# Hunfly Bauxite Mine – Water Quality Monitoring System Data Review

August 2024

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# 1. Introduction

#### 1.1. Purpose

RARE Environmental Pty Ltd (RARE) was engaged by SciDev Pty Ltd (SciDev) to analyse and comment on raw turbidity monitoring data collected by their Water Quality Monitoring Systems (WQMSs) under Section 6 of the Environmental Protection Act 1986 at the Huntly Bauxite Mine, owned and operated by Alcoa of Australia Limited (Alcoa). Stream turbidity monitoring is a core regulatory requirement stipulated as part of Alcoa's approvals and operating framework. The data for this reporting period was collected in August of 2024.

This report has been prepared to assess the quality of data provided and identify potential drainage incidents ('true' events) per the procedure detailed below within that data. Where possible recommendations are made for either WQMS network upgrades or further investigation of events identified within the data. This report should not be considered an assessment of the WQMS network and/or Alcoa's compliance to relevant legislation and requirements, nor should it be considered an assessment of the suitability of the adopted trigger level and event classification procedure.

#### 1.2. Context

Data from each location has been collected and compared against the drainage incident trigger level outlined in the *Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023* Schedule 1 Division 2 Cl. 6. Trigger events have then been assessed against Alcoa's turbidity event classification guidelines to determine whether the event is true, i.e. caused by stream turbidity, or false, i.e. caused by stream debris, algae or other. For the purpose of this report a turbidity event is an event where turbidity levels, measured by a WQMS, are at least 25 nephelometric turbidity units (NTU) for a period of at least 1 hour.

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

#### 1.3. Monitoring Requirements

Under Schedule 1, Division 2 ("Controls on activities"), of the *Environmental Protection (Darling Range Bauxite Mining Proposals) Exemption Order 2023* a drainage incident is defined as:

- a) a runoff from a disturbance area to the surrounding environment of surface water that has a turbidity of at least 25 nephelometric turbidity units for a period of at least 1 hour; or
- b) a discharge from containment infrastructure that includes or may include environmentally hazardous material;

#### 1.4. Water Quality Monitoring System (WQMS)

At the Huntly site, for this reporting period, 34 (thirty-four) WQMSs have been installed in streams within or downstream of mining operations to monitor stream turbidity levels. Each turbidity monitoring station is fitted with an Aquas SMR10 turbidity probe. The Aquas probes are placed directly in the streams, mounted at 90 degrees to the flow of water. Each sensor has a guard to protect the lens from larger debris and the units are fitted with a lens screen wiper. Note: disruptions or errant readings can occur with smaller pieces of debris (leaves etc.).

Data is collected via a Data Taker DT82 logger. Data from each logger is linked to an IOT data modem to transmit to a cloud-based platform. Data is logged locally in 6 second intervals with a 6-minute average pushed into the cloud-based platform. A float switch or cell indicates sensor immersion or a dry stream.

## 1.5. Data Review & Event Classification Process

Data produced by the WQMSs is reviewed by RARE per the following procedure and in consultation with SciDev. This allows for the identification of true events that require investigation to determine whether the mining operations may have contributed to the elevated turbidity levels, and false events.



#### Figure 1: Data Review & Event Classification Process

The process considers the physical aspects of the WQMS deployment, the data collection by that monitor and finally classification of the events identified in that data. Classification of events is per Alcoa's procedure to identify events as true or false.

A 'true' stream turbidity exceedance event that is caused by an actual increase in stream water turbidity. Alcoa has identified that 'true' turbidity exceedance events typically show a sharp turbidity incline before gradually trailing off as the stream turbidity level returns to background.





'False' stream turbidity exceedance events are caused by factors other than an actual increase in stream water turbidity (i.e. organic debris covering the monitor such as sticks/leaves/algae, stream water turbulence or air bubbles and fluctuating water levels that intermittently cover the monitor lens and then recede). Alcoa has identified that 'false' turbidity exceedance events typically illustrate sharp inclines and declines for turbidity when the data is graphed over time and lack the distinctive 'bell curve' shape that is associated with 'true' turbidity exceedance events. Huntly Bauxite Mine – Water Quality Monitoring System Data Review Environmental



Figure 3: Typical 'false' exceedance event showing both a sharp incline and decline.

Any 'true' events identified in this report have been listed in Section 3.

# 2. WQMS Data Review

For the reporting period of August 2024, 247,706 data points were collected by 34 (thirty-four) WQMSs across the Huntly site. From this data a total of 70 (seventy) events were flagged where turbidity levels above 25 NTU were held for an hour or more. The following sections review this data, beginning with the deployment and operation of the WQMSs.

### 2.1. Deployment & Collection

From the data provided there were several units producing erroneous results, marked by spikes and/or non-sensical peaks.

RARE have identified WQMSs in **Table 1** that require review in regards erroneous data. SciDev confirmed that the data generated by these units is invalid and has therefore been excluded from further analysis.

Two temporary investigation monitors, identified as FPWR1 and SE12INV, were installed on July 26<sup>th</sup> and August 12<sup>th</sup> respectively, and are included in this report.

Excluding the data from these units leaves 49 (forty-nine) potential turbidity events during the reporting period across 19 (nineteen) units as discussed in the following section.

Table 1: WQMS Requiring Review

Unit	Dates	SciDev Comment
FPWR1	August 4 <sup>th</sup>	Stream dry, no sign of recent flow
FPWR1	August 9 <sup>th</sup>	First stream flow, heavy stream bed debris present impacting sensor
SE01T	August 18 <sup>th</sup>	Data trend indicates false event, turbidity values drop from 32.86 to 8.52 within 6 minutes. Sensor found in the bottom of the stream bed.
SE02T	August 16 <sup>th</sup>	SE02T stream is flowing and sensor sitting in flow cell. Alot of debris on stream bed and around sensor. Observed a white foam substance floating close to sensor and around the creek. Cleaned sensor and installed back in stream. Forest track is eroded and upwelling with water. False event triggered by debris build up around sensor. No mining related activities found.
SE05T	August 24 <sup>th</sup> 9am-8pm, (3 events)	Data trend shows erratic turbidity values. Sensor is situated in rapid flow below a precipice, turbidity increasing after rainfall due to increased flow. Site inspected on 25/08/2024, stream clear, turbidity reading at time of arrival 25NTU. Sensor removed for inspection; lens was clean. Stream bed debris had built up around the sensor support. Sensor repositioned; turbidity values dropped to 6.2NTU. Sensor to be relocated to a less turbulent area of the stream.
SE05T	August 25 <sup>th</sup> (3 events)	Data trend shows erratic turbidity values. Sensor is situated in rapid flow below a precipice, turbidity increasing after rainfall due to increased flow. Site inspected on 25/08/2024, stream clear, turbidity reading at time of arrival 25NTU. Sensor removed for inspection; lens was clean. Stream bed debris had built up around the sensor support. Sensor repositioned; turbidity values dropped to 6.2NTU. Sensor to be relocated to a less turbulent area of the stream.
SE06T	August 2 <sup>nd</sup>	Data trend indicates false event. Stream level is low, and stream bed is heavily impacted by debris
SE09T	August 12 <sup>th</sup>	Sensor had come loose from the support and was sitting in stream bed sediment.
SE12T	August 5 <sup>th</sup>	Stream drop, sensor out of water. Sensor repositioned within the stream bed; turbidity values dropped to 1NTU
SE12T	August 9 <sup>th</sup> to 10 <sup>th</sup> (2 events)	Stream drop, sensor out of water. Sensor repositioned within the stream bed; turbidity values dropped to 6NTU
SE12INV	August 29 <sup>th</sup>	Heavy build-up of leaf and organic matter impacting sensor when visited on the 2/09/2024. Stream is very low, and sensor is in/out of water

