HUNTER VALLEY OPERATIONS

Monthly Environmental Monitoring Report December 2021

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1 Introduction

This report has been compiled to provide a monthly summary of environmental monitoring results for Hunter Valley Operations (HVO). This report includes all monitoring data collected for the period 1 to 31 December 2021 (the 'Reporting Period').

2 Air Quality

2.1 Meteorological Monitoring

HVO maintains two meteorological stations: 'HVO Corporate' and 'Cheshunt' (refer to **Figure 4**)

2.1.1 Rainfall

Rainfall for the period is summarised in **Table 1**. The 2019, 2020 and 2021 trends are shown in **Figure 1**.

Table 1 - Rainfall data for the Reporting Period

2021	Monthly Rainfall (mm)	Cumulative Rainfall (mm)
January	50.6	50.6
February	106.4	157.0
March	178.0	335.0
April	12.8	347.8
May	28.2	376
June	60.2	436.2
July	22.8	459.0
August	38.0	497.0
September	26.0	523.0
October	56.2	579.2
November	226.0	805.2
December	105.0	910.2

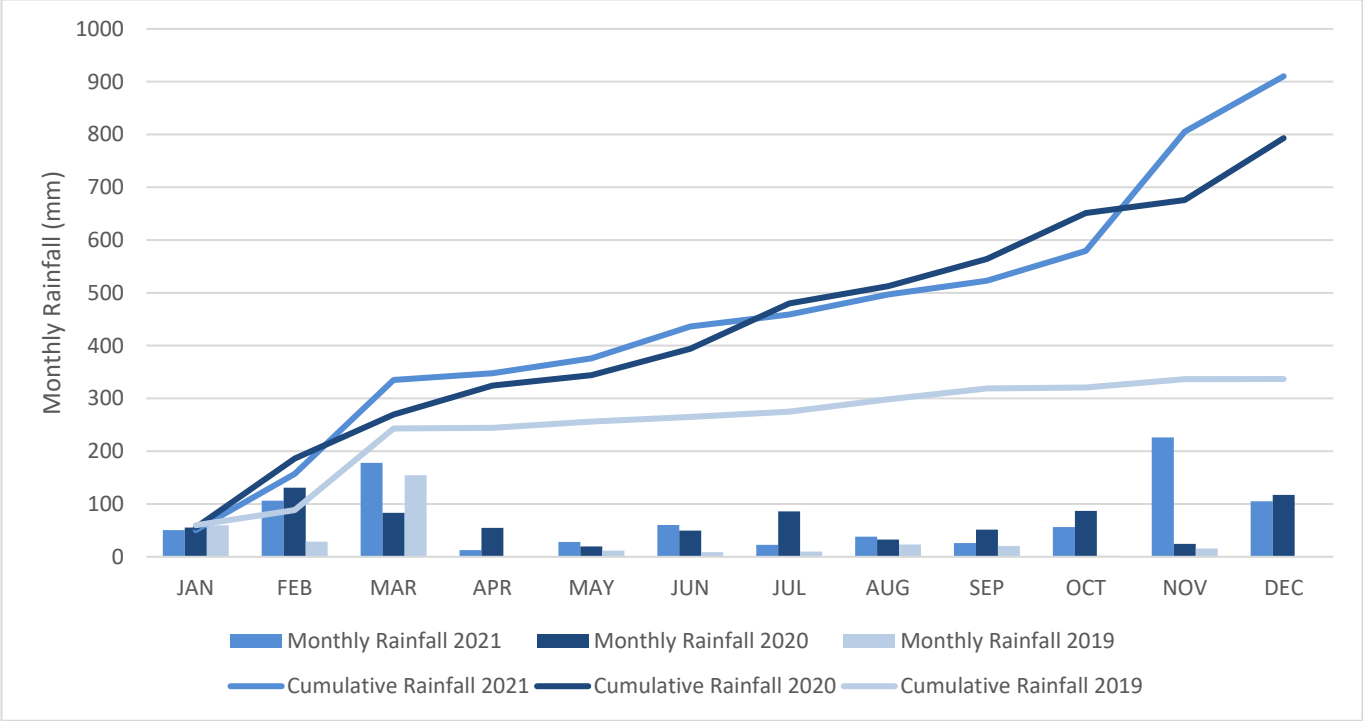


Figure 1 - Rainfall Summary 2021

2.1.2 Wind Speed and Direction

South easterly winds were prevailing during the reporting period as shown in **Figure 2** (HVO Corporate) and **Figure 3** (HVO Cheshunt).

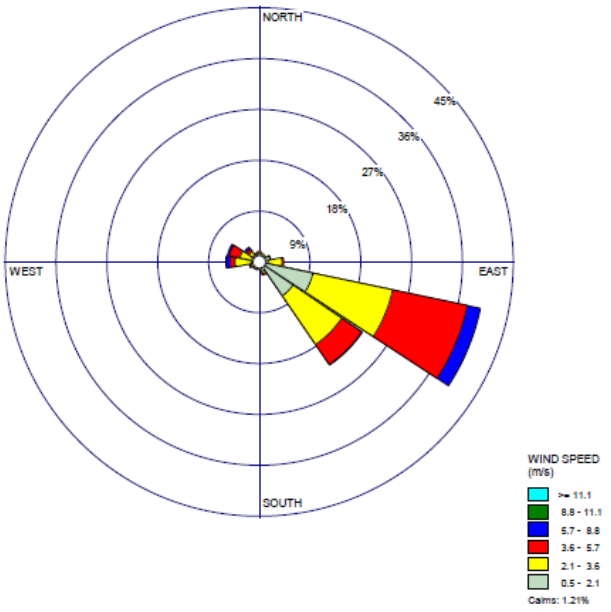


Figure 2 - HVO Corporate Wind Rose for the Reporting Period

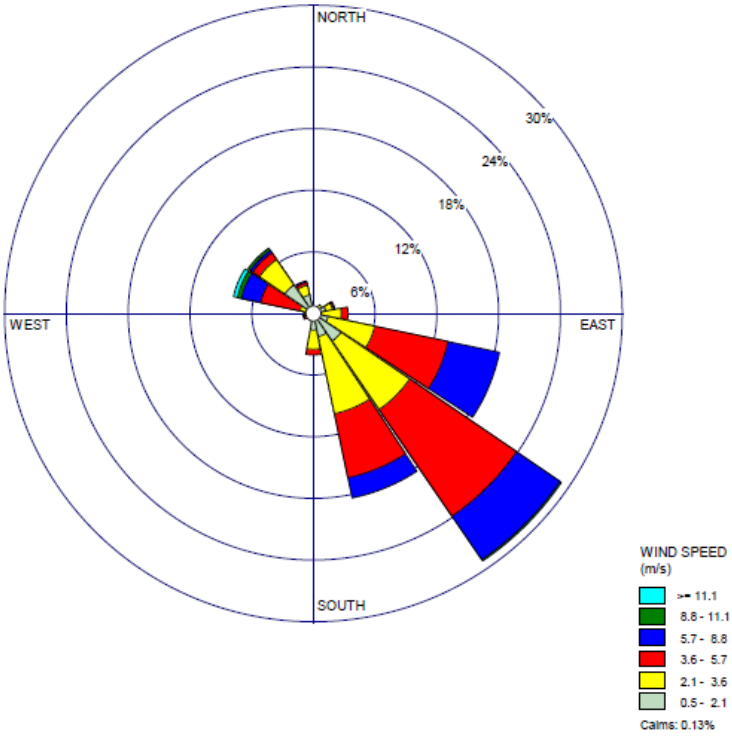


Figure 3 - HVO Cheshunt Wind Rose for the Reporting Period

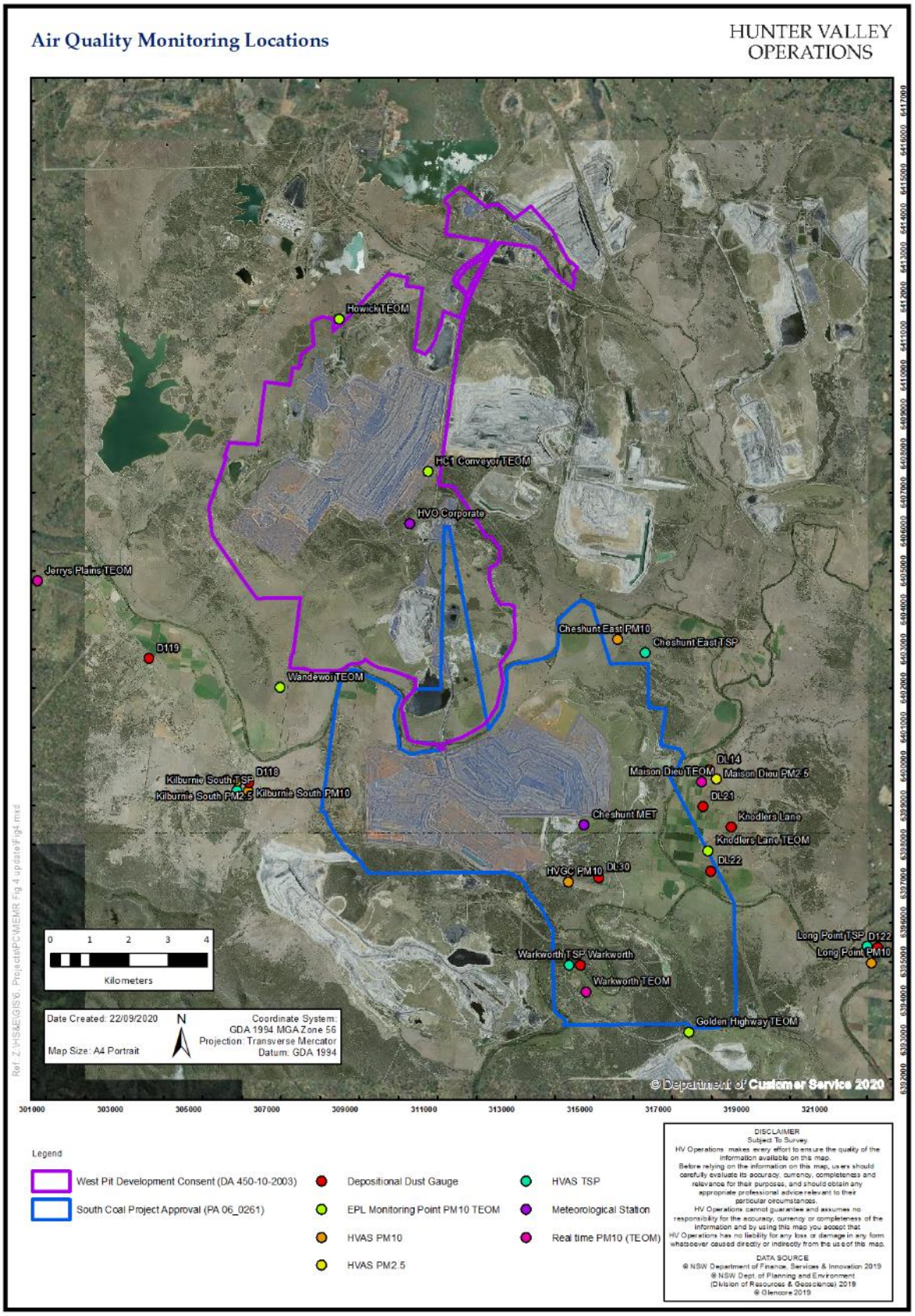


Figure 4 - Air Quality Monitoring Location Plan

2.2 Depositional Dust

HVO operates and maintains a network of nine depositional dust gauges situated on private and mine owned land surrounding HVO to monitor regional air quality.

Figure 5 displays insoluble solids results from depositional dust gauges during the reporting period compared against the annual impact assessment criteria. Any monthly results deemed to be contaminated (due to presence of bird droppings, insects, etc.) are not displayed. An assessment of HVO's contribution against the long-term impact assessment criteria will be provided in the 2021 Annual Review.

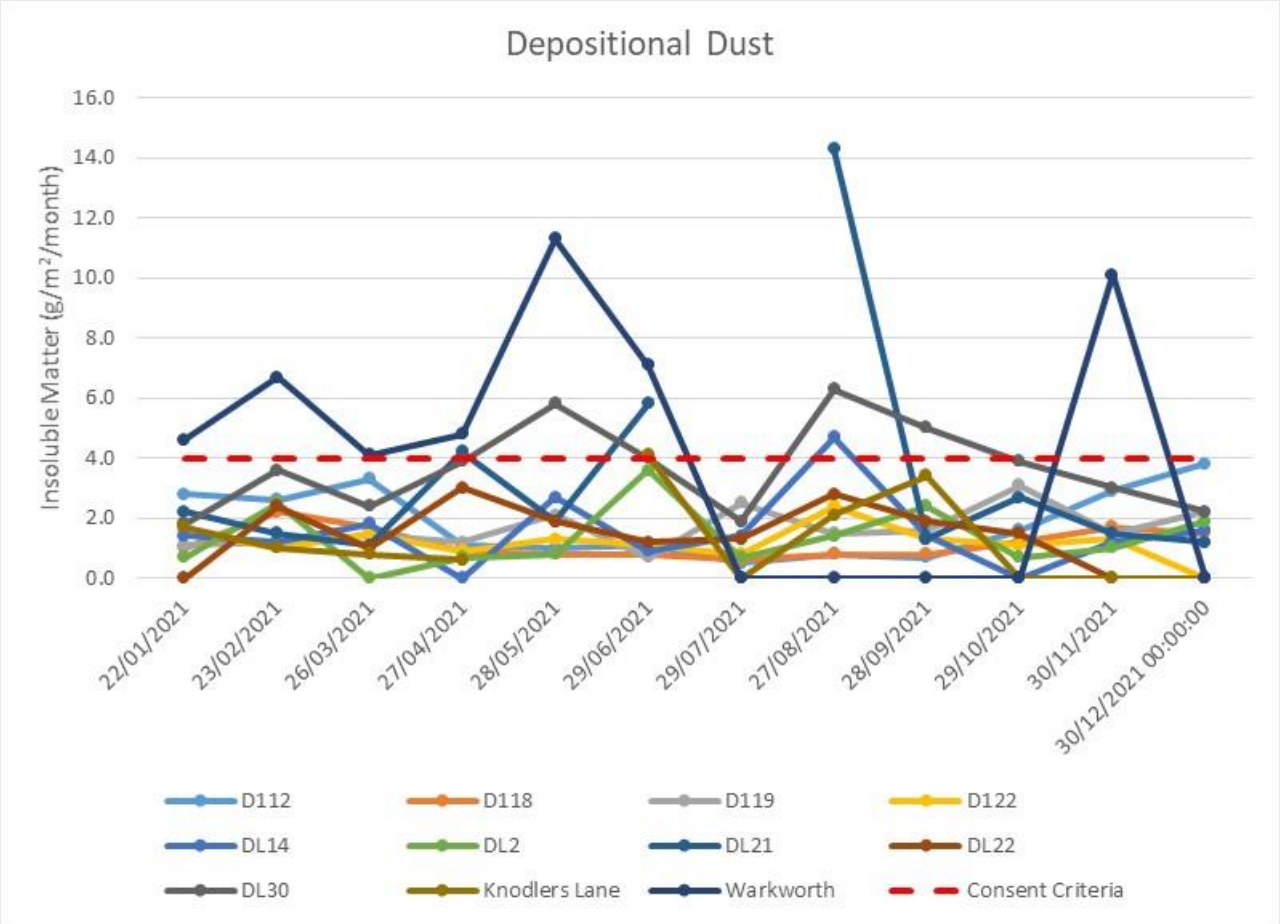


Figure* 5 - *Depositional Dust Results for the Reporting Period

2.3 Suspended Particles

Suspended particles are measured by a network of High Volume Air Samplers (HVAS) measuring Total Suspended Particulates (TSP) and Particulate Matter <10µm (PM_{10}). The Kilburnie South and Maison Dieu HVAS also monitor Particulate Matter <2.5µm ($PM_{2.5}$). The location of these monitors can be seen in **Figure 4**. Each HVAS runs for 24-hours on a six-day cycle.

2.3.1 HVAS PM_{10} Results

2.3.1.1 Performance against short term impact assessment criteria

Figure 6 shows individual PM_{10} results at each monitoring station against the short-term impact assessment criteria of 50µg/m^3. No exceedances were recorded.

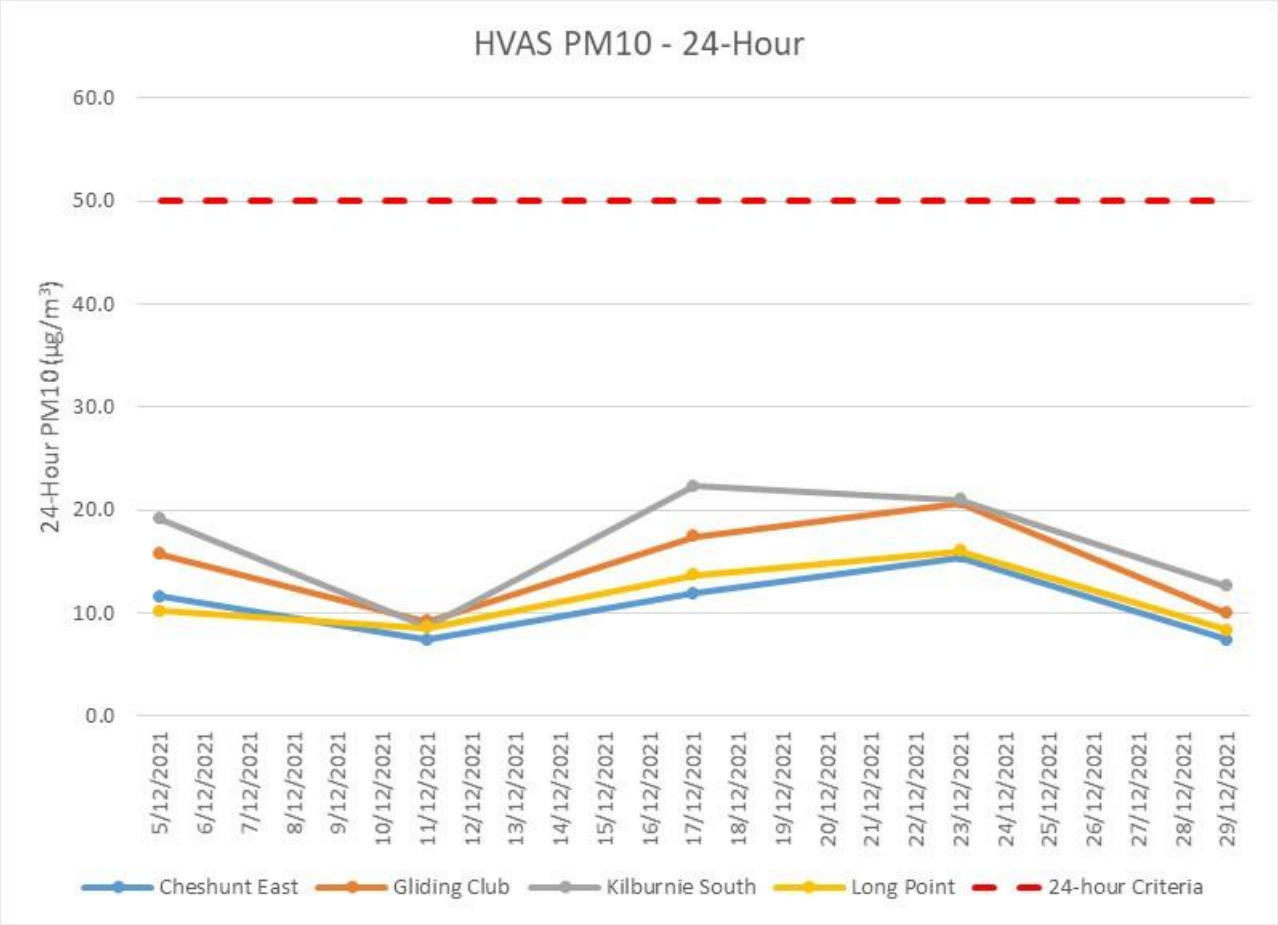


Figure 6 - Individual PM_{10} Results for the Reporting Period

2.3.1.2 Performance against long term impact assessment criteria

Figure 7 shows the year to date annual average PM_{10} results. All monitors were below the relevant long term impact assessment criteria during the reporting period. An assessment of HVO's contribution against the long-term impact assessment criteria will be provided in the 2021 Annual Review.

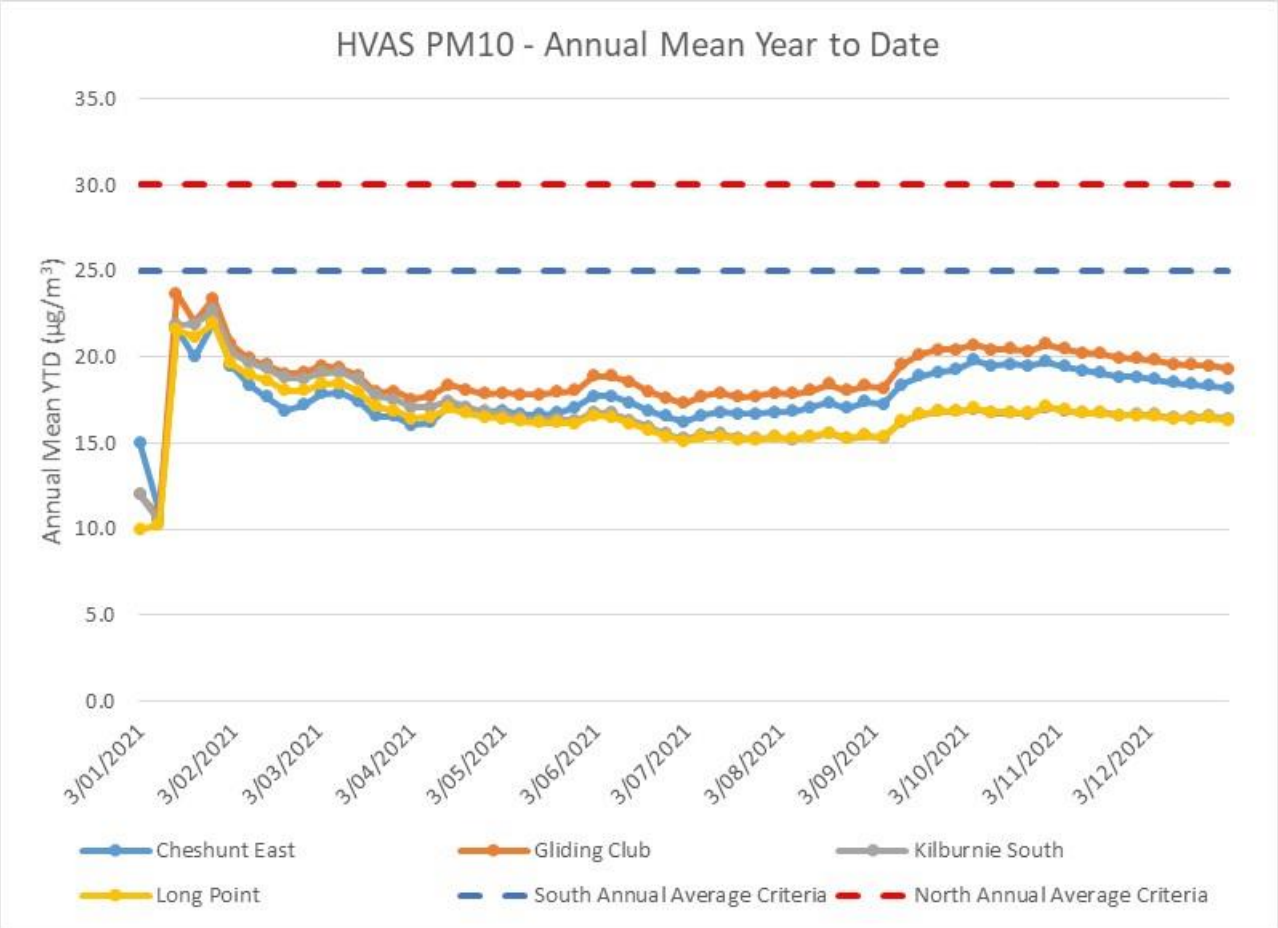


Figure 7 - Year to Date Average PM_{10} as at end of the Reporting Period

2.3.2 HVAS $PM_{2.5}$ Results

HVO monitors $PM_{2.5}$ at two HVAS locations, Kilburnie South and Maison Dieu.

2.3.2.1 Performance against short term impact assessment criteria

Figure 8 shows individual $PM_{2.5}$ results at each monitoring station against the HVO South short-term impact assessment criteria of 25µg/m^3. No exceedances were recorded.

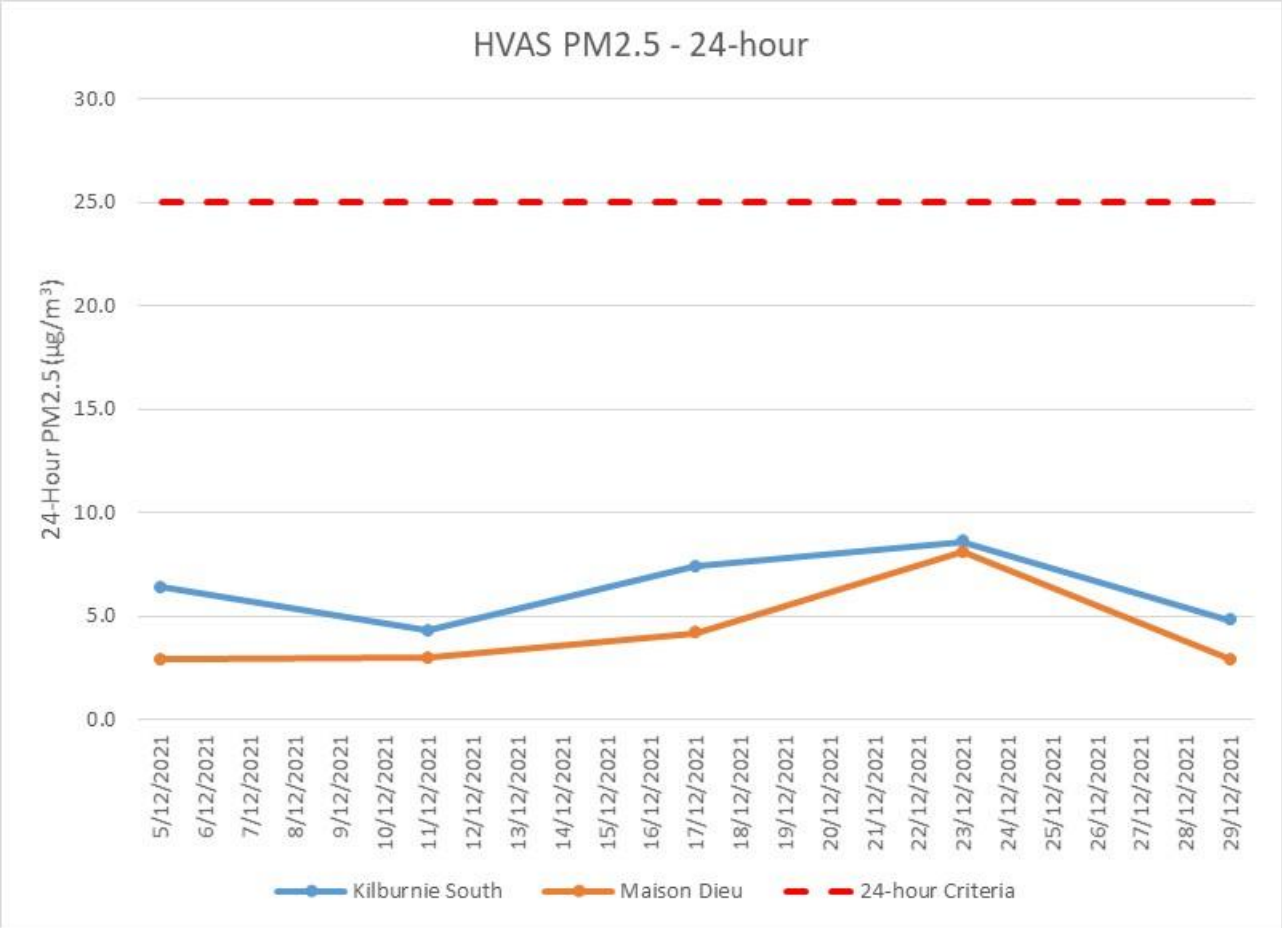


Figure 8 - Individual $PM_{2.5}$ Results for the Reporting Period

2.3.2.2 Performance against long term impact assessment criteria

Figure 9 shows the year to date annual average $PM_{2.5}$ results. Maison Dieu recorded an annual average exceedance above the $PM_{2.5}$ Annual Rolling Mean criteria of 8µg/m^3.

An assessment of HVO's contribution against the long term impact assessment criteria will be provided in the 2021 Annual Review.

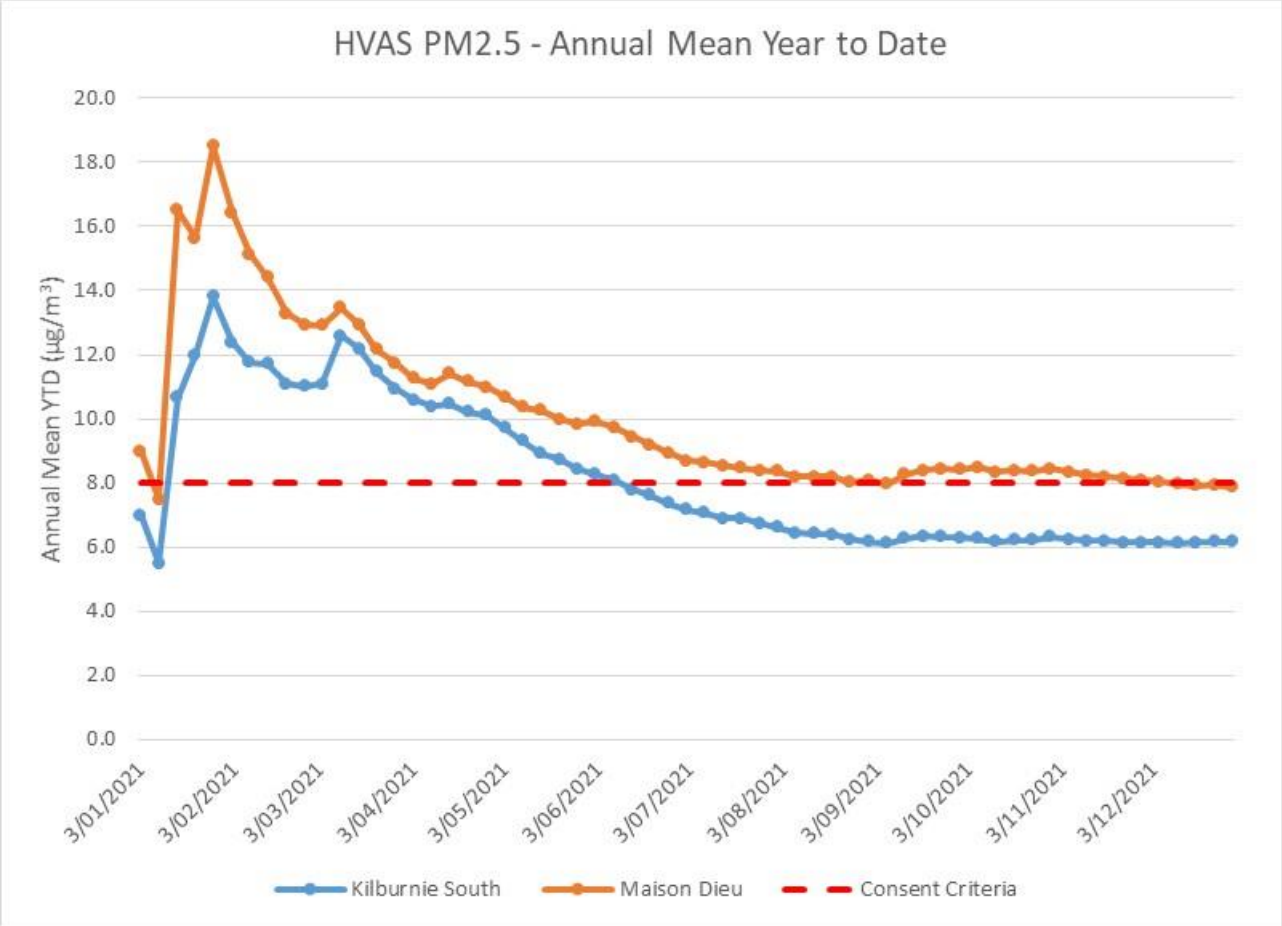


Figure 9 - Year to Date Average $PM_{2.5}$ as at end of the Reporting Period

2.3.3 TSP Results

2.3.3.1 Performance against long term impact assessment criteria

Figure 10 shows the annual average TSP results compared against the long-term impact assessment criteria of 90µg/m^3.

