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19 September 2025

s74
 Eden Estates (Newcastle) Pty Ltd
 C\ - Harrington Estates
 Suite 1.02, 3 Thomas Holt Drive
 Macquarie Park NSW 2113

Dear s74

Site Auditor Advice on Sampling, Analysis and Quality Plan (SAQP) for Hazardous Ground Gas Assessment, Lake Road, Wallsend NSW

1.0 Background

s74 was engaged by Eden Estates (Newcastle) Pty Ltd (Eden Estates) as the Landuse Auditor (LUA), accredited by the NSW Environment Protection Authority (NSW EPA) under the Contaminated Land Management Act 1997, (Accreditation No. 9819), to provide an independent review of the Sampling, Analysis and Quality Plan (SAQP) for Hazardous Ground Gas Assessment for the proposed residential subdivision off Lake Road, Wallsend NSW.

2.0 Intrusive Investigation – Sampling, Analysis and Quality Plan (SAQP)

The LUA has reviewed the final version of the following key report:

- **Douglas Partners (2025)** 'Sampling, Analysis and Quality Plan for Hazardous Ground Gas Assessment, Proposed Residential Subdivision, off Lake Road, Wallsend, NSW', project reference 91610.08.R.003.Rev3 (Revision 3), dated 4 September 2025.

The Auditor's review of the SAQP followed the NSW Environmental Protection Authority (EPA) guidelines including the *NSW EPA's (2020) Consultant Reporting Guidelines*. All comments raised in relation to earlier drafts were closed out to the satisfaction of the LUA.

3.0 Auditor Opinion

It is the Auditor's opinion that the SAQP presented in **Douglas Partners (2025)** is consistent with NSW EPA guidelines.

Subject to meeting the proposed data quality objectives (DQOs), the data will be of adequate quality to feed directly into the further assessment, remediation (if necessary) and redevelopment of the proposed subdivision off Lake Road, Wallsend NSW.

4.0 EPA Requirements for LUA Information

Consistent with EPA requirements for provision of Auditor information and staged "sign-off" of sites that are the subject of progressive assessment, remediation and validation, I am required to advise that:

- This interim advice does not constitute a Site Audit Report (SAR) or Site Audit Statement (SAS).
- This information is considered by this Auditor to be consistent with EPA guidelines and policies.
- This interim advice does not derogate from any other approval matters that may relate to the Site.

I would be pleased to provide further explanation as to the basis of this Auditor's Interim Advice (AIA), at your request.

Yours sincerely,

s74

NSWEPA Accredited Site Auditor No. 9819
AECOM Chief Environmental Scientist (ANZ)

Enclosed:

- **Douglas Partners (2025)** 'Sampling, Analysis and Quality Plan for Hazardous Ground Gas Assessment, off Lake Road, Wallsend, NSW, 91610.08.R.003.Rev3 (Revision 3)' dated 4 September 2025 (67 pages)

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Sampling, Analysis and Quality Plan for Hazardous Ground Gas Assessment

Proposed Residential Subdivision

off Lake Road, Wallsend NSW

**Prepared for Eden Estates (Newcastle) Pty
Ltd**

Project 91610.08

4 September 2025

Released by the Environment Protection Authority under the GIPA Act; EPA1375

Document History

Details

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Revision 2	– Harrington Estate (Newcastle) Pty Ltd
Revision 3	– Harrington Estate (Newcastle) Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature

Date

Author	s74	4 September 2025
Reviewer	s74	4 September 2025

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Sampling, Analysis and Quality Plan for Hazardous Ground Gas Assessment

Proposed Residential Subdivision off Lake Road, Wallsend NSW

1. Introduction

This Sampling, Analysis and Quality Plan (SAQP) prepared by Douglas Partners Pty Ltd (Douglas) presents the proposed methodology and requirements for landfill gas monitoring for a proposed residential development located off Lake Road, Wallsend NSW. The site of the assessment is an area within the north-eastern part of the overall development area, which is within about 1000 m of the existing Summerhill Waste Management Centre (SWMC). Preparation of this SAQP was commissioned by Eden Estates (Newcastle) Pty Ltd in a purchase order dated 13 August 2024. The work was undertaken in accordance with Douglas Partners Pty Ltd (Douglas) proposal 91610.08 dated 13 August 2024.

The site is located to the south of the existing Summerhill Waste Management Centre (SWMC) – refer Figure 1.

The objective of the monitoring presented in this SAQP is to allow evaluation of the risk associated with ground gas migrating from the adjacent SWMC towards the proposed residential subdivision off Lake Road. In addition, the monitoring will assist with:

- Assessment of the potential for landfill gas migration from the SWMC landfills which are located to the north of the proposed development (approximately 500 m to 750 m from the northern proposed extent of residential development); and
- The implications (if any) on the proposed development.
- The proposed methodology for evaluation of the soil and groundwater contamination risks is presented in a separate SAQP titled Sampling Analysis and Quality Plan for Targeted Contamination Testing, Proposed Residential Subdivision, Off Link Road, Wallsend (Reference: 91610.10.R.001.Rev0, dated 5 September 2025).

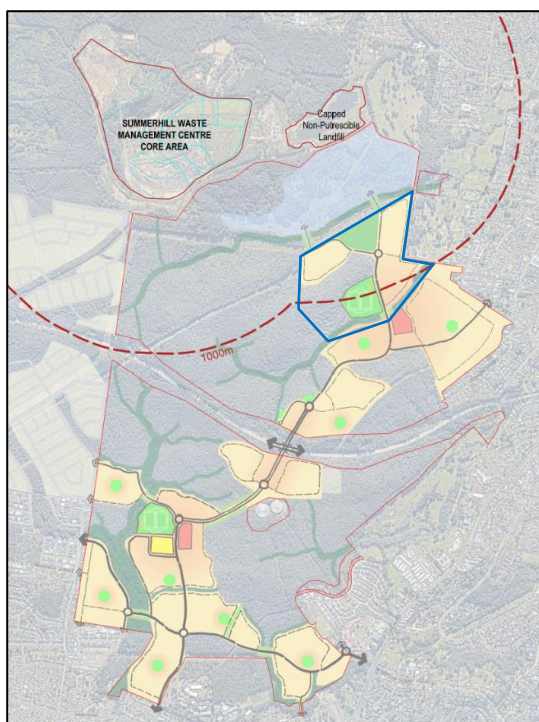


Figure 1: Image showing the current proposed development layout and position of SWMC together with 1000 m buffer to SWMC. Blue polygon shown approximately boundary of site.

This report must be read in conjunction with all appendices including the notes provided in Appendix A.

The following key Australian and International guidelines were consulted in the preparation of this report:

- NSW EPA. (2020). Assessment and Management of Hazardous Ground Gases.
- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013).
- Vic EPA (2015). Publication 788.3: Best Practice Environmental Management Series – Siting, Design, Operation and Rehabilitation of Landfills. as it provides guidance on development in close proximity to the landfill buffer zones.
- Vic EPA (2018). Publication 1490.1: Closed landfill Guidelines.
- NSW EPA. (2022). Contaminated Land Guidelines, Sampling Design Guidelines.
- NSW EPA. (2016). Environmental Guidelines, Solid Waste Landfills, Second Edition, 2016.
- CIRIA. (2007). Assessing Risks Posed by Hazardous Ground Gases to Buildings (C665).
- UK Environment Agency 'guidance on management of landfill gas' (SEPA 2004).

2. Site Description and Environmental Setting

The overall proposed development area covers a large area of land extending from Elmore Vale in the south-east, Fletcher in the north and Edgeworth in the south-west. The Newcastle Link Road bisects the development area and runs east-west as indicated on Figure 2 below.

The site of the assessment associated with this SAQP is located in the north-eastern portion of the development area i.e., the blue polygon shown in Figure 1. It is noted that the area between site and the SWMC is currently not scheduled for development, and will be the subject of separate investigations following confirmation of the intent and nature of the development in that area.

The overall development area was separated into two areas for the purpose of ground gas monitoring and assessment of risk, as shown on the attached Urbanco drawing and as follows:

- Northern most extent of proposed residential development (about 500 m from SWMC) to about 1000 m from SWMC, which is defined as the site; and
- Areas beyond 1000 m buffer (i.e. beyond the site).

The site is primarily covered with dense vegetation, although some areas have been previously cleared. The cleared areas were mostly associated with pit top facilities for former coal mining collieries.

Figure 1 below shows an aerial image of the site with lot identification. Drawing 1, in Appendix B, also provides information on the extents of the site.



Table 1 below provides information on s

Table 1: Summary of site identification and environmental setting

Item	Comment
Site Address	North and south of existing Newcastle Link Road, Wallsend. South of existing Summerhill Waste Management Centre.
Development Area Lot / DP	• Lot 1 in DP192650; • Lot 1 in DP822151; • Lot 2 in DP800035; • Lot 31 in DP35580; • Lots A and B in DP 36897; • Lot 130 in DP1155943; • Lot 3057 in DP1208470; • Lot 3051 in DP1202601; • Lot 3052 in DP1202601; • Lot 3053 in DP1202601; • Lot 350 in DP1167367.
Site	• Lot 1 in DP822151; • Lot 2 in DP800035 • Lot 3057 in DP1208470.
Topography	The ground surface at the site ranges in elevation from about RL 20 to about RL 90 relative to Australian Height Datum (AHD). The topography is complex and includes three valleys. Two of the valleys fall towards the north-east and one towards the south-west. The areas of higher elevation are typically within the north-west and west of the site, but include a spur with an elevation of up to about RL 90 m which projects into the site from the west.
Surrounding Land Use	North – Summerhill Waste Management Centre is located to the north (approximately 500 m to 750 m from the northern proposed extent of residential development) South – Future/additional stages of residential development East – Existing residential development West – Bushland
Geological Mapping	Reference to the 1:100,000 Geological Survey of New South Wales database indicates that the site is underlain by the Newcastle Coal Measures. Reference to the 1:13680 scale Surface Geology Map of the Newcastle Coalfields published by BHP indicates that the Warners Bay Formation subcrops to the west of the site and locally extends onto the site. The age of the strata increases to the east and the Waratah Sandstone, which forms the basal member of the Newcastle Coal Measures, subcrops near north-east of the site boundary. The site is toward the western margin of the outcrop of the Newcastle Coal Measures. The stratigraphy in this area is complex as several seams merge into each other as shown on Figure 3. In some areas the Nobbys Seam merges into the underlying upper split of the Dudley Seam and thereafter is called the “Young Wallsend Seam”. Similarly, in some areas, the Dudley Seams merges into the Yard Seam and is called the Dudley Yard Seam. With further coalescence of the seams, the entire interval from the Nobbys Seam to the Borehole Seam merges into a single coal seam called the West Borehole Seam.

