Monthly Environmental Monitoring Report

Yancoal Mt Thorley Warkworth

December 2018

CONTENTS

1.0 INTRODUCTION 5

2.0 AIR QUALITY 5

2.1 Meteorological Monitoring 5

2.1.1 Rainfall 5

2.1.2 Wind Speed and Direction 5

2.2 Depositional Dust 7

2.3 Suspended Particulates 7

2.3.1 HVAS PM_{10} Results 7

2.3.2 TSP Results 8

2.3.3 Real Time PM_{10} Results 8

2.3.4 Real Time Alarms for Air Quality 8

3.0 WATER QUALITY 9

3.1 Surface Water 9

3.1.1 Surface Water Monitoring Results 9

3.1.2 Surface Water Trigger Tracking 13

3.2 Groundwater Monitoring 16

3.2.1 Groundwater Trigger Tracking 39

4.0 BLAST MONITORING 44

4.1 Blast Monitoring Results 44

5.0 NOISE 47

5.1 Attended Noise Monitoring Results 47

5.1.1 WML Noise Assessment 47

5.1.2 MTO Noise Assessment 48

5.1.3 Low Frequency Assessment 50

5.2 Noise Management Measures 52

6.0 OPERATIONAL DOWNTIME 52

7.0 REHABILITATION 53

8.0 ENVIRONMENTAL INCIDENTS 53

9.0 COMPLAINTS 53

Appendix A: Meteorological Data 54

Figures

Figure 1: Rainfall Trends YTD 5
Figure 2: Charlton Ridge Wind Rose – December 2018 5
Figure 3: Air Quality Monitoring Locations 6
Figure 4: Depositional Dust – December 2018 7
Figure 5: Individual PM_{10} Results – December 2018 7
Figure 6: Annual Average PM_{10} – December 2018 8
Figure 7: Annual Average Total Suspended Particulates – December 2018 8
Figure 8: Real Time PM_{10} 24hr average and Year-to-date average – December 2018 9
Figure 9: Site Dams Electrical Conductivity Trend – December 2018 10
Figure 10: Site Dams pH Trend – December 2018 10
Figure 11: Site Dams Total Suspended Solids Trend – December 2018 11
Figure 12: Watercourse Electrical Conductivity Trend – December 2018 11
Figure 13: Watercourse pH Trend – December 2018 12
Figure 14: Watercourse Total Suspended Solids Trend – December 2018 12
Figure 15: Surface Water Monitoring Location Plan 15
Figure 16: Bayswater Seam Electrical Conductivity Trend – December 2018 16
Figure 17: Bayswater Seam pH Trend – December 2018 17
Figure 18: Bayswater Seam Standing Water Level Trend – December 2018 17
Figure 19: Blakefield Seam Electrical Conductivity Trend – December 2018 18
Figure 20: Blakefield Seam pH Trend – December 2018 18
Figure 21: Blakefield Seam Standing Water Level Trend – December 2018 19
Figure 22: Bowfield Seam Electrical Conductivity Trend – December 2018 19
Figure 23: Bowfield Seam pH Trend – December 2018 20
Figure 24: Bowfield Seam Standing Water Level Trend – December 2018 20
Figure 25: Redbank Seam Electrical Conductivity Trend – December 2018 21
Figure 26: Redbank Seam pH Trend – December 2018 21
Figure 27: Redbank Seam Standing Water Level Trend – December 2018 22
Figure 28: Shallow Overburden Seam Electrical Conductivity Trend – December 2018 22
Figure 29: Shallow Overburden Seam pH Trend – December 2018 23
Figure 30: Shallow Overburden Seam Standing Water Level Trend – December 2018 23
Figure 31: Vaux Seam Electrical Conductivity Trend – December 2018 24
Figure 32: Vaux Seam pH Trend – December 2018 24
Figure 33: Vaux Seam Standing Water Level Trend – December 2018 25
Figure 34: Wambo Seam Electrical Conductivity Trend – December 2018 25
Figure 35: Wambo Seam pH Trend – December 2018 26
Figure 36: Wambo Seam Standing Water Level Trend – December 2018 26
Figure 37: Warkworth Seam Electrical Conductivity Trend – December 2018 27
Figure 38: Warkworth Seam pH Trend – December 2018 27
Figure 39: Warkworth Seam Standing Water Level Trend – December 2018 28
Figure 40: Wollombi Alluvium 1 Electrical Conductivity Trend – December 2018 28
Figure 41: Wollombi Alluvium 1 pH Trend – December 2018 29
Figure 42: Wollombi Alluvium 2 Electrical Conductivity Trend – December 2018 29
Figure 43: Wollombi Alluvium 2 pH Trend – December 2018 30
Figure 44: Wollombi Alluvium Standing Water Level Trend – December 2018 30
Figure 45: Aeolian Warkworth Sands Electrical Conductivity Trend – December 2018 31
Figure 46: Aeolian Warkworth Sands pH Trend – December 2018 31
Figure 47: Aeolian Warkworth Sands Standing Water Level Trend – December 2018 32

Figure 48: Hunter River Alluvium 1 Seam Electrical Conductivity Trend – December 2018 **32**
Figure 49: Hunter River Alluvium 1 Seam pH Trend – December 2018 **33**
Figure 50: Hunter River Alluvium 2 Seam Electrical Conductivity Trend – December 2018 **33**
Figure 51: Hunter River Alluvium 2 Seam pH Trend – December 2018 **34**
Figure 52: Hunter River Alluvium 3 Seam Electrical Conductivity Trend – December 2018 **34**
Figure 53: Hunter River Alluvium 3 Seam pH Trend – December 2018 **35**
Figure 54: Hunter River Alluvium 4 Seam Electrical Conductivity Trend – December 2018 **35**
Figure 55: Hunter River Alluvium 4 Seam pH Trend – December 2018 **36**
Figure 56: Hunter River Alluvium 5 Seam Electrical Conductivity Trend – December 2018 **36**
Figure 57: Hunter River Alluvium 5 Seam pH Trend – December 2018 **37**
Figure 58: Hunter River Alluvium 6 Seam Electrical Conductivity – December 2018 **37**
Figure 59: Hunter River Alluvium 6 Seam pH Trend – December 2018 **38**
Figure 60: Hunter River Alluvium Standing Water Level Trend – December 2018 **38**
Figure 61: Groundwater Monitoring Location Plan **43**
Figure 62: Abbey Green Blast Monitoring Results – December 2018 **44**
Figure 63: Bulga Village Blast Monitoring Results – December 2018 **44**
Figure 64: MTIE Blast Monitoring Results – December 2018 **45**
Figure 65: Warkworth Blast Monitoring Results - December 2018 **45**
Figure 66: Wambo Road Blast Monitoring Results – December 2018 **45**
Figure 67: Wollemi Peak Road Blast Monitoring Results - December 2018 **45**
Figure 68: Blast and Vibration Monitoring Location Plan **46**
Figure 69: Noise Monitoring Location Plan **51**
Figure 70: Operational Downtime by Equipment Type – December 2018 **52**
Figure 71: Rehabilitation YTD - December 2018 **53**
Figure 72: Complaints Summary - YTD December 2018 **53**

Tables

Table 1: Monthly Rainfall MTW **5**
Table 2: Surface Water Trigger Tracking – December YTD 2018 **13**
Table 3: Groundwater Triggers - 2018 **40**
Table 4: Blasting Limits **44**
Table 5: $L_{Aeq,\ 15\ minute}$ Warkworth Impact Assessment Criteria – December 2018 **47**
Table 6: $L_{A1,\ 1\ minute}$ Warkworth Impact Assessment Criteria – December 2018 **47**
Table 7: $L_{Aeq,\ 15minute}$ Mount Thorley Operations - Impact Assessment Criteria – December 2018 **48**
Table 8: $L_{A1,\ 1Minute}$ Mount Thorley Operations - Impact Assessment Criteria – December 2018 **48**
Table 9: Low Frequency Noise Assessment - December 2018 **50**
Table 10: Supplementary Attended Noise Monitoring Data – December 2018 **52**
Table 11: Meteorological Data – Charlton Ridge Meteorological Station – December 2018 **55**

Revision History

Version No.	Person Responsible	Document Status	Date
1.0	**Environmental Advisor**	**Final**	**31/01/2019**

1.0 INTRODUCTION

This report has been compiled to provide a monthly summary of environmental monitoring results for Mt Thorley Warkworth (MTW). This report includes all monitoring data collected for the period 1 December to 31 December 2018.

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

2018	Monthly Rainfall (mm)	Cumulative Rainfall (mm)
December	90.4	392.5

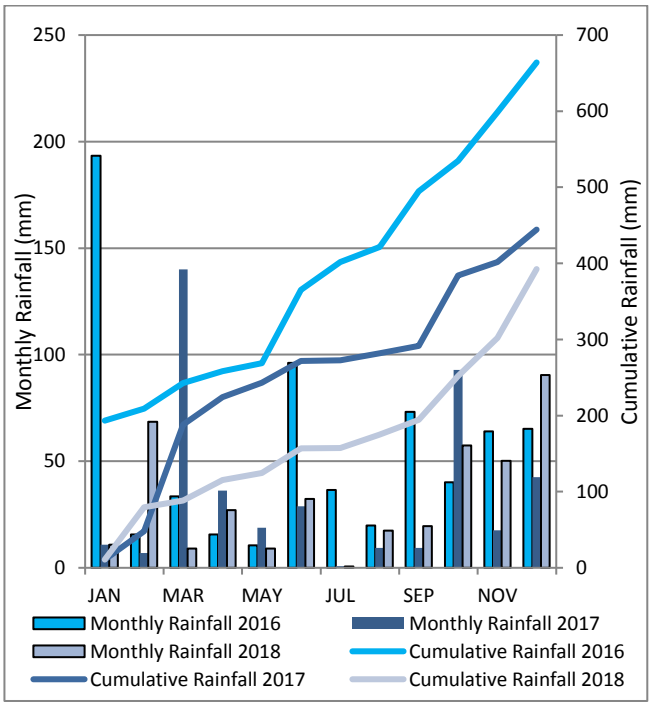


Figure 1: Rainfall Trends YTD

2.1.2 Wind Speed and Direction

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

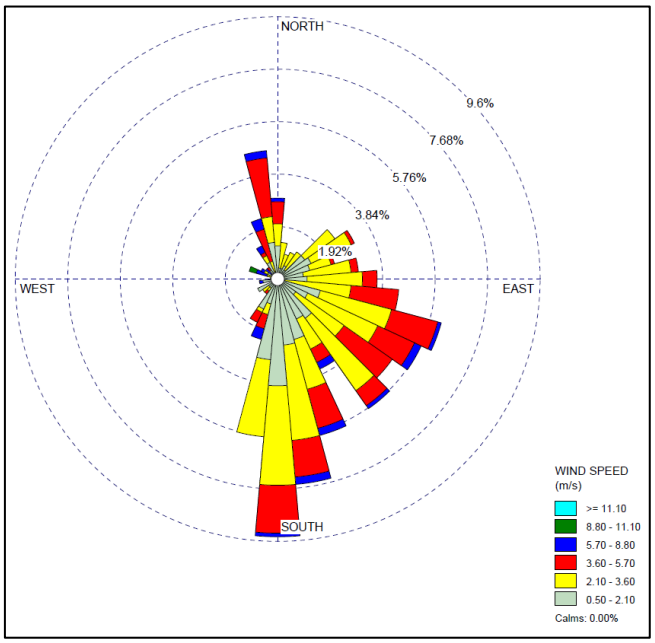


Figure 2: Charlton Ridge Wind Rose – December 2018

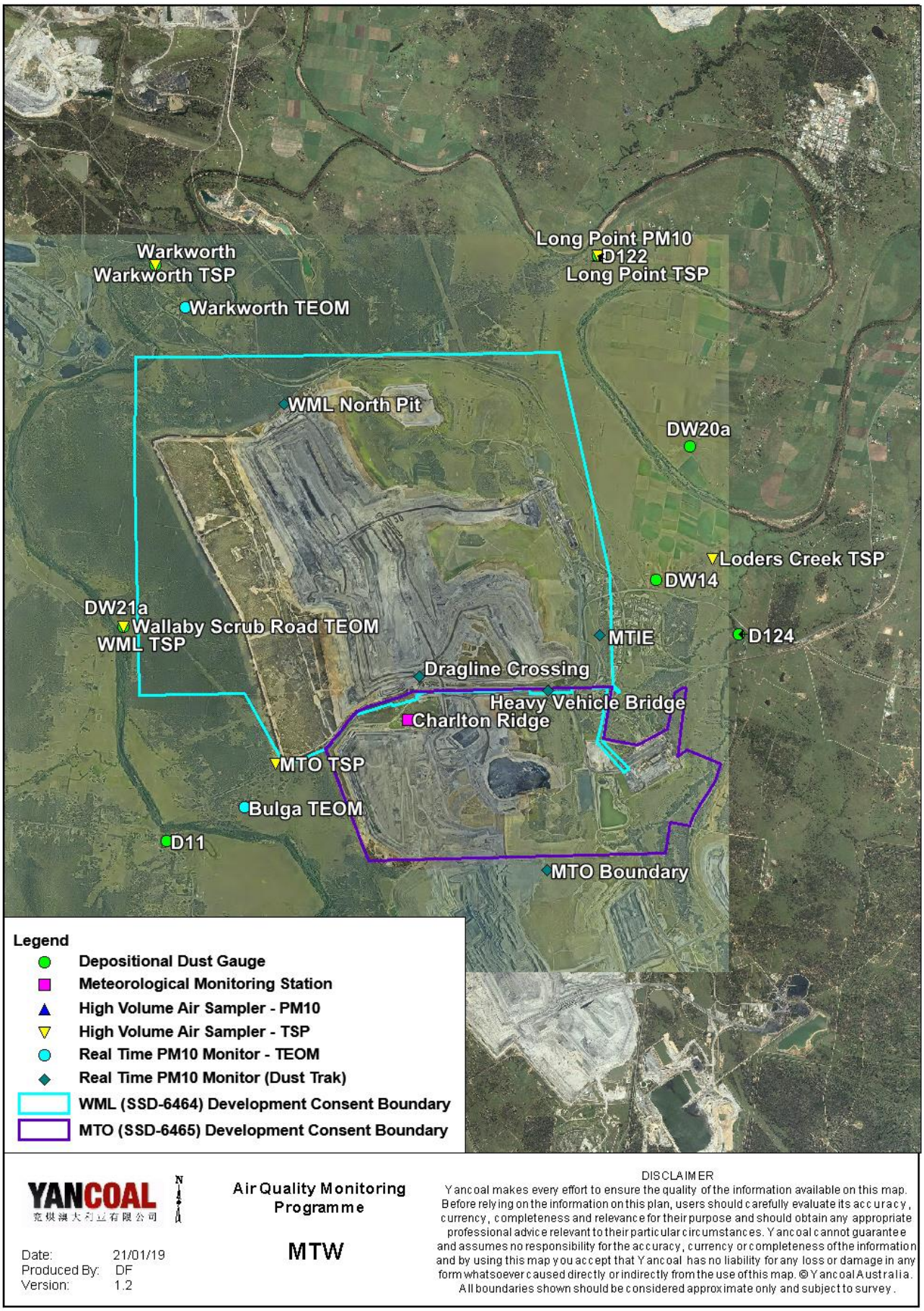


Figure 3: Air Quality Monitoring Locations

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 DW20a and Warkworth monitors recorded monthly results above the long-term impact assessment criteria of 4.0 g/m^2 per month. There is no evidence to suggest that the results are contaminated. Accordingly, the results will be included in the annual average calculation.

An assessment of MTW's contribution to the long-term Impact assessment criteria will be provided in the 2018 Annual Review Report.

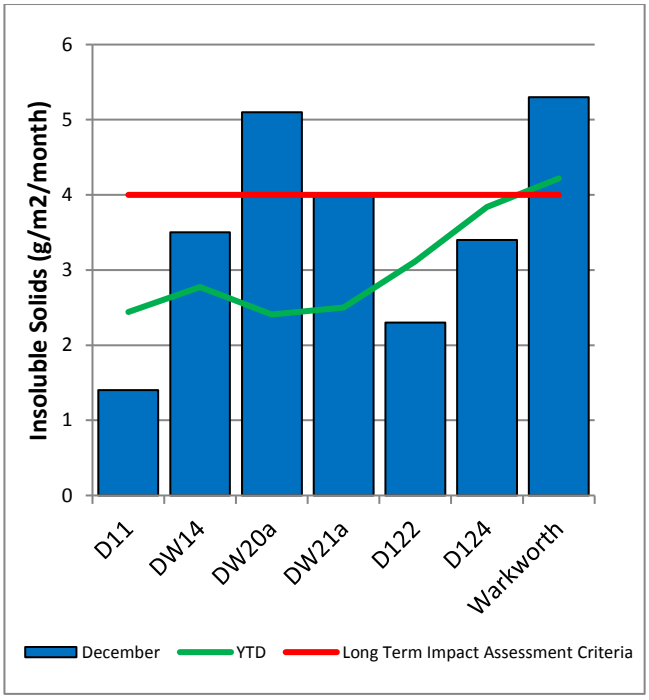


Figure 4: Depositional Dust – December 2018

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 each monitoring station against the short-term impact assessment criteria of 50µg/m^3.

Data was not available on 15 December 2018 at the Warkworth HVAS due to power related issues.

On 27 December 2018 the MTO PM_{10} HVAS unit recorded a result of 58 µg/m3, which is greater than the short term (24hr) PM10 impact assessment criteria.

Investigation indicates that the likely MTW contribution to the result at the MTO monitoring location is less than 65%. Accordingly, no further action is required (as per approved Air Quality Monitoring Programme).

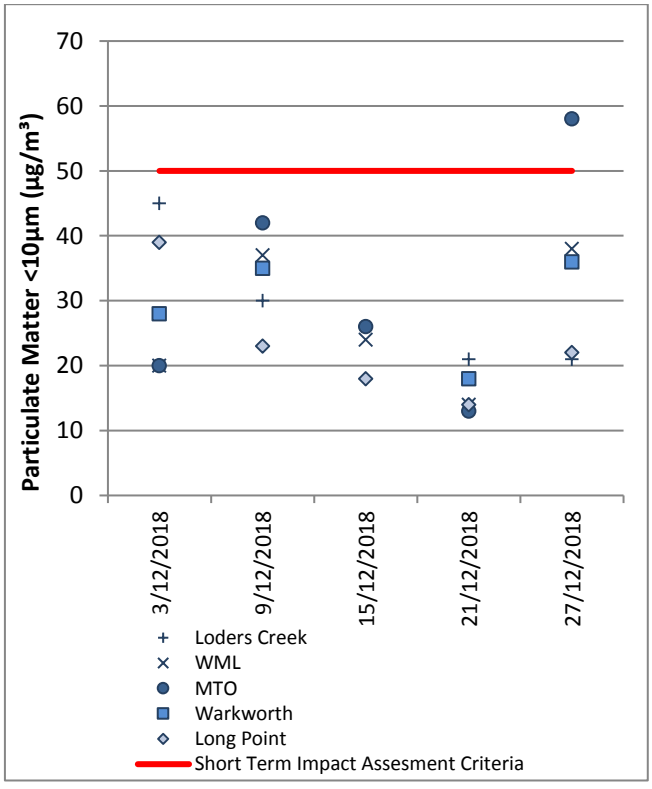


Figure 5: Individual PM_{10} Results – December 2018

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

An assessment of MTW's contribution to the long-term Impact assessment criteria will be provided in the 2018 Annual Review Report.

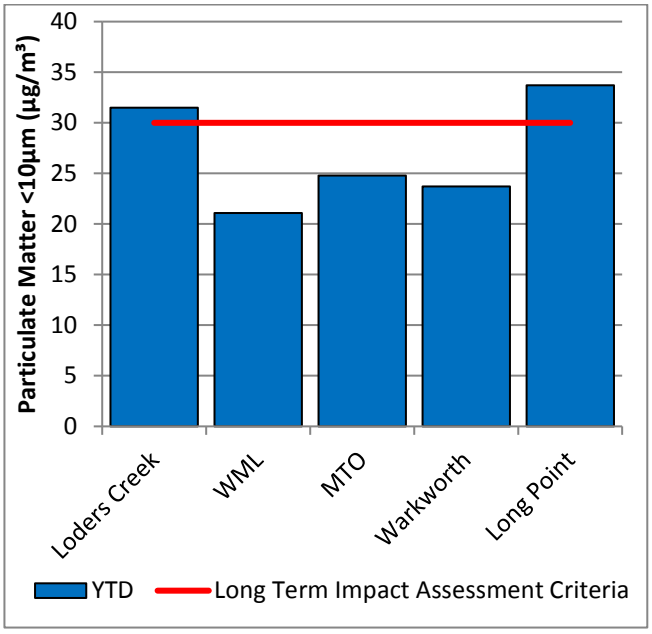


Figure 6: Annual Average PM_{10} – December 2018

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 assessment of MTW's contribution to the long-term assessment criteria will be reported in the 2018 Annual Review Report.

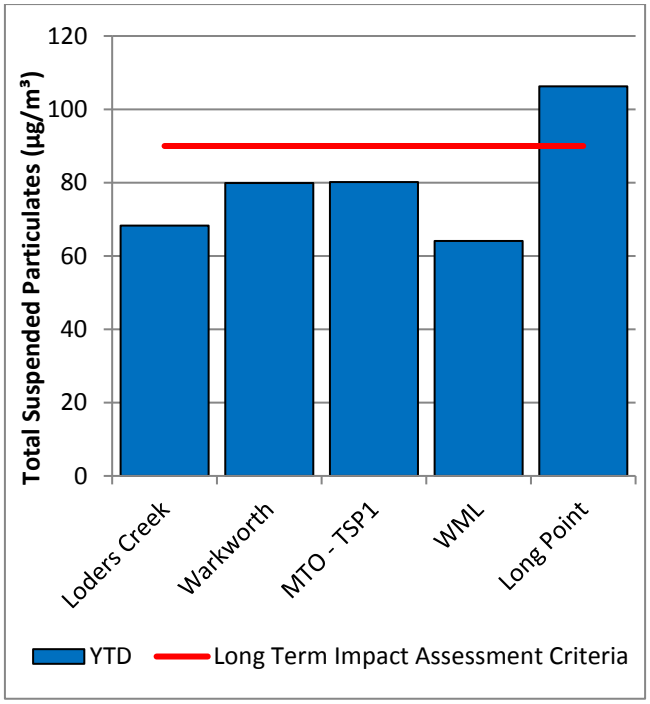


Figure 7: Annual Average Total Suspended Particulates – December 2018

2.3.3 Real Time PM_{10} Results

Mt 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.

On 27 December 2018, the Wallaby Scrub Road TEOM (82.7 µg/m³) exceeded the short term (24hr) criteria. This measurement was assessed for MTW's potential contribution based on meteorological conditions on this day resulting in a maximum estimated contribution of 26.6 µg/m³ (less than 33% contribution to the result) from the direction of MTW. Accordingly, no further action is required (as per approved Air Quality Monitoring Programme).

2.3.4 Real Time Alarms for Air Quality

During December, the real time monitoring system generated 138 automated air quality related alerts, including 11 alerts for adverse meteorological conditions and 127 alerts for elevated PM10 levels.

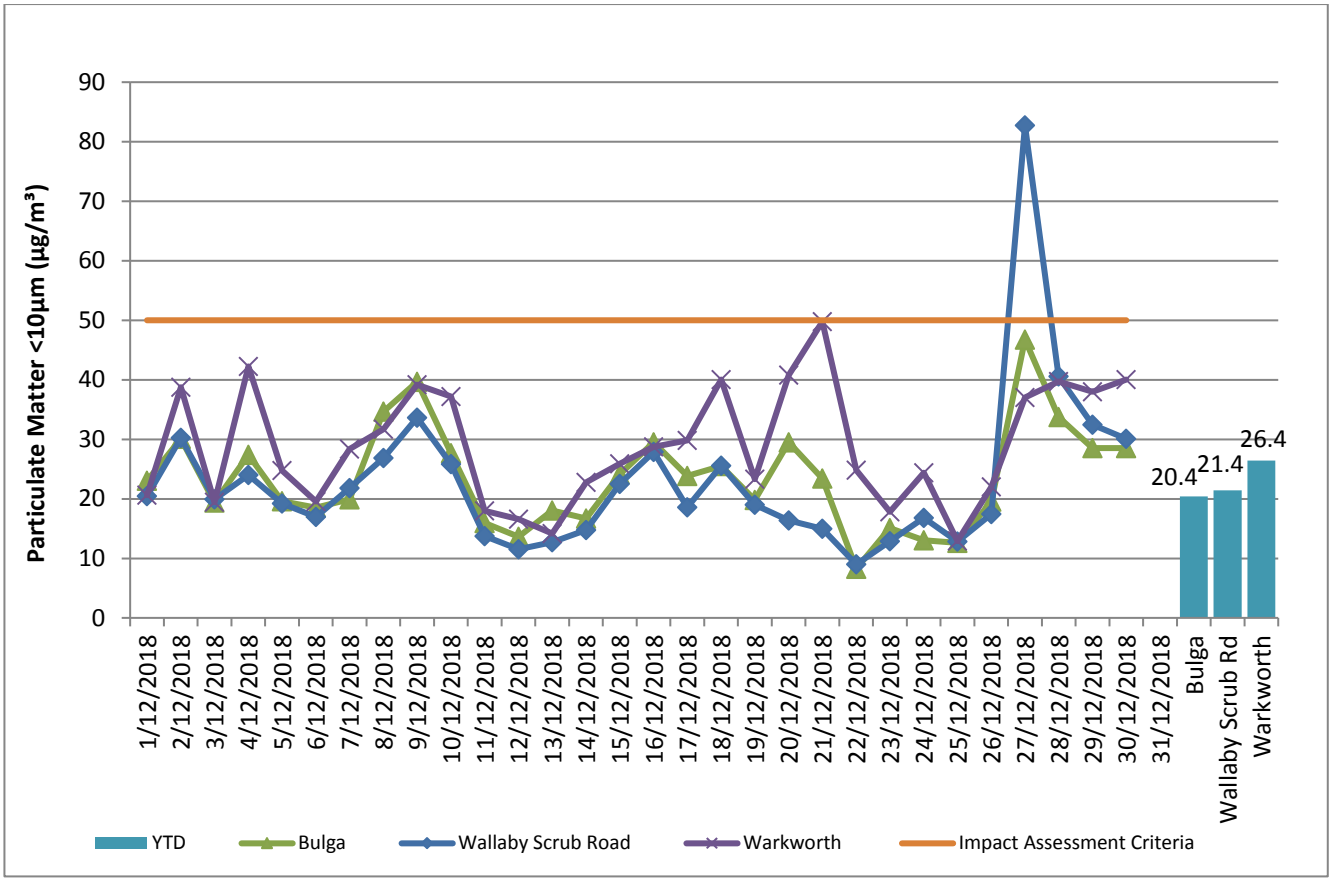


Figure 8: Real Time PM_{10} 24hr average and Year-to-date average – December 2018

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 (2015 – current) within MTW mine dams. **Figure 12** to **Figure 14** show the long-term surface water trend (2015 - current) in surrounding watercourses.

