NSW Site Auditor Scheme

Site Audit Statement

A site audit statement summarises the findings of a site audit. For full details of the site auditor's findings, evaluations and conclusions, refer to the associated site audit report.

This form was approved under the *Contaminated Land Management Act 1997* on 12 October 2017.

For information about completing this form, go to Part IV.

Part I: Site audit identification

Site audit statement no. 0301-2203

This site audit is a:

❑ statutory audit

☑ non-statutory audit

within the meaning of the *Contaminated Land Management Act 1997*.

Site auditor details

(As accredited under the *Contaminated Land Management Act 1997*)

Name	James Davis		
Company	Enviroview Pty Ltd		
Address	PO Box 327		
	GLADESVILLE NSW	Postcode	2110
Phone	0467 375 481		
Email	james.davis@enviroview.com.au		

Site details

Address	Lot 206 DP 1265922 (Stage 2C)		
	5 Johnston Crescent		
	HORSLEY PARK, NSW	Postcode	2175

Property description

(Attach a separate list if several properties are included in the site audit.)

Lot 206 in DP 1265922

Local government area	Fairfield City Council
Area of site (include units, e.g. hectares)	5.05 Ha
Current zoning	IN1 –General Industrial under Fairfield Local Environmental Plan Amendment (Western Sydney Employment Area) 2009

Regulation and notification

To the best of my knowledge:

❑ **the site is** the subject of a declaration, order, agreement, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985,* as follows: (provide the no. if applicable)

- ❑ Declaration no.
- ❑ Order no.
- ❑ Proposal no.
- ❑ Notice no.

☑ **the site is not** the subject of a declaration, order, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*.

To the best of my knowledge:

❑ the site **has** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*

☑ the site **has not** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*.

Site audit commissioned by

Name	Wayne Pasalich		
Company	CSR Building Products Limited		
Address	Triniti 3, 39 Delhi Road,		
	NORTH RYDE, NSW	Postcode	2113
Phone	02 9964 1784		
Email	WPASALICH@csr.com.au		

Contact details for contact person (if different from above)

Name

Phone

Email

Nature of statutory requirements (not applicable for non-statutory audits)

- ❑ Requirements under the *Contaminated Land Management Act* 1997 (e.g. management order; please specify, including date of issue)

- ❑ Requirements imposed by an environmental planning instrument (please specify, including date of issue)

- ❑ Development consent requirements under the *Environmental Planning and Assessment Act 1979* (please specify consent authority and date of issue)

- ❑ Requirements under other legislation (please specify, including date of issue)

Purpose of site audit

❑ **A1** To determine land use suitability

Intended uses of the land:

OR

☑ **A2** To determine land use suitability subject to compliance with either an active or passive environmental management plan

Intended uses of the land: Commercial/industrial

OR

(Tick all that apply)

❑ **B1** To determine the nature and extent of contamination

❑ **B2** To determine the appropriateness of:

- ❑ an investigation plan
- ❑ a remediation plan
- ❑ a management plan

❑ **B3** To determine the appropriateness of a **site testing plan** to determine if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*

❑ **B4** To determine the compliance with an approved:

- ❑ **voluntary management proposal** or
- ❑ **management order** under the *Contaminated Land Management Act 1997*

❑ **B5** To determine if the land can be made suitable for a particular use (or uses) if the site is remediated or managed in accordance with a specified plan.

Intended uses of the land:

Information sources for site audit

Consultancies which conducted the site investigations and/or remediation:

DLA Environmental, ERM Australia, Biogas Systems Australia, DBD Environmental

Titles of reports reviewed:

DLA Environmental Services (June 2013). *Phase 1 Preliminary Environmental Site Assessment, Lot 1 in DP 106143 CSR Building Products 327-335 Burley Road, Horsley Park.* Reference DLH1121_H0000033, dated June 2013. (DLA, June 2013)

DLA Environmental Services (September 2013). *Phase 2 Detailed Environmental Site Assessment, Lot 1 in DP 106143 CSR Building Products 327-335 Burley Road, Horsley Park.* Reference DLH1121_H0068, dated September 2013. (DLA, September 2013)

DLA Environmental Services Pty Ltd (DLA) (February 2018). *Stage 1 and Stage 2 February 2018 Site Status – 327-335 Burley Road, Horsley Park, NSW 2175*. Report No. DL3109_S008131, dated 22 February 2018. (DLA, February 2018)

ERM (December 2018). *Addendum to Remediation Action Plan: Bund Wall Remediation Strategy, 327 – 335 Burley Road, Horsley Park, NSW 2175.* Reference 0449086_S009295, dated 7 December 2018. (ERM, December 2018)

ERM (December 2019). *Remediation Action Plan, 327-335 Burley Road, Horsley Park NSW 2175.* Reference S010173, dated 20 December 2019. (ERM, December 2019)

Biogas Systems Australia (November 2020). *LFG Management Plan, Environmental Management Plan for Landfill Gas, Horsley Park Landfill*. Reference: 0103_RPT0076.D, dated 13 November 2020. (BSA, 2020)

ERM (August 2021). *Landfill Gas Risk Assessment, Horsley Logistic Park, 327-335 Burley Rd, Horsley Park NSW 2175*. Reference S011005_0565895, dated 10 August 2021. (ERM, August 2021)

ERM (September 2021). *Validation Report, Stage 2C, 3 Johnston Crescent, Horsley Park NSW 2175.* Reference 0449086_S011259, dated 27 June 2022. (ERM, May 2022)

Site audit report details

Title	Site Audit Report, Lot 206 in DP 1265922 (Stage 2C), 5 Johnston Crescent Horsley Park NSW
Report no.	600105_0301-2203
Date	28 June 2022

Part II: Auditor's findings

Please complete either Section A1, Section A2 or Section B, not more than one section. (Strike out the irrelevant sections.)

- Use **Section A1** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **without the implementation** of an environmental management plan.
- Use **Section A2** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **with the implementation** of an active or passive environmental management plan.
- Use **Section B** where the audit is to determine:
    - (B1) the nature and extent of contamination, and/or
    - (B2) the appropriateness of an investigation, remediation or management plan[1], and/or
    - (B3) the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or
    - (B4) whether the terms of the approved voluntary management proposal or management order have been complied with, and/or
    - (B5) whether the site can be made suitable for a specified land use (or uses) if the site is remediated or managed in accordance with the implementation of a specified plan.

[1] For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

~~Section A1~~

~~I certify that, in my opinion:~~

~~The **site is suitable** for the following uses:~~

(Tick all appropriate uses and strike out those not applicable.)

- ☐ ~~Residential, including substantial vegetable garden and poultry~~
- ☐ ~~Residential, including substantial vegetable garden, excluding poultry~~
- ☐ ~~Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~
- ☐ ~~Day care centre, preschool, primary school~~
- ☐ ~~Residential with minimal opportunity for soil access, including units~~
- ☐ ~~Secondary school~~
- ☐ ~~Park, recreational open space, playing field~~
- ☐ ~~Commercial/industrial~~
- ☐ ~~Other (please specify):~~

_____

OR

- ☐ ~~I certify that, in my opinion, the **site is not suitable** for any use due to the risk of harm from contamination.~~

~~Overall comments:~~

_____

_____

_____

_____

_____

Section A2

I certify that, in my opinion:

Subject to compliance with the **attached** environmental management plan[2] (EMP), the site is suitable for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

☐ ~~Residential, including substantial vegetable garden and poultry~~

☐ ~~Residential, including substantial vegetable garden, excluding poultry~~

☐ ~~Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~

☐ ~~Day care centre, preschool, primary school~~

☐ ~~Residential with minimal opportunity for soil access, including units~~

☐ ~~Secondary school~~

☐ ~~Park, recreational open space, playing field~~

☑ **Commercial/industrial**

☐ ~~Other (please specify):~~

_____

~~EMP details~~

Title:	LFG Management Plan, Environmental Management Plan for Landfill Gas, Horsley Park Landfill. Document Reference 0103_RPT0076.D.		
Author:	Biogas Systems Australia		
Date:	13 November 2020	No. of pages	48 (incl. cover)

EMP summary

This EMP (attached) is required to be implemented to address residual contamination on the site.

The EMP: (Tick appropriate box and strike out the other option.)

☐ ~~requires operation and/or maintenance of **active** control systems~~[3]

☑ requires maintenance of **passive** control systems only[3].

[2] Refer to Part IV for an explanation of an environmental management plan.
[3] Refer to Part IV for definitions of active and passive control systems.

Purpose of the EMP:

The EMP was developed with respect to the landfill gas at the former Camide landfill to ensure protection of the surrounding properties including the subject Site Audit site.

To ensure the protection of the surrounding land users the EMP which relates to the management of the former landfill site, located to the west of the subject Site Audit site, prescribes monitoring, reporting and further mitigation actions (if required), to manage the risks to the surrounding land users.

Description of the nature of the residual contamination:

Landfilling activities on the adjacent land to the Site Audit site occurred between 1990 and 1994 with an estimated 950,000 m^3 of waste material placed within a former quarry. It was reported that commercial and industrial wastes were primarily received, however some putrescible wastes are also considered likely to also be present. A Landfill Closure Plan (LCP) was developed in 1999 and included an RAP which provided details of landfill assessment activities and key findings in relation to landfill gas. The landfill site is regulated by the NSW EPA under an Environmental Protection Licence (EPL) (EPL #123). The EPL includes monitoring requirements for the landfill.

The landfill has undergone assessment and investigation since the LCP was implemented. Remediation options were developed and remediation works undertaken to manage landfill gas emissions. A landfill gas monitoring well network was established around the former landfill, with quarterly monitoring of selected wells occurring as part of the EPL #123. A biofiltration trench was constructed around the remainder of the landfill between July 2018 and May 2019 and results from post-installation monitoring at perimeter locations outside of the biofiltration trench in May 2019 indicate a reduction of methane concentrations to below 1 % v/v. A Landfill Gas Risk Assessment was undertaken regarding the Site Audit site which has confirmed very low risk to the Site Audit site.

While no specific land use or development constraints for the Site Audit site has been identified, given the proximity of the landfill and relatively limited timeframe of consistent monitoring, ongoing landfill gas monitoring and routine risk-based assessment of monitoring results is required within the landfill site to ensure mitigation measures, including the installed biofiltration trench continue to be effective, and that the migration of landfill gas does not pose a risk to surrounding properties including the Site Audit site.

Summary of the actions required by the EMP:

Ongoing monitoring at the landfill site will comprise:

- Quarterly monitoring of gas concentrations in all nominated monitoring wells using a calibrated landfill gas monitor (Geotech GA5000 Landfill Gas Analyser or similar). Landfill gas concentrations and gas flow rates will be collected so that an assessment of landfill gas regime and performance of the landfill gas mitigation measures can be made. Groundwater levels will also be gauged and recorded during this monitoring event;

- Quarterly grid-based monitoring of the former landfill surface including biofiltration trench will be undertaken using a calibrated sensitive landfill gas detector (for example RKI Eagle Multi-Gas Monitoring); and

- Quarterly monitoring of enclosed structures (namely utility/service pits) within the landfill site will be undertaken using a calibrated sensitive landfill gas detector (for example RKI Eagle Multi-Gas Monitoring).

A summary table providing details of the various threshold/assessment criteria to be adopted for the evaluation of monitoring data is clearly set out within the EMP.

Monitoring protocols are set out in the EMP for each type of data collection (service pits, sub-surface gas and ambient air/surface monitoring) at the landfill site to ensure consistent monitoring approaches are adopted. The EMP outlines that all monitoring data will be collated and reported on a quarterly basis with recommendations provided, as needed. Upon completion 12 months of monitoring, an annual review and report will be prepared to summarise landfill gas conditions and determine future monitoring/management requirements at the site.

The EMP noted that if reportable environmental conditions are detected during any monitoring event, immediate corrective action will be required. Corrective actions are set out within the EMP.

How the EMP can reasonably be made to be legally enforceable:

While the requirements of the EMP are not specifically included in the EPL, ongoing monitoring is a requirement and subject to ongoing regulation by the NSW EPA.

In addition, there will exist a contract for sale of the land with specific provision for the Vendor (CSR) to undertake all obligations relating to the contamination of the site. The provision in the contract will operate as a Deed following completion of the Sale and will enable the Purchaser to seek specific performance of that agreement regarding the obligations imposed by the EMP.

How there will be appropriate public notification:

This Site Audit Statement with the EMP attached will be provided to Fairfield City Council, a reference to this Site Audit Statement must be recorded on the s 10.7 Planning Certificate as is required under the guidelines to the SEPP (Resilience and Hazards) 2021 (previously SEPP 55).

