HUNTER VALLEY
OPERATIONS

2024 ANNUAL ENVIRONMENTAL REVIEW

DOCUMENT NUMBER
HVOOC-748212775-6

STATUS
[Document Status (Office)]

VERSION
[Document Version (Office)]

EFFECTIVE
[Effective Date]

REVIEW
[Planned Review Date]

OWNER
[Owner (Office)]

TITLE BLOCK

Name of Operations	Hunter Valley Operations
Name of Operator	HV Operations Pty Ltd
Development Consent / Project Approval	DA 450-10-2003 / PA 06_0261
Name of holder of development consent/project approval	HV Operations Pty Ltd
Mining Lease Number	Contained within Table 3-2 of this report
Name of Mining Lease Holder	Contained within Table 3-2 of this report
Water Licence Number	Contained within Table 3-4 of this report
Name of Water Licence Holder	Contained within Table 3-4 of this report

I, David Foster, certify that this audit report is a true and accurate record of the compliance status of Hunter Valley Operations for the period 01/01/2024 to 31/12/2024 and that I am authorised to make this statement on behalf of Hunter Valley Operations.

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 Authorised Reporting Officer	David Foster
Title of Authorised Reporting Officer	General Manager
Signature of Authorised Reporting Officer	
Date	31/03/2025

TABLE OF CONTENTS

FIGURES

TABLES

1 | STATEMENT OF COMPLIANCE

Table 1-1 is a Statement of Compliance against the relevant approvals. **Table 1-2** provides a brief summary of the non-compliances against development consents and a reference to where these are addressed within this Annual Review. **Table 1-3** shows the compliance status descriptions relating to **Table 1-2**.

Table 1-1: Statement of Compliance

Were all conditions of the relevant approvals complied with?	
PA 06_0261 (HVO South)	No
DA 450-10-2003 (HVO North)	No

Table 1-2: Non-Compliances

Relevant Approval	Condition Number	Condition Description	Compliance Status	Where Addressed in Annual Review
DA 450-10-2003	Schedule 3 Condition 4A	Cheshunt East PM_{10} Exceedance 5 February 2024	Non-compliant (low)	Section 11
DA 450-10-2003	Schedule 3 Condition 4A	Jerrys Plains PM_{10} Exceedance 13 March 2024	Non-compliant (low)	Section 11
PA 06_0261	Schedule 3, Condition 18	Level 4B Blast Fume Event 4 June 2024	Non-compliant (low)	Section 11
EPL 640	E1.1	Dam 17N Pumping Incident 22 June 2024	Non-compliant (low)	Section 11
DA 450-10-2003	Schedule 3 Condition 4A	Jerrys Plains PM_{10} Exceedance 4 November 2024	Non-compliant (low)	Section 11
DA 450-10-2003	Schedule 3 Condition 4A	Cheshunt East PM_{10} Exceedance 7 November 2024	Non-compliant (low)	Section 11
DA 450-10-2003	Schedule 3, Condition 17	Level 4B Blast Fume Event 22 November 2024	Non-compliant (low)	Section 11
DA 450-10-2003	Schedule 3 Condition 4A	Jerrys Plains PM_{10} Exceedance 14 December 2024	Non-compliant (low)	Section 11
DA 450-10-2003	Schedule 3, Condition 4A	DL30 Depositional Dust Annual Exceedance	Non-compliant (low)	Section 11
PA 06_0261	Schedule 3 Condition 19	Warkworth TSP Annual Average Exceedance	Non-compliant (low)	Section 11

Table 1-3: Compliance Status Key for Table 1-2

Risk Level	Colour Code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: Potential for serious environmental consequences, but is unlikely to occur; or Potential for moderate environmental consequences, but is unlikely to occur
Low	Non-compliant	Non-compliance with: Potential for moderate environmental consequences, but is unlikely to occur or Potential for low environmental consequences, but is unlikely 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)

2 | INTRODUCTION

2.1 | DOCUMENT PURPOSE

This Annual Review is written to satisfy the requirements of the Development Consents and conditions of mining leases held by Hunter Valley Operations (HVO) for events which occurred during the 2024 calendar year (the reporting period). The Annual Review has been written in accordance with the *Post-approval requirements for State significant mining developments – Annual Review Guideline* (NSW Government, October 2015).

This report is distributed to:

- NSW Department of Planning, Housing and Infrastructure (DPHI);
- NSW Resource Regulator (RR);
- NSW Environment Protection Authority (EPA);
- Department of Climate Change, Energy, the Environment and Water—Water (DCCEEW – Water);
- Singleton Council;
- Muswellbrook Shire Council; and
- HVO Community Consultative Committee (CCC).

2.2 | BACKGROUND

HVO is situated in the Upper Hunter Valley between Singleton and Muswellbrook, approximately 24 km northwest of Singleton, and approximately 100 km northwest of Newcastle. The Hunter River geographically divides HVO into HVO North (DA 450-10-2003) and HVO South (PA 06_0261), however they are integrated operationally with personnel, equipment and materials utilised as required. This improves operational efficiency, rationalisation of infrastructure and resource utilisation.

HVO is owned through a Joint Venture (JV) between Glencore (49%) and Yancoal (51%).

The regional context and layout of the HVO pits and facilities are shown in **Figure 2-1** and **Figure 2-2** respectively.

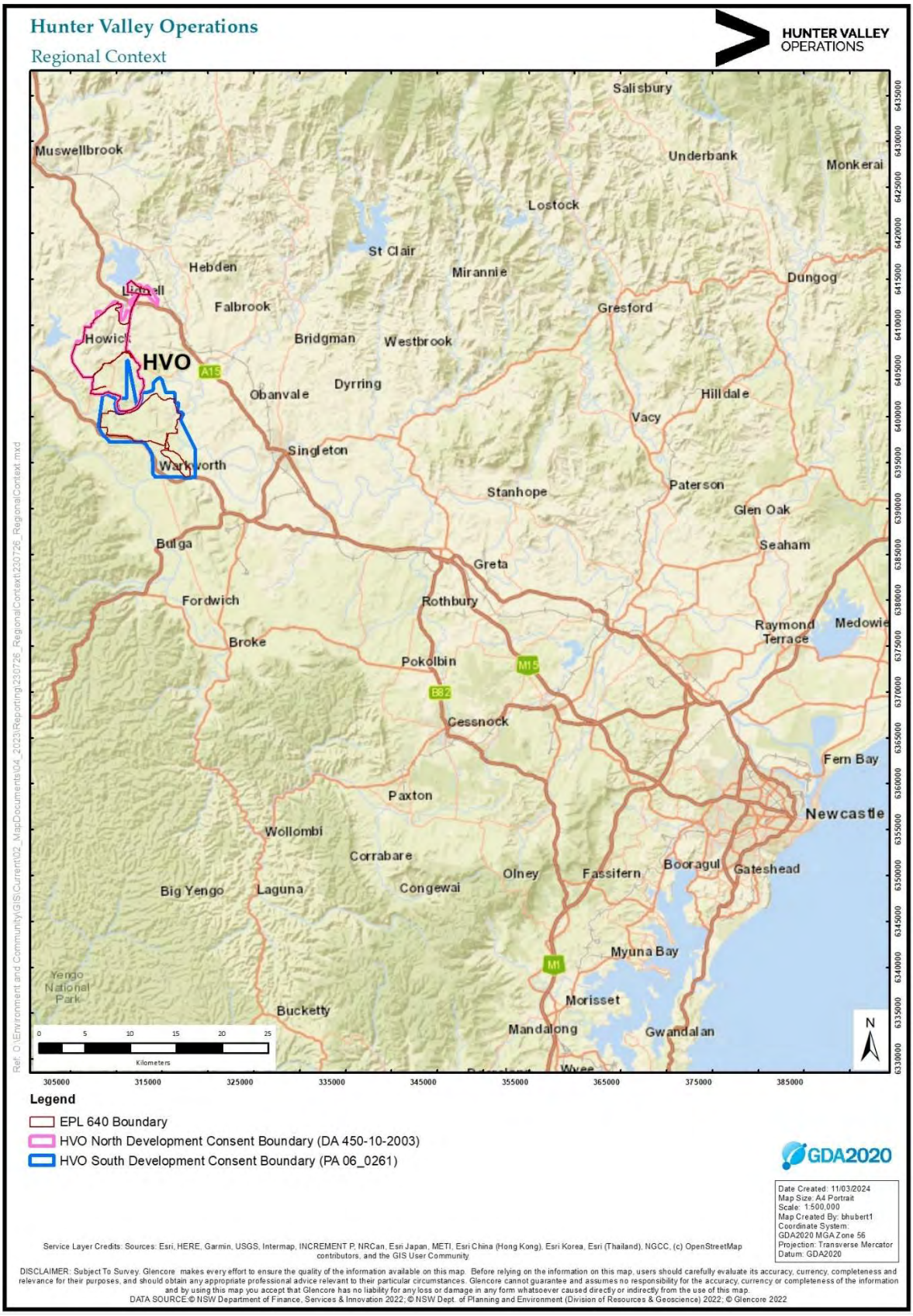


Figure 2-1: Regional Context

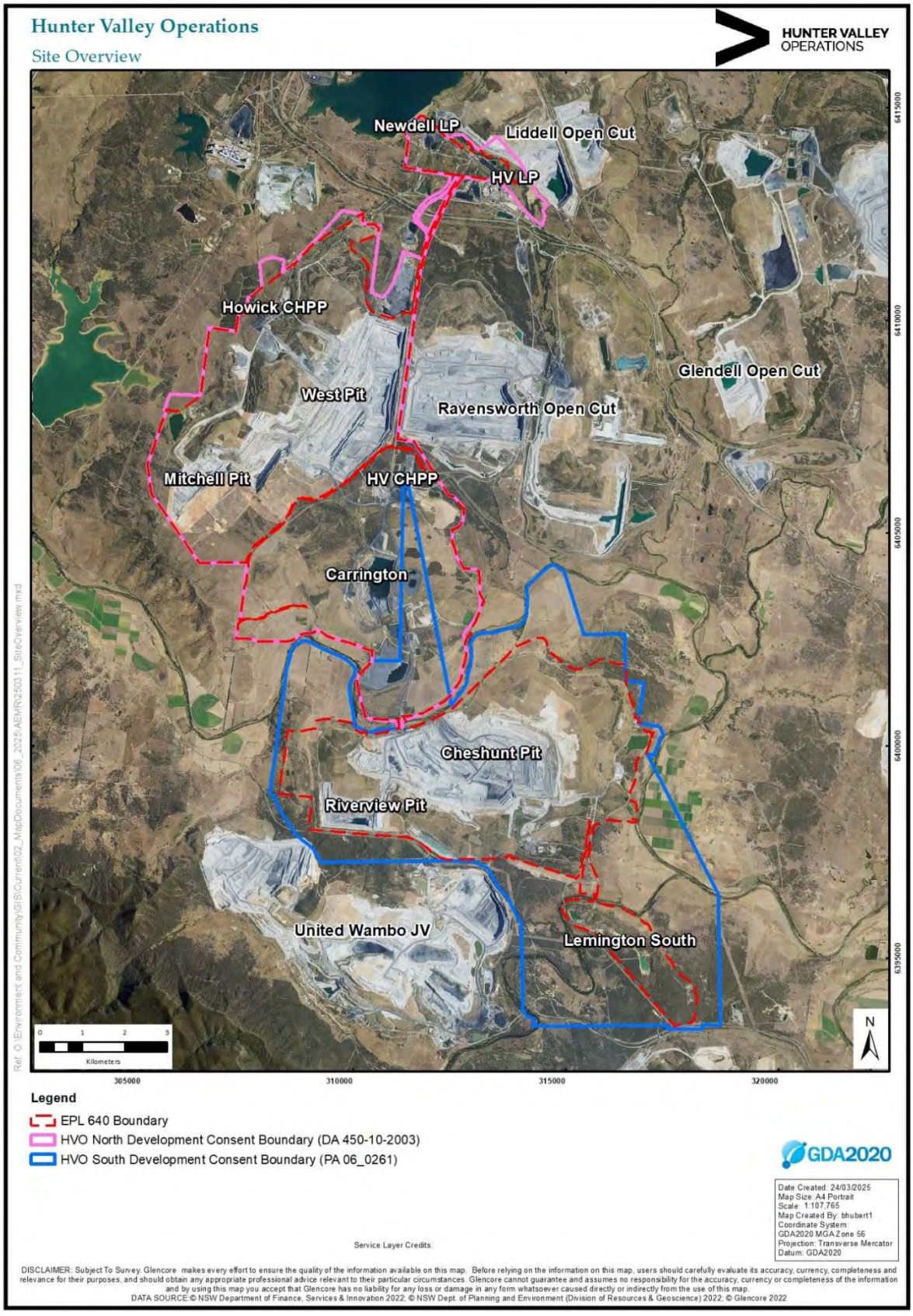


Figure 2-2: Hunter Valley Operations Site Overview

2.3 | MINE CONTACTS

Key mine contacts are listed in **Table 2-1**.

Table 2-1: Mine Contacts

Contact	Role	Phone	Email
David Foster	General Manager	1800 888 733	david.foster@hvo.com.au
Ben de Somer	Environment and Community Manager		ben.desomer@hvo.com.au

3 | OBJECTIVES

3.1 | APPROVALS, LEASES AND LICENCES

3.1.1 | CURRENT APPROVALS

The status of HVO development consents, licences and relevant approvals are listed in:

Table 3-1: HVO Major Approvals

Table 3-2: HVO Mining Tenements

Table 3-3: HVO Licences and Permits

Table 3-4: Water Related Approvals

Table 3-5: Surface Water Access Licences 2023/24 Water Year

Table 3-6: Groundwater Access Licences

Table 3-1: HVO Major Approvals

Approval Number	Description	Issue Date	Expiry Date
HVO North DA 450-10-2003 MOD 7	HVO West Pit Extension and Minor Modifications (2003); and associated modifications. MOD 7 approved July 2017. Covers West Pit (approved production limit of 12 Mtpa), Carrington Pit (approved production limit of 10 Mtpa), HVCPP (approved processing limit of 20 Mtpa) and Howick CHPP (approved processing limit of 6 Mtpa). An application to modify the HVO North approval (MOD 8) for an extension of time for mining operations through to 31 December 2026 was submitted in November 2024. The Modification Report was placed on public exhibition from 27 November 2024 through to 10 December 2024.	28/07/2017	12/06/2025
HVO South PA 06_0261 MOD 8	Hunter Valley Operations – South Coal Project and associated modifications. MOD 8 Approved 6 February 2023. Covers Riverview and Cheshunt Pits (approved production limit of 20 Mtpa) and processing rate of 20 Mtpa across HVO coal preparation plants.	06/02/2023	24/03/2030
EPBC 2016/7640	Hunter Valley Operations – State approved mining Hunter Valley NSW	10/10/2016	31/12/2030

Table 3-2: Summary of Mining Tenements

Title	Mining Tenement	Titleholder	Purpose	Grant Date	Expiry Date	Status
AL 32	Assessment Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	04/11/2020	03/11/2026	Granted
AL 33	Assessment Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	04/11/2020	03/11/2026	Granted
AL 34	Assessment Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	04/11/2020	03/11/2026	Granted
AUTH 72	Authorisation	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	08/03/1977	08/03/2027	Granted
EL 5291	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	28/04/1997	28/04/2029	Granted
EL 5292	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	28/04/1997	27/04/2028	Granted
EL 5417	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	23/12/1997	23/12/2027	Granted
EL 5418	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	23/12/1997	23/12/2028	Granted
EL 5606	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	11/08/1999	11/08/2029	Granted
EL 8175	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	23/09/2013	23/09/2026	Granted
EL 8821	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	13/02/2019	13/02/2025	Renewal Pending
(Part) CCL 708	Various Sub leases	Liddell Tenements Pty Ltd	Prospecting and Mining Coal	17/05/1990	17/05/2044	Granted
CCL 714	Consolidated Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	23/05/1990	30/08/2030	Granted
CCL 755	Consolidated Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	24/01/1990	05/03/2030	Granted
CL 327	Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	06/03/1989	06/03/2031	Granted
CL 359	Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	21/05/1990	21/05/2032	Granted

Title	Mining Tenement	Titleholder	Purpose	Grant Date	Expiry Date	Status
CL 360	Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	29/05/1990	29/05/2032	Granted
CL 398	Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	04/06/1992	04/06/2034	Granted
CL 584	Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	01/01/1982	31/12/2044	Granted
CML 4	Consolidated Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	02/03/1993	03/06/2033	Granted
ML 1324	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	19/08/1993	19/08/2035	Granted
ML 1337	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	01/02/1994	01/02/2034	Granted
ML 1359	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	01/11/1994	1/11/2036	Granted
ML 1406	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	27/02/1997	10/02/2027	Granted
ML 1428	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	15/04/1998	14/04/2040	Granted
ML 1465	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	21/02/2000	21/02/2042	Granted
ML 1474	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	24/11/2000	23/11/2042	Granted
ML 1482	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	19/03/2001	19/03/2040	Granted
ML 1500	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	21/12/2001	20/12/2043	Granted
ML 1526	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	03/12/2002	02/12/2044	Granted
ML 1560	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	28/01/2005	27/01/2026	Renewal Pending
ML 1589	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	02/11/2006	01/11/2027	Granted

Title	Mining Tenement	Titleholder	Purpose	Grant Date	Expiry Date	Status
ML 1622	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	22/10/2010	10/03/2027	Granted
ML 1634	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	31/07/2009	31/07/2030	Granted
ML 1682	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	16/12/2012	15/12/2033	Granted
ML 1704	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	05/12/2014	05/12/2035	Granted
ML 1705	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	17/12/2014	17/12/2035	Granted
ML 1706	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	09/12/2014	09/12/2035	Granted
ML 1707	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	09/12/2014	09/12/2035	Granted
ML 1710	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	22/12/2016	10/03/2027	Granted
ML 1732	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	06/04/2016	06/04/2037	Granted
ML 1734	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	06/04/2016	06/04/2037	Granted
ML 1748	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	05/12/2016	04/12/2037	Granted
ML 1753	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	19/04/2017	19/04/2038	Granted
ML 1810	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	04/11/2020	04/11/2041	Granted
ML 1811	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	04/11/2020	04/11/2041	Granted
ML 1840	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	03/11/2022	03/11/2043	Granted
ML 1841	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	3/11/2022	03/11/2043	Granted

Title	Mining Tenement	Titleholder	Purpose	Grant Date	Expiry Date	Status
ML 1849	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	16/05/2023	16/05/2044	Granted
ML 1867	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	16/11/2023	16/11/2044	Granted
ML 1869	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	15/12/2023	15/12/2044	Granted
ML 1870	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities (Mining Purposes)	15/12/2023	15/12/2044	Granted
ML 1871	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	15/12/2023	15/12/2044	Granted
AL 32	Assessment Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	04/11/2020	03/11/2026	Granted
AL 33	Assessment Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	04/11/2020	03/11/2026	Granted

Table 3-3: HVO Licences and Permits

Type	Licence Number	Description	Authority	Expiry Date
Environment Protection Licence	EPL640	Environment Protection Licence	EPA	N/A
Licence to Store Explosives	XSTR200117	Licence to Store	SafeWork	02/05/2026
Radiation Licence	RML5085293	Radiation Management Licence	EPA	14/11/2025
Aboriginal Heritage Permit	C0001890	Care Agreement	NSW DCCEEW	03/06/2036
	C0002193	Aboriginal Heritage Impact Permit	NSW DCCEEW	06/12/2026
	5219	Aboriginal Heritage Impact Permit	NSW DCCEEW	12/06/2025
Road Closure Permit	2269820	Road Occupancy Licenses– Golden Highway	RMS	31/12/2024
	N/A	Road Closure Approval - Lemington Road	Singleton Council	30/06/2025

Table 3-4: Water Related Approvals

Licence Number	Type of Licence	Purpose	Legislation	Description	Expiry Date
20BL030566	Bore	Well	Part 5 Water Act 1912	East Open Cut	Perpetuity
20BL141584	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – Carrington Work Licence	Perpetuity
20BL166637	Bore	Monitoring Bore	Part 5 Water Act 1912	No Current Bores	Perpetuity
20BL168820	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – Bores: CGW39, CGW45a, CGW46, CGW47, CGW47a, CGW48, CGW49, P50/38.5, CGW56, 4036C, 4035P, 4032P, 4034P, 4033P, 4053P, 4052P, 4051C, 4040P, 4038C, 4037P Destroyed: CGW7, CGW50, CGW57, CGW58, CGW59, CGW60, CGW61, CGW62, CGW63	Perpetuity
20BL169241	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – Bores: DM1, HF3, HF7 Destroyed: DM2	Perpetuity
20BL169641	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – Bores: CGW5, CGW51A, CGW52, CGW53, CGW54, CGW55A, CGW53A, CGW52A, CGW54A, CGW6, CFW55, CFW57, CFW57A, CFW59, and CFW55R. Destroyed: CGW1, CGW2, CGW3, CGW5, CGW8, CGW9, CGW10, CGW12, CGW13, CGW14, CGW30, CGW33, CGW34, CGW35, CGW36, CGW37, CGW38, CGW40, CGW41, CGW42, CGW43, CGW44, CFW56, CFW56A, CFW58	Perpetuity

Licence Number	Type of Licence	Purpose	Legislation	Description	Expiry Date
20BL170496	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: BZ10 (CHPZ 2A), BZ11 (CHPZ 3A), BZ18 (CHPZ 10A), BZ20 (CHPZ 12A), BZ21 (CHPZ 13D), BZ21A (CHPZ 13A), BZ20A (CHPZ 12D), BZ11A (CHPZ 3D) Destroyed: AP50/47.5, AQ52, AV50/56.5, AS50/62.5, AR55, Bunc 3, BZ25 (Bunc 12), BZ23 (Bunc 14), BZ24 (Bunc 13),	Perpetuity
20BL170497	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: BZ15 (CHPZ 7A), BZ16 (CHPZ 8D), BZ17 (CHPZ 9A), BZ19 (CHPZ 11A), BZ16A (CHPZ 8A), Bunc 46D Destroyed: Bunc 39 (Shallow & Deep), Bunc 44D	Perpetuity
20BL170498	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: BZ12 (CHPZ 4A), BZ13 (CHPZ 5A), BZ14, BZ9 (CHPZ 1A), BC1, BC1a, BZ8-1, BZ8-2, BZ8-3, HG1, HG2, HG2a, HG3, S4, S6, BZ22 (CHPZ14D), BZ22A (CHPZ 14A), BZ5-1, BZ5-2 Destroyed: S2, S3, S9, S11	Perpetuity
20BL171423	Bore	Monitoring Bore	Part 5 Water Act 1912	E1.5	Perpetuity
20BL171424	Bore	Monitoring Bore	Part 5 Water Act 1912	Destroyed: GW9711	Perpetuity
20BL171425	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: GW9701, GW9710	Perpetuity
20BL171426	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: GW9702 Destroyed: D2(WH236)	Perpetuity
20BL171427	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: C335, C630 (BFS)	Perpetuity
20BL171428	Bore	Monitoring Bore	Part 5 Water Act 1912	D807	Perpetuity
20BL171429	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: B925 (BFS), C122 (BFS), C122 (WDH)	Perpetuity
20BL171430	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: C613 (BFS), C809 (GM/WDH)	Perpetuity
20BL171431	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: B631 (BFS), B631 (WDH)	Perpetuity
20BL171432	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: C130 (AFSH1), C130 (ALL), C130(BFS), C130 (WDH)	Perpetuity
20BL171433	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bore B334 (BFS)	Perpetuity
20BL171434	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: C317 (BFS), C317 (WDH)	Perpetuity
20BL171435	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: BZ3-1, BZ3-2, BZ3-3	Perpetuity

Licence Number	Type of Licence	Purpose	Legislation	Description	Expiry Date
20BL171436	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: BZ4A(1), BZ4A(2), BZ4B	Perpetuity
20BL171437	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: WG1, WG2, WG3	Perpetuity
20BL171439	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: BRN, E012	Perpetuity
20BL171492	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: C1(WJ039), GW9704, North, GWAR981	Perpetuity
20BL171681	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: Bunc 45A, Bunc 45D	Perpetuity
20BL171725	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: B425 (WDH), BRS, C621 (BFS), C919 (ALL), D317 (BFS), D317(ALL), D317(WDH) Destroyed: D420, D425, D621, PB02	Perpetuity
20BL171726	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: SR002, SR003, SR004, SR005, SR006, SR007	Perpetuity
20BL171727	Bore	Monitoring Bore	Part 5 Water Act 1912	SR001	Perpetuity
20BL171728	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: BZ2B, BZ1-1, BZ1-2, BZ1-3, BZ2-1, BZ2-2	Perpetuity
20BL171762	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: C817, D010 (BFS), D214 (BFS), D406 (BFS) (AFS), D510 (BFS), PB01 (ALL), D510 (AFS), D010 (GM), D010 (WDH), D406 (BFS) (AFS), D612 (AFS), D612 (BFS)	Perpetuity
20BL171851	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North/South – Bores: HV2, PZ1CH200, PZ2CH400, PZ3CH800, 4118P, 4119P	Perpetuity
20BL171852	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – PZ4CH1380	Perpetuity
20BL171853	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – DM3	Perpetuity
20BL171854	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – Bores: DM5, PZ6CH2450	Perpetuity
20BL171855	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – PZ5CH1800	Perpetuity
20BL171856	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – Bores: HV6, HV3, DM6, HV2 (2), 4113P, 4114P. 4116P, 4117P	Perpetuity
20BL171857	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: HV4, HV4 (2) (GA3), GA3,	Perpetuity
20BL171858	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – DM4	Perpetuity
20BL171895	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO West – Destroyed: NPZ4	Perpetuity

Licence Number	Type of Licence	Purpose	Legislation	Description	Expiry Date
20BL171896	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO West – NPZ2	Perpetuity
20BL171897	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO West – Bores: NPZ1 Destroyed: NPZ5	Perpetuity
20BL171898	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO West – NPZ3	Perpetuity
20BL173062	Bore	Monitoring Bore	Part 5 Water Act 1912	RC14	Perpetuity
20BL173065	Bore	Monitoring Bore	Part 5 Water Act 1912	HQ11	Perpetuity
20BL173063	Bore	Monitoring Bore	Part 5 Water Act 1912	RC07, RC08	Perpetuity
20BL173064	Bore	Monitoring Bore	Part 5 Water Act 1912	RC06	Perpetuity
20BL173069	Bore	Monitoring Bore	Part 5 Water Act 1912	RC11	Perpetuity
20CA201247	Works Approval	Pumping Plant	Water Management Act 2000	Associated with WAL965	Perpetuity
20CA212713	Works Approval	Pumping Plant	Water Management Act 2000	Associated with WAL36190	30/06/2025
20FW213280	Flood Work Approval	Levee	Water Management Act 2000	HVO North Carrington Levee 5	21/09/2027
20FW213281 Formerly 20CW802613	Flood Work Approval	Levee	Water Management Act 2000	HVO South – Barry Levee	21/09/2027
20FW213277 Formerly 20CW802603	Flood Work Approval	Block Dam	Water Management Act 2000	HVO South – Hobden Gully Levee	21/09/2027
20FW213278 Formerly 20CW802604	Flood Work Approval	Levee	Water Management Act 2000	HVO North – North Pit Levee 3	21/09/2027
20WA210991 (see WAL 18307) Formerly 20SL050903	Stream Diversion	Stream Diversion	Water Management Act 2000	HVO West – Parnells Creek Dam	09/01/2033
20WA211427 Formerly 20SL061290	Stream Diversion	Cutting (Diversion Drain)	Section 10 Water Act 1912	Pikes Gully Creek Stream Diversion	07/09/2033

Licence Number	Type of Licence	Purpose	Legislation	Description	Expiry Date
20WA210985 (see WAL 18327) 20SL042746	Diversion Works	Industrial	Water Management Act 2000	HV Loading Point Pump Bayswater Creek	08/09/2032
20WA211428 20SL061594	Stream Diversion	Cutting (Diversion Drain)	Water Management Act 2000	HVO North – Carrington Stream Diversion	31/07/2032
20WA201238 (see WAL 962)	Diversion Works	Pumping Plant	Water Management Act 2000	HVCPP River Pump	16/03/2028
20WA201257 (see WAL 970)	Diversion Works	Pumping Plant	Water Management Act 2000	HVO South – LCPP River Pump	Perpetuity
20WA201338 (see WAL 1006)	Diversion Works	Pumping Plant	Water Management Act 2000	HVO South – LCPP River Pump	Perpetuity
20WA201501 (see WAL 1070)	Diversion Works	Pumping Plant	Water Management Act 2000	HVO South – LCPP River Pump	Perpetuity
20WA201685 (see WAL 13387)	Diversion Works	Pumping Plant	Water Management Act 2000	HVO West – "Lake Liddell" Licence	Perpetuity
20FW213274	Flood Work Approval	Levee	Water Management Act 2000	Riverview	26/10/2028

Table 3-5: Surface Water Access Licences 2023/24 Water Year

Licence Number	Description	Water Source	Water Sharing Plan	Water Source Management Zone	Entitlement (ML)	Passive Take / Inflows (ML)	Active Pumping (ML)	Total Take (ML)
WAL 867	Comleroi, farming & irrigation	Hunter River	Hunter Regulated River WSP	Zone 2a (Hunter River From Glennies Creek Junction To Wollombi Brook Junction)	486	0	446.5	446.5
WAL 962	HVO North – HVCPP River Pump – Water Access Licence	Hunter River	Hunter Regulated River WSP	Zone 1b (Hunter River From Goulburn River Junction To Glennies Creek Junction)	3,165	0	0	0
WAL 969	HVO South – Former Riverview pump	Hunter River	Hunter Regulated River WSP	Zone 1b (Hunter River From Goulburn River Junction To Glennies Creek Junction)	39	0	0	0

Licence Number	Description	Water Source	Water Sharing Plan	Water Source Management Zone	Entitlement (ML)	Passive Take / Inflows (ML)	Active Pumping (ML)	Total Take (ML)
WAL 970	HVO South – LCPP River Pump – Water Access Licence	Hunter River	Hunter Regulated River WSP	Zone 2a (Hunter River From Glennies Creek Junction To Wollombi Brook Junction)	500	0	0	0
WAL 1006	HVO South – LCPP River Pump – Water Access Licence	Hunter River	Hunter Regulated River WSP	Zone 2a (Hunter River From Glennies Creek Junction To Wollombi Brook Junction)	500	27	0	27
WAL 1070	HVO South - LCPP River Pump – Water Access Licence	Hunter River	Hunter Regulated River WSP	Zone 2a (Hunter River From Glennies Creek Junction To Wollombi Brook Junction)	500	0	0	0
WAL 13387	Macquarie Generation Hunter River Pump Station	Hunter River	Hunter Regulated River WSP	Zone 1b (Hunter River From Goulburn River Junction To Glennies Creek Junction)	20	0	0	0
WAL 13391	HVO North – Alluvial Rehabilitation Irrigation.	Hunter River	Hunter Regulated River WSP	Zone 1b (Hunter River From Goulburn River Junction To Glennies Creek Junction	420 (525 ML with transfers)	0	0	0
WAL 18127	Carrington BB1	Hunter River Alluvium	Hunter Unregulated and Alluvial Water Sources WSP	Hunter Regulated River Alluvial Water Source – Upstream Glennies Creek management zone	383	0	0	0
WAL 18158	Ollenberry	Hunter River Alluvium	Hunter Unregulated and Alluvial Water Sources WSP	Hunter Regulated River Alluvial Water Source – Upstream Glennies Creek management zone	65	0	0	0
WAL 18307	HVO West – Parnells Creek Dam (Diversion Works Bywash)	Unregulated River	Hunter Unregulated and Alluvial Water Sources WSP	Jerrys Water Source; Jerrys Management Zone	500	32	0	32

Licence Number	Description	Water Source	Water Sharing Plan	Water Source Management Zone	Entitlement (ML)	Passive Take / Inflows (ML)	Active Pumping (ML)	Total Take (ML)
WAL 18327	HV Loading Point Pump Bayswater Creek (Diversion Works)	Unregulated River	Hunter Unregulated and Alluvial Water Sources WSP	Jerrys Water Source; Jerrys Management Zone	150	0	0	0
WAL 23889	Greenleek	Wollombi Brook	Hunter Unregulated and Alluvial Water Sources WSP	Lower Wollombi Brook Water Source	144	0	0	0
WAL 36190	HVO North, old farm bore	Hunter River Alluvium	Hunter Unregulated and Alluvial Water Sources WSP	Hunter Regulated River Alluvial Water Source – Jerrys Management Zone	120	0	0	0
WAL 41527	HVO North (Carrington Pit)	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	700	0	0	0
WAL 41533	HVO North – Pit Excavation	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	20	0	0	0

Table 3-6: Groundwater Access Licences

Licence Number	Description	Water Source	Water Sharping Plan (WSP)	Water Source – Management Zone	Entitlement (ML)	Passive Take / Inflows (ML)	Active Pumping (ML)	Total (ML)
WAL 39798	Lemington Underground (LUG) Bore	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	1,800	0	510.6	510.6
WAL 40462	HVO Pit Excavations / Alluvial Lands Bores (x4)	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	2,400	751	0	751
WAL 40463	HVO Pit Excavations / Alluvial Lands Bores (x4)	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	180	180	0	180
WAL 40466	HVO Pit Excavations / Alluvial Lands Bores (x4)	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	460	460	0	460
WAL 41527	HVO North – Carrington Pit	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16) Previously Water Act 1912	Permian Coal Seams	700	700	0	700

3.1.2 | MANAGEMENT PLANS, PROGRAMS, STRATEGIES

HVO is required by the site approvals to develop and submit a range of environmental management plans for approval prior to implementation. Approved management plans are made publicly available on the HVO website (https://hvo.com.au/).

Many updated plans have been submitted to DPHI. Some plans remain under review and will be submitted to DPHI in 2025. The status of management plans is shown in **Table 3-7** and **Table 3-8**.

Table 3-7: Management Plans Required for HVO North

Management Plan	Date Approved	Date of Latest Version Submitted to DPHI
Agricultural Lands Reinstatement Management Plan*	20/06/2022	11/08/2023
Fine Reject Management Strategy	19/01/2023	-
HVO Air Quality and Greenhouse Gas Management Plan	19/05/2022	-
HVO Blast Management Plan	03/04/2019	29/08/2023
HVO Bushfire Management Plan	N/A	N/A
HVO Environmental Management Strategy	08/01/2019	29/08/2023
HVO Noise Management Plan	17/03/2025	-
HVO North Heritage Management Plan	21/10/2024	-
HVO River Red Gum Rehabilitation & Restoration Strategy	19/05/2022	11/08/2023
HVO Water Management Plan	16/10/2018	29/08/2023
Final Void Management Plan	16/05/2022	-
Rehabilitation Management Plan and Forward Program**	N/A	N/A

*The Agricultural Lands Reinstatement Management Plan states that the agricultural reinstatement activities and monitoring results will be reported in the HVO Annual Environment Review (Annual Review). However, work has not yet commenced hence no monitoring or reporting against the management plan specific to the Carrington West Wing project is provided in this report.

**The Rehabilitation Management Plan and Forward Program is prepared in accordance with the provisions under the Mining Act 1992 and is not approved by DPHI.

N/A: Plan does not require approval by DPHI.

Table 3-8: Management Plans Required for HVO South

Management Plan	Date Approved	Date of Latest Version Submitted to DPHI
HVGC Amenity Management Plan	09/05/2024	-
HVO Air Quality and Greenhouse Gas Management Plan	19/05/2022	-
HVO Biodiversity Offset Strategy	23/10/2017	-
HVO Blast Management Plan	03/04/2019	29/08/2023
HVO Bushfire Management Plan	N/A	N/A
HVO Environmental Management Strategy	08/01/2019	29/08/2023
HVO Integrated Biodiversity Management Plan	02/08/2018	11/08/2023
HVO Noise Management Plan	17/03/2025	-
HVO River Red Gum Rehabilitation & Restoration Strategy	19/05/2022	11/08/2023
HVO South Aboriginal Cultural Heritage Management Plan	21/10/2024	-
HVO Water Management Plan	16/10/2018	29/08/2023
Rehabilitation Management Plan and Forward Program**	N/A	N/A
Biodiversity Management Plan (offsets component)	26/06/2017- Goulburn River Biodiversity Area Management Plan***	-

** The Rehabilitation Management Plan and Forward Program is prepared in accordance with the provisions under the Mining Act 1992 and is not approved by DPHI.

*** Is a component of a management plan managed by Mt Thorley Warkworth (MTW)

N/A: Plan does not require approval by DPHI.

4 | OPERATIONS SUMMARY

4.1 | MINING

Areas to be mined are geologically modelled, a mine plan is formed, and the relevant mining locations are surveyed prior to mining. The mining process is illustrated in **Figure 4-1**. There are no active underground workings at HVO.

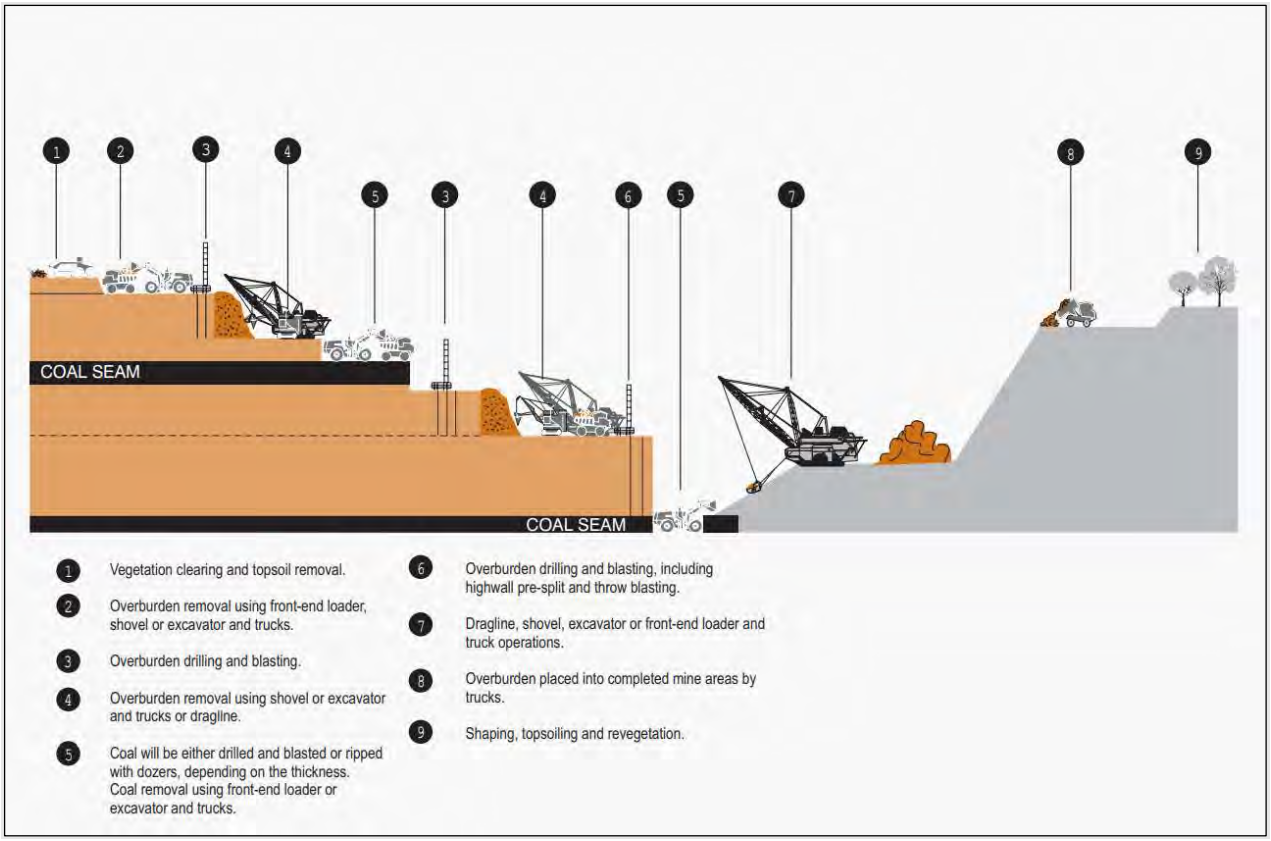


Figure 4-1: Open Cut Mining Schematic

HVO's last dragline ceased operation in 2023, with material movement being replaced by truck and excavators. Mining progress deviated slightly from the schedule of the RMP as a result of normal variations in productivity and utilisation.

The mining equipment employed to carry out mining operations at HVO in 2023 and 2024 is detailed in **Table 4-1** along with the fleet forecast for 2025.

Table 4-1: HVO Equipment Used 2023-2025

Equipment Type	Number Used in 2023	Number Used in 2024	Forecast Numbers in 2025
Scrapers	3	3	3
Drills	9	9	9
Draglines	0	0	0
Shovels	2	2	2
Excavators	13	13	13
Trucks	90	90	90
Loaders	6	7	7
Service Trucks	6	6	6
Track Dozers	31	32	33
Rubber Tyre Dozers	4	4	4
Graders	12	13	13
Water Trucks	10	10	10
Floats	1	1	1
Cable Reeler	1	1	1
Cable Tractors	2	2	2
Total	**190**	**193**	**194**

4.1.1 | MINERAL PROCESSING

HVO generally operates two CHPPs – Hunter Valley (HVCPP) and Howick (HCPP). HCPP was restarted in August 2024 following minor chute and MCC upgrades. The commencement of a new fit for purpose carpark facility began construction at HCPP in 2024 with the carpark scheduled for completion in 2025.

Upgrades to HVCPP consist of a flotation plant, which is currently under construction and expected to be completed in 2025. The flotation upgrade involves the addition of a flotation circuit to the existing HVCPP. The upgrade aims to increase the overall product yield by floating ultrafine coal that currently reports to the Carrington tailings storage facility. Upgrades of HVCPP raw coal dust suppression system were also completed in 2024 with skirt boxes fitted with dust containment hood and double dust curtains, as well as improved dust spray nozzle configurations to provide optimal misting of the coal stream at the head and tail ends of the conveyors.

During 2024 coal was transported to both HVCPP and HCPP where it was crushed to size and processed to remove impurities. Processing produces saleable coal, along with coarse and fine reject material. Coarse rejects are disposed of in-pit and fine rejects are placed in a tailings dam in accordance with the RMP. HVCPP has stockpile facilities for processed (saleable) coal, whilst the raw (unprocessed) coal stockpiles were decommissioned in March and May 2024. HCPP has stockpile facilities for both processed and raw coal.

Product coal is transported to one of two loading points, Hunter Valley Load Point (HVLP) and Newdell Load Point (NLP) via conveyor belt or road. The capacity of HVCPP and HOCPP stockpile facilities are listed in **Table 4-2** along with the capacities of HVLP and NLP stockpiles.

Table 4-2: Stockpile Capacities

Location	Raw Stockpile (t)	Saleable Stockpile (t)
Hunter Valley CHPP	0	40,000
Howick CHPP	15,000	32,000
Newdell Load Point	0	450,000
Hunter Valley Load Point	0	354,000

As previously noted, product coal is transported to one of two loading points via conveyor belt or road as detailed in **Table 4-3.** The coal from HVCPP is transported to HVLP and NLP by means of overland conveyor whereas coal from HOCPP is trucked to NLP. After the coal has reached either HVLP or the NLP it is transported to the Port of Newcastle by rail.

Table 4-3: Methods of Coal Transportation

Transport Category	Quantity (Mt)
Coal transported from the site via trains	11.6
Amount of coal received from Hunter Valley Operations South of the Hunter River	6.3
Amount of coal hauled by road to the Hunter Valley Loading Point	Nil
Coal hauled by road to the Newdell Load Point	0.8
Amount of coal hauled by road from the Newdell Loading Point to the Ravensworth Coal Terminal	Nil
Amount of coal hauled by road from the Hunter Valley Loading Point to the Ravensworth Coal Terminal	Nil
Number of coal haulage truck movements generated by the development. (Includes coal hauled to stockpile, coal hauled to bins, coal hauled from stockpile to bins)	150,574

4.1.2 | PRODUCTION STATISTICS

Project approvals allow for the extraction of up to 22 million ROM tonnes from operations north of the Hunter River and 20 million ROM tonnes from operations south of the Hunter River. A summary of production and waste at HVO during 2024 in comparison to previous years and approval limits is provided in **Table 4-4**.

Product coal includes low-ash, semi-soft and steaming coals.

Table 4-4: Production Statistics and Correlating Project Approval Limits

Aspect	Approved Limit (PA 06_0261 and DA 450-10-2003)	Reporting Period 2023	Reporting Period 2024	Forecast for 2025
Prime Waste(Mbcm)	-	94.72	104.68	105.43
ROM Coal (Mtpa) (mined)	42	15.28	14.83	18.63
- *HVO South*	20	7.23	6.35	10.00
- *West Pit*	12	6.24	7.2	6.30
- *Mitchell Pit*		0.41	1.28	2.33
Total ROM Coal Processed	26	13.77	13.5	17.4
HVCPP Feed (Mt) – ar	N/A	11.88	12.6	15.17
HVCPP Product (Mt) – ar		8.63	9.1	11.46
HVCPP Bypass (Mt) – ar		1.88	1.9	0
HVCPP Coarse Reject (Mt) – ar		2.35	1.92	1.92
HVCPP Tailings (Mt) – db		0.89	1.58	1.83
HCPP Feed (Mt) – ar		0	0.9	1.70
HCPP Product (Mt) – ar		0	0.6	1.11
HCPP Bypass (Mt) – ar		0	0.2	1.40
HCPP Coarse Reject (Mt) – ar		0	0.3	0.35
HCPP Tailings (Mt) – db		0	0.1	0.23

ar – 'as received' includes moisture

db – 'dry basis' does not include moisture

4.1.3 | SUMMARY OF CHANGES

The below changes occurred in 2024:

- CHPP production increased in 2024 compared with 2023 due to the restarting of HCPP and improved HVCPP performance after partial completion of the debottlenecking project upgrades.
- Mining in the Carrington West Wing location has not yet commenced. As of the time of reporting, mining in this area is not planned to commence during 2025.
- HCPP restarted production in August 2024 after minor chute and MCC upgrades were completed.
- Construction of a carpark facility was completed HCPP in 2024.
- A flotation plant is currently under construction at HVCPP and is due to be completed in 2025. The flotation plant aims to increase the overall product yield by floating ultrafine coal that currently reports to the Carrington tailings storage facility.
- HVCPP raw coal stockpiles were decommissioned in March and May 2024.
- HVCPP raw coal dust suppression system upgrades completed in 2024.

- Tailings emplacement continued in the Carrington and Cumnock Void 3 tailings storage facilities during 2024.

4.2 | FORECAST OPERATIONS FOR NEXT REPORTING PERIOD

Table 4-5 outlines the forecast operations for the next reporting period.

Table 4-5: Production Operations Forecast

Material	Unit	2024 (Forecast)	2024 (Actual)	2025 Forecast	2026 Forecast
Stripped Topsoil	kbcm	172.0	138	93	139
Rock / Overburden	Mbcm	112.50	106.64	107.32	111.45
ROM Coal	Mt	17.26	14.83	18.63	20.35
Reject Material	Mt	4.49	1.88	3.71	4.94
Product	Mt	12.77	11.72	13.99	14.89

5 | ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

DPHI responded to HVO on 18 June 2024 accepting the 2023 HVO Annual Review. DPHI did not require any changes to the 2023 Annual Review nor request any changes to be made to future Annual Reviews.

6 | ENVIRONMENTAL PERFORMANCE

6.1 | METEOROLOGICAL DATA

The collection of meteorological (weather) data is carried out to assist in day-to-day operational decisions, planning, environmental management and to maintain a historic record. The meteorological stations record:

- wind speed
- wind direction
- temperature
- humidity
- solar radiation
- rainfall

HVO operates two real-time meteorological stations; the HVO Corporate Meteorological Station and the Cheshunt Meteorological Station. The locations of these monitors are shown in **Figure 6-2**. Daily average data is publicly available via the Monthly Environmental Monitoring Reports published on the HVO website.

Total annual rainfall for 2024 was 645.2mm (recorded at the HVO Corporate Meteorological Station) compared to 459.0mm in 2023 and 1047.2mm in 2022. (**Figure 6-1**).

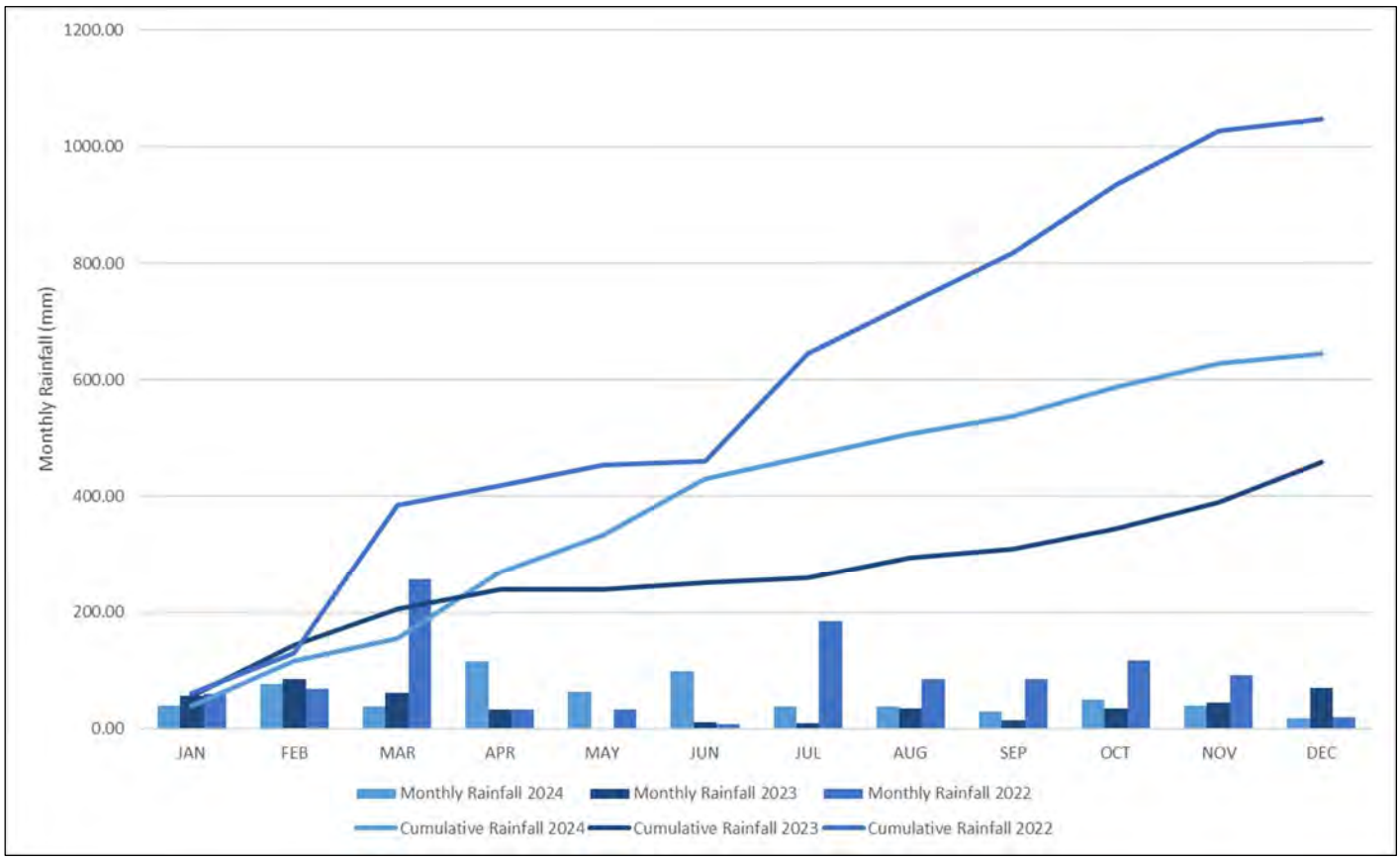


Figure 6-1: HVO Corporate Meteorological Station 2022 – 2024 Rainfall Data

6.2 | NOISE

6.2.1 | NOISE MANAGEMENT

Mining activities at HVO are managed to minimise adverse noise impacts and to maintain compliance with permissible noise limits at nearby private residences. A combination of proactive and reactive noise controls are employed to ensure effective management of noise. Noise controls are as detailed in the HVO Noise Management Plan (NMP).

6.2.2 | SOUND ATTENUATION OF HEAVY EQUIPMENT

All haul trucks at HVO have been fitted with sound attenuation kits. New equipment brought to site arrives sound attenuated or is scheduled for retrofitting prior to operation.

Onsite sound power level testing was completed on sixteen (16) heavy vehicles during 2024. HVO acquired twenty-seven (27) new heavy vehicles during 2024, all of which achieved compliance in accordance with site power testing requirements. Routine sound power level testing will be completed according to a schedule to ensure compliance throughout 2025.

6.2.3 | REAL TIME NOISE MANAGEMENT

HVO operates a network of directional real-time noise monitors to measure and manage noise emissions and to minimise community impact.

The real-time system generates alarms when elevated noise is measured, triggering the implementation of reactive controls to reduce noise levels. HVO received and responded to 1,372 noise alarms during 2024. Noise alarm triggers are based on internally set noise criteria. Alarms received include noise exceedances from other mines and non-mine sources. HVO recorded twelve (12) hours of equipment downtime for the management of noise during 2024. The location of real-time noise monitoring locations as per the approved NMP are shown in **Figure 6-2**. The Barnowl noise monitor at Moses Crossing experienced intermittent outages which had become more prevalent due to deteriorating software and hardware. A replacement monitor is scheduled for installation during 2025.

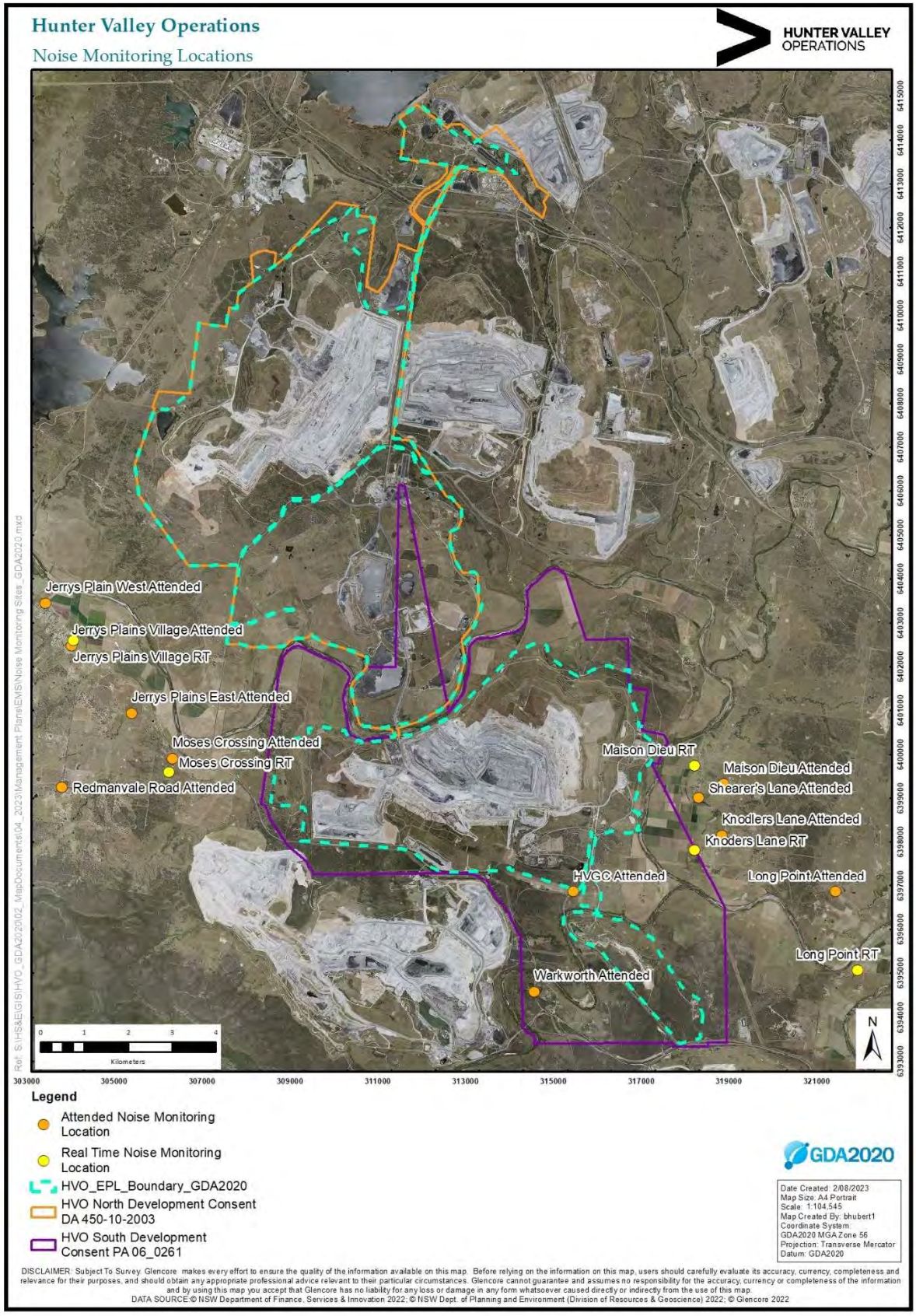


Figure 6-2: HVO Attended and Real Time Noise Monitoring Locations

Attended monitoring during 2024 was compared to real time noise monitoring results where a comparison could be made (e.g., where HVO was audible) in order to validate real time noise monitoring systems. Where comparisons were able to be made, results indicated that the real time monitoring system generally recorded higher noise measurements than attended monitoring, or measurements that aligned with real time measurements. Comparisons were not able to be made for a majority of measurements due to low/inaudible noise from HVO than attended noise measurements.

Details of this assessment is provided in **Table 6-1**.

Table 6-1: Comparison of Attended and Real Time Noise Monitoring During 2024

Monitoring Location	Number of attended noise measurements where comparison could be made[1]		Real time measurements that aligned[2] with attended measurements		Real time measurements with positive variance > 3dB(A) of attended measurements		Real time measurements with negative variance >3dB(A) of attended measurements	
	South	North	South	North	South	North	South	North
MaisonDieu	3	0	0	0	3	0	0	0
Knodlers Lane	2	0	1	0	1	0	0	0
Long Point	1	0	0	0	0	0	1	0
Kilburnie South	1	2	0	0	1	2	0	0
Jerrys Plains Village	0	2	0	1	0	1	0	0

Notes:

[1] Includes measurements under all meteorological conditions

[2] Aligned indicates measurements were within 3dB (A) of each other or measurement results <25dB indicated that source contribution was in audible or not measurable.

6.2.4 | OPERATIONAL NOISE PERFORMANCE

HVO engages a suitably qualified and experienced acoustic consultant to undertake routine attended noise compliance monitoring at nearby private residences to assess compliance with the relevant Project Approval and EPL noise criteria, in accordance with the HVO NMP. Monitoring is undertaken at a frequency of one night per month and an additional one night per quarter as required by the HVO North Approval. This monitoring is undertaken to evaluate and assess noise impacts under a range of meteorological conditions throughout the year.

A total of 121 measurements were recorded during 2024. Each measurement involves an assessment of HVO mine noise against the various $L_{Aeq,\ 15minute}$ and $L_{A1,1min}$ noise criteria in place under the HVO North and South Approvals. Full details for all noise assessments completed can be found in HVO Monthly Environmental Monitoring Reports published on the HVO website.

HVO was compliant with relevant noise criteria for all measurements recorded in 2024.

Comparison between the 2024 L_{Aeq} attended noise monitoring results (maximum HVO contribution levels measured under applicable meteorological conditions) and previous years are shown in **Table 6-2**.

Table 6-2: Comparison of 2024 Noise Monitoring Results Against Previous Years

Year	Number of Measurements	Number of measurements which exceeded allowable noise (under applicable	Number of non-compliances
2024	121	0	0
2023	120	0	0
2022	120	0	0
2021	121	1	0
2020	110	0	0
2019	101	1	0
2018	105	3	0
2017	100	1*	0
2016	109	2*	0

* The now superseded NSW Industrial Noise Policy (INP) allowed for the measured result to be less than or equal to 2 dB above the applicable noise limit without constituting a non-compliance. Note: Where the measured result is greater than 2dB above the applicable noise limit, the site has 75 minutes to reduce noise levels below applicable noise limits before constituting a non- compliance. As of late October 2017, the NSW INP was superseded by the Noise Policy for Industry (Npfl), with the requirements of this policy implemented in late 2017.

6.2.5 | COMPARISON WITH PREDICTIONS

Comparisons against the predicted noise levels in the Noise Impact Assessment (NIA) for HVO North prepared in October 2010 to support Modification 3 of the HVO North DA (450-10-2003). Noise predictions contained within the NIA do not correspond with specific meteorological conditions. Attended noise monitoring results have been compared directly to Year 5, mitigated, total noise predictions in the NIA for Carrington & West Pit under all meteorological conditions where noise criteria were applicable. This comparison is shown in **Table 6-3**.

Table 6-3: Comparison of 2024 Attended Noise Monitoring Against EIS Predictions

Location	Units	EIS Prediction	2024 max measured LAeq 15 min (under applicable met conditions)
Shearers Lane	dB(A)	27	34
Kilburnie South	dB(A)	37	34
Jerrys Plains	dB(A)	41	33
Jerrys Plains East	dB(A)	39	30
Jerrys Plains West	dB(A)	41	31

Comparison of measured results against the modelled predictions demonstrates noise levels lower than predicted at the majority of monitoring locations. While the maximum noise measured for Shearers Lane was 34 dBA (against an EIS prediction of 27), noise was below the EIS prediction for the majority of monitoring events, with 66% of measurements being inaudible or not measurable.

Comparisons against the predicted noise levels in the HVO South Modification 5 Environmental Assessment have been made against Stage 2 modelling scenario (indicative of activities carried out during 2021), (Table 6.10 of Appendix E– Hunter Valley Operations South Modification 5 Approval Environmental Assessment Report Volume 2). The comparison (**Table 6-4**) indicates that noise during 2024 was lower than predicted levels for all receptors.

Table 6-4: Comparison of 2024 Monitoring Against HVO South (Stage 2 HVO South Modification 5 EA – 2017)

Location	Units	EIS Prediction (INP)	2024 max measured LAeq 15 min (under applicable met conditions)
Knodlers Lane	dB(A)	40	32
Maison Dieu	dB(A)	40	33
Shearers Lane	dB(A)	41	34
Kilburnie South	dB(A)	39	34
Jerrys Plains	dB(A)	34	Inaudible
Jerrys Plains East	dB(A)	36	<20
Jerrys Plains West	dB(A)	32	Inaudible
Long Point	dB(A)	37	27

6.3 | BLASTING

6.3.1 | BLASTING MANAGEMENT

HVO operates a blast monitoring network to assess and evaluate blast vibration and overpressure impacts against the HVO North and HVO South Consent Criteria. There was 100% blast data capture for all blast monitors in 2023.

Monitors are located at or in close proximity to nearby privately owned residences as shown in Figure 2 in Appendix D of the HVO Blast Management Plan (HVO, 2019). The monitors function as regulatory compliance monitors. These monitors are located at:

- Jerrys Plains Village
- Warkworth
- Maison Dieu
- Moses Crossing
- Knodlers Lane

See **Figure 6-3** for the blast monitoring locations.

6.3.2 | BLASTING PERFORMANCE

234 blast events were initiated at HVO during the reporting period. 115 blasts were fired at HVO South and 119 at HVO North. HVO complied with all blasting related consent and licence conditions. Air blast overpressure and ground vibration results for all blasts fired during the reporting period are presented in **Figure 6-4** to **Figure 6-8**.

There were no blasts recorded with overpressure greater than 115 dB(L). There were no exceedances of the 5 mm/s ground vibration criteria at any residence on privately-owned land.

Blasting occurred only between the hours of 7am and 6pm Monday to Saturday and no blasting was carried out on Sundays or Public Holidays. No more than four (4) blasts were fired per day and the maximum number of blasts fired during any week was eight (8), which is less than the maximum weekly blasting frequencies as specified in both project approvals.

HVO closed Lemington Road on 60 occasions for an average of 11.4 minutes, and Comleroi Road on 3 occasions for an average of 16.7 minutes. In addition, on 30 occasions the closure of Lemington Road and Comleroi Road was initiated however was cancelled due to changes in operational requirements.

In accordance with PA 06_0261, long term blast monitoring data has been reviewed to identify any trends in the monitoring data over the life of the project. Both ground vibration and overpressure monitoring results have remained generally consistent since monitoring commenced, with no increasing trends developing in the data. Notably in 2024 there was only one exceedance of 115 dB(L) air blast overpressure criteria.

See **Table 6-5** and **Table 6-6** for a review of long-term blasting data for both ground vibration and overpressure.

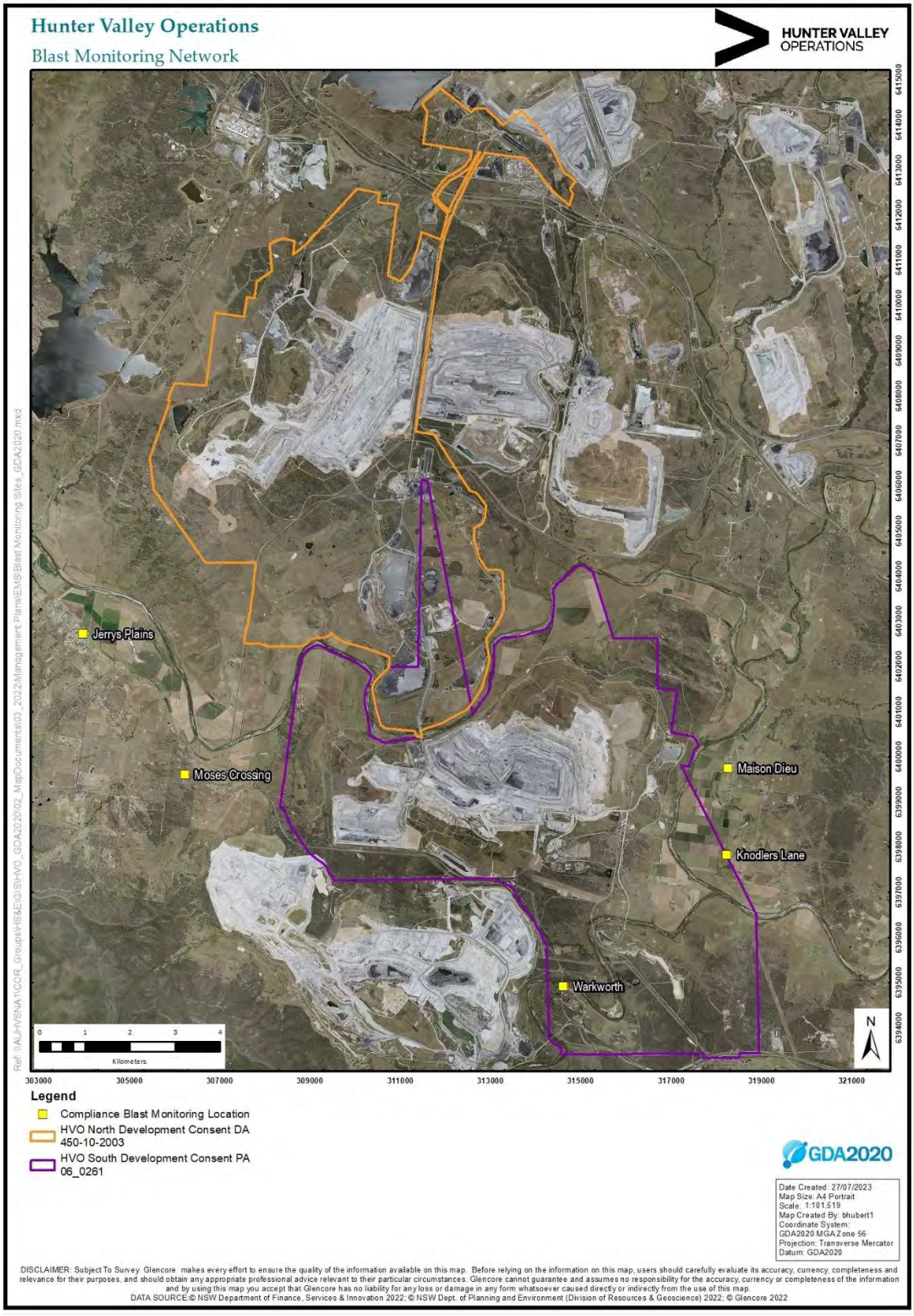


Figure 6-3: HVO Blast Monitoring Network

Table 6-5: Recent Blasting Data Trends for HVO North

Monitoring Location	2021		2022		2023		2024	
	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)
Moses Crossing	0	0	0	0	0	0	0	0
Jerrys Plains	0	0	0	0	0	0	0	0
Warkworth	0	0	0	0	0	0	0	0
Maison Dieu	0	0	0	0	0	0	0	0
Knodlers Lane	0	0	0	0	0	0	0.4	0

Table 6-6: Recent Blasting Data Trends for HVO South

Monitoring Location	2021		2022		2023		2024	
	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)
Moses Crossing	0	0	0	0	0	0	0	0
Jerrys Plains	0	0	0	0	0.4	0	0	0
Warkworth	0	0	0	0	0	0	0	0
Maison Dieu	0	0	0	0	0	0	0	0
Knodlers Lane	0	0	0.8	0	0	0	0	0

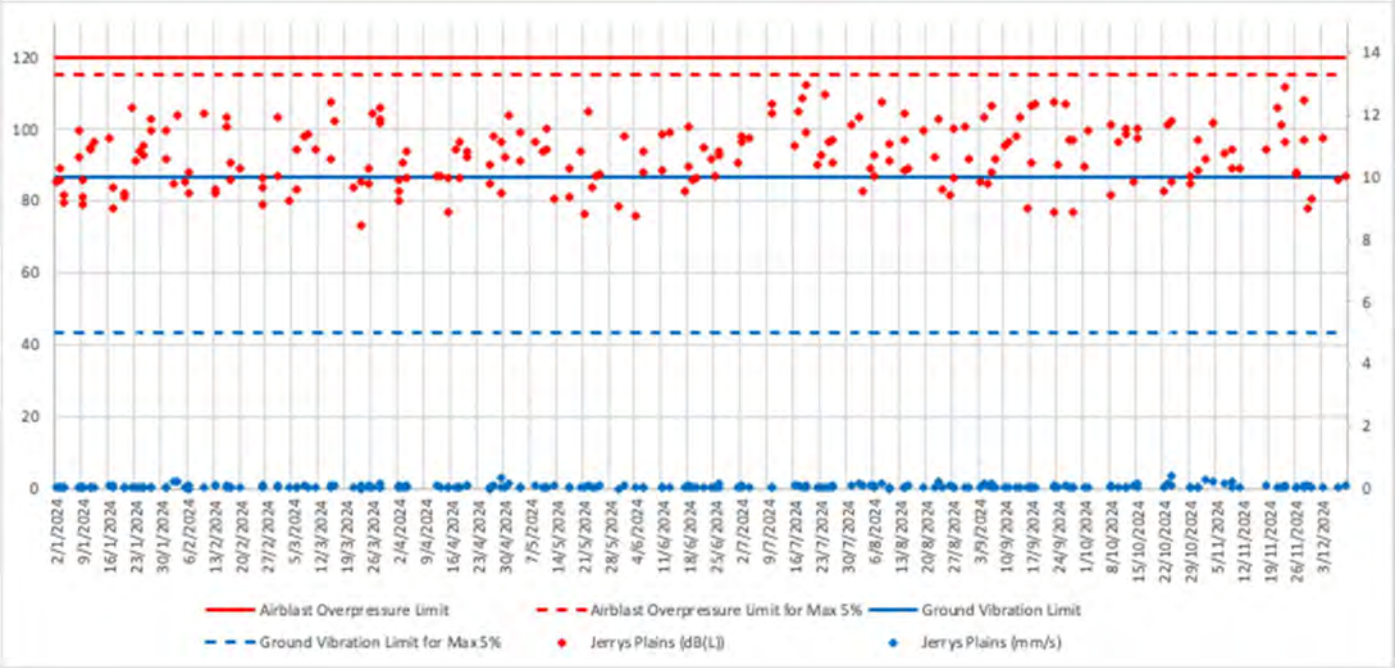


Figure 6-4: Jerrys Plains Blast Monitoring Results 2024

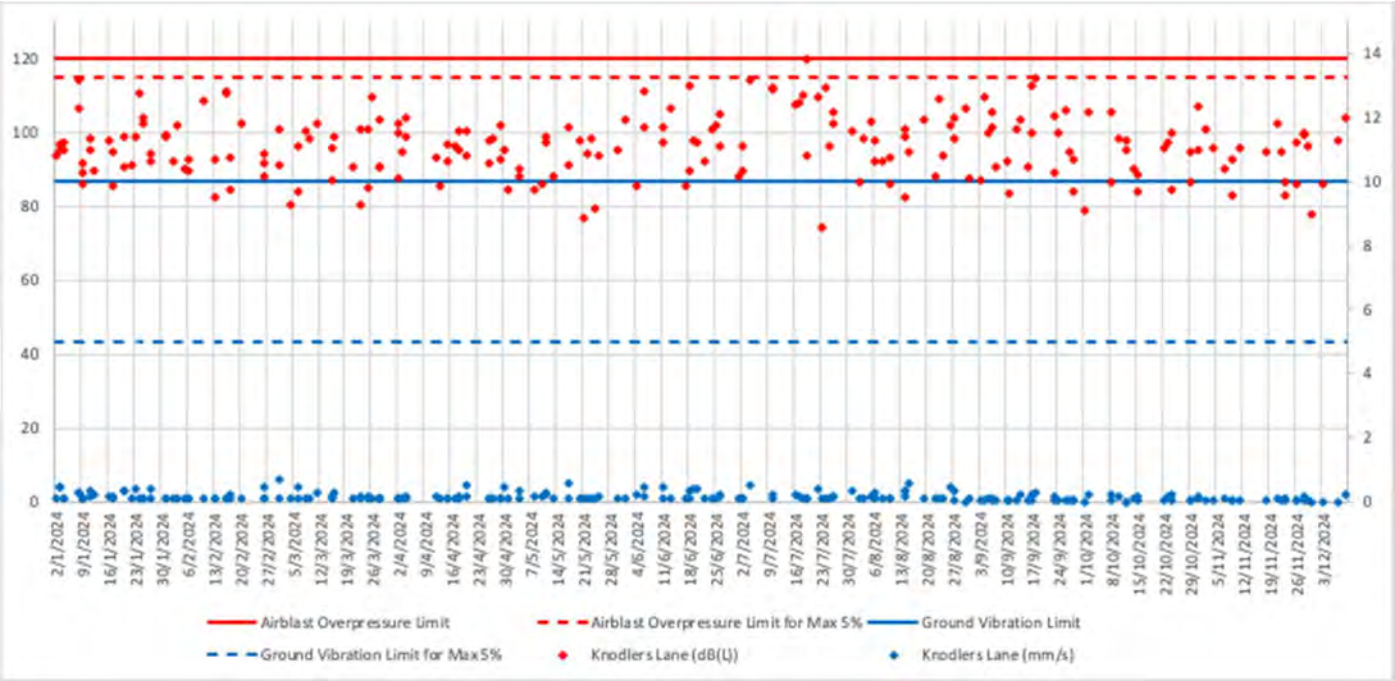


Figure 6-5: Knodlers Lane Blast Monitoring Results 2024

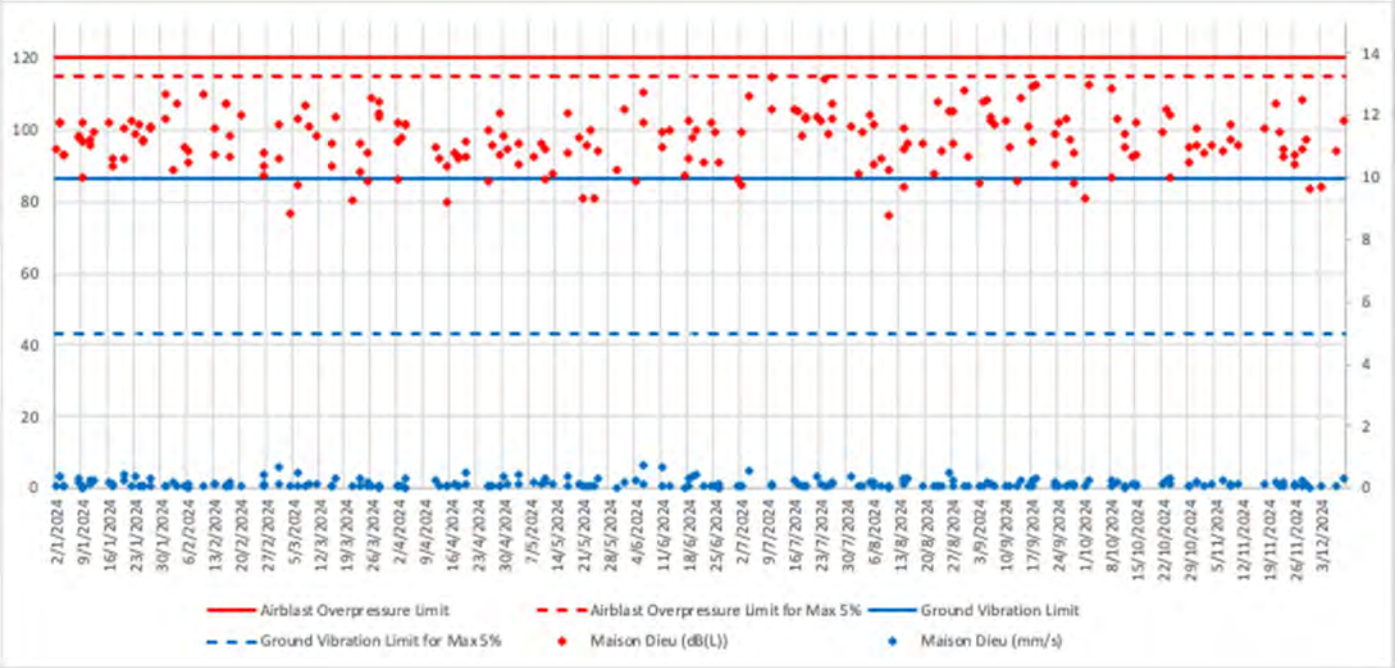


Figure 6-6: Maison Dieu Blast Monitoring Results 2024

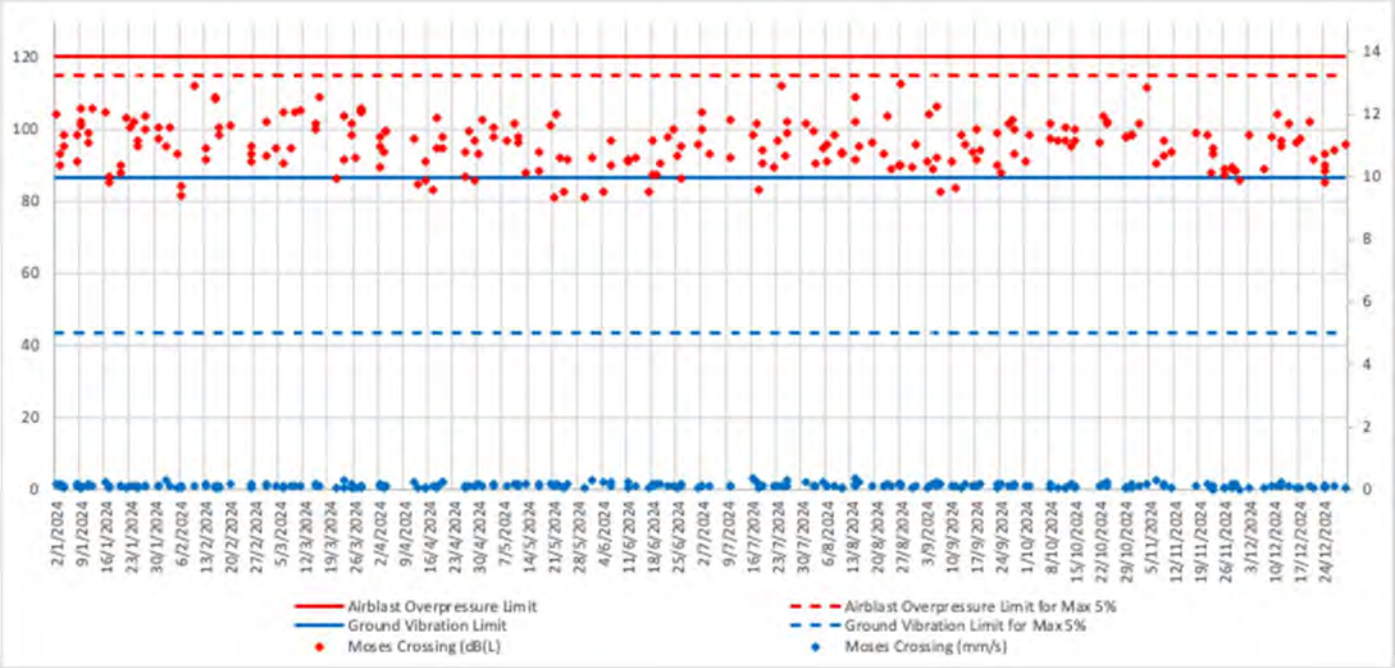


Figure 6-7: Moses Crossing Blast Monitoring Results 2024

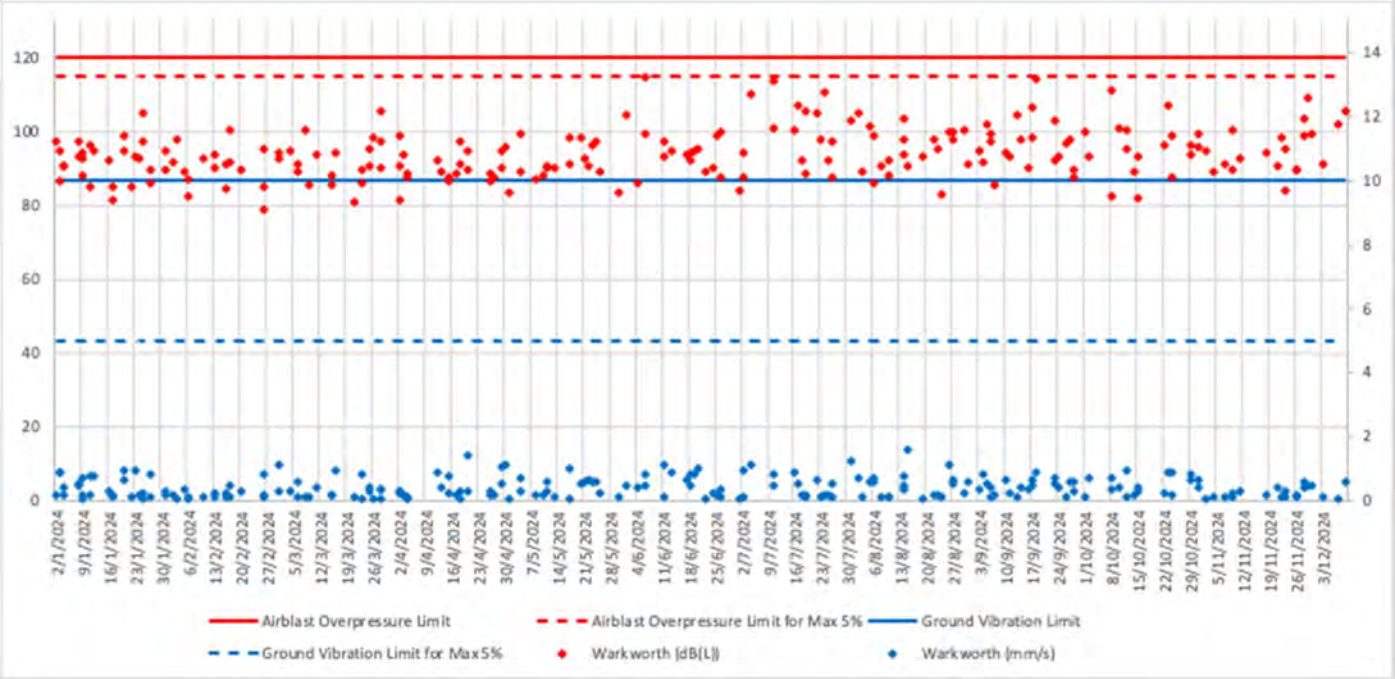


Figure 6-8: Warkworth Blast Monitoring Results 2024

6.3.3 | BLAST FUME MANAGEMENT

Blasting operations at HVO are undertaken in accordance with the HVO Post Blast Fume Generation Mitigation and Management Plan. The plan outlines the practices to be utilised to reduce the risk of generation of post blast fume and reduce potential offsite impact from any fume which may be produced. This includes specialised blasting design, appropriate product selection, on-bench water management, implementation of fume management zones and use of existing blasting permissions to identify likely path of any fume which may be produced and restrictions on firing.

All blasts are observed for fume and any fume produced is ranked according to the Australian Explosive Industry & Safety Group (AEISG) Scale.

Fume rankings for shots fired during 2024 and comparison to previous years is provided in **Table 6-7**. There was a marginal increase in Category 3 and 4 blast fume events during 2024 compared to 2023. This included:

- Ten (10) Category 3 blast fume events, of which internal investigations were undertaken into the cause of each, and outcomes incorporated into updating current practices where appropriate.
- Three (3) Category 4 blast fume events, of which all were reported to DPHI. In summary these events entailed:
    - A blast in Cheshunt Pit 1 on 4 June, which produced post blast fume ranked as Level 4B. Fume from the blast travelled from initiation points in an easterly direction and dispersed onsite. Internal investigation found the blast was impacted by a rain event following loading and before initiation;
    - A blast in Cheshunt Pit 2 on 15 October, which produced post blast fume ranked as Level 4B. Fume from the blast travelled from the initiation point in a north-westerly direction and dispersed onsite. An external investigation found cracking and weak strata as the likely

causes. As a result, loading practices were updated to minimise the risk of future events; and

- A blast in West Pit on 22 November, which produced post blast fume ranked as Level 4B. Fume and dust from the blast travelled from the initiation point in a westerly direction and dispersed within the blast exclusion zone. An external investigation found weak strata, wet blast holes and a rain event as the likely causes.

No community complaints were received regarding blast fume.

Table 6-7: Visible Blast Fume Ranking According to the AEISG Colour Scale

AEISG Ranking	2019	2020	2021	2022	2023	2024
0	202	160	170	212	218	194
1	39	22	45	52	43	58
2	15	27	27	30	23	26
3	4	0	3	4	6	10
4	0	0	1	0	1	3
5	0	0	0	0	0	0
Total*	260	209	246	298	291	291

* Where a number of individual blasts were fired as a blast event, fume was assessed for each individual blast pattern rather than for the event as a whole.

6.4 | AIR QUALITY

6.4.1 | AIR QUALITY MANAGEMENT

Air quality management initiatives are implemented at HVO to ensure that:

- Air quality impacts on surrounding residents are minimised;
- All statutory requirements are adhered to; and
- Local community and regulators are kept informed through prompt and effective response to issues and complaints.

Air quality control mechanisms employed at HVO are described in detail in the *Hunter Valley Operations Air Quality and Greenhouse Gas Management Plan (AQGGMP)*, publicly available via the HVO website.

HVO continued to implement operational controls to manage dust emissions in accordance with the AQGGMP. An improvement programme continued for West Pit to further mitigate dust emissions including reintroduction of chemical dust suppressants, trialling mobile irrigation systems, improving the standard of dust inspections and conducting dust TARP training with the workforce.

6.4.2 | AIR QUALITY MONITORING

Air quality monitoring at HVO is undertaken in accordance with the HVO Air Quality Monitoring Program (AQMP). An extensive network of monitoring equipment is utilised to assess performance against the relevant conditions of HVO's approvals. Air quality monitoring locations are shown in **Figure 6-9**. Air quality monitoring data is made publicly available through the HVO Monthly Environmental Monitoring Report, available on the HVO website.

6.4.3 | AIR QUALITY PERFORMANCE

6.4.3.1 | REAL TIME AIR QUALITY MANAGEMENT

HVO's real time air quality monitoring stations continuously log information and transmit data to a central database, generating alarms when particulate matter levels exceed internal trigger limits to guide the operational management of air quality on site.

A total of 1,456 real time alarms for air quality and meteorological conditions were received and acknowledged during 2024, which is a decrease from 3,150 alarms recorded during 2023. This decrease is likely due to the increase in wet weather days recorded across site during 2024.

In response, 2,891 hours of equipment downtime was recorded due to air quality management. A detailed breakdown of air quality related equipment stoppages (per month, per equipment type) presented in **Figure 6-10.** Note that these delays are instances where operations were completely stopped and does not include occasions where operations were changed/modified but not stopped (e.g. changed from exposed dump to in-pit dump).

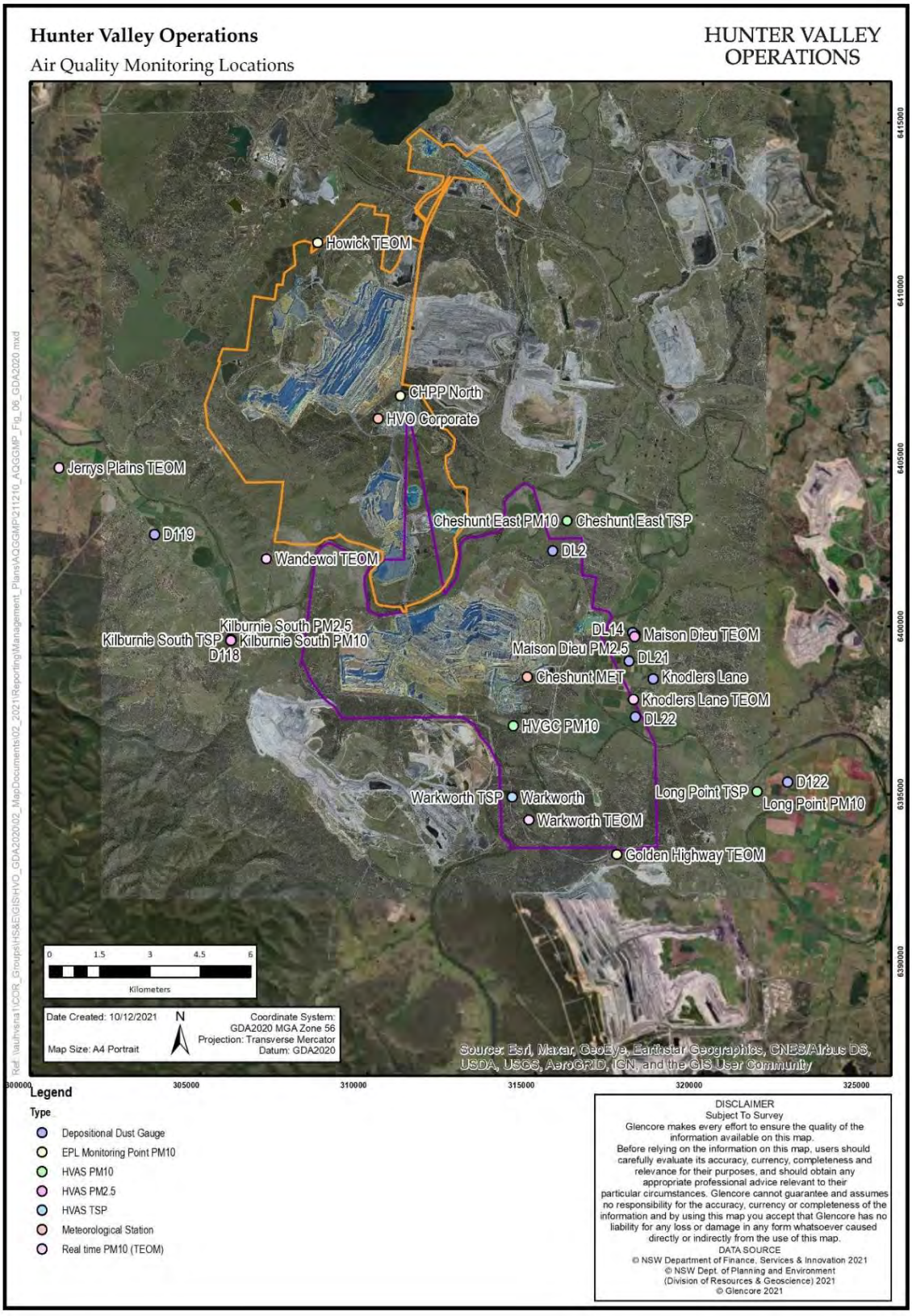


Figure 6-9: Air Quality Monitoring Locations

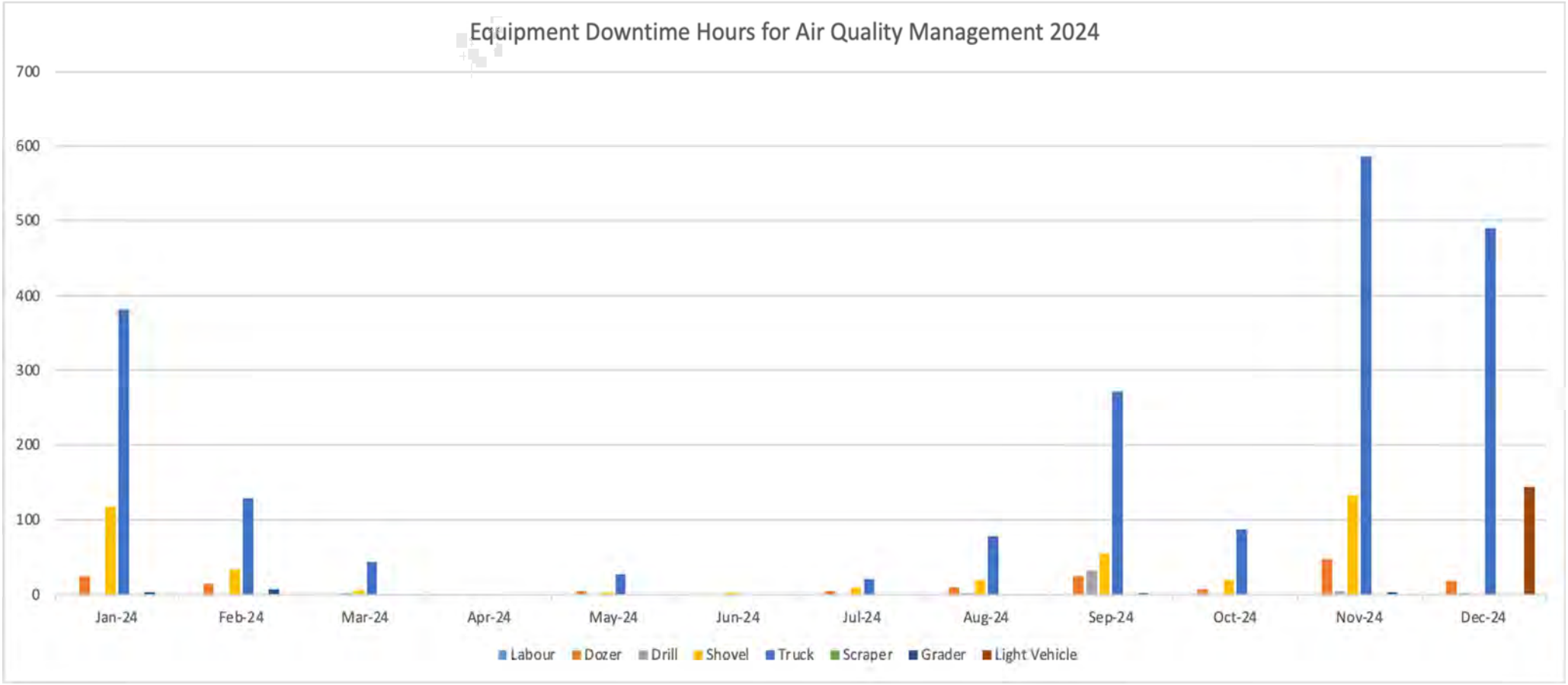


Figure 6-10: Equipment Downtime Hours for Air Quality Management 2024

Data availability from HVO's real time air quality monitoring stations is presented in **Table 6-8.** There was high data availability across the network with common reasons for data mis-captures being data-logger and modem issues.

Table 6-8: Real Time PM_{10} Air Quality Monitoring Data Availability 2024

Monitoring Location	2024 Data Availability
Warkworth	97.3%
Knodlers Lane	99.5%
Maison Dieu	97.5%
Howick	98.6%
CHPP North	88.2%
Wandewoi	94.2%
Golden Highway	98.4%
Jerrys Plains	99.2%

Note: Data availability calculated across 2023 is based on availability of a 24-hour average result. Greater than 75% data capture is required to record a 24hr average result.

6.4.3.2 | TEMPORARY STABILISATION

Aerial seeding was undertaken during May 2024 by fixed wing aircraft to provide temporary cover to areas exposed to wind generated dust and erosion at HVO. Waste dumps and exposed areas were selected for seeding if they were not planned to be disturbed within the preceding six months. An area of approximately 395 ha was seeded with fourteen tonnes of selected seed mix with germination opportunities across all seasons (refer to **Figure 6-11**). All areas were seeded using an exotic pasture and legume mix suitable for autumn sowing. A starter fertiliser was mixed with the seed prior to loading to provide sufficient nutrients for plant growth.

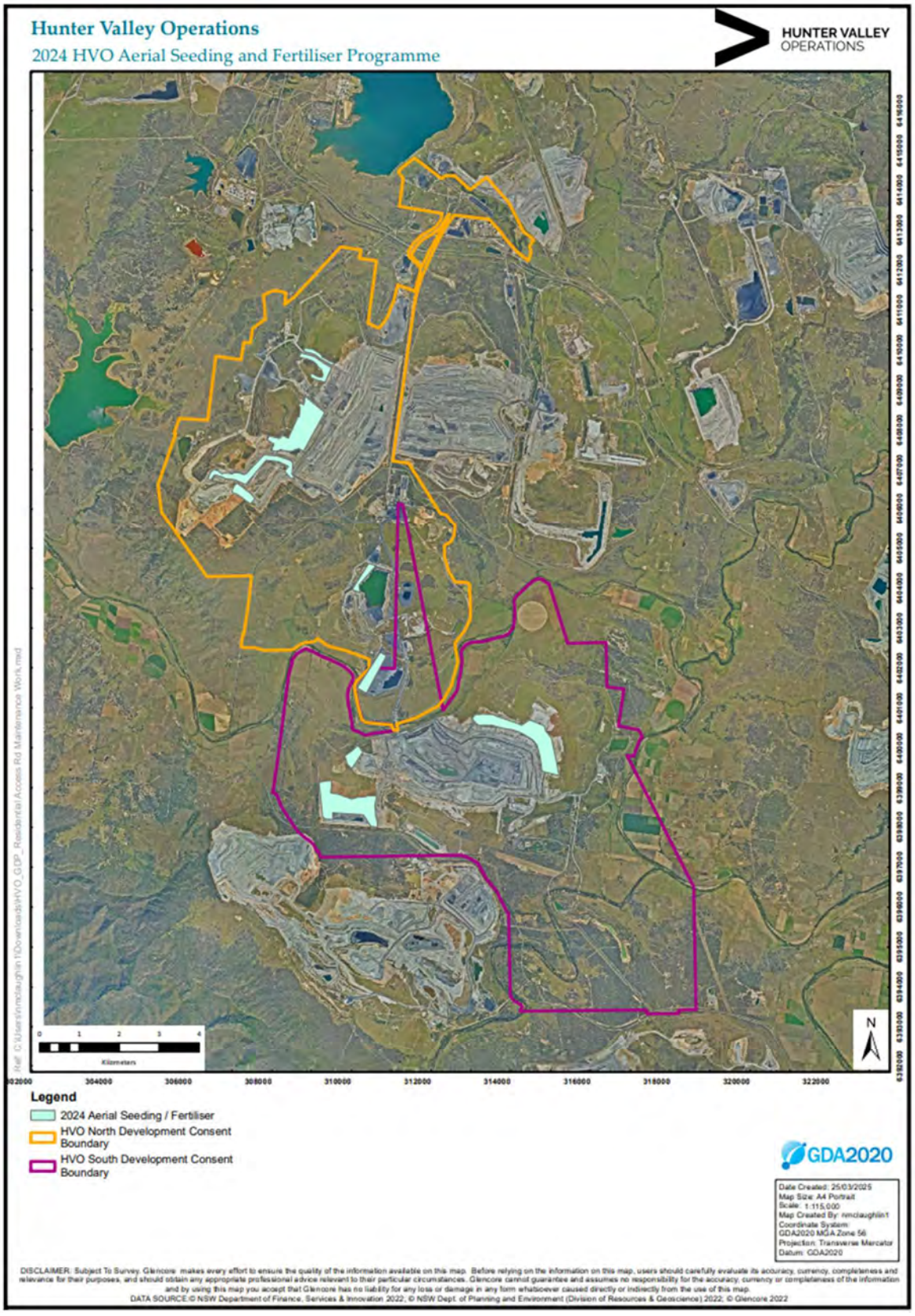


Figure 6-11: 2024 Aerial Seeding Locations

6.4.3.3 | DEPOSITIONAL DUST

Depositional dust is monitored at nine locations in accordance with the AQGGMP. The annual average insoluble matter deposition rates in 2024 compared with the depositional dust impact assessment criterion and previous years' data are shown in **Figure 6-12**.

Depositional dust samples are collected monthly. Where field observations denote a sample as contaminated (typically with insects, bird droppings or vegetation), the results are excluded from annual average compliance assessment.

The DL30 and Warkworth monitoring locations exceeded the annual average insoluble matter deposition rate criteria of 4 g/m^2/month (HVO North only) during 2024. However, all results were below the maximum insoluble solids incremental increase criterion of 2 g/m^2/month and hence compliant with criteria (**Figure 6-13**).

An external specialist investigation (See **Appendix A**) determined the exceedances to be due to local sources of dust in close proximity to the monitor. The elevated levels at DL30 and Warkworth were assessed to estimate the maximum contribution from HVO North to the annual results. The HVO North maximum contribution to the incremental increase at DL30 was 0.2 g/m^2/month, and 0.1 g/m^2/month at Warkworth. These maximum concentrations were not deemed to have caused the exceedances (**Table 6-9**). The monitors are located in close proximity to HVO South, on the opposite side of HVO North. Given the significant separation distances between HVO North and these monitors, HVO North's contribution to these monitoring sites would always be low and likely indiscernible from background concentrations and the influences of other mines. Therefore, HVO North could only reasonably have a tangible impact at its nearest monitors which include D118 and D119. These monitors recorded annual average deposited dust levels below both the incremental and cumulative criteria.

Table 6-9: Dust Deposition Annual Average Assessment

Date	Site	Measured Annual Average Dust Deposition (g/m^2/month)	Annual Average Dust Deposition Criteria (g/m^2/month)	HVO's Contribution to Dust Deposition (g/m^2/month)	Discussion
2024	DL30	4.3	4	0.2	An external consultant was engaged to investigate the exceedance, which determined that HVO North could have only provided a minor contribution to the exceedance which is attributable to local sources of dust near the monitor.
2024	Warkworth	8.3	4	0.0	An external consultant was engaged to investigate the exceedance, which determined that HVO North could have only provided a minor contribution to the exceedance which is attributable to local sources of dust near the monitor.

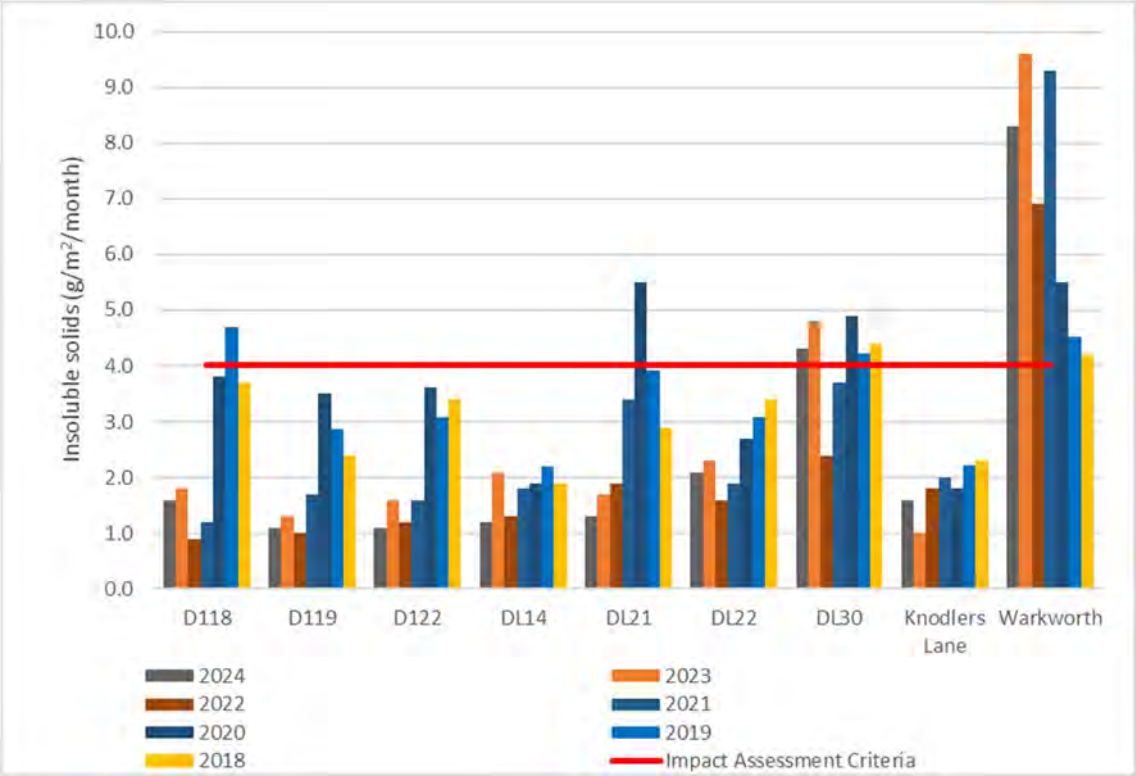


Figure 6-12: Annual Average Insoluble Matter Deposition Rates 2018-2024

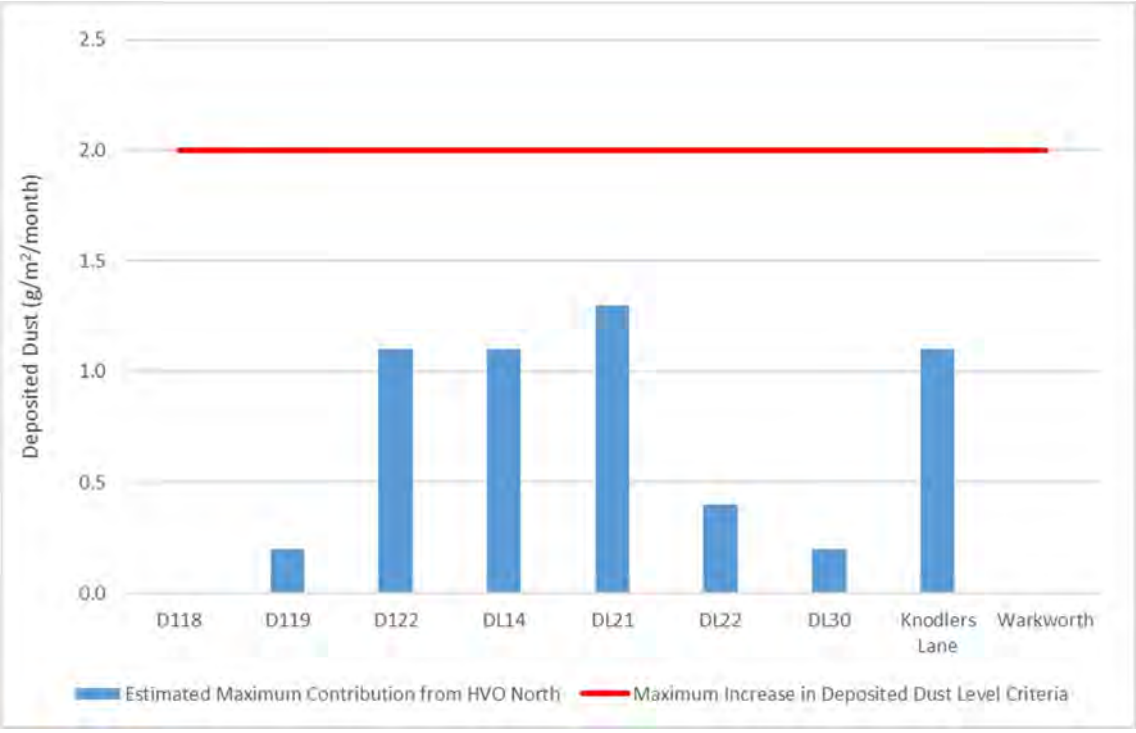


Figure 6-13: Maximum Allowable Increase in Deposited Dust Level 2024

6.4.3.4 | TOTAL SUSPENDED PARTICULATES (TSP)

TSP is monitored using High Volume Air Samplers (HVAS) at six locations in accordance with the AQGGMP.

Annual average TSP concentrations recorded in 2024 compared with the long-term impact assessment criterion and data from previous years are shown in **Figure 6-14.** TSP results in 2024 are considered to be similar to historical trends with the exception of Warkworth which recorded 137.5 µg/m^3 compared to a criteria of 90 ug/m^3.

Contributions at the TSP monitors were estimated to be the 24-hour concentrations minus an estimated background level on the corresponding day. The background level is considered to be the level which excludes the contribution from HVO but may include the influence of other sources, including other mines, localised sources, or regional sources of background dust. For the Warkworth monitor, which is often downwind of HVO South and a neighbouring mine concurrently, the daily contribution is considered to include both mines. In order to determine the contribution from HVO South alone, the combined mining increment was scaled by the proportion of time the monitor was downwind of HVO South relative to the total time the monitor was downwind of both mines during each 24-hour period.

Further methodology for determining HVO contribution is presented in Section 2.7.1 of **Appendix A**. This investigation method has determined the maximum possible contribution of HVO South to the Warkworth annual average to be 41.6 µg/m^3.

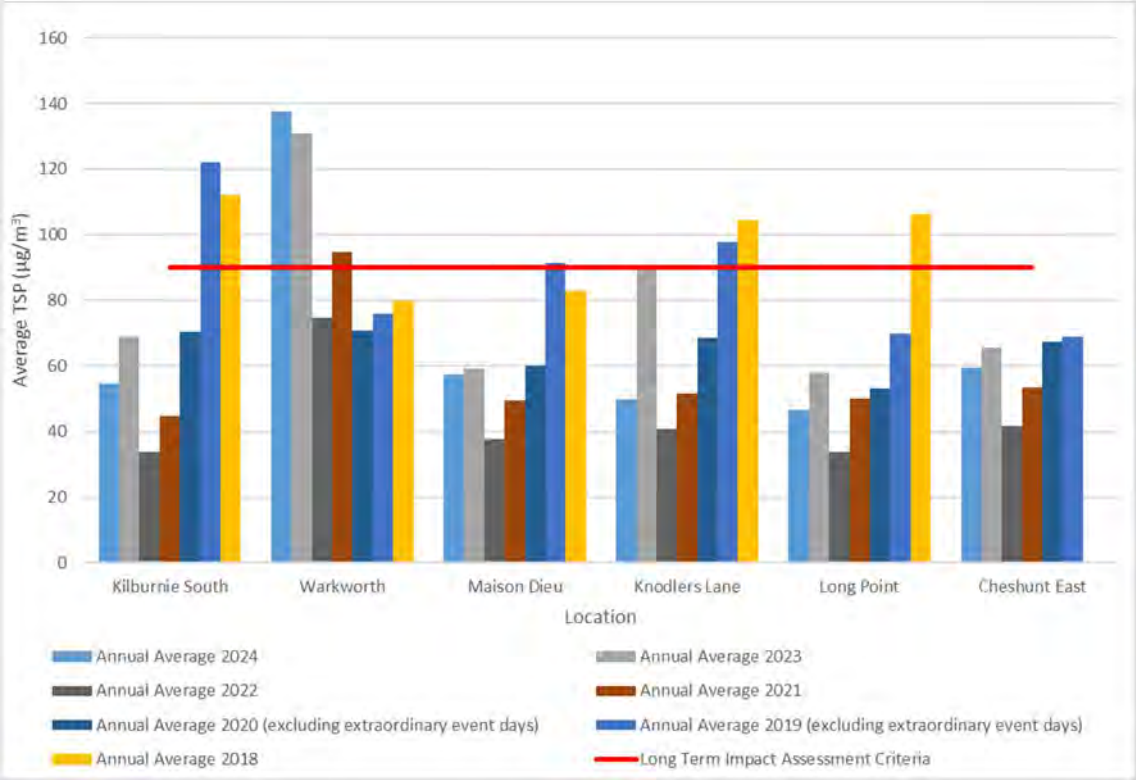


Figure 6-14: Annual Average TSP Concentrations 2018 to 2024 (Excludes Extraordinary Events)

Table 6-10: 2024 TSP HVAS Exceedance Investigation

Date	Site	Measured Annual Average TSP Level (µg/m^3)	HVO Annual Average TSP Criteria (µg/m^3)	Estimated HVO Maximum Contribution to TSP Level (µg/m^3)	Discussion
2024	Warkworth	137.5	90 (HVO South)	41.6	Investigated by external consultant based on wind direction. Refer to **Appendix A**.

Two (2) TSP measurements were not able to be collected on the scheduled sampling date (based on a sampling frequency of every six days). Details of these mis-captures are provided in **Table 6-11**.

Table 6-11: TSP HVAS 24hr Mis-captures

HVAS Location	Date	Reason for Miscapture
Cheshunt East TSP	27/08/2024	HVAS did not run for sufficient time due to an area wide power outage.
Kilburnie South TSP	13/11/2024	HVAS did not run for sufficient time due to a power trip

6.4.3.5 | PARTICULATE MATTER <10µM (PM_{10})

Particulate Matter <10 µm^3 (PM_{10}) is monitored using High Volume Air Samplers (HVAS) and Real Time Tapered Element Oscillating Microbalance (TEOM) monitors. Monitoring is used to assess against short term (24 hour) and annual average air quality criteria.

6.4.3.5.1 | PARTICULATE MATTER <10µM (PM_{10}) – SHORT TERM (24-HOUR AVERAGE) IMPACT ASSESSMENT CRITERIA

Short Term (24-hour average) PM_{10} concentrations from HVO North and South were measured using HVAS and TEOM monitors and assessed against the relevant criteria as per the AQGGMP. For TEOM monitors, this is calculated daily using measured hourly average data. The HVAS samples are taken over a 24-hour period every sixth day. Short term (24-hour average) results recorded by HVO's TEOM compliance monitoring network during 2024 is presented in **Figure 6-15**. The data presented includes total measured results including contribution from all particulate sources.

Two PM_{10} measurements were not able to be collected on the scheduled sampling date (based on a sampling frequency of every six days). Details of these mis-captures are provided in **Table 6-12**.

Table 6-12: PM_{10} HVAS 24hr Mis-captures

HVAS Location	Date	Reason for Miscapture
Cheshunt East PM_{10}	27/08/2024	HVAS did not run for sufficient time due to an area wide power outage.
Kilburnie South PM_{10}	13/11/2024	HVAS did not run for sufficient time due to a power trip

In 2024 there were no exceedances recorded against the HVO South Consent due to site contributions being below the incremental air quality criterion (HVO South contribution alone). Six (6) air quality exceedances were recorded against the HVO North Consent based on the total contribution criteria (HVO North contribution plus all other sources). Outcomes of the exceedance assessments are provided in **Table 6-13.** These exceedances required notification to DPHI as the HVO contribution was greater than 0 (zero). Refer to **Section 11** for further information on these notifications. A complete record of HVO's assessment of measured exceedances is included in **Appendix A**.

Table 6-13: 2024 PM_{10} 24hr Exceedance Investigation

Date	Site	Measured 24-Hour Average PM_{10} Level ($\mu g/m^3$)	HVO 24-Hour Average PM_{10} Criteria ($\mu g/m^3$)	Estimated HVO Maximum Incremental Contribution to PM_{10} Level ($\mu g/m^3$)	Discussion
5/02/2024	Cheshunt East HVAS	69.1	50	13.4	Investigated based on wind direction, site contribution not significant.
13/03/2024	Jerrys Plains TEOM	51.2	50	13.3[1]/6.4[2]	Investigated based on wind direction, site contribution below compliance limit
4/11/2024	Jerrys Plains TEOM	57.9	50	6.5[1]/1.2[2]	Investigated based on wind direction, site contribution not significant.
7/11/2024	Cheshunt East HVAS	53.9	50	11.1	Investigated based on wind direction, site contribution not significant.
14/12/2024	Jerrys Plains TEOM	50.5	50	9.5[1]/6.3[2]	Investigated based on wind direction, site contribution not significant.

1 HVO South contribution

2 HVO North contribution

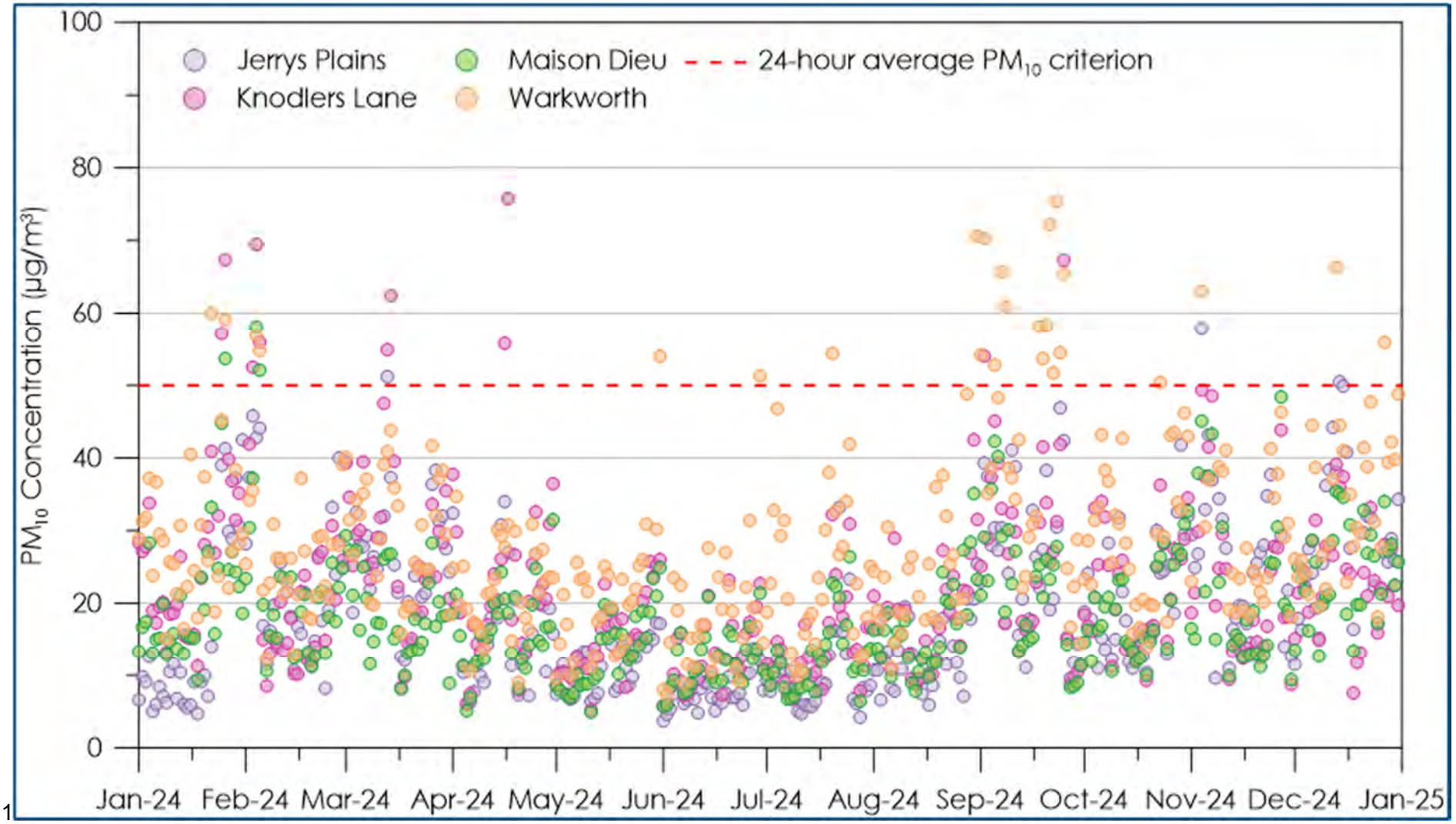


Figure 6-15: TEOM 24-hour Average Total PM_{10} Results 2024

6.4.3.5.2 | LONG TERM PM_{10} IMPACT ASSESSMENT CRITERIA

Annual average PM_{10} concentrations were calculated for both HVAS and TEOM monitors and assessed against the relevant criteria as per the AQGGMP. This was undertaken for TEOM monitors using hourly average data and was calculated for HVAS units using 24-hour average concentrations on each of the run days.

Annual average PM_{10} levels were above the impact assessment criteria at the Hunter Valley Gliding Club (HVAS) and Warkworth (TEOM) during the reporting period (refer to **Table 6-14**). These exceedances were investigated by a specialist consultant (see **Appendix A**). The investigation estimated maximum incremental contribution to PM_{10} level from HVO South to be a minor contribution to the overall result. There are no privately owned residences near the Warkworth or Glider Club monitors and HVO has a Concessions and Mitigation Agreement with the Gliding Club with respect to air quality levels when the facilities are in use. Refer to Section 2.6.1 of **Appendix A** for more information.

Table 6-14: 2024 PM_{10} Exceedance Investigation

Date	Site	Measured Annual Average PM10 Level (µg/m^3)	HVO Annual Average PM10 Criteria (µg/m^3)	Estimated HVO Maximum Contribution to PM_{10} Level (µg/m^3) from HVO South	Discussion
2024	Warkworth (TEOM)	28.0	25 (HVO South)	2.7	Investigated based on wind direction, site contribution not significant.
2024	Glider Club (HVAS)	28.8	25 (HVO South)	11.2	Investigated based on wind direction, site contribution not significant.

A comparison of the long term PM_{10} impact assessment criterion and previous years' data are shown in **Figure 6-16**.

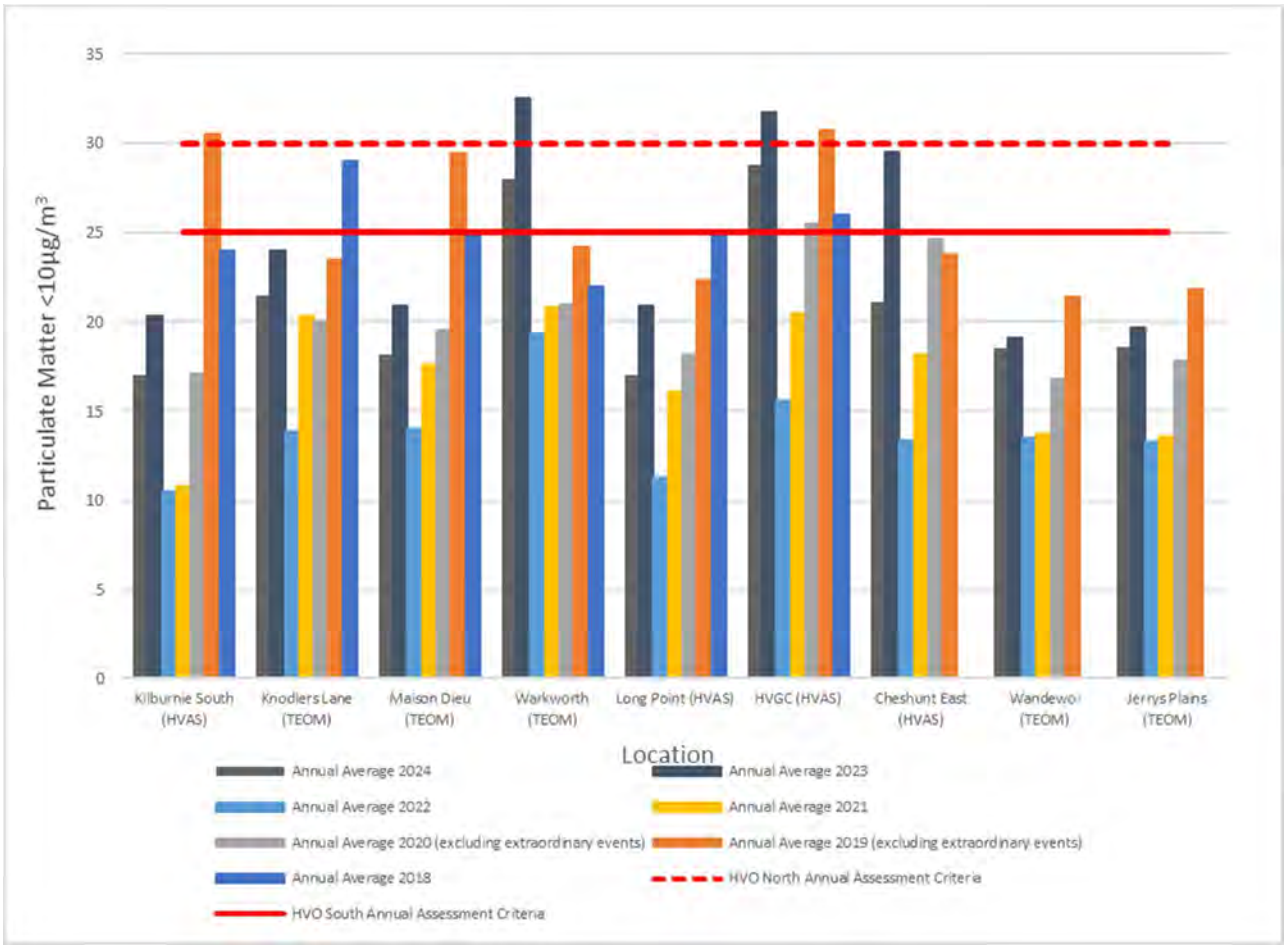


Figure 6-16: Annual Average HVAS PM10 Results 2018 to 2024

6.4.3.5.3 | $PM_{2.5}$ SHORT TERM IMPACT ASSESSMENT CRITERIA

$PM_{2.5}$ samples were collected at Maison Dieu and Kilburnie South using HVAS, and these results are provided in **Table 6-16** and **Figure 6-17**.

There were four (4) $PM_{2.5}$ measurements that were not able to be collected on the scheduled sampling dates (**Table 6-15**).

Table 6-15: $PM_{2.5}$ HVAS Mis-captures - 2024

HVAS Location	Date	Reason for Miscapture
Kilburnie South	12/03/2024	No power at unit due to blown electrical fuse
Maison Dieu	28/06/2024	Power tripped at monitoring unit
Kilburnie South	13/11/2024	Power tripped at monitoring unit

Results above criteria were recorded over 4 monitoring days during 2024. The results were investigated and HVO's contribution was assessed based on wind direction (**Table 6-16**). The investigations determined HVO South was below its incremental criteria for all results. As discussed in the Long-Term Impact section the $PM_{2.5}$ levels recorded appear to be anomalously high when compared to co-located PM_{10} monitor results.

Table 6-16: Short Term Impact Assessment Criteria – $PM_{2.5}$ Results 2024

Date	Site	Measured 24-Hour Average $PM_{2.5}$ Level ($\mu g/m^3$)	HVO South 24-Hour Average $PM_{2.5}$ Incremental Criteria ($\mu g/m^3$)	Estimated HVO South Contribution to $PM_{2.5}$ Level ($\mu g/m^3$)	Discussion
5/02/2024	Kilburnie South	48.2	25	1.3	Investigated based on wind direction and background, site contribution below criteria
5/02/2024	Maison Dieu	37.0	25	12.3	Investigated based on wind direction and background, site contribution below criteria
2/09/2024	Maison Dieu	29.1	25	6.2	Investigated based on wind direction and background, site contribution below criteria
7/11/2024	Maison Dieu	51.4	25	4.4	Investigated based on wind direction and background, site contribution below criteria

Date	Site	Measured 24-Hour Average $PM_{2.5}$ Level ($\mu g/m^3$)	HVO South 24-Hour Average $PM_{2.5}$ Incremental Criteria ($\mu g/m^3$)	Estimated HVO South Contribution to $PM_{2.5}$ Level ($\mu g/m^3$)	Discussion
7/11/2024	Kilburnie South	25.6	25	0.9	Investigated based on wind direction and background, site contribution below criteria
25/11/2024	Kilburnie South	25.9	25	6.5	Investigated based on wind direction and background, site contribution below criteria

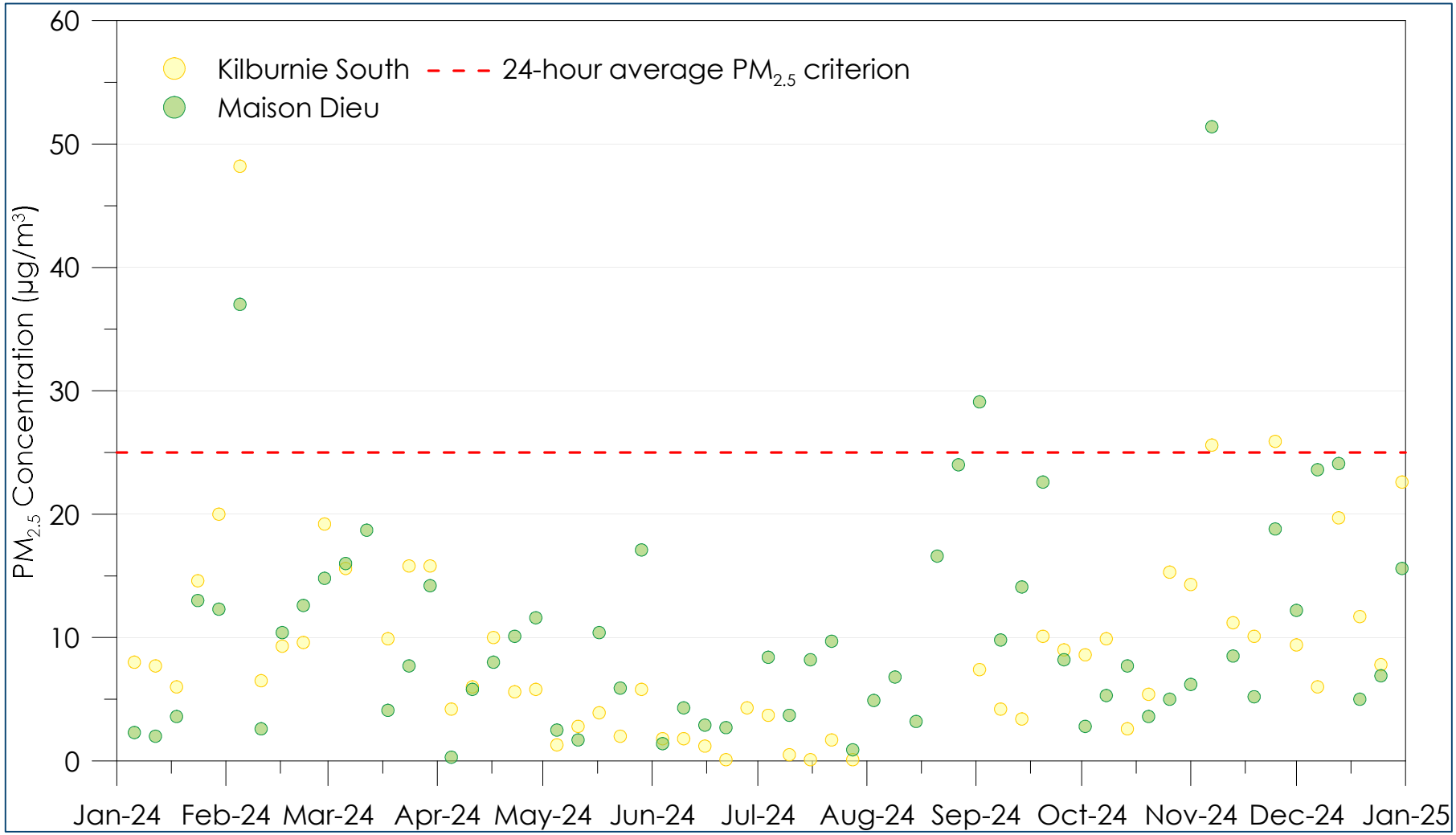


Figure 6-17: 24-hour Average $PM_{2.5}$ Results 2024

6.4.3.5.4 | PARTICULATE MATTER <2.5µM ($PM_{2.5}$) – LONG TERM (ANNUAL AVERAGE) IMPACT ASSESSMENT CRITERIA

Annual average $PM_{2.5}$ was above the annual average criteria of 8 µg/m^3 at both locations for the reporting period (**Table 6-17)**. While HVO's contribution is not calculated to be significant, the elevated total levels are considered to be anomalously high and are not consistent with other regional $PM_{2.5}$ monitors or expected ratios of co-located $PM_{2.5}$ monitors. $PM_{2.5}$ levels recorded have been investigated throughout the year, including:

- Monitoring locations have been inspected multiple times to identify any significant local $PM_{2.5}$ sources, with none identified.
- Calculation of PM_{10}:$PM_{2.5}$ ratios for monitoring equipment for co-located units (as shown in **Table 6-18**). The ratio in the Hunter Valley is typically 0.3 to 0.4. Ratios measured at HVO range from 0.40 to 0.78.
- Comparison to levels recorded by EBAMs installed in March 2023.

It is believed that the source of the high readings is due to the high-volume air sampler monitoring method. HVO engaged an air quality consultant to review the air quality monitoring network. The review recommended the implementation of real-time $PM_{2.5}$ monitoring at Maison Dieu and Kilburnie South. During March 2023, HVO installed Beta Attenuation Mass Monitors (EBAMs) which is an equivalent type to that used in the EPA's Upper Hunter Air Quality Monitoring Network. The use of the EBAMs is pending DPHI approval of the AQGG Management Plan. The aim of these monitors is to determine the potential contribution of HVO South to annual average $PM_{2.5}$ levels recorded at HVO HVAS monitors. Given that the results recorded at the Maison Dieu and Kilburnie South HVAS monitors appears to be implausibly high, monitoring data at these locations have been used in order to estimate HVO South's increment to the recorded levels.

HVO South contributions to the BAM monitors were estimated on an hourly basis for HVAS run days. The hourly contributions were estimated as the concentrations recorded at each monitor minus the estimated background level. The hourly contributions were then averaged for each 24-hour period to determine the 24-hour contributions from HVO South. The percentage contribution of the total level recorded at the BAM monitors was applied to the HVAS monitoring results for 2024 to determine the potential contribution from HVO South to the monitors. The two BAM monitors at Maison Dieu and Kilburnie South recorded an average of 4.9µg/m^3 and 4.8 µg/m^3 respectively. Further information is presented in Section 2.5.1 of **Appendix A**.

Table 6-17: $PM_{2.5}$ Annual Average Monitoring Data 2024

Monitoring Location	HVO South Annual Average $PM_{2.5}$ Criteria (µg/m^3)	Measured Annual Average $PM_{2.5}$ Level (µg/m^3)	Estimated Contribution to Annual Average $PM_{2.5}$ Level (µg/m^3)
Maison Dieu	8	10.5	0.4
Kilburnie South	8	8.9	0.1

Table 6-18: Annual $PM_{2.5}$ / PM_{10} Ratios in Upper Hunter

Year	$PM_{2.5}$ / PM_{10} Ratios					
	Muswellbrook	Singleton	Camberwell	Merriwa	Maison Dieu	Kilburnie South
2015	0.46	0.39	0.33	*	*	*
2016	0.44	0.41	0.31	*	*	*
2017	0.43	0.39	0.27	*	*	*
2018	0.35	0.34	0.27	*	*	*
2019	0.35	0.36	0.26	*	*	*
2020	0.41	0.41	0.31	*	0.63	0.78
2021	0.41	0.37	0.30	0.38	0.48	0.54
2022	0.39	0.36	0.32	0.31	0.40	0.57
2023	0.35	0.37	0.30	0.34	0.43	0.62
2024	0.41	0.44	0.33	0.34	0.50	0.47

* Monitoring locations were not in place during this year

$PM_{2.5}$ levels measured at the Maison Dieu and Kilburnie South HVAS units were higher than UHAQMN annual average $PM_{2.5}$ results in comparable locations, as shown in **Table 6-19**.

Table 6-19: UHAQMN Annual Average $PM_{2.5}$ Results for 2024

UHAQMN Monitor	Measured Annual Average 2024 $PM_{2.5}$ Level ($\mu g/m^3$)
Muswellbrook	7.1
Singleton	7.3
Camberwell	5.9
Merriwa	4.6

6.4.4 | COMPARISON AGAINST EA PREDICTIONS

Table 6-20 and **Table 6-21** show a comparison between 2024 air quality data and the Stage 2 predictions made in the HVO South Modification 5 EIS. Comparisons have been made against the predictions listed in the EA for the nearest private residence to each monitoring location.

PM_{10} measurements in 2024 were similar to or below predicted levels for all monitoring locations for both short term (24-hour average) and long term (annual average) criteria as shown in **Table 6-14**. Annual average TSP measurements in 2024 were below predicted levels for all monitoring locations aside from Warkworth and Knodlers Lane. These results are discussed in **Section 6.4.3.4**.

*Table 6-20: HVO South PM_{10} Annual Average Results Compared Against Cumulative Predictions^*

Site (EA Receptor)	Short Term (24hr) Criteria		Long Term (Annual Average) Criteria	
	Predicted Maximum 24hr PM_{10} Due to HVO South Alone ($\mu g/m^3$) Stage 2	2024 Maximum 24hr PM_{10} HVO Contribution ($\mu g/m^3$)	Predicted PM_{10} Annual Averages ($\mu g/m^3$) Stage 2	2024 PM_{10} Annual Average ($\mu g/m^3$)
Maison Dieu (256)	36	18.5	21	18.2
Warkworth (90)	95	22.4	46	28.0
Kilburnie South (307)	31	17.9	27	17.0
Knodlers Lane (117)	59	29.8	28	21.5
Long Point (137)	36	13.0	20	17.0
Hunter Valley Gliding Club***	>50	44.6	>30	28.8

^ Cumulative predictions for Stage 2 of the HVO South Mod 5 Environmental Assessment.

*** The HVGC has entered into a Concessions and Mitigation Agreement with Hunter Valley Operations.

*Table 6-21: HVO South TSP Annual Average Results Compared Against Cumulative Predictions^*

Site (EA Receptor)	Long Term (Annual Average) TSP Criteria	
	Stage 2 Prediction ($\mu g/m^3$)	2024 PM_{10} Annual Average ($\mu g/m^3$)
Maison Dieu (256)	60	49.6
Warkworth (90)	106	137.5
Kilburnie South (307)	76	54.6
Knodlers Lane (117)	75	79.0
Long Point (137)	61	46.7

^ Cumulative predictions for Stage 2 of the HVO South Mod 5 Environmental Assessment.

Table 6-22 and **Table 6-23** detail comparisons between 2024 air quality monitoring results and the modelled predictions from the 2010 HVO North Carrington West Wing Air Quality Impact Assessment. Predictions have been sourced from modelled scenarios of Year Five of the Carrington West Wing development. It should be noted that while Approval has been granted for the commencement of that project, works have not yet commenced.

Annual average PM_{10} levels for 2024 were above the predicted annual average presented in **Table 6-22** however HVO estimated contributions (North and South) to these were low. Annual average TSP levels were also above predicted levels (**Table 6-23**). HVO contribution to these has been estimated (**Appendix A**) to be low and not considered to be the primary cause of the elevated levels.

*Table 6-22: HVO North 2024 PM_{10} Annual Average Results Compared Against Cumulative Predictions^*

Site (EA Receptor)	Long Term (Annual Average) Criteria			
	Predicted PM_{10} Annual Average ($\mu g/m^3$)	2024 PM_{10} Annual Average ($\mu g/m^3$)	HVO North Estimated Contribution to 2024 PM_{10} Annual Average ($\mu g/m^3$)	HVO South Estimated Contribution to 2024 PM_{10} Annual Average ($\mu g/m^3$)
Maison Dieu (6)	21.1	18.2	*	2.2
Warkworth (39)	46.3	28.0	*	2.7
Kilburnie South (4)	26.7	17.0	1.2	2.4
Jerrys Plains (13)	13.4	18.6	1.3	2.9
Cheshunt East (7)	29.3	21.1	4.5	*

^ Cumulative predictions for Year Five (CWW) of the HVO North Environmental Assessment.

* no relevant criteria for this location under the consent

*Table 6-23: HVO North 2024 TSP Annual Average Results Compared Against Cumulative Predictions^*

Site (EA Receptor)	Long Term (Annual Average) Criteria		
	Predicted TSP Annual Average ($\mu g/m^3$)	2024 TSP Annual Average ($\mu g/m^3$)	HVO TSP Contribution ($\mu g/m^3$)
Maison Dieu (6)#	43.7	49.6	9.6 (HVO South)
Warkworth (39) #	46.3	137.5	41.6 (HVO South)
Kilburnie South (4)	44.9	54.6	2.6 (HVO North) 9.8 (HVO South)
Cheshunt East (7)	44.5	59.5	18.3 (HVO North)

^ Cumulative predictions for Year Five (CWW) of the HVO North Environmental Assessment.

Being upwind of HVO South, separate HVO North contribution was not calculated.

6.5 | GREENHOUSE GAS AND ENERGY MANAGEMENT

6.5.1 | REPORTED GREENHOUSE GAS EMISSIONS

HVO reports greenhouse gas emissions (GHG) in accordance with National Energy and Greenhouse Gases (NGER) legislation. Each financial year HVO is required to submit to the Federal government the emissions from their NGERs registered facility into the Emissions and Energy Reporting System (EERS). The NGERs reporting year is based on a financial year, not a calendar year such as this Annual Review. The values in this report also cover a financial year.

Table 6-24 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) compared to annual average emissions forecast for HVO South (PA 06_0261) in the *Air Quality and Greenhouse Gas Study HVO South Modification 5 (Todoroski Air Sciences, 2017*) (the EIS forecast). Greenhouse emission forecasts for HVO

North are only suitable for comparison in the EIS for the Carrington West Wing modification, which has not commenced.

Table 6-24: Greenhouse Gas Emissions 2024

Emissions	NGERS Reported Emissions (tonnes CO_2e-)			Predicted Emissions
	FY22	FY23	FY24	
Scope 1	577,874	456,690	637,147	570,807
Scope 2	93,865	61,585	58,720	137,231
Total Scope 1 & Scope 2	671,739	518,275	695,867	708,038

6.5.2 | COMPARISON AGAINST PREDICTIONS

The EIS forecast estimated that the annual average greenhouse gas emissions (Scope 1 and Scope 2) from HVO South would be 708,038 CO_2e-. As outlined in **Table 6-24**, total emissions during FY2024 were 695,867 CO_2e-. Total emissions reported are for the HVO Complex, which includes activities in both HVO South and HVO North. While Scope 1 emissions were above EIS forecast for the financial year, Scope 2 emissions were below forecast, and total Scope 1 and Scope 2 was below the EIS forecast. Considering that total emissions are below forecast and that the forecast does not include HVO North, HVO is considered to be operating in line with predictions.

Table 6-24 shows reported emissions for the past 3 NGERS reporting periods. Levels have been below predictions during each reporting period. Greenhouse gas emissions show close alignment with coal production for each reporting period.

6.5.3 | STEPS TAKEN TO IMPROVE ENERGY EFFICIENCY AND REDUCE GHG EMISSIONS

HVO is actively engaged in minimising greenhouse gas emissions associated with their coal operations and supporting the NSW Government objectives of net-zero emissions by 2050. In addition, HVO is governed by a range of climate change commitments made by Yancoal and Glencore, as the JV partners of HVO, including:

- Yancoal
  - Supporting innovation and investment in carbon capture, utilisation and storage through various industry and policy initiatives, to work towards the commitments outlined in the Paris Agreement;
  - Taking a constructive role in public policy development and participation in relevant industry associations, guided by recognition of the aims of the Paris Agreement; and
  - Supporting research into technologies that will reduce GHG emissions from the downstream consumption of products (Scope 3).
- Glencore
  - Glencore Coal Australia open cut and underground sites minimise emissions from diesel and electricity consumption by:
    - Optimisation of mining practices e.g. haulage planning, blast design, conveying arrangements.

- Optimisation of engine performance e.g. studies undertaken in collaboration with OEMs to enhance fuel efficiency and emissions reduction.
- New fleet is purchased with the most fuel-efficient engines available.
- Ongoing monitoring of potential biofuel and fuel additive opportunities.
- Ongoing monitoring and assessment of emerging technologies.

HVO also manages greenhouse gas emissions through the following:

- Continuing to look to use new, economically feasible, technologies to improve efficiencies and reduce emissions including fuel switching and electricity from renewable sources.
- Update our 3-year plan every three years for investigating and implementing all reasonable and feasible measures to minimise greenhouse gas emissions.
- Continue to implement operational control efficiencies such as minimising haul distances, and optimising ramp gradients, payload management and scheduling activities to optimise equipment use.

6.6 | WASTE AND HAZARDOUS MATERIALS

6.6.1 | RECYCLING

HVO has continued reinforcing the principles of effective waste management across the site, including recycling.

During the reporting period, 7% of non-mineral waste material generated at HVO was disposed of in licensed offsite landfill facilities and 93% of waste was recycled. This is a similar result to 2023.

A total of 12,211 tonnes of waste was removed from site during the reporting period. The high recycling rates are influenced by the recycling of effluent (9,694 tonnes), waste oil (1,088 tonnes) and scrap steel (814 tonnes).

6.6.2 | SEWAGE TREATMENT/DISPOSAL

The sewage treatment and disposal facilities at HVO consist of sewage treatment plants which treat, disinfect and re-use the treated effluent on-site where practicable. The remaining effluent from some septic systems that is unable to be treated on site is sent to approved facilities for disposal.

HVO currently operates 3 main grouped on-site sewage management facilities that are interconnected from multiple systems. These facilities are located at Howick, HVO North and HVO South. Design works continued towards upgrade of these systems.

6.6.3 | HYDROCARBONS

A total of 1,088 kL of waste oil was taken offsite to be refined into a base oil for reuse in new oil products during the reporting period. Other hydrocarbons recycled via a licenced waste hydrocarbon disposal contractor include approximately 17.3 tonnes of waste grease.

6.6.4 | CONTAMINATED SOIL

HVO operates and maintains two bioremediation areas to manage hydrocarbon contaminated soil.

Contaminated soil is taken to one of the bioremediation areas and placed in cells based on the time of contamination. Contaminated soil is spread out in beds approximately 300 mm in height and turned to provide aeration for beneficial microbial activity.

Soil in the treatment area is sampled and tested as required until total hydrocarbon levels are below relevant guidelines. Soil meeting these criteria is then removed and disposed of in the spoil dump.

6.6.5 | ACID ROCK DRAINAGE

There were no observed issues relating to Acid Rock Drainage during 2024. The Geochemical Monitoring Programme was reviewed during the reporting period, and this will be implemented from 2025.

6.6.6 | BUILDING DEMOLITION

No building demolition was conducted during 2024.

6.6.7 | WASTE/HAZARDOUS MATERIALS NON-COMPLIANCES

There were no externally reportable incidents related to waste or hazardous material management during the reporting period.

6.7 | HERITAGE

6.7.1 | ABORIGINAL CULTURAL HERITAGE MANAGEMENT AND COMMUNITY CONSULTATION

Aboriginal cultural heritage is managed under the provisions of separate Aboriginal Cultural Heritage Management Plans (ACHMPs) approved for each consent. At HVO North, where mining or associated development activities may impact Aboriginal cultural heritage sites, an Aboriginal Heritage Impact Permit (AHIP) must also be sought from Heritage New South Wales (formerly Office of Environment and Heritage) under Part 6 of the National Parks and Wildlife Act 1974 (NPW Act), on the basis of the management requirements established through the ACHMP process.

The HVO South ACHMP area was approved as a State Significant Development which excludes the requirement for obtaining AHIPs prior to implementing cultural heritage management measures authorised under the provisions of the ACHMP.

HVO consults with the Hunter Valley Operations Cultural Heritage Working Group (CHWG) which is comprised of representatives from HVO and Registered Aboriginal Parties (RAPs) from upper Hunter Valley aboriginal community groups, corporations and individuals. The CHWG met and discussed cultural heritage management matters associated with HVO at two meetings during 2024 – 2 May and 19 December.

Aboriginal cultural heritage at HVO is managed in consultation with the RAPs associated with the CHWG, in accordance with the ACHMPs, and development consent conditions, to protect, manage and mitigate cultural heritage at HVO. Management measures include:

- Ongoing consultation and involvement of the local Aboriginal community in all matters pertaining to Aboriginal cultural heritage management;
- Compliance with existing ACHMP's and Development Consent conditions;
- A cultural heritage Geographic Information System (GIS) and Cultural Heritage Zone Plan (CHZP) incorporating cultural heritage spatial and spatial data (site location, description, assessments, date recorded, associated reports, management provisions and various other details to assist with the management of sites);
- A Ground Disturbance Permit (GDP) system for the assessment and approval of ground disturbing activities to ensure these activities do not disturb cultural heritage places;
- Limit of Disturbance Boundary (LODB) procedures to demarcate approved disturbance areas and delineate areas not to be disturbed;
- Ongoing cultural heritage site inspections, monitoring and auditing along with regular compliance inspections of development works;
- Protective management measures such as fencing/barricading sites to avoid disturbance, protective buffer zones, cultural heritage off-set areas; and
- Communicating cultural heritage issues and site awareness to personnel via internal electronic and face to face processes.

In consultation with the CHWG and Heritage NSW, a Cultural Heritage Storage Facility (CHSF) was established at the Hunter Valley Services complex. The CHSF is a storage shed, with an adjacent shipping container, fitted out to allow safe and secure storage of cultural materials such as stone artefacts. It is a central repository for all materials collected during community collection and salvage activities on all lands related to HVO (including offset properties).

6.7.2 | ABORIGINAL ARCHAEOLOGICAL AND CULTURAL HERITAGE INVESTIGATIONS

EMM conducted a due diligence assessment and survey at one area during 2024. This area was the subject of a proposal to extend an existing car park to accommodate truck parking. As part of the pre works, five objects were identified that required verification by an archaeologist to determine if they were cultural in origin. The objects were inspected by RAPs on 2 May 2025 and an EMM archaeologist on 3 May 2024, with both groups confirming they were ACH artefacts. As a result, permanent barricading has been installed and the car park redesigned to avoid the artefacts. The site has been documented as AHIMS 37-2-6621.

During 2024, consultation with Registered Aboriginal Parties (RAPs) associated with the HVO Continuation Project (HVO South (SSD1186621) and HVO North (SSD 11826681) continued in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010). A summary of the primary consultation activities completed during the 2024 included:

- Provision of newsletters
- Project update letters/emails
- Introduction to proposed time extension modification to the HVO North Development Consent (DA 450-10-2003) letter/email

Consultation with Project RAPs will remain ongoing throughout 2025 during the assessment phase of the HVO Continuation Project.

HVO also conducted consultation meetings as part of the requirements for preparing the ACHA for the Mitchell Pit South AHIP application. Consultation meetings were conducted on the following dates:

- Meeting 1: 7 February 2024;
- Sub Committee Meeting: 28 March 2024
- Meeting 2: 2 May 2024;
- Meeting 3: 31 May 2024

The Mitchell Pit South AHIP application was submitted to Heritage NSW on 13 August 2024. The application was approved, with AHIP 5350 issued on 23 December 2024.

That's

6.7.3 | HERITAGE AUDITS AND INCIDENTS

Under the provisions of the HVO South ACHMP, two compliance inspections were conducted during 2024 and under the provisions of the HVO North HMP, a single compliance inspection was conducted during 2024. The purpose of the compliance inspections is to provide / allow RAPs:

- The opportunity to visit mine operations and mine areas to inspect operational compliance with ACHMP/HMP provisions and GDP procedures;
- To inspect and monitor the condition and management of sites; and
- To review the effectiveness and performance of the ACHMP/HMP provisions in the management of cultural heritage at the mine.

These compliance inspections were conducted by RAP representatives of the CHWG with the assistance of a qualified archaeologist and HVO personnel.

The biannual 2024 HVO South compliance inspection was conducted on 22 April 2024 by two RAP representatives of the CHWG. A total of fifteen Aboriginal heritage sites were inspected focusing on locations on the Hunter River at the Nichols block and Barellan and Comleroi farms. The findings and recommendations of these inspections are documented in the HVO South Aboriginal Heritage Management Plan April 2024 Compliance Audit Inspections report dated June 2024 and included as **Appendix C**.

The annual 2024 HVO South and HVO North compliance inspection was conducted between 18 and 20 of November 2024 by three RAP representatives of the CHWG, a suitably qualified and experienced archaeologist and HVO personnel. During the HVO South portion of the compliance inspection, a total of 55 Aboriginal heritage sites were inspected in the HVO South Area / Long Point area. These areas are not active mining areas, with some utilised for grazing by third party rural licensees. During the HVO North portion of the compliance inspection, a total of 37 heritage sites were assessed including Carrington south, Carrington north, Hunter Valley Services, Hunter Valley Load Point on the north west periphery of West Pit and CM-CD-1. The findings and recommendations of these inspections are documented in the Hunter Valley Operations Aboriginal Heritage Management Plans November 2024 Compliance Audit Inspections report dated December 2024 and included as **Appendix C**.

The inspections found that all sites have been managed in conformance with the ACHMP/HMP requirements. Sites requiring maintenance and upgrades to site barricading, fencing and vegetative sediment controls were identified. Barricade upgrade and maintenance will be included as part of the works proposed for 2025. Inspections were hampered by high vegetation and ground cover. The CM-CD1 site report included reference to the recent program of cultural burning (refer to **Section 6.8.2**) and the need to complete fencing, to assist with demarcation of control zones for various activities including exclusion areas

and areas where specific land management activities can be conducted. The report also noted the need to maintain feral pig control programs to reduce potential disturbance of this site.

During the reporting period, there were 45 GDPs assessed for cultural heritage management considerations at HVO.

There were no incidents, nor any unauthorised disturbance caused to cultural heritage sites at HVO during 2024.

Figure 6-18: Participants of the CM-CD-1 cultural burn, conducted 4 September 2024

6.7.4 | HISTORIC HERITAGE – MANAGEMENT AND COMMUNITY CONSULTATION

Consultation was conducted at the Hunter Valley Operations Community Consultative Committee (CCC) Meetings held on 7 February, 8 May, 28 August and 13 November 2024 as outlined in **Section 9**. Topics discussed included:

- Yard maintenance works and Termite Interception System inspections at LEP listed European heritage properties;
- Progress on HVO ‘s plan for an Historic Homestead Project, which included the completion of detailed survey and condition reports for the Archerfield, Wandewoi and Carrington Stud homesteads;
- Ongoing maintenance of the Cockatoo Fence Asset Protection Zone maintenance works;
- Preparation of the Archerfield homestead Conservation Management Plan; and
- Planning and tender for the Wandewoi homestead balustrade repair.

A Conservation Management Plan was prepared and submitted to Singleton Council for the Archerfield homestead complex of buildings in 2024. Conservation and maintenance works are planned for Archerfield and Wandewoi homesteads during 2025 and 2026.

Figure 6-19: Aerial view of Wandewoi homestead

6.8 | BUSHFIRE MANAGEMENT

The following bushfire management control and mitigation activities outlined in the HVO Bushfire Management Plan were completed at HVO during 2024.

6.8.1 | OPERATIONAL AREAS

Bushfire mitigation measures undertaken in operational areas in 2024 are detailed in **Table 6-25**.

Table 6-25: Bushfire Mitigation Measures Undertaken in Operational Areas

Task	Completion Note
Inspect and maintain operational area fire trails and breaks	Completed as per SAP maintenance strategy
Inspect, install and maintain signage for main intersections, and gates of firebreak trails	Completed as per SAP maintenance strategy

Task	Completion Note
Inspect and maintain areas surrounding administration buildings, workshops, crib huts and external roads	Completed as per SAP maintenance strategy
Inspect and maintain areas around power poles, switch yards, transformers, air break switches, and substations	Completed as per SAP maintenance strategy
Inspect and maintain areas around powerlines	Completed as per SAP maintenance strategy
Inspect and maintain areas around CHPP and load points	Completed as per SAP maintenance strategy
Inspect and maintain HC1 conveyor	Completed as per SAP maintenance strategy
Inspect and maintain workshops	Completed as per SAP maintenance strategy
Inspect and maintain water hydrant and pump function	Completed as per SAP maintenance strategy
Report any instances of bushfire outbreak to supervisor / manager, or raise emergency alarm	HVO did not record any bushfire related emergency alarms during 2024
Review Bushfire Management Plan including currency of information including maps, access routes	Plan reviewed and updated during 2024. Updated Plan endorsed by Hunter RFS (August) and Singleton Council (September) 2024
Bushfire reporting in the Annual Review, including any incidents and/or complaints	Completed – this report. No incidents or complaints received during 2024
Annual liaison with Rural Fire Service	Meeting held 23 September 2024

6.8.2 | NON-OPERATIONAL AREAS

Bushfire mitigation measures undertaken in non-operational areas in 2024 are detailed in **Table 6-26**.

Table 6-26: Bushfire Mitigation Measures Undertaken in Non-Operational Areas

Task	Completion Note
Report any instances of bushfire outbreak to supervisor / manager, or raise emergency alarm	HVO did not record any bushfire related emergency alarms at its non-operational properties during 2024
Inspect and maintain non-operational fire trails and breaks	Inspection and maintenance of fire trails completed during August and November 2024
Inspect, install and maintain signage for gates or firebreak trails	Fire trail signage inspected during August and November 2024
Review fuel loads and complete necessary reduction including areas adjacent to neighbouring properties	Fuel load inspection and review completed between May and September 2024

HVO conducted its first cultural burn at cultural heritage site CM-CD-1 on 4 September 2024. This work was conducted in accordance with the HVO North Heritage Management Plan and will be a regular component of HVO's land management and pasture based fuel load management.

6.8.3 | HVO BUSHFIRE MANAGEMENT PLAN REVIEW AND IMPROVEMENT

HVO reviewed and updated the Bushfire Management Plan in 2024, with RFS and Singleton Council endorsement of the Plan during September 2024.

7 | WATER MANAGEMENT

HVO manages surface and ground water according to three main objectives:

- Fresh water usage is minimised.
- Impacts on the environment and HVO neighbours are minimised; and
- Interference to mining production is minimal.

This is achieved by:

- Minimising freshwater use from the Hunter River.
- Preferentially using mine water for coal preparation and dust suppression.
- Emphasis on control of water quality and quantity at the source.
- Segregating waters of different quality where practical.
- Recycling on-site water.
- Ongoing maintenance and review of the system; and
- Disposing of water to the environment in accordance with statutes and regulations.

Plans showing the layout of all water management structures and key pipelines are shown in **Figure 7-1** to **Figure 7-3**. The HVO Water Management Plan contains further detail on management practices and is available on HVO website. Note that **Figure 7-1** to **Figure 7-3** are updated versions of plans presented in the currently approved *HVO Water Management* Plan and have been included in the revised version of the plan provided to DPHI for approval.

Figure 7-1: West Pit Water Management Infrastructure

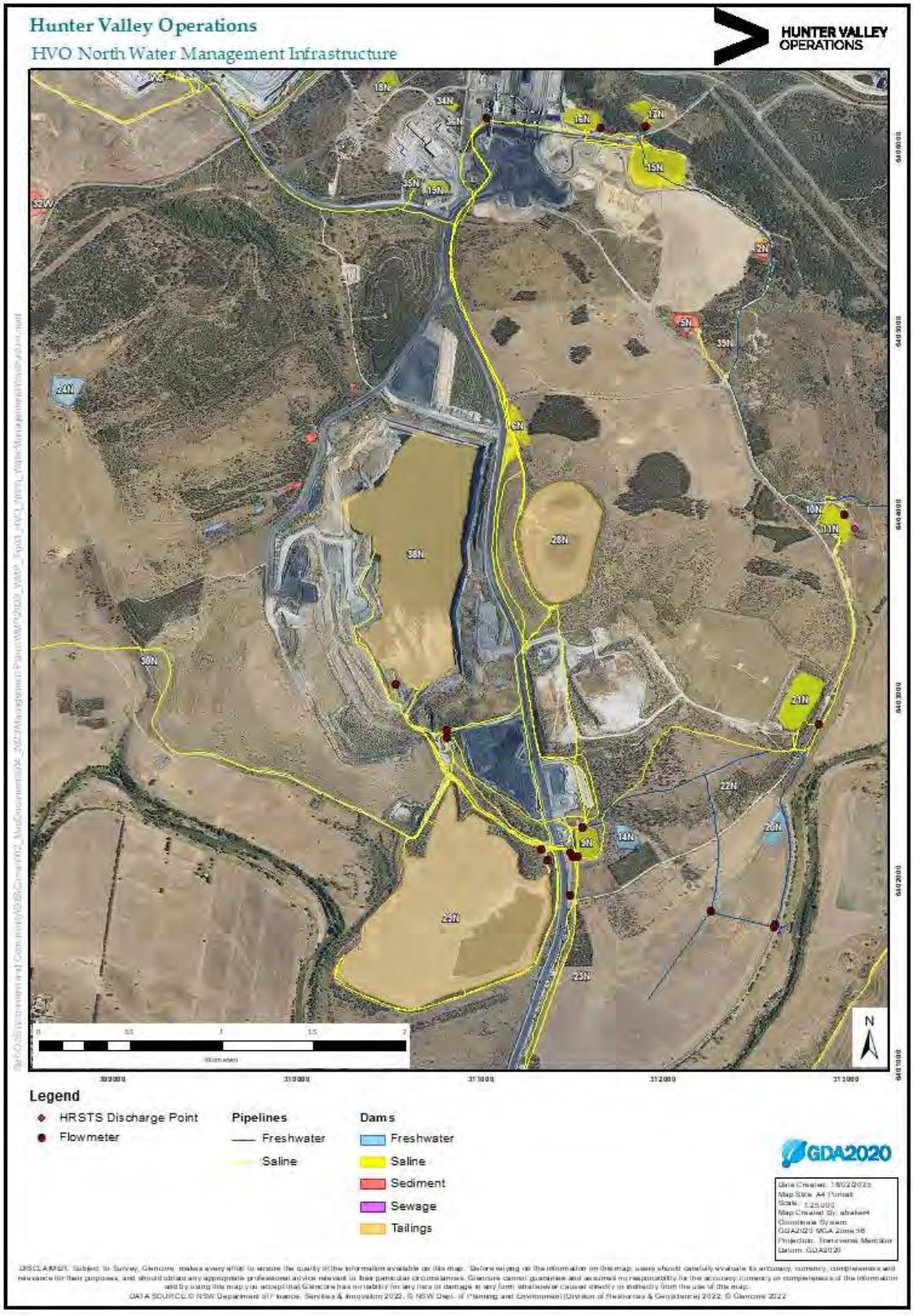


Figure 7-2: North Pit Water Management Infrastructure

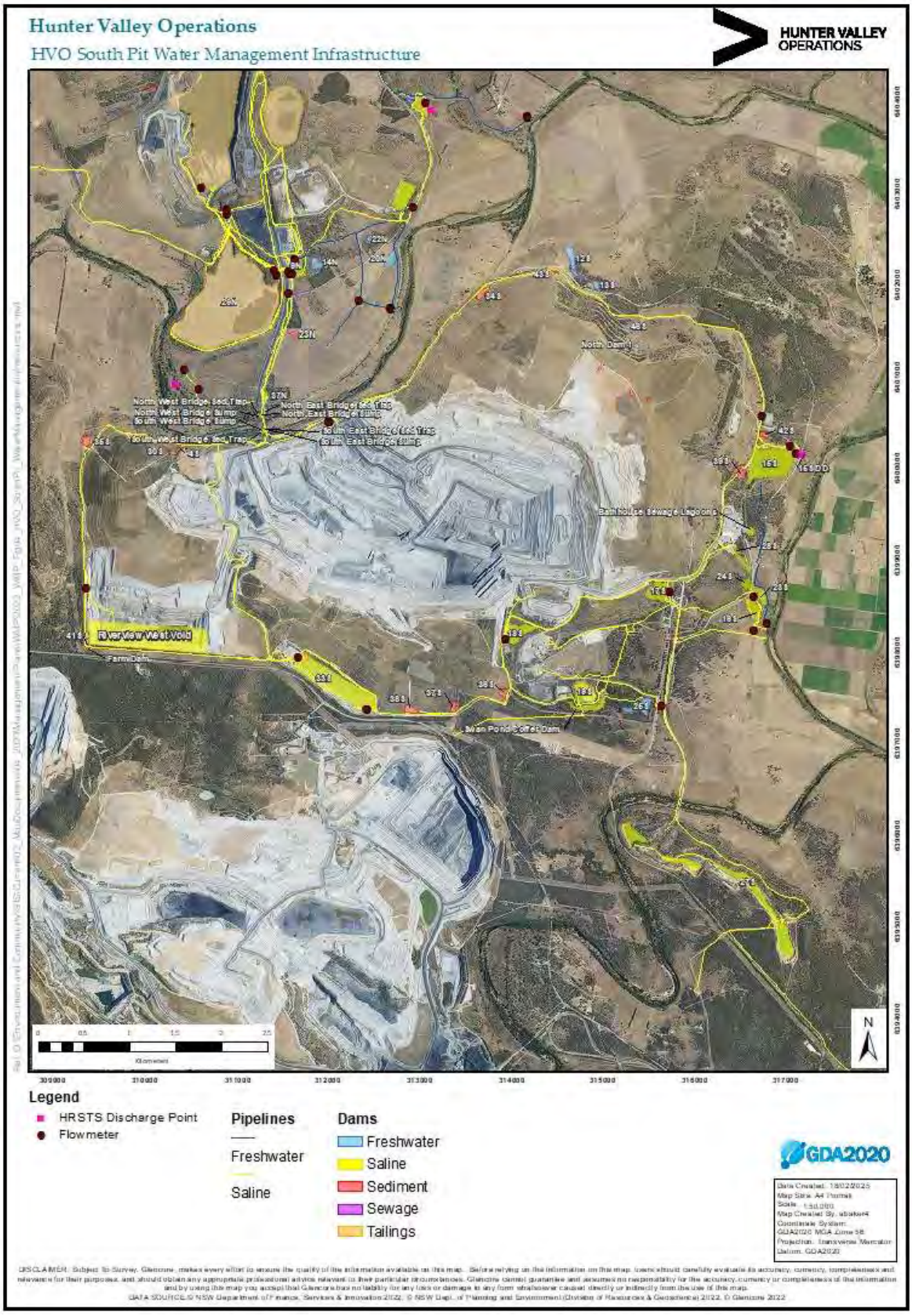


Figure 7-3: South Pit Water Management Infrastructure

7.1 | WATER BALANCE

The 2024 static water balance for HVO is presented in **Table 7-1**.

Table 7-1: 2024 Water Balance

Water Stream	Volume (ML)
Inputs	
Fresh Water (potable)	56 (0.6%)
Fresh Water (Hunter River extraction)	2 (0%)
Groundwater	1,660 (17.8%)
Rainfall Runoff	6,307 (67.6%)
Recycled to CHPP from Tails & Storage (not included in total)	1,266 (13.6%)
Imported (Liddell/Ravensworth (via Cumnock))	4 (0%)
Water from ROM Coal	1,299 (13.9%)
Total Inputs	**9,328**
Outputs	
Dust Suppression	2,101 (29.9%)
Evaporation – Mine Water & Tailings Dams	2,257 (32.1%)
Entrained in Process Waste	682 (9.7%)
Discharged (HRSTS)	80 (1.0%)
Vehicle Wash-down	311 (4.4%)
Sent to Third Party	6 (0.1%)
Miscellaneous Industrial Use	351 (5.0%)
Water in Coarse Reject	396 (5.6%)
Water in Product Coal	853 (12.1%)
Total Outputs	**7,038**
Change in Pit Storage	**2,291 (increase)**

7.1.1 | WATER INPUTS

A total of 645.2 mm of rainfall was recorded at HVO in 2024 producing an estimated 6,307 ML of runoff. Water falling on undisturbed clean water catchments is diverted off site into natural systems where practicable.

Groundwater inflows to the pits are calculated via numerical groundwater modelling methods and were estimated to have contributed 1,660 ML to the site during 2024 (**Table 7-1**). 2 ML of fresh water was extracted from the Hunter River during the reporting period.

7.1.2 | WATER OUTPUTS

The main outputs were water use for dust suppression (2,101 ML), evaporation from dams (2,257 ML), water entrained in process waste (682 ML) and water in product coal (853 ML).

HVO participates in the Hunter River Salinity Trading Scheme (HRSTS) allowing it to discharge from licensed discharge points during declared discharge events, associated with increased flow in the Hunter River. HVO maintains three licensed discharge monitoring locations:

- Dam 11N, located at HVO North, which discharges to Farrell's Creek.
- Lake James, located at HVO South, which discharges to the Hunter River; and
- Parnell's Dam, located at HVO West, which discharges to Parnell's Creek.

80 ML was discharged under the Hunter River Salinity Trading Scheme and Environment Protection Licence 640 during 2024.

7.2 | SURFACE WATER

Surface water monitoring activities continued in 2024 in accordance with the HVO WMP and HVO Surface Water Monitoring Program (SWMP). HVO maintains a network of surface water monitoring sites located on mine site dams, discharge points and surrounding natural watercourses (**Figure 7-4**). Water quality monitoring is undertaken to verify the effectiveness of the water management system onsite, and to identify the emergence of potentially adverse effects on surrounding watercourses. A number of mine water dams are monitored routinely to verify the quality of mine water. This water is used in coal processing, dust suppression, and other day to day activities around the mine.

Surface water monitoring data is reviewed on a quarterly basis. The review involves a comparison of measured pH, Electrical Conductivity (EC) and Total Suspended Solids (TSS) results against internal trigger values which have been derived from the historical data set. The response to measured monitoring levels outside the trigger limits is detailed in the HVO Monthly Environmental Monitoring Reports that can be found on the HVO website.

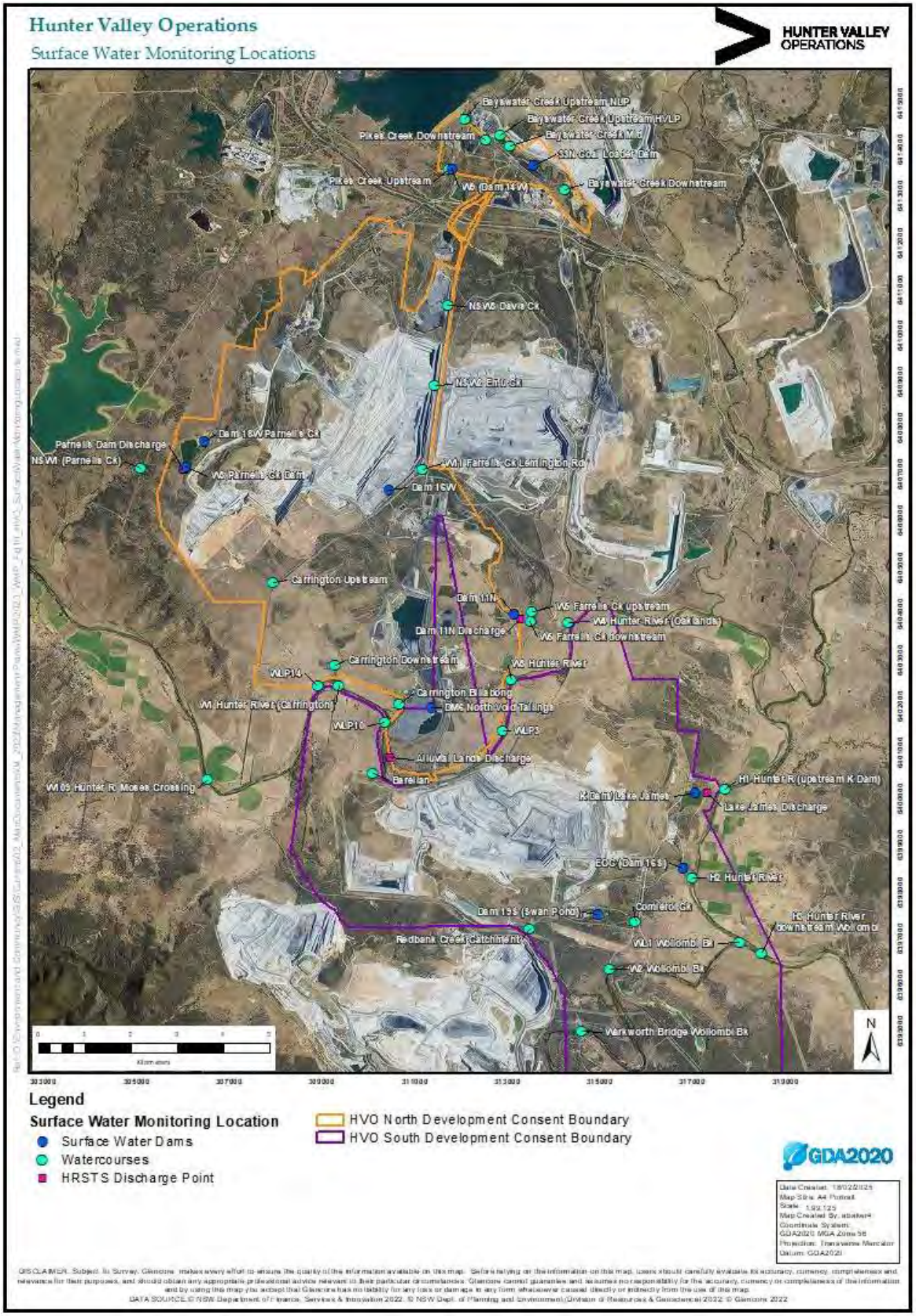


Figure 7-4: Surface Monitoring Locations

7.2.1 | SURFACE WATER MONITORING

Routine surface water monitoring was undertaken in 2024 in accordance with the HVO SWMP. All laboratory analysis of surface water was carried out in accordance with approved methods by a NATA accredited laboratory.

Water quality is evaluated through the parameters of pH, EC and TSS. Pertinent surface water sites are also sampled for comprehensive analysis annually. Long term water quality trends for the Hunter River, Wollombi Brook, other surrounding tributaries, and site dams are also presented in this section. The sampling frequency for ephemeral water sites was modified in 2016, from quarterly to a rain-event trigger system, in an effort to ensure samples taken were more representative of typical water quality for those streams – up to eight sampling events per annum can now be taken under the revised sampling protocol.

All required sampling and analysis was undertaken, except as detailed in **Table 7-2**. Australia and New Zealand Environment and Conservation Council (ANZECC) criteria are shown in the figures for comparative purposes only.

Table 7-2: HVO Water Monitoring Data Recovery for 2024 (By Exception)

Location	Data Recovery (%)	Comments
46S	75%	No access during monitoring event
DM6	75%	No access during monitoring event

7.2.1.1 | HUNTER RIVER

The Hunter River was sampled from eight monitoring locations during 2024. Long term trends for pH, EC and TSS are shown in **Figure 7-5** to **Figure 7-7**.

No exceedances were triggered during 2024

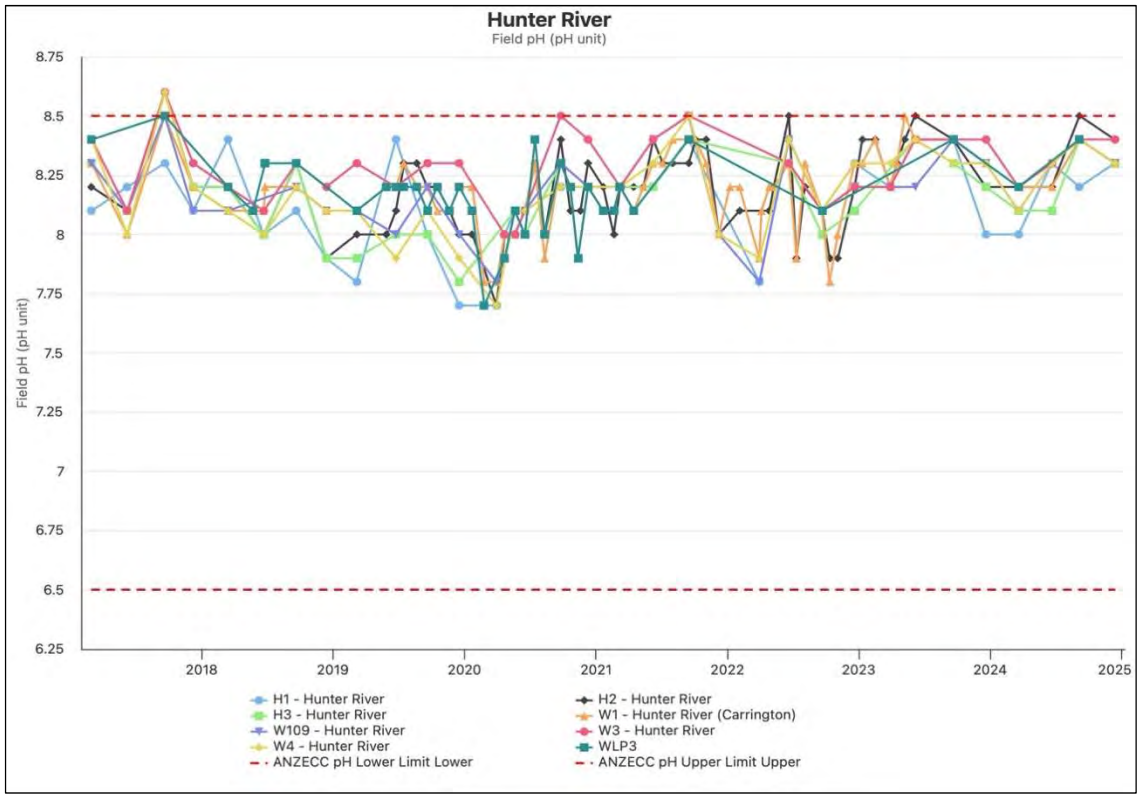


Figure 7-5: Hunter River pH Trends 2017 - 2024

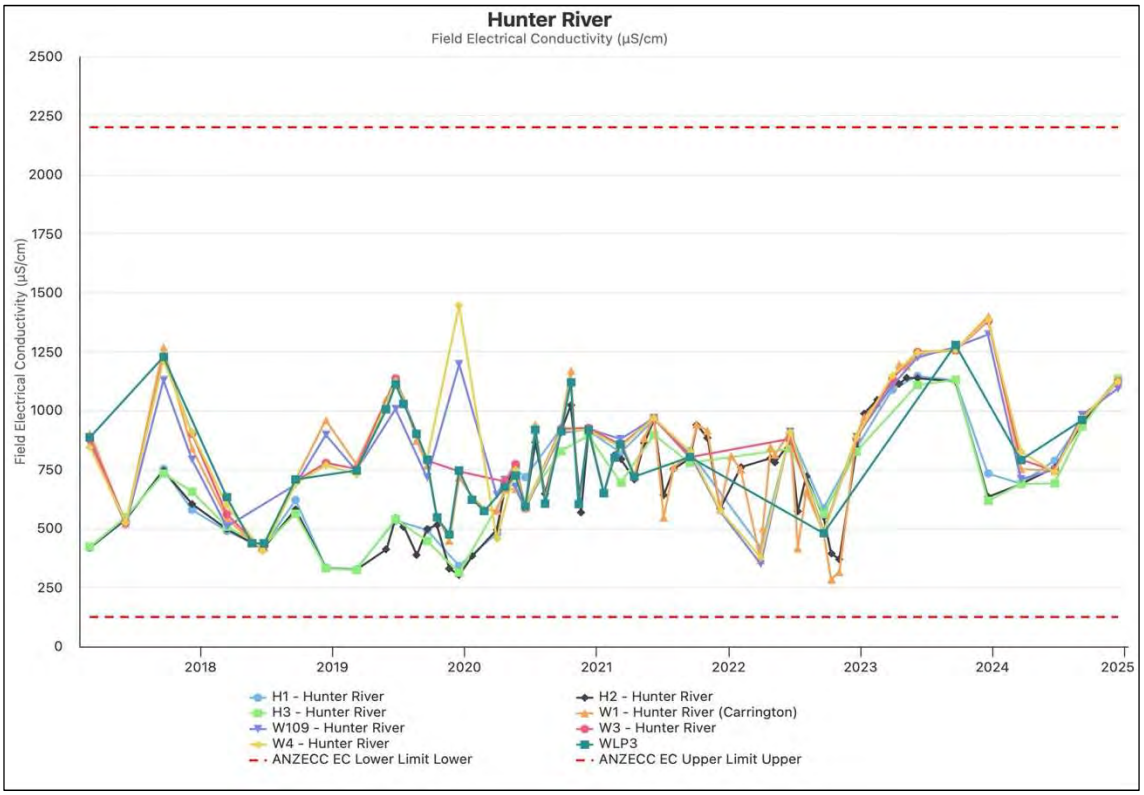


Figure 7-6: Hunter River EC Trends 2017 - 2024

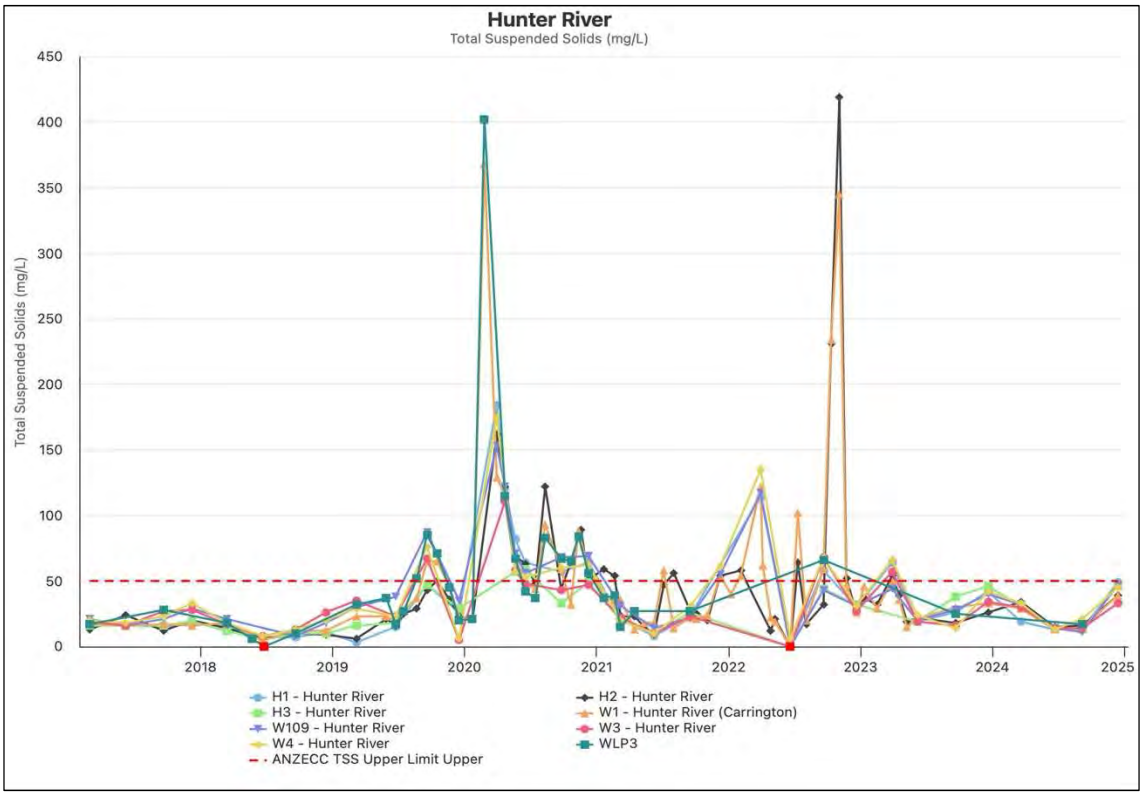


Figure 7-7: Hunter River TSS Trends 2017 - 2024

7.2.1.2 | WOLLOMBI BROOK

Wollombi Brook was sampled from three monitoring locations during 2024. Long term trends for pH, EC and TSS from Wollombi Brook are shown in **Figure 7-8** to **Figure 7-10**. Results were generally consistent with historical trends and acceptable ranges.

Monitoring undertaken 11/03/2024 at Wollombi Brook W2 recorded a TSS level of 160 mg/m^3. The most recent rainfall recorded prior was 15.8mm on 2/03/2024, 9 days prior to sampling. Field observations by the monitoring consultant stated there was no flow and that 'suspended fines' were present. Given the absence of flow, the result indicates either recent disturbance of the pooled water, or dispersive fines that had not settled since the rainfall event 9 days prior. There were no mining related activities in the vicinity of W2 that could have caused the elevated TSS result.

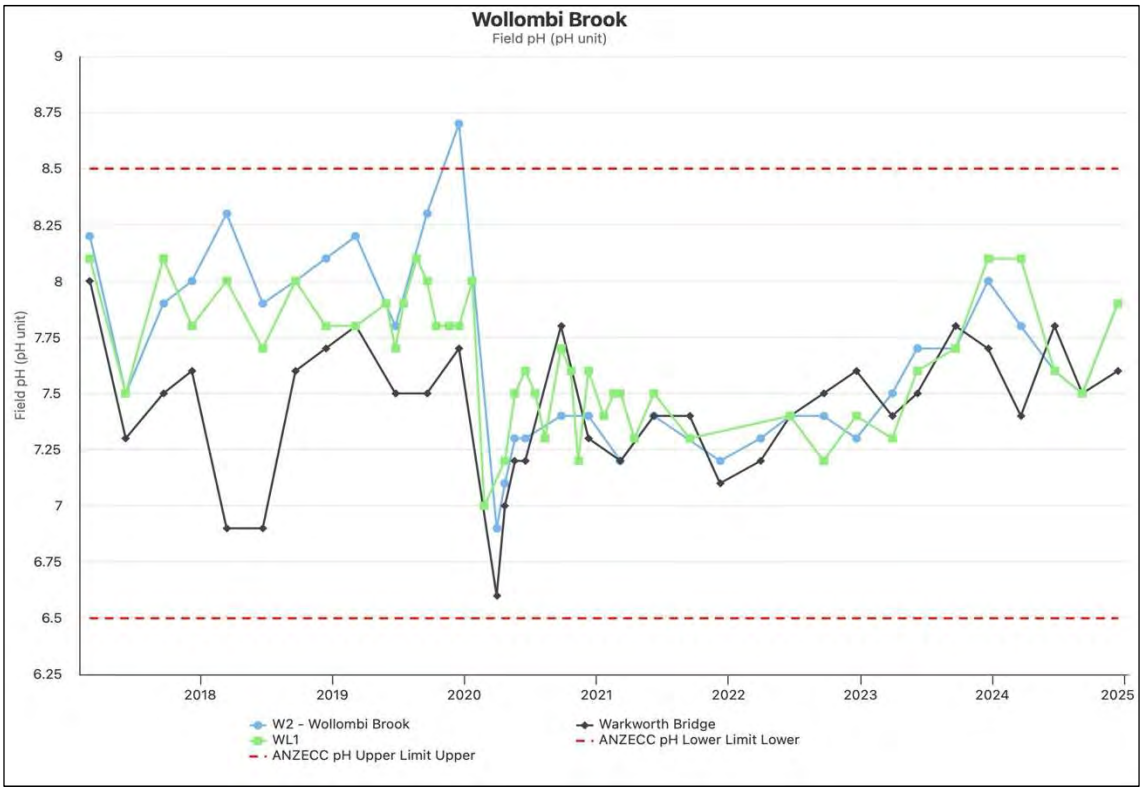


Figure 7-8: Wollombi Brook pH Trends 2017 - 2024

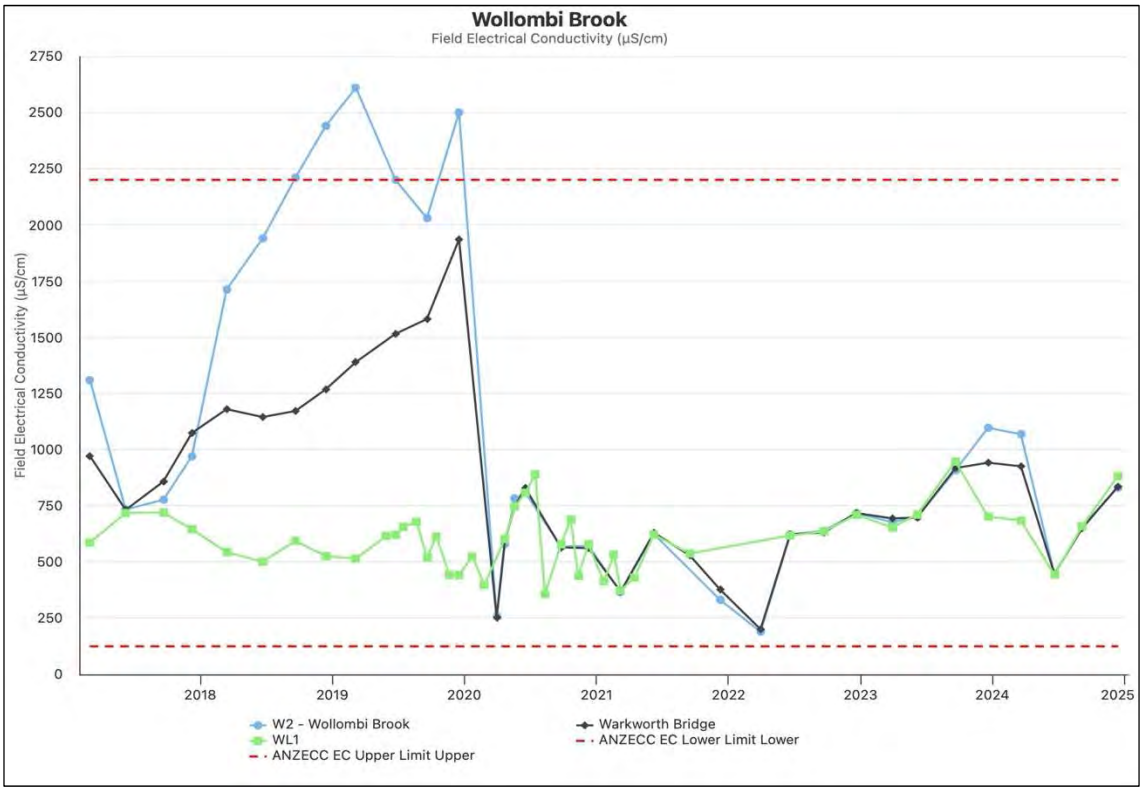


Figure 7-9: Wollombi Brook EC Trends 2017 – 2024

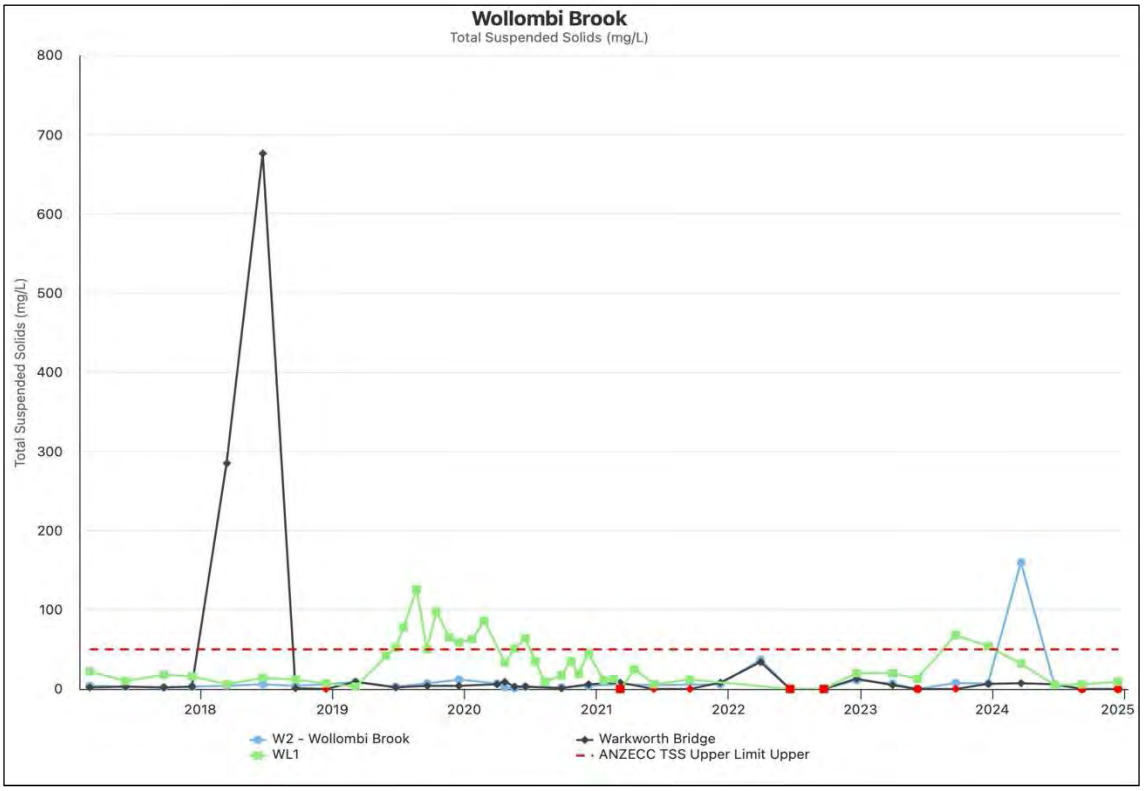


Figure 7-10: Wollombi Brook TSS Trends 2017 - 2024

7.2.1.3 | OTHER SURROUNDING TRIBUTARIES

Rain event-based monitoring of natural tributaries surrounding HVO continued during 2024.

In accordance with the HVO WMP, two rain event sampling rounds were triggered during 2024. These occurred following rainfall greater ≥30mm in a 24-hour period on the days of 05/04/2024 and 01/06/2023. Monitoring during these rain events occurred on the following water courses:

- Comleroi Creek.
- Emu Creek.
- Farrells Creek.
- Pikes Creek (no water running to be sampled).
- Redbank Creek.
- Davis Creek.
- Bayswater Creek; and
- Parnells Creek. (no water running to be sampled).

Long term trends for pH, EC and TSS are shown **Figure 7-11** to **Figure 7-14**. On occasion, some sampling sites recorded results outside of the internal trigger levels however, results for water quality remained generally consistent with historical trends The ephemeral nature of these monitoring locations is the primary reason for the considerable variation in physical water quality.

Trigger tracking results are detailed in **Table 7-3**.

Table 7-3: Other Tributaries Internal Trigger Exceedance Results

Location	Date	Trigger Limit	Action Taken in Response
Bayswater Creek Upstream HPLV	03/06/2024	TSS – 50	First Exceedance of TSS. - Field Observations indicate that the sample was brown in colour and slightly turbid. - Approximately 60mm of rainfall in the seven days prior to exceedance. - Large rain event 2 days prior to exceedance, 39.4mm at Cheshunt and 45.2mm at HVO Corp on 01/06/2024) is considered to have resulted in the elevated reading due to transportation of particulates in rainwater runoff to Bayswater Creek. - No sediment basins overtopped during rain event - The result on 03/6/24 is consistent with the most recent previous elevated TSS result (50 mg/L, 21/12/2023) following significant rain event (30.4mm at Cheshunt and 39mm at HVO Corp between 19/12/2023 and 20/12/2023). Investigation: There were no onsite events identified to indicate that the TSS exceedance was associated with a HVO mining impact. The TSS exceedance appears to be a result of rainfall prior to sampling leading to elevated suspended solids concentrations in broader catchment runoff.
Bayswater Creek Midstream HPLV	03/06/2024	TSS – 50	First Exceedance of TSS. - Field Observations indicate that the sample was brown in colour and slightly turbid. - Approximately 60mm of rainfall in the seven days prior to exceedance. - Large rain event 2 days prior to exceedance, 39.4mm at Cheshunt and 45.2mm at HVO Corp on 01/06/2024) is considered to have resulted in the elevated reading due to transportation of particulates in rainwater runoff to Bayswater Creek. - No sediment basins overtopped during rain event - The result on 03/6/24 is consistent with the most recent previous elevated TSS result (50 mg/L, 21/12/2023) following significant rain event (30.4mm at Cheshunt and 39mm at HVO Corp between 19/12/2023 and 20/12/2023). Investigation: There were no onsite events identified to indicate that the TSS exceedance was associated with a HVO mining impact. The TSS exceedance appears to be a result of rainfall prior to sampling leading to elevated suspended solids concentrations in broader catchment runoff.

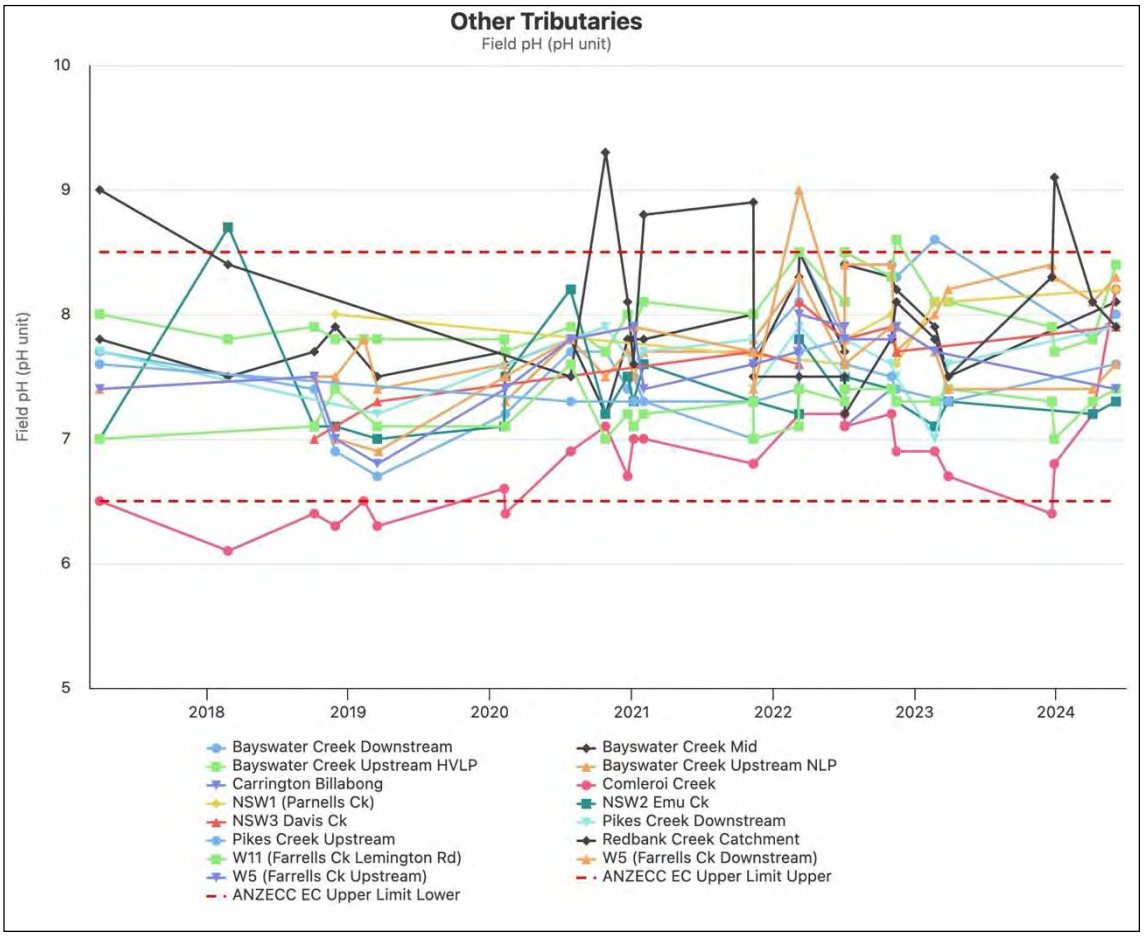


Figure 7-11: Other Tributaries pH Trends 2017 - 2024

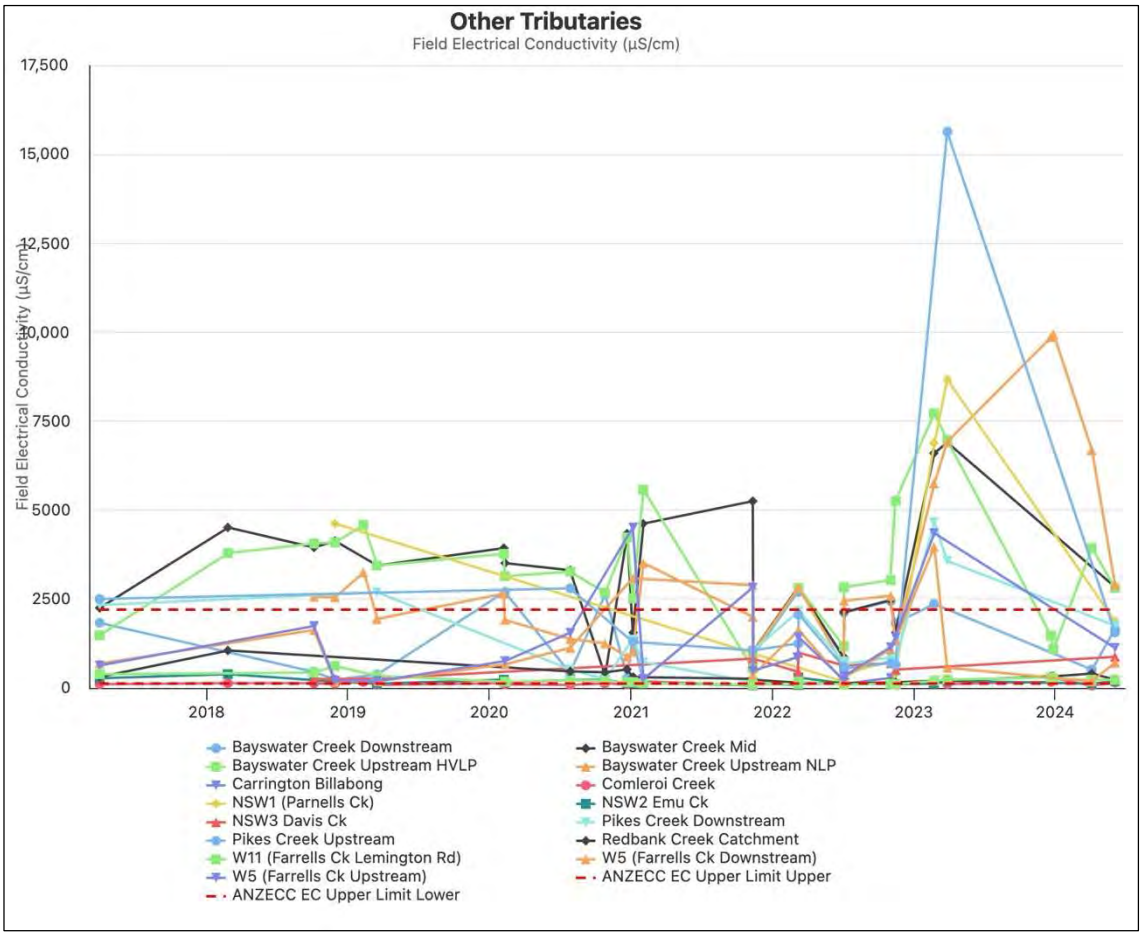


Figure 7-12: Other Tributaries EC Trends 2017 - 2024

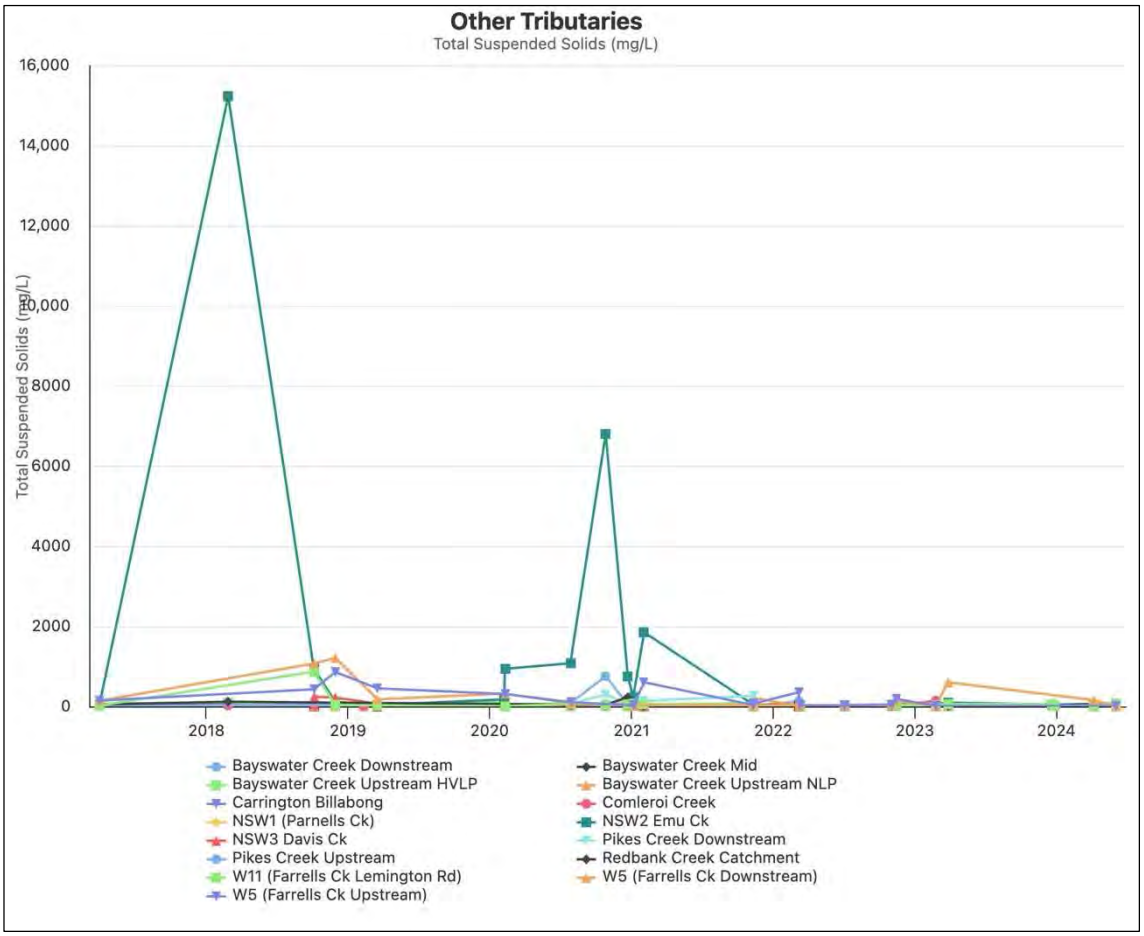


Figure 7-13: Other Tributaries TSS Trends 2017 – 2024

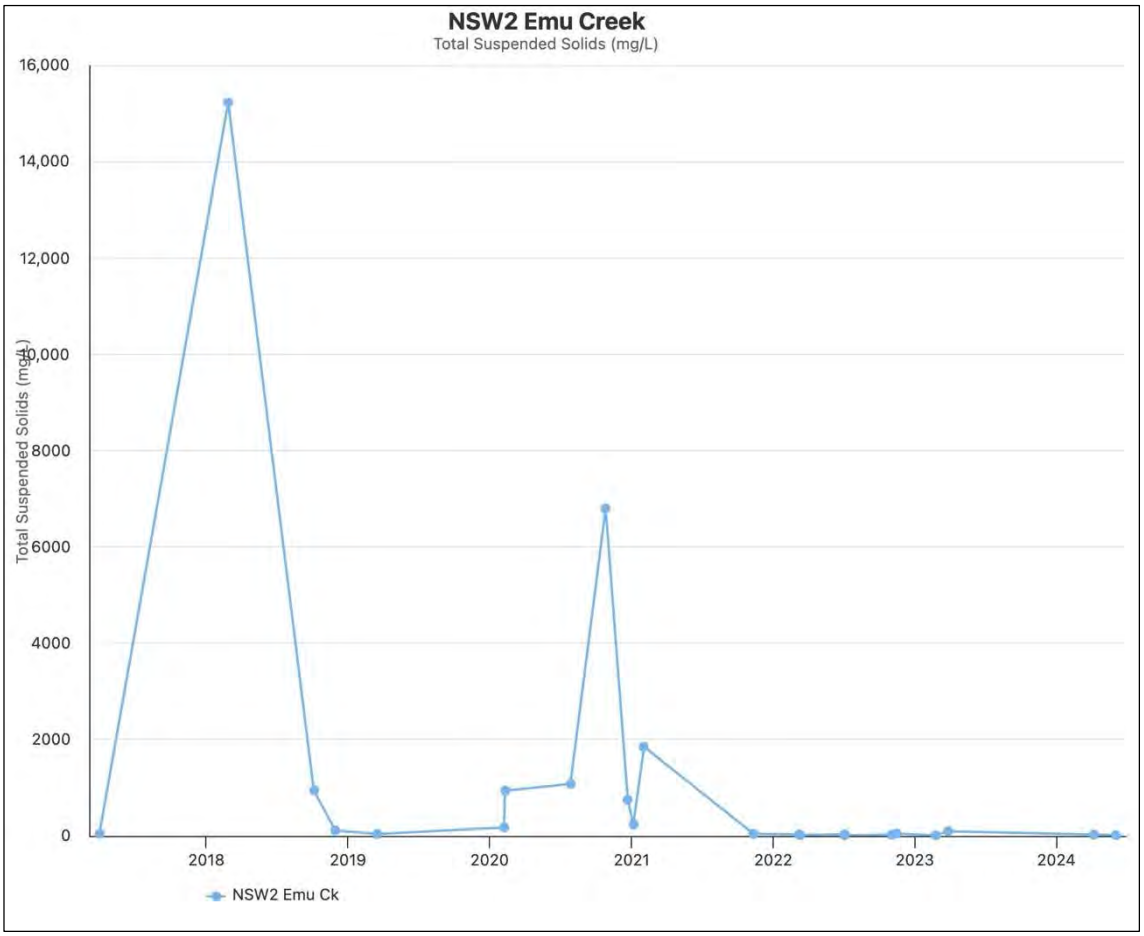


Figure 7-14: NSW2 Emu Creek TSS Trends 2017-2024

7.2.1.4 | HVO SITE DAMS

During 2024 monitoring was completed at across 10 onsite dams. Long term trends for pH, EC and TSS are shown in **Figure 7-15** to **Figure 7-17**. HVO's onsite dams do not have impact assessment criteria. Results for water quality remained generally consistent with historical water quality trends.

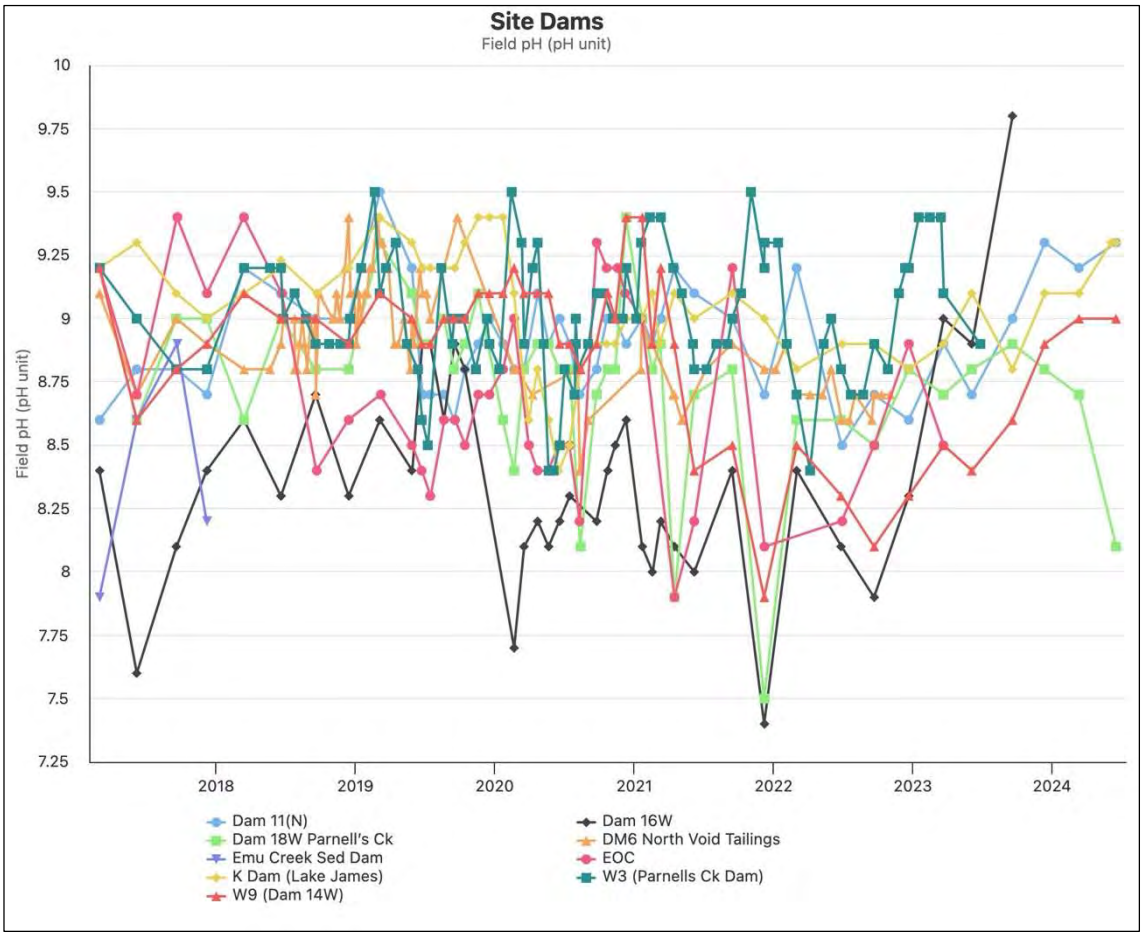


Figure 7-15: HVO Site Dams pH Trends 2017 - 2024

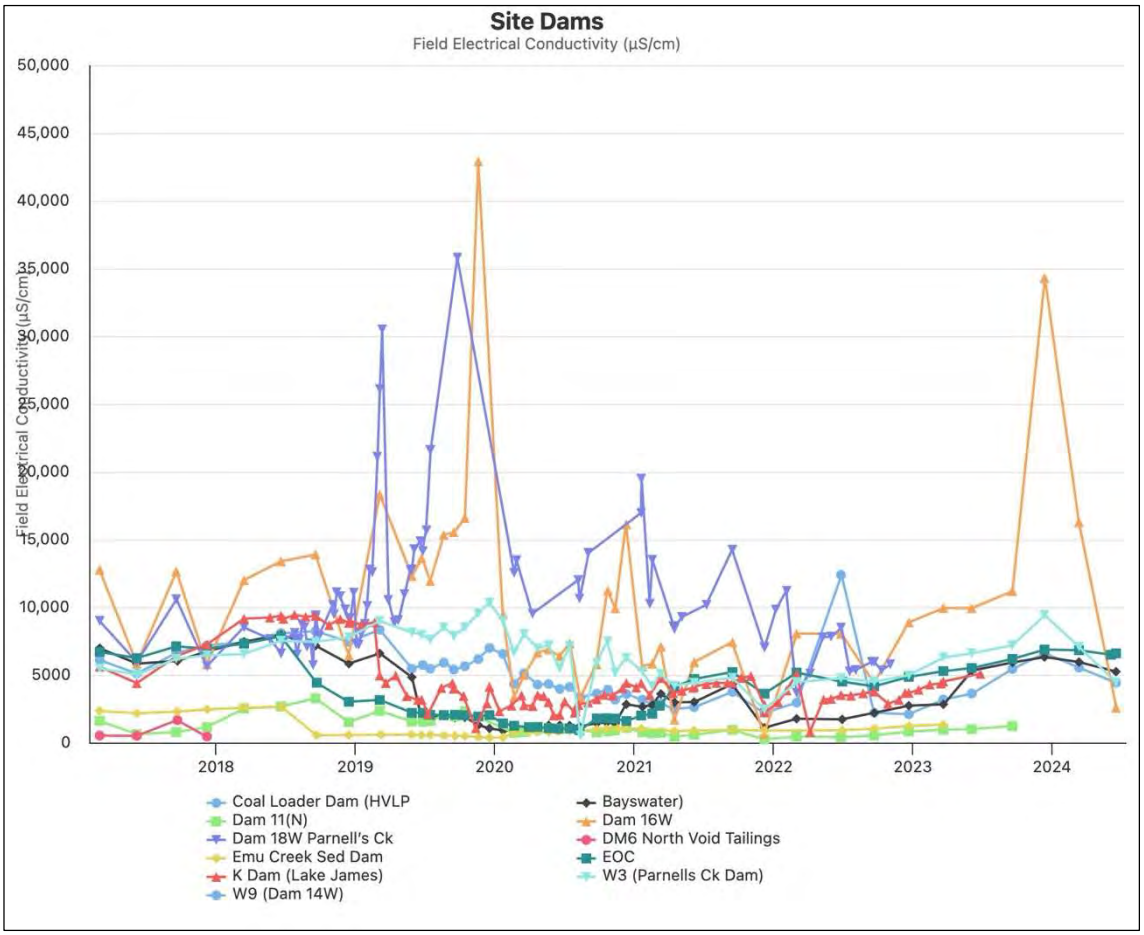


Figure 7-16: HVO Site Dams EC Trends 2017 – 2024

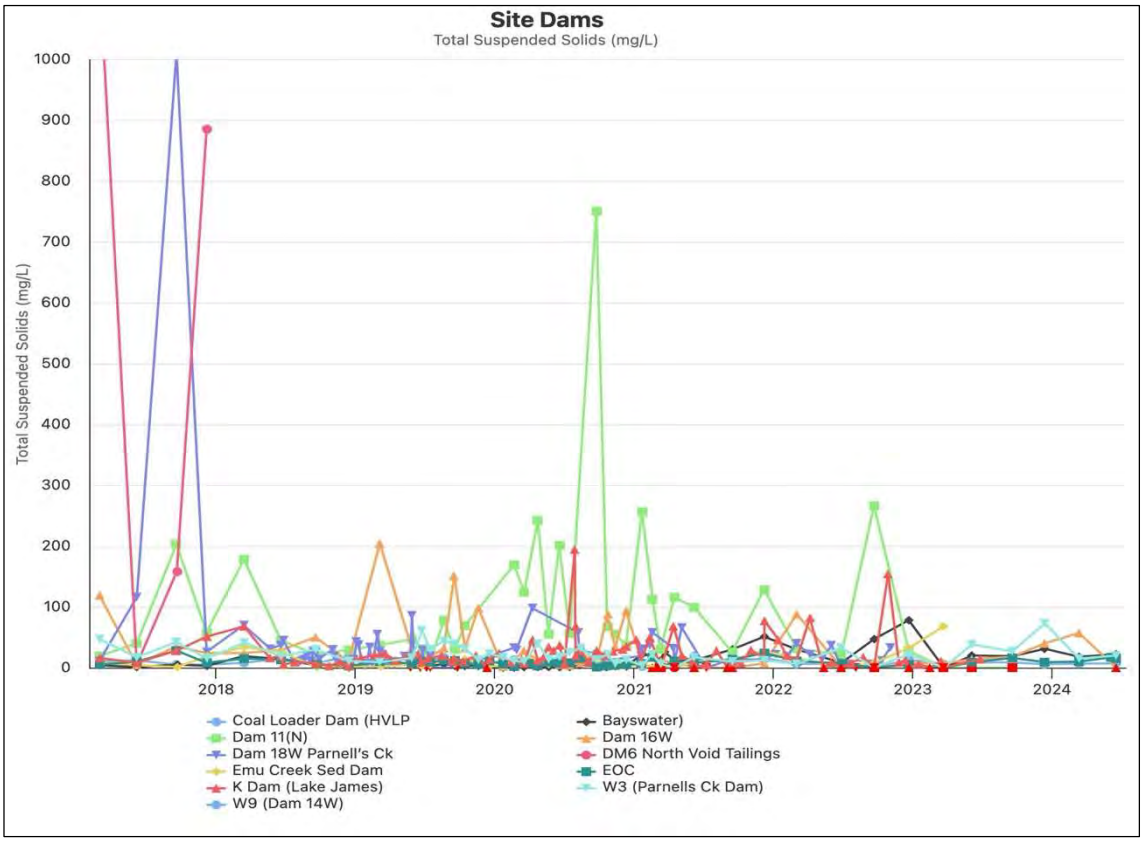


Figure 7-17: HVO Site Dams TSS Trends 2017 - 2024

7.3 | COMPARISON WITH EIS PREDICTIONS

7.3.1 | SOUTH PIT EIS PREDICTIONS

The South Pit EIS estimated an 'instantaneous' water quality for Electrical Conductivity of 5,700 µS/cm as an upper limit. Instantaneous water quality is a simple estimate obtained by dividing the total salt available by the maximum amount of possible void water. Electrical Conductivity measurements at Lake James averaged 6,664 µS/cm during 2024, are slightly elevated compared to predicted EC levels.

The South Pit EIS estimated average runoff water quality from undisturbed catchments to be 400 mg/L for TSS and 615 µS/cm for EC. Comleroi Creek, south of Cheshunt Pit, was sampled twice during rainfall events in 2024 resulting in average TSS of 14 mg/L and average EC of 218 µS/cm, demonstrating that runoff water from undisturbed catchments in the HVO South area is of better quality than that which was predicted in the EIS.

7.3.2 | CARRINGTON PIT EIS PREDICTIONS

The long term mine water quality for Carrington is discussed in the Carrington Mine Environmental Impact Statement (ERM 1999). The EIS estimated an “instantaneous” water quality for Electrical Conductivity of 7,050 µS/cm.

Dewatering from Carrington is a mixture of surface runoff from overburden emplacements, coal mining areas and seepage from the coal seams and alluvium. Water is directed to Dam 9N and into Dam 11N. The average EC and TSS in Dam 11N during 2024 was 5,648 µS/cm and 17.3 mg/L respectively and is considered broadly representative of mine water quality for Carrington.

The Carrington EIS states that runoff from undisturbed catchments within the Carrington Pit will be directed around the mine via contour banks or surface drains to discharge where possible into natural creeks. The salinity of the runoff water was predicted to be approximately 615 µS/cm. Runoff from rehabilitated lands was initially predicted to have higher TSS, with levels approaching pre-mining conditions after several years. Carrington Billabong (where water quality would be measured for this comparison) did not have any EC results during the 2024 rain event monitoring rounds, as the area was recorded as dry on all occasions.

7.3.3 | WEST PIT EIS PREDICTIONS

The West Pit EIS included the data in **Table 7-4** as representative of water quality in the local catchment area. During the review period Emu Creek (NSW2) recorded an average pH of 7.2 and an average EC of 314 µS/cm, both lower than the predicted results of **Table 42**. The pH and EC at Farrells Creek (combined upstream and downstream monitoring sites) averaged 7.5 and 675 µS/cm respectively during the review period, were also lower than EIS predictions. The average pH and EC for Davis Creek (NSW3) were 7.9 and 874 µS/cm respectively during the review period, equal to and slightly lower than EIS predictions. Parnell’s Dam measured an average EC of 5,912 µS/cm in 2024, within the prediction.

Table 7-4: Representative Water Quality for West Pit

Watercourse	pH (pH Units)	EC (µS/cm)
Davis Creek	7.7 to 8.4	767 to +8,000
Emu Creek	7.5 to 8.8	365 to +1,000
Farrells Creek	7.0 to 9.2	195 to +12,000
Mine Water (Parnell's Dam)	-	2,400 to 6,300

7.4 | PERFORMANCE RELATING TO HRSTS DISCHARGES

HVO participates in the Hunter River Salinity Trading Scheme (HRSTS), allowing it to discharge to the Hunter River via three licensed discharge points, including Dam 11N, Dam 15S (Lake James) and Dam 9W (Parnells Dam). Discharges can only take place subject to the scheme's regulations.

As required by the EPL, HVO submitted a discharge report for the 2023/24 financial year. A total of 79.7ML of water discharged during 2024 in accordance with the HRSTS.

7.5 | GROUNDWATER

7.5.1 | GROUNDWATER MANAGEMENT

Groundwater monitoring activities were undertaken in 2024 in accordance with the HVO WMP and Groundwater Monitoring Programme. The monitoring results are used to establish and monitor trends in physical and geochemical parameters of surrounding groundwater potentially influenced by mining.

The groundwater monitoring programme at HVO measures the quality of groundwater against background data, EIS predictions and historical trends. Ground water quality is evaluated through the parameters of pH, EC, and Standing Water Level (SWL) (measured as elevation in metres with respect to the Australian Height Datum, mAHD). On a periodic basis (nominally once per annum) a comprehensive suite of analytes are measured, including major anions, cations and metals. Prior to sampling for comprehensive analysis, bore purging is undertaken to ensure a representative sample is collected.

Groundwater monitoring data is reviewed regularly for trigger exceedances and analysed in detail on a quarterly basis. The review involves a comparison of measured results against internal trigger values which have been derived from the historical data set. Trigger limits are calculated as the 95th percentile maximum value (EC and pH) and the 5th percentile minimum value (pH only) from data collected since 2011. Trigger levels have been set on the basis of geographical proximity and target stratigraphy. Bores that record as dry and bores of unknown seam have not been included in calculation of the trigger limits. The response to measured data outside the trigger limits is detailed in the HVO Water Management Plan. Where investigations and subsequent actions have been undertaken following review of monitoring data, these are detailed in this section. Monitoring locations are shown in **Figure 7-18**.

The Annual Groundwater Impacts Review conducted during 2024 is provided in **Appendix B**.

7.5.2 | GROUNDWATER PERFORMANCE

Sampling of groundwater was carried out in accordance with the HVO Groundwater Monitoring Programme. Where laboratory analysis was undertaken, this was performed by a NATA accredited laboratory. Sites with a data capture rate of less than 100 per cent are outlined in **Table 7-5**. Data recovery presented in this table has been calculated based on the number of times the sampling location was able to be accessed and at least one sampling parameter was able to be collected. Detailed data capture by sampling parameters is provided in **Appendix B**.

Table 7-5: HVO Groundwater Monitoring Data Recovery for 2024 (By Exception)

Location	Data Recovery	Comments
BZ4A(2)	50%	Insufficient water to sample
C122(BFS)	50%	Unable to sample due to wildlife
CGW45	0%	Blocked, unable to sample
GW-101	50%	Dry, unable to sample
GW-107	50%	Dry, unable to sample
GW-108	50%	Blocked, unable to sample
NPz3	0%	Bore collapsed
NPz5	0%	Mined through
4051C	50%	Blocked, unable to sample
4116P	0%	Blocked, during Q2 sampling round, now remediated
B425(WDH)	50%	Insufficient water to sample
C122(BFS)	50%	Insufficient water to sample
CGW45	0%	Blocked, unable to sample
D510(AFS)	0%	Blocked, unable to sample
D612(AFS)	50%	Insufficient water to sample
GW-101	50%	Dry, insufficient water to sample
GW-107	50%	Dry, insufficient water to sample
GW-108	0%	Blocked, unable to sample
NPz3	0%	Bore collapsed
NPz5	0%	Mined through
4051C	50%	Blocked, unable to sample
C122(BFS)	50%	Insufficient water to sample
CGW45	0%	Blocked, unable to sample
CGW45	0%	No access
GW-101	50%	Dry, insufficient water to sample
GW-107	50%	Dry, insufficient water to sample
GW-108	0%	Blocked, unable to sample

Location	Data Recovery	Comments
NPz3	0%	Bore collapsed
NPz5	0%	Mined through
BUNC45A	50%	HVO requested that a sample not to be collected in Q4
BZ4A(2)	50%	Insufficient water to sample in Q2 and Q4
BZ8-2	75%	No access in Q4
CGW45	0%	Blocked
D612 (AFS)	50%	Dry Q1 to Q4
GW-101	50%	Dry Q1 to Q4
GW-107	50%	Dry Q1 to Q4
GW-108	50%	Blocked, unable to sample Q1 to Q4
NPz3	0%	Bore Collapsed
NPz5	0%	Mined through, no longer exists
GW-103	0%	All sensors failed in 2020
GW-105 (V3)	0%	Sensor failed in 2020
GW-110	0%	Calibration data unavailable

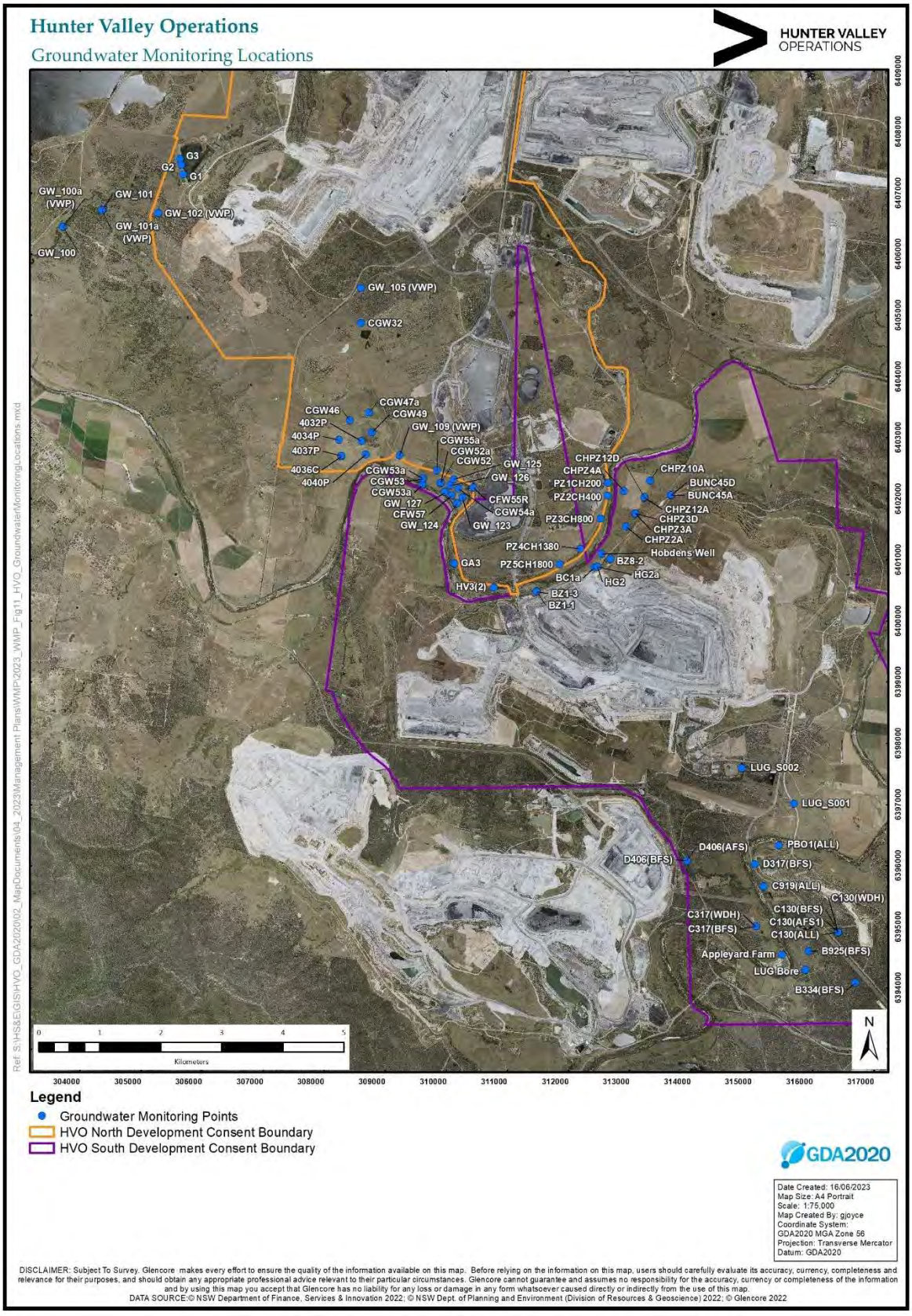


Figure 7-18: Groundwater Monitoring Network at HVO

7.5.3 | GROUNDWATER MONITORING SUMMARY

The following section presents groundwater monitoring data in relation to the geographic locations and target stratigraphy for groundwater monitoring bores.

Each location is discussed, and a summary of monitoring data presented. Where monitoring results required further investigation, these results are summarised. A trigger is considered to be exceeded when levels are outside of the internal statistical trigger limit for three (3) consecutive monitoring events. A detailed Annual Groundwater Review is provided in **Appendix B**.

7.5.4 | CARRINGTON BROONIE

The EC, pH and SWL trends for 2017 to 2024 for Carrington Broonie Seam groundwater bores are shown in **Figure 7-19** to **Figure 7-21** respectively. Water quality results were generally consistent with historical ranges with some minor variation noted with pH and SWL results. These levels were considered to be consistent with historical concentrations, with no adverse impacts identified.

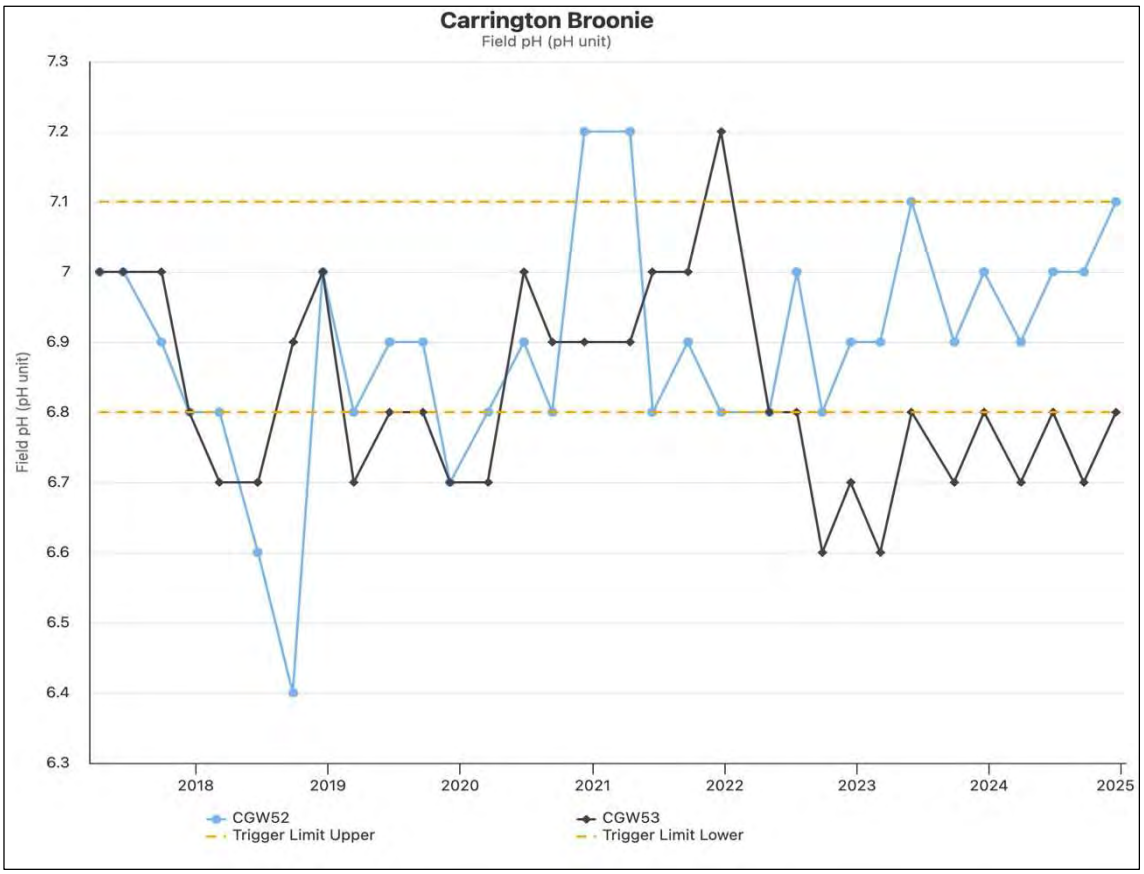


Figure 7-19: Carrington Broonie Groundwater pH Trends 2017 - 2024

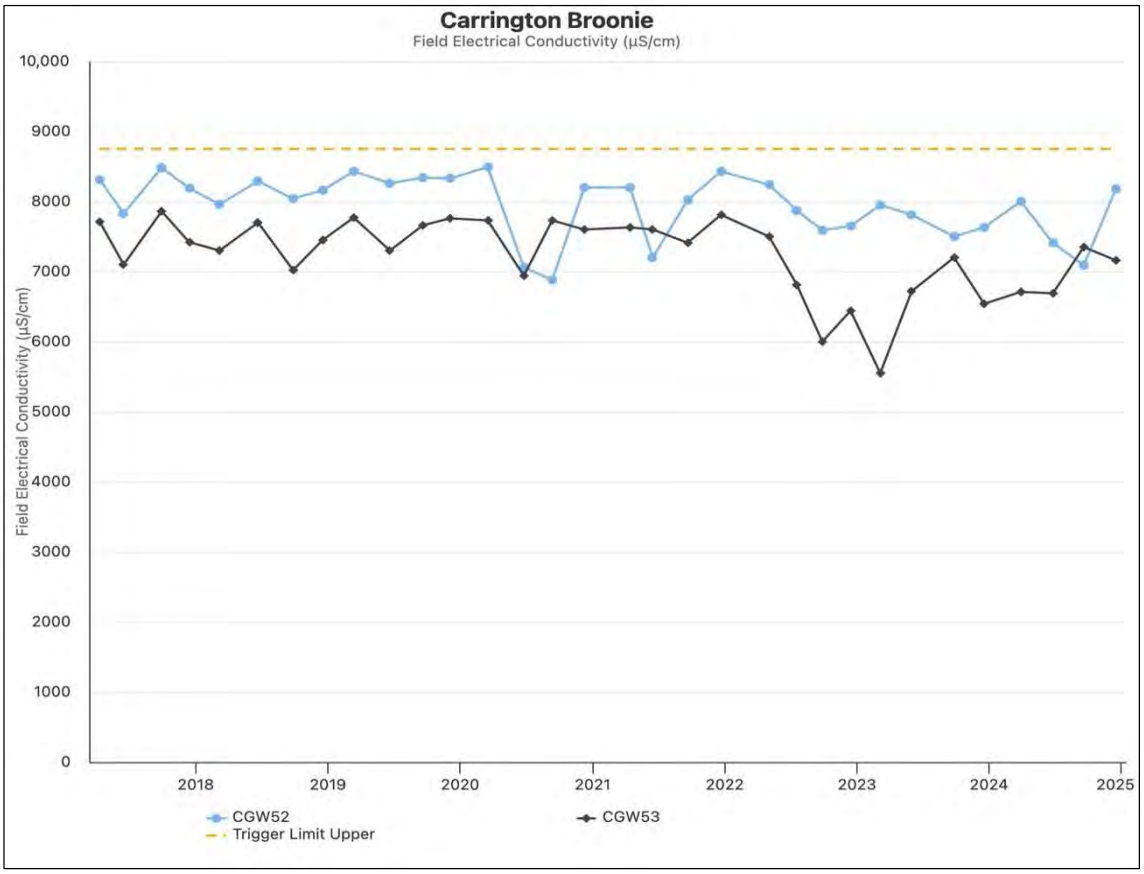


Figure 7-20: Carrington Broonie Groundwater EC Trends 2017 - 2024

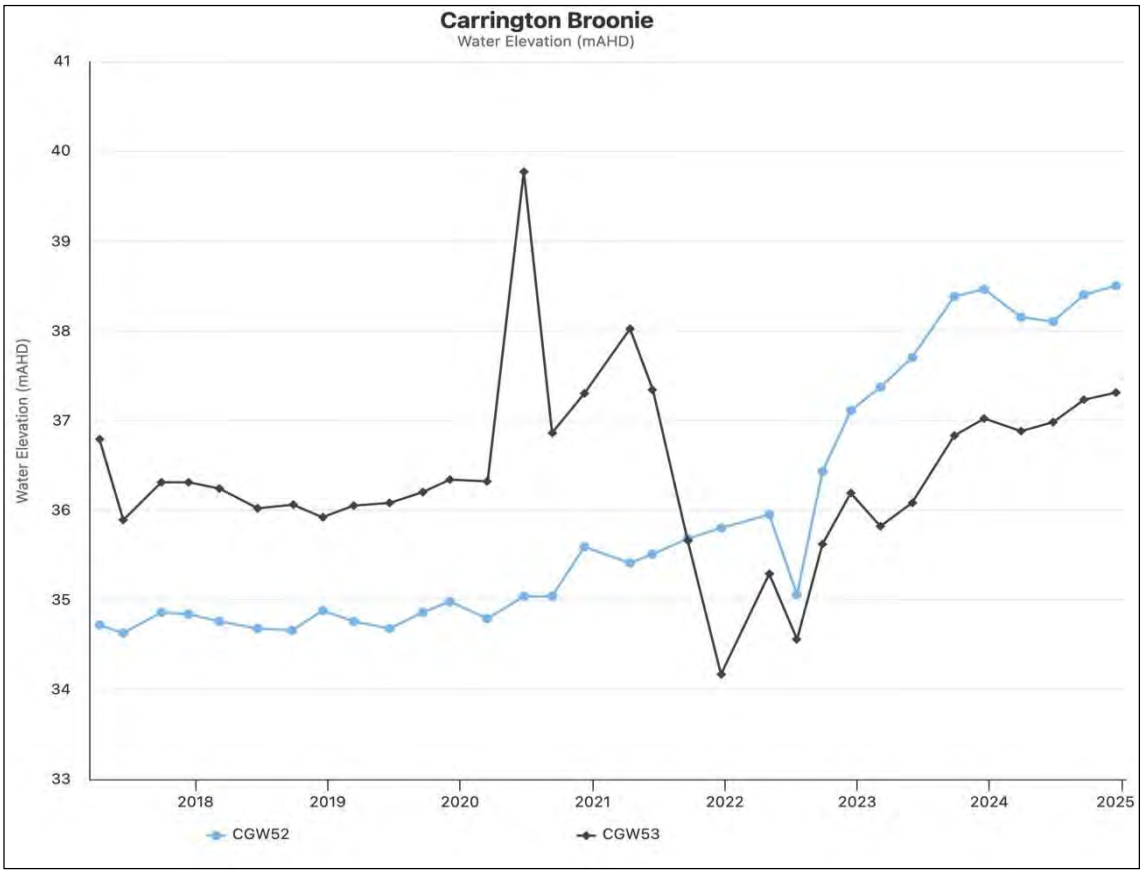


Figure 7-21: Carrington Broonie Groundwater SWL Trends 2017 - 2024

7.5.5 | CARRINGTON ALLUVIUM

The EC, pH and SWL trends for 2017 to 2024 for Carrington Alluvium groundwater bores are shown in **Figure 7-22** to **Figure 7-24**. Water quality results were generally consistent with historical trends.

New triggers have been developed following an expert review of the groundwater network and better represent current conditions and monitoring in the area. These have been included in the revised Water Management Plan pending approval. Monitoring results are assessed against these new triggers as part of the North Void Tailings Storage Facility (NV TSF) Pollution Reduction Programme monitoring and reporting requirements via the Environmental Protection Licence. The current EC trigger is considered not to be representative of historical (pre-mining) conditions or adequate to assess improving water quality following seepage from the NV TSF.

HVO continued to mitigate potential impacts of seepage from the NV TSF. This included no deposition of tailings to the TSF and decanting of surface water to allow the tailings to dry and consolidate. Monitoring of the area continues at an increased frequency including data collection from continuous groundwater loggers measuring water level and quality. EC and pH have stabilised and standing water level has declined; this is an indication that current controls are being effective.

As part of a Pollution Reduction Programme, works in 2024 included ongoing assessment of effectiveness for a low permeability barrier wall to be constructed between the TSF and the alluvium.

Trigger exceedances in the Carrington Alluvium are detailed in **Table 6.2** of **Appendix B**.

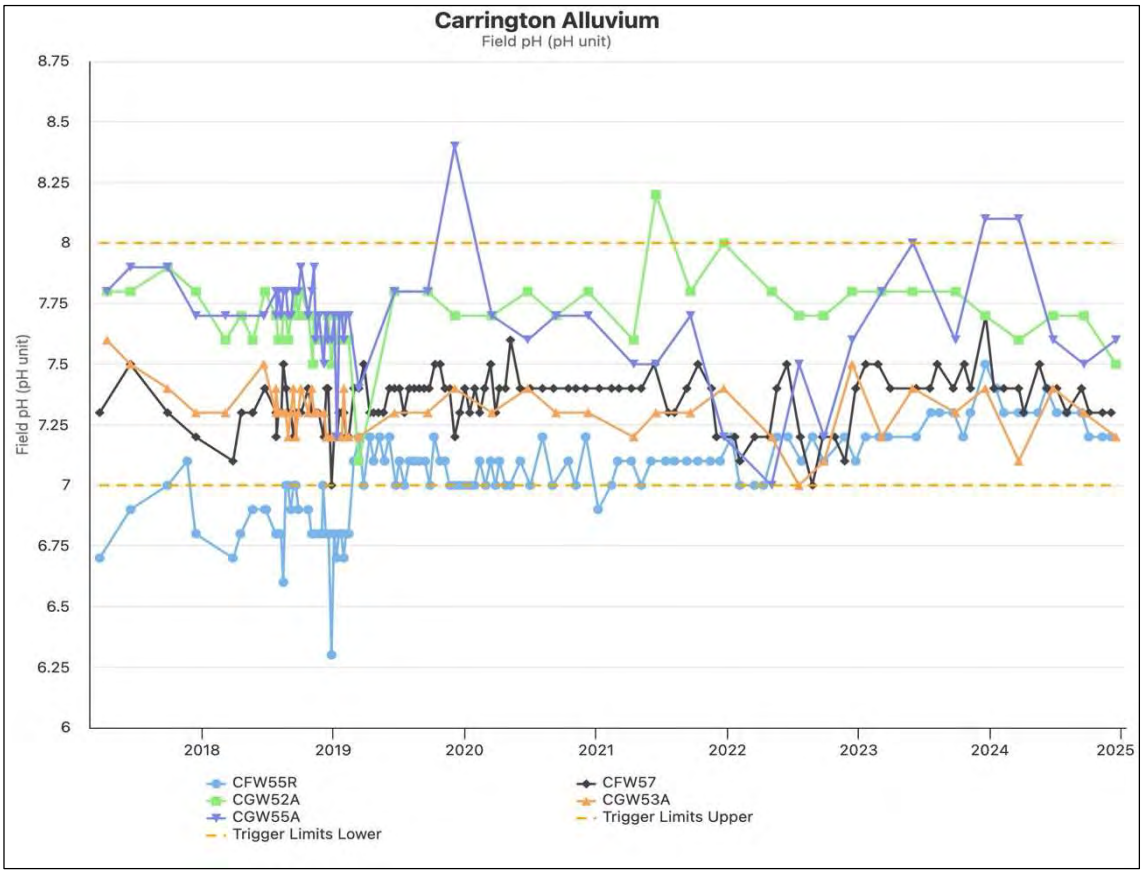


Figure 7-22: Carrington Alluvium Groundwater pH Trends 2017 - 2024

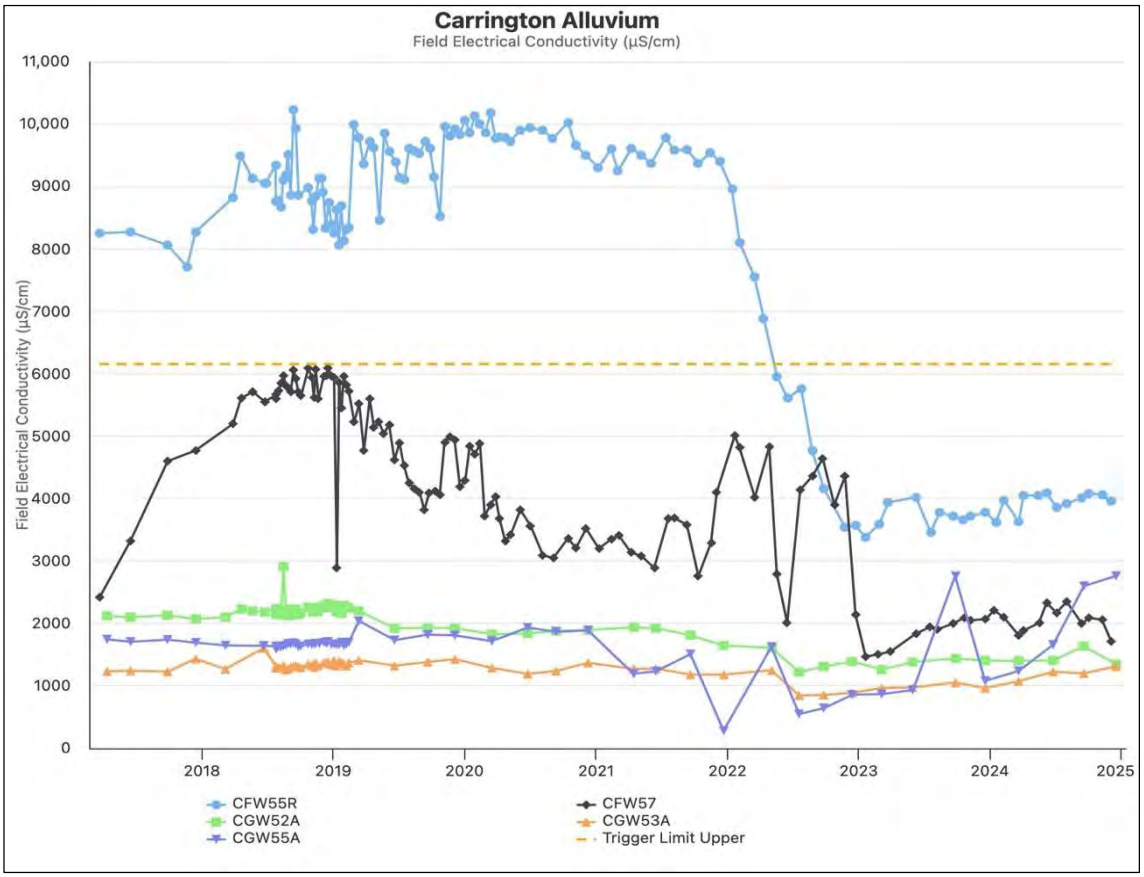


Figure 7-23: Carrington Alluvium Groundwater EC Trends 2017-2024

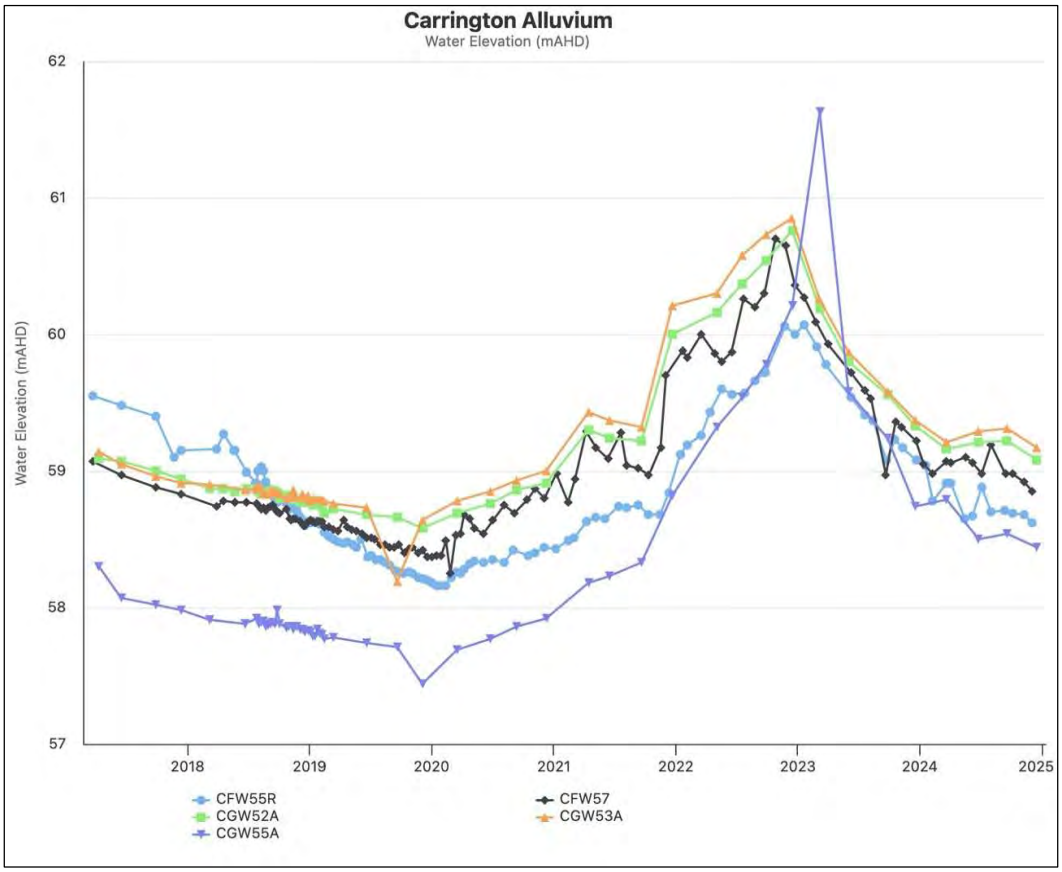


Figure 7-24: Carrington Alluvium Groundwater SWL Trends 2017 - 2024

7.5.6 | CARRINGTON INTERBURDEN

The EC, pH and SWL trends for 2017 to 2024 for groundwater bores in the Carrington Interburden are shown in **Figure 7-25** to **Figure 7-27** respectively. Water quality results were generally consistent with historical trends aside from CGW51a pH. There have been 11 consecutive readings above the pH trigger level at CGW51a since September 2022 – refer to **Table 6.2** of **Appendix B**.

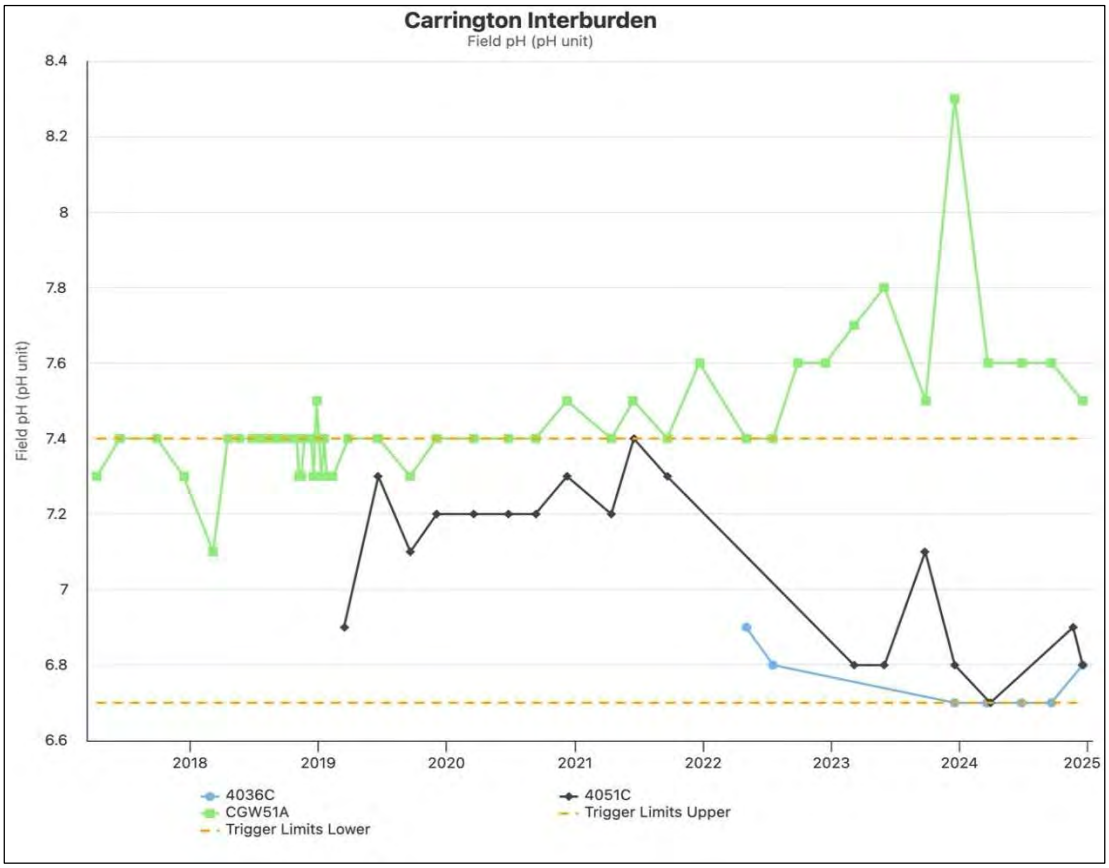


Figure 7-25: Carrington Interburden Groundwater pH Trends 2017 – 2024

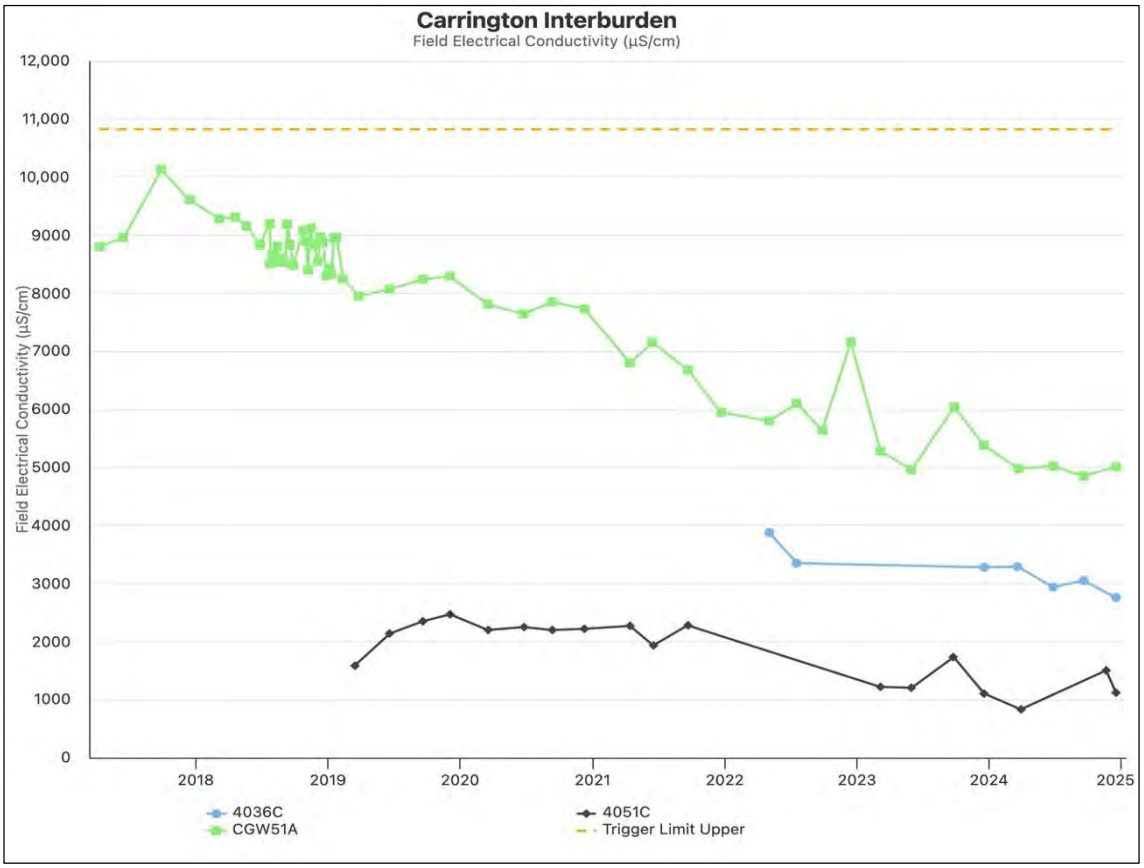


Figure 7-26: Carrington Interburden Groundwater EC Trends 2017 - 2024

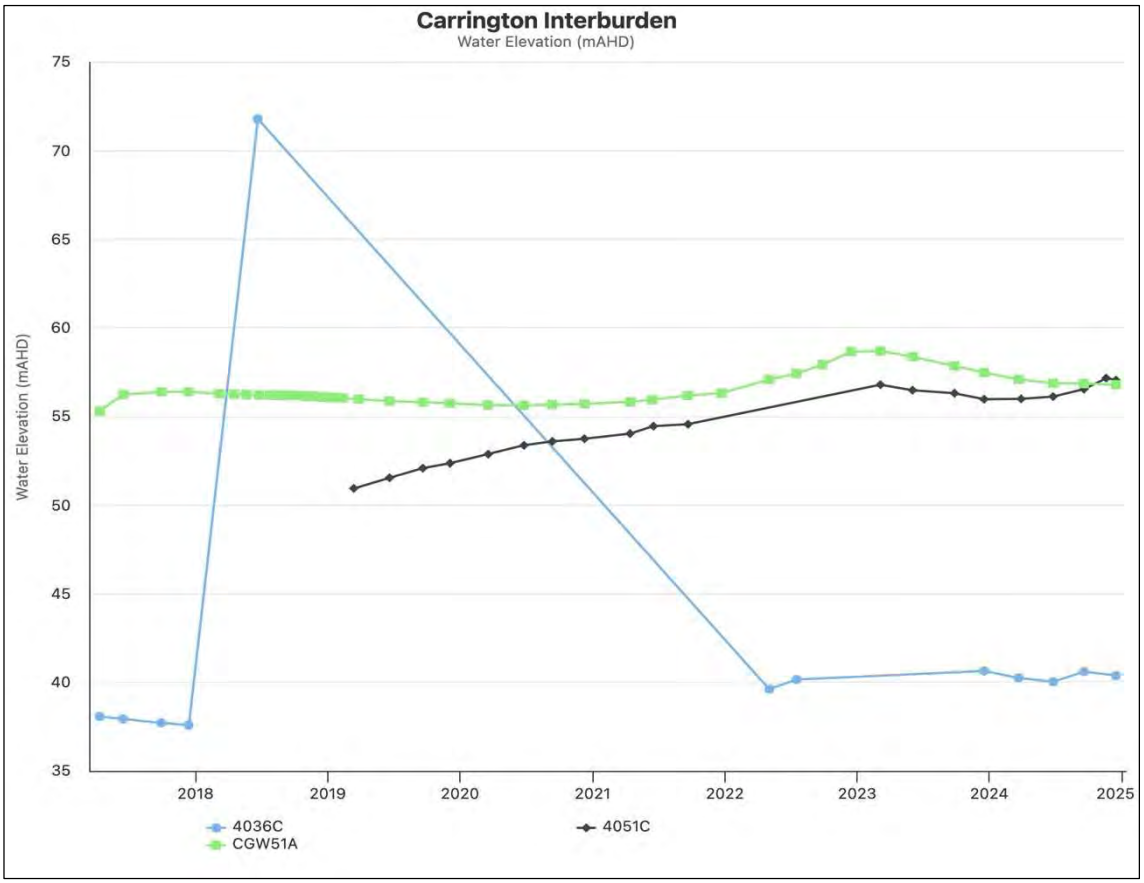


Figure 7-27: Carrington Interburden Groundwater SWL Trends 2017 - 2024

7.5.7 | CARRINGTON WEST WING ALLUVIUM

Results are shown in **Figure 7-28** to **Figure 7-30**. Water quality results were generally consistent with historical trends. Bore CGW49 intersects alluvium within the western limb of the paleochannel. Historical readings show that bore CGW49 has recorded pH ranging between 7.3 and 7.7. Review of pH readings remained fairly stable and within historical levels over 2024. The results show no adverse impacts due to mining.

There were no trigger exceedances in 2024.

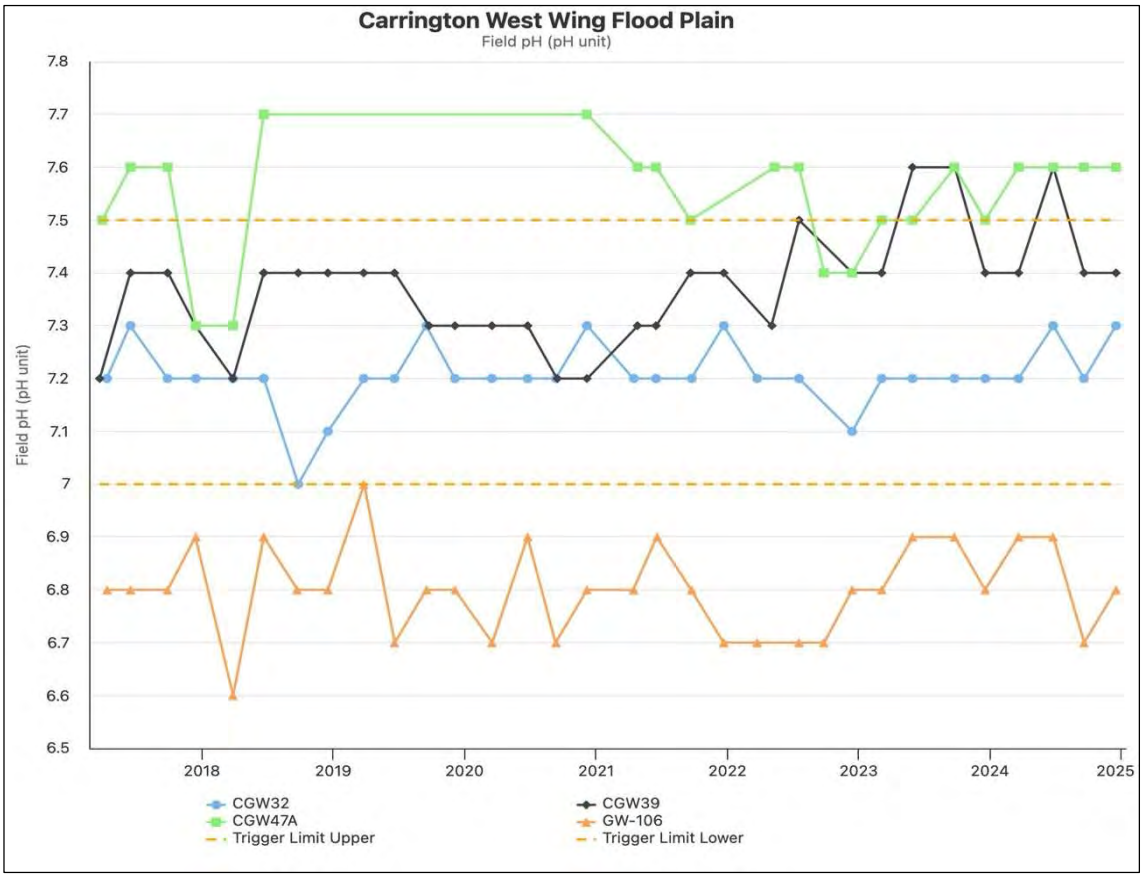


Figure 7-28: Carrington West Wing Alluvium Groundwater pH Trends 2017 - 2024

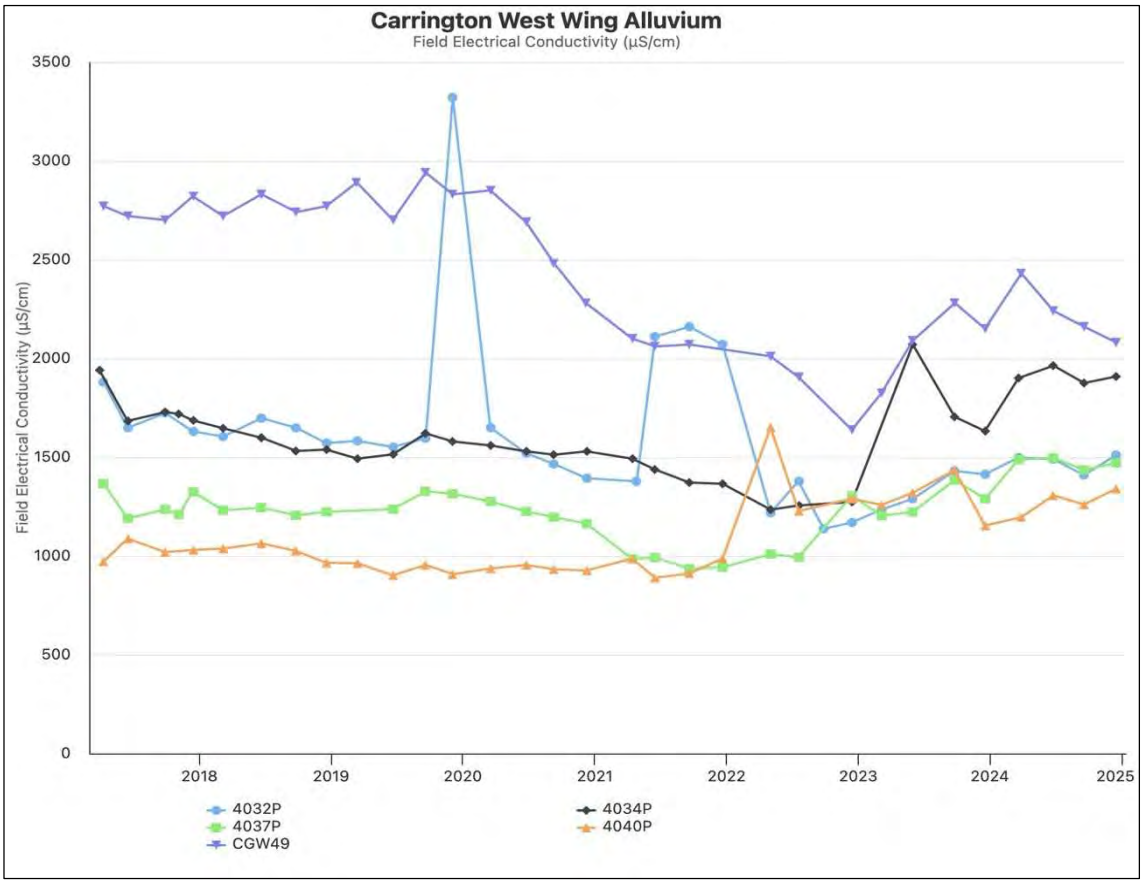


Figure 7-29: Carrington West Wing Alluvium Groundwater EC Trends 2017 – 2024

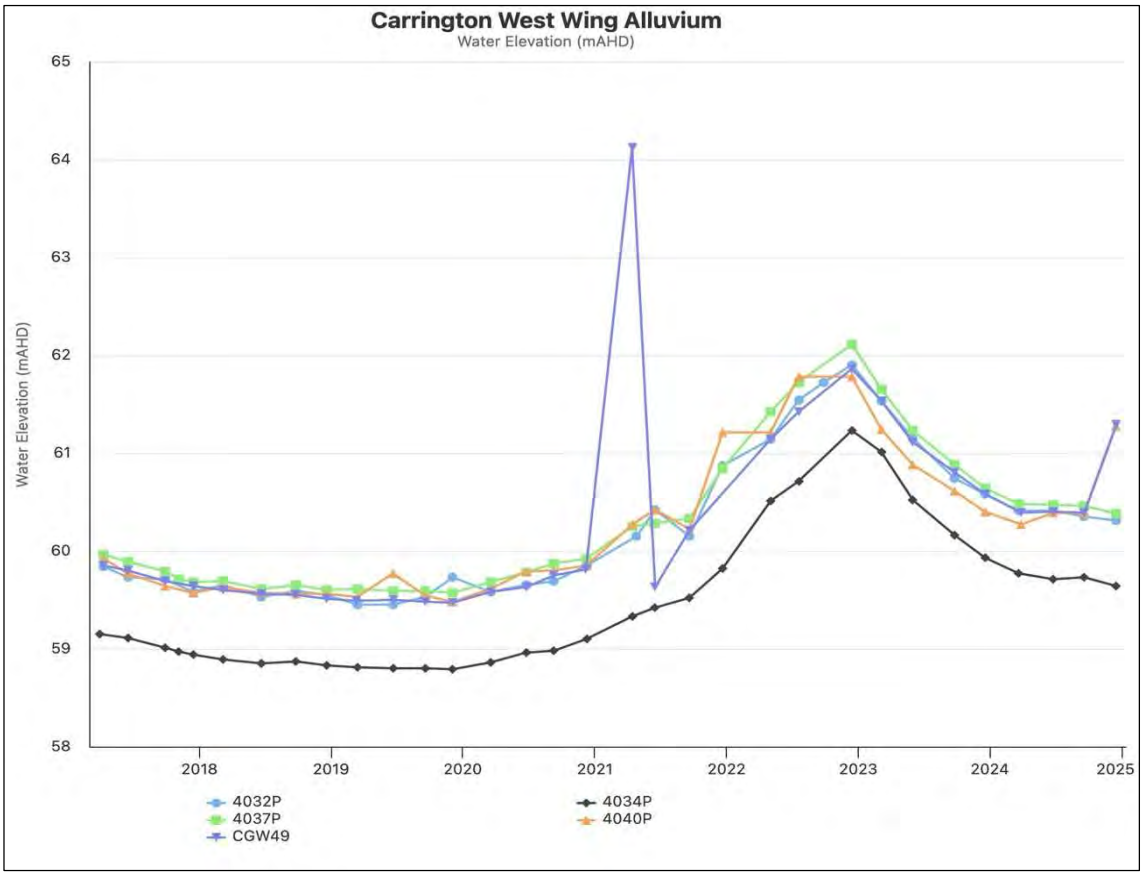


Figure 7-30: Carrington West Wing Alluvium Groundwater SWL Trends 2017 - 2024

7.5.8 | CARRINGTON WEST WING FLOOD PLAIN

Results are shown in **Figure 7-31** to **Figure 7-33**. Water quality results were generally consistent with historical trends.

There were no trigger exceedances during 2024.

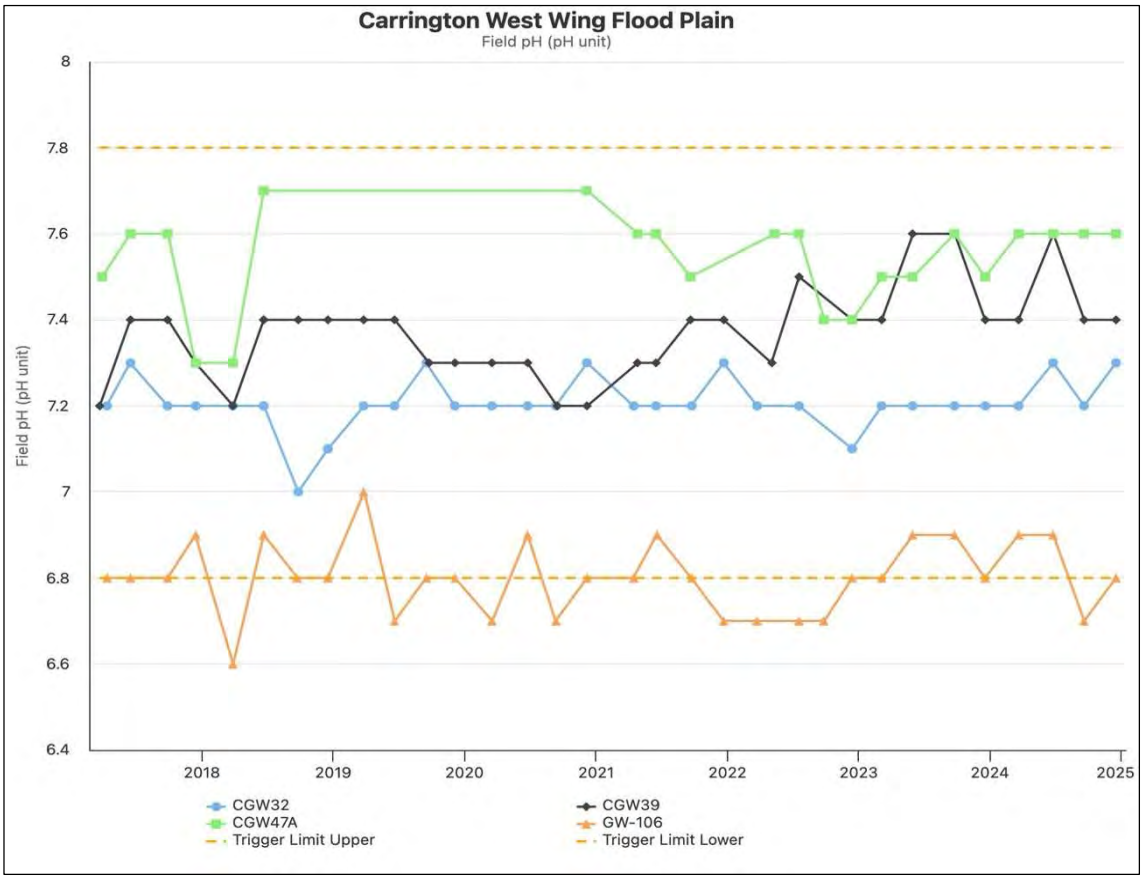


Figure 7-31: Carrington West Wing Flood Plain Groundwater pH Trends 2017 - 2024

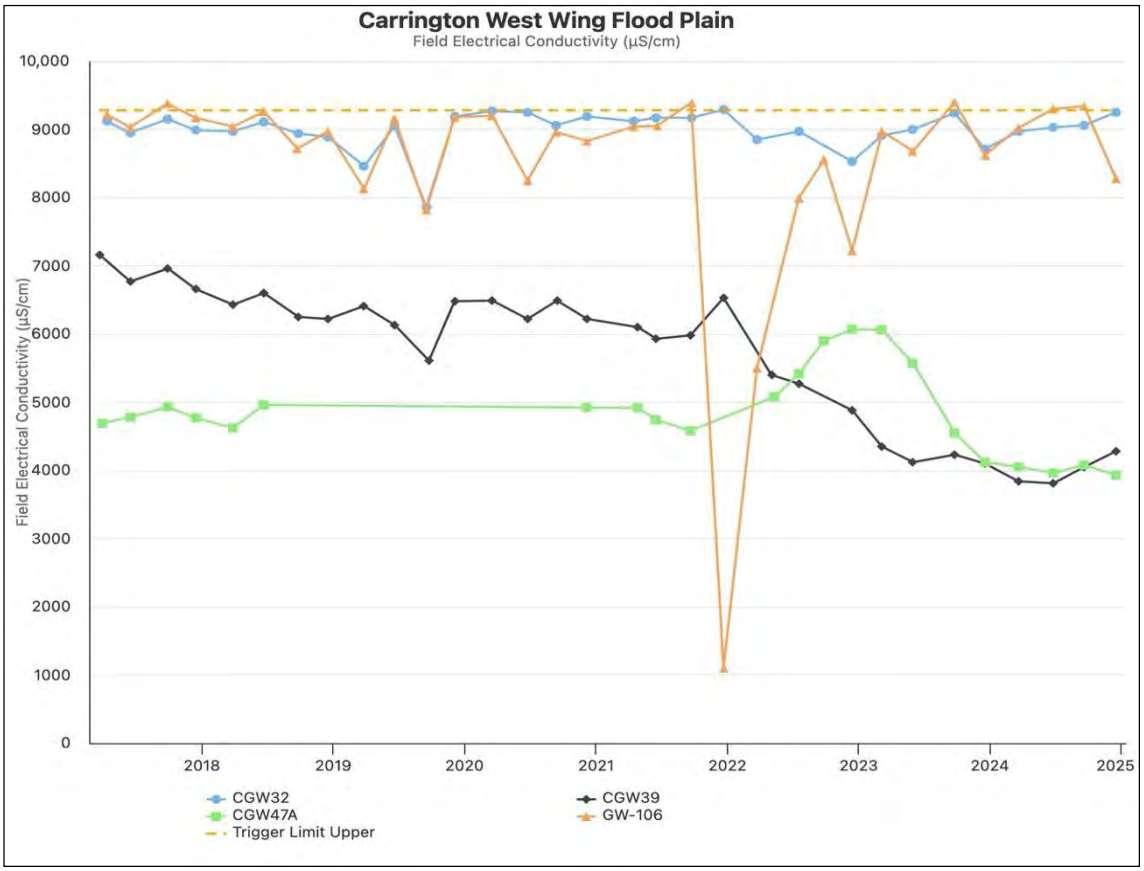


Figure 7-32: Carrington West Wing Flood Plain Groundwater EC Trends 2017 – 2024

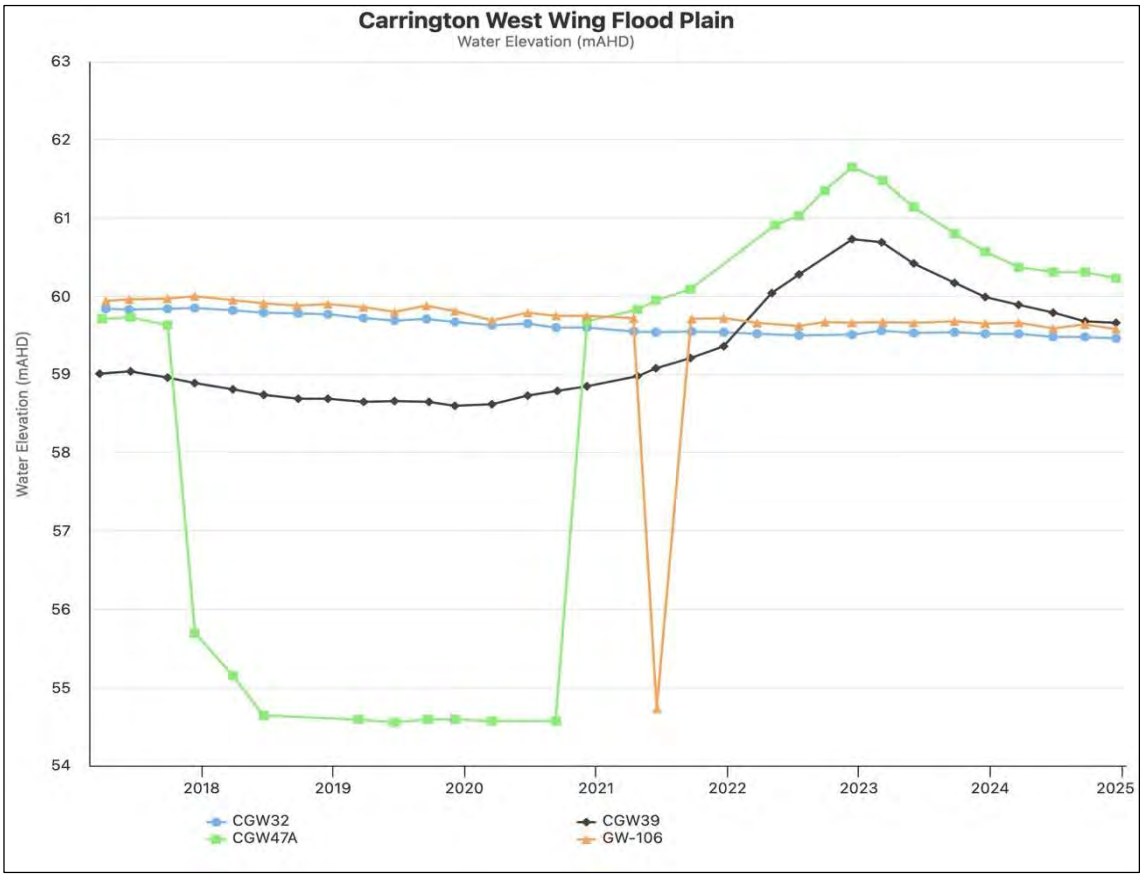


Figure 7-33: Carrington West Wing Flood Plain Groundwater SWL Trends 2017 - 2024

7.5.9 | CHESHUNT / NORTH PIT ALLUVIUM

Electrical Conductivity, pH and SWL trends for 2017 to 2024 are shown in **Figure 7-34** to **Figure 7-36**. Water quality results were generally consistent with historical trends. Hobdens Well is screened within alluvium, located between the Hunter River and Cheshunt Pit. Historical readings show that Hobdens Well has recorded pH ranging between 7.1 and 7.6. Review of pH readings indicated levels fluctuated slightly, but within historical levels over 2024. It is recommended by Umwelt that the trigger level is updated to reflect historical trends.

Trigger tracking results for Hobdens Well are further detailed in **Table 5.3** of **Appendix B**.

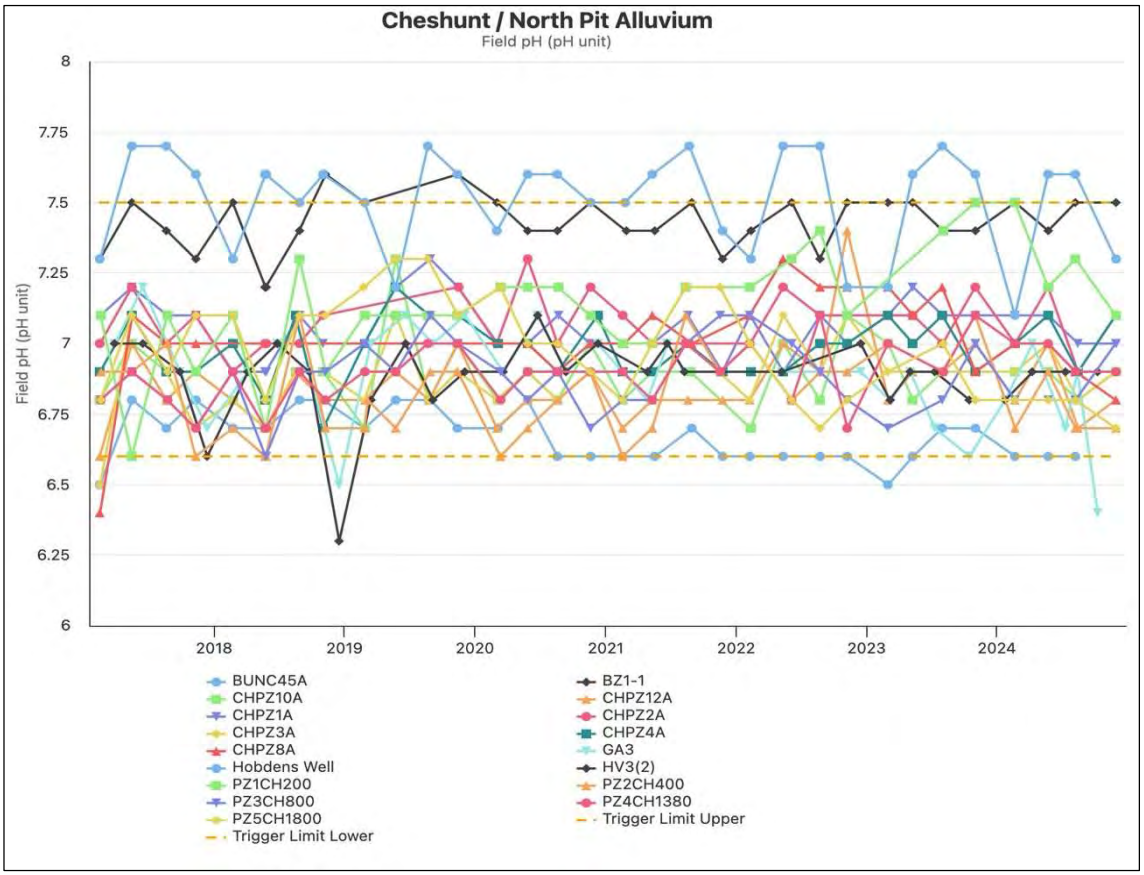


Figure 7-34: Cheshunt / North Pit Alluvium Groundwater pH Trends 2017 - 2024

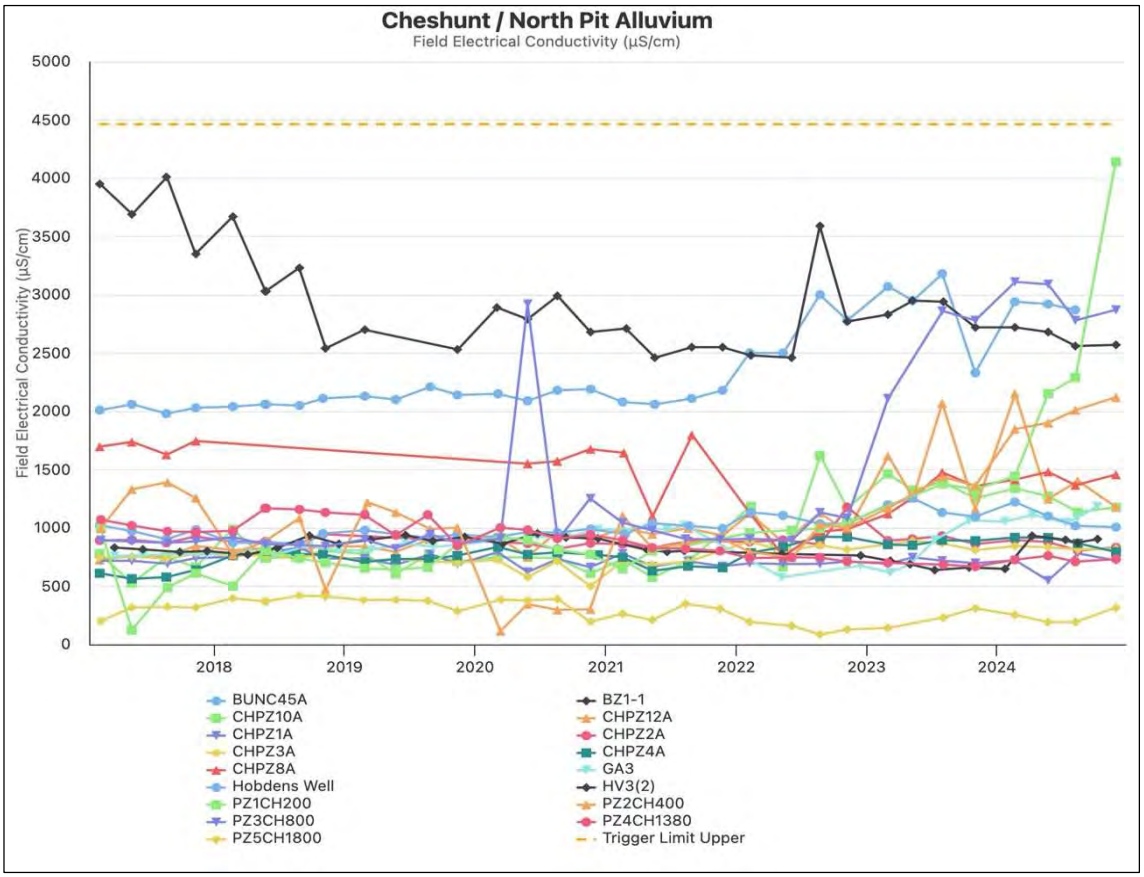


Figure 7-35: Cheshunt / North Pit Alluvium Groundwater EC Trends 2017 – 2024

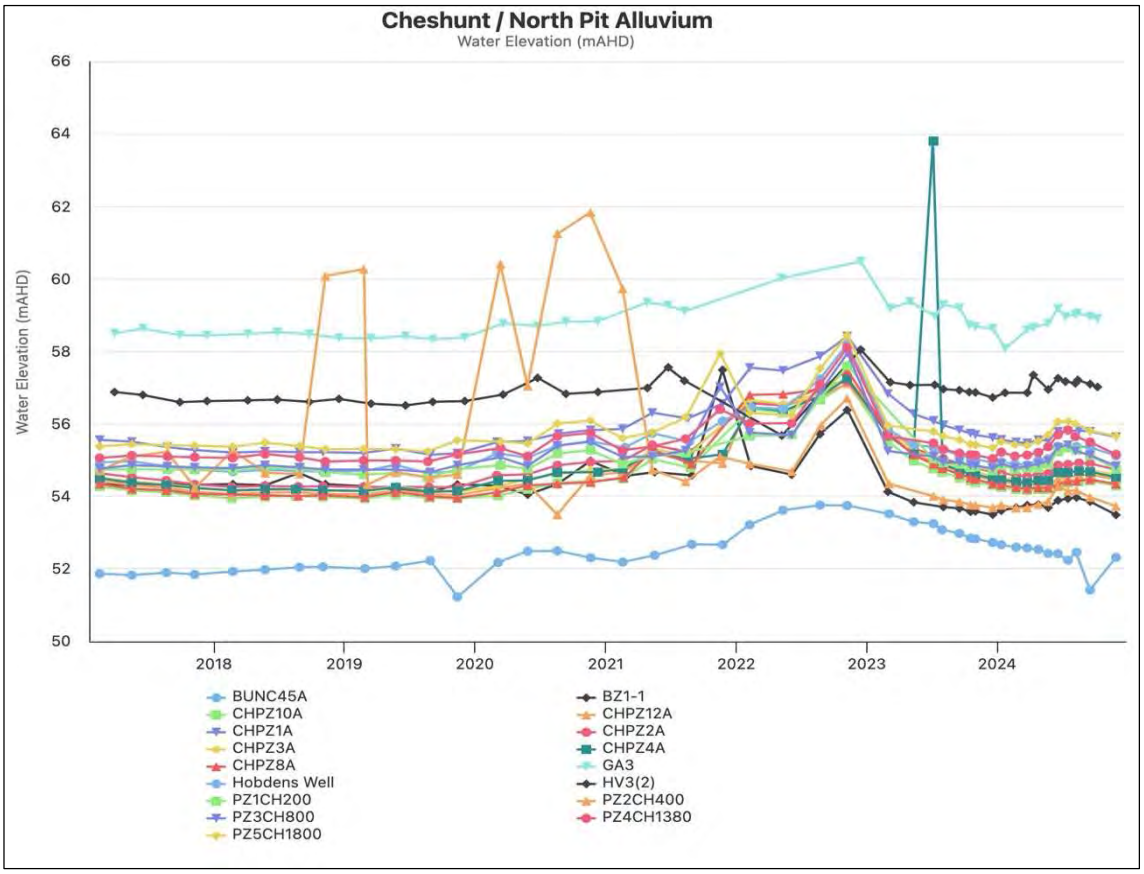


Figure 7-36: Cheshunt / North Pit Alluvium Groundwater SWL Trends 2017 - 2024

7.5.10 | CHESHUNT INTERBURDEN

The EC, pH and SWL trends for 2017 to 2024 are shown in **Figure 7-37** to **Figure 7-39**. Water quality results were generally consistent with historical trends.

There were no trigger exceedances during 2024 (i.e. more than 3 consecutive results outside of trigger limits).

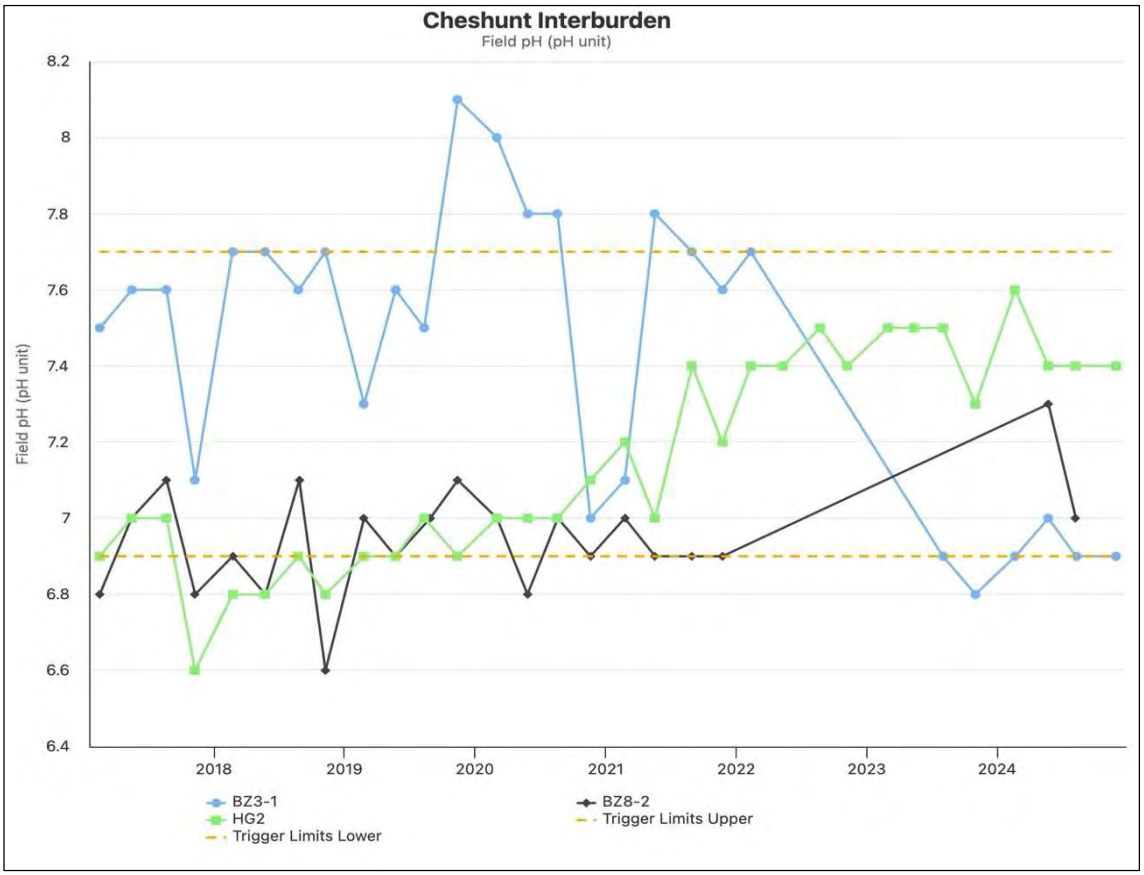


Figure 7-37: Cheshunt Interburden Groundwater pH Trends 2017 - 2024

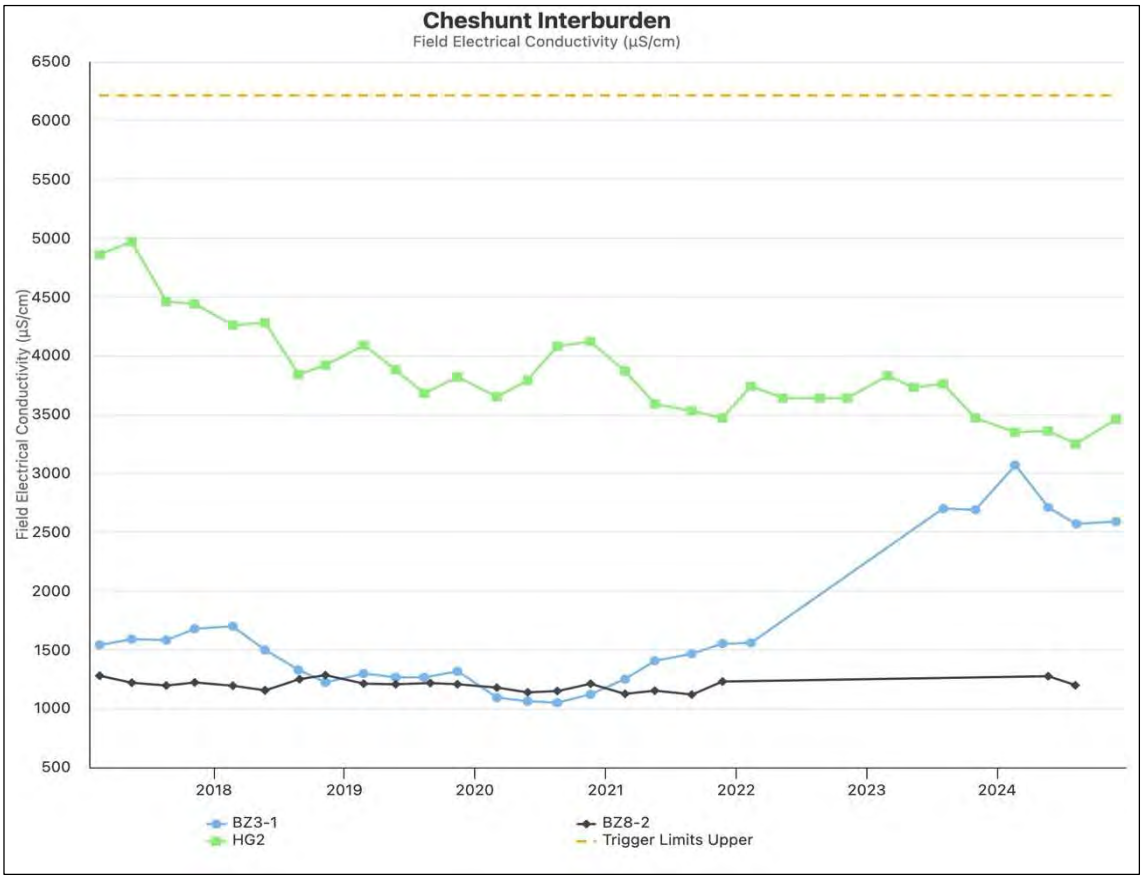


Figure 7-38: Cheshunt Interburden Groundwater EC Trends 2017 – 2024

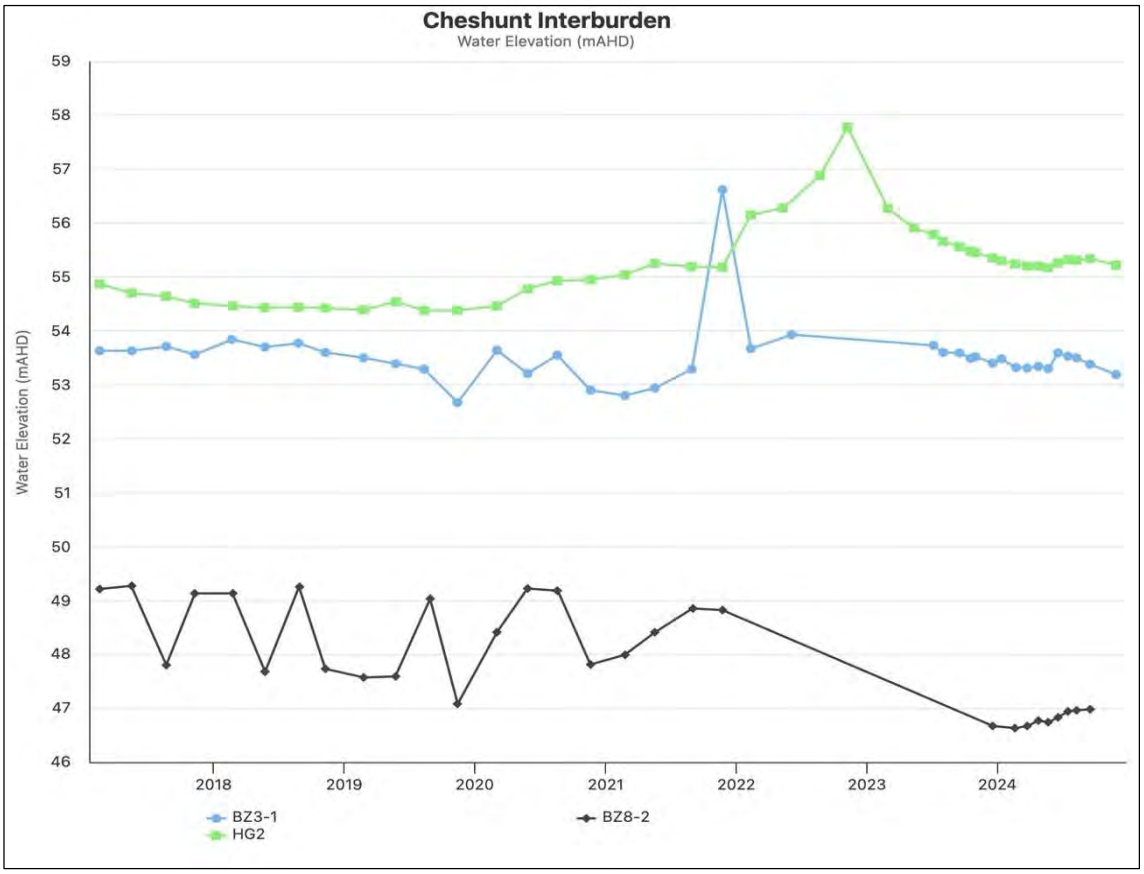


Figure 7-39: Cheshunt Interburden Groundwater SWL Trends 2017 - 2024

7.5.11 | CHESHUNT MT ARTHUR

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-40** to **Figure 7-42**. Water quality results were generally consistent with historical trends except for pH. Based on historical data, pH results from all three bores have been gradually trending downward since July 2011. The groundwater level measured at the bores has typically been within or below the screened section of bores BZ4A(2) and BZ3-3 (pH – 5th Percentile). Purging/sample collection within bore BZ2A(1) and BZ3-3 may induce localised groundwater drawdown to within the screened section. This may be the cause of the reducing pH measured at these bores. The updated draft WMP includes amendments to the Cheshunt - Mt Arthur seam groundwater monitoring, including:

• BZ2A(1) and BZ3-3 being removed from trigger level assessment, with trigger values remaining for BZ4(A)2; and

• the pH trigger level value reducing to 6.4 (from the current value of 6.5) for all bores monitoring the Cheshunt- Mt Arthur Seam.

Bore BZ3-3, located between Cheshunt Pit and the Hunter River, and had an increasing pH trend between June 2006 (6.0) and August 2012 (7.1) followed by a decreasing trend between December 2012 (7.1) and November 2022 (6.1). The 2023 readings ranging between of 6.2 and 6.4 are within the historical range. The 2019 Groundwater Annual Review (SLR, 2020) recommended further investigation of the bore condition and construction to confirm the geology being monitored in all of the 'BZ' bores in the Cheshunt area to understand the cause of the variability in the trends between the bores. Comprehensive water quality analysis was undertaken in August 2022. The results indicated the declining pH trend is not due to connectivity to spoil water via the nearby fault.

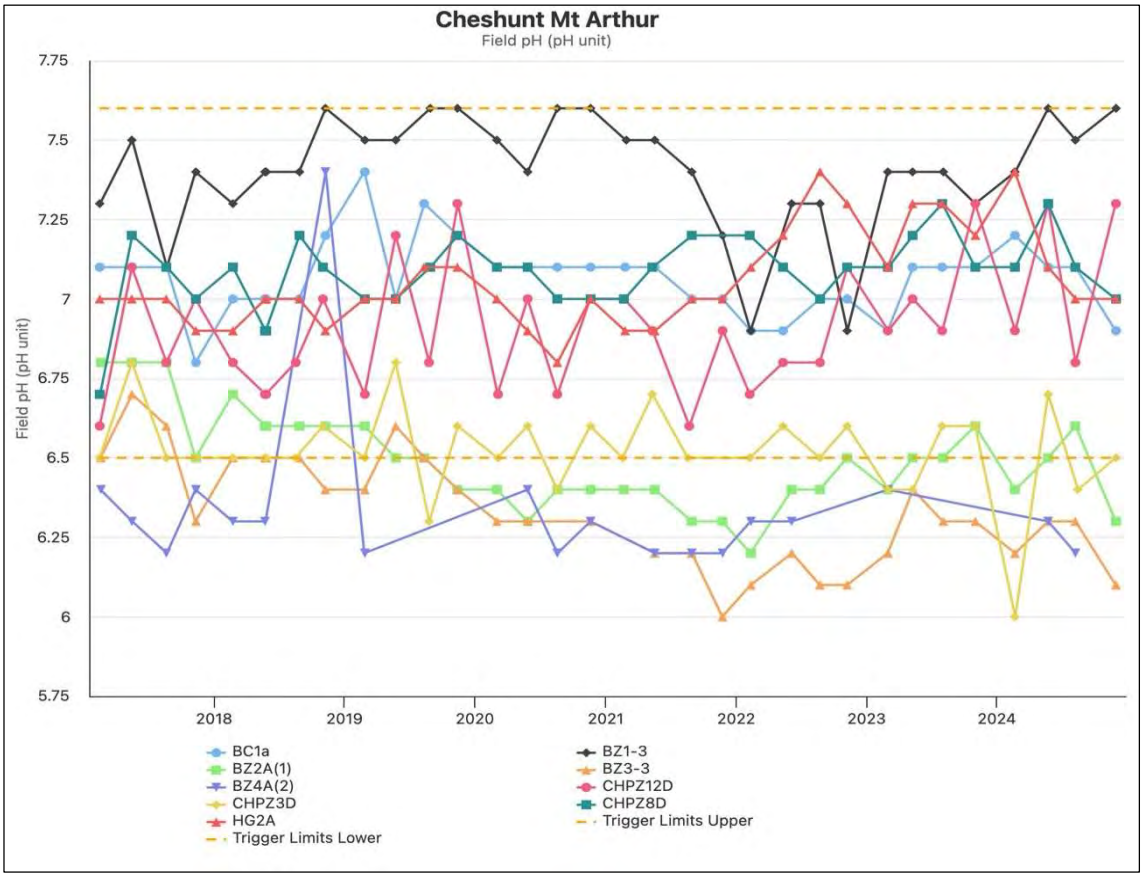


Figure 7-40: Cheshunt Mt Arthur Groundwater pH Trends 2017 - 2024

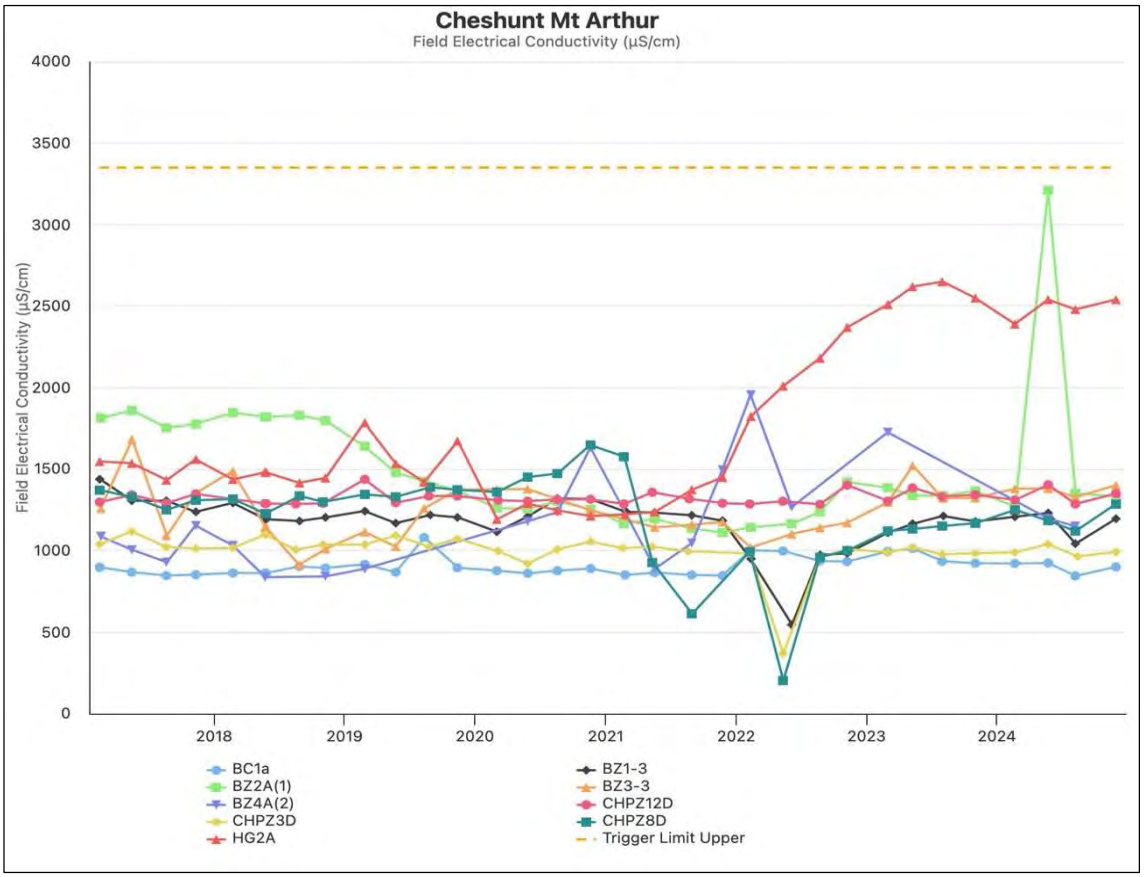


Figure 7-41: Cheshunt Mt Arthur Groundwater EC Trends 2017 – 2024

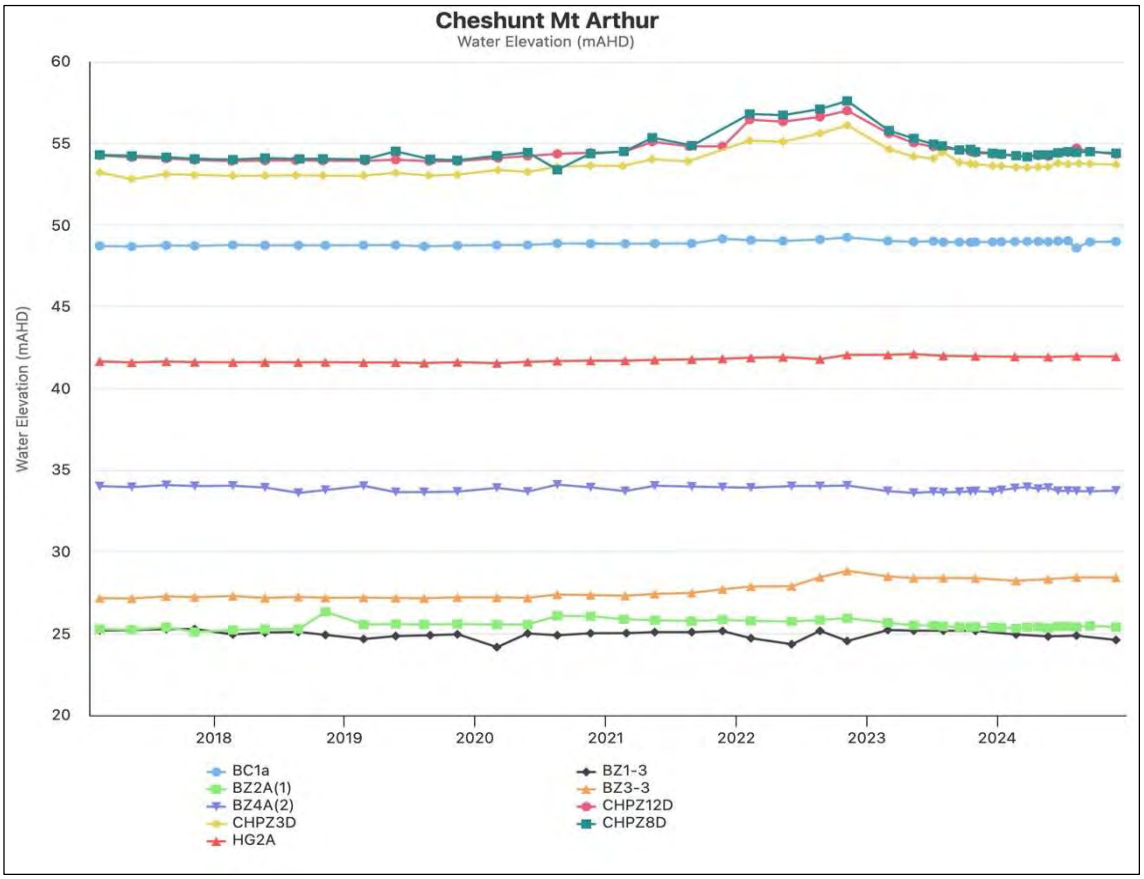


Figure 7-42: Cheshunt Mt Arthur Groundwater SWL Trends 2017 - 2024

7.5.12 | CHESHUNT PIERCEFIELD

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-43** to **Figure 7-45**. Water quality results were generally consistent with historical trends.

There were no trigger exceedances recorded in 2024.

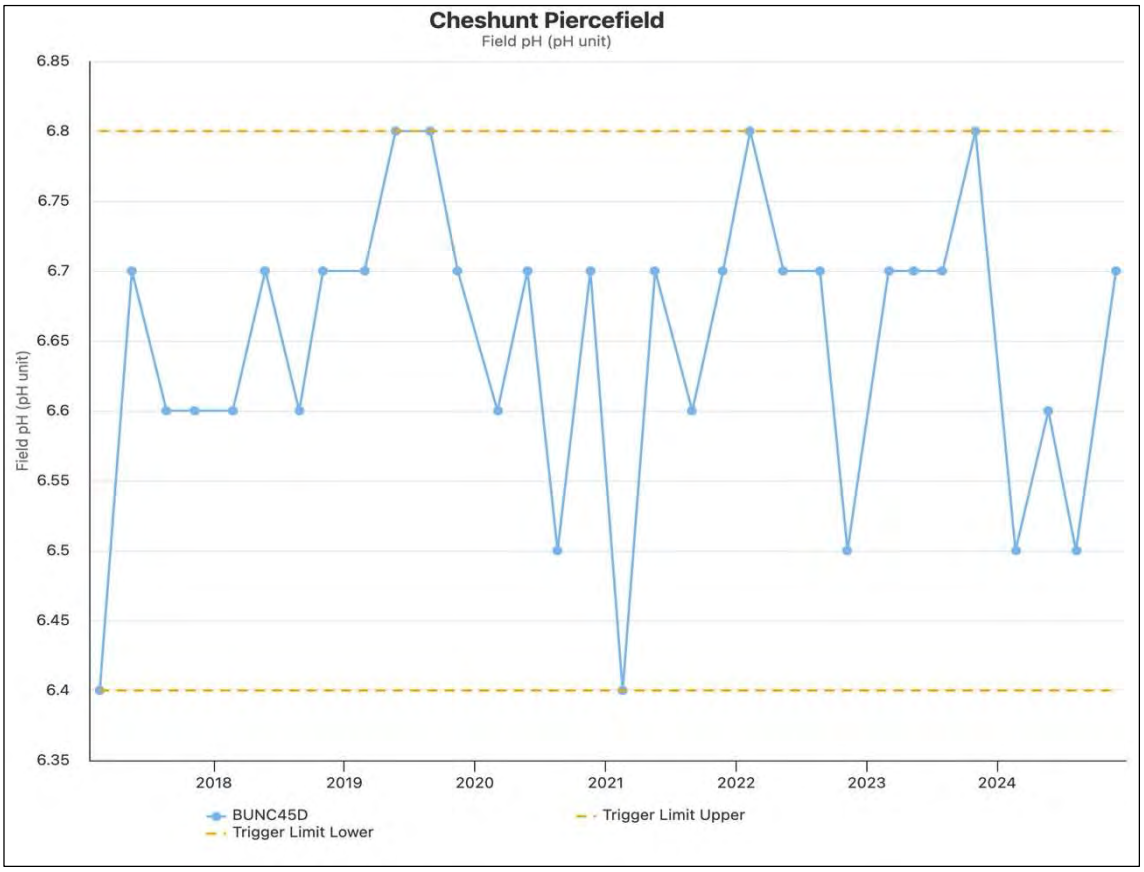


Figure 7-43: Cheshunt Piercefield Groundwater pH Trends 2017 - 2024

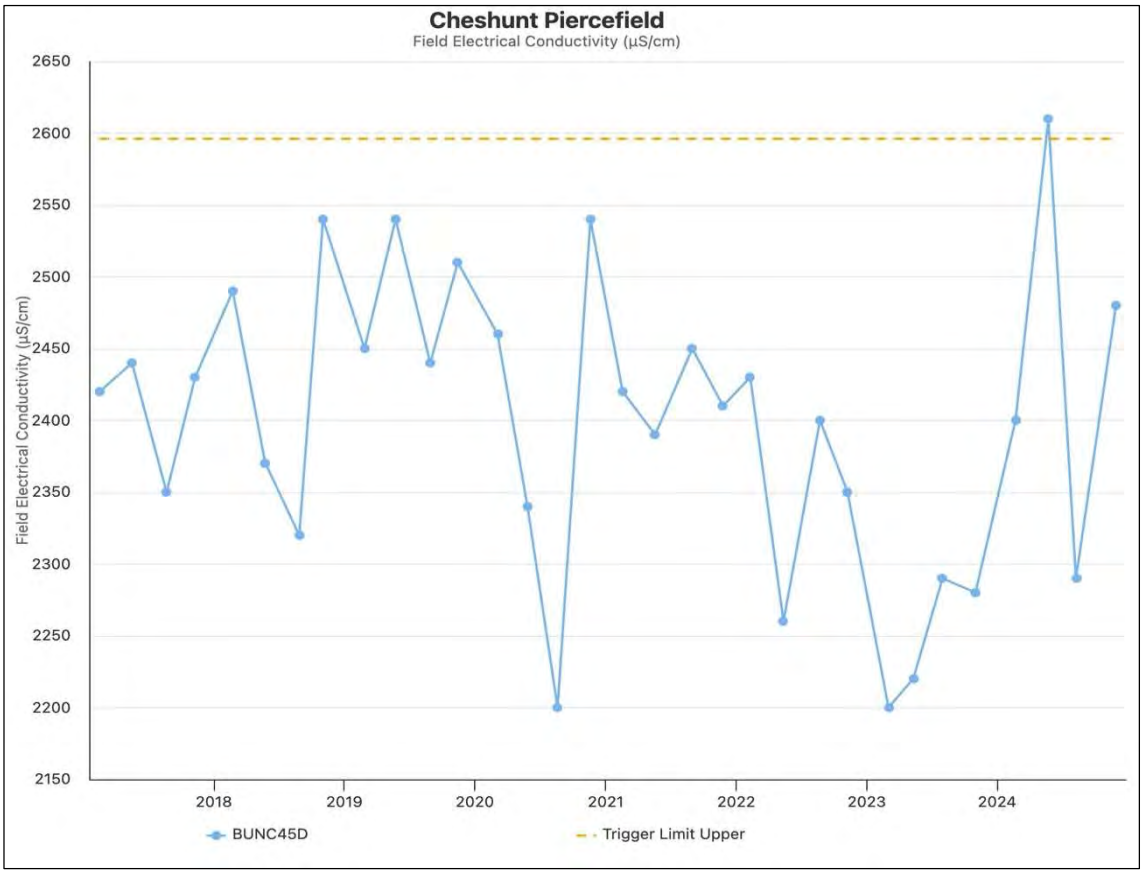


Figure 7-44: Cheshunt Piercefield Groundwater EC Trends 2017 – 2024

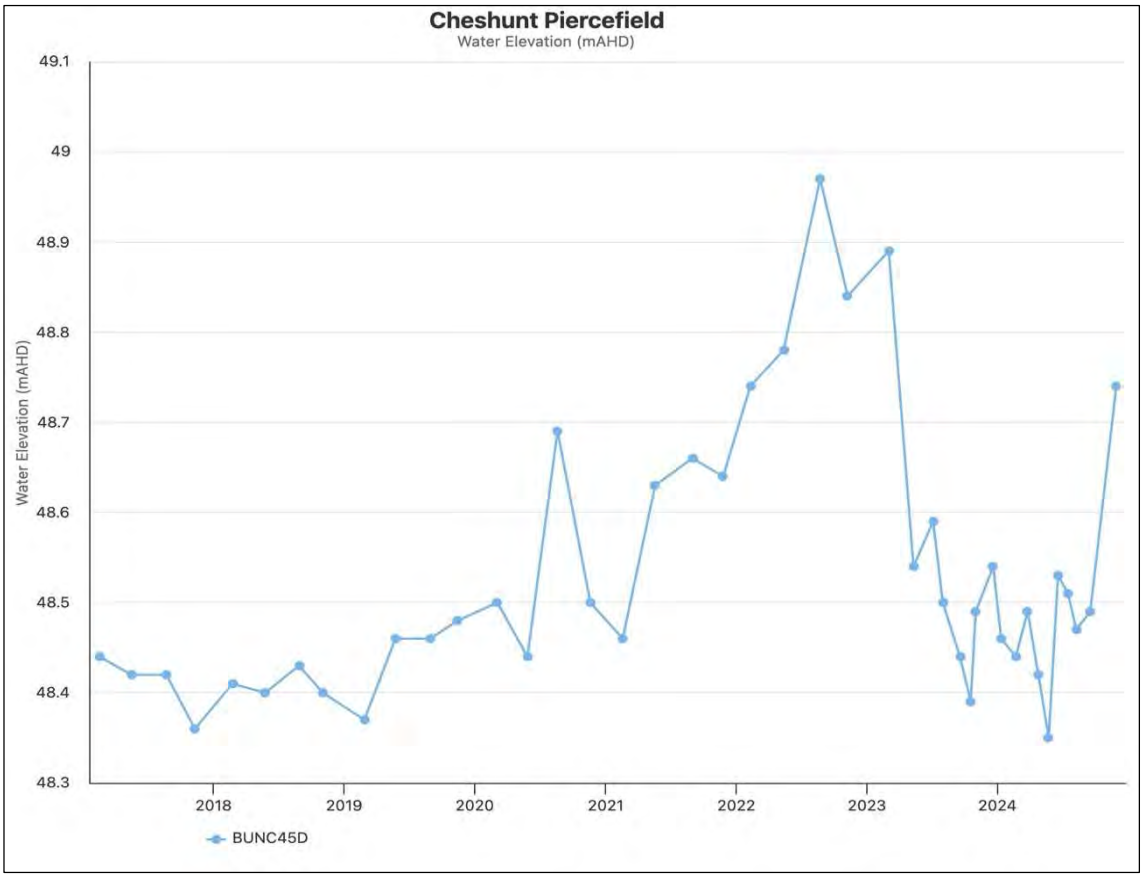


Figure 7-45: Cheshunt Piercefield Groundwater SWL Trends 2017 - 2024

7.5.13 | LEMINGTON SOUTH ALLUVIUM

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-46** to **Figure 7-48**. Water quality results were generally consistent with historical trends. Refer to **Table 5.4** of **Appendix B**.

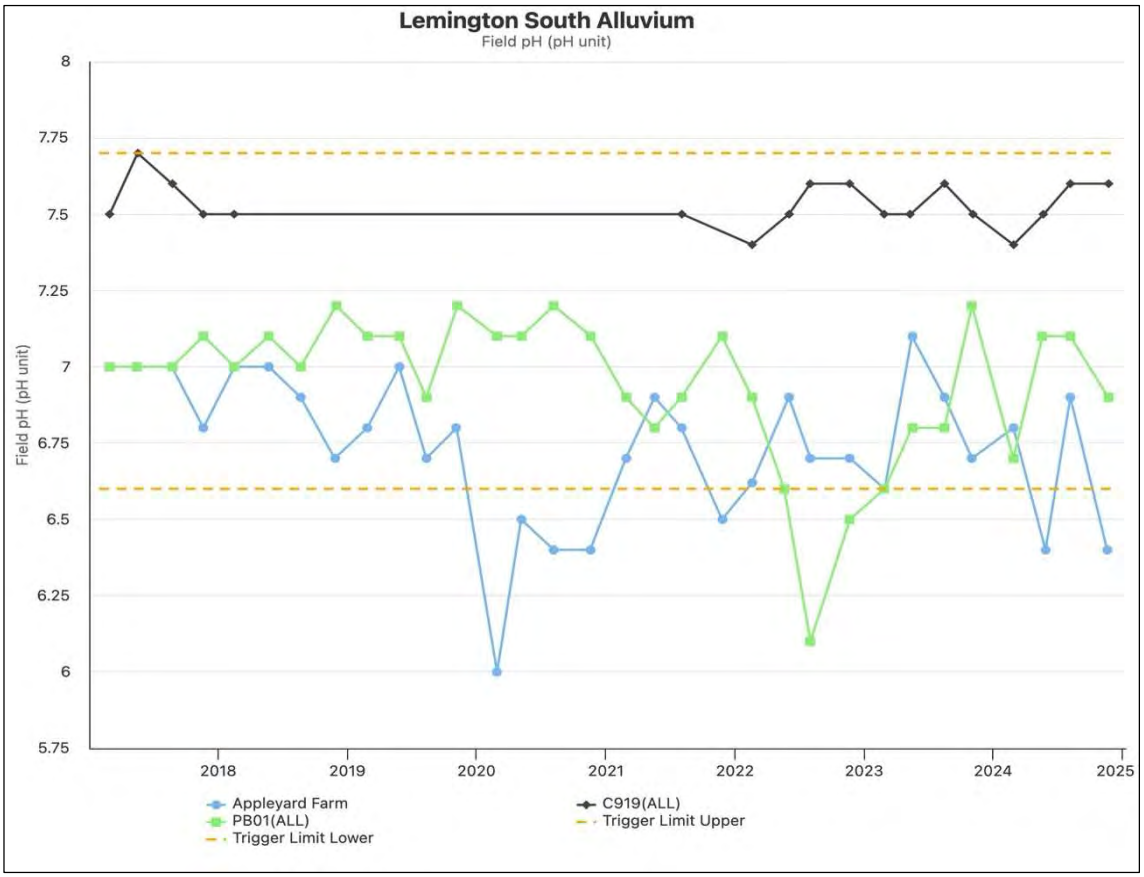


Figure 7-46: Lemington South Alluvium Groundwater pH Trends 2017 - 2024

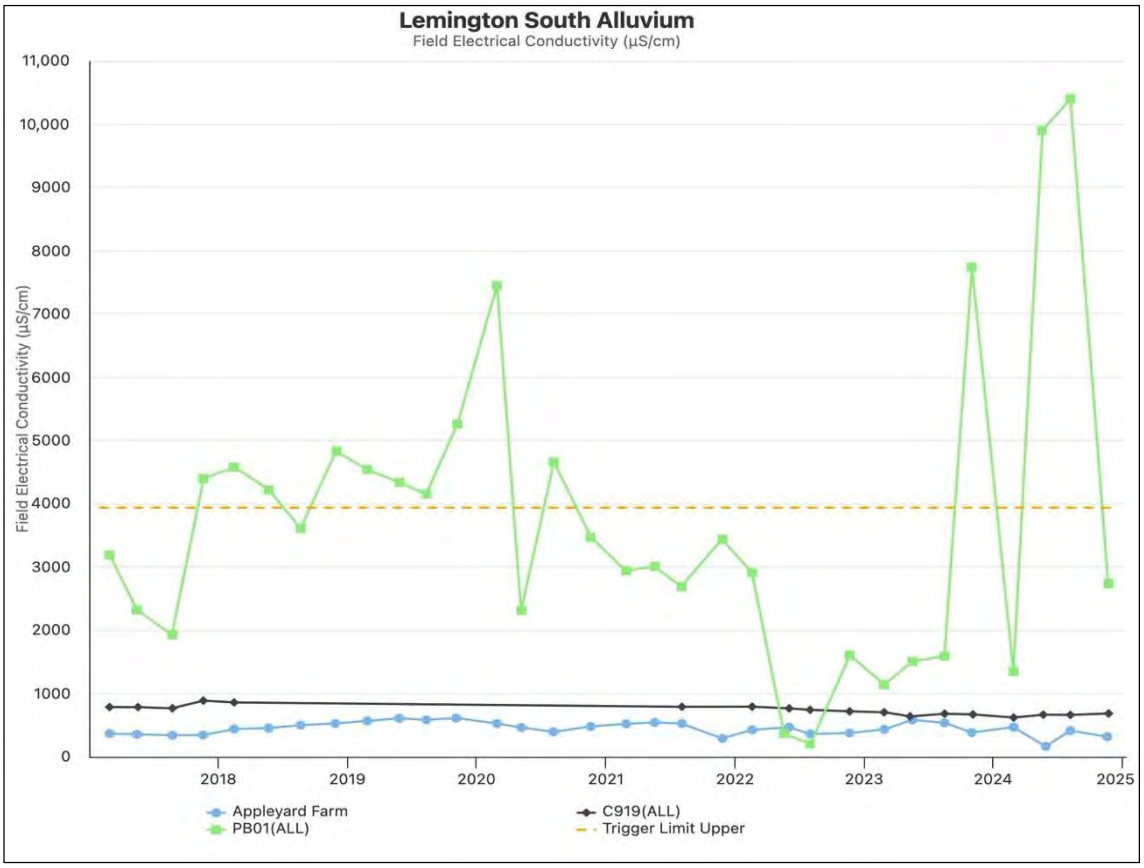


Figure 7-47: Lemington South Alluvium Groundwater EC Trends 2017 – 2024

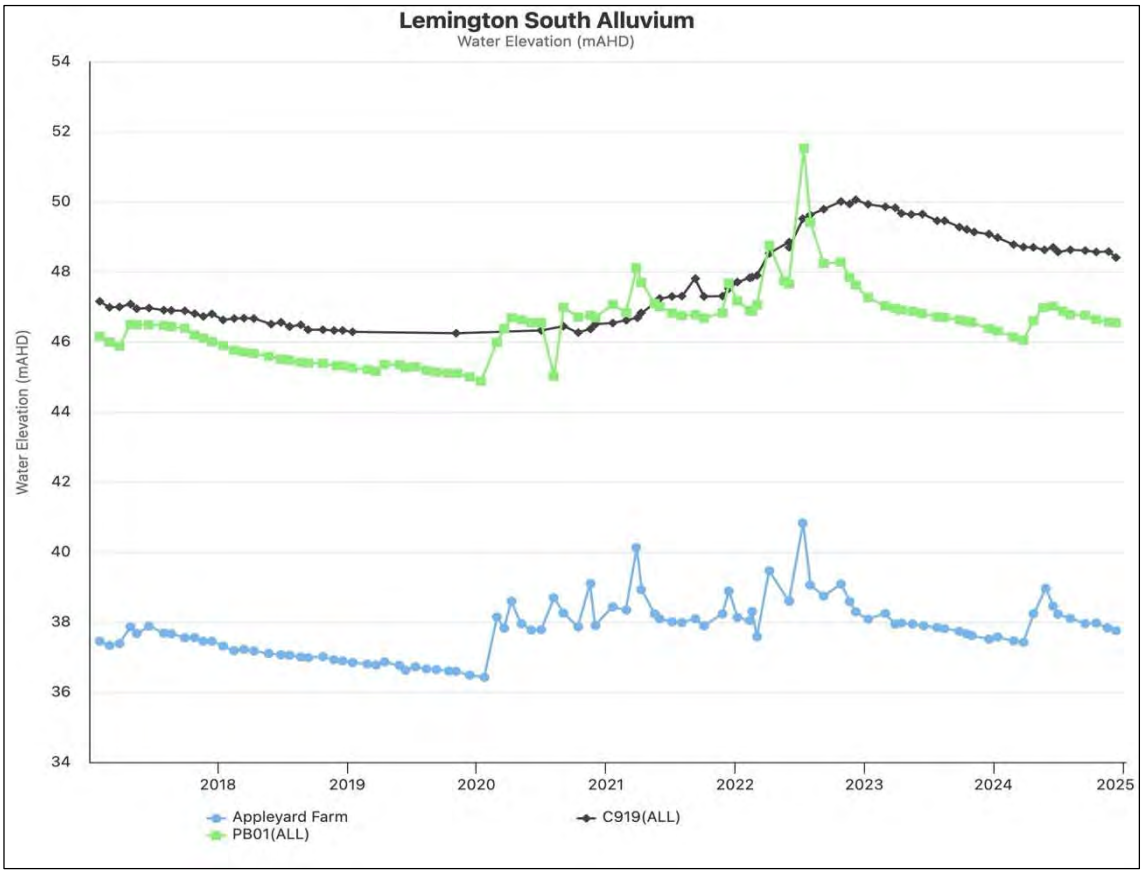


Figure 7-48: Lemington South Alluvium Groundwater SWL Trends 2017 - 2024

7.5.14 | LEMINGTON SOUTH ARROWFIELD

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-49** to **Figure 7-51**. Water quality results were generally consistent with historical trends.

There were no exceedances of trigger levels (3 or more consecutive events) in 2024.

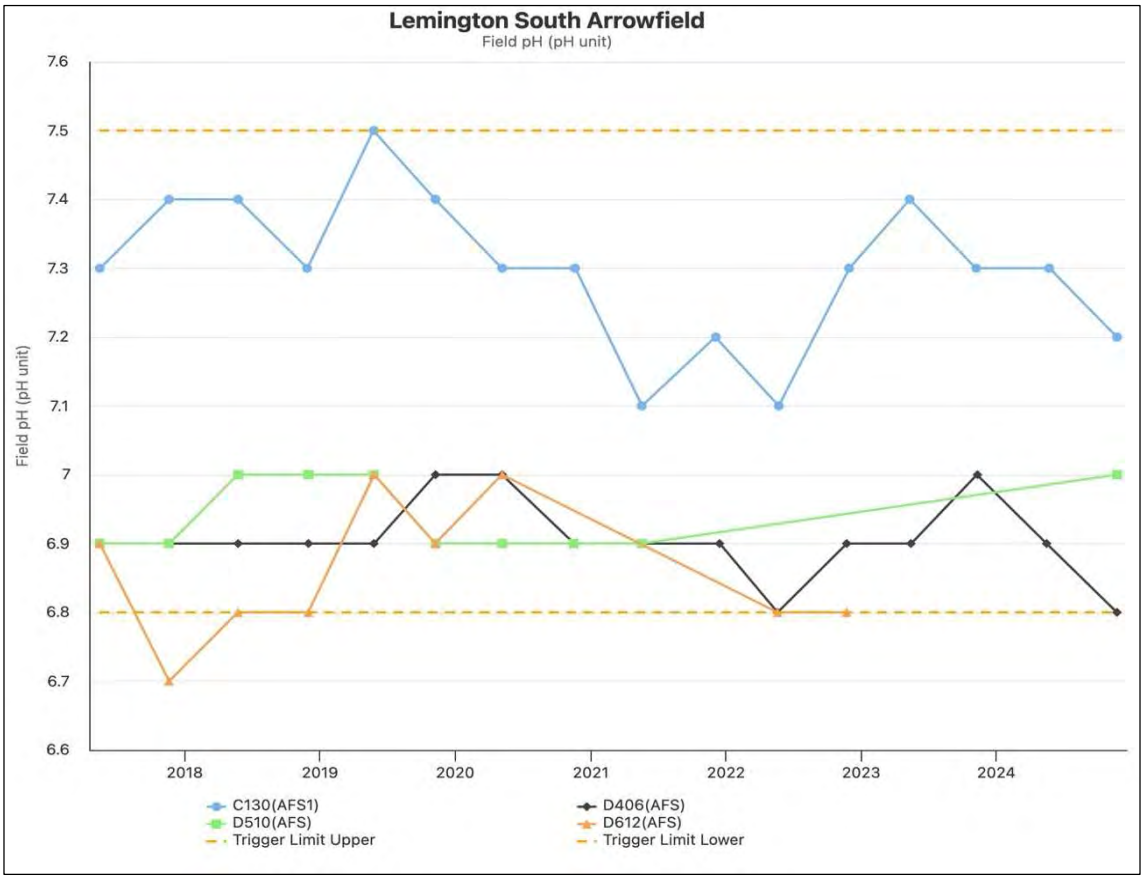


Figure 7-49: Lemington South Arrowfield Groundwater pH Trends 2017 - 2024

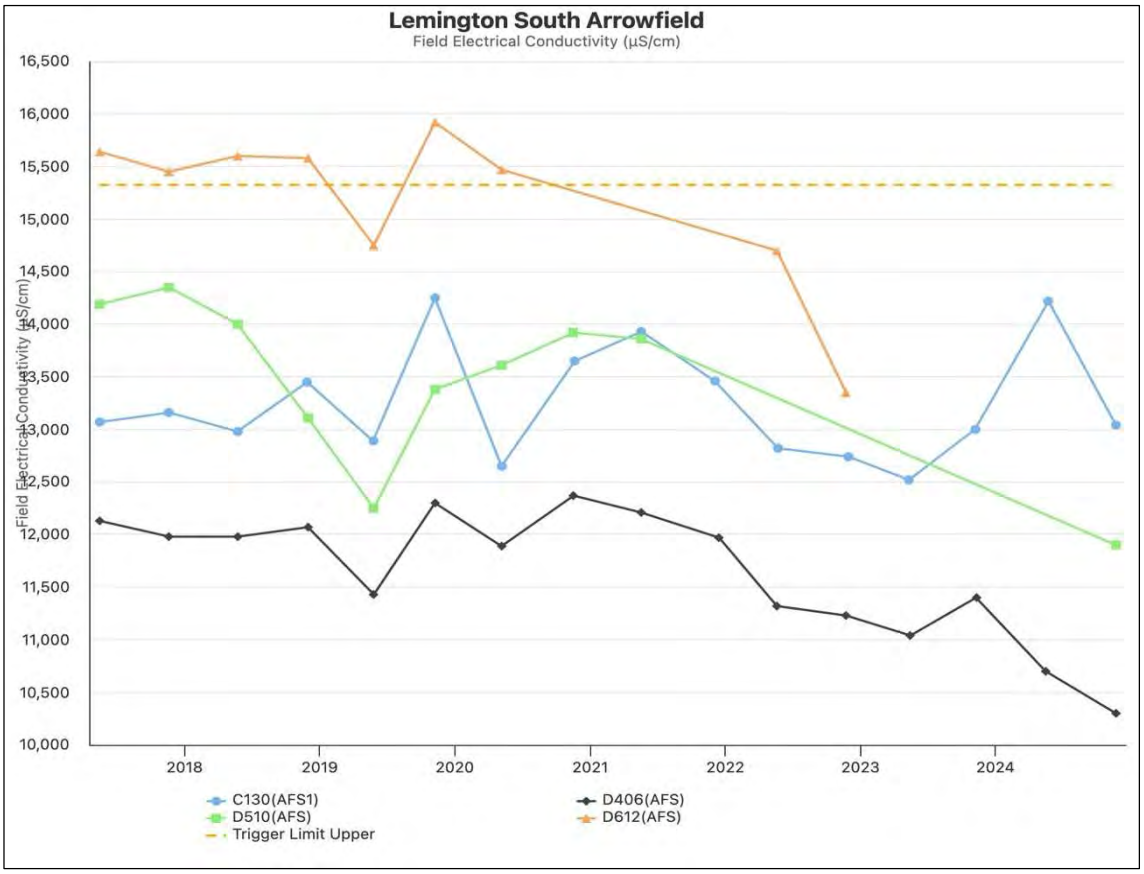


Figure 7-50: Lemington South Arrowfield Groundwater EC Trends 2017 - 2024

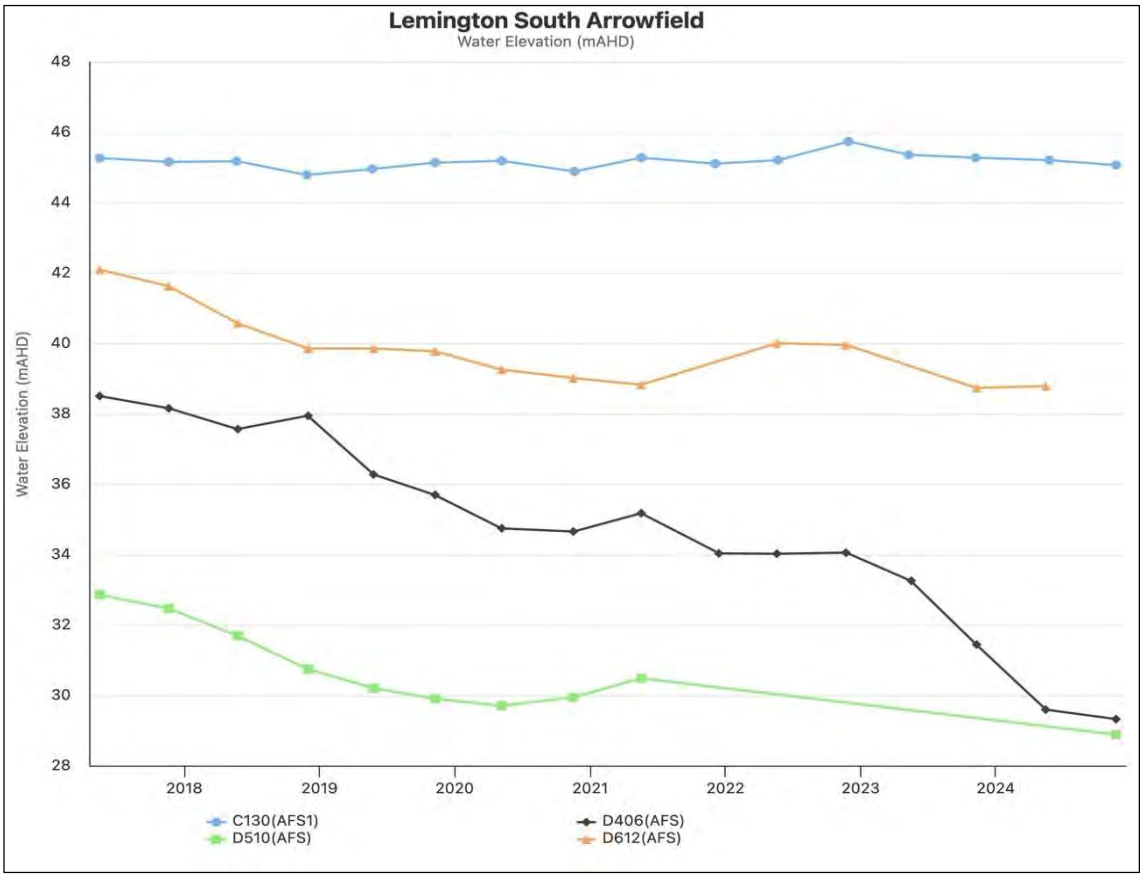


Figure 7-51: Lemington South Arrowfield Groundwater SWL Trends 2017 - 2024

7.5.15 | LEMINGTON SOUTH BOWFIELD

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-52** to **Figure 7-54**. Water quality results were generally considered to be consistent with historical trends. There were no exceedances of trigger levels (3 or more consecutive events) in 2024.

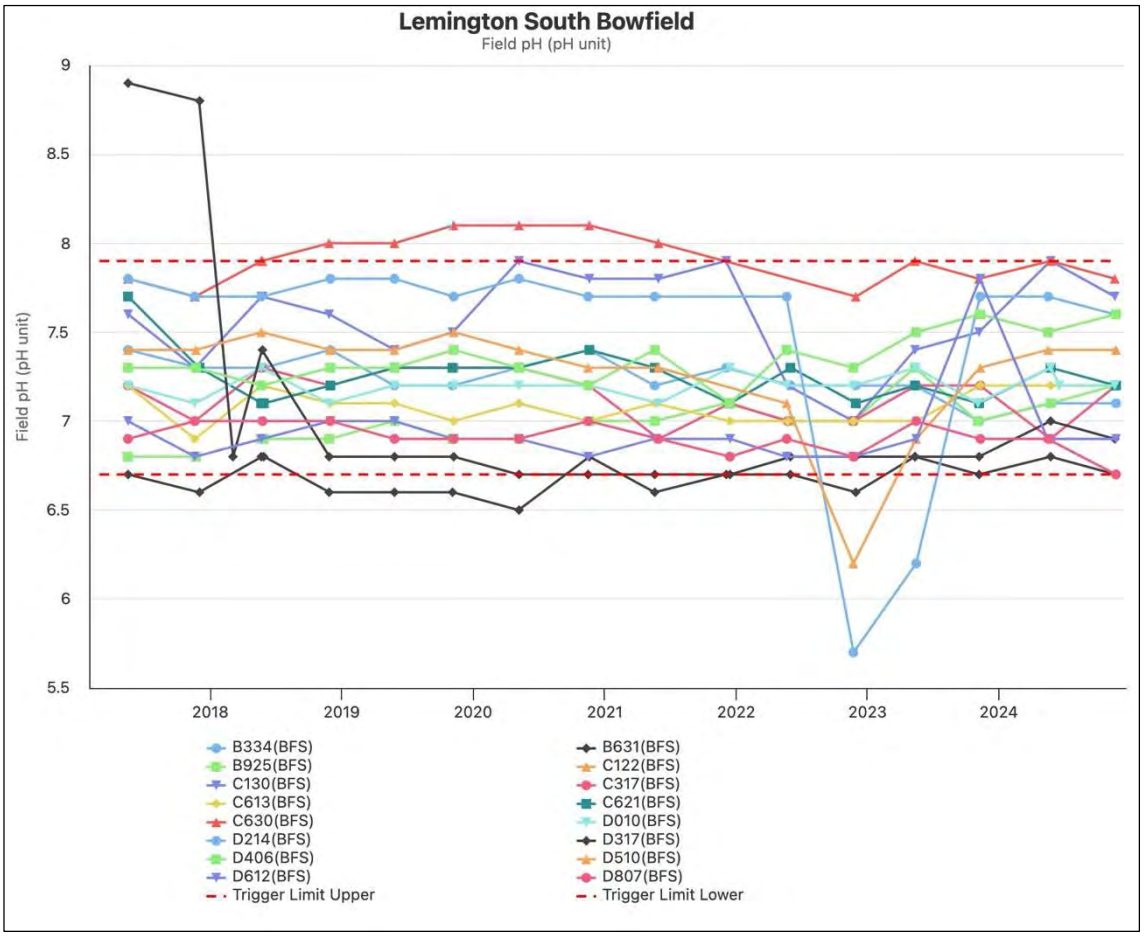


Figure 7-52: Lemington South Bowfield Groundwater pH Trends 2017 – 2024

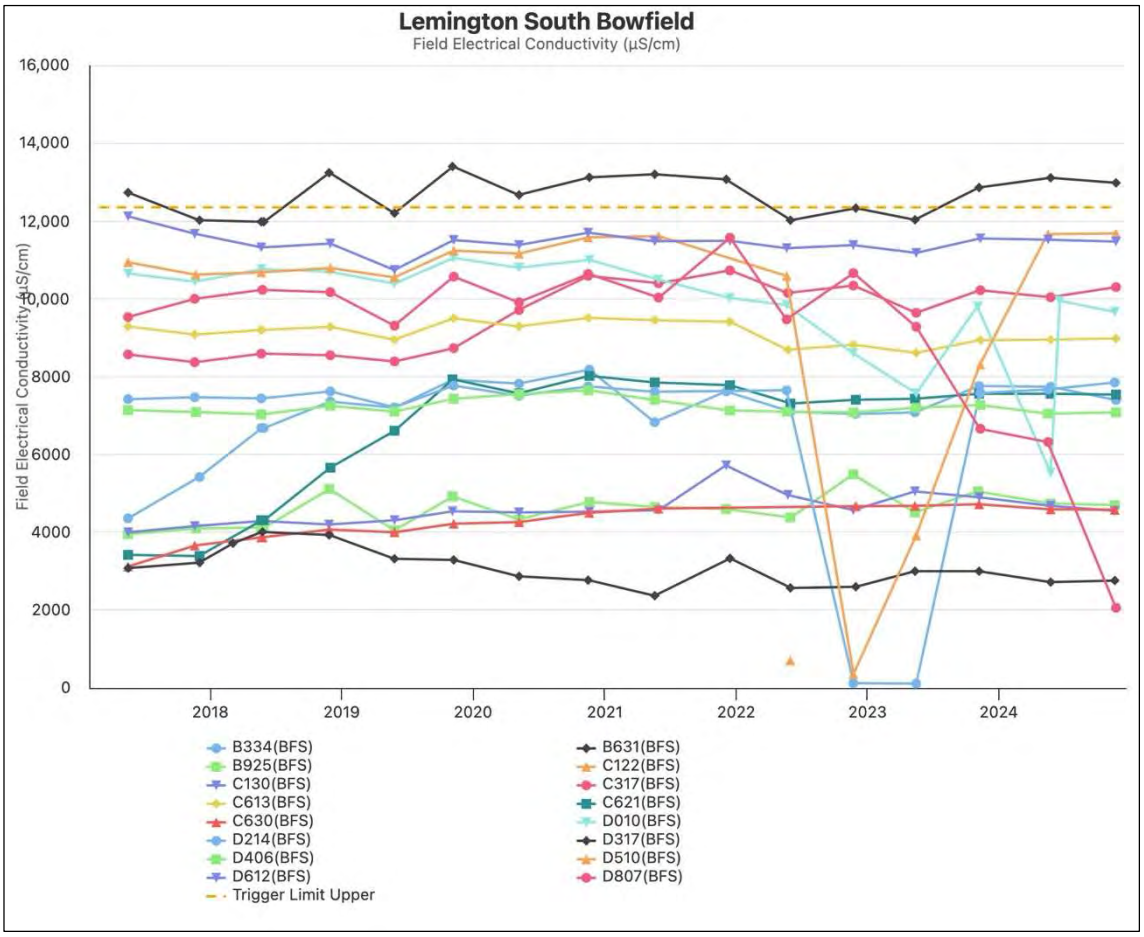


Figure 7-53: Lemington South Bowfield Groundwater EC Trends 2017 – 2024

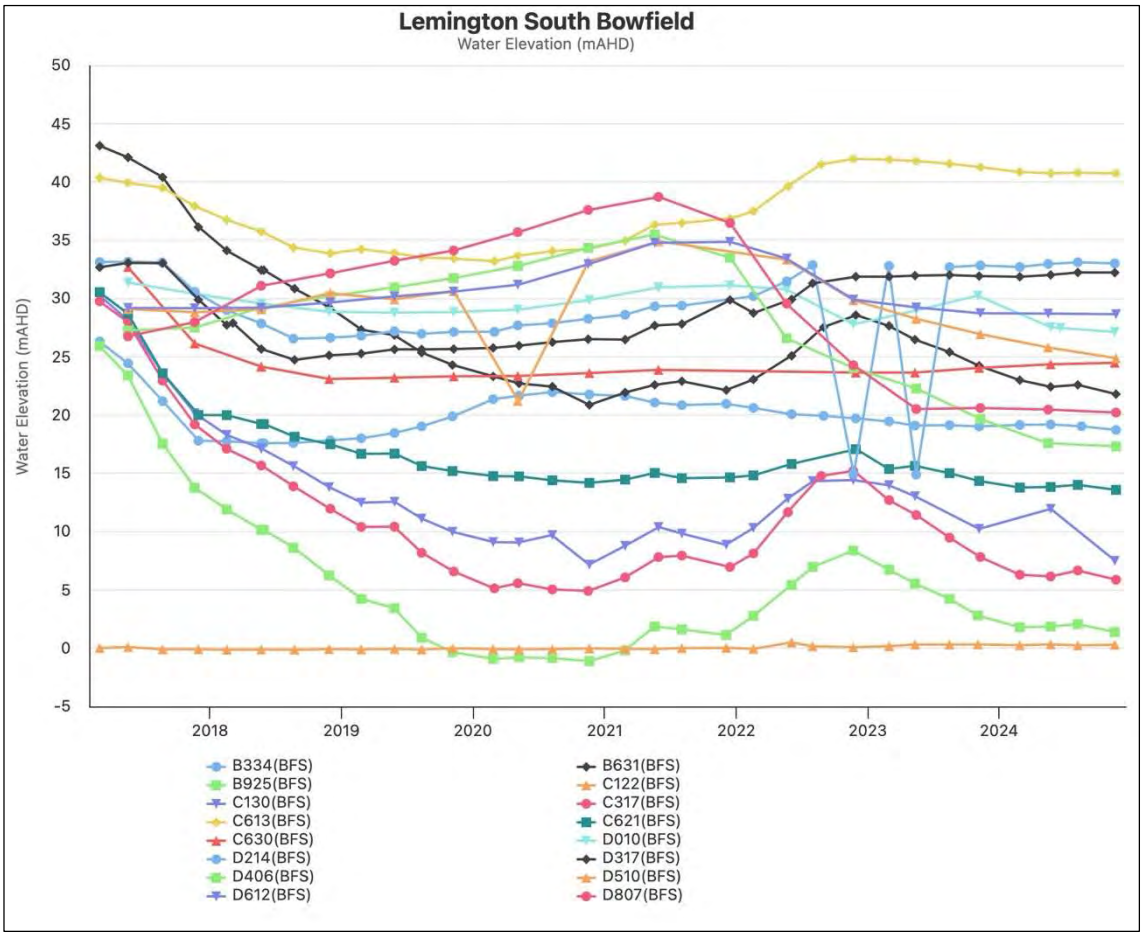


Figure 7-54: Lemington South Bowfield Groundwater SWL Trends 2017 - 2024

7.5.16 | LEMINGTON SOUTH INTERBURDEN

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-55** to **Figure 7-57**. Historical readings of C130(ALL) show regular fluctuations of pH between 6.6 and 7.2 The 2024 readings for pH are considered consistent with historical concentrations.

