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AIR QUALITY, ODOUR AND GREENHOUSE GAS MANAGEMENT PLAN

EASTERN CREEK RECYCLING ECOLOGY PARK (& LANDFILL)

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AIR QUALITY, ODOUR AND GREENHOUSE GAS MANAGEMENT PLAN (AQMP)

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4/08/2020	A	Whole Document	Draft	Ros Dent
16/12/2020	B	Whole Document	Updated with client comments from EMS	Ros Dent
04/02/2021	1	Whole Document	Draft for DPIE Review	Ros Dent
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30/07/2021	5	Sections 1.4, 3, 4 and 5	Updated to include Bingo comments	Ros Dent

ACRONYMS AND DEFINITIONS

Acronym / Term	Meaning
AQIA	Air Quality Impact Assessment
AQMP	Air Quality Management Plan
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
AQMP	Air Quality Management Plan
CARs	Corrective actions request
C&D	Construction and Demolition
C&I	Commercial and Industrial
CoA	Conditions of Approval
DADI	Dial-a-Dump Industries
DPIE	Department of Planning, Industry and Environment
EAR	Environmental Assessment Report
EES	NSW Environment, Energy and Science (part of DPIE)
EMP	Environment Management Plans
EMS	Environmental Management Strategy
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
GHG	Greenhouse gas
Material harm	Material harm is harm that: • Involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or • Results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment).
MPC	Materials Processing Centre
OEH	NSW Office of Environment and Heritage (now NSW EES, a part DPIE)
OEMP	Operational Environmental Management Plan
OU	Odour Unit
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 microns
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 microns
POEO Act	*Protection of the Environment Operations Act 1997 (NWS)*
POEO Regulations	*Protection of the Environment Operations (Waste) Regulation 2014*.
RtS	Response to Submissions
SEQ	Integrated Occupational Health, Safety, Environment and Quality Management Systems

Acronym / Term	Meaning
SSD	State significant development
TPA	Tonnes per Annum
TSP	Total Suspended Particulate (matter)

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1 INTRODUCTION

1.1 Background

Bingo Industries Limited (Bingo) acquired the Eastern Creek Recycling Ecology Park (& Landfill) (the Facility) in February 2019 and took over the management of the Eastern Creek site in April 2019. The site was previously known as the Genesis Facility.

The Facility is located at Honeycomb Drive, Eastern Creek in the central western suburbs of Sydney NSW, approximately 36 km west of the Sydney CBD, 18 km west of Parramatta and 12 km east of Penrith. The site is located wholly within the Local Government Area (LGA) of Blacktown, situated in the area known as the M7 Business Hub. The operational area is approximately 54 hectares (ha) and was a former breccia quarry that closed when it ceased extraction activities.

The existing Facility, including recycling centre/s and landfill were granted approval by the then Minister for Planning under Section 75J of the *Environmental Planning and Assessment (EP&A) Act 1979* on 22 November 2009 (MP 06_0139) and commenced operation in June 2012.

The Facility operates under two Environment Protection Licences (EPL) issued by the Environment Protection Authority (EPA); EPL 20121 focusses on resource recovery and EPL13426 covers landfill operations. The Facility has approval to:

- Accept up to two million tonnes per annum (Mtpa) of C&D (construction and demolition) and C&I (commercial and industrial) waste and landfilling of the quarry void of up to 1,000,000 tpa of non-putrescible waste (including asbestos and other non-recyclable waste), excluding residual chute waste from the material processing centre;
- Crushing, grinding and separating works to process waste masonry material located in an area earmarked as the Segregated Materials Area (SMA)
- Stockpile up to 50 tonnes of waste tyres
- Stockpile up to 20,000 tonnes of green waste.

The Facility is operated by Dial-a-Dump (EC) Pty Ltd Industries (DADEC), a fully owned subsidiary of Bingo Industries Pty Ltd.

1.2 Purpose and Application

The MOD6 Conditions of Approval specifically amended *Schedule 3 Condition 37*, which details the requirements to be addressed in the *Air Quality, Odour and Greenhouse Gas Management Plan* (AQMP). This AQMP has been prepared to address this Condition and also identifies the environmental management measures that will be applied to activities undertaken across the Facility (detailed in **Section 1.4**) to manage identified environmental risks, specifically those impacting air quality.

The AQMP has considered the following:

- The Project Approval as modified (MP 06_0139);
- The Statement of Commitments (SoC) included in the Environmental Assessment Report (EAR)[1] and subsequent modification assessments;
- Requirements and obligations stipulated within EPL 20121 and EPL 13426;
- NSW Government guidelines for Environmental Management Plans (Post Approval Guideline, April 2020);
- Northstar Air Quality Audit Report pursuant to Condition 37a of the Project Approval.

[1] Environmental Assessment Report (EAR), Environmental Resources Management Australia (ERM), dated December 2008 (Reference: 0088621)

1.3 Objectives and Targets

Table 1-1 below outlines the objectives and targets set out for the Facility for the management of air quality, odour and greenhouse gas during operation. These objectives and targets were developed by Bingo based on regulatory requirements, industry experience, best practice, and the site air quality audit undertaken in July 2020.

Table 1-1: Objectives and Targets

Objective	Target	Timeframe	Accountability
Dust prevention, minimisation and control	Comply with the requirements of: • Conditions of MP 06_0139 • EPL 20121 • EPL 13426 • *Protection of the Environment Operations Act (POEO) 1997* • *POEO (Clean Air) Regulation* 2010	Ongoing	Site Supervisor / Environmental Manager NSW
Odour prevention, minimisation and control		Ongoing	Site Supervisor / Environmental Manager NSW
Greenhouse gas emission minimisation and control		Ongoing	Site Supervisor / Environmental Manager NSW

1.4 Consultation

Under Schedule 3 Condition 6(a) of the Project Approval, the AQMP is required to be prepared in consultation with NSW Environmental Protection Authority (NSW EPA).

Table 1-2 demonstrates evidence of consultation.

Table 1-2: Summary of Consultation with Agencies

Relevant Agency	Date	Contact	Comments
DPIE	06/07/2021	William Hodgkinson, Team Leader, Industry Assessments	Updates required to author details and updates to section on odour in the AQMP
DPIE	30/07/2021		Submission of updated AQMP to address DPIE comments
EPA	18/06/2021	Rob Hogan, Manager, Regulatory Operations Metro	Updates to Air Quality Plan to align with relevant operational elements referenced in the LGM Plan.

Schedule 3 Condition 6(a) of the Project Approval requires that the AQMP is prepared to the satisfaction of the Planning Secretary.

The approved AQMP will be implemented during the life of the Facility and is retained at the site office, and will be made available for inspection if requested.

1.5 Authors

Schedule 3 Condition 6(a) of the Project Approval requires the AQMP to be prepared by a suitably qualified, experienced, and independent expert whose appointment has been endorsed by the Planning Secretary.

The endorsement for the author has been provided in **Appendix A.**

The AQMP has been prepared by the following authors:

Author Details	Qualifications and Experience
Martin Doyle	**PhD Air Quality Meteorology (University of East Anglia, UK, 2004), BSc (Hons) Environmental Science (University of East Anglia, UK, 1998), Certified Air Quality Professional (CAQP), Clean Air Society of Australia and New Zealand (CASANZ)** Martin has almost 20 years of experience in the field of air quality, from academic research to public and private environmental consultancy. He completed his doctorate in 2004 in air pollution meteorology and was a Senior Research Associate at the University of East Anglia, which has the UK's highest rating for the quality of environmental research undertaken. His work has been included in UK Department of the Environment, Food and Rural Affairs Air Quality Expert Group state-of-science reports on PM_{10} and NO_2. His major areas of expertise include air quality monitoring (including monitoring network design and data analysis), emissions inventory development, atmospheric dispersion modelling (using TAPM, CALPUFF, AUSPLUME, CALINE and AERMOD), greenhouse gas assessment and climate change impact assessment, independent peer review and performance of audits. Martin has significant experience across all sectors (see overleaf) and broad experience in assessment of air pollutants including odour. Martin authored Chapter 4 and Chapter 5.1 to 5.7.
Heather Tilley	**B Sc (Biological Life Sciences), B Sc Hons (Physical Geography)** Heather has over 30 years' experience in environmental impact assessment, post approvals, on-site construction environmental management, including waste management, environmental auditing and compliance monitoring on large infrastructure projects. Heather authored Chapters 1, 2, 3 and provided input to Chapter 5.5 to 5.12.

2 FACILITY DESCRIPTION

2.1 Facility Overview

The Facility covers an operational area of 54 hectares (ha) (including the surface area of the quarry) at Lot 1 DP 1145808; and Lot 2 DP 1247691, within an area being developed for commercial and industrial use under the *State Environmental Planning Policy (Western Sydney Employment Area) 2009 (the SEPP 2009*).

The Facility is accessed via Kangaroo Avenue located to the east and north-east of the site. The site is located within the Eastern Creek industrial precinct/M7 business hub and is bounded by the Western Motorway (M4) to the north, Kangaroo Avenue to the east and Honeycomb Drive to the south. The Archbold Road extension will run parallel to the western boundary of the site (Transport for NSW (TfNSW), 2019). The Eastern Creek REP is bounded by commercial and industrial buildings to the immediate north, east and south of the site. The closest residential receivers are located approximately 400 metres (m) to the north in the suburb of Minchinbury and approximately 1.2 kilometres (km) west in the suburb of Erskine Park. To the east of the Eastern Creek REP site is a 29-ha unoccupied site owned by DPIE (see **Figure 2-1**).

The Facility as managed under this EMS includes the following approved infrastructure:

- Site entrance with security gatehouse and weighbridge;
- Site offices and amenities;
- Parking for light vehicles and trucks, staff and visitors;
- Materials processing centre with equipment comprising:
  - screening areas with overhead gantry crane, screener and conveyors;
  - storage bays;
  - load out area;
- Segregated Materials Area (crushing);
- General solid (non-putrescible) landfill;
- Wheel wash bay.

Mounds of overburden material (amenity berms) which act as impervious barriers and visual screens are located to the north, south and west of the Facility operational area. A Conservation Area is also located at the north-western corner of the operations area which is fenced and maintained as part of the operations of the Facility.

Appendix B shows the layout of the Facility.

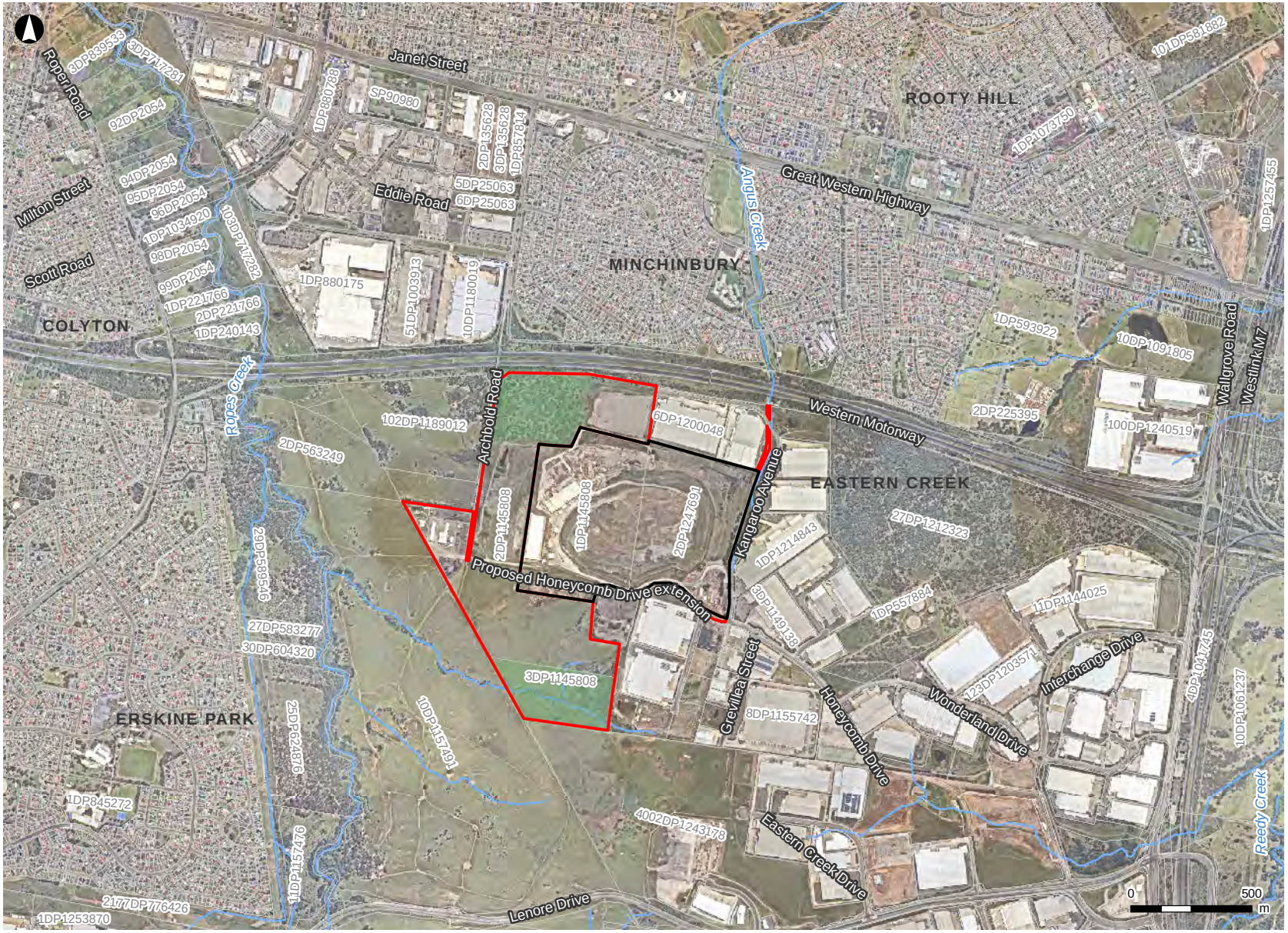

Figure 2-1: Facility location

2.2 Waste Sources

2.2.1 Permissible waste

The Facility has the capacity to receive up to 2 Mtpa general solid waste (non-putrescible) types, as defined by Schedule 2 of the *Protection of the Environment Operations (POEO) Act 1997:*

The following type of materials will be received:

- Construction and demolition (C&D) waste;
- Commercial and industrial (C&I) waste;
- Waste streams complying with acceptable waste for general solid waste (non-putrescible) facilities and assessed to be inert waste or solid waste following the technical assessment procedure outlined in Part 1 of the *Waste Classification Guidelines (NSW EPA, 2014);*
- Virgin excavated natural material
- Tyres
- Soil that meets CT1 and EPL thresholds
- Green waste.

Materials received will comprise both segregated materials and mixed materials ,which will include but not be limited to, brick, concrete, virgin excavated natural material (VENM), terracotta roof tiles, soils, green waste, timber, metals, paper and plastics. The undifferentiated materials incapable of economic separation or later sale, or which is the residue from recycling processes, will be taken to the landfill for disposal.

Materials suitable for recycling include, but not be limited to, both hardfill materials (e.g. sand, soil concrete, brick and tile) and also specified materials (e.g. metals (including steel), plastics, paper, timber, vegetation, carpet and mattresses etc).

Materials recycled for sale will meet specifications prescribed by the POEO Act and the relevant resource recovery orders and exemptions for aggregate, soils, fines and mulch.

2.2.2 Non permissible wastes

Schedule 3 Condition 1 of the Project Approval details which wastes cannot be received at the Facility. Screening of wastes at the /weighbridge is for early detection of non-conforming waste to prevent entry to the site.

2.2.3 Conditional wastes

Conditional wastes are not permitted in the MPC but may be accepted if approved by NSW EPA and listed on the sites licence, and by prior arrangement for landfilling. Some Conditional wastes may be accepted but require prior treatment or particular disposal procedures.

2.3 Waste Processing

Section 2 of the **Environmental Management Strategy (EMS)** and the **Waste Monitoring Plans** both describe the waste process flow in detail.

2.4 Waste Process Flow

Figure 2-2 details the processing flow of waste material as the material is segregated, processed, stored and sold or disposed at the landfill.

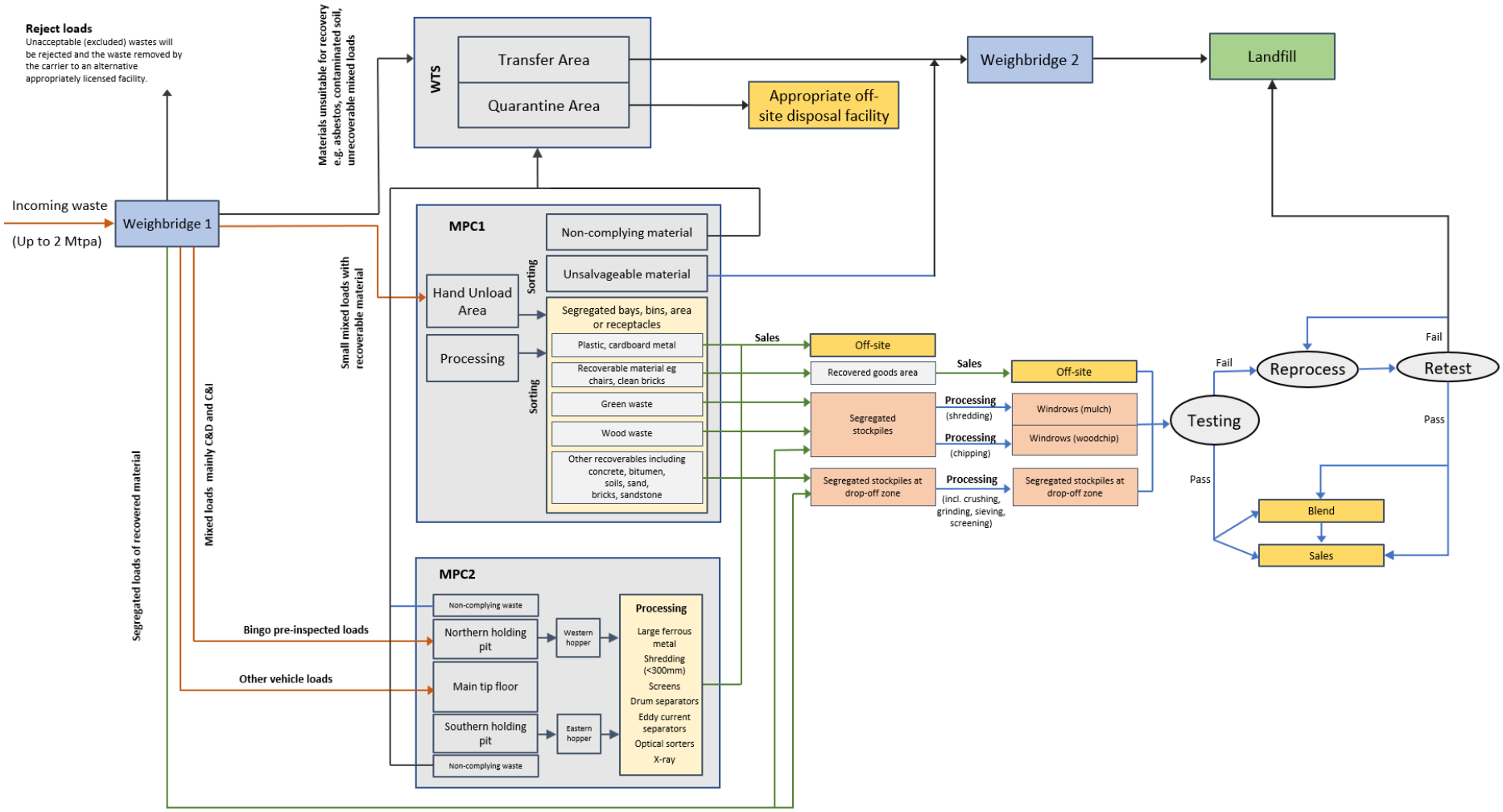

Figure 2-2: Process Flow of Facility Inputs and Outputs

2.4.1 Operating Hours

Table 2-1 details the operating hours as approved under *Schedule 3 Condition 39* of MP 06_0139 Modification 6.