SE15T	August 18 <sup>th</sup>	Data trend indicates false event. Erratic turbidity values with sharp incline and decline after 5.4mm of rainfall since 7:00AM. Site inspected on 20/08/2024, stream level is deep, and sensor is unable to be accessed for cleaning. Debris was present in the stream bed and caught around the sensor. Maintenance contractor scheduled to increase lens auto-wipe function interval.
SE15T	August 28 <sup>th</sup> – 31st	Sensor is impacted by debris and cannot be accessed due to deep stream channel. Additional sensor to be installed
SE34T	August 7 <sup>th</sup> - 11 <sup>th</sup>	Rapid stream flow, stream bed heavily burdened with branches and debris, sensor had come away from support and was swinging freely in the stream flow close to the stream bed. Turbidity value on arrival 1288NTU, dropped to 0.7 after cleaning and repositioning the sensor.
SE60T	July 23 <sup>rd</sup> to August 1 <sup>st</sup> (2 events)	Stream flow recorded on 23/07/2024. Prior to this, maintenance contractor advised sensor likely reading high due to the narrow flow cell unique to this site. Turbidity values started to drop when the sensor was submerged in ponded water (prior to flow). Site was inspected on 26/07/2024, stream clear and no sign of mining sediment in the stream bed. Sensor was removed from flow cell; no cleaning was required. Base of flow cell inspected and flushed, no sediment within. A mid-depth water sample was taken which returned a turbidity reading of 1.74NTU. Maintenance contractor attended site on 1/08/2024, reset sensor to factory settings and recalibrated, repositioned sensor within the stream bed outside of the flow cell, turbidity values reading at 1.7NTU. Catchment inspection was completed to ensure no mining related impact to stream during period of sensor fault.



### 2.2. Classification

Analysing the data collected outside of the above periods leaves 49 (forty-nine) potential turbidity events during the reporting period across 19 (nineteen) units as summarised in **Table 2**. For this reporting period there were 33 (thirty-three) 'true' turbidity events identified. Refer to the following section for analysis. *Table 2: Turbidity events summary* 

Data						Huntly WQN	/IS Data - Au	gust 2024 - E	vents with tu	rbidity > 25	NTU for an h	our or more					
Date	DB01T	DB02T	FPWR1	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T
1/08/2024													1				
2/08/2024			2														
3/08/2024																	
4/08/2024																	
5/08/2024											1						
6/08/2024																	
7/08/2024										1			1	1 3	1	1	
8/08/2024												1		2			
9/08/2024																	
10/08/2024																	
11/08/2024													1				
12/08/2024																	
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17/08/2024		2															
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27/08/2024												1					
28/08/2024												1					
29/08/2024																	
30/08/2024																	
31/08/2024																	

Note: Grey cells indicate data has been excluded. False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text. See following section for analysis.



Data	Huntly WQMS Data - August 2024 - Events with turbidity > 25 NTU for an hour or more																
Date	SE09T	SE10T	SE11T	SE12T	SE12INV	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T
1/08/2024															1		
2/08/2024																	
3/08/2024																	
4/08/2024																	
5/08/2024		1															
6/08/2024				1													
7/08/2024			1	2		3					2	1	1		2		
8/08/2024																	
9/08/2024																	
10/08/2024																	
11/08/2024																	
12/08/2024																	
13/08/2024									1								
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28/08/2024																	
29/08/2024													1				
30/08/2024																	
31/08/2024					1												

Note: Grey cells indicate data has been excluded. False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text. See following section for analysis.

# **RARE**

## 2.2.1. DB02T Potential Turbidity Events

Chart(s) for data flagged at monitor DB02T are shown below for the potential events identified in the reporting period.





This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.

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## 2.2.2. FPWR1 Potential Turbidity Events

Chart(s) for data flagged at monitor FPWR1 are shown below for the potential events identified in the reporting period.



These events are marked by gradual inclines and gradual return to background levels indicative of a 'true' event, flagged for further investigation.

## 2.2.3. PD01T Potential Turbidity Events

Chart(s) for data flagged at monitor PD01T are shown below for the potential events identified in the reporting period.



## 2.2.4. SE01T Potential Turbidity Events

Chart(s) for data flagged at monitor SE01T are shown below for the potential events identified in the reporting period.



This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.



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## 2.2.5. SE02T Potential Turbidity Events

Chart(s) for data flagged at monitor SE02T are shown below for the potential events identified in the reporting period.



This event is marked by sporadic peaks, indicative of a 'false' event.



This event is marked by sporadic peaks, indicative of a 'false' event.

![](_page_14_Picture_0.jpeg)

![](_page_14_Figure_2.jpeg)

These events are marked by a sharp inclines and declines, indicative of a 'false' event.

#### 2.2.6. SE03T Potential Turbidity Events

Chart(s) for data flagged at monitor SE03T are shown below for the potential events identified in the reporting period.

![](_page_14_Figure_6.jpeg)

![](_page_15_Picture_0.jpeg)

![](_page_15_Figure_1.jpeg)

![](_page_15_Figure_3.jpeg)

This event is marked by a sharp incline and decline, indicative of a 'false' event.

## 2.2.7. SE05T Potential Turbidity Events

Chart(s) for data flagged at monitor SE05T are shown below for the potential events identified in the reporting period.

![](_page_16_Figure_4.jpeg)

This event is marked by a gradual incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.

![](_page_16_Figure_6.jpeg)

This event is marked by sporadic peaks, indicative of a 'false' event.

![](_page_17_Picture_0.jpeg)

![](_page_17_Figure_1.jpeg)

This event is marked by sporadic peaks, indicative of a 'false' event.

![](_page_17_Figure_3.jpeg)

This event is marked by sporadic peaks, indicative of a 'false' event.

![](_page_18_Picture_0.jpeg)

![](_page_18_Figure_1.jpeg)

This event is marked by sporadic peaks, indicative of a 'false' event.

![](_page_18_Figure_3.jpeg)

This event is marked by sporadic peaks, indicative of a 'false' event.

![](_page_19_Picture_0.jpeg)

![](_page_19_Figure_1.jpeg)

![](_page_19_Figure_3.jpeg)

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## 2.2.8. SE06T Potential Turbidity Events

Chart(s) for data flagged at monitor SE06T are shown below for the potential events identified in the reporting period.

![](_page_20_Figure_4.jpeg)

This event is marked by a sharp inclines and gradual return to background levels indicative of a 'true' event, flagged for further investigation.

![](_page_20_Figure_6.jpeg)

This event is marked by a gradual inclines and gradual return to background levels indicative of a 'true' event, flagged for further investigation. Data unavailable for remainder of August 24<sup>th</sup>.