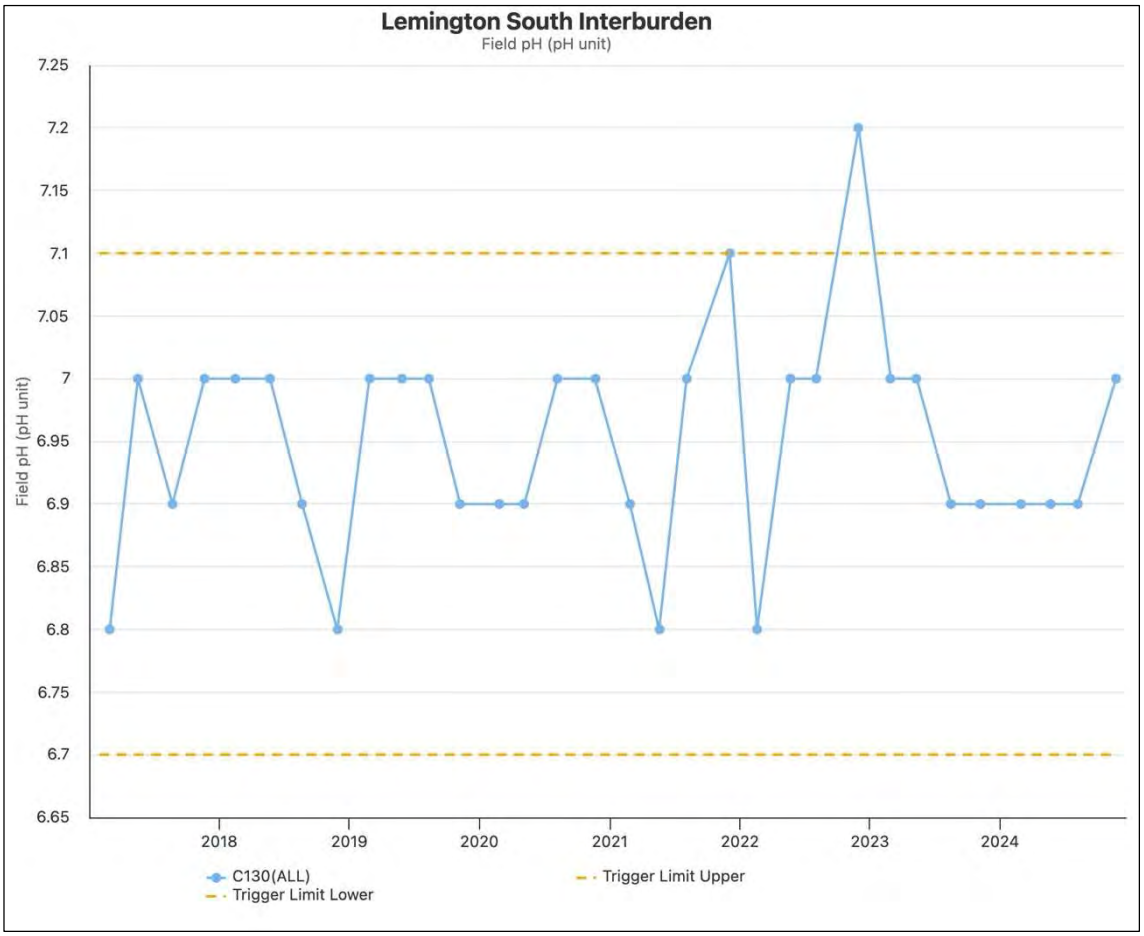


Figure 7-55: Lemington South Interburden Groundwater pH Trends 2017 - 2024

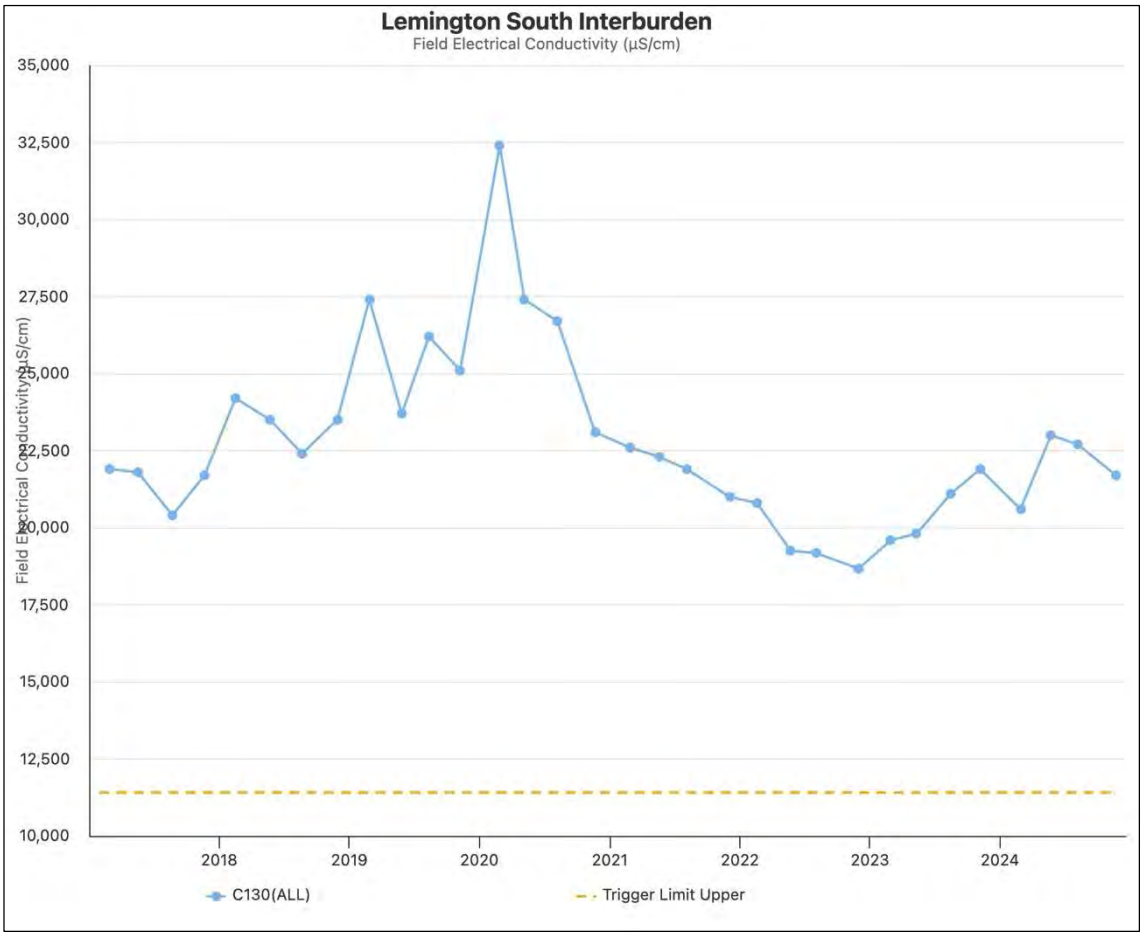


Figure 7-56: Lemington South Interburden Groundwater EC Trends 2017 - 2024

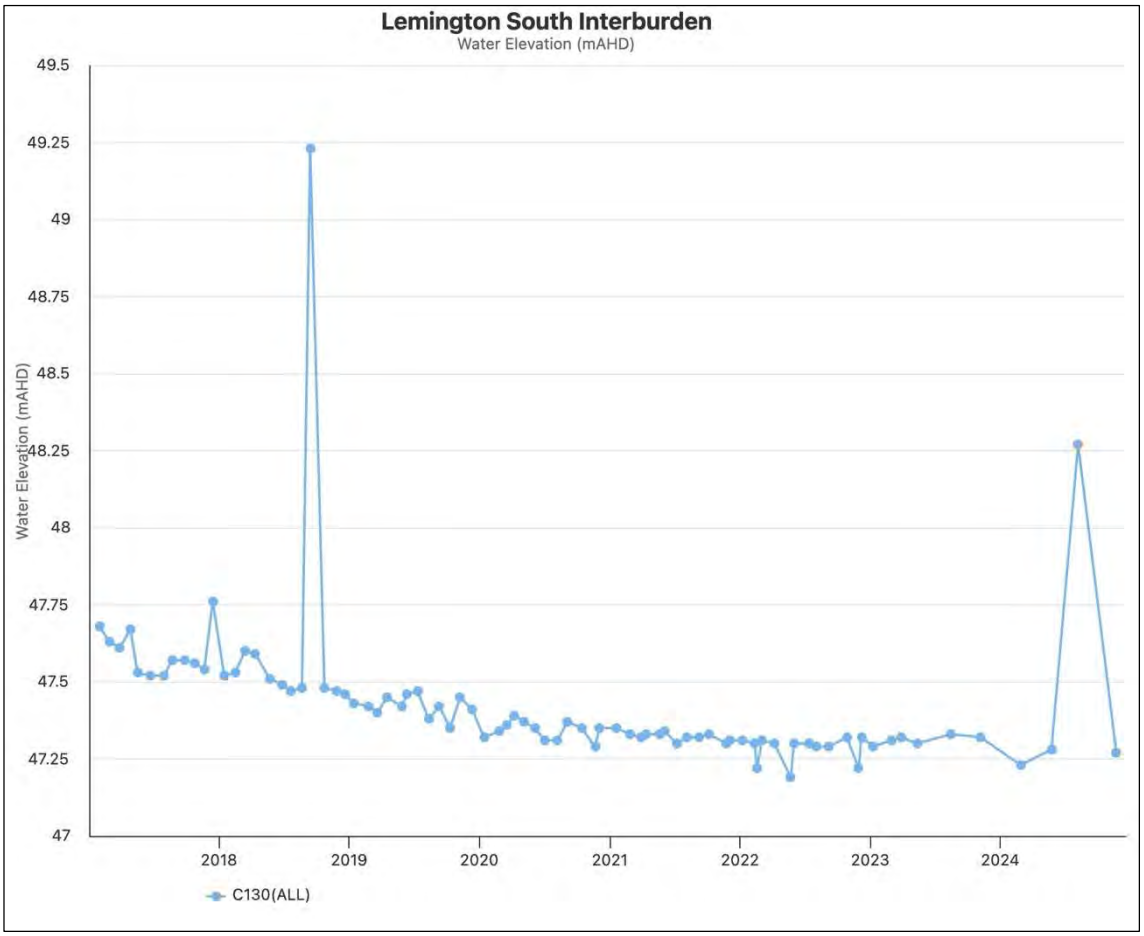


Figure 7-57: Lemington South Interburden Groundwater SWL Trends 2017 - 2024

7.5.17 | LEMINGTON SOUTH WOODLANDS HILL

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-58** to **Figure 7-60**. Water quality results were generally consistent with historical trends, with no measurements outside of trigger limits for three (3) consecutive monitoring events or greater aside from C130(WDH), with EC above trigger limits for the last 3 monitoring events. This was investigated by Umwelt in the Groundwater Annual Review (refer to **Section 5.2.4.2** of **Appendix B**).

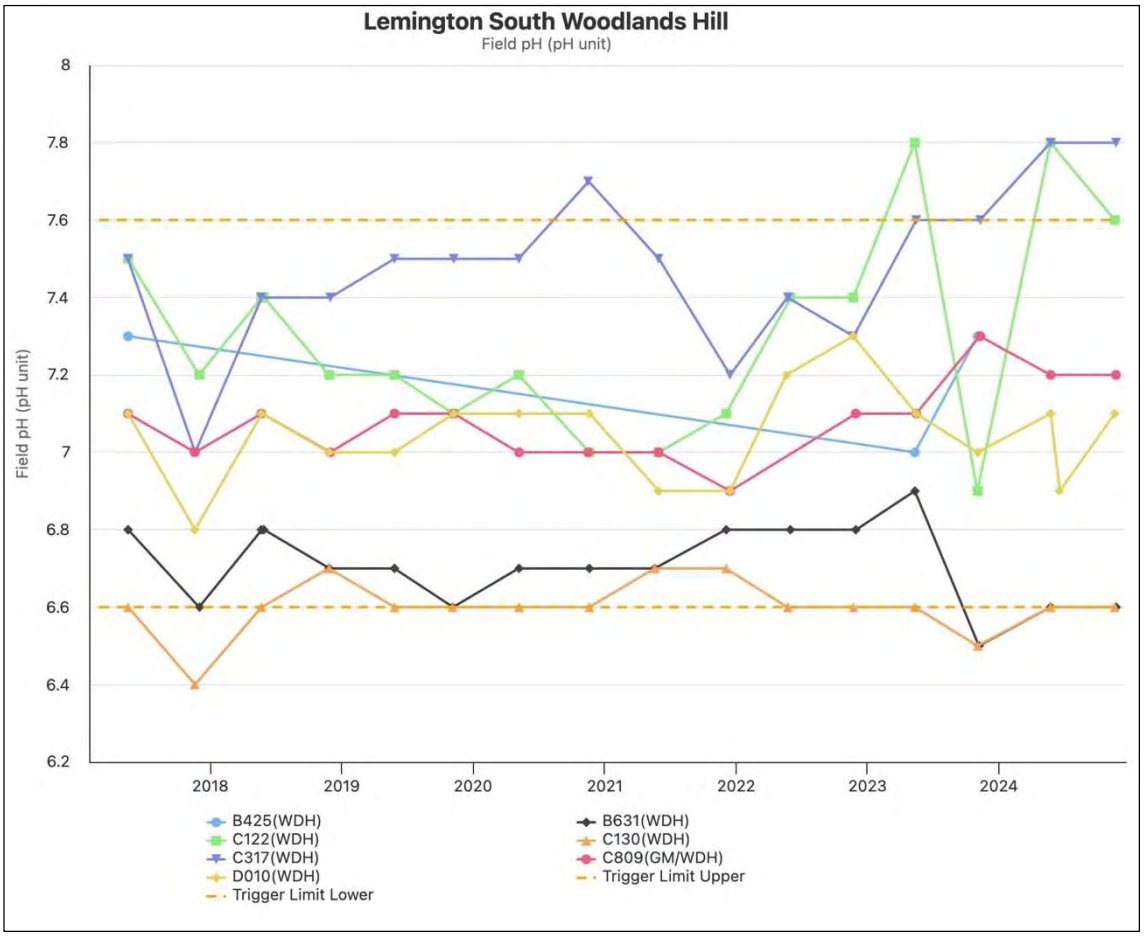


Figure 7-58: Lemington South Woodlands Hill Groundwater pH Trends 2017 – 2024

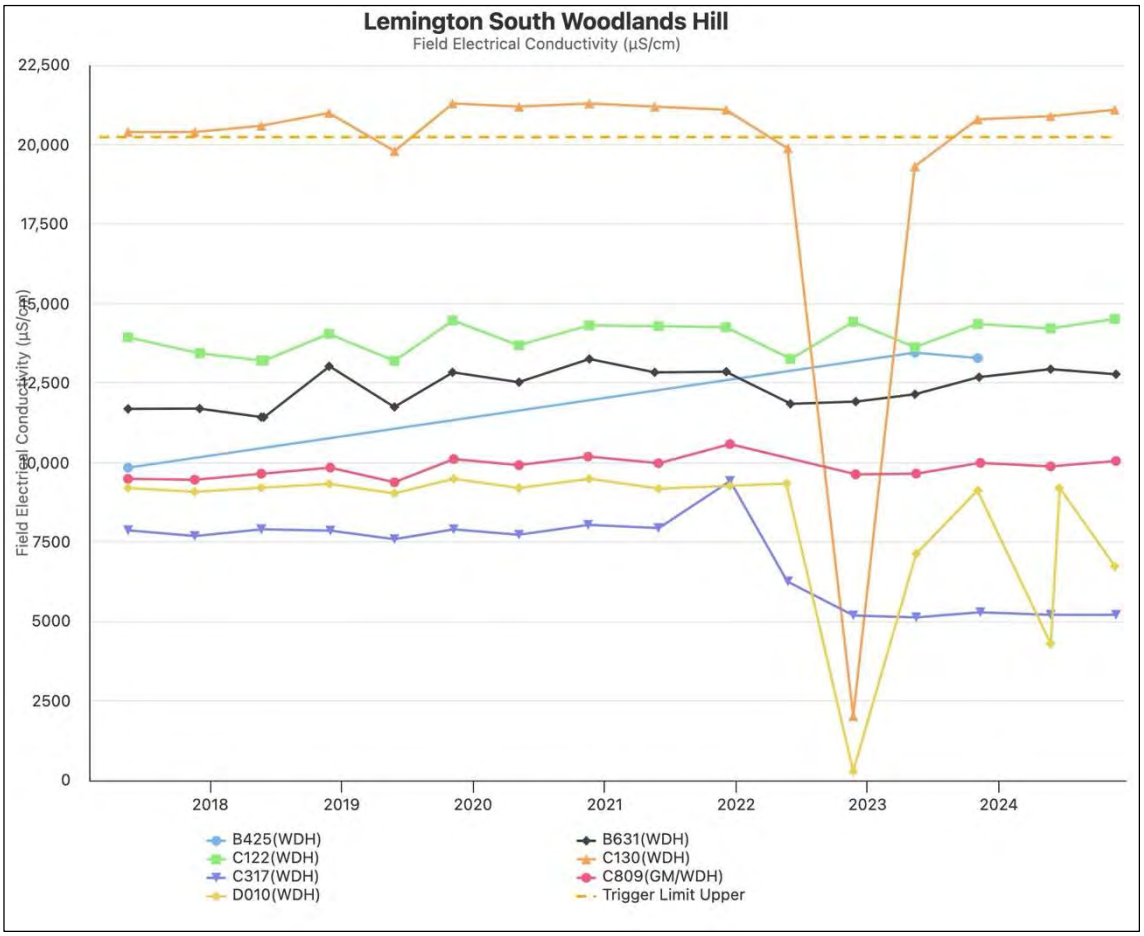


Figure 7-59: Lemington South Woodlands Hill Groundwater EC Trends 2017 - 2024

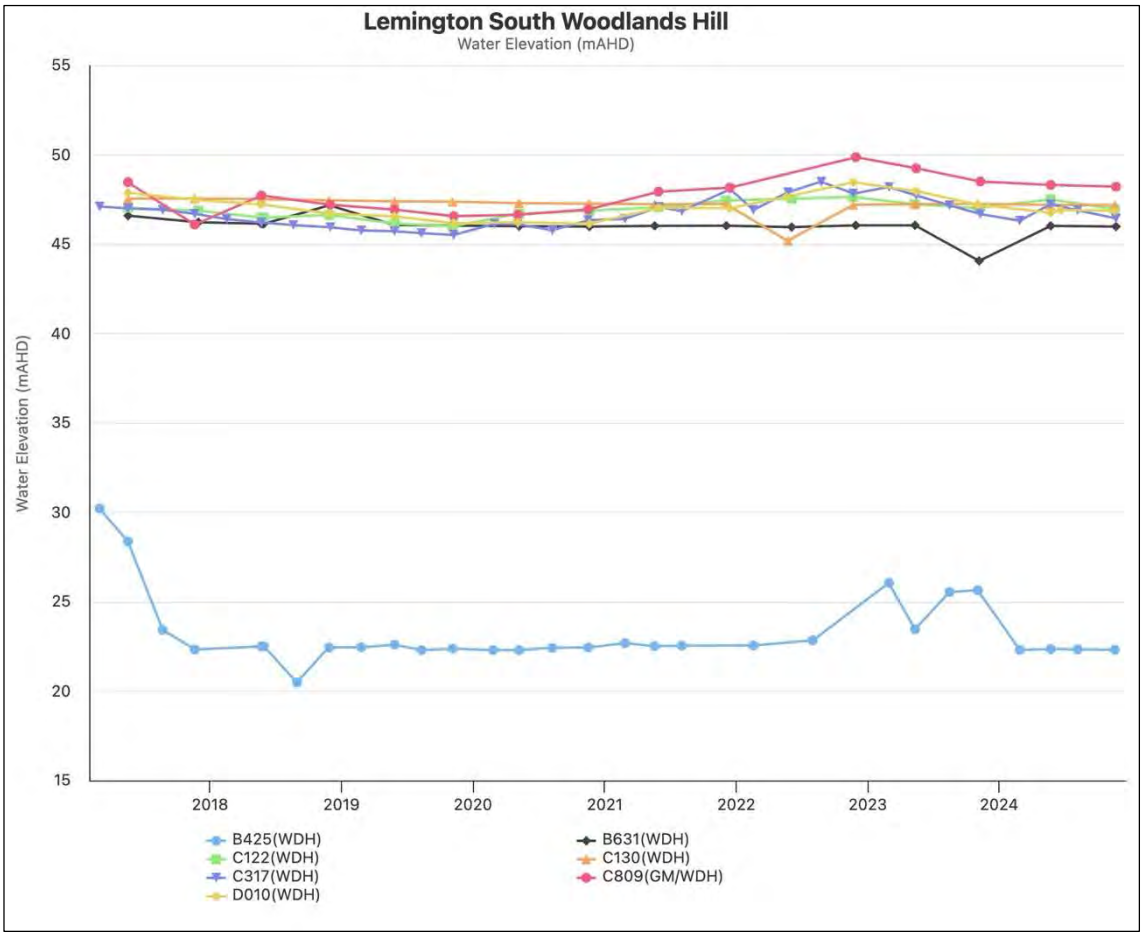


Figure 7-60: Lemington South Woodlands Hill Groundwater SWL Trends 2017 - 2024

7.5.18 | LEMINGTON SOUTH GLEN MUNRO

pH, EC and SWL trends at Lemington South Glen Munro from 2017 to 2024 are shown in **Figure 7-61** to **Figure 7-63**. Water quality results were generally consistent with historical trends.

EC levels for D010(GM) were above trigger level in Q2 and Q4. The assignment of trigger values has been removed for bore D010(GM) in the draft WMP that has been submitted to DPHI for approval.

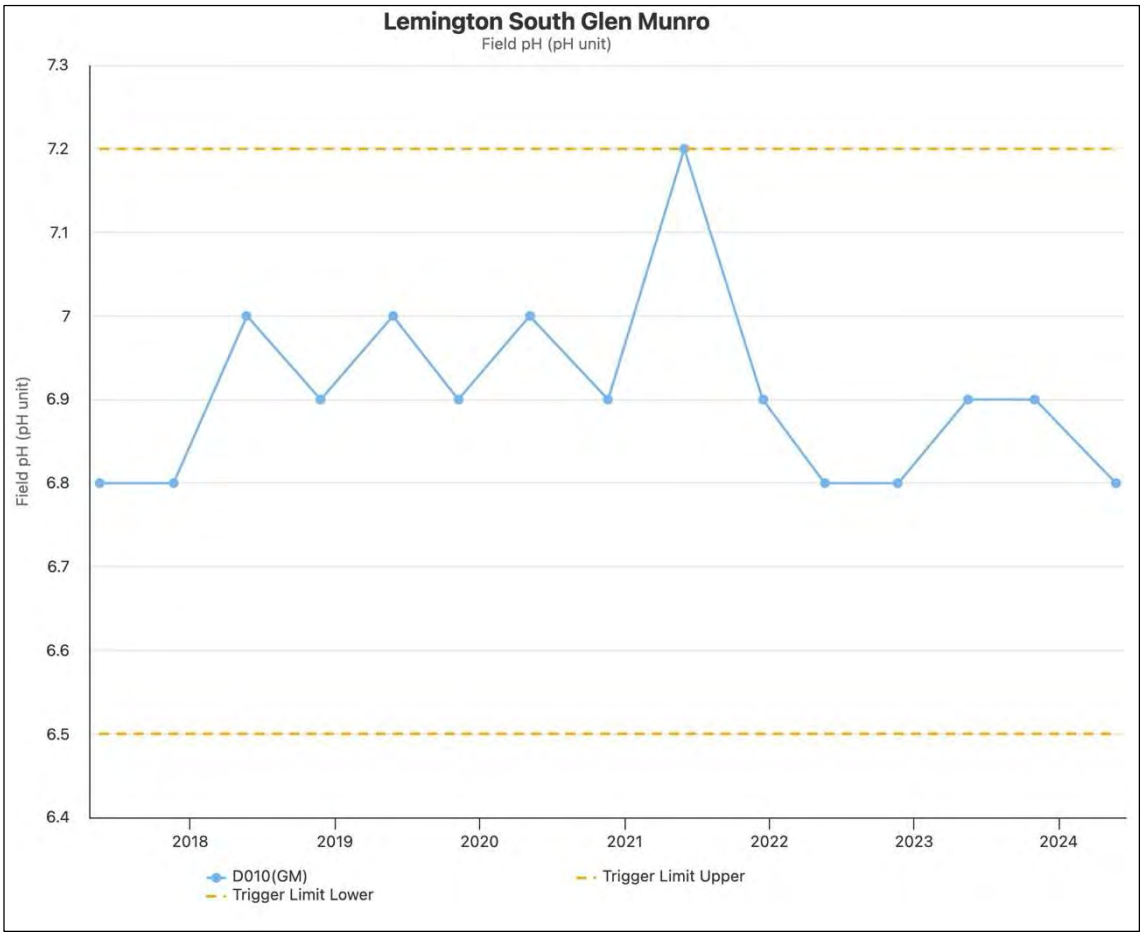


Figure 7-61: Lemington South Glen Munro Groundwater pH Trends 2017 - 2024

Figure 7-62: Lemington South Glen Munro Groundwater EC Trends 2017 - 2024

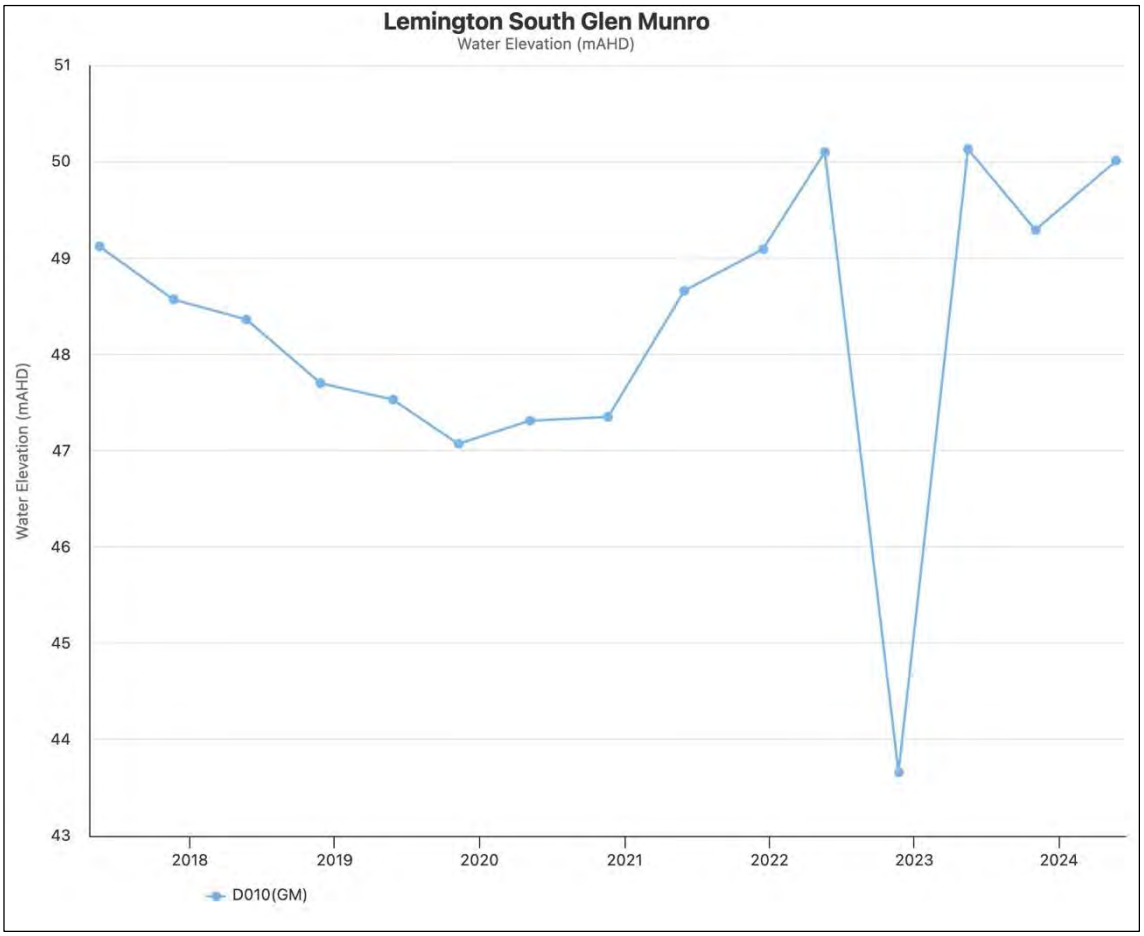


Figure 7-63: Lemington South Glen Munro Groundwater SWL Trends 2017 - 2024

7.5.19 | NORTH PIT SPOIL

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-64** to **Figure 7-66**. Groundwater within the spoil flows from northern-most bore DM1 in a southerly direction towards the southern-most bore MB14HVO03. EC and pH were found to generally be within historical levels.

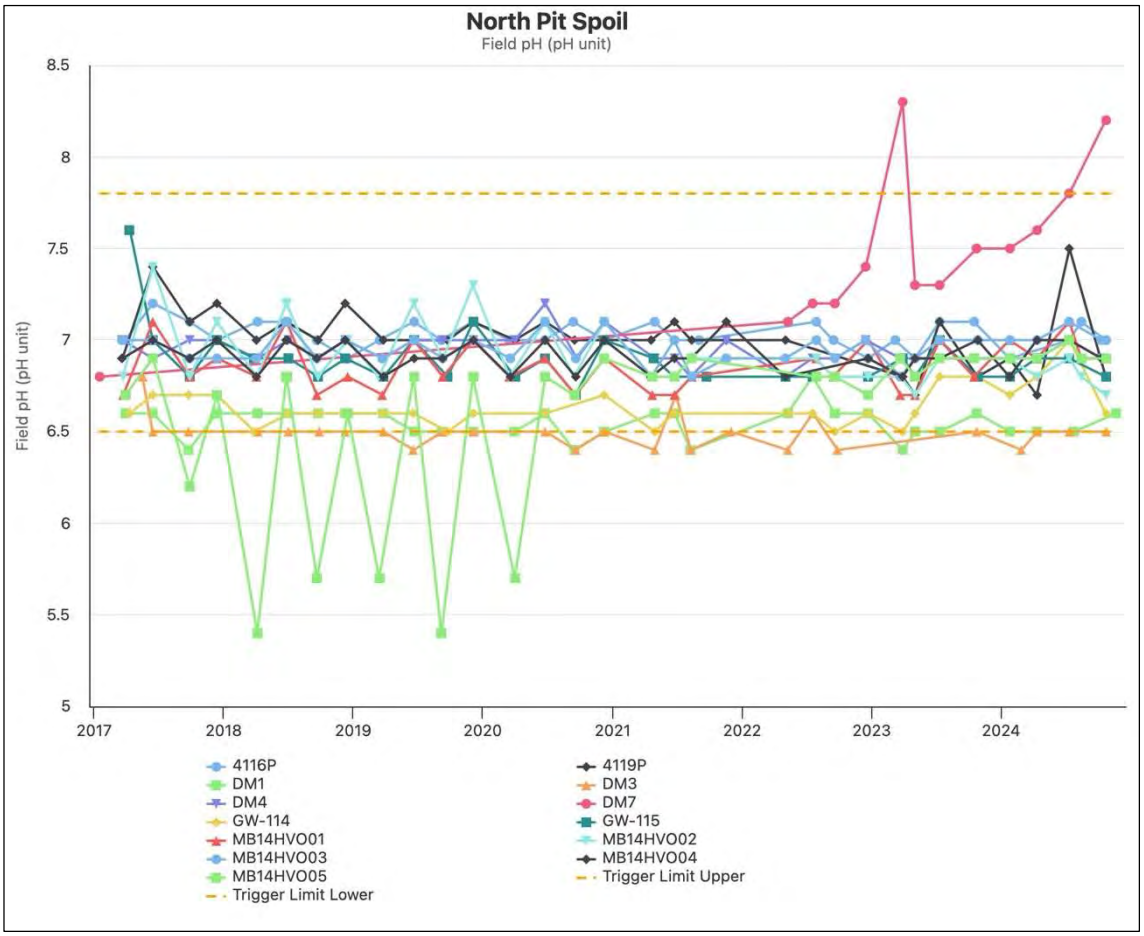


Figure 7-64: North Pit Spoil Groundwater pH Trends 2017 - 2024

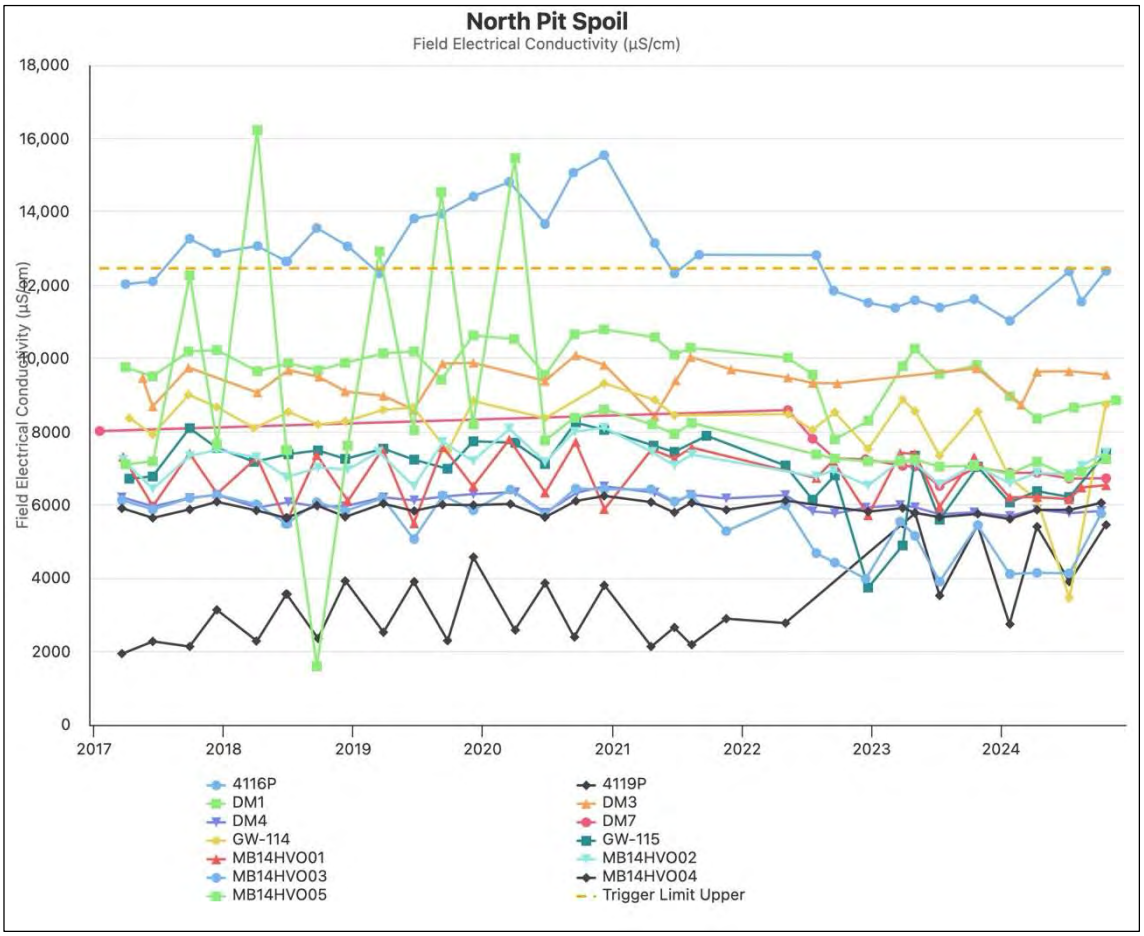


Figure 7-65: North Pit Spoil Groundwater EC Trends 2017 – 2024

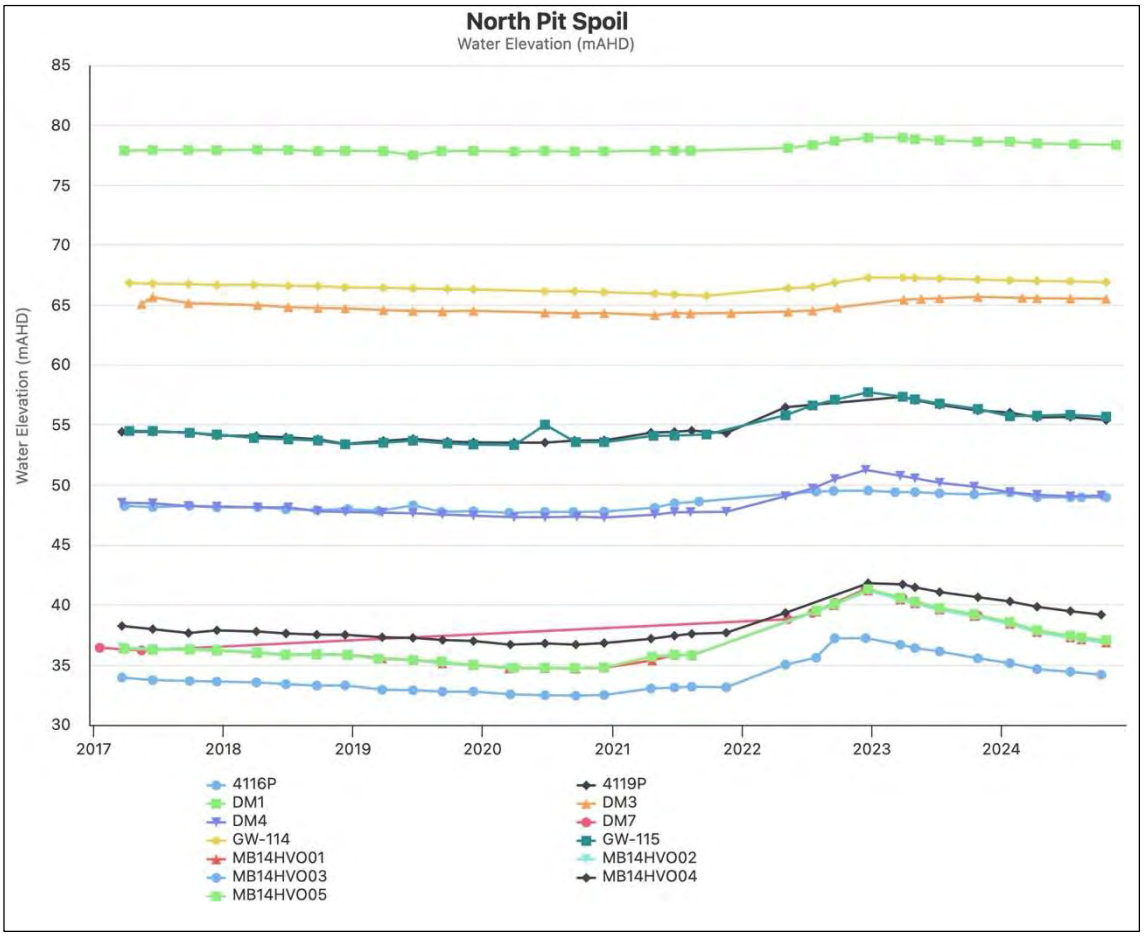


Figure 7-66: North Pit Spoil Groundwater SWL Trends 2017 - 2024

7.5.20 | WEST PIT ALLUVIUM

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-67** to **Figure 7-69**. Bore GW-101 was unable to be sampled due to insufficient water and lack of access throughout 2024. Water quality results were generally consistent with historical trends.

Bores G1, G2 and G3 continued to be monitored on a monthly basis during the reporting period. Monitoring in bores GW-100 and GW-101 was undertaken quarterly in accordance with the HVO Groundwater Monitoring Programme.

Bore GW-100 recorded consecutive EC readings above the trigger level for 2024. Prior to 2023, EC concentrations remained relatively stable. The EC exceedances are understood to be due to declining groundwater levels. Trends will continue to be monitored to determine if they are related to mining activities. Further detail on this exceedance is presented in **Appendix B**.

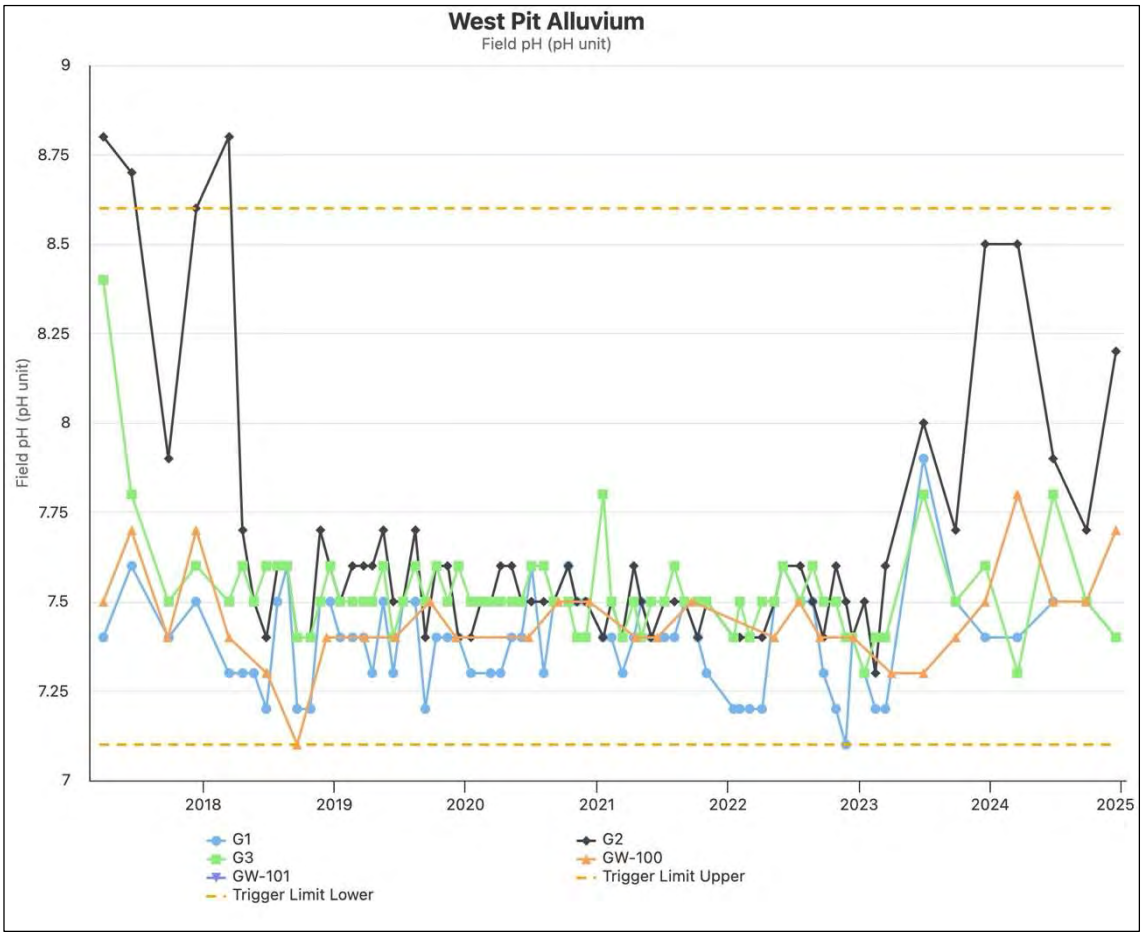


Figure 7-67: West Pit Alluvium Groundwater pH Trends 2017 - 2024

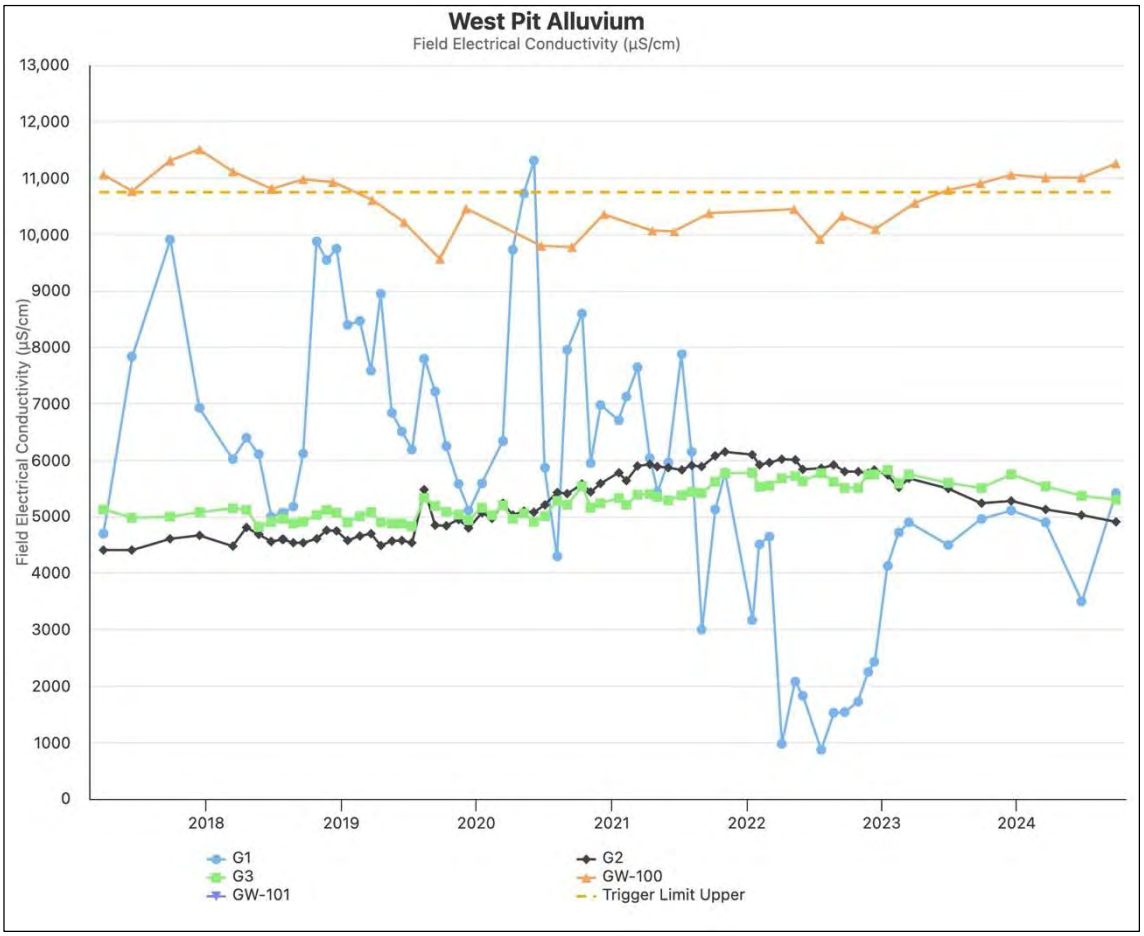


Figure 7-68: West Pit Alluvium Groundwater EC Trends 2017 - 2024

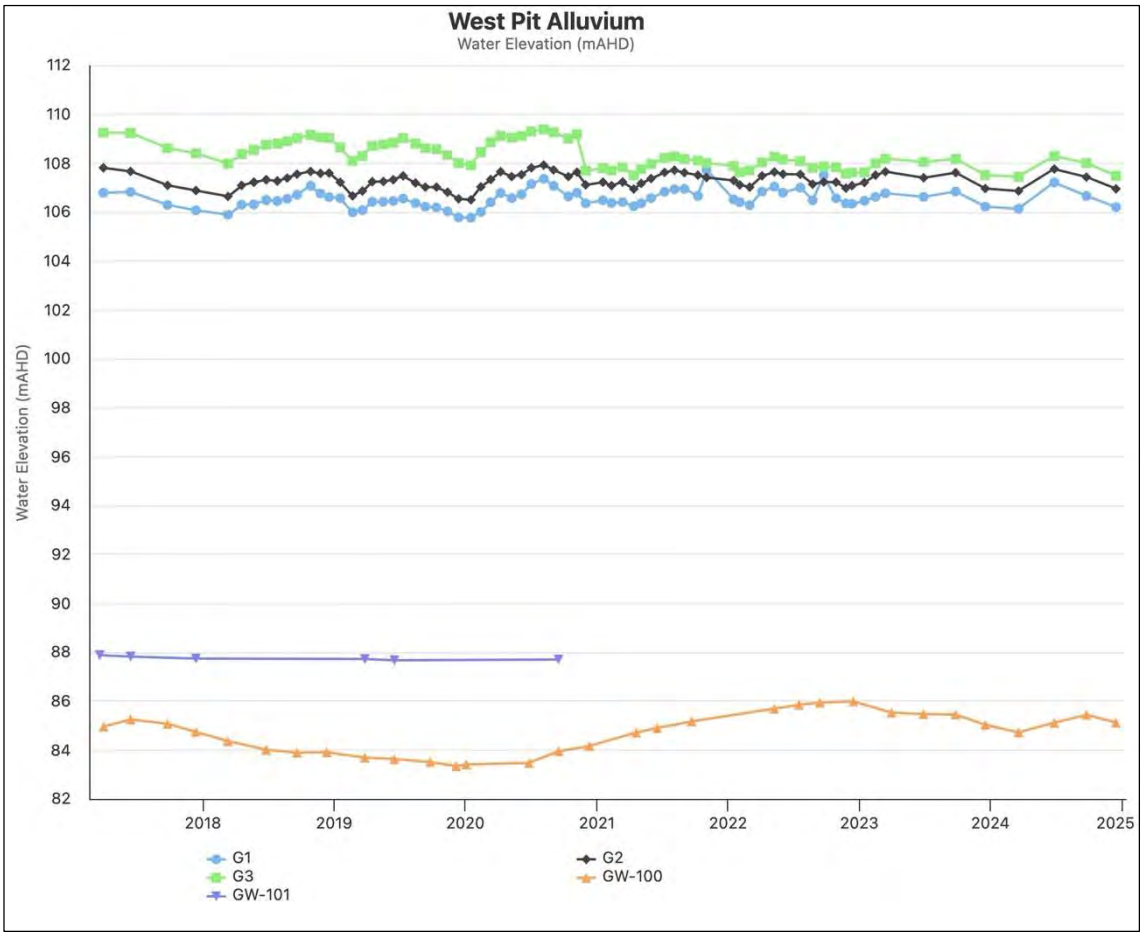


Figure 7-69: West Pit Alluvium Groundwater SWL Trends 2017 - 2024

7.5.21 | WEST PIT SANDSTONE/SILTSTONE

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-70** to **Figure 7-72**. Water quality results were generally consistent with historical trends.

EC was above trigger limit at NPZ2 for all readings during the monitoring period. NPZ2 is located northwest of West Pit beyond the outcrop of coal seams mined at West Pit and intersects Interburden sequences beneath the coal seams. EC readings range from 12,590 µS/cm (December 2014) and 19,400 µS/cm (December 2009). The 2024 readings are consistent with historical concentrations. The 2019 Groundwater Network Review (SLR, 2019a) noted that the bore is unlikely to detect relevant site impacts and recommended removal from the compliance monitoring network but kept in operational monitoring network for future work. The bore has already been removed from the compliance monitoring network in version 3.4 of the WMP which is currently with DPHI for approval.

Further discussion of NPZ2 levels is presented in **Table 6.2** of **Appendix B**.

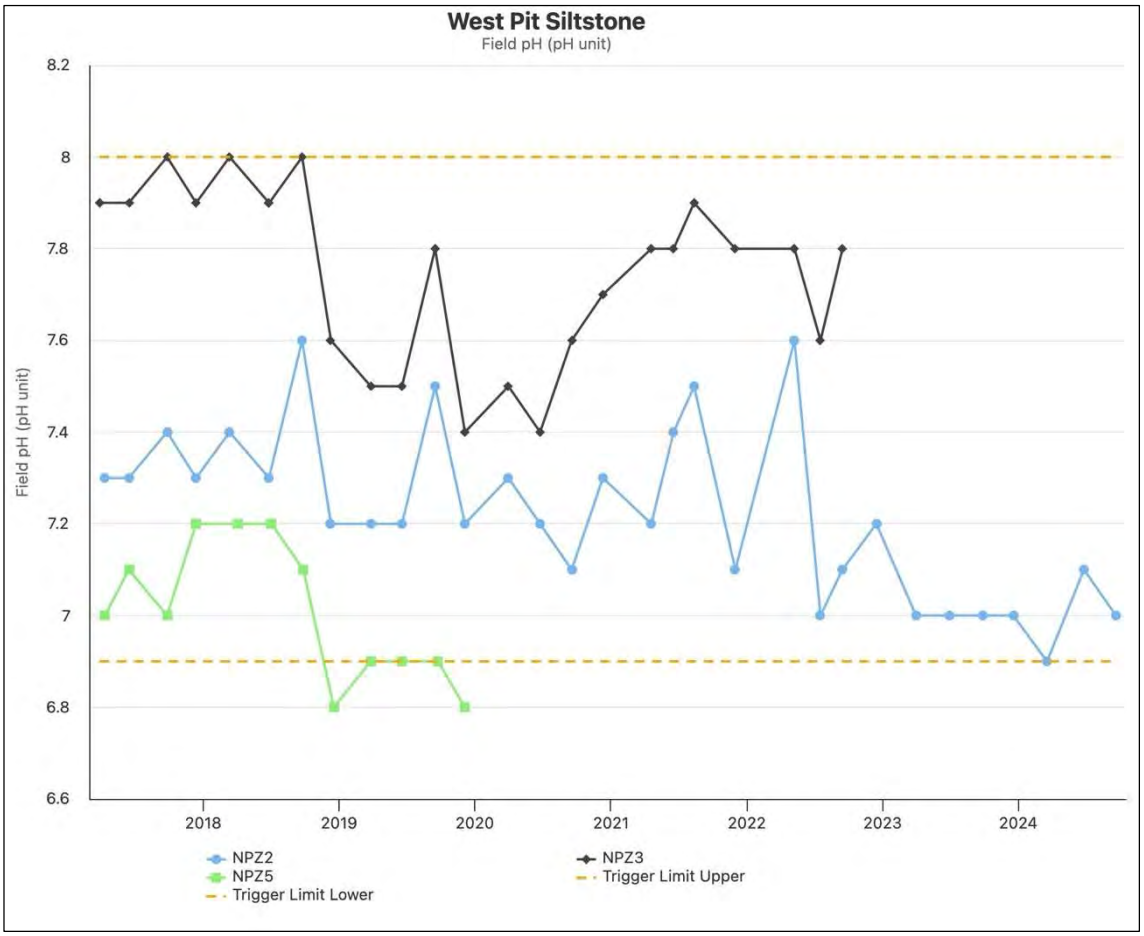


Figure 7-70: West Pit Sandstone/Siltstone Groundwater pH 2017 - 2024

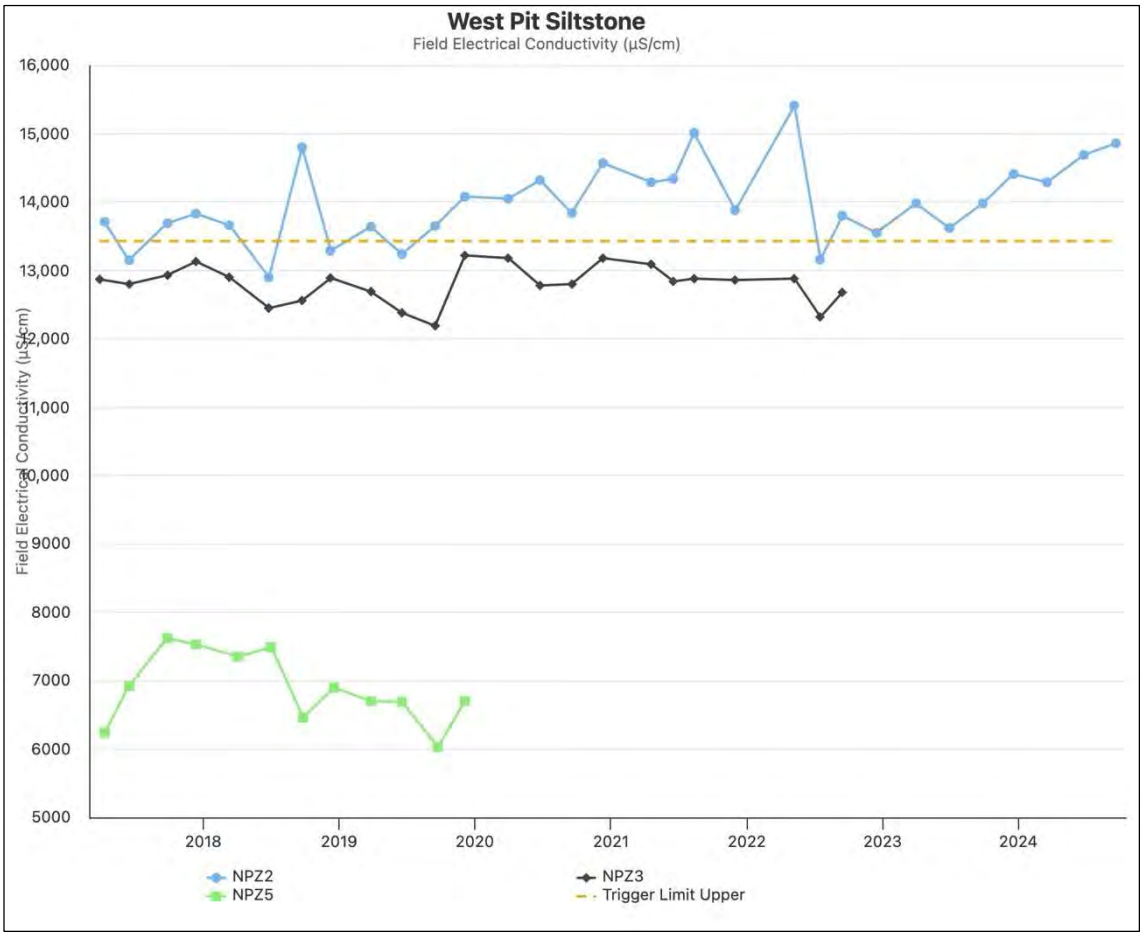


Figure 7-71: West Pit Sandstone/Siltstone Groundwater EC Trends 2017 - 2024

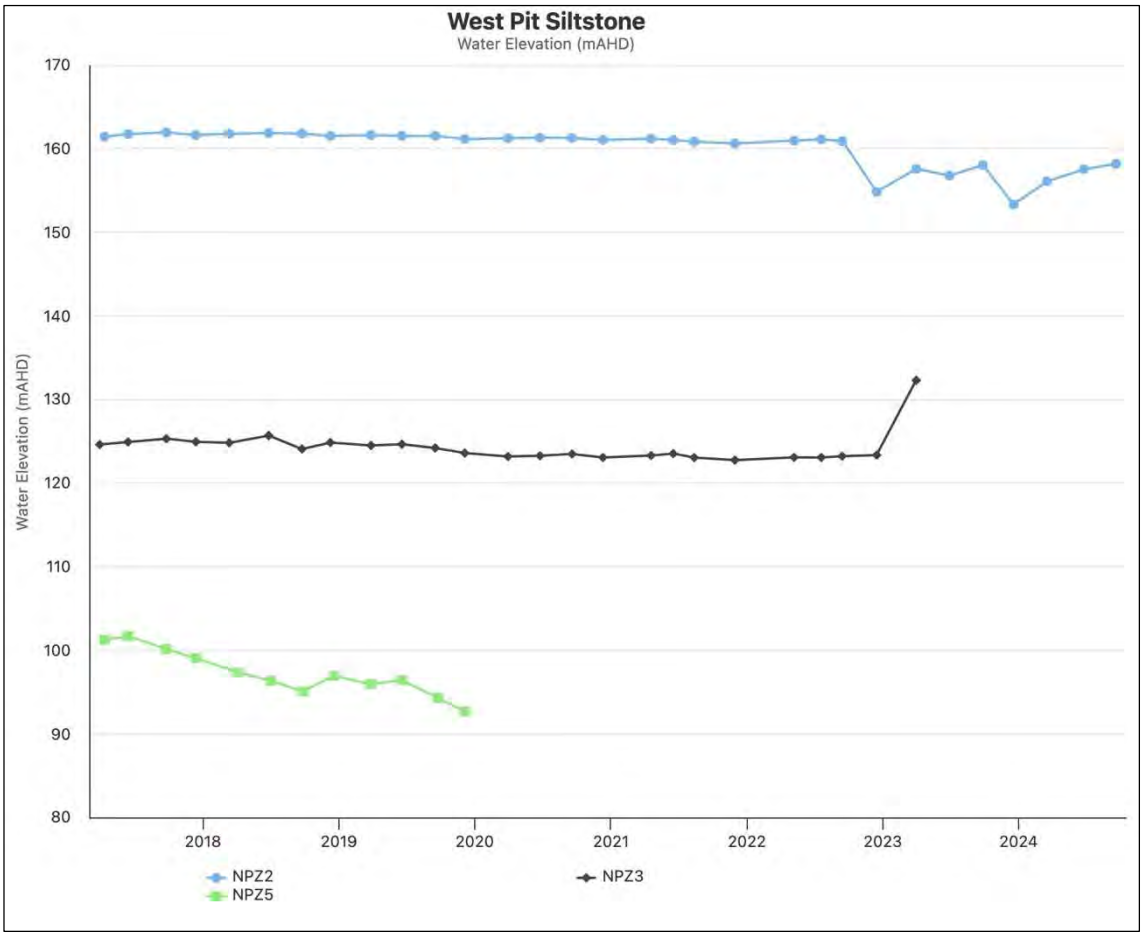


Figure 7-72: West Pit Sandstone/Siltstone Groundwater SWL Trends 2017 – 2024

7.5.22 | CARRINGTON WEST WING BAYSWATER

The pH, EC and SWL trends for 2017 to 2024 are shown in **Figure 7-73** to **Figure 7-75**. Water quality results showed a drop in EC and SWL. Bore CGW46 recorded pH below the lower trigger level in Q1, Q2 and Q4. Historical pH readings for the bore since 2005 show regular fluctuations of between 7.1 and 7.8. The 2023 readings ranging from 7.0 to 7.3 are considered consistent with historical concentrations, with no adverse impacts identified. The bore was successfully cleaned and purged by AECOM during 2024 and was reassessed using a borehole camera during 2024.

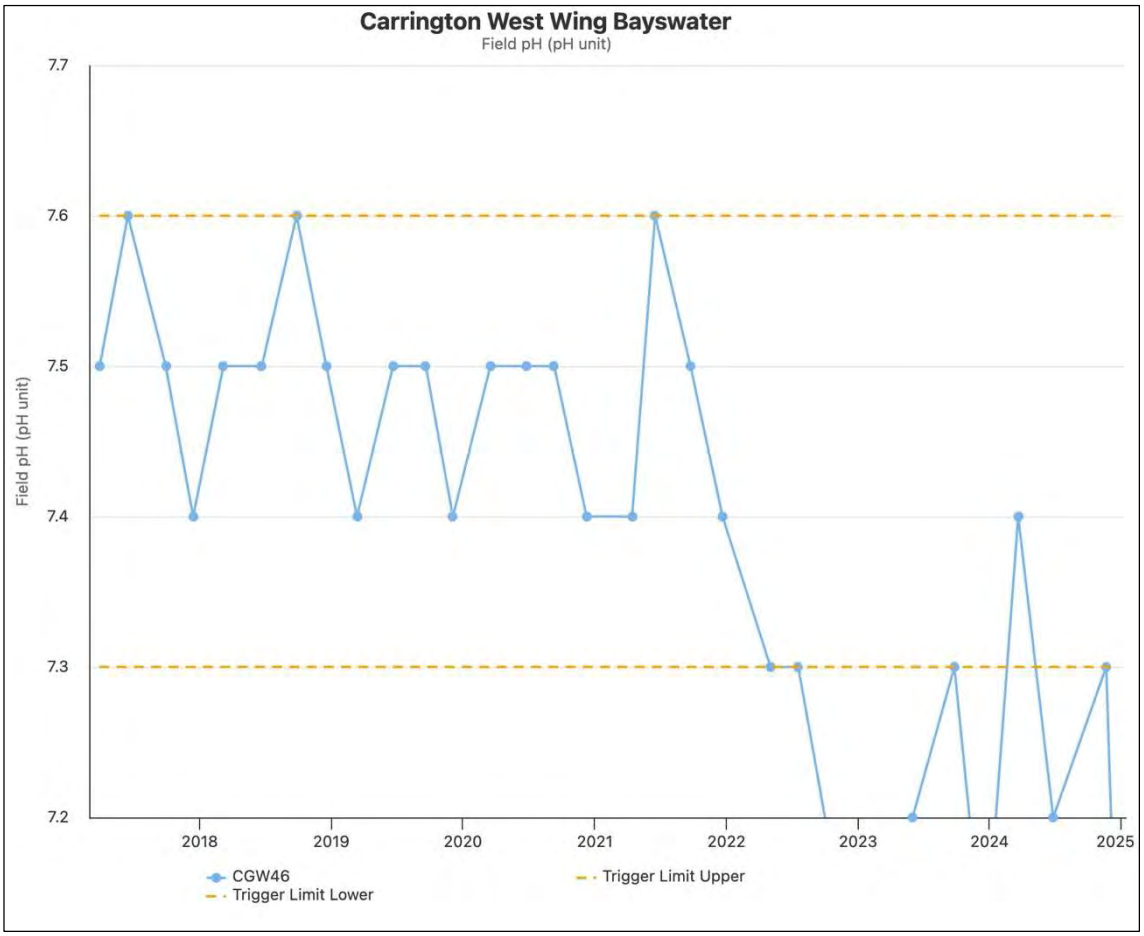


Figure 7-73: Carrington West Wing Bayswater Groundwater pH Trends 2017 to 2024

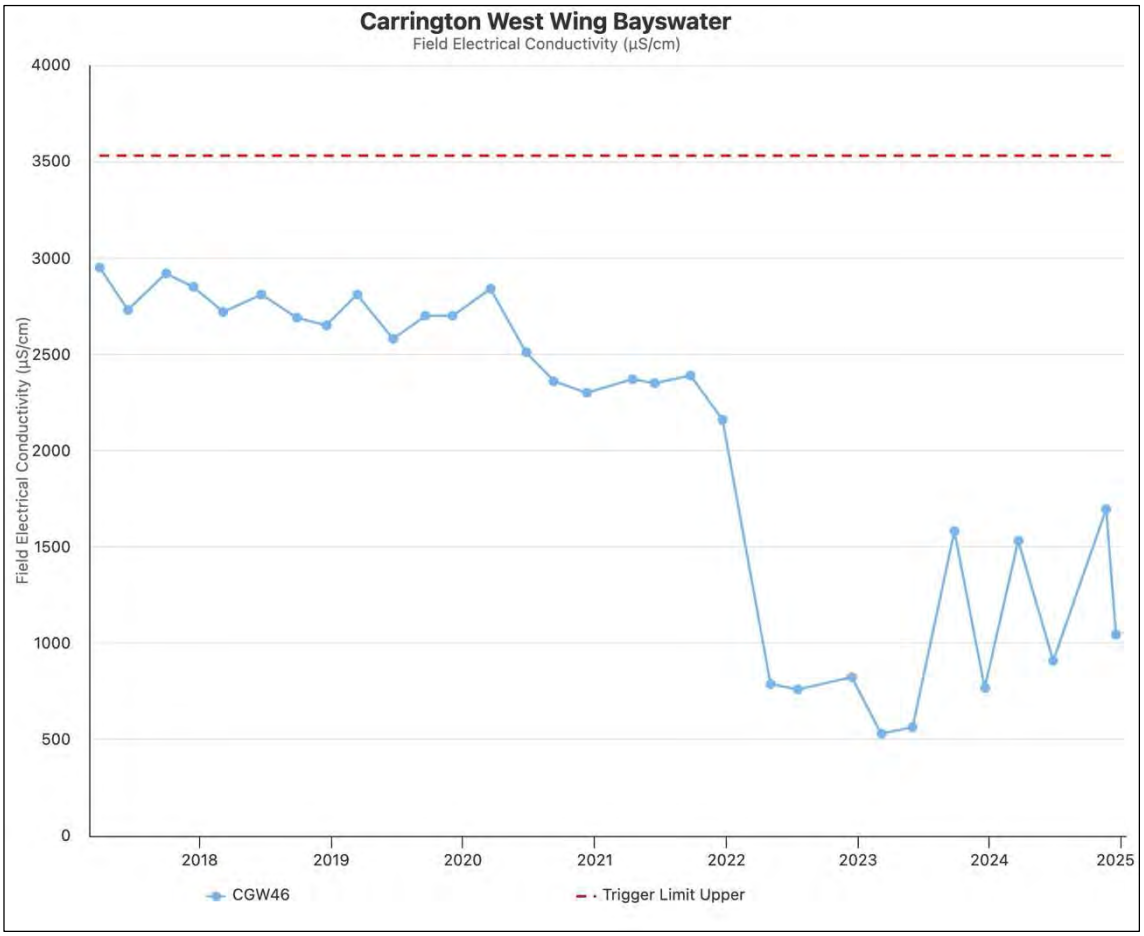


Figure 7-74: Carrington West Wing Bayswater Groundwater EC Trends 2017 to 2024

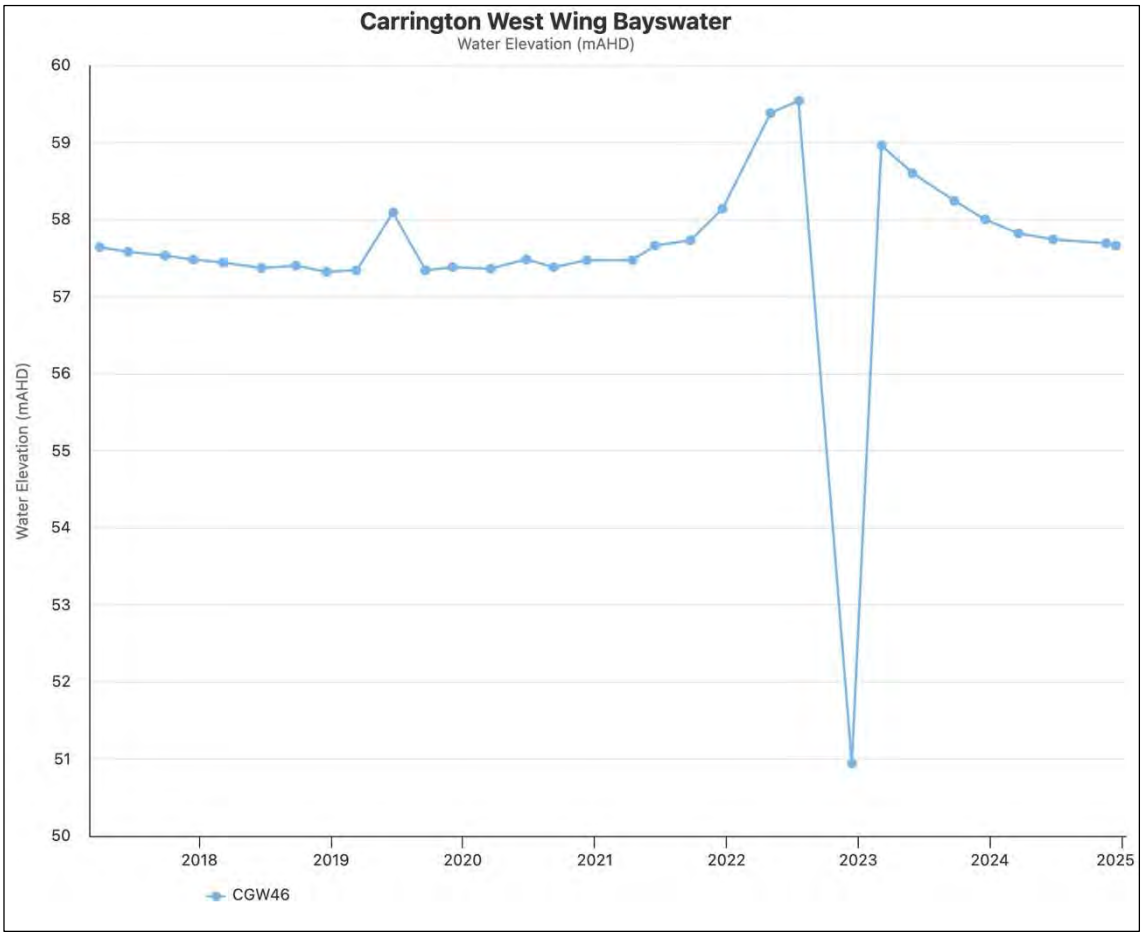


Figure 7-75: Carrington West Wing Bayswater Groundwater SWL Trends 2017 to 2024

7.6 | COMPENSATORY WATER SUPPLY

During 2024 HVO did not provide compensatory water supply or alternate compensation in lieu of compensatory water supply under any new or existing agreements, and circumstances which may trigger a requirement to provide a compensatory water supply were not identified.

7.7 | PROGRESS AGAINST RECOMMENDATIONS IN 2022 ANNUAL GROUNDWATER REVIEW

A number of recommendations were made in the Annual Groundwater Monitoring Review produced by Umwelt (Appendix B of the 2023 Annual Review) in **Section 9**. Progress against these actions is shown in **Table 7-6**.

Table 7-6: Progress Against Recommendations in 2023 Annual Groundwater Review

Recommendation	Progress in 2024
4051C - Bore is blocked. Recommend the condition of the bore is checked with a downhole camera and if bore is irreparable, it should be removed from the WMP.	Bore repaired and monument reinstated in Q1 2025.
B425(WD) - Verify the depth of the base of screen and total depth. If current bore details are correct the bore should be removed from the WMP, and ongoing monitoring be conducted at nearby bore C130(WDH). Groundwater levels have been below the base of the screen at B425(WDH) since 2017.	Depth of base of screen and total depth verified in 2024. It is noted that B425(WDH) has been removed from revised WMP which is awaiting DPHI approval.
BZ2A(1) - Water quality exceedance during the reporting period. Recommend the bore condition and construction details are checked and the pH trigger levels be reviewed. Comprehensive water quality analysis should be undertaken to help determine the cause of the declining pH trend. It is noted that the bore has already been removed from the compliance monitoring network in version 3.4 of the WMP which is currently with DPHI for approval.	Updated in revised WMP. Awaiting DPHI approval.
BZ3-3 - Water quality exceedance during the reporting period. The bore is a 25 mm diameter bore, which is hindering water quality sampling and should be removed from the monitoring schedule.. It is noted that the bore has already been removed from the compliance monitoring network in version 3.4 of the WMP which is currently with DCCEEW for approval.	Updated in revised WMP. Awaiting DPHI approval. Depth of base of screen and total depth confirmed in 2024.
BZ4A(2) - Provide screen interval depth collected in 2024 by AECOM. If current bore details are correct the bore should be removed from the WMP but kept as part of the operational monitoring network for ongoing monitoring of groundwater recovery post mining. Water quality samples should not be collected if the groundwater level is below the base of the screen.	Depth of base of screen and total depth confirmed. Water level below screen, water samples not taken as too low. To be removed from WMP.
C130(WDH) - Revise EC and pH trigger levels in the draft WMP as water quality data trends indicate the trigger will continue to exceed the trigger levels in the draft WMP which is currently with DPHI for approval.	Updated in revised WMP. Awaiting DPHI approval. Bore purged and re-sampled Q1 2025.
C630(BFS) - Water quality exceedance during the reporting period. Recommend that the proposed pH and EC trigger levels are revised before finalising version 3.4 of the WMP which is currently with DPHI for approval.	PH & EC trigger levels revised by Groundwater specialist prior to submitting WMP v3.4.
CFW55R - Groundwater level trigger exceedance during the reporting period. Revised water level trigger level already updated in version 3.4 of the WMP, which is currently with DPHI for approval.	Updated in revised WMP. Awaiting DPHI approval.
CFW55R - Water quality exceedance during the reporting period. It is noted that the trigger level has already been reviewed and updated to 11,510 µS/cm in version 3.4 of the WMP which is currently with DPHI for approval. Current EC readings will be below the revised trigger level.	Updated in revised WMP. Awaiting DPHI approval.
CFW57 - Groundwater level trigger exceedance during the reporting period. Revised water level trigger level already updated in version 3.4 of the WMP, which is currently with DPHI for approval.	Updated in revised WMP. Awaiting DPHI approval.

Recommendation	Progress in 2024
CGW39 - Check the condition and location of the bore and confirm if it is screened within alluvium or spoil.	Screens inspected with camera in 2024. Nothing visible of concern to note.
CGW45 - Bore has been blocked and unable to be monitored since 2018. Bore has been checked and an extension has been added to increase the height of the casing above the ground surface to avoid further blockages. Work is continuing to clear the existing blockage and reinstating the bore.	Bore scheduled to be unblocked Q2 2025.
CGW51a - Bore CGW51a should be decommissioned to minimise potential mixing due to the construction of the bore and a new bore be installed within the spoil material to replace CGW51a. It is noted that bore CGW51a has been removed from the draft WMP which is awaiting approval.	Updated in revised WMP. Awaiting DPHI approval. New bore scheduled for installation in 2025.
CGW53a - Groundwater level trigger exceedance during the reporting period. Revised water level trigger level already updated in version 3.4 of the WMP, which is currently with DPHI for approval.	Updated in revised WMP. Awaiting DPHI approval.
CGW55a - Groundwater level trigger exceedance during the reporting period. Revised water level trigger level already updated in version 3.4 of the WMP, which is currently with DPHI for approval.	Updated in revised WMP. Awaiting DPHI approval.
D510(AFS) - Bore blocked in May 2022. Check condition of bore and casing with a downhole camera. If unable to be remediated, remove from the WMP.	Bore blocked and damaged. Remove from WMP. Bore repaired and monument reinstated January 2025.
G1 - The condition of bore G1 is checked to determine the cause of the water quality fluctuations.	Water quality results have been stable since January 2023. Potentially impacted previously to increased rainfall in 2022.
GW-103 - The sensors have been checked and are irreparable. The VWP will be removed from the draft WMP.	Updated in revised WMP. Awaiting DPHI approval.
GW-105 - Check the VWP sensors as the deepest sensor has failed and is no longer recording data.	The deepest sensor (VW3) has failed due to an open circuit and is no longer recording data. The sensor should be removed from the revised WMP and the monitoring schedule.
GW-106 - Water quality exceedance during the reporting period. It is noted that the bore has already been removed in version 3.4 of the WMP, which is currently with DPHI for approval.	Updated in revised WMP. Awaiting DPHI approval.
GW-109 - Check the VWP sensors as the deepest sensor (VW3) has failed and no longer recording data. Local site conditions and the condition of the GW-109 should be reviewed, and groundwater conditions within the spoil in Carrington Pit continue to be monitored to determine if the difference between sensors VW1 and VW2 is due to sensor drift or an additional source of recharge to the shallow stratigraphy.	Status of VW3 and site condition to be assessed during 2024. Results seem consistent after new battery installation.
GW-110 - Calibration data from VWP installation required, if available, to convert raw data to water levels.	Calibration data unavailable for conversion. To be decommissioned as per recommendation in Annual GW Report Appendix

Recommendation	Progress in 2024
NPz2 - Water quality exceedance during the reporting period. It is noted that the bore has already been removed from the compliance monitoring network in version 3.4 of the WMP which is currently with DPHI for approval. Bores NPz2 and NPz3 remain in the monitoring program to assist with future assessments and assessment of post closure groundwater conditions.	Updated in revised WMP. Awaiting DPHI approval. Bore NPz3 scheduled for replacement Q4 2025.

8 | REHABILITATION AND LAND MANAGEMENT

8.1 | SUMMARY OF REHABILITATION

Rehabilitation at HVO is undertaken in accordance with commitments made in 2024-2026 Forward Works Program (FWP) and Rehabilitation Management Plan (RMP).

A summary of the key rehabilitation performance indicators is shown in **Table 8-1**.

Table 8-1: Key Rehabilitation Performance Indicators

Mine Area Type	Previous Reporting Period (Actual) Year 2023 (ha)	This Reporting Period (Actual) Year 2024 (ha)	Next Reporting Period (Forecast) Year 2025 (ha)
A. Total disturbance footprint[1]	6964.78	7233.83	7393.18
B. Total active disturbance[2]	4161.10	4303.28	4473.62
C. Growth medium development[3]	138.69	44.75	34.00
D. Land under active rehabilitation[4]	2803.69	2930.55	2919.56
E. Completed rehabilitation[5]	0.00	0.00	0.00

8.2 | REHABILITATION OVERVIEW

A summary of rehabilitation completed in 2024 is shown in **Table 8-2**.

[1] **Total mine footprint** includes all areas within a mining lease that either have at some point in time or continue to pose a rehabilitation liability due to mining and associated activities. As such it is the sum of total active disturbance, decommissioning, landform establishment, growth medium development, ecosystem establishment, ecosystem development and relinquished lands (as defined in NSW RR Guidelines). Please note that subsidence remediation areas are excluded

[2] **Total active disturbance** includes all areas ultimately requiring rehabilitation such as: on-lease exploration areas, stripped areas ahead of mining, infrastructure areas, water management infrastructure, sewage treatment facilities, topsoil stockpiles areas, access tracks and haul road, active mining areas, waste emplacements (active/unshaped/in or out-of-pit), and tailings dams (active/unshaped/uncapped).

[3] **Growth medium development** – includes the sum of mine disturbed land that is under the following rehabilitation phases – decommissioning, landform establishment and growth medium development (as defined in NSW RR Guidelines).

[4] **Land under active rehabilitation** – includes areas under rehabilitation and being managed to achieve relinquishment – includes the following rehabilitation phases– “ecosystem and land use establishment” or “ecosystem land use development” as described in the NSW RR Guidelines

[5] **Completed rehabilitation** – requires formal sign off by the NSW RR that the area has successfully met the rehabilitation land use objectives and completion criteria.

Table 8-2: Summary of New Rehabilitation Completed in 2024

Rehabilitation Site Name	Rehabilitation Type	Seed Mix	Area (ha)	Summary
HVORIV202401	New Rehabilitation	Woodland	5.53	Final landform sown with final cover
HVOCHE202401	New Rehabilitation	Pasture	0.65	Final landform sown with final cover
HVOWES202401	New Rehabilitation	Pasture	0.71	Final landform sown with final cover
HVOWES202402	New Rehabilitation	Pasture	2.98	Final landform sown with final cover
HVORIV202402	New Rehabilitation	Pasture	6.89	Final landform sown with final cover
HVOCHE202402	New Rehabilitation	Woodland	25.54	Final landform sown with final cover
HVOCAR202402	New Rehabilitation	Pasture	27.17	Final landform sown with final cover
HVOCAR202401	GMD	Pasture	88.51	Final landform sown with final cover
TOTAL REHABILITATION			**157.98**	

8.3 | REHABILITATION PERFORMANCE

A total of 157.98 ha rehabilitation was undertaken during 2024, including 69.47 ha of new rehabilitation, and 88.51 ha of Growth Media Development (GMD) progression. Details of the rehabilitation areas completed during 2024 are provided in **Figure 8-1** and **Figure 8-2**.

Table 8-3 details the amount of rehabilitation and disturbance completed during the reporting period compared with proposed area in the respective FWP.

Table 8-3: Summary of Rehabilitation and Disturbance Completed in 2024

FWP	2023 Totals (ha)	
	Actual	Proposed FWP (2023)
Rehabilitation		
HVO North	30.86	30.54
HVO South	38.61	38.41
GMD North	88.51	88.51
GMD South	0	0
HVO Total	157.98	157.46
Rehabilitation Disturbance		
HVO North	20.01	6.53
HVO South	14.85	9.90
HVO Total	34.86	16.44
New Disturbance		
HVO North	262.70	320.72
HVO South	0.00	63.82
HVO Total	262.70	384.55
Net Rehabilitation (Rehabilitation minus Rehabilitation Disturbance)		
HVO Total (Rehab)	HVO Total (Rehab Disturbance)	HVO Total
157.98	34.86	123.12

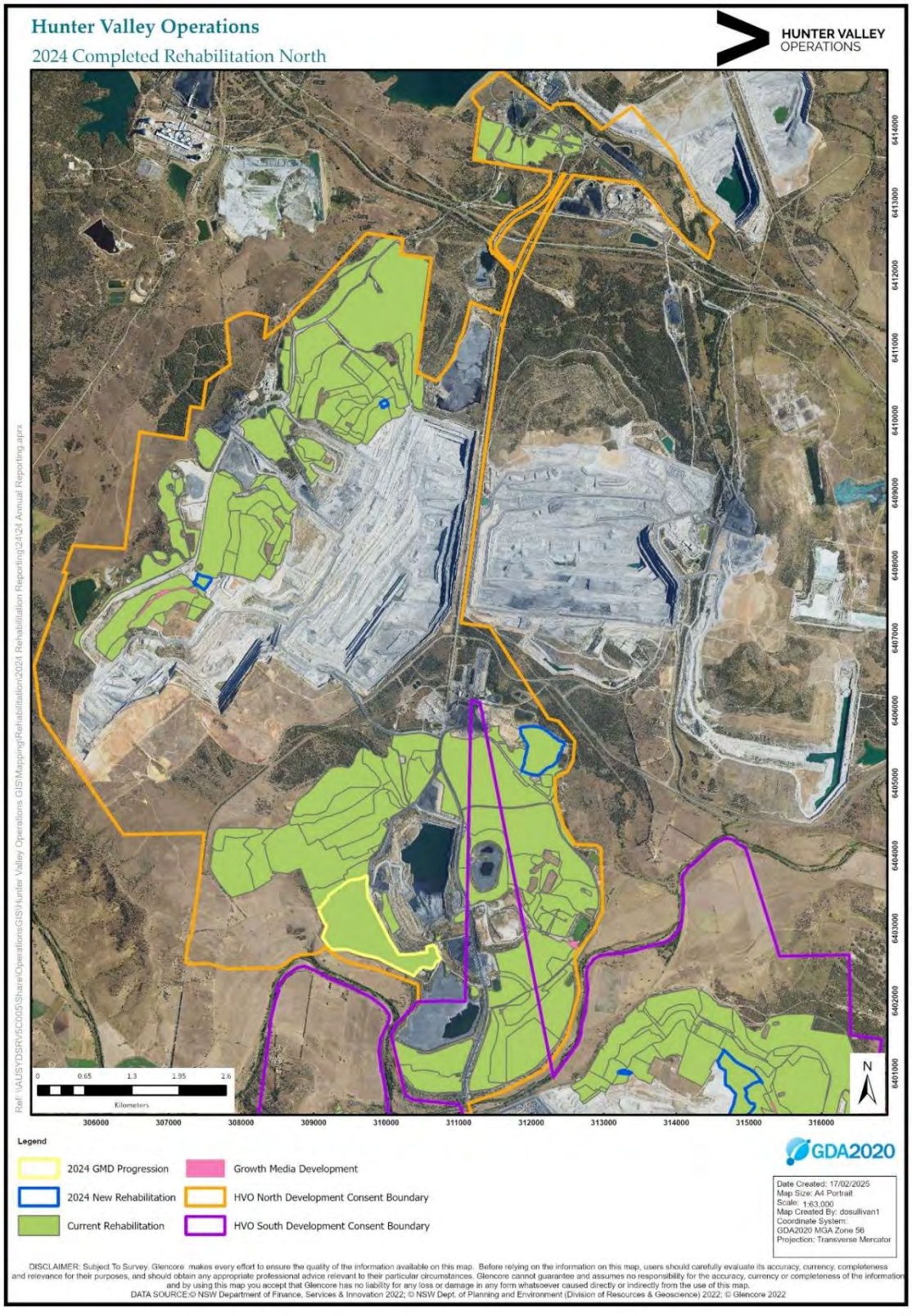


Figure 8-1: HVO Rehabilitation Areas - North

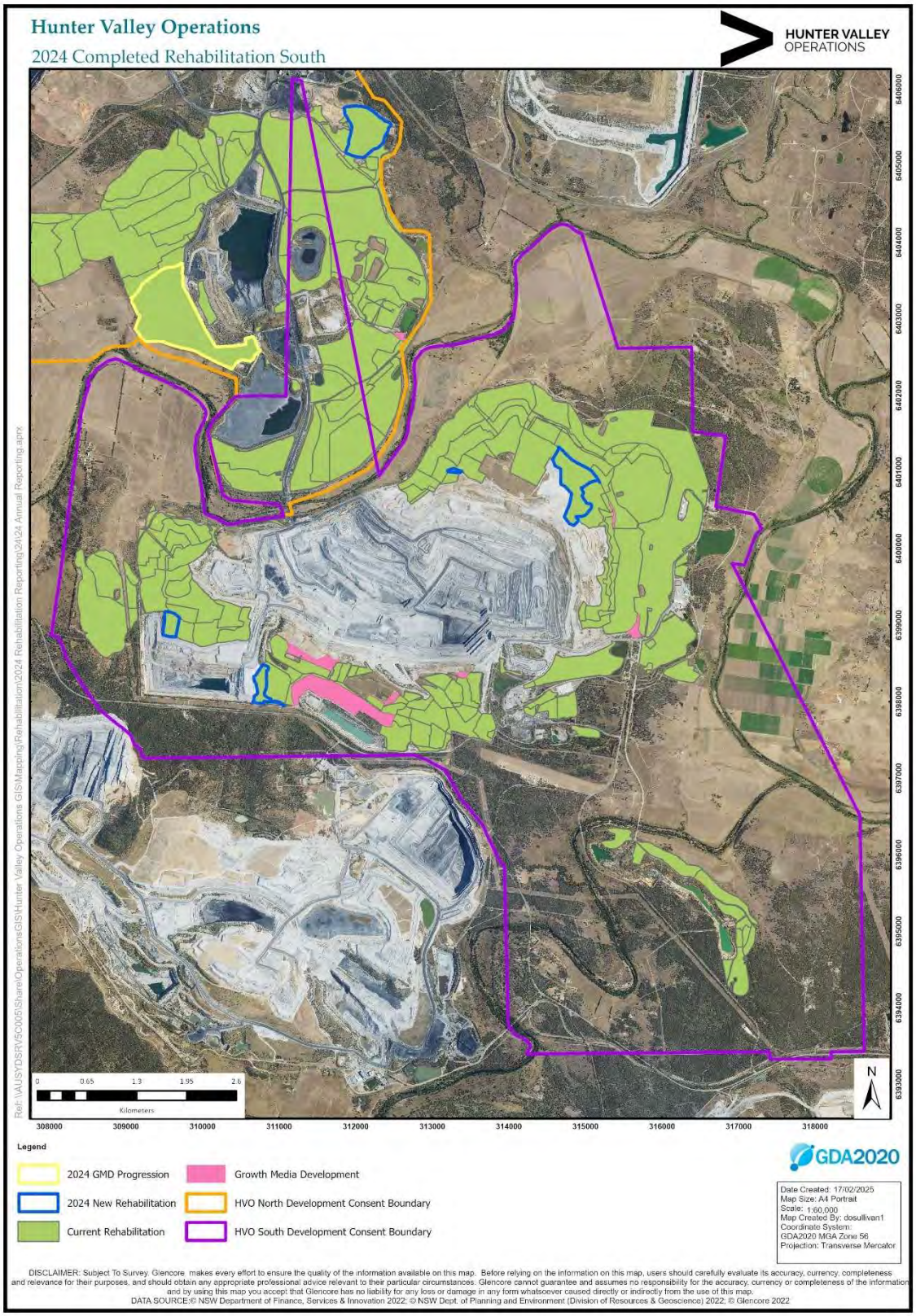


Figure 8-2: HVO Rehabilitation Areas - South

A comparison of rehabilitation progression against predictions in the *HVO West Pit Extension and Minor Modifications Environmental Impact Statement (EIS) (October 2003*) and subsequent modifications to the HVO North approval (DA 450-10-2003) indicates that rehabilitation progression is generally consistent with EIS predictions. Planning approval modifications that changed the rate of rehabilitation progression at HVO North include: Carrington East Extension (Modification 2 - 2006); Carrington Out-of-Pit TSF (Modification 4 - 2014); and Carrington In-Pit TSF (Modification 6 - 2014). When the modifications listed above are taken into account the EIS projection for cumulative rehabilitation area at the end of 2018 was 1,766.9 hectares. The EIS projection for average annual rehabilitation between 2018 (Year 14) and 2024 (Year 20) is 26.2 hectares hence projected rehabilitation at the end of 2024 was 1950.30 hectares. Land under active rehabilitation at HVO North at the end of 2024 totalled 1,810.51 hectares. A further 3.27 hectares is classified as within growth medium development phase representing a total rehabilitation management footprint at end of 2024 of 1,1813.78 hectares. This is below EIS predictions due to the rate of mining progression in HVO North being slower than forecast in the EIS and hence effecting areas available for rehabilitation.

As at the end of 2024, rehabilitation progress for HVO South is consistent with the predictions in the Hunter Valley Operations South - Modification 5 (2017) although with similar considerations to HVO North with respect to current rehabilitation phase classifications. The EIS projection for cumulative rehabilitation area at the end of Stage 2 (Year 2022) was 1,114 hectares The EIS projection for average annual rehabilitation between Stage 2 and Stage 3 (Year 2026) is 22 hectares hence projected rehabilitation at the end of 2024 was 1158 hectares. Land under active rehabilitation at the end of 2024 was 1,109.70 hectares in association with 41.47 hectares in growth medium development phase with the total rehabilitation management footprint at end 2024 totalling 1151.17 hectares and therefore consistent with EIS progression.

8.4 | REHABILITATION PROGRAMME VARIATIONS

The 2024 variations to the rehabilitation programme are summarised in **Table 8-4**.

Table 8-4: Variations to the Rehabilitation Program in 2024

FWP	Has rehabilitation work proceeded generally in accordance with the conditions of an accepted Rehabilitation Management Plan?	Comment
HVO South	Yes	HVO South net rehabilitation (net rehabilitation = rehabilitation minus – rehabilitation disturbance) completed during period 2024 was 23.76. HVO North net rehabilitation (net rehabilitation = rehabilitation minus – rehabilitation disturbance) completed during period 2024 was 99.36. Both areas are progressing in line with FWP forecasts **Historic rehabilitation** Following receipt of a Section 240 notice issued 18/7/19 from the Resources Regulator, rehabilitation in the GMD phase that was only sown with a cover crop was re-classified from completed to temporary rehab. HVO has since commenced a program of re-sowing these areas with its final land use species. Further information is provided in **Section 8.9.2**. During 2024, 88.51 ha of GMD was progressed to final cover in HVO North.
HVO North	Yes	

8.5 | REHABILITATION TRIALS

No rehabilitation trials were conducted during 2024.

8.6 | KEY ISSUES THAT MAY AFFECT REHABILITATION

The first rehabilitation risk assessment for HVO was undertaken in 2022 and was used in the development of the RMP. This risk assessment was reviewed in 2024. There were no risks identified as being a high risk to rehabilitation establishment. The ten medium risks identified were

- Failure to identify topsoil types when salvaging/stockpiling (e.g. pasture vs woodland);
- Limited biological resources available for salvage;
- Soil (topsoil and/or subsoil) deficit for rehabilitation activities;
- Soils inadequate to support revegetation or agricultural land capability;
- Weed infestation limiting target species / community;
- Low tailings beach shear strength delays capping;
- TSF final landforms contained by constructed embankments not geotechnically stable;
- Weather and climatic influences (drought, flood) during initial establishment;
- Insufficient establishment of target species and limited species diversity; and
- Acacia Saligna infestations limiting target species/community

These key risks have been addressed in a rehabilitation Trigger Action Response Plan (TARP) within the HVO RMP. The TARP identifies the required management actions in the event of impacts to rehabilitation, or where rehabilitation outcomes are not achieved in an acceptable timeframe.

8.7 | REHABILITATION MONITORING

HVO adopted the revised GCAA rehabilitation monitoring program to monitor rehabilitation areas and trajectory towards meeting the rehabilitation objectives and performance and closure criteria. The monitoring framework comprises Initial Establishment Monitoring (IEM) and Long Term Monitoring (LTM) depending upon the age of the rehabilitation area. Additionally, a walkover assessment is completed whereby the full extent of each monitoring block included in the annual program is assessed for maintenance requirements.

IEM is a rapid style assessment of young (≤3 years old) rehabilitated areas, principally to determine germination success and landform stability, and describes differing methods for HVO's key final land uses of grazing and non-specific woodland.

LTM utilises the Biodiversity Assessment Methodology (BAM) to compare rehabilitation areas with analogue site results. The objective of the LTM program (areas ≥4 years old) is to evaluate progress of rehabilitation towards fulfilling completion criteria and, ultimately, the targeted post-mining land use. Like methods apply for LTM of both rehabilitation and reference monitoring sites.

Monitoring during 2024 represented a continuation of this ecological monitoring program adopted during 2020. During the 2024 monitoring, 124 sites were monitored and these comprised:

- 8 IEM Non-specific Woodland sites (4 blocks);
- 46 LTM Non-specific Woodland sites (19 blocks);
- 21 IEM Pasture sites (8 blocks); and
- 48 LTM Pasture sites (17 blocks).

The results of the annual rehabilitation monitoring, combined with the annual walkover, are utilised to assess rehabilitation performance against the sites closure criteria, the RMP TARP and GCAA's Rehabilitation Report Card. The location of sites monitored in 2024 can be seen below in Figure 8-3.

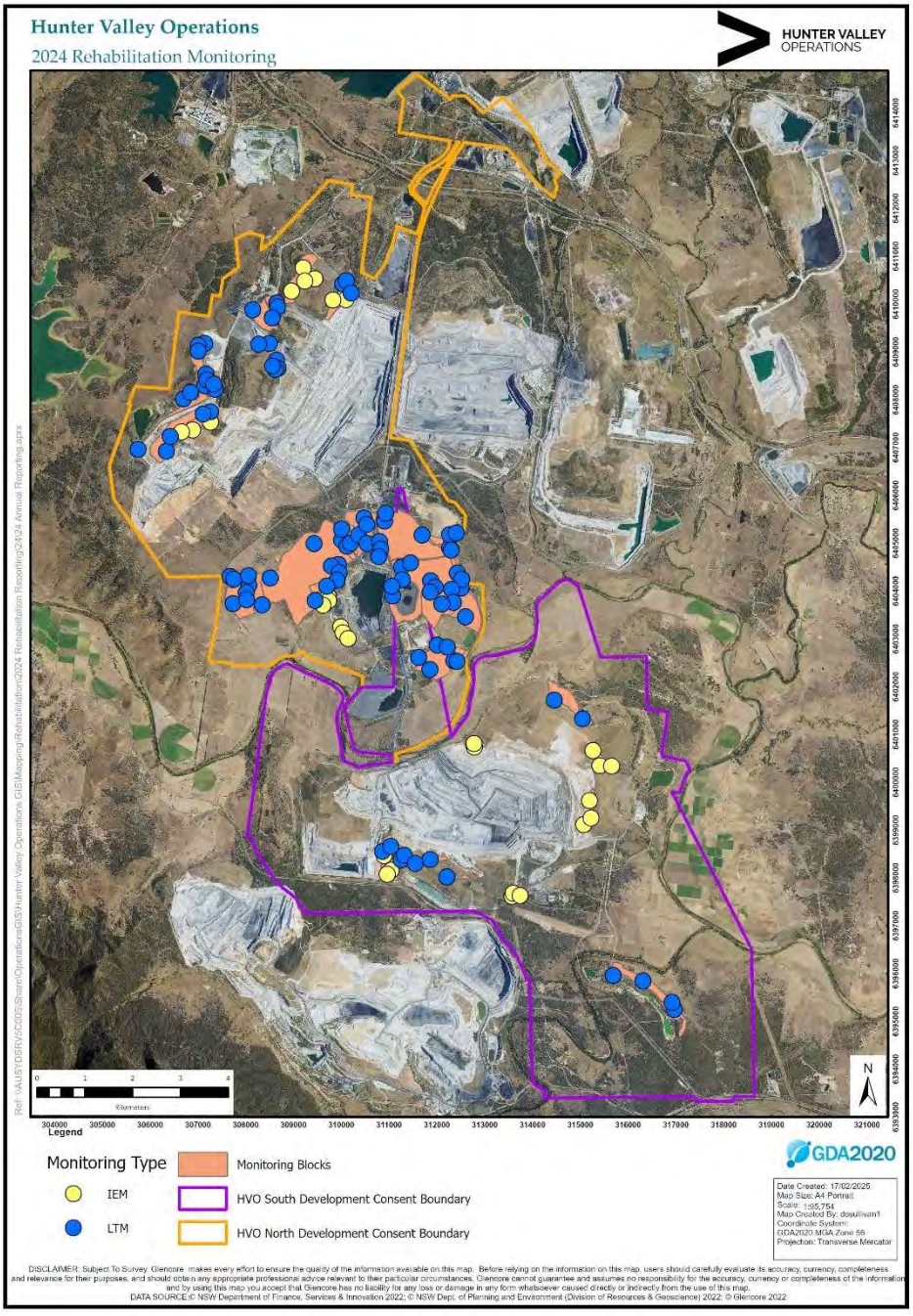


Figure 8-3: 2024 Rehabilitation Monitoring Sites

8.7.1 | MONITORING PEFORMANCE

Overall, the majority of the rehabilitation blocks monitored in 2024 are trending towards meeting the rehabilitation criteria. Generally, older rehabilitation blocks (prior to 2015) exhibited lower target species diversity and higher weed coverage. Recommendations have been made to improve these blocks and a detailed maintenance plans have been developed for each block. Erosion was also a major contributor to maintenance works required in older rehabilitation blocks. Monitoring results from younger blocks generally identified a higher abundance of species from target communities, lower weed presence and less erosion.

Pasture IEM blocks generally performed well, with only low occurrence of weeds or bare ground being observed. Erosion was present within a number of these blocks however it was generally minor and isolated in nature. Pasture composition also either met, or was trending towards meeting, early establishment targets. Pasture LTM block monitoring results were more variable. Groundcover was acceptable across all blocks, however moderate to major erosion was also noted in three of the 17 blocks monitored. Weed species were also more prevalent, however targeted maintenance was only identified as being required in six of the 17 blocks. Suitable pasture species composition was low across all long-term monitoring sites. To address this HVO will engage an agronomist to develop a pasture rehabilitation monitoring program in 2025.

Native woodland IEM blocks exhibited acceptable groundcover and minimal erosion. Weed species were present and require targeted maintenance in three of the four blocks monitored. Tree stems and native composition were generally below early establishment targets, however active management of these aspects were not recommended due to the young age of the rehabilitation and expectation they will improve over time. Of the 19 native woodland LTM blocks monitored, two exhibited moderate to major erosion which requires rework, despite all blocks having acceptable groundcover levels. Weed species were also prevalent, with only two of the 19 blocks not requiring targeted weed control. Native tree canopy results performed well, despite native tree stem densities and native species composition generally being below target levels. To address low species composition levels in older woodland an infill planting program will be completed in older woodland rehabilitation in 2025.

HVO has developed a detailed maintenance plan for all rehabilitation blocks on site, which will be implemented continuously to continue progressing rehabilitation towards closure criteria.

8.8 | REHABILITATION MAINTENANCE

Management of rehabilitated areas is undertaken proactively to assist in initial establishment and when issues are identified through monitoring, auditing or inspections.

An overview of key rehabilitation maintenance activities is detailed below.

8.8.1 | EAST TSF ENFORCEABLE UNDERTAKING

HVO previously operated the East TSF adjacent to its Hunter Valley Coal Preparation Plant. The East TSF was capped and rehabilitated approximately 25 years ago in accordance with practices commonly employed at the time.

During March 2019, discharge of dirty water from the area occurred into the adjacent Farrell Creek. HVO conducted initial remediation works to the incident area, repairing some existing contour banks and re-seeded some bare areas to enhance the stability of the area. HVO subsequently entered into an Enforceable Undertaking with the NSW EPA that requires HVO to prepare and implement a Remediation Plan for the East TSF.

A remediation plan for the area was developed which included:

- Placing additional fill to ensure minimum cap of 0.5m across the facility
- Construction of surface water management and sediment and erosion controls including contour banks and a drop structure to convey water into existing sediment dams
- Topsoiling, biomix application and seeding with pasture final land use species

HVO notified the NSW EPA that works were completed in accordance with the design in December 2024. The site will now be managed in accordance with HVO rehabilitation monitoring and maintenance program.

8.8.2 | SECTION 240 MAINTENANCE PROGRAM

In July 2019 the NSW Resources Regulator (RR) issued HVO with Notice 3259 under Section 240(1)(c) of the Mining Act (1992) (Section 240 Improvement Notice) requiring HVO to outline measures or actions to improve progressive rehabilitation performance across the site. This notice also required HVO to develop a maintenance plan to re seed areas that were seeded with a cover crop and not final land use. HVO was also issued with S240 notices NTCE 0009902 and NTCE 0009942 in relation to contour bank failure, tunnelling and gullying on HVO's Western Out of Pit (WOOP) emplacement which required HVO rehabilitate the area in consultation with Hunter Local Land Services (HLLS).

In response to these notices HVO has developed and committed to a rehabilitation maintenance and improvement program across the site. An overview of work from the plan undertaken during 2024 is detailed further below.

8.8.2.1 | WOOP DUMP REPAIRS

In response to S240 notices NTCE 0009902 and NTCE 0009942 covering contour bank failure, tunnelling and gullying on HVO's Western Out of Pit (WOOP) emplacement, works were completed in January 2025 and involved repair of the contour banks, stabilisation of gully erosion and construction of a drop structure. In line with requirements under the S240 notice, HVO submitted a report on the 5th of March 2025 to the NSW RR detailing works completed and outlining ongoing control measures to be implemented to prevent a recurrence of erosion, poor surface water management and landform instability. Works were completed to the satisfaction of the HLLS and included:

- Repair of tunnel erosion on contour banks
- Repair of gully erosion
- Turf lining of contour banks on HLLS land
- Installation of a drop structure, coir logs and jute mesh
- Topsoiling, amelioration and seeding of maintenance work areas

The site will be incorporated into the HVO rehabilitation monitoring program and HVO will continue to work with HLLS to ensure long term stability of the landform is maintained.

Figure 8-4- Jute mesh and vegetation establishment at WOOP Dump

8.8.2.2 | SEEDING OF COVER CROP AREAS TO FINAL LAND USE

Since 2020, HVO has seeded 328 hectares of rehabilitation that was initially seeded with cover crop with final land use including 88.5 hectares at Carrington in 2024.Maintenance works completed included mulching the area, boom spraying, amelioration and seeding with pasture final land use.

Figure 8-5: Seeding of Final Land Use Species at Carrington

In 2025, HVO will seed the remaining 10.75ha of cover crop area that is yet to be seeded with final land use that is not going to be disturbed by future mining activities. The maintenance plan for these areas can be seen below in **Table 8-5**.

Table 8-5: 2025 GMD Plan

Location	Block Name	Area (Hectares)	Works Required
Cheshunt	• HVOCHE201302 • HVOCHE201303	3.1	• Boom spraying of weeds • Soil amelioration (if required) • Seeding with final land use (Pasture)
Riverview	• HVORIV201301 • HVORIV201302	4.49	
Carrington	• HVOCAR201701	0.96	
Wilton	• HVOWIL201301	2.31	

Once works have been completed these areas are reclassified from GMD to rehabilitation and monitored in line with the rehabilitation monitoring methodology outlined above.

8.8.3 | REHABILITATION MAINTENANCE PROGRAM

Rehabilitation inspections and monitoring conducted at HVO aim to identify rehabilitation risks and maintenance requirements. Each year an annual rehabilitation maintenance plan is developed which includes range of maintenance activities that are undertaken to improve the quality of rehabilitation at HVO and progress towards closure criteria. These include weed spraying, erosion repair, vegetation management and topsoil management. Works completed in 2024 are discussed below.

8.8.3.1 | WEED CONTROL

Broadacre weed treatment within rehabilitation areas is undertaken using agricultural methods comprising boom sprays, wick wipers and slasher/mulchers. In existing rehabilitation areas boom spraying is primarily used to manage cover crop and fallow areas prior to sowing to final native seed mixes. Pre-emergent application of herbicide is used when appropriate and necessary to control emerging weeds in the period between sowing and germination of the desired species. Wick wiping targets rapidly growing exotic grasses and other erect growing weeds in the period following native germination while desirable species remain below the wiper target zone. Slashing and mulching is also used to remove rank pasture grasses, stimulate fresh growth and control dense infestation of Acacia Saligna. Hand spraying and manual removal of weeds is undertaken in rehabilitation areas with early stage and establishing native vegetation that would be likely to be damaged or destroyed should broadacre methods be used.

The key weed species targeted in 2024 maintenance works were Galenia (Galenia pubescens), Saligna (Acacia saligna), Blue Heliotrope (Heliotropium amplexicaule), Rhodes grass (Chloris gayana) and Mustard Weed (Brassica juncea).

During 2024 rehabilitation blocks totalling 233ha were boom sprayed, wick wiped, slashed/mulched or spot sprayed. Blocks managed can be seen below in **Figure 8-6.**

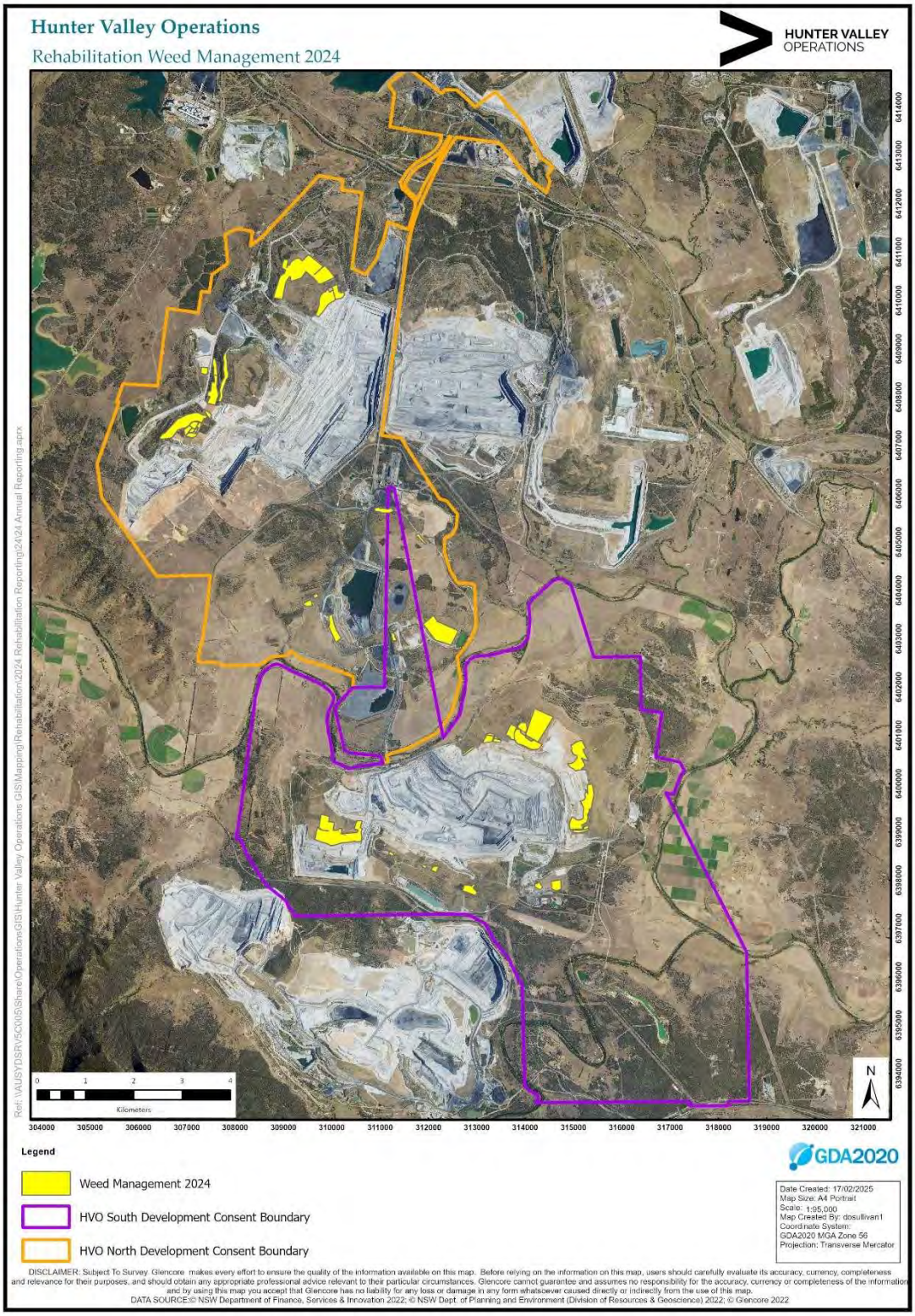


Figure 8-6: Weed Management Activities Conducted in 2024

8.8.3.2 | EROSION REPAIRS

Drainage structures such as contour banks, drop structures and sediment dams are largely functioning as designed and require little to no maintenance, particularly in more recently established rehabilitation areas. Erosion repairs were conducted across the site during 2024 in line with the annual rehabilitation maintenance plan including drainage repair, contour re shaping and desilting. As discussed above, major re-work of erosion areas was completed at the WOOP Dump and East TSF in 2024.

Temporary erosion controls such as coir logs are also placed in new rehabilitation areas as required to limit erosion and sediment and erosion plans developed for individual rehabilitation areas as required.

The 2024 rehabilitation monitoring identified some contour failures in historical areas which had mainly stabilised, along with some minor riling and gullying in newer rehabilitation areas. These have been prioritised and incorporated into HVO's rehabilitation maintenance plan.

8.8.3.3 | VEGETATION ENHANCEMENT

In addition to the progression of GMD areas throughout the year, HVO undertakes regular re-seeding in rehabilitation areas that have been identified as failing or requiring additional species diversity. The need for these interventions, and the most appropriate method, are identified during the Annual Walkover, Ecological monitoring and internal monthly inspection of rehabilitation areas. During 2024, erosion repairs were re-seeded and no tube-stock planting occurred. A tubestock infill planting program will be completed in 2025 to increase diversity in older woodland sites.

8.8.3.4 | TOPSOIL MANAGEMENT

Prior to topsoil stripping occurring, soil profiling and testing is completed to understand amelioration required and topsoil stripping depth. If possible, topsoil is directly placed on rehabilitation areas. If this cannot occur the soil is placed in a topsoil stockpile, where it is shaped and seeded with a target species for its intended final land use (pasture/woodland).

An annual inspections of topsoil stockpiles is completed to identify required maintenance activities. In 2024 the annual inspection identified a number of maintenance works including weed control, mulching and re-seeding (if weed species have dominated). These maintenance activities will be completed as part of the 2025 rehabilitation maintenance program.

8.8.4 | GRAZING OF REHABILITATION AREAS

Grazing of rehabilitation areas is utilised to encourage and maintain pasture diversity, encourage nutrient cycling, and assist in fuel load management. A licence agreement is in place for grazing 666ha of HVO North rehabilitation area, with temporary fuel load licences across a further 394ha of rehabilitated land around HVO North and 210ha around HVO South. Opportunities to integrate grazing to assist rehabilitation progression continues to be assessed.

During 2024, HVO undertook an assessment of the Alluvial Lands Rehabilitation Area which included engaging an agronomist to undertake a land capability assessment and complete gap analysis to understand what is needed for the site to reach relevant completion criteria. Outcomes from this work will continue to be implemented in 2025 in line with the annual rehabilitation maintenance plan.

8.9 | VERTEBRATE PEST MANAGEMENT

A number of baiting programs are carried out on a seasonal basis as part of the HVO Vertebrate Pest Action Plan. These programs are conducted at a level of frequency designed to disrupt pest species breeding/colonisation cycles and employ a variety of methodologies including baiting, trapping and ground based shooting.

8.9.1 | WILD DOG AND FOX BAITING PROGRAMS

Three 1080 ground baiting programs targeting wild dogs and foxes were implemented across operational and biodiversity areas. These were undertaken during summer, winter, and spring. Each program consisted of approximately 60 bait sites utilising meat and ejector baits. Baits were checked over a three to six week period and replaced each week when taken. The winter and spring baiting programs were synchronised to coincide with neighbouring mine operations programs, with the timing of these events coordinated with and by Hunter Local Land Services.

8.9.2 | PIG TRAPPING AND BAITING

Two pig baiting program using sodium nitrite 'Hoggone' baiting systems were implemented at HVO during autumn and winter. The autumn program resulted in 33 pigs being controlled, while the winter program accounted for 34 pigs. An additional 59 pigs were controlled by rural licensees using a combination of pig traps, shooting and 'Hoggone' baiting systems on buffer properties over the course of the year. The programs undertaken throughout the year resulted in 126 pigs being controlled.

8.9.3 | GROUND BASED SHOOTING

Two shooters attend the HVO site on a regular basis opportunistically controlling feral pest species. Feral species controlled include pigs, wild dogs, foxes, hares/ rabbits, deer, and cats.

Table 8-6 summarises the results from the programs carried out at HVO during 2024.

Table 8-6: Summary of Vertebrate Pest Management 2024

	1080 Baiting			Hoggone Baiting	Trapping		Shooting			
	Total Lethal Baits Laid	Takes by Wild Dog	Takes by Fox	Takes by Feral Pig	Wild Dog	Feral Pig	Feral Pig	Wild Dog/ Fox	Feral Cat	Hares & Rabbits
Summer	169	48	74	0	0	0	1	0	0	0
Autumn-Winter	173	43	18	33	0	24	19	0	0	0
Spring	183	5	84	34	0	0	15	0	0	0
Total	**525**	**96**	**176**	**67**	**0**	**24**	**35**	**0**	**0**	**0**

Table 8-7 provides a comparison of results from the last 25 baiting programs undertaken at HVO. Results reported indicate the majority of takes by dogs or foxes. Sighting reports also confirm that a high number of wild dogs and foxes rapidly re infiltrate the area after programs complete. The number of takes by dogs in spring has dropped (5 takes in spring compared to 43 in the autumn program), and takes by foxes has increased (84 in spring compared to 18 in autumn). The results validate recommendations by the current vertebrate pest control contractor to extend the length of baiting programs to catch new dogs and foxes entering the territory vacated by terminated pest animals. Programs in 2024 were extended by several weeks and the quantity of baits laid increased by approximately 20% compared to previous years. This resulted in a significant increase in takes attributed to foxes and a decline in wild dog takes. The decline in wild dog takes is consistent with a decline in the 2023 reporting period.

Table 8-7: Comparison of Results Between Baiting Programs at HVO

Baiting Program	No of Baiting Sites	Baiting Opportunities	Baits taken by Dogs	Dog (%)	Baits Taken by Foxes	Fox (%)	Baits Taken by Non Target Species	Other (%)	Total No. of Baits Taken	No Sites Where Baits Taken At Least Once	Represented as Percentage (%)	No. Sites with Baits Taken on All Occasions	No. Sites With No Baits Taken	No. Baits Disturbed Not Taken	No. Baits Taken Alternatively by Dog or Fox	Baiting Efficiency %	Baiting Efficiency Excluding Other
1606 HVO	60	180	94	96%	4	4%	0	0	98	54	90%	10	6	6	4	54%	54%
1609 HVO	60	180	83	94%	5	6%	0	0%	88	49	82%	11	11	12	3	49%	49%
1702 HVO	59	117	58	84%	10	14.5%	1	1.5%	69	49	87%	20	11	7	5	59%	58%
1705 HVO	60	120	70	95%	4	5%	0	0%	74	51	85%	23	9	3	0	62%	62%
1709 HVO	60	120	67	96%	3	4%	0	0	70	48	80%	22	12	5	2	58%	58%
1803 HVO	60	120	69	90%	6	8%	2	2%	77	49	82%	31	11	7	0	64%	63%
1806 HVO	60	120	77	94%	5	6%	0	0%	82	50	83%	32	10	8	4	68%	68%
1809 HVO	61	122	73	87%	10	12%	1	1%	84	50	82%	34	11	2	6	69%	68%
1905 HVO	64	124	61	85%	10	14%	1	1%	72	50	78%	22	17	8	8	64%	63%
1910 HVO	60	120	66	93%	4	6%	1	1%	71	48	80%	23	12	9	2	59%	58%
2002 HVO	60	140	72	94%	4	5%	1	1%	77	48	80%	2	12	9	2	55%	54%
2005 HVO	60	118	44	71%	15	24%	3	5%	62	41	68%	21	19	12	6	53%	50%
2010 HVO	60	120	56	89%	4	6%	3	5%	63	43	72%	20	17	7	2	53%	50%

Baiting Program	No of Baiting Sites	Baiting Opportunities	Baits taken by Dogs	Dog (%)	Baits Taken by Foxes	Fox (%)	Baits Taken by Non Target Species	Other (%)	Total No. of Baits Taken	No Sites Where Baits Taken At Least Once	Represented as Percentage (%)	No. Sites with Baits Taken on All Occasions	No. Sites With No Baits Taken	No. Baits Disturbed Not Taken	No. Baits Taken Alternatively by Dog or Fox	Baiting Efficiency %	Baiting Efficiency Excluding Other
2102 HVO	60	113	51	65%	16	21%	11	14%	78	53	80%	26	7	12	5	69%	59
2105 HVO	60	119	65	72%	16	18%	11	12%	90	55	92%	37	5	8	7	76%	66%
2110 HVO	63	119	47	61%	15	19%	15	19%	77	51	81%	26	12	4	5	65%	52%
2202 HVO	60	118	48	71%	7	10%	14	21%	68	46	77%	22	14	2	4	58%	46%
2205 HVO	60	119	48	74%	9	14%	8	12%	65	45	75%	20	15	2	6	55%	48%
2210 HVO	60	117	49	59%	6	9%	21	32%	66	45	75%	21	15	1	4	56%	38%
2302 HVO	60	116	44	51%	10	12%	32	37%	86	49	82%	36	11	5	3	74%	47%
2305 HVO	60	120	54	68%	7	9%	18	23%	79	52	87%	27	8	5	3	66%	51%
2310 HVO	55	204	22	32%	39	56%	8	12%	69	50	91%	5	8	8	*	34%	30%
2402-03 HVO	51-60	169	48	38%	74	59%	3	3%	125	58	97%	22	1	*	25	74%	72%
2405-06 HVO	60	173	43	68%	18	28%	2	4%	63	39	65%	6	21	*	6	36%	35%
2410-11	61	183	5	5%	84	88%	6	8%	95	52	85%	11	9	*	3	52%	48%

*Data no longer recorded

8.10 | HISTORIC HOMESTEADS

Planning for improvements to historic heritage homesteads progressed in 2024 and included the preparation of detailed costings and budget for the works identified in the 2023 Phase 1 Survey and Condition Reports for the Archerfield, Wandewoi and Carrington Stud homesteads. Tenders were completed for balustrade repair works to the Wandewoi homestead in December 2024, with works planned to commence in 2025.

8.10.1 | DERELICT RURAL BUILDINGS

HVO removed debris from a timber hayshed at Comleroi Farm that lost its roof following an isolated weather event in Feb 2024. Following this event an audit was conducted of all known rural timber structures to identify buildings with poor structural integrity and prioritise their repair or demolition.

8.11 | TAILINGS MANAGEMENT

Key tailings management activities in 2024 included:

- Continued Secondary Flocculent dosage into Carrington in Pit TSF was made, to improve beaching;
- Additional pumping infrastructure installed in Carrington in Pit TSF to reduce decant size and increase consolidation.
- Spigot locations re-designed to optimise storage and minimise decant pond size.
- Temporary cessation of deposition into Dam 6W TSF has been extended, allowing time for consolidation prior to final top up deposition.
- Ongoing implementation of the North Void TSF Management Plan to manage and mitigate any potential impacts from an identified seepage pathway. Provision of quarterly and annual analysis reports to EPA;
    - North Void Shear Vane Testing of Surface and GeoChem Sampling completed
- Capping of Bob's Dump initiated

Table 8-8 outlines the current state of Tailings Storage Facilities across HVO that are still active or pending decommissioning.

Table 8-8: HVO Tailings Storage Facilities

Facility	Status	Decant System
North Void	Inactive	Decant pumps in place, pumping as required.
Dam 6W	Inactive	Decant pumps in place, pumping as required.
Cumnock Void	Active	Decant pump in place, regular pumping when deposition occurring.
Bob's Dump	Inactive; preparation for decommissioning	Pump in place, pumping as required.
Southeast TSF	Decommissioned and rehabilitated	N/A
Central TSF	Inactive	No pumps required due to drying after rainfall (small catchment reporting to TSF).
Carrington In-pit TSF	Active	Decant pumps in place, regular pumping.

8.12 | RIVER RED GUM RESTORATION AND REHABILITATION

8.12.1 | RIVER RED GUM OVERVIEW

Eucalyptus camaldulensis (River Red Gum) populations have become increasingly rare and degraded in the Hunter Valley, and the entire population occurring within the Hunter catchment is now listed as an Endangered Population under the NSW *Biodiversity Conservation Act 2016*. There are a number of River Red Gum sites across HVO North and South. HVO manages the River Red Gum stands on lands that it owns in accordance with the HVO River Red Gum Restoration and Rehabilitation Strategy (Strategy) (HVO 2020) which is a compliance requirement under Sch 3, Condition 31 of DA 450-10-2003.

The sites at HVO have been categorised into a high level of management at the Carrington Billabong, intermediate level at the priority sites and low level at the low priority sites. Each level has been allocated varying amount of monitoring and maintenance as outlined in the Strategy.

As the site with the highest priority, the objectives of the monitoring program at Carrington Billabong are to:

- determine if there is any improvement or deterioration in RRG within Carrington Billabong;
- determine if there is any improvement or deterioration of the natural habitat at Carrington Billabong;
- provide management recommendations to achieve further improvements in the ecological management of the site to assist in the recovery of RRG and their habitat;
- remove any potential influence that mining activities at HVO may have on the population. The monitoring results are compared to a reference site to the north of HVO that is not within a mining area.

The locations of the River Red Gum stands at HVO are shown in **Figure 8-3**.

The Strategy has an established monitoring programme of the river red gum subpopulations and vegetation communities in Carrington Billabong and priority sites on the Hunter River and Wollombi Brook in HVO North and South. The Reference Site is located between Scone and Aberdeen (NSW).

Ecological monitoring was not required in 2024 and is scheduled to occur in 2025.

In previous years, tubestock plantings have been undertaken to reduce the linear influence of the billabong on the existing mature *E. camaldulensis*, and contribute towards the development of a vegetated corridor representing the Hunter Floodplain Red Gum Woodland community, connecting the Hunter River populations with the stands in the Billabong. Over time, the new plantings should offer some protection to the mature individuals from storm events and assist to reduce the competitive advantages of the annual weeds on recruiting native species.

The vast majority of the earlier planting have survived through 2024 as they were above the level of the grass and were not able to be overshaded. The planting losses that did occur were primarily the result of herbivore grazing, and losses attributable to grass growth when ground conditions prevented the slasher from accessing the area. These losses will be supplemented during the 2025 planting works.

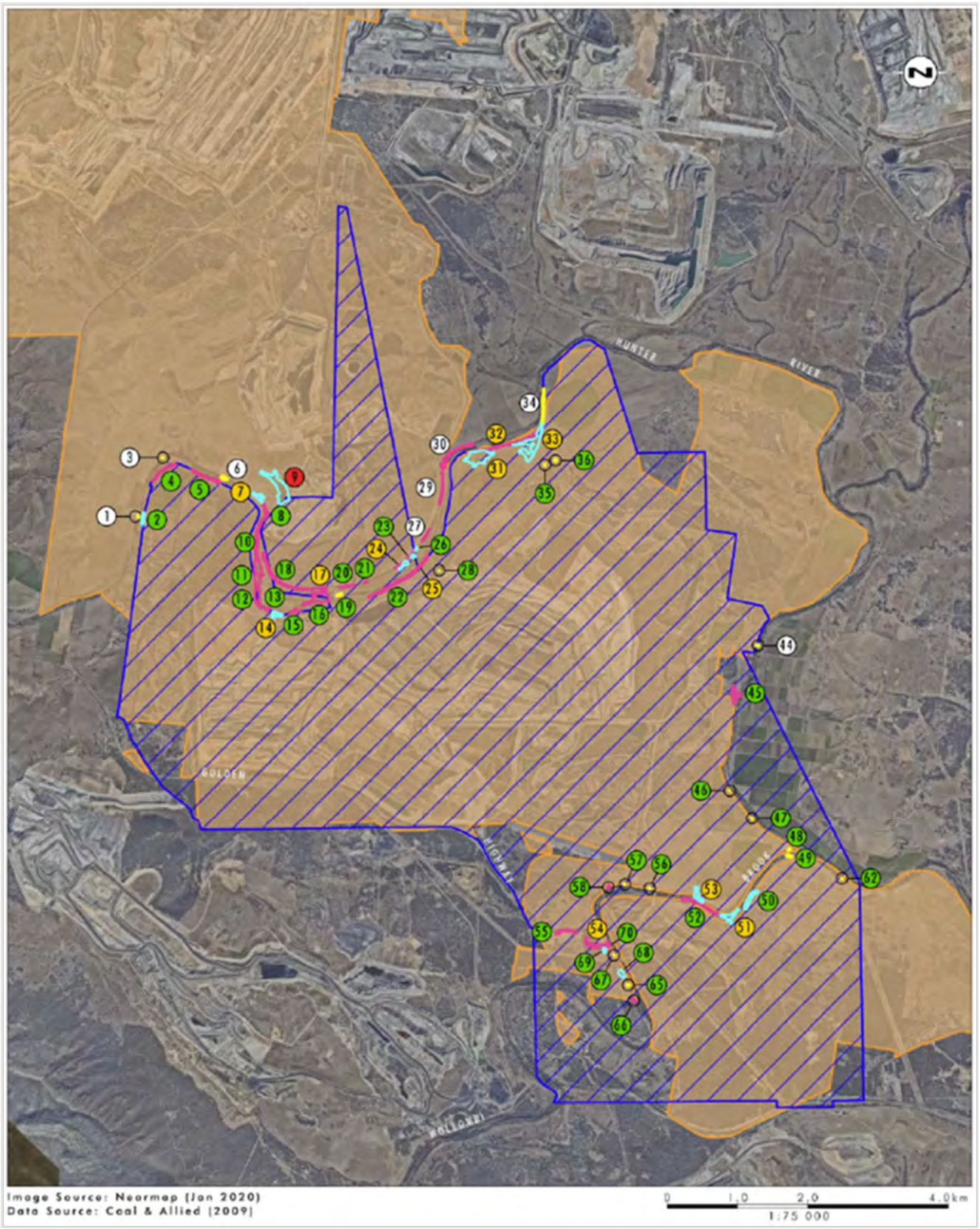


Figure 8-3: Eucalyptus camaldulensis stands being managed at HVO

8.12.2 | RRG MONITORING ACTIVITIES

8.12.2.1 | RAINFALL AND RECRUITMENT

The rainfall received in 2024 was around the average received at HVO (**Figure 8-4**). The total rainfall for the year at HVO (Corp) was 645.2 mm, which was an increase on 2023.

This increased rainfall from 2023 was observed within the alluvial areas via a flush of thistle in particular. While observed recruitment of native species did not occur within the River Red Gum areas, native species germination was observed within other remnant bushland areas across HVO.

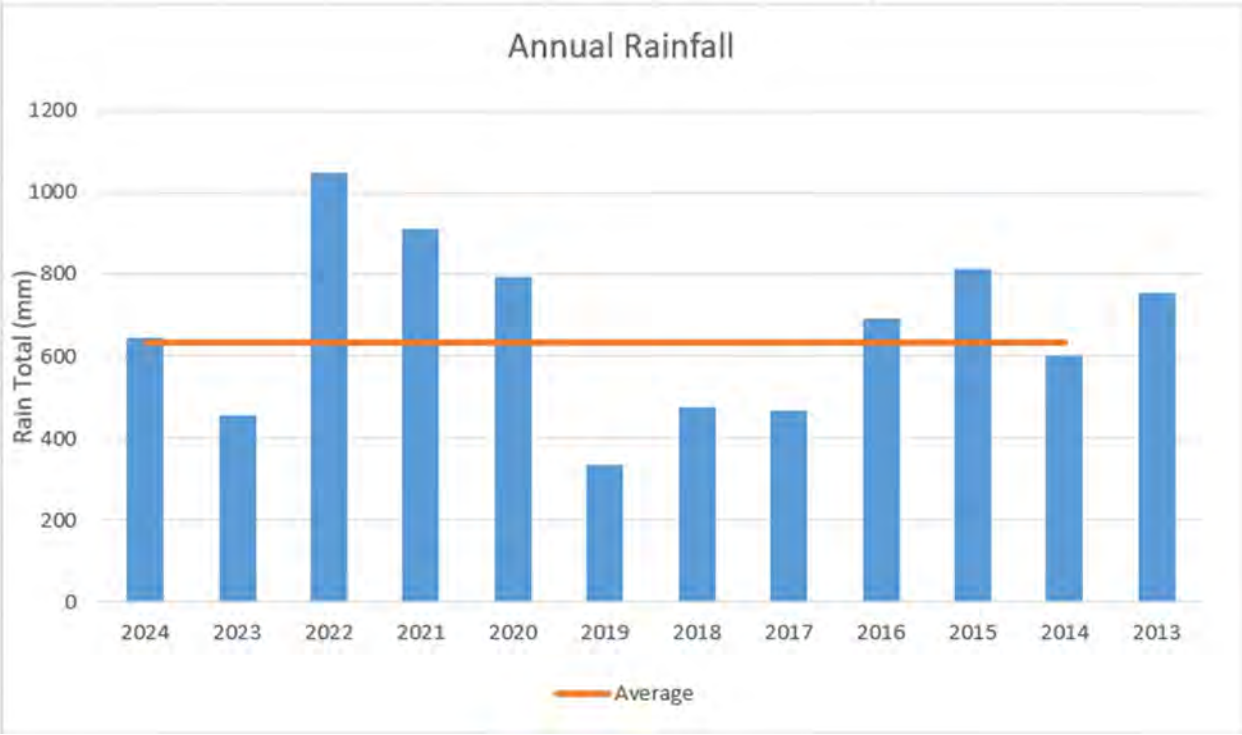


Figure 8-4: Annual rainfall at HVO Lemington since 2013

8.12.2.2 | CONSERVATION GENOMICS

During 2024, the Research Centre for Ecosystem Resilience at the Botanic Gardens of Sydney, included stands of River Red Gum at HVO within their study assessing the genetic relationships of the Hunter Catchment *E. camaldulensis* population to the species wider distribution, assess levels of genetic diversity and health of remnant stands in the region, and develop genetically informed seed sourcing strategies to maximise the success and self-sustainability of restored populations of the species in the region (Fahey et al 2024).

The results indicated that the Carrington billabong stand was the most genetically diverse stand occurring within the Hunter. It was shown that *E. camaldulensis* frequently hybridises with other Red Gum species where they co-occur both within and outside the Hunter catchment, and that all stands in the region are *E.* subsp. *camaldulensis*, with close genetic relationships to populations in the Namoi catchment. Based upon the frequency of hybrids and levels of genetic diversity, it was recommended seeds are sourced from

the largest stands of *E. camaldulensis*, and preferentially from stands along major waterways, rather than smaller tributaries, to minimise the collection of hybrid seed and maximise captured genetic diversity.

These results were published in:

> Fahey P, Hogbin P, van der Merwe M, Rossetto M (2024) Conservation Genomics of *Eucalyptus camaldulensis* in the Hunter in support of genetically informed seed sourcing. Research Centre for Ecosystem Resilience, Royal Botanic Garden Sydney.

As such, the management of the River Red Gums at HVO has incorporated these findings into the management actions; *E. camaldulensis* seed has been purchased from the Namoi to include within the plantings at HVO for 2025, and seed is only collected at HVO from the stands along the Hunter River, not those on the Wollombi Brook.

8.12.2.3 | CARRINGTON BILLABONG TREE HEALTH DECLINE

The results of previous monitoring events have indicated that some mature trees within the Carrington billabong have been in decline. During 2023 and 2024, it was noted that a few trees had died, or were being repeatedly defoliated by insects. Preliminary investigations by an arborist in 2023 observed that a population of juvenile plantings immediately adjacent to the affected trees were not being defoliated to the same extent. This indicates that the insect defoliation was a secondary impact, as a result of a primary infection.

Soil testing around the declining vegetation identified the presence of the soil pathogen, *Phytophthora*.

During 2024, ArborCarbon was contracted to assist HVO with determining the cause(s) of decline and premature death of River Red Gums at Carrington Billabong. Their report stated that soil-borne pathogens, such as *Phytophthora inundata,* may be causing stress to the trees and dieback, allowing foliage-feeding insect pests to further impact canopy health.

Phytophthora inundata is a plant pathogen causing damage to trees and shrubs, particularly in wet or flooded soils. As a result of the La Nina weather system during previous years, the Billabong was flooded for most of 2022 and the first few months of 2023, which would have allowed the *P.inundata* to 'germinate' and become mobile.

While it is not technically feasible to eradicate *Phytophthora* species at the Carrington Billabong, management of the area aims to:

- slow the spread of the pathogens across Hunter Valley Operations land,
- reduce feral animals within the area, specifically pigs, to prevent to dispersal of the soil pathogen, and
- maintain ecological processes for the potential development of natural resistance in the population of susceptible species.

These aims are being implemented through a concentrated effort on vertebrate pest management activities, targeted weed management within riparian areas to reduce pig habitat, extensive plantings of river red gums within priority areas to reduce edge effects and connect individual stands where possible, and, planting *E.camaldulensis* tubestock originating from the Namoi catchment at HVO to assist to improve genetic fitness of the HVO populations.

8.12.2.4 | RIVER RED GUM MONITORING

As per the River Red Gum Rehabilitation and Restoration Strategy, no monitoring was required during 2024. Biennial monitoring will resume in 2025.

8.12.2.5 | GROUNDWATER MONITORING

The groundwater at key locations across HVO are monitored to determine the impact of mining and whether any reported seepage from the North Void tailings storage facility is having an impact on the Carrington Billabong.

Triggers have been defined for water levels and water quality (pH, sulphate and sulphate/chloride ratio) to determine whether any hydrological changes could be influencing the adjacent vegetation communities, such as the River Red Gum populations. Three consecutive readings above the trigger level constitute an exceedance, which will initiate further investigation into the likely causes of the values and/or report the exceedance in specified cases. The groundwater level trigger criteria relate to an observed rise in groundwater levels by more than 0.5 m over a 12-month period and in conjunction with water quality changes, not related to climate trends.

The location of the trigger bores in the vicinity of the Carrington Billabong can be seen in **Figure 8-5**.

There were no bores with groundwater levels above the trigger level during the reporting period. Groundwater levels have generally trended downwards in response to generally below average rainfall from January 2023 onwards.

pH levels for the trigger bores ranged between 7.3 (CFW55R and GW-127) and 7.9 (GW-125) during the reporting period. There were no pH trigger exceedances recorded during the reporting period.

A recorded change in the sulphate and water level in some bores in the alluvium was identified in 2017 to be due to seepage from the adjacent North Void Tailings facility. As noted in the groundwater section of this report, management actions have been successful in lowering sulphate levels and these are now generally stable.

Sulphate concentrations for the trigger bores remained low (<200 mg/L), with no concentrations above the trigger level recorded. The exception was sulphate concentrations in bore CFW55R, which fluctuated with a concentration of 380 mg/L in June 2024 and 389 mg/L in September 2024.

Overall, there was a declining sulphate/chloride ratio trend over the reporting period, with the exception of bore CFW55R, which fluctuated similar to sulphate concentrations. Elevated sulphate concentrations were recorded at the Hunter River surface water monitoring sites WLP10 and WLP14 above the trigger level of 40 mg/L in August and September 2024. Sulphate concentrations were higher at the upstream site WLP14 (48 mg/L) compared to downstream site WLP10 (43 mg/L) in August, indicating the source of the elevated sulphate concentrations is likely upstream of HVO. In September, sulphate concentrations at downstream site WLP10 (41 mg/L) were slightly higher than upstream site WLP14 (40 mg/L).

EC and pH levels in the Hunter River, recorded at WLP10 increased over the reporting period but did not exceed the trigger levels. At WLP14 EC and pH remained relatively stable.

Figure 8-5: Groundwater Monitoring Locations adjacent to the Carrington Billabong

Table 8-9: Observations that Relate to the Monitoring Objectives Outlined in the Strategy

Goals	Objectives	2024 Observations
To reduce the impacts of threatening processes on the stands	To supress or eradicate the in situ environmental factors that are acting to reduce the viability of the remnant population	Weeds continue to dominate the species assemblage at Carrington Billabong. However, the previous 10 years of data suggests that active management and restoration should continue in order to "suppress and eradicate" this threat. *Phytophthora* protocols have been implemented, and feral pig management is continuing to minimise the spread of *Phytophthora* where possible. The growth of plantings in cleared areas adjacent to the Billabong has continued. It is hoped that, while these trees may protect the remnant trees from climatic factors, they may also provide habitat for birds and other species that may prey on the invertebrates that consume the eucalypt leaves.
	To improve the conditions within this population such that it can withstand reasonable periods of stress, predation and shortage of water supply	Planted eucalypts (discussed above) will play a role in protecting the remnant from climatic and biotic threats. Recommendations from genetic studies will be incorporated, and tubestock, originating from seed collected from the Namoi catchment, will be introduced across HVO stands.
To aid the establishment of the appropriate conditions to promote the health of the River Red Gum populations	To identify the likely *ex situ* factors that are contributing to the reduction in viability of this population and the health of the billabong and act, where possible, to control those factors or to take account of those factors in management approaches if they are not able to be directly controlled	The ERA outlines the groundwater exceedance issues around Carrington Billabong and ecological monitoring and triggers. To minimise the spread of *Phytophthora* where possible, *Phytophthora* protocols have been implemented, access tracks have

Goals	Objectives	2024 Observations
		been revised, and feral pig management is continuing.
	To ensure that the results of ongoing monitoring are appropriately used to modify the management regime in response to new or unexpected information	Annual weed and condition assessments, along with biennial ecological assessments, provide information to ensure that the intended targets are being achieved. Further monitoring, weed management and tubestock planting is planned for 2025.
Increase the understanding of the water requirements of the River Red Gums	Develop an understanding of water requirements through the timely monitoring of responses of River Red Gums to flood and storm events	The Strategy requires additional monitoring to be undertaken when triggered by flooding. No floods occurred during 2024. Groundwater monitoring is undertaken at Carrington Billabong.
To enhance the River Red Gum population to enable it to persist as a viable functioning population	To assist this population to continue to self-propagate to ensure ample replacement of senescing trees with juvenile recruits.	Limited natural recruitment has been observed to date. In 2024, grass weed wiping was trialled to determine the effectiveness of this technique for targeted weed control. Active weed and feral animal control will continue to assist the community to become a self-sustaining population.
	To support the establishment of a self-sustaining, functional and viable ecosystem that resembles what is likely to have been present in Carrington Billabong prior to European settlement	Ecological monitoring will continue in 2025. Management activities will continue, which will include tubestock planting to consolidate and expand on linear populations and connect adjacent areas where possible.
	To support the establishment of a self-sustaining, functional and viable ecosystem	
To increase biodiversity including residence habitat, foraging habitat and native flora and fauna species	To increase habitat for the identified and potential native flora and fauna species	During 2024, 1000 tubestock of RRG were planted across HVO priority areas in combination with 400 other species representative of the EEC community or species that provide dense habitat for

Goals	Objectives	2024 Observations
		insectivorous birds. While not all survived kangaroo and pig activities, or competition from grass and weeds, in combination with tubestock plantings that occurred in 2021 and 2022, the habitat area and local linkages will improve with tubestock establishment over time. The earlier trees have established and will provide effective habitat for small fauna in the future. Further tubestock plantings are planned for 2025.
To determine if there is any improvement or deterioration in RRG within Carrington Billabong	Monitoring was not required during 2024, however, tree deaths were investigated and the presence of *Phytophthora inundata* was confirmed. 2023 monitoring assessed the trees as “stressed” and had moderate to severe insect/fungal attack. This was exacerbated in an area of the Billabong during 2024 with several mature trees succumbing to the Phytophthora infection and repeated insect attacks.	
To determine if there is any improvement or deterioration of the natural habitat at Carrington Billabong	Monitoring was not required during 2024.	
To provide management recommendations to achieve further improvements in the ecological management of the site to assist in the recovery of RRG and their habitat	While it is not technically feasible to eradicate *Phytophthora* species at the Carrington Billabong, management of the RRG across HVO aims to: • slow the spread of the pathogens across Hunter Valley Operations land, • reduce feral animals within the area, specifically pigs, to prevent to dispersal of the soil pathogen, • continued weed management and reduce ground cover biomass, • continue to plant additional canopy and midstorey species in open areas, and • maintain ecological processes for the potential development of natural resistance in the population of susceptible species.	

8.12.3 | ECOLOGICAL RISK ASSESSMENT

HVO has a monitoring programme in place to monitor changes in groundwater quality due to seepage from the North Void TSF. Carrington Billabong is located adjacent to the North Void TSF.

As part of Condition 8, E2.1 of EPL 640, HVO has implemented a monitoring program that includes an Ecological Risk Assessment (ERA) (Umwelt 2020) that assesses the impact to the RRG community from the North Void TSF seepage. The annual monitoring is required to detect any notable decline in ecological condition of RRG at the Carrington Billabong. Should ecological monitoring identify any of the following factors, additional investigations will be implemented to determine the cause:

- An increase in tree dieback of 10% or greater compared to the previous year;
- Adult tree death of 10% compared to the previous year;
- Remnant ecological health scores decline of 10% compared to the previous year; and
- Unforeseen event that indicates a relatively rapid decline in ecological health or function that can't be linked to catchment wide causes (such as drought).

The results of the 2024 monitoring relative to these ERA trigger values is presented in **Table 8-10**.

Table 8-10: Factors to be Considered to Detect a Notable Decline in Ecological Condition of the RRG Community in Accordance with the ERA (Umwelt 2020)

Trigger	Monitoring Outcome - 2024
Groundwater quality indicates an increase in seepage from NV TSF	There were no bores with water levels trending above the trigger levels over the reporting period. With the exception of CFW55R, sulphate concentrations remained relatively stable over the reporting period. Sulphate concentrations in bore CFW55R fluctuated over the reporting period with an overall slight increase. Surface water monitoring sites in the Hunter River upstream and downstream of the NV TSF did not record any levels above the trigger levels for pH or EC during the reporting period. However, sulphate concentrations were elevated in August and September above the trigger level. Concentrations were higher at the upstream monitoring site (WLP14) indicating the source is likely further upstream from HVO.
An increase in tree dieback of 10% or greater compared to the previous year	For the 44 trees were monitored in both 2023 and 2024, there was a general decrease in the health of trees. Data for these trees showed that 30% had a decrease in the Canopy extent, 50% had a decrease in Crown tip growth, and 14% showed an increase in the Crown tip dieoff; and overall 32% of trees had a decrease in the overall canopy condition score, although, 48% of trees showed no change in canopy condition. Investigations identified *Phytophthora* to be present within the Billabong and, along with the repeated insect herbivory on the weakened trees, is likely to have contributed to tree decline.

Adult tree death of 10% compared to the previous year	Mortality of RRG cannot be determined for 2024 as not all trees from 2023 were monitored. However, no dead trees monitored in 2024 were alive when they were last surveyed, indicating that there has been no new deaths and no change in the mortality rate at Carrington Billabong.
Remnant ecological health scores decline of 10% compared to the previous year	2024 REHA assessments at Carrington Billabong were marginally higher than what was recorded in 2023, with only one site having a lower score in 2024 than in 2023.
Unforeseen event that indicates a relatively rapid decline in ecological health or function that can't be linked to catchment wide causes (such as drought)	Although rainfall in 2024 was around the climatic average, no RRG were monitored at the Reference site in 2024, so potential impacts of the rainfall at Carrington Billabong cannot be compared against any catchment wide patterns which may have occurred.

8.12.4 | MANAGEMENT ACTIONS

8.12.4.1 | TUBESTOCK PLANTING

A tubestock planting campaign did occur during March and April 2024. The focus was on the priority areas identified within the River Red Gum Rehabilitation and Restoration Strategy. 1400 tubestock were planted in the areas indicated in **Figure 8-6**.

The plants received supplementary watering post-planting to assist with establishment, but, in some areas, were subject to kangaroo grazing, pig rooting and overshadowing by thistle growth which reduced survival. These areas will be replanted during 2025 with the aim to expand the individual stands to reduce edge effects, develop connections between stands where possible, and improve ecological processes within the community.

Lessons from the 2024 plantings will be applied to the management activities in 2025.

Figure 8-6: 2024 Priority River Red Gum planting areas.

8.12.4.2 | WEED MANAGEMENT

During 2024, weed management outside the rehabilitation areas at HVO had a focus on riparian areas and other areas identified by the various inspections as containing specific priority weed species. These areas were targeted as they would afford benefits to the management of the River Red Gum populations, reducing pig habitat within riparian areas, improve the condition of areas that are assessed under the requirements of the HVO Riparian Vegetation and Stream Erosion Monitoring Program, and assist to reduce weeds that were known to be of concern.

As with previous years, the primary weeds of concern within riparian and River Red Gum areas include the balloon vine (*Cardiospermum grandiflorum*) and castor oil plant (*Ricinus communis*), which can smother adult trees, outcompete juvenile regrowth via shading, and provide habitat for feral pig populations. Thistle growth was an additional weed that caused issues during 2024 within the alluvial areas. The growth was rapid between inspections and, given the excellent growing conditions experienced, was able to smother the planted tubestock in some areas where it was not identified.

The River Red Gum areas that were targeted for weed control can be seen in **Figure 8-7**.

Within the Billabong, HVO has been concentrating efforts on regular slashing the open areas and the adjacent grazing paddock to reduce the possibility for weeds to establish and reseed. Previously, the density of exotic weeds smothered the shorter native species in the area. Slashing the open areas within the Billabong and priority areas did occur and the weeds did not obtain the height observed in previous years. The exception was the River Red Gum Priority site 33 where thistle growth was able to overshadow the planted tubestock resulting in plant losses before they were detected.

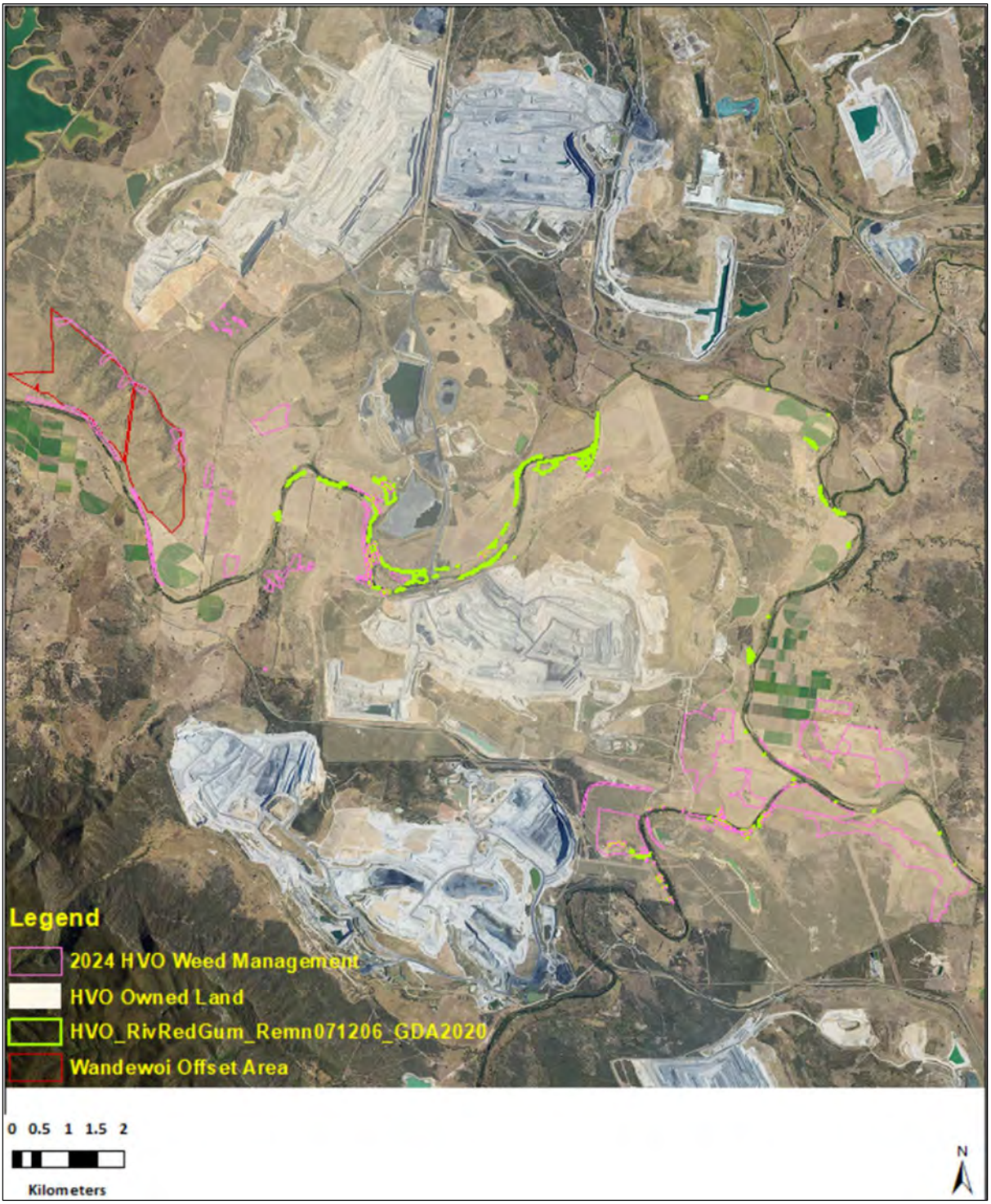


Figure 8-7: Weed management at HVO

8.12.4.3 | VERTEBRATE PEST CONTROL

As part of HVO's Vertebrate Pest Action Plan, programs are carried out on a seasonal basis and include sites where the River Red Gum populations are found. These programmes are conducted at a level of frequency designed to disrupt pest species breeding/colonisation cycles and employ a variety of methodologies including baiting, trapping and ground-based shooting. Feral pig control was undertaken in the Billabong and other RRG sites as a result of pig activity being observed. The focus on riparian weed management during 2024 was also intended to disrupt potential breeding sites for feral pigs. The removal of this habitat will open these areas, encourage native species recruitment and reduce the number of suitable areas for pigs to reside. Further detail on vertebrate pest control undertaken in 2024 is included in **Section 8.9**.

8.13 | BIODIVERSITY OFFSETS

8.13.1 | GOULBURN RIVER BIODIVERSITY AREA OVERVIEW

In accordance with condition 29 of HVO's Project Approval, PA 06_0261, Hunter Valley Operations are accountable for managing a 140ha offset at the Goulburn River Biodiversity Area (BA).

HVO manage a number of other offsets including the Wandewoi, Condon View, Crescent Head and Mitchelhill biodiversity areas, however, these are managed under EPBC approval 2016/7640, are subject to compliance reporting under that approval and are not subject to further discussion in this document.

The Goulburn River BA is located near the town of Merriwa and, when considered in combination with the adjoining offset for the Warkworth Mine, forms an area of protected vegetation extending from the Goulburn River National Park (**Figure 8-9**). The Goulburn River BA is managed according to the Goulburn River Management Plan that is available on the HVO website.

Given that the Goulburn River offsets for the Warkworth Mine and HVO are adjacent to each other, and both parties have a common managing partner in Yancoal, HVO and the Warkworth Mine have a commercial agreement for the HVO BA to be managed by the Warkworth Mine on its behalf. The benefit of this agreement is a reduction in duplication related to the management and monitoring activities that are undertaken by consultants and contractors. As such, while the figures presented below may include information relating to the Warkworth Mine, the text will focus on the data and activities originating from the HVO BA.

8.13.2 | WEATHER RECORDS

Overall, the rainfall recorded at the closest weather station to the Goulburn River BA exceeded the average total rainfall during 2024 (**Figure 8-8**). In this period, the Merriwa (Roscommon gauge) received 738.2 mm, which exceeded, by 140 mm, the mean average rainfall for the area (598 mm).

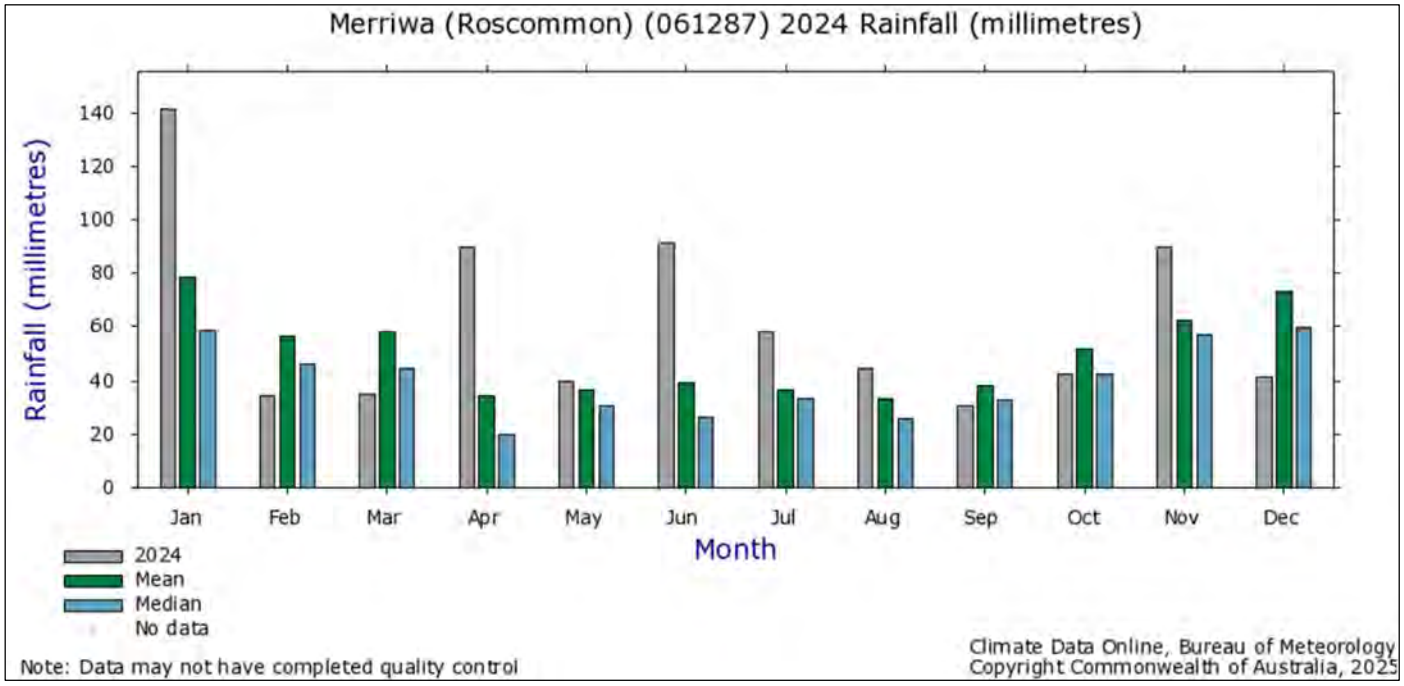


Figure 8-8: Rainfall Records Recorded at the Merriwa (Roscommon) Gauge - 2024

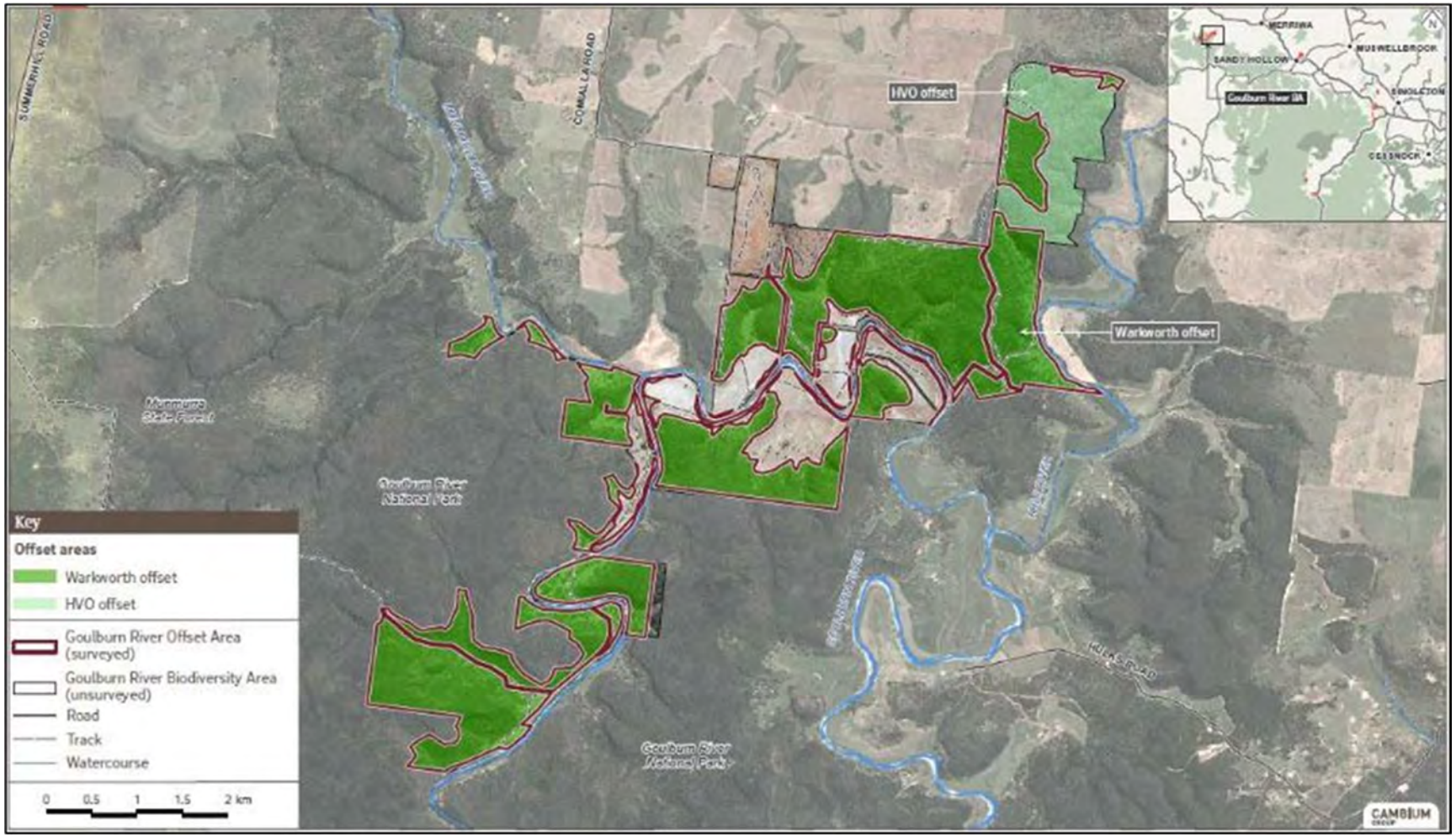


Figure 8-9: HVO's Goulburn River Offset and Adjoining Warkworth Mine Offset

8.13.3 | BIODIVERSITY AREA MANAGEMENT ACTIVITIES

The management activities implemented within the HVO biodiversity offset during 2024 were primarily weed management and feral animal control.

The tracks and fence lines were slashed during 2024 and the areas treated for weeds is shown in **Figure 8-10**. The majority of the HVO offset is in good condition with few weeds. The need for weed and feral animal intervention is assessed during the regular property inspections.

A summary of the key actions in the offset management plan and whether they occurred during 2024 is outlined in **Table 8-11** below.

Table 8-11: Biodiversity Area Management Activities 2024

Activity	Description
Weed Control	Focus on Prickly Pear and African Lovegrass.
Habitat Monitoring	The remnant woodland vegetation at the HVO portion of the Goulburn River BA is generally stable and should continue to recover from past disturbance with limited management intervention. The vegetation is in generally good condition, with a high native floristic biodiversity and low weed cover.
Bird Assemblage Monitoring	No Regent Honeyeaters or Swift Parrots were recorded, despite Regent Honeyeaters being recorded in the adjacent MTW biodiversity area. Three threatened bird species were detected during the surveys, and emus were recorded within the HVO offset for the first time. There was no statistically significant difference in species richness in total and woodland birds relative to 2022.
Infrastructure Management and Improvement	Tracks and fence lines slashed for vegetation regrowth and fire management.
Vertebrate Pest Management	Autumn/Winter and the Spring vertebrate pest management (baiting) programmes undertaken. Vertebrate pest thermal ground shoot occurred in March.
Property Inspections	Property inspections occurred in Feb, April, May, Sept, Oct, Dec.

Figure 8-10: Areas of weed control within HVO's Goulburn River Offset and adjoining Warkworth Mine Offset

8.13.3.1 | PROPERTY INSPECTIONS AND RAPID CONDITION ASSESSMENT

The HVO offset was assessed for the presence of weeds, native fauna, waste or stray stock, the state of the gates and fences and tracks, as well as any evidence of vertebrate pests or unauthorised activities during February, April, May, September, October and December 2024.

The reports were reviewed on receipt and any necessary actions undertaken or scheduled. In general, the site has limited weed issues despite the proximity to farmland, minor pig activities are typically detected during the inspections, and a variety of native fauna are observed commonly include kangaroos, wallabies and wallaroos, lace monitors and various species of native birds.

The tracks are typically in good condition and any fallen trees are removed during the inspection.

Signage on the gates into the HVO offset identify the HVO biodiversity offset and assist to delineate the boundary from the adjoining MTW biodiversity area.

The Rapid Condition Assessment was undertaken in November 2024 and the results are presented in **Table 8-12**. The results are consistent with the assessment for 2023, with both sites having a tally of 19 during both years.

Table 8-12: Rapid Condition Assessment results for 2024

Rapid Site Assessment - Woodland

Biodiversity Area	Goulburn River
Date	November 15 and 22 2024
Auditor	J Blair

Note: True = 1, False = 0 **Site #**	R GR1	R GR2	R GR3	R GR4	R GR5	R GR6	R GR7	R GR8	R GR9	R GR10	R GR11	R HVO1	R HVO2
Low grazing intensity - never farmed	1	1	Grassland	Grassland	1	1	1	1	1	1	1	1	1
Tree and shrub regeneration present (<2m)	1	1			1	1	1	1	1	1	1	1	1
Infrequent fire regime (<5year intervals)	1	1			1	1	1	1	1	1	1	1	1
Healthy mature trees (no dieback)	1	1			1	1	0	0	0	1	1	1	1
Little to no evidence of rabbits	1	1			1	1	1	1	1	1	1	1	1
Little to no evidence of foxes/cats	1	1			1	1	1	1	1	1	1	1	1
Low abundance of weeds (most remnants contain some weeds)	1	1			1	0	0	1	0	0	0	1	1
No evidence of firewood collection	1	1			1	1	1	1	1	1	1	1	1
No obvious signs of erosion or salinity	1	1			1	0	1	1	1	1	1	1	1
Not susceptible to fertiliser application, herbicide or pesticide drift	1	1			1	1	1	1	1	1	1	1	1
Less than 20% trees with Mistletoe (NB some mistletoe is healthy)	1	1			1	1	0	1	1	1	1	1	1
Few tracks, trails or fence lines	0	1			1	1	1	1	1	1	1	0	1
Presence of native shrubs	1	1			1	0	0	0	0	0	1	1	1
Presence of large, old growth trees with hollows	1	1			0	0	0	0	1	0	1	1	0
Dead timber is left standing	1	1			1	1	1	1	1	1	0	1	1
Fallen timber and logs are left on the ground	1	1			1	1	1	1	1	1	1	1	1
Abundance of native ground flora	1	1			1	0	1	1	1	1	1	1	1
Presence of litter, cryptogams, cracks and rocks	1	1			1	1	1	1	1	1	1	1	1
Remnant is large (> 5ha is optimum)	1	1			1	1	1	1	1	1	1	1	1
Connected to or in close proximity to other remnant vegetation	1	1			1	1	1	1	1	1	1	1	1
Health Rating	19	20			19	15	15	17	17	17	18	19	19

Note. The results relevant for the HVO offset are shown on the right side as HVO1 and HVO2.

8.13.3.2 | FERAL ANIMAL CONTROL

HVO undertakes vertebrate pest management activities within the offset properties that it manages. The aim of the vertebrate pest management program is to target wild dogs and foxes that have been reported in and around the BA. The programme involves 1080 ground baiting and ejector baiting in conjunction with the Hunter Local Land Services (HLLS), National Parks and Wildlife Services (NPWS) and local landholders. The Autumn/Winter and the Spring programs were the 18th and 19th respective programs to have occurred at the Goulburn River BA.

The ground baiting method used aligns with the *Humane pest animal control: Code of Practice and Standard Operating Procedures* produced by NSW Department of Primary Industry (DPI). An attractant was also added to lure wild dogs and foxes to the baiting sites to maximise the chances of the bait being detected and taken. The household grade fertilizer**,** *Charlie Carp (*seaweed extract*)* was used as an attractant in this program.

In accordance with the Pesticide Control (1080 Liquid Concentrate and Bait Products) Order 2020, neighbours were notified of the baiting program at least three days prior to the laying of the baits, by letter and / or public notice. In addition to the letter and public notices, 1080 poison notice signs were established on all properties that were baited.

During each program, nine bait stations were established within and adjacent to the HVO biodiversity area along with monitoring cameras to record the effectiveness of the stations. The locations and results of the Spring 2024 program is shown in **Figure 8-11.**

With the exception of one location in autumn, during both programs, each station recorded at least one bait taken within the baiting period. The camera monitoring indicated that the baits were taken by either a dog, fox, pig or, less frequently, goannas.

For the HVO portion of Goulburn River BA during the winter programme, there were 15 takes recorded over nine bait sites: two by wild dogs, eight by foxes, and five by non-target species. The Spring baiting programme recorded 17 takes over the nine bait sites, four by wild dogs, six by foxes, and seven by non-target species.

The results reflect seasonal change where the lace monitors become less active in cooler months and foraging decreases substantially. The results are welcomed as although research shows that Australian native fauna is naturally resistant to 1080 and concentrations in the meat bait need to be substantially higher to adversely affect the animals, any native species take is an undesirable outcome for baiting results. Therefore, continued baiting during this season is ideal to minimise lace monitor takes and optimise target species takes.

The motion sensor cameras established at the sites in photographic mode successfully captured images of target species taking the baits and as well as documenting species that occur within the area. These include an emu plus chicks, bush-tailed possums, wallaby species, wombats, lace monitors as well as pigs, hares, foxes and various bird species.

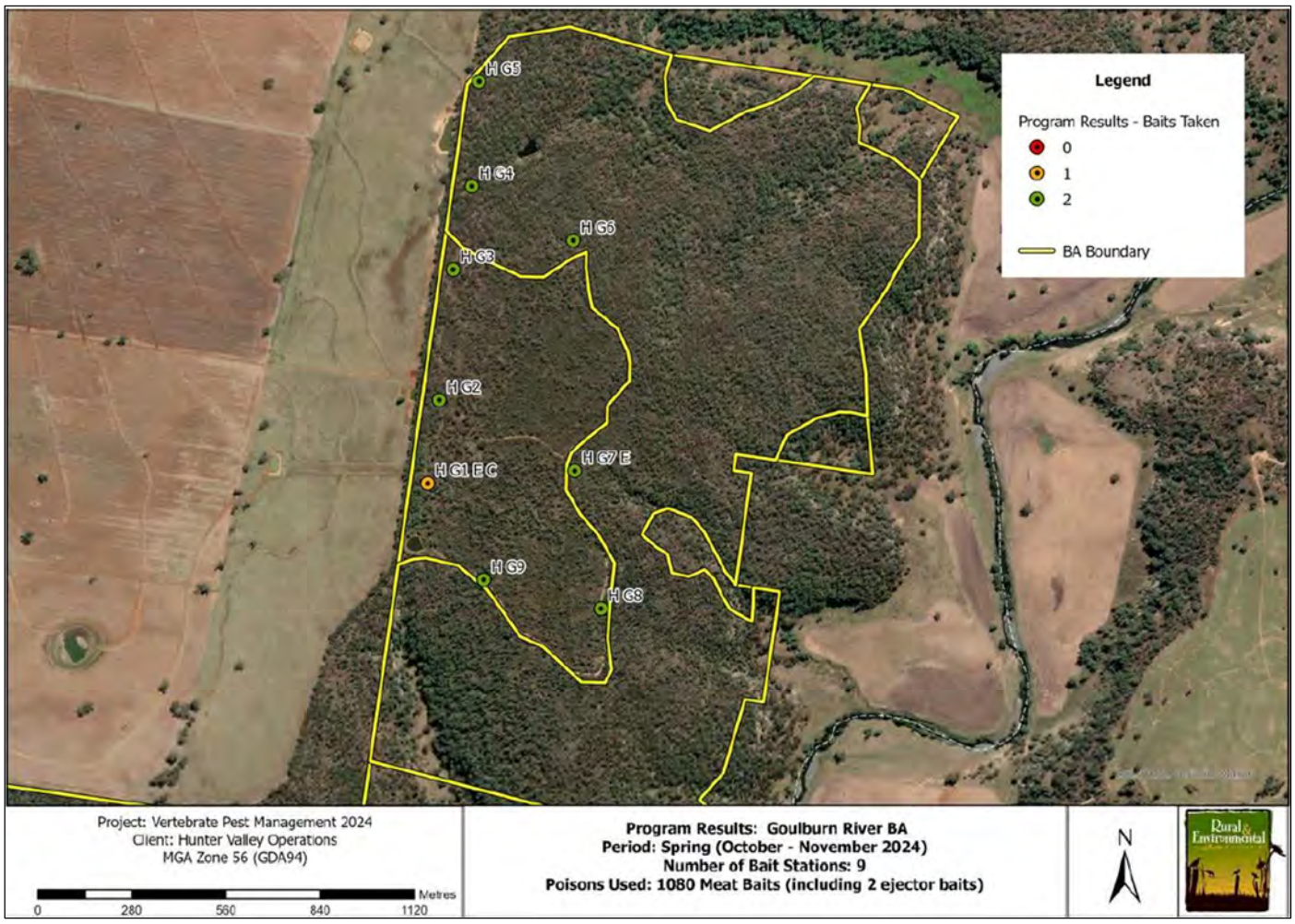


Figure 8-11: 2024 Vertebrate pest baiting locations and Spring Programme results at the Goulburn River Offset

Note: the HVO BA in the northeast corner contained nine baits.

9 | COMMUNITY

9.1 | COMPLAINTS

HVO provides a 24-hour Community Complaints Hotline (via freecall number 1800 888 733) for community members to comment on concerns relating to its operations. All complaint details are recorded in a database in accordance with Condition M6.2 of Environmental Protection Licence 640 and made available on HVO's website (www.hvo.com.au).

A total of thirteen (13) complaints were received by HVO during 2024 (refer to **Figure 9-1**). This represents an increase over nine (9) complaints for the previous year, however it is lower than the average amount of complaints received at HVO over the past decade (**Figure 9-3**). Complaints were related to blasting, dust, traffic and noise. **Figure 9-2** presents the number of complaints per complaint type. Details of complaints received during 2024 are outlined in **Table 9-1.**

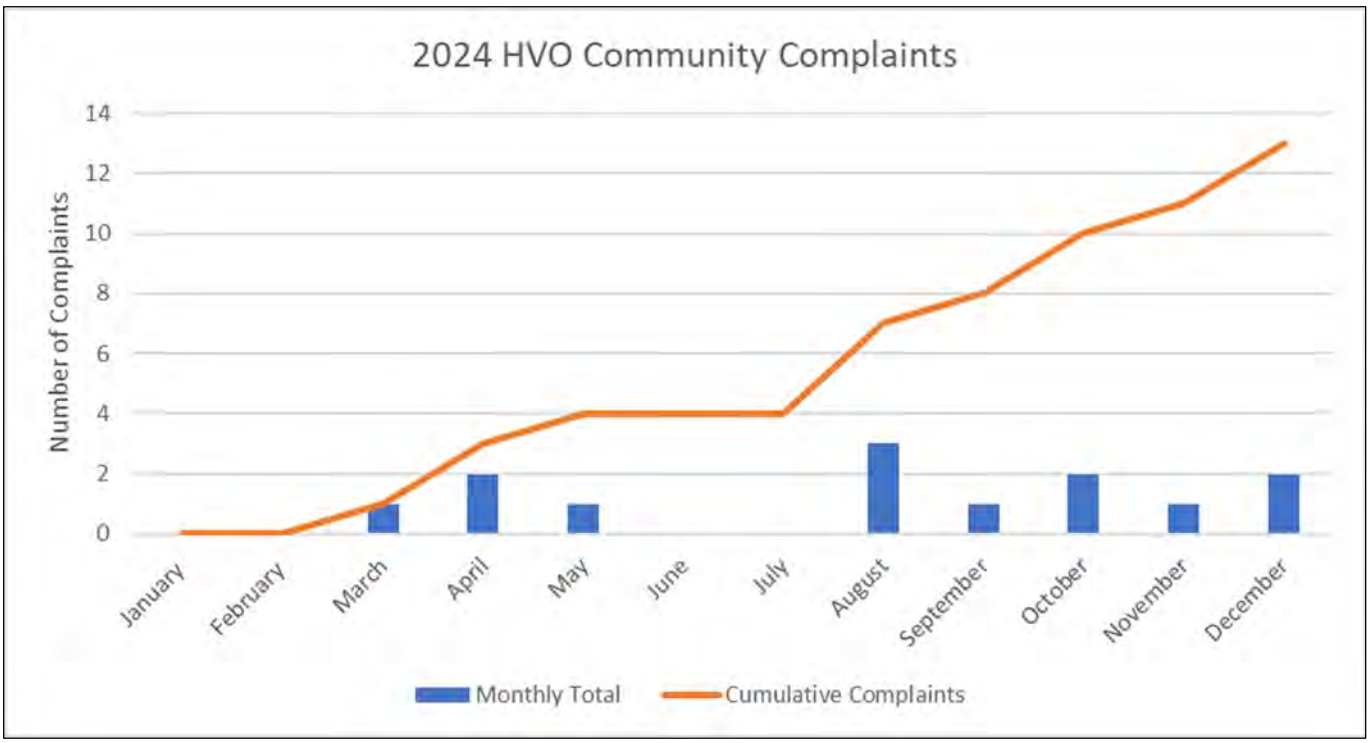


Figure 9-1: Summary of Community Complaints in 2024

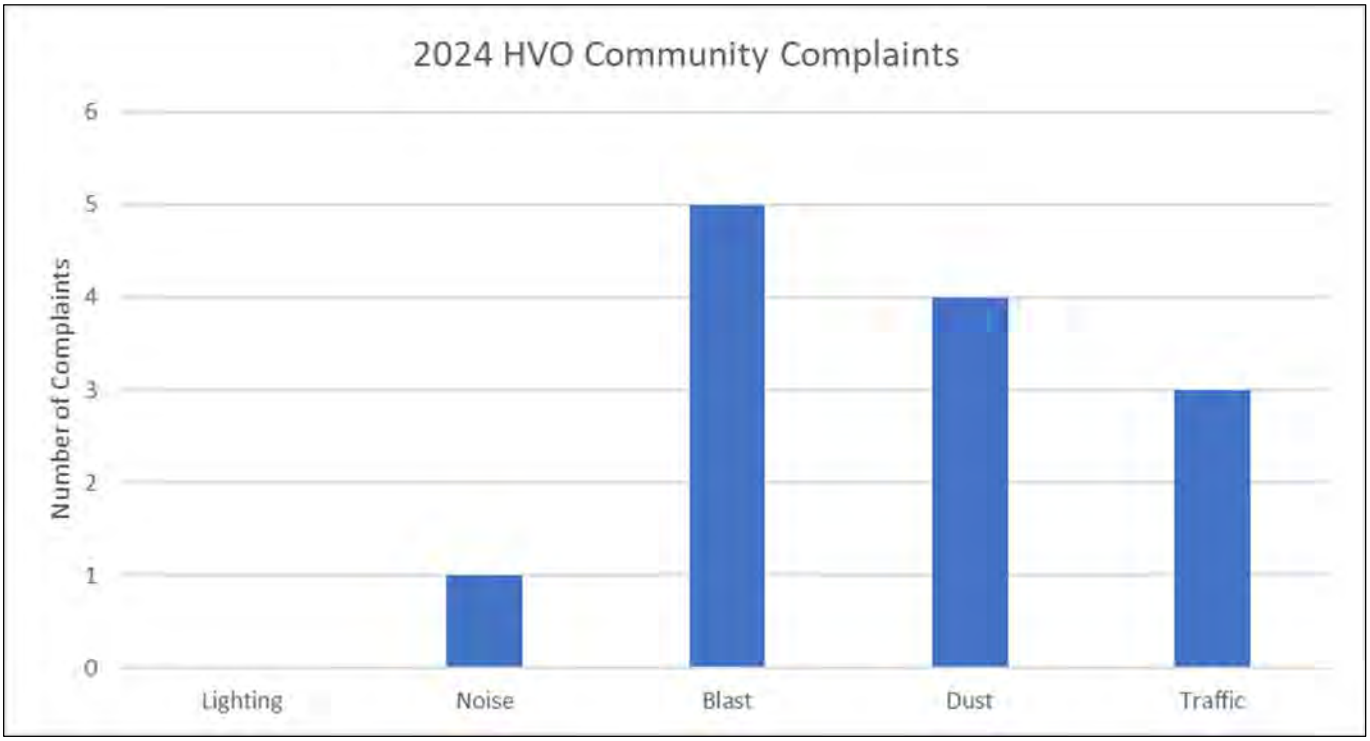


Figure 9-2: Number of Complaints per Type in 2024

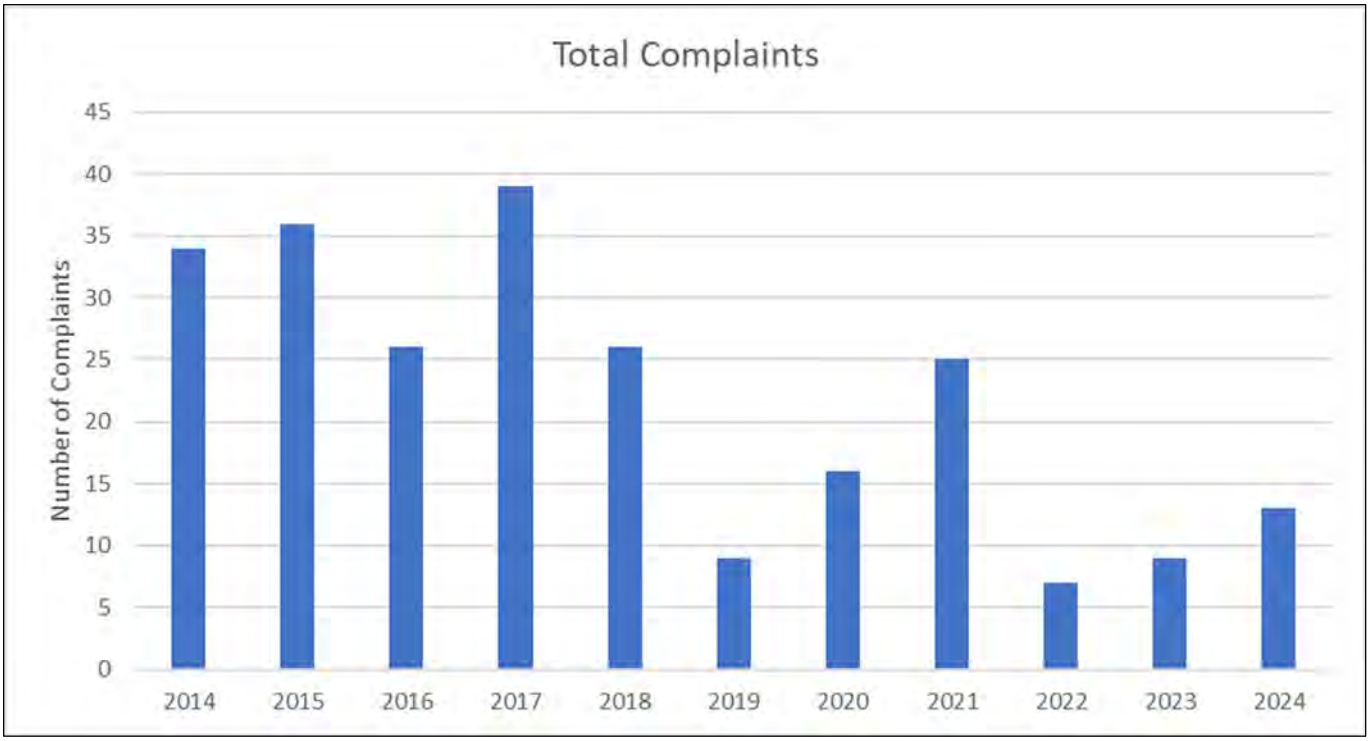


Figure 9-3: Community Complaints 2014-2024

Table 9-1: Details of Complaints Received in 2024

Date	Time	Nature of Complaint	Description	Follow Up Action
12 March 2024	8:59pm	Noise	A resident of Jerrys Plains called the Community Complaints Hotline at 8:59pm regarding noise, commenting that “noise is pretty loud tonight” as well as equipment horns could be heard	The OCE on duty in South Pit contacted the resident at 9:02pm and subsequently notified the OCE on duty in West Pit. Following communication between West Pit OCE and relevant equipment operators, horn use and dumping practices – thought to be the causes of the disturbance – were altered and/or stopped. An internal investigation conducted following the complaint found that no noise alarms had triggered within one hour of the complaint. Horn noise was audible from noise recordings at the Jerrys Plains noise monitor.
2 April 2024	1:31pm	Blast	A resident of Jerrys Plains called the United Wambo Joint Venture (UWJV) Community Complaints Hotline at 1:31pm regarding noise and vibration from a blast. This was relayed to HVO given they did not have a blast at that time.	A member of the HVO Environment and Community team contacted the resident to advise a blast had been fired in the Mitchell Pit at 1:29pm. The closest monitor to the resident recorded overpressure of 105.5 dBL against a criteria of 120 dBL and ground vibration of 0.11mm/s against a criteria of 10mm/s.
4 April 2024	12:30pm	Traffic	A resident of Jerrys Plains called the Community Complaints Hotline at 12:30pm regarding traffic incidents at HVO North entry off Lemington Road. The resident reported that a vehicle exiting HVO North on the afternoon of 3 April failed to stop at the stop sign and almost collided with his wife’s vehicle. They have witnessed other vehicles failing to stop at the same location within the past two months.	An internal investigation following the complaint resulted in a sitewide presentation about the importance of road safety whilst travelling to and from HVO delivered at daily HCOMs. Vegetation maintenance was performed to increase visibility at the intersection.

Date	Time	Nature of Complaint	Description	Follow Up Action
3 May 2024	7:40am	Traffic	A resident of Jerrys Plains called the Environment and community Officer directly regarding a traffic incident at HVO North's intersection with Lemington Road. The resident reported that a vehicle (small truck) exiting HVO North at approximately 7:40am on 3 May failed to stop at the stop sign and almost collided with his wifes vehicle.	Following an internal investigation into the complaint, a site-wide communication about road safety and the 100km/h speed limit along Lemington Road was delivered at daily HCOMs. In addition, road marking, signs and the surveillance camera near the intersection will be upgraded.
30 August 2024	10:05am	Blast	A resident of Jerrys Plains contacted the HVO Environment and Community officer directly via telephone at 10:05am describing two loud blasts in succession as well as floor movement and house shudder. The Environment and Community Officer communicated to the resident advising that a blast had been fired in the HVO Mitchell Pit at 10:04am.	The closest monitor to the resident recorded overpressure of 100.18 dBL against a criteria of 120 dBL and ground vibration of 0.06mm/s against a criteria of 10mm/s.
30 August 2024	10:13am	Blast	A resident of Jerrys Plains contacted the HVO Community Complaints Hotline at 10:13am describing two loud blasts in succession. The Environment and Community Officer communicated to the resident via telephone shortly after the call to advise a blast had been fired in the HVO Mitchell Pit at 10:04am.	The closest monitors to the resident, Jerrys Plains, recorded blasting levels below relevant criteria. Jerrys Plains Village: Overpressure 100.18 dBL against a criteria of 120dBL and ground vibration of 0.06mm/s against a criteria of 10mm/s. HVO conducted an internal investigation into the blast and provided the results to the resident

Date	Time	Nature of Complaint	Description	Follow Up Action
30 August 2024	10:19am	Blast	A resident of Jerrys Plains contacted the HVO Community Complaints Hotline at 10:19am describing two loud blasts in succession. The Environment and Community Officer communicated to the resident via telephone shortly after the call o advise a blast had been fired in the HVO Mitchell Pit at 10:04am.	The closest monitors to the resident, Jerrys Plains, recorded blasting levels below relevant criteria. Jerrys Plains Village: Overpressure 100.18 dBL against a criteria of 120dBL and ground vibration of 0.06mm/s against a criteria of 10mm/s. HVO conducted an internal investigation into the blast and provided the results to the resident.
24 September 2024	1:50pm	Blast	A resident of Maison Dieu contacted the HVO Community Complaints Hotline at 1:50pm describing a blast that occurred at 1.30pm that shook their house and left dust over their cars.	The HVO Environment and Community Officer communicated to the resident via telephone shortly after the call to advise a blast had been fired in the HVO Cheshunt Pit at 1:29pm. The closest monitors to the resident, Maison Dieu and Knodlers Lane, recorded blasting levels below relevant criteria. These monitors recorded overpressures of 112.74 and 114.6dBL respectively against a criteria of 120dBL and ground vibration of 0.33 and 0.26mm/s respectively against a criteria of 10mm/s. HVO conducted an internal investigation into the blast and as requested, provided the outcomes to the resident.
21 October 2024	6:33pm	Traffic	A member of the community called the HVO Community Complaints Hotline at 6:33am on 22 October regarding a traffic hazard at the intersection of the HVO South access road and Golden Highway. The community member reported that a vehicle exiting HVO South on the afternoon of 21 October failed to give way causing hem to brake sharply to avoid a collision with the offending vehicle.	A communication about the importance of providing an adequate gap at this intersection was provided to Mine and Maintenance teams at HVO South.

Date	Time	Nature of Complaint	Description	Follow Up Action
30 October 2024	1:50pm	Air Quality	A resident of Putty Road, Mt Thorley contacted the HVO community complaints hotline at 1.50pm on 30 October 2024 regarding poor air quality. The resident was not able to attribute the dusty conditions to a blast event or any other event or location related to HVO. The residence is approximately 13km from HVO's nearest active mining area.	The daily 24-hr results from the two closest real-time PM10 monitors (Knodlers Lane and Maison Dieu) were below the compliance limits.
4 November 2024	9:27am	Air Quality	A resident of Putty Road, Mt Thorley contacted HVO regarding poor air quality. The resident attributed dusty conditions to HVO South.	Representatives from HVO's Environment and Community team attended the residence to discuss the residents' concerns. The daily 24-hr results from the two closest real-time PM10 monitors (Knodlers Lane and Maison Dieu) were below the compliance limits. The residence is approximately 13km from HVO's nearest active mining area.
17 December 2024	11:00am	Air Quality	A resident of Putty Road, Mt Thorley contacted the HVO community complaints hotline regarding poor air quality. The resident attributed the dusty conditions to HVO South.	The resident was contacted by a HVO Environment and Community Officer to further discuss the nature of the complaint. The daily 24-hr results from the two closest real-time PM10 monitors (Knodlers Lane and Maison Dieu) were below the compliance limits.
21 December 2024	11:14am	Air Quality	A resident of Putty Road, Mt Thorley directly contacted a HVO Environment and Community Officer via telephone regarding poor air quality. The resident attributed the dusty conditions to HVO South.	The daily 24-hr results from the two closest real-time PM10 monitors (Knodlers Lane and Maison Dieu) were below the compliance limits.

9.2 | REVIEW OF COMMUNITY ENGAGEMENT

9.2.1 | COMMUNICATION

Two near neighbour newsletters were sent to HVO's near neighbours during 2024 providing an overview of:

- Operational updates
- Community initiatives and contributions
- Community grants programme
- Community information days
- Weed and pest management
- Continuation Project updates
- Communication tools –website, environmental monitoring public reporting website and the blast notification SMS alert system
- Water filter, tank cleaning and gutter cleaning availability

The HVO website as well as a social media channels also provided regular communications throughout 2024 on various aspects of the business.

9.2.2 | CONSULTATION AND ENGAGEMENT ACTIVITIES

Consultation and engagement activities included:

- Community grants
- Support of the Jerrys Plains Primary School Ready4school (preschool) programme
- Apprentice community working bees at Branxton pre-school
- Community perception survey
- The Community Consultative Committee
- Supply of amenity resources – water filters, tank and gutter cleans
- Resident notifications of air quality exceedances (where applicable)
- Community information sessions

Community information sessions were held at Jerrys Pains (23 April and 23 October) and Maison Dieu (13 April and 26 October) to provide information to near neighbours on current operations and the HVO Continuation Project.

HVO continued to encourage the community to contact the company in a way that suits the individual community members, including a 24-hour community information hotline.

9.2.3 | COMMUNITY CONSULTATIVE COMMITTEE

The HVO CCC meetings were held in February, May, August, and November 2024. The HVO CCC meet to discuss operations, projects and mine activities. The Committee is comprised of HVO representatives, community members and other key external stakeholders, including Singleton Council. The HVO CCC minutes are available on the HVO website (www.hvo.com.au). The community is invited to visit the website(s) to learn more about the HVO CCC.

In 2024 CCC members were:

- Dr Colin Gellatly (Independent chairperson)
- Cr Sue George (Singleton Council)
- Dr Neville Hodkinson
- Mrs Janelle Wenham
- Mr Brian Atfield
- Mrs Di Gee
- Mr Todd Mills
- Mr Michael Wellard
- Mrs Jeanie Hayes
- Mrs Sarah Purser (minute taker)
- HVO General Manager – David Foster
- HVO Environment & Community Manager – Andrew Speechly
- HVO Environment & Community Officer – Nic McLaughlin

9.2.4 | COMMUNITY GRANTS

HVO supports local not for profit organisations applications for support that have a clear community benefit in terms of capacity building, heath, environment and/or local need via its community grants programme. A total financial contribution of approximately $121,721 was provided to community organisations during 2024.

Local organisations successful in obtaining funding included:

- Jerrys Plains Public School – Ready4School programme
- Singleton PCYC - 2024 Book Fair to raise funds for youth activities at the centre
- Rotary Club of Singleton on Hunter - Silver sponsor of Singleton Art Prize
- Singleton Public Library - Little Bang Science Programme workshops for 3–5-year-olds
- Denman Public School - Renaissance Star Reading literacy programme for Kindergarten to Year 6 students
- Singleton Public School - Replace electronic whiteboards in classrooms
- Singleton Neighbourhood Centre - Personal safety devices for volunteers servicing vulnerable groups

- Maitland Tenambit BMX Club - Installation of a transponder (timing loop) system to enable riders to compare racing and training times
- Upper Hunter Homeless - Additional food kept on site to feed people experiencing homelessness
- Sandy Hollow Public School - Line marking of athletic fields and beach sand for long jump pit
- Hunter Valley Camp Draft - Upgrade toilet and shower facilities for both sexes at Whittingham facility
- Mark Hughes Foundation - Support to hold 50 Sparkling Years fundraising event
- Muswellbrook High School - Funding for Student Representative Council to hold a colour run event to support Motor Neuron Disease research
- Cessnock City Council - Support to hold Our Bushland Festival
- Australian Stock Horse Association - Prize money for Eastern Branch ASHS Championships and Performance Weekend
- Sunnyfield - Weekly pottery classes during school term for clients with a disability
- St Catherine's Catholic College - First Aid Course for Year 10 students
- NSW Scout Association - Support an Upper Hunter scout to attend the Queensland Scout Jamboree
- Business Singleton - Platinum sponsor of Singleton Business Awards
- Maitland Steam and Antique Machinery Association - Mezzanine flooring to prevent flooding at Hunter Valley Steamfest
- Muswellbrook Chamber of Commerce - Exhibit sponsor of TV, Movie and Nostalgia Festival
- Westpac Rescue Helicopter - Charity Golf Day
- Bellbird Cricket Club - Gazebos, iPads
- Detour Youth Services - Music therapy room
- Singleton Neighbourhood Centre - Signage
- Samaritans Singleton - Christmas Eve Lunch 2024
- Singleton Fire Brigade Social Club - Annual Santa lolly run

In addition to the HVO community grants programme, five HVO haul trucks continued their partnerships with local/regional charities during 2024. The trays of the trucks have been painted in the colours of Westpac Rescue Helicopter Service, Hunter Prostate Cancer Alliance, Type 1 Foundation, Singleton Family Support and Hunter Breast Cancer Foundation. The charities receive an agreed donation for every load the trucks haul, plus other fundraising support throughout the year. These charities received a combined $40,000 for the 2024 calendar year. Each of the five charities also took part in the HVO Family Day where donations were collected as part of the dunk tank display.

Multiple HVO employees donated back their Christmas gift vouchers, of which HVO matched that giving and delivered $3,400 in gift vouchers to Singleton Family Support ($2,600) and the Singleton Salvation Army ($1,800) in time for Christmas. HVO also provided St Vincent de Paul with non-perishable food items collected as part of HVOs staff Christmas giving project.

Food remaining after the HVO Family Day on 25 May 2024 was donated and transported to the Singleton Neighbourhood centre.

The HVO apprentice programme conducted two full days of in-kind service at Branxton Preschool during early 2024 to assist in the construction of the school's new playground area by:

- Erecting raised garden beds
- Painting structures and fences
- Spreading mulch
- Erecting signage
- Assembling outdoor furniture
- Laying turf

9.2.5 | HVO CONTINUATION PROJECT

Community members and stakeholders have been consulted through each step of the HVO Continuation Project. Community feedback has helped to design and refine the proposal and our plans to minimise and manage social and environmental impacts.

HVO used a variety of tools to provide information and gather feedback consistent with the State Significant Development Engagement Guidelines 2021, Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 and the Secretary's Environmental Assessment Requirements (SEARs) issued by DPHI.

Engagement has also included the following:

- Project newsletters for the local community;
- Community information sessions in Jerrys Plains, Maison Dieu and Long Point;
- Other community and stakeholder meetings;
- Consultation with HVO's Community Consultative Committee;
- Information on the HVO website and social media channels;
- Consultation with 33 RAPs; and
- Responding to email and phone enquiries.

The HVO Continuation Project Environmental Impact Statement was placed on public exhibition by DPHI during February 2023. HVO reviewed all submissions and in November 2023 submitted a Submissions Report and an Amendment Report to DPHI. During 2024 DPHI has asked for more detailed information on several occasions as part of its assessment of the HVO Continuation Project. HVO is conducting additional modelling and mine planning to provide this information.

The Federal Government will independently assess the HVO Continuation Project in accordance with the *Environment Protection and Biodiversity Conservation Act* 1999.

10 | INDEPENDENT AUDIT

The last Independent Environmental Audit (IEA) was undertaken in November 2022. This audit was undertaken against the conditions of both Project Approval PA 06_0261 (as modified) and DA 450-10-2003 (as modified). The audit also assessed compliance with other licences and approvals including mining leases and EPL 640.

RPS AAP Consulting Pty Ltd (RPS) were engaged and endorsed by DPHI as suitably qualified, independent experts to undertake the audit. The timeframe for the audit was from 2 December 2019 to 30 November 2022. The site inspection component of the audit was undertaken over three days between 28 and 30 November 2022.

The audit report and HVO's response to the auditor's recommendations were submitted to the DPHI on 23 February 2023.

The audit report was revised and resubmitted June 2023 to address comments from DPHI.

The audit identified 14 non-compliances with PA 06_0261 and DA 450-10-2003:

- 6 non-compliances associated with PA 06_0261
- 8 non-compliances associated with DA 450-10-2003

These findings, along with the auditor's recommendation and HVO's response to these recommendations, are summarized in **Table 10-1**. The 2022 IEA can be downloaded from the HVO Website.

The next IEA is scheduled to commence in November 2025.

Table 10-1: Independent Audit Recommendations

Ref	Recommendation	HVO Response	Due Date
HVO South – PA 06_0261 Non-Compliance Recommendations			
S2 C2	No Further Action Required	No Further Action Required	N/A
S2 C2A	Refer S2 C2	No Further Action Required	N/A
S3 C2	Reference in Table 9 of the Monthly Environmental Monitoring Reports should be updated to reference LA1, 1-minute criteria Where a tonality penalty has been applied, the monthly report should include discussion and clarification on whether this constitutes an exceedance or is attributable to other sources.	HVO will amend future Monthly Environmental Monitoring Reports to included updated reference HVO will amend future Noise Reports to include discussion and clarification regarding observed tonality penalties	Complete
S2 C7	No Further Action Required	No Further Action Required	N/A
S3 C15	Ensure that the blasting schedule on the HVO website is maintained.	Issue with the Blasting Schedule link from the “Contacts” page has been rectified	Complete
S3 C15	It is recommended that management plans, and other necessary documents include a table itemising the matters raised during consultation with identified parties, and description of the resolution of these matters.	HVO will amend and include in future revised management plans and other necessary documents a table itemising the matters raised during consultation with identified parties, and description of the resolution of these matters.	Complete*
S3 C18	Recommend updating Section 1, Table 1 to Table 3 of the BMP to ensure correct references in column 3 (“Section of BMP which addresses this requirement”, “Where Commitment is addressed”, “Where Condition is addressed”).	HVO will amend in the next revision of the Blast Management Plan.	Complete* The BMP was updated and resubmitted
S3 C19	It is recommended that operators are provided with refresher training to ensure awareness of these TARPs and to ensure more proactive management of wheel generated and plant-generated dust.	HVO will roll out refresher training to operators to ensure awareness of Dust TARPS.	Complete

Ref	Recommendation	HVO Response	Due Date
S3 C25	Repair the eroded batter to Dam 37S or redirect flow to the existing stabilised entries. Sediment should then be removed from the basin to restore capacity	HVO will include repair works in future works programs to ensure completion. HVO will undertake a review of current sediment storage capacity compared to dam design criteria to determine whether further desilting is required.	Complete
S3 C27	Version 3.4 of the WMP has been issued to the secretary and is awaiting approval. Review the contents of the WMP to reflect the audit findings when next updated.	HVO will amend in the next revision of the Water Management Plan.	Complete* WMP was resubmitted.
S3 C58	Ensure that waste containers have lids fitted and/or are stored undercover to limit additional generation of contaminated liquid.	HVO will undertake a site inspection to ensure lids are fitted to waste containers on bunded pallets that are not undercover and reinforce this expectation with a site communication.	Complete
HVO North – DA 450-10-2003 Non-Compliance Recommendations			
S2 C2	No Further Action Required	No Further Action Required	N/A
S2 C2A	Refer S2 C2	No Further Action Required	N/A
S3 C2	Where a tonality penalty has been applied, the monthly report should include discussion and clarification on whether this constitutes an exceedance or is attributable to other sources.	HVO will amend future Noise Reports to include discussion and clarification regarding observed tonality penalties	Complete
S3 C4A	It is recommended that operators are provided with refresher training to ensure awareness of these TARPs and to ensure more proactive management of wheel generated and plant-generated dust	HVO will roll out refresher training to operators to ensure awareness of TARPS	Complete
S3 C7	Reference in Table 9 of the Monthly Environmental Monitoring Reports should be updated to reference LA1, 1-minute criteria	HVO will amend future Monthly Environmental Monitoring Reports to included updated reference	Complete

Ref	Recommendation	HVO Response	Due Date
S3 C10	Recommend updating Section 8.1.1, Table 8-1 to reference AS1055- 2018 (supersedes AS1055-1997), and include reference to NSW EPA Approved methods for the measurement and analysis of environmental noise in NSW, 2022.	HVO will amend in the next revision of the Noise Management Plan.	Complete
S3 C19	Recommend updating Section 1, Table 1 to Table 3 of the BMP to ensure correct references in column 3 (“Section of BMP which addresses this requirement”, “Where Commitment is addressed”, “Where Condition is addressed”).	HVO will amend in the next revision of the Blast Management Plan.	Complete*
S3 C20	No Further Action Required	No Further Action Required	N/A
S3 C21	No Further Action Required	No Further Action Required	N/A
S3 C27	Version 3.4 of the WMP has been issued to the secretary and is awaiting approval. Review the contents of the WMP to reflect the audit findings when next updated. Repair the inlet to Dam 5N to stop ongoing sedimentation, remove sediment from the dam, and confirm the capacity of Dam 5N and Dam 2N meets industry guidelines.	HVO will amend in the next revision of the Water Management Plan. HVO will include repair works in future works programs to ensure completion. HVO will undertake a review of current storage capacity in relation to Bluebook Standard to confirm whether current storage capacities are sufficient or additional capacity is required.	Complete* Complete Complete
S3 C28A	No Further Action Required	No Further Action Required	N/A

* Date indicates when Management Plans are submitted for Department approval. Timing of approval and finalisation of the plan with the changes is outside of HVO’s control.

11 | INCIDENTS AND NON-COMPLIANCES

During 2024 there were twelve (12) incidents that required reporting to DPHI. These were related to air quality, blast fume and water and are summarised below.

Cheshunt East PM_{10} Exceedance – 5 February 2024

HVO recorded a 24-hour average of 69.1 µg/m^3 at the Cheshunt East HVAS, above the HVO North consent criteria of 50 µg/m^3. The maximum HVO contribution to this exceedance was calculated to be 13.4 µg/m^3. HVO considers that all reasonable and feasible avoidance and mitigation measures were taken in accordance with the site AQGGMP to manage particulate emissions on this day.

Jerrys Plains PM_{10} Exceedance – 13 March 2024

HVO recorded a 24-hour average of 51.2 µg/m^3 at the Jerrys Plains TEOM, above the HVO North consent criteria of 50 µg/m^3. The maximum HVO contribution to this exceedance was calculated to be 13.3 µg/m^3. HVO considers that all reasonable and feasible avoidance and mitigation measures were taken in accordance with the site AQGGMP to manage particulate emissions on this day.

Level 4B Blast Fume Event - 4 June 2024

HVO initiated a blast in Cheshunt Pit 1 at 1:09pm on Tuesday 4 June 2024. Post initiation, fume was observed and ranked Level 4B in accordance with the AEISG rating scale. Blast fume travelled from the initiation point post ignition in a south-easterly direction, dispersing over the pit. The blast was postponed due to the identification of a 'possible' risk of blast fume, and the Glider Club being occupied and downwind of the blast on 31 May 2024 when the blast was initially scheduled.

HVO received approximately 51mm of rain between 31 May and 2 June. This is considered to be the primary cause of the fume. The blast was designed and loaded in accordance with fume mitigation practices and HVO's pre-blast risk assessment adequately identified risks and controls to mitigate offsite impacts.

Dam 17N Pumping Incident - 22 June 2024

During a routine inspection by the CHPP, a small diameter hose was found to be discharging mine water into Farrells Creek. The hose was connected to a pump as part of works to dewater Dam 17N. The maximum estimated volume discharged to Farrells Creek was 523kL between 13 and 22 June. The pump was immediately turned off and water quality testing undertaken. Upstream water quality had a higher salinity than the discharged water and downstream samples. It was determined that no actual or potential environmental harm was caused. EPA was notified on 24 June and incident report submitted. HVO received a Penalty Infringement Notice of $30,000 from the EPA for this event.

Jerrys Plains PM_{10} Exceedance – 4 November 2024

HVO recorded a 24-hour average of 57.9 µg/m^3 at the Jerrys Plains TEOM, above the HVO North consent criteria of 50 µg/m^3. The maximum HVO contribution to this exceedance was calculated to be 1.2 µg/m^3. HVO considers that all reasonable and feasible avoidance and mitigation measures were taken in accordance with the site AQGGMP to manage particulate emissions on this day.

Cheshunt East PM10 Exceedance – 7 November 2024

HVO recorded a 24-hour average of 53.9 µg/m^3 at the Cheshunt East HVAS, above the HVO North consent criteria of 50 µg/m^3. The maximum HVO contribution to this exceedance was calculated to be 11.1 µg/m^3. HVO considers that all reasonable and feasible avoidance and mitigation measures were taken in accordance with the site AQGGMP to manage particulate emissions on this day.

Level 4B Blast Fume Event – 22 November 2024

HVO initiated a blast in West Pit at 1:20pm on Friday 22 November 2024. Post initiation, fume was observed and ranked Level 4B in accordance with the AEISG rating scale. Blast fume travelled from the initiation point post ignition in a westerly direction, dispersing over the pit. The blast was planned to be fired on Wednesday 20th November, however loading of the blast was delayed by two days due to rain. As part of the pre-blast risk assessment, it was identified that fume was possible from the blast as a result of rain received during loading (9.4mm).

The blast was designed and loaded in accordance with fume mitigation practices and HVO's pre-blast risk assessment adequately identified risks and controls to mitigate offsite impacts. Internal loading practices are being reviewed and will be updated as required to reduce likelihood of fume generation as a result of loss in confinement and water ingress.

Jerrys Plains PM_{10} Exceedance – 14 December 2024

HVO recorded a 24-hour average of 50.6 µg/m3 at the Jerrys Plains TEOM, above the HVO North consent criteria of 50 µg/m3. The maximum HVO contribution to this exceedance was calculated to be 13.0 µg/m3. HVO considers that all reasonable and feasible avoidance and mitigation measures were taken in accordance with the site AQGGMP to manage particulate emissions on this day.

DL30 and Warkworth Depositional Dust Exceedances – 2024 Annual Average

The DL30 and Warkworth monitoring locations exceeded the annual average insoluble matter deposition rate criteria of 4 g/m^2/month (HVO North only) during 2024. However, all results were below the maximum insoluble solids incremental increase criterion of 2 g/m^2/month and hence compliant with criteria.

An external specialist investigation determined the exceedances to be due to local sources of dust in close proximity to the monitors. The elevated levels at DL30 and Warkworth were assessed to estimate the maximum contribution from HVO North to the annual results. The HVO North maximum contribution to the incremental increase at DL30 was 0.2 g/m^2/month, and 0.0 g/m^2/month at Warkworth. These maximum concentrations were not deemed to have caused the exceedances. The monitors are located in close proximity to HVO South, on the opposite side of HVO North. Given the significant separation distances between HVO North and these monitors, HVO North's contribution to these monitoring sites would always be low and likely indiscernible from background concentrations and the influences of other mines. Therefore, HVO North could only reasonably have a tangible impact at its nearest monitors which include D118 and D119.

Warkworth TSP Exceedance – 2024 Annual Average

The Warkworth TSP monitoring location recorded an annual average of 137.5 µg/m^3 compared to a criteria of 90 ug/m^3.

Contributions at the TSP monitors were estimated to be the 24-hour concentrations minus an estimated background level on the corresponding day. The background level is considered to be the level which excludes the contribution from HVO but may include the influence of other sources, including other mines, localised sources, or regional sources of background dust. For the Warkworth monitor, which is often downwind of HVO South and a neighbouring mine concurrently, the daily contribution is considered to include both mines. In order to determine the contribution from HVO South alone, the combined mining increment was scaled by the proportion of time the monitor was downwind of HVO South relative to the total time the monitor was downwind of both mines during each 24-hour period.

Further methodology for determining HVO contribution is presented in Section 2.7.1 of **Appendix A**. This investigation method has determined the contribution of HVO South to the Warkworth annual average to be 41.6 µg/m^3.

Warkworth and Hunter Valley Glider Club (HVGC) PM_{10} Exceedances – 2024 Annual Average

Annual average PM_{10} levels were above the impact assessment criteria of 25 µg/m^3 for HVO South at the Hunter Valley Gliding Club (HVAS) (28.8 µg/m^3) and Warkworth (TEOM) (28.0 µg/m^3) during 2024. These exceedances were investigated by a specialist consultant (see **Appendix A**). The investigation estimated maximum incremental contribution to PM_{10} level from HVO South to be a minor contribution to the overall result (2.7 µg/m^3 for Warkworth, 28.8 µg/m^3 for HVGC). There are no privately owned residences near the Warkworth or Glider Club monitors and HVO has a Concessions and Mitigation Agreement with the Gliding Club with respect to air quality levels when the facilities are in use. Refer to Section 2.6.1 of **Appendix A** for more information.

Maison Dieu and Kilburnie South $PM_{2.5}$ Exceedances – 2024 Annual Average

Annual average $PM_{2.5}$ was above the annual average criteria of 8 µg/m^3 at Maison Dieu (10.5 µg/m^3) and Kilburnie South (8.9 µg/m^3) for the reporting period. While HVO's contribution is not calculated to be significant, the elevated total levels are considered to be anomalously high and are not consistent with other regional $PM_{2.5}$ monitors or expected ratios of co-located $PM_{2.5}$ monitors. $PM_{2.5}$ levels recorded have been investigated throughout the year, including:

- Monitoring locations have been inspected multiple times to identify any significant local $PM_{2.5}$ sources, with none identified.
- Calculation of PM_{10}:$PM_{2.5}$ ratios for monitoring equipment for co-located units. The ratio in the Hunter Valley is typically 0.3 to 0.4. Ratios measured at HVO range from 0.31 to 0.78.
- Comparison to levels recorded by new EBAMs installed in March 2023.

It is believed that the source of the high readings is due to the high-volume air sampler monitoring method. HVO engaged an air quality consultant to review the air quality monitoring network. The review recommended the implementation of real-time $PM_{2.5}$ monitoring at Maison Dieu and Kilburnie South. During March 2023, HVO installed Beta Attenuation Mass Monitors (EBAMs) which is an equivalent type to that used in the EPA's Upper Hunter Air Quality Monitoring Network. The use of the EBAMs is pending DPHI approval of the AQGG Management Plan. The aim of these monitors is to determine the potential contribution of HVO South to annual average $PM_{2.5}$ levels recorded at HVO HVAS monitors. Given that the results recorded at the Maison Dieu and Kilburnie South HVAS monitors appears to be implausibly high, monitoring data at these locations have been used in order to estimate HVO South's increment to the recorded levels.

12 | ACTIVITIES TO BE COMPLETED IN 2025

12.1 | APPROVALS

Continued assessment and determination of the HVO Continuation Project and HVO North MOD 8.

12.2 | NOISE

Noise management improvements identified for implementation in 2025 include:

- Sound Power Level testing of various heavy mining equipment,
- Install replacements for ageing Barnowl monitors; and
- Fitting of sound attenuation to new heavy mining equipment brought to site.

12.3 | AIR QUALITY

Air quality management improvements identified for implementation in 2025 include:

- Aerial seeding of overburden that is temporarily unavailable for rehabilitation where available,
- Continue implementation of recommendations from a review of the air quality monitoring program,
- Upgrading watercart fill points for reliability and improve filling times,
- Implement new real-time monitoring data interface; and

12.4 | BLASTING

HVO will continue to manage blasting activities in 2025 in accordance with the *Blast Management Plan*.

12.5 | ABORIGINAL AND HISTORIC HERITAGE

Improvements to historic heritage identified for implementation during 2025 include implementation of the balustrade repair work for Wandewoi homestead and tendering for repair works identified at Archerfield homestead.

Following approval of the Mitchell Pit South AHIP application and the granting of AHIP 5350 during December 2024, HVO will commence community salvage works during early 2025.

12.6 | WATER

Improvements to mine water management in 2025 include:

- Install erosion and sediment control infrastructure ahead of mining in Mitchell Pit;

- Detailed engineering and scoping of water containment projects beyond 2025;
- Continue geotechnical investigations and engineering for barrier wall installation or alternative method to control seepage from the North Void TSF; and
- Ongoing upgrade of internal water transfer pipelines, pumping infrastructure, and system controls and monitoring

12.7 | REHABILITATION

During the next reporting period key focus areas for HVO will be:

- Completion of annual rehabilitation target of 54.6 ha of new rehabilitation,
- Continuation of Section 240 rehabilitation maintenance plan including progression of 10.75 hectares of historic cover crop management areas to final target land use.

12.8 | TAILINGS STORAGE FACILITIES

The following tailing storage facility activities are planned for 2025:

- Continuation of management activities for the North Void TSF, focusing on monitoring, dewatering and surface strength development,
    - CPTu testing and additional groundwater monitoring locations to be installed in 2025, to inform ground water modelling, barrier wall design and TSF closure plans.
- Review & Update of all tailings dam Operational and Maintenance Manuals,
- Continue capping activities on Bob's Dump TSF; and
    - CPTu testing and additional groundwater monitoring locations to be installed in 2025, to inform ground water modelling, barrier wall design and TSF closure plans.
- Continue Geochemical sampling analysis on tailings and exploration drill holes
- Installation of new spigot locations in Carington In Pit TSF; and
- CSER research project vegetation trial occurring on Dam 6.

12.9 | STAKEHOLDER ENGAGEMENT

The following stakeholder engagement activities are planned for 2025:

- Hosting four CCC meetings,
- Implementing two rounds of the HVO Community Grants Fund,
- Undertaking an improvement project in the community with HVO Apprentices,
- Developing and distributing two community newsletters,
- Conducting two Community Information sessions (at Jerrys Plains and Maison Dieu),
- Regular website updates including environmental monitoring reports and CCC meeting agendas, minutes and presentations;
- Regular social media updates;
- Hosting a School Site Tour; and
- Stakeholder engagement activities related to the HVO Continuation Project and HVO North MOD 8.

12.10 | INDEPENDENT ENVIRONMENTAL AUDIT

The next IEA is scheduled to commence in November 2025.

APPENDIX A: ANNUAL AIR QUALITY REVIEW

HUNTER VALLEY OPERATIONS ANNUAL DATA REVIEW 2024

Hunter Valley Operations

24 March 2025

Job Number 23121677K

Prepared by
Todoroski Air Sciences Pty Ltd
Suite 2B, 14 Glen Street
Eastwood, NSW 2122
Phone: (02) 9874 2123
Fax: (02) 9874 2125
Email: info@airsciences.com.au

HUNTER VALLEY OPERATIONS ANNUAL DATA REVIEW 2024

DOCUMENT CONTROL

Prepared by	Reviewed by
EA	DK

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

Todoroski Air Sciences have conducted an annual review of the 2024 measured dust levels at monitors which are part of the Hunter Valley Operations (HVO) North and South air quality monitoring network. Elevated short term (i.e. 24-hour average) levels are investigated routinely throughout the year; hence the focus of this review is to present all annual average levels and conduct an analysis on any elevated readings recorded in 2024. This report also includes a comparison between the dust levels measured in 2024 with the modelled predictions for the approximate "Stage 3" per the *Air Quality and Greenhouse Gas Assessment HVO South Modification 5* **Todoroski Air Sciences, 2017**).

This investigation has analysed the following elevated levels in detail:

- An annual average deposited dust level of 4.3g/m^2/month recorded at the DL30 deposited dust gauge monitor;
- An annual average deposited dust level of 8.3g/m^2/month recorded at the Warkworth deposited dust gauge monitor;
- An annual average $PM_{2.5}$ level of 10.5µg/m^3 recorded at the Maison Dieu HVAS monitor;
- An annual average $PM_{2.5}$ level of 8.9µg/m^3 recorded at the Kilburnie South HVAS monitor;
- An annual average PM_{10} level of 28.0µg/m^3 recorded at the Warkworth TEOM monitor;
- An annual average PM_{10} level of 28.8µg/m^3 recorded at the Gliding Club HVAS monitor; and,
- An annual average TSP level of 137.5µg/m^3 recorded at the Warkworth HVAS monitor.

It is noteworthy that the criteria for HVO North differ to those for HVO South. As outlined below, HVO South has more stringent criteria for some pollutants and averaging periods. This arises due to the criteria applicable to new or modified projects becoming more stringent over time.

2 ANNUAL AIR QUALITY CRITERIA

2.1 HVO North

2.1.1 Air Quality Criteria

As per HVO North consent DA 450-10-2003 "*Except for the air-affected land referred to in Table 1, the Applicant must ensure that all reasonable and feasible avoidance and mitigation measures are employed so that the particulate matter emissions generated by the development do not exceed the criteria listed in Tables 2, 3 or 4 at any residence on privately-owned land or on more than 25 percent of any privately-owned land. In this condition 'reasonable and feasible avoidance and mitigation measures' includes, but is not limited to, the operational requirements in Condition 5 of Schedule 4 and the requirements in Conditions 5 and 6 of Schedule 4 to develop and implement a real-time air quality management system that ensures effective operational responses to the risks of exceedance of the criteria.*"

The criteria from Tables 2 to 4 as per the HVO North consent DA 450-10-2003 are set out below:

Table 2: Long term criteria for particulate matter

Pollutant	Averaging period	[d]Criterion
Total suspended particulate (TSP) matter	Annual	[a] 90 µg/m³
Particulate matter < 10 µm (PM_{10})	Annual	[a] 30 µg/m³

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources)
[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed to by the Secretary.

Table 3: Short term criteria for particulate matter

Pollutant	Averaging period	[d]Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	[a]50 µg/m³

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources)
[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed to by the Secretary.

Table 4: Long term criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c]Deposited dust	Annual	[b]2 g/m²/month	[a]4 g/m²/month

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to other sources)
[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own)
[c] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method

When the measured cumulative annual average deposited dust level at compliance monitors is below the criterion of 4g/m²/month in Table 4 it is inferred that compliance is achieved. If this criterion is exceeded, the applicant must demonstrate compliance with the maximum increase in the deposited dust level of 2g/m²/month.

2.1.2 Air Quality Acquisition Criteria

"*If particulate matter emissions generated by the development exceed the criteria in Tables 5, 6 or 7 on a systemic basis at any residence on privately-owned land or on more than 25 percent of any privately-owned land, then upon receiving a written request for acquisition from the landowner the Applicant must acquire the land in accordance with the procedures in Conditions 7 and 8 of Schedule 5.*"

Table 5: Long term acquisition criteria for particulate matter

Pollutant	Averaging period	[d]Criterion
Total suspended particulate (TSP) matter	Annual	[a] 90 µg/m³
Particulate matter < 10 µm (PM_{10})	Annual	[a] 30 µg/m³

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources)
[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed to by the Secretary.

Table 6: Short term acquisition criteria for particulate matter

Pollutant	Averaging period	[d]Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	[a]150 µg/m³
Particulate matter < 10 µm (PM_{10})	24 hour	[b]50 µg/m³

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources)
[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own)
[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed to by the Secretary.

Table 7: Long term acquisition criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c]Deposited dust	Annual	[b]2 g/m²/month	[a]4 g/m²/month

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to other sources)
[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own)
[c] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method

When the measured cumulative annual average deposited dust level at compliance monitors is below the criterion of 4g/m^2/month in Table 4 it is inferred that compliance is achieved. If this criterion is exceeded, the applicant must demonstrate compliance with the maximum increase in the deposited dust level of 2g/m^2/month.

2.2 HVO South

2.2.1 Air Quality Criteria

As per HVO South consent PA 06_0261 "*The Proponent must ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the project do not exceed the air quality impact assessment criteria listed in Table 8 at any residence on privately-owned land, the Hunter Valley Gliding Club (when in use) or on more than 25 percent of any privately-owned land.*"

Table 8: Air quality impact assessment criteria

Pollutant	Averaging period	[d]Criterion
Particulate matter < 10 µm (PM_{10})	Annual	[a,c] 25 µg/m³
	24 hour	[b] 50 µg/m³
Particulate matter < 2.5 µm ($PM_{2.5}$)	Annual	[a,c] 8 µg/m³
	24 hour	[b] 25 µg/m³
Total suspended particulate (TSP) matter	Annual	[a,c] 90 µg/m³

Air quality impacts at HVGC are to be assessed in the immediate vicinity of its residential facilities and/or clubhouse. Air quality limits are only applicable during times of use that have been notified by HVGC to the Proponent.
[a] Total impact (i.e. incremental increase in concentrations due to the project plus background concentrations due to all other sources).
[b] Incremental impact (i.e. incremental increase in concentrations due to the project on its own).
[c] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed to by the Secretary.

"However, if the Proponent has a written negotiated air quality agreement with any landowner or HVGC to exceed the air quality limits in Table 8 and a copy of this agreement has been forwarded to the Department and EPA, then the Proponent may exceed the air quality limits in Table 8 in accordance with the negotiated air quality agreement."

2.3 Air Quality Criteria Summary

The monitoring locations and annual average criteria for HVO North and HVO South set out in the relevant approvals are presented in **Table 2-1**.

Table 2-1: Annual air quality criteria

Location	HVO North		HVO South
Deposited Dust Gauges (g/m²/month)			
D112*	-	-	-
D118	2[1]	4[2]	-
D119	2[1]	4[2]	-
D122	2[1]	4[2]	-
DL14	2[1]	4[2]	-
DL2*	-	-	-
DL21	2[1]	4[2]	-
DL22	2[1]	4[2]	-
DL30	2[1]	4[2]	-
Knodlers Lane	2[1]	4[2]	-
Warkworth	2[1]	4[2]	-
PM_{10} TEOM (µg/m³)			
Wandewoi*	30		25
Golden Highway*	-		-
Howick*	-		-
Knodlers Lane	-		25
Warkworth	-		25
Jerrys Plains	30		25
Maison Dieu	-		25
PM_{10} HVAS (µg/m³)			
Cheshunt East	30		-
Gliding Club	-		25
Long Point	-		25
Kilburnie South	30		25
$PM_{2.5}$ HVAS (µg/m³)			
Maison Dieu	-		8
Kilburnie South	-		8
TSP HVAS (µg/m³)			
Cheshunt East	90		-
Warkworth	-		90
Wandewoi*	-		-
Maison Dieu	-		90
Long Point	-		90
Knodlers Lane	-		90
Kilburnie South	90		90

[1] Maximum increase in deposited dust level, [2] Maximum total deposited dust level

*Per HVO's Air Quality Management Plan Table 5: HVO Air Quality Monitoring – Planning Approval Compliance Assessment, D112, DL2, Golden Highway and Howick are not compliance monitors. D112, DL2 and Wandewoi are used as representative monitoring locations for mine-owned land.

2.4 Deposited Dust Data

Table 2-2 and **Figure 2-1** summarise the HVO deposited dust monitoring data for the 2024 period.

The DL30 and Warkworth monitors recorded a total annual average level above the criterion of 4g/m^2/month.

Table 2-2: HVO monthly deposited dust monitoring data (g/m^2/month) – 2024

Month	D112	D118	D119	D122	DL14	DL2	DL21	DL22	DL30	Knodlers Lane	Warkworth
Jan	1.8	1.4	0.7	1.7	0.6	6.5c	0.7	3.5c	3.6	0.7	8.5
Feb	4.5c	2.1	1.2	0.9	1.6	7.7	2.5	3.9c	8.8c	0.9	8.7
Mar	1.5	1.9	1.3	0.6	1.0	0.7	1.9c	2.9	4.3	0.7	7.1
Apr	1.7	1.4	0.8	0.5	0.7	1.2	0.6	2.8	2.7	0.8	7.9
May	0.7	0.9	0.5	0.5	0.6	0.5	1.1	1.2	1.9	2.5	7.9
Jun	3.3	0.8	0.9	2.0	1.4	1.4	1.3	1.2	5.3	1.8	39.3c
Jul	1.0	0.8	1.5	0.8	1.1	0.7	0.6	1.1	4.6c	1.7	7.6
Aug	1.4	1.3	1.2	1.6	3.5c	1.8	1.8	3.4c	5.5	2.5	10.9
Sep	4.9c	0.9	0.7	0.7	1.3	ND	1.4	1.5	15.1c	3.8	9.0
Oct	15.7c	1.8	0.8	0.6	0.6	1.2	1.6	2.5	6.2	0.8	8.2
Nov	2.2	3.0	1.9	1.7	2.1	2.0	2.0c	2.8	4.6	1.1	8.6
Dec	3.3	3.1	2.1	2.0	2.3	1.6	18.3c	3.1	4.7	1.4	6.7
Annual Average	1.9	1.6	1.1	1.1	1.2	1.9	1.3	2.1	**4.3**	1.6	**8.3**

c - Sample contaminated, not included in annual average calculation.

ND – No data (Gauge on ground at the time of collection, gauge did not contain water and as a result was not submitted for analysis).

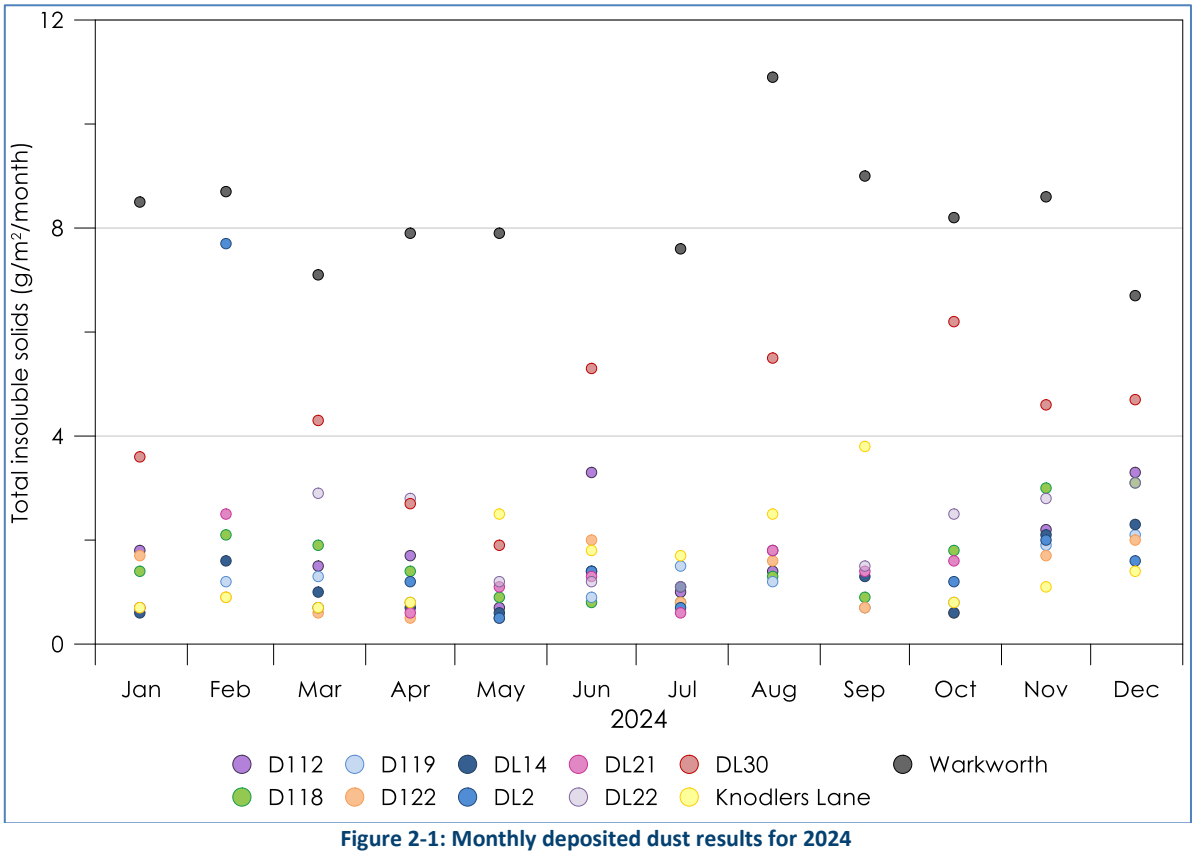


Figure 2-1: Monthly deposited dust results for 2024

Figure 2-2 presents a plan of the dust gauge monitoring locations in the area around HVO and the annual average deposited dust levels. The figure includes annual windrose plots of the meteorological data collected at the Cheshunt and HVO Corporate Automatic Weather Stations (AWS) during 2024. Winds predominantly originated along a northwest/west-northwest and east-southeast/south-southeast axis at Cheshunt, and a west/west-northwest and southeast/east-southeast axis at HVO Corp.

Figure 2-2: Annual deposited dust results for 2024

As set out in the Air Quality Criteria section, deposited dust criteria are applicable for HVO North as per DA 450-10-2003. It is important to note that, there are no criteria applicable to HVO South for deposited dust levels per PA 06_0261.

When the measured cumulative annual average deposited dust level is below the criterion of 4g/m^2/month it is generally inferred that compliance is achieved. The majority of dust which deposits on surfaces will not travel significant distances, and thus deposited dust levels are most affected by any very near sources. Hence if the cumulative criterion is exceeded, the applicant would need to show

compliance with the maximum (incremental) increase in the deposited dust level of 2g/m^2/month due to their activities, (which means there is a closer "other source" affecting the cumulative total reading). When the deposited dust level exceeds the criteria, the operator would need to further evaluate their compliance.

Figure 2-2 indicates that the DL30 and Warkworth monitors recorded an annual average of 4.3g/m^2/month and 8.3g/m^2/month, respectively, in 2024 which were above the total criterion of 4g/m^2/month.

It is noted that over the past few years, neighbouring mining activities along one of the prominent wind axes have progressed significantly closer toward the DL30 and Warkworth monitors which may be impacting the deposited dust levels.

Figure 2-2 shows that most of the deposited dust monitors are located in close proximity to HVO South, on the opposite side of HVO South from HVO North. Given the significant separation distances between HVO North and these monitors, HVO North's contribution to these monitoring sites would be low and likely indiscernible from background concentrations and the influences of other mines. Therefore, HVO North could only reasonably have a tangible impact at its nearest monitors which include D112, D119 and DL2 and as such, it is considered that HVO North could not have had significantly contributed to the DL30 and Warkworth deposited dust levels.

Table 2-2 and **Figure 2-2** show that D112, D119 and DL2 recorded annual average deposited dust levels below both the incremental and cumulative criteria and because dust from a mine cannot "leap frog" a monitor and cause higher impacts beyond the monitor it can be inferred that HVO North was compliant per DA 450-10-2003 at these and all other locations beyond. Note that D112 and DL2 are not compliance monitoring locations, however DL2 is on a prevailing wind axis relative to the HVO North operations and is perhaps the best sited monitor to indicate the deposited dust levels due to the operation at that distance downwind.

2.4.1 Deposited Dust Investigation

A simple and conservative approach has been adopted in order to calculate HVO North's contribution to the levels recorded at the deposited dust gauges. If monitors were downwind of HVO North for less than 5% of the time during the monthly sample period, HVO North's contribution to the monitor was assumed to be zero for that sample. If the monitors were downwind of HVO North for at least 5% of the time, then HVO North's contribution was assumed to be the total recorded level minus the minimum recorded monthly value in the monitoring network. This estimation is likely to overestimate the contribution from HVO North as it assumes the total difference between the recorded value and the low background level is due to HVO North and does not account for the likely impact of other sources such as neighbouring mines or localised sources. For monitors outside HVO North's reasonable range of impact (as discussed above), HVO North's contribution was estimated to be less than or equal to the nearest intermediate monitor's contribution (D112, D119 or DL2). Monthly contributions were not calculated for monitors where the relevant monthly sample was invalid.

Table 2-3 presents the annual average deposited levels recorded in 2024 and HVO North's estimated contribution to the annual average deposited dust levels. The analysis shows that the estimated incremental contributions from HVO North to all monitors, including the elevated annual level at the Warkworth would be below the incremental annual average criterion of 2g/m^2/month.

The analysis shows that HVO North's conservatively calculated contribution to the DL30 and Warkworth monitors in 2024 would have been a maximum of 0.2g/m^2/month or 4% of the 4.3g/m^2/month, and 0.0g/m^2/month or 0% of the 8.3g/m^2/month, respectively. This indicates that the deposited dust level at DL30 and Warkworth in 2024 would be over the applicable total criterion of 4g/m^2/month regardless of the contribution from HVO North.

Table 2-3: HVO North's estimated contribution and annual average deposited dust levels 2024

Month	D112	D118	D119	D122	DL14	DL2	DL21	DL22	DL30	Knodlers Lane	Warkworth
	Percentage of time downwind of HVO (north) (%)										
January	4%	2%	3%	7%	16%	22%	13%	8%	5%	9%	2%
February	7%	3%	6%	8%	15%	18%	13%	10%	7%	11%	3%
March	9%	4%	7%	8%	15%	18%	13%	10%	7%	11%	3%
April	10%	3%	5%	20%	29%	33%	27%	21%	12%	25%	2%
May	12%	5%	4%	21%	30%	31%	28%	23%	11%	27%	3%
June	5%	1%	1%	27%	64%	75%	54%	28%	11%	39%	2%
July	4%	2%	3%	18%	53%	67%	43%	19%	6%	29%	2%
August	7%	4%	3%	21%	45%	54%	37%	23%	11%	30%	3%
September	4%	2%	2%	18%	53%	77%	39%	18%	6%	29%	1%
October	7%	2%	4%	9%	23%	32%	18%	10%	4%	14%	2%
November	9%	5%	6%	9%	24%	29%	19%	10%	5%	13%	3%
December	9%	5%	8%	8%	23%	32%	18%	9%	4%	12%	2%
Month	**HVO monthly deposited dust monitoring data (g/m^2/month)**										
January	1.8	1.4	0.7	1.7	0.6	6.5c	0.7	3.5c	3.6	0.7	8.5
February	4.5c	2.1	1.2	0.9	1.6	7.7	2.5	3.9c	8.8c	0.9	8.7
March	1.5	1.9	1.3	0.6	1.0	0.7	1.9c	2.9	4.3	0.7	7.1
April	1.7	1.4	0.8	0.5	0.7	1.2	0.6	2.8	2.7	0.8	7.9
May	0.7	0.9	0.5	0.5	0.6	0.5	1.1	1.2	1.9	2.5	7.9
June	3.3	0.8	0.9	2.0	1.4	1.4	1.3	1.2	5.3	1.8	39.3c
July	1.0	0.8	1.5	0.8	1.1	0.7	0.6	1.1	4.6c	1.7	7.6
August	1.4	1.3	1.2	1.6	3.5c	1.8	1.8	3.4c	5.5	2.5	10.9
September	4.9c	0.9	0.7	0.7	1.3	ND	1.4	1.5	15.1c	3.8	9.0
October	15.7c	1.8	0.8	0.6	0.6	1.2	1.6	2.5	6.2	0.8	8.2
November	2.2	3.0	1.9	1.7	2.1	2.0	2.0c	2.8	4.6	1.1	8.6
December	3.3	3.1	2.1	2.0	2.3	1.6	18.3c	3.1	4.7	1.4	6.7
Annual average	1.9	1.6	1.1	1.1	1.2	1.9	1.3	2.1	**4.3**	1.6	**8.3**

Month	Estimated Background	HVO North's maximum estimated contribution to monitor (g/m^2/month)										
Jan	0.6	0.0	0.0	0.0	-*	-*	-	-*	-	0.0	-*	0.0
Feb	0.9	-	0.0	0.3	6.8*	6.8*	6.8	6.8*	-	-	6.8*	0.0
Mar	0.6	0.9	0.0	0.7	0.1*	0.1*	0.1	-	0.1*	0.1*	0.1*	0.0
Apr	0.5	1.2	0.0	0.0	0.7*	0.7*	0.7	0.7*	0.7*	0.7*	0.7*	0.0
May	0.5	0.2	0.0	0.0	0.0*	0.0*	0.0	0.0*	0.0*	0.0*	0.0*	0.0
Jun	0.8	0.0	0.0	0.0	0.6*	0.6*	0.6	0.6*	0.6*	0.6*	0.6*	-
Jul	0.6	0.0	0.0	0.0	0.1*	0.1*	0.1	0.1*	0.1*	-	0.1*	0.0
Aug	1.2	0.2	0.0	0.0	0.6*	-	0.6	0.6*	-	0.6*	0.6*	0.0
Sep	0.7	-	0.0	0.0	-*	-*	-	-*	-*	-	-*	0.0
Oct	0.6	-	0.0	0.0	0.6*	0.6*	0.6	0.6*	0.6*	0.0	0.6*	0.0
Nov	1.1	1.1	0.0	0.8	0.9*	0.9*	0.9	-	0.9*	0.0	0.9*	0.0
Dec	1.4	1.9	0.0	0.7	0.2*	0.2*	0.2	-	0.2*	0.0	0.2*	0.0
Annual average	**0.8**	**0.6**	**0.0**	**0.2**	**1.1**	**1.1**	**1.1**	**1.3**	**0.4**	**0.2**	**1.1**	**0.0**

c – contaminated sample

*Contribution assumed to be equal to (or less than) that of intermediate DL2 monitor. Note that D112 and DL2 are not compliance monitors

- contribution not calculated due to contaminated sample

2.5 $PM_{2.5}$ Data

Figure 2-3 presents the 24-hour average $PM_{2.5}$ HVAS results recorded during 2024 for Kilburnie South and Maison Dieu. The figures show that on occasion in 2024, 24-hour average $PM_{2.5}$ levels above the criteria were recorded. The results were assessed through investigation, as summarised in **Table C-1** of **Appendix C** and were found to have not been significantly contributed to by HVO.

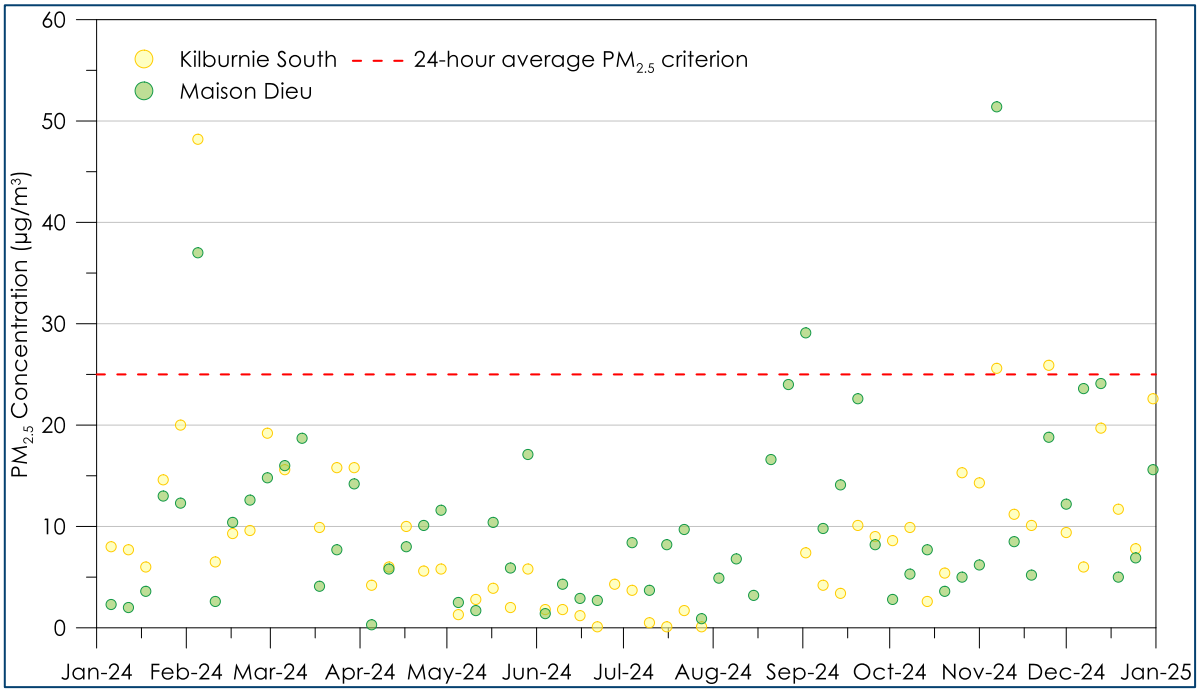


Figure 2-3: Kilburnie South and Maison Dieu 24-hour average $PM_{2.5}$ HVAS results for 2024

Table 2-4 includes the annual average HVAS $PM_{2.5}$ monitoring data for Maison Dieu and Kilburnie South in 2024. The monitoring data for the 2024 review period show that the HVO monitors recorded levels above 8µg/m^3.

Table 2-4: HVAS $PM_{2.5}$ annual average monitoring data – 2024

Location	Measured HVAS $PM_{2.5}$ (µg/m^3)
Maison Dieu	**10.5**
Kilburnie South	**8.9**

Table 2-5 includes the UHAQMN $PM_{2.5}$ annual average data for the 2024 period. The monitoring data for the 2024 review period show that the UHAQMN monitors recorded levels below 8µg/m^3.

Table 2-5: UHAQMN $PM_{2.5}$ levels – 2024

Monitor	Measured $PM_{2.5}$ level (µg/m^3)
Muswellbrook	7.1
Singleton	7.3
Camberwell	5.9
Merriwa	4.6

The annual average $PM_{2.5}$ levels during the 2024 period are shown at their monitor locations in **Figure 2-4**. The figure also includes annual windrose plots of the meteorological data collected at the Cheshunt and HVO Corp Automatic Weather Stations (AWS) during 2024.

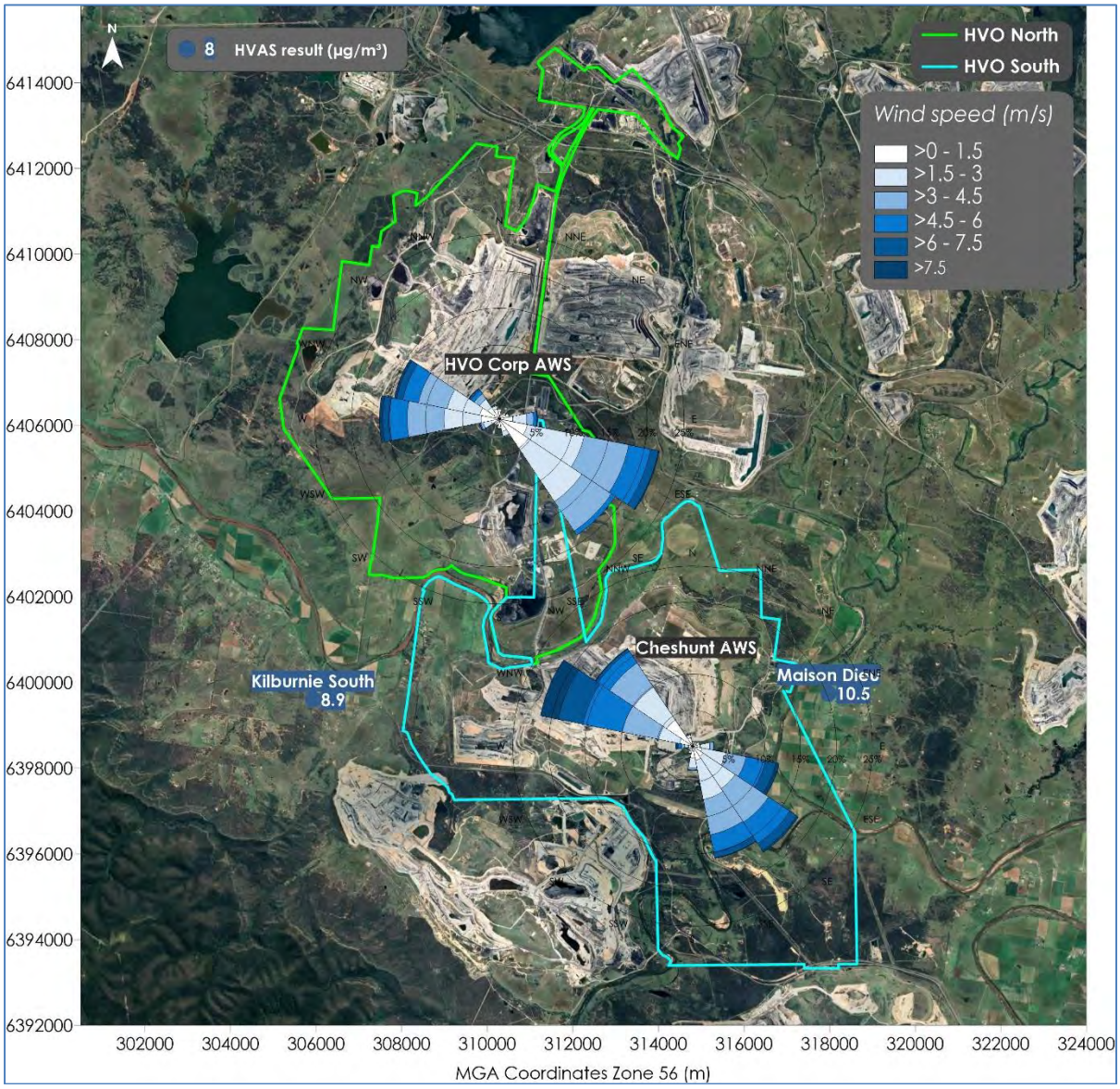


Figure 2-4: HVAS $PM_{2.5}$ results for 2024

The data in **Table 2-4** and **Table 2-5** show that the $PM_{2.5}$ HVAS results recorded at Maison Dieu and Kilburnie South were high in comparison to the results recorded by the DCCEEW monitoring stations. This is unusual considering both Kilburnie South and Maison Dieu monitors are situated away from any known significant sources of $PM_{2.5}$ (mines generate emissions in the coarser PM_{10} range), whereas the Muswellbrook, and to a lesser extent Singleton and Camberwell monitors, are known to be impacted by localised smoke from wood heaters. This is highlighted further in **Table 2-6** which shows the ratio of $PM_{2.5}$ / PM_{10} levels in the Upper Hunter since 2015. Both HVO monitors recorded higher $PM_{2.5}$ / PM_{10} ratios in 2024 than any other Upper Hunter monitor.

The $PM_{2.5}$ / PM_{10} ratios for the Maison Dieu and Kilburnie South monitors are implausibly high for this locality, indicating a likely problem with the data, as indicated previously in the *Review of PM2.5 Real Time Response Triggers* **(TAS, 2023)**.

Table 2-6: $PM_{2.5}$ / PM_{10} ratios in Upper Hunter

Year	$PM_{2.5}$ / PM_{10} ratio					
	Muswellbrook	Singleton	Camberwell	Merriwa	Maison Dieu	Kilburnie South
2015	0.46	0.39	0.33	-	-	-
2016	0.44	0.41	0.31	-	-	-
2017	0.43	0.39	0.27	-	-	-
2018	0.35	0.34	0.27	-	-	-
2019	0.35	0.36	0.26	-	-	-
2020	0.41	0.41	0.31	-	0.63	0.78
2021	0.41	0.37	0.30	0.38	0.48	0.54
2022	0.39	0.36	0.32	0.31	0.40	0.57
2023	0.35	0.37	0.30	0.34	0.43	0.62
2024	0.41	0.44	0.33	0.34	0.50	0.47

- Not Applicable

Figure 2-5 and **Figure 2-6** presents a comparison of the PM_{10}/$PM_{2.5}$ HVAS and $PM_{2.5}$ BAM monitoring data at Maison Dieu and Kilburnie South at HVO in 2024, respectively. The figures show that the HVAS and BAM data generally had good agreement with each other during the cooler months, whereas the HVAS data more frequently recorded higher particulate levels than the BAM during the warmer months. On occasion, the $PM_{2.5}$ HVAS monitoring data is similar to the PM_{10} HVAS data, indicating issues of overestimation by the $PM_{2.5}$ HVAS monitors (i.e. potentially drawing in PM_{10} through the $PM_{2.5}$ head).

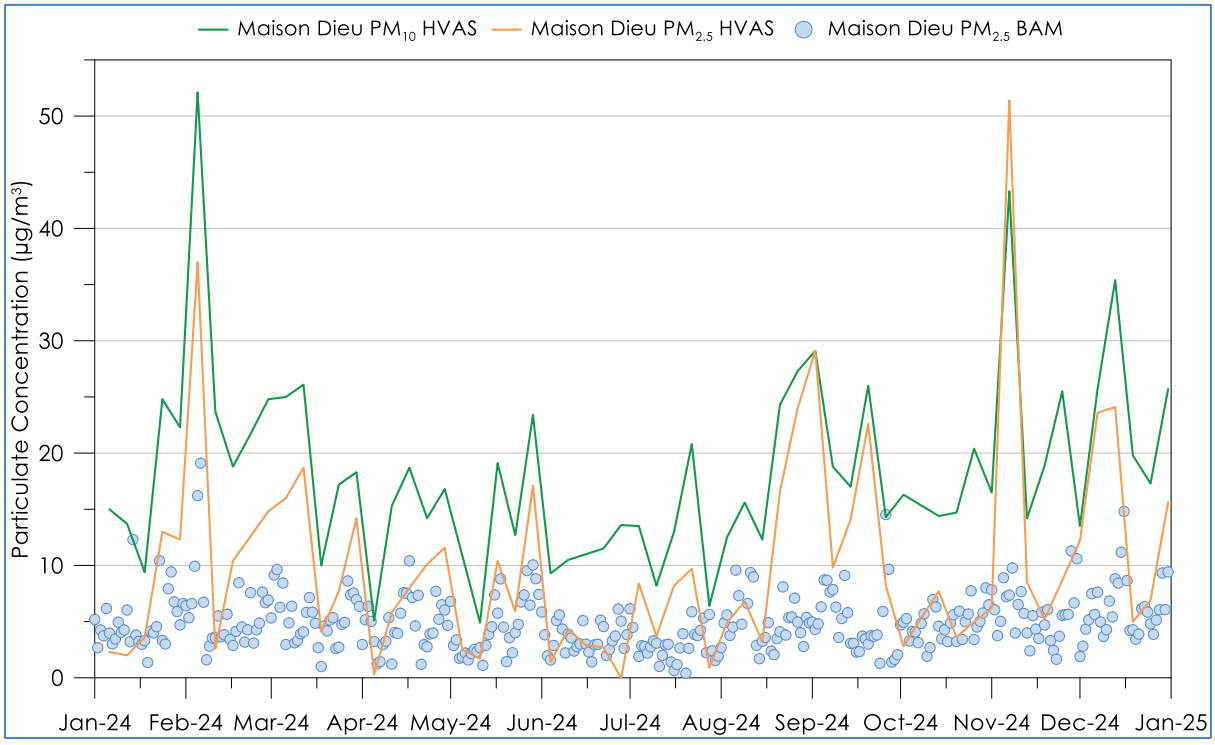


Figure 2-5: Maison Dieu $PM_{2.5}$ and PM_{10} HVAS and BAM data in 2024

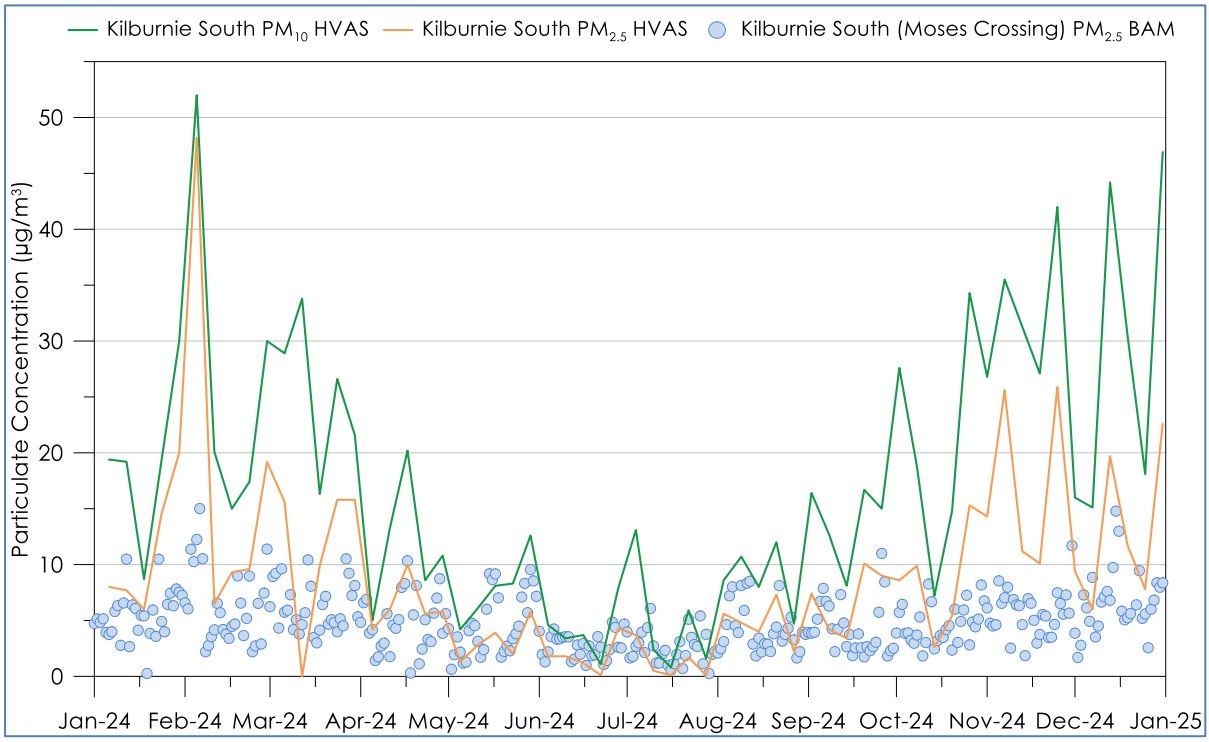


Figure 2-6: Kilburnie South $PM_{2.5}$ and PM_{10} HVAS and BAM data in 2024

2.5.1 BAM monitoring

HVO commissioned BAM instruments at Kilburnie South (Moses Crossing) and Maison Dieu in March 2023 and have been collecting $PM_{2.5}$ data from both HVAS and BAMs units. PM_{10} data are also collected at these locations, with a HVAS at Kilburnie South (Moses Crossing) and a Tapered Element Oscillating Microbalance (TEOM) at Maison Dieu. The use of these BAM instruments is pending DPHI approval of the AQGHG Management Plan and will be used to complement HVO's existing reactive dust system and PM_{10} alarms, in order to notify operations of high dust events and potential exceedances. The **TAS (2023)** review presents a detailed analysis of the HVAS and BAM monitoring data.

Figure 2-7 presents the locations of the HVO $PM_{2.5}$ and PM_{10} monitoring instruments (including BAM, HVAS and TEOM monitors) and the HVO weather stations.

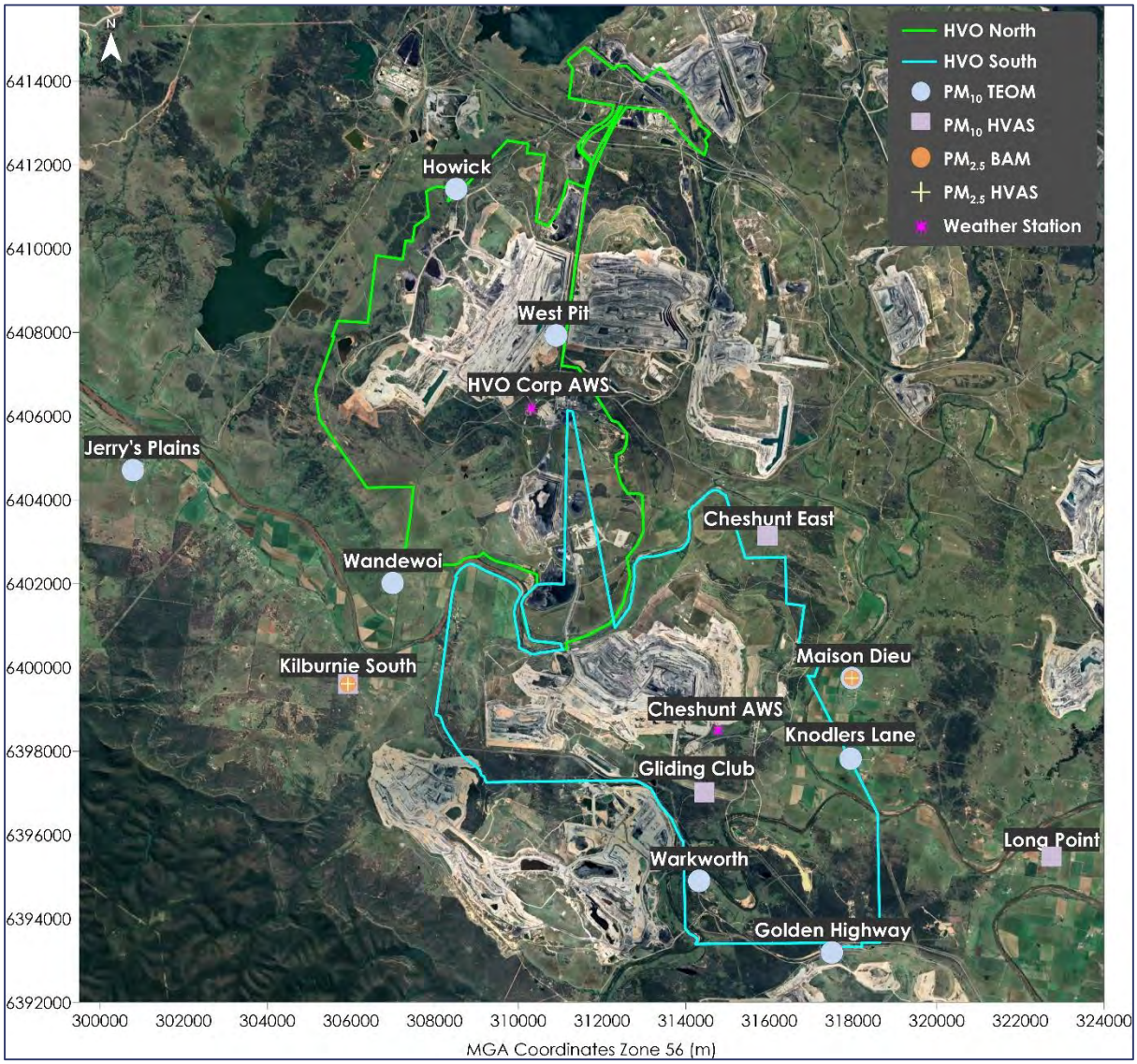


Figure 2-7: HVO $PM_{2.5}$ and PM_{10} monitoring network

Table 2-7 includes the annual average BAM $PM_{2.5}$ monitoring data for Maison Dieu and Kilburnie South (Moses Crossing) in 2024. The monitoring data for the 2024 review period show that the HVO monitors recorded levels below 8µg/m^3.

Table 2-7: BAM $PM_{2.5}$ annual average monitoring data – 2024

Location	Measured BAM $PM_{2.5}$ (µg/m^3)
Maison Dieu	4.9
Kilburnie South (Moses Crossing)	4.8

Figure 2-8 presents the $PM_{2.5}$ data collected by the BAM instruments during 2024. The figure shows that the 24-hour average levels recorded by the instruments at Maison Dieu and Kilburnie South (Moses Crossing) were relatively similar and were well below the relevant criterion of 25µg/m^3 in the review period.

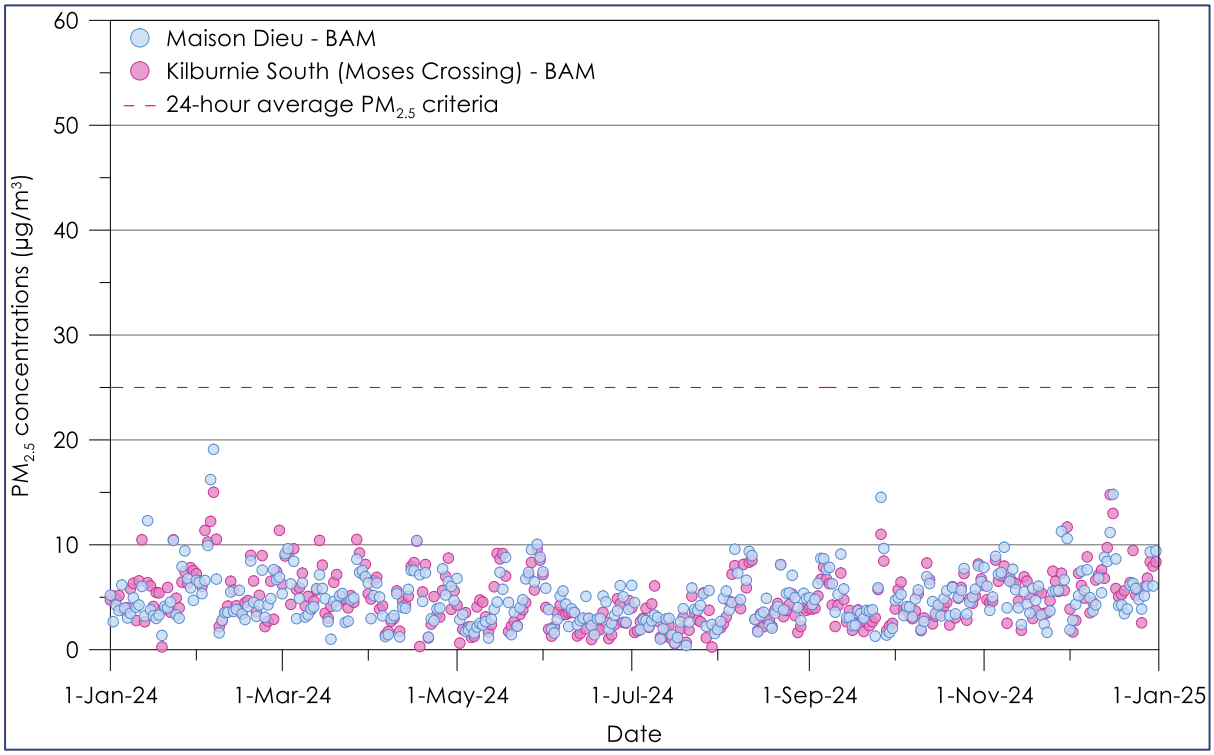


Figure 2-8: 24-hour average $PM_{2.5}$ BAM data

2.5.2 $PM_{2.5}$ Investigation

The aim of this analysis is to determine the potential contribution of HVO South to the 2024 annual average $PM_{2.5}$ levels recorded at the HVO HVAS monitors.

Given that the results recorded at the Maison Dieu and Kilburnie South HVAS monitors appear to be implausibly high, the BAM $PM_{2.5}$ monitoring data at these locations have been used in order to estimate HVO South's increment to the recorded levels. The estimated percentage contribution at the BAM monitors has been applied to the HVAS monitoring results for only the HVAS run days. This provides a more plausible contribution of HVO to the HVAS monitors during 2024.

The HVO South contributions to the BAM monitors were estimated on an hourly basis. The hourly contributions were estimated as the concentrations recorded at each monitor minus the estimated background level. The contribution for a given hour was considered to be zero where the monitor was not downwind of HVO South for that hour. The hourly contributions were then averaged for each 24-hour period to determine the 24-hour contributions from HVO South. The percentage contribution of the total level recorded at the BAM monitors was applied to the HVAS monitoring results for 2024 to determine the potential contribution from HVO South to the monitors.

A more detailed analysis was conducted for some days where levels exceeded the 24-hour average criterion. Days in which HVO South's contribution were already estimated (analyses for elevated 24-hour average readings) are presented in **Table C-1** of **Appendix C**.

Table 2-8 presents the annual average $PM_{2.5}$ levels recorded in 2024 and HVO South's estimated contribution to the annual average $PM_{2.5}$ levels. **Table C-2** of **Appendix C** shows the 24-hour average $PM_{2.5}$ levels and the estimated $PM_{2.5}$ contribution of HVO South at each of the HVO monitors for each monitoring day of 2024.

Table 2-8: HVO South's estimated contribution and annual average $PM_{2.5}$ levels 2024

Location	Monitor Type	Compliance (level) (µg/m³)	Measured annual average $PM_{2.5}$ level (µg/m³)	Estimated contribution to annual average $PM_{2.5}$ level (µg/m³)
Maison Dieu	HVAS	8 (HVO South)	**10.5**	0.4
Kilburnie South	HVAS	8 (HVO South)	**8.9**	0.1

Table 2-11 indicates that maximum HVO contributions, would have been:

- 0.4µg/m^3 or 4% of the 10.5µg/m^3 from HVO South at the Maison Dieu HVAS in 2024; and,
- 0.1µg/m^3 or 2% of the 8.9µg/m^3 from HVO South at the Kilburnie South HVAS in 2024.

2.6 PM_{10} Data

Figure 2-9, **Figure 2-10** and **Figure 2-11** present the 24-hour average HVO PM_{10} HVAS and PM_{10} TEOM compliance and non-compliance monitor results recorded during 2024 respectively. It is to be noted that the PM_{10} criterion does not apply to the non-compliance monitors.

The HVAS and TEOM PM_{10} data show reasonably similar trends through 2024. The figures show that on occasion in 2024, 24-hour average PM_{10} levels above the criteria were recorded. The elevated results at compliance monitors were assessed through specific investigations conducted throughout the year, as summarised in **Table B-1** of **Appendix B**.

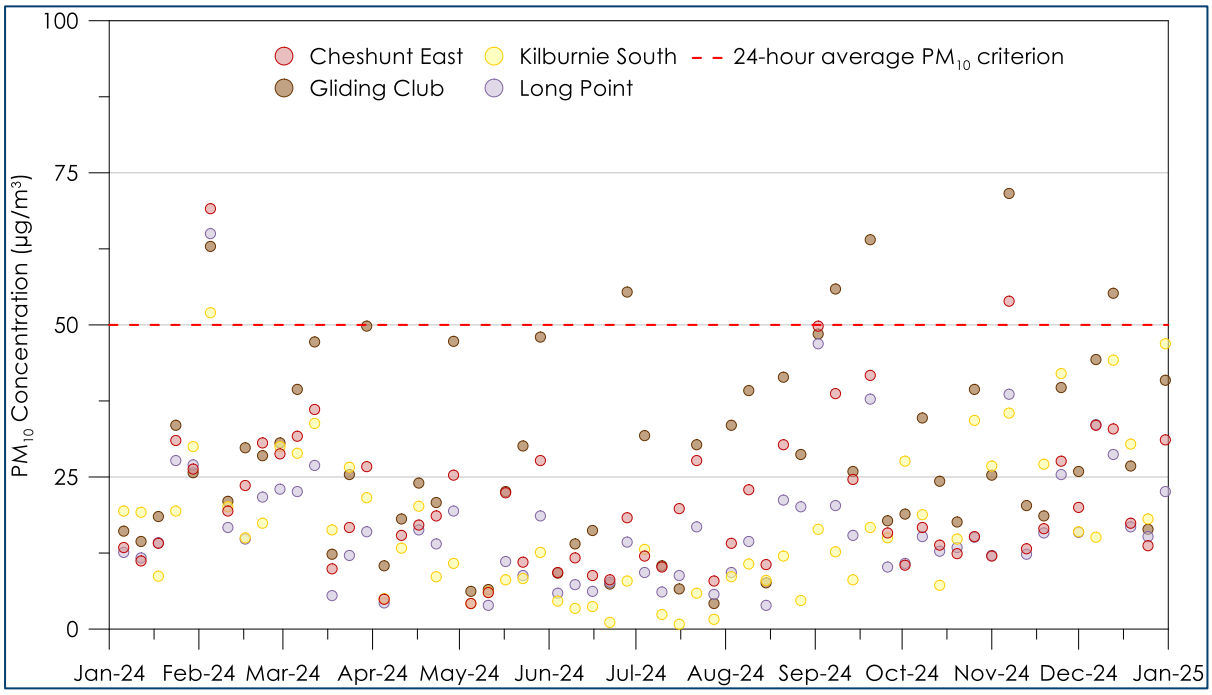


Figure 2-9: 24-hour average PM_{10} HVAS results for 2024

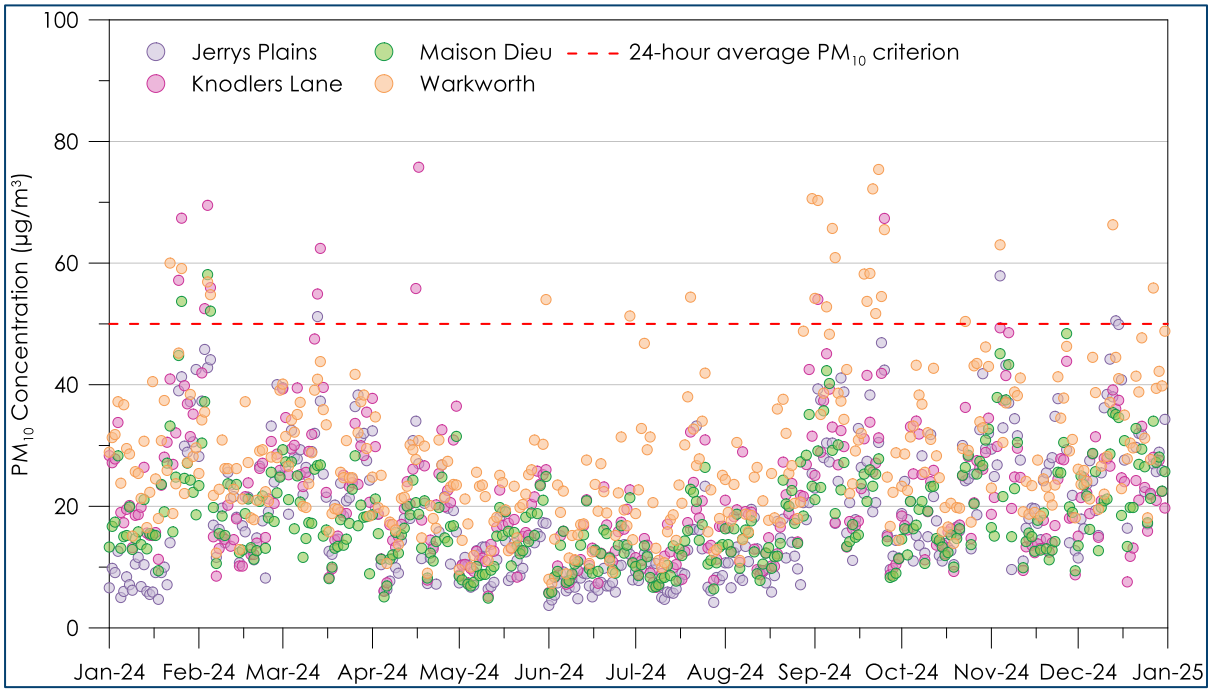


Figure 2-10: 24-hour average PM_{10} TEOM results for 2024 – compliance monitors

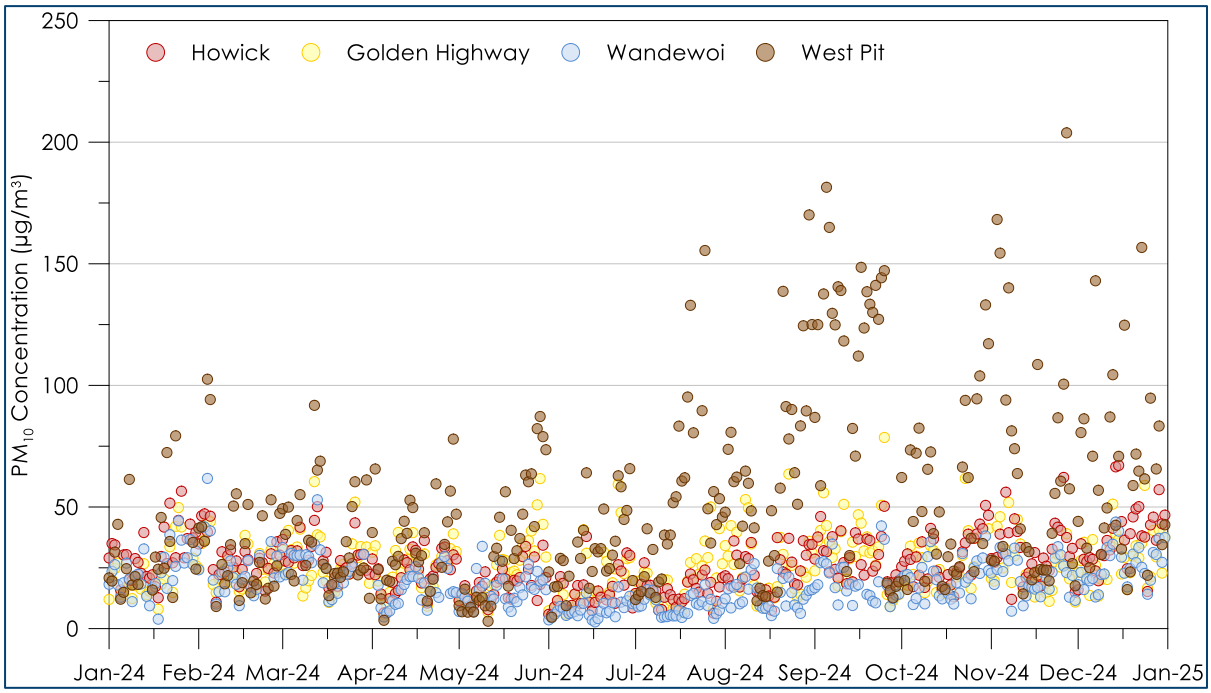


Figure 2-11: 24-hour average PM_{10} TEOM results for 2024 – non-compliance monitors

Table 2-9 includes a summary of all the annual average HVAS and TEOM PM_{10} monitoring data for the general HVO area in 2024. With regard to the HVAS PM_{10} and TEOM PM_{10} annual average data, obviously erroneous data, data with error codes and monitors which contain less than 75% data have not been included in **Table 2-9**.

Note for this annual review, TEOM data time was assessed per Australian Eastern Standard Time (AEST) as used by DCCEEW, however some minor differences arise with the operational data which uses Australian Eastern Daylight Time (AEDT). Some minor differences also arise as HVO collects data in real-

time from DCCEEW monitors using a separate HVO logger which may result in minor additional time shift effect.

The table shows that the compliance TEOM and HVAS monitors recorded annual average PM_{10} levels below the relevant PM_{10} criteria of 25µg/m^3 in 2024, except the Gliding Club HVAS and Warkworth TEOM monitors.

Table 2-9: HVAS and TEOM PM_{10} annual average monitoring data – 2024

Location	Measured HVAS PM_{10} (µg/m^3)	Measured TEOM PM_{10} (µg/m^3)	Compliance monitor?
Golden Highway	-	25.4	No
Howick	-	26.0	No
West Pit	-	50.6	No
Wandewoi	-	18.5	Yes
Knodlers Lane	-	21.5	Yes
Warkworth	-	**28.0**	Yes
Jerrys Plains	-	18.6	Yes
Maison Dieu	-	18.2	Yes
Cheshunt East	21.1	-	Yes
Gliding Club	**28.8**	-	Yes
Long Point	17.0	-	Yes
Kilburnie South	17.0	-	Yes

Table 2-10 summarises the Upper Hunter Air Quality Monitoring Network (UHAQMN) PM_{10} annual average data for the 2024 period. The monitoring data for the 2024 review period show that the levels recorded by the UHAQMN network were similar to those recorded by the monitors surrounding HVO, with all the monitors recording levels below 25µg/m^3, except Warkworth.

Table 2-10: UHAQMN PM_{10} levels – 2024

Monitor	Measured PM_{10} level (µg/m^3)
Muswellbrook	18.5
Singleton	18.7
Maison Dieu	18.2
Camberwell	19.4
Singleton NW	20.1
Mount Thorley	21.0
Bulga	17.0
Muswellbrook NW	16.3
Wybong	15.7
Aberdeen	14.0
Singleton South	18.2
Jerrys Plains	18.6
Warkworth	**28.0**
Merriwa	13.8

Annual average PM_{10} levels during the 2024 period are shown in **Figure 2-12**. The figure includes annual windrose plots of the meteorological data collected at the Cheshunt and HVO Corp Automatic Weather Stations (AWS) during 2024.

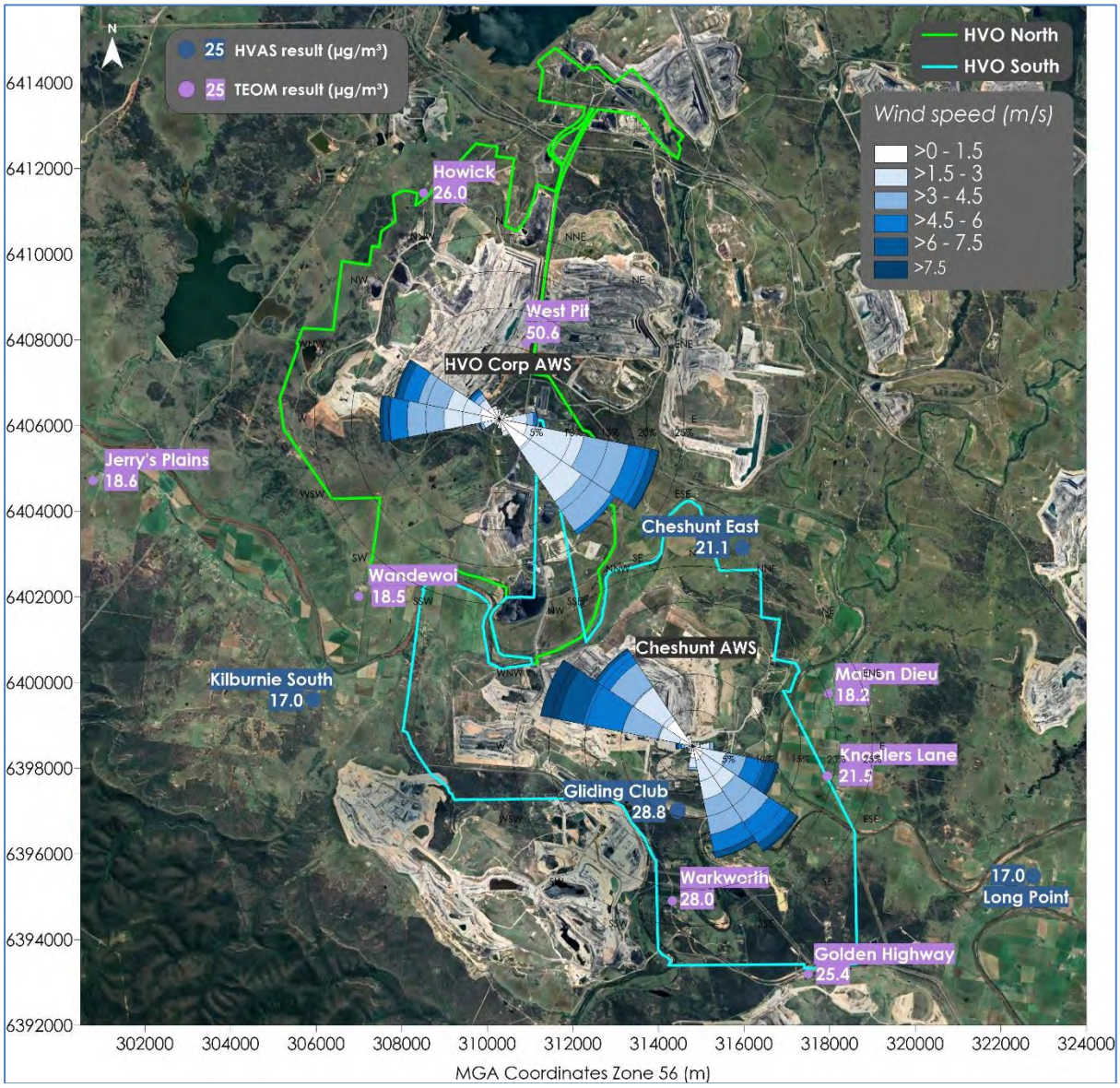


Figure 2-12: Annual average HVAS and TEOM PM_{10} results for 2024

2.6.1 PM_{10} Investigation

The aim of this analysis is to determine the potential contribution of HVO North and HVO South to the 2024 annual average PM_{10} levels recorded at the HVO TEOM and HVAS monitors.

The HVO North and HVO South contributions to the TEOM monitors were estimated on an hourly basis. The hourly contributions were estimated as the concentrations recorded at each monitor minus an estimated background level (average of upwind monitors) for the corresponding hour. The contribution for a given hour was considered to be zero where the monitor was not downwind of HVO (North/ South) for that hour. Where all monitors were downwind of HVO North/South (based on the representative Cheshunt or HVO Corp weather station), the minimum value recorded was selected as the background for that hour. The hourly contributions were then averaged for each 24-hour period to determine the 24-hour contributions from HVO North and HVO South.

The contributions at the HVAS monitors were estimated to be the 24-hour concentrations recorded at each monitor minus an estimated background level on the corresponding day.

The background level in this context is considered to be the level which excludes the contribution from HVO but may include the influence of other sources, including other mines, localised sources, or regional sources of background dust.

For days when the monitor was not downwind of HVO North/ South (i.e. <5% downwind), the HVO North/ South contribution to this monitor was considered to be zero. Where the monitor was downwind of HVO North/ South for some part of the day, the background levels for that day were taken to be the average level recorded by the monitors in the local network which were downwind for less than 15% of the time. If the monitors were downwind of HVO for greater than 15% of the time, than the minimum measured levels across the monitors was taken as the background level.

Note that the 24-hour average contributions presented in this analysis are estimated using a simple, conservative method based on the daily contributions and would likely overestimate the HVO North/ South actual 24-hour average contribution. Where the downwind angle of the monitor from HVO North and South overlap, the estimated contributions for each HVO North and HVO South would include the influence of the other. Furthermore, the approach does not factor in dispersion of pollutants with distance, thus a more distant mine can make the same contribution as a closer mine for the same wind angle. This leads to calculating much higher contributions than may possibly be the actual case. Therefore, the data presented in this section should only be used for conservatively estimating levels on an annual average basis. A more detailed analysis was conducted for some days where levels exceed the 24-hour average criterion.

Table 2-11 presents the annual average PM_{10} levels recorded in 2024 and HVO's estimated contribution to the annual average PM_{10} levels, for each analysis. **Appendix B** shows the 24-hour average PM_{10} levels and the estimated PM_{10} contribution of HVO North and HVO South where relevant at each of the HVO monitors for each monitoring day of 2024. Days in which HVO's contribution were already estimated (analyses for elevated 24-hour average readings) are presented in **Table B-1** of **Appendix B** and were used where possible. It is noted that the 24-hour TEOM values presented in **Table B-1** are based on the raw AEST readings.

Table 2-11: HVO's maximum estimated contribution and annual average PM_{10} levels 2024

Location	Monitor Type	HVO Compliance (level) (µg/m³)	Measured annual average PM_{10} level (µg/m³)	Estimated contribution to annual average PM_{10} level (µg/m³)	
				HVO North	HVO South
Golden Highway	TEOM	-	25.4	-	-
Howick	TEOM	-	26.0	-	-
West Pit	TEOM	-	**50.6**	-	-
Wandewoi	TEOM	North (30) & South (25)	18.5	0.8	4.8
Knodlers Lane	TEOM	South (25)	21.5	2.6	4.5
Warkworth	TEOM	South (25)	**28.0**	0.4	2.7
Jerrys Plains	TEOM	North (30) & South (25)	18.6	1.3	2.9
Maison Dieu	TEOM	South (25)	18.2	3.4	2.2
Cheshunt East	HVAS	North (30)	21.1	4.5	-
Gliding Club	HVAS	South (25)	**28.8**	-	11.2
Long Point	HVAS	South (25)	17.0	-	1.6
Kilburnie South	HVAS	North (30) & South (25)	17.0	1.2	2.4

2.7 TSP Data

Table 2-12 and **Figure 2-14** summarise the annual average and 24-hour average TSP HVAS monitoring data respectively for the HVO area in 2024. The table shows that the TSP HVAS monitors recorded annual average levels below the criterion of 90µg/m^3 in 2024, except the Warkworth monitor which recorded an annual average TSP level of 137.5µg/m^3.

Table 2-12: TSP HVAS annual average monitoring data (all data) – 2024

Location	Measured HVAS TSP level (µg/m^3)
Cheshunt East	59.5
Warkworth	**137.5**
Wandewoi	57.3
Maison Dieu	49.6
Long Point	46.7
Knodlers Lane	79.0
Kilburnie South	54.6

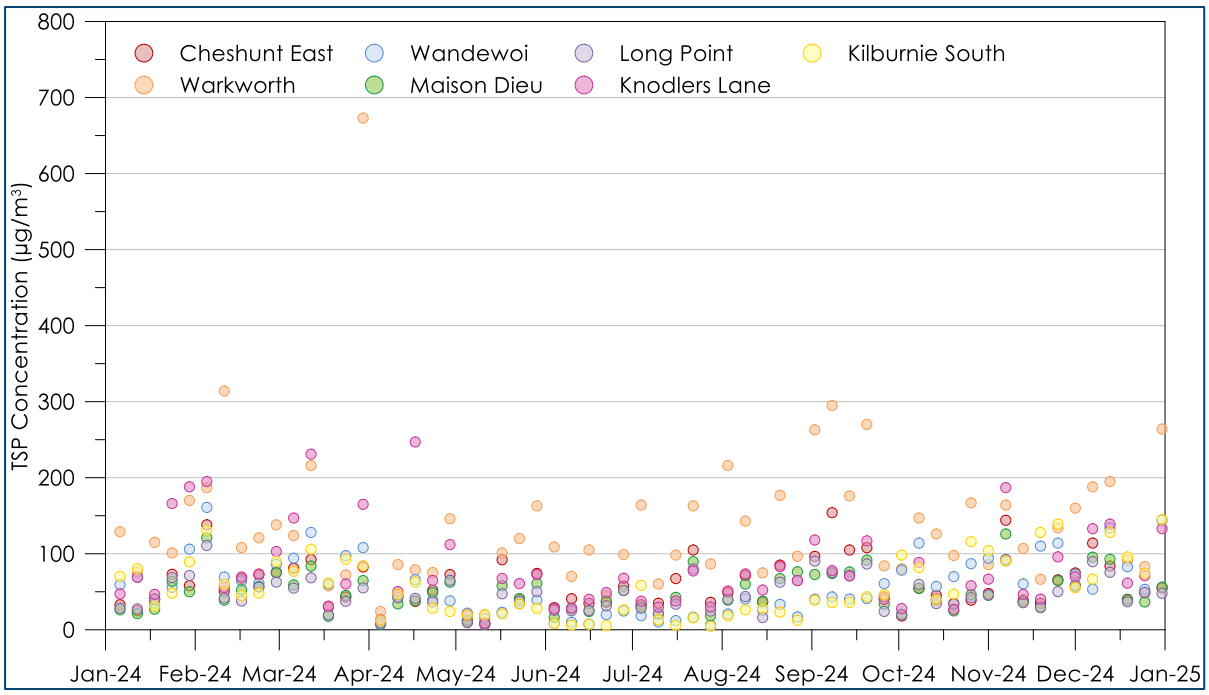


Figure 2-13: 24-hour average TSP HVAS results for 2024

The annual average TSP levels during the 2024 period are shown in **Figure 2-14**. The figure includes annual windrose plots of the meteorological data collected at the Cheshunt and HVO Corp Automatic Weather Stations (AWS) during 2024.

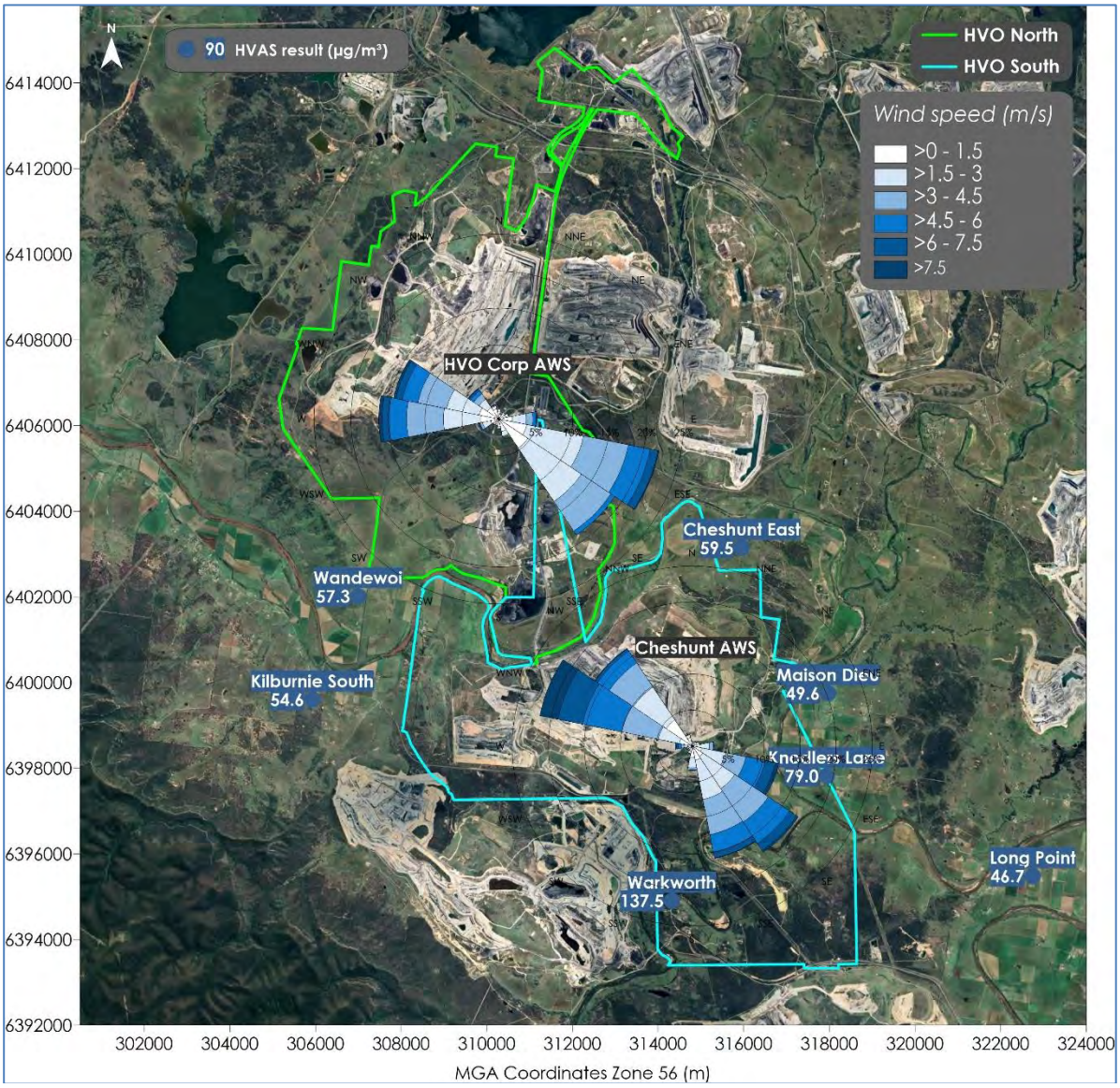


Figure 2-14: TSP HVAS results for 2024

2.7.1 TSP Investigation

The aim of this analysis is to determine the potential contribution of HVO North and HVO South to the 2024 annual average TSP levels recorded at the HVO HVAS monitors.

The Warkworth TSP monitor recorded significantly higher levels than the other monitors in the network in 2024. This is discussed further in the Air Quality Monitoring Network Upper Hunter report by the Department of Climate Change, Energy, the Environment and Water (**DCCEEW 2024a)**.

The contributions at the TSP HVAS monitors were estimated to be the 24-hour concentrations recorded at each monitor minus an estimated background level on the corresponding day. The background level in this context is considered to be the level which excludes the contribution from HVO but may include the influence of other sources, including other mines, localised sources, or regional sources of background dust.

For days when the monitor was not downwind of HVO North/ South (i.e. <5% downwind), the HVO North/ South contribution to this monitor was considered to be zero. Where the monitor was downwind

of HVO North/ South for some part of the day, the background levels for that day were taken to be the average level recorded by the monitors in the local network which were downwind for less than 15% of the time. If the monitors were downwind of HVO for greater than 15% of the time, than the minimum measured levels across the monitors was taken as the background level.

For the Warkworth monitor, which is often downwind of HVO South and a neighbouring mine concurrently, the daily contribution is considered to include both mines. In order to determine the contribution from HVO South alone, the combined mining increment was scaled by the proportion of time the monitor was downwind of HVO South relative to the total time the monitor was downwind of both mines during each 24-hour average period.

Note that the 24-hour average contributions presented in this analysis are estimated using a simplistic and conservative method based on the daily contributions and would likely overestimate the HVO North/ South actual 24-hour average contribution. Where the downwind angle of the monitor from HVO North and South overlap, the estimated contributions for each HVO North and HVO South would include the influence of the other. Furthermore, the approach does not factor in dispersion of pollutants with distance, thus a more distant mine can make the same contribution as a closer mine for the same wind angle. This leads to calculating much higher contributions than may possibly be the actual case. Therefore, the data presented should only be used for estimating levels on an annual average basis.

Table 2-13 presents the annual average TSP levels recorded in 2024 and HVO's estimated contribution to the annual average TSP levels, for each analysis. **Appendix A** shows the 24-hour average TSP levels and the estimated TSP contribution of HVO North and HVO South where relevant at each of the HVO monitors for each monitoring day of 2024.

Table 2-13: HVO's estimated contribution and annual average TSP levels 2024

Location	HVO Compliance (level) (µg/m³)	Measured annual average TSP level (µg/m³)	Estimated contribution to annual average TSP level (µg/m³)	
			HVO North	HVO South
Cheshunt East	North (90)	59.5	18.3	-
Warkworth	South (90)	**137.5**	-	41.6
Wandewoi	-	57.3	-	-
Maison Dieu	South (90)	49.6	-	9.6
Long Point	South (90)	46.7	-	8.1
Knodlers Lane	South (90)	79.0	-	28.7
Kilburnie South	North (90) & South (90)	54.6	2.6	9.8

3 COMPARISON BETWEEN MEASURED DATA AND MODELLED RESULTS

Monitoring data collected as part of the HVO ambient air quality monitoring network during 2024 was compared with modelling predictions for "Stage 3" per the *Air Quality and Greenhouse Gas Assessment HVO South Modification 5* **Todoroski Air Sciences, 2017**). It is understood that in general, the "Stage 3" modelling scenario is representative of the operations in 2026.

3.1 Annual average deposited dust

Figure 3-1 presents an overlay of the measured 2024 annual average deposited dust levels over the dispersion modelling contours for "Stage 3". The measured and predicted data in the figure include dust levels from HVO and other sources.

Table 3-1 presents a comparison of the long-term measured annual average deposited dust concentrations with the predicted annual average level for the modelling scenario "Stage 3". The data indicates that the measured data is typically lower than the predicted values by approximately 0.1-1.3 g/m^2/month. The DL30 monitor was 6.1g/m^2/month lower than the predicted value and the Warkworth monitor was 4.9g/m^2/month higher than the predicted value.

Table 3-1: Comparison of measured long term annual average deposited dust levels with predicted level (g/m^2/month)

Monitor	Annual Average (g/m^2/month) – Criteria = 4g/m^2/month	Predicted level
	2024	
D112	1.9	2.3
D118	1.6	2.9
D119	1.1	2.0
D122	1.1	2.3
DL14	1.2	2.0
DL2	1.9	2.0
DL21	1.3	2.4
DL22	2.1	3.0
DL30	4.3	10.4
Knodlers Lane	1.6	2.4
Warkworth	8.3	3.4

The majority of the monitors measured levels in 2024 close to or below the 2g/m^2/month contour.

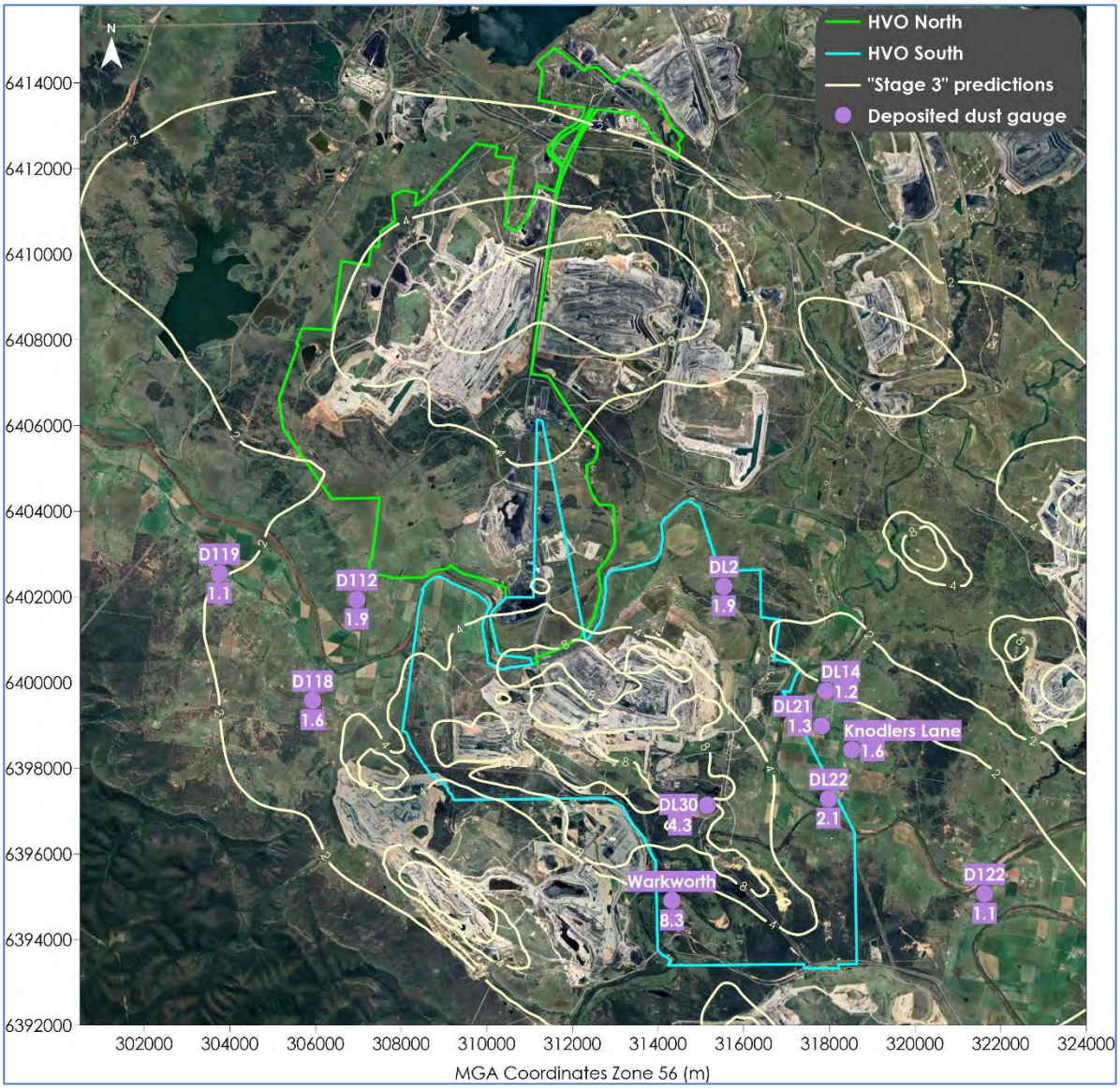


Figure 3-1: Annual average deposited dust monitoring data for 2024 superimposed over the predicted cumulative deposited dust annual average modelling contour (HVO plus other sources) (Source: Todoroski Air Sciences, 2017).

3.2 Annual average $PM_{2.5}$

Figure 3-2 presents an overlay of the measured 2024 annual average $PM_{2.5}$ data superimposed over the dispersion modelling contours for "Year 2021". The measured and predicted data in the figure include dust levels from HVO and other sources.

Table 3-2 presents a comparison of the long-term measured annual average $PM_{2.5}$ concentrations with the predicted annual average level for the modelling scenario "Stage 3". The data indicates that the measured data was 1.7-3.9 µg/m^3 higher than the predicted values. As discussed in **Section 2.5**, the HVAS monitors tend to overestimate actual $PM_{2.5}$ levels. Therefore, these discrepancies in the measurement data can be attributed to this overestimation when compared to the predicted levels.

Table 3-2: Comparison of measured long term annual average $PM_{2.5}$ levels with predicted level (µg/m^3)

Monitor	Annual Average (µg/m^3) – Criteria = 8 µg/m^3	Predicted level
	2024	
Maison Dieu	**10.5**	6.6
Kilburnie South	**8.9**	7.2

Figure 3-2 shows that the recorded annual average $PM_{2.5}$ levels were generally within in the predicted band for the "Stage 3" modelling scenario.

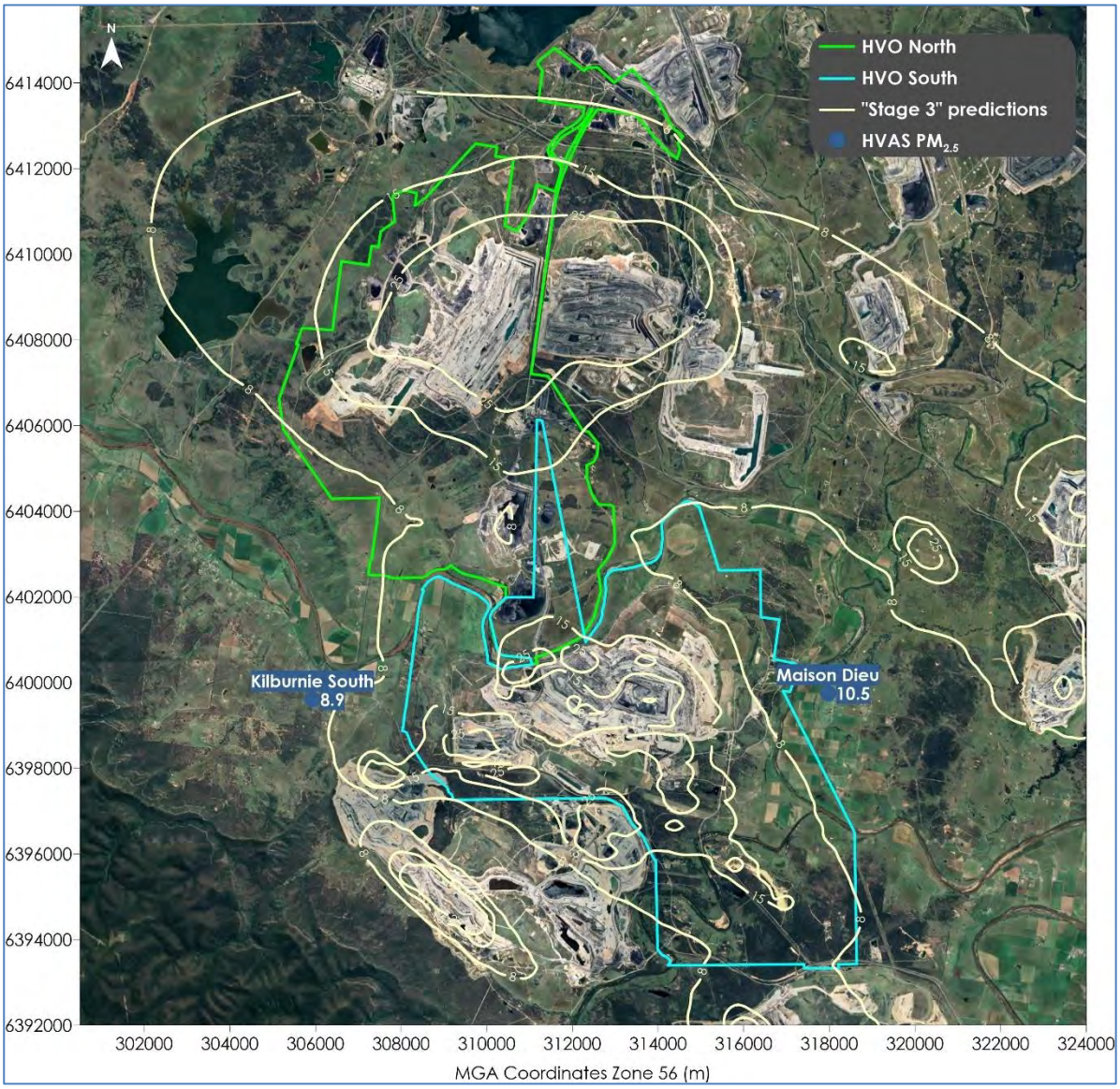


Figure 3-2: Annual average $PM_{2.5}$ monitoring data for 2024 superimposed over the predicted cumulative $PM_{2.5}$ annual average modelling contour (HVO plus other sources) (Source: Todoroski Air Sciences, 2017)

3.3 Annual average PM_{10}

Figure 3-3 presents the measured 2024 annual average PM_{10} data superimposed over the dispersion modelling contours for "Year 2021". The measured and predicted data in the figure include dust levels from HVO and other sources.

Table 3-3 presents a comparison of the long-term measured annual average PM_{10} concentrations from with the predicted annual average level for the modelling scenario "Stage 3". These discrepancies can be attributed to the above average rainfall between April and October and significantly lower dust levels in 2024, as indicated by the monitoring data. This increased rainfall likely resulted in a reduction of dust levels, which may have influenced the observed variations when compared to the predicted. However, some monitors recorded dust levels that were relatively consistent with the modelling predictions.

Table 3-3: Comparison of measured long term annual average PM_{10} levels with predicted level (µg/m³)

Monitor	Annual Average (µg/m³) – Criteria = 25 µg/m³		Predicted level
	HVAS	TEOM	
	2024		
Golden Highway	-	25.4	41.3
Howick	-	26.0	> 50
West Pit	-	50.6	> 50
Wandewoi	-	18.5	27.7
Knodlers Lane	-	21.5	28.6
Warkworth	-	**28.0**	46.3
Jerrys Plains	-	18.6	13.4
Maison Dieu	-	18.2	21.1
Cheshunt East	21.1	-	29.3
Gliding Club	**28.8**	-	> 50
Long Point	17.0	-	17.7
Kilburnie South	17.0	-	26.7

Figure 3-3 shows that the recorded annual average levels in 2024 were lower than the predicted levels for the "Stage 3" modelling scenario.

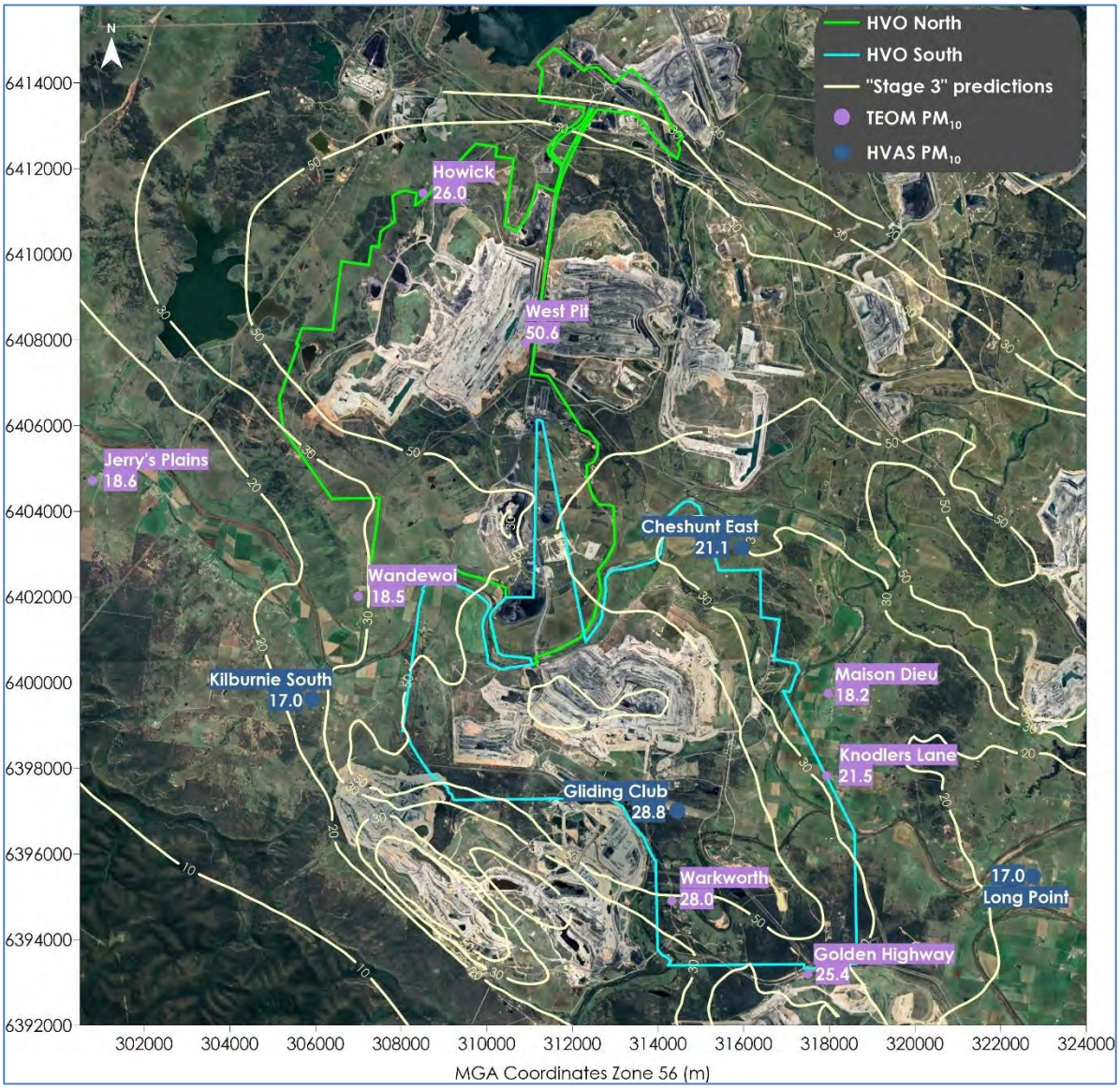


Figure 3-3: Annual average PM_{10} monitoring data for 2024 superimposed over the predicted cumulative PM_{10} annual average modelling contour (HVO plus other sources) (Source: Todoroski Air Sciences, 2017)

3.4 Annual average TSP

Figure 3-3 presents the measured 2024 annual average TSP data superimposed over the dispersion modelling contours for "Year 2021". The measured and predicted data in the figure include dust levels from HVO and other sources.

Table 3-3 presents a comparison of the long-term measured annual average TSP concentrations from with the predicted annual average level for the modelling scenario "Stage 3".

The data indicates that the measured data was typically lower than the predicted values, except for Warkworth and Knodlers Lane which observed levels approximately 30.4µg/m^3 and 3.4µg/m^3 higher than the "Stage 3" predictions.

Table 3-4: Comparison of measured long term annual average TSP levels with predicted level (µg/m^3)

Monitor	Annual Average (µg/m^3) – Criteria = 90 µg/m^3	Predicted level
	2024	
Cheshunt East	59.5	72.6
Warkworth	**137.5**	107.1
Wandewoi	57.3	75.2
Maison Dieu	49.6	60.8
Long Point	46.7	56.7
Knodlers Lane	79.0	75.6
Kilburnie South	54.6	74.9

Figure 3-3 shows that the recorded annual average levels in 2024 were generally lower than the "Stage 3" modelling scenario.

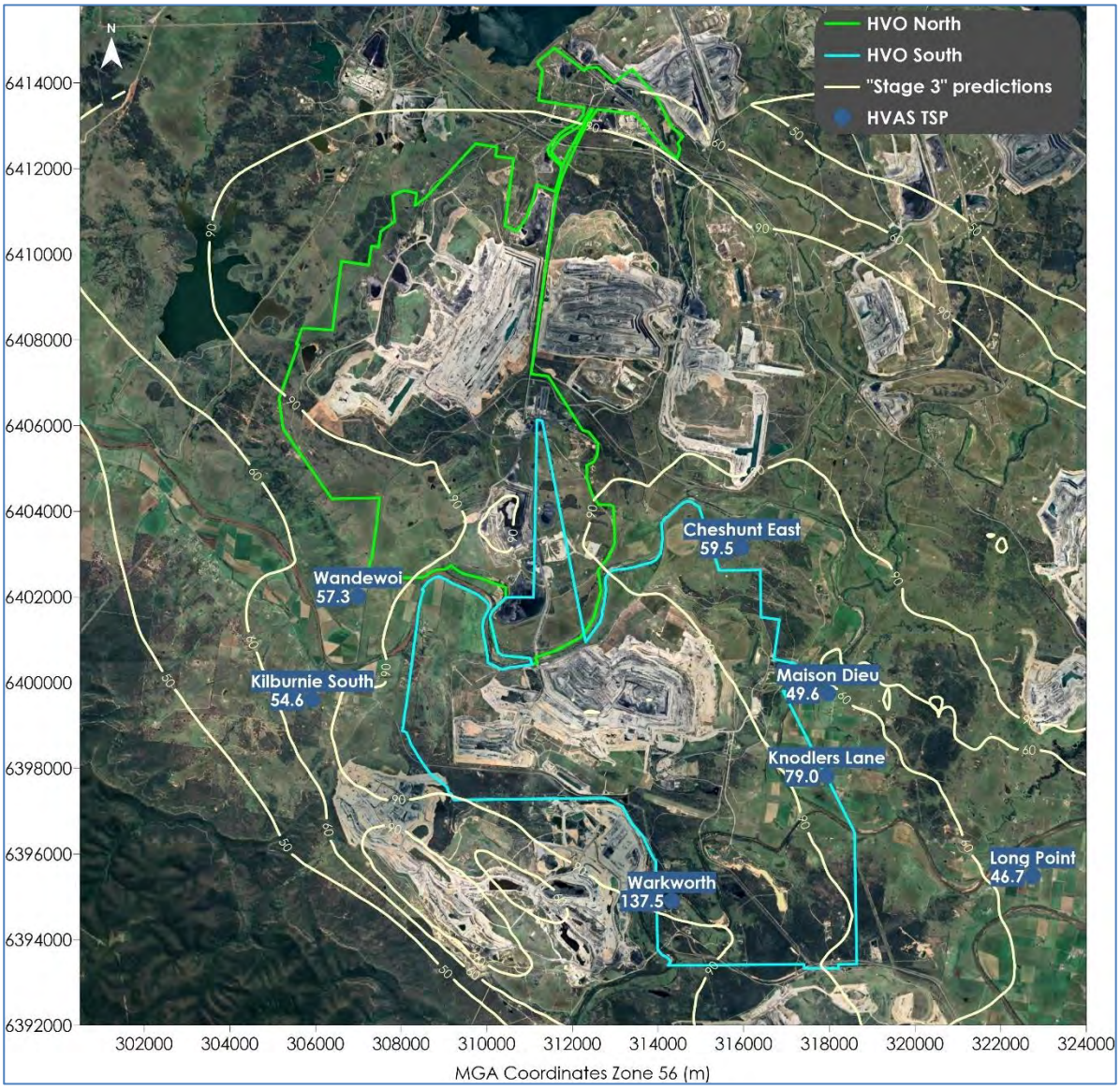


Figure 3-4: Annual average TSP monitoring data for 2024 superimposed over the predicted cumulative TSP annual average modelling contour (HVO plus other sources) (Source: Todoroski Air Sciences, 2017)

4 CONCLUSIONS

This investigation has reviewed the annual average deposited dust, TSP, PM_{10}, and $PM_{2.5}$ levels recorded at HVO during the 2024 calendar year.

An annual average deposited dust level above the cumulative criterion of 4g/m^2/month was recorded at the DL30 and Warkworth monitor, however the analysis indicates that HVO North's contribution to these levels was well below the 2g/m^2/month incremental criterion and that the total level would have been over 4g/m^2/month regardless of any contribution from HVO North.

The annual average TSP, PM_{10} and $PM_{2.5}$ levels were above the relevant criteria at some compliance monitoring locations during 2024. The following monitors above the relevant criteria during 2024 include:

- Annual average TSP – Warkworth HVAS monitor;
- Annual average PM_{10} – Warkworth TEOM and Gliding Club HVAS monitor; and,
- Annual average $PM_{2.5}$ – Maison Dieu HVAS and Kilburnie South HVAS monitor.

An analysis was undertaken for the potential contribution from HVO North and South on the monitors and indicates that HVO did not contribute more than the relevant criteria to the annual average TSP, PM_{10} and $PM_{2.5}$ levels at the monitors during 2024.

The comparison of the measured results to the model predictions for "Stage 3" shows that the annual average measured levels in 2024 were generally lower than the modelling predictions. These discrepancies can be attributed to 2024 being a relatively wet year, which likely influenced the measured levels relative to the predicted values for "Stage 3".

5 REFERENCES

DCCEEW (2024a)

"Air Quality Monitoring Network Upper Hunter Spring 2023 seasonal newsletter", Department of Climate Change, Energy the Environment and Water, December 2024.

TAS (2023)

"Review of PM2.5 Real Time Response Triggers", Todoroski Air Sciences, December 2023.

Appendix A

24-hour Average Levels and Estimated Contributions - TSP

Table A-1: 24-hour average TSP HVAS levels, percent time downwind and estimated contributions – HVO North

Date	Percentage of time downwind (%)							24-hour average TSP level (µg/m³)								HVO North's estimated max. contribution to TSP level (µg/m³)	
	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Estimated Background	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Cheshunt East	Kilburnie South
6/01/2024	0%	0%	0%	0%	0%	0%	0%	52.8	32.9	129.0	59.3	26.3	28.6	47.1	70.2	0.0	0.0
12/01/2024	0%	0%	0%	0%	0%	0%	0%	43.7	24.9	76.0	69.1	21.2	27.4	69.1	80.1	0.0	0.0
18/01/2024	100%	0%	0%	58%	4%	4%	0%	60.4	40.6	115.0	35.0	27.1	40.3	46.6	31.1	0.0	0.0
24/01/2024	58%	8%	21%	46%	29%	42%	13%	48.1	73.0	101.0	55.7	63.7	68.6	166.0	48.1	24.9	0.0
30/01/2024	0%	0%	8%	0%	0%	0%	0%	107.5	58.0	170.0	106.0	50.0	71.3	188.0	89.4	0.0	0.0
5/02/2024	46%	4%	0%	38%	21%	29%	0%	131.0	138.0	187.0	161.0	121.0	111.0	195.0	131.0	7.0	0.0
11/02/2024	0%	0%	0%	0%	0%	0%	0%	100.2	51.0	314.0	69.3	38.9	41.7	55.6	59.7	0.0	0.0
17/02/2024	8%	8%	21%	13%	4%	8%	4%	63.4	67.4	108.0	64.4	52.5	37.9	69.4	45.0	4.0	0.0
23/02/2024	75%	8%	0%	67%	38%	46%	0%	54.8	72.3	121.0	61.4	56.9	56.2	73.4	48.2	17.5	0.0
29/02/2024	54%	4%	4%	29%	4%	4%	4%	113.9	75.5	138.0	86.3	74.9	62.7	103.0	89.7	0.0	0.0
6/03/2024	25%	13%	8%	38%	13%	38%	4%	54.8	81.0	124.0	94.2	58.9	54.8	147.0	77.0	26.2	0.0
12/03/2024	29%	8%	33%	29%	21%	25%	13%	68.4	92.4	216.0	128.0	83.8	68.4	231.0	106.0	24.0	37.6
18/03/2024	0%	0%	4%	0%	0%	0%	0%	31.3	30.1	57.8	60.2	17.8	19.8	31.1	61.2	0.0	0.0
24/03/2024	0%	13%	42%	8%	0%	8%	25%	46.5	43.1	72.0	97.3	45.2	37.5	60.3	92.8	0.0	46.3
30/03/2024	29%	13%	25%	33%	17%	33%	8%	55.1	82.6	673.0	108.0	64.7	55.1	165.0	84.3	27.5	29.2
5/04/2024	0%	0%	0%	0%	0%	0%	0%	12.5	10.0	24.0	9.8	7.1	8.7	12.9	12.2	0.0	0.0
11/04/2024	50%	0%	4%	50%	50%	50%	0%	34.0	45.2	85.8	42.0	34.0	42.6	50.2	47.0	11.2	0.0
17/04/2024	17%	0%	25%	17%	4%	8%	4%	60.1	37.4	78.9	66.0	38.1	41.3	247.0	62.8	0.0	0.0
23/04/2024	58%	0%	17%	54%	33%	42%	4%	28.4	51.9	75.2	38.9	48.9	36.4	64.9	28.4	23.5	0.0
29/04/2024	71%	0%	8%	67%	46%	54%	0%	24.0	72.6	146.0	38.0	62.5	65.1	112.0	24.0	48.6	0.0
5/05/2024	0%	0%	4%	0%	0%	0%	4%	14.6	10.4	21.0	21.9	12.7	9.4	19.3	19.8	0.0	0.0
11/05/2024	0%	0%	0%	0%	0%	0%	0%	11.8	8.6	19.9	14.6	7.0	7.0	8.6	19.5	0.0	0.0
17/05/2024	92%	0%	4%	92%	63%	75%	0%	21.9	92.0	101.0	22.9	58.0	47.4	67.5	20.8	70.2	0.0
23/05/2024	54%	0%	8%	54%	42%	54%	0%	33.7	40.7	120.0	34.7	40.9	37.7	60.7	33.7	7.0	0.0
29/05/2024	58%	4%	13%	67%	46%	67%	0%	28.3	74.2	163.0	39.1	61.0	50.1	72.7	28.3	45.9	0.0
4/06/2024	100%	0%	0%	63%	0%	0%	0%	41.8	29.1	109.0	8.4	16.3	25.6	27.2	8.1	0.0	0.0
10/06/2024	79%	0%	4%	71%	42%	42%	0%	8.1	40.8	70.2	9.9	27.4	25.1	28.6	6.2	32.8	0.0
16/06/2024	71%	0%	0%	54%	29%	42%	0%	7.3	34.7	105.0	7.4	24.0	25.5	40.0	7.2	27.4	0.0
22/06/2024	50%	0%	0%	50%	50%	50%	0%	5.4	36.1	44.4	19.9	37.9	31.5	49.0	5.4	30.7	0.0

Date	Percentage of time downwind (%)							24-hour average TSP level (µg/m³)								HVO North's estimated max. contribution to TSP level (µg/m³)	
	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Estimated Background	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Cheshunt East	Kilburnie South
28/06/2024	58%	4%	13%	58%	58%	58%	0%	24.7	57.4	99.0	24.7	51.6	51.6	67.8	26.4	32.7	0.0
4/07/2024	0%	0%	0%	0%	0%	0%	0%	58.5	32.9	164.0	18.6	29.7	28.4	37.6	58.4	0.0	0.0
10/07/2024	100%	0%	0%	88%	42%	42%	0%	11.7	35.0	60.1	10.3	20.8	21.2	29.8	13.0	23.4	0.0
16/07/2024	100%	0%	0%	63%	0%	0%	0%	38.7	67.4	98.3	12.0	42.7	33.6	37.9	5.8	28.7	0.0
22/07/2024	100%	0%	0%	100%	79%	79%	0%	16.2	105.0	163.0	16.6	89.6	80.0	77.3	15.7	88.9	0.0
28/07/2024	100%	0%	0%	29%	4%	4%	0%	32.3	36.1	86.5	6.0	18.4	24.6	30.0	4.5	3.8	0.0
3/08/2024	71%	0%	17%	71%	38%	67%	4%	18.2	48.8	216.0	20.7	38.9	40.1	51.0	18.2	30.6	0.0
9/08/2024	63%	8%	13%	67%	38%	46%	4%	26.1	71.3	143.0	40.6	60.1	43.7	73.5	26.1	45.2	0.0
15/08/2024	0%	0%	8%	0%	0%	0%	4%	43.5	36.5	74.8	26.0	37.6	16.1	52.3	27.8	0.0	0.0
21/08/2024	92%	8%	0%	71%	25%	50%	0%	28.3	85.1	177.0	33.3	67.4	62.5	83.0	23.2	56.9	0.0
27/08/2024	100%	0%	0%	67%	42%	42%	0%	14.7	-	96.7	16.8	76.3	64.8	64.7	12.5	-	0.0
2/09/2024	100%	0%	0%	38%	8%	8%	0%	114.0	96.6	263.0	40.2	72.7	90.3	118.0	38.8	0.0	0.0
8/09/2024	92%	4%	8%	63%	33%	33%	8%	39.6	154.0	295.0	43.2	73.9	75.3	77.8	35.9	114.5	0.0
14/09/2024	79%	4%	4%	58%	33%	38%	4%	38.2	105.0	176.0	40.4	76.0	71.6	70.7	35.9	66.9	0.0
20/09/2024	100%	0%	0%	67%	38%	38%	0%	42.3	108.0	270.0	41.1	91.6	86.5	117.0	43.4	65.8	0.0
26/09/2024	0%	0%	4%	0%	0%	0%	0%	45.2	43.1	84.0	60.7	33.8	24.1	40.0	46.2	0.0	0.0
2/10/2024	0%	0%	0%	0%	0%	0%	0%	33.2	18.2	80.3	78.4	20.3	19.5	27.9	98.2	0.0	0.0
8/10/2024	17%	0%	0%	17%	8%	13%	0%	103.4	54.6	147.0	114.0	54.6	59.7	88.5	81.7	0.0	0.0
14/10/2024	71%	0%	8%	67%	42%	42%	0%	39.9	45.2	126.0	57.0	39.1	34.4	40.6	39.9	5.3	0.0
20/10/2024	4%	0%	13%	4%	4%	4%	4%	43.6	34.6	97.7	69.9	24.8	33.9	26.8	46.8	0.0	0.0
26/10/2024	0%	0%	0%	0%	0%	0%	0%	70.4	38.9	167.0	87.0	46.1	42.1	57.9	116.0	0.0	0.0
1/11/2024	0%	0%	4%	0%	0%	0%	0%	58.3	47.8	85.8	94.0	45.2	46.0	66.5	104.0	0.0	0.0
7/11/2024	42%	13%	13%	29%	13%	25%	13%	90.4	144.0	164.0	91.0	126.0	92.5	187.0	90.4	53.6	0.0
13/11/2024	21%	0%	21%	17%	4%	4%	17%	107.0	38.8	107.0	60.3	36.6	35.6	46.6	-	0.0	-
19/11/2024	0%	0%	0%	0%	0%	0%	0%	40.1	34.7	66.4	110.0	29.1	29.8	40.3	128.0	0.0	0.0
25/11/2024	25%	0%	17%	21%	8%	8%	17%	134.0	65.6	134.0	114.0	64.6	50.1	95.9	139.0	0.0	5.0
1/12/2024	63%	0%	8%	29%	4%	4%	4%	107.7	74.7	160.0	73.0	57.1	58.7	69.6	55.4	0.0	0.0
7/12/2024	92%	4%	0%	42%	13%	13%	0%	60.0	114.0	188.0	53.4	95.5	89.5	133.0	66.6	54.0	0.0
13/12/2024	58%	0%	21%	42%	21%	21%	0%	128.0	83.9	195.0	134.0	92.8	75.6	139.0	128.0	0.0	0.0
19/12/2024	0%	0%	4%	0%	0%	0%	4%	53.8	40.0	91.5	83.1	39.4	36.8	61.3	95.8	0.0	0.0

Date	Percentage of time downwind (%)							24-hour average TSP level (µg/m³)								HVO North's estimated max. contribution to TSP level (µg/m³)	
	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Estimated Background	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Cheshunt East	Kilburnie South
25/12/2024	8%	4%	21%	8%	4%	8%	13%	67.8	48.7	83.1	53.2	36.6	49.2	71.1	74.3	0.0	6.5
31/12/2024	0%	0%	13%	0%	0%	0%	8%	111.2	54.9	264.0	144.0	56.2	48.0	133.0	145.0	0.0	33.8

- No data

Table A-2: 24-hour average TSP HVAS levels, percent time downwind and estimated contributions – HVO South

Date	Percentage of time downwind (%)							24-hour average TSP level (µg/m³)								HVO South's estimated max. contribution to TSP level (µg/m³)				
	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Estimated Background	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Warkworth	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South
6/01/2024	0%	0%	100%	0%	0%	0%	38%	52.8	32.9	129.0	59.3	26.3	28.6	47.1	70.2	0.0	0.0	0.0	0.0	17.4
12/01/2024	0%	0%	100%	0%	0%	0%	42%	43.7	24.9	76.0	69.1	21.2	27.4	69.1	80.1	0.0	0.0	0.0	0.0	36.4
18/01/2024	0%	4%	0%	96%	96%	100%	0%	60.4	40.6	115.0	35.0	27.1	40.3	46.6	31.1	0.0	0.0	0.0	0.0	0.0
24/01/2024	0%	46%	17%	21%	33%	50%	4%	48.1	73.0	101.0	55.7	63.7	68.6	166.0	48.1	36.4	15.6	20.5	117.9	0.0
30/01/2024	0%	0%	92%	0%	0%	0%	63%	107.5	58.0	170.0	106.0	50.0	71.3	188.0	89.4	0.0	0.0	0.0	0.0	0.0
5/02/2024	4%	33%	38%	17%	25%	38%	13%	131.0	138.0	187.0	161.0	121.0	111.0	195.0	131.0	34.5	0.0	0.0	64.0	0.0
11/02/2024	0%	0%	100%	0%	0%	0%	38%	100.2	51.0	314.0	69.3	38.9	41.7	55.6	59.7	0.0	0.0	0.0	0.0	0.0
17/02/2024	0%	13%	67%	4%	4%	8%	8%	63.4	67.4	108.0	64.4	52.5	37.9	69.4	45.0	33.5	0.0	0.0	6.0	0.0
23/02/2024	4%	46%	4%	38%	42%	75%	0%	54.8	72.3	121.0	61.4	56.9	56.2	73.4	48.2	36.4	2.1	1.4	18.6	0.0
29/02/2024	13%	8%	25%	58%	46%	54%	4%	113.9	75.5	138.0	86.3	74.9	62.7	103.0	89.7	3.0	0.0	0.0	0.0	0.0
6/03/2024	0%	38%	46%	4%	4%	17%	21%	54.8	81.0	124.0	94.2	58.9	54.8	147.0	77.0	62.3	0.0	0.0	92.2	22.2
12/03/2024	0%	38%	33%	4%	4%	25%	13%	68.4	92.4	216.0	128.0	83.8	68.4	231.0	106.0	132.8	0.0	0.0	162.6	37.6
18/03/2024	4%	0%	92%	0%	0%	0%	38%	31.3	30.1	57.8	60.2	17.8	19.8	31.1	61.2	0.0	0.0	0.0	0.0	29.9
24/03/2024	0%	21%	46%	0%	0%	0%	17%	46.5	43.1	72.0	97.3	45.2	37.5	60.3	92.8	25.5	0.0	0.0	0.0	46.3
30/03/2024	0%	42%	33%	0%	0%	17%	21%	55.1	82.6	673.0	108.0	64.7	55.1	165.0	84.3	617.9	0.0	0.0	109.9	29.2
5/04/2024	0%	0%	100%	0%	0%	0%	25%	12.5	10.0	24.0	9.8	7.1	8.7	12.9	12.2	0.0	0.0	0.0	0.0	0.0
11/04/2024	4%	50%	46%	0%	4%	50%	21%	34.0	45.2	85.8	42.0	34.0	42.6	50.2	47.0	47.8	0.0	0.0	16.2	13.0
17/04/2024	0%	8%	58%	8%	8%	13%	29%	60.1	37.4	78.9	66.0	38.1	41.3	247.0	62.8	9.4	0.0	0.0	186.9	2.7

Date	Percentage of time downwind (%)							24-hour average TSP level (µg/m³)								HVO South's estimated max. contribution to TSP level (µg/m³)				
	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Estimated Background	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Warkworth	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South
23/04/2024	4%	42%	25%	17%	21%	50%	13%	28.4	51.9	75.2	38.9	48.9	36.4	64.9	28.4	31.2	20.5	8.0	36.5	0.0
29/04/2024	8%	63%	8%	17%	38%	63%	8%	24.0	72.6	146.0	38.0	62.5	65.1	112.0	24.0	96.3	38.5	41.1	88.0	0.0
5/05/2024	0%	0%	83%	0%	0%	0%	13%	14.6	10.4	21.0	21.9	12.7	9.4	19.3	19.8	0.0	0.0	0.0	0.0	5.2
11/05/2024	0%	0%	100%	0%	0%	0%	8%	11.8	8.6	19.9	14.6	7.0	7.0	8.6	19.5	0.0	0.0	0.0	0.0	7.7
17/05/2024	4%	75%	4%	13%	38%	79%	0%	21.9	92.0	101.0	22.9	58.0	47.4	67.5	20.8	64.8	36.2	25.6	45.7	0.0
23/05/2024	13%	54%	25%	0%	0%	42%	17%	33.7	40.7	120.0	34.7	40.9	37.7	60.7	33.7	80.1	0.0	0.0	27.0	0.0
29/05/2024	4%	67%	21%	0%	8%	46%	8%	28.3	74.2	163.0	39.1	61.0	50.1	72.7	28.3	126.8	0.0	21.8	44.4	0.0
4/06/2024	0%	0%	0%	100%	100%	100%	0%	41.8	29.1	109.0	8.4	16.3	25.6	27.2	8.1	0.0	0.0	0.0	0.0	0.0
10/06/2024	4%	42%	8%	38%	54%	79%	0%	8.1	40.8	70.2	9.9	27.4	25.1	28.6	6.2	32.7	19.4	17.1	20.6	0.0
16/06/2024	8%	42%	0%	50%	13%	63%	0%	7.3	34.7	105.0	7.4	24.0	25.5	40.0	7.2	44.4	16.7	18.2	32.7	0.0
22/06/2024	4%	50%	33%	0%	0%	50%	0%	5.4	36.1	44.4	19.9	37.9	31.5	49.0	5.4	39.0	0.0	0.0	43.6	0.0
28/06/2024	8%	63%	21%	0%	4%	58%	17%	24.7	57.4	99.0	24.7	51.6	51.6	67.8	26.4	74.3	0.0	0.0	43.1	1.7
4/07/2024	0%	0%	100%	0%	0%	0%	4%	58.5	32.9	164.0	18.6	29.7	28.4	37.6	58.4	0.0	0.0	0.0	0.0	0.0
10/07/2024	0%	42%	0%	58%	92%	100%	0%	11.7	35.0	60.1	10.3	20.8	21.2	29.8	13.0	20.2	9.2	9.6	18.2	0.0
16/07/2024	0%	0%	0%	100%	100%	100%	0%	38.7	67.4	98.3	12.0	42.7	33.6	37.9	5.8	0.0	4.0	0.0	0.0	0.0
22/07/2024	0%	79%	0%	21%	58%	100%	0%	16.2	105.0	163.0	16.6	89.6	80.0	77.3	15.7	116.3	73.5	63.9	61.2	0.0
28/07/2024	0%	4%	0%	96%	75%	100%	0%	32.3	36.1	86.5	6.0	18.4	24.6	30.0	4.5	0.0	0.0	0.0	0.0	0.0
3/08/2024	8%	67%	0%	13%	8%	42%	0%	18.2	48.8	216.0	20.7	38.9	40.1	51.0	18.2	166.6	20.7	21.9	32.8	0.0
9/08/2024	4%	46%	8%	29%	33%	67%	4%	26.1	71.3	143.0	40.6	60.1	43.7	73.5	26.1	71.4	34.0	17.6	47.4	0.0
15/08/2024	8%	0%	71%	0%	0%	0%	17%	43.5	36.5	74.8	26.0	37.6	16.1	52.3	27.8	0.0	0.0	0.0	0.0	0.0
21/08/2024	0%	50%	0%	50%	58%	75%	0%	28.3	85.1	177.0	33.3	67.4	62.5	83.0	23.2	74.4	39.2	34.3	54.8	0.0
27/08/2024	0%	42%	0%	58%	92%	100%	0%	14.7		96.7	16.8	76.3	64.8	64.7	12.5	34.2	61.7	50.2	50.1	0.0
2/09/2024	0%	8%	0%	92%	75%	100%	0%	114.0	96.6	263.0	40.2	72.7	90.3	118.0	38.8	12.4	0.0	0.0	4.0	0.0
8/09/2024	0%	38%	0%	58%	63%	92%	0%	39.6	154.0	295.0	43.2	73.9	75.3	77.8	35.9	100.0	34.4	35.8	38.3	0.0
14/09/2024	4%	38%	4%	54%	42%	79%	4%	38.2	105.0	176.0	40.4	76.0	71.6	70.7	35.9	56.4	37.9	33.5	32.6	0.0
20/09/2024	0%	38%	0%	63%	88%	100%	0%	42.3	108.0	270.0	41.1	91.6	86.5	117.0	43.4	85.4	49.4	44.3	74.8	0.0
26/09/2024	0%	0%	83%	0%	0%	0%	13%	45.2	43.1	84.0	60.7	33.8	24.1	40.0	46.2	0.0	0.0	0.0	0.0	1.0
2/10/2024	0%	0%	96%	0%	0%	0%	54%	33.2	18.2	80.3	78.4	20.3	19.5	27.9	98.2	0.0	0.0	0.0	0.0	65.0
8/10/2024	0%	13%	83%	4%	4%	13%	42%	103.4	54.6	147.0	114.0	54.6	59.7	88.5	81.7	32.7	0.0	0.0	0.0	0.0
14/10/2024	4%	42%	17%	33%	46%	71%	4%	39.9	45.2	126.0	57.0	39.1	34.4	40.6	39.9	47.8	0.0	0.0	0.7	0.0

Date	Percentage of time downwind (%)							24-hour average TSP level (µg/m³)								HVO South's estimated max. contribution to TSP level (µg/m³)				
	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Estimated Background	Cheshunt East	Warkworth	Wandewoi	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South	Warkworth	Maison Dieu	Long Point	Knodlers Lane	Kilburnie South
20/10/2024	8%	4%	63%	4%	0%	4%	58%	43.6	34.6	97.7	69.9	24.8	33.9	26.8	46.8	0.0	0.0	0.0	0.0	3.2
26/10/2024	0%	0%	100%	0%	0%	0%	38%	70.4	38.9	167.0	87.0	46.1	42.1	57.9	116.0	0.0	0.0	0.0	0.0	45.6
1/11/2024	0%	0%	96%	0%	0%	0%	38%	58.3	47.8	85.8	94.0	45.2	46.0	66.5	104.0	0.0	0.0	0.0	0.0	45.7
7/11/2024	4%	38%	8%	33%	25%	38%	0%	90.4	144.0	164.0	91.0	126.0	92.5	187.0	90.4	36.8	35.6	2.1	96.6	0.0
13/11/2024	8%	8%	50%	21%	17%	25%	33%	107.0	38.8	107.0	60.3	36.6	35.6	46.6	-	0.0	0.0	0.0	0.0	-
19/11/2024	0%	0%	100%	0%	0%	0%	63%	40.1	34.7	66.4	110.0	29.1	29.8	40.3	128.0	0.0	0.0	0.0	0.0	87.9
25/11/2024	0%	8%	50%	17%	13%	25%	29%	134.0	65.6	134.0	114.0	64.6	50.1	95.9	139.0	0.0	0.0	0.0	0.0	5.0
1/12/2024	8%	4%	13%	63%	63%	63%	4%	107.7	74.7	160.0	73.0	57.1	58.7	69.6	55.4	0.0	0.0	0.0	0.0	0.0
7/12/2024	4%	17%	0%	75%	67%	92%	0%	60.0	114.0	188.0	53.4	95.5	89.5	133.0	66.6	23.3	35.5	29.5	73.0	0.0
13/12/2024	4%	21%	25%	38%	42%	58%	8%	128.0	83.9	195.0	134.0	92.8	75.6	139.0	128.0	23.9	0.0	0.0	11.0	0.0
19/12/2024	0%	0%	92%	0%	0%	0%	67%	53.8	40.0	91.5	83.1	39.4	36.8	61.3	95.8	0.0	0.0	0.0	0.0	42.0
25/12/2024	8%	13%	54%	8%	0%	4%	42%	67.8	48.7	83.1	53.2	36.6	49.2	71.1	74.3	9.2	0.0	0.0	0.0	6.5
31/12/2024	0%	0%	83%	0%	0%	0%	46%	111.2	54.9	264.0	144.0	56.2	48.0	133.0	145.0	0.0	0.0	0.0	0.0	33.8

- No data

Appendix B

24-hour Average Levels and Estimated Contributions - PM_{10}

Table B-1: Detailed analyses for elevated 24-hour average PM_{10} readings

Date	Site	Measured 24-hour average PM_{10} level (µg/m³)	HVO 24-hour average PM_{10} Incremental Criteria (µg/m³)	Estimated HVO Incremental contribution to PM_{10} level (µg/m³)
22/01/2024	Warkworth TEOM	60.0	50	0.0
25/01/2024	Knodlers Lane TEOM	57.2	50	8.8
26/01/2024	Knodlers Lane TEOM	67.4	50	18.3
	Maison Dieu TEOM	53.7	50	4.8
	Warkworth TEOM	59.1	50	0.0
3/02/2024	Knodlers Lane TEOM	52.5	50	0.0
4/02/2024	Knodlers Lane TEOM	69.5	50	7.0
	Maison Dieu TEOM	58.1	50	8.9
	Wandewoi TEOM	61.8	50	0.0
	Warkworth TEOM	56.9	50	0.0
5/02/2024	Cheshunt East HVAS	69.1	50	13.4
	Gliding Club HVAS	62.9	50	10.9
	Kilburnie South HVAS	52.0	50	17.9
	Long Point HVAS	65.0	50	13.0
	Knodlers Lane TEOM	56.0	50	8.0
	Maison Dieu TEOM	52.1	50	4.3
	Warkworth TEOM	54.8	50	14.7
13/03/2024	Jerrys Plains TEOM	51.2	50	13.3/6.4
	Knodlers Lane TEOM	54.9	50	0.0
	Wandewoi TEOM	53.0	50	4.6
14/03/2024	Knodlers Lane TEOM	62.4	50	0.7
16/04/2024	Knodlers Lane TEOM	55.8	50	0.0
17/04/2024	Knodlers Lane TEOM	75.8	50	0.1
31/05/2024	Warkworth TEOM	54.0	50	22.4
28/06/2024	Gliding Club HVAS*	55.4	50	44.6
29/06/2024	Warkworth TEOM	51.3	50	13.2
20/07/2024	Warkworth TEOM	54.4	50	0.0
31/08/2024	Warkworth TEOM	70.6	50	0.0
1/09/2024	Warkworth TEOM	54.2	50	0.0
2/09/2024	Knodlers Lane TEOM	54.0	50	21.4
	Warkworth TEOM	70.3	50	0.0
5/09/2024	Warkworth TEOM	52.8	50	0.0

Date	Site	Measured 24-hour average PM_{10} level ($\mu g/m^3$)	HVO 24-hour average PM_{10} Incremental Criteria ($\mu g/m^3$)	Estimated HVO Incremental contribution to PM_{10} level ($\mu g/m^3$)
7/09/2024	Warkworth TEOM	65.7	50	0.0
8/09/2024	Warkworth TEOM	60.9	50	0.5
	Gliding Club HVAS	55.9	50	39.2
18/09/2024	Warkworth TEOM	58.2	50	0.0
19/09/2024	Warkworth TEOM	53.7	50	0.0
20/09/2024	Warkworth TEOM	58.3	50	0.0
	Gliding Club HVAS	64.0	50	37.7
21/09/2024	Warkworth TEOM	72.2	50	0.0
22/09/2024	Warkworth TEOM	51.7	50	0.0
23/09/2024	Warkworth TEOM	75.4	50	10.5
24/09/2024	Warkworth TEOM	54.5	50	0.0
25/09/2024	Warkworth TEOM	65.5	50	0.0
	Knodlers Lane TEOM	67.4	50	21.0
23/10/2024	Warkworth TEOM	50.4	50	0.0
4/11/2024	Jerrys Plains TEOM	57.9	50	6.5[1]/1.2[2]
	Warkworth TEOM	63.0	50	0.0
7/11/2024	Cheshunt East HVAS	53.9	50	11.1
	Gliding Club HVAS*	71.6	50	38.8
13/12/2024	Warkworth TEOM	66.3	50	0.0
	Gliding Club HVAS	55.2	50	6.9
14/12/2024	Jerrys Plains TEOM	50.5	50	9.5[1]/6.3[2]
27/12/2024	Warkworth TEOM	55.9	50	0.0

*Gliding Club not operational, hence per PA 06_0261 the air quality impact assessment criteria do not apply

[1]HVO South contribution

[2]HVO North contribution

Table B-2: 24-hour average PM_{10} TEOM levels, percent time downwind and estimated contributions – HVO North