Table 2-1: MP 06_0139 as Modified Approved Operating Hours

Activity	Day	Time
Construction	Monday to Friday	7:00am to 6:00pm
	Saturday	8:00am to 4:00pm
	Sunday and Public Holidays	Nil
Material Processing Centre (MPC1 and MPC2): Operation, waste receival, chute use and maintenance	Monday to Friday	24 hours
	Saturday	24 hours
	Sunday and Public Holidays	24 hours
Segregated Material Area (SMA): Crushing and screening	Monday to Friday	6:00am to 6:00pm
	Saturday	8:00am to 4:00pm
	Sunday and Public Holidays	8:00am to 4:00pm
Segregated Material Area (SMA): Receipt of segregated material	Monday to Friday	24 hours
	Saturday	8:00am to 4:00pm
	Sunday and Public Holidays	8:00am to 4:00pm
Landfill: truck deliveries	Monday to Friday	5am to 9pm

3 STATUTORY REQUIREMENTS

3.1 Legal and Other Obligations

The legislation, planning instruments and guidelines considered during development of this plan are listed below with specific details provided in the Legislation Register within Appendix B of the OEMP.

- *Environmental Planning and Assessment Act (EP&A) 1979;*
- *Environmental Planning and Assessment Regulation (EP&A Reg) 2000;*
- *Protection of the Environment Operations (POEO) Act 1997;*
- *Protection of the Environment Operations (Clean Air) Regulation 2010;*
- *National Greenhouse and Energy Reporting (NGER) Act 2007.*

Additional legislation, standards and guidelines relating to the management of air quality include:

- Environment Protection Licences (EPL 20121 and EPL 13426);
- *Approved methods for the modelling and assessment of air pollutants in New South Wales (NSW EPA, 2017)*
- *Approved methods for the sampling and analysis of air pollutants in New South Wales (NSW DEC, 2006)*
- *Technical framework: Assessment and management of odour from stationary sources in NSW (NSW DEC, 2006)*
- *Technical notes: Assessment and management of odour from stationary sources in NSW (NSW DEC, 2006)*
- *Environmental Guidelines for Solid Waste Landfills (NSW EPA, 2016 Second Edition).*

3.2 Project Approval

3.2.1 EP&A Act Approval

The original Project Approval for the site was granted by the Minister for Planning in 2009 (MP 06_0139) under Section 75J of the NSW EP&A Act. Seven modifications have been approved since 2009, with the most recent modification (MOD8) approved on 3 March 2021.

The Project Approval include requirements to be addressed in this plan and to be delivered during operation of the Facility. These requirements, and how they are addressed in the plan are provided in **Table 3-1**.

Table 3-1: Conditions of MP 06_0139 as modified

#	Requirement	Document Reference
Schedule 3 – Specific Environmental Conditions		
37	**Air Quality, Odour and Greenhouse Gas Management Plan** The Applicant must prepare and implement an Air Quality, Odour and Greenhouse Gas Management Plan for the project to the satisfaction of the Planning Secretary. This plan must:	This Plan
(a)	be prepared in consultation with the EPA and by a suitably qualified, experienced and independent expert whose appointment has been endorsed by the Planning Secretary;	Sections 1.4 and 1.5 Appendix A

#	Requirement	Document Reference
(b)	include an air quality and odour monitoring program, which details:	
	• the location, frequency and duration of monitoring which adequately represents the sensitive receptors;	Section 5
	• the provision for real-time boundary particulate matter monitoring; and	Section 5.5
	• key performance indicators for monitoring;	Section 5.1
(c)	include an air quality and odour mitigation strategy which:	
	• details proactive measures to minimise odour and air quality impacts;	Section 4.4
	• identifies real-time boundary monitoring trigger levels for remedial action;	Sections 3.4, 5.5, 5.6
	• details the remedial action that will be taken if trigger levels are exceeded;	Section 5.6.3
(d)	include a program for monitoring subsurface gas, surface gas emission, and gas accumulation which:	
	• is in general accordance with the guidance in sections 15-18 of Appendix A of the DEC's Environmental Guidelines for Solid Waste Landfills; and	Section 5.2
	• includes a protocol for remediating uncontrolled landfill gas emissions;	Section 5.2.1
(e)	describe protocols for record keeping and compliance reporting; and	Section 5.8
(f)	describe protocols for the review and revision of the plan to ensure any controls remain effective over time.	Section 5.8.1
Schedule 5 – Environmental Management, Reporting and Auditing		
2	**Management Plan Requirements** The Applicant shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	This Plan
(a)	detailed baseline data;	Section 4.1
(b)	a description of:	
	• the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 1.4
	• any relevant limits or performance measures/criteria;	Section 3.4
	• the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 4.3
(c)	a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 4.3
(d)	a program to monitor and report on the:	
	• impacts and environmental performance of the project;	Section 5.1
	• effectiveness of any management measures (see c above);	Section 5.8.1
(e)	a contingency plan to manage any unpredicted impacts and their consequences;	Section 4.4.6
(f)	a program to investigate and implement ways to improve the environmental performance of the project over time;	Section 5.2

#	Requirement	Document Reference
(g)	a protocol for managing and reporting any:	
	• incidents;	Section 5.10
	• complaints;	Section 5.11
	• non-compliances with statutory requirements; and	Section 5.12
	• exceedances of the impact assessment criteria and/or performance criteria; and	
(h)	a protocol for periodic review of the plan.	Section 5.8.1

3.2.2 Statement of Commitments

The Statement of Commitments (SoC) relevant to air quality, odour and greenhouse gases were identified in the 2008 EAR[2]. These have been summarised in **Table 3-2**.

Table 3-2: Relevant SoC for Air Quality (EAR, 2008)

SoC #	Statement of Commitment	Document Reference
5. Operational Environmental Performance		
5.4 Air Quality		
5.4.1	A real-time dust monitoring and reactive control system will be implemented to identify activities that may lead to off-site air quality impacts. The dust monitoring can be used to assess compliance with DECC ambient air quality criteria. A minimum of one real time monitor (e.g. DustTrak, TEOM, E-Bam, E-Sampler) will be used to identify real-time impacts and delineate short term particulate matter concentrations and thus trigger required maintenance/ repairs or development of engineering solutions.	Section 5.5 Section 5.6
5.4.2	Monitoring will be undertaken as per NSW EPA (1996) *Environment Guidelines: Solid Waste Landfills*[3] for the gas management system. Unless otherwise approved by NSW EPA, monitoring will be conducted monthly for initial operations, and if no adverse impacts are observed, will be reduced to quarterly after six months of operations and to annually after 18 months of operation. Monitoring would include a walkover along chimneys with monitoring of landfill gas (methane and hydrogen sulfide) undertaken using a suitable LFG monitor e.g. GA 2000, capable of reading % gas and % LEL. Monitoring shall also include recording of odour observations including the monitoring of BioMagic key odour sources to minimise emissions.	Section 5.2
5.4.3	An Air Quality Management Plan (AQMP) shall be prepared which will be included in the LEMP and EWMP to be developed for the Project, with a focus on activities which generate the most significant emissions – in this instance those associated with haulage movements and transfer and loading activities.	This Plan

[2] Environmental Assessment Report, Environmental Resources Management Australia (ERM), dated December 2008 (Reference: 0088621)

[3] Since the project was approved, there have been various revisions of the *Environment Guidelines: Solid Waste Landfill*. The most the current version is the Second Edition dated 2016.
https://www.epa.nsw.gov.au/~/media/EPA/Corporate%20Site/resources/waste/solid-waste-landfill-guidelines-160259.ashx

SoC #	Statement of Commitment	Document Reference
5.10 Greenhouse Gas		
5.10.1	Inventory of emissions will be prepared and maintained to monitor greenhouse gas throughout the life of the Project	Section 5.3
5.10.2	Undertake an internal review annually to identify techniques to minimise energy use and assess if equipment is operating at optimum energy efficiency. Internal review to address inventory of emissions levels.	Section 5.3
5.10.3	Energy efficiency to be a priority for of all new mobile and fixed equipment during procurement for both diesel and electric powered equipment.	Section 5.3
5.10.4	All greenhouse gas producing equipment will be maintained to retain high levels of energy efficiency	Section 5.3

It should be noted that although SoC 5.4.2 outlines the need to monitor landfill gas in accordance with *Environment Guidelines: Solid Waste Landfills* (NSW EPA, 1996), this guidance document has been superseded by a second edition (NSW EPA, 2016). A review of the second edition determined that the requirements for landfill gas monitoring programs outlined in both documents are similar (i.e. considered to be the same intent, with varying wording), however, the second edition includes updated concentration thresholds regarding methane (CH_4) and carbon dioxide (CO_2). Therefore, the landfill gas monitoring program outlined in this AQMP has been determined in accordance with *Environment Guidelines: Solid Waste, Second Edition* (NSW EPA, 2016).

3.3 Environment Protection Licence Conditions

The most recent EPLs associated with the Facility were issued by NSW EPA on 12 April 2018 (EPL 20121) and 7 June 2019 (EPL 13426).

Conditions within that EPLs associated with air quality and how they have been addressed within this plan are presented in **Table 3-3**. The EPLs will be amended to align with Modification 6.

Table 3-3: Relevant EPL Conditions

<table>
<tr><th>EPL Condition</th><th>Requirement</th><th>Document Reference</th></tr>
<tr><td colspan="3">EPL 20121</td></tr>
<tr><td>P1.1</td><td>The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.
EPA ID 1: Dust monitoring Point North
EPA ID 2: Dust monitoring Point East
EPA ID 3: Dust monitoring Point South
EPA ID 4: Dust monitoring Point West</td><td>Section 5.5</td></tr>
<tr><td>M2.3</td><td>Air Monitoring Requirements for EPA ID 1-4<table><tr><th>Pollutant</th><th>Units of Measure</th><th>Frequency</th><th>Sampling Method</th></tr><tr><td>Particulates - Deposited Matter</td><td>grams per square metre per month (g/m^2/month)</td><td>Quarterly</td><td>Australian Standard 3580.10.1-2003</td></tr></table></td><td>Section 5.5</td></tr>
</table>

EPL Condition	Requirement	Document Reference
M3.1	Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with: a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place. **Note:** The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".	Section 5.1
M7.3	The EPA may require the proponent to conduct assessments or investigations that identify the extent of any potentially offensive odour emissions beyond the boundary of the premises. The scope of such investigations to be agreed to by the EPA and may include revised air dispersion modelling based on actual site emissions data, well designed field investigations according to German standards, and/ or use of field olfactometers, and analysis of detailed complaints records and on-site meteorological data.	Section 5.7.2 Section 5.4
O3.1	The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.	This Plan
O3.2	The licensee must ensure that all activities conducted at the premises are carried out in a manner which minimises or prevents the generation of dust.	This Plan
O3.3	Trucks entering and leaving the premises that are carrying loads must be covered at all times, except during loading and unloading.	Section 4.4.1
O3.4	The Licensee must ensure that all stockpiles are kept wet during the transfer of waste to and from stockpiles and during processing to minimise the generation of dust.	Section 4.4.2, 4.4.3
O3.5	The licensee must ensure that no material, including sediment or oil, is tracked from the premises.	Section 4.4.1
O6.6	Leachate must not be irrigated and/or used for dust control at the premises.	Section 4.4
EPL 13426		
M7.1	The proponent must provide an annual audit of the design, operation and odour management practices of the operation with the primary aim of identifying improvements that lead to attainment of best practice in regard to minimising odour emitted from the premises. The proponent must implement all reasonable audit recommendations. The scope of such an audit to be regularly reviewed in consultation with the EPA.	Section 5.7.2
M7.2	The EPA may require the proponent to conduct assessments or investigations that identify the extent of any potentially offensive odour emissions beyond the boundary of the premises. The scope of such investigations to be agreed to by the EPA and may include revised air dispersion modelling based on actual site emissions data, well designed field investigations according to German standards, and/ or use of field olfactometers, and analysis of detailed complaints records and on-site meteorological data.	Section 5.7.2

EPL Condition	Requirement	Document Reference
M7.3	Within one year after the Licence is varied to allow the disposal of waste at the Premises, the licensee must implement a landfill gas monitoring program designed to demonstrate whether landfill gas is migrating from the premises. This landfill gas monitoring program must meet the environmental goals detailed in Benchmark Technique 16 and 17 of the EPA Environmental Guidelines: Solid Waste Landfills (2016).	Section 5.2
O3.1	All operations and activities occurring at the premises must be carried out in a manner that will minimise the emission of dust from the premises.	This Plan
O3.2	Trucks entering and leaving the premises that are carrying loads must be covered at all times, except during loading and unloading.	Section 4.4.1

3.4 Relevant Air Quality Criteria

The air quality criteria applicable to the operation of the Facility are presented in **Table 3-4,** which are consistent with the criteria adopted to inform MOD6 for the Facility (Ramboll, 2018).

Air quality criteria are also outlined in *Schedule 3, Condition 29* of MP 06_0139. These are broadly consistent with the criteria outlined in **Table 3-4,** with the exception of annual average PM_{10}, which has been updated by NSW EPA to be 25 $\mu g \cdot m^{-3}$, and the inclusion of $PM_{2.5}$ criteria.

Table 3-4: Air quality Criteria Applicable to the Facility

Pollutant	Averaging period	Goal	Source
Total suspended particulate (TSP)	Annual	90 $\mu g/m^3$	(NHMRC, 1996)
PM_{10}	Maximum 24-hour	50 $\mu g/m^3$	(DoE, 2016)
	Annual	25 $\mu g/m^3$	
$PM_{2.5}$	Maximum 24-hour	25 $\mu g/m^3$	
	Annual	8 $\mu g/m^3$	
Dust deposition	Annual	2 g/m^2/month (incremental increase) 4 g/m^2/month (maximum cumulative)	(NERDDC, 1998)

3.4.1 Odour

The POEO Act is applicable to all scheduled activities in NSW. Section 129 of the POEO Act provides a requirement to not cause or permit the emission of any offensive odour from the premises. The operations at the Facility are scheduled activities under Schedule 1 of the POEO Act, and the principles contained within the POEO Act are enforceable.

For reference, 'offensive odour' is defined within the POEO Act as:

> *an odour:*
>
> *(a) that, by reason of its strength, nature, duration, character or quality, or the time at which it is emitted, or any other circumstances:*
>
> *(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
>
> *(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*
>
> *(b) that is of a strength, nature, duration, character or quality prescribed by the regulations or that is emitted at a time, or in other circumstances, prescribed by the regulations.*

3.5 Roles and Responsibilities

Key roles and responsibilities applicable to this AQMP are presented in **Table 3-5**.

Table 3-5: Roles and Responsibilities

Roles	Responsibilities
General Manager Resource Recovery NSW	• Ensuring an AQMP is developed and implemented; ensuring compliance with Project Approval conditions and any regulatory or other requirements • Ensuring appropriate resources are available to implement all aspects of the AQMP and maintain necessary records
Safety and Quality Manager NSW	• Provide support for the Site Supervisor • Participate in investigations of accidents on site • Take action to resolve non-conformances, non-compliances and incidents
Environmental Manager NSW	• Advise the General Manager Resource Recovery NSW on environmental issues • Undertaking reporting and internal audit annually • Review, maintain and assist implementation of the Environmental Management System
Site Environmental Officer	• Identifying risks to air quality associated with the operations undertaken on site • Developing and implementing procedures and measures to minimise or eliminate any risks identified • Ensuring that all personnel undertaking work at the site receive adequate training and education in the environmental measures developed to mitigate or minimise risks associated with air quality at the site • Implement appropriate air quality monitoring to ensure that the management measures prescribed in this Plan are effective
Site Operations Manager	• Effectively implement environmental controls on-site in accordance with environmental obligations • Demonstrate that suppliers and sub-contractors are implementing environmental requirements • Managing and minimising water consumption, energy consumption, waste consumption and emission of greenhouse gases, wherever possible. • Report environmental non-conformances, incidents and potential incidents to the Environment Manager NSW and General Manager Operations NSW • Manage and direct works in a manner that minimises potential for environmental impacts or stop works if there is a risk of environmental harm
Site Supervisors (Landfill / MPC / Crusher)	• Assisting in the development, implementation and maintenance of mitigation measures to minimise or eliminate the identified environmental risks • Complying with environmental measures and procedures implemented to minimise or eliminate environmental risks • Maintaining onsite records and documents for inspection as required • Attending environmental training and other educational sessions • Reporting any environmental incidents that may occur in accordance with the AQMP • Inducting all staff, workers and any person conducting or engaged by the company to complete and works onsite

Roles	Responsibilities
Yard and Plant Operators (all sites)	• Completing the site induction • Assisting management to mitigate any environmental hazards • Ensuring that the site is regularly inspected for potential hazards that may cause harm • Attending environmental training and other educational sessions • Continuous awareness of activities and processes that may have environmental impacts; and • Reporting incidents promptly and assisting with implementing control measures as required
Weighbridge Officer	• Obtain information about the load to be tipped prior to tipping as part of the Waste Monitoring Program. • Preparation of waste management reports. • Overall management and maintenance of weighbridge systems
Traffic Controller	• Supervise turning movements in/out of the driveway and any potential access conflicts between large trucks • Supervise and direct drivers around and out of the site • Monitor general driver behaviour including any drivers disobeying instructions.
Contractors	• Completing the site induction • Identifying the environmental risks associated with their activities at the site • Developing mitigating measures to minimise or eliminate the identified environmental risks • Being aware of and following onsite instructions and procedures implemented to minimise or eliminate environmental risks

3.6 Training and Competence

All personnel undertaking work at the Facility will undergo general environmental awareness training and training relevant to their responsibilities under the Facility Environmental Management Strategy (**EMS)**.

