Alcoa of Australia Limited

Annual Environmental Review

2024

July 2025

Contents

Tables

Figures

1. Introduction

Alcoa operates the Huntly and Willowdale bauxite mines in Western Australia to supply bauxite to alumina refineries at Pinjarra, Wagerup and Kwinana (currently curtailed).

Alcoa's WA mines operate within Mineral Lease 1SA (ML1SA) (Figure 1) under the following State Agreement Acts: *Alumina Refinery Agreement Act 1961* (WA), *Alumina Refinery (Pinjarra) Agreement Act 1969* (WA), *Alumina Refinery (Wagerup) Agreement Act 1978* (WA), *Acts Amendment Act 1978* (WA), and the *Alumina Refinery Agreements (Alcoa) Amendment Act 1987* (WA). Alcoa submits a mine plan for bauxite mining within ML1SA to the State for review and approval. The 10 Year Mine Plan is submitted in accordance with clause 5 of the *Alumina Refinery (Wagerup) Agreement Act 1978* (WA) (Wagerup State Agreement) and as voluntarily agreed by the State and Alcoa for mining not covered by the Wagerup State Agreement.

Mining and Management Programs (MMP) were previously assessed by the Mining and Management Program Liaison Group (MMPLG). Following a State Government review in 2024, a revised administrative framework was developed, resulting in the dissolution of the MMPLG and formation of Bauxite Strategic Executive Committee (BSEC) and Alcoa Independent Technical Advisory Group (ITAG).

The MMP is submitted annually to the Minister for State Development (the Minister) for endorsement. The Minister bases endorsement on advice from BSEC, which refers the MMP to the ITAG for technical review and feedback. The Minister also seeks concurrence with the Minsters for Environment and Water before providing final endorsement.

This Annual Environmental Report (Report) is submitted by Alcoa to the Department of Energy and Economic Diversification (formerly the Department of Jobs, Tourism, Science and Innovation) to meet the commitments in Schedule 2 of Ministerial Statement 728, and to review environmental performance with the applicable MMP to which the activities occurred under in the reporting year. The 2023 – 2027 MMP was the active MMP from 1 January 2024 until a technical rollover for the 2024 – 2028 period and was approved by the Minister for State Development on 21 October 2024.

The Huntly and Willowdale mines each consist of mining sub-regions. Huntly mining operations are in the Myara mine region and maintenance workshops are at the McCoy mine region. The Willowdale mining operations are in the Larego mine region with maintenance workshops at the Arundel mine region. Bauxite processing at the mines includes mining and crushing ore for transport to the refineries by conveyor and rail.

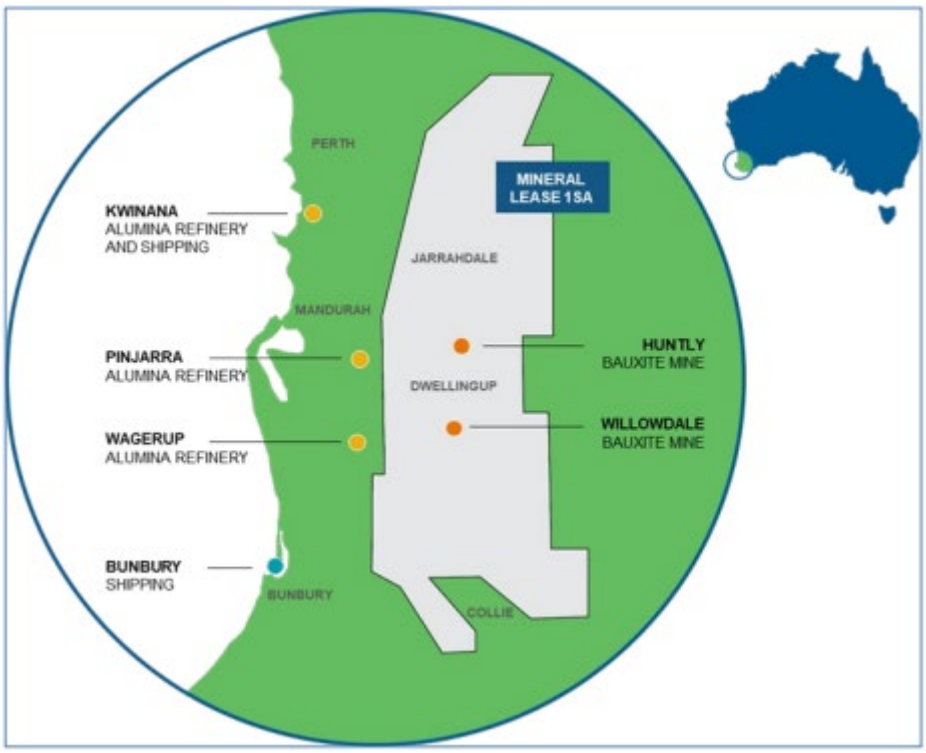


Figure 1: Locations of Alcoa WA operations and Mineral Lease 1sa

2. Environmental Management System

Alcoa's bauxite operations Environmental Management System (EMS) is certified to the ISO14001:2015 standard.

The EMS is subject to regular audits, including an ISO 14001 re-certification audit every three years and ISO 14001 surveillance audits that occur every year a re-certification audit is not required. These audits are conducted by an accredited certification body. A surveillance audit was undertaken in May 2024 which confirmed the management system complies with the requirements of ISO 14001.

3. Heritage

Prior to conducting ground disturbing activities, Alcoa's Cultural Heritage Subject Matter Expert(s) undertake comprehensive assessment of known Cultural Heritage and European sites in statutory databases and Alcoa's spatial information which may potentially be impacted by the activity. To avoid and minimise impact on Cultural Heritage Values, controls and buffer areas are implemented through the Ground Disturbance Permitting (GDP) process and executed on the ground prior to any disturbance.

Alcoa's heritage survey methodology commences with site avoidance level of heritage assessments, which are required ahead of any flexible work programs (such as exploration and other drilling activities), followed by site identification level of heritage assessments, ahead of more intensive ground disturbance activities.

All heritage surveys are undertaken by the relevant Regional Corporation and involve Traditional Owners supported by heritage consultants of their choosing. Alcoa analyses all results and applies its

mitigation hierarchy, to the greatest extent possible, to avoid impacting Cultural Heritage Values. Where Alcoa determines that an activity may impact a Cultural Heritage Value, Alcoa undertakes further engagement with Traditional Owners to discuss mitigation of heritage impacts and the statutory approvals that will be required. Alcoa will then secure the necessary approval (a Section 18 or Regulation 10) under the *Aboriginal Heritage Act 1972* (WA) or relevant Regulations, prior to the proposed activities being undertaken.

4. Mine Rehabilitation

Rehabilitation (for the purpose of Table 1 and Table 2) includes areas that have been assessed and confirmed as achieving the landform and soil return requirements of the relevant Rehabilitation Completion Criteria. The Rehabilitation Completion Criteria are the agreed criteria and prescriptions of the year of rehabilitation establishment. Alcoa has received Certificates of Acceptance – formal acceptance of rehabilitated areas by the State that have met the completion criteria – for a total of 1,355 hectares in Jarrahdale Area One (issued in 2005) and Jarrahdale Area Two (issued in 2007) and are reintegrated into the Department of Biodiversity, Conservation and Attractions' Forest management program.

Table 1: ML1SA land use reconciliation 2024

Mine Activity Type	Disturbance			Rehabilitation			Total Area of Activity (ha)
	MRF Category	Previous (ha)	Total (ha)	MRF Category	Previous (ha)	Total (ha)	Total (ha)
Fuel Storage Facility	B	1	1	E	0	0	1
Workshop	B	13	11	E	0	0	12
Dam – fresh water	B	51	51	E	16	16	67
Mining void	C	3,544	3,156	E	19,054	19,589	22,745
Borrow pit or shallow surface excavation (with a depth of less than 5 metres)	C	53	44	E	109	113	157
Building (other than a workshop) or camp site	C	108	131	E	24	24	155
Transport or service infrastructure corridor	C	1,415	1,504	E	2,250	2,323	3,827
Laydown or hardstand area	C	0	2	E	0	0	2
Processing equipment or stockpile associated with Basic Raw Material extraction	C	116	138	E	25	25	164
Topsoil Stockpile	E	413	326	E	1,088	1,131	1,457
TOTALS		**5,714**	**5,366**		**22,567**	**23,220**	**28,586**

4.1 Rehabilitation Performance

A summary of the native vegetation clearing, total rehabilitated and total cleared land un-rehabilitated (open area) is provided in Table 2.

Table 2: Rehabilitation extents for Huntly, Willowdale and Jarrahdale mines

Land area category	Huntly	Willowdale	Jarrahdale
Total area of native vegetation clearing to date (ha)	17,510.72	7,010.12	4,088.00
Total area of completed rehabilitation (ha)	13,884.86	5,229.48	4,088.00
Total area of rehabilitation completed in 2024 (ha) (2024 rehab)	469.45	187.05	0
Total area of vegetation clearing un-rehabilitated (ha)	3,705.90	1,745.30	0
Total area of rehabilitation where a Certificate of Acceptance has been issued (ha)	0	0	1,355.00
Total area of rehabilitation yet to be submitted to the BSEC for assessment (ha)	13,884.86	5,229.48	2,733.00

4.2 Rehabilitation Establishment

Revegetation of rehabilitated mine pits occurs through application of Fresh Topsoil (topsoil stored for less than 3 months that contains a natural seed bank), supplemented by seeding some understorey species, and a Jarrah and Marri overstorey seed mix. The seed used in rehabilitation is sourced from provenance zones agreed in the Alcoa-DEC Working Arrangements[1]. Certain understorey species that cannot be established via topsoil return or through seed application are hand planted (recalcitrant species). Seed and cutting material of recalcitrant species is also sourced within agreed provenance zones.

Monitoring at 9 months evaluates rehabilitated areas for tree and legume densities and the presence of weeds against the current Completion Criteria (2016 onwards). Data for areas rehabilitated between 2021, 2022 and 2023 are provided in Table 3 below. Where stem density for Jarrah and Marri is identified below the minimum 600 stems per hectare, as stated in the Completion Criteria, targeted seedling planting is undertaken in the following rehabilitation season to increase stems to the required level. Any failure to achieve the minimum stem density is likely due to a combination of factors, including landscaping (i.e. erosion), topsoil management (i.e. the seedlings are left too long, or stored in a wet area), and below-average rainfall during critical growth and establishment periods. Legumes play a role in nitrogen cycling by fixing atmospheric nitrogen, which is reflected by their inclusion as a species group in the Completion Criteria. Legumes generally form a persistent soil seed bank due to having water-impermeable 'physically dormant' seeds. While legumes are included in the applied seed mix, most species come from seeds within the Fresh Topsoil applied in rehabilitation.

[1] Alcoa/DEC Working Arrangements Bauxite Mining Operations 2011-2015. DEC is now DBCA

Table 3: Plant establishment for 2021 – 2023 rehabilitated areas at nine months old (means weighted by pit area)

Rehabilitation Year	Monitored year	Site	Legume Density (plants/m^2) *Minimum 0.5	Seeded Tree Density (stems/ha) *Minimum 600 & Maximum 1,400
2021	2022	Huntly	0.42	818
		Willowdale	0.68	455
		Weighted mean	0.58	604
2022	2023	Huntly	0.94	798
		Willowdale	1.09	584
		Weighted mean	0.97	749
2023	2024	Huntly	0.64	1050
		Willowdale	0.75	772
		Weighted mean	0.68	939
* Completion Criteria 2016 Onwards				

4.3 Rehabilitation Plant Species Richness

Botanical monitoring at 15 months assesses the species richness (the number for species recorded in a mine rehabilitation area as a percentage of the number of species recorded in forest reference plots) of the rehabilitated area compared to the surrounding unmined forest. The current Completion Criteria requires that all rehabilitated areas achieve a minimum of 60% species richness. If a pit doesn't achieve the minimum 60% species richness target, remediation will be undertaken to elevate species richness to meet the Completion Criteria standard. The mean species richness at each site for rehabilitation undertaken in 2021 – 2023 is outlined in Table 4.

Table 4: Plot richness mean at Huntly and Willowdale for rehabilitation years

Rehabilitation Year	Year Monitored	Huntly	Willowdale	Total WA Mining
2021	2022	100.26%	84.12%	91.00%
2022	2023	88.35%	79.76%	86.40%
2023	2024	81.48%	73.99%	78.48%

Of the 2023 rehabilitation year, all 33 pits at Huntly and 18 out of 22 at Willowdale met or exceeded the 15-month botanical monitoring Completion Criteria target of 60% species richness. The four isolated pits at Willowdale that did not meet the Completion Criteria target of 60% species richness are likely attributed to underperforming topsoil as a growth medium for broadcast seeds and plants combined with below-average weather conditions.

4.4 Plant Production

Alcoa's plant production and seed supply consists of four key aspects:

- purchase, treatment and supply of seed for mine rehabilitation;
- production of recalcitrant plant species;
- plant establishment in Alcoa mine rehabilitation; and
- research and development work.

All mine rehabilitation receives a seed mix comprising approximately 35 Jarrah Forest species (including key tree species Jarrah and Marri). Seed is broadcast within 7 days of the completion of contour ripping, at a rate of approximately 800 grams per hectare. Plants are propagated by external suppliers using established protocols and supplied to Alcoa for planting into mine rehabilitation in winter each year. Planting occurs 1 year after seeding, hence areas seeded in 2023 are then planted in 2024.

4.4.1 Recalcitrant Species

Recalcitrant species are often difficult or impossible to re-establish using conventional direct seeding application methods and require propagation by tissue culture, cuttings or seeds. Table 5 shows the total number of recalcitrant plants planted in rehabilitated mine pits during rehabilitation year 2022, 2023 and 2024. The number of plants produced is on an upward trend as external suppliers become more experienced propagating Jarrah Forest species and as new species are introduced. Research and development is on-going in an effort to further increase the richness and density of these species in mine rehabilitation.

Table 5: Mine recalcitrant plantings

Year of planting	Number planted	Target
2022	556,123	427,560
2023	439,046	426,720
2024	531,543	386,391

5. Dieback Management

Alcoa's dieback management system includes mapping dieback infection, classification of haul road systems, and operational control procedures.

Planned mining areas are dieback mapped within 12 months of clearing by consultants that are registered with the Department of Biodiversity, Conservation and Attractions.

5.1 Operational Controls

Management actions include (but are not limited to):

- Dieback boundaries delineated in field via dieback pegs and tape;
- signage and provision of maps to personnel; and
- equipment clean-down prior to any entry to dieback free areas from either dieback, suspected dieback or uninterpretable areas, and re-entry to such areas.

A ‘dieback breach’ occurs when dieback hygiene procedures are not followed, or when surface water or soil from a dieback area impacts a dieback free area. Dieback breaches for 2022 to 2024 are detailed in Table 6.

To understand the impact of a dieback breach, reinterpretation of the dieback lines is required. Due to the confined nature of dieback breaches in 2024, it is expected that the total area affected will be less than 1 ha.

Table 6: Number of dieback incidents 2022 - 2024

Year	Huntly		Willowdale	
	No. Breaches	Area Affected (ha)	No. Breaches	Area Affected (ha)
2022	7	23.20	0	-
2023	4	65.52	0	-
2024	1	0.15*	2	To be confirmed

*Estimated

5.2 Dieback Forest Rehabilitation (DFR)

In the revised Wagerup Environmental Review and Management Plan (in consultation with DBCA), Alcoa committed to implement a program to rehabilitate unmined areas of forest affected by dieback, regardless of the cause, within ML1SA. The program is strategically planned and executed by DBCA, and funded by Alcoa. The objective is to rehabilitate forest degraded by dieback. DFR treatment was previously completed, and received sign-off from the DBCA, for Arundel, Del Park, Huntly, and White Road mining regions.

6. Water

6.1 Drainage Events

Currently, Alcoa is operating under a range of definitions for what constitutes a drainage event/turbidity event. The variations in definitions come from the differing approval and agreement documents that currently apply to operations. These documents include the:

- s6 Exemption Order[2] (s6);
- 2023-2027 MMP (MMP); and
- Water Working Arrangements[3] (WWA).

While the s6 and MMP have definitions of events that generally align, the definition in the WWA is different. Under the s6 a drainage event is defined as:

[2] Environmental Protection (Darling Range Bauxite Mining Proposals) Exemption Order 2023, SL 2023/200
[3] Water Working Arrangements Between Alcoa World Alumina, Department of Water and Environmental Regulation and Water Corporation covering Alcoa’s mining operations in Western Australia, Version 5.

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 (NTU) for a period of at least 1 hour; or

b) a discharge from containment infrastructure that includes or may include environmentally hazardous material.

The MMP defines a drainage event as:

- Event where surface water runoff from the mining disturbance footprint to surrounding environment except where turbidity is measured below 25 NTU.

And further defines a failure of containment infrastructure as:

- Uncontrolled or unmanaged release of surface water from constructed drainage management infrastructure.

Reporting is aligned under both the s6 and MMP, requiring reporting of discharges from containment infrastructure that may contain environmentally hazardous materials and drainage events as defined above.

The WWAs do not define what constitutes a drainage event but do define a turbidity event (see section 6.3), with reporting requirements only applicable within Proclaimed Catchments[4] .

The absence of a drainage event definition under the Water Working Arrangements has resulted in differences in interpretation of what constitutes an event and therefore what has been reported to the Water Corporation and DWER. For 2024, drainage events reported under the WWA were events where water and sediment exited the disturbance footprint of the mine site, regardless of impact or extent. With the monitoring and reporting requirements associated with Section 6 & MMP implementation, additional resources were allocated to improve identification of events. As a result, long term data trends in reportable events under the Water Working Arrangements (Table 8) may not directly correlate with performance or impact.

For clarity, Table 7 outlines the number of drainage events under each different definition and reporting requirement in 2024 and includes those not required to be reported under any other mechanism.

Table 7: Drainage events in 2024

	Reported under s6 / MMP[1]	Reported under WWA	Reported under both s6 / MMP and WWA
Huntly	3	29	0
Willowdale	5	15	0
TOTAL	8	44	0

[1]Only includes events under both definitions – i.e. runoff with associated turbidity event >25NTU for 1 hour or discharge from containment infrastructure that may contain environmentally hazardous materials – that were confirmed events following finalisation of 21-day report.

[4] Referred to as proclaimed drinking water source area (PDWSA) declared under the Metropolitan Water Supply, Sewerage and Drainage Act 1909.

Table 8: Drainage events reported under the Water Working Arrangements 2020-2024

	2020	2021	2022	2023	2024
Huntly	15	56	9	8	29
Willowdale	8	15	3	2	15
TOTAL	23	71	12	10	44

Figure 2 shows the identified causes of the drainage events. As shown, rehabilitation pits were the greatest contributor to drainage events at Huntly in 2024. The majority of these rehabilitation pits are in the early stages of growth, that is, pits that are either recently landscaped or have minimal growth (i.e. within 1 – 2 years of rehabilitation landform and seeding completion). The slope and batter of the rehabilitation pit, as well as the integrity of rip lines are key to ensuring water is contained within the pit in these early stages of vegetation growth.

Haul road sump overflows were another large contributor to events in 2024, any required to be reported under s6 were confirmed to not contain any environmentally hazardous materials. Initiatives to improve sump capacity and reduce events are outlined in section 6.2 below.

All events are raised in Alcoa's incident management system and investigated to determine root cause and identify appropriate corrective actions. These include immediate temporary controls, such as pumping of sumps to reduce water levels, and long-term actions to ensure no reoccurrence.

Of those reported, only the eight confirmed events under the s6/MMP definition had any mining related impacts to stream zones with confirmed turbidity exceedances as a result. No observable impacts to the catchment from these turbidity events have been identified. Downstream turbidity monitoring sites did not record turbidity events during or following the recorded events. All other events were investigated and confirmed that no sediment or water deposition into stream zones occurred.

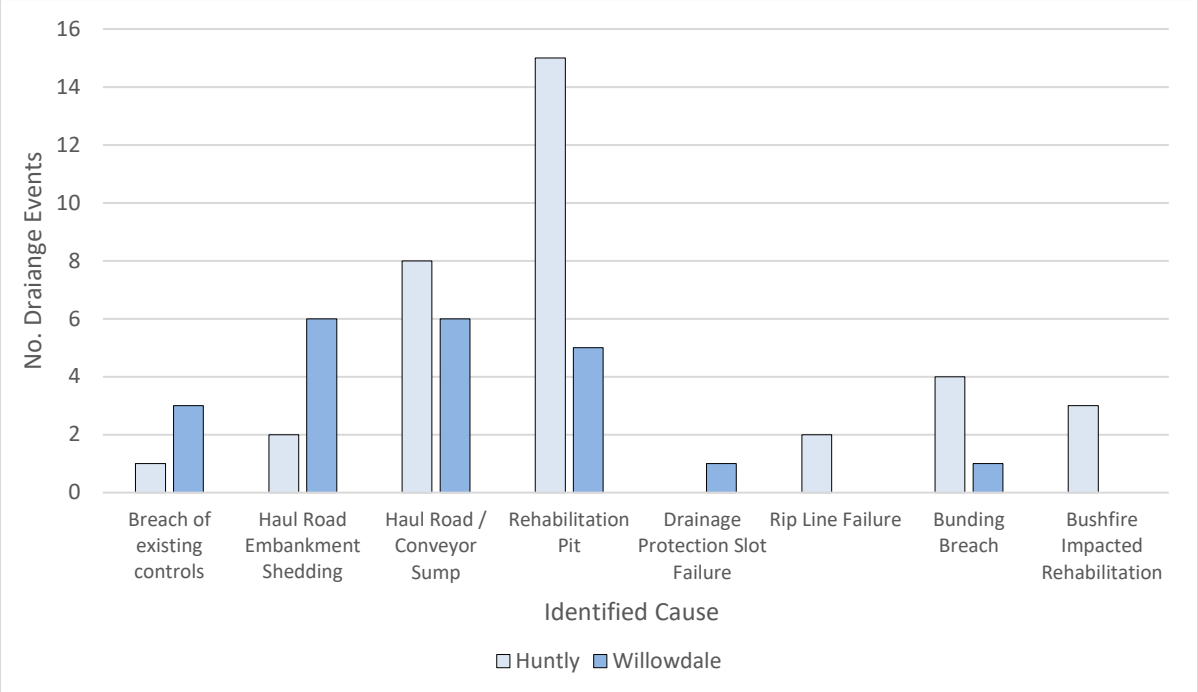


Figure 2: Identified causes of drainage events – 2024

6.2 Catchment Protection Initiatives

In the past three years, Alcoa has significantly uplifted drainage controls and processes to mitigate the risks to drinking water catchments from operations. This has included the implementation of uplifted drainage standards in new pits and infrastructure as per the Drainage Control Management Plan Summary document and other active management controls including:

- Identification of priority legacy drainage risk areas and defining and implementing additional controls to ensure drainage capacity meets contemporary standards, specifically, capacity to contain a 1%, 24-hr Annual Exceedance Probability (AEP) rainfall event.
- Active water management activities including:
    - temporary pipeline and pump systems established to manage water accumulation within active pits, rehabilitation areas, haul road sumps and fixed plant sumps; and
    - installation of engineered designed ‘drainage trenches’ within (recent and legacy) pit and rehabilitation areas to capture turbid surface water runoff within operational areas.
- Ongoing work of a full-time water crew established at each site in 2021 to actively manage water on-site.
- Drainage Control Management Plans (DCMPs) developed for each pit and implemented to ensure sufficient pit capacity.
- Regular checks of drainage control as-builts.
- Risk assessment process developed using LiDAR/Drone technology to identify where pit catchment is deficient and ensuring additional controls implemented as soon as practicable.

6.3 Monitoring

6.3.1 Stream Turbidity

Stream turbidity monitoring points located immediately upstream of neighbours or public water supply storage reservoirs are referred to as Compliance Monitoring Points in accordance with the WWA operational requirements. The turbidity level at these points reflects the quality of water entering a reservoir. Alcoa has also installed local monitoring points upstream of Compliance Monitoring Points to facilitate turbidity assessment of the broader active mine region. Local monitors provide information on the performance of the drainage infrastructure of the mine.

Agreed reporting limits are set under the WWA, and all monitored turbidity events greater than 25 NTU for an hour or more at Compliance Monitors are reported to Water Corporation and DWER. Identified turbidity events that fit the definition of a drainage event under the s6 Exemption Order or 2023-2027 MMP are also reported. As noted in section 6.1, turbidity and drainage are linked in the definition of a drainage event under the s6 Exemption Order and 2023-2027 MMP. This means that the reported events in Table 9 and 10 below are also captured in reported drainage events in Table 7.

As with drainage events, there are several turbidity events that occur that are not required to be reported under any other mechanism, i.e. local monitors that do not meet the definition of a drainage event under the s6 Exemption Order. This Report will include all events.

Turbidity sensors measure stream turbidity levels in 6-second intervals that are recorded by a logger as 6-minute averages. Where telemetry is available, live data is transmitted to site personnel. Where transmission via telemetry is not available, data is downloaded monthly or after every 20 mm or greater rain event. The turbidity monitoring network is reviewed each year to ensure monitors are appropriately located and additional monitors added as required.

It is common to see turbidity events in the first month of the winter season, or as the streams are flushed after being dry over the summer. These events are attributed to the flushing effect through vegetation and increased stream flow.

6.3.1.1 Huntly

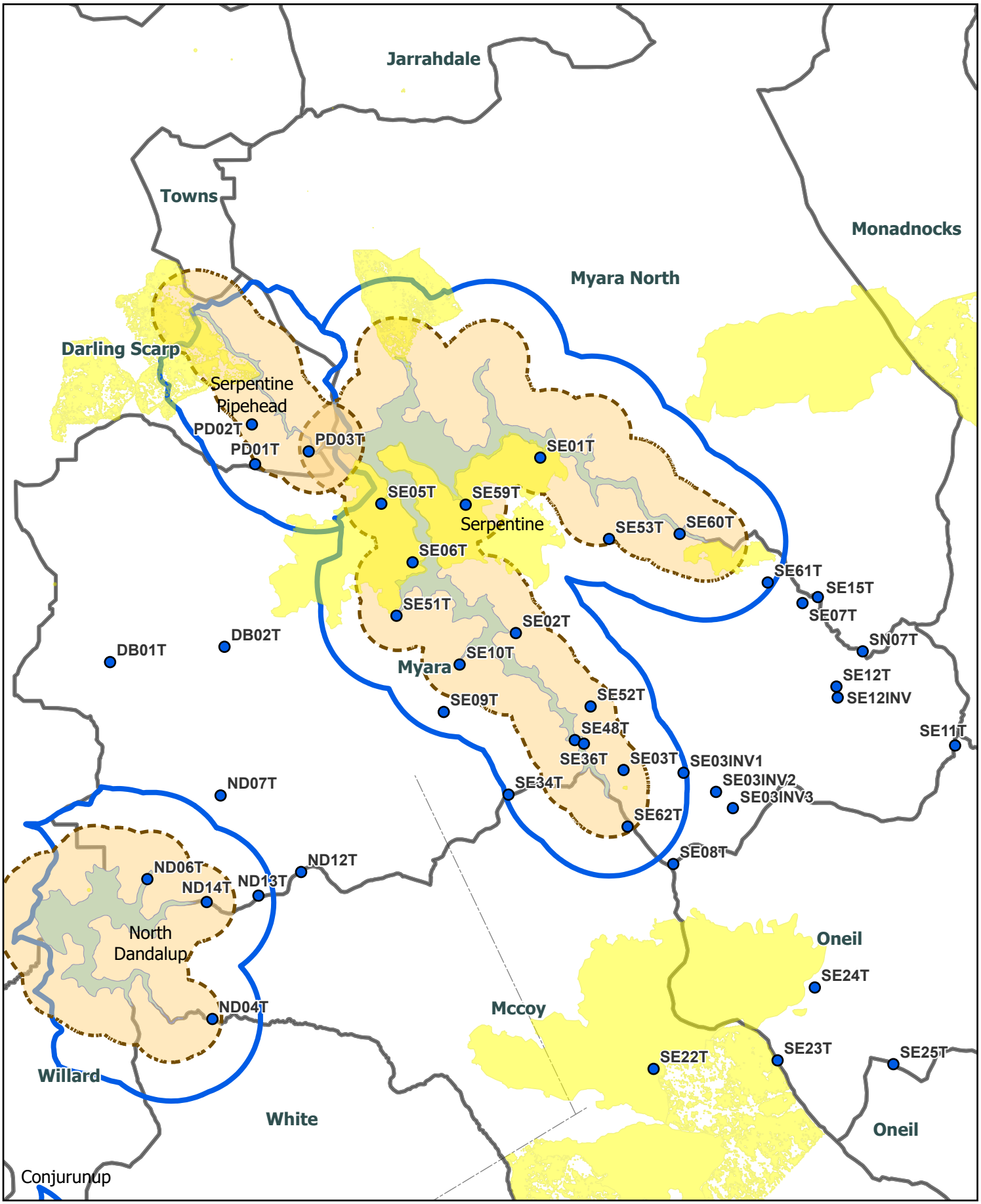
In total Huntly has 44 monitors across five separate catchments, the majority located within the Serpentine Dam catchment associated with mining activities in the Myara region.

The Huntly turbidity monitoring network (Figure 4) includes Local and Compliance monitors primarily in the catchments associated with North Dandalup Dam, Serpentine Main Dam, Serpentine Pipehead Dam and Dirk Brook. North Dandalup, Serpentine Pipehead and Serpentine are public drinking water supply dams. Dirk Brook is a water source for private properties downstream.

An additional 10 monitors were installed in 2024 - nine installed within the Serpentine Dam catchment and one within the Conjurunup Creek Pipehead Dam catchment.

Of the turbidity exceedances reported in 2024 (Table 9), the three reported under s6/MMP with confirmed mining related impacts were due to water shedding off the side of steep haul road embankments. The events were caused by the same embankments at the same turbidity monitor location. No observable impacts to the catchment from these turbidity events have been identified. Management actions have been initiated to prevent shedding from occurring in these locations in the future, including the use of engineering controls. A further 22 events were attributed to a bushfire

that occurred in November 2023 directly south of the Serpentine Dam and has left the forest floor bare, with areas of exposed soil (Figure 3).



Legend

- Top Water Line 1km Buffer (1km RPZ)
- Reservoir Protection Zones (RPZ)
- Major Dams
- Regions
- Conveyors
- Huntly Turbidity Monitors
  - Installed
- Recent Fire History
  - 2023

N

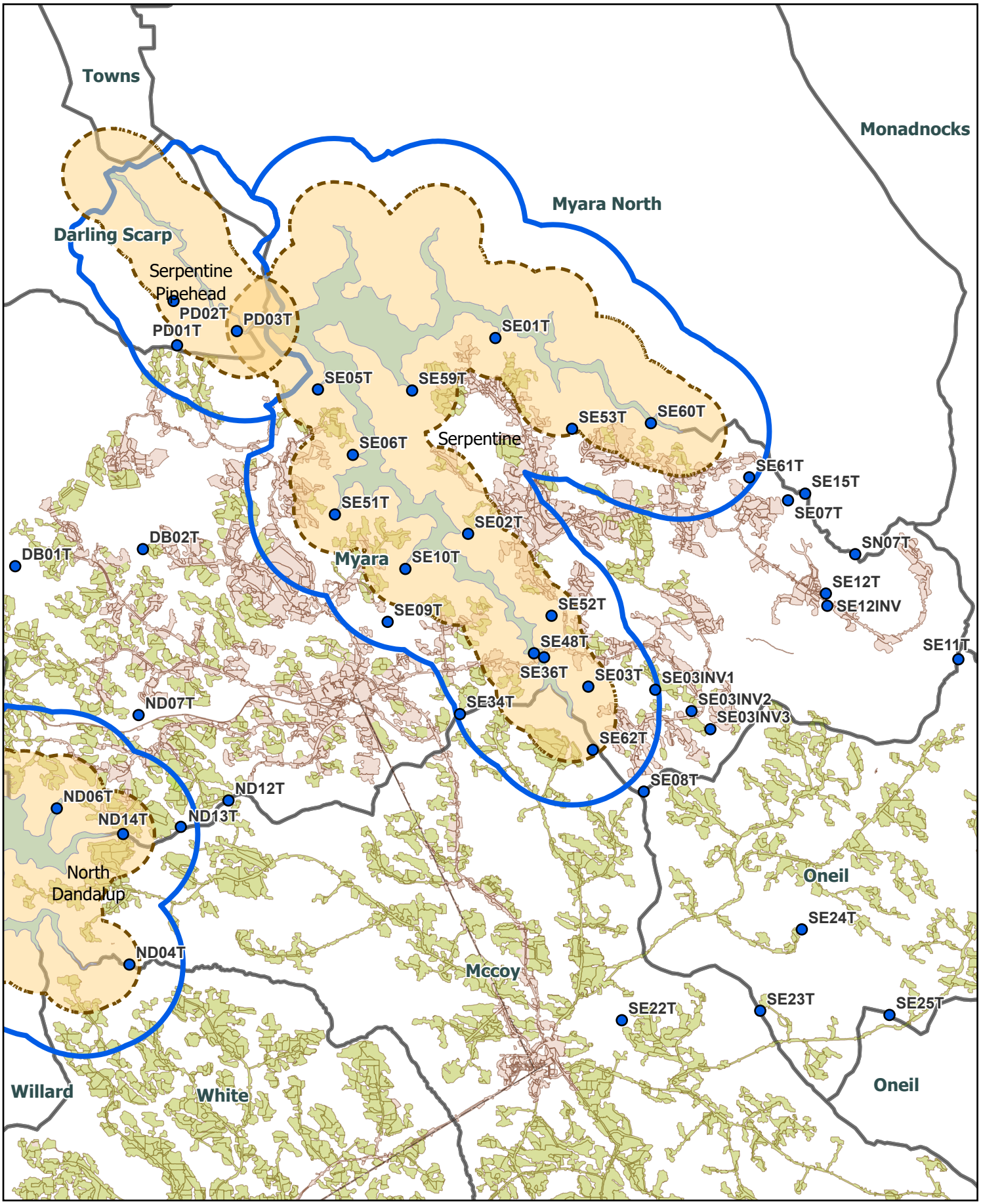
0 0.75 1.5 3 Km

Annual Environmental Review

Figure 3: 2023 Bushfire Location

Scale: 1:127,798

Date Printed: 23/04/2025



Legend

- Top Water Line 1km Buffer (1km RPZ)
- Reservoir Protection Zones (RPZ)
- Major Dams
- Huntly Rehab
- Regions
- Huntly Clearing
- Conveyors

Huntly Turbidity Monitors

- Installed

N

0 0.75 1.5 3 Km

Annual Environmental Review

Figure 4: Huntly Turbidity Monitoring Network

Scale: 1:114,501

Date Printed: 23/04/2025

Table 9: Turbidity events Huntly 2024

Monitoring Point	Monitor Type (Compliance/ Local)	Monitor Install Date	Stream Catchment	Reported under s6 / MMP		Reported under WWA		Not previously reported	
				No. Events	No. Events with Confirmed Mining Contributions	No. Events	No. Events with Confirmed Mining Contributions	No. Events	No. Events with confirmed mining contributions
DB01	L	2012	Dirk Brook	-	-	-	-	-	-
DB02	L	2017	Dirk Brook	-	-	-	-	2	0
FPWR1	L	2024	Dirk Brook	-	-	-	-	-	-
ND04	C	2001	North Dandalup	-	-	-	-	-	-
ND06	C	2012	North Dandalup	-	-	1	0	-	-
ND07	L	2020	North Dandalup	-	-	-	-	1	0
ND12	L	2023	North Dandalup	-	-	-	-	-	-
ND13	L	2022	North Dandalup	-	-	-	-	-	-
ND14	C	2010	North Dandalup	-	-	1	0	-	-
PD01	C	2018	Serpentine Pipehead	-	-	8	0	-	-
PD02	C	2018	Serpentine Pipehead	-	-	-	-	-	-
PD03	C	2021	Serpentine Pipehead	-	-	-	-	-	-

Monitoring Point	Monitor Type (Compliance/ Local)	Monitor Install Date	Stream Catchment	Reported under s6 / MMP		Reported under WWA		Not previously reported	
				No. Events	No. Events with Confirmed Mining Contributions	No. Events	No. Events with Confirmed Mining Contributions	No. Events	No. Events with confirmed mining contributions
SE01	C	2022	Serpentine	-	-	1	0	-	-
SE02	C	2022	Serpentine	-	-	2	0	-	-
SE03	L	2023	Serpentine	2	0	-	-	9	0
SEO3INV1[1]	L	2024	Serpentine	-	-	-	-	-	-
SEO3INV2[1]	L	2024	Serpentine	-	-	-	-	-	-
SEO3INV3[1]	L	2024	Serpentine	-	-	-	-	-	-
SE05	C	2022	Serpentine	-	-	15	0	-	-
SE06	C	2022	Serpentine	-	-	1	0	-	-
SE07	L	2022	Serpentine	-	-	-	-	2	0
SE08	L	2023	Serpentine	-	-	-	-	-	-
SE09	L	2023	Serpentine	-	-	-	-	-	-
SE10	C	2012	Serpentine	-	-	-	-	-	-
SE11	L	2022	Serpentine	-	-	-	-	2	0
SE12	L	2022	Serpentine	3	3	-	-	2	0
SE12INV[1]	L	2024	Serpentine	-	-	-	-	-	-
SE15	L	2022	Serpentine	-	-	-	-	1	0
SE22	L	2024	Serpentine	-	-	-	-	-	-
SE23	L	2024	Serpentine	-	-	-	-	-	-
SE24	L	2024	Serpentine	-	-	-	-	-	-
SE25	L	2024	Serpentine	-	-	-	-	-	-

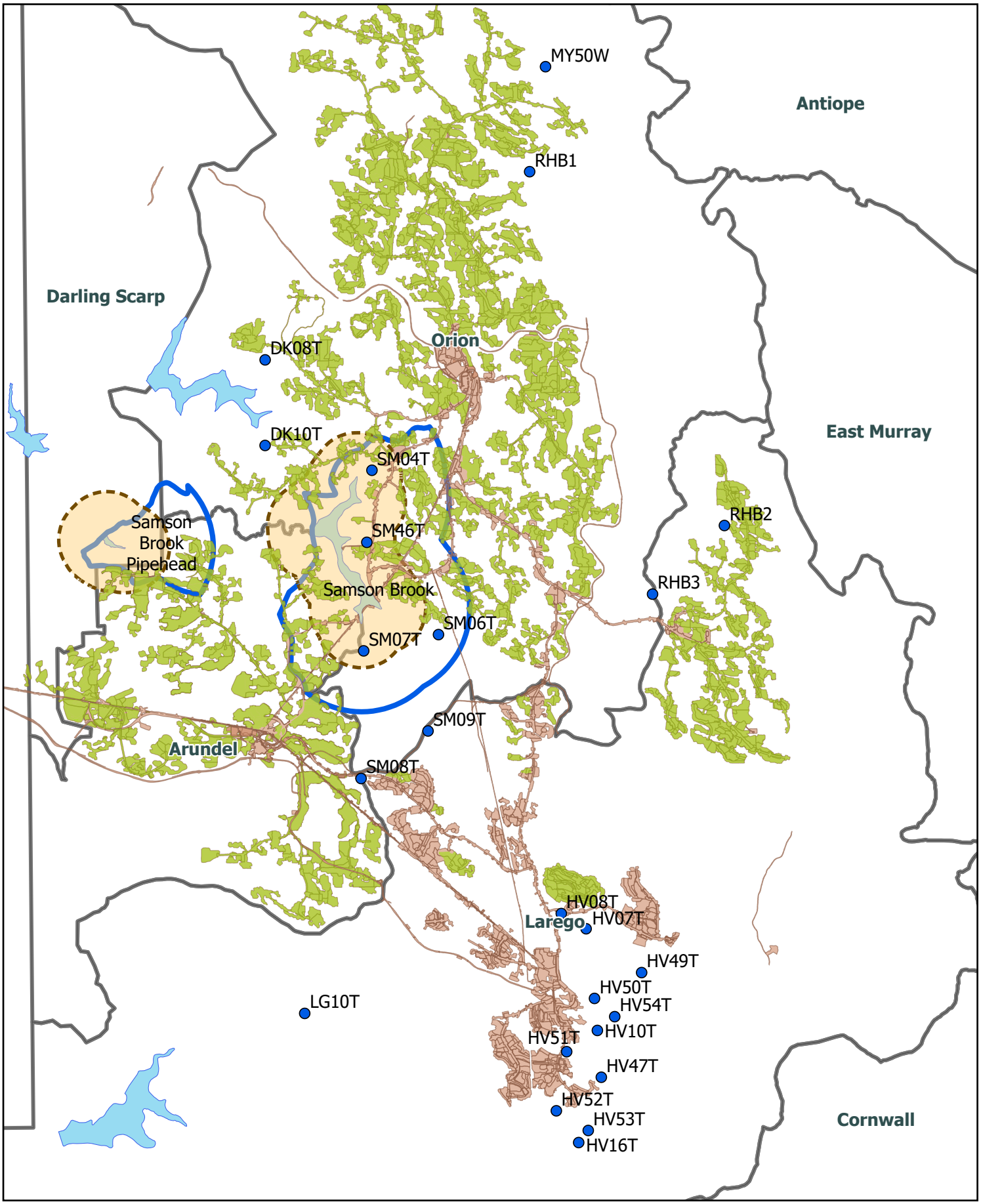
Monitoring Point	Monitor Type (Compliance/ Local)	Monitor Install Date	Stream Catchment	Reported under s6 / MMP		Reported under WWA		Not previously reported	
				No. Events	No. Events with Confirmed Mining Contributions	No. Events	No. Events with Confirmed Mining Contributions	No. Events	No. Events with confirmed mining contributions
SE26	L	2024	Serpentine	-	-	-	-	-	-
SE34	L	2022	Serpentine	-	-	-	-	-	-
SE36	L	2023	Serpentine	-	-	-	-	-	-
SE48	C	2012	Serpentine	-	-	-	-	-	-
SE51	C	2012	Serpentine	-	-	5	0	-	-
SE52	C	2016	Serpentine	-	-	10	0	1	0
SE53	C	2013	Serpentine	-	-	2	0	-	-
SE59	C	2018	Serpentine	-	-	11	0	-	-
SE60	C	2022	Serpentine	-	-	-	-	-	-
SE61	L	2020	Serpentine	-	-	-	-	16	0
SE62	L	2020	Serpentine	-	-	-	-	-	-
SN07	L	2023	Serpentine	-	-	-	-	-	-
			TOTAL	**5**	**3**	**32**	**0**	**36**	**0**

6.3.1.2 Willowdale

Willowdale has a total of 24 active turbidity monitors including Compliance and Local monitoring points in the Samson Dam, Stirling Dam and Murray catchments (Figure 5). Samson and Stirling catchments are public drinking water supply dams whilst the Murray is used by neighbours downstream.

An additional nine turbidity monitors were installed at Willowdale in 2024 - six in the Stirling Dam catchment and three in the Murray catchment. Those in the Stirling Dam catchment are associated with new and future mining areas within the Larego mine region, whilst those in the Murray catchment are associated with rehabilitation in the northern Larego and Orion mining regions.

Of the turbidity exceedances reported in 2024 at Willowdale (Table 10), the five reported under s6/MMP with confirmed mining related impacts were due to water shedding off the side of steep haul road embankments. The events were caused by the same embankments at the same turbidity monitor location. No observable impacts to the catchment from these turbidity events have been identified. Management actions have been initiated to prevent shedding from occurring in these locations in the future, including the use of engineering controls.



Legend

- Top Water Line 1km Buffer (1km RPZ)
- Reservoir Protection Zones (RPZ)
- Major Dams
- Regions
- Conveyors
- Willowdale Rehab
- Willowdale Clearing

Willowdale Turbidity Monitors

- Installed

N

0 0.75 1.5 3 Km

Annual Environmental Review

Figure 5: Willowdale Turbidity Monitoring Network

Scale: 1:112,804

Date Printed: 23/04/2025

Table 10: Willowdale turbidity events 2024

Sample Point	Compliance / Local (L) Monitor	Install date	Stream Catchment	S6/MMP Reportable Events		WWA Reportable Events		Not Previously Reported	
				No. Events	No. Events with Confirmed Mining Contributions	No. Events	No. Events with Confirmed Mining Contributions	No. Events	No. Events with Confirmed Mining Contributions
SM04	C	Pre-1999	Samson	-	-	-	-	-	-
SM06	C	2007	Samson	-	-	-	-	-	-
SM07	C	2019	Samson	-	-	4	0	-	-
SM08	L	2020	Samson	1	0	-	-	1	0
SM09	C	2020	Samson	-	-	-	-	-	-
SM46	C	1999	Samson	-	-	-	-	-	-
MY50W	C	2007	Murray	-	-	-	-	-	-
DK08	C	2007	Waroona	-	-	-	-	-	-
DK10	C	2004	Waroona	-	-	-	-	-	-
HV08	L	2020	Stirling	5	5	-	-	-	-
HV10	L	2020	Stirling	-	-	-	-	-	-
HV47	L	2022	Stirling	-	-	-	-	-	-
HV16	C	2022	Stirling	1	0	1	0	-	-
			Total	**7**	**5**	**5**	**0**	**1**	**0**

6.3.2 Groundwater

In 2022, Alcoa began installing groundwater monitoring bores to facilitate assessment of groundwater levels and water quality in proposed mining areas. This process has been embedded and continues to occur on an ongoing basis to inform mine planning and development of Drainage Control Management Plans.

At the end of 2024, this ongoing program has installed 678 groundwater monitoring bores across Huntly and Willowdale. The boreholes are installed prior to mining to understand the baseline site conditions and interim groundwater levels and inform pit design.

Alcoa also aims to utilise groundwater level data obtained from the bores with rainfall records to understand the recharge from precipitation in the long term and to assess the groundwater response before, after and during mining operations.

The updated Water Resources Management Plan (WRMP), submitted in February 2025, includes an upgraded regional groundwater monitoring program, which involves the installation of a further 134 bores to capture groundwater quality data across Alcoa's current mining areas.

In addition, the WRMP has committed to a further 63 monitoring bores in hydrocarbon storage areas to identify and facilitate a rapid response to any potential impacts. These bores will be installed as part of a staged approach over the next two years, with exact details subject to change.

6.3.3 Surface Water

A regional surface water monitoring program took place across 64 locations from August to October 2024 both within and outside of the mining disturbance footprint. The analytical results from this program indicate that Alcoa's operational impacts to surface water do not present an unacceptable risk to human health. Most analyte concentrations were below the assessment levels relevant to human health, with no human health criteria exceedances noted for TRHs, BTEXN, SVOCs, PAHs, herbicides, and pesticides. Some exceedances were reported for pH at the Willowdale mine site and pH, microbial parameters and select metals at the Huntly mine site. Of the exceedances that were reported:

- pH exceedances were consistent between background and receiving environment locations, indicating that these exceedances are a result of natural levels rather than mining activities.
- Thermotolerant coliforms and E. coli was detected above the Australian Drinking Water Guidelines (ADWG) health criteria but were likely the result of wild animals in and around the surface water features, as levels were consistent between background and receiving monitoring locations. Similarly, the assumptions behind the drinking water criteria are not satisfied by the human exposure scenarios for the surface water features. The recreational waters criteria are more applicable to the streamlines within the mine sites and all thermotolerant coliforms or E. coli concentrations were below these criteria.
- Al (Aluminium), Fe (Iron) and Mn (Manganese) were present above the NPUG or ADWG aesthetic criteria in some locations and levels were largely consistent between background and receiving monitoring sites. A review of the guidelines confirms that these assessment levels are based on aesthetic considerations (staining of fittings and laundry) or equipment functionality (clogged filters or irrigation equipment). All total metals concentrations were below the ADWG health criteria.

As part of Alcoa's commitments in the updated WRMP, regional surface water monitoring events will be undertaken biannually in order to gain a better understanding of surface water quality within Alcoa's mining areas.

6.4 Water Use and Conservation

Alcoa draws water from surface water sources under licences issued by DWER, and under water supply agreements with the Water Corporation. Additional water is collected from rainfall runoff and treated wastewater. The majority of water is used for haul road dust suppression and construction. Other uses include vehicle and equipment cleaning, drinking water, crusher plant cleaning and dust control, garden reticulation, amenities and fire control.

Figure 6 shows the annual volume of freshwater abstracted under the DWER surface water licences and Water Corporation supply agreements, and the freshwater usage rate for each mine. The usage rate is calculated based on the volume of water used, average haul distance and tonnes of bauxite produced. Freshwater abstraction is highly dependent on rainfall. In years of low rainfall, freshwater use increases to compensate for the low runoff captured from the mine facilities and the increased need for dust suppression.

Freshwater usage was relatively stable between 2022 and 2024, though the usage rate was slightly higher at both sites in 2024 compared to previous years. Due to increased rehabilitation targets, greater numbers of machinery were operating at both sites, increasing the need for dust suppression and therefore the usage rate. Willowdale has also seen a slight increase in haul distance between 2022 and 2024.

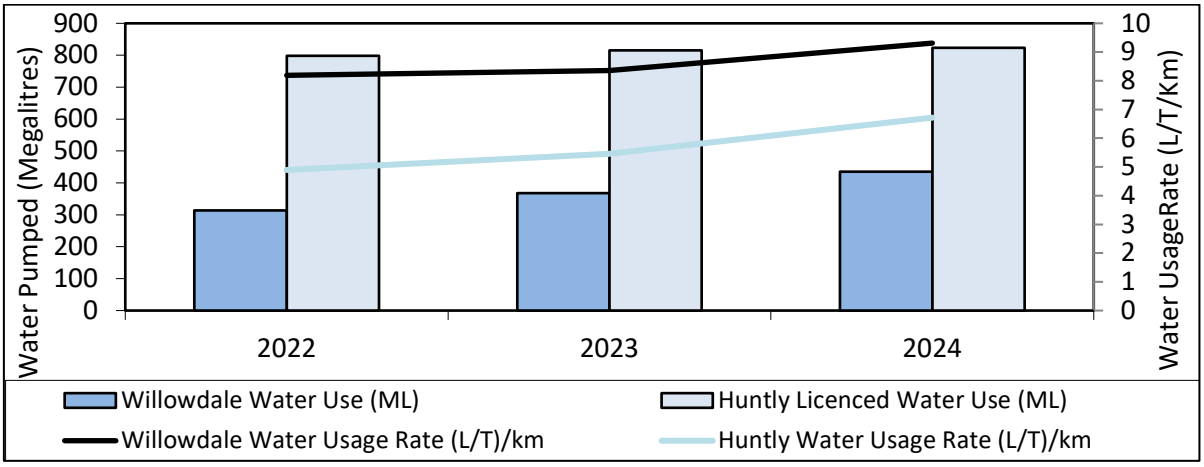


Figure 6: Freshwater use 2022 – 2024

6.4.1 Water Use Efficiency Initiatives

Alcoa is continually reviewing opportunities to improve water efficiency, increase water reuse and increase the amount of runoff captured on site.

