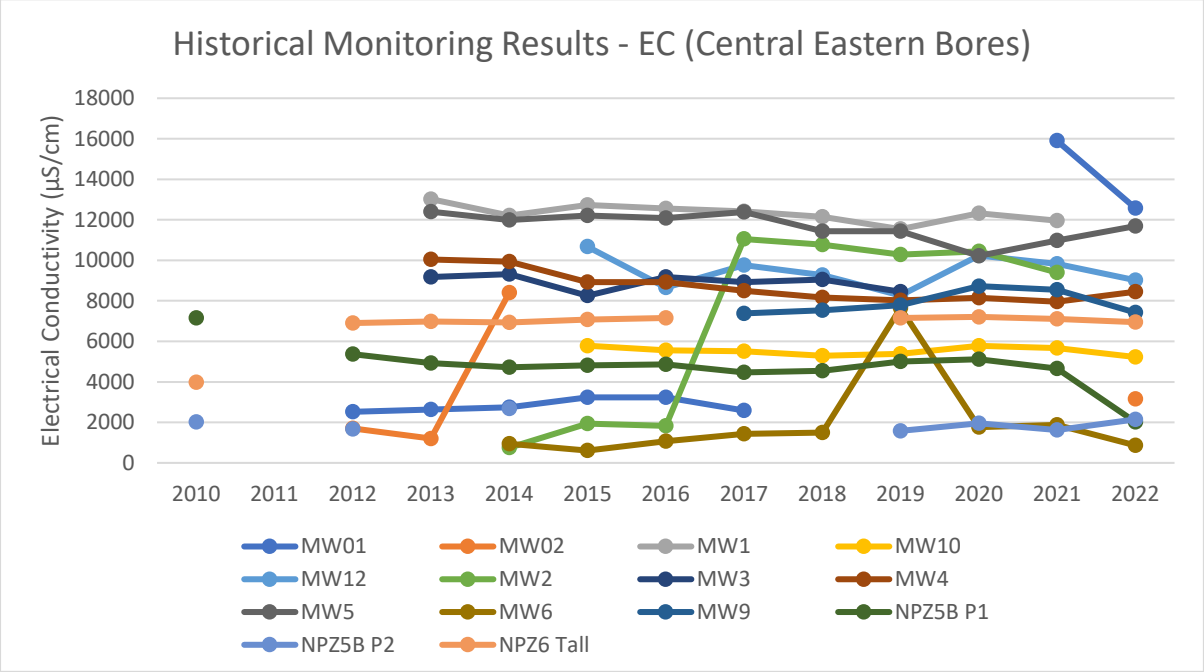


Figure G 4 Historical Monitoring Results EC Central Eastern Bores

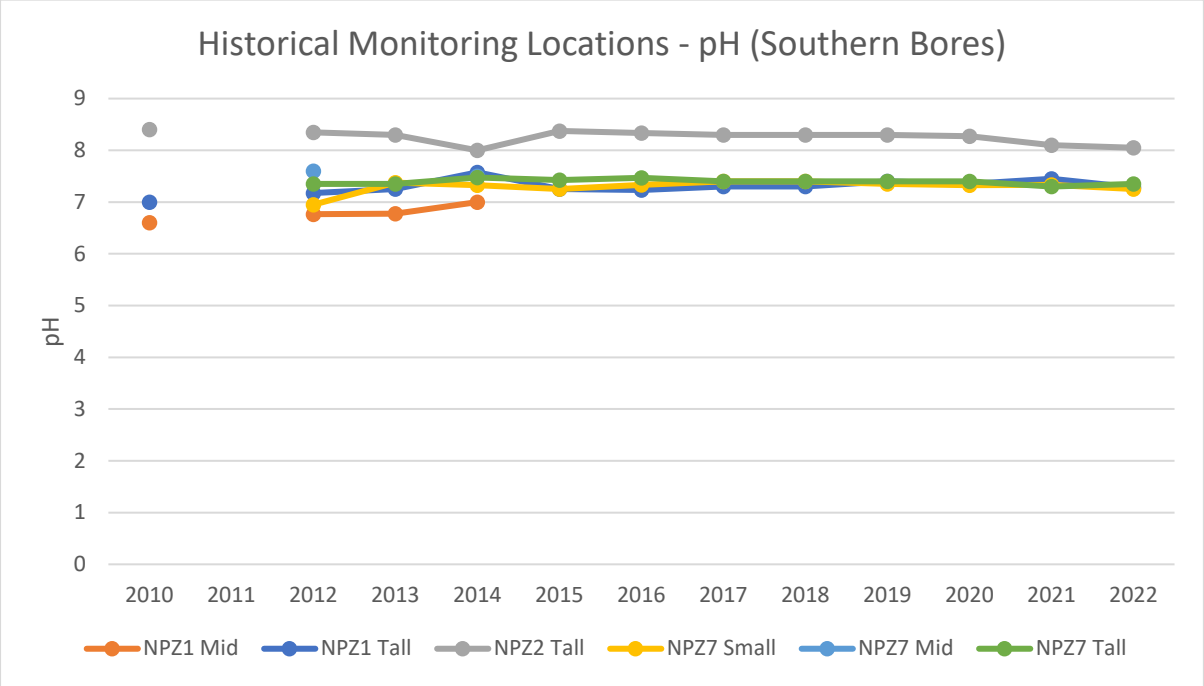


Figure G 5 Historical Monitoring Results pH Southern Bores

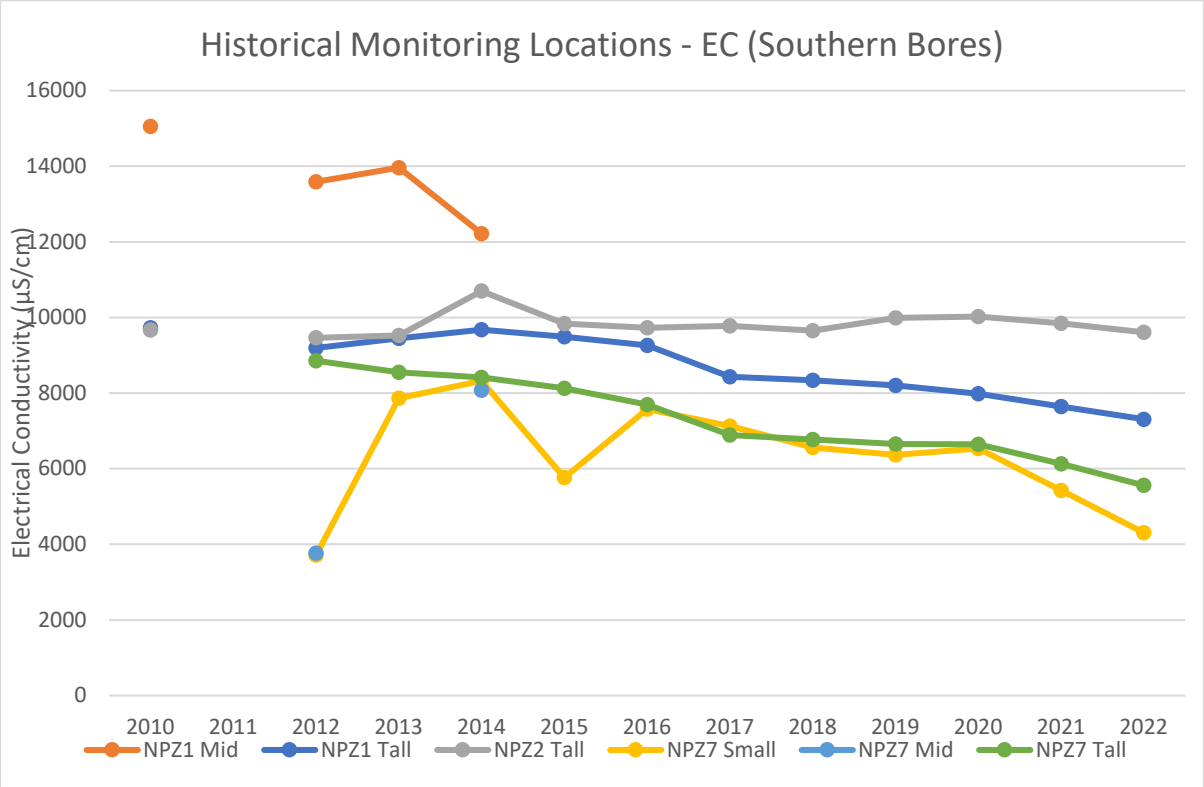


Figure G 6 Historical Monitoring Results EC Southern Bores

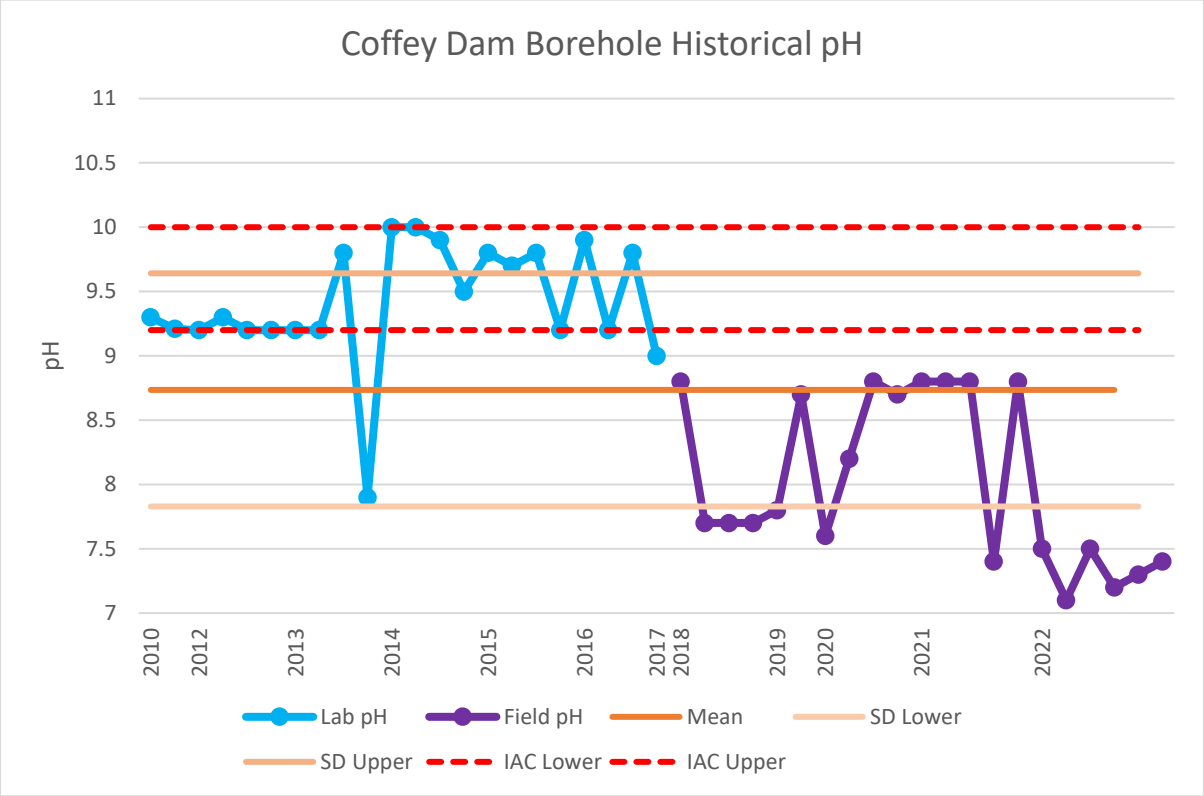


Figure G 7 Historical Monitoring Results pH Coffey Dam Borehole

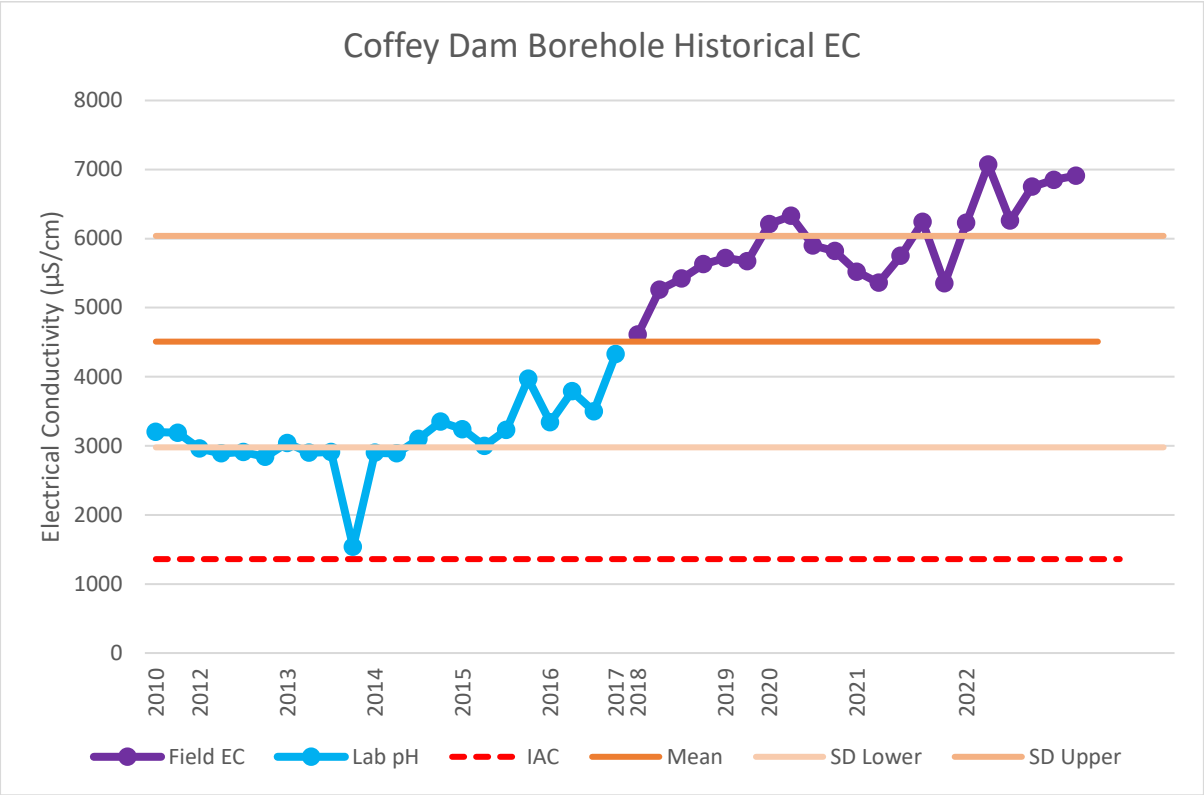


Figure G 8 Historical Monitoring Results EC Coffey Dam Borehole

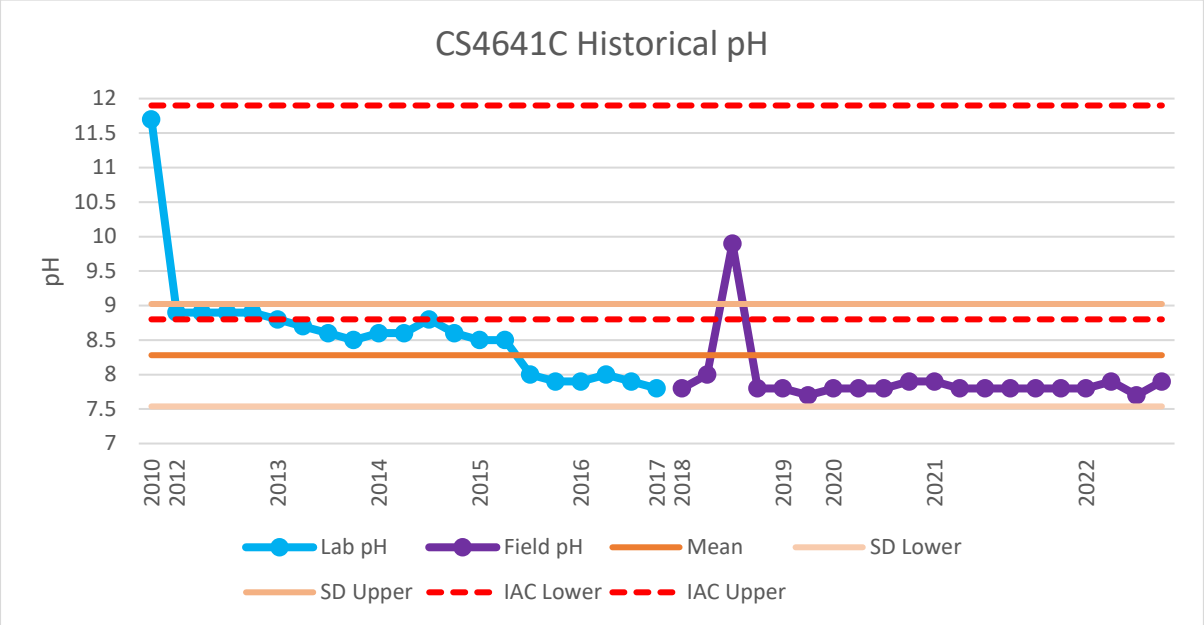


Figure G 9 Historical Monitoring Results pH CS4641C

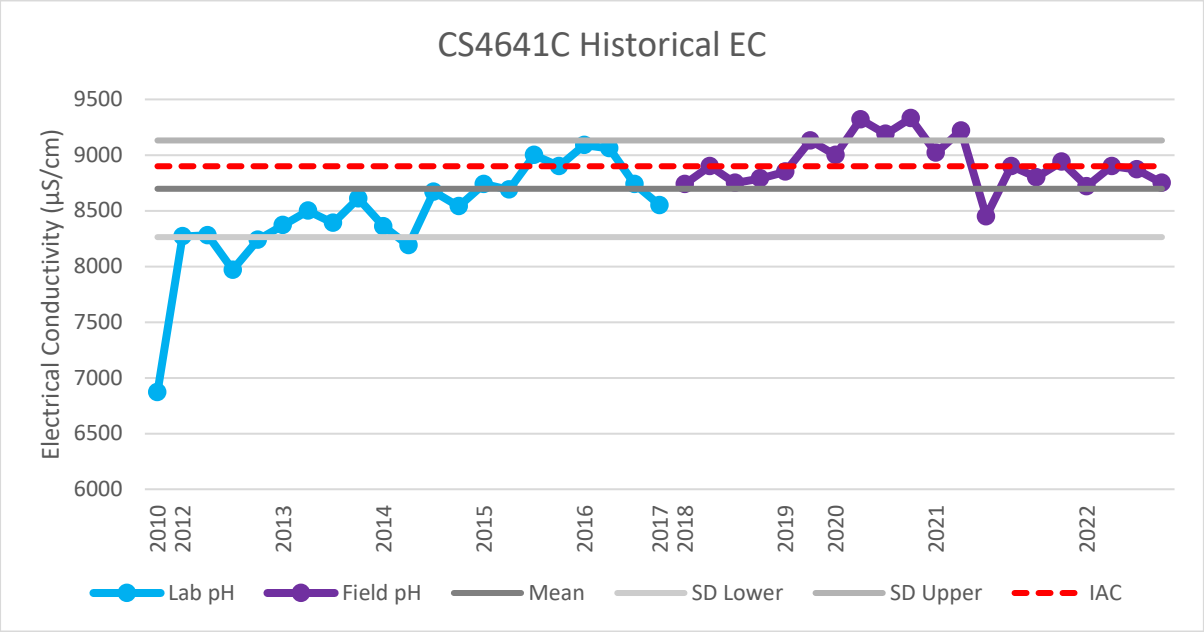


Figure G 10 Historical Monitoring Results EC CS4641C

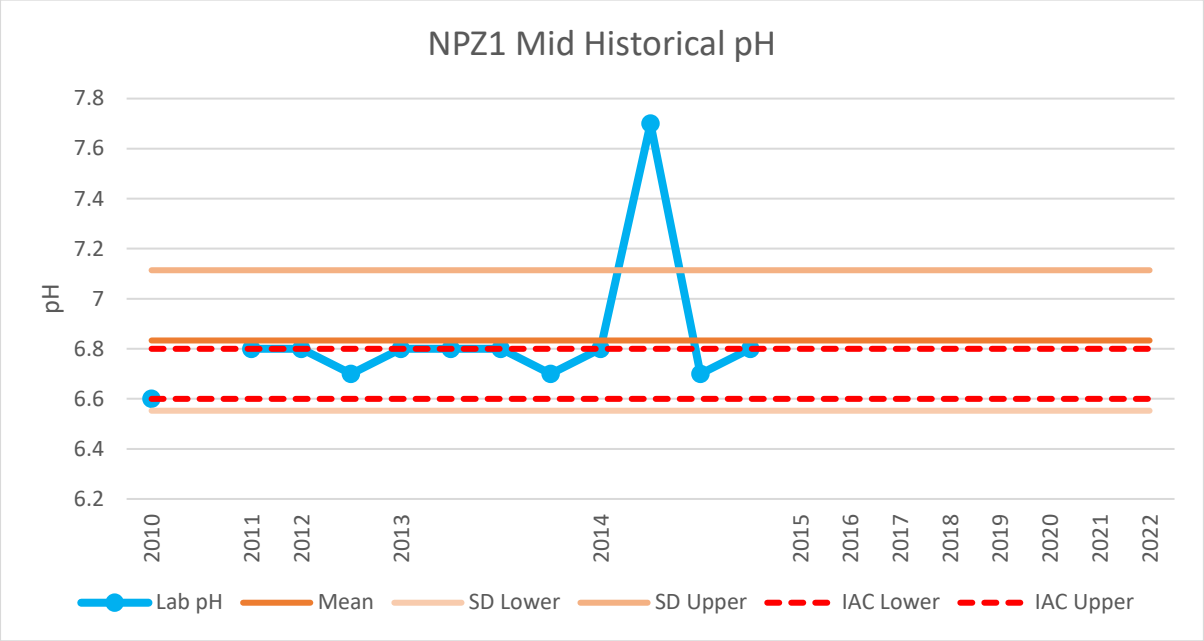


Figure G 11 Historical Monitoring Results pH NPZ1 Mid

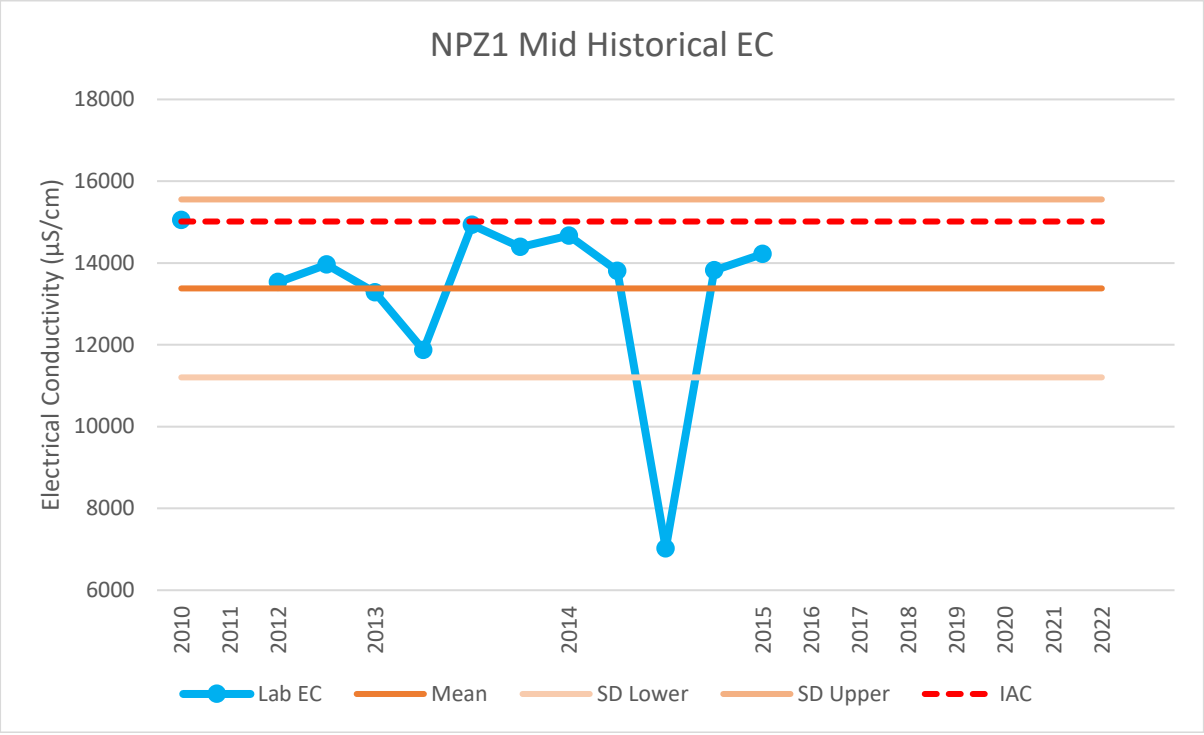


Figure G 12 Historical Monitoring Results EC NPZ1 Mid

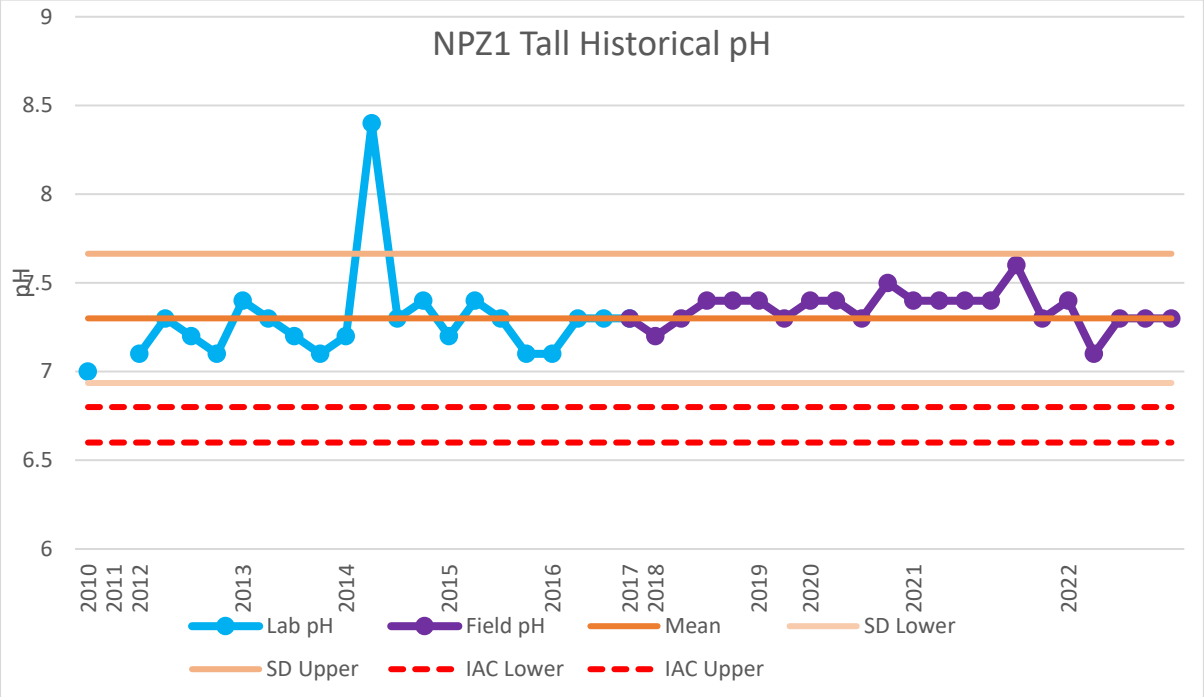


Figure G 13 Historical Monitoring Results pH NPZ1 Tall

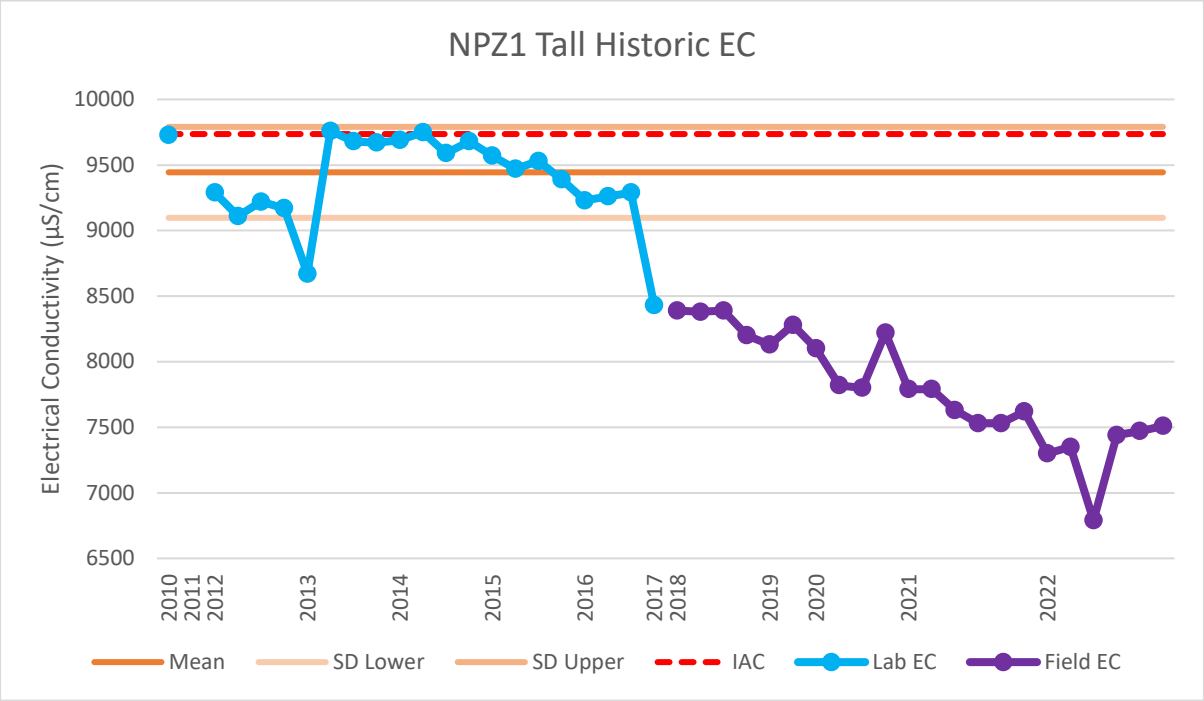


Figure G 14 Historical Monitoring Results EC NPZ1 Tall

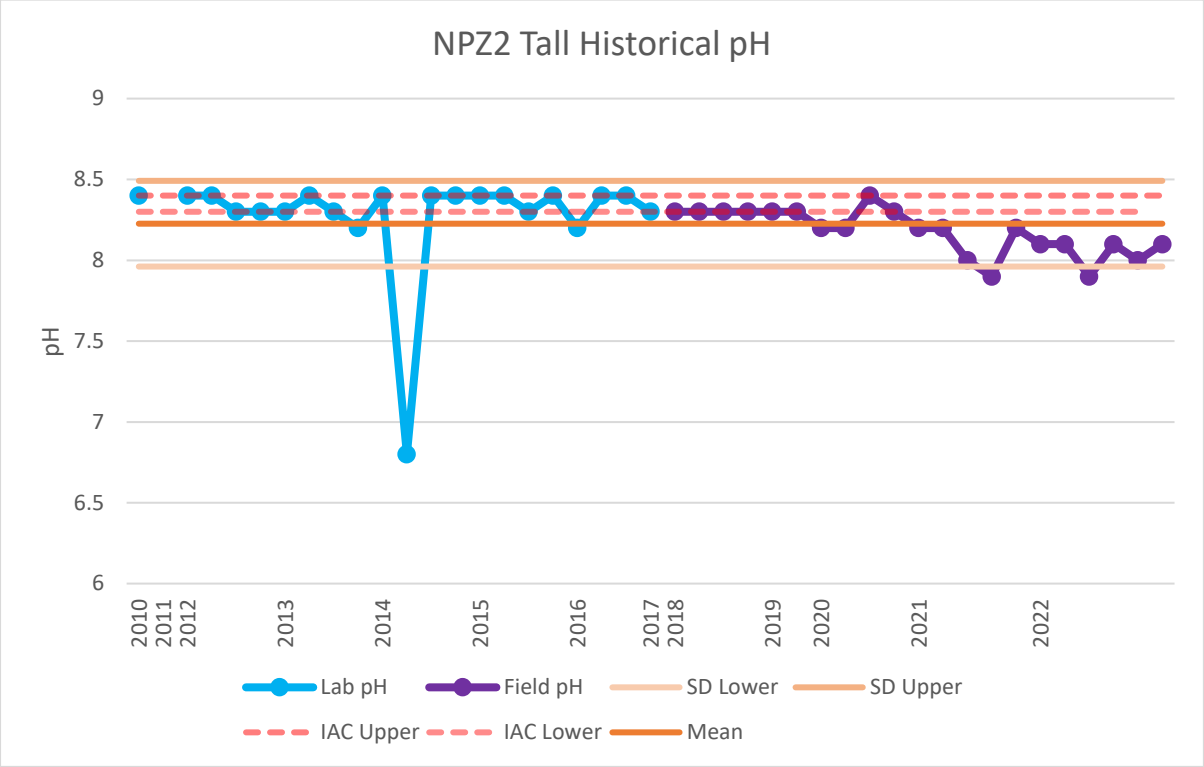


Figure G 15 Historical Monitoring Results pH NPZ2 Tall

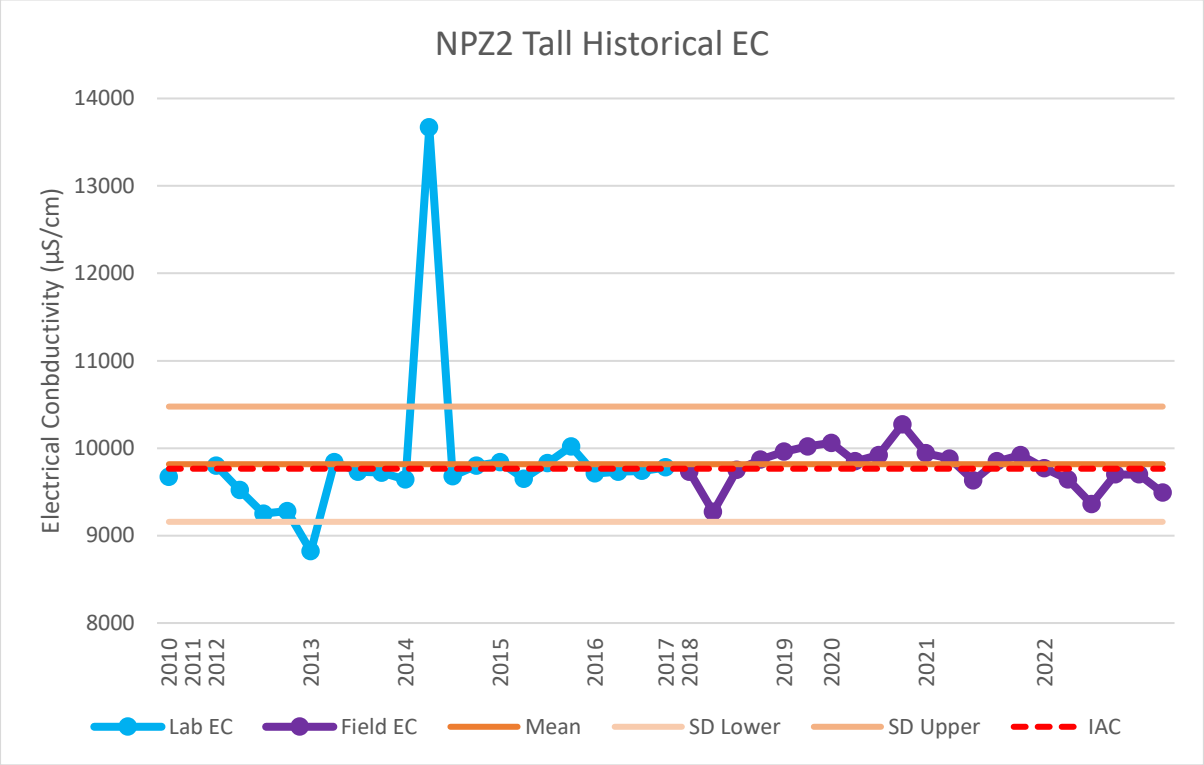


Figure G 16 Historical Monitoring Results EC NPZ2 Tall

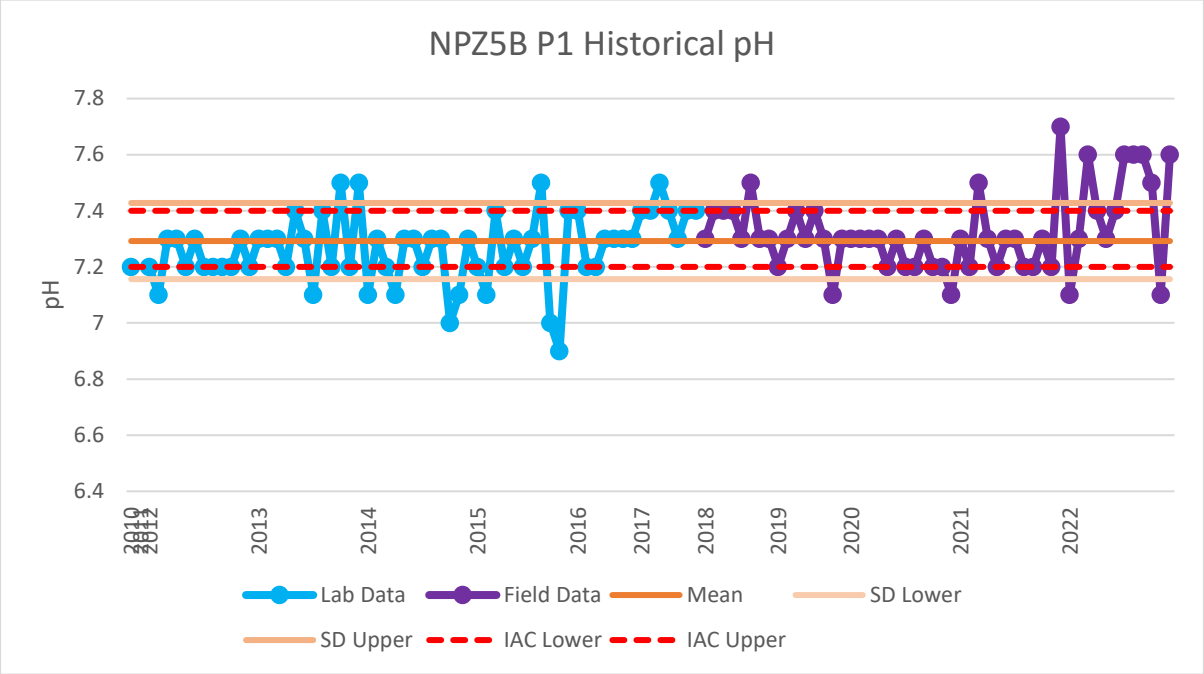


Figure G 17 Historical Monitoring Results pH NPZ5B P1

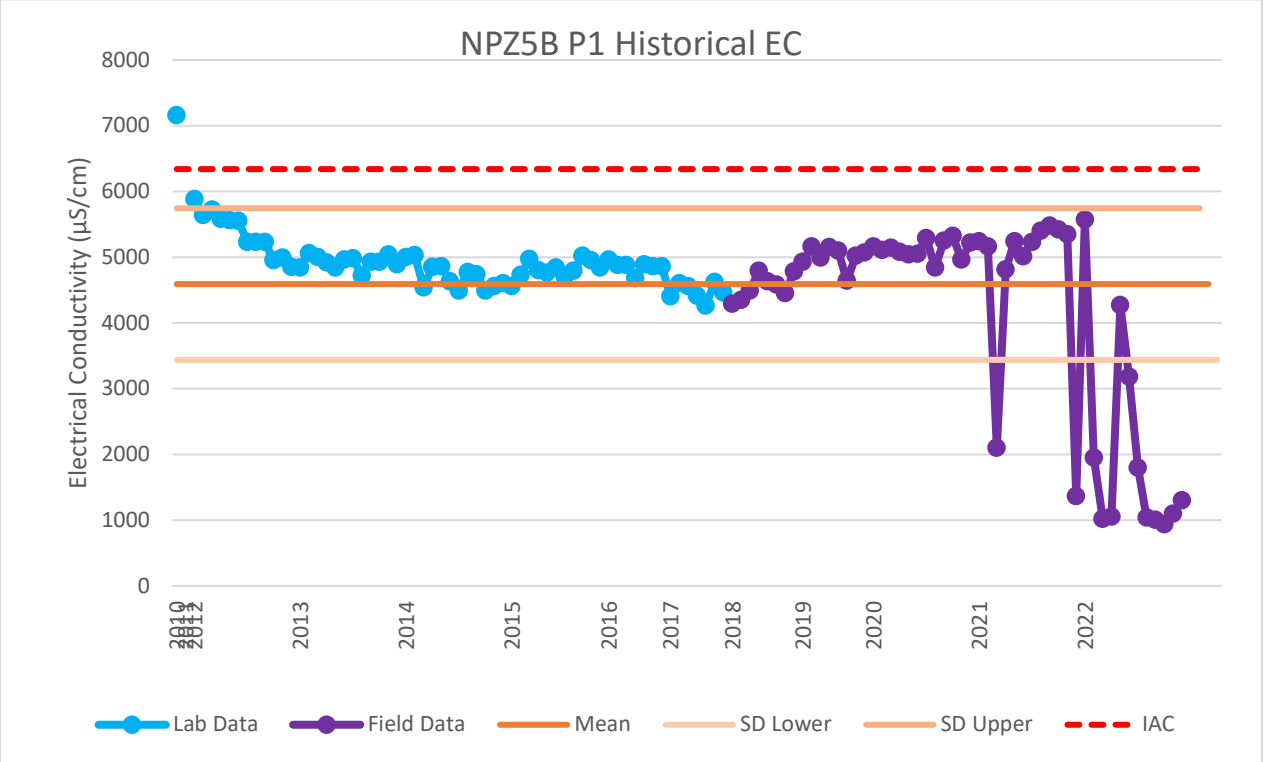


Figure G 18 Historical Monitoring Results EC NPZ5B P1

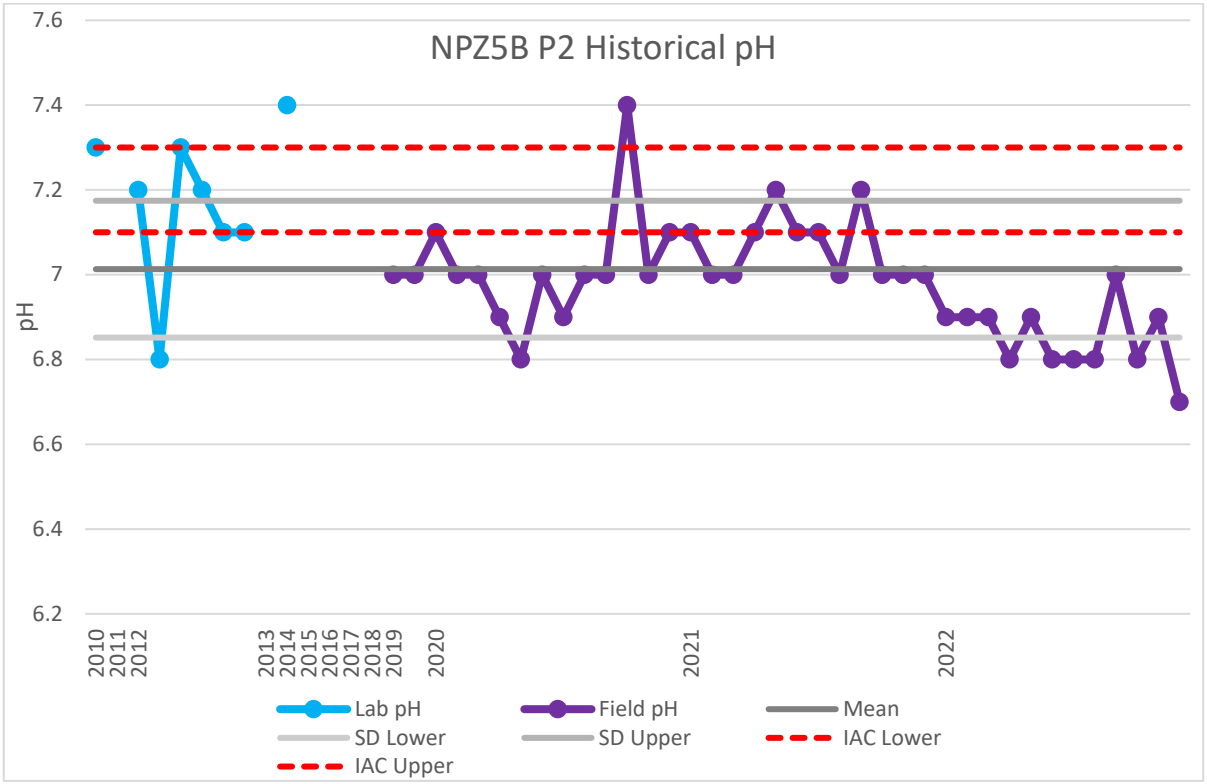