Records of Project environmental induction and other environmental training will be maintained and readily accessible.

Details of training are provided in Section 4.4 of the EMS.

4 IMPLEMENTATION

This section addresses the key air quality risks associated with operation of the Facility and the environmental controls established to manage key risks.

4.1 Existing Environment

4.1.1 Sensitive Land Uses

To ensure that the sensitivity of land surrounding the Facility is understood, population-density data has been examined. Population-density data based on the 2016 census, have been obtained from the Australian Bureau of Statistics (ABS) for a 1 square kilometre (km^2) grid, covering mainland Australia (ABS, 2017).

For clarity, the ABS use the following categories to analyse population density (persons·km^{-2}):

- Very high (>8 000);
- High (>5 000);
- Medium (>2 000);
- Low (>500);
- Very low (<500); and,
- No population (0).

The Facility and neighbouring land uses are located in an area of 'very low' population density (<500 persons·km^{-2}), which would be expected given the largely industrial activities of the immediate area (see **Figure 4-1**).

Other locations shown in **Figure 4-1** are located in areas of 'low' and 'medium' populations.

The population density within a radius of 2 km relative to the Facility is illustrated in **Figure 4-1.**

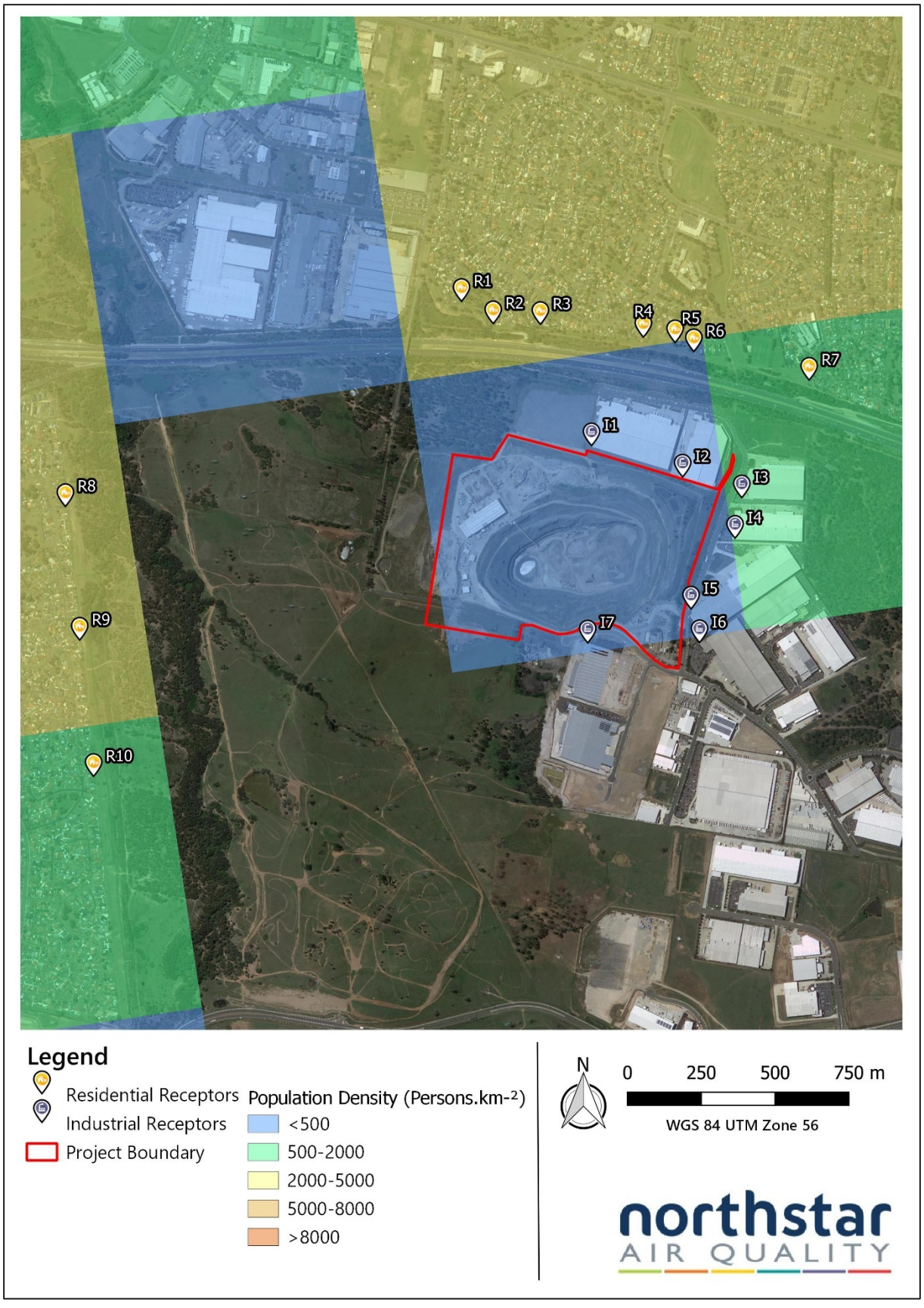

Figure 4-1: Population Density and Potential Indicative Sensitive Land Use Locations

4.1.2 Air Quality

Air quality monitoring for particulates is performed by DADEC using a Beta Attenuation Monitor (BAM) to measure PM_{10}. The BAM is located at 93 Minchin Drive, Minchinbury as displayed in **Figure 4-2**. PM_{10} data from the BAM has been provided by Bingo for the period 29 June 2016 to 1 September 2020. This data has been assessed and compared to PM_{10} data measured at an Air Quality Monitoring Station (AQMS) located approximately 5.5 km to the west of the Facility at St Marys, and operated by NSW Department of Planning, Industry and Environment (DPIE) for the same period. A comparison of these data sets allows for an assessment of the contribution of onsite activities to local air quality as shown in **Figure 4-2** and **Figure 4-3**.

It can be seen in **Figure 4-3** that PM_{10} concentrations measured by DADEC in the residential area to the north of the Facility and at the St Marys AQMS generally show similar patterns over the five-year period. Frequent exceedances of the short term PM_{10} criterion were observed between late 2019 and early 2020 at both the BAM and St Marys AQMS, however, this is most likely due to widespread, intense bushfires when many AQMS across NSW measured similar exceedances during this period.

Dust deposition is also measured at the Facility at four Dust Deposition Gauges (DDGs) located around the Premises as illustrated in **Figure 4-2**. The data has been derived from the MOD6 AQIA (Ramboll, 2018) for four years from 2016 to 2020 as summarised in **Table 4-2**.

As shown in **Table 4-2**, the annual average dust deposition rates are generally below 4 g m^{-2} $month^{-1}$ which is the maximum cumulative criterion outlined in **Table 3-4**. One elevation above the criterion at the eastern dust deposition gauge was recorded in 2019. This exceedance has been attributed to onsite works which has been reviewed to ensure that such elevations do not occur in future.

Figure 4-2: Particulate Monitoring Locations

Table 4-1: Particulate Matter Measurements at DADEC BAM and St Marys AQMS

Pollutant / averaging period	2016		2017		2018		2019		2020		Criterion
	St Marys	DADEC	St Marys	DADEC	St Marys	DADEC	St Marys	DADEC	St Marys	DADEC	
Maximum 24-hour average PM_{10} concentration	35	29.7	49.8	45	**100.5**	**98**	**159.8**	**162**	**260.3**	**175**	**50 µg·m^{-3}**
Annual average PM_{10} concentration	14.7	13.8	16.2	16.4	19.4	18	24.7	24.7	19.5	20.7	**25 µg·m^{-3}**

Table 4-2: Annual Dust Deposition

Site	2016	2017	2018	2019	2020	Total Average
North DDG	1.1	0.7	1.5	1.9	2.0	**1.4**
East DDG	1.5	1.8	1.7	5.0	3.9	**2.8**
South DDG	1.6	2.0	2.2	2.7	3.3	**2.4**
West DDG	2.1	1.6	2.3	2.7	3.6	**2.5**
Total Average	**1.2**	**1.5**	**1.8**	**3.1**	**3.2**	**2.2**

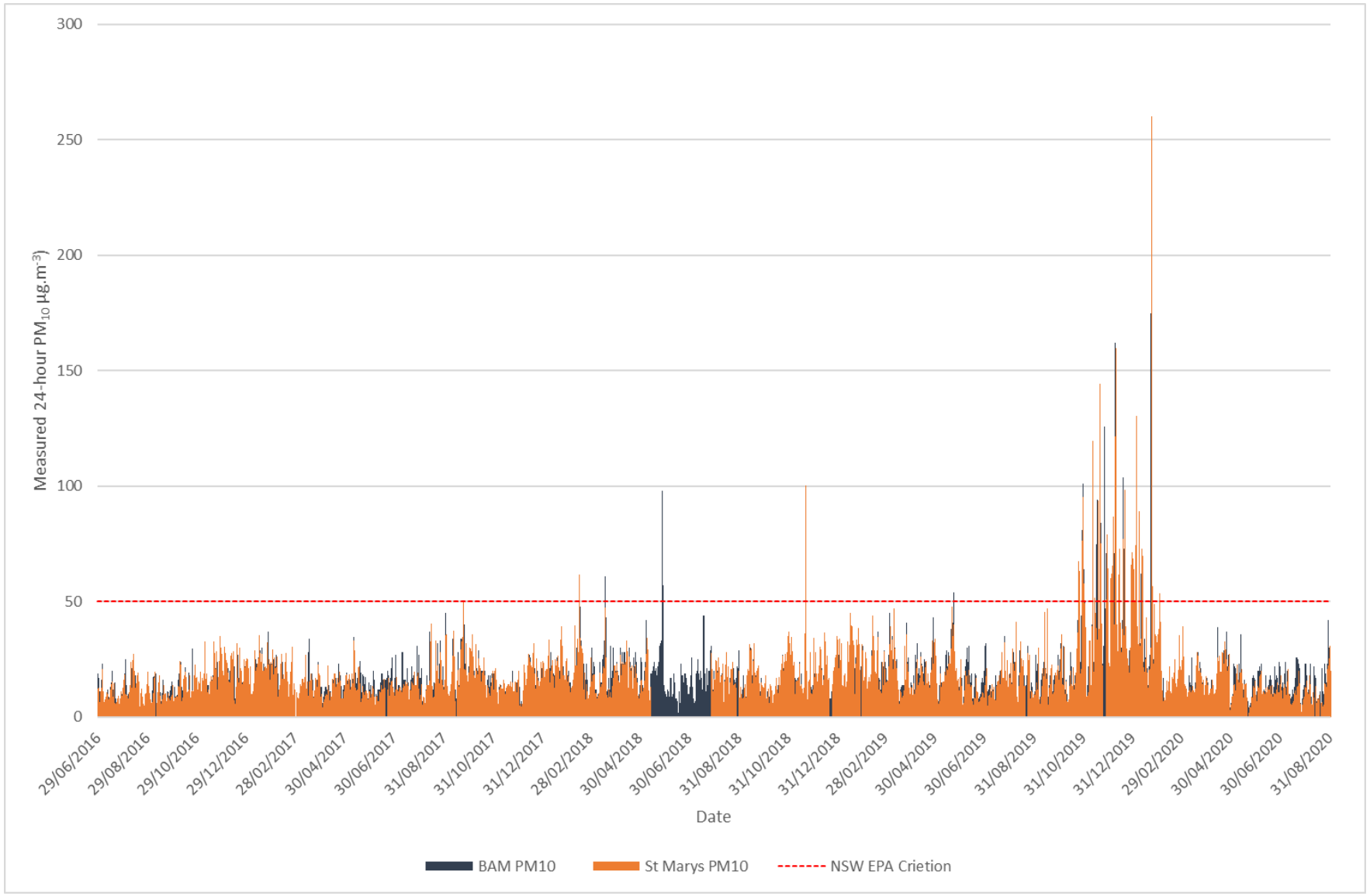

Figure 4-3: PM_{10} Measurements, St Mary's AQMS and Bingo 2015 to 2020

4.1.3 Meteorology

The meteorology experienced within an area, can govern the generation (in the case of wind-dependent emission sources), dispersion, transport and eventual fate of pollutants in the atmosphere. The meteorological conditions surrounding the Facility have been characterised using data collected at nearby AQMS, and at Automatic Weather Stations (AWS) operated by the Bureau of Meteorology (BoM).

Section 4 of the AQIA which supported Modification 6 (MP 06_0139 MOD6) adopted observed meteorological data from St Marys AQMS and Horsley Park AWS operated by the BoM as these stations are proximate to the Facility. Horsley Park AWS was decommissioned in 2017 and therefore meteorological data at St Marys AQMS from 2015-2019 has been analysed for the purposes of this AQMP.

A summary of the meteorological conditions at St Marys AQMS is summarised in **Figure 4-4**.

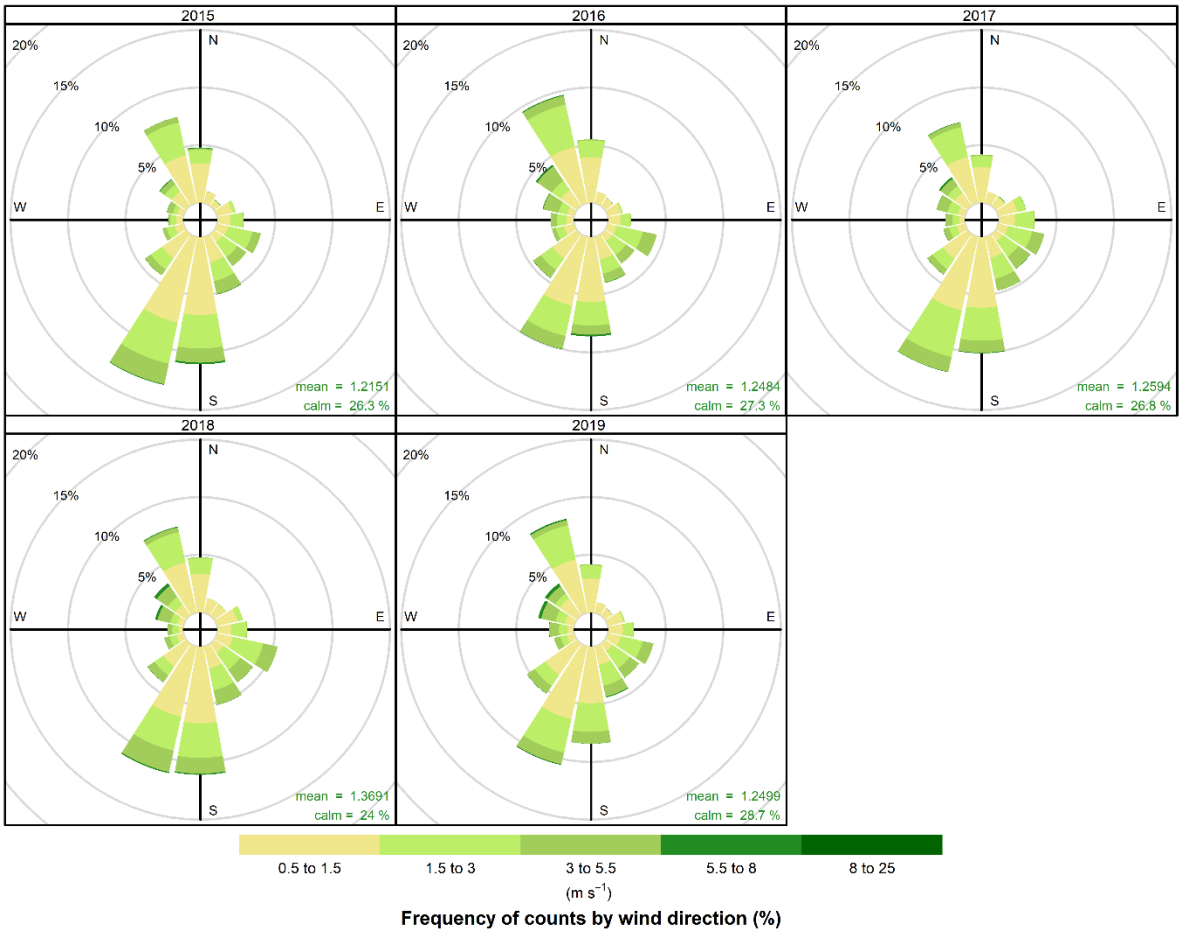

Figure 4-4: St Marys AQMS Wind Roses 2015-2019

In summary, from 2015 to 2019 winds at St Marys AQMS show similar patterns across each of the years, with a predominant south-westerly wind component.

The majority of wind speeds experienced at St Marys AQMS over the 5-year period are generally in the range <0.5 m·s^{-1} to 5.5 m·s^{-1} with the highest wind speeds (i.e.<8 m·s^{-1}) occurring from a north-westerly direction. Winds of this speed are not frequent, occurring <0.04% of the observed hours over the 5-year period. Calm winds (i.e. <0.5 m s^{-1}) occur during 26.7% of hours on average across the 5-year period.

4.2 Aspects, Impacts and Risks

The following outlines the potential sources of air pollutants, and the air quality impacts which may be associated with the operation of the Facility as determined in the original Environmental Assessment Report (ERM, 2008), subsequent modifications, as determined within the Air Quality Assessment undertaken for Modification 6 (Ramboll, 2018), and as determined through the Air Quality Audit for the Facility as performed in July 2020 (Northstar, 2020).

4.2.1 Modification 6 Identified Impacts

The AQIA (Ramboll, 2018) to support Modification 6 (MP 06_0139 MOD6) was performed on the basis of an annual material throughput of 2 Mtpa. Particulate emissions were estimated on an assumed 50/50 split of materials entering the Materials Processing Centre (MPC) and the landfill. The existing dust management measures performed at the Facility were also integrated into the assessment to estimate particulate emissions.

The dust emission sources have been identified as following:

- Movement of vehicles on travel routes and re-entrainment of dust from paved and unpaved surfaces (49 % of total, controlled PM_{10} emissions);
- Material handling (20 % of total, controlled PM_{10} emissions);
- Wind erosion from exposed surfaces and stockpiles (21 % of total, controlled PM_{10} emissions); and,
- Diesel vehicle exhaust from the trucks, front end loaders, excavators etc. (10 % of total, controlled PM_{10} emissions).

A conservative particulate emissions control factor of 40 % was applied to the unloading of materials from trucks, material sorting and handling, and loading product materials to trucks, given that the activities are performed within an enclosed building. A control factor of 70 % was also assumed to account for the mist sprays operating in the MPC shed for waste sorting and loading the hopper (Ramboll, 2018).

The conclusions of the AQIA (Ramboll, 2018) to support Modification 6 (MP 06_0139 MOD6) are summarised below. Based on an annual throughput of 2 Mtpa, the AQIA identified that:

- Maximum 24-hour average cumulative (i.e. including background) PM_{10} concentrations predicted at surrounding sensitive receptor locations were below the relevant ambient air quality criterion of 50 $\mu g \cdot m^{-3}$;
- Maximum 24-hour average cumulative $PM_{2.5}$ concentrations predicted at surrounding sensitive receptor locations exceeded the relevant ambient air quality criterion of 25 $\mu g \cdot m^{-3}$. However, it was concluded that this was due to exceedances in the existing background $PM_{2.5}$ concentrations;
- Annual average cumulative $PM_{2.5}$ concentrations predicted as a result of the proposed operation at surrounding sensitive receptor locations exceeded the relevant ambient air quality criterion of 8 $\mu g \cdot m^{-3}$ (see above);
- Annual average cumulative PM_{10} concentrations predicted as a result of the proposed operation were below the ambient air quality criterion of 25 $\mu g \cdot m^{-3}$;
- Annual average cumulative dust deposition rates predicted as a result of the proposed operation were below the relevant ambient air quality criterion of 4 $g \cdot m^{-2} \cdot month^{-1}$;
- Odour impact from the landfill as a result of the proposed operation at surrounding sensitive receptor locations were below the odour goal of 2 OU (odour units).

4.2.2 Potential Operational Impacts

Based upon the findings of the AQIA (Ramboll, 2018), operational air quality impacts may be associated primarily with materials transport, the unloading, handling, sorting and loading of materials, wind erosion and odour.

Based on the calculations of potential particulate emissions outlined in the EAR and Modification application (see **Section 4.2.1**), the largest proportion of emissions (greater than 49 %) are associated with wheel generated dust along unpaved roads. It is therefore important that these areas are kept damp and a low silt content is maintained through the removal of deposited material. Other sources of emissions at the site can be more easily controlled through containment within the building, and the application of the additional measures as discussed in **Section 4.4.**

4.3 Key Performance Indicators

As previously outlined in **Section 1.3**, the key objectives of the AQMP are to prevent, minimise and/or control the impacts of the activities performed at the Facility on local air quality. To achieve these objectives, management measures have been outlined in **Section 4.3**. The success of the management measures will be determined through compliance with Key Performance Indicators (KPIs) as summarised in **Table 4-3**.

Table 4-3: KPIs Associated with the Management of Air Quality

Measure	Target	Timeframe	Responsibility	Documentation
Meeting relevant air quality criteria	Comply with relevant NSW EPA and EPL air quality criteria (see Section 3.4)	At all times	Site Environmental Officer Site supervisor	Environmental inspection checklist
Visible dust emissions	Any emissions of visible dust investigated immediately. Review controls applied and increase controls or modify activities	At all times	Site Environmental Officer Site supervisor	Environmental inspection checklist Site supervisor's daily checklist
Spillage or track-out onto public roads	Any spillage or track-out on public roads to be cleaned immediately	At all times	Site supervisor	Environmental inspection checklist Site supervisor's daily checklist
Complaints regarding air quality	Zero complaints. Any complaints would be investigated (see **Section 4.4.5**)	At all times	Site Environmental Officer Site supervisor	Complaints register
Meeting Project Approval Conditions regarding air quality	Compliance with conditions	At all times	Site Environmental Officer Site supervisor	Environmental inspection checklist

4.4 Management Measures

This section describes the overall approach to managing and mitigating risks to air quality during operation of the Facility.

Management measures are summarised in **Table 4-4**. These measures are based on best practice and compliance matrices detailed in **Section 3.2**, as well as DADEC's requirements and standards. They are also consistent with the management measures as outlined within the assessments of air quality presented for Modification 6 (Ramboll, 2018) and the Statement of Commitments (see **Section 3.2.2**).

The success of these measures will be determined by KPIs including meeting the relevant air quality criteria and resulting in no visible dust emissions (see **Section 4.3**).

Each measure is given an identification (ID) and an indication of whether the measure is proactive or reactive in nature (or can be implemented as both). It also noted whether the measure acts to prevent the formation of dust, minimise the formation of dust, or control dust once it has been generated.

Details regarding how the management measures will be implemented at the Facility are discussed in **Sections 4.4.1** to **4.4.6**.

In relation to commitments and requirements associated with monitoring and review, these are expanded upon in **Section 5**.

It is noted that no leachate will be used to control dust at the Facility.

Table 4-4: Management Measures

ID	Management Measure	Timing	Responsibility	Implementation
AQ1 Proactive Minimise/Control	All material handling, processing and storage are within the MPC.	During operation	Site Supervisor	**Section 4.4.2**
AQ2 Proactive Reactive Control	Misting sprays operated within MPC to dampen material as it is sorted and before being loaded to the hopper.	During operation	Site Supervisor	**Section 4.4.2**
AQ3 Proactive Prevent/Minimise/Control	All loads to be inspected prior to unloading and water sprays to be used on dusty loads.	During Operation	Site Supervisor	**Section 4.4.1**
AQ4 Proactive Prevent/Minimise	The majority of travel routes onsite are sealed (exceptions are the haul route into the pit and within the segregated materials area).	Ongoing	Site Supervisor	**Section 4.4.1**
AQ5 Proactive/Reactive Minimise/Control	Fixed water sprays will be used during operation of the mobile crusher and shredder to dampen stockpiled materials before processing.	During operation	Site Supervisor	**Section 4.4.2**
AQ6 Proactive/Reactive Minimise/Control	Fixed water sprays on product storage areas.	During operation	Site Supervisor	**Section 4.4.3**
AQ7 Proactive/Reactive Prevent/Minimise/Control	Water carts operating on unsealed haul road into the pit, within the landfill and on the paved roads as needed.	During operation	Site Supervisor	**Section 4.4.1**
AQ8 Proactive Minimise	Speed limit of 25 km $\cdot hr^{-1}$ for site access road, and 10 km $\cdot hr^{-1}$ for all internal roads.	During operation	Site Supervisor	**Section 4.4.1**
AQ9 Proactive/Reactive Minimise	Water cannon/attachment to water cart operating will operate within the pit when materials are unloaded to supress dust generation	During operation	Site Supervisor	**Section 4.4.3**

ID	Management Measure	Timing	Responsibility	Implementation
AQ10 Proactive/Reactive Minimise/Control	A dedicated street sweeper will be available onsite at all times to clean paved roadways, hardstand areas and driveways.	During Operation	Site Supervisor	**Section 4.4.1**
AQ11 Proactive Minimise	Operation of a chute to transport waste into the pit will minimise vehicle kilometres travelled.	During operation	Site Supervisor	**Section 4.4.1**
AQ12 Reactive Minimise/Control	Activities performed onsite will be modified during periods of high winds	During operation	Site Supervisor	**Section 4.4.3 and Section 5.6**
AQ13 Proactive Minimise	Minimise drop heights of materials.	During operation	Site Supervisor	**Section 4.4.2**
AQ14 Reactive Minimise/Control	Cleaning spills of materials immediately.	During operation	Site Supervisor	**Section 4.4.2**
AQ15 Proactive Prevent/Minimise	The active tipping face will be covered daily before the close of business in line with EPL	During operation	Site Supervisor	**Section 4.4.3 and Section 4.4.4**
AQ16 Proactive/Reactive Prevent/Minimise/Control	Intermediate VENM covering will be applied to all surfaces of the landfill that will be exposed for extended periods of time (more than 90 days) in line with EPL.	During operation	Site Supervisor	**Section 4.4.4**
AQ17 Proactive Prevent/Minimise/Control	Implement interim capping as agreed by EPA.	During operation	Site Supervisor	**Section 4.4.4**
AQ18 Proactive Prevent	Ensure fittings on leachate risers and pipework is airtight to manage potential odour generated from leachate sources.	Prior to operation and ongoing	Site Supervisor	**Section 4.4.4**

ID	Management Measure	Timing	Responsibility	Implementation
AQ19 Proactive/Reactive Minimise/Control	Undertake regular discharge of leachate to sewer to maintain and control leachate levels in the landfill.	During operation	Site Supervisor	**Section 4.4.4**
AQ20 Proactive Minimise	Vehicles will be maintained and operated in accordance with manufacturer's guidance to minimise emissions	Prior to operation and ongoing	Site Supervisor	**Section 4.4.1**
AQ21 Proactive/Reactive Prevent/Minimise	All trucks entering the Facility will be required to keep their load covered until such time as they are ready to unload	During operation	Site Supervisor	**Section 4.4.1 and Section 4.4.4**
AQ22 Proactive/Reactive Prevent	Inspection of waste loads to ensure that unacceptable/excluded wastes do not enter the site.	During operation	Site Supervisor	**Section 4.4.4**
AQ23 Proactive Prevent/Minimise	All vehicles are checked for mud and soil on tyres prior to leaving site and where mud or soil is detected on the entrance road (i.e. "track out"), staff will be deployed to sweep the road.	Prior to operations and ongoing	Site Supervisor	**Section 4.4.1**
AQ24 Proactive/Reactive Prevent/Minimise/Control	Additional dust monitoring will be performed as and when required.	Prior to operations and ongoing	Site Supervisor	**Section 4.4.5 and Section 5.5**

The management measures summarised above are discussed in greater detail below.

4.4.1 Transport

Air quality impacts associated with transport are generally driven by wheel generated dust associated with heavy vehicle movements. A number of control measures identified in **Table 4-4** therefore aim to minimise the risk of wheel generated dust emissions.

A summary of the adopted control measures associated with transport emission sources is presented in **Table 4-5**.

Table 4-5: Control Measures Applicable to Transport Sources

ID	Management Measure
AQ3, AQ4, AQ7, AQ8, AQ11, AQ20, AQ21, AQ23	• Loads inspected and water sprays • Sealed roads • Water carts • Speed limits of 25 km hr^{-1} and 10 km hr^{-1} • Vacuum sweeper • Operation of chute • Vehicle emissions • Covered loads • Chemical suppressants (if required)

All waste loads entering the Facility site will be inspected and water sprays will be used on dusty loads to minimise dust generation during unloading within the Facility (AQ3).

Paved roads onsite (AQ4) will be maintained by a number of water carts (AQ7) sufficient to allow unsealed haul roads to be watered at a frequency of 2 L m^{-2} hr^{-1}.

A vehicle speed limit of 25 km hr^{-1} will be enforced along the access roadway and 10 km hr^{-1} after the weighbridge (AQ8), which will be signed at the entrance to the Facility, and also signed at strategic locations around the Facility.

A dedicated street sweeper (AQ10) will be available onsite at all times to clean paved roadways, hardstand areas and driveways. If the street sweeper is not available a street sweeper will be contracted to perform the required tasks.

The chute to the landfill (AQ11) will be operated to reduce the number of vehicles required to transport materials into the landfill void.

Vehicles will be maintained and operated in accordance with manufacturer's guidance to minimise emissions (AQ20).

All trucks entering the Facility will be required to keep their load covered until such time as they are ready to unload (AQ21). The Site Supervisor or Yard and Plant Operators indicate to the driver to uncover the load immediately prior to unloading.

Applying chemical suppressants to unpaved roads is discussed further in **Section 4.4.6**.

4.4.2 Materials Handling and Processing

Materials handling and processing can often result in dust generation. The management measures outlined in **Table 4-4** associated with materials unloading, handling, processing and loading are summarised in **Table 4-6**.

Table 4-6: Control Measures Applicable to Materials Handling

ID	Management Measure
AQ1, AQ2, AQ5, AQ9, AQ12, AQ14	• MPC shed • Misting sprays for sorting material • Water spray for crusher and shredder • Water cannon or attachment to water cart in pit • Drop heights minimised • Cleaning spills

The performance of all material unloading, transfer, storage, sorting, and loading activities will be performed within the MPC shed (AQ1). This provides a significant level of dust control and in conjunction with the application of misting sprays (AQ2), a 90 % level of dust control is anticipated. It will be important to ensure that the integrity of the building is maintained, and that cross ventilation is minimised.

The fixed water sprays (AQ5) (termed rainbirds) associated with the mobile crusher and shredder will be operated to dampen stockpiled materials before processing. The rainbirds will also be linked to an automated system so that during periods of high winds (>30 km h^{-1}) they will be activated to decrease wind erosion (see **Section 4.4.3**).

The water cannon or attachment to the water cart (AQ9) will be operated when materials are unloaded into the pit to supress dust generation.

Drop heights (AQ13) from conveyors will be kept to a minimum and material spills that occur will be promptly cleaned before having potential to be pulverised by vehicle movements (AQ14).

4.4.3 Wind Erosion

Strong winds travelling over stockpiles and exposed areas can generate dust in significant quantities. Therefore, a number of the control measures detailed in **Table 4-4** address the need to mitigate dust generated by wind erosion. These measures are summarised in **Table 4-7**.

Table 4-7: Control Measures Applicable to Wind Erosion

ID	Management Measure
AQ6, AQ12	• Water sprays on storage areas • Modification of activity in high winds

Storage areas and stockpiles will need to be continuously kept damp through the use of water sprays / rainbirds (AQ6).

Activities performed onsite will need to be modified during periods of high winds (AQ12). For the purposes of this AQMP, high wind is defined as wind speed measured above 30 km h^{-1} that are observed at times when there is no rain. The onsite meteorological monitoring station (see **Section 5.5**) will provide the Facility with a reliable method to determine the wind speed and will include software that automatically operates the fixed water spray system when winds exceed 30 km h^{-1}.

Modification of activities will also occur if trigger levels outlined in the Trigger Response Action Plan (TARP) are exceeded (see **Section 5.6**). A detailed summary on responses to trigger levels is discussed in **Section 5.6.3**.

The Site Supervisor also has the authority to cease operations if weather conditions continue to have a major negative impact on the operations at the Facility. Cessation of operations will be performed only after all available mitigation measures have been employed. Given that the majority of activities are performed within the MPC shed, the activities to be ceased would generally be limited to the movement of vehicles within the Facility boundary. Should doors of the building be closed, material handling, processing and loading can continue, and doors will not be opened until such time as the incident is deemed to have concluded (at the discretion of the Site Supervisor).

4.4.4 Odour

EPL 20121 permits composting of up to 50,000 tonnes per annum of green waste, however this activity is not currently undertaken, only dry wood waste is mulched. Therefore, any odours that may be generated from the Facility are primarily associated with the active tipping face, leachate management and landfill gas.

Hydrogen sulphide (H_2S) is an odorous trace gas and is known to be present in landfill gas. The Facility has received odour complaints noting odours consistent with landfill gas.

Bingo, in consultation with NSW EPA, has developed an action plan to address potential odour issues. These are summarised as follows:

- A landfill gas (LFG) pumping trial and temporary flares to determine if sufficient gas is available to operate a flaring system and control landfill gas emissions and odour. The pumping trial will be undertaken until sufficient information is gathered to inform the capacity required for the permanent landfill gas extraction system and a steady state is achieved with the LFG.
- The development of a permanent landfill gas management system aligned with longer term landfill development/filling requirements and based on the outcomes from the pumping trial.

EPA has installed dedicated H_2S monitors at locations surrounding the Facility and in Minchinbury and data downloaded from these monitors indicate that, with the expanded landfill extraction and flaring system installed, H_2S concentrations recorded during the trials at the nearest locations in Minchinbury are below the relevant odour threshold.

Other mitigation methods outside of landfill gas collection and treatment currently employed to control odour emissions on site are identified in **Table 4-4** and are briefly summarised in **Table 4-6**.

Table 4-8: Control Measures Applicable to Odour

ID	Management Measure
AQ15, AQ16, AQ17, AQ18, AQ21, AQ22	• Cover tipping face • Immediate burial of odorous material • VENM covering • Interim capping • Airtight fittings on leachate risers and pipework • Treat leachate stored in sump • Waste loads covered • Inspection of waste loads • Complaints handling procedure

Odour will be managed to ensure compliance with the EPL.

All odour complaints will be recorded in the complaints handling procedure outlined in **Section 4.4.5**.

4.4.5 Other

Management measures that are not relevant to any specific activity onsite or aspect of air quality are outlined below in **Table 4-9**.

Table 4-9: Additional control measures

ID	Management Measure
AQ24	• Additional dust monitors

Additional dust monitoring will be performed onsite where necessary (AQ24). A detailed summary regarding the updated dust monitoring program is outlined in **Section 5.5**.

4.4.6 Contingency Operational Measures

The efficacy of the measures outlined above will be continually reviewed, as outlined in **Section 5**. Any failures, or anticipated failures in mitigation and management measures will be captured through the daily site inspections and inspection checklist. Where remedial actions are required to ensure that all management measures remain in place and effective, these will be performed at the earliest opportunity.

Chemical suppressants are not currently used at the Facility as water sprays have been the predominant management method to control wheel generated dust from unpaved roads. The application of chemical suppressants has therefore been identified in **Table 4-4** to be applied only if required. This will be determined as required if the water sprays do not adequately mitigate dust generation in accordance with the KPIs outlined in **Section 4.3**.

In the event that chemical suppressants are identified as required, an initial trial application will be performed to assess the efficacy of the method.

It is anticipated that the AQMP is implemented without the use of chemical suppressants for the first six months (i.e. to June 2021). Should visible dust observations continued to be observed, and the modification of activities fails to address those issues (including the implementation of the TARP), a series of trials of chemical suppressants will be initiated. This AQMP does not outline those trials, but an update to this AQMP will be provided should those trials be required.

5 MONITORING AND REVIEW

5.1 Monitoring Requirements

Air quality monitoring will be conducted as per the requirement of this AQMP and the Project Approval Conditions.

Monitoring requirements relevant to the AQMP are summarised in **Table 5-1**.

Table 5-1: Monitoring Requirements

Monitoring Focus	Sub-category	Area/Location	Responsibility	Frequency
Landfill Gas	Subsurface gas	Site perimeter	Site Supervisor	Quarterly checks as per the Landfill Gas Management Plan (LFGMP)
	Surface gas	Over landfill	Site Supervisor	Monthly checks as per the LFGMP
	Gas accumulation	Proximate buildings	Site Supervisor	Monthly checks as per the LFGMP
Odour	N/A	Site and immediate surrounds	Site Supervisor	Daily checks and as per the LFGMP
Dust	N/A	Dust monitoring locations	Site Supervisor	Real time monitoring and ad-hoc assessments

Monitoring of pollutants will be undertaken in accordance with any methodology which is required by or under the POEO Act or approved in writing by the EPA.

5.2 Landfill Gas Monitoring

Landfill gas will be generated as operations at the Facility proceed. SoC 5.4.2 (see **Table 3-2**) outlines the requirement to include a program for monitoring subsurface gas, surface gas emission, and gas accumulation in accordance with *Environmental Guidelines for Solid Waste Landfills* (NSW EPA, 1996) (see **Section 3.2.2**). However, as stated in **Section 3.2.2** the NSW EPA guidance document (NSW EPA, 1996) has been superseded by a second edition (NSW EPA, 2016) which has been adopted in this AQMP.

