BALD HILL QUARRY

Jugiong Regional Landfill

Review of Environmental Impacts for Modification

JULY 2025

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DOCUMENT CONTROL

Version	Date	Amendment	Author	Authorised
1	31/10/2024	Updated from comms with DPHI	B FOURIE	T WILLSALLEN /J WILKINSON
2	26/3/2025	Updated from letter from DPHI	B FOURIE	T WILLSALLEN / J WILKINSON
3	8/7/2025	Change in Legislation	BFOURIE	T WILLSALLEN / J WILKINSON

1. Introduction

1.1 Overview

1.2 Applicants' details

The proponent Bald Hill Quarry operates a number of Quarries and regional landfill in south-western NSW. BHQ is a private company and took possession of the quarry from the previous operator in 1989. BHQ has two directors, Mr John Wilkinson holding tertiary qualifications in geology and geophysics and Mr Tony Willsallen tertiary qualifications in agricultural economics.

The application and modification is solely focused around the Regional Landfill

1.3 Background

Bald Hill Quarry Pty Ltd (BHQ), is a regional landfill and quarry operating adjacent to the Hume Highway 7km east of Jugiong in Southern NSW (Figure 1-1). The Landfill has been operating since 2002 and is approved to take class 1 solid waste.

The landfill was established to provide a waste disposal facility to eight Local Government Areas (LGA) and allowed for a maximum of 20,000 tonnes per annum (tpa) from municipal to industrial sources within these LGAs.

The Landfill known as "Ecofill" is accommodated in an exhausted quarry void. Ecofill has a contractual arrangement with a consortium of now four Local Government Councils known as South West Regional Waste Management Group (SWRWMG) to take waste from their waste transfer stations and furthermore to restrict receipt of all other sources of waste to the LGAs the Councils represent. The Facility is open Five (5) days a week with most waste being delivered by truck.

In 2007, there was minor amendments to the DA, however in 2012 there was a major modification to increase the annual limit from 20,000 tonnes to 40,000 tonnes per annum.

BHQ Jugiong operates under Environmental Protection Licence (EPL) number 2552, last updated in April 2024.

BHQ modified DA 262-09-01 under Section 4.55 (1A) of the EPA Act to add a condition to assist in dealing with natural disaster waste in 2020. The operation continues as the same development.

1.4 Proposed modification

This Review of Environmental Impacts for Modification report has been prepared by Bald Hill Quarry Pty Ltd ('the proponent') to accompany an application under Section 4.55 of the *Environmental Planning and Assessment Act 1979* (EPA Act) to the NSW Department of Planning, Housing and Infrastructure (DPHI) to modify Development Consent 262-09-01.

A thorough review has been undertaken of the consent conditions after an Independent Environmental Audit (IEA). A meeting with DPHI was undertaken on the action to address each condition of concern. Some conditions could be met by updating the LEMP and others have been identified to be out of date, inconsistent with changes to legislation and too prescriptive and repetitive. This modification is based around updating or amending specific conditions, however a thorough review is required to generally update this consent.

For the purpose of this document, the "Landfill' refers to those components of the Bald Hill Quarry site associated with the operation of the Bald Hill Quarry Regional Landfill. These include:

- The weighbridge

- The quarry void (now landfill)
- The transfer station
- The leachate evaporation pond and
- Infrastructure associated with the operation of the landfill.

1.5 Site location

Bald Hill Quarry Regional Landfill Jugiong site is located within the Hilltops LGA and is approximately 7km east of Jugiong in the Riverina Region, NSW. The sites infrastructure is located on the following Figure 1-2 and lot description below:

TABLE 1-1: LOCATION AND LAND DESCRIPTION

Land Description	Zoning	Owner	Components
Lots 7 DP 133540 Lots 11 and 12 DP439146 Suburb of Berremangra, Local Government Area (LGA) of Hilltops	RU1 Primary Production	Bald Hill Quarry Unit Trust	Site Access Road Regional Landfill and Transfer station

FIGURE 1-1: LOCATION OF JUGIONG REGIONAL LANDFILL

FIGURE 1-2: EXISTING LANDFILL SITE INFRASTRUCTURE

2. Strategic Context

This section identifies the projects strategic context based on relevant strategic government plans, polices and guidelines and any project agreements.

In 2000, the South West Waste Group (SWWG) is a group created by seven local councils to deal with regional waste issues. They reported in November 1999 that their Group covers an area of 18 821 km2 and a population of 48 575. Cootamundra covers an additional 1 525 km2 with a population of 7 463. The SWWG area includes nine major population centres where 29 520 people make up 60 per cent of the population. A further 13 per cent reside in 27 villages. The population is not expected to change significantly over the coming years.

There are currently ten major landfills in the SWWG area that accept in excess of 1 000 m3 of wastes each year. There are 23 smaller village landfills and five transfer stations which receive in total over 20 080 tonnes of wastes each year. Some 15 267 tonnes of additional wastes are diverted annually through recycling and green waste composting/mulching. The Cootamundra area expect to divert approximately 1 500 t per annum from local landfills to the Bald Hill Quarry Regional Landfill.

The 1999 SWWG report concluded that five of the ten major landfills will be exhausted within eight years at the then current rates of waste disposal. At that time, four Shire Councils and 50 per cent of the population in the area would be without a landfill. Similarly, 14 of the 23 village landfills would be full within five years. The remaining five large and nine small landfill sites face ongoing issues such as:

- location concerns;
- increasing operating costs;
- community pressure; and
- EPA regulations.

As a result of investigations by the SWWG, it was determined that there was urgent justifiable demand for replacement landfill space and that the proposed Bald Hill Quarry Regional Landfill was the preferred option as it would be central to all eight Shires. The group also believes the use of a central facility would increase the standard of waste disposal and transfer station operations across all Shires.

Need for the modification

Due to the age of the consent and some concerns around non-compliances with being able to meet some conditions this modification is necessary to ensure BHQ are compliant into the future. There is also a minor physical alteration back to the original development included.