Interested parties will have access to the information on the planning certificate on application, including reference to this Site Audit Statement. When land is bought or sold in NSW the *Conveyancing Act 1919* and *Conveyancing (Sale of Land) Regulation 2010* requires that a s 10.7 Planning Certificate be attached to the contract of sale for the land.

~~**Overall comments:**~~

Section B

Purpose of the plan[4] which is the subject of this audit:

_____

_____

_____

I certify that, in my opinion:

(B1)

☐ The nature and extent of the contamination **has** been appropriately determined

☐ The nature and extent of the contamination **has not** been appropriately determined

AND/OR (B2)

☐ The investigation, remediation or management plan **is** appropriate for the purpose stated above

☐ The investigation, remediation or management plan **is not** appropriate for the purpose stated above

AND/OR (B3)

☐ The site testing plan:

☐ **is** appropriate to determine

☐ **is not** appropriate to determine

if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*

AND/OR (B4)

☐ The terms of the approved voluntary management proposal* or management order** (strike out as appropriate):

☐ **have** been complied with

☐ **have not** been complied with.

*voluntary management proposal no.

_____

**management order no.

_____

AND/OR (B5)

☐ The site **can be made suitable** for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

☐ Residential, including substantial vegetable garden and poultry

[4] For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

- ☐ Residential, including substantial vegetable garden, excluding poultry
- ☐ Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry
- ☐ Day care centre, preschool, primary school
- ☐ Residential with minimal opportunity for soil access, including units
- ☐ Secondary school
- ☐ Park, recreational open space, playing field
- ☐ Commercial/industrial
- ☐ Other (please specify):

IF the site is remediated/managed* in accordance with the following plan (**attached**):

*Strike out as appropriate

Plan title

Plan author

Plan date No. of pages

SUBJECT to compliance with the following condition(s):

Overall comments:

Part III: Auditor's declaration

I am accredited as a site auditor by the NSW Environment Protection Authority (EPA) under the *Contaminated Land Management Act 1997.*

Accreditation no. 0301

I certify that:

- I have completed the site audit free of any conflicts of interest as defined in the *Contaminated Land Management Act 1997,* and
- with due regard to relevant laws and guidelines, I have examined and am familiar with the reports and information referred to in Part I of this site audit, and
- on the basis of inquiries I have made of those individuals immediately responsible for making those reports and obtaining the information referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete, and
- this statement is, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties under the *Contaminated Land Management Act 1997* for wilfully making false or misleading statements.

Signed

Date 28 June 2022

Part IV: Explanatory notes

To be complete, a site audit statement form must be issued with all four parts.

How to complete this form

Part I

Part I identifies the auditor, the site, the purpose of the audit and the information used by the auditor in making the site audit findings.

Part II

Part II contains the auditor's opinion of the suitability of the site for specified uses or of the appropriateness of an investigation, or remediation plan or management plan which may enable a particular use. It sets out succinct and definitive information to assist decision-making about the use or uses of the site or a plan or proposal to manage or remediate the site.

The auditor is to complete either Section A1 or Section A2 or Section B of Part II, **not** more than one section.

Section A1

In Section A1 the auditor may conclude that the land is *suitable* for a specified use or uses OR *not suitable* for any beneficial use due to the risk of harm from contamination.

By certifying that the site is *suitable*, an auditor declares that, at the time of completion of the site audit, no further investigation or remediation or management of the site was needed to render the site fit for the specified use(s). **Conditions must not be** imposed on a Section A1 site audit statement. Auditors may include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

Section A2

In Section A2 the auditor may conclude that the land is *suitable* for a specified use(s) subject to a condition for implementation of an environmental management plan (EMP).

Environmental management plan

Within the context of contaminated sites management, an EMP (sometimes also called a 'site management plan') means a plan which addresses the integration of environmental mitigation and monitoring measures for soil, groundwater and/or hazardous ground gases throughout an existing or proposed land use. An EMP succinctly describes the nature and location of contamination remaining on site and states what the objectives of the plan are, how contaminants will be managed, who will be responsible for the plan's implementation and over what time frame actions specified in the plan will take place.

By certifying that the site is suitable subject to implementation of an EMP, an auditor declares that, at the time of completion of the site audit, there was sufficient information satisfying guidelines made or approved under the *Contaminated Land Management Act 1997* (CLM Act) to determine that implementation of the EMP was feasible and would enable the specified use(s) of the site and no further investigation or remediation of the site was needed to render the site fit for the specified use(s).

Implementation of an EMP is required to ensure the site remains suitable for the specified use(s). The plan should be legally enforceable: for example, a requirement of a notice under the CLM Act or a development consent condition issued by a planning authority. There should also be appropriate public notification of the plan, e.g. on a certificate issued under s.149 of *the Environmental Planning and Assessment Act 1979*.

Active or passive control systems

Auditors must specify whether the EMP requires operation and/or maintenance of active control systems or requires maintenance of passive control systems only. Active management systems usually incorporate mechanical components and/or require monitoring and, because of this, regular maintenance and inspection are necessary. Most active management systems are applied at sites where if the systems are not implemented an unacceptable risk may occur. Passive management systems usually require minimal management and maintenance and do not usually incorporate mechanical components.

Auditor's comments

Auditors may also include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

Section B

In Section B the auditor draws conclusions on the nature and extent of contamination, and/or suitability of plans relating to the investigation, remediation or management of the land, and/or the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or whether the terms of an approved voluntary management proposal or management order made under the CLM Act have been complied with, and/or whether the site can be made suitable for a specified land use or uses if the site is remediated or managed in accordance with the implementation of a specified plan.

By certifying that a site *can be made suitable* for a use or uses if remediated or managed in accordance with a specified plan, the auditor declares that, at the time the audit was completed, there was sufficient information satisfying guidelines made or approved under the CLM Act to determine that implementation of the plan was feasible and would enable the specified use(s) of the site in the future.

For a site that *can be made suitable*, any **conditions** specified by the auditor in Section B should be limited to minor modifications or additions to the specified plan. However, if the auditor considers that further audits of the site (e.g. to validate remediation) are required, the auditor must note this as a condition in the site audit statement. The condition must not specify an individual auditor, only that further audits are required.

Auditors may also include **comments** which are observations in light of the audit which provide a more complete understanding of the environmental context to aid decision-making in relation to the site.

Part III

In **Part III** the auditor certifies their standing as an accredited auditor under the CLM Act and makes other relevant declarations.

Where to send completed forms

In addition to furnishing a copy of the audit statement to the person(s) who commissioned the site audit, statutory site audit statements must be sent to

- the **NSW Environment Protection Authority**: nswauditors@epa.nsw.gov.au or as specified by the EPA

  AND

- the **local council** for the land which is the subject of the audit.

LFG Management Plan

Environmental Management Plan for Landfill Gas, Horsley Park Landfill

CSR Building Products Limited

Job ID. 0103

PROJECT NAME:	Environmental Management Plan for Landfill Gas, Horsley Park Landfill
JOB ID:	0103
DOCUMENT CONTROL NUMBER	0103_RPT0076.D
PREPARED FOR:	CSR Building Products Limited
APPROVED FOR RELEASE BY:	Dr Ben Dearman

DOCUMENT CONTROL

VERSION	DATE	COMMENT	PREPARED BY	REVIEWED BY
A	02.09.2020	Updated for Auditor Review	Mitchell Browne	Jack Horan
B	13.11.2020	Final	Mitchell Browne	Jack Horan

DISCLAIMER

Biogas Systems Australia acts in all professional matters as a faithful advisor to the Client and exercises all reasonable skill and care in the provision of its professional services.

Reports are commissioned by and prepared for the exclusive use of the Client. They are subject to and issued in accordance with the agreement between the Client and Biogas Systems Australia. Biogas Systems Australia is not responsible for any liability and accepts no responsibility whatsoever arising from the misapplication or misinterpretation by third parties of the contents of its reports.

Except where expressly stated, Biogas Systems Australia does not attempt to verify the accuracy, validity or comprehensiveness of any information supplied to Biogas Systems Australia for its reports.

Where site inspections, testing or fieldwork have taken place, the report is based on the information made available by the client or their nominees during the visit, visual observations and any subsequent discussions with regulatory authorities. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Biogas Systems Australia is both complete and accurate. It is further assumed that normal activities were being undertaken at the site on the day of the site visit(s), unless explicitly stated otherwise.

CONTENTS

TABLES

EXECUTIVE SUMMARY

The objective of this Environmental Management Plan (EMP) is to provide a landfill gas (LFG) management plan that can be enforced to ensure protection of surrounding land users from the former Camide Landfill. To achieve the objective of the EMP the following aspects of LFG management will be addressed to ensure ongoing suitability of the neighbouring sites for commercial/industrial land use including:

- Monitoring and management of subsurface emission in the perimeter well network
- Monitoring and management of surface emissions form the landfill cap and biofiltration trench (BT)
- Monitoring and management of service pits and enclosed spaces on the landfill and adjacent to the landfill (where possible).

The investigations completed to date include installation of a perimeter monitoring network and regular monitoring of LFG conditions at the boundary of the former Camide Landfill. The implementation of a gas interception biofiltration trench was initially installed along the western boundary of the landfill in June 2005 and after the success of this trial, was extended around the entire perimeter of the landfill. The construction of the biofiltration trench around the remainder of the landfill was commenced in July 2018 and completed in May 2019.

Results of the post installation monitoring at perimeter locations outside of the BT in May 2019 and subsequent monitoring indicate a reduction of methane concentrations to below the threshold concentration of 1%v/v. This monitoring confirmed the effectiveness of the northern portion of the BT in the direction of the closest commercial / industrial land user.

To ensure the protection of the surrounding land users this EMP has been developed, which prescribes monitoring, reporting and further mitigation actions (if required). To manage the risks to the surrounding land users, the monitoring of service pits and enclosed spaces (stormwater pits), surface emissions (landfill cap and BT), subsurface migration and water levels (perimeter monitoring) is required. These monitoring activities will not only assess the risk to the surrounding land users but also provide data for ongoing validation of the effectiveness of the BT at mitigating lateral migration of gas from the landfill.

The monitoring of these locations will be completed quarterly, compared against threshold criteria sourced from the Hazardous Ground Gas (NSW 2019) guidelines and reported both quarterly and annually. In the event that a threshold criterion is exceeded for methane or an increasing carbon dioxide trend is observed, additional investigation will be required to determine the course of action which may range from increased monitoring frequency to notification of the regulatory authorities in the event of explosive conditions or acute human health risk.

The site owner (currently CSR Building Products Limited) is the responsible party for ensuring the EMP is executed and the objectives of the EMP are met which is detailed in a legal clause as part of the contract for sale of the closest adjacent properties to the north, south and west of the Former Camide Landfill.

The intent of the EMP is to continue monitoring for at least a period of 24 months from commencement and reassess the stability of landfill gas generation and migration and there is no longer a risk to surrounding land users.

1 INTRODUCTION

This Environmental Management Plan (EMP) has been prepared to document the management and monitoring requirements for the former Camide Landfill (Figure 1) to demonstrate that the landfill gas does not present a risk to surrounding off-site properties.

There is an existing EMP which is part of the contract for sale "Pursuant to clause 38.3 of sale contract dated 9 March 2018 between CSR Building Products Limited and Australand C & I Land Holdings (Australand) as Trustee for Frasers Property C & I Land Holdings (Horsley Park No 2) Trust in respect of the sale of Lots 101 & 102, 327 – 335 Burley Road, Horsley Park CSR Building Products. This previous EMP was written to address the requirements to monitor and manage the risk between the Former Camide Landfill and the Stage 1 development.

As part of the development of an EMP to monitor and manage the risk between the Former Camide Landfill and the Stage 2 development the original Environmental Management Plan (EMP) (Ref 0103 BSA RPT0075.C) was expanded on to include the additional monitoring requirements for Stage 2. This will result in two EMPs for the Former Camide Landfill site which will need to be administered by CSR. For the purpose of implementation, this EMP covers the requirements of the original EMP for Stage 1 plus the additional requirements for Stage 2. This meets the objective of the client to maintain the existing EMP under its contractual requirements with Australand and Horsley Park No 2 whilst meeting the additional management requirements for Stage 2 and the contractual requirements with ESR Australia.

The current EMP (this documents) details the monitoring requirements, roles, responsibilities, reporting requirements and enforceability to ensure that LFG emissions do not impact human health and the environment of surrounding properties both Stage 1 and Stage 2.

1.1 Background

Camide operated a non-putrescible solid waste landfill at the Horsley Park site from 1990 to 1994. The landfilling took place in a quarry void created by clay extraction activities. It has been estimated that 950,000 m^3 of waste was imported to the site in an area of 4.1ha of the site as indicated in Figure 1.

At the completion of landfilling in 1994 the waste was capped with a 1m thick compacted clay layer and a 500mm thick revegetation/landscaping layer in accordance with the Landfill Closure Plan (LCP) (EGIS 1999). At the time of the capping and closure of the landfill the surrounding land users were the other active parts of the quarry activities to the north and the east and open rural land use which bounds the landfill to the west and the south.

Since the capping activities there has been significant site development and regional development of the land surrounding the landfill into commercial industrial land uses. This development has resulted in the encroachment of commercial / industrial development to the north of the northern boundary of the former Camide Landfill. Surrounding land use to the west, south and east have not significantly changed since implementation of the LCP.

The planned commercial / industrial development to the east and south of the landfill is proposed within 250m of the inferred extent of waste. The historical monitoring of perimeter wells at the former Camide Landfill site indicated that hazardous ground gases may potentially migrate laterally which could potentially impact adjacent off-site land users of the Stage 1 and Stage 2 development.

The remedial solution which was designed for the site included a biofiltration trench (BT) to mitigate fugitive gas emissions by oxidation. The trench is installed around the entire perimeter of the former Camide Landfill and is extend into groundwater to 9m in some sections.

As part of the post remediation validation monitoring of LFG wells outside of the BT has been undertaken since May 2019 which report that the lateral migration of fugitive emissions from the former Camide Landfill is being

managed. Generation of LFG and migration pathways of LFG can change over time and the relatively small timeframes for monitoring need to be addressed to ensure that conditions have not changed.

During the final installation of the BT some wells were damaged or were in close proximity to the trench which may be influencing the gas concentrations and flow reported during the monthly spot monitoring. As part of the Stage 2 development to the east and south of the landfill ten additional LFG wells and one background LFG location were established to ensure that the perimeter spacing along the eastern and southern boundary of the landfill was approximately 20m. The background LFG location is a sufficient distance from the landfill and is shown on Figure 4.

The development of this EMP is to assist in the long term monitoring of the LFG generation and migration pathways to ensure that the neighbouring properties are protected.

1.2 EMP Objectives

The objective of the EMP is to provide a landfill gas management plan that will be enforced to ensure protection of surrounding land users from the former Camide Landfill.

To achieve the objective of the EMP the following aspects of LFG management will be addressed to ensure ongoing suitability of the neighbouring sites for commercial/industrial land use including:

- Monitoring and management of subsurface emissions in the perimeter well network
- Monitoring and management of surface emissions from the landfill cap and the biofiltration trench
- Monitoring and management of emissions in service pits and enclosed spaces on the landfill and adjacent to the landfill (where possible).

2 SITE OVERVIEW

2.1 Site Description

2.1.1 Location

The site is located at 327 to 335 Burley road, Horsley Park (refer Figure 1). The site is currently identified as Lot 103 of Deposited Plan 1214912 (Historically - Lot 1 Deposited Plan 1228114) based on SIX maps (*maps,six.nsw.gov.au* – accessed 12.11.2020). The landfill site is a part of a larger portion of land which is subject to development plan DA97 – 1085. The landfill is located in the south western corner of the site. A summary of site details is presented in Table 1.

Table 1 – Site Details

Item	Description
Site name and address	Former Camide Landfill, 327 to 335 Burley Road, Horsley Park, NSW 2175
Real property description	Current property description is Lot 103 of Deposited Plan 1214912 as identified in SIX maps (Historically - Lot 1 Deposited Plan 1228114) The EPL details refer to Lot 2 DP 1228114.
Current site owner	CSR Building Products Ltd
Surrounding Allotments	Lots 101, 102 (Stage1 Development) and 103 (Stage 2 Development), 327 – 335 Burley Road, Horsley Park These lots are currently identified in six maps as DP1259616 Lot 202, DP1264857 Lot 301 and DP1214912 Lot 103 respectively
Operational timeframe	Landfilling between 1990 – 1994
Area	Approximately 4.1 hectares
Volume	Approximately 950,000 m^3
Depth	Total waste thickness is estimated to approximately 18 m below ground surface
Waste composition	No putrescible wastes recorded only commercial and industrial*

* Waste disposal records were not available to review in the previous LCP therefore the potential presence of some putrescible wastes exists.

2.1.2 Surrounding Land Use

The land use of the surrounding area is summarised in Table 2.

Table 2 - Surrounding Land Uses

Direction	Use
North	Stage 1 development area. Further to the north is commercial/industrial
South	Stage 2A development area. Rural land with open pasture further to the south.
East	Stage 2C development area (future commercial). Rural land use and market gardens further east
West	Pasture with commercial/industrial land use further to the west

2.2 Site History and Management

As detailed in the background in Section 1 the site was utilised as a quarry prior to 1990. Landfilling activities commenced in 1990 and ceased in 1994 with an estimated 950,000 m^3 of fill placed in the former quarry. The LCP was prepared in accordance with the requirements of the deferred Commencement Conditions 1 to 3 of DA97 – 1085 and in the NSW EPA Guidelines in effect at the time.

2.2.1 Landfill Closure Plan

The Landfill Closure Plan (LCP) (EGIS 1999) was developed for the site in 1999, which outlined ongoing monitoring to be undertaken and stabilisation criteria for the cessation of LFG monitoring. The LCP was prepared in accordance with the requirements of the deferred Commencement Conditions 1 to 3 of DA97 – 1085 and in accordance with the NSW EPA Guidelines in effect at the time. The original Remediation Action Plan (RAP) was presented within the LCP (EGIS 1999) based on several environmental investigations undertaken prior to 1999 which are referenced in Section 6. The current RAP for Stage 2 was developed in 2014 and amended in 2019 to reflect current site conditions (*Ref: Remediation Action Plan. Lot 1 in DP 106143, CSR Building Products, 327 – 335 Burley Road, Horsley Park. (Revised September 2019*)

2.2.2 Environment Protection Licence (EPL) #123

In addition to the LCP an Environment Protection Licence (EPL) #123 is active for the site and regulated by the EPA. The EPL outlines monitoring requirements, maximum scale and load limit for particular contaminants relating to these activities. The EPL for the site is currently active for the following scheduled activities:

- Ceramic works.
- Crushing, grinding or separating.
- Extractive activities.
- Mining for minerals.

In addition to these activities, the EPL addresses monitoring and reporting requirements for the landfill. There has been extensive monitoring of groundwater, leachate, landfill gas since the commencement of the LCP and as part of the EPL which are referenced in Section 6. The objective of the EPL is to regulate specific activities and although useful data is collected the has a different objective.

It should be noted that at the time of writing this EMP, an application is with the NSW EPA (Notice No. 1570706) to surrender the EPL on a section of the site. The application aims to surrender the EPL for Lots 101 and 102 of the EPL#123 from lot 103 (now identified at Stage 1, Stage 2 and Stage 3) of which a portion of this is the Former Camide Landfill.

2.2.3 Remedial History

The landfill has undergone years of assessment since the closure of the landfilling activities and has since been monitoring the LFG emissions and implemented gas migration controls for the identified LFG at the site. Table 3 below gives a brief history of the activities undertaken on the site to date.

Of all the activities and investigation completed to date the most significant is the implementation of a gas interception biofilter and trench was installed along the western boundary of the landfill in June 2005. It was installed as a trial to assess the validity of this type of gas mitigation solution (Dever 2009). Quarterly monitoring of wells GM1-GM11 was undertaken from October 2006 in accordance with EPL #123. Monitoring wells GM12-GM32 were installed in July 2017 to monitoring the lateral migration of LFG from the site. The trial was confirmed a success in the 2009 report and was then adopted for the balance of the landfill perimeter.

The construction of a biofilter and trench around the remainder of the landfill was commenced in July 2018 and completed in May 2019. As part of the Stage 1 and Stage 2 developments additional investigation location have been added at the perimeter of the former Landfill to ensure the spacing is adequate to continue to monitor the potential for fugitive emissions.

Table 3 – Site History Chronology of Activities

Date	Detail
1994	Landfill ceased. Base of landfill RL 58.0m AHD. Volume of void estimated at 950,000 m3 based on a plan of the excavated void and a plan of final landform of the Camide landfill (Egis Consulting Australia Pty Limited, April 1999)
October 1998	Development consent for continued quarrying, landfilling and site remediation granted in Land and Environment Court with conditions that a Landfill Closure Plan be developed and implemented for the pre-existing Camide landfill
October 1998	Investigation of the Camide landfill commenced: thickness and construction of landfill capping layer assessed using test pits (thickness varied from 200 mm to 800 mm). Past groundwater monitoring reviewed. Surface and sub-surface gas measured. Additional groundwater wells installed to the full depth of the landfill.
August 1999	LCP proposes upgrading of landfill capping layer, installation of landfill gas monitoring wells, and a landfill gas monitoring program to complement the groundwater monitoring program. This was reflected in the EPA licence, which included these monitoring locations as a variation dated 22/6/2001. These points were monitored monthly, waters were reduced the quarterly in July 2002.
June 2000	Landfill capping upgraded according to LCP. Consequences were reduced surface gas emissions but increased sub-surface gas migration.
May 2001	EPA require investigation of the levels of leachate and landfill gas being generated by the decomposing waste present in the landfill, Pollution Reduction Program (PRP) added to EPL 123.
October 2002	Development application for conventional landfill gas management in accordance with EPA requirements submitted to Fairfield Council.
December 2003	DA consent granted from Fairfield Council to install gas extraction and flaring system. Local residents objected on grounds of noise, visual aesthetics and emissions, leading to alternative treatments being sought.
November 2004	Proposal to investigate passive biofiltration system submitted to EPA.
March 2005	Trial biofilter added to EPL123 PRP
June 2005	Stage 1 trial construction of gas interception biofilter and trench along western boundary of landfill. Gas readings were monitored until March 2006. Average gas in GM7 prior to installation 37.5%; 0.6% after installation. Report on stage 1 submitted to EPA.
April 2006	Application is made to the EPA regarding decreasing monitoring to quarterly due to the stabilisation of the landfill; variation of the licence is dated August 2006.
October 2006	Full scale version of trench constructed and PRP regarding the trench removed from the EPL.
October 2006 to Present	Monitoring undertaken quarterly as required by EPL 123 (VGT)
October 2013	Mulch replaced over biofilter trench, repairs to observation wells.
July 2017	Landfill gas wells GM12 – GM32 installed by DLA
August 2017 - ongoing	Landfill gas monitoring of GM12 – GM32 undertaken by DLA/ERM
July 2018 to May 2019	Remainder of biofiltration trench constructed
June 2019	Landfill Gas Risk Assessment of Stage 1 completed. This report includes review of the data which was collected for the validation of the effectiveness of the BT
September 2020	Landfill Gas Risk Assessment of Stage 2 completed. This report includes review of the data which was collected for the validation of the effectiveness of the BT

2.3 Environmental Setting

The environmental setting and surrounding environment are detailed in the LCP (EGIS 1999), RAP (DLA 2017) report with summary information also provided in the LFGRA (DLA 2017) report which are referenced in Section 6. These conditions were further investigated and refined in two LFGRA which assess the risk to Stage 1 (2019 BSA) and Stage 2 (DBD 2020) which immediately adjoin the former Camide Landfill. The site setting includes the wider background of the setting which includes the quarry operations (by PGH Bricks & Pavers), the surrounding adjacent sites and the former Camide Landfill (specifically Landfill Gas). A summary of the key information from these reports is provided in the following sections.

2.3.1 Regional Geology

The 1:100,000 Soil Landscape Sheet for Penrith (9030, 1989) shows the landform to comprise the Blacktown Unit with gently undulating rises on Wianamatta Group bedrock with slopes usually <5% and broad round hill crests.

The Blacktown Unit is described as a 'Residual Landscape'. The soils of this unit comprise hard setting, mottled texture contrast soils, including shallow (<1.5m) red and brown podsols on the crests, grading to deeper (>2m) yellow podsols on the lower slopes and near drainage lines. This unit is associated with known salinity and dispersive hazard, particularly in lower slopes and streamlines where soils have the potential to become waterlogged.

2.3.2 Site Specific Geology

Previous investigations have indicated that the Site contains red podzolics with brown silty to clay loam topsoils and dark red sub plastic medium clay subsoils which are in turn underlain by weathered sandstone, shale and siltstone bedrock encountered at depths ranging from 0.9 to 5.2 metres.