Water saving initiatives at Huntly and Willowdale in 2024 included:

- continuation of daily and weekly water crew inspections;
- regular network maintenance;
- fortnightly updates on water usage rates sent to supervisors to help track and provide transparency on water usage;

- water saving techniques whilst watering haul roads where safe or practical to do so (e.g. spot spraying, using centre spray only, ensure no watering of bunds); and
- maintenance on water cart sprays to ensure efficient watering of haul roads (e.g. ensure the rate of application is appropriate).

Other water saving initiatives at Willowdale in 2024 included:

- introduction of water saving targets for water cart usage. Restrictions of number of water cart loads per day were introduced based on weather conditions and haul distances;
- discharges from the Larego wastewater treatment unit were directed to the Larego 50ML Reservoir for reuse; and
- new signage encouraging water saving in the office and home was installed in administrative buildings near water sources (bathrooms and kitchens).

6.5 Dangerous Goods and Hazardous Materials Management

6.5.1 Loss of Containment (LOC)

Alcoa records mining related chemical and hydrocarbon spills in its environmental incident reporting system. The total annual spills (>20L) onto unsealed ground for 2022 to 2024 are displayed in Figure 7. All site personnel are trained in spill response and equipment is maintained to reduce the risk of spills occurring. Machinery part fatigue is the greatest contributor to spills at both sites accounting for 40% of total spills (Figure 8). Any area affected by a spill is remediated and remediation is confirmed via testing of remediated soil for presence of the relevant contaminants. The standard to confirm remediation is based on the National Environmental Protection (Assessment of Site Contamination) Measure 2013.

To reduce the number of spills due to part fatigue, hose replacement maintenance activities occur as per manufacturers requirements. Further, a dedicated hose replacement technician is utilised to review equipment in the field and change out any hose as required prior to scheduled maintenance times.

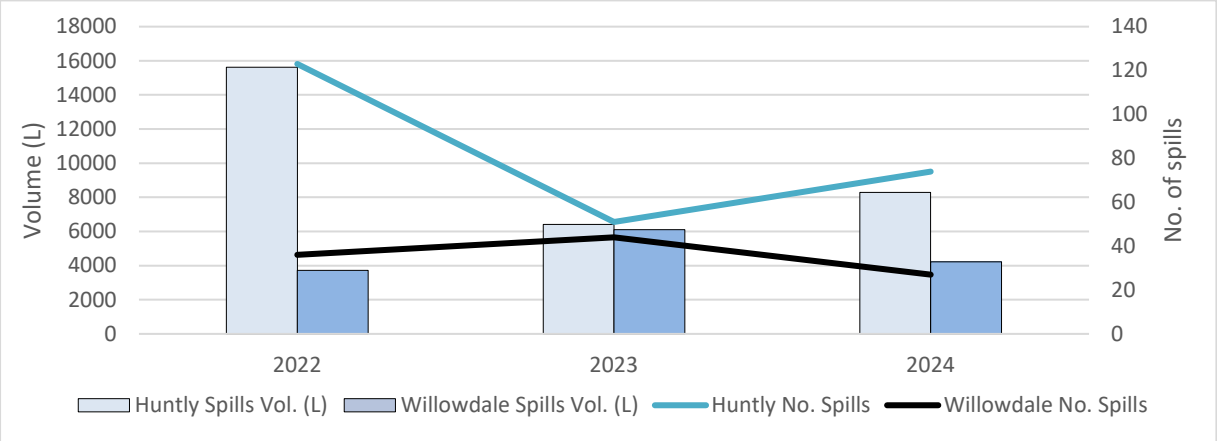


Figure 7: Total number of spills >20L to unsealed ground and spill volumes

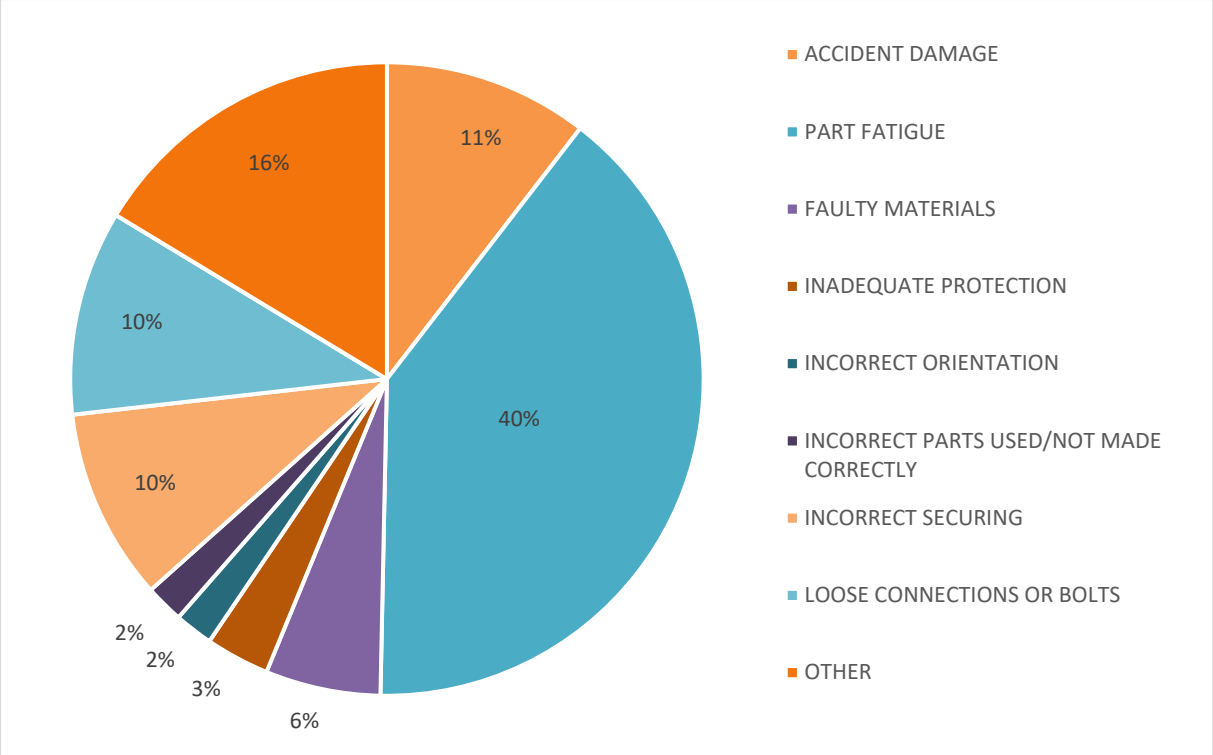


Figure 8: Loss of containment cause categories across Huntly and Willowdale 2024

6.5.2 Section 72 Notifications

Section 72 (s.72) of the *Environmental Protection Act 1986* (WA) outlines the obligation to report discharges of waste to the environment if the discharge of waste has caused or is likely to cause pollution, material environmental harm or serious environmental harm.

There were no incidents reported under s.72 in 2024.

7. Waste Management

Controlled Wastes generated at the WA mine sites are managed as per the *Environmental Protection (Controlled Waste) Regulations 2004* (WA). The Western Australia Operations waste team facilitates Alcoa's waste management program with the aim of minimising waste sent to landfill. Table 11 shows the volumes of waste sent for different management types at both sites during 2024.

Table 12 shows the waste streams that account for the greatest percentage of the total waste volume and the associated management methodology for 2024.

In February 2024, Willowdale received a licence amendment to the Part V Licence L6465 which, along with the Prevention Notice 202304 issued to Alcoa on 4 May 2023, required management of operational stormwater sumps to maintain freeboard and prevent overflow to the environment. Construction of the PFAS Treatment Unit (PTU) commenced under the amended licence to treat potentially PFAS affected water which would help to maintain freeboard requirements. Commissioning of the PTU began in November 2024, prior to this, potentially PFAS affected water was required to be transferred offsite to an appropriately licenced disposal facility. This accounted for

35,768t of water disposed under the "Landfill and Other Disposal" category for Willowdale. This volume is expected to decrease into 2025 as the PTU becomes operational and water is treated and discharged as per Licence requirements.

Table 11: Waste volume (t) and management method 2024

Management Method	Hazardous		Non-Hazardous	
	Huntly	Willowdale	Huntly	Willowdale
Total Generated	2514.78	39257.94	1138.35	300.05
Recycling and Other Recovery	674.55	251.56	968	215.1
Incineration	21.81	2.9	0	0
Landfill and Other Disposal	1818.42	39,003.48	170.35	84.94

Table 12: Volumes and management method of waste streams contributing the highest volume to total waste in 2024

Waste Type	Waste Category	Recycling and Other Recovery		Landfill and Other Disposal	
		HUN	WDL	HUN	WDL
Heavy Vehicle Tyres	T140	60.918	54.644	219.46	37.24
PFAS Contaminated Liquids	M270	-	-	28.80	35768.60
Hydrocarbon Sludge	J180	-	-	1285.5	278.302
Oil/Water Mix	J120	4.02	1.27	27.985	61.57
Waste Oil	J100	545.77	171.33	-	-
Domestic Waste	N/A	-	-	166.99	42.365
Domestic Recyclables	N/A	30.074	10.51	-	-

8. Noise

8.1 Operational noise

Noise management plans are in place at both Huntly and Willowdale mines to manage compliance with the *Environmental Protection (Noise) Regulations 1997*.

8.1.1 Huntly

Huntly mining operations has a two-stage operational noise management process. The first stage comprises a predictive noise model that considers the planned mining activities, equipment location, and forecast weather conditions to predict the noise impact on identified sensitive premises. The mine plan is adjusted in consideration of the noise model results to ensure all planned mining is within the assigned levels of the *Environmental Protection (Noise) Regulations 1997* (WA).

The second stage is an operational noise modelling tool. The operational noise model considers actual mining activities, equipment location, and live weather data to model the potential noise impact on identified sensitive premises. The operational noise model is monitored during active operations. If

the model predicts a risk of exceeding the *Environmental Protection (Noise) Regulations 1997* (WA) assigned levels, operations are altered to ensure compliance with the regulations is maintained.

8.1.2 Willowdale

The Willowdale Mine uses noise modelling to establish day and night mining areas and manage the risk of noise impacts on noise sensitive receptors. Equipment operating in noise sensitive mining areas is monitored by fixed noise monitors on or near private property.

Periodic noise monitoring of the 371 conveyor is conducted by site-based environmental personnel. The data is then used to identify changes in noise levels at specific modules on the conveyor or across the conveyor system to assist with maintenance. Noise attenuation treatments were completed in 2021 for the Arundel Transfer Station, with minor treatments to Conveyor 371. Further mitigation measures have been defined in the latest Part V Licence (L6465) amendment and will be implemented as per the licence requirements.

9. Energy and Greenhouse Gas Emissions

9.1 Operational Emissions

The CO_2 emissions rate for Huntly and Willowdale mines is identified in Figure 9 below. Emissions at Huntly are higher per tonne of bauxite mined due to additional equipment, including increased conveyor length, and previously the tertiary crushing of Kwinana ore, Kwinana stockpile reclaim operations and train loading for bauxite supply to Kwinana refinery, which ended in 2024.

In 2023, both sites showed a drop in emissions largely due to altered emissions calculations and emission factors used, in-line with the updated National Greenhouse Accounts Factors 2023[5]. As the 2023-2027 MMP was approved in December 2023, there was a rise in emissions over 2024 due to increased activities particularly to meet increased rehabilitation targets.