Strategic planning context

Government plans, policies and guidelines relevant to the Proposals strategic context include:

- State Environmental Planning Policy (SEPP) 48 – Major Putrescible Landfill Sites
- State Environmental Planning Policy (SEPP) 11 – Traffic Generating developments
- Harden LEP
- NSW south east and tablelands regional plan 2036
- Hilltops 2040 local strategic planning statement

3. Descriptions of the modifications

3.1 The proposal

The proposed modification to DA 262-09-01 is requested after a thorough review of the consent conditions during the IEA in 2020 and 2023. A list of the specific conditions requested to be modified is presented below in Table 3-2. In this table there is details on justification for the change with additional information and discussion further presented in Section 6.

TABLE 3-1 – MODIFICATION PROPOSAL AN APPROVED PROJECT COMPARISON

Aspect	Approved Project	Modification Proposal
Location and tenure		
Land	Lot 7 DP133540, Lot 11 and 12 DP439146	No change
Land clearing/levelling	Project already a disturbed site	No change
Construction		
Hours	7am to 10pm Monday to Friday and from 7am to 5pm on Saturdays, Sundays and public holidays.	No change
Operation		
Tonnes	40,000	No change
Ancillary facilities	All identified in the EIS	No change
Site Access	Off the Hume highway then onto private road	No change

3.2 Consent conditions to be modified

TABLE 3-2: CONSENT CONDITIONS TO BE MODIFIED

Condition Number	Consent Requirement	Detailed description of why the condition should be modified	Suggested condition wording
11.2	The Applicant must prepare a post closure landfill rehabilitation management plan. This plan must be documented in the LEMP and address the following: • Capping the landfill in accordance with benchmark technique 28 “Site Capping and Revegetation” documented in the "Environmental Guidelines: Solid Waste Landfills;“	Condition 11.2 requires a post closure landfill rehabilitation management plan. Condition 16.3 requires a Landscape rehabilitation plan. A closure plan is not required until 12 months prior to closing, so having this level of information in the LEMP is not appropriate.	The Applicant must rehabilitate the site to achieve a final landform in accordance with the criteria in the Landfill Guidelines, or its latest version. The Applicant must prepare a Landfill Closure Plan (LCP) to the satisfaction of the Planning Secretary. The LCP must: (a) be prepared in accordance with section 76 of the POEO Act; (b) be prepared by a suitably qualified and experienced experts(s);

Condition Number	Consent Requirement	Detailed description of why the condition should be modified	Suggested condition wording
	• post closure environmental monitoring requirements; • post closure leachate management; • post closure landfill gas management; • post closure management of surface water in the event that the void is not filled with waste; and • the estimated cost of these works must be provided and should be based on a nominal period of 50 years after the landfill ceases to accept waste. The duration of this period will be determined from actual monitoring data at the time.	The Landfill closure plan will be structured off the requirements outlined in Section 9,10,11 of the EPA Environmental Guidelines – Solid waste landfills, 2016. The modification to this condition does not change or impact the development resulting in being substantially the same development	(c) be submitted to the EPA and Planning Secretary twelve (12) months prior to the planned closure of the landfill; (d) detail the requirements for ongoing management of the capped waste mass; (e) detail the maintenance procedures for the final capping, in accordance with the requirements of the Landfill Guidelines, or its latest version; (f) describe monitoring and management measures to ensure the integrity of the cap; (g) describe ongoing surface water and leachate management, odour and dust control; (h) detail landfill gas monitoring and maintenance; and (i) identify future land use/s on the site. See Section 6 for more detail.
16.2	The Applicant shall prepare and implement a revised Landfill Environmental Management Plan (LEMP). The LEMP shall: a) be prepared in consultation with the EPA and to the satisfaction of the Director-General; (b) be prepared in accordance with the EPA's Environmental Guidelines: Solid Waste Landfills; (c) incorporate MOD 2; and (d) be submitted to the Department within 3 months of commencement of MOD 2	Wording is too prescriptive. The Applicant shall implement and review the Landfill Environmental Management Plan (LEMP). The LEMP shall: a) be prepared in consultation with the EPA and to the satisfaction of the Director-General; (b) be prepared in accordance with the EPA's Environmental Guidelines: Solid Waste Landfills; (c) incorporate information from any modifications to DA262-09-01; and (d) be submitted to the Department within 3 months of any updates.	Within three (3) months of the submission of any: audit required under this approval; incident report under condition XXX of this schedule; or annual review under condition XXX of this schedule; and/or modification to this approval The Applicant shall review, and if necessary revise the plans and programs required under this approval to the satisfaction of the Planning Secretary. Note: This is to ensure the plans and programs are updated on a regular basis and incorporate any recommended measures to improve the environmental performance of the Project.
16.3	The Applicant must document in the LEMP a landscape rehabilitation plan, which shall address, but not necessarily be	This condition could be provided at a high level overview of rehabilitation.	The Applicant must document in the LEMP a post closure landscape rehabilitation plan, which shall address, but not necessarily be limited, to the following matters:

Condition Number	Consent Requirement	Detailed description of why the condition should be modified	Suggested condition wording
	limited, to the following matters: clear identification of the proposed rehabilitation works to be undertaken; the rehabilitation standards to be adopted; a rehabilitation schedule (to be reviewed on a regular basis); procedures for stabilisation of exposed soil areas; a post-establishment maintenance and monitoring program for rehabilitated areas; closure strategies in the event that landfilling activities conclude prior to reaching the final levels stated in the EIS; a closure plan in accordance with section 76 of the POEO Act (see Condition 12.2); site capping and revegetation in accordance with the EPA's Environmental Guidelines: Solid Waste Landfills; the use of tubestock from local seed in the rehabilitation works; soil improvement measures including the possible use of green waste compost produced on site; enhance habitat potential of the site for native fauna and the conservation value of the existing ecological communities; control exotic weed infestations and minimise the long-term potential for further weed infestation of the site; ensure bush regeneration work is undertaken by appropriately qualified bush regenerators.	To have this as a requirement prior to closure planning is counterproductive. The LEMP does have what was proposed in the EIS, however this condition is very prescriptive with several unknown aspects. The progressive rehabilitation and species selection would come after capping design, as it would be dependent on the cap selected. This condition also includes too much detail around capping and closure, which can be provided in condition 11.2 closure planning suggestions. The modification to this condition does not change or impact the development resulting in being substantially the same development	clear identification of the proposed rehabilitation works to be undertaken; the rehabilitation standards to be adopted; a rehabilitation schedule procedures for stabilisation of exposed soil areas; a post-establishment maintenance and monitoring program for rehabilitated areas; • post closure environmental monitoring requirements; • post closure leachate management; • post closure landfill gas management; • post closure management of surface water in the event that the void is not filled with waste closure strategies in the event that landfilling activities conclude prior to reaching the final levels stated in the EIS; See Section 6 for more detail.

Condition Number	Consent Requirement	Detailed description of why the condition should be modified	Suggested condition wording
	post closure environmental monitoring; post closure management of surface water; post closure management of sedimentation dams; post closure leachate management; and post closure landfill gas management.		
21.1	The Applicant must provide the EPA with information on the quantity of waste received at the facility and the quantity of waste transported from the facility each quarter. The information in respect of a particular quarter is to be provided on the approved Form WISQTR.1 and must be received by the EPA within 60 days of the end of that quarter. For the purposes of this Condition each of the following periods is a quarter: • (Quarter 1) 1 January - 31 March • (Quarter 2) 1 April - 30 June • (Quarter 3) 1 July - 30 September • (Quarter 4) 1 October - 31 December	The waste is reported on an annual basis to the EPA. The wording needs to be changed and more flexible if there are further changes within other government departments. Applicant to comply with EPA waste reporting requirements.	Out of date **Suggestion:** The Applicant must provide the EPA with information on the quantity and type of waste received at the facility in accordance with the EPAs Annual Waste Report.
32.5	The flare system must be ground level, shrouded with greater than or equal to 0.6 seconds retention time at greater than or equal to 760oC. The flare system must be provided with automatic combustion air control, automatic shutoff gas valve and automatic re-start system.	In 2015 and 2021 an efficiency test of the gas flare was undertaken and a report provided by Air Labs Environmental. The flare is not an enclosed flare however complies with clause 68 of the Clean Air Regulation. Please remove reference to 0.6 seconds and 760oC, as these are requirements	Update in wording to Align with EPL. See Section 6 for more detail.

Condition Number	Consent Requirement	Detailed description of why the condition should be modified	Suggested condition wording
		of an enclosed flare. Please see attached a letter from the EPA. The flare system must achieve a 98% destruction efficiency as outline by EPA.	
33.1	For each monitoring/discharge point specified in the table below (by point number), the parameter must be equal to or greater than the lower limits specified for that parameter in the table. Res time 0.6sec, temp 760 degrees C.	As above. See report attached in Appendix A. Not relevant to BHQ flare. Delete or refer to EPL.	Update in wording to Align with EPL. See Section 6 for more detail

3.3 Substantially the same development

The modification proposal seeks to modify the project approval (DA 262-09-01) under section 4.55(1A) of the EP&A Act. The test for modifications is whether the development to be modified is 'substantially the same development' for that which was originally approved, or as modified where the modification was approved under section 75W. In this case Modification 3 was the last modification which was approved under section 4.55(1A) and therefore forms the baseline for the modification proposal. The modification proposal is considered substantially the same development in that:

- The proposed modifications will not result in any changes to the intent or use of the site as approved, i.e. a waste management facility.
- It does not seek to increase the maximum processing capacity.
- It will ensure BHQ can be compliant with all conditions in the future.
- It is required and necessary change for the closure of the operation.
- The modification does not alter the approved developments consistency with the applicable environmental planning instruments and policies, including its strategic context as present in section 2 of this modification report.

4. Statutory context

BHQ Landfill operation was approved under Section 80(1) of the EP&A Act on the 16 August 2002. The approval requires the development to be undertaken in accordance with the conditions of consent and the approved plans and specifications described in the EIS and any submissions or documents provided as part of the project approval.

The consent requires a thorough review and a range of amendments. A modification to DA 262-09-01 under Section 4.55 is required to modify the consent conditions relating to the site.

Section 4.55 of the EP&A Act contains three pathways for which a consent may be modified including:

- Section 4.55 (1) - modification involving minor error, misdescription or miscalculation
- Section 4.55 (1A) – modifications involving minimal environmental impacts
- Section 4.55 (2) – other modifications

BHQ believe that the modification would be the appropriate approval pathway under Section 4.55 (1A) of the EP&A Act. The operation remains substantially the same development as outlined in section 3.3, as there are no major changes or environmental impacts to the operation.

Further, in determining an application for modification under section 4.55, the consent authority must also take into consideration matters referred to in Section 4.15 of the EP&A Act. An assessment of the modification proposal in consideration of the matter is present in Table 4-1.

