

City of Newcastle
12 Stewart Avenue
Newcastle West 2300

ATTN: Shane Cahill

Date: 6th September 2024

Sent via email: scahill@ncc.nsw.gov.au
pmilles@ncc.nsw.gov.au

Dear Shane,

Re: Eden Estates Rezoning Request – Newcastle Link Road

Thankyou for your correspondence dated 24th July 2024. It is noted in CN's correspondence that a request is made of Eden Estates to withdraw the above planning proposal. It is understood that this request to withdraw is made on the basis of the various matters raised in the letter received from Environmental Protection Authority NSW (EPA) on 15th July 2024.

The various matters raised in the EPA letter do not preclude the proposed residential development, but rather may take time to address in detail depending on the investigations required. I refer to the enclosed correspondence provided by Douglas Partners and Ramboll which provide preliminary comment on two key matters raised being underground gas and contamination, and the proposed way forward. A comprehensive response to all matters raised by EPA is forthcoming and is anticipated to be provided to EPA within the coming week.

It is proposed that the matters raised by EPA can be addressed by more detailed studies at the appropriate time during the planning process. Specific reference is made to the potential presence of ground gas on the site due to the landfill activities of the Summerhill Waste Management Facility as raised by EPA.

With reference to the enclosed correspondence provided by Douglas Partners, it is noted that EPA policy delineates a 250m minimum buffer to landfill facilities whilst also

referencing a nominal 1000m buffer for new landfill sites. It is noted that the proposed residential development is a minimum of 529m from the capped non-putrescible landfill cell (eastern cell), and a minimum of 764m from the current/future putrescible landfill cell (western cell).

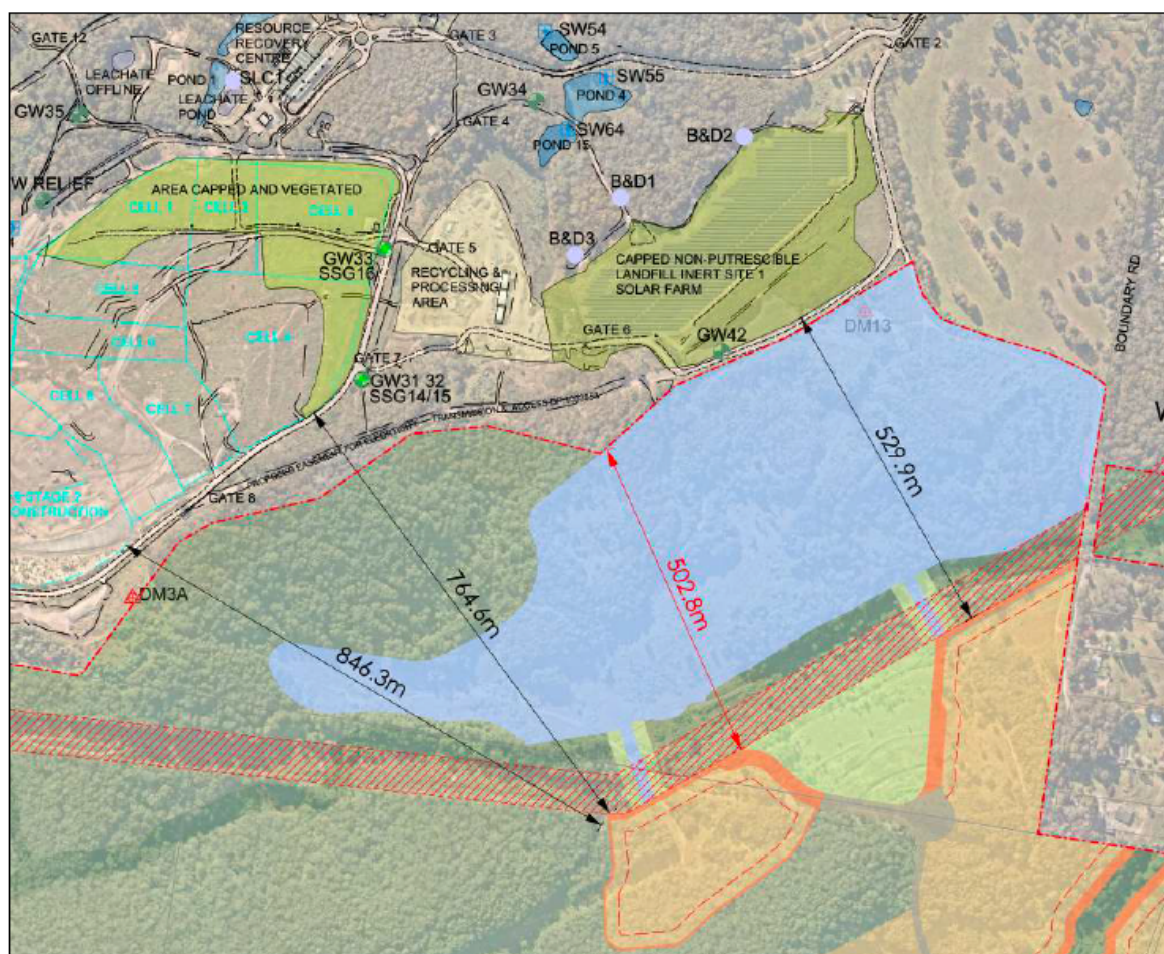


Figure 1: Proposed residential development distance to Summerhill

Having regard for these proposed buffer distances, and the scale of the site included within the proposal, Douglas Partners has proposed to delineate the proposed sampling and analysis plan utilising the 1000m radius as nominated by EPA policy. The ground gas assessment methodology as proposed by Douglas Partners provides a suggested way forward to ensure comprehensive testing and analysis is undertaken with recognition of the risk profile of the various locations across the site.

In summary, it is proposed for the following to be undertaken in consultation with EPA to ascertain the presence or otherwise of underground gases on the site:

1. *Review of available data to develop a conceptual site model for gas migration.*
2. *Identification of data gaps that would be required to develop the SAQP*
3. *Development of preliminary SAQP including but not limited to:*
 - a. *Relevant/applicable guidelines;*
 - b. *Preliminary conceptual site model for landfill gas generation and migration;*
 - c. *Monitoring and sampling approach;*
 - d. *Drawing showing proposed location of boreholes;*
 - e. *Timetable / frequency of monitoring;*
4. *Implementation of the SAQP*

Despite the concerns raised by the EPA regarding the presence of underground gas within the landfill facility, it is presumed that any pollution generated by the facility is not migrating from the facility to adjoining properties.

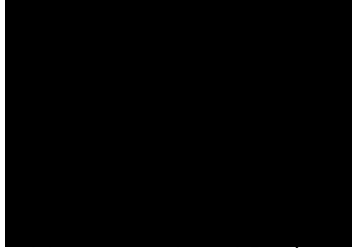
Notwithstanding, the proposed implementation of a Sampling Analysis Quality Plan by Douglas Partners will allow the matter to be thoroughly investigated to ensure potential land use conflicts are avoided.

In light of the above, and as requested by CN, it is agreed to withdraw the planning proposal in order to facilitate the formulation of the SAQP and resolution of the matter with EPA. It is anticipated that a planning proposal will be relodged expeditiously following the endorsement of the SAQP by EPA.

It is noted that circa 345 dwellings are proposed within 1000m of the landfill facility, with circa 3300 dwellings proposed outside of the 1000m radius and as such it is expected that planning assessment can progress across the entire site whilst the SAQP is being implemented to confirm any assumptions made during the initial planning assessment.

We look forward to working with CN, EPA, LMCC and DPHI to resolve land use outcomes across the entire site to deliver 3600 well located homes on this strategic urban release site.

Yours sincerely,



Manager – Land Projects

Encl:

- Response to contamination queries (Ramboll)
- Proposed SAQP methodology – underground gas (Douglas Partners)
- Request for information - underground gas (Douglas Partners)

NSW Environmental Protection Authority
Locked Bag 5022
Parramatta NSW 2124

12 September 2024

Dear [REDACTED]

1.0 Introduction

This submission is made on behalf of Eden Estates in relation to a request made by the applicant on December 2020 to rezone C4 Environmental living land to residential, environmental and employment zones at 144 Boundary Road, Wallsend. The purpose of this letter is to provide a response to comments received by the NSW Environment Protection Authority (EPA) dated 15 July 2024 (EPA ref. DPC24/471046-3). We appreciate the EPA taking the time to undertake a comprehensive review of the planning proposal and advice on the way forward.

This submission should be read in conjunction with the following:

- Supplementary advice, prepared by Douglas Partners (**Attachment A**)
- Supplementary Preliminary Site Investigation advice dated 3 September 2024, prepared by Ramboll (**Attachment B**)

The EPA is committed to delivering positive planning and environmental outcomes that support healthy environments, economies and communities – an objective that resonates strongly with Eden Estates.

Eden Estates is a development group that has a proud legacy of successfully delivering a number of award-winning residential estates (Harrington Park, Harrington Grove and Catherine Park Estate) within Greater Sydney for more than 25 years. The planning proposal is the first step in delivering approximately 3,700 dwellings (including homes for key worker, first home buyers, rent to buy, seniors and accessible housing), securing more than 330 ha of native vegetation on the site (in perpetuity) and 380 ha of native vegetation at Ellalong Lagoon (biodiversity stewardship site) in perpetuity, land for a new school, playing fields and 238 ongoing direct and 78 additional indirect full time equivalent jobs. Eden Estates is committed to delivering good planning outcomes.

2.0 Summary

As demonstrated within this response, there is no impediment in terms of contamination, noise and vibration, air quality and stormwater management, that cannot be appropriately managed, that would prevent planning and development of land for the proposed uses as envisaged in the planning proposal.

- The planning proposal has considered the potential impacts associated with this facility in terms of noise, dust, air, odour and gas migration on future sensitive (residential) and non-sensitive (commercial and light industrial) envisaged on the site. In our opinion, any potential land use conflict is or can be effectively managed through a combination of the following:
 - Establishing a buffer between the SWMC and future residential uses within the site. The planning proposal includes a minimum 500m wide buffer within the northern boundary of the site, between the existing SWMC and future sensitive residential uses. Within the minimum 500m buffer is native vegetation (conservation land), Maryland Creek and 'transition land' with

permissible uses to be agreed with the City of Newcastle Council (Council) in consultation with the EPA. No residents are expected to reside in this area (i.e. no caretaker etc).

- Preparation and implementation of a Sampling, Analysis and Quality Plan (SAQP) in consultation with the EPA for land that is within 1,000m of the SMWC. The SAQP will provide a more thorough understanding and assessment of the potential risk associated with ground gas migration from the SWMC onto the site. It will also determine appropriate mitigation measures (both on and off site) if they are required. Whilst the characteristic situation for the wells located on the SWMC boundary indicate a “moderate to high” and “high” risk, Douglas Partners note 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, landfill cell details, landfill cell materials, lining conditions of landfill, groundwater levels). They note that the gas readings and flow may be completely 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.
- Proposed mitigation measures/engineering controls within the site - if the analysis concludes this is required. Potential mitigation measures could include active or passive venting under slabs or the construction of interception barriers. It is noted that around 340 dwellings of some 3,700 dwellings that could be accommodated on the overall site are within the 1,000m buffer. The details of any future mitigation measure (if they are even required) will be discussed with Council and the EPA before being documented at the development application stage when the design of buildings, subdivision layout and other detailed matters are known. These types of mitigation measures are not uncommon and, in our view, would not preclude future redevelopment of the site as proposed.
- Compliance by the operators of the existing SWMC with the relevant development consent and Environment Protection Licence (EPL) including section 5.4 of the EPA’s Landfill Guidelines which require operators of landfills to demonstrate landfill gas is not accumulating at dangerous levels in enclosed spaces in all building and other enclosed structures within 250m of deposited waste or leachate storage on or near a landfill.
- The Preliminary Site Investigation (PSI) prepared by Ramboll which accompanied the planning proposal concluded that the site can be made suitable for the proposed rezoning, including sensitive residential land use, subject to the removal of illegally dumped wastes, further investigation to close out data gaps and remediation. Ramboll have reviewed the EPA letter and reconfirmed their previous advice – that any contamination present at the site can be appropriately remediated and thus will not prevent planning and development of the land for the proposed uses.

The PSI details a clear and robust methodology for Eden Estates to follow. This methodology sets out how gaps in data are to be resolved (i.e. preparation of an SAQP for soil, ground gas and groundwater sampling) as well as the next steps required to be undertaken to conclude that the site is suitable for the proposed end uses. These next steps include the preparation of a detailed site investigation, remedial action plan, completing the remediation and preparation of a management plan for the long term (if required) and preparation of a validation report demonstrating that the remediation was successfully implemented.

Based on their experience, Ramboll have concluded that any contamination present at the site can be remediated either by on-site containment, off-site disposal or a combination of both options and that any anticipated site contaminants can be remediated by proven techniques.



Like other recently completed major rezonings, it is proposed to undertake a detailed site investigation post Gateway and prior to the lodgement of any future early works DA. This approach is consistent with Section 4.1.2 of the current guidelines (Managing Land Contamination – Planning Guidelines, SEPP 55 Remediation of land, 1998) and the Draft Contaminated Land Planning Guidelines (2019) which contemplate rezonings that cover large areas of land, where it is difficult for a planning authority to be satisfied that every part of the land is suitable for the proposed uses(s) in terms of contamination at the rezoning stage. The guidelines state that in these situations, the rezoning should be allowed to progress, provided existing measures are in place to ensure that the potential for contamination and the suitability of the land for any proposed use are assessed in more detail once detailed proposals are made. In our view, there are a number of suitable measures in place to ensure contamination is appropriately dealt with. These include:

- Clause 4.6 of the Resilience and Hazards SEPP – states that a consent authority must not grant consent to a DA unless it has considered whether the land is contaminated. The consent authority must also be satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the intended purpose and that the land will be remediated before the land is used for that purpose. The Resilience and Hazards SEPP requires a consent authority to consider the findings of a preliminary investigation or a detailed investigation. Future DAs for the site will be subject to this provision.
- Section B7 of Newcastle Development Control Plan 2023 details Council's policy regarding the management of contaminated land. Future DAs for the site will need to comply with this policy.
- *Contaminated Land Management Act 1997*. This establishes a process for the investigation and remediation of sites that pose a significant risk to human health or the environment. Future DAs for the site will need to comply with these provisions.

A detailed response to the matters raised by the EPA follows.

3.0 Buffers to residential uses, schools and other sensitive uses

The EPA's letter refers to page 4 of the Environmental Guidelines, Solid waste landfills (2016) (Landfill Guidelines) and notes that in the case of large putrescible waste landfills (more than 50,000 tonnes of putrescible waste per year), buffers of at least 1,000m 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. The 1,000m buffer referenced in the EPA letter is discussed in the context of siting new putrescible landfill operations and notes this is not always practicable to achieve. As shown in Figure 1, there are already existing residential uses to the north and north-east of the SWMC that are well within 1,000m of the existing SWMC. Only part of the Eden Estates site is within 1,000m of the SWMC. If gas migration is confirmed as an issue, and mitigation measures are required, then this would potentially effect ~340 dwellings out of some 3,700 dwellings that could be accommodated on the overall site. Based on the advice from Douglas Partners, in our view, the potential for gas migration would not preclude redevelopment of the overall site.



