Huntly Bauxite Mine – WQMS Data Review

May 2025

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Contents

1. Executive Summary

This report, prepared by RARE Environmental Pty Ltd and SciDev Pty Ltd for Alcoa, provides an analysis of turbidity data collected from Water Quality Monitoring Systems (WQMSs) deployed at the Huntly bauxite mining operations during May 2025. The primary objective of this analysis was to evaluate the quality of the data, identify potential "true" turbidity exceedance events, and support Alcoa's compliance reporting obligations under Schedule 1, Division 2, Clause 6 of the **Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023**.

The analysis focused on identifying and classifying turbidity events where levels exceeded 25 nephelometric turbidity units (NTU) for at least one hour. Events were categorized as "true" or "false" based on Alcoa's **Turbidity Event Classification Guidelines**, which distinguish actual turbidity increases (true events) from false readings caused by environmental factors such as debris, air bubbles, or fluctuating water levels.

Key findings include:

- **True Events**: Zero "true" turbidity exceedance events were identified.
- **Further Investigation**: One event was flagged for further investigation.
- **False Events**: Thirty-four 'false' events were identified, primarily attributed to factors such as debris accumulation, sensor obstructions, and water turbulence.
- **Excluded Units**: Twenty-nine WQMS units were excluded from the analysis due to invalid data caused by equipment faults or environmental interference.

The report also highlights periods of missing data, which occurred due to system logoffs, equipment faults, or unplanned shutdowns. These gaps are detailed in the report to ensure transparency in data handling.

2. Scope

RARE Environmental Pty Ltd and SciDev Pty Ltd were engaged by Alcoa to analyse turbidity data collected from the Huntly Water Quality Monitoring Systems (WQMSs). The primary objective of this engagement is to assess the quality of the collected data and identify potential "true" turbidity events. This analysis supports Alcoa's reporting obligations under *Schedule 1, Division 2, Clause 6 of the Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023*.

3. Introduction

3.1. Background

Alcoa of Australia Ltd (Alcoa) operates two bauxite mines, Huntly and Willowdale, approximately 100 km southeast of Perth, Western Australia. These mining operations are subject to environmental controls mandated by the *Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023*.

Under this Exemption Order, Alcoa is required to implement drainage control measures and monitor effectiveness in water bodies within and downstream of mining operations. Turbidity, a critical water quality parameter, is monitored using Water Quality Monitoring Systems (WQMSs), to detect deviations and identify high-turbidity events.

Alcoa is obligated to report monthly on-stream turbidity, including the identification and classification of any “true” high-turbidity exceedance events. (Refer to Appendix B for the site map showing WQMS locations.)

3.2. Monitoring requirements

Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023 specifies that a drainage incident occurs when:

> *a) runoff from a disturbance area enters the surrounding environment, resulting in surface water turbidity of at least 25 NTU for a duration of at least one hour; or*
>
> *b) a discharge from containment infrastructure includes, or may include, environmentally hazardous material.*

Trigger levels for drainage incidents are outlined in *Schedule 1* of the Exemption Order. To meet these requirements, Alcoa has developed "Turbidity Event Classification Guidelines" which define a true turbidity exceedance event as a WQMS recording turbidity levels of at least 25 NTU for a period exceeding one hour.

3.3. Water Quality Management Systems (WQMSs)

During the May 2025 monitoring period, forty-three WQMS units were deployed to monitor turbidity levels in streams subject to surface water runoff within and downstream of Huntly mining operations.

Each WQMS unit consists of the following components:

Aquas SMR10 Turbidity Probe

> Positioned at a 90-degree angle to water flow, each probe is equipped with an automatic lens wiper and a guard to protect against larger debris.

Data Taker DT82 Logger

> Records data locally every 6 seconds, with 6-minute averages transmitted via IoT-enabled modems to a cloud-based platform.

Float Switch

Detects whether the sensor is submerged, or the stream is dry.

3.4. Purpose

This report aims to analyse turbidity data collected during May 2025, focusing on the identification and classification of "true" turbidity exceedance events based on Alcoa's Turbidity Event Classification Guidelines.

3.5. Exclusions

This report is not intended as:

- An assessment of the WQMS network or Alcoa's compliance with relevant legislation and requirements.
- An evaluation of the suitability of the trigger levels or event classification procedures adopted by Alcoa.

3.6. Abbreviations

	Term
IoT	Internet of Things
NTU	Nephelometric Turbidity Units
WQMS	Water Quality Management System

4. Methodology

4.1. WQMS Locations

A site map showing the WQMSs locations is provided in Appendix B.

4.2. Data Review

Data recorded by the WQMS Units was reviewed and potential events where turbidity levels exceeded 25 NTU for at least one hour. Each potential event was categorised as either 'true 'or 'false'.

4.2.1. True Turbidity Exceedance Events

These events are caused by an actual increase in stream turbidity. Per Alcoa's "Turbidity Event Classification Guidelines" true exceedance events typically exhibit:

- A sharp, sudden incline in turbidity levels.
- A return to baseline turbidity levels in a pattern resembling a normal (Gaussian) distribution.

Figure 1 Typical 'true' exceedance event showing the sharp incline and gradual return to background levels.

4.2.2. False Turbidity Exceedance Events

These events are caused by factors unrelated to actual turbidity increase, such as:

- Organic debris (e.g., leaves, sticks, algae) obstructing the sensor
- Air bubbles or water turbulence near the sensor
- Fluctuating water levels intermittently covering and uncover the sensor lens.

False events typically exhibit sharp inclines and declines without the characteristic bell curve shape of true events.

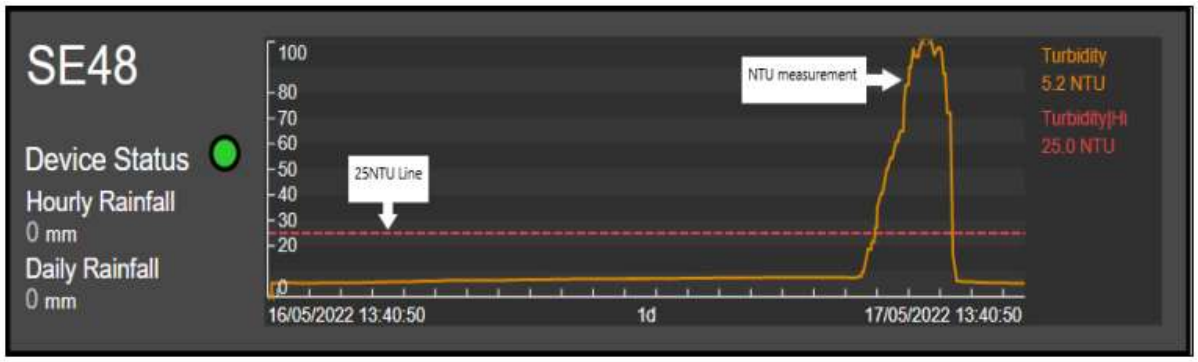

Figure 2 Typical 'false' exceedance event showing both a sharp incline and decline

4.2.3. Missing Data

Missing data occurs when a WQMS unit fails to record information, this can occur from unexpected system logoffs, equipment faults, or unplanned shutdowns.

5. Results and Discussion

5.1. Events

Table 1 provides a summary of identified events. Table 2 offers detailed information about each event.

Table 1 Events Summary

Category	# of events
Flagged for further investigation	1
False	34

Table 2 Events Details

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
HUN-2505-001	SE02T	'False'	9/05/2025 18:30	11/05/2025 8:48	1d, 14hr, 17min	66.12	39.37
HUN-2505-002	SE02T	'False'	18/05/2025 4:00	20/05/2025 16:00	2d, 12hr	82.24	46.58
HUN-2505-003	SE03T	'False'	7/05/2025 12:54	7/05/2025 15:18	2hr, 24min	25.73	25.43
HUN-2505-004	SE03T	'False'	7/05/2025 15:30	8/05/2025 11:48	20hr, 18min	70.58	27.14
HUN-2505-005	SE03T	'False'	16/05/2025 8:18	16/05/2025 11:00	2hr, 41min	71.02	47.63
HUN-2505-006	SE03T	'False'	18/05/2025 3:54	18/05/2025 5:24	1hr, 30min	95.91	64.30
HUN-2505-007	SE03T	'False'	18/05/2025 7:36	18/05/2025 9:30	1hr, 54min	107.95	68.90
HUN-2505-008	SE03T	'False'	19/05/2025 1:06	19/05/2025 2:30	1hr, 23min	103.59	70.23
HUN-2505-009	SE03T	'False'	20/05/2025 12:33	20/05/2025 14:16	1hr, 43min	57.72	36.50
HUN-2505-010	SE03T	'False'	20/05/2025 21:39	20/05/2025 22:51	1hr, 12min	114.96	67.26
HUN-2505-011	SE03T	'False'	21/05/2025 12:11	21/05/2025 13:12	1hr	121.76	65.93
HUN-2505-012	SE03T	'False'	25/05/2025 11:09	25/05/2025 13:04	1hr, 55min	100.19	75.27
HUN-2505-013	SE03T	'False'	25/05/2025 22:10	26/05/2025 0:05	1hr, 55min	104.36	65.15
HUN-2505-014	SE03T	'False'	27/05/2025 15:11	27/05/2025 16:35	1hr, 24min	121.62	94.71
HUN-2505-015	SE03T	'False'	27/05/2025 19:07	27/05/2025 20:32	1hr, 24min	127.37	81.76
HUN-2505-016	SE03T	'False'	28/05/2025 2:11	28/05/2025 3:12	1hr	98.77	61.28