All monitors except for Warkworth were below the relevant long-term impact assessment criteria during the reporting period.

An assessment of HVO's contribution against the long-term impact assessment criteria will be provided in the 2021 Annual Review.

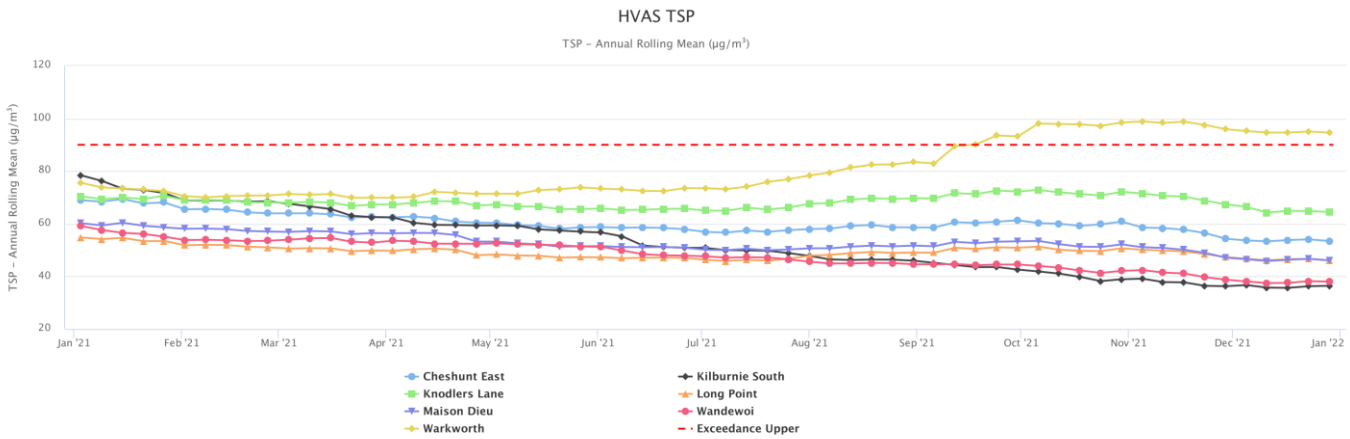


Figure 10 - Year to Date Average Total Suspended Particulates as at end of the Reporting Period

2.3.4 Real Time PM_{10} Results

HVO maintains a network of real time PM_{10} monitors. The real time air quality monitoring stations continuously record information and transmit data to a central database, generating alarms when particulate matter levels exceed internal trigger levels. Results from real time PM_{10} monitoring are used as a reactive measure to guide mining operations to help achieve compliance with the relevant conditions of the project approval.

Figure 11 shows the daily 24-hour average PM_{10} result from the real time monitoring sites which shows no exceedances for the reporting period. The year to date annual averages for each monitoring site are shown in **Figure 12**.

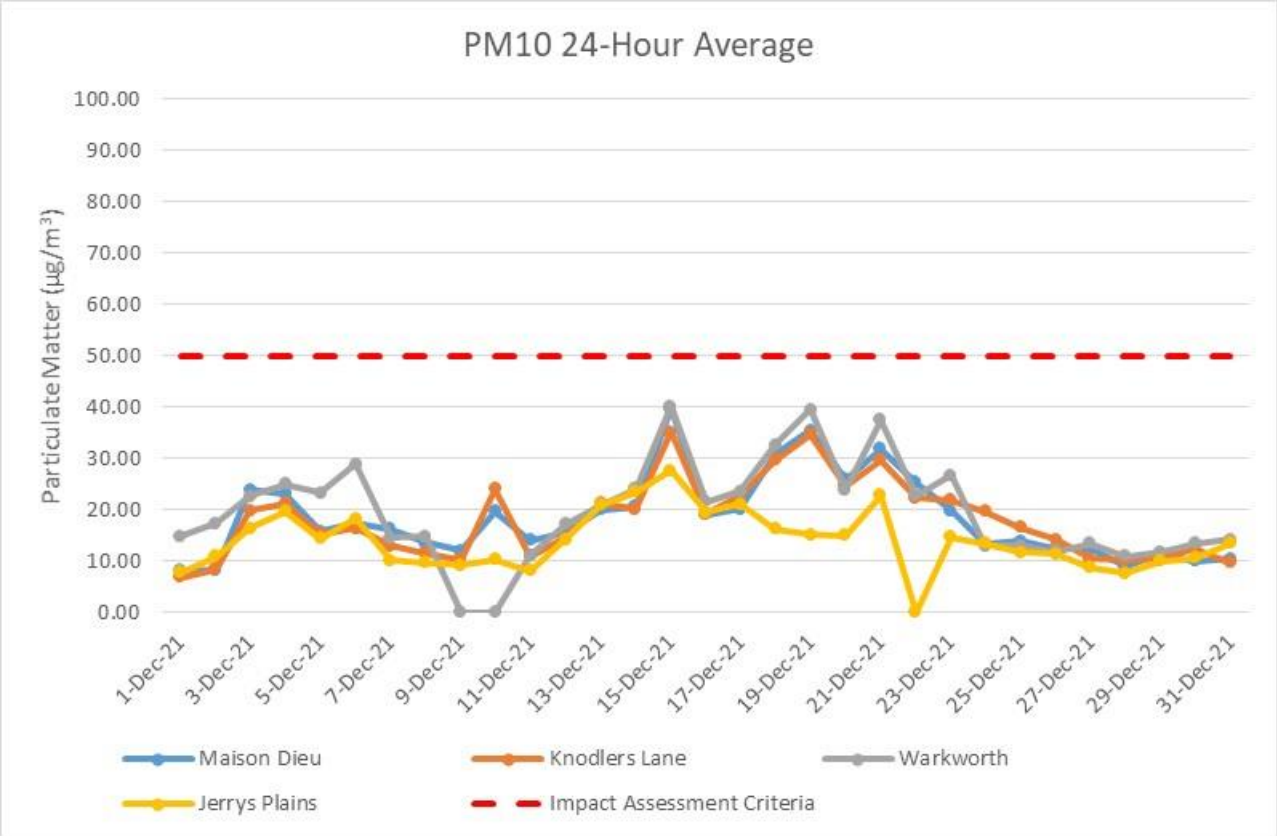


Figure 11 - Real Time PM_{10} 24hr for the Reporting Period

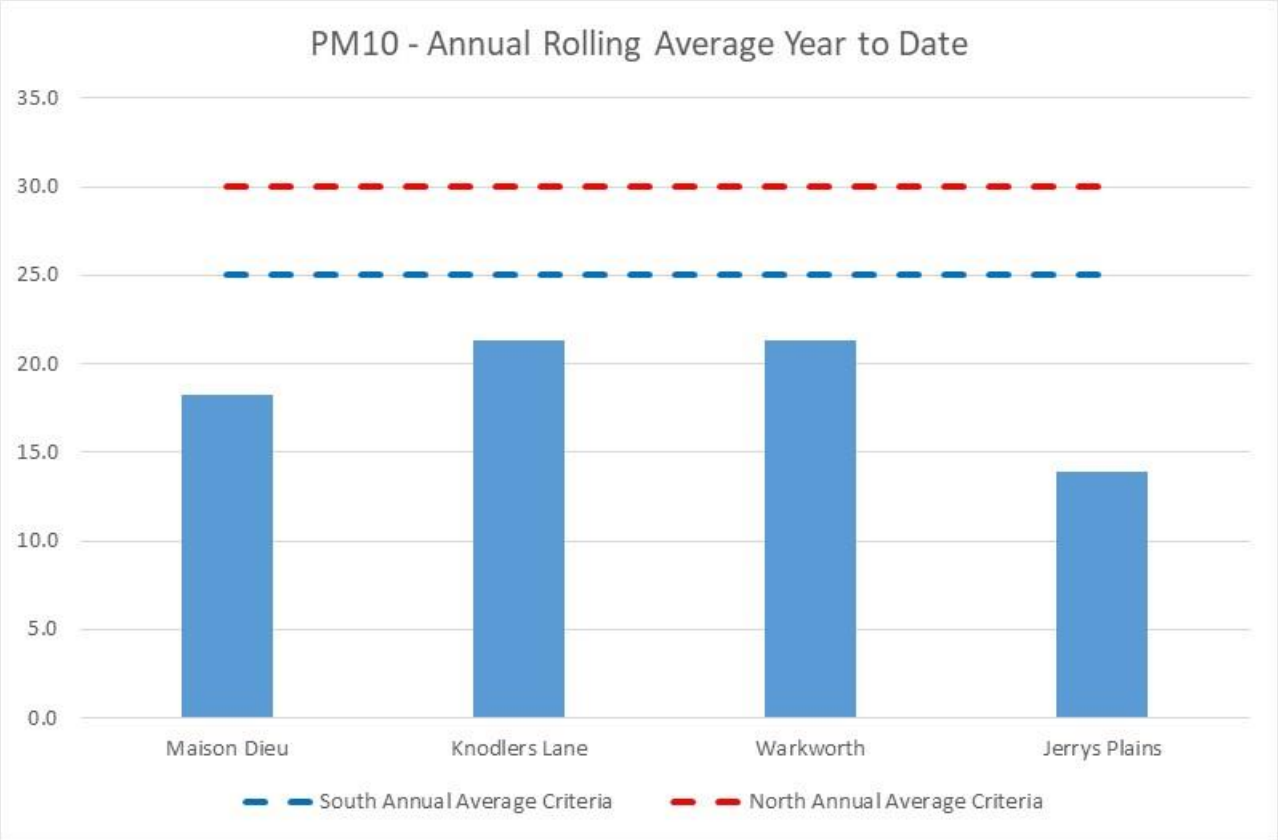


Figure 12 - Real Time PM_{10} Annual Average at the end of the Reporting Period

2.3.5 Real Time Alarms for Air Quality

The real time monitoring system generated 49 automated air quality related alarms during the reporting period. 42 alarms related to adverse weather conditions and 7 alarms related to dust conditions.

3 Water Quality

HVO maintains a network of surface water and groundwater monitoring sites.

3.1 Surface Water

Surface watercourses are sampled on a quarterly sampling regime. Water quality is assessed through the parameters of pH, electrical conductivity (EC) and Total Suspended Solids (TSS). The location of surface water monitoring points across HVO are shown in **Figure 13**.

Results from monitoring on site dams, the Hunter River and other natural tributaries are provided in **Figure 14** to **Figure 25**

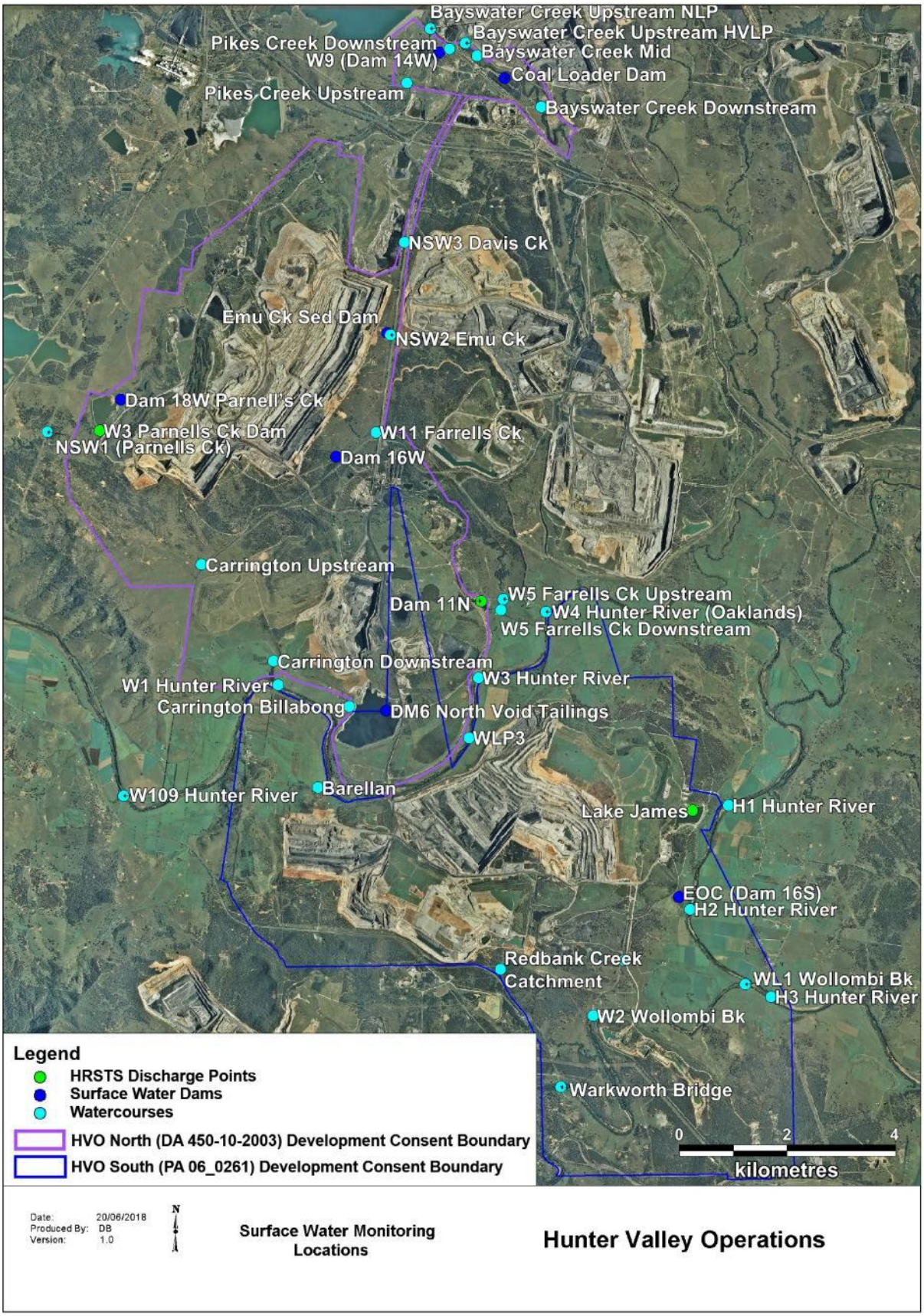


Figure 13 - HVO Surface Water Monitoring Locations

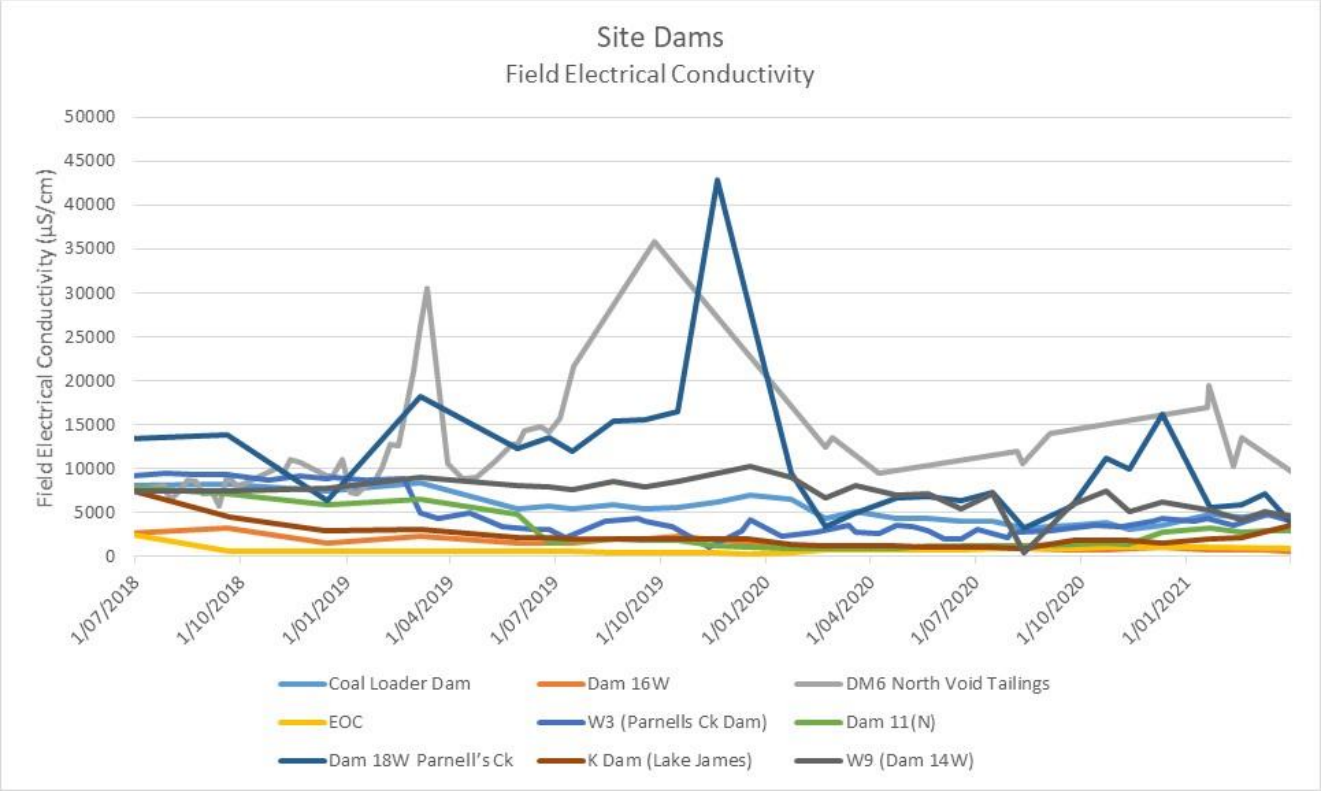


Figure 14 - Site Dams Electrical Conductivity – December 2021

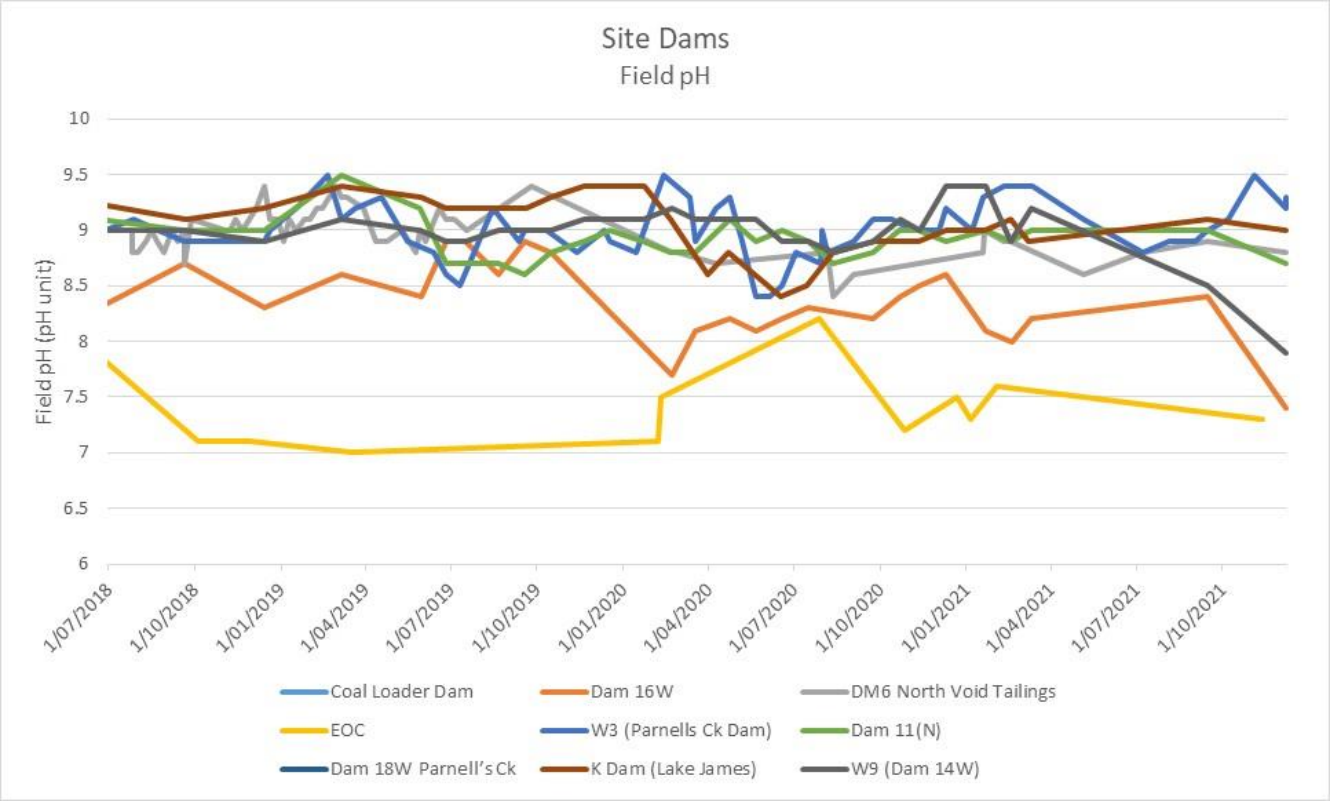


Figure 15 - Site Dams Field pH – December 2021

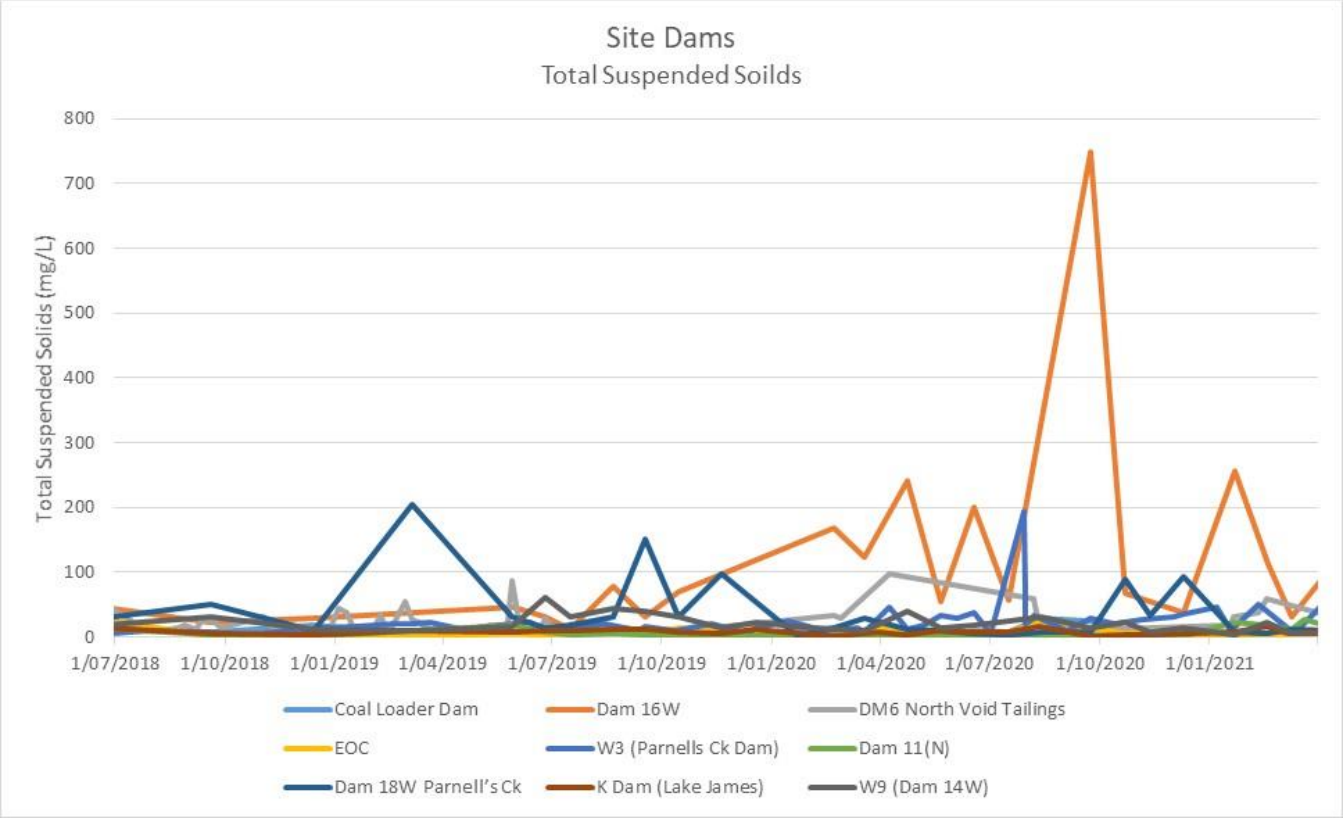


Figure 16 - Site Dams Total Suspended Solids - December 2021

Figure 17 - Wollombi Brook Electrical Conductivity – December 2021

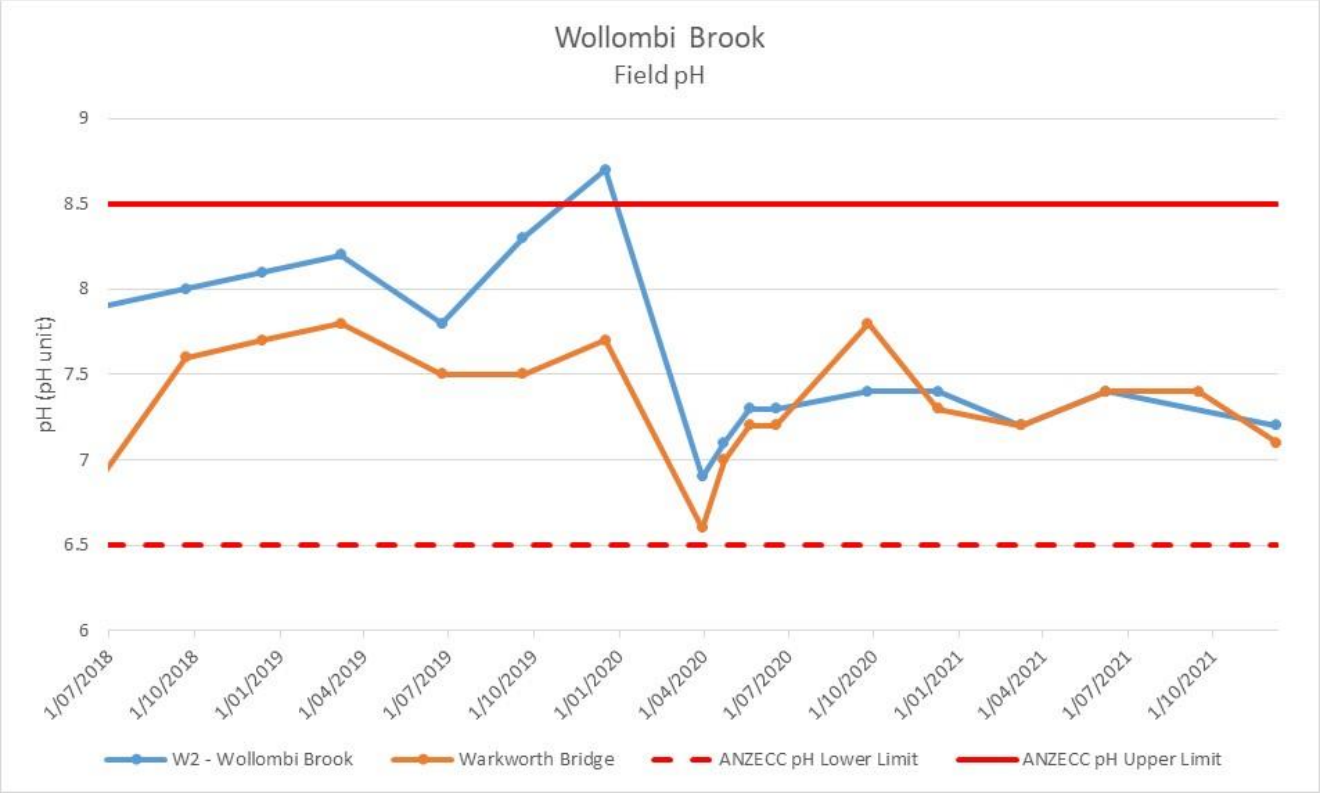


Figure 18 - Wollombi Brook Field pH – December 2021

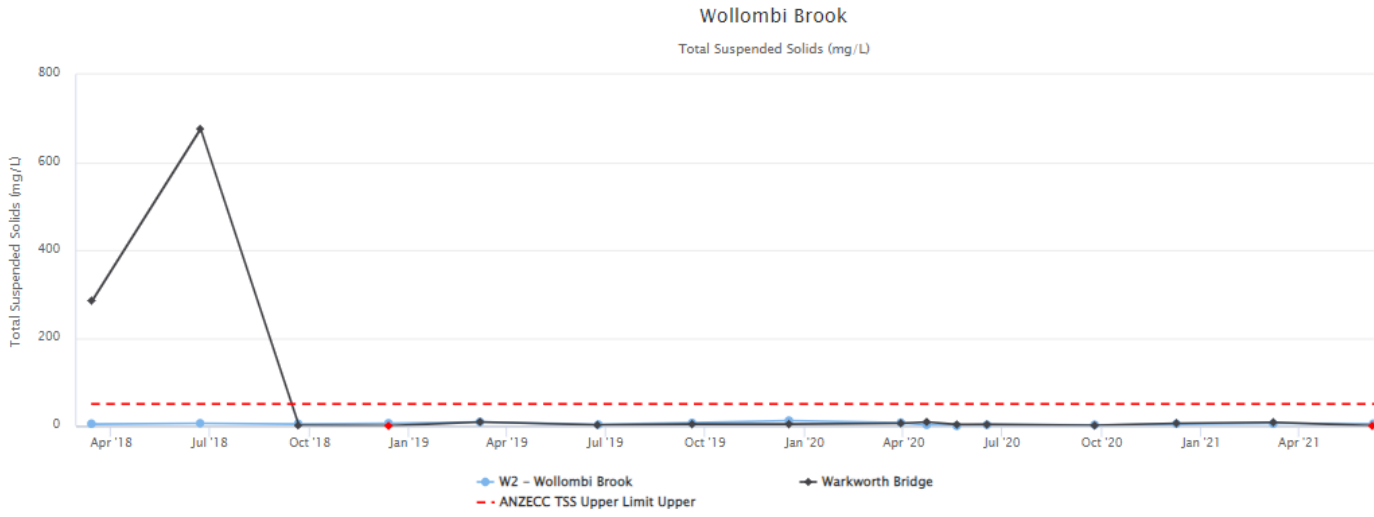


Figure 19 - Wollombi Brook Total Suspended Solids – December 2021

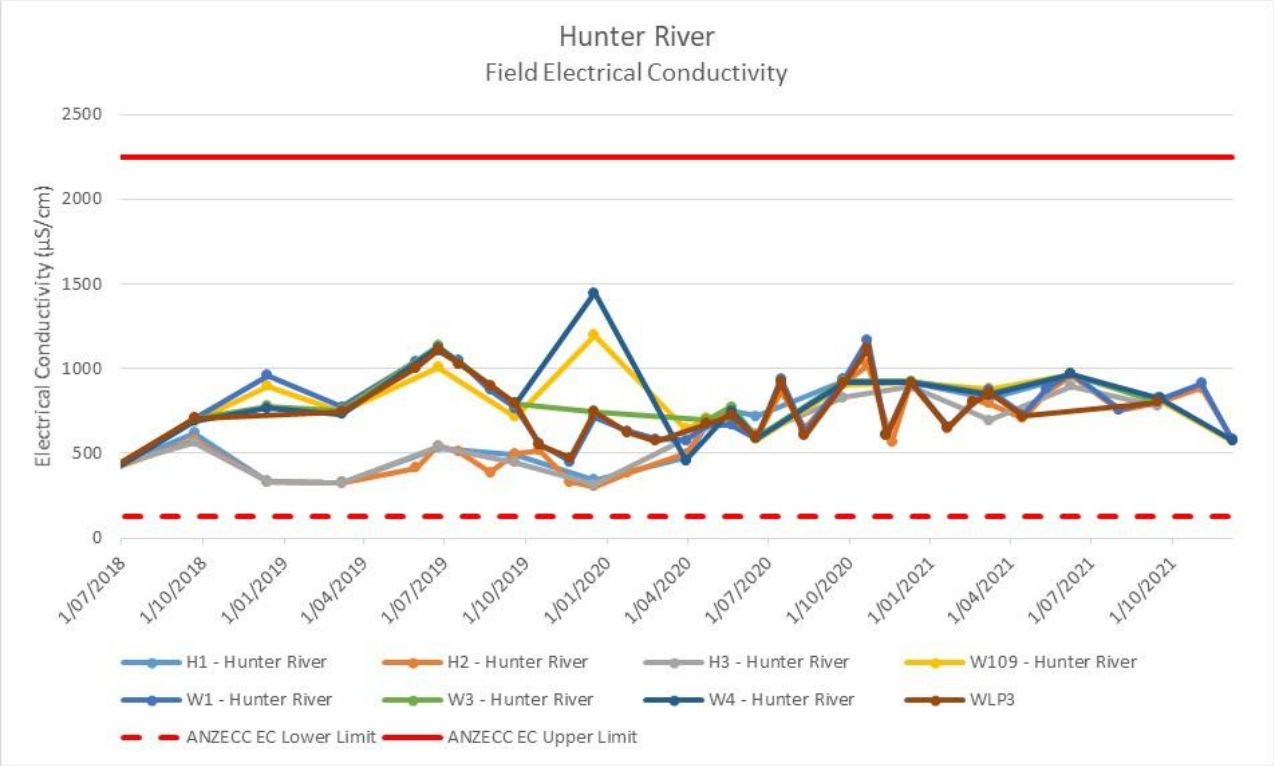


Figure 20 - Hunter River Electrical Conductivity - December 2021

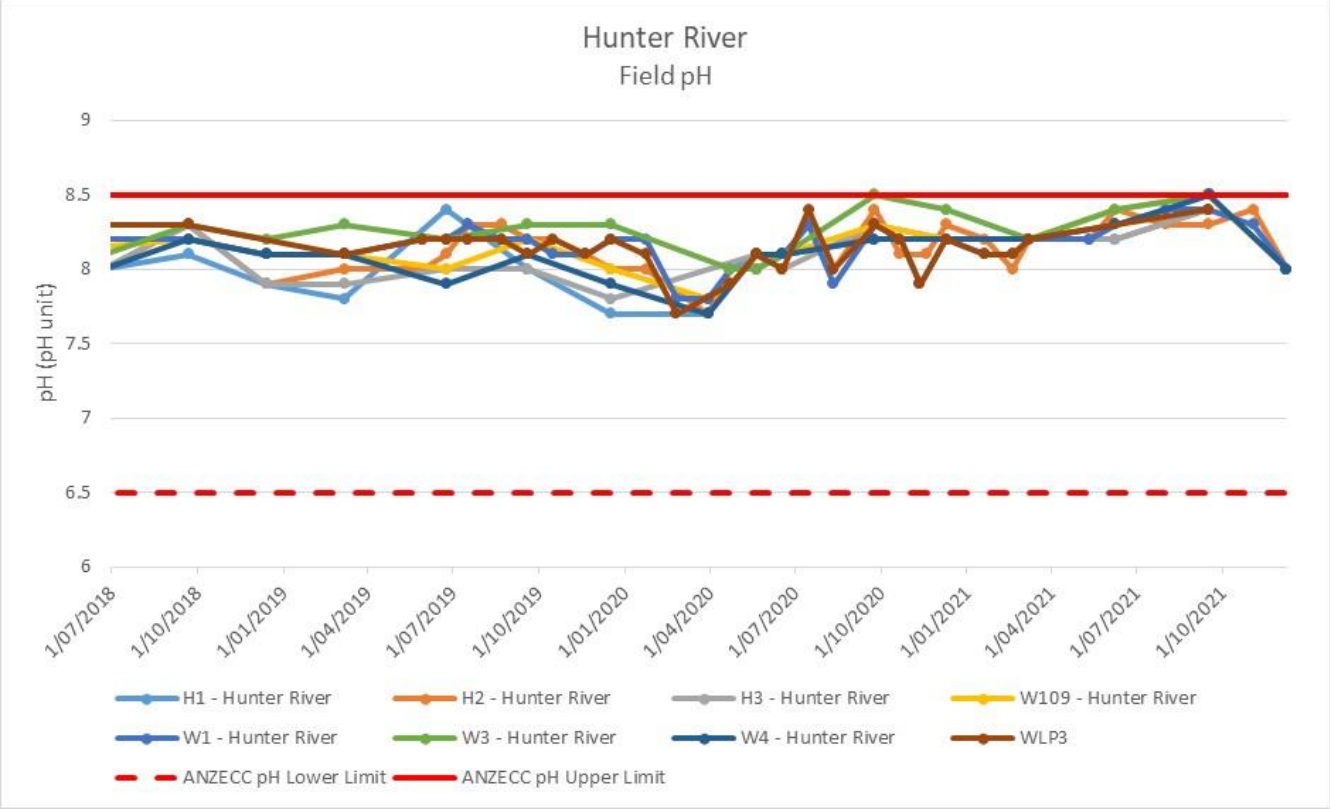


Figure 21 - Hunter River Field pH – December 2021

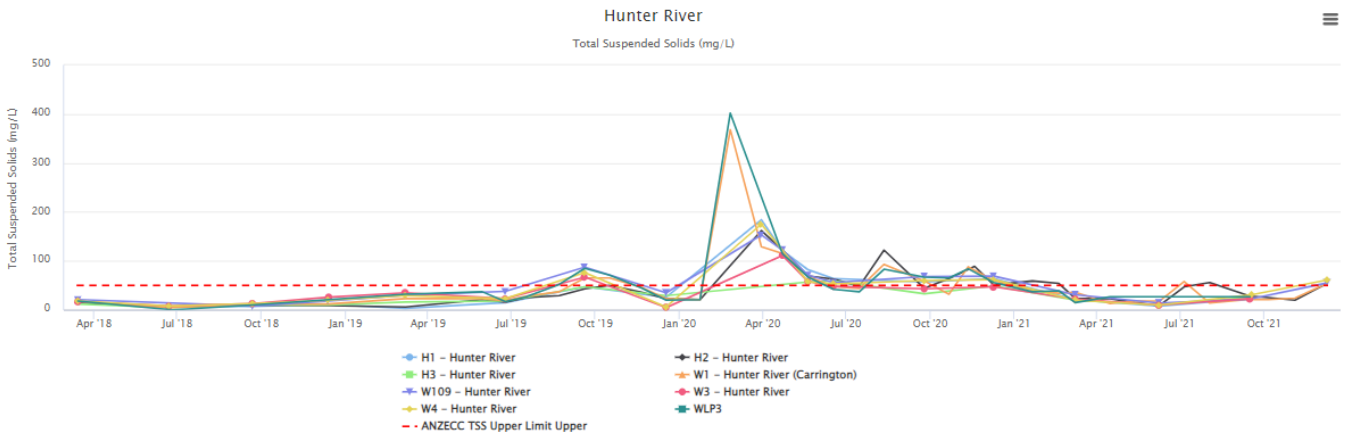


Figure 22 - Hunter River Total Suspended Solids - December 2021

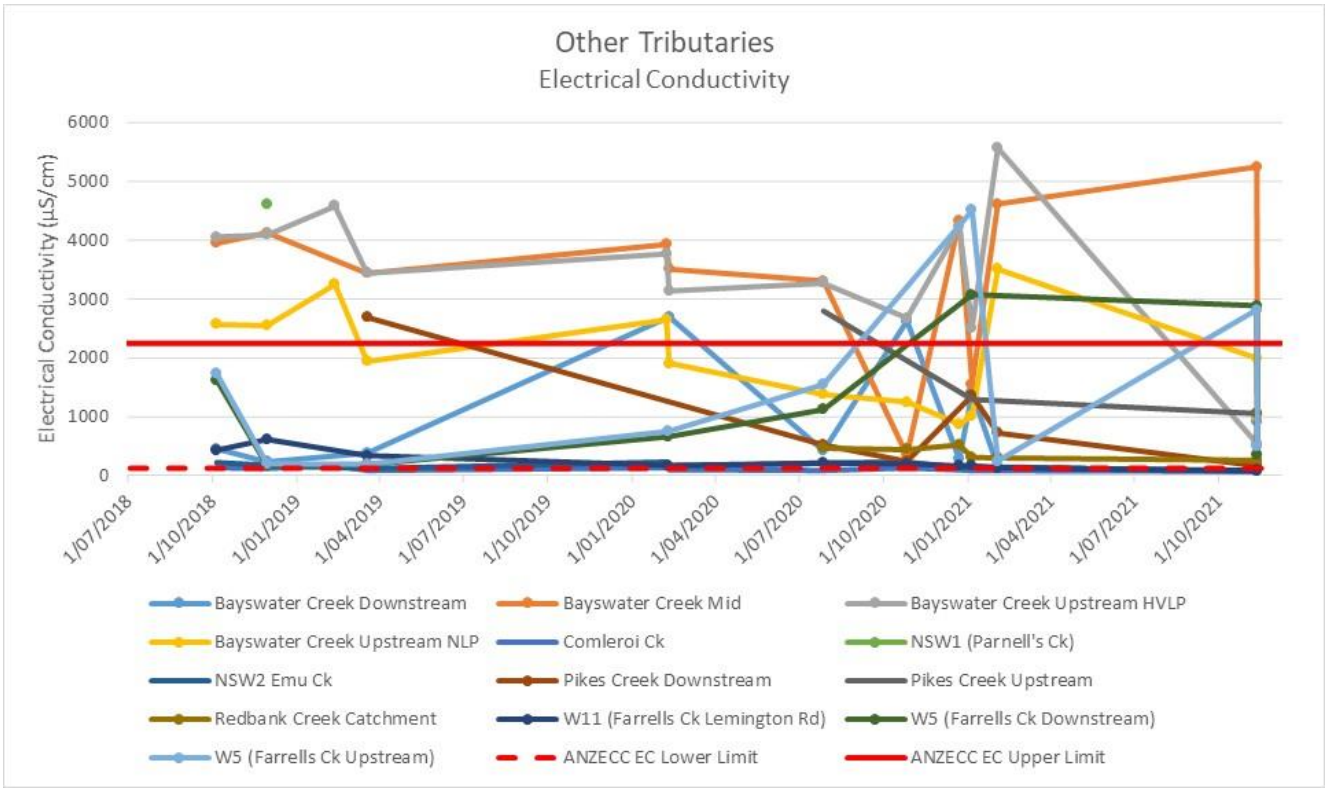


Figure 23 - Other Tributaries Electrical Conductivity - December 2021

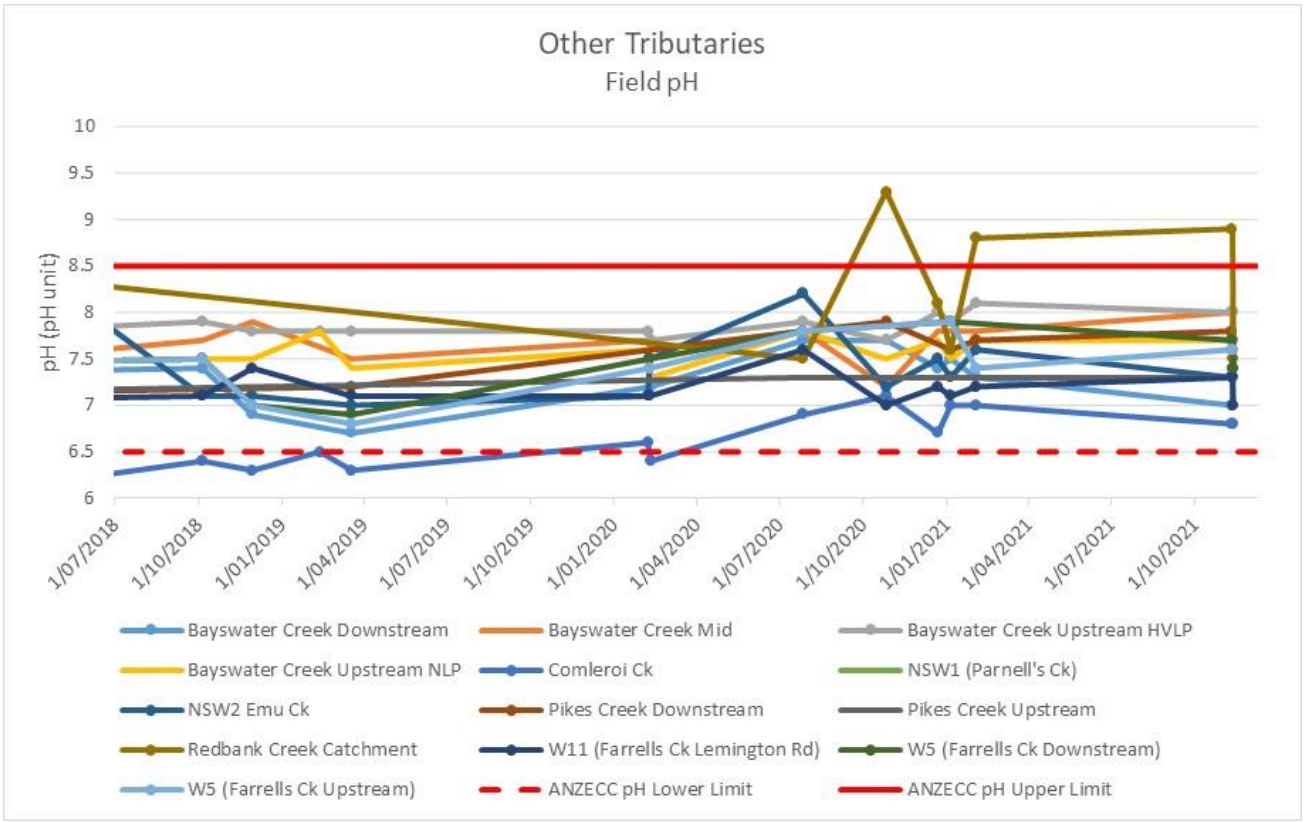


Figure 24 - Other Tributaries Field pH - December 2021

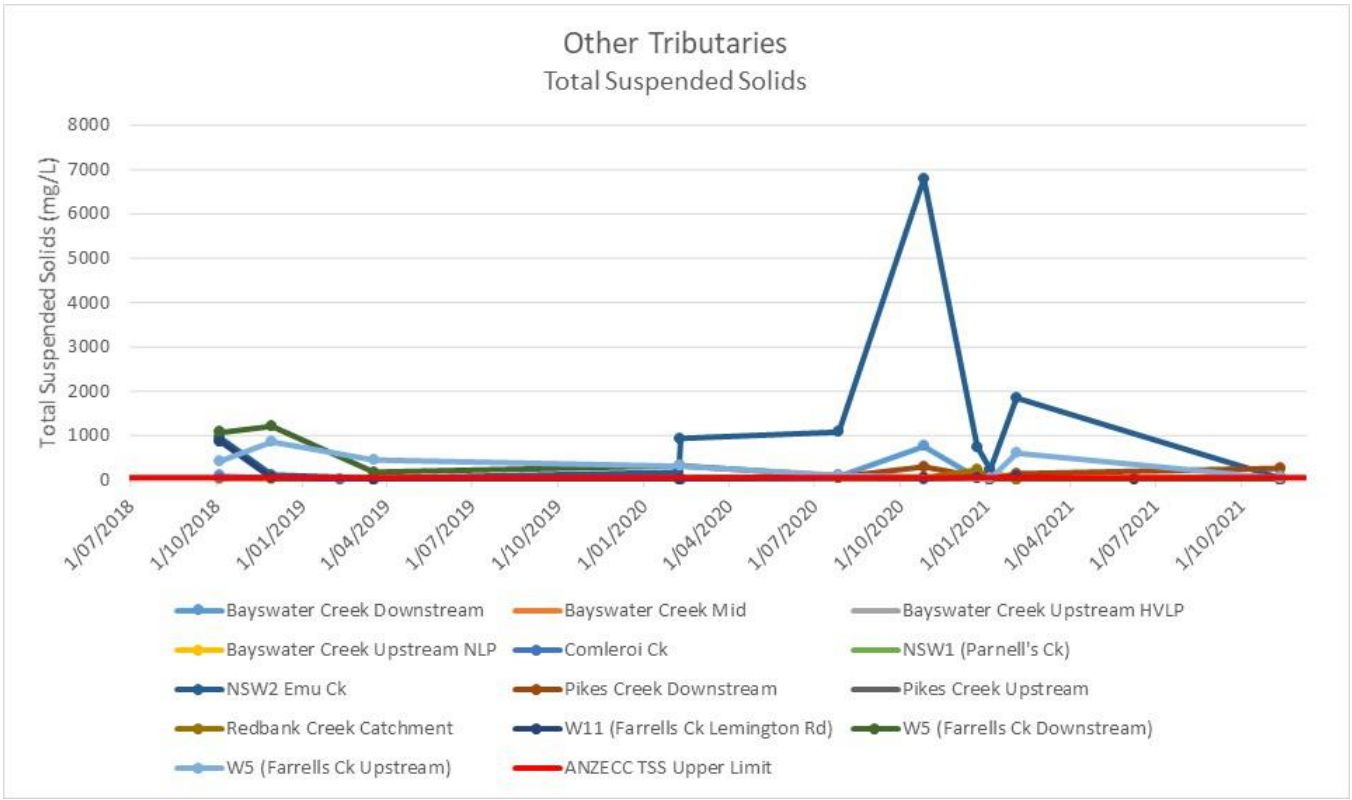


Figure 25 - Other Tributaries Total Suspended Solids - December 2021

3.1.1 Surface Water Trigger Tracking

Internal trigger limits have been developed to assess monitoring data on an on-going basis and to highlight potentially adverse surface water impacts. The process for evaluating monitoring results against the internal triggers and subsequent responses are outlined in the HVO Water Management Plan.

Surface water trigger tracking results are summarised in **Table 2** .

Table 2 - Surface Water Trigger Tracking – Q4 2021

Site	Date	Trigger Limit Breached	Response Action
Bayswater Creek Midstream	11/11/2021	EC	First consecutive trigger exceedance, Watching Brief*
Pikes Creek Downstream	11/11/2021	TSS	Second exceedance of TSS (264mg/L). Rain event sampling after 58mm of rain was recorded in the previous 24-hour period. Field observations indicate that the sample was taken from a pool of water as there was no visible flow in the creek line. Based on both of these factors, it can be assumed that the sample taken is not representative of flows in Pikes Creek and that there is no impact to suggest mining influence. The ephemeral nature of this monitoring location is the primary reason for considerable variation in physical water quality.
W11 (Farrells Ck Lemington Rd)	11/11/2021	TSS	Third exceedance of TSS (64mg/L). Rain event sampling after 58mm of rain was recorded in the previous 24-hour period. Field observations indicate that the sample was taken from an area of slow flow in the creek line. Based on both of these factors, it can be assumed that the sample taken is not representative of flows in Farrells Creek and that there is no impact to suggest mining influence. The ephemeral nature of this monitoring location is the primary reason for considerable variation in physical water quality
Bayswater Creek Midstream	12/11/2021	pH	First consecutive trigger exceedance, Watching Brief*
W11 (Farrells Ck Lemington Rd)	12/11/2021	pH	First consecutive trigger exceedance, Watching Brief*
H2 – Hunter River	8/12/2021	TSS	Fourth breach of TSS trigger (54mg/L). Field observations indicate that the water at the sample site was slightly turbid when the sample was taken. H2 is a downstream surface water monitoring location. Water monitoring indicates that water quality is consistent with upstream

			results at W109 (55mg/L) and W1 (54mg/L) and the water quality expected in the Hunter River following rainfall in the 24 hours preceding monitoring. No evidence to suggest elevated TSS is associated with mining influence.
W109 – Hunter River	8/12/2021	TSS	First breach of TSS trigger (55mg/L). Field observations indicate that the water at the sample site slightly turbid when the sample was taken. W109 is an upstream surface water monitoring location. Results are generally consistent with observations and water quality expected in the Hunter River following rainfall in the 24 hours preceding monitoring. No evidence to suggest elevated TSS is associated with mining influence.
W1 - Hunter River	8/12/2021	TSS	Second breach of TSS trigger (54mg/L). Field observations indicate that the water at the sample site was slightly turbid when the sample was taken. W1 is an upstream surface water monitoring. Water monitoring indicates that water quality is consistent with upstream (W109 – 55mg/L) and downstream (H2 – 54mg/L) results and the water quality expected in the Hunter River following rainfall in the 24 hours preceding monitoring. No evidence to suggest elevated TSS is associated with mining influence.
W4- Hunter River	8/12/2021	TSS	First breach of TSS trigger (61mg/L). Field observations indicate that the water at the sample site was slightly turbid when the sample was taken. W4 is a downstream surface water monitoring location. Water monitoring indicates that water quality is consistent with upstream (W109 – 55mg/L) and downstream (H2 – 54mg/L) results and the water quality expected in the Hunter River following rainfall in the 24 hours preceding monitoring. No evidence to suggest elevated TSS is associated with mining influence.

3.2 Site Water Use

HVO is permitted to extract water from the Hunter River under water allocation licenses issued by Water NSW.

HVO did not extract water from the Hunter River during the reporting period.

3.3 HRSTS Discharge

HVO participates in the Hunter River Salinity Trading Scheme (HRSTS), allowing discharge from licensed discharge points Dam 11N (to Farrell's Creek), Lake James (to the Hunter River) and Parnell's Dam (to Parnell's Creek). Discharges can only take place subject to HRSTS regulations.

HVO discharged 350ML under the HRSTS during the reporting period.

3.4 Groundwater Monitoring Results

Groundwater monitoring is undertaken on a quarterly basis in accordance with the HVO Water Management Plan and Groundwater Monitoring Program. The location of groundwater monitoring points across HVO are show in **Figure 26.**

