Monthly Environmental Monitoring Report

Yancoal Mt Thorley Warkworth

September 2021

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Revision History

Version No.	Person Responsible	Document Status	Date
1.0	**Environment and Community Advisor**	**Final**	**09/02/2022**

1.0 INTRODUCTION

This report has been compiled to provide a monthly summary of environmental monitoring results for Mount Thorley Warkworth (MTW). This report includes all monitoring data collected for the period 1 September to 30 September 2021.

2.0 AIR QUALITY

2.1 Meteorological Monitoring

Meteorological data is collected at MTW's 'Charlton Ridge' meteorological station (refer to **Figure 3:** Air Quality Monitoring Locations).

2.1.1 Rainfall

Rainfall for the period is summarised in **Table 1**, the year-to-date trend and historical trend are shown in **Figure 1**.

Table 1: Monthly Rainfall MTW

2021	Monthly Rainfall (mm)	Cumulative Rainfall (mm)
September	20.6	599

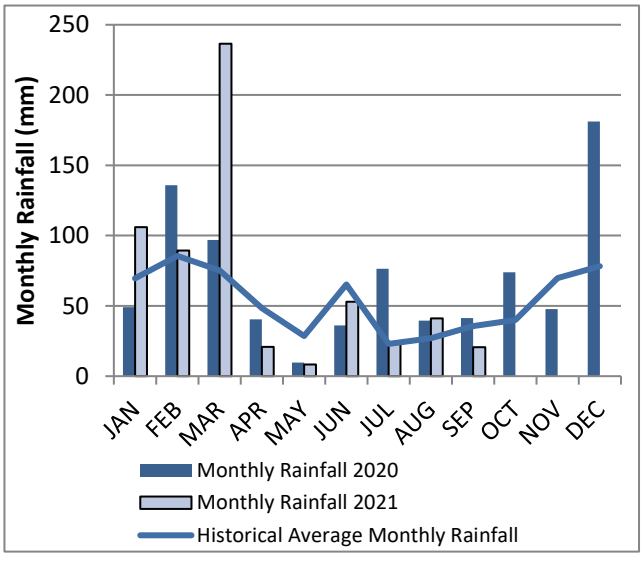


Figure 1: Rainfall Trends YTD

Note: The historical average monthly rainfall is calculated from 2007 to 2021 monthly totals

2.1.2 Wind Speed and Direction

Winds from the north west were dominant throughout the reporting period as shown in **Figure 2**..

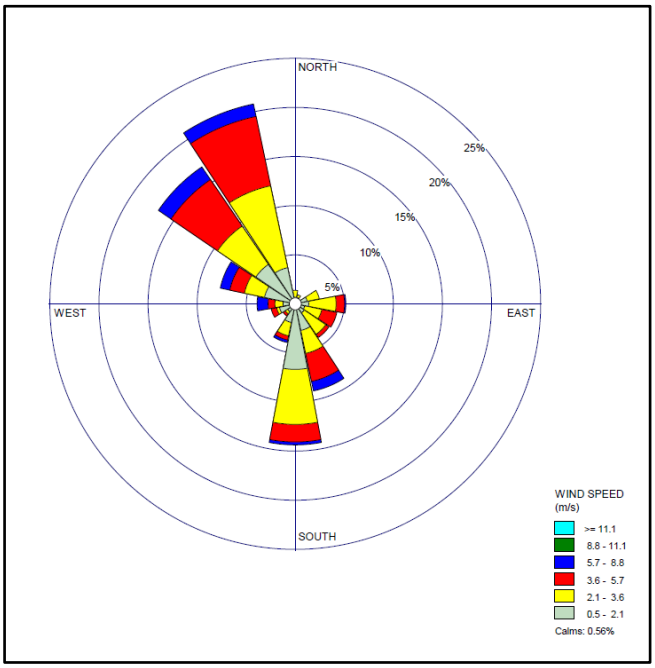


Figure 2: Charlton Ridge Wind Rose – September 2021

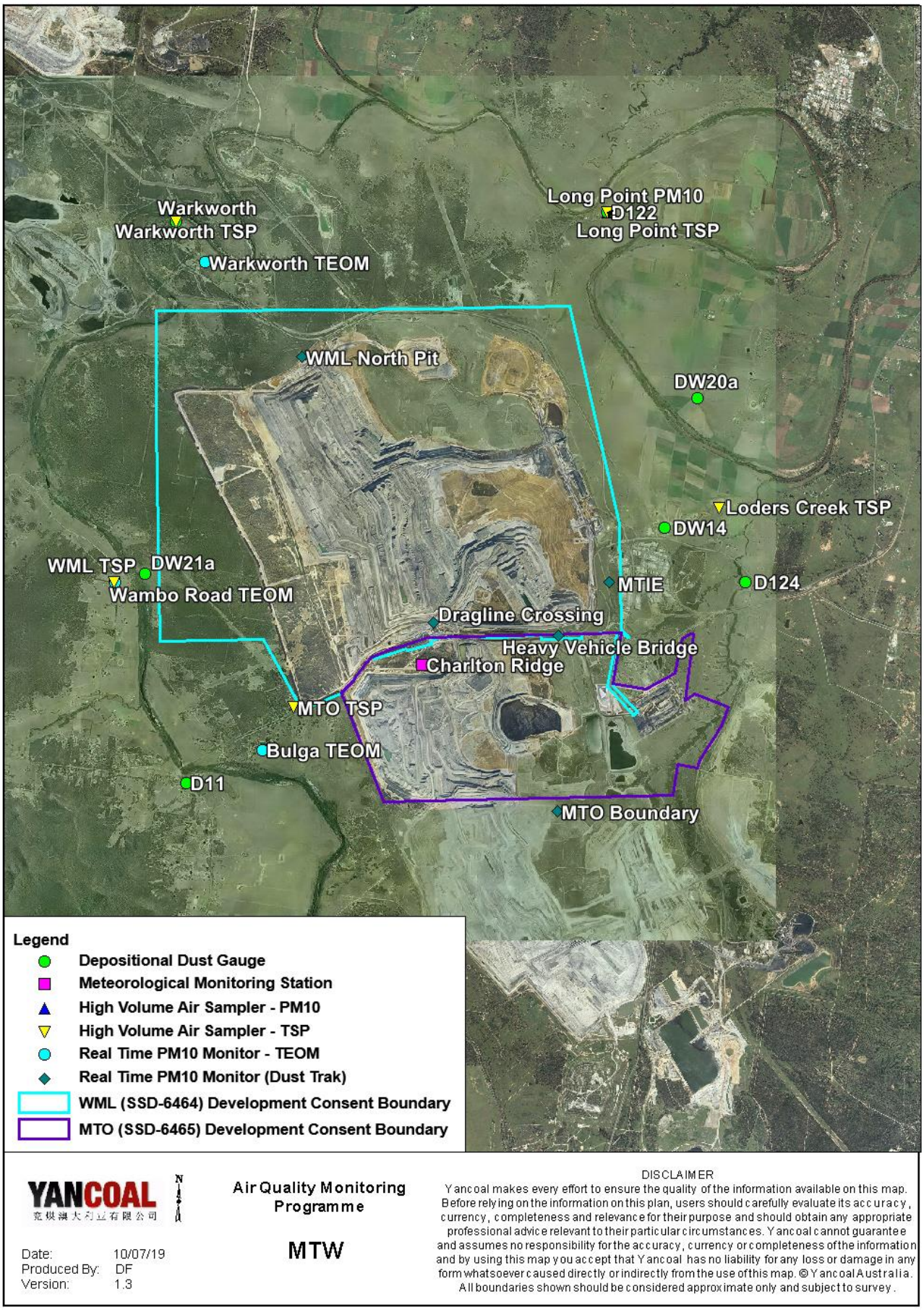


Figure 3: Air Quality Monitoring Locations

2.2 Depositional Dust

To monitor regional air quality, MTW operates and maintains a network of seven depositional dust gauges, situated on private and mine owned land surrounding MTW.

Figure 4 displays insoluble solids results from depositional dust gauges during the reporting period compared against the year-to-date average and the annual impact assessment criteria.

During the reporting period the Warkworth monitor recorded a monthly result above the long-term impact assessment criteria of 4.0 g/m2 per month. There is no evidence to suggest that the Warkworth result is contaminated. An external investigation of an elevated result at this monitor was undertaken for a July 2021 reading, which indicated the July result was anomalous and was then excluded from annual average calculation. Since that time, the August to September results have been elevated compared to other depositional dust results. MTW is progressing further investigation of the potential influence of localised sources to determine possible reasons for the result, as recommended by a specialist Air Quality specialist consultant. Presently, the result is included in the annual average calculation.

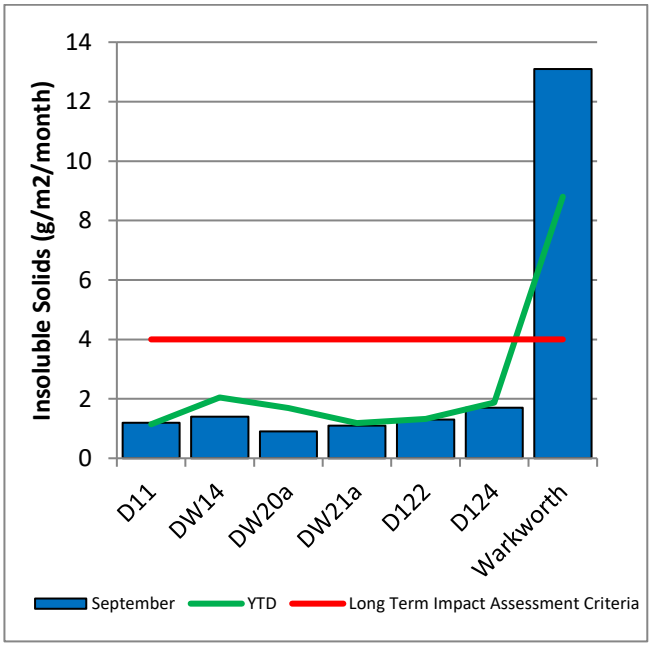


Figure 4: Depositional Dust – September 2021

2.3 Suspended Particulates

Suspended particulates are measured by a network of High Volume Air Samplers (HVAS) measuring Total Suspended Particulates (TSP) and Particulate Matter <10µm (PM_{10}). The location of these monitors can be found in **Figure 3**. Each HVAS was run for 24 hours on a six-day cycle in accordance with EPA requirements.

2.3.1 HVAS PM_{10} Results

Figure 5 shows the individual PM_{10} results at the monitoring station against the short-term impact assessment criteria of 50µg/m³.

On 12 September 2021 the Long Point HVAS PM10 unit recorded a result of 57 µg/m³, which is greater than the short term (24hr) PM10 impact assessment criteria.

Investigation determined that the wind direction was generally not from MTW's angle of influence and that the likely MTW contribution to the results is less than 75%. Accordingly, no further action is required (as per approved Air Quality Monitoring Programme).

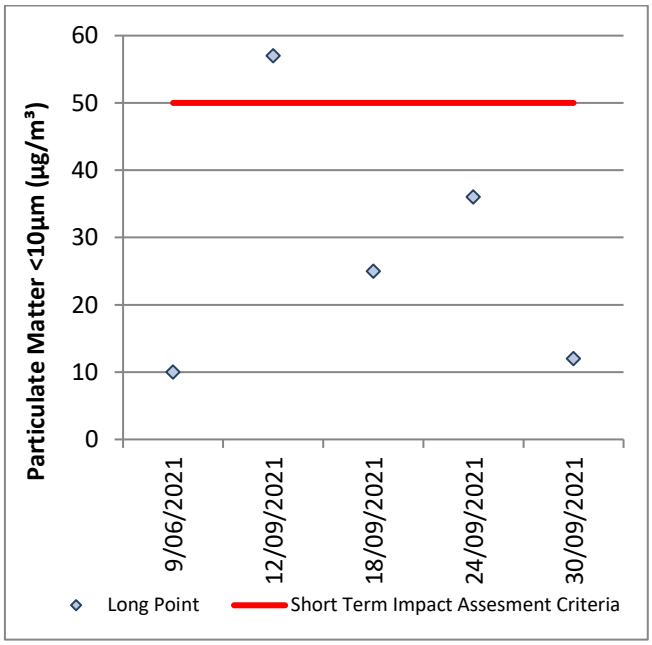


Figure 5: Individual PM_{10} Results – September 2021

Figure 6 shows the annual average PM_{10} results against the long-term impact assessment criteria.

An annual assessment of MTW's compliance with the Long-Term Impact Assessment Criteria will be provided in the 2021 Annual Review Report.

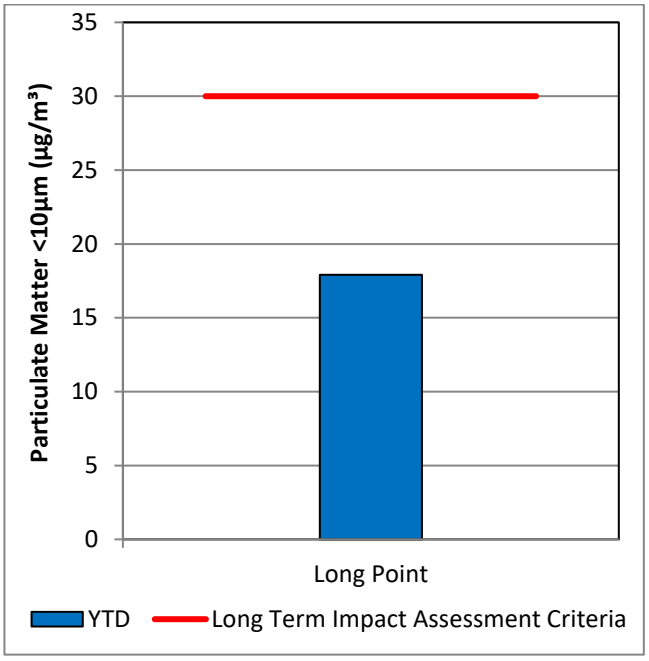


Figure 6: Annual Average PM_{10} – September 2021

2.3.2 TSP Results

Figure 7 shows the annual average TSP results compared against the long-term impact assessment criteria of 90µg/m³.

An annual assessment of MTW's compliance with the Long-Term Impact Assessment Criteria will be provided in the 2021 **Annual Review Report.**

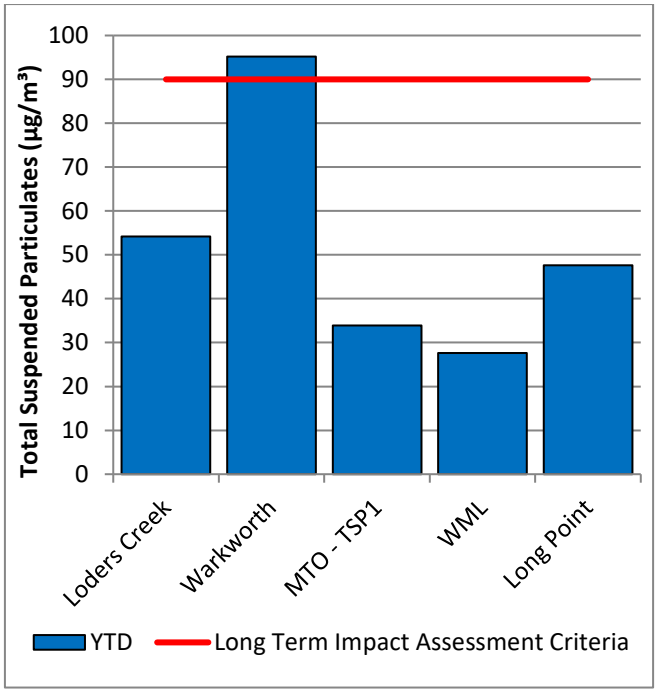


Figure 7: Annual Average Total Suspended Particulates – September 2021

2.3.3 Real Time PM_{10} Results

Mount Thorley Warkworth maintains a network of real time PM_{10} monitors. The 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.

Results for real time dust sampling are shown in **Figure 8**, including the daily 24-hour average PM_{10} result and the annual PM_{10} average.

During September one exceedance was recorded at Warkworth on 12 September from the Warkworth monitor. Investigation determined that the wind direction was generally not from MTW's angle of influence and that the likely MTW contribution to the results is less than 75%.

2.3.4 Real Time Alarms for Air Quality

During September, the real-time monitoring system generated 115 automated air quality related alerts, including 16 alerts for adverse meteorological conditions and 99 alerts for elevated PM_{10} levels.

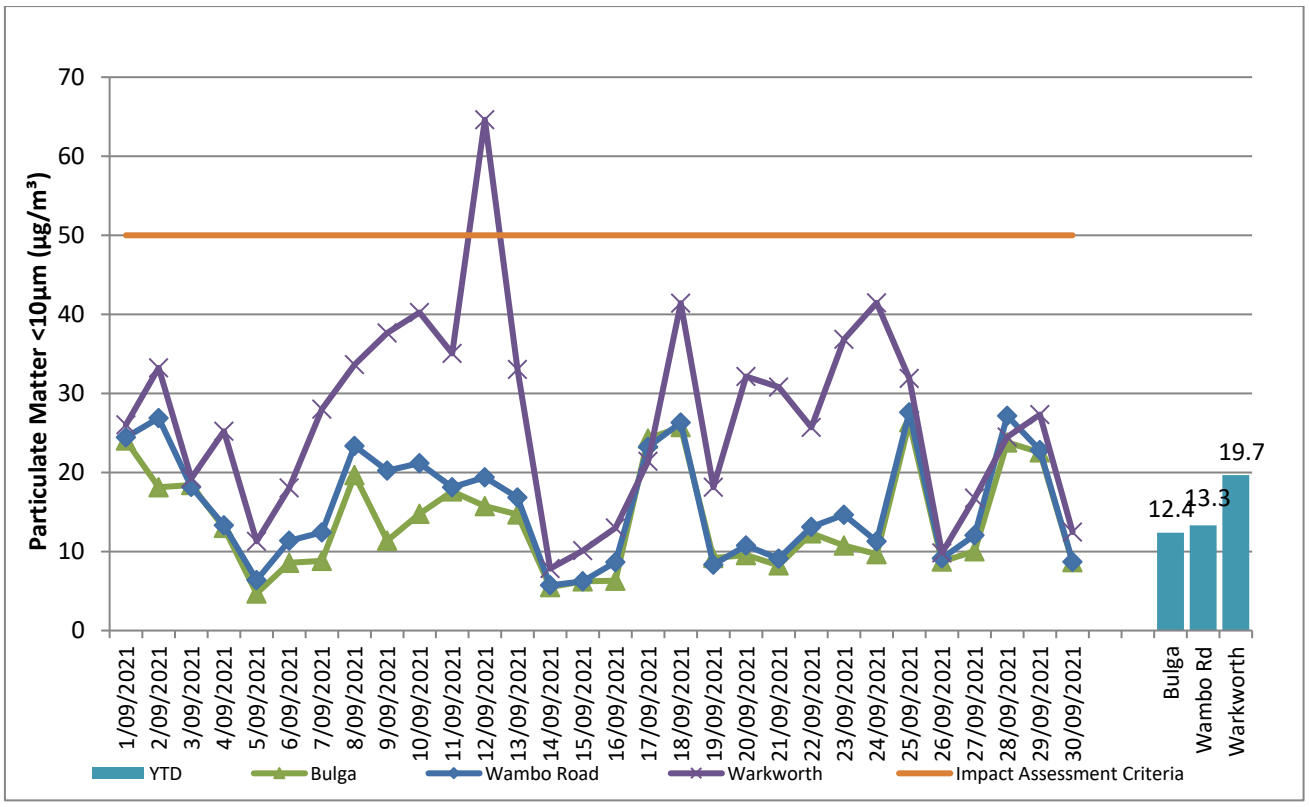


Figure 8: Real Time PM_{10} 24hr average and Year-to-date average – September 2021

3.0 WATER QUALITY

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

3.1 Surface Water

Monitoring is conducted at mine site dams and surrounding natural watercourses. The surface water monitoring locations are outlined in **Figure 15**.

Surface water courses are sampled on a monthly or quarterly sampling regime. Water quality is evaluated through the parameters of pH, Electrical Conductivity (EC) and Total Suspended Solids (TSS). The Hunter River and the Wollombi Brook are sampled both upstream and downstream of mining operations, to monitor the potential impact of mining. Other Hunter River tributaries are also monitored.

3.1.1 Surface Water Monitoring Results

Figure 9 to **Figure 11** show the long-term surface water trend (2018 – current) within MTW mine dams. **Figure 12** to **Figure 14** show the long-term surface water trend (2018 - current) in surrounding watercourses.