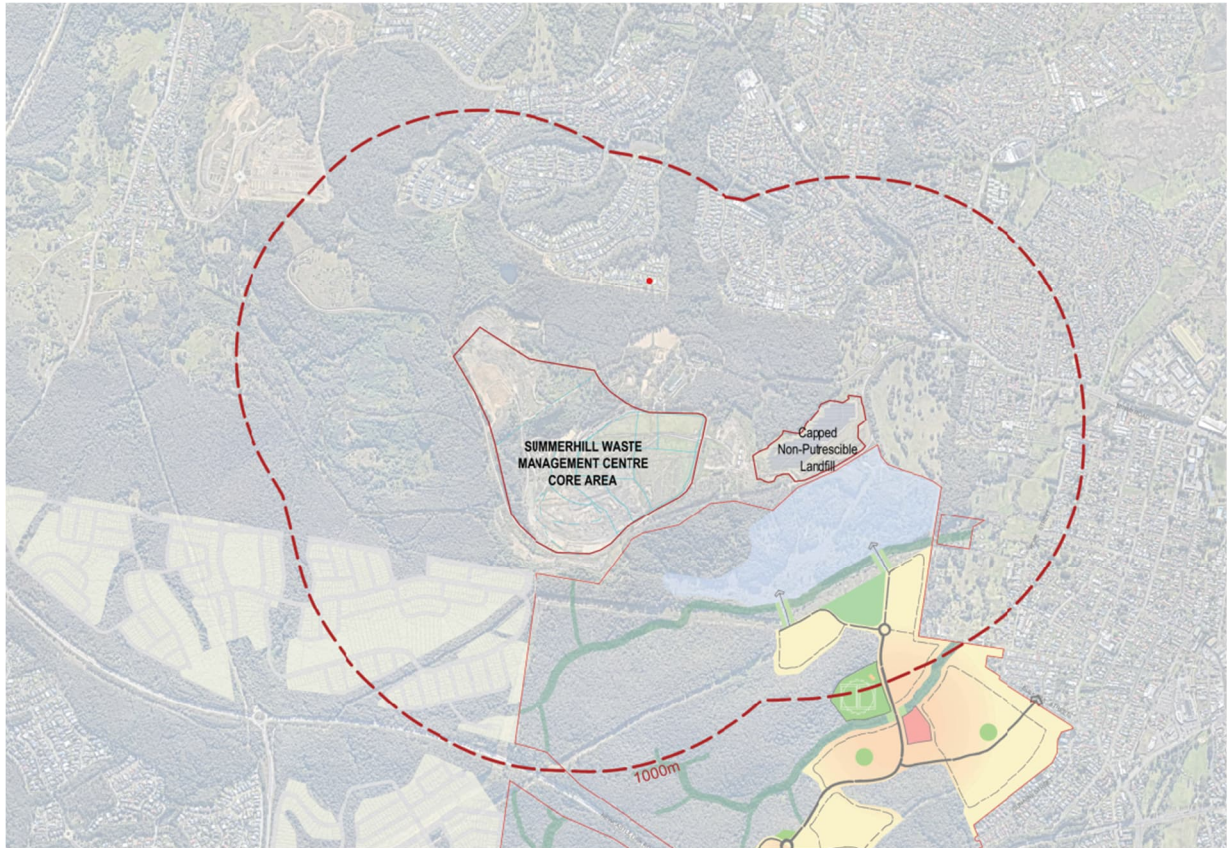


Figure 1 – 1,000m buffer surrounding the existing SWMC (prepared by Urbanco)

As stated in the Landfill Guidelines, there are a number of recognised environmentally sensitive and inappropriate areas for landfilling which both the Department of Planning, Homes and Infrastructure as well as the EPA agree on. In relation to locating landfills within proximity to residential zones, dwellings, schools or hospitals the Landfill Guidelines are much clearer and state that landfills should not be located within 250m of these uses. The closest potential residential dwelling on the site is a minimum of 500m away from the landfill operation. As discussed throughout this submission, separation/providing a buffer is only one mechanism in which potential land use conflicts with the SWMC is proposed to be managed. Where achieving a 1,000m buffer from residential uses is not possible or residential uses are already located within the 1,000m buffer (i.e. like the SWMC), the priority should be on ensuring that these types of facilities are operated in a manner that minimises environmental impact, whilst measures should be put in place to ensure the introduction of potentially sensitive uses in proximity to these types of facilities does not unreasonably infringe upon the existing operations of the SWMC. The planning proposal has, or has a methodology in place, to appropriately address potential land use conflict impacts.

4.0 Current and future operations of Summerhill Waste Management Centre (SWMC)

SWMC is an existing waste management facility licensed to receive a total of 362,000 tonnes of waste material per year. The EPA recommends that land uses be informed by current and future operations of the SWMC (recommendation 1).

The EPA letter states that the existing facility “*generates odour, sub-surface landfill gas, noise and air emissions*”. It goes on to state that “*controls are used to mitigate these issues, but even with these in place, it can be difficult to prevent adverse impacts beyond the boundary and that locating receivers near such facilities may lead to increased community complaints, regulatory oversight and pressure on the operator to mitigate adverse impacts*”.

Development consent for the SWMC was originally granted consent in 1993. Over the years it has been the subject of a number of modifications, the most recent of which sought approval for a materials recovery facility and concrete batching plant (DA2022-01422) and an organics processing facility (DA2022-00572). In approving the original waste management centre and assessing the current modifications – an assessment of the potential environmental impacts of the approved facility, as proposed to be amended, would have been undertaken. It is assumed this assessment considered the potential impacts of the SWMC on sensitive residential uses within 1,000m of the SWMC including residential areas to the north and east of the facility. In granting approval to the original application (as modified), the consent authority and EPA must have concluded that these impacts were acceptable and/or capable of being appropriately conditioned and/or managed. Given the planning proposal was formally lodged with Council in December 2020 some consideration of Eden Estates future plans on the site (as an adjoining land owner) including the introduction of residential uses should have been considered. As a matter of principle, as a boundary interface exists, any development proposal on one site needs to recognise and take into account the form of development likely to occur in an adjoining site or different zone. In our view, the planning proposal has appropriately considered the location and potential impacts associated with the SWMC in terms of noise, dust, air, odour and gas migration on future sensitive (residential) and non-sensitive (commercial and light industrial) envisaged on the site. As demonstrated throughout this submission, any potential land use conflict is or can be effectively managed – the key management strategy being the provision of a 500m wide buffer between the SWMC and the closest future residential use.

The planning proposal has been prepared on the general assumption that the SWMC complies with the relevant development consent and EPL. Like all applicants, the operators of the current facility are required to comply (indefinitely) with the terms of the relevant planning approval and conditions of consent as well as the EPL, set in place to protect the environment, prevent pollution incidents occurring including those beyond the boundary of the SWMC.

With consideration of the EPA’s position that despite robust controls being in place it can be difficult to prevent adverse impacts beyond the boundary of the existing SWMC, the northern boundary of the proposed residential zone in the planning proposal has been set back a minimum of 500m from the outer edge of the two existing land fill sites. Within the minimum 500m buffer is a mix of native vegetation (conservation land), Maryland Creek and ‘transition’ land – future permissible land uses to be agreed with Council in consultation with the EPA. No residential accommodation (i.e. caretaker residence etc) is envisaged within the future ‘transition’ zone.

In relation to the EPA’s comment about subsurface gas migration from the landfill and previous coal mining works and concerns with recent monitoring results on or near the southern boundary of SWMC, Douglas Partners have provided advice which describes additional monitoring and analysis that will *occur to confirm the extent of potential subsurface gas migration from the existing SWMC onto the site (refer to **Attachment A**). The results of this monitoring will be discussed with Council and the EPA and then used to inform the scope of work for future development applications (DAs) when proposed land uses and built form are confirmed.

Douglas Partners have prepared a detailed methodology to resolve the potential gas migration issue (refer to **Attachment A**). The proposed methodology includes the preparation and implementation of a Sampling, Analysis and Quality Plan (SAQP) in consultation with the EPA for land that is within 1,000m of the SWMC. The SAQP will provide a more thorough understanding and assessment of the potential risk associated with ground gas migration from the SWMC onto the site. It will be used to determine appropriate mitigation measures (both on and off site) if they are required. Douglas Partners have advised that whilst the characteristic situation from the wells located on the SWMC boundary indicate a “moderate to high” and “high” risk, they note that this risk is influenced by a number of partially known elements (gas monitoring results, well locations) as well as a number of unknown elements (well construction details, subsurface conditions, landfill cell details, landfill cell materials, lining conditions of landfill, groundwater levels). In their opinion, gas readings and flow may be completely 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. The location of the future monitoring wells could potentially be positioned on the northernmost (closest) area of the residential development in proximity to the landfill. If poor results are obtained from such monitoring and analysis in the area within the 1,000m buffer, additional monitoring and analysis may be required at the 1,000m buffer to demonstrate that the assumption that beyond this distance, the risk does not apply is valid. For areas beyond the 1,000m buffer, Douglas Partners have recommended that ‘standard’ approval process occur on the assumption that ground gas migration from the landfill is not an issue.

Douglas Partners have advised that any gas migration from the existing SWMC can be appropriately dealt with and the land, the subject of the planning proposal, can be made suitable for future development, satisfying the requirements of State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP).

5.0 Noise and vibration assessment

The EPA has recommended that a noise and vibration assessment be undertaken. Eden Estates have no issue with undertaking a noise and vibration assessment and are happy to commit to do this post Gateway, when details in relation to development footprints and lot layouts are further progressed. Eden Estates have no issue with the inclusion of a condition to this effect.

As stated in the Department’s Local Environmental Plan Making Guideline (2023), a planning proposal is not a DA and therefore the *“technical information, and level of detail, outlined in the planning proposal should be proportionate to the category and scale of the planning proposal. The technical information should lead to the conclusion that the planning proposal can be completed within a reasonable timeframe, identified impacts can be addressed and the site is suitable for the proposal”*.

Attachment C of the Department’s guidelines (page 10) states that acoustic reports would only be required in exceptional circumstances, where a proposal envisages residential or other sensitive uses such as schools, seniors housing and the land to which the planning proposal relates is exposed to significant noise sources.

It is assumed that noise and vibration from the SWMC complies with the EPA’s Noise Policy for Industry. Under this planning proposal, future residential uses are more than 500m away from the existing SWMC and separated by native vegetation (conservation land) and ‘transition land’. It is noted that physical separation from a noise source is only one mitigation measure. Should the analysis determine that additional noise mitigation measures are required (i.e. additional setbacks, landscape mounding, barriers, facade and window treatments) then this will be documented at the detailed DA stage. Based on the

above, and in our experience, it would be reasonable to form the view that noise and vibration is unlikely to preclude future redevelopment of the site.

6.0 Air quality impact assessment

The EPA has recommended that the proponent undertake an air quality impact assessment to identify air quality mitigation measures that can be applied to prevent and manage air and odour related land-use conflicts, particularly those associated with the SWMC. Eden Estates has no issue with undertaking a preliminary air quality impact assessment and is happy to commit to doing this post Gateway. Eden Estates has no objection with the imposition of a condition to this effect. Should the results of this assessment require mitigation measures then the structure plan can be adjusted. Based on the above, and in our opinion, it would be open to Council to reasonably conclude that the land to which the planning proposal relates is suitable for the uses envisaged and the planning proposal should continue to be progressed.

7.0 Contaminated land

The Preliminary Site Investigation undertaken by Ramboll accompanied the planning proposal and concluded that the potential for widespread contamination across the site was low, that the majority of the site is suitable for rezoning for any future land use including sensitive residential land use, subject to removal of any illegally dumped wastes (which is ongoing). Further investigation of the former collieries and areas associated with former mining activities is required to assess the suitability of these areas for certain land uses with or without remediation. The investigation recommended the development of a SAQP for soil, ground gas and groundwater sampling within the former Wallsend No.2 Colliery operations be prepared at the appropriate time.

Based on the review of the PSI, the EPA has recommended that a detailed site investigation report be prepared to cover the following areas:

- the operational areas of the former New Wallsend No. 2 Colliery
- the operational and emplacement areas of the former Wallsend Borehole Colliery
- the “ballast borehole site” and “former compressor house and borehole site” (southern portion of the Proposal area)

A supplementary response to the detailed comments on the PSI has been undertaken by Ramboll and is included at **Attachment B**. The PSI details a clear and robust methodology for the Eden Estates to follow. This methodology sets out how gaps in data are to be resolved as well as the next steps required to be undertaken to conclude that the site is suitable for the end uses. These next steps include the preparation of a detailed site investigation, remedial action plan, completing the remediation and preparation of a management plan for the long term (if required) and preparation of a validation report demonstrating that the remediation was successfully implemented. Based on their experience, Ramboll have reconfirmed previous advice and have concluded that any contamination present at the site is likely to be amenable to remediation by on-site containment, off-site disposal or a combination of both options and that any anticipated site contaminants can be remediated by proven techniques. Contamination will not prevent planning and development of the land for the proposed uses.

Eden Estates has no issue with a requirement to undertake a detailed site investigation at the detailed design stage, prior to the lodgement of any future DA. This approach is consistent with the current and draft land contamination guidelines which contemplate rezonings that cover large areas of land and have

been the subject of a preliminary site investigation which has concluded that contamination will not prevent planning and development of the land for the proposed uses.

Section 4.1.2 of the current guidelines (Managing Land Contamination – Planning Guidelines, SEPP 55 Remediation of land, 1998) states:

*Rezoning that cover a large area, for example, more than one property, usually describe proposed land uses very generally both in type and location. This makes it difficult for a planning authority to be satisfied that every part of the land is suitable for the proposed use(s) in terms of contamination at the rezoning stage. **In these cases, the rezoning should be allowed to proceed, provided measures are in place to ensure that the potential for contamination and the suitability of the land for any proposed use are assessed once detailed proposals are made**.*

The Draft Contaminated Land Planning Guidelines (2019) include similar provisions (refer to page 20). The planning proposal covers a large area (574 ha) and is supported by a PSI demonstrating that the land is suitable or can be made suitable for the intended uses. There are also existing measures in place to ensure that the potential for contamination and the suitability of the land for any proposed use are assessed in more detail once detailed proposals are made.

These measures include:

- Clause 4.6 of the Resilience and Hazards SEPP – states that a consent authority must not grant consent to a DA unless it has considered whether the land is contaminated. The consent authority must also be satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the intended purpose and that the land will be remediated before the land is used for that purpose. The Resilience and Hazards SEPP requires a consent authority to consider the findings of a preliminary investigation or a detailed investigation. Future DAs for the site will be subject to this provision.
- Section B7 of Newcastle Development Control Plan 2023 details Council's policy regarding the management of contaminated land. Future DAs for the site will need to comply with this policy.
- Contaminated Land Management Act 1997. This establishes a process for the investigation and remediation of sites that pose a significant risk to human health or the environment.

8.0 Water Management Strategy

The EPA letter recommends a water management strategy be prepared to demonstrate how the detailed proposal will be designed and operated to meet the objectives of the NSW Water Quality and River Flow Objectives (Objectives), the requirements of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) the Risk-Based Framework for Considering Waterway Health Outcomes in Strategic Land-Use Planning Decisions (OEH and EPA, 2017) and the Managing Urban Stormwater: Soils and Construction (Landcom, 2004).

Preliminary plans showing the indicative location of water quality detention basins and water quality basins formed part of the planning proposal. A water management strategy will be prepared post Gateway when the location and design of water quality and water quantity treatments has been further progressed. The strategy will focus on mitigating the impacts of the development on the total water cycle and maximising the environmental, social and economic benefits achievable by utilising responsible and sustainable stormwater management practices. Stormwater management techniques and design options being considered for the management of nutrients and suspended solids discharging from the site include

vegetated swales and buffers, wetlands and ponds, rain gardens, bio-retention systems and detention basins. Eden Estates have no issue with the inclusion of a Gateway condition to this effect.

9.0 Conclusion

We trust the EPA will consider the responses to the matters raised in the letter dated 15 July 2024 in consideration of the planning proposal. Based on the advice of Douglas Partners and Ramboll, there does not appear to be any impediment in terms of contamination, noise and vibration, air quality and stormwater management that cannot be appropriately managed or resolved either prior to rezoning or at the detailed DA stage – that would prevent planning and development of the site for the proposed uses as envisaged in the planning proposal. We would welcome the opportunity to discuss our response with the EPA in person or via Teams and in particular look forward to receiving any comments and/or other feedback on the proposed methodology to move the planning proposal forward. Eden Estates is committed to delivering positive planning and environmental outcomes on the site.

Should you have any questions, please do not hesitate to me on [REDACTED] or email [REDACTED]

Yours sincerely

[REDACTED]

cc. City of Newcastle Council



NSW EPA
Locked Bag 5022
Parramatta, NSW, 2124

Project 91610.08
30 August 2024
R.002.Rev1
MPG

Attention: Victoria Lee
Email: info@epa.nsw.gov.au

Copy to
City of Newcastle Council
282 King Street
Newcastle, NSW, 2300

Attention: Peter Milles
Email: pmilles@ncc.nsw.gov.au

Potential Assessment Methodology for Ground Gas Assessment Proposed Residential Subdivision off Lake Road, Wallsend NSW

Following review of the letter from NSW EPA dated 15 July 2024, Douglas Partners Pty Ltd (Douglas) provides this preliminary comment in relation to the possible assessment methodology to evaluate the risk associated with ground gas migrating from the adjacent Summerhill Waste Management Centre (SWMC) towards the proposed residential subdivision off Lake Road.

Douglas have undertaken previous geotechnical investigations within the proposed development area. The land between the Summerhill Landfill and the residential development footprint includes a number of areas of deep fill, including backfilled former open cut mines, emplacement areas and former high walls (refer Figure 1). Douglas has undertaken subsurface investigations in this area of the site, as shown in Figure 2, which indicated that fill depths ranged from zero to approximately 20 m in the area close to the SWMC boundary.

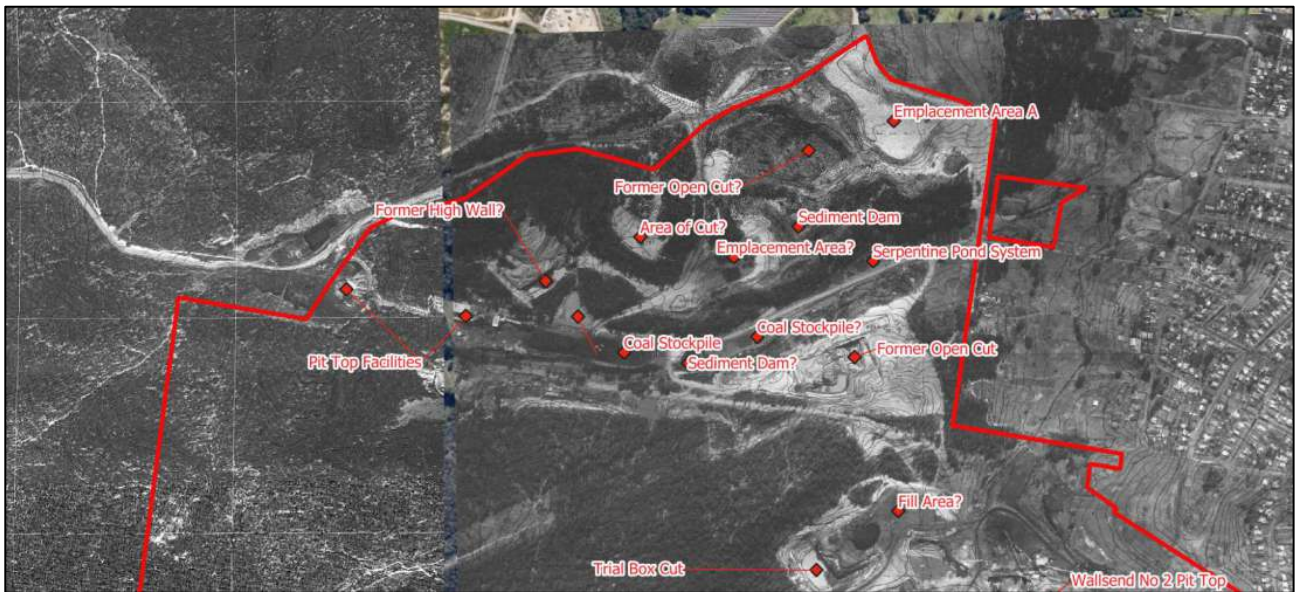


Figure 1: Extract from previous Douglas investigation/s showing areas of deep fill near northern extent of development land holdings

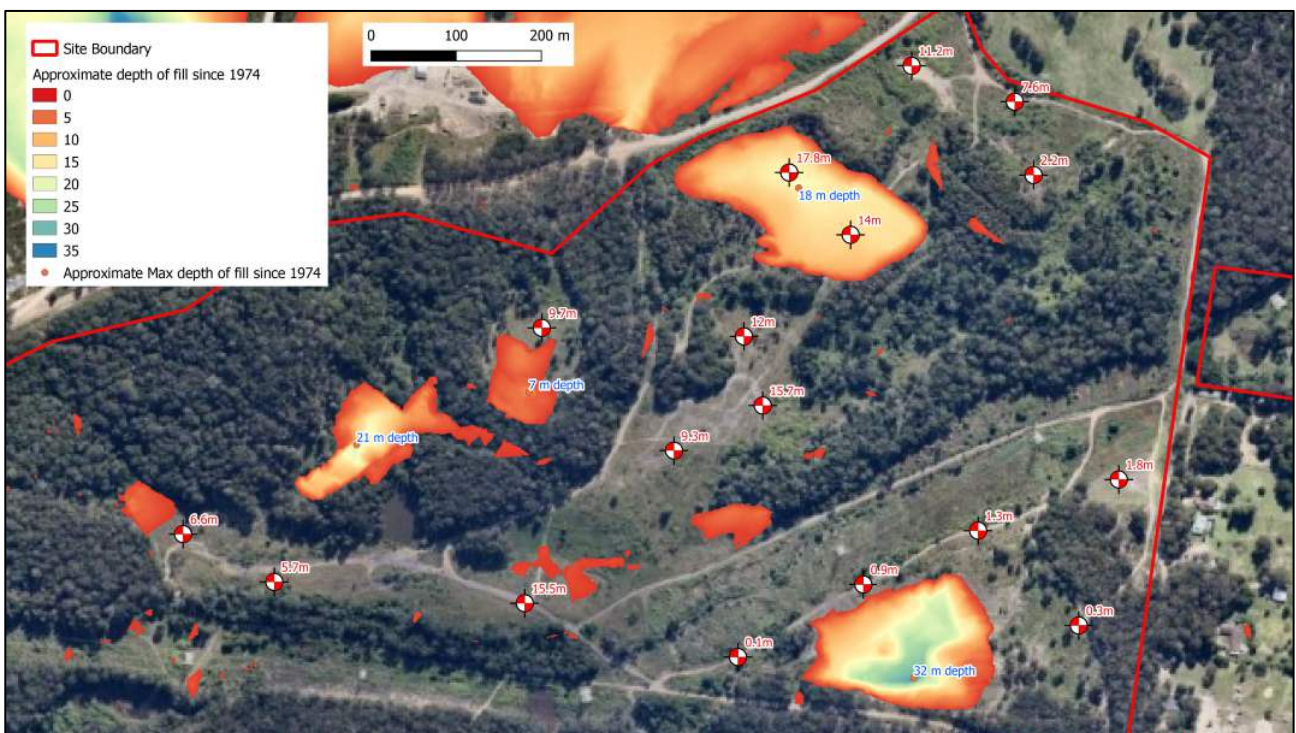


Figure 2: Extract from previous Douglas investigation/s showing previous subsurface investigation locations and depth of fill (inferred or encountered)

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 attached provides the location of the gas monitoring locations and a preliminary assessment of characteristic situation for ground gases, as evaluated using the procedures in NSW EPA Soil 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. The additional information requested from Newcastle Council and subsequent investigations informed by the Sampling, Analysis and Quality Plan (SAQP) 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.

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 may be 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:

- Areas beyond 1000 m buffer; and
- Areas within 1000 m buffer.

The suggested approach for assessment of ground gas risk, and development application (subject to advice from town planners) could be as follows:

- Areas beyond 1000 m buffer - Undertake normal development application process (including contamination assessments to address the requirements of Chapter 4.6 of SEPP Resilience and Hazards) with the assumption that ground gas migration from the landfill is not an issue. It is noted, however, that the EPA may require ground-truthing data to support such an approach, and accordingly the relevant contamination assessments will give due consideration to these requirements;
- Areas within 1000 m buffer – Develop SAQP and implement (i.e. install wells, monitor, analyse and report) to characterise and understand the risk of ground gases to these areas of the proposed residential development, and keep the relevant authorities informed of results as they become available. The location of the future monitoring wells could potentially be positioned on the northernmost (closest) area of the residential development in proximity to the landfill. It is noted that if poor results are obtained from such monitoring and analysis in the area within the 1000 m buffer, additional monitoring and analysis may be required at the 1000 m buffer to demonstrate that the assumption that beyond this distance, the risk does not apply is valid.

The appropriate scope of work for the landfill gas assessment will be developed within the SAQP following compilation of available relevant data and identification of data gaps, with the SAQP likely to include:

- Relevant/applicable guidelines;
- Site identification and environmental setting;
- Preliminary conceptual site model for landfill gas generation and migration;
- Data quality objectives;
- Monitoring and sampling approach;
- Drawing showing proposed location of boreholes;
- Description of data to be collected and methodology for data collection;
- Monitoring procedure, including any templates, procedures for the implementation and data collection;
- Timetable / frequency of monitoring;
- General requirements for the proposed scope of work developed in the SAQP;
- Quality assurance and quality control requirements;
- Reporting requirements.

The SAQP would be developed with reference to the following Australian and International guidelines:

- NSW EPA. (2020). Assessment and Management of Hazardous Ground Gases.
- 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' (2004).

Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this letter for this project at off Lake Road, Wallsend NSW in line with Douglas' proposal 91610.08 dated 5 August 2024 and acceptance received from Tim Goldacre of Eden Estates (Newcastle) Pty Ltd. 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.

Douglas' advice is based upon the conditions known to Douglas at the time of preparation. 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 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.

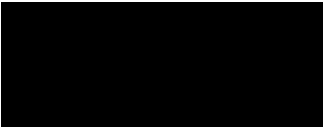
This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully

Douglas Partners Pty Ltd

Reviewed by


Principal
Senior Associate

Attachments: About this Report
Drawing 1: Summary of Existing Gas Monitoring Wells and Characteristic Situation
Plan 055.WS.054, prepared by Urbanco and titled Summerhill Waste Management Centre Buffers Plan



Rock Strength

Rock strength is defined by the Unconfined Compressive Strength and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $IS_{(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Abbreviation	Unconfined Compressive Strength MPa	Point Load Index * $IS_{(50)}$ MPa
Very low	VL	0.6 - 2	0.03 - 0.1
Low	L	2 - 6	0.1 - 0.3
Medium	M	6 - 20	0.3 - 1.0
High	H	20 - 60	1 - 3
Very high	VH	60 - 200	3 - 10
Extremely high	EH	>200	>10

* Assumes a ratio of 20:1 for UCS to $IS_{(50)}$. It should be noted that the UCS to $IS_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Residual Soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.
<i>Note: If HW and MW cannot be differentiated use DW (see below)</i>		
Distinctly weathered	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.

Rock Descriptions

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

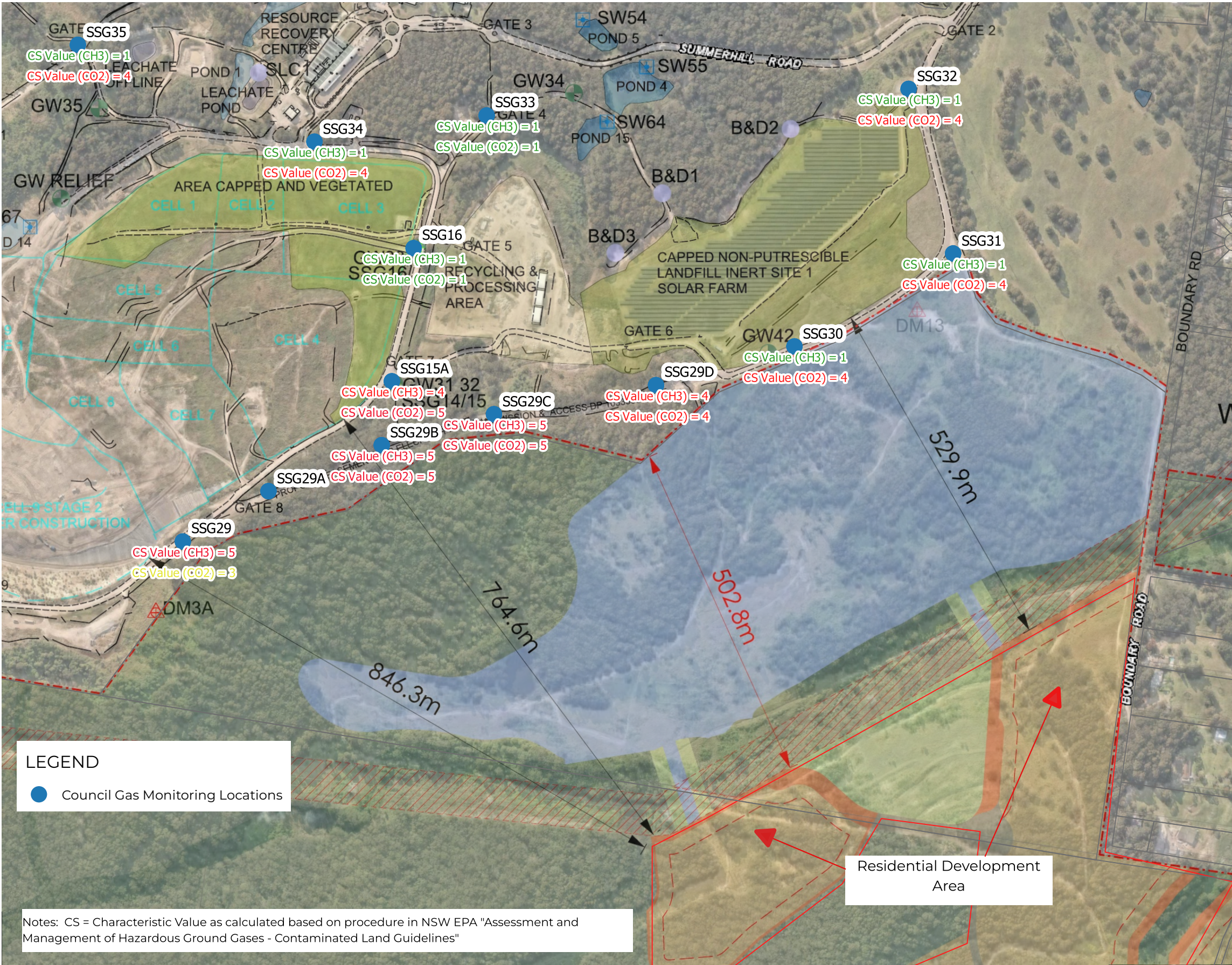
$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} > 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

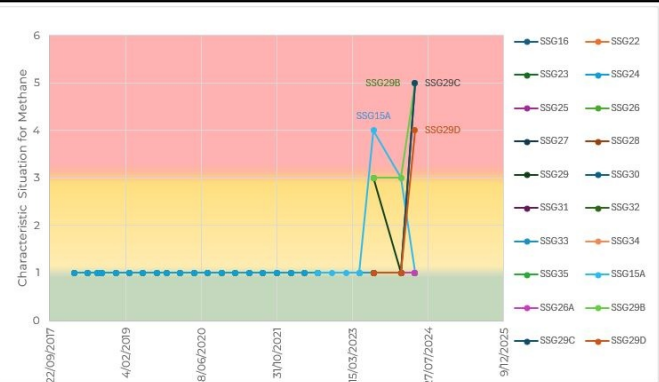
Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

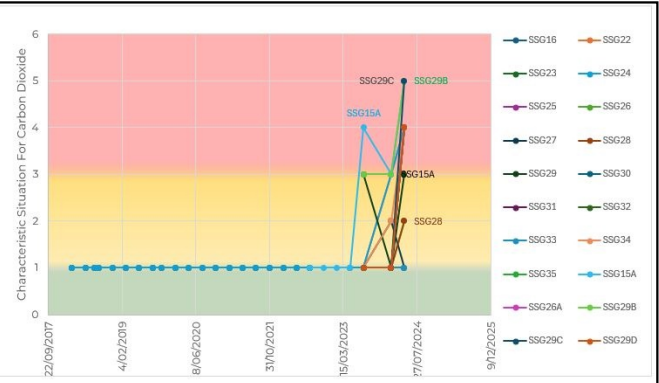
Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m



SITE LOCATION



Characteristic Situation Over Time Methane



Characteristic Situation Over Time Carbon Dioxide

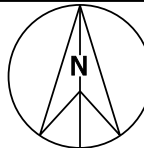
NOTE:

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

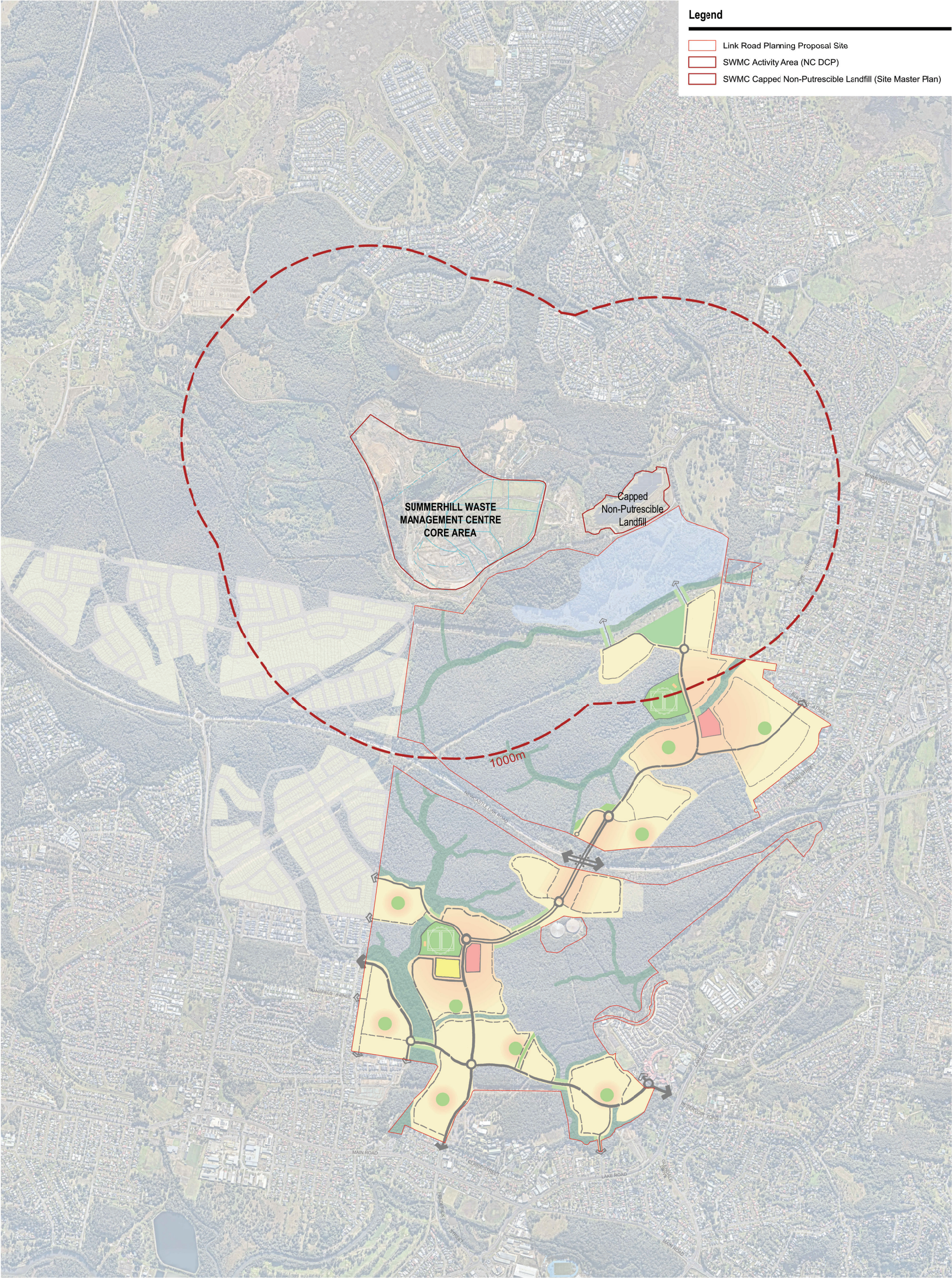


CLIENT: Eden Estatets Pty Ltd
OFFICE: Newcastle
DRAWN BY: MPG
DATE: 23.August.2024

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: 0



- Legend**
- Link Road Planning Proposal Site
 - SWMC Activity Area (NC DCP)
 - SWMC Capped Non-Putrescible Landfill (Site Master Plan)

Eden Estates (Newcastle) Pty Ltd

[REDACTED]
[REDACTED]
[REDACTED]

Attention: [REDACTED]

Dear [REDACTED]

Date 3 September 2024

PRELIMINARY SITE INVESTIGATION – LAND AT FREDERICK STREET AND GLENDON CRESCENT, GLENDALE, NEW SOUTH WALES

Ramboll
The Arc
45a Watt Street
Newcastle NSW 2300
Australia

T +61 2 4962 5444

www.ramboll.com

Ref 318000981
Document ID Ltr 002

Ramboll Australia Pty Ltd (Ramboll) completed preliminary site investigation (PSI), titled 'Former New Wallsend Colliery Site, Newcastle Link Road, Preliminary Site Investigation', on 15 December 2020, to support the submission of a planning proposal to City of Newcastle Council (CN) and Lake Macquarie City Council (LMCC) for the rezoning of land at Frederick Street and Glendon Crescent, Glendale, NSW (the site, **Figure 1**) for residential, employment, recreational and environmental conservation purposes. The scope of the PSI covered the entire project area, incorporating portions of land located within both the LMCC and the CN Local Government Areas (LGA), and included a review of site history information, review of previous investigation reports for the entire project area and a site inspection.

The PSI concluded that the site (**Figure 1**) can be made suitable for the proposed rezoning, including sensitive residential land use, subject to the removal of illegally dumped wastes and further investigation to close out data gaps and uncertainties, and successful remediation. Based on the information collected during the PSI, data gaps should be addressed through preparation of a Sampling Analysis and Quality Plan detailing further investigation as follows:

- Soil, ground gas and groundwater sampling within the former operations area, targeting:
 - Areas where residual contamination such as the former hydrocarbon excavation and location of former noise bund.
 - At depth in the trial box cut and borrow pit.
 - Filled in dams and other excavations.

- Locations of former buildings for assessment of hazardous building materials.
- Carbonaceous material and coal reject emplacement areas (including potential for hazardous ground gas).
- Soil, ground gas and groundwater sampling within the footprint of the former Collieries.
- Soil sampling along former tram lines and railways.
- Soil sampling in areas of illegally dumped waste material.
- Soil sampling in areas of potential weed and pest control spraying.
- Surface water and sediment sampling within onsite creeks and surface water bodies where there is the potential for mine water to have been discharged.

Ramboll also recommends seeking additional information and reports regarding:

- The closure of the former Wallsend Borehole Colliery.
- Environmental monitoring following the closure of the former New Wallsend No. 2 Colliery.
- The potential burial of machinery and plant within shafts at the former New Wallsend No. 2 Colliery.
- Potential for impact to the site from off site sources including the adjacent Summer Hill Waste Emplacement Facility.

The PSI identified that a detailed site investigation of potential contamination and remediation of the land is required in order to make the land suitable for use. Contamination present at the site is likely to be amenable to remediation by onsite containment, off site disposal or a combination of both options. Other remedial options may be available and could be considered once site characterisation is completed, however it is my experience that the anticipated site contaminants are able to be remediated by proven remedial techniques.

To render the land suitable for the proposed use, the following steps are required:

- Review additional reports if available
- Prepare a sampling and analytical quality plan incorporating a sampling program to address data gaps
- Complete a detailed site investigation
- Complete a remedial action plan, including an assessment of remedial options
- Complete remediation, and where required prepare a management plan for the long term management of any residual contaminants
- Prepare a validation report demonstrating that the remediation was successfully implemented and concluding on the suitability of the site for the use.

The above steps can be included as conditions in the planning determination to ensure that these tasks are completed prior to the use or development of the land.

Yours sincerely

Ramboll Australia Pty Ltd



Certified Environmental Practitioner (Site Contamination Specialist) SC401000

Principal, Country Market Director APAC
Environment and Health

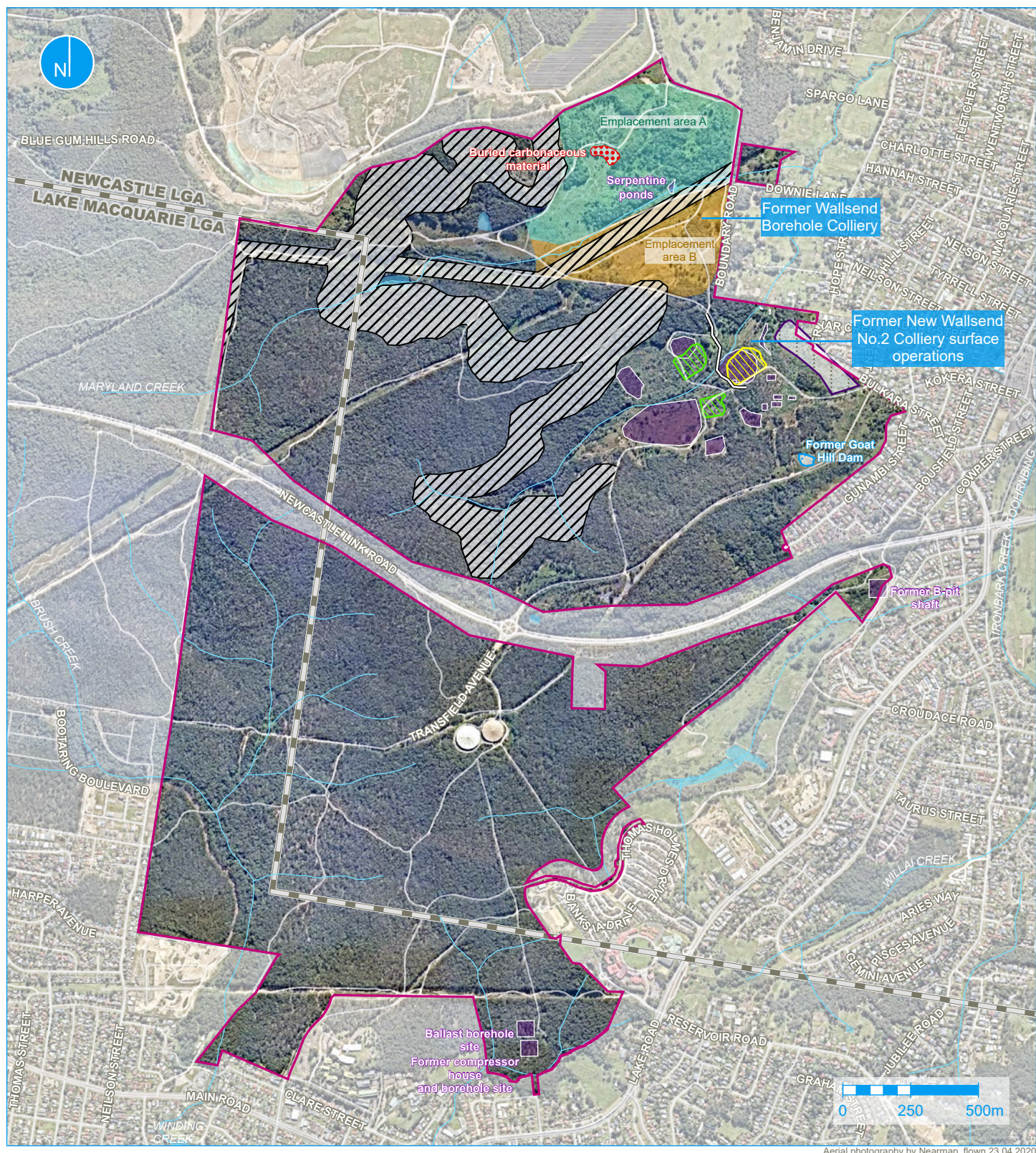


Enc: Figure 1. Site plan

Limitations

This advice was conducted on behalf of Eden Estates (Newcastle) Pty Ltd for the purpose of assessing the suitability of land for the proposed use.

Ramboll has relied on the documents referenced in this letter in preparing the opinion. The conclusions presented in this report represent Ramboll's professional judgment based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment. Site conditions may change over time. This report is based on conditions encountered at the Site at the time of the referenced reports and Ramboll disclaims responsibility for any changes that may have occurred after this time.



Legend

- Site
- Area of steep slope, unable to be accessed during site visit
- Waterway (NSW Spatial Services)
- Waterbody (NSW Spatial Services)
- Former site feature
- Borrow pit
- Hydrocarbon excavation area
- Buried carbonaceous material
- Former Goat Hill Dam
- Noise bund
- Emplacement area A
- Emplacement area B

A4
1:20,000

Figure 1

Eden Estates (Newcastle) Pty Ltd

[REDACTED]
[REDACTED]
[REDACTED]

Attention: [REDACTED]

Dear [REDACTED]

Date 3 September 2024

PRELIMINARY SITE INVESTIGATION – LAND AT FREDERICK STREET AND GLENDON CRESCENT, GLENDALE, NEW SOUTH WALES

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The PSI identified that a detailed site investigation of potential contamination and remediation of the land is required in order to make the land suitable for use. Contamination present at the site is likely to be amenable to remediation by onsite containment, off site disposal or a combination of both options. Other remedial options may be available and could be considered once site characterisation is completed, however it is my experience that the anticipated site contaminants are able to be remediated by proven remedial techniques.