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
1/01/2024	12.0	29.0	6.6	28.3	13.3	18.2	28.9	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
2/01/2024	19.9	34.9	9.8	27.2	16.7	23.5	31.3	0%	88%	17%	0%	0%	8%	0%	0.0	1.7
3/01/2024	24.7	34.4	9.1	27.8	17.4	26.3	31.8	0%	96%	21%	0%	0%	0%	0%	0.5	0.0
4/01/2024	27.0	-	12.6	33.8	28.3	17.9	37.2	13%	58%	4%	38%	38%	0%	13%	0.0	0.0
5/01/2024	14.0	15.9	5.0	19.0	13.1	12.9	23.8	0%	100%	4%	0%	0%	0%	0%	0.0	0.0
6/01/2024	15.7	30.3	6.0	17.3	15.0	18.8	36.7	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
7/01/2024	17.2	30.4	8.4	19.5	15.2	26.9	29.5	0%	96%	13%	0%	0%	4%	0%	0.0	0.1
8/01/2024	18.6	20.0	7.1	20.1	19.9	20.4	28.6	4%	21%	0%	21%	42%	4%	4%	0.0	0.8
9/01/2024	12.3	19.9	6.2	13.2	12.9	11.1	15.1	0%	50%	0%	17%	50%	4%	0%	0.0	0.9
10/01/2024	17.7	28.8	10.5	18.5	14.7	21.6	25.7	0%	100%	21%	0%	0%	0%	0%	0.1	0.0
11/01/2024	19.6	27.3	11.6	18.6	15.8	22.4	25.4	0%	96%	17%	0%	0%	0%	0%	0.2	0.0
12/01/2024	16.2	22.7	6.8	19.8	13.7	18.3	21.3	0%	100%	4%	0%	0%	0%	0%	0.4	0.0
13/01/2024	26.7	39.5	10.4	26.4	21.1	32.7	30.7	4%	75%	25%	4%	0%	17%	4%	0.0	3.7
14/01/2024	13.9	21.4	6.0	15.6	13.0	13.3	16.5	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
15/01/2024	15.4	20.7	5.5	15.2	15.5	9.4	22.3	0%	100%	13%	0%	0%	0%	0%	0.0	0.0
16/01/2024	17.4	22.1	5.9	15.2	15.3	16.7	40.5	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
17/01/2024	21.8	17.2	9.1	15.7	15.2	18.6	24.5	4%	38%	17%	21%	29%	21%	8%	0.4	3.4
18/01/2024	8.0	12.7	4.7	11.3	9.4	3.9	18.0	0%	0%	0%	8%	63%	0%	0%	0.0	0.0
19/01/2024	18.2	29.7	9.1	23.5	23.6	23.0	30.8	4%	38%	0%	29%	42%	0%	4%	0.0	0.0
20/01/2024	20.5	41.8	10.0	28.1	19.1	29.3	37.4	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
21/01/2024	26.3	26.8	7.1	30.5	27.1	16.5	25.9	13%	0%	0%	38%	54%	13%	0%	0.0	3.0
22/01/2024	33.6	51.6	14.0	40.9	33.2	38.6	60.0	4%	96%	4%	4%	4%	0%	0%	0.0	0.0
23/01/2024	14.9	27.0	-	26.9	15.8	19.7	18.8	0%	92%	21%	0%	0%	0%	0%	-	0.0
24/01/2024	42.0	29.1	-	32.1	24.8	25.6	23.7	17%	29%	8%	42%	46%	17%	8%	-	1.9
25/01/2024	49.7	44.5	39.0	57.2	44.8	44.3	45.2	4%	25%	4%	25%	38%	0%	0%	0.2	0.0
26/01/2024	41.8	56.5	41.3	67.4	53.7	36.4	59.1	0%	25%	17%	33%	38%	0%	0%	4.5	0.0
27/01/2024	-	29.1	29.9	39.8	24.6	26.9	22.1	0%	100%	21%	0%	0%	0%	0%	2.5	0.0
28/01/2024	-	37.0	28.9	36.9	27.1	29.2	27.2	0%	100%	38%	0%	0%	0%	0%	3.5	0.0
29/01/2024	-	43.0	37.2	31.5	24.3	36.6	38.4	0%	79%	13%	0%	13%	4%	0%	4.3	1.3
30/01/2024	28.9	37.3	30.6	35.2	22.3	26.3	28.2	0%	92%	21%	0%	0%	8%	0%	3.8	0.0
31/01/2024	25.9	39.6	42.5	-	18.6	31.9	29.6	0%	100%	25%	0%	0%	0%	0%	10.3	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
1/02/2024	24.6	34.8	28.2	-	23.4	24.2	25.4	8%	71%	4%	4%	4%	17%	4%	2.3	6.3
2/02/2024	35.0	46.4	37.3	41.9	30.4	41.7	34.2	13%	46%	17%	29%	46%	4%	4%	5.0	2.7
3/02/2024	36.4	47.2	45.8	52.5	37.2	41.8	35.5	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
4/02/2024	44.6	39.7	42.8	69.5	58.1	61.8	56.9	4%	25%	13%	29%	46%	17%	13%	1.1	0.0
5/02/2024	44.0	46.2	44.1	56.0	52.1	40.2	54.8	13%	33%	4%	29%	38%	0%	4%	1.2	0.0
6/02/2024	18.1	24.2	16.9	15.0	19.8	20.0	21.8	0%	67%	8%	0%	4%	8%	4%	0.7	1.2
7/02/2024	14.8	10.9	11.6	8.5	10.6	10.1	12.3	0%	92%	29%	0%	0%	0%	0%	1.9	0.0
8/02/2024	20.7	22.2	16.2	13.1	15.5	15.2	22.8	0%	100%	17%	0%	0%	0%	0%	1.2	0.0
9/02/2024	22.0	31.6	19.7	15.1	18.4	23.2	30.9	0%	88%	21%	0%	0%	13%	0%	2.2	1.4
10/02/2024	24.2	23.3	14.0	14.6	15.2	15.1	26.2	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
11/02/2024	29.3	30.0	25.6	20.2	23.7	25.1	26.2	0%	100%	13%	0%	0%	0%	0%	1.0	0.0
12/02/2024	19.1	32.3	23.5	13.4	-	27.8	21.3	0%	71%	29%	0%	0%	25%	0%	5.7	5.4
13/02/2024	23.0	25.3	21.6	14.5	-	20.9	22.8	25%	29%	8%	29%	29%	8%	21%	1.8	1.3
14/02/2024	22.9	27.8	18.2	17.9	23.6	18.2	26.2	13%	29%	8%	58%	67%	4%	0%	0.9	0.4
15/02/2024	15.3	17.2	10.7	10.2	12.4	9.4	12.9	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
16/02/2024	16.3	24.3	16.8	10.2	12.8	20.4	21.2	0%	96%	21%	0%	0%	0%	0%	1.4	0.0
17/02/2024	38.3	31.7	15.8	21.6	18.8	21.4	37.2	4%	63%	13%	8%	13%	21%	8%	0.4	2.1
18/02/2024	34.8	28.4	21.5	23.9	21.2	27.9	27.2	8%	42%	21%	17%	17%	25%	4%	0.8	4.3
19/02/2024	17.6	17.3	12.9	12.1	13.2	17.1	18.1	4%	71%	21%	4%	8%	13%	0%	1.2	1.2
20/02/2024	15.2	17.3	11.2	12.1	11.3	13.5	17.8	0%	88%	21%	0%	0%	0%	0%	0.4	0.0
21/02/2024	17.9	22.7	14.8	13.9	12.7	16.2	21.0	0%	92%	17%	0%	0%	4%	0%	0.9	0.6
22/02/2024	30.9	29.0	26.6	26.2	20.8	30.1	29.1	8%	58%	25%	21%	13%	13%	13%	2.2	1.2
23/02/2024	24.4	27.1	17.6	27.1	21.7	-	29.3	8%	13%	0%	46%	67%	0%	8%	0.0	-
24/02/2024	19.2	15.4	8.2	14.9	13.1	-	22.4	0%	100%	0%	0%	0%	0%	0%	0.0	-
25/02/2024	24.1	24.8	19.1	21.2	18.1	-	20.8	0%	71%	33%	0%	0%	21%	0%	1.9	-
26/02/2024	32.3	30.8	33.2	30.7	25.6	35.7	28.1	25%	42%	29%	42%	46%	13%	13%	7.2	0.0
27/02/2024	26.8	22.8	24.0	20.5	17.5	20.8	-	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
28/02/2024	22.9	35.7	40.0	28.6	22.2	29.8	28.0	0%	75%	38%	0%	0%	21%	0%	6.5	1.8
29/02/2024	27.2	30.2	25.0	25.9	24.8	21.2	39.1	0%	17%	0%	8%	33%	8%	4%	0.0	0.3
1/03/2024	32.3	36.7	39.5	39.3	29.3	33.3	40.1	0%	42%	8%	13%	21%	21%	4%	1.1	2.1
2/03/2024	22.7	27.8	26.5	34.6	27.3	22.1	31.5	0%	29%	13%	13%	29%	8%	0%	1.7	0.4
3/03/2024	40.4	27.2	18.7	25.2	21.1	23.0	26.6	4%	63%	4%	17%	21%	0%	4%	0.0	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
4/03/2024	32.4	32.1	32.5	29.4	27.3	30.9	34.2	0%	100%	42%	0%	0%	0%	0%	5.2	0.0
5/03/2024	26.9	29.1	28.1	30.0	16.3	30.2	32.2	0%	100%	29%	0%	0%	0%	0%	4.5	0.0
6/03/2024	33.6	32.0	27.8	39.5	25.0	29.9	35.1	25%	46%	21%	38%	38%	8%	13%	2.9	0.8
7/03/2024	40.9	41.7	29.3	25.2	20.7	30.2	37.1	13%	67%	29%	21%	25%	8%	8%	4.3	1.6
8/03/2024	13.4	25.9	21.9	23.3	11.6	19.9	20.0	0%	88%	33%	0%	0%	0%	0%	4.8	0.0
9/03/2024	16.7	27.2	26.4	25.6	14.7	30.3	19.8	0%	79%	50%	0%	0%	4%	0%	6.3	0.3
10/03/2024	19.7	28.1	24.7	29.0	17.3	29.6	23.7	0%	71%	42%	0%	0%	0%	0%	4.6	0.0
11/03/2024	21.8	33.8	29.0	31.8	17.2	27.1	28.8	0%	88%	46%	0%	0%	8%	0%	7.9	0.7
12/03/2024	60.4	44.5	32.0	47.5	26.1	34.8	39.1	8%	33%	25%	25%	29%	33%	8%	6.2	5.9
13/03/2024	38.5	50.1	51.2	54.9	26.7	53.0	40.9	0%	63%	46%	0%	0%	17%	0%	13.3	4.6
14/03/2024	37.7	-	37.3	62.4	26.8	32.4	43.8	0%	33%	8%	38%	46%	4%	0%	1.8	1.0
15/03/2024	23.1	27.8	25.3	39.5	15.1	18.8	35.9	0%	100%	21%	0%	0%	0%	0%	5.5	0.0
16/03/2024	19.5	31.4	21.5	22.3	16.1	25.0	33.4	0%	100%	17%	0%	0%	0%	0%	2.2	0.0
17/03/2024	10.7	16.7	12.6	8.3	8.1	11.1	15.8	0%	96%	4%	0%	0%	4%	0%	0.2	0.4
18/03/2024	13.4	17.5	12.1	9.7	10.0	11.9	18.8	0%	83%	25%	0%	0%	4%	0%	1.1	0.2
19/03/2024	14.9	21.0	20.2	14.5	13.1	18.7	19.6	8%	58%	25%	8%	8%	25%	8%	2.0	1.1
20/03/2024	17.0	17.4	14.6	15.1	13.4	14.5	19.5	4%	33%	4%	33%	50%	0%	0%	0.6	0.0
21/03/2024	24.5	28.0	23.8	19.0	17.8	21.8	25.6	0%	100%	33%	0%	0%	0%	0%	2.4	0.0
22/03/2024	26.4	23.8	18.4	25.1	13.6	18.8	24.7	0%	88%	4%	0%	0%	4%	0%	0.0	0.4
23/03/2024	23.7	25.0	20.9	18.8	14.6	22.2	30.8	8%	58%	17%	13%	13%	17%	13%	2.5	1.9
24/03/2024	22.4	22.4	21.4	23.3	17.2	23.6	24.7	8%	42%	21%	8%	8%	46%	13%	2.9	6.3
25/03/2024	34.8	26.7	24.5	23.9	22.8	25.5	24.7	4%	25%	4%	42%	58%	8%	4%	0.6	4.4
26/03/2024	52.0	43.5	36.4	33.6	28.3	-	41.7	21%	50%	29%	29%	29%	13%	4%	3.3	-
27/03/2024	29.2	30.2	38.3	23.6	16.8	-	32.1	0%	83%	38%	0%	0%	13%	0%	13.9	-
28/03/2024	33.7	30.4	31.3	29.9	20.2	-	37.2	0%	100%	17%	0%	0%	0%	0%	3.0	-
29/03/2024	24.9	30.6	32.0	28.4	18.2	30.5	38.3	0%	92%	29%	0%	0%	0%	0%	5.7	0.0
30/03/2024	33.5	24.0	27.5	35.5	18.3	-	29.5	21%	29%	21%	33%	33%	25%	13%	6.8	-
31/03/2024	18.6	22.4	24.3	20.7	8.9	-	18.4	0%	83%	21%	0%	0%	13%	0%	3.3	-
1/04/2024	31.4	28.6	32.4	37.7	18.6	-	24.8	13%	58%	25%	21%	13%	17%	8%	8.3	-
2/04/2024	34.1	22.2	19.8	29.8	21.2	-	34.7	4%	13%	4%	46%	79%	0%	4%	0.3	-
3/04/2024	19.5	24.6	18.7	18.7	15.5	17.8	19.8	8%	42%	8%	46%	46%	8%	4%	1.3	0.5
4/04/2024	13.6	14.2	10.4	11.3	11.3	8.5	25.1	0%	100%	0%	0%	0%	0%	0%	0.0	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
5/04/2024	5.6	6.5	6.0	6.1	5.1	4.8	19.2	0%	96%	4%	0%	0%	4%	0%	0.2	0.3
6/04/2024	8.9	6.5	6.3	7.4	6.9	6.4	10.6	17%	0%	0%	46%	67%	4%	17%	0.0	0.0
7/04/2024	14.9	12.3	7.7	17.0	11.3	7.2	17.4	4%	0%	0%	58%	67%	4%	0%	0.0	0.0
8/04/2024	21.2	19.0	11.4	14.4	12.0	11.4	17.0	4%	17%	0%	50%	63%	4%	0%	0.0	0.0
9/04/2024	32.1	14.5	9.9	13.3	15.7	10.0	16.1	0%	29%	0%	29%	42%	0%	0%	0.0	0.0
10/04/2024	39.5	15.7	9.0	15.0	12.3	10.4	13.7	0%	79%	0%	8%	8%	0%	0%	0.0	0.0
11/04/2024	23.3	20.9	14.3	17.0	15.3	16.0	21.3	0%	58%	8%	42%	42%	4%	0%	0.8	0.0
12/04/2024	26.8	28.2	18.0	19.6	16.4	18.1	21.5	21%	50%	17%	33%	33%	17%	0%	0.9	0.6
13/04/2024	28.6	27.1	20.0	24.0	20.0	20.2	23.3	4%	33%	8%	42%	42%	13%	4%	0.3	1.5
14/04/2024	32.6	24.2	18.0	20.4	18.6	21.4	30.1	17%	17%	13%	46%	50%	25%	4%	2.7	1.4
15/04/2024	39.4	33.6	30.8	26.1	24.3	21.4	29.3	8%	25%	0%	54%	58%	4%	0%	0.0	0.3
16/04/2024	30.3	32.2	34.0	55.8	20.6	25.5	27.7	4%	67%	13%	4%	4%	13%	0%	2.9	0.9
17/04/2024	22.3	24.4	27.0	75.8	18.7	20.8	30.8	4%	58%	21%	13%	21%	25%	0%	7.0	3.1
18/04/2024	16.8	18.8	11.4	17.7	13.1	11.8	14.8	4%	4%	4%	58%	75%	8%	4%	0.8	1.5
19/04/2024	30.7	36.2	20.5	26.6	20.9	18.8	29.9	17%	50%	0%	50%	50%	0%	0%	0.0	0.0
20/04/2024	9.2	10.5	7.3	7.9	8.2	7.6	9.0	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
21/04/2024	17.0	20.5	11.5	14.5	12.3	15.3	20.1	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
22/04/2024	17.3	21.6	13.4	13.0	11.0	20.3	18.0	0%	79%	33%	0%	0%	13%	0%	2.9	2.3
23/04/2024	26.2	25.2	7.2	20.2	14.2	14.8	16.4	8%	25%	4%	46%	58%	8%	0%	0.1	1.2
24/04/2024	27.1	26.7	15.8	25.4	19.8	12.8	30.9	4%	21%	0%	46%	54%	4%	0%	0.0	0.0
25/04/2024	29.7	33.0	26.8	32.6	24.8	27.7	26.8	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
26/04/2024	29.1	33.5	21.6	19.9	14.8	29.6	21.4	4%	83%	17%	4%	4%	8%	4%	1.8	2.0
27/04/2024	26.5	28.0	19.7	22.6	14.2	24.7	27.4	13%	75%	13%	17%	17%	17%	4%	1.0	1.6
28/04/2024	32.9	24.2	10.5	20.6	16.7	14.4	23.2	4%	25%	13%	33%	42%	17%	4%	0.5	1.5
29/04/2024	39.0	30.3	19.3	30.9	16.8	15.2	23.6	8%	4%	4%	54%	67%	4%	0%	1.4	0.0
30/04/2024	31.7	28.6	15.8	36.5	31.5	14.8	23.5	0%	88%	0%	0%	0%	4%	0%	0.0	0.0
1/05/2024	11.6	11.5	7.4	8.7	8.5	7.1	9.6	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
2/05/2024	12.1	14.5	10.4	10.3	7.9	14.3	14.4	0%	92%	13%	0%	0%	0%	0%	1.1	0.0
3/05/2024	15.3	17.6	11.6	10.5	-	12.9	21.2	0%	75%	8%	0%	0%	17%	0%	1.0	2.2
4/05/2024	9.9	12.2	10.3	7.4	7.2	11.3	17.1	0%	92%	46%	0%	0%	0%	0%	3.7	0.0
5/05/2024	12.5	8.9	6.7	9.7	6.9	8.1	10.0	0%	92%	4%	0%	0%	4%	0%	0.3	0.4
6/05/2024	10.2	9.7	7.0	9.3	7.5	7.0	11.9	0%	96%	4%	0%	0%	4%	0%	0.0	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
7/05/2024	14.8	15.4	12.7	12.6	10.1	24.7	25.6	0%	88%	29%	0%	0%	8%	0%	1.6	0.5
8/05/2024	14.4	19.0	12.1	11.1	8.6	16.2	23.3	0%	88%	13%	0%	0%	13%	0%	1.4	1.1
9/05/2024	13.7	17.4	13.3	11.5	8.8	33.8	23.5	0%	75%	21%	0%	0%	21%	0%	2.4	4.5
10/05/2024	12.8	23.3	13.3	10.9	8.8	18.6	21.6	0%	100%	4%	0%	0%	0%	0%	0.3	0.0
11/05/2024	6.8	7.8	6.4	5.2	4.9	10.6	11.1	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
12/05/2024	17.4	12.0	6.8	13.7	9.5	13.3	12.7	0%	38%	4%	21%	21%	21%	0%	0.0	6.1
13/05/2024	18.3	14.0	7.5	12.6	10.1	12.2	17.5	13%	13%	0%	58%	75%	4%	8%	0.0	0.0
14/05/2024	26.3	19.1	11.2	16.5	15.1	17.8	18.2	0%	29%	8%	67%	67%	4%	0%	0.0	0.3
15/05/2024	38.3	20.4	18.2	22.7	19.8	28.1	25.1	17%	21%	4%	50%	58%	33%	13%	0.0	3.4
16/05/2024	28.4	24.4	19.1	16.9	15.2	20.4	23.9	17%	63%	17%	25%	25%	38%	13%	1.2	3.2
17/05/2024	28.0	20.5	14.3	19.1	19.1	12.2	19.4	13%	0%	0%	83%	100%	0%	0%	0.0	0.0
18/05/2024	22.5	12.6	7.8	17.2	15.9	8.8	12.7	0%	71%	4%	13%	13%	4%	0%	0.2	0.0
19/05/2024	23.0	12.1	8.4	13.1	10.2	7.1	13.2	8%	17%	4%	67%	67%	4%	0%	0.1	0.1
20/05/2024	23.6	19.9	13.9	17.8	15.7	12.5	23.3	4%	29%	8%	50%	50%	17%	4%	0.7	1.8
21/05/2024	22.1	19.5	11.1	8.4	13.5	11.0	14.8	0%	67%	17%	4%	4%	29%	0%	2.0	0.2
22/05/2024	28.1	21.0	8.6	12.7	12.2	16.8	19.8	33%	21%	4%	58%	58%	17%	21%	0.0	2.1
23/05/2024	34.9	29.6	9.8	15.1	12.7	13.8	20.3	8%	46%	8%	50%	50%	8%	0%	0.5	0.8
24/05/2024	31.2	33.8	12.5	15.7	18.2	21.3	22.0	8%	46%	0%	46%	46%	21%	4%	0.0	3.9
25/05/2024	36.2	24.4	14.7	15.2	14.2	26.5	25.2	29%	54%	4%	29%	29%	29%	8%	0.5	6.3
26/05/2024	40.2	17.8	14.8	20.3	18.9	16.9	26.0	8%	0%	0%	75%	83%	0%	0%	0.0	0.0
27/05/2024	31.9	29.5	14.0	21.6	15.2	16.1	30.9	4%	33%	0%	58%	63%	0%	0%	0.0	0.0
28/05/2024	50.9	11.5	15.5	25.8	18.8	23.5	-	13%	33%	4%	46%	46%	21%	4%	0.0	6.9
29/05/2024	61.7	18.1	15.0	23.6	23.4	19.6	-	25%	21%	8%	67%	67%	13%	4%	0.8	1.7
30/05/2024	42.9	34.3	17.3	25.2	21.0	20.0	30.2	8%	21%	0%	71%	71%	4%	4%	0.0	1.1
31/05/2024	29.4	21.0	17.2	26.0	24.9	16.0	54.0	8%	0%	0%	58%	79%	4%	8%	0.0	0.1
1/06/2024	7.3	5.9	3.7	5.8	5.7	3.6	8.0	0%	75%	4%	13%	17%	8%	0%	0.1	0.2
2/06/2024	5.3	5.6	4.6	6.0	5.9	4.5	7.3	0%	13%	0%	42%	79%	0%	0%	0.0	0.0
3/06/2024	8.5	8.9	5.4	8.3	8.4	5.8	14.6	0%	0%	0%	4%	54%	0%	0%	0.0	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
4/06/2024	11.4	11.5	7.4	10.2	9.3	7.2	23.5	0%	0%	0%	0%	67%	0%	0%	0.0	0.0
5/06/2024	18.6	21.4	9.0	15.1	13.6	9.1	19.0	17%	4%	17%	63%	67%	8%	8%	0.3	0.3
6/06/2024	13.9	18.6	9.2	15.9	15.9	8.2	22.5	4%	17%	0%	58%	63%	4%	4%	0.0	0.0
7/06/2024	5.9	7.7	6.1	7.2	7.5	5.4	8.9	0%	0%	0%	46%	100%	0%	0%	0.0	0.0
8/06/2024	6.7	7.6	6.6	7.4	7.8	6.2	11.5	0%	0%	0%	17%	100%	0%	0%	0.0	0.0
9/06/2024	7.4	9.6	8.0	8.7	8.9	6.6	15.2	0%	0%	0%	8%	92%	0%	0%	0.0	0.0
10/06/2024	14.2	14.2	6.7	11.0	10.5	7.0	11.2	8%	17%	0%	46%	75%	4%	0%	0.0	0.0
11/06/2024	11.0	17.7	4.8	9.4	10.9	5.3	15.3	0%	0%	0%	33%	63%	0%	0%	0.0	0.0
12/06/2024	12.8	10.3	8.2	11.2	13.6	7.6	17.0	0%	0%	0%	4%	38%	0%	0%	0.0	0.0
13/06/2024	40.7	18.0	9.0	16.8	15.3	10.4	17.1	13%	25%	0%	38%	38%	0%	4%	0.0	0.0
14/06/2024	31.0	37.9	8.9	21.1	20.9	14.7	27.6	13%	63%	0%	42%	42%	4%	4%	0.0	0.1
15/06/2024	14.4	10.8	6.9	10.3	9.7	5.6	10.6	0%	79%	0%	0%	4%	0%	0%	0.0	0.0
16/06/2024	12.8	7.4	5.1	13.1	9.0	3.5	12.5	13%	0%	0%	42%	63%	0%	0%	0.0	0.0
17/06/2024	15.3	10.7	6.7	12.6	12.8	2.7	23.6	0%	0%	0%	54%	100%	0%	0%	0.0	0.0
18/06/2024	12.3	15.5	6.2	7.3	9.3	4.1	19.2	0%	0%	0%	58%	96%	0%	0%	0.0	0.0
19/06/2024	13.3	12.9	7.5	12.3	12.2	7.1	27.0	0%	0%	0%	29%	71%	0%	0%	0.0	0.0
20/06/2024	31.4	-	9.8	23.2	16.1	10.4	22.4	4%	0%	0%	75%	83%	0%	0%	0.0	0.0
21/06/2024	27.6	11.8	6.9	16.9	15.5	6.5	18.9	0%	0%	0%	33%	71%	0%	0%	0.0	0.0
22/06/2024	14.9	14.0	6.9	11.6	11.5	7.1	11.0	0%	46%	0%	42%	42%	0%	0%	0.0	0.0
23/06/2024	18.8	17.4	7.5	10.9	9.6	10.6	9.1	4%	50%	8%	21%	21%	8%	0%	0.0	0.4
24/06/2024	24.5	10.4	5.9	12.7	9.0	4.9	15.2	13%	4%	0%	46%	75%	0%	4%	0.0	0.0
25/06/2024	59.3	26.2	10.2	15.8	13.6	17.1	22.2	13%	33%	8%	67%	67%	4%	4%	0.7	0.2
26/06/2024	47.7	23.7	10.3	17.4	16.8	10.9	31.4	8%	0%	0%	63%	88%	0%	0%	0.0	0.0
27/06/2024	22.6	17.9	13.7	16.2	12.3	8.6	19.4	8%	0%	0%	75%	96%	0%	0%	0.0	0.0
28/06/2024	28.8	31.1	13.0	19.5	13.6	11.4	16.8	8%	21%	17%	58%	58%	17%	4%	3.9	1.4
29/06/2024	29.2	30.1	12.1	22.7	21.4	13.3	51.3	8%	0%	0%	71%	88%	0%	8%	0.0	0.0
30/06/2024	13.5	8.5	7.9	10.8	10.7	10.3	14.5	4%	58%	4%	4%	21%	8%	4%	0.0	0.2
1/07/2024	19.5	14.5	9.3	11.5	10.1	10.6	18.8	0%	88%	13%	0%	0%	4%	0%	0.0	0.2

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
2/07/2024	14.5	11.8	7.8	8.8	8.6	9.0	22.7	0%	88%	8%	0%	0%	8%	0%	0.0	0.6
3/07/2024	19.9	18.2	9.7	11.1	10.4	9.3	32.8	0%	100%	4%	0%	0%	0%	0%	0.0	0.0
4/07/2024	23.3	27.0	12.2	14.7	13.5	12.1	46.8	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
5/07/2024	22.8	17.7	11.9	13.6	11.7	16.0	29.3	0%	71%	4%	0%	0%	25%	0%	0.2	5.7
6/07/2024	14.9	17.8	10.8	9.0	8.3	13.9	31.4	0%	100%	8%	0%	0%	0%	0%	0.5	0.0
7/07/2024	15.3	15.0	9.5	7.4	6.7	15.8	20.6	4%	58%	29%	17%	17%	29%	4%	1.5	3.3
8/07/2024	10.5	15.6	10.6	6.7	6.8	11.9	13.1	0%	67%	38%	4%	4%	21%	0%	2.6	1.8
9/07/2024	11.4	7.6	6.8	7.1	7.1	7.5	11.1	8%	29%	8%	29%	46%	8%	8%	0.3	0.4
10/07/2024	7.8	7.8	5.0	9.0	8.2	4.6	9.9	0%	0%	0%	42%	88%	0%	0%	0.0	0.0
11/07/2024	20.1	12.9	4.7	11.8	8.3	4.9	10.7	4%	25%	4%	50%	71%	0%	4%	0.0	0.0
12/07/2024	20.0	16.4	5.9	17.0	10.3	4.9	15.8	17%	4%	0%	58%	67%	8%	13%	0.0	0.0
13/07/2024	11.5	13.9	5.8	12.5	8.6	5.6	17.8	0%	0%	0%	38%	88%	0%	0%	0.0	0.0
14/07/2024	8.1	11.9	5.7	9.9	13.5	5.2	18.6	0%	0%	0%	17%	50%	0%	0%	0.0	0.0
15/07/2024	7.2	8.8	6.4	10.4	7.7	5.3	14.4	0%	0%	0%	4%	50%	0%	0%	0.0	0.0
16/07/2024	10.9	12.1	7.8	12.1	13.0	7.5	23.5	0%	0%	0%	0%	63%	0%	0%	0.0	0.0
17/07/2024	6.8	11.0	9.0	8.0	11.9	4.6	20.5	0%	0%	0%	8%	75%	0%	0%	0.0	0.0
18/07/2024	14.2	12.3	8.8	12.6	14.3	6.5	30.1	0%	0%	0%	4%	63%	0%	0%	0.0	0.0
19/07/2024	19.5	19.1	12.8	17.3	16.0	6.2	38.0	0%	0%	0%	8%	71%	0%	0%	0.0	0.0
20/07/2024	27.2	22.5	16.2	32.2	22.8	13.7	54.4	0%	0%	0%	0%	46%	0%	0%	0.0	0.0
21/07/2024	20.5	20.0	16.2	23.9	22.3	14.4	32.7	0%	0%	0%	25%	71%	0%	0%	0.0	0.0
22/07/2024	28.8	16.5	33.2	19.5	20.8	10.3	26.7	0%	0%	0%	79%	100%	0%	0%	0.0	0.0
23/07/2024	22.4	15.0	16.1	18.1	14.4	9.7	27.8	0%	0%	0%	71%	88%	0%	0%	0.0	0.0
24/07/2024	25.7	22.0	13.0	20.9	17.0	11.0	34.0	8%	0%	0%	63%	88%	0%	8%	0.0	0.0
25/07/2024	36.0	24.1	23.3	30.9	26.4	18.0	41.9	4%	0%	0%	75%	96%	4%	4%	0.0	0.1
26/07/2024	29.2	14.5	6.7	13.2	10.5	9.4	15.8	8%	21%	0%	25%	42%	4%	4%	0.0	0.0
27/07/2024	50.0	19.0	6.1	13.6	11.1	12.1	22.7	4%	21%	0%	21%	67%	0%	4%	0.0	0.0
28/07/2024	8.1	6.3	4.2	7.8	6.4	4.2	12.5	0%	0%	0%	4%	21%	0%	0%	0.0	0.0
29/07/2024	20.8	11.3	8.3	11.3	10.7	6.1	12.9	0%	33%	0%	13%	50%	0%	0%	0.0	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
30/07/2024	41.1	17.1	7.9	16.7	13.3	7.5	18.0	8%	50%	0%	29%	29%	4%	4%	0.0	0.0
31/07/2024	26.6	21.0	8.6	16.7	13.7	10.5	25.1	4%	88%	0%	13%	13%	0%	0%	0.0	0.0
1/08/2024	34.1	21.7	10.7	21.0	16.3	12.2	24.4	21%	63%	4%	33%	38%	13%	13%	0.2	0.6
2/08/2024	29.8	20.5	10.7	16.4	13.7	16.4	19.0	4%	42%	8%	29%	29%	33%	0%	0.9	2.0
3/08/2024	42.3	17.5	6.6	12.6	12.5	8.5	17.6	29%	8%	0%	75%	79%	4%	0%	0.0	0.1
4/08/2024	26.4	36.0	12.4	18.3	16.3	17.0	23.6	4%	46%	4%	46%	54%	8%	4%	0.6	1.7
5/08/2024	39.7	30.2	13.3	19.4	18.7	18.2	30.5	4%	54%	0%	46%	58%	0%	4%	0.0	0.0
6/08/2024	15.6	17.1	8.2	10.8	9.8	10.2	11.1	8%	25%	4%	46%	46%	0%	4%	0.1	0.0
7/08/2024	20.9	20.4	7.8	28.9	14.6	10.9	14.5	0%	42%	0%	42%	54%	4%	4%	0.0	0.0
8/08/2024	53.0	29.6	13.4	19.1	16.1	21.2	18.7	29%	29%	13%	42%	42%	17%	8%	0.3	1.0
9/08/2024	49.7	28.8	10.9	18.7	15.6	16.2	15.8	4%	17%	8%	46%	67%	13%	4%	0.2	0.3
10/08/2024	34.8	35.4	19.5	19.0	17.6	24.2	18.5	8%	63%	13%	21%	25%	13%	8%	1.4	2.0
11/08/2024	17.8	22.0	18.2	12.9	12.5	26.7	24.8	8%	79%	17%	13%	13%	13%	4%	1.0	3.9
12/08/2024	9.2	15.2	13.0	9.6	8.9	16.7	26.4	0%	96%	13%	0%	0%	4%	0%	1.0	0.5
13/08/2024	9.3	14.5	9.5	8.7	7.8	9.5	-	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
14/08/2024	9.3	10.1	9.2	9.4	10.5	8.4	20.9	0%	79%	21%	0%	0%	13%	0%	1.0	0.8
15/08/2024	14.1	15.9	7.4	12.3	12.3	8.3	-	0%	83%	4%	0%	0%	4%	0%	0.0	0.1
16/08/2024	16.6	13.4	9.7	14.8	13.2	9.2	17.7	0%	38%	0%	33%	54%	0%	0%	0.0	0.0
17/08/2024	13.9	7.6	5.9	10.2	9.8	5.3	25.4	0%	0%	0%	21%	67%	0%	0%	0.0	0.0
18/08/2024	12.6	12.9	8.6	10.1	11.7	7.2	18.1	0%	38%	17%	17%	42%	13%	0%	0.3	0.1
19/08/2024	17.3	37.4	17.5	12.2	11.8	24.7	36.0	0%	100%	21%	0%	0%	0%	0%	1.6	0.0
20/08/2024	37.5	28.3	14.8	16.6	13.9	14.9	17.3	21%	42%	4%	54%	50%	8%	13%	0.0	0.4
21/08/2024	30.5	23.3	17.9	27.3	24.3	20.6	37.6	17%	0%	0%	46%	75%	0%	4%	0.0	0.0
22/08/2024	25.9	22.5	11.5	21.9	20.4	9.3	32.0	8%	4%	0%	63%	83%	4%	0%	0.0	0.0
23/08/2024	63.5	37.1	20.0	18.8	20.0	21.1	25.4	13%	38%	4%	50%	50%	8%	8%	0.4	0.1
24/08/2024	26.0	27.3	14.1	23.8	22.6	14.8	26.7	0%	0%	0%	33%	83%	4%	0%	0.0	0.2
25/08/2024	16.4	18.4	11.8	17.8	17.2	9.7	20.5	4%	0%	0%	33%	75%	0%	4%	0.0	0.0
26/08/2024	12.8	18.0	9.7	14.1	13.9	8.5	18.0	0%	0%	0%	29%	79%	0%	0%	0.0	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
27/08/2024	14.2	23.7	7.1	21.8	27.3	6.2	20.7	0%	0%	0%	38%	63%	0%	0%	0.0	0.0
28/08/2024	23.2	36.1	20.6	21.6	18.4	12.1	48.8	0%	0%	0%	0%	42%	0%	0%	0.0	0.0
29/08/2024	21.1	30.2	17.8	26.9	28.4	13.7	-	0%	0%	0%	21%	54%	0%	0%	0.0	0.0
30/08/2024	35.9	34.5	20.6	42.5	35.1	15.7	-	0%	0%	0%	21%	75%	0%	0%	0.0	0.0
31/08/2024	31.2	34.7	25.4	31.5	23.3	16.0	70.6	0%	0%	0%	0%	29%	0%	0%	0.0	0.0
1/09/2024	23.8	28.6	23.0	25.1	21.1	16.8	54.2	0%	0%	0%	0%	42%	0%	0%	0.0	0.0
2/09/2024	36.2	37.7	39.3	54.0	29.1	18.1	70.3	0%	0%	0%	8%	29%	0%	0%	0.0	0.0
3/09/2024	40.4	46.1	37.5	28.9	23.1	27.1	35.1	0%	58%	25%	25%	29%	4%	0%	9.1	0.0
4/09/2024	55.8	32.0	28.0	37.4	35.7	27.5	38.6	4%	0%	0%	50%	50%	21%	8%	0.0	1.6
5/09/2024	42.3	31.6	30.4	45.1	42.3	26.6	52.8	4%	0%	0%	58%	83%	0%	4%	0.0	0.0
6/09/2024	35.7	23.4	27.3	39.3	40.2	22.9	48.3	0%	0%	0%	54%	96%	0%	0%	0.0	0.0
7/09/2024	29.3	37.8	30.4	33.0	29.2	34.7	65.7	4%	21%	0%	17%	54%	17%	4%	0.0	4.9
8/09/2024	32.8	24.4	17.2	17.3	18.8	16.8	60.9	0%	0%	0%	42%	71%	0%	0%	0.0	0.0
9/09/2024	17.5	20.8	24.1	26.8	30.1	9.7	38.6	0%	0%	0%	46%	83%	0%	0%	0.0	0.0
10/09/2024	39.8	40.2	41.1	32.4	22.7	25.0	37.3	8%	67%	8%	21%	25%	4%	0%	1.4	0.1
11/09/2024	51.1	27.2	38.8	29.8	27.2	25.2	34.3	4%	8%	0%	38%	54%	13%	13%	0.0	0.9
12/09/2024	20.3	18.4	15.6	13.3	13.4	15.5	42.5	0%	67%	4%	13%	25%	0%	0%	0.5	0.0
13/09/2024	28.7	29.2	20.6	17.5	14.2	18.3	22.1	0%	63%	38%	0%	0%	21%	0%	6.4	1.0
14/09/2024	35.5	19.2	11.1	16.3	17.0	9.5	23.7	4%	13%	4%	38%	58%	4%	4%	0.4	0.3
15/09/2024	29.6	39.4	17.8	16.8	14.9	17.4	29.1	0%	96%	0%	4%	4%	0%	0%	0.0	0.0
16/09/2024	46.8	36.9	32.8	17.6	15.3	18.1	30.9	4%	25%	4%	25%	46%	0%	0%	0.4	0.0
17/09/2024	43.4	26.3	26.4	22.9	23.7	-	32.0	0%	4%	4%	79%	92%	21%	0%	0.4	-
18/09/2024	31.9	22.0	22.1	31.1	25.3	-	58.2	0%	0%	0%	4%	50%	0%	0%	0.0	-
19/09/2024	37.7	36.8	27.4	41.5	20.8	14.1	53.7	0%	0%	0%	25%	46%	0%	0%	0.0	0.0
20/09/2024	31.1	36.2	38.3	33.8	26.0	13.6	58.3	0%	0%	0%	33%	67%	0%	0%	0.0	0.0
21/09/2024	32.0	23.6	19.1	25.6	23.3	11.3	72.2	0%	0%	0%	29%	67%	0%	0%	0.0	0.0
22/09/2024	26.1	25.8	20.6	27.1	25.3	10.6	51.7	0%	0%	0%	50%	75%	0%	0%	0.0	0.0
23/09/2024	33.6	30.4	30.5	31.2	27.8	19.3	75.4	8%	0%	0%	50%	79%	0%	0%	0.0	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
24/09/2024	50.7	37.9	46.9	41.9	-	42.2	54.5	13%	8%	0%	63%	58%	21%	8%	0.0	3.0
25/09/2024	78.6	50.3	42.4	67.4	-	36.7	65.5	4%	4%	8%	63%	71%	4%	0%	0.1	0.0
26/09/2024	14.0	19.3	15.3	15.0	14.3	17.8	24.8	0%	100%	4%	0%	0%	0%	0%	0.0	0.0
27/09/2024	9.0	14.8	9.6	8.8	8.3	9.1	16.7	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
28/09/2024	11.6	19.0	11.8	9.8	8.5	12.4	22.3	0%	100%	4%	0%	0%	0%	0%	0.5	0.0
29/09/2024	13.6	22.1	14.4	10.5	9.0	13.7	28.8	0%	96%	4%	0%	0%	0%	0%	0.2	0.0
30/09/2024	14.0	19.6	11.5	11.3	11.4	14.2	14.4	4%	71%	33%	8%	8%	8%	8%	2.4	1.0
1/10/2024	17.9	25.5	18.8	18.4	14.6	20.6	23.3	13%	33%	17%	33%	33%	33%	4%	1.0	3.3
2/10/2024	21.3	27.7	24.1	16.8	16.3	21.9	28.6	0%	96%	21%	0%	0%	0%	0%	3.2	0.0
3/10/2024	17.9	30.7	17.8	16.1	12.0	22.2	22.6	0%	96%	13%	0%	0%	0%	0%	0.9	0.0
4/10/2024	33.9	28.4	20.8	33.1	20.8	20.9	31.4	4%	0%	0%	46%	75%	4%	4%	0.0	0.5
5/10/2024	22.3	17.2	11.0	25.3	16.3	9.9	33.2	0%	0%	0%	13%	63%	0%	0%	0.0	0.0
6/10/2024	29.8	29.4	15.2	34.0	16.9	12.4	43.2	0%	0%	0%	13%	42%	0%	0%	0.0	0.0
7/10/2024	35.2	22.0	13.6	31.9	19.5	16.6	38.3	4%	0%	0%	46%	63%	0%	0%	0.0	0.0
8/10/2024	29.1	35.7	28.3	25.2	20.8	25.2	36.8	0%	92%	0%	4%	8%	0%	0%	0.0	0.0
9/10/2024	14.8	16.9	12.3	11.2	10.6	10.2	25.6	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
10/10/2024	19.4	20.4	15.0	19.1	19.2	29.6	32.1	13%	33%	4%	29%	25%	25%	4%	0.4	4.6
11/10/2024	34.0	41.2	31.8	24.1	23.2	35.8	31.0	8%	38%	38%	8%	13%	38%	8%	6.7	9.3
12/10/2024	32.0	36.9	21.6	25.9	23.3	23.6	42.7	0%	100%	8%	0%	0%	0%	0%	0.0	0.0
13/10/2024	14.8	23.7	17.6	13.6	14.7	20.1	28.3	0%	88%	25%	0%	0%	0%	0%	1.5	0.0
14/10/2024	24.3	21.1	11.9	14.2	14.4	13.5	24.7	4%	17%	4%	46%	71%	13%	0%	0.1	1.7
15/10/2024	16.1	16.1	11.0	13.8	13.3	12.2	15.8	0%	83%	0%	13%	21%	0%	0%	0.0	0.0
16/10/2024	14.4	16.6	13.9	12.2	11.9	16.5	19.8	0%	92%	8%	0%	0%	4%	0%	0.3	0.8
17/10/2024	16.5	22.2	13.2	15.8	12.4	14.5	16.6	0%	50%	0%	21%	25%	8%	13%	0.0	0.6
18/10/2024	15.0	18.0	12.7	16.3	15.3	12.1	20.5	0%	0%	0%	38%	88%	4%	0%	0.0	0.3
19/10/2024	13.2	13.0	10.4	9.3	10.0	10.1	13.9	0%	17%	13%	0%	38%	8%	0%	1.6	0.5
20/10/2024	21.2	23.3	16.6	15.3	14.7	18.9	19.8	0%	75%	33%	4%	4%	8%	0%	2.7	0.4
21/10/2024	21.8	25.0	16.0	16.9	16.3	14.6	19.7	0%	88%	25%	0%	0%	4%	0%	1.1	0.1

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
22/10/2024	30.1	31.6	30.0	25.0	25.1	30.8	29.5	8%	38%	13%	8%	13%	29%	13%	1.6	4.9
23/10/2024	61.7	35.3	24.2	36.3	26.4	19.1	50.4	4%	0%	0%	38%	46%	8%	0%	0.0	1.8
24/10/2024	40.3	38.8	24.5	28.2	28.4	20.8	29.2	0%	79%	13%	13%	13%	4%	0%	0.8	0.8
25/10/2024	16.5	22.0	13.0	14.7	13.7	12.3	17.4	8%	46%	0%	29%	25%	4%	4%	0.0	0.2
26/10/2024	25.4	37.1	25.3	20.6	20.4	25.0	43.1	0%	96%	17%	0%	0%	0%	0%	2.4	0.0
27/10/2024	37.2	38.9	18.6	27.5	25.3	27.8	43.5	4%	21%	4%	29%	42%	13%	0%	0.0	2.3
28/10/2024	-	43.0	32.6	26.4	27.4	22.7	33.9	0%	38%	8%	29%	54%	0%	0%	1.2	0.0
29/10/2024	-	41.0	41.8	26.1	26.7	29.1	32.9	0%	83%	29%	0%	0%	8%	0%	10.5	0.6
30/10/2024	-	50.7	29.5	28.9	30.9	38.0	46.2	4%	38%	8%	25%	42%	0%	4%	1.1	0.0
31/10/2024	41.0	46.6	32.0	34.5	32.7	23.9	43.0	0%	38%	13%	33%	42%	4%	0%	3.2	0.1
1/11/2024	20.5	28.8	29.4	18.7	16.5	22.8	23.0	0%	100%	8%	0%	0%	0%	0%	2.9	0.0
2/11/2024	19.5	27.2	24.9	21.5	15.1	18.2	-	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
3/11/2024	42.0	29.3	26.8	29.8	37.9	24.3	-	8%	0%	0%	58%	92%	13%	4%	0.0	0.8
4/11/2024	46.0	38.8	57.9	49.4	45.1	33.4	63.0	0%	29%	8%	17%	50%	4%	0%	1.2	0.4
5/11/2024	24.9	30.8	32.9	37.4	21.6	23.5	30.5	0%	100%	17%	0%	0%	0%	0%	4.1	0.0
6/11/2024	32.5	56.1	43.2	41.5	37.5	30.7	37.0	13%	25%	8%	21%	38%	38%	8%	0.3	3.0
7/11/2024	51.8	39.4	37.0	48.5	43.3	27.9	-	13%	25%	0%	25%	29%	13%	13%	0.0	2.3
8/11/2024	18.9	12.1	9.6	19.7	15.0	7.2	-	0%	4%	4%	8%	33%	4%	4%	0.2	0.0
9/11/2024	30.0	45.1	34.4	24.8	22.9	33.1	38.8	0%	71%	21%	0%	0%	25%	0%	4.1	3.3
10/11/2024	44.9	39.9	31.6	29.5	30.5	28.1	38.2	0%	58%	38%	17%	17%	17%	4%	7.3	0.0
11/11/2024	34.8	33.4	27.6	24.8	-	19.3	41.1	0%	96%	8%	0%	0%	4%	0%	0.2	0.0
12/11/2024	16.1	17.1	11.0	9.4	9.9	9.4	19.1	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
13/11/2024	22.2	21.1	16.4	13.3	14.2	13.4	24.1	0%	42%	33%	4%	17%	21%	0%	3.0	0.8
14/11/2024	21.6	22.9	18.0	14.7	15.6	17.7	18.7	17%	71%	17%	17%	17%	17%	13%	0.9	0.5
15/11/2024	19.5	26.6	19.7	13.6	15.0	17.0	23.4	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
16/11/2024	13.0	31.3	19.6	12.4	12.6	16.3	19.0	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
17/11/2024	22.8	21.9	17.2	13.8	17.7	16.9	27.6	29%	4%	4%	63%	71%	21%	17%	0.0	1.4
18/11/2024	16.1	17.5	14.5	13.0	12.8	13.1	18.4	0%	21%	0%	17%	50%	8%	8%	0.0	0.6

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
19/11/2024	20.8	29.0	24.2	17.7	18.9	23.1	24.5	0%	100%	17%	0%	0%	0%	0%	2.2	0.0
20/11/2024	14.7	25.7	25.5	14.7	13.0	21.1	23.2	0%	92%	17%	0%	0%	4%	0%	4.0	0.8
21/11/2024	11.2	23.8	27.0	12.4	11.2	16.2	21.5	0%	100%	42%	0%	0%	0%	0%	9.7	0.0
22/11/2024	15.7	32.6	28.0	14.0	12.8	23.2	20.2	4%	79%	25%	4%	0%	17%	4%	5.3	2.4
23/11/2024	27.5	43.3	34.8	16.8	14.2	29.0	23.5	8%	54%	38%	17%	17%	29%	4%	9.3	3.9
24/11/2024	30.5	41.7	37.7	24.5	25.6	33.7	41.3	0%	63%	13%	13%	17%	13%	0%	2.7	1.7
25/11/2024	25.3	40.4	-	27.8	25.5	30.3	34.5	0%	50%	25%	8%	21%	17%	0%	-	2.2
26/11/2024	26.3	62.2	-	27.6	30.5	25.8	37.8	0%	33%	8%	29%	42%	4%	0%	-	0.1
27/11/2024	39.0	37.4	29.3	43.8	48.4	23.0	46.3	0%	0%	0%	42%	88%	0%	0%	0.0	0.0
28/11/2024	20.5	29.7	14.0	18.0	19.9	12.9	29.1	0%	25%	4%	4%	54%	0%	0%	0.2	0.0
29/11/2024	25.2	33.0	21.8	18.2	19.0	21.9	31.0	0%	88%	13%	0%	4%	8%	4%	0.5	0.9
30/11/2024	10.9	15.0	12.7	8.7	9.4	11.6	18.1	0%	79%	4%	0%	0%	17%	0%	0.1	0.7
1/12/2024	23.1	16.0	11.5	15.1	13.5	18.1	26.1	0%	13%	4%	8%	33%	4%	0%	0.0	0.0
2/12/2024	28.0	34.9	17.9	21.4	25.0	23.1	23.6	0%	17%	4%	42%	63%	0%	0%	0.0	0.0
3/12/2024	35.5	28.5	16.3	24.7	23.5	16.0	25.9	8%	4%	0%	25%	67%	0%	4%	0.0	0.0
4/12/2024	21.1	27.5	23.6	22.2	21.7	20.5	24.1	4%	63%	17%	17%	21%	0%	4%	2.9	0.0
5/12/2024	13.6	29.1	27.5	18.8	16.2	19.7	21.2	0%	100%	25%	0%	0%	0%	0%	6.3	0.0
6/12/2024	36.6	28.5	24.2	28.6	28.7	20.6	44.5	8%	13%	4%	33%	50%	13%	13%	0.3	2.1
7/12/2024	26.1	23.7	19.3	31.4	25.7	13.0	38.7	0%	0%	0%	13%	50%	0%	0%	0.0	0.0
8/12/2024	13.3	19.7	15.2	14.9	12.7	13.9	19.5	0%	42%	4%	8%	54%	0%	0%	0.3	0.0
9/12/2024	20.2	30.5	25.5	20.9	19.8	22.3	26.6	0%	100%	0%	0%	0%	0%	0%	0.0	0.0
10/12/2024	22.2	30.0	36.2	27.9	20.9	22.5	22.0	4%	58%	38%	13%	21%	4%	4%	9.7	0.4
11/12/2024	20.2	36.2	38.4	27.8	21.2	33.3	28.2	0%	71%	21%	4%	4%	29%	4%	5.2	6.8
12/12/2024	33.7	32.3	44.2	26.6	28.6	30.0	37.1	4%	21%	8%	38%	50%	17%	4%	1.6	4.7
13/12/2024	51.2	41.2	38.0	39.1	35.4	34.7	66.3	0%	33%	4%	21%	42%	17%	0%	0.1	5.6
14/12/2024	39.0	66.5	50.5	36.0	35.1	43.8	44.5	0%	75%	38%	0%	0%	8%	0%	6.3	2.6
15/12/2024	36.6	67.1	49.9	37.4	34.6	40.1	41.0	8%	54%	17%	8%	8%	17%	4%	3.6	2.6
16/12/2024	22.5	44.0	40.8	24.7	18.5	29.4	22.9	0%	96%	25%	0%	0%	0%	0%	11.2	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO North's estimated max. contribution to level (µg/m³)	
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Wandewoi
17/12/2024	29.2	36.4	27.6	24.0	30.8	22.8	35.0	0%	29%	4%	42%	46%	4%	0%	1.1	0.8
18/12/2024	16.0	24.6	16.4	7.6	13.4	17.1	27.8	0%	100%	13%	0%	0%	0%	0%	1.3	0.0
19/12/2024	23.0	39.0	-	11.8	19.8	24.7	30.4	0%	88%	38%	0%	0%	4%	0%	-	0.3
20/12/2024	29.8	45.9	-	13.1	19.8	30.6	29.6	4%	63%	29%	13%	8%	21%	4%	-	4.0
21/12/2024	34.0	49.2	29.7	24.2	32.8	27.2	41.4	8%	42%	4%	21%	29%	13%	4%	0.8	1.5
22/12/2024	29.0	50.1	32.0	21.0	26.9	33.3	38.8	0%	75%	21%	0%	0%	25%	0%	4.7	5.5
23/12/2024	35.1	38.1	31.8	33.2	29.4	25.2	47.7	0%	21%	0%	4%	25%	0%	0%	0.0	0.0
24/12/2024	58.9	37.6	22.4	23.1	26.5	22.7	31.2	4%	71%	8%	4%	8%	4%	4%	0.2	0.5
25/12/2024	16.7	15.3	17.1	15.9	17.3	14.1	18.1	4%	63%	25%	8%	8%	21%	4%	1.9	0.6
26/12/2024	21.3	42.6	21.9	22.1	21.3	19.9	27.7	13%	25%	17%	33%	42%	33%	8%	1.0	1.7
27/12/2024	40.3	45.8	27.0	28.1	34.0	31.3	55.9	0%	17%	0%	25%	58%	4%	0%	0.0	0.1
28/12/2024	29.5	36.3	25.7	21.0	27.2	30.5	39.4	0%	50%	17%	0%	4%	21%	0%	1.7	2.3
29/12/2024	40.7	57.1	28.9	27.6	28.1	37.1	42.2	0%	50%	17%	25%	29%	17%	0%	2.3	4.2
30/12/2024	22.9	43.1	25.9	22.4	22.5	27.2	39.8	0%	92%	17%	0%	0%	0%	0%	2.4	0.0
31/12/2024	36.8	46.4	34.3	19.3	25.7	37.4	48.8	0%	63%	38%	0%	0%	13%	0%	6.5	0.9

- No data

Note for this annual review, TEOM data time was assessed per Australian Eastern Standard Time (AEST) as used by DCCEEW, however some minor differences arise with the operational data which uses Australian Eastern Daylight Time (AEDT). Some minor differences also arise as HVO collects data in real-time from DCCEEW monitors using a separate HVO logger which may result in minor additional time shift effect.

Table B-3: 24-hour average PM_{10} TEOM levels, percent time downwind and estimated contributions – HVO South

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
1/01/2024	12.0	29.0	6.6	28.3	13.3	18.2	28.9	0%	0%	88%	0%	0%	100%	0%	0.0	0.0	0.0	11.6	0.0
2/01/2024	19.9	34.9	9.8	27.2	16.7	23.5	31.3	0%	0%	79%	0%	0%	88%	0%	1.0	0.0	0.0	12.2	0.0
3/01/2024	24.7	34.4	9.1	27.8	17.4	26.3	31.8	0%	4%	42%	0%	0%	100%	0%	0.9	0.0	0.0	18.5	0.0
4/01/2024	27.0	-	12.6	33.8	28.3	17.9	37.2	38%	0%	42%	25%	0%	58%	33%	4.4	9.0	0.0	7.0	13.0
5/01/2024	14.0	15.9	5.0	19.0	13.1	12.9	23.8	0%	0%	75%	0%	0%	100%	0%	0.4	0.0	0.0	8.3	0.0
6/01/2024	15.7	30.3	6.0	17.3	15.0	18.8	36.7	0%	0%	67%	0%	0%	100%	0%	0.7	0.0	0.0	13.5	0.0
7/01/2024	17.2	30.4	8.4	19.5	15.2	26.9	29.5	0%	4%	50%	0%	0%	96%	0%	0.3	0.0	0.0	18.7	0.0
8/01/2024	18.6	20.0	7.1	20.1	19.9	20.4	28.6	21%	0%	13%	58%	38%	13%	25%	0.0	9.2	5.4	4.0	4.9
9/01/2024	12.3	19.9	6.2	13.2	12.9	11.1	15.1	17%	4%	46%	50%	33%	46%	13%	0.9	4.8	2.8	3.1	1.8
10/01/2024	17.7	28.8	10.5	18.5	14.7	21.6	25.7	0%	0%	79%	0%	0%	100%	0%	1.5	0.0	0.0	12.6	0.0
11/01/2024	19.6	27.3	11.6	18.6	15.8	22.4	25.4	0%	0%	92%	0%	0%	96%	0%	1.4	0.0	0.0	12.4	0.0
12/01/2024	16.2	22.7	6.8	19.8	13.7	18.3	21.3	0%	0%	92%	0%	0%	100%	0%	1.0	0.0	0.0	12.6	0.0
13/01/2024	26.7	39.5	10.4	26.4	21.1	32.7	30.7	4%	0%	54%	0%	0%	71%	8%	0.1	0.0	0.0	17.3	1.1
14/01/2024	13.9	21.4	6.0	15.6	13.0	13.3	16.5	0%	0%	79%	0%	0%	100%	0%	1.3	0.0	0.0	8.5	0.0
15/01/2024	15.4	20.7	5.5	15.2	15.5	9.4	22.3	0%	0%	100%	0%	0%	100%	0%	1.1	0.0	0.0	5.5	0.0
16/01/2024	17.4	22.1	5.9	15.2	15.3	16.7	40.5	0%	0%	83%	0%	0%	100%	0%	0.1	0.0	0.0	11.0	0.0
17/01/2024	21.8	17.2	9.1	15.7	15.2	18.6	24.5	25%	0%	13%	38%	21%	29%	33%	0.0	4.6	1.7	5.9	5.6
18/01/2024	8.0	12.7	4.7	11.3	9.4	3.9	18.0	8%	0%	0%	100%	92%	0%	8%	0.0	10.5	7.5	0.0	1.9
19/01/2024	18.2	29.7	9.1	23.5	23.6	23.0	30.8	29%	0%	33%	58%	33%	33%	21%	0.1	10.2	5.8	12.3	2.1
20/01/2024	20.5	41.8	10.0	28.1	19.1	29.3	37.4	0%	0%	75%	0%	0%	100%	0%	0.1	0.0	0.0	19.5	0.0
21/01/2024	26.3	26.8	7.1	30.5	27.1	16.5	25.9	38%	0%	0%	75%	54%	0%	29%	0.0	21.3	12.6	0.0	4.7
22/01/2024	33.6	51.6	14.0	40.9	33.2	38.6	60.0	4%	0%	96%	0%	0%	96%	4%	0.0	0.0	0.0	23.8	0.0
23/01/2024	14.9	27.0	-	26.9	15.8	19.7	18.8	0%	0%	71%	0%	0%	100%	0%	-	0.0	0.0	9.8	0.0
24/01/2024	42.0	29.1	-	32.1	24.8	25.6	23.7	46%	21%	0%	50%	21%	13%	29%	-	10.1	2.5	3.2	6.0
25/01/2024	49.7	44.5	39.0	57.2	44.8	44.3	45.2	25%	0%	21%	58%	38%	25%	29%	3.7	8.8	14.3	10.1	7.9
26/01/2024	41.8	56.5	41.3	67.4	53.7	36.4	59.1	33%	0%	21%	75%	42%	21%	17%	5.1	18.3	4.8	2.5	0.0
27/01/2024	-	29.1	29.9	39.8	24.6	26.9	22.1	0%	0%	100%	0%	0%	100%	0%	8.9	0.0	0.0	6.0	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
28/01/2024	-	37.0	28.9	36.9	27.1	29.2	27.2	0%	4%	71%	0%	0%	100%	0%	5.8	0.0	0.0	7.9	0.0
29/01/2024	-	43.0	37.2	31.5	24.3	36.6	38.4	0%	0%	50%	13%	13%	79%	0%	11.2	3.5	2.2	17.6	0.0
30/01/2024	28.9	37.3	30.6	35.2	22.3	26.3	28.2	0%	0%	79%	0%	0%	92%	0%	10.2	0.0	0.0	8.1	0.0
31/01/2024	25.9	39.6	42.5	-	18.6	31.9	29.6	0%	4%	88%	0%	0%	100%	0%	37.3	-	0.0	32.0	0.0
1/02/2024	24.6	34.8	28.2	-	23.4	24.2	25.4	8%	4%	63%	0%	0%	67%	13%	15.1	-	0.0	13.9	3.5
2/02/2024	35.0	46.4	37.3	41.9	30.4	41.7	34.2	29%	0%	46%	33%	17%	46%	25%	8.3	11.0	5.4	18.6	2.2
3/02/2024	36.4	47.2	45.8	52.5	37.2	41.8	35.5	0%	0%	88%	0%	0%	100%	0%	12.1	0.0	0.0	9.3	0.0
4/02/2024	44.6	39.7	42.8	69.5	58.1	61.8	56.9	38%	8%	8%	46%	21%	25%	33%	2.5	7.0	8.9	0.0	0.0
5/02/2024	44.0	46.2	44.1	56.0	52.1	40.2	54.8	33%	0%	33%	38%	17%	38%	21%	7.1	8.0	4.3	11.3	14.7
6/02/2024	18.1	24.2	16.9	15.0	19.8	20.0	21.8	4%	4%	42%	13%	13%	54%	4%	3.2	1.0	3.0	2.9	1.1
7/02/2024	14.8	10.9	11.6	8.5	10.6	10.1	12.3	0%	0%	92%	0%	0%	96%	0%	4.5	0.0	0.0	3.6	0.0
8/02/2024	20.7	22.2	16.2	13.1	15.5	15.2	22.8	0%	0%	96%	0%	0%	100%	0%	5.0	0.0	0.0	4.0	0.0
9/02/2024	22.0	31.6	19.7	15.1	18.4	23.2	30.9	0%	0%	75%	0%	0%	88%	0%	4.8	0.0	0.0	8.4	0.0
10/02/2024	24.2	23.3	14.0	14.6	15.2	15.1	26.2	0%	13%	42%	0%	0%	100%	0%	3.4	0.0	0.0	6.7	0.0
11/02/2024	29.3	30.0	25.6	20.2	23.7	25.1	26.2	0%	0%	54%	0%	0%	100%	0%	4.8	0.0	0.0	6.0	0.0
12/02/2024	19.1	32.3	23.5	13.4	-	27.8	21.3	0%	21%	29%	0%	0%	54%	0%	2.1	0.0	-	9.9	0.0
13/02/2024	23.0	25.3	21.6	14.5	-	20.9	22.8	33%	4%	13%	13%	8%	17%	42%	1.3	1.9	-	3.7	10.0
14/02/2024	22.9	27.8	18.2	17.9	23.6	18.2	26.2	58%	0%	29%	54%	8%	29%	46%	3.9	6.6	1.1	4.3	7.2
15/02/2024	15.3	17.2	10.7	10.2	12.4	9.4	12.9	0%	0%	88%	0%	0%	100%	0%	3.1	0.0	0.0	2.0	0.0
16/02/2024	16.3	24.3	16.8	10.2	12.8	20.4	21.2	0%	4%	71%	0%	0%	100%	0%	5.9	0.0	0.0	12.0	0.0
17/02/2024	38.3	31.7	15.8	21.6	18.8	21.4	37.2	13%	4%	42%	8%	4%	67%	13%	1.0	1.1	0.7	8.0	2.2
18/02/2024	34.8	28.4	21.5	23.9	21.2	27.9	27.2	17%	8%	29%	17%	13%	38%	17%	4.1	1.5	1.2	5.9	2.4
19/02/2024	17.6	17.3	12.9	12.1	13.2	17.1	18.1	4%	4%	38%	4%	8%	54%	4%	2.2	0.2	0.5	4.4	0.6
20/02/2024	15.2	17.3	11.2	12.1	11.3	13.5	17.8	0%	8%	50%	0%	0%	88%	0%	1.6	0.0	0.0	5.0	0.0
21/02/2024	17.9	22.7	14.8	13.9	12.7	16.2	21.0	0%	0%	71%	0%	0%	96%	0%	4.6	0.0	0.0	6.7	0.0
22/02/2024	30.9	29.0	26.6	26.2	20.8	30.1	29.1	25%	4%	21%	13%	4%	54%	25%	3.7	1.6	0.0	11.2	3.5
23/02/2024	24.4	27.1	17.6	27.1	21.7	-	29.3	46%	4%	4%	75%	33%	13%	42%	0.0	13.9	6.0	-	8.4
24/02/2024	19.2	15.4	8.2	14.9	13.1	-	22.4	0%	0%	50%	0%	0%	100%	0%	0.7	0.0	0.0	-	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
25/02/2024	24.1	24.8	19.1	21.2	18.1	-	20.8	0%	0%	33%	0%	0%	71%	0%	2.3	0.0	0.0	-	0.0
26/02/2024	32.3	30.8	33.2	30.7	25.6	35.7	28.1	46%	0%	33%	25%	4%	42%	46%	4.2	5.3	1.5	11.7	9.8
27/02/2024	26.8	22.8	24.0	20.5	17.5	20.8	-	0%	0%	67%	0%	0%	100%	0%	5.2	0.0	0.0	6.1	-
28/02/2024	22.9	35.7	40.0	28.6	22.2	29.8	28.0	0%	4%	63%	0%	0%	75%	0%	12.1	0.0	0.0	7.3	0.0
29/02/2024	27.2	30.2	25.0	25.9	24.8	21.2	39.1	8%	0%	4%	63%	63%	17%	13%	1.1	7.2	4.8	2.5	1.1
1/03/2024	32.3	36.7	39.5	39.3	29.3	33.3	40.1	13%	13%	21%	25%	8%	38%	21%	6.3	3.1	1.3	6.7	5.6
2/03/2024	22.7	27.8	26.5	34.6	27.3	22.1	31.5	13%	0%	21%	54%	46%	29%	8%	0.5	18.2	8.6	2.8	1.3
3/03/2024	40.4	27.2	18.7	25.2	21.1	23.0	26.6	17%	8%	29%	25%	13%	50%	13%	1.4	1.5	0.8	5.9	1.0
4/03/2024	32.4	32.1	32.5	29.4	27.3	30.9	34.2	0%	0%	83%	0%	0%	100%	0%	7.0	0.0	0.0	7.7	0.0
5/03/2024	26.9	29.1	28.1	30.0	16.3	30.2	32.2	0%	0%	75%	0%	0%	100%	0%	8.9	0.0	0.0	14.5	0.0
6/03/2024	33.6	32.0	27.8	39.5	25.0	29.9	35.1	38%	0%	33%	17%	4%	46%	38%	3.7	3.0	1.2	10.6	7.8
7/03/2024	40.9	41.7	29.3	25.2	20.7	30.2	37.1	25%	0%	67%	17%	4%	71%	25%	9.4	0.6	0.0	9.8	5.9
8/03/2024	13.4	25.9	21.9	23.3	11.6	19.9	20.0	0%	0%	63%	0%	0%	96%	0%	8.0	0.0	0.0	9.9	0.0
9/03/2024	16.7	27.2	26.4	25.6	14.7	30.3	19.8	0%	0%	42%	0%	0%	83%	0%	6.6	0.0	0.0	16.0	0.0
10/03/2024	19.7	28.1	24.7	29.0	17.3	29.6	23.7	0%	4%	42%	0%	0%	88%	0%	4.8	0.0	0.0	13.7	0.0
11/03/2024	21.8	33.8	29.0	31.8	17.2	27.1	28.8	0%	0%	42%	0%	0%	88%	0%	5.6	0.0	0.0	11.5	0.0
12/03/2024	60.4	44.5	32.0	47.5	26.1	34.8	39.1	29%	0%	25%	25%	4%	33%	38%	3.4	5.1	0.0	6.3	11.0
13/03/2024	38.5	50.1	51.2	54.9	26.7	53.0	40.9	0%	0%	46%	0%	0%	75%	0%	6.4	0.0	0.0	4.6	0.0
14/03/2024	37.7	-	37.3	62.4	26.8	32.4	43.8	38%	0%	33%	54%	17%	33%	25%	11.7	0.7	3.2	10.9	3.7
15/03/2024	23.1	27.8	25.3	39.5	15.1	18.8	35.9	0%	0%	63%	0%	0%	100%	0%	12.1	0.0	0.0	8.1	0.0
16/03/2024	19.5	31.4	21.5	22.3	16.1	25.0	33.4	0%	0%	75%	0%	0%	100%	0%	5.8	0.0	0.0	11.3	0.0
17/03/2024	10.7	16.7	12.6	8.3	8.1	11.1	15.8	0%	4%	63%	0%	0%	96%	0%	4.7	0.0	0.0	4.3	0.0
18/03/2024	13.4	17.5	12.1	9.7	10.0	11.9	18.8	0%	8%	58%	0%	0%	92%	0%	2.6	0.0	0.0	3.8	0.0
19/03/2024	14.9	21.0	20.2	14.5	13.1	18.7	19.6	8%	4%	38%	0%	0%	63%	17%	3.0	0.0	0.0	5.3	0.8
20/03/2024	17.0	17.4	14.6	15.1	13.4	14.5	19.5	33%	0%	33%	63%	33%	33%	25%	2.9	4.8	2.6	3.8	3.0
21/03/2024	24.5	28.0	23.8	19.0	17.8	21.8	25.6	0%	0%	83%	0%	0%	100%	0%	6.9	0.0	0.0	5.7	0.0
22/03/2024	26.4	23.8	18.4	25.1	13.6	18.8	24.7	0%	8%	63%	0%	4%	79%	0%	4.8	0.0	0.1	6.4	0.0
23/03/2024	23.7	25.0	20.9	18.8	14.6	22.2	30.8	17%	4%	33%	13%	8%	67%	21%	4.2	1.4	0.6	7.0	5.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
24/03/2024	22.4	22.4	21.4	23.3	17.2	23.6	24.7	13%	0%	13%	0%	0%	42%	21%	1.0	0.0	0.0	3.4	2.1
25/03/2024	34.8	26.7	24.5	23.9	22.8	25.5	24.7	42%	13%	4%	58%	21%	17%	38%	0.6	7.2	2.4	5.2	4.1
26/03/2024	52.0	43.5	36.4	33.6	28.3	-	41.7	29%	0%	25%	8%	4%	50%	25%	6.9	0.8	0.5	-	7.5
27/03/2024	29.2	30.2	38.3	23.6	16.8	-	32.1	0%	0%	79%	0%	0%	88%	0%	17.5	0.0	0.0	-	0.0
28/03/2024	33.7	30.4	31.3	29.9	20.2	-	37.2	0%	13%	58%	0%	0%	96%	0%	6.4	0.0	0.0	-	0.0
29/03/2024	24.9	30.6	32.0	28.4	18.2	30.5	38.3	0%	0%	75%	0%	0%	96%	0%	12.2	0.0	0.0	14.2	0.0
30/03/2024	33.5	24.0	27.5	35.5	18.3	-	29.5	38%	0%	17%	17%	0%	33%	42%	2.6	3.9	0.0	-	10.4
31/03/2024	18.6	22.4	24.3	20.7	8.9	-	18.4	0%	13%	54%	0%	0%	79%	0%	11.1	0.0	0.0	-	0.0
1/04/2024	31.4	28.6	32.4	37.7	18.6	-	24.8	21%	0%	29%	8%	0%	71%	17%	3.8	0.8	0.0	-	5.3
2/04/2024	34.1	22.2	19.8	29.8	21.2	-	34.7	46%	0%	8%	83%	42%	13%	29%	0.8	15.0	3.6	-	3.4
3/04/2024	19.5	24.6	18.7	18.7	15.5	17.8	19.8	50%	0%	38%	38%	0%	42%	46%	5.6	3.4	0.0	5.1	4.0
4/04/2024	13.6	14.2	10.4	11.3	11.3	8.5	25.1	0%	4%	67%	0%	0%	100%	0%	2.8	0.0	0.0	1.3	0.0
5/04/2024	5.6	6.5	6.0	6.1	5.1	4.8	19.2	0%	0%	92%	0%	0%	96%	0%	2.6	0.0	0.0	1.5	0.0
6/04/2024	8.9	6.5	6.3	7.4	6.9	6.4	10.6	46%	0%	0%	79%	50%	0%	42%	0.0	3.3	2.6	0.0	3.2
7/04/2024	14.9	12.3	7.7	17.0	11.3	7.2	17.4	58%	0%	0%	96%	42%	0%	42%	0.0	10.6	2.8	0.0	4.5
8/04/2024	21.2	19.0	11.4	14.4	12.0	11.4	17.0	50%	8%	0%	75%	29%	8%	38%	0.0	5.0	1.3	1.8	3.0
9/04/2024	32.1	14.5	9.9	13.3	15.7	10.0	16.1	29%	25%	0%	46%	33%	4%	21%	0.0	2.8	2.6	0.0	2.0
10/04/2024	39.5	15.7	9.0	15.0	12.3	10.4	13.7	8%	42%	8%	8%	0%	29%	4%	0.1	0.7	0.0	1.1	1.5
11/04/2024	23.3	20.9	14.3	17.0	15.3	16.0	21.3	42%	8%	25%	42%	0%	54%	42%	1.5	3.7	0.0	4.6	6.8
12/04/2024	26.8	28.2	18.0	19.6	16.4	18.1	21.5	33%	0%	17%	13%	0%	50%	33%	0.5	0.9	0.0	3.7	6.2
13/04/2024	28.6	27.1	20.0	24.0	20.0	20.2	23.3	42%	0%	13%	38%	0%	38%	42%	0.6	3.4	0.0	4.2	5.5
14/04/2024	32.6	24.2	18.0	20.4	18.6	21.4	30.1	50%	4%	0%	42%	8%	17%	42%	0.0	4.4	0.2	2.6	6.1
15/04/2024	39.4	33.6	30.8	26.1	24.3	21.4	29.3	54%	13%	0%	54%	8%	13%	42%	0.0	4.6	0.2	1.5	4.4
16/04/2024	30.3	32.2	34.0	55.8	20.6	25.5	27.7	4%	0%	33%	4%	8%	63%	8%	9.4	0.0	0.1	5.2	0.8
17/04/2024	22.3	24.4	27.0	75.8	18.7	20.8	30.8	13%	4%	42%	17%	13%	54%	13%	5.4	0.1	0.9	4.1	1.0
18/04/2024	16.8	18.8	11.4	17.7	13.1	11.8	14.8	63%	4%	0%	83%	25%	0%	38%	0.0	9.8	1.9	0.0	2.3
19/04/2024	30.7	36.2	20.5	26.6	20.9	18.8	29.9	50%	8%	25%	33%	0%	46%	50%	0.4	3.6	0.0	0.9	5.4
20/04/2024	9.2	10.5	7.3	7.9	8.2	7.6	9.0	0%	8%	17%	0%	0%	88%	0%	0.3	0.0	0.0	2.2	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
21/04/2024	17.0	20.5	11.5	14.5	12.3	15.3	20.1	0%	8%	58%	0%	0%	100%	0%	0.4	0.0	0.0	4.8	0.0
22/04/2024	17.3	21.6	13.4	13.0	11.0	20.3	18.0	0%	17%	46%	0%	0%	67%	0%	2.9	0.0	0.0	7.6	0.0
23/04/2024	26.2	25.2	7.2	20.2	14.2	14.8	16.4	46%	4%	17%	50%	21%	17%	42%	0.1	7.9	3.1	2.4	3.7
24/04/2024	27.1	26.7	15.8	25.4	19.8	12.8	30.9	46%	0%	4%	75%	33%	17%	46%	0.0	11.3	3.8	1.9	7.9
25/04/2024	29.7	33.0	26.8	32.6	24.8	27.7	26.8	0%	8%	46%	0%	0%	96%	0%	4.7	0.0	0.0	8.0	0.0
26/04/2024	29.1	33.5	21.6	19.9	14.8	29.6	21.4	4%	0%	67%	4%	4%	83%	4%	6.6	0.0	1.1	13.1	0.5
27/04/2024	26.5	28.0	19.7	22.6	14.2	24.7	27.4	17%	8%	50%	4%	0%	67%	17%	4.5	0.5	0.0	7.7	6.6
28/04/2024	32.9	24.2	10.5	20.6	16.7	14.4	23.2	33%	13%	13%	38%	8%	25%	33%	0.7	4.4	1.1	1.9	7.4
29/04/2024	39.0	30.3	19.3	30.9	16.8	15.2	23.6	54%	0%	0%	63%	17%	4%	42%	0.0	11.5	2.5	0.9	5.6
30/04/2024	31.7	28.6	15.8	36.5	31.5	14.8	23.5	0%	8%	13%	0%	0%	79%	0%	1.5	0.0	0.0	3.1	0.0
1/05/2024	11.6	11.5	7.4	8.7	8.5	7.1	9.6	0%	4%	46%	0%	0%	100%	0%	0.9	0.0	0.0	1.4	0.0
2/05/2024	12.1	14.5	10.4	10.3	7.9	14.3	14.4	0%	0%	50%	0%	0%	100%	0%	2.9	0.0	0.0	8.4	0.0
3/05/2024	15.3	17.6	11.6	10.5	-	12.9	21.2	0%	0%	71%	0%	0%	75%	0%	4.4	0.0	-	4.0	0.0
4/05/2024	9.9	12.2	10.3	7.4	7.2	11.3	17.1	0%	0%	75%	0%	0%	100%	0%	4.2	0.0	0.0	7.0	0.0
5/05/2024	12.5	8.9	6.7	9.7	6.9	8.1	10.0	0%	21%	42%	0%	0%	75%	0%	1.4	0.0	0.0	3.4	0.0
6/05/2024	10.2	9.7	7.0	9.3	7.5	7.0	11.9	0%	4%	67%	0%	0%	96%	0%	1.4	0.0	0.0	1.9	0.0
7/05/2024	14.8	15.4	12.7	12.6	10.1	24.7	25.6	0%	4%	79%	0%	0%	88%	0%	3.9	0.0	0.0	16.4	0.0
8/05/2024	14.4	19.0	12.1	11.1	8.6	16.2	23.3	0%	0%	83%	0%	0%	88%	0%	3.7	0.0	0.0	8.0	0.0
9/05/2024	13.7	17.4	13.3	11.5	8.8	33.8	23.5	0%	0%	50%	0%	0%	79%	0%	3.5	0.0	0.0	22.7	0.0
10/05/2024	12.8	23.3	13.3	10.9	8.8	18.6	21.6	0%	0%	92%	0%	0%	100%	0%	5.2	0.0	0.0	10.8	0.0
11/05/2024	6.8	7.8	6.4	5.2	4.9	10.6	11.1	0%	0%	92%	0%	0%	100%	0%	4.0	0.0	0.0	8.7	0.0
12/05/2024	17.4	12.0	6.8	13.7	9.5	13.3	12.7	21%	25%	4%	33%	21%	21%	17%	0.0	3.2	1.1	1.0	1.3
13/05/2024	18.3	14.0	7.5	12.6	10.1	12.2	17.5	58%	8%	0%	67%	25%	8%	33%	0.0	4.9	2.2	0.0	3.3
14/05/2024	26.3	19.1	11.2	16.5	15.1	17.8	18.2	67%	4%	17%	67%	0%	29%	63%	0.7	4.0	0.0	3.5	7.8
15/05/2024	38.3	20.4	18.2	22.7	19.8	28.1	25.1	54%	8%	4%	50%	13%	13%	58%	0.0	4.8	0.6	1.0	9.8
16/05/2024	28.4	24.4	19.1	16.9	15.2	20.4	23.9	33%	0%	42%	13%	0%	63%	33%	4.4	0.4	0.0	5.7	5.7
17/05/2024	28.0	20.5	14.3	19.1	19.1	12.2	19.4	83%	0%	0%	88%	13%	0%	58%	0.0	7.6	1.3	0.0	5.8
18/05/2024	22.5	12.6	7.8	17.2	15.9	8.8	12.7	13%	38%	0%	17%	4%	58%	13%	0.0	2.5	0.4	2.2	0.8

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
19/05/2024	23.0	12.1	8.4	13.1	10.2	7.1	13.2	67%	17%	0%	67%	17%	4%	50%	0.0	5.5	0.5	0.0	5.1
20/05/2024	23.6	19.9	13.9	17.8	15.7	12.5	23.3	50%	13%	8%	50%	8%	17%	46%	0.8	6.8	0.0	0.2	7.9
21/05/2024	22.1	19.5	11.1	8.4	13.5	11.0	14.8	4%	17%	33%	4%	0%	46%	4%	2.4	0.0	0.0	3.3	0.3
22/05/2024	28.1	21.0	8.6	12.7	12.2	16.8	19.8	58%	4%	4%	25%	0%	17%	67%	0.3	2.9	0.0	4.2	12.4
23/05/2024	34.9	29.6	9.8	15.1	12.7	13.8	20.3	50%	17%	13%	42%	4%	25%	50%	0.5	3.1	0.4	2.0	8.7
24/05/2024	31.2	33.8	12.5	15.7	18.2	21.3	22.0	46%	4%	29%	38%	0%	42%	42%	2.0	0.5	0.0	7.8	8.7
25/05/2024	36.2	24.4	14.7	15.2	14.2	26.5	25.2	29%	17%	33%	0%	0%	46%	33%	3.4	0.0	0.0	6.2	6.2
26/05/2024	40.2	17.8	14.8	20.3	18.9	16.9	26.0	75%	0%	0%	83%	17%	0%	58%	0.0	9.4	1.2	0.0	9.3
27/05/2024	31.9	29.5	14.0	21.6	15.2	16.1	30.9	58%	8%	0%	63%	8%	29%	54%	0.0	3.5	0.7	4.1	12.3
28/05/2024	50.9	11.5	15.5	25.8	18.8	23.5	-	46%	4%	21%	33%	8%	21%	42%	4.2	4.0	1.0	5.5	-
29/05/2024	61.7	18.1	15.0	23.6	23.4	19.6	-	67%	13%	0%	42%	0%	21%	58%	0.0	4.3	0.0	3.3	-
30/05/2024	42.9	34.3	17.3	25.2	21.0	20.0	30.2	71%	13%	8%	67%	4%	13%	58%	0.4	5.6	0.7	1.6	11.3
31/05/2024	29.4	21.0	17.2	26.0	24.9	16.0	54.0	58%	0%	0%	88%	38%	0%	50%	0.0	12.5	5.4	0.0	22.4
1/06/2024	7.3	5.9	3.7	5.8	5.7	3.6	8.0	13%	38%	8%	21%	13%	21%	13%	0.0	0.3	0.3	1.1	0.9
2/06/2024	5.3	5.6	4.6	6.0	5.9	4.5	7.3	42%	0%	0%	83%	50%	0%	8%	0.0	2.5	2.2	0.0	0.2
3/06/2024	8.5	8.9	5.4	8.3	8.4	5.8	14.6	4%	0%	0%	100%	96%	0%	0%	0.0	4.8	4.8	0.0	0.0
4/06/2024	11.4	11.5	7.4	10.2	9.3	7.2	23.5	0%	0%	0%	100%	100%	0%	0%	0.0	5.2	4.3	0.0	0.0
5/06/2024	18.6	21.4	9.0	15.1	13.6	9.1	19.0	67%	0%	0%	63%	13%	8%	63%	0.0	4.8	1.1	0.2	7.5
6/06/2024	13.9	18.6	9.2	15.9	15.9	8.2	22.5	58%	8%	8%	79%	33%	13%	54%	0.1	8.7	2.9	0.4	11.0
7/06/2024	5.9	7.7	6.1	7.2	7.5	5.4	8.9	46%	0%	0%	100%	54%	0%	4%	0.0	3.0	1.7	0.0	0.4
8/06/2024	6.7	7.6	6.6	7.4	7.8	6.2	11.5	17%	0%	0%	100%	83%	0%	0%	0.0	3.1	2.8	0.0	0.0
9/06/2024	7.4	9.6	8.0	8.7	8.9	6.6	15.2	8%	0%	0%	100%	92%	0%	0%	0.0	4.1	4.0	0.0	0.0
10/06/2024	14.2	14.2	6.7	11.0	10.5	7.0	11.2	46%	8%	0%	71%	33%	8%	33%	0.0	4.8	1.9	0.4	3.0
11/06/2024	11.0	17.7	4.8	9.4	10.9	5.3	15.3	33%	0%	0%	100%	67%	0%	21%	0.0	7.5	6.9	0.0	1.5
12/06/2024	12.8	10.3	8.2	11.2	13.6	7.6	17.0	4%	0%	0%	75%	96%	0%	0%	0.0	4.2	10.1	0.0	0.0
13/06/2024	40.7	18.0	9.0	16.8	15.3	10.4	17.1	42%	0%	8%	50%	29%	8%	50%	0.0	6.3	2.8	0.4	6.0
14/06/2024	31.0	37.9	8.9	21.1	20.9	14.7	27.6	42%	17%	21%	29%	0%	58%	42%	0.2	6.4	0.0	4.4	10.1
15/06/2024	14.4	10.8	6.9	10.3	9.7	5.6	10.6	0%	29%	8%	8%	13%	54%	0%	0.4	0.6	0.8	1.3	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
16/06/2024	12.8	7.4	5.1	13.1	9.0	3.5	12.5	42%	0%	0%	71%	58%	0%	42%	0.0	6.4	4.8	0.0	4.0
17/06/2024	15.3	10.7	6.7	12.6	12.8	2.7	23.6	54%	0%	0%	100%	42%	0%	33%	0.0	9.6	3.3	0.0	8.3
18/06/2024	12.3	15.5	6.2	7.3	9.3	4.1	19.2	58%	0%	0%	100%	42%	0%	33%	0.0	3.8	2.3	0.0	3.2
19/06/2024	13.3	12.9	7.5	12.3	12.2	7.1	27.0	29%	0%	0%	100%	71%	0%	0%	0.0	6.2	4.5	0.0	0.0
20/06/2024	31.4	-	9.8	23.2	16.1	10.4	22.4	75%	0%	0%	96%	25%	0%	50%	0.0	14.1	2.3	0.0	4.1
21/06/2024	27.6	11.8	6.9	16.9	15.5	6.5	18.9	33%	0%	0%	96%	67%	0%	29%	0.0	11.0	7.3	0.0	6.4
22/06/2024	14.9	14.0	6.9	11.6	11.5	7.1	11.0	42%	13%	4%	42%	0%	42%	42%	0.1	2.1	0.0	1.2	4.9
23/06/2024	18.8	17.4	7.5	10.9	9.6	10.6	9.1	21%	4%	29%	21%	4%	46%	21%	0.4	0.4	0.3	1.3	1.8
24/06/2024	24.5	10.4	5.9	12.7	9.0	4.9	15.2	46%	0%	0%	75%	46%	4%	29%	0.0	6.1	2.8	0.0	3.1
25/06/2024	59.3	26.2	10.2	15.8	13.6	17.1	22.2	67%	8%	4%	54%	0%	25%	58%	0.0	2.9	0.0	4.3	9.9
26/06/2024	47.7	23.7	10.3	17.4	16.8	10.9	31.4	63%	0%	0%	92%	38%	0%	50%	0.0	8.6	2.6	0.0	12.6
27/06/2024	22.6	17.9	13.7	16.2	12.3	8.6	19.4	75%	0%	0%	92%	25%	0%	58%	0.0	8.6	0.4	0.0	8.7
28/06/2024	28.8	31.1	13.0	19.5	13.6	11.4	16.8	63%	4%	17%	54%	0%	21%	58%	1.4	6.8	0.0	1.7	5.8
29/06/2024	29.2	30.1	12.1	22.7	21.4	13.3	51.3	75%	0%	0%	92%	25%	0%	38%	0.0	10.3	2.8	0.0	13.2
30/06/2024	13.5	8.5	7.9	10.8	10.7	10.3	14.5	4%	13%	33%	21%	25%	50%	4%	0.6	1.4	1.7	3.5	0.7
1/07/2024	19.5	14.5	9.3	11.5	10.1	10.6	18.8	0%	0%	67%	0%	0%	96%	0%	2.0	0.0	0.0	3.7	0.0
2/07/2024	14.5	11.8	7.8	8.8	8.6	9.0	22.7	0%	0%	63%	0%	0%	88%	0%	1.4	0.0	0.0	2.3	0.0
3/07/2024	19.9	18.2	9.7	11.1	10.4	9.3	32.8	0%	0%	67%	0%	0%	100%	0%	1.5	0.0	0.0	1.3	0.0
4/07/2024	23.3	27.0	12.2	14.7	13.5	12.1	46.8	0%	0%	71%	0%	0%	100%	0%	1.2	0.0	0.0	1.7	0.0
5/07/2024	22.8	17.7	11.9	13.6	11.7	16.0	29.3	0%	0%	38%	0%	0%	71%	0%	2.0	0.0	0.0	2.2	0.0
6/07/2024	14.9	17.8	10.8	9.0	8.3	13.9	31.4	0%	0%	79%	0%	0%	100%	0%	2.6	0.0	0.0	7.3	0.0
7/07/2024	15.3	15.0	9.5	7.4	6.7	15.8	20.6	17%	4%	42%	8%	0%	54%	17%	2.1	0.0	0.0	4.8	2.6
8/07/2024	10.5	15.6	10.6	6.7	6.8	11.9	13.1	4%	8%	33%	4%	0%	58%	4%	2.0	0.2	0.0	3.7	0.3
9/07/2024	11.4	7.6	6.8	7.1	7.1	7.5	11.1	38%	4%	8%	58%	38%	13%	33%	0.3	1.9	1.2	0.4	1.6
10/07/2024	7.8	7.8	5.0	9.0	8.2	4.6	9.9	42%	0%	0%	100%	58%	0%	8%	0.0	5.1	2.2	0.0	0.5
11/07/2024	20.1	12.9	4.7	11.8	8.3	4.9	10.7	54%	4%	13%	75%	25%	17%	46%	0.3	7.6	1.3	0.0	2.5
12/07/2024	20.0	16.4	5.9	17.0	10.3	4.9	15.8	67%	0%	0%	79%	29%	0%	50%	0.0	9.8	0.8	0.0	6.9
13/07/2024	11.5	13.9	5.8	12.5	8.6	5.6	17.8	38%	0%	0%	96%	63%	0%	21%	0.0	7.4	1.9	0.0	4.9

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
14/07/2024	8.1	11.9	5.7	9.9	13.5	5.2	18.6	17%	0%	0%	100%	83%	0%	0%	0.0	5.2	7.2	0.0	0.0
15/07/2024	7.2	8.8	6.4	10.4	7.7	5.3	14.4	4%	0%	0%	100%	96%	0%	4%	0.0	6.0	3.2	0.0	0.2
16/07/2024	10.9	12.1	7.8	12.1	13.0	7.5	23.5	0%	0%	0%	100%	100%	0%	0%	0.0	6.0	7.0	0.0	0.0
17/07/2024	6.8	11.0	9.0	8.0	11.9	4.6	20.5	8%	0%	0%	100%	92%	0%	0%	0.0	4.4	6.9	0.0	0.0
18/07/2024	14.2	12.3	8.8	12.6	14.3	6.5	30.1	4%	0%	0%	100%	96%	0%	0%	0.0	6.4	8.1	0.0	0.0
19/07/2024	19.5	19.1	12.8	17.3	16.0	6.2	38.0	8%	0%	0%	100%	92%	0%	0%	0.0	11.5	9.1	0.0	0.0
20/07/2024	27.2	22.5	16.2	32.2	22.8	13.7	54.4	0%	0%	0%	100%	100%	0%	0%	0.0	20.2	10.8	0.0	0.0
21/07/2024	20.5	20.0	16.2	23.9	22.3	14.4	32.7	25%	0%	0%	100%	75%	0%	13%	0.0	11.2	7.0	0.0	3.6
22/07/2024	28.8	16.5	33.2	19.5	20.8	10.3	26.7	79%	0%	0%	100%	21%	0%	42%	0.0	10.9	3.2	0.0	8.7
23/07/2024	22.4	15.0	16.1	18.1	14.4	9.7	27.8	71%	0%	0%	100%	29%	0%	63%	0.0	10.8	2.1	0.0	12.2
24/07/2024	25.7	22.0	13.0	20.9	17.0	11.0	34.0	63%	0%	0%	92%	38%	0%	50%	0.0	10.6	3.9	0.0	12.5
25/07/2024	36.0	24.1	23.3	30.9	26.4	18.0	41.9	75%	0%	0%	96%	21%	0%	58%	0.0	17.7	5.4	0.0	13.6
26/07/2024	29.2	14.5	6.7	13.2	10.5	9.4	15.8	25%	8%	4%	71%	54%	8%	25%	0.0	5.1	3.7	0.9	2.8
27/07/2024	50.0	19.0	6.1	13.6	11.1	12.1	22.7	21%	0%	13%	71%	58%	17%	13%	0.0	5.8	3.2	5.6	2.5
28/07/2024	8.1	6.3	4.2	7.8	6.4	4.2	12.5	4%	0%	0%	100%	96%	0%	0%	0.0	4.4	2.9	0.0	0.0
29/07/2024	20.8	11.3	8.3	11.3	10.7	6.1	12.9	13%	8%	8%	54%	46%	13%	0%	0.0	2.2	2.3	0.5	0.0
30/07/2024	41.1	17.1	7.9	16.7	13.3	7.5	18.0	29%	25%	0%	25%	8%	29%	33%	0.0	2.9	0.9	0.1	4.9
31/07/2024	26.6	21.0	8.6	16.7	13.7	10.5	25.1	13%	38%	17%	13%	17%	42%	8%	0.1	1.1	0.8	1.1	2.1
1/08/2024	34.1	21.7	10.7	21.0	16.3	12.2	24.4	33%	13%	13%	21%	13%	46%	29%	0.1	3.2	0.3	0.8	3.7
2/08/2024	29.8	20.5	10.7	16.4	13.7	16.4	19.0	29%	8%	17%	25%	4%	25%	29%	0.2	2.7	0.3	3.2	4.7
3/08/2024	42.3	17.5	6.6	12.6	12.5	8.5	17.6	75%	0%	0%	50%	8%	0%	71%	0.0	3.1	0.6	0.0	9.5
4/08/2024	26.4	36.0	12.4	18.3	16.3	17.0	23.6	46%	8%	21%	50%	8%	33%	33%	0.6	2.7	0.3	3.0	4.5
5/08/2024	39.7	30.2	13.3	19.4	18.7	18.2	30.5	46%	8%	25%	54%	13%	38%	38%	1.5	5.2	0.8	2.8	12.0
6/08/2024	15.6	17.1	8.2	10.8	9.8	10.2	11.1	46%	17%	4%	54%	21%	8%	29%	0.1	2.0	0.9	0.0	2.1
7/08/2024	20.9	20.4	7.8	28.9	14.6	10.9	14.5	42%	8%	13%	54%	13%	38%	33%	0.0	3.1	0.7	3.6	1.6
8/08/2024	53.0	29.6	13.4	19.1	16.1	21.2	18.7	42%	17%	4%	13%	0%	8%	50%	0.1	1.7	0.0	1.5	6.4
9/08/2024	49.7	28.8	10.9	18.7	15.6	16.2	15.8	46%	8%	8%	71%	29%	8%	38%	0.3	6.1	1.4	0.3	2.2
10/08/2024	34.8	35.4	19.5	19.0	17.6	24.2	18.5	25%	0%	50%	17%	4%	63%	21%	4.0	1.1	0.3	6.2	2.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
11/08/2024	17.8	22.0	18.2	12.9	12.5	26.7	24.8	13%	4%	54%	4%	0%	83%	13%	4.6	0.1	0.0	11.7	1.3
12/08/2024	9.2	15.2	13.0	9.6	8.9	16.7	26.4	0%	0%	88%	0%	0%	96%	0%	4.7	0.0	0.0	8.3	0.0
13/08/2024	9.3	14.5	9.5	8.7	7.8	9.5	-	0%	21%	33%	0%	0%	88%	0%	1.7	0.0	0.0	2.7	-
14/08/2024	9.3	10.1	9.2	9.4	10.5	8.4	20.9	0%	21%	38%	0%	0%	71%	0%	1.8	0.0	0.0	1.4	0.0
15/08/2024	14.1	15.9	7.4	12.3	12.3	8.3	-	0%	4%	58%	0%	0%	79%	0%	2.3	0.0	0.0	3.1	-
16/08/2024	16.6	13.4	9.7	14.8	13.2	9.2	17.7	33%	0%	21%	63%	29%	33%	13%	0.4	4.2	2.4	1.6	0.8
17/08/2024	13.9	7.6	5.9	10.2	9.8	5.3	25.4	21%	0%	0%	100%	79%	0%	13%	0.0	5.8	3.8	0.0	2.5
18/08/2024	12.6	12.9	8.6	10.1	11.7	7.2	18.1	17%	4%	25%	50%	33%	33%	8%	0.7	2.5	3.2	0.8	1.7
19/08/2024	17.3	37.4	17.5	12.2	11.8	24.7	36.0	0%	0%	71%	0%	0%	100%	0%	5.6	0.0	0.0	14.8	0.0
20/08/2024	37.5	28.3	14.8	16.6	13.9	14.9	17.3	54%	8%	17%	38%	4%	29%	54%	0.8	3.1	0.0	1.9	4.7
21/08/2024	30.5	23.3	17.9	27.3	24.3	20.6	37.6	46%	0%	0%	83%	54%	0%	38%	0.0	14.5	7.7	0.0	6.2
22/08/2024	25.9	22.5	11.5	21.9	20.4	9.3	32.0	63%	4%	0%	92%	38%	4%	42%	0.0	13.1	3.3	0.0	12.0
23/08/2024	63.5	37.1	20.0	18.8	20.0	21.1	25.4	54%	4%	13%	42%	0%	29%	50%	1.8	4.1	0.0	6.5	9.3
24/08/2024	26.0	27.3	14.1	23.8	22.6	14.8	26.7	33%	0%	0%	92%	63%	0%	17%	0.0	11.7	7.6	0.0	1.6
25/08/2024	16.4	18.4	11.8	17.8	17.2	9.7	20.5	33%	0%	0%	96%	67%	0%	29%	0.0	8.8	4.6	0.0	4.6
26/08/2024	12.8	18.0	9.7	14.1	13.9	8.5	18.0	29%	0%	0%	100%	71%	0%	8%	0.0	6.8	3.2	0.0	1.1
27/08/2024	14.2	23.7	7.1	21.8	27.3	6.2	20.7	38%	0%	0%	100%	63%	0%	4%	0.0	17.3	18.5	0.0	0.4
28/08/2024	23.2	36.1	20.6	21.6	18.4	12.1	48.8	0%	0%	0%	100%	100%	0%	0%	0.0	11.0	7.8	0.0	0.0
29/08/2024	21.1	30.2	17.8	26.9	28.4	13.7	-	21%	0%	0%	100%	79%	0%	0%	0.0	14.4	12.6	0.0	-
30/08/2024	35.9	34.5	20.6	42.5	35.1	15.7	-	21%	0%	0%	100%	79%	0%	0%	0.0	27.8	12.2	0.0	-
31/08/2024	31.2	34.7	25.4	31.5	23.3	16.0	70.6	0%	0%	0%	100%	100%	0%	0%	0.0	16.2	8.0	0.0	0.0
1/09/2024	23.8	28.6	23.0	25.1	21.1	16.8	54.2	0%	0%	0%	100%	100%	0%	0%	0.0	11.8	7.8	0.0	0.0
2/09/2024	36.2	37.7	39.3	54.0	29.1	18.1	70.3	8%	0%	0%	100%	92%	0%	8%	0.0	21.4	11.4	0.0	0.0
3/09/2024	40.4	46.1	37.5	28.9	23.1	27.1	35.1	25%	4%	25%	33%	8%	63%	17%	11.2	3.5	0.5	9.5	7.0
4/09/2024	55.8	32.0	28.0	37.4	35.7	27.5	38.6	58%	0%	0%	75%	29%	0%	46%	0.0	14.6	7.3	0.0	13.0
5/09/2024	42.3	31.6	30.4	45.1	42.3	26.6	52.8	58%	0%	0%	96%	42%	0%	33%	0.0	21.6	8.2	0.0	0.0
6/09/2024	35.7	23.4	27.3	39.3	40.2	22.9	48.3	54%	0%	0%	100%	42%	0%	17%	0.0	20.4	6.8	0.0	2.8
7/09/2024	29.3	37.8	30.4	33.0	29.2	34.7	65.7	21%	0%	13%	63%	46%	21%	4%	2.8	4.8	3.0	4.9	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
8/09/2024	32.8	24.4	17.2	17.3	18.8	16.8	60.9	42%	0%	0%	100%	58%	0%	29%	0.0	8.6	7.3	0.0	0.5
9/09/2024	17.5	20.8	24.1	26.8	30.1	9.7	38.6	46%	0%	0%	100%	54%	0%	38%	0.0	17.9	13.4	0.0	10.0
10/09/2024	39.8	40.2	41.1	32.4	22.7	25.0	37.3	21%	0%	58%	21%	8%	67%	25%	25.4	6.8	0.8	11.6	10.0
11/09/2024	51.1	27.2	38.8	29.8	27.2	25.2	34.3	42%	4%	0%	67%	33%	4%	38%	0.0	10.5	5.9	0.3	9.0
12/09/2024	20.3	18.4	15.6	13.3	13.4	15.5	42.5	13%	0%	38%	29%	21%	63%	8%	2.2	1.4	1.5	4.9	2.8
13/09/2024	28.7	29.2	20.6	17.5	14.2	18.3	22.1	0%	4%	33%	4%	8%	58%	0%	0.6	0.3	0.0	2.6	0.0
14/09/2024	35.5	19.2	11.1	16.3	17.0	9.5	23.7	38%	0%	8%	75%	50%	13%	29%	0.0	5.4	5.2	1.8	3.7
15/09/2024	29.6	39.4	17.8	16.8	14.9	17.4	29.1	4%	21%	33%	4%	8%	83%	0%	1.3	0.2	0.0	6.3	0.0
16/09/2024	46.8	36.9	32.8	17.6	15.3	18.1	30.9	25%	4%	17%	67%	50%	17%	21%	2.3	6.3	3.6	2.1	3.6
17/09/2024	43.4	26.3	26.4	22.9	23.7	-	32.0	79%	4%	0%	92%	17%	0%	63%	0.0	9.3	2.3	-	13.6
18/09/2024	31.9	22.0	22.1	31.1	25.3	-	58.2	4%	0%	0%	100%	96%	0%	0%	0.0	20.9	14.9	-	0.0
19/09/2024	37.7	36.8	27.4	41.5	20.8	14.1	53.7	25%	0%	0%	100%	75%	0%	25%	0.0	29.8	4.4	0.0	0.0
20/09/2024	31.1	36.2	38.3	33.8	26.0	13.6	58.3	33%	0%	0%	100%	67%	0%	8%	0.0	20.5	7.4	0.0	0.0
21/09/2024	32.0	23.6	19.1	25.6	23.3	11.3	72.2	29%	0%	0%	100%	71%	0%	8%	0.0	15.6	6.7	0.0	0.0
22/09/2024	26.1	25.8	20.6	27.1	25.3	10.6	51.7	50%	0%	0%	100%	50%	0%	33%	0.0	16.9	3.9	0.0	0.0
23/09/2024	33.6	30.4	30.5	31.2	27.8	19.3	75.4	50%	0%	0%	92%	46%	0%	38%	0.0	14.2	3.9	0.0	10.5
24/09/2024	50.7	37.9	46.9	41.9	-	42.2	54.5	63%	0%	4%	50%	4%	4%	67%	1.6	12.9	-	1.5	0.0
25/09/2024	78.6	50.3	42.4	67.4	-	36.7	65.5	63%	0%	0%	83%	25%	4%	54%	0.0	21.0	-	0.0	0.0
26/09/2024	14.0	19.3	15.3	15.0	14.3	17.8	24.8	0%	4%	17%	0%	0%	88%	0%	0.2	0.0	0.0	4.4	0.0
27/09/2024	9.0	14.8	9.6	8.8	8.3	9.1	16.7	0%	0%	63%	0%	0%	100%	0%	3.0	0.0	0.0	3.3	0.0
28/09/2024	11.6	19.0	11.8	9.8	8.5	12.4	22.3	0%	0%	83%	0%	0%	100%	0%	3.9	0.0	0.0	5.7	0.0
29/09/2024	13.6	22.1	14.4	10.5	9.0	13.7	28.8	0%	13%	50%	0%	0%	92%	0%	3.9	0.0	0.0	4.9	0.0
30/09/2024	14.0	19.6	11.5	11.3	11.4	14.2	14.4	13%	8%	29%	17%	8%	63%	17%	1.6	0.5	0.0	5.6	1.0
1/10/2024	17.9	25.5	18.8	18.4	14.6	20.6	23.3	33%	0%	25%	29%	8%	33%	25%	2.2	3.0	0.0	2.2	2.6
2/10/2024	21.3	27.7	24.1	16.8	16.3	21.9	28.6	0%	0%	79%	0%	0%	96%	0%	6.4	0.0	0.0	7.1	0.0
3/10/2024	17.9	30.7	17.8	16.1	12.0	22.2	22.6	0%	0%	71%	0%	0%	100%	0%	5.7	0.0	0.0	12.6	0.0
4/10/2024	33.9	28.4	20.8	33.1	20.8	20.9	31.4	46%	0%	0%	88%	42%	0%	33%	0.0	19.1	5.0	0.0	5.2
5/10/2024	22.3	17.2	11.0	25.3	16.3	9.9	33.2	13%	0%	0%	100%	88%	0%	4%	0.0	16.7	5.3	0.0	1.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
6/10/2024	29.8	29.4	15.2	34.0	16.9	12.4	43.2	13%	0%	0%	100%	83%	0%	8%	0.0	22.7	3.2	0.0	4.1
7/10/2024	35.2	22.0	13.6	31.9	19.5	16.6	38.3	46%	0%	0%	92%	54%	0%	29%	0.0	19.5	4.5	0.0	4.0
8/10/2024	29.1	35.7	28.3	25.2	20.8	25.2	36.8	4%	0%	67%	8%	4%	92%	4%	13.8	3.0	0.7	10.5	1.1
9/10/2024	14.8	16.9	12.3	11.2	10.6	10.2	25.6	0%	0%	92%	0%	0%	100%	0%	3.2	0.0	0.0	1.7	0.0
10/10/2024	19.4	20.4	15.0	19.1	19.2	29.6	32.1	29%	8%	13%	17%	0%	25%	38%	0.0	1.5	0.0	7.4	3.6
11/10/2024	34.0	41.2	31.8	24.1	23.2	35.8	31.0	13%	4%	13%	17%	17%	33%	17%	3.7	1.2	0.9	6.4	2.1
12/10/2024	32.0	36.9	21.6	25.9	23.3	23.6	42.7	0%	0%	63%	0%	0%	96%	0%	2.7	0.0	0.0	6.4	0.0
13/10/2024	14.8	23.7	17.6	13.6	14.7	20.1	28.3	0%	0%	63%	0%	0%	96%	0%	3.8	0.0	0.0	8.5	0.0
14/10/2024	24.3	21.1	11.9	14.2	14.4	13.5	24.7	46%	8%	4%	71%	33%	8%	29%	0.0	4.6	2.9	0.9	7.5
15/10/2024	16.1	16.1	11.0	13.8	13.3	12.2	15.8	13%	4%	67%	21%	8%	79%	8%	2.2	1.6	0.4	2.9	0.3
16/10/2024	14.4	16.6	13.9	12.2	11.9	16.5	19.8	0%	0%	42%	0%	0%	92%	0%	1.7	0.0	0.0	5.9	0.0
17/10/2024	16.5	22.2	13.2	15.8	12.4	14.5	16.6	25%	4%	29%	38%	21%	46%	29%	1.8	2.6	1.2	2.7	3.1
18/10/2024	15.0	18.0	12.7	16.3	15.3	12.1	20.5	38%	0%	0%	96%	58%	0%	13%	0.0	6.5	3.4	0.0	1.9
19/10/2024	13.2	13.0	10.4	9.3	10.0	10.1	13.9	0%	4%	4%	63%	63%	17%	4%	0.0	1.6	2.1	1.6	0.2
20/10/2024	21.2	23.3	16.6	15.3	14.7	18.9	19.8	4%	8%	54%	4%	4%	67%	4%	3.4	0.1	0.0	6.2	0.0
21/10/2024	21.8	25.0	16.0	16.9	16.3	14.6	19.7	0%	13%	46%	0%	0%	79%	0%	2.1	0.0	0.0	2.2	0.0
22/10/2024	30.1	31.6	30.0	25.0	25.1	30.8	29.5	17%	13%	21%	21%	21%	29%	21%	4.0	2.4	2.2	5.7	3.4
23/10/2024	61.7	35.3	24.2	36.3	26.4	19.1	50.4	38%	0%	0%	88%	54%	0%	21%	0.0	20.8	8.5	0.0	0.0
24/10/2024	40.3	38.8	24.5	28.2	28.4	20.8	29.2	13%	21%	33%	17%	4%	46%	8%	4.5	2.7	1.1	4.0	3.0
25/10/2024	16.5	22.0	13.0	14.7	13.7	12.3	17.4	29%	13%	29%	29%	17%	33%	25%	4.1	3.5	1.0	5.0	2.9
26/10/2024	25.4	37.1	25.3	20.6	20.4	25.0	43.1	0%	0%	54%	0%	0%	100%	0%	5.7	0.0	0.0	9.4	0.0
27/10/2024	37.2	38.9	18.6	27.5	25.3	27.8	43.5	29%	0%	4%	63%	38%	21%	21%	0.0	8.1	5.1	6.3	5.4
28/10/2024	-	43.0	32.6	26.4	27.4	22.7	33.9	29%	0%	29%	63%	33%	38%	17%	4.5	6.9	6.6	5.3	3.4
29/10/2024	-	41.0	41.8	26.1	26.7	29.1	32.9	0%	0%	58%	0%	0%	88%	0%	7.7	0.0	0.0	5.0	0.0
30/10/2024	-	50.7	29.5	28.9	30.9	38.0	46.2	25%	4%	25%	50%	29%	38%	17%	2.0	6.0	6.1	11.2	3.8
31/10/2024	41.0	46.6	32.0	34.5	32.7	23.9	43.0	33%	13%	13%	42%	8%	29%	33%	1.2	7.8	3.2	5.7	10.8
1/11/2024	20.5	28.8	29.4	18.7	16.5	22.8	23.0	0%	4%	83%	0%	0%	100%	0%	14.3	0.0	0.0	9.0	0.0
2/11/2024	19.5	27.2	24.9	21.5	15.1	18.2	-	0%	0%	79%	0%	0%	100%	0%	11.8	0.0	0.0	5.7	-

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
3/11/2024	42.0	29.3	26.8	29.8	37.9	24.3	-	58%	0%	0%	83%	38%	0%	38%	0.0	12.1	10.3	0.0	-
4/11/2024	46.0	38.8	57.9	49.4	45.1	33.4	63.0	17%	4%	17%	63%	46%	25%	4%	6.5	20.4	14.4	5.0	0.0
5/11/2024	24.9	30.8	32.9	37.4	21.6	23.5	30.5	0%	0%	88%	0%	0%	100%	0%	15.9	0.0	0.0	6.7	0.0
6/11/2024	32.5	56.1	43.2	41.5	37.5	30.7	37.0	21%	4%	4%	25%	17%	17%	25%	0.3	3.2	2.0	2.7	8.9
7/11/2024	51.8	39.4	37.0	48.5	43.3	27.9	-	29%	8%	4%	38%	33%	8%	33%	0.0	7.5	7.8	1.2	-
8/11/2024	18.9	12.1	9.6	19.7	15.0	7.2	-	8%	0%	0%	83%	75%	0%	4%	0.0	8.9	4.9	0.0	-
9/11/2024	30.0	45.1	34.4	24.8	22.9	33.1	38.8	0%	0%	38%	0%	0%	71%	0%	7.0	0.0	0.0	11.4	0.0
10/11/2024	44.9	39.9	31.6	29.5	30.5	28.1	38.2	21%	0%	46%	17%	4%	63%	17%	6.6	2.4	0.0	8.8	2.1
11/11/2024	34.8	33.4	27.6	24.8	-	19.3	41.1	0%	13%	71%	0%	0%	96%	0%	8.9	0.0	-	2.3	0.0
12/11/2024	16.1	17.1	11.0	9.4	9.9	9.4	19.1	0%	0%	79%	0%	0%	100%	0%	3.3	0.0	0.0	3.4	0.0
13/11/2024	22.2	21.1	16.4	13.3	14.2	13.4	24.1	4%	4%	21%	25%	21%	46%	8%	1.9	0.7	1.2	1.4	0.6
14/11/2024	21.6	22.9	18.0	14.7	15.6	17.7	18.7	25%	0%	58%	13%	4%	67%	21%	4.6	1.1	0.8	4.8	0.6
15/11/2024	19.5	26.6	19.7	13.6	15.0	17.0	23.4	0%	0%	100%	0%	0%	100%	0%	6.7	0.0	0.0	4.1	0.0
16/11/2024	13.0	31.3	19.6	12.4	12.6	16.3	19.0	0%	4%	79%	0%	0%	96%	0%	7.8	0.0	0.0	5.2	0.0
17/11/2024	22.8	21.9	17.2	13.8	17.7	16.9	27.6	67%	0%	0%	50%	13%	4%	63%	0.0	1.3	3.3	0.2	11.4
18/11/2024	16.1	17.5	14.5	13.0	12.8	13.1	18.4	21%	0%	17%	67%	50%	21%	21%	1.5	2.3	1.4	1.8	2.3
19/11/2024	20.8	29.0	24.2	17.7	18.9	23.1	24.5	0%	0%	96%	0%	0%	100%	0%	7.4	0.0	0.0	6.6	0.0
20/11/2024	14.7	25.7	25.5	14.7	13.0	21.1	23.2	0%	0%	67%	0%	0%	96%	0%	12.1	0.0	0.0	10.2	0.0
21/11/2024	11.2	23.8	27.0	12.4	11.2	16.2	21.5	0%	0%	71%	0%	0%	100%	0%	14.8	0.0	0.0	7.1	0.0
22/11/2024	15.7	32.6	28.0	14.0	12.8	23.2	20.2	4%	0%	46%	4%	4%	83%	4%	9.2	0.0	1.0	12.1	0.7
23/11/2024	27.5	43.3	34.8	16.8	14.2	29.0	23.5	21%	4%	25%	21%	8%	58%	21%	4.1	0.8	0.5	14.0	3.0
24/11/2024	30.5	41.7	37.7	24.5	25.6	33.7	41.3	13%	0%	42%	17%	17%	63%	13%	13.8	1.7	3.4	16.2	3.6
25/11/2024	25.3	40.4	-	27.8	25.5	30.3	34.5	8%	0%	38%	25%	17%	50%	8%	-	2.8	2.7	11.5	1.2
26/11/2024	26.3	62.2	-	27.6	30.5	25.8	37.8	29%	4%	13%	58%	29%	29%	21%	-	7.3	7.0	7.1	3.6
27/11/2024	39.0	37.4	29.3	43.8	48.4	23.0	46.3	42%	0%	0%	96%	58%	0%	25%	0.0	24.6	15.6	0.0	3.6
28/11/2024	20.5	29.7	14.0	18.0	19.9	12.9	29.1	4%	4%	13%	75%	71%	21%	4%	0.7	6.8	9.3	0.4	0.5
29/11/2024	25.2	33.0	21.8	18.2	19.0	21.9	31.0	0%	8%	67%	4%	4%	79%	4%	5.9	0.1	0.0	5.5	1.5
30/11/2024	10.9	15.0	12.7	8.7	9.4	11.6	18.1	0%	17%	29%	13%	21%	54%	0%	1.6	0.3	0.2	2.1	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
1/12/2024	23.1	16.0	11.5	15.1	13.5	18.1	26.1	8%	4%	8%	71%	67%	13%	0%	0.0	5.3	4.2	3.2	0.0
2/12/2024	28.0	34.9	17.9	21.4	25.0	23.1	23.6	42%	8%	0%	79%	38%	4%	29%	0.0	10.2	7.8	3.3	2.5
3/12/2024	35.5	28.5	16.3	24.7	23.5	16.0	25.9	25%	0%	0%	88%	71%	0%	21%	0.0	9.7	6.2	0.0	2.1
4/12/2024	21.1	27.5	23.6	22.2	21.7	20.5	24.1	17%	0%	63%	25%	13%	67%	21%	7.1	2.1	1.6	5.4	2.4
5/12/2024	13.6	29.1	27.5	18.8	16.2	19.7	21.2	0%	0%	83%	0%	0%	100%	0%	14.3	0.0	0.0	8.2	0.0
6/12/2024	36.6	28.5	24.2	28.6	28.7	20.6	44.5	33%	0%	4%	50%	29%	4%	25%	0.4	7.3	6.7	0.5	5.4
7/12/2024	26.1	23.7	19.3	31.4	25.7	13.0	38.7	13%	0%	0%	100%	83%	0%	4%	0.0	20.9	14.4	0.0	0.7
8/12/2024	13.3	19.7	15.2	14.9	12.7	13.9	19.5	8%	0%	42%	58%	50%	42%	4%	5.4	3.3	2.0	6.0	1.3
9/12/2024	20.2	30.5	25.5	20.9	19.8	22.3	26.6	0%	0%	88%	0%	0%	100%	0%	5.8	0.0	0.0	4.7	0.0
10/12/2024	22.2	30.0	36.2	27.9	20.9	22.5	22.0	13%	4%	50%	17%	8%	58%	8%	14.6	1.2	1.2	8.3	1.8
11/12/2024	20.2	36.2	38.4	27.8	21.2	33.3	28.2	8%	4%	50%	4%	0%	71%	8%	12.1	0.2	0.0	10.8	0.7
12/12/2024	33.7	32.3	44.2	26.6	28.6	30.0	37.1	42%	0%	4%	67%	29%	21%	21%	0.8	4.3	3.3	5.2	2.4
13/12/2024	51.2	41.2	38.0	39.1	35.4	34.7	66.3	21%	0%	0%	58%	38%	29%	17%	0.0	7.4	3.0	4.1	0.0
14/12/2024	39.0	66.5	50.5	36.0	35.1	43.8	44.5	0%	0%	67%	0%	0%	88%	0%	9.5	0.0	0.0	11.6	0.0
15/12/2024	36.6	67.1	49.9	37.4	34.6	40.1	41.0	13%	0%	46%	4%	4%	50%	13%	14.1	0.1	0.0	10.5	3.2
16/12/2024	22.5	44.0	40.8	24.7	18.5	29.4	22.9	0%	0%	75%	0%	0%	96%	0%	22.6	0.0	0.0	17.4	0.0
17/12/2024	29.2	36.4	27.6	24.0	30.8	22.8	35.0	42%	0%	8%	63%	21%	29%	33%	2.0	6.8	2.6	5.4	6.7
18/12/2024	16.0	24.6	16.4	7.6	13.4	17.1	27.8	0%	0%	92%	0%	0%	100%	0%	9.6	0.0	0.0	10.8	0.0
19/12/2024	23.0	39.0	-	11.8	19.8	24.7	30.4	0%	0%	63%	0%	0%	92%	0%	-	0.0	0.0	12.9	0.0
20/12/2024	29.8	45.9	-	13.1	19.8	30.6	29.6	13%	4%	38%	13%	4%	63%	13%	-	0.0	0.4	11.4	2.3
21/12/2024	34.0	49.2	29.7	24.2	32.8	27.2	41.4	21%	0%	25%	25%	13%	42%	25%	4.0	1.5	3.3	7.1	4.3
22/12/2024	29.0	50.1	32.0	21.0	26.9	33.3	38.8	0%	0%	63%	0%	0%	75%	0%	6.1	0.0	0.0	7.9	0.0
23/12/2024	35.1	38.1	31.8	33.2	29.4	25.2	47.7	4%	0%	4%	71%	71%	17%	4%	0.0	12.8	11.2	5.2	0.1
24/12/2024	58.9	37.6	22.4	23.1	26.5	22.7	31.2	4%	13%	54%	13%	33%	54%	4%	4.1	1.5	6.0	5.9	0.6
25/12/2024	16.7	15.3	17.1	15.9	17.3	14.1	18.1	8%	8%	46%	4%	8%	54%	13%	2.2	0.0	0.4	1.5	1.0
26/12/2024	21.3	42.6	21.9	22.1	21.3	19.9	27.7	33%	4%	13%	38%	17%	29%	29%	3.9	2.0	1.3	3.1	4.1
27/12/2024	40.3	45.8	27.0	28.1	34.0	31.3	55.9	25%	4%	8%	75%	54%	13%	13%	0.6	9.8	9.8	5.0	0.0
28/12/2024	29.5	36.3	25.7	21.0	27.2	30.5	39.4	0%	0%	33%	13%	13%	54%	0%	1.9	2.7	2.0	11.3	0.0

Date	24-hour average level (µg/m³)							Percentage of time downwind (%)							HVO South's estimated max. contribution to level (µg/m³)				
	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Golden Highway	Howick	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth	Jerrys Plains	Knodlers Lane	Maison Dieu	Wandewoi	Warkworth
29/12/2024	40.7	57.1	28.9	27.6	28.1	37.1	42.2	25%	0%	33%	29%	4%	50%	25%	5.7	0.8	0.3	9.8	3.4
30/12/2024	22.9	43.1	25.9	22.4	22.5	27.2	39.8	0%	0%	71%	0%	0%	96%	0%	6.4	0.0	0.0	9.9	0.0
31/12/2024	36.8	46.4	34.3	19.3	25.7	37.4	48.8	0%	0%	50%	0%	0%	75%	0%	9.6	0.0	0.0	19.4	0.0

- No data

Note for this annual review, TEOM data time was assessed per Australian Eastern Standard Time (AEST) as used by DCCEEW, however some minor differences arise with the operational data which uses Australian Eastern Daylight Time (AEDT). Some minor differences also arise as HVO collects data in real-time from DCCEEW monitors using a separate HVO logger which may result in minor additional time shift effect.

Table B-4: 24-hour average PM_{10} HVAS levels, percent time downwind and estimated contributions – HVO North

Date	Percentage of time downwind (%)				24-hour average PM_{10} level (µg/m³)					HVO North's estimated max. contribution to PM_{10} level (µg/m³)	
	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Estimated Background	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Cheshunt East	Kilburnie South
6/01/2024	0%	0%	0%	0%	18.5	13.4	16.1	12.6	19.4	0.0	0.0
12/01/2024	0%	0%	0%	0%	15.7	11.2	14.4	11.7	19.2	0.0	0.0
18/01/2024	100%	0%	4%	0%	9.3	14.1	18.5	14.2	8.7	4.8	0.0
24/01/2024	58%	17%	29%	13%	19.4	31.0	33.5	27.7	19.4	11.6	0.0
30/01/2024	0%	0%	0%	0%	28.0	26.3	25.7	27.0	30.0	0.0	0.0
5/02/2024	46%	13%	21%	0%	52.0	69.1	62.9	65.0	52.0	13.4	17.9
11/02/2024	0%	0%	0%	0%	22.6	19.4	21.0	16.7	20.1	0.0	0.0
17/02/2024	8%	8%	4%	4%	24.2	23.6	29.8	14.8	15.0	0.0	0.0
23/02/2024	75%	8%	38%	0%	20.7	30.6	28.5	21.7	17.4	9.9	0.0
29/02/2024	54%	4%	4%	4%	30.3	28.8	30.6	23.0	30.0	0.0	0.0
6/03/2024	25%	25%	13%	4%	22.6	31.7	39.4	22.6	28.9	9.1	0.0
12/03/2024	29%	13%	21%	13%	26.1	36.1	47.2	26.9	33.8	10.0	7.7

Date	Percentage of time downwind (%)				24-hour average PM_{10} level (µg/m³)					HVO North's estimated max. contribution to PM_{10} level (µg/m³)	
	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Estimated Background	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Cheshunt East	Kilburnie South
18/03/2024	0%	0%	0%	0%	11.2	9.9	12.3	5.5	16.3	0.0	0.0
24/03/2024	0%	13%	0%	25%	18.3	16.7	25.4	12.1	26.6	0.0	8.3
30/03/2024	29%	25%	17%	8%	16.0	26.7	49.8	16.0	21.6	10.7	5.6
5/04/2024	0%	0%	0%	0%	7.5	4.9	10.4	4.3	5.0	0.0	0.0
11/04/2024	50%	0%	50%	0%	13.3	15.4	18.1	-	13.3	2.1	0.0
17/04/2024	17%	4%	4%	4%	23.1	17.1	24.0	16.3	20.2	0.0	0.0
23/04/2024	58%	4%	33%	4%	7.2	18.6	20.8	14.0	8.6	11.4	0.0
29/04/2024	71%	8%	46%	0%	20.1	25.3	47.3	19.4	10.8	5.2	0.0
5/05/2024	0%	0%	0%	4%	8.7	4.2	6.2	-	4.2	0.0	0.0
11/05/2024	0%	0%	0%	0%	6.3	6.0	6.5	3.9	6.1	0.0	0.0
17/05/2024	92%	13%	63%	0%	13.8	22.4	22.6	11.1	8.1	8.6	0.0
23/05/2024	54%	13%	42%	0%	8.3	11.0	30.1	8.8	8.3	2.7	0.0
29/05/2024	58%	21%	46%	0%	13.8	27.7	48.0	18.6	12.6	13.9	0.0
4/06/2024	100%	0%	0%	0%	10.9	9.3	9.2	5.9	4.6	0.0	0.0
10/06/2024	79%	0%	42%	0%	5.7	11.7	14.0	7.3	3.4	6.0	0.0
16/06/2024	71%	13%	29%	0%	4.9	8.8	16.2	6.2	3.7	3.9	0.0
22/06/2024	50%	0%	50%	0%	4.0	8.1	7.4	7.7	1.1	4.1	0.0
28/06/2024	58%	4%	58%	0%	7.9	18.3	55.4	14.3	7.9	10.4	0.0
4/07/2024	0%	0%	0%	0%	19.0	12.0	31.8	9.3	13.1	0.0	0.0
10/07/2024	100%	0%	42%	0%	5.9	10.2	10.4	6.1	2.4	4.3	0.0
16/07/2024	100%	0%	0%	0%	10.4	19.8	6.6	8.8	0.8	9.4	0.0
22/07/2024	100%	0%	79%	0%	16.5	27.7	30.3	16.8	5.9	11.2	0.0
28/07/2024	100%	0%	4%	0%	6.2	7.9	4.2	5.7	1.6	1.7	0.0
3/08/2024	71%	29%	38%	4%	7.6	14.1	33.5	9.3	8.6	6.5	0.0
9/08/2024	63%	8%	38%	4%	19.7	22.9	39.2	14.4	10.7	3.2	0.0
15/08/2024	0%	0%	0%	4%	10.6	10.6	7.6	3.9	8.0	0.0	0.0
21/08/2024	92%	25%	25%	0%	18.5	30.3	41.4	21.2	12.0	11.8	0.0
27/08/2024	100%	0%	42%	0%	12.5	-	28.7	20.1	4.7	-	0.0

Date	Percentage of time downwind (%)				24-hour average PM_{10} level (µg/m³)					HVO North's estimated max. contribution to PM_{10} level (µg/m³)	
	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Estimated Background	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Cheshunt East	Kilburnie South
2/09/2024	100%	0%	8%	0%	36.3	49.8	48.5	46.9	16.4	13.5	0.0
8/09/2024	92%	4%	33%	8%	17.8	38.7	55.9	20.3	12.7	20.9	0.0
14/09/2024	79%	4%	33%	4%	12.0	24.6	25.9	15.4	8.1	12.6	0.0
20/09/2024	100%	0%	38%	0%	32.6	41.7	64.0	37.8	16.7	9.1	0.0
26/09/2024	0%	0%	0%	0%	15.6	15.8	17.8	10.2	15.0	0.0	0.0
2/10/2024	0%	0%	0%	0%	17.4	10.5	18.9	10.8	27.6	0.0	0.0
8/10/2024	17%	0%	8%	0%	27.0	16.7	34.7	15.2	18.8	0.0	0.0
14/10/2024	71%	0%	42%	0%	9.6	13.8	24.3	12.8	7.2	4.3	0.0
20/10/2024	4%	0%	4%	4%	16.1	12.4	17.6	13.4	14.8	0.0	0.0
26/10/2024	0%	0%	0%	0%	23.3	15.2	39.4	15.1	34.3	0.0	0.0
1/11/2024	0%	0%	0%	0%	17.1	12.0	25.3	12.1	26.8	0.0	0.0
7/11/2024	42%	17%	13%	13%	36.3	53.9	71.6	38.6	35.5	11.1	0.0
13/11/2024	21%	0%	4%	17%	23.1	13.2	20.3	12.3	-	0.0	-
19/11/2024	0%	0%	0%	0%	19.0	16.5	18.6	15.8	27.1	0.0	0.0
25/11/2024	25%	0%	8%	17%	29.9	27.6	39.7	25.4	42.0	0.0	12.1
1/12/2024	63%	0%	4%	4%	18.5	20.0	25.9	15.9	16.0	1.5	0.0
7/12/2024	92%	4%	13%	0%	22.7	33.5	44.3	33.6	15.1	10.8	0.0
13/12/2024	58%	0%	21%	0%	41.1	32.9	55.2	28.7	44.2	0.0	0.0
19/12/2024	0%	0%	0%	4%	19.9	17.4	26.8	16.8	30.4	0.0	0.0
25/12/2024	8%	8%	4%	13%	16.5	13.7	16.4	15.2	18.1	0.0	1.6
31/12/2024	0%	0%	0%	8%	30.9	31.1	40.9	22.6	46.9	0.0	16.0

- No data

Table B-5: 24-hour average PM_{10} HVAS levels, percent time downwind and estimated contributions – HVO South

Date	Percentage of time downwind (%)				24-hour average PM_{10} level (µg/m³)					HVO South's estimated max. contribution to PM_{10} level (µg/m³)		
	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Estimated Background	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Gliding Club	Long Point	Kilburnie South
6/01/2024	0%	63%	0%	38%	18.5	13.4	16.1	12.6	19.4	0.0	0.0	0.9
12/01/2024	0%	92%	0%	42%	15.7	11.2	14.4	11.7	19.2	0.0	0.0	3.5
18/01/2024	0%	100%	96%	0%	9.3	14.1	18.5	14.2	8.7	9.2	4.9	0.0
24/01/2024	0%	83%	33%	4%	19.4	31.0	33.5	27.7	19.4	14.1	8.3	0.0
30/01/2024	0%	88%	0%	63%	28.0	26.3	25.7	27.0	30.0	0.0	0.0	2.0
5/02/2024	4%	88%	25%	13%	52.0	69.1	62.9	65.0	52.0	10.9	13.0	17.9
11/02/2024	0%	46%	0%	38%	22.6	19.4	21.0	16.7	20.1	0.0	0.0	0.0
17/02/2024	0%	54%	4%	8%	24.2	23.6	29.8	14.8	15.0	5.6	0.0	0.0
23/02/2024	4%	96%	42%	0%	20.7	30.6	28.5	21.7	17.4	7.8	1.0	0.0
29/02/2024	13%	79%	46%	4%	30.3	28.8	30.6	23.0	30.0	0.3	0.0	0.0
6/03/2024	0%	83%	4%	21%	22.6	31.7	39.4	22.6	28.9	16.8	0.0	6.3
12/03/2024	0%	79%	4%	13%	26.1	36.1	47.2	26.9	33.8	21.1	0.0	7.7
18/03/2024	4%	67%	0%	38%	11.2	9.9	12.3	5.5	16.3	1.1	0.0	5.1
24/03/2024	0%	75%	0%	17%	18.3	16.7	25.4	12.1	26.6	7.1	0.0	8.3
30/03/2024	0%	88%	0%	21%	16.0	26.7	49.8	16.0	21.6	33.8	0.0	5.6
5/04/2024	0%	71%	0%	25%	7.5	4.9	10.4	4.3	5.0	2.9	0.0	0.0
11/04/2024	4%	83%	4%	21%	13.3	15.4	18.1	-	13.3	4.8	-	0.0
17/04/2024	0%	67%	8%	29%	23.1	17.1	24.0	16.3	20.2	0.9	0.0	0.0
23/04/2024	4%	67%	21%	13%	7.2	18.6	20.8	14.0	8.6	13.6	6.8	1.4
29/04/2024	8%	79%	38%	8%	20.1	25.3	47.3	19.4	10.8	27.2	0.0	0.0
5/05/2024	0%	46%	0%	13%	8.7	4.2	6.2	-	4.2	0.0	-	0.0
11/05/2024	0%	92%	0%	8%	6.3	6.0	6.5	3.9	6.1	0.2	0.0	0.0
17/05/2024	4%	92%	38%	0%	13.8	22.4	22.6	11.1	8.1	8.8	0.0	0.0
23/05/2024	13%	75%	0%	17%	8.3	11.0	30.1	8.8	8.3	21.8	0.0	0.0
29/05/2024	4%	79%	8%	8%	13.8	27.7	48.0	18.6	12.6	34.2	4.8	0.0
4/06/2024	0%	100%	100%	0%	10.9	9.3	9.2	5.9	4.6	0.0	0.0	0.0
10/06/2024	4%	79%	54%	0%	5.7	11.7	14.0	7.3	3.4	8.3	1.6	0.0

Date	Percentage of time downwind (%)				24-hour average PM_{10} level (µg/m³)					HVO South's estimated max. contribution to PM_{10} level (µg/m³)		
	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Estimated Background	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Gliding Club	Long Point	Kilburnie South
16/06/2024	8%	54%	13%	0%	4.9	8.8	16.2	6.2	3.7	11.3	1.3	0.0
22/06/2024	4%	50%	0%	0%	4.0	8.1	7.4	7.7	1.1	3.4	0.0	0.0
28/06/2024	8%	83%	4%	17%	7.9	18.3	55.4	14.3	7.9	44.6	0.0	0.0
4/07/2024	0%	54%	0%	4%	19.0	12.0	31.8	9.3	13.1	12.8	0.0	0.0
10/07/2024	0%	100%	92%	0%	5.9	10.2	10.4	6.1	2.4	4.5	0.2	0.0
16/07/2024	0%	100%	100%	0%	10.4	19.8	6.6	8.8	0.8	0.0	0.0	0.0
22/07/2024	0%	100%	58%	0%	16.5	27.7	30.3	16.8	5.9	13.8	0.3	0.0
28/07/2024	0%	75%	75%	0%	6.2	7.9	4.2	5.7	1.6	0.0	0.0	0.0
3/08/2024	8%	83%	8%	0%	7.6	14.1	33.5	9.3	8.6	25.9	1.7	0.0
9/08/2024	4%	79%	33%	4%	19.7	22.9	39.2	14.4	10.7	19.5	0.0	0.0
15/08/2024	8%	46%	0%	17%	10.6	10.6	7.6	3.9	8.0	0.0	0.0	0.0
21/08/2024	0%	100%	58%	0%	18.5	30.3	41.4	21.2	12.0	22.9	2.7	0.0
27/08/2024	0%	100%	92%	0%	12.5	-	28.7	20.1	4.7	16.2	7.6	0.0
2/09/2024	0%	83%	75%	0%	36.3	49.8	48.5	46.9	16.4	12.2	10.6	0.0
8/09/2024	0%	96%	63%	0%	17.8	38.7	55.9	20.3	12.7	38.1	2.5	0.0
14/09/2024	4%	75%	42%	4%	12.0	24.6	25.9	15.4	8.1	13.9	3.4	0.0
20/09/2024	0%	100%	88%	0%	32.6	41.7	64.0	37.8	16.7	37.7	5.2	0.0
26/09/2024	0%	25%	0%	13%	15.6	15.8	17.8	10.2	15.0	2.2	0.0	0.0
2/10/2024	0%	96%	0%	54%	17.4	10.5	18.9	10.8	27.6	1.5	0.0	10.2
8/10/2024	0%	67%	4%	42%	27.0	16.7	34.7	15.2	18.8	7.7	0.0	0.0
14/10/2024	4%	88%	46%	4%	9.6	13.8	24.3	12.8	7.2	14.8	3.3	0.0
20/10/2024	8%	79%	0%	58%	16.1	12.4	17.6	13.4	14.8	1.5	0.0	0.0
26/10/2024	0%	79%	0%	38%	23.3	15.2	39.4	15.1	34.3	16.1	0.0	11.0
1/11/2024	0%	75%	0%	38%	17.1	12.0	25.3	12.1	26.8	8.2	0.0	9.7
7/11/2024	4%	67%	25%	0%	36.3	53.9	71.6	38.6	35.5	38.8	2.4	0.0
13/11/2024	8%	79%	17%	33%	23.1	13.2	20.3	12.3	-	0.0	0.0	-
19/11/2024	0%	100%	0%	63%	19.0	16.5	18.6	15.8	27.1	0.0	0.0	8.1

Date	Percentage of time downwind (%)				24-hour average PM_{10} level (µg/m³)					HVO South's estimated max. contribution to PM_{10} level (µg/m³)		
	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Estimated Background	Cheshunt East	Gliding Club	Long Point	Kilburnie South	Gliding Club	Long Point	Kilburnie South
25/11/2024	0%	96%	13%	29%	29.9	27.6	39.7	25.4	42.0	9.8	0.0	12.1
1/12/2024	8%	83%	63%	4%	18.5	20.0	25.9	15.9	16.0	7.4	0.0	0.0
7/12/2024	4%	75%	67%	0%	22.7	33.5	44.3	33.6	15.1	21.6	10.9	0.0
13/12/2024	4%	79%	42%	8%	41.1	32.9	55.2	28.7	44.2	6.9	0.0	3.1
19/12/2024	0%	100%	0%	67%	19.9	17.4	26.8	16.8	30.4	6.9	0.0	10.5
25/12/2024	8%	88%	0%	42%	16.5	13.7	16.4	15.2	18.1	0.0	0.0	1.6
31/12/2024	0%	92%	0%	46%	30.9	31.1	40.9	22.6	46.9	10.0	0.0	16.0

- No data

Appendix C

24-hour Average Levels and Estimated Contributions - $PM_{2.5}$

Table C-1: Detailed analyses for elevated 24-hour average $PM_{2.5}$ readings

Date	Site	Measured 24-hour average $PM_{2.5}$ level (µg/m³)	HVO 24-hour average $PM_{2.5}$ Incremental Criteria (µg/m³)	Estimated HVO Incremental contribution to $PM_{2.5}$ level (µg/m³)
5/02/2024	Kilburnie South HVAS	48.2	25	1.3
	Maison Dieu TEOM	37.0	25	12.3
2/09/2024	Maison Dieu HVAS	29.1	25	6.2
7/11/2024	Maison Dieu HVAS	51.4	25	4.4
	Kilburnie South HVAS	25.6	25	0.9
25/11/2024	Kilburnie South HVAS	25.9	25	6.5

Table C-2: 24-hour average $PM_{2.5}$ HVAS levels, percent time downwind and estimated contributions – HVO South

Date	Percentage of time downwind of HVO South (%)		24-hour average $PM_{2.5}$ level (µg/m³)			HVO South's estimated max. contribution to $PM_{2.5}$ level (µg/m³)	
	Maison Dieu	Kilburnie South	Background	Maison Dieu	Kilburnie South	Maison Dieu	Kilburnie South
6/01/2024	0%	38%	2.3	0.0	1.4	0.0	0.0
12/01/2024	0%	42%	2.0	0.0	0.2	0.0	0.0
18/01/2024	96%	0%	6.0	0.7	0.0	0.0	0.0
24/01/2024	21%	4%	4.2	2.3	1.3	0.0	0.0
30/01/2024	0%	63%	12.3	0.0	3.5	0.0	0.0
5/02/2024	17%	13%	18.2	0.6	0.1	0.0	1.3
11/02/2024	0%	38%	2.6	0.0	1.2	0.0	0.0
17/02/2024	4%	8%	6.8	0.0	0.4	0.0	0.0
23/02/2024	38%	0%	9.6	1.1	0.0	0.0	0.0
29/02/2024	58%	4%	7.2	1.0	0.2	0.0	0.0
6/03/2024	4%	21%	7.0	0.5	1.4	0.0	0.0
12/03/2024	4%	13%	8.3	0.0	0.0	0.0	0.0
18/03/2024	0%	38%	4.1	0.0	1.7	0.0	0.0
24/03/2024	0%	17%	5.7	0.0	1.2	0.0	0.0
30/03/2024	0%	21%	7.2	0.0	0.1	0.0	0.0
5/04/2024	0%	25%	0.3	0.0	0.3	0.0	0.0
11/04/2024	0%	21%	5.7	0.0	0.4	0.0	0.0
17/04/2024	8%	29%	8.5	0.0	0.4	0.0	0.0
23/04/2024	17%	13%	5.6	0.6	0.0	0.0	0.0
29/04/2024	17%	8%	8.9	0.3	0.8	0.0	0.0
5/05/2024	0%	13%	2.5	0.0	0.0	0.0	0.0
11/05/2024	0%	8%	1.7	0.0	0.1	0.0	0.0
17/05/2024	13%	0%	3.9	1.4	0.0	0.0	0.0
23/05/2024	0%	17%	8.4	0.0	0.0	0.0	0.0

Date	Percentage of time downwind of HVO South (%)		24-hour average $PM_{2.5}$ level (µg/m³)			HVO South's estimated max. contribution to $PM_{2.5}$ level (µg/m³)	
	Maison Dieu	Kilburnie South	Background	Maison Dieu	Kilburnie South	Maison Dieu	Kilburnie South
29/05/2024	0%	8%	12.0	0.0	0.0	0.0	0.0
4/06/2024	100%	0%	1.8	0.3	0.0	0.0	0.0
10/06/2024	38%	0%	1.8	0.2	0.0	0.0	0.0
16/06/2024	50%	0%	1.2	0.9	0.0	0.0	0.0
22/06/2024	0%	0%	0.1	0.0	0.0	0.0	0.0
28/06/2024	0%	17%	8.5	0.0	0.0	0.0	0.0
4/07/2024	0%	4%	6.1	0.0	0.0	0.0	0.0
10/07/2024	58%	0%	0.5	1.0	0.0	0.5	0.0
16/07/2024	100%	0%	0.1	13.1	0.0	13.0	0.0
22/07/2024	21%	0%	1.7	0.8	0.0	0.0	0.0
28/07/2024	96%	0%	0.1	0.3	0.0	0.2	0.0
3/08/2024	13%	0%	5.6	0.0	0.0	-	0.0
9/08/2024	29%	4%	11.5	0.0	0.0	-	0.0
15/08/2024	0%	17%	3.2	0.0	0.0	-	0.0
21/08/2024	50%	0%	7.3	0.0	0.0	-	0.0
27/08/2024	58%	0%	2.2	0.0	0.0	-	0.0
2/09/2024	92%	0%	7.4	9.1	0.0	6.2	0.0
8/09/2024	58%	0%	8.2	2.0	0.0	0.0	0.0
14/09/2024	54%	4%	6.0	3.5	0.0	0.0	0.0
20/09/2024	63%	0%	10.1	4.3	0.0	0.0	0.0
26/09/2024	0%	13%	8.2	0.0	0.0	0.0	0.0
2/10/2024	0%	54%	2.8	0.0	1.2	0.0	0.0
8/10/2024	4%	42%	6.1	0.0	1.5	0.0	0.0
14/10/2024	33%	4%	2.6	0.6	0.0	0.0	0.0
20/10/2024	4%	58%	5.6	0.0	0.4	0.0	0.0
26/10/2024	0%	38%	5.0	0.0	1.9	0.0	0.0
1/11/2024	0%	38%	6.2	0.0	0.2	0.0	0.0
7/11/2024	33%	0%	9.9	3.6	0.0	4.4	0.9
13/11/2024	21%	33%	6.3	0.0	1.6	0.0	0.0
19/11/2024	0%	63%	5.2	0.0	0.4	0.0	0.0
25/11/2024	17%	29%	5.0	0.0	1.0	0.0	6.5
1/12/2024	63%	4%	4.5	1.8	0.0	0.0	0.0
7/12/2024	75%	0%	6.0	5.3	0.0	0.0	0.0
13/12/2024	38%	8%	9.5	1.6	1.0	0.0	0.0
19/12/2024	0%	67%	5.0	0.0	2.3	0.0	0.0
25/12/2024	8%	42%	6.0	0.0	0.4	0.0	0.0
31/12/2024	0%	46%	15.6	0.0	4.7	0.0	0.0

- No data

APPENDIX B: ANNUAL GROUNDWATER REVIEW

umwelt
Environmental & Social Consultants

HUNTER VALLEY OPERATIONS

2024 GROUNDWATER ANNUAL REVIEW

FINAL

March 2025

HUNTER VALLEY OPERATIONS

2024 GROUNDWATER ANNUAL REVIEW

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Hunter Valley Operations Pty Ltd

Project Director: Claire Stephenson
Project Manager: Kirsty Cooksey
Report No. 21188/R25
Date: March 2025

umwelt
Environmental & Social Consultants

ISO 9001 Quality

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Prepared By		Reviewed and Approved for Issue	
	Name	Date	Name	Date
Draft V1	K Cooksey	09/03/2025	C Stephenson	11/03/2025
Final V2	K Cooksey	19/03/2025	C Stephenson	19/03/2025

Table of Contents

Figures

Tables

Appendices

1.0 Introduction

1.1 Overview

The Hunter Valley Operations (HVO) coal mining complex is located approximately 24 km northwest of Singleton, NSW. HVO is comprised of multiple open cut pits within the HVO North and HVO South operations, separated by the Hunter River. Mining is currently being undertaken in Cheshunt Pit 1 and 2, Riverview, West Pit and Mitchell Pit, with additional disturbance occurring in Wilton Pit, Mitchell Pit, and West Pit.

The Hunter Valley Operations Water Management Plan (WMP) (V3) (HVO, 2018) dated 16 October 2018 covers approval commitments in Project Approvals:

- DA 450-10-2003 (Schedule 3, Condition 27) for HVO North.
- PA 06_0261 (Schedule 3, Condition 27 and 28) for HVO South.
- Individual bore license conditions (20BL173587-89, 20BL173847 and 20BL173392).
- Conditions of Environment Protection Licence 640.

This includes requirements for the monitoring of groundwater, assessment of potential impacts and reporting. As part of compliance with mine approval conditions, routine groundwater monitoring is conducted across HVO, and the data reviewed and analysed on a quarterly basis.

This report summarises the groundwater level and quality results for monitoring completed between 1 January and 31 December 2024 (the reporting period).

Umwelt have been engaged to undertake the annual review of the groundwater monitoring data collected during the reporting period. This report presents a summary of the groundwater data collected, high level discussion on any missing data or trigger exceedances, and recommendations (where relevant). This report has been developed in accordance with the approval conditions and requirements outlined within the 2018 WMP (HVO, 2018).

1.2 Scope

This report presents:

- Site background:
    - Legislative requirements and conditions relevant to groundwater
    - Mine activities over reporting period
    - Hydrogeological regime
    - Groundwater monitoring network and programme.

- Data review:
    - Review and illustration (i.e., hydrographs) of groundwater level trends
    - Review and illustration (i.e., hydrographs) of groundwater quality trends
    - Comparison of water level and quality trends to relevant trigger levels and natural trends (i.e., surface water levels and rainfall)
    - Assess compliance with mine approval conditions and present a checklist summarising findings.
- Discussion of groundwater impacts and compliance over the reporting period and provision of recommendations.

2.0 HVO Complex

The following section provides a description of the HVO Complex relevant to this annual groundwater review. The site layout is shown in **Figure 2.1**.

2.1 Mine Operations

The mine areas across HVO, approved mining timeframes and activities undertaken over 2024, are summarised in **Table 2.1**. During 2024, active mining was undertaken in Cheshunt Pit 1 and 2, Riverview North, West Pit and Mitchell Pit, with additional disturbance occurring in Wilton Pit, Mitchell Pit, West Pit, Riverview Pit and Glider Pit.

Table 2.1 HVO Activities

Mine Area		Approved Life of Mining	Target Seam	Activities in 2024
HVO North	Alluvial Lands	1993 to 2003	Vaux	Inactive, fully rehabilitated
	Carrington Pit	2000 to 2025	Bayswater	Inactive, used for tailings storage and water storage
	Carrington West Wing	2023 to 2025	Bayswater	Not commenced
	Glider Pit	2016 to 2017	Vaux	Inactive, fully rehabilitated
	North Pit	1979 to 2003	Vaux	Inactive, converted to TSF
	West Pit (Includes Wilton and Mitchell Pits)	1949 to 2025	Bayswater to Hebden	Active mining
HVO South	Cheshunt Pit	2002 to 2030	Bayswater	Active mining in Pits 1 and 2
	Riverview Pit	1997 to 2030	Bayswater	Active mining
	Lemington mine (Underground)	1971 to 1992	Mt Arthur	Inactive
	South Lemington Pit 1	1998 to 2024	Bowfield	Inactive, used for water storage
	South Lemington Pit 2	2015 to 2030	Vaux	Not commenced

Table 2.2 summarises the tailings storage facilities (TSF) across HVO. The TSF's are managed in accordance with the site Fine Rejects Management Strategy, including decant requirements to enable consolidation of the material.

Table 2.2 Approved Tailing Storage Facilities Summary

Mine Area	Location	Status
Dam 6W	West Pit	Active (intermittent deposition).
Bobs Dump TSF (20W)	West Pit	Capping and rehabilitation commenced in Q3 of 2024.
North Void TSF (29N)	North Pit	Inactive, ceased receiving tailings in 2019. Decommissioning and management of decant pond commenced.
South East TSF (27N)	North Pit	Capping and rehabilitation complete.
Central TSF (28N)	North Pit	Inactive.
Carrington Out of Pit Fine Reject Emplacement (COOP FRE)	Carrington area – out of pit emplacement	Approved but not constructed.
Carrington In Pit Fine Reject Emplacement (FRE)	Carrington area – in pit emplacement	Active, receiving tailings since 2019.
Cumnock Void TSF	Ravensworth	Active. On Ravensworth land and Glencore's responsibility.
West Pit	West Pit	Approved but not constructed.
Lemington 1 TSF Cell A	Lemington South	Rehabilitated.
Lemington 1 TSF Cell B	Lemington South	Rehabilitated.
Lemington 2 TSF	Lemington South	Rehabilitated.
Lemington 3 TSF	Lemingtion South	Rehabilitated.
Lemingotn 4 TSF Cell A	Lemington South	Rehabilitated.
Lemington 4 TSF Cell B	Lemingtion South	Rehabilitated.
Lemington 5 TSF	Lemington South	Rehabilitated.
Howick TSF	West Pit	Rehabilitated.
Eastern TSF	North Pit	Rehabilitated.
Western TSF Cell A	West Pit	Rehabilitated.
Western Cell TSF Cell B	West Pit	Rehabilitated.

During 2024 Carrington In Pit Fine Reject Emplacement was actively used for tailings storage. Cumnock Void 3 also received tailings from Howick CHPP. North Void ceased receiving tailings in January 2019; decommissioning has commenced.

Groundwater was abstracted from the Lemington Underground Bore (LUG) during 2024. LUG Bore is a production bore constructed into the historical Lemington Underground beneath HVO that mined the Mt Arthur Seam of the Whittingham Coal Measures, with this mine having been inactive since 1999. Abstraction from LUG Bore is managed by Yancoal for the Mt Thorley Warkworth (MTW) operations. It is noted that the WAL for the LUG Bore was permanently relinquished to MTW in early 2024.

FIGURE 2.1

Site Layout

Legend

- Barrier Walls
- Road
- Mapped Watercourses (named)
- Mine Areas

0 1 2
Kilometres

Scale 1:85,000 at A4
GDA2020 MGA Zone 56

Image Source: ESRI Basemap (2022) **Data source:** NSW DFSI (2022)

C:\USERS\HHARIRAM\UMWELT (AUSTRALIA) PTY. LTD\21188 - 03 S&V\F_R15\21188_R15_LEMINGTONSOUTH_V3.APRX - 21188_R07_201_SITELAYOUT_V2

2.2 Groundwater Impact Predictions

Groundwater impacts associated with the approved operations at HVO have been progressively assessed for each mining area, including:

- Alluvial Lands Project Groundwater Assessment (MMA, 1992).
- Carrington Pit Groundwater Assessment (MER, 1998).
- West Pit Extension Groundwater Assessment (MER, 2003).
- Carrington Pit Extended Groundwater Assessment (MER, 2005).
- Carrington West Wing Groundwater Assessment (MER, 2010).
- HVO South Groundwater Assessment (ERM, 2008).
- HVO North Modification 4 Groundwater Assessment – Carrington Out of Pit Fine Reject Emplacement (AGE, 2013b).
- HVO North Modification 6 Groundwater Assessment – Carrington In Pit Fine Reject Emplacement (AGE, 2016).
- HVO South Modification 5 Groundwater Assessment (AGE, 2017).
- HVO Continuation Project Groundwater Assessment (AGE, 2022).

2.2.1 Groundwater Assessment for Current Approval

The Environmental Assessment prepared for HVO South Modification 5 includes a groundwater assessment completed by AGE (2017). The groundwater assessment included development of a numerical groundwater model to represent groundwater response to approved mine activities and the proposed modification.

The approved operations included mining at Cheshunt Pit, Riverview Pit, Glider Pit and West Pit, as well as surrounding non-HVO mining operations (i.e., Ravensworth, United Wambo and Mt Thorley Warkworth) and abstraction from the LUG Bore. The model also included approved mining at Carrington West Wing until 2021; however, no mining has occurred at Carrington West Wing to date.

The model was calibrated to the end of 2015 and groundwater conditions and groundwater response to approved mining to the end of 2015, as reported by AGE (2017), indicated:

- Groundwater within the hard rock units is directly intercepted by approved operations at HVO.
- Groundwater within the confined to semi-confined Permian coal measures became depressurised around the area of active mining. Groundwater drawdown responses were observed around 2 km to 6 km from active mine areas within the Permian coal measures.
- There is no direct interception of groundwater within alluvium for active mine operations at HVO. However, historically the South Lemington Pit 1 footprint did directly intercept alluvium and barrier walls were established at Alluvial Lands and Carrington Pit to separate mine areas from alluvium.

- With depressurisation of the coal measures, the model predicted a reduction in upward seepage to the alluvium that was referred to as 'indirect take'.
- These findings largely aligned with historical groundwater assessments conducted for the approved operations across HVO. Groundwater licenses have been obtained for the approved operations, as discussed in **Section 2.4**. Management and monitoring requirements of potential groundwater related impacts from approved operations are captured within the development consent conditions. Schedule 3, Condition 27 of Development Consent (DA 450-10-2003) for HVO North, last updated January 2017 for Modification 6 and again in July 2017 (no changes to groundwater conditions in July 2017).
- Schedule 3, Condition 28 of the Project Approval (PA 06_0261) for HVO South, last updated October 2012.

These conditions are addressed within the site WMP. Further discussion on the monitoring and management requirements is included within **Section 2.3**.

2.3 Groundwater Approval Conditions

In accordance with the development consent approval conditions, HVO are required to prepare and implement a WMP to the satisfaction of the Secretary. **Table 2.3** presents a summary of the relevant groundwater conditions from the development consent and WMP. The table identifies where the conditions relating to routine groundwater monitoring for 2024 have been addressed.

Table 2.3 Groundwater Conditions Addressed Within WMP

Approval Condition	Condition	Where Addressed
Sch. 3, Cond. 27(c) (PA 06_0261)	A groundwater monitoring programme that includes:	
	• *Additional baseline data of groundwater levels yield and quality in the region, and privately-owned groundwater bores, which could be affected by the project;*	See WMP. No private bores predicted to be impacted for current approved operations and no monitoring of private bores.
	• *Groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts of the project; and*	See **Section 4.3** for criteria **Section 6.0** comparison to triggers.
	• *A programme to monitor:* o *Groundwater inflows to the open cut mining operations; and*	See WMP.
	o *Impacts of the project on the region's aquifers, any groundwater bores, and surrounding watercourses, and in particular, the Hunter River and Wollombi Brook and adjacent alluvium; and*	See **Section 6.0**.

Approval Condition	Condition	Where Addressed
Sch. 3, Cond. 27(c) (DA450-10-2003)	A Groundwater Management Plan, which includes:	
	• *Detailed baseline data on groundwater levels, yield and quality in the region, and privately- owned groundwater bores, that could be affected by the development;*	See WMP.
	• *Groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts;*	See **Section 4.3** for criteria **Section 6.0** comparison to triggers.
	• *A programme to monitor:*	
	o *Groundwater inflows to the open cut mining operations;*	See WMP.
	o *the impacts of the development on:* ▪ *The alluvial aquifers, including additional groundwater monitoring bores as required by NOW;*	See **Section 5.1**.
	▪ *The effectiveness of the low permeability barrier;*	See **Section 5.3**.
	o *Base flows to the Hunter River;*	Groundwater trends reviewed in **Section 5.0**.
	o *Any groundwater bores on privately-owned land that could be affected by the development;*	No private bores predicted to be impacted for current approved operations and no monitoring of private bores.
	o *Groundwater dependent ecosystems, including the River Red Gum Floodplain Woodland EEC located in the Hunter River alluvium;*	See WMP.
	o *The seepage/leachate from water storages, backfilled voids and the final void;*	See **Section 5.3** – including discussion on groundwater trends within North Pit spoil.
	o *The development, including an independent review of the model, every three years and comparison of monitoring results with modelled predictions; and*	See **Section 8.0**.
	o *A plan to respond to any exceedances of the groundwater assessment criteria.*	See **Section 9.2**.
Sch. 3, Cond. 27(c) (DA450-10-2003)	• *A programme to validate and recalibrate (if necessary) the groundwater model for the development, including an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions;*	See **Section 8.0**.

Approval Condition	Condition	Where Addressed
HVO South Statement of Commitments	In addition to the mitigation measures undertaken at HVO for groundwater management, the following controls specific to the proposal will be implemented: • *Groundwater Flow To and From Rivers:* o *development of protocols for monitoring and reporting of NOW stream gauge results to clearly record any reductions in flows that are attributed to mining. This will include monitoring Hunter River flows immediately up gradient and down gradient of the site. In addition, consideration will be given to tying in specific CNA water level recordings with current NOW gauging locations;*	See Surface Water Review.
	o *monitoring of groundwater elevations within alluvium between the Hunter River and the Cheshunt Pit; and*	See **Section 5.1.3**.
	o *measured groundwater elevations and river flow will be assessed against predictions to determine whether application of additional management measures is required; and*	See **Section 8.0**.
	o *offset seepage to pits in accordance with regulatory requirements.*	See WMP.

Consent conditions for the approved Carrington West Wing extension (Modification 3) are also included in the WMP; however, there are no current plans to commence mining in this area in the near future.

Groundwater monitoring is conducted in accordance with the Groundwater Monitoring Programme outlined within Appendix A of the WMP. The programme outlines groundwater monitoring frequency, parameters to be tested and groundwater triggers for electrical conductivity (EC) and pH. This annual review is based upon the monitoring and reporting requirements documented within the October 2018 version of the WMP. However, an updated WMP was submitted by HVO to Department of Planning Housing and Infrastructure (DPHI) and is awaiting approval. Further discussion on the groundwater monitoring programme and triggers is included in **Section 4.0**.

2.4 Groundwater Licensing

Under the Water Act 1912 and Water Management Act 2000, sufficient water access licences (WAL) are required for approval of the mine developments. HVO holds sufficient licences for direct and indirect take associated with approved operations. Groundwater licenses held for HVO are outlined in **Table 2.4**.

Over the reporting period the WAL for 1800 units of water from the historical Lemington Underground workings (WAL39798 was transferred to Mt Thorley Warkworth (MTW) operations.

Table 2.4 Groundwater Licences Held by HVO

License Number	Description	Water Sharing Plan	Water Source - Management Zone	Approved Extraction (ML)
WAL40462	HVO Pit Excavations – Alluvial Lands Bores	North Coast Fractured and Porous Rock	Permian Coal Seams	2,400
WAL40463				180
WAL40466				460
WAL41527	HVO North – Carrington Pit			700
WAL41533	HVO North Pit Excavation			20
WAL18127	Carrington BB1	Hunter Unregulated and Alluvial Water Sources	Hunter Regulated River Alluvial Water Source – Upstream Glennies Creek Management zone	383
WAL18158	Ollenberry			65
WAL18307	HVO West – Parnells Creek Dam (Diversion Works Bywash)		Jerrys Management Zone	500
WAL18327	HV Loading Point Pump Bayswater Creek (Diversion Works)			150
WAL36190	HVO North, old farm bore			120
WAL23889	Greenleek		Lower Wollombi Brook Water Source	144
WAL962 (20AL201237)	Surface water access – West Pit area	Hunter Regulated River Water Source	Hunter River (Zone 1b) between Goulburn River junction and Glennies Creek junction	3,165
WAL970, WAL1006 & WAL1070 (20AL201256, 20AL201337 & 20AL201500)	Surface water access – HVO North and HVO South areas		Hunter River (Zone 2a) between Glennies Creek junction and Wollombi Brook junction	1,500 (500 each)

3.0 Environmental Setting

3.1 Climate

The climate within the HVO area is sub-tropical, with temperatures, rainfall and evaporation highest over the summer months of December to February. Daily rainfall data is collected at HVO at the site meteorological gauge (HVO Corp). **Table 3.1** provides the historical average monthly rainfall data (2012 to 2024), as well as monthly data from site. Annual rainfall for 2024 was slightly below the long term average. However, between April and October 2024 rainfall was above average for five out of seven months, with significant rainfall recorded in April of 114.8 mm.

Climate data was also obtained from the Scientific Information for Land Owners (SILO) database of historical climate records for Australia hosted by the Department of Environment and Science (DES). This service interpolates raw rainfall and evaporation records obtained from the Bureau of Meteorology (BOM), with data gaps addressed through data processing in order to provide a spatially and temporally complete climate dataset.

Climate data was obtained for a SILO grid point (Latitude -32.50, Longitude 151.00) at HVO between 01/01/1900 to 31/12/2024. A summary of rainfall data for SILO is presented in **Table 3.1**. The rainfall data indicates above average rainfall throughout the year with the exception of January, March, and October to December. Based on the SILO dataset the total rainfall over 2024 was above average with 644.2 mm recorded.

Over 2024, the site and SILO rainfall data are a relatively good match; however, the historical average recorded differs due to the difference in the length of time rainfall has been recorded.

Table 3.1 Monthly Rainfall (mm)

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Site Historical Average	75.9	72.9	107.6	47.2	23.3	40.6	39.1	35.2	33.2	46.9	72.8	62.1	**656.8**
Site 2024	39.4	76.6	39.2	114.8	62.8	98.2	37.6	38.2	30.8	50.0	40.2	17.6	**645.4**
SILO Historical Average	72.8	69.8	65.3	45.5	38.6	46.1	40.9	35.5	39.9	50.0	61.9	67.5	**633.8**
SILO 2024	43.7	74.7	34.9	122.4	64.5	63.8	43.1	45.0	41.2	41.7	46.5	22.7	**644.2**

Long term climate trends in the HVO site (HVO Corp) rainfall data from 2012 to present are displayed using a cumulative rainfall departure (CRD) rainfall plot in **Figure 3.1**. The CRD graphically shows trends in recorded rainfall compared to long-term averages and provides a historical record of relatively wet and dry periods. A rising trend in slope in the CRD graph indicates periods of above average rainfall, whilst a declining slope indicates periods when rainfall is below average. A level slope indicates average rainfall conditions. The area has generally experienced below average rainfall from 2016 until the end of 2019. From 2020 to 2022 the site experienced above average rainfall, followed by below average rainfall until March 2024. Above average rainfall was recorded in April, May, June, August and October followed by below average rainfall in November and December 2024. **Figure 3.2** shows that the SILO average monthly evaporation exceeds rainfall in all months.

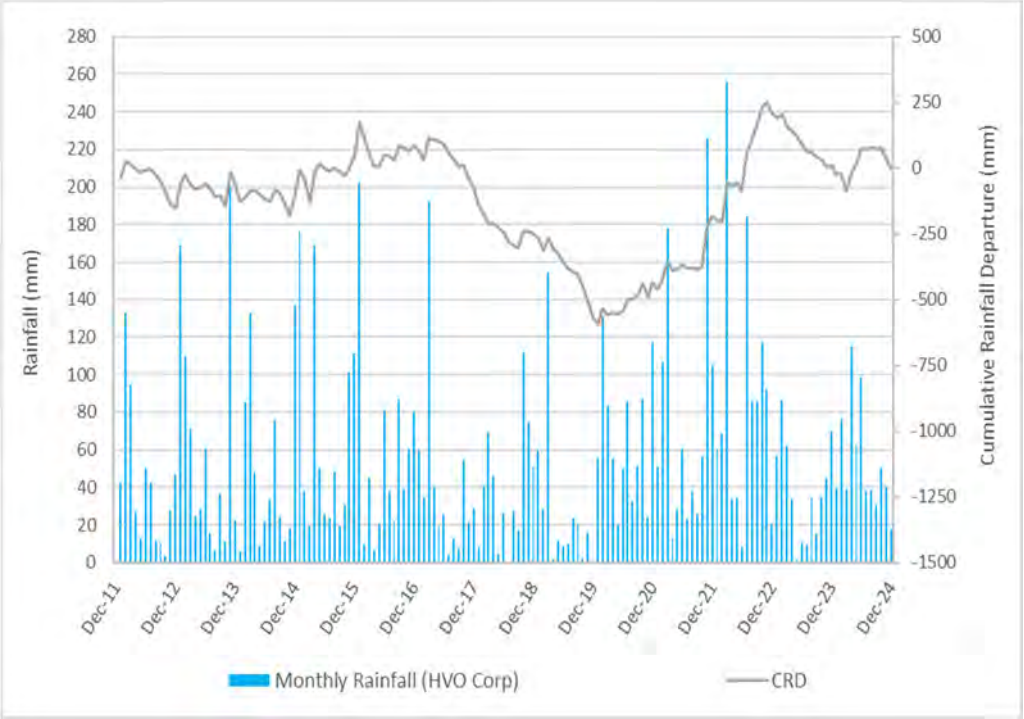


Figure 3.1 Cumulative Rainfall Departure and Monthly Site Rainfall

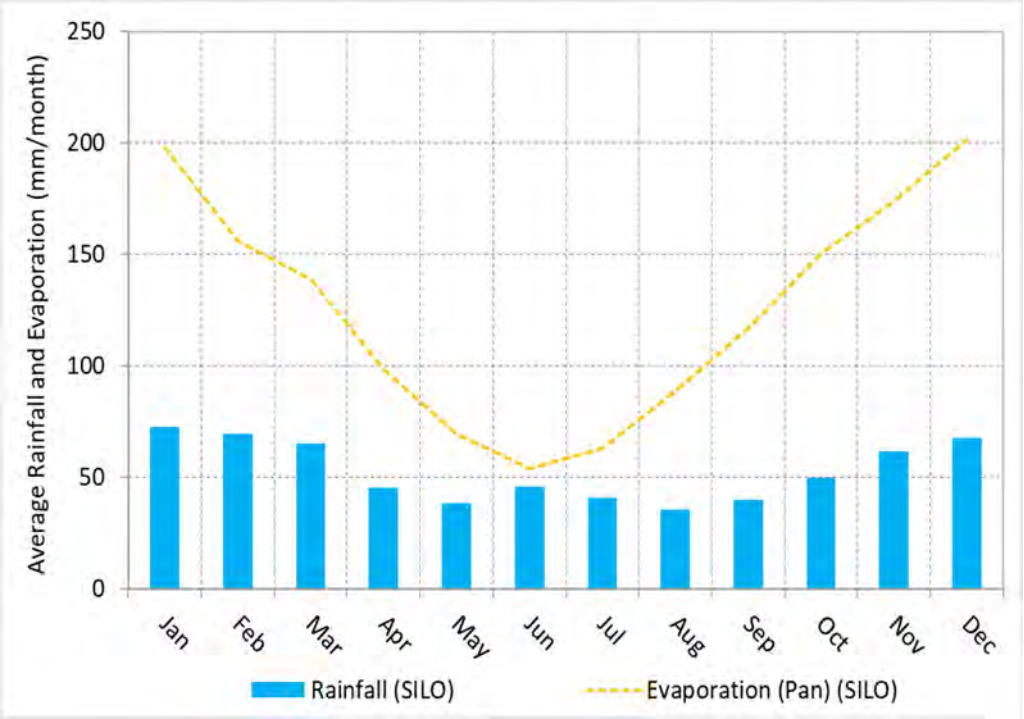


Figure 3.2 Evaporation

3.2 Streamflow

The terrain and drainage at HVO are dominated by the easterly flowing Hunter River, which dissects the complex in a general east-west direction. Ground elevations range between 60 m Australian Height Datum (mAHD) along the Hunter River alluvial plains to 180 mAHD in the northern parts of HVO North and in the western parts of HVO South. Minor ephemeral drainage features are also present around HVO North (i.e., Parnells Creek, Farrells Creek and Bayswater Creek) and HVO South (Wollombi Brook), which drain into the Hunter River.

Real time stream flow data is monitored along the Hunter River and Wollombi Brook at WaterNSW gauging stations via the Hunter Integrated Telemetry System (HITS). Time series river water elevations (mean level above zero-gauge elevation) are shown in **Figure 3.3** for three HITS stations (Hunter River @ Liddell, Hunter River @ U/S Foy Brook and Wollombi Brook @ Warkworth). In addition, HVO monitors the Hunter River monthly at surface water sites WL03 and WL05, WLP10 and WLP14.

During the reporting period, stream elevations within the Hunter River ranged from 67.8 mAHD upstream at Liddell (210083), down to 49.4 mAHD at Foy Brook (210126). Levels fluctuated slightly over 2024 in response to slightly below average rainfall. Review of stream discharge for the Hunter River at Foy Brook indicates discharge rates peaked in June with the highest flow of 7,746 MLs/day recorded on the 4 June 2024.

During the reporting period, stream elevations within Wollombi Brook at Warkworth (210004) ranged between 48.7 mAHD and 50.9 mAHD. Stream discharge indicates flow within Wollombi Brook ranged from no flow to 4,261 ML/day (8 May) during the reporting period.

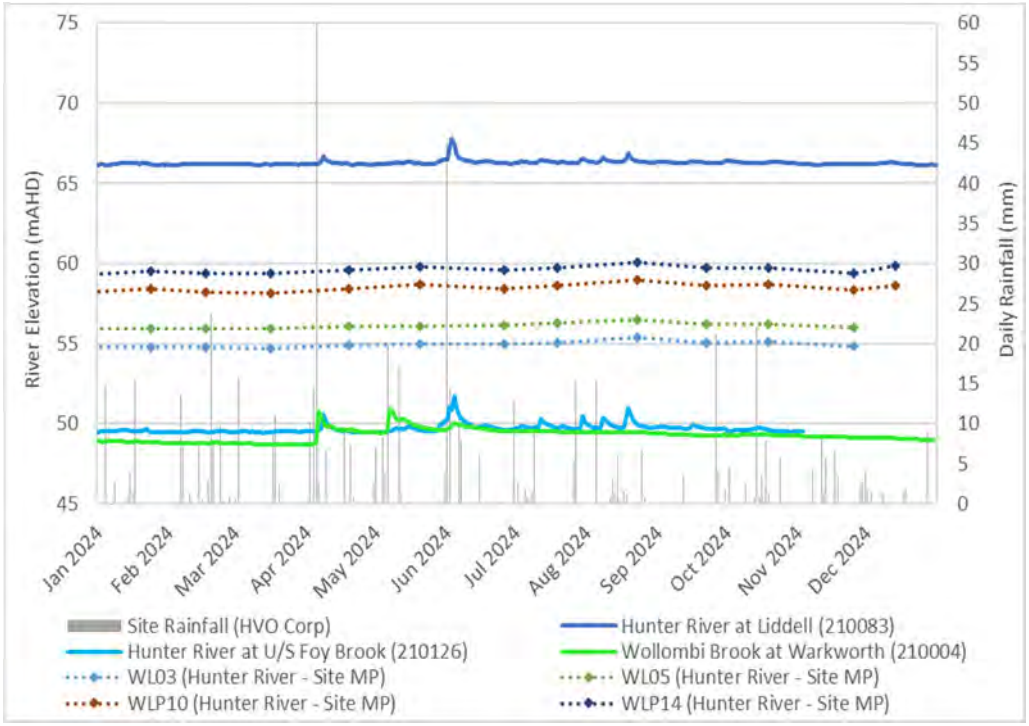


Figure 3.3 Surface Water Levels

3.3 Geology

HVO lies within the Hunter Coalfields, which are dominated by the Permian aged Whittingham Coal Measures of the Sydney Basin. The Whittingham Coal Measures are comprised of the Jerrys Plains Sub-group and Van Sub-group, which consist of coal seams with overburden and overburden (sandstone, siltstone, tuffaceous mudstone and conglomerate). The Whittingham Coal Measures are truncated to the east by the Hunter-Mooki Thrust Fault and occur at HVO as stratified (layered) sequences that dip at a shallow angle to the southwest. The coal seams subcrop to the north and east of the HVO complex (SLR, 2020). The Muswellbrook Anticline and the Bayswater Syncline are also present to the west and north and east of HVO, respectively.

The Whittingham Coal Measures are incised by a paleochannel of the Hunter River within HVO North. The properties and extent of the paleochannel were assessed and mapped by MER (2008). The paleochannel comprises heterogeneous distribution of silts, sands and gravels.

Quaternary alluvium, comprising surficial sediments of silts and clays, unconformably overlies the Permian coal measures along the Hunter River and Wollombi Brook. Along the Hunter River and Wollombi Brook, the surficial sediments overlie basal sands and gravels that are between 7 m to 20 m thick (SLR, 2020).

Within HVO North, mined out areas have been backfilled with spoil and fine rejects. The spoil consists of Permian interburden and overburden waste material.

The surface geology within the HVO complex is summarised in **Table 3.2** and shown in **Figure 3.4**.

Table 3.2 HVO Generalised Stratigraphy (*After*: SLR, 2020)

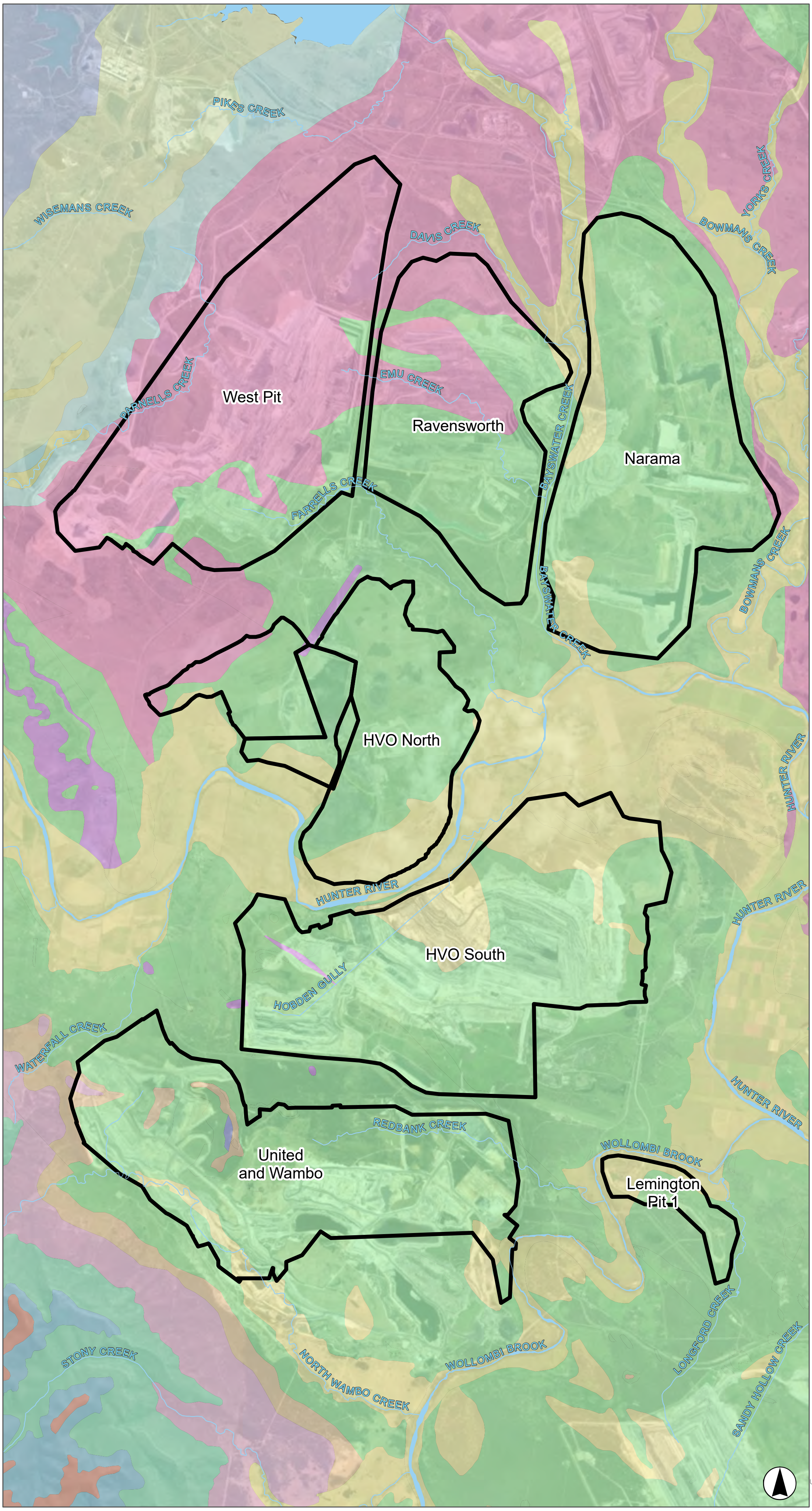
Age	Stratigraphic Unit		Description
Cainozoic	Quaternary alluvial sediments (Qa)	Surficial alluvium (Qhb)	Shallow sequences of clay, silty sand and sand.
		Productive basal sand/gravel (Qha)	Basal sands and gravels along major watercourses (i.e., Hunter River and Wollombi Brook).
	Silicified weathering profile (Czas)		Silcrete.
	Alluvial terraces (Cza)		Silt, sand and gravel.
Jurassic	Volcanics (Jv)		Flows, sills and dykes.
Permian	Whittingham Coal Measures	Jerrys Plains Sub-group (Pswj)	Coal bearing sequences interbedded with sandstone and siltstone. Coal seams (youngest to oldest) include Whybrow, Redbank Creek, Wambo, Whynot, Blakefield, Glen Munro, Woodlands Hill, Arrowfield, Bowfield, Warkworth, Mt Arthur, Piercefield, Vaux, Broonie and Bayswater.
		Archerfield Sandstone (Pswv)	Lithic sandstone marker bed.
		Vane Sub-group (Pswv)	Coal bearing sequences interbedded with sandstone and siltstone. Coal seams (youngest to oldest) include Lemington, Pikes Gully, Arties Liddell, Barrett and Hebden.
		Saltwater Creek Formation (Psws)	Sandstone and siltstone, minor coaly bands, siltstone at base.

FIGURE 3.4

Surface Geology

Legend
- Mine Areas
- Mapped Watercourses (named)
- Road
- Mapped Watercourses (named)
- Named Waterbody

Geology
- Alluvial Deposits
- Sills and Dykes
- Banks Wall Sandstone
- Narrabeen Group
- Widden Brook Conglomerate
- Newcastle Coal Measures
- Watts Sandstone
- Denman Formation
- Jerrys Plains Subgroup
- Vane Subgroup
- Saltwater Creek Formation
- Branxton Formation
- Mulbring Siltstone



0 1 2
Kilometres

Scale 1:90,000 at A4
GDA2020 MGA Zone 56

Image Source: ESRI Basemap (2022) **Data source:** NSW DFSI (2022)

3.4 Groundwater Units

The main groundwater units at HVO and the surrounding area are the productive alluvium associated with the Hunter River and Wollombi Brook, and the Permian coal seams of the Whittingham Coal Measures. Groundwater unit information has been derived from historical groundwater assessment reports, summarised in **Section 2.2**.

3.4.1 Alluvium

The Quaternary alluvium is an unconfined groundwater system that is recharged by rainfall infiltration, streamflow and upward leakage from the underlying stratigraphy, particularly in undisturbed areas (i.e., away from active mining). The flow direction within the alluvium generally follows topography. (Groundwater within the Hunter River alluvium flows in an easterly direction, while water within the Wollombi Brook alluvium flows in a north to north-easterly direction towards the Hunter River (SLR, 2020).

Regionally, the Hunter River and Wollombi Brook predominantly gain water from the surrounding alluvium, as well as from rainfall and regulated flow. However, there are also areas with losing conditions where rivers recharge the underlying alluvium. These losing conditions can occur around areas of active mining, where the hydraulic gradient is increased due to depressurisation of the underlying coal measures. Losing conditions also occur within the more topographically elevated tributaries of the main water courses, where the water table is deeper and not connected directly to the streams (SLR, 2020).

The less productive groundwater within the surficial alluvium does not meet the ANZECC (2000) water quality guidelines for stock water supply. However, the water quality of the highly productive alluvium, which includes basal sands and gravels is considered suitable for stock water supply. However, most agricultural producers (crop and cattle) utilise surface water resources (Hunter River and Wollombi Brook) in preference to alluvial groundwater (SLR, 2020).

The alluvial aquifer of the Hunter River supports Carrington Billabong, an ephemeral freshwater wetland located south of Carrington Pit that is considered a Groundwater Dependant Ecosystem (GDE). Alluvial groundwater levels around Carrington Billabong have remained relatively stable during active mining at Carrington Pit. This is due to installation of a barrier wall through the unconsolidated alluvial sediments, which separates the Billabong from Carrington Pit. The stable alluvial groundwater levels in this area are also taken to indicate limited hydraulic connection between the nearby paleochannel alluvium and the underlying depressurised coal measures (SLR, 2020).

3.4.2 Permian Coal Measures

The Whittingham Coal Measures outcrop across the north and east of the HVO complex. The coal measures form unconfined groundwater systems at outcrop, becoming semi-confined to confined as they dip towards the southwest.

Recharge occurs from direct rainfall infiltrating into the formations through the thin soil cover and weathered profile. The coal measures also occur at subcrop in localised zones beneath the alluvium associated with the Hunter River and Wollombi Brook, where the unit is recharged by downward seepage where gradients induce flow. The coal seams are typically moderately to slightly permeable, with hydraulic conductivity of the interburden generally less than coal seams but more variable, depending on the predominance of fractures in the rock mass. The hydraulic conductivity of the coal seams generally decreases with depth due to the closure of the cleats with increasing stratigraphic pressure (SLR, 2020).

Groundwater flow direction within the Whittingham Coal Measures is influenced by the local geomorphology and structural geology. The long history of mining within the region has also significantly altered groundwater flow paths within the Permian units. On a regional scale, groundwater flow in the Permian aquifers follows topography, flowing in a north-easterly direction. On a local scale, groundwater levels show drawdown impacts associated with the extensive active mining areas. Groundwater discharge from the Whittingham Coal Measures occurs as discharge to active mining and abstraction bores, as well as upward seepage to the Quaternary alluvium where hydraulic gradients induce flow (SLR, 2020).

Due to the poor water quality of the Permian coal measures, that generally exceeds ANZECC (2000) water quality guidelines for stock supply, there is no significant usage of groundwater from the Permian coal measures. Stock supply is primarily derived from perennial surface water flows (Hunter River and Wollombi Brook) and the more productive alluvial aquifer (SLR, 2020).

4.0 Groundwater Monitoring

4.1 Groundwater Monitoring Program

Groundwater monitoring is conducted at HVO in accordance with the WMP (HVO, 2018), which includes details on the Groundwater Management Plan and Groundwater Monitoring Program. The monitoring results are used to monitor trends in physical and geochemical parameters of groundwaters that are potentially influenced by mining.

The groundwater monitoring network at HVO is comprised of a series of monitoring bores and vibrating wire piezometers (VWPs), detailed in **Appendix A**. The groundwater monitoring network, outlined within the WMP, is comprised of 127 monitoring sites which includes 119 compliance monitoring bores and eight VWPs, as detailed in **Table 4.1**. Of the 119 compliance monitoring bores, 104 have water quality triggers and five have water level triggers defined. The groundwater monitoring network is presented in **Figure 4.1** to **Figure 4.3**.

In 2019, SLR undertook a network review which identified some changes in target geology compared to the WMP. The network review also assessed the condition and purpose of each bore and made recommendations to remove bores from the monitoring network that were damaged or destroyed, not providing representative groundwater data, where duplicate monitoring locations existed and where site activities have ceased. In 2023, Umwelt reviewed the draft WMP and made further recommendations on the monitoring network. Groundwater level and quality triggers were also reviewed, and the trigger levels were updated based on all historical data available and set based on geographical and target stratigraphy. The baseline data was used to update the 95th percentile for EC and 5th and 95th percentiles for pH. An updated groundwater monitoring program has been included in the draft WMP (version 3.4) which is currently with DPHI awaiting approval. For the purposes of annual reporting, the results are presented in comparison to the details in the current WMP (HVO, 2018) and, if exceedances recorded, discussed with reference to the revised monitoring programme recommendations.

Table 4.1 Groundwater Monitoring Network

Geology	Location	No. of Bores
Alluvium	Carrington	5
	Carrington West Wing	9
	Cheshunt/North Pit	17
	Lemington South	3
	West Pit	5
Permian coal measures	Carrington	5
	Carrington West Wing	2
	Cheshunt	13
	Lemington South	30
	Southern	12
	West Pit	11 (8 VWPs)
Spoil	Carrington	2
	North Pit	13

Monitoring of groundwater levels and groundwater quality is undertaken at the bores detailed in the WMP (HVO, 2018), and defined below:

- Groundwater Level (127 bores):
    - Manual groundwater elevation/depth to groundwater measurements at a monthly (4), quarterly (94) or six monthly (29) frequency
    - Monitoring bore data logger/VWP sensors download quarterly, and verification and validation of instrument drift and correction.
- Groundwater Quality Analysis – Standard (119 bores):
    - Quarterly: field readings of water temperature, pH and electrical conductivity (EC).
- Groundwater Quality Analysis – Comprehensive (65 bores):
    - Six Monthly (27) or Annually (38): the standard analysis with the addition of laboratory analysis of pH, EC, Total Dissolved Solids (TDS), Aluminium, Arsenic, Boron, Calcium, Cadmium, Chloride, Carbonate, Copper, Mercury, Potassium, Magnesium, Sodium, Nickel, Lead, Selenium, Sulphate, Zinc, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, Hydroxide Alkalinity. Three of the six monthly monitoring bores (CHPZ1A, PZ2CH400 and PZ3CH800) require the following additional analyses: Beryllium, Cobalt, Fluoride, Iron, Manganese, Ammonia, Nitrite, Nitrate, Phosphorus, Rubidium, Antimony, Silica, Strontium.

Groundwater quality sampling is undertaken quarterly by external contractors AECOM in accordance with AS/NZS 5667.1:1998 (R2016) Guidance on the design of sampling programs, sampling techniques and the prevention and handling of samples and AS/NZ 5667.11:1998 (R2016) *Guidance on sampling of groundwater.* Field sheets, detailing the sample location, date, time, field EC, field pH and water level below top of casing are completed by AECOM during each monitoring round. The field sheets compiled by AECOM and results stored in HVO's EMD have been reviewed by Umwelt for this report. A summary of the water quality data is presented in **Appendix F**.

4.2 Data Recovery

Groundwater level and quality data, along with field and lab sheets, were downloaded from the HVO site database (EMD) by Umwelt. As per the WMP, groundwater level monitoring and sampling is required to be carried out at 127 monitoring bores. Over 2024, monitoring of 123 bores was undertaken. Four bores were unable to be monitored throughout the year, either due to the bore collapsed (NPz3), bore blocked (CGW45 and GW-108), bore mined out (NPz5), data unable to be downloaded due to failed VWP units (GW-103 and GW-105 (V3)) or calibration information for data conversion is unavailable (GW-110).

Monitoring bores with a data capture rate of less than 100 per cent are summarised in **Table 4.2**.

Table 4.2 Groundwater Monitoring Data Recovery – Compliance Bores

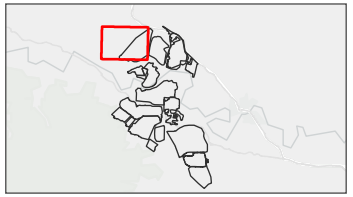
Bore ID	Type Not Measured	Data Recovery	Comments
BUNC45A	WL	50%	HVO requested that a sample not to be collected in Q4
BZ4A(2)	WQ	50%	Insufficient water to sample in Q2 and Q4
BZ8-2	WL/WQ	75%	No access in Q4
CGW45	WL/WQ	0%	Blocked
D612 (AFS)	WQ	50%	Dry Q1 to Q4
GW-101	WQ	50%	Dry Q1 to Q4
GW-107	WQ	50%	Dry Q1 to Q4
GW-108	WL	50%	Blocked, unable to sample Q1 to Q4
NPz3	WL/WQ	0%	Bore Collapsed
NPz5	WL, WQ	0%	Mined through, no longer exists
GW-103	WL	0%	All sensors failed in 2020
GW-105 (V3)	WL	0%	Sensor failed in 2020
GW-110	WL	0%	Calibration data unavailable

FIGURE 4.1

Groundwater Monitoring Network – HVO North: West Pit

Legend

- Groundwater Compliance Monitoring Network
- Mine Areas



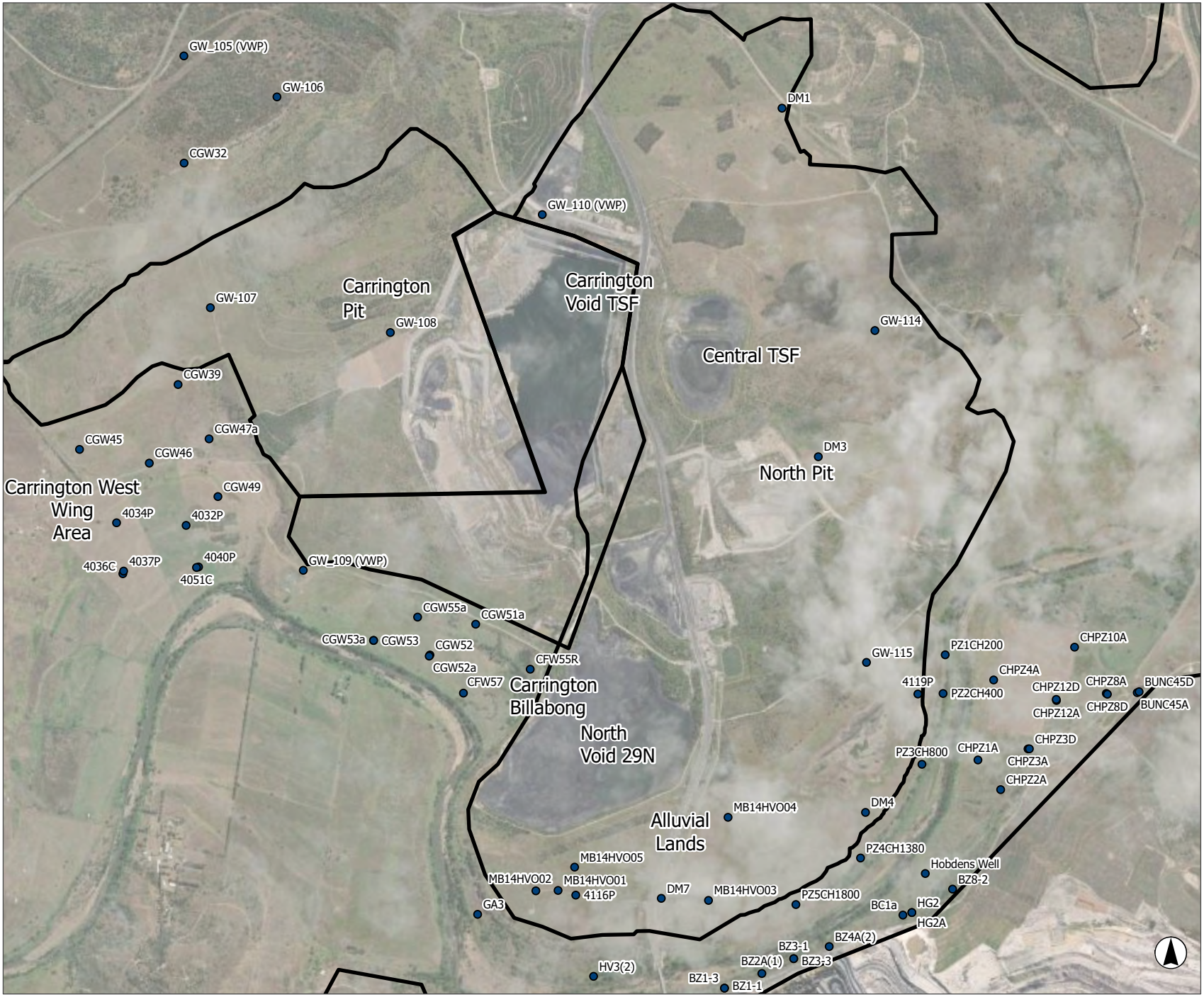
Scale 1:35,000 at A4

GDA2020 MGA Zone 56

Image Source: ESRI Basemap (2022) **Data source:** NSW DFSI (2022)

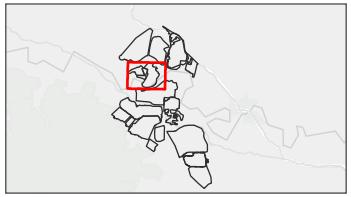
FIGURE 4.2

Groundwater Monitoring Network – HVO North: North Pit and Carrington



Legend

- Groundwater Compliance Monitoring Network
- Mine Areas



0 0.5 1
Kilometers

Scale 1:28,500 at A4
GDA2020 MGA Zone 56

Image Source: ESRI Basemap (2022) **Data source:** NSW DFSI (2022)

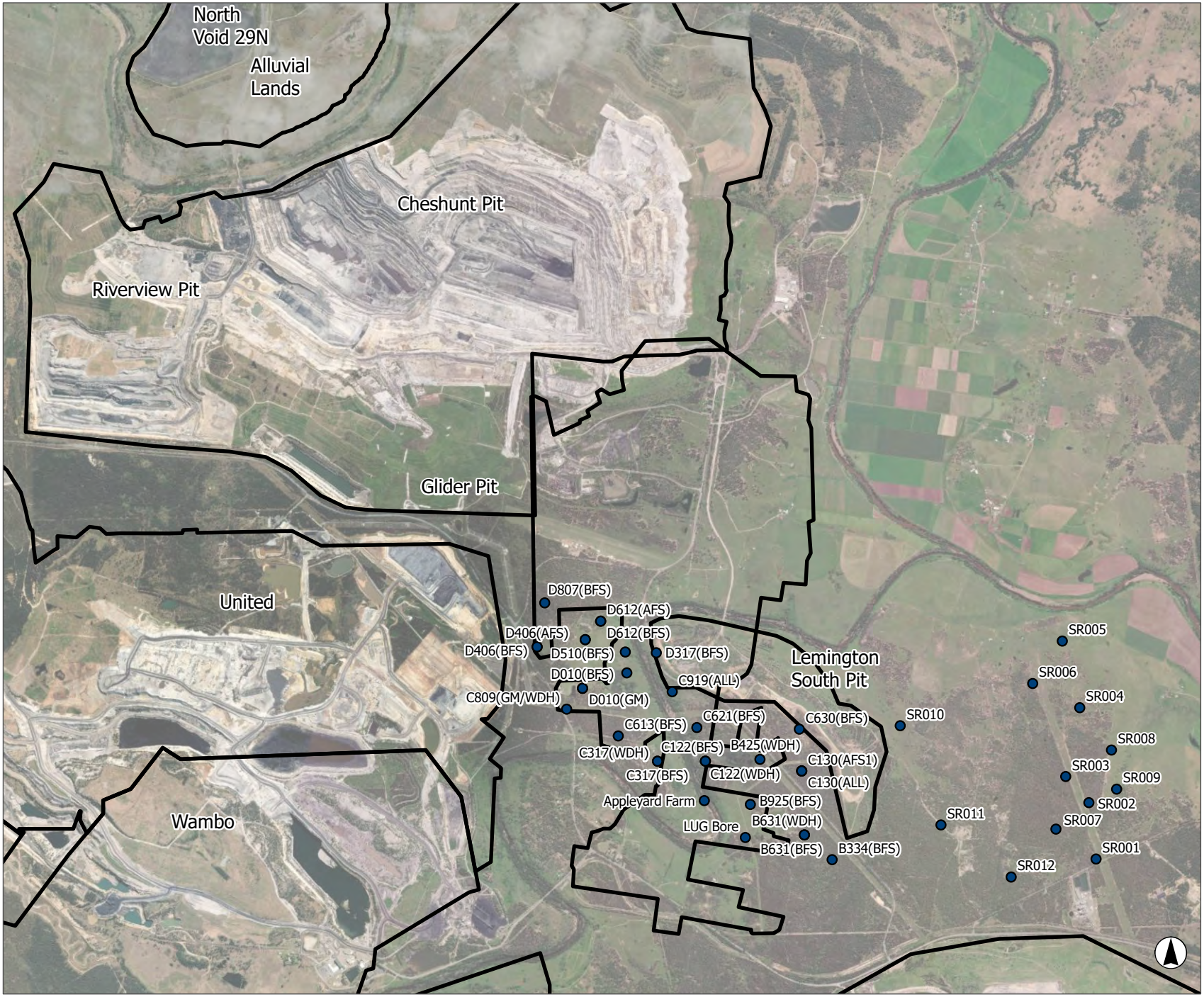
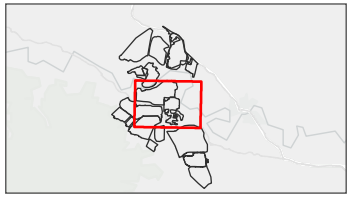


FIGURE 4.3

Groundwater Monitoring Network – HVO South: Riverview Pit, Cheshunt Pit and Lemington South

Legend

- Groundwater Compliance Monitoring Network
- Mine Areas



0 0.5 1
Kilometers

Scale 1:50,000 at A4
GDA2020 MGA Zone 56

Image Source: ESRI Basemap (2022) **Data source:** NSW DFSI (2022)

4.3 Groundwater Triggers

Groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts, are detailed in the WMP (HVO, 2018). These criteria are summarised in **Table 4.3**.

Table 4.3 Groundwater Impact Assessment Criteria

Criteria	Description
1	The groundwater level does not decline more than 2 m at any privately owned bores and wells identified in the HVO complex EA's (with the exception of a single bore on land owned by the Ravensworth mine (10011459) which is predicted to decline by a maximum of 2.7 m).
2	Water quality does not lower the beneficial use category of the groundwater source beyond 40 m from the mining pit. This will be identified using groundwater triggers (EC) for individual monitoring bores specified in the Groundwater Monitoring Programme.
3	The alluvial groundwater source within 40 m of the recognised GDE communities does not experience more than a 10% reduction in piezometric levels predicted in the EA's for HVO North and HVO South (allowing for typical climatic variation).

Criteria 2 in **Table 4.3** relates to the trigger levels established for EC based on the 95th percentile, and the 5th and 95th percentiles for pH, of data collected from 2011 onwards (HVO, 2018). The trigger levels, as presented in the WMP (HVO, 2018) are summarised in **Table 4.4**. Groundwater quality data from the compliance monitoring bores have been compared to the trigger levels in **Section 6.0**.

Table 4.4 Groundwater Quality Trigger Levels

Location	Target Stratigraphy	pH (5th Percentile)	pH (95th Percentile)	EC (µS/cm) (95th Percentile)
Carrington	Alluvium	7.0	8.0	6,154
	Interburden (sandstone/siltstone)	6.7	7.4	10,824
	Broonie Seam	6.8	7.1	8,628
Carrington West Wing	Alluvium	7.0	7.5	2,775
	Bayswater	7.3	7.6	3,531
	LBL	6.5	7.2	1,894
Cheshunt	Mt Arthur Seam	6.5	7.6	3,350
	Interburden (sandstone/siltstone)	6.9	7.7	6,213
	Piercefield Seam	6.4	6.8	2,596
Cheshunt/North Pit	Alluvium	6.6	7.5	4,462
Lemington South	Bowfield Seam	6.7	7.9	12,440
	Woodlands Hill Seam	6.6	7.6	20,240
	Arrowfield Seam	6.8	7.5	15,324
	Alluvium	6.6	7.7	3,938
	Glen Munro Seam	6.7	7.1	11,408
	Interburden (sandstone/siltstone)	6.8	7.0	22,700

Location	Target Stratigraphy	pH (5th Percentile)	pH (95th Percentile)	EC (µS/cm) (95th Percentile)
North Pit	Spoil	6.5	7.8	12,460
West Pit	Interburden (sandstone/siltstone)	6.9	8.0	13,428

The WMP (HVO, 2018) also includes individual groundwater level triggers for five bores in the Carrington alluvium, based on the 5th and 95th percentile of the available standing water level (SWL) data for each bore. The trigger levels are detailed in **Table 4.5**. The SWL triggers for the five alluvium bores were derived to meet the AIP criteria for GDE communities at HVO (HVO, 2018).

Table 4.5 Water Level Trigger Levels – Carrington Alluvium

Bore	SWL Trigger (mAHD) (5th Percentile)	SWL Trigger (mAHD) (95th Percentile)
CFW55R	57.06	59.41
CFW57	58.24	59.24
CGW52a	58.23	60.52
CGW53a	58.33	59.19
CGW55a	57.49	58.43

A trigger exceedance is defined as three consecutive measurements of EC, pH or SWL that exceed trigger values specified in the WMP (HVO, 2018). An exceedance will trigger a site-specific investigation, which will determine the source and risk of impact on water quality, impacts to GDE communities and will be reported in the annual review (HVO, 2018).

In addition, triggers have been developed for the North Void Tailings Facility (NV TSF) assessment under the Environmental Protection Licence (EPL). Water level triggers were assigned to alluvial bores positioned within and just outside the extent of impacted groundwater. These triggers will supersede triggers outlined in **Table 4.5** and have been updated in the revised WMP which is with DPHI awaiting approval.

Similarly, groundwater level and groundwater quality triggers have also been revised for a number of other bores in the revised WMP (version 3.4) which is awaiting approval from DPHI.

5.0 Monitoring Results

A summary of the water level and water quality results is provided for each of the main water bearing units (alluvium, Permian coal measures and spoil) in **Section 5.1** to **Section 5.3**. Routine water level readings for 2024 are presented in **Appendix B** and historical trends are presented in **Appendix C**. Routine EC and pH readings and historical trends are presented in **Appendix D** and **Appendix E**, respectively.

5.1 Alluvium

One bore was recorded as dry throughout 2024 (GW-101). Most alluvial bores recorded a relatively stable groundwater levels over 2024 in response to slightly below average rainfall over the same period. Where saturated, groundwater within the alluvium occurred between 0.80 m (bore G2) and 21.21 m below surface (bore BUNC45A) over 2024. Discussion of groundwater level and quality trends within the alluvium is included for each of the mine areas from **Section 5.1.1** to **Section 5.1.4**.

5.1.1 West Pit

5.1.1.1 Groundwater Level Trends

Groundwater levels for the five alluvial/regolith bores north and northwest of West Pit are presented in **Figure 5.1**. Over 2024 groundwater elevations within the three bores (G1, G2 and G3) on the south-western side of Parnell's Creek Dam ranged between 106.56 mAHD (2.04 mbgl) and 109.80 mAHD (0.80 mbgl), in bores G3 and G2, respectively. Groundwater levels remained relatively stable over 2024.

Bores GW-100 and GW-101 are located along Parnell's Creek, downslope of the dam (18W). Groundwater levels within bore GW-100 remained stable over 2024. Review of the bore construction log indicates GW-100 is 6 m deep and has a screen from 4.4 m to 5 m below surface within gravels (colluvial deposit). Groundwater levels within bore GW-100 show a general decline since 2015 from 4.68 m below top of casing (TOC) to 6.21 mbTOC near the base of the bore in December 2019. Groundwater levels increased from January 2020 to 3.56 mbTOC in December 2022 in response to above average rainfall followed by a decline of 0.5 m over 2023 in response to below average rainfall. Groundwater levels remained stable over 2024.

Bore GW-101 was recorded as dry throughout 2024, a continuation of the trend over 2022 and 2023. Bore GW-101 is 12 m deep and has a screen from 9 m to 12 m depth within clay. Bore GW-101 has recorded groundwater levels over 12 mbgl and noted as dry or having insufficient water to sample since 2013. This may relate to the construction of the bore screen across low permeability clay.

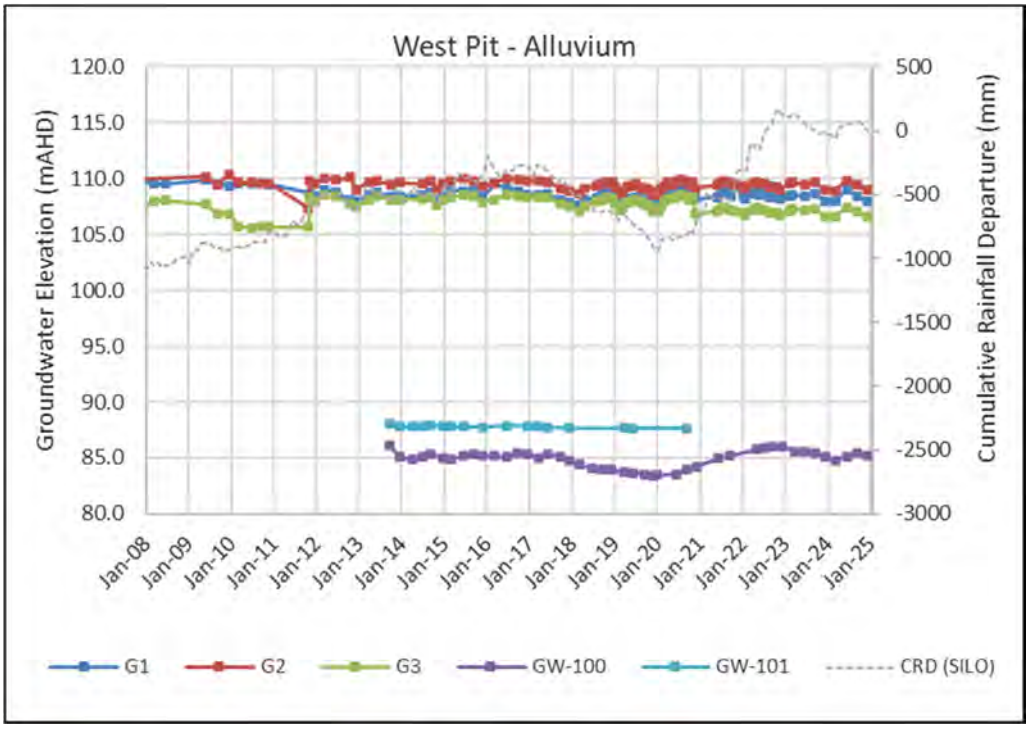


Figure 5.1 Groundwater Levels – West Pit Alluvium

5.1.1.2 Groundwater Quality Trends

The pH and EC readings recorded over 2024 are summarised in **Table 5.1**.

Table 5.1 Summary of pH and EC Recorded Over 2024 – West Pit Alluvium

Screened Lithology	pH Range	EC Range (µS/cm)	Comment
Alluvium	7.3 – 8.5	3,500 – 11,310	Bore GW-100 recorded consecutive EC readings above the trigger level throughout 2024, increasing from 11,010 µS/cm (Jan) to 11,310 µS/cm (Dec).

EC within the alluvial groundwater at bore GW-100 increased slightly over 2024, in a similar trend to 2023. Prior to 2023 EC concentrations remained relatively stable ranging between 9,570 µS/cm and 11,510 µS/cm. Although the 2024 EC readings are within the historical range, they are consecutive and therefore constitute and exceedance and this is discussed further in **Section 6.0**.

5.1.2 Carrington and Carrington West Wing

5.1.2.1 Groundwater Level Trends

Groundwater levels for alluvial bores on the western limb of the paleochannel, near Carrington West Wing, are shown in **Figure 5.2**. Over 2024 groundwater elevations within bores 4032P, 4034P, 4037P, 4040P, and CGW49 in this area ranged between 59.64 mAHD and 61.29 mAHD (11.51 mbgl and 7.76 mbgl), in bores 4034P and CGW49 respectively. Groundwater levels remained relatively stable over 2024 in all bores, with the exception of bore CGW49, which recorded a rise in water level of 0.9 m between September and December 2024.

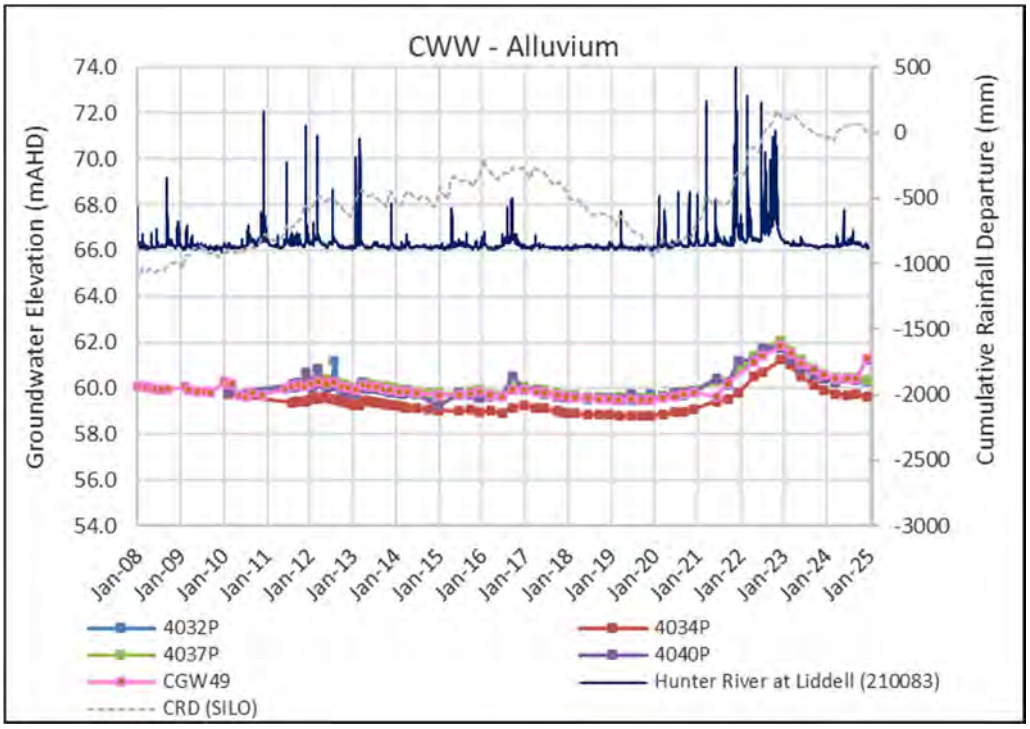


Figure 5.2 Groundwater Levels – Carrington West Wing Alluvium (Western Limb)

Groundwater levels for bores within the floodplain alluvium on the northern end of the paleochannel (CGW32 and GW-106) and the two bores on the western limb of the paleochannel (CGW39 and CGW47a) near Carrington and Carrington West Wing are shown in **Figure 5.3**. Over 2024 groundwater elevations within the four bores in this area ranged between 59.46 mAHD (19.02 mbgl) and 60.37 mAHD (10.02 mbgl). All bores remained relatively stable over 2024.

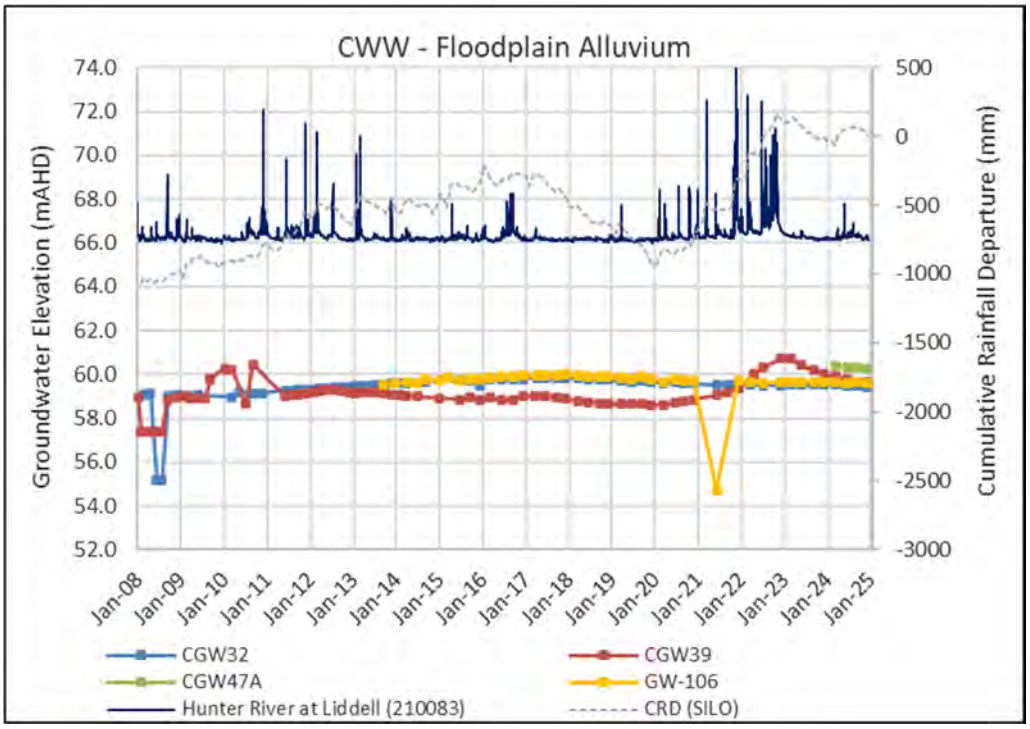


Figure 5.3 Groundwater Levels – Carrington West Wing – Floodplain Alluvium (Western Limb)

Groundwater levels for the five bores within the alluvium on the eastern limb of the paleochannel near Carrington Pit are shown in **Figure 5.4**. The groundwater levels in all five bores, CFW55R, CGW53a, CFW57, CGW55a and CGW52a, remained relatively stable with minor fluctuations over 2024.

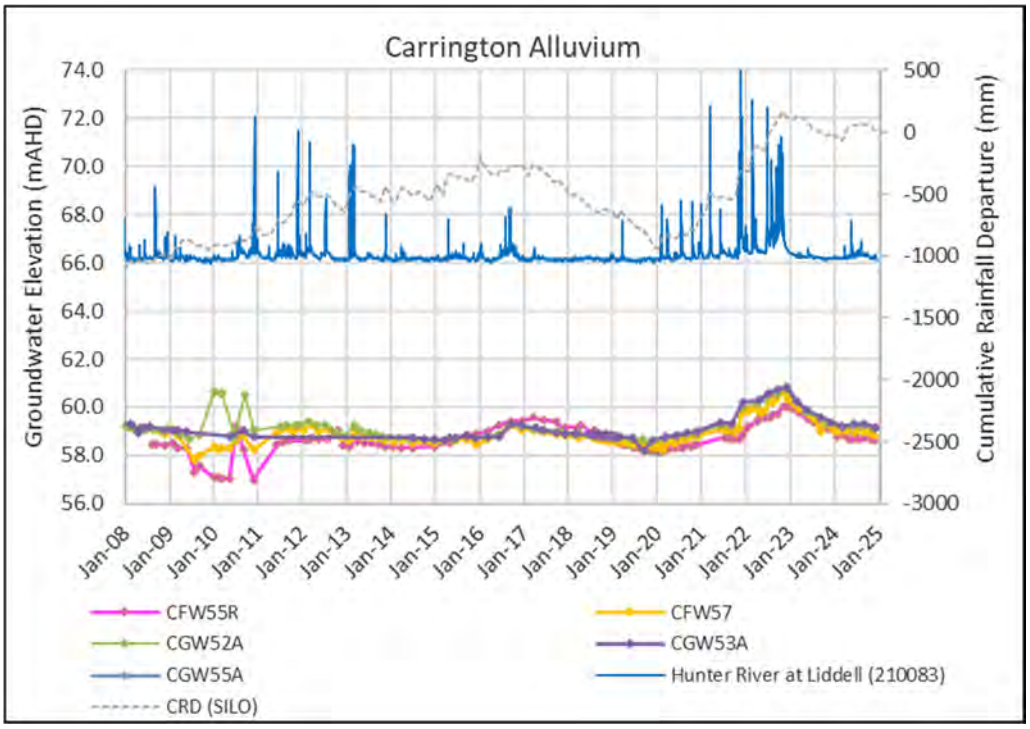


Figure 5.4 Groundwater Levels – Carrington Alluvium

Existing groundwater monitoring bores located to the west of the NV TSF, are used to monitor groundwater levels and quality within the Carrington Billabong area and monitor the extent of impacts and response to management practices. Groundwater level triggers were assigned to five alluvial bores at Carrington; CFW55R, CFW57, CGW52a, CGW53a and CGW55a. Groundwater level graphs for each of the bores are compared to CRD in **Figure 5.5** and **Figure 5.9**.

Groundwater levels within all five bores recorded an overall slight decline over 2024 in response to slightly below average rainfall and stream flow. Groundwater levels in bores CGW53a and CGW55a exceeded the 95th percentile trigger between mid to late 2021 and December 2024. Groundwater levels in bores CFW55R, CFW57 and CGW52a did not exceed the trigger levels over 2024. The exceedances are discussed further in **Section 6.0**.

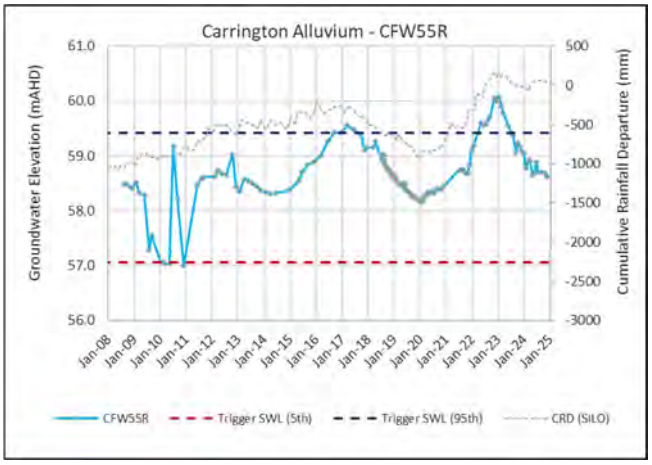


Figure 5.5 Groundwater Levels – CFW55R

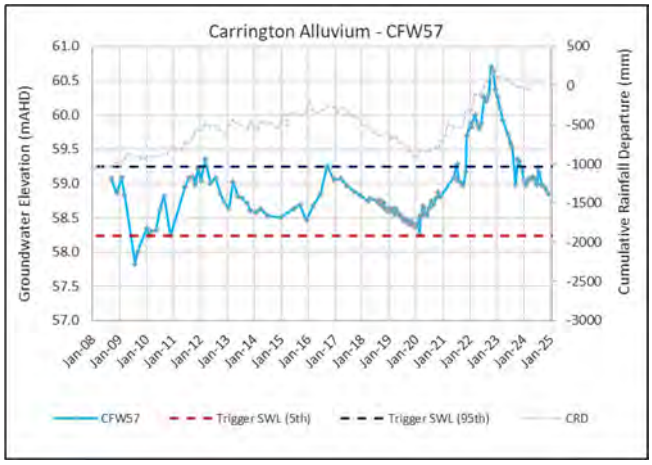


Figure 5.6 Groundwater Levels – CFW57

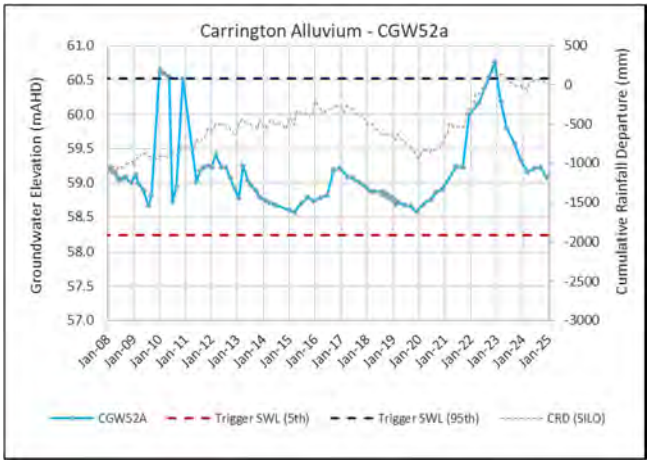


Figure 5.7 Groundwater Levels – CGW52a

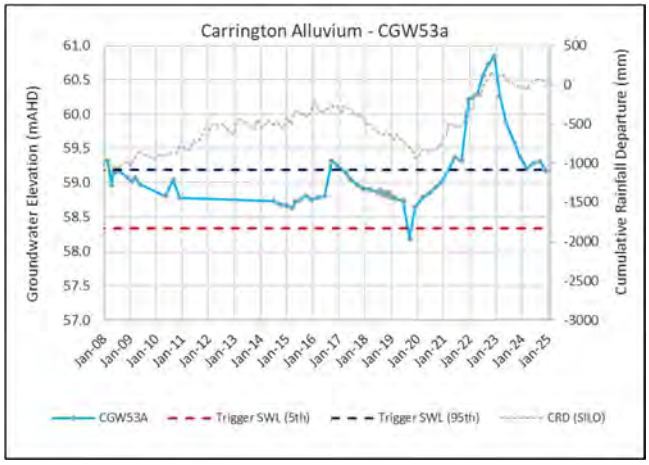


Figure 5.8 Groundwater Levels – CGW53a

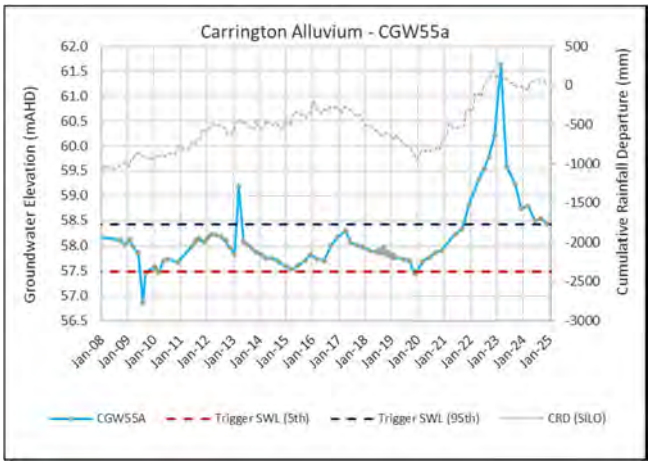


Figure 5.9 Groundwater Levels – CGW55a

5.1.2.2 Groundwater Quality Trends

The pH and EC readings recorded over 2024 are summarised in **Table 5.2**.

Table 5.2 Summary of pH and EC Recorded Over 2024 – Carrington and Carrington West Wing Alluvium

Screened Lithology	pH Range	EC Range (µS/cm)	Comment
Carrington Alluvium	7.1 – 8.1	1,075 – 4,090	Bore CGW55a recorded one pH reading (8.1) above the upper trigger level in Q1.
Carrington West Wing Alluvium	7.2 – 7.5	1,196 – 2,430	There were no pH or EC exceedances recorded over 2024.

Bore CGW55a intersects alluvium within the eastern limb of the paleochannel near Carrington. Historical readings show that bore CGW55a has recorded pH ranging between 6.8 and 8.4. Over 2024 pH readings remained relatively stable and within historical levels. The results show no adverse impacts due to mining.

5.1.3 Cheshunt Pit/North Pit

5.1.3.1 Groundwater Level Trends

Groundwater levels for bores within the alluvium north and south of the Hunter River, between North Pit and Cheshunt Pit are shown in **Figure 5.10**. Where the alluvium is saturated, groundwater levels ranged between 51.47 mAHD (21.21 mbgl) and 61.82 mAHD (9.57 mbgl), in bores BUNC45A and BZ1-2, respectively. Over 2024, groundwater levels remained relatively stable, with minor fluctuations.

Groundwater levels in bore BUNC45A were at or below the base of the screen since monitoring began and over 2024. Groundwater quality samples should not be collected if water level is below 19.3 mbTOC as they will likely not be representative of the surrounding aquifer. It is noted that bore BZ1-1 is included in the current WMP as being within the alluvium; however, as identified in prior annual reviews (AGE, 2013a) the bore likely intersects interburden material. The target lithology has been updated in the revised WMP, which has been submitted to DPHI for approval.

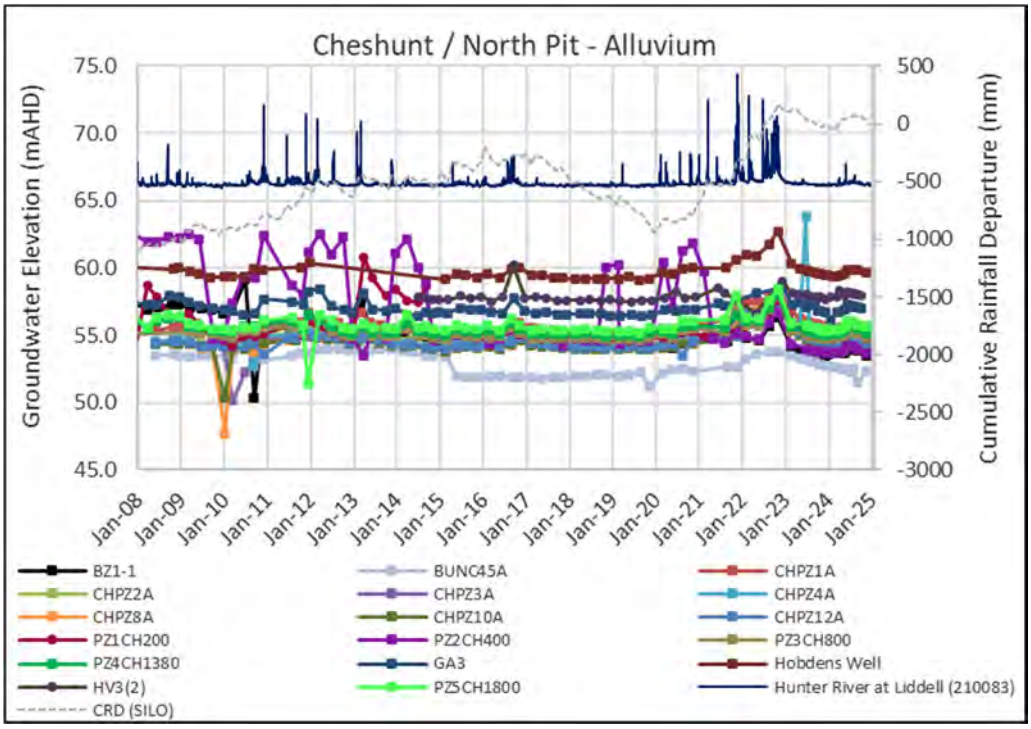


Figure 5.10 Groundwater Levels – Cheshunt/North Pit Alluvium

5.1.3.2 Groundwater Quality Trends

The pH and EC readings recorded over 2024 are summarised in **Table 5.3**.

Table 5.3 Summary of pH and EC Recorded Over 2024 – Cheshunt and North Pit Alluvium

Screened Lithology	pH Range	EC Range (µS/cm)	Comment
Alluvium	6.4 – 7.6	191 – 4,140	Bore Hobdens Well recorded consecutive pH readings above the upper trigger level of 7.5, in Q2 (7.6) and Q3 (7.6).
			Bore GA3 recorded one pH reading below the lower trigger level of 6.6, in Q4 (6.4).

Hobdens Well is screened within alluvium and is located between the Hunter River and Cheshunt Pit. Historical readings show that Hobdens Well recorded pH ranging between 7.1 and 8.2. Review of pH readings indicated levels fluctuated slightly, but within historical levels over 2024. The results show no adverse impacts due to mining. It is recommended the trigger level be updated to reflect historical trends.

From the network review undertaken in 2018, it is noted that bore GA3 is screened within coal south of the Alluvial Lands barrier wall. Groundwater pH within the bore has ranged from 6.5 to 7.9. The reading of 6.4 recorded in 2024 is outside of the historical range.

5.1.4 Lemington South

5.1.4.1 Groundwater Level Trends

Groundwater levels for four bores within the alluvium at Lemington South, along Wollombi Brook, are shown in **Figure 5.11**. Groundwater levels ranged from 45.16 mAHD (13.89 mbgl) to 49.46 mAHD (4.42 mbgl) in bores D317(ALL) and Appleyard Farm, respectively. Groundwater levels in the alluvium remained relatively stable over 2024; however, a slight decline was recorded in bores D317(ALL) and C919(ALL) of 0.11 m and 0.57 m, respectively. Bores PB01(ALL) and Appleyard Farm fluctuated, recording a slight increase of 0.18 m and 0.24 m, respectively.

Bore PB01(ALL) is located 150 m west of Wollombi Brook and Appleyard Farm is 50 m west of Wollombi Brook and 1.2 km upstream of Lemington South Pit. The Wollombi Brook at Warkworth stream gauge is located approximately 350 m upstream of Appleyard Farm. Bores PB01(ALL) and Appleyard Farm increased slightly over 2024, likely in response to the significant rainfall events in April and May 2024.

Bore D317(ALL) is located 45 m from Lemington South Pit, approximately 190 m to the east of Wollombi Brook. Bore C919(ALL) is located 100 m east of Wollombi Brook and 200 m west of Lemington South Pit. Groundwater levels decreased slightly in both bores over 2024.

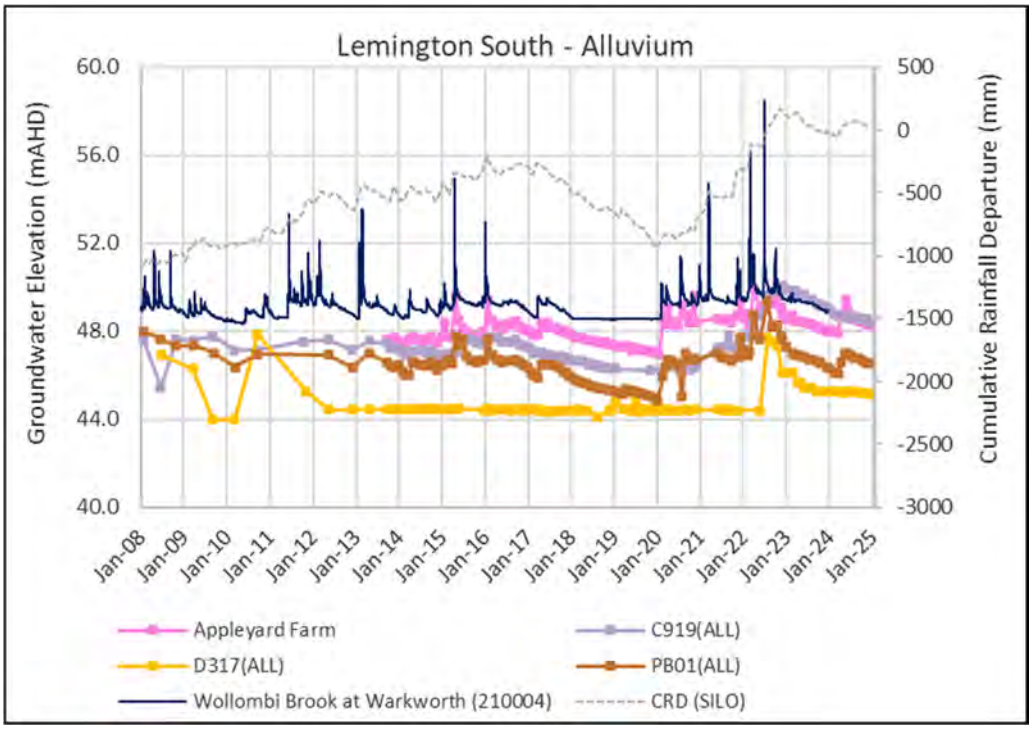


Figure 5.11 Groundwater Levels – Lemington South Alluvium

5.1.4.2 Groundwater Quality Trends

The pH and EC readings recorded over 2024 are summarised in **Table 5.4**.

Table 5.4 Summary of pH and EC Recorded Over 2024 – Lemington South

Screened Lithology	pH Range	EC Range (µS/cm)	Comment
Alluvium	6.4 – 7.6	166 – 10,400	Bore PB01 (ALL) recorded two EC readings above the trigger level in Q2 (9,900 µS/cm) and Q3 (10,400 µS/cm).
			Bore Appleyard Farm recorded two pH readings above the lower trigger level in Q2 (6.4 µS/cm) and Q4 (6.4 µS/cm).

Bore PB01(ALL) is screened within alluvium, located to the west of Wollombi Brook, in an area overlying the historical Lemington Underground but with no active mining or land clearance. Historical readings show that PB01(ALL) recorded EC levels ranging between 205 µS/cm and 7,740 µS/cm. EC readings fluctuated over 2024 with an overall increase and exceeding historical maximums. EC levels recorded at PB01(ALL) have fluctuated significantly since monitoring commenced. The increasing EC trend over 2023 and 2024 is likely due to below average rainfall over the same period. No adverse impacts due to mining have been identified.

Bore Appleyard Farm is screened within the alluvium, located on the west bank of Wollombi Brook, in an area overlying the historical Lemington underground but with no active mining or land clearance. Historical readings shows that Appleyard Farm recorded pH levels ranging between 6.0 and 7.4. The pH readings recorded over 2024 fluctuated over, but remained within the historical range.

5.2 Permian Coal Measures

Two bores in the Permian coal measures were recorded as blocked or collapsed (CGW45 and NPz3) over 2024, with bore D510(AFS) recorded as blocked in Q2. Discussion on groundwater level and quality trends within the Permian coal measures is included for each of the mine locations from **Section 5.2.1** to **Section 5.2.4**.

5.2.1 West Pit

5.2.1.1 Groundwater Level Trends

Three bores (NPz2, NPz3 and NPz5) target the Permian coal measures at West Pit; however, bore NPz5 was mined out in 2020 and NPz3 was recorded as blocked.

Groundwater elevations for the bores at West Pit are presented in **Figure 5.12**. Groundwater levels within bore NPz2 declined by around 4.66 m in November 2023 and increased by 5.34 m over 2024.The decline in groundwater levels was unique to the bore, with no known land use activities in the area that may have caused the trend. Bore NPz2 is located upslope from West Pit, on the northwest side. Review of the geology mapped at bore NPz2 identified that it intersects the Saltwater Creek Formation (Pswc). The Saltwater Creek Formation underlies the Vane Subgroup mined at West Pit. The Saltwater Creek Formation comprises laminated sequences of siltstone and sandstone, and the underlying Mulbring Siltstone comprises low permeability siltstone and claystone units and is considered to act as a confining unit (SLR, 2020).

The cause of the groundwater trend at NPz2 is unclear and would require further information regarding historical land use activities in the region. However, based on available information, the cause for the changes in groundwater levels do not appear to correlate to mine activities conducted at West Pit. Bore NPz2 has been removed from the compliance network within the draft WMP as the location and construction of the bore precludes it from providing an indication of potential impacts. The draft WMP has been submitted to DCCEEW for approval. It is recommended that the bore remains in the operational monitoring program to assist with future assessments and assessment of post closure groundwater conditions.

Bore NPz3 has been recorded as blocked since December 2022. In 2023, AECOM investigated the condition of the bore using a downhole camera and the footage showed major deformation of the PVC casing. The bore has already been removed from the compliance monitoring network in the updated draft WMP which is currently with DCCEEW for approval. It is recommended that the bore be replaced, as it will be required for monitoring of final voids following closure.

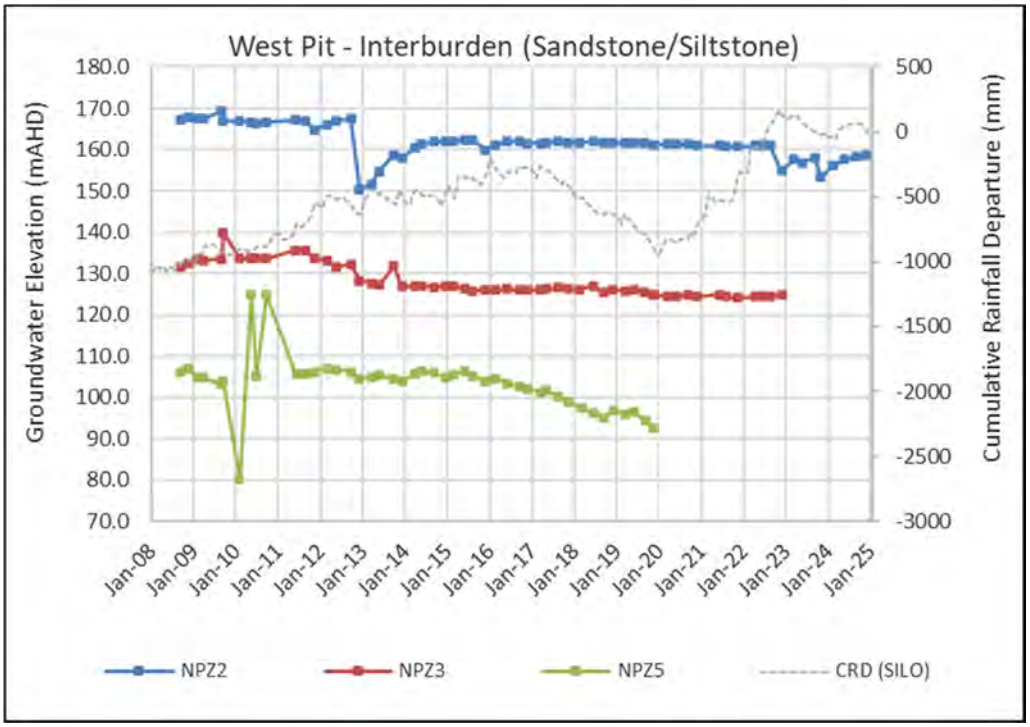


Figure 5.12 Groundwater Levels – West Pit Permian Coal Measures

Vibrating Wire Piezometers

In 2012, six VWPs were installed to monitor the coal seam and interburden sequences of the Permian coal measures in the West Pit area (GW-100a, GW-101a, GW-102, GW-103, GW-104 and GW-105), as summarised in **Table 5.5**. Over time a number of sensors within each VWP site have failed. With the exception of GW-103 and sensor VW3 in GW-105, which both failed in 2020, the VWPs were repaired in 2023 enabling data download.

VWPs GW-100a, GW-101a and GW-102 are located west of West Pit and south of Parnells Dam. GW-100a (Barrett Seam and interburden) recorded a slight decline while GW-101a (interburden) remained stable over 2024. GW-102 (interburden – sandstone with minor coal) fluctuated with a continued decline due to mining in West Pit. Groundwater level trends for the VWPs are presented in **Figure 5.13**.

VWPs GW-103, GW-104 and GW-105 are located south of West Pit. GW-104 VW1 (Lower Pikes Gully Seam), VW2 (interburden material) and VW3 (in sandstone above the Barrett Seam) all continued to decline over 2024 due to depressurisation from mining at West Pit. Levels in GW-105 VW1 (undifferentiated coal) remained relatively stable while levels in VW2 (tuffaceous coal) declined slightly over 2024 due to mining at West Pit. Groundwater level trends for the VWPs are presented in **Figure 5.14**.

Table 5.5 VWP Summary – West Pit

VWP ID	Sensor ID	Depth (mbgl)	Geology	Location	Comment
GW-100a	VW1	51.0	Barret Seam and Interburden	West of West Pit	Overall, stable levels with a slight decline.
GW-101a	VW1	51.0	Interburden (siltstone/sandstone)	West of West Pit	Overall, stable levels.
GW-102	VW1	60.5	Interburden (sandstone with minor coal)	West of West Pit	Fluctuating levels with an overall decline since November 2022.
GW-103	VW1	25.5	Undifferentiated and weathered coal	South of West Pit	All sensors failed 20/01/2020.
	VW2	64.0	Siltstone and coal		
	VW3	119.5	Sandstone		
GW-104	VW1	59.0	Lower Pikes Gully Seam	South of West Pit	Relatively stable between January 2022 and June 2023 followed by a slight decline.
	VW2	107	Sandstone near Upper Liddell Seam		Levels have continued to decline since January 2019.
	VW3	135	Sandstone above Barrett Seam		Sharp decline in levels from July 2023.
GW-105	VW1	33.0	Undifferentiated coal	South of West Pit	Relatively stable since October 2020.
	VW2	103.5	Tuffaceous coal		Relatively stable between November 2019 and March 2023, followed by a slight decline.
	VW3	154.0	Coal		Sensor failed 17/02/2020.

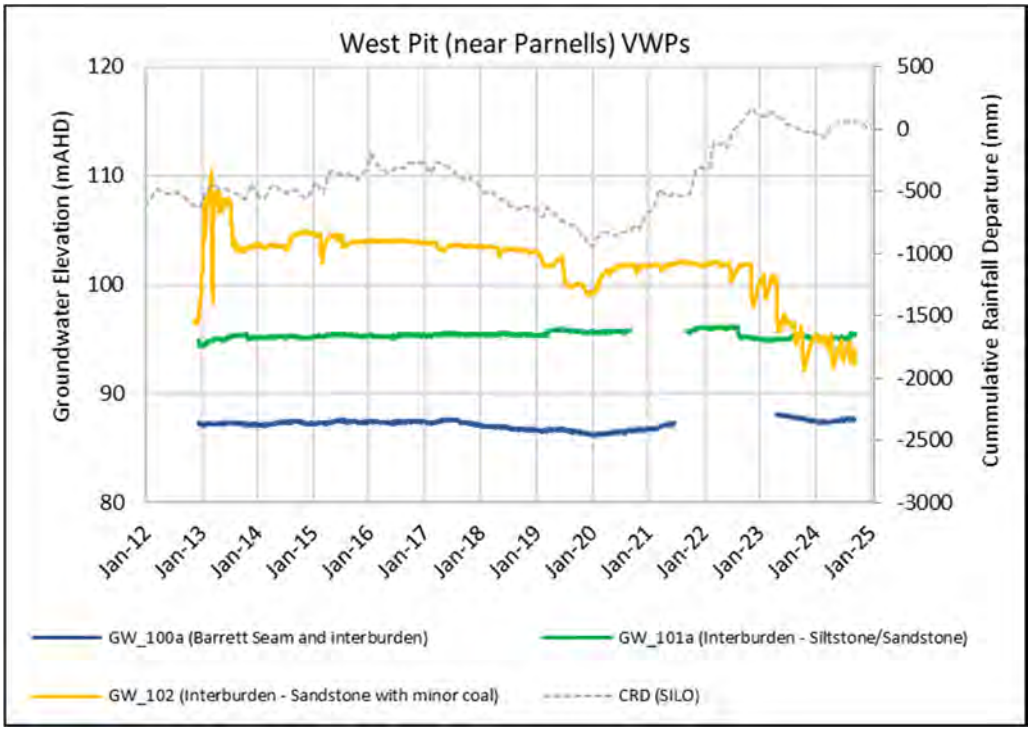


Figure 5.13 Groundwater Levels (VWPs) – West Pit Permian Coal Measures Near Parnells Dam

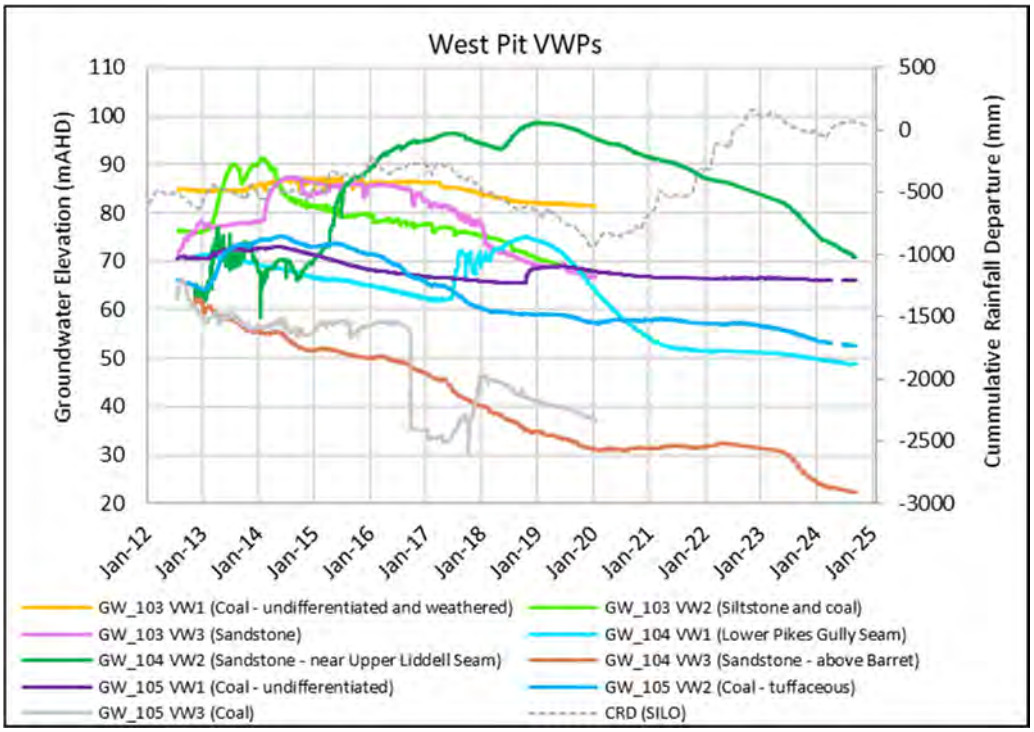


Figure 5.14 Groundwater Levels (VWPs) – West Pit Permian Coal Measures

5.2.1.2 Groundwater Quality Trends

The pH and EC readings recorded over 2024 are summarised in **Table 5.6**.

Table 5.6 Summary of pH and EC Recorded Over 2024 – West Pit Permian Coal Measures

Screened Lithology	pH Range	EC Range (µS/cm)	Comment
Sandstone/siltstone	6.9 – 7.1	14,290 – 14,860	Bore NPz2 recorded four consecutive EC concentrations above the trigger level over 2024.

Bore NPz2 is located approximately 4.5 km northeast of Plashett Reservoir and 1 km northwest of the West Pit mine area. The bore intersects interburden material (siltstone/sandstone) of the deeper Permian coal measures; with a screened interval between 57 mbgl to 60 mbgl. Historical EC readings for NPz2 since 2008 show regular fluctuations between 12,590 µS/cm and 19,400 µS/cm. The 2024 readings are considered consistent with historical concentrations. Although the 2024 EC readings are within the historical range, they are consecutive and therefore constitute and exceedance and this is discussed further in **Section 6.0**.

Based on available information, the cause for the changes in EC at NPz2 do not appear to correlate to mine activities conducted at West Pit. The network review undertaken by SLR in 2019 recommended that NPz2 be removed from the compliance network as the bore location and construction does not provide information on potential impacts related to site activities, and this has been undertaken in the draft WMP which is awaiting approval. This bore should continue to be monitored to assist with other assessments and post closure monitoring.

5.2.2 Carrington and Carrington West Wing

5.2.2.1 Groundwater Level Trends

The WMP includes seven monitoring bores with screens that intersect the Permian coal measures at Carrington and Carrington West Wing. This includes two bores within the Bayswater Seam (CGW45 and CGW46), two within the Broonie Seam (CGW52 and CGW53) and three within the interburden material (4036C, 4051C and CGW51a). Bore CGW45 was reported as blocked over 2024. Groundwater elevations for the seven bores are presented in **Figure 5.15**.

Bore CGW46 intersects the shallow Bayswater Seam underlying alluvium on the western limb of the paleochannel. Over 2024, groundwater levels ranged between 59.33 mAHD (12.62 mbgl) and 59.49 mAHD (12.46 mbgl), declining by 0.24 m over the year. The condition of the bore was investigated by AECOM in 2023. It is noted that the depth of the bore was measured at 51.80 m below surface. In addition, historically the casing above the ground surface has been damaged allowing ingress of surface water and debris. AECOM checked the bore with a downhole camera and noted the column of water within the bore was dirty and the screened interval was unable to be seen. The bore was cleaned out and the screens were checked to confirm the bore cleaning was successful in 2024.

Bore CGW45 intersects the Bayswater Seam at a depth of approximately 28 m. Over 2024, the bore was recorded as blocked. The bore has been blocked since 2018. Historically the casing above ground had been damaged and was at ground level allowing surface water and debris ingress causing the blockage. An extension was added to the casing to increase the height of the casing above the ground surface to avoid further blockages. The bore was found to be blocked again in 2023 and the was not able to be removed. Removal of the blockage will be attempted again in 2025. Due to the bore condition CGW45 has been removed from the draft WMP which is awaiting approval. The bore should also be removed from the monitoring schedule.

Bores CGW52 and CGW53 both intersect the Broonie Seam and have recorded a rise in water levels since 2019, with the recovery in groundwater conditions following the cessation of mining at Carrington Pit. Over 2024, groundwater levels ranged between 36.88 mAHD (32.99 mbgl) and 38.50 mAHD (32.20 mbgl). Groundwater levels in both bore CGW52 fluctuated overall 2024 with an overall decline of 0.04 m. Bore CGW53 increased slightly by 0.29 m over 2024 similar to 2023.

Bores 4036C, 4051C and CGW51a are screened within interburden. Over 2024, groundwater levels declined and ranged between 40.03 mAHD (30.67 mbgl) and 57.09 mAHD (12.95 mbgl).

Construction details for bore CGW51a indicate it is screened within alluvium comprising fine to medium grained gravel and sand immediately overlying coal. As a result, groundwater within the bore is representative of alluvial groundwater and groundwater within the weathered coal measures. Due to the bore construction and potential for mixing, CGW51a has been removed from the draft WMP, which is currently with DCCEEW for approval. Bore CGW51a is used to monitor groundwater levels surrounding the backfilled Carrington Pit. Monitoring should continue to ensure the void continues to act as a groundwater sink. To enable this, it is recommended that a new bore be installed to replace CGW51a.

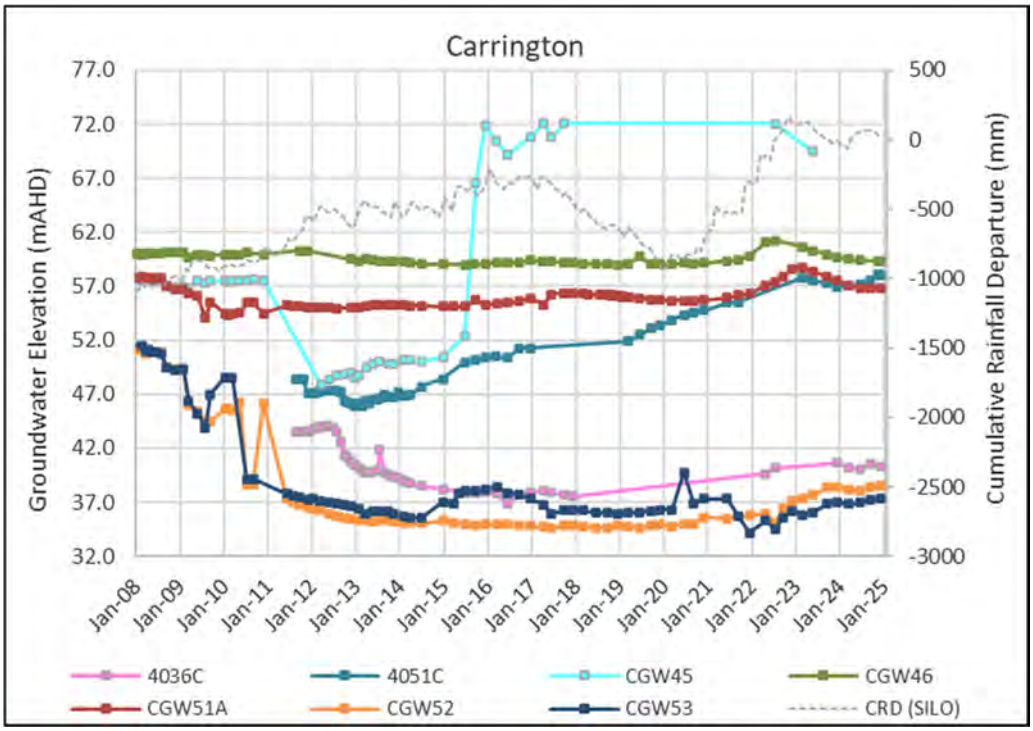


Figure 5.15 Groundwater Levels – Carrington Permian Coal Measures

Vibrating Wire Piezometers

In 2012, two VWPs were installed to monitor the coal seam and interburden sequences of the Permian coal measures west of Carrington Pit (GW-109 and GW-110), as summarised in **Table 5.7**. Groundwater level trends for the VWPs are presented in **Figure 5.16**.

Within GW-109, sensor VW3 (Bayswater Seam) failed in 2012, but was repaired in 2021. In addition, the calibration details for GW-110 are not available, therefore data could not be converted and graphed. However, GW-110 is located near the highwall within Carrington Pit void and may be decommissioned.

Ongoing monitoring of groundwater level recovery in spoil material near Carrington Pit void can continue to be conducted at bores GW-107 and GW-108.

In GW-109, sensor VW1 (weathered coal) recorded declining levels from October 2021 until 2023 when levels stabilised. Over 2024, levels increased slightly. Deeper sensor VW2 (tuffaceous coal) recorded a rise in groundwater levels at a lower elevation. The difference in the two sensors may relate to an additional source of recharge to the shallow stratigraphy. Sensor VW3 (Bayswater Seam) recorded a sharp increase in water levels between July 2021 and April 2024. The levels recorded are near the ground surface of 85.3 mAHD, reaching 80.3 mAHD by December 2024. It is recommended that local site conditions be reviewed.

Table 5.7 VWP Summary – Carrington Area

VWP ID	Sensor ID	Depth (mbgl)	Geology	Location	Comment
GW-109	VW1	31.5	Weathered coal	West of Carrington Pit	Slight decline in levels between October 2021 and December 2023. Followed by a slight increase over 2024.
	VW2	65.0	Tuffaceous coal		Remained relatively stable since 2012, with a slight increase from 2021 onwards.
	VW3	59.5	Bayswater Seam		Sensor failed between 2012, but repaired in 2021. Levels increased sharply between July 2021 and April 2024, near the ground surface by December 2024 (80.3 mAHD).
GW-110	VW1	38.0	Sandstone	North of Carrington Pit	Calibration data unavailable to convert raw data. Remove from monitoring network.
	VW2	63.0	Sandstone		
	VW3	93.0	Bayswater Seam		

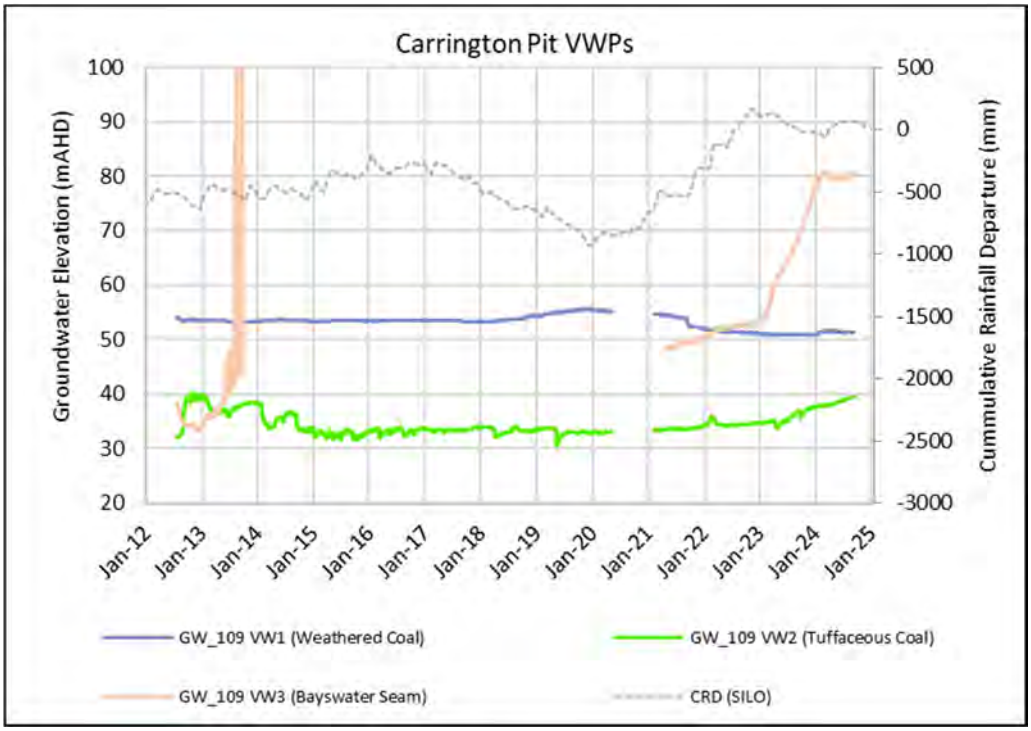


Figure 5.16 Groundwater Levels (VWPs) – Carrington Permian Coal Measures

5.2.2.2 Groundwater Quality Trends

The pH and EC readings recorded over 2024 are summarised in **Table 5.8**.

Table 5.8 Summary of pH and EC Recorded Over 2024 – Carrington and Carrington West Wing Permian Coal Measures

Screened Lithology	pH Range	EC Range (µS/cm)	Comment
Carrington Interburden	6.7 – 7.6	833 – 5,020	Bore CGW51a recorded pH readings above the upper trigger level over 2024.
Carrington Broonie Seam	6.6 – 7.1	6,690 – 8,180	Bore CGW53 recorded pH below the lower trigger level in Q2 (6.7) and Q3 (6.7).
CWW Bayswater Seam	7.1 – 7.4	909 – 1,696	Bore CGW46 recorded pH below the lower trigger level in Q4 (7.0).

Bore CGW51a was found to be screened within the alluvium (SLR, 2020). As a result, groundwater within the bore is representative of alluvial groundwater and groundwater within the weathered coal measures. SLR (2020) recommended that due to the construction of the bore, it should be decommissioned to minimise potential mixing. Historical pH readings for the bore since 2005 show minor fluctuations between 6.8 and 8.1. The 2024 readings decreased marginally from 7.6 in January to 7.5 by December. The pH levels were consecutive readings above the trigger level of 7.4 and therefore constitutes an exceedance; this is discussed further in **Section 6.0**.

Bore CGW53 is located along the Hunter River, constructed with a screen from 38.5 m to 41.5 m below surface with 25 mm diameter casing, screened across coal (Broonie Seam). Historical pH readings for the bore since 2005 show regular fluctuations of between 6.6 and 7.8. The 2024 readings ranging from 6.7 to 6.8 are considered consistent with historical concentrations, with no adverse impacts identified.

Bore CGW46 is located approximately 900 m north of the Hunter River, screened across coal (Bayswater Seam). Historical pH readings for the bore since 2005 show regular fluctuations of between 7.1 and 7.8. The 2024 readings ranging from 7.1 to 7.4 are considered consistent with historical concentrations, with no adverse impacts identified. As noted in **Section 5.2.2.1**, the condition of the bore was investigated and then cleaned and purged by AECOM in 2023. The condition of the bore screen was reassessed and the cleaning found to be successful.

5.2.3 Cheshunt Pit/North Pit

5.2.3.1 Groundwater Level Trends

The WMP includes thirteen monitoring bores screened within the Permian coal measures at Cheshunt Pit. This includes nine bores within the Mt Arthur Seam (BC1a, BZ1-3, BZ2A(1), BZ3-3, BZ4A(2), CHPZ3D, CHPZ8D, CHPZ12D, HG2a), one within the Piercefield Seam (BUNC45D) and three within interburden (BZ3-1, BZ8-2 and HG2). Groundwater elevations for the bores are presented in **Figure 5.17** to **Figure 5.19**.

With the exception of bores CHPZ3D, CHPZ8D and CHPZ12D, groundwater levels within the Mt Arthur Seam remained relatively stable over 2024 ranging from 24.68 mAHD (46.71 mbgl) to 54.71 mAHD (8.55 mbgl) in bores BZ1-3 and CHPZ12D, respectively. Bores CHPZ3D, CHPZ8D and CHPZ12D, located over 1 km northeast of Cheshunt Pit, to the north of the rehabilitated Barry's Pit, were relatively stable with an overall increase of less than 0.10 m in 2024. Bore BUNC45D, located in the same area but screened within the Piercefield Seam, also recorded a slight increase of 0.28 m over 2024.

Groundwater levels within the Cheshunt Interburden ranged from 46.64 mAHD (21.16 mbgl) and 55.97 mAHD (11.43 mbgl) in bores BZ8-2 and HG2, respectively.

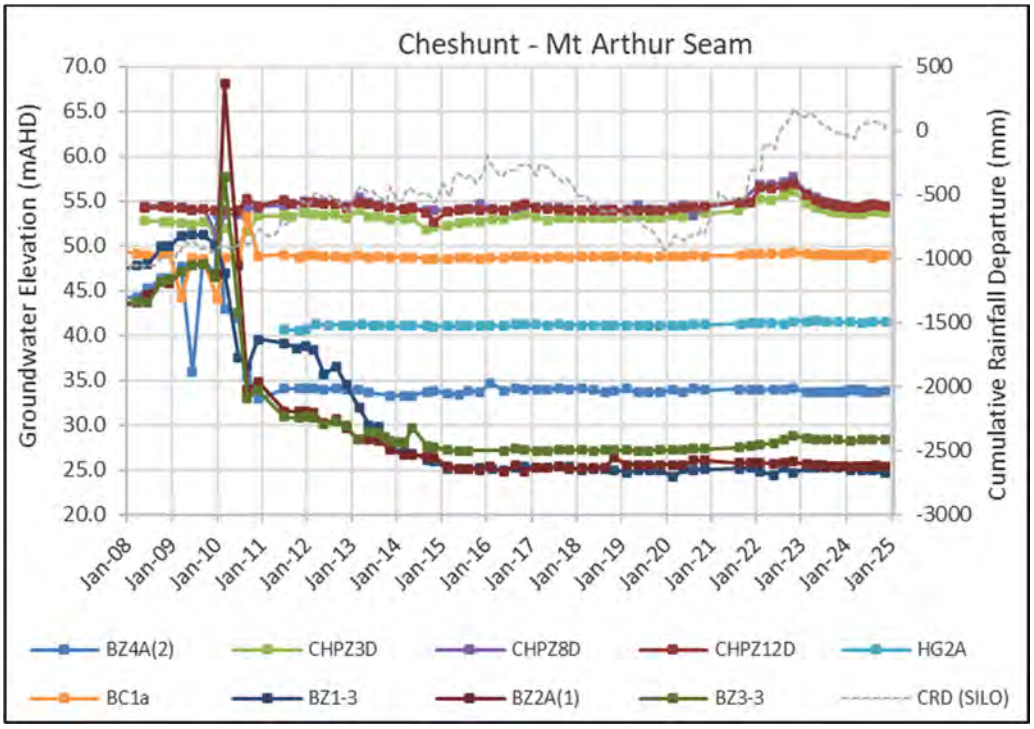


Figure 5.17 Groundwater Levels – Cheshunt Mt Arthur Seam

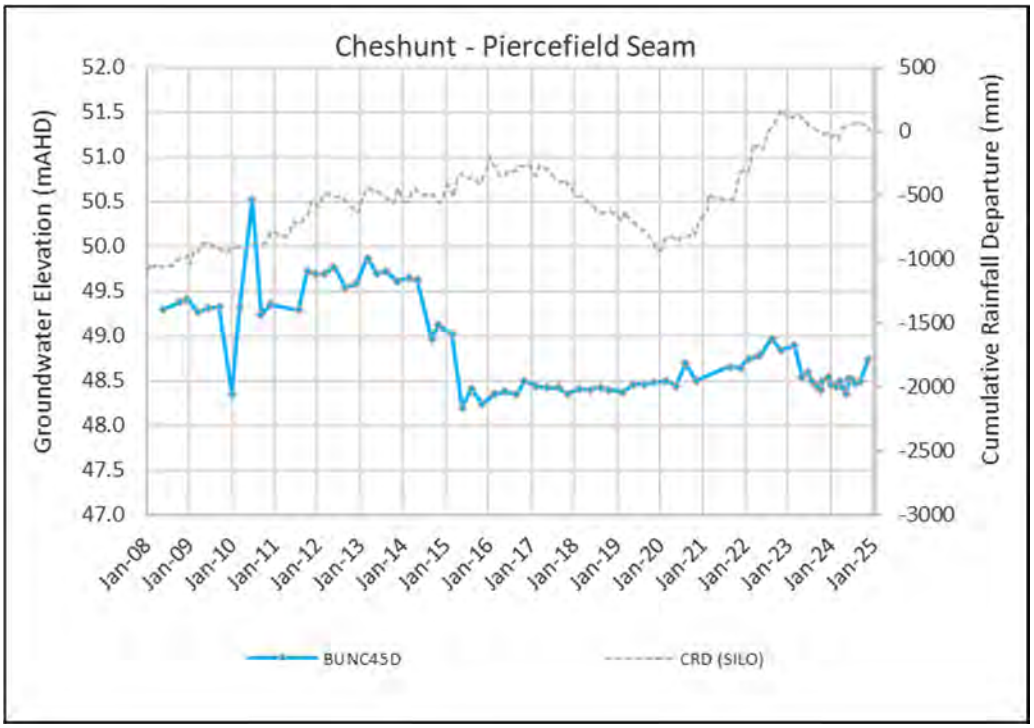


Figure 5.18 Groundwater Levels – Cheshunt Piercefield Seam

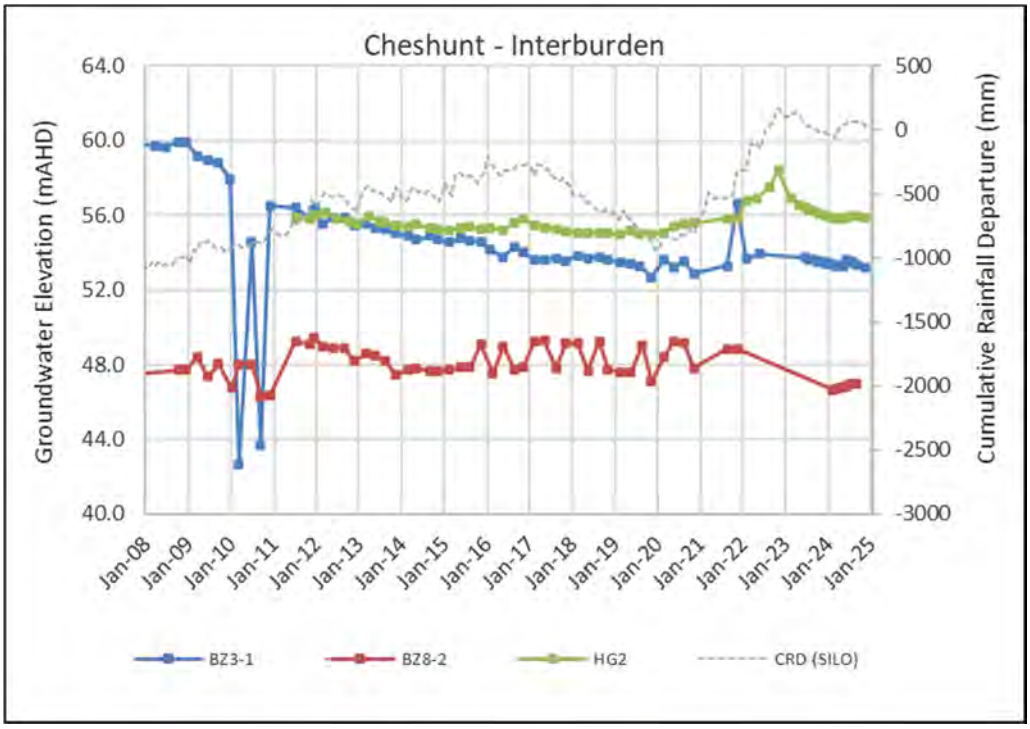


Figure 5.19 Groundwater Levels – Cheshunt Interburden

5.2.3.2 Groundwater Quality Trends

The pH and EC readings recorded over 2024 are summarised in **Table 5.9**.

Table 5.9 Summary of pH and EC Recorded Over 2024 – Cheshunt Permian Coal Measures

Screened Lithology	pH Range	EC Range (µS/cm)	Comment
Interburden	6.9 – 7.6	1,198 – 3,460	No exceedances.
Mt Arthur Seam	6.0 – 7.6	845 – 3,210	Bores BZ2A(1), BZ3-3, BZ4A(2) and CHPZ3D recorded pH levels below the lower trigger level ranging between 6.0 and 6.4. Only bore BZ3-3 recorded consecutive readings, constituting an exceedance.
Piercefield Seam	6.7 – 6.8	2,200 – 2,290	Bore BUNC45D recorded one EC reading above the trigger level in Q2 (2,610 µS/cm).

Bores CHPZ3D, BZ2A(1), BZ3-3 and BZ4A(2) intersect the Mt Arthur Seam and are located between Cheshunt Pit and the Hunter River. The historical pH range for the four bores is 6.0 to 8.2. The 2024 pH readings for these bores are within the historical range. Only bore BZ3-3 recorded consecutive readings below the trigger level of 6.5 and therefore constitutes an exceedance; this is discussed further in **Section 6.0**.

It is noted that the bore depth and screened interval was checked by AECOM in 2024. Screened interval depth details required to check the construction details. If current bore details are correct the bore should be removed from the WMP but kept as part of the operational monitoring network for ongoing monitoring of groundwater recovery post mining. Water quality samples should not be collected if the groundwater level is below the base of the screen.

Bore BUNC45D intersects the Piercefield Seam and is located between Cheshunt Pit and the Hunter River. The historical EC range is 1,790 µS/cm and 3,350 µS/cm. The 2024 readings are within the historical range.

5.2.4 Lemington South

5.2.4.1 Groundwater Level Trends

The WMP includes 29 monitoring bores with screen that intersects the Permian coal measures at Lemington South. This includes:

- Four bores within the Arrowfield Seam – C130(AFS1), D406(AFS), D510(AFS) and D612(AFS).
- One bore within the shallow interburden material (siltstone/sandstone) – C130(ALL).
- Eight bores within the Glen Munro Seam and/or Woodlands Hill Seam – B425(WDH), B631(WDH), C122(WDH), C130(WDH), C317(WDH), C809(GM/WDH), D010(WDH) and D010(GM).
- Sixteen bores within the Bowfield Seam – B334(BFS), B631(BFS), B925(BFS), C122(BFS), C130(BFS), C317(BFS), C613(BFS), C621(BFS), C630(BFS), D010(BFS), D214(BFS), D317(BFS), D406(BFS), D510(BFS), D612(BFS) and D807(BFS).

Groundwater level trends for bores targeting the Arrowfield Seam are presented in **Figure 5.20**. Bore D510(AFS) was recorded as blocked in Q2, with only one reading collected in 2024 of 28.88 mAHD in Q4. Groundwater levels in bore D612(AFS) declined by 0.05 m by May 2024, before being recorded as dry by December 2024. Groundwater levels in bore C130(AFS1) declined by 0.21 m compared to bore D406(AFS) which continued to decline over 2024 by 2.21 m. The decline in water levels in D406(AFS) is likely due to depressurisation due to active mining at the neighbouring United Wambo mine which is located 400 m to the west of the bore.

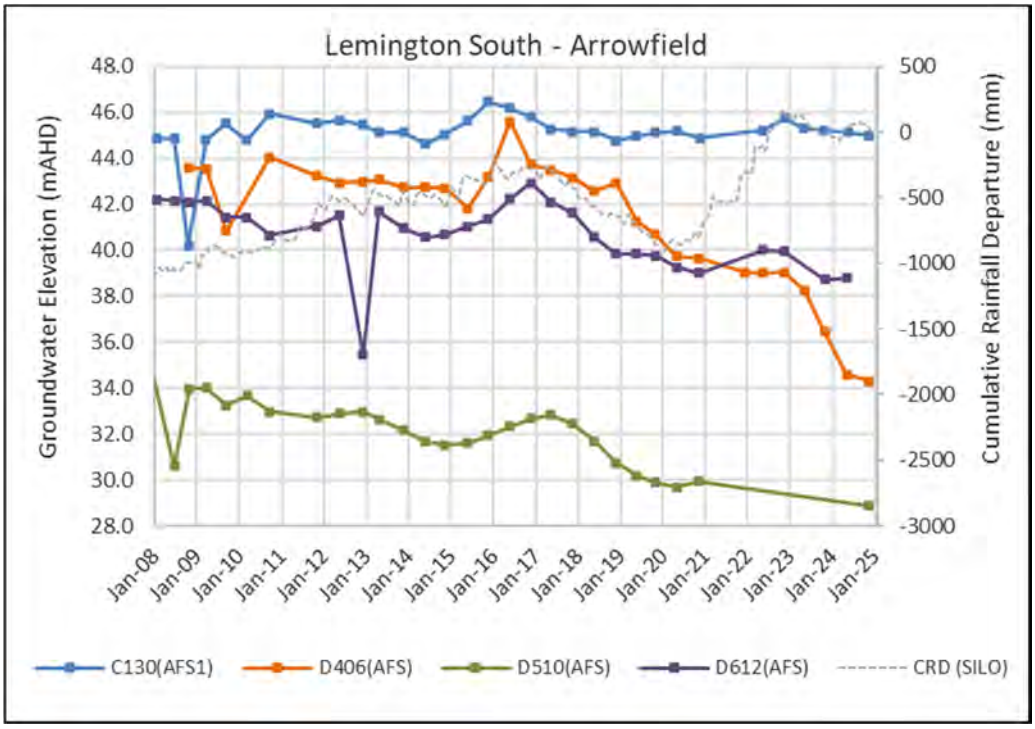


Figure 5.20 Groundwater Levels – Lemington South Arrowfield Seam

Groundwater level trends for bores targeting the shallow interburden, Woodlands Hill Seam and Glen Munro Seam are presented in **Figure 5.21**. With the exception of B425(WDH), B631(WDH), C317(WDH) and D010(GM), groundwater levels remained relatively stable over 2024.

Groundwater levels in bore D010(GM) declined by 0.18 m and bore C317(WDH) declined by 0.25 m over 2024.

Groundwater levels in bore B631(WDH) increased by 1.92 m over 2024, ranging from 44.06 mAHD (27.92 mbgl) to 46.02 mAHD (25.96 mbgl) between the end of 2023 and December 2024. It appears the reading in November 2023 of 44.06 mAHD is erroneous based on historical water level trends. Ongoing review of future readings is recommended to confirm if the reading was erroneous.

Groundwater levels in bore B425(WDH) declined by 3.33 m over 2024, ranging between 222.30 mAHD (35.58 mbgl) and 25.64 mAHD (32.24 mbgl). These elevations and trends correspond more closely with trends observed for the Bowfield Seam bores. The 2019 network review undertaken by SLR recommended that the bore be removed from the monitoring network in favour of ongoing monitoring at nearby bore C130(WDH) (SLR, 2020). It is noted that B425(WDH) has been removed from revised WMP which is awaiting approval.

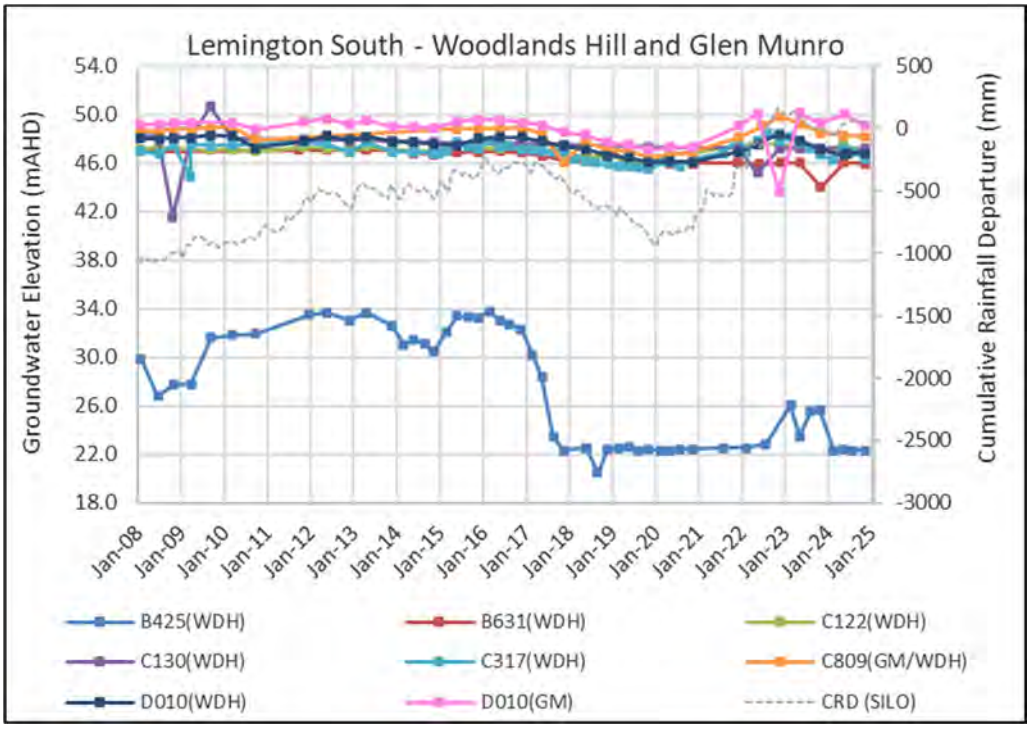


Figure 5.21 Groundwater Levels – Lemington South Woodlands Hill and Glen Munro Seams

Groundwater level trends for bores targeting the Bowfield Seam are presented in **Figure 5.22**. Over 2024, groundwater elevations ranged between -0.30 mAHD (58.50 mbgl) (C122(BFS)) and 40.85 mAHD (22.79 mbgl), in bores C122(BFS) and C130(BFS), respectively. Interpolated groundwater elevation contours for the Bowfield Seam are presented in **Figure 5.23**, based on November 2024 readings.

Groundwater levels in bores C630(BFS), D214(BFS) and D317(BFS) increased by up to 0.44 m over 2024. Bore C122(BFS), located to the west and furthest from Lemington South Pit, continued to remain dry.

Groundwater levels declined by up to 2.74 m in bores B334(BFS), B631(BFS), B925(BFS), C130(BFS), C317(BFS), C613(BFS), and C621(BFS), in response to abstraction from LUG Bore. The bores are located 300 m to 1.8 km from LUG Bore.

LUG Bore intersects the historical Lemington Underground workings, which mined through the Bowfield Seam. Over 2024 (calendar year) 304.6 ML of water was abstracted from the bore, at an average rate of 0.8 ML /day. Groundwater elevations are higher in the northwest as shown in **Figure 5.23**, which illustrates groundwater flows towards LUG Bore from the northwest within a 1.8 km radius. This trend is visible in a range of bores intersecting the Permian coal measures in the area.

Bores D010(BFS), D406(BFS), D510(BFS), D612(BFS) and D807(BFS) are located between Lemington South Pit and United Open Cut, over 2.4 km to the northwest of LUG Bore. With the exception of D010(BFS), groundwater levels declined by up to 3.12 m over 2024. The groundwater flow direction in this area is to the northwest away from LUG Bore and towards the United Open Cut. The declining trend likely relates to depressurisation of the coal measures from active mining within the United Open Cut, which is located approximately 700 m to the west of these bores. This is consistent with cumulative impacts predicted by AGE (2016).

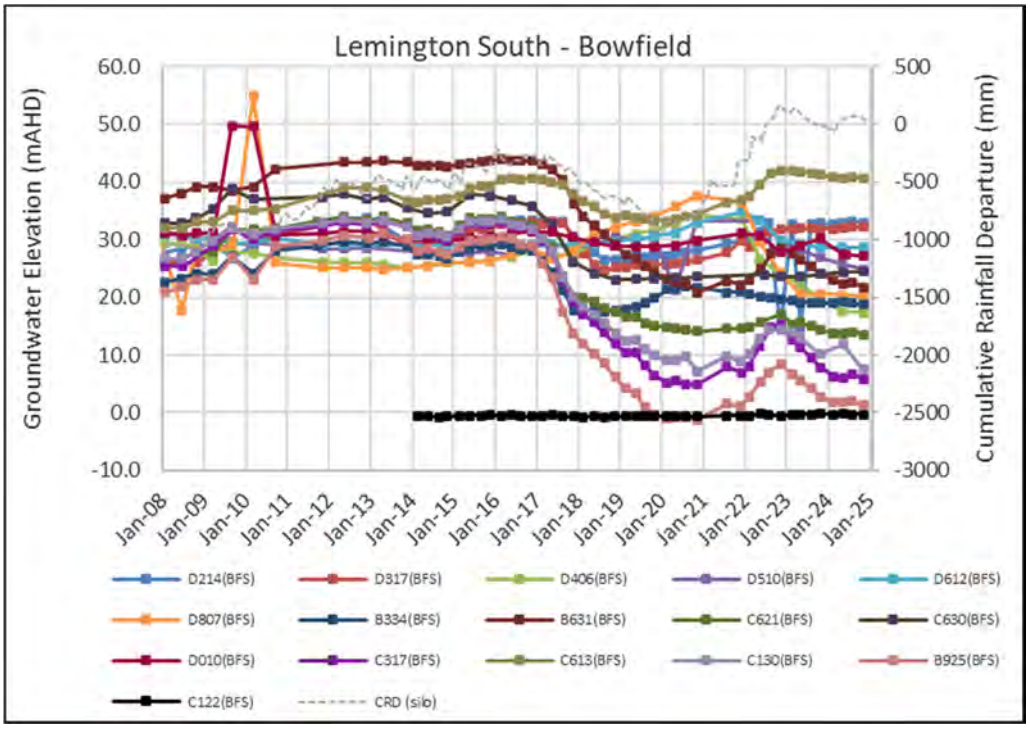


Figure 5.22 Groundwater Levels – Lemington South Bowfield Seam

5.2.4.2 Groundwater Quality Trends

The pH and EC readings recorded over 2024 are summarised in **Table 5.10**.

Table 5.10 Summary of pH and EC Recorded Over 2024 – Lemington South Permian Coal Measures

Screened Lithology	pH Range	EC Range (µS/cm)	Comment
Interburden	6.9 – 7.0	20,600 – 23,000	No exceedances.
Arrowfield Seam	6.8 – 7.3	10,300 – 14,220	No exceedances.
Bowfield Seam	6.7 – 7.9	2,060 – 13,110	No exceedances.
Glen Munro Seam	6.8 – 7.1	11,480 – 11,560	Bore D010(GM) recorded EC levels above the trigger level in Q2 and Q4.
Woodlands Hill Seam	6.6 – 7.8	4,300 – 21,100	Bore C122(WDH) recorded pH above the upper trigger level in Q2. Bore C317(WDH) recorded pH above the upper trigger level in Q2 and Q4. Bore C130(WDH) recorded EC levels above the trigger level in Q2 and Q4.

Bore C130(WDH) is located between Lemington South pit and the LUG Bore and intersects the Woodlands Hill Seam at a depth of 22 m. Historical readings since 2000 show regular fluctuations of EC ranging from 18,210 µS/cm to 21,300 µS/cm. The 2024 readings for EC (20,900 µS/cm and 21,100 µS/cm) are considered consistent with historical concentrations.

In 2023, Umwelt undertook a trigger investigation for bore C130(WDH). The investigation noted that the C130 series of bores are 28 years old leading to deterioration of the bores over time which may be influencing water quality results. The investigation recommended undertaking comprehensive water quality analysis of water stored in the Lemington South Pit to determine if there is any seepage to the surrounding groundwater, monitored by the C130 series of bores ((Umwelt, 2023b). A water quality sample was collected from South Lemington Pit in September 2024. However, only bores C130(ALL) and C130(AFS1) have major ion analysis data available for comparison of the water type (major ions). Based on the available water quality data it is unlikely that seepage is occurring from the pit to the surrounding groundwater. However, it is recommended that an additional round of comprehensive water quality analysis (major ions) is undertaken in all C130 bores and South Lemington Pit to confirm that seepage is not occurring. If it is determined that there is no connection between the pit and the surrounding groundwater, the change in water quality is likely due to bore deterioration in which case the C130 series of bores should be replaced.

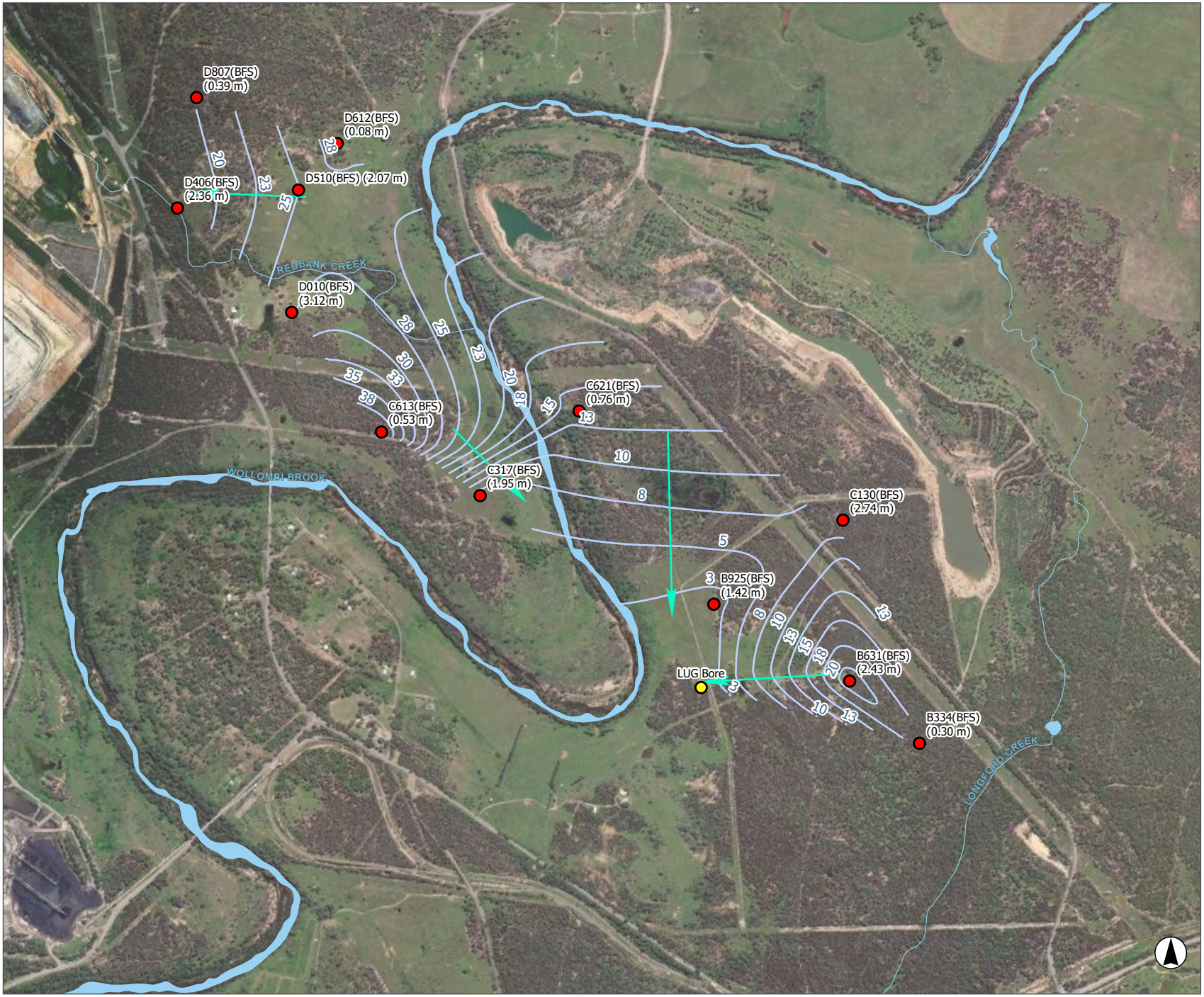
Bore C122(WDH) is located approximately 1,500 m west of Lemington South Pit and 170 m east of Wollombi Brook. Historical readings since 2000 show regular fluctuations of pH ranging from 6.9 to 8.1. The 2024 reading of 7.8 is therefore considered consistent with historical levels.

Bore C317(WDH) is located approximately 1,700 m west of Lemington South Pit and 300 m east of Wollombi Brook. Historical readings since 2000 show regular fluctuations of pH ranging from 6.7 to 8.2. The 2024 readings of 7.8 are therefore considered consistent with historical levels.

Bore D010(GM) is located between Lemington South Pit and LUG Bore. Historical readings since 2000 show regular fluctuations of EC between 9,050 µS/cm and 12,310 µS/cm. The 2024 reading of 11,480 µS/cm is therefore considered consistent with historical concentrations.

FIGURE 5.23

Interpolated LUG Bore Groundwater Drawdown – Bowfield Seam



Legend

- Bowfield DD Arrows
- LUG Bore
- Bowfield Seam Drawdown
- Interpolated Groundwater Contours (mAHD)
- Mapped Watercourses (named)
- Named Waterbody

0 0.5 1
Kilometers

Scale 1:19,881 at A4
GDA2020 MGA Zone 56

Image Source: ESRI Basemap (2022) **Data source:** NSW DFSI (2022)

5.3 Spoil

Bore GW-108 recorded as blocked in Q2 and bore GW-107 was recorded as dry throughout 2024. Discussion on groundwater level and quality trends within the spoil is included for each of the mine locations from **Section 5.3.1** to **Section 5.3.2**.

In 2023, AECOM investigated the blockage in GW-108 with a downhole camera. The bore is deformed at depth preventing the collection of water quality samples. It was recommended that alternative sampling methods were trialled and if unsuccessful the bore should be replaced as it forms part of the monitoring programme following void closure. AECOM noted in 2024 that the deformation is major and the depth to water is too great for low-flow sampling methods. HVO plans to install a replacement bore in 2025.

In addition, comparison of groundwater levels and bore screen interval indicates bore GW-114, located within North Pit, is likely dry, and readings may relate to water within the sump at the base of the bore.

5.3.1 North Pit

5.3.1.1 Groundwater Level Trends

Groundwater levels for the spoil are presented in **Figure 5.24**. Over 2024, groundwater levels within the bores ranged between 34.15 mAHD (32.95 mbgl) and 78.63 mAHD (24.10 mbgl), in bores MB14HVO03 and DM1, respectively. Groundwater levels decreased by up to 1.51 m (MB14HVO05), consistent with rainfall trends. Groundwater within the spoil flows from northern-most bore DM1 in a southerly direction towards the southern-most bore MB14HVO03.

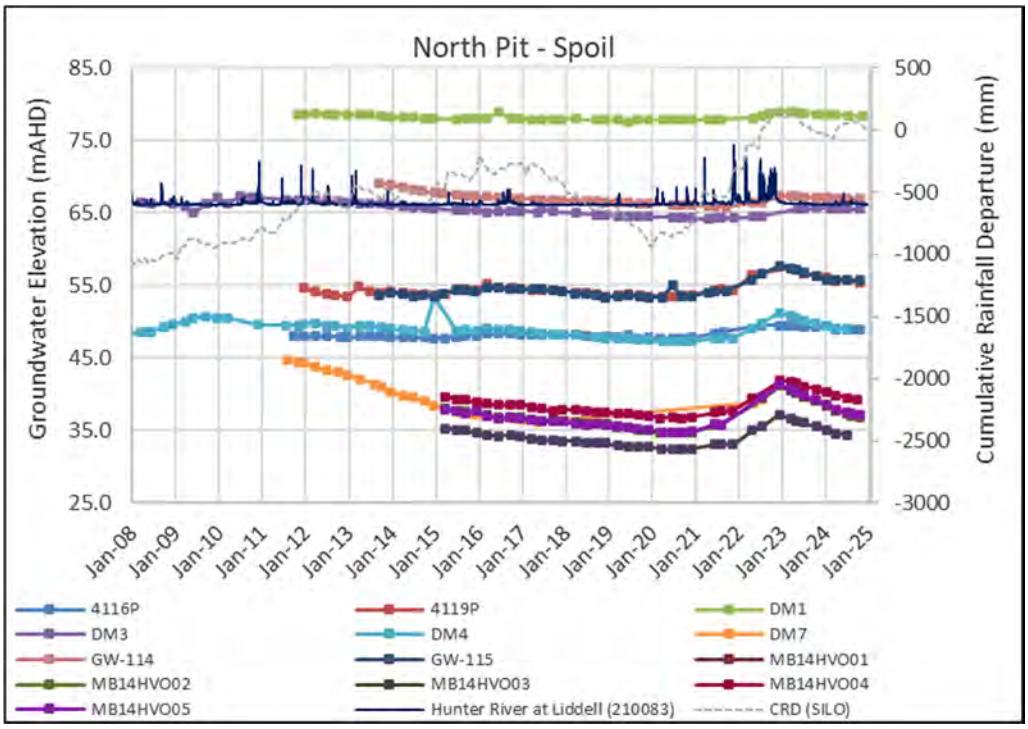


Figure 5.24 Groundwater Levels – North Pit Spoil

5.3.1.2 Groundwater Quality Trends

The pH and EC readings recorded over 2024 are summarised in **Table 5.11**.

Table 5.11 Summary of pH and EC Recorded Over 2023 – North Pit Spoil

Screened Lithology	pH Range	EC Range (µS/cm)	Comment
Spoil	6.4 – 8.2	2,750 – 12,390	Bore DM3 recorded pH (6.4) below the lower trigger level in Q1. Bore DM7 recorded pH (8.2) above the upper trigger level in Q4.

Bore DM3 is located within North Pit and intersects spoil. Historical pH readings since 2004 range between 6.1 and 7.2. The 2024 reading of 6.4 is therefore considered consistent with historical concentrations.

Bore DM7 is located within North Pit and intersects spoil. Historical pH readings since 2010 range between 6.8 and 8.8. The 2024 reading of 8.2 is therefore considered consistent with historical concentrations.

5.3.2 Carrington

5.3.2.1 Groundwater Level Trends

Groundwater levels for the spoil are presented in **Figure 5.25**. Bore GW-108 was blocked in Q2 and bore GW-107 was dry over 2024. Groundwater levels recorded in bore GW-108 ranged between 28.05 mAHD (56.35 mbgl) and 29.04 mAHD (55.36 mbgl).

Although not included in the WMP, bore GW-129 has also been reviewed as it monitors groundwater levels within the spoil in the Carrington area to the west of the NV TSF. Over 2024, groundwater levels within GW-129 declined from 57.13 mAHD (15.17 mbgl) in January to 56.82 mAHD (15.48 mbgl) December in response to slightly below average rainfall over the same period.

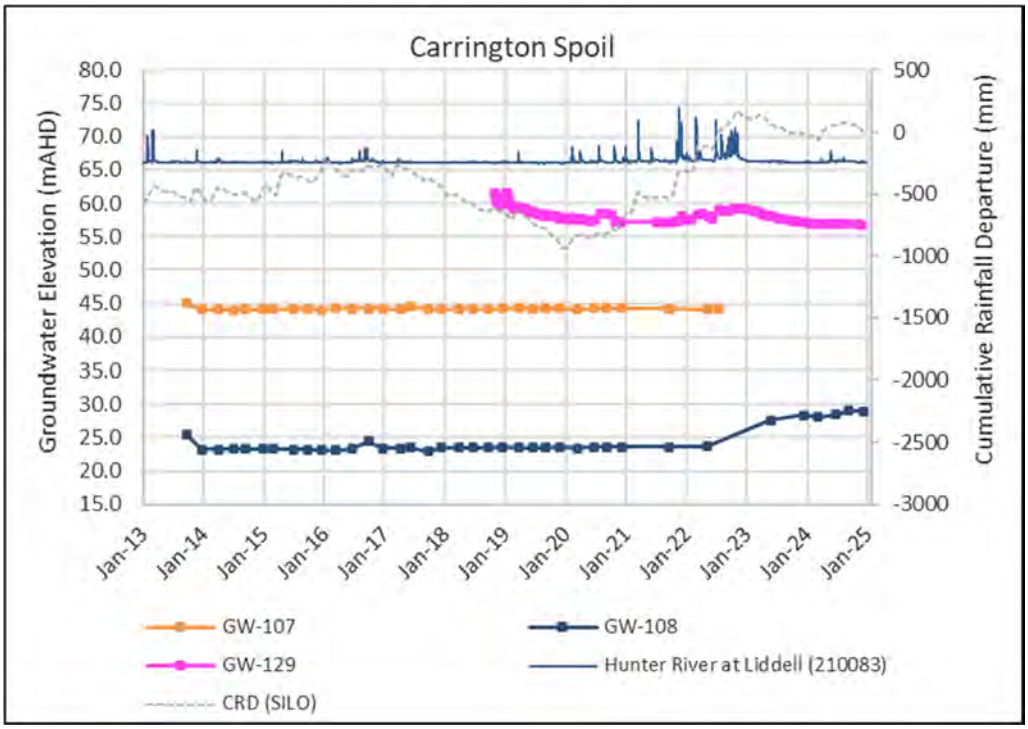


Figure 5.25 Groundwater Levels – Carrington Spoil

5.3.2.2 Groundwater Quality Trends

Routine monitoring of EC and pH was unable to undertaken at bore GW-107 as it was recorded as dry over 2024. Although groundwater levels were monitored in bore GW-108, groundwater samples were unable to be collected as a pump is unable to pass the deformation within the bore casing.

Although not included in the WMP, due to limited data for the Carrington spoil water quality data from bore GW-129 has been reviewed. Over 2024, pH levels ranged from 7.1 to 7.2, while EC concentrations fluctuated throughout the year ranging from 6,380 µS/cm to 6,920 µS/cm.

6.0 Trigger Exceedances

6.1 Groundwater Levels

Groundwater level data collected over 2024 have been compared to the trigger values for the five monitoring bores which have trigger levels assigned as outlined in the WMP (HVO, 2018).

Bores CGW53a and CGW55a recorded groundwater level exceedances over 2024. The trigger exceedances have been reviewed by comparing groundwater levels and climate trends as shown in **Figure 5.5** to **Figure 5.9**. An analysis of the trigger exceedance is summarised in **Table 6.2** and location shown on **Figure 6.1**.

It is noted that these water level trigger levels have been superseded with the trigger criteria for NV TSF that were established to monitor performance of measures to minimise seepage to alluvium. The trigger levels have been updated in the revised WMP which is awaiting approval.

6.2 Groundwater Quality

Water quality data collected over 2024 have been compared to the trigger values outlined in the WMP (HVO, 2018). Bores where pH or EC values were outside the trigger level are summarised in **Table 6.1**. However, only bores with three or more consecutive readings outside the trigger level are considered an exceedance. Trigger exceedances have been reviewed by comparing the data to groundwater levels and climate indicated by the cumulative rainfall departure plot. An analysis of the trigger exceedances is summarised in **Table 6.3** and the locations shown on **Figure 6.2**.

Table 6.1 Summary of Water Quality Readings Outside Trigger Levels Over 2024

Location	WMP Lithology	Bore ID	Monitoring Period	Outside pH Trigger Levels	Above EC Trigger Level
Carrington	Alluvium	CGW51a	**Q1/Q2/Q3/Q4**	✓	
	Broonie Seam	CGW53	Q1/Q3	✓	
	Alluvium	CGW55a	Q1	✓	
Carrington West Wing	Alluvium	GW-106	Q2/Q3	✓	✓
	Bayswater Seam	CGW46	Q2/Q4	✓	
Cheshunt	Mt Arthur Seam	BZ2A(1)	Q1/Q4	✓	
	Mt Arthur Seam	BZ3-3	**Q1/Q2/Q3/Q4**	✓	
	Mt Arthur Seam	BZ4A(2)	Q2/Q3	✓	
	Mt Arthur Seam	CHPZ3D	Q1/Q3	✓	
	Piercefield Seam	BUNC45D	Q2		✓
Cheshunt/North Pit	Alluvium	GA3	Q4	✓	
	Alluvium	Hobdens Well	Q2/Q3	✓	

Location	WMP Lithology	Bore ID	Monitoring Period	Outside pH Trigger Levels	Above EC Trigger Level
Lemington South	Bowfield Seam	B631(BFS)	Q2/Q4		✓
	Woodlands Hill Seam	C130(WDH)	Q2/Q4	✓	✓
	Woodlands Hill Seam	C122(WDH)	Q2	✓	
	Woodlands Hill Seam	C317(WDH)	Q2/Q4	✓	✓
	Glen Munro Seam	D010(GM)	Q2/Q4		✓
	Alluvium	Appleyard Farm	Q2/Q4	✓	✓
	Alluvium	C130(ALL)	Q2		✓
	Alluvium	PB01(ALL)	Q2/Q3		✓
North Pit	Spoil	DM3	Q1	✓	
	Spoil	DM7	Q4	✓	
West Pit	Alluvium	GW-100	**Q1/Q2/Q3/Q4**		✓
	Sandstone/Siltstone	NPz2	**Q1/Q2/Q3/Q4**		✓

Table 6.2 Groundwater Level Trigger Exceedances

Bore ID	Exceedance	Location	Screened Lithology	Comment	Actions
CGW53a	Fourteen consecutive water level readings above the 95th percentile trigger level of 59.19 mAHD between June 2021 and September 2024	Carrington Billabong area, ~1000 m west of NV TSF and ~100 m northeast of the Hunter River	Carrington Alluvium	The purpose of bore CGW53a is monitoring of the groundwater response to mining/recovery in Carrington. Groundwater levels in bore CGW53a have gradually increased since December 2019 with a sharp increase between September 2021 and September 2022 in response to above average rainfall and is not related to mining activities. Over 2023 and 2024, groundwater levels declined in response to below average rainfall.	The trigger level within the current WMP has been updated in the revised WMP which is with DPHI for approval. The revised trigger was exceeded in March 2023 following above average rainfall in 2022. Groundwater levels had a declining trend below the revised trigger over 2023 and 2024. No further action is considered necessary.
CGW55a	Thirteen consecutive water level readings above the 95th percentile trigger level of 58.43 mAHD since December 2021	Carrington Billabong area, ~850 m west of NV TSF and ~350 m northeast of the Hunter River	Carrington Alluvium	The purpose of bore CGW53a is monitoring of the groundwater response to mining/recovery in Carrington. Groundwater levels in bore CGW53a have gradually increased since December 2019 with a sharp increase between September 2021 and September 2022 in response to above average rainfall and is not related to mining activities. Over 2023 and 2024, groundwater levels declined in response to below average rainfall.	The trigger level within the current WMP has been updated in the revised WMP which is with DPHI for approval. The revised trigger was exceeded until September 2023 following above average rainfall in 2022; however, levels had a declining trend over 2023 and 2024. No further action is considered necessary.

Table 6.3 Groundwater Quality Trigger Exceedances

Bore ID	Exceedance	Location	Screened Lithology	Comment/Trend	Actions
BZ3-3	pH – eighteen consecutive readings below the lower pH trigger level of 6.5 since November 2019	Cheshunt	Mt Arthur Seam	Bore BZ3-3, located between Cheshunt Pit and the Hunter River, and had an increasing pH trend between June 2006 (6.0) and August 2012 (7.1) followed by a decreasing trend between December 2012 (7.1) and November 2022 (6.1). The 2024 readings ranging between of 6.1 and 6.3 are within the historical range. The 2019 Groundwater Annual Review (SLR, 2020) recommended further investigation of the bore condition and construction to confirm the geology being monitored in all of the 'BZ' bores in the Cheshunt area to understand the cause of the variability in the trends between the bores. Comprehensive water quality analysis was undertaken in August 2022. The results indicated the declining pH trend is not due to connectivity to spoil water via the nearby fault.	The bore is a 25 mm diameter bore, which is hindering water quality sampling and should be removed from the monitoring schedule. It is noted that the bore has already been removed from the compliance monitoring network in version 3.4 of the revised WMP, which is currently with DCCEEW for approval.
CGW51a	pH – ten consecutive readings above the trigger level of 7.4 since September 2022	Carrington	Interburden	Bore CGW51a is located 500 m to the northwest of the NV TSF and approximately 480 m northeast of the Hunter River and intersects interburden. Historic pH readings range from 6.8 (November 2006) and 8.3 (December 2023). The 2024 readings ranged between 7.5 and 8.6. The 2019 Annual Review (SLR, 2019) noted the bore is screened within alluvium and weathered coal measures. It was recommended the bore be decommissioned and replaced with a new bore as the current bore does not provide representative results from one groundwater unit.	Decommission the bore to prevent potential mixing of alluvial and Permian aquifers and install a replacement bore which can be used for monitoring to ensure the backfilled Carrington Pit continues to act as a groundwater sink. It is noted that the bore has already been removed from the compliance monitoring network in version 3.4 of the revised WMP, which is currently with DCCEEW for approval.

Bore ID	Exceedance	Location	Screened Lithology	Comment/Trend	Actions
GW-100	EC – seven consecutive readings above the trigger level of 10,751 µS/cm since June 2023	West Pit	Alluvium	Bore GW-100 is located approximately 1.8 km south of Plashett Reservoir and 2.4 km west of West Pit and intersects alluvium. Historic EC readings range from 9,570 µS/cm (September 2019) and 11,510 µS/cm (December 2017). The 2024 readings ranged between 11,010 µS/cm and 11,310 µS/cm and are within the historical range. An increasing trend in EC has been recorded since December 2022 and coincides with declining groundwater levels in response to below average rainfall.	The EC exceedances are due to declining groundwater levels. Trends should continue to be monitored to determine if they are related to mining activities.
NPz2	EC – ten consecutive readings above the trigger level of 13,428 µS/cm since September 2022	West Pit	Sandstone/ Siltstone	Bore NPz2, located approximately 4.5 km northeast of Plashett Reservoir and 1 km northwest of the West Pit mine area, has a screened interval between 57-60 mbgl within interburden underlying coal seams. EC readings range from 12,590 µS/cm (December 2014) and 19,400 µS/cm (December 2009). The 2024 readings ranging between 14,290 µS/cm and 14,860 µS/cm are consistent with historical concentrations. SLR (2020) previously recommended removing NPz2 from the compliance network as the bore location and construction does not provide information on potential impacts related to site activities but should remain in the operational network for future assessments and post closure monitoring.	It is noted that the bore has already been removed from the compliance monitoring network in the updated draft WMP which is currently with DCCEEW for approval. However, NPz2 should remain in the operational monitoring network to assist with future assessments and post closure monitoring. No further action is considered necessary.

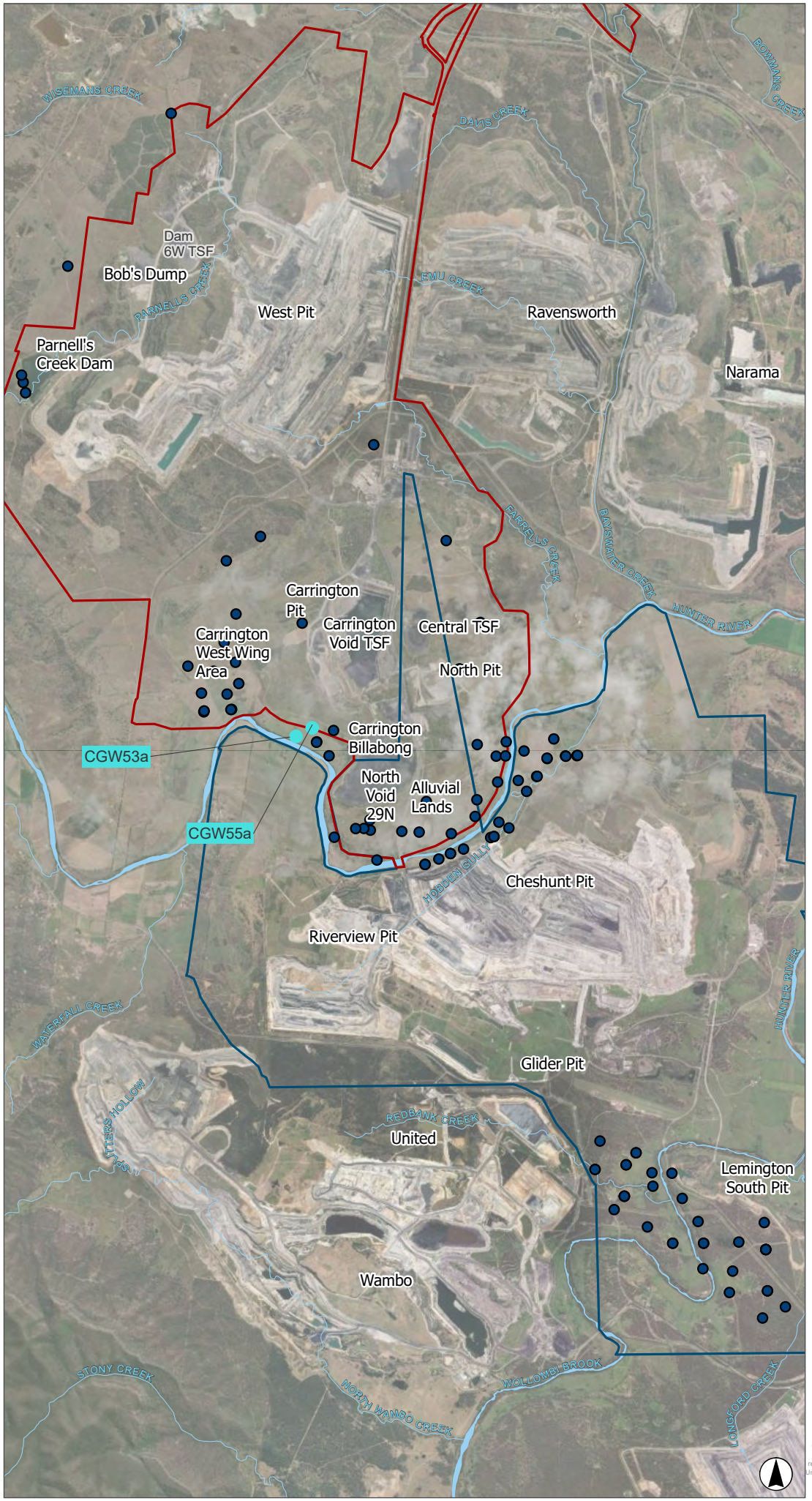


FIGURE 6.1

Groundwater Level Exceedence

Legend

- Groundwater Level Exceedance
- Groundwater No Exceedance
- Mapped Watercourses (named)
- HVO North Development Consent Boundary
- HVO South Development Consent Boundary
- Named Waterbody

0 1 2
Kilometres

Scale 1:80,000 at A4
GDA2020 MGA Zone 56

Image Source: ESRI Basemap (2022) **Data source:** NSW DFSI (2022)

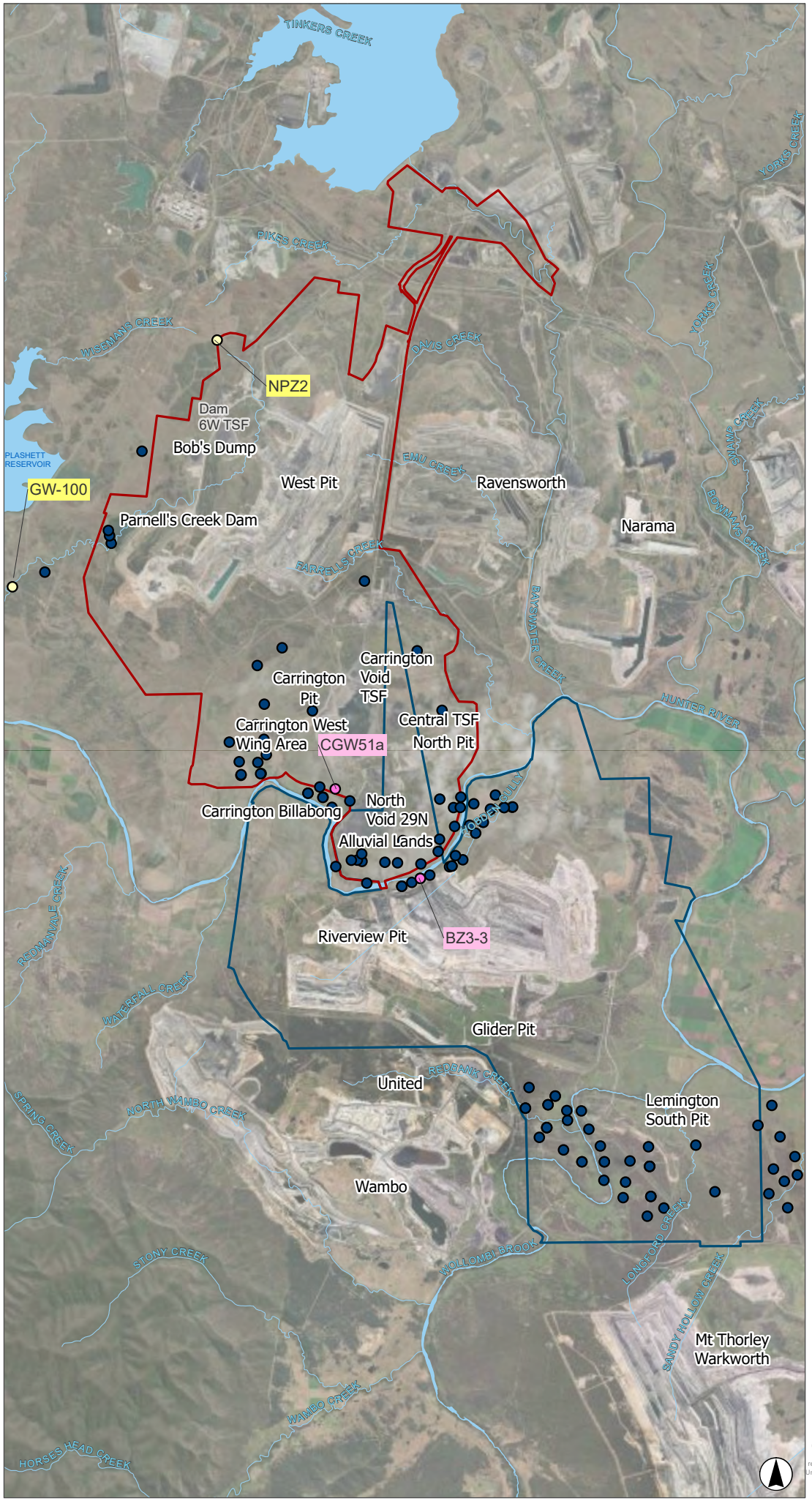


FIGURE 6.2

Groundwater Quality Exceedence

Legend

Exceedance Type

- EC Exceedance
- pH Exceedance
- Groundwater No Exceedence
- Mapped Watercourses (named)
- HVO North Development Consent Boundary
- HVO South Development Consent Boundary
- Named Waterbody

0 1 2
Kilometres

Scale 1:110,000 at A4
GDA2020 MGA Zone 56

Image Source: ESRI Basemap (2022) **Data source:** NSW DFSI (2022)

7.0 Groundwater Take

The direct or indirect take of all groundwater is required to be accounted for under the Water Management Act 2000. At HVO the take of water occurs via:

- Direct take:
    - Incidental take – water intercepted within mine workings and extracted for safety
    - Consumptive take – water pumped directly from water supply bores (i.e., LUG bore).
- Indirect take – depressurisation of Permian coal measures inducing inter-formation flows. Indirect take includes loss of baseflow, reduced upward seepage from Permian to alluvium and additional seepage from alluvium to underlying Permian.

A numerical groundwater model was developed for the HVO Continuation Project Groundwater Impact Assessment (AGE, 2022). The model was calibrated up to December 2020 and replicates mine progression on a quarterly basis to the year 2056. Umwelt completed handover of the existing MODFLOW groundwater model used for the HVO Continuation Project Groundwater Impact Assessment. The model was utilised for the Final Void Management Plan (Umwelt, 2024), with updates applied to the assumptions of spoil properties, removal of faults within mined out areas and removal of the unmined Carrington West Wing area. The refined model was utilised to extract the predicted groundwater take over the 2024 reporting period, which includes direct and indirect take.

Loss of baseflow is required to be assessed as specified in the WMP. Loss of baseflow includes reduction in contributions to the river from connected alluvium and additional leakage of streamflow into the connected alluvium. Baseflow is not measurable and therefore can only be quantified and reported on from the groundwater model with results provided as indirect take. This process is illustrated in **Figure 7.2** below.

Baseflow loss from the Hunter River is accounted for in the indirect take under the Hunter Regulated River Water Source WSP (Hunter River management zone). Baseflow loss in Wollombi Brook is accounted for in the indirect take under the Hunter Unregulated River and Alluvial Water Source WSP (Lower Wollombi Brook Water Source management zone). Indirect take, inclusive of baseflow, is reported in **Table 7.1**.

As shown in **Figure 7.2**, the system is connected, and indirect take also includes reduced upward seepage from Permian to alluvium and additional seepage from alluvium to underlying Permian. Therefore, water loss in the alluvium in turn induces water loss from the surface water system. Consistent with the approach undertaken for previous approvals, and as reported by AGE (2016), to exclude double accounting in this connected system the maximum indirect take from any one source (alluvium or surface water) is applied.

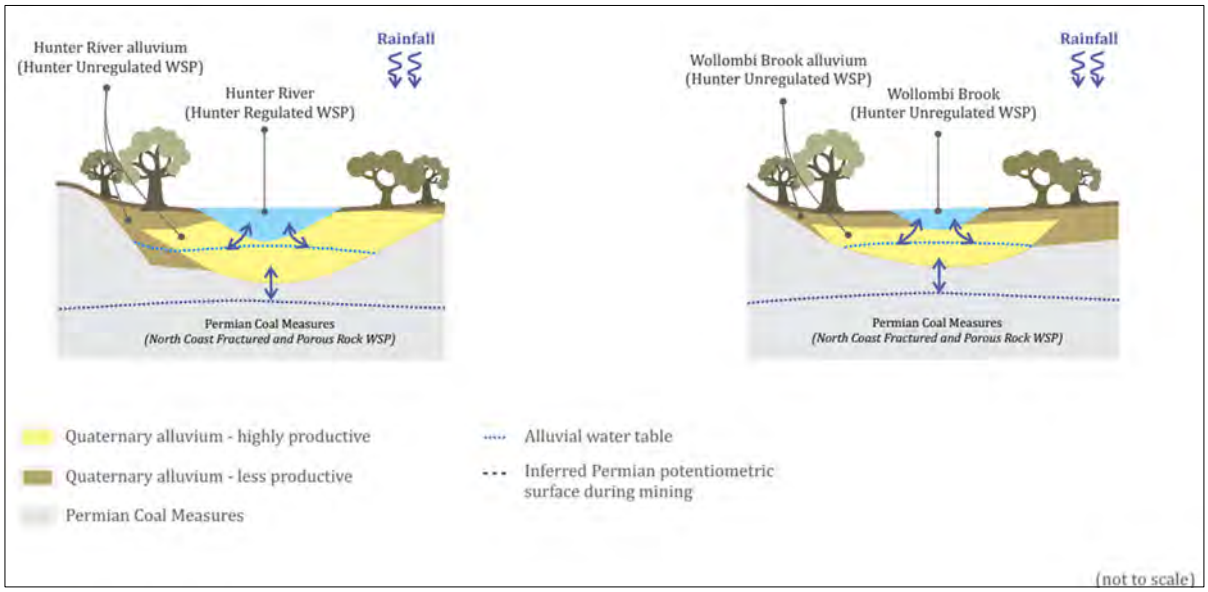


Figure 7.1 Schematic Showing Baseflow Licensing (Source: AGE, 2016)

The predicted take of groundwater from the various groundwater sources associated with HVO and are summarised in **Table 7.1**. Over the 2024 reporting year the total take under the Hunter Regulated water source was estimated at 27 ML, and 2,230 ML from the North Coast Fractured and Porous Rock water source.

Groundwater taken from LUG Bore under WAL39798 of up to 339 ML/year also occurred over the reporting period. However, as noted earlier the WAL was transferred to MTW in 2024, therefore it is now captured under MTW annual reporting requirements.

Table 7.1 2024 Predicted Groundwater Take

Groundwater Take	Hunter Regulated River WSP (ML)	Hunter Unregulated River and Alluvial Water Sources WSP (ML)	North Coast Fractured and Porous Rock WSP (ML)
HVO Mine Operations (incidental and indirect take)*	27	374	1,898

*Note: * HVO Continuation Project (2024)*

8.0 Summary and Recommendations

8.1 Summary

This annual groundwater review covers data collected from 1 January to 31 December 2024 and was completed in compliance with:

- Condition 27 of Development Consent DA 450-10-2003 for HVO North.
- Condition 28 of the Project Approval PA 06_0261 for HVO South.
- Individual bore license conditions (20BL173587-89, 20BL173847 and 20BL173392).
- Conditions of Environment Protection Licence 640.

Over 2024 operations across HVO included active mining at Cheshunt Pit 1 and 2, Riverview, West Pit and Mitchell Pit, with additional disturbance occurring in Wilton Pit, Mitchell Pit, West Pit. Carrington Pit TSF and Cumnock Void 3 were used during the year on HVO land. Groundwater was abstracted from LUG Bore over 2024; however, the WAL for LUG was permanently relinquished to MTW in early 2024.

Review of site climate data indicates the region generally experienced slightly below average rainfall over 2024. Similar trends are reflected in stream levels for the Hunter River and Wollombi Brook from the HITS stations and site monitoring locations (WL03, WL05, WL10 and WL14). Stream flows in the Hunter River and Wollombi Brook remained relatively stable over 2024 in response to below average rainfall.

Groundwater monitoring was largely conducted in accordance with the Groundwater Monitoring Programme outlined within the WMP (HVO, 2018). However, water level and water quality readings were not taken in all required bores due to a range of factors such as dry, blocked/collapsed bore conditions and access restrictions.

Review of groundwater level trends indicates that where saturated, water levels within the alluvium generally remained relatively stable in response to rainfall and stream flow trends following slightly below average rainfall over the reporting period.

Four alluvium bores (CGW53a and CGW55a) recorded groundwater level exceedances, attributable to decreased rainfall and streamflow. It is noted that the trigger level for the four alluvium bores has been superseded with triggers developed for monitoring NV TSF seepage and these triggers have either not been exceeded or do not require action in accordance with the trigger response protocol applied. The trigger levels have been revised in the draft WMP which is with DCCEEW for approval. Groundwater within the Permian coal measures remained relatively stable over 2024.

Review of water quality results and comparison to trigger levels for EC and pH identified that several bores exceeded triggers for EC and pH. However, the 2024 readings were generally in line with historical trends for these bores.

Quantification of groundwater take was undertaken based on reported volumes estimated for approved operations as part of the HVO Continuation Project Groundwater Impact Assessment (AGE, 2022) and metered abstraction volumes from LUG Bore. Based on this, over the 2024 reporting year the total take under the Hunter Regulated water source was estimated at 27 ML, and around 1,898 ML from the North Coast Fractured and Porous Rock water source. These volumes are within the licensed take for each groundwater source.

8.2 Recommendations

Based on review of the available data for 2024, recommendations are summarised in **Table 8.1**.

Table 8.1 Summary of Recommendations

Bore ID	Recommendation
BUNC45A	Water levels at or below the base of the screen since monitoring began. Water quality samples should not be collected if water level is below 19.3 mbTOC as they will likely not be representative of the surrounding aquifer.
BZ3-3	Groundwater quality (pH) exceedance during the reporting period. The bore is a 25 mm diameter bore, which is hindering water quality sampling and should be removed from the monitoring schedule. It is noted that the bore has already been removed from the compliance monitoring network in version 3.4 of the revised WMP which is currently with DCCEEW for approval.
BZ4A(2)	Provide screen interval depth collected in 2024 by AECOM. If current bore details are correct the bore should be removed from the WMP but kept as part of the operational monitoring network for ongoing monitoring of groundwater recovery post mining. Water quality samples should not be collected if the groundwater level is below the base of the screen.
C130(WDH)	In 2023, Umwelt undertook a trigger investigation for bore C130(WDH). The investigation noted that the C130 series of bores are 28 years old leading to deterioration of the bores over time which may be influencing water quality results. The investigation recommended undertaking comprehensive water quality analysis of water stored in the Lemington South Pit to determine if there is any seepage to the surrounding groundwater, monitored by the C130 series of bores ((Umwelt, 2023b). A water quality sample was collected from South Lemington Pit in September 2024. However, only bores C130(ALL) and C130(AFS1) have major ion analysis data available for comparison. Based on the available water quality data it is unlikely that seepage is occurring from the pit to the surrounding groundwater. However, it is recommended that an additional round of comprehensive water quality analysis (major ions) is undertaken in all C130 bores and South Lemington Pit to confirm that seepage is not occurring. If it is determined that there is no connection between the pit and the surrounding groundwater, the change in water quality is likely due to bore deterioration in which case the C130 series of bores should be replaced.
CGW45	Over 2024, the bore was recorded as blocked. An extension was added to the casing to increase the height of the casing above the ground surface to avoid further blockages. Removal of the blockage will be attempted again in 2025. Due to the bore condition CGW45 has been removed from the draft WMP which is awaiting approval. The bore should also be removed from the monitoring schedule.
CGW51a	Groundwater quality (pH) exceedance during the reporting period. The bore is used to monitor groundwater levels surrounding the backfilled Carrington Pit. Decommission the bore to prevent potential mixing of alluvial and Permian aquifers and install a replacement bore which can be used for monitoring to ensure the backfilled Carrington Pit continues to act as a groundwater sink. It is noted that the bore has already been removed from the compliance monitoring network in version 3.4 of the revised WMP which is currently with DCCEEW for approval.

Bore ID	Recommendation
CGW53a	Groundwater level trigger exceedance during the reporting period. Revised water level trigger already updated in the updated draft WMP, which is currently with DCCEEW for approval.
CGW55a	Groundwater level trigger exceedance during the reporting period. Revised water level trigger already updated in the updated draft WMP, which is currently with DCCEEW for approval.
GW-100	Groundwater quality (EC) exceedance during the reporting period. The EC exceedances are due to declining groundwater levels. Trends should continue to be monitored to determine if they are related to mining activities.
GW-103	The sensors have been checked and are irreparable. The VWP has been removed from the draft WMP which is awaiting approval. The VWP should also be removed from the monitoring schedule.
GW-105	The deepest sensor (VW3) has failed due to an open circuit and is no longer recording data. The sensor should be removed from the revised WMP and the monitoring schedule.
GW-108	In 2023, AECOM investigated the blockage with a downhole camera. The bore is deformed at depth preventing the collection of water quality samples. A replacement bore is planned to be drilled in 2025 as bore GW-108 forms part of the void closure plan.
GW-109	Review local site conditions to determine if any additional source of recharge to the shallow stratigraphy is present.
GW-110	Calibration data from VWP installation is unavailable to convert raw data to water levels. Decommission the VWP and remove from monitoring schedule.
NPz2	Groundwater quality (EC) exceedance during the reporting period. It is noted that the bore has already been removed from the compliance monitoring network in the updated draft WMP which is currently with DCCEEW for approval. However, NPz2 should remain in the operational monitoring network to assist with future assessments and post closure monitoring. No further action is considered necessary.
NPz3	Bore NPz3 has been recorded as blocked since December 2022. In 2023, AECOM investigated the condition of the bore using a downhole camera. The footage showed major deformation of the PVC casing. The bore has already been removed from the compliance monitoring network in the updated draft WMP which is currently with DCCEEW for approval. However, it is recommended that the bore is replaced as it will be required for monitoring of final voids following closure.

9.0 References

Australasian Groundwater and Environmental Consultants (AGE), 2013a. 2012 HVO South Groundwater Impacts Report, prepared for Coal & Allied Operations Pty Ltd, March 2013.

Australasian Groundwater and Environmental Consultants (AGE), 2013b. HVO North Modification Fine Reject Emplacement Groundwater Assessment, prepared for Coal & Allied Operations Pty Ltd, June 2013.

Australasian Groundwater and Environmental Consultants (AGE), 2016. HVO North Modification 6 Groundwater Study, prepared for EMM Consulting for Coal & Allied Operations Pty Ltd, November 2016.

Australasian Groundwater and Environmental Consultants (AGE), 2017. HVO South Modification 5 Groundwater Study, prepared for EMM Consulting for Coal & Allied Operations Pty Ltd, January 2017.

Australasian Groundwater and Environmental Consultants (AGE), 2022. HVO Continuation Project Groundwater Impact Assessment, prepared for EMM Consulting for Coal & Allied Operations Pty Ltd, December 2022.

Department of Environment and Science (DES), 2022. SILO – Australian Climate Data from 1889 to Yesterday. https://www.longpaddock.qld.gov.au/silo/

Bureau of Meteorology (BoM), 2018. Bureau of Meteorology Groundwater Dependent Ecosystems Atlas. http://www.bom.gov.au/water/groundwater/gde/

Environmental Resources Management (ERM), 2008. Groundwater Assessment, Hunter Valley Operations South Coal Project, Annex J, prepared for Coal & Allied Operations Pty Ltd, January 2008.

Hunter Valley Operations (HVO), 2018. Hunter Valley Operations – Water Management Plan. Hunter Valley Operations Pty Ltd. Version 3.0, 16 October 2018.

Mackie Environmental Research (MER), 1998. Hunter Valley South Mining Extension: Groundwater and Surface Water Management Studies, prepared for Rio Tinto Coal, July 1998.

Mackie Environmental Research (MER), 2003. West Pit Extension Groundwater Assessment, prepared for Coal & Allied, 2003.

Mackie Environmental Research (MER) 2005. Assessment of River Leakage Within the Cheshunt Pit Buffer Zone, prepared for Coal & Allied, April 2005.

Mackie Environmental Research (MER) 2010. Carrington West Wing Modification – Groundwater Assessment, prepared for Coal & Allied, in Carrington West Wing Environmental Assessment (EA), Volume 2, Appendix E – Groundwater Study, March 2010.

Mackie Martin & Associates, 1992. Hunter Valley Mine Alluvial Floodplain Groundwater Studies, prepared for Coal & Allied, Appendix D – Groundwater Study, August 1992.

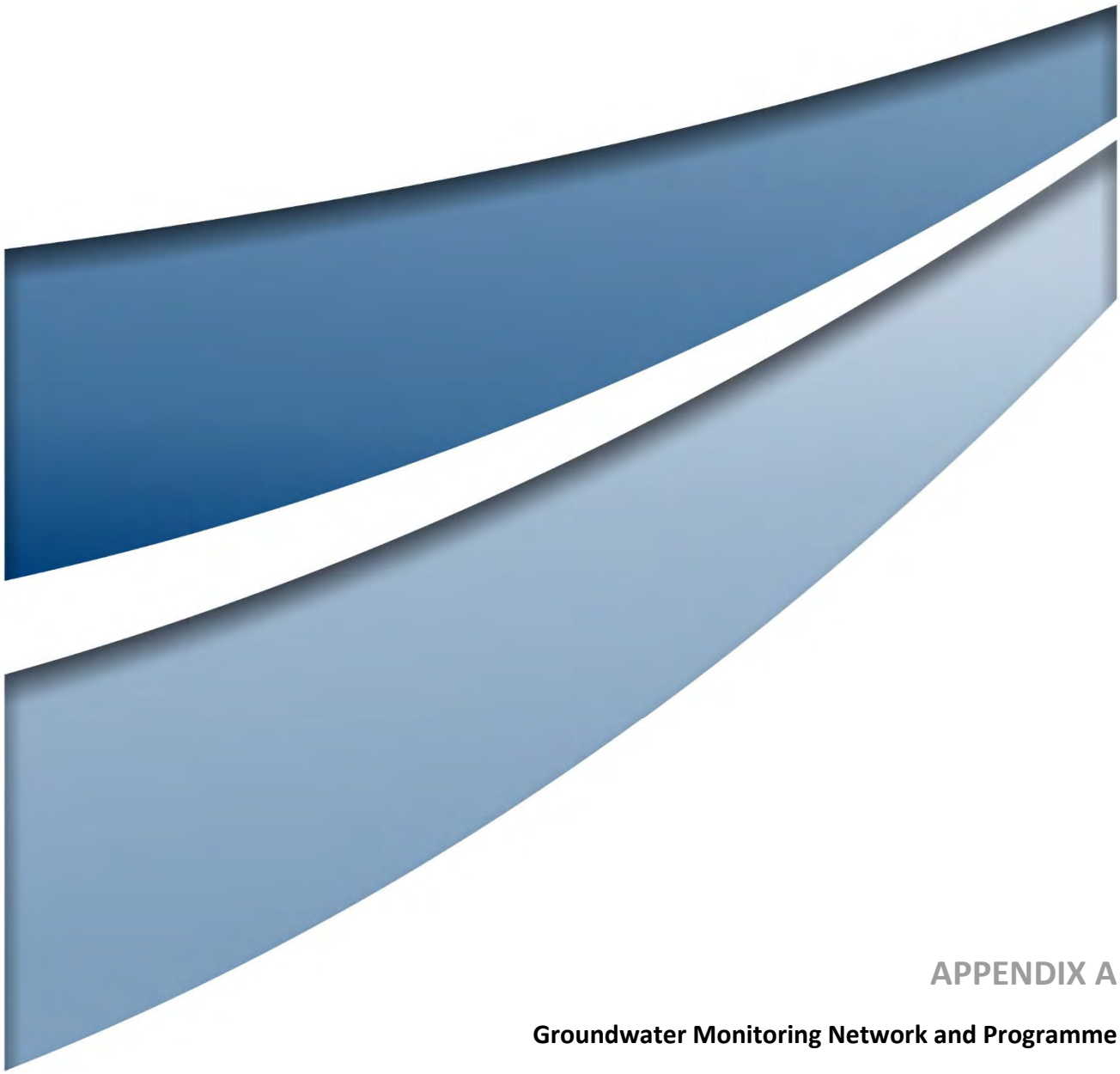
SLR Consulting Australia Pty Ltd (SLR), 2019. Hunter Valley Operations – Groundwater Monitoring Network Review. Prepared for Hunter Valley Operations Pty Ltd, July 2019, 620.12182-R12.

SLR Consulting Australia Pty Ltd (SLR), 2020. Hunter Valley Operations – Annual Groundwater Review 2019. Prepared for Hunter Valley Operations Pty Ltd, March 2020. 620.12182.00000-R13.

Umwelt Environmental & Social Consultants (Umwelt), 2023a. North Void Tailings Storage Facility – 2022 Annual Analysis Report. Prepared for Hunter Valley Operations Pty Ltd, February 2023, 21188/R08.

Umwelt Environmental & Social Consultants (Umwelt), 2023b. Water Quality Review – Bores C130(WDH) and C630(BFS). Prepared for Hunter Valley Operations Pty Ltd, July 2023, 21188/R09.

Umwelt Environmental & Social Consultants (Umwelt), 2023c. Triennial Groundwater Model Review – HVO. Prepared for Hunter Valley Operations Pty Ltd, March 2023, 21188/R10.



APPENDIX A

Groundwater Monitoring Network and Programme

Bore ID	WMP Geology	Easting (m)	Northing (m)	Ground Level (mAHD)	Screen Base (mAHD)	Screened Interval / Sensor Depth (mbgl)	Groundwater Monitoring Programme				
							Water Level	EC	pH	Comprehensive Analysis	Alk/ Acidity
4032P	Carrington West Wing Alluvium	308609	6402945	69.35	56.89	6.46–12.46	Q	Q	Q	6M	
4034P	Carrington West Wing Alluvium	308239	6402959	71.15	56.86	5.29–14.29	Q	Q	Q	6M	
4036C	Carrington Interburden	308272	6402688	70.7	37.68	32.02–33.02	Q	Q	Q		
4037P	Carrington West Wing Alluvium	308277	6402702	70.74	57.47	7.27–13.27	Q	Q	Q	6M	
4040P	Carrington West Wing Alluvium	308675	6402724	69.16	58.23	4.93–10.93	Q	Q	Q		
4051C	Carrington Interburden	308664	6402721	68.92	37.1	30.82–31.82	Q	Q	Q		
4116P	North Pit Spoil	310681	6400978	70.17	47.98	19.59–22.19	Q	Q	Q	6M	
4119P	North Pit Spoil	312501	6402048	63.51	47.24	13.67–16.27	Q	Q	Q	6M	
Appleyard Farm	Lemington South Alluvium	315491	6394639	53.88	43.88	6.20–9.20	M	Q	Q	A	
B334(BFS)	Lemington South Bowfield	316684	6394088	73.37	9.17	58.20–64.20	Q	6M	6M		
B425(WDH)	Lemington South Woodlands Hill	316010	6395024	57.88	22.69	31.19–35.19	Q	6M	6M	A	
B631(BFS)	Lemington South Bowfield	316425	6394319	72.11	-11.56	77.67–83.67	Q	6M	6M		
B631(WDH)	Lemington South Woodlands Hill	316424	6394319	71.98	39.95	29.53–32.03	6M	6M	6M		
B925(BFS)	Lemington South Bowfield	315921	6394604	62.45	-24.18	80.63–86.63	Q	6M	6M	A	
BC1a	Cheshunt Mt Arthur	312421	6400872	66.08	?	21.70– ?	Q	Q	Q		
BUNC45A	Cheshunt / North Pit Alluvium	313667	6402055	72.9	52.9	17.00–20.00	Q	Q	Q	6M	
BUNC45D	Cheshunt Mt Arthur Seam (Piercefield in WMP)	313677	6402060	73.36	44.82	25.54–28.54	Q	Q	Q	6M	
BZ1-1	Cheshunt / North Pit Interburden (Alluvium in WMP)	311472	6400483	71.39	47.79	20.60–23.60	Q	Q	Q	6M	
BZ1-3	Cheshunt Mt Arthur	311472	6400483	71.39	15.79	52.60–55.60	Q	Q	Q	6M	
BZ2A(1)	Cheshunt Mt Arthur	311671	6400561	71.17	19.62	48.55–51.55	Q	Q	Q		
BZ3-1	Cheshunt Interburden	311840	6400640	69.97	?	?	Q	Q	Q		
BZ3-3	Cheshunt Mt Arthur	311840	6400640	69.97	25.83	41.14–44.14	Q	Q	Q		
BZ4A(2)	Cheshunt Mt Arthur	312029	6400705	74.4	34	37.40–40.40	Q	Q	Q		
BZ8-2	Cheshunt Interburden	312685	6401010	67.8	46.8	18.00–21.00	Q	Q	Q	6M	

Bore ID	WMP Geology	Easting (m)	Northing	Ground	Screen Base	Screened Interval /	Groundwater Monitoring Programme				
C122(BFS)	Lemington South Bowfield	315501	6395007	58.2	?	?	Q	Q	Q		
C122(WDH)	Lemington South Woodlands Hill	315501	6395007	58.44	36.13	19.31–22.31	6M	6M	6M		
C130(AFS1)	Lemington South Arrowfield	316400	6394916	63.17	19.56	41.61–43.61	6M	6M	6M	A	
C130(ALL)	Lemington South Interburden	316400	6394916	63.17	46.55	14.62–16.62	Q	Q	Q	A	
C130(BFS)	Lemington South Bowfield	316400	6394916	62.98	-1.18	55.16–64.16	6M	6M	6M		
C130(WDH)	Lemington South Woodlands Hill	316400	6394916	63.14	42.02	18.62–21.12	6M	6M	6M		
C317(BFS)	Lemington South Bowfield	315054	6395007	60.38	-15.76	69.64–76.14	Q	6M	6M		
C317(WDH)	Lemington South Woodlands Hill	315054	6395007	60.12	26.83	30.79–33.29	Q	6M	6M		
C613(BFS)	Lemington South Bowfield	314688	6395243	63.64	-21.05	76.69–84.69	Q	6M	6M		
C621(BFS)	Lemington South Bowfield	315421	6395321	58.37	2.69	46.68–55.68	Q	6M	6M		
C630(BFS)	Lemington South Bowfield	316378	6395306	68.81	20.85	39.96–47.96	6M	6M	6M		
C809(GM/WDH)	Lemington South Woodlands Hill	314207	6395493	59.13	21.44	27.69–37.69	6M	6M	6M		
C919(ALL)	Lemington South Alluvium	315192	6395655	57.94	44.74	7.20–13.20	M	Q	Q	A	
CFW55R	Carrington Alluvium	310439	6402180	69.78	53.88	8.90–15.90	Q	Q	Q	6M	
CFW57	Carrington Alluvium	310084	6402053	70.05	55.35	7.70–14.70	Q	Q	Q	6M	
CGW32	Carrington West Wing Flood Plain	308598	6404872	78.48	56.06	13.42–22.42	Q	Q	Q		
CGW39	Carrington West Wing Flood Plain Alluvium?	308566	6403694	70.31	56.84	4.47–13.47	Q	Q	Q	6M	
CGW45	Carrington West Wing Bayswater Seam (LBL in WMP)	308042	6403349	71.83	?	28.3– ?	Q	Q	Q		
CGW46	Carrington West Wing Bayswater	308413	6403276	71.95	51.80	?	Q	Q	Q	6M	
CGW47a	Carrington West Wing Broonie Seam (Flood Plain in WMP)	308731	6403405	70.39	?	16.03– ?	Q	Q	Q	6M	
CGW49	Carrington West Wing Bayswater Seam (Alluvium in WMP)	308778	6403098	69.05	?	12.78– ?	Q	Q	Q		
CGW51a	Carrington Interburden	310149	6402419	70.04	54.21	12.83–15.83	Q	Q	Q		
CGW52	Carrington Broonie	309906	6402255	70.7	28.8	38.90–41.90	Q	Q	Q		
CGW52a	Carrington Alluvium	309902	6402249	70.61	53.36	14.25–17.25	Q	Q	Q		
CGW53	Carrington Broonie	309606	6402333	69.87	28.98	37.89–40.89	Q	Q	Q		

Bore ID	WMP Geology	Easting (m)	Northing	Ground	Screen Base	Screened Interval /	Groundwater Monitoring Programme				
CGW53a	Carrington Alluvium	309606	6402333	69.83	55.83	11.00–14.00	Q	Q	Q		
CGW55a	Carrington Alluvium	309840	6402457	70.56	55.24	12.32–15.32	Q	Q	Q		
CHPZ10A	Cheshunt / North Pit Alluvium	313334	6402297	62.57	50.77	8.70–11.80	Q	Q	Q	6M	
CHPZ12A	Cheshunt / North Pit Alluvium	313238	6402013	63.13	51.93	9.20–11.20	Q	Q	Q	6M	
CHPZ12D	Cheshunt Mt Arthur	313236	6402019	63.26	51.51	? –11.75	Q	Q	Q	6M	
CHPZ1A	Cheshunt / North Pit Alluvium	312820	6401697	65.9	48.2	14.00–17.70	Q	Q	Q	6M*	
CHPZ2A	Cheshunt / North Pit Alluvium	312941	6401539	65.14	48.88	13.06–16.26	Q	Q	Q	6M	
CHPZ3A	Cheshunt / North Pit Alluvium	313086	6401756	63.18	52.36	13.82–10.82	Q	Q	Q	6M	
CHPZ3D	Cheshunt Mt Arthur	313094	6401756	62.96	40	19.86–22.96	Q	Q	Q	6M	
CHPZ4A	Cheshunt / North Pit Alluvium	312904	6402123	65.45	51.99	10.16–13.46	Q	Q	Q	6M	
CHPZ8A	Cheshunt / North Pit Alluvium	313503	6402051	60.05	54.85	3.20–5.20	Q	Q	Q	6M	
CHPZ8D	Cheshunt Mt Arthur	313508	6402047	59.89	51.6	4.79–8.29	Q	Q	Q	6M	
D010(BFS)	Lemington South Bowfield	314355	6395687	55.94	-10.17	59.61–66.11	6M	6M	6M		
D010(GM)	Lemington South Glen Munro	314355	6395687	55.95	39.26	12.19–16.69	6M	6M	6M	A	
D010(WDH)	Lemington South Woodlands Hill	314355	6395687	55.93	33.76	19.17–22.17	6M	6M	6M		
D214(BFS)	Lemington South Bowfield	314768	6395831	56.67	4.5	42.67–52.17	Q	6*M	6*M		
D317(BFS)	Lemington South Bowfield	315043	6396019	59.64	15.77	38.67–43.87	Q	6M	6M		
D406(AFS)	Lemington South Arrowfield	313931	6396074	57.41	30.23	23.68–27.18	6M	6M	6M		
D406(BFS)	Lemington South Bowfield	313931	6396074	57.36	0.68	50.68–56.68	6M	6M	6M		
D510(AFS)	Lemington South Arrowfield	314380	6396141	54.99	24.81	25.18–30.18	6M	6M	6M		
D510(BFS)	Lemington South Bowfield	314380	6396141	54.98	17.28	33.70–37.70	6M	6M	6M		
D612(AFS)	Lemington South Arrowfield	314524	6396314	62.16	?	23.62– ?	6M	6M	6M		
D612(BFS)	Lemington South Bowfield	314524	6396314	62.1	?	28.81– ?	6M	6M	6M		
D807(BFS)	Lemington South Bowfield	314002	6396484	59.94	19.29	35.65–40.65	6M	6M	6M		
DM1	North Pit Spoil	311778	6405164	102.73	?	28.83– ?	Q	Q	Q	A	Q
DM3	North Pit Spoil	311971	6403310	94.14	?	40.67– ?	Q	Q	Q	A	Q

Bore ID	WMP Geology	Easting (m)	Northing	Ground	Screen Base	Screened Interval /	Groundwater Monitoring Programme				
DM4	North Pit Spoil	312222	6401418	64.85	?	54.16– ?	Q	Q	Q	A	Q
DM7	North Pit Spoil	311136	6400961	69.26	?	30.87– ?	Q	Q	Q	A	Q
G1	West Pit Alluvium	305694	6407301	110	?	<10.00– ?	Q	Q	Q	A	
G2	West Pit Alluvium	305660	6407451	110.6	?	3.04– ?	Q	Q	Q	A	
G3	West Pit Alluvium	305636	6407556	108.6	?	<10.00– ?	Q	Q	Q	A	
GA3	Cheshunt / North Pit Coal (Alluvium in WMP)	310159	6400876	67.02	?	12.00– ?	Q	Q	Q		
GW-100	West Pit Alluvium	303729	6406436	89.6	84.6	4.40–5.00	Q	Q	Q	A	
GW-100a (VWP)	Carrington Barrett Seam and Interburden	303722	6406445	89.4	-	51.00	Q*				
GW-101	West Pit Alluvium	304374	6406728	100.5	88.5	9.00–12.00	Q	Q	Q	A	
GW-101a (VWP)	Carrington Interburden (Siltstone/Sandstone)	304362	6406721	100.5	-	51.00	Q*				
GW-102 (VWP)	Carrington Interburden (Sandstone with minor coal)	305280	6406668	114.6	-	60.50	Q*				
GW-103 (VWP)	Carrington Coal – undifferentiated and weathered	306769	6404610	103.2	-	25.50	Q*				
	Carrington Siltstone and coal				-	64.50					
	Carrington Sandstone – mg, fresh				-	119.50					
GW-104 (VWP)	Carrington Lower Pikes Gully Seam	307549	6404657	86.7	-	59.00	Q*				
	Carrington Sandstone IB (near Upper Liddell Seam)				-	107.00					
	Carrington Sandstone (above Barret)				-	135.00					
GW-105 (VWP)	Carrington Coal – undifferentiated	308597	6405442	93.1	-	33.00	Q*				
	Carrington Coal – tuffaceous				-	103.50					
	Carrington Coal				-	154.00					
GW-106	Carrington West Wing Alluvium	309092	6405224	82.3	56.1	23.20–26.20	Q	Q	Q	A	
GW-107	Carrington Spoil	308738	6404103	73.5	46.3	24.20–27.20	Q	Q	Q	A	
GW-108	Carrington Spoil	309695	6403971	84.4	25.9	52.50–58.50	Q	Q	Q	A	
GW-109 (VWP)	Carrington Coal – slightly weathered	309232	6402706	85.2	-	31.50	Q*				
	Carrington Coal – tuffaceous				-	65.00					
	Carrington Bayswater Seam				-	89.50					

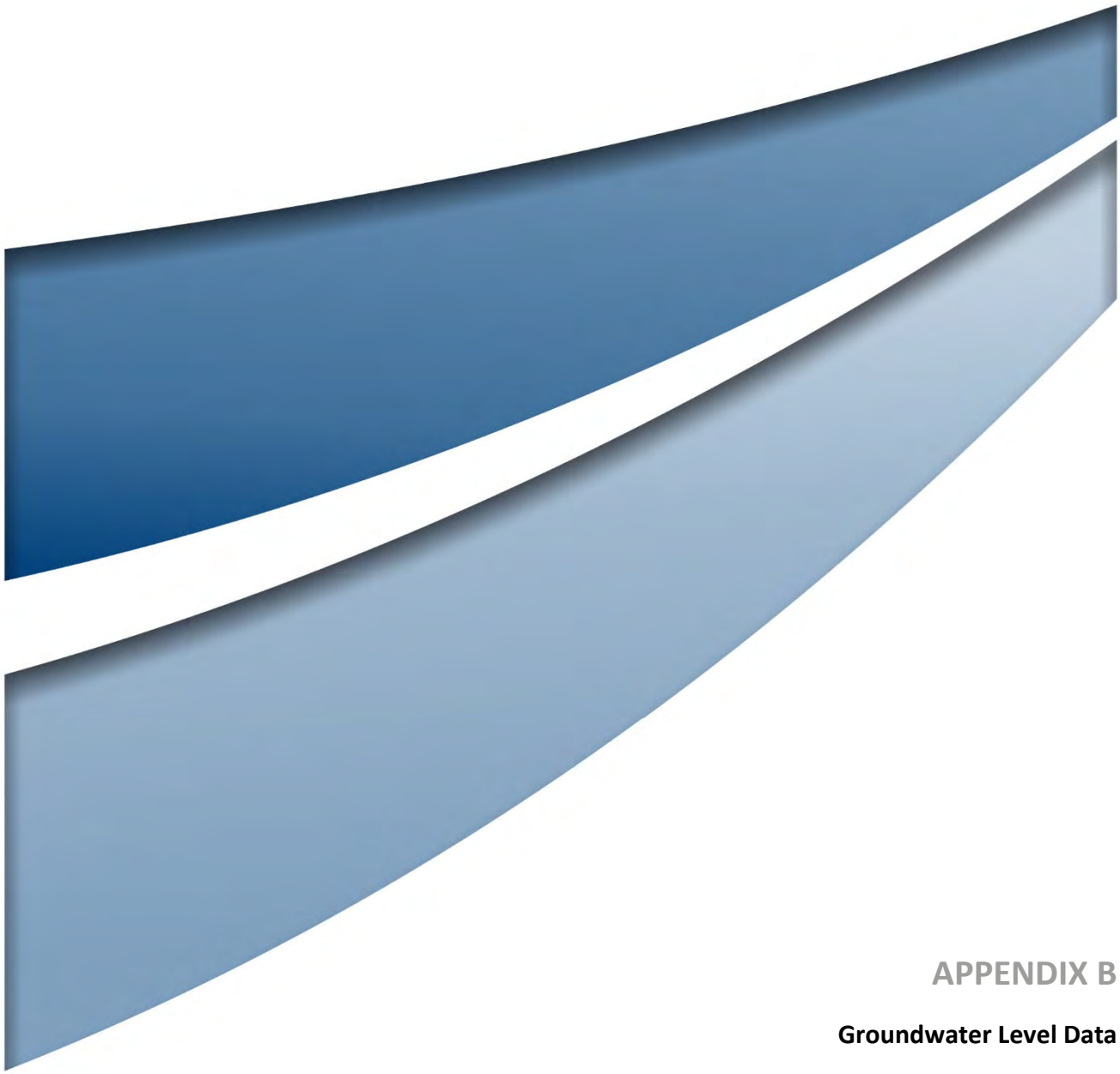
Bore ID	WMP Geology	Easting (m)	Northing	Ground	Screen Base	Screened Interval /	Groundwater Monitoring Programme				
GW-110 (VWP)	Carrington Sandstone – fresh	310503	6404598	124.6	-	38.00	Q*				
	Carrington Sandstone				-	63.00					
	Carrington Bayswater Seam				-	93.00					
GW-114	North Pit Spoil	312272	6403981	98.2	68.2	27.00–30.00	Q	Q	Q	A	
GW-115	North Pit Spoil	312227	6402216	68.3	40.1	22.20–28.20	Q	Q	Q	A	
HG2	Cheshunt Interburden	312469	6400886	67.4	51.03	10.37–16.37	Q	Q	Q		
HG2a	Cheshunt Mt Arthur	312469	6400886	66.82	39.07	25.75–27.75	Q	Q	Q		
Hobdens Well	Cheshunt / North Pit Alluvium	312540	6401093	71	?	?	Q	Q	Q	A	
HV3(2)	Cheshunt / North Pit Alluvium	310776	6400546	68.06	51.94	? –16.12	Q	Q	Q		
LUG Bore	Lemington South Mt Arthur	315874	6394295	?	?	?	M	Q	Q	A	
MB14HVO01	North Pit Spoil	310587	6401003	71.3	-18.7	? –90.00	Q	Q	Q	A	
MB14HVO02	North Pit Spoil	310469	6401001	70.9	61.9	? –90.00	Q	Q	Q	A	
MB14HVO03	North Pit Spoil	311387	6400950	67.1	-12.9	? –80.00	Q	Q	Q	A	
MB14HVO04	North Pit Spoil	311491	6401392	67.1	12.1	? –55.00	Q	Q	Q	A	
MB14HVO05	North Pit Spoil	310675	6401127	71.7	-13.3	? –85.00	Q	Q	Q	A	
NPz2	West Pit Sandstone/Siltstone	307800	6411340	190.48	131.08	56.40–59.40	Q	Q	Q	A	
NPz3	West Pit Sandstone/Siltstone	306305	6409131	148.4	?	93.30–96.60	Q	Q	Q	A	
NPz5	West Pit Sandstone/Siltstone	310730	6406550	113.76	71.49	39.27–42.27	Q	Q	Q	A	
PB01(ALL)	Lemington South Alluvium	314754	6396026	54.37	42.11	9.26–12.26	M	Q	Q	A	
PZ1CH200	Cheshunt / North Pit Alluvium	312646	6402256	62.06	51.06	>8.90–11.00	Q	Q	Q		
PZ2CH400	Cheshunt / North Pit Alluvium	312635	6402051	62.53	51.43	>9.90–11.10	Q	Q	Q	6M*	
PZ3CH800	Cheshunt / North Pit Alluvium	312522	6401674	64.16	?	10.47– ?	Q	Q	Q	6M*	
PZ4CH1380	Cheshunt / North Pit Alluvium	312196	6401176	64.93	?	14.48– ?	Q	Q	Q		
PZ5CH1800	Cheshunt / North Pit Alluvium	311852	6400928	66.1	?	14.90– ?	Q	Q	Q		
SR001	Southern Coal	319146	6394094	58.44	?	59.18– ?	6M	6M	6M		
SR002	Southern Bayswater Seam	319079	6394620	56.99	16.38	37.61–40.61	6M	6M	6M		

Bore ID	WMP Geology	Easting (m)	Northing	Ground	Screen Base	Screened Interval /	Groundwater Monitoring Programme				
SR003	Southern Bayswater Seam	318863	6394864	61.33	?	63.88– ?	6M	6M	6M		
SR004	Southern Bayswater Seam	318994	6395506	78.15	?	39.87– ?	6M	6M	6M		
SR005	Southern Bayswater Seam	318831	6396128	65.36	?	26.39– ?	6M	6M	6M		
SR006	Southern Bayswater Seam	318555	6395732	83.31	?	91.44– ?	6M	6M	6M		
SR007	Southern Overburden and Vaux Seam	318772	6394373	60.9	23.4	31.50–37.50	6M	6M	6M	A	
SR008	Southern Siltstone/sandstone below Lemington Seam	319290	6395111	56.8	26.4	24.40–30.40	6M	6M	6M	A	
SR009	Southern Lemington Seam	319338	6394746	56.1	19.7	30.40–36.40	6M	6M	6M	A	
SR010	Southern Conglomerate and Warkworth Seam	317319	6395338	57.5	26.9	24.60–30.60	6M	6M	6M	A	
SR011	Southern Mt Arthur Seam and underburden	317699	6394412	88.2	40.8	41.40–47.40	6M	6M	6M	A	
SR012	Southern Overburden – conglomerate and sandstone	316354	6393926	76.2	46.8	23.40–29.40	6M	6M	6M	A	

Comprehensive analysis includes major ions TDS, Al, As, B, Ca, Cd, Cl, (CO3), Cu, Hg, K, Mg, Na, Ni, Pb, Se, SO4 (or S), Zn, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, Hydroxide Alkalinity.