2.3.3 Hydrology and Hydrogeology

The structural and textural characteristics of the Bringelly Shale underlying the Site and of the Wianamatta Group determine the hydrological regime of the region. Claystones, siltstones and sandstones underlying the Site are of negligible porosity and permeability due to the fine-grained nature and the degree of intergranular cementation. Groundwater in these formations is stored and migrates principally through fractures and joints.

Surface clays derived from the weathering and alteration of the Bringelly Shale form a capping layer over the underlying and less weathered rock mass restricting infiltration and groundwater recharge. The limited groundwater recharge and low permeability results in poor flushing of the rock mass, leaving connate salts within the sediments. As a result, high salinity and low yield are a common trait of the groundwater within the Wianamatta bedrock.

The distribution of groundwater levels across the entire Site does not form a consistent pattern, locally the groundwater levels are influenced by the quarry voids. Overall a gradient exists in a north-westerly direction towards Ropes Creek. Typically, groundwater levels at the Site vary between 2 and 10 metres below existing natural ground levels.

2.3.4 Landfill Gas

Previous investigations of LFG at the Camide Landfill site have found elevated concentrations of landfill gases in perimeter wells at the south, north and eastern perimeter. Methane gas was measured in excess of 1%v/v (DLA 2016) which therefore does not comply with the investigation criteria. In response to these exceedances additional investigations including a Remediation Action Plan (DLA 2017) and installation of a biofiltration trench (BT) around the perimeter of the waste mass has been executed and validated along the northern boundary by three rounds of monitoring data (5th April 2019, 17th April 2019 and the 10th May 2019). It should be noted that the western portion of the BT was previously validated by Dever (2009) and the southern and eastern portions of the trench have only one round of validation monitoring.

Results of the post installation monitoring at perimeter locations outside of the BT in May 2019 indicate a reduction of methane concentrations to below the threshold concentration of 1%v/v. The subsequent

monitoring of the northern portion of the BT undertaken by Biogas Systems on the 22nd May 2019 and 19th June 2019 confirmed the effectiveness of the BT as reported in Stage 1 Landfill Gas Risk Assessment Horsley Park 2019. This monitoring confirmed the effectiveness of the northern portion of the BT in the direction of the closest commercial / industrial land user.

In order to assess the gas migration (pathways) from the former landfill (source) to the Stage 2 development (receptor) newly installed perimeter wells were installed and monitored in an intensive six-week program. The risk assessment undertaken relies predominantly on the data gathered from the continuous monitoring locations and six weeks of spot monitoring of the new and relevant existing LFG wells. In addition to this intensive investigation, historical spot monitoring and groundwater level data has been utilised where it is deemed suitable for this risk assessment.

The data gaps addressed in this assessment include the re-establishment of a perimeter well spacing of 20m through additional locations and replacement of wells, more thorough investigation of conditions utilising continuous gas monitor, confirmation of borehole flow using a GFM, dipping of groundwater wells on multiple occasions to gain an understanding of groundwater elevation respective to the biofiltration trench and investigation of the effectiveness of the biofiltration trench.

Under current site conditions LFG at the Stage 1 and Stage 2 developments are not considered to pose an unacceptable risk to on-site human receptors. The LFG risk between Stage 1 and Stage 2 and the former Camide Landfill was determined to be Low (CS2) based on the Level 2 risk analysis and assessments completed for each adjoining site. There are no current sources on the Stage 1 and Stage 2 sites (except for CO2 in validated geotechnical fill). The only plausible pathways and therefore potential risk is only fully realised when ground gas can migrate beneath or through the biofiltration trench.

The surveyed depth of the trench is known from as constructed drawings, confirmation of the current perimeter well network elevation and depth in meters Australian Height Datum has been identified as a data gap requiring future work. The current assessment of the depth of groundwater and the depth of the biofiltration trench has been calculated using as constructed survey (relative levels) and field measurements meters below ground surface. More accurate confirmation of these elevations will provide more certainty that migration beneath the biofiltration trench is not occurring.

The Level 1 risk analysis and assessment identified services in proximity to the landfill as a potential receptor with a moderate qualitative risk. The services present on the Camide landfill are limited to stormwater which is collected along the western boundary and discharged by gravity to the north of the Stage 1 devleopment. This is the only plausible pathway for gas migration through services from the former Camide Landfill. There are no proposed or existing services between Stage 2 and the former Camide Landfill.

Based on the findings of this landfill gas risk assessment, the risk of landfill gas migration from the former Camide Landfill onto the Stage 1 and Stage 2 developments and causing harm to human health is considered low and no specific development constraints have been identified with the exception of ensuring that the buildings are constructed with a reinforced concrete ground-bearing foundation raft slab with limited service penetrations cast into slab.

3 LANDFILL GAS MANAGEMENT

3.1 Introduction

Landfill gas is being generated from the landfill and has the potential to migrate for a period of 10-20 years at levels that may cause harm to human health of the environment. Although significant investigations and remediation to prevent lateral migration (specifically the Biofiltration Trench) has been completed, the gas mitigation measure should be validated, and site conditions assessed over time.

The long-term monitoring of LFG is required to account for changing site conditions, climatic conditions and any natural disasters that may alter the effectiveness of the gas mitigation measures.

The term 'hazardous ground gas' is applied to both gases and vapours that may be present within the pore space of soils and rocks and may impact adversely upon human health and safety or the integrity of structures and may consequently affect activities such as the construction and management of buildings. Such gases or vapours may be of natural or anthropogenic origin.

The ground gases that are generally of concern in this context are:

- Methane, carbon dioxide, carbon monoxide, petroleum vapours, hydrogen, hydrogen sulphide, radon, volatile organic compounds (VOCs).

Of concern at the former Camide Landfill is the presence of methane and carbon dioxide in high concentrations.

- Methane (CH_4) is a flammable gas that is explosive in the concentration range 5–15% v/v in air (somewhat different ranges may apply in atmospheres with enhanced or reduced oxygen concentrations). It is also potentially an asphyxiant if its presence results in a low oxygen concentration. It is less dense than air and has a distinct odour.
- Carbon dioxide (CO_2) is an asphyxiant and toxic gas that is significantly denser than air and is odourless.

This EMP is the document to assist stakeholders manage landfill gas and ensure the performance of the gas mitigation measures until evidence suggest there is no longer a risk to surrounding land users.

3.2 Regulatory Requirements

The following laws, and relevant associated regulatory instruments, have been considered in the preparation of this EMP.

- Protection of the Environment Operations (POEO) Act 1997.
- Environment Planning and Assessment (EP&A) Act 1979.
- Contaminated Land Management (CLM) Act 1997.

The site is no longer an operating landfill, however, still maintains an EPL. The proposed screening criteria for the objective of this EMP is to provide a landfill gas management plan that will be enforced to ensure protection of surrounding land users from the former Camide Landfill. Therefore, the application of screening criteria from the Assessment and Management of Hazardous Ground Gases (NSW 2019) are the most applicable for the assessment of risk to surrounding sites posed by the former landfilling activities.

3.2.1 Environmental and Safety Plans

It is acknowledged that there are environmental and WHS risks associated with any works completed within the landfill site. This EMP has not specifically outlined the requirements for management of future potential civil works which may include excavation for maintenance and installation of services as these risks vary depending on the scope of works. The management of these future works will be required to be addressed in a standalone Construction Environmental Management Plan (CEMP) prepared by a suitably qualified

consultant or contractor specific to the works. The CEMP will include associated safety and environmental management requirements associated with ground disturbance activities with particular reference to hazardous gases, confined space, reinstatement and rectification or cap and the biofiltration trench as required. Any changes to site conditions will need to be reflected in an updated EMP to ensure risk is properly managed and monitored.

3.3 LFG Migration Controls

3.3.1 Landfill Cap

A landfill cap consisting of 1m clay and 0.5m landscaping material has been constructed at the site. The purpose of the cap is to reduce infiltration and reduce surface gas emissions. The landfill cap should be maintained to ensure continued performance. Performance of the cap will be assessed through surface monitoring and inspections as outlined below.

3.3.2 Perimeter Biofiltration Trench

The biofiltration trench should be maintained to ensure continued performance. This includes topping up the trench with coarse mulch as required and ensuring that the biofiltration media remains moist, particularly during the drier months. Monitoring and management of the biofiltration trench should be conducted in accordance with the handbook for the design, construction, operation, monitoring and maintenance of a passive landfill gas drainage and biofiltration system (NSW DECC, 2010). Performance of the biofiltration trench will be assessed through surface monitoring and inspection as outlined below.

3.4 Adopted Threshold Criteria

The following table outlines the adopted threshold criteria to be applied to subsurface, surface and biofiltration trench emissions and enclosed space monitoring. The summary Table 4 below highlights the key criteria and the section below detail each aspect of monitoring.

Table 4 – Subsurface Gas Monitoring Locations

Aspect	Parameter	Threshold (NSW EPA 2019)
Subsurface	Methane (CH4)	1 %v/v
	Carbon dioxide (CO2)	1.5%v/v above historical
	Carbon monoxide (CO)	5ppm (Limit of Instrument error)
	Hydrogen sulphide (H2S)	5ppm (Limit of Instrument error)
	Water Level	Depth to water exceed the total
Surface Emissions	Methane (CH4)	500ppm (0.05%v/v)
	Windspeed	10 km/h
Biofiltration Trench	Moisture (Hand Squeeze)	50-60% Moisture*
Enclosed Space Monitoring	Methane (CH4)	1%v/v
	Carbon dioxide (CO2)	1.5%v/v
	Carbon monoxide (CO)	5ppm (Limit of Instrument error)
	Hydrogen sulphide (H2S)	5ppm (Limit of Instrument error)

*Field test commonly used in composting, refers to requirements in the handbook for Biofiltration (NSW DECCW, 2010)

3.5 Subsurface Gas Monitoring (Perimeter LFG Wells)

3.5.1 Requirements

The perimeter well network was established to monitor the lateral migration of LFG from the landfill. Post installation of the BT these perimeter wells act as trigger wells to monitor the effectiveness of the gas mitigation

measure. These perimeter wells are required to be operational to monitor the effectiveness of the trench and inform future landfill gas risk assessments if possible.

3.5.2 Objectives

The objective of the subsurface gas monitoring is to detect lateral migration of landfill gas across the biofiltration trench and measure the potential risk to off-site properties.

3.5.3 Monitoring Locations

Subsurface monitoring should be undertaken on all landfill gas monitoring wells for the Camide Landfill however the specific wells required to monitor conditions which may impact Stage 2 are outlined in Table 5 below. Monitoring locations are shown on Figure 2. Subsurface monitoring should be undertaken in accordance with NSW EPA *Environmental Guidelines: Solid Waste Landfill* (SWLG 2016).

Table 5 – Subsurface Gas Monitoring Locations

Well ID	Inside or Outside Trench
GM1	Outside
GM6	Outside
GM7	Outside
GM8	Outside
GM9	Outside
GM10	Outside
GM12	Outside
GM13	Outside
GM13A	Outside
GM14	Outside
GM15	Outside
GM15A	Outside
GM17	Outside
GM18	Outside
GM20	Outside
GM21	Inside**
GM22	Inside**
GM23	Outside
GM25	Outside
GM26	Outside
GM27	Outside
GM28	Inside**
GM29	Inside**
GM30	Outside
GM31	Outside
GM32	Outside
GM33	Outside
GM34	Outside
GM35	Outside
GM36	Outside
GM37	Outside
GM38	Outside

Well ID	Inside or Outside Trench
GM39	Outside
GM40	Outside
GM41	Outside
GM42	Outside
GM43	Outside / Background
GM44	Outside

'**' These wells are included in the monitoring program to provide data over time of the landfill gas conditions. They are not to be assessed against the threshold criteria for action due to their location on the inside of the biofiltration trench.

The condition of each LFG well should be noted on field forms and confirmation as operational or not for the purpose of LFG monitoring. In the event that a monitoring well becomes unsuitable for purpose then the replacement of the monitoring wells should be considered with respect to the overall coverage of the monitoring network.

3.5.4 Landfill gas analyser

Monitoring subsurface wells with a GA5000 LFG gas analyser (or equivalent) will be used to assess concentration of typical landfill gas constituents listed below in Table 6. The performance specification of the LFG analyser is presented in Table 6 below. The monitoring procedure for landfill gas well monitoring and bump test quality control requirements are provided in Appendix D.