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## 2.2.9. SE07T Potential Turbidity Events

Chart(s) for data flagged at monitor SE07T are shown below for the potential events identified in the reporting period.

![](_page_21_Figure_4.jpeg)

This event is marked by sporadic peaks, indicative of a 'false' event.

## 2.2.10. SE10T Potential Turbidity Events

Chart(s) for data flagged at monitor SE10T are shown below for the potential events identified in the reporting period.

![](_page_21_Figure_8.jpeg)

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## 2.2.11. SE11T Potential Turbidity Events

![](_page_22_Figure_3.jpeg)

![](_page_22_Figure_4.jpeg)

This event is marked by a sharp incline and decline, indicative of a 'false' event.

## 2.2.12. SE12T Potential Turbidity Events

Chart(s) for data flagged at monitor SE12T are shown below for the potential events identified in the reporting period.

![](_page_22_Figure_8.jpeg)

![](_page_23_Picture_0.jpeg)

![](_page_23_Figure_1.jpeg)

![](_page_23_Figure_3.jpeg)

## 2.2.13. SE12INV Potential Turbidity Events

Chart(s) for data flagged at monitor SE12INV are shown below for the potential events identified in the reporting period.

![](_page_24_Figure_3.jpeg)

This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.

#### 2.2.14. SE15T Potential Turbidity Events

Chart(s) for data flagged at monitor SE15T are shown below for the potential events identified in the reporting period.

![](_page_24_Figure_7.jpeg)

These events are marked by a sharp incline and declines, indicative of a 'false' event.

![](_page_25_Picture_0.jpeg)

![](_page_25_Figure_1.jpeg)

### 2.2.15. SE48T Potential Turbidity Events

Chart(s) for data flagged at monitor SE48T are shown below for the potential events identified in the reporting period.

![](_page_25_Figure_5.jpeg)

This event is marked by a sharp incline and decline, indicative of a 'false' event.

## 2.2.16. SE52T Potential Turbidity Events

Chart(s) for data flagged at monitor SE52T are shown below for the potential events identified in the reporting period.

![](_page_26_Figure_3.jpeg)

This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.

![](_page_26_Figure_5.jpeg)

![](_page_27_Figure_1.jpeg)

## 2.2.17. SE53T Potential Turbidity Events

![](_page_27_Figure_4.jpeg)

![](_page_27_Figure_5.jpeg)

This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.

#### 2.2.18. SE59T Potential Turbidity Events

Chart(s) for data flagged at monitor SE59T are shown below for the potential events identified in the reporting period.

![](_page_28_Figure_1.jpeg)

![](_page_28_Figure_3.jpeg)

This event is marked by a gradual incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.

#### 2.2.19. SE61T Potential Turbidity Events

Chart(s) for data flagged at monitor SE61T are shown below for the potential events identified in the reporting period.

![](_page_29_Picture_0.jpeg)

![](_page_29_Figure_1.jpeg)

![](_page_29_Figure_3.jpeg)

![](_page_30_Figure_1.jpeg)

![](_page_30_Figure_3.jpeg)

![](_page_31_Picture_0.jpeg)

![](_page_31_Figure_1.jpeg)

![](_page_31_Figure_3.jpeg)

![](_page_32_Picture_0.jpeg)

![](_page_32_Figure_1.jpeg)

## 2.3. True Turbidity Events

For this reporting period, 33 (thirty-three) potential drainage or 'true' incidents were identified for further investigation.

Table 3: True Turk	oidity Events					
Event ID	Monitor	Date(s)	Start Time	End Time	Duration	Peak Turbidity (NTU)
HUN-2408-001	DB02T	17/08/24	1:18:00 PM	4:24:00 PM	3hrs 6min	98.50
HUN-2408-002	DB02T	17/08/24	6:18:00 PM	8:36:00 PM	2hrs 18min	30.32
HUN-2408-003	FPWR1	01/08/24 - 02/08/24	11:30:00 PM	4:18:00 AM	4hrs 48min	76.28
HUN-2408-004	FPWR1	02/08/24	4:48:00 AM	5:54:00 AM	1hr 6min	32.92
HUN-2408-005	PD01T	07/08/24	2:24:00 AM	5:36:00 AM	3hrs 12min	98.33
HUN-2408-006	SE01T	04/08/24 - 05/08/24	3:12:00 PM	1:00:00 AM	9hrs 48min	168.97
HUN-2408-007	SE01T	21/08/24	11:00:00 AM	12:42:00 PM	1hr 42min	127.1
HUN-2408-008	SE03T	31/07/24 - 01/08/24	11:48:00 PM	5:00:00 AM	5hrs 12min	33.32
HUN-2408-009	SE03T	06/08/24 - 07/08/24	10:54:00 PM	11:54:00 AM	13hrs	49.49
HUN-2408-010	SE05T	07/08/24	1:36:00 AM	8:30:00 AM	6hrs 54min	280.44
HUN-2408-011	SE05T	23/08/24	10:48:00 AM	12:48:00 PM	2hrs 30min	62.81
HUN-2408-012	SE05T	24/08/24	3:18:00 AM	7:18:00 AM	4hrs	155.68
HUN-2408-013	SE06T	07/08/24	1:42:00 AM	4:24:00 AM	2hrs 40min	241.94
HUN-2408-014	SE06T	24/08/24	3:59:00 AM	5:24:00 AM	1hr 25min	82.15
HUN-2408-015	SE10T	05/08/24	3:29:00 AM	9:20:00 AM	5hrs 48min	101.87
HUN-2408-016	SE12T	06/08/24 – 07/08/24	9:48:00 PM	12:06:00 AM	2hrs 18min	890.07
HUN-2408-017	SE12T	07/08/24	1:24:00 AM	4:30:00 AM	3hrs 6min	866.19
HUN-2408-018	SE12T	07/08/24	4:48:00 AM	7:00:00 AM	2hrs 12min	33.41
HUN-2408-019	SE12INV	30/08/24 - 01/09/24*	9:36:00 AM	20:02:00 PM	58hrs 36min	379.56
HUN-2408-020	SE15T	26/08/24	2:06:00 PM	4:06:00 PM	2hrs	60.87
HUN-2408-021	SE52T	06/08/24 - 07/08/24	10:48:00 PM	12:54:00 AM	2hrs 6min	166.66
HUN-2408-022	SE52T	07/08/24	2:24:00 AM	7:00:00 AM	4hrs 36min	197.36
HUN-2408-023	SE52T	24/08/24	4:30:00 AM	6:30:00 AM	2hrs	48.78
HUN-2408-024	SE53T	07/08/24	3:30:00 AM	8:42:00 AM	5hrs 12min	72.89
HUN-2408-025	SE59T	07/08/24	1:54:00 AM	7:06:00 AM	5hrs 30min	262.46
HUN-2408-026	SE59T	29/08/24	4:00:00 AM	5:30:00 PM	13hrs 30min	76.41
HUN-2408-027	SE61T	01/08/24	1:54:00 AM	3:42:00 AM	1hrs 48min	27.14
HUN-2408-028	SE61T	07/08/24	1:30:00 AM	6:06:00 PM	13hrs 48min	518.36
HUN-2408-029	SE61T	07/08/24	6:24:00 PM	8:48:00 PM	2hrs 18min	29.33
HUN-2408-030	SE61T	13/08/24 - 14/08/24	11:36:00 PM	2:42:00 AM	3hrs 6min	27.91
HUN-2408-031	SE61T	18/08/24	8:12:00 AM	4:12:00 PM	7hrs 30min	85.48
HUN-2408-032	SE61T	23/08/24	13:24:00 PM	21:36:00 PM	7hrs 24min	47.99
HUN-2408-033	SE61T	24/08/24	5:00:00 AM	9:00:00 PM	16hrs	79.78

\*end date and time provided by Alcoa

## 2.4. Investigation Outcomes

SciDev provided the following in regards to the identified 'true' events.