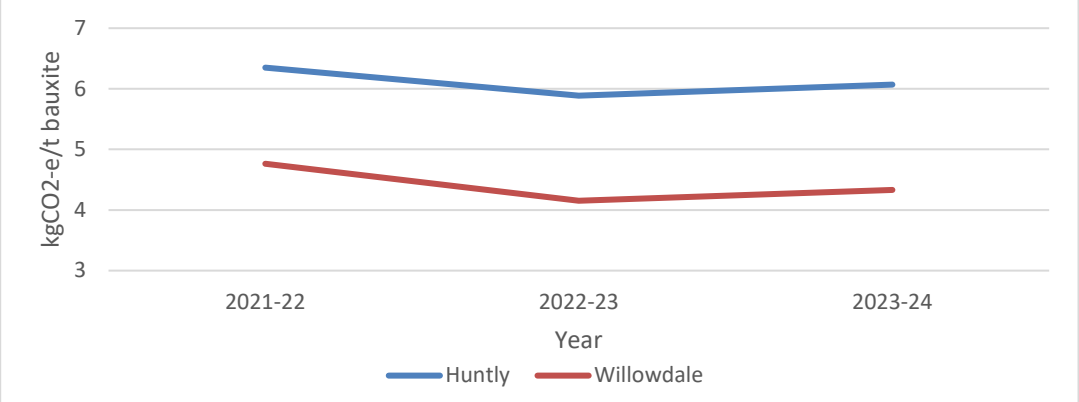


Figure 9: CO_2e Emissions for 2021 to 2024 (includes Scope 1 and Scope 2 emissions)

[5] DCCEEW (2023) Australian National Greenhouse Accounts Factors: For individuals and organisations estimating greenhouse gas emissions

10.Community Engagement

10.1 Overview

Alcoa strives to develop and maintain strong and mutually beneficial relationships with stakeholders, including communities near the Huntly and Willowdale Bauxite Mines, consistent with our Social Policy:

> '*Our vision is to create sustainable value in the communities where we have a presence and to secure the support of these communities through the full life cycle of our operations.*
>
> *We are committed to conducting our business activities responsibly, acknowledging and respecting the rights, cultures, and heritage of all members of the communities where we operate. We manage our social performance through the effective identification of social risks and impacts related to our activities, seeking to avoid, minimize, mitigate, and remediate negative impacts and aspire to leave a positive legacy.*
>
> *We actively engage with the communities and stakeholders where we operate, and we see our presence as an opportunity to enable economic activity while supporting educational, cultural and environmental programs through partnerships.'*

Effective stakeholder communications and engagement is key to a well-informed community and maintaining Alcoa's license to operate.

Alcoa has an extensive and mature stakeholder and community engagement program for its Western Australian operations. This has included engagement (Table 14) over many years with a broad range of stakeholders and community members regarding existing and future operations (Table 13).

Table 13: Stakeholders and communities relevant to Huntly and Willowdale mines

Category	Huntly	Willowdale
Local Government	Shire of Serpentine Jarrahdale, Shire of Murray, City of Mandurah, Shire of Wandering	Shires of Harvey and Waroona
Local Members	Members for Murray-Wellington, Darling Range and Canning	Member for Murray-Wellington
Traditional Owners	Gnaala Kaala Boodja, Bilya Organisation and Winjan	Gnaala Kaala Boodja, Harvey and Waroona Aboriginal Corporations
Mine Neighbour (current)	Karnet Prison Farm, Bodhinyana Monestary and ~95 private property owners.	Lake Brockman Tourist Park (Logue Brook Dam) ~100 private property owners.
Future mine communities	Residents in Jarrahdale and Dwellingup	Proposed mine transition to Larego South
Community Consultative Networks	Jarrahdale CCN and Dwellingup CCN	Wagerup/Willowdale CCN
Other	Local businesses, schools and organisations; activist groups, local and state media, Water Corporation, Community investment partners	Munda Biddi Trail Foundation, local businesses, schools and organisations; activist groups, local and state media, Water Corporation, Community investment partners

.

Table 14: Engagement activities

Activity	Details	Frequency
Five Year Mine Plan Consultation	Letter in the post and/or email to all neighbours and nearby community members offering a face-to-face consultation on the current DRAFT Five Year Mine Plan. Occurs May/ June each year	Annual
Shire Council Briefing	Presentation on location and business updates to the Shire of Murray, Shire of Serpentine Jarrahdale and Shire of Waroona, with a focus on open communication and Q&A	Quarterly / Annually
Blasting notifications	Text message and email notification to those who have opted to be part of this notification list, prior to and following a blast.	As required
Letter in the post	Often relating to project information, opportunity to send addressed letter in the post updating neighbours and nearby community members in a timely manner on matters.	As required
Email	Often relating to project information and updates, emails can be used to send to stakeholders and community members distributing information in a timely manner.	As required
Phone call/ text message	Contacting individuals via phone call or text message on urgent matters or as required.	As required
Community Newsletter	Community newsletter send via addressed post to neighbours and nearby communities. Includes information on investments, projects, employment, social stories, myth busting and Q&As.	Quarterly
Community Information Sessions	Organised events in local venues for community to learn about areas of the business, talk to employees, raise concerns and seek updates from the business and operations.	As required
Community Partnerships	Annual Community Partnerships, Charitable Contributions and Grants program designed to support areas of our local communities financially on projects that align with Alcoa's key pillars.	Ongoing
Community Consultation Network (CCN)	Jarrahdale CCN bi-monthly at Jarrahdale Primary est. Oct 2023 Dwellingup CCN monthly at DWL PS est. Oct 2024.	Monthly Bimonthly
Community event display	Educational and interactive displays at Community events, often in alignment with partnerships. Waroona, Harvey, Brunswick Agricultural shows.	As required
Media Release	Media story distributed as required, to educate the community and stakeholders on what Alcoa does, how we do it and the great contributions made to the economy.	As required
Advertorials	Paid advertising in local newspapers for awareness and information sharing. Mandurah Mail, Coastal Times, Serpentine Jarrahdale Examiner.	As required
Tour of Operations	The Alcoa tours team and individuals have the ability to offer tours of operations for stakeholders. A great way to showcase what we do, how we do it and increase transparency.	As required
Pop up office Keysbrook NEW	Hosted every Thursday in Jarrahdale and Friday in Dwellingup with signage and information, ability for 2-way conversations.	Weekly Monthly

Activity	Details	Frequency
	Pop up display and presence at Monthly Coffee Morning at Keysbrook Park.	
Corporate led channels (Website and Social Media)	Encourage stakeholders to stay up to date with news and happenings via the below channels. Alcoa Australia Facebook - https://www.facebook.com/alcoaaustralia Alcoa Website - https://www.alcoa.com/global/en/home/	Ongoing

10.2 Five-year mine plan consultation

Alcoa's Five-Year Mine Plan consultation facilitates stakeholder feedback for the development and finalisation of the proposed plan.

Every year Alcoa identifies property owners adjacent to existing and future mining boundaries and writes to them offering the opportunity to meet and discuss Alcoa's mine plans, and a tour of the Huntly and Willowdale Mine. This is to ensure relevant communities adjacent to existing and planned mining operations are consulted on and understand matters that might affect or be of interest to them.

The stakeholder groups invited for consultation previously included current and future mine neighbours and relevant government representatives. In 2024, Alcoa broadened the range of stakeholders invited to provide feedback on the Five-Year Mine Plans, to take in many different interest and stakeholders groups, including:

- community consultation networks;
- forest recreation groups and clubs;
- environmental sustainability groups and organisations;
- chambers of commerce & industry;
- local businesses;
- tourist businesses & organisations;
- local & regional Aboriginal Corporations; and
- local community groups of interest.

Published MMPs include a stakeholder engagement register(page 355 of the 2024-2028 MMP).

The Alcoa webpage includes extensive information on our current and future approvals which can be accessed by stakeholders and the public. This includes copies of our approved MMPs and information related to future mine approvals. This can be accessed at the links below:

- https://www.alcoa.com/australia/en/sustainability/reports-publications
- https://www.alcoa.com/australia/en/mine-approvals

10.3 Tours

To support stakeholders understanding of operations, Alcoa provides tours of its WA mines and refineries to stakeholders, communities, education institutions, government representatives and the general public. Alcoa's Public Tour and Education Program has hosted 642,023 visitors since it began in 1978.

10.4 Community Investment

A key contributor to the Australian economy for many decades, Alcoa plays an important role in supporting the communities in which it operates and beyond. Our social investment program aims to help build stronger sustainable communities that have the capacity to address local challenges and opportunities.

In 2024, Alcoa and its global charity, the Alcoa Foundation, invested $5.85 million into Western Australian and Victorian communities. Regional projects, including those funded by the Alcoa Foundation, are focused on supporting at scale impact initiatives, while each operating location maintains a partnership program which responds directly to host community needs. It is important to note that Willowdale Mine and the Wagerup Alumina Refinery share common stakeholders and co-partner on local partnerships (represented below).

Alcoa employees are active community members and are supported to dedicate thousands of volunteer hours every year to non-profit and community groups through Alcoa's Volunteers program. Further, Alcoa Community Together in Our Neighbourhood (ACTION) program which recognises our employees' volunteering efforts with a $3000 grant to the group or charity of their choice. In 2024 Alcoa provided local charities with 60 ACTION grants (Table 15).

Table 15: Community partnerships

Site	2024 Community Partnerships Investment
Huntly	Partnerships • Byford Secondary College – Careers Expo • Byford Secondary College – Indigenous Scholarship • Mandurah Wildlife Centre – Rehab centre • Dwellingup100 – Bike competition • Dwellingup Community Assoc – Whim Restoration • Jarrahdale Community Collective – Outdoor Hub • GP Down South – Aboriginal Youth Camp Shire of Serpentine Jarrahdale – Youth Skill Up Prog • Serpentine Jarrahdale Lions Club – Log Chop event • Jarrahdale Primary School – Kindy play area Serpentine Golf Club – Clubroom upgrades Mundijong Heritage Gardens – Shed upgrades • Manjedal Scouts WA – Muddy Buddies event • Jarrahdale Cuppa Club – Bus hire • Central Districts Axemans Assoc – Dwellingup Log Chop • Discovery Forest Centre – Front entrance decking • North Dandalup Primary School – Canteen • Clontarf Foundation – Academy resources • Dwellingup Little Folk – Music festival Dwellingup Community Village – Furniture • Dwellingup Primary School – IT equipment Dwellingup Razor Backs -100th celebrations GOSH Hackathon – event

Site	2024 Community Partnerships Investment
	• Deadly Koolinga Chief Program ACTION Grants Charitable Donations
Willowdale	Partnerships: • Munda Biddi Trail Foundation – volunteers and community engagement Mandurah Wildlife Rehabilitation Centre Inc Clontarf Foundation CME – STEM digital Technology school program Waroona Aboriginal and Torres Strait Islander Corporation - support of office space rent. SW Aboriginal Basketball Corporation – Regional basketball competition in Waroona • SW Horse Trails Club Inc – One Day Event in Harvey • Waroona District High School – Telethon Speech and Hearing program Harvey Mainstreet Inc – 2025 • Harvey Harvest Festival support for free kids rides • St Joseph's School – Waroona STEM-A-THON ACTION Grants

10.5 Community contacts

Alcoa's Community Consultation System (CCS) records all incoming and outgoing contacts with neighbours and the community. The database captures all issues, requirements for further action, resolutions and outcomes in relation to contacts with the community. An Alcoa representative promptly follows up all complaints and requests for information and the database allows for the tracking of these follow-up activities. The complaint types, status and other variations of CCS entries are displayed in Figures 10 to 13 below.

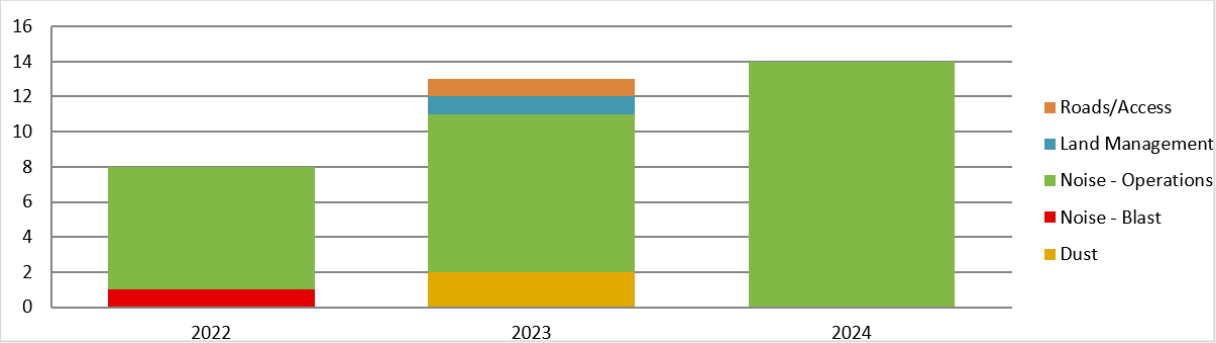


Figure 10: Complaint types – Huntly

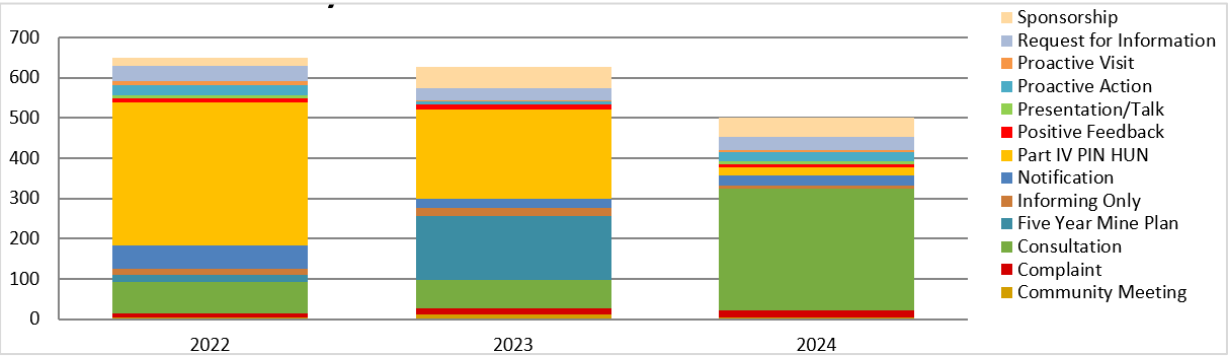


Figure 11: Community contact types – Huntly

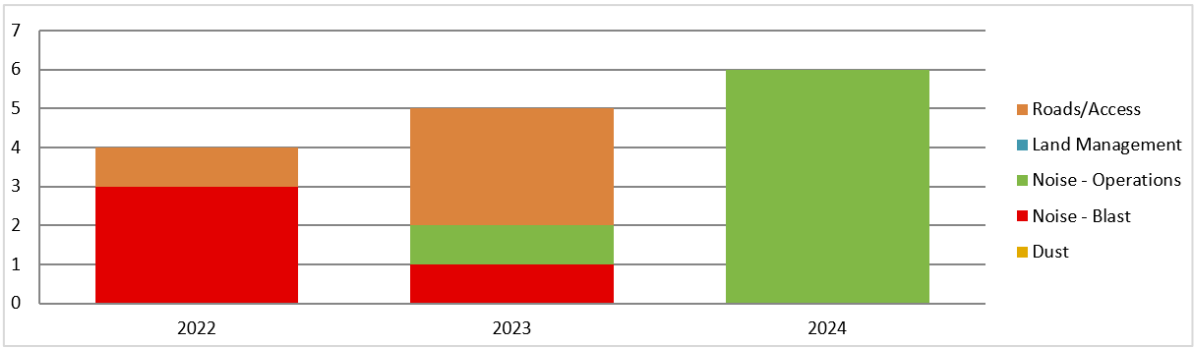


Figure 12: Complaint types – Willowdale

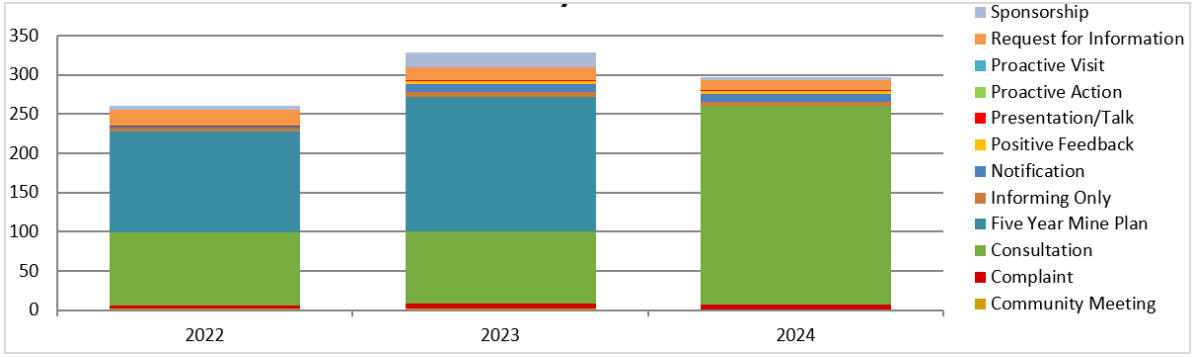


Figure 13: Community contact types – Willowdale

11.Research

Alcoa's Research Team continues to undertake internal research projects, and collaborative research with a range of tertiary institutions, other mining companies, State Government departments, national research programs and research groups. Research is undertaken on a broad range of topics related to the environmental impacts of bauxite mining in the jarrah forest, and ongoing improvements to mine rehabilitation.

11.1 Rehabilitation Execution

The mine rehabilitation research program encompasses aspects of the establishment, development and management of the restored ecosystems on rehabilitated bauxite mines to improve establishment, provide confidence in longer-term development and resilience, and to seek more cost-effective approaches.

11.1.1 Quantifying Contour Rip Line Error

Contour ripping is a well demonstrated surface preparation technique, used to control the overland flow of water and prevent soil erosion, while providing storage and increasing infiltration. However, the effectiveness of contour ripping as both a water storage mechanism, and an impediment to surface flow velocities is fundamentally linked to the furrow's adherence to the generalised (macro) topographical contour. Where contour ripping does not conform to the aspect of the landscape (rip line error), water stored inside the furrow continues to flow downslope, rendering the rip lines less effective. Although the importance of contour ripping is well demonstrated in literature, few methods have been developed to automatically analyse ripped landforms to accurately quantify ripping

direction without the need for manual delineation. Identifying the degree of rip line error, and its interaction with other landscape features, is an important step in understanding the movement of surface water in modified landscapes.

In 2024, a new geospatial algorithm and associated workflow were developed to quantify the direction of riplines in Alcoa's rehabilitation, using high resolution Digital Elevation Models (DEM). This workflow automatically identifies ripping direction to a high degree of accuracy across rehabilitated slopes and then compares the result with the generalised topographical aspect, to produce a contour rip line error. This algorithm provides opportunities for auditing and certification of rehabilitated slopes, as well as enabling adaptive management and remediation options for rehabilitation before erosion can develop.

This work is planned for integration into the rehabilitation execution workflow in 2025, with an open-access publication in the same year detailing the algorithm.

11.1.2 Direct seeding trials (ASSI)

In the autumn of 2021, 2022, 2023 and 2024 large-scale trials were undertaken at Willowdale to assess operational scale options for the shallow incorporation of seeds at the time of contour ripping (i.e. at the end of the rehabilitation process). This trial, through the Cooperative Research Centre for Transformations in Mining Economies (CRC TiME), in collaboration with the University of Western Australia and Kings Park Science, utilised a custom-built apparatus attached to the rear of the contour ripping dozer. The equipment was designed for and trialled previously on waste rock dumps in the Pilbara. The trials haven been monitored each spring. Following each trial, improvements to the custom-built apparatus have been made. In 2024, additional trials investigating the use of seed technology were undertaken, including the use of flash flaming and seed pelleting.

11.1.3 Seed dormancy and germination of Hibbertia to inform seed propagation for ecological restoration (PhD project)

Several plant species are challenging to return to rehabilitation because methods for propagation are not known. Developing methods to overcome seed dormancy can lead to more efficient nursery propagation and seed pre-treatment prior to direct seeding. One genus, Hibbertia, has seeds with morphophysiological dormancy, which requires a complex sequence of environmental cues to stimulate germination. This genus is the focus of a PhD project to improve seed germination to ultimately improve numbers of species within this genus in the rehabilitation. This project commenced in 2022. Outcomes of this will be provided in future environmental reviews as the PhD project is expected to run for three and a half to four years.

Two 16+ week laboratory experiments have been conducted investigating the influence of temperature, Karrikinolide, Gibberellic Acid and dark stratification, as well as imbibition testing on ten Hibbertia species collected between Mundaring and Boddington in late 2022. In 2023, the seed collection season was concluded with six species and over 40,000 seeds. In 2024, laboratory and nursery studies were established.

11.1.4 Willowdale DRT Trial

Fresh Topsoil is a critical enabler to Alcoa achieving its species richness target. In recognition of the value of the topsoil and that a topsoil shortage could have significant implication on species richness, research has commenced to understand the implication of topsoil spread at a shallower depth. Return of fresh topsoil at a shallower depth may result in a decrease in the number of seeds returned through

the topsoil seed bank. If this is the case, this reduced seed bank may need to be supplemented by greater amount of seeding and recalcitrant plantings. This trial tests different depths of topsoil and different seeding rates to target species richness requirements of the Rehabilitation Completion Criteria.

Trials were designed in 2022 and then installed in 2023 across three locations at Alcoa's Willowdale mine. Each of the three locations contain three Fresh Topsoil treatments being no Fresh Topsoil, 5mm Fresh Topsoil, and 10mm Fresh Topsoil, and three seeding treatment types being no Seed, Standard Seed Mix, and Accelerated Seed Mix (Figure 14).

Nine and 15 month monitoring of the trial area was completed in 2024, with analysis and memo due to be completed in 2025. Preliminary results support initial expectations around legume density, with substantial germination after the first winter, followed by an immediate decline due to summer mortality, and then a slight increase after the second winter (delayed emergence of dormant seed). Additionally, legumes tended to do better when broadcast over DRT, however there was no apparent difference between 5mm and 10mm DRT. Even when rehabilitation received no DRT or broadcast seed, an average of one plant per square meter was recorded at establishment, indicating substantial seed set from stockpiled topsoil.

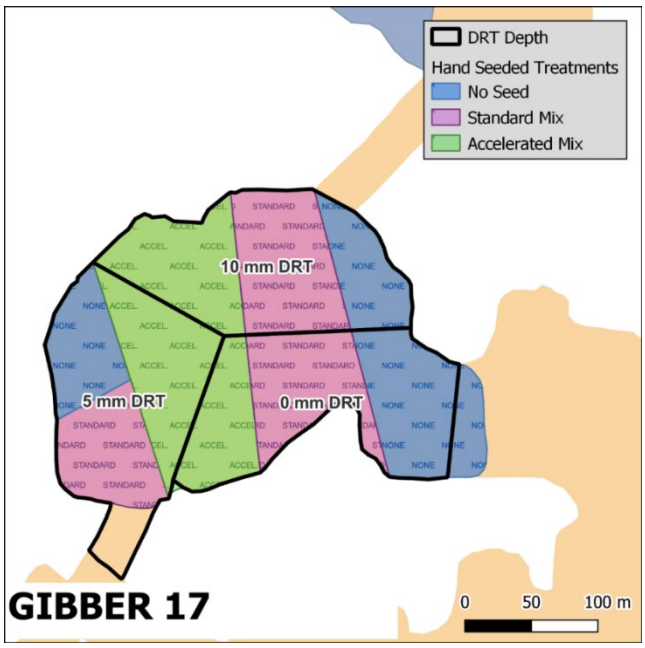


Figure 14: One of three pits as part of the DRT and seeding trial

11.1.1 Erosion

Research commenced in 2018 on the use of Unmanned Aerial Vehicle (UAV) based stereometric derived Digital Elevation Modelling (DEMs) to map erosion scours across current era rehabilitation. It is intended that the DEMs may be used to identify key Seeding (Irregular pit edge, off-contour ripping, or concave slopes) and Feeding (Steep slopes, large catchment, or insufficient storage) topographic parameters for erosion. Alcoa is co-supervising a student, who started in March 2023, to continue this research. Already the student has completed her first major submission (and associated publication) on analysing parameters of erosion initiation, as well preparing analysis for her second publication.

11.2 Enhancing Forest Flora Knowledge

The Enhancing Forest Flora Knowledge research program investigates the development and resilience of both forest and rehabilitated ecosystems and their diverse ecological communities, focusing on the impacts of climate change, altered fire regimes, and dieback on native plant life. Examining the long-term trajectory of these sites will reveal their capacity to support healthy and functioning ecosystems.

11.2.1 Impacts of fire on rehabilitation and reference communities

Fire is a regular but inconsistent impact in the Northern Jarrah Forest. As a result, The Northern Jarrah Forest is largely resilient to fire, with flora biomass recovering from fire generally within three to five years. Alcoa's rehabilitation is considered similarly resilient to fire, with numerous research studies published over the last three decades focusing on post-fire recovery of vegetation in rehabilitation. Although this collection of research presents a comprehensive picture of post-fire recovery of vegetation across rehabilitation completed prior to 2000, it leaves open questions around the recovery trajectory of land rehabilitated in the modern era, which differs in its restoration prescription. Additionally, this research focuses on long term trends in post-fire recovery, leaving questions around the immediate and successional trends of ecosystem function as it transitions towards its recovered state.

To build on existing knowledge, and to answer these outstanding questions, a total of 40 floristic plots were established in recently burnt, unburnt, and burn scheduled areas within both forest and 10+ year old rehabilitation. Each floristic plot measured the count, cover, and height of all vascular plant species, with metrics separately recorded for each species' apparent fire persistence strategy (i.e. basal resprouting, canopy resprouting, seeding).

Analysis of the 2024 results will be completed in 2025, in addition to the establishment of new monitoring plots (and re-monitoring of existing plots).

Figure 15: Monitoring plot of the 6-month post-fire recovering of 18-year-old rehabilitation at Willowdale

11.2.2 Rehabilitation Trajectory

In 2024, a review of the rehabilitation Completion Criteria was undertaken as a collaborative process with DBCA. To help facilitate this work, data from Alcoa's botanical monitoring was analysed and presented for each Completion Criteria metric. This involved collation of new monitoring points established in 2023 for both overstorey and understorey floristic plots, as well as appropriate data recorded historically. Additionally, 50 new plots were established in spring 2024 to further fill gaps in

the understanding of changes in rehabilitation over time. These trajectories are instrumental in building models of rehabilitation, with the long-term goal of ensuring rehabilitation success through identification of areas requiring remediation.