Acid Sulfate Soil	The site is located in an area mapped as having no known occurrence of acid sulfate soils. A small area in the north-eastern corner (Lots A and B in DP 36897) is mapped as 'no known occurrence' of acid sulfate soils but is at an elevation of less than 10 m AHD.
Soil Landscape Mapping	The mapping indicates that the site extends over soils belonging to several landscape groups, as follows: • Killingworth Group (erosional), with limitations associated with this soil group including a high water erosion hazard, mine subsidence district, localised foundation hazard, localised shallow soils, localised seasonal waterlogging, sodic/dispersible soils of low wet strength and very strongly acidic soils of low fertility; • Cedar Hill Group (colluvial). Soils within this group are described as being moderately deep to deep (0.6 m to 2 m). Limitations associated with this soil group include high mass movement hazard, high foundation hazard, steep slopes, mine subsidence district and acidic soil; • Warners Bay (residual). Soils within this ground are described as being moderately deep to deep (1 m to greater than 1.5 m). Limitations associated with this soil group include high water erosion hazard, foundation hazard, localised steep slopes, localised mass movement hazard, high run-on hazard, moderate to high shrink-swell; and • Disturbed Terrain. These areas are highly variable and have been identified to have been largely disturbed in the past. The limitations depend on the nature of the site.

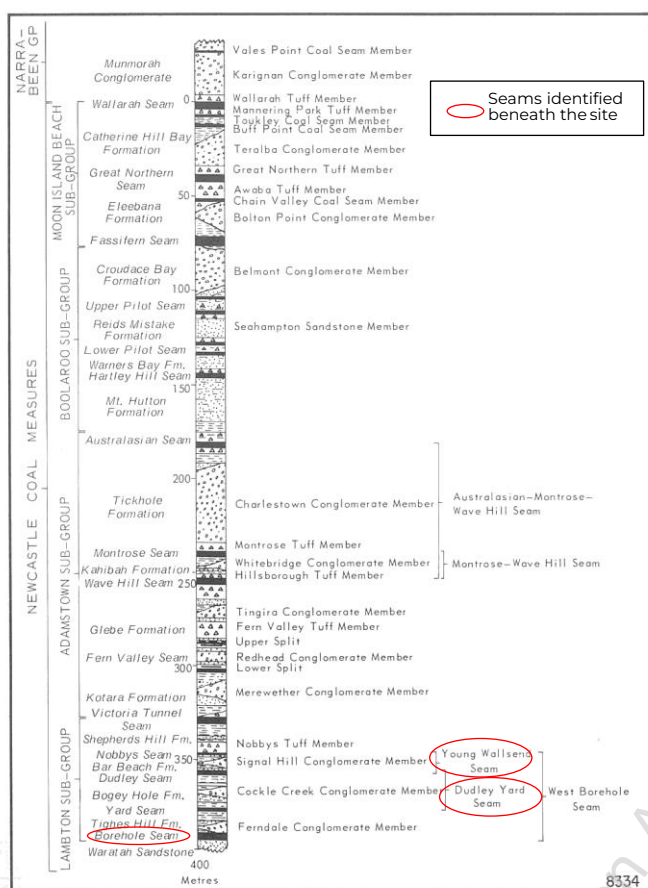


Figure 3: Stratigraphy of the Newcastle Coal Measures, reproduced from (Packham, 1969)

3. Background

Previous relevant investigations undertaken by Douglas include:

(Douglas, 2019) – **Preliminary Mine Workings Investigation**

This report presents the results of historical mining records to identify potential subsidence risks, preliminary comments on subsidence hazards to guide further investigations, site drawings showing mining activities and potential areas of concern.

From the perspective of landfill gas, this report provides information in relation to the depth of coal seams in the area of interest. In this regard, two coal seams have been identified in the northern part of the development area (ie the site), as follows:

- **Dudley/Young Wallsend Seam**, which ranges in depth between 0 m to 50 m below the surface and was mined by the Gretley and New Wallsend No. 2 Collieries; and
- **Borehole Seam**, which generally ranges in depth from 30 m to 100 m beneath the surface, although some area where as little as 10 m may be present were identified, and was mined by the Wallsend, Cooperative, Maryland, Elmore Vale, and Jesmond Collieries.

(DP, 2020) – Desktop Geotechnical Assessment

This assessment provided a review of the overall development area to identify potential geotechnical hazards, assessing soil and fill conditions, evaluating subsurface stability, and identifying areas that might require further detailed investigation before development.

For the assessment of landfill gas migration, this report provides information in relation to the subsurface conditions in the northern area of the overall development site, particularly around the previous Wallsend No. 2 Colliery, which has significant areas of deep fill due to historical mining activities and emplacements (refer Figure 4). Fill depths in various parts of the northern section of the development area and within the site include:

- Up to 30 m of fill in the former open cut identified as the No. 3 Trial Box Cut.
- Up to 26 m of fill in the former trial box cut west of the Wallsend No. 2 Colliery facilities.
- Up to 18 m of fill in the former open cut in the northern area of the colliery.
- Additional areas have fill depths ranging from 6 to 12 meters within the colliery pit top facilities.

The fill includes a mix of coal washery rejects, crushed shale, coal chitter, clay, and gravelly overburden materials. Fill material appears to have been placed without proper geotechnical controls, resulting in variable strength and compaction.

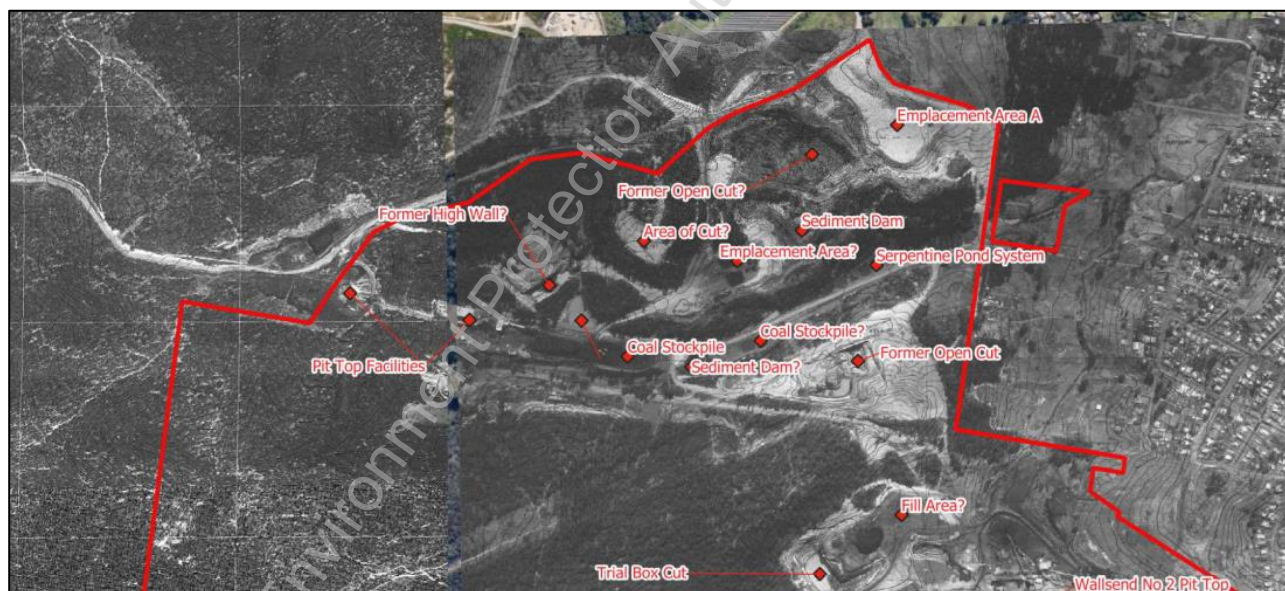


Figure 4: Extract from previous Douglas investigation/s showing areas of deep fill near northern extent of development land holdings

(DP, 2021) – Desktop Mine Subsidence Assessment

Douglas carried out a desktop mine subsidence assessment for the proposed residential development with a focus on evaluating potential subsidence risks associated with historical underground coal mining activities to inform the feasibility and planning of the development.

For the assessment of landfill gas migration, this report provided more detailed information on depth of fill and depth to coal seams in the northern part of the site. Based on the results of the desktop assessment, the depth to the Young Wallsend/Dudley seam in the northern part of the site ranged from zero to about 50 m. Similarly, the depth of cover to the lower Borehole Seam ranged from about 10 m in the gullies to 80 m.

(DP, 2020a) – **Geotechnical Investigation of Filled Areas**

This report presented the results of subsurface geotechnical investigation in areas of known fill across the broader development area.

The investigation included the drilling of **30 boreholes** (Bores 1001 to 1022 and 1024 to 1031) which targeted the area of known fill, including within the northern area. Depths of fill in the northern area were found to range from about 1 m to about 18 m (refer Figure 5).

Comparison was also undertaken between contours available on mapping from 1974 and the recent contour mapping which indicated that fill in specific areas of the northern part of the site was up to 20 m to 30 m (refer Figure 5).

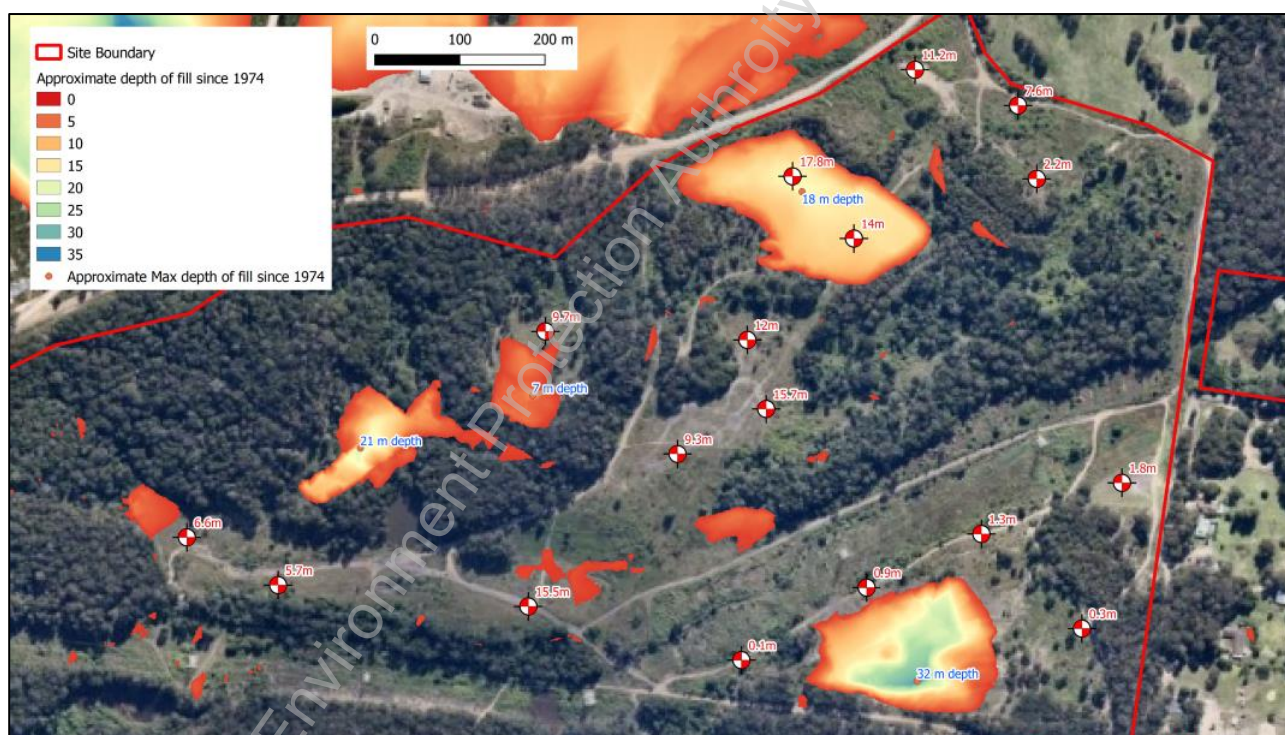


Figure 5: Extract from previous Douglas investigation/s showing previous subsurface investigation locations and depth of fill (inferred or encountered)

The fill material encountered were a mix of coal washery rejects, sandy clay, gravelly clay, and coal fines and included both carbonaceous materials (such as coal fines and crushed shale) and non-carbonaceous materials (such as gravelly sandy clay). Some areas contained large cobbles and occasional boulders, which were remnants of previous mining and reclamation activities.

Groundwater monitoring wells were installed, within Bores 1005, 1012, 1013 and 1016 located in the northern area of the site. Groundwater was encountered in a number of bores, and in the installed monitoring wells, in the northern part of the site at levels of about RL 20 m to RL 40 m, at depths of about 6 m to 12 m below the ground surface.

Subsurface LFG Monitoring Data at SWMC

As part of this SAQP preparation, subsurface gas monitoring data between 2018 and 2024 for the SWMC was obtained and reviewed from the City of Newcastle website (<https://newcastle.nsw.gov.au/living/waste-and-recycling/summerhill-waste-management-centre/environmental-monitoring/landfill-gas-monitoring>). Based on the data, it is understood that since 2018, subsurface gas monitoring has been undertaken at the SWMC on a quarterly basis. The raw data obtained from the Council website has been reproduced in Appendix C of this SAQP. Based on Douglas' analysis of the data, a summary of the current understanding of the ground gas conditions at the SWMC's southern boundary is discussed in Section 5.2.1 along with the potential implications on the site and the identified data gaps.

4. Scope of Work

The current scope of work is to prepare this SAQP to document the methodology and requirements of the proposed landfill gas monitoring works within the site, which is located in the north-eastern part of the overall development area.

5. Conceptual Site Model

5.1 Landfill Gas Generation Process

Ground gasses, and in particular methane and carbon dioxide are generated during decay of the putrescible waste and organic materials contained within the landfill, generally as follows:

- During the initial stages (Stage 1), oxygen contained within the waste is consumed which results in the production of carbon dioxide;
- The next stage of gas production (Stage 2) is generally associated with anaerobic conditions within the waste, generally with the increase of carbon dioxide;
- This is followed by periods of transitional aerobic and anaerobic conditions (Stage 3). During these periods, methane production increases;
- The next stage (Stage 4) is generally associated with a steady state condition and methane and carbon dioxide are created in a ratio of about 3:2;
- The final stage (Stage 5) is associated with a reduction in microbial activity and methane and carbon dioxide gas production reduces and potentially ceases.

It is noted that the stages rarely occur in sequence within a landfill mass and may overlap.

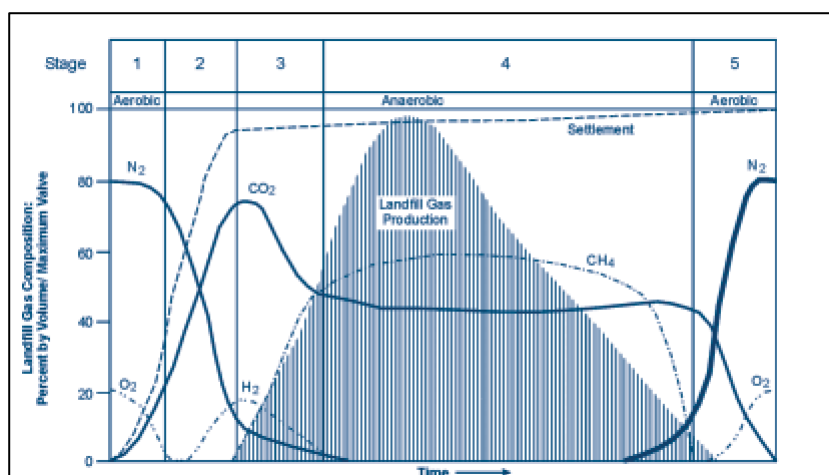


Figure 6: Idealised representation of landfill gas generation (SEPA, 2004)

5.2 Identified Potential Sources of Hazardous Ground Gases and Potential Transport Pathways

Based on the available information at this stage, a preliminary conceptual site model (CSM) has been developed to evaluate potential sources and transport pathways that could result in unacceptable impacts to potential receptors at the site. The summary CSM is outlined in Table 2.

Table 2: Potential Ground Gas Sources and Transport Pathways to Proposed Residential Development Areas

Potential Source	Proximity to Residential Development Area	Potential Transport Pathways	Potential Exposure Pathways
S1. Landfill gas from SWMC	At least 500 m to the north	T1. Lateral migration through coal seams (Young Wallsend or Borehole) and via either: T1.1 direct exposure (seam outcrops); or T1.2 through interceding subsurface strata T2. Through subsurface strata above coal seams	E1. Inhalation of gas accumulating in excavations, buildings and confined spaces E2. Asphyxiation hazards due to gas accumulating in excavations, buildings and confined spaces E3. Explosion risk from accumulation of volatile / flammable ground gases in excavations, buildings and confined spaces
S2. Coal seam gas from Young Wallsend or Borehole Seam	Beneath the site ranging at depths from about 10 m to greater than 100 m	T1.1. Direct exposure (seam outcrops) T1.2. Through interceding subsurface strata	E1. Inhalation of gas accumulating in excavations, buildings and confined spaces E2. Asphyxiation hazards due to gas accumulating in excavations, buildings and confined spaces E3. Explosion risk from accumulation of volatile / flammable ground gases in excavations, buildings and confined spaces

5.2.1 Potential Source 1 - Landfill Gas from SWMC

As discussed above in Section 5.1, hazardous ground gasses can be produced during decay of the decomposable waste in landfills.

The ability of landfill gas to migrate into the site would depend on a number of landfill construction and subsurface profile considerations. Only limited information on these considerations is currently available. The conceptual site model for gas generation and transport has been developed based on a number of assumptions, which will be further assessed during implementation of the SAQP.

These include:

- The geometry of the landfill cells at the site, including base level and footprint;
- Material contained within each of the landfill cells, particularly whether the material is putrescible or non-putrescible;
- Any lining which is in place for the landfill cells;
- Capping system over existing closed cells;
- Gas collection and ventilation systems for the landfill;
- Gas and groundwater monitoring locations and results. It is noted that the quarterly gas monitoring results for monitoring extending from 2018 to Q2 2024 is available on the City of Newcastle website, with an Environmental monitoring location plan, however the location of the monitoring wells is to be confirmed.

Drawing 2 shows a section through the Summerhill Waste Management Centre and the northern portion of Eden Estates land (ie the site). As shown on the sections, the primary potential source of ground gasses is the landfill cells.

Current understanding of Ground Gas Conditions

In a letter from NSW EPA dated 15 July 2024, the EPA notes that significant ground gas readings have been noted on the common boundary between the landfill and the site and hence there is a risk of ground gas migration from the landfill to the Eden Estates site. In this regard, following a brief review of the available limited information in relation to ground gas monitoring at the SWMC, Drawing 1 in Appendix B provides the known location of the existing gas monitoring locations and a preliminary assessment of characteristic situation for ground gases, as evaluated using the procedures in NSW EPA Solid Waste Landfill Guidelines (NSW EPA, 2016). The characteristic situation for the wells located on the SWMC boundary indicate a “moderate to high” and “high” risk. It must be noted, however, that this risk is influenced by a number of currently partially known elements (gas monitoring results, well locations) as well as a number of currently unknown elements (well construction details, subsurface conditions, well response zones, landfill cell details, landfill cell materials, lining conditions of landfill, groundwater levels). The gas readings and flow may be different on the northern-most boundary of the proposed residential footprint, and consequently the characteristic situation (and risk profile) may be different to that which is present on the common boundary. Some of this additional information has been requested from Newcastle Council. Other information will be obtained during subsequent investigations informed by this Sampling, Analysis and Quality Plan (SAQP).

This combined information will facilitate addressing this data gap and better characterize the subsurface profile and ground gas conditions and allow a more thorough assessment of risk associated with ground gases.

5.2.2 Potential Source 2 – Coal Seam Gas

A secondary potential source was identified and is gas created within the underlying coal seams (Young Wallsend and Borehole Seams).

5.3 Potential Transport Pathways

5.3.1 Potential Migration Pathways

A number of potential receptors were identified for the proposed residential development use, which include:

- Future construction and intrusive maintenance workers;
- Future residential development users.

Drawing 2 provides a conceptual site model of the subsurface conditions beneath the site and the adjacent SWMC along an alignment through the site. Figure 7, below, shows an extract from the conceptual site model through Section AA.

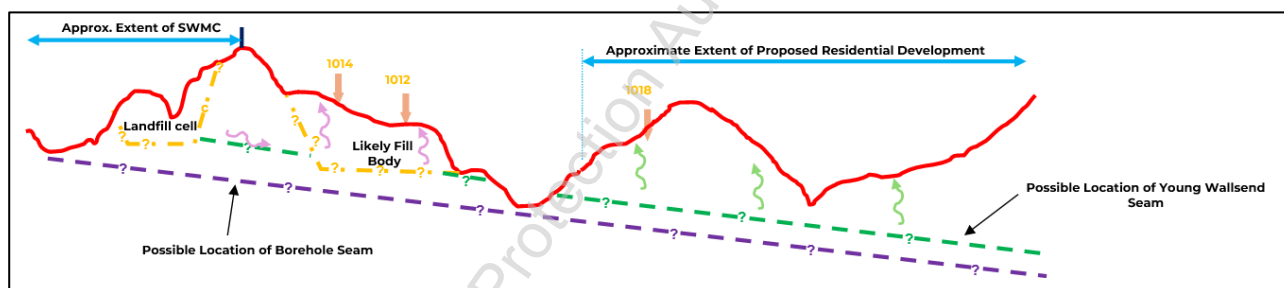


Figure 7: Conceptual Site Model of Possible Ground Gas Migration Pathways through Section AA (purple pathway for landfill gas and green pathway for coal seam gas).

The identified transport and exposure pathways for hazardous ground gases, based on the current and future land uses which have been considered are discussed in the following sections.

5.3.2 Potential Transport Pathway 1 – Coal Seams

A potential pathway for migration of ground gases through subsurface strata (above groundwater) would be any continuous coal seams. Reference to Drawing 2 and Figure 7 indicates that it is possible that the coal seams, particularly the Young Wallsend Seam, daylight within the landfill cells and may potentially continue to the south under the proposed residential development site. Mapping and previous investigation boreholes indicate that this seam may daylight between the SWMC and the northern limit of proposed residential development. The history of mining in the area, and particularly historical open cut mining in the northern area of Eden Estates land holdings also indicate that this may be the case.

A potential pathway for gas migration includes through the upper coal seam and into the proposed development area either by direct exposure of the coal seam at the seam outcrop (Pathway T1.1) or through the coal seam and then through the interceding subsurface profile and to the surface (Pathway T1.2).

5.3.3 Potential Transport Pathway 2 – Permeable Layers in Subsurface Strata above Coal Seams

A further transport pathway, involving migration of ground gases through the subsurface strata above the coal seams (within more permeable layers) has also been identified as Pathway T2. As outlined Section 3, a number of areas of the site contain deep fill, which is located in relatively close proximity to the SWMC. These areas may allow a preferential pathway for gas migration. It is noted, however, that these areas of deep fill are generally located to the north of the proposed extent of residential development.

5.4 Potential Exposure Pathways

Depending on the presence of a complete transport / migration pathway to allow gas to migrate into the proposed residential development, the potential exposure pathways for hazardous ground gases at the site may include:

- E1: Inhalation of toxic ground gases accumulating in excavations, buildings or confined spaces and in open air;
- E2: Asphyxiation hazards (oxygen deficient atmospheres) from accumulation of hazardous ground gases in excavations, buildings or confined spaces;
- E3: Explosion risk from accumulation of volatile / flammable ground gases in excavations, buildings or confined spaces.

5.5 Contaminants of Potential Concern

Based on the available information to date, in relation to ground gases at the site, and the proposed future use of the land as residential development, the gases of interest are:

- Methane (CH₄);
- Carbon Dioxide (CO₂); and
- Hydrogen Sulphide (H₂S).

Other potential contaminants of concern in the vapour phase of the gas derived from the waste materials are considered less likely and have not been characterised to date.

6. Data Quality Objectives

6.1 General

The SAQP has been devised broadly in accordance with the seven-step data quality objectives (DQO) process which is provided in Appendix B, Schedule B2 of NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)* [NEPM] (NEPC, 2013). Table 3 below provides the data quality objectives for the SAQP.

Table 3: Data quality objectives

Step	Summary
1: State the problem	The objective of the investigation is to assess the risk of hazardous ground gasses impacting on the proposed residential development, and particularly the presence of hazardous ground gases migrating from the adjacent SWMC and/or from the coal seams underlying the site. A preliminary conceptual site model (CSM) has been prepared (refer Section 5) for the proposed development. The project team will consist of experienced environmental and geo-environmental engineers and scientists working in the roles of Project Principal, Project Reviewer, Project Manager, field staff.
2: Identify the decisions / goal of the study	The site history has identified two potential sources of hazardous ground gases, including landfill cells within SWMC and the coal seams underlying the site (refer Section 5). The CSM identifies the associated contaminants of potential concern (CoPC) and the likely transport and exposure pathways. The decision is to establish a suitable scope of gas well installation and monitoring to assess the risk of hazardous ground gases impacting the proposed residential development.
3: Identify the information inputs	Inputs to the investigation will be the results of gas monitoring, and potentially laboratory testing of gas samples. Additional information will be obtained from Council records, particularly in relation to the construction and constituents of the landfill cells at SWMC. Historical gas monitoring results for SWMC were utilised to carry out preliminary assessment of ground gases and develop the CSM.
4: Define the study boundaries	The lateral boundaries of the investigation area are as follows: Lateral extent: Northern most extent of proposed residential development (refer Drawing 3). This is generally the proposed development area of the site (including areas of residential development and green space) within about 1000 m of the SWMC. In this regard, the southern extent is the line of wells located approximately 1000 m from the SWMC. The eastern and western extent is limited to the extents of the line of gas wells; Vertical extent: from the existing ground surface to the base of the proposed gas wells The assessment is limited to the timeframe over which the field investigation was undertaken.
5: Develop the analytical approach (or decision rule)	The decision rule is to compare all monitoring results to the assessment criteria, as outlined in NSW EPA (2020a). The assessment approach is set out in Section 7 and includes the installation of groundwater (for determination of groundwater levels only) and gas monitoring wells. Following periodic monitoring, the results will be assessed for characteristic situation in accordance with the procedures outlined in NSW EPA (2020a) for risk to human health, and assessment for the need for further assessment and engineering controls.

Step	Summary
	It is acknowledged that ongoing processes within the SWMC can potentially change the gas risk over time and therefore the risk profile to the proposed development.
6: Specify the performance or acceptance criteria	Several potential sources of errors may occur, including false negative data concluding that a concentration of a relevant parameter is not present above the relevant criteria, when it is. Conversely, false positive data concluding that a concentration of a relevant parameter is above the relevant criteria. These errors can occur due to field sampling, incorrect sampling method, uncalibrated sampling equipment and/or errors in data transcription. The gas monitoring data collected from the wells are considered to be suitable provided appropriate monitoring procedures and methods are utilised, as outlined in Section 7.4. Unless conclusive information from the collected data is sufficient to reject the null hypothesis, it is assumed that the baseline condition is true, which considers that the existing gas risk to human health is unacceptable. The monitoring should be complete requiring all locations to be monitored at the required frequency, and by experienced and suitably trained personnel using appropriately calibrated equipment. All monitoring results will be compared and considered comparable by using consistent methods of monitoring and analysis throughout the monitoring rounds. Precision of the results will be obtained by using appropriately calibrated monitoring equipment, operated by experienced personnel, with the results reviewed by experienced personnel.
7: Optimise the design for obtaining data	As the purpose of the sampling program is to assess for potential hazardous ground gases impacting on the future proposed residential development, the sampling program is reliant on professional judgement to identify and sample the potentially affected areas. This has been undertaken based on the available information. Further details regarding the proposed sampling plan are presented in Section 7.

6.2 Site Assessment Criteria

The overall assessment will be undertaken with due consideration to the requirements set out in NEPC (2013). However, noting that NEPC (2013) does not provide guidance on hazardous ground gases, the landfill gas assessment criteria that have been adopted to evaluate potential risks to receptors that may be impacted by LFG migrating into the site have been sourced from the following guidelines:

- NSW EPA (2016) Environmental Guidelines: Solid Waste Landfills - Landfill Gas Sub-Surface Monitoring;
- NSW EPA (2020a) Assessment and Management of Hazardous Ground Gases (amended May 2020).

Whilst NSW EPA (2016) is primarily associated with landfill construction / operation / closure, it does provide general guidance on allowable gas concentrations migrating off-site. Consequently, these criteria have been adopted as initial LFG screening criteria given that the northern most extent of the site is located ~500m from the SWMC.

Based on the above, the initial screening criteria for landfill gas concentrations are provided in Table 4 below.

Table 4: Landfill Gas Assessment Criteria

Contaminant	NSW EPA (2016)
Methane	1% v/v
Carbon dioxide	7.4% v/v ie., 1.5% v/v above background concentrations ¹

Notes:

1. Background concentrations to be determined. However as an initial screening level, a background concentration of 5.9% v/v shall be adopted based on concentration recorded in SSG30 during May 2024 monitoring event (sourced from SWMC monitoring data presented in Appendix C).

Reference has also been made to the (NSW EPA, 2020a). It is noted that the guidelines primarily focus on ground gas risks to buildings and structures, and are therefore relevant given the site's proximity to the SWMC and the potential for LFG migration into the proposed residential development area. Accordingly, the criteria from these guidelines will be used to evaluate the potential risk to buildings and structures at the site and to facilitate identification of suitable management strategies. The guidance can be broadly summarised as outlined in Table 5 below.

Table 5: Summary of EPA (2020) Ground Gas Risk Assessment

Risk Classification	Gas Screening Value ¹ (L/hr)	Characteristic Situation	Additional Factors	Typical Sources
Very Low Risk	<0.07	1	Typically, methane <1% v/v and/or carbon dioxide <5% v/v; otherwise consider increase to CS 2	Natural soils with low organic content. Typical fill.
Low Risk	<0.7	2	Borehole flow rate not to exceed 70 L/hr; otherwise consider increase to CS 3	Natural soils with high organic content. Recent deep fill
Moderate Risk	<3.5	3	-	Old inert waste landfill Flooded mine workings.
Moderate to high risk	<15	4	Consider need for Level 3 risk assessment	Mine workings susceptible to flooding. Closed putrescible waste landfill
High risk	<70	5	Level 3 risk assessment required	Shallow, unflooded abandoned mine workings
Very High risk	>70	6		Recently used putrescible waste landfill

Notes:

1. GSV = Maximum borehole flowrate (L/hr)/ maximum gas concentration (%v/v).

Given that the proposed investigation is being undertaken to evaluate whether there is a risk of LFG migration into the proposed development area, site-specific assessment criteria are not being proposed at this early stage. Based on the outcomes of the proposed investigation, the need to for site-specific criteria will be considered and discussed with the auditor.

7. Gas Monitoring and Sampling Approach

7.1 General Approach

The assessment of the potential for gas to be migrating from the adjacent SWMC to the proposed residential development will be assessed by the following methods:

- Installation and development of gas wells for monitoring and groundwater wells (for determination of groundwater levels only);
- Routine monitoring of gas wells for hazard ground gases and groundwater wells for groundwater levels only;
- Potential laboratory testing of gas samples for identification purposes (i.e. speciation testing for determination of landfill origin or coal mine origin). The need for this testing would be dependent on the levels of hazardous ground gases encountered;
- Assessment of monitoring results against the relevant guidelines, including (NSW EPA, 2020a), for characteristic situation;
- Reporting on monitoring results and assessment.

Further details on the monitoring and sampling approach are discussed in the following sub-sections.

7.2 Sampling Locations

Reference to the NSW EPA Solid Waste Landfill Guidelines states that *"In the case of large putrescible waste landfills (more than 50 000 tonnes of putrescible waste per year), buffers of at least 1000 m should be provided where practicable to residential zones, schools and hospitals to protect the amenity of these land uses from odour, noise and other impacts."* It is noted that the context of this statement in the guideline seems to be on the citing of landfills in relation to existing residential developments rather than citing residential development near an existing landfill. It is further noted that the guidelines "do not contain express buffer distances or locational requirements". The guideline does however provide a list of inappropriate areas of landfilling, which includes "within 250 metres of a residential zone or dwelling, school or hospital not associated with the facility".

Therefore, it is considered appropriate to separate the overall site into two areas for the purpose of ground gas monitoring and assessment of risk, as shown on the attached Urbanco drawing and as follows:

- Northern most extent of proposed residential development (about 500 m from SWMC); and
- Areas beyond 1000 m buffer.

As outlined in Section 3, the subsurface strata within the area between SWMC and the proposed residential development includes areas of a mixture of deep fill material (coal washery rejects, sandy clay, gravelly clay, and coal fines) and areas of residual soils over bedrock. The bedrock generally includes conglomerate, sandstone, siltstone and coal seams.

Reference to SEPA (2004) indicates that a preliminary borehole spacing of 50 m to 100 m would be suitable.

The work would be undertaken in phases, as follows:

- Phase 1: Installation of gas wells within the northern extent of proposed residential development. These bores would be a combination of deep and shallow gas wells at an initial spacing of about 100 m. Four groundwater monitoring wells would also be installed along this line of bores to facilitate collection of groundwater samples.
- Phase 2: Depending on the results of initial monitoring results, additional bores would be installed to close the spacing between wells to about 50 m in areas where elevated gas readings are obtained.
- Phase 3: Should elevated gas readings be observed within the initial phases of monitoring, installation of a second line of gas bores, located at approximately the 1000 m buffer distance, would be undertaken. For this line of bores a spacing of 100 m will be adopted.

Drawing 3 shows the approximate proposed gas well locations. A brief inspection of the site indicates that the majority of the locations along the northern extent of proposed residential development is readily accessible. The locations along the 1000 m buffer line may require some access work to be completed prior to drilling.

In summary the number of wells is shown in Table 4 below.

Table 4: Summary of Well Locations

Phase	Well Type	Number	Numbering	Approximate Location
1	Gas Well – Deep	5	1, 3, 5, 7, 9	Northern extent of proposed residential development
	Gas Well – Shallow	5	2, 4, 6, 8, 10	
	Groundwater Well	4	GW1 to GW4	
2	Gas Well – Deep	4	1001, 1003, 1005, 1007	Northern extent of proposed residential development
	Gas Well – Shallow	4	1002, 1004, 1006, 1008	
3	Gas Well - Mid depth	10	2001 to 2010	Along 1000 m buffer line
	Groundwater Well	3	GW5 to GW7	Along 1000 m buffer line

7.3 Well Construction

The gas monitoring wells should be constructed as follows:

- Drilling of 100 mm diameter borehole at the proposed well location. Some of the bores would be drilled using non-core recovery techniques, however some should be undertaken using techniques which allow coring of the bedrock to recover samples of the rock strata;
- In order to assess the identified ground gas sources and pathways, the following approach will be adopted:
 - Deep Wells (to assess S1-T1.1 and S2-T1.1) – taken to the lesser of 5 m below the coal seam (if present) or 3 m below the permanent groundwater level;
 - Shallow Wells (to assess S1-T1.2, S1-T2, S2-T1.2) – taken to the lesser of 5 m or 3 m below the permanent groundwater level;
 - Along the northern alignment of bores for Phase 1 (refer Drawing 3) deep and shallow wells would be alternated;
 - To assist with understanding of groundwater depths, separate groundwater wells would be installed, where groundwater is encountered within the depth of investigation as described above.
- For Phase 3, along the proposed alignment of bores at the 1000 m buffer from SWMC, deep wells to intersect the coal seams are not considered necessary at this stage as the potential transport pathway (T1) through the coal seams would be assessed via the deep wells within the northern alignment of bores. These bores at the approximately 1000 m buffer alignment would be drilled to the lesser of 10 m depth or 3 m below the permanent groundwater level;
- Installation of a gas monitoring wells in the relevant bores;

- The gas monitoring wells will be constructed of:
 - 50 mm diameter flush threaded Class 18 uPVC and machine slotted screens. The depth interval of the slotted screen is to be determined based on the subsurface conditions encountered, however should aim to encompass the strata that is most likely to allow migration of ground gasses (i.e. coal seam or other permeable layers);
 - An appropriate end cap will be installed at the base of the well;
 - A sand filter will be installed to approximately 1 m above the screened section, with an approximately 1 m thick bentonite sealing layer above;
 - The upper section of the annulus of the piezometers will be backfilled with cuttings and screened sand to approximately 1 m below the surface where a 1 m concrete plug is to be installed;
 - Each well is to be fitted with a gas-tight cap with quick connect gas fitting;
 - A stick-up of approximately 1 m will be provided above the ground surface;
 - A steel monument cover is to be placed at the surface.
- The MGA coordinates of each well are to be recorded using a differential GPS unit which is normally accurate to within about ± 0.1 m depending on satellite coverage.

The groundwater monitoring wells will be constructed as above with the following alterations:

- The slotted depth interval will extend over the likely groundwater table and should be a minimum of 3 m in length;
- An appropriate (quick connect) gas cap will be securely placed at the top of the well.

7.4 Gas Monitoring

Following installation and development of the gas wells, all wells will be monitored in accordance with the procedures outlined in NSW EPA (2020). The monitoring method is described as follows:

- Review of meteorological data prior to sampling (notably, atmospheric pressure and rainfall);
- At each well utilising a suitable calibrated landfill gas meter (ie GA5000 or GFM430):
 - Recording the time and atmospheric conditions with the meter (barometric pressure) prior to sampling.
 - Connect the meter to the gas sampling cap on the well.
 - Measure barometric pressure.
 - Measurement and recording of flow (L/h) for a duration of 10 minutes. Note if negligible and stable flow (0 – 0.3 L/h) is observed, a reduced period of 3-5 minutes may be considered appropriate.
 - Measurement and recording of bulk gas (O_2 , CH_4 , CO_2 , CO and H_2S) concentrations for a duration of 10 minutes.
 - Using an electronic interface meter, measurement and recording of potential standing water in the well following the above sampling procedure.
- Summarising on standardised field sampling sheets:
 - Flow and concentration data at minute intervals.

- o Peak flow and bulk gas concentrations for each event.
- o Local atmospheric conditions during the sampling event (ie, BOM data or equivalent).
- Subsequent to collection of LFG data using the calibrated GA5000 (or similar), a calibrated photoionisation detector (PID) will be attached to the quick connect gas fitting to screen for volatile organic compounds.
- The gas screening value (GSV) will be derived based on the results of the gas monitoring and using the Wilson and Card method (refer Section 6.2). This method defines the characteristics situation (CS) value for the site based on the borehole gas volumetric flow for methane and carbon dioxide.
- Should significant gas readings be encountered, with a characteristic situation of greater than 1, consideration would be given to laboratory testing of recovered gas samples for further assessment of the source (i.e. landfill or coal seam gas).

7.4.1 Quality Assurance / Quality Control

The overall investigation/monitoring programme will at a minimum include the following quality assurance/quality control measures:

- The LFG wells will be constructed with an adequate seal to minimise the potential for drawing atmospheric air into the well during monitoring. This will be achieved by placing the screen and a bentonite seal for all LFG wells at least 1.5m below the surface and subsequently backfilling the top 1.5m (above the bentonite) with spoil recovered from the drilling.
- Review of meteorological data prior to sampling (notably, atmospheric pressure and rainfall). Where possible LFG screening will be avoided during heavy rain events although dropping pressure events will be targeted where practical.
- Use of competent staff that are experienced with LFG monitoring using the proposed equipment.
- Use of calibrated field equipment for each event with suitable detection limits (GA5000, GFM30 or equivalent).
- Use of standard field sheets and procedures.

On completion of each monitoring event, the data will be reviewed to evaluate whether the DQO requirements have been met. Should the results indicate otherwise, the procedures will be revaluated and any modifications to the procedures will be discussed with the auditor and implemented following receipt of their approval.

7.5 Groundwater Monitoring

Groundwater levels will be monitored in the groundwater wells, as well as in the gas monitoring bores (following gas readings being taken) during each monitoring round for the sole purpose of understanding the groundwater levels within the site.

7.6 Monitoring Frequency

EPA (2020) notes that “for bulk ground gases and moderate-sensitivity development (equivalent to the ‘residential use with minimal access to soil’ exposure setting), CIRIA (2007) recommends between six and 12 monitoring events extending over two to 24 months (unless the source’s gas-

generation potential is very high).” It notes further that the NSW “guidelines are not intended to be prescriptive in this respect. Consistent with the general approach to contaminated land assessment adopted in NSW and nationally, professional judgement is required, based on a sound CSM and the sensitivity of the proposed site use. Such decisions must be fully justified in the relevant reports.”

Accordingly, the monitoring frequency and duration for landfill gas will be undertaken every two months over a period of two years (24 months). The location of the monitoring wells is shown on Drawing 3, Appendix B.

Following this monitoring period, the need for and frequency of further monitoring rounds would be re-assessed. The re-assessed frequency would be dependent on the gas conditions encountered during the initial period of monitoring.

Monitoring should be undertaken during periods of lower barometric pressure where possible.

7.7 Reporting

At the end of the ground gas monitoring period, a report, reviewed will be provided outlining:

- The results of the initial investigation and installation of the wells;
- A description of the monitoring events and results of the monitoring events;
- Updated conceptual site model for hazardous ground gas migration;
- Assessment of risk of hazardous ground gas migration to the proposed residential development;
- Potential engineering controls to mitigate the risks of hazardous ground gas and allow residential development, if required.

The report will be reviewed by a Certified Environmental Practitioner (Site Contamination).

8. References

Douglas. (2019). *Report on Preliminary Mine Workings Assessment, Proposed Future Development, Link Road, Wallsend, Project 91610.00*. Douglas Partners Pty Ltd.

DP. (2020). *Report on Desktop Geotechnical Assessment, Proposed Residential Development, New Wallsend, Off Bulkara Street, Wallsend, Project 91610.03*. Douglas Partners Pty Ltd.

DP. (2020a). *Report on Geotechnical Investigation of Filled Areas Proposed Residential Development, Off Bulkara Street, Wallsend, Project 91610.05*. Douglas Partners Pty Ltd.

DP. (2021). *Report on Desktop Mine Subsidence Assessment, New Wallsend Residential Development Area, Off Bulkara Street, Wallsend, Project 91610.04*. Douglas Partners Pty Ltd.

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]*. Australian Government Publishing Services Canberra: National Environment Protection Council.

NSW EPA. (2016). *Environmental Guidelines, Solid Waste Landfills, Second Edition, 2016*. NSW Environment Protection Authority.

NSW EPA. (2020a). *Assessment and Management of Hazardous Ground Gases*. NSW Environment Protection Authority.

NSW EPA. (2020b). *Guidelines for Consultants Reporting on Contaminated Land*. Contaminated Land Guidelines: NSW Environment Protection Authority.

Packham, G. (1969). *The Geology of New South Wales*. Geological Society of Australia Incorporated, Sydney.

SEPA. (2004). *Guidance on the management of landfill gas, LFTGN03, Landfill Directive*. Scottish Environmental Protection Agency.

9. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this SAQP for this project located off Lake Road, Wallsend NSW in line with Douglas' proposal dated 5 August 2024 and acceptance received from Tim Goldacre of Eden Estates (Newcastle) Pty Ltd in purchase order No LR-DP-04 dated 13 August 2024. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Eden Estates (Newcastle) Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions from previous subsurface investigations on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after Douglas' field testing has been completed.

Douglas' advice is based upon the conditions encountered during previous investigations. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the environmental / groundwater components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

Released by the Environment Protection Authority under the GIPA Act; EPR 375

Appendix A

About This Report

Introduction

These notes have been provided to amplify Douglas' report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

Douglas' reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Engagement Terms for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather

changes. They may not be the same at the time of construction as are indicated in the report; and

- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, Douglas will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, Douglas cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, Douglas will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, Douglas requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. Douglas would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

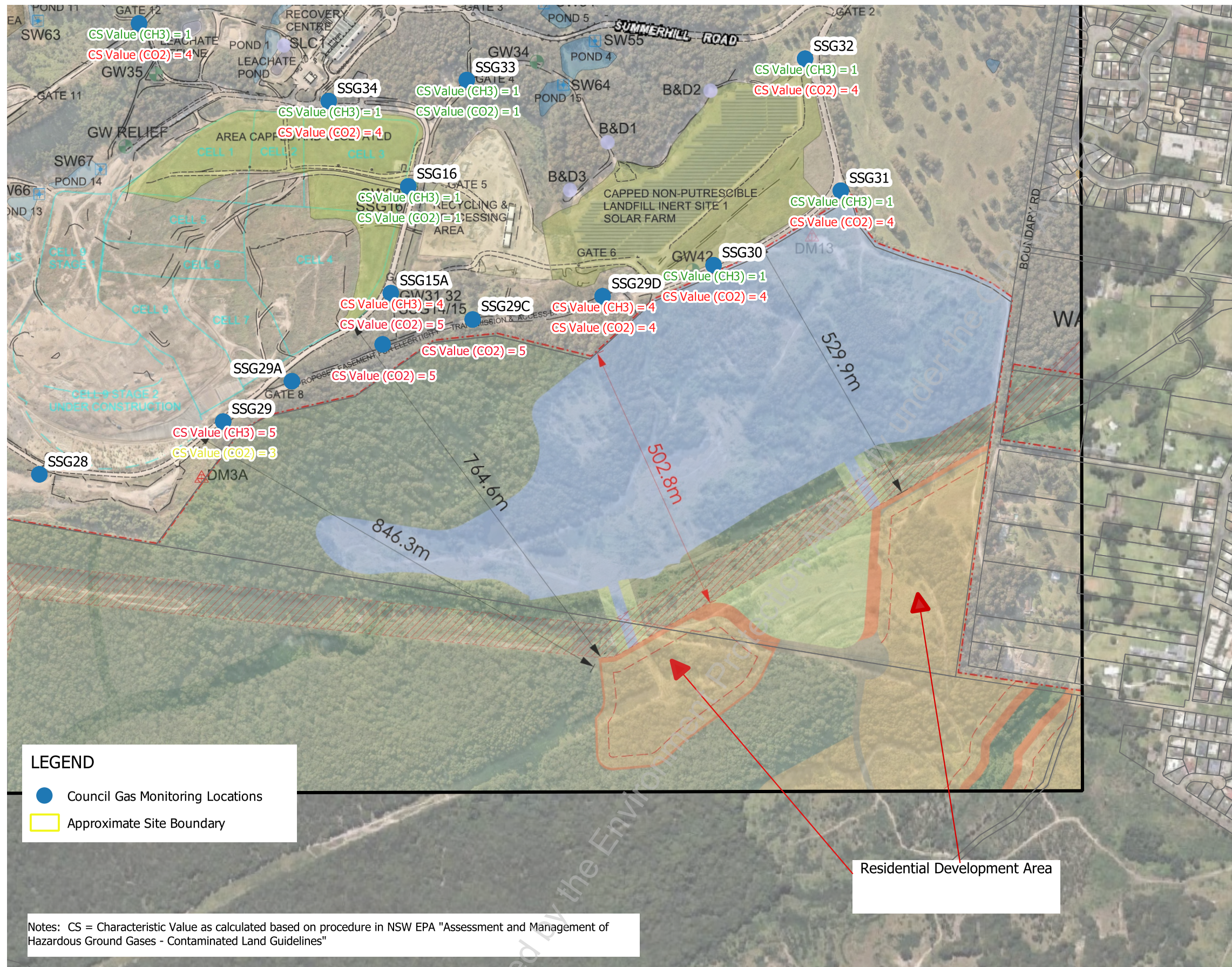
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Appendix B

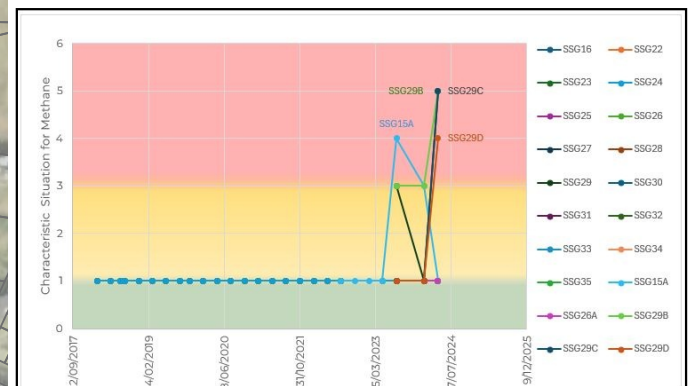
Drawing 1 – Summary of Existing Gas Monitoring Wells and Characteristic Situation

Drawing 2 – Conceptual Site Model – Section AA

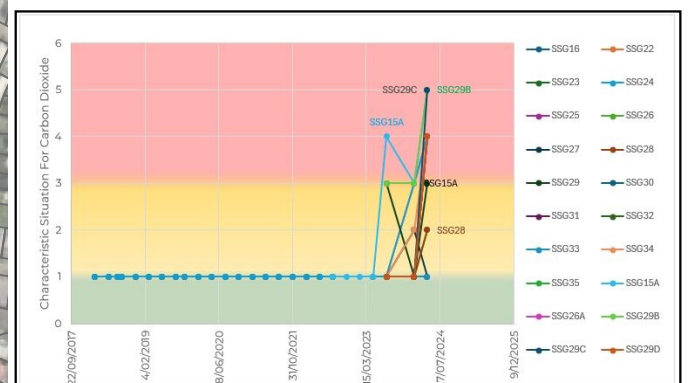
Drawing 3 – SAQP for Ground Gas Assessment - Proposed Well Locations



SITE LOCATION



Characteristic Situation Over Time Methane



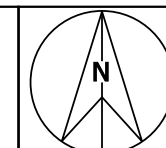
Characteristic Situation Over Time Carbon Dioxide

0 100 200 300 400 500 m

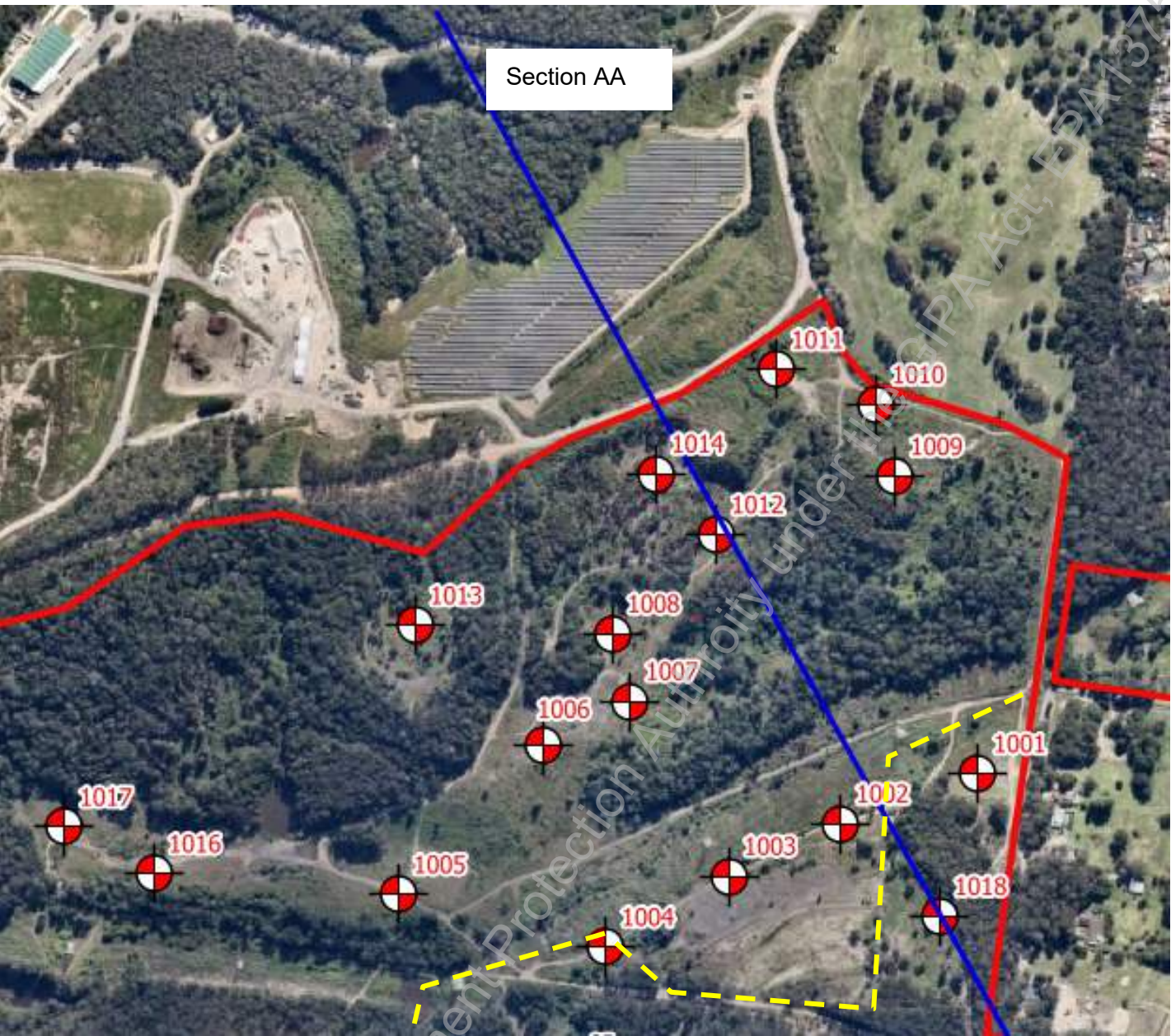


CLIENT: Eden Estatets Pty Ltd
OFFICE: Newcastle
DRAWN BY: S74
DATE: 01.April.2025

TITLE: **Summary of Existing Gas Monitoring Wells and Characteristic Situation**
Proposed Residential Development
144 Boundary Road, Wallsend, NSW



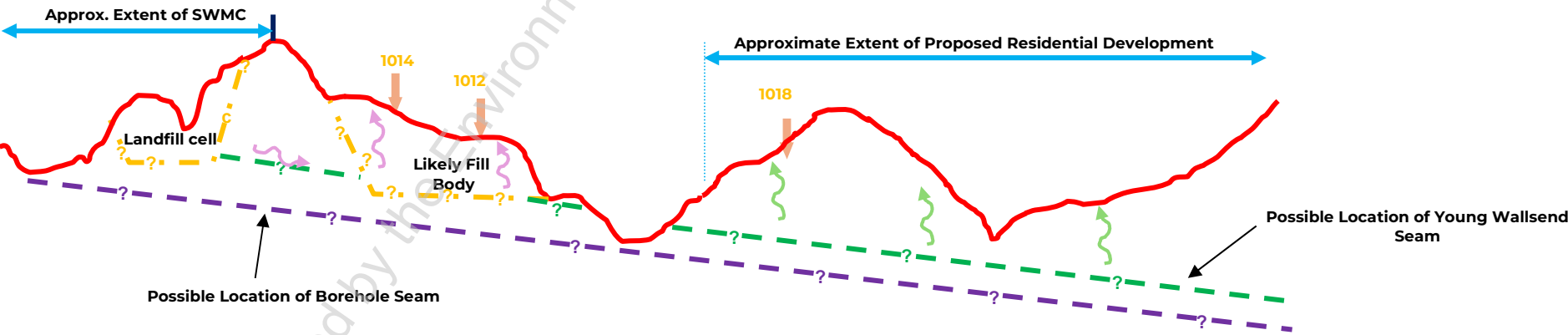
PROJECT: 91610.08
DRAWING No: 1
REVISION: 1



Notes to Drawing:

Surface level, depths and locations are approximate only.
Depth to coal seams are approximate only and based on desktop interpolation.
Conceptual site model only to illustrate possible hazardous ground gas migration pathways

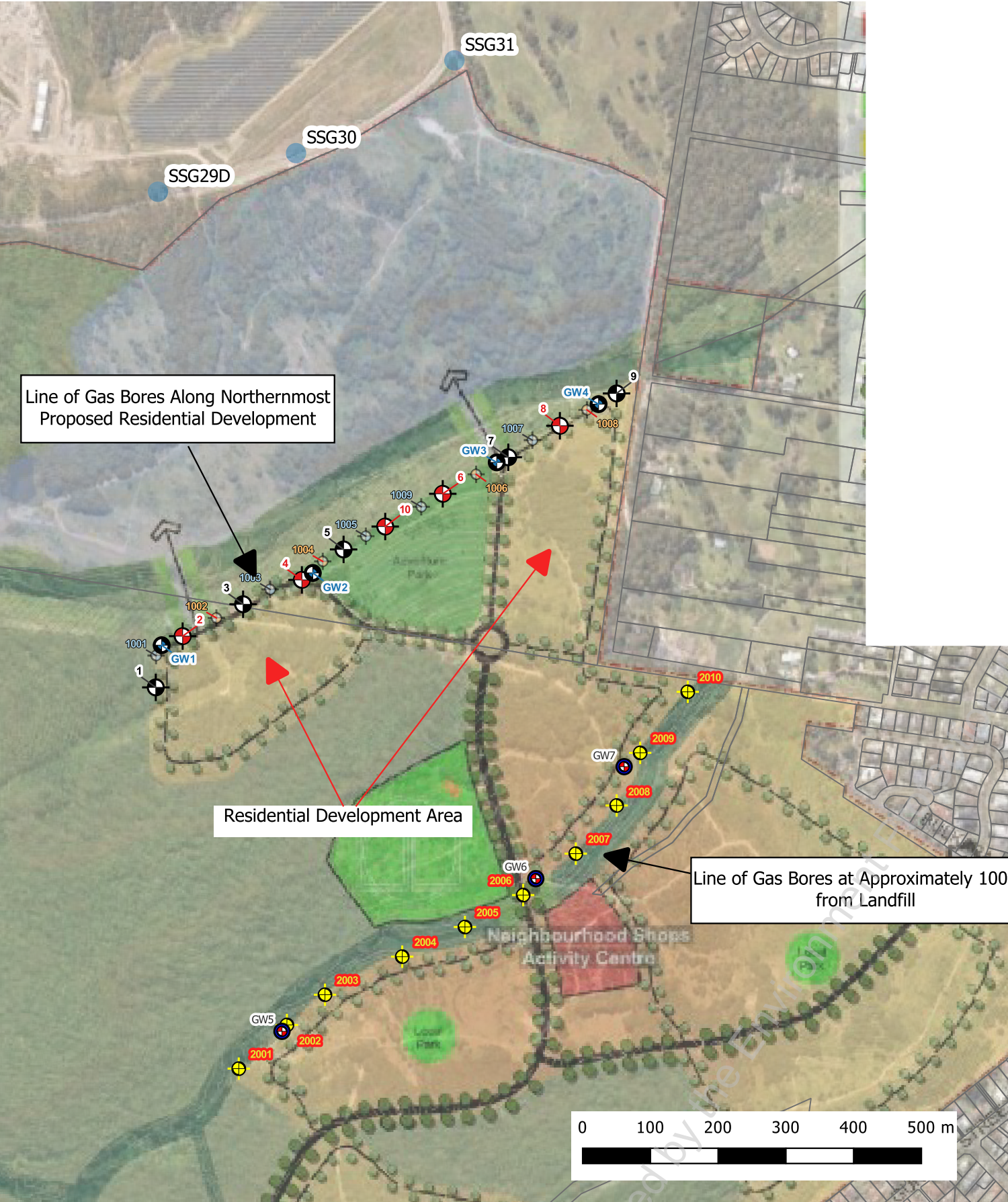
Scale for Conceptual Section:
1:7500 horizontal (approximately)
1:1500 vertical (approximately)



CLIENT:	Eden Estates (Newcastle) Pty Ltd	
OFFICE:	Newcastle	DRAWN BY: s74
SCALE:	As Shown	DATE: 27.11.2024

TITLE: **Conceptual Site Model – Section AA**
Hazardous Ground Gas Migration

PROJECT No:	991610.08
DRAWING No:	2
REVISION:	0



LEGEND	
Phase 1	Phase 2
Gas Wells - Deep	Gas Well - Deep
Gas Wells - Shallow	Gas Well - Shallow
Groundwater Wells	Phase 3 - Gas Well - Mid Depth
	Phase 3 - Groundwater Wells
	Council Gas Monitoring Locations

NOTE:

1. Drawing projection in GDA2020 / MGA zone 56, adapted from aerial imagery from "GoogleEarth"

2. Test locations are approximate only and were located using differential GPS typically accurate to ± 0.1 m depending on satellite coverage

Appendix C

Council Data

Subsurface Gas Results

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

Newcastle City Council - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units		%v/v	%v/v	% v/v	ppm
LOR		0.1	0.1	0.1	0.1
NCC ID	EPL ID				
SGG16	16	0	0.1	20.1	0
SSG23	23	0	0.1	20.1	0
SSG24	24	0	34.9	12.7	0
Threshold		1.0% above background	1.5 % above background	-	-

Notes:

Date sample collected 13/3/18. Date published 20/3/18.

All units g/m²/month

NCC = Newcastle City Council

EPL = Environment Protection Licence

Thresholds are based on the NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of dust deposition gauges can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

Newcastle City Council - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
NCC ID	EPL ID				
SGG16	16	0	0	21.3	1
SSG23	23	0	1.5	19.4	0
SSG24*	24	1	0.1	21.2	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Date samples collected 14/6/18. Date published 27/6/18.

LOR = Limit of reporting of the instrument

NCC = Newcastle City Council

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 2 August 2017

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of dust deposition gauges can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

Newcastle City Council - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
NCC ID	EPL ID				
SGG16	16	0	10	2.3	0
SSG23	23	0	5.7	2.5	0
SSG24*	24	0	0	21	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Date samples collected 21/9/18. Date published 29/10/18.

LOR = Limit of reporting of the instrument

NCC = Newcastle City Council

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 2 August 2017

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of dust deposition gauges can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0.0	0.0	19.8	1
SSG23	23	0.0	12.6	4.8	0
SSG24*	24	0.0	0.0	20.5	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Date samples collected 18/12/2018. Date published 18/1/2019.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 2 August 2017

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of dust deposition gauges can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0	19.7	1
SSG23	23	0	5.9	12	0
SSG24*	24	0	0	21.1	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Data supplied 11.3.2019. Date published 20.3.2019

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 2 August 2017

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of dust deposition gauges can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0.1	20.9	0
SSG23	23	0.1	12.5	6.3	0
SSG24*	24	0	0.1	21.2	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Date samples collected 21/06/2019. Date published 29/7/2019.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 2 August 2017

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of dust deposition gauges can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0.1	20.8	0
SSG23	23	0	11.2	7.1	0
SSG24*	24	0	0.1	21.4	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 24/9/2019. Final data obtained 4/10/2019. Date published 21/10/2019.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 10 December 2018

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

November 2019

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0.1	20.1	0
SSG23	23	0	4.5	4.5	0
SSG24*	24	0	0	20.8	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 15/11/19. Final data obtained 25/11/19. Date published 28.11.2019.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 10 December 2018

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

February 2020

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre - 141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0	20.5	0
SSG23	23	0	5.5	13.3	0
SSG24*	24	0	0	20.6	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 21/02/20. Final data obtained 28/02/20. Date published 06/03/20.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 3rd February 2020

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

May 2020

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0.1	21.6	0
SSG23	23	0	8.9	10.4	0
SSG24*	24	0	0	21.6	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 18/05/20. Final data obtained 18/06/20. Date published 18/06/20.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 10 December 2018

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

August 2020

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	16.3	2.9	0
SSG23	23	0	1.9	18.3	0
SSG24*	24	0	0.1	21.2	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 21/08/20. Date published 15/09/20

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 10 December 2018

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

November 2020

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0.1	20.5	0
SSG23	23	0	0	20.9	0
SSG24*	24	0	0.1	20.5	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 20/11/20. Final data obtained 5/12/20. 11/12/20.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 10 December 2018

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

February 2021

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0	20.3	1
SSG23	23	0	0	20.3	1
SSG24*	24	0	0	20.1	1
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 19/02/21. Final data obtained 18/03/21. Published date: 19/03/21.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 10 December 2018

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

August 2021

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0	21.3	0
SSG23	23	0	0	22.8	0
SSG24*	24	0	0	21.1	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 05/08/21. Final data obtained 23/08/21. Published date: 25/08/21.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 19 July 2021

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

May 2021

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0.1	20.2	1
SSG23	23	0	0.1	20.9	0
SSG24*	24	0	0.1	20.4	1
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 21/05/21. Final data obtained 24/05/21. Date published 28/05/21.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 10 December 2018

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

November 2021

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0.1	21.0	0
SSG23	23	0	0	20.3	1
SSG24*	24	0	0	20.3	1
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 04/11/21. Final data obtained 04/11/21. Published date: 19/04/2022

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 19 July 2021

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

February 2022

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	0.1	20.7	0
SSG23	23	0	0.1	20.6	0
SSG24*	24	0	0.1	20.5	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 04/02/22. Final data obtained 04/02/22. Published date: 19/04/22.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 19 July 2021

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

May 2022

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SGG16	16	0	17.9	1.3	1
SSG23	23	0	14.8	2.8	2
SSG24*	24	0	0.1	22.5	1
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 06/05/22. Final data obtained 06/05/22. Published date: 17/06/22.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 19 July 2021

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

August 2022

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SSG15A	67	37.8	30.7	0	0
SGG16	16	0	17.9	0.7	0
SSG23	23	0	0.1	20.4	0
SSG24*	24	0	13.2	5.1	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 09/08/22. Final data obtained 17/08/22. Published date: 19/09/22.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

* Well historically sealed due to water level above the screened interval. Results in previous publications are pre-purge data and may not be indicative of actual subsurface gas concentrations. An alternate purge method was successfully applied in June 2018, allowing collection of the necessary post-purge data.

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 19 July 2021

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

November 2022

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SSG15A	67	37.7	30.4	0	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 15/11/22. Final data obtained 15/11/22. Published date: 15/12/22.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 5 July 2022

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

February 2023

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	0.1
CN ID	EPL ID				
SSG15A	67	34.6	29.5	0.3	0
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 16/02/23. Final data obtained 16/02/23. Published date: 15/03/23.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 5 July 2022

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A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

May 2023

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas

City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Oxygen O ₂	Hydrogen Sulfide H ₂ S
Units:		%v/v	%v/v	% v/v	ppm
LOR:		0.1	0.1	0.1	1
CN ID	EPL ID				
SSG15A	67	35.9	30.3	<0.1	1
Threshold		1.0% above background ¹ 1.25% ²	1.5 % above background ¹	-	-

Notes:

Sampling date 23/05/23. Final data obtained 23/05/23. Published date: 15/06/23.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 20 March 2023

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

August 2023

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas
City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Carbon Monoxide CO	Nitrogen N	Pressure	Oxygen O ₂	Hydrogen Sulfide H ₂ S	Flow Rate
Units:		%	%	%	%	KPa	%	%	L/hr
LOR:		0.1	0.1	0.0001			0.1	0.0001	
CN ID	EPL ID								
SSG15A	67	37.1	31.0	<0.0001	31.2	0.028	0.3	0.0001	0.2
SSG22	87	<0.1	5.9	<0.0001	81.7	0.009	12.0	<0.0001	0
SSG24	88	<0.1	7.9	<0.0001	80.0	-0.016	11.7	<0.0001	0
SSG25	89	<0.1	14.6	<0.0001	80.7	-0.012	4.3	<0.0001	0
SSG26	90	<0.1	1.6	<0.0001	79.0	-0.495	19.4	<0.0001	0
SSG27	91	0.3	1.8	<0.0001	79.2	-0.009	18.3	<0.0001	0
SSG28	92	0.2	0.6	<0.0001	79.2	-3.26	19.6	0.0001	0
SSG29	93	26.4	14.0	<0.0001	54.3	-0.03	4.9	0.0020	0.1
SSG30	94	<0.1	4.2	0.0001	82.4	0.003	13.4	<0.0001	0
SSG31	95	<0.1	5.7	<0.0001	83.8	0.003	10.5	<0.0001	0
SSG32	96	0.1	4.1	<0.0001	85.4	-0.019	10.0	<0.0001	0
SSG33	97	<0.1	0.1	<0.0001	78.4	0.017	21.5	<0.0001	0
SSG34	98	<0.1	12.8	<0.0001	77.8	-0.031	9.4	<0.0001	0
SSG35	99	<0.1	4.1	<0.0001	79.4	0.012	16.5	<0.0001	0
SSG29B	101	24.6	26.2	0.0007	47.4	0.007	1.8	<0.0001	0.1
SSG29C	102	<0.1	7.4	0.0004	82.0	-4.47	10.6	<0.0001	0
SSG29D	103	3.6	3.6	0.0001	76.0	-1.00	16.8	<0.0001	0
SSG26A	104	<0.1	0.1	0.0001	79.7	-0.005	20.2	<0.0001	0

Threshold	1.0% above background ¹ 1.25% ²	1.5 % above background ¹		-	-	-	--	-
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- Please note the nitrogen concentration is automatically calculated by the instrument.

Sampling date 11/08/23. Final data obtained 11/08/23. Published date: 22/09/23.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 20 March 2023

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Subsurface Gas Results

February 2024

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas
City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Carbon Monoxide CO	Nitrogen N	Pressure	Oxygen O ₂	Hydrogen Sulfide H ₂ S	Flow Rate
Units:		%	%	%	%	KPa	%	%	L/hr
LOR:		0.1	0.1	0.0001			0.1	0.0001	
CN ID	EPL ID								
SSG15A	67	30.2	28.2	<0.0001	41.6	0.016	<0.1	<0.0001	0.1
SSG22	87	<0.1	10.4	<0.0001	83.5	0.005	6.1	0.0001	0.1
SSG24	88	<0.1	9.5	<0.0001	80.5	0.03	10	<0.0001	0.1
SSG25	89	<0.1	13.7	<0.0001	80.2	-0.012	6.1	<0.0001	<0.1
SSG26	90	<0.1	0.3	<0.0001	80.6	0.012	19.1	<0.0001	<0.1
SSG27	91	0.1	2.4	<0.0001	80.1	0.009	17.4	0.0001	0.1
SSG28	92	<0.1	0.3	<0.0001	81.5	-0.014	18.2	0.0001	-0.1
SSG29	93	26.5	21.2	0.0001	52.3	0.009	<0.1	0.0075	<0.1
SSG30	94	<0.1	9.8	0.0001	86.6	-0.009	3.6	<0.0001	<0.1
SSG31	95	<0.1	1.5	<0.0001	80.7	0.009	17.8	<0.0001	<0.1
SSG32	96	0.1	0.6	<0.0001	79.7	0.003	19.6	<0.0001	<0.1
SSG33	97	0.2	0.1	<0.0001	79.7	0.002	20	0.0001	<0.1
SSG34	98	0.2	6.1	<0.0001	80.6	0.002	13.1	0.0001	0.1
SSG35	99	<0.1	4.1	<0.0001	78.9	0.007	17	<0.0001	<0.1
SSG29B	101	20.4	20.8	0.0005	55	0.003	3.8	<0.0001	0.1
SSG29C	102	<0.1	6.2	0.0002	82.2	-0.112	11.6	<0.0001	-0.4
SSG29D	103	5.4	4.8	<0.0001	74.7	0	15.1	<0.0001	-0.1
SSG26A	104	<0.1	2.6	<0.0001	80	-0.01	17.4	0.0001	<0.1

Threshold	1.0% above background ¹ 1.0% ²	1.5 % above background ¹		-	-	-	--	-
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- Please note the nitrogen concentration is automatically calculated by the instrument.

Sampling date 16, 17 and 21 November 2023. Final data obtained 22/02/24. Published date: 20/03/24.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 4 July 2023

A copy of the Environmental Protection Licence can be viewed at: <http://app.epa.nsw.gov.au/prpoeoapp/>

A map showing the location of gas wells can be viewed at: <http://www.newcastle.nsw.gov.au/Living/Waste-recycling/Summerhill-Waste-management-Centre/Environmental-Monitoring-Data>

Subsurface Gas Results

May 2024

Environment Protection Licence 5897 - Condition M2 - Air Quality - Quarterly Subsurface Gas
City of Newcastle - Summerhill Waste Management Centre
141 Minmi Road, Wallsend, NSW

Parameter		Methane CH ₄	Carbon Dioxide CO ₂	Carbon Monoxide CO	Nitrogen N	Pressure	Oxygen O ₂	Hydrogen Sulfide H ₂ S	Flow Rate
Units:		%	%	%	%	KPa	%	%	L/hr
LOR:		0.1	0.1	0.0001			0.1	0.0001	
CN ID	EPL ID								
SSG15A	67	34.7	30.2	<0.0001	34.9	0.116	0.2	<0.0001	1.1
SSG22	87	<0.1	4.5	<0.0001	81.9	0.105	13.6	<0.0001	1.1
SSG24	88	<0.1	8.7	<0.0001	82.7	0.13	8.6	<0.0001	1.1
SSG25	89	<0.1	14.9	<0.0001	80.3	0.088	4.8	<0.0001	1
SSG26	90	<0.1	0.5	<0.0001	79.6	0.112	19.9	<0.0001	1
SSG27	91	<0.1	<0.1	<0.0001	79.2	0.109	20.8	<0.0001	1.1
SSG28	92	<0.1	0.4	<0.0001	79.9	0.086	19.7	<0.0001	0.9
SSG29	93	23.6	20.7	<0.0001	54.2	0.109	1.5	<0.0001	1
SSG30	94	<0.1	5.9	<0.0001	92.2	0.091	1.9	<0.0001	1
SSG31	95	<0.1	14.3	<0.0001	84.7	0.109	1	<0.0001	1
SSG32	96	<0.1	3.7	<0.0001	83.1	0.103	13.2	<0.0001	1
SSG33	97	<0.1	<0.1	<0.0001	79.1	0.102	20.9	<0.0001	1
SSG34	98	<0.1	10.6	<0.0001	81.1	0.102	8.3	<0.0001	1.1
SSG35	99	<0.1	3.6	<0.0001	80.5	0.107	15.9	<0.0001	1
SSG29B	101	23	25	<0.0001	49.6	0.103	2.4	<0.0001	1.1
SSG29C	102	66.4	28.7	<0.0001	4.9	-0.012	<0.1	<0.0001	0.6
SSG29D	103	14.3	12.2	<0.0001	68.7	0.1	4.8	<0.0001	0.9
SSG26A	104	<0.1	6.4	<0.0001	82.2	0.09	11.4	<0.0001	1

Threshold	1.0% above background ¹ 1.0% ²	1.5 % above background ¹		-	-	-	--	-
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- Please note the nitrogen concentration is automatically calculated by the instrument.

Sampling date 29 May 2024 Published date: 20/06/24.

LOR = Limit of reporting of the instrument

CN = City of Newcastle

EPL = Environment Protection Licence

1. NSW EPA Environmental Guidelines for Solid Waste Landfills, 2016.

2. EPL 5897, version date 4 July 2023

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