A separate **Landfill Gas Management Plan** has been prepared to provide a basis for the management, control and monitoring of landfill gas at the Facility to minimise the migration of emissions of landfill gas and to ensure that there is no risk of harm to human health or the surrounding environment. Landfill gas monitoring will be undertaken by independent Consultants in accordance with the **Landfill Gas Management Plan**. In summary, the following landfill gas monitoring is undertaken:

- Subsurface landfill gas is currently monitored in wells located around the Facility. Recorded results of subsurface gas monitoring will be included in the annual environmental report.
- Surface gas monitoring is performed by completing a walkover survey of the landfill every month using a calibrated landfill gas monitor (capable of reading % gas). Monthly measurements of surface gas and reporting of corrective action will also form part of the annual environmental report.
- Landfill gas accumulation in buildings must be monitored to prevent risk of explosion and will be performed at the Facility on a monthly frequency with a calibrated landfill gas monitor.

The **Landfill Gas Management Plan** also includes an action plan for remediating uncontrolled landfill gas emissions as required by Schedule 3, Condition 37 (d) of the Project Approval.

5.2.1 Remediating Uncontrolled Landfill Gas

Schedule 3, Condition 37 (d) of the Project Approval outlines that the landfill gas monitoring program must also include a protocol for remediating uncontrolled landfill gas emissions. Uncontrolled landfill gas emissions generally occur due to breaches in the cover material. Therefore, the primary remediation method will comprise of repairing or replacing cover material and ensuring it is compacted tightly to account for increases in pressure beneath the landfill cap (NSW EPA, 2016).

If uncontrolled landfill gas is observed, monitoring will be conducted daily until emissions are controlled. If an ongoing problem is experienced, methane and carbon dioxide alarms may need to be installed. This will be managed and monitored in accordance with the **Landfill Gas Management Plan.**

NSW EPA *Environmental Guidelines for Solid Waste Landfills, Second Edition* (NSW EPA, 2016) requires that methane exceedances for any landfill gas must be reported to NSW EPA within 24 hours of the incident. Documentation regarding assessment of emissions and the mitigation methods or proposed methods used to control and prevent further emissions must also be reported to NSW EPA within 14 days of the incident.

5.3 Greenhouse Gas

The Project Approval conditions do not require Bingo to monitor greenhouse gas at the Facility, however, the Statement of Commitments outlines the need to record an inventory of greenhouse gas associated with activities performed onsite.

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) introduced a single national framework for reporting and disseminating company information about greenhouse gas emissions, energy production and energy consumption. Bingo is registered and currently reports to the Clean Energy Regulator in line with reporting obligations under the NGER Act. All reporting under the NGER Scheme is through the Emissions and Energy Reporting System[4] (EERS).

The primary concern for greenhouse gas emissions generated from the Facility will comprise of potential methane (CH_4) and carbon dioxide (CO_2) emissions originating from landfill gas. These gases are generated as a by-product of anaerobic waste decomposition of organic matter. Methane is of a particular concern as it is a significant greenhouse gas that is 25 times more potent than carbon dioxide. If these gases are produced in quantities over thresholds outlined in **Section 5.2**, they will need to be managed. Landfill gas is further addressed in the **Landfill Gas Management Plan.**

Emissions of carbon dioxide will also be produced through the combustion of fuel from vehicles, plant and machinery. All equipment will be operated and maintained in accordance with the requirements of the POEO Act and POEO (Clean Air) Regulation (see **Sections 3.1 and 3.4**).

As the landfill gas monitoring program outlined in **Section 5.2** will record the concentrations of methane and carbon dioxide, an inventory of greenhouse gas can be produced using these values. An annual review will also be performed to discuss techniques and strategies for reducing emissions.

5.3.1 Greenhouse gas reduction

Bingo has a strategy in place to reduce greenhouse gas emissions and has committed to the development of Science Based Targets (SBT). These targets will provide Bingo with a clearly defined roadmap to reduce emissions in line with the Paris Agreement goals to limit global warming. As this roadmap becomes clearer the role of the Eastern Creek facility in contributing to these targets will become clearer. In establishing a pathway to decarbonisation, the SBT will assist with framing Scope 1, 2 and 3 emissions targets.

BINGO is also a member of the RE100 and has committed to achieving 100% renewable electricity across the group's network of facilities by 2025. RE100 is a global initiative bringing together the world's most influential businesses committed to achieving 100% renewable electricity.

[4] http://www.cleanenergyregulator.gov.au/OSR/CP/Pages/default.aspx

In alignment with the RE100 commitments, Bingo applies a gigajoule (GJ) intensity measure per million dollars of revenue and tonnes treated, which allows the energy decarbonisation efforts and achievements to be tracked.

Bingo has installed infrastructure for the extraction of landfill gas and in May 2021 commenced a landfill gas pumping trial. Although initially installed for the management of odour, plans include management of greenhouse gases.

5.4 Odour Monitoring

Monitoring of odour emissions will be performed at the Facility through a daily site inspection and boundary observations by the Site Supervisor or delegate. The odour control observations will be made during the peak morning deliveries and repeated as required to adequately account for changing conditions. This will include boundary observations at suitable locations downwind of the site to assess any odour observations beyond the site boundary. The trigger applicable for odour monitoring checks is the observation of offensive odour ('yes/no'), conducted over a 10-minute period at a suitable location.

Positive off-site odour observations will necessitate an immediate review of conditions and activities by the Site Supervisor who will have the authorisation to review operations performed on-site and alter site activities and/or additional controls necessary to effectively manage those risks.

EPA has installed dedicated H_2S monitors at locations surrounding the Facility and in Minchinbury, and data downloaded from these monitors indicate that, with the expanded landfill extraction and flaring system installed, H_2S concentrations recorded during the trials at the nearest locations in Minchinbury are below the odour threshold.

Odour complaints will continue to be managed through the complaints handling procedure outlined in **Section 4.4.5**. If required, additional field odour surveys will be conducted around the site boundary. These will be performed on days when weather conditions are considered 'worst-case' summarised as follows:

- Calm morning conditions (when dispersion is weak);
- Middle of hot day; and/or,
- When wind directions are moving towards sensitive receptors;

and the site has received odour complaints.

The field odour surveys will be conducted by personnel trained to conduct odour assessments in accordance with olfactory testing as outlined in *Australian Standard AS 4323.3:2001 Stationary Emissions – Determination of odour concentration by dynamic olfactometry* (Standards Australia, 2001).

5.5 Dust Monitoring

The aim of the proposed dust monitoring program is to avoid exceedances of particulate matter criteria at nearby sensitive receptors. A real-time monitoring program, combined with a Trigger Action Response Plan (TARP), will provide a proactive approach to minimising particulate matter off-site. Further details of the monitoring triggers, TARP, and appropriate averaging periods are described in **Section 5.6**, however these measures will be regularly reviewed and updated if required during system implementation.

A dust monitoring program has been practiced onsite since landfill operations began in 2009. Dust monitoring will continue to be performed at the Facility as outlined in the Project Approval condition Schedule 3, 37 (b) (see **Section 3.2.1**). Dust monitoring is currently performed at four DDGs located around the Premises and a BAM located proximate to the Facility at 93 Minchin Drive, Minchinbury (see **Section 4.1.2**). The locations of these monitors have been previously illustrated in **Figure 4-2** (see **Section 4.1.2**).

The DDGs record the monthly rate of dust deposition ('dust fallout') and can be a useful measure of changing air quality. The BAM provides a reliable measure of daily average PM_{10} concentrations, however, the ability to calculate off-site impacts using one PM_{10} monitor can be difficult. Therefore, a second PM_{10} monitor will be installed and managed by the Facility to better determine the incremental contribution from onsite activities to the measured particulate concentrations in the area.

Careful placement of a second PM_{10} monitor will allow the upwind (the background, or non-Facility impacted) concentration and downwind (the cumulative, or Facility impacted) concentration to be measured and the incremental concentration (Facility contribution) calculated from those values in defined wind vector ranges.

The placement of any monitoring equipment will pay due regard to the wind environment of the area and meteorological monitoring data for the 2015 to 2019 period has been examined in **Section 4.1.3**. Annual and seasonal wind roses for that three-year period are presented in **Figure 4-4**.

The dominant (i.e. most prevalent) wind directions are measured from the south-west through to south. Therefore, the dust monitoring program will focus on measuring impacts associated with these wind directions.

The following outlines how two PM_{10} monitors will be located to determine upwind / downwind concentrations.

The current BAM located to the northeast of the Facility is located in a preferred direction relative to the site as the predominant wind in the area derives from the southwest (see **Section 4.1.3**). The second monitoring location will be located to allow a determination of upwind / downwind concentration and will therefore be placed across the Facility operations, away from the first monitoring location as shown in **Figure 5-1**. For the purposes of this AQMP, the proposed second PM_{10} monitor location is referred to as Dust Monitor 2 (DM2).

It should be noted that the proposed location of DM2 shown in **Figure 5-1** is provided as an indicative location only. Complications such as land ownership may determine the exact location of an additional dust monitor.

Figure 5-1: Proposed Dust Monitor Locations

The combination of the two monitors will allow for:

- An assessment of the contribution of the Facility operations to the downwind PM_{10} concentrations in southerly through south-westerly wind directions at BAM (as [BAM PM_{10}] - [DM2 PM_{10}]).
- An assessment of the contribution of the Facility operations to the downwind PM_{10} concentrations in northerly through north-easterly wind directions at DM2 (as [DM2 PM_{10}] – [BAM PM_{10}]).

The 24-hour average PM_{10} concentrations measured by the dust monitoring program will be included as part of the annual environmental report.

Visible observations will also be performed by the Site Supervisor and/or Site Environmental Officer during the daily site inspection. The dust control observations will be made during the peak morning deliveries and repeated as required to adequately account for changing conditions. A 'Daily Checklist' will be used to record each day's visible dust plume observations, noting any potential sources that may change due to changing conditions or require further observation.

A meteorological monitoring station will be installed at the Facility to assist in the determination of upwind/downwind concentrations, and to assist in the determination of 'adverse wind conditions' when the rain birds are activated. The following data will be collected by the AWS on a continuous basis:

- Rainfall;
- Temperature (at 2 m and 10 m);
- Wind direction (at 10 m);
- Wind speed (at 10 m);
- Sigma theta; and
- Total solar radiation (at 10 m).

Real-time meteorological data from the AWS will be made available to the Site Operations Manager to assist in operational monitoring. The AWS will be configured to provide alerts to the Site Operations Manager notifying of specific meteorological conditions to direct a real-time response to conditions.

The meteorological station will be installed and situated in compliance with A*S 3580.14-2011 Method for sampling and analysis of ambient air - Meteorological monitoring for ambient air quality monitoring applications*.

5.6 Trigger Action Response Plan (TARP)

A Trigger Action Response Plan (TARP) has been developed as part of the AQMP. The TARP describes the actions to be taken when specific trigger levels are exceeded.

The description of the TARP has been divided into two sections. Firstly, a description of how the trigger levels are to be determined is described in **Section 5.6.1** and secondly, the actions which will be taken in response to the trigger levels is provided within **Section 5.6.3**.

5.6.1 Determination of Trigger Levels for the TARP

Results of the real-time dust monitoring program can be used as discussed in **Section 5.5** to provide a quantifiable estimation of the contribution of the Facility operations to those concentrations likely to be measured off-site during certain wind directions. Should resultant concentrations experienced off-site indicate that an exceedance of the 24-hour PM_{10} criterion is likely (or indeed, any concentration determined to be required to be achieved), and that modification of activities at the Facility will assist in reducing the likelihood of that exceedance (or value), then a system can be implemented to ensure that those modifications occur to achieve the preferred environmental outcome.

5.6.2 Operation of the TARP

Several issues arise in the operation of a responsive system such as this, which include:

- Are concentrations measured at the monitoring locations representative of the impacts likely to be measured off-site?
- What is the relationship between short-term (e.g. 1 hour) PM_{10} concentrations and 24-hour PM_{10} concentrations in different wind directions?
- How is success of the system to be determined?

The following provides responses to those issues, in relation to the current monitoring plan. It is noted that the composite elements of the TARP are necessarily in development, given the early stages at which the real-time particulate monitoring system is progressed.

1. ***Are concentrations measured at the monitoring locations representative of the impacts likely to be measured off-site?***

Given the proposed locations of the dust monitors (see **Section 5.5**), the concentrations of PM_{10} measured are likely to be representative of those experienced at surrounding receptor locations, assuming that the major source of particulate matter is the activities being performed at the Facility.

The existing BAM is currently situated in an area of sensitive receptors located to the northeast of the Facility as seen in **Figure 5-1**. Therefore, concentrations of PM_{10} measured at the BAM will be representative of neighbouring receptors with a high degree of accuracy.

The proposed location of DM2 (see **Figure 5-1**) is considered to be representative of receptors to the southwest of the Facility due to its proximity (590 m).

2. ***What is the relationship between short term (e.g. 1 hour) PM_{10} concentrations and 24-hour PM_{10} concentrations in different wind conditions?***

The proposed and upgraded monitoring network is designed to enable and facilitate pro-active modification of site activities to ensure that air quality criteria are not exceeded at surrounding receptor locations. Given that the relevant criterion for PM_{10} relates to a 24-hour averaging period, modification must be performed on a shorter timeframe to ensure that the 24-hour criterion is achieved / managed. No relationships between the 1-hour and 24-hour PM_{10} concentrations relating to the site operation are currently available. However, it is proposed that hourly average PM_{10} concentrations are examined and a relationship between 1-hour and a rolling 24-hour concentration is calculated once the real-time monitoring program is operational. It is not currently feasible to do this with the 24-hour BAM PM_{10} data.

Clearly, the relationship will differ according to the locations of activities being performed and the direction and strength of the wind. Monitoring data should be examined over a period of time to assess the appropriate 1-hour / 24-hour relationships in various wind directions and if possible, associate these relationships with activities and locations of activities being performed. Reference to **Section 5.5** allows an assessment of the contribution from the Facility operations in certain wind directions and an assessment of whether modification of activities would be beneficial. Clearly, in conditions when the background particulate environment is significantly affected by external sources (such as dust storms or bushfire), then modification of activities may not result in any meaningful reductions in off-site impacts associated with the Facility.

For the purposes of allowing the proposed monitoring program and updated Trigger Action Response Plan to be commenced, an interim 1-hour trigger level of 100 $\mu g \cdot m^{-3}$ is initially proposed and this will be under review. To allow an appropriate management response / action associated with increasing risk of off-site particulate impacts, a 'traffic light' system is proposed which is outlined in **Table 5-2**. This will be revised in response to the measured concentration values following monitoring program implementation.

The Down Wind Increment (DWI) will be calculated on any occasion where the 1-hour PM_{10} measurement of any monitor exceeds a total concentration of 100 $\mu g \cdot m^{-3}$. At this time the wind

direction recorded by the onsite meteorological station will be recorded and the following actions will be undertaken:

- Taking into account pre-specified wind-arcs (which will be determined after monitor installation), the DWI will be calculated;
- Where the calculated DWI is <100 $\mu g \cdot m^{-3}$, or wind directions are outside of the pre-specified wind-arcs (indicating a non-site particulate source), no Action level will be triggered and standard controls as per the AQMP will continue; and,
- Where the calculated DWI is ≥ 100 $\mu g \cdot m^{-3}$ (which suggests that the monitor is downwind of the site, and impacts may be due to site activities), the cascade response as described in **Section 5.6.3** will be employed.

Table 5-2: Trigger Levels

Action level	1-hour average PM_{10} concentration ($\mu g \cdot m^{-3}$)
None	DWI <100 $\mu g \cdot m^{-3}$
A	≥100 $\mu g \cdot m$-3 DWI <150 $\mu g \cdot m^{-3}$
B	≥150 $\mu g \cdot m$-3 DWI <250 $\mu g \cdot m^{-3}$
C	DWI ≥250 $\mu g \cdot m^{-3}$

Note: DWI = DownWind Increment calculated according to Section 5.5.

A balance must be found at the early stage of network design and development so that exceedances do not occur, whilst also not unreasonably and unnecessarily restricting site activities. Based on the review of monitoring data in **Section 4.1.2**, exceedances of the maximum 24-hour average PM_{10} criterion have not been common, although have increased over the previous 2 years due to regional particulate events, and therefore this can be considered to be a reasonable strategy to establish realistic short-term (1-hour) trigger values and which represents a low risk strategy to off-site impacts.

It is noted that the relationships between 1-hour and rolling 24-hour average PM_{10} concentrations are proposed. Usual practice is to determine compliance or otherwise with a 24-hour standard based on the daily average (00:00hrs to 23:59hrs). However, the presence of short term peaks, especially towards the end of the day can often not provide sufficient time to modify activities to ensure that standards are not exceeded, especially during those days when the background (i.e. non-Facility related) concentrations are approaching, but not exceeding the criterion. This distinction is important and will be noted in any reporting of compliance against the air quality criteria.

3. How is success of the system to be determined?

The success of the system would be determined through:

- Compliance with the KPIs outlined in **Section 4.3**;
- The successful calibration of the real-time monitoring stations;
- Real-time monitoring data indicates compliance with the relevant criteria in **Table 3-4**; and
- Absence of any complaints related to air quality that can be directly attributed to the Facility.

5.6.3 Responses to Trigger Levels in the TARP

Should trigger levels outlined in **Table 5-2** (see **Section 5.6.1**) be reached, then a hierarchy of management and mitigation options will be initiated as identified in **Table 4-4** (see **Section 4.4**). These controls will be implemented appropriate to the activities being performed at the Facility at that time.

The Site Operations Manager will maintain a log of activities being performed at the Facility. The log will be required to include the activity being performed and the general location of the activity. These variables will allow a management response to be initiated, and will provide options on how to deal with the triggering of any level.

The hierarchy of response will be (each level including continual monitoring of particulate concentrations):

- **Action Level A**: Identify activities being performed and whether any additional emission controls can be applied to those activities (i.e. increased watering of roads and stockpiles, water cannon operating in the pit);
- **Action Level B**: Apply the controls identified during **Action Level A**; and,
- **Action Level C**: Depending on the activities being performed, progressively decrease the rate of activity or cease operations if emissions cannot be adequately controlled in accordance with the KPIs (see **Section 4.3**).

5.6.4 Daily Site Inspections under the TARP

Daily site inspections will be carried out during Facility operations. Daily environmental inspections will include, but not be limited to:

- Visual inspection of airborne dust;
- Ensure roads leaving the site are free of soil, and prevention of soil tracking onto the road network; and,
- Ensure all loaded vehicles leaving the premises are covered and cleaned of materials that may fall on public roads.

Any environmental inspection reports will include the above observations, with remedial or corrective actions noted (as appropriate). Any remedial or corrective actions should be reported to the Site Supervisor and/or the Site Environmental Officer as soon as is practicable.

5.7 Environmental Auditing

Auditing will be undertaken in accordance with the SEQ Management system and the Project Approval requirements as outlined within the overarching EMS. Auditing applicable to this AQMP is summarised in **Table 5-3**.