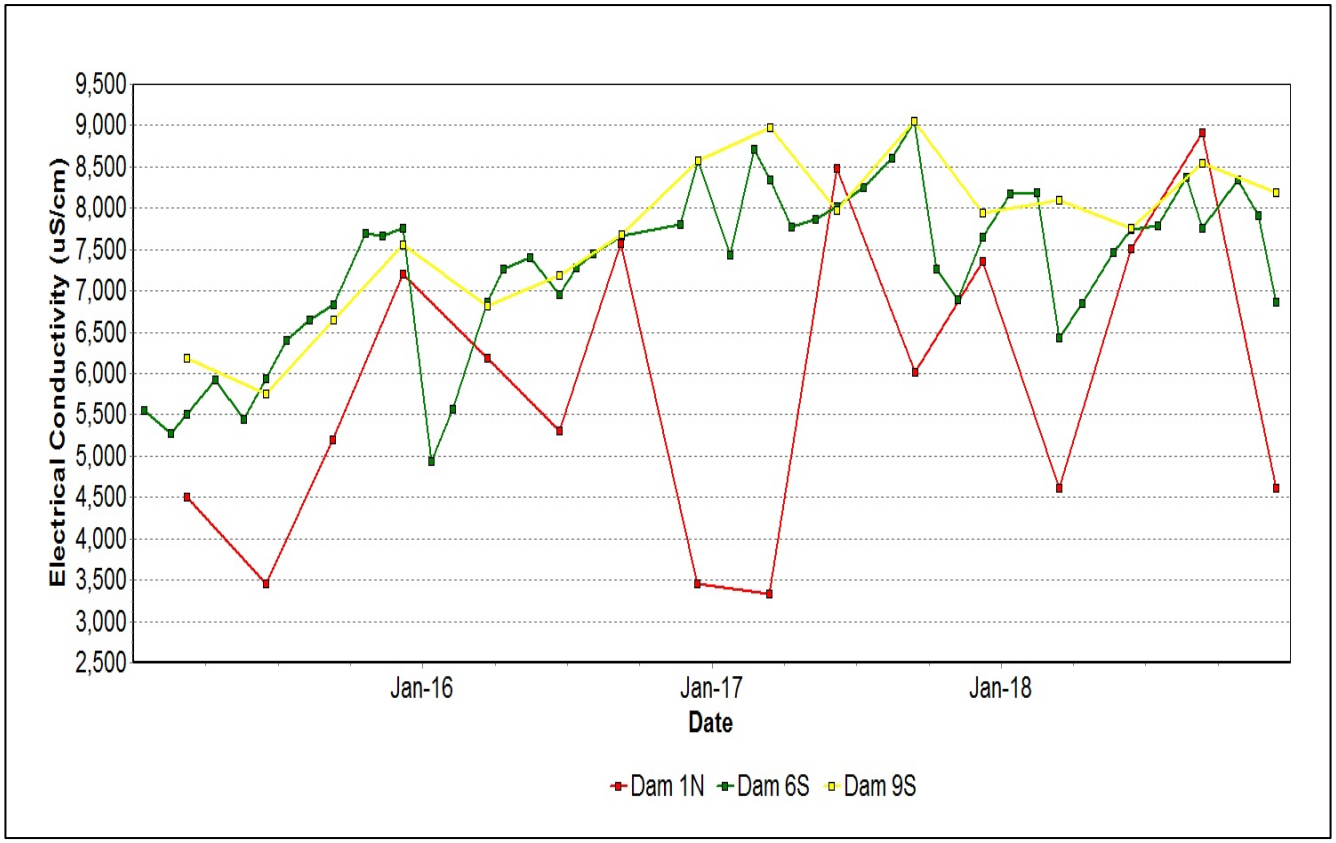


Figure 9: Site Dams Electrical Conductivity Trend – December 2018

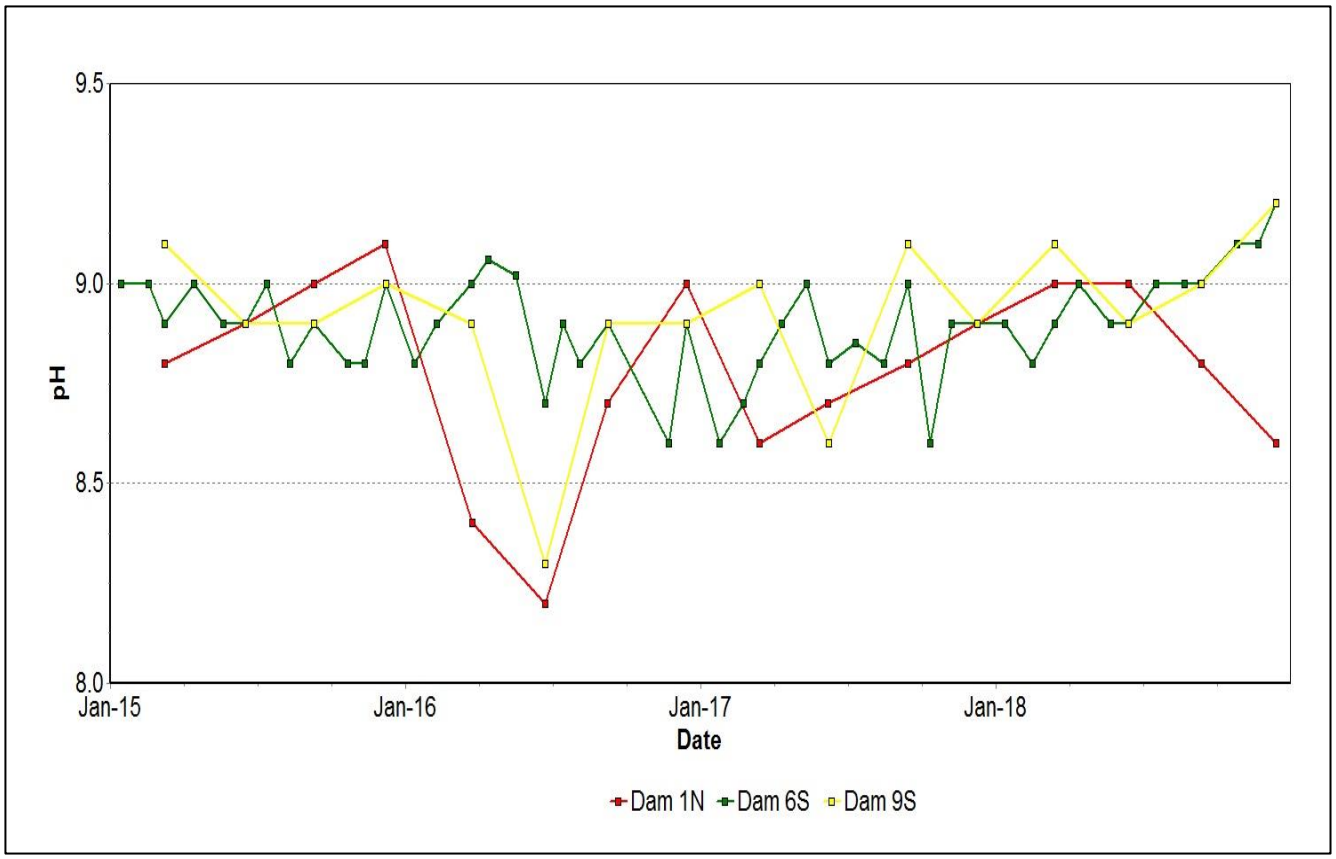


Figure 10: Site Dams pH Trend – December 2018

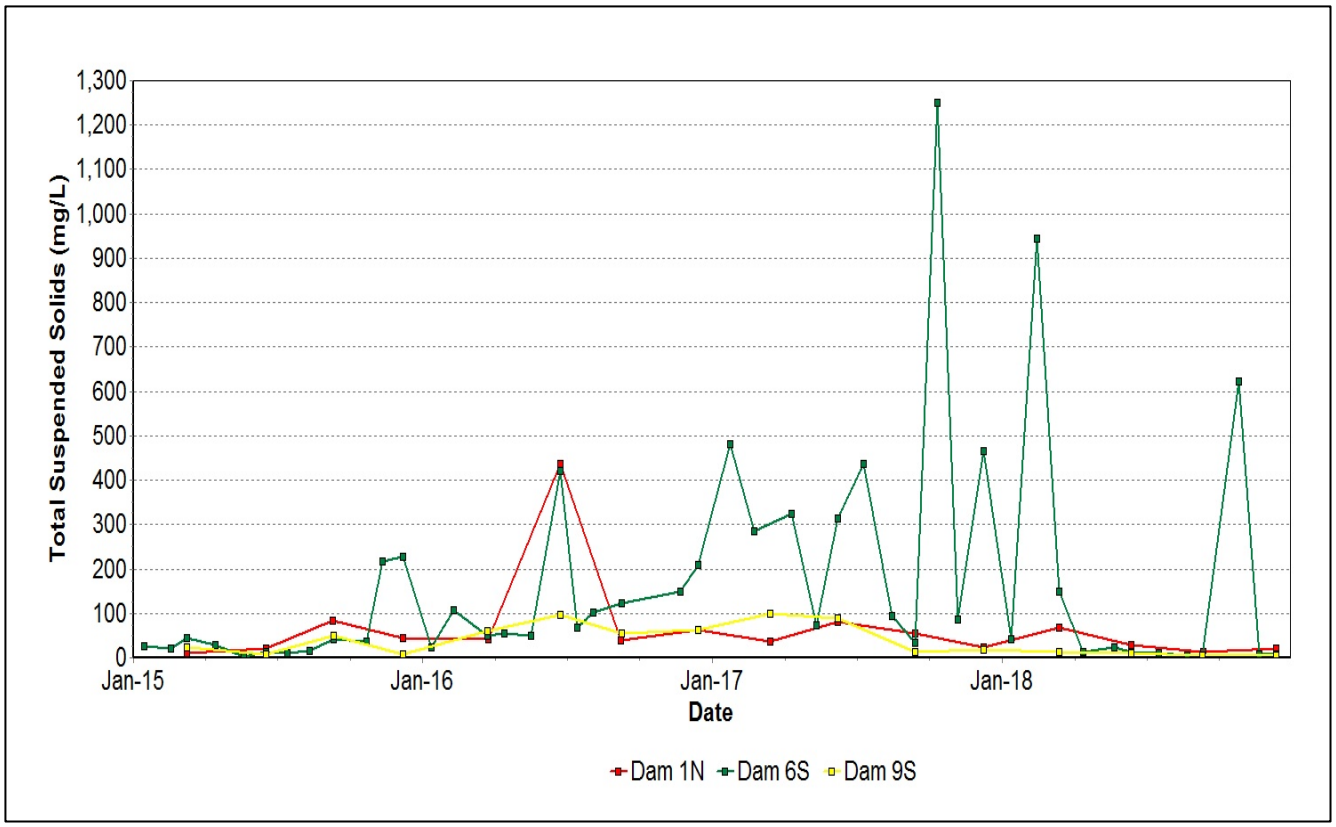
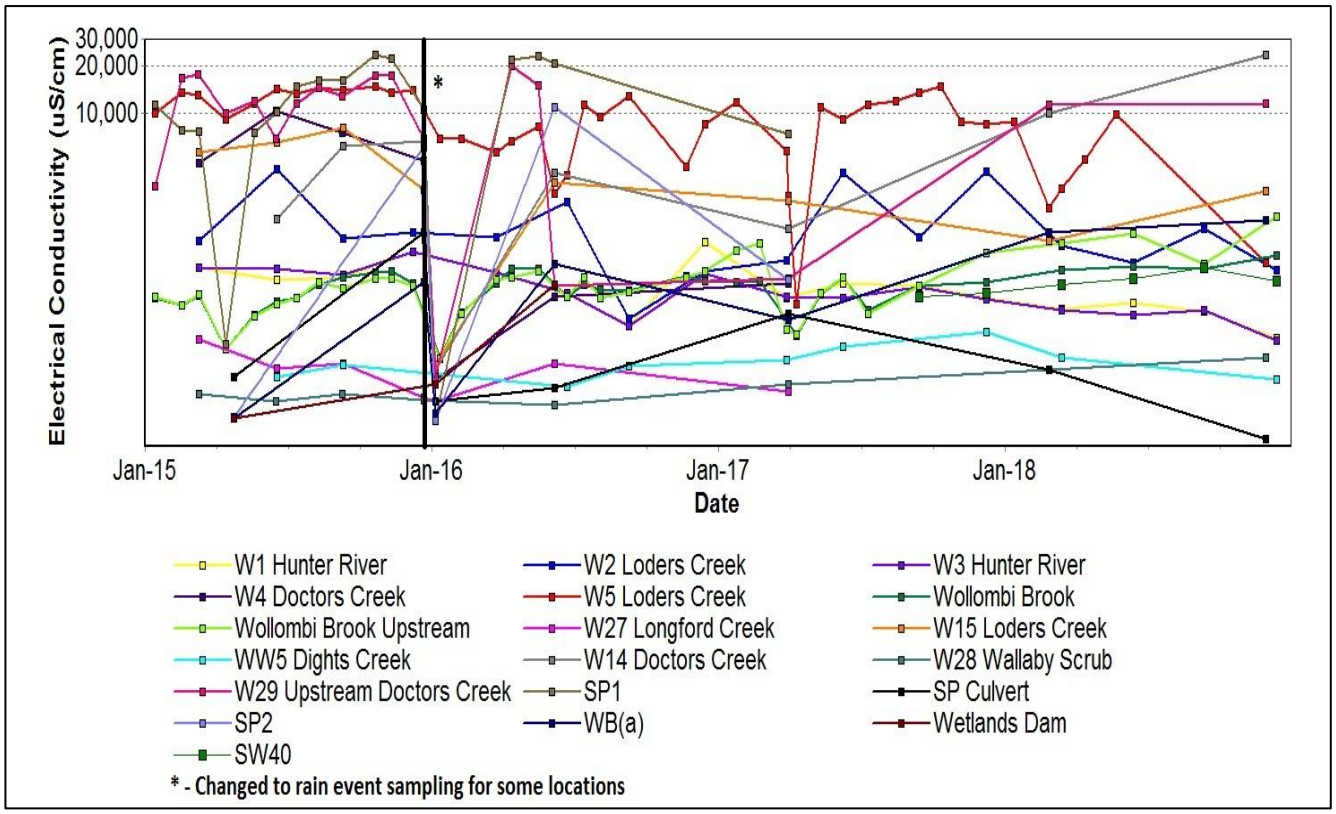
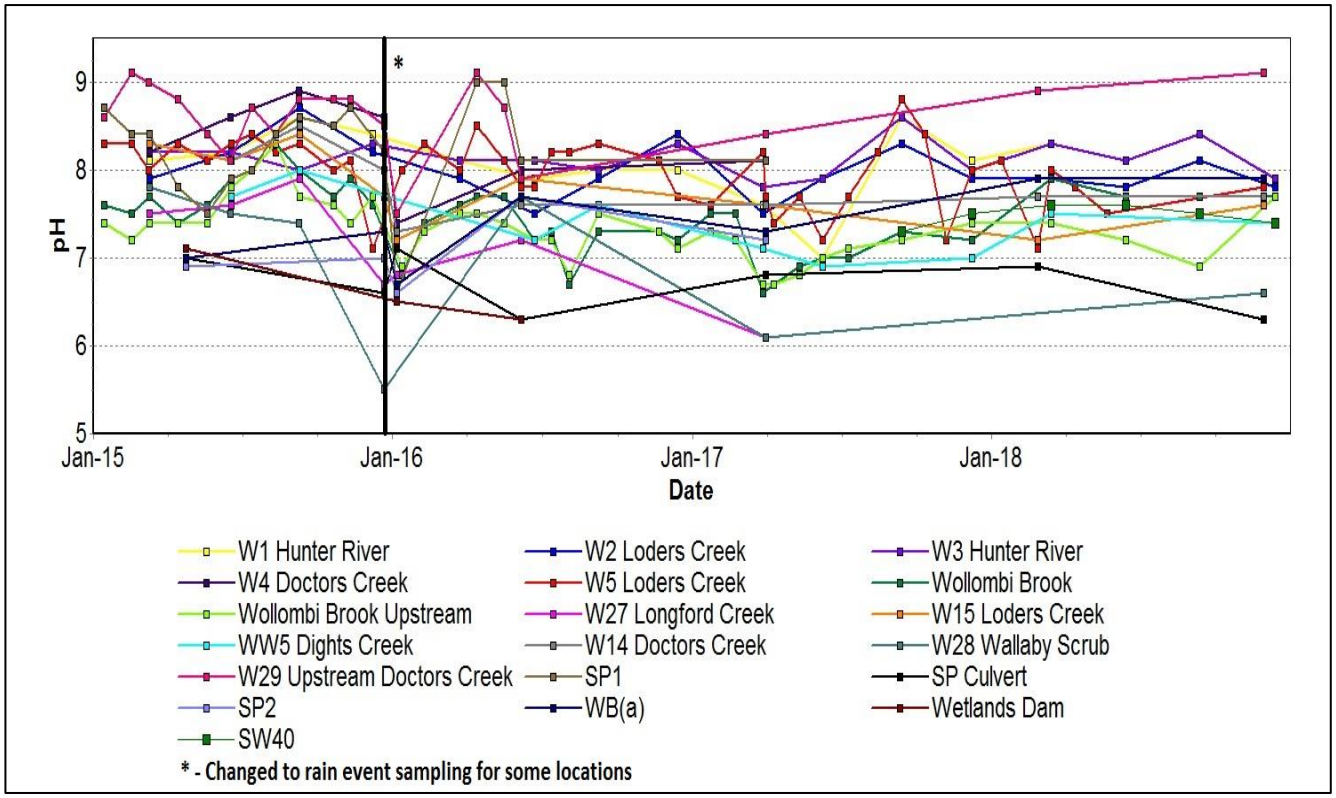


Figure 11: Site Dams Total Suspended Solids Trend – December 2018



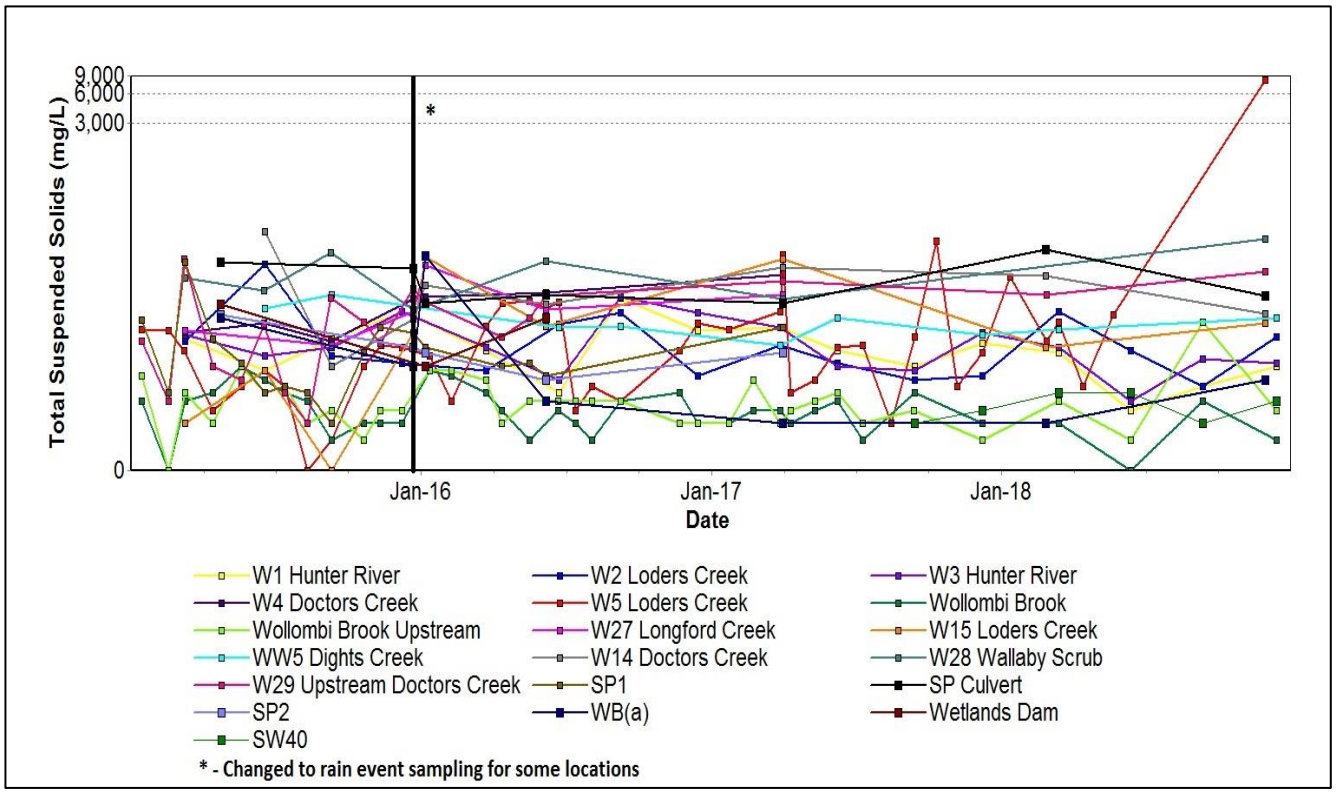
Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

Figure 12: Watercourse Electrical Conductivity Trend – December 2018



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 – December 2018



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 – December 2018

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 – December YTD 2018

Site	Date	Trigger Limit Breached	Action Taken in Response
W14	26/02/2018	EC –95th Percentile	Watching Brief*
W14	29/11/2018	EC –95th Percentile	Watching Brief*
W28	29/11/2018	EC –95th Percentile	Watching Brief*
Wollombi Brook	14/03/2018	EC –95th Percentile	Watching Brief*
Wollombi Brook	13/06/2018	EC –95th Percentile	Watching Brief*
Wollombi Brook	11/09/2018	EC –95th Percentile	Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Continue to watch and monitor.
Wollombi Brook	13/12/2018	EC –95th Percentile	Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Continue to watch and monitor.
Wollombi Brook Upstream	14/03/2018	EC –95th Percentile	Watching Brief*
Wollombi Brook Upstream	13/06/2018	EC –95th Percentile	Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Continue to watch and monitor.
Wollombi Brook Upstream	13/12/2018	EC –95th Percentile	Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Continue to watch and monitor.
SW40	11/09/2018	EC –95th Percentile	Watching Brief*
W5	14/02/2018	pH –5th Percentile	Watching Brief*
W5	22/05/2018	pH –5th Percentile	Watching Brief*
W15	26/02/2018	pH –5th Percentile	Watching Brief*
W5	12/01/2018	TSS – 50mg/L (ANZECC criteria)	Field investigation did not identify any mining related sources of sediment. Elevated TSS associated with high intensity rainfall event after prolonged dry period. No further action taken
W5	29/11/2018	TSS – 50mg/L (ANZECC criteria)	Field investigation did not identify any mining related sources of sediment. Elevated TSS

			associated with high intensity rainfall event after prolonged dry period. No further action taken
W14	26/02/2018	TSS – 50mg/L (ANZECC criteria)	Field investigation did not identify any mining related sources of sediment. Elevated TSS associated with high intensity rainfall event after prolonged dry period. No further action taken
W28	13/12/2018	TSS – 50mg/L (ANZECC criteria)	Field notes indicate that sample taken from water with no flow. Elevated TSS associated with high intensity rainfall event after prolonged dry period. No further action taken
W29	26/02/2018	TSS – 50mg/L (ANZECC criteria)	Field investigation did not identify any mining related sources of sediment. Elevated TSS associated with high intensity rainfall event after prolonged dry period. No further action taken
W29	13/12/2018	TSS – 50mg/L (ANZECC criteria)	Field notes indicate that sample taken from water with no flow (Pool). Elevated TSS associated with high intensity rainfall event after prolonged dry period. No further action taken

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

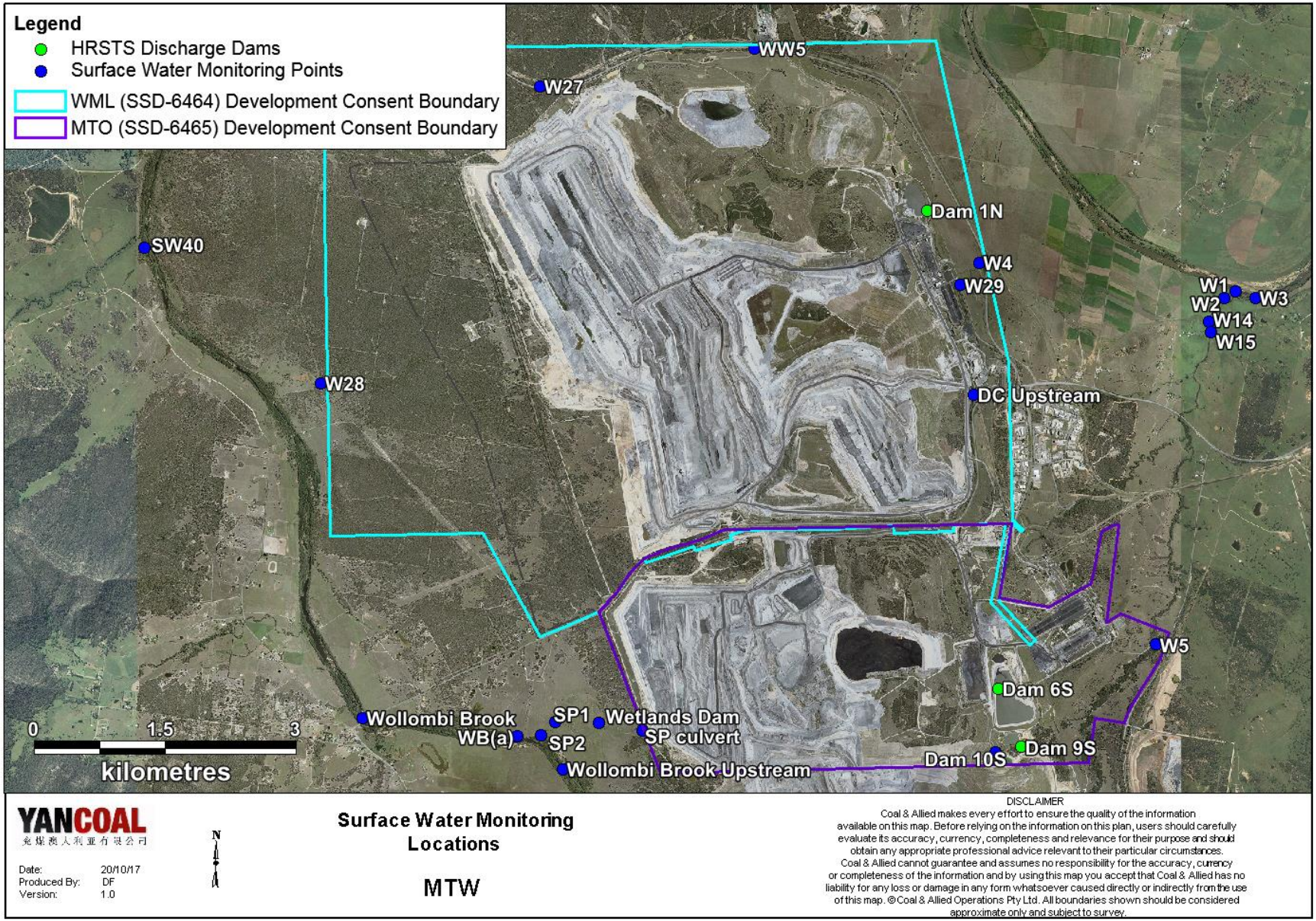


Figure 15: Surface Water Monitoring Location Plan

3.2 Groundwater Monitoring

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

Figure 16 to **Figure 60** show the long-term water quality trends (2015 – current) for groundwater bores monitored at MTW.