**TDS, Al, As, B, Be, Ca, Cd, Cl, CO3, Co, Cu, F, Fe, Hg, K, Mg, Mn, Na, Ni, NH3, NO2, NO3, P, Pb, Rb, Sb, Se, SO4 (or S), SiO2, Sr, Zn, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, Hydroxide Alkalinity.*

Notes: Q – Data downloaded quarterly*
M – Monthly
Q – Quarterly
6M – Six Monthly
A – Annual



APPENDIX B

Groundwater Level Data

Table B.1 Groundwater Level Data – Alluvium

Bore ID	WMP Geology	Ground Level (mAHD)	Screen Base (mAHD)	Screened Interval (mbgl)	Q1 SWL (mAHD)			Q2 SWL (mAHD)			Q3 SWL (mAHD)			Q4 SWL (mAHD)		
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4032P	Carrington West Wing Alluvium	69.35	56.89	6.46 - 12.46	-	-	60.41	-	-	60.41	-	-	60.35	-	-	60.31
4034P	Carrington West Wing Alluvium	71.15	56.86	5.29 - 14.29	-	-	59.77	-	-	59.71	-	-	59.73	-	-	59.64
4037P	Carrington West Wing Alluvium	70.74	57.47	7.27 - 13.27	-	-	60.48	-	-	60.47	-	-	60.46	-	-	60.38
4040P	Carrington West Wing Alluvium	69.16	58.23	4.93 - 10.93	-	-	60.27	-	-	60.39	-	-	60.38	-	-	61.28
CGW49	Carrington West Wing Alluvium	69.05	?	12.78 - ?	-	-	60.39	-	-	60.40	-	-	60.39	-	-	61.29
GW-106	Carrington West Wing Alluvium	82.30	56.10	23.20 - 26.20	-	-	59.66	-	-	59.59	-	-	59.64	-	-	59.58
CGW32	Carrington West Wing Flood Plain	78.48	56.06	13.42 - 22.42	-	-	59.52	-	-	59.48	-	-	59.48	-	-	59.46
CGW39	Carrington West Wing Flood Plain	70.31	56.84	4.47 - 13.47	-	-	59.89	-	-	59.79	-	-	59.68	-	-	59.66
CGW47a	Carrington West Wing Flood Plain	70.39	?	16.03 - ?	-	-	60.37	-	-	60.31	-	-	60.31	-	-	60.23
CFW55R	Carrington Alluvium	69.78	53.88	8.90 - 15.90	59.04	58.78	58.91	58.91	58.65	58.67	58.88	58.70	58.71	58.69	58.68	58.62
CFW57	Carrington Alluvium	70.05	55.35	7.70 - 14.70	59.05	58.98	59.07	59.06	59.10	59.06	58.98	59.19	58.98	58.98	58.92	58.85
CGW51a	Carrington Alluvium	70.04	54.21	12.83 - 15.83	-	-	57.09	-	-	56.87	-	-	56.85	-	-	56.79
CGW52a	Carrington Alluvium	70.61	53.36	14.25 - 17.25	-	-	59.16	-	-	59.21	-	-	59.22	-	-	59.08
CGW53a	Carrington Alluvium	69.83	55.83	11.00 - 14.00	-	-	**59.21**	-	-	**59.29**	-	-	**59.31**	-	-	59.17
CGW55a	Carrington Alluvium	70.56	55.24	12.32 - 15.32	-	-	**58.79**	-	-	**58.50**	-	-	**58.54**	-	-	**58.44**
BUNC45A	Cheshunt / North Pit Alluvium	72.90	52.90	17.00 - 20.00	52.72	52.65	52.63	52.59	52.48	52.47	52.29	52.51	51.47	-	52.37	-
BZ1-1	Cheshunt / North Pit Alluvium	71.39	47.79	20.60 - 23.60	53.61	53.69	53.76	53.78	53.69	53.89	53.94	53.97	53.86	-	53.49	-
CHPZ10A	Cheshunt / North Pit Alluvium	62.57	50.77	8.70 - 11.80	54.25	54.19	54.17	54.19	54.19	54.32	54.37	54.41	54.43	-	54.29	-
CHPZ12A	Cheshunt / North Pit Alluvium	63.13	51.93	9.20 - 11.20	54.42	54.35	54.31	54.35	54.34	54.49	54.54	54.58	54.60	-	54.47	-
CHPZ1A	Cheshunt / North Pit Alluvium	65.90	48.20	14.00 - 17.70	55.57	55.50	55.47	55.56	55.54	55.79	55.80	55.82	55.79	-	55.64	-
CHPZ2A	Cheshunt / North Pit Alluvium	65.14	48.88	13.06 - 16.26	54.65	54.59	54.55	54.63	54.63	54.86	54.88	54.92	54.91	-	54.74	-
CHPZ3A	Cheshunt / North Pit Alluvium	63.18	52.36	13.82 - 10.82	54.53	54.46	54.43	54.47	54.47	54.64	54.68	54.73	54.73	-	54.60	-
CHPZ4A	Cheshunt / North Pit Alluvium	65.45	51.99	10.16 - 13.46	54.46	54.41	54.38	54.44	54.44	54.66	54.66	54.70	54.68	-	54.53	-
CHPZ8A	Cheshunt / North Pit Alluvium	60.05	54.85	3.20 - 5.20	54.31	54.25	54.21	54.24	54.24	54.32	54.42	54.42	54.47	-	54.34	-
GA3	Cheshunt / North Pit Alluvium	67.02	?	12.00 - ?	56.18	-	56.70	56.76	56.87	57.28	57.06	57.12	57.06	57.00	-	-
Hobdens Well	Cheshunt / North Pit Alluvium	71.00	?	?	59.45	59.40	59.37	59.50	59.54	59.88	59.88	59.88	59.86	-	59.62	-
HV3(2)	Cheshunt / North Pit Alluvium	68.06	51.94	? - 16.12	57.83	-	57.83	58.32	57.92	58.23	58.14	58.09	58.07	57.99	-	-
PZ1CH200	Cheshunt / North Pit Alluvium	62.06	51.06	>8.90 - 11.00	54.85	54.74	54.78	54.78	54.89	55.23	55.34	55.27	55.13	-	54.75	-
PZ2CH400	Cheshunt / North Pit Alluvium	62.53	51.43	>9.90 - 11.10	53.76	53.68	53.69	53.78	53.86	54.27	54.15	54.17	53.98	-	53.73	-
PZ3CH800	Cheshunt / North Pit Alluvium	64.16	?	10.47 - ?	54.90	54.79	54.83	54.90	54.98	55.35	55.42	55.25	55.14	-	54.84	-
PZ4CH1380	Cheshunt / North Pit Alluvium	64.93	?	14.48 - ?	55.22	55.11	55.14	55.21	55.37	55.70	55.83	55.65	55.50	-	55.16	-
PZ5CH1800	Cheshunt / North Pit Alluvium	66.10	?	14.90 - ?	55.51	55.43	55.41	55.52	55.70	56.06	56.07	56.00	55.81	-	55.67	-
Appleyard Farm	Lemington South Alluvium	53.88	43.88	6.20 - 9.20	48.07	47.96	47.92	48.74	49.46	48.95	48.72	48.60	48.45	48.47	48.33	48.25
C919(ALL)	Lemington South Alluvium	57.94	44.74	7.20 - 13.20	48.97	48.77	48.70	48.69	48.62	48.69	48.56	48.62	48.60	48.56	48.57	48.40
PB01(ALL)	Lemington South Alluvium	54.37	42.11	9.26 - 12.26	46.30	46.13	46.04	46.60	46.97	47.01	46.87	46.77	46.75	46.63	46.56	46.54
G1	West Pit Alluvium	110.00	?	<10.00 - ?	-	-	107.93	-	-	109.01	-	-	108.46	-	-	108.00
G2	West Pit Alluvium	110.60	?	3.04 - ?	-	-	108.90	-	-	109.80	-	-	109.47	-	-	108.99
G3	West Pit Alluvium	108.60	?	<10.00 - ?	-	-	106.56	-	-	107.41	-	-	107.12	-	-	106.60
GW-100	West Pit Alluvium	89.60	84.60	4.40 - 5.00	-	-	84.77	-	-	85.16	-	-	85.49	-	-	85.17
GW-101	West Pit Alluvium	100.50	88.50	9.00 - 12.00	**Dry**			**Dry**			**Dry**			**Dry**		

Table B.2 Groundwater Level Data – Permian Coal Measures

Bore ID	WMP Geology	Ground Level (mAHD)	Screen Base (mAHD)	Screened Interval (mbgl)	Q1 SWL (mAHD)			Q2 SWL (mAHD)			Q3 SWL (mAHD)			Q4 SWL (mAHD)		
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CGW45	Carrington West Wing LBL	71.83	?	28.3 - ?	Blocked			Blocked			Blocked			Blocked		
CGW46	Carrington West Wing Bayswater	71.95	51.80	?	-	-	59.49	-	-	59.41	No access			-	59.36	59.33
CGW52	Carrington Broonie	70.70	28.80	38.90 - 41.90	-	-	38.15	-	-	38.10	-	-	38.40	-	-	38.50
CGW53	Carrington Broonie	69.87	28.98	37.89 - 40.89	-	-	36.88	-	-	36.98	-	-	37.23	-	-	37.31
4036C	Carrington Interburden	70.70	37.68	32.02 - 33.02	-	-	40.25	-	-	40.03	-	-	40.60	-	-	40.38
4051C	Carrington Interburden	68.92	37.10	30.82 - 31.82	-	-	56.99	-	-	57.12	-	-	57.54	-	58.16	58.05
CGW51a	Carrington Interburden	70.04	54.21	12.83 - 15.83	-	-	57.09	-	-	56.87	-	-	56.85	-	-	56.79
BZ3-1	Cheshunt Interburden	69.97	?	?	53.48	53.32	53.31	53.34	53.30	53.59	53.53	53.50	53.38	-	53.19	-
BZ8-2	Cheshunt Interburden	67.80	46.80	18.00 - 21.00	-	46.64	46.68	46.78	46.75	46.84	46.95	46.97	46.99	No access		
HG2	Cheshunt Interburden	67.40	51.03	10.37 - 16.37	55.93	55.87	55.83	55.83	55.80	55.89	55.95	55.94	55.97	-	55.85	-
BC1a	Cheshunt Mt Arthur	66.08	?	21.70 - ?	48.98	48.99	49.00	49.00	48.98	49.02	49.04	48.60	48.97	-	48.99	-
BZ1-3	Cheshunt Mt Arthur	71.39	15.79	52.60 - 55.60	-	25.02	-	-	24.90	-	-	24.95	-	-	24.68	-
BZ2A(1)	Cheshunt Mt Arthur	71.17	19.62	48.55 - 51.55	25.37	25.32	25.39	25.41	25.34	25.44	25.44	25.41	25.48	-	25.40	-
BZ3-3	Cheshunt Mt Arthur	69.97	25.83	41.14 - 44.14	-	28.23	-	-	28.33	-	-	28.44	-	-	28.43	-
BZ4A(2)	Cheshunt Mt Arthur	74.40	34.00	37.40 - 40.40	33.78	33.90	33.97	33.86	33.92	33.73	33.74	33.72	33.71	-	33.75	-
CHPZ12D	Cheshunt Mt Arthur	63.26	51.51	? - 11.75	54.32	54.25	54.18	54.25	54.21	54.41	54.45	54.71	54.51	-	54.34	-
CHPZ3D	Cheshunt Mt Arthur	62.96	40.00	19.86 - 22.96	53.62	53.54	53.52	53.55	53.57	53.79	53.73	53.77	53.75	-	53.70	-
CHPZ8D	Cheshunt Mt Arthur	59.89	51.60	4.79 - 8.29	54.35	54.25	54.18	54.30	54.30	54.43	54.50	54.45	54.49	-	54.40	-
HG2a	Cheshunt Mt Arthur	66.82	39.07	25.75 - 27.75	-	41.46	-	-	41.45	-	-	41.49	-	-	41.47	-
BUNC45D	Cheshunt Piercefield	73.36	44.82	25.54 - 28.54	48.46	48.44	48.49	48.42	48.35	48.53	48.51	48.47	48.49	-	48.74	-
C130(AFS1)	Lemington South Arrowfield	63.17	19.56	41.61 - 43.61	NR (6M)			-	45.14	-	NR (6M)			-	45.00	-
D406(AFS)	Lemington South Arrowfield	57.41	30.23	23.68 - 27.18	NR (6M)			-	34.59	-	NR (6M)			-	34.32	-
D510(AFS)	Lemington South Arrowfield	54.99	24.81	25.18 - 30.18	NR (6M)			Blocked			NR (6M)			-	28.88	-
D612(AFS)	Lemington South Arrowfield	62.16	?	23.62 - ?	NR (6M)			-	38.78	-	NR (6M)			Dry		
B334(BFS)	Lemington South Bowfield	73.37	9.17	58.20 - 64.20	-	19.15	-	-	19.19	-	-	19.04	-	-	18.72	-
B631(BFS)	Lemington South Bowfield	72.11	-11.56	77.67 - 83.67	-	22.99	-	-	22.42	-	-	22.59	-	-	21.79	-
B925(BFS)	Lemington South Bowfield	62.45	-24.18	80.63 - 86.63	-	1.79	-	-	1.86	-	-	2.06	-	-	1.38	-
C122(BFS)	Lemington South Bowfield	58.20	?	?	-	-0.29	-	-	-0.22	-	-	-0.30	-	-	-0.25	-
C130(BFS)	Lemington South Bowfield	62.98	-1.18	55.16 - 64.16	NR (6M)			-	11.95	-	NR (6M)			-	7.49	-
C317(BFS)	Lemington South Bowfield	60.38	-15.76	69.64 - 76.14	-	6.30	-	-	6.15	-	-	6.66	-	-	5.87	-
C613(BFS)	Lemington South Bowfield	63.64	-21.05	76.69 - 84.69	-	40.85	-	-	40.74	-	-	40.78	-	-	40.73	-
C621(BFS)	Lemington South Bowfield	58.37	2.69	46.68 - 55.68	-	13.78	-	-	13.83	-	-	14.01	-	-	13.58	-
C630(BFS)	Lemington South Bowfield	68.81	20.85	39.96 - 47.96	NR (6M)			-	24.35	-	NR (6M)			-	24.48	-
D010(BFS)	Lemington South Bowfield	55.94	-10.17	59.61 - 66.11	NR (6M)			-	27.52	27.47	NR (6M)			-	27.12	-
D214(BFS)	Lemington South Bowfield	56.67	4.50	42.67 - 52.17	-	32.70	-	-	32.96	-	-	33.10	-	-	33.01	-
D317(BFS)	Lemington South Bowfield	59.64	15.77	38.67 - 43.87	-	31.86	-	-	32.02	-	-	32.23	-	-	32.22	-
D406(BFS)	Lemington South Bowfield	57.36	0.68	50.68 - 56.68	NR (6M)			-	17.58	-	NR (6M)			-	17.31	-
D510(BFS)	Lemington South Bowfield	54.98	17.28	33.70 - 37.70	NR (6M)			-	25.80	-	NR (6M)			-	24.87	-
D612(BFS)	Lemington South Bowfield	62.10	?	28.81 - ?	NR (6M)			-	28.70	-	NR (6M)			-	28.65	-
D807(BFS)	Lemington South Bowfield	59.94	19.29	35.65 - 40.65	NR (6M)			-	20.47	-	NR (6M)			-	20.21	-
D010(GM)	Lemington South Glen Munro	55.95	39.26	12.19 - 16.69	NR (6M)			-	50.01	-	NR (6M)			-	49.11	-
C130(ALL)	Lemington South Interburden	63.17	46.55	14.62 - 16.62	-	47.30	-	-	47.35	-	-	48.34	-	-	47.34	-
B425(WDH)	Lemington South Woodlands Hill	57.88	22.69	31.19 - 35.19	-	22.30	-	-	22.35	-	-	22.33	-	-	22.31	-
B631(WDH)	Lemington South Woodlands Hill	71.98	39.95	29.53 - 32.03	NR (6M)			-	46.02	-	NR (6M)			-	45.98	-
C122(WDH)	Lemington South Woodlands Hill	58.44	36.13	19.31 - 22.31	NR (6M)			-	47.50	-	NR (6M)			-	46.95	-
C130(WDH)	Lemington South Woodlands Hill	63.14	42.02	18.62 - 21.12	NR (6M)			-	47.19	-	NR (6M)			-	47.18	-
C317(WDH)	Lemington South Woodlands Hill	60.12	26.83	30.79 - 33.29	-	46.31	-	-	47.23	-	-	46.89	-	-	46.43	-
C809(GM/WDH)	Lemington South Woodlands Hill	59.13	21.44	27.69 - 37.69	NR (6M)			-	48.31	-	NR (6M)			-	48.21	-
D010(WDH)	Lemington South Woodlands Hill	55.93	33.76	19.17 - 22.17	NR (6M)			-	46.68	46.83	NR (6M)			-	46.80	-
LUG Bore	Lemington South Mt Arthur	?	?	?	NM (Bore Head Sealed)			NM (Bore Head Sealed)			NM (Bore Head Sealed)			NM (Bore Head Sealed)		
NPz2	West Pit Sandstone/Siltstone	190.48	131.08	56.40 - 59.40	-	-	156.13	-	-	157.56	-	-	158.22	-	-	158.69
NPz3	West Pit Sandstone/Siltstone	148.40	?	93.30 - 96.60	Bore Collapsed			Bore collapsed			Bore collapsed			Bore collapsed		

Table B.2 Groundwater Level Data – Permian Coal Measures

Bore ID	WMP Geology	Ground Level (mAHD)	Screen Base (mAHD)	Screened Interval (mbgl)	Q1 SWL (mAHD)			Q2 SWL (mAHD)			Q3 SWL (mAHD)			Q4 SWL (mAHD)		
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NPz5	West Pit Sandstone/Siltstone	113.76	71.49	39.27 - 42.27	Mined through			Mined through			Mined through			Mined through		
SR001	Southern Coal	58.44	?	59.18 - ?	NR (6M)			-	-	48.16	NR (6M)			-	-	47.97
SR002	Southern Bayswater Seam	56.99	16.38	37.61 - 40.61	NR (6M)			-	-	42.10	NR (6M)			-	-	41.88
SR003	Southern Bayswater Seam	61.33	?	63.88 - ?	NR (6M)			-	-	42.61	NR (6M)			-	-	42.34
SR004	Southern Bayswater Seam	78.15	?	39.87 - ?	NR (6M)			-	-	42.60	NR (6M)			-	-	42.32
SR005	Southern Bayswater Seam	65.36	?	26.39 - ?	NR (6M)			-	-	43.70	NR (6M)			-	-	43.45
SR006	Southern Bayswater Seam	83.31	?	91.44 - ?	NR (6M)			-	-	43.62	NR (6M)			-	-	43.35
SR007	Southern Overburden and Vaux Seam	60.90	23.40	31.50 - 37.50	NR (6M)			-	-	26.14	NR (6M)			-	-	25.05
SR008	Southern Siltstone/sandstone below Lemington Seam	56.80	26.40	24.40 - 30.40	NR (6M)			-	-	47.95	47.98	-	-	-	-	47.96
SR009	Southern Lemington Seam	56.10	19.70	30.40 - 36.40	NR (6M)			-	-	49.85	NR (6M)			-	-	49.85
SR010	Southern Conglomerate and Warkworth Seam	57.50	26.90	24.60 - 30.60	NR (6M)			-	-	47.36	47.34	-	-	-	-	47.38
SR011	Southern Mt Arthur Seam and underburden	88.20	40.80	41.40 - 47.40	NR (6M)			-	-	53.93	NR (6M)			-	-	53.88
SR012	Southern Overburden - conglomerate and sandstone	76.20	46.80	23.40 - 29.40	NR (6M)			-	-	51.15	NR (6M)			-	-	51.02

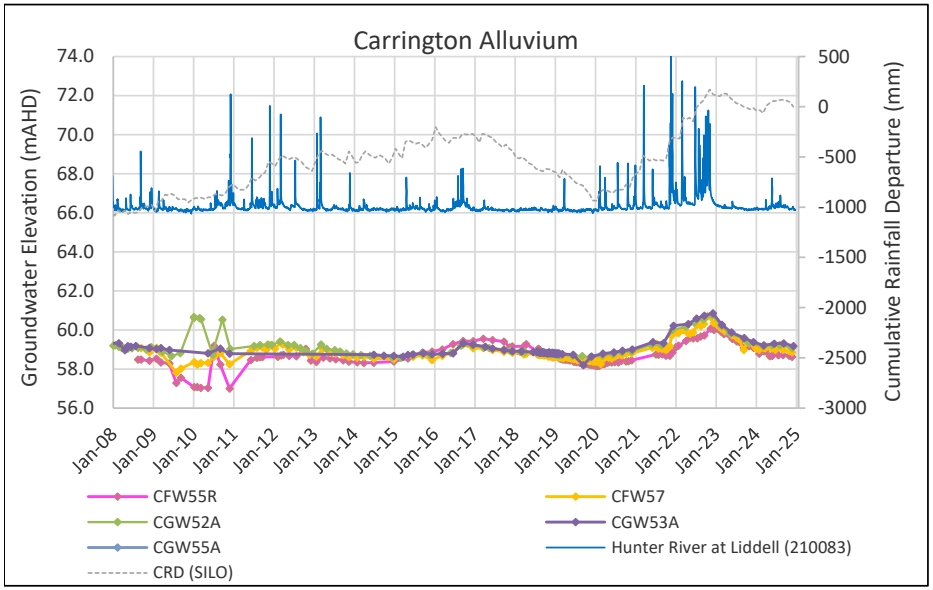
Note: NR (6m) = not required (6 monthly monitoring only)

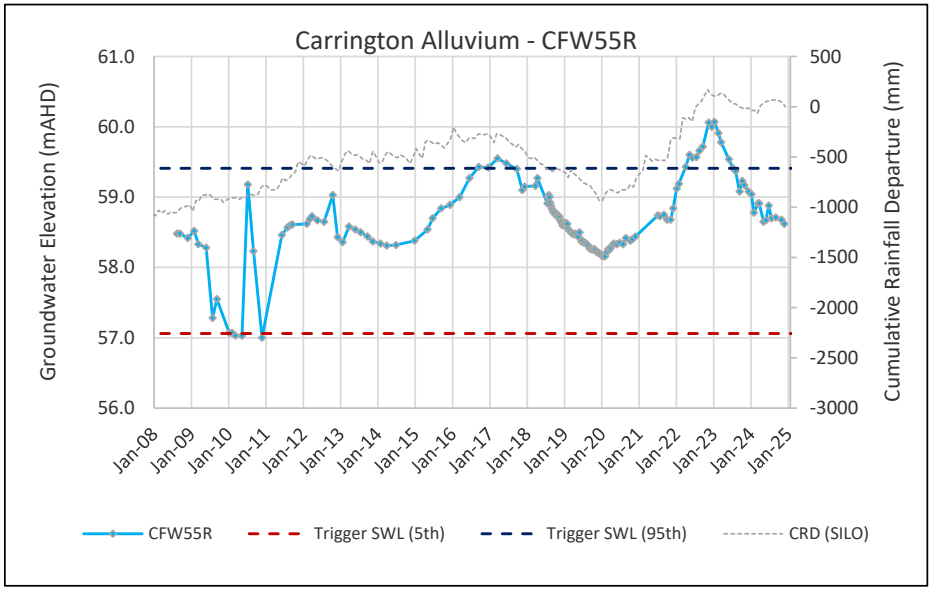
Table B.3 Groundwater Level Data – Spoil

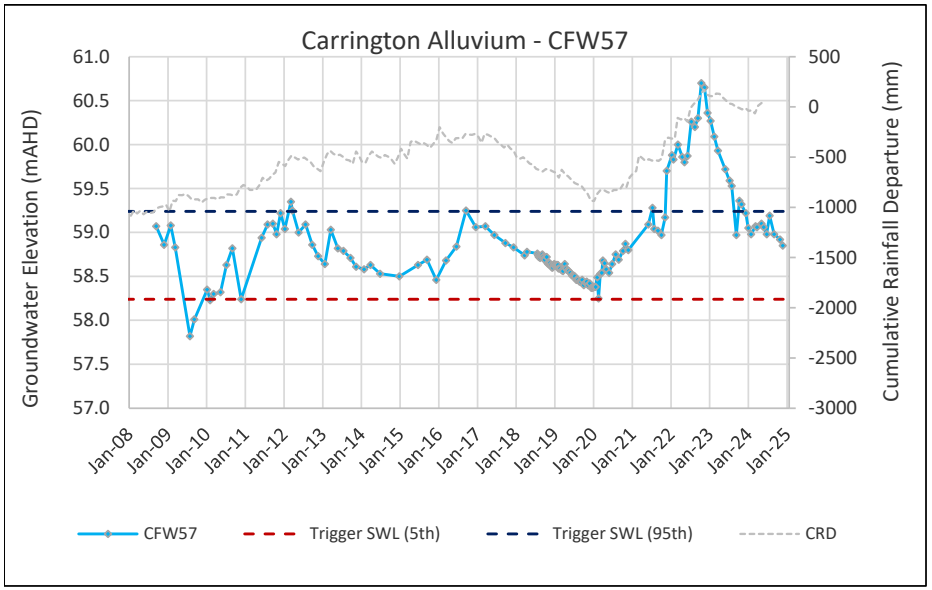
Bore ID	WMP Geology	Ground Level (mAHD)	Screen Base (mAHD)	Screened Interval (mbgl)	Q1 SWL (mAHD)			Q2 SWL (mAHD)			Q3 SWL (mAHD)			Q4 SWL (mAHD)		
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GW-107	Carrington Spoil	73.50	46.30	24.20 - 27.20	Dry			Dry			Dry			Dry		
GW-108	Carrington Spoil	84.40	25.90	52.50 - 58.50	-	-	28.05	Blocked			28.50	-	29.04	-	-	28.95
4116P	North Pit Spoil	70.17	47.98	19.59 - 22.19	49.38	-	-	48.99	-	-	48.98	48.98	-	48.98	-	-
4119P	North Pit Spoil	63.51	47.24	13.67 - 16.27	56.05	-	-	55.64	-	-	55.68	-	-	55.42	-	-
DM1	North Pit Spoil	102.73	?	28.83 - ?	78.63	-	-	78.48	-	-	78.43	-	-	-	78.36	-
DM3	North Pit Spoil	94.14	?	40.67 - ?	-	65.61	-	65.58	-	-	65.56	-	-	65.53	-	-
DM4	North Pit Spoil	64.85	?	54.16 - ?	49.41	-	-	49.19	-	-	49.06	-	-	49.13	-	-
DM7	North Pit Spoil	69.26	?	30.87 - ?	38.55	-	-	37.83	-	-	37.37	-	-	37.02	-	-
GW-114	North Pit Spoil	98.20	68.20	27.00 - 30.00	67.08	-	-	67.02	-	-	66.99	-	-	66.93	-	-
GW-115	North Pit Spoil	68.30	40.10	22.20 - 28.20	55.72	-	-	55.77	-	-	55.84	-	-	55.68	-	-
MB14HVO01	North Pit Spoil	71.30	-18.70	? - 90.00	38.44	-	-	37.76	-	-	37.31	37.14	-	36.88	-	-
MB14HVO02	North Pit Spoil	70.90	-19.10	? - 90.00	38.40	-	-	37.71	-	-	37.27	37.09	-	36.92	-	-
MB14HVO03	North Pit Spoil	67.10	-12.90	? - 80.00	35.11	-	-	34.61	-	-	34.39	-	-	34.15	-	-
MB14HVO04	North Pit Spoil	67.10	12.10	? - 55.00	40.34	-	-	39.89	-	-	39.53	-	-	39.23	-	-
MB14HVO05	North Pit Spoil	71.70	-13.30	? - 85.00	38.61	-	-	37.92	-	-	37.48	37.32	-	37.10	-	-

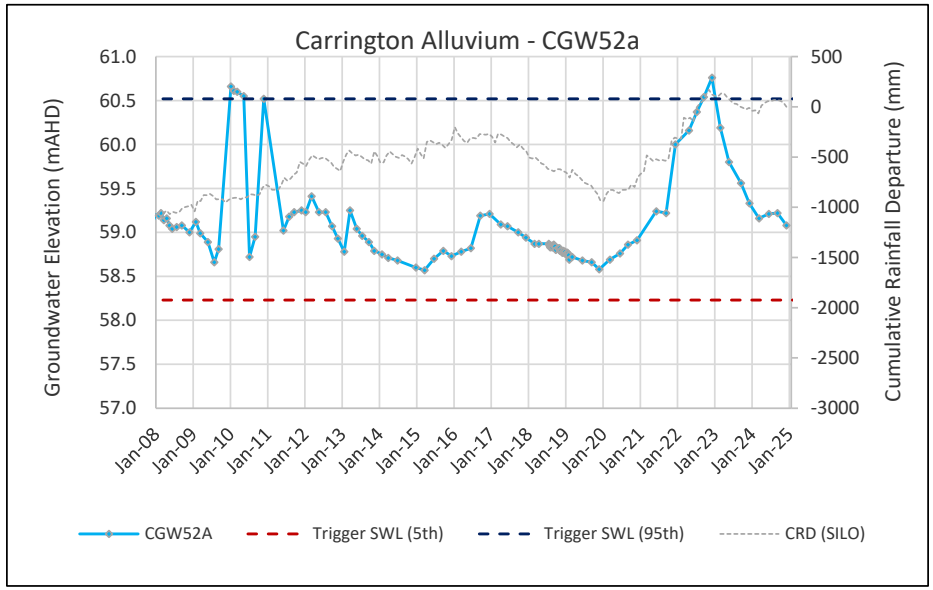
APPENDIX C

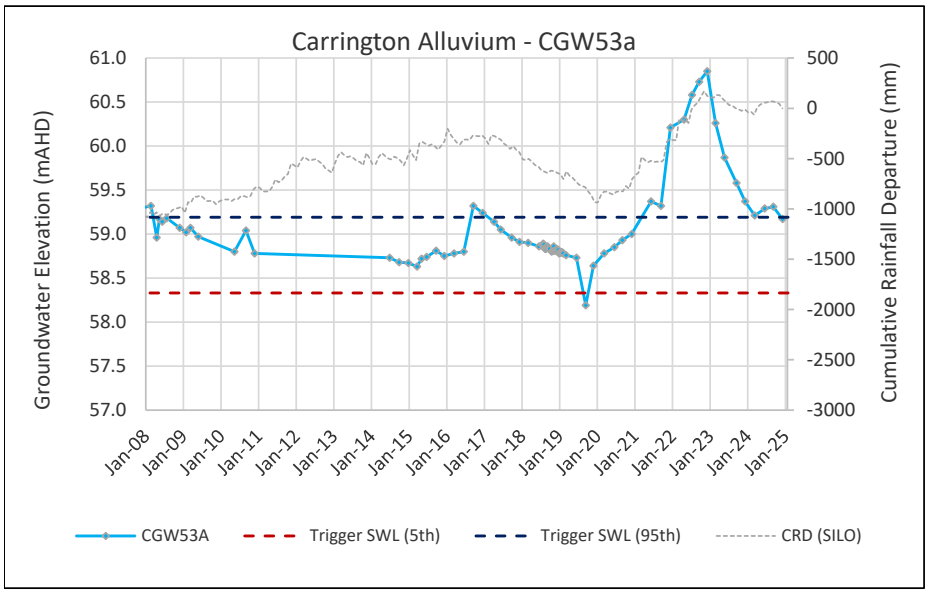
Groundwater Level Graphs

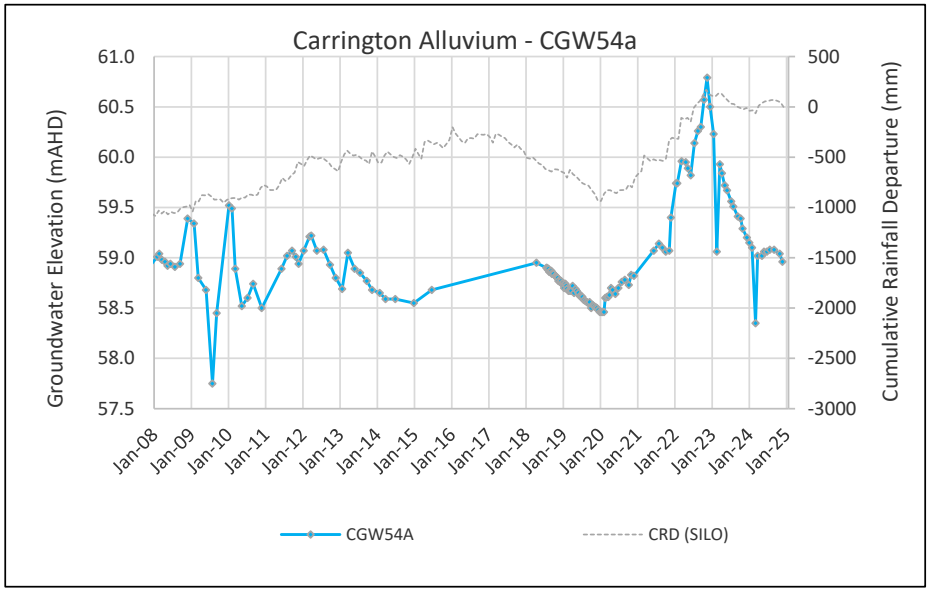

Carrington Alluvium
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
74.0
72.0
70.0
68.0
66.0
64.0
62.0
60.0
58.0
56.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CFW55R
CFW57
CGW52A
CGW53A
CGW55A
Hunter River at Liddell (210083)
CRD (SILO)

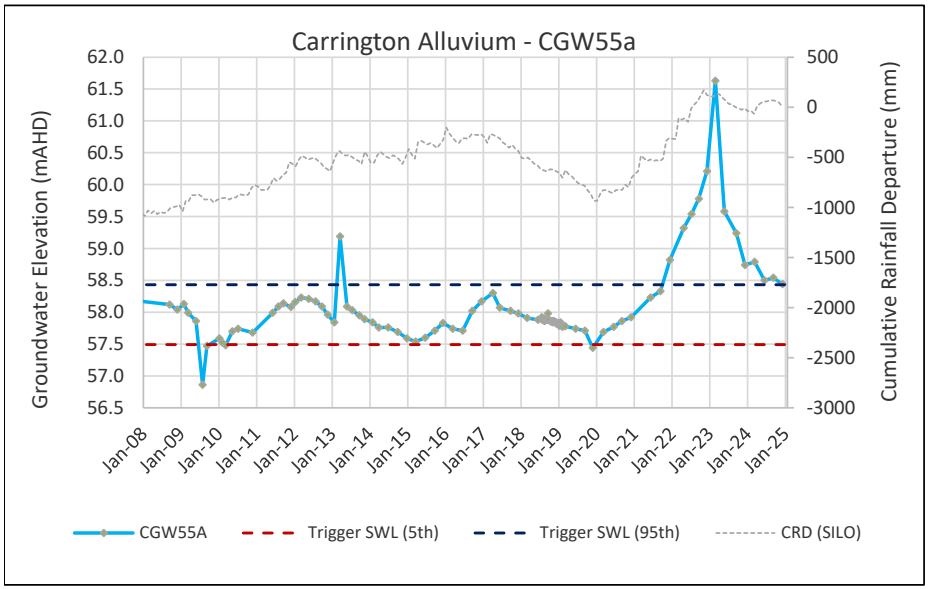

Carrington Alluvium - CFW55R
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
61.0
60.0
59.0
58.0
57.0
56.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CFW55R
Trigger SWL (5th)
Trigger SWL (95th)
CRD (SILO)

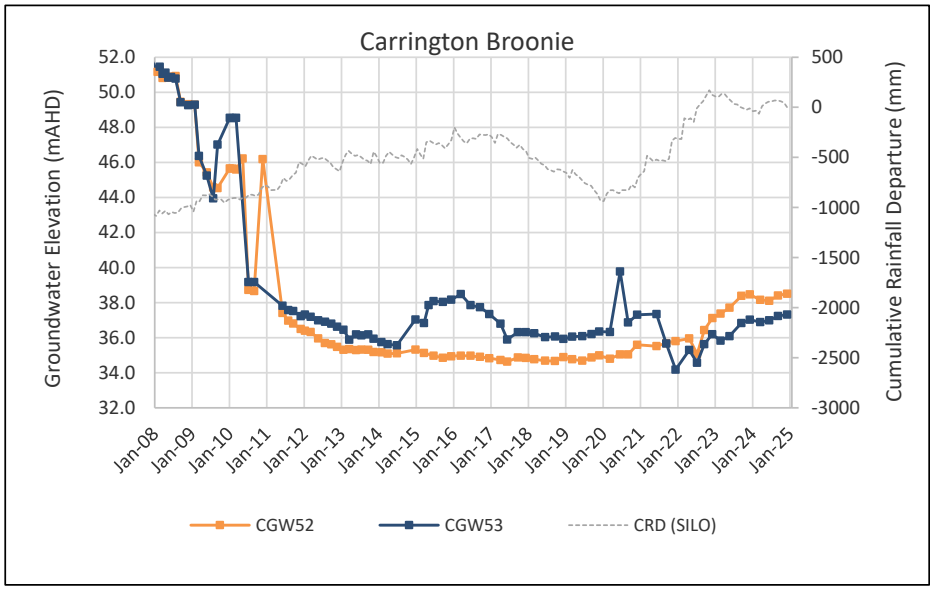

Carrington Alluvium - CFW57
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
61.0
60.5
60.0
59.5
59.0
58.5
58.0
57.5
57.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CFW57
Trigger SWL (5th)
Trigger SWL (95th)
CRD

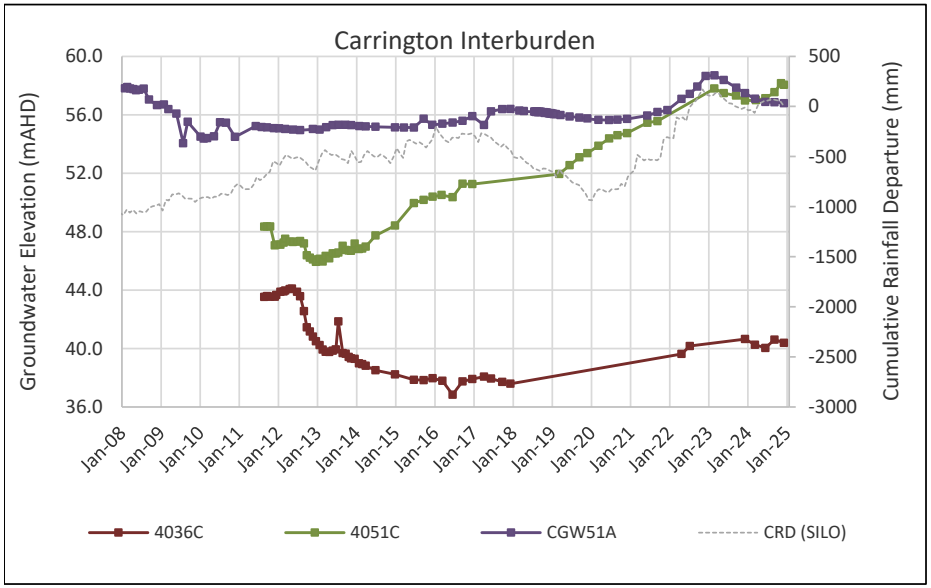

Carrington Alluvium - CGW52a
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
61.0
60.5
60.0
59.5
59.0
58.5
58.0
57.5
57.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW52A
Trigger SWL (5th)
Trigger SWL (95th)
CRD (SILO)

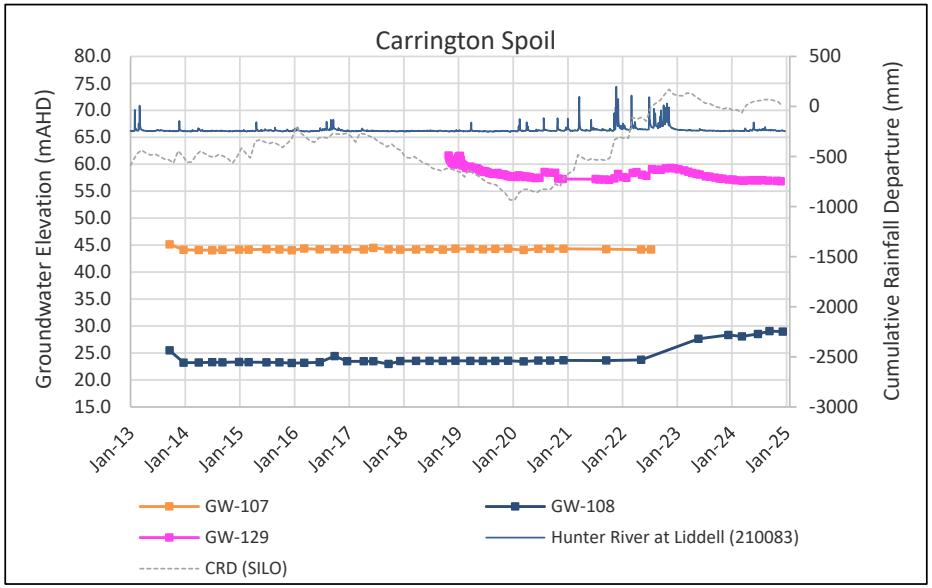

Carrington Alluvium - CGW53a
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
61.0
60.5
60.0
59.5
59.0
58.5
58.0
57.5
57.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW53A
Trigger SWL (5th)
Trigger SWL (95th)
CRD (SILO)

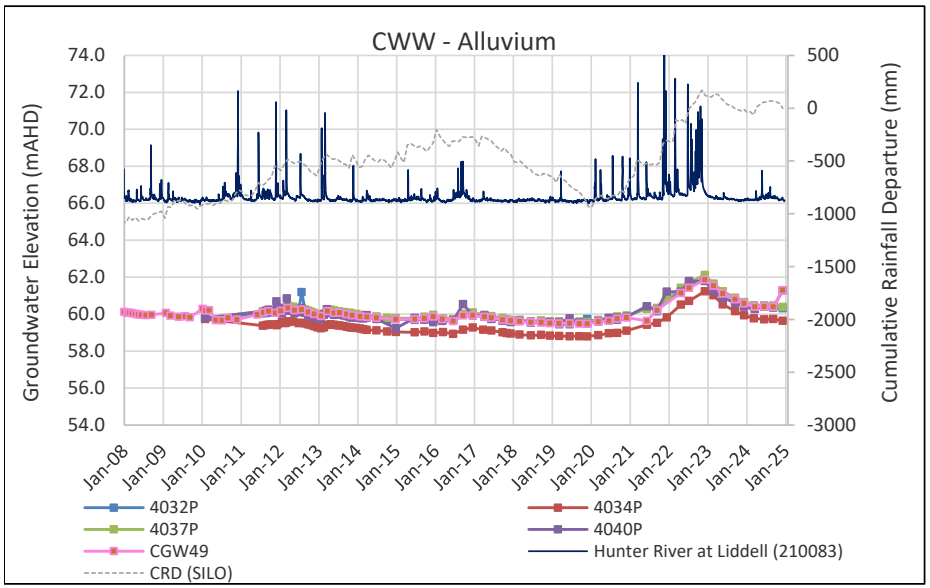

Carrington Alluvium - CGW54a
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
61.0
60.5
60.0
59.5
59.0
58.5
58.0
57.5
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW54A
CRD (SILO)

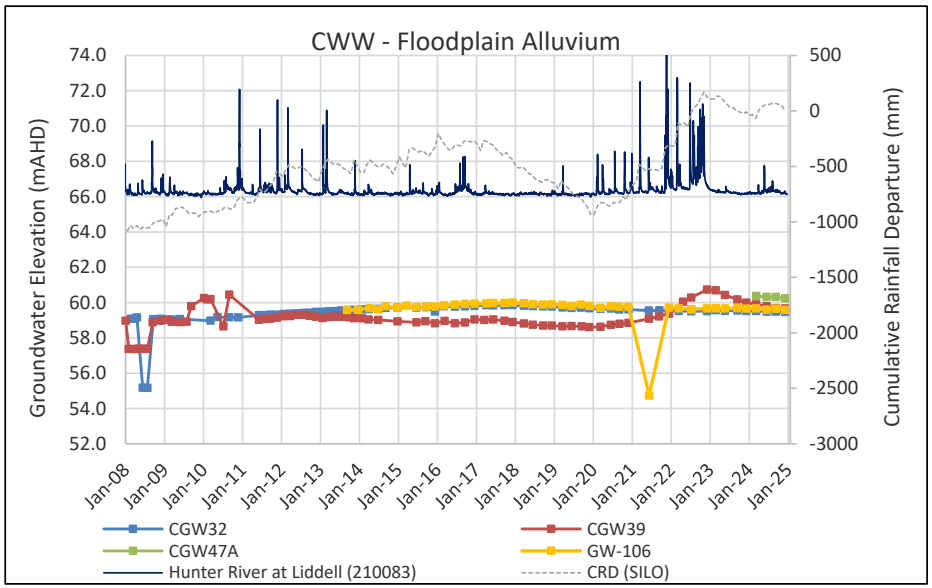

Carrington Alluvium - CGW55a
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
62.0
61.5
61.0
60.5
60.0
59.5
59.0
58.5
58.0
57.5
57.0
56.5
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW55A
Trigger SWL (5th)
Trigger SWL (95th)
CRD (SILO)

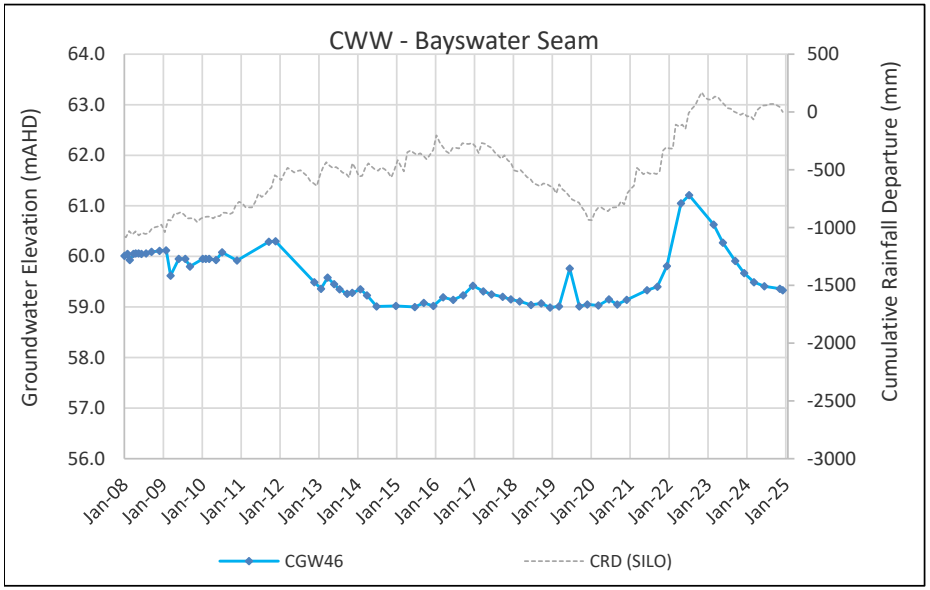

Carrington Broonie
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
52.0
50.0
48.0
46.0
44.0
42.0
40.0
38.0
36.0
34.0
32.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW52
CGW53
CRD (SILO)

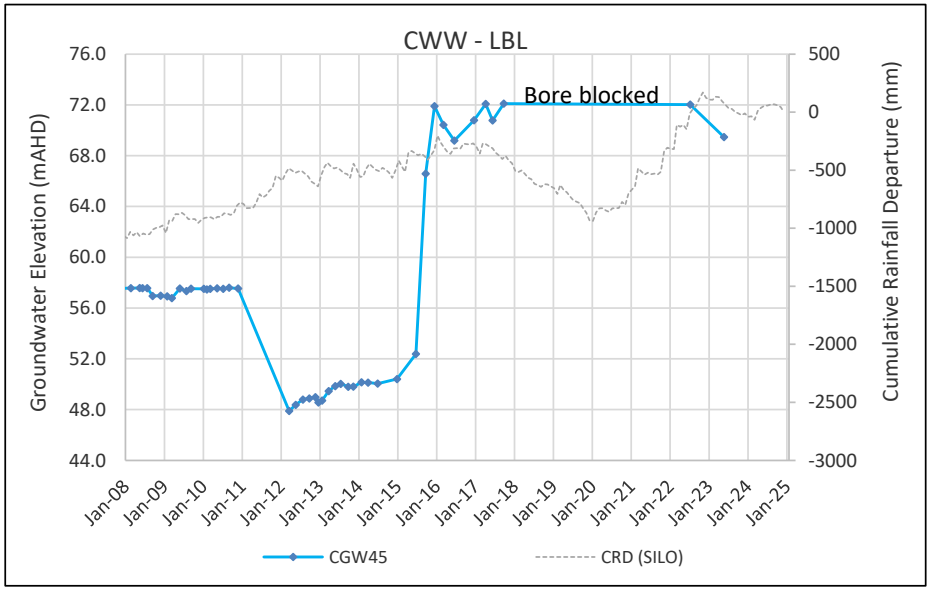

Carrington Interburden
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
60.0
56.0
52.0
48.0
44.0
40.0
36.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
4036C
4051C
CGW51A
CRD (SILO)

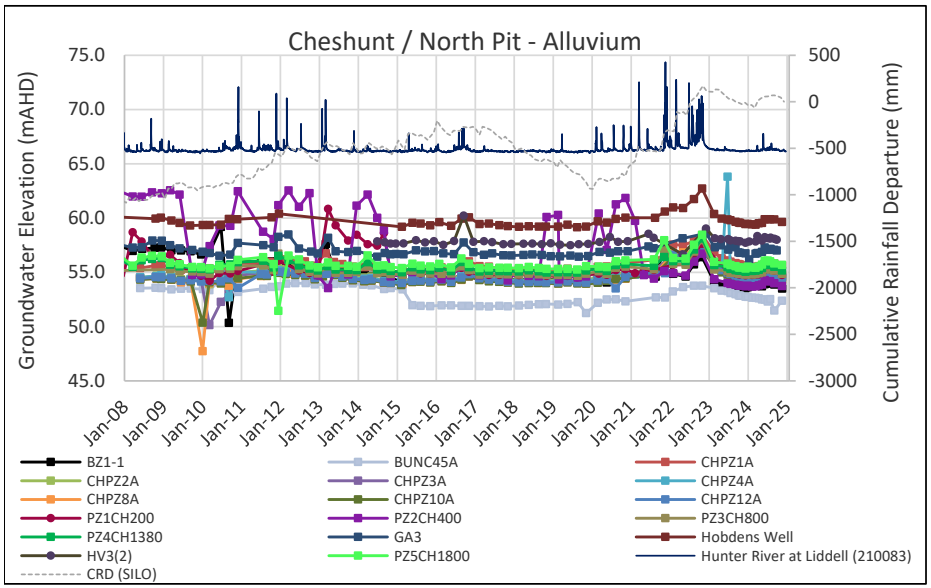

Carrington Spoil
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
GW-107
GW-108
GW-129
Hunter River at Liddell (210083)
CRD (SILO)

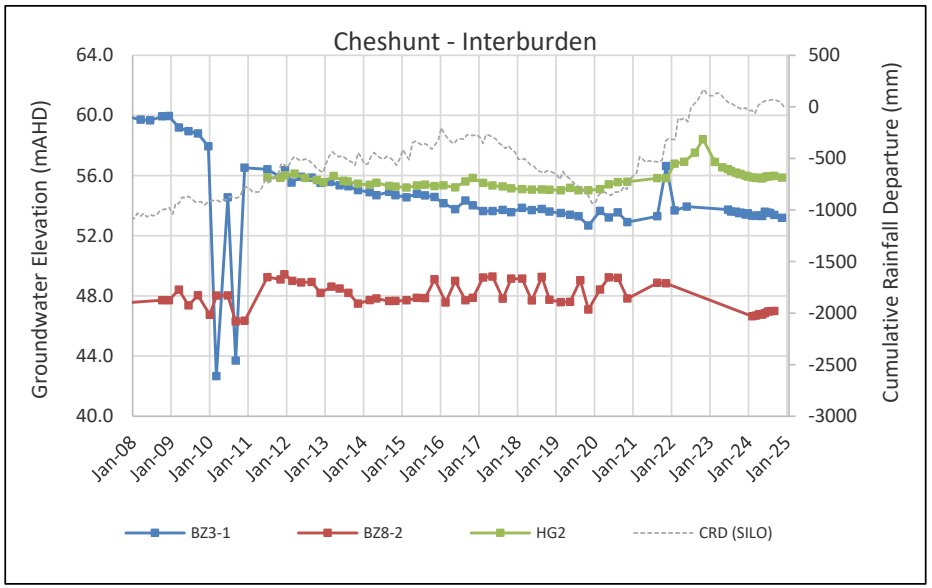

CWW - Alluvium
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
74.0
72.0
70.0
68.0
66.0
64.0
62.0
60.0
58.0
56.0
54.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
4032P
4034P
4037P
4040P
CGW49
Hunter River at Liddell (210083)
CRD (SILO)

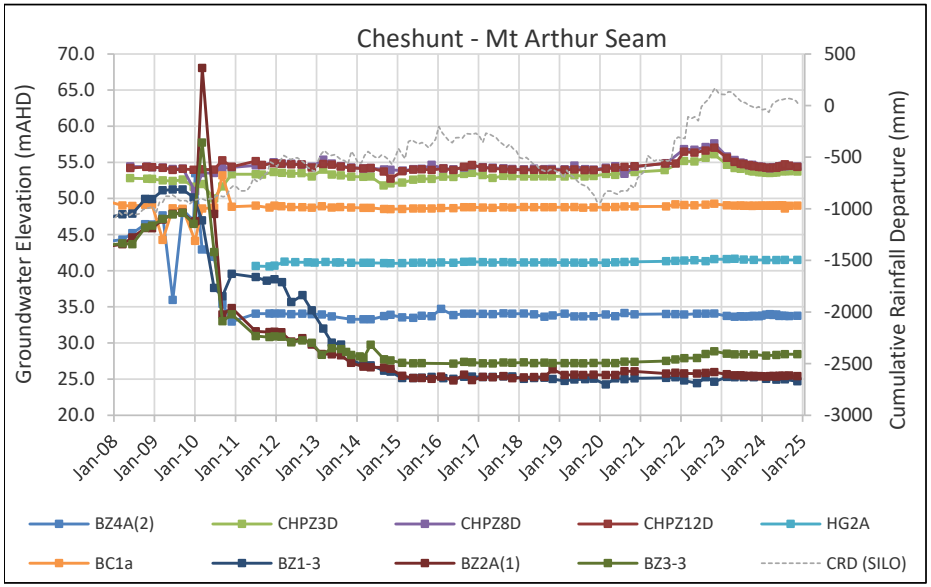

CWW - Floodplain Alluvium
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
74.0
72.0
70.0
68.0
66.0
64.0
62.0
60.0
58.0
56.0
54.0
52.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW32
CGW39
CGW47A
GW-106
Hunter River at Liddell (210083)
CRD (SILO)

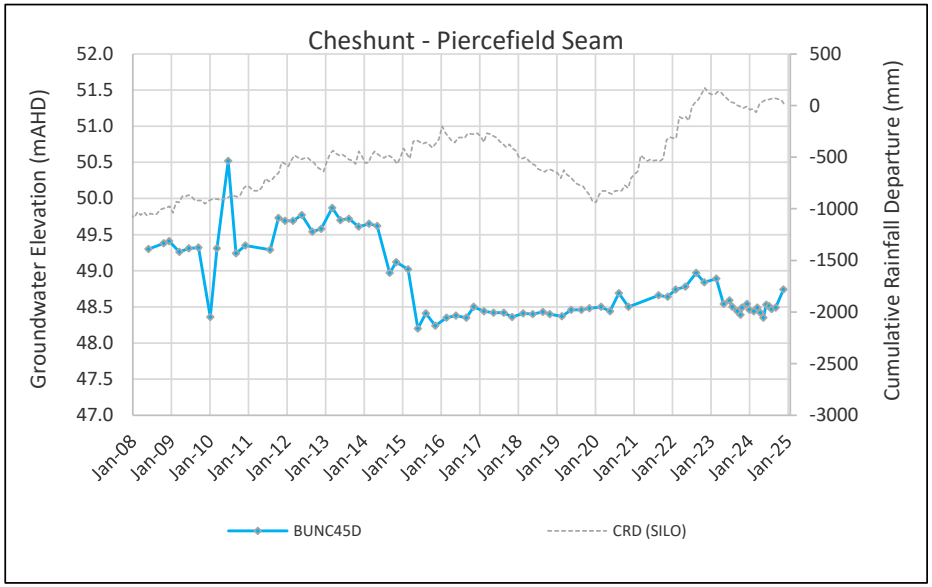

CWW - Bayswater Seam
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
64.0
63.0
62.0
61.0
60.0
59.0
58.0
57.0
56.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW46
CRD (SILO)

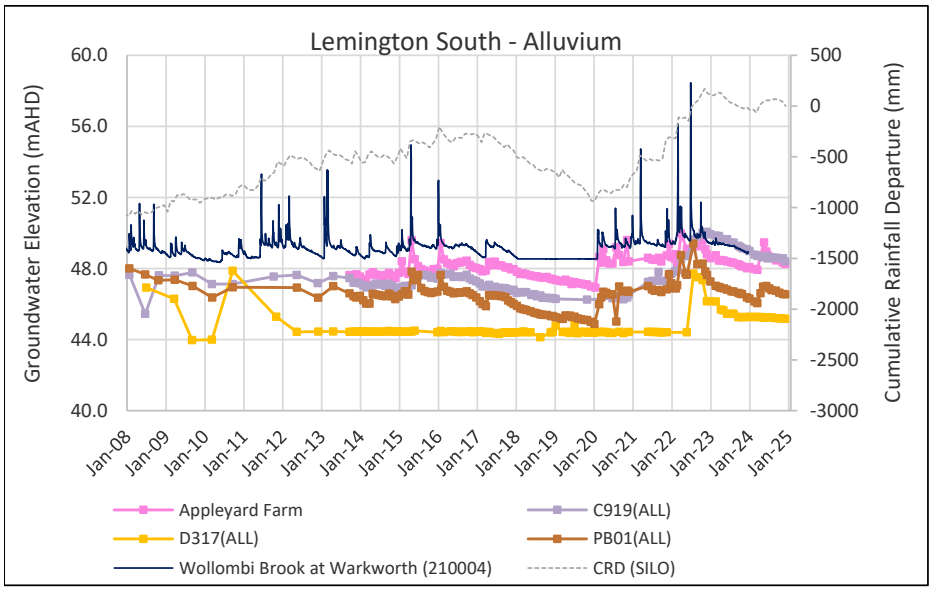

CWW - LBL
Bore blocked
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
76.0
72.0
68.0
64.0
60.0
56.0
52.0
48.0
44.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW45
CRD (SILO)

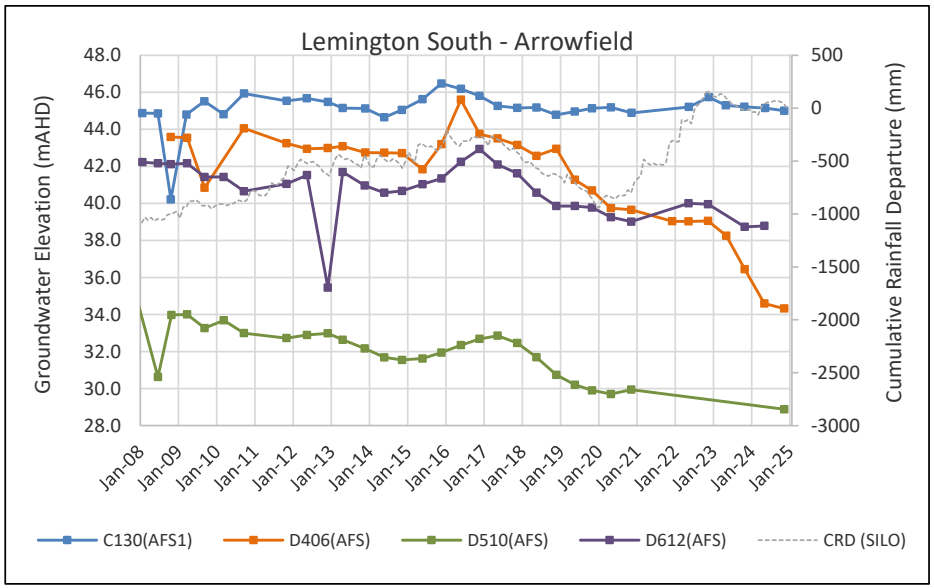

Cheshunt / North Pit - Alluvium
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
75.0
70.0
65.0
60.0
55.0
50.0
45.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
BZ1-1
BUNC45A
CHPZ1A
CHPZ2A
CHPZ3A
CHPZ4A
CHPZ8A
CHPZ10A
CHPZ12A
PZ1CH200
PZ2CH400
PZ3CH800
PZ4CH1380
GA3
Hobdens Well
HV3(2)
PZ5CH1800
Hunter River at Liddell (210083)
CRD (SILO)

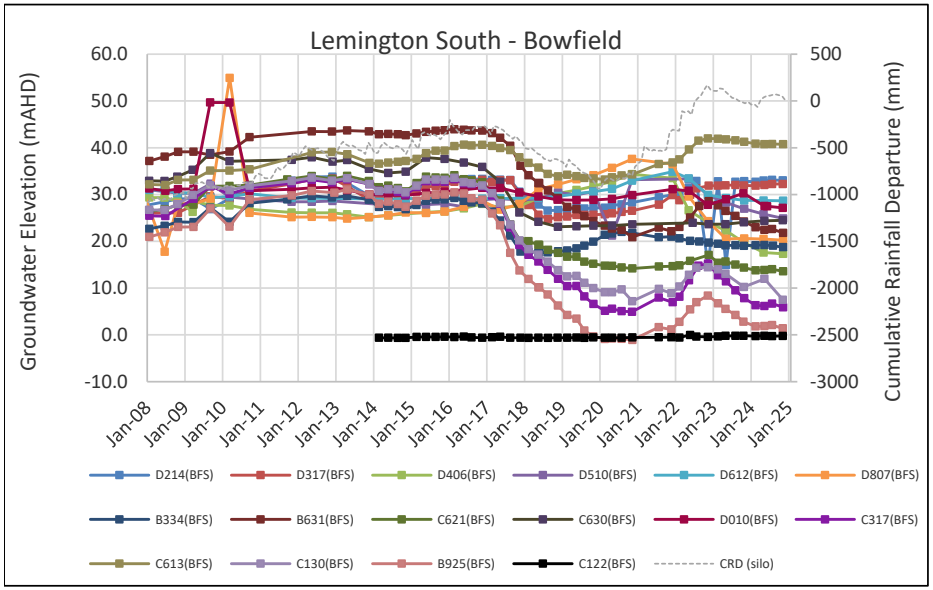

Cheshunt - Interburden
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
64.0
60.0
56.0
52.0
48.0
44.0
40.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
BZ3-1
BZ8-2
HG2
CRD (SILO)

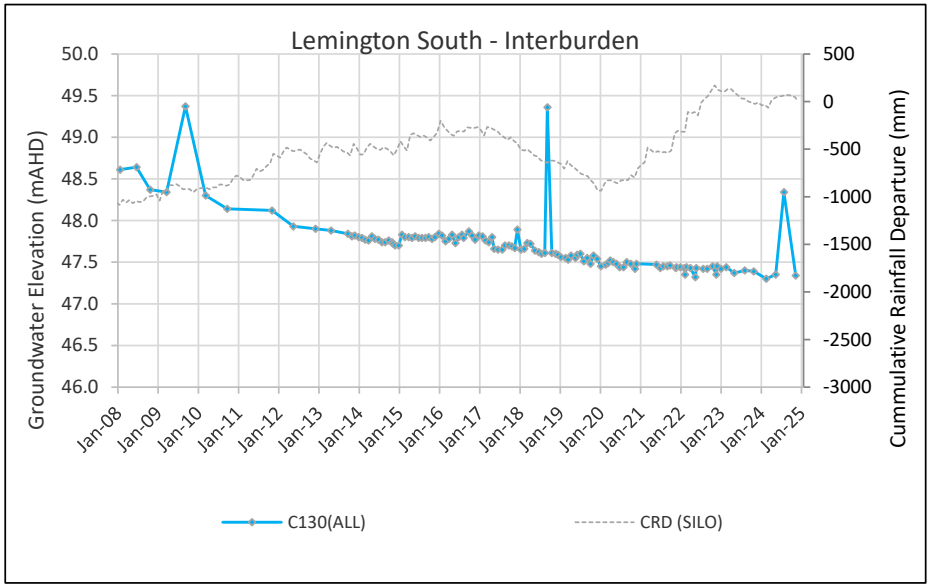

Cheshunt - Mt Arthur Seam
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
BZ4A(2)
CHPZ3D
CHPZ8D
CHPZ12D
HG2A
BC1a
BZ1-3
BZ2A(1)
BZ3-3
CRD (SILO)

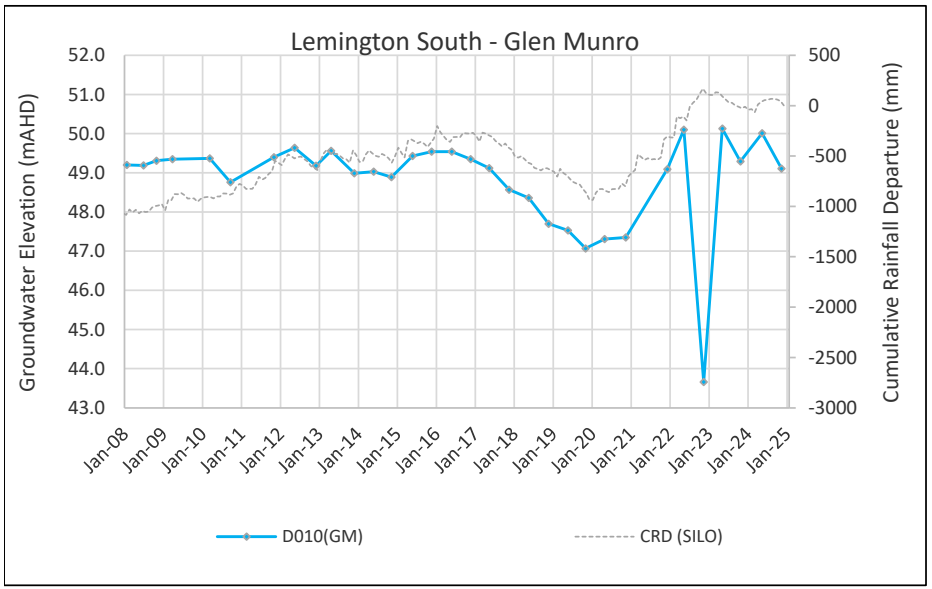

Cheshunt - Piercefield Seam
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
52.0
51.5
51.0
50.5
50.0
49.5
49.0
48.5
48.0
47.5
47.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
BUNC45D
CRD (SILO)

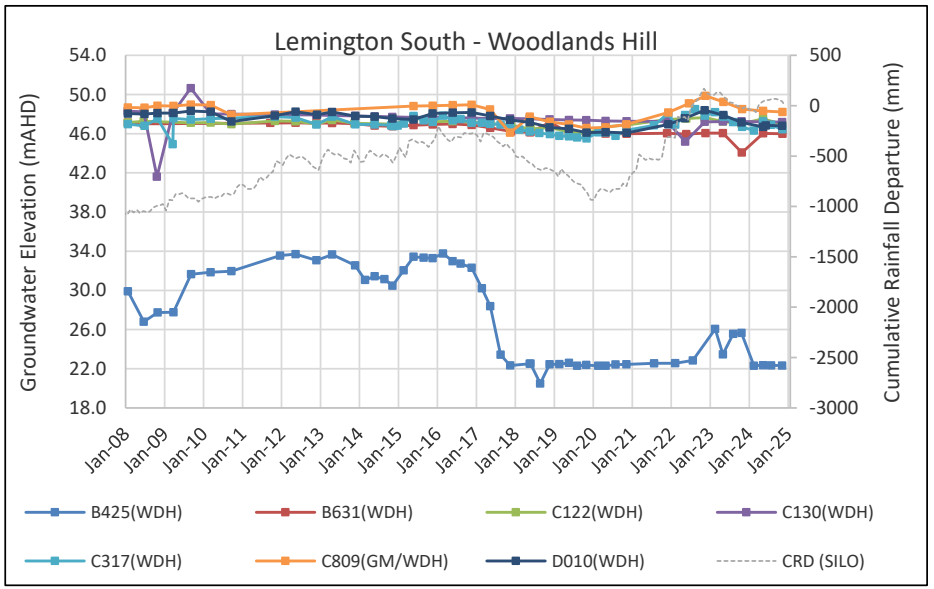

Lemington South - Alluvium
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
60.0
56.0
52.0
48.0
44.0
40.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
Appleyard Farm
C919(ALL)
D317(ALL)
PB01(ALL)
Wollombi Brook at Warkworth (210004)
CRD (SILO)

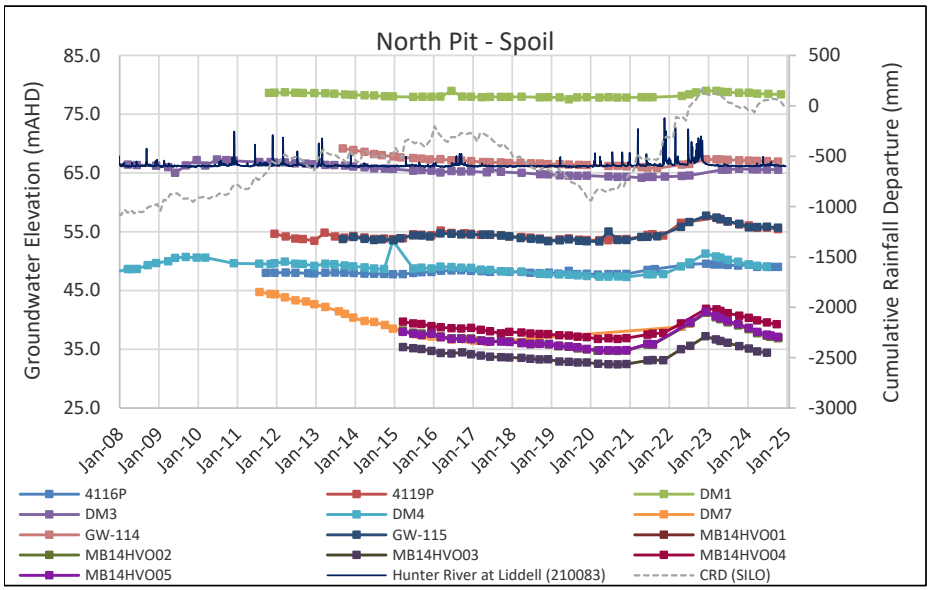

Lemington South - Arrowfield
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
48.0
46.0
44.0
42.0
40.0
38.0
36.0
34.0
32.0
30.0
28.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
C130(AFS1)
D406(AFS)
D510(AFS)
D612(AFS)
CRD (SILO)

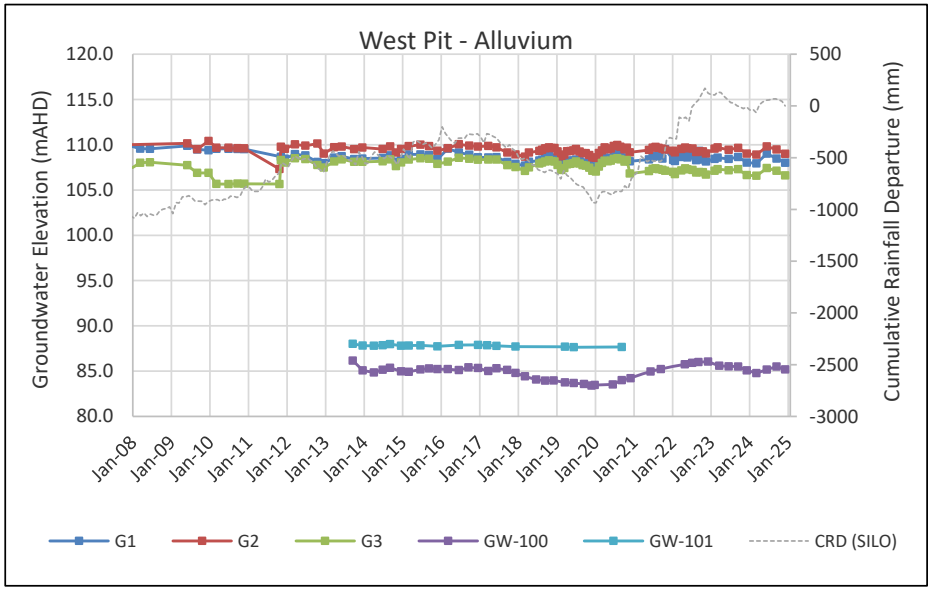

Lemington South - Bowfield
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
-10.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
D214(BFS)
D317(BFS)
D406(BFS)
D510(BFS)
D612(BFS)
D807(BFS)
B334(BFS)
B631(BFS)
C621(BFS)
C630(BFS)
D010(BFS)
C317(BFS)
C613(BFS)
C130(BFS)
B925(BFS)
C122(BFS)
CRD (silo)

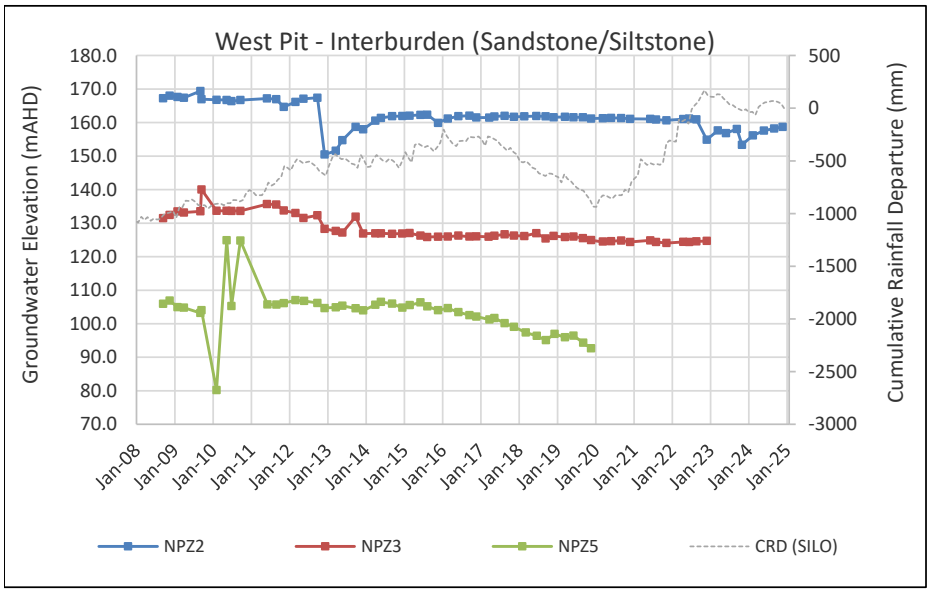

Lemington South - Interburden
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
50.0
49.5
49.0
48.5
48.0
47.5
47.0
46.5
46.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
C130(ALL)
CRD (SILO)

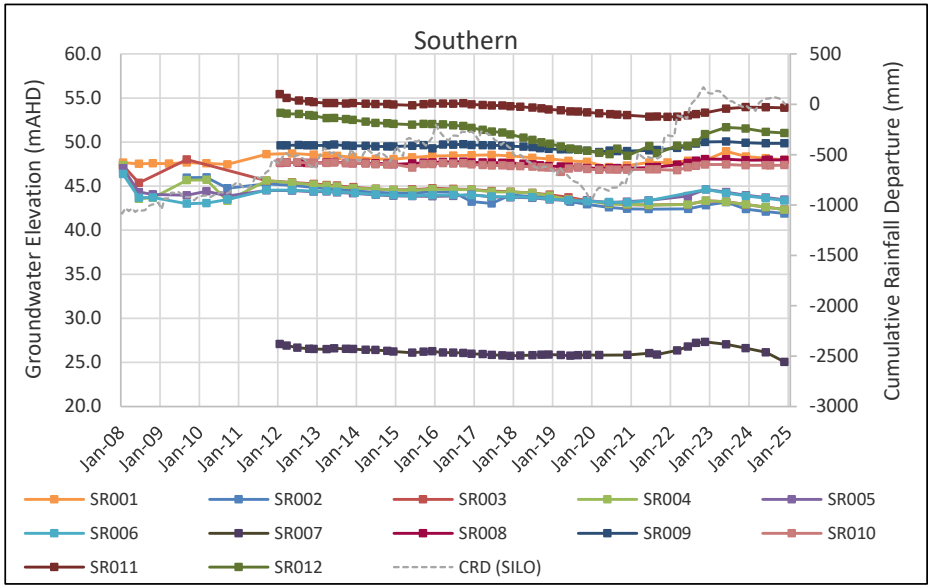

Lemington South - Glen Munro
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
52.0
51.0
50.0
49.0
48.0
47.0
46.0
45.0
44.0
43.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
D010(GM)
CRD (SILO)

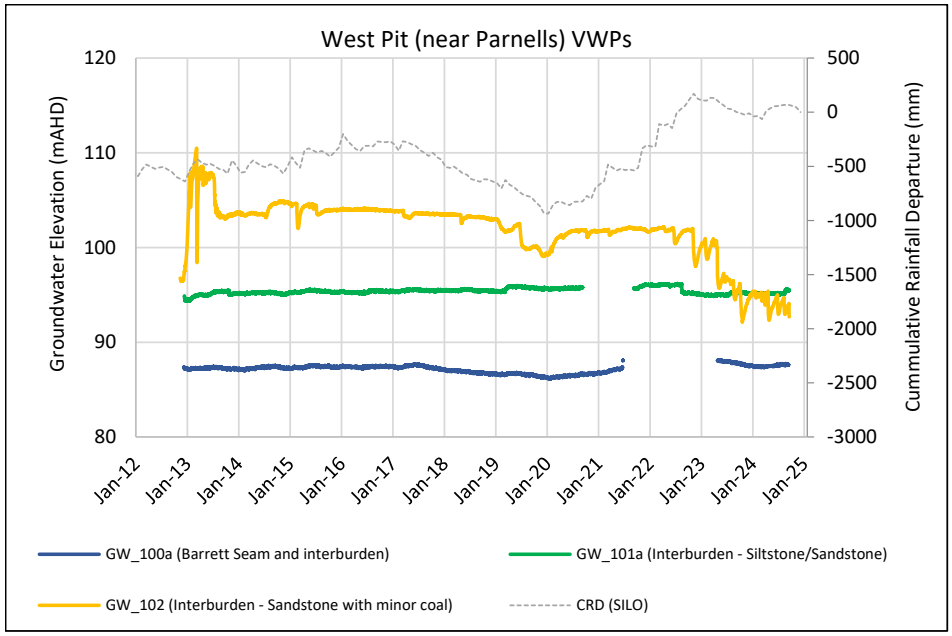

Lemington South - Woodlands Hill
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
54.0
50.0
46.0
42.0
38.0
34.0
30.0
26.0
22.0
18.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
B425(WDH)
B631(WDH)
C122(WDH)
C130(WDH)
C317(WDH)
C809(GM/WDH)
D010(WDH)
CRD (SILO)

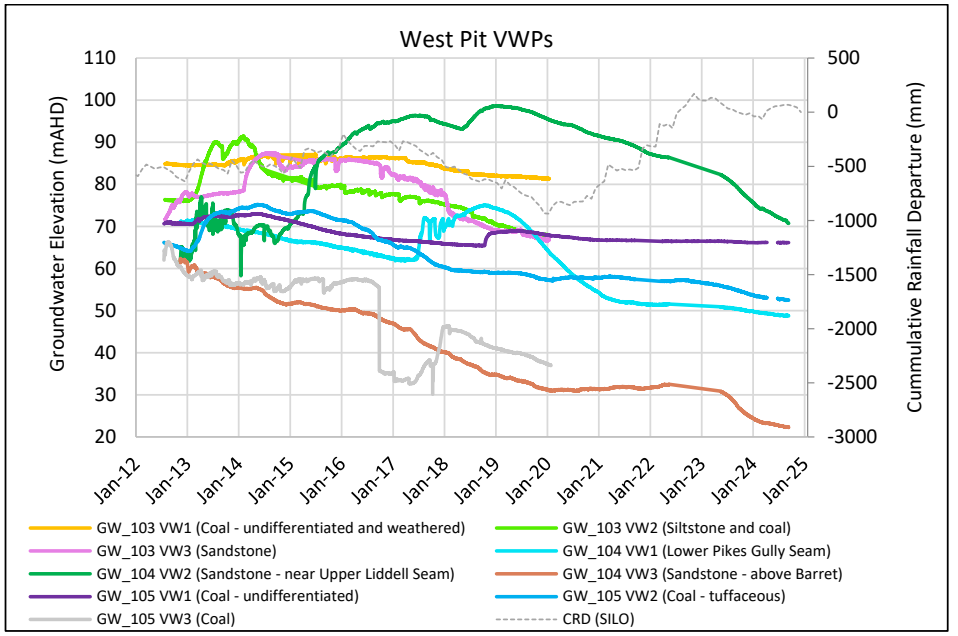

North Pit - Spoil
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
85.0
75.0
65.0
55.0
45.0
35.0
25.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
4116P
4119P
DM1
DM3
DM4
DM7
GW-114
GW-115
MB14HVO01
MB14HVO02
MB14HVO03
MB14HVO04
MB14HVO05
Hunter River at Liddell (210083)
CRD (SILO)

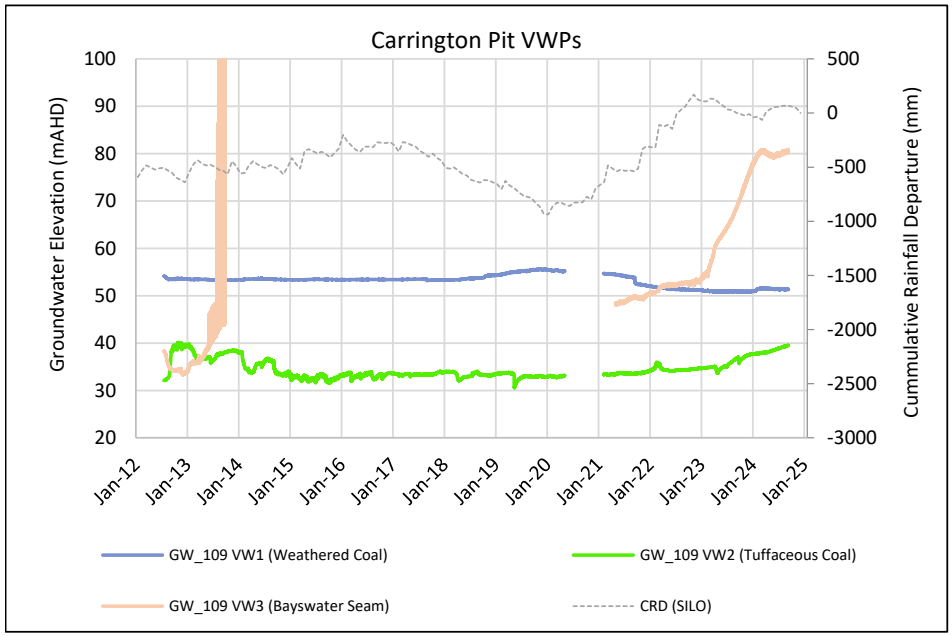

West Pit - Alluvium
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
120.0
115.0
110.0
105.0
100.0
95.0
90.0
85.0
80.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
G1
G2
G3
GW-100
GW-101
CRD (SILO)

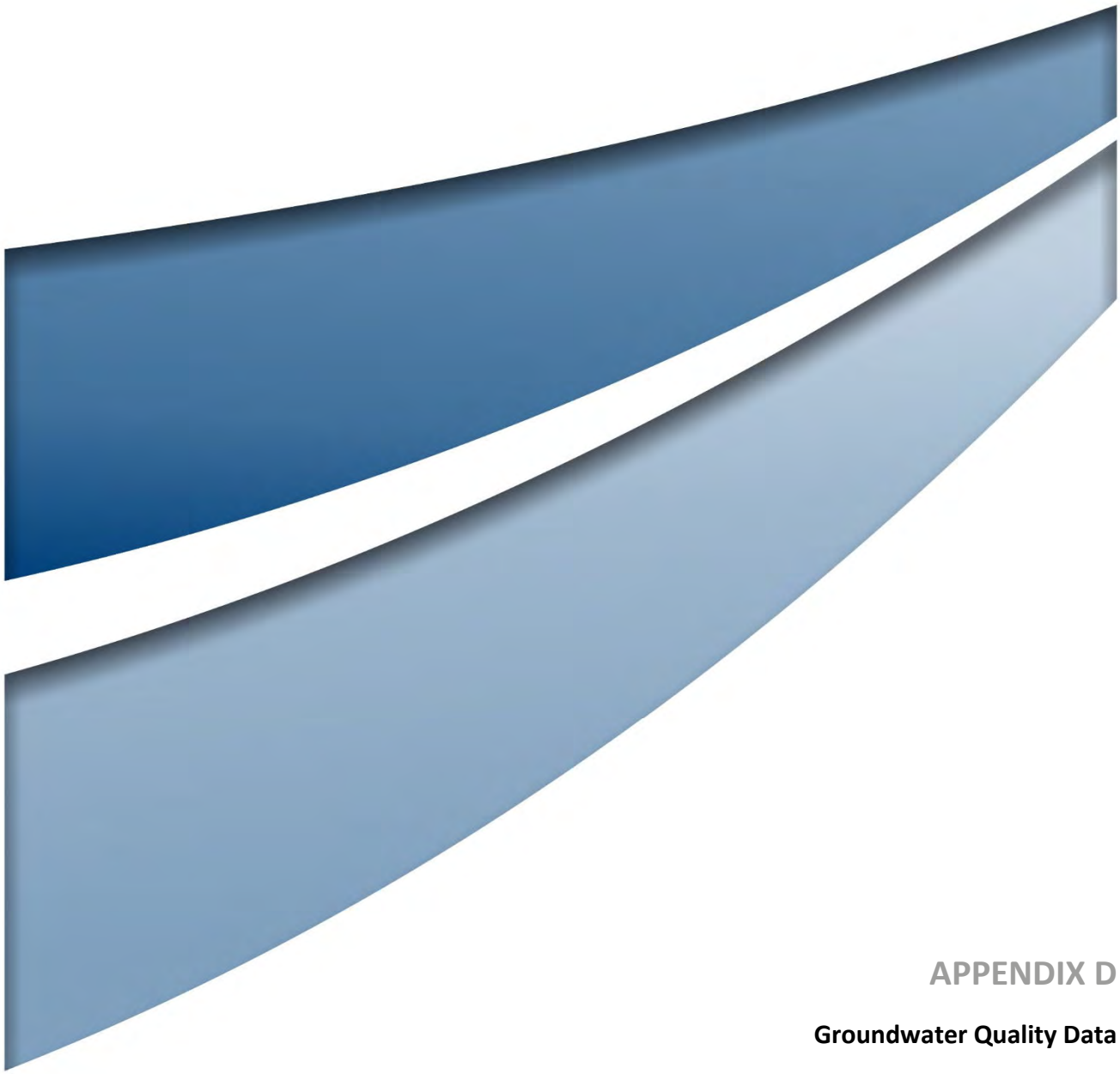

West Pit - Interburden (Sandstone/Siltstone)
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
NPZ2
NPZ3
NPZ5
CRD (SILO)


Southern
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR001
SR002
SR003
SR004
SR005
SR006
SR007
SR008
SR009
SR010
SR011
SR012
CRD (SILO)


West Pit (near Parnells) VWPs
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
120
110
100
90
80
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
GW_100a (Barrett Seam and interburden)
GW_101a (Interburden - Siltstone/Sandstone)
GW_102 (Interburden - Sandstone with minor coal)
CRD (SILO)


West Pit VWPs
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
110
100
90
80
70
60
50
40
30
20
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
GW_103 VW1 (Coal - undifferentiated and weathered)
GW_103 VW2 (Siltstone and coal)
GW_103 VW3 (Sandstone)
GW_104 VW1 (Lower Pikes Gully Seam)
GW_104 VW2 (Sandstone - near Upper Liddell Seam)
GW_104 VW3 (Sandstone - above Barret)
GW_105 VW1 (Coal - undifferentiated)
GW_105 VW2 (Coal - tuffaceous)
GW_105 VW3 (Coal)
CRD (SILO)


Carrington Pit VWPs
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
100
90
80
70
60
50
40
30
20
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
GW_109 VW1 (Weathered Coal)
GW_109 VW2 (Tuffaceous Coal)
GW_109 VW3 (Bayswater Seam)
CRD (SILO)



APPENDIX D

Groundwater Quality Data

Table D.1 Groundwater Quality Data – Alluvium

Bore ID	WMP Geology	pH Trigger		pH (Q1)			pH (Q2)			pH (Q3)			pH (Q4)			EC Trigger (µS/cm)	EC (Q1) (µS/cm)			EC (Q2) (µS/cm)			EC (µS/cm) (Q3)			EC (µS/cm) (Q4)		
		(5th Percentile)	(95th Percentile)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CFW55R	Carrington Alluvium	7.0	8.0	7.4	7.3	7.3	7.3	7.3	7.4	7.3	7.3	7.3	7.2	7.2	7.2	6154	3620	3970	3630	4050	4050	4090	3860	3920	4010	4080	4060	3960
CFW57	Carrington Alluvium	7.0	8.0	7.4	7.4	7.4	7.3	7.5	7.4	7.4	7.3	7.4	7.3	7.3	7.3	6154	2210	2100	1808	1887	2010	2330	2170	2350	2000	2090	2060	1712
CGW52a	Carrington Alluvium	7.0	8.0	-	-	7.6	-	-	7.7	-	-	7.7	-	-	7.5	6154	-	-	1400	-	-	1407	-	-	1635	-	-	1348
CGW53a	Carrington Alluvium	7.0	8.0	-	-	7.1	-	-	7.4	-	-	7.3	-	-	7.2	6154	-	-	1075	-	-	1226	-	-	1200	-	-	1310
CGW55a	Carrington Alluvium	7.0	8.0	-	-	8.1	-	-	7.6	-	-	7.5	-	-	7.6	6154	-	-	1240	-	-	1661	-	-	2600	-	-	2760
4032P	Carrington West Wing Alluvium	7.0	7.5	-	-	7.4	-	-	7.4	-	-	7.4	-	-	7.3	2775	-	-	1498	-	-	1489	-	-	1409	-	-	1511
4034P	Carrington West Wing Alluvium	7.0	7.5	-	-	7.4	-	-	7.4	-	-	7.3	-	-	7.4	2775	-	-	1900	-	-	1963	-	-	1875	-	-	1908
4037P	Carrington West Wing Alluvium	7.0	7.5	-	-	7.3	-	-	7.3	-	-	7.3	-	-	7.2	2775	-	-	1487	-	-	1496	-	-	1435	-	-	1470
4040P	Carrington West Wing Alluvium	7.0	7.5	-	-	7.2	-	-	7.2	-	-	7.2	-	-	7.2	2775	-	-	1196	-	-	1306	-	-	1260	-	-	1340
CGW49	Carrington West Wing Alluvium	7.0	7.5	-	-	7.5	-	-	7.5	-	-	7.5	-	-	7.5	2775	-	-	2430	-	-	2240	-	-	2160	-	-	2080
GW-106	Carrington West Wing Alluvium	6.8	7.8	-	-	6.9	-	-	6.9	-	-	6.7	-	-	6.8	9280	-	-	9020	-	-	9300	-	-	9340	-	-	8280
CGW32	Carrington West Wing Flood Plain	6.8	7.8	-	-	7.2	-	-	7.3	-	-	7.2	-	-	7.3	9280	-	-	8970	-	-	9030	-	-	9060	-	-	9250
CGW39	Carrington West Wing Flood Plain	6.8	7.8	-	-	7.4	-	-	7.6	-	-	7.4	-	-	7.4	9280	-	-	3840	-	-	3810	-	-	4050	-	-	4280
CGW47a	Carrington West Wing Flood Plain	6.8	7.8	-	-	7.6	-	-	7.6	-	-	7.6	-	-	7.6	9280	-	-	4050	-	-	3960	-	-	4080	-	-	3930
BUNC45A	Cheshunt / North Pit Alluvium	6.6	7.5	-	6.6	-	-	6.6	-	-	6.6	-	NM			4462	-	2940	-	-	2920	-	-	2870	-	NM		
BZ1-1	Cheshunt / North Pit Alluvium	6.6	7.5	-	7.5	-	-	7.4	-	-	7.5	-	-	7.5	-	4462	-	2720	-	-	2680	-	-	2560	-	-	2570	-
CHPZ10A	Cheshunt / North Pit Alluvium	6.6	7.5	-	6.9	-	-	6.9	-	-	6.8	-	-	6.9	-	4462	-	1338	-	-	1272	-	-	1135	-	-	1176	-
CHPZ12A	Cheshunt / North Pit Alluvium	6.6	7.5	-	6.8	-	-	7.0	-	-	6.7	-	-	6.8	-	4462	-	2150	-	-	1247	-	-	1403	-	-	1180	-
CHPZ1A	Cheshunt / North Pit Alluvium	6.6	7.5	-	7.1	-	-	7.1	-	-	7.0	-	-	7.0	-	4462	-	722	-	-	548	-	-	781	-	-	720	-
CHPZ2A	Cheshunt / North Pit Alluvium	6.6	7.5	-	7.0	-	-	7.2	-	-	6.9	-	-	7.1	-	4462	-	895	-	-	879	-	-	805	-	-	832	-
CHPZ3A	Cheshunt / North Pit Alluvium	6.6	7.5	-	6.9	-	-	7.0	-	-	6.8	-	-	6.9	-	4462	-	844	-	-	833	-	-	816	-	-	821	-
CHPZ4A	Cheshunt / North Pit Alluvium	6.6	7.5	-	7.0	-	-	7.1	-	-	6.9	-	-	7.1	-	4462	-	918	-	-	916	-	-	867	-	-	794	-
CHPZ8A	Cheshunt / North Pit Alluvium	6.6	7.5	-	7.0	-	-	7.0	-	-	6.9	-	-	6.8	-	4462	-	1414	-	-	1480	-	-	1366	-	-	1456	-
GA3	Cheshunt / North Pit Alluvium	6.6	7.5	6.8	-	-	7.0	-	-	6.7	-	-	6.4	-	-	4462	1053	-	-	1112	-	-	1045	-	-	1185	-	-
Hobdens Well	Cheshunt / North Pit Alluvium	6.6	7.5	-	7.1	-	-	7.6	-	-	7.6	-	-	7.3	-	4462	-	1222	-	-	1100	-	-	1018	-	-	1006	-
HV3(2)	Cheshunt / North Pit Alluvium	6.6	7.5	6.8	-	-	6.9	-	-	-	6.9	-	6.9	-	-	4462	648	-	-	932	-	-	-	873	-	904	-	-
PZ1CH200	Cheshunt / North Pit Alluvium	6.6	7.5	-	7.5	-	-	7.2	-	-	7.3	-	-	7.1	-	4462	-	1442	-	-	2150	-	-	2290	-	-	4140	-
PZ2CH400	Cheshunt / North Pit Alluvium	6.6	7.5	-	6.7	-	-	6.9	-	-	6.7	-	-	6.7	-	4462	-	1847	-	-	1901	-	-	2010	-	-	2120	-
PZ3CH800	Cheshunt / North Pit Alluvium	6.6	7.5	-	6.8	-	-	6.8	-	-	6.8	-	-	7.0	-	4462	-	3110	-	-	3090	-	-	2780	-	-	2870	-
PZ4CH1380	Cheshunt / North Pit Alluvium	6.6	7.5	-	7.0	-	-	7.0	-	-	6.9	-	-	6.9	-	4462	-	726	-	-	761	-	-	710	-	-	732	-
PZ5CH1800	Cheshunt / North Pit Alluvium	6.6	7.5	-	6.8	-	-	6.8	-	-	6.8	-	-	6.7	-	4462	-	254	-	-	191	-	-	192	-	-	315	-
Appleyard Farm	Lemington South Alluvium	6.6	7.7	-	6.8	-	-	6.4	-	-	6.9	-	-	6.4	-	3938	-	469	-	-	166	-	-	414	-	-	318	-
C919(ALL)	Lemington South Alluvium	6.6	7.7	-	7.4	-	-	7.5	-	-	7.6	-	-	7.6	-	3938	-	621	-	-	666	-	-	663	-	-	685	-
PB01(ALL)	Lemington South Alluvium	6.6	7.7	-	6.7	-	-	7.1	-	-	7.1	-	-	6.9	-	3938	-	1347	-	-	9900	-	-	10400	-	-	2740	-
G1	West Pit Alluvium	7.1	8.6	-	-	7.4	-	-	7.5	-	-	7.5	-	-	7.4	10751	-	-	4900	-	-	3500	-	-	5420	-	-	4600
G2	West Pit Alluvium	7.1	8.6	-	-	8.5	-	-	7.9	-	-	7.7	-	-	8.2	10751	-	-	5130	-	-	5030	-	-	4910	-	-	4700
G3	West Pit Alluvium	7.1	8.6	-	-	7.3	-	-	7.8	-	-	7.5	-	-	7.4	10751	-	-	5540	-	-	5370	-	-	5300	-	-	5350
GW-100	West Pit Alluvium	7.1	8.6	-	-	7.8	-	-	7.5	-	-	7.5	-	-	7.7	10751	-	-	11010	-	-	11010	-	-	11260	-	-	11310
GW-101	West Pit Alluvium	7.1	8.6	Dry			Dry			Dry			Dry			10751	Dry			Dry			Dry			Dry		

Table D.2 Groundwater Quality Data – Permian Coal Measures

Bore ID	WMP Geology	pH Trigger (5th Percentile)	pH Trigger (95th Percentile)	pH (Q1)			pH (Q2)			pH (Q3)			pH (Q4)			EC Trigger (µS/cm)	EC (Q1) (µS/cm)			EC (Q2) (µS/cm)			EC (µS/cm) (Q3)			EC (µS/cm) (Q4)		
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CGW51a	Carrington Interburden?	6.7	7.4	-	-	7.6	-	-	7.6	-	-	7.6	-	-	7.5	10824	-	-	4980	-	-	5020	-	-	4850	-	-	5010
CGW52	Carrington Broonie	6.8	7.1	-	-	6.9	-	-	7.0	-	-	7.0	-	-	7.1	8628	-	-	8000	-	-	7410	-	-	7090	-	-	8180
CGW53	Carrington Broonie	6.8	7.1	-	-	6.7	-	-	6.8	-	-	6.7	-	-	6.8	8628	-	-	6710	-	-	6690	-	-	7350	-	-	7160
4036C	Carrington Interburden	6.7	7.4	-	-	6.7	-	-	6.7	-	-	6.7	-	-	6.8	10824	-	-	3290	-	-	2940	-	-	3050	-	-	2760
4051C	Carrington Interburden	6.7	7.4	-	-	6.7	Blocked			Blocked			-	6.9	6.8	10824	-	-	833	Blocked			Blocked			-	1504	1120
BZ3-1	Carrington Interburden	6.9	7.7	-	6.9	-	-	7.0	-	-	6.9	-	-	6.9	-	6213	-	3070	-	-	2710	-	-	2570	-	-	2590	-
BZ8-2	Carrington Interburden	6.9	7.7	-	Dry	-	-	7.3	-	-	7.0	-	No Access			6213	-	Dry	-	-	1275	-	-	1198	-	No Access		
HG2	Carrington Interburden	6.9	7.7	-	7.6	-	-	7.4	-	-	7.4	-	-	7.4	-	6213	-	3350	-	-	3360	-	-	3250	-	-	3460	-
CGW46	Carrington West Wing Bayswater	7.3	7.6	-	-	7.4	-	-	7.2	No access			-	7.3	7.1	3531	-	-	1532	-	-	909	No access			-	1696	1045
CGW45	Carrington West Wing LBL	6.5	7.2	Blocked			Blocked			Blocked			Blocked			1894	Blocked			Blocked			Blocked			Blocked		
BC1a	Cheshunt Mt Arthur	6.5	7.6	-	7.2	-	-	7.1	-	-	7.1	-	-	6.9	-	3350	-	921	-	-	924	-	-	845	-	-	900	-
BZ1-3	Cheshunt Mt Arthur	6.5	7.6	-	7.4	-	-	7.6	-	-	7.5	-	-	7.6	-	3350	-	1208	-	-	1231	-	-	1043	-	-	1196	-
BZ2A(1)	Cheshunt Mt Arthur	6.5	7.6	-	6.4	-	-	6.5	-	-	6.6	-	-	6.3	-	3350	-	1270	-	-	3210	-	-	1352	-	-	1333	-
BZ3-3	Cheshunt Mt Arthur	6.5	7.6	-	6.2	-	-	6.3	-	-	6.3	-	-	6.1	-	3350	-	1380	-	-	1381	-	-	1328	-	-	1401	-
BZ4A(2)	Cheshunt Mt Arthur	6.5	7.6	-	-	-	-	6.3	-	-	6.2	-	Insufficient water to sample			3350	-	-	-	-	1197	-	-	1150	-	Insufficient water to sample		
CHPZ12D	Cheshunt Mt Arthur	6.5	7.6	-	6.9	-	-	7.3	-	-	6.8	-	-	7.3	-	3350	-	1311	-	-	1404	-	-	1286	-	-	1350	-
CHPZ3D	Cheshunt Mt Arthur	6.5	7.6	-	6.0	-	-	6.7	-	-	6.4	-	-	6.5	-	3350	-	990	-	-	1040	-	-	964	-	-	993	-
CHPZ8D	Cheshunt Mt Arthur	6.5	7.6	-	7.1	-	-	7.3	-	-	7.1	-	-	7.0	-	3350	-	1250	-	-	1184	-	-	1120	-	-	1285	-
HG2a	Cheshunt Mt Arthur	6.5	7.6	-	7.4	-	-	7.1	-	-	7.0	-	-	7.0	-	3350	-	2390	-	-	2540	-	-	2480	-	-	2540	-
BUNC45D	Cheshunt Piercefield	6.4	6.8	-	6.5	-	-	6.6	-	-	6.5	-	-	6.7	-	2596	-	2400	-	-	2610	-	-	2290	-	-	2480	-
C130(AFS1)	Lemington South Arrowfield	6.8	7.5	NR (6M)			-	7.3	-	NR (6M)			-	7.2	-	15324	NR (6M)			-	14220	-	NR (6M)			-	13040	-
D406(AFS)	Lemington South Arrowfield	6.8	7.5	NR (6M)			-	6.9	-	NR (6M)			-	6.8	-	15324	NR (6M)			-	10700	-	NR (6M)			-	10300	-
D510(AFS)	Lemington South Arrowfield	6.8	7.5	NR (6M)			Blocked			NR (6M)			-	7.0	-	15324	NR (6M)			Blocked			NR (6M)			-	11900	-
D612(AFS)	Lemington South Arrowfield	6.8	7.5	NR (6M)			Insufficient water to sample			NR (6M)			Dry			15324	NR (6M)			Insufficient water to sample			NR (6M)			Dry		
B334(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.1	-	NR (6M)			-	7.1	-	12440	NR (6M)			-	7740	-	NR (6M)			-	7400	-
B631(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	6.8	-	NR (6M)			-	6.7	-	12440	NR (6M)			-	13110	-	NR (6M)			-	12980	-
B925(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.1	-	NR (6M)			-	7.2	-	12440	NR (6M)			-	4740	-	NR (6M)			-	4700	-
C122(BFS)	Lemington South Bowfield	6.7	7.9	-	-	-	Insufficient water to sample			Insufficient water to sample			Insufficient water to sample			12440	-	-	-	Insufficient water to sample			Insufficient water to sample			Insufficient water to sample		
C130(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.9	-	NR (6M)			-	7.7	-	12440	NR (6M)			-	4680	-	NR (6M)			-	4550	-
C317(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	6.9	-	NR (6M)			-	7.2	-	12440	NR (6M)			-	10040	-	NR (6M)			-	10300	-
C613(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.2	-	NR (6M)			-	7.2	-	12440	NR (6M)			-	8950	-	NR (6M)			-	8980	-
C621(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.3	-	NR (6M)			-	7.2	-	12440	NR (6M)			-	7560	-	NR (6M)			-	7540	-
C630(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.9	-	NR (6M)			-	7.8	-	12440	NR (6M)			-	4590	-	NR (6M)			-	4580	-
D010(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.3	-	NR (6M)			-	7.2	-	11408	NR (6M)			-	5530	-	NR (6M)			-	9660	-
D214(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.7	-	NR (6M)			-	7.6	-	12440	NR (6M)			-	7670	-	NR (6M)			-	7850	-
D317(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.0	-	NR (6M)			-	6.9	-	12440	NR (6M)			-	2720	-	NR (6M)			-	2760	-
D406(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.5	-	NR (6M)			-	7.6	-	12440	NR (6M)			-	7050	-	NR (6M)			-	7080	-
D510(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	7.4	-	NR (6M)			-	7.4	-	12440	NR (6M)			-	11660	-	NR (6M)			-	11680	-
D612(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	6.9	-	NR (6M)			-	6.9	-	12440	NR (6M)			-	11520	-	NR (6M)			-	11470	-
D807(BFS)	Lemington South Bowfield	6.7	7.9	NR (6M)			-	6.9	-	NR (6M)			-	6.7	-	12440	NR (6M)			-	6320	-	NR (6M)			-	2060	-
D010(GM)	Lemington South Glen Munro	6.7	7.1	NR (6M)			-	6.8	-	NR (6M)			-	7.1	-	11408	NR (6M)			-	11560	-	NR (6M)			-	11480	-
C130(ALL)	Lemington South Interburden	6.8	7.0	-	6.9	-	-	6.9	-	-	6.9	-	-	7.0	-	22700	-	20600	-	-	23000	-	-	22700	-	-	21700	-
LUG Bore	Lemington South Mt Arthur	No Trigger		-	7.5	-	NM			NM			-	7.1	-	No Trigger	-	8410	-	NM			NM			-	8590	-
B425(WDH)	Lemington South Woodlands Hill	6.6	7.6	NR (6M)			Dry			NR (6M)			Insufficient water to sample			20240	NR (6M)			Dry			NR (6M)			Insufficient water to sample		
B631(WDH)	Lemington South Woodlands Hill	6.6	7.6	NR (6M)			-	6.6	-	NR (6M)			-	6.6	-	20240	NR (6M)			-	12940	-	NR (6M)			-	12780	-
C122(WDH)	Lemington South Woodlands Hill	6.6	7.6	NR (6M)			-	7.8	-	NR (6M)			-	7.6	-	20240	NR (6M)			-	14220	-	NR (6M)			-	14520	-
C130(WDH)	Lemington South Woodlands Hill	6.6	7.6	NR (6M)			-	6.6	-	NR (6M)			-	6.6	-	20240	NR (6M)			-	20900	-	NR (6M)			-	21100	-
C317(WDH)	Lemington South Woodlands Hill	6.6	7.6	NR (6M)			-	7.8	-	NR (6M)			-	7.8	-	20240	NR (6M)			-	5210	-	NR (6M)			-	5210	-
C809(GM/WDH)	Lemington South Woodlands Hill	6.6	7.6	NR (6M)			-	7.2	-	NR (6M)			-	7.2	-	20240	NR (6M)			-	9880	-	NR (6M)			-	10050	-
D010(WDH)	Lemington South Woodlands Hill	6.6	7.6	NR (6M)			-	7.1	6.9	NR (6M)			-	7.1	-	20240	NR (6M)			-	4300	9200	NR (6M)			-	6740	-
SR002	Southern Bayswater Seam	No Trigger		NR (6M)			-	-	7.2	NR (6M)			-	-	6.9	No Trigger	NR (6M)			-	-	13820	NR (6M)			-	-	13920
SR003	Southern Bayswater Seam	No Trigger		NR (6M)			-	-	7.3	NR (6M)			-	-	7.1	No Trigger	NR (6M)			-	-	8590	NR (6M)			-	-	8970
SR004	Southern Bayswater Seam	No Trigger		NR (6M)			-	-	6.8	NR (6M)			-	-	6.7	No Trigger	NR (6M)			-	-	12150	NR (6M)			-	-	12740
SR005	Southern Bayswater Seam	No Trigger		NR (6M)			-	-	6.4	NR (6M)			-	-	6.4	No Trigger	NR (6M)			-	-	3130	NR (6M)			-	-	3160
SR006	Southern Bayswater Seam	No Trigger		NR (6M)			-	-	7.0	NR (6M)			-	-	7.0	No Trigger	NR (6M)			-	-	11480	NR (6M)			-	-	11380

Table D.2 Groundwater Quality Data – Permian Coal Measures

Bore ID	WMP Geology	pH Trigger (5th Percentile)	pH Trigger (95th Percentile)	pH (Q1)			pH (Q2)			pH (Q3)			pH (Q4)			EC Trigger (µS/cm)	EC (Q1) (µS/cm)			EC (Q2) (µS/cm)			EC (µS/cm) (Q3)			EC (µS/cm) (Q4)		
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SR001	Southern Coal	No Trigger		NR (6M)			-	-	6.8	NR (6M)			-	-	6.6	No Trigger	NR (6M)			-	-	14980	NR (6M)			-	-	15360
SR010	Southern Conglomerate and Warkworth Seam	No Trigger		NR (6M)			-	-	7.8	7.1	-	-	-	-	6.9	No Trigger	NR (6M)			-	-	1042	3850	-	-	-	-	5640
SR009	Southern Lemington Seam	No Trigger		NR (6M)			-	-	7.4	NR (6M)			-	-	7.3	No Trigger	NR (6M)			-	-	5800	NR (6M)			-	-	6280
SR011	Southern Mt Arthur Seam and underburden	No Trigger		NR (6M)			-	-	6.7	NR (6M)			-	-	6.5	No Trigger	NR (6M)			-	-	15760	NR (6M)			-	-	16680
SR012	Southern Overburden - conglomerate and sandstone	No Trigger		NR (6M)			-	-	6.7	NR (6M)			-	-	6.7	No Trigger	NR (6M)			-	-	14130	NR (6M)			-	-	13860
SR007	Southern Overburden and Vaux Seam	No Trigger		NR (6M)			-	-	6.6	NR (6M)			-	-	6.5	No Trigger	NR (6M)			-	-	6310	NR (6M)			-	-	6620
SR008	Southern Siltstone/sandstone below Lemington Seam	No Trigger		NR (6M)			-	-	6.8	6.9	-	-	-	-	6.8	No Trigger	NR (6M)			-	-	162	11740	-	-	-	-	14230
NPz2	West Pit Sandstone/Siltstone	6.9	8.0	-	-	6.9	-	-	7.1	-	-	7.0	-	-	6.9	13428	-	-	14290	-	-	14690	-	-	14860	-	-	14840
NPz3	West Pit Sandstone/Siltstone	6.9	8.0	Bore Collapsed			Bore Collapsed			Bore Collapsed			Bore Collapsed			13428	Bore Collapsed			Bore Collapsed			Bore Collapsed			Bore Collapsed		
NPz5	West Pit Sandstone/Siltstone	6.9	8.0	Mined through			Mined through			Mined through			Mined through			13428	Mined through			Mined through			Mined through			Mined through		

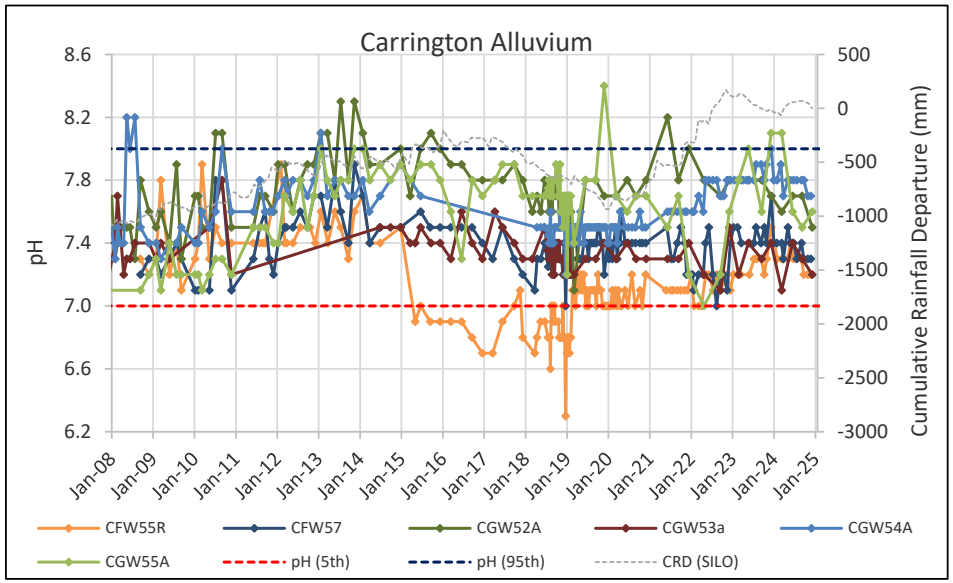
Note: NR (6m) = not required (6 monthly monitoring only)

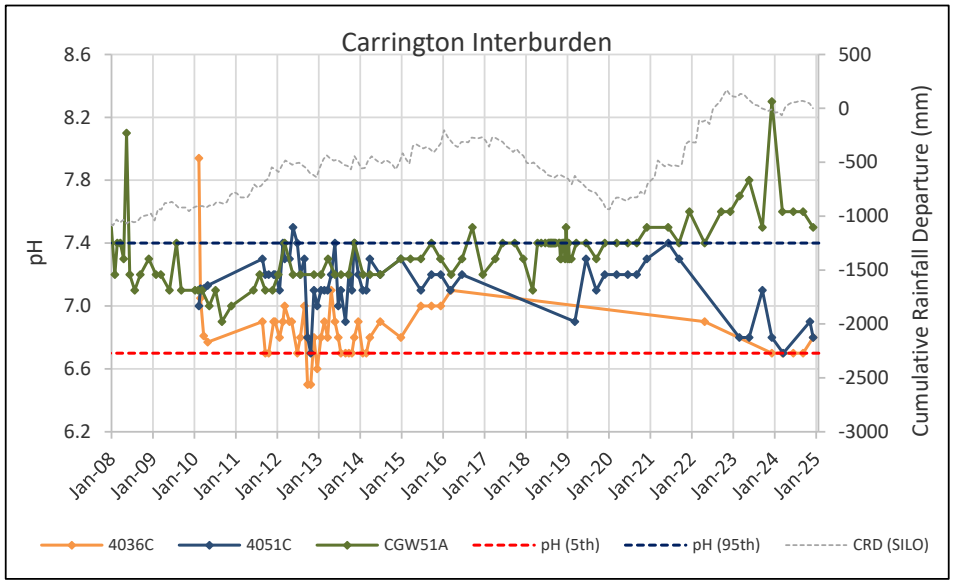
Table D.3 Groundwater Quality Data – Spoil

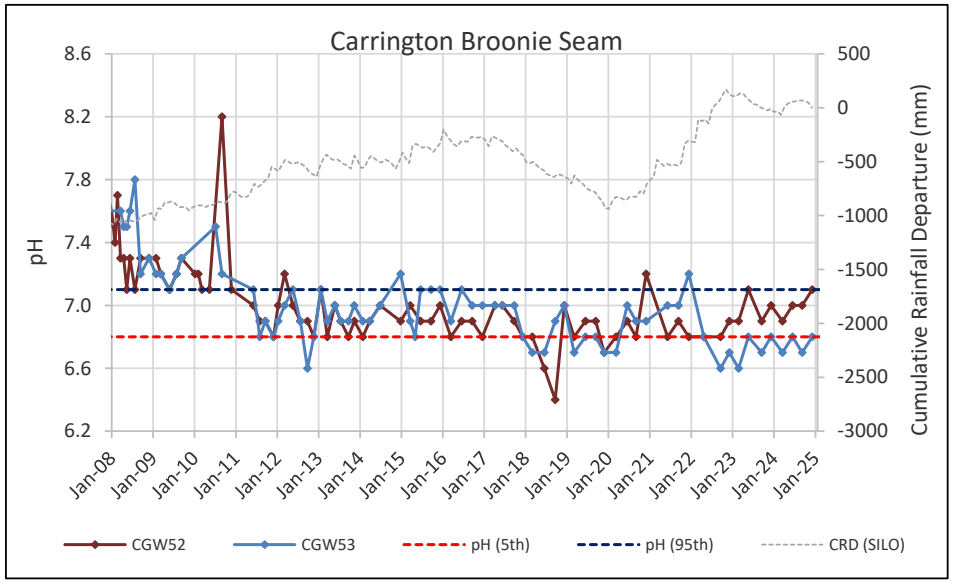
Bore ID	WMP Geology	pH Trigger (5th Percentile)	pH Trigger (95th Percentile)	pH (Q1)			pH (Q2)			pH (Q3)			pH (Q4)			EC Trigger (µS/cm)	EC (Q1) (µS/cm)			EC (Q2) (µS/cm)			EC (µS/cm) (Q3)			EC (µS/cm) (Q4)		
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GW-107	Carrington Spoil	No Trigger		Dry			Dry			Dry			Dry			No Trigger	Dry			Dry			Dry			Dry		
GW-108	Carrington Spoil	No Trigger		Blocked			Blocked			Blocked			NM			No Trigger	Blocked			Blocked			Blocked			NM		
4116P	North Pit Spoil	6.5	7.8	6.9	-	-	Blocked			7.0	7.1	-	7.0	-	-	12460	11030	-	-	Blocked			12380	11550	-	12390	-	-
4119P	North Pit Spoil	6.5	7.8	6.9	-	-	6.7	-	-	7.5	-	-	6.8	-	-	12460	2750	-	-	5410	-	-	3910	-	-	5460	-	-
DM1	North Pit Spoil	6.5	7.8	6.5	-	-	6.5	-	-	6.5	-	-	-	6.6	-	12460	8970	-	-	8360	-	-	8660	-	-	-	8860	-
DM3	North Pit Spoil	6.5	7.8	-	6.4	-	6.5	-	-	6.5	-	-	6.5	-	-	12460	-	8740	-	9640	-	-	9650	-	-	9560	-	-
DM4	North Pit Spoil	6.5	7.8	6.9	-	-	6.9	-	-	7.0	-	-	6.9	-	-	12460	5700	-	-	5880	-	-	5780	-	-	5840	-	-
DM7	North Pit Spoil	6.5	7.8	7.5	-	-	7.6	-	-	7.8	-	-	8.2	-	-	12460	6880	-	-	6880	-	-	6720	-	-	6730	-	-
GW-114	North Pit Spoil	6.5	7.8	6.7	-	-	6.8	-	-	7.0	-	-	6.6	-	-	12460	6750	-	-	6140	-	-	3460	-	-	8740	-	-
GW-115	North Pit Spoil	6.5	7.8	6.8	-	-	6.9	-	-	6.9	-	-	6.8	-	-	12460	6070	-	-	6380	-	-	6220	-	-	7420	-	-
MB14HVO01	North Pit Spoil	6.5	7.8	7.0	-	-	6.9	-	-	7.1	6.9	-	6.9	-	-	12460	6210	-	-	6220	-	-	6160	6480	-	6540	-	-
MB14HVO02	North Pit Spoil	6.5	7.8	6.9	-	-	6.8	-	-	6.9	6.8	-	6.7	-	-	12460	6590	-	-	6880	-	-	6840	7070	-	7430	-	-
MB14HVO03	North Pit Spoil	6.5	7.8	7.0	-	-	7.0	-	-	7.1	-	-	7.0	-	-	12460	4120	-	-	4150	-	-	4140	-	-	5770	-	-
MB14HVO04	North Pit Spoil	6.5	7.8	6.8	-	-	7.0	-	-	7.0	-	-	6.9	-	-	12460	5620	-	-	5870	-	-	5870	-	-	6060	-	-
MB14HVO05	North Pit Spoil	6.5	7.8	6.9	-	-	6.9	-	-	7.0	6.9	-	6.9	-	-	12460	6840	-	-	7180	-	-	6770	6910	-	7250	-	-

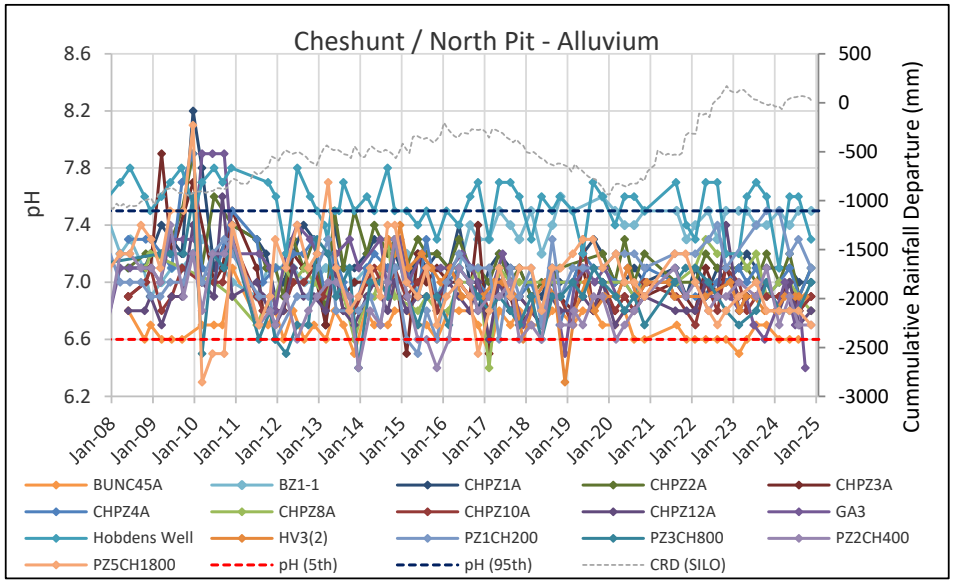
APPENDIX E

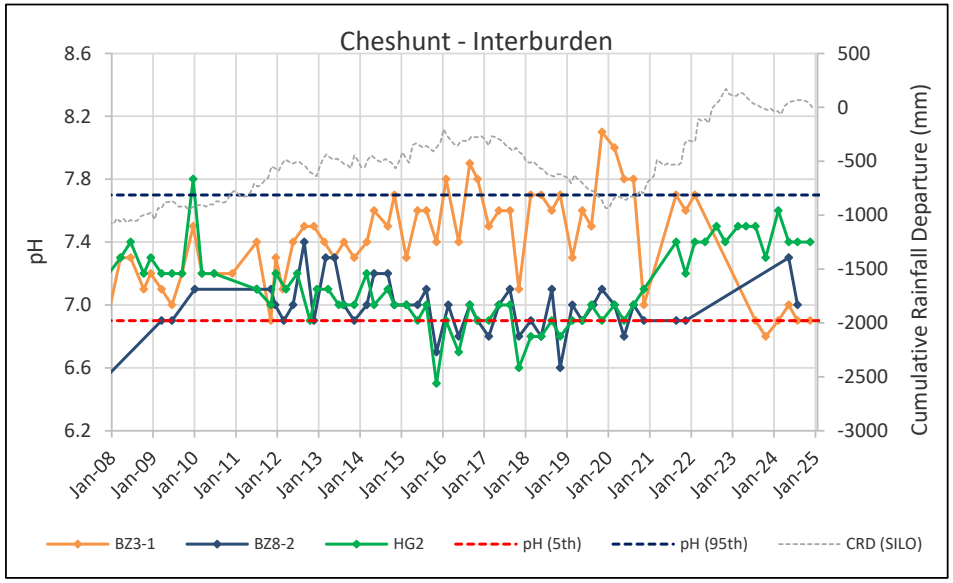
Groundwater Quality Graphs

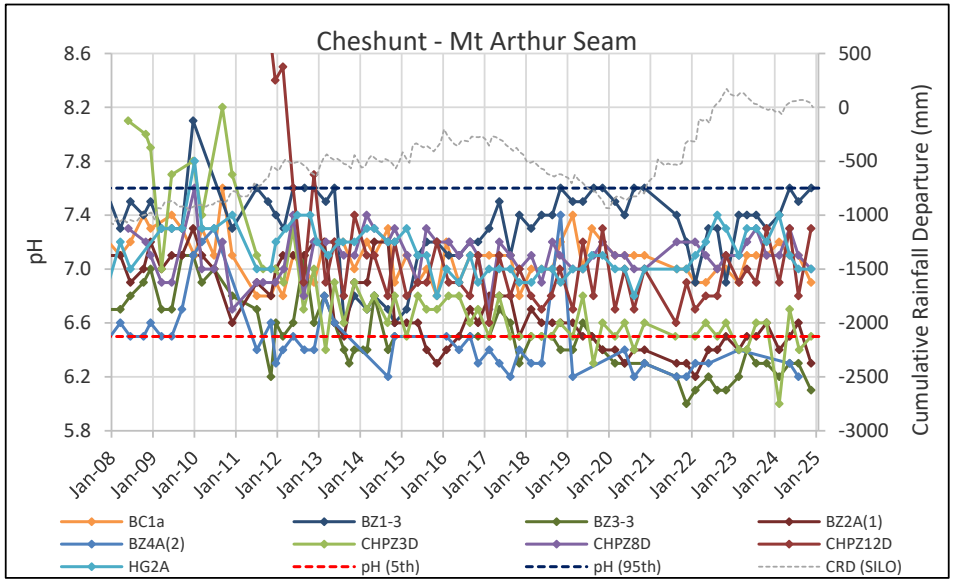

Carrington Alluvium
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CFW55R
CFW57
CGW52A
CGW53a
CGW54A
CGW55A
pH (5th)
pH (95th)
CRD (SILO)

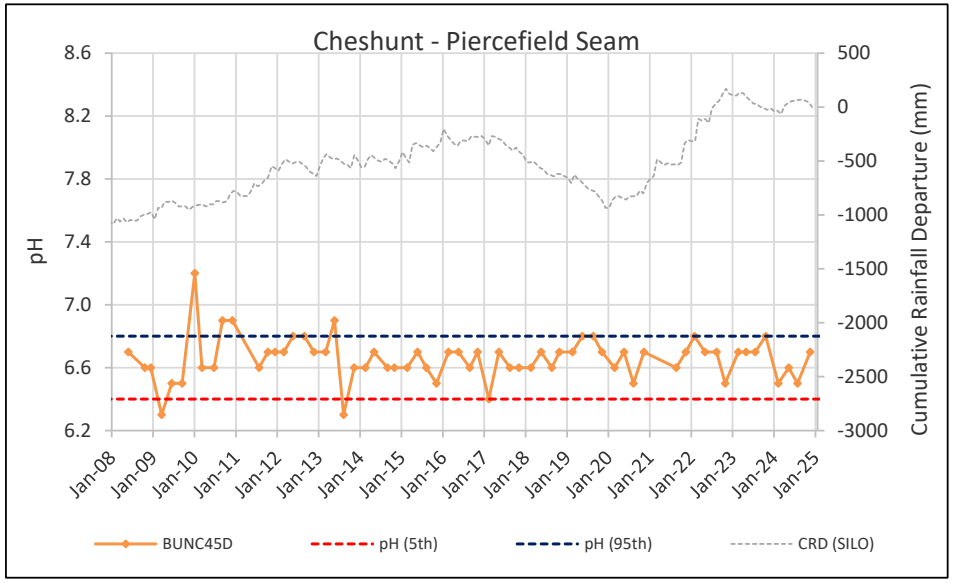

Carrington Interburden
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
4036C
4051C
CGW51A
pH (5th)
pH (95th)
CRD (SILO)

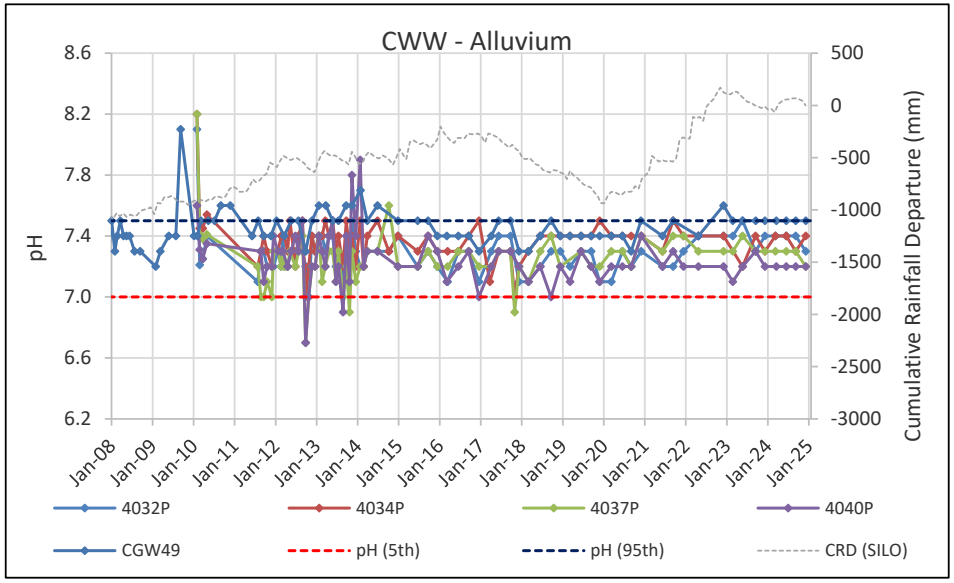

Carrington Broonie Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW52
CGW53
pH (5th)
pH (95th)
CRD (SILO)

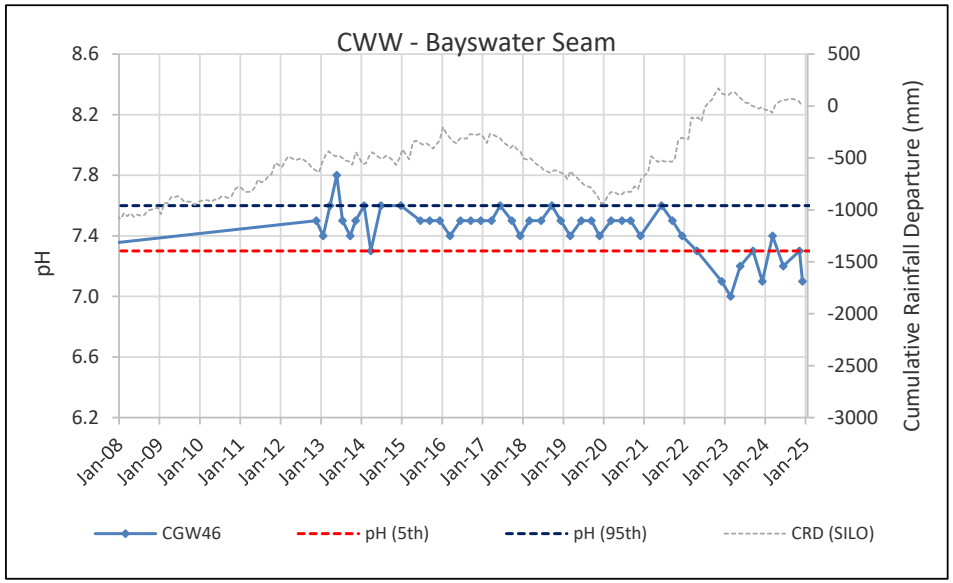

Cheshunt / North Pit - Alluvium
pH
Cummulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
BUNC45A
BZ1-1
CHPZ1A
CHPZ2A
CHPZ3A
CHPZ4A
CHPZ8A
CHPZ10A
CHPZ12A
GA3
Hobdens Well
HV3(2)
PZ1CH200
PZ3CH800
PZ2CH400
PZ5CH1800
pH (5th)
pH (95th)
CRD (SILO)

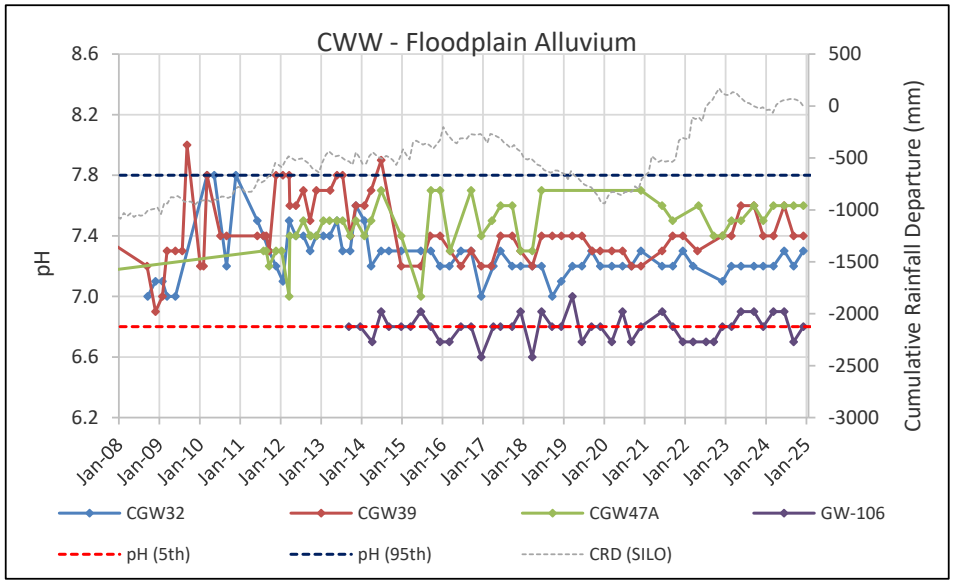

Cheshunt - Interburden
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
BZ3-1
BZ8-2
HG2
pH (5th)
pH (95th)
CRD (SILO)

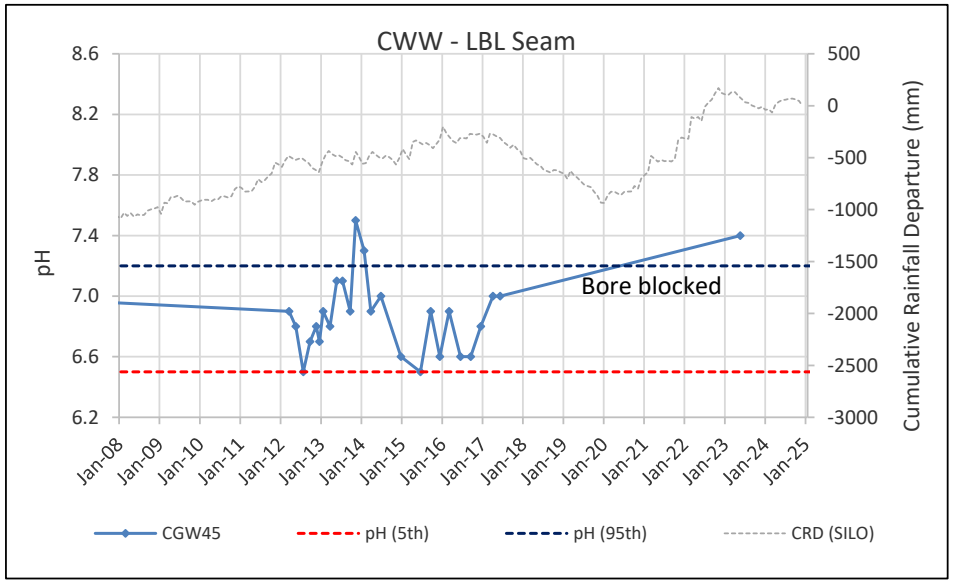

Cheshunt - Mt Arthur Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
5.8
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
BC1a
BZ1-3
BZ3-3
BZ2A(1)
BZ4A(2)
CHPZ3D
CHPZ8D
CHPZ12D
HG2A
pH (5th)
pH (95th)
CRD (SILO)

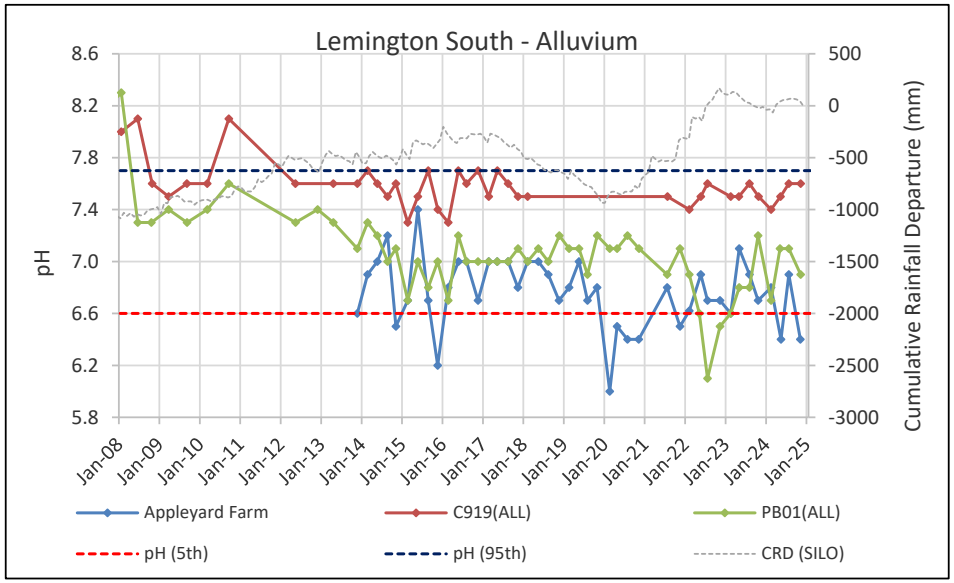

Cheshunt - Piercefield Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
BUNC45D
pH (5th)
pH (95th)
CRD (SILO)

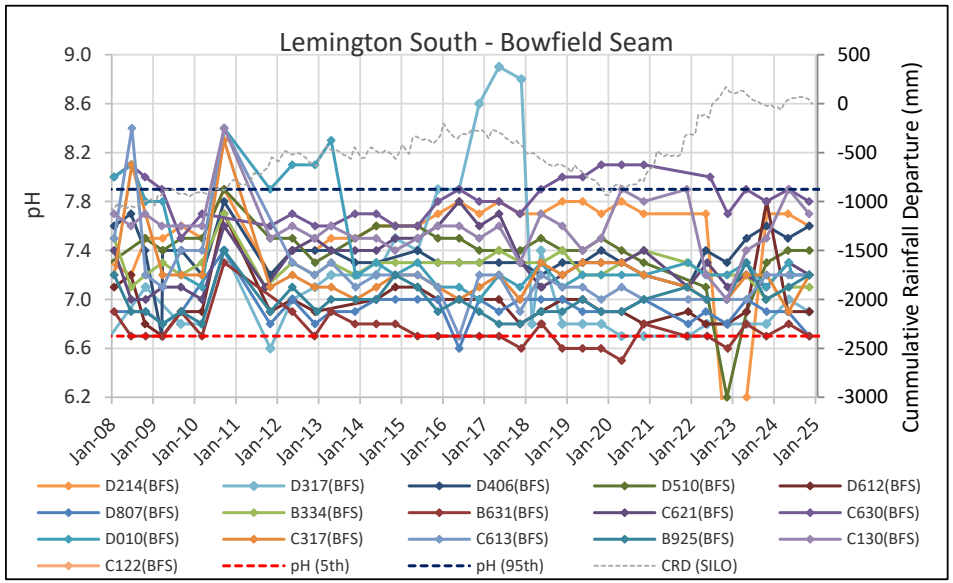

CWW - Alluvium
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
4032P
4034P
4037P
4040P
CGW49
pH (5th)
pH (95th)
CRD (SILO)

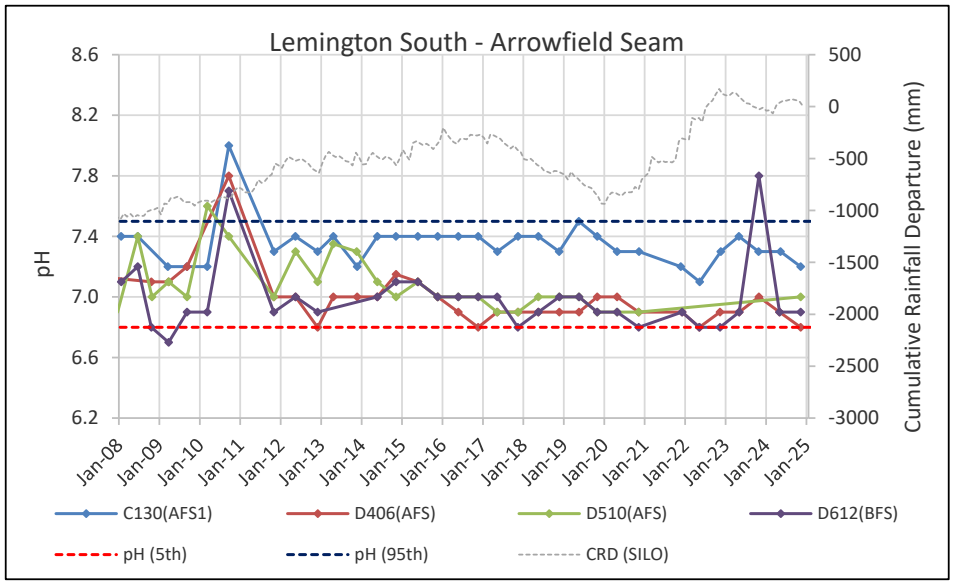

CWW - Bayswater Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW46
pH (5th)
pH (95th)
CRD (SILO)

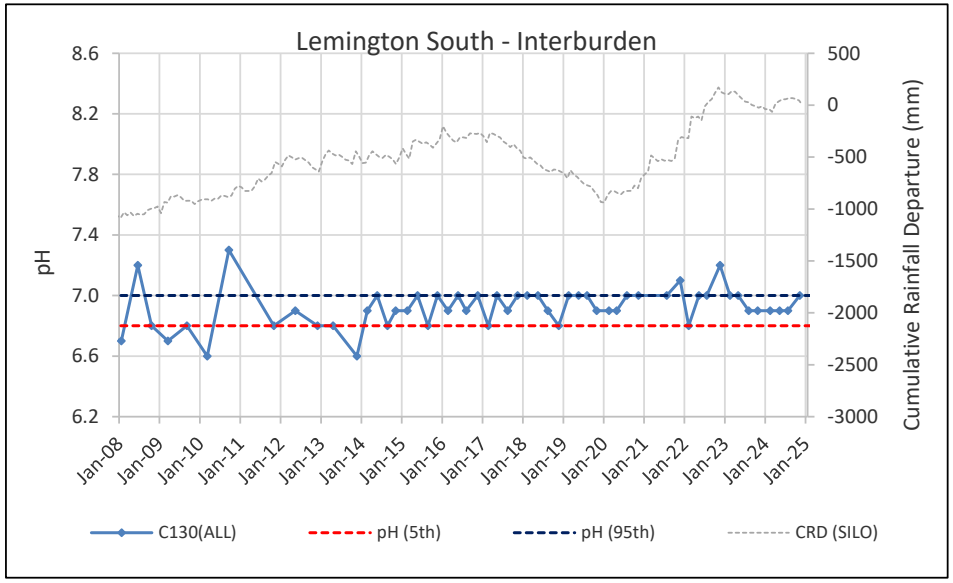

CWW - Floodplain Alluvium
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
CGW32
CGW39
CGW47A
GW-106
pH (5th)
pH (95th)
CRD (SILO)

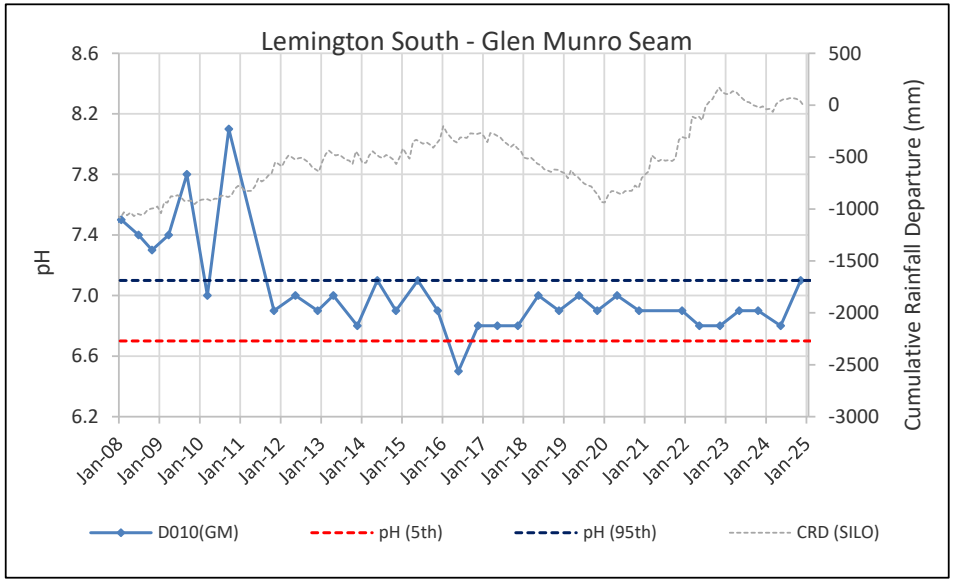

CWW - LBL Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
Bore blocked
CGW45
pH (5th)
pH (95th)
CRD (SILO)

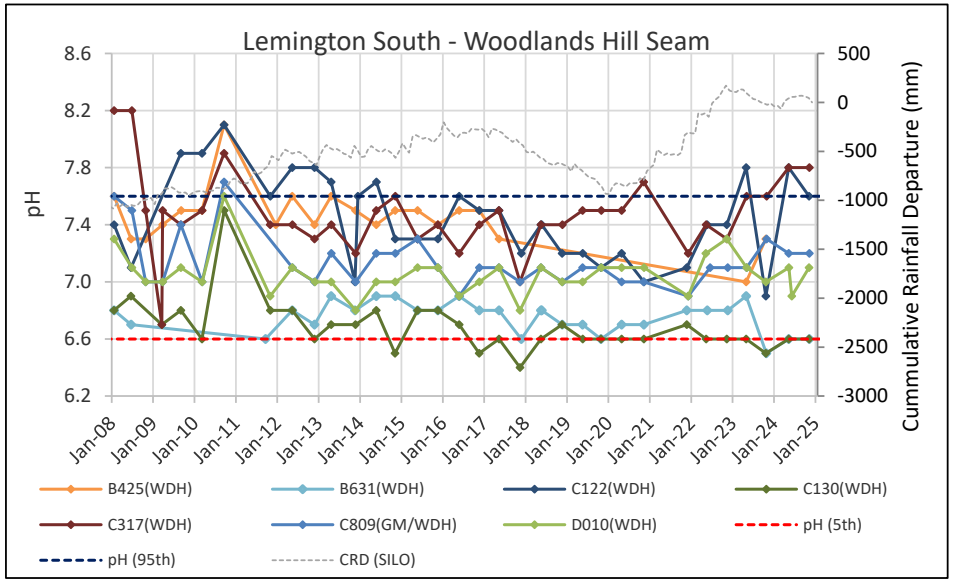

Lemington South - Alluvium
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
5.8
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
Appleyard Farm
C919(ALL)
PB01(ALL)
pH (5th)
pH (95th)
CRD (SILO)

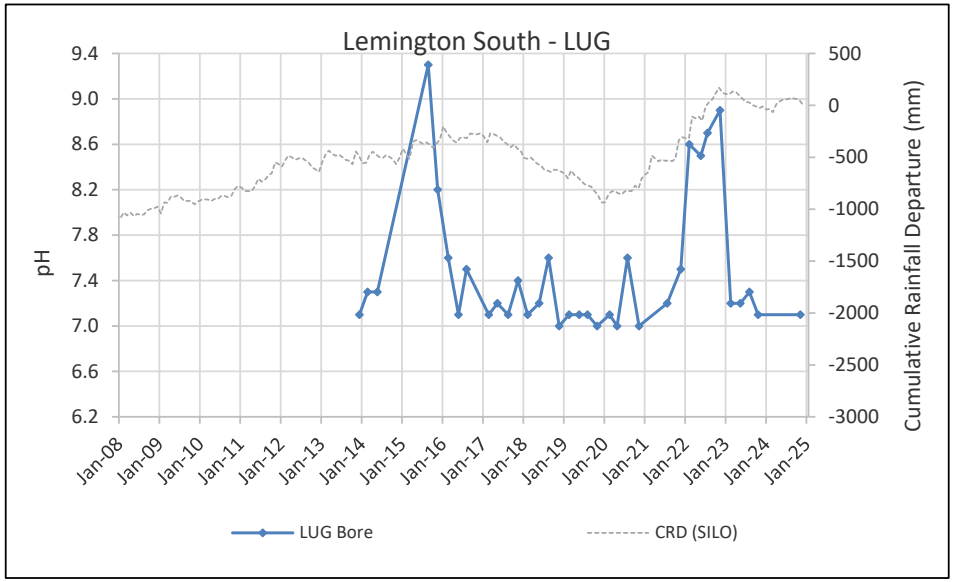

Lemington South - Bowfield Seam
pH
Cummulative Rainfall Departure (mm)
9.0
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
D214(BFS)
D317(BFS)
D406(BFS)
D510(BFS)
D612(BFS)
D807(BFS)
B334(BFS)
B631(BFS)
C621(BFS)
C630(BFS)
D010(BFS)
C317(BFS)
C613(BFS)
B925(BFS)
C130(BFS)
C122(BFS)
pH (5th)
pH (95th)
CRD (SILO)

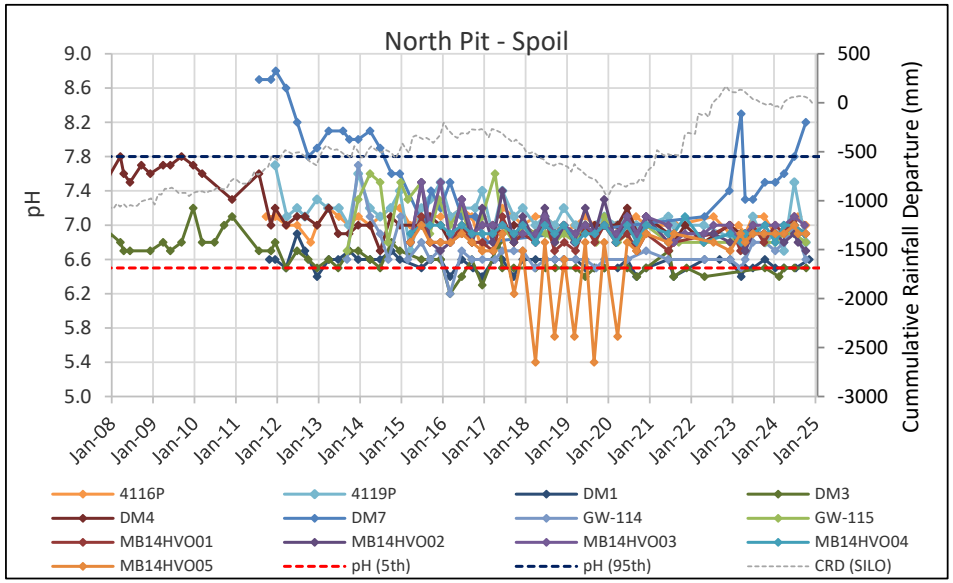

Lemington South - Arrowfield Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
C130(AFS1)
D406(AFS)
D510(AFS)
D612(BFS)
pH (5th)
pH (95th)
CRD (SILO)

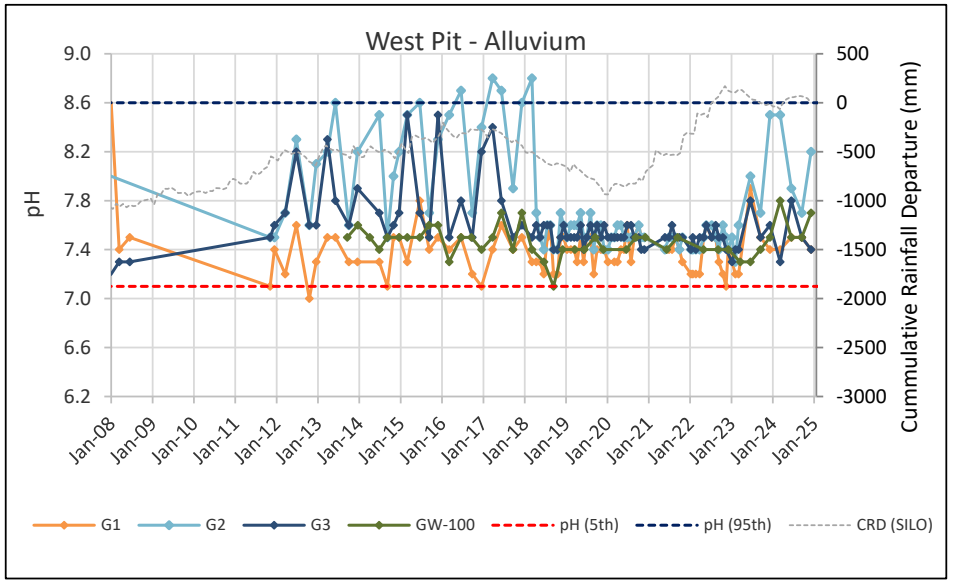

Lemington South - Interburden
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
C130(ALL)
pH (5th)
pH (95th)
CRD (SILO)

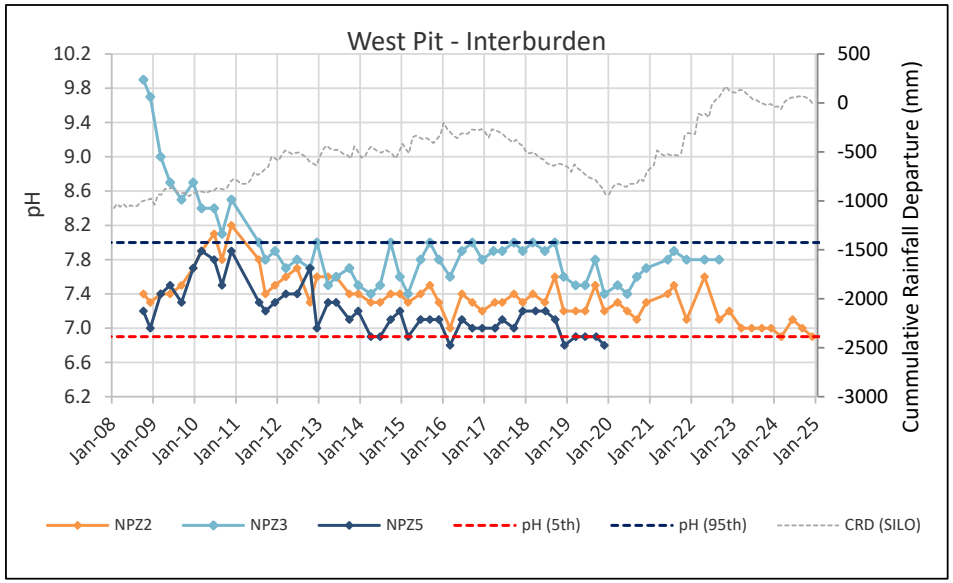

Lemington South - Glen Munro Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
D010(GM)
pH (5th)
pH (95th)
CRD (SILO)

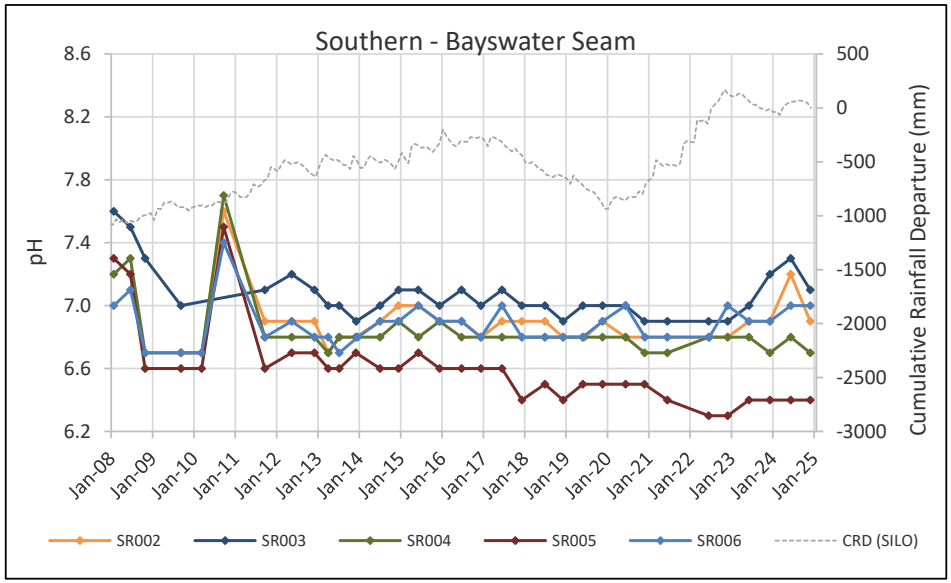

Lemington South - Woodlands Hill Seam
pH
Cummulative Rainfall Departure (mm)
B425(WDH)
B631(WDH)
C122(WDH)
C130(WDH)
C317(WDH)
C809(GM/WDH)
D010(WDH)
pH (5th)
pH (95th)
CRD (SILO)

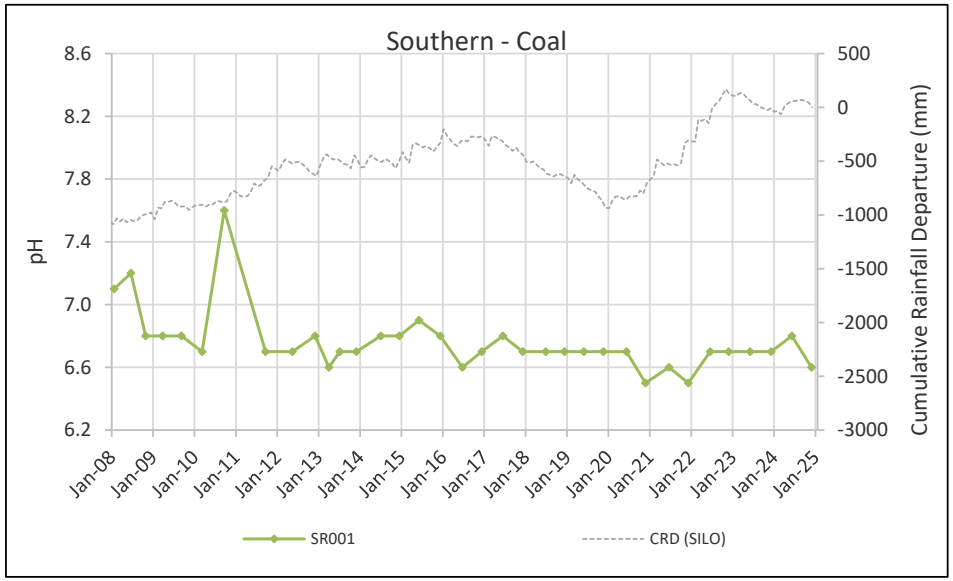

Lemington South - LUG
pH
Cumulative Rainfall Departure (mm)
LUG Bore
CRD (SILO)

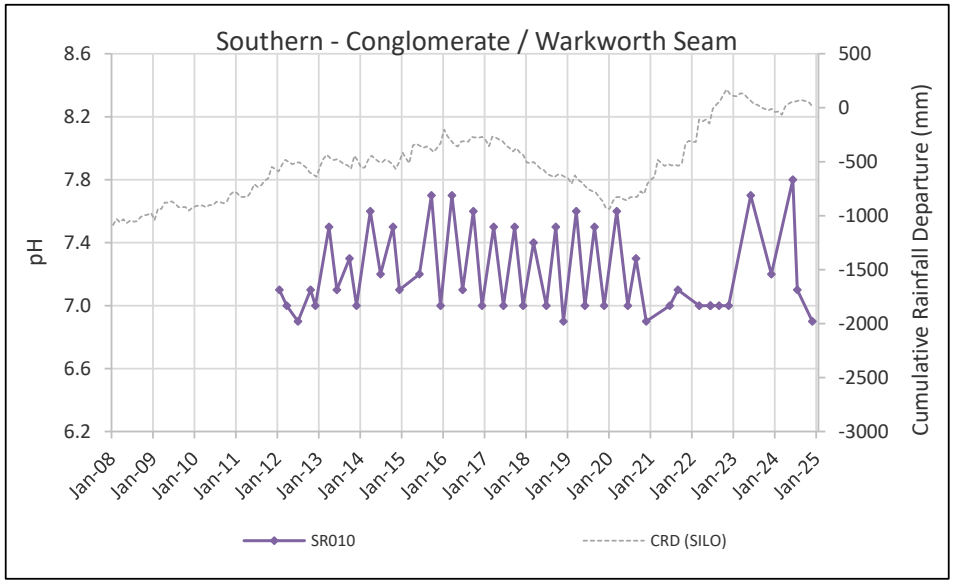

North Pit - Spoil
pH
Cummulative Rainfall Departure (mm)
4116P
4119P
DM1
DM3
DM4
DM7
GW-114
GW-115
MB14HVO01
MB14HVO02
MB14HVO03
MB14HVO04
MB14HVO05
pH (5th)
pH (95th)
CRD (SILO)

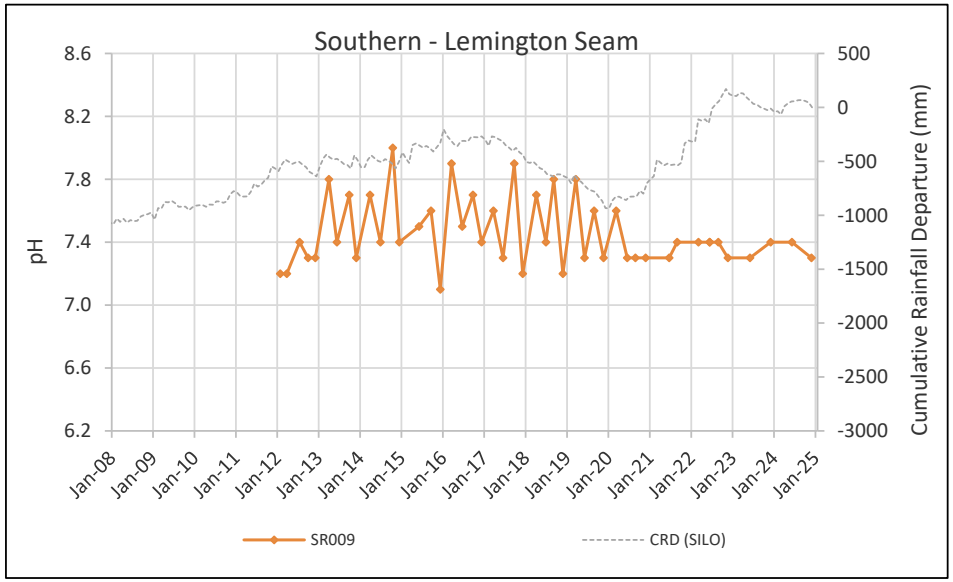

West Pit - Alluvium
pH
Cummulative Rainfall Departure (mm)
G1
G2
G3
GW-100
pH (5th)
pH (95th)
CRD (SILO)

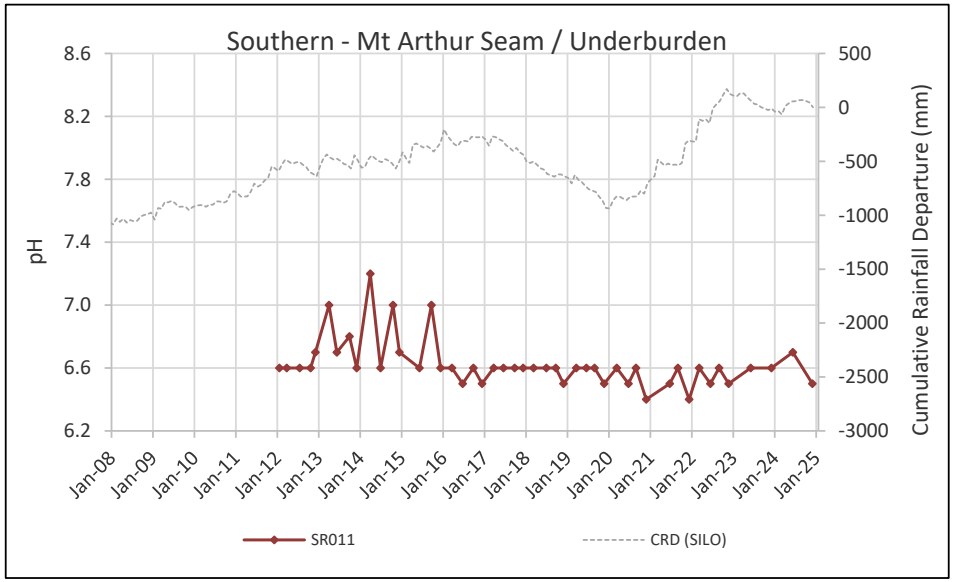

West Pit - Interburden
pH
Cummulative Rainfall Departure (mm)
10.2
9.8
9.4
9.0
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
NPZ2
NPZ3
NPZ5
pH (5th)
pH (95th)
CRD (SILO)

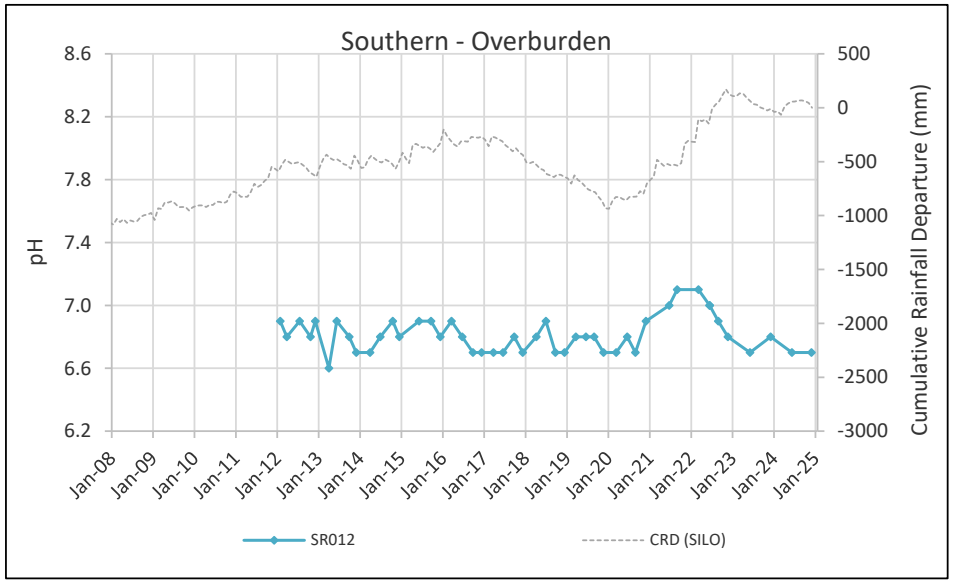

Southern - Bayswater Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR002
SR003
SR004
SR005
SR006
CRD (SILO)

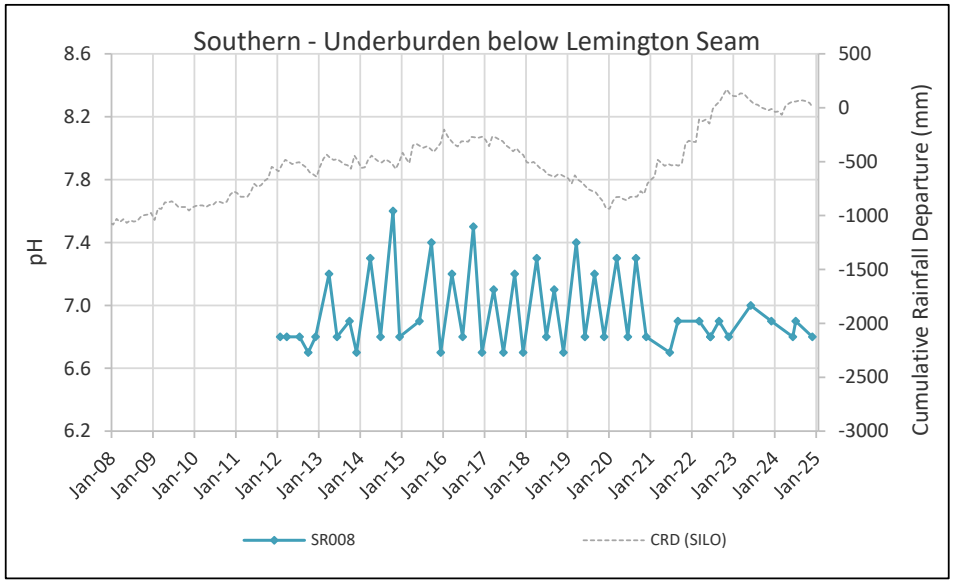

Southern - Coal
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR001
CRD (SILO)

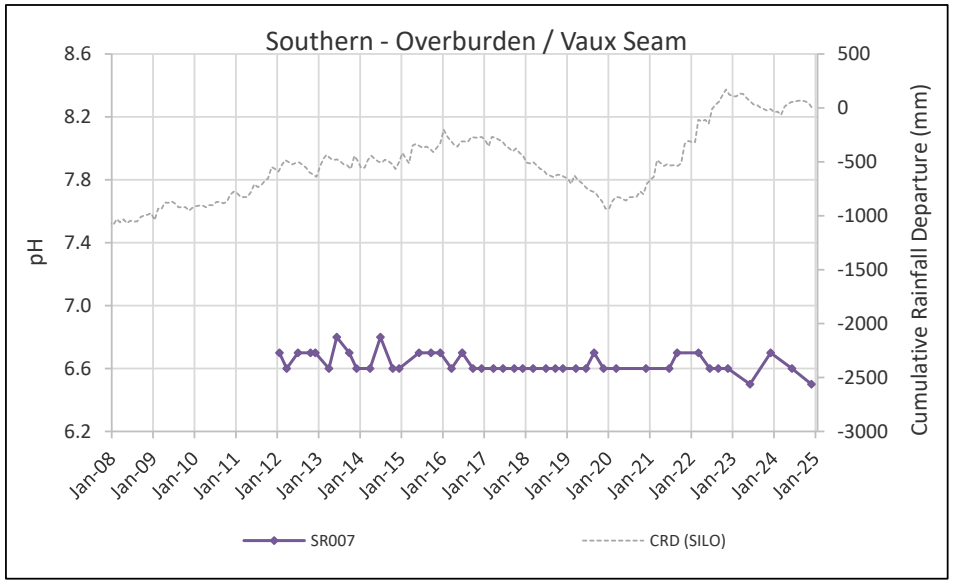

Southern - Conglomerate / Warkworth Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR010
CRD (SILO)

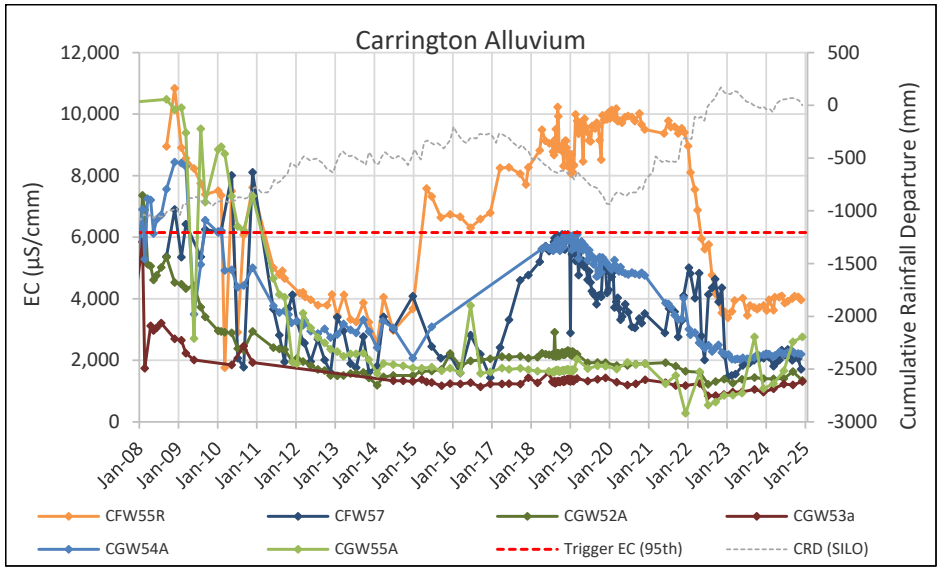

Southern - Lemington Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR009
CRD (SILO)

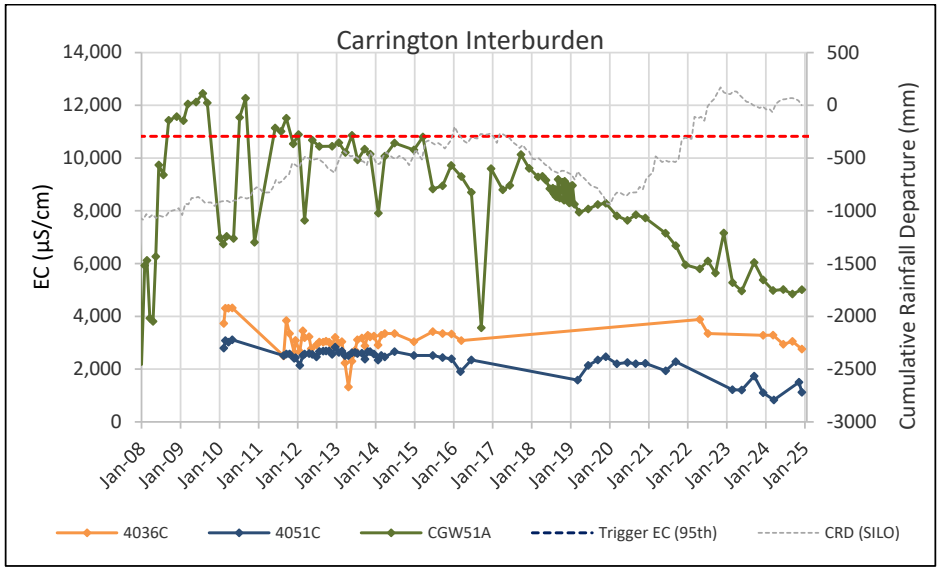

Southern - Mt Arthur Seam / Underburden
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR011
CRD (SILO)

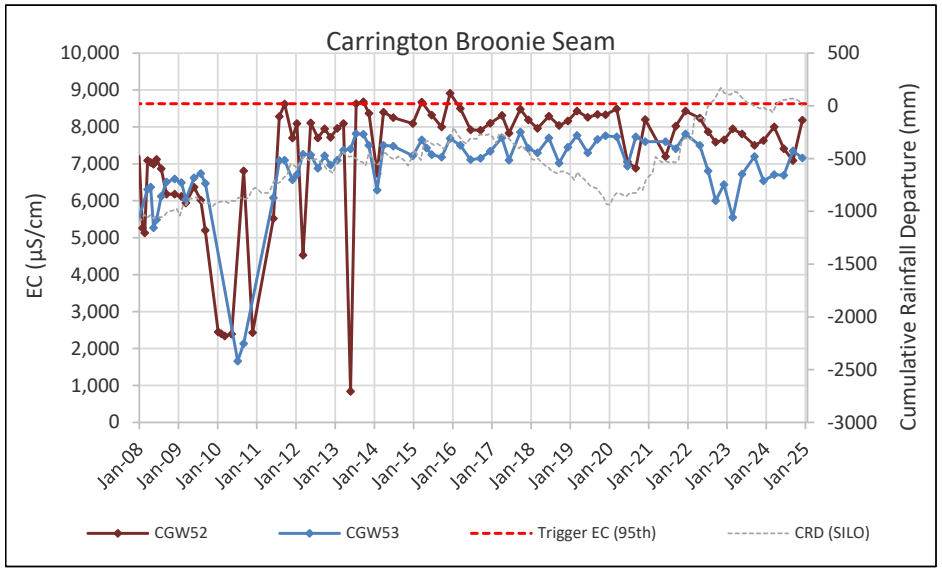

Southern - Overburden
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR012
CRD (SILO)

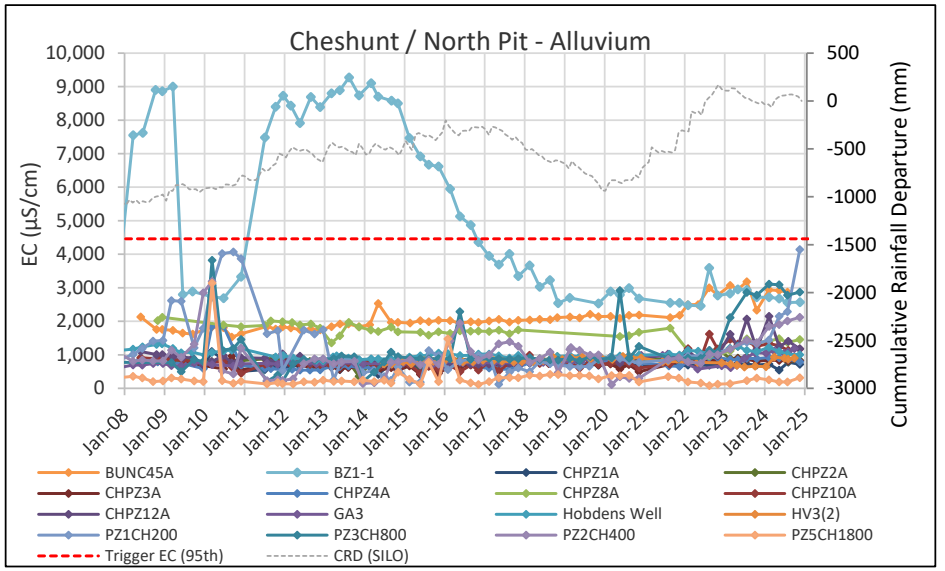

Southern - Underburden below Lemington Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR008
CRD (SILO)

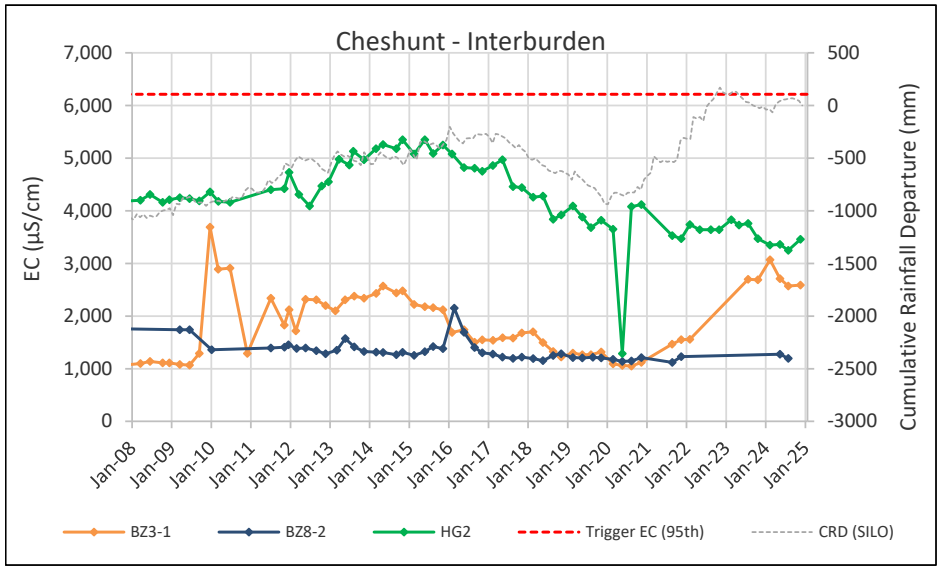

Southern - Overburden / Vaux Seam
pH
Cumulative Rainfall Departure (mm)
8.6
8.2
7.8
7.4
7.0
6.6
6.2
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR007
CRD (SILO)

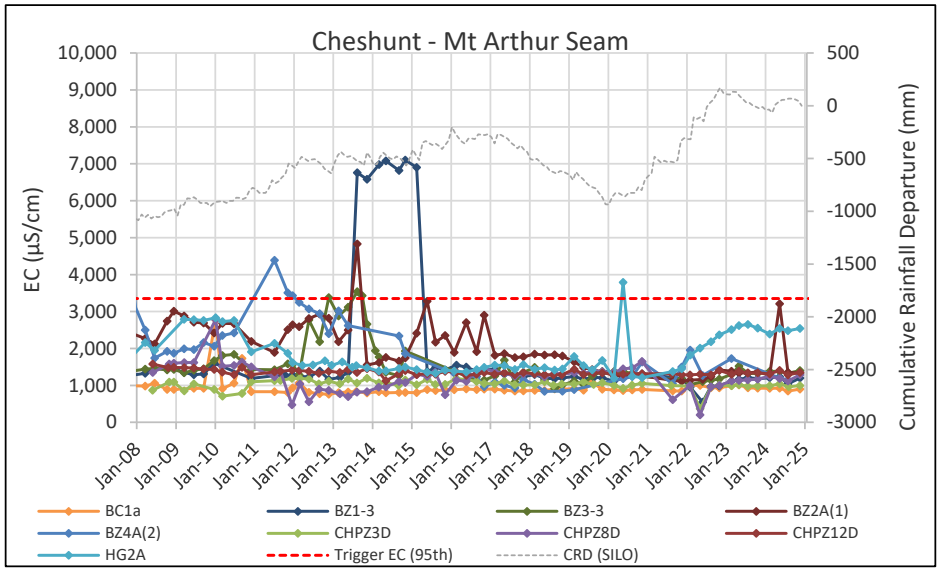

Carrington Alluvium
EC (µS/cmm)
Cumulative Rainfall Departure (mm)
CFW55R
CFW57
CGW52A
CGW53a
CGW54A
CGW55A
Trigger EC (95th)
CRD (SILO)

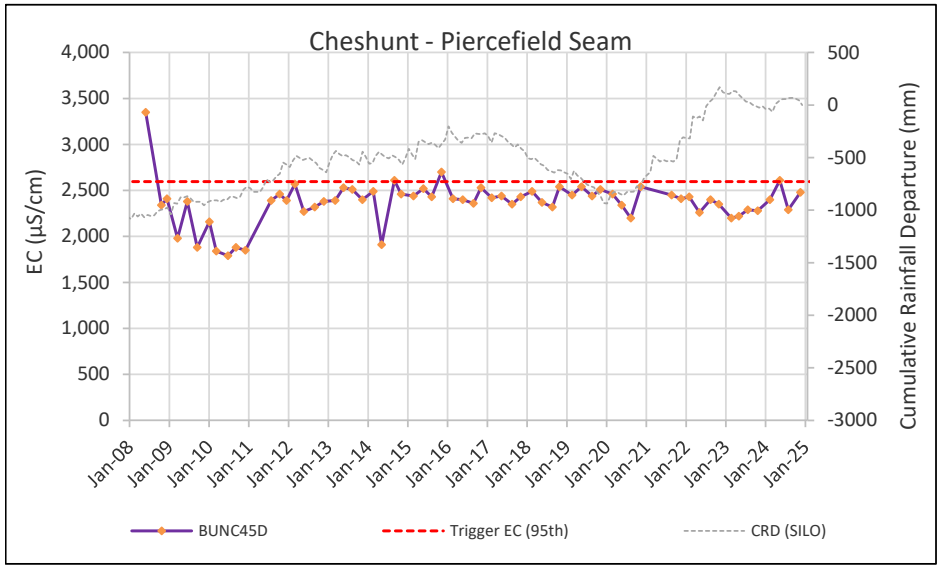

Carrington Interburden
EC (µS/cm)
Cumulative Rainfall Departure (mm)
4036C
4051C
CGW51A
Trigger EC (95th)
CRD (SILO)

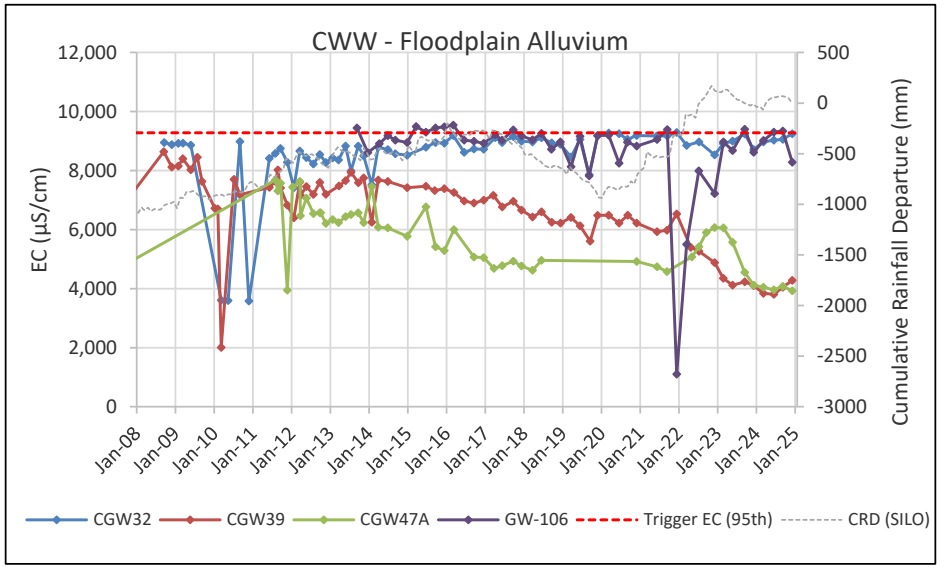

Carrington Broonie Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
CGW52
CGW53
Trigger EC (95th)
CRD (SILO)

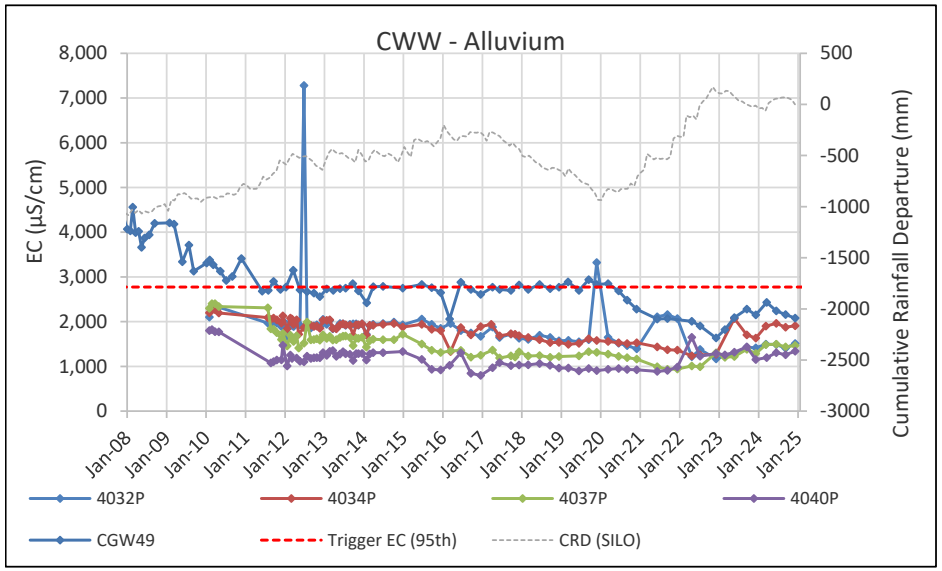

Cheshunt / North Pit - Alluvium
EC (µS/cm)
Cummulative Rainfall Departure (mm)
BUNC45A
BZ1-1
CHPZ1A
CHPZ2A
CHPZ3A
CHPZ4A
CHPZ8A
CHPZ10A
CHPZ12A
GA3
Hobdens Well
HV3(2)
PZ1CH200
PZ3CH800
PZ2CH400
PZ5CH1800
Trigger EC (95th)
CRD (SILO)

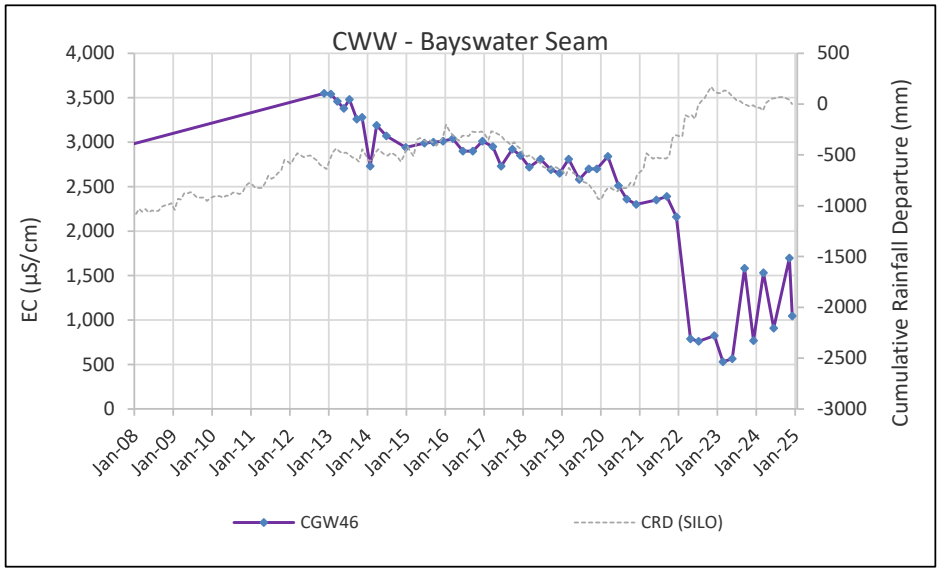

Cheshunt - Interburden
EC (µS/cm)
Cumulative Rainfall Departure (mm)
BZ3-1
BZ8-2
HG2
Trigger EC (95th)
CRD (SILO)

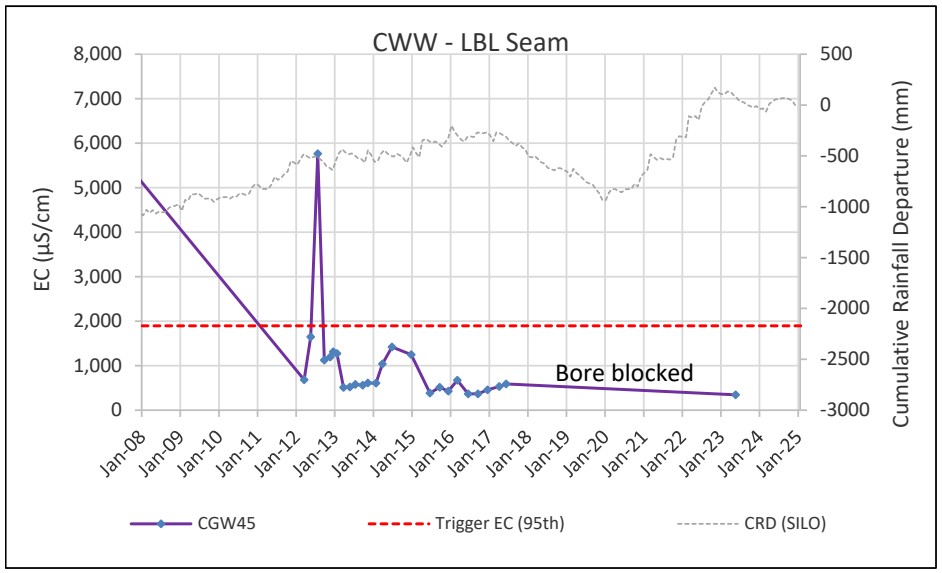

Cheshunt - Mt Arthur Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
BC1a
BZ1-3
BZ3-3
BZ2A(1)
BZ4A(2)
CHPZ3D
CHPZ8D
CHPZ12D
HG2A
Trigger EC (95th)
CRD (SILO)