Table 4: Investigation Outcomes

Event ID	Event Classification	Alcoa Investigation
HUN-2408-001	Non-Mining Related	Site inspected on 18/08/2024. Stream flowing quickly and mostly clear with some algae growth along bed. Reeds were heavily impacted sensor
HUN-2408-002	Non-Mining Related	area. Catchment area has been inspected, no evidence of mining contribution found. Areas of forest track run off are contacting the stream.
HUN-2408-003 HUN-2408-004	Non-Mining Related	Stream dry, no sign of recent flow
HUN-2408-005	Non-Mining Related	The monitoring site was inspected on the 09/08/2024, stream was clear with no evidence of mining sediment visible within the stream bed. Vegetation / debris was caught around the sensor. Evidence of track run off was found at the turbidity monitoring point and nearby forest tracks. Inspection of the PD01T catchment area was completed, no evidence of mining related contribution was found.
HUN-2408-006	Non-Mining Related	Site inspected on 4/08/2024. Sensor impacted by debris.
HUN-2408-007	Non-Mining Related	Site inspected on 21/08/2024, Sensor sitting in the stream bed. Sensor cleaned and repositioned, turbidity values gradually declined as stream bed sediment re-settled.
HUN-2408-008	Non-Mining	Catchment inspection completed, no evidence of mining related contribution found. Impacted area of previous drainage event inspected, controls holding up well. No evidence of further mobilisation of sediment
HUN-2408-009	Related	Catchment inspection completed, no evidence of mining related contribution found. Impacted area of previous drainage event inspected, controls holding up well. No evidence of further mobilisation of sediment
HUN-2408-010	Non-Mining Related	Site inspected on 08/08/2024. A dark stream turbidity appearance was observed at the time of inspection, with debris deposited in the stream bed. The surrounding forest was impacted by fire in November 2023 which has left the forest floor bare with areas of exposed soil, erosion scours were observed which have contacted the stream from forest floor and surrounding forest tracks. Inspection of the SE05T catchment area was completed, no evidence of mining related contribution was found.
HUN-2408-011	Non-Mining	Data trend shows erratic turbidity values. Sensor is situated in rapid flow below a precipice, turbidity increasing after rainfall due to increased flow. Site inspected on 25/08/2024, stream clear, turbidity reading at
HUN-2408-012	Related	time of arrival 25NTU. Sensor removed for inspection, lens was clean. Stream bed debris had built up around the sensor support. Sensor repositioned, turbidity values dropped to 6.2NTU. Sensor to be relocated to a less turbulent area of the stream.
HUN-2408-013	Non-Mining Related	Site inspected on 7/08/2024, sensor heavily impacted by debris. Stream is very shallow, flowing and clear, no evidence of mining sediment in the stream bed. Potentially a false event however turbidity values increase with rainfall intensity. Catchment inspection completed, no evidence of mining related contribution found.
HUN-2408-014	Non-Mining Related	Data trend indicates false event. Heavy debris in the stream bed.
HUN-2408-015	Non-Mining Related	Site inspected on 5/08/2024, stream flowing but water level low. Sensor not sitting in stream and had contact with debris, this can trigger false turbidity event. Cleaned sensor and installed back in stream

HUN-2408-016		Site inspected on 7/08/2024, debris caught around sensor, turbidity reading 6.89NTU. As per the previously reported turbidity event on 28th July 2024, Alcoa observed during field inspections erosion of an outer haul road embankment that may have potentially contributed to the turbidity events measured at SE12T. Sedimentation fencing and have
HUN-2408-017	Mining Related	bales were installed outside of the haul road embankment on 31st July. Ongoing monitoring of this area have shown that although installed controls are proving effective, material from the initial embankment erosion is still on the forest floor and within the stream bed and is
HUN-2408-018		catchment has identified an additional potential contribution to elevated stream turbidity from a forest track up stream of SE12T, an investigation monitor was placed downstream of the forest track on 12/08/2024 to inform investigations
HUN-2408-019	Non-Mining Related	Heavy build up of leaf and organic matter impacting sensor when visited on the 2/09/2024. Stream is very low and sensor is in/out of water
HUN-2408-020	Non-Mining Related	Sensor is impacted by debris and cannot be accessed due to deep stream channel. Additional sensor to be installed
HUN-2408-021	Non-Mining	The monitoring site was inspected on the 07/08/2024, stream was clear with no evidence of mining sediment visible within the stream bed. Vegetation / debris was caught around the sensor. Evidence of track run
HUN-2408-022	Related	off was found at the turbidity monitoring point and nearby forest tracks. Inspection of the SE52T catchment area was completed, no evidence of mining related contribution was found.
HUN-2408-023	Non-Mining Related	Site inspected on 25/08/2024, stream clear and sensor clean, turbidity reading on arrival 6.44NTU. Inspection of the SE52T catchment area was completed on 25/08/2024, no contributing sources found in surrounding mining footprint. Some areas of concern identified on forest tracks within the catchment which are potentially contributing to turbidity and
HUN-2408-024	Non-Mining Related	Data trend shows likely true turbidity event. The monitoring site was inspected on the 09/08/2024, stream was clear with no evidence of mining sediment visible within the stream bed. Vegetation / debris was caught around the sensor. Evidence of forest track being heavily impacted by groundwater running down the track to stream culvert upstream of the monitor. Catchment inspection was completed, no evidence of mining contribution found.
HUN-2408-025	Non-Mining Related	The monitoring site was inspected on the 09/08/2024. Several erosion scours were found across the forest floor which have made contact with the stream, upstream of SE59T monitoring point. This area was impacted by fire in November 2023 which has left the forest floor bare with exposed soil and is likely to contribute to stream turbidity during rainfall events until the forest floor has restabilized and the stream bank vegetation has regrown. Stream clear at time of inspection however sediment from the surrounding surfaces and stream bank has built up in the stream bed. Inspection of operational areas within the SE59T catchment was completed, no evidence of mining contribution was found.
HUN-2408-026	Non-Mining Related	Site inspected on 1/09/2024, sensor impacted by debris. Stream is fast flowing and clear, no evidence of mining sediment in the stream bed. Potentially a false event however turbidity values increase with rainfall intensity and lots of spikes on PI Vision, from the start of the event to the end of the event. Catchment inspection completed, no evidence of mining related contribution found.