Table 6 – Specification for handheld gas monitors

Range	CH_4	0 - 70% to specification, 0-100% reading		
	CO_2	0 - 40% to specification, 0-100% reading		
	O_2	0 - 25%		
	CO	0 – 200 ppm		
	H_2S	0 – 200 ppm		
	Flow	± 3.0 L/hr		
	Pressure	± 4.0 mb		
Typical accuracy	**Gas**	**0-5 %v/v**	**5-15 %v/v**	**15 %- Full Scale (FS)**
	CH_4	±0.5%	±1.0%	±3.0%
	CO_2	±0.5%	±1.0%	±3.0%
	O_2	±1.0%	±1.0%	±1.0%
	Gas		**0-FS**	
	CO (0 – 500 ppm version)		±10.0% FS	
	CO (0 to 2000 ppm, H_2 compensated version)		±10.0% of reading or 15 ppm, whichever is greater	
	H_2S (0 - 200 ppm)		±10.0% FS	

Table 7 – Subsurface Gas Monitoring Parameters

Parameter	Unit of Measurement
Methane (CH_4)	%v/v
Carbon dioxide (CO_2)	%v/v
Carbon monoxide (CO)	ppm
Hydrogen sulphide (H_2S)	ppm
Oxygen (O_2)	%v/v
Flow rate	Litres/hour
Pressure	mb (equivalent to Hpa)
Water level	mbgl

Table 8 – Subsurface Gas Monitoring Threshold

Parameter	Threshold (NSW EPA 2019)
Methane (CH_4)	1 %v/v
Carbon dioxide (CO_2)	1.5%v/v above historical background levels or above the identified background level reported in GM43 (Appendix B)
Carbon monoxide (CO)	5ppm (Limit of Instrument error)
Hydrogen sulphide (H_2S)	5ppm (Limit of Instrument error)
Water Level	Depth to water exceed the total depth of the biofiltration trench

In the event that a threshold concentration is exceeded this will trigger additional investigation in the form of data interrogation (QA/QC) and potentially resampling of the location(s) that exceeded the threshold. The background levels for carbon dioxide have been taken from the post BT installation or the highest reported background CO2 concentration reported at GM43 as shown in the table in Appendix B. The initial screening assessment against adopted criteria provides the first pass investigation of the gas conditions. Following the screening assessment results are to be plotted against historical and assessed for increasing trends. In the event of an increasing trend for LFG constituent's further investigation into the risk this increasing concentration will have on the adjacent Stage 2 development and occupants.

The water level threshold is a secondary indicator of the BT effectiveness and should be considered with gas concentration reported at the same location. In the event that gas concentration has exceeded threshold criteria and show a reported increasing trend comparison of trench invert levels and standing water levels mAHD should be reviewed. More intensive monitoring of groundwater conditions may be required to determine the period that a potential pathway exists beneath the BT.

This increased risk (if identified) could result in a Tier 3 risk assessment with Vapour Intrusion (VI) modelling or fast tracking future contingency measures of implementing an active gas extraction system.

The timing of the monitoring and frequency of the monitoring events is outlined in Table 9.

Table 9 – Subsurface Gas Timing and Frequency

Action Item	Frequency	Timing
Subsurface gas monitoring	Quarterly	February, May, August, November

The quarterly monitoring should continue for a period of 24 months following the implementation of this EMP. After a period of 24 months a review of the LFG trend should indicate a stable or reducing concentration trend for both methane and carbon dioxide and have reported below 1%v/v and 1.5%v/v (or established background) respectively for a period of 24 months.

In the event that a well(s) is reported dry at total depth an investigation of well integrity and weekly investigation of water levels and gas concentrations should be undertaken to assess the risk of off-site migration and effectiveness of the BT. If the well(s) experiences extended dry conditions a landfill gas risks assessment should be undertaken to determine the effectiveness of the BT and reassess the potential LFG risk to surrounding land users.

3.5.5 Reporting

Quarterly and annual reporting requirements as outlined in Section 5.

If methane concentrations exceed 1.25 %v/v (25% of the lower explosive limit) in the perimeter wells during monitoring, reporting to EPA is required as outlined in Section 60(4) of the CLM Act requires a person who has a duty to report contamination to notify the NSW EPA.

In the event that corrective actions are required reporting in the form of individual reports detailing the investigations undertaken will be submitted to the Project Manager, Site Owner and passed on to the appropriate regulatory authorities and notification to adjacent property owners where required.

3.5.6 Corrective / Contingency Actions

If methane concentrations exceed 1%v/v and other LFG constituents (CO2, H2S, CO) report data that represents an increasing trend within perimeter monitoring wells. an increase in testing frequency should be undertaken. The initial response will be to increase testing frequency based on a review of the data by the Environmental Consultant. Indicatively the initial assessments would be daily until stabilised then return to quarterly.

If exceedances of landfill gases are persistent and an increasing concentration trend is established over a period of three consecutive monitoring events this will trigger an update to the 2017 LFG Risk Assessment for the Camide Landfill (DLA, 2017), Stage 1 LFG Risk Assessment (DBD 2019) and Stage 2 LFG Risk Assessment (DBD 2020) to address the potential risk to off-site receptors. A landfill gas risk assessment should be undertaken in accordance with Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases (NSW 2019) to determine additional LFG mitigation options.

Notifications will be made to the adjacent property owners/management if an update of the Stage 1 LFGRA and Stage 2 LFGRA is required (i.e. increasing concentrations trend and off-site service monitoring is required)

If a potential risk to off-site land uses is identified (via increasing trend in the perimeter monitoring wells over three consecutive events) in the routine monitoring or subsequent follow up monitoring of the off-site services, mitigation measures should be implemented in accordance with recommendations of the updated landfill gas risk assessment.

3.6 Surface Gas and Biofiltration Trench Monitoring

3.6.1 Requirements

The landfill has been capped to reduce water infiltration and vertical landfill gas migration. To ensure the ongoing performance of the cap, monitoring and maintenance is required.

3.6.2 Objectives

The objective of the surface gas monitoring is to demonstrate that the landfill cap is effective in controlling the emission of landfill gas and reducing infiltration. Monitoring the surface of the landfill should locate any point sources that may be emitting landfill gas.

3.6.3 Performance Indicators

- Methane concentrations do not exceed 500 ppm
- No large cracks or erosion noted
- Biofilter media in good condition, at correct moisture levels and has not subsided

3.6.4 Monitoring Requirements

Surface monitoring should be undertaken on the landfill in accordance with SWLG 2016 and EPL 123. Biofiltration trench monitoring should be undertaken in accordance with the handbook for the design, construction, operation, monitoring and maintenance of a passive landfill gas drainage and biofiltration system (NSW DECCW, 2010)

3.6.5 Surface and utility pit gas analyser

Surface gas monitoring should be undertaken with a device with a detection sensitivity for methane of less than 100 ppm. An RKI Eagle 2 or TDL 500 instrument (or equivalent) is the preferred instrument with the required detection limit. Preferred instrument specification is summarised in Table 10 and the units of measurements and threshold for further investigation are outlined in Table 11. The monitoring procedure for surface walkover is outlined below and the bump test requirements are provided in Appendix D.

Table 10 – Surface gas analyser specification

Item	Range
Response Time, T90	CH4 - 4.5 seconds T10 standards: 2 seconds with suction rod T90: 6 seconds with suction rod T10: < 3.5 seconds
Gases Measured	CH4 by laser spectroscopy
Range	CH4 - 0-10,000 ppm and 0 ppm to 100% gas volume
ATEX	II 2G Ex ib IIB T4
CE	94/9/CE directive dated March 23rd 1994

During the surface gas and biofiltration trench walkover the wind conditions should be gathered using a handheld anemometer and recorded frequently on field notes.

Table 11 – Surface Gas Monitoring Parameters and Threshold

Parameter	Unit of Measurement	Threshold (NSW 2019)
Methane (CH_4)	ppm or %v/v	500ppm (0.05%v/v)
Windspeed	km/h	10 km/h
Moisture (Hand Squeeze)	-	50-60% Moisture*

*Hand squeeze methodology is not a threshold regulated in the NSW EPA 2019 guidelines or in the biofiltration handbook (DECCW 2010). This is a field test used in composting to easily determine moisture content of a similar media to the material present in the biofiltration trench.

The criteria for rainfall should be considered and noted if rainfall occurs prior to the surface emissions investigation. Although these are recommended values, they are not always achievable in period of dropping barometric pressure and need to be considered during the reporting phases. The timing of the monitoring and frequency of the monitoring events is outlined in Table 12.

Table 12 – Surface Emissions Timing and Frequency

Action Item	Frequency	Timing
Surface gas monitoring	Quarterly	February, May, August, November

3.6.6 Surface Walkover Monitoring Procedure

Methane should be tested in the atmosphere 50mm above the landfill surface in areas with intermediate or final cover/capping. Testing should be conducted in a grid pattern across the landfill surface at 25-metre spacings. Depressions in the cover material, or surface fissures away from the sampling grid, should also be investigated. The monitoring should be performed on calm days (winds below 10 kilometres/hour) and preferably during periods of relatively low and stable atmospheric pressure (e.g. less than 101.3 kPa). The procedure above is based on the surface emissions monitoring section of '*Environmental Guidelines: Solid Waste Landfill*' 2016.

3.6.7 Biofiltration Monitoring and Management

The following procedure for management and monitoring of the biofiltration trench has been taken from the NSW Department of Environment, Climate Change and Water 'Handbook *for the design, construction, operation, monitoring and maintenance of a passive landfill gas drainage and biofiltration system*' (March 2010). Monitoring should occur quarterly plus after significant rainfall events e.g. > 20 mm of rainfall. Monitoring should also occur more regularly during drought to check the moisture levels of the biofilter media. Regular monitoring should include:

A regular inspection of the biofilter to assess the following:

- odours from the biofilter.
- condition of the biofilter media including settlement, formation of a surface crust, scouring, and / or desiccation of the media.
- moisture content of the upper layers of the biofilter media.
- ponding of water on the surface of the biofilter media.
- condition of vegetation growing on the biofilter surface, including weeds / unwanted vegetation; and
- condition of surface water management measures.

Monitoring of the following:

- composition and flow of landfill gas from the passive drainage system(s) to the biofilter(s) emissions / flux from the surface of the biofilter (methane and carbon dioxide).
- moisture content of the upper layers of the biofilter media, particularly in a dry / hot climate / drought condition; and
- depth of drainage water in the gas distribution layer / biofilter media.

The hand squeezed method for moisture determination is commonly used in the organics processing industry.

The simple method is as follows:

- Take a tennis ball sized sample of the organic material in your hand. Be aware of sharp objects.
- Squeeze the organic material like a firm handshake.
- Open your hand and inspect the organic material.

Results - If free water is released the organic material is too wet. If the organic material crumbles and falls apart it is too dry. If the organic material stays together the moisture content is correct (50-60%).

Maintenance of a passive gas drainage and biofiltration system is dependent on the results of monitoring and may involve the following:

- drainage of water from the aggregate gas distribution layer if the biofilter is in box / above ground or lined
- maintaining vegetation growth on the biofilter media e.g. mowing, trimming, weed removal and disposal
- topping up the media to overcome media settlement, if required

- turn / fork upper layer of media, as required, when / if a crust forms
- addition of a wetting agent to the biofilter media (upper layers), if found to not be holding water
- replacement of the upper layers of the biofilter media, if the crust too hard to break up and / or a wetting agent does not work.

Replacement of the biofilter media, if required, as determined by monitoring. Indicators may include:

- reduced biofilter performance i.e. methane oxidation rate
- large / excessive settlement, which may adversely affect media porosity and subsequently gas and water movement through the biofilter media
- ponding of water on the surface of the biofilter, which may indicate clogging and
- clogging of the biofilter media, which may be due to settlement, microbial growth or EPS formation, and which may adversely affect media porosity and subsequently gas and water movement through the biofilter media.

The biofilter media should be pre-mixed off site (at the source / producer of the materials) and delivered to site immediately prior to placement in the biofilter, to minimise construction time and storage on site, and consequently minimise potential odours or contamination of stormwater runoff.

Excavated waste should be disposed of immediately after excavation at an approved waste disposal site. Landfilled waste should not be stockpiled on the site.

3.6.8 Reporting

Quarterly and annual reporting requirements as outlined in Section 5.

In the event that corrective actions are required reporting of in the form of individual reports detailing the investigations undertaken will be submitted to the Project Manager, Site Owner and passed on to the appropriate regulatory authorities where required.

3.6.9 Corrective Actions

If methane concentrations exceed 500 ppm corrective action is required. Initial response is to complete additional walkovers with increased frequency (initially daily until conditions report below the adopted criteria). Flux (emissions) monitoring would then be conducted to quantify emission rates and help identify the extent of gas loss through the biofiltration trench.

The increase in methane concentrations above 500ppm at the surface may indicate a failure in the biofiltration media. After initial investigations the following actions, guided by the findings and observations of the biofiltration trench may include but not be limited to:

- Repairing or replacing cover material (spent biofiltration media).
- Repairing or replacing underlying porous material (clear any blockages).
- Adjustment or installation of landfill gas controls to extract and treat gas.

3.7 Gas Accumulation in Enclosed Structures

3.7.1 Requirements

Monitoring of the potential for LFG to accumulate in subsurface pits and enclosures (i.e. stormwater pits, telecommunication, power pits, irrigation pits etc) on or near the landfill to ensure gas is not accumulating to dangerous levels.

Landfill gas is primarily made up of methane, carbon dioxide, carbon monoxide and hydrogen sulphide and must not accumulate in buildings. Methane is explosive in the range of 5% to 15% (volume/volume), and landfill gas can be an asphyxiant in enclosed spaces.

3.7.2 Objectives

The objective of the subsurface structure gas monitoring is to monitor gas build up which may have the potential to be explosive risk on site and have the potential to migrate off-site to surrounding land users.

3.7.3 Performance Indicators

- Methane concentrations do not exceed 1 %v/v (NSW 2019)

3.7.4 Monitoring Requirements

Gas accumulation monitoring in enclosed structures monitoring should be undertaken in accordance with SWLG 2016 and the procedures outlined in Appendix D. Monitor potential gas accumulation in subsurface structures which do not have preventative measures installed. These monitoring points should include the stormwater pits which run to the north across into Stage 1 from the landfill site as shown on Figure 3 and Table 13 below. The monitoring procedure for landfill gas monitoring of enclosed structure and bump test quality control requirements are provided in Appendix D.

Table 13 – Enclosed structures identified for monitoring

Enclosed Structure ID	On-site Structure
SW1	On-site (Inside BT)
SW2	On-site (Outside BT)

The stormwater pits collect surface water from the landfill capping and direct waters into the initial collection pit (SW1) which is located beneath the surface on the inside of the BT. This pit is connected to the next pit (SW2) which is located in the detention basin to the north and then connects into a stormwater management system which moves to the north along the western boundary of the Stage 1 property to discharge near Burley Road.

It should be noted that the future plans indicate an adjacent road to the west of the landfill which will include services including, but not limited to, stormwater. These future locations should be included in updated versions of the EMP or noted and incorporated into the monitoring schedule.

3.7.5 Landfill gas analyser

Monitoring of utility pits with an LFG gas analyser (GA5000 or equivalent) will be used to assess concentration of typical landfill gas constituents. The performance specification of the LFG analyser is presented below in Table 14 and the units of measurement are provided in Table 15. The threshold for LFG gas concentrations in enclosed structures is presented in Table 16 with other gases to be recorded for information rather than a threshold for action.

Table 14 – Specification for handheld gas monitors

Range	CH_4	0 - 70% to specification, 0-100% reading		
	CO_2	0 - 40% to specification, 0-100% reading		
	O_2	0 - 25%		
	CO	0 – 200 ppm		
	H_2S	0 – 200 ppm		
	Flow	± 3.0 L/hr		
	Pressure	± 4.0 mb		
Typical accuracy	**Gas**	**0-5 %v/v**	**5-15 %v/v**	**15 %- Full Scale (FS)**
	CH_4	±0.5%	±1.0%	±3.0%

	CO_2	±0.5%	±1.0%	±3.0%
	O_2	±1.0%	±1.0%	±1.0%
	Gas		**0-FS**	
	CO (0 – 500 ppm version)		±10.0% FS	
	CO (0 to 2000 ppm, H_2 compensated version)		±10.0% of reading or 15 ppm, whichever is greater	
	H_2S (0 - 200 ppm)		±10.0% FS	

Table 15 – Enclosed Structure Gas Monitoring Parameters

Parameter	Unit of Measurement
Methane (CH_4)	%v/v
Carbon dioxide (CO_2)	%v/v
Carbon monoxide (CO)	ppm
Hydrogen sulphide (H_2S)	ppm
Oxygen (O_2)	%v/v

Table 16 – Enclosed Structure Gas Monitoring Threshold

Parameter	Threshold (NSW 2019)
Methane (CH_4)	1%v/v
Carbon dioxide (CO_2)	1.5%v/v
Carbon monoxide (CO)	5ppm (Limit of Instrument error)
Hydrogen sulphide (H_2S)	5ppm (Limit of Instrument error)

In the event that a threshold concentration is exceeded this will trigger additional investigation in the form of an initial data interrogation and resampling of the location(s) that exceeded the threshold. The timing of the monitoring and frequency of the monitoring events is outlined in Table 17.

Table 17 – Enclosed Gas Timing and Frequency

Action Item	Frequency	Timing
Enclosed structure gas monitoring	Quarterly	February, May, August, November

3.7.6 Reporting

Quarterly and annual reporting requirements as outlined in Section 5.

If methane concentrations exceed 1.25 %v/v (25% of the lower explosive level) in the enclosed structure during monitoring, reporting to EPA is required as outlined in Section 60(4) of the CLM Act requires a person who has a duty to report contamination to notify the NSW EPA.

In the event that corrective actions are required reporting of in the form of individual reports detailing the investigations undertaken will be submitted to the Project Manager, Site Owner and passed on to the appropriate regulatory authorities and adjacent property owners where required.

3.7.7 Corrective Actions

If methane concentrations exceed the adopted threshold criteria within enclosed structures, an increase in testing frequency should be undertaken. The increase in frequency should be determined based on a review of the data by the Environmental Consultant. Indicatively the initial assessments would be daily until stabilised then return to quarterly.

If exceedances of landfill gases are persistent and an increasing concentration trend is established there is a potential risk to off-site receptors. A landfill gas risk assessment should be undertaken in accordance with *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases (NSW 2019)* to determine additional LFG mitigation options.

If a potential risk to offsite land uses is identified, mitigation measures should be implemented in accordance with recommendations of and updated landfill gas risk assessment.

These may include application of proprietary products (sealants i.e Sikaflex) that seal the inside of pits alterations to the pit lids (i.e. fireproof mesh) and or ventilation.

3.8 Data Collection

To ensure the data collected is of sufficient quality and can be relied upon the works should be undertaken by a suitably qualified person. The methodologies for collection of data should be undertaken in accordance with SWLG 2016 and industry best practice.

All equipment used for the collection of data should have appropriate detection levels and accuracy for the monitoring undertaken. Calibration certificates and other quality assurance and quality control procedures undertaken should be documented and discussed in the annual report.

In preparation for each monitoring event weather conditions including rainfall, windspeed and barometric conditions before during and after each monitoring event should be downloaded from the Bureau of Meteorology (BOM). Specifically, BOM data should be collected from the nearest weather station (Badgerys Creek) that collects this data at the required frequency.

The required field forms to complete the field data collection are provided in Appendix C.

4 ROLES AND RESPONSIBILTIES

The roles and responsibilities for execution of the EMP is outlined in Table 18 below.

Table 18 – Roles and Responsibilities for the EMP

Responsible party	Task
CSR Building Products Limited (Site Owner)	Implementation of EMP including the following: ▪ Maintains ultimate responsibility for implementation of the EMP. ▪ Acknowledge that the EMP is an important document for the safe operation and management of the Site. Make an executive manager responsible for implementation. ▪ Appoint a project manager and an environmental consultant, to perform the necessary tasks as specified in the EMP. ▪ Provide this EMP to purchasers, tenants and contractors, or delegate this role to the owner's solicitor or agent. ▪ Ensure that potential future purchasers of the former Camide Landfill Site are aware of remediation works that have been undertaken and the need to develop their own ongoing management measures to ensure that the integrity of the gas mitigation system is not compromised and that there is no unacceptable risk to building occupants as a result of Hazardous Ground Gas (HGG) intrusion. ▪ Review plans for future works and associated method statements as required, to check that adequate environmental management measures are incorporated into the planning and are aligned with this EMP. ▪ Ensure monitoring works are being conducted and reported to the Site Auditor (if required) in compliance with the requirements included in this EMP. ▪ Maintenance of any site controls or protection measures which form part of this EMP. ▪ Maintenance of the document so that it continues to reflect the site conditions, best practice occupational health and safety recommendations and any changes to the regulatory framework ▪ Maintenance of the document so that it continues to reflect the site conditions, best practice occupational health and safety recommendations and any changes to the regulatory framework ▪ Submit reports to the appropriate regulatory authority or adjacent site owners where required. ▪ Notify the NSW EPA when required as outlined in Section 60(4) of the CLM Act.
Project Manager	▪ Provide competent and suitably qualified personnel for the investigation and/or monitoring of environmental matters. ▪ Liaise with the site owner on environmental management issues. ▪ Coordinate the activities of specialist sub-consultants, testing sub-contractors and project personnel with environmental assessment/monitoring responsibilities. ▪ Assess the suitability of specialist sub-consultants, testing organisations to carry out environmental assessment monitoring/responsibilities.
Environmental Consultant	▪ Undertake monitoring of landfill gas as outlined in this EMP to assess the integrity of the cap and gas mitigation system to validate that there is no unacceptable risk to site users as a result of HGG. ▪ Ensure QA/QC procedures according to the Australian Standards and NEPC guideline requirements are employed. ▪ The Environmental consultant will be complying with statutory requirements applicable to their work, reporting any incidents that may result health or environmental risk arising in connection with their work, and provide monitoring data to the Project Manager and Site Owner in a timely manner.

Responsible party	Task
	▪ Provide assessment reports the with recommendations, as required, based upon the results obtained during investigation / monitoring works.
Employees and Caretakers of the former Camide Landfill	▪ Notify the site owner or its representative of any situation which they consider may represent a potential health risk (such as unexpected finds). ▪ Respond to the directions of the site owner, project manager or other person with delegated authority with respect to environmental matters. ▪ Do not undertake any works (without the permission of the site owner) which may potentially cause environmental impacts (such as disturbance of the landfill capping layer).
Contractors and maintenance workers	▪ Subcontractors employed during any future works will have contractual obligations placed on them to comply with the EMP. As part of the tender briefing process, potential subcontractors should be made aware of their obligations to minimise the environmental impacts of their works. ▪ Subcontractors and suppliers will be required to attend inductions where specific environmental issues are addressed if deemed appropriate. They will be made aware of their requirements to adhere to the EMP in the induction program. ▪ Ensure that risks have been assessed and suitable control measures implemented where the site cap will be disturbed. ▪ Ensure the gas mitigation system and capping are protected during future works. ▪ Ensure that operatives are briefed on the presence of contaminated material below the cap and the potential for landfill gas in trenches, excavations, enclosed voids or within the gas mitigation system.

4.1 Enforcement of the EMP

The responsible party for execution of the EMP will be the site owner (currently CSR Building Products Limited) who will ensure that the works are undertaken and where required threshold exceedances acted upon. In addition to this responsibility the following legal enforceability is outlined in the sale of contract as detailed below.

"Pursuant to the sale contracts between CSR Building Products Limited and the owners of Stage 1 (DP1259616 Lot 202 and DP1264857 Lot 301) and Stage 2 (DP1214912 Lot 103). Trust in respect of the sale of Lots 101 & 102, 327 – 335 Burley Road, Horsley Park CSR Building Products Limited is:

1. responsible to perform any continuing obligations (including under the EMP) which relate to Lots 101, 102 (Stage1 Development) and 103 (Stage 2 Development), 327 – 335 Burley Road, Horsley Park These lots are currently identified in six maps as DP1259616 Lot 202, DP1264857 Lot 301 and DP1214912 Lot 103 respectively.

2. entitled to gain access to Lots 101, 102 & 103, 327 – 335 Burley Road, Horsley Park to enable it to discharge those obligations.

CSR Building Products Limited's rights and obligations continue until its obligations are discharged and, for clarity, do not end with settlement of its sale of Lots 101, 102 & 103, 327 – 335 Burley Road, Horsley Park."

4.2 Currency of the EMP

The site owner is responsible for the site conditions and management of the former Camide landfill to ensure that the EMP is executed and risk to surrounding land users does not exist. The validity of the EMP is to an extent based on the site conditions remaining stable as a closed landfill with regular monitoring and maintenance.

In the event that the site conditions change (i.e. additional development on the landfill) or conditions on adjacent and surrounding sites change (i.e. additional underground services, roads etc) there may be a

requirement to assess these changes in a LFG risk assessment. Any minor changes that occur should be reported in the annual report and may not require a complete update of the risk assessment, however if considered significant by the Environmental Consultant a recommendation to review the pathway in a formal risk assessment should be made.