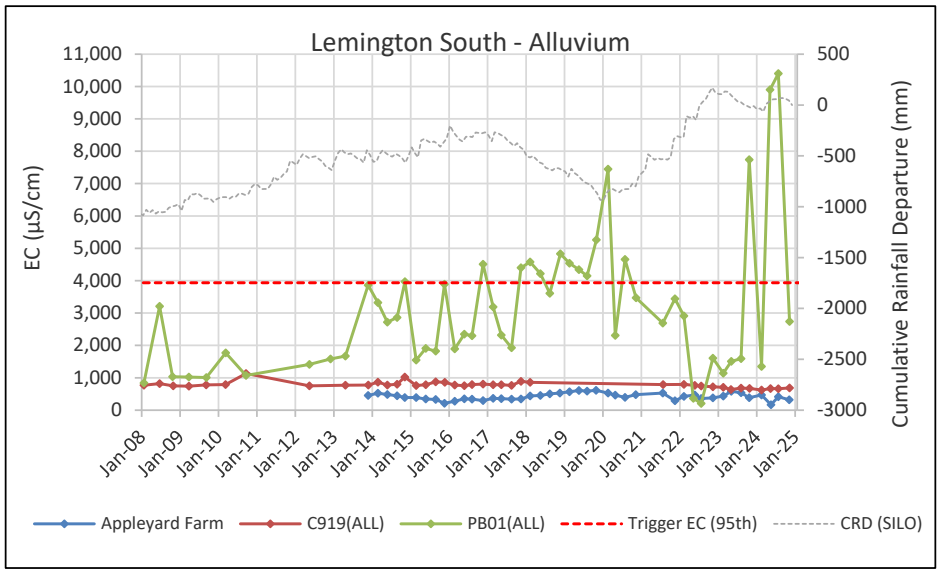

Cheshunt - Piercefield Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
BUNC45D
Trigger EC (95th)
CRD (SILO)

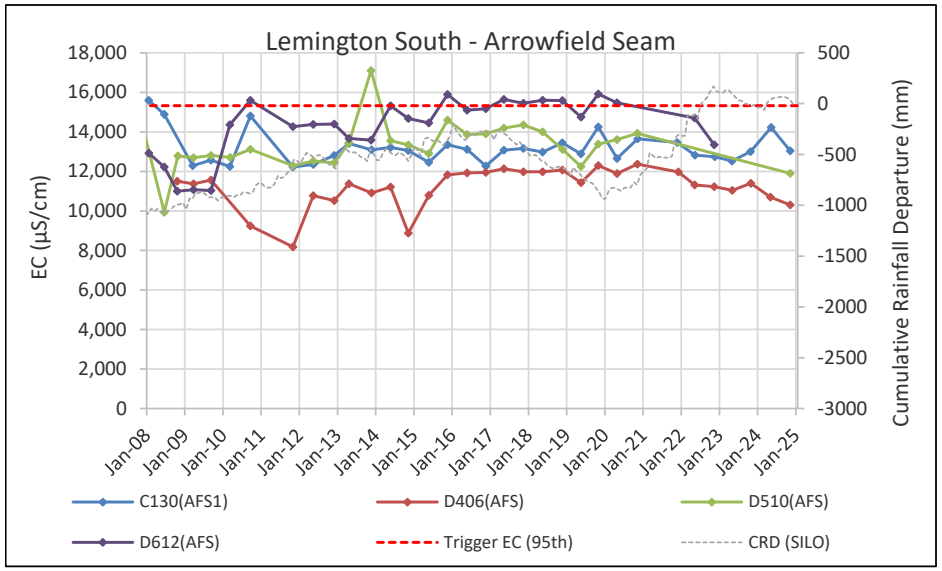

CWW - Floodplain Alluvium
EC (µS/cm)
Cumulative Rainfall Departure (mm)
CGW32
CGW39
CGW47A
GW-106
Trigger EC (95th)
CRD (SILO)

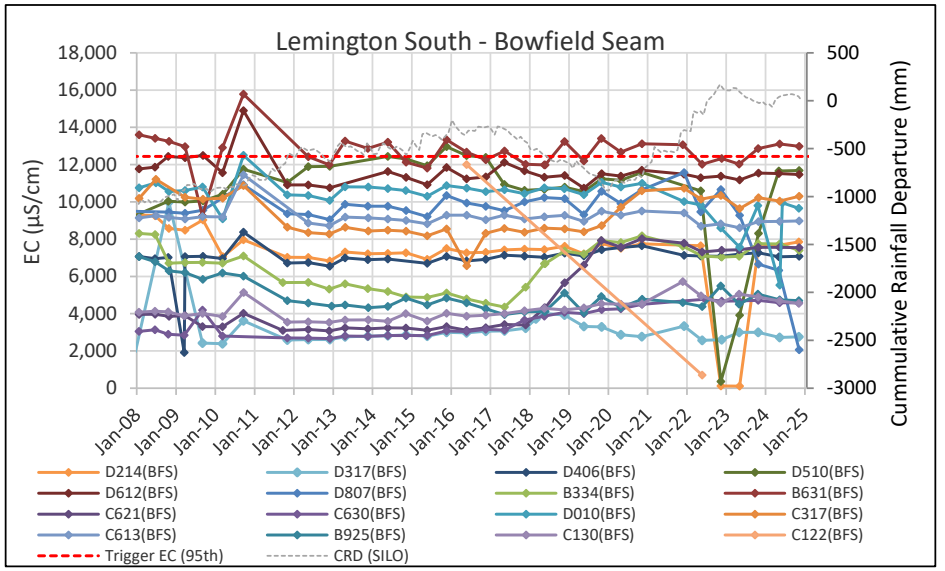

CWW - Alluvium
EC (µS/cm)
Cumulative Rainfall Departure (mm)
4032P
4034P
4037P
4040P
CGW49
Trigger EC (95th)
CRD (SILO)

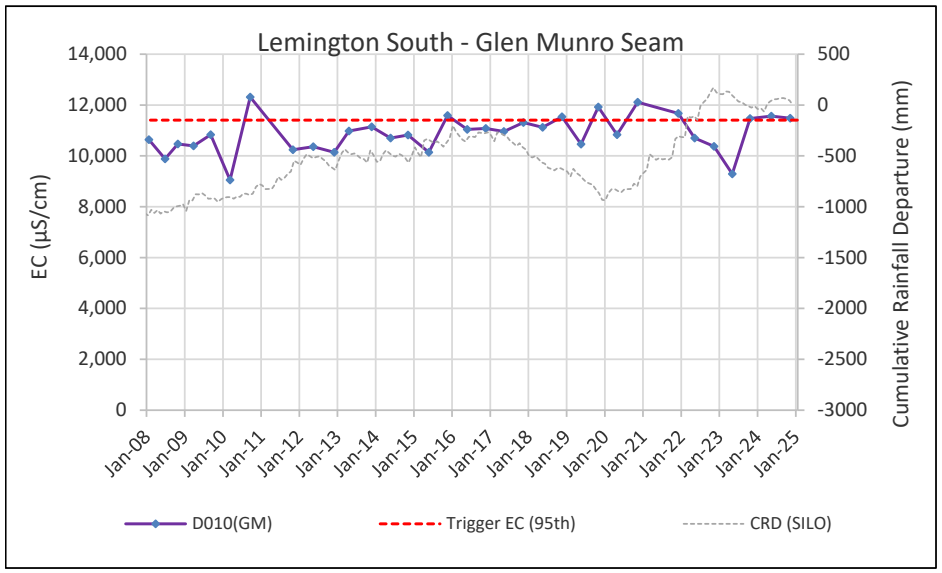

CWW - Bayswater Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
CGW46
CRD (SILO)

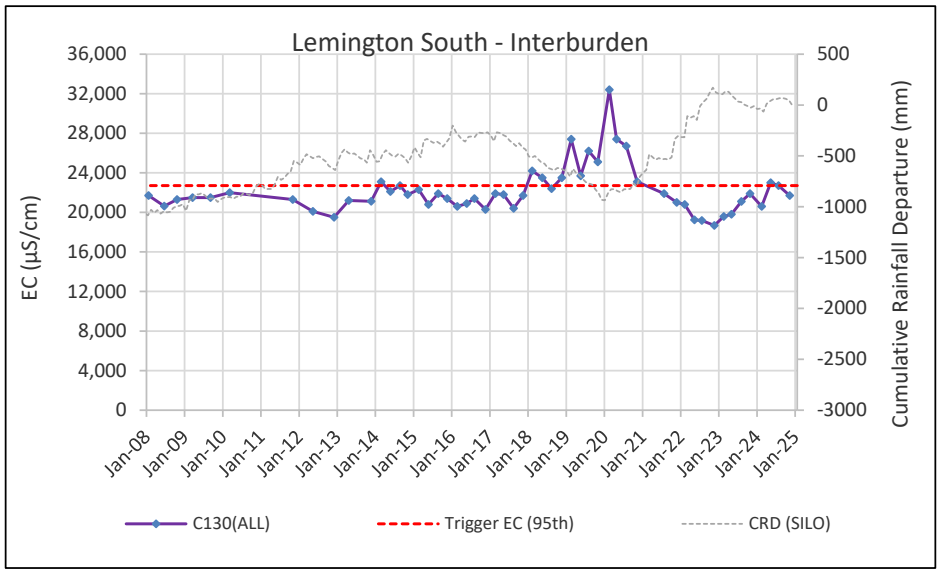

CWW - LBL Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
Bore blocked
CGW45
Trigger EC (95th)
CRD (SILO)

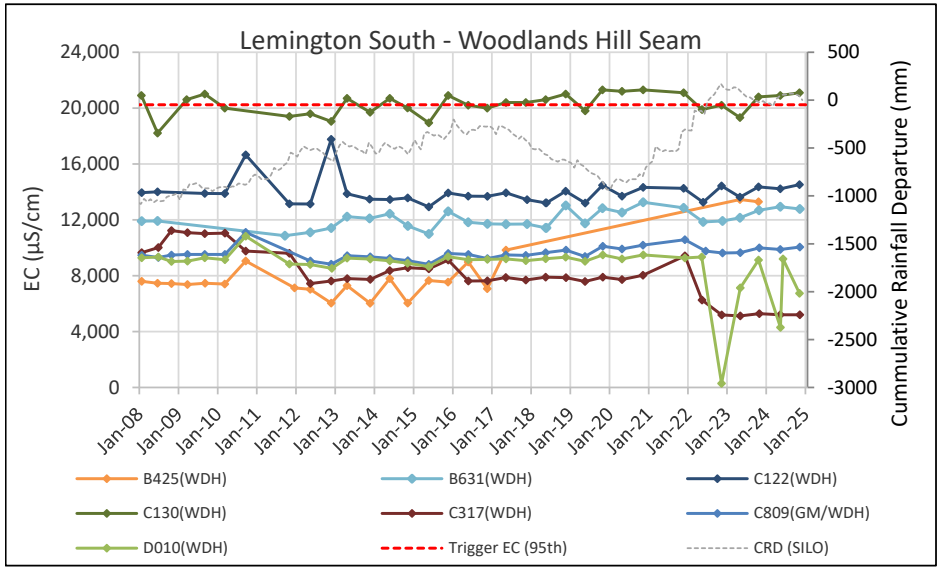

Lemington South - Alluvium
EC (µS/cm)
Cumulative Rainfall Departure (mm)
Appleyard Farm
C919(ALL)
PB01(ALL)
Trigger EC (95th)
CRD (SILO)

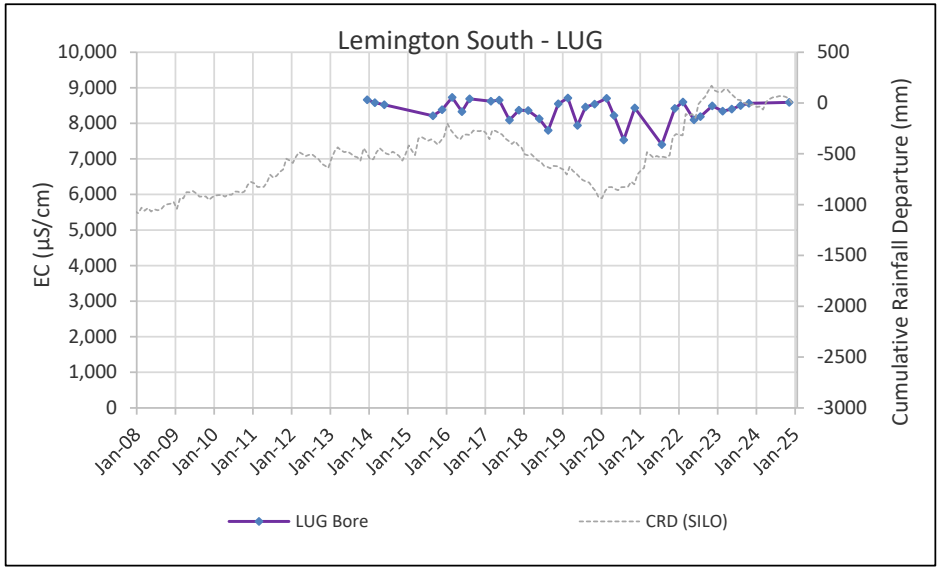

Lemington South - Arrowfield Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
C130(AFS1)
D406(AFS)
D510(AFS)
D612(AFS)
Trigger EC (95th)
CRD (SILO)

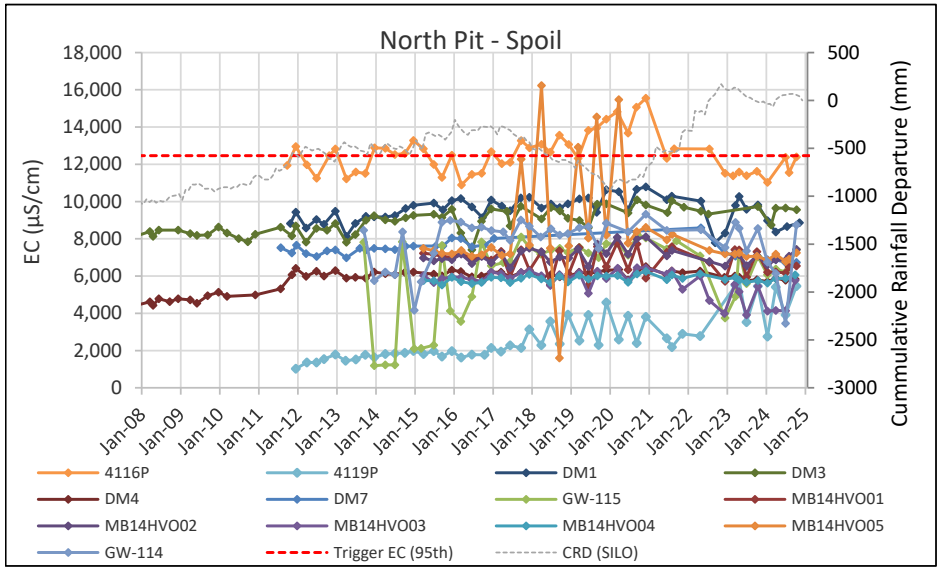

Lemington South - Bowfield Seam
EC (µS/cm)
Cummulative Rainfall Departure (mm)
D214(BFS)
D317(BFS)
D406(BFS)
D510(BFS)
D612(BFS)
D807(BFS)
B334(BFS)
B631(BFS)
C621(BFS)
C630(BFS)
D010(BFS)
C317(BFS)
C613(BFS)
B925(BFS)
C130(BFS)
C122(BFS)
Trigger EC (95th)
CRD (SILO)

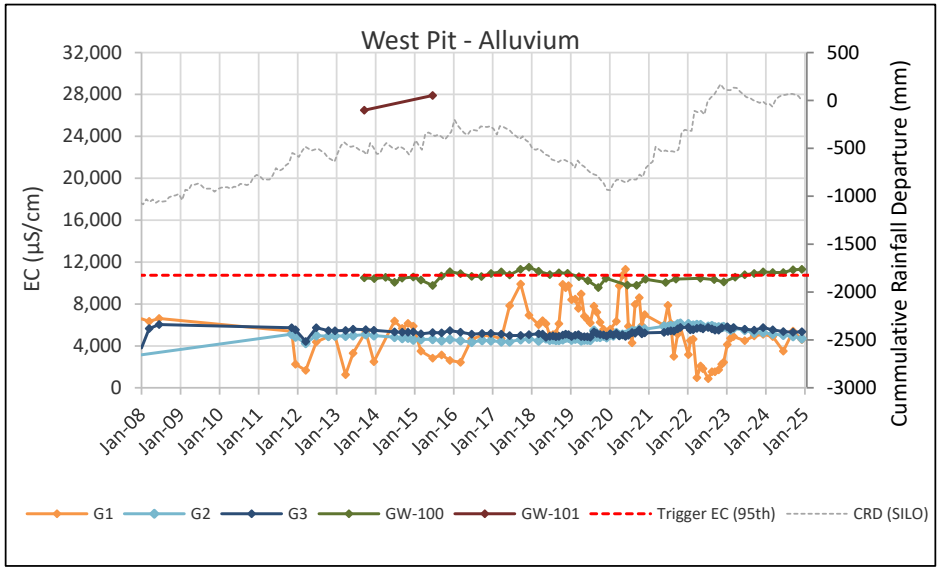

Lemington South - Glen Munro Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
D010(GM)
Trigger EC (95th)
CRD (SILO)

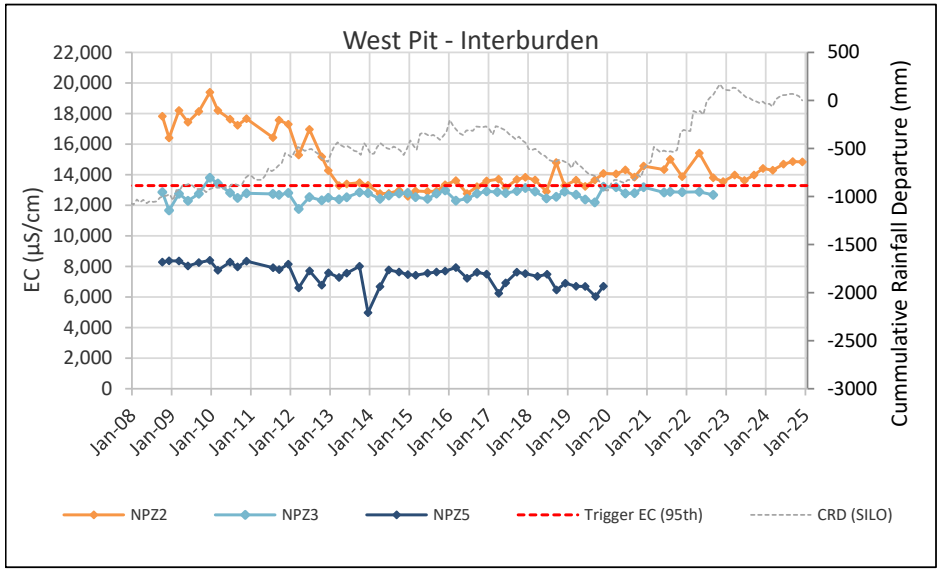

Lemington South - Interburden
EC (µS/cm)
Cumulative Rainfall Departure (mm)
C130(ALL)
Trigger EC (95th)
CRD (SILO)

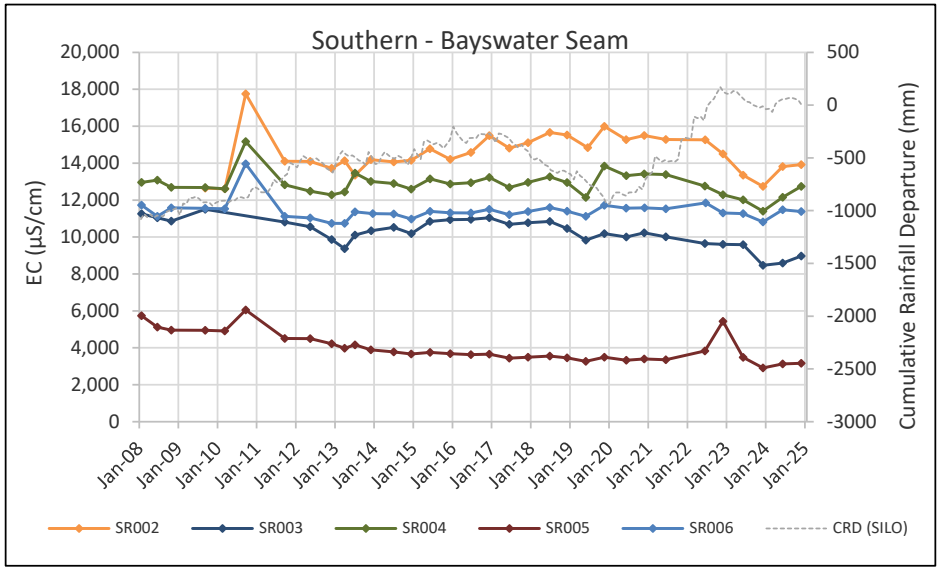

Lemington South - Woodlands Hill Seam
EC (µS/cm)
Cummulative Rainfall Departure (mm)
B425(WDH)
B631(WDH)
C122(WDH)
C130(WDH)
C317(WDH)
C809(GM/WDH)
D010(WDH)
Trigger EC (95th)
CRD (SILO)

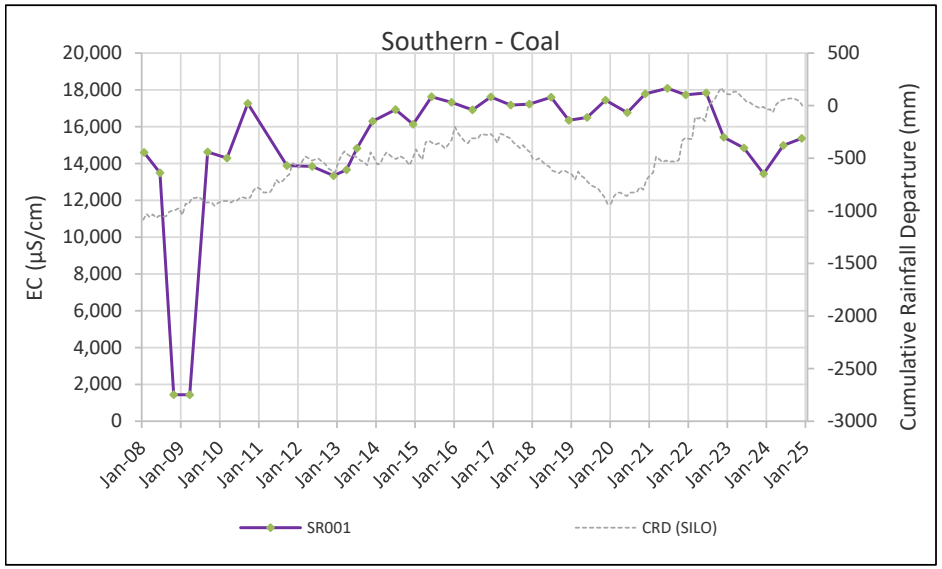

Lemington South - LUG
EC (µS/cm)
Cumulative Rainfall Departure (mm)
LUG Bore
CRD (SILO)

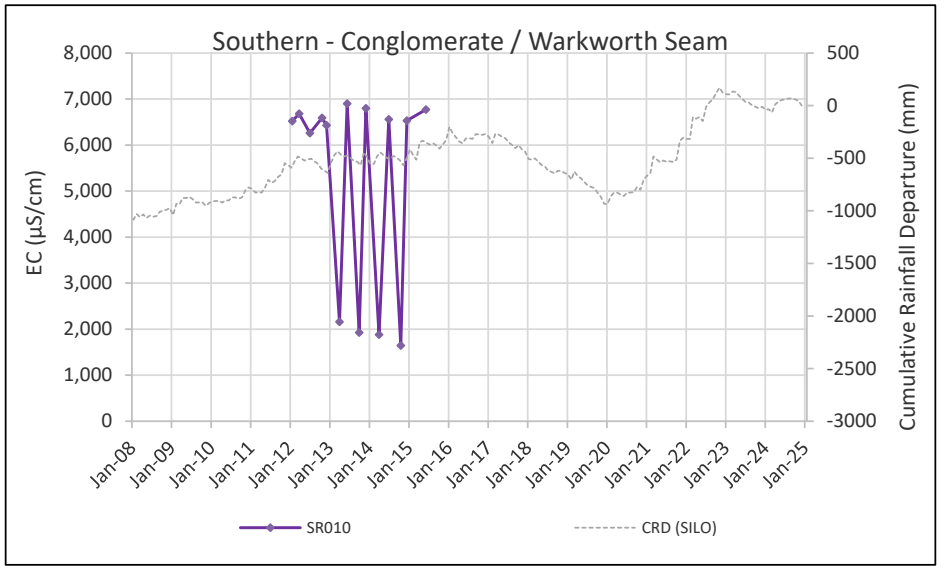

North Pit - Spoil
EC (µS/cm)
Cummulative Rainfall Departure (mm)
4116P
4119P
DM1
DM3
DM4
DM7
GW-115
MB14HVO01
MB14HVO02
MB14HVO03
MB14HVO04
MB14HVO05
GW-114
Trigger EC (95th)
CRD (SILO)

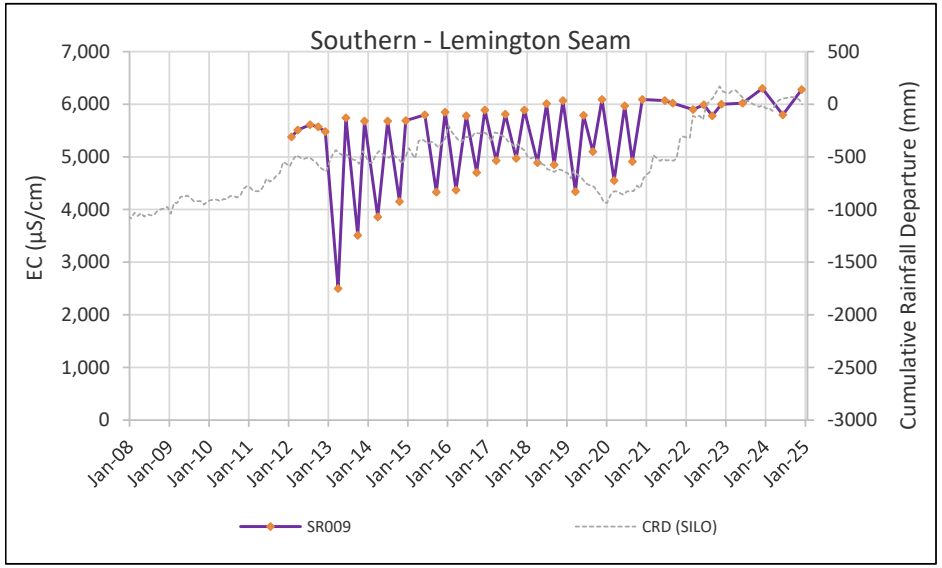

West Pit - Alluvium
EC (µS/cm)
Cummulative Rainfall Departure (mm)
G1
G2
G3
GW-100
GW-101
Trigger EC (95th)
CRD (SILO)

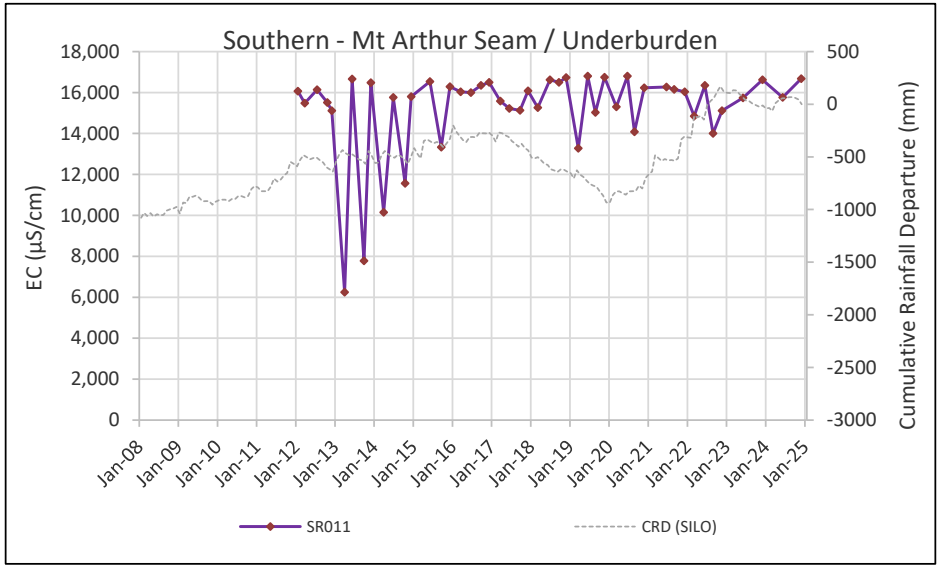

West Pit - Interburden
EC (µS/cm)
Cummulative Rainfall Departure (mm)
NPZ2
NPZ3
NPZ5
Trigger EC (95th)
CRD (SILO)

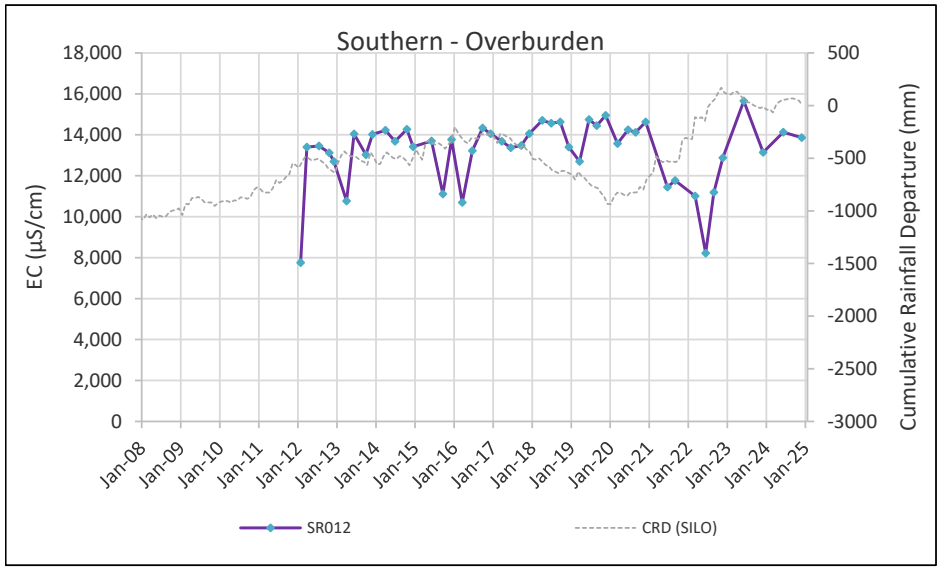

Southern - Bayswater Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
SR002
SR003
SR004
SR005
SR006
CRD (SILO)

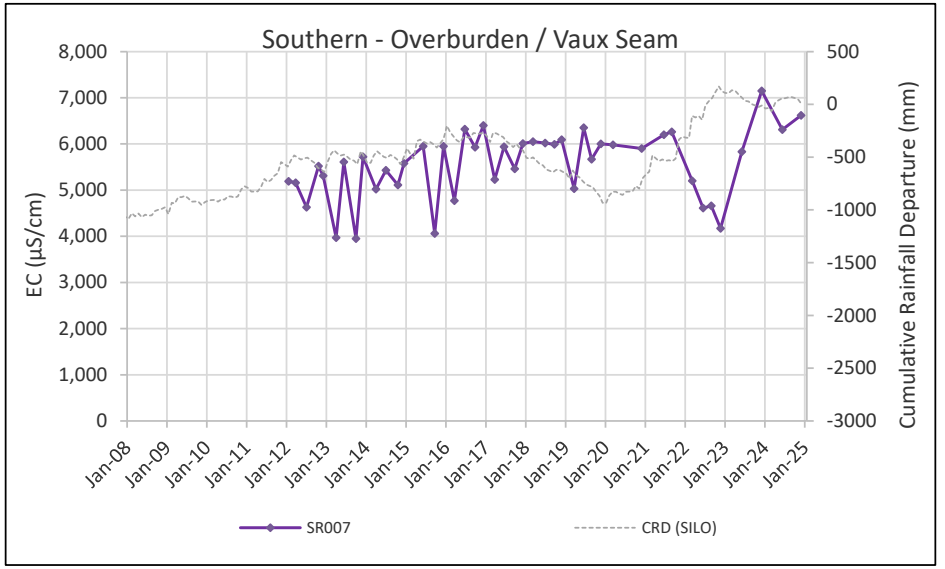

Southern - Coal
EC (µS/cm)
Cumulative Rainfall Departure (mm)
SR001
CRD (SILO)

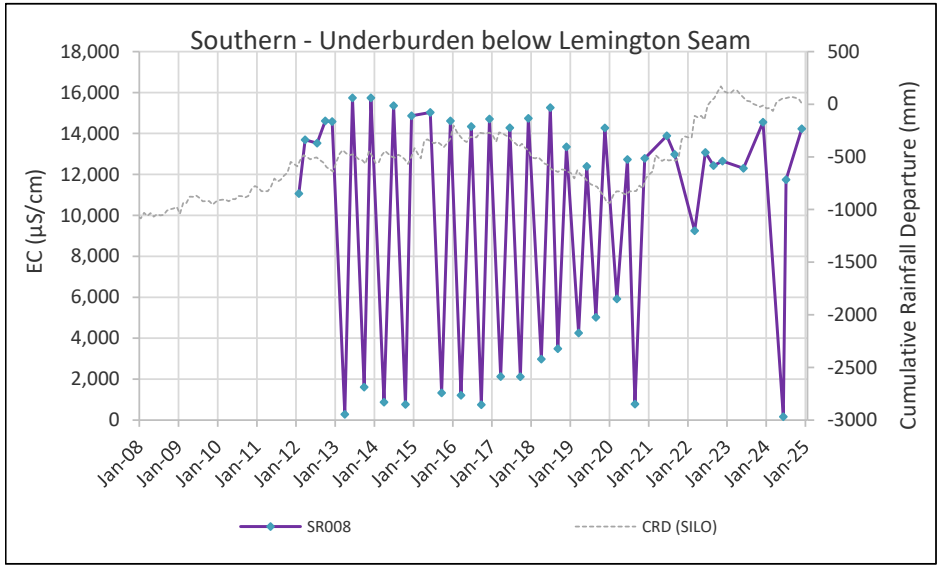

Southern - Conglomerate / Warkworth Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
SR010
CRD (SILO)

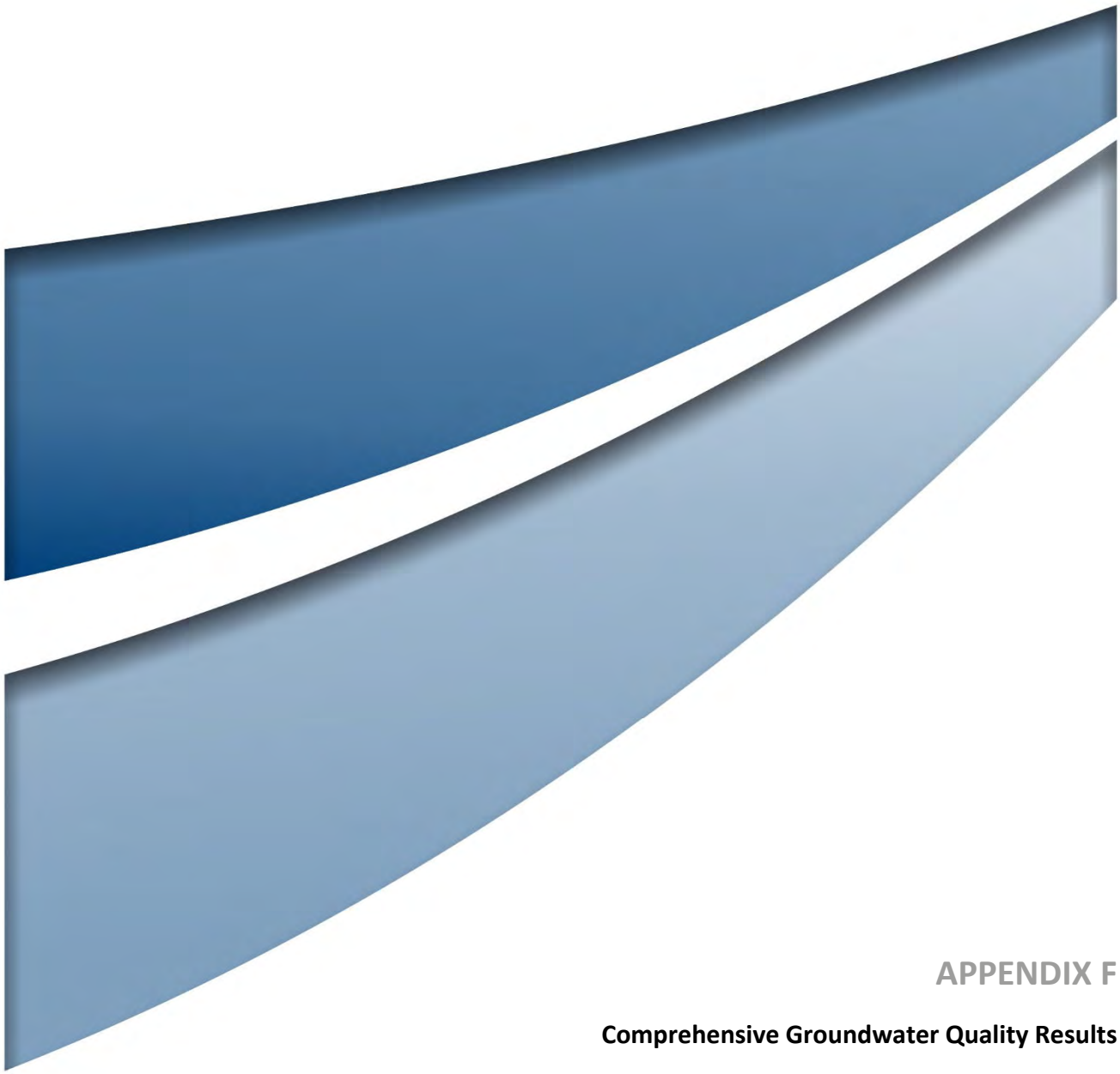

Southern - Lemington Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR009
CRD (SILO)


Southern - Mt Arthur Seam / Underburden
EC (µS/cm)
Cumulative Rainfall Departure (mm)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR011
CRD (SILO)


Southern - Overburden
EC (µS/cm)
Cumulative Rainfall Departure (mm)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR012
CRD (SILO)


Southern - Overburden / Vaux Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR007
CRD (SILO)


Southern - Underburden below Lemington Seam
EC (µS/cm)
Cumulative Rainfall Departure (mm)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
500
0
-500
-1000
-1500
-2000
-2500
-3000
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
SR008
CRD (SILO)



APPENDIX F

Comprehensive Groundwater Quality Results

2024 Q1 Comprehensive Water Quality Analysis:

Bore ID	Date	Geology	Depth to Water from Stand Pipe (mbToC)	Field pH (pH unit)	Field Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Carbonate Alkalinity as CaCO3 (mg/L)	Hydroxide Alkalinity as CaCO3 (mg/L)	Bicarbonate Alkalinity as CaCO3 (mg/L)	Total Alkalinity as CaCO3 (mg/L)	Sulfate as SO4 (mg/L)	Dissolved Calcium (mg/L)	Dissolved Chloride (mg/L)	Dissolved Magnesium (mg/L)	Dissolved Potassium (mg/L)	Dissolved Sodium (mg/L)	Total Aluminium (mg/L)	Total Arsenic (mg/L)	Total Boron (mg/L)	Total Cadmium (mg/L)	Total Cobalt (mg/L)	Total Copper (mg/L)	Total Lead (mg/L)	Total Mercury (mg/L)	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Zinc (mg/L)
4032P	20/03/2024	Carrington West Wing_Alluvium	9.88	7.4	1498	940	74.00	< 20	480.00	560.00	43.00	58.00	160.00	65.00	2.70	200.00	8.60	-	0.07	< 0.0002	-	0.04	0.01	< 0.0001	0.02	0.01	0.11
4034P	20/03/2024	Carrington West Wing_Alluvium	11.69	7.4	1900	1200	< 20	< 20	480.00	480.00	69.00	71.00	320.00	99.00	3.40	220.00	4.90	0.01	0.07	< 0.0002	-	0.06	0.01	-	0.02	0.02	0.10
4036C	20/03/2024	Carrington_Interburden	31.53	6.7	3290	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4037P	20/03/2024	Carrington West Wing_Alluvium	11.29	7.3	1487	830	61.00	< 20	340.00	400.00	44.00	85.00	220.00	80.00	2.30	140.00	2.80	-	0.06	< 0.0002	-	0.05	-	-	0.01	0.01	0.06
4040P	28/03/2024	Carrington West Wing_Alluvium	9.86	7.2	1196	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4051C	28/03/2024	Carrington_Interburden	12.91	6.7	833	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4116P	24/01/2024	North Pit_Spoil	22.10	6.9	11030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4119P	24/01/2024	North Pit_Spoil	8.69	6.9	2750	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Appleyard Farm	27/02/2024	Lemington South_Alluvium	6.74	6.8	469	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BC1a	20/02/2024	Cheshunt_Mt Arthur	17.37	7.2	921	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUNC45A	21/02/2024	Cheshunt / North Pit_Alluvium	20.60	6.6	2940	1500	< 20	< 20	560.00	560.00	67.00	82.00	610.00	58.00	7.40	430.00	0.17	-	0.10	< 0.0002	-	-	< 0.001	< 0.0001	0.01	< 0.001	0.03
BUNC45D	21/02/2024	Cheshunt_Piercefield	25.28	6.5	2400	1400	< 20	< 20	900.00	900.00	< 40	71.00	290.00	53.00	12.00	370.00	0.24	-	0.16	< 0.0002	-	< 0.001	< 0.001	< 0.0001	-	< 0.001	0.01
BZ1-1	21/02/2024	Cheshunt / North Pit_Alluvium	18.10	7.5	2720	1500	< 20	< 20	670.00	670.00	77.00	16.00	430.00	40.00	11.00	530.00	3.90	-	0.09	-	-	0.13	0.01	< 0.0001	0.03	< 0.001	0.12
BZ1-3	21/02/2024	Cheshunt_Mt Arthur	46.77	7.4	1208	700	42.00	< 20	420.00	460.00	36.00	14.00	130.00	26.00	12.00	220.00	0.49	< 0.001	0.11	< 0.0002	-	0.02	-	< 0.0001	0.04	< 0.001	0.04
BZ2A(1)	21/02/2024	Cheshunt_Mt Arthur	46.40	6.4	1270	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BZ3-1	21/02/2024	Cheshunt_Interburden	16.97	6.9	3070	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BZ3-3	21/02/2024	Cheshunt_Mt Arthur	42.10	6.2	1380	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C130(ALL)	27/02/2024	Lemington South_Interburden	16.19	6.9	20600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C919(ALL)	27/02/2024	Lemington South_Alluvium	9.47	7.4	621	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CFW55R	17/01/2024	Carrington_Alluvium	11.24	7.4	3620	3400	< 20	< 20	730.00	730.00	300.00	19.00	540.00	39.00	16.00	750.00	0.71	-	0.11	-	-	0.01	-	< 0.0001	0.02	-	0.01
CFW57	12/01/2024	Carrington_Alluvium	11.70	7.4	2210	1200	< 20	< 20	560.00	560.00	65.00	32.00	260.00	50.00	3.30	290.00	0.40	< 0.001	0.10	< 0.0002	-	< 0.001	< 0.001	< 0.0001	-	-	< 0.005
CGW32	20/03/2024	Carrington West Wing_Flood Plain	19.54	7.2	8970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW39	20/03/2024	Carrington West Wing_Flood Plain	10.95	7.4	3840	2300	85.00	< 20	700.00	780.00	64.00	56.00	700.00	99.00	5.00	660.00	< 0.05	-	0.08	< 0.0002	-	< 0.001	< 0.001	< 0.0001	< 0.001	0.02	< 0.005
CGW45A	20/03/2024	Carrington West Wing_Broonie	12.67	7.2	7170	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW46	20/03/2024	Carrington West Wing_Bayswater	12.46	7.4	1532	920	< 20	< 20	450.00	450.00	37.00	40.00	200.00	45.00	46.00	180.00	0.56	-	0.08	< 0.0002	-	0.01	-	< 0.0001	0.01	0.01	0.03
CGW47A	20/03/2024	Carrington West Wing_Flood Plain	10.46	7.6	4050	2400	< 20	< 20	810.00	810.00	120.00	69.00	860.00	130.00	5.40	640.00	< 0.05	-	0.08	< 0.0002	-	< 0.001	< 0.001	< 0.0001	< 0.001	0.01	0.01
CGW49	28/03/2024	Carrington West Wing_Alluvium	9.18	7.5	2430	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW51A	21/03/2024	Carrington_Interburden	13.12	7.6	4980	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW52	28/03/2024	Carrington_Broonie	33.25	6.9	8000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW52A	21/03/2024	Carrington_Alluvium	12.20	7.6	1400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW53	28/03/2024	Carrington_Broonie	33.60	6.7	6710	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW53A	21/03/2024	Carrington_Alluvium	11.32	7.1	1075	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW54A	12/01/2024	Carrington_Alluvium	10.85	7.8	2190	1300	< 20	< 20	600.00	600.00	73.00	9.30	270.00	26.00	4.80	420.00	0.06	-	0.12	< 0.0002	-	< 0.001	< 0.001	< 0.0001	< 0.001	0.01	< 0.005
CGW55A	21/03/2024	Carrington_Alluvium	12.25	8.1	1240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ10A	21/02/2024	Cheshunt / North Pit_Alluvium	9.18	6.9	1338	900	< 20	< 20	450.00	450.00	96.00	120.00	120.00	70.00	1.80	56.00	0.31	< 0.001	0.06	< 0.0002	-	-	< 0.001	< 0.0001	0.01	0.01	< 0.005
CHPZ12A	21/02/2024	Cheshunt / North Pit_Alluvium	9.08	6.8	2150	1500	< 20	< 20	350.00	350.00	170.00	170.00	260.00	110.00	1.30	62.00	0.16	< 0.001	0.07	< 0.0002	-	-	< 0.001	< 0.0001	-	0.01	0.01
CHPZ12D	21/02/2024	Cheshunt_Mt Arthur	9.26	6.9	1311	850	< 20	< 20	610.00	610.00	< 20	19.00	93.00	14.00	9.40	270.00	0.08	< 0.001	0.14	< 0.0002	-	-	< 0.001	< 0.0001	-	< 0.001	0.02
CHPZ1A	21/02/2024	Cheshunt / North Pit_Alluvium	11.40	7.1	722	460	< 20	< 20	310.00	310.00	32.00	50.00	51.00	32.00	2.40	56.00	< 0.05	< 0.001	< 0.05	< 0.0002	< 0.001	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.001	< 0.005
CHPZ2A	21/02/2024	Cheshunt / North Pit_Alluvium	11.19	7.0	895	580	< 20	< 20	280.00	280.00	43.00	50.00	90.00	41.00	1.00	77.00	< 0.05	< 0.001	0.06	< 0.0002	-	< 0.001	< 0.001	< 0.0001	-	-	< 0.005
CHPZ3A	21/02/2024	Cheshunt / North Pit_Alluvium	9.40	6.9	844	560	< 20	< 20	270.00	270.00	38.00	54.00	89.00	40.00	1.10	64.00	< 0.05	< 0.001	0.06	< 0.0002	-	< 0.001	< 0.001	< 0.0001	-	< 0.001	< 0.005
CHPZ3D	21/02/2024	Cheshunt_Mt Arthur	10.06	6.0	990	650	< 20	< 20	450.00	450.00	< 20	10.00	66.00	12.00	6.40	200.00	0.11	< 0.001	0.15	< 0.0002	-	< 0.001	< 0.001	< 0.0001	-	< 0.001	< 0.005
CHPZ4A	21/02/2024	Cheshunt / North Pit_Alluvium	11.78	7.0	918	620	< 20	< 20	360.00	360.00	43.00	64.00	67.00	41.00	2.50	63.00	0.08	< 0.001	< 0.05	< 0.0002	-	< 0.001	< 0.001	< 0.0001	< 0.001	-	< 0.005
CHPZ8A	21/02/2024	Cheshunt / North Pit_Alluvium	6.60	7.0	1414	970	< 20	< 20	610.00	610.00	130.00	160.00	140.00	97.00	5.90	37.00	52.00	0.01	0.09	-	-	0.11	0.03	< 0.0001	0.16	< 0.001	0.22
CHPZ8D	21/02/2024	Cheshunt_Mt Arthur	6.85	7.1	1250	790	< 20	< 20	510.00	510.00	52.00	120.00	120.00	65.00	2.90	45.00	1.10	-	0.07	< 0.0002	-	0.01	-	< 0.0001	-	< 0.001	0.02
DM1	24/01/2024	North Pit_Spoil	24.42	6.5	8970	-	-	-	-	930.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM3	27/02/2024	North Pit_Spoil	29.36	6.4	8740	-	< 10	< 20	920.00	920.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM4	24/01/2024	North Pit_Spoil	16.28	6.9	5700	-	-	-	-	1000.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM7	24/01/2024	North Pit_Spoil	31.84	7.5	6880	-	-	-	-	950.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G1	18/03/2024	West Pit_Alluvium	2.07	7.4	4900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G2	18/03/2024	West Pit_Alluvium	1.70	8.5	5130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G3	18/03/2024	West Pit_Alluvium	2.04	7.3	5540	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA3	24/01/2024	Cheshunt / North Pit_Alluvium	10.84	6.8	1053	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-100	18/03/2024	West Pit_Alluvium	4.83	7.8	11010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-106	20/03/2024	Carrington West Wing_Flood Plain	23.44	6.9	9020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-114	24/01/2024	North Pit_Spoil	31.12	6.7	6750	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-115	24/01/2024	North Pit_Spoil	12.58	6.8	6070	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-120	17/01/2024	North Void_Alluvium	11.56	7.3	4130	3400	< 20	< 20	750.00	750.00	420.00	23.00	580.00	51.00	19.00	850.00	< 0.05	< 0.001	0.11	< 0.0002	-	-	< 0.001	< 0.0001	0.01	-	< 0.005
GW-122	12/01/2024	North Void_Permian	10.99	7.3	5770	3400	< 20	< 20	640.00	640.00	300.00	120.00	1300.00	170.00	5.70	740.00	< 0.05	0.01	0.10	< 0.0002	-	< 0.001	< 0.001	< 0.0001	0.01	0.02	0.02
GW-123	12/01/2024	North Void_Alluvium	10.70	7.5	3750	2200	< 20	< 20	710.00	710.00	210.00	26.00	540.00	64.00	9.20	600.00	< 0.05	-	0.14	< 0.0002	-	< 0.001	< 0.001	< 0.0001	< 0.001	0.01	< 0.005
GW-124	12/01/2024	North Void_Alluvium	10.39	7.6	2920	1700	< 20	< 20	640.00	640.00	140.00	15.00	380.00	39.00	5.50	520.00	0.26	-	0.14	< 0.0002	-	< 0.001	< 0.001	< 0.0001	0.01	0.01	< 0.005
GW-125	12/01/2024	North Void_Alluvium	9.78	7.8	2660	1500	< 20	< 20	640.00	640.00	72.00	14.00	330.00	25.00	8.40	450.00	0.09	-	0.16	< 0.0002	-	< 0.001	< 0.001	-	< 0.001	-	< 0.005
GW-126	12/01/2024	North Void_Alluvium	11.89	7.8	1576	910	< 20	< 20	500.00	500.00	44.00	8.70	160.00	20.00	3.30	300.00	< 0.05	-	0.12	< 0.0002	-	< 0.001	< 0.001	< 0.0001	< 0.001	-	< 0.005
GW-127	12/01/2024	North Void_Alluvium	10.30	7.3	1613	930	< 20	< 20	500.00	500.00	53.00	32.00	180.00	38.00	2.60	250.00	< 0.05	< 0.001	0.09	< 0.0002	-	< 0.001	< 0.001	-	< 0.001	-	< 0.005
GW-128	12/01/2024	North Void_Alluvium	11.52	7.3	5850	3500	< 20	< 20	1000.00	1000.00	430.00	31.00	910.00	120.00	20.00	1000.00	0.05	-	0.19	< 0.0002	-	0.01	< 0.001	-	0.01	-	0.02
GW-129	17/01/2024	Carrington_Spoil	15.90	7.2	6450	5500	< 20	< 20	880.00	880.00	830.00	58.00	1000.00	95.00	25.00	1300.00	0.34	0.01	0.10	< 0.0002	-	-	< 0.001	< 0.0001	0.04	< 0.001	0.02
HG2	20/02/2024	Cheshunt_Interburden	12.16	7.6	3350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HG2A	20/02/2024	Cheshunt_Mt Arthur	25.41	7.4	2390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hobdens Well	20/02/2024	Cheshunt / North Pit_Alluvium	12.30	7.1	1222	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HV3(2)	24/01/2024	Cheshunt / North Pit_Alluvium	10.81	6.8	648	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LUG001	27/02/2024	Lemington South_Mt Arthur	80.27	6.8	5090	3100	< 20	< 20	1600.00	1600.00	4.30	49.00	870.00	51.00	22.00	1100.00	< 0.05	0.04	0.17	< 0.0002	-	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.001	< 0.005
MB14HVO01	24/01/2024	North Pit_Spoil	32.86	7.0	6210	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MB14HVO02	24/01/2024	North Pit_Spoil	32.50	6.9	6590	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MB14HVO03	24/01/2024	North Pit_Spoil	31.99	7.0	4120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MB14HVO04	24/01/2024	North Pit_Spoil	26.76	6.8	5620	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MB14HVO05	24/01/2024	North Pit_Spoil	33.09	6.9	6840	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NPZ2	18/03/2024	West Pit_Sandstone/Siltstone	34.95	6.9	14290	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB01(ALL)	27/02/2024	Lemington South_Alluvium	8.48	6.7	1347	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PZ1CH200	20/02/2024	Cheshunt / North Pit_Alluvium	7.42	7.5	1442	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PZ2CH400	21/02/2024	Cheshunt / North Pit_Alluvium	8.95	6.7	1847	1300	< 20	< 20	540.00	540.00	220.00	140.00	220.00	88.00	6.20	130.00	0.38	-	< 0.05	< 0.0002	-	-	< 0.001	< 0.0001	-	< 0.001	0.02
PZ3CH800	21/02/2024	Cheshunt / North Pit_Alluvium	9.37	6.8	3110	2000	< 20	< 20	700.00	700.00	370.00	230.00	460.00	130.00	8.10	270.00	0.35	< 0.001	0.06	< 0.0002	-	-	-	< 0.0001	0.01	< 0.001	0.04
PZ4CH1380	20/02/2024	Cheshunt / North Pit_Alluvium	9.92	7.0	726	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PZ5CH1800	20/02/2024	Cheshunt / North Pit_Alluvium	10.77	6.8	254	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Additionl analsyses for CHPZ1A, PZ2CH400 and PZ3CH800:

Bore ID	Date	Geology	Total Antimony (mg/L)	Total Beryllium (mg/L)	Total Cobalt (mg/L)	Total Flouride (mg/L)	Total Iron (mg/L)	Total Manganese (mg/L)	Total Phosphorus as P (mg/L)	Total Rubidium (mg/L)	Reactive Silica as SO2 (mg/L)	Total Strontium (mg/L)	Ammonia as N (mg/L)	Nitrite + Nitrate as N (mg/L)
CHPZ1A	21/02/2024	Cheshunt / North Pit_Alluvium	< 0.005	< 0.001	< 0.001	< 1	0.10	-	0.09	< 0.5	18.00	0.46	< 0.01	1.80
PZ2CH400	21/02/2024	Cheshunt / North Pit_Alluvium	< 0.005	< 0.001	0.002	< 2	3.20	-	0.45	< 0.5	22.00	1.50	1.70	0.25
PZ3CH800	21/02/2024	Cheshunt / North Pit_Alluvium	< 0.005	< 0.001	0.002	< 2	0.84	-	0.45	< 0.5	23.00	2.30	0.22	0.16

2024 Q2 Comprehensive Water Quality Analysis:

Bore ID	Date	Geology	Depth to Water from Stand Pipe (mBToC)	Field pH (pH unit)	Field Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Carbonate Alkalinity as CaCO3 (mg/L)	Hydroxide Alkalinity as CaCO3 (mg/L)	Bicarbonate Alkalinity as CaCO3 (mg/L)	Total Alkalinity as CaCO3 (mg/L)	Sulfate as SO4 (mg/L)	Dissolved Calcium (mg/L)	Dissolved Chloride (mg/L)	Dissolved Magnesium (mg/L)	Dissolved Potassium (mg/L)	Dissolved Sodium (mg/L)	Total Aluminium (mg/L)	Total Arsenic (mg/L)	Total Boron (mg/L)	Total Cadmium (mg/L)	Total Cobalt (mg/L)	Total Copper (mg/L)	Total Lead (mg/L)	Total Mercury (mg/L)	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Zinc (mg/L)
4032P	25/06/2024	Carrington West Wing_Alluvium	9.88	7.4	1489	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4034P	25/06/2024	Carrington West Wing_Alluvium	11.75	7.4	1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4036c	25/06/2024	Carrington_Interburden	31.75	6.7	2940	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4037P	25/06/2024	Carrington West Wing_Alluvium	11.30	7.3	1496	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4040P	25/06/2024	Carrington West Wing_Alluvium	9.74	7.2	1306	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4119P	10/04/2024	North Pit_Spoil	9.10	6.7	5410	-	< 20	< 20	860.00	860.00	1100.00	-	-	-	-	-	< 0.05	-	-	< 0.0002	-	-	< 0.001	-	0.12	-	-
B334(BFS)	23/05/2024	Lemington South_Bowfield	54.48	7.1	7740	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B631(BFS)	23/05/2024	Lemington South_Bowfield	50.02	6.8	13110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B631(WDH)	23/05/2024	Lemington South_Woodlands Hill	26.23	6.6	12940	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B925(BFS)	23/05/2024	Lemington South_Bowfield	60.96	7.1	4740	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BZ1-3	23/05/2024	Cheshunt_Mt Arthur	46.89	7.6	1231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BZ3-3	23/05/2024	Cheshunt_Mt Arthur	42.00	6.3	1381	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C130(ALL)	23/05/2024	Lemington South_Interburden	16.14	6.9	23000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C122(WDH)	23/05/2024	Lemington South_Woodlands Hill	11.23	7.8	14220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C130(AFS1)	23/05/2024	Lemington South_Arrowfield	18.36	7.3	14220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C130(BFS)	23/05/2024	Lemington South_Bowfield	51.37	7.9	4680	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C130(WDH)	23/05/2024	Lemington South_Woodlands Hill	16.33	6.6	20900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C317(BFS)	23/05/2024	Lemington South_Bowfield	54.59	6.9	10040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C317(WDH)	23/05/2024	Lemington South_Woodlands Hill	13.10	7.8	5210	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C613(BFS)	23/05/2024	Lemington South_Bowfield	23.21	7.2	8950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C621(BFS)	23/05/2024	Lemington South_Bowfield	44.86	7.3	7560	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C630(BFS)	23/05/2024	Lemington South_Bowfield	44.80	7.9	4590	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C809(GM/WDH)	23/05/2024	Lemington South_Woodlands Hill	11.13	7.2	9880	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CFW55R	6/06/2024	Carrington_Alluvium	11.61	7.4	4090	2300.00	< 20	< 20	670.00	670.00	380.00	0.00	660.00	0.00	0.00	0.00	1.30	< 0.001	0.10	< 0.0002	-	-	< 0.001	< 0.0001	0.01	-	< 0.005
CFW57	6/06/2024	Carrington_Alluvium	11.69	7.4	2330	1200.00	< 20	< 20	530.00	530.00	110.00	0.00	280.00	0.00	0.00	0.00	0.14	< 0.001	0.07	< 0.0002	-	< 0.001	< 0.001	< 0.0001	0.01	-	< 0.005
CGW32	25/06/2024	Carrington West Wing_Flood Plain	19.58	7.3	9030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW39	25/06/2024	Carrington West Wing_Flood Plain	11.05	7.6	3810	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW45A	25/06/2024	CWW / Broonie Seam	12.84	7.2	7400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW46	25/06/2024	Carrington West Wing_Bayswater	12.54	7.2	909	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW47a	25/06/2024	Carrington West Wing_Flood Plain	10.52	7.6	3960	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW49	25/06/2024	Carrington West Wing_Alluvium	9.17	7.5	2240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW51a	25/06/2024	Carrington_Interburden	13.34	7.6	5020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW52	25/06/2024	Carrington_Broonie	33.30	7.0	7410	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW52a	25/06/2024	Carrington_Alluvium	12.15	7.7	1407	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW53	25/06/2024	Carrington_Broonie	33.50	6.8	6690	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW53a	25/06/2024	Carrington_Alluvium	11.24	7.4	1226	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW54A	6/06/2024	Carrington_Alluvium	10.94	7.8	2240	1200.00	< 20	< 20	570.00	570.00	91.00	0.00	280.00	0.00	0.00	0.00	0.21	-	0.09	< 0.0002	-	< 0.001	< 0.001	< 0.0001	< 0.001	0.01	< 0.005
CGW55a	25/06/2024	Carrington_Alluvium	12.54	7.6	1661	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D010(BFS)	18/06/2024	Lemington South_Bowfield	28.86	7.2	9950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D010(GM)	24/05/2024	Lemington South_Glen Munro	6.25	6.8	11560	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D010(WDH)	18/06/2024	Lemington South_Woodlands Hill	9.43	6.9	9200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D214(BFS)	15/05/2024	Lemington South_Bowfield	24.04	7.7	7670	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D317(BFS)	23/05/2024	Lemington South_Bowfield	27.95	7.0	2720	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D406(AFS)	15/05/2024	Lemington South_Arrowfield	23.14	6.9	10700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D510(BFS)	15/05/2024	Lemington South_Bowfield	29.48	7.4	11660	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D807(BFS)	15/05/2024	Lemington South_Bowfield	39.82	6.9	6320	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM1	10/04/2024	North Pit_Spoil	24.57	6.5	8360	-	< 5	< 5	1000.00	1000.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G1	25/06/2024	West Pit_Alluvium	0.99	7.5	3500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G2	25/06/2024	West Pit_Alluvium	0.80	7.9	5030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G3	25/06/2024	West Pit_Alluvium	1.19	7.8	5370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-100	25/06/2024	West Pit_Alluvium	4.44	7.5	11010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-106	25/06/2024	Carrington West Wing_Flood Plain	23.51	6.9	9300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-114	11/04/2024	North Pit_Spoil	31.18	6.8	6140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-115	10/04/2024	North Pit_Spoil	12.53	6.9	6380	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-120	6/06/2024	North Void_Alluvium	11.75	7.3	4560	3100.00	< 20	< 20	640.00	640.00	530.00	0.00	720.00	0.00	0.00	0.00	0.11	< 0.001	0.10	< 0.0002	-	-	< 0.001	< 0.0001	0.01	-	< 0.005
GW-122	6/06/2024	North Void_Permian	10.28	7.3	5050	3400.00	< 20	< 20	600.00	600.00	290.00	0.00	1200.00	0.00	0.00	0.00	< 0.05	0.01	0.07	< 0.0002	-	-	< 0.001	< 0.0001	0.02	0.01	0.01
GW-123	6/06/2024	North Void_Alluvium	10.78	7.5	3500	2100.00	< 20	< 20	600.00	600.00	220.00	0.00	630.00	0.00	0.00	0.00	< 0.05	-	0.09	< 0.0002	-	< 0.001	< 0.001	< 0.0001	< 0.001	0.00	< 0.005
GW-124	6/06/2024	North Void_Alluvium	9.96	7.6	2860	1600.00	< 20	< 20	590.00	590.00	170.00	0.00	410.00	0.00	0.00	0.00	< 0.25	-	0.10	< 0.0002	-	-	< 0.001	< 0.0001	0.02	-	0.01
GW-125	6/06/2024	North Void_Alluvium	9.92	7.8	2400	1400.00	< 20	< 20	580.00	580.00	85.00	0.00	450.00	0.00	0.00	0.00	0.11	-	0.13	< 0.0002	-	-	< 0.001	< 0.0001	-	-	< 0.005
GW-126	6/06/2024	North Void_Alluvium	12.00	7.8	1569	1100.00	< 20	< 20	450.00	450.00	57.00	0.00	160.00	0.00	0.00	0.00	< 0.05	-	0.08	< 0.0002	-	< 0.001	< 0.001	< 0.0001	< 0.001	-	< 0.005
GW-127	6/06/2024	North Void_Alluvium	10.30	7.4	1922	980.00	< 20	< 20	470.00	470.00	77.00	0.00	180.00	0.00	0.00	0.00	< 0.05	< 0.001	< 0.05	< 0.0002	-	-	< 0.001	-	0.01	0.00	0.01
GW-128	6/06/2024	North Void_Alluvium	11.73	7.4	5420	4000.00	< 20	< 20	860.00	860.00	490.00	0.00	1100.00	0.00	0.00	0.00	0.53	-	0.15	< 0.0002	-	0.04	< 0.001	-	0.03	-	0.04
GW-129	6/06/2024	Carrington_Spoil	16.00	7.2	6880	4300.00	< 20	< 20	840.00	840.00	990.00	0.00	1300.00	0.00	0.00	0.00	0.75	0.01	0.08	< 0.0002	-	-	< 0.001	< 0.0001	0.04	< 0.001	0.02
HG2a	23/05/2024	Cheshunt_Mt Arthur	25.42	7.1	2540	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LUG001	15/05/2024		79.18	7.1	5390	-	< 20	< 20	1400.00	1400.00	< 40	-	-	-	-	-	< 0.05	-	-	< 0.0002	-	-	< 0.001	< 0.0001	< 0.001	-	-
MB14HVO01	10/04/2024	North Pit_Spoil	33.54	6.9	6220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MB14HVO02	10/04/2024	North Pit_Spoil	33.19	6.8	6880	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MB14HVO03	10/04/2024	North Pit_Spoil	32.49	7.0	4150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MB14HVO04	10/04/2024	North Pit_Spoil	27.21	7.0	5870	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MB14HVO05	10/04/2024	North Pit_Spoil	33.78	6.9	7180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nrh2	25/06/2024	West Pit_Sandstone/Siltstone	33.52	7.1	14490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR001	20/06/2024	Southern_Coal	11.10	6.8	14980	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR002	20/06/2024	Southern_Bayswater Seam	15.28	7.2	13820	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR003	20/06/2024	Southern_Bayswater Seam	19.28	7.3	8590	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR004	20/06/2024	Southern_Bayswater Seam	36.32	6.8	12150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR005	20/06/2024	Southern_Bayswater Seam	22.35	6.4	3130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR006	20/06/2024	Southern_Bayswater Seam	40.50	7.0	11480	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR007	20/06/2024	Southern_Overburden and Vaux Seam coal	34.76	6.6	6310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR008	20/06/2024	Southern_Siltstone/sandstone below Lemington Seam	8.85	6.8	162	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR009	20/06/2024	Southern_Lemington Seam	6.25	7.4	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR010	20/06/2024	Southern_Conglomerate and Warkworth Seam	10.14	7.8	1042	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR011	20/06/2024	Southern_Mt Arthur Seam and underburden	34.27	6.7	15760	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR012	20/06/2024	Southern_Overburden - conglomerate and sandstone	25.05	6.7	14130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

2024 Q3 Comprehensive Water Quality Analysis:

Bore ID	Date	Geology	Depth to Water from Stand Pipe (mbToC)	Field pH (pH unit)	Field Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Carbonate Alkalinity as CaCO3 (mg/L)	Hydroxide Alkalinity as CaCO3 (mg/L)	Bicarbonate Alkalinity as CaCO3 (mg/L)	Total Alkalinity as CaCO3 (mg/L)	Sulfate as SO4 (mg/L)	Dissolved Chloride (mg/L)	Dissolved Calcium (mg/L)	Dissolved Magnesium (mg/L)	Dissolved Potassium (mg/L)	Dissolved Sodium (mg/L)	Total Aluminium (mg/L)	Total Arsenic (mg/L)	Total Boron (mg/L)	Total Cadmium (mg/L)	Total Caesium (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/L)	Total Copper (mg/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)	Total Nickel (mg/L)	Total Phosphorus as P (mg/L)	Total Rubidium (mg/L)	Total Selenium (mg/L)	Total Silicon (mg/L)	Total Strontium (mg/L)	Total Zinc (mg/L)
4032P	18/09/2024	Carrington West Wing_Alluvium	9.94	7.4	1409	818	<1	<1	429.00	429.00	41.00	194.00	48.00	58.00	2.00	191.00	4.85	-	0.05	<0.0001	-	0.010	-	0.02	-	-	-	-	<0.0001	0.01	-	-	<0.01	-	-	0.04
4034P	18/09/2024	Carrington West Wing_Alluvium	11.73	7.3	1875	1040	<1	<1	444.00	444.00	51.00	335.00	70.00	98.00	3.00	212.00	0.22	-	0.06	<0.0001	-	-	-	0.01	-	<0.001	-	-	<0.0001	0.01	-	-	0.01	-	-	0.03
4037P	18/09/2024	Carrington West Wing_Alluvium	11.31	7.3	1435	812	<1	<1	353.00	353.00	43.00	253.00	75.00	74.00	1.00	137.00	0.45	-	<0.05	<0.0001	-	-	-	0.01	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.02
4116P	11/07/2024	North Pit_Spoil	22.50	7.0	12380	8110	<1	<1	926.00	926.00	1780.00	3370.00	168.00	561.00	35.00	1930.00	1.89	-	0.11	-	-	-	-	0.04	-	-	-	-	<0.0001	0.02	-	-	<0.01	-	-	0.09
BUNC45A	8/08/2024	Cheshunt / North Pit_Alluvium	20.74	6.6	2870	1660	<1	<1	471.00	471.00	86.00	764.00	80.00	58.00	7.00	445.00	0.40	-	0.07	<0.0001	-	-	-	-	-	<0.001	-	-	<0.0001	0.01	-	-	<0.01	-	-	0.03
BUNC45D	8/08/2024	Cheshunt_Piercefield	25.25	6.5	2290	1330	<1	<1	782.00	782.00	<1	413.00	65.00	50.00	10.00	372.00	0.30	<0.001	0.13	<0.0001	-	-	-	-	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.01
BZ1-1	8/08/2024	Cheshunt / North Pit_Alluvium	17.82	7.5	2560	1520	<1	<1	598.00	598.00	112.00	596.00	12.00	34.00	9.00	534.00	1.60	-	0.07	-	-	-	-	0.12	-	-	-	-	<0.0001	0.01	-	-	<0.01	-	-	0.03
BZ1-3	8/08/2024	Cheshunt_Mt Arthur	46.84	7.5	1043	610	<1	<1	347.00	347.00	34.00	159.00	9.00	19.00	10.00	194.00	0.94	-	0.07	-	-	-	-	0.06	-	-	-	-	<0.0001	0.04	-	-	<0.01	-	-	0.04
CFW55R	4/07/2024	Carrington_Alluvium	11.40	7.3	3860	2300	< 20	< 20	760.00	760.00	330.00	630.00	22.00	49.00	12.00	750.00	0.70	< 0.001	0.12	< 0.0002	-	-	-	-	-	< 0.001	-	-	< 0.0001	0.01	-	-	-	-	-	< 0.005
CFW57	4/07/2024	Carrington_Alluvium	11.77	7.4	2170	1300	< 20	< 20	610.00	610.00	80.00	280.00	35.00	46.00	2.50	340.00	< 0.05	< 0.001	0.08	< 0.0002	-	-	-	< 0.001	-	< 0.001	-	-	< 0.0001	< 0.001	-	-	-	-	-	< 0.005
CGW39	19/09/2024	Carrington West Wing_Flood Plain	11.16	7.4	4050	2360	<1	<1	762.00	762.00	181.00	872.00	68.00	113.00	5.00	725.00	<0.01	<0.001	0.06	<0.0001	-	-	-	<0.001	-	<0.001	-	-	<0.0001	<0.001	-	-	0.02	-	-	<0.005
CGW47a	19/09/2024	Carrington West Wing_Flood Plain	10.52	7.6	4080	2360	<1	<1	754.00	754.00	140.00	932.00	75.00	138.00	5.00	671.00	0.02	<0.001	0.05	<0.0001	-	-	-	<0.001	-	<0.001	-	-	<0.0001	<0.001	-	-	0.01	-	-	<0.005
CGW54A	4/07/2024	Carrington_Alluvium	10.94	7.8	2210	1300	< 20	< 20	660.00	660.00	74.00	240.00	11.00	21.00	3.60	430.00	< 0.05	-	0.12	< 0.0002	-	-	-	< 0.001	-	< 0.001	-	-	< 0.0001	< 0.001	-	-	0.01	-	-	< 0.005
CHPZ10A	15/08/2024	Cheshunt / North Pit_Alluvium	8.96	6.8	1135	694	<1	<1	387.00	387.00	108.00	133.00	108.00	67.00	2.00	60.00	0.03	<0.001	<0.05	<0.0001	-	-	-	<0.001	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	<0.005
CHPZ12A	15/08/2024	Cheshunt / North Pit_Alluvium	8.85	6.7	1403	1020	<1	<1	265.00	265.00	135.00	195.00	132.00	83.00	1.00	60.00	<0.01	<0.001	<0.05	<0.0001	-	-	-	<0.001	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	<0.005
CHPZ12D	8/08/2024	Cheshunt_Mt Arthur	8.80	6.8	1286	816	<1	<1	568.00	568.00	1.00	142.00	16.00	11.00	8.00	270.00	0.12	<0.001	0.10	<0.0001	-	-	-	<0.001	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.01
CHPZ1A	15/08/2024	Cheshunt / North Pit_Alluvium	11.08	7.0	781	440	<1	<1	265.00	265.00	32.00	100.00	56.00	38.00	2.00	61.00	0.02	<0.001	<0.05	<0.0001	-	-	<0.001	<0.001	<0.05	<0.001	-	0.040	<0.0001	<0.001	0.06	<0.001	<0.01	23.00	0.46	<0.005
CHPZ2A	15/08/2024	Cheshunt / North Pit_Alluvium	10.86	6.9	805	474	<1	<1	239.00	239.00	42.00	120.00	44.00	37.00	<1	80.00	<0.01	<0.001	<0.05	<0.0001	-	-	-	0.04	-	-	-	-	<0.0001	0.01	-	-	<0.01	-	-	0.03
CHPZ3A	15/08/2024	Cheshunt / North Pit_Alluvium	9.13	6.8	816	458	<1	<1	204.00	204.00	46.00	144.00	52.00	40.00	1.00	68.00	0.83	<0.001	<0.05	<0.0001	-	-	-	0.01	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.01
CHPZ3D	15/08/2024	Cheshunt_Mt Arthur	9.83	6.4	964	524	<1	<1	386.00	386.00	<1	74.00	6.00	8.00	6.00	211.00	0.19	<0.001	0.09	<0.0001	-	-	-	<0.001	-	<0.001	-	-	<0.0001	<0.001	-	-	<0.01	-	-	0.01
CHPZ4A	15/08/2024	Cheshunt / North Pit_Alluvium	11.49	6.9	867	523	<1	<1	298.00	298.00	43.00	102.00	69.00	44.00	2.00	64.00	0.32	<0.001	<0.05	<0.0001	-	-	-	<0.001	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	<0.005
CHPZ8A	8/08/2024	Cheshunt / North Pit_Alluvium	6.43	6.9	1366	1000	<1	<1	546.00	546.00	142.00	173.00	156.00	85.00	<1	41.00	33.70	0.01	0.07	<0.0001	-	-	-	0.05	-	0.01	-	-	<0.0001	0.07	-	-	0.02	-	-	0.09
CHPZ8D	8/08/2024	Cheshunt_Mt Arthur	6.65	7.1	1120	760	<1	<1	406.00	406.00	53.00	164.00	109.00	60.00	2.00	44.00	0.60	-	0.05	<0.0001	-	-	-	-	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.01
DM1	24/07/2024	North Pit_Spoil	24.62	6.5	8660	-	<1	<1	862.00	862.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM3	11/07/2024	North Pit_Spoil	29.41	6.5	9650	-	<1	<1	724.00	724.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM4	11/07/2024	North Pit_Spoil	16.63	7.0	5780	-	<1	<1	786.00	786.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM7	11/07/2024	North Pit_Spoil	33.02	7.8	6720	-	<1	<1	652.00	652.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM8	24/09/2024		31.92	-	-	2480	<1	<1	1180.00	1180.00	344.00	553.00	11.00	141.00	33.00	743.00	0.35	<0.001	0.09	<0.0001	-	-	-	-	-	-	-	-	<0.0001	0.01	-	-	<0.01	-	-	0.50
DM9	24/09/2024		32.68	-	-	2680	<1	<1	1300.00	1300.00	8.00	841.00	8.00	114.00	22.00	863.00	0.57	<0.001	0.06	<0.0001	-	-	-	0.01	-	-	-	-	<0.0001	0.01	-	-	<0.01	-	-	0.19
G1	25/09/2024	West Pit_Alluvium	1.54	7.5	5420	3440	<1	<1	544.00	544.00	775.00	958.00	69.00	114.00	7.00	979.00	0.05	<0.001	0.12	<0.0001	-	<0.001	-	-	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.03
G2	25/09/2024	West Pit_Alluvium	1.13	7.7	4910	3110	<1	<1	711.00	711.00	693.00	768.00	22.00	120.00	11.00	941.00	0.07	<0.001	0.36	<0.0001	-	<0.001	-	0.01	-	-	-	-	<0.0001	0.01	-	-	<0.01	-	-	0.03
G3	25/09/2024	West Pit_Alluvium	1.48	7.5	5300	3450	<1	<1	749.00	749.00	731.00	897.00	21.00	112.00	8.00	1090.00	0.04	<0.001	0.28	<0.0001	-	<0.001	-	-	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.02
GW-100	25/09/2024	West Pit_Alluvium	4.11	7.5	11260	7180	<1	<1	2880.00	2880.00	319.00	2280.00	7.00	94.00	68.00	2610.00	0.15	<0.001	0.50	<0.0001	-	<0.001	-	-	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.02
GW-106	19/09/2024	Carrington West Wing_Flood Plain	23.46	6.7	9340	6020	<1	<1	1080.00	1080.00	620.00	2760.00	161.00	346.00	33.00	1580.00	0.03	<0.001	0.13	<0.0001	-	0.020	-	-	-	<0.001	-	-	<0.0001	0.01	-	-	<0.01	-	-	<0.005
GW-120	4/07/2024	North Void_Alluvium	11.73	7.3	4610	2800	< 20	< 20	800.00	800.00	480.00	760.00	28.00	75.00	15.00	860.00	0.09	< 0.001	0.13	< 0.0002	-	-	-	-	-	< 0.001	-	-	< 0.0001	0.01	-	-	-	-	-	< 0.005
GW-122	4/07/2024	North Void_Permian	10.86	7.3	4980	3000	< 20	< 20	700.00	700.00	270.00	1000.00	110.00	150.00	4.30	720.00	< 0.05	0.01	0.09	< 0.0002	-	-	-	-	-	< 0.001	-	-	< 0.0001	0.01	-	-	0.02	-	-	0.01
GW-123	4/07/2024	North Void_Alluvium	10.79	7.6	3400	1900	< 20	< 20	720.00	720.00	180.00	490.00	26.00	58.00	6.80	610.00	< 0.05	-	0.12	< 0.0002	-	-	-	< 0.001	-	< 0.001	-	-	< 0.0001	< 0.001	-	-	0.01	-	-	< 0.005
GW-124	4/07/2024	North Void_Alluvium	10.32	7.7	2890	1700	< 20	< 20	720.00	720.00	130.00	370.00	16.00	37.00	3.80	570.00	< 0.05	-	0.12	< 0.0002	-	-	-	-	-	< 0.001	-	-	< 0.0001	-	-	-	-	-	-	< 0.005
GW-125	4/07/2024	North Void_Alluvium	9.88	7.9	2550	1300	< 20	< 20	630.00	630.00	74.00	330.00	12.00	19.00	4.70	450.00	0.10	-	0.12	< 0.0002	-	-	-	-	-	< 0.001	-	-	< 0.0001	-	-	-	-	-	-	< 0.005
GW-126	4/07/2024	North Void_Alluvium	11.98	7.8	1584	930	< 20	< 20	560.00	560.00	38.00	140.00	9.40	16.00	2.50	300.00	< 0.05	-	0.10	< 0.0002	-	-	-	< 0.001	-	< 0.001	-	-	< 0.0001	< 0.001	-	-	-	-	-	< 0.005
GW-127	4/07/2024	North Void_Alluvium	10.36	7.3	1650	910	< 20	< 20	540.00	540.00	50.00	190.00	39.00	37.00	2.20	240.00	< 0.05	< 0.001	0.06	< 0.0002	-	-	-	-	-	< 0.001	-	-	-	-	-	-	-	-	-	< 0.005
GW-128	4/07/2024	North Void_Alluvium	11.72	7.4	5210	3200	< 20	< 20	980.00	980.00	440.00	970.00	29.00	110.00	14.00	980.00	0.06	-	0.15	-	-	-	-	0.01	-	< 0.001	-	-	-	0.01	-	-	-	-	-	0.02
GW-129	4/07/2024	Carrington_Spoil	16.06	7.2	6840	4400	< 20	< 20	960.00	960.00	930.00	1200.00	66.00	130.00	22.00	1300.00	0.22	0.01	0.10	< 0.0002	-	-	-	-	-	< 0.001	-	-	< 0.0001	0.03	-	-	< 0.001	-	-	0.02
Hobdens Well	8/08/2024	Cheshunt / North Pit_Alluvium	11.82	7.6	1018	572	<1	<1	289.00	289.00	26.00	198.00	40.00	44.00	1.00	111.00	0.06	<0.001	<0.05	<0.0001	-	-	-	<0.001	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.05
LUG001	6/08/2024		78.08	7.1	5490	3260	<1	<1	1220.00	1220.00	<1	1060.00	57.00	53.00	18.00	1060.00	0.30	0.04	0.19	<0.0001	-	-	-	<0.001	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.01
NPz2	19/09/2024	West Pit_Sandstone/Siltstone	32.86	7.0	14860	8780	<1	<1	392.00	392.00	415.00	5260.00	99.00	111.00	15.00	3220.00	0.12	-	0.31	<0.0001	-	-	-	-	-	<0.001	-	-	<0.0001	-	-	-	<0.01	-	-	0.03
PZ2CH400	8/08/2024	Cheshunt / North Pit_Alluvium	8.46	6.7	2010	1410	<1	<1	503.00	503.00	252.00	354.00	183.00	99.00	5.00	152.00	1.14	<0.001	<0.05	<0.0001	-	-	-	-	2.940	<0.001	-	0.390	<0.0001	-	0.53	0.003	<0.01	32.90	1.45	0.02
PZ3CH800	8/08/2024	Cheshunt / North Pit_Alluvium	8.91	6.8	2780	1900	<1	<1	598.00	598.00	334.00	526.00	223.00	122.00	5.00	235.00	1.14	<0.001	<0.05	-	-	-	-	-	1.880	-	-	0.050	<0.0001	0.01	0.21	0.003	<0.01	36.90	1.81	0.06

2024 Q4 Comprehensive Water Quality Analysis:

Bore ID	Date	Geology	Depth to Water from Stand Pipe (mbToC)	Field pH (pH unit)	Field Electrical Conductivity (uS/cm)	Total Dissolved Solids (mg/L)	Carbonate Alkalinity as CaCO3 (mg/L)	Hydroxide Alkalinity as CaCO3 (mg/L)	Bicarbonate Alkalinity as CaCO3 (mg/L)	Total Alkalinity as CaCO3 (mg/L)	Sulfate as SO4 (mg/L)	Dissolved Calcium (mg/L)	Dissolved Chloride (mg/L)	Dissolved Magnesium (mg/L)	Dissolved Potasium (mg/L)	Dissolved Sodium (mg/L)	Total Aluminium (mg/L)	Total Arsenic (mg/L)	Total Boron (mg/L)	Total Cadmium (mg/L)	Total Cobalt (mg/L)	Total Copper (mg/L)	Total Lead (mg/L)	Total Mercury (mg/L)	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Zinc (mg/L)
4032P	16/12/2024	Carrington West Wing_Alluvium	9.98	7.3	1511	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4034P	16/12/2024	Carrington West Wing_Alluvium	11.82	7.4	1908	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4036c	16/12/2024	Carrington_Interburden	31.40	6.8	2760	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4037P	16/12/2024	Carrington West Wing_Alluvium	11.39	7.2	1470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4040P	16/12/2024	Carrington West Wing_Alluvium	8.85	7.2	1340	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4051C	19/11/2024	Carrington_Interburden	11.74	6.9	1504	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4116P	21/10/2024	North Pit_Spoil	22.50	7.0	12390	7950	<1	<1	1080	1080	1110	79	3690	588	34	1970	1.330	0.002	0.140	0.001	0.000	0.014	0.010	0.000	0.022	<0.01	0.128
4119P	21/10/2024	North Pit_Spoil	9.32	6.8	5460	3610	<1	<1	857	857	1210	125	858	213	21	861	0.040	0.112	0.110	<0.0001	0.000	<0.001	<0.001	<0.0001	0.114	<0.01	0.054
Appleyard Farm	18/11/2024	Lemington South_Alluvium	6.37	6.4	318	184	<1	<1	84	84	13	9	42	8	4	37	0.060	<0.001	<0.05	<0.0001	0.000	0.002	<0.001	<0.0001	9	0.002	<0.01	0.007
B334(BFS)	21/11/2024	Lemington South_Bowfield	54.95	7.1	7400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B631(BFS)	21/11/2024	Lemington South_Bowfield	50.65	6.7	12980	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B631(WDH)	21/11/2024	Lemington South_Woodlands Hill	26.27	6.6	12780	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B925(BFS)	18/11/2024	Lemington South_Bowfield	61.44	7.2	4700	2600	<1	<1	1140	1140	<1	16	976	14	16	1060	0.050	<0.001	0.120	<0.0001	0.000	0.004	<0.001	<0.0001	0.004	<0.01	0.024
BC1a	28/11/2024	Cheshunt_Mt Arthur	17.37	6.9	900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUNC45D	28/11/2024	Cheshunt_Piercefield	24.98	6.7	2480	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BZ1-1	29/11/2024	Cheshunt / North Pit_Alluvium	18.30	7.5	2570	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BZ1-3	29/11/2024	Cheshunt_Mt Arthur	47.11	7.6	1190	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BZ2A(1)	28/11/2024	Cheshunt_Mt Arthur	46.32	6.3	1333	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BZ3-3	28/11/2024	Cheshunt_Mt Arthur	41.90	6.1	1401	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C122(WDH)	18/11/2024	Lemington South_Woodlands Hill	11.78	7.6	14520	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C130(AFS1)	21/11/2024	Lemington South_Arrowfield	18.50	7.2	13040	7150	<1	<1	674	674	4	91	4410	153	53	2770	0.130	0.002	0.160	<0.0001	0.000	0.006	0.001	<0.0001	0.014	<0.01	0.022
C130(ALL)	21/11/2024	Lemington South_Interburden	16.15	7.0	21700	16000	<1	<1	816	816	608	205	7310	769	76	4190	7.540	0.004	<0.05	0.003	0.000	0.047	0.331	<0.0001	0.020	<0.01	0.090
C130(BFS)	18/11/2024	Lemington South_Bowfield	55.83	7.7	4550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C130(WDH)	18/11/2024	Lemington South_Woodlands Hill	16.34	6.6	21100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C317(BFS)	21/11/2024	Lemington South_Bowfield	54.87	7.2	10300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C317(WDH)	21/11/2024	Lemington South_Woodlands Hill	13.90	7.8	5210	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C613(BFS)	21/11/2024	Lemington South_Bowfield	23.22	7.2	8980	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C621(BFS)	21/11/2024	Lemington South_Bowfield	45.11	7.2	7540	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C621(BFS)	21/11/2024	Lemington South_Bowfield	45.11	7.2	7540	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C630(BFS)	18/11/2024	Lemington South_Bowfield	44.67	7.8	4580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C809(GM)(WDH)	21/11/2024	Lemington South_Woodlands Hill	11.23	7.2	10050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C919(ALL)	21/11/2024	Lemington South_Alluvium	9.67	7.6	685	442	<1	<1	260	260	13	54	45	27	3	62	4.120	<0.001	<0.05	<0.0001	0.000	0.011	0.008	<0.0001	0.004	<0.01	0.029
CFW55R	7/11/2024	Carrington_Alluvium	11.60	7.2	4060	2540	<1	<1	690	690	375	24	805	50	14	821	0.130	<0.001	0.110	<0.0001	0.000	0.001	<0.001	<0.0001	0.005	<0.01	<0.005
CFW57	7/11/2024	Carrington_Alluvium	11.83	7.3	2060	1340	<1	<1	543	543	107	33	427	45	3	388	1.320	<0.001	0.070	<0.0001	0.000	0.006	<0.001	<0.0001	0.066	<0.01	<0.005
CGW32	16/12/2024	Carrington West Wing_Flood Plain	19.60	7.3	9250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW39	16/12/2024	Carrington West Wing_Flood Plain	11.18	7.4	4280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW45A	16/12/2024	CWW / Broonie Seam	13.12	7.2	7400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW46	19/11/2024	Carrington West Wing_Bayswater	12.59	7.3	1696	870	<1	<1	383	383	38	38	257	44	43	181	0.450	0.002	0.060	<0.0001	0.000	0.008	<0.001	<0.0001	0.007	<0.01	0.060
CGW47a	16/12/2024	Carrington West Wing_Flood Plain	10.60	7.6	3930	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW49	16/12/2024	Carrington West Wing_Alluvium	8.28	7.5	2080	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW51a	16/12/2024	Carrington_Interburden	13.42	7.5	5010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW52	16/12/2024	Carrington_Broonie	32.90	7.1	8180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW52a	16/12/2024	Carrington_Alluvium	12.28	7.5	1348	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW53	16/12/2024	Carrington_Broonie	33.17	6.8	7160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW53a	16/12/2024	Carrington_Alluvium	11.36	7.2	1316	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CGW54A	7/11/2024	Carrington_Alluvium	10.96	7.7	2220	1420	<1	<1	592	592	96	8	422	16	4	493	0.080	0.002	0.100	<0.0001	0.000	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005
CGW55a	16/12/2024	Carrington_Alluvium	12.60	7.6	2760	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ10A	28/11/2024	Cheshunt / North Pit_Alluvium	9.08	6.9	1176	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ12A	28/11/2024	Cheshunt / North Pit_Alluvium	8.96	6.8	1180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ12D	28/11/2024	Cheshunt_Mt Arthur	9.17	7.3	1350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ1A	28/11/2024	Cheshunt / North Pit_Alluvium	11.26	7.0	720	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ2A	28/11/2024	Cheshunt / North Pit_Alluvium	11.04	7.1	832	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ3A	28/11/2024	Cheshunt / North Pit_Alluvium	9.26	6.9	821	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ3D	28/11/2024	Cheshunt_Mt Arthur	9.90	6.5	993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ4A	28/11/2024	Cheshunt / North Pit_Alluvium	11.66	7.1	794	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ8A	28/11/2024	Cheshunt / North Pit_Alluvium	6.51	6.8	1456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHPZ8D	28/11/2024	Cheshunt_Mt Arthur	6.70	7.0	1285	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D010(BFS)	18/11/2024	Lemington South_Bowfield	29.21	7.2	9660	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D010(GM)	21/11/2024	Lemington South_Glen Munro	7.15	7.1	11480	7090	<1	<1	1020	1020	348	96	3590	404	58	2110	0.960	0.001	0.120	0.000	0.000	0.031	0.032	<0.0001	0.006	<0.01	0.045
D010(WDH)	18/11/2024	Lemington South_Woodlands Hill	9.46	7.1	6740	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D214(BFS)	18/11/2024	Lemington South_Bowfield	23.99	7.6	7850	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D317(BFS)	18/11/2024	Lemington South_Bowfield	27.75	6.9	2760	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D406(AFS)	21/11/2024	Lemington South_Arrowfield	23.41	6.8	10300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D510(BFS)	21/11/2024	Lemington South_Bowfield	30.41	7.4	11680	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D612(BFS)	21/11/2024	Lemington South_Bowfield	33.79	6.9	11470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D807(BFS)	21/11/2024	Lemington South_Bowfield	40.08	6.7	2060	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM1	19/11/2024	North Pit_Spoil	24.69	6.6	8860	6440	<1	<1	777	777	1680	90	1730	495	58	1380	1.180	0.014	0.130	0.000	0.000	0.019	0.003	<0.0001	0.035	<0.01	0.106
DM3	23/10/2024	North Pit_Spoil	29.44	6.5	9560	6680	<1	<1	873	873	1830	0	2270	0	0	0	0.080	<0.001	0.080	<0.0001	0.000	0.005	0.001	<0.0001	0.024	<0.01	0.050
DM4	9/10/2024	North Pit_Spoil	16.56	6.9	5840	3880	<1	<1	847	847	1070	136	889	146	32	1050	0.120	0.257	0.130	<0.0001	0.000	0.008	<0.001	<0.0001	0.005	<0.01	0.028
DM7	21/10/2024	North Pit_Spoil	33.37	8.2	6730	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G1	16/12/2024	West Pit_Alluvium	2.00	7.4	4600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G2	16/12/2024	West Pit_Alluvium	1.61	8.2	4700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G3	16/12/2024	West Pit_Alluvium	2.00	7.4	5350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA3	9/10/2024	Cheshunt / North Pit_Alluvium	10.02	6.4	1185	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-100	16/12/2024	West Pit_Alluvium	4.43	7.7	11310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-106	16/12/2024	Carrington West Wing_Flood Plain	23.52	6.8	8280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW-114	21/10/2024	North Pit_Spoil	31.27	6.6	8740	5920	<1	<1	836	836	1980	172	1700	479	39	1340	0.120	0.011	0.180	0.000	0.000	0.003	<0.001	<0.0001	0.160	<0.01	0.102
GW-115	21/10/2024	North Pit_Spoil	12.62	6.8	7420	5040	<1	<1	800	800	1970	160	1280	293	26	1260	<0.01	0.016	0.130	<0.0001	0.000	<0.001	<0.001	<0.0001	0.078	<0.01	0.037
GW-120	7/11/2024	North Void_Alluvium	11.74	7.2	4550	3170	<1	<1	758	758	404	29	821	66	17	917	0.090	<0.001	0.110	<0.0001	0.000	<0.001	<0.001	<0.0001	0.004	<0.01	<0.005
GW-122	17/10/2024	North Void_Permian	11.00	7.4	4680	2700	<1	<1	622	622	269	107	1080	145	5	746	0.150	0.010	<0.05	0.000	0.000	0.002	<0.001	<0.0001	0.009	0.020	0.010
GW-123	17/10/2024	North Void_Alluvium	10.82	7.6	2930	1720	<1	<1	629	629	136	18	544	46	7	594	0.040	0.002	0.060	0.000	0.000	<0.001	<0.001	<0.0001	18	<0.01	<0.005
GW-124	7/11/2024	North Void_Alluvium	10.52	7.6	2780	1660	<1	<1	626	626	131	11	471	26	4	558	0.030	0.001	0.100	<0.0001	0.000	0.002	<0.001	<0.0001	0.006	<0.01	<0.005
GW-125	7/11/2024	North Void_Alluvium	9.90	7.8	2080	1240	<1	<1	555	555	57	6	331	10	5	455	0.060	0.002	0.110	<0.0001	0.000	0.002	<0.001	<0.0001	0.001	<0.01	<0.005
GW-126	7/11/2024	North Void_Alluvium	12.01	7.7	1562	958	<1	<1	494	494	46	5	204	10	3	339	<0.01	0.002	0.090	<0.0001	0.000	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005
GW-127	7/11/2024	North Void_Alluvium	10.41	7.2	1322	792	<1	<1	458	458	31	24	158	26	2	225	0.010	<0.001	0.050	<0.0001	0.000	0.001	<0.001	<0.0001	0.005	<0.01	<0.005
GW-128	7/11/2024	North Void_Alluvium	11.73	7.3	5100	3280	<1	<1	887	887	386	35	940	90	16	1010	0.300	<0.001	0.160	<0.0001	0.000	0.033	<0.001	<0.0001	0.015	<0.01	0.052
GW-129	7/11/2024	Carrington_Spoil	16.13	7.1	6920	4410	<1	<1	872	872	874	77	1420	123	25	1370	0.110	0.008	0.100	<0.0001	0.000	0.001	<0.001	<0.0001	0.037	<0.01	0.015
HG2	28/11/2024	Cheshunt_Interburden	12.18	7.4	3460	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HG2a	28/11/2024	Cheshunt_Mt Arthur	25.40	7.0	2540	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hobdens Well	28/11/2024	Cheshunt / North Pit_Alluvium	12.08	7.3	1006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HV3(2)	9/10/2024	Cheshunt / North Pit_Alluvium	10.65	6.9	904	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LUG001	18/11/2024	Lemington South_Mt Arthur	78.49	6.9	5610	3200	<1	<1	1510	1510	<1	42	960	45	31	1300	0.080	0.077	0.180	<0.0001	0.000	<0.001	<0.001	<0.0001	<0.001	<0.01	0.015
LUG Bore	18/11/2024	Lemington South_Mt Arthur	-	7.1	8590	5140	<1	<1	2580	2580	<1	26	1450	23	19	2120	<0.01	0.050	0.200	<0.0001	0.000	0.002	<0.001	<0.0001	0.001	<0.01	0.009
MB14HVO01	21/10/2024	North Pit_Spoil	34.42	6.9	6540	4150	<1	<1	916	916	1150	106	1220	255	27	1090	0.100	0.012	0.110	<0.0001	0.000	0.009	0.003	<0.0001	0.012	<0.01	0.039
MB14HVO02	21/10/2024	North Pit_Spoil	33.98	6.7	7430	5410	<1	<1	784	784	1350	0	1390	0	0	0	<0.01	0.167	0.140	<0.0001	0.000	<0.001	<0.001	<0.0001	0.075	<0.01	0.023
MB14HVO03	9/10/2024	North Pit_Spoil	32.95	7.0	5770	3760	<1	<1	820	820	980	165	1030	176	26	935	<0.01	0.183	0.130	<0.0001	0.000	<0.001	<0.001	<0.0001	0.003	<0.01	<0.005
MB14HVO04	9/10/2024	0/01/1900	27.87	6.9	6060	4280	<1	<1	744	744	1220	264	1120	232	24	848	<0.01	0.120	0.100	<0.0001	0.000	0.001	<0.001	<0.0001	0.031	<0.01	<0.005
MB14HVO05	21/10/2024	North Pit_Spoil	34.60	6.9	7250	4870	<1	<1	808	808	1540	126	1320	311	33	1170	0.060	0.041	0.100	<0.0001	0.000	<0.001	<0.001	<0.0001	0.035	<0.01	0.028
NPZ2	16/12/2024	West Pit_Sandstone/Siltstone	32.39	6.9	14840	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB01(ALL)	21/11/2024	Lemington South_Alluvium	8.05	6.9	2740	1600	<1	<1	182	182	119	45	735	88	13	429	2.610	0.004	0.100	0.000	0.000	0.012	0.014	<0.0001	0.006	<0.01	0.033
PZ1CH20C	28/11/2024	Cheshunt / North Pit_Alluvium	7.41	7.1	4140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PZ2CH40C	28/11/2024	Cheshunt / North Pit_Alluvium	8.90	6.7	2120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PZ3CH80C	28/11/2024	Cheshunt / North Pit_Alluvium	9.32	7.0	2870	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PZ4CH138C	28/11/2024	Cheshunt / North Pit_Alluvium	9.87	6.9	732	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PZ5CH180C	28/11/2024	Cheshunt / North Pit_Alluvium	10.53	6.7	315	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR001	10/12/2024	Southern_Coal	11.29	6.6	15360	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR002	10/12/2024	Southern_Bayswater Seam	15.50	6.9	13920	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR003	10/12/2024	Southern_Bayswater Seam	19.55	7.1	8970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR004	10/12/2024	Southern_Bayswater Seam	36.60	6.7	12740	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR005	10/12/2024	Southern_Bayswater Seam	22.60	6.4	3160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR006	10/12/2024	Southern_Bayswater Seam	40.77	7.0	11380	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SR007	10/12/2024	Southern_Overburden and Vaux Seam coal	35.85	6.5	6620	4750	<1	<1	732	732	248	221	1650	369	16	756	0.060	0.002	<0.05	<0.0001	0.000	<0.001	<0.001	<0.0001	0.004	<0.01	<0.005
SR008	10/12/2024	Southern_Siltstone/sandstone below Lemington Seam	8.84	6.8	14230	8830	<1	<1	1060	1060	367	152	4220	301	19	2800	0.060	<0.001	0.050	<0.0001	0.000	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005
SR009	10/12/2024	Southern_Lemington Seam	6.25	7.3	6280	3650	<1	<1	787	787	69	37	1490	60	8	1290	<0.01	<0.001	0.070	<0.0001	0.000	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005
SR010	10/12/2024	Southern_Conglomerate and Warkworth Seam	10.12	6.9	5640	3420	<1	<1	604	604	244	106	1370	151	13	959	<0.01	<0.001	<0.05	<0.0001	0.000	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005
SR011	10/12/2024	Southern_Mt Arthur Seam and underburden	34.32	6.5	16680	12000	<1	<1	819	819	779	505	5130	644	36	2520	<0.01	<0.001	0.050	<0.0001	0.000	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005
SR012	10/12/2024	Southern_Overburden - conglomerate and sandstone	25.18	6.7	13860	10400	<1	<1	988	988	622	274	4100	545	44	2150	0.020	<0.001	<0.05	<0.0001	0.000	<0.001	<0.001	<0.0001	0.015	<0.01	<0.005

umwelt
Environmental & Social Consultants

Umwelt (Australia) Pty Limited

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au

APPENDIX C: 2024 HERITAGE COMPLIANCE INSPECTION AUDITS

Hunter Valley Operations
Aboriginal Heritage Management Plans
November 2024 Compliance Audit Inspections

Report prepared for

Hunter Valley Operations

December 2024

Joel Deacon

ARROW
HERITAGE SOLUTIONS

Introduction

The Hunter Valley Operations Joint Venture (HVOJV) manages the Hunter Valley Operations (HVO) mining complex and associated Biodiversity Areas located in the Hunter Valley. The HVOJV provides management services that include accountability for Aboriginal cultural heritage (ACH) and community consultation.

The development of HVO's mining operations has occurred through a process of expansion and acquisition, and as a result there are two separate development approvals that apply to the operations - HVO North (DA_450-10-2003) and HVO South (PA_06_0261). The mining and processing activities at HVO are geographically divided by the Hunter River, with movement of coal, overburden, equipment, materials and personnel between the two operational areas.

Each consent contains a condition requiring the development of an Aboriginal Heritage Management Plan (AHMP). Such plans have been developed in consultation with the Aboriginal community through the HVO Cultural Heritage Working Group (CHWG) and approved for each operational area. Within each of these plans, provision is made to conduct annual AHMP compliance inspections (biannual for HVO South) with members of the Aboriginal community throughout the life of operations. The purpose of the compliance inspections is to afford the Aboriginal stakeholders and the HVOJV:

- the opportunity to visit mine operations and mine areas to inspect the operational compliance with AHMP provisions and Ground Disturbance Permit procedures;
- to inspect and monitor the condition and management of various ACH sites; and
- to review the effectiveness and performance of AHMP provisions in the management of cultural heritage at the mine.

Due to the number of ACH sites within the AHMP areas and the time required to inspect all sites, it is not feasible to inspect every ACH site during the same field trip. Therefore, a regular, rolling program of compliance inspections has been implemented that will visit all sites periodically over a number of years. A record will be kept of each compliance inspection against each ACH site, so that it can be ensured that each site is inspected regularly.

Proposed Activity and Project Brief

The compliance inspections involved the following elements:

- An AHMP compliance inspection report pro-forma was completed for each ACH site or area visited;
- Photographs of the inspected ACH sites were also taken;
- The pro-forma noted the outcomes of the inspection including evidence of compliance or non-compliance with AHMP provisions, recommendations on improvements to management provisions and/or recommendations on corrective actions;
- Sites inspected were selected on the basis of length of time since previous inspection or accuracy of data held for that site, to ensure that sites are re- inspected in a timely manner (i.e. a 5-10 year time frame).
- Specific site condition monitoring inspection of CM-CD1, as per Schedule 15 of the HVO North HMP; and
- Two recently identified 'chance finds' of Aboriginal heritage objects were also inspected and recorded, with one artefact collected in compliance with the HVO North HMP and relevant Aboriginal Heritage Impact Permit (AHIP).

Timing & Personnel

The HVO 2024 H2 AHMP compliance inspection program was conducted between 18-20 November 2024. The personnel involved in these inspections were:

- Joel Deacon (Arrow Heritage Solutions Principal Archaeologist)
- Peter Bowman (HVO Environment & Community Officer)
- Paulette Hickey (CHWG Representative – Wattaka Cultural Consultants)
- Rhonda Ward (CHWG Representative – Ungooroo Cultural & Community Services)
- Tammy Sampson (CHWG Representative – Bawurra Cultural Consultants)

Arrow Heritage Solutions were engaged as independent heritage consultants to conduct the AHMP compliance inspections, and Joel Deacon acted as technical advisor and is the author of this report. HVO's Environment & Community Officer Peter Bowman arranged the compliance inspection programs and escorted the field team.

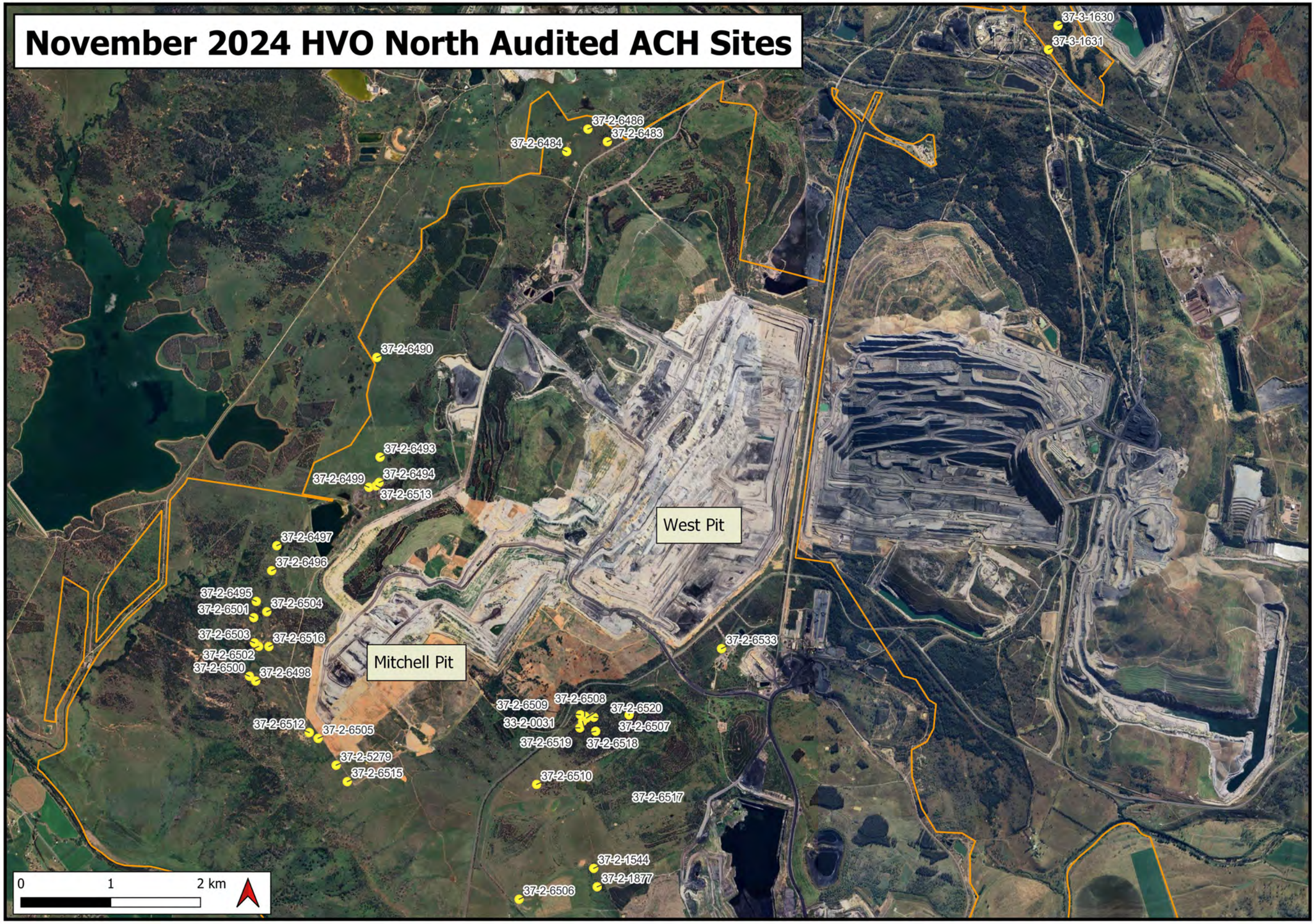
HVO North AHMP Compliance Inspection

A total of 37 ACH sites were inspected across various areas at HVO North, including Carrington South, Carrington North, Hunter Valley Services, the Hunter Valley Load Point and areas on the north-western periphery of the mine site between Howick and Mitchell Pit (see map below). Although not active mining zones, these areas were selected for inspection as they had not yet been subject to compliance inspections. Some of the sites are located adjacent to active mining or infrastructure areas and some are located on agricultural properties.

Results

Table 1 details the results of the HVO North compliance inspection and summarises the information recorded on the individual pro-forma inspection sheets. Using a mobile mapper pre-loaded with the GIS co-ordinates for each ACH site, the field team travelled to each locale and attempted to re-identify each site. Sometimes this was not possible due to poor ground surface visibility (GSV) arising from high vegetation cover, in which case the site was assessed to determine that the vicinity had not been inadvertently disturbed. Another factor affecting site re-identification was the age of the original recording and the level of data recorded. The presence and condition of barricading or fencing was noted, as well as the presence and nature of various potential site disturbing factors (e.g erosion, animal, human). General observations of each site were made if necessary, and, based on information provided for all of the above factors, management recommendations were discussed and agreed by the field team for each site

November 2024 HVO North Audited ACH Sites



AHIMS ID	Site Name	Inspection Date	Site re-identified?	Site intact?	Site fenced/barricaded?	Fencing/barricading intact?	Natural erosion	Livestock damage	Human disturbance	Animal disturbance	Pests & weeds	General observations	Management recommendations
37-2-1544	CM 41	18/11/24	Yes	Yes	Yes	Yes	No	No	No	No	Yes	some artefacts relocated in burnt area	No specific management recommendations
37-2-1877	CM-CD1	18/11/24	Yes	Yes	Yes	Yes	No	No	No	No	Yes		Continue with burning regime
37-2-5279	HVO-633	19/11/24	Yes	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-3-1630	HVOCP_TR300_IF1	18/11/24	No	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-3-1631	HVOCP_TR300_IF2	18/11/24	Yes	Yes	Yes	No	No	No	No	No	No	v poor GSV	Re-barricade or fence site
37-2-6510	TR100-AS1	18/11/24	Yes	Yes	No	-	No	cattle tracks	No	No	No		No specific management recommendations
37-2-6508	TR103-AS1	18/11/24	Yes	Yes	No	-	Yes	No	old track	No	No		No specific management recommendations
37-2-6509	TR103-IF1	18/11/24	Yes	Yes	No	-	No	No	No	No	cactus present		No specific management recommendations
37-2-6507	TR104-AS1	18/11/24	Yes	Yes	No	-	slight	No	No	No	No		When permitted, salvage ASAP
37-2-6517	TR104-AS2	18/11/24	Yes	Yes	No	-	No	No	under powerline	No	No		No specific management recommendations
33-2-0031	TR104-IF1	18/11/24	No	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-2-6518	TR104-IF2	18/11/24	Yes	Yes	No	-	No	No	powerline track	No	No		No specific management recommendations
37-2-6519	TR105-AS1	18/11/24	Yes	Yes	No	-	in eroded gully	cattle tracks	No	No	No		No specific management recommendations
37-2-6520	TR110-AS1	18/11/24	Yes	Yes	No	-	erosion scald	No	No	No	No		No specific management recommendations
37-2-6533	TR151-AS1	18/11/24	Yes	Yes	Yes	Yes	No	No	No	No	No		No specific management recommendations
37-2-6483	TR18-AS3	20/11/24	No	Yes	Yes	No	No	No	No	No	No	has been avoided by recent GDP works	Reinstate bunting
37-2-6486	TR20-AS1	20/11/24	Yes	Yes	No	-	revegetating scald	No	No	No	No		No specific management recommendations
37-2-6484	TR20-IF1	20/11/24	No	Yes	No	-	in eroded gully	No	No	No	No		No specific management recommendations
37-2-6490	TR24-AS1	20/11/24	Yes	Yes	No	-	erosion scald	No	No	No	No		No specific management recommendations
37-2-6493	TR30-AS1	20/11/24	Yes	Yes	Yes	No	No	No	No	No	No		No specific management recommendations
37-2-6494	TR31-AS1	20/11/24	No	Yes	Yes	No	No	No	No	No	No		Rebarricade site
37-2-6513	TR32-AS1	20/11/24	No	Yes	Yes	Yes	No	No	No	No	No		No specific management recommendations
37-2-6499	TR32-AS2	20/11/24	Yes	Yes	Yes	Yes	revegetating scald	No	No	No	No		No specific management recommendations
37-2-6495	TR47-AS1	20/11/24	Yes	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-2-6497	TR47-AS2	20/11/24	Yes	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-2-6496	TR47-IF1	20/11/24	Yes	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-2-6512	TR49-AS1	20/11/24	No	Yes	No	-	severe	No	eroded track	No	No		No specific management recommendations

37-2-6516	TR49-AS2	20/11/24	Yes	Yes	No	-	No	No	under powerline	No	No		No specific management recommendations
37-2-6515	TR49-IF1	20/11/24	No	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-2-6505	TR49-IF2	20/11/24	No	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-2-6504	TR49-IF3	20/11/24	Yes	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-2-6503	TR50-AS1	20/11/24	Yes	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-2-6502	TR50-AS2	20/11/24	Yes	Yes	No	-	No	No	on track	No	No		No specific management recommendations
37-2-6501	TR50-IF1	20/11/24	Yes	Yes	No	-	No	No	No	No	No		No specific management recommendations
37-2-6500	TR51-AS1	20/11/24	Yes	Yes	No	-	Yes	No	No	No	No		No specific management recommendations
37-2-6498	TR51-IF1	20/11/24	Yes	Yes	No	-	No	No	on track	No	No		No specific management recommendations
37-2-6506	TR75-IF1	20/11/24	Yes	Yes	Yes	No	No	cattle tracks	on dam wall	No	No		When permitted, salvage ASAP

Table 1: Results of the November 2024 HVO North Aboriginal Sites Compliance Inspection

Aboriginal Site Management Recommendations

There were no specific management recommendations put forward for 31 of the 37 ACH sites visited. The specific recommendations that were proposed related to the repair of site barricading or future salvage collection. The recent burning activity at CM-CD1 was also recommended for regular recurrence (see section below).

Re-install barricading or demarcation

Site: 37-3-1631; 37-2-6483, 37-2-6494

As a general observation, most of the barricading, where installed at ACH sites, was in a good state of repair. The repair of barricading at three ACH sites has been recommended as a protective measure as they are located in proximity to access or activity areas. Barricading should consist of hi-vis string line and signage delineating the area as an ACH site to be avoided.

Example of dilapidated barricading to be repaired

Salvage ACH site as soon as permissible

Site: 37-2-6506; 37-2-6507

Two ACH sites were recommended for salvage as soon permissible under any new future development consent. Both sites are currently at risk, from either stock damage (37-2-6506 – located on a dam wall) or erosion (37-2-6507). The current HVO North development consent does not permit salvage without a valid Aboriginal Heritage Impact Permit, however, if granted, the current development application on foot would permit salvage under the terms of an approved AHMP.

Artefact from 37-2-6506 located on dam wall

CM-CD1

The HVO North HMP (Schedule 15) contains a specific Plan of Management for Aboriginal site CM-CD1 (AHIMS ID 37-2-1877) that includes a description of measures that would be implemented to protect, monitor and manage potential impacts on the site by HVO North's mining operations and associated activities. As shown on the map in Appendix A, CM-CD1 includes an area c.450m long and up to 25m in width and is located immediately to the west of HVO Carrington Pit and c.900m north of the Hunter River.

As part of the brief for this compliance inspection audit, the consultant was also required to audit the current condition of CM-CD1 with reference to the management measures outlined in Schedule 15 of the HVO AHMP. It should be positively noted that the elements of the management regime identified in previous compliance audits continue to be robustly applied, and a burning program has also been recently commenced to assist with vegetation management. The maintenance of these management processes will be the ongoing focus of compliance audits at CM-CD1:

1. A disturbance exclusion buffer area will be maintained around Aboriginal cultural heritage site 37-2-1877 (CM-CD1) of not less than 20m from the boundary of the recorded extent of the CM-CD1 site and incorporating the Older Stratum.

   During the November 2024 inspection of CM-CD1 no unauthorised ground disturbance was noted within the disturbance exclusion buffer area (as bound by the co-ordinates in Point 2 below). This area has been demarcated with pegs and subject to vegetation slashing using hand-held equipment.

2. The CM-CD1 disturbance exclusion buffer area will be aligned within the following coordinates (GDA 94):
   i. North-East corner at E308805 and N6403833
   ii. North-West corner at E308696 and N6403791
   iii. South-West corner at E308861 and N6403341
   iv. South-East corner at E308996 and N6403355

   See Point 1.

3. The CM-CD1 disturbance exclusion buffer area is to be zoned as a Zone 1 Restricted Access Area within the HVO North Cultural Heritage Zoning Scheme (CHZS). All development disturbance activities are to be excluded from within the buffer area.

The CM-CD1 exclusion area is zoned as Zone 1 in the HVO North CHZS.

4. The CM-CD1 disturbance exclusion buffer area will be delineated with stock-proof fencing and appropriate signage denoting that the area is a Restricted Access Area and no ground disturbance is authorised within the buffer area except where such ground disturbance is authorised under the provisions of this Plan of Management. Ground disturbance, such as for archaeological investigations, may require a consent under relevant legislation.
   The entirety of CM-CD1, including a substantial buffer, has been delineated with stock-proof fencing and adequate Cultural Heritage Site signage is visible on the fence.

5. Access within the CM-CD1 disturbance exclusion buffer area will be limited to authorised personnel and visitors only either on foot (e.g. for monitoring inspections) or in light vehicles (e.g. for pest, weed and fire management) for the purposes of implementing the management provisions approved under this Plan of Management.
   No evidence was noted to suggest the contrary has occurred, with vegetation slashing and recent burning activities having been conducted on foot with hand-held tools only.

6. An annual site condition monitoring inspection will be conducted by HVO personnel with representatives of the CHWG and the results of the inspection reported as an element of the HVO North DA 450-10-2003 Annual Environmental Management Report. The results of the inspection will also be reported to Aboriginal community stakeholders through the CHWG and/or other relevant Aboriginal community consultation forum.
   This report documents the 2024 annual site condition inspection.

7. A series of condition and disturbance monitoring photo points will be established within the CM-CD1 disturbance exclusion buffer area and condition monitoring images taken during the course of the annual monitoring inspection.
   Five photographic monitoring points have been established from where disturbance monitoring photographs of CM-CD1 are taken. These points are located in the north-west, north-east, south-west and south-east of the site, as well as the centre. These photographs and their locational information are contained in Appendix A of this report.

8. HVO will determine the nature and risks of potential impacts of blasting activities upon site CM-CD1 as an element of the HVO North blast management plan. Consistent with the results of the risk assessment process used to inform the development of the HVO North blast management plan, HVO will implement appropriate management measures to protect site CM-CD1 from any adverse impact that may be caused by blasting in a manner consistent with the provisions of this Plan of Management. In accordance with Schedule 4 of Condition 40 of the Approval, regular visual monitoring will be undertaken to confirm that impacts have not been caused by blasting vibration or from flyrock impacts.

No evidence of any blasting-related disturbance or flyrock impacts were noted during the site inspection. Indeed, blasting activity in the Carrington Pit ceased on 17th October 2018 and mining and blasting activity was been focused on the eastern side of the Carrington Pit in the years leading up to the cessation of blasting.

9. As mining, and related blasting activities, approach the CM-CD1 disturbance exclusion buffer area, regular visual monitoring to confirm that impacts have not been caused by blasting vibration will be conducted by HVO personnel. Damage to CM-CD1 caused by flyrock is considered a very low risk, however, if it is evident, through regular monitoring, that this risk profile may increase in the future, protective management measures will be considered.

See above Point 8.

10. A variety of land management activities will be required to maintain the cultural and environmental values of the CM-CD1 disturbance exclusion buffer area. Land management activities approved under this HMP are as follows.

    i. Hand or light vehicle spraying of weeds.
    ii. Brush cutting by hand to control weeds and vegetation.
    iii. Prescribed burning and fire protection management.
    iv. Maintenance of fencing including replacement of posts as required.

No evidence was noted of any adverse impacts to CM-CD1 by any of the land management practices listed above. It was noted that weed and vegetation management and prescribed burning within the CM-CD1 disturbance exclusion buffer had been recently and successfully undertaken.

Recommendations

CM-CD1 continues to be managed well, with no evident impacts to the site's cultural heritage values. All recommended actions from previous compliance inspections have been implemented. The following recommendations relate to land management activities that could be implemented to maintain the environmental values of the site:

- **The recent prescribed burning program implemented at CM-CD1 appeared to have been successful in helping to control vegetation, particularly weeds. This burning program should be continued with regular burns planned approximately annually;**
- **Using a hand-held brush-cutter and proceeding on foot, the 20m CM-CD1 buffer area should continue to be subject to weed and vegetation growth slashing as and when required;**
- **A fence should be installed around this 20m CM-CD1 buffer area aligned with the current demarcation pegs;**
- **Access between this fence and the outer perimeter fence is restricted to light vehicles and the management of vegetation and pasture-based fuel loads to be achieved through low impact intermittent grazing by livestock;**
- **The CM-CD1 area should continue to be targeted during HVO's vermin control program in order to reduce feral pig disturbance as much as possible.**

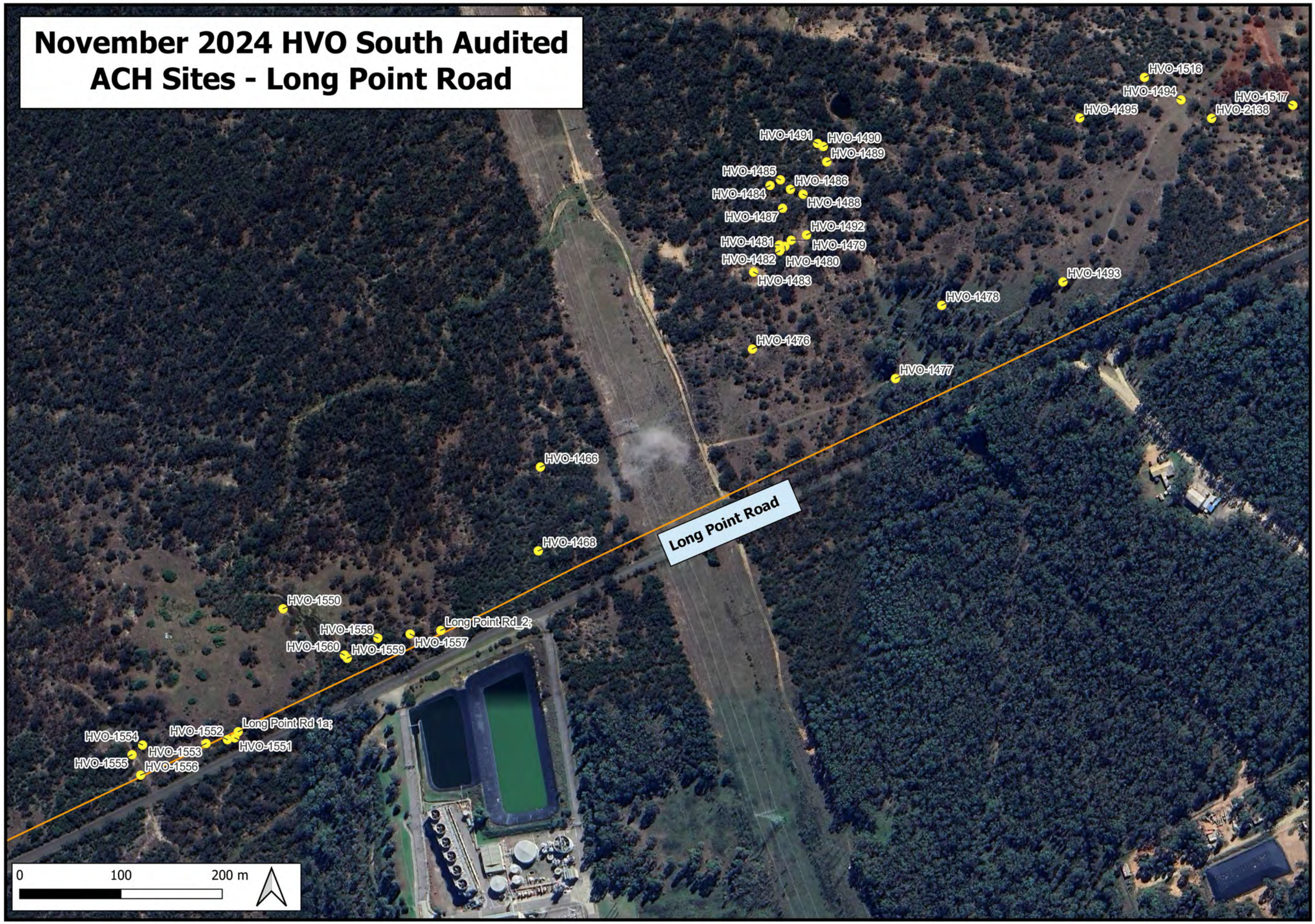
HVO South AHMP Compliance Inspection

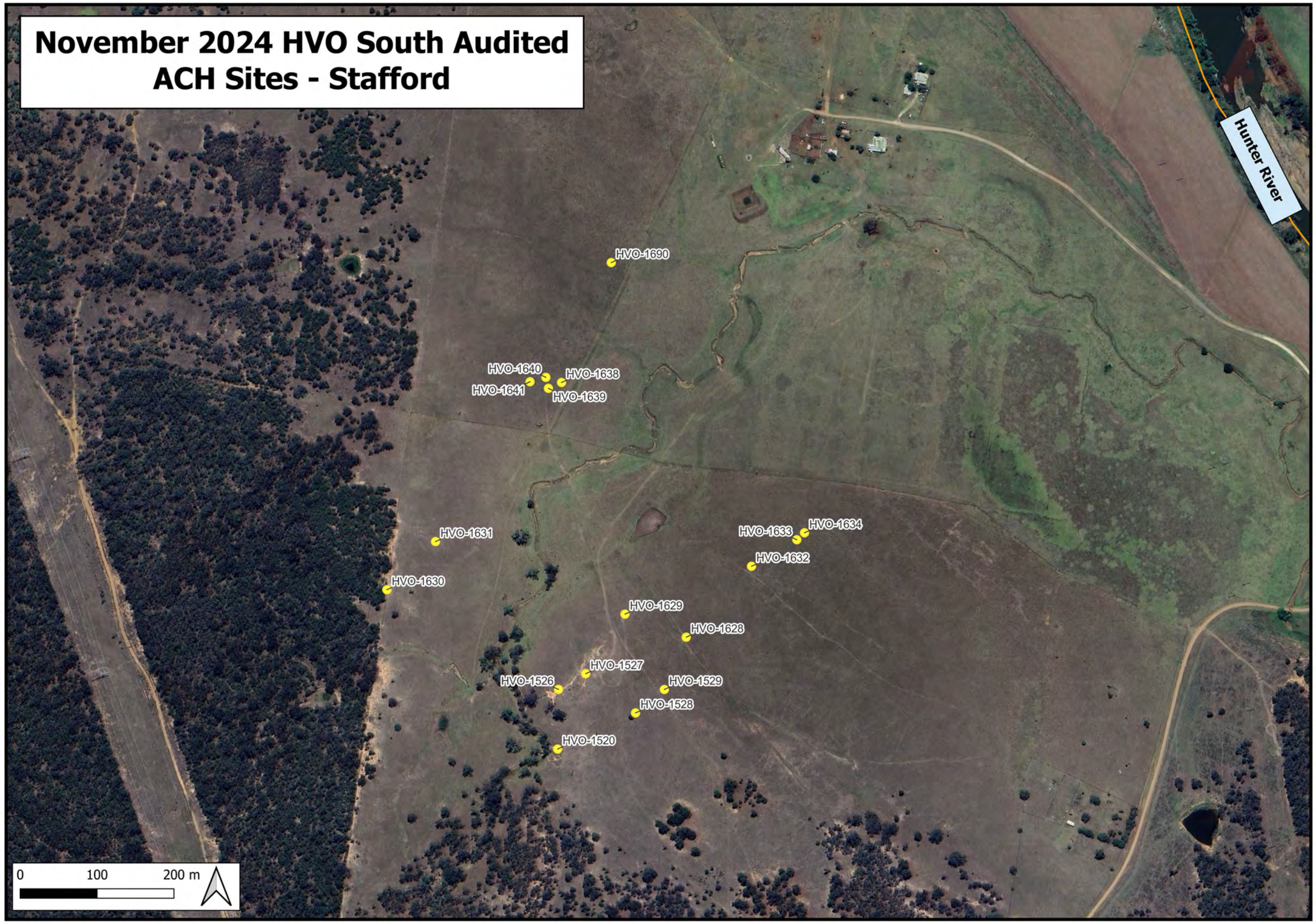
A total of 55 ACH sites were inspected in the HVO South area, at the Stafford/Long Point Rd areas (see maps below). Although not active mining zones, these areas were selected for inspection as they are accessed by third party users, including for grazing activities.

Results

Table 2 summarises the results of the HVO South compliance inspection and summarises the information recorded on the individual pro-forma inspection sheets. Using a mobile mapper pre-loaded with the GIS co-ordinates for each Aboriginal heritage site, the field team travelled to each locale and attempted to re-identify each site. Sometimes this was not possible due to poor GSV arising from high vegetation cover, in which case the site was assessed to determine that the vicinity had not been inadvertently disturbed. Another factor affecting site re-identification was the age of the original recording and the level of data recorded. The presence and condition of barricading or fencing was noted, as well as the presence and nature of various potential site disturbing factors (e.g erosion, animal, human). General observations of each site were made if necessary, and, based on information provided for all of the above factors, management recommendations were discussed and agreed by the field team for each site.

November 2024 HVO South Audited ACH Sites - Long Point Road




November 2024 HVO South Audited ACH Sites - Stafford
Hunter River
HVO-1690
HVO-1640
HVO-1638
HVO-1641
HVO-1639
HVO-1631
HVO-1633
HVO-1634
HVO-1632
HVO-1630
HVO-1629
HVO-1628
HVO-1527
HVO-1526
HVO-1529
HVO-1528
HVO-1520
0
100
200 m

AHIMS ID	Site Name	Inspection Date	Site re-identified?	Site intact?	Site fenced/barricaded?	Fencing/barricading intact?	Natural erosion	Livestock damage	Human disturbance	Animal disturbance	Pests & weeds	General observations	Management recommendations
37-6-4021	HVO-1466	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4059	HVO-1468	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4020	HVO-1476	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4057	HVO-1477	19/11/24	No	Yes	Yes	No	No	No	No	No	No		No specific management recommendations
37-6-4056	HVO-1478	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1479	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1480	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1481	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1482	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1483	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1484	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1485	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1486	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1487	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1488	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1489	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1490	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1491	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4044	HVO-1492	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4055	HVO-1493	19/11/24	Yes	Yes	Yes	Yes	No	No	No	No	No		No specific management recommendations
37-6-4036	HVO-1494	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4036	HVO-1495	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4036	HVO-1516	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4036	HVO-1517	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4075	HVO-1520	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4083	HVO-1526	19/11/24	Yes	Yes	No		in erosion scour	No	No	No	No		No specific management recommendations
37-6-4083	HVO-1527	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4082	HVO-1528	19/11/24	Yes	Yes	No		No	No	No	ants nest	No		No specific management recommendations
37-6-4082	HVO-1529	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4058	HVO-1550	19/11/24	No	Yes	No		on creek edge	No	No	No	No		No specific management recommendations
37-6-4025	HVO-1551	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4025	HVO-1552	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4025	HVO-1553	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4026	HVO-1554	19/11/24	No	Yes	Yes	No	No	No	No	No	No		No specific management recommendations
37-6-4026	HVO-1555	19/11/24	Yes	Yes	Yes	No	No	No	No	No	No		No specific management recommendations
37-6-0623	HVO-1556	19/11/24	No	Yes	Yes	No	No	No	No	No	No		Revisit site with site card/report details
37-6-4024	HVO-1557	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4024	HVO-1558	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4024	HVO-1559	19/11/24	No	Yes	No		No	No	No	pig-rooting	No		No specific management recommendations
37-6-4024	HVO-1560	19/11/24	No	Yes	No		No	No	No	pig-rooting	No		No specific management recommendations
37-6-4076	HVO-1628	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4077	HVO-1629	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations

37-6-4078	HVO-1630	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4079	HVO-1631	19/11/24	Yes	Yes	Yes	No	No	No	No	No	No	embedded outside of old barricade	No specific management recommendations
37-6-4080	HVO-1632	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4035	HVO-1633	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4035	HVO-1634	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-4034	HVO-1638	19/11/24	Yes	Yes	No		No	No	No	No	No	v poor GSV	No specific management recommendations
37-6-4034	HVO-1639	19/11/24	No	Yes	No		No	No	No	No	No	v poor GSV	No specific management recommendations
37-6-4034	HVO-1640	19/11/24	Yes	Yes	No		No	No	No	No	No	v poor GSV	No specific management recommendations
37-6-4034	HVO-1641	19/11/24	Yes	Yes	No		No	No	No	No	No	v poor GSV	No specific management recommendations
37-6-4070	HVO-1690	19/11/24	No	Yes	No		No	No	No	No	No	v poor GSV	No specific management recommendations
37-6-4036	HVO-2138	19/11/24	Yes	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-0618	Long Point Rd 1a	19/11/24	No	Yes	No		No	No	No	No	No		No specific management recommendations
37-6-0615	Long Point Rd_2	19/11/24	No	Yes	No		No	No	No	No	No		Check report/site card/past AHIPs for true location/salvage status

Table 2: Results of the November 2024 HVO South Aboriginal Sites Compliance Inspection

Aboriginal Site Management Recommendations

There were no specific management recommendations put forward for all but two of the ACH sites visited. The specific recommendations that were proposed relate to obtaining further information from reports and other records to aid in future re-identification efforts.

Check survey reports, site cards, AHIPs to confirm locational information

Site: 37-6-0615; 37-6-0623

These two sites were recorded outside of HVO's standard process and, therefore, information on their nature, extent and validity is lacking. No artefacts were identified during the current audit at their registered co-ordinates. Investigation of site cards, reports and AHIPs issued in the vicinity is required to ascertain the exact circumstances surrounding their recording and potential salvage.

Location of 37-6-0615 adjacent to Long Point Rd and Redbank Power Station

Ground Disturbance Audit Check

Aside from affording CHWG representatives with an opportunity to visit mining operations and monitor the condition of ACH sites, another intention of the compliance inspections is to

provide the opportunity to inspect the operational compliance with AHMP provisions and GDP procedures. To this end, two inspections were made of chance ACH finds at recent GDP project areas at Mitchell Pit and Carrington West.

TR100-AS1 (37-2-6510) Drilling Chance Find

A drilling program at Carrington West was conducted under the authority of a GDP earlier in 2024. A previously recorded site - TR100-AS1 – was identified in the vicinity and was avoided by the drilling works, which were located 100m to the south-west of the site. During an inspection of the drill pad rehabilitation works, HVO Environment and Community staff identified what they believed to be Aboriginal stone artefacts. In accordance with the Chance Finds procedure contained within the HVO North HMP, works in the area ceased pending an inspection by an archaeologist and representatives of the RAPs, which was conducted on 18 November 2024.

Example of chance find from drilling site – confirmed as mudstone flake

The inspection party confirmed that the chance finds were artefactual, consisting of ten mudstone flakes across a c.10m x 10m area. These finds are located across the same cleared

plain landform upon which nearby TR100-AS1 was recorded, and, as such, the new finds are considered an extension of that previously recorded site.

It is recommended that the site extent boundary for ACH site TR100-AS1 (37-2-6510) be extended to incorporate the new finds.

HVO-1769 (37-2-5379) Vegetation Clearing Chance Find

Pre-mining vegetation clearing was conducted in the Mitchell Pit area earlier in 2024 under the authority of a GDP. The area in question was covered by AHIP C002193 and had been previously salvaged in 2019. During an inspection of the clearing works, HVO Environment and Community staff identified what they believed to be an Aboriginal stone artefact. In accordance with the Chance Finds procedure contained within the HVO North HMP, works in the area ceased pending an inspection by an archaeologist and representatives of the RAPs, which was conducted on 18 November 2024.

The inspection party confirmed that the chance find was artefactual – a mudstone single-platform core possibly used as a scraper. This artefact was collected under the authority of AHIP C0002193 and taken to the Hunter Valley Services Cultural Heritage Storage Facility for storage with those artefacts collected during the 2019 salvage program.

Mudstone single-platform core collected from HVO-1769

Recommendations from the November 2024 AHMP Audit

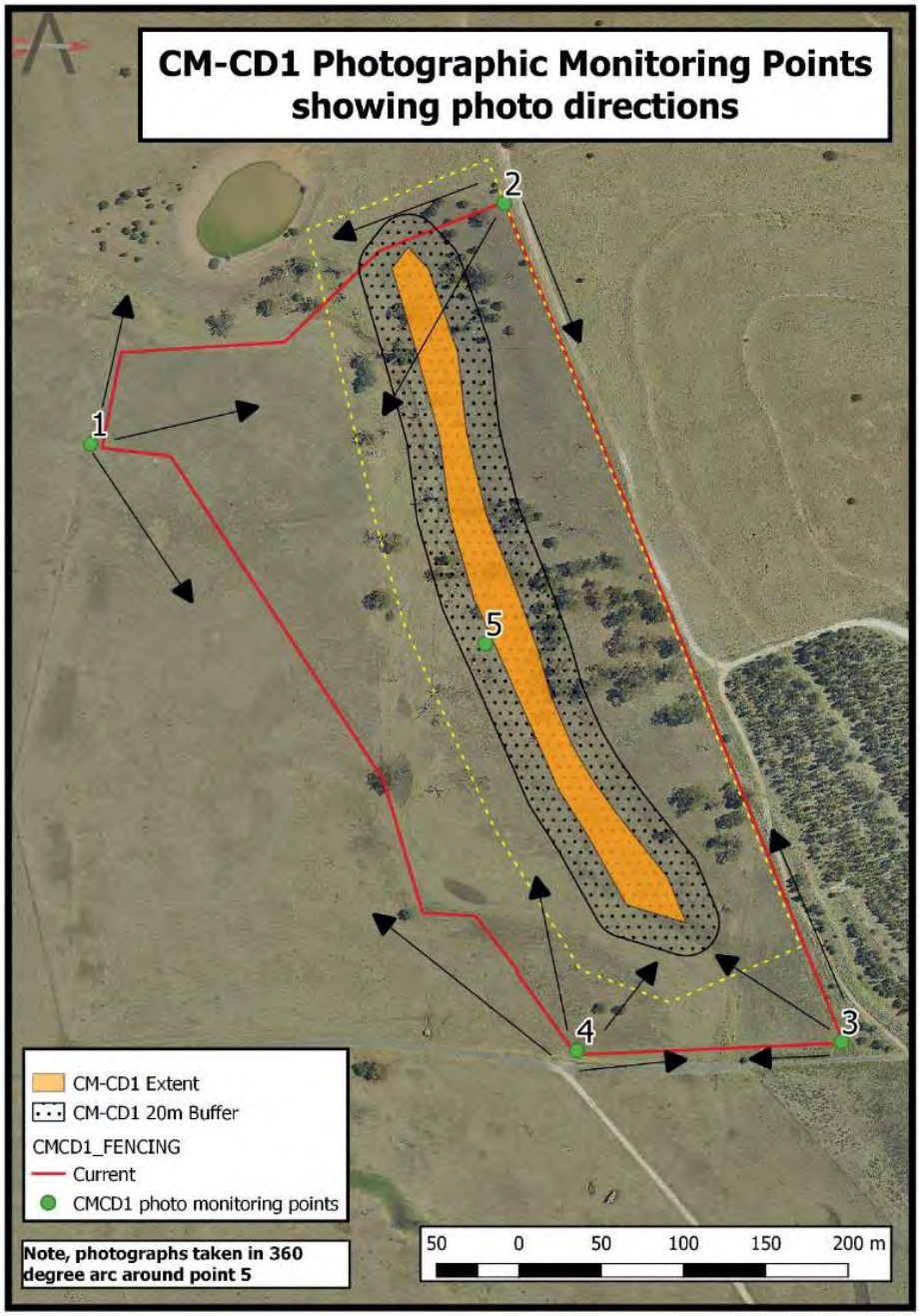
The following ACH management recommendations are provided as a result of the November 2024 AHMPs Compliance Audit.

1. **Reinstall barricading or demarcation at ACH sites 37-3-1631, 37-2-6483 and 37-2-6494;**
2. **Salvage ACH sites 37-2-6506 and 37-2-6507 as soon as permits or consents are in place;**
3. **Check site cards, reports and previous AHIPs surrounding ACH sites 37-6-0615 and 37-6-0623 to confirm site information and locations prior to next audit;**
4. **The recent prescribed burning program implemented at CM-CD1 should be continued with regular burns planned approximately annually;**
5. **Using a hand-held brush-cutter and proceeding on foot, the 20m CM-CD1 buffer area should continue to be subject to weed and vegetation growth slashing as and when required;**
6. **A fence should be installed around this 20m CM-CD1 buffer area aligned with the current demarcation pegs;**
7. **The CM-CD1 area should continue to be targeted during HVO's vermin control program in order to reduce feral pig disturbance as much as possible; and**
8. **A fence should be installed around this 20m CM-CD1 buffer area aligned with the current demarcation pegs.**

APPENDIX A – CM-CD1 PHOTO MONITORING RESULTS

Photo Point #	Location at CM-CD1	Easting	Northing
1	North-west	308614	6403653
2	North-east	308814	6403807
3	South-east	309022	6403297
4	South-west	308860	6403290
5	Centre	308809	6403513

Co-ordinates (GDA94, z56) for CM-CD1 photo monitoring points



Location of CM-CD1 photo monitoring points

CM-CD1 Monitoring Point 1 Panorama – November 2024

CM-CD1 Monitoring Point 2 Panorama – November 2024

CM-CD1 Monitoring Point 3 Panorama – November 2024

CM-CD1 Monitoring Point 4 Panorama – November 2024

CM-CD1 Monitoring Point 5 Panorama – November 2024: (L-R: north through east through south)

CM-CD1 Monitoring Point 5 Panorama – November 2024 (L-R: south through west through north)

Hunter Valley Operations South Aboriginal Heritage Management Plan April 2024 Compliance Audit Inspection

Report prepared for

Hunter Valley Operations

June 2024

Joel Deacon

ARROW
HERITAGE SOLUTIONS

Introduction

The Hunter Valley Operations Joint Venture (HVOJV) manages the Hunter Valley Operations (HVO) mining complex located in the Hunter Valley. The HVOJV provides management services that include accountability for Aboriginal cultural heritage (ACH) and community consultation. The development of mining operations has occurred through a process of expansion and acquisition, and as a result there are two separate development approvals that apply to the operation - HVO North (DA_450-10-2003) and HVO South (PA_06_0261). The mining and processing activities at HVO are geographically divided by the Hunter River, with movement of coal, overburden, equipment, materials and personnel between the two operational areas.

Each consent contains a condition requiring the development of an Aboriginal Heritage Management Plan (AHMP). These plans have been developed in consultation with the Aboriginal community through the HVO Cultural Heritage Working Group (CHWG) and approved for each operational area. Within each of these plans, provision is made to conduct annual AHMP compliance inspections (biannual for HVO South) with members of the Aboriginal community throughout the life of operations. The purpose of the compliance inspections is to afford the Aboriginal stakeholders and the HVOJV:

- the opportunity to visit mine operations and mine areas to inspect the operational compliance with AHMP provisions and Ground Disturbance Permit (GDP) procedures;
- to inspect and monitor the condition and management of various ACH sites; and
- to review the effectiveness and performance of AHMP provisions in the management of cultural heritage at the mine.

Due to the number of ACH sites within the AHMP areas and the time required to inspect all sites, it is not feasible to inspect every ACH site during the same field trip. Therefore, a regular, rolling program of compliance inspections has been implemented that will visit all sites periodically over a number of years. A record will be kept of each compliance inspection against each ACH site, so that it can be ensured that each site is inspected regularly.

Proposed Activity and Project Brief

The compliance inspection involved visiting a number of ACH sites at HVO South, where an AHMP compliance inspection pro-forma was completed for each (included as Appendix A to this report). These proformas noted the outcomes of the inspection including evidence of compliance or non-compliance with AHMP provisions, and recommendations on

improvements to management provisions or corrective actions. Photographs of the inspected ACH sites were also taken.

Timing & Personnel

The HVO South 2024 H1 AHMP compliance inspection program was conducted on 22 April 2024. The personnel involved in these inspections were:

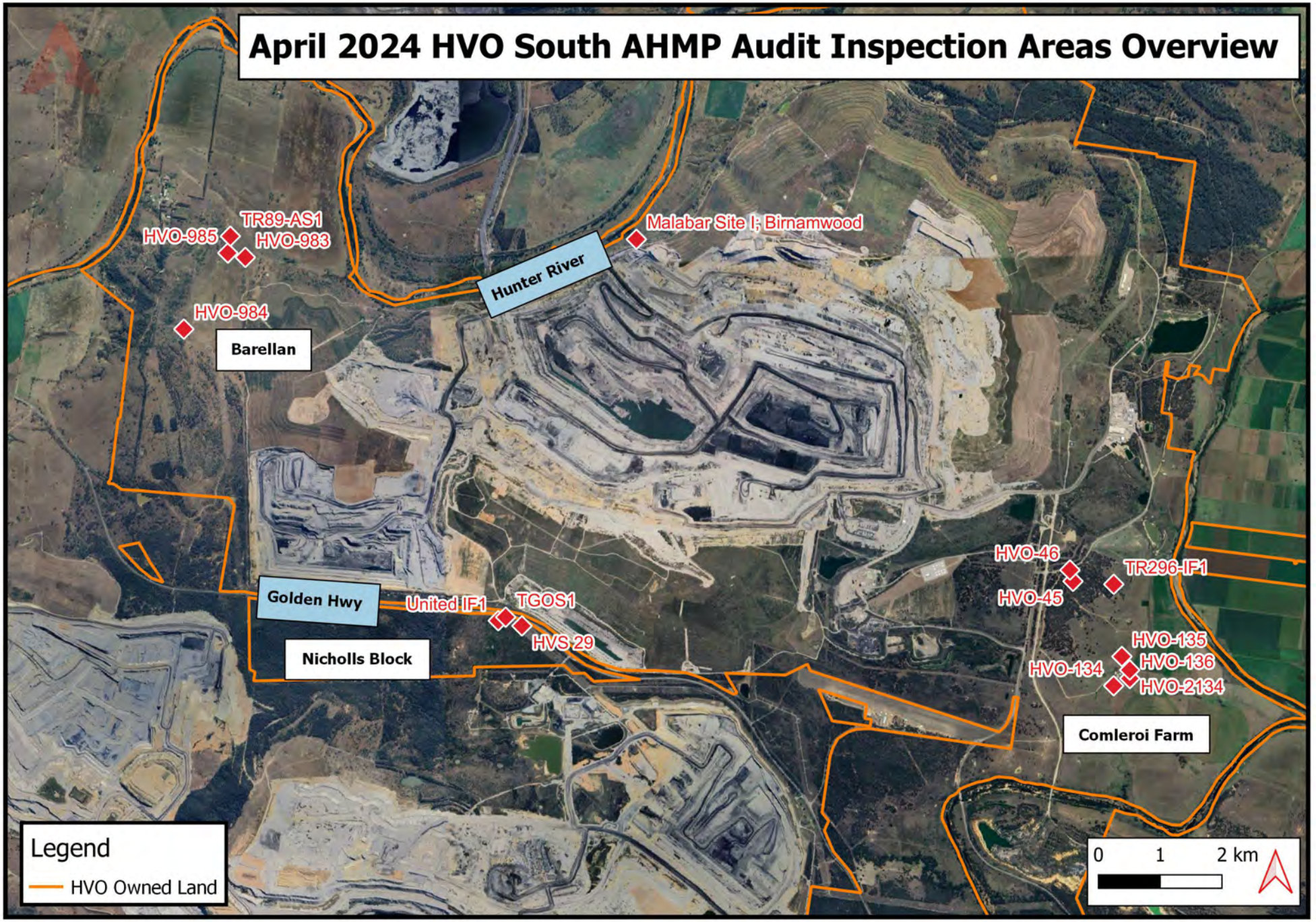
- Joel Deacon (Arrow Heritage Solutions Principal Archaeologist)
- Peter Bowman (HVO Environment and Community Officer)
- Luke Hickey (CHWG Representative)
- Joshua Hickey (CHWG Representative)

Arrow Heritage Solutions were engaged as independent heritage consultants to conduct the AHMP compliance inspections, with Joel Deacon acting as technical advisor and author of this report. HVO's Environment & Community Officer Peter Bowman arranged the compliance inspection programs and escorted the field team.

Results

A total of 15 ACH sites were inspected in the HVO South area, at locations on the Hunter River, the Nicholls Block, ex-Barellan Farm and Comleroi Farm (see map below). Although not active mining zones, these areas were selected for inspection as they are located adjacent to active mining or infrastructure areas, or located on operating agricultural properties.

The table below details the results of the compliance inspection and summarises the information recorded on the individual pro-forma inspection sheets. Using a mobile mapper pre-loaded with the GIS co-ordinates for each ACH site, the field team travelled to each locale and attempted to re-identify each site. Sometimes this was not possible due to poor ground surface visibility (GSV) arising from high vegetation cover, in which case the site was assessed to determine that the vicinity had not been inadvertently disturbed. Another factor affecting site re-identification was the age of the original recording and the level of data recorded. The presence and condition of barricading or fencing was noted, as well as the presence and nature of various potential site disturbing factors (e.g erosion, animal, human). General observations of each site were made if necessary, and, based on information provided for all of the above factors, management recommendations were discussed and agreed by the field team for each site.


April 2024 HVO South AHMP Audit Inspection Areas Overview
TR89-AS1
HVO-985
HVO-983
Malabar Site I; Birnamwood
Hunter River
HVO-984
Barellan
HVO-46
TR296-IF1
HVO-45
Golden Hwy
United IF1
TGOS1
HVS 29
Nicholls Block
HVO-135
HVO-136
HVO-134
HVO-2134
Comleroi Farm
Legend
HVO Owned Land
0
1
2 km

AHIMS ID	Site Name	Inspection Date	Site re-identified?	Site intact?	Site fenced/barricaded?	Fencing/barricading intact?	Natural erosion	Livestock damage	Human disturbance	Animal disturbance	Pests & weeds	General observations	Management recommendations
37-2-0946	TR89-AS1	22/4/2024	Yes	Yes	No	-	No	Cattle track	No	No	No		
37-5-0253	HVS 29	22/4/2024	No	Yes	Yes	No	No	No	Powerline corridor	No	No		
37-5-0568	HVO-983	22/4/2024	No	Yes	No	-	No	No	No	No	No		
37-5-0569	HVO-984	22/4/2024	No	Yes	Yes	No	No	No		No	No		
37-5-0570	HVO-985	22/4/2024	No	Yes	Yes	No	No	No	No	No	No		
37-5-0584	United IF1	22/4/2024	No	Yes	Yes	No	No	No	Historic earthworks	No	No		
37-5-0914	TGOS1	22/4/2024	No	Yes	No	-	No	No	No	No	No		
37-6-0166	Malabar Site I; Birnamwood[1]	22/4/2024	No	Yes	Yes	Yes	No	No	On track edge	No	Weed infested		Inspect again when GSV conditions improve
37-6-1765	HVO-134	22/4/2024	No	Yes	No	-	No	No	No	No	No	Located on vegetated thoroughfare	Salvage when GSV conditions improve
37-6-1766	HVO-135	22/4/2024	No	Yes	No	-	No	Active farm	No	No	No		Salvage when GSV conditions improve
37-6-1767	HVO-136	22/4/2024	No	Yes	No	-	No	Active farm	No	No	No		Salvage when GSV conditions improve
37-6-3244	HVO-45	22/4/2024	No	Yes	No	-	No	No	No	No	No		
37-6-3245	HVO-46	22/4/2024	Yes	Yes	No	-	No	No	Just off track	No	No		
37-6-3878	HVO-2134	22/4/2024	No	Yes	No	-	No	Active farm	No	No	No	Located on vegetated thoroughfare	Salvage when GSV conditions improve
37-6-4116	TR296-IF1	22/4/2024	Yes	Yes	No	-	No	No	No	No	No		

[1] This site has been registered on AHIMS as 'Malabar Site I; Birnamwood', named for the old property on which it was recorded. Please note that, despite this registration, the correct spelling for this property is "Burnumwood".

Aboriginal Site Management Recommendations

Management recommendations were provided for some of the ACH sites visited, however, as the majority of sites were located on intact landforms with very low risk of future disturbance, the field team were satisfied with the current passive management regime. The nature of those recommendations that were forthcoming are described below.

Potentially salvage to avoid further harm

Site: 37-6-1765; 37-6-1766; 37-6-1767; 37-6-3878 (HVO-134, HVO-135, HVO-136, HVO-2134)

These four sites are located in high activity areas surrounding operating farm infrastructure and houses. Access by light vehicles as well as stock movement have a high potential of harming the artefacts present at these sites. Currently, substantial surface grass cover is helping with site integrity, but also prevents effective re-identification of the artefacts in question.

To avoid potential damage to these sites, it is recommended that they be salvaged by representatives of the CHWG when conditions are improved for GSV.

Location of site HVO-134 near gateway

Location of HVO-135 in cow paddock

Location of HVO-136 (left) and HVO-2134 in active farm access areas

Reassess during future audit

Site: 37-6-0166 (Malabar Site I; Birnamwood)

This site has been fenced but is currently infested by a thick covering of weeds and grasses. The site is an old recording and it is unclear whether the current fencing is arbitrary or accurately reflects the site's extent. It is recommended that the site is revisited with the report and site cards when vegetation levels are much lower so that better attempts can be made to relocate its contents.

View of vegetation cover across 37-6-0166

Recommendations from the April 2024 AHMP Audit

The following site-specific ACH management recommendations are provided as a result of the April 2024 AHMP Compliance Audit.

1. **When GSV conditions allow, consider the salvage of sites HVO-134, HVO-135, HVO-136 and HVO-2134 to prevent further damage from operational farming activities; and**
2. **When GSV conditions allow, revisit Malabar Site I; Birnamwood during a future compliance inspection in order to confirm its contents and status.**

Appendix A: Completed ACH Site Condition Monitoring Inspection Proformas

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	22/1	HV0-135

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

Site GPS co-ords: *Zone/Datum MGA94/Zone56*	*Easting*	*Northing*
Was the site re-identified?	Yes	(No)
Is the site intact?	(Yes)	No
Is the site fenced, barricaded and/or sign posted?	Yes	No
Is the site fencing, barricading and/or signage intact?	Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment:		
Animal Disturbance	Yes	No
Comment: active home farm		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:
Salvage when visible

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:

Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	22/4	HVO-2139

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

Site GPS co-ords: (Zone/Datum MGA94/Zone56)	Easting	Northing
Was the site re-identified?	Yes	(No)
Is the site intact?	(Yes)	No
Is the site fenced, barricaded and/or sign posted?	Yes	No
Is the site fencing, barricading and/or signage intact?	Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment:		
Animal Disturbance	Yes	No
Comment: in active farm traffic area		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:
salvage when visible

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:

Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:		DATE:	SITE #: HVO
HVO South PA_06_0261	✓	22/9	HVO-136
HVO North DA 450-10-2003			

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

Site GPS co-ords:	Zone/Datum MGA94/Zone56	Easting	Northing
Was the site re-identified?		Yes	No
Is the site intact?		Yes	No
Is the site fenced, barricaded and/or sign posted?		Yes	No
Is the site fencing, barricading and/or signage intact?		Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment: on active farm		
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:
potentially salvage some drought

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:

Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	2014	HVO-134

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

Site GPS co-ords: (Zone/Datum MGA94/Zone56)	Easting	Northing
Was the site re-identified?	Yes	(No)
Is the site intact?	(Yes)	No
Is the site fenced, barricaded and/or sign posted?	Yes	(No)
Is the site fencing, barricading and/or signage intact?	Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment:		
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:
located on vegetated floodplain. potentially salvage in drought

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:

Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	22/4	TR296-IF1

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

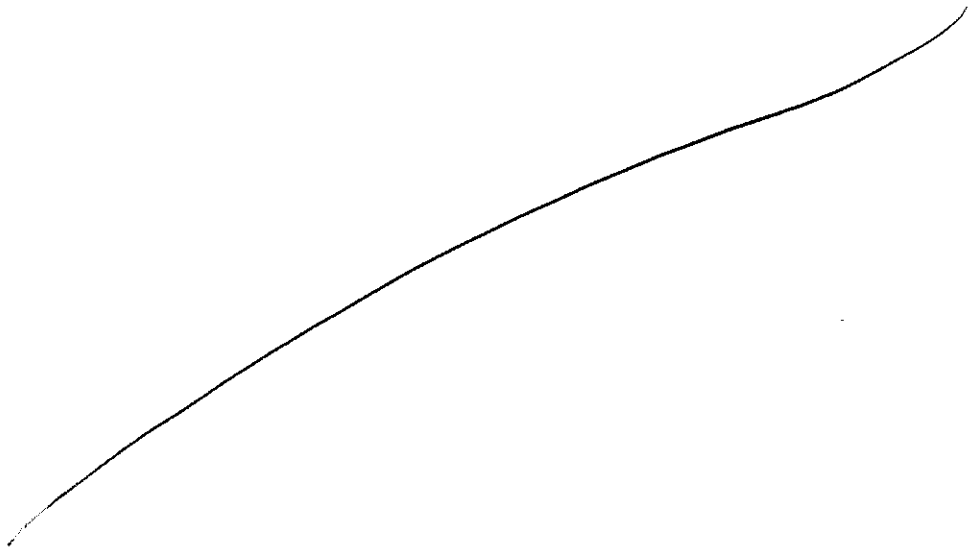
Site GPS co-ords:	Zone/Datum MGA94/Zone56	Easting	Northing
Was the site re-identified?		Yes	No
Is the site intact?		Yes	No
Is the site fenced, barricaded and/or sign posted?		Yes	No
Is the site fencing, barricading and/or signage intact?		Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment:		
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:


Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:		DATE:	SITE #: HVO
HVO South PA_06_0261	✓	22/4	HVO - 4J
HVO North DA 450-10-2003			

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

Site GPS co-ords:	Zone/Datum MGA94/Zone56	Easting	Northing
Was the site re-identified?		Yes	No
Is the site intact?		Yes	No
Is the site fenced, barricaded and/or sign posted?		Yes	No
Is the site fencing, barricading and/or signage intact?		Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment:		
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:

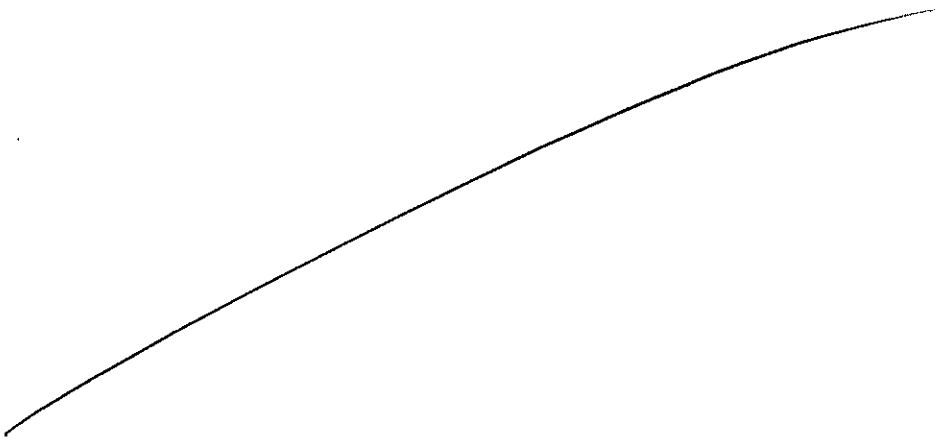
IF(M) IFP(M) found @

315862 6398049

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:



Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	28/4/24	HVO-46

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

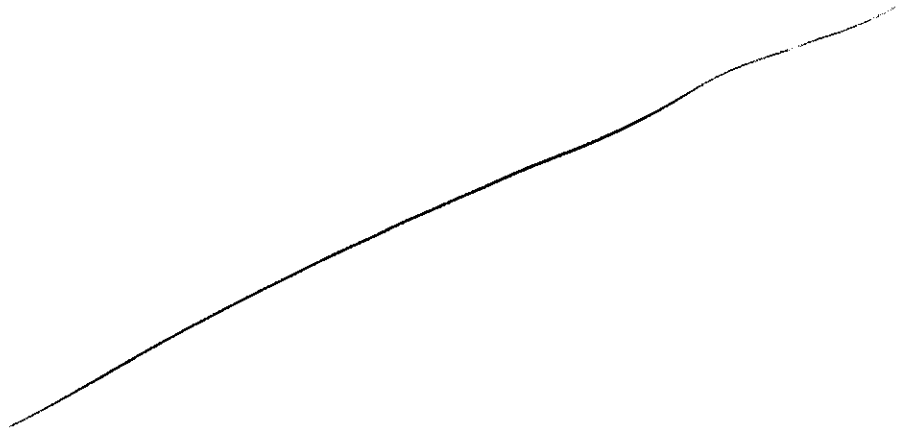
Site GPS co-ords: (Zone/Datum MGA94/Zone56)	Easting	Northing
Was the site re-identified?	(Yes)	No
Is the site intact?	Yes	(No)
Is the site fenced, barricaded and/or sign posted?	Yes	(No)
Is the site fencing, barricading and/or signage intact?	Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	(No)
Comment:		
Livestock Damage	Yes	(No)
Comment:		
Human Disturbance	(Yes)	No
Comment:	just off track	
Animal Disturbance	Yes	(No)
Comment:		
Pests & Weeds	Yes	(No)
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:


Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:		DATE:	SITE #: HVO
HVO South PA_06_0261	✓	22/4/26	Malabar Site 1 Birnamwood
HVO North DA 450-10-2003			

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

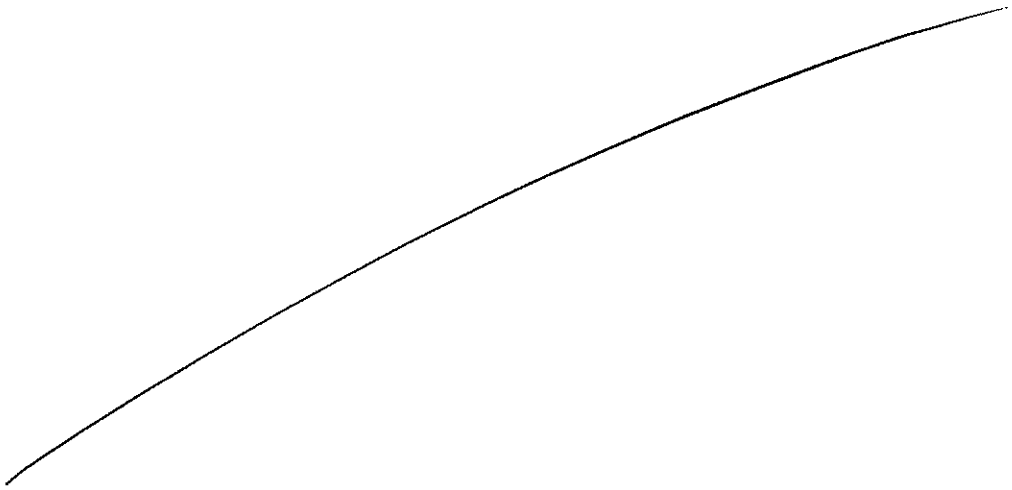
Site GPS co-ords: Zone/Datum MGA94/Zone56	Easting	Northing
Was the site re-identified?	Yes	~~No~~
Is the site intact?	~~Yes~~	No
Is the site fenced, barricaded and/or sign posted?	Yes	No
Is the site fencing, barricading and/or signage intact?	Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	~~No~~
Comment:		
Livestock Damage	Yes	~~No~~
Comment:		
Human Disturbance	Yes	~~No~~
Comment:		
Animal Disturbance	Yes	~~No~~
Comment:		
Pests & Weeds	~~Yes~~	No
Comment: galenia		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:
heavily overgrown w/ 0 wt. Try again when in drought

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:


Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	22/4	HVO - 983

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

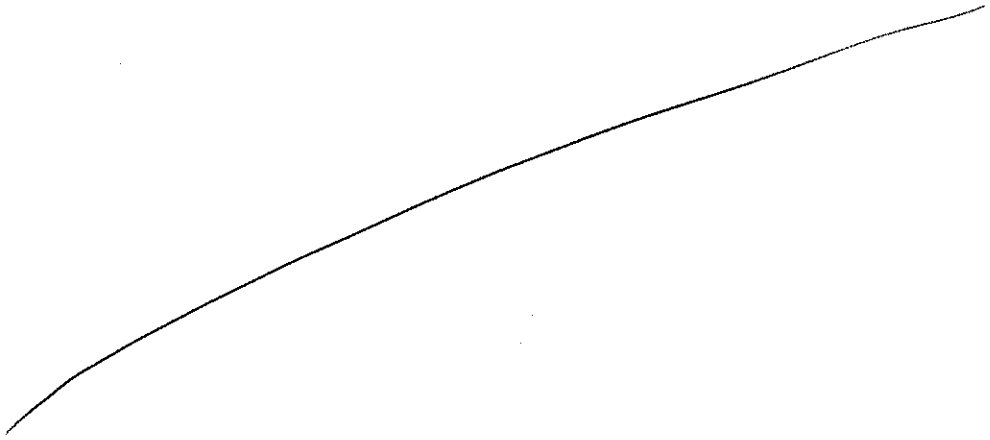
Site GPS co-ords: (Zone/Datum MGA94/Zone56)	Easting	Northing
Was the site re-identified?	Yes	No
Is the site intact?	Yes	No
Is the site fenced, barricaded and/or sign posted?	Yes	No
Is the site fencing, barricading and/or signage intact?	Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment:		
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:


Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	22/4	HVO-981

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

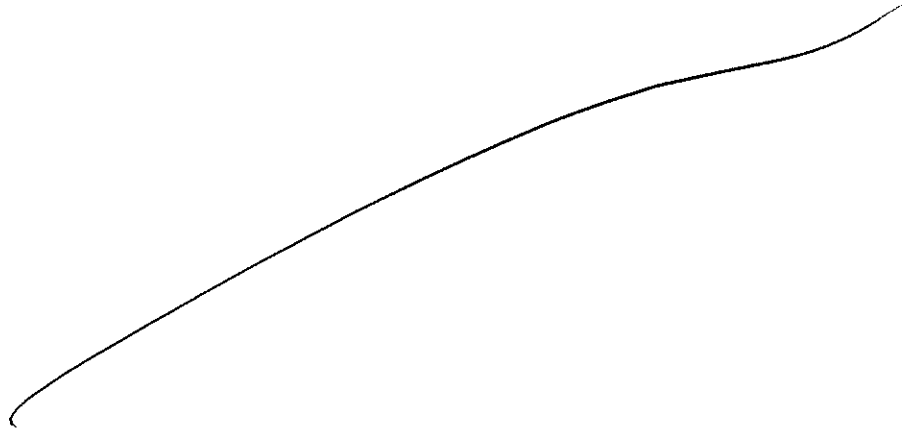
Site GPS co-ords: (Zone/Datum MGA94/Zone56)	Easting	Northing
Was the site re-identified?	Yes	(No)
Is the site intact?	(Yes)	No
Is the site fenced, barricaded and/or sign posted?	(Yes)	No
Is the site fencing, barricading and/or signage intact?	Yes	(No)

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment:		
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:


Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:		DATE:	SITE #: HVO
HVO South PA_06_0261	☑	22/9	TR89-A51
HVO North DA 450-10-2003	☐		

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

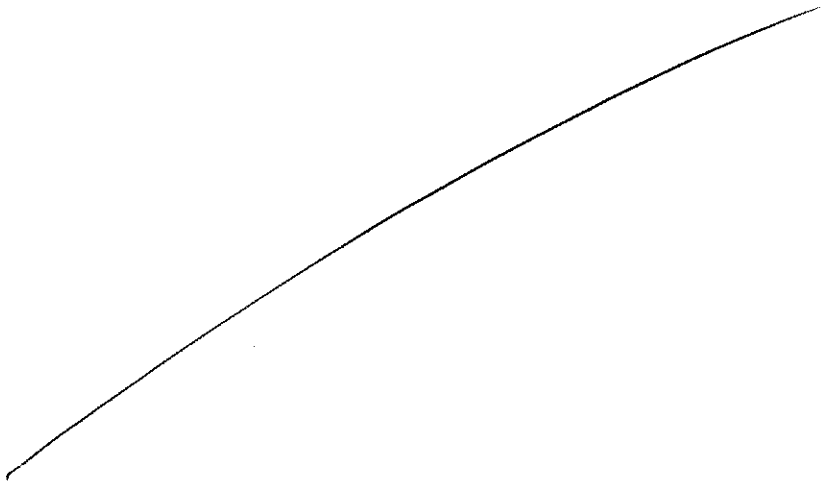
Site GPS co-ords:	Zone/Datum MGA94/Zone56	Easting	Northing
Was the site re-identified?		Yes	No
Is the site intact?		Yes	No
Is the site fenced, barricaded and/or sign posted?		Yes	No
Is the site fencing, barricading and/or signage intact?		Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:	Cattle tracks	
Human Disturbance	Yes	No
Comment:		
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:
+2 BB (M)

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:


Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	22/4	HVS 29

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

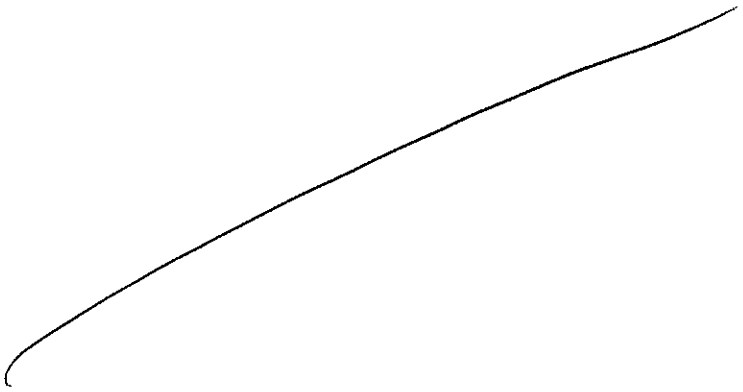
Site GPS co-ords:	Zone/Datum MGA94/Zone56	Easting	Northing
Was the site re-identified?		Yes	No
Is the site intact?		Yes	No
Is the site fenced, barricaded and/or sign posted?		Yes	No
Is the site fencing, barricading and/or signage intact?		Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment:		
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:


Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	22/4	TG05-1

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

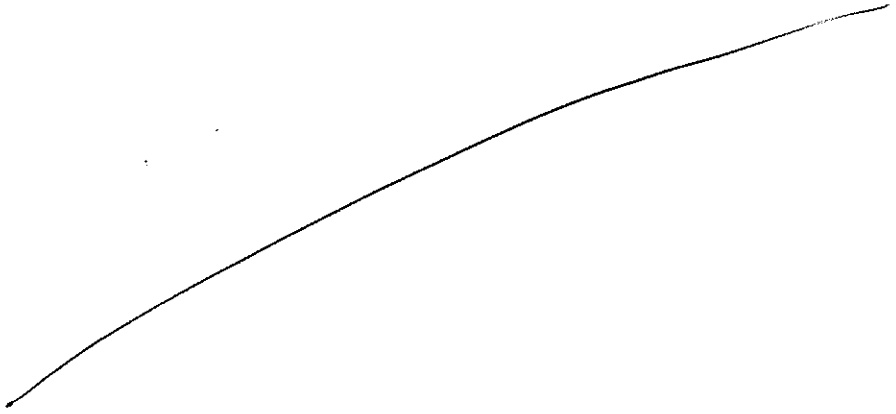
Site GPS co-ords: (Zone/Datum MGA94/Zone56)	Easting	Northing
Was the site re-identified?	Yes	No
Is the site intact?	Yes	No
Is the site fenced, barricaded and/or sign posted?	Yes	No
Is the site fencing, barricading and/or signage intact?	Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment: on track edge		
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:


Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	22/4	United 1F1

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

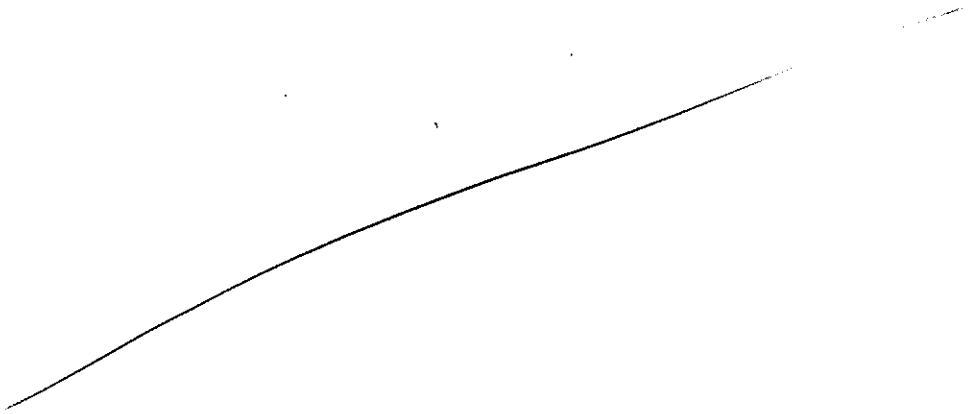
Site GPS co-ords:	Zone/Datum MGA94/Zone56	Easting	Northing
Was the site re-identified?		Yes	(No)
Is the site intact?		(Yes)	No
Is the site fenced, barricaded and/or sign posted?		(Yes)	No
Is the site fencing, barricading and/or signage intact?		Yes	(No)

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment:	past earthworks	
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:


Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE

HUNTER VALLEY OPERATIONS

OPERATION:	DATE:	SITE #: HVO
HVO South PA_06_0261 ☑ HVO North DA 450-10-2003 ☐	22/4	HVO-984

ABORIGINAL CULTURAL HERITAGE SITE/AREA CONDITION MONITORING INSPECTION PROFORMA

PROGRAM DETAILS: CHWG ACH inspections: HVO North (DA 450-10-2003) & HVO South (PA_06_0261) ACHMP

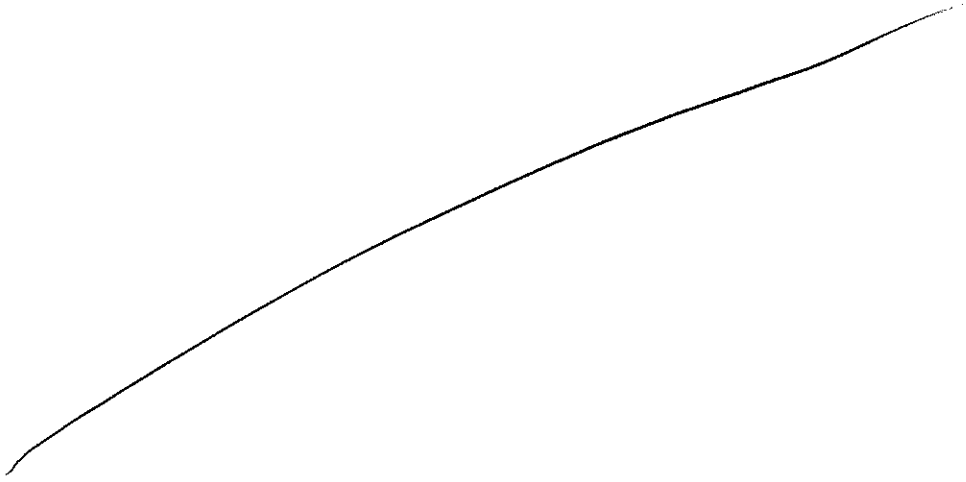
Site GPS co-ords: (Zone/Datum MGA94/Zone56)	Easting	Northing
Was the site re-identified?	Yes	No
Is the site intact?	Yes	No
Is the site fenced, barricaded and/or sign posted?	Yes	No
Is the site fencing, barricading and/or signage intact?	Yes	No

MANAGEMENT OBSERVATIONS		
Natural Erosion	Yes	No
Comment:		
Livestock Damage	Yes	No
Comment:		
Human Disturbance	Yes	No
Comment:		
Animal Disturbance	Yes	No
Comment:		
Pests & Weeds	Yes	No
Comment:		
	Yes	No
Comment:		
	Yes	No
Comment:		

General Management Observations:

ABORIGINAL CULTURAL HERITAGE SITE/AREA MONITORING INSPECTION PROFORMA

Specific Management Recommendations	Yes	No

If yes please note recommendations:


Other comments:

MONITORING PARTICIPANTS		
NAME	AFFILIATION	SIGNATURE