HUN-2408-027	Non-Mining Related	Site inspected on 01/08/2024. Stream was flowing and heavily falling onto the sensor. Evidence of algae on sensor when cleaned. NTU on arrival was 11.33 reducing to 10.99 NTU after clean. Catchment area has been inspected, no evidence of mining drainage concerns found. Sections of the forest track has eroded from rainfall and runoff is impacting the stream.
HUN-2408-028	Non-Mining	Site inspected on 08/08/2024. Stream is fast flowing and cascading as a waterfall directly onto the sensor. Turbidity value 11.13 NTU on arrival which dropped to 10.99 NTU after cleaning. Heavy tannin presence
HUN-2408-029	Related	upstream of sensor. Catchment area has been inspected, no evidence of mining contribution found. Sections of the forest track rainfall erosion are contacting the stream.
HUN-2408-030		Attended site and downloaded data. Stream is clear and flowing, probe/
HUN-2408-031	Non-Mining Related	sensor sitting in stream with water level dropping to a low level. All pits, haul roads, sumps inspected within this catchment of SE61Thad no issues. All drainages installed are holding water very well. Forest track to SE61T is flowing with water upwelling from the ground. Downes 16 pit has a pool of clear water at the back of the pit, flowing into the creek and forest. No mining related activity found during this investigation.
HUN-2408-032		Site inspected on 25/08/2024. Stream is fast flowing and cascading as a
HUN-2408-033	Non-Mining Related	waterfall directly onto the sensor. Turbidity value * NTU on arrival which dropped to * NTU after cleaning. Heavy tannin presence upstream of sensor. Catchment area has been inspected, no evidence of mining contribution found. Sections of the forest track runoff from rainfall is contacting the stream.

No further investigation is required at this time of the events flagged within.

# 3. Recommendations

## 3.1. WQMS Network

RARE recommends:

- WQMSs include a flow switch or similar mechanism to detect when the stream is dry if they haven't been fitted with one.
- Perform routine maintenance on all units to ensure their correct operation.
- Continue monitoring Biochemical Oxygen Demand levels at SE61T.

![](_page_38_Picture_0.jpeg)

## 4. Raw WQMS Data

Date					Huntle	ey WQMS Da	ata -August 2	2024 - Event	s with turbid	ity > 25 NTl	J for an ho	ur or more					
	DB01T	DB02T	FPWR1	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T
1/08/2024													1				
2/08/2024			2												1		
3/08/2024																	
4/08/2024			1														
5/08/2024											1						
6/08/2024																	
7/08/2024										1			1	1 3	1	1	
8/08/2024												1		2			
9/08/2024			1														
10/08/2024																	
11/08/2024													1				
12/08/2024																	
13/08/2024																	
14/08/2024																	
15/08/2024																	
16/08/2024												1					
17/08/2024		2															
18/08/2024											1						
19/08/2024																	
20/08/2024																	
21/08/2024											1						
22/08/2024																	
23/08/2024														1			
24/08/2024														<b>1</b> 3	1		
25/08/2024												1		3			
26/08/2024																	
27/08/2024												1					
28/08/2024												1					
29/08/2024																	
30/08/2024																	
31/08/2024																	

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

![](_page_39_Picture_0.jpeg)

Date																	
	SE09T	SE10T	SE11T	SE12T	SE12INV	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T
1/08/2024														2	1		
2/08/2024																	
3/08/2024																	
4/08/2024																	
5/08/2024		1		1													
6/08/2024				1													
7/08/2024			1	2		3					2	1	1		2		
8/08/2024																	
9/08/2024																	
10/08/2024				2													
11/08/2024							1										
12/08/2024	1																
13/08/2024									1								
14/08/2024															1		
15/08/2024																	
16/08/2024																	
17/08/2024																	
18/08/2024						1									1		
19/08/2024																	
20/08/2024																	
21/08/2024																	
22/08/2024																	
23/08/2024															1		
24/08/2024											1				1		
25/08/2024																	
26/08/2024						1											
27/08/2024																	
28/08/2024																	
29/08/2024					1								1				
30/08/2024																	
31/08/2024					1	1											

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 - August 2024 - Turbidity (Daily Average, NTU)

![](_page_40_Picture_0.jpeg)

Huntly Bauxite Mine – Water Quality Monitoring System Data Review

	DB01T	DB02T	FPWR1	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T
1/08/2024	0.9	28.8	2.9	1.6	1.6	0.9	2.8	1.7	1.7	7.1	5.9	4.8	16.8	6.0	9.1	1.3	2.2
2/08/2024	1.0	1.7	20.1	1.5	1.3	0.6	1.9	1.6	1.0	4.0	8.0	4.7	4.8	4.5	9.1	1.1	1.1
3/08/2024	1.0	1.6	10.4	1.3	1.3	0.6	1.9	1.6	1.0	4.3	3.1	4.7	4.3	4.7	11.7	1.1	1.1
4/08/2024	1.0	1.7	29.1	1.3	1.3	0.6	1.9	1.6	1.0	4.5	25.2	13.1	3.6	4.7	9.3	1.2	1.2
5/08/2024	1.0	1.8	11.0	1.6	1.3	0.6	1.9	1.6	1.0	4.2	9.2	4.7	3.6	4.9	9.5	0.6	1.2
6/08/2024	1.0	25.0	9.7	1.8	1.4	0.6	1.9	1.6	1.1	4.4	4.4	4.8	5.6	6.8	5.4	0.5	1.7
7/08/2024	1.1	1.7	14.0	1.9	2.4	6.8	2.5	2.0	2.1	15.0	4.0	9.2	35.4	43.9	16.0	13.7	3.8
8/08/2024	0.9	1.7	0.5	1.5	1.7	7.4	2.1	2.0	1.1	4.2	4.2	24.8	11.1	19.8	7.7	0.7	24.0
9/08/2024	0.9	1.7	29.8	1.3	1.4	7.4	1.9	1.7	1.0	3.5	2.4	5.0	9.2	2.8	5.2	1.1	4.8
10/08/2024	1.0	7.0	7.9	1.2	1.4	7.0	1.9	1.7	1.0	3.5	0.5	4.8	8.8	2.5	0.9	1.1	1.1
11/08/2024	0.9	1.6	2.2	1.2	1.4	6.5	1.9	1.7	1.1	4.0	0.3	6.5	11.6	4.4	3.7	1.3	1.1
12/08/2024	0.9	5.6	0.5	1.2	1.3	6.5	2.3	1.9	1.0	4.0	0.3	4.8	19.2	3.0	1.6	1.6	1.1
13/08/2024	0.9	6.8	0.4	1.1	1.1	6.5	5.1	1.6	1.0	4.2	0.4	4.9	6.0	5.0	1.6	1.9	1.1
14/08/2024	0.9	2.1	0.2	1.1	1.1	6.6	9.4	1.8	1.1	5.3	0.8	4.9	10.5	4.9	1.6	1.9	1.0
15/08/2024	0.9	1.7	0.1	1.2	1.2	6.5	3.0	1.5	1.0	4.3	1.3	4.9	6.2	4.3	1.6	1.9	1.0
16/08/2024	0.9	1.6	0.1	1.2	1.1	6.5	1.8	1.8	1.0	4.1	1.7	46.2	5.2	3.7	0.9	1.9	1.5
17/08/2024	0.9	14.0	0.2	1.2	1.2	6.6	1.8	2.4	1.3	5.7	5.0	4.7	7.3	6.2	1.7	1.9	1.1
18/08/2024	1.0	7.5	2.6	1.4	1.5	7.2	2.4	3.1	1.7	6.9	57.5	6.4	14.8	11.6	1.0	3.9	1.1
19/08/2024	0.9	9.6	0.4	1.5	1.2	6.4	2.4	1.5	1.1	4.8	5.1	5.0	6.9	13.3	1.7	1.9	1.1
20/08/2024	0.9	3.0	0.1	1.2	1.1	6.2	1.8	1.2	1.0	4.5	5.8	6.1	5.8	8.8	1.2	1.9	1.1
21/08/2024	0.9	2.1	0.1	1.1	1.1	6.2	1.8	1.2	1.0	4.5	11.2	12.8	6.4	4.6	1.7	1.9	1.1
22/08/2024	1.0	2.1	0.2	1.0	1.1	6.2	1.9	1.1	1.0	5.0	3.2	4.8	9.6	6.0	1.9	1.9	1.1
23/08/2024	0.9	2.4	0.9	1.1	1.1	6.3	2.0	1.1	0.8	7.3	2.9	17.5	11.8	16.1	3.7	1.9	1.1
24/08/2024	1.0	1.7	1.5	1.6	1.2	3.8	2.2	1.1	0.9	8.2	3.2	9.9	13.6	36.0	19.3	1.9	1.4
25/08/2024	0.9	2.0	1.7	1.2	1.0	1.0	2.0	1.0	0.8	5.4	3.5	95.4	7.9	15.8	4.2	1.9	5.3
26/08/2024	0.9	1.5	1.6	1.1	0.9	1.0	2.3	1.0	0.8	4.9	4.1	4.4	6.8	2.9	0.7	1.9	1.6
27/08/2024	0.9	1.5	1.3	1.0	1.0	1.0	2.0	1.1	0.8	4.9	4.8	78.5	6.9	4.0	1.1	1.9	1.1
28/08/2024	0.9	1.4	1.8	1.0	1.0	1.2	2.0	1.0	0.8	4.8	5.2	154.3	6.3	2.9	1.0	1.9	1.1
29/08/2024	0.9	2.4	1.3	1.0	1.0	1.0	2.1	1.1	0.8	5.3	5.6	4.3	8.9	3.9	0.9	1.9	1.1
30/08/2024	0.9	21.7	2.0	1.0	1.0	0.9	2.2	1.3	0.8	4.9	6.2	5.5	5.6	3.5	0.8	1.9	1.1
31/08/2024	0.9	1.4	2.4	0.9	1.0	0.9	2.5	1.1	0.8	5.1	7.0	4.5	5.3	3.4	0.8	1.9	1.1