TABLE 4-1 – ASSESSMENT OF THE MODIFICATION PROPOSAL AGAINST THE EP&A ACT

Clause and requirement	Modification proposal consistency
Section 4.55 (2)	
(**2) Other modifications** A consent authority may, on application being made by the applicant or any other person entitled at act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if -	
(a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and	The modification proposal is considered substantially the same development in that: • The proposed modifications will not result in any changes to the intent or use of the site as approved, i.e. a waste management facility. • It does not see to increase the maximum processing capacity. • It will ensure BHQ can be complaint with all conditions in the future. • It is required and necessary change for the closure of the operation. • The modifications does not alter the approved developments consistency with the applicable environmental planning instruments and policies, including its strategic context as present in section 2 of this modification report.
Section 4.15 (1)	
a) The provision of:	
(i) any environmental planning instrument, and	This Section (Section 4) outlines relevant provisions in applicable environmental planning instruments and where the modification report addresses those provisions.
(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has	No draft instruments apply to this site

notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and	
(iii) any development control plan, and	Section 2.10 of *State Environmental Planning Policy (Planning Systems) 2021* states that development control plans do not apply to State significant development. As discussed further below, the Modification Proposal is consistent with the relevant provisions of the relevant development controls.
(iiii) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and	The Applicant has not offered to enter into Section 7.4 Planning Agreement.
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	No physical works causing environmental impacts. The works will not have any social or economic impacts as they are required for closure of the site. There will be minimal environmental impacts however will be minor and short term to the cumulative impact from the site due to it general operations.
(c) the suitability of the site for the development	The site remains suitable for such a purpose as it is appropriately removed from surrounding sensitive uses by existing open space and existing adjacent quarry operation.
(d) any submissions made in accordance with this Act or the regulations	The DPHI will exhibit the Modification Proposal per its Community Partition Plan. The Applicant will respond to submissions as directed by the DPHI.
(e) the public interest	The modification proposal is in the public interest for the following reasons: • Ensure compliance of the operation • Is required for successful closure of the operation.

In summary, the Modification Proposal is considered suitable for assessment (and approval) under Section 4.55(1A) of the EP&A Act.

5. Community engagement

There are no major changes that require any additional government consultation. There are no changes required for access or offsite and no changes that create additional environmental impact.

Neighbours are over 1.7 km away and there is no change to any activities onsite that will impact them.

6. Assessment of Impacts

Below additional information has been provided on some conditions that require further details around the requested change and assessment on potential Environmental Effects.

6.1 Post closure and rehabilitation conditions

Condition 11.2

As outlined in Table 3-2, BHQ believes that this condition could be more specific to a post closure landfill rehabilitation management plan. As the condition is written it conflicts with another condition and is too prescriptive to be practical.

A closure plan is not required until 12 months prior to closing (EPA Guidelines), so having this level of information in the LEMP is not appropriate. This also conflicts with condition 5.4 of this consent.

The Landfill closure plan will be structured off the requirements outlined in Section 9,10,11 of the EPA Environmental Guidelines – Solid waste landfills, 2016.

Condition 11.2 refers to the 1996 Environmental Guidelines: Solid Waste Landfills with regards to benchmark technique 28. Benchmark technique 28 no longer exists and this needs to be updated to reflect the current guidelines.

BHQ have provided a suggested condition that would be more in line with a practical requirement.

The modification to this condition does not change or impact the development resulting in being substantially the same development

Condition 16.3

As outlined in Table 3-2, BHQ believes that this condition could be more specific to provide a high level overview of rehabilitation. The LEMP is an operational document and does outline what was proposed in the EIS, however this condition is too prescriptive and does not add any value to the operation of the landfill. The EIS which was completed in 2001 outlines broad rehabilitation commitments and stabilising the cap with grasses. There is no mention of particular tree species, tubestock or creating a habitat for native fauna.

The progressive rehabilitation and species selection would come after capping design, as it would be dependent on the cap selected, which is in progress.

This condition also includes requirements around capping and closure, which should be provided in condition 11.2 closure planning suggestions.

BHQ have provided a suggested condition that would be more line with a practical requirement.

The modification to this condition does not change or impact the development resulting in being substantially the same development

6.2 Landfill Gas Flare

The gas flare was installed as outlined in the 2001 Environmental Impact Statement.

An assessment of the flare was performed in June 2021 by Air Labs Environmental. The results and report are provided in Appendix A with the flare achieving the destruction efficiency.

The flare does meet clause 68 (b) of the Clean Air Regulation, with regards to achieving 98% destruction efficiency.

Clause 68 of the Clean Air Regulation specifies enclosed ground-level flares for treating landfill gas must meet the following operating conditions:

- gas residence: >0.6 seconds;
- combustion temperature >760oC; or
- in another way that ensures that the destruction efficiency of the flare, in relation to landfill gas entering the flare, is more than 98%.

See attached a letter from the EPA in 2021 supporting and confirming the change to the wording and reference to the flare which is now reflected in our EPL (Appendix A).

7. Justification of the modified project

BHQ has effectively managed the consent for over 20 years. During Independent Environmental Audits (IEA) it has been noted that BHQ demonstrated a good understanding of their obligations under the Approval and positive measures were observed during the audit that demonstrated compliance with many of the requirements of the Approval.

In 2020 GHD identified 37 non-compliances with BHQ identifying many inconsistencies and contacting DPHI with regards to modifying the consent. BHQ also actioned many of the non-compliances with addressing 22 of the 31 corrective actions reducing the non-compliances in 2023 IEA to 17 non-compliances.

BHQ believes that if the consent is not modified then non-compliances are inevitable however not due to BHQ management of the site. Section 6 has provided clear and concise evidence to outline the requirements of this request and the negligible environmental impact of these changes.

The proposed modifications will allow BHQ to focus on relevant operational requirements to ensure compliance in the future.

8. References

Corkery, 2001. Environmental Impact Statement – Bald Hill Quarry Landfill via Jugiong.

Corkery, 2012. Environmental Assessment – Increase in Annual Waste Quantities to the Bald Hill Quarry Regional Landfill via Jugiong, NSW.

PAEHolme, 2012. Air Quality Assessment Report.

Airlabs Environmental. 2021. Environmental Assessment of the Landfill Gas Flare located at the Blad Hill Quarry Site in Jugiong.

Stuart Hercules, 2009. In-field Determination of Landfill Gas Generation at Bald Hill Quarry, Jugiong.

Appendices

Appendix A – Flare and Gas Report and EPA Letter

DATE OF REPORT: 30TH JUNE 2021

Mr Tony Willsallen
Bald Hill Quarry Pty Ltd
Hume Highway
JUGIONG NSW 2726

TEST REPORT NO. JUN21091.2

ENVIRONMENTAL ASSESSMENT OF THE LANDFILL GAS FLARE LOCATED AT THE BALD HILL QUARRY SITE IN JUGIONG

DATE OF SAMPLING: 10TH JUNE 2021

ACCREDITATION:

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INTRODUCTION

Airlabs Environmental Pty Ltd was commissioned by Bald Hill Quarry Pty Ltd to assess the Destruction & Removal Efficiency (DRE) of the Landfill Gas Flare located at the Bald Hill Quarry Site in Jugiong. The gas retention time in the Landfill Gas Flare was also calculated.

The Landfill Gas Flare is depicted in Figure 1 below:

Figure 1: Landfill Gas Flare Sampling Locations

This assessment considered odour, odorous compounds, volatile organic compounds and air toxics. Testing was conducted for the following parameters:

- Temperature, gas velocity and volumetric flow rate
- Concentration of water vapour (moisture content)
- Concentration and emission rate of:
  - odour
  - methane
  - volatile organic compounds
  - trace chemical compounds, including reduced sulfur compounds, aldehydes and amines.

So that the DRE could be determined, monitoring was undertaken with and without ignition of the flare. All sampling was conducted on 10th June 2021.

QUALITY STATEMENT

Airlabs Environmental is committed to providing the highest quality data to all our clients, as reflected in our ISO 17025 (NATA) accreditation. This requires strict adherence to and continuous improvement of all our processes and test work. Our goal is to meet or exceed the QA/QC requirements as set by our clients and appropriate governmental entities and to ensure that all data generated is scientifically valid, defensible and of known measurement uncertainty following the best available testing methods.

TEST METHODS

A summary of test methods is provided in Table 1 below. Specific details of the methods used are available upon request.

Table 1: Summary of Test Methods

Test Parameter	Test Method	Method Detection Limit	Estimated Measurement Uncertainty	NATA Accredited	
				Sampling	Analysis
Sample Plane Criteria	AS 4323.1	N/A	N/A	✓	N/A
Water Vapour (Moisture Content)	NSWEPA TM-22	0.4%	± 5%	✓	✓
Gas Velocity, Temperature and Volume Flow Rate	NSWEPA TM-2	2 m/s (Gas Velocity) 273K (Temp)	± 10% (Gas Velocity & Flow) ± 1% (Temp)	✓	N/A
Odour	AS/NZS 4323.3	20 OU	95% confidence interval	✓	✓
Methane (CH_4)	Infrared	0.2%	± 5%	X	X
Reduced Sulfur Compounds	USEPA 15	1 ppb	± 15%	✓	✓
Volatile Organic Compounds	NSWEPA TM-34	0.002 mg/Nm^3	± 20%	✓	✓
Aldehydes	NIOSH 2541	USEPA TO11A	± 20%	X	X
Amines	NSW EPA TM-34	0.002 mg/Nm^3	± 15%	✓	X

DEFINITIONS

'AS'	Australian Standard.
'AS/NZS'	Australian/New Zealand Standard.
'NSWEPA'	New South Wales Environment Protection Authority.
'USEPA'	United States Environmental Protection Agency.
'NIOSH'	National Institute for Occupational Safety and Health.
'm^3/min'	Actual gas flowrate in wet cubic metres per minute as flare conditions.
'K'	Absolute temperature in Kelvin (°C + 273).
'STP'	Standard temperature and pressure (0°C and 101.325 kPa).
'Nm^3/min'	Normalised gas flowrate in cubic metres per minute at STP (wet or dry basis).
'% v/v'	Percentage in air or gas, volumetric basis.
'OU'	Odour concentration in odour units (expressed at 0°C, wet basis).
'OU/min'	Odour emission rate in odour units per minute.
'mg/Nm^3'	Milligrams (10^{-3} grams) of substance per dry cubic metre of gas at STP.
'mg/min'	Milligrams (10^{-3} grams) of substance emitted per minute.
'<'	Less than. The value stated is the limit of detection.

ASSESSMENT OF SAMPLING PLANE

The required number of sampling points is governed by the dimensions of a duct or stack and is provided in Australian Standard 4323.1-1995 'Stationary Source Emissions, Method 1: Selection of Sampling Provisions'. Table 2 below summarises the requirements for a circular stack or duct.

Table 2: Minimum Number of Sampling Points for Circular Sampling Planes

Sampling plane diameter m	Minimum number of sampling traverses	Minimum number of access holes	Minimum number of sampling points per radius	Minimum total number of sampling points
>0.20 ≤0.35	2	2	1	4
>0.35 ≤0.70	2	2	2	8
>0.70 ≤1.50	2	2	3	12
>1.50 ≤2.50	2	4	4	16
>2.50 ≤4.00	2	4	6	24
>4.00 ≤6.00	3	6	5	30
>6.00	3	6	6	36

The criteria for sampling planes as specified in AS 4323.1 states that, in the absence of cyclonic flow activity, ideal sampling plane conditions are found to exist at the positions given in Table 3 below:

ASSESSMENT OF SAMPLING PLANE Continued

Table 3: Criteria for the Selection of Sampling Planes

Type of flow disturbance	Minimum distance upstream from flow disturbance in diameters, *D*	Minimum distance downstream from flow disturbance in diameters, *D*
Bend, connection, junction, direction change	>2D	>6D
Louvre, butterfly damper (partially closed or closed)	>3D	>6D
Axial fan	>3D	>8D (see Note)
Centrifugal fan	>3D	>6D

NOTE: The plane should be selected as far as practicable from a fan. Flow straighteners may be required to ensure the position chosen meets the check criteria listed in Items (a) to (f) below.

Section 4.1 of AS 4323.1-1995 (Ideal Sampling Positions) states that the location of the sampling plane shall be such that it meets the following criteria:

(a) The gas flow is basically in the same direction at all points along each sampling traverse.
(b) The gas velocity at all sampling points is greater than 3 m/s.
(c) The gas flow profile at the sampling plane shall be steady, evenly distributed and not have a cyclonic component which exceeds an angle of 15° to the duct axis, when measured near the periphery of a circular sampling plane.
(d) The temperature difference between adjacent points of the survey along each sampling traverse is less than 10% of the absolute temperature, and the temperature at any point differs by less than 10% from the mean.
(e) The ratio of the highest to lowest pitot pressure difference shall not exceed 9:1 and the ratio of highest to lowest gas velocities shall not exceed 3:1. For isokinetic testing with the use of impingers, the gas velocity ratio across the sampling plane should not exceed 1.6:1.
(f) The gas temperature at the sampling plane should preferably be above the dewpoint.

For non-ideal sampling positions, Section 4.2 of AS 4323.1-1995 states that a greater number of sampling points can be used to maintain as much accuracy as possible. The sampling point factors used to calculate the number of sampling points are provided in Table 4 below.

ASSESSMENT OF SAMPLING PLANE Continued

Table 4: Sample Point Factors

Non-ideal Situation	Sampling Point Factors
Sampling plane downstream from disturbance:	
Diameters less than Table 3	
0	1.00
1	1.05
2	1.10
3	1.15
4 or more	1.20
Sampling plane upstream from disturbance:	
Diameters less than Table 3	
0	1.00
0.5	1.05
1.0	1.10
1.5 or more	1.15

NOTE: The sample point correction factor is the product of both the upstream and downstream factors, raised to the next even number for each sampling traverse.

The sampling plane details for the Landfill Gas Flare, and number of sampling points required by AS 4323.1-1995, are provided in Table 5 below:

Table 5: Sampling Plane Details for the Landfill Gas Flare

Sampling Plane Details	
Shape of Duct	Circular
Actual Duct Internal Diameter (m)	0.460
Type of Disturbance, Upstream	Burner
Distance from Upstream Disturbance	5.7D (< 6D)
Type of Disturbance, Downstream	Flare outlet
Distance to Downstream Disturbance	1D (< 2D)
Sample Plane Location Satisfies Table 3 Criteria	No
Standard No. of Sampling Points per Traverse	4
Number of Traverses	2
Correction Factor	1.16
Corrected No. of Sampling Points per Traverse	6
Total No. of Sampling Points	12
Stratified	No
Cyclonic	No (< 15°)
Pitot Pressure Difference	1.7:1 (< 9:1)
Velocity Difference	1.3:1 (< 1.6:1)
Absolute Temperature Difference (K)	< 10%
Minimum Velocity at any Sample Point (m/s)	2.2 (< 3)
Compliance with AS 4323.1-1995 (Non-Ideal Sampling Positions)	No (minimum velocity was < 3 m/s)

RESULTS

Table 6: Gas Flow Conditions for the Landfill Gas Flare on 10th June 2021

Test Parameter	Flame Off	Flame On
Testing period (hrs)	12:30 – 13:00	11:14 – 11:54
Stack dimensions at sampling plane (m)	0.460	0.460
Average stack gas temperature (K)	286 (13°C)	448 (175°C)[a]
Average velocity at sampling plane (m/s)	0.13 (estimated)[b]	2.5
Actual gas flow rate (m^3/min)	1.3 (estimated)	25
Normalised gas flow rate at STP, wet (Nm^3/min)	1.2 (estimated)	15
Moisture content (%v/v)	1.0	6.2
Normalised gas flow rate at STP, dry (Nm^3/min)	1.2 (estimated)	14

Table 7: Test Results for the Landfill Gas Flare on 10th June 2021

Gaseous Constituent	Flame Off	Flame On
Odour	**(OU)**	**(OU)**
Odour	190,000	200
General Gases	**(% v/v)**	**(% v/v)**
Methane[c]	23.5	< 0.2
Reduced Sulfur Compounds	**(mg/Nm³)**	**(mg/Nm³)**
Hydrogen sulfide	193	0.23
Carbon disulfide	0.18	< 0.002
Methyl mercaptan	1.2	< 0.002
Ethyl mercaptan	0.024	< 0.002
Dimethyl sulfide	0.036	< 0.002
Dimethyl disulfide	0.055	< 0.002
Dimethyl trisulfide	0.017	< 0.002
Isopropyl mercaptan	< 0.002	< 0.002
n-Propyl mercaptan	0.0073	< 0.002
Ethylmethyl sulfide	< 0.002	< 0.002
s-Butyl mercaptan	< 0.002	< 0.002
Diethyl sulfide	< 0.002	< 0.002
n-Butyl mercaptan	0.0049	< 0.002
Volatile Organic Compounds	**(mg/Nm³)**	**(mg/Nm³)**
Benzene	0.26	< 0.002
Toluene	3.1	0.0027
Ethylbenzene	0.94	< 0.002
m & p-Xylenes	0.72	< 0.002
o-Xylene	0.35	< 0.002
4-Isopropyltoluene	0.073	< 0.002
Styrene	0.10	< 0.002
Propene	0.025	< 0.002
Dichlorodifluoromethane	< 0.002	< 0.002
Chloromethane	< 0.002	< 0.002

[a] The temperature was reduced at the measurement point in the extension piece (flame shield) due to air ingress. The average flare temperature measured approximately 0.5m above the flame was 854°C.

[b] The gas velocity in the flare was less than the method detection limit when the flame was off. The estimated velocity is based on the landfill gas flow rate recorded by the client.

[c] The methane concentration was diluted at the measurement point due to air ingress. The concentration of methane determined at the burner was 50.7%.

RESULTS CONTINUED

Table 7 Continued: Test Results for the Landfill Gas Flare on 10th June 2021

Gaseous Constituent	Flame Off	Flame On
Volatile Organic Compounds (Continued)	**(mg/Nm³)**	**(mg/Nm³)**
1,2-Dichlorotetrafluoroethane	< 0.002	< 0.002
Vinyl chloride	0.0057	< 0.002
1,3-Butadiene	< 0.002	< 0.002
Ethanol	1.3	< 0.002
Bromomethane	< 0.002	< 0.002
Chloroethane	< 0.002	< 0.002
Acetone	0.77	< 0.002
2-Propanol	< 0.002	< 0.002
1,1-Dichloroethene	< 0.002	< 0.002
Dichloromethane	< 0.002	< 0.002
1,1,2-Trichloro-1,2,2 trifluoroethane	< 0.002	< 0.002
trans-1,2-Dichloroethene	< 0.002	< 0.002
1,1-Dichloroethane	< 0.002	< 0.002
Methyl-tert-butylether (MTBE)	< 0.002	< 0.002
Vinyl acetate	< 0.002	< 0.002
2-Butanone (MEK)	< 0.002	< 0.002
cis-1,2-Dichloroethene	< 0.002	< 0.002
Hexane	0.017	< 0.002
Chloroform	0.085	< 0.002
Ethyl Acetate	0.021	< 0.002
Tetrahydrofuran	0.34	< 0.002
1,2-Dichloroethane	< 0.002	< 0.002
1,1,1-Trichloroethane	< 0.002	< 0.002
Carbon tetrachloride	0.0063	< 0.002
Cyclohexane	0.072	< 0.002
1,2-Dichloropropane	0.0051	< 0.002
Bromodichloromethane	0.028	< 0.002
Trichloroethene	< 0.002	< 0.002
1,4-Dioxane	< 0.002	< 0.002
Heptane	0.14	< 0.002
Methyl methacrylate	< 0.002	< 0.002
cis-1,3-Dichloropropene	< 0.002	< 0.002
4-Methyl-2-pentanone (MIBK)	0.0097	< 0.002
trans-1,3-Dichloropropene	< 0.002	< 0.002
1,1,2-Trichloroethane	< 0.002	< 0.002
2-Hexanone (MBK)	< 0.002	< 0.002
Dibromochloromethane	0.014	< 0.002
1,2-Dibromoethane	< 0.002	< 0.002
Tetrachloroethylene	< 0.002	< 0.002
Chlorobenzene	0.033	< 0.002
Bromoform	0.0071	< 0.002
1,1,2,2-Tetrachloroethane	< 0.002	< 0.002
4-Ethyltoluene	0.020	< 0.002
1,3,5-Trimethylbenzene	< 0.002	< 0.002
1,2,4-Trimethylbenzene	< 0.002	< 0.002
Benzyl chloride	0.018	< 0.002
1,2-Dichlorobenzene	0.0057	< 0.002
1,2,4-Trichlorobenzene	0.0042	< 0.002

RESULTS CONTINUED

Table 7 Continued: Test Results for the Landfill Gas Flare on 10th June 2021

Gaseous Constituent	Flame Off	Flame On
Volatile Organic Compounds (Continued)	**(mg/Nm³)**	**(mg/Nm³)**
1,3-Dichlorobenzene	0.013	< 0.002
1,4-Dichlorobenzene	0.021	< 0.002
Hexachlorobutadiene	< 0.002	< 0.002
Naphthalene	< 0.002	< 0.002
Tetradecane	< 0.002	< 0.002
Dimethyl decane	< 0.002	< 0.002
Dimethyl nonane	0.055	< 0.002
Octane	0.036	< 0.002
Limonene	0.0085	< 0.002
Ethyl ether	0.17	< 0.002
Nonane	0.034	< 0.002
Pentamethyl heptane	0.078	< 0.002
Aldehydes	**(mg/Nm³)**	**(mg/Nm³)**
Acetaldehyde	0.53	< 0.002
Acrolein	0.040	< 0.002
n-Heptaldehyde	0.0091	< 0.002
n-Hexaldehyde	0.0076	< 0.002
n-Nonaldehyde	0.0084	< 0.002
n-Octaldehyde	0.012	< 0.002
Amines	**(mg/Nm³)**	**(mg/Nm³)**
Methylamine	0.053	< 0.002
Dimethylamine	0.0084	< 0.002
Trimethylamine	< 0.002	< 0.002
Ethylamine	0.0026	< 0.002
Diethylamine	< 0.002	< 0.002
Triethylamine	< 0.002	< 0.002

CALCULATION OF DESTRUCTION & REMOVAL EFFICIENCY

The Destruction & Removal Efficiency (DRE) of gaseous constituents in a flare can be calculated as follows:

$DRE = (1 - (W_o/W_i)).100\ \%$

where W_i = feed rate of gaseous constituent
and W_o = emission rate of gaseous constituent.

It was only possible to calculate the DRE of gaseous constituents in cases where the concentration could be quantified with both the flare on and the flare off. This was the case with three parameters, which are given in Table 8 below.

Table 8: Destruction & Removal Efficiency (DRE) of Gaseous Constituent in the Landfill Gas Flare

Gaseous Constituent	Flare Off		Flare On		DRE
	Concentration in Feed	Feed Rate W_i	Concentration in Emission	Emission Rate W_o	
Odour[d]	190,000 OU	230,000 OU/min	200 OU	3,000 OU/min	98.7%
Hydrogen sulfide	193 mg/Nm³	232 mg/min	0.23 mg/Nm³	3.2 mg/min	98.6%
Toluene	3.1 mg/Nm³	3.7 mg/min	0.0027 mg/Nm³	0.038 mg/min	99.0%

CALCULATION OF GAS RETENTION TIME

The retention (residence) time of gaseous constituents in the flare was calculated using the effective volume of the flare chamber (post-burner) and the gas flow rate in the flare.

The effective volume of the flare chamber is calculated as follows:

Distance from flare to chamber exit (h) = 3.10m
Radius of chamber (r) = 0.230m
Volume of chamber = $\pi r^2 h = \pi$ x $(0.230m)^2$ x 3.10m = $0.515m^3$.