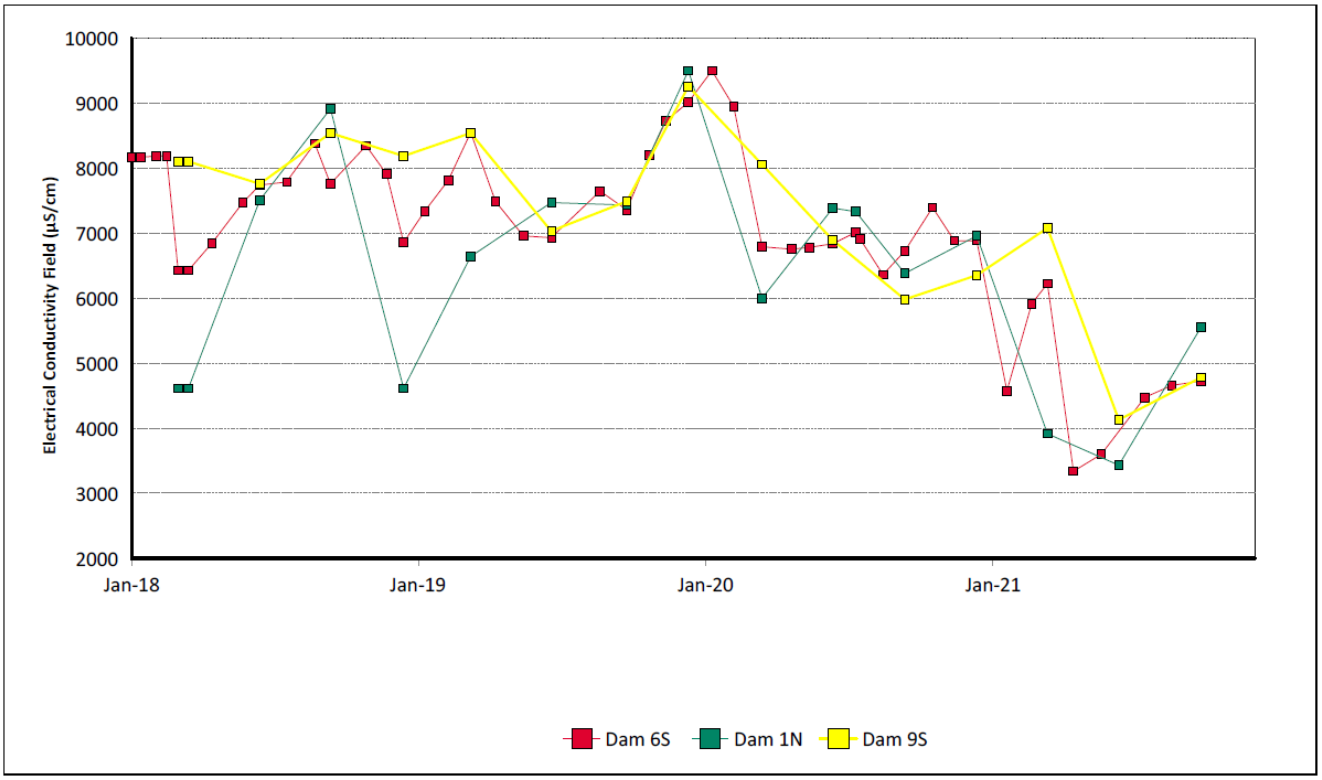


Figure 9: Site Dams Electrical Conductivity Trend – September 2021

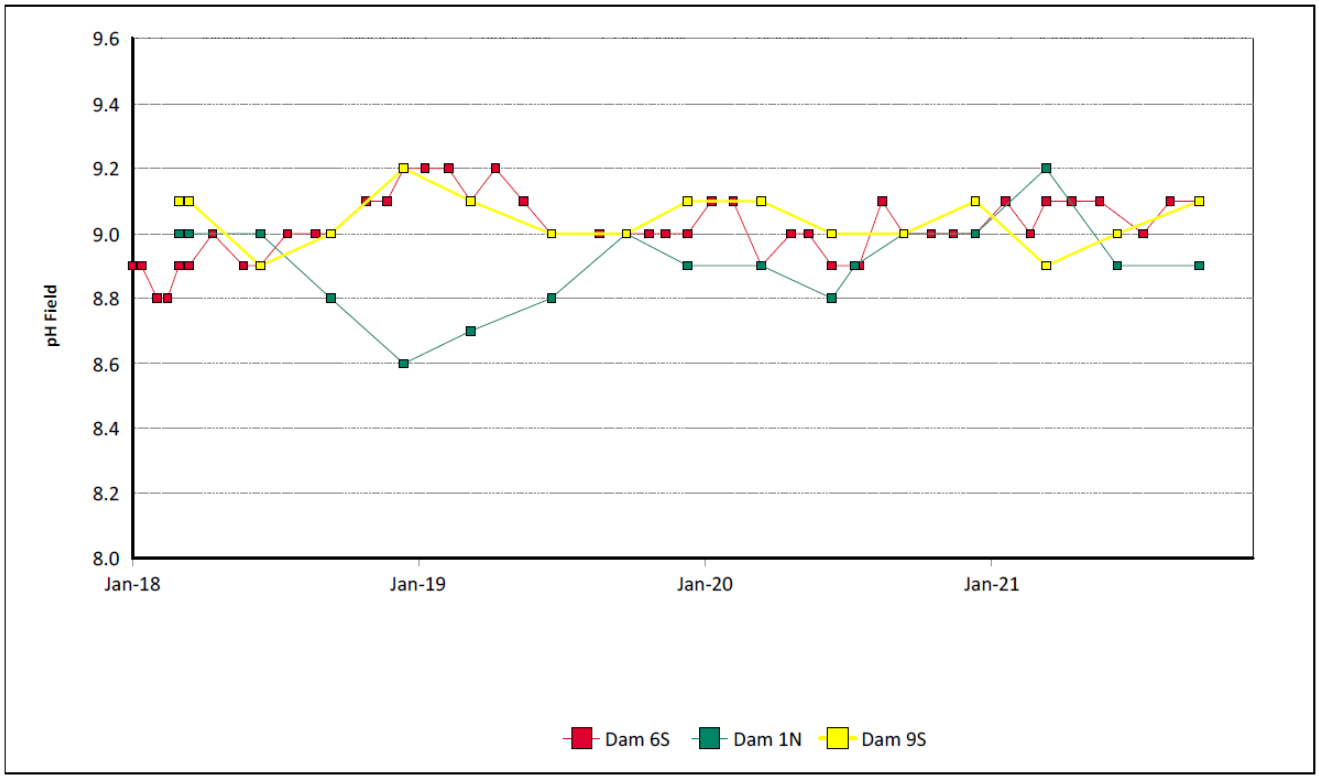


Figure 10: Site Dams pH Trend – September 2021

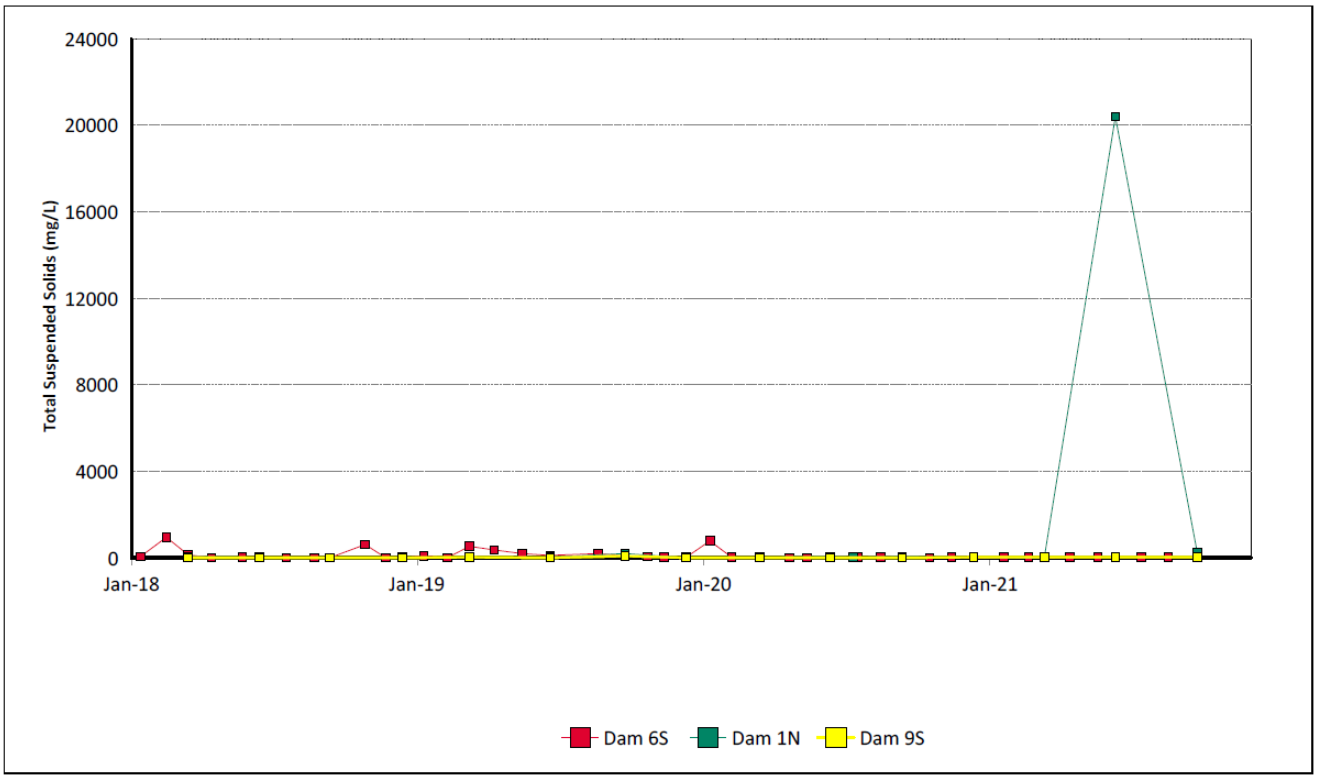
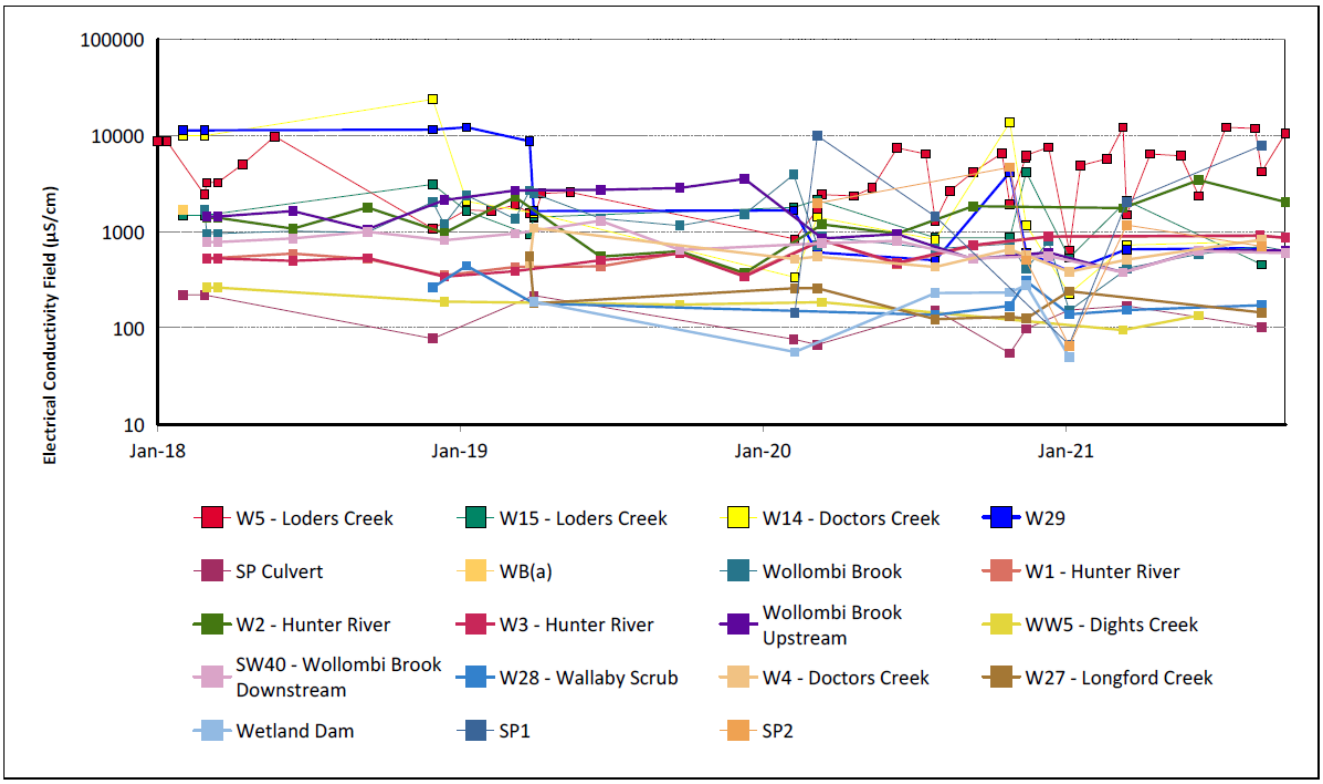
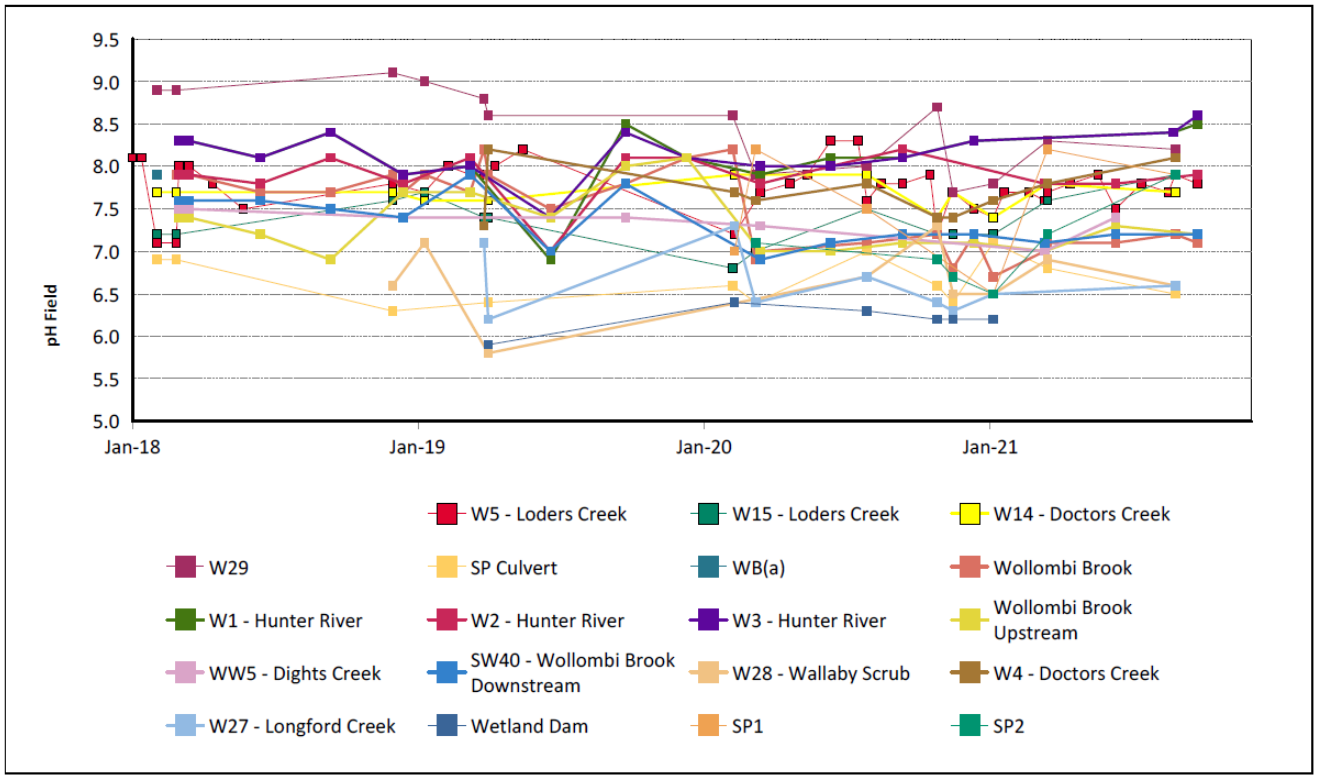


Figure 11: Site Dams Total Suspended Solids Trend – September 2021



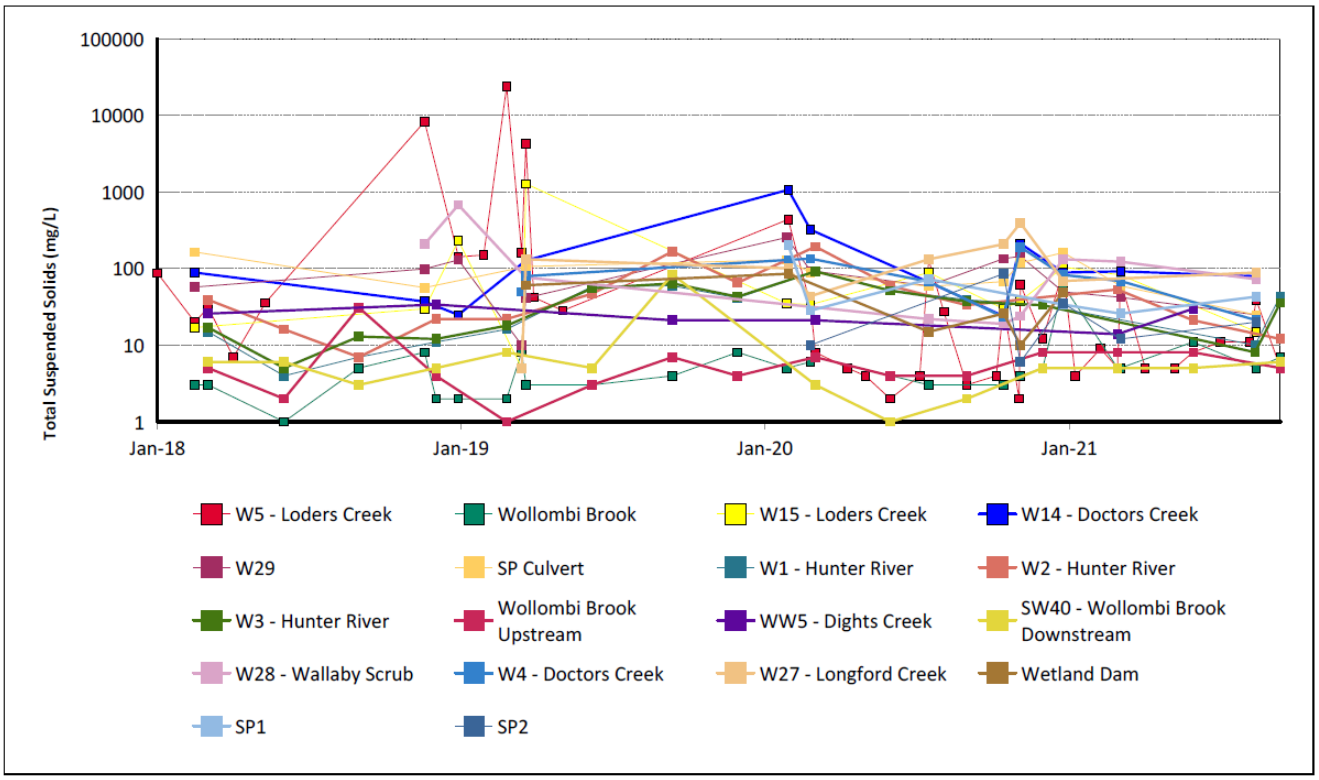
Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

Figure 12: Watercourse Electrical Conductivity Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

Figure 13: Watercourse pH Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

Figure 14: Watercourse Total Suspended Solids Trend – September 2021

3.1.2 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 MTW Water Management Plan.

Current internal surface water trigger limit breaches are summarised in **Table 2**.

Table 2: Surface Water Trigger Tracking – September YTD 2021

Site	Date	Trigger Limit Breached	Action Taken in Response
SP1	05/01/2021	pH –5th Percentile	Monitoring results back within trigger limits for March and August 2021 sample rounds. No follow up required.
W5	05/01/2021	pH –5th Percentile	Monitoring results back within trigger limits for February 2021 and all subsequent sample rounds. No follow up required.
W15	05/01/2021	pH –5th Percentile	Cyclical lower-pH measurements are consistently seen in the historical trend for this Loders Creek monitoring location. Monitoring results back within trigger limits for March 2021 sample round. No follow up required.
W29	05/01/2021	pH –5th Percentile	Monitoring results back within trigger limits for March and August 2021 sample rounds. No follow up required.
W3	23/09/2021	pH –5th Percentile	Watching Brief*
W2	11/03/2021	TSS – 50mg/L (ANZECC criteria)	Unlikely to be associated with MTW mining related impacts. Elevated TSS results most likely attributable to sampling from water with no flow. Note: Result is not considered to be a valid representation given that there was no flow at the time of sampling. Monitoring results back within trigger limits for June and September 2021 sample rounds. No follow up required.
W4	05/01/2021	TSS – 50mg/L (ANZECC criteria)	Watching Brief*. Elevated TSS associated with high runoff due to rainfall event (79.4mm on 4 January). Consistent with and higher than upstream sample W29 (which is closer to MTW); no mine site sources of sediment identified (no dam overtopping and/or site discharges recorded during the event).

Site	Date	Trigger Limit Breached	Action Taken in Response
W4	15/03/2021	TSS – 50mg/L (ANZECC criteria)	Watching Brief*. Elevated TSS associated with rainfall event (36.2mm on 14 March) and is considered related to sampling from slow flowing water. Consistent with and higher than upstream sample W29 (which is closer to MTW); no mine site sources of sediment identified. Monitoring results back within trigger limits for August 2021 sample round. No follow up required.
W5	05/01/2021	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (79.4mm on 4 January), resulting in mobilisation of sediment in Loders Creek. No MTW site sources of sediment identified. No follow up required.
W5	15/03/2021	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with rainfall event (36.2mm on 14 March), resulting in mobilisation of sediment in Loders Creek. No MTW site sources of sediment identified. Monitoring results back within trigger limits for August 2021 sample round. No follow up required.
W14	05/01/2021	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (79.4mm on 4 January). No mine site sources of sediment identified. Upstream sample W29 (which is closer to MTW) indicates source of sediment may be partially attributable to runoff from downstream farming properties. No follow up required.
W14	15/03/2021	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with rainfall event (36.2mm on 14 March), resulting in mobilisation of sediment in Doctors Creek. No mine site sources of sediment identified. Upstream sample W29 (which is closer to MTW) indicates source of sediment may be partially attributable to runoff from downstream farming properties. No follow up required.
W14	25/08/2021	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with rainfall event (31.4mm on 24 August), resulting in mobilisation of sediment in Doctors Creek. No mine site sources of sediment identified. Upstream sample W29 (which is closer to MTW) indicates source of sediment may be partially attributable to runoff

Site	Date	Trigger Limit Breached	Action Taken in Response
			from downstream farming properties. No follow up required.
W15	05/01/2021	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Elevated TSS results most likely attributable to high runoff due to rainfall event (79.4mm on 4 January), resulting in mobilisation of sediment in Loders Creek. In addition, TSS results were potentially affected by turbid water associated with the overtopping of one mine water dam at MTO and several MTCL dams/catchment basins which were reported to EPA and DPIE.
W15	15/03/2021	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with rainfall event (36.2mm on 14 March), resulting in mobilisation of sediment in Loders Creek. No mine site sources of sediment identified. Monitoring results back within trigger limits for August 2021 sample round. No follow up required.
W27	05/01/2021	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Elevated TSS results most likely attributable to high runoff due to rainfall event (79.4mm on 4 January). In addition, TSS results were potentially affected by turbid water associated with the overtopping of an MTW mine water dam as a result of the rainfall event which was reported to EPA and DPIE.
W27	25/08/2021	TSS – 50mg/L (ANZECC criteria)	Watching Brief* Elevated TSS results most likely attributable to high runoff due to rainfall event (31.4mm on 24 August). Note: location was too shallow to sample in March 2021 sample round.
W28	05/01/2021	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Elevated TSS results most likely attributable to high runoff due to rainfall event (79.4mm on 4 January). In addition, TSS results were potentially affected by turbid water associated with the overtopping of MTW sediment dams as a result of greater than design rainfall, which were reported to EPA and DPIE.
W28	15/03/2021	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with rainfall event (36.2mm on 14 March). No mine site sources of sediment identified. No follow up required.

Site	Date	Trigger Limit Breached	Action Taken in Response
W28	25/08/2021	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with rainfall event (31.4mm on 24 August). No mine site sources of sediment identified.

* = Watching brief established pending outcomes of subsequent monitoring events.

3.2 HRSTS Discharge

MTW participates in the Hunter River Salinity Trading Scheme (HRSTS), allowing discharge from licensed discharge points located at Dam 1N and Dam 9S. Discharges can only take place subject to HRSTS regulations.

MTW did not undertake any HRSTS discharges in the reporting period.

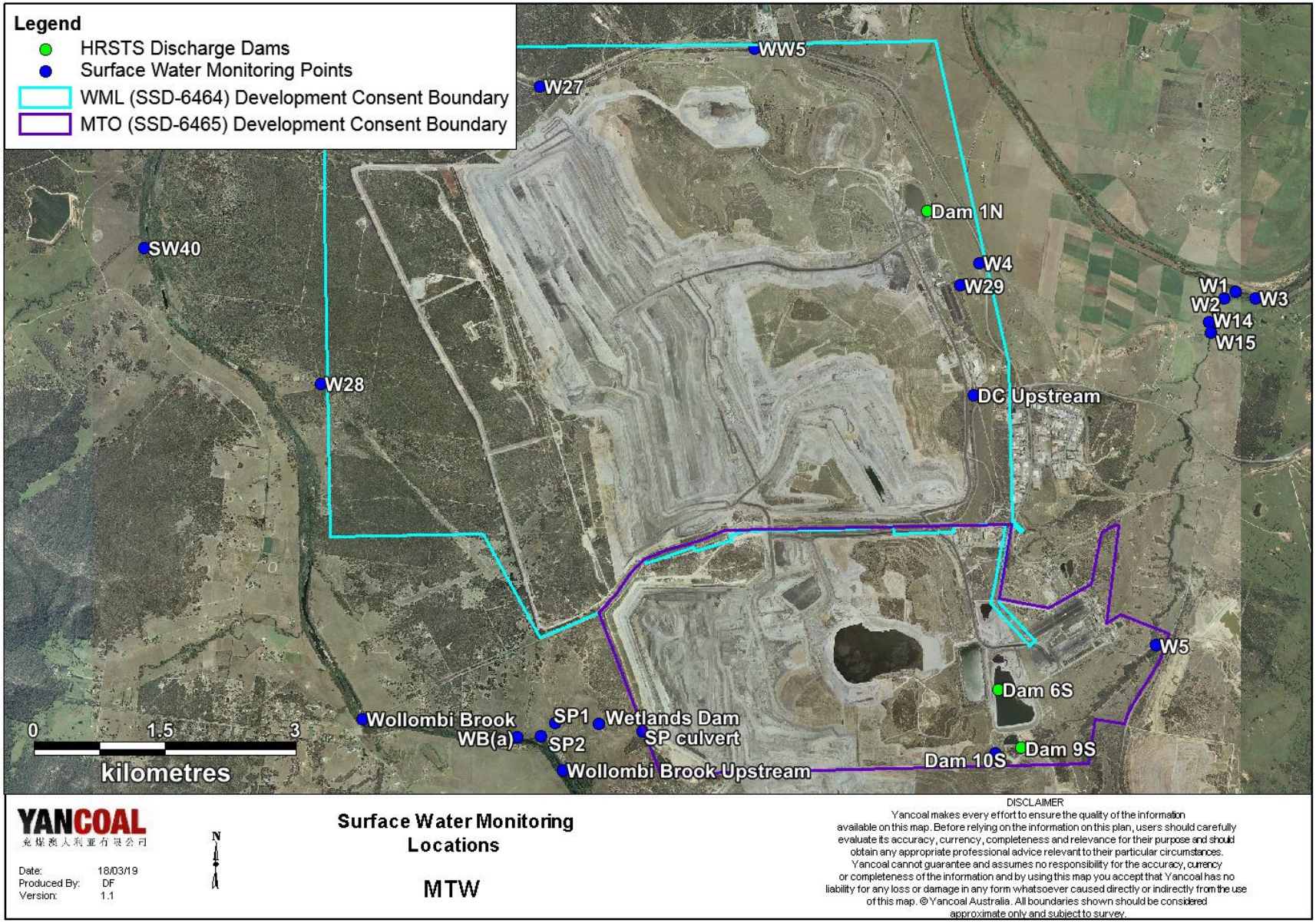
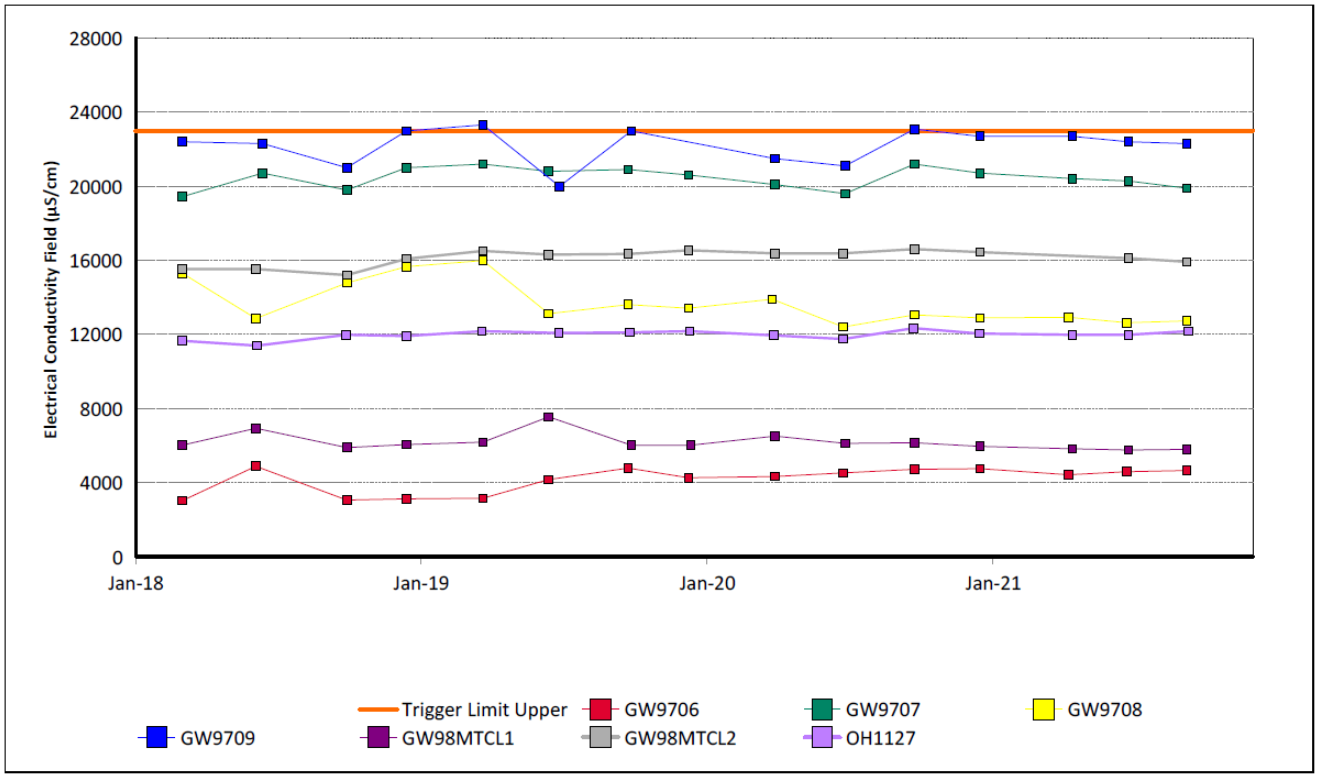


Figure 15: Surface Water Monitoring Location Plan

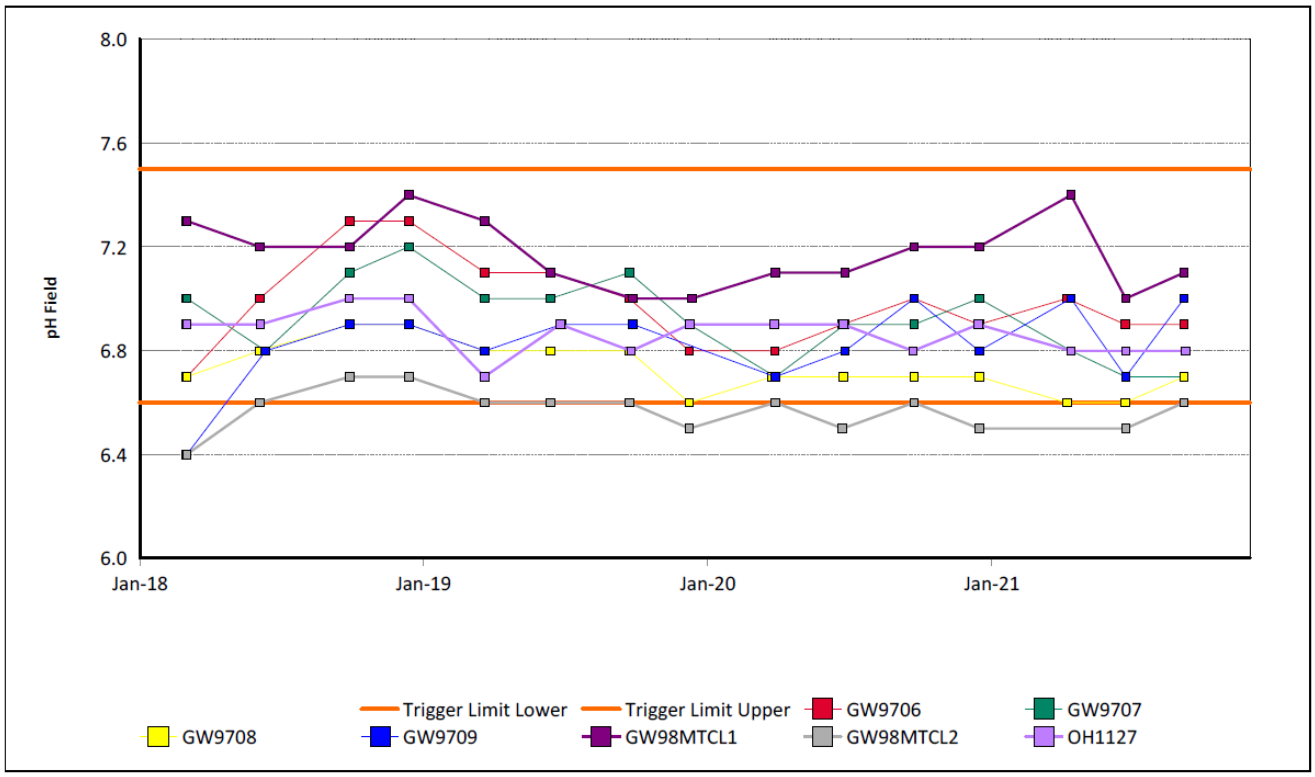
3.3 Groundwater Monitoring

Groundwater monitoring is undertaken on a quarterly basis in accordance with the MTW Groundwater Monitoring Programme.

Figure 16 to **Figure 61** show the long-term water quality trends (2018 – current) for groundwater bores monitored at MTW.



Note: Missing data indicates that there was insufficient water to take a sample.
Figure 16: Bayswater Seam Electrical Conductivity Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 17: Bayswater Seam pH Trend – September 2021