To render the land suitable for the proposed use, the following steps are required:

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- Complete a remedial action plan, including an assessment of remedial options
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The above steps can be included as conditions in the planning determination to ensure that these tasks are completed prior to the use or development of the land.

Yours sincerely

Ramboll Australia Pty Ltd



Certified Environmental Practitioner (Site Contamination Specialist) SC401000

Principal, Country Market Director APAC
Environment and Health

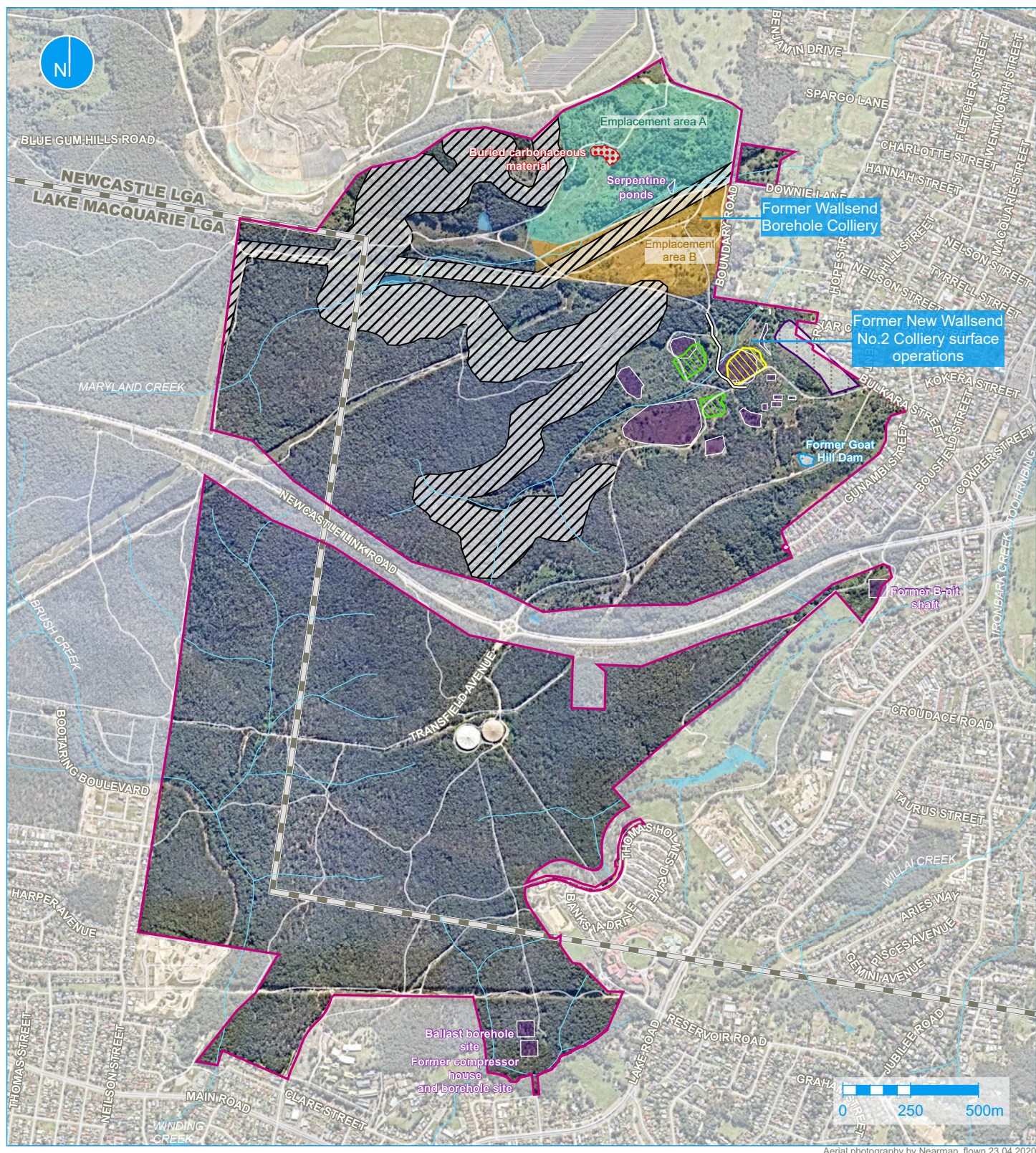


Enc: Figure 1. Site plan

Limitations

This advice was conducted on behalf of Eden Estates (Newcastle) Pty Ltd for the purpose of assessing the suitability of land for the proposed use.

Ramboll has relied on the documents referenced in this letter in preparing the opinion. The conclusions presented in this report represent Ramboll's professional judgment based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment. Site conditions may change over time. This report is based on conditions encountered at the Site at the time of the referenced reports and Ramboll disclaims responsibility for any changes that may have occurred after this time.



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- Noise bund
- Emplacement area A
- Emplacement area B

A4
1:20,000

Figure 1

Newcastle City Council
Po Box 489
NEWCASTLE, NSW, 2300

Project 91610.08
26 August 2024
R.001.Rev1
MPG

Attention: Summerhill Waste Management Centre – Manager

Request for Information
Preparation of Sampling Analysis and Quality Plan for Ground
Gas Migration Assessment
Proposed Residential Subdivision
off Lake Road, Wallsend NSW

Douglas Partners Pty Ltd (Douglas) has been engaged by Eden Estates (Newcastle) Pty Ltd (Eden Estates), who have proposed to construct a future residential subdivision at 144 Boundary Road, Wallsend, which is located to the south of the Summerhill Waste Management Centre (SWMC).

Eden Estates have engaged Douglas to undertake assessment of the subsurface ground gas levels in the northern areas of the proposed residential development. This involves the preparation of a sampling analysis and quality plan (SAQP), which will outline the procedures for assessment and monitoring of the ground gases in the assessment area. The specifics of the SAQP will be developed following collation of relevant data, but is likely to include preparation of a conceptual site model for ground gas migration, data quality objectives, monitoring and sampling approach (including details on locations and construction of gas monitoring wells), monitoring procedures, frequency of monitoring, and reporting requirements.

It is understood that SWMC has a number of cells which contain various landfill materials, some putrescible and some non-putrescible. Figure 1, below, shows the location of the proposed residential subdivision relative to the SWMC.

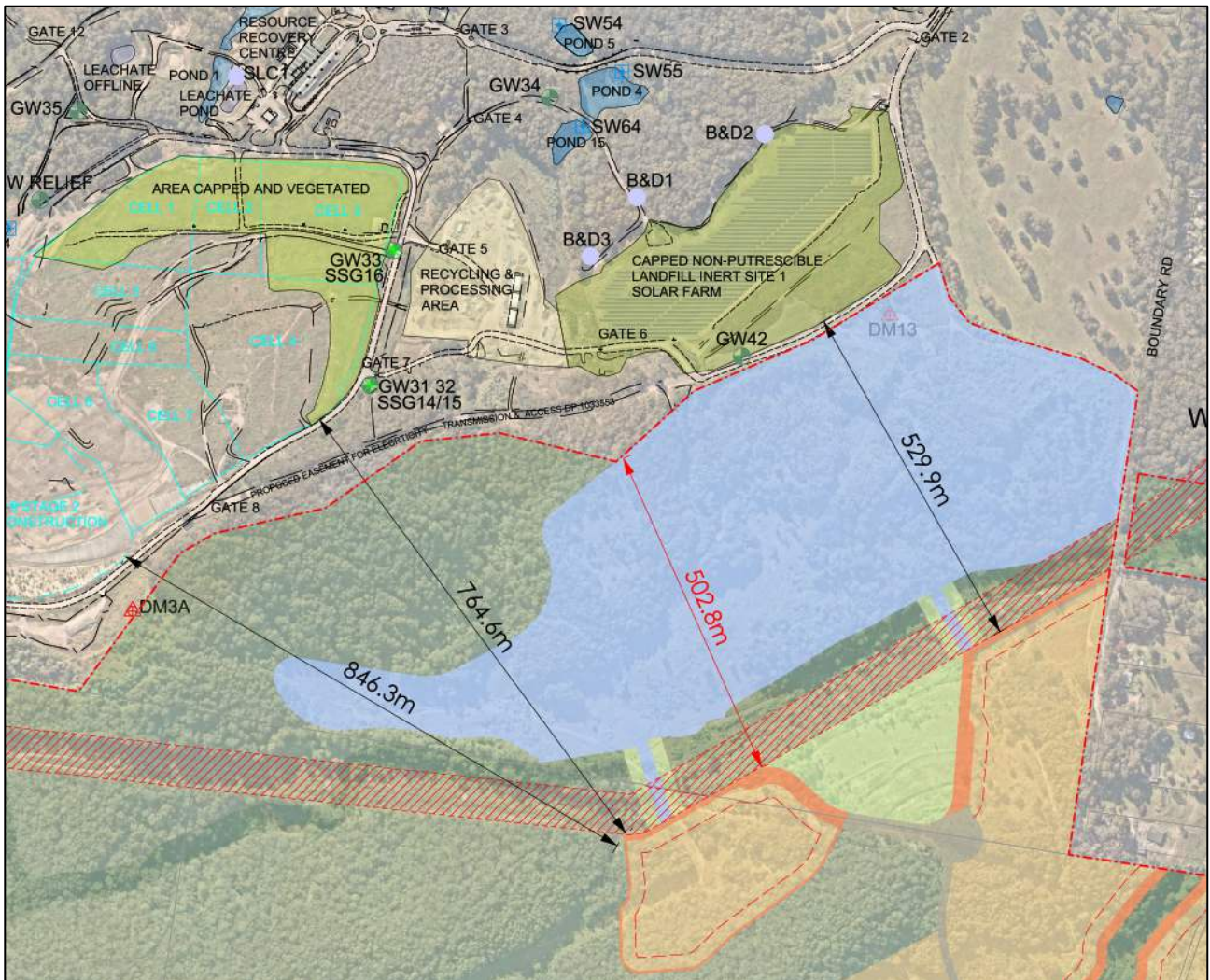


Figure 1: Drawing showing the proposed residential development (orange areas) relative to SWMC (green and other areas)

Reference to a letter from NSW EPA dated 15 July 2024 indicates that subsurface gas monitoring results on or near the southern boundary of SWMC and near the proposed rezoning at the former Borehole Colliery area (just south of SWMC) dated from February 2024 showed elevated levels of methane at 24.6% and 26.4% and carbon dioxide at 14% and 26.2%. The exact location of these gas readings is not known.

Reference to the Environmental Protection Licence for SWMC indicates that at least 18 monitoring locations are present at SWMC, although the exact locations are not shown.

To assist with the development of the SAQP, Eden Estates and Douglas requests the following information:

- Details on the geometry of the landfill cells at the site, including base level and footprint;
- Details in relation to the material contained within each of the landfill cells, particularly whether the material is putrescible or non-putrescible;
- Details on any lining which is in place for the landfill cells;

- Details on the capping system over existing closed cells;
- Details on any 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;
- Previous investigation data in the landfill; and
- Any other information Council holds that may be relevant to the SAQP.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully

Douglas Partners Pty Ltd



Principal

NSW EPA
Locked Bag 5022
Parramatta, NSW, 2124

Project 91610.08
30 August 2024
R.002.Rev1
MPG

Attention: Victoria Lee
Email: info@epa.nsw.gov.au

Copy to
City of Newcastle Council
282 King Street
Newcastle, NSW, 2300

Attention: Peter Milles
Email: pmilles@ncc.nsw.gov.au

Potential Assessment Methodology for Ground Gas Assessment Proposed Residential Subdivision off Lake Road, Wallsend NSW

Following review of the letter from NSW EPA dated 15 July 2024, Douglas Partners Pty Ltd (Douglas) provides this preliminary comment in relation to the possible assessment methodology to evaluate the risk associated with ground gas migrating from the adjacent Summerhill Waste Management Centre (SWMC) towards the proposed residential subdivision off Lake Road.

Douglas have undertaken previous geotechnical investigations within the proposed development area. The land between the Summerhill Landfill and the residential development footprint includes a number of areas of deep fill, including backfilled former open cut mines, emplacement areas and former high walls (refer Figure 1). Douglas has undertaken subsurface investigations in this area of the site, as shown in Figure 2, which indicated that fill depths ranged from zero to approximately 20 m in the area close to the SWMC boundary.

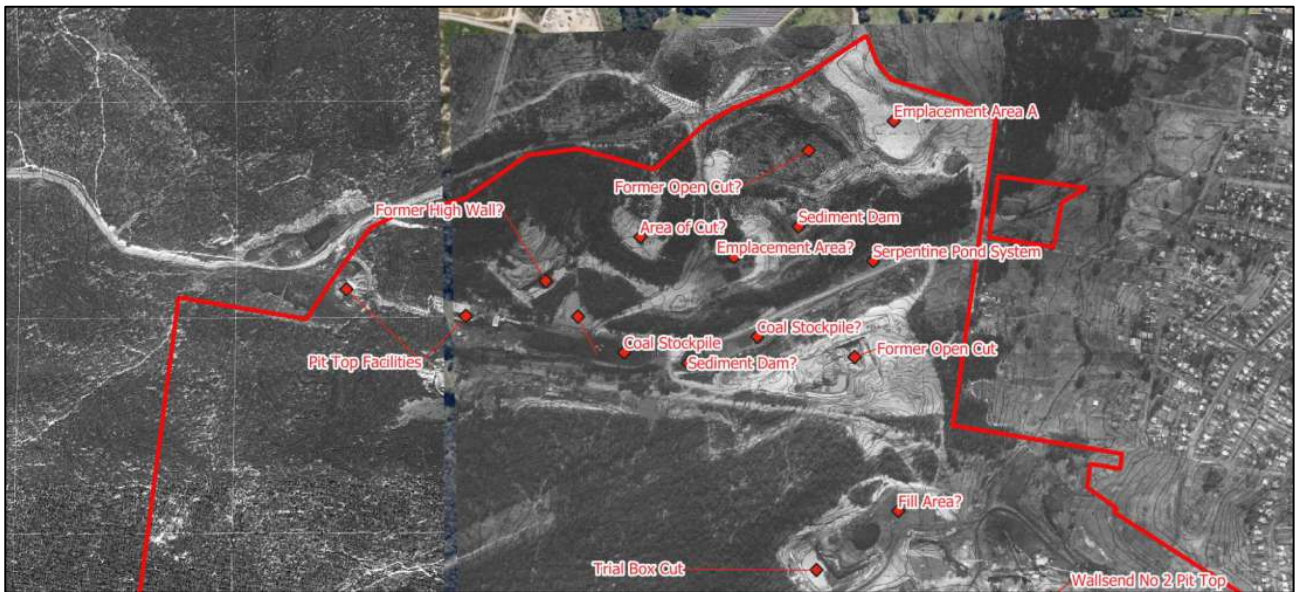


Figure 1: Extract from previous Douglas investigation/s showing areas of deep fill near northern extent of development land holdings