Groundwater monitoring results are provided in **Figure 27** to **Figure 80**

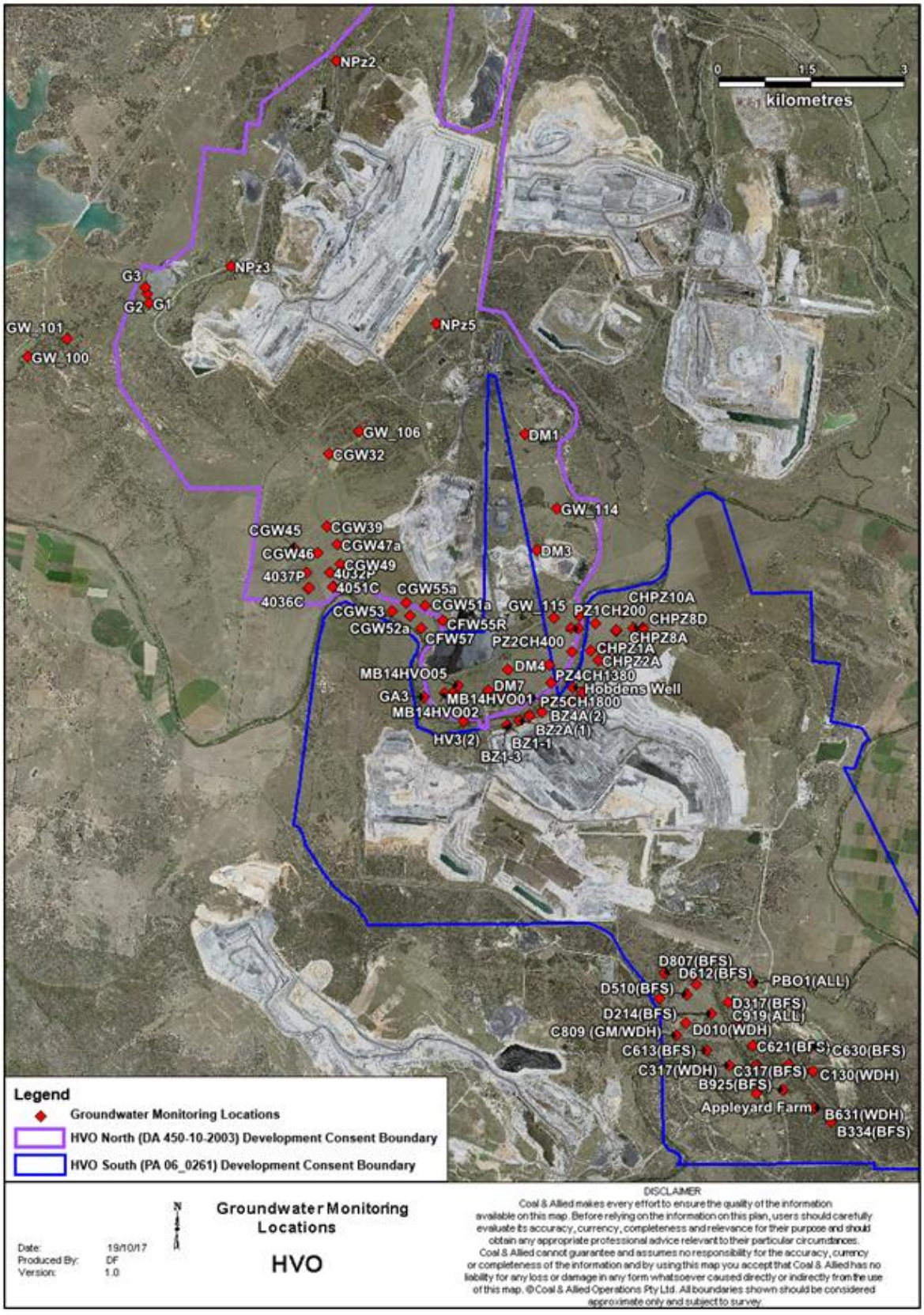


Figure 26 Groundwater monitoring Locations at HVO

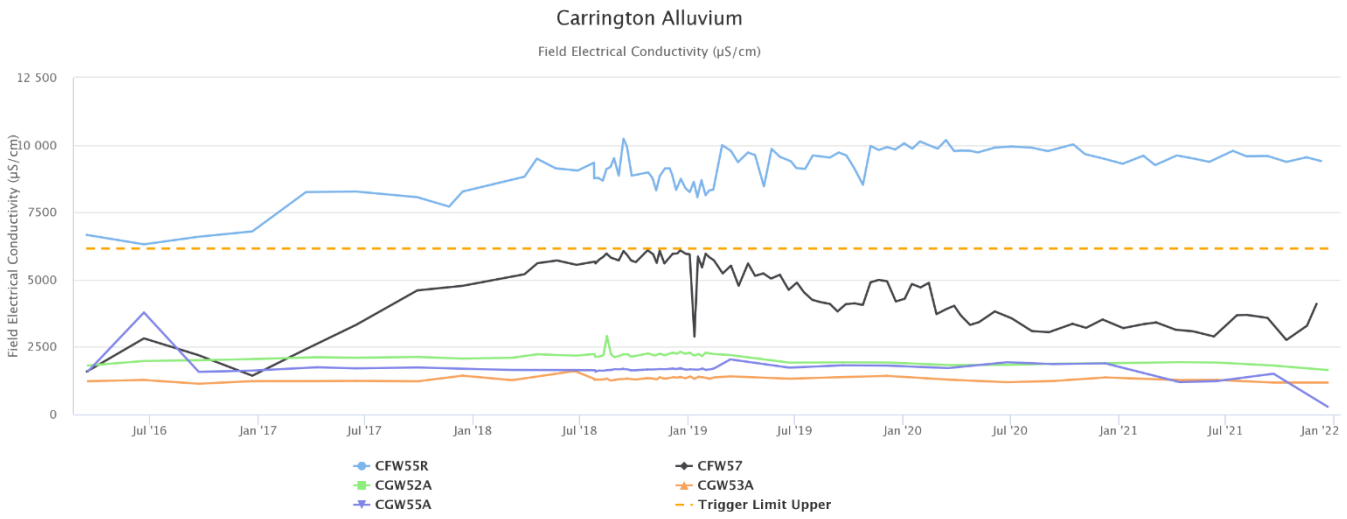


Figure 27 - Carrington Alluvium Electrical Conductivity Trend – Q4 2021

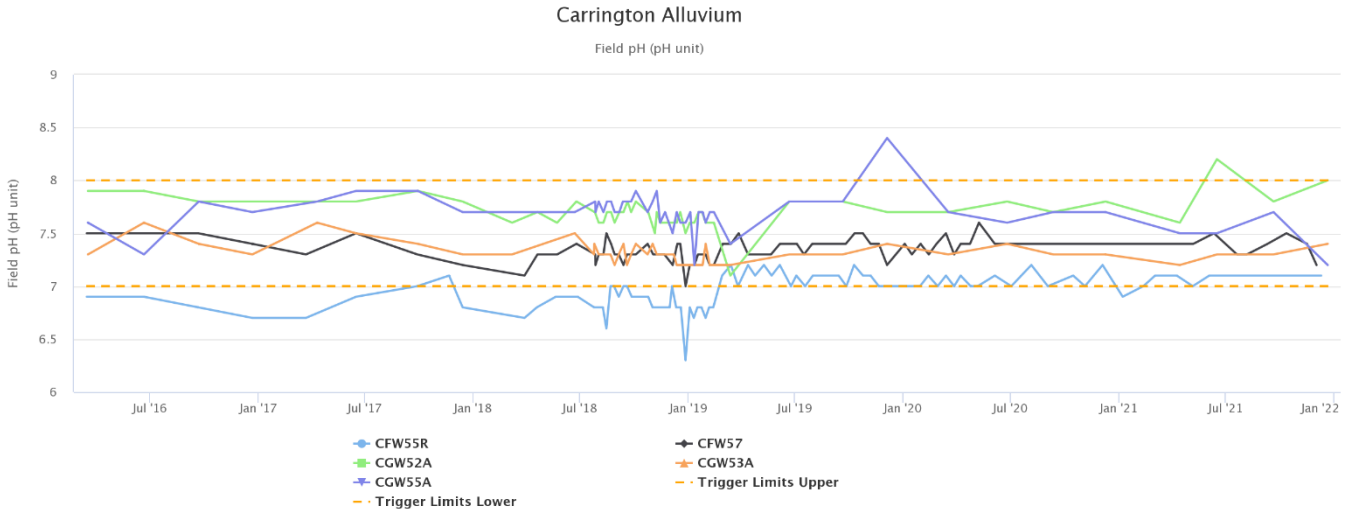


Figure 28 - Carrington Alluvium Field pH Trend – Q4 2021

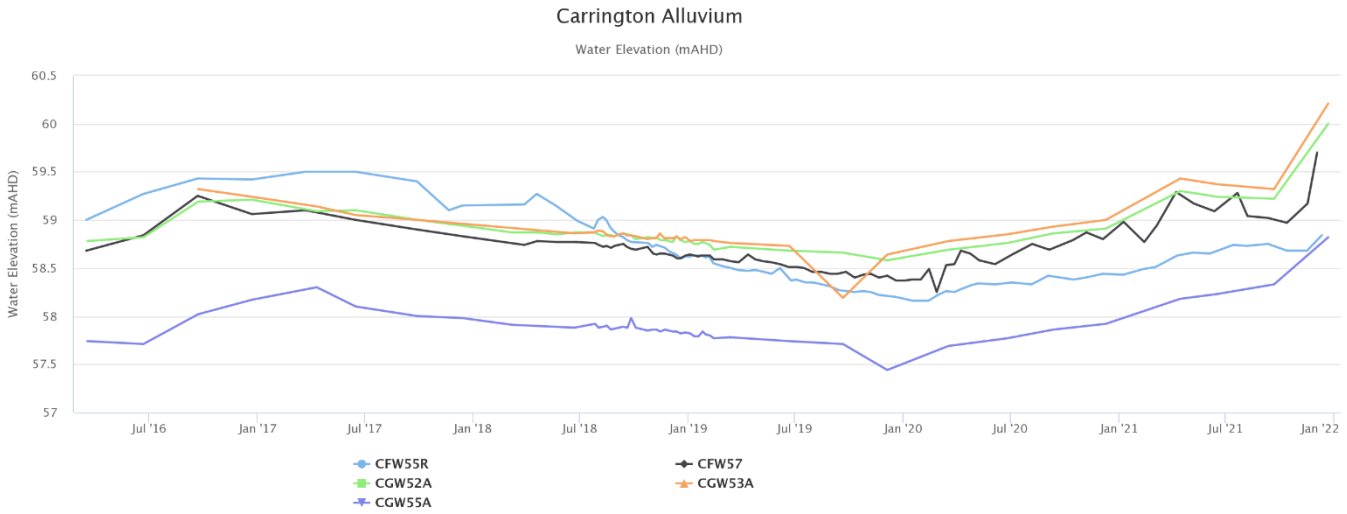


Figure 29 - Carrington Alluvium Water Elevation Trend – Q4 2021

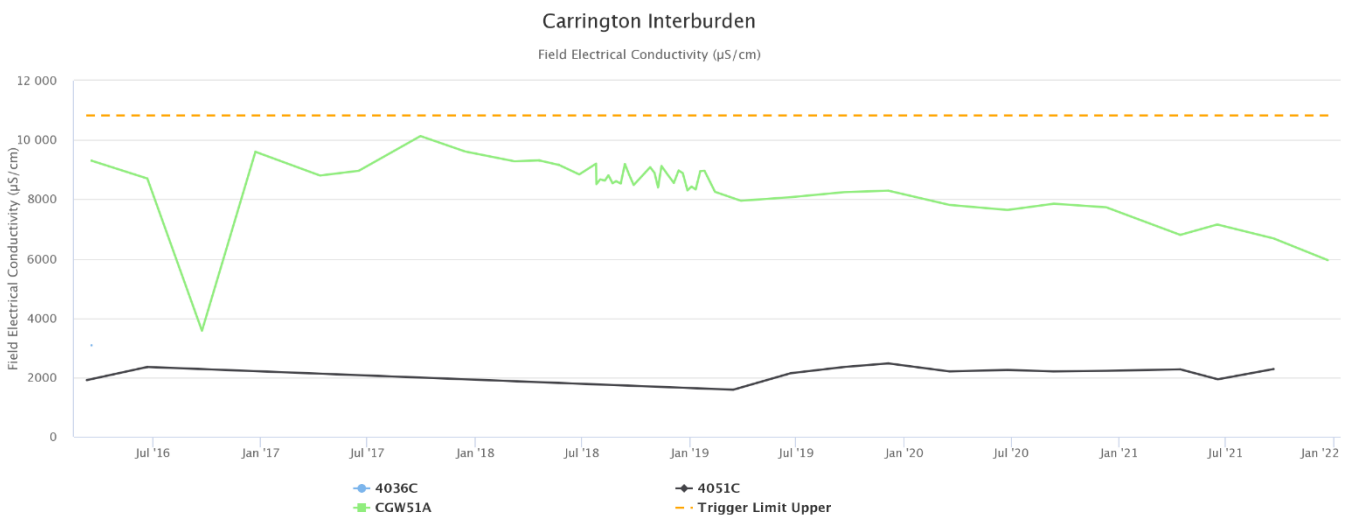


Figure 30 - Carrington Interburden Electrical Conductivity Trend – Q4 2021

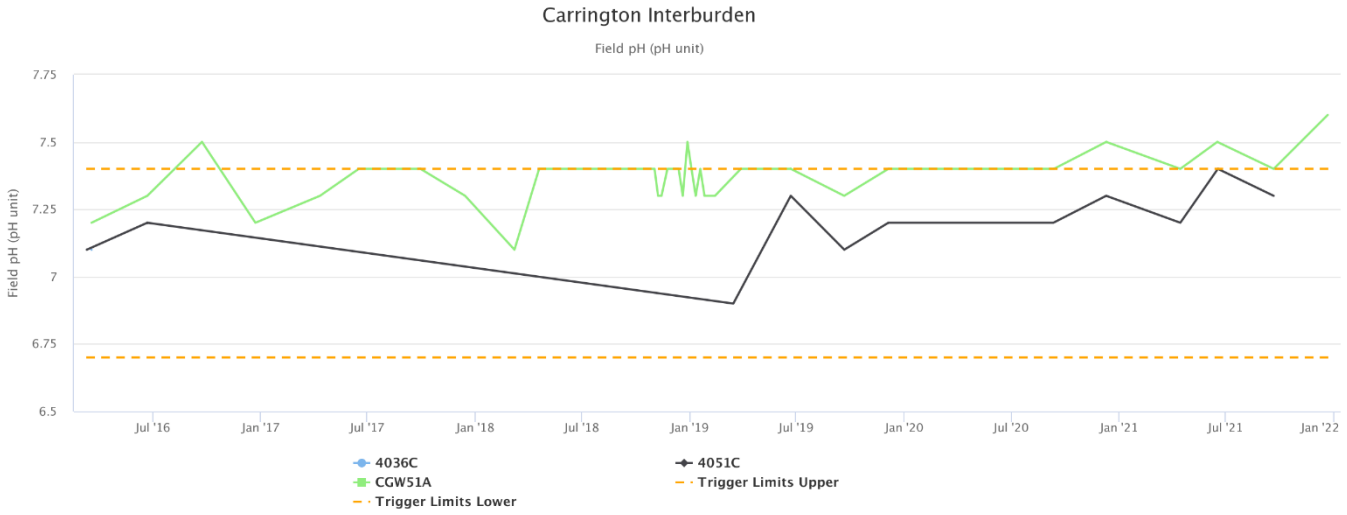
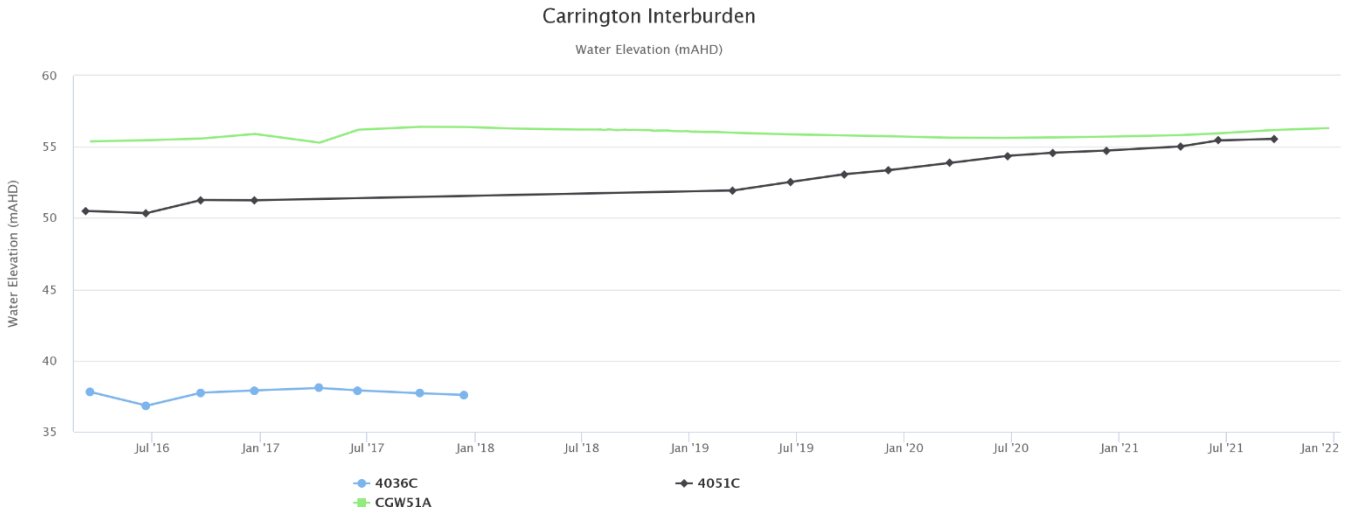


Figure 31 - Carrington Interburden Field pH Trend – Q4 2021



** 4036C had insufficient water for sampling*

Figure 32 - Carrington Interburden Water Elevation Trend – Q4 2021

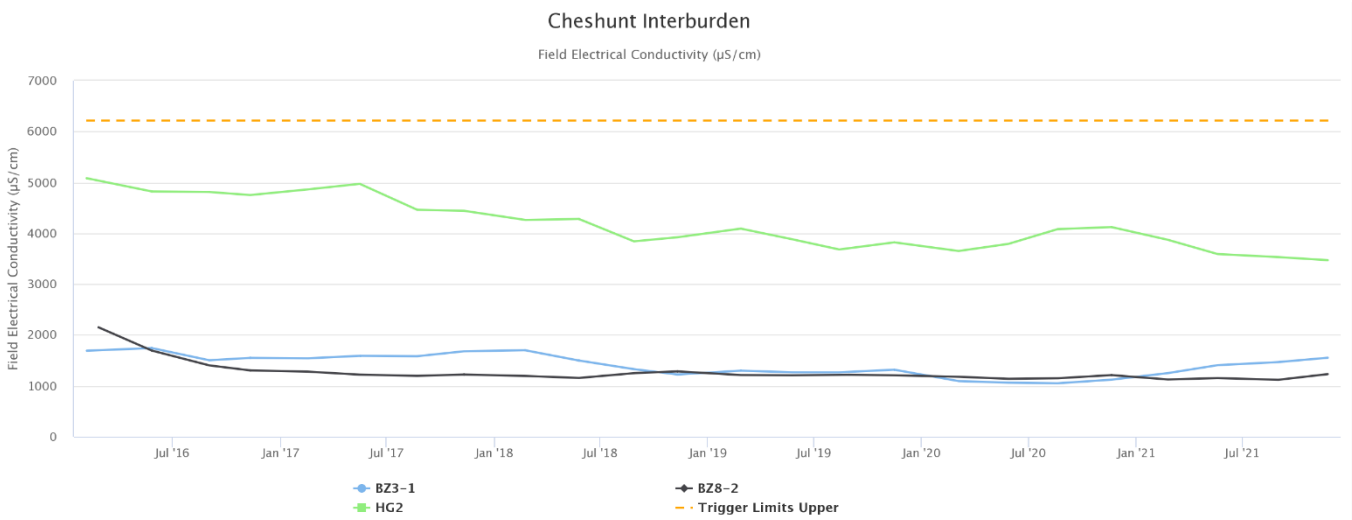


Figure 33 - Cheshunt Interburden Electrical Conductivity Trend – Q4 2021

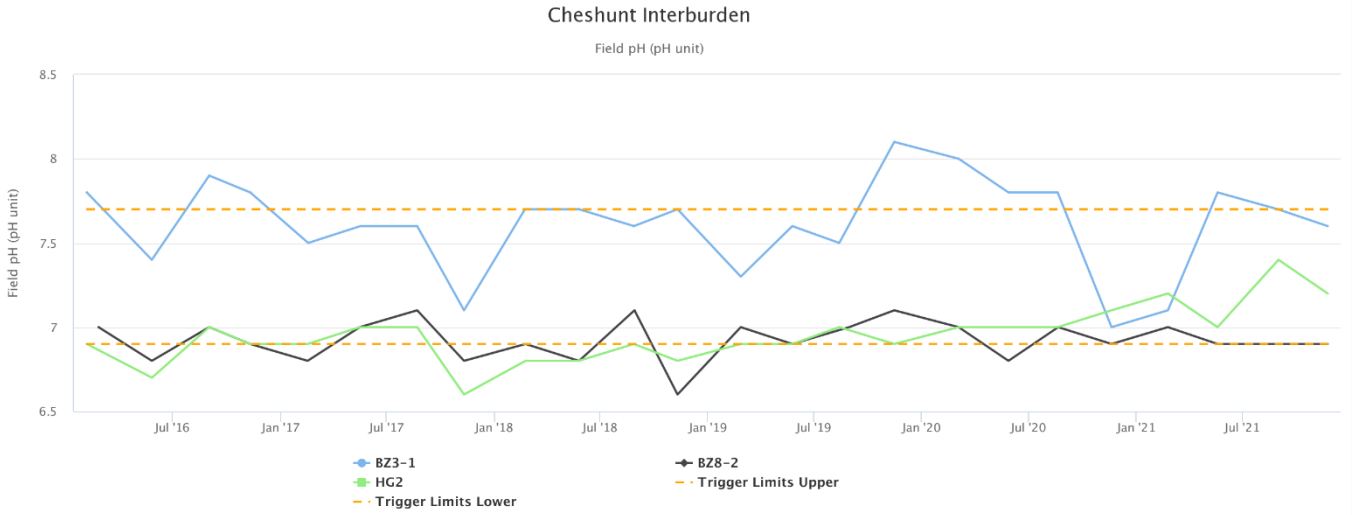


Figure 34 - Cheshunt Interburden Field pH Trend – Q4 2021

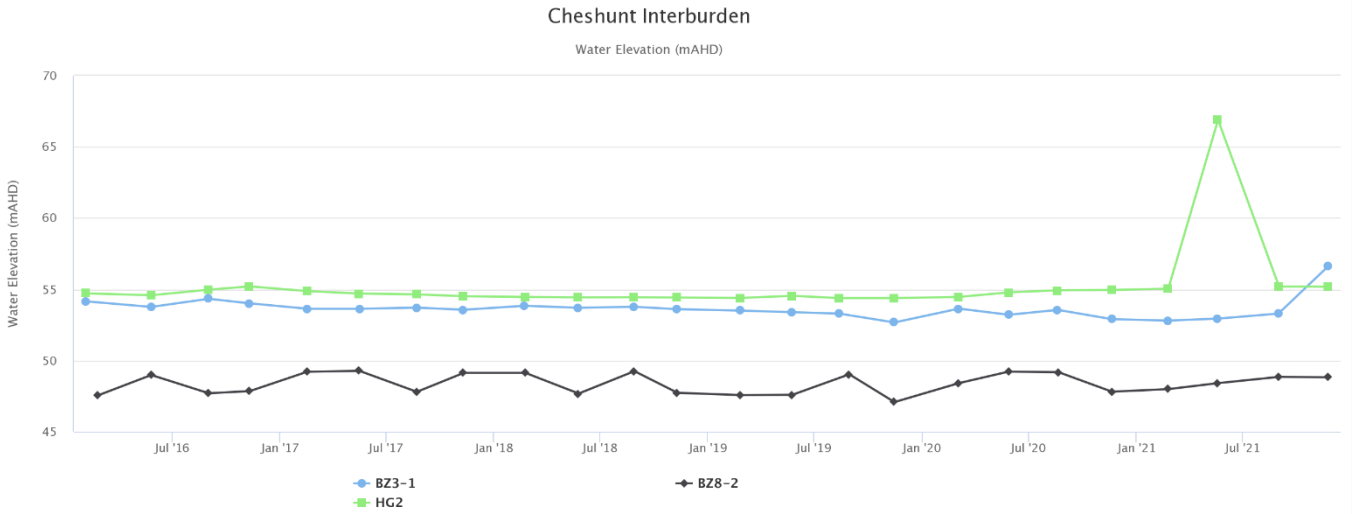


Figure 35 – Cheshunt Interburden Water Elevation Trend – Q4 2021

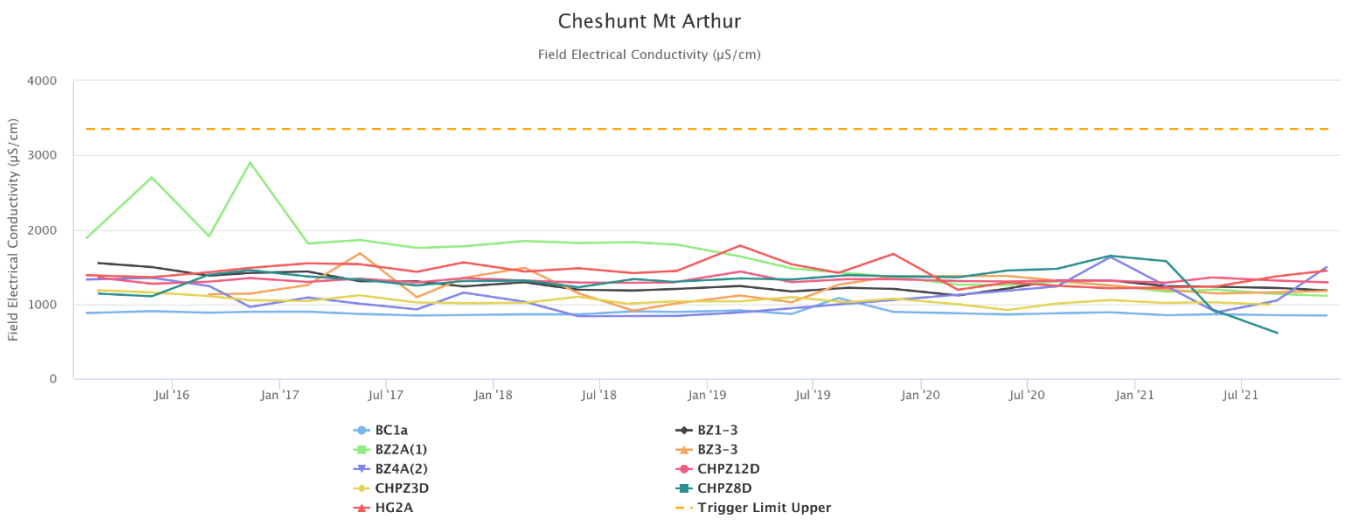


Figure 36 - Cheshunt Mt Arthur Electrical Conductivity Trend – Q4 2021

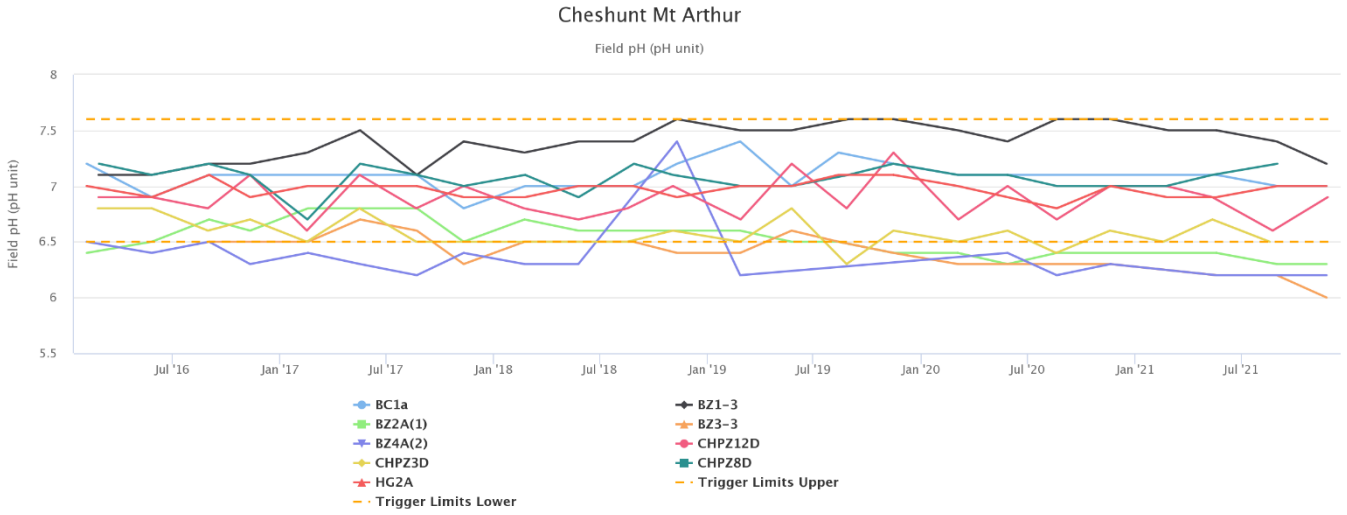


Figure 37 - Cheshunt Mt Arthur Field pH Trend - Q4 2021

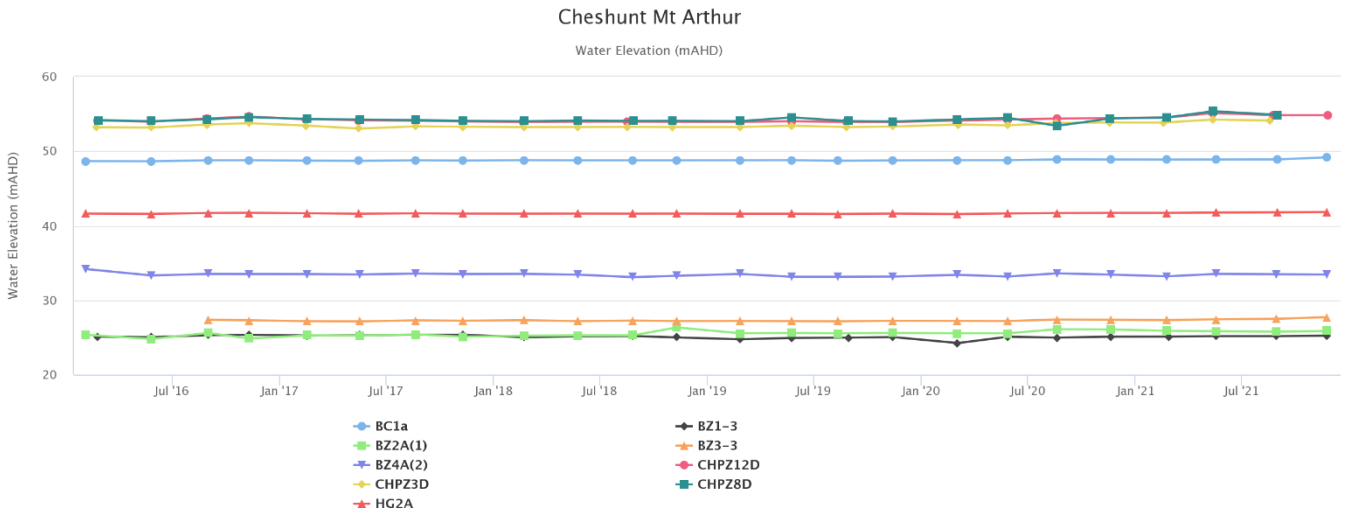


Figure 38 - Cheshunt Mt Arthur Water Elevation Trend – Q4 2021

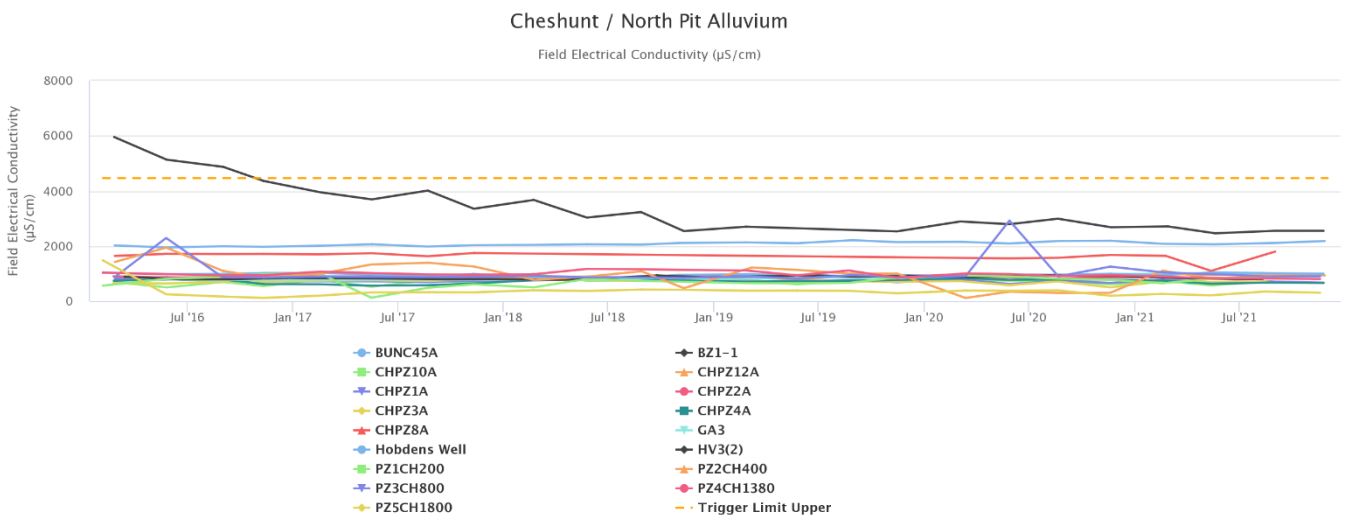


Figure 39 - Cheshunt North Pit Alluvium Electrical Conductivity Trend – Q4 2021

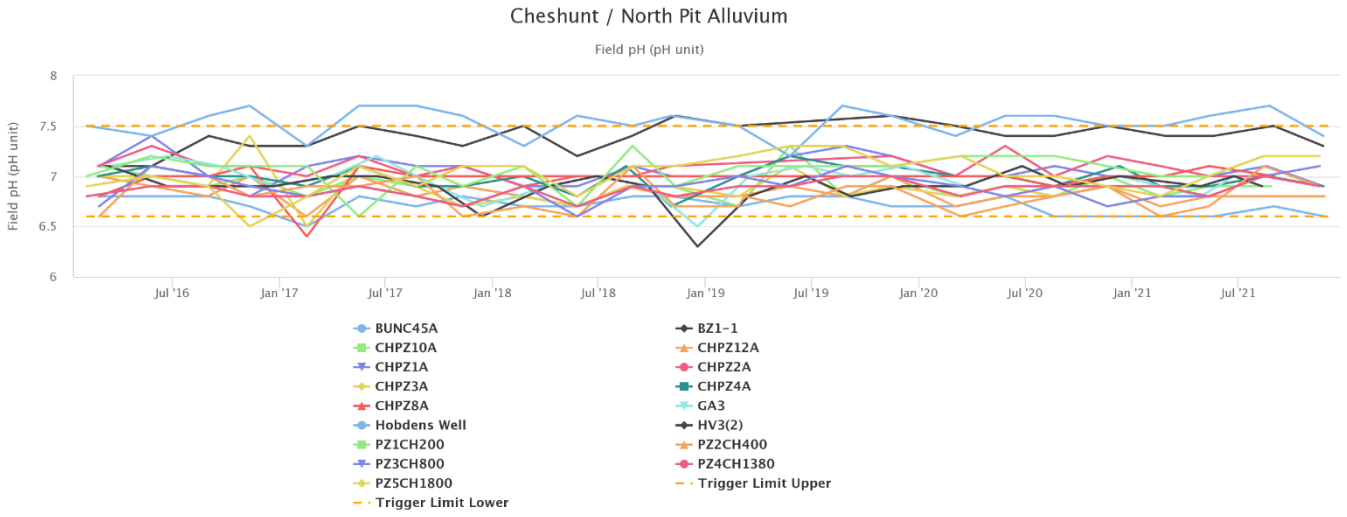


Figure 40 - Cheshunt North Pit Alluvium Field pH Trend – Q4 2021

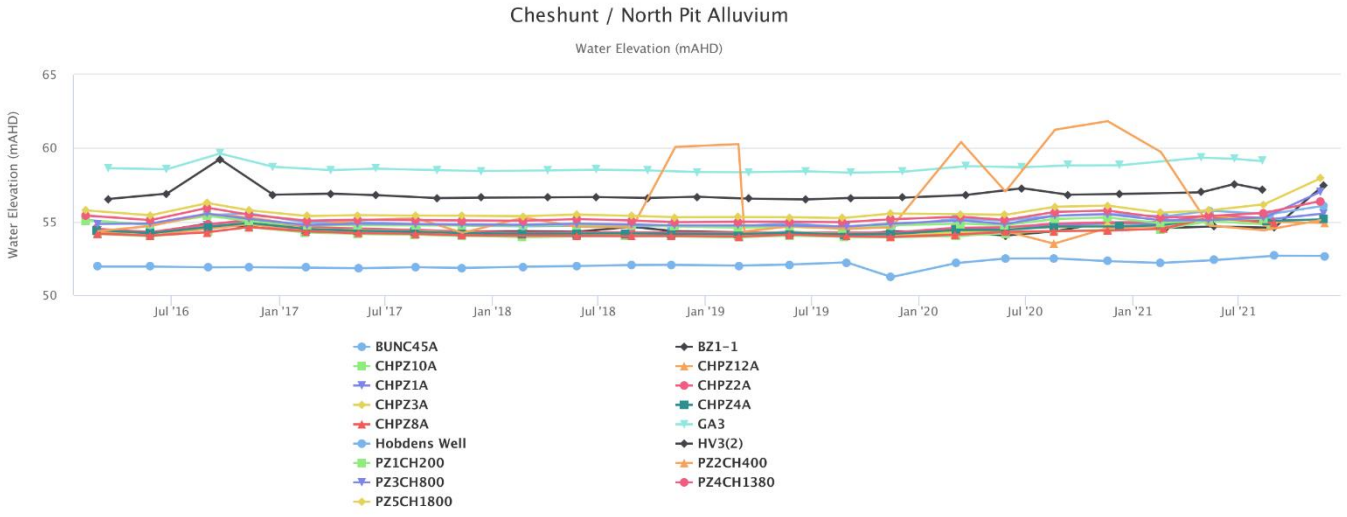


Figure 41 - Cheshunt North Pit Alluvium Water Elevation Trend – Q4 2021

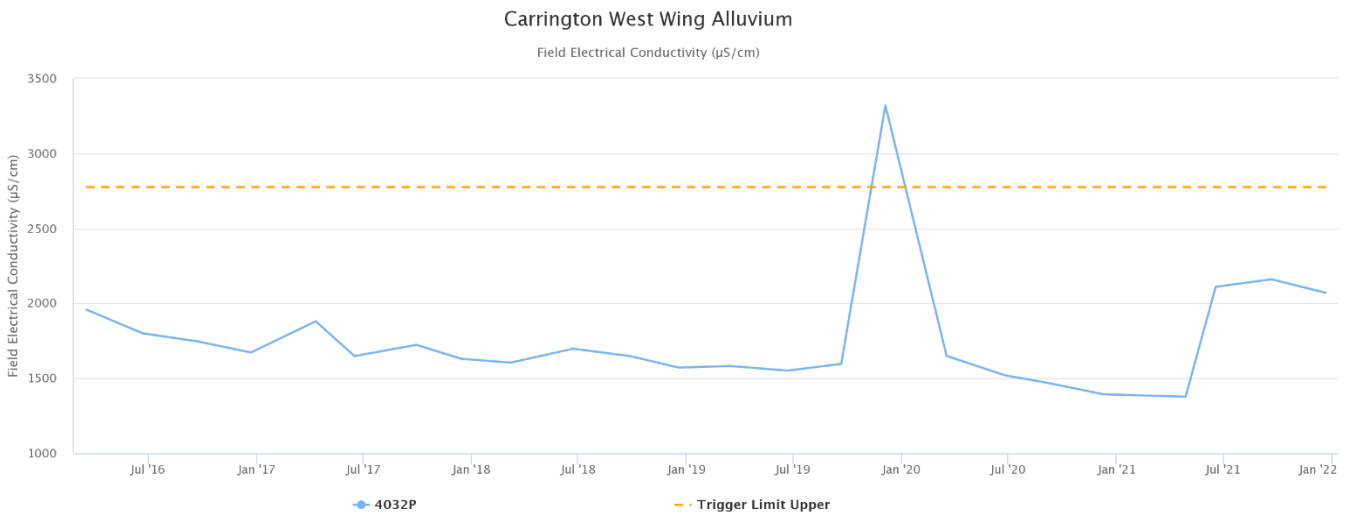


Figure 42 - Carrington West Wing Alluvium Electrical Conductivity Trend – Q4 2021

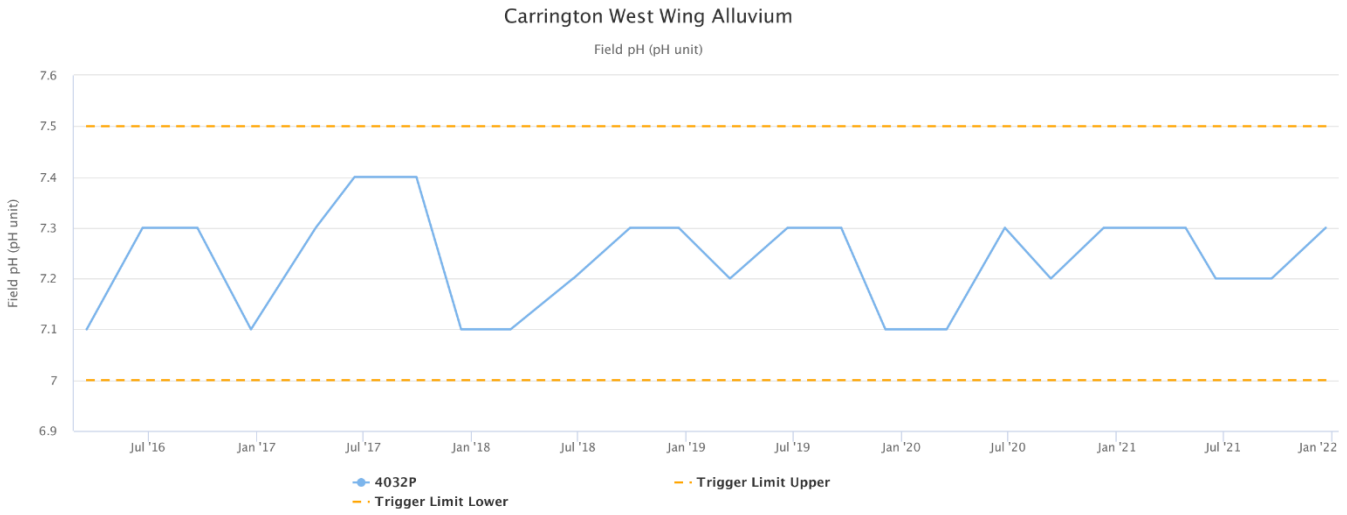


Figure 43 - Carrington West Wing Alluvium Field Ph Trend – Q4 2021

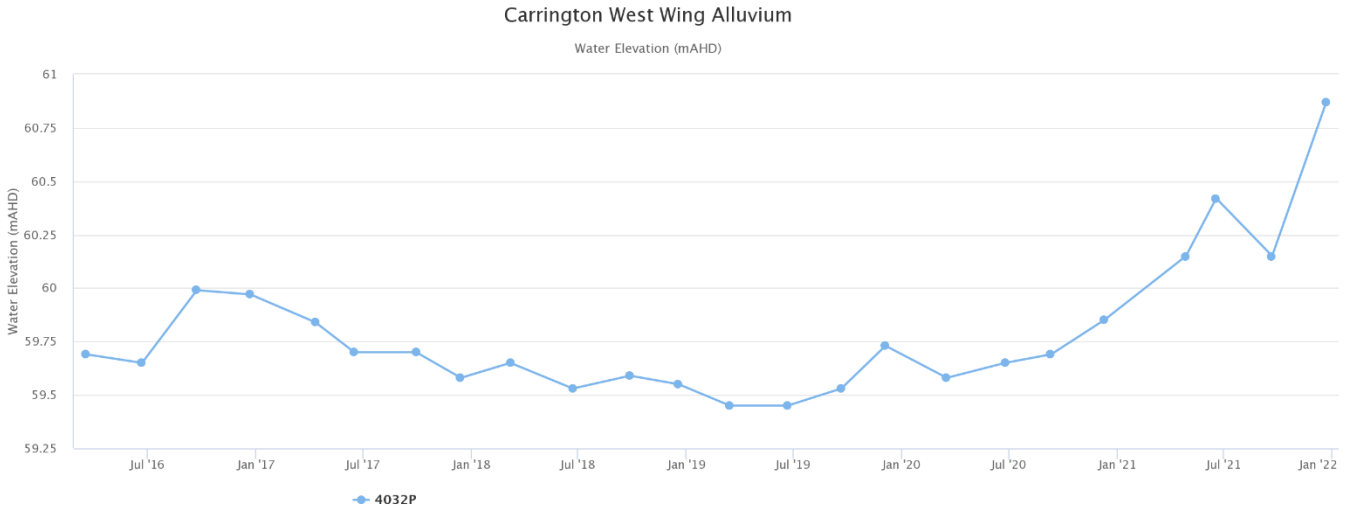


Figure 44 - Carrington West Wing Alluvium Water Elevation Trend – Q4 2021

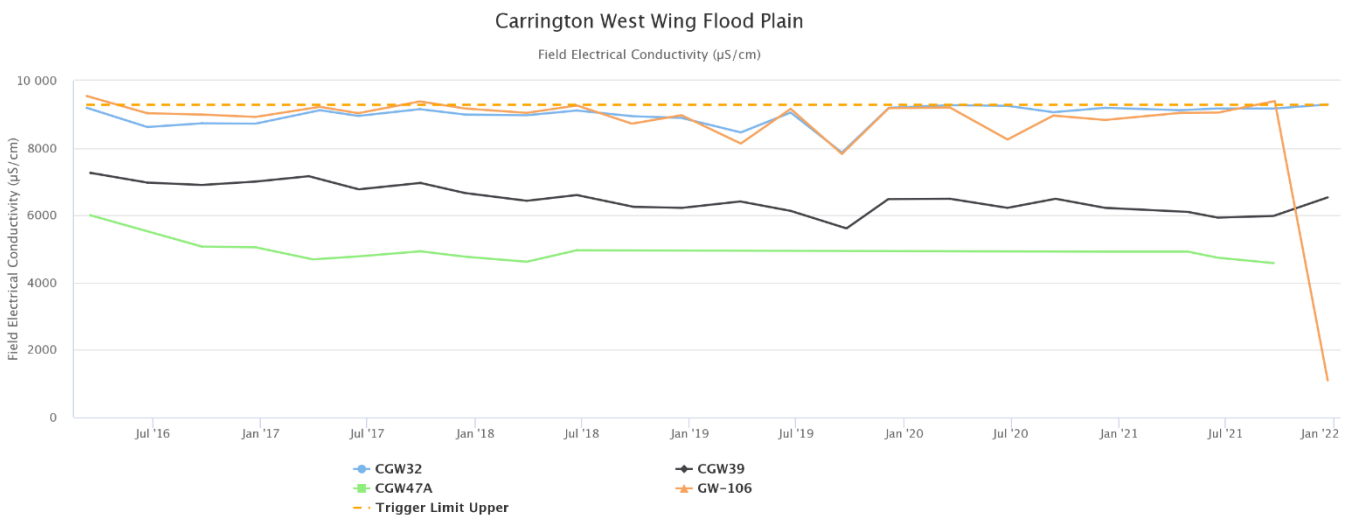


Figure 45 - Carrington West Wing Flood Plain Electrical Conductivity trend – Q4 2021

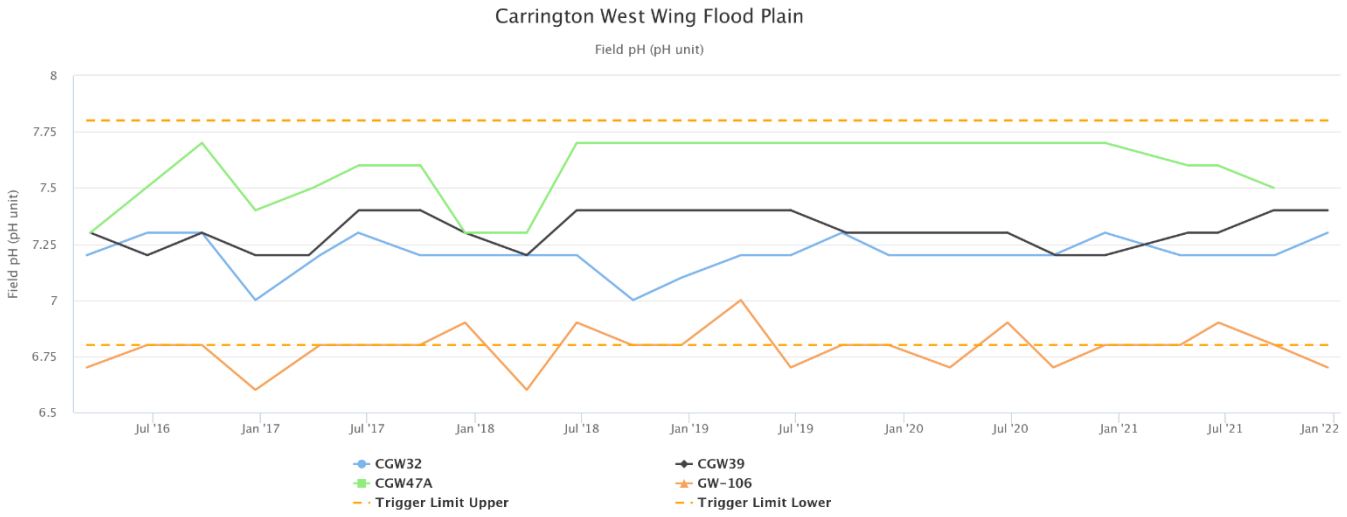


Figure 46 - Carrington West Wing Flood Plain Field pH Trend – Q4 2021

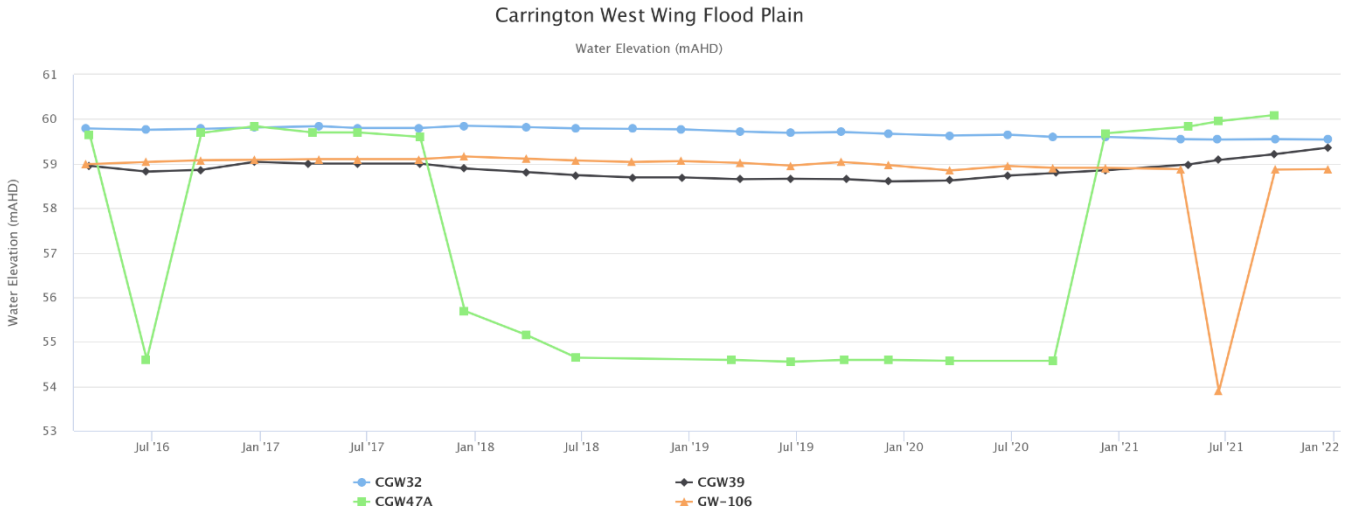


Figure 47 - Carrington West Wing Flood Plain Water Elevation Trend – Q4 2021

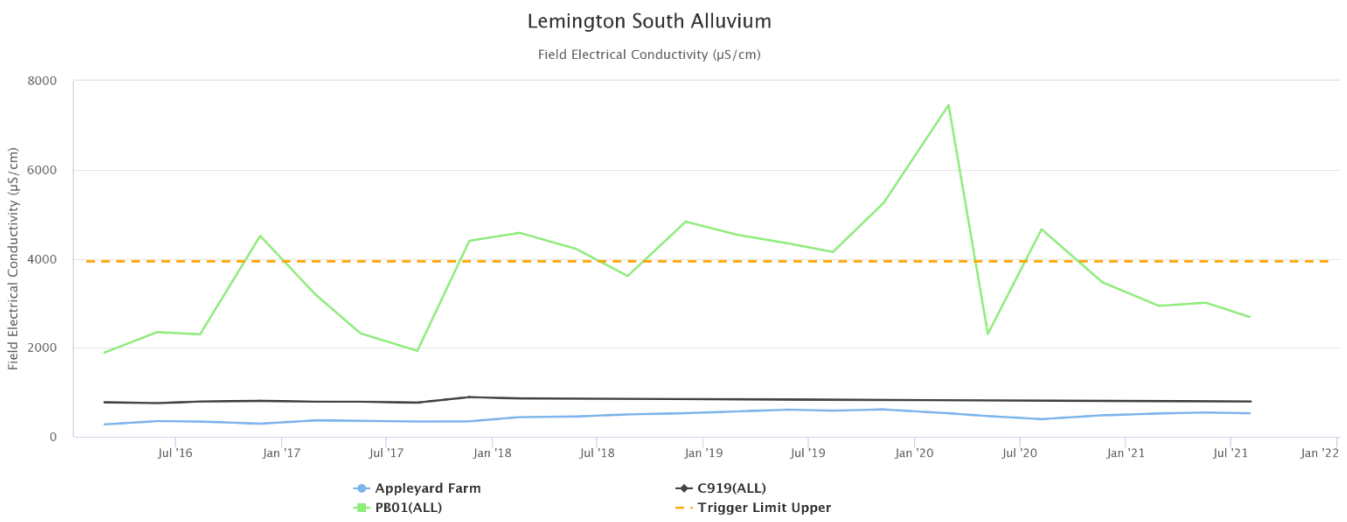


Figure 48 - Lemington South Alluvium Electrical Conductivity Trend – Q4 2021

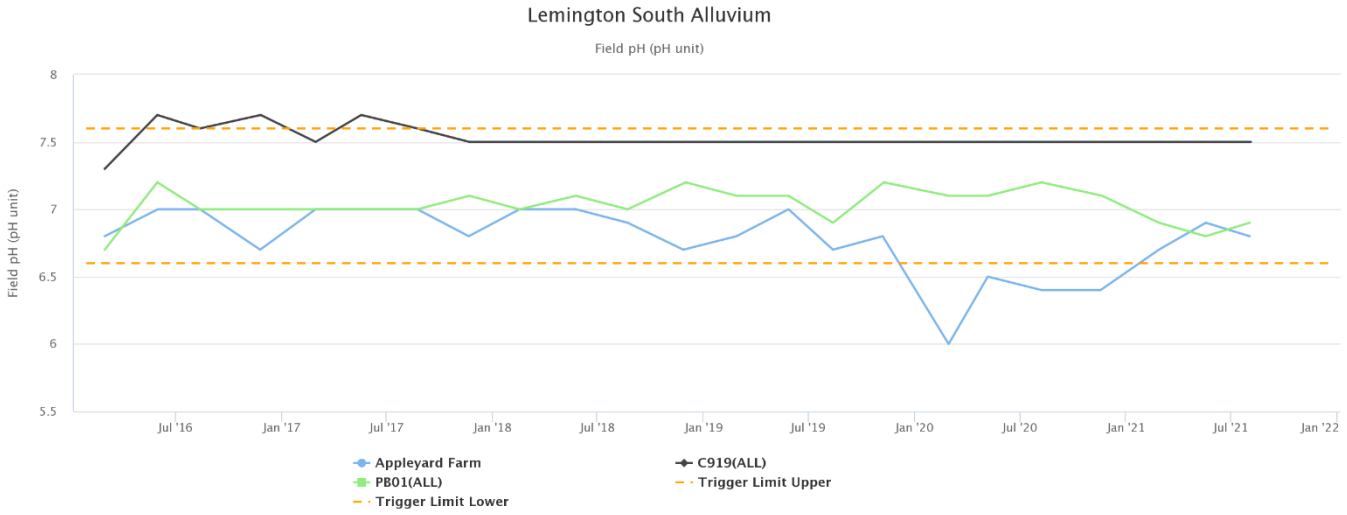


Figure 49 Lemington South Alluvium Field pH Trend – Q4 2021

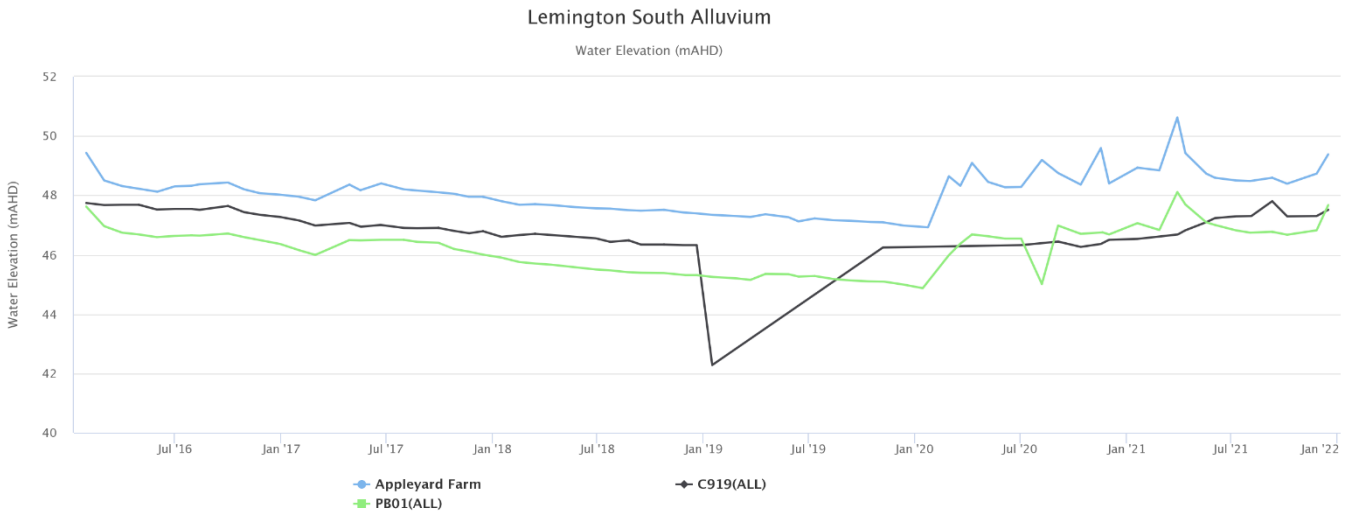


Figure 50 - Lemington South Alluvium Water Elevation Trend – Q4 2021

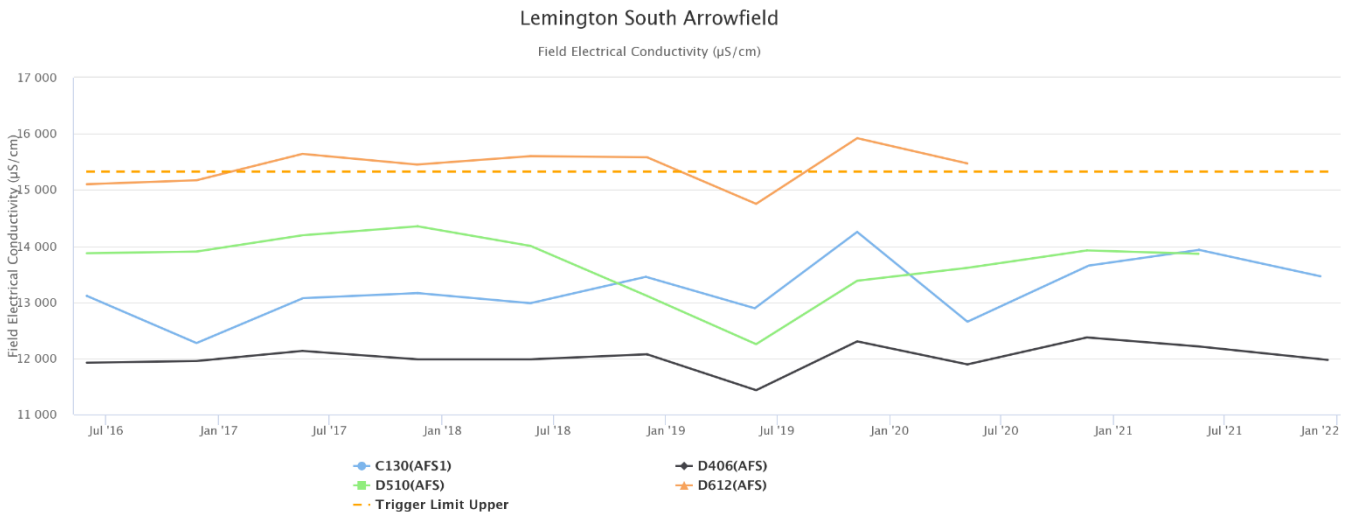


Figure 51 - Lemington South Arrowfield Electrical Conductivity Trend – Q4 2021

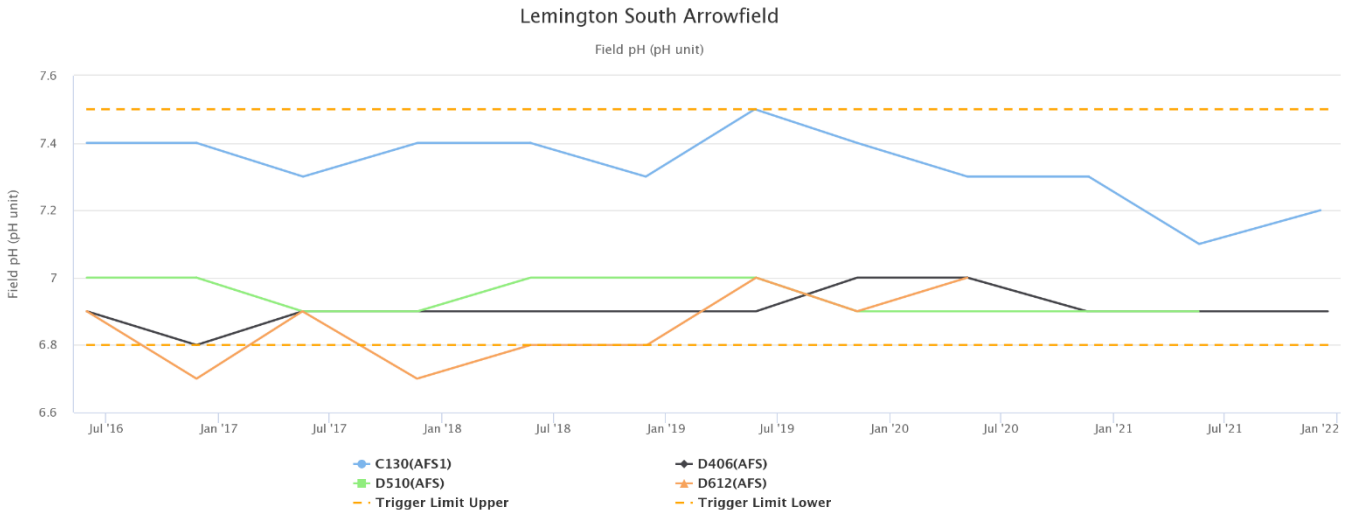


Figure 52 - Lemington South Arrowfield Field pH Trend – Q4 2021

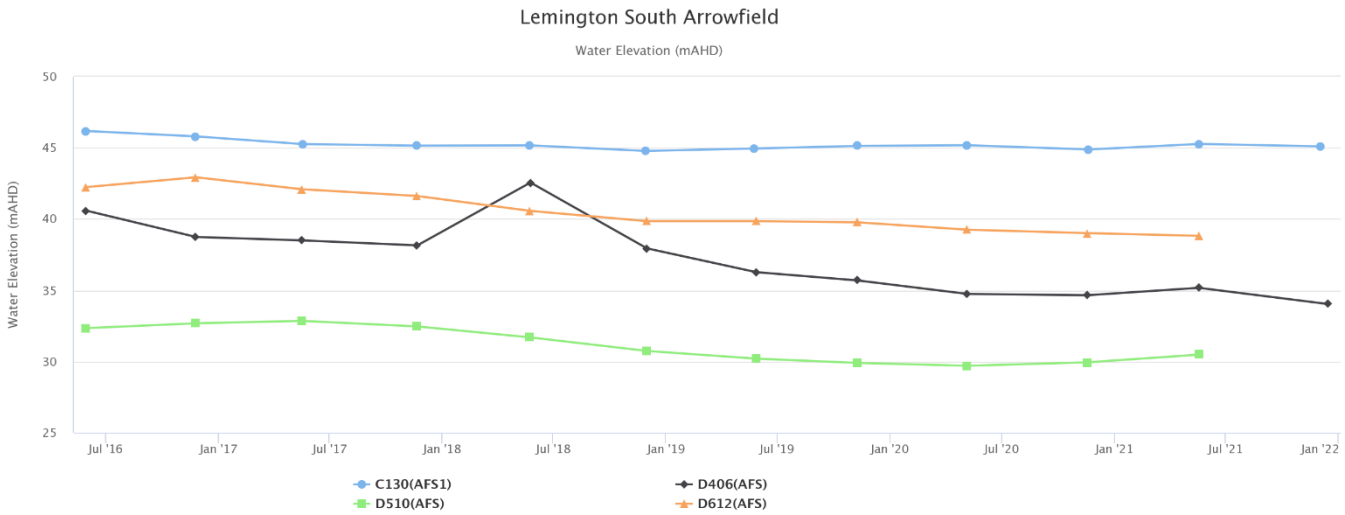


Figure 53 - Lemington South Arrowfield Water Elevation Trend – Q4 2021

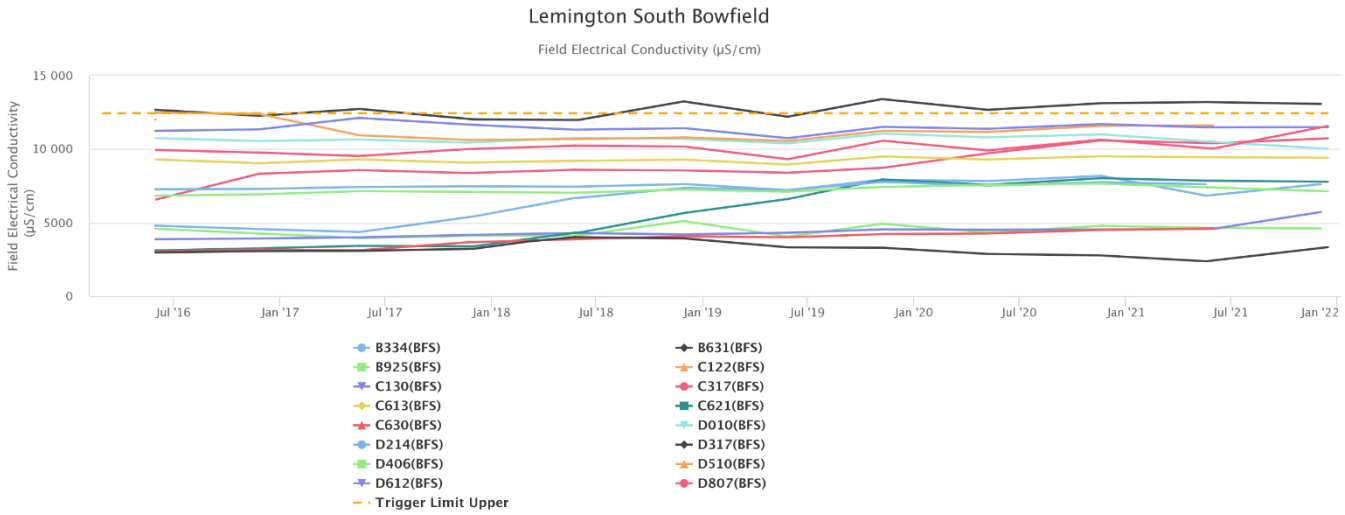


Figure 54 - Lemington South Bowfield Electrical Conductivity Trend – Q4 2021

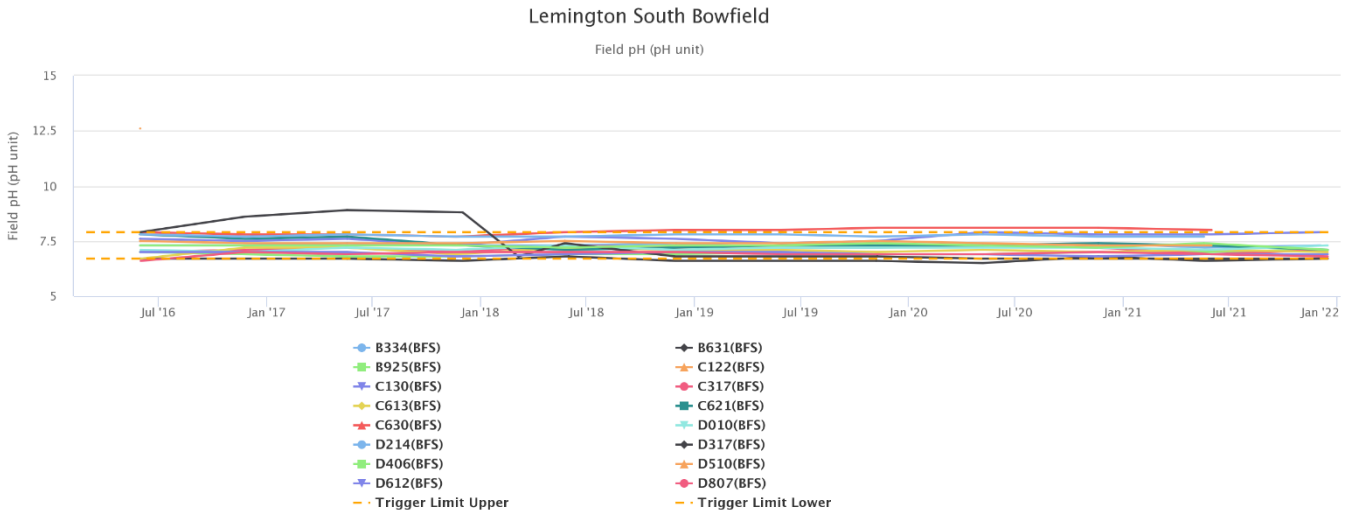


Figure 55 - Lemington South Bowfield Field pH Trend – Q4 2021

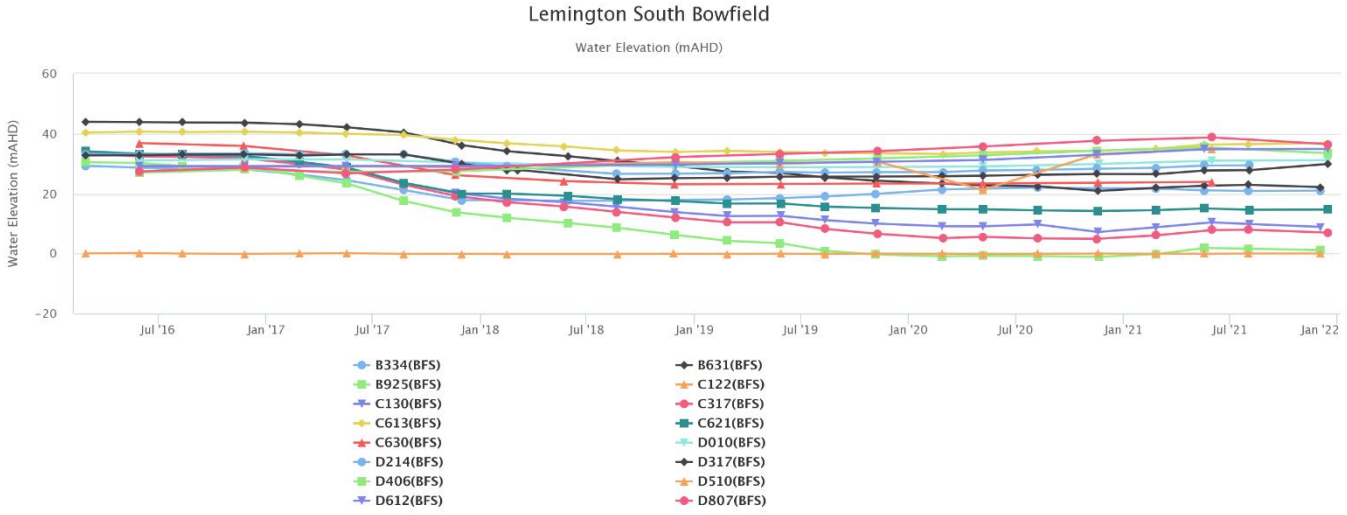


Figure 56 - Lemington South Bowfield Water Elevation Trend – Q4 2021

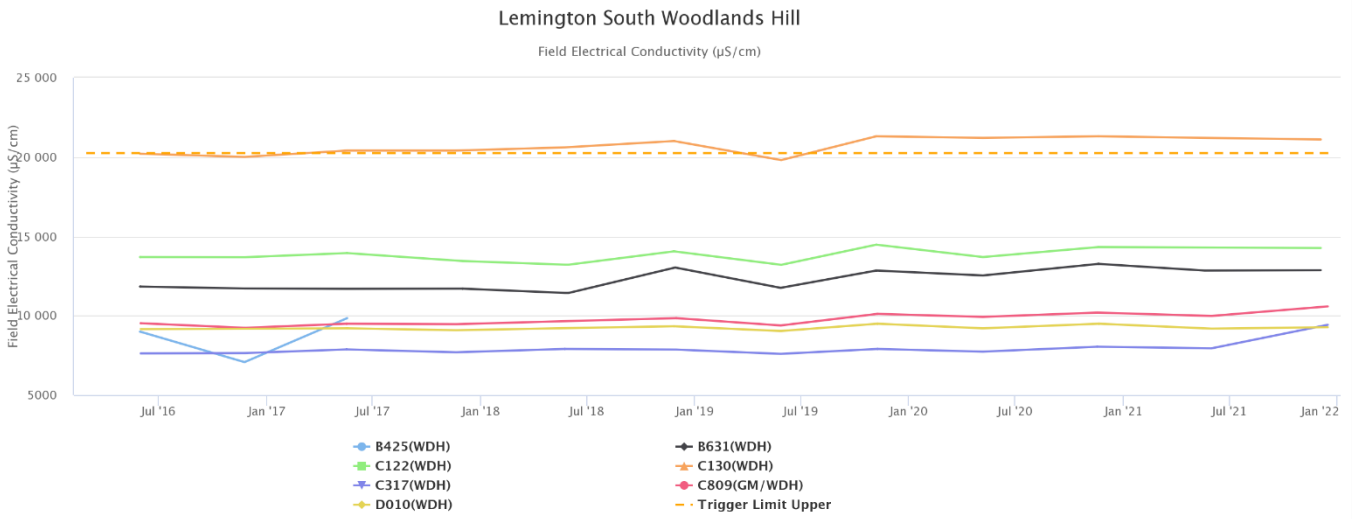


Figure 57 - Lemington South Woodlands Hill Electrical Conductivity Trend – Q4 2021