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
HUN-2505-017	SE03T	'False'	28/05/2025 5:07	28/05/2025 6:32	1hr, 24min	97.31	52.66
HUN-2505-018	SE03T	'False'	28/05/2025 8:09	28/05/2025 9:34	1hr, 24min	98.21	52.32
HUN-2505-019	SE05T	'False'	4/05/2025 22:30	5/05/2025 3:30	4hr, 59min	39.34	30.57
HUN-2505-020	SE05T	'False'	5/05/2025 16:00	6/05/2025 13:42	21hr, 42min	93.26	46.66
HUN-2505-021	SE05T	'False'	11/05/2025 2:48	11/05/2025 6:06	3hr, 17min	138.43	62.45
HUN-2505-022	SE05T	'False'	13/05/2025 21:06	13/05/2025 22:18	1hr, 12min	112.68	78.01
HUN-2505-023	SE05T	'False'	16/05/2025 20:00	17/05/2025 15:42	19hr, 42min	212.85	124.48
HUN-2505-024	SE05T	'False'	22/05/2025 17:42	22/05/2025 21:54	4hr, 12min	289.57	181.37
HUN-2505-025	SE05T	'False'	24/05/2025 12:24	24/05/2025 23:12	10hr, 48min	151.07	31.84
HUN-2505-026	SE05T	'False'	29/05/2025 19:57	30/05/2025 6:39	10hr, 42min	79.19	37.07
HUN-2505-027	SE06T	'False'	1/05/2025 0:00	5/05/2025 13:06	4d, 13hr, 5min	614.80	166.15
HUN-2505-028	SE06T	'False'	11/05/2025 18:06	11/05/2025 19:48	1hr, 42min	28.74	26.66
HUN-2505-029	SE06T	'False'	11/05/2025 20:06	11/05/2025 21:24	1hr, 17min	32.21	27.97
HUN-2505-030	SE06T	'False'	11/05/2025 23:48	12/05/2025 1:12	1hr, 24min	32.69	28.62
HUN-2505-031	SE06T	'False'	12/05/2025 1:24	14/05/2025 10:36	2d, 9hr, 12min	261.28	43.58
HUN-2505-032	SE06T	'False'	14/05/2025 13:06	14/05/2025 23:00	9hr, 53min	45.59	28.19
HUN-2505-033	SE06T	'False'	16/05/2025 5:36	17/05/2025 14:54	1d, 9hr, 18min	458.94	94.20
HUN-2505-034	SE06T	'False'	22/05/2025 22:36	23/05/2025 1:06	2hr, 29min	37.36	33.10
HUN-2505-035	SE61T	Additional Investigation Required	30/05/2025 19:48	31/05/2025 0:00	4hr, 12min	48.00	32.54

* End date and time provided by Alcoa

5.2. Additional Investigation

One event was flagged for additional investigation.

5.2.1. Additional Investigation

The event, occurring between 19:48 and 23:59 on the 30th of May exhibits a sharp, incline in turbidity levels followed by a gradual return to baseline levels in a pattern resembling a normal (Gaussian) distribution as shown in Figure 3 below. This criteria is in line with a typical true event as per the 'Turbidity Event Classification Guidelines'.

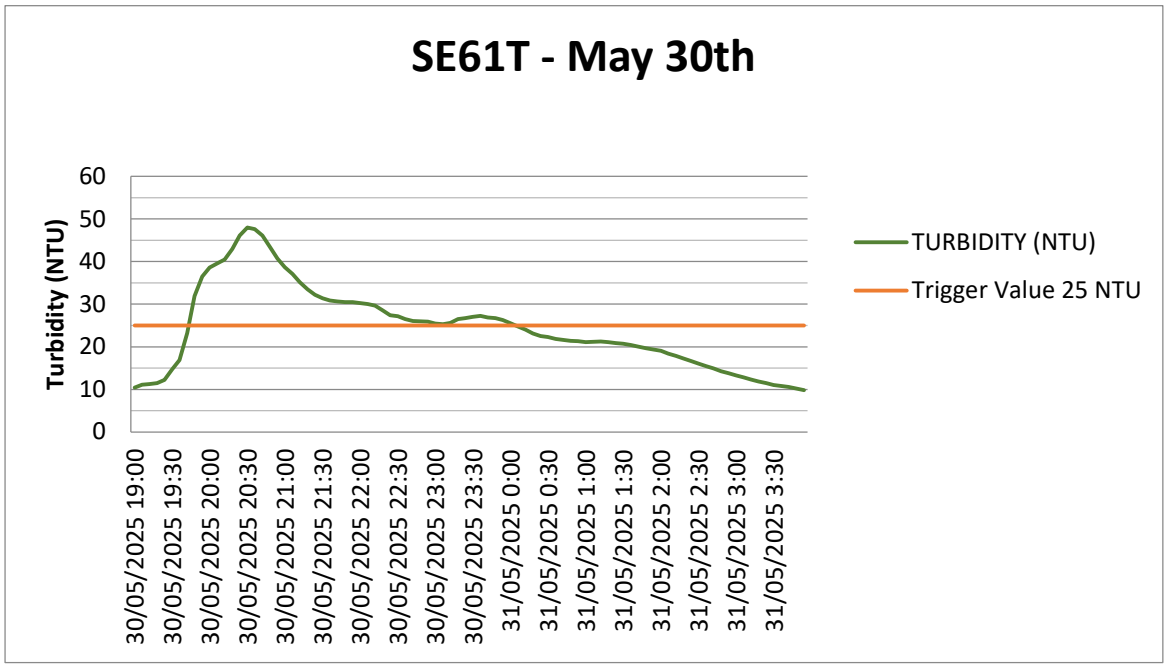

Figure 3 HUN-2505-035

Further investigation into the event and location has determined the following

- Rainfall occurred in the 12 hours prior to the event however, an inspection conducted on the 01/06/2025 confirmed the sensor was affected by algal growth, flow conditions were low, and the stream appeared clear with no signs of sediment build up.
- This location has had recuring issues with algal growth causing erroneous data.

Field notes provided by Alcoa are included below.

"Data trend shows a gradual increase in turbidity values following 2.6mm of rainfall in the preceding 12 hours (with a total of 8.4mm in the preceding 24 hours), followed by a gradual decline. The WQMS was inspected on 1/06/2025; the stream was low-flowing and clear, sensor was impacted by algae. The placement of this WQMS is scheduled to be relocated due to concerns about false data attributed to moderately high levels of BOD and the year-round presence of red algae. The sensor is situated below a precipice, which is likely to be impacted

by higher turbidity as stream flow increases. The SE61T catchment inspection was completed, no mining-related contributions were found."

Based on the field notes, recurring issues at this location and no evidence of increase sediment loading at the site this event is considered a false event. No additional investigation is required.

5.3. True Event(s)

Zero 'True' turbidity events were identified during the reporting period.

5.4. False Event(s)

Thirty four 'False' events were identified during the reporting period. Rationale on potential causes is summarised below.