Table 5-3: Environmental Auditing Requirements

Requirement	Area/ Location	Responsibility	Frequency	Ref
Air quality audit	Site wide	Suitably qualified, experienced and independent expert	Within six months of the approval of 06 0139 MOD 6, and every two years thereafter	MP_06 0139 MOD 6, Sch3 C37a
Independent 3rd party audit	AQMP	External Independent Auditor	Annually	MP_06 0139 MOD 6, Sch5 C7
Odour management practices	AQMP	Suitably qualified, experienced and independent expert	Annually	EPL 13426 Condition M7.1

5.7.1 Project Approval Conditions

Schedule 3 Condition 37a requires the following to be undertaken as part of the Air Quality Audit:

Within six months of the approval of 06 0139 MOD 6, and every two years thereafter, the Applicant *must prepare a site-wide air quality audit to the satisfaction of the Planning Secretary. The audit must:*

a) be undertaken by suitably qualified, experienced and independent expert;

b) be prepared in consultation with the EPA;

c) audit all aspects of the project with the potential to generate air emissions;

d) assess the current operation against the air quality impact predictions in the AQIA (Ramboll Australia Pty Ltd, dated August 2018);

e) review and benchmark on-site mitigation measures, management practices and operations against best practice for air quality management and opportunities for continuous improvement;

f) compare any emissions with relevant limits contained in conditions to this approval;

g) where any limits are exceeded or it is identified that current mitigation measures or management practices are not consistent with best practice, the air quality audit must identify additional mitigation

h) measures to prevent and minimise emissions as far as practical. This includes consideration of:

i) Sealing pans of or all site haul roads,

ii) installation and/or upgrade of conveyors and associated dust suppression systems,

iii) non-road diesel equipment and diesel combustion emission controls,

iv) additional reactive management measures including but not limited to temporarily ceasing or altering operations or site practices; and

v) the measures detailed within the AQIA (Ramboll Australia Pty Ltd, dated August 2018) specify a timeframe for when any mitigation measures identified in sub-clause (g) will be implemented; and

i) *inform the update to the Air Quality, Odour and Greenhouse Gas Management Plan required under Condition 37 of Schedule 3.*

The AQMP will be updated based on the findings of the audit, as required. The current audit report is included as Appendix C.

5.7.2 EPL Odour Requirements

EPL 13426 Condition M7.1 requires Bingo to undertake an annual audit of the design, operation and odour management practices of the operation with the primary aim of identifying improvements that lead to attainment of best practice in regard to minimising odour emitted from the premises. Bingo must implement all reasonable audit recommendations. The scope of this audit will be regularly reviewed in consultation with the EPA.

EPL 13426 Condition M7.2 and EPL 20121 Condition M7.3 states that the EPA may require Bingo to conduct assessments or investigations that identify the extent of any potentially offensive odour emissions beyond the boundary of the premises. The scope of such an investigation will be agreed to by the EPA and may include revised air dispersion modelling based on actual site emissions data, well designed field investigations according to German standards, and/ or use of field olfactometers, and analysis of detailed complaints records and on-site meteorological data. More details are provided in the **Landfill Gas Management Plan**.

5.8 Reporting

Reporting requirements for monitoring, auditing and as required in the Project Approval will be undertaken in accordance with the overarching EMS. Reporting requirements applicable to this AQMP is summarised in **Table 5-4**.

Table 5-4: Environmental Reporting Requirements

Requirement	Area/Location	Responsibility	Frequency
Incident reporting to EPA	Site	Environmental Manager NSW	Upon identification of an incident resulting in material environmental harm.

Requirement	Area/Location	Responsibility	Frequency
NGERS annual report	Site	Environmental Manager NSW	Annually. Submitted on 31 October for reporting year 1 July to 30 June,

5.8.1 Greenhouse Gas Reporting

Bingo currently reports to the Clean Energy Regulator in line with reporting obligations under the NGER Act. All reporting under the NGER Scheme is through the Emissions and Energy Reporting System[5] (EERS).

The Task Force on Climate-related Financial Disclosures (TCFD) has developed a framework to help public companies and other organisations more effectively disclose climate-related risks and opportunities through their existing reporting processes. BINGO acknowledges the 2017 recommendations of the TCFD and will be taking a phased approach to reporting climate-related financial risks against the TCFD and is working towards providing a detailed scenario analysis in future disclosures.

5.9 Review and Continuous Improvement

Review and improvement of this plan will be undertaken in accordance with the Project Approval and Section 6.6 of the EMS. Continuous improvement will be achieved by the ongoing evaluation of environmental management performance and effectiveness of this plan against regular environmental auditing, environmental policies, objectives and targets.

The updated plan and a summary of changes will be available on site and distributed to all relevant stakeholders in accordance with SEQ Management System document control procedure.

5.10 Incidents

In the event of a safety / environmental incident or unpredicted impacts relating to waste and resource recovery operations, it is the responsibility of all personnel to report the incident or event to the Site Supervisor.

All environmental incidents are to be reported and managed in accordance with *Incident Reporting Investigation and Review Procedure (SOP-SEQ001)*. Incidents are classified based on the incident's severity as shown in Section 4.7 of the EMS.

All incidents will be managed and reported according to Section 4.7.2 of the EMS.

5.11 Complaints

Complaints may be received directly from stakeholders, or indirectly via the dedicated phone number, website.

Complaints handling will be undertaken in accordance with Section 4.6 of the EMS.

5.12 Non-Compliance, Non-Conformances and Corrective Actions

Non-compliance may be identified via internal and external audits, site monitoring, inspections and observations, environmental incidents and emergencies, complaints and management reviews.

Non-compliance, non-conformances and resulting corrective actions are to be managed in accordance with Section 6.3 of the EMS.

[5] http://www.cleanenergyregulator.gov.au/OSR/CP/Pages/default.aspx

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APPENDIX A DPIE ENDORSEMENT

Ms Katie McCallum
Senior Legal Counsel, Environment and Planning
Bingo Industries
305 Parramatta Road
Auburn NSW 2144

Dear Ms McCallum

Genesis Waste Management Facility (06_0139)
Appointment of Air Quality Experts

I refer to your email dated 27 May 2020, seeking endorsement for the appointment of Gary Graham and Martin Doyle of NorthStar Air Quality Pty Ltd for the preparation of the updated Air Quality, Odour and Greenhouse Gas Management Plan as required by Condition 37 of Schedule 3 of 06_0139.

The Department has reviewed the curriculum vitae of Gary Graham and Martin Doyle and approves their appointment.

Should you have any further enquiries, please contact Bianca Thornton, Planning and Assessment, at the Department on (02) 8217 2040 or via email at bianca.thornton@planning.nsw.gov.au.

Yours sincerely

15/7/20

Chris Ritchie
Director
Industry Assessments
as delegate of the Planning Secretary

APPENDIX B SITE LAYOUT

LEGEND

- Operational boundary
- Project boundary
- Conservation zone
- Amenity berm
- Green and timber waste
- Material processing centre (MPC1)
- Material processing centre (MPC2)
- Segregated stockpile area
- Property boundary
- Site access road
- Internal road
- Watercourse

1:7,111 at A4

ARCADIS

ARCADIS AUSTRALIA PACIFIC PTY LTD
ABN 76 104 485 289
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Coordinate System: GDA 1994 MGA Zone 56
Date issued: March 30, 2021
Aerial imagery source: nearmap Jan 2021

Appendix B - Site Layout

Date: 30/03/2021 Path: H:\AAP_GIS\Publishers\Workspace\B_Workshop\2020\20200720_30056657\L-GIS\A_Current\B_Maps\MgmtPlan\G30056657_MgmtPlan_002_SiteLayout_A4L_v5.mxd
Created by : GC Updated by : GC QA by : RB

APPENDIX C AIR QUALITY AUDIT 2020

This document has been prepared on behalf of **Dial a Dump (EC) Pty Ltd**

Northstar Air Quality Pty Ltd,

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Eastern Creek Recycling Ecology Park (& Landfill)

Air Quality Audit

Addressee(s):	**Dial a Dump (EC) Pty Ltd**
Report Reference:	**20.1135.FR1V1**
Date:	**9 February 2021**

Quality Control

Study	Status	Prepared	Checked	Authorised by
INTRODUCTION	Final	Northstar Air Quality	GCG	MD
AUDIT METHODOLOGY	Final	Northstar Air Quality	GCG	MD
POTENTIAL FOR GENERATION OF EMISSIONS	Final	Northstar Air Quality	GCG	MD
AIR QUALITY IMPACT ASSESSMENT PREDICTIONS	Final	Northstar Air Quality	GCG	MD
BEST PRACTICE AIR QUALITY MANAGEMENT	Final	Northstar Air Quality	GCG	MD
RELEVANT LIMITS	Final	Northstar Air Quality	GCG	MD
AUDIT FINDINGS	Final	Northstar Air Quality	GCG	MD
SUMMARY	Final	Northstar Air Quality	GCG	MD

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R*x*)	(V*x*)
20	1028	Final	R1	V1
Based upon the above, the specific reference for this version of the report is:				20.1135.FR1V1

Final Authority

This report must by regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below.

Martin Doyle **9 February 2021**

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1. INTRODUCTION

Dial a Dump (EC) Pty Ltd (DADEC) has engaged Northstar Air Quality Pty Ltd (Northstar) to provide a site-wide air quality audit to meet the requirements of Project Approval 06_0139 (as modified). PA 06_0139 is associated with the Eastern Creek Waste Project, now termed the Eastern Creek Recycling Ecology Park (& Landfill) (the Premises). The Premises is also termed the 'Genesis Facility' in some documents. The Premises address is 1 Kangaroo Avenue, Eastern Creek, NSW (also listed as Honeycomb Drive in some documents). Bingo Industries Limited (Bingo) acquired the Premises in February 2019 and took over the management of the Eastern Creek site in April 2019.

1.1 Audit Scope

The relevant Project Approval conditions to which this audit relates are outlined below (from Schedule 3 of modified PA 06_0139):

37a. Within six months of the approval of 06_0139 MOD6, and every two years thereafter, the Proponent must prepare a site-wide air quality audit to the satisfaction of the Planning Secretary. The audit must:

a) be undertaken by a suitably qualified, experienced and independent expert;

b) be prepared in consultation with the EPA;

c) audit all aspects of the project with the potential to generate air emissions;

d) assess the current operation against the air quality impact predictions in the AQIA (Ramboll Australia Pty Ltd, dated August 2018);

e) review and benchmark on-site mitigation measures, management practices and operations against best practice for air quality management and opportunities for continuous improvement;

f) compare any emissions with relevant limits contained in conditions to this approval;

g) where any limits are exceeded or it is identified that current mitigation measures or management practices are not consistent with best practice, the air quality audit must identify additional mitigation measures to prevent or minimise emissions as far as practical. This includes consideration of:

- *i. Sealing parts or all site haul roads,*
- *ii. installation and/or upgrade of conveyors and associated dust suppression systems,*
- *iii. non-road diesel equipment and diesel combustion emission controls,*
- *iv. additional reactive management measures including but not limited to temporarily ceasing or altering operations or site practices; and*
- *v. the measures detailed within the AQIA (Ramboll Australia Pty Ltd, dated August 2018).*

h) specify a timeframe for when any mitigation measures identified in sub-clause (g) will be implemented; and

i) inform the update to the Air Quality, Odour and Greenhouse Gas Management Plan required under Condition 37 of Schedule 3.

Further to the requirements of PA 06_0139, two Environment Protection Licences (EPL) issued by the NSW Environment Protection Authority (EPA) are associated with activities at the Premises:

- EPL 13426 associated with landfilling operations; and
- EPL 20121 associated with the materials processing centre (MPC).

2. AUDIT METHODOLOGY

The audit was performed on Monday 20 July 2020 by Dr Martin Doyle, Director and Air Quality Scientist at Northstar Air Quality. Martin has over 20 years' experience in matters relating to air quality, odour and greenhouse gas and has been involved in numerous environmental audits.

On 15 July 2020, NSW Department of Planning, Industry & Environment (DPIE) endorsed the appointment of Martin Doyle and Gary Graham of Northstar to prepare the updated Air Quality, Odour and Greenhouse Gas Management Plan as required by Condition 37 of Schedule 3 of PA 06_0139. The site wide air quality audit required by Condition 37a of Schedule 3 of PA 06_0139 is assumed to be covered by this endorsement.

2.1 Consultation

NSW EPA has been provided a copy of this audit report for comment.

2.2 Site Inspection

An inspection of the Premises was performed to review the processes and procedures adopted. A review of the following documents was performed prior to the site inspection:

- Air Quality, Odour and Greenhouse Gas Management Plan, Revised 16 March 2017 (DADI, 2017).
- Air Quality Impact Assessment – Modification 6 (Ramboll Australia, 2018).

During the site inspection, it became clear that the Air Quality, Odour and Greenhouse Gas Management Plan (DADI, 2017) was out of date. Given that the Air Quality, Odour and Greenhouse Gas Management Plan (AQMP) is to be updated, informed by the findings of this audit, the requirements of Condition 37a, Schedule 3 of PA 06_0139 were used as the basis for the audit.

2.3 Audit Compliance Requirements

As presented in NSW Government (May 2020) *Independent Audit – Post Approval Requirements*, the criteria outlined in **Table 1** were adopted for the site-wide air quality audit.

Table 1 Audit compliance criteria

Status	Description
Compliant	The auditor has collected sufficient verifiable evidence to demonstrate that all elements of the requirement have been complied with within the scope of the audit
Non-compliant	The auditor has determined that one or more specific elements of the conditions or requirements have not been complied with within the scope of the audit

Status	Description
Not triggered	A requirement has an activation or timing trigger that has not been met during the temporal scope of the audit being undertaken (may be a retrospective or future requirement), therefore an assessment of compliance is not relevant

3. POTENTIAL FOR GENERATION OF EMISSIONS

Condition 37a. (c) of PA 06_0139 requires that the audit:

> *…audit all aspects of the project with the potential to generate air emissions.*

The following describes the operations being performed at the Premises and through review of the processes and observations obtained during the site inspection, identifies those which have the potential to result in emissions to air. Presented in **Table 2** are the activities which have the potential to result in emissions of particulate matter and combustion related pollutants, and in **Table 3** those which have the potential to result in emissions of odour.

It is noted that no composting is currently performed at the Premises, although this activity is approved through PA 06_0139.

Table 2 Activities performed at the Premises with the potential to result in air emissions

Activity	Location
Movement of heavy vehicles on paved roads	Site access road to MPC Internal site roads around MPC and timber yard Road from MPC to base of landfill
Movement of heavy vehicles on unpaved roads	Road from base of landfill to tip face Internal site roads around crushing/screening area
Material unloading	MPC Timber yard Crushing and screening area Landfill
Material handling	MPC Timber yard Crushing and screening area
Material processing	MPC Timber yard Crushing/screening area
Material loading	MPC Timber yard Crushing/screening area
Wind erosion	MPC Timber yard Crushing and screening area Landfill
Use of on-road and non-road diesel equipment	MPC Timber yard Crushing and screening area Landfill

Table 3 Activities performed at the Premises with the potential to result in odour emissions

Activity	Location
Storage of waste material	Timber yard Landfill
Leachate treatment	Leachate treatment plant

An independent odour audit was performed at the Premises by Northstar in December 2019, which included a Field Ambient Odour Assessment. The independent odour audit considered the requirements of PA 06_0139 (as relevant at that time), EPL 20121 and EPL 13426, and determined that site operations were compliant with those requirements which the exception of conditions associated with the AQMP, which is to be updated.

The independent odour audit concluded that:

> *"…the field ambient odour assessment performed downwind of the Premises indicates that the operations being performed results in 'very weak' odour intensity in the area surrounding the Premises. A maximum observed odour intensity of 'weak' was observed during the ambient odour assessment. Based upon the observations obtained during the field odour assessment, it is not considered that the odour generated by the operations at the Premises will cause an adverse impact on any surrounding receptors (i.e. an offensive odour) should management measures be continued to be implemented as observed."*

and

> *"Based on the findings of the site inspection and field ambient odour assessment, the management practices being performed at the Premises to ensure that offensive odour is not emitted from the Premises are suitable, as confirmed through examination of the complaints history for the Premises which indicates that no odour complaints have been received since August 2016."*

Based upon the above, it is therefore concluded that the activities at the Premises with the potential to cause emissions of odour are being managed appropriately, and this audit report is focussed on the potential for impacts associated with particulate matter.

4. AIR QUALITY IMPACT ASSESSMENT PREDICTIONS

Condition 37a. (d) of PA 06_0139 requires that the audit:

> ***...assess the current operation against the air quality impact predictions in the AQIA (Ramboll Australia Pty Ltd, dated August 2018)***

Presented in **Table 4** are the air quality impact predictions as presented in the MOD6 air quality impact assessment (AQIA) (Ramboll Australia, 2018). The maximum predictions at each of the identified residential and commercial receptors are presented in **Table 4**, as reported in Ramboll Australia (2018). The results are presented as incremental impacts (incr.) associated with the predicted impact of the activities at the Premises on their own, and as a cumulative impact (cumul.), which include the impact of regional background conditions, as determined through the use of data measured at the NSW Department of Planning, Environment & Industry (DPIE) air quality monitoring station (AQMS) at Prospect and St Mary's, and using data collected as part of the Premises operation (at that time).

Also presented in **Table 4** are the available results of continuous air quality monitoring for PM_{10} performed by Bingo at a location within Minchinbury (93 Minchinbury Drive), to the northwest of the Premises between 29 June 2016 to 1 September 2020. These data are reflective of potential impacts at the residential receptors identified in the AQIA but cannot be used to reflect potential impacts at the closer commercial receptor locations without caution. This monitoring location will be subject to review as part of the performance of the Air Quality, Odour and Greenhouse Gas Management Plan.

Bingo also performs deposited dust monitoring at four locations surrounding the Premises (as required by EPL 20121), and the most relevant monitoring points have been identified through review of the AQIA (monitoring point 1 [northern boundary] to reflect impacts at residential receptors, and monitoring point 2 [eastern boundary] to reflect impacts at commercial receptors). Data for the period 2016 to 2020 have been reviewed.

Current operations will be most reflective of air quality monitoring data associated with the calendar year 2020, and these measurements have been reviewed. Increases in particulate concentrations were experienced across NSW during 2020 due to the bushfire emergency in late 2019/2020 and therefore the maximum concentrations will be highly influenced by extraordinary events, rather than the operations at the Premises.

The measurements as discussed above are noted as 'Meas.' in **Table 4**.

No odour monitoring data is available to confirm the dispersion model predictions as presented in the AQIA. However, an independent odour audit was performed by Northstar in December 2019, which included a Field Ambient Odour Assessment. The independent odour audit concluded that:

"…the field ambient odour assessment performed downwind of the Premises indicates that the operations being performed results in 'very weak' odour intensity in the area surrounding the Premises. A maximum observed odour intensity of 'weak' was observed during the ambient odour assessment. Based upon the observations obtained during the field odour assessment, it is not considered that the odour generated by the operations at the Premises will cause an adverse impact on any surrounding receptors (i.e. an offensive odour) should management measures be continued to be implemented as observed."