4.2.1 Perimeter Monitoring Network

The suitability of the perimeter monitoring network should be reviewed annually to ensure that the objectives of the EMP are being met. Consideration should be given to replace lost/destroyed wells to ensure the currency of the EMP and adequacy of the perimeter monitoring network to meet the minimum requirements of the intent of this EMP. This should be undertaken during the annual review as outlined in Section 5.

5 REPORTING/REVIEW

5.1 General

Quarterly monitoring will be reported in a summary letter outlining the works completed, weather conditions and a summary of exceedances. The report will also include tabulated data and compared to the relevant threshold criteria and a figure of the surface walkover survey. The quarterly report will be issued to the Site Owner who should act on any exceedances (if required).

Annual reporting of landfill gas results should be undertaken and submitted to the Site Owner for review and action where required. This report should include presentation of results over the previous 12 months. Any trends or significant results should be highlighted and explained. A review of the methodologies employed, and quality of the data collected should be presented within the annual report. The annual reporting should include an assessment of the risks present at the site boundary as per assessment procedures set out in NSW EPA (2019). Ongoing assessment of the Gas Characterisation Score as measured at the boundary will be utilised as an assessment of potential risk to adjacent properties and site users. Annual review of the monitoring program with regards to site configuration (i.e. development) should be documented in this reporting to capture any significant changes to the site configuration.

Technical reports must be prepared and signed by appropriately qualified and experienced persons. The NSW EPA recognises the CEnvP (SC) and CPSS CSAM certifications as providing a thorough process for certifying contaminated land consultants to an acceptable minimum standard of competency.

5.2 Incident Reporting

The EPA shall be notified of any incident that represents a threat to the environment. If methane is detected at concentrations above 1 % (volume/volume), the occupier must notify the EPA promptly. Within 14 days of this notification, the owner of the site must submit a plan to the EPA for further investigation and/or remediation of the elevated gas levels.

If an acute or explosive risk from ground gases is suspected then immediate action, including contacting relevant emergency services, should be taken to address the risk. It is possible that during ground gas investigations, the presence of gas that is positively or tentatively identified as originating from leaks in gas mains or other services may be detected. In these circumstances the service provider and, if appropriate, the emergency services (NSW Police, NSW Fire and Rescue) should be notified immediately.

5.3 Emergency Contacts

In the event of an incident which has resulted in an acute risk to human health or explosion then dial triple zero to request the required assistance. For incidents that are not considered to put human health in imminent danger then the Project Manager and/or the Site Owner should be notified. Details of the Project Manager and Site Owner should be provided during the site induction.

The list of contacts in Table 18 below outlines the contact details which may be called upon or require notification in an emergency situation.

Table 19 – Emergency Contacts List

Service	Number
All life threatening emergencies	000 (triple zero)
NSW State Emergency Services (SES) – emergency in floods and storms	132 500
NSW Police Assistance – Non-life-threatening calls	131 444
Inner West Council – Emergency after hours:	02 9392 5000
Ausgrid – Power failure, power lines down	13 13 88
Jemena Gas	13 19 09

Service	Number
Sydney Water	13 20 90
Telstra	13 22 03
Optus	13 13 44

5.4 Current and Future Site Conditions

The landfill site is currently a dormant site with no development presently within the allotment with the exception of stormwater bunds, detention pond and associated pits and pipes. The surface capping and access roads are at final leaves and are currently unsealed.

There are no proposed plans to develop the former Camide Landfill site with the only potential change in conditions to improve the gas management or in the event that gas migration measures are required to be implemented (i.e. active LFG extraction system.

In the event that future development is proposed or an active gas extraction system was proposed the works would likely have already triggered an assessment of LFG risk for the risk to on-site users.

5.5 Review

Annually the Environmental Consultant shall review the environmental performance of the site (to be included in the annual report). The review should:

- Analyse the monitoring results and compare them against the relevant statutory requirements, limits or performance measures/criteria and monitoring results of previous years.
- Identify any non-compliance over the last year and describe what actions were or are being taken to ensure compliance.
- Identify any trends in the monitoring data.
- Outline any actions that are required to be implemented to improve environmental performance.
- Identify any additional activities on-site and adjacent to site that may impact LFG migration pathways.
- Confirm or update the previous Characteristic Situation (CS) based on the update Gas Screening Values.

If actions or conditions arise that have altered the conditions of the site, then an additional LFG risk assessment should be completed to assess the risk to surrounding off-site users. In the event that the results of an updated LFGRA require additional LFG mitigation measures (i.e. active extraction) then the EMP should be reviewed and updated to reflect the significantly changes site conditions.

In undertaking a revision of the current EMP the following must occur:

- The site owner must inform the adjacent site owners of the change in conditions.
- If required notify the relevant authorities for environmental and planning changes (including but not limited to NSW EPA and Council).

6 REFERENCES

Biogas Systems Australia (BSA) 2019 – Landfill Gas Risk Assessment, Stage 1 Horsley Park NSW.

Biogas Systems Australia (BSA) 2019 – Environmental Management Plan Landfill, Horsley Park NSW (Stage 1).

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DLA (2013) *Phase 2 Detailed Environmental Site Assessment, Lot 1 in DP 106143, CSR Building Products, 327 – 335 Burley Road, Horsley Park*. DLA Environmental.

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DLA (2017) *Former Camide Landfill - Landfill Gas Risk Assessment, 327 – 335 Burley Road, Horsley Park NSW 2175.*

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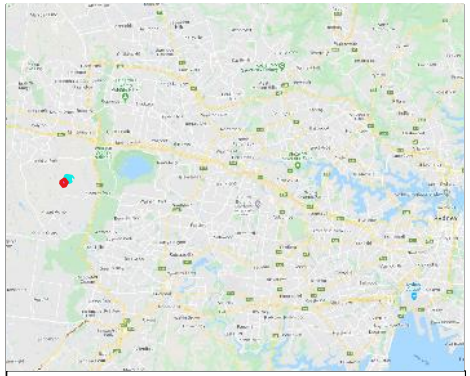
VIC EPA Publication 1684, (February 2018), *Landfill gas fugitive emissions monitoring guideline*.

New South Wales Environmental Protection Agency (2016), *'Environmental Guidelines: Solid Waste Landfill*'.

Appendix A: FIGURES



LEGEND

- Stage 1
- Stage 2A
- Stage 2B
- Stage 2C
- Stage 3

Site Boundary

- Former Carmide Landfill

0 0.1 0.2 km

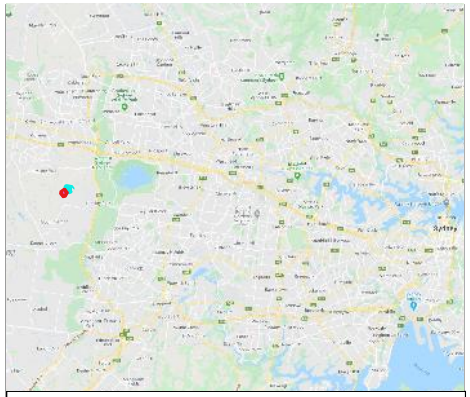
N

Job No. 0103	Revision No: 2
Project: CSR Horsley Park	
Aerial Image Source: Google December 2018	
Drawn by: MB	Checked by: JH

Note: Survey data has been used where available. Existing biofiltration trench and extent of waste have been replicated from Calibre plans.
Existing biofiltration trench constructed in 2005.
New biofiltration trench constructed between 2017 and 2019.

Figure 1 - Site Location Plan

biogas systems



LEGEND

Site Boundary

Former Carmide Landfill

Trench

Existing Trench

New Trench

Monitoring Wells

LFG

New LFG Location

Damaged / Decommissioned

0 10 20 30 40 50 m

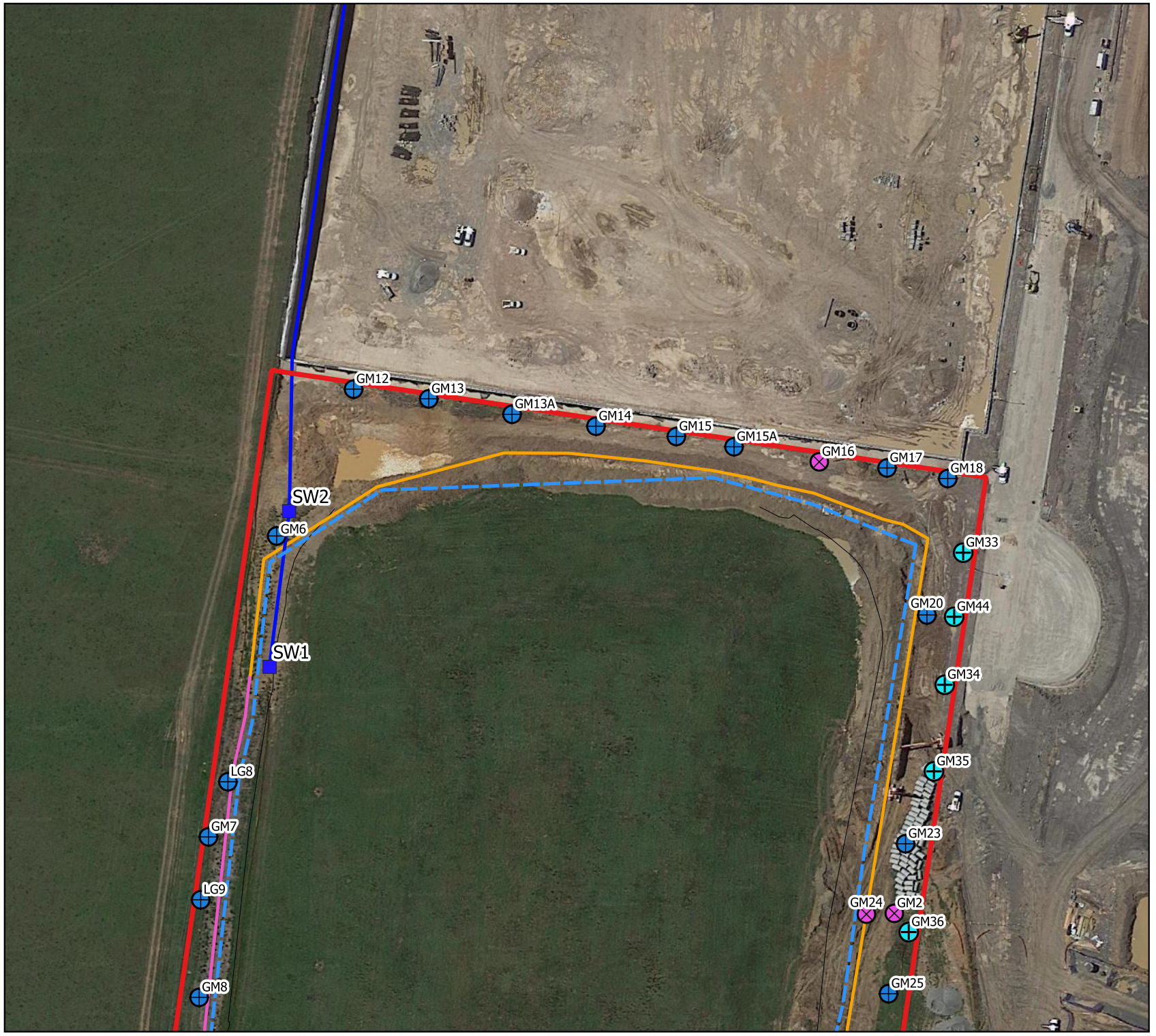
N

Job No. 0103	Revision No: 2
Project: CSR Horsley Park	
Aerial Image Source: Google December 2018	
Drawn by: MB	Checked by: JH

Note: Survey data has been used where available. Existing biofiltration trench and extent of waste have been replicated from Calibre plans.
Existing biofiltration trench constructed in 2005.
New biofiltration trench constructed between 2017 and 2019.

Figure 2 - LFG Well Locations

biogas systems



LEGEND

- Former Camide Landfill
- Existing Biofiltration Trench
- New Biofiltration Trench
- Extent of Waste
- SW Pits

Monitoring Wells

- LFG
- New LFG Location
- Damaged / Decommissioned

0 10 20 30 40 50 m

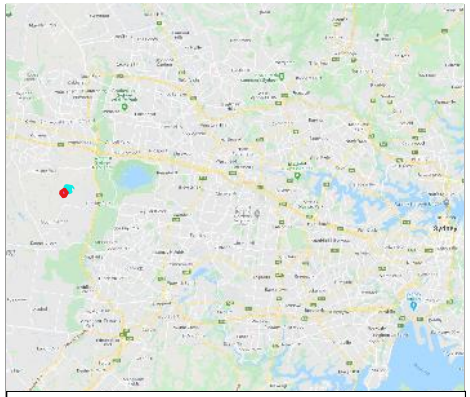
N

Job No. 0103	Revision No: 3
Project: CSR Horsley Park	
Aerial Image Source: Google December 2018	
Drawn by: MB	Checked by: JH

Note: Survey data has been used where available. Existing biofiltration trench and extent of waste have been replicated from Calibre plans.
Existing biofiltration trench constructed in 2005.
New biofiltration trench constructed between 2017 and 2019.

Figure 3 - Site Stormwater Pit Location

biogas systems



LEGEND

Site Boundary

Former Carmide Landfill

Trench

Existing Trench

New Trench

Monitoring Wells

Background Location

0 50 100 150 200 m

N

Job No. 0103	Revision No: 1
Project: CSR Horsley Park	
Aerial Image Source: Google December 2018	
Drawn by: MB	Checked by: JH

Note: Survey data has been used where available. Existing biofiltration trench and extent of waste have been replicated from Calibre plans.
Existing biofiltration trench constructed in 2005.
New biofiltration trench constructed between 2017 and 2019.

Figure 4 - Background LFG Well Location

biogas systems

Appendix B: CARBON DIOXIDE BACKGROUND CONCENTRATIONS TABLE

Table 1
Background Concentrations for Methane and Carbon Dioxide (Sept 2020)

Location	Stabilised Background Concentrations (1st September 2020)		Well Location inside /outside biofiltration trench	Well Location around the landfill
	CH_4	CO_2		
ID number	% v/v	% v/v		
GM1	0.0	6.4	Outside	EASTERN
GM6	0.0	6.4	Outside	WEST
GM7	0.0	6.4	Outside	
GM8	0.0	6.4	Outside	
GM9	0.0	6.4	Outside	
GM10	0.0	6.4	Outside	
GM12	0.0	6.4	Outside	NORTHERN
GM13	0.0	6.4	Outside	
GM13A	0.0	6.4	Outside	
GM14	0.0	6.4	Outside	
GM15	0.0	6.4	Outside	
GM15A	0.0	6.4	Outside	
GM17	0.0	9.5	Outside	
GM18	0.0	6.4	Outside	
GM20	0.6	10.3	Outside	EASTERN
GM21	1.0	6.4	Inside*	
GM22	40.9	21.1	Inside*	
GM23	0.0	9.8	Outside	
GM25	0.0	14.4	Outside	
GM26	0.0	17.2	Outside	
GM27	0.3	16.2	Outside	
GM28	25.3	19.7	Inside*	SOUTHERN
GM29	0.1	12.9	Inside*	
GM30	0.0	6.4	Outside	
GM31	0.1	12.5	Outside	
GM32	0.0	6.4	Outside	
GM33	0.2	6.4	Outside	EASTERN
GM34	0.1	6.4	Outside	
GM35	0.0	6.4	Outside	
GM36	0.0	6.4	Outside	
GM37	0.0	6.4	Outside	
GM38	0.0	6.4	Outside	SOUTHERN
GM39	0.0	6.4	Outside	
GM40	0.0	6.4	Outside	
GM41	0.0	6.4	Outside	
GM42	0.0	6.4	Outside	
GM43	0.0	4.9	Outside	Background
GM44	0.0	6.4	Outside	EASTERN
LG8	0.0	6.4	Outside	WESTERN
LG9	0.0	6.4	Outside	
LG10	0.0	6.4	Outside	

Note: The results are taken from ERM Raw data provided for review and the previously reported VGT results for wells GM6-GM10

*'These well locations are located on the inside of the BT in close proximity to the waste and are only monitored to assist in future interpretations rather than threshold criteria

Appendix C: TEMPLATE FIELD FORMS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Site:			Occupier:		Licence/notice number:				Date:		Start time:			Finish time:		
2	Monitoring personnel:					Monitoring equipment:				Date of last calibration:			Bump test:				
3	Atmospheric pressure at start (mb):					Rising or falling: Stable/Falling				Weather and ground conditions:							
4					Peak (% v/v)			Stabilised (% v/v)			Stabilised (ppm)		Stabilised (% v/v				
5	ID	Start time	Atmospheric pressure (mb)	Relative pressure (mb)	CH4	CO2	Min O2 (% v/v)	CH4	CO2	O2	CO	H2S	Bal	Aspiration time when stabilised readings were taken, add note if not stabilised	Flow (l/h)	Depth to water (mBGL)	Comments e.g. bore condition (sealed, unsealed, CH4 CO2 CH4 CO2 O2 Balance desiccated bentonite etc)
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	
24																	

Instrument				
Serial number				
Next manfacturer's cal due				
Gas mixture	100 ppm isobutylene and 2.5 % v/v methane balance nitrogen			

Date	**Instrument zeroed** Y/N	**Result** Within limits (+/- 5%)	**Pump, filters and battery check**	**Signature**

Date	Instrument zeroed Y/N	Result Within limits (+/- 5%)	Pump, filters and battery check	Signature

Appendix D: MONITORING PROCEDURES

LANDFILL GAS WELL MONITORING PROCEDURE

The following provides a detailed repeatable procedure for recording gases from monitoring wells in Australia and has been adapted as follows:

1. Prior to arrival at the site, monitoring personnel should complete a brief desktop review of the locations to be monitored to develop an understanding of the number and types of locations to be monitored and the likely time required to complete the monitoring.

2. Before starting monitoring, turn the instruments on in a location unlikely to be affected by LFG (or other air contaminants). Confirm that the instruments give readings that are considered likely for these conditions (generally <0.1% methane, <0.1% carbon dioxide, 21.0% oxygen, 79% balance (nitrogen) for an extractive landfill gas analyser and 0.0 ppm for a low-concentration methane detector). Bump test the instrument and recalibrate if outside tolerances of +/- 5%.

3. Record background information, including site identification, start time of the monitoring round, date, prevailing weather and recent weather conditions, current ground conditions, instruments used (and serial numbers), person completing monitoring and so on. During the monitoring any observations of significance (like changes in weather) will also be noted.

4. Visually inspect the monitoring well and, without breaking the gastight seal, note any issues or deficiencies that may prevent representative data being obtained (such as landfill gas odours, unsealed bores, screened sections of pipework above ground level, failed bentonite seal or an open gas tap). Note whether the bore is locked and secure.

5. Connect the sample tubing to the monitoring well and record the differential pressure, including whether the pressure is positive (+) or negative (–). This must be done in a manner that prevents the pressure in the well, being altered prior to measurement. If the well is fitted with a gas sampling tap, connect the sample tubing to the instrument and the gas sampling tap prior to opening the tap. If the well is fitted with a quick-connect coupling, connect the sample tubing to the instrument before being fitted to the bore quick-connect fitting. Record the differential pressure then the well flow in litres per hour. Flow and pressure must be recorded before starting the instrument pump or measuring gas concentrations as the pump may remove any accumulated gas in the well headspace leading to a false negative.

6. Record the atmospheric pressure. Turn on the pump and record the peak and stabilised concentrations of methane and carbon dioxide and other gases as required that may be required.

7. If the monitored gas concentrations have not reached a stabilised concentration (stable gas concentration (±0.3 %v/v) after monitoring for a short period (3 minutes) after three minutes of continuous sampling record the final gas concentrations, along with the direction and rate of change in concentration (rapidly or slowly increasing or decreasing) and note them as non-stabilised final readings.

8. If very high LFG concentrations are recorded on the instrument (>30 %v/v methane and/or 30 %v/v carbon dioxide), then monitoring of the well should be extended beyond three minutes to try to further determine the persistence of the gas detected within the well.

9. Once the peak and stabilised concentrations have been recorded, fully close the gas sampling tap (if applicable) and disconnect the sample tubing from the gas tap.

10. All recording of variables will be carried out using the GA5000's in-built logging software combined with proprietary software. This reduces risk of transcription error and as logging software eliminates the need for pencil and paper it means that delays caused by inclement weather are reduced.

GAS IN ENCOLOSED STRUCTURES AND SERVICE PIT PROCEDURE

The Victorian EPA developed the '*Landfill Gas Fugitive Emissions Monitoring Guidelines'*, Publication 1684 (February 2018) provides the most comprehensive protocol for recording gases from utility and service pits in Australia and has been adapted as follows:

1. Prior to arrival at the site, monitoring personnel should complete a brief desktop review of the locations to be monitored to develop an understanding of the number and types of locations to be monitored and the likely time required to complete the monitoring. The instrument should also be checked for calibration information and bump checked with a certified gas mixture.
2. Before starting monitoring, turn the instrument on in a location unlikely to be affected by landfill gas (or other air contaminants where possible). Confirm the instrument is giving readings considered likely for the conditions. Note that the global background methane concentration is ~ 1.8 ppm (Myhre et al, 2013). If using an FID or Eagle, it can be influenced by emissions from vehicles and industry/commerce. If a busy road or active industrial or commercial emissions are observed nearby, note their effect on the readings of the RKI Eagle before commencing monitoring of the subsurface services.
3. Note background information, including site identification, start time of the monitoring round, date, atmospheric pressure, prevailing weather and recent weather conditions, current ground conditions, instruments used (calibration and serial numbers), person completing monitoring and so on. During monitoring any observations of significance (like changes in weather) should be noted.
4. Record the type and location of the first monitoring location. It is often useful to record the address (street number and name) of the monitoring location and/or GPS coordinates.
5. Visually inspect the location and note any issues or deficiencies with the location that may prevent representative landfill gas monitoring data being obtained (this might include landfill gas odours, unsealed service or inaccessible service).
6. Record factors that may influence the method of monitoring, and that may be useful to record, include:
    - dimensions of the subsurface service
    - sealing of the subsurface service
    - accessibility of the subsurface service
    - any known landfill gas dissipation measures
    - weight of access panels or covers into subsurface services
    - locking mechanisms on access panels or covers (if applicable).
7. Turn on the instrument and insert the probe into the metal grate. Attempt to monitor across the lateral and vertical profile of the service to account for the density of methane which may be venting from different areas inside the service pit.

8. Record the highest concentration of methane and approximately stable concentration should this occur. Due to the resolution of the instrument used and the mixing of gases in the sub-surface services with air, the ppm readings rarely stabilise to a set number but will tend to stay within a range, this range should be recorded. Particular attention will be focused on the pipe inlet (preferential lateral migration) and the valve pit walls/box itself (to assess LFG moving directly from the nearby soil/fill in contact or close to the box).

BUMP TEST PROCEDURE

To check the accuracy of the in-house or rented gas analysers, the Field Technicians conduct calibration checks according to the following approach:

1. Functional (bump) tests are performed during each data download. The bump tests are conducted prior to and after the full calibration for each instrument. A bump test involves exposing the instrument to a calibration gas mixture of known oxygen and methane concentrations to demonstrate instrument response. The bump test verifies the alarm is triggered when gas of a sufficient concentration is applied and assesses whether the instrument accurately measures concentration when a gas of known concentration is applied. The post calibration bump test verifies the instrument has been calibrated successfully. The bump test procedures include the following steps:
2. Attach the Gas Alert clip to the Technician's top pocket and turn on. If at any stage the alarm sounds, turn off gas and vacate the area until clear.
3. Multi-gas containing a known concentration of oxygen, methane concentration, carbon dioxide, hydrogen sulphide and carbon monoxide is applied to the sampling inlet to check the sensor. The Field Technician attaches the tubing to the sample inlet on the instrument and activates the manually controlled regulator. The concentration of gases is selected to be like the range of gases expected to be recorded on site e.g. if the site instrumenting was for perimeter well compliance then methane calibration Gas range would be about 1.0 to 2.5 % v/v.
4. With the calibration gas applied to the sample inlet, the LEL reading is allowed to stabilise (30 seconds approximately), and recorded on a calibration field sheet, or in the electronic workbook format. A maximum margin of ±5 % in the reading is acceptable.
5. Full calibration of gas instruments is conducted during each visit or when the above field verification test is outside the acceptable range. A full calibration consists of a fresh air calibration and a multi-sensor field calibration using a known gas mixture. The fresh air calibration is conducted in the open air outside of dwellings or enclosed areas. Both types of calibrations are automatically performed by the instruments once selected.
6. In the event the full calibration fails, the malfunctioning instrument is replaced with an instrument that meets all requirements (including calibration) and specifications. The malfunctioning instrument is returned to the Equipment Manager for inspection and assessment, who attempts to determine whether the unit must be returned to the supplier for a factory calibration. Until the factory calibration is performed on the malfunctioning instrument, it is replaced by another, fully calibrated instrument