Table 3 False Events Rationale

Event ID	Monitor ID	Rationale	Field Notes
HUN-2505-001	SE02T	This event is marked by a gradual increase and a rapid decrease in turbidity. This is indicative of a false event.	Site visited 11/05/2025. Stream is low, flowing and heavily impacted by red algae. NTU arrival 56.0942, post clean 1.8887. Data trend indicates false event.
HUN-2505-002	SE02T	This event is marked by a gradual increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on 20/05/2025. Stream clear, stream bed and sensor impacted by algae. Foam and organic matter floating upstream of sensor. Cleaned sensor and returned into stream. Arrival NTU 74.06, post clean 2.14 NTU.
HUN-2505-003	SE03T	This event is marked by a gradual increase with multiple peaks. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-004	SE03T	This event is marked by a rapid increase and a rapid decrease in turbidity. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-005	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity with multiple peaks. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-006	SE03T	This event is marked by a gradual increase with multiple peaks. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-007	SE03T	This event is marked by a gradual increase with multiple peaks. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025

Event ID	Monitor ID	Rationale	Field Notes
HUN-2505-008	SE03T	This event is marked by a gradual increase with multiple peaks. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-009	SE03T	This event is marked by a gradual increase with multiple peaks. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-010	SE03T	This event is marked by a gradual increase with multiple peaks followed by a rapid decrease. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-011	SE03T	This event is marked by a gradual increase with multiple peaks followed by a rapid decrease. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-012	SE03T	This event is marked by several rapid increases in turbidity with multiple peaks followed by a rapid decrease. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-013	SE03T	This event is marked by several rapid increases in turbidity with multiple peaks followed by a rapid decrease. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-014	SE03T	This event is marked by several rapid increases in turbidity with multiple peaks followed by a rapid decrease. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-015	SE03T	This event is marked by several rapid increases in turbidity with multiple	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025

Event ID	Monitor ID	Rationale	Field Notes
		peaks followed by a rapid decrease. This is indicative of a false event.	
HUN-2505-016	SE03T	This event is marked by a rapid increase and a rapid decrease in turbidity. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-017	SE03T	This event is marked by a rapid increase and a rapid decrease in turbidity. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-018	SE03T	This event is marked by a rapid increase and a rapid decrease in turbidity. This is indicative of a false event.	Intermittent false data spikes due to sensor calibration fault. Resolved on 28/05/2025
HUN-2505-019	SE05T	This event is marked by a gradual increase and a rapid decrease in turbidity with multiple peaks. This is indicative of a false event.	Data trend indicates a gradual incline in turbidity levels corresponding with increase in rainfall and stream flow. At 33:30 5/05/2025, turbidity levels decreased to 20-25 NTU but rose again to over 25 NTU by 4:00 PM. The site was inspected on 6/06/2025, the stream bed was heavily impacted by algae and debris, which easily dispersed through the water when disturbed. The sensor was significantly affected by algae and debris, showing a turbidity value of 68.7 NTU upon arrival, which dropped to 2.4 NTU after cleaning. The data trend over the two-day period indicates a false event, turbidity levels remained stable at ~2.5 NTU in the hours following lens cleaning.
HUN-2505-020	SE05T	This event is marked by a gradual increase and a rapid decrease in turbidity with multiple peaks. This is indicative of a false event.	Data trend indicates a gradual incline in turbidity levels corresponding with increase in rainfall and stream flow. At 33:30 5/05/2025, turbidity levels decreased to 20-25 NTU but rose again to over 25 NTU by 4:00 PM. The site was inspected on 6/06/2025, the stream bed was heavily impacted by algae

Event ID	Monitor ID	Rationale	Field Notes
			and debris, which easily dispersed through the water when disturbed. The sensor was significantly affected by algae and debris, showing a turbidity value of 68.7 NTU upon arrival, which dropped to 2.4 NTU after cleaning. The data trend over the two-day period indicates a false event, turbidity levels remained stable at ~2.5 NTU in the hours following lens cleaning.
HUN-2505-021	SE05T	This event is marked by a gradual increase and a rapid decrease in turbidity with multiple peaks. This is indicative of a false event.	Data trend indicates false event, potentially debris caught on the lens. Stream bed is heavily impacted by debris/algae
HUN-2505-022	SE05T	This event is marked by sporadic peaks. This is indicative of a false event.	Data trend indicates false event, potentially debris caught on the lens. Stream bed is heavily impacted by debris/algae
HUN-2505-023	SE05T	This event is marked by sporadic peaks. This is indicative of a false event.	Data trend indicates false event, potentially debris caught on the lens. Stream bed is heavily impacted by debris/algae
HUN-2505-024	SE05T	This event is marked by sporadic peaks. This is indicative of a false event.	Dat trend indicates false event, sharp incline and decline, potentially debris on the lens.
HUN-2505-025	SE05T	This event is marked by a rapid increase in turbidity followed by a rapid decrease. This is indicative of a false event.	The data trend suggests a false event, showing a gradual rise in turbidity levels followed by an erratic pattern and a sharp decline.
HUN-2505-026	SE05T	This event is marked by sporadic peaks. This is indicative of a false event.	Exceedance on Pi following a 8.8mm rain. The event was considered true and not mining related. Upon arrival, the stream was flowing. There was heavy algae growth in stream bed and on surrounding vegetation. Cleaned sensor and returned into stream. NTU on arrival 7.22 post clean 7.00 NTU. No mining related disturbance. All debris looked natural.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2505-027	SE06T	This event is marked by a gradual increase and a rapid decrease in turbidity with multiple peaks. This is indicative of a false event.	Data trend indicates false event. Site inspected on 5/05/2025, stream very low and sensor impacted by stream bed sediment /debris. Turbidity reading on arrival 188NTU which dropped to 0.4NTU after lens cleaning.
HUN-2505-028	SE06T	This event is marked by sporadic peaks. This is indicative of a false event.	Data trend indicates false event. Site inspected on 17/05/2025, stream very low and sensor impacted by stream bed sediment /debris. Turbidity reading on arrival 383NTU which dropped to 0.4NTU after lens cleaning.
HUN-2505-029	SE06T	This event is marked by sporadic peaks. This is indicative of a false event.	Data trend indicates false event. Site inspected on 17/05/2025, stream very low and sensor impacted by stream bed sediment /debris. Turbidity reading on arrival 383NTU which dropped to 0.4NTU after lens cleaning.
HUN-2505-030	SE06T	This event is marked by sporadic peaks. This is indicative of a false event.	Data trend indicates false event. Site inspected on 17/05/2025, stream very low and sensor impacted by stream bed sediment /debris. Turbidity reading on arrival 383NTU which dropped to 0.4NTU after lens cleaning.
HUN-2505-031	SE06T	This event is marked by a gradual increase and a rapid decrease in turbidity with multiple peaks. This is indicative of a false event.	Data trend indicates false event. Site inspected on 17/05/2025, stream very low and sensor impacted by stream bed sediment /debris. Turbidity reading on arrival 383NTU which dropped to 0.4NTU after lens cleaning.
HUN-2505-032	SE06T	This event is marked by sporadic peaks. This is indicative of a false event.	Data trend indicates false event. Site inspected on 17/05/2025, stream very low and sensor impacted by stream bed sediment /debris. Turbidity reading on arrival 383NTU which dropped to 0.4NTU after lens cleaning.
HUN-2505-033	SE06T	This event is marked by a gradual increase and a rapid decrease in turbidity with multiple peaks. This is indicative of a false event.	Data trend indicates false event. Site inspected on 17/05/2025, stream very low and sensor impacted by stream bed sediment /debris. Turbidity reading on arrival 383NTU which dropped to 0.4NTU after lens cleaning.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2505-034	SE06T	This event is marked by sporadic peaks. This is indicative of a false event.	Stream is shallow, and the sensor is positioned close to the stream bed surrounded by sediment and debris. The turbidity and rainfall data indicate a false event; turbidity levels increased from 11 NTU to over 25 NTU as rainfall began. After an additional 4mm of rainfall, turbidity decreased, likely due to the increased streamflow flushing the sediment. Site inspected on 25/05/2025. Turbidity reading on arrival was 13NTU which dropped to 1.2 after cleaning.

5.5. Excluded WQMS Units

Twenty-nine WQMS Units were excluded from analysis due to erroneous data. Alcoa confirmed the invalidity of data recorded from these units and provided commentary on the condition of each.