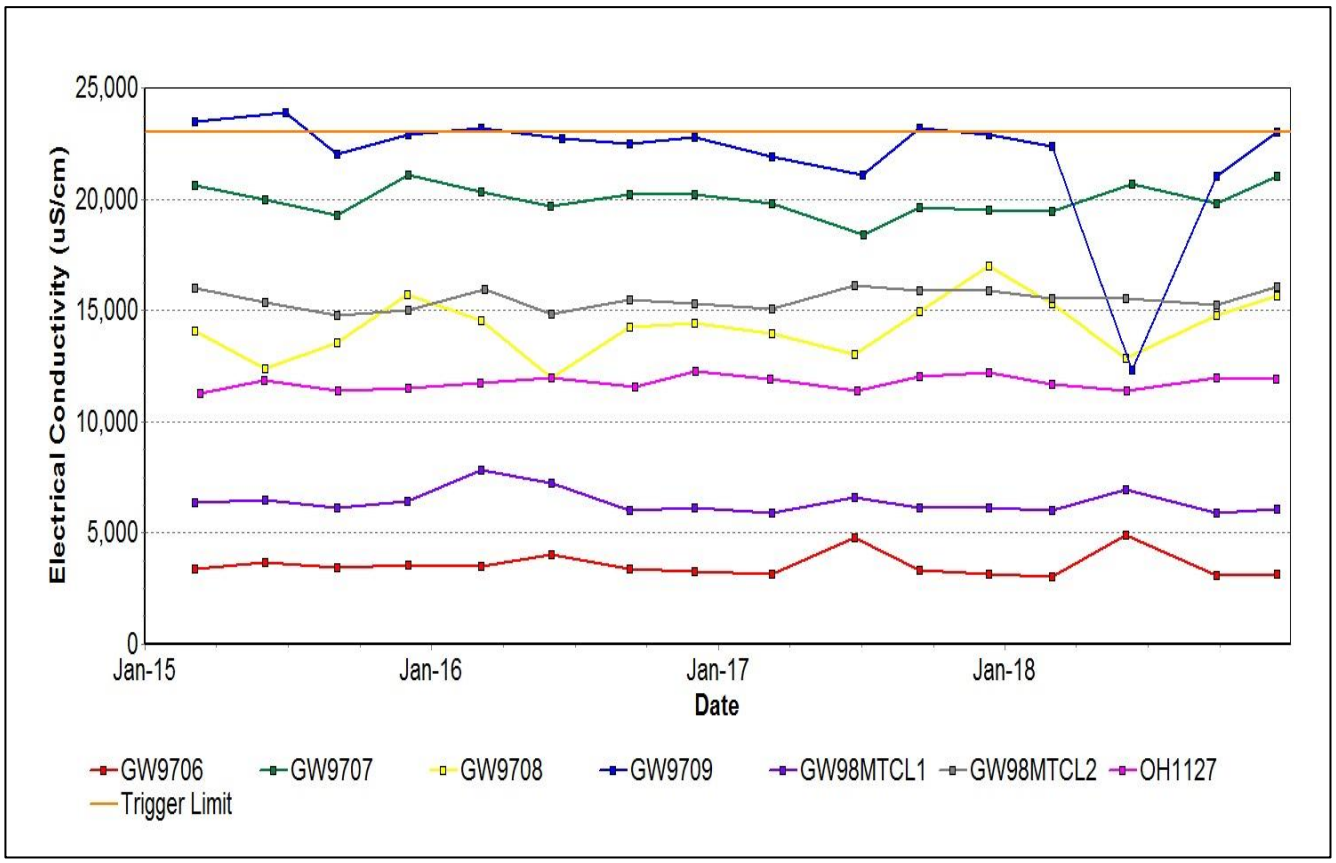


Figure 16: Bayswater Seam Electrical Conductivity Trend – December 2018

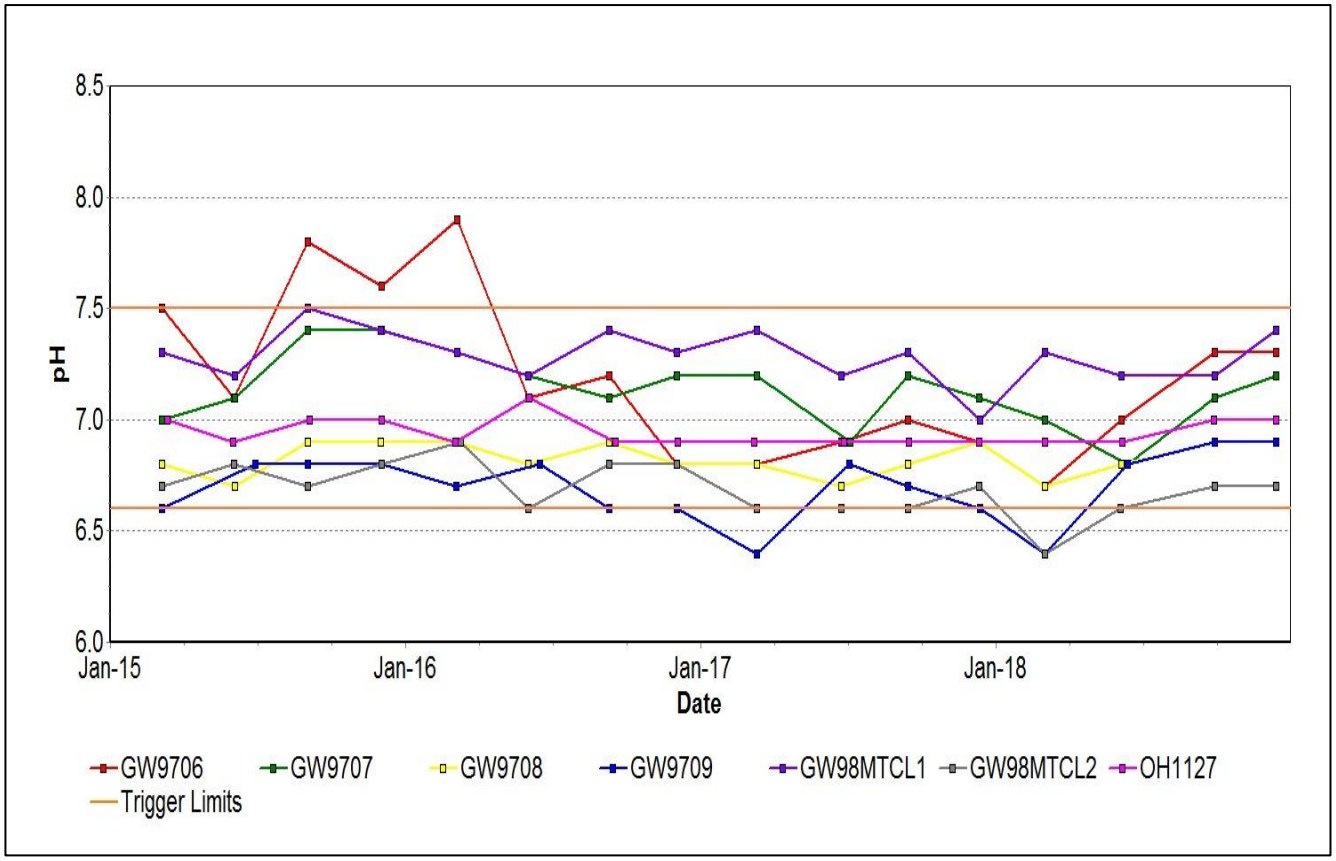


Figure 17: Bayswater Seam pH Trend – December 2018

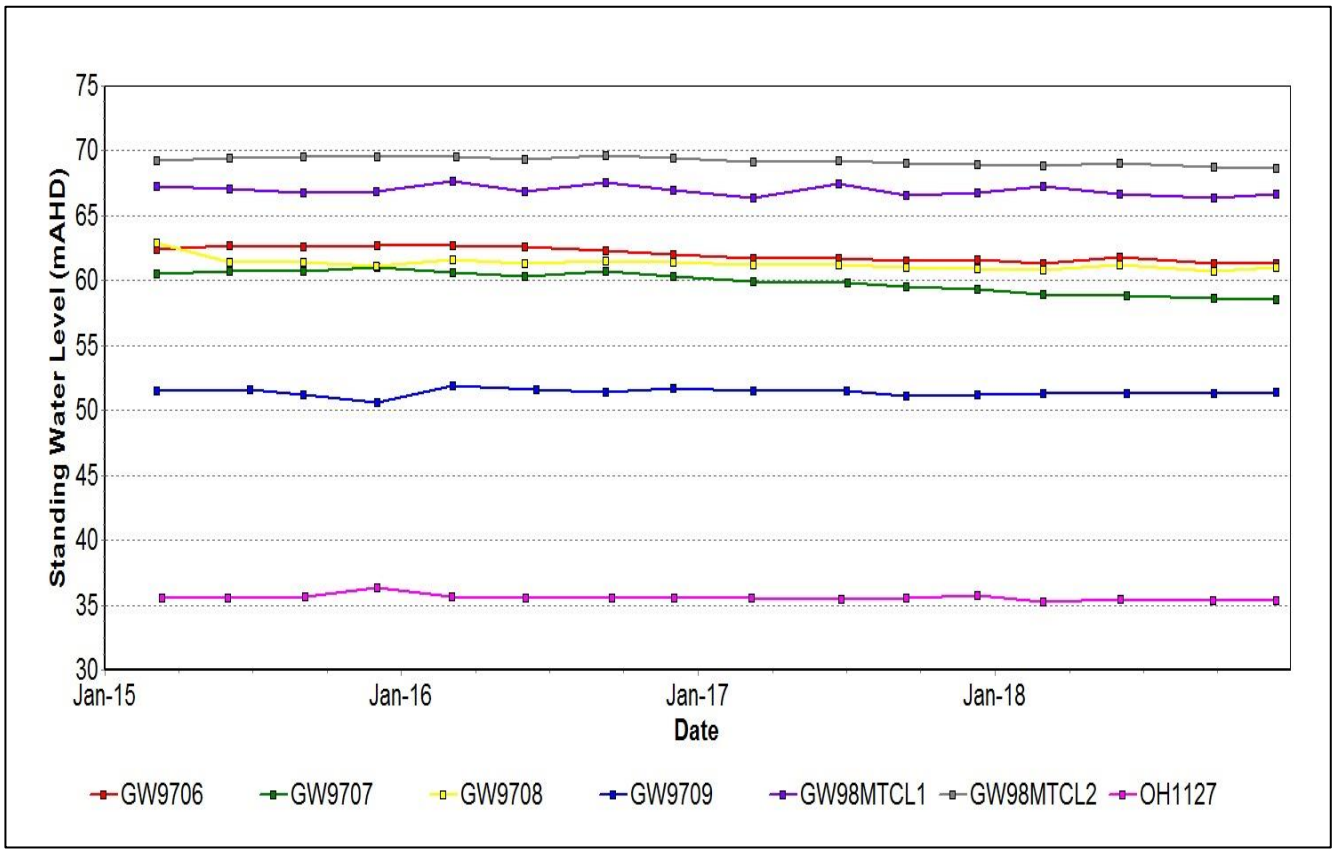


Figure 18: Bayswater Seam Standing Water Level Trend – December 2018

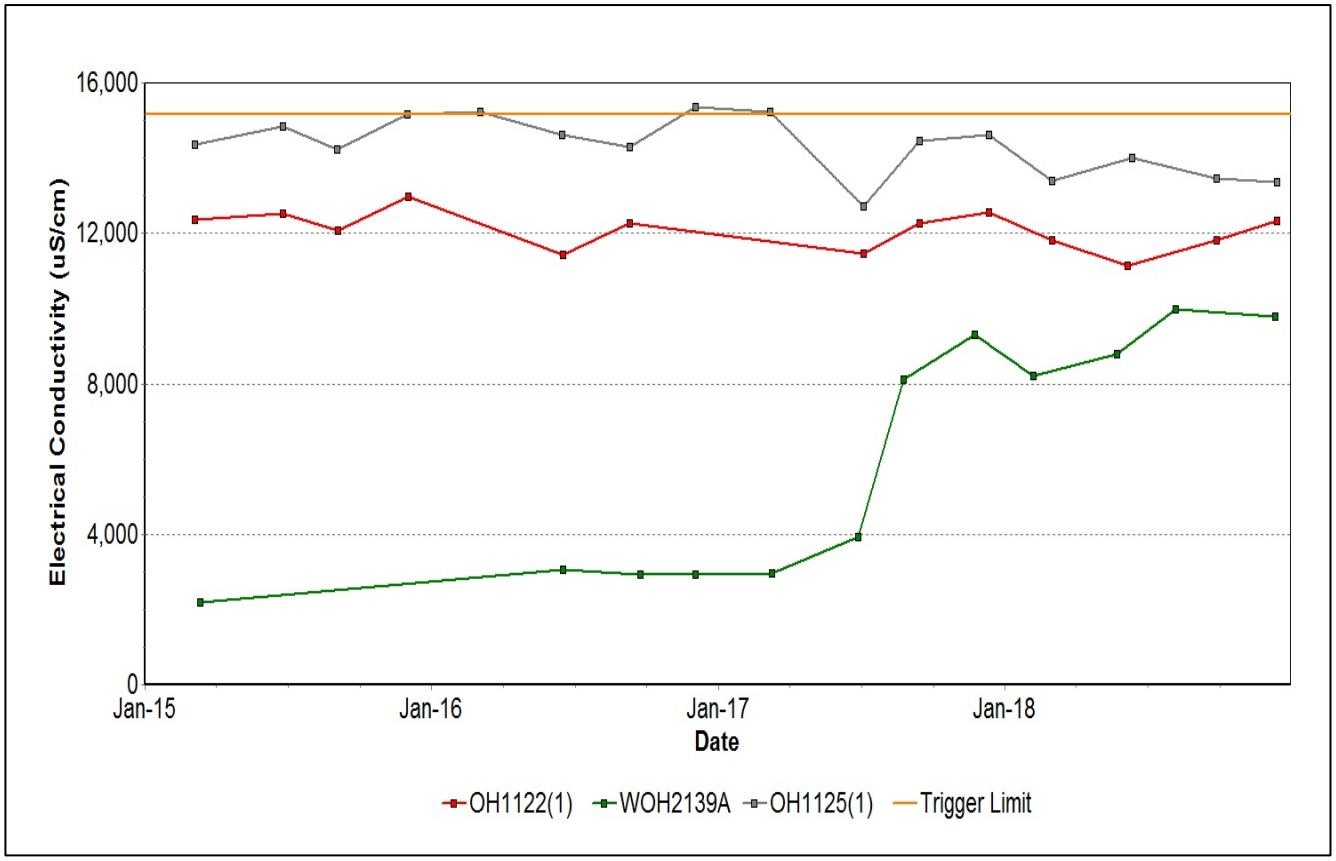


Figure 19: Blakefield Seam Electrical Conductivity Trend – December 2018

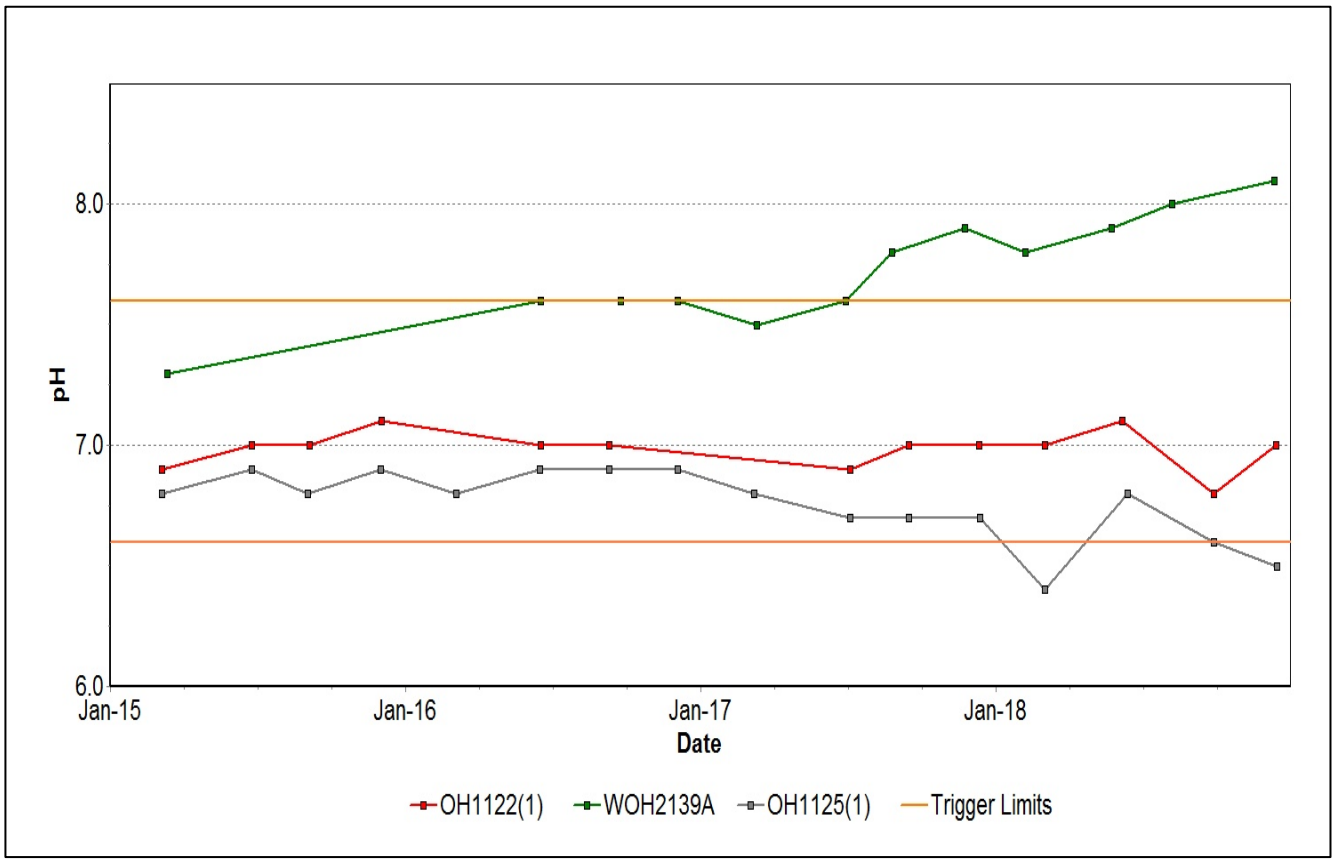


Figure 20: Blakefield Seam pH Trend – December 2018

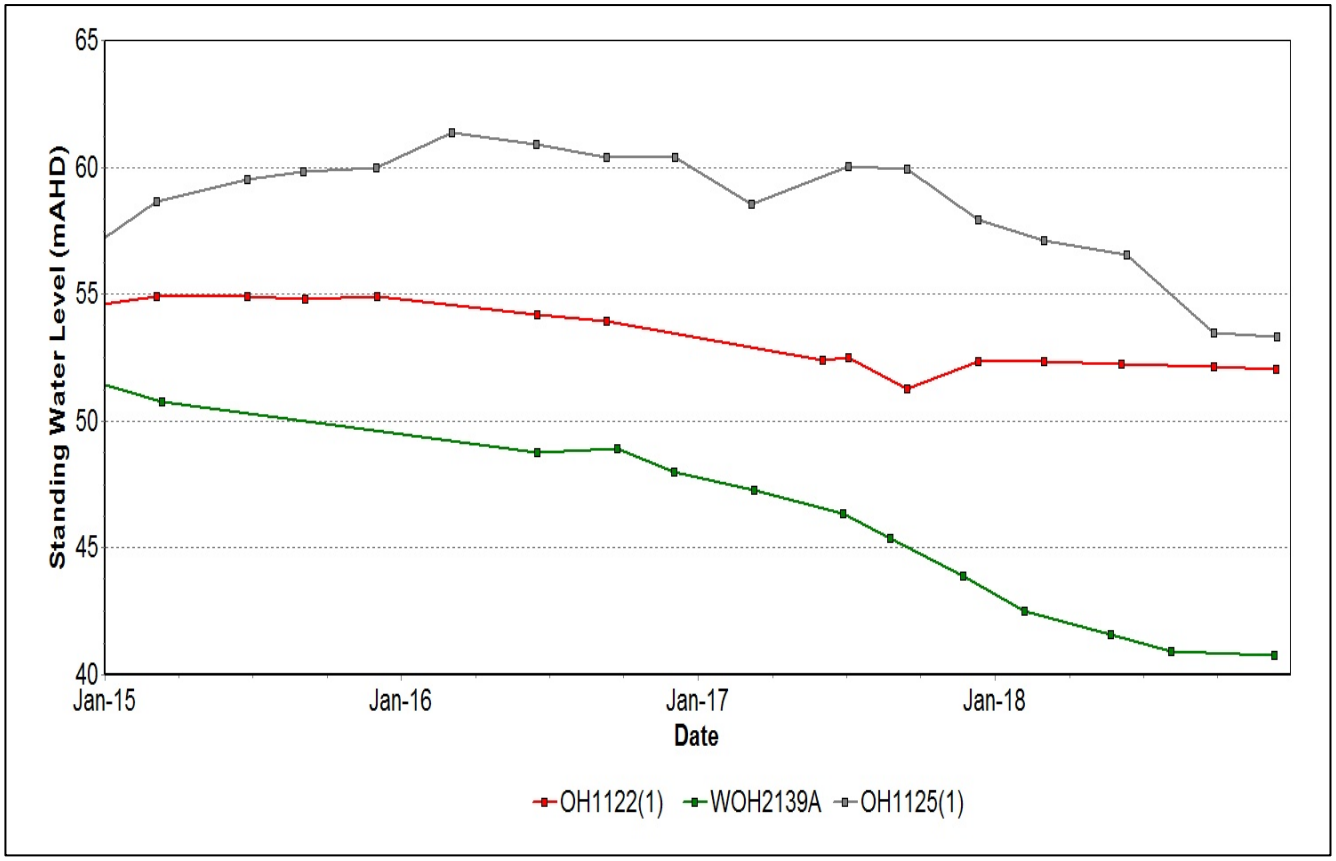


Figure 21: Blakefield Seam Standing Water Level Trend – December 2018

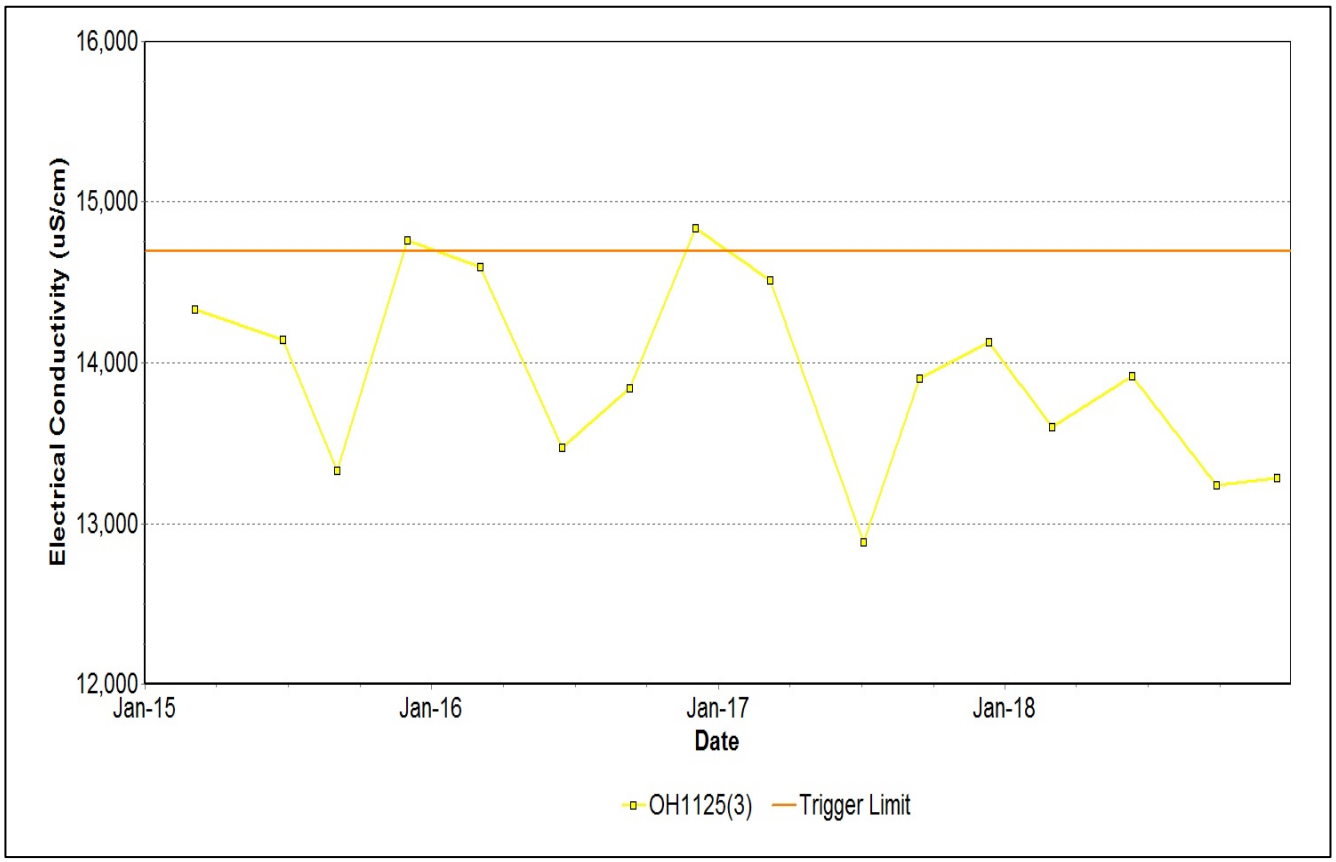


Figure 22: Bowfield Seam Electrical Conductivity Trend – December 2018

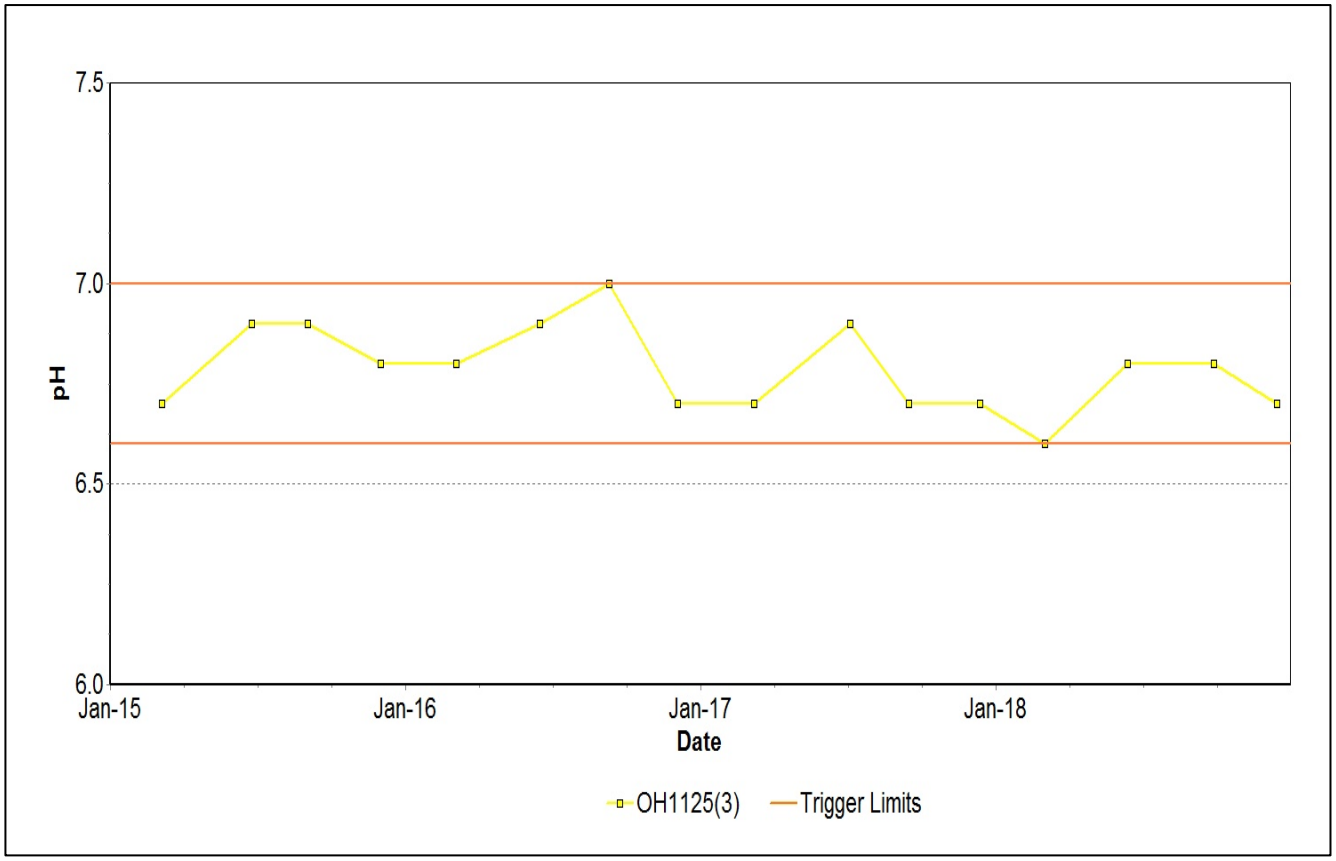


Figure 23: Bowfield Seam pH Trend – December 2018

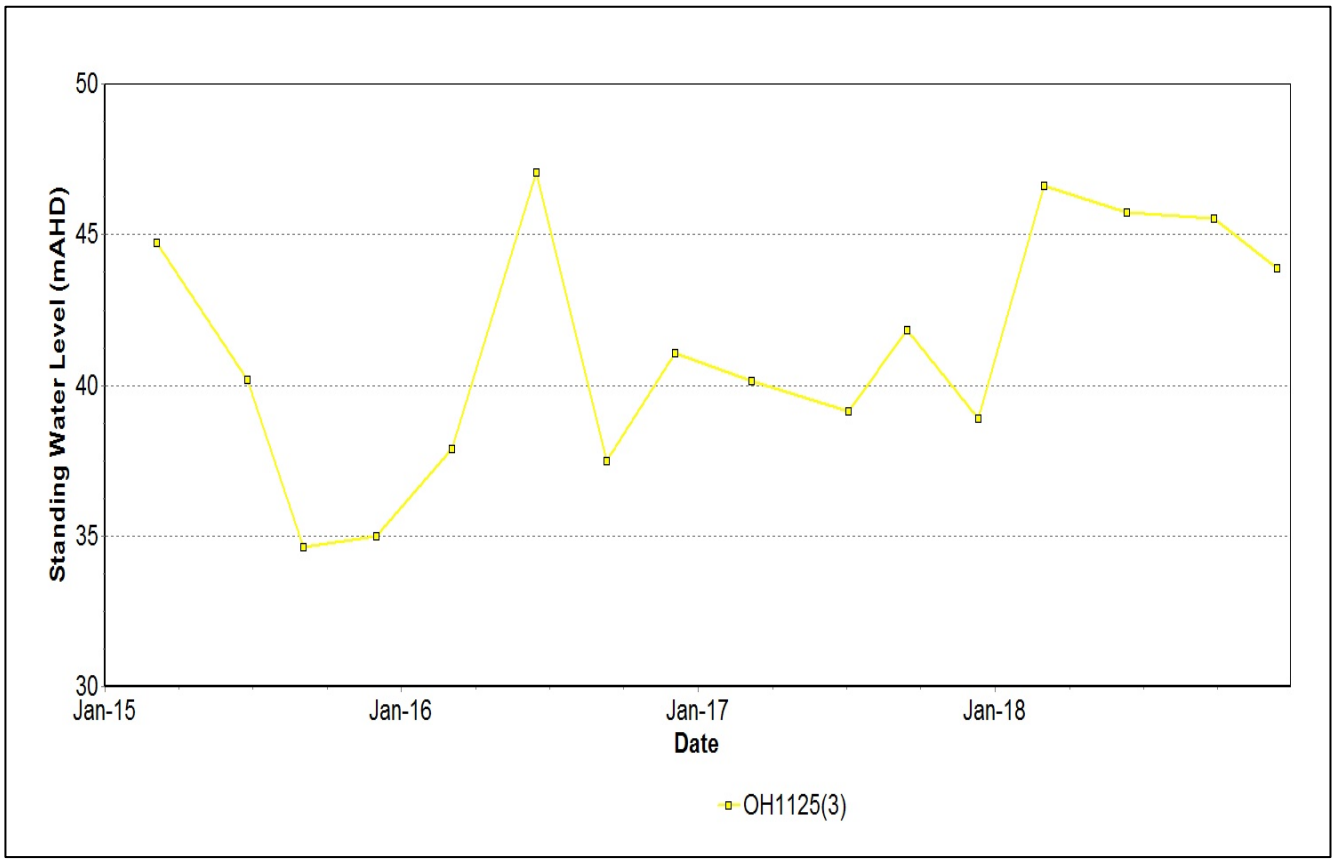


Figure 24: Bowfield Seam Standing Water Level Trend – December 2018