Note: Daily averages above 25 NTU have been annotated by **black** bold text. Daily averages inclusive of with true events for further investigation are annotated by **red** bold text. Grey shading indicates no data available for that day at that unit.

![](_page_41_Picture_0.jpeg)

Dato						Н	untly WQMS	5 Data - Augu	st 2024 - Tur	bidity (Daily	Average, NT	U)					
Date	SE09T	SE10T	SE11T	SE12T	SE12INV	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T
1/08/2024	1.4	16.0	1.0	3.2		3.0	1.3	2.6	4.5	167.0	8.2	2.3	6.7	13.7	12.9	3.0	3.0
2/08/2024	1.1	1.5	0.3	2.0		2.7	1.1	2.1	4.6	361.2	5.2	0.3	2.8	2.7	3.3	2.2	2.5
3/08/2024	1.4	1.4	0.3	1.7		3.0	1.1	1.7	3.3	331.3	4.9	0.2	3.0	1.5	2.6	1.8	2.9
4/08/2024	1.1	1.5	0.8	3.1		3.0	1.2	3.4	3.0	378.2	4.7	0.2	2.7	1.5	2.1	1.6	2.7
5/08/2024	1.1	19.1	1.2	15.8		2.7	1.2	3.3	3.7	310.0	4.4	0.1	2.6	1.3	2.0	1.3	2.6
6/08/2024	1.0	1.3	2.7	25.1		2.5	1.3	1.4	3.2	143.7	6.5	0.3	4.2	1.1	2.4	1.2	2.5
7/08/2024	2.2	3.1	14.2	49.4		45.3	631.5	5.3	8.9	234.2	26.0	15.3	24.3	8.6	83.1	4.9	8.4
8/08/2024	5.1	1.6	1.2	2.1		17.6	1204.0	7.1	5.1	300.2	7.9	2.5	5.7	13.2	12.3	3.3	6.6
9/08/2024	673.7	1.4	0.2	13.5		19.2	1083.3	2.1	3.5	211.5	5.8	1.2	3.9	4.5	6.6	1.7	6.0
10/08/2024	312.3	1.4	0.4	33.9		17.7	1111.9	1.4	3.1	374.4	5.0	0.9	3.0	3.0	4.4	1.3	4.7
11/08/2024	481.4	3.7	4.4	10.8			531.5	1.3	2.9	199.5	4.7	1.1	3.7	2.0	5.2	1.2	3.6
12/08/2024	244.6	1.3	0.3	8.4	1.5	3.0	0.7	1.3	3.7	291.8	3.0	0.7	3.0	1.5	4.7	1.0	2.8
13/08/2024	1.0	1.3	0.4	11.3	7.2	22.3	0.7	1.3	11.6	363.8	3.6	1.1	4.4	1.2	5.4	1.0	2.3
14/08/2024	1.0	6.7	0.9	7.5	0.8	11.3	0.7	1.6	3.1	211.4	5.8	2.7	6.0	1.2	12.4	1.1	2.2
15/08/2024	1.0	1.3	0.3	5.7	0.9	12.0	0.7	1.8	3.1	205.9	4.4	0.9	3.8	1.1	7.1	1.2	2.1
16/08/2024	1.0	1.4	0.2	5.0	0.6	16.2	0.7	1.7	3.0	124.4	2.4	0.7	3.3	1.2	6.2	1.3	2.1
17/08/2024	1.0	1.3	0.2	8.2	5.3	17.8	0.7	1.7	3.1	191.1	4.1	1.2	4.8	1.1	8.2	1.3	2.3
18/08/2024	1.1	1.7	1.6	7.3	2.5	84.1	0.9	2.3	4.6	196.3	10.2	4.9	9.0	3.0	29.6	1.7	2.5
19/08/2024	1.0	1.4	0.3	5.4	0.6	22.0	0.8	1.9	4.2	391.8	5.4	1.3	5.1	1.6	9.6	1.6	2.9
20/08/2024	1.0	1.4	0.3	4.8	0.6	24.9	0.7	1.4	3.8	306.1	4.7	0.9	4.8	1.6	7.7	1.4	3.1
21/08/2024	1.1	1.4	0.3	5.3	0.6	21.9	0.7	1.4	3.2	197.6	4.1	0.6	4.7	1.4	8.3	1.2	2.6
22/08/2024	1.1	1.4	0.6	4.8	1.1	21.7	0.7	1.3	2.7	403.2	5.6	1.2	6.3	1.2	11.8	1.2	2.6
23/08/2024	1.0	1.5	0.9	6.9	2.8	0.0	0.8	1.9	3.3	331.0	8.4	4.0	10.5	1.4	26.8	1.5	2.1
24/08/2024	1.1	1.8	2.8	14.5	7.2	3.1	0.9	2.2	8.3	363.4	12.6	4.2	11.2	2.2	34.5	2.7	3.3
25/08/2024	1.0	1.5	0.4	5.2	1.0	23.9	0.9	2.3	4.4	324.8	6.2	1.5	7.0	2.3	11.0	3.1	3.9
26/08/2024	1.0	1.4	0.2	4.8	0.7	11.6	0.8	4.4	3.9	329.7	5.3	1.1	7.2	2.3	8.4	2.1	3.9
27/08/2024	1.0	1.4	0.2	5.0	2.0	15.2	0.8	1.8	3.3	176.7	5.1	1.1	8.9	1.8	8.9	1.5	2.8
28/08/2024	1.1	1.4	0.4	5.3	109.7	67.5	0.9	2.3		300.9	4.1	0.9	9.4	1.4	9.2	1.3	2.6
29/08/2024	1.2	1.4	0.4	5.3	91.7	88.0	0.9	2.6	2.9	225.5	5.3	1.8	34.4	1.3	11.7	1.3	2.5
30/08/2024	1.0	1.4	0.5	4.4	96.7	86.5	1.2	2.9	9.1	69.0	4.2	1.1	15.3	1.2	9.8	1.3	14.2
31/08/2024	1.0	1.4	0.4	4.3	69.9	88.1	1.0	1.4	3.3	70.4	2.8	1.1	5.0	1.2	11.5	2.4	14.8