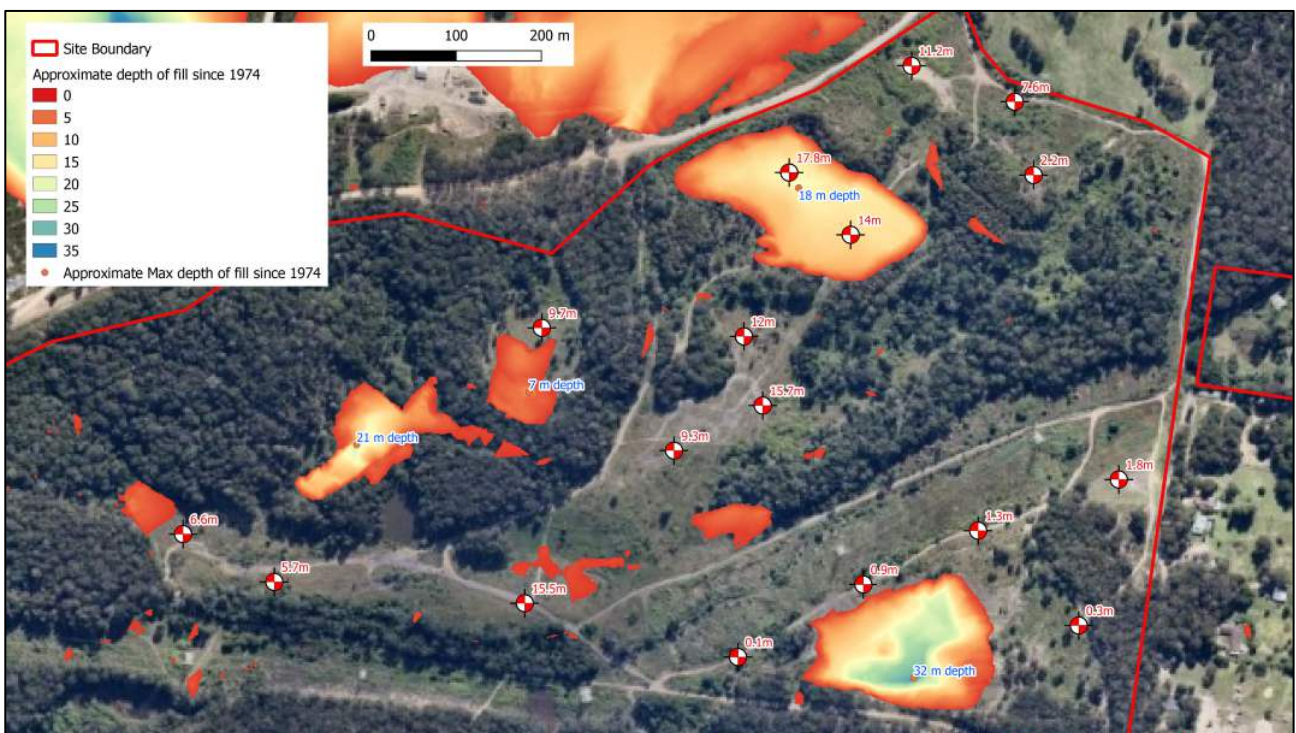


Figure 2: Extract from previous Douglas investigation/s showing previous subsurface investigation locations and depth of fill (inferred or encountered)

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 attached provides the location of the gas monitoring locations and a preliminary assessment of characteristic situation for ground gases, as evaluated using the procedures in NSW EPA Soil 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. The additional information requested from Newcastle Council and subsequent investigations informed by the Sampling, Analysis and Quality Plan (SAQP) 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.

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 may be 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:

- Areas beyond 1000 m buffer; and
- Areas within 1000 m buffer.

The suggested approach for assessment of ground gas risk, and development application (subject to advice from town planners) could be as follows:

- Areas beyond 1000 m buffer - Undertake normal development application process (including contamination assessments to address the requirements of Chapter 4.6 of SEPP Resilience and Hazards) with the assumption that ground gas migration from the landfill is not an issue. It is noted, however, that the EPA may require ground-truthing data to support such an approach, and accordingly the relevant contamination assessments will give due consideration to these requirements;
- Areas within 1000 m buffer – Develop SAQP and implement (i.e. install wells, monitor, analyse and report) to characterise and understand the risk of ground gases to these areas of the proposed residential development, and keep the relevant authorities informed of results as they become available. The location of the future monitoring wells could potentially be positioned on the northernmost (closest) area of the residential development in proximity to the landfill. It is noted that if poor results are obtained from such monitoring and analysis in the area within the 1000 m buffer, additional monitoring and analysis may be required at the 1000 m buffer to demonstrate that the assumption that beyond this distance, the risk does not apply is valid.

The appropriate scope of work for the landfill gas assessment will be developed within the SAQP following compilation of available relevant data and identification of data gaps, with the SAQP likely to include:

- Relevant/applicable guidelines;
- Site identification and environmental setting;
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- Monitoring procedure, including any templates, procedures for the implementation and data collection;
- Timetable / frequency of monitoring;
- General requirements for the proposed scope of work developed in the SAQP;
- Quality assurance and quality control requirements;
- Reporting requirements.

The SAQP would be developed with reference to the following Australian and International guidelines:

- NSW EPA. (2020). Assessment and Management of Hazardous Ground Gases.
- 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' (2004).

Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this letter for this project at off Lake Road, Wallsend NSW in line with Douglas' proposal 91610.08 dated 5 August 2024 and acceptance received from Tim Goldacre of Eden Estates (Newcastle) Pty Ltd. 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.

Douglas' advice is based upon the conditions known to Douglas at the time of preparation. 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 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.

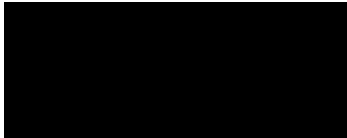
This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation,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

Please contact the undersigned if you have any questions on this matter.

Yours faithfully

Douglas Partners Pty Ltd

A black rectangular box redacting the signature of the Principal.

Principal

Reviewed by

A black rectangular box redacting the signature of the Senior Associate.

Senior Associate

Attachments: About this Report
Drawing 1: Summary of Existing Gas Monitoring Wells and Characteristic Situation
Plan 055.WS.054, prepared by Urbanco and titled Summerhill Waste Management Centre Buffers Plan



Rock Strength

Rock strength is defined by the Unconfined Compressive Strength and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $IS_{(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Abbreviation	Unconfined Compressive Strength MPa	Point Load Index * $IS_{(50)}$ MPa
Very low	VL	0.6 - 2	0.03 - 0.1
Low	L	2 - 6	0.1 - 0.3
Medium	M	6 - 20	0.3 - 1.0
High	H	20 - 60	1 - 3
Very high	VH	60 - 200	3 - 10
Extremely high	EH	>200	>10

* Assumes a ratio of 20:1 for UCS to $IS_{(50)}$. It should be noted that the UCS to $IS_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Residual Soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.
<i>Note: If HW and MW cannot be differentiated use DW (see below)</i>		
Distinctly weathered	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.

Rock Descriptions

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

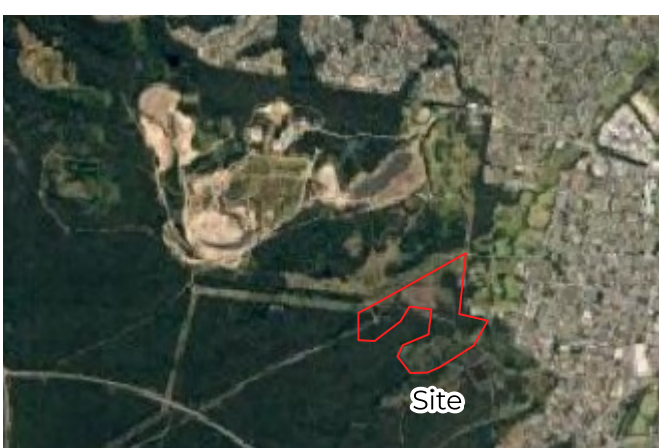
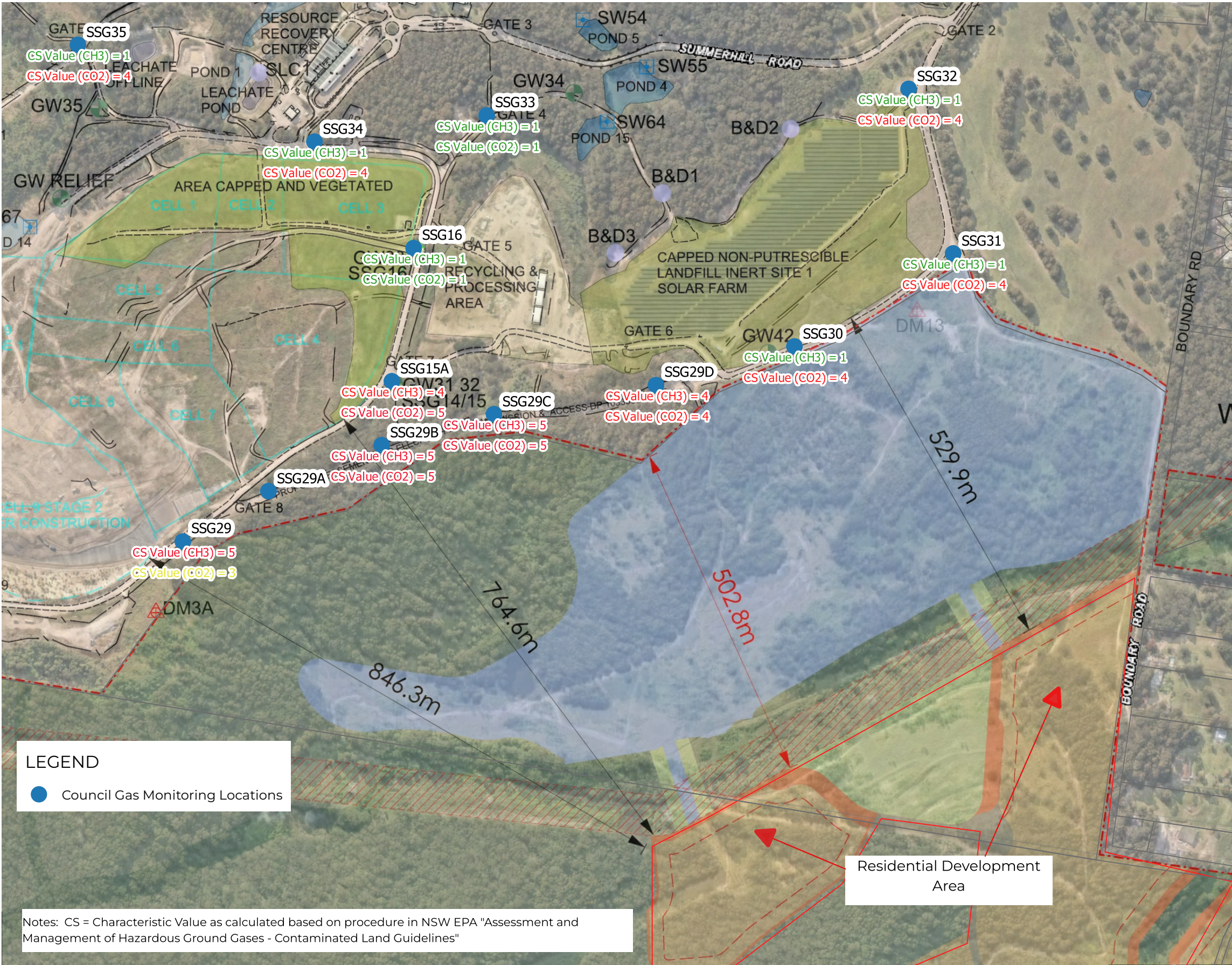
$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} > 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

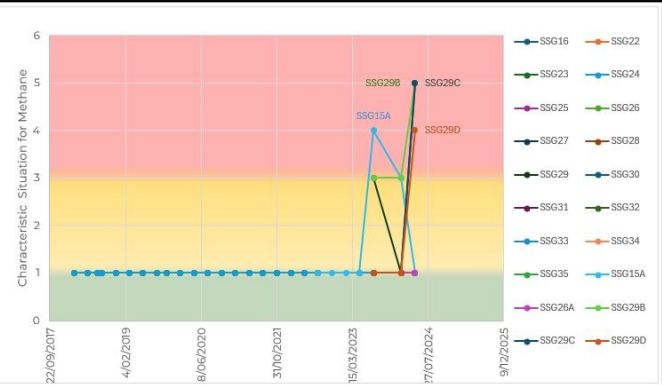
Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

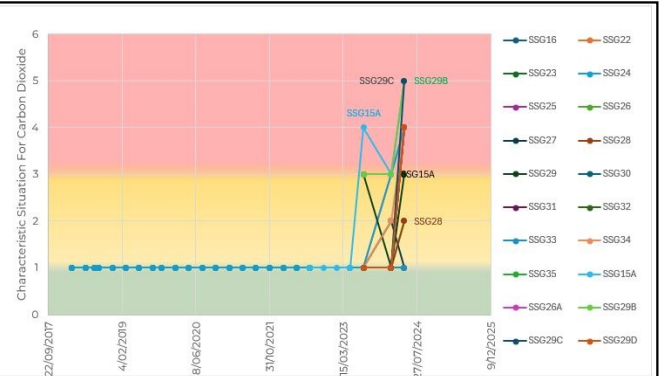
Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m



SITE LOCATION

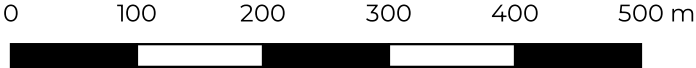


Characteristic Situation Over Time
Methane



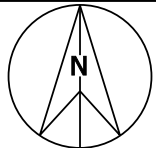
Characteristic Situation Over Time
Carbon Dioxide