It should be noted that the predictions in the AQIA (Ramboll Australia, 2018) include the potential impact of composting operations which are not currently operational, nor were operational in December 2019.

Table 4 Air quality predictions from MOD6 AQIA (Ramboll Australia, 2018) and associated measurements

Pollutant	Averaging period	Units	Residential			Commercial			Criterion
			Incr.	Cumul.	Meas.	Incr.	Cumul.	Meas.	
PM_{10}	Annual	$\mu g \cdot m^{-3}$	2.3	21.2	20.7	4.9	23.8	-	25
	24-hr	$\mu g \cdot m^{-3}$	10.4	44.7	175.0(A) 48.0(A)	21.6	49.9	-	50
$PM_{2.5}$	Annual	$\mu g \cdot m^{-3}$	0.6	9.2	-	1.2	9.8	-	8
	24-hr	$\mu g \cdot m^{-3}$	3.0	25.4	-	4.8	26.9	-	25
TSP	Annual	$\mu g \cdot m^{-3}$	3.6	50.8	-	12.3	59.5	-	90
Dep. dust	Annual	$g \cdot m^{-2} \cdot month^{-1}$	0.2	2.2	2.0	0.7	2.7	3.9	4
Odour	99th perc.	OU	<2	<2	-	3	3	-	2 / 7

Note: (A) 175.0 $\mu g \cdot m^{-3}$ is the maximum 24-hour PM_{10} concentration and is associated with bushfire events. 48.0 $\mu g \cdot m^{-3}$ is the maximum non-exceeding measured PM_{10} concentration.

Based on the results outlined in **Table 4** and specifically the comparison of predicted concentration values with measured values, the operations at the Premises are not likely to be causing impacts in exceedance of those predicted in the AQIA at surrounding residential receptor locations.

Although limited data is available to determine the potential impacts at commercial receptor locations, based on the results of dust deposition monitoring, impacts are shown to be below the relevant deposited dust criterion.

5. BEST PRACTICE AIR QUALITY MANAGEMENT

Condition 37a. (e) of PA 06_0139 requires that the audit:

> ***…review and benchmark on-site mitigation measures, management practices and operations against best practice for air quality management and opportunities for continuous improvement;***

The following outlines the best practice management measures for dust control which are generally accepted by NSW EPA and have quantifiable emission control efficiencies which can be justified to provide reassurance that emissions are being managed appropriately.

The measures associated with particulate management at landfills have been identified through review of:

- NSW EPA Environmental Guidelines, Solid Waste Landfills (NSW EPA, 2016)

Further measures associated with particulate management have been identified through review of:

- Katestone (2011) NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining. June 2011 (Katestone, 2011); and,
- NPI (2012) National Pollutant Inventory Emission Estimation Technique Manual for Mining, Version 3.1. (NPI, 2012).

Conditions O6.5, O6.6 and O6.7 of EPL 20121 outline the requirements associated with the management of leachate at the Premises. The independent odour audit performed by Northstar in December 2019 determined that the operations at the Premises associated with leachate generation, management, and disposal were all compliant with the EPL conditions.

Not all mitigation measures in a particular category are required to be implemented to be able to represent best practice emission control. The limitations of a site (including potential operational, environmental, and economic constraints) will result in some measures being adopted in preference to others.

Presented in **Table 5** are the activities performed at the Premises identified as having the potential to result in emissions of particulate matter (derived from **Section 3**). Best practice emission controls associated with those activities, the particulate mitigation measures assumed in the performance of the MOD6 AQIA (Ramboll Australia, 2018), and the particulate management/mitigation measures observed during the performance of the site visit are also presented in **Table 5**.

Any discrepancies identified between best practice management, the assumptions adopted within the MOD6 AQIA (Ramboll Australia, 2018), and the observations made during the site visit are identified in **Table 5** and discussed in **Table 6**.

It is acknowledged that the acquisition of the Premises by Bingo has resulted in a period of 'bedding in', where management plans and mitigation measures are undergoing modification and equipment is being transferred from other Bingo operations to the Premises.

The characteristics of the site (e.g. size, number of activities being performed, material characteristics) represent a challenge to the management of dust. The AQMP will outline the management measures to be adopted as part of the site operation, and include a detailed approach to the implementation of those measures, including a Trigger Action Response Plan (TARP) which would provide a series of triggers (indicated through either visual observations, meteorological or air quality measurements) and associated responses.

Table 5 Comparison of best practice particulate management, the MOD6 AQIA and observations (July 2020)

Activity	Location	Particulate emission controls 'Best Practice'	Particulate emission controls Ramboll AQIA August 2018	Particulate emission controls Observations 20 July 2020
Movement of heavy vehicles on paved roads	Site access road to MPC Internal site roads around MPC and timber yard Road from MPC to base of landfill	• Minimising vehicle kilometres travelled by bypassing roads (e.g. using conveyors).		• The chute from near to the MPC to the landfill was observed to be out of operation, due to a recent fire.
		• Maintaining a speed limit of 40 km·hr^{-1} or less on haul roads.		• Speed limit of 25 km·hr^{-1} for site access road, and 10 km·hr^{-1} for all internal roads.
		• Watering of haul roads using static sprays or water trucks.	• Water truck operating on unsealed haul road into the pit, within the landfill and on the paved roads as needed.	• A water truck is operated at the Premises.
		• Flushing of roads using water.	• A fixed water spray system operates on the access roadway.	• See **Table 6**.
		• Vacuum sweeping of roads.		• A vacuum sweeper is operated at the Premises.
		• Application of chemical suppressants.		• See **Table 6**.
			• The majority of travel routes onsite are sealed (exceptions are the haul route into the pit and within the segregated materials area).	• The majority of travel routes onsite are sealed (exceptions are the haul route into the pit and within the segregated materials area).
Movement of heavy vehicles	Road from base of landfill to tip face Internal site roads	• Minimising vehicle kilometres travelled by bypassing roads (e.g. using conveyors).		• The chute from near to the MPC to the landfill was observed to be out of operation, due to a recent fire.

Activity	Location	Particulate emission controls 'Best Practice'	Particulate emission controls Ramboll AQIA August 2018	Particulate emission controls Observations 20 July 2020
on unpaved roads	around crushing/screening area	• Maintaining a speed limit of 40 km·hr^{-1} or less on haul roads.	• Speed limit of 40 km·hr^{-1} for unsealed haul road into the pit.	• Speed limit of 25 km·hr^{-1} for site access road, and 10 km·hr^{-1} for all internal roads.
		• Watering of haul roads using static sprays or water trucks.	• Water truck operating on unsealed haul road into the pit, within the landfill and on the paved roads as needed. • Water cannon operating within the pit	• A water truck is operated at the Premises.
		• Application of chemical suppressants		• See **Table 6**.
Material unloading	MPC Timber yard Crushing and screening area Landfill	• Minimising drop heights.		• See **Table 6**.
		• Use of water/mist sprays.	• Misting sprays operated within the shed to dampen material as it is sorted and before being loaded to the hopper. • Water cannon operating within the pit	• Misting sprays operated within the shed to dampen material as it is sorted and before being loaded to the hopper. • Loads are inspected prior to unloading and water sprays are used on dusty loads.
		• Modification of activities in windy conditions.		• See **Table 6**.
		• Performance of activities within an enclosure, or shielded from the wind.	• Enclosure of material handling and processing and storage within the MPC shed.	• Enclosure of material handling and processing and storage within the MPC shed.
Material handling	MPC Timber yard Crushing and screening area	• Minimising drop heights.		• Vehicle unloading is performed to minimise emissions.
		• Use of water/mist sprays.	• Misting sprays operated within the shed to dampen material as it is sorted and before being loaded to the hopper.	• Misting sprays operated within the shed to dampen material as it is sorted and before being loaded to the hopper.

Activity	Location	Particulate emission controls 'Best Practice'	Particulate emission controls Ramboll AQIA August 2018	Particulate emission controls Observations 20 July 2020
			• Fixed water sprays on product storage areas. • Water cannon operating within the pit	
		• Modification of activities in windy conditions.		• See **Table 6**.
		• Performance of activities within an enclosure, or shielded from the wind.	• Enclosure of material handling and processing and storage within the MPC shed.	• Enclosure of material handling and processing and storage within the MPC shed.
Material processing	MPC Timber yard Crushing/screening area	• Minimising drop heights.		• See **Table 6**.
		• Use of water/mist sprays.	• Misting sprays operated within the shed to dampen material as it is sorted and before being loaded to the hopper. • Water sprays on the mobile crusher and shredder. • Fixed water sprays on product storage areas.	• Misting sprays operated within the shed to dampen material as it is sorted and before being loaded to the hopper.
		• Modification of activities in windy conditions.		• See **Table 6**.
		• Performance of activities within an enclosure, or shielded from the wind.	• Enclosure of material handling and processing and storage within the MPC shed.	• Enclosure of material handling and processing and storage within the MPC shed.
Material loading	MPC Timber yard	• Minimising drop heights.		• Vehicle unloading is performed to minimise emissions.

Activity	Location	Particulate emission controls 'Best Practice'	Particulate emission controls Ramboll AQIA August 2018	Particulate emission controls Observations 20 July 2020
	Crushing/screening area	• Use of water/mist sprays.	• Misting sprays operated within the shed to dampen material as it is sorted and before being loaded to the hopper. • Water sprays on the mobile crusher and shredder. • Fixed water sprays on product storage areas.	• Misting sprays operated within the shed to dampen material as it is sorted and before being loaded to the hopper.
		• Modification of activities in windy conditions.		• See **Table 6**.
		• Performance of activities within an enclosure, or shielded from the wind.	• Enclosure of material handling and processing and storage within the MPC shed.	• Enclosure of material handling and processing and storage within the MPC shed.
Wind erosion	MPC Timber yard Crushing and screening area Landfill	• Use of water/mist sprays.	• Misting sprays operated within the shed to dampen material as it is sorted and before being loaded to the hopper. • Fixed water sprays on product storage areas. • Water cannon operating within the pit.	• Misting sprays operated within the shed to dampen material as it is sorted and before being loaded to the hopper.
		• Cover storage areas with tarps during high wind conditions.		• See **Table 6**.
		• Reduce storage pile heights.		• See **Table 6**.
		• Plant vegetative wind breaks.	• Established earth bund along the northern boundary of the pit.	• Established earth bund along the northern boundary of the pit.
		• Use 3-sided bins.		• See **Table 6**.

Activity	Location	Particulate emission controls 'Best Practice'	Particulate emission controls Ramboll AQIA August 2018	Particulate emission controls Observations 20 July 2020
		• Modification of activities in windy conditions.		• See **Table 6**.
		• Performance of activities within an enclosure, or shielded from the wind.	• Enclosure of material handling and processing and storage within the MPC shed.	• Enclosure of material handling and processing and storage within the MPC shed.

As identified in **Table 5**, a number of discrepancies have been identified through this audit between operational air quality controls, 'best practice' and the assumptions presented in (Ramboll Australia, 2018).

Table 6 Identified discrepancies in particulate management approaches

Activity	Location	Identified discrepancy
Movement of heavy vehicles on paved roads	Site access road to MPC Internal site roads around MPC and timber yard Road from MPC to base of landfill	• Speed limits at the Premises are lower than those which represent best practice for particulate control and are lower than those assumed in the AQIA. • The fixed water spray system along the access roadway was not operational during the site audit. • Chemical suppressants are not used at the Premises. • The chute was not operational.
Movement of heavy vehicles on unpaved roads	Road from base of landfill to tip face Internal site roads around crushing/screening area	• Speed limits at the Premises are lower than those which represent best practice for particulate control and are lower than those assumed in the AQIA. • Chemical suppressants are not used at the Premises. • The chute was not operational.
Material unloading	MPC Timber yard Crushing and screening area Landfill	• An approach to modifying activities in windy or elevated particulate conditions is defined in the AQMP but will be updated. • The fixed water sprays within the crushing and screening areas were not operational. • The water spray attachment to the water cart was not observed to be operational within the pit.
Material handling	MPC Timber yard Crushing and screening area	• An approach to modifying activities in windy or elevated particulate conditions is defined in the AQMP but will be updated. • The fixed water sprays within the crushing and screening areas were not operational.
Material processing	MPC Timber yard Crushing/screening area	• An approach to modifying activities in windy or elevated particulate conditions is defined in the AQMP but will be updated. • The fixed water sprays within the crushing and screening areas were not operational. • Water sprays on the crushing and screening plant were not operational.
Material loading	MPC Timber yard Crushing/screening area	• An approach to modifying activities in windy or elevated particulate conditions is defined in the AQMP but will be updated.

Activity	Location	Identified discrepancy
		• Water sprays on the crushing and screening plant were not operational. • The fixed water sprays within the crushing and screening areas were not operational.
Wind erosion	MPC Timber yard Crushing and screening area Landfill	• The fixed water sprays within the crushing and screening areas were not operational. • The water cannon was not observed to be operational within the pit. • An approach to modifying activities in windy or elevated particulate conditions is defined in the AQMP but will be updated.

6. RELEVANT LIMITS

Condition 37a. (f) of PA 06_0139 requires that the audit:

> ***…compare any emissions with relevant limits contained in conditions to this approval***

Air quality criteria are also outlined in Schedule 3, Condition 29 of PA 06_0139. These are broadly consistent with the criteria outlined in **Table 7**, with the exception of annual average PM_{10}, which has been updated by NSW EPA to be 25 $\mu g \cdot m^{-3}$, and the inclusion of $PM_{2.5}$ criteria.

Table 7 Air quality criteria applicable to the Premises

Pollutant	Averaging period	Goal	Source
Total suspended particulate (TSP)	Annual	90 mg/m^3	(NHMRC, 1996)
PM_{10}	Maximum 24-hour	50 mg/m^3	(DoE, 2016)
	Annual	25 mg/m^3 (A)	
$PM_{2.5}$	Maximum 24-hour	25 mg/m^3 (A)	
	Annual	8 mg/m^3 (A)	
Dust deposition	Annual	2 g/m^2/month (incremental increase) 4 g/m^2/month (maximum cumulative)	(NERDDC, 1998)

Note (A): Not included in PA 06_0139, or a different value. Most up to date criteria from (NSW EPA, 2017) presented above.

7. AUDIT FINDINGS

Condition 37a. (g) and (h) of PA 06_0139 requires that:

> *g) where any limits are exceeded or it is identified that current mitigation measures or management practices are not consistent with best practice, the air quality audit must identify additional mitigation measures to prevent or minimise emissions as far as practical. This includes consideration of:*
>
> *i. Sealing parts or all site haul roads,*
> *ii. installation and/or upgrade of conveyors and associated dust suppression systems,*
> *iii. non-road diesel equipment and diesel combustion emission controls,*
> *iv. additional reactive management measures including but not limited to temporarily ceasing or altering operations or site practices; and*
> *v. the measures detailed within the AQIA (Ramboll Australia Pty Ltd, dated August 2018).*
>
> *h) specify a timeframe for when any mitigation measures identified in sub-clause (g) will be implemented*

The audit has identified a number of 'best practice' measures that are not employed as part of current particulate mitigation and management practices performed at the Premises. However, the measures currently implemented are shown to result in the achievement of air quality criteria at nearby residential receptor locations, as based on the analysis presented in **Section 4**.

As required by Condition 37a (g) of PA 06_0139, the audit is required to identify additional mitigation measures to prevent or minimise emissions as far as practical. The following measures have been identified as representing best practice, or were assumed to be adopted during the performance of the MOD6 AQIA (Ramboll Australia, 2018), but are not currently implemented at the Premises.

- Sealing parts or all site haul roads

Sealing of all parts of the site road network is not considered to represent an appropriate solution to the issues experienced at the Premises. In certain parts of the Premises, the silt loading of paved roads can be high, as a result of unavoidable loss of material from trucks which is then pulverised through the action of heavy vehicle movement. Paved roads at the Premises are regularly watered, and swept using a vacuum sweeper, although it would be recommended that this is performed in a more coordinated manner to ensure that all areas of the paved road network are 'treated' on a regular basis, rather than on an 'as needs' basis. For example, the emissions control factor associated with unpaved haul road watering reflects treatment every hour, and therefore, water carts should be deployed to ensure that this treatment rate can be maintained.

The application of chemical suppressants to unpaved haul routes may be a more appropriate, and cost-effective solution, in conjunction with the use of an appropriate vacuum sweeper and water cart use. This is discussed in more detail below.

- The chute to the landfill was not operational during the site audit.

It is understood that the chute to the landfill was damaged in a recent fire and was not operational during the audit. It is understood that this has now been repaired and is operational.

- The fixed water spray system along the access roadway was not operational during the site audit.

The access roadway was not identified as a major source of dust during the site visit, which is supported by the emissions inventory presented in (Ramboll Australia, 2018). Some material spills were noted, although these were observed to be swept by hand before having the potential to be pulverised by heavy vehicle movements. No track-out of material onto the public road network was observed during the site visit, which indicates that any material which is deposited onto the long access road (either from the main site near the MPC, or which may fall from vehicles accessing the site) is not tracked off-site to any significant degree.

A fixed water system would assist in the reduction of wheel generated dust, although that system may be considered to be an alternative to regular water cart treatment. This would be investigated in the performance of the AQMP.

- Chemical suppressants are not used at the Premises.

Chemical suppressants are not currently used at the Premises, as the application of water has been the primary control method for road sources (paved and unpaved). It is understood that Bingo are examining the potential for the use of chemical suppressants on unpaved roads across the Premises which may reduce the requirement for constant watering and allow the water cart to be deployed elsewhere at the Premises.

The AQMP will outline the potential for use of chemical suppressants at the Premises as a potential contingency measure. Chemical suppressants would only be adopted as a primary control method at the Premises if trials were shown to be successful.

- An approach to modifying activities in windy conditions is defined but requires improvement:

It is understood that Bingo are currently in the process of upgrading the meteorological monitoring station at the Premises. In conjunction with this upgrade, the AQMP will review the location of the AQMS (currently located at 93 Minchinbury Drive) and assess whether any additional AQMS are required to support a Trigger Action Response Plan (TARP) for the Premises. Full details of the TARP, including the trigger levels and associated actions, will be provided in the updated AQMP for the Premises.

- The fixed water sprays within the crushing and screening areas were not operational.

At the time of the site visit, the fixed water sprays (termed rainbirds) were not in operation across the crushing and screening area of the Premises. Discussions with Bingo indicated that these rainbirds were being repaired and upgraded to be wind speed activated (activation wind speed yet to be determined). This task is also associated with the upgrade of the meteorological monitoring station (see above). The use of the rainbirds would be incorporated into the TARP (see above).

- Water sprays on the crushing and screening plant were not operational.

Through discussions with Bingo, it is understood that the water sprays associated with the crushing and screening plant have now been delivered and are operational.

- The water cannon was not observed to be operational within the pit.

It is recommended that the water cannon, or the water spray attachment to the water cart, is located within the pit and operated when vehicles are unloading materials.