Note: Daily averages above 25 NTU have been annotated by **black** bold text. Daily averages inclusive of with true events for further investigation are annotated by **red** bold text. Grey shading indicates no data available for that day at that unit.

# Appendix A. Huntly WQMS Locations

![](_page_43_Figure_0.jpeg)

# Appendix B. WQMS General Arrangement

![](_page_45_Figure_0.jpeg)

# Willowdale Mine – Water Quality Monitoring System Data Review

August 2024

Revision: 01 Date: 04 October 2024 Client: SciDev Pty Ltd Issued to: SciDev & Alcoa of Australia

![](_page_46_Picture_3.jpeg)

![](_page_47_Picture_1.jpeg)

# **Document Control**

Project Details							
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![](_page_47_Picture_7.jpeg)

![](_page_48_Picture_1.jpeg)

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![](_page_49_Picture_1.jpeg)

# 1. Introduction

#### 1.1. Purpose

RARE Environmental Pty Ltd (RARE) was engaged by SciDev Pty Ltd (SciDev) to analyse and comment on raw turbidity monitoring data collected by their Water Quality Monitoring Systems (WQMSs), at the Willowdale Mine, owned and operated by Alcoa of Australia Limited (Alcoa). Stream turbidity monitoring is a core regulatory requirement stipulated as part of Alcoa's approvals and operating framework. The data for this reporting period was collected in August of 2024 from monitors under Section 6.

This report has been prepared to assess the quality of data provided and identify potential drainage incidents ('true' events) per the procedure detailed below within that data. Where possible recommendations are made for either WQMS network upgrades or further investigation of events identified within the data. This report should not be considered an assessment of the WQMS network and/or Alcoa's compliance to relevant legislation and requirements, nor should it be considered an assessment of the suitability of the adopted trigger level and event classification procedure.

#### 1.2. Context

Data from each location has been collected and compared against the drainage incident trigger level outlined in the *Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023* Schedule 1 Division 2 Cl. 6. Trigger events have then been assessed against Alcoa's turbidity event classification guidelines to determine whether the event is true, i.e. caused by stream turbidity, or false, i.e. caused by stream debris, algae or other. For the purpose of this report a turbidity event is an event where turbidity levels, measured by a WQMS, are at least 25 nephelometric turbidity units (NTU) for a period of at least 1 hour.

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

#### 1.3. Monitoring Requirements

Under Schedule 1, Division 2 ("Controls on activities"), of the *Environmental Protection (Darling Range Bauxite Mining Proposals) Exemption Order 2023* a drainage incident is defined as:

- a) a runoff from a disturbance area to the surrounding environment of surface water that has a turbidity of at least 25 nephelometric turbidity units for a period of at least 1 hour; or
- b) a discharge from containment infrastructure that includes or may include environmentally hazardous material;

#### 1.4. Water Quality Monitoring System (WQMS)

At the Willowdale site, for this reporting period, 4 (four) active WQMSs have been installed as per Section 6, in streams within or downstream of mining operations to monitor stream turbidity levels. Each turbidity monitoring station is fitted with an Aquas SMR10 turbidity probe. The Aquas probes are placed directly in the streams, mounted at 90 degrees to the flow of water. Each sensor has a guard to protect the lens from larger debris and the units are fitted with a lens screen wiper. Note: disruptions or errant readings can occur with smaller pieces of debris (leaves etc.).

Data is collected via a Data Taker DT82 logger. Data from each logger is linked to an IOT data modem to transmit to a cloud-based platform. Data is logged locally in 6 second intervals with a 6-minute average pushed into the cloud-based platform. A float switch or cell indicates sensor immersion or a dry stream.

![](_page_50_Picture_1.jpeg)

#### 1.5. Data Review & Event Classification Process

Data produced by the WQMSs is reviewed by RARE per the following procedure and in consultation with SciDev. This allows for the identification of true events that require investigation to determine whether the mining operations may have contributed to the elevated turbidity levels, and false events.

![](_page_50_Figure_4.jpeg)

#### Figure 1: Data Review & Event Classification Process

The process considers the physical aspects of the WQMS deployment, the data collection by that monitor and finally classification of the events identified in that data. Classification of events is per Alcoa's procedure to identify events as true or false.

A 'true' stream turbidity exceedance event that is caused by an actual increase in stream water turbidity. Alcoa has identified that 'true' turbidity exceedance events typically show a sharp turbidity incline before gradually trailing off as the stream turbidity level returns to background.

![](_page_50_Figure_8.jpeg)

![](_page_50_Figure_9.jpeg)

'False' stream turbidity exceedance events are caused by factors other than an actual increase in stream water turbidity (i.e. organic debris covering the monitor such as sticks/leaves/algae, stream water turbulence or air bubbles and fluctuating water levels that intermittently cover the monitor lens and then recede). Alcoa has identified that 'false' turbidity exceedance events typically illustrate sharp inclines and declines for turbidity when the data is graphed over time and lack the distinctive 'bell curve' shape that is associated with 'true' turbidity exceedance events.

![](_page_51_Picture_0.jpeg)

![](_page_51_Figure_2.jpeg)

Figure 3: Typical 'false' exceedance event showing both a sharp incline and decline.

Any 'true' events identified in this report have been listed in Section 3.

![](_page_52_Picture_1.jpeg)

## 2. WQMS Data Review

For the reporting period of August 2024, 32,243 data points were collected by 4 (four) active WQMSs across the Willowdale site. From this data a total of 10 (ten) events were flagged where turbidity levels above 25 NTU were held for an hour or more. The following sections review this data, beginning with the deployment and operation of the WQMSs.

#### 2.1. Deployment & Collection

Two new water quality monitors, identified as RHB2 and RHB3, were installed on July 30<sup>th</sup> 2024 and August 2<sup>nd</sup> 2024 respectively.