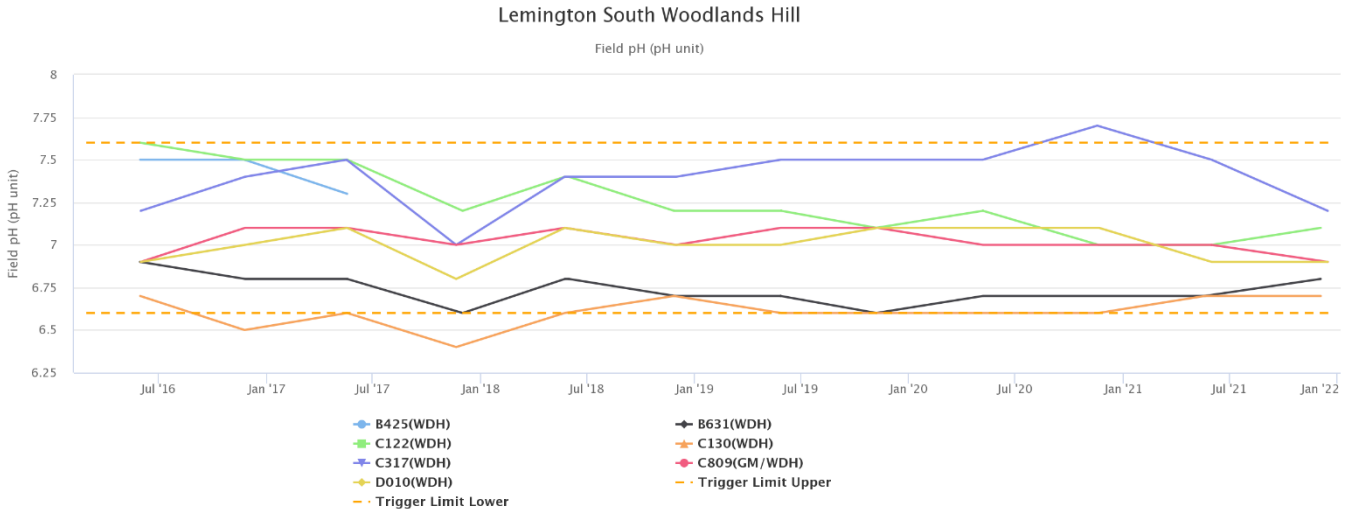


Figure 58 - Lemington South Woodlands Hill Field pH Trend – Q4 2021

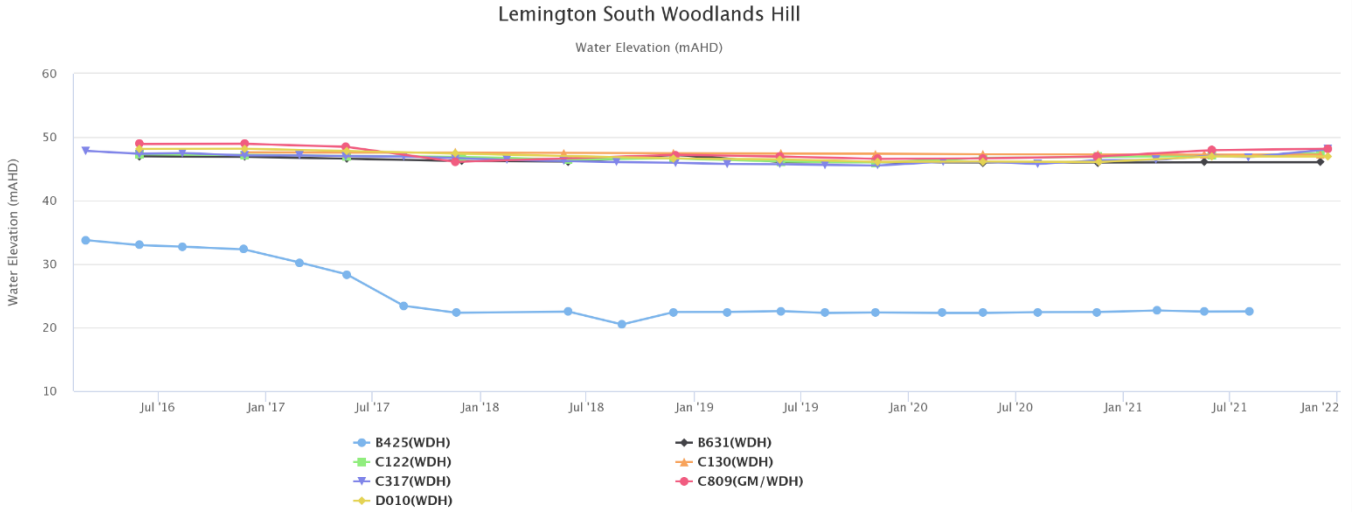


Figure 59 - Lemington South Woodlands Hill Water Elevation Trend – Q4 2021

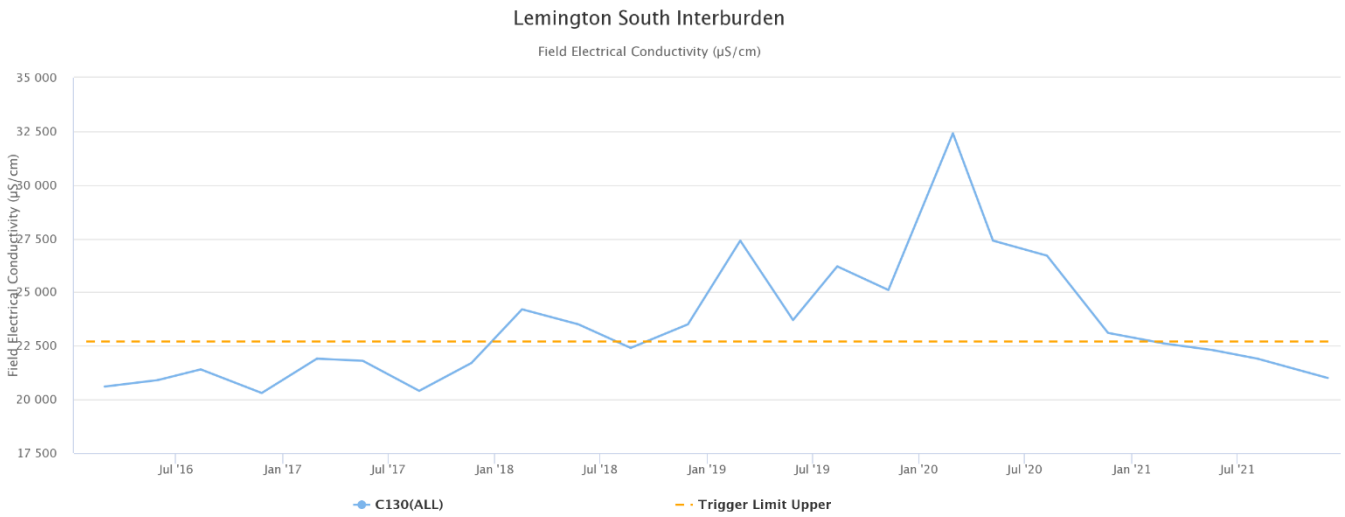


Figure 60 - Lemington South Interburden Electrical Conductivity Trend – Q4 2021

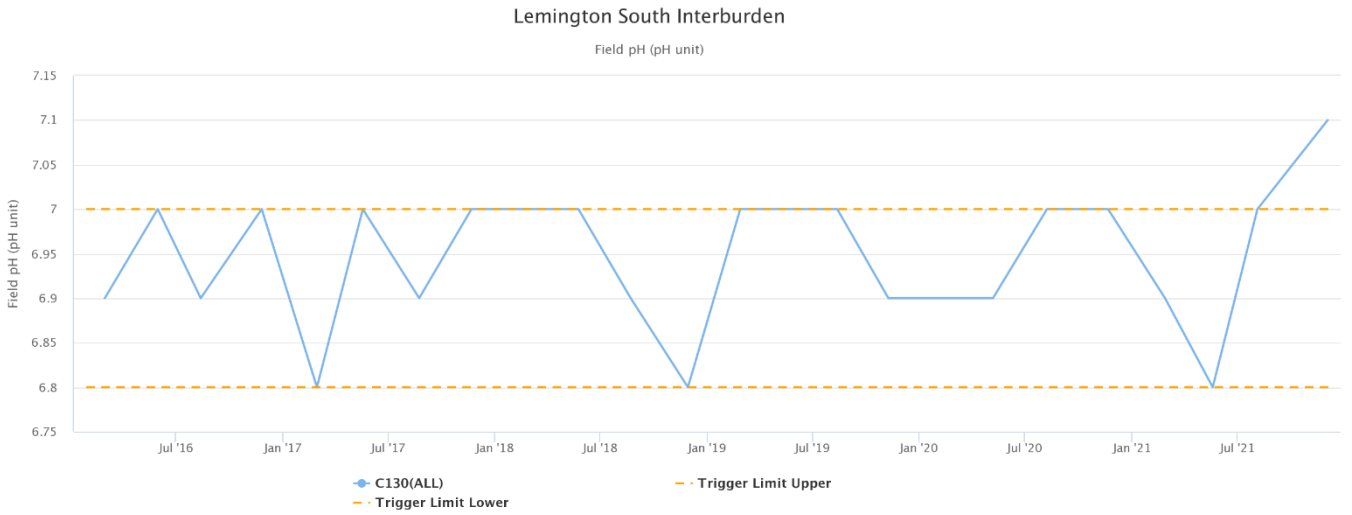


Figure 61 - Lemington South Interburden Field pH Trend – Q4 2021

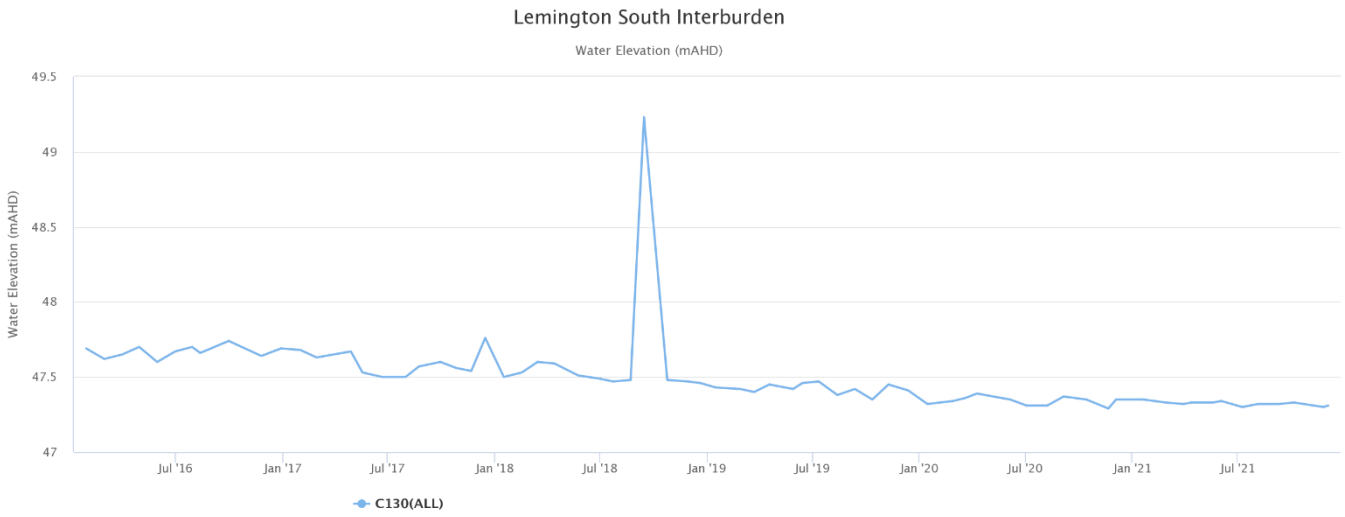


Figure 62 - Lemington South Interburden Water Elevation Trend – Q4 2021

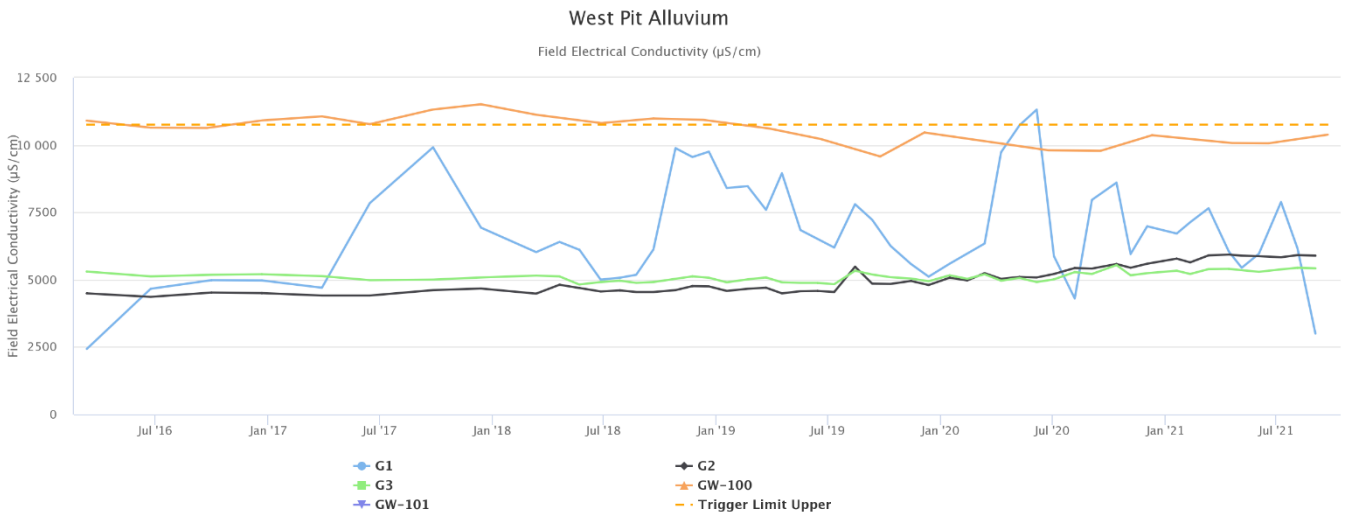


Figure 63 - West Pit Alluvium Electrical Conductivity Trend - Q4 2021

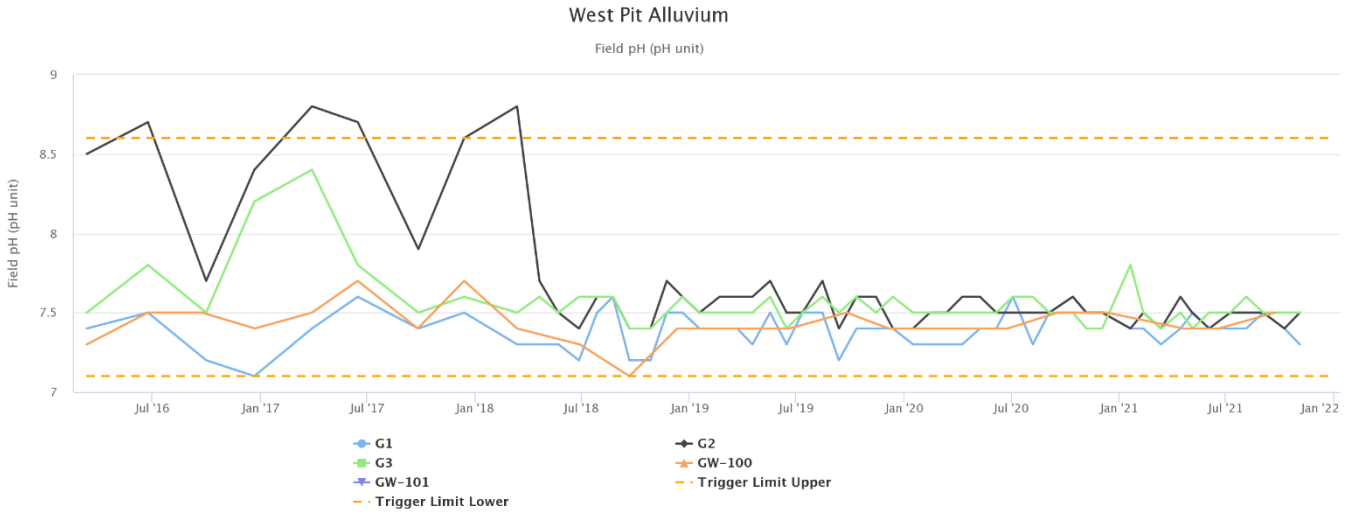
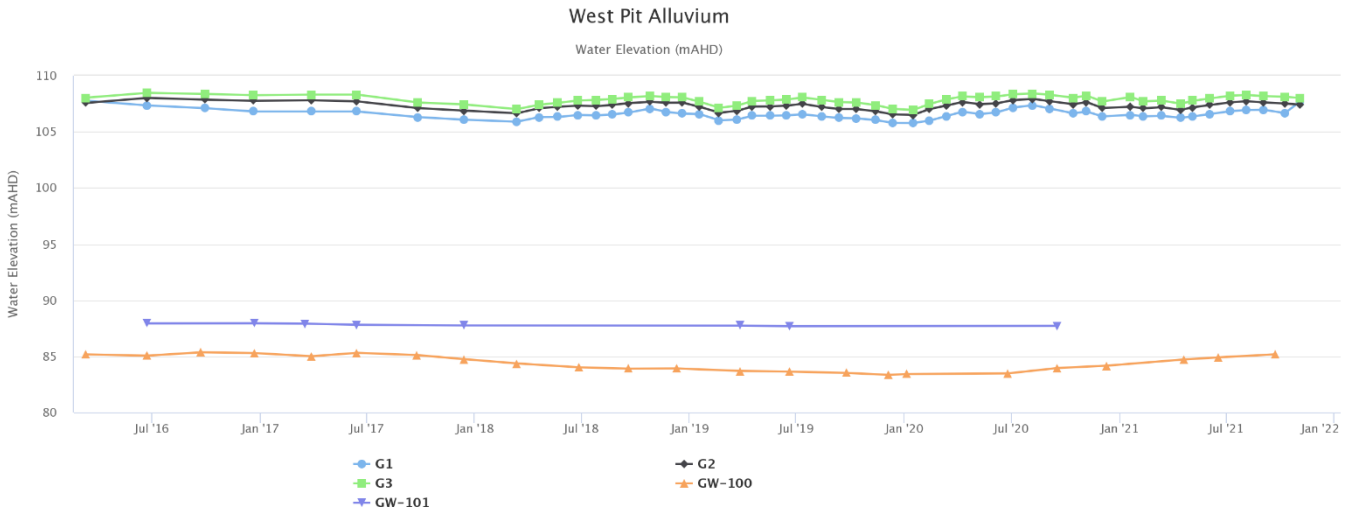