Table 4 Excluded WQMS Units

Unit	Dates	Comments
DB01T	01/05/2025-31/05/2025	Stream dry as of 3/01/2025
DB02T	01/05/2025-31/05/2025	Stream dry as of 15/02/2025
FPWR1	01/05/2025-31/05/2025	Stream dry as of 1/01/2025. Monitor offline due to fault.
ND04T	01/05/2025-31/05/2025	Stream dry as of 1/01/2025
ND12T	01/05/2025-31/05/2025	Stream dry as of 21/12/2024
ND13T	01/05/2025-31/05/2025	Unit inactive pending equipment repair up to 12/05/2025. Site inspected on 12/05/2025, unit vandalised and parts stolen. Unit scheduled for replacement 4/06/2025
PD02T	01/05/2025-31/05/2025	Awaiting water corp approval to access Pipe head catchment
PD03T	01/05/2025-31/05/2025	Awaiting water corp approval to access Pipe head catchment
SE01T	01/05/2025-31/05/2025	Stream dry as of 4/01/2025
SE03INV3	01/05/2025-31/05/2025	Stream dry as of 28/11/2024. Sensor reading high values. Fault repairs have been scheduled.
SE07T	01/05/2025-31/05/2025	Stream dry as of 28/11/2024
SE08T	01/05/2025-31/05/2025	Stream dry as of 31/01/2025
SE09T	01/05/2025-31/05/2025	Stream dry as of 5/01/2025
SE10T	01/05/2025-31/05/2025	Stream dry as of 5/01/2025
SE11T	01/05/2025-31/05/2025	Stream dry as of 28/10/2024
SE12INV	01/05/2025-31/05/2025	Stream dry as of 5/11/2024
SE12T	01/05/2025-31/05/2025	Stream dry as of 8/12/2024
SE15T	01/05/2025-31/05/2025	Stream dry as of 16/11/2024
SE22T	01/05/2025-31/05/2025	Stream dry as of 14/12/2024
SE23T	01/05/2025-31/05/2025	Stream dry as of 15/10/2024
SE24T	01/05/2025-31/05/2025	Stream dry as of 2/11/2024
SE25T	01/05/2025-31/05/2025	Stream dry as of 2/11/2024
SE26T	01/05/2025-31/05/2025	Stream dry as of 15/10/2024
SE34T	01/05/2025-31/05/2025	Stream dry as of 28/12/2024
SE36T	01/05/2025-31/05/2025	Stream dry as of 5/01/2025
SE48T	01/05/2025-31/05/2025	Stream dry as of 23/12/2024
SE60T	01/05/2025-31/05/2025	Stream dry as of 5/12/2024
SE62T	01/05/2025-31/05/2025	Stream dry as of 28/12/2024
SN07T	01/05/2025-31/05/2025	Stream dry as of 26/01/2025

5.6. Missing Data

Periods of missing data are detailed in Table 5.

Table 5 Missing Data Summary

Missing Data ID	Unit	Start	End	Comments
MD-2505-001	SE06T	1/05/2025 7:48	4/05/2025 11:24	Data loss due to system fault
MD-2505-002	SE06T	6/05/2025 0:54	8/05/2025 12:18	Data loss due to system fault
MD-2505-003	SE06T	10/05/2025 7:42	11/05/2025 15:24	Data loss due to system fault
MD-2505-004	SE06T	13/05/2025 2:24	14/05/2025 10:06	Data loss due to system power failure. Additional solar array installed
MD-2505-005	SE61T	19/05/2025 7:48	26/05/2025 12:00	Data gap 19/05/2025 7:48 to 26/05/2025 due to system malfunction.
MD-2505-006	ND06T	16/04/2025	15/05/2025 0:00	Data loss 16/04/2025 to 15/05/2025 due to system malfunction.
MD-2505-007	ND06T	23/05/2025 3:24	26/05/2025 10:24	Data loss 23/05/2025 3:24 to 26/05/2025 due to system malfunction. Unit repaired on 26/05/2025
MD-2505-008	ND07T	7/05/2025 3:15	7/05/2025 11:32	8 Hours, 17 minutes data loss on 7/05/2025 due to system power fault
MD-2505-009	ND07T	10/05/2025 19:14	12/05/2025 19:13	System fault
MD-2505-010	SE02T	01/05/2025	2/05/2025 13:30	Sensor fault 1/05/2025 to 2/05/2025. Sensor replaced on 2/05/2025
MD-2505-011	SE03INV1	10/05/2025 19:14	12/05/2025 19:13	system power failure. Scheduled for additional solar array installation
MD-2505-012	SE03INV1	23/05/2025 21:51	27/05/2025 14:53	System power failure
MD-2505-013	SE03INV1	28/05/2025 20:35	30/05/2025 13:59	System power failure
MD-2505-014	SE03INV1	30/05/2025 23:59	31/05/2025 23:59	System power failure

MD-2505-001	SE51T	10/05/2025 19:13	12/05/2025 19:18	System Fault

6. Appendices

Appendix A. Huntly Raw WQMS Data

Date	Huntly WQMS Data – May 2025 - Events with turbidity > 25 NTU for an hour or more																
	DB01T	DB02T	FPWR1	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T
1/05/2025															**1**		
2/05/2025																	
3/05/2025																	
4/05/2025														**1**			
5/05/2025														**1**			
6/05/2025																	
7/05/2025													**2**				
8/05/2025																	
9/05/2025												**1**					
10/05/2025																	
11/05/2025														**1**	**3**		
12/05/2025															**2**		
13/05/2025														**1**			
14/05/2025															**1**		
15/05/2025																	
16/05/2025													**1**	**1**	**1**		
17/05/2025																	
18/05/2025												**1**	**2**				
19/05/2025													**1**				
20/05/2025													**2**				
21/05/2025													**1**				
22/05/2025														**1**	**1**		
23/05/2025																	
24/05/2025													**2**	**1**			
25/05/2025																	
26/05/2025													**2**				
27/05/2025													**3**				
28/05/2025																	
29/05/2025														**1**			
30/05/2025																	
31/05/2025																	

Note: False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text

Date	Huntly WQMS Data -May 2025 - Events with turbidity > 25 NTU for an hour or more																
	SE09T	SE10T	SE11T	SE12T	SE12INV	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T
1/05/2025																	
2/05/2025																	
3/05/2025																	
4/05/2025																	
5/05/2025																	
6/05/2025																	
7/05/2025																	
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25/05/2025																	
26/05/2025																	
27/05/2025																	
28/05/2025																	
29/05/2025																	
30/05/2025															**1**		
31/05/2025																	

Note: False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text

Date	Huntly WQMS Data – May 2025 - Events with turbidity > 25 NTU for an hour or more																
	SE22T	SE23T	SE25T	SE24T	SE03INV1	SE03INV3	SE24T										
1/05/2025																	
2/05/2025																	
3/05/2025																	
4/05/2025																	
5/05/2025																	
6/05/2025																	
7/05/2025																	
8/05/2025																	
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26/05/2025																	
27/05/2025																	
28/05/2025																	
29/05/2025																	
30/05/2025																	
31/05/2025																	

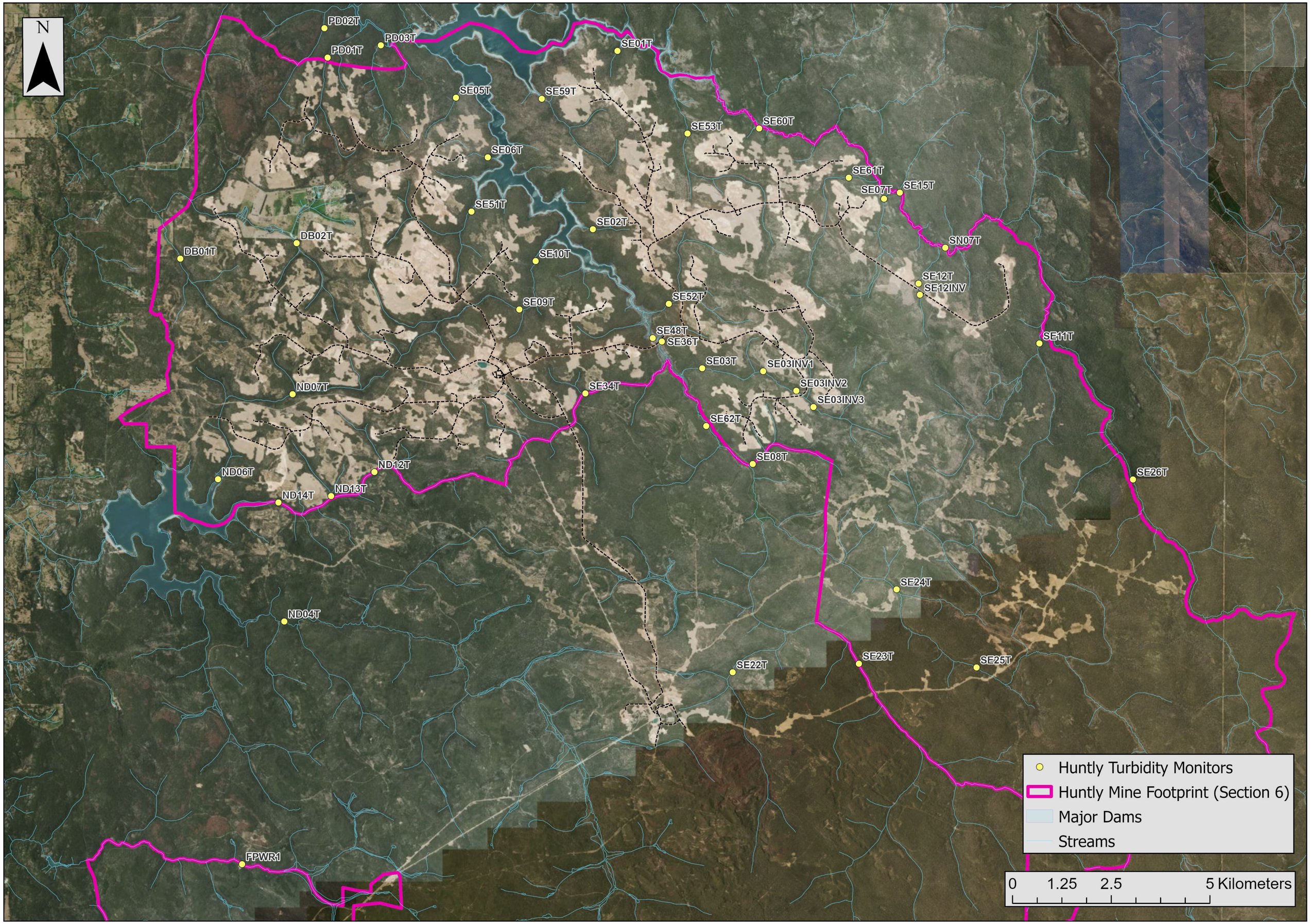
Note: False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text