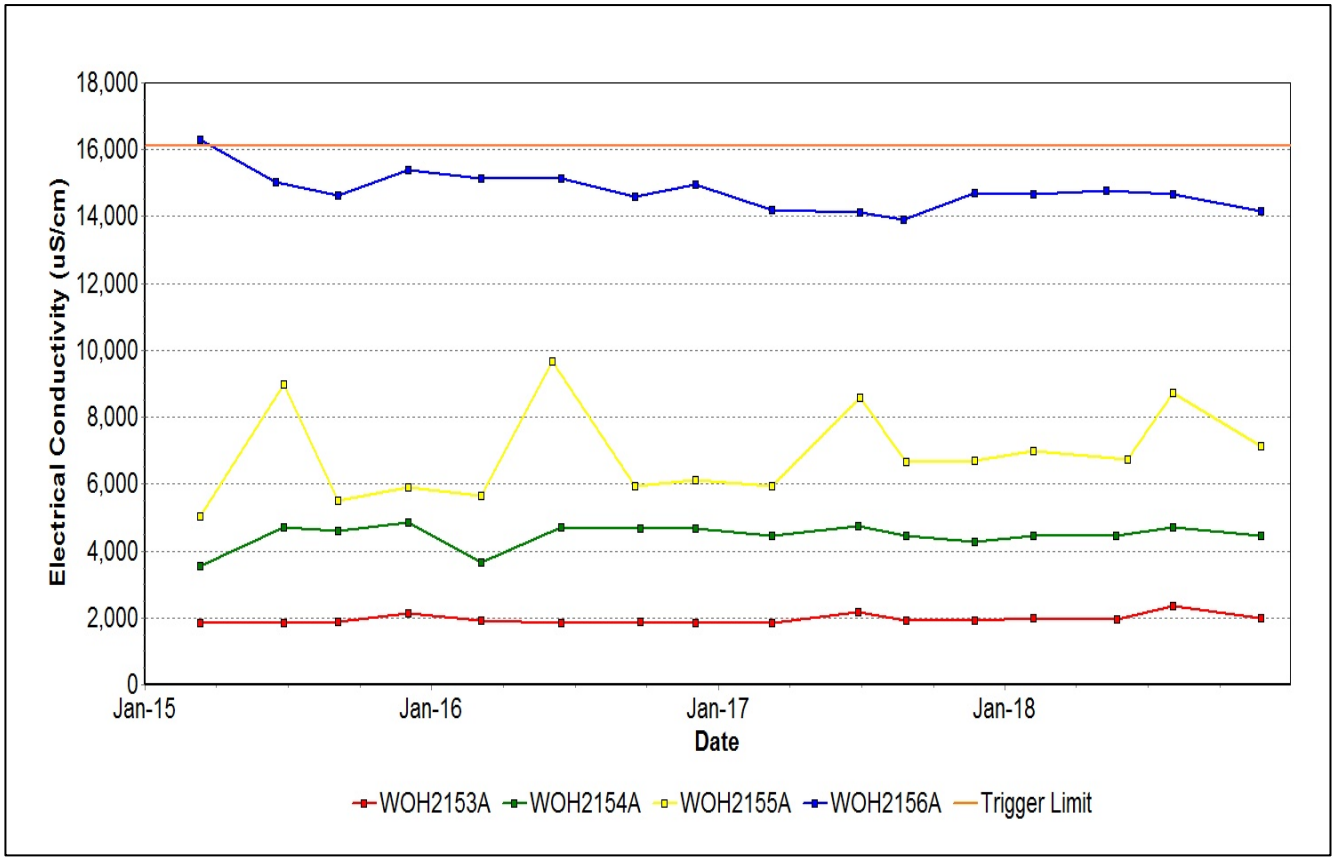


Figure 25: Redbank Seam Electrical Conductivity Trend – December 2018

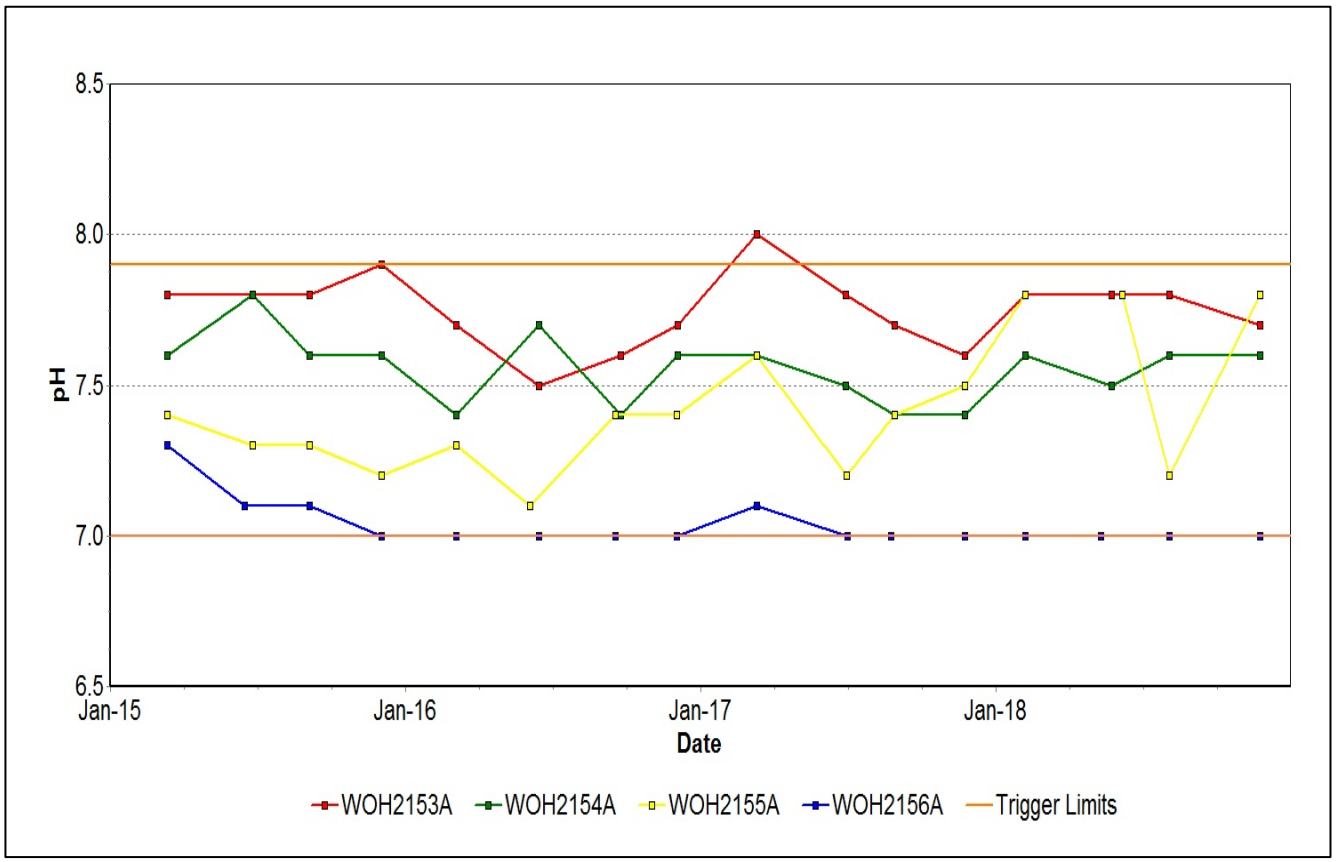


Figure 26: Redbank Seam pH Trend – December 2018

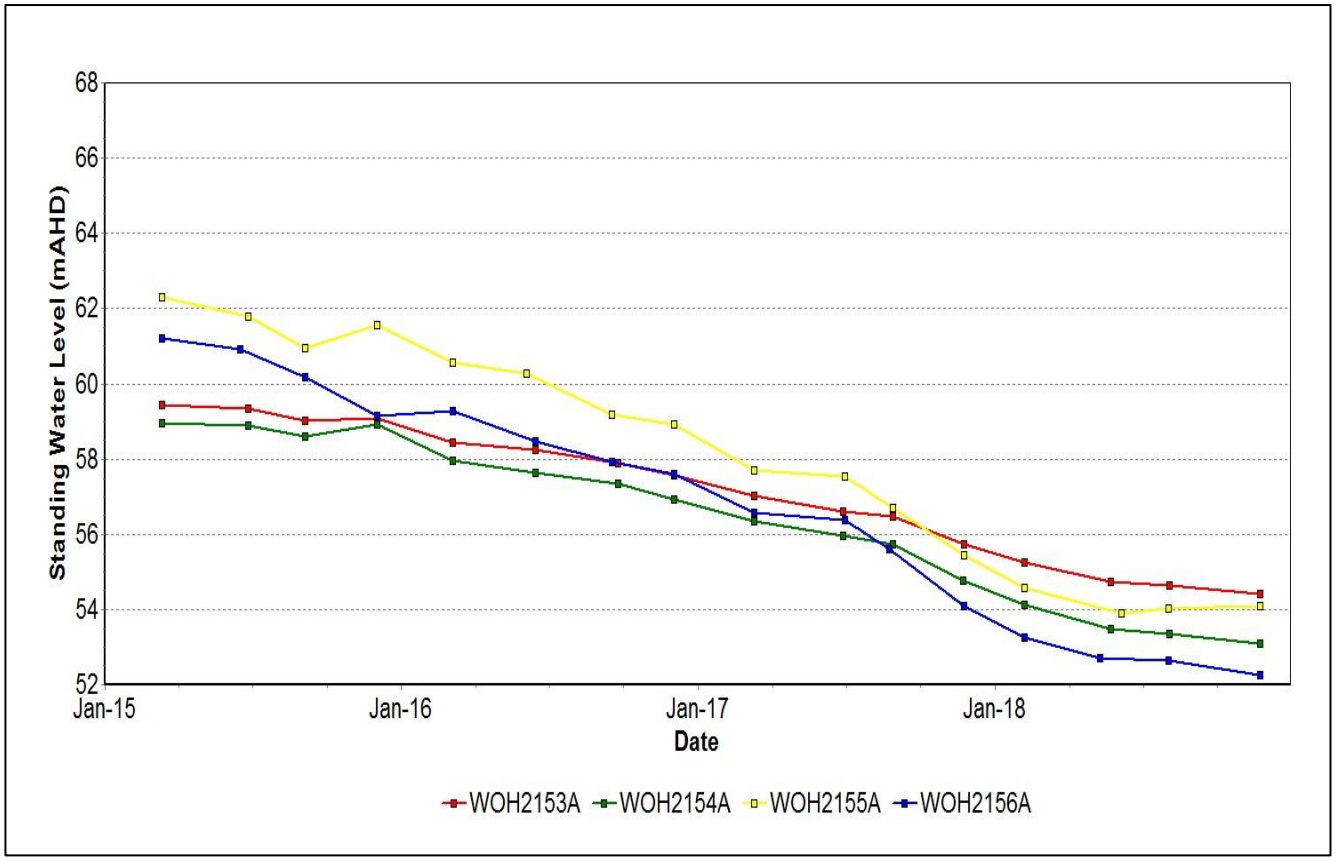


Figure 27: Redbank Seam Standing Water Level Trend – December 2018

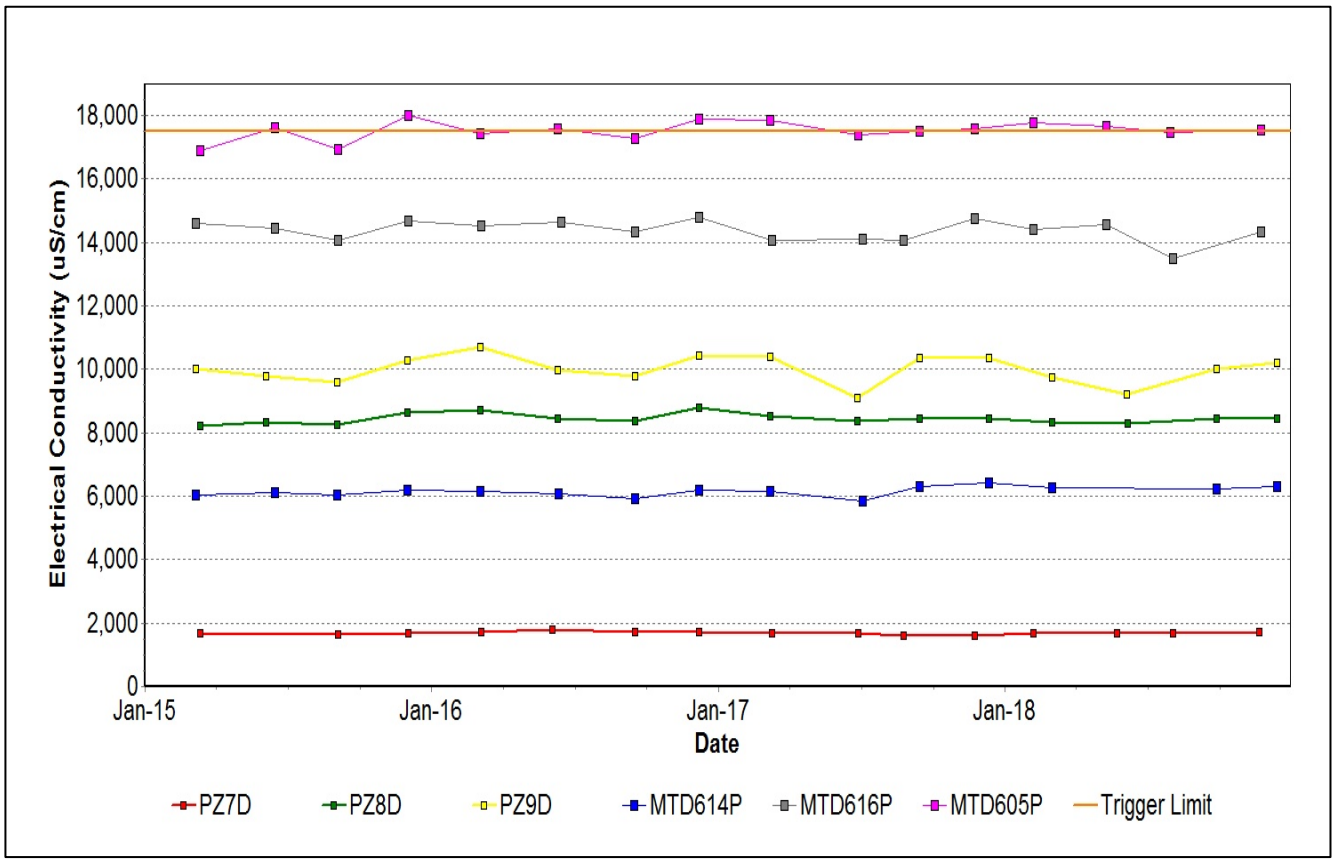


Figure 28: Shallow Overburden Seam Electrical Conductivity Trend – December 2018

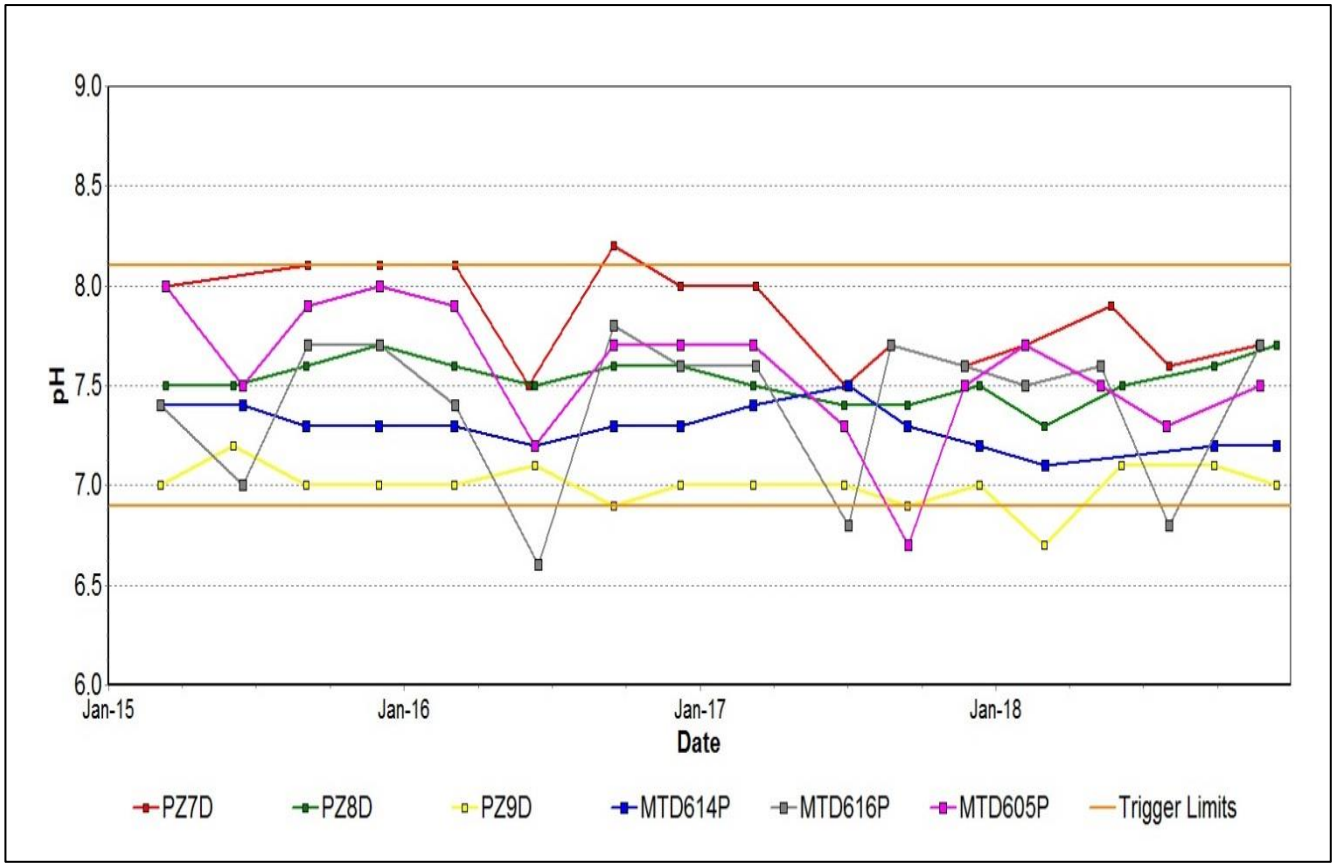


Figure 29: Shallow Overburden Seam pH Trend – December 2018

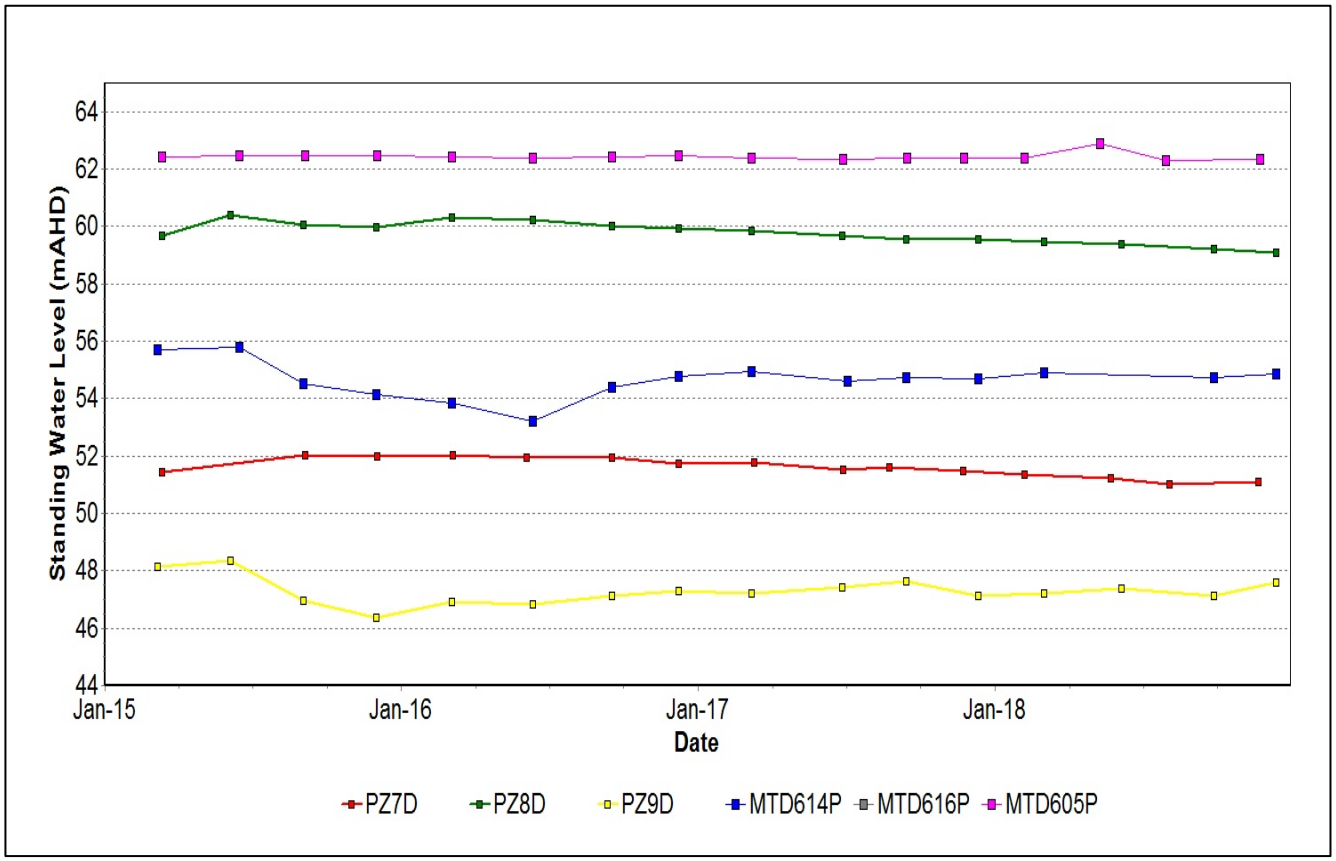


Figure 30: Shallow Overburden Seam Standing Water Level Trend – December 2018

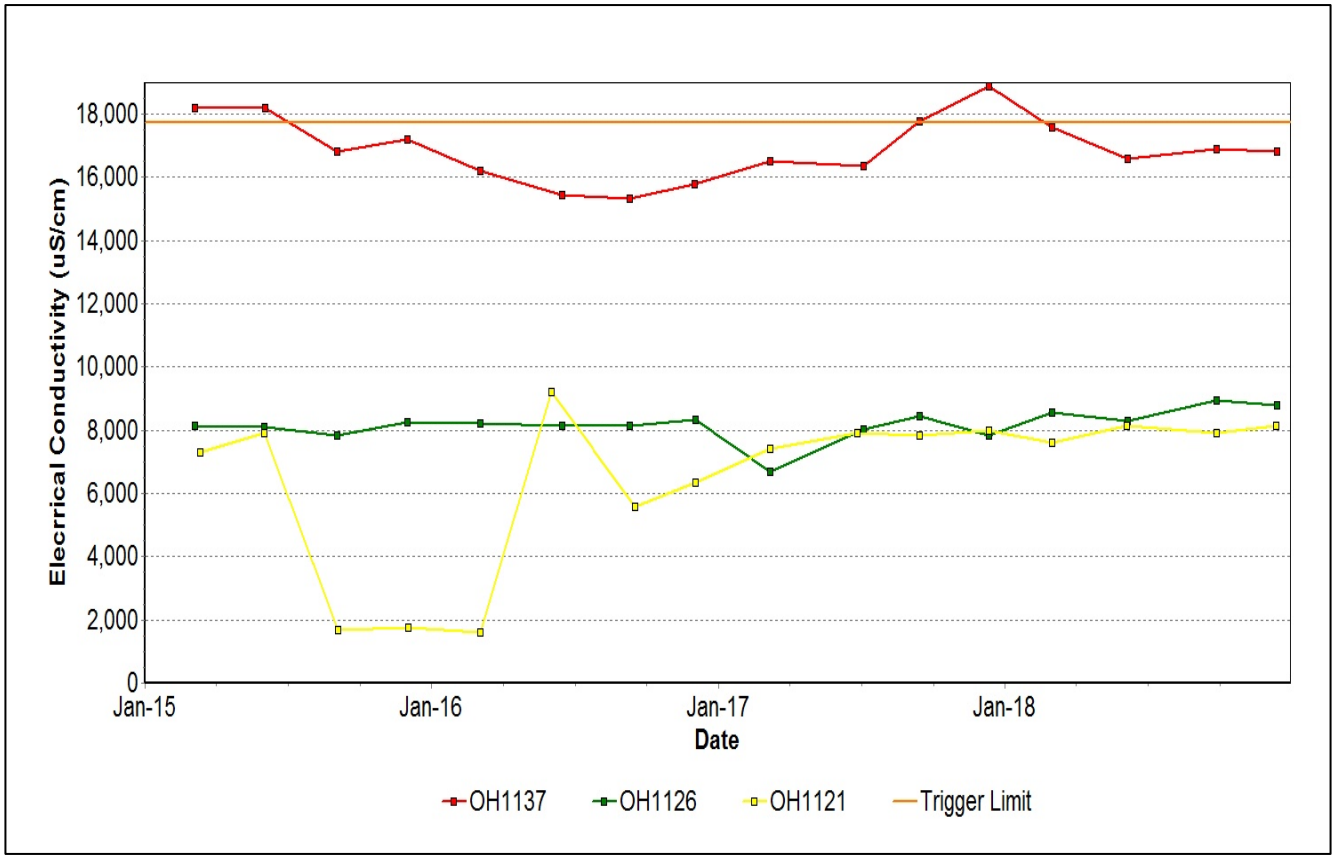


Figure 31: Vaux Seam Electrical Conductivity Trend – December 2018

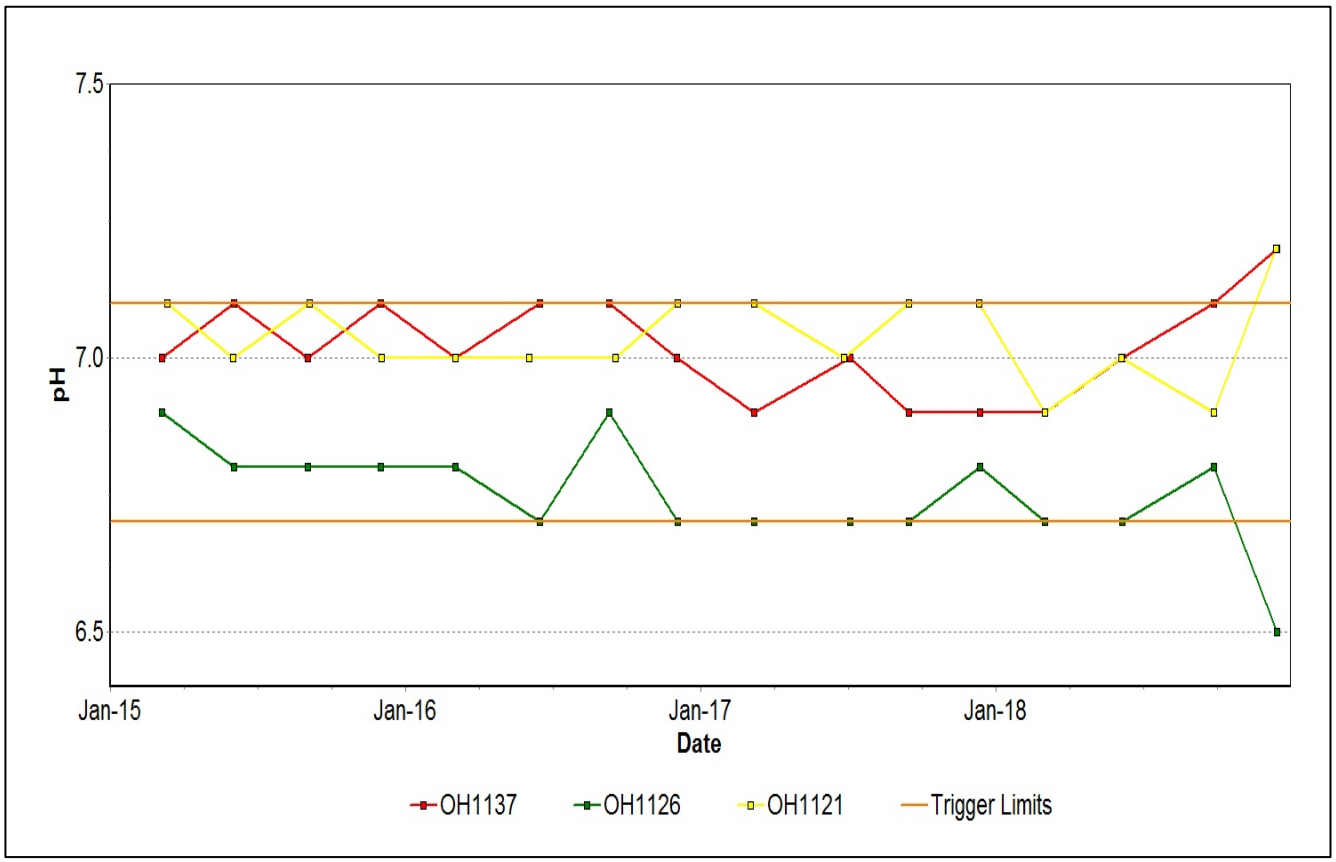


Figure 32: Vaux Seam pH Trend – December 2018

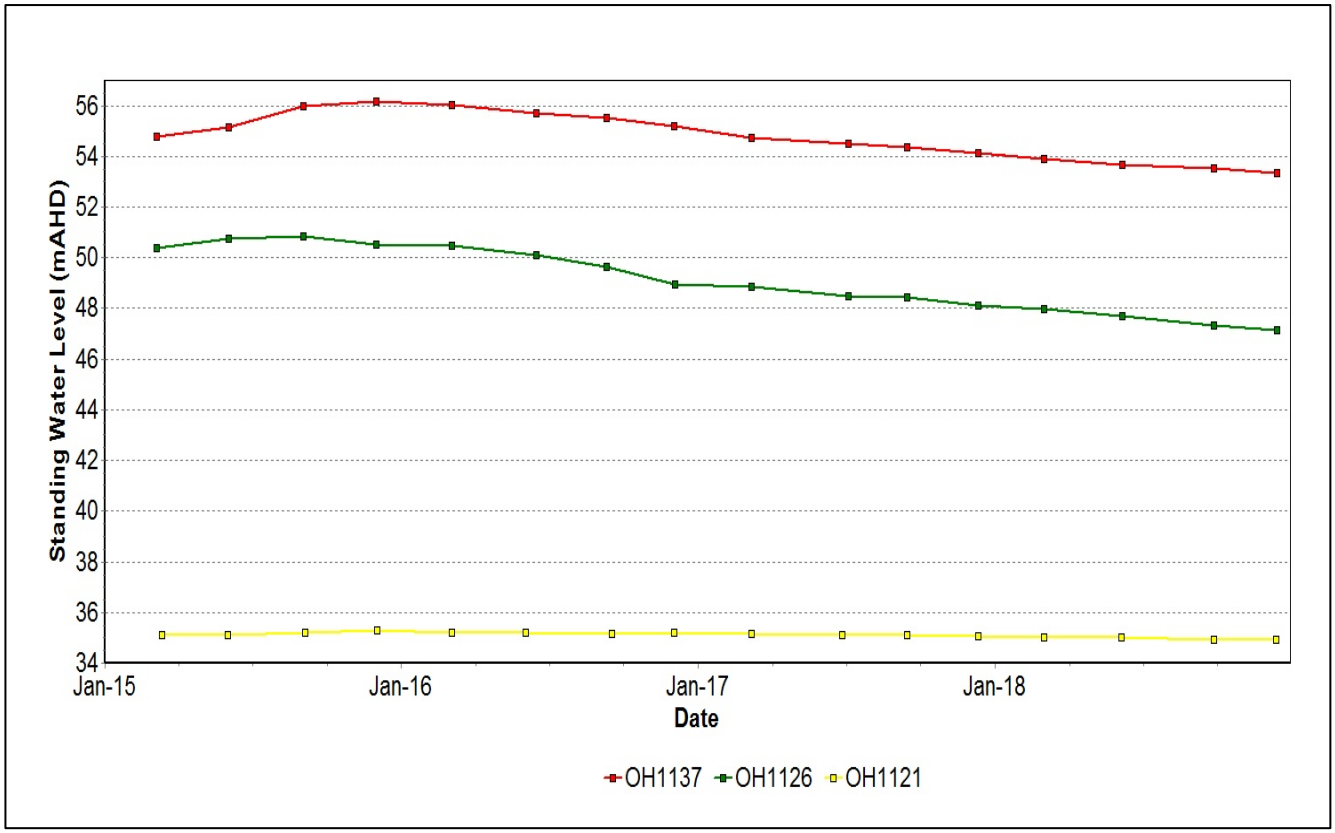
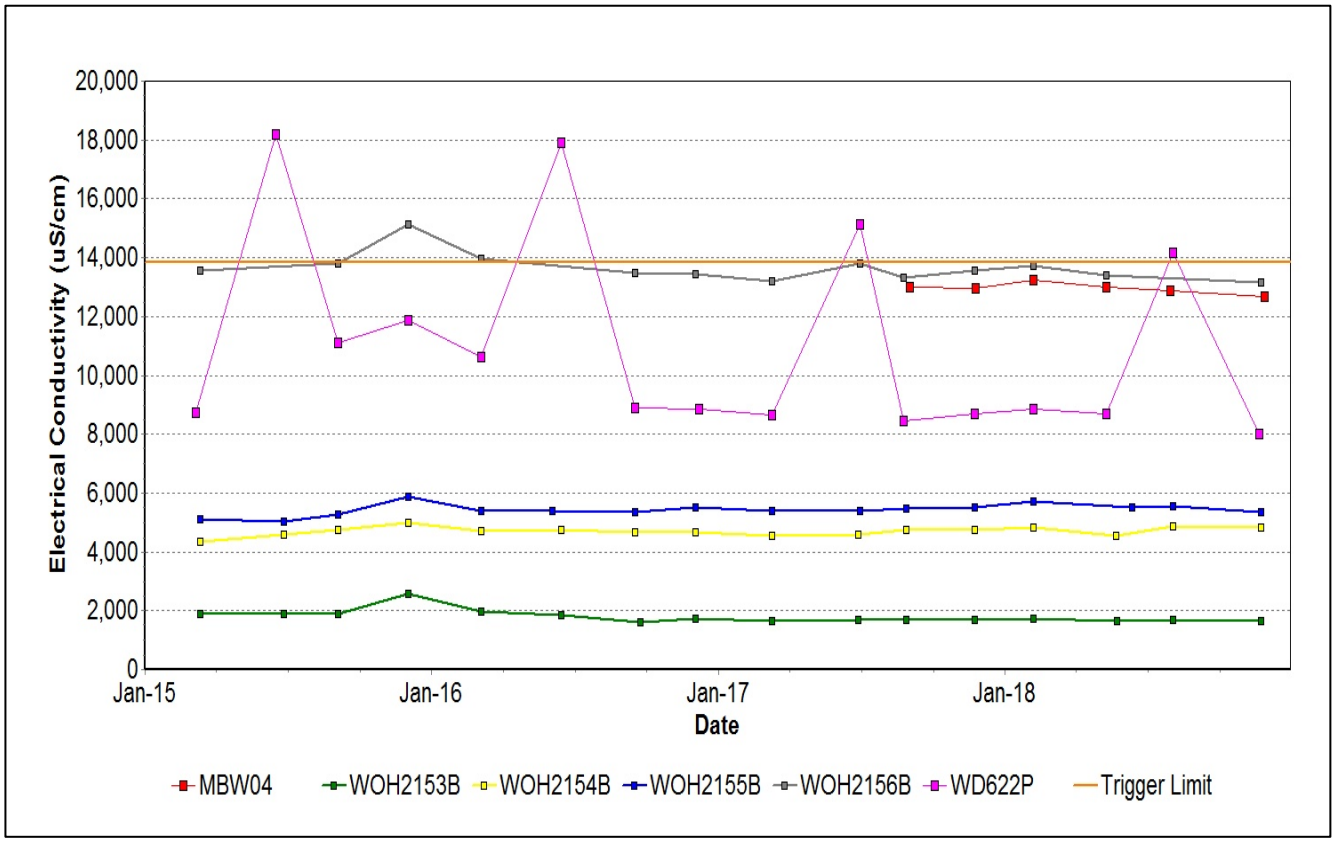
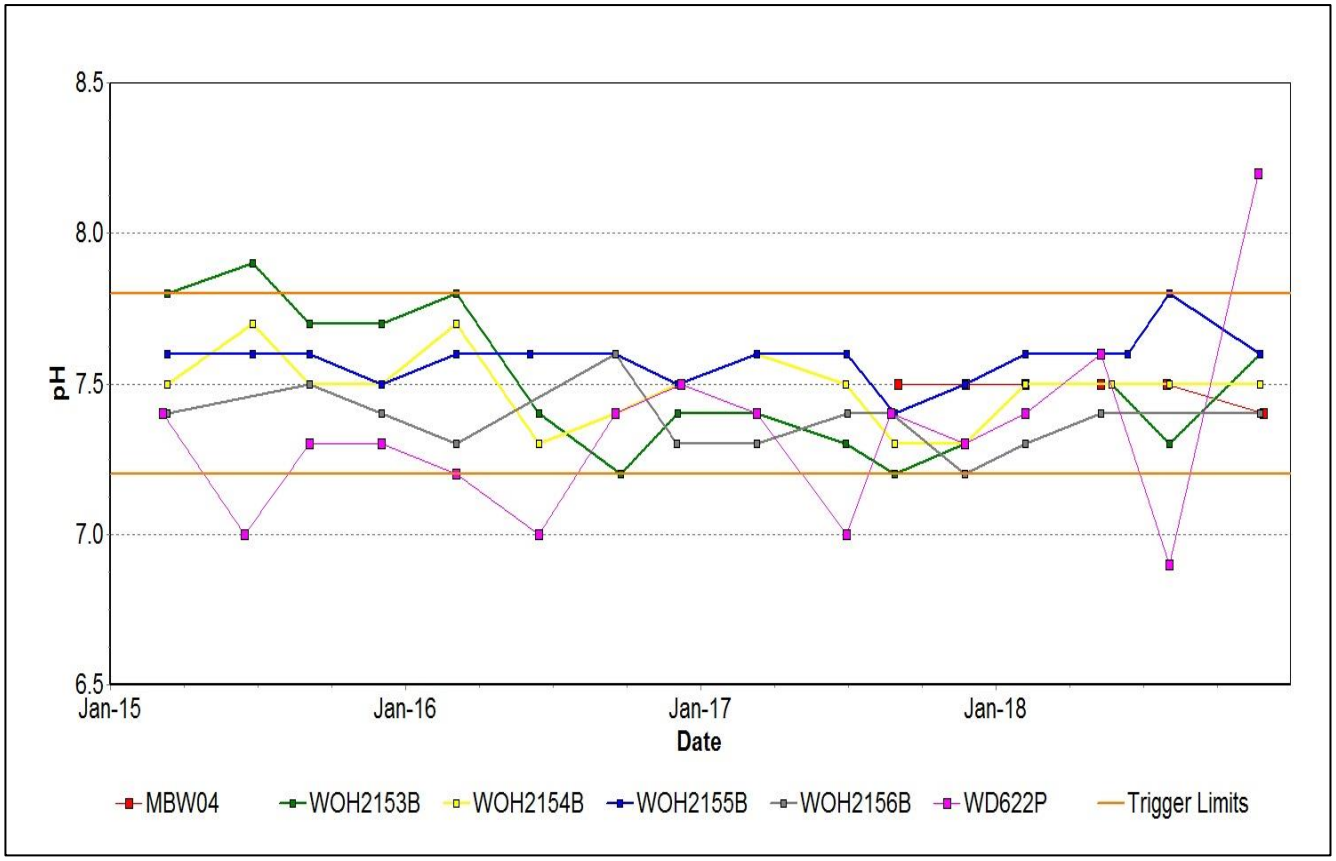


Figure 33: Vaux Seam Standing Water Level Trend – December 2018



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

Figure 34: Wambo Seam Electrical Conductivity Trend – December 2018



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

Figure 35: Wambo Seam pH Trend – December 2018

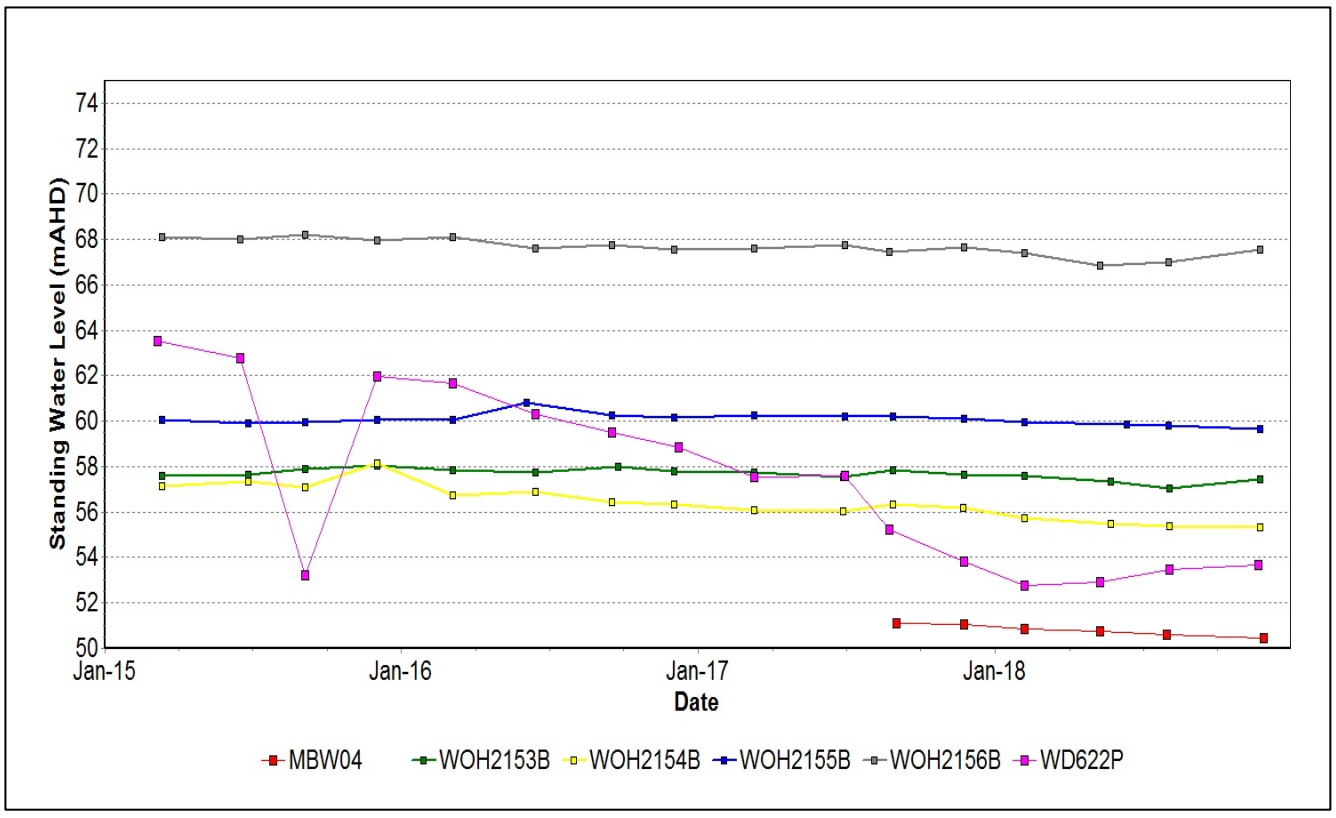


Figure 36: Wambo Seam Standing Water Level Trend – December 2018

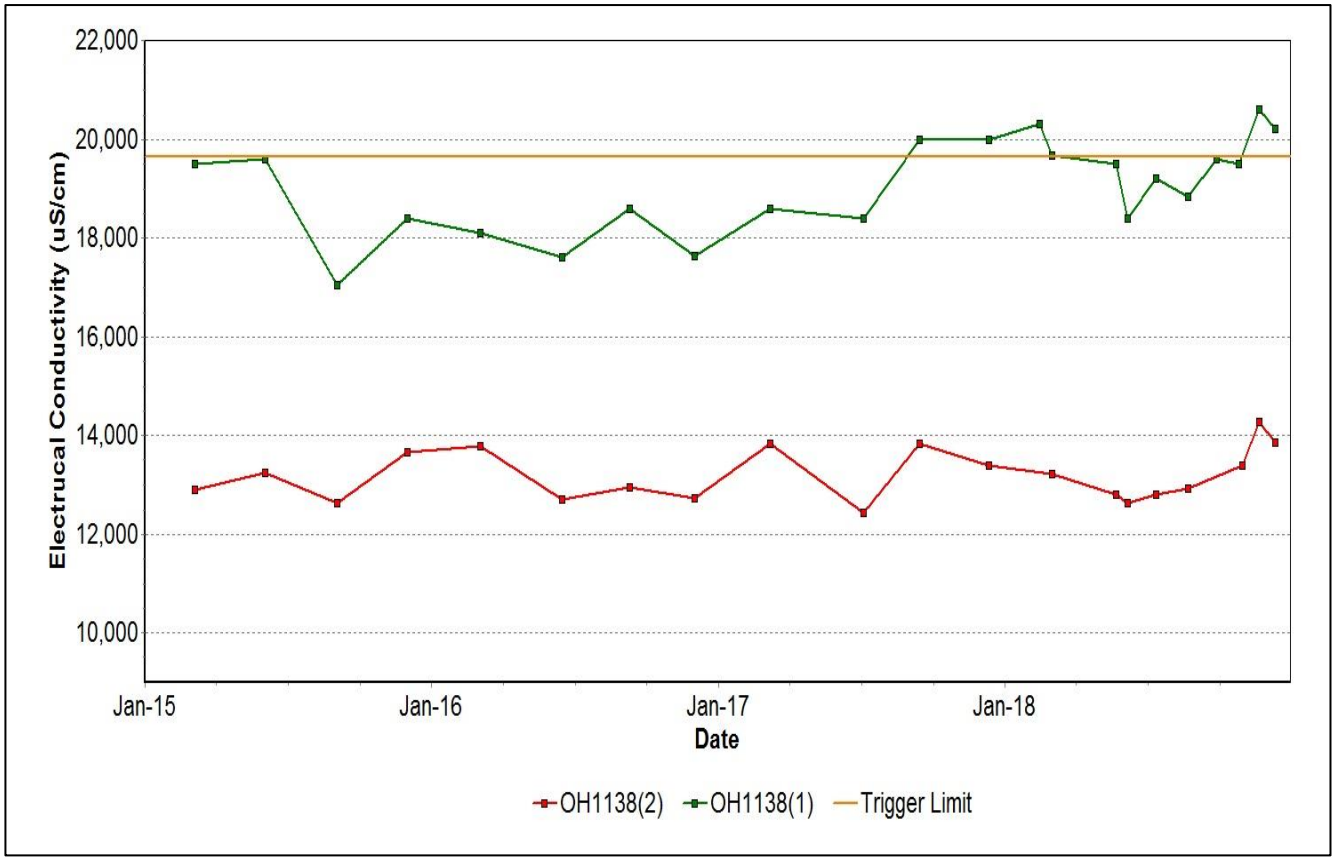


Figure 37: Warkworth Seam Electrical Conductivity Trend – December 2018

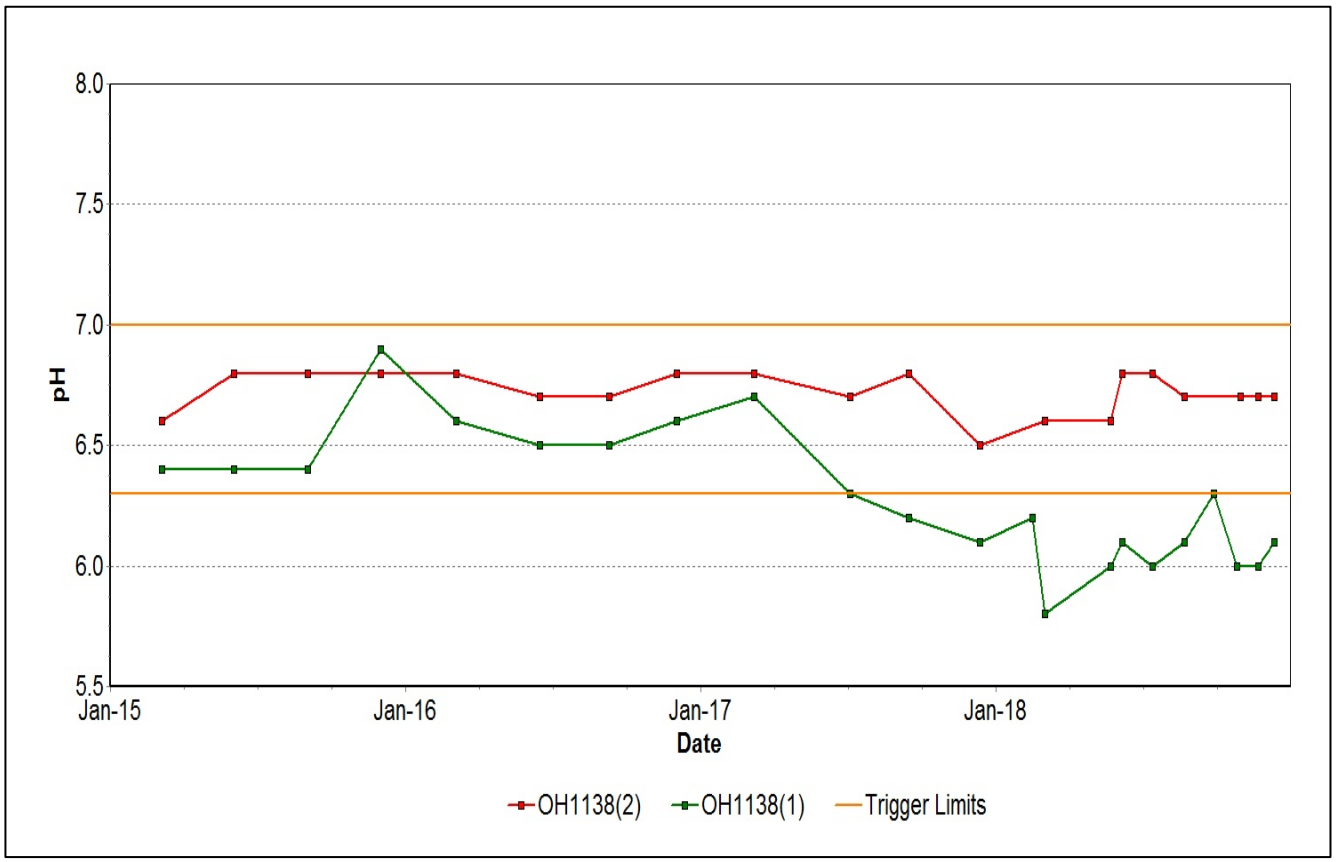


Figure 38: Warkworth Seam pH Trend – December 2018

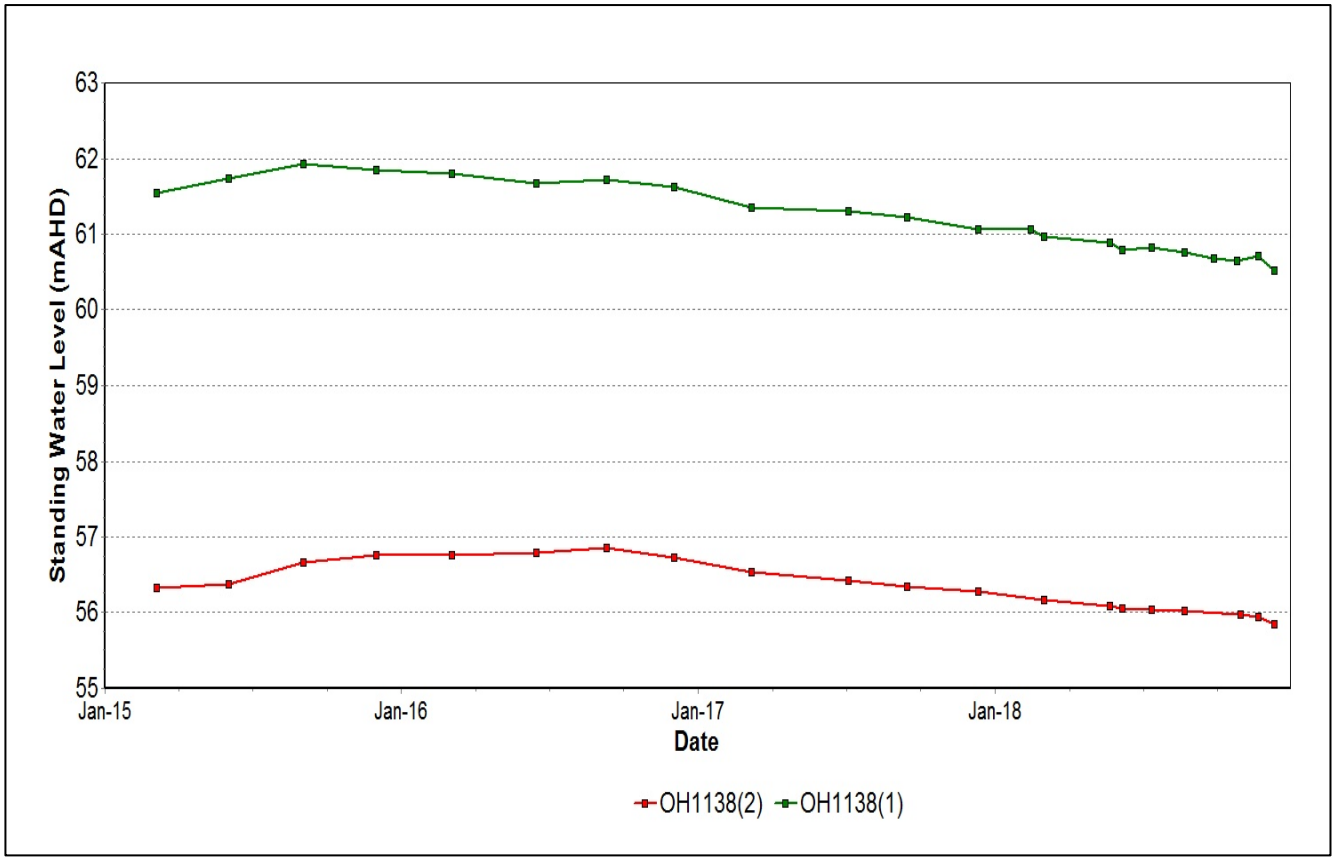


Figure 39: Warkworth Seam Standing Water Level Trend – December 2018

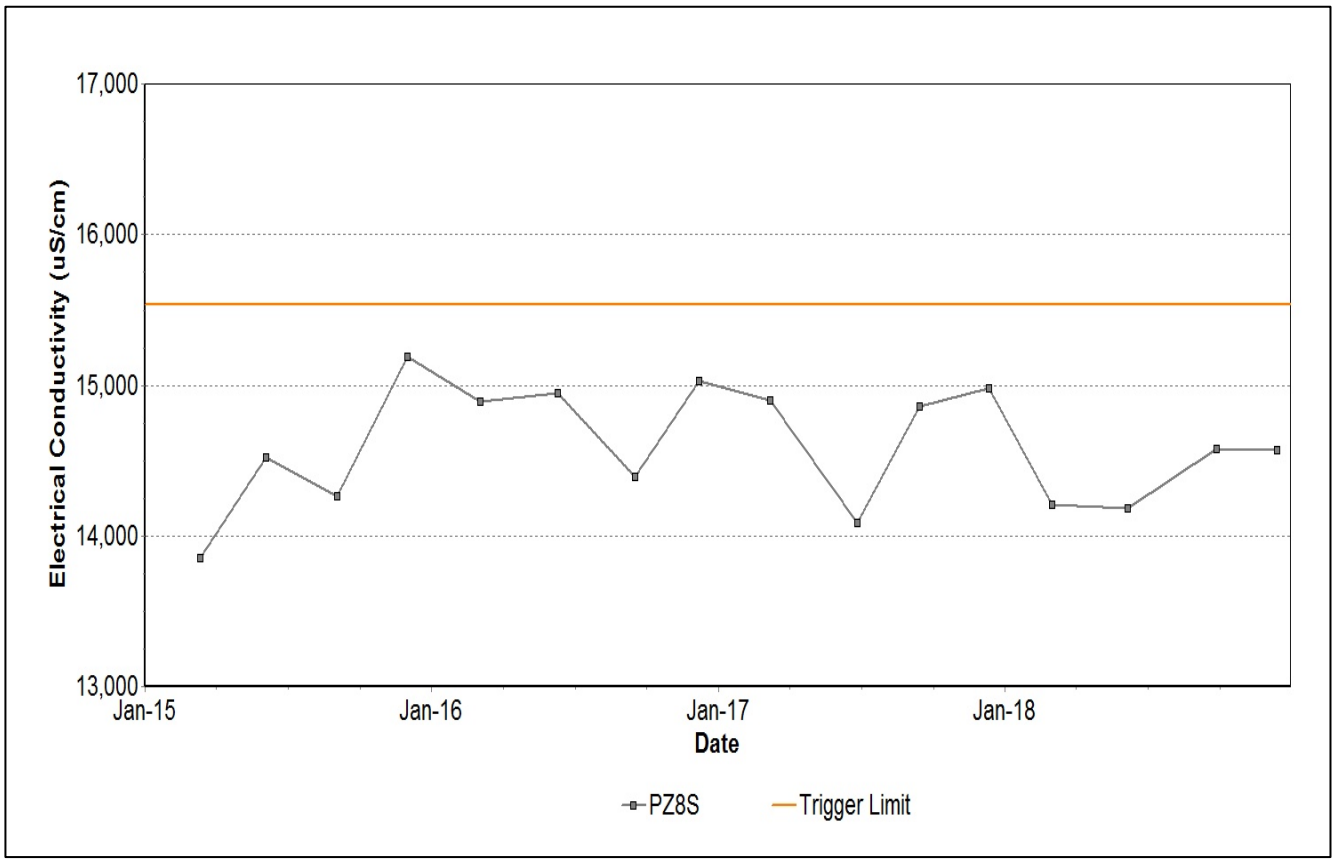


Figure 40: Wollombi Alluvium 1 Electrical Conductivity Trend – December 2018

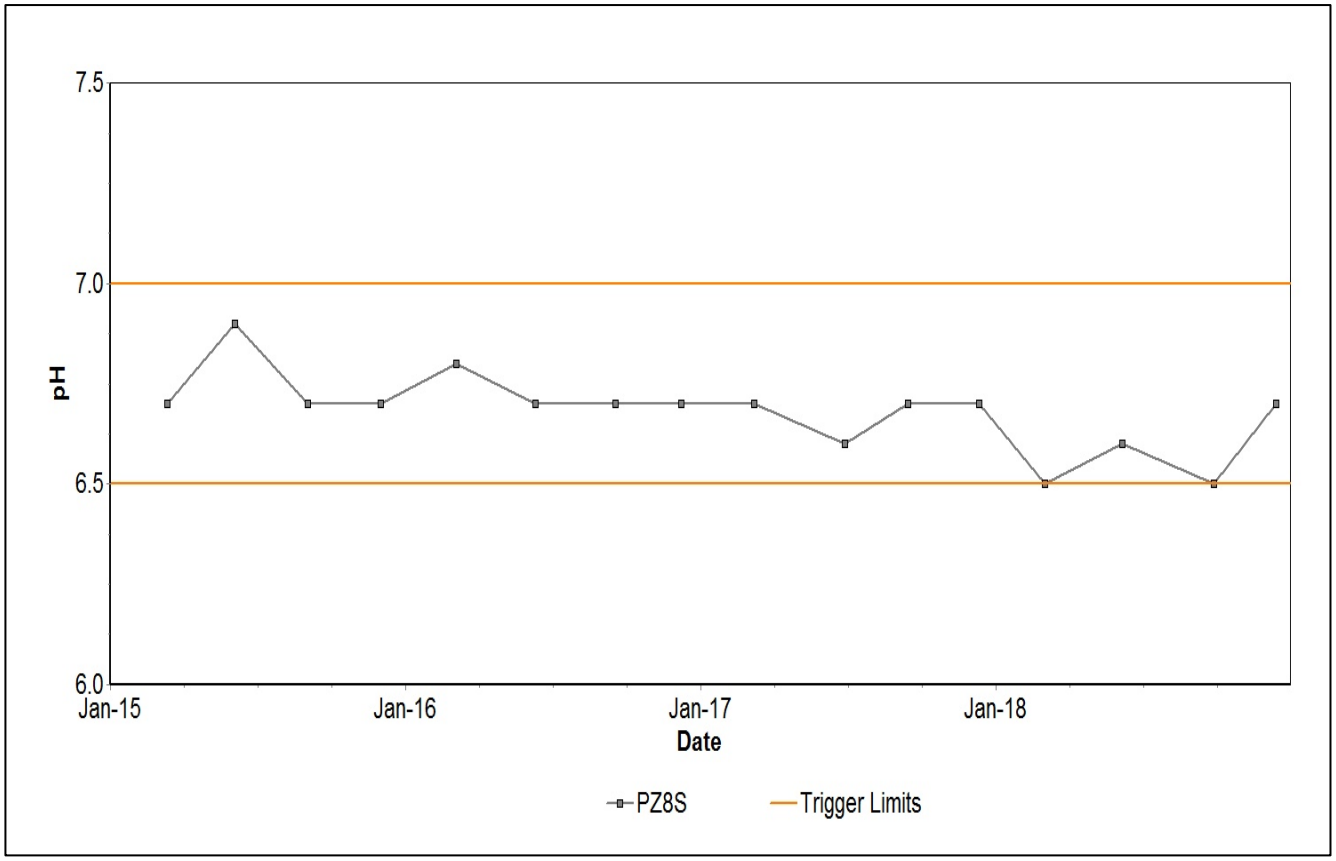


Figure 41: Wollombi Alluvium 1 pH Trend – December 2018

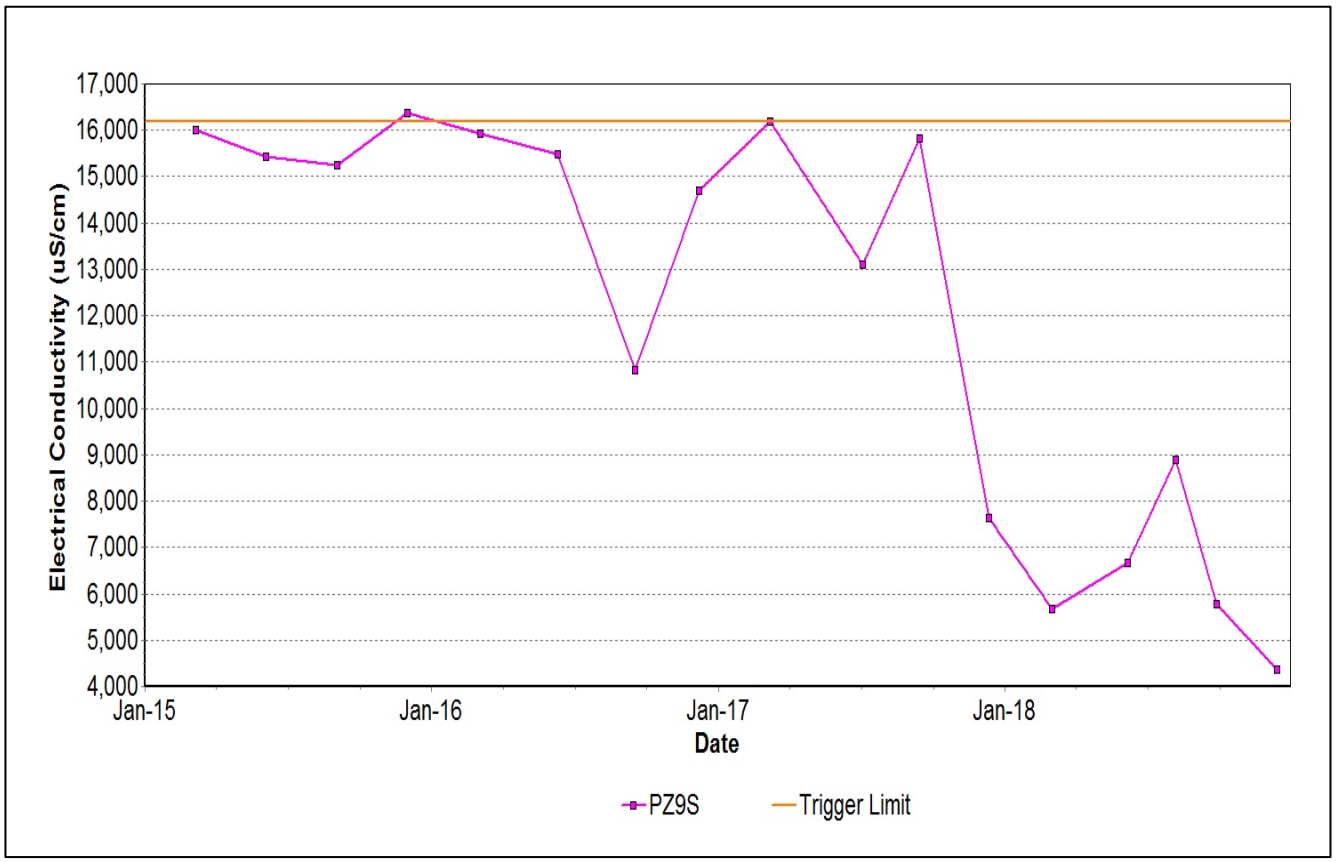


Figure 42: Wollombi Alluvium 2 Electrical Conductivity Trend – December 2018

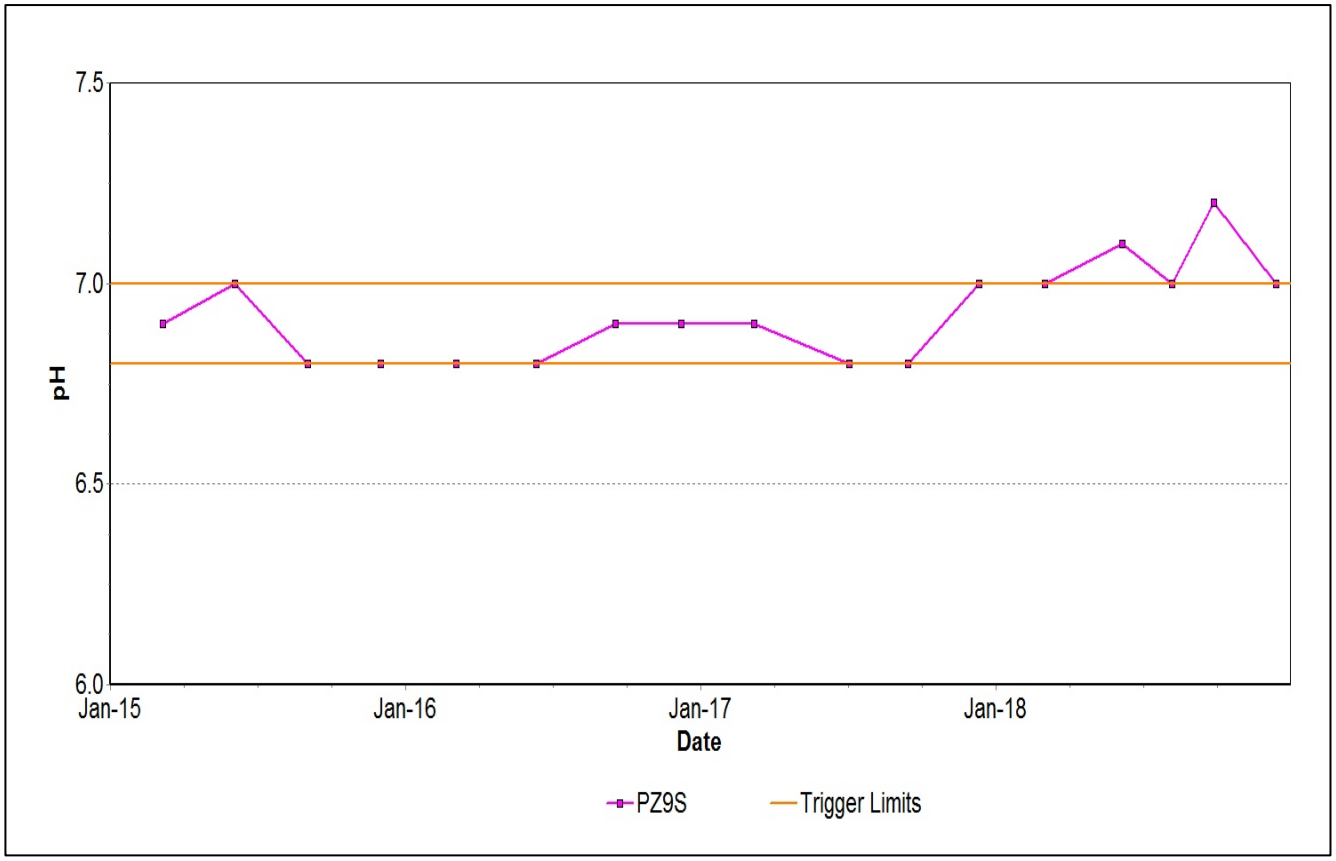


Figure 43: Wollombi Alluvium 2 pH Trend – December 2018

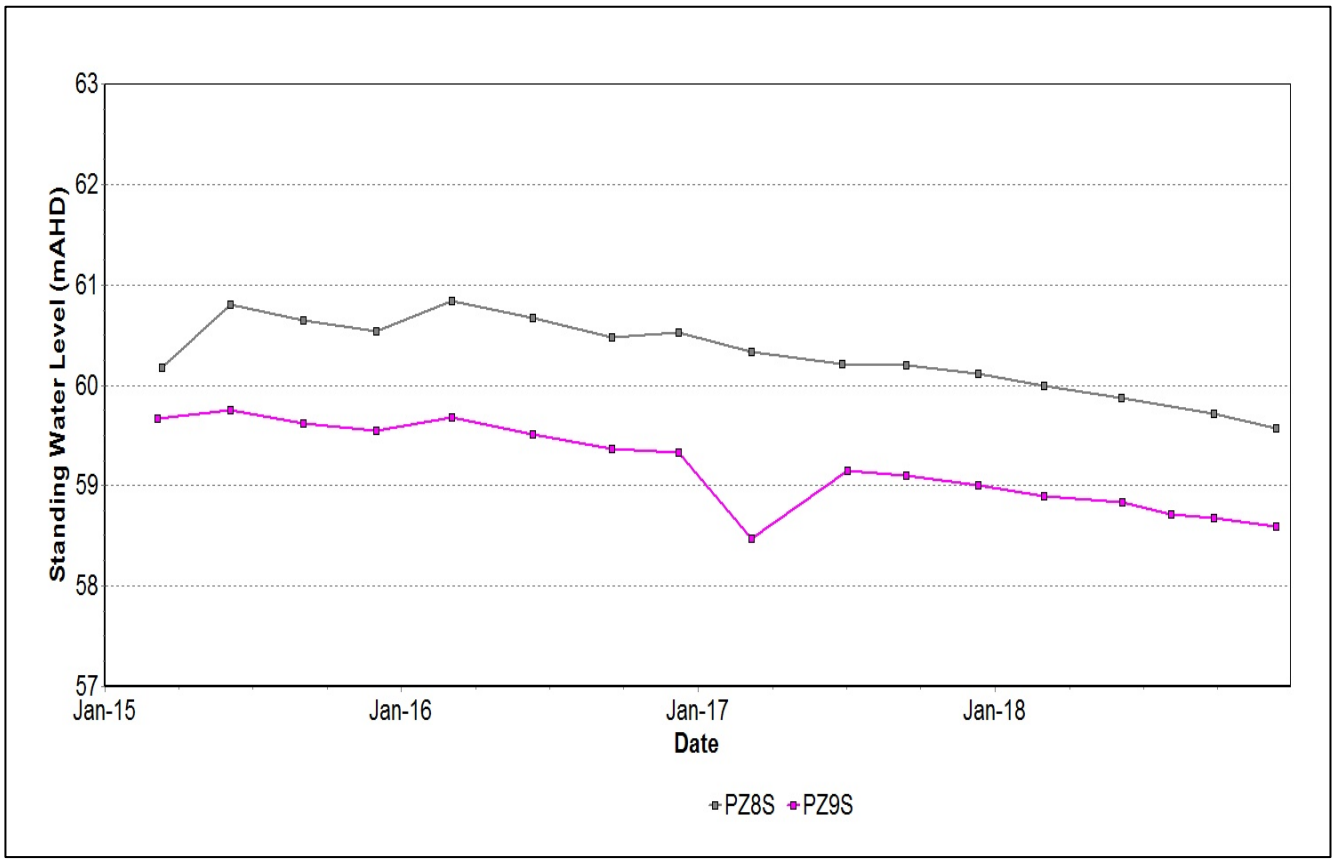


Figure 44: Wollombi Alluvium Standing Water Level Trend – December 2018

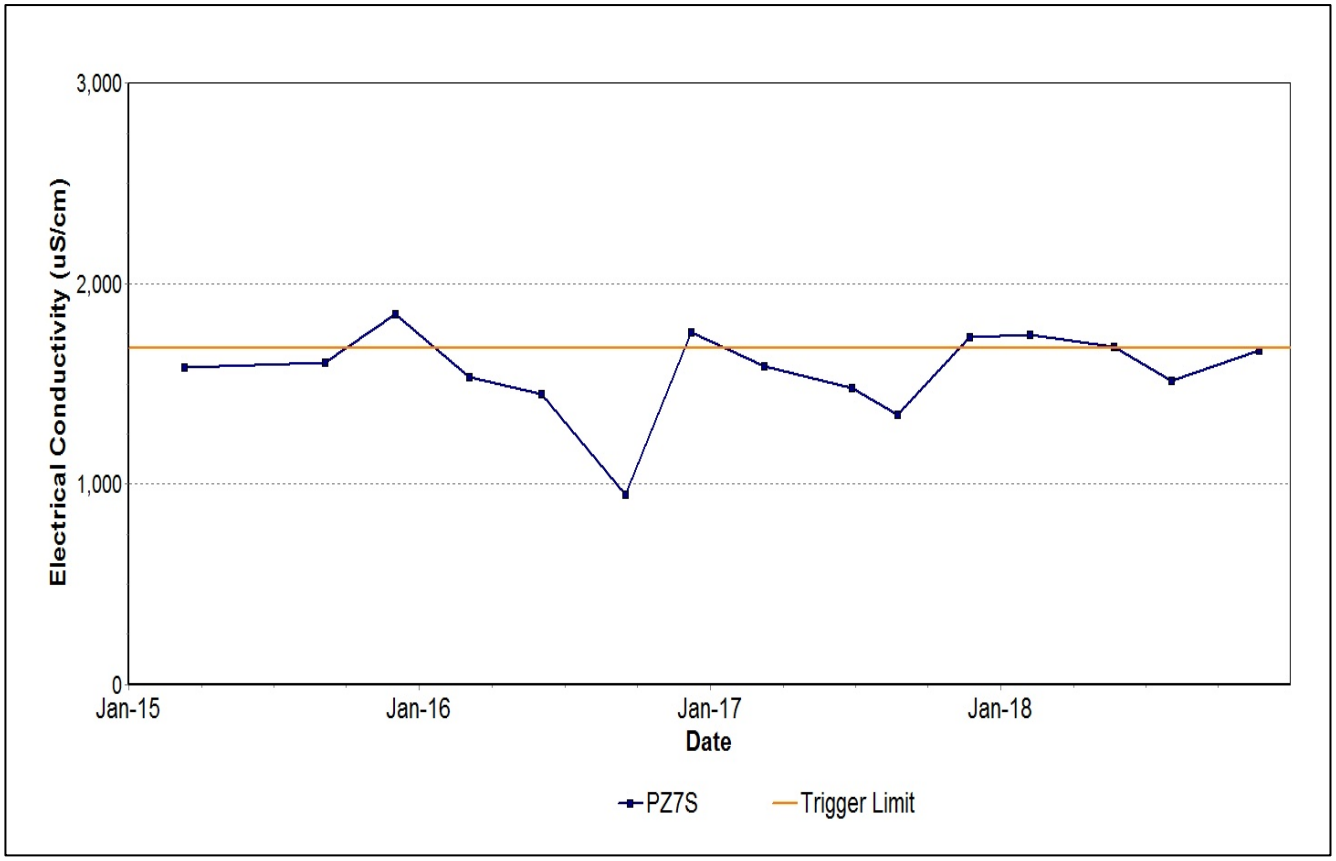


Figure 45: Aeolian Warkworth Sands Electrical Conductivity Trend – December 2018

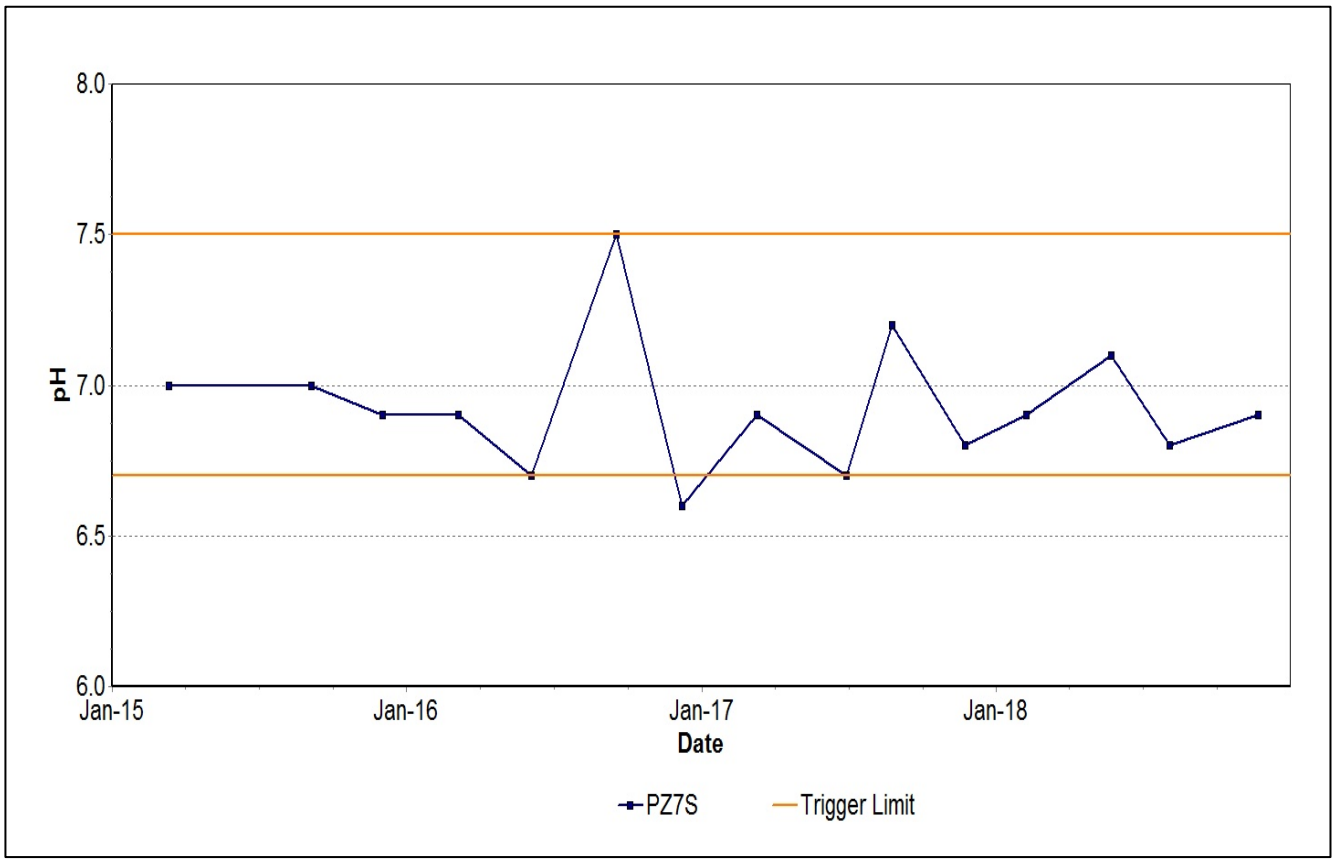


Figure 46: Aeolian Warkworth Sands pH Trend – December 2018

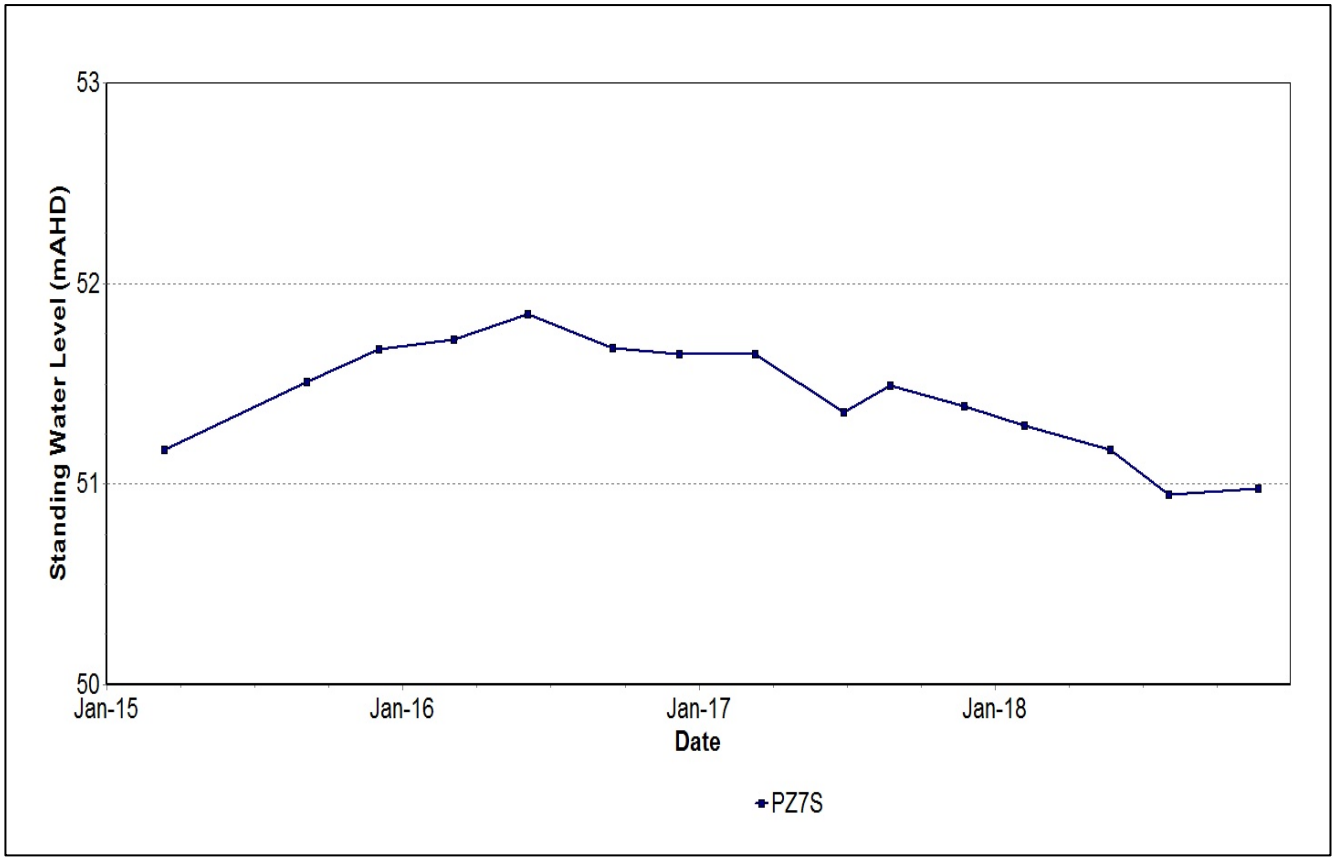


Figure 47: Aeolian Warkworth Sands Standing Water Level Trend – December 2018

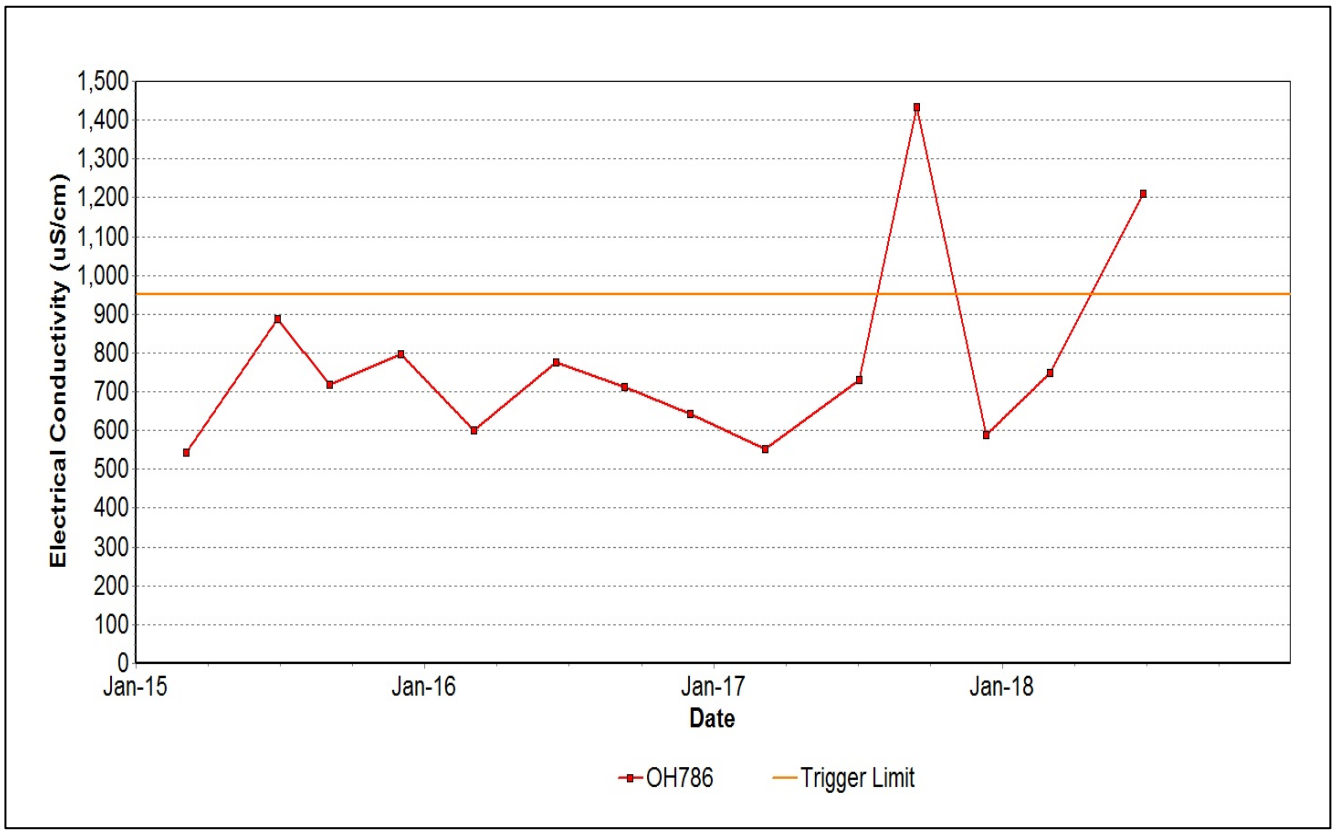


Figure 48: Hunter River Alluvium 1 Seam Electrical Conductivity Trend – December 2018

Note: There has been insufficient water to sample since June 2018.

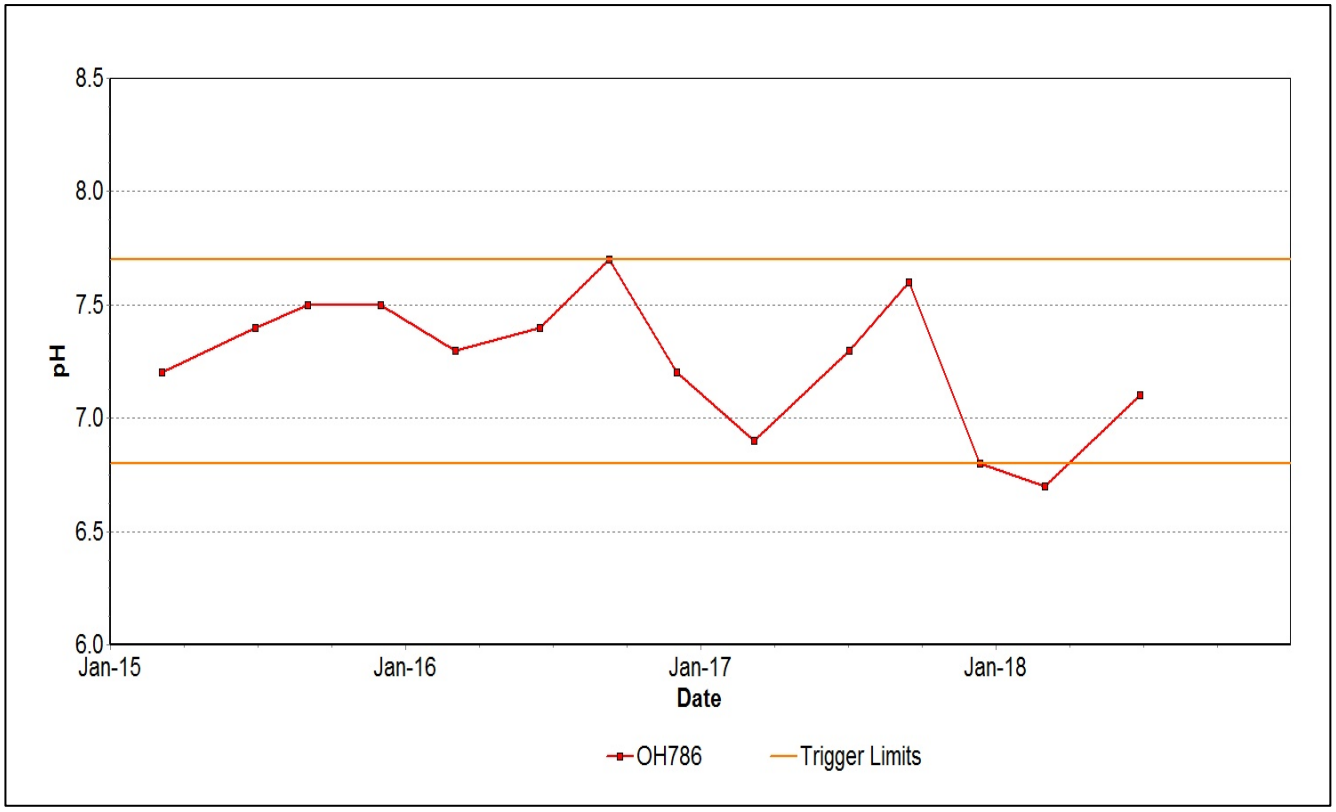


Figure 49: Hunter River Alluvium 1 Seam pH Trend – December 2018

Note: There has been insufficient water to sample since June 2018.

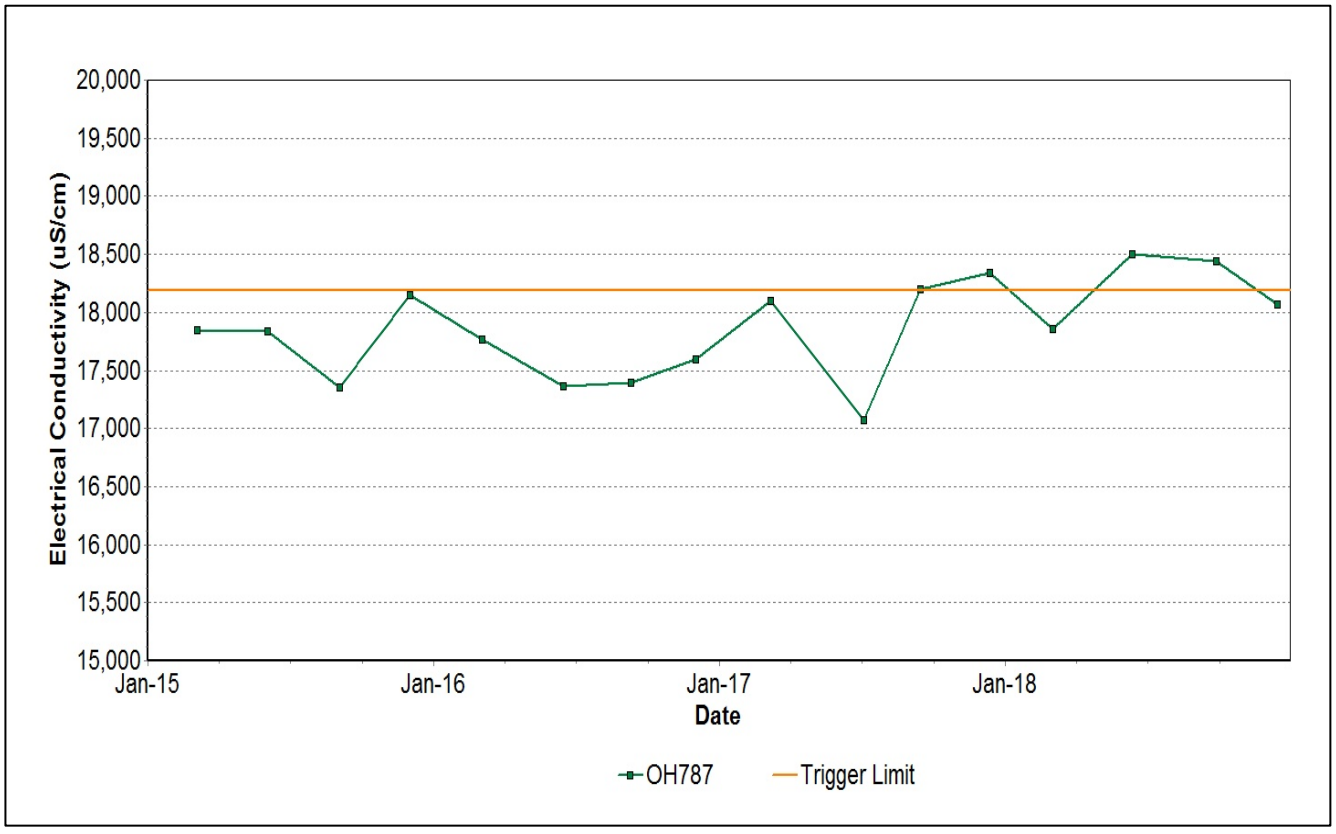


Figure 50: Hunter River Alluvium 2 Seam Electrical Conductivity Trend – December 2018

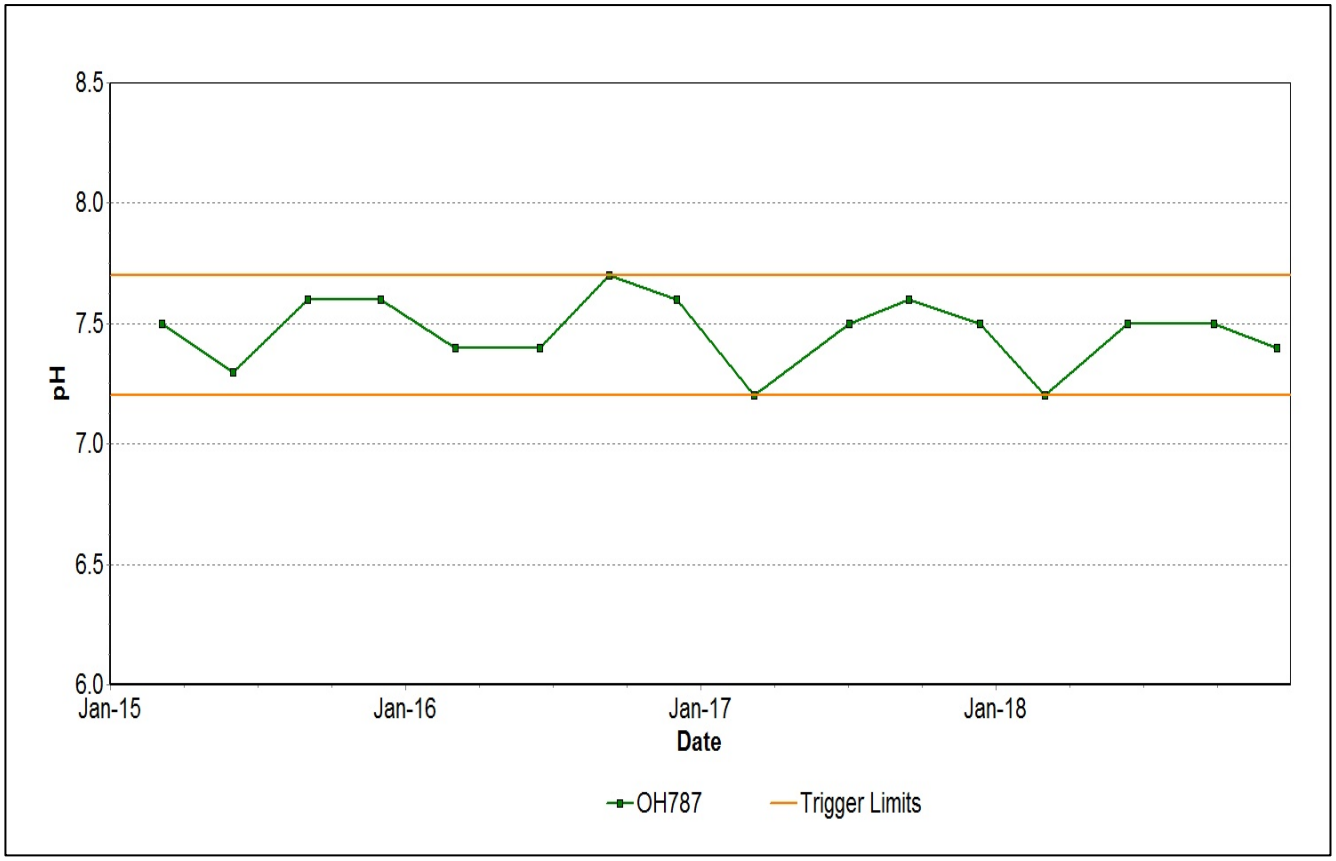


Figure 51: Hunter River Alluvium 2 Seam pH Trend – December 2018

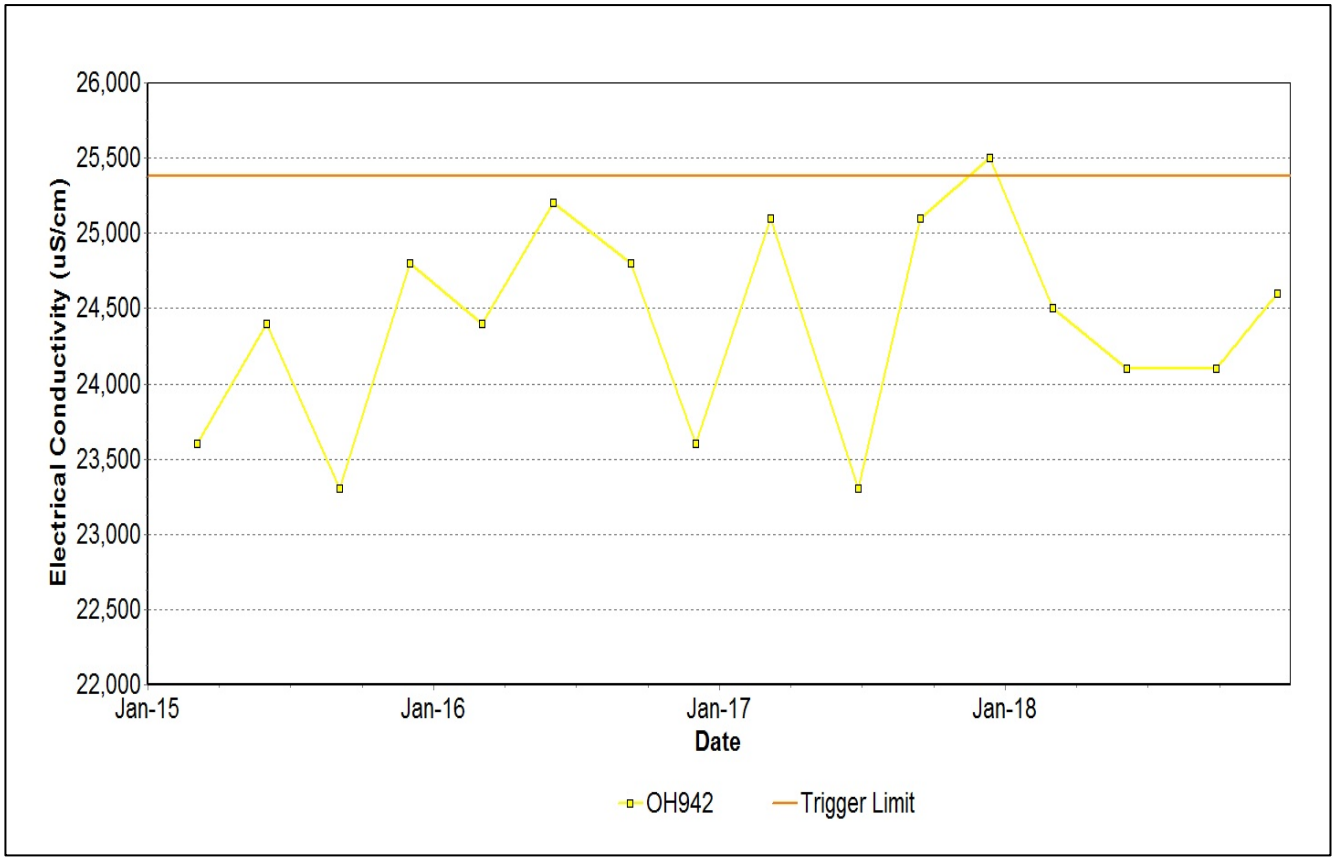


Figure 52: Hunter River Alluvium 3 Seam Electrical Conductivity Trend – December 2018

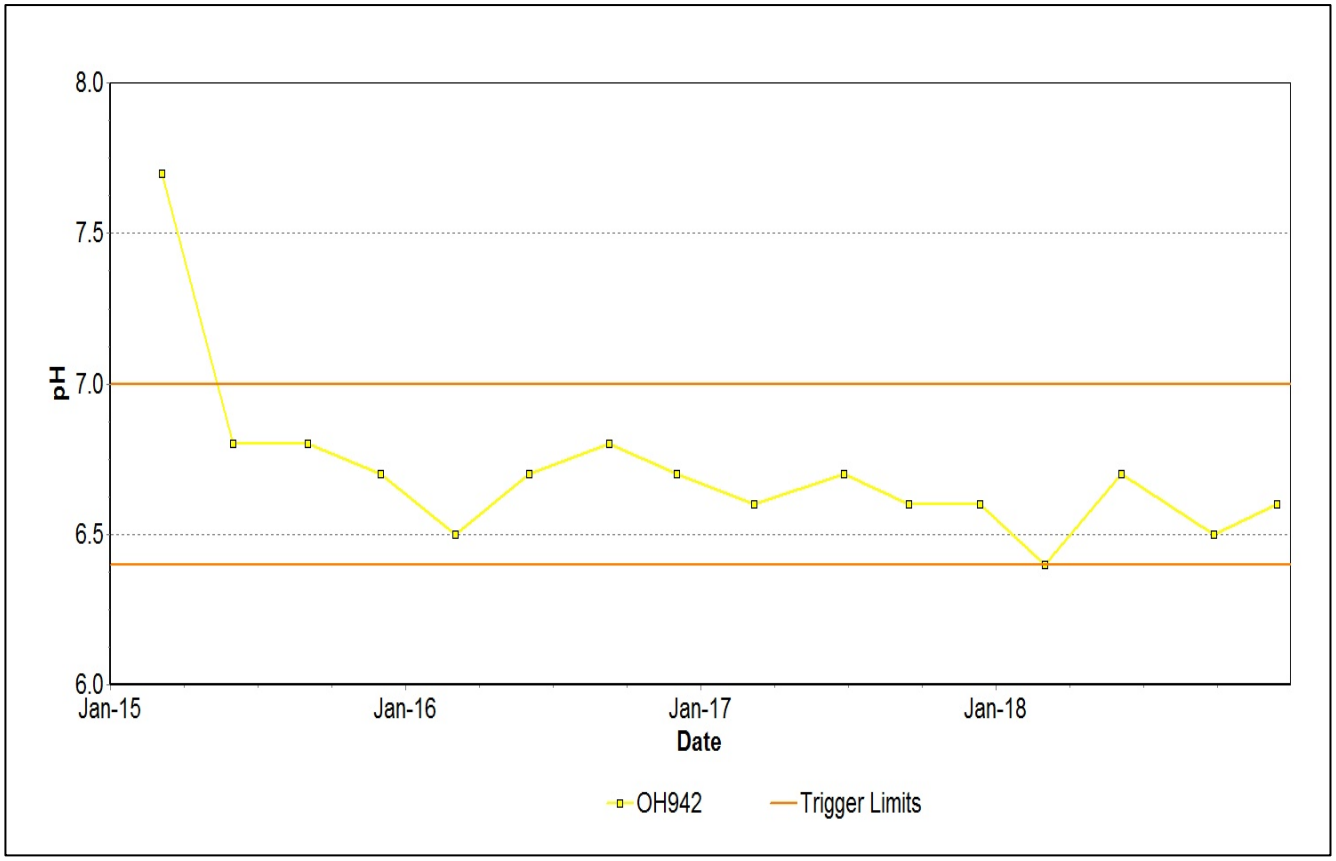


Figure 53: Hunter River Alluvium 3 Seam pH Trend – December 2018

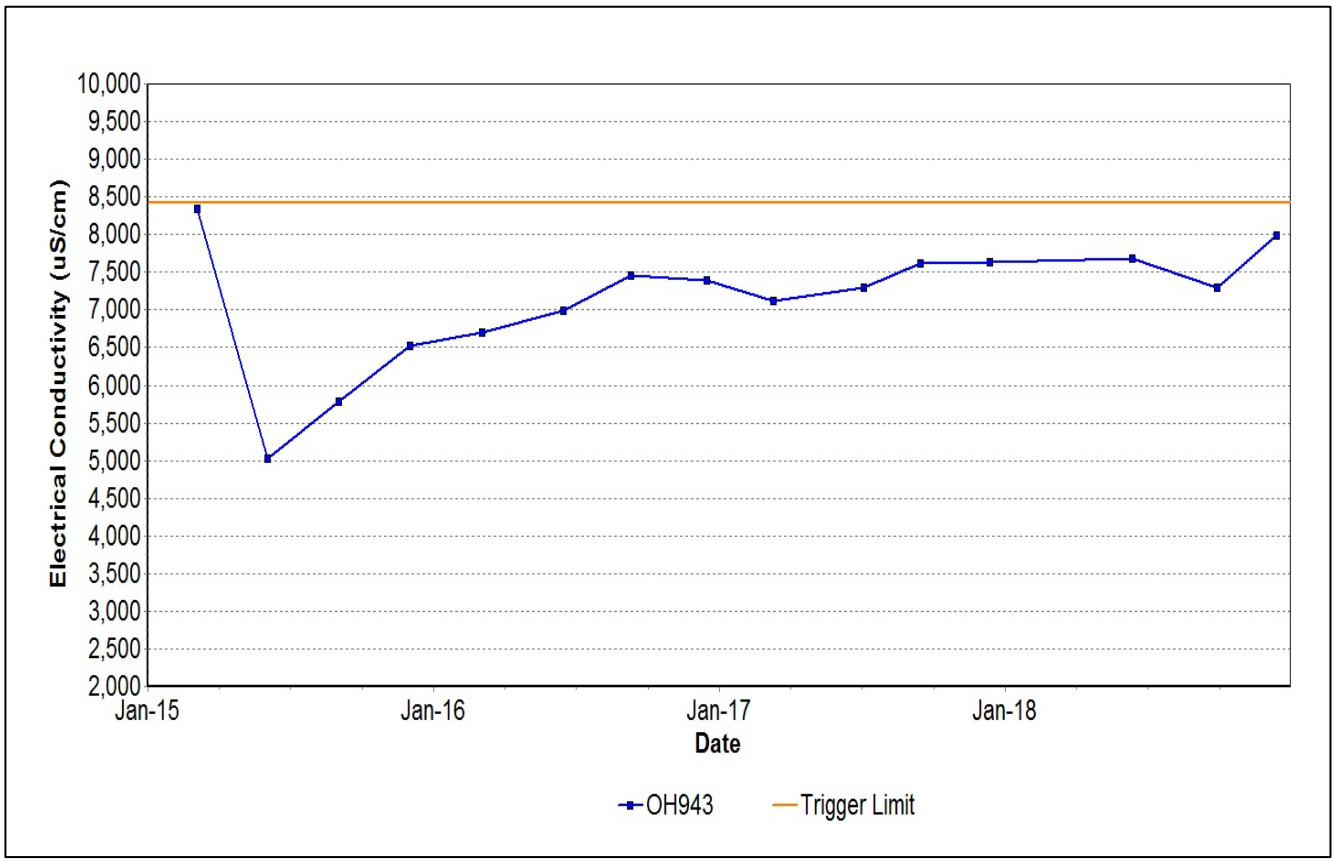


Figure 54: Hunter River Alluvium 4 Seam Electrical Conductivity Trend – December 2018