Figure 64 - West Pit Alluvium Field pH Trend – Q4 2021



** GW -101 had insufficient water for sampling*

Figure 65 - West Pit Alluvium Water Elevation Trend - Q4 2021

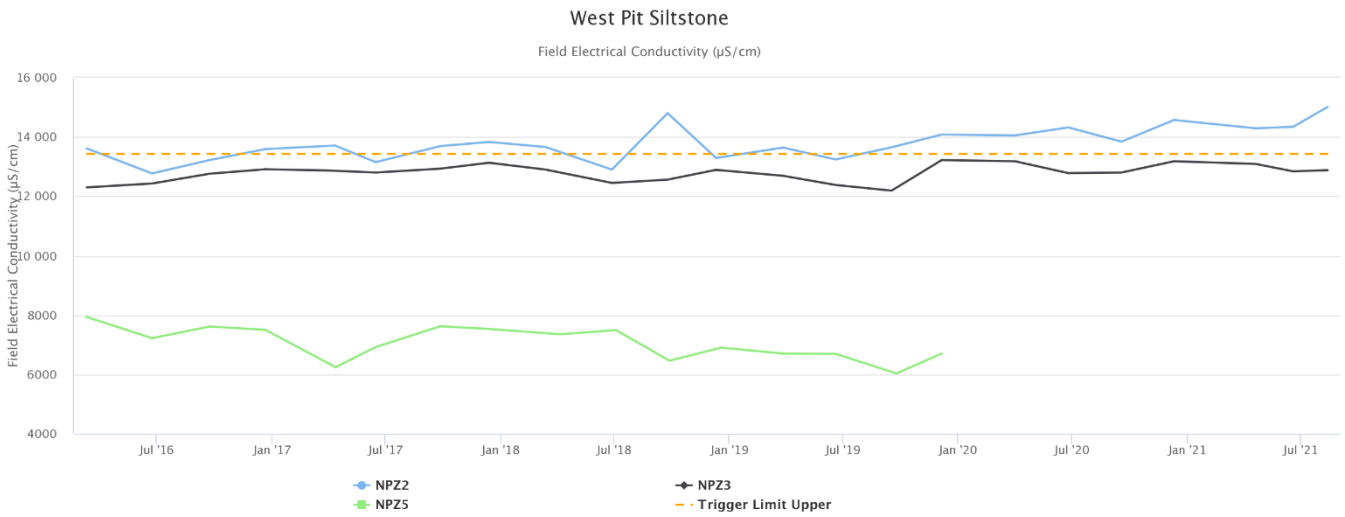


Figure 66 - West Pit Siltstone Electrical Conductivity Trend – Q4 2021

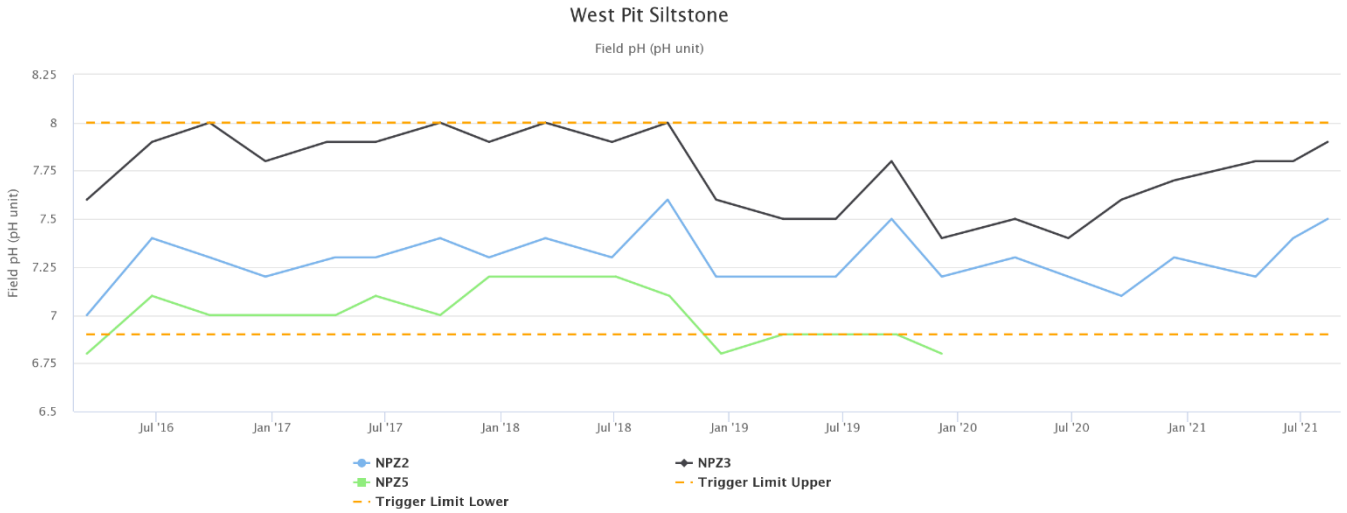


Figure 67 - West Pit Siltstone Field pH Trend - Q4 2021

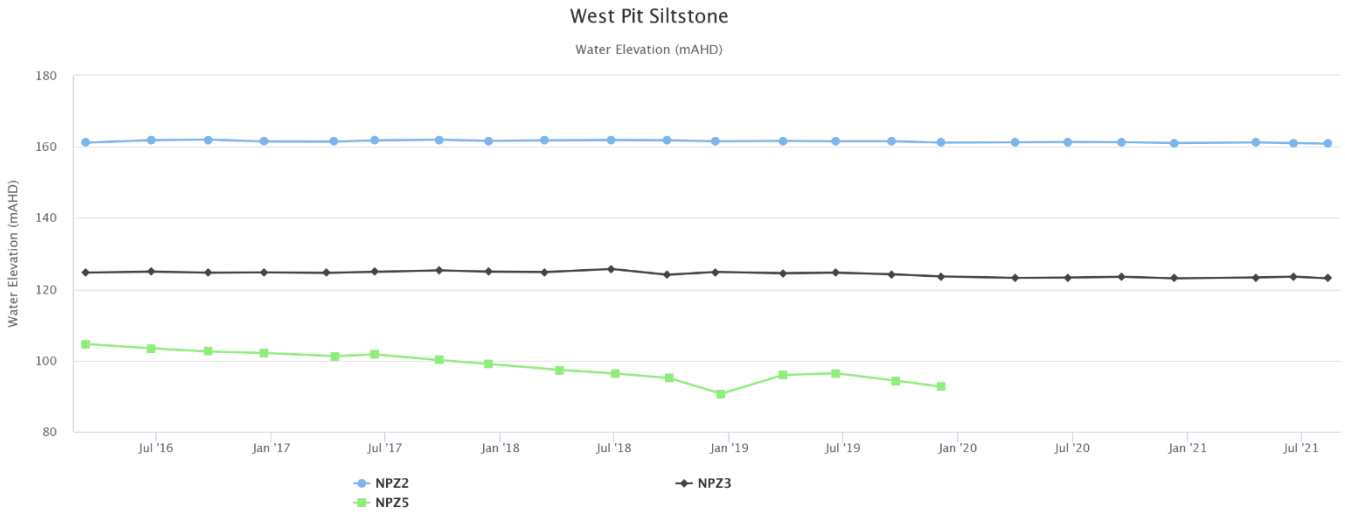


Figure 68 - West Pit Siltstone Water Elevation Trend – Q4 2021

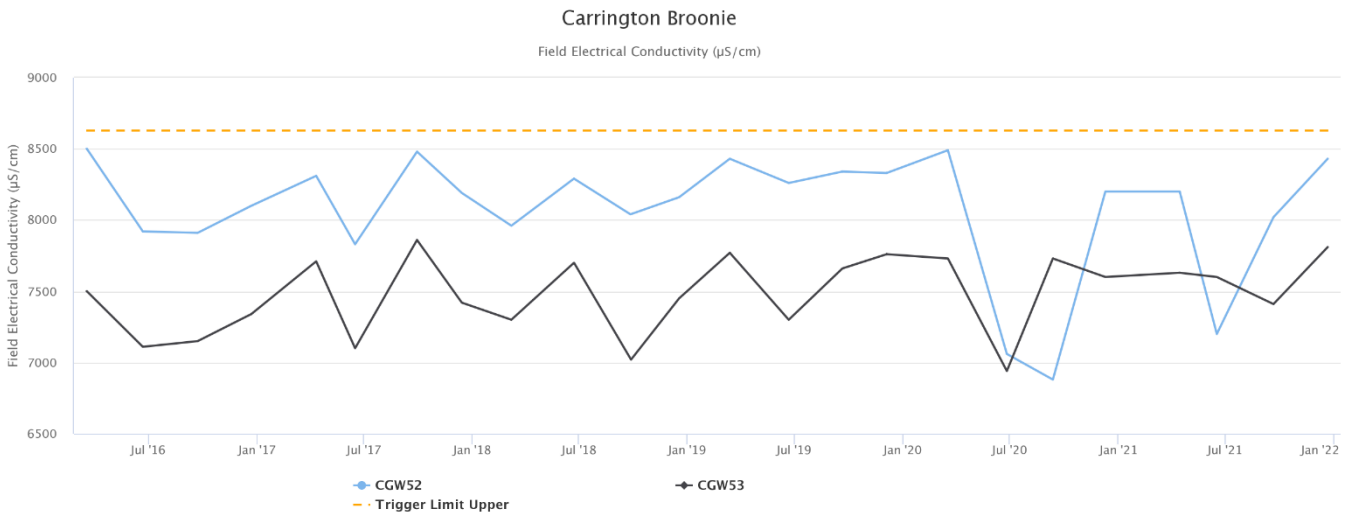


Figure 69 - Carrington Broonie Electrical Conductivity Trend – Q4 2021

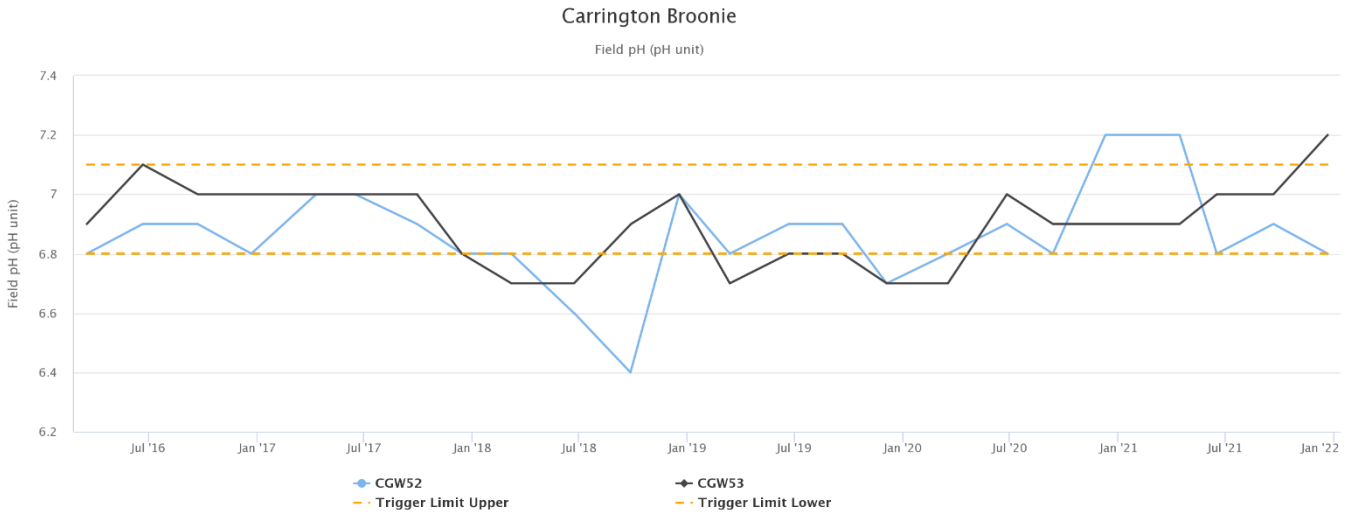


Figure 70 - Carrington Broonie Field pH Trend – Q4 2021

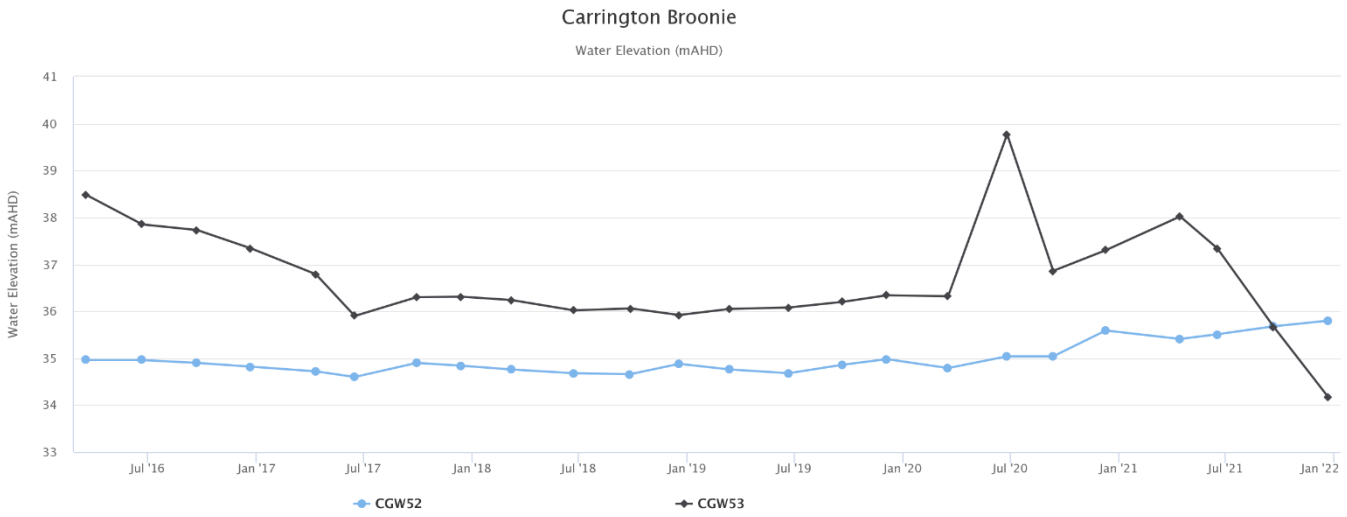


Figure 71 - Carrington Broonie Water Elevation Trend - Q4 2021

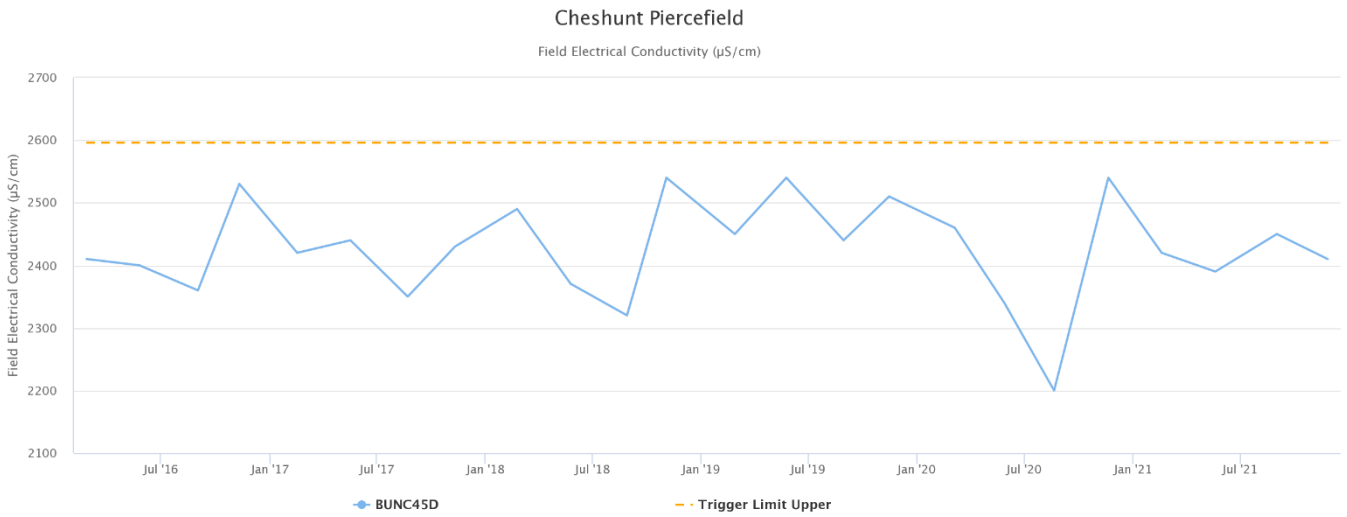


Figure 72 - Cheshunt Piercefield Electrical Conductivity Trend – Q4 2021

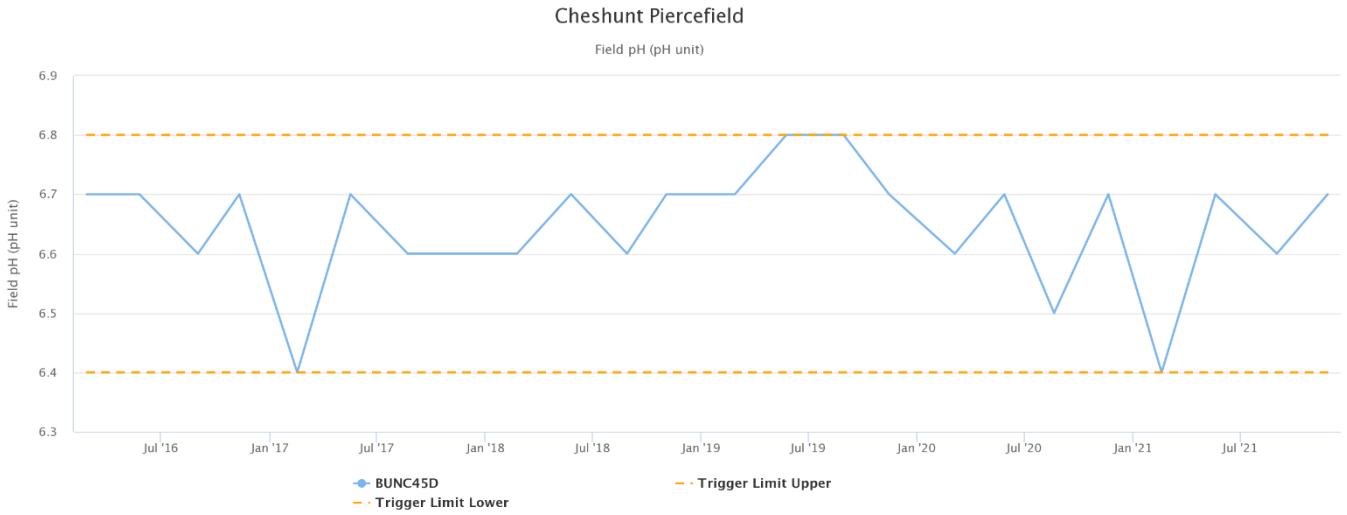


Figure 73 - Cheshunt Piercefield Field pH Trend – Q4 2021

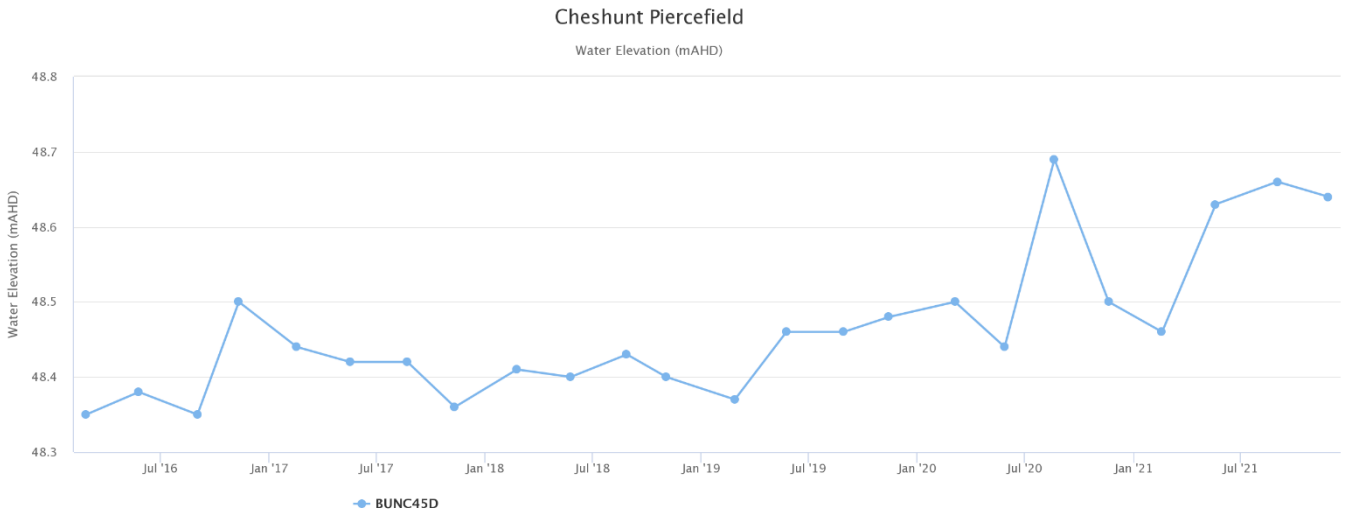


Figure 74 - Cheshunt Piercefield Water Elevation Trend – Q4 2021

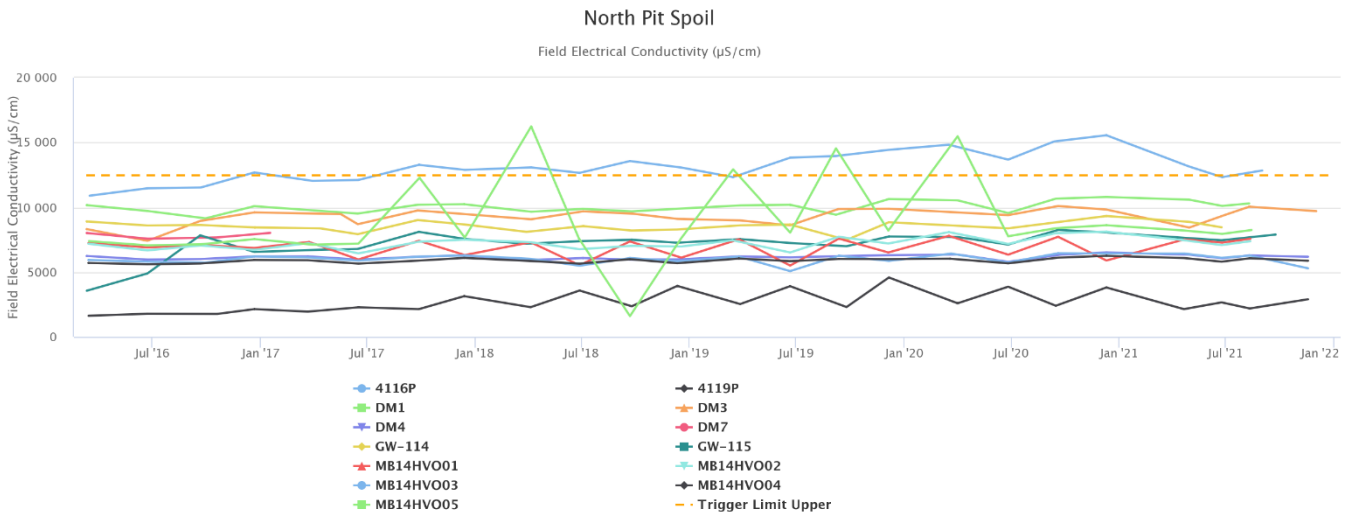


Figure 75 - North Pit Spoil Electrical Conductivity Trend – Q4 2021

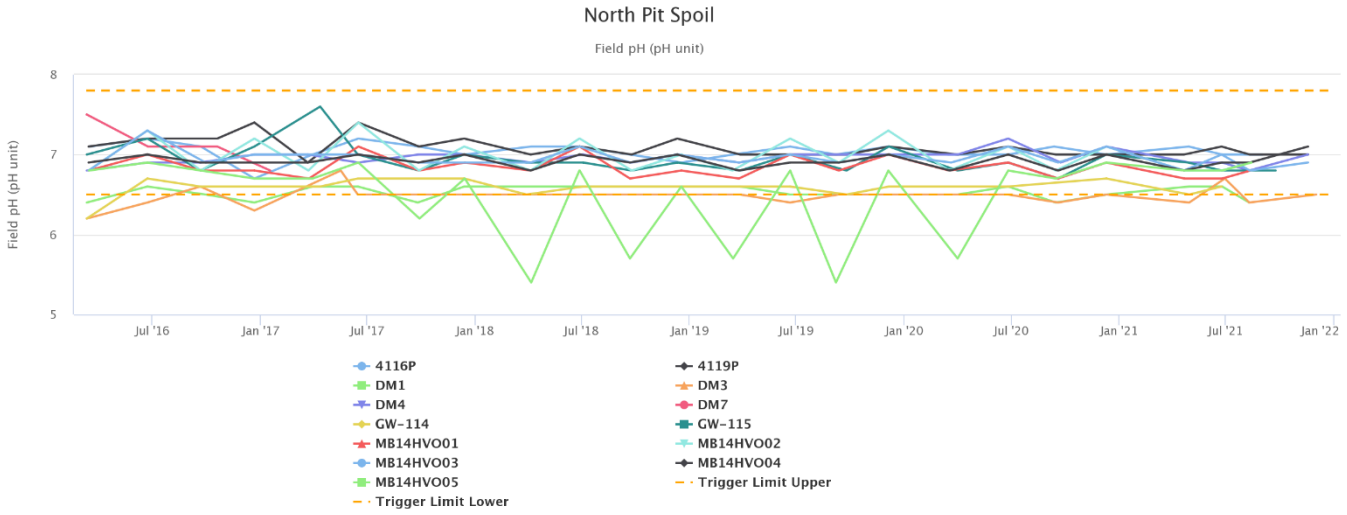


Figure 76 - North Pit Spoil Field pH Trend – Q4 2021

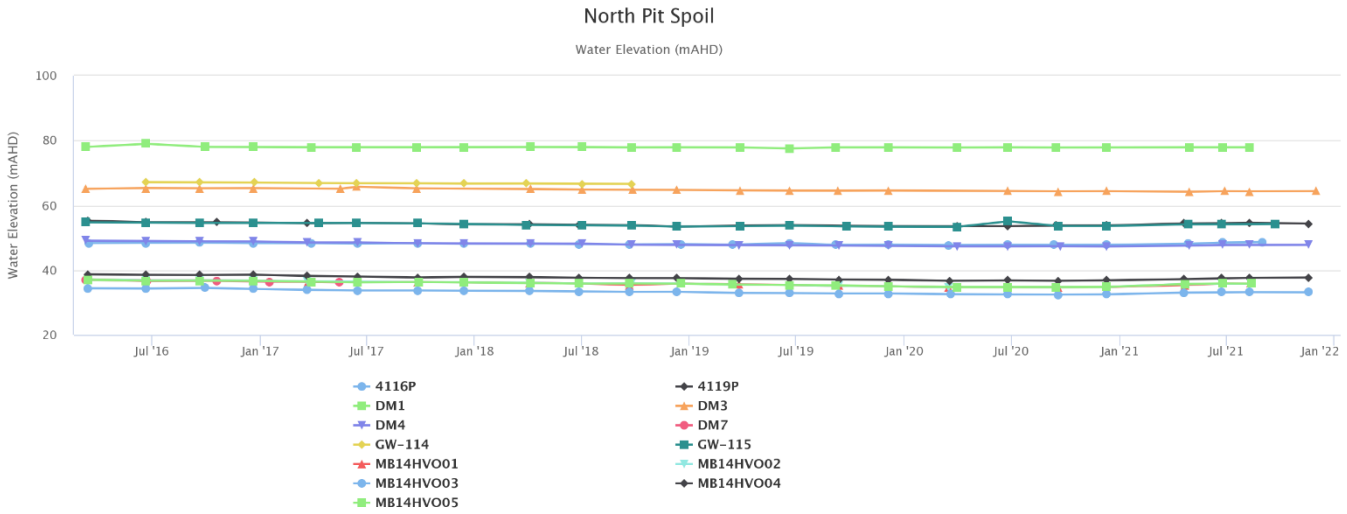


Figure 77 - North Pit Spoil Water Elevation Trend – Q4 2021

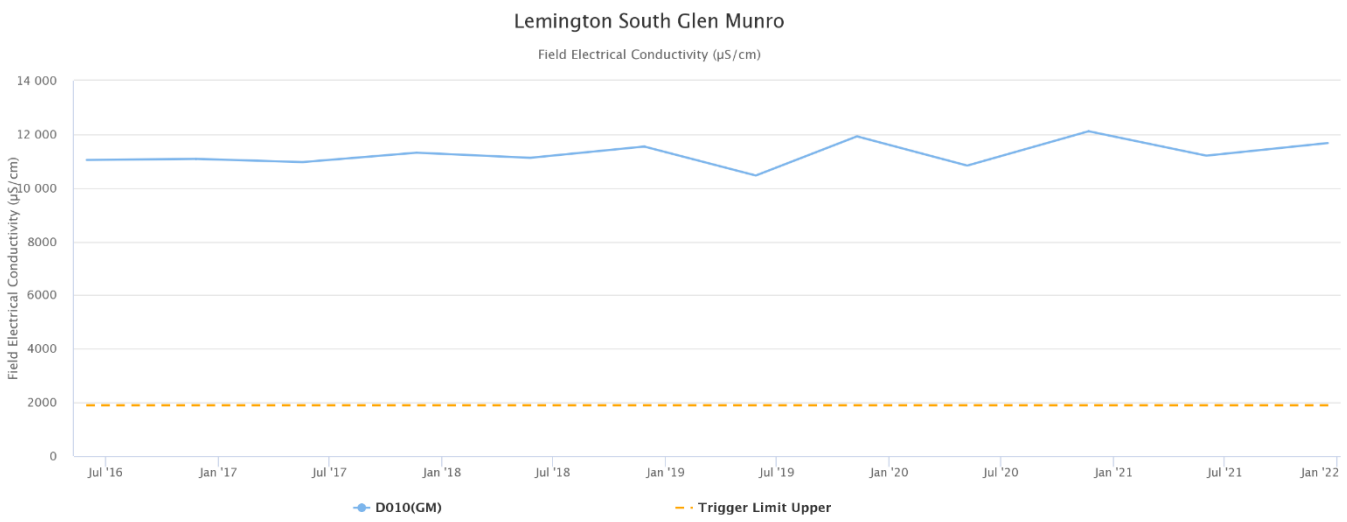


Figure 78 - Lemington South Glen Munro Electrical Conductivity Trend – Q4 2021

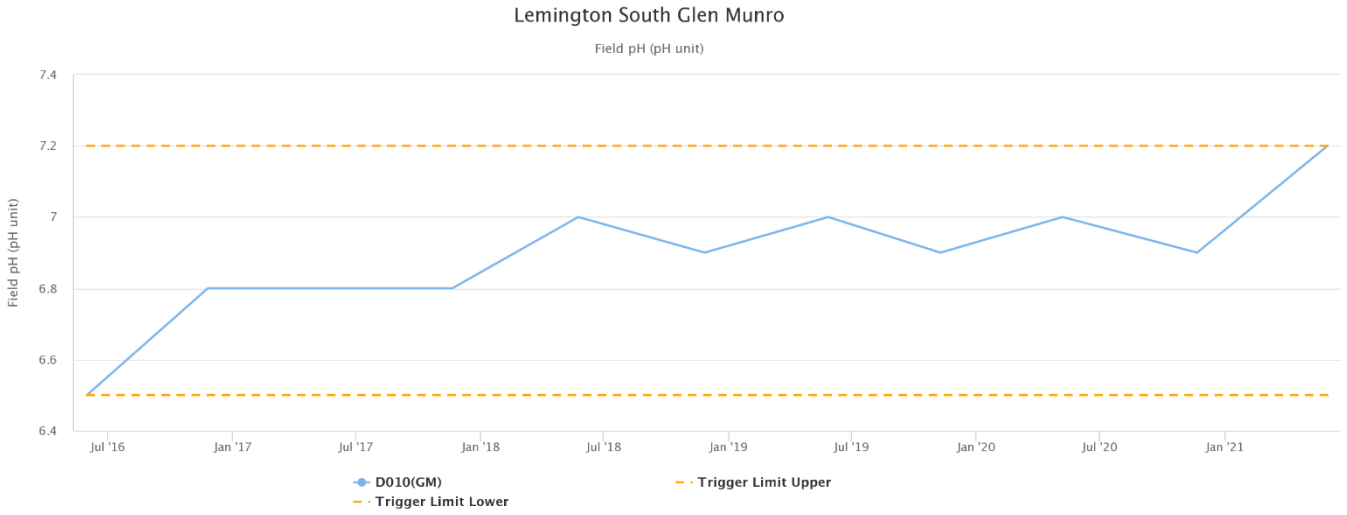


Figure 79 - Lemington South Glen Munro Field pH Trend - Q4 2021

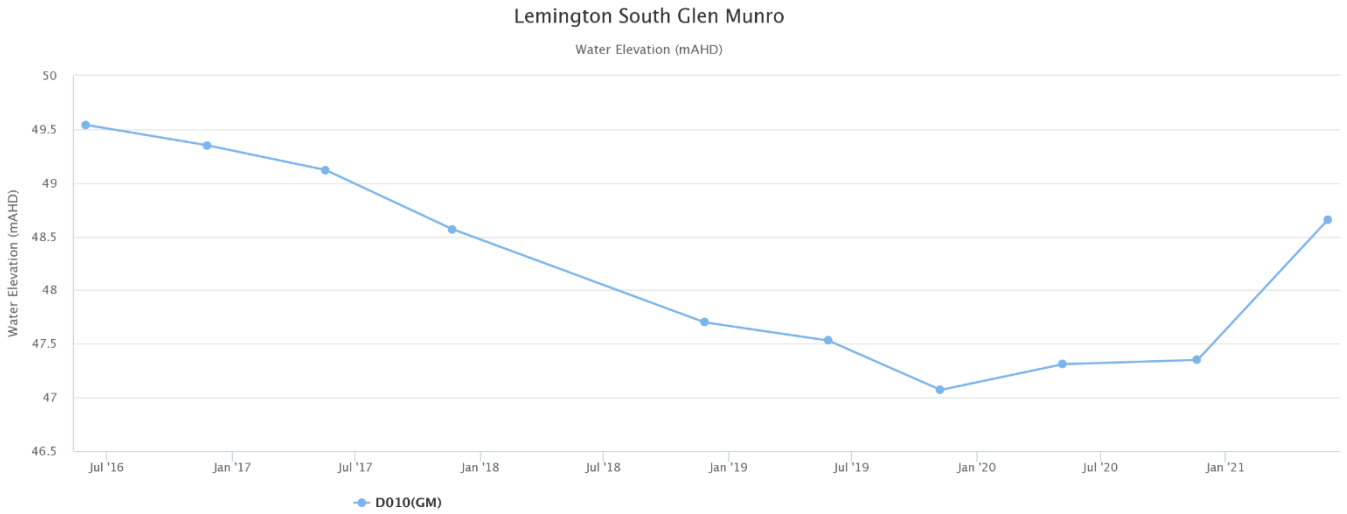


Figure 80 - Lemington South Glen Munro Water Elevation Trend – Q4 2021

3.4.1 Groundwater Trigger Tracking

Internal trigger limits have been developed to assess monitoring data on an on-going basis and to highlight potentially adverse groundwater impacts. The process for evaluating monitoring results against the internal triggers and subsequent responses is outlined in the HVO Water Management Plan.

Groundwater trigger tracking results are summarised below in **Table 3.**

Table 3 - Groundwater Trigger Tracking – Q4 2021

Site	Date	Trigger Limit Breached	Response Action
CFW55R	12/10/2021	EC	Investigation Ongoing
BZ2A(1)	23/11/2021	pH	Investigation Ongoing
BZ3-3	23/11/2021	pH	Third consecutive trigger exceedance – investigation commenced
BZ4A(2)	23/11/2021	pH	Third consecutive trigger exceedance – investigation commenced
NPZ2	1/12/2021	EC	Investigation Ongoing
CFW55R	15/11/2021	EC	Investigation Ongoing
B631 (BFS)	3/12/2021	EC	Second consecutive trigger exceedance - watching brief established
C130(ALL)	3/12/2021	EC	Investigation Ongoing
C130 (WDH)	3/12/2021	EC	Investigation Ongoing
CFW57	2/12/2021	Water Elevation	First consecutive trigger exceedance - watching brief established
D010 (GM)	15/12/2021	EC	Investigation Ongoing
CGW53A	21/12/2021	Water Elevation	Investigation Ongoing
CGW55A	21/12/2021	Water Elevation	First consecutive trigger exceedance - watching brief established
CGW51a	21/12/2021	pH	Second consecutive trigger exceedance – watching brief established
CGW53	21/12/2021	pH	First consecutive trigger exceedance – watching brief established
CGW32	21/12/2021	EC	First consecutive trigger exceedance - watching brief established
GW106	21/12/2021	pH	First consecutive trigger exceedance - watching brief established

4 Blasting

HVO maintains a network of blast monitoring units located at nearby privately owned residences and function as regulatory compliance monitors. The location of these monitors can be found in **Figure 81**. Blasting criteria for HVO are summarised in **Table 4**.

Table 4 - Blasting Criteria

Airblast Overpressure ((L))	Comments
115	5% of the total number of blasts in a 12-month period
120	0% of blasts
Ground Vibration (mm/s)	**Comments**
5	5% of the total number of blasts in a 12-month period
10	0% of blasts

4.1 Blast Monitoring Results

Seventeen blasts were initiated at HVO during the reporting period. Blast monitoring results for the period are shown in **Table 5 and Table 6**.

Table 5 - Overpressure Blast Monitoring Results for the reporting period

Date and Time	Moses Crossing (dB)	Jerrys Plains Village (dB)	Maison Dieu (dB)	Warkworth (dB)	Knodlers Lane (dB)
2/12/2021 13:37	106.54	92.42	91.88	95.12	98.4
6/12/2021 10:28	95.14	105.17	100.44	82.05	99.42
6/12/2021 11:20	96.03	97.77	95.95	88.83	95.48
10/12/2021 15:18	109.23	105.7	114.49	99.33	111.84
11/12/2021 14:10	96.33	84.88	97.24	87.54	100.61
15/12/2021 13:00	99.22	89.14	94.16	99.65	98.23
16/12/2021 12:58	88.82	87.82	87.73	83.91	87.8
17/12/2021 13:48	85.9	88.81	80.61	93.34	87.6
17/12/2021 13:49	83.8	87.78	92.71	94.69	82.5
20/12/2021 13:25	89.96	91.73	93.4	90.48	86.33
21/12/2021 12:03	89.83	84.54	92.66	104.64	93.7
21/12/2021 12:04	87.96	87.49	91.8	97.02	93.27

Table 6 - Ground Vibration Blast Monitoring Results for the reporting period

Date and Time	Moses Crossing (mm/s)	Jerrys Plains Village (mm/s)	Maison Dieu (mm/s)	Warkworth (mm/s)	Knodlers Lane (mm/s)
2/12/2021 13:37	0.12	0.02	0.17	0.58	0.23
6/12/2021 10:28	0.31	0.09	0.09	0.46	0.1
6/12/2021 11:20	0.22	0.11	0.09	0.17	0.12
10/12/2021 15:18	0.2	0.06	0.18	0.84	0.22
11/12/2021 14:10	0.12	0.03	0.31	0.34	0.24
15/12/2021 13:00	0.41	0.11	0.2	0.6	0.14
16/12/2021 12:58	0.09	0.02	0.05	0.21	0.09
17/12/2021 13:48	0.2	0.24	0.09	0.69	0.09
17/12/2021 13:49	0.17	0.07	0.05	0.69	0.09
20/12/2021 13:25	0.14	0.14	0.07	0.25	0.11
21/12/2021 12:03	0.09	0.03	0.03	0.19	0.09
21/12/2021 12:04	0.09	0.03	0.03	0.17	0.08

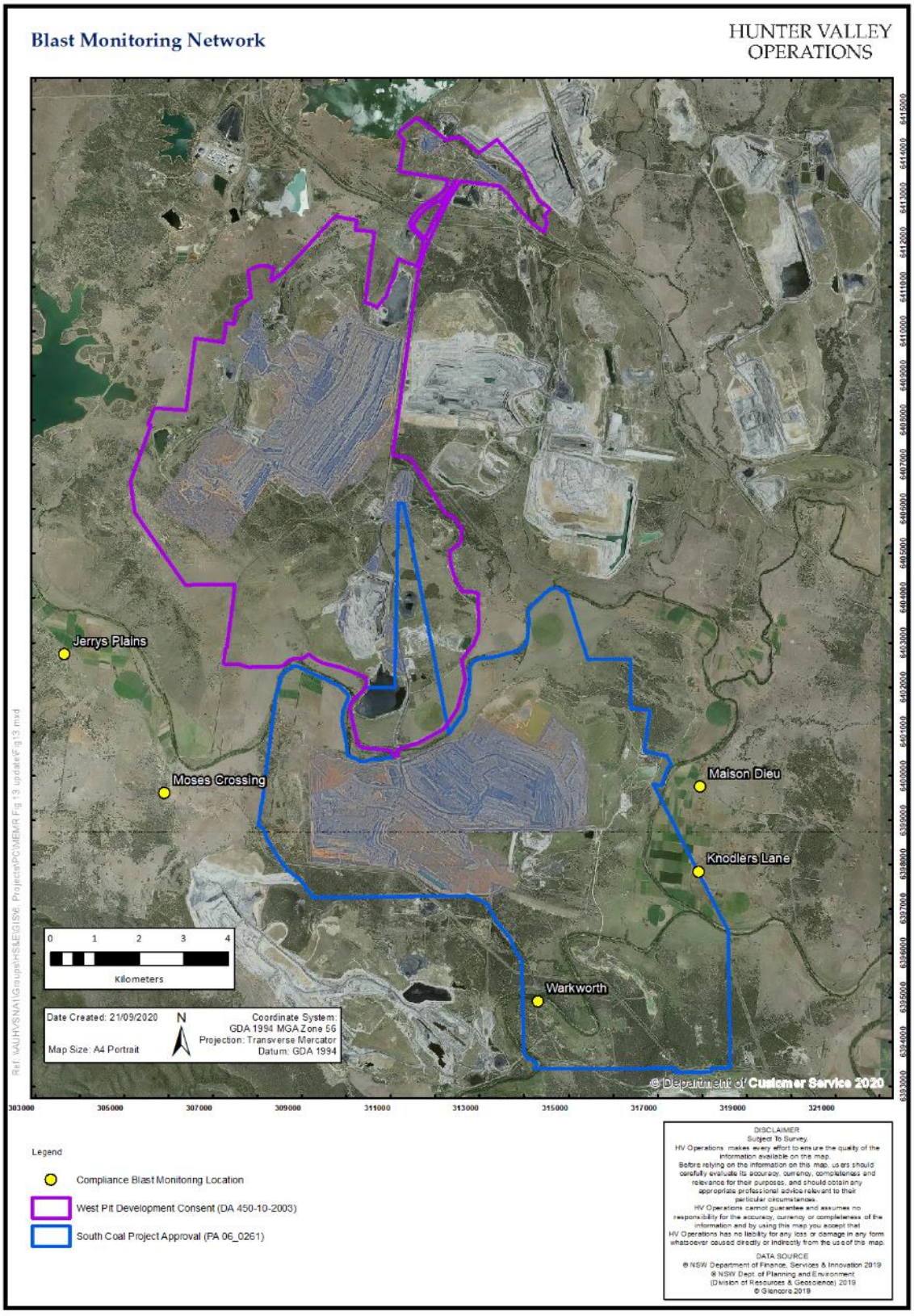


Figure 81 - Blast Monitoring Location Plan

5 Noise

Routine attended noise monitoring occurs at defined locations around HVO, as described in the HVO Noise Monitoring Program. The noise monitoring aims to quantify and describe the acoustic environment around the site and compare results with specified limits. The attended noise monitoring locations are displayed in **Figure 82**.

5.1 Attended Noise Monitoring Results

Attended monitoring was conducted at receiver locations around HVO on the night of 13 December 2021.

Monitoring results are detailed in **Table 7** to **Table 11.**

Table 7 - LAeq,15minute HVO North Against Impact Assessment Criteria for the reporting period

Location	Date and Time	Wind Speed (m/s)[1]	Stability Class	Criterion (A)	Criterion Applies[2]	HVO North L_{Aeq} [3,4,5,6,]	Exceedance[4,5]
Shearers Lane	13/12/2021 21:22	3.2	D	35	No	IA	NA
Knodlers Lane	13/12/2021 21:46	3	D	35	No	IA	NA
Maison Dieu	13/12/2021 21:00	2.7	D	35	No	IA	NA
Long Point (Dights Crossing)	13/12/2021 22:38	3.2	D	35	No	IA	NA
Kilburnie South	13/12/2021 23:14	3.6	D	39	No	IA	NA
Jerrys Plains East	13/12/2021 22:50	3.2	D	39	No	IA	NA
Jerrys Plains Village	13/12/2021 21:22	3.2	D	40	No	<25	NA
Jerrys Plains West	13/12/2021 21:02	2.7	D	40	No	<25	NA
HVGC	13/12/2021 23:43	3.2	D	Nil	No	IA	NA

1. Atmospheric data is sourced from the HVO Corporate AWS using logged meteorological data;

2. Noise criteria apply under all meteorological conditions except during periods of rain or hail, wind speeds greater than 3m/s measured at 10 metres above ground level, or temperature inversion conditions greater than 3 degrees C/100m (G stability class);

3. Site-only LAeq,15minute attributed to HVO North Pit Area; including modifying factors if applicable;

4. Bold results in red indicate exceedance of criterion; and

5. NA in criterion column indicates no criterion is applicable at this location. NA in exceedance column means atmospheric conditions outside specified in approval therefore criterion not applicable.

Table 8 - LAeq,15minute HVO North Against Land Acquisition Criteria for the reporting period

Location	Date and Time	Wind Speed (m/s)[1]	Stability Class	Criterion (A)	Criterion Applies[2]	HVO North L_{Aeq} [3,4,6,]	Exceedance[4,5]
Shearers Lane	13/12/2021 21:22	3.2	D	41	No	IA	NA
Knodlers Lane	13/12/2021 21:46	3	D	41	No	IA	NA
Maison Dieu	13/12/2021 21:00	2.7	D	41	No	IA	NA
Long Point (Dights Crossing)	13/12/2021 22:38	3.2	D	41	No	IA	NA
Kilburnie South	13/12/2021 23:14	3.6	D	41	No	IA	NA
Jerrys Plains East	13/12/2021 22:50	3.2	D	41	No	IA	NA
Jerrys Plains Village	13/12/2021 21:22	3.2	D	41	No	<25	NA
Jerrys Plains West	13/12/2021 21:02	2.7	D	41	No	<25	NA
HVGC	13/12/2021 23:43	3.2	D	NA	No	IA	NA

1. Atmospheric data is sourced from the HVO Corporate AWS using logged meteorological data;

2. Noise criteria apply under all meteorological conditions except during periods of rain or hail, wind speeds greater than 3m/s measured at 10 metres above ground level, or temperature inversion conditions greater than 3 degrees C/100m (G stability class);

3. Site-only LAeq,15minute attributed to HVO North Pit Area; including modifying factors if applicable;

4. Bold results in red indicate exceedance of criterion; and

5. NA in criterion column indicates no criterion is applicable at this location. NA in exceedance column means atmospheric conditions outside specified in approval therefore criterion not applicable.

Table 9 - LA1,1minute HVO North Against Impact Assessment Criteria for the reporting period

Location	Date and Time	Wind Speed (m/s)[1]	Stability Class	Criterion (A)	Criterion Applies[2]	HVO North L_{Aeq} [3,4,6,]	Exceedance[4,5]
Shearers Lane	13/12/2021 21:22	3.2	D	46	No	IA	NA
Knodlers Lane	13/12/2021 21:46	3	D	46	No	IA	NA
Maison Dieu	13/12/2021 21:00	2.7	D	46	No	IA	NA
Long Point (Dights Crossing)	13/12/2021 22:38	3.2	D	46	No	IA	NA
Kilburnie South	13/12/2021 23:14	3.6	D	46	No	IA	NA
Jerrys Plains East	13/12/2021 22:50	3.2	D	46	No	IA	NA
Jerrys Plains Village	13/12/2021 21:22	3.2	D	46	No	<25	NA
Jerrys Plains West	13/12/2021 21:02	2.7	D	46	No	<25	NA
HVGC	13/12/2021 23:43	3.2	D	NA	No	IA	NA

1. Atmospheric data is sourced from the HVO Corporate AWS using logged meteorological data;

2. Noise criteria apply under all meteorological conditions except during periods of rain or hail, wind speeds greater than 3m/s measured at 10 metres above ground level, or temperature inversion conditions greater than 3 degrees C/100m (G stability class);

3. Site-only LA1,1 minute attributed to HVO North Pit Area; including modifying factors if applicable;

4. Bold results in red indicate exceedance of criterion; and

5. NA in criterion column indicates no criterion is applicable at this location. NA in exceedance column means atmospheric conditions outside specified in approval therefore criterion not applicable.

Table 10 - LAeq,15minute HVO South Against Impact Assessment Criteria for the reporting period

Location	Date and Time	Wind Speed (m/s)[1]	Stability Class	Criterion (A)	Criterion Applies[2]	HVO South L_{Aeq} [3,4,6,]	Exceedance[4,5]
Shearers Lane	13/12/2021 21:22	4.9	E	41	No	IA	NA
Knodlers Lane	13/12/2021 21:46	4.9	D	40	No	IA	NA
Maison Dieu	13/12/2021 21:00	6.3	D	39	No	IA	NA
Long Point (Dights Crossing)	13/12/2021 22:38	4.3	E	37	No	IA	NA
Kilburnie South	13/12/2021 23:14	4.9	E	39	No	33	NA
Jerrys Plains East	13/12/2021 22:50	4.3	E	38	No	28	NA
Jerrys Plains Village	13/12/2021 21:22	4.9	E	35	No	IA	NA
Jerrys Plains West	13/12/2021 21:02	6.3	D	35	No	IA	NA
HVGC	13/12/2021 23:43	4.3	D	55	No	IA	NA

1. Atmospheric data is sourced from the HVO Cheshunt AWS using logged meteorological data;

2. Noise criteria apply for wind speeds up to 3m/s (at a height of 10m), or during stability class G conditions. Criterion may or may not apply due to rounding of meteorological data values;

3. Site-only L_{Aeq} 15 minute attributed to HVO South Pit Area, including modifying factors if applicable;

4. Bold results in red indicate exceedance of criterion; and

5. NA in criterion column indicates no criterion is applicable at this location. NA in exceedance column means atmospheric conditions outside specified in approval therefore criterion not applicable.

Table 11 - LA1,1minute HVO South Against Impact Assessment Criteria for the reporting period

Location	Date and Time	Wind Speed (m/s)[1]	Stability Class	Criterion (A)	Criterion Applies[2]	HVO South L_{Aeq} [3,4,6,7]	Exceedance[4,5]
Shearers Lane	13/12/2021 21:22	4.9	E	45	No	IA	NA
Knodlers Lane	13/12/2021 21:46	4.9	D	45	No	IA	NA
Maison Dieu	13/12/2021 21:00	6.3	D	45	No	IA	NA
Long Point (Dights Crossing)	13/12/2021 22:38	4.3	E	45	No	IA	NA
Kilburnie South	13/12/2021 23:14	4.9	E	45	No	35	NA
Jerrys Plains East	13/12/2021 22:50	4.3	E	45	No	30	NA
Jerrys Plains Village	13/12/2021 21:22	4.9	E	45	No	IA	NA
Jerrys Plains West	13/12/2021 21:02	6.3	D	45	No	IA	NA
HVGC	13/12/2021 23:43	4.3	D	NA	No	NM	NA

1. Atmospheric data is sourced from the HVO Cheshunt AWS using logged meteorological data;

2. Noise criteria apply for wind speeds up to 3m/s (at a height of 10m), or during stability class G conditions. Criterion may or may not apply due to rounding of meteorological data values;

3. Site-only LA 1 minute attributed to HVO South Pit Area, including modifying factors if applicable;

4. Bold results in red indicate exceedance of criterion;

5. NA in criterion column indicates no criterion is applicable at this location. NA in exceedance column means atmospheric conditions outside specified in approval therefore criterion not applicable.

5.2 Low Frequency Assessment

In accordance with the requirements of the EPA's Noise Policy for Industry (NPfI), the applicability of the low frequency modification penalty has been assessed. No penalties were applied for monitoring undertaken through the reporting period. The assessments for the low frequency noise are shown in **Table 12** and **Table 13**.

Table 12 - Modifying Factor Assessment HVO North for the reporting period

Location	Date and Time	Measured HVO North L_{Aeq}	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[1]	Low-frequency Modifying Factor?	Maximum Exceedance of NPfI Reference Spectrum[1,2]	Total Penalty [2]
Shearers Lane	13/12/2021 21:22	IA	No	No	No	NA	NA	NA	NA
Knodlers Lane	13/12/2021 21:46	IA	No	No	No	NA	NA	NA	NA
Maison Dieu	13/12/2021 21:00	IA	No	No	No	NA	NA	NA	NA
Long Point (Dights Crossing)	13/12/2021 22:38	IA	No	No	No	NA	NA	NA	NA
Kilburnie South	13/12/2021 23:14	IA	No	No	No	NA	NA	NA	NA
Jerrys Plains East	13/12/2021 22:50	IA	No	No	No	NA	NA	NA	NA
Jerrys Plains Village	13/12/2021 21:22	<25	No	No	No	NA	NA	NA	NA
Jerrys Plains West	13/12/2021 21:02	<25	No	No	No	NA	NA	NA	NA
HVGC	13/12/2021 23:43	IA	No	No	No	NA	NA	NA	NA

1. NA denotes 'not applicable'; and

2. Bold results indicate that application of NPfI modifying factor/s is required

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Table 13 - Modifying Factor Assessment HVO South for the reporting period

Location	Date and Time	Measured HVO South L_{Aeq}	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[1]	Low-frequency Modifying Factor?	Maximum Exceedance of NPfI Reference Spectrum [1,2]	Total Penalty [2]
Shearers Lane	13/12/2021 21:22	IA	No	No	No	NA	NA	NA	NA
Knodlers Lane	13/12/2021 21:46	IA	No	No	No	NA	NA	NA	NA
Maison Dieu	13/12/2021 21:00	IA	No	No	No	NA	NA	NA	NA
Long Point (Dights Crossing)	13/12/2021 22:38	IA	No	No	No	NA	NA	NA	NA
Kilburnie South	13/12/2021 23:14	33	No	No	No	NA	NA	NA	NA
Jerrys Plains East	13/12/2021 22:50	28	No	No	No	NA	NA	NA	NA
Jerrys Plains Village	13/12/2021 21:22	IA	No	No	No	NA	NA	NA	NA
Jerrys Plains West	13/12/2021 21:02	IA	No	No	No	NA	NA	NA	NA
HVGC	13/12/2021 23:43	IA	No	No	No	NA	NA	NA	NA

1. NA denotes ‘not applicable’; and

2. Bold results indicate that application of NPfI modifying factor/s is required

5.3 Real Time Noise Monitoring

HVO utilises a network of real-time directional noise monitors to manage noise impacts on a continuous basis, shown in **Figure 82**. Noise alarms are in place at five monitoring locations (Knodlers Lane, Maison Dieu, Jerrys Plains, Moses Crossing, and Long Point) which alert HVO staff to elevated noise levels that require investigation.

HVO investigates and responds to noise alarms with appropriate modification to operations. Changes in response to a noise alarm can include replacing equipment with alternative units, changing or relocating tasks, or shutting down equipment. It should be noted that this assessment does not compliment or conflict with attended noise monitoring detailed in **Section 5.1**. Real time monitoring data includes non-mine noise sources such as animals, road traffic and weather.

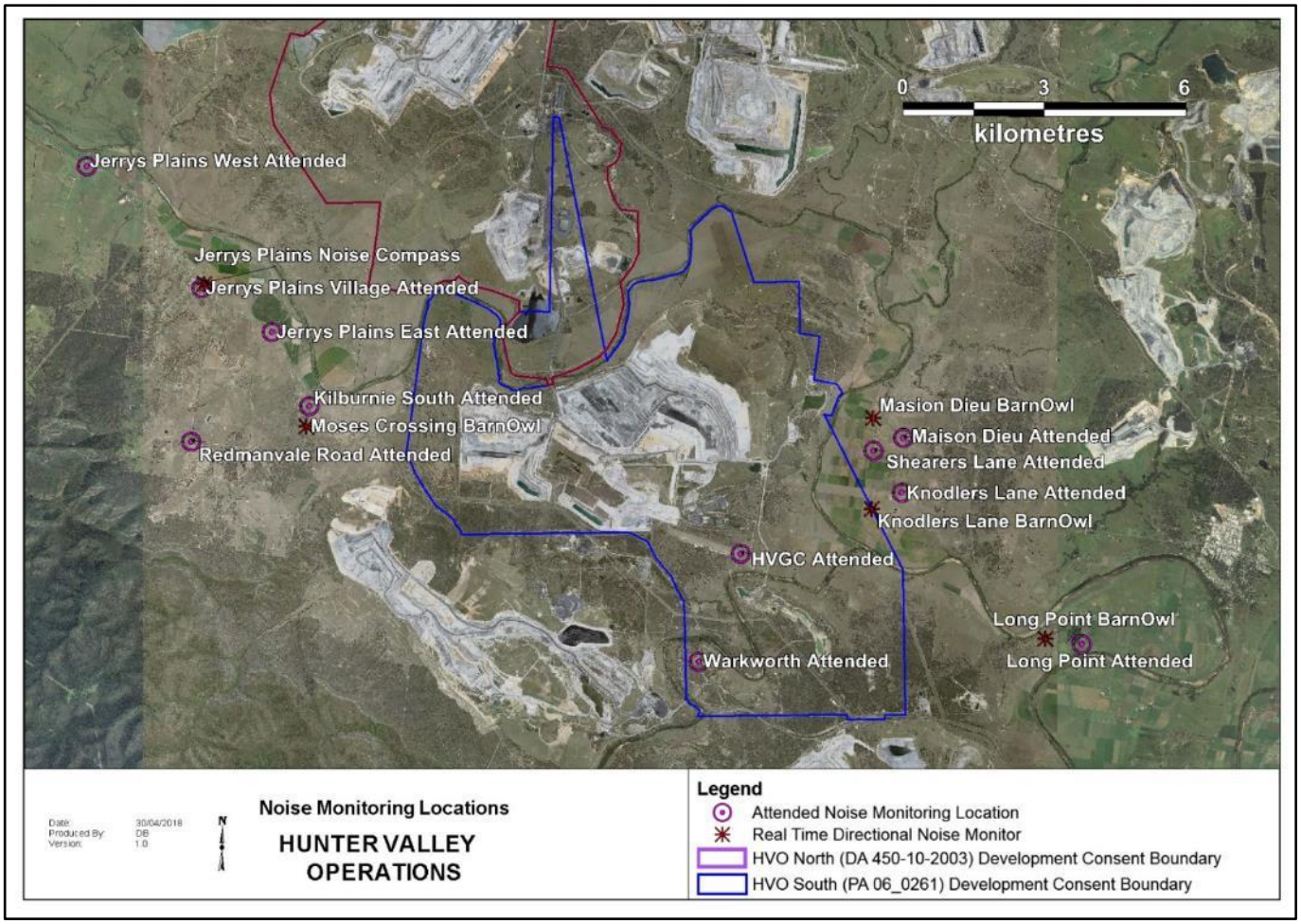

Figure 82 - Noise Monitoring Location Plan

6 Operational Downtime

A total of 289.4 hours of equipment downtime were logged in response to real time monitoring and inspections for environmental factors such as noise and dust during the reporting period. Operational downtime by equipment type is show in **Figure 83**. 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).

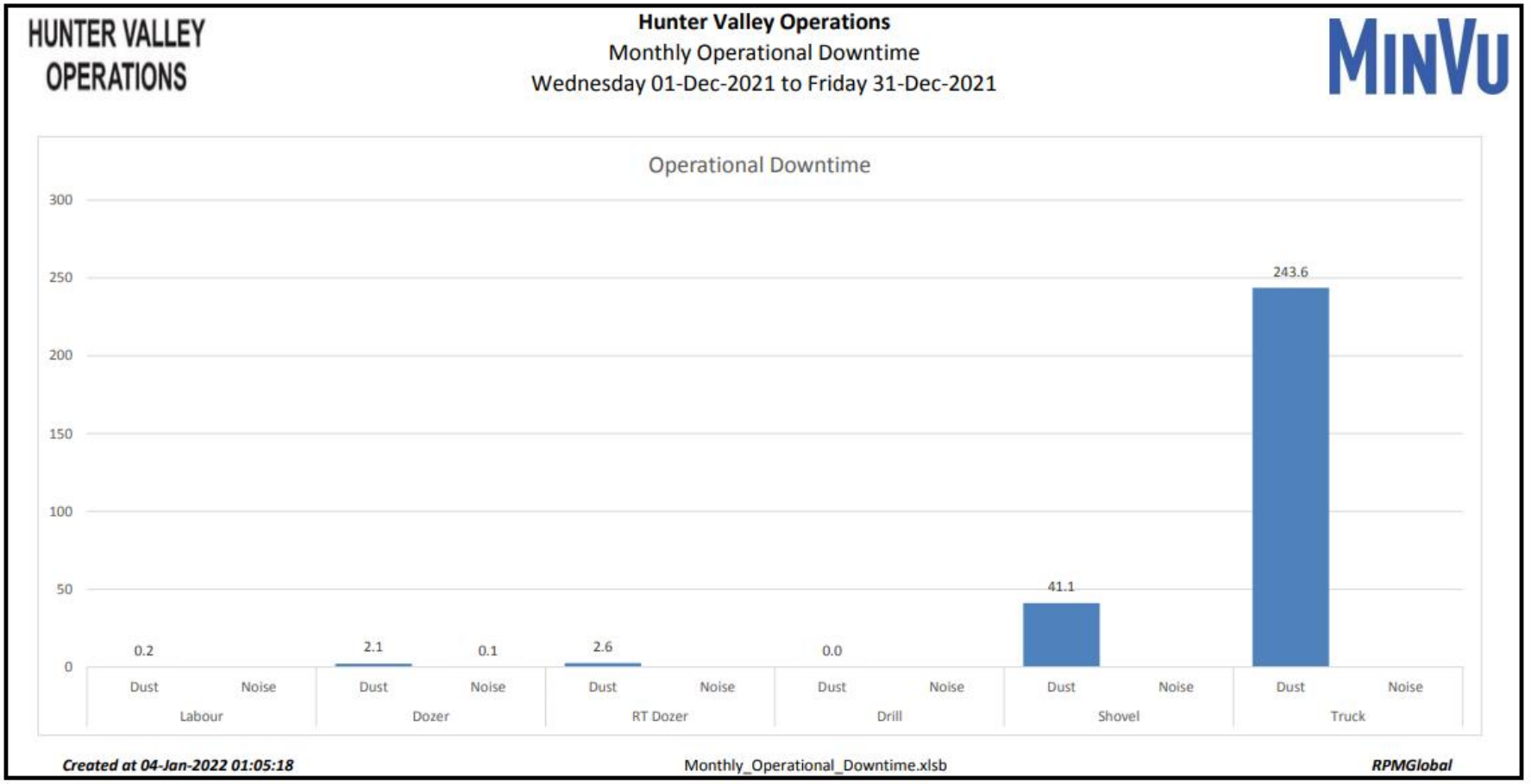

Figure 83 - Operational Downtime by Equipment Type for the reporting period

7 Rehabilitation

The following activities related to rehabilitation were completed during the reporting period:

- 1.57 Ha of land was reshaped
- 1.57 Ha of land was released (became available for the application of topsoil)
- 20.56 Ha of land was topsoiled
- 21.97 Ha of land was rehabilitated

Year to date progress is shown in **Figure 84**.

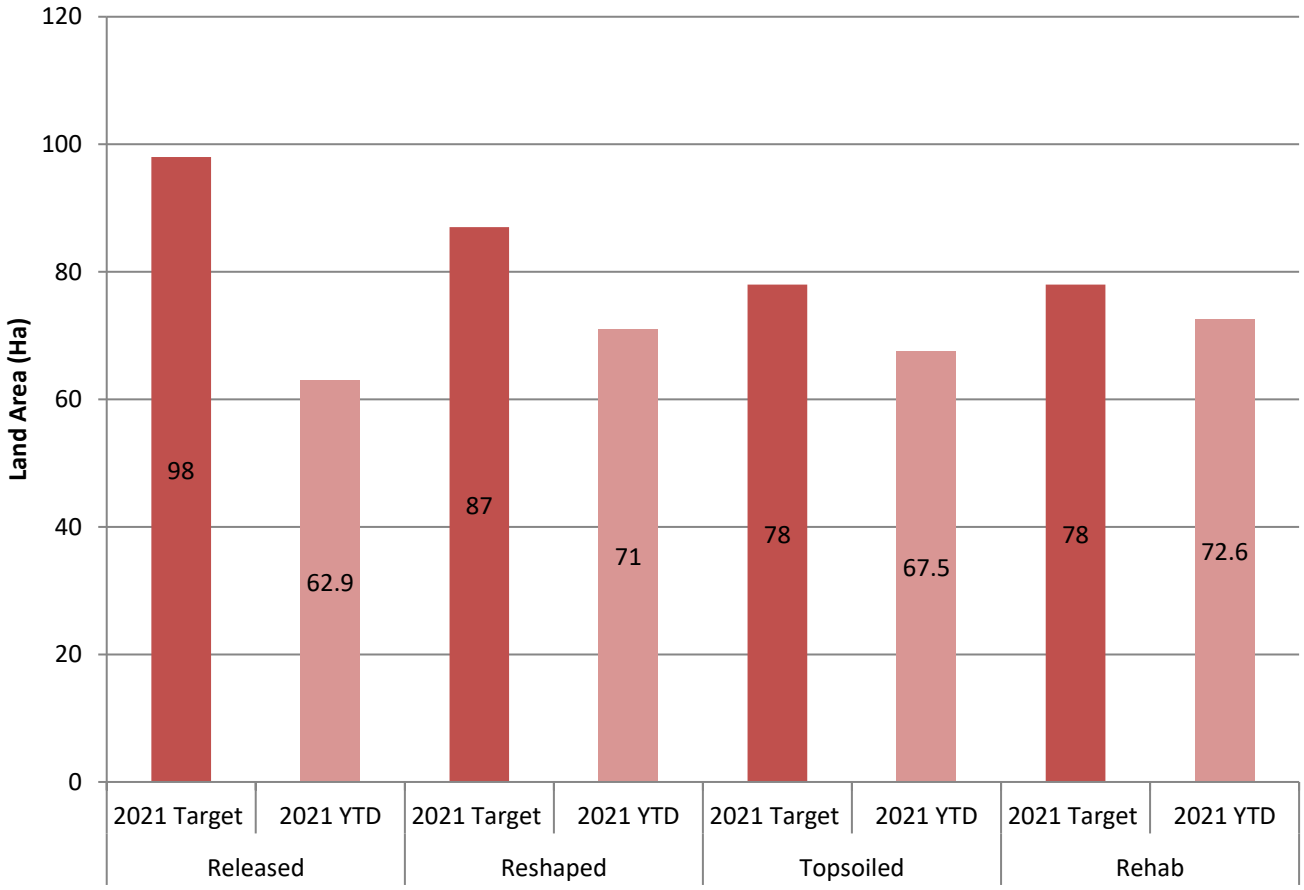

Figure 84 - Rehabilitation YTD December 2021

8 Complaints

One complaint was received during the reporting period. Details of complaints received are shown in **Table 14**.

Table 14 - Complaints Summary 2021

Month	Noise	Dust	Blast	Lighting	Other	Total
January	1	-	-	1	-	**2**
February	-	-	-	-	-	**-**
March	-	-	-	-	-	**-**
April	-	-	3	1	-	**4**
May	2	-	2	1	-	**5**
June	1	-	3	-	-	**4**
July	-	1	-	-	-	**1**
August	-	2	-	-	1	**3**
September	1	-	2	-	-	**3**
October	-	-	2	-	-	**2**
November	-	-	-	-	-	**-**
December	-	1	-	-	-	**1**
Total	**5**	**4**	**12**	**3**	**1**	**25**

9 Environmental Incidents

There was one reportable environmental incident during the reporting period:

- **9/12/2021 – Warkworth TEOM Miscapture**

The Warkworth TEOM produced 58% data capture for 9 December and 53% data capture for 10 December, less than the required 75% capture rate. The DPIE technician was contacted who confirmed that the failure was due to data logger lockup on the TEOM. DPIE was notified of the miscapture. The TEOM is not under the control of HVO.

Appendix A - Meteorological Data

Date	Air Temp Max (°C)	Air Temp Min (°C)	Relative Humidity (Max %)	Relative Humidity (Min %)	Solar Radiation Maximum (W/Sq. M)	Average Wind Direction (°)	Average Wind Speed (m/sec)	Rainfall (mm)
1/12/2021	24.8	9.9	111.2	62.8	1638	119.5	3.1	0
2/12/2021	27.5	10.4	108.9	47.2	1755	118.9	2.9	0
3/12/2021	33.8	8.6	111.4	33.4	1282	182.5	2.1	37.6
4/12/2021	27.6	8.8	110.7	48.7	1409	127.1	2.6	1
5/12/2021	21.5	5.6	100	54.2	1657	117.2	4.5	0
6/12/2021	22.1	4.0	96.6	59.9	1669	121.9	3.6	0.2
7/12/2021	26.4	7.8	110.1	57.4	1517	206.4	1.7	15
8/12/2021	27.2	8.4	111.4	52.4	1406	167.1	2.7	24.8
9/12/2021	24.0	7.6	111.6	62.8	1656	129.6	1.9	2.6
10/12/2021	23.1	5.0	93.6	28.8	1372	256.8	4.8	0
11/12/2021	20.7	7.1	89.5	46.9	1738	127.4	2.6	0
12/12/2021	24.5	5.4	95.9	39.2	1432	110.1	2.5	0
13/12/2021	27.4	8.1	94	35.9	1194	128.9	2.1	0
14/12/2021	27.6	6.1	100	39.4	1314	143.8	2.1	0
15/12/2021	33.0	6.5	100	16.2	1104	187.1	1.5	0
16/12/2021	27.0	11.8	100	52.4	1643	119.4	2.8	1
17/12/2021	27.7	10.3	92.6	51.6	1661	116.5	3.1	0
18/12/2021	34.5	9.2	100	32.5	1257	255.1	2.6	0
19/12/2021	33.1	12.7	97.8	34.5	1511	247.5	3.9	2.2
20/12/2021	34.6	10.7	100	30.8	1341	208.6	1.7	0
21/12/2021	35.4	14.2	100	37.7	1266	200.1	2.1	0
22/12/2021	31.3	14.4	100	44.2	1502	197.1	2.9	6.4
23/12/2021	28.2	12.6	100	54.6	1550	126.5	2.2	0
24/12/2021	29.8	10.5	109.1	46.4	1368	116.1	2.9	0
25/12/2021	32.1	11.3	100	30.0	1108	138.3	2.0	0

Date	Air Temp Max (°C)	Air Temp Min (°C)	Relative Humidity (Max %)	Relative Humidity (Min %)	Solar Radiation Maximum (W/Sq. M)	Average Wind Direction (°)	Average Wind Speed (m/sec)	Rainfall (mm)
26/12/2021	30.9	10.7	109.7	31.6	1155	109	2.7	9.6
27/12/2021	22.3	7.9	110.2	62.7	1480	129	4.3	4.4
28/12/2021	22.6	6.8	109.9	50.3	1611	125.7	3.5	1.2
29/12/2021	24.6	6.3	100	46.7	1733	118.3	2.5	0.2
30/12/2021	27.6	5.5	100	32.8	1551	117.9	2.7	0
31/12/2021	29.4	7.0	100	28.9	1178	114.6	2.3	0