Date	Huntly WQMS Data – May 2025 - Turbidity (Daily Average, NTU)																
	DB01T	DB02T	FPWR1	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T
1/05/2025						3.08			3.90	6.14		0.01	7.67	4.37	56.68		
2/05/2025						3.50			1.52	6.79		0.71	7.50	7.79			
3/05/2025						7.48			1.84	8.23		2.18	8.95	9.45			
4/05/2025						3.50			1.64	15.46		1.69	10.08	10.42	194.18		
5/05/2025						3.08			1.64	6.76		1.70	16.66	28.20	113.09		
6/05/2025						3.10			1.87	6.61		2.07	20.76	32.78	0.91		
7/05/2025						1.69			1.63	7.69		3.32	25.16	2.58			
8/05/2025						0.79			30.00	5.82		8.02	14.27	3.32	6.32		
9/05/2025						0.79			1.67	2.50		20.57	1.48	4.20	10.79		
10/05/2025						0.78			1.62	2.56		37.72	1.85	3.26	15.49		
11/05/2025									1.30	2.82		19.98	2.32	15.77	26.51		
12/05/2025						0.85			2.06	3.06		1.89	2.58	5.93	37.67		
13/05/2025						0.86			0.84	3.37		2.14	2.80	18.72	60.10		
14/05/2025						0.91			1.02	4.60		3.05	3.65	3.51	28.08		
15/05/2025					0.95	0.90			0.84	2.89		5.14	3.14	3.60	19.58		
16/05/2025					0.98	0.89			0.84	2.73		8.41	9.72	21.92	44.79		
17/05/2025					0.94	0.91			0.86	3.07		16.76	4.17	87.86	91.62		
18/05/2025					0.97	0.92			0.83	3.35		31.69	17.88	2.59	0.54		
19/05/2025					0.98	1.66			0.83	3.43		46.26	22.73	2.71	0.74		
20/05/2025					1.00	0.98			0.84	3.03		43.33	23.07	2.94	1.35		
21/05/2025					1.03	0.97			1.18	3.43		2.10	27.60	3.60	2.84		
22/05/2025					1.06	1.09			0.86	3.41		2.67	34.86	37.58	12.16		
23/05/2025					1.25	1.10			0.96	3.60		3.42	1.23	9.59	9.77		
24/05/2025						1.04			0.85	3.50		3.41	27.44	26.71	3.60		
25/05/2025						1.21			1.11	3.48		7.99	20.58	5.73	5.00		
26/05/2025					0.99	1.02			0.88	2.54		6.41	29.72	2.97	0.52		
27/05/2025					1.01	0.98			0.85	2.49		1.36	41.05	4.23	0.58		
28/05/2025					1.01	0.95			0.87	2.72		1.32	19.38	5.67	0.64		
29/05/2025					1.00	0.96			1.21	2.79		1.45	10.41	13.72	0.93		
30/05/2025					1.33	1.19			1.44	3.90		3.10	9.90	17.18	1.56		
31/05/2025					1.64	1.03			1.05	8.99		1.40	10.49	4.97	1.57		

Date	Huntly WQMS Data – May 2025 - Turbidity (Daily Average, NTU)																
	SE09T	SE10T	SE11T	SE12T	SE12INV	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T
1/05/2025										0.11	0.46	1.21	6.19		19.34		
2/05/2025										0.31	3.45	1.20	3.45		19.05		
3/05/2025										1.28	6.70	1.31	3.01		6.56		
4/05/2025										1.35	5.71	1.24	1.47		6.96		
5/05/2025										0.40	5.75	1.20	1.51		6.71		
6/05/2025										0.15	5.77	1.27	1.69		16.71		
7/05/2025										0.22	5.67	1.27	1.96		19.48		
8/05/2025										0.25	5.67	1.25	2.46		19.50		
9/05/2025										0.16	5.73	1.25	3.60		19.44		
10/05/2025										0.18	5.67	1.22	4.90		19.65		
11/05/2025											5.70	1.20	3.17		19.85		
12/05/2025										0.34	5.79	1.21	1.44		19.94		
13/05/2025										0.87	5.90	1.22	1.82		19.96		
14/05/2025										4.46	5.87	1.23	2.24		20.02		
15/05/2025										12.98	5.91	1.28	2.94		20.07		
16/05/2025										4.73	5.79	1.28	3.81		20.16		
17/05/2025										0.56	9.65	1.30	4.79		20.20		
18/05/2025										0.31	9.28	1.34	5.82		20.22		
19/05/2025										0.31	9.90	1.35	6.22		20.89		
20/05/2025										0.31	5.94	1.38	6.65				
21/05/2025										0.28	5.82	1.38	8.03				
22/05/2025										0.32	6.06	1.40	9.47				
23/05/2025										0.43	6.62	1.39	9.51				
24/05/2025										0.26	5.87	1.45	10.08				
25/05/2025										1.09	7.70	1.45	12.86				
26/05/2025										0.34	6.35	1.44	14.36		1.57		
27/05/2025										0.43	8.31	1.44	16.27		1.54		
28/05/2025										0.36	11.46	1.43	19.51		1.48		
29/05/2025										0.57	13.39	1.39	14.74		1.85		
30/05/2025										1.71	7.01	1.69	4.44		8.62		
31/05/2025										3.43	10.91	1.77	3.87		5.74		

Date	Huntly WQMS Data – May 2025 - Turbidity (Daily Average, NTU)																	
	SE22T	SE23T	SE25T	SE24T	SE03INV1	SE03INV3	SE24T											
1/05/2025					2.19													
2/05/2025					2.20													
3/05/2025					2.37													
4/05/2025					2.32													
5/05/2025					2.12													
6/05/2025					2.17													
7/05/2025					2.30													
8/05/2025					2.20													
9/05/2025					1.87													
10/05/2025					1.84													
11/05/2025																		
12/05/2025					2.01													
13/05/2025					2.12													
14/05/2025					2.21													
15/05/2025					2.24													
16/05/2025					2.34													
17/05/2025					2.42													
18/05/2025					2.41													
19/05/2025					2.26													
20/05/2025					2.30													
21/05/2025					2.28													
22/05/2025					2.75													
23/05/2025					4.16													
24/05/2025																		
25/05/2025																		
26/05/2025																		
27/05/2025					7.11													
28/05/2025					7.32													
29/05/2025																		
30/05/2025					3.08													
31/05/2025																		

Appendix B. Huntly WQMS Locations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PD01T
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SE05T
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SE60T
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DB02T
DB01T
SE10T
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SE12INV
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SE09T
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SE36T
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SE03INV3
ND07T
SE34T
SE62T
SE08T
ND12T
ND06T
ND13T
ND14T
SE26T
SE24T
ND04T
SE23T
SE25T
SE22T
FPWR1
Huntly Turbidity Monitors
Huntly Mine Footprint (Section 6)
Major Dams
Streams
0
1.25
2.5
5 Kilometers

Appendix C. WQMS General Arrangement

ANTENNA

SOLAR PANEL

DATA TRANSMISSION TO IOT

DATA OUTLET

POWER INLET

40 X 60 MM CABLE DUCT

20 AMP MPPT
SOLAR CHARGER

40 X 60 MM CABLE DUCT

SIERRA WIRELESS FX30

40 X 60 MM CABLE DUCT

12 V, 120 AH LI-ION BATTERY

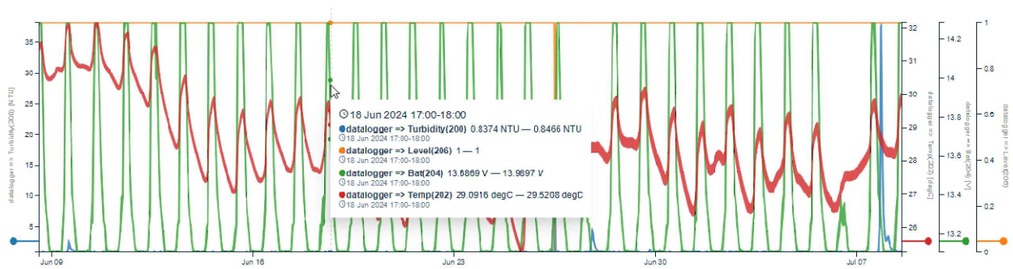
DATA INLET

SENSOR

STREAM DRY

SENSOR

STREAM FLOWING



REV.	REMARKS	DATE	DESIGNED	DRAWN	CHECKED	APPROVED	REFERENCE DRAWINGS
0	ISSUE FOR APPROVAL	05.07.2024	A.K.	S.A.	A.K.	A.K.	

ALL DIMENSIONS IN MILLIMETRES U.N.O.
LEVELS ARE IN METRES ON AHD U.N.O.
DO NOT SCALE DRAWING
IF IN DOUBT - ASK
TOLERANCES ISO2768-m U.N.O.

CLIENT

NSW - BUILDING G, 22 POWERS RD, SEVEN HILLS, NSW 2147
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SCIDEV

TITLE
IOT TURBIDITY MONITORING STATION
SITE LAYOUT
GENERAL ARRANGEMENT

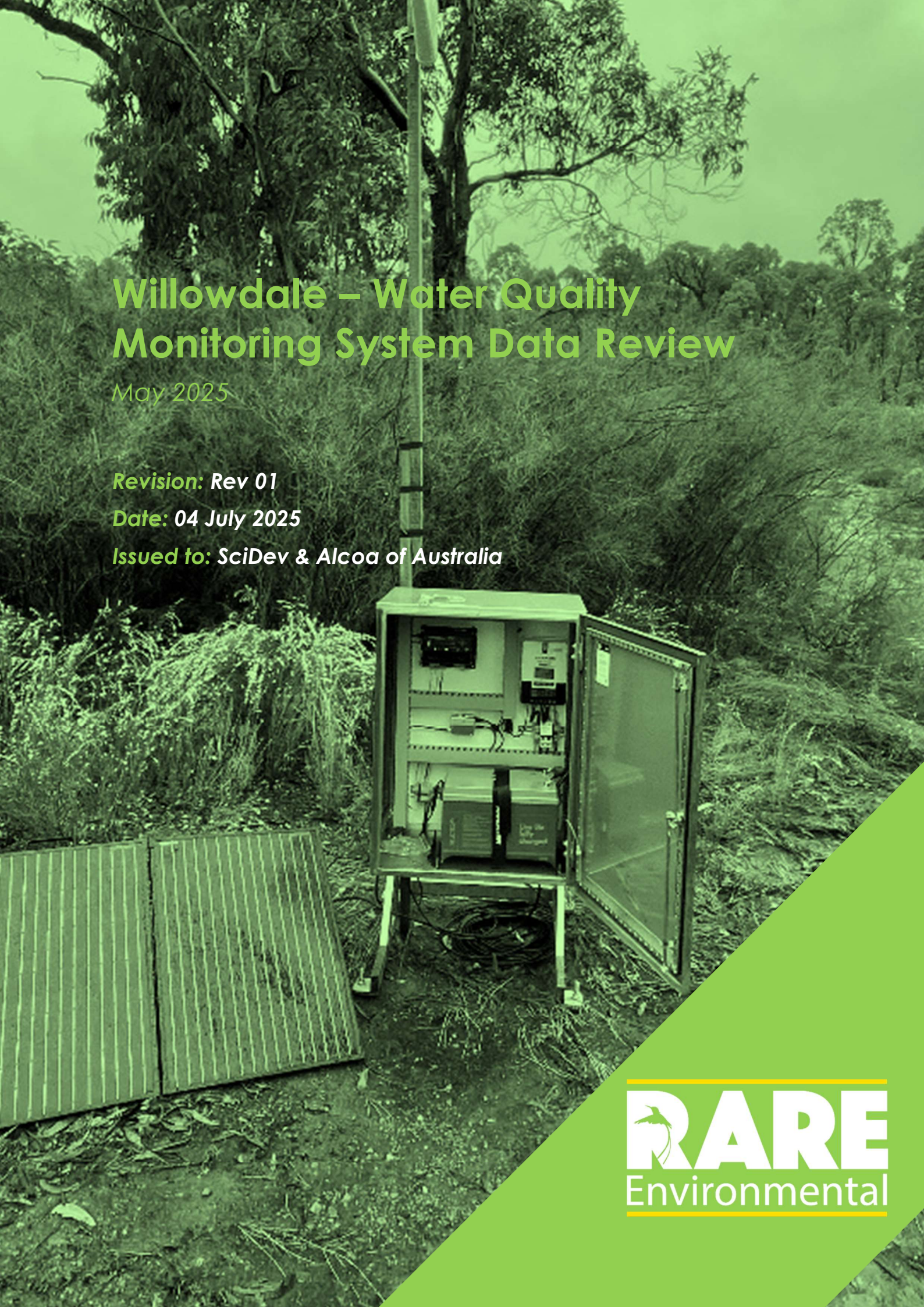
SHEET 1 OF 2

SCALE NTS OR AS SHOWN

DRAWING NO.
HI0090 - ALCOA WQMS

SHEET SIZE
A3

REV.
1



Willowdale – Water Quality Monitoring System Data Review

May 2025

Revision: ***Rev 01***

Date: ***04 July 2025***

Issued to: ***SciDev & Alcoa of Australia***

RARE Environmental

Document Control

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Document History and Status						
Revision	Date	Description	Prepared	Reviewed	Approved	Issued to
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Report Sign Off					
Report Version	01				
Prepared by		Technical Review		Approved for Issue	
Michael Minter		Georgia Duffy		Georgia Duffy	
Name	Michael Minter	Name	Georgia Duffy	Name	Georgia Duffy
Position	Env. Engineer	Position	Chemical Engineer	Position	Chemical Engineer
Date	04/07/25	Date	04/07/25	Date	04/07/25

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Infrastructure Sustainability Council MEMBER

Contents

1. Executive Summary

This report, prepared by RARE Environmental Pty Ltd and SciDev Pty Ltd for Alcoa, provides an analysis of turbidity data collected from Water Quality Monitoring Systems (WQMSs) deployed at the Willowdale bauxite mining operations during May 2025. The primary objective of this analysis was to evaluate the quality of the data, identify potential "true" turbidity exceedance events, and support Alcoa's compliance reporting obligations under Schedule 1, Division 2, Clause 6 of the **Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023**.

The analysis focused on identifying and classifying turbidity events where levels exceeded 25 nephelometric turbidity units (NTU) for at least one hour. Events were categorized as "true" or "false" based on Alcoa's **Turbidity Event Classification Guidelines**, which distinguish actual turbidity increases (true events) from false readings caused by environmental factors such as debris, air bubbles, or fluctuating water levels.

Key findings include:

- **True Events**: Zero "true" turbidity exceedance events were identified.
- **Further Investigation**: Zero events were flagged for further investigation.
- **False Events**: Three 'false' events were identified, primarily attributed to factors such as debris accumulation, sensor obstructions, and water turbulence.
- **Excluded Units**: Two WQMS units were excluded from the analysis due to invalid data caused by equipment faults or environmental interference.

The report also highlights periods of missing data, which occurred due to system logoffs, equipment faults, or unplanned shutdowns. These gaps are detailed in the report to ensure transparency in data handling.

2. Scope

RARE Environmental Pty Ltd and SciDev Pty Ltd were engaged by Alcoa to analyse turbidity data collected from the Willowdale Water Quality Monitoring Systems (WQMSs). The primary objective of this engagement is to assess the quality of the collected data and identify potential "true" turbidity events. This analysis supports Alcoa's reporting obligations under *Schedule 1, Division 2, Clause 6 of the Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023*.