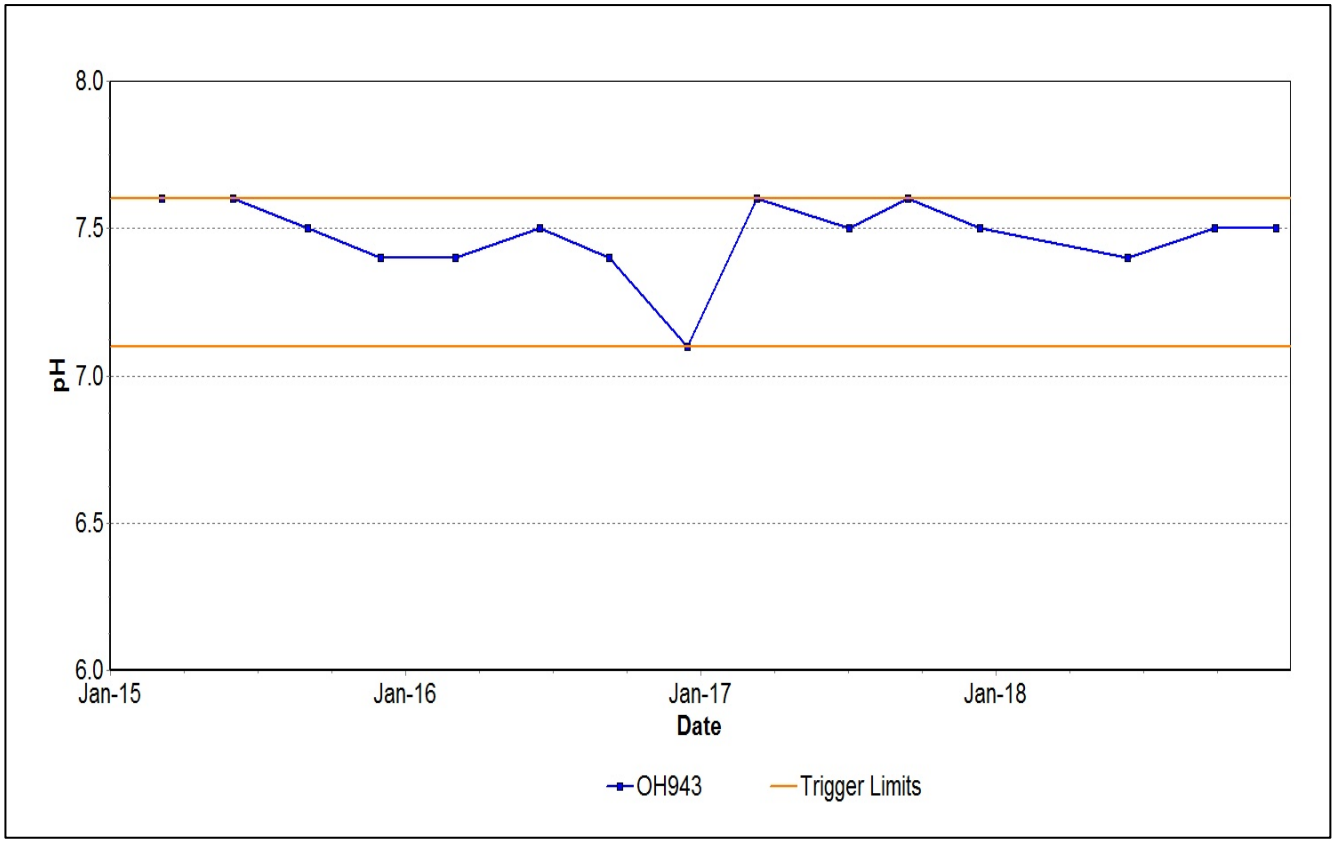
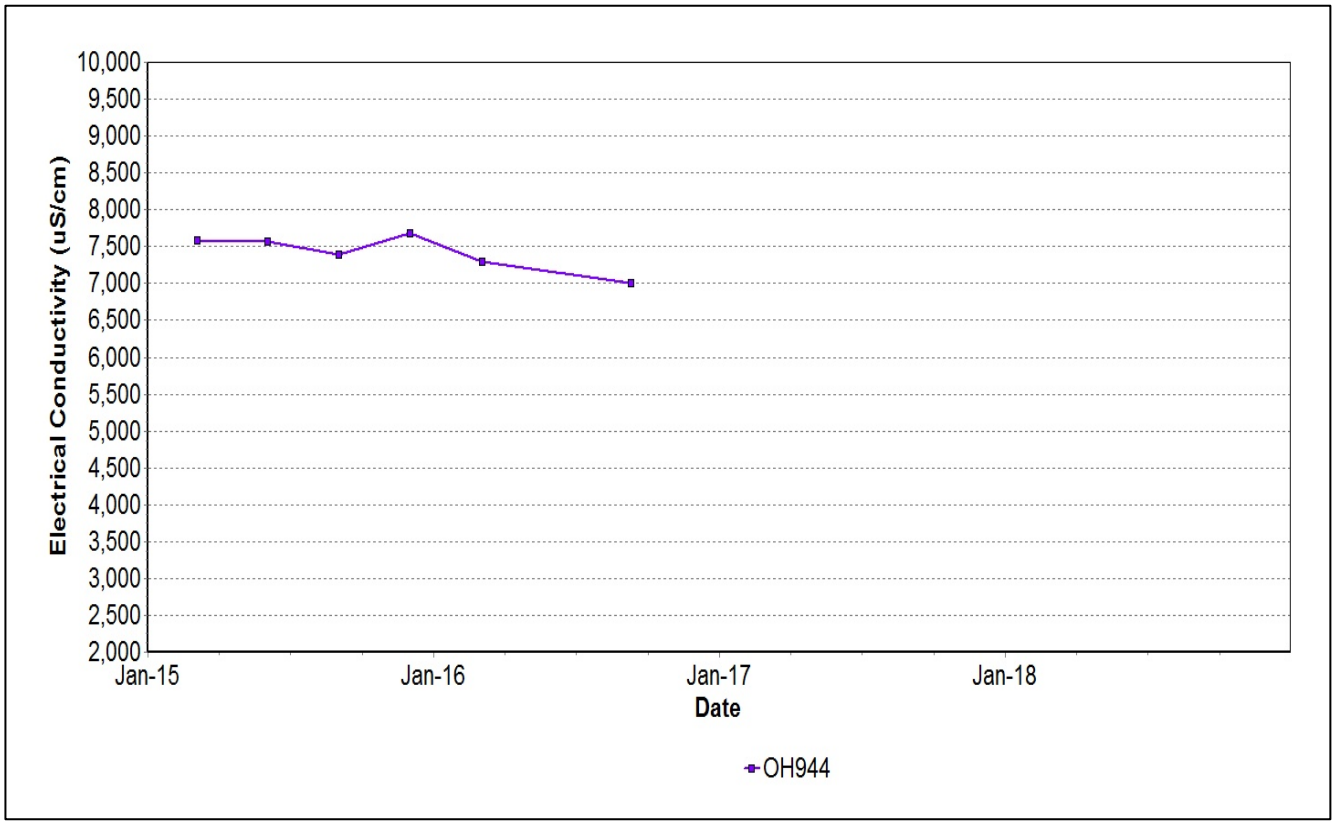
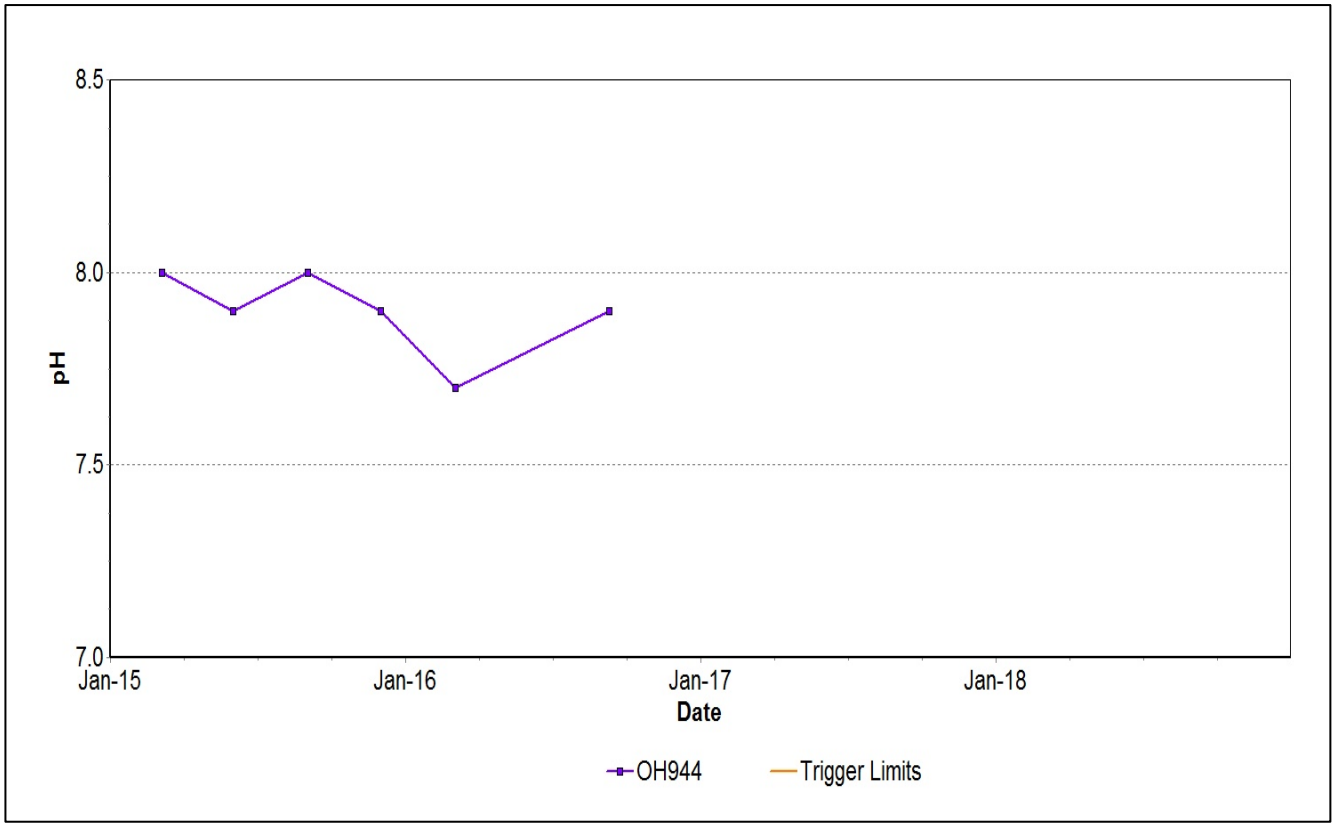


Figure 55: Hunter River Alluvium 4 Seam pH Trend – December 2018



Note: There has been insufficient water to sample since December 2016.

Figure 56: Hunter River Alluvium 5 Seam Electrical Conductivity Trend – December 2018



Note: There has been insufficient water to sample since December 2016.

Figure 57: Hunter River Alluvium 5 Seam pH Trend – December 2018

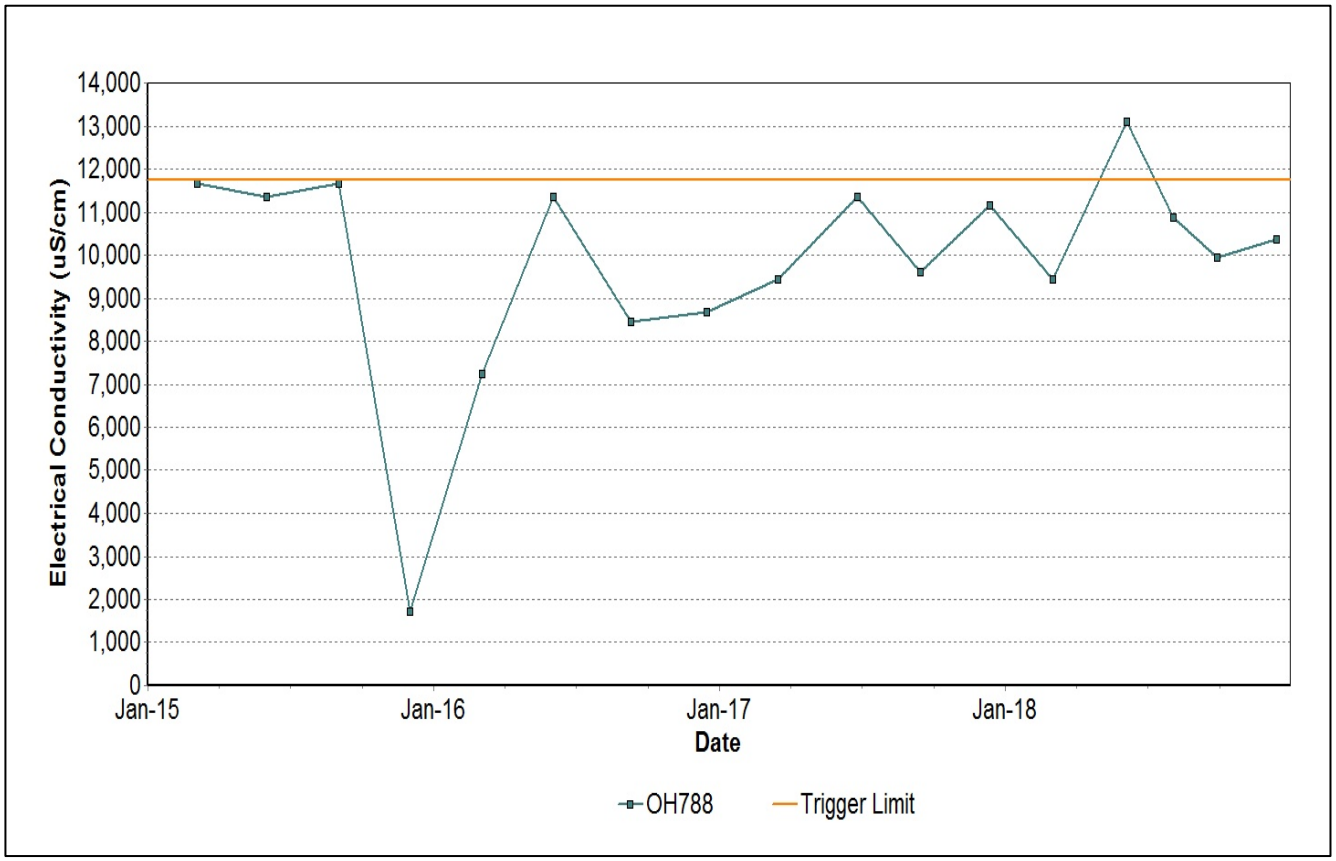


Figure 58: Hunter River Alluvium 6 Seam Electrical Conductivity – December 2018

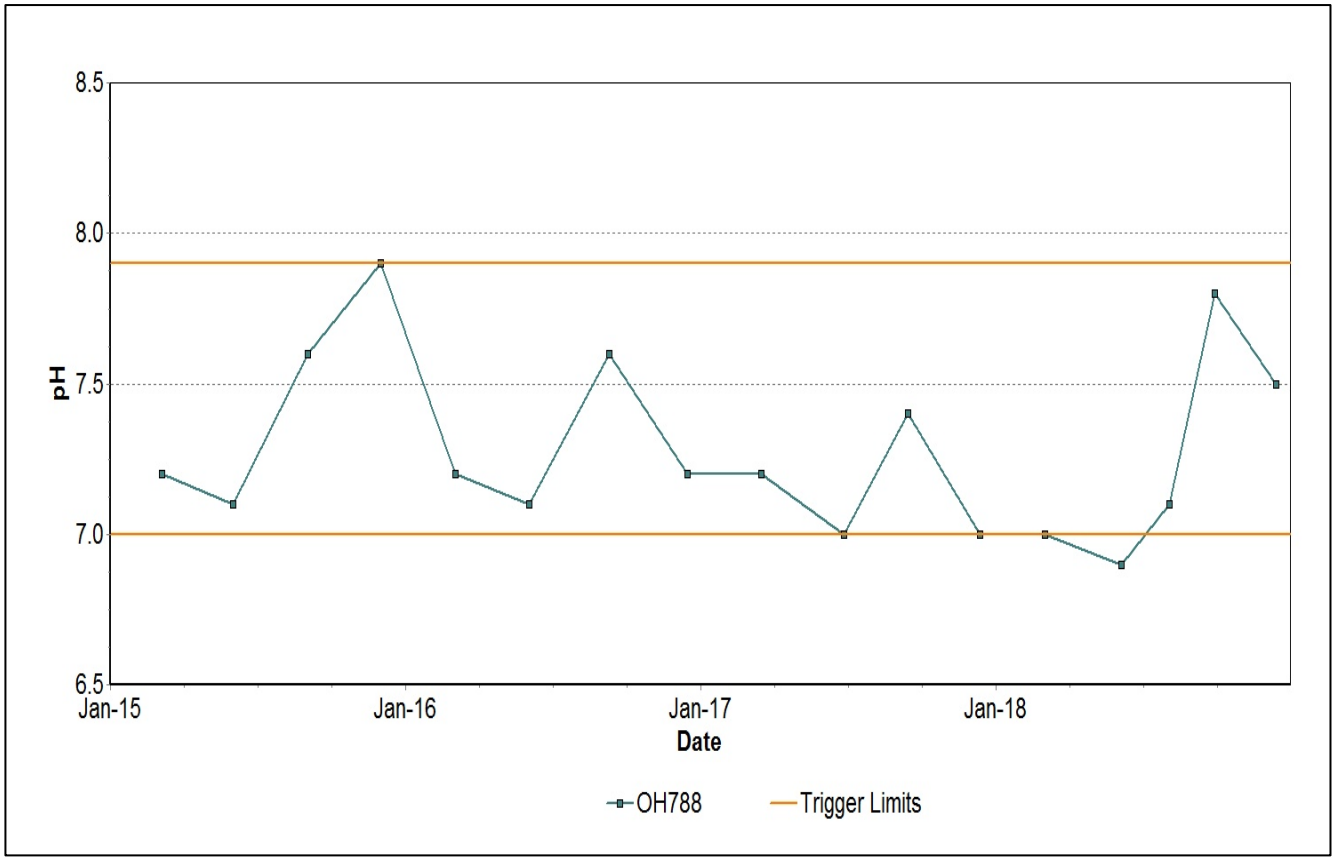
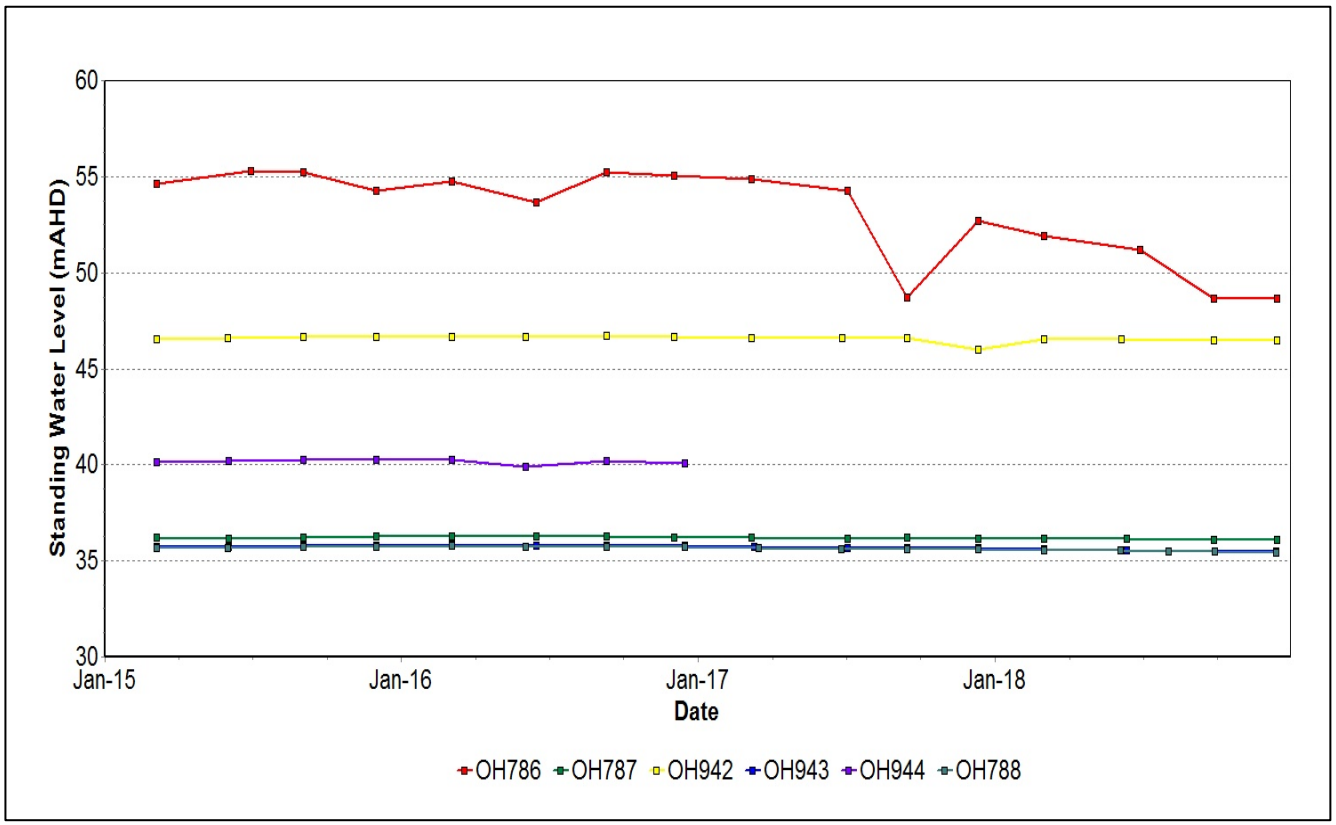


Figure 59: Hunter River Alluvium 6 Seam pH Trend – December 2018



Note: There has been insufficient water to sample at OH944 since December 2016.

Figure 60: Hunter River Alluvium Standing Water Level Trend – December 2018

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 61**.

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

Table 3: Groundwater Triggers - 2018

Site	Date	Trigger Limit Breached	Action Taken in Response
OH 786	28/06/2018	EC – 95th Percentile	Watching Brief*
OH 787	02/03/2018	EC – 95th Percentile	Data is stable and consistent with historical trend; no further action
OH 787	12/06/2018	EC – 95th Percentile	Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Continue to watch and monitor
OH 787	27/09/2018	EC – 95th Percentile	Continue to watch and monitor
OH788	04/06/2018	EC – 95th Percentile	Watching Brief*
MTD605P	06/02/2018	EC – 95th Percentile	Data is stable and consistent with historical trend; no further action
MTD605P	10/05/2018	EC – 95th Percentile	Data is stable and consistent with historical trend, other bores within the Shallow Overburden are stable; no further action required
MTD605P	23/11/2018	EC – 95th Percentile	Watching Brief*
WD622P	03/08/2018	EC – 95th Percentile	Watching Brief*
WOH2156B	06/02/2018	EC – 95th Percentile	Data is stable and consistent with historical trend; no further action
OH 1138(1)	02/03/2018	EC – 95th Percentile	Data is stable and consistent with historical trend; no further action
OH 1138(1)	21/11/2018	EC – 95th Percentile	Watching Brief*
OH 1138(1)	11/12/2018	EC – 95th Percentile	Increasing trend identified. Watching Brief*
GW9709	13/12/2018	EC – 95th Percentile	Watching Brief*
OH 786	02/03/2018	pH –5th Percentile	Watching Brief*
OH 787	02/03/2018	pH –5th Percentile	Watching Brief*
OH 942	02/03/2018	pH –5th Percentile	Watching Brief*
OH 788	02/03/2018	pH –5th Percentile	Watching Brief*
OH 788	04/06/2018	pH –5th Percentile	Follow up monitoring undertaken in August and December indicates that data returned to within trigger levels. No further action required.
PZ8S	02/03/2018	pH –5th Percentile	Watching Brief*

PZ9S	02/03/2018	pH – 95th Percentile	Watching Brief*
PZ9S	06/06/2018	pH – 95th Percentile	Investigation commenced.
PZ9S	27/09/2018	pH – 95th Percentile	Investigation indicates change to pH is likely the result of depressurisation, as evidenced by falling water level. There is <300mm left in the piezometer water column. This trend is consistent with effects of nearby mining. Continue routine monitoring. No further action required.
GW9709	02/03/2018	pH –5th Percentile	Watching Brief*
GW98MTCL2	02/03/2018	pH –5th Percentile	Watching Brief*
GW98MTCL2	04/06/2018	pH –5th Percentile	Watching Brief*
WOH2139A	06/02/2018	pH – 95th Percentile	Data is stable and consistent with historical trend; no further action
WOH2139A	23/05/2018	pH – 95th Percentile	Data is stable and consistent with historical trend. Other bores within the Blakefield seam are stable; no further action required
WOH2139A	06/08/2018	pH – 95th Percentile	Increasing trend identified. Undertake additional monitoring on increased frequency.
WOH2139A	13/12/2018	pH – 95th Percentile	Increasing trend identified. Undertake additional monitoring on increased frequency.
MTD616P	03/08/2018	pH –5th Percentile	Watching Brief*
OH 1125(1)	02/03/2018	pH –5th Percentile	Watching Brief*
MB15MTW01D	06/02/2018	pH –5th Percentile	Watching Brief*
MB15MTW01D	10/05/2018	pH –5th Percentile	Data is stable and consistent with historical trend, other bores within the Shallow Overburden are stable; no further action required
MB15MTW01D	23/11/2018	pH –5th Percentile	Watching Brief*
PZ9D	02/03/2018	pH –5th Percentile	Watching Brief*
OH 1137	14/12/2018	pH – 95th Percentile	Watching Brief*
OH 1126	14/12/2018	pH – 5th Percentile	Watching Brief*
OH 1121	13/12/2018	pH – 95th Percentile	Watching Brief*
OH 1138(1)	06/02/2018	pH –5th Percentile	Investigation commenced.

OH 1138(1)	06/06/2018	pH –5th Percentile	pH beginning to recover to historic levels. Continue to monitor on increased frequency
OH 1138(1)	27/09/2018	N/A	pH beginning to recover to historic levels in June and returned to being within trigger levels in September. Continue to monitor on increased frequency to confirm.
OH 1138(1)	26/10/2018	pH –5th Percentile	Watching Brief*
OH 1138(1)	21/11/2018	pH –5th Percentile	Watching Brief*
OH 1138(1)	11/12/2018	pH –5th Percentile	pH beginning to recover to historic levels. Continue to monitor on increased frequency
WD622P	03/08/2018	pH –5th Percentile	Watching Brief*
WD622P	21/11/2018	pH – 95th Percentile	Watching Brief*

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

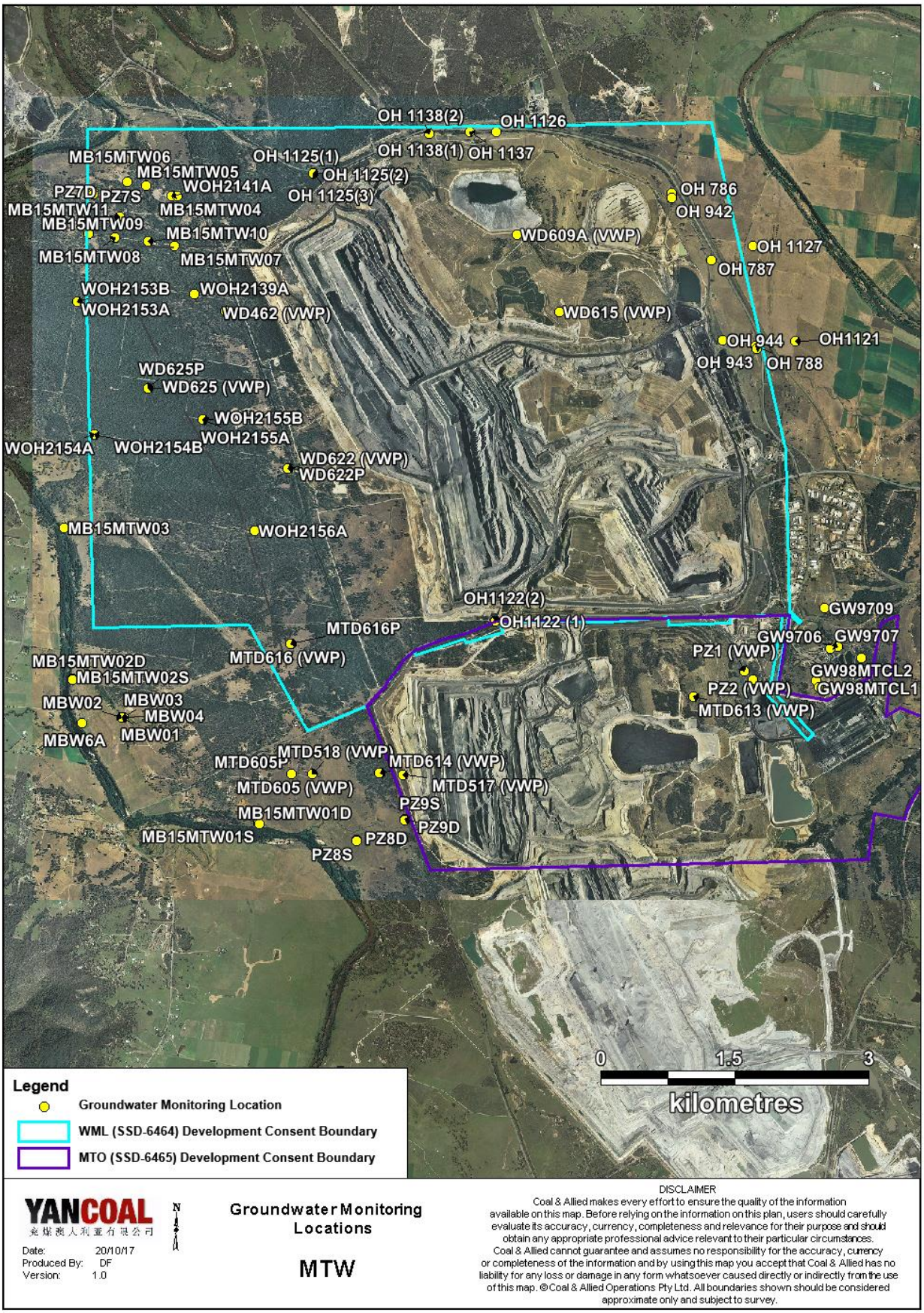


Figure 61: Groundwater Monitoring Location Plan

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 68**.