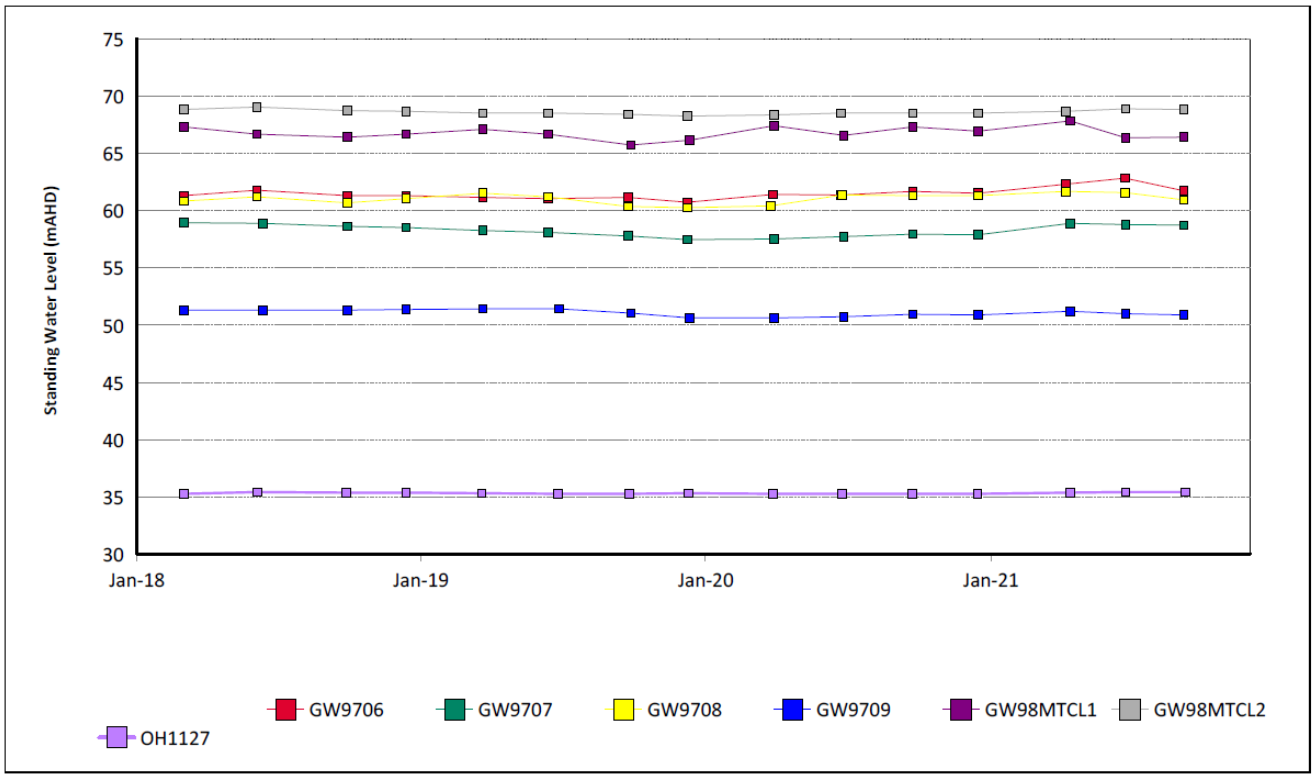
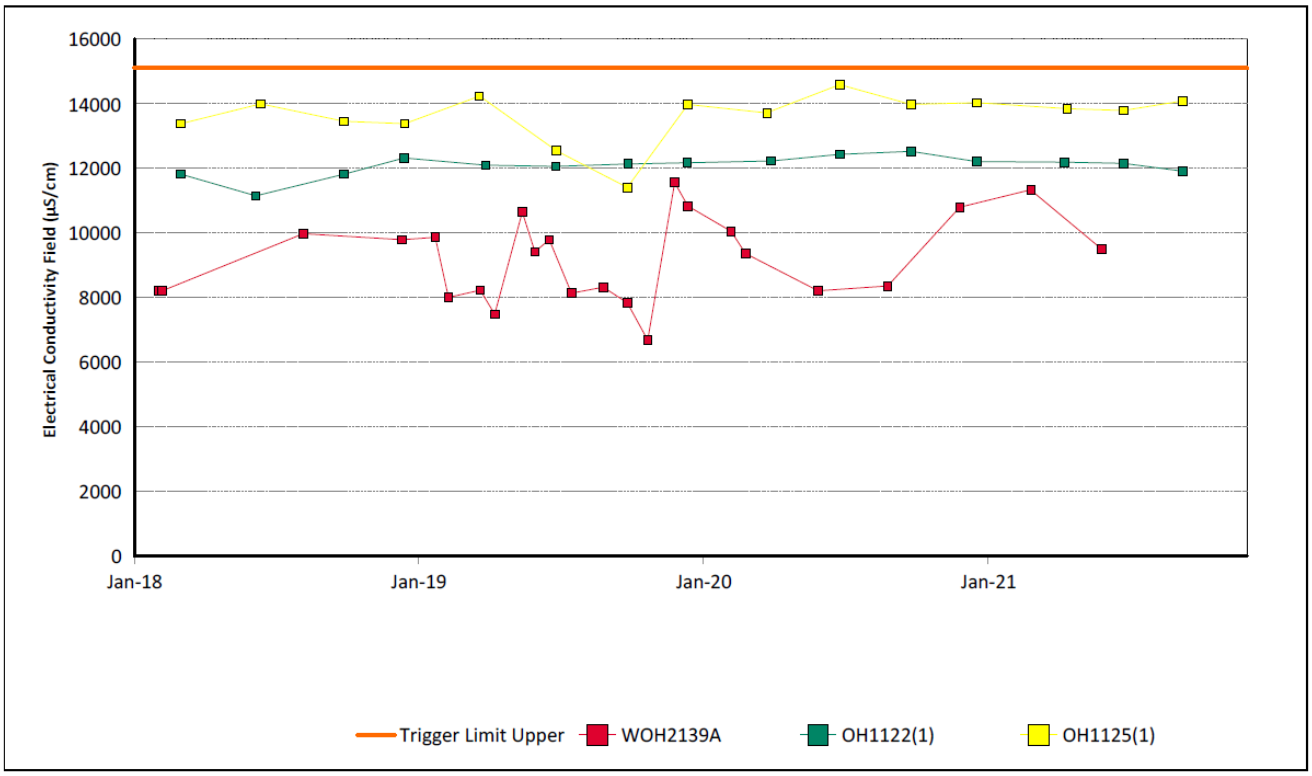
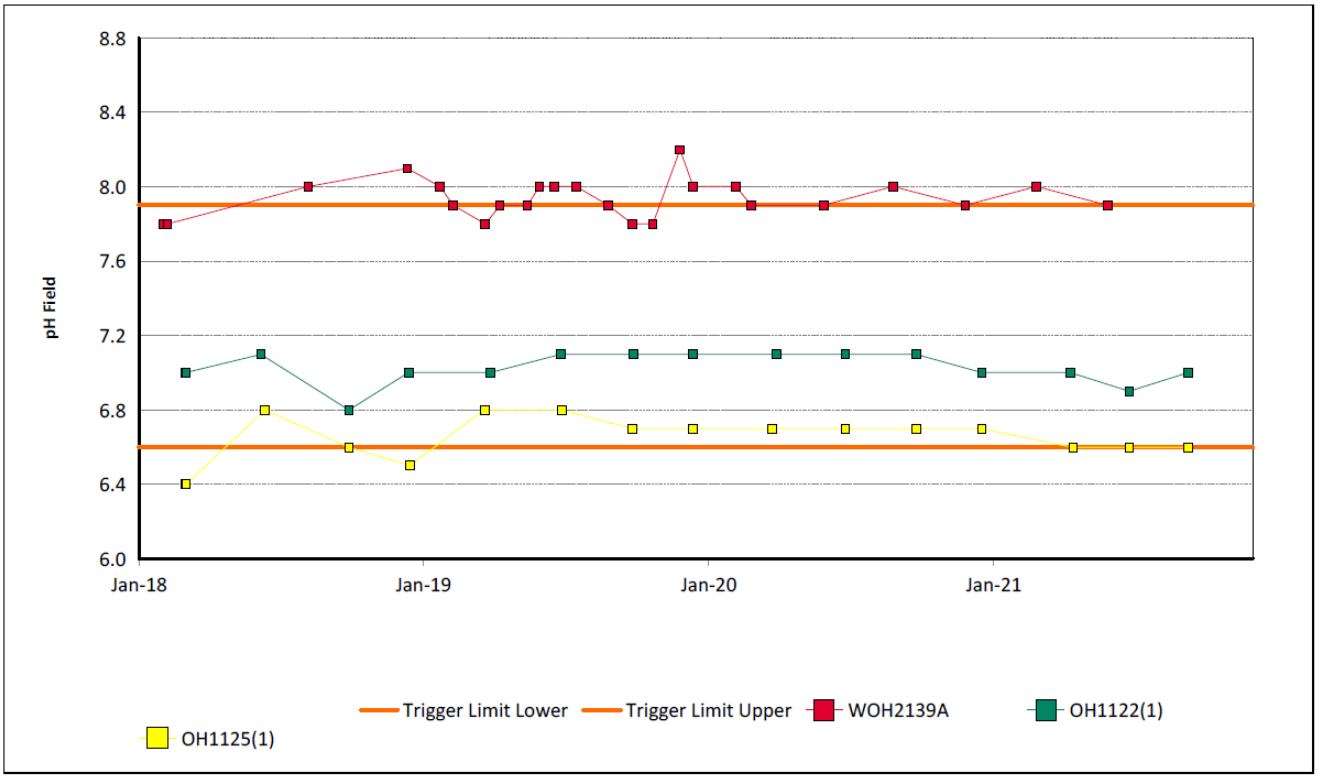


Figure 18: Bayswater Seam Standing Water Level Trend – September 2021



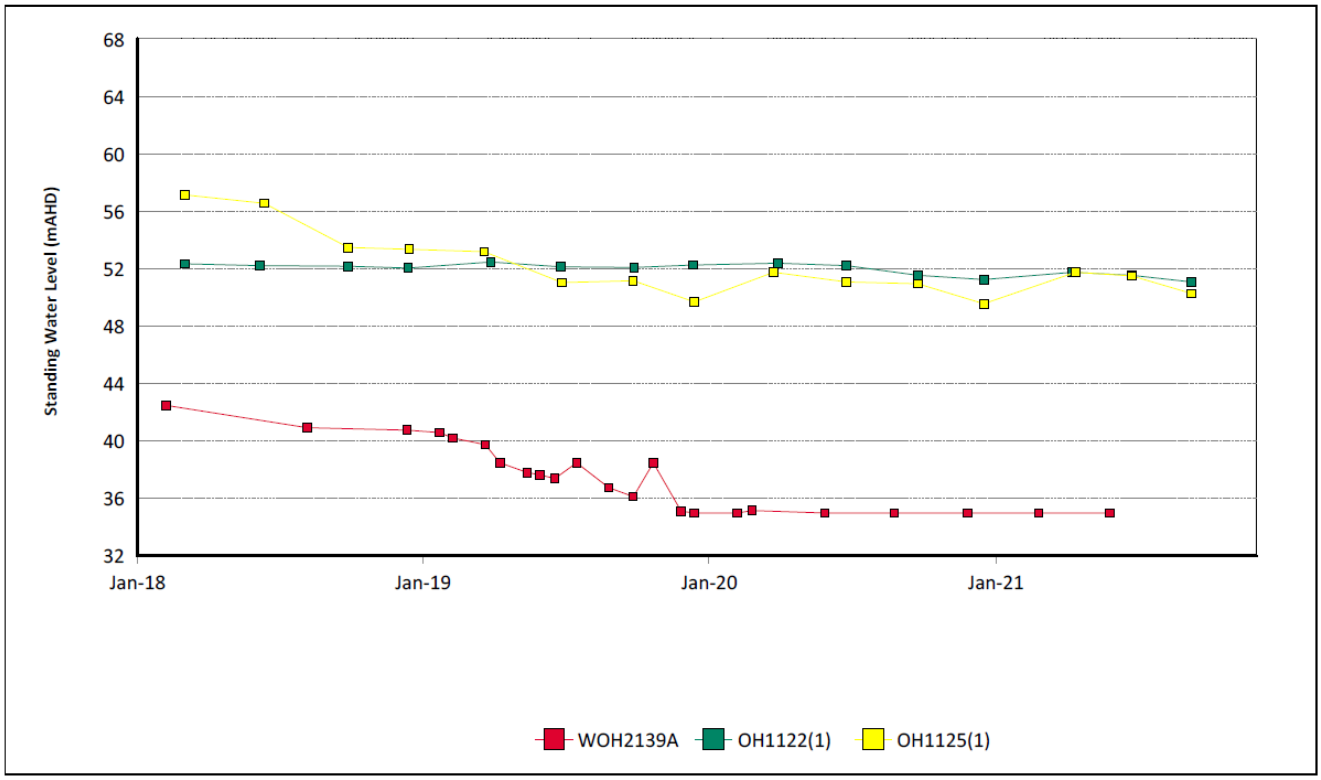
Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

Figure 19: Blakefield Seam Electrical Conductivity Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

Figure 20: Blakefield Seam pH Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