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

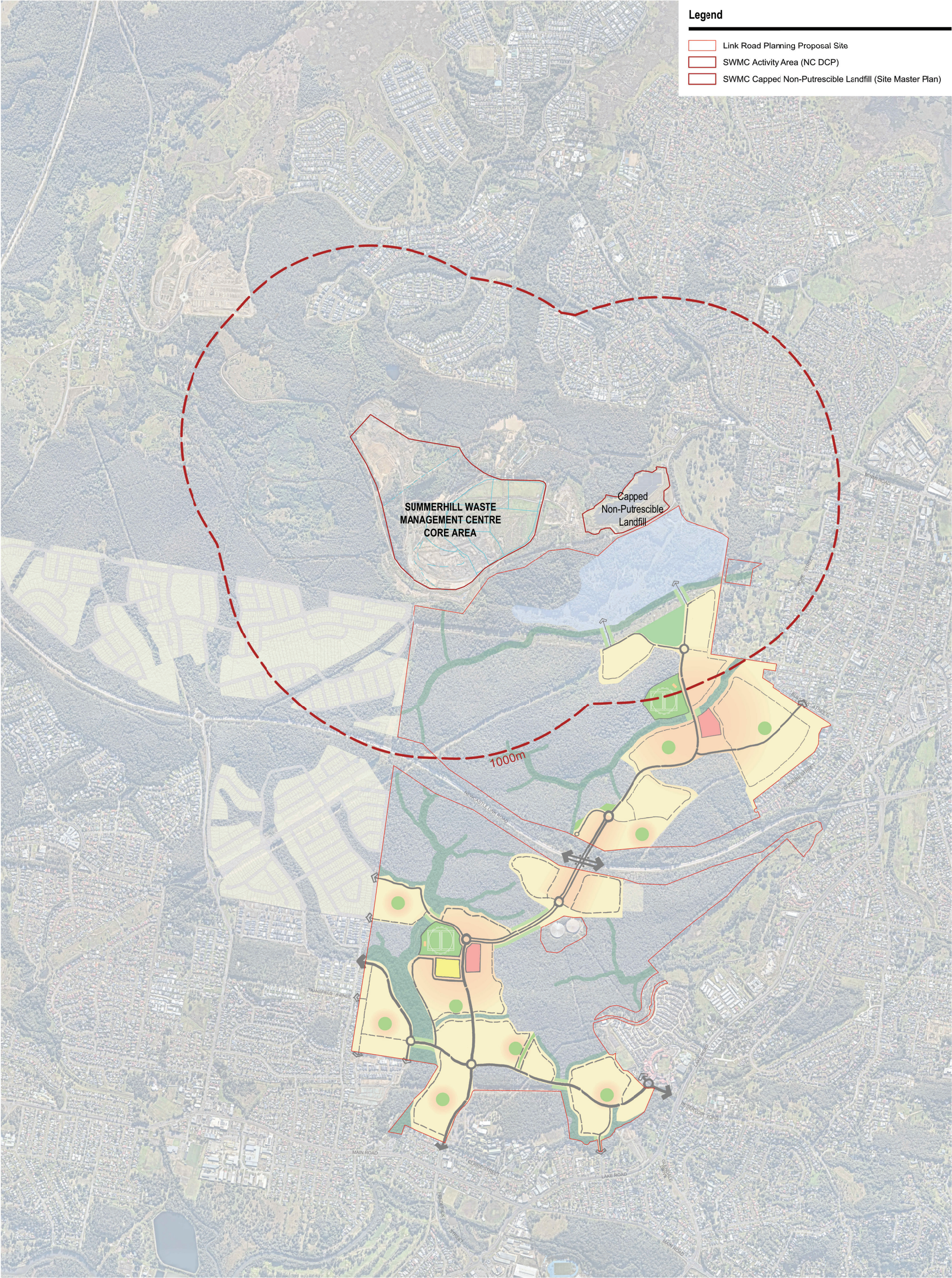


CLIENT:	Eden Estatets Pty Ltd	
OFFICE:	Newcastle	DRAWN BY: MPG
		DATE: 23.August.2024

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:	0



- Legend**
- Link Road Planning Proposal Site
 - SWMC Activity Area (NC DCP)
 - SWMC Capped Non-Putrescible Landfill (Site Master Plan)

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

27 November 2024

Document History

Details

Project No.	91610.08
Document Title	Sampling, Analysis and Quality Plan for Hazardous Ground Gas Assessment
Site Address	off Lake Road, Wallsend NSW
Report Prepared For	Eden Estates (Newcastle) Pty Ltd
Filename	91610.08.R.003.Rev0

Status and Review

Status	Prepared by	Reviewed by	Date issued
Revision 0			27 November 2024

Distribution of Copies

Status	Issued to
Revision 0	Tim Goldacre – 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		27 November 2024
Reviewer		27 November 2024

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Appendix A: About This Report

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

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 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.

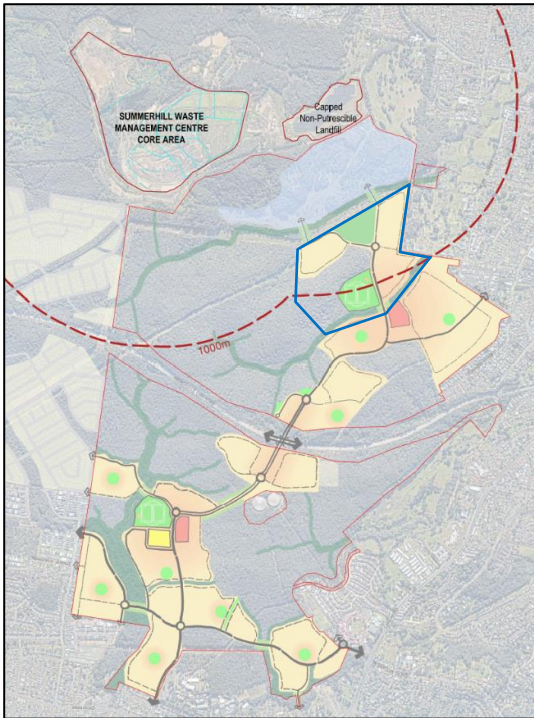


Figure 1: Image showing the current proposed development layout and position of SWMC together with 1000 m buffer to SWMC. Blue polygon shown approximately boundary of site.

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.
- 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.
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- 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.

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.

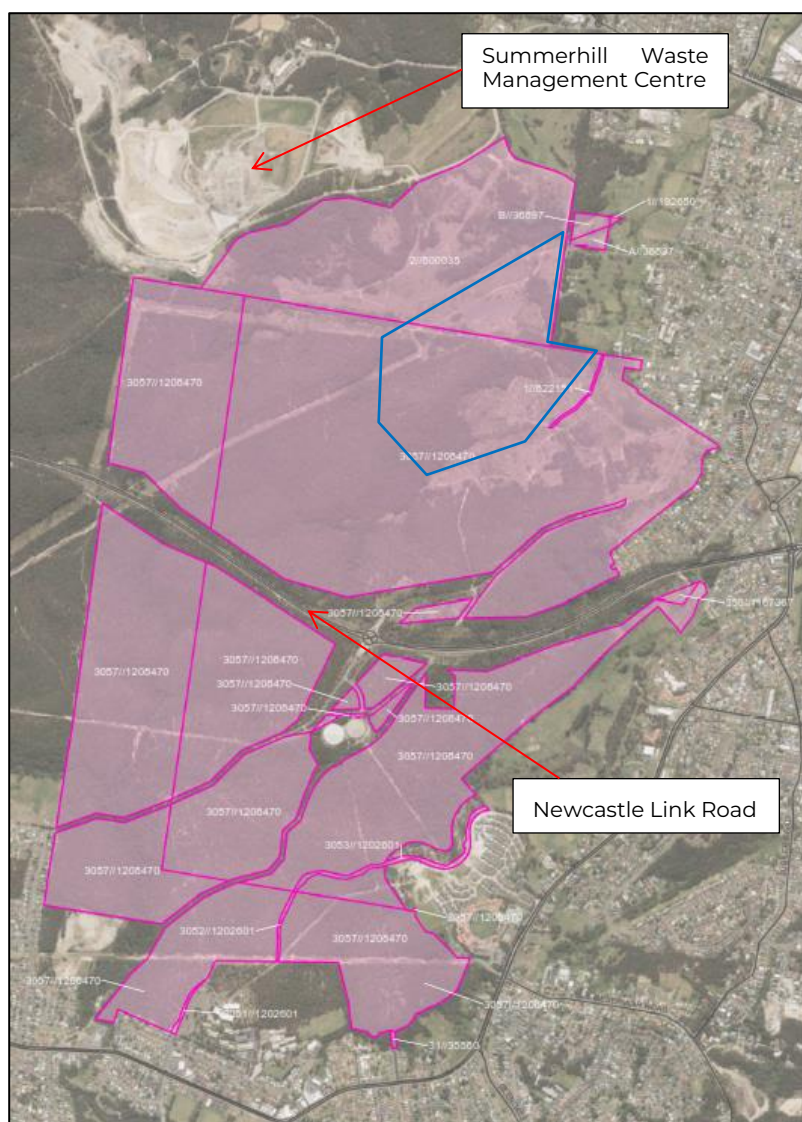


Figure 2: Site location plan with overall development area shown in pink and approximate extent of site in blue (provided by client)

Table 1 below provides information on site identification and environmental setting for the site.

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
Lot / DP	• Lot 1 in DPI92650; • 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.
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.

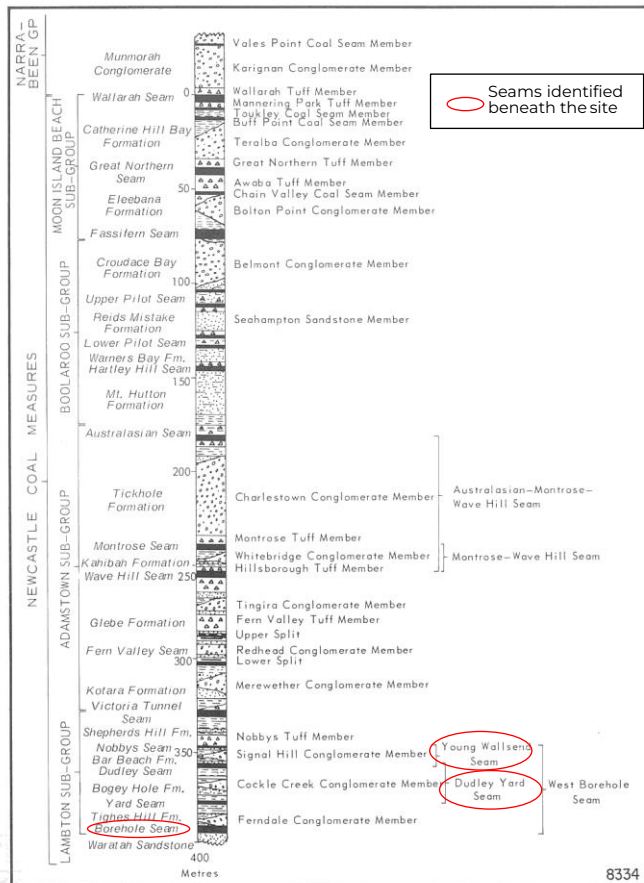


Figure 3: Stratigraphy of the Newcastle Coal Measures, reproduced from (Packham, 1969)

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.

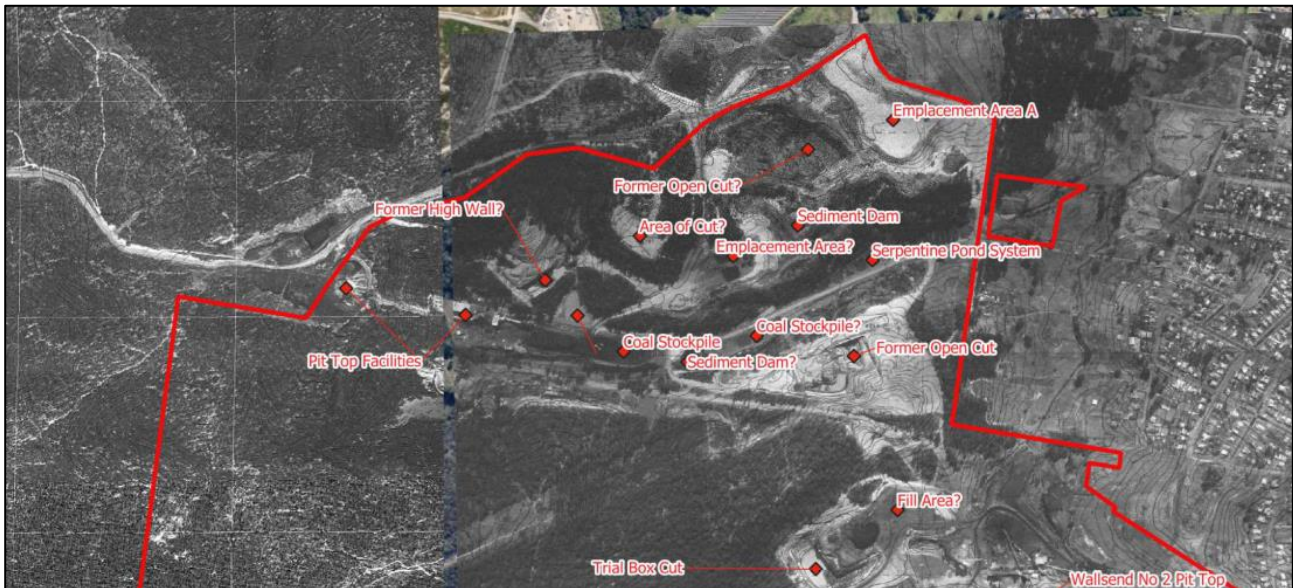


Figure 4: Extract from previous Douglas investigation/s showing areas of deep fill near northern extent of development land holdings

(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).

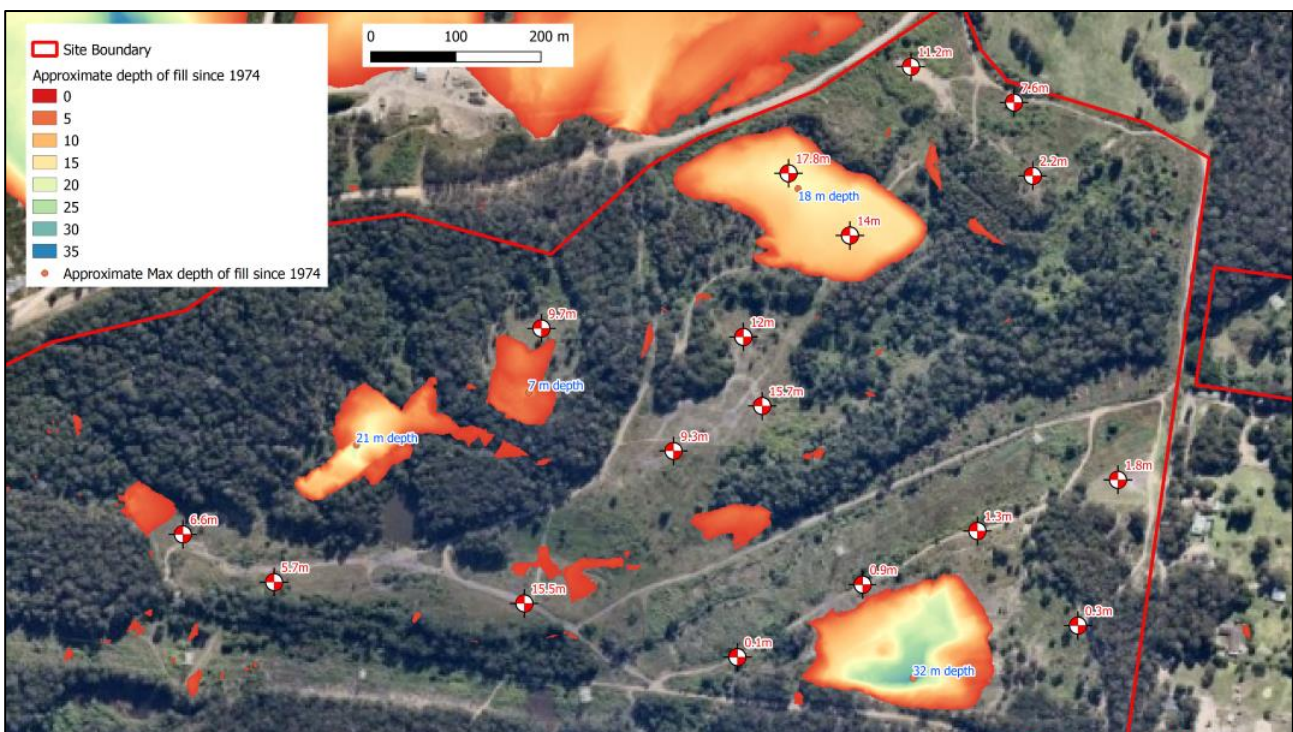


Figure 5: Extract from previous Douglas investigation/s showing previous subsurface investigation locations and depth of fill (inferred or encountered)

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, including 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.