11.2.3 Turner Block Thinning

DBCA and Forest Products Commission have been undertaking ecological thinning operations in the Turner Forest Block since 2020. Originally, 20 monitoring plots were established in and around the Turner Forest Block as a BACI design to assess impacts from thinning operations on rehabilitation. In 2024, additional plots were established at control sites to bolster the BACI design, in anticipation of thinning resuming in the Turner Forest Block in 2025 and 2026.

This project will inform decision making around thinning of rehabilitation, provide confidence to regulators that thinning rehabilitation does not impact restoration objectives or Completion Criteria success.

11.2.4 Recalcitrant survival trial

The Recalcitrant Survival Trial aims to evaluate early field survival for nursery-raised plants in rehabilitation. Many of the species being used have not been previously grown for mine rehabilitation so there is no available data on how they might perform when grown in the nursery and then transplanted to mine rehabilitation. This trial will assess if plant guards and larger pots contribute to increased plant growth or survival, as well as an assessment of:

- plant species performance (survival, spread) in relation to transplant shock and subsequent stressors;
- animal grazing pressure and plant protection techniques (e.g. guarding, systemic deterrents); and
- the effects of pot type on plant performance.

Results will guide species selection and assist us with an adaptive management approach in future rehabilitation seasons.

The trial commenced in 2018, and approximately 50 species have been tested during this time. In 2024, 20 sites established in previous years were monitored, plus 12 additional sites were planted. Data was analysed and results fed back into the recalcitrant planning process as part of ongoing adaptive management.

11.2.5 Natural Capital Accounting

In 2024, a project to assess the Natural Capital of Alcoa's rehabilitation was completed in association with CRC TiME and Murdoch University. Natural Capital is a term used to describe the world's stocks and flows of natural assets, such as native forests and associated ecosystem functions, which provide ecosystem services that sustain human health and well-being.

Natural Capital Accounting is the process of measuring the total stocks and flows of natural resources and ecosystem services. This project used Alcoa's extensive ecological data on the rehabilitation of Jarrah Forest after bauxite mining. Among other avenues of research, the data was used to test the sensitivity of the framework in relation to:

- variation in spatial and temporal scales;

- different approaches to scoring ecosystem extent and condition; and
- different measures of restoration success.

The framework has the potential to inform the valuation of changes in natural capital assets for mining rehabilitation, enabling a transparent means to measure outcomes and demonstrate the value and performance of rehabilitation.

The project was published in a case study on the CRC TiME website https://crctime.com.au/research/projects/project-2-7/. In 2024, the project learnings were communicated as part of a panel discussion at a CRC TiME workshop. A paper has been prepared for submission to a journal.

11.3 Fauna Protection and Return

The fauna research program aims to:

- understand mining impacts on all faunal groups through research and monitoring;
- inform mine planning and mine activities to manage and mitigate mine impacts, particularly on threatened species; and
- improve restoration practices for fauna recolonisation and establishment.

11.3.1 Fauna culvert monitoring project

A comprehensive culvert monitoring project was undertaken in 2024 as part of a masters project through Murdoch University. Remote cameras were placed at either end of culverts to monitor fauna use, particularly by feral cats, and determine whether they move through the entire length of the culvert. Additionally, cameras were placed in the adjacent forest on each side of the culvert to provide a control site against which to compare the data. This will inform future road designs and appropriate culvert design for native fauna. It will also determine if culverts can be used as lures for feral cat control.

11.3.2 Long Term Fauna Monitoring Program

The long-term fauna monitoring program (LTFMP) has been running since 1992, and underwent reviews in 2003, 2009, 2021 and 2023. The program monitors five, ten and fifteen-year rehabilitation, as well as unmined forest and stream zones, in the same year. This is to account for climatic variation between years so data from each age rehabilitation is more comparable. Targeted quokka monitoring was undertaken in streamzones, and targeted chuditch monitoring was undertaken across the landscape both within mining areas and outside mining areas. Short-range endemic (SRE) surveys were also carried out as part of the program, whereby each site was searched for mygalomorph spider burrows, and hand foraged to locate other invertebrate SRE species.

No additional monitoring was completed in 2024.

11.3.3 Black Cockatoo Research

Breeding success and behaviour continues to be monitored at known nests in the Huntly area, in particular at ‘Yamba’. This area was excised from the mine plan and set aside as a conservation area in 2014 due to an unusually high density of nest trees and excellent habitat. Monitoring has been carried out regularly since this time, monitoring 87 nest trees. Since monitoring began in 2014, 17 hollows have been lost due to hollows collapsing and trees falling. Almost all the nest trees have

chewing around the entrance, however to date, only 46 of these nest trees are confirmed breeding hollows. Anecdotal evidence suggests that at all sites there are always some nest trees which are chewed regularly but never used for breeding. This is an area that warrants further study to better understand Black Cockatoo behaviour.

A total of nine full days and three evening visits were spent monitoring black cockatoos at the Yamba area between January 2024 and January 2025. A total of 12 Forest Red-tailed Black Cockatoo (FRTBC) pairs were recorded breeding in the area with probable egg laying dates commencing in late July and birds still present on nest sites through to September. Carnaby's and Baudin's Cockatoos were recorded in the area but not as breeding pairs. Of note are the observations of Carnaby's feeding on Hakea undulata in rehabilitated areas in July and August.

11.3.4 Mygalomorph Research

Mygalomorph spiders are short-range endemic invertebrates, and as such, are presumed to be highly susceptible to disturbance. The aim of this research was to:

- develop a more ethical method for surveying mygalomorphs; and
- determine if mygalomorphs were able to re-establish after disturbance.

There are three key components to this project:

- Develop a trap to capture mygalomorphs to avoid burrow excavation. This involved designing, building and testing a trap that sits on top of the burrow and captures the spider within unharmed.
- Determine if mygalomorphs are able to re-burrow after disturbance. This involved placing captured mygalomorphs in a tube of soil and filming their movements over the course of 1-2 weeks. Mygalomorphs live exclusively in burrows (except when the males leave to mate), so the assumption was that spiders would re-dig a new burrow if displaced from their original burrow.
- Survey rehabilitated areas of different ages to determine if mygalomorphs return to highly disturbed areas. This involved searching/hand foraging several rehabilitated areas to locate burrows, and trapping the spider to obtain a genetic sample for identification purposes. Various ages of rehabilitation were surveyed to determine how long after disturbance these species would re-colonise an area.

During 2024, the final trials were carried out for these projects. Data will be analysed and results published in 2025.

11.3.5 Streamzone macroinvertebrates

In 2004, Alcoa began its Trial Mining Project (TMP) of the Cameron experimental catchment area (Cameron Corridor), which lies within the Intermediate Rainfall Zone (IRZ) of the Darling Scarp region, south-west Western Australia. Mining of this area has since been completed and most mined-out areas have now been rehabilitated.

As streams of the Cameron Corridor and surrounding areas have naturally low salinity levels (median <300 µS/cm), there is the risk that any increase in median annual salinity above 500 µS/cm may adversely impact aquatic macroinvertebrate communities. Given the relatively pristine nature of streams in the region, potential increases in turbidity, suspended sediment loads, and changes in the

permanency and predictability of streamflow caused by mine-related clearing is also of concern. The goal of this aquatic monitoring program is to investigate the potential impact of Alcoa's mining operations on aquatic fauna biodiversity in the IRZ.

Since 2004, 16 potentially impacted stream locations, and seven control locations have been monitored multiple times, with the most recent being September 2023. Results were analysed in 2024, primarily looking at macroinvertebrate communities in relation to water sampling metrics such as dissolved oxygen, pH, and electrical conductivity. Monitoring will continue in 2025 to further explore biotic and abiotic changes, as well as continue ensuring there is no detrimental impact from Alcoa's mining on freshwater streams in the Northern Jarrah Forest.

11.3.6 Quokka Habitat Mapping

The aim of this project is to locate remnant populations of quokkas within Alcoa's mining lease to:

- mitigate any impacts and;
- contribute to the knowledge of current distribution for the species.

Accessible stream zones at each site were assessed to determine if suitable habitat for quokkas exists. If the habitat was suitable, five cameras were deployed at the end of runnels where possible, baited with universal bait. These cameras were left in situ for five days and re-baited daily. Each location was monitored in both summer and winter, to capture any seasonal movements. If quokkas were located, a more extensive array of cameras were deployed to determine how far up slope and up or down stream they were moving, to give an estimation of habitat extent. All surveys have been completed at Willowdale mine, with five out of the 22 sites surveyed housing quokkas. All presence or absence surveys have been carried out at Huntly, with 17 out of 30 sites having quokkas. The extent surveys at Huntly are yet to be completed; these are planned for 2025, after which time all the extent monitoring data will be analysed.

11.4 Catchment Hydrology

11.4.1 Long-term Experimental Catchments

Alcoa continues to monitor several catchments associated with long-term studies into the effect of climate, forest cover, and mining or rehabilitation treatments in the IRZ and High Rainfall Zone (HRZ) on groundwater and streamflow (Table 16). This includes both surface water and groundwater monitoring locations.

Table 16: Alcoa catchments for bauxite hydrology research

Catchment	Area (ha)	Mined area (%)	Station opened	Mining Period	
				First Clearing	Rehabilitation Complete
IRZ catchments					
Gordon	197	Control	1988	-	-
River Road	24,300	1.2	2014	2010	-
HRZ catchments					

Catchment	Area (ha)	Mined area (%)	Station opened	Mining Period	
				First Clearing	Rehabilitation Complete
Banksiadale East	206	49	2012	c.1986	1992
Bates	223	Control	1988	-	-
Del Park	131	32	1974	1975	1989
Lewis	201	51	1977	1996	2003
Mt William	445	22	1980	1995	2000

11.4.2 Drainage Protection Slot effectiveness

A field study into Drainage Protection Slot (DPS) effectiveness focusing on upslope and downslope surface water characteristics under a range of actual rainfall conditions was required under condition 3 of the Forest Clearing Advice 23B approval. The report was provided to the MOG on 23 December 2024.

Key outcomes from this study found:

- The placement of DPS along the contours is critical for their effective functioning. When a DPS is aligned along the contours, water is able to distribute evenly and horizontally along the DPS, preventing water flow beyond the DPS and reducing the risk of water accumulating in low spots.
- The practice of deploying multiple, narrower DPS systems placed along the contours, rather than fewer, wider DPS systems, is considered to be more effective. This configuration reduces the likelihood of water accumulating in low points and provides greater surface area for water to spread out.

11.5 Research Communication

In May 2024, Alcoa organised the Jarrah Forest Environmental Research Symposium to facilitate knowledge sharing within Alcoa and between organisations undertaking research in the forest. Sixteen invited speakers from Alcoa, Murdoch University, Edith Cowan University, the University of Western Australia, the Department of Biodiversity, Conservation and Attractions, and Data Analysis Australia presented their research. Over 100 people from 21 organisations attended in person, and several more attended online.

11.6 Alcoa and Collaborator Publications

Martyn Yenson, A. J., K. D. Sommerville, L. K. Guja, D. J. Merritt, E. L. Dalziell, T. D. Auld, L. Broadhurst, D. J. Coates, L. Commander and A. D. Crawford (2024). "Ex situ germplasm collections of exceptional species are a vital part of the conservation of Australia's national plant treasures." Plants, People, Planet 6(1): 44-66.

Trotter, L., Wardell-Johnson, G., Grigg, A., Luxton, S. and Robinson, T.P. (2024). Capitalising on the floristic survey as a non-destructive line of evidence for mineral potential modelling: a case

study of bauxite in south-western Australia. Land 2024, 13, 1995. https://doi.org/10.3390/land13121995, 1-25.

11.7 Journal Articles/Reports with Affiliated Partners (non-Alcoa authors)

Parkhurst T and Standish RJ 2023. Natural Capital Accounting in the mining sector: The Alcoa case study - testing the SEEA-EA framework in the context of mine rehabilitation. Internal report prepared by Murdoch University for CRC TiME, August 2023.

11.8 Conference Presentations and Proceedings

Commander, L, Barker, J, Blackburn, C, Grigg, A, Mullins, G & Pattinson, A 2024, 'Research-led adaptive management in rehabilitation' in M. T. A.B. Fourie and G. Boggs (eds.), Australian Centre for Geomechanics, Perth, pp. 415-426, 10.36487/ACG_repo/2415_30.

Commander, L 2024 'Rehabilitation of the Jarrah Forest in Western Australia' 14th Australasian Plant Conservation Conference, Toowoomba, Queensland, October 2004