A timetable for the implementation of the above measures, and any others required as part of the TARP, (incorporated into the AQMP), would be provided within the AQMP. It is likely that any implementation would be progressive.

It is noted that speed limits at the Premises are signed as lower than those which represent best practice for particulate control and are lower than those assumed in the AQIA. This will result in lower emissions than those which might have been assumed in the AQIA (Ramboll Australia, 2018).

Table 8 Audit findings

Number	Condition	Comments and observations	Compliance
PA 06_0139 – 37a.			
1	37a. Within six months of the approval of 06_0139 MOD6, and every two years thereafter, the Proponent must prepare a site-wide air quality audit to the satisfaction of the Planning Secretary. The audit must:	Approval was granted on 29 April 2020 and the audit is required to be performed by 29 October 2020. The site visit component of the audit was performed on 20 July 2020. The audit report is dated XX September 2020.	Compliant
2	a) be undertaken by a suitably qualified, experienced and independent expert	Dr Martin Doyle (PhD, BSc (Hons) Environmental Science, Certified Air Quality Professional (CAQP) of the Clean Air Society of Australia and New Zealand (CASANZ)) of Northstar performed the site-wide air quality audit. Martin has over 20 years' experience in air quality and odour issues. Martin's CV is attached as Appendix A.	Compliant
3	b) be prepared in consultation with the EPA	The audit report has been provided to NSW EPA for review.	Compliant
4	c) audit all aspects of the project with the potential to generate air emissions	This audit has considered all aspects of the project which may emit particulate and odour emissions.	Compliant
5	d) assess the current operation against the air quality impact predictions in the AQIA (Ramboll Australia Pty Ltd, dated August 2018)	Air quality monitoring data has been reviewed and compared with predictions provided in the MOD6 AQIA (Ramboll Australia, 2018). Based on the available data associated with the most recent year of measurements (2020), impacts at residential and commercial receptors are likely to be compliant with the air quality criteria adopted in (Ramboll Australia, 2018).	Compliant
6	e) review and benchmark on-site mitigation measures, management practices and operations against best practice for air quality management and opportunities for continuous improvement	Based on the findings of the site inspection the management practices being performed at the Premises are not consistent with best practice.	Non-compliant

Number	Condition	Comments and observations	Compliance
7	f) compare any emissions with relevant limits contained in conditions to this approval.	Section 6 includes the relevant emission limits	Not triggered
8	g) where any limits are exceeded or it is identified that current mitigation measures or management practices are not consistent with best practice, the air quality audit must identify additional mitigation measures to prevent or minimise emissions as far as practical. This includes consideration of: i Sealing parts or all site haul roads ii installation and/or upgrade of conveyors and associated dust suppression systems iii non-road diesel equipment and diesel combustion emission controls iv additional reactive management measures including but not limited to temporarily ceasing or altering operations or site practices v the measures detailed within the AQIA (Ramboll Australia Pty Ltd, dated August 2018)	Given that the audit has identified that best management practice is not being performed at the Premises, additional mitigation measures have been identified. These will be expanded upon in the performance of the AQMP. Importantly, the implementation of any measures required will be fully outlined in the AQMP, and where they are not required to be continuously implemented, details of the triggers and resulting responses associated with particulate management measures will be provided.	Compliant
14	h) specify a timeframe for when any mitigation measures identified in sub-clause (g) will be implemented	The timeframes for implementation will be provided in the AQMP.	Not triggered
15	i) inform the update to the Air Quality, Odour and Greenhouse Gas Management Plan required under Condition 37 of Schedule 3	The findings of this site-wide air quality audit will be used to inform the update to the AQMP.	Compliant

8. SUMMARY

Based upon the information reviewed the following recommendations are proposed.

8.1 Audit Non-Compliances

Table 9 presents the observed non-compliances against the audited odour conditions (see **Table 8**).

Table 9 Site-wide air quality audit non-compliances

Number	Condition	Comments and observations	Compliance
6	PA 06_0139 Condition 37a. e) review and benchmark on-site mitigation measures, management practices and operations against best practice for air quality management and opportunities for continuous improvement	Current site management measures were observed to not be consistent with best practice, or with the assumptions adopted in the AQIA for MOD6. The AQMP will outline a range of additional management and mitigation measures, and will also include a Trigger Action Response Plan (TARP), informed by monitoring data, which would allow reactive management of operations to assist in the avoidance of exceedances of air quality criteria at surrounding receptor locations.	Non-compliant

8.2 Recommendations

The findings of the site-wide air quality audit indicate that the particulate matter management and mitigation measures implemented at the Premises are not in alignment with best practice, or in line with the assumptions adopted in the performance of the most recent AQIA (MOD6) (Ramboll Australia, 2018).

The AQMP for the Premises is to be updated, informed by the findings of this site-wide air quality audit. In relation to particulate matter, it will be important that the measures outlined within the AQMP fully meet the requirements of Condition 37.

Given the nature and scale of the Premises, it is considered to be important that the AQMP provides a clear and defined approach to air quality management. Measures may be split into those which are continually applied, those which are required to be implemented at a specific frequency, and those which should be applied only under certain conditions.

A Trigger Action Response Plan (TARP) will be developed for the Premises, which would provide a 'decision-tree' approach to air quality management. This approach is recommended as it allows definite metrics to be determined with specific actions, which can be assigned to specific personnel or operational departments. It also allows the recording of any actions taken, which can inform any subsequent audits. **Table 10** provides a summary of the recommendations resulting from the performance of this audit.

Table 10 Summary of recommendations

Number	Recommendation
1	Ensure that the AQMP provides a clear and defined approach to air quality management
2	Include Trigger Action Response Plan (TARP) in the AQMP
3	Ensure that haul road watering occurs on a hourly basis, to maintain the emission control efficiency as reported in the literature
4	Investigate the use of chemical suppressants as a potential contingency measure
5	Ensure that the rainbirds and all other control systems are maintained to allow their operation at all required times
6	Ensure that the water spray attachment to the water cart, or water cannon, is operational within the pit when vehicles are unloading materials

APPENDIX A

Martin Doyle

Director

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qualifications

- PhD Air Quality Meteorology (University of East Anglia, UK, 2004)
- BSc (Hons) Environmental Science (University of East Anglia, UK, 1998)
- Certified Air Quality Professional (CAQP), Clean Air Society of Australia and New Zealand (CASANZ)

membership

- CASANZ NSW Branch Committee member 2007 - 2012
- CASANZ NSW Branch Training Activities Coordinator 2007 - 2012
- CASANZ Federal Deputy Chair Training Activities Executive 2008 – 2010

special expertise

Martin provides a range of expertise including:

- Air quality and greenhouse gas impact assessment
- Dispersion modelling studies including a range of specialist software
- Ambient air quality and meteorology studies
- Satellite remote sensing
- Geographical Information Systems (GIS)
- Indoor air quality and occupational exposure assessment
- Process & air pollution control due diligence and testing
- Odour impact assessment and audit
- Climate change impact assessment
- Expert testimony and witness
- Independent peer review and audit

background

Martin has almost 20 years of experience in the field of air quality, from academic research to public and private environmental consultancy. He completed his doctorate in 2004 in air pollution meteorology and was a Senior Research Associate at the University of East Anglia, which has the UK's highest rating for the quality of environmental research undertaken. His work has been included in UK Department of the Environment, Food and Rural Affairs Air Quality Expert Group state-of-science reports on PM_{10} and NO_2.

His major areas of expertise include air quality monitoring (including monitoring network design and data analysis), emissions inventory development, atmospheric dispersion modelling (using TAPM, CALPUFF, AUSPLUME, CALINE and AERMOD), greenhouse gas assessment and climate change impact assessment, independent peer review and performance of audits.

Martin has significant experience across all sectors (see overleaf) and broad experience in assessment of air pollutants including odour.

Use of Geographical Information Systems (GIS) and other software to present data to non-specialists in easy to understand formats is one of Martin's key interests.

selected project experience

Agribusiness

- Intensive Poultry Facility, Peer Review, NSW
- Blayney Abattoir, NSW
- Bourke Small Stock Abattoir, NSW
- The Ranch Poultry Complex, NSW
- Abattoir and Rendering Plant, NSW
- Maylands Poultry Farm, NSW
- Milk Production Facility, NSW
- Serpentine Poultry Farm Expansion, WA
- Westmere Grains, VIC

Clients in this sector include: CAPRA Development, Dairy Farmers, Darmad, Saines Lucas Solicitors, Scolexia, Thomas Foods International Tamworth.

Resources & Waste

- Milbrae Quarries (Strontian Quarry), AQIA, NSW
- Sydney Trains Dunmore Quarry, AQIA, NSW
- Milbrae Quarries (Hillview Quarry), AQIA, NSW
- Albion Park Quarry AQMP, NSW
- Milbrae Quarries (Walleroobie Quarry), AQIA, NSW
- Milbrae Quarries (Western Riverina Quarry), AQIA, NSW
- Albion Park Quarry Expansion AQIA, NSW
- Karuah South Quarry, AQIA, NSW
- Bangus Quarry, AQIA, Tumblong, NSW
- Ralston Quarry, AQIA, NSW
- Willowtree Quarry, AQIA, NSW
- Resource Recovery Facility, St Marys NSW
- Materials Recycling Facility, Operational Dust Management Plan, Padstow
- SUEZ Lucas Heights Leachate Treatment Plant, NSW
- 5R Solutions Glass Recycling Facility, NSW
- Traco Tyre Recycling Facility, NSW
- MET Construction Materials Recycling Facility, NSW
- Confidential, Integrated Mining and Waste Development, NT
- East Arm Waste Transfer Station Risk Assessment, NT
- Erskine Park Waste Transfer Station, NSW
- Bingo Waste Transfer Stations (St Marys, Mortdale), NSW
- Albion Park Quarry, NSW
- Glenfield Waste Services Materials Recycling Facility, NSW
- Kemps Creek Alternative Waste Treatment Facility, NSW
- Twinza Oil Project, PNG (GHG)
- Wafi Golpu Project, PNG (GHG)
- P'nyang Project, PNG (GHG)
- Freida River Project, PNG
- Mandalong Southern Extension Project, NSW
- Springvale Mine Extension Project, NSW
- Angus Place Mine Extension Project, NSW
- Lidsdale Siding Extension Project, NSW
- Airly Mine Extension Project, NSW
- Clarence Colliery REA V Project, NSW
- Northern Coal Logistics Project, NSW
- Neubeck Coal Project, NSW
- Karuah Quarry East Expansion Project, NSW
- Jandra Quarry Expansion Project, NSW
- Woodsreef Mine Rehabilitation Project, NSW
- Eastern Creek Organic Resource Recovery Facility, NSW
- Centennial Coal Company, PRP Assessments, NSW
- Peabody Energy, PRP Assessments, NSW
- Solomon Project, WA
- Carrow/Koppio Project, SA
- Area C Iron Ore Mine, WA
- Ace Landscapes Dust Management, NSW
- Redhill Waste Management Facility, WA
- Dromana Landfill, Mornington Peninsula, VIC
- Tropicana Gold Mine, WA
- Woodlawn Bioreactor Project, NSW
- Bigryli Uranium Exploration Project, NT
- Narrabri Coal Project, NSW

- Roy Hill Iron Ore Project, WA
- Glebe Island Bulk Sands Project, NSW
- Duralie Coal Mine Extension Project, NSW
- Cavehill Quarry, VIC
- Central Coast Sands, NSW
- Donalds Mineral Sands, VIC
- Brickworks (Client Confidential), VIC
- Sepon Gold and Copper Mine, Laos
- Werris Creek Coal Mine, NSW
- East Guyong Quarry, NSW
- Darling Downs Sand Extraction Project, QLD
- Belmont and Sunnyside Coal, NSW
- Whitehaven CHPP, NSW
- Wagga Wagga Sand and Gravel Extraction, NSW
- Roy Hill Iron Ore, WA
- Solomon Iron Ore Project, WA
- Leongatha Quarry Extension, VIC (GHG)
- Narrabri CSG Power Plant, NSW (GHG)
- Sunnyside Coal Project, NSW (GHG)

Clients in this sector include: Ace Landscapes, Anglo Gold Ashanti, APP Corporation, BHP BIO, Boral, Centennial Coal Company, Cleanaway, Cleary Bros, Coffey International, Energy Metals, Environmental Earth Sciences, Environmental Property Services, EMRC, Erias Group, ExxonMobil, Fortescue Metals Group, Groundwork plus, Hanson, Holcim, NSW Department of Mines, Peabody Energy, Roy Hill Iron Ore, RW Corkerys, SUEZ Australia, Tellus Holdings Ltd, Veolia, Whitehaven Coal, Xstrata.

Property

- Modular Brewery, Odour Assessment, WA
- Eastern Creek Retail Park, Odour Advice, NSW
- Baked Provisions Odour Assessment, NSW
- Horsley Drive Business Park Warehouse and Distribution Facility, NSW
- Childcare Centre Air Quality Assessment, NSW
- Poultry Farm Odour Assessment, Austral NSW
- Marsden Park North Development, NSW
- Survitec Development Application, NSW
- Tyres4U Development Application, NSW
- Leppington Precinct Development, NSW
- Emerald Hills Development, NSW
- Trinity Point Marina Project, NSW
- South Orange Urban Release Area, NSW
- Warehouse & Distribution Facility, Chullora NSW
- Berrys Bay Marina Project, NSW
- Culburra STP, NSW
- Oakdale Central Development, NSW
- Oakdale West Development, NSW
- Acacia Ridge Campus AQ Investigation, QLD
- Wilton Junction Land Use Mapping, NSW
- Bungaribee Estate Data Centre, NSW
- Orange Pump Station No.1, NSW
- North Orange Pump Station, NSW
- Crowne Plaza Newcastle Brewery Odour, NSW
- Crowne Plaza Hunter Valley Brewery Odour Assessment, NSW
- P&N Beverages Odour Assessment, NSW
- Hurricanes Bar & Grill Odour Management, Darling Harbour, Bondi, Brighton-le-Sands, NSW
- Ridges World Square Schwartz Brewery Odour Audit, NSW
- Newtown Hotel Odour Audit, NSW
- Club Burwood, Smoking Balcony AQ Assessment, NSW
- Leppington Part Precinct, NSW
- Currarong Sewerage Scheme - CEMP audit, NSW
- Brooklyn Child Care Centre, NSW
- Emirates Wolgan Valley Resort - CEMP audit, NSW
- Fairfield RSL - Environmental Audit, NSW
- VOC Monitoring, Reserve Bank of Australia, NSW
- Great Barrier Reef Marine Park Authority, QLD (GHG)

Clients in this sector include: ADW Johnson, Cardno, City of Sydney Council, Commercial & Industrial Property Group, Elton Consulting, Frasers Property Group, Geolyse, Goodman, Hosking Munro, JBA Planning, Meriton, Mirvac, QLD DPW, Shine Pre-School, Urbis, Worley Parsons.

Transport & Infrastructure

- Sydney Metro EIS Peer Review, NSW
- WestConnex Peer Review, NSW
- NorthConnex Peer Review, NSW
- Lower Main North Quadruplication Lite, NSW
- Epping to Chatswood Rail Line, NSW
- Enfield Intermodal Logistics Centre, NSW
- Northern Coal Logistics, NSW
- Capital Metro Stage 1 EIS, ACT
- Solomon Project Road Transportation Study, WA
- Sydney Harbour Bridge Lead Paint Removal Compliance and Verification, NSW
- North Ryde Transport Orientated Development, NSW
- Enfield to Chatswood Rail Line, NSW
- M1 Motorway Service Station, NSW
- Mitchell's Transportation Efficiency Project, WA
- Enfield Intermodal Logistics Centre, NSW
- M2 Upgrade, Sydney NSW
- Majura Parkway, ACT
- Clarrie Hermes Drive Extension, ACT

Clients in this sector include: Strathfield Council, Centennial Coal, EG Property Group, Fortescue Metals Group, Goodman, Hornsby Shire Council, Leightons Contractors, McDonalds Australia, Mitchell's, NSW Ports, P&N Beverages, Parsons Brinkerhoff, SMEC, Strathfield Council, Sydney Harbour Bridge Alliance, Transport for NSW, Urbis.

Industry

- Pre-cast Concrete Facility, Wetherill Park, NSW
- Concrete Batching Plant, Picton NSW
- Crematorium, Mayfield NSW
- Boral Kooragang Island Materials Recycling Facility, NSW
- Frenchs Forest Bushland Crematorium, NSW
- Boral Scoresby Opportunities and Constraints assessment, VIC
- BlueScope Steel PRP Assessment, NSW
- Pentarch Munitions Disposal Project, NSW
- Shoalhaven Starches Odour Audit, NSW
- Boral Granville Concrete Batching Plant, NSW
- Tuggeranong Crematorium, ACT
- Vopak Terminals PRP Assessment, NSW
- Eastern Asphalt Plant, Bairnsdale VIC
- Givaudan Odour Management, NSW
- Allens Asphalt, QLD
- SIMS Metal, QLD
- Metals Recycling Facility, NSW

Clients in this sector include: Austral Bricks, BlueScope Steel, Boral, Canberra Cemeteries, Environmental Property Services, Givaudan, Ignite Architects, Pentarch, Shoalhaven Starches, Vopak.

Energy

- Reeves Plains Power Station, SA
- Port Hedland Power Station, WA
- Solomon Project, WA
- West Qurna II Gas Field Development, Iraq
- Munmorah & Bayswater B Independent Peer Review, NSW
- Santos Fairview CS1&2 LNG, QLD
- Bamarang Power Station, NSW (including Plume Rise Assessment)
- Powergen, UK
- TXU Energi, UK

Clients in this sector include: Alinta Energy, Coffey International, Fortescue Metals Group, GHD, NSW Department of Planning and Environment, Infratil Energy, Santos.

publications

Rahaman F, Lawrence K, Starke G, Graham G & Doyle M, *Estimation of Odour Emissions from Broiler Farms – An Alternative Approach* Proceedings of the 21st Clean Air Society for Australia and New Zealand, Sydney 2013

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Doyle M & Dorling SR, *Particulate Pollution: New Perspectives on Measurement, Source Apportionment and Policy*, Proceedings of the 5th Urban Air Quality Conference, Valencia, Spain, 2005

Doyle M & and Dorling SR, *Meteorological Classification and Aggregation Approaches in Support of Models-3 Air Quality Simulations*, Proceedings of the 4th International Conference on Urban Air Quality. Prague, Czech Republic, pp424-427, 2003

Chatterton T, Dorling SR, Doyle M et al. *A Rigorous Inter-comparison of Ground-level Ozone Predictions*, Atmospheric Environment 37, 3237-3253, 2003

Doyle M & and Dorling SR, *Visibility Trends in the UK 1950 -1997*, Atmospheric Environment, 36, 3161-3172, 2002

Doyle M & and Dorling SR, *Satellite and Ground Based Monitoring of Aerosol Plumes*, Water, Air and Soil Pollution, Volume 2, Numbers 5-6, pp615-629, 2002