Figure 21: Blakefield Seam Standing Water Level Trend – September 2021

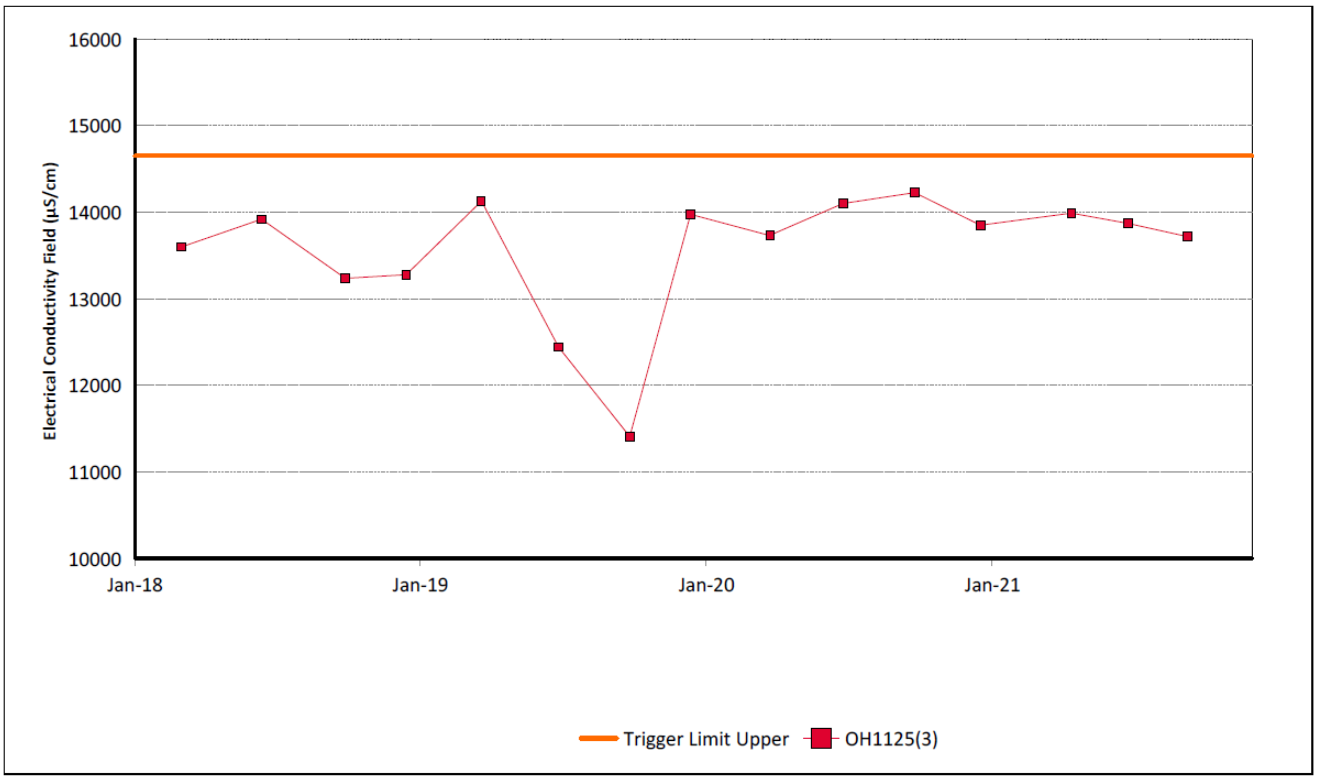


Figure 22: Bowfield Seam Electrical Conductivity Trend – September 2021

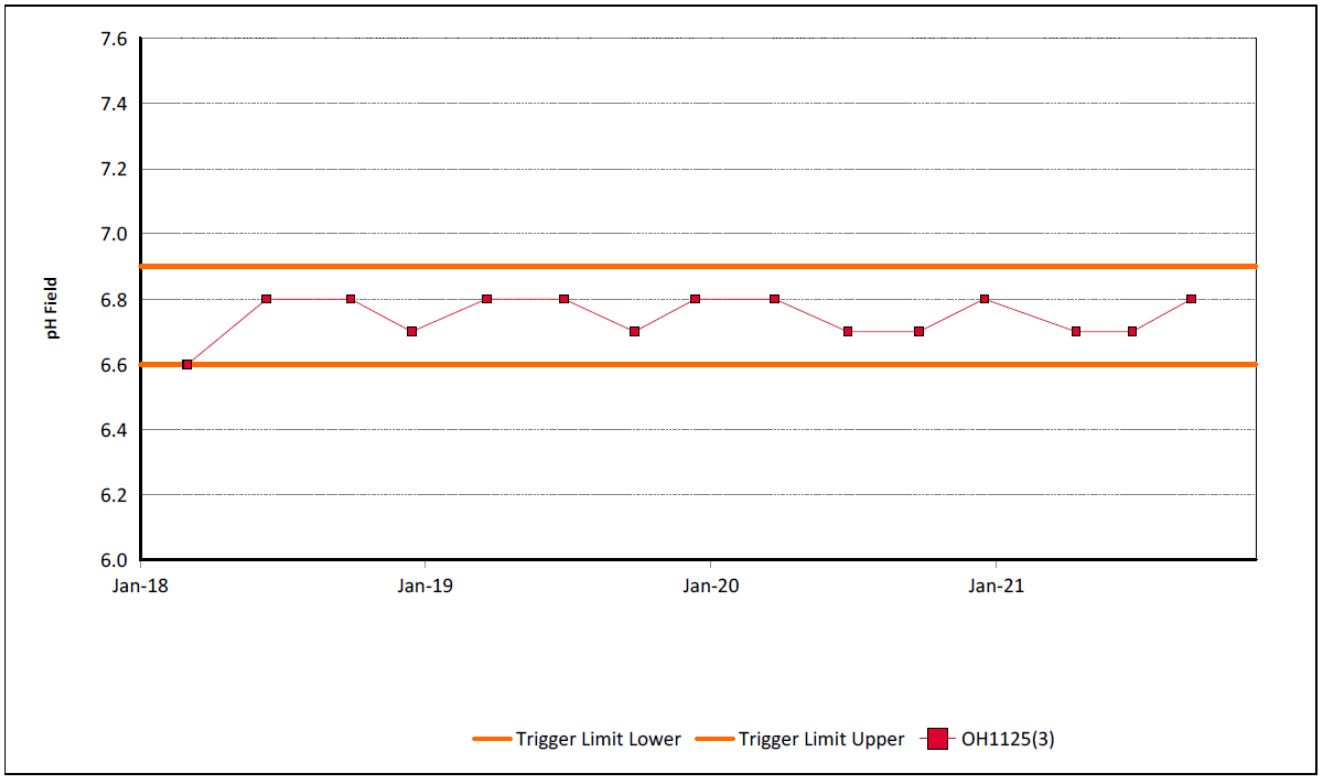


Figure 23: Bowfield Seam pH Trend – September 2021

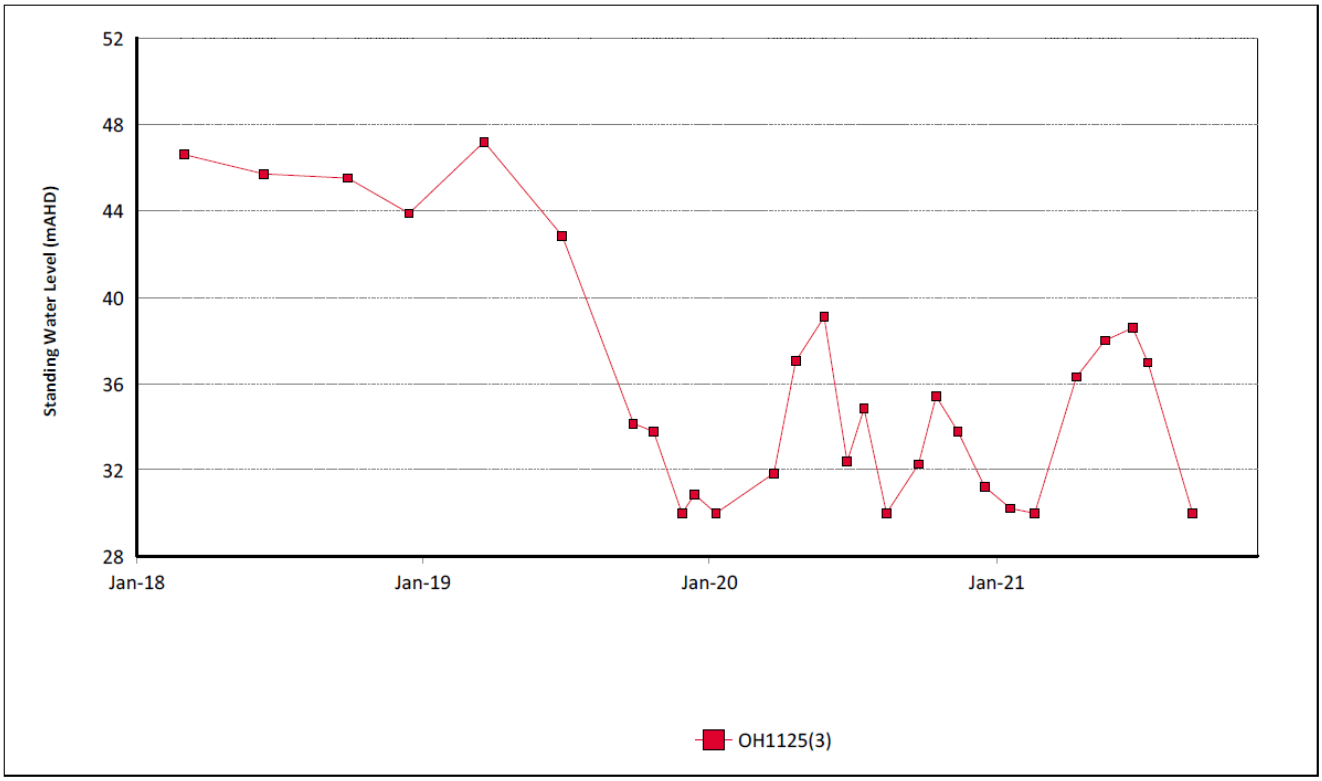


Figure 24: Bowfield Seam Standing Water Level Trend – September 2021

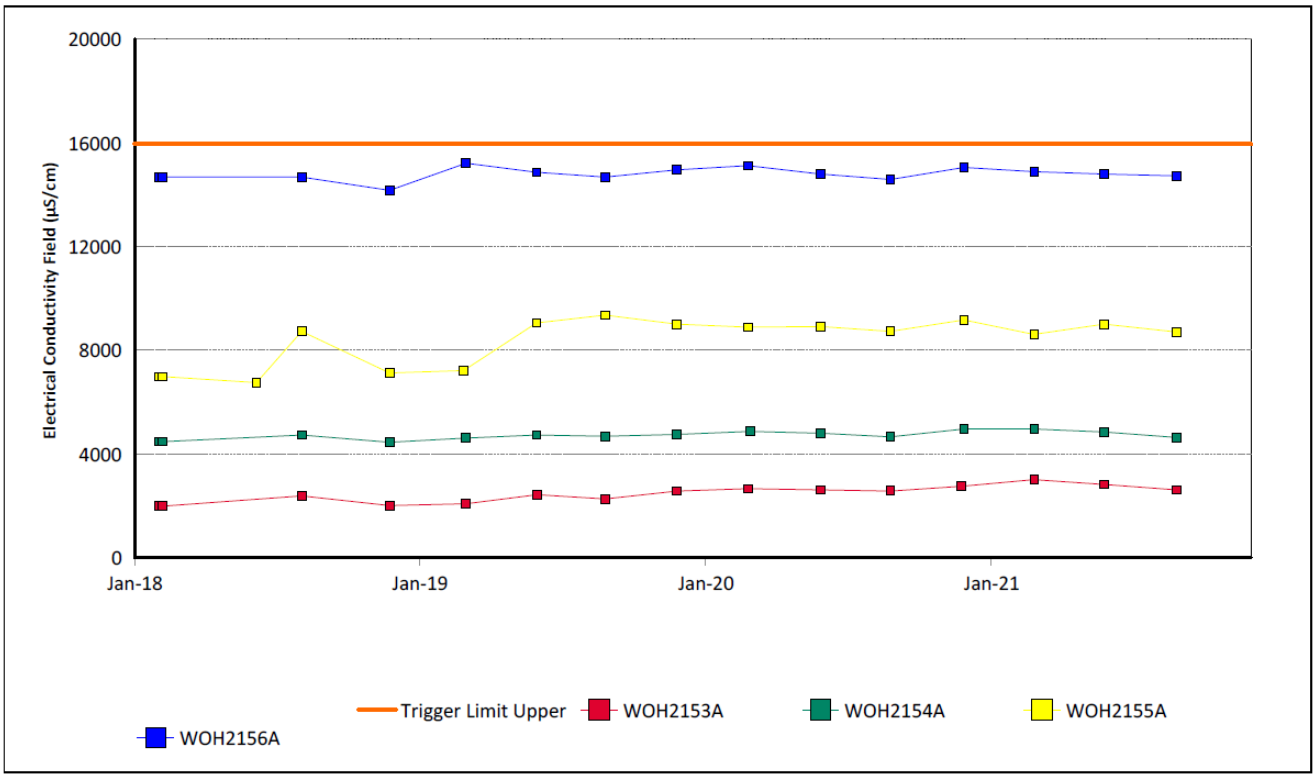


Figure 25: Redbank Seam Electrical Conductivity Trend – September 2021

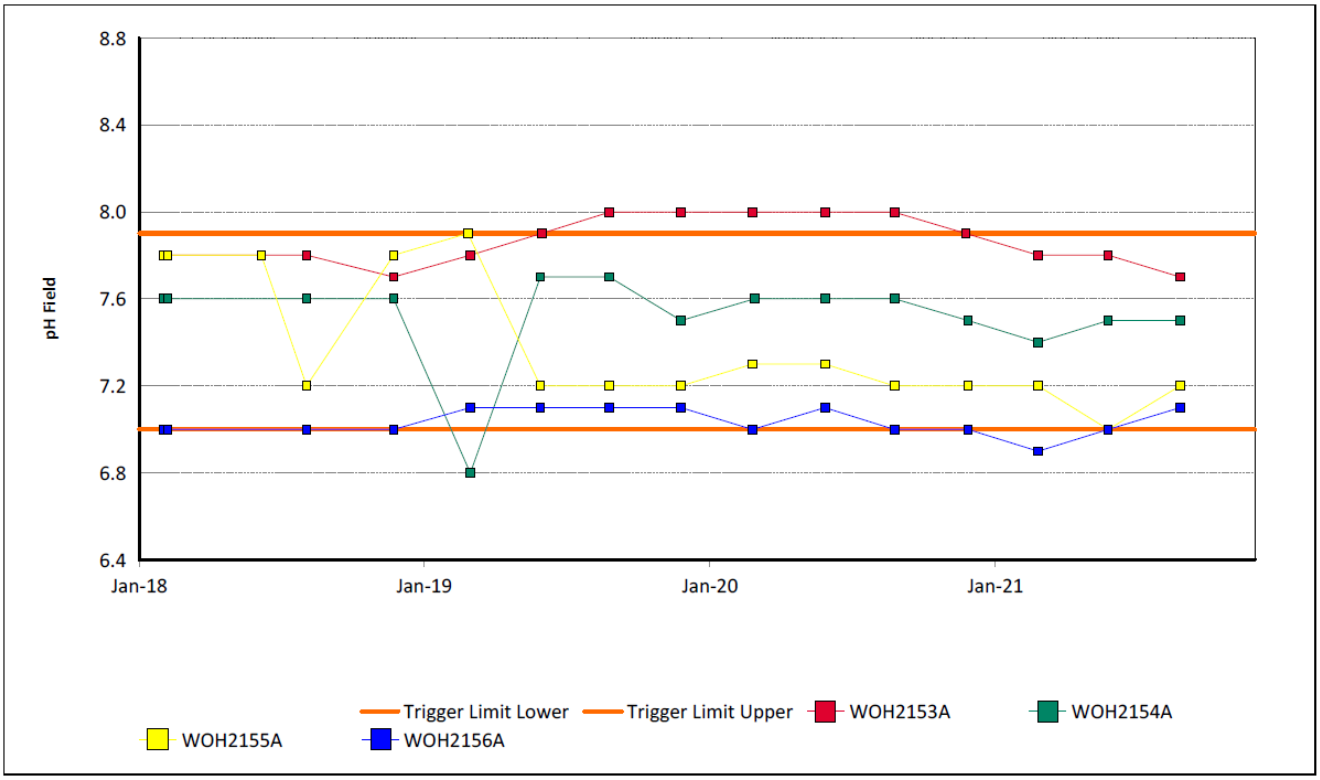


Figure 26: Redbank Seam pH Trend – September 2021

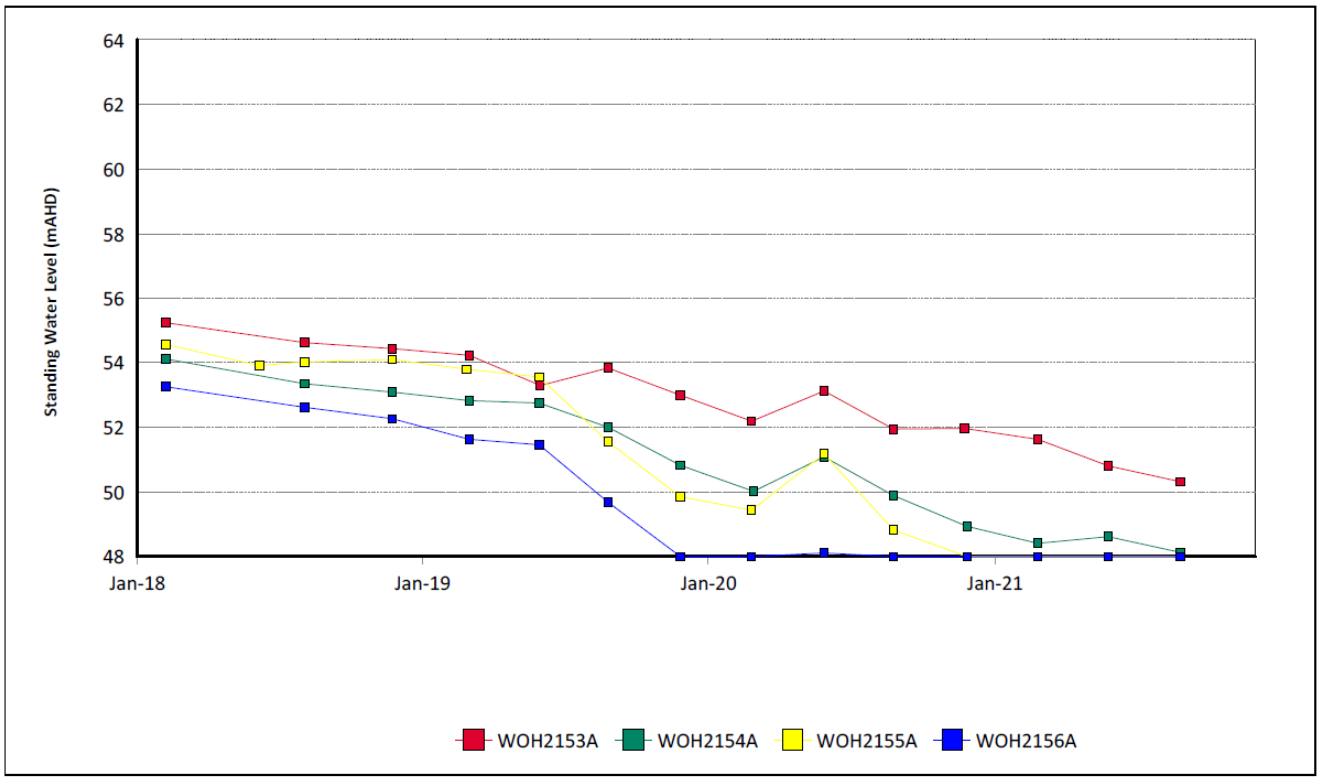


Figure 27: Redbank Seam Standing Water Level Trend – September 2021

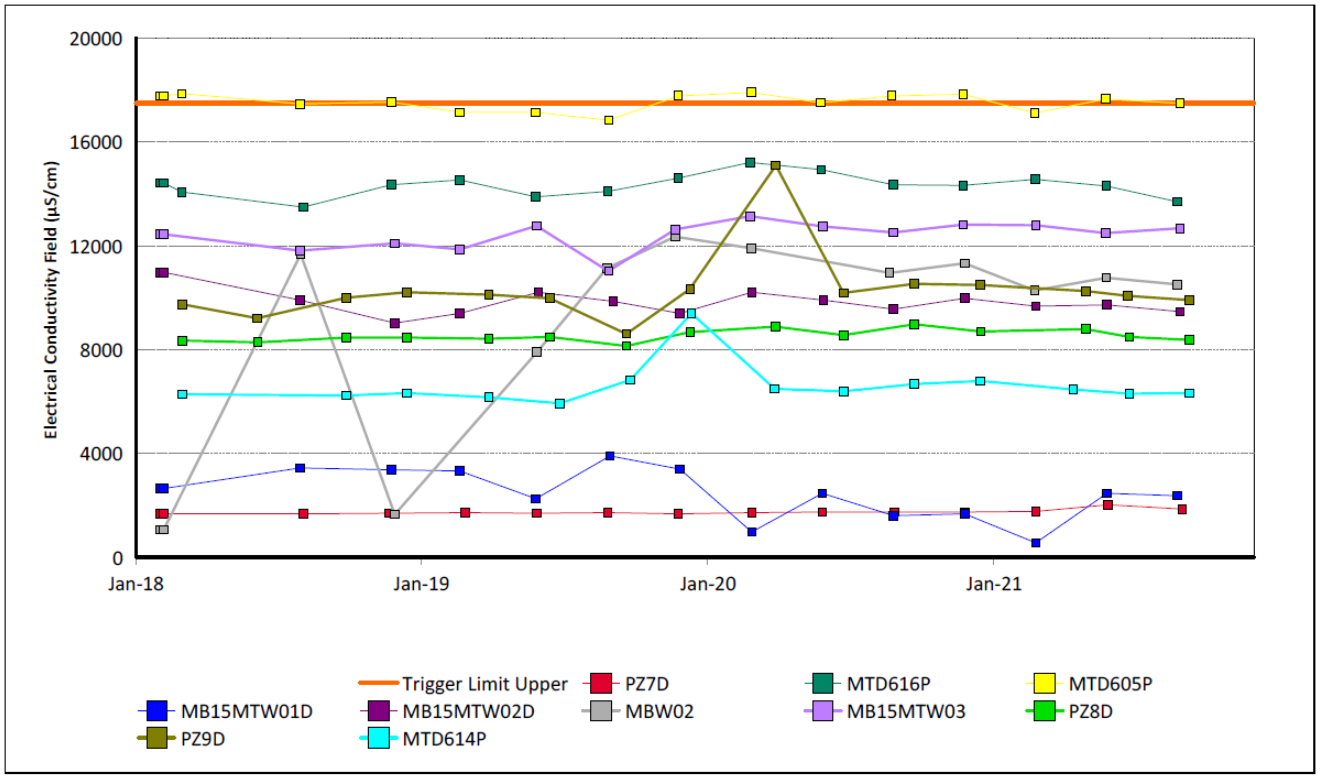


Figure 28: Shallow Overburden Electrical Conductivity Trend – September 2021

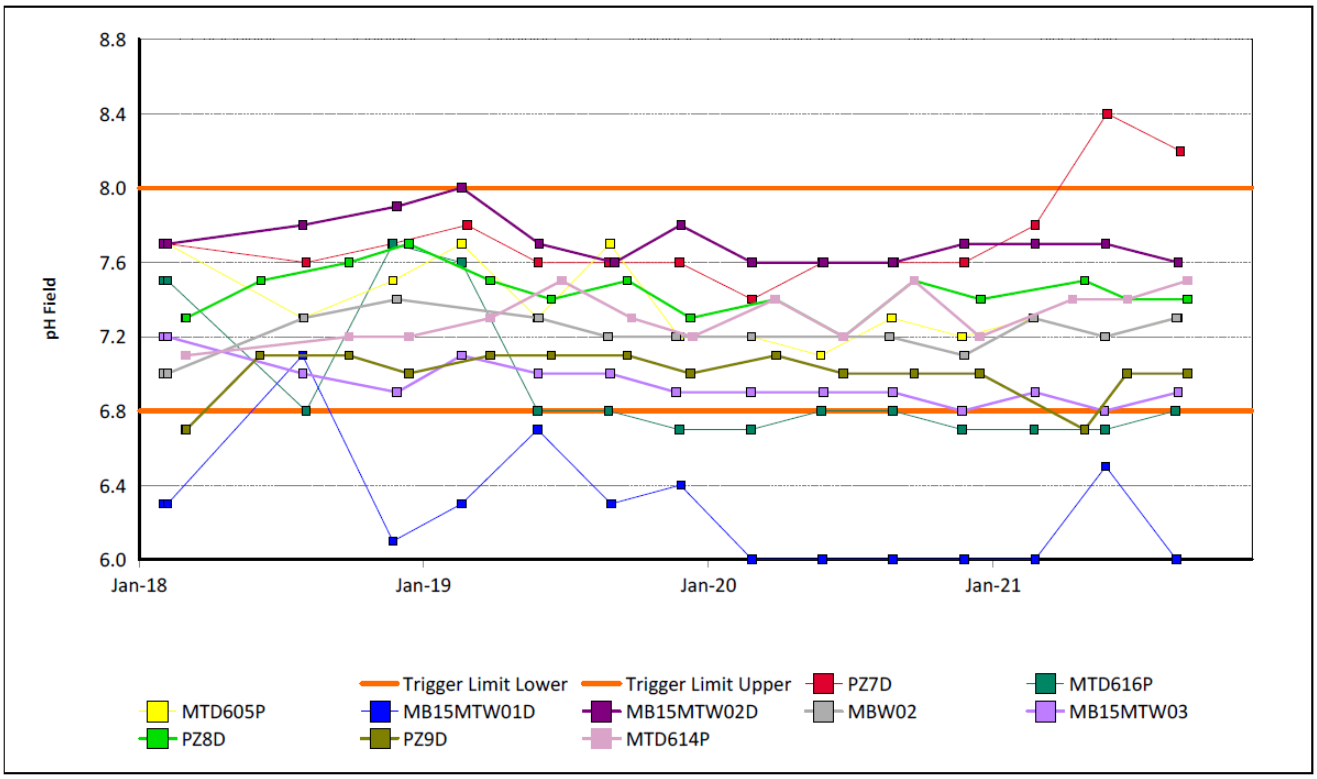


Figure 29: Shallow Overburden pH Trend – September 2021

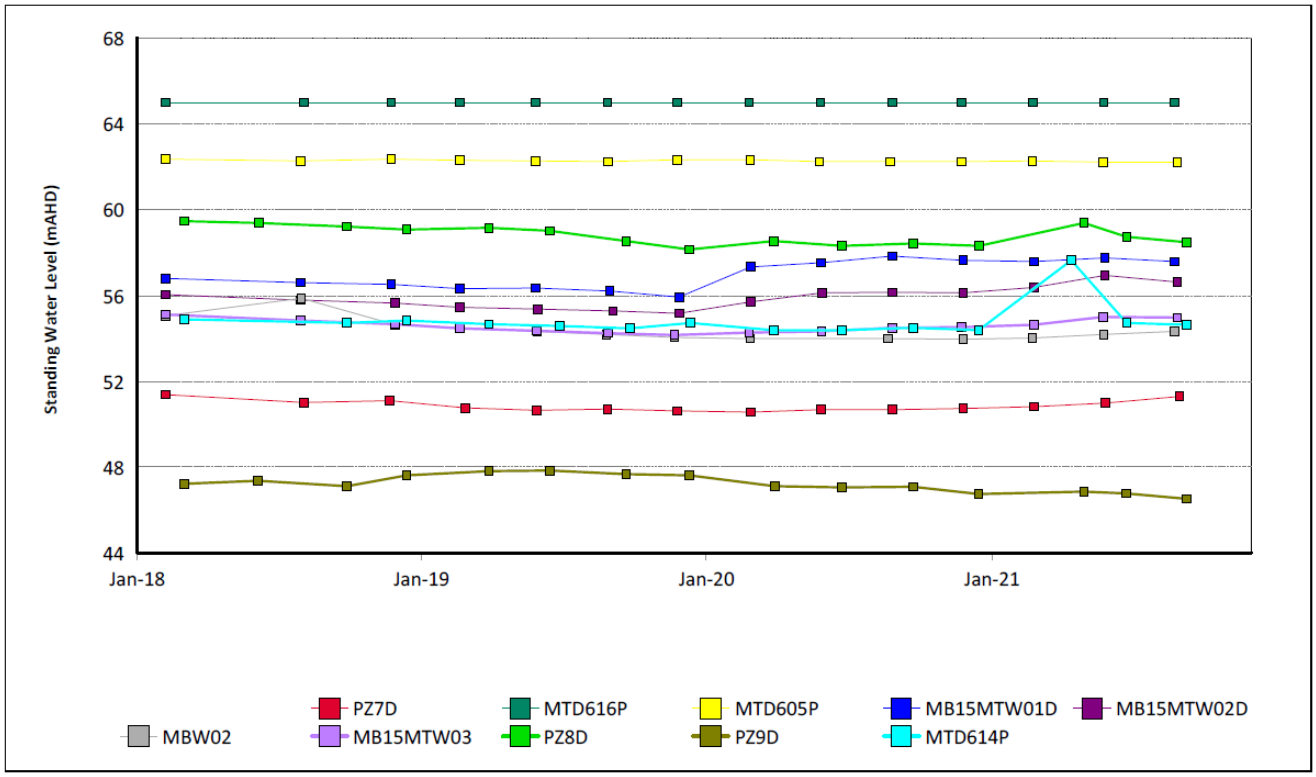
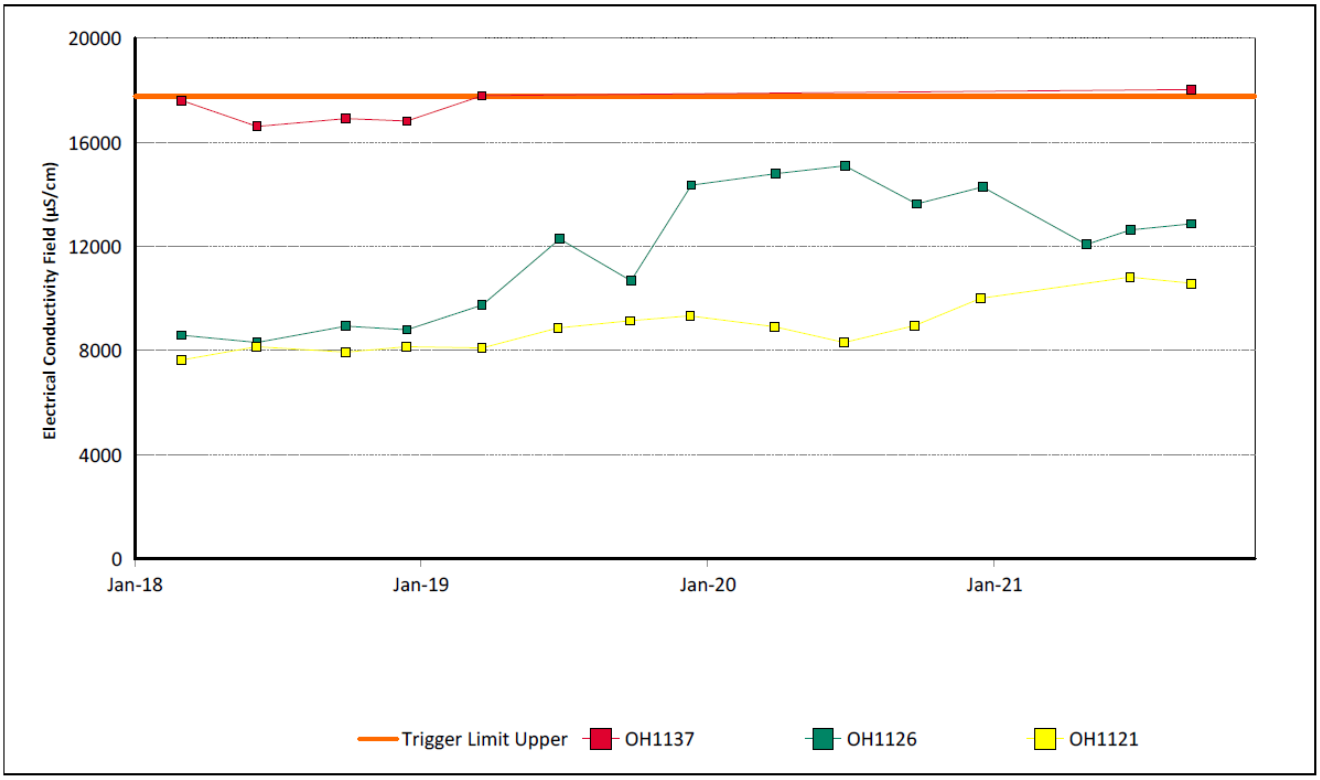
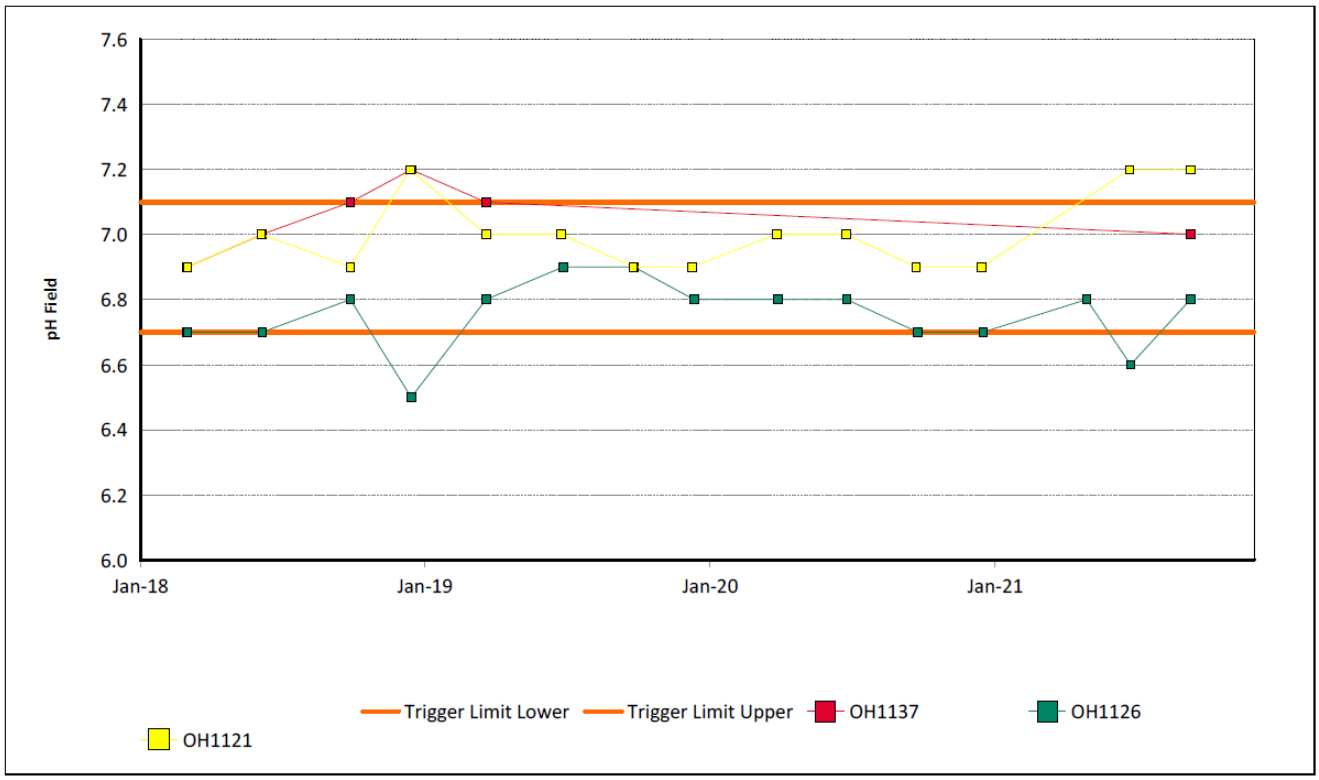


Figure 30: Shallow Overburden Standing Water Level Trend – September 2021



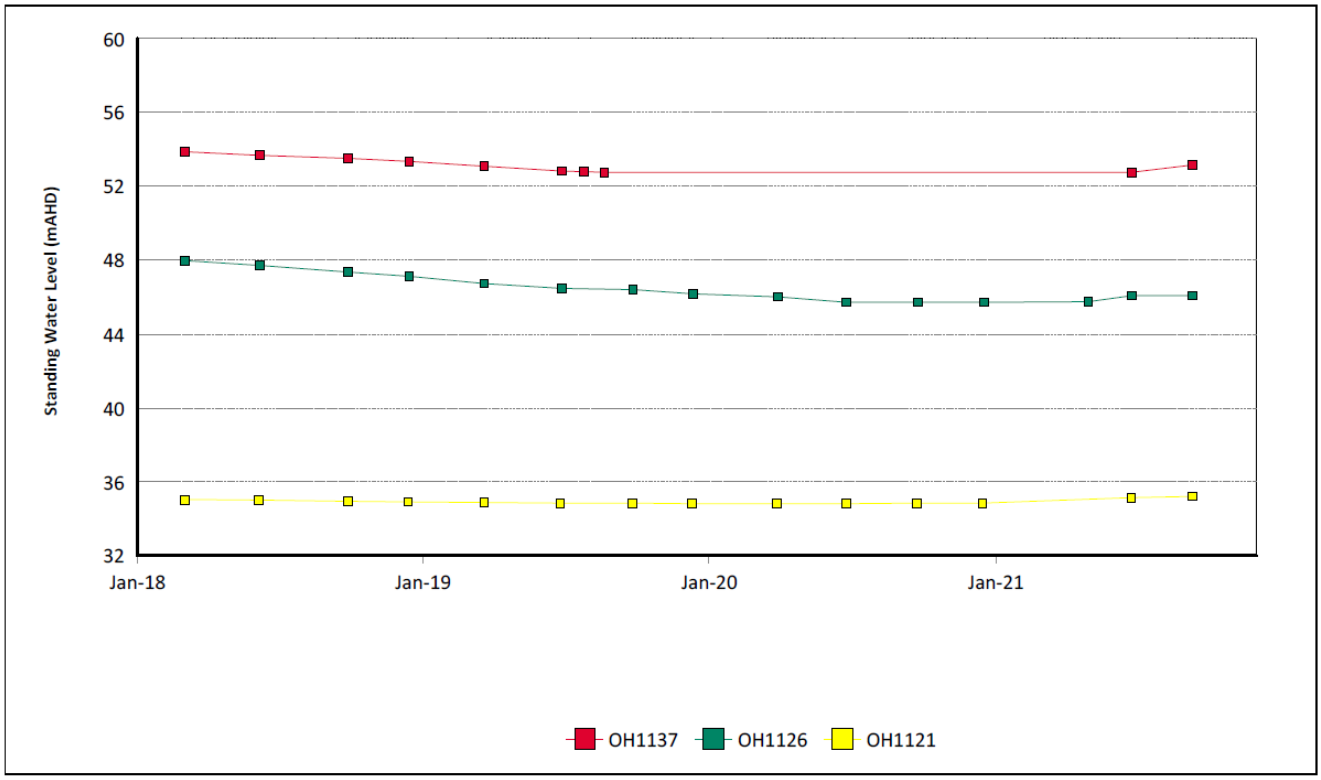
Note: Missing data indicates that there was insufficient water to take a sample.

Figure 31: Vaux Seam Electrical Conductivity Trend – September 2021

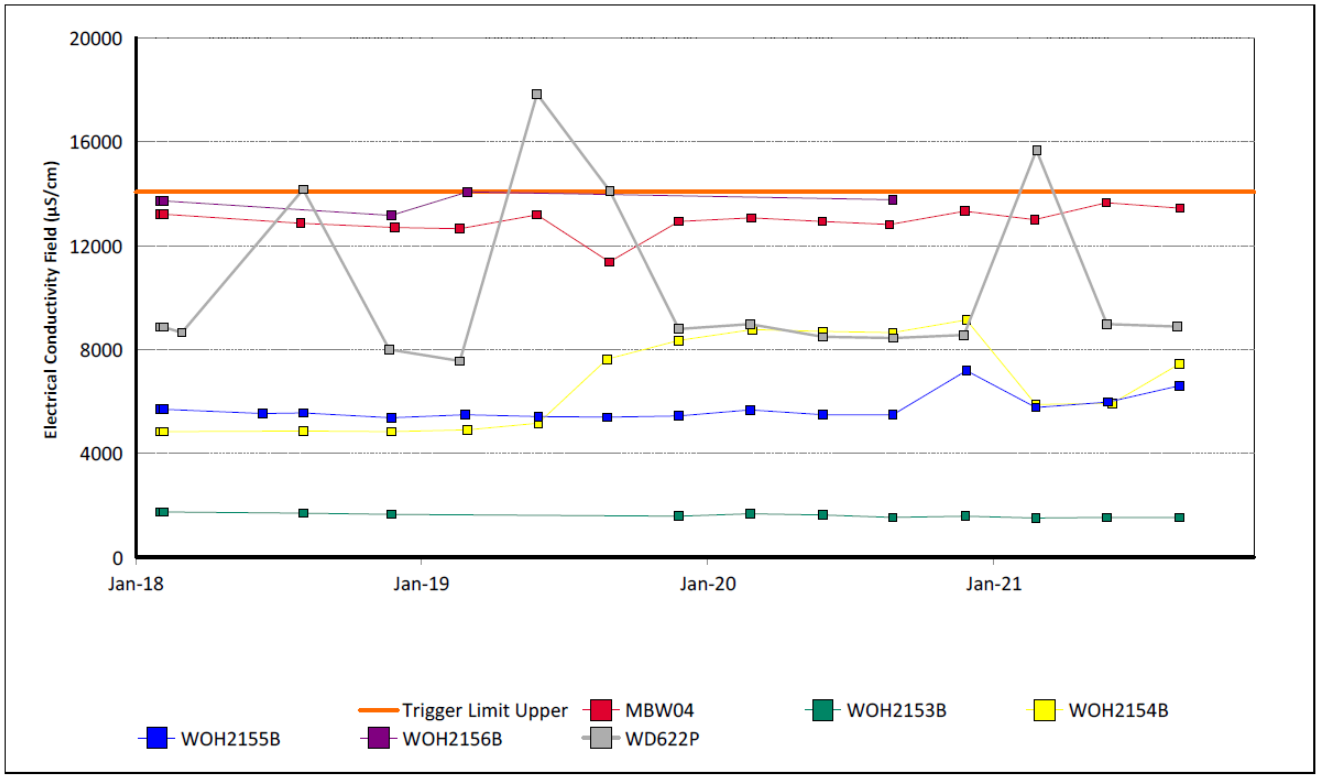


Note: Missing data indicates that there was insufficient water to take a sample.

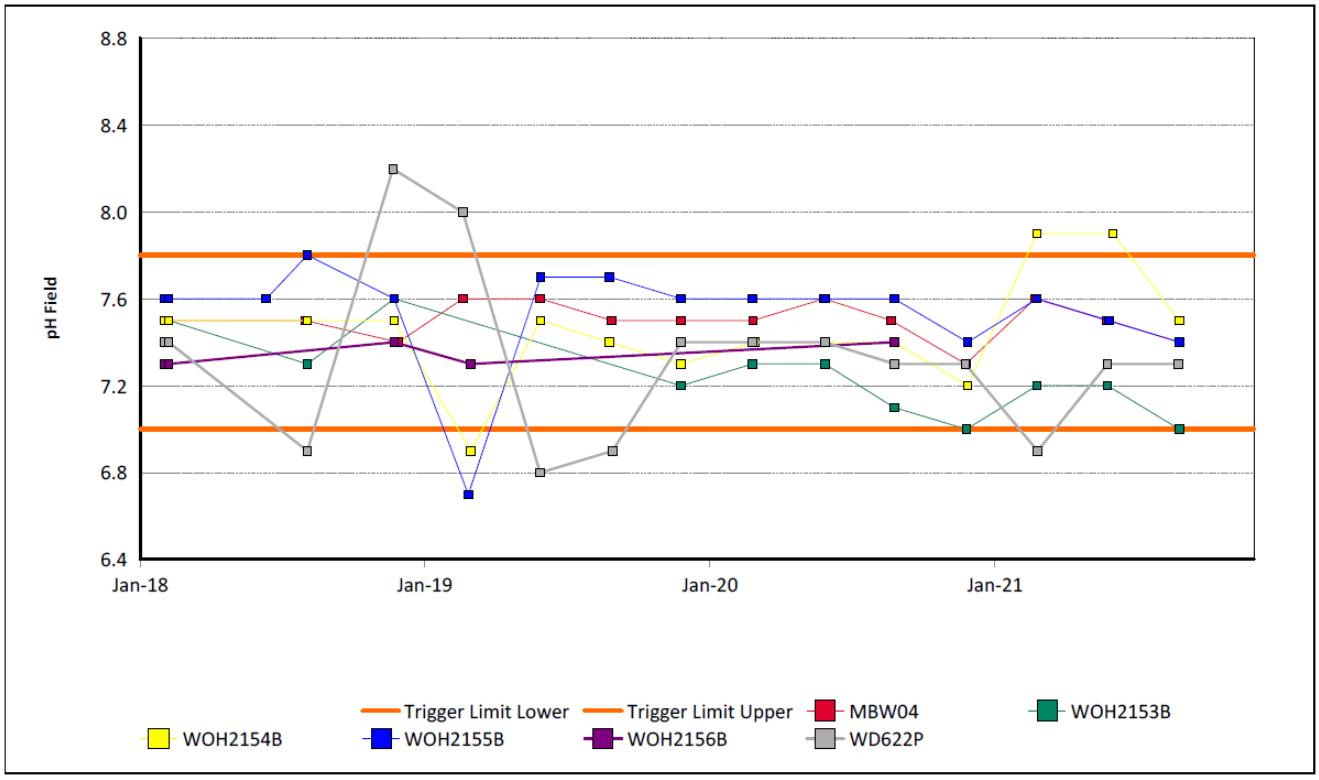
Figure 32: Vaux Seam pH Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample.
Figure 33: Vaux Seam Standing Water Level Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample.
Figure 34: Wambo Seam Electrical Conductivity Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 35: Wambo Seam pH Trend – September 2021

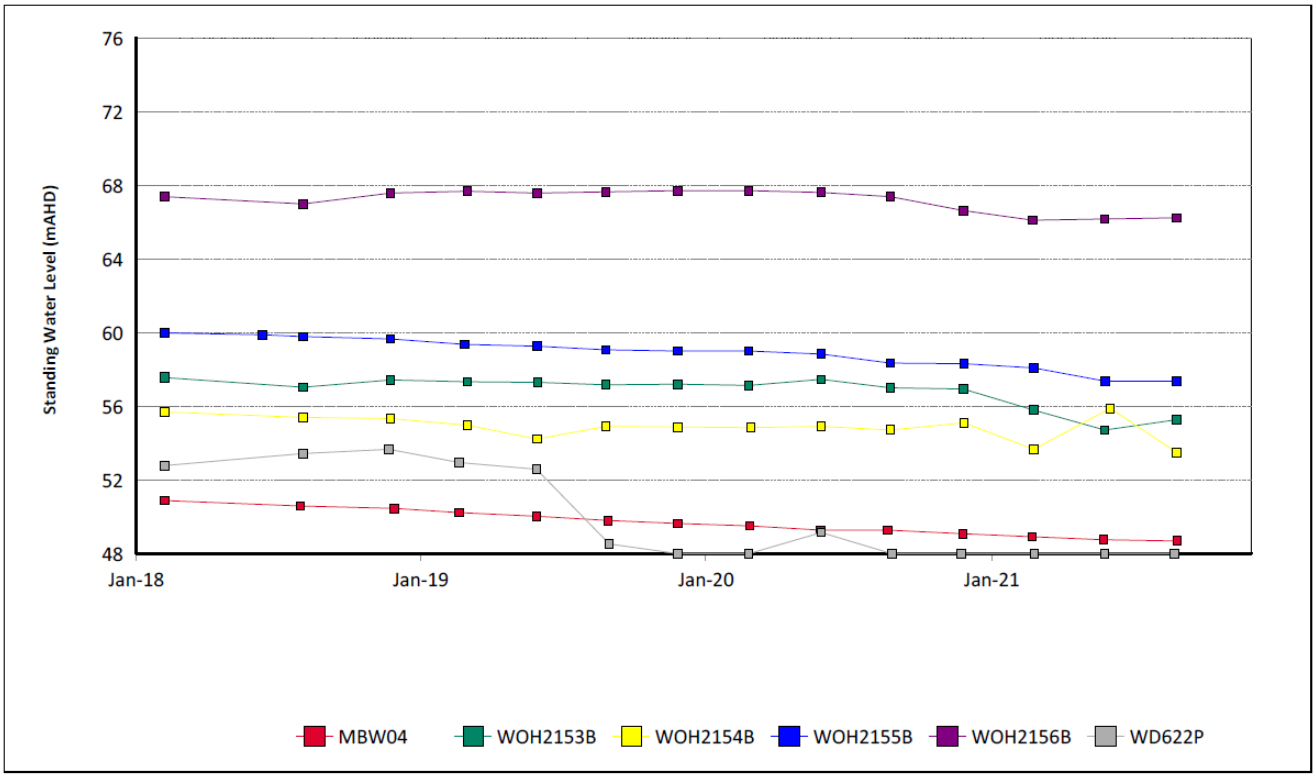


Figure 36: Wambo Seam Standing Water Level Trend – September 2021

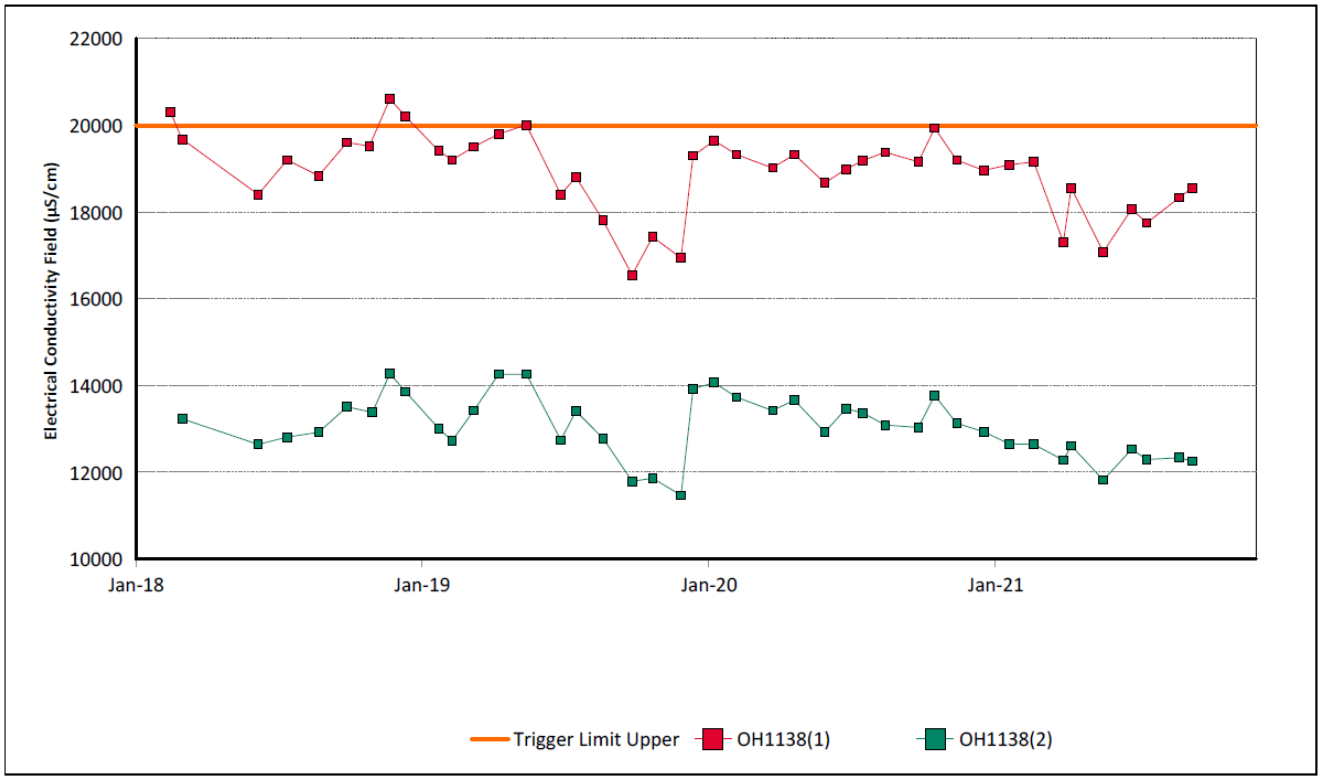


Figure 37: Warkworth Seam Electrical Conductivity Trend – September 2021

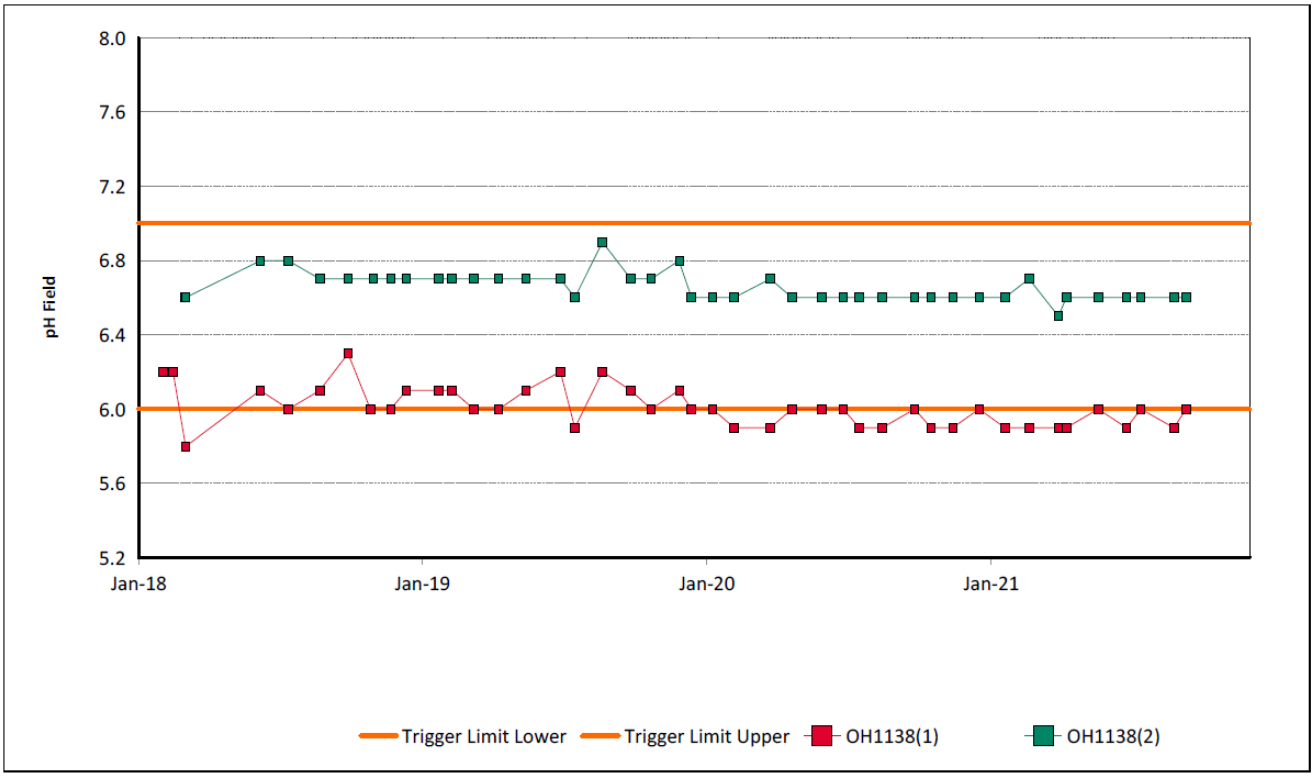


Figure 38: Warkworth Seam pH Trend – September 2021

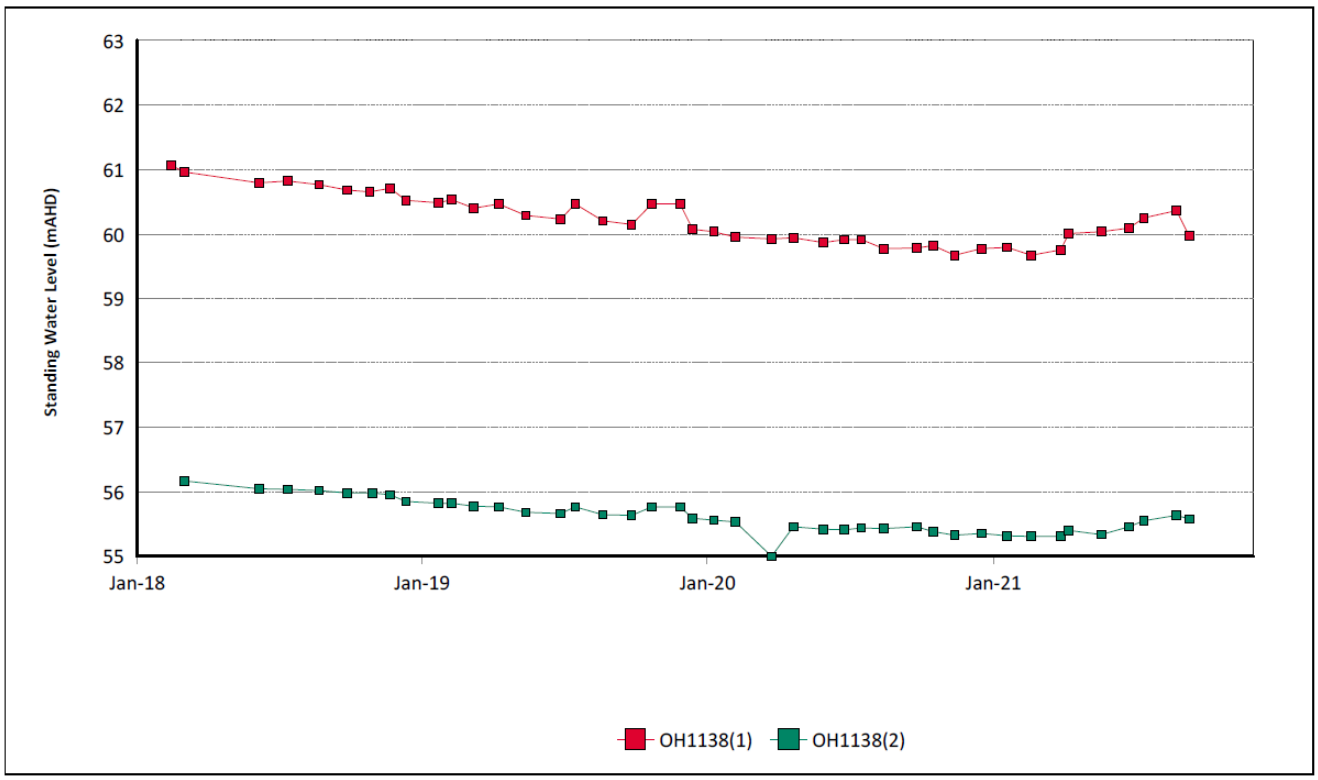


Figure 39: Warkworth Seam Standing Water Level Trend – September 2021

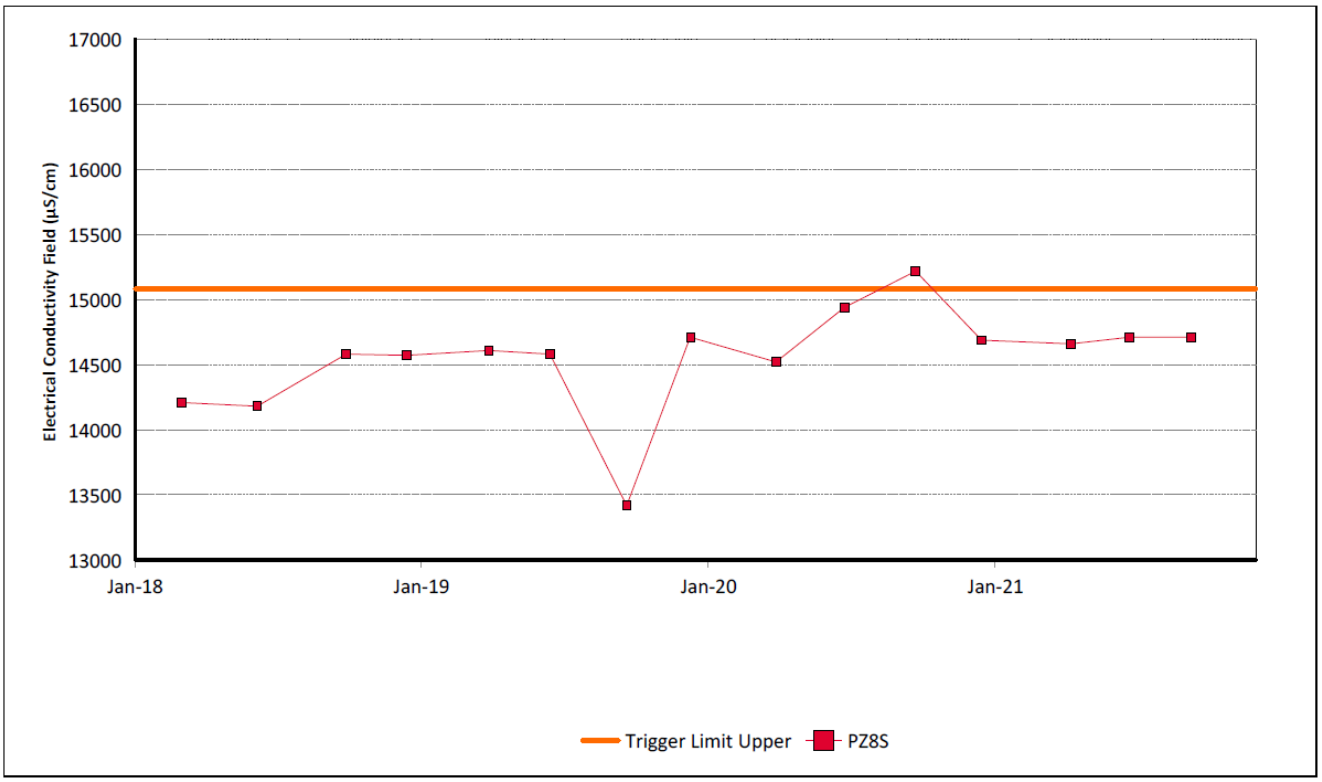


Figure 40: Wollombi Alluvium Electrical Conductivity Trend – September 2021

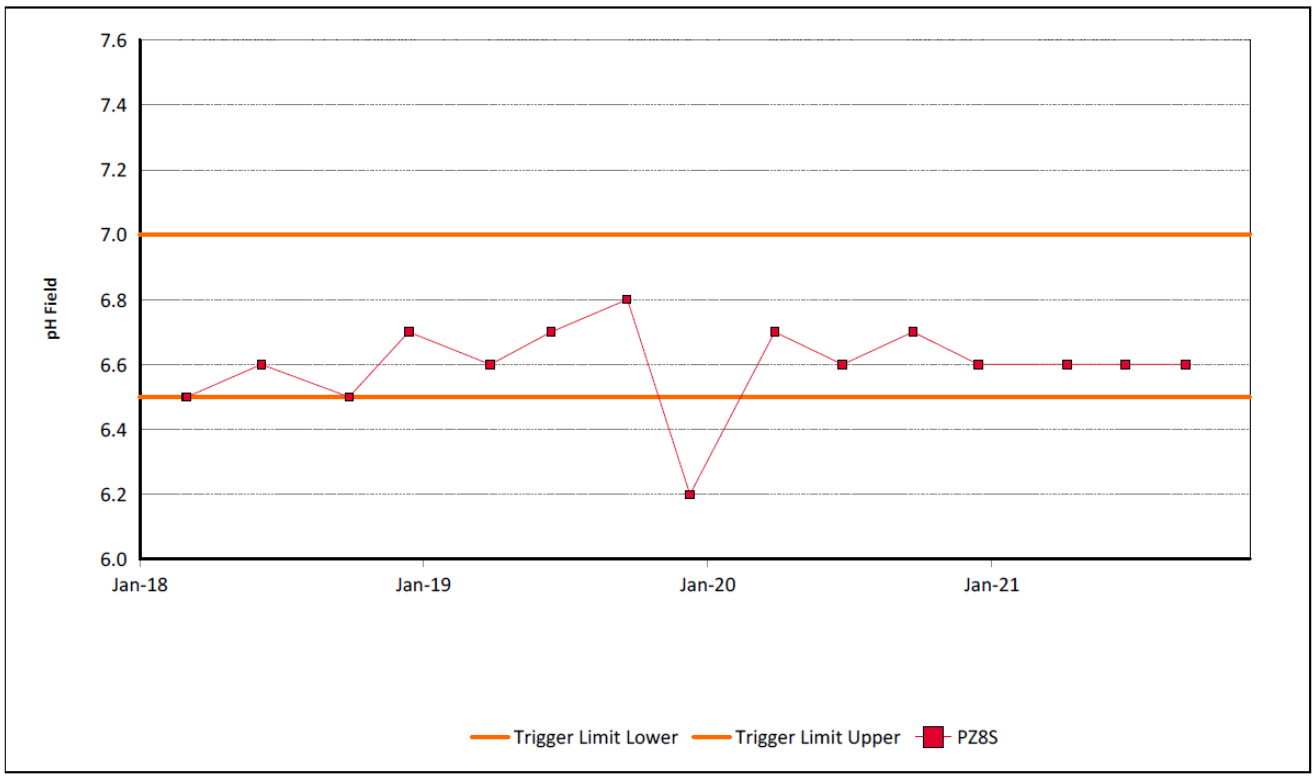
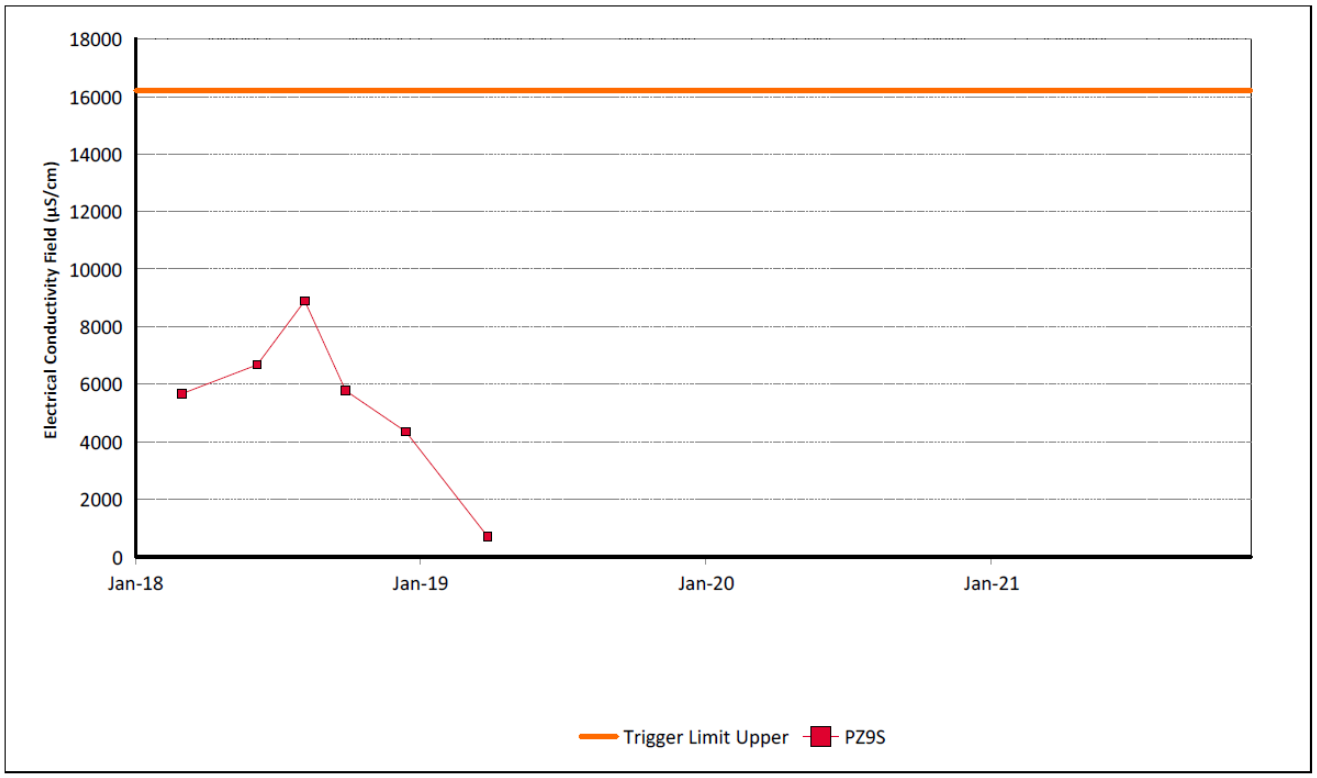
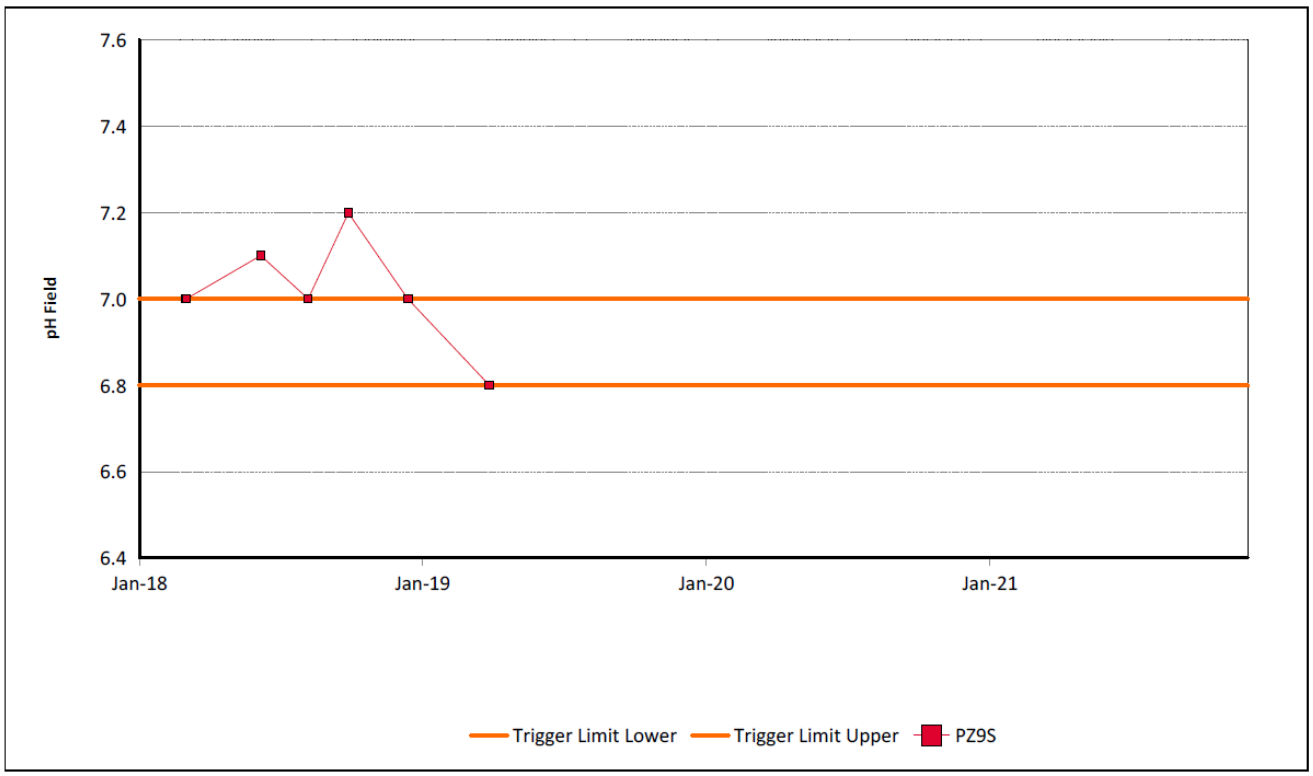


Figure 41: Wollombi Alluvium pH Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 42: Wollombi Alluvium 2 Electrical Conductivity Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 43: Wollombi Alluvium 2 pH Trend – September 2021

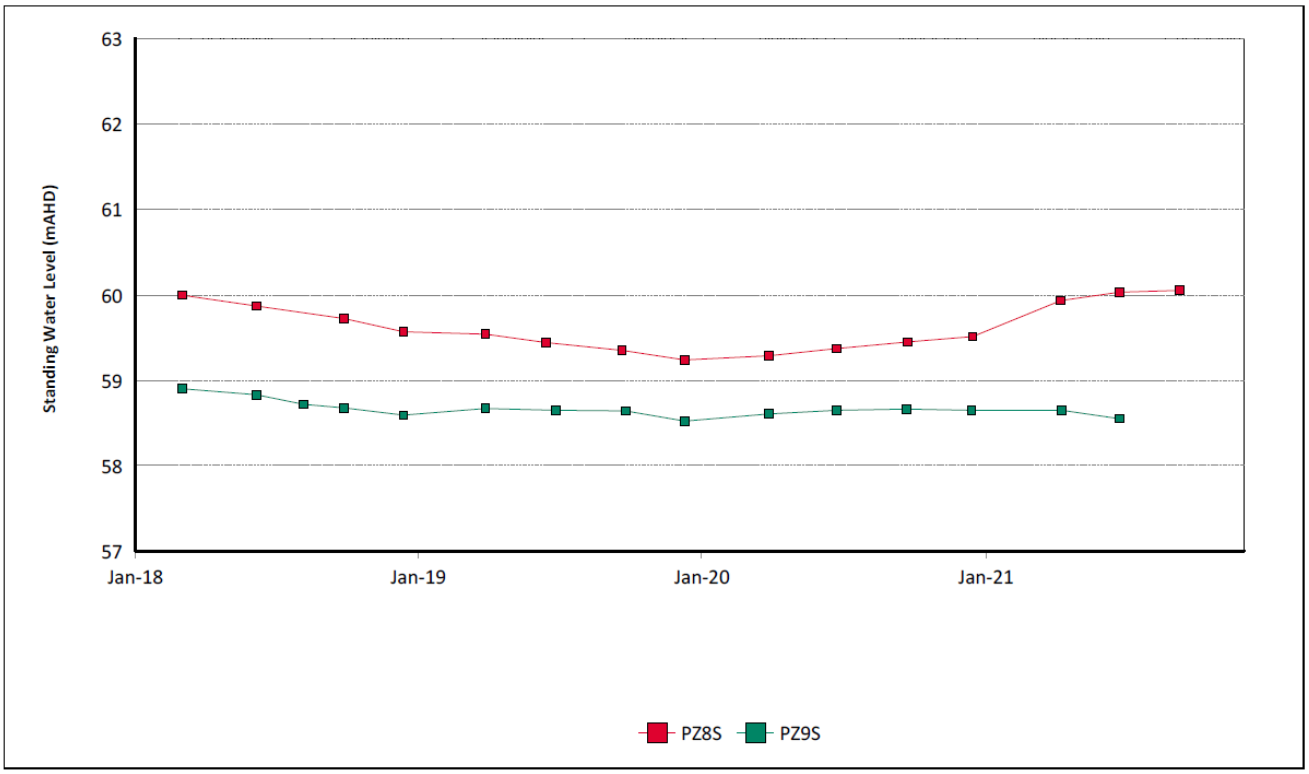


Figure 44: Wollombi Alluvium Standing Water Level Trend – September 2021

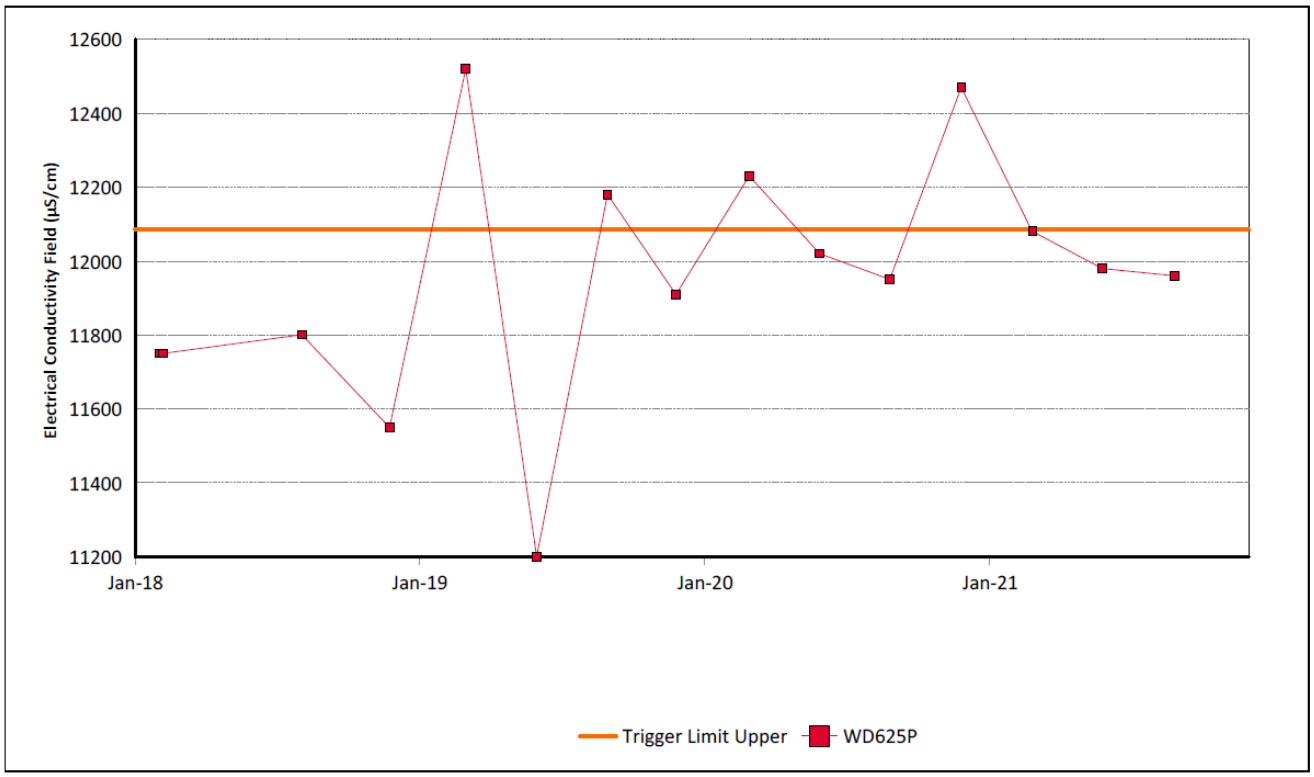


Figure 45: Woodlands Hill Seam Electrical Conductivity Trend - September 2021

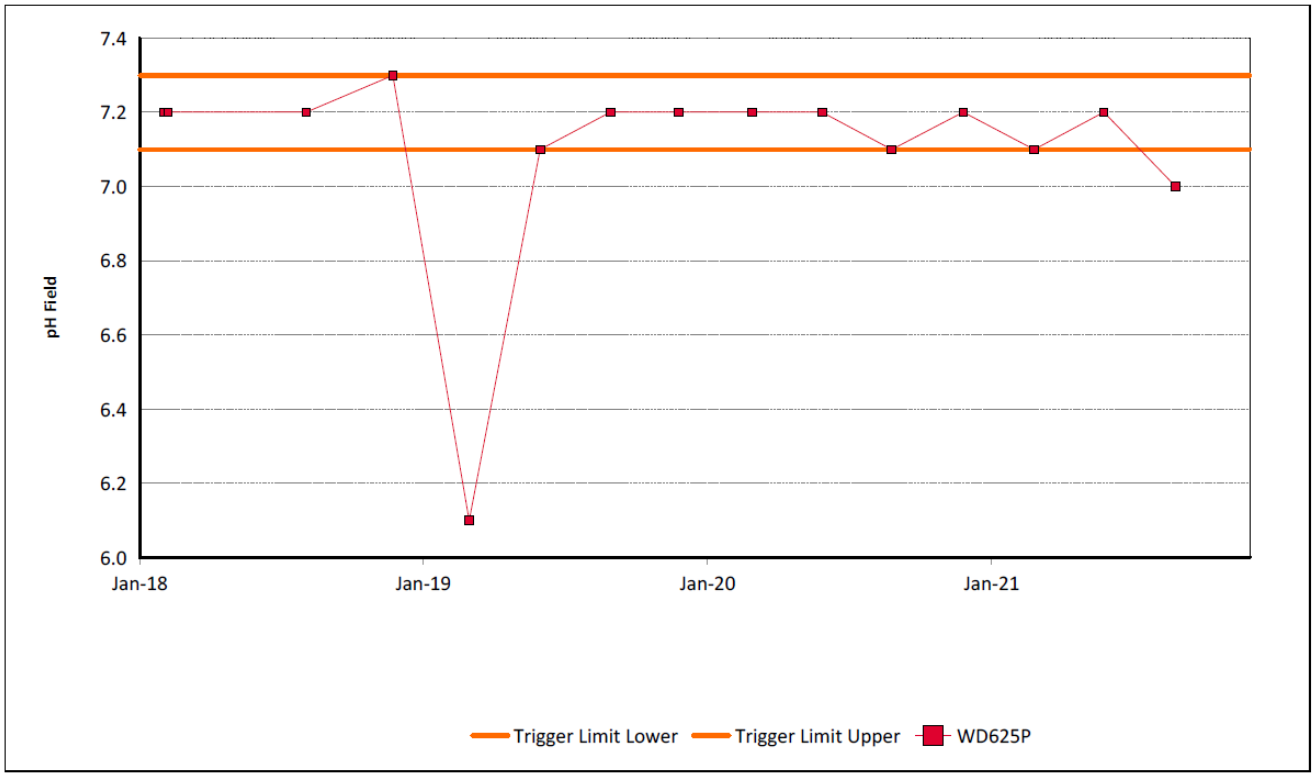


Figure 46: Woodlands Hill Seam pH Trend - September 2021

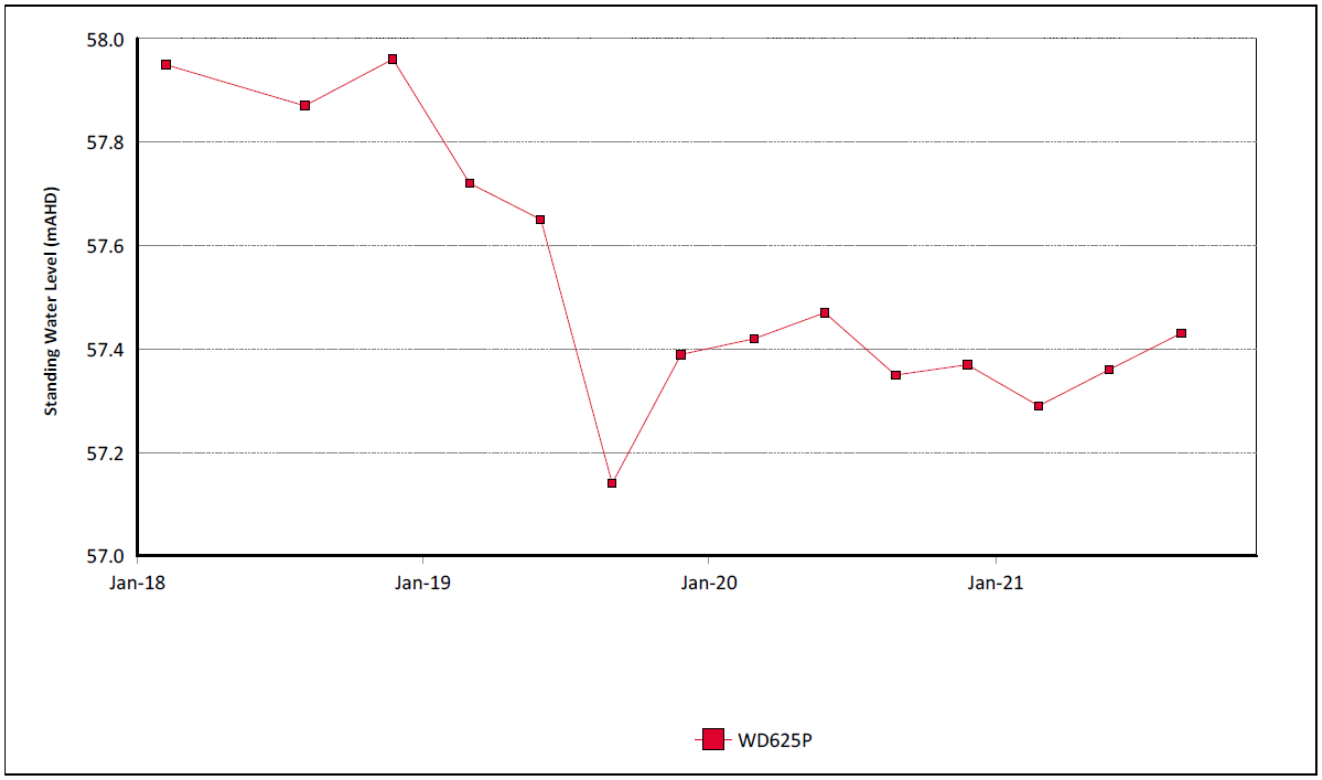


Figure 47: Woodlands Hill Seam Standing Water Level Trend - September 2021

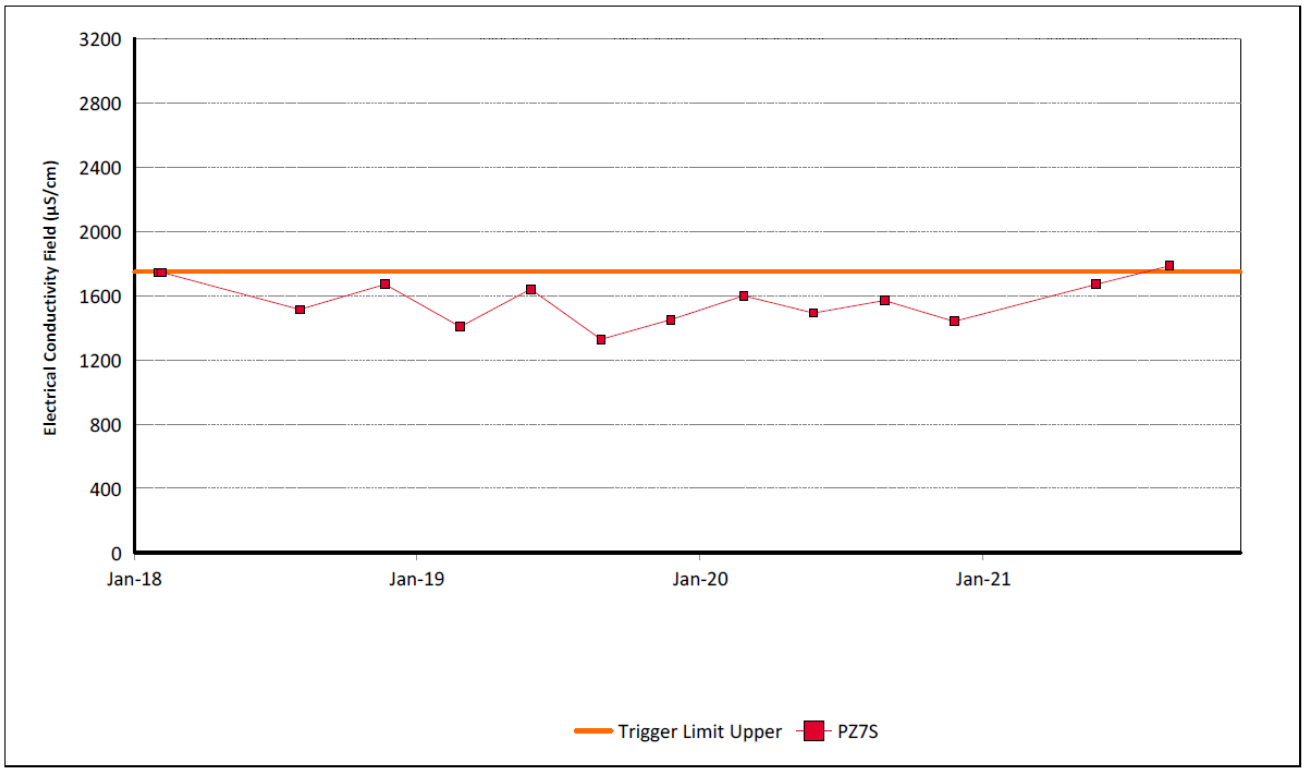


Figure 48: Aeolian Warkworth Sands Electrical Conductivity Trend – September 2021

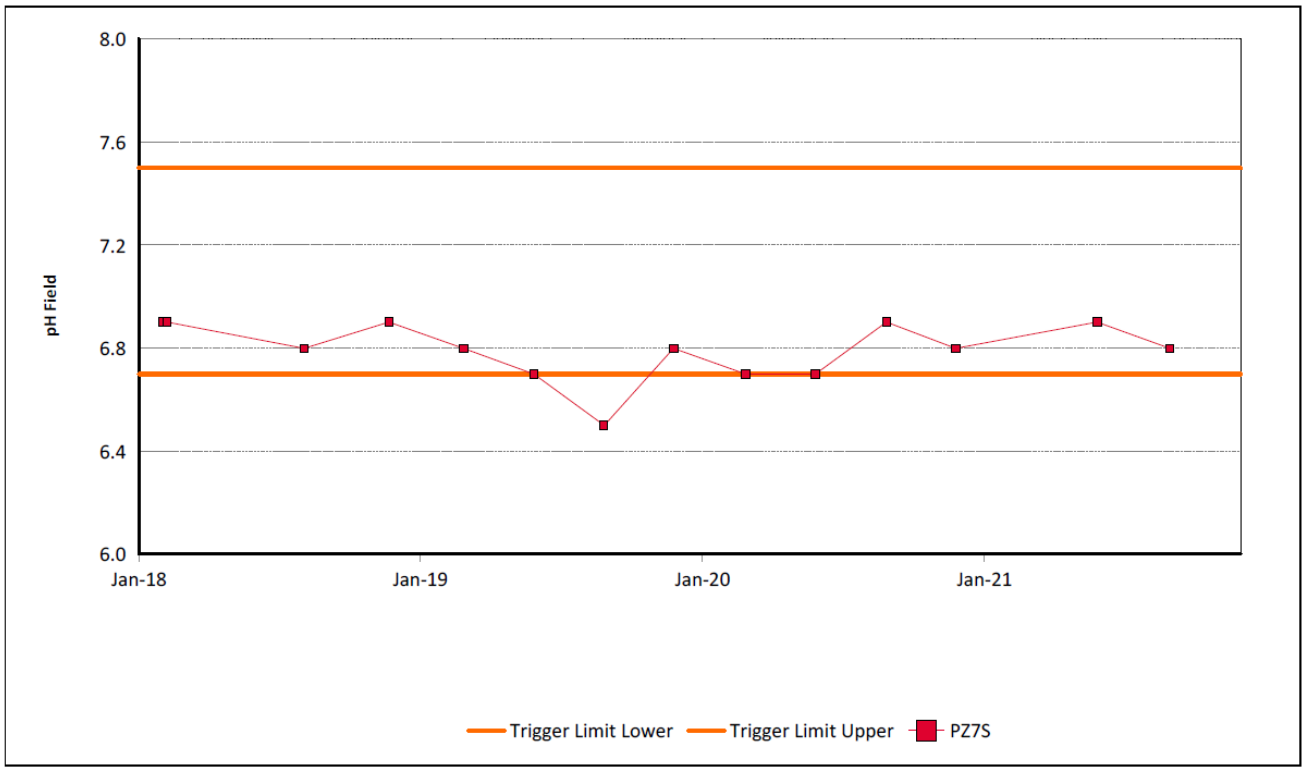


Figure 49: Aeolian Warkworth Sands pH Trend – September 2021

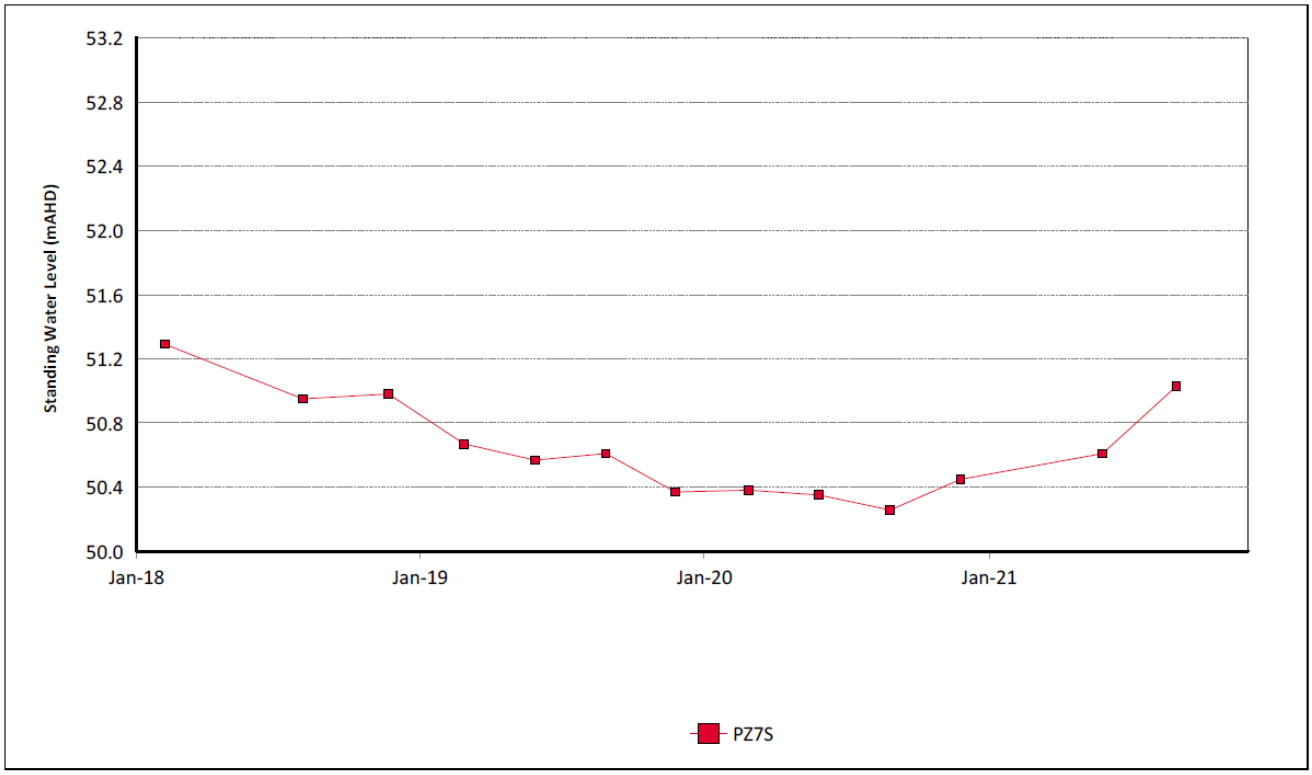


Figure 50: Aeolian Warkworth Sands Standing Water Level Trend – September 2021

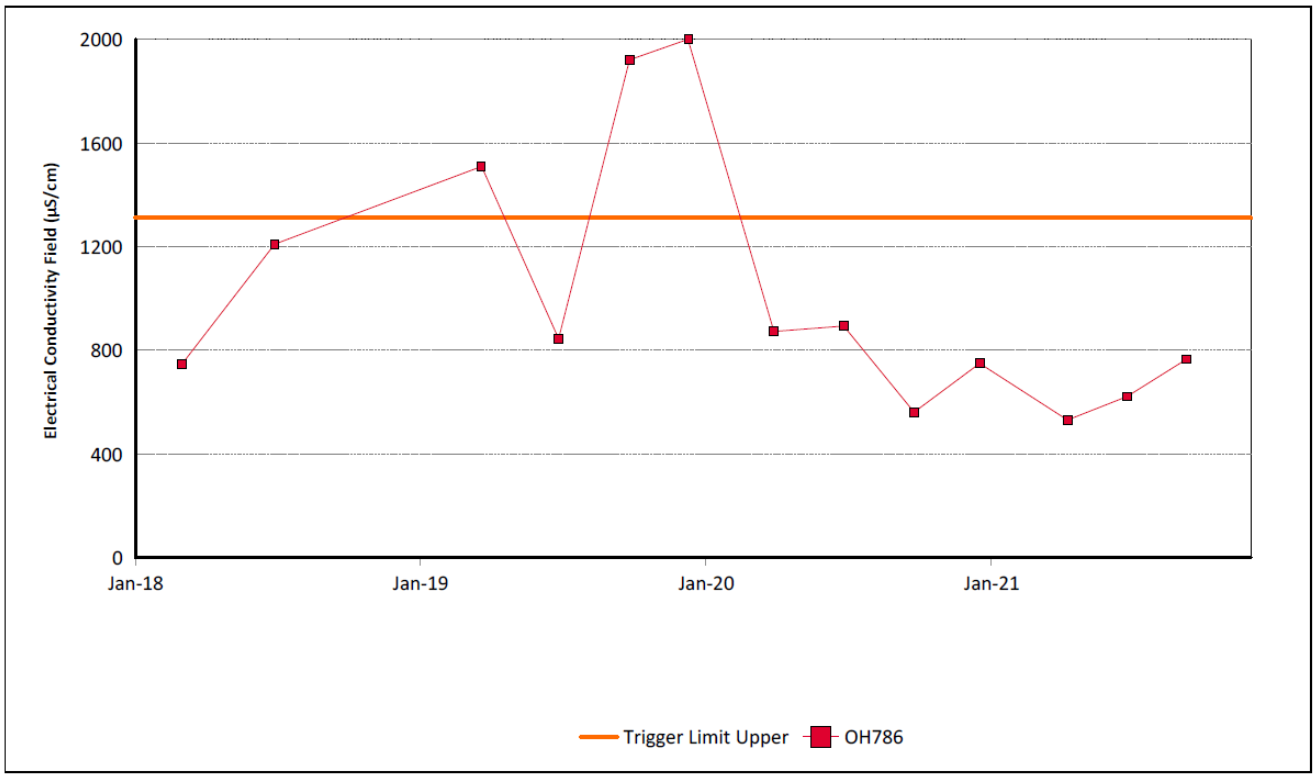


Figure 51: Hunter River Alluvium 1 Electrical Conductivity Trend – September 2021

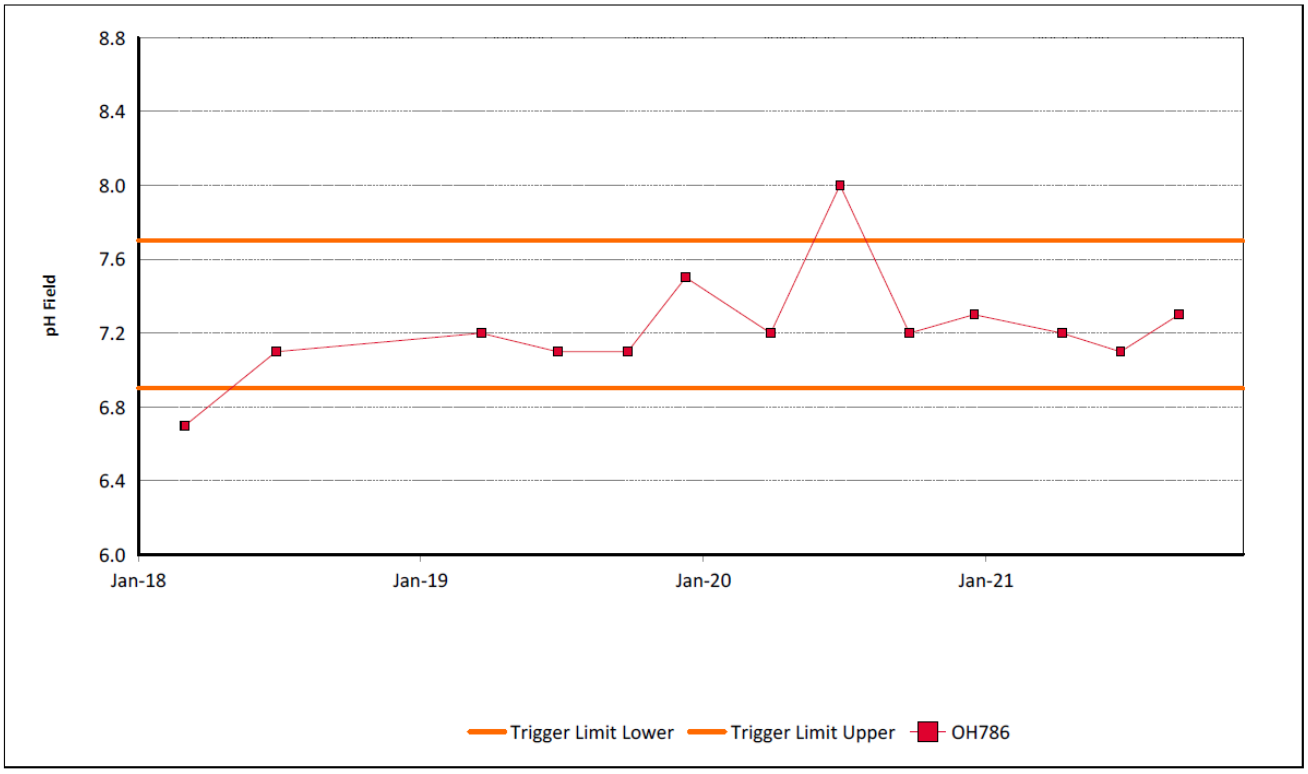


Figure 52: Hunter River Alluvium 1 pH Trend – September 2021

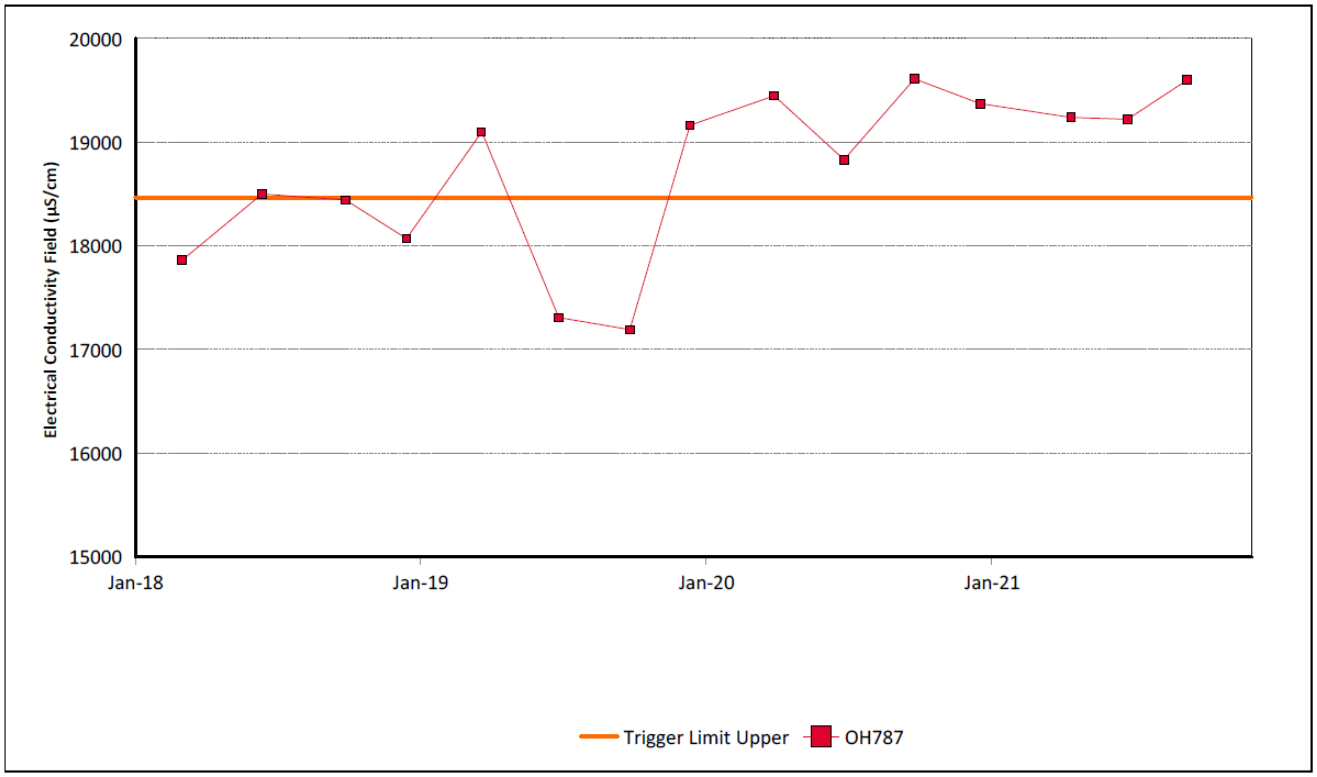


Figure 53: Hunter River Alluvium 2 Electrical Conductivity Trend – September 2021

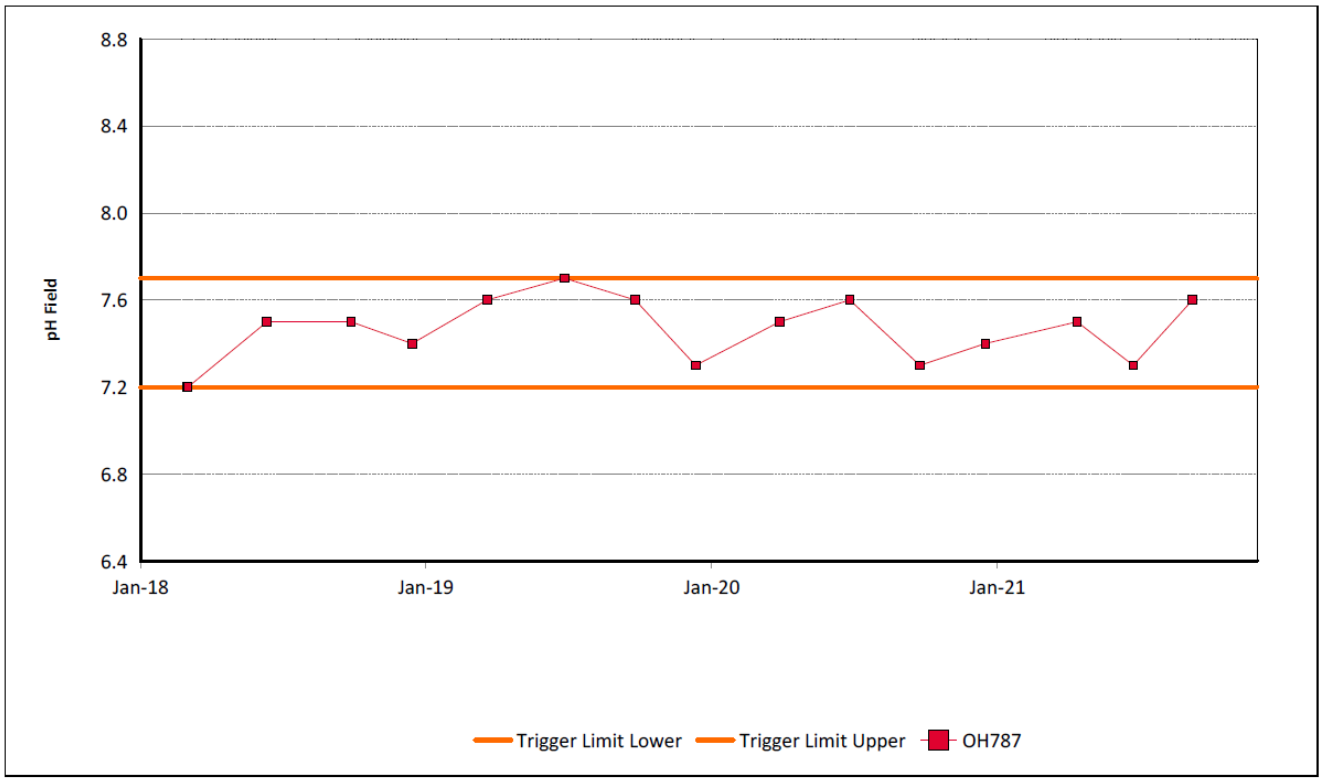


Figure 54: Hunter River Alluvium 2 pH Trend – September 2021

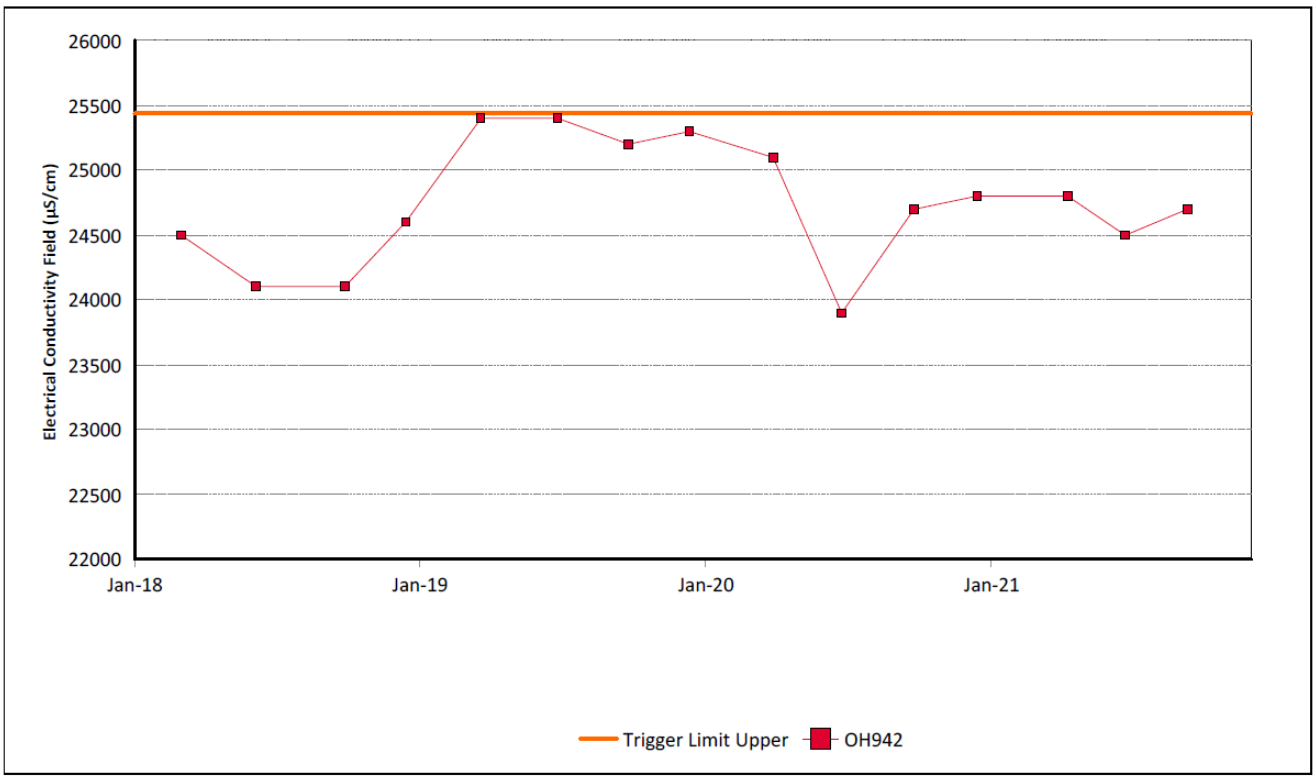


Figure 55: Hunter River Alluvium 3 Electrical Conductivity Trend – September 2021