The wet gas flow rate in the chamber was $25m^3/min$ at 175°C = $0.42m^3/s$.

Hence the gas retention time determined in the flare at 175°C was $\frac{0.515m3}{0.42m3/s}$ = 1.2 seconds.

This is twice the required gas retention time. However, at 760°C the gas flow rate would be greatly increased, leading to a significant decrease in the gas retention time, as calculated below:

The wet gas flow rate in the chamber was $0.42m^3/s$ at 175°C.
At 760°C, the wet gas flow rate = $0.42\ x\ \frac{(273+760)}{(273+175)}$ = 0.97 m^3/s.

The gas retention time at 760°C = $\frac{0.515m3}{0.97m3/s}$ = 0.53 seconds.

[d] Odour concentrations are determined on a wet basis at STP. The wet gas flow rate at STP is used when calculating the odour emission rate.

DISCUSSION

The landfill gas flare achieved the required destruction and removal efficiency of 98% during testing conducted on 10th July 2021.

Whilst the flare was ignited, a temperature of 854°C was measured at a height of approximately 0.5m above the flame. However, the flare temperature dropped to an averaged 175°C at the sampling plane. It should be noted that this is a flare and not a controlled air combustion chamber. As such, a large quantity of cooling air is permitted to enter the flare after combustion manner and rapidly cool the combustion gases.

Based on the gas flow conditions determined at the sampling plane (0.42m^3/s at 175°C, wet), a gas retention time of 1.2 seconds was calculated. This is double the required gas retention time of 0.6 seconds. However, when the gas flow rate is adjusted to a temperature of 760°C, the gas retention time is reduced to 0.53 seconds.

A much larger supply of gas would be required for the flare to achieve a minimum temperature of 760°C throughout the chamber. It is understood that only about 20% of the annual waste received by the landfill is organic, meaning that the production of landfill gas is currently quite limited. If available, the combustion of additional landfill gas in the flare would increase the average temperature along its length, but this would also reduce the gas retention time in the chamber.

DOC21/744241

Mr John Wilkinson and Mr Tony Willsallen
Bald Hill Quarry Pty. Limited
Hume Highway
JUGIONG NSW 2726

Attention: Ms Belinda Fourie

Email: safety@baldhillquarry.com.au

27 August 2021

Dear Ms Fourie,

Bald Hill Regional Landfill – EPL 2552

Gas Flare Performance, Stormwater Management and Bench Slumping

I refer to Environment Protection Licence (EPL) 2552, held by Bald Hill Quarry Pty Limited (the Licensee) for Bald Hill Quarry (the Premises). I also refer to your correspondence to the Environment Protection Authority (EPA) dated 30 June 2021 addressing non-compliances identified in the Independent Environmental Audit (the IEA) by GHD Pty Ltd in November 2020.

The EPA has reviewed the information provided and provides the following advice.

Stormwater Management and Bench Slumping

The IEA identified concerns regarding the slumping of in-situ granite material above the benches of the landfill which has resulted in surface water entering the landfill void. The EPA understands that the Licensee considers stormwater management to be operating effectively in this area. However, the Licensee has also acknowledged that a sediment pond in this catchment has been removed and has raised safety concerns in repairing the slumped benches due to bench instability.

Clean water entering the landfill void increases the volume of leachate generated that then needs to be managed. The EPA considers it appropriate for the Licensee to obtain specialist advice regarding bench stability issues.

The EPA reminds you that as per Conditions O1 and O2 of the licence, licensed activities must be carried out in a competent manner, and all plant and equipment must be maintained in a proper and efficient condition. This includes all clean water diversions and erosion and sediment controls. In addition, Condition O5.7 of the licence requires all surface drainage works to be installed and maintained around the top benches of the quarry void. The design of these works must be documented in the LEMP. In that regard, the EPA requires the Licensee to:

1. Engage a suitably qualified person/s to:
    a. undertake an assessment of the relevant area taking into consideration the upcoming liner works and design capacity of surface water management systems
    b. propose corrective actions to ensure clean water is diverted away from the landfill and the relevant conditions of the licence are complied with. This should include any required amendments to the LEMP.
2. Nominate the dates by which each of the identified corrective actions will be implemented.

The EPA requests an update on the progress of these works by 15 December 2021.

Gas Flare

The Licensee is required to operate a landfill gas flare to destroy volatile organic compounds and odours from landfill gas generated in the waste mass at the Premises. The landfill gas flare is required to meet certain parameters specified under the *Protection of the Environment (Clean Air) Regulation 2010* (the Clean Air Regulation) to ensure it effectively destroys odours and volatile organic compounds released from the landfill. Specifically, the Clean Air Regulation requires the flare to comply with either or both requirements relating to:

1. residence time and temperature (Clause 50 and 51)
2. destruction efficiency (Clause 52).

The IEA identified the flare system operated at the Premises did not comply the conditions of the consent. Specifically, these conditions state:

1. the flare must destroy 98% of Volatile organic compounds, air toxics and odour; and
2. the flare system must be ground level, shrouded with greater than or equal to 0.6 seconds retention time at greater than or equal to 760^{oC}. The flare system must be provided with automatic combustion air control, automatic shutoff gas valve and automatic re-start system.

The Licensee has since provided the EPA with sampling results which demonstrate that the flare is achieving the destruction efficiency required under Clause 52 of the Clean Air Regulation. In that regard, the EPA advises that we can support a modification of consent to amend the existing conditions relating to the flare consistent with the Clean Air Regulation. The EPA recommends that the Licensee liaises with the relevant planning consent authority regarding this matter.

If you require any further information regarding this matter, please contact me on (02) 6229 7002 or by email to info@epa.nsw.gov.au.

Yours sincerely

CARLIE ARMSTRONG
Unit Head Regulatory Operations