RARE have identified WQMSs in **Table 1** that require review in regard to false events data. SciDev confirmed that the data generated by these units was invalid and therefore excluded from further analysis.

Excluding the data from these units leaves 8 (eight) potential turbidity events during the reporting period across 2 (two) units as discussed in the following section.

Unit	Dates	SCIDEV Comment
HV07	11/08/2024	Stream inspected on 11/08/2024 at 8am. The stream was not flowing. The probe was situated in a stagnant pond that was murky. No further evidence of sediment buildup from overnight rainfall. Turbidity readings showed sharp increases and decreases. Given there is no water flow, it is likely that existing shallow, murky pond water created a false event.
PTM01	13/08/2024	Stream wasn't flowing and water was stagnant for the duration of the turbidity event. There were no signs of sediment deposition at the location of the turbidity monitor. Due to the sharp increases and decreases in the turbidity readings, it is likely these readings were caused by debris on the sensor or the probe shifting in the stream. End of probe was placed in the fine sediment in the stream, therefore accumulating on lens between each wipe. Event classified as a false event.

Table 1. WOMS Requiring Review

![](_page_53_Picture_1.jpeg)

### 2.2. Classification

Analysing the data collected outside of the above periods leaves 8 (eight) potential turbidity events during the reporting period across 2 (two) units as summarised in **Table 2**.

For this reporting period there was no 'true' turbidity events identified. Refer to the following section for analysis.

Table 2. Turbidit	y events summary			
Date	Willowdale W	QMS Data -August 2024 - Ev	ents with turbidity > 25 NTU fo	r an hour or more
	HV07	PTM01	RHB2	RHB3
1/08/2024				
2/08/2024				1
3/08/2024				
4/08/2024				
5/08/2024				
6/08/2024				
7/08/2024				
8/08/2024				
9/08/2024		1		
10/08/2024				
11/08/2024				
12/08/2024				
13/08/2024				
14/08/2024				4
15/08/2024				
16/08/2024				
17/08/2024				
18/08/2024				
19/08/2024				
20/08/2024				1
21/08/2024				
22/08/2024				
23/08/2024				
24/08/2024				
25/08/2024				
26/08/2024				
27/08/2024				1
28/08/2024				
29/08/2024				
30/08/2024				
31/08/2024				

Note: Grey cells indicate data has been excluded. False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text. See following section for analysis.

![](_page_54_Picture_1.jpeg)

#### 2.2.1. PTM01 Potential Turbidity Events

Chart(s) for data flagged at monitor PTM01 are shown below for the potential events identified in the reporting period.

![](_page_54_Figure_4.jpeg)

This event is marked by a sharp incline and a sharp decline, indicative of a false event.

#### 2.2.2. RHB3 Potential Turbidity Events

Chart(s) for data flagged at monitor RHB3 are shown below for the potential events identified in the reporting period.

![](_page_54_Figure_8.jpeg)

This event is marked by a sharp incline and decline, indicative of a 'false' event.

![](_page_55_Picture_0.jpeg)

![](_page_55_Picture_1.jpeg)

![](_page_55_Figure_2.jpeg)

These events are marked by sharp inclines and declines, indicative of a 'false' event.

![](_page_55_Figure_4.jpeg)

This event is marked by a sharp incline and decline, indicative of a 'false' event.

![](_page_56_Picture_1.jpeg)

![](_page_56_Figure_2.jpeg)

This event is marked by a sharp incline and decline, indicative of a 'false' event.

#### 2.3. True Turbidity Events

For this reporting period, no potential drainage or 'true' incidents were identified for further investigation.

#### 2.4. Investigation Outcomes

No Investigation required

![](_page_57_Picture_1.jpeg)

## 3. **Recommendations**

### 3.1. WQMS Network

RARE recommends:

• Perform a maintenance and deployment review of all units to ensure their correct operation.

## 4. Raw WQMS Data

Date	Willowdale WC	QMS Data -August 2024 - Event	ts with turbidity > 25 NTU for a	an hour or more
	HV07	PTM01	RHB2	RHB3
1/08/2024				
2/08/2024				1
3/08/2024				
4/08/2024				
5/08/2024				
6/08/2024				
7/08/2024				
8/08/2024				
9/08/2024		1		
10/08/2024				
11/08/2024	1			
12/08/2024				
13/08/2024		1		
14/08/2024				4
15/08/2024				
16/08/2024				
17/08/2024				
18/08/2024				
19/08/2024				
20/08/2024				1
21/08/2024				
22/08/2024				
23/08/2024				
24/08/2024				
25/08/2024				
26/08/2024				
27/08/2024				1
28/08/2024				
29/08/2024				
30/08/2024				
31/08/2024				

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

![](_page_59_Picture_0.jpeg)

Willowdale Mine – Water Quality Monitoring System Data Review

Data	Willowdale WQMS D	ata -August 2024 - Turbidity (Daily	Average, NTU)	
Date	HV07	PTM01	RHB2	RHB3
1/08/2024	1.8	7.1	4.3	
2/08/2024	1.0	6.4	2.6	92.7
3/08/2024	1.0	5.2	2.3	2.4
4/08/2024	0.9	5.1	2.1	2.6
5/08/2024	0.9	4.9	2.0	2.4
6/08/2024	0.9	5.0	2.0	2.7
7/08/2024	1.3	5.1	1.9	7.3
8/08/2024	1.0	5.2	1.9	2.0
9/08/2024	1.1	15.4	1.9	1.7
10/08/2024	1.2	6.8	1.8	1.3
11/08/2024	15.8	3.5	1.8	2.2
12/08/2024	0.9	1.5	1.7	1.8
13/08/2024	1.0	16.8	1.7	1.9
14/08/2024	0.9	2.7	1.6	27.0
15/08/2024	0.9	1.7	1.6	4.5
16/08/2024	0.9	1.8	1.5	1.3
17/08/2024	0.9	1.9	1.4	4.1
18/08/2024	0.9	1.9	1.6	6.9
19/08/2024	0.9	2.0	1.7	1.5
20/08/2024	0.9	2.1	1.7	5.8
21/08/2024	1.3	2.2	1.5	9.0
22/08/2024	1.8	2.1		7.0
23/08/2024	1.9	2.1		4.3
24/08/2024	1.1	2.2		4.0
25/08/2024	0.9	1.6		5.2
26/08/2024	0.9	1.2	4.1	3.1
27/08/2024	0.9	1.1	3.8	7.6
28/08/2024	0.9	1.1	2.8	7.9
29/08/2024	0.9	1.1	2.8	10.9
30/08/2024	0.9	1.2	3.2	2.3
31/08/2024	1.0	1.2	2.1	2.0

Note: Daily averages above 25 NTU have been annotated by **black** bold text. Daily averages inclusive of with true events for further investigation are annotated by **red** bold text. Grey shading indicates no data available for that day at that unit.

![](_page_60_Picture_1.jpeg)

## Appendix A. Willowdale WQMS Locations

![](_page_61_Figure_0.jpeg)

![](_page_62_Picture_1.jpeg)

# Appendix B. WQMS General Arrangement

![](_page_63_Figure_0.jpeg)