Figure G 19 Historical Monitoring Results pH NPZ5B P2

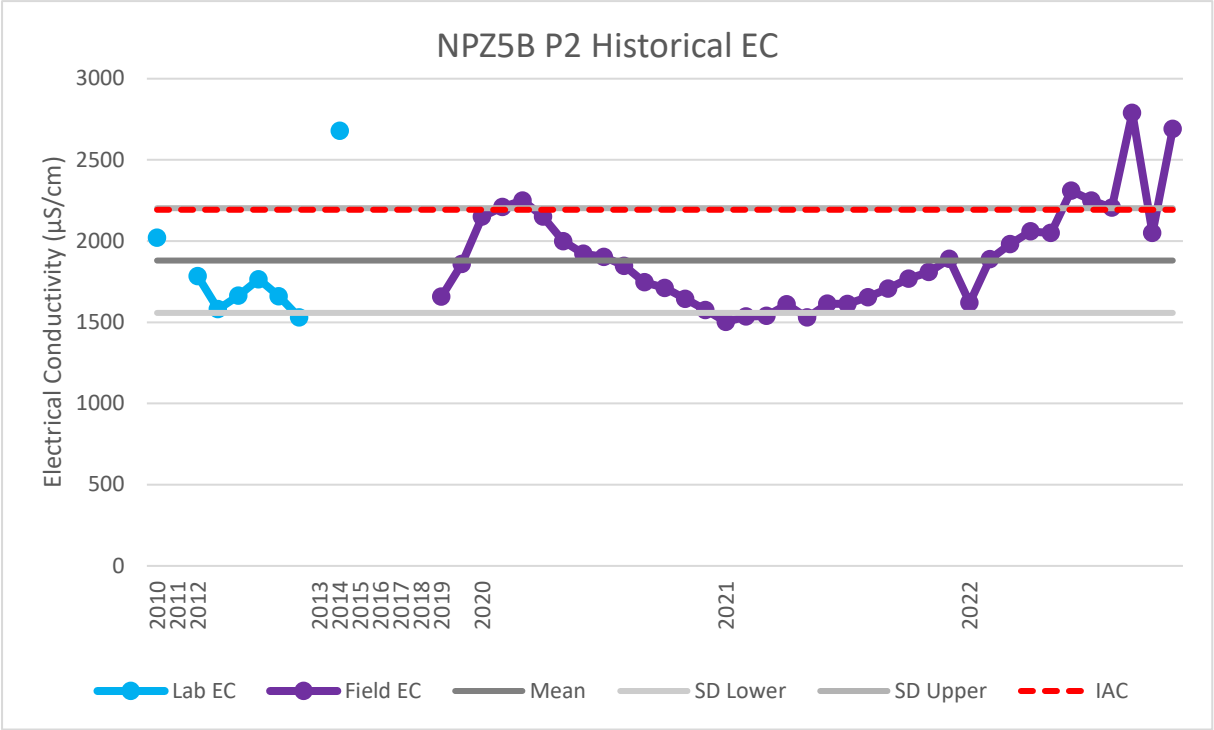


Figure G 20 Historical Monitoring Results EC NPZ5B P2

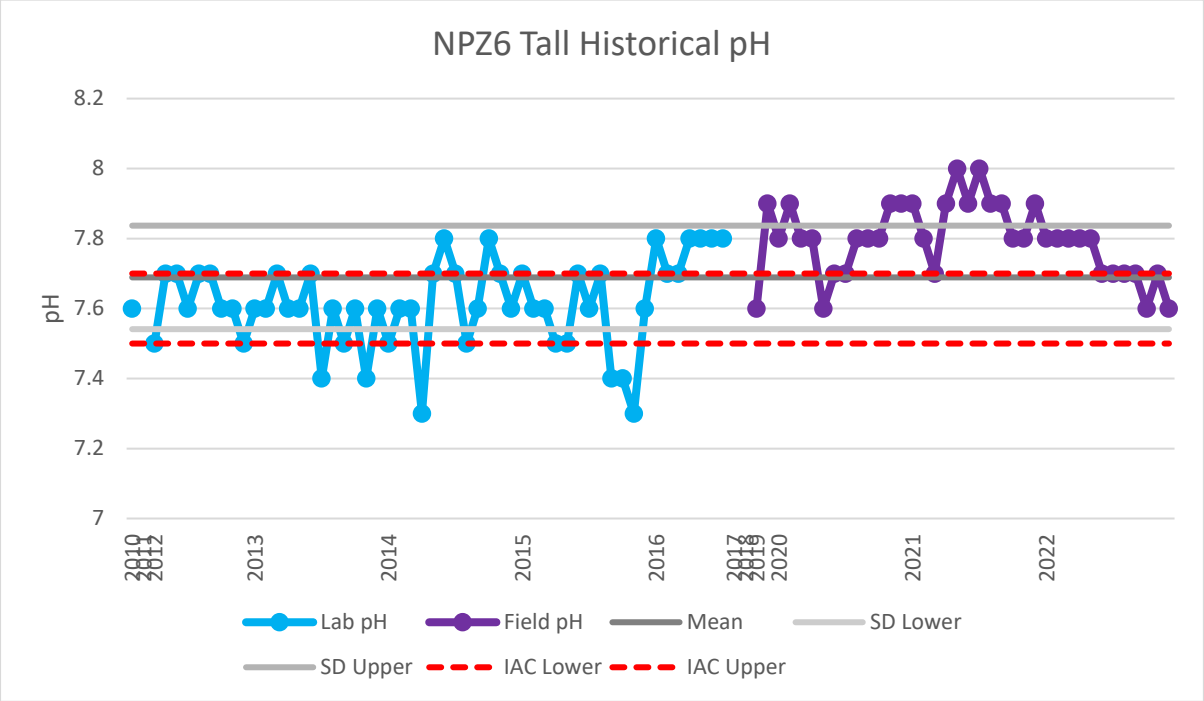


Figure G 21 Historical Monitoring Results pH NPZ6 Tall

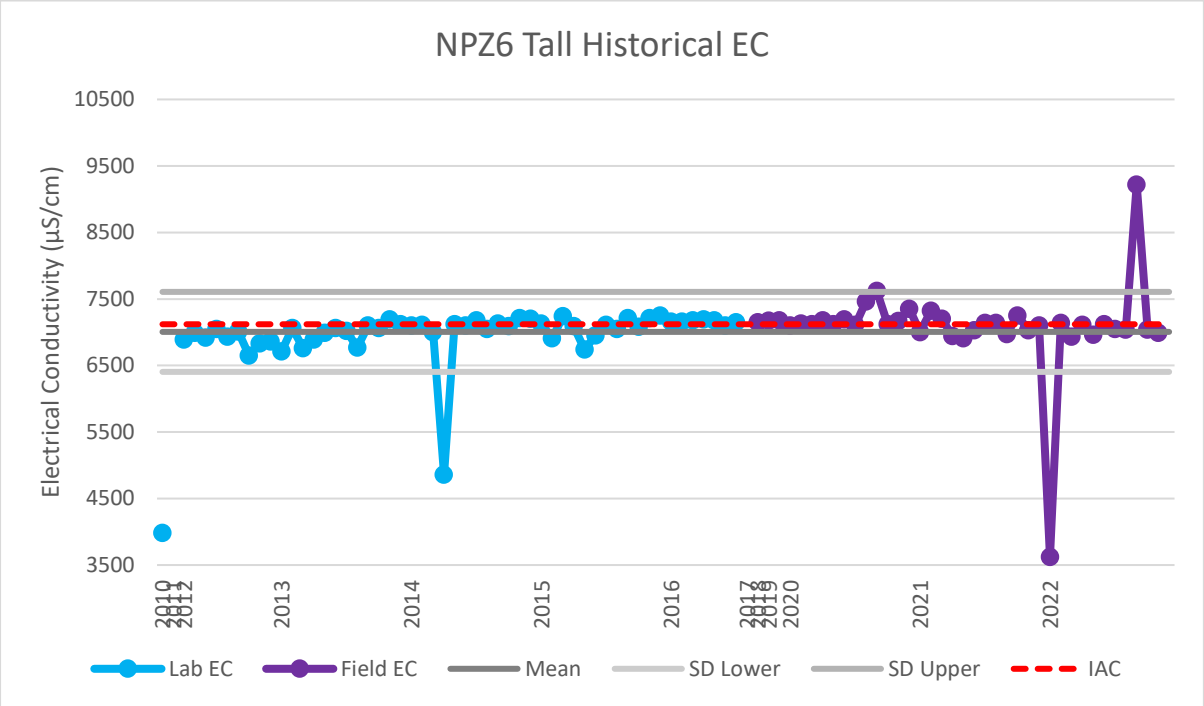


Figure G 22 Historical Monitoring Results EC NPZ6 Tall

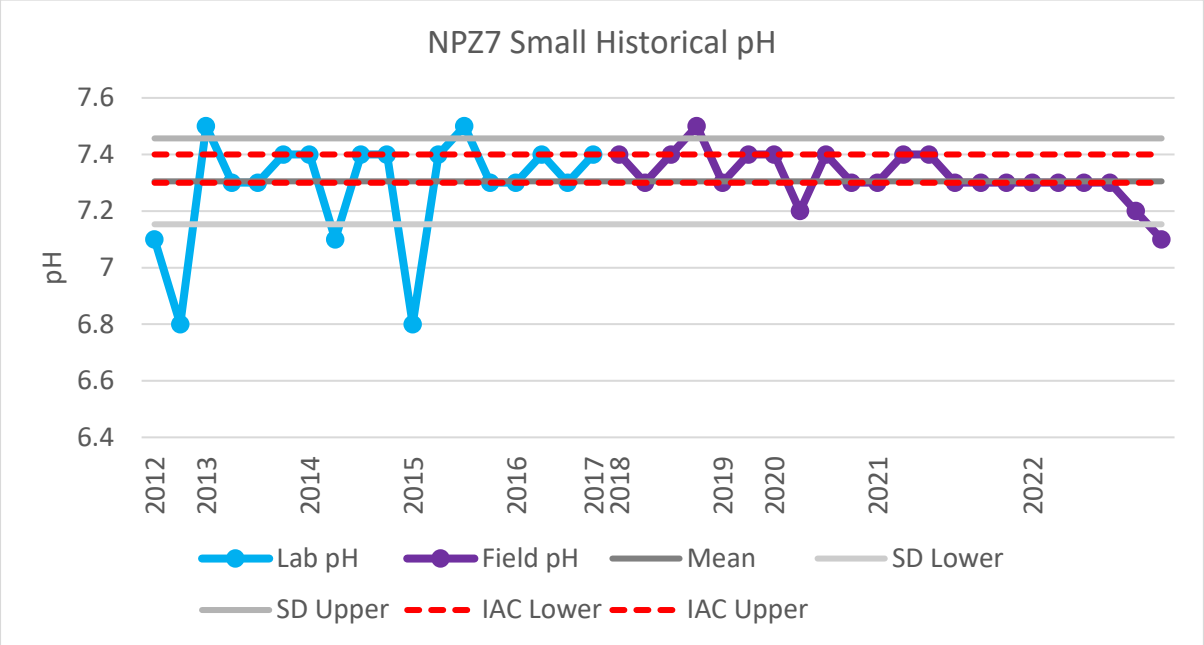


Figure G 23 Historical Monitoring Results pH NPZ7 Small

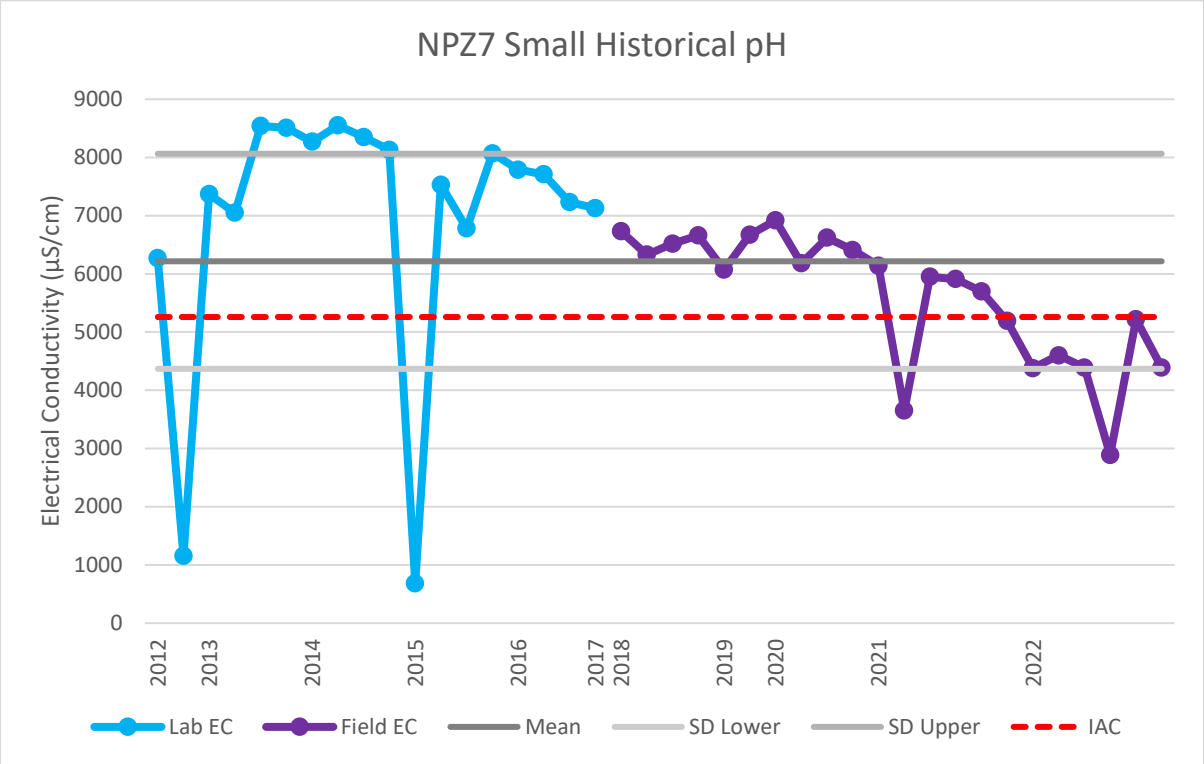


Figure G 24 Historical Monitoring Results EC NPZ7 Small

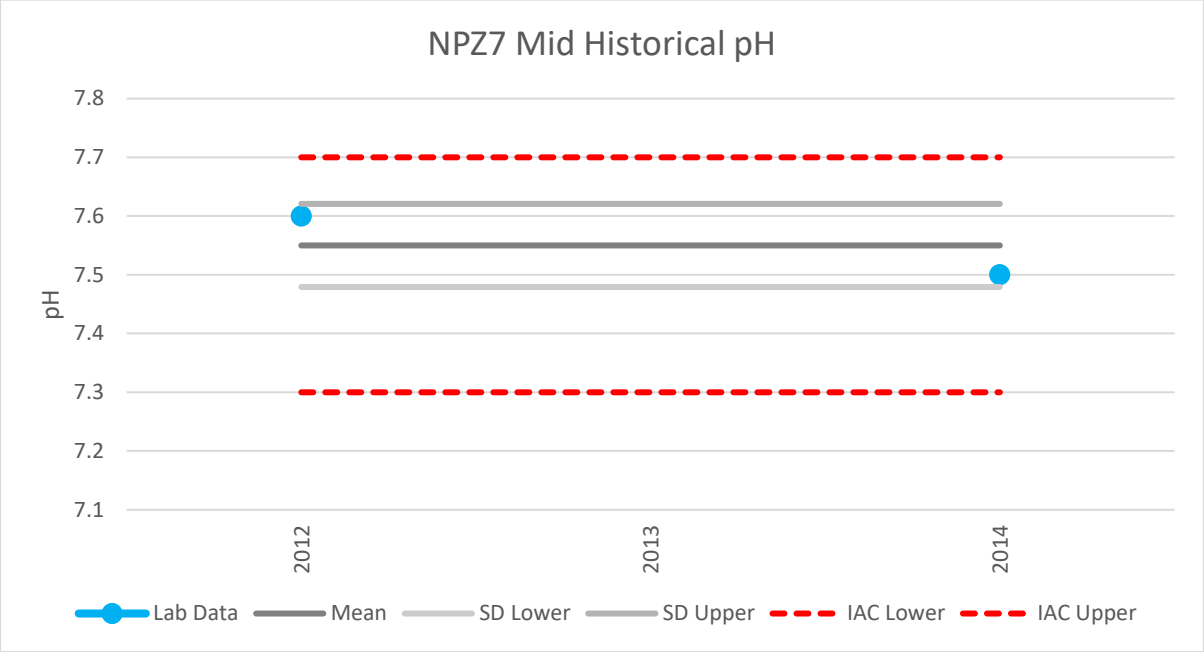


Figure G 25 Historical Monitoring Results pH NPZ7 Mid

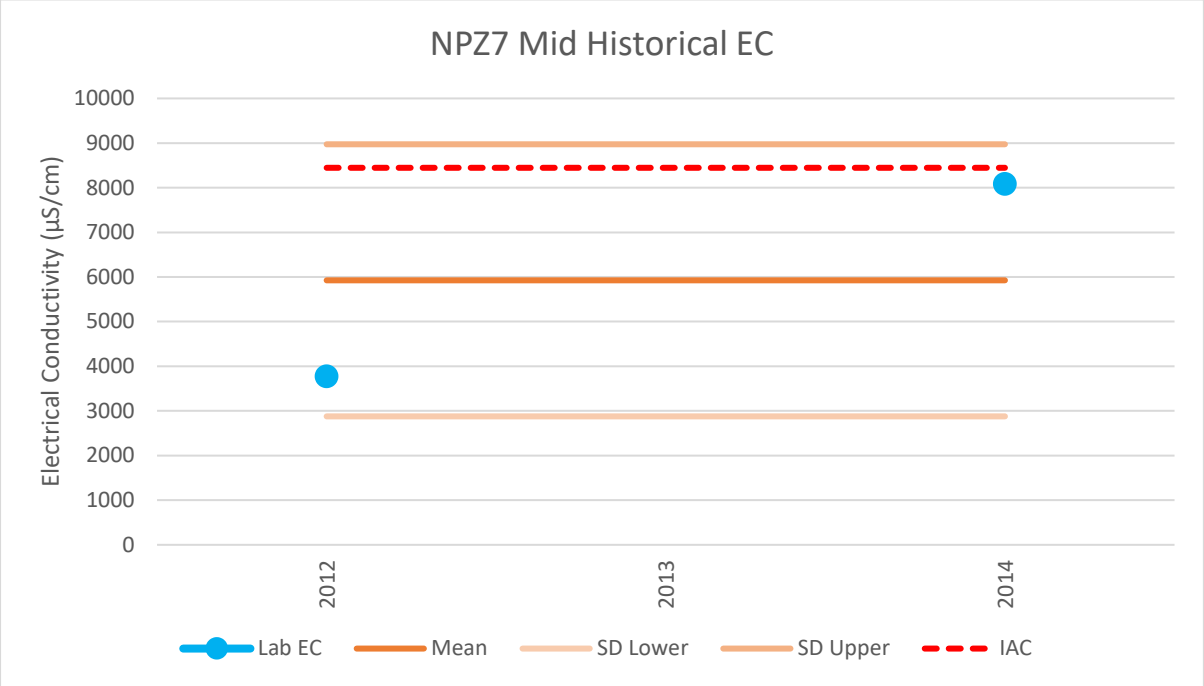


Figure G 26 Historical Monitoring Results EC NPZ7 Mid

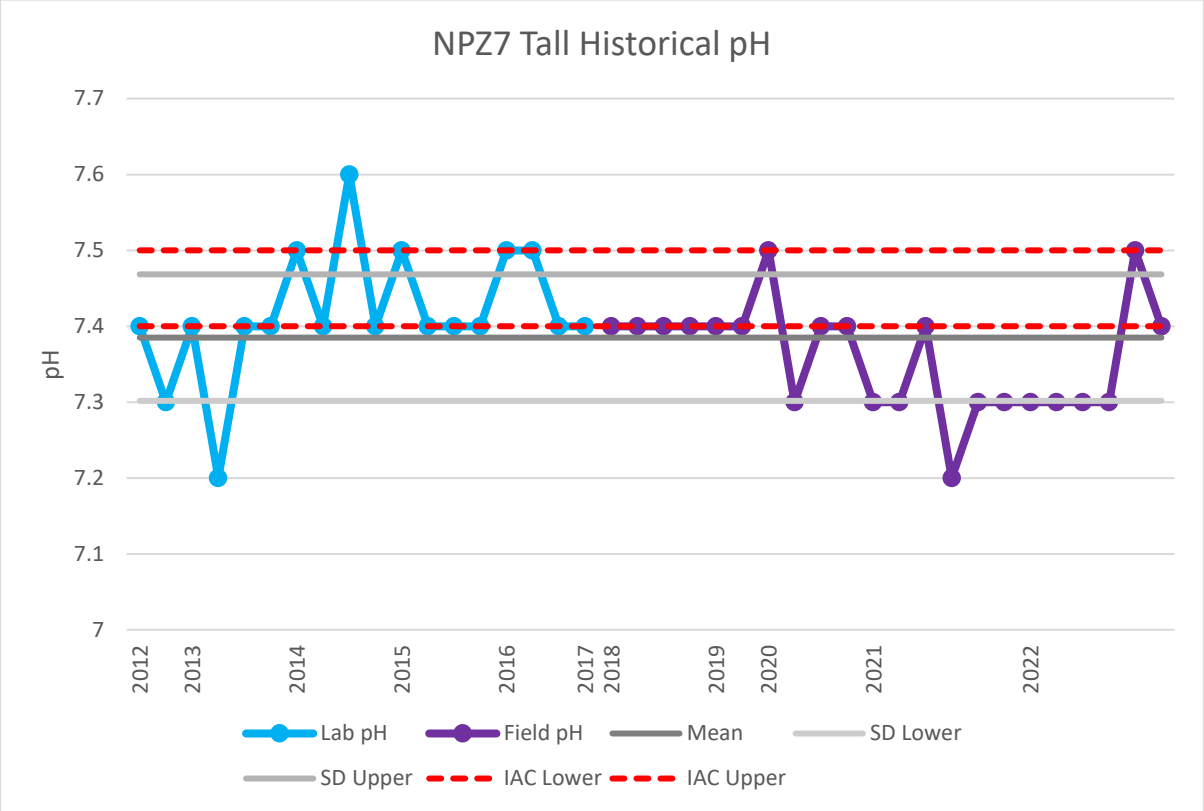


Figure G 27 Historical Monitoring Results pH NPZ7 Tall

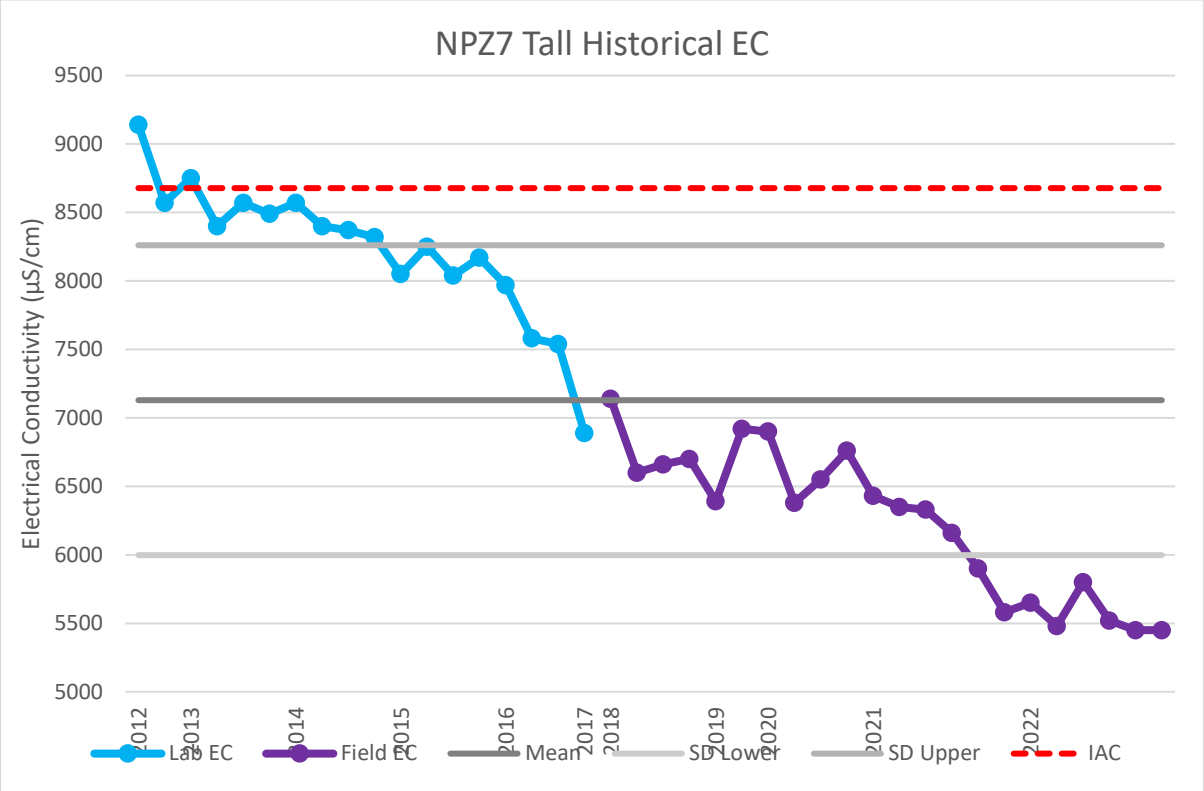


Figure G 28 Historical Monitoring Results EC NPZ7 Tall

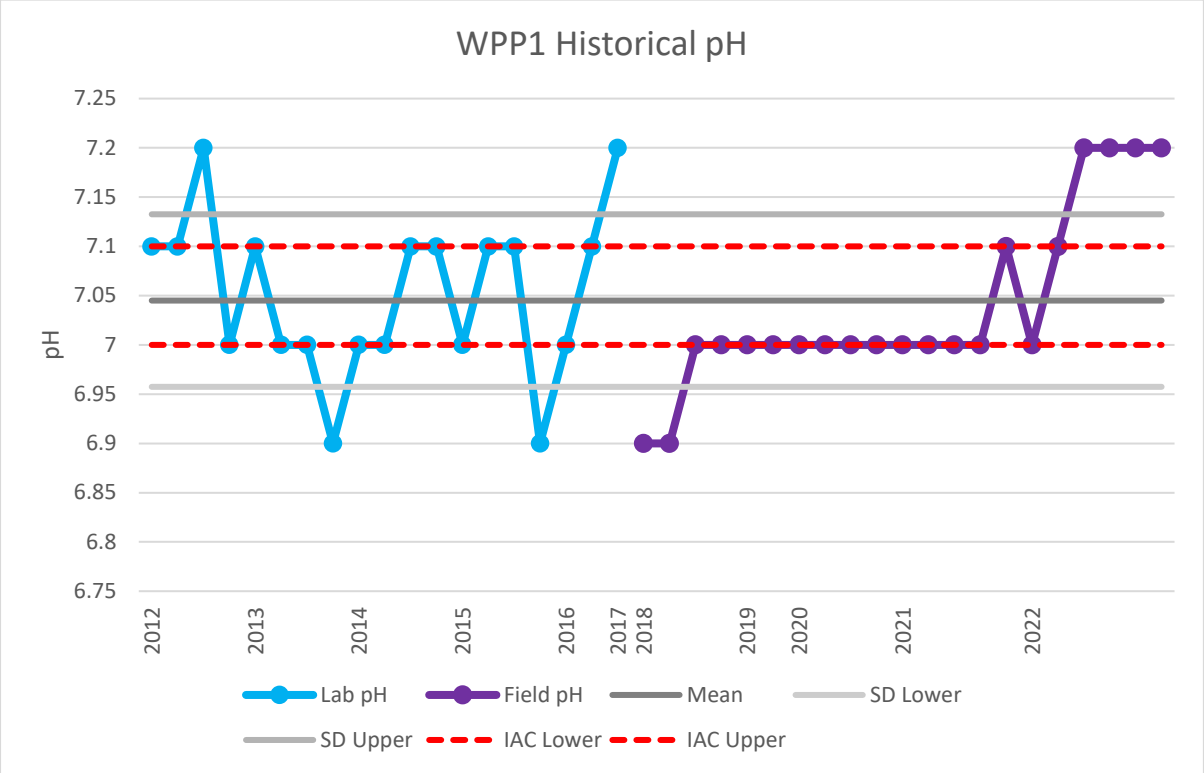


Figure G 29 Historical Monitoring Results pH WPP1

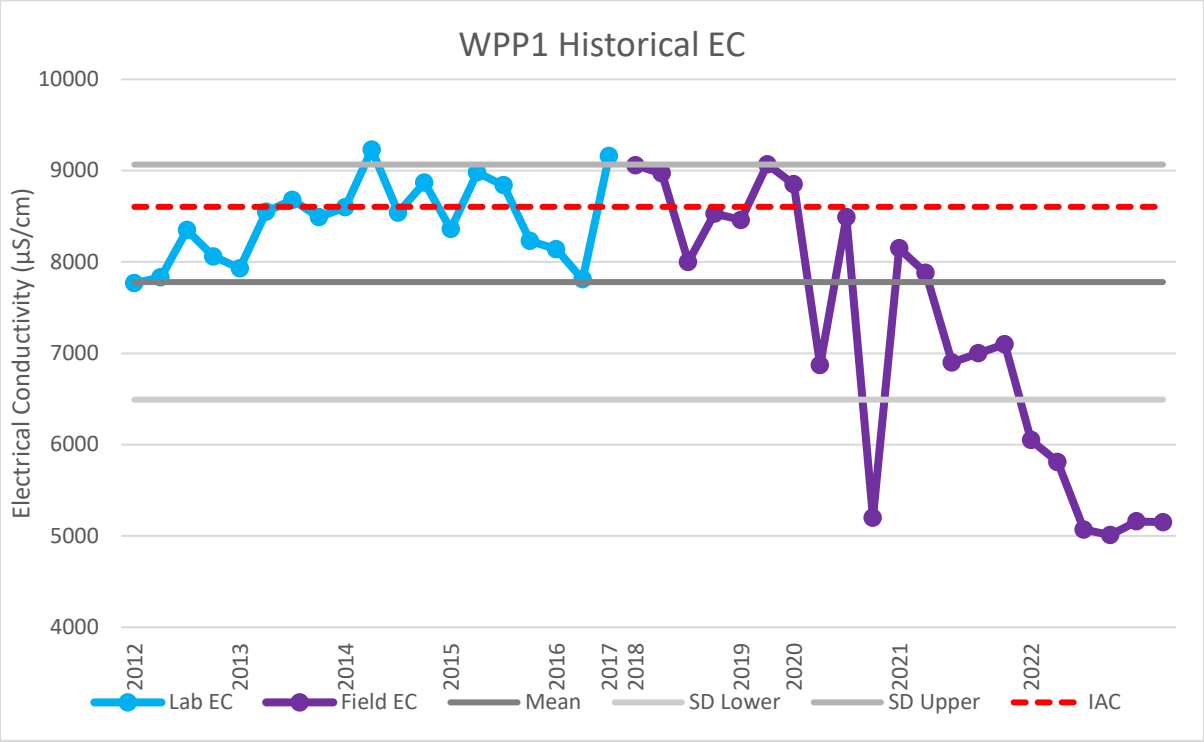


Figure G 30 Historical Monitoring Results EC WPP1

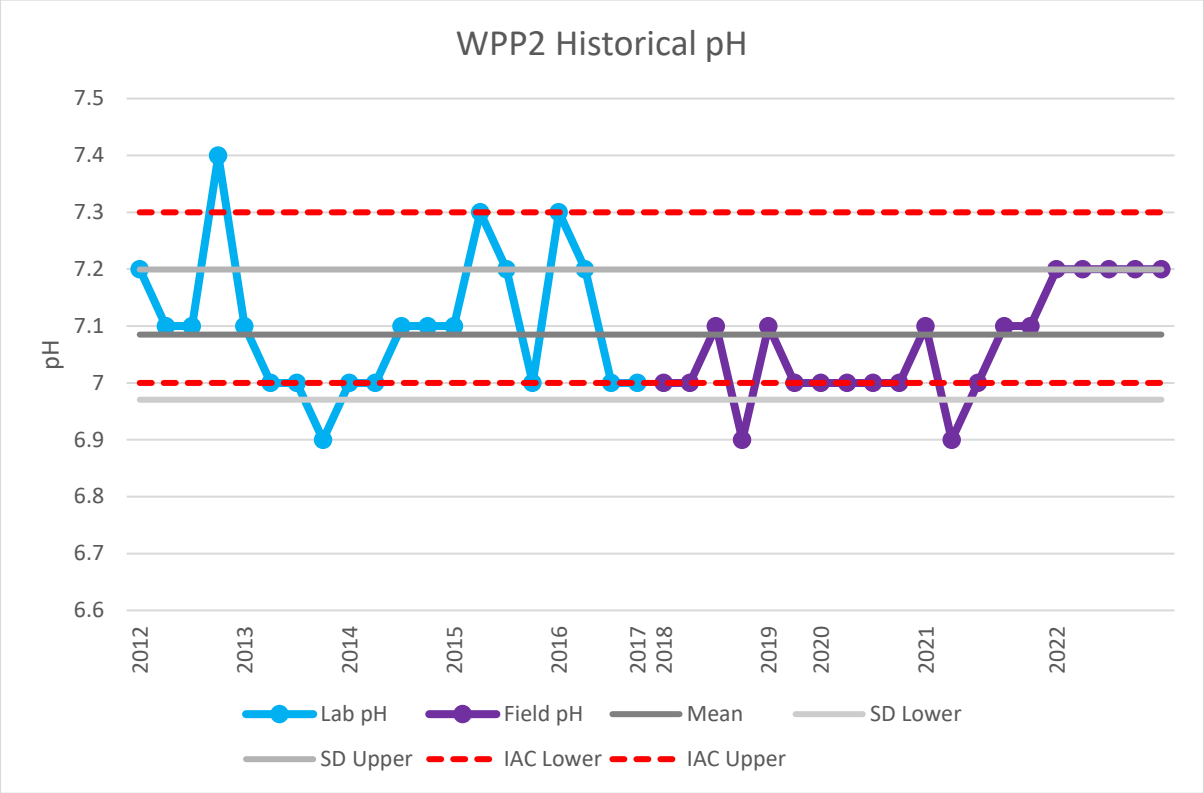


Figure G 31 Historical Monitoring Results pH WPP2

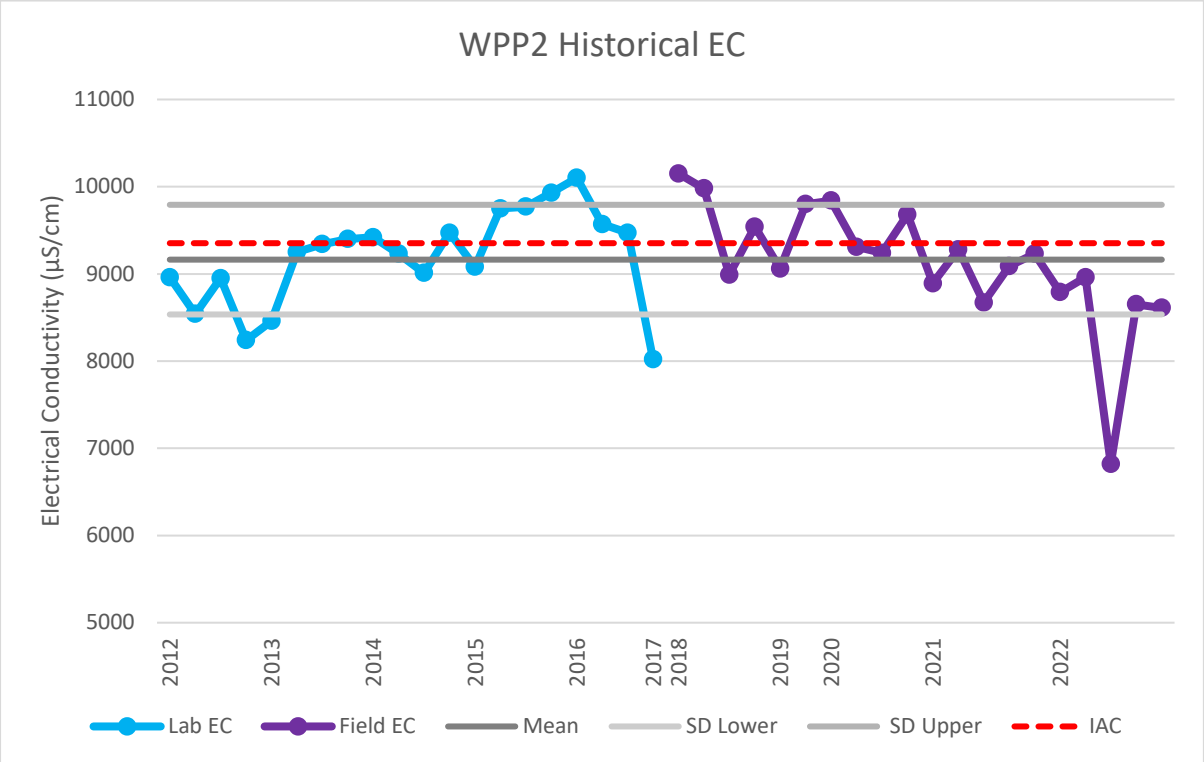


Figure G 32 Historical Monitoring Results EC WPP2 Tall

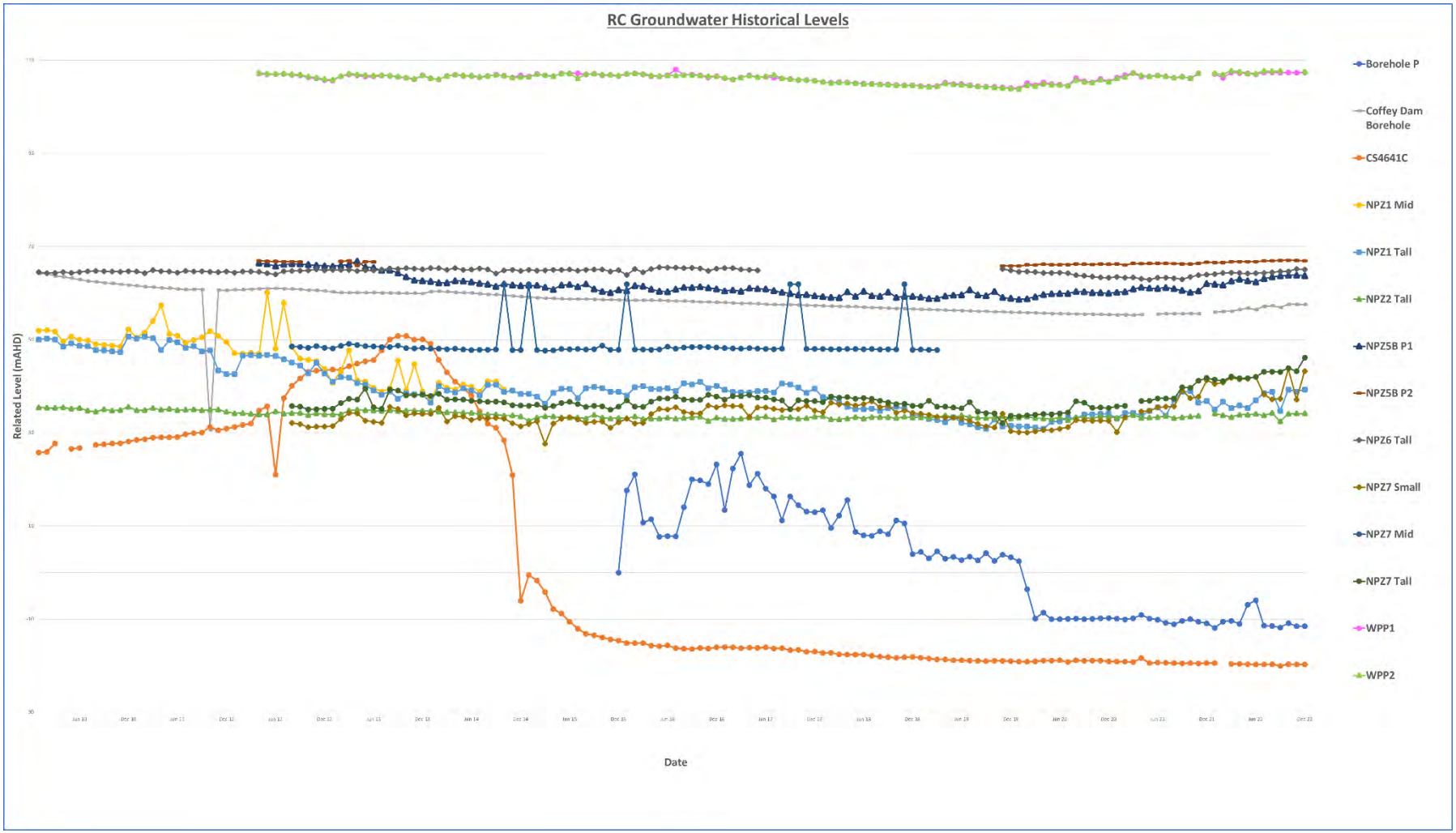


Figure G *33* Historical Groundwater Monitoring Levels

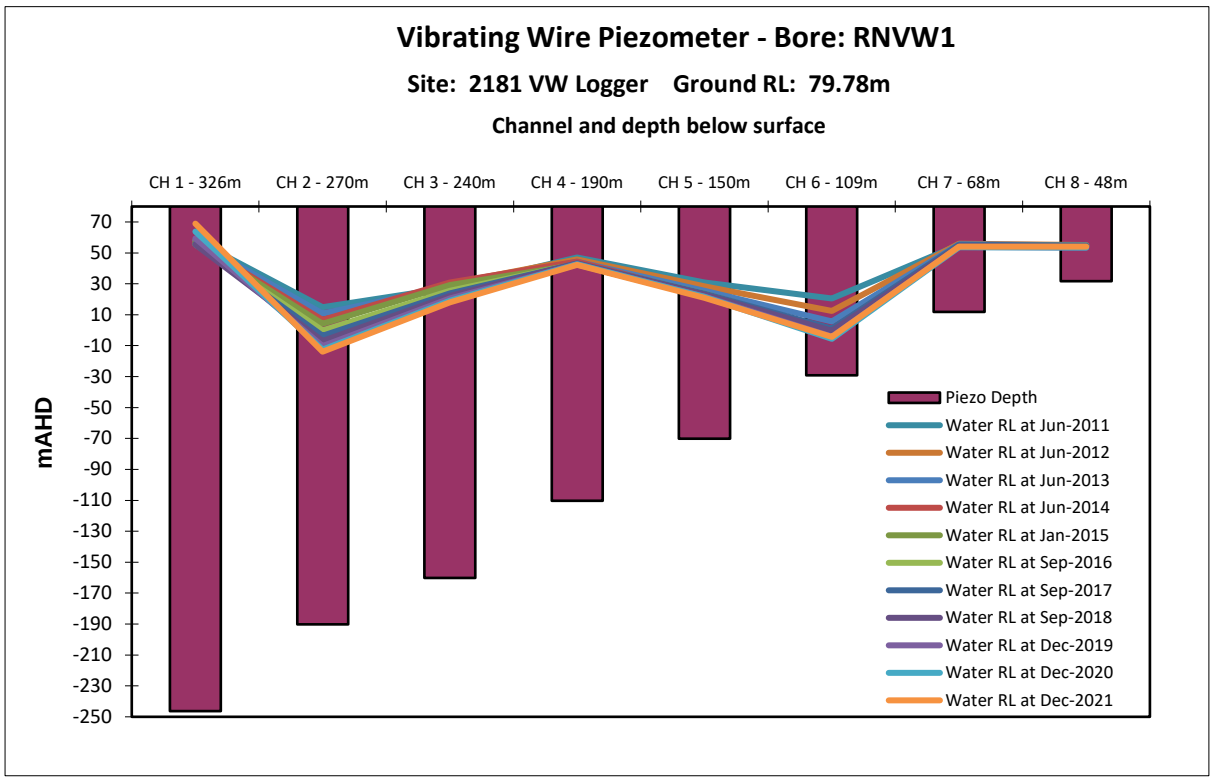


Figure G 34 Vibrating Wire Piezometer - Bore: RNVW1

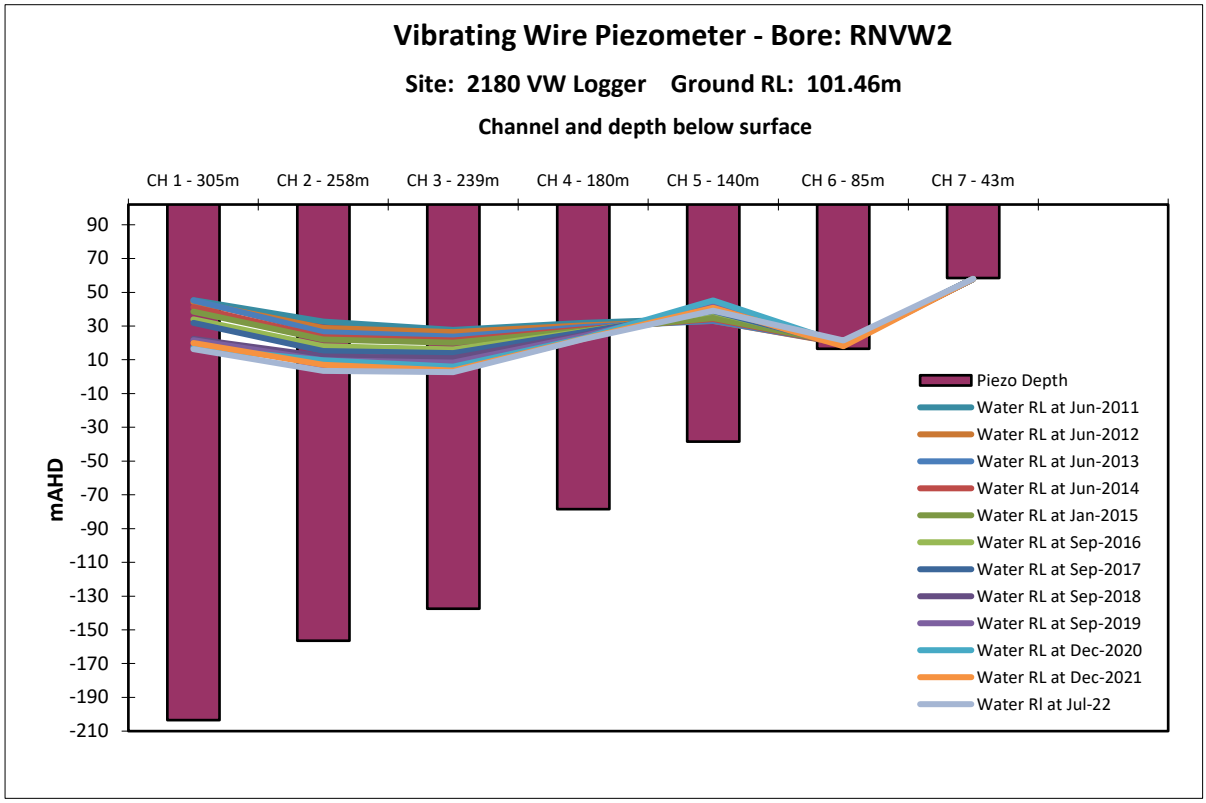


Figure G 35 Vibrating Wire Piezometer - Bore: RNVW2

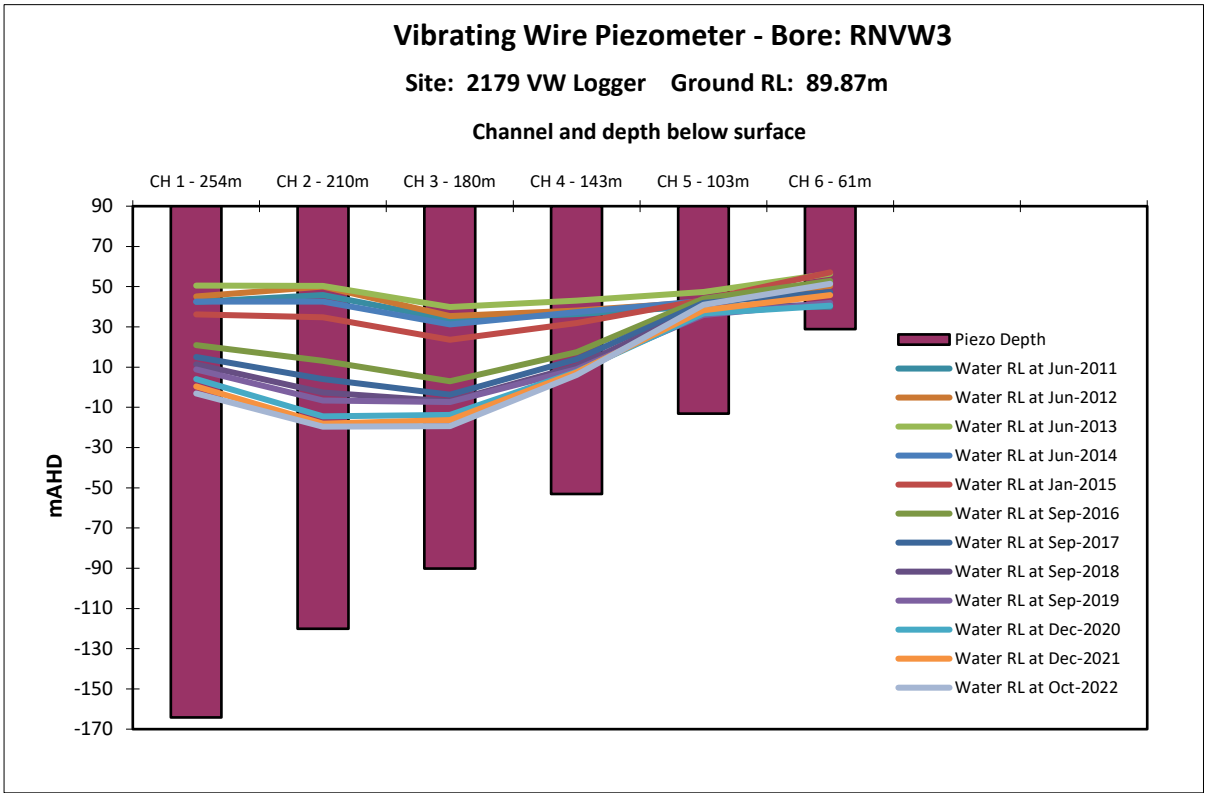


Figure G 36 Vibrating Wire Piezometer - Bore: RNVW3

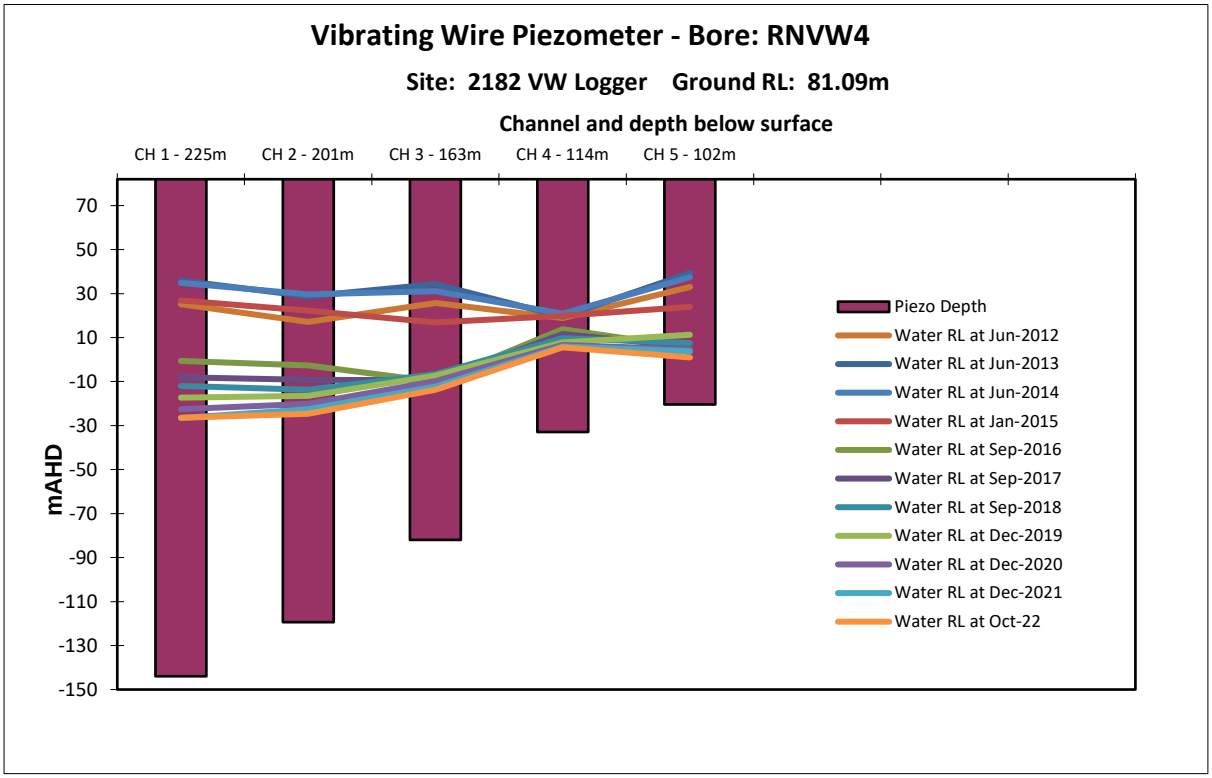


Figure G 37 Vibrating Wire Piezometer - Bore:RNVW4

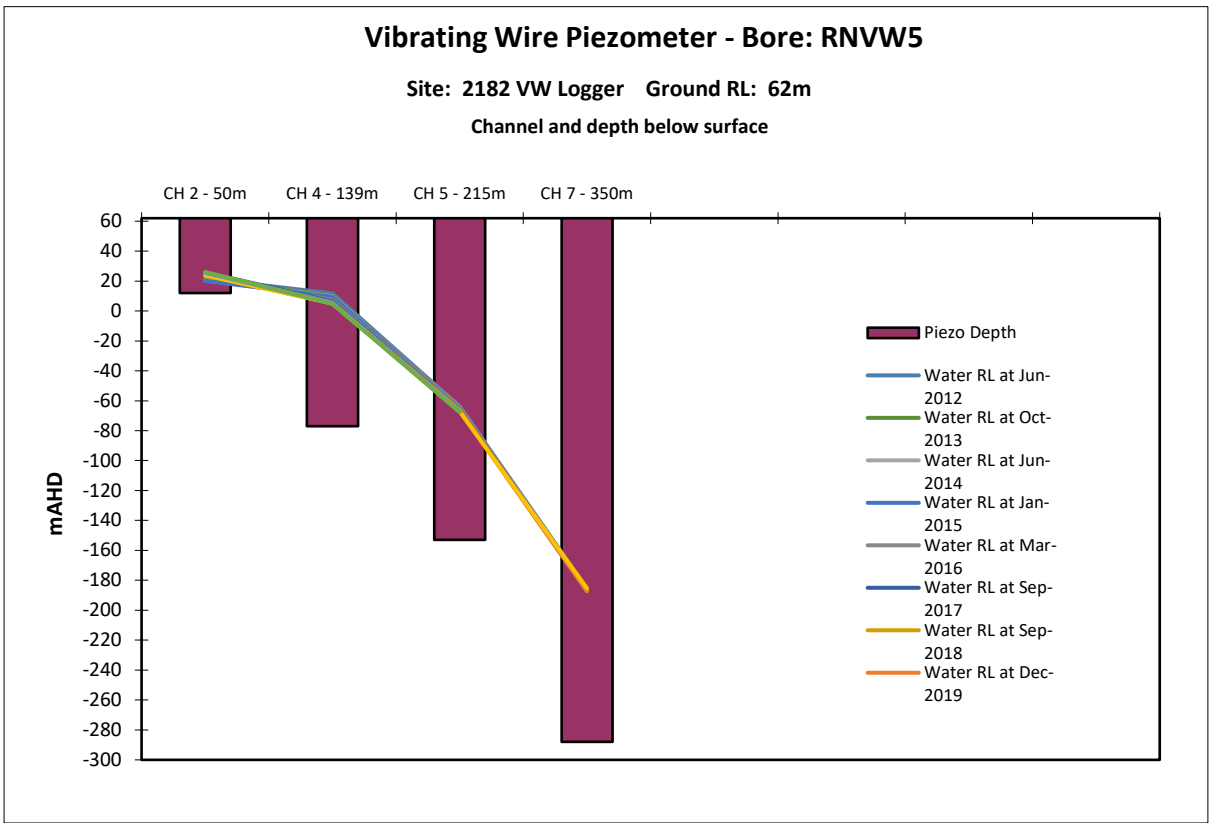


Figure G 38 Vibrating Wire Piezometer - Bore: RNVW5

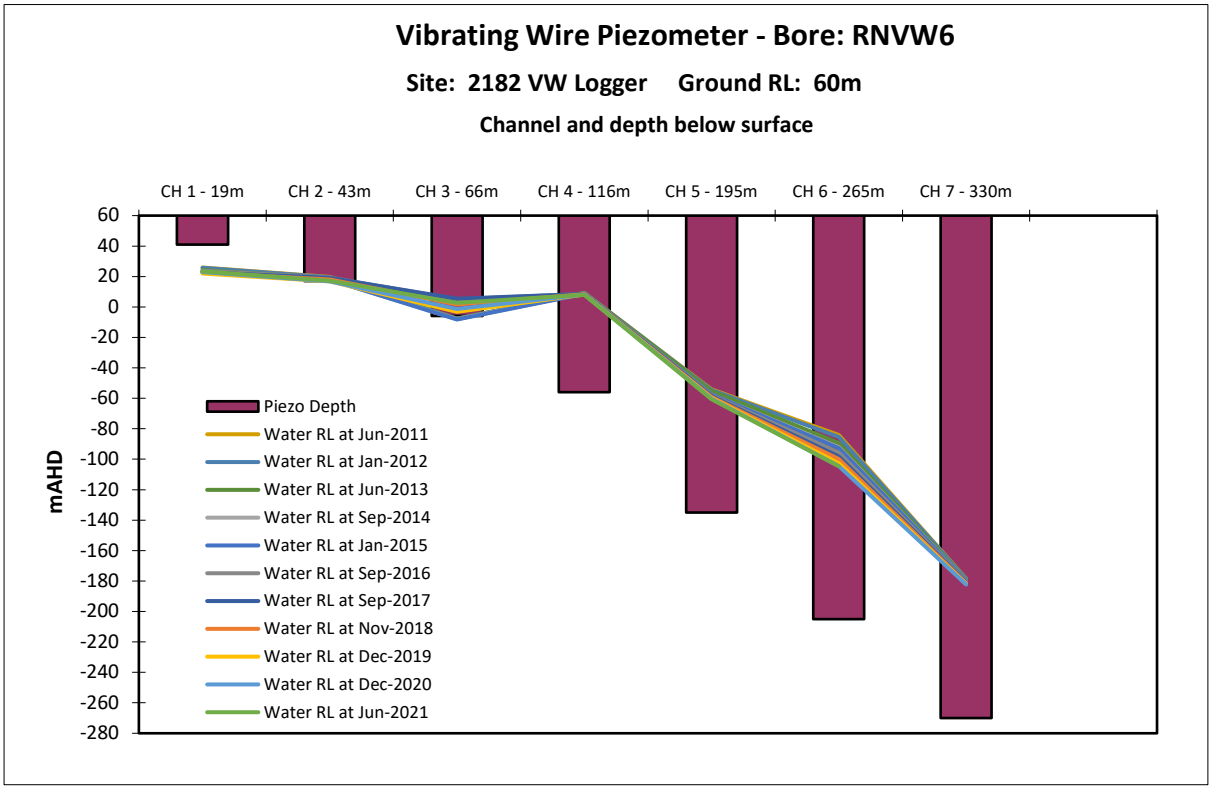


Figure G 39 Vibrating Wire Piezometer - Bore: RNVW6

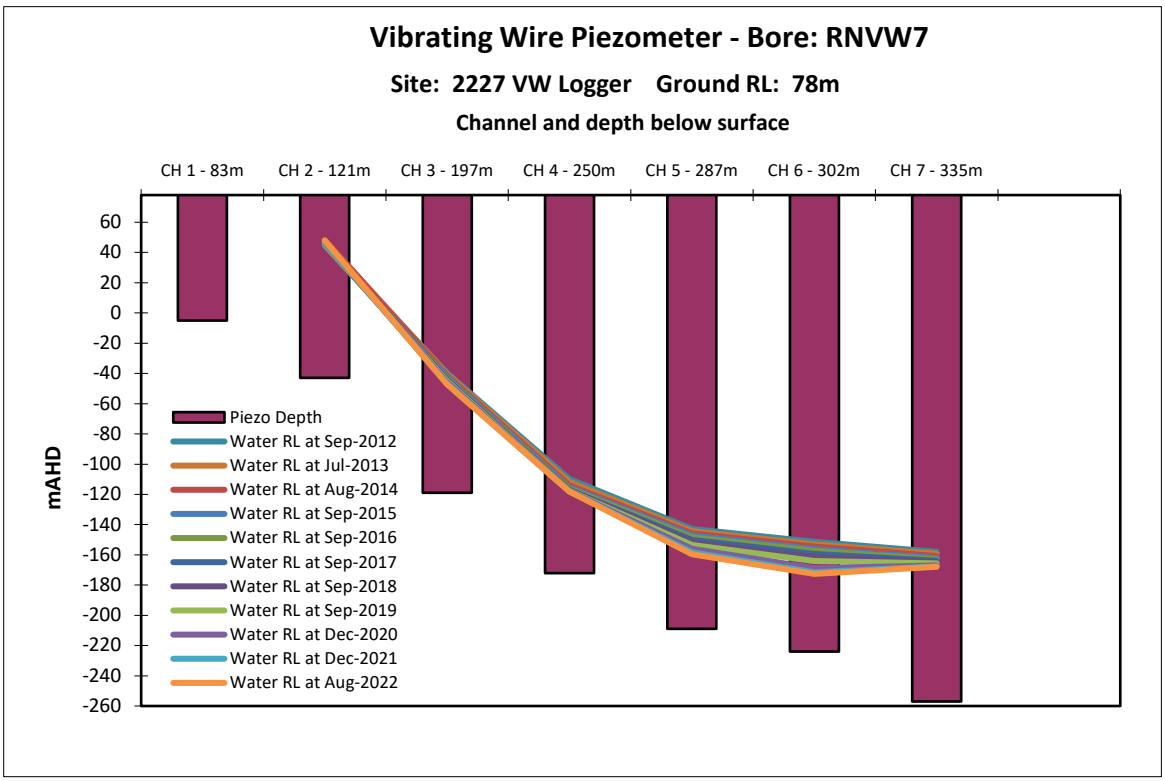


Figure G 40 Vibrating Wire Piezometer - Bore: RNVW7

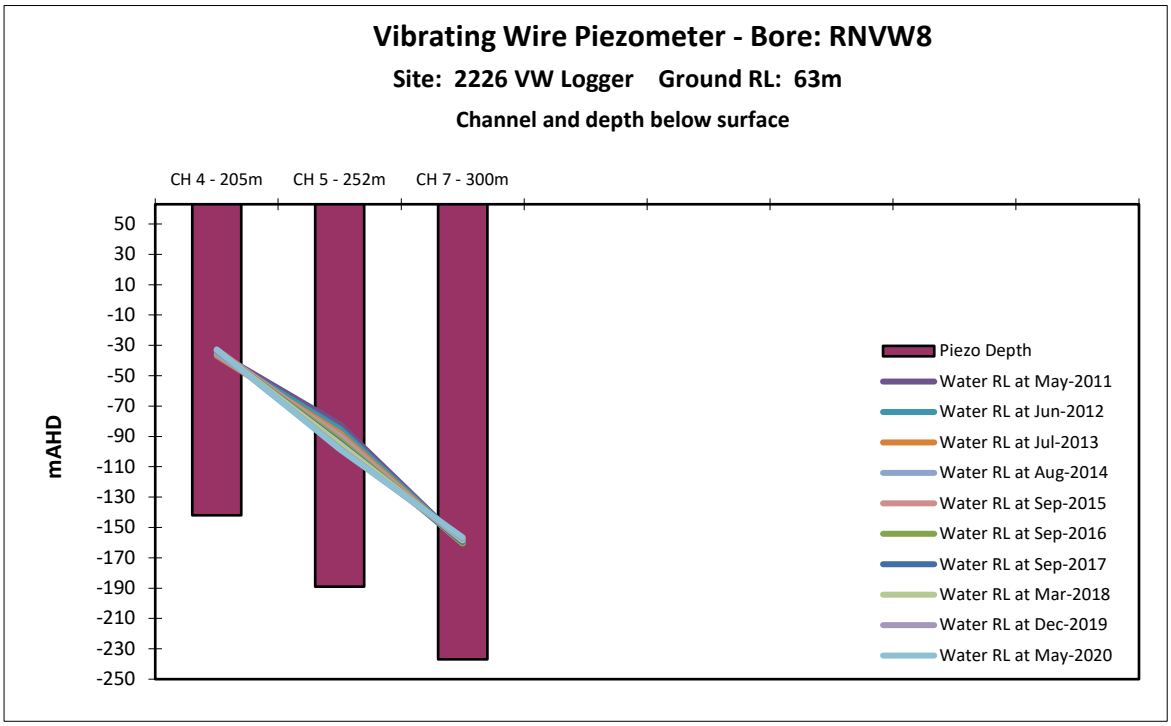


Figure G 41 Vibrating Wire Piezometer - Bore: RNVW8

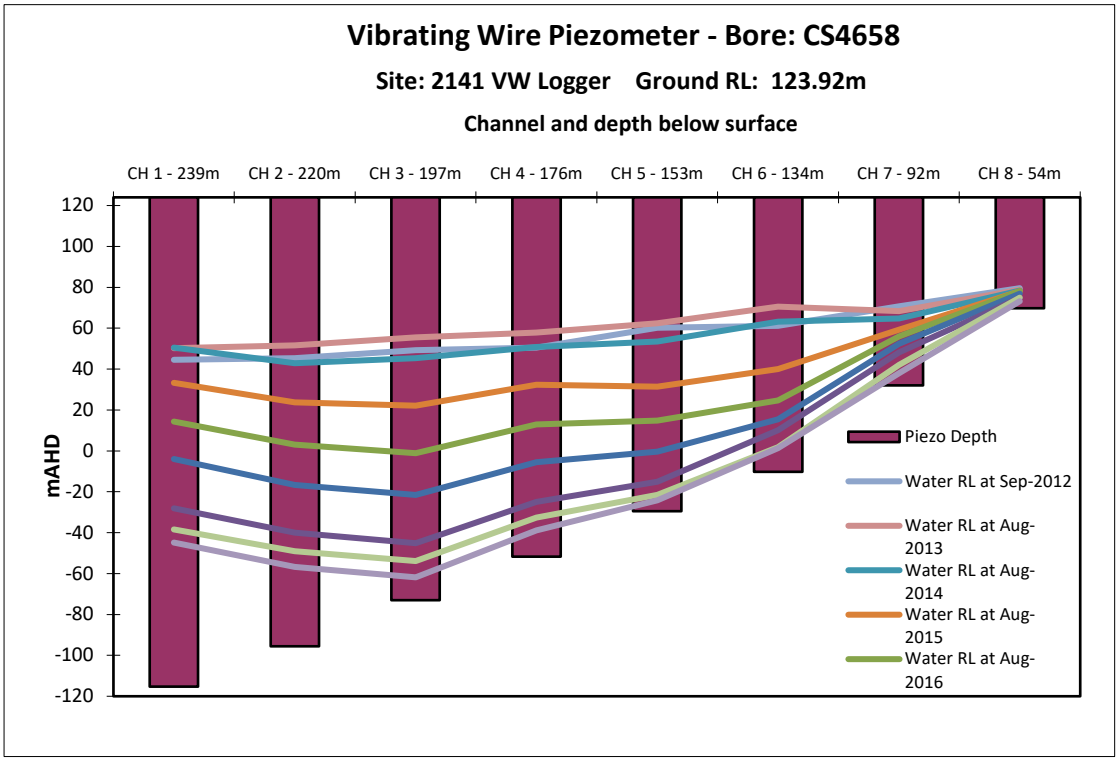


Figure G 42 Vibrating Wire Piezometer - Bore: CS4658

Appendix H - Biodiversity Offset Area Compliance

OAMP Reference	Objective	Target Criteria to be Achieved	2022 Monitoring Results	Corrective Actions
Table 6.4	Augment existing vegetation communities in areas zoned natural regeneration.	Evidence of natural regeneration (tree seedlings), decrease in target weeds or target weeds <10% (see weed management plan), no evidence that feral animals are significantly affecting regeneration (visual assessment).	Regeneration recorded across all BOAs. Limited regeneration in Clifton grassland sites. Richness of weed species is largely unchanged. Density of weed species has decreased since previous years monitoring. Several target weed species recorded at both grassland and woodland sites in these BOAs. Some impacts to vegetation from feral animals observed, particularly feral pigs in grassland areas.	