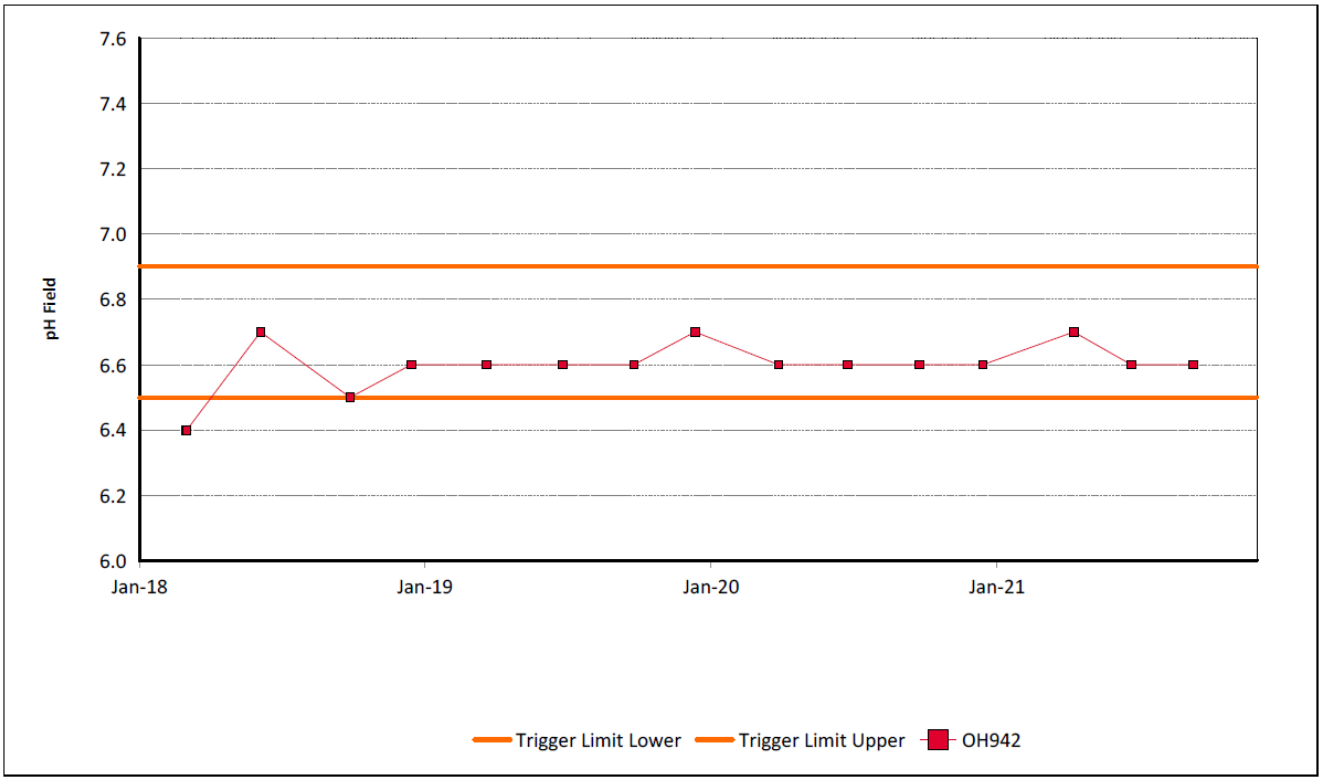
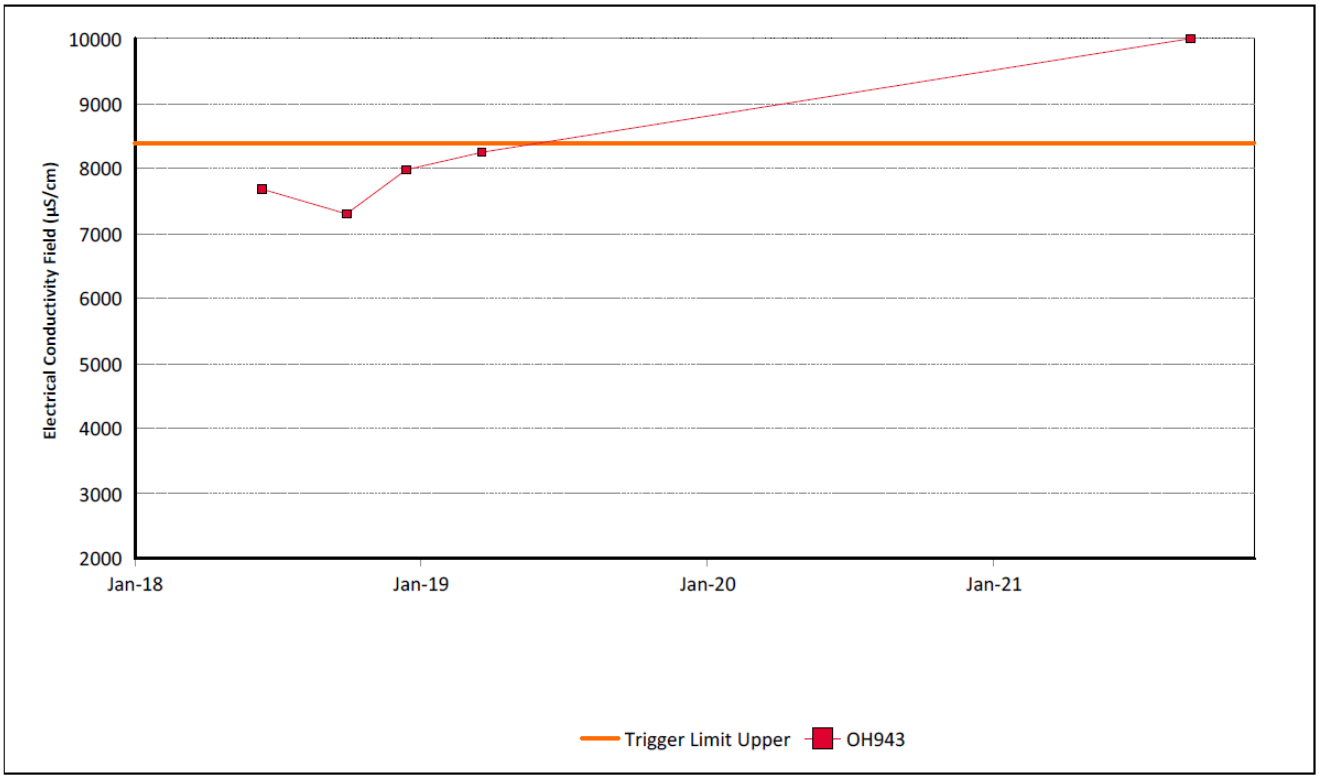
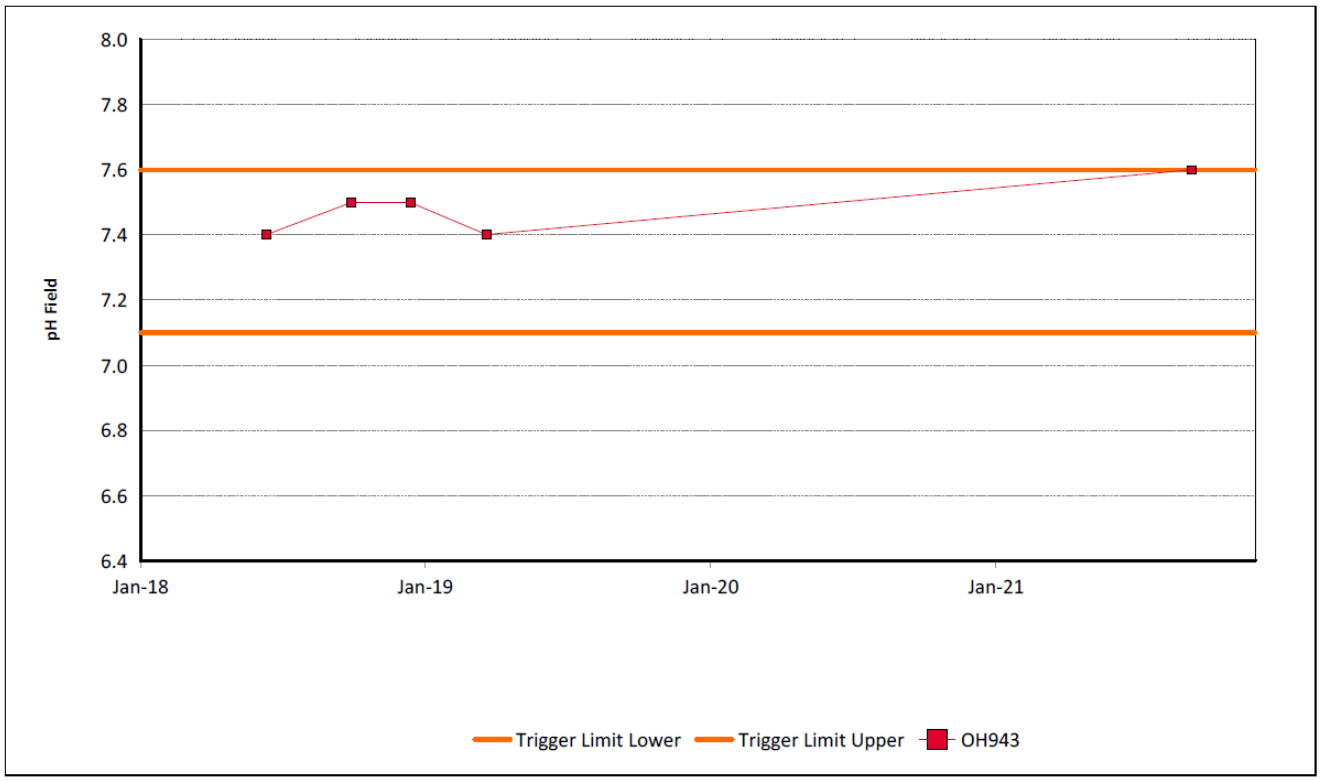


Figure 56: Hunter River Alluvium 3 pH Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 57: Hunter River Alluvium 4 Electrical Conductivity Trend – September 2021



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 58: Hunter River Alluvium 4 pH Trend – September 2021

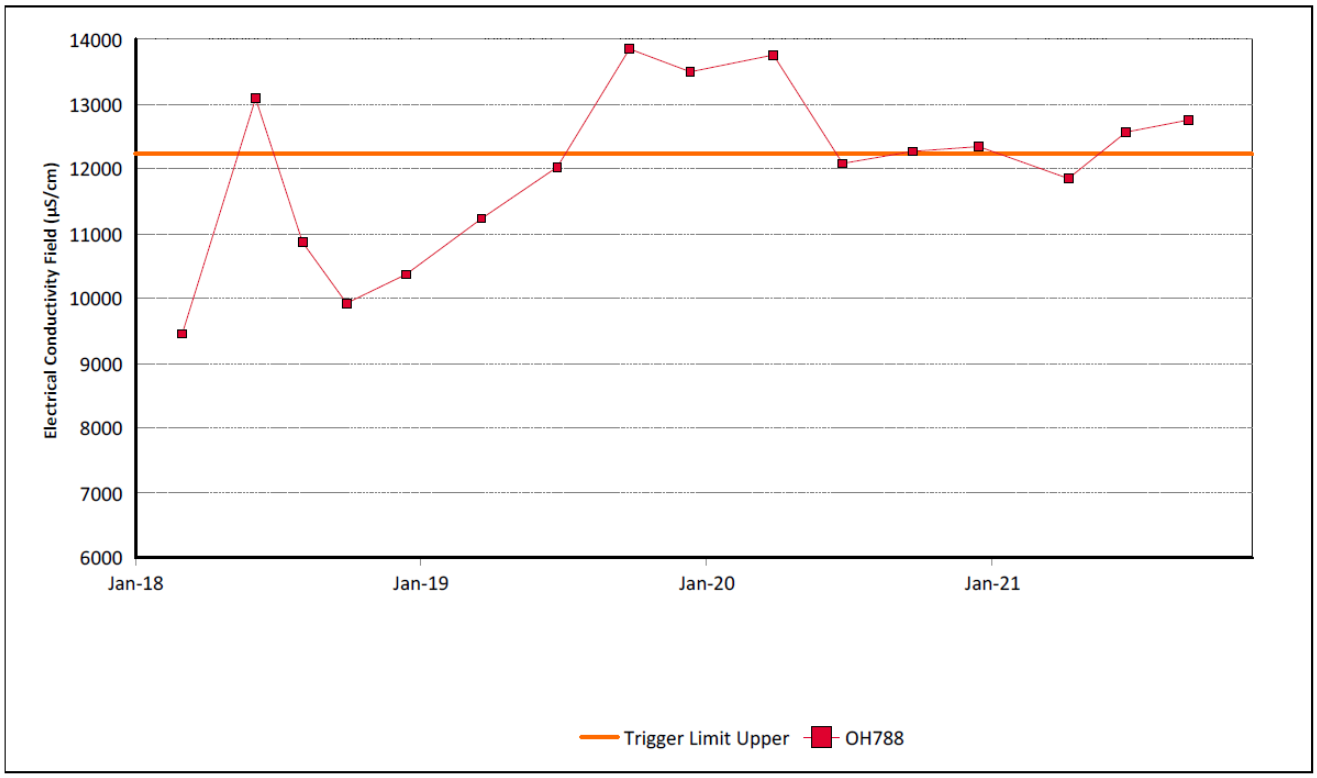


Figure 59: Hunter River Alluvium 5 Electrical Conductivity – September 2021

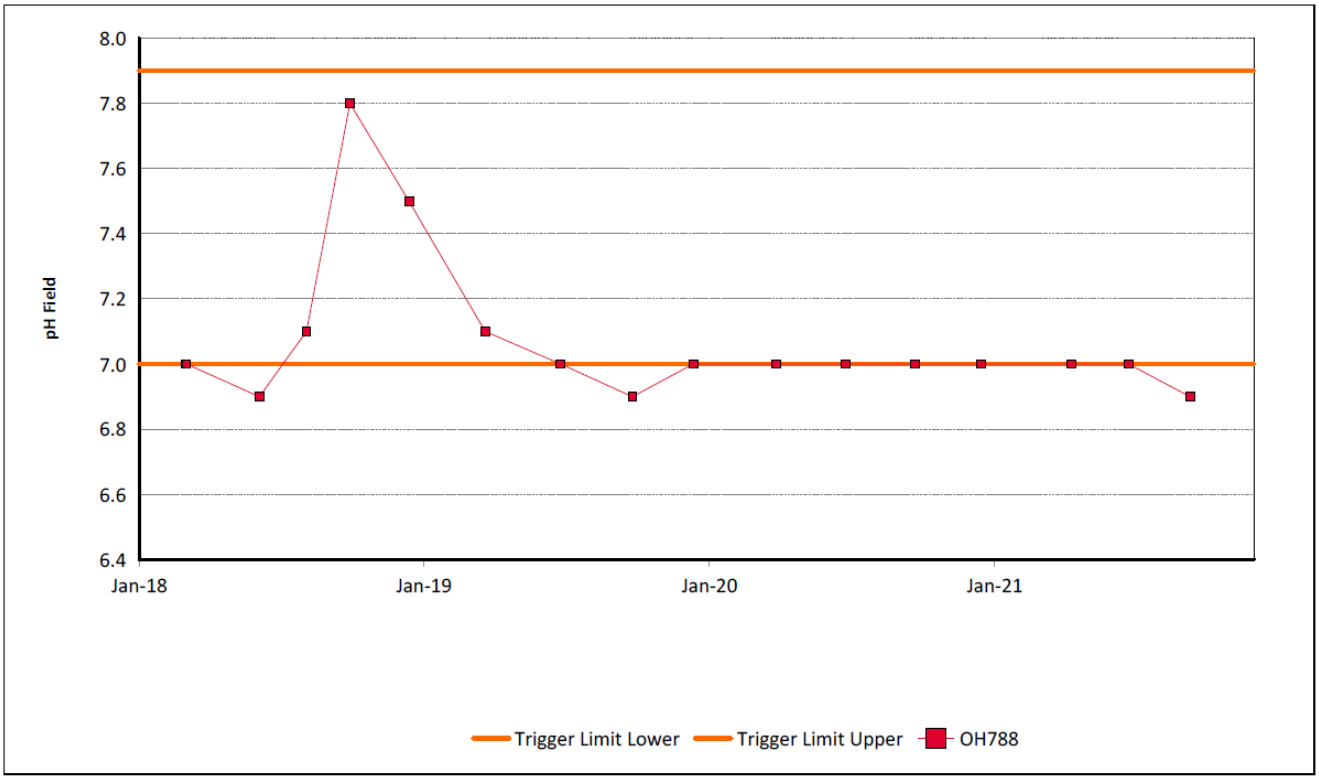


Figure 60: Hunter River Alluvium 5 pH Trend – September 2021

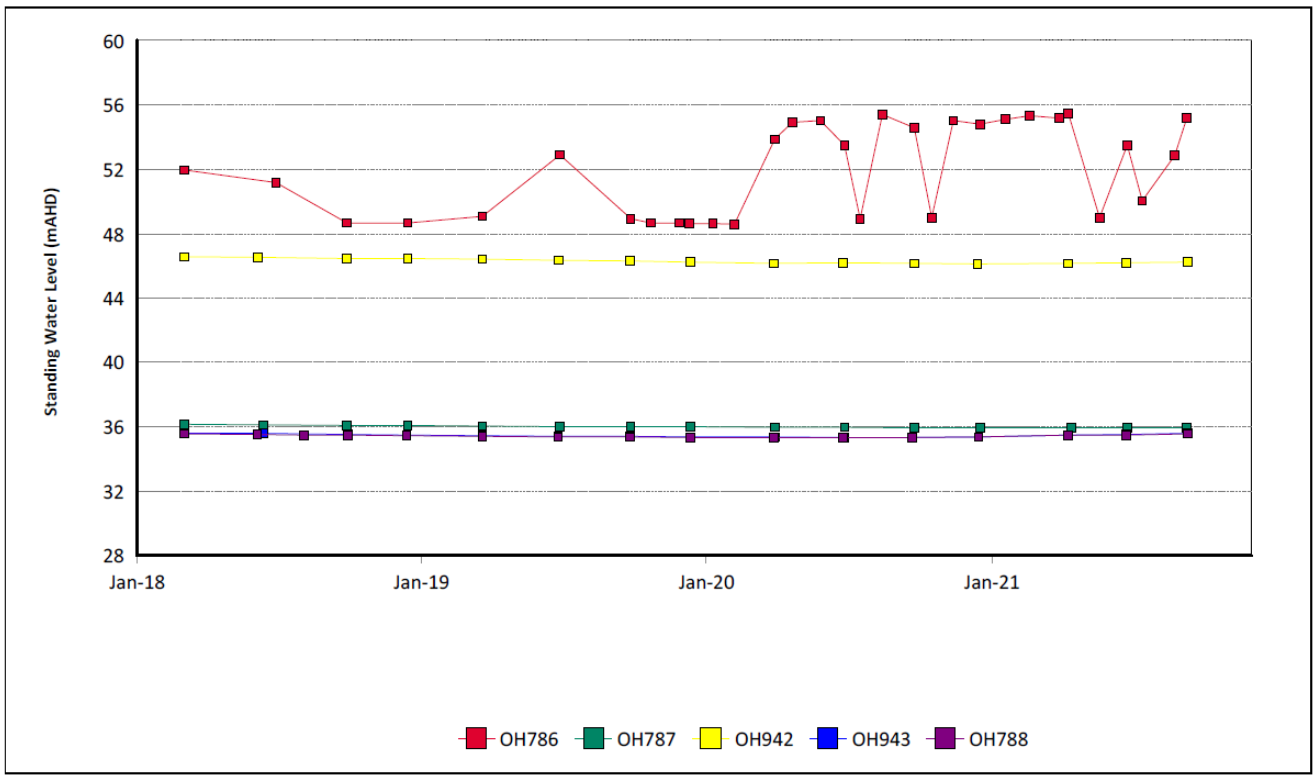


Figure 61: Hunter River Alluvium Standing Water Level Trend – September 2021

3.2.1 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 are outlined in the MTW Water Management Plan. Locations of groundwater bores are shown in **Figure 62.**

Current internal groundwater trigger limit breaches are summarised in **Table 3**.

Table 3: Groundwater Triggers – 2021

Site	Date	Trigger Limit Breached	Action Taken in Response
OH787	13/04/2021	EC – 95th Percentile	Watching Brief* A change to the sampling methodology implemented in 2019 i.e. low flow pumping/purging prior to all sampling and analysis, is considered the cause of the measured increase in EC since then.
OH787	24/06/2021	EC – 95th Percentile	Watching Brief*
OH787	8/09/2021	EC – 95th Percentile	In field investigation completed, no water interaction with surface observed. (Note EC relatively consistent at 753-1133 uS/cm above 95th trigger limit value of 18467uS/cm). Continue Watching Brief*. Review at 2021 Annual GW Report
OH788	22/06/2021	EC – 95th Percentile	Watching Brief*
OH788	9/09/2021	EC – 95th Percentile	Watching Brief*
MTD605P	24/05/2021	EC – 95th Percentile	Watching Brief* Returned to within 95th percentile for 27/8/21 sample result
WD622P	25/02/2021	EC – 95th Percentile	Watching Brief* Returned to within 95th percentile for 26/5/21 sample result.
PZ7S	30/08/2021	EC – 95th Percentile	Watching Brief*
OH1137	9/09/2021	EC – 95th Percentile	Watching Brief*
OH943	9/09/2021	EC – 95th Percentile	September 2021 is the first time that sufficient water for sample has been present since 2019. Watching Brief*
GW98MTCL2	23/06/2021	pH – 5th Percentile	Watching Brief* Returned to above 5th percentile for 6/9/21 sample result
WOH2139A	25/02/2021	pH – 95th Percentile	Watching Brief* Returned to within 95th percentile for 27/5/21 sample result.
WOH2156A	25/02/2021	pH – 5th Percentile	Watching Brief* Returned to above 5th percentile for 26/5/21 sample result.
MB15MTW01D	25/02/2021	pH – 5th Percentile	Watching Brief* A change to the sampling methodology implemented in 2019 i.e. low flow pumping/purging prior to all sampling and analysis, is possibly considered the cause of the measured drop in pH results below 5th percentile trigger level since then.
MB15MTW01D	26/05/2021	pH – 5th Percentile	A change to the sampling methodology implemented in 2019 i.e. low flow pumping/purging prior to all sampling and analysis, is possibly considered the cause of the measured drop in pH results below 5th percentile trigger level since then.
MB15MTW01D	24/08/2021	pH – 5th Percentile	A change to the sampling methodology implemented in 2019 i.e. low flow pumping/purging prior to all sampling and analysis, is possibly considered the cause of the measured drop in pH results below 5th percentile trigger level since then. No investigation required.
MTD616P	25/02/2021	pH – 5th Percentile	Watching Brief*

Site	Date	Trigger Limit Breached	Action Taken in Response
MTD616P	25/05/2021	pH – 5th Percentile	Watching Brief* Returned to above 5th percentile for 23/8/21 sample result
WD622P	25/02/2021	pH – 5th Percentile	Watching Brief* Returned to above 5th percentile for 26/5/21 sample result.
WOH2154B	24/02/2021	pH – 95th Percentile	Watching Brief*
WOH2154B	2/06/2021	pH – 95th Percentile	Watching Brief* Returned to within 95th percentile for 26/8/21 sample result
PZ9D	29/04/2021	pH – 5th Percentile	Watching Brief* Returned to above 5th percentile for 22/6/21 sample result.
OH788	9/09/2021	pH – 95th Percentile	Watching Brief*
OH1137	9/09/2021	pH – 95th Percentile	Watching Brief*
OH1138(1)	19/01/2021	pH – 5th Percentile	Watching Brief*
OH1138(1)	19/02/2021	pH – 5th Percentile	Watching Brief*
OH1138(1)	29/03/2021	pH – 5th Percentile	Results were investigated in the MTW 2020 Annual Groundwater Review. pH results for monitoring bore OH1138 likely to be attributable to the regional drawdown associated within the active mining in North Pit and the potential influences from the abstraction of water from the Lemington underground workings. Continue Watching Brief*
OH1138(1)	8/04/2021	pH – 5th Percentile	See March comment re investigation at this location. Returned to the 5th percentile for 19/5/21 sample result. Continue Watching Brief*
OH1138(1)	24/06/2021	pH – 5th Percentile	See March comment re investigation at this location. Returned to the 5th percentile for 13/7/21 sample result. Continue Watching Brief*
OH1138(1)	24/08/2021	pH – 5th Percentile	See March comment re investigation at this location. Returned to the 5th percentile for 9/9/21 sample result. Continue Watching Brief*
PZ7D	27/05/2021	pH – 95th Percentile	Watching Brief*
PZ7D	30/08/2021	pH – 95th Percentile	Watching Brief*
OH1121	23/06/2021	pH – 95th Percentile	Watching Brief*
OH1121	9/09/2021	pH – 95th Percentile	Watching Brief*
OH1126	24/06/2021	pH – 5th Percentile	Watching Brief* Returned to above 5th percentile for 9/9/21 sample result
WD625P	26/08/2021	pH – 95th Percentile	Watching Brief*
OH788	9/09/2021	pH – 5th Percentile	Watching Brief*

* = Watching brief established pending outcomes of subsequent monitoring events. No specific actions required.

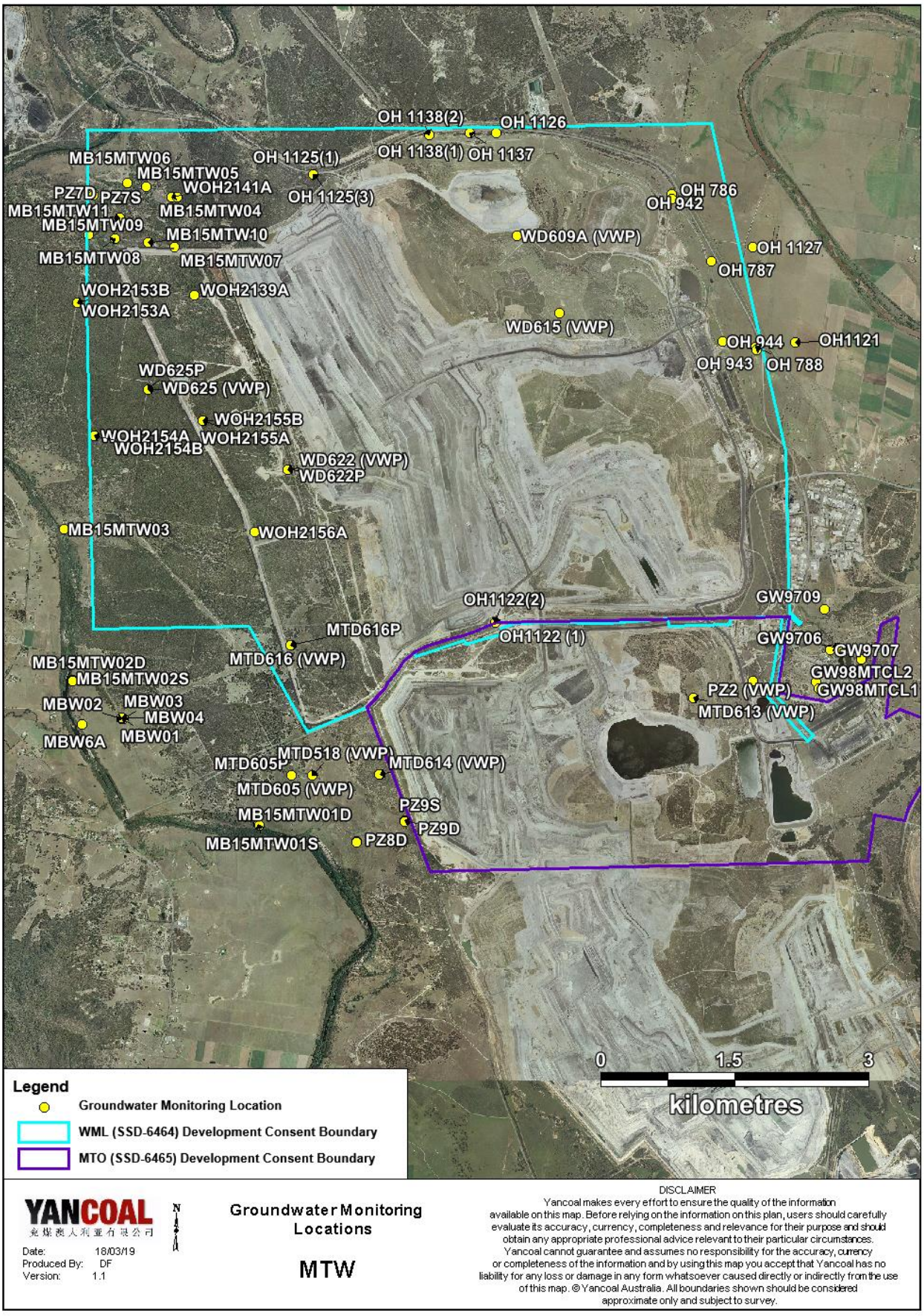


Figure 62: Groundwater Monitoring Location Plan

4.0 BLAST MONITORING

MTW have a network of six blast monitoring units. These are located at nearby privately-owned residences and function as regulatory compliance monitors.

The location of these monitors can be found in **Figure 69**.

4.1 Blast Monitoring Results

During September 2021, 22 blasts were initiated at MTW. Error! Reference source not found. to Error! Reference source not found. show the blast monitoring results for the reporting period against the impact assessment criteria. The criteria is summarised in **Table 4**.

Table 4: Blasting Limits

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

During the reporting period no blasts exceeded the 115 dB(L) 5% threshold for airblast overpressure or 5mm/s 5% threshold for ground vibration.

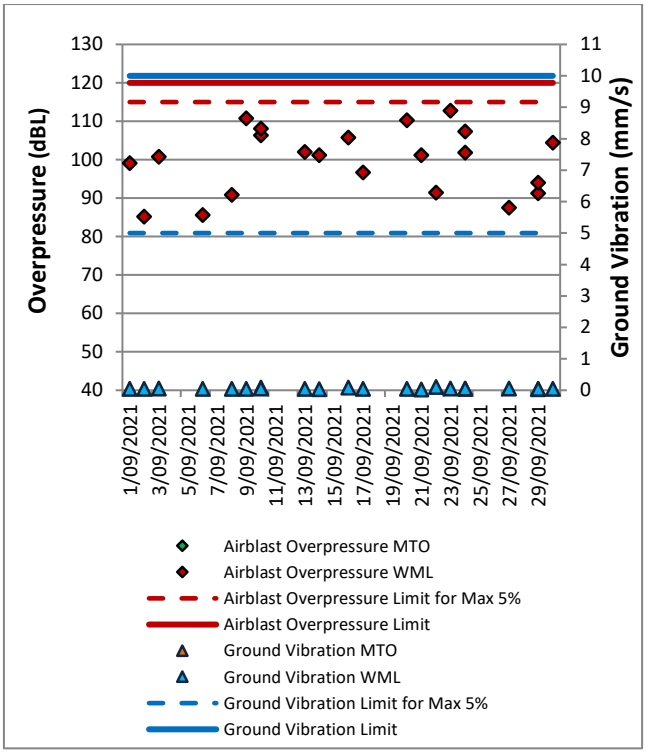


Figure 63: Abbey Green Blast Monitoring Results – September 2021

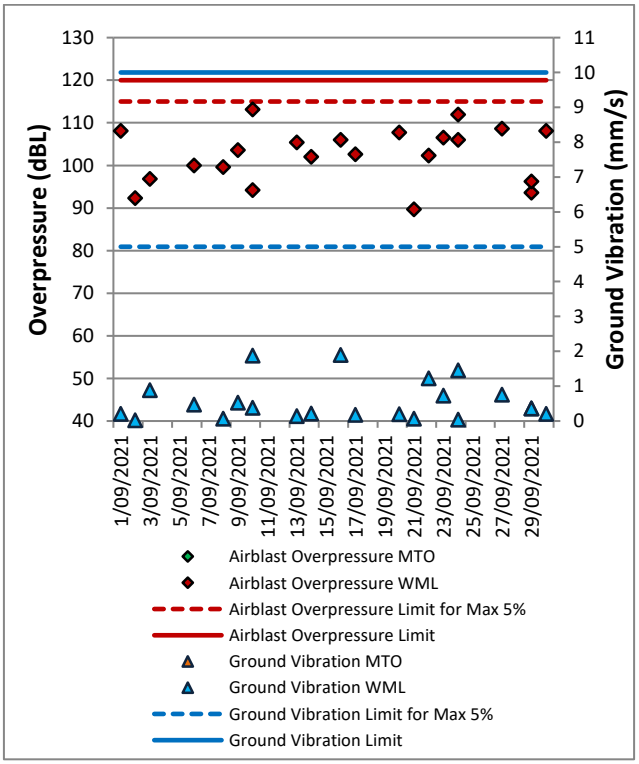


Figure 64: Bulga Village Blast Monitoring Results – September 2021

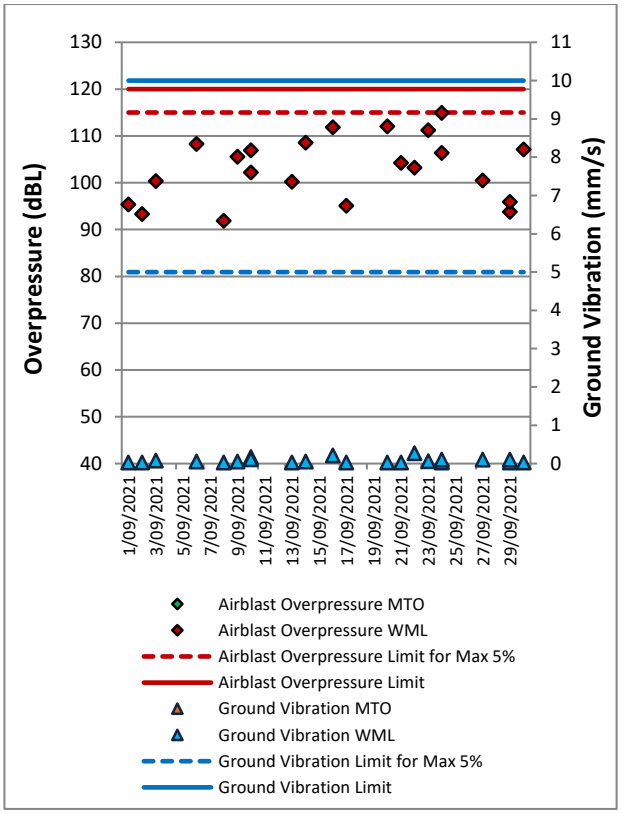


Figure 65: MTIE Blast Monitoring Results – September 2021

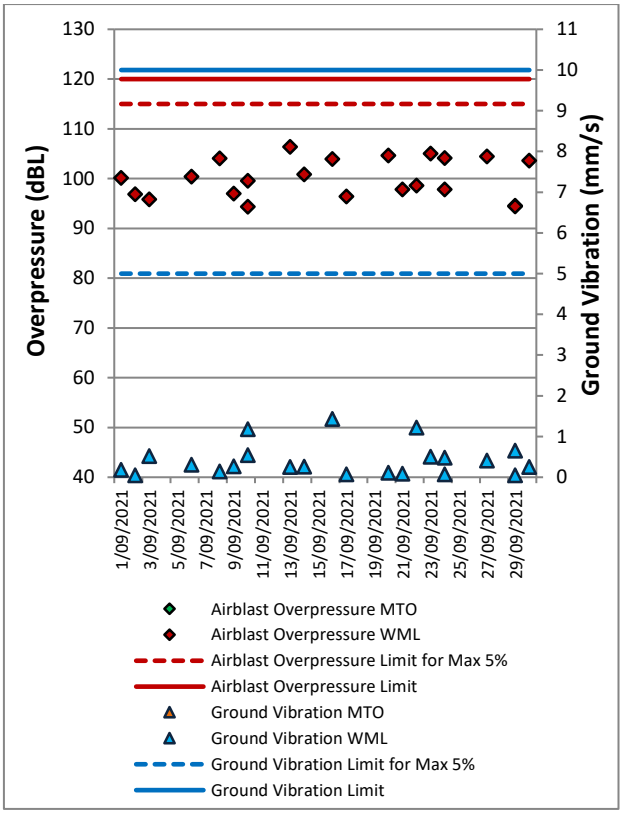


Figure 67: Wambo Road Blast Monitoring Results – September 2021

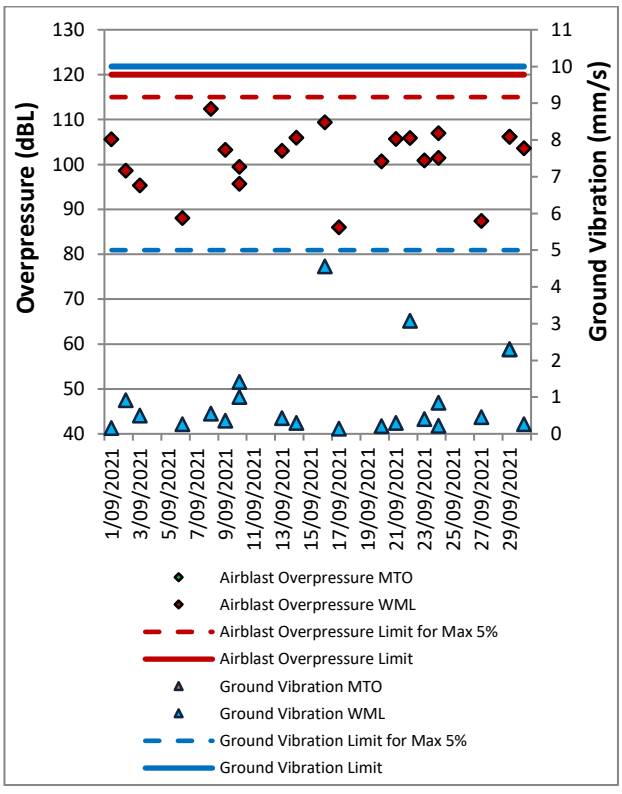


Figure 66: Warkworth Blast Monitoring Results - September 2021

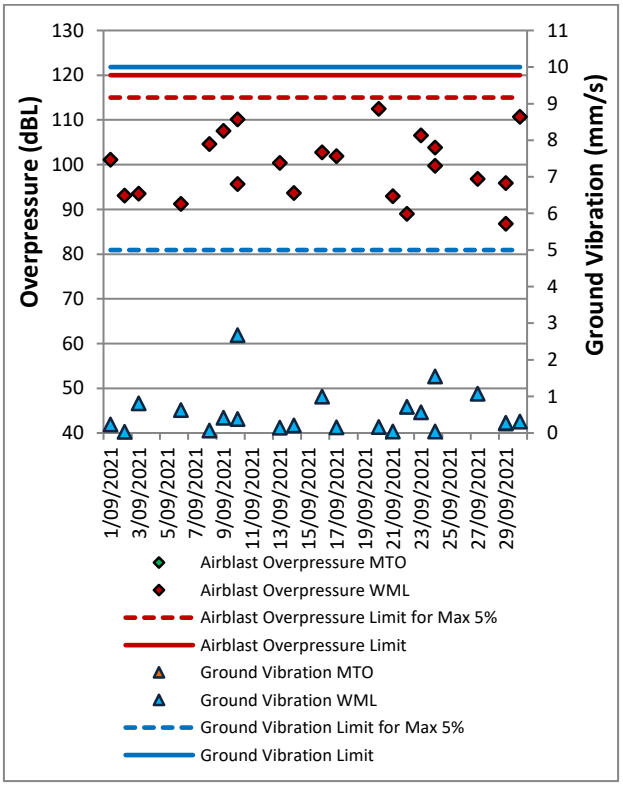


Figure 68: Wollemi Peak Road Blast Monitoring Results - September 2021

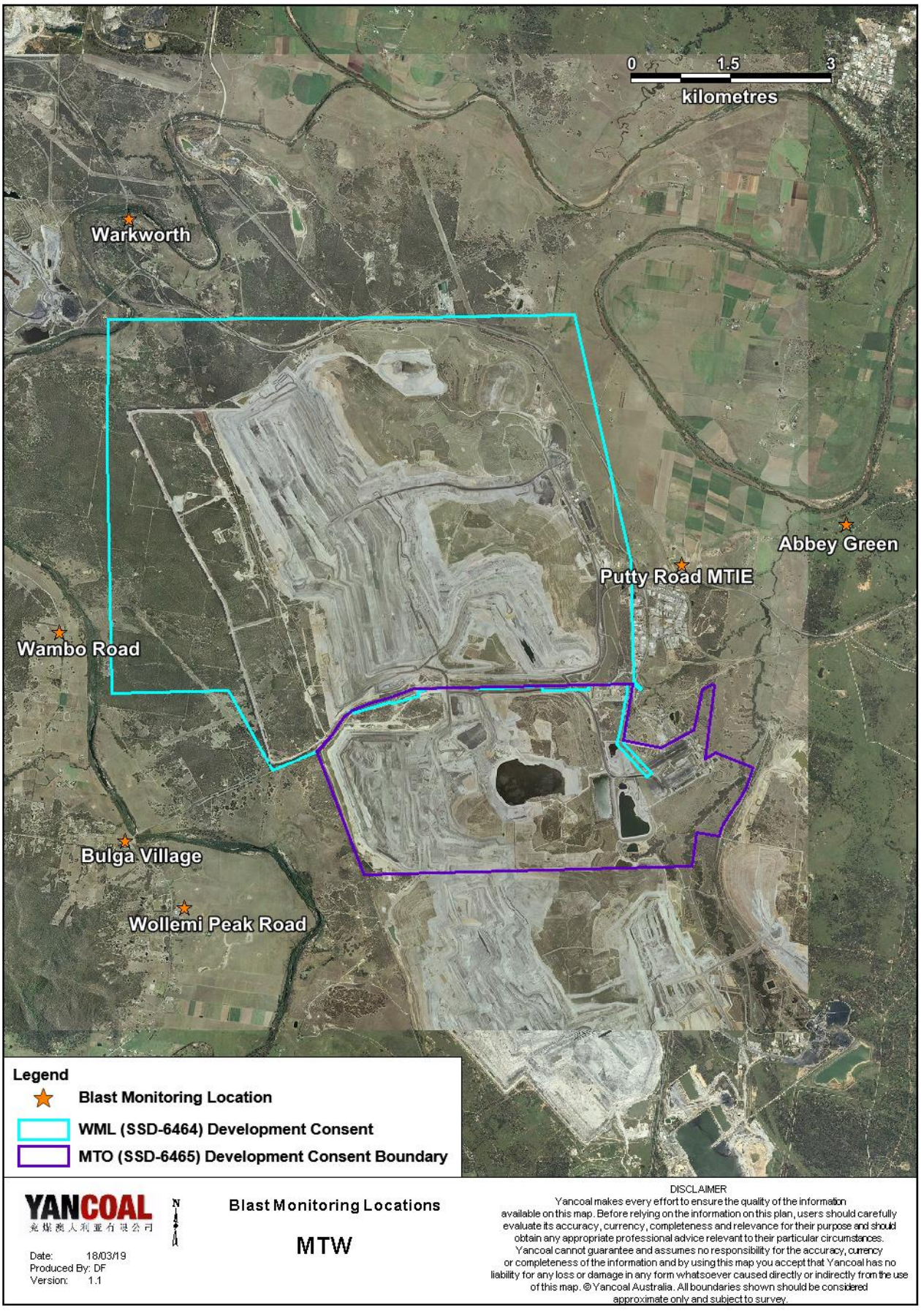


Figure 69: Blast and Vibration Monitoring Location Plan

5.0 NOISE

Routine attended noise monitoring is carried out in accordance with the MTW Noise Management Plan. A review against EIS predictions will be reported in the Annual Review Report. The purpose of the noise surveys is to quantify and describe the acoustic environment around the site and compare results with specified limits. Unattended monitoring (real time noise monitoring) also occurs at five sites surrounding MTW. The attended noise monitoring locations are displayed in **Figure 70.**

5.1 Attended Noise Monitoring Results

Attended monitoring was conducted at receiver locations surrounding MTW on the night of 7 September 2021. All measurements complied with the relevant criteria. Results are detailed in **Table 5** to **Table 8**.

5.1.1 WML Noise Assessment

Compliance assessments undertaken against the WML noise criteria are presented in **Table 5** and **Table 6**.

Table 5: $L_{Aeq,\ 15\ minute}$ Warkworth Impact Assessment Criteria – September 2021

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion (dB(A))	Criterion Applies?[1]	WML L_{Aeq} dB[2,3,4,5]	Exceedance[3,6]
Bulga RFS	7/09/2021 22:51	1.7	F	37	Yes	IA	Nil
Bulga Village	7/09/2021 22:11	1.3	F	38	Yes	IA	Nil
Gouldsville	7/09/2021 21:27	3.0	D	38	Yes	29	Nil
Inlet Rd	7/09/2021 21:22	2.5	D	37	Yes	NM	Nil
Inlet Rd West	7/09/2021 21:00	2.9	E	35	Yes	IA	Nil
Long Point	7/09/2021 21:01	2.9	E	35	Yes	27	Nil
South Bulga	7/09/2021 23:38	1.7	E	35	Yes	IA	Nil
Wambo Road	7/09/2021 21:49	2.7	D	38	Yes	IA	Nil

Notes:

1. Noise emission limits apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;

2. Estimated or measured LAeq,15minute attributed to WML;

3. Bold results in red are possible exceedances of relevant criteria;

4. IA denotes 'Inaudible';

5. NM denotes 'Not measurable', this means some noise was audible but could not be quantified

6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable.

Table 6: $L_{A1, 1\ minute}$ Warkworth Impact Assessment Criteria – September 2021

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion (dB(A))	Criterion Applies?[1]	WML L_{Aeq} dB[2,3,4,5]	Exceedance[3,6]
Bulga RFS	7/09/2021 22:51	1.7	F	47	Yes	IA	Nil
Bulga Village	7/09/2021 22:11	1.3	F	48	Yes	IA	Nil
Gouldsville	7/09/2021 21:27	3.0	D	48	Yes	32	Nil
Inlet Rd	7/09/2021 21:22	2.5	D	47	Yes	NM	Nil
Inlet Rd West	7/09/2021 21:00	2.9	E	45	Yes	IA	Nil
Long Point	7/09/2021 21:01	2.9	E	45	Yes	28	Nil
South Bulga	7/09/2021 23:38	1.7	E	45	Yes	IA	Nil
Wambo Road	7/09/2021 21:49	2.7	D	48	Yes	IA	Nil

Notes:
1. Noise emission limits apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;
2. Estimated or measured LA1,1minute attributed to WML;
3. Bold results in red are possible exceedances of relevant criteria;
4. IA denotes 'Inaudible';
5. NM denotes 'Not measurable', this means some noise was audible but could not be quantified
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not Applicable.

5.1.2 MTO Noise Assessment

Compliance assessments undertaken against the MTO noise criteria are presented in **Table 7** and **Table 8**.

Table 7: $L_{Aeq, 15minute}$ Mount Thorley Operations - Impact Assessment Criteria – September 2021

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO L_{Aeq} dB[2,3]	Exceedance[3,4]
Bulga RFS	7/09/2021 22:51	1.7	F	37	Yes	NM	Nil
Bulga Village	7/09/2021 22:11	1.3	F	38	Yes	IA	Nil
Gouldsville	7/09/2021 21:27	3.0	D	35	Yes	IA	Nil
Inlet Rd	7/09/2021 21:22	2.5	D	37	Yes	IA	Nil
Inlet Rd West	7/09/2021 21:00	2.9	E	35	Yes	IA	Nil
Long Point	7/09/2021 21:01	2.9	E	35	Yes	IA	Nil
South Bulga	7/09/2021 23:38	1.7	E	36	Yes	32	Nil
Wambo Road	7/09/2021 21:49	2.7	D	38	Yes	NM	Nil

Notes:
1. Noise emission limits apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;
2. Estimated or measured LA1,1minute attributed to WML;
3. Bold results in red are possible exceedances of relevant criteria;
4. IA denotes 'Inaudible';
5. NM denotes 'Not measurable', this means some noise was audible but could not be quantified
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not Applicable.

Table 8: $L_{A1, 1Minute}$ Mount Thorley Operations - Impact Assessment Criteria – September 2021

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO $L_{A1, 1min}$ dB[2,3]	Exceedance[3,4]
Bulga RFS	7/09/2021 22:51	1.7	F	47	Yes	NM	Nil
Bulga Village	7/09/2021 22:11	1.3	F	48	Yes	IA	Nil
Gouldsville	7/09/2021 21:27	3.0	D	45	Yes	IA	Nil
Inlet Rd	7/09/2021 21:22	2.5	D	47	Yes	IA	Nil
Inlet Rd West	7/09/2021 21:00	2.9	E	45	Yes	IA	Nil
Long Point	7/09/2021 21:01	2.9	E	45	Yes	IA	Nil
South Bulga	7/09/2021 23:38	1.7	E	46	Yes	42	Nil
Wambo Road	7/09/2021 21:49	2.7	D	48	Yes	NM	Nil

Notes:
1. Noise emission limits apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;
2. Estimated or measured LA1,1minute attributed to WML;
3. Bold results in red are possible exceedances of relevant criteria;
4. IA denotes 'Inaudible';
5. NM denotes 'Not measurable', this means some noise was audible but could not be quantified
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not Applicable.

5.1.3 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. There were no noise measurements taken during the reporting period which required the penalty to be applied. The WML assessment for low frequency noise is shown in **Table 9** and the MTO assessment for low frequency noise is shown in **Table 10.**

Table 9: Warkworth Low Frequency Noise Assessment – September 2021

Location	Date and Time	Measured WML LAeq dB[1,2]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[3]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [3,4]	Penalty dB[4]	Exceedance
Bulga RFS	7/09/2021 22:51	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	7/09/2021 22:11	IA	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	7/09/2021 21:27	29	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	7/09/2021 21:22	NM	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	7/09/2021 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
Long Point	7/09/2021 21:01	27	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	7/09/2021 23:38	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	7/09/2021 21:49	IA	Yes	No	No	NA	No	NA	Nil	NA

Notes:
1. IA denotes 'Inaudible';
2. NM denotes 'Not measurable', this means some noise was audible but could not be quantified
3. NA denotes 'not applicable'; and
4. Bold results indicate that application of NPfI modifying factor/s is required.

Table 10: Mount Thorley Operations Low Frequency Noise Assessment – September 2021

Location	Date and Time	Measured WML LAeq dB[1,2]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[3]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [3,4]	Penalty dB[4]	Exceedance
Bulga RFS	7/09/2021 22:51	NM	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	7/09/2021 22:11	IA	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	7/09/2021 21:27	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	7/09/2021 21:22	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	7/09/2021 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
Long Point	7/09/2021 21:01	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	7/09/2021 23:38	32	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	7/09/2021 21:49	NM	Yes	No	No	NA	No	NA	Nil	NA

Notes:
1. IA denotes 'Inaudible';
2. NM denotes 'Not measurable', this means some noise was audible but could not be quantified
3. NA denotes 'not applicable'; and
4. Bold results indicate that application of NPfI modifying factor/s is required.

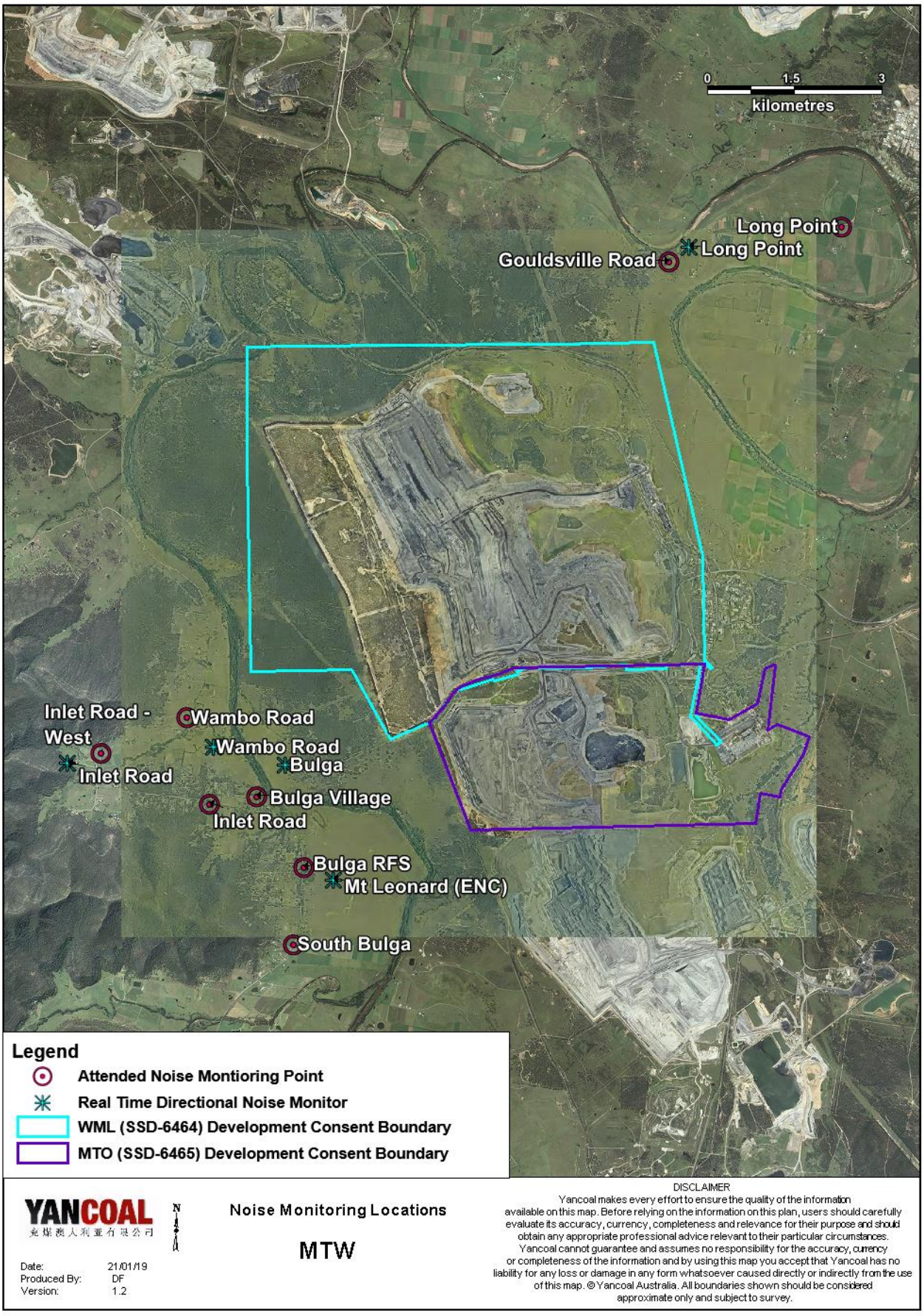


Figure 70: Noise Monitoring Location Plan

5.2 Noise Management Measures

A program of targeted supplementary attended noise monitoring is in place at MTW, supported by the real-time directional monitoring network and ensuring the highest level of noise management is maintained. The supplementary program is undertaken by MTW personnel and involves:

- Routine inspections from both inside and outside the mine boundary;
- Routine and as-required handheld noise assessments (undertaken in response to noise alarm and/or community complaint), comparing measured levels against consent noise limits; and
- Validation monitoring following operational modifications to assess the adequacy of the modifications.

Where a noise assessment identifies noise emissions which are exceeding the relevant noise limit(s) for any particular residence, modifications will be made so as to ensure that the noise event is resolved within 75 minutes of identification. The actions taken are commensurate with the nature and severity of the noise event, but can include:

- Changing the haul route to a less noise sensitive haul;
- Changing dump locations (in-pit or less exposed dump option)
- Reducing equipment numbers;
- Shut down of task; or
- Site shut down.

A summary of these assessments undertaken during September are provided in **Table 11.**

Table 11: Supplementary Attended Noise Monitoring Data – September 2021

No. of assessments	No. of assessments > trigger	No. of nights where assessments > trigger	% greater than trigger
611	20	7	3.27

: Measurements are taken under all meteorological conditions, including conditions under which the consent noise criteria do not apply.

6.0 OPERATIONAL DOWNTIME

During September a total of 596 hours of equipment downtime was logged in response to environmental events such as dust, noise and adverse meteorological conditions. Operational downtime by equipment type is shown in **Figure 71**.

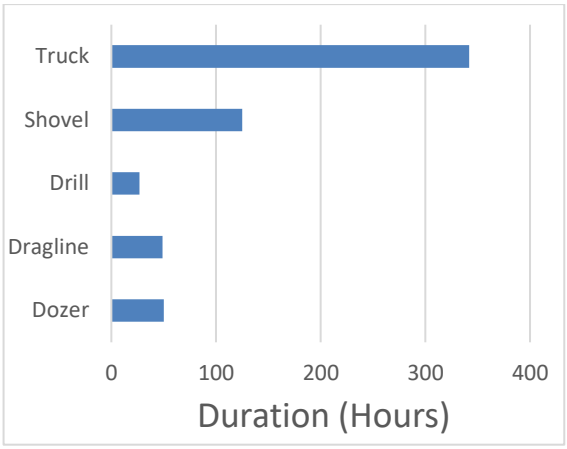


Figure 71: Operational Downtime by Equipment Type – September 2021

7.0 REHABILITATION

During September, 12.96 Ha of land was released for rehabilitation and 33.41 Ha was bulk shaped. No land was topsoiled or Rehabilitated during the reporting period. Year-to-date progress can be viewed in **Figure 72.**

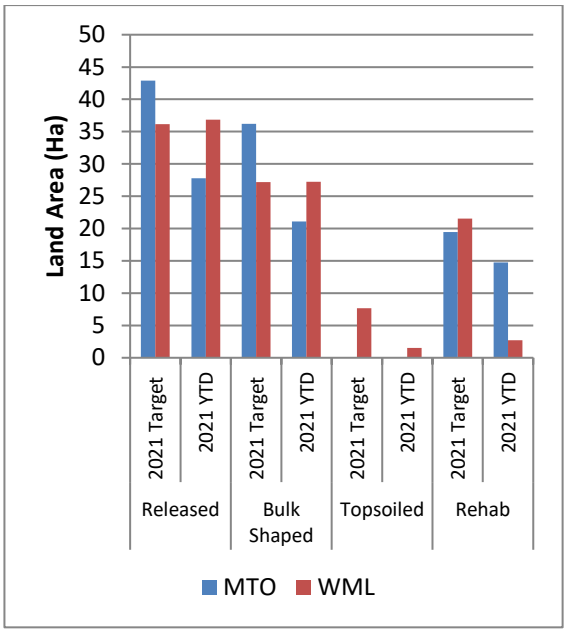


Figure 72: Rehabilitation YTD – September 2021

8.0 ENVIRONMENTAL INCIDENTS

There were no reportable environmental incidents recorded during the reporting period.

9.0 COMPLAINTS

During the reporting period 30 complaints were received, details of these complaints are displayed in **Table 12** Error! Reference source not found.below.

Table 12: Complaints Summary - YTD

	Noise	Dust	Blast	Lighting	Other	Total
January	1	0	6	4	1	12
February	4	0	3	0	0	7
March	5	0	3	3	1	12
April	6	2	1	10	0	19
May	3	1	10	5	0	19
June	2	0	4	0	0	6
July	1	0	5	3	1	10
August	12	8	5	1	0	26
September	3	11	7	8	1	30
October						
November						
December						
Total	37	22	44	34	4	141

Appendix A: Meteorological Data

Table 13: Meteorological Data – Charlton Ridge Meteorological Station – September 2021

Date	Air Temperature Maximum (°C)	Air Temperature Minimum (°C)	Relative Humidity Maximum (%)	Relative Humidity Minimum (%)	Wind Direction Average (°)	Wind Speed Average (m/sec)	Rainfall(mm)
1/09/2021	26	2	87	17	203	9	0
2/09/2021	26	6	88	44	144	9	0
3/09/2021	25	6	98	25	198	8	0
4/09/2021	24	7	97	37	285	12	1.4
5/09/2021	18	6	97	28	298	15	1.4
6/09/2021	21	3	85	20	239	10	0
7/09/2021	25	1	87	12	267	12	0
8/09/2021	22	4	79	32	243	2	0
9/09/2021	27	4	84	10	308	13	0
10/09/2021	29	10	94	14	260	12	0
11/09/2021	29	7	97	15	289	12	0
12/09/2021	30	8	68	6	288	20	0
13/09/2021	21	5	98	25	141	14	8.2
14/09/2021	16	5	95	50	169	14	1.4
15/09/2021	20	5	85	33	170	10	0
16/09/2021	20	4	92	42	148	10	0
17/09/2021	23	2	97	25	209	7	0
18/09/2021	29	9	90	27	264	18	0.6
19/09/2021	24	7	91	18	296	13	0.2
20/09/2021	27	7	67	10	290	18	0
21/09/2021	17	4	67	24	207	20	0
22/09/2021	21	2	82	28	213	7	0
23/09/2021	26	4	86	22	309	13	0
24/09/2021	27	6	82	21	295	16	0
25/09/2021	27	8	79	13	210	13	0
26/09/2021	17	7	89	49	142	11	0
27/09/2021	21	3	95	35	132	11	0.2
28/09/2021	25	11	75	32	103	8	0
29/09/2021	21	7	98	53	204	15	7.2
30/09/2021	24	6	99	49	210	13	0