3. Introduction

3.1. Background

Alcoa of Australia Ltd (Alcoa) operates two bauxite mines, Huntly and Willowdale, approximately 100 km southeast of Perth, Western Australia. These mining operations are subject to environmental controls mandated by the *Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023*.

Under this Exemption Order, Alcoa is required to implement drainage control measures and monitor effectiveness in water bodies within and downstream of mining operations. Turbidity, a critical water quality parameter, is monitored using Water Quality Monitoring Systems (WQMSs), to detect deviations and identify high-turbidity events.

Alcoa is obligated to report monthly on-stream turbidity, including the identification and classification of any “true” high-turbidity exceedance events. (Refer to Appendix B for the site map showing WQMS locations.)

3.2. Monitoring requirements

Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023 specifies that a drainage incident occurs when:

> *a) runoff from a disturbance area enters the surrounding environment, resulting in surface water turbidity of at least 25 NTU for a duration of at least one hour; or*
>
> *b) a discharge from containment infrastructure includes, or May include, environmentally hazardous material.*

Trigger levels for drainage incidents are outlined in *Schedule 1* of the Exemption Order. To meet these requirements, Alcoa has developed "Turbidity Event Classification Guidelines" which define a true turbidity exceedance event as a WQMS recording turbidity levels of at least 25 NTU for a period exceeding one hour.

3.3. Water Quality Management Systems (WQMSs)

During the May 2025 monitoring period, 4 Turbidity units were deployed in section 6 areas to monitor turbidity levels in streams subject to surface water runoff within and downstream of Willowdale mining operations.

Each WQMS unit consists of the following components:

Aquas SMR10 Turbidity Probe

> Positioned at a 90-degree angle to water flow, each probe is equipped with an automatic lens wiper and a guard to protect against larger debris.

Data Taker DT82 Logger

> Records data locally every 6 seconds, with 6-minute averages transmitted via IoT-enabled modems to a cloud-based platform.

Float Switch

Detects whether the sensor is submerged, or the stream is dry.

3.4. Purpose

This report aims to analyse turbidity data collected during May 2025, focusing on the identification and classification of "true" turbidity exceedance events based on Alcoa's Turbidity Event Classification Guidelines.

3.5. Exclusions

This report is not intended as:

- An assessment of the WQMS network or Alcoa's compliance with relevant legislation and requirements.
- An evaluation of the suitability of the trigger levels or event classification procedures adopted by Alcoa.

3.6. Abbreviations

	Term
IoT	Internet of Things
NTU	Nephelometric Turbidity Units
WQMS	Water Quality Management System

4. Methodology

4.1. WQMS Locations

A site map showing the WQMSs locations is provided in Appendix B.

4.2. Data Review

Data recorded by the WQMS Units was reviewed and potential events where turbidity levels exceeded 25 NTU for at least one hour. Each potential event was categorised as either 'true 'or 'false'.

4.2.1. True Turbidity Exceedance Events

These events are caused by an actual increase in stream turbidity. Per Alcoa's "Turbidity Event Classification Guidelines" true exceedance events typically exhibit:

- A sharp, sudden incline in turbidity levels.
- A return to baseline turbidity levels in a pattern resembling a normal (Gaussian) distribution.

Figure 1 Typical 'true' exceedance event showing the sharp incline and gradual return to background levels.

4.2.2. False Turbidity Exceedance Events

These events are caused by factors unrelated to actual turbidity increase, such as:

- Organic debris (e.g., leaves, sticks, algae) obstructing the sensor
- Air bubbles or water turbulence near the sensor
- Fluctuating water levels intermittently covering and uncover the sensor lens.

False events typically exhibit sharp inclines and declines without the characteristic bell curve shape of true events.

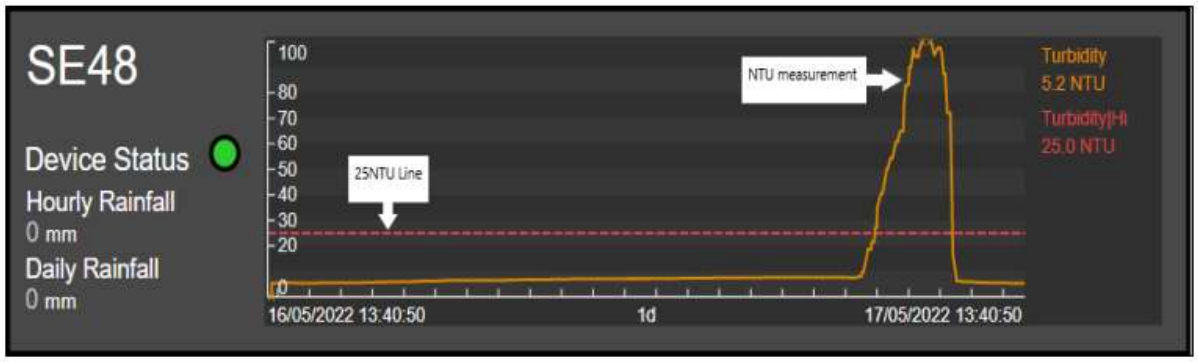


Figure 2 Typical 'false' exceedance event showing both a sharp incline and decline

4.2.3. Missing Data

Missing data occurs when a WQMS unit fails to record information, this can occur from unexpected system logoffs, equipment faults, or unplanned shutdowns.

5. Results and Discussion

5.1. Events

Table 1 provides a summary of identified events. Table 2 offers detailed information about each event.

Table 1 Events Summary

Category	# of events
Flagged for further investigation	0
False	3

Table 2 Events Details

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
WDL-2505-001	RHB2	'False'	15/05/2025 19:48	15/05/2025 22:06	2hr, 17min	72.85	43.92
WDL-2505-002	RHB2	'False'	16/05/2025 9:24	16/05/2025 11:36	2hr, 11min	31.94	30.5
WDL-2505-003	RHB2	'False'	16/05/2025 17:30	16/05/2025 19:48	2hr, 18min	33.16	30.27

5.2. Additional Investigation

Zero events were identified for further investigation.

5.3. True Event(s)

Zero potential 'true' turbidity events were identified during the reporting period.

5.4. False Event(s)

Three events were identified during the reporting period. Rationale on potential causes is summarised below.

Table 3 False Events Rationale

Event ID	Monitor ID	Rationale	Field Notes
WDL-2505-001	RHB2	This event is marked by a gradual increase with multiple peaks. This is indicative of a false event.	On review of Data 24/05/2025, undertook inspection of stream on the same day. Noted the probe had been fouled and cleaned with cloth. The stream was very shallow < 10 cm, flowing slowly, and clear with no indication a turbidity event had occurred. In addition, there had been no rainfall or evidence of a drainage event prior to the increased readings. The stream is currently groundwater fed from a location approximately 200 meters upstream. There is some rehabilitation areas upstream of the probe however no active mining.
WDL-2505-002	RHB2	This event is marked by evidence of erroneous data. Both before and after the event the sensor is returning a fault error. The data is sustained at over 25 NTU before returning to fault status. This is indicative of a false event.	On review of Data 24/05/2025, undertook inspection of stream on the same day. Noted the probe had been fouled and cleaned with cloth. The stream was very shallow < 10 cm, flowing slowly, and clear with no indication a turbidity event had occurred. In addition, there had been no rainfall or evidence of a drainage event prior to the increased readings. The stream is currently groundwater fed from a location approximately 200 meters upstream. There is some rehabilitation areas upstream of the probe however no active mining.
WDL-2505-003	RHB2	This event is marked by evidence of erroneous data. Before the event the sensor is returning a fault error, and after the event the values gradually return to background levels. This is indicative of a false event.	On review of Data 24/05/2025, undertook inspection of stream on the same day. Noted the probe had been fouled and cleaned with cloth. The stream was very shallow < 10 cm, flowing slowly, and clear with no indication a turbidity event had occurred. In addition, there had been no rainfall or evidence of a drainage event prior to the increased readings. The stream is currently groundwater fed from a location approximately 200 meters upstream. There is some rehabilitation areas upstream of the probe however no active mining.

5.5. Excluded WQMS Units

Two WQMS Units were excluded from analysis due to erroneous data. Alcoa confirmed the invalidity of data recorded from these units and provided commentary on the condition of each.

Table 2 Excluded WQMS Units

Unit	Dates	Comments
HV07	01/05/2025-31/05/2025	Stream dry, probe installed in a bucket of deionised water for protection
HV49T	01/05/2025-31/05/2025	Stream dry, probe installed in a bucket of deionised water for protection

5.6. Missing Data

Periods of missing data are detailed in Table 3.

Table 3 Missing Data Summary

Missing Data ID	Unit	Start	End	Comments
MD-2505-01	RHB3	01/05/2025	31/05/2025	No valid data

6. Appendices

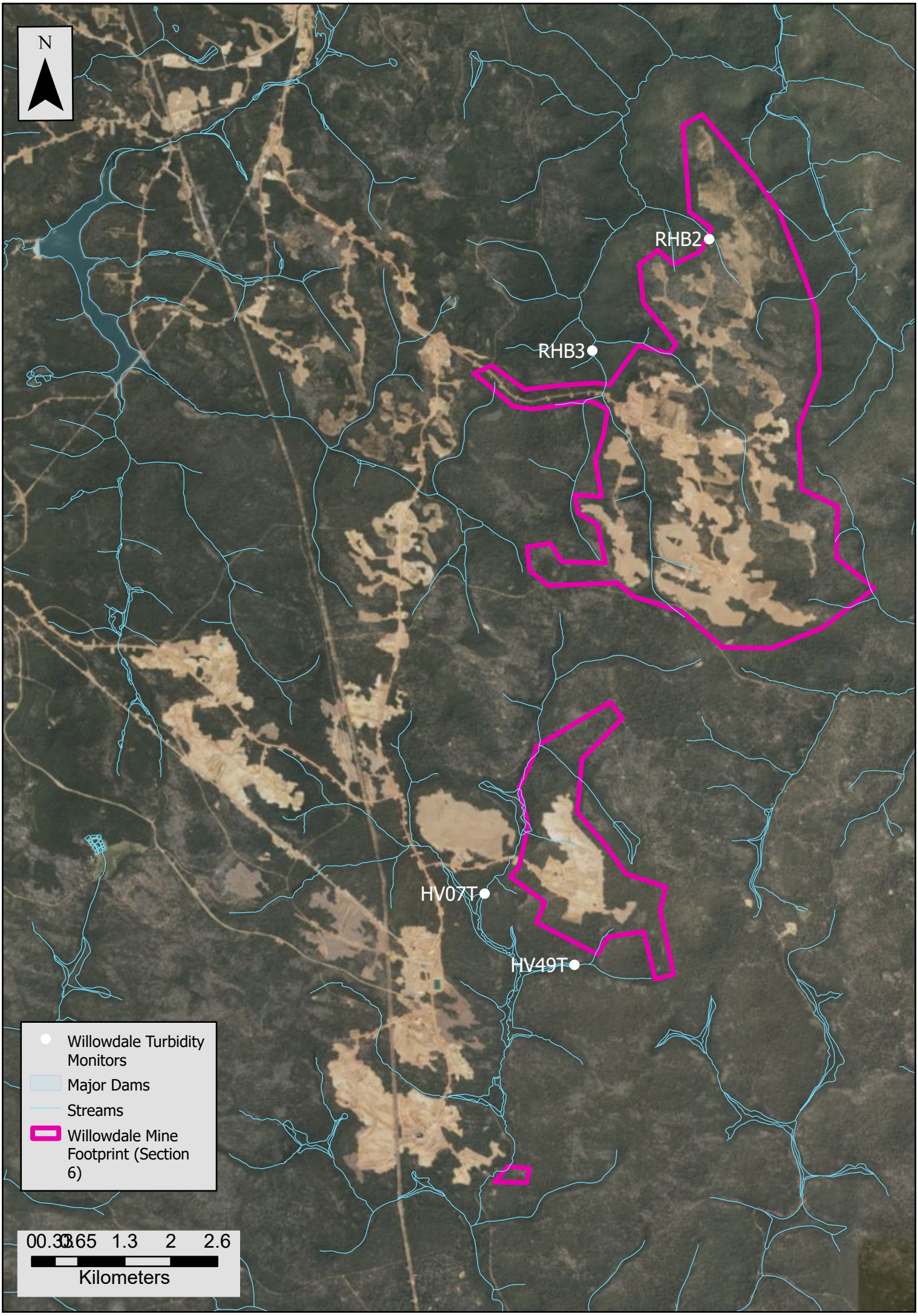
Appendix A. Willowdale Raw WQMS Data

Date	Willowdale WQMS Data - May 2025 - Events with turbidity > 25 NTU for an hour or more			
	HV07T	HV49T	RHB2	RHB3
1/05/2025				
2/05/2025				
3/05/2025				
4/05/2025				
5/05/2025				
6/05/2025				
7/05/2025				
8/05/2025				
9/05/2025				
10/05/2025				
11/05/2025				
12/05/2025				
13/05/2025				
14/05/2025				
15/05/2025			**1**	
16/05/2025			**2**	
17/05/2025				
18/05/2025				
19/05/2025				
20/05/2025				
21/05/2025				
22/05/2025				
23/05/2025				
24/05/2025				
25/05/2025				
26/05/2025				
27/05/2025				
28/05/2025				
29/05/2025				
30/05/2025				
31/05/2025				

Date	Willowdale WQMS Data - May 2025 – Daily Average Turbidity (NTU)			
	HV07T	HV49T	RHB2	RHB3
1/05/2025			6.04	
2/05/2025			6.82	
3/05/2025			6.91	
4/05/2025			6.81	
5/05/2025			6.81	
6/05/2025			6.48	
7/05/2025			6.86	
8/05/2025			6.60	
9/05/2025			6.47	
10/05/2025			6.39	
11/05/2025			6.57	
12/05/2025			6.70	
13/05/2025			6.72	
14/05/2025			7.00	
15/05/2025			17.14	
16/05/2025			22.85	
17/05/2025			10.64	
18/05/2025			9.30	
19/05/2025			13.72	
20/05/2025			9.36	
21/05/2025			10.71	
22/05/2025			7.88	
23/05/2025			8.00	
24/05/2025			8.88	
25/05/2025			9.02	
26/05/2025			9.05	
27/05/2025			9.08	
28/05/2025			9.04	
29/05/2025			9.30	
30/05/2025			9.57	
31/05/2025			10.06	

* - Adjusted average with sensor fault data removed

Appendix B. Willowdale WQMS Locations


N
RHB2
RHB3
HV07T
HV49T
Willowdale Turbidity Monitors
Major Dams
Streams
Willowdale Mine Footprint (Section 6)
0 0.33 0.65 1.3 2 2.6
Kilometers

Appendix C. WQMS General Arrangement

ANTENNA

SOLAR PANEL

DATA TRANSMISSION TO IOT

DATA OUTLET

POWER INLET

40 X 60 MM CABLE DUCT

20 AMP MPPT
SOLAR CHARGER

40 X 60 MM CABLE DUCT

SIERRA WIRELESS FX30

40 X 60 MM CABLE DUCT

12 V, 120 AH LI-ION BATTERY

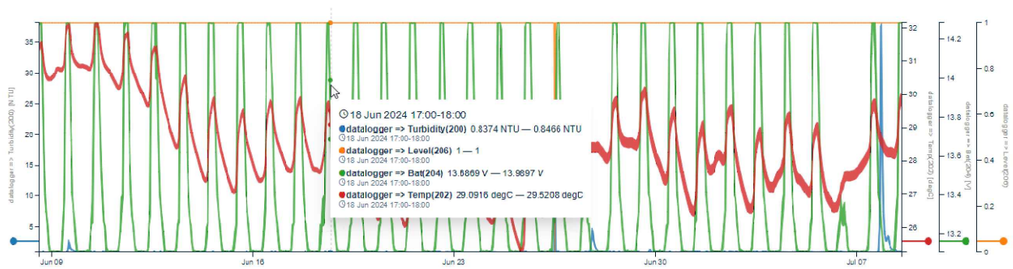
DATA INLET

SENSOR

STREAM DRY

SENSOR

STREAM FLOWING



REV.	REMARKS	DATE	DESIGNED	DRAWN	CHECKED	APPROVED	REFERENCE DRAWINGS
0	ISSUE FOR APPROVAL	05.07.2024	A.K.	S.A.	A.K.	A.K.	

ALL DIMENSIONS IN MILLIMETRES U.N.O.
LEVELS ARE IN METRES ON AHD U.N.O.
DO NOT SCALE DRAWING
IF IN DOUBT - ASK
TOLERANCES ISO2768-m U.N.O.

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SCIDEV

TITLE
IOT TURBIDITY MONITORING STATION
SITE LAYOUT
GENERAL ARRANGEMENT

SHEET 1 OF 2

SCALE NTS OR AS SHOWN

DRAWING NO.
HI0090 - ALCOA WQMS

SHEET SIZE
A3

REV.
1