Additional assisted regeneration in open grassland areas. Continue to implement management actions outlined in OAMP. Undertake brush-matting (where resources permit) in grassland areas (as per Recommendations). Continue feral animal management within all BOAs.
	Re-establish regionally significant vegetation communities consistent with remnant vegetation in areas zoned assisted regeneration and remediation.	Assisted regeneration and remediation areas within the Offset Areas contain flora species assemblage characteristic of the vegetation communities that are being created.	Data was collected from established monitoring sites to allow for timeline comparisons. Grassland areas, particularly those in Ravensworth and Clifton lack canopy regeneration. Further regeneration assistance may be required.	Focus assisted regeneration efforts in grassland areas. Continue to undertake scheduled seeding/ planting works. Undertake brush-matting and soil amelioration measures in grassland areas (as per Recommendations).
	Re-establish or augment fauna habitats for native and threatened fauna (woodland/forest).	Regeneration and remediation areas contain flora species that provide food, shelter and refuge opportunities for native and threatened fauna.	Data was collected from established monitoring sites to allow for timeline comparisons. Habitat still provided for a range of species. Several threatened fauna species detected historically, historically and in current monitoring year. Differences in floristics between woodland and grassland sites remain. Regeneration of flora species that provide habitat to fauna species is advancing in HOA and SOAs. Assistance in RNOA and COA is likely needed.	Assistance in grassland regeneration and shrub regeneration may be beneficial. Continue to implement management and monitoring actions as per the OAMP.
		Evidence of a range of vegetation structural habitats exists (e.g., canopy species, shrubs, ground cover, developing litter layer etc.) that are commensurate with native and threatened fauna that occur within the area.		
		Native/threatened woodland fauna are utilising offset areas.		
	Re-establish and augment habitat for the Green and Golden Bell Frog (wetland and open grassland areas).	Green and Golden Bell Frog habitat reestablishment and augmentation areas contain flora species that are commensurate with those known to provide habitat for this species.	Structural habitat elements present. Water now present in most dams during the GGBF survey period. Nine dams in RNOA, three in HOA, one in COA and three in SOA had moderately sufficient to suitable habitat features to support the GGBF. Evidence of flora plantings near dams at HOA. No GGBFs were recorded during surveys.	Continue to implement management actions as per the OAMP. HOA has the highest number of dams however the vast majority still lack suitable habitat. Augmentation at these dams likely beneficial. Consider alternate monitoring methods (as per Recommendations). More robust survey for *Gambusia holbrooki* necessary.