4.1 Blast Monitoring Results

During December 2018, 22 blasts were initiated at MTW. **Figure 62** to **Figure 67** show the blast monitoring results for the reporting period against the impact assessment criteria. The criteria are 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 one blast exceeded the 120 dB(L) threshold for airblast overpressure at the Bulga Village monitoring location and was investigated (refer to section 8.0 below). No blasts exceeded the 5% threshold for airblast overpressure or 5mm/s 5% threshold for ground vibration.

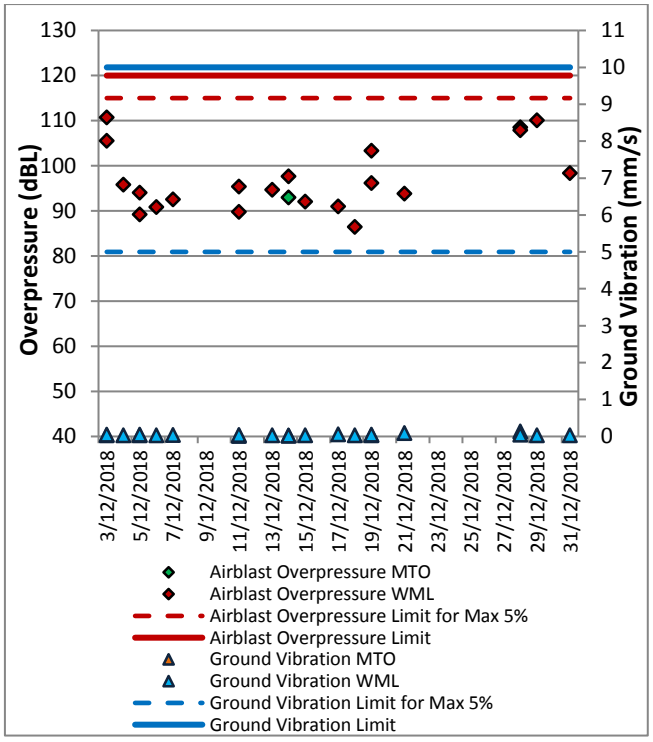


Figure 62: Abbey Green Blast Monitoring Results – December 2018

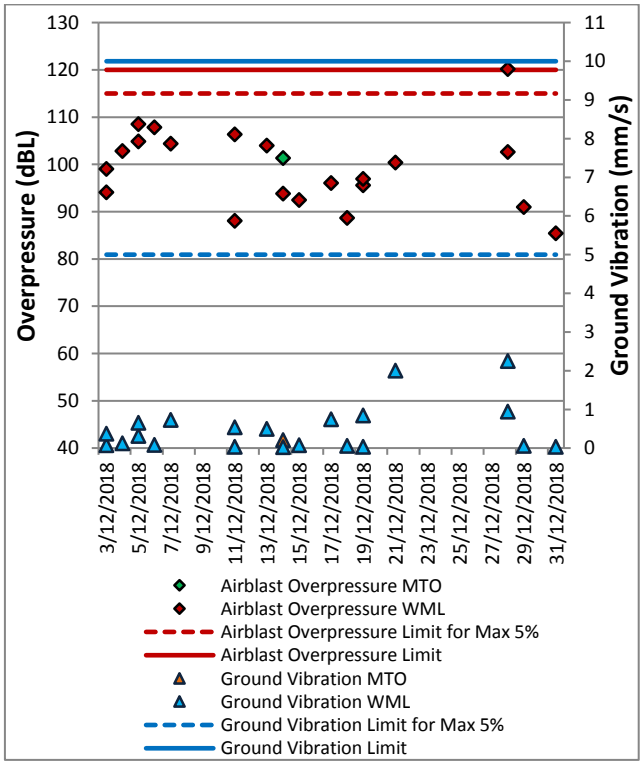


Figure 63: Bulga Village Blast Monitoring Results – December 2018

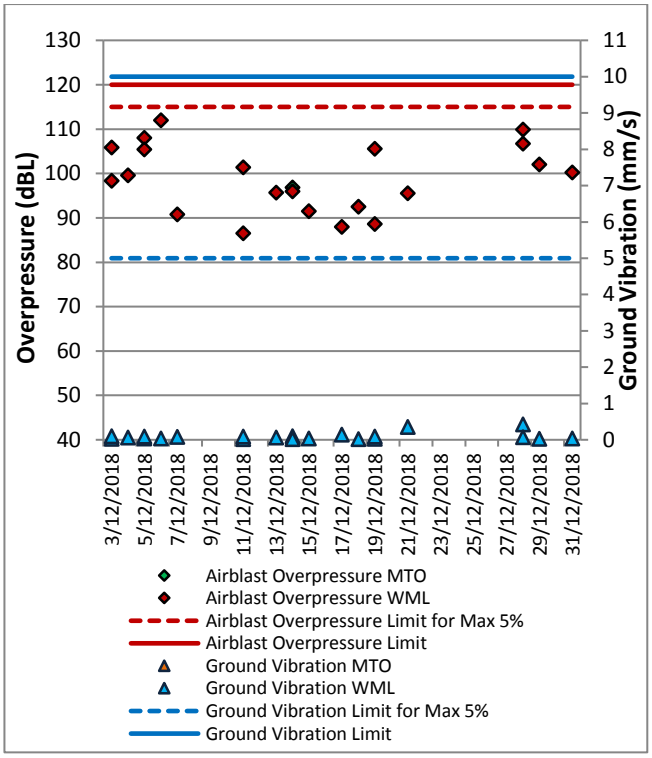


Figure 64: MTIE Blast Monitoring Results – December 2018

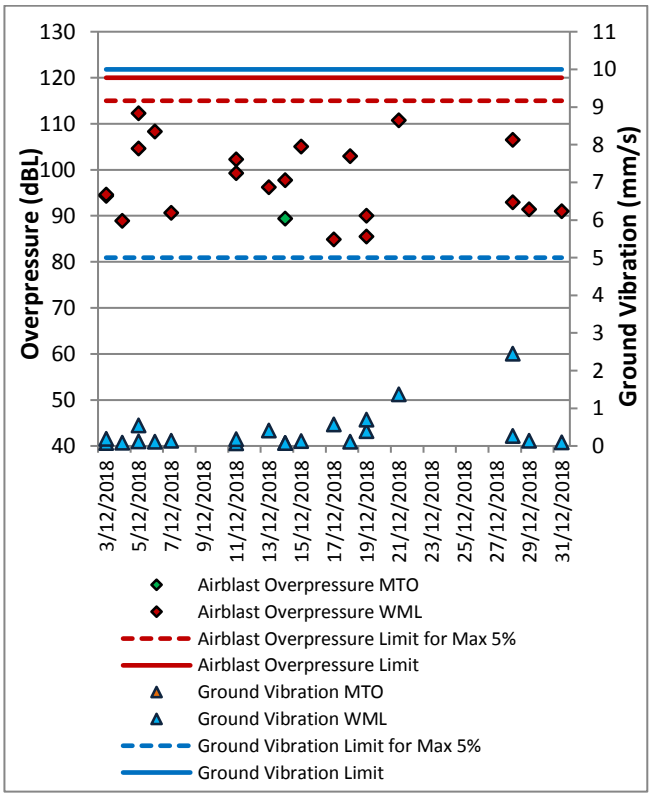


Figure 65: Warkworth Blast Monitoring Results - December 2018

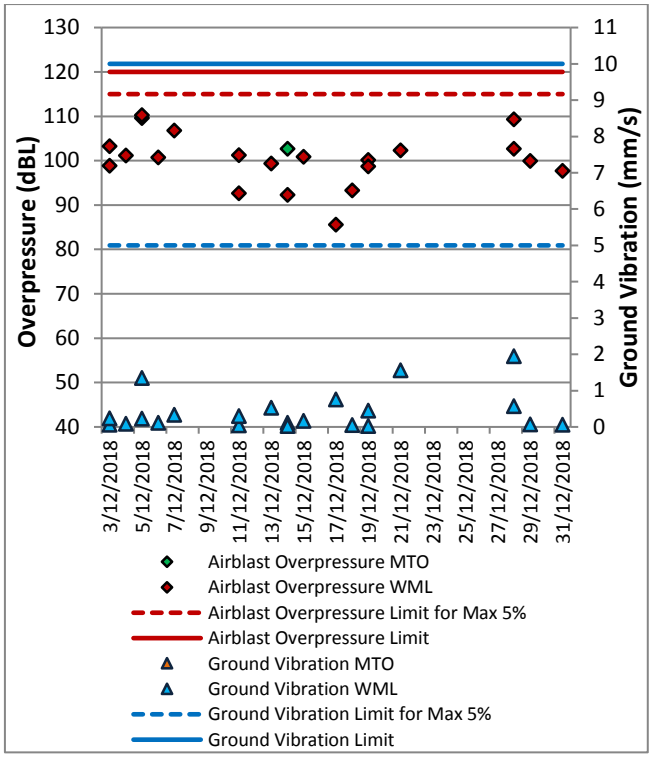


Figure 66: Wambo Road Blast Monitoring Results – December 2018

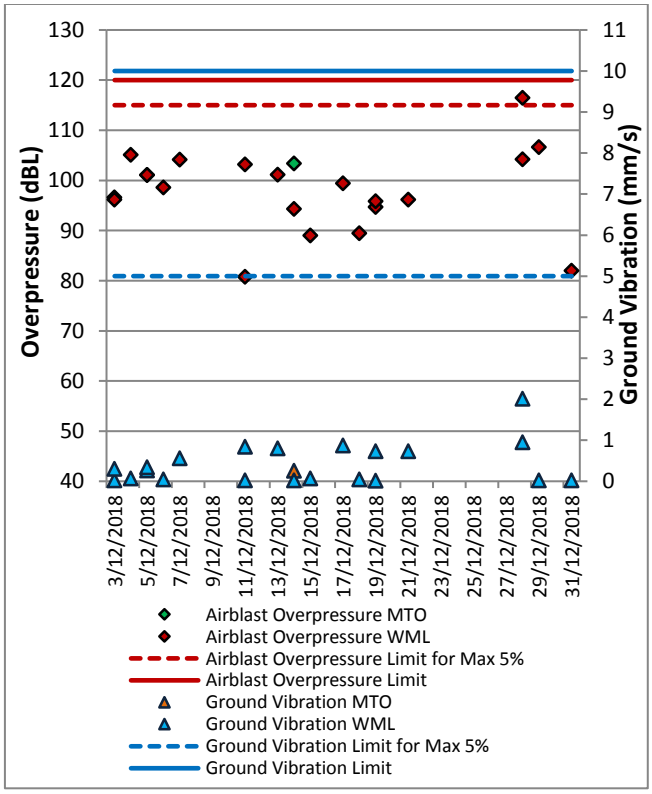


Figure 67: Wollemi Peak Road Blast Monitoring Results - December 2018

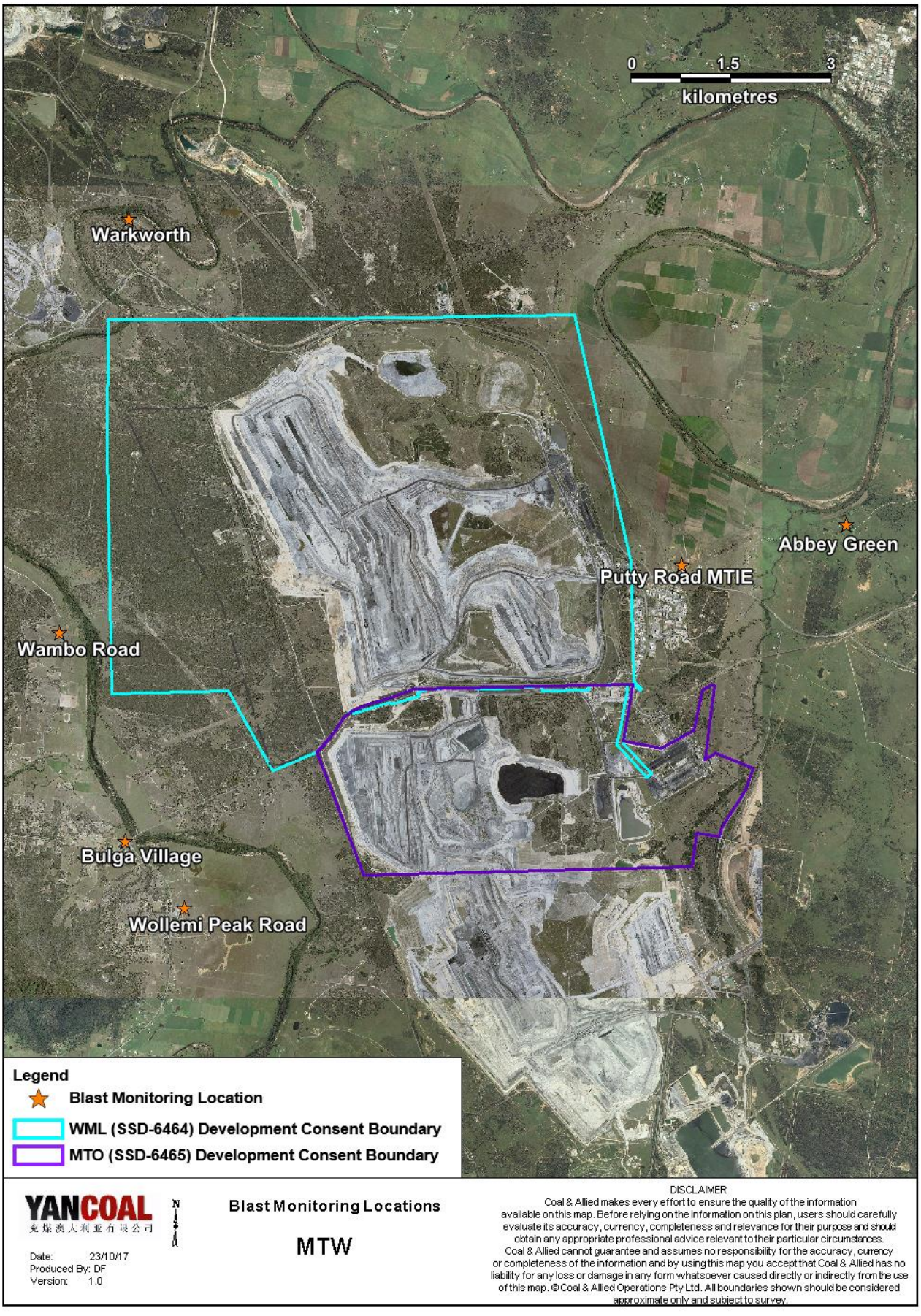


Figure 68: Blast and Vibration Monitoring Location Plan

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 69**.

5.1 Attended Noise Monitoring Results

Attended monitoring was conducted at receiver locations surrounding MTW on the night of 17/18 December 2018. 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 **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. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable; 5. Re-measure; and 6. Low frequency modifying factor applied.*

Table 6.

Table 5: $L_{Aeq,\ 15\ minute}$ Warkworth Impact Assessment Criteria – December 2018

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion (dB(A))	Criterion Applies?[1]	WML L_{Aeq} dB[2,3]	Exceedance[3,4]
Bulga RFS	17/12/2018 21:00	2.8	E	37	Yes	<30	Nil
Bulga Village	18/12/2018 0:35	3.8	D	38	No	IA	NA
Gouldsville	17/12/2018 22:32	2.6	D	38	Yes	IA	Nil
Inlet Rd	17/12/2018 21:29	2.1	E	37	Yes	37[6]	Nil
Inlet Rd West	17/12/2018 21:00	2.8	E	35	Yes	30	Nil
Long Point	17/12/2018 22:57	3.4	D	35	No	IA	NA
South Bulga	17/12/2018 21:24	2.1	E	35	Yes	IA	Nil
Wambo Road	17/12/2018 23:19	3.6	D	38	No	39[6]	NA
Wambo Road[5]	18/12/2018 0:03	3.7	D	38	No	<30	NA

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. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable;
5. Re-measure; and
6. Low frequency modifying factor applied.

Table 6: $L_{A1,\ 1\ minute}$ Warkworth Impact Assessment Criteria – December 2018

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion (dB(A))	Criterion Applies?[1]	WML L_{Aeq} dB[2,3]	Exceedance[3,4]
Bulga RFS	17/12/2018 21:00	2.8	E	47	Yes	<30	Nil
Bulga Village	18/12/2018 0:35	3.8	D	48	No	IA	NA
Gouldsville	17/12/2018 22:32	2.6	D	48	Yes	IA	Nil
Inlet Rd	17/12/2018 21:29	2.1	E	47	Yes	39	Nil

Inlet Rd West	17/12/2018 21:00	2.8	E	45	Yes	38	Nil
Long Point	17/12/2018 22:57	3.4	D	45	No	IA	NA
South Bulga	17/12/2018 21:24	2.1	E	45	Yes	IA	Nil
Wambo Road	17/12/2018 23:19	3.6	D	48	No	46	NA
Wambo Road[5]	18/12/2018 0:03	3.7	D	48	No	33	NA

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. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable; and
5. Re-measure.

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 – December 2018

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	17/12/2018 21:00	2.8	E	37	Yes	32	Nil
Bulga Village	18/12/2018 0:35	3.8	D	38	No	<30	NA
Gouldsville	17/12/2018 22:32	2.6	D	35	Yes	<25	Nil
Inlet Rd	17/12/2018 21:29	2.1	E	37	Yes	NM	Nil
Inlet Rd West	17/12/2018 21:00	2.8	E	35	Yes	IA	Nil
Long Point	17/12/2018 22:57	3.4	D	35	No	IA	NA
South Bulga	17/12/2018 21:24	2.1	E	36	Yes	30	Nil
Wambo Road	17/12/2018 23:19	3.6	D	38	No	IA	NA
Wambo Road[5]	18/12/2018 0:03	3.7	D	38	No	<30	NA

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 MTO;
3. Bold results in red are possible exceedances of relevant criteria;
4. NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable; and
5. Re-measure.

Table 8: $L_{A1,\ 1Minute}$ Mount Thorley Operations - Impact Assessment Criteria – December 2018

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	17/12/2018 21:00	2.8	E	47	Yes	41	Nil
Bulga Village	18/12/2018 0:35	3.8	D	48	No	32	NA
Gouldsville	17/12/2018 22:32	2.6	D	45	Yes	<30	Nil

Inlet Rd	17/12/2018 21:29	2.1	E	47	Yes	NM	Nil
Inlet Rd West	17/12/2018 21:00	2.8	E	45	Yes	IA	Nil
Long Point	17/12/2018 22:57	3.4	D	45	No	IA	NA
South Bulga	17/12/2018 21:24	2.1	E	46	Yes	32	Nil
Wambo Road	17/12/2018 23:19	3.6	D	48	No	IA	NA
Wambo Road[5]	18/12/2018 0:03	3.7	D	48	No	<30	NA

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 MTO;
3. Bold results in red are possible exceedances of relevant criteria;
4. NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable; and
5. Re-measure.

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 assessment for low frequency noise is shown in **Table 9**.

Table 9: Low Frequency Noise Assessment - December 2018

Location	Date and Time	Measured Site Only LA_{eq} dB (WML/MTO)	Site Only LC_{eq} dB[1] (WML/MTO)	Site Only LC_{eq}-LA_{eq} dB [1,3] (WML/MTO)	Result Max exceedance of ref spectrum dB[1,3] (WML/MTO)	Penalty dB[1] (WML/MTO)	Exceedance
Bulga RFS	17/12/2018 21:00	<30/32	NA/53	NA/NA	NA/NA	NA/NA	NA
Bulga Village	18/12/2018 0:35	IA/<30	NA/NA	NA/NA	NA/NA	NA/NA	NA
Gouldsville	17/12/2018 22:32	IA/<25	NA/NA	NA/NA	NA/NA	NA/NA	NA
Inlet Rd	17/12/2018 21:29	35/NM	54/NA	19/NA	2/NA	2/NA	NA
Inlet Rd West	17/12/2018 21:00	30/IA	49/NA	19/NA	NA/NA	NA/NA	NA
Long Point	17/12/2018 22:57	IA/IA	NA/NA	NA/NA	NA/NA	NA/NA	NA
South Bulga	17/12/2018 21:24	IA/30	NA/NA	NA/NA	NA/NA	NA/NA	NA
Wambo Road	17/12/2018 23:19	39/IA	56/NA	18/NA	2/NA	2/NA	NA
Wambo Road[4]	18/12/2018 0:03	<30/<30	NA/NA	NA/NA	NA/NA	NA/NA	NA

Notes:

1. Where it is not possible to determine the site-only result due to the presence of other low-frequency noise sources occurring during the measurement, or where criteria were not applicable due to meteorological conditions, or where site-only contributions were more than 5 dB less than the relevant LAeq criterion this is noted as NA (not available) and no further assessment has been undertaken;

2. As per NPfI, if LCeq −LAeq ≥ 15 dB further assessment of low-frequency noise required as detailed in Sections 2.4 and 3.3 of this report;

3. As per NPfI, compare measured spectrum against reference spectrum to determine if the low-frequency modifying factor is triggered and application of penalty is required; and

4. Re-measure.

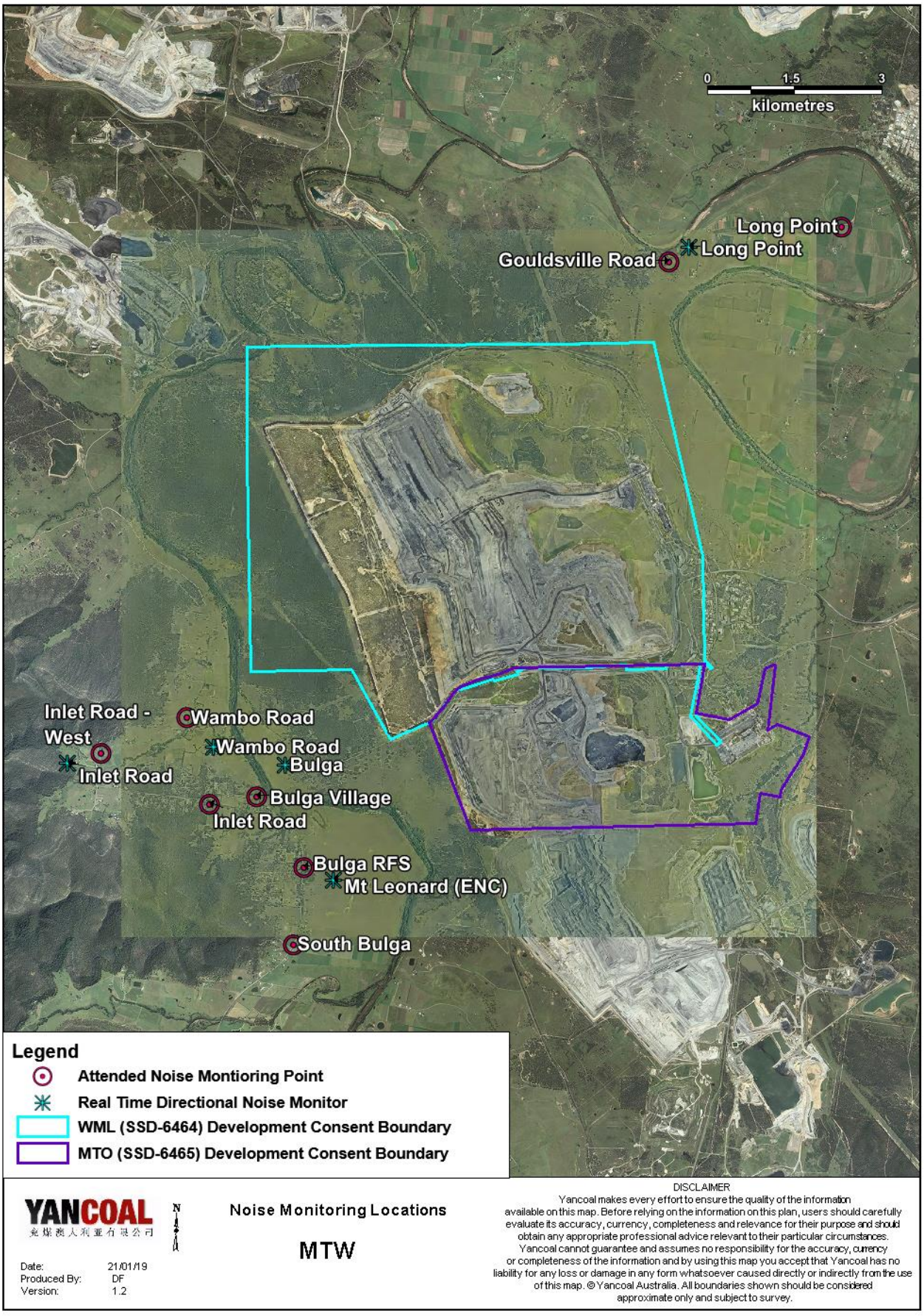


Figure 69: Noise Monitoring Location Plan

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 December are provided in **Table 10**.

.

Table 10: Supplementary Attended Noise Monitoring Data – December 2018

No. of assessments	No. of assessments > trigger	No. of nights where assessments > trigger	% greater than trigger
603	8	4	1.3

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

6.0 OPERATIONAL DOWNTIME

During December a total of 1035 hours of equipment downtime was logged in response to environmental events such as dust, noise and elevated wind impacts. Operational downtime by equipment type is shown in **Figure 70**.

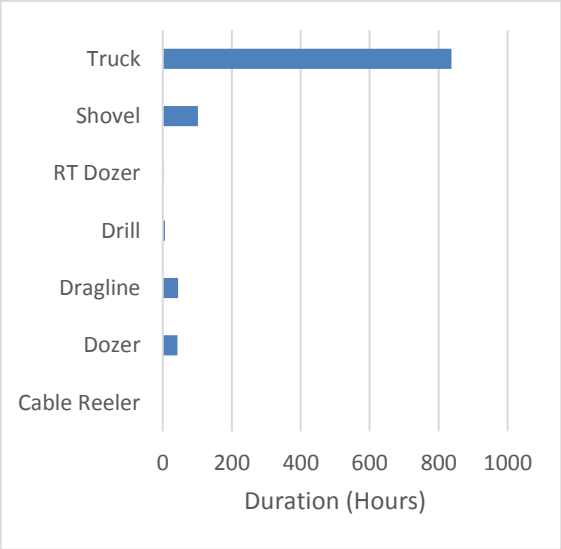


Figure 70: Operational Downtime by Equipment Type – December 2018

7.0 REHABILITATION

During December 8.0Ha of land was released, 42.3Ha was bulk shaped, 29.3Ha was topsoiled, 12.4Ha was composted, and 48.7Ha was rehabilitated. Year-to-date progress can be viewed in **Figure 71**

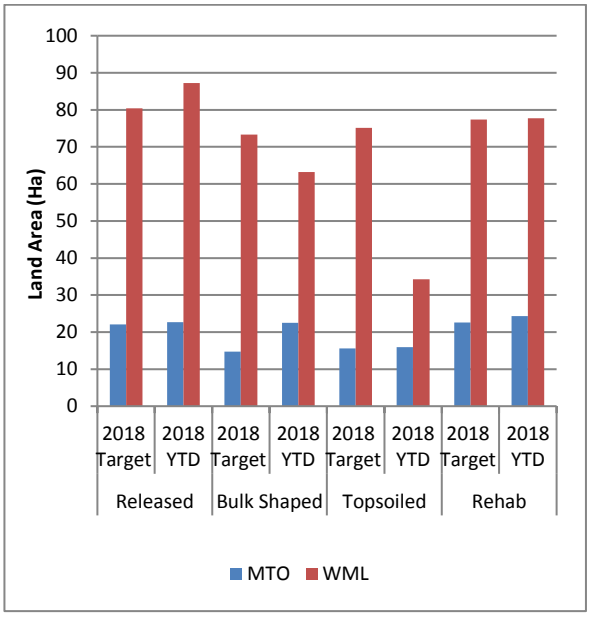


Figure 71: Rehabilitation YTD - December 2018

8.0 ENVIRONMENTAL INCIDENTS

There was one environmental incident recorded during the reporting period.

On 28 December 2018, one blast exceeded the 115dB(L) threshold for airblast overpressure at the Wollemi Peak Road blast monitor. This blast also exceeded the 120dB(L) threshold for airblast overpressure at the Bulga Village blast monitor. The exceedance was reported to the Department of Planning and Environment (DP&E) and to the Environment Protection Authority (EPA) on 28 December 2018. A written report was also provided to DP&E and to the EPA for this blast which noted that wind gusts produced substantial air pressure peaks both before and during the blast which increased air pressure levels recorded at the Bulga Village monitor. No blasts exceeded the 5mm/s threshold for ground vibration.

9.0 COMPLAINTS

During the reporting period 36 complaints were received, details of these complaints are displayed in **Figure 72** below.

	Noise	Dust	Blast	Lighting	Other	Total
January	9	6	15	1	0	31
February	7	4	3	3	0	17
March	24	0	0	3	0	27
April	8	3	9	3	2	25
May	13	11	3	3	0	30
June	14	2	8	0	0	24
July	9	12	8	0	0	29
August	22	13	5	3	0	43
December	22	9	3	5	1	40
October	16	4	0	5	0	25
November	5	8	9	2	0	24
December	22	4	6	4	0	36
Total	171	76	69	32	3	351

Figure 72: Complaints Summary - YTD December 2018

Appendix A: Meteorological Data

Table 11: Meteorological Data – Charlton Ridge Meteorological Station – December 2018

Date	Air Temperature Maximum (°C)	Air Temperature Minimum (°C)	Relative Humidity Maximum (%)	Relative Humidity Minimum (%)	Solar Radiation Maximum (W/Sq. M)	Wind Direction Average (°)	Wind Speed Average (m/sec)	Rainfall(mm)
1/12/2018	35	13	93	12	1135	142	2.4	0.2
2/12/2018	37	14	90	7	1496	240	4.5	0.0
3/12/2018	33	14	83	9	1164	200	2.8	0.0
4/12/2018	30	14	73	21	1209	172	3.0	0.0
5/12/2018	23	16	82	50	1624	128	3.6	0.0
6/12/2018	28	15	81	30	1453	122	3.1	0.0
7/12/2018	30	13	74	23	1201	122	2.9	0.0
8/12/2018	33	14	81	15	1141	140	2.3	0.0
9/12/2018	36	15	86	16	1238	123	2.2	0.0
10/12/2018	35	18	77	20	1395	163	3.2	0.0
11/12/2018	22	16	96	72	334	149	2.3	11.8
12/12/2018	24	15	92	67	1293	143	2.2	1.2
13/12/2018	32	17	95	39	1469	150	2.5	2.4
14/12/2018	26	18	93	61	1541	159	1.9	3.6
15/12/2018	25	17	97	72	959	167	2.0	24.4
16/12/2018	34	18	96	29	1201	174	2.4	0.0
17/12/2018	33	19	86	36	1369	152	2.3	1.4
18/12/2018	31	19	83	44	1474	151	3.2	0.0
19/12/2018	30	20	93	48	1486	128	2.3	2.8
20/12/2018	36	19	97	29	1413	199	3.2	4.2
21/12/2018	25	18	86	53	1266	155	3.4	0.2
22/12/2018	26	14	94	34	1422	170	4.0	0.0
23/12/2018	26	14	75	32	1496	143	3.1	0.0
24/12/2018	29	11	86	26	1270	140	2.5	0.0
25/12/2018	34	13	91	21	1138	148	2.2	0.0
26/12/2018	35	16	71	14	1139	134	2.1	0.0
27/12/2018	38	17	79	10	1110	129	2.0	0.0
28/12/2018	40	18	67	9	1136	145	2.5	0.0
29/12/2018	40	18	78	10	1127	150	2.7	0.0
30/12/2018	39	20	69	11	1122	182	3.2	0.0
31/12/2018	40	17	96	11	1235	164	2.7	38.4