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.

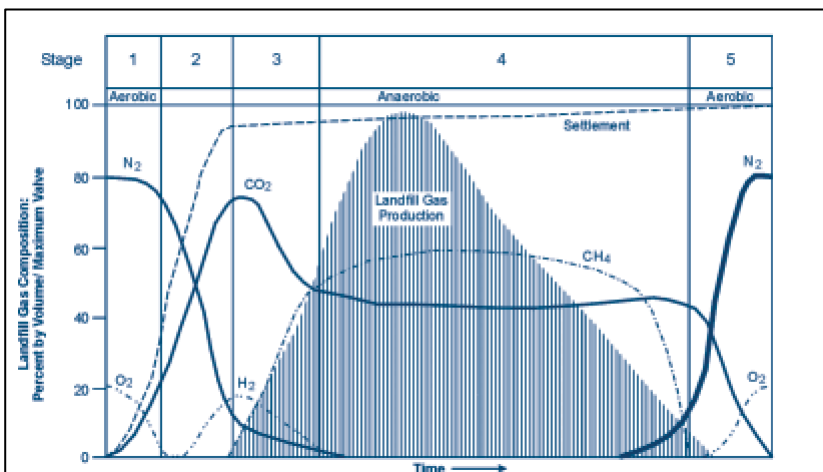


Figure 6: Idealised representation of landfill gas generation (SEPA, 2004)

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 of 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.

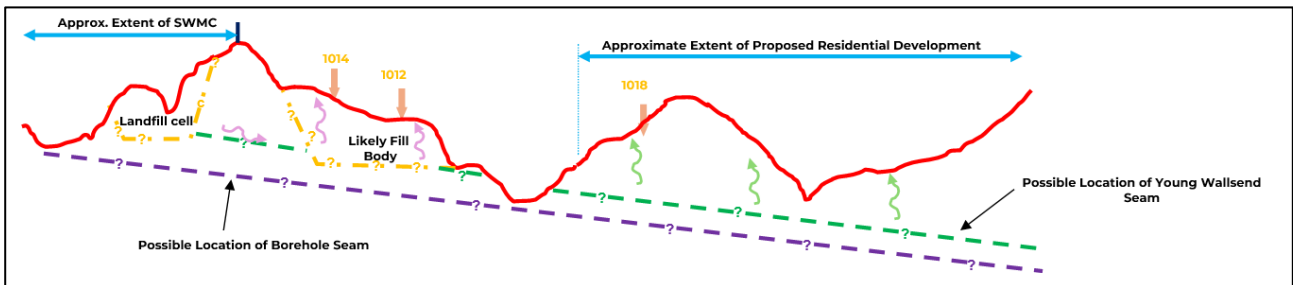


Figure 7: Conceptual Site Model of Possible Ground Gas Migration Pathways through Section AA (purple pathway for landfill gas and green pathway for coal seam gas).

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

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.

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 would be suitable. It is noted that additional wells may be required should significant gas readings be observed during monitoring. It is noted that a second line of bores, located at 1000 m from SWMC will be installed, and for this line of bores an increased spacing of 100 m will be implemented.

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

Well Type	Number	Approximate Location
Gas Well – Deep	9	Northern extent of proposed residential development
Gas Well – Shallow	7	Northern extent of proposed residential development
Gas Well - Mid depth	10	Along 1000 m buffer line
Groundwater Well	7	Northern extent of proposed residential development and 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; and
 - 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 (refer Drawing 3) deep and shallow wells would be alternated.
 - To assist with understanding of groundwater depths, separate groundwater wells would be installed at a frequency of 1 groundwater well to 5 gas bores, where groundwater is encountered within the depth of investigation as described above.
- 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 should 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 should be installed at the base of the well;

- A sand filter should 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 should 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 should 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 should be constructed as above with the following alterations:

- The slotted depth interval should extend over the likely groundwater table and should be a minimum of 3 m in length;
- An appropriate end cap should be 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:

- Record the barometric pressure and general weather conditions during monitoring events;
- Connect the tube on the calibrated landfill gas analyser (GA5000) to the quick connect gas fitting on the well cap;
- Set the analyser pump on and record concentrations of:
 - Methane;
 - Carbon dioxide;
 - Oxygen;
 - Carbon monoxide;
 - Hydrogen sulphide;
 - Atmospheric pressure;
 - Relative bore pressure;
 - Gas flow.
- Readings will be taken generally at 30 second intervals, for a minimum of ten minutes and until concentrations have generally stabilised.
- The gas screening value (GSV) will be derived based on the results of the gas monitoring and using the Wilson and Card method. This method defines the characteristics situation (CS) value for the site based on the limiting 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).

7.5 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 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.

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.

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.

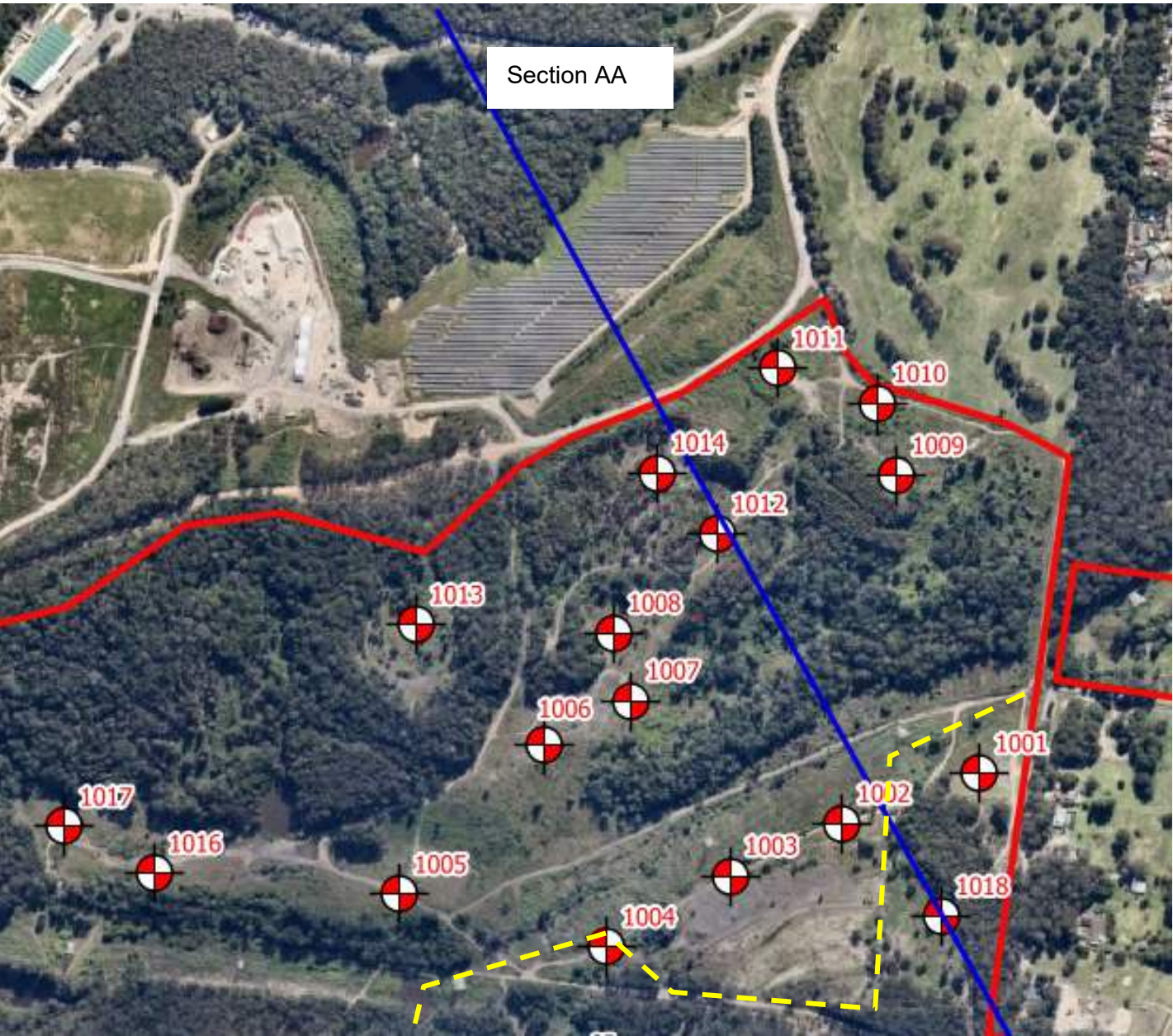
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Appendix B

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



Notes to Drawing:

Surface level, depths and locations are approximate only.

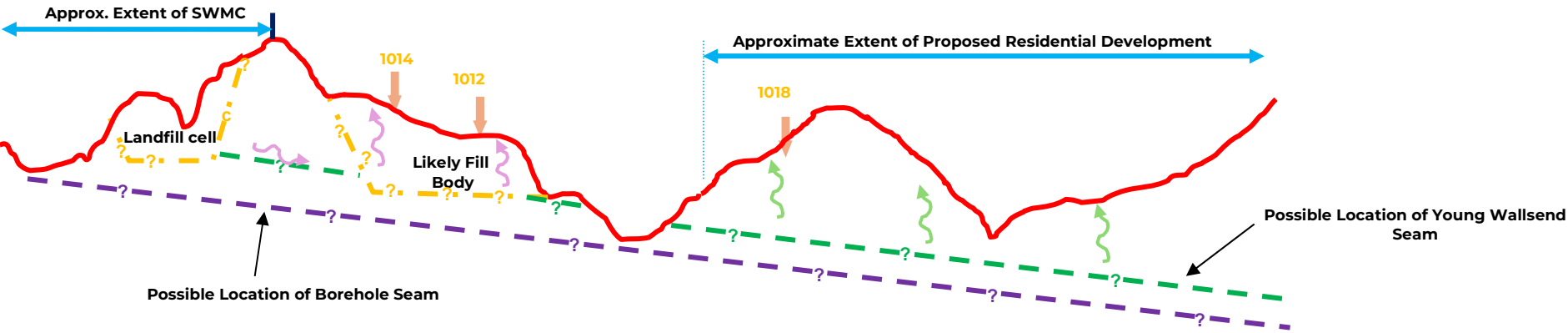
Depth to coal seams are approximate only and based on desktop interpolation.

Conceptual site model only to illustrate possible hazardous ground gas migration pathways

Scale for Conceptual Section:

1:7500 horizontal (approximately)

1:1500 vertical (approximately)

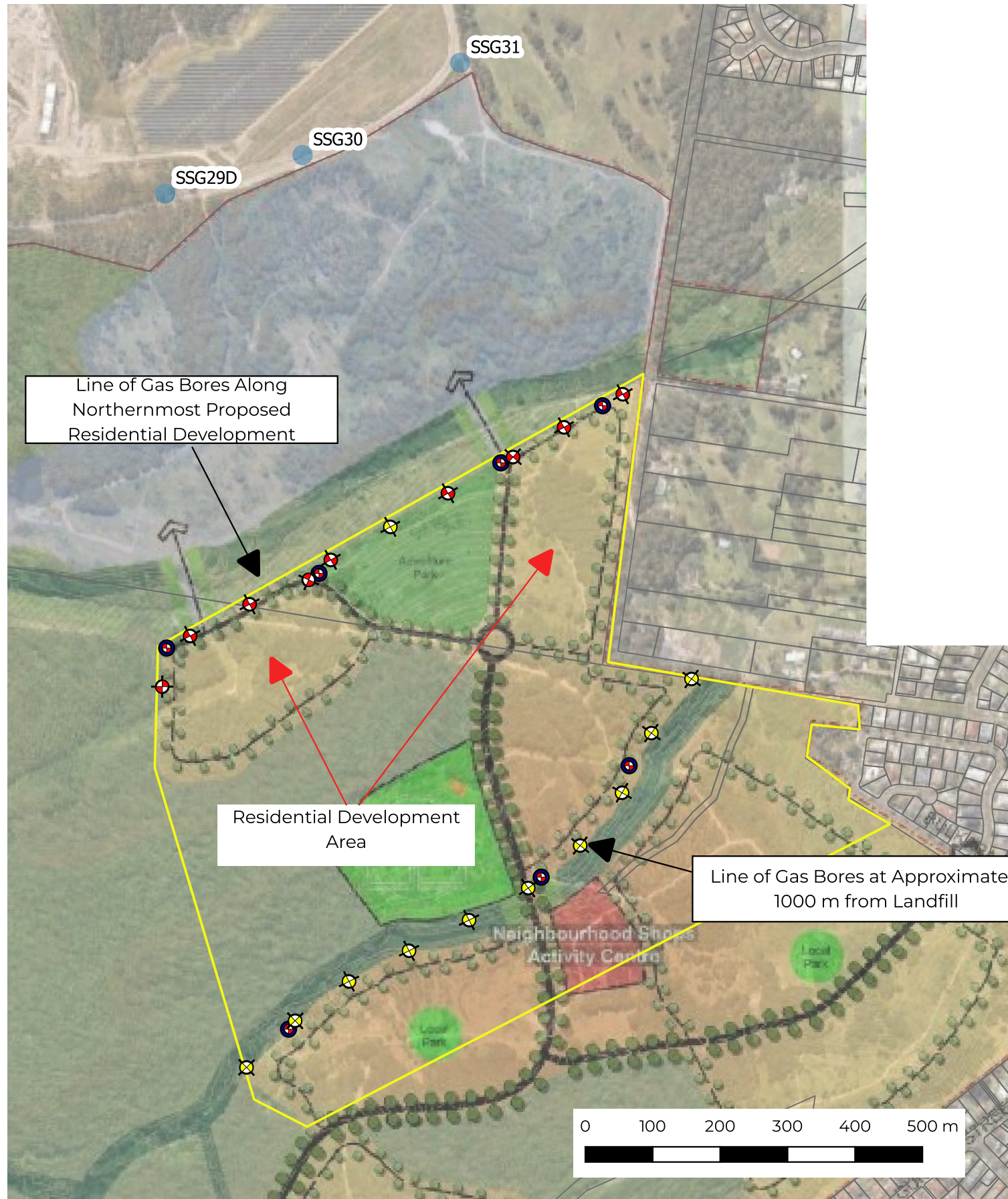


CLIENT:	Eden Estates (Newcastle) Pty Ltd	
OFFICE:	Newcastle	DRAWN BY: MPG
SCALE:	As Shown	DATE: 27.11.2024

TITLE: **Conceptual Site Model – Section AA**

Hazardous Ground Gas Migration

PROJECT No:	991610.08
DRAWING No:	2
REVISION:	0



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



North-eastern well alignment



North-west well alignment

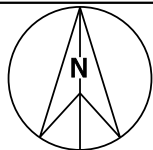
LEGEND

- Council Gas Monitoring Locations
- ⊕ Deep bores
- ⊕ Shallow bore
- ⊕ Groundwater Wells



CLIENT: Eden Estatets Pty Ltd
OFFICE: Newcastle DRAWN BY: MPG
DATE: 27.November.2024

TITLE: **SAQP for Ground Gas Assessment - Proposed Well Locations**
Proposed Residential Development
144 Boundary Road, Wallsend, NSW



PROJECT: 91610.08
DRAWING No: 3
REVISION: 1