Table 7.3	Targeted weed removal across all offset properties to remove noxious and perennial weed species.	Decrease in abundance of all target weed species in first ten years.	Target weed species recorded across all BOAs. Target weed species recorded at both grassland and woodland sites in these BOAs. Target weed coverage over the BOA monitoring sites overall is lower in the current monitoring round.	Continue weed mapping and focus on management plan priorities. Continue to implement management actions as per the OAMP with focus on areas described in this report.
		Weed infestations considered negligible across all four offset properties within 15 years.	Data was collected from established monitoring sites to allow for timeline comparisons and future analysis. Exotic species richness/density overall is lower across the BOA's however, some grassland sties carry large areas of exotic species.	
	Primary, secondary and maintenance weeding within areas zoned assisted regeneration and remediation, to prepare the sites for planting and maintain them so that weed infestation does not compromise the survival of planted seedlings.	Assisted regeneration and remediation areas within the Offset Areas are dominated by native species in all strata (trees, shrubs, groundcover).	Monitoring did not cover any areas with assisted regeneration. The continued success of one area of assisted regeneration was noted in Hillcrest.	Continue to implement management actions as per the OAMP.

OAMP Reference	Objective	Target Criteria to be Achieved	2022 Monitoring Results	Corrective Actions
Table 8.1	To minimise browsing/disturbance of regeneration areas.	Minimal level of browsing observed (<10% of plants showing evidence of rabbit browsing in permanent plots).	Rabbits observed within the RNOA and Hillcrest during the 2022 monitoring programme.	Continue feral rabbit management at RNOA and Hillcrest. Continue to implement management actions as per the OAMP.
		Disturbance by feral pigs (i.e. digging) is minimal (visual assessment).	Feral pigs were recorded within RNOA during the 2022 monitoring programme.	Continue to implement management actions as per the OAMP.
	To minimise predation of, or competition with, native species by feral pest species.	Evidence of foxes/feral cats/wild dogs (including scats, dens, signs of predation) is minimal (Visual assessment).	Dog observed crossing through HOA. No evidence of foxes or cats in 2022.	Continue to implement management actions for feral animals as per the OAMP.
		Regular monitoring by PIR cameras show only occasional use of the site by feral predators.	Cameras were deployed in 2022 but did not target feral pests, so unable to comment. Feral pests likely still active in some areas.	Ensure monitoring of feral animals is conducted.
Table 11.1	Increase habitat linkages between Davis and Bayswater Creeks in RNOA through augmenting /creating a series of dams.	A series of 10 dams with habitat specific to the Green and Golden Bell Frog have been created /augmented between Davis and Bayswater Creeks.	15 dams exist that support habitat specific to the Green and Golden Bell Frog across all BOA's	Continue to implement management actions as per the OAMP and OMP.
	Removal of Mosquito Fish from dams on all four properties.	Dams and waterways are free of Mosquito Fish.	No evidence of Mosquito Fish in dams surveyed.	Continue monitoring for Mosquito Fish as per the OAMP. More detailed survey may be necessary to determine.
	Maintain/augment Green and Golden Bell Frog habitat on RNOA and HOA.	All dams to include native emergent and fringing plant species, surrounding shelter sites and unshaded areas within three years.	here was no increase in available habitat for GGBF during the current monitoring period. However there were numerous dams that supported appropriate habitat for the species.	Focus assisted plantings of suitable aquatic vegetation at dams identified as limited or not suitable habitat for the GGBF. Assisted plantings should aim to create dense patches of vegetation rather than sparse plantings. Continue to implement management actions as per the OAMP.
	Conduct ongoing annual Green and Golden Bell Frog surveys on RNOA and HOA to provide a better understanding of the local population.	Increased understanding of the Hunter Catchment Green and Golden Bell Frog population.	No records of the GGBF during the 2022 monitoring programme.	Continue to implement management and monitoring actions as described in the OAMP. Implement other survey methods as discussed in Recommendations.