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SAMPLING AND ANALYSIS QUALITY PLAN

August 2021
J169135

DEPARTMENT OF EDUCATION (SCHOOL INFRASTRUCTURE NSW)

7-11 BURROWAY ROAD, WENTWORTH POINT, NSW

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Proposal

The proposed development is for the construction of a school whereby the project is known as Sydney Olympic Park new high school. The school is to be developed in two stages. The SSD application will seek consent for both Stage One and Stage Two. While Stage Two is submitted as part of this proposal, construction is subject to approval of additional funding.

Stage One will provide for a Stream 5 high school, catering for up to 850 students. Stage Two will bring the school up to a stream 9 school capability catering up to 1,530 students.

The design features a six storey building. To the north of the site, a hall building (for sports and performance) is proposed.

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The play space required to meet the need of students for Stage One can be generally accommodated onsite, within the 9,511sqm available. Additional play space may be required to accommodate the increased student numbers anticipated during Stage 2. The proposed adjoining play space comprises an area of around 8,800sqm, and will be subject to a Joint Use Arrangement and available for public use outside school hours. The future Wentworth Point Peninsula Park will result in an open space area of approximately 4 ha.

The remainder of the peninsula (TfNSW land) is under review and will be subject to a separate approval process. Redevelopment of this land will include the new access road proposed off Burroway Road along the eastern boundary of the subject site and is proposed to include car parking, drop-off zones and delivery zones.

Site Description

The proposed development is located within the peninsula of Wentworth Point at 7-11 Burroway Road, Wentworth Park across parts of three lots; Lot 202 DP1216628, Lot 203 DP1216628 and Lot 204 DP1216628. The site forms part of the Wentworth Point Planned Precinct, which was rezoned in 2014 for the purposes of high density residential, public recreation, school and business purposes.
The site is approximately 9,511sqm in area, with a frontage of approximately 91m to Burroway Road. It currently contains vacant land, which is cleared of all past development, and almost entirely cleared of native vegetation.

The surrounding area is generally characterised by high rise residential and mixed-use developments. The site is directly adjacent to the Wentworth Point Peninsula Park and immediately east of Wentworth Point Public School.

Site Aerial Map
Source: Mecone

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Sampling and Analysis Quality Plan

7-11 Burroway Road, Wentworth Point, NSW

Department of Education (School Infrastructure NSW)

Table of Contents

1 Introduction

This Sampling and Analysis Quality Plan (SAQP) is prepared for the Detailed Site Investigation (DSI) that will be undertaken to close out the data gaps associated with soil contamination, groundwater, soil vapor and hazardous ground gas at the Proposed Sydney Olympic Park High School - 7-11 Burroway Road, Wentworth Point, NSW (the site). The DSI shall be undertaken by taking this document as a basis aiming to supply the necessary data for the preparation of a Remediation Action Plan (RAP) for the site.

2 Background

The site is identified as parts of three lots; Lot 202 DP1216628, Lot 203 DP1216628 and Lot 204 DP1216628 and covers an approximate area of 0.95 ha (refer to the site boundary displayed in Figure 1). The site was vacant at the time of this investigation. The site is planned to be developed by Department of Education (Schools Infrastructure of NSW) as a high school site, which is known as Sydney Olympic Park new high school (SOPHS) (see. Figure 2 for planned development layout).

Greencap undertook a Preliminary Site Investigation (PSI) for the site and prepared the PSI Report (Greencap 2021). Based on the findings of the PSI it is understood that the site situated on reclaimed land where extensive filling had occurred in the past. The PSI indicated the site has a history of contamination associated with petroleum hydrocarbons, poly-cyclic aromatic hydrocarbons (PAH), heavy metals, asbestos in fill (bonded and friable), and ground gas. Former potentially contaminating activities identified included: legacy landfilling, industrial operations (inc. waste recycling, and timber production), and legacy demolition activities on-site.

The site was noted to be largely sealed with concrete (this excludes the Play Space area to the north of the site, see Figure 1). Northern and north-western section of the site was observed to be extensively filled with imported fill. A relatively large (potentially > 20,000 m3, portion within the Site and Play Space area) soil mound was observed to extend along the western border of the site and stretches towards north west in to the Play Space area. The stratigraphy on site is expected to be fill material followed by alluvial soils and sediments, followed by sandstone bedrock.

The site is situated on a Class 2 Acid Sulfate Soil zone, which means the site may contain Acid Sulfate Soils below the natural ground surface. Therefore an Acid Sulfate Soils Assessment and Management Planning will be required for the proposed development. Former RAP (PB 2015) concluded the site is characterised as moderate to high risk for hazardous ground gases. This corresponds to a characteristic gas situation 4, which requires to be further investigated.

2.1 Site Description Summary

A summary of the general site information is presented on **Table 1** below. Site locality and layout maps are provided in **Figure 1** and **Figure 2**.

Table 1: Site Information

Site Address:	7-11 Burroway Road, Wentworth Point, NSW
Property Identification:	Part of 202 and 203 / DP1216628
Approximate Area:	0.95 ha (total area including the Site and Play Space area equals to 2.2 ha), see. Figure 1
Current Zoning:	B1 Neighbourhood Centre, R4 High Density Residential and RE1 Public Recreation
Current Site Use:	Vacant Land

Potential Site Users:	• Future students and staff, parents of the students; and • Current and future site workers and other temporary visitors.	
Surrounding Site Use:	**North**	Parramatta River
	East	Parramatta River
	South	Riverside Medicine Park Wharf
	West	Wentworth Point Public School, Marina Square Shopping Mall
Surface Water Bodies:	**North**	Parramatta River (~25 m distance)
	East	Parramatta River (~126 m distance)
Heritage items	No known heritage items were identified on the site	

The nearest sensitive human receptors are i) the future students and staff, ii) parents of the students, iii) construction and other site workers, and iv) other temporary visitors. Parramatta River located towards both north and east of the site is considered as the nearest environmental receptor.

According to Penrith 1:100 000 Geological Sheet 9030 (Clark N.R. and Jones D.C., 1991) the site is underlain by anthropogenic deposits – Natural surface elevation raised by placement of fill over former estuarine swamps and subaqueous estuarine margins (supratidal to subtidal zone); estuarine banks and islands formed from dredged spoil. The anthropogenic deposit overlies quaternary silty to peaty quartz sand, silt and clay.

2.2 Review of former Remediation Action Plan (Parsons Brinckerhoff 2015)

Greencap was provided with a historical Remediation Action Plan (RAP) for the site, which belonged to the year 2015. This document was titled as "Parsons Brinckerhoff – Detailed Remediation Action Plan – Infrastructure Delivery, January 2015". This RAP covered a larger project area and the site defined in the scope of this investigation fell into an area defined as "Stage 1 Area" in the former RAP. Below anecdotal (reference reports mentioned in this RAP was not available for review therefore data could not be validated) information was obtained from this RAP:

- Fill material was noted as: 0.0 – 2.4 mBGL;
- Natural material was noted as: 1.0 – 4.8 mBGL and
- Sandstone was encountered at some locations with depth of 4.4 – 4.8 mBGL.
- Standing water levels (SWLs) was noted to be ranging from 0.6 mBGL to 3.7 mBGL.
- Lead, total recoverable hydrocarbons (TRH) (C10-C36), Benzo(a)pyrene, polyaromatic hydrocarbon (PAH) exceedances were identified in soil assessment, asbestos (both friable and bonded) was identified in fill material, groundwater contamination of copper, chromium and zinc was identified (Additional contamination assessment – Stage 1 Area, incorporated results from the 2010 detailed site investigation GHD, 2012).
- A potential unacceptable ground gas vapour risk was identified to future land users via the vapour inhalation exposure pathway (Stage 1 health risk assessment GHD, 2013c).
- Based on the maximum characteristic situation (CS) values obtained for Stage 1 Area certain locations/areas were considered to require gas protection measures (post-development). (Additional ground gas monitoring GHD, 2013d).
- Three areas in Stage 1 area were given CS4 ratings, which represents a moderate to high ground gas risk (Ground gas monitoring conducted by GHD).

It must be noted that the ground gas risk assessment report was not available for review. The historical RAP (PB 2015) indicated the highest readings were taken from eastern section of Stage 1 Area (off-site), however, suggested the entire site to be classified as CS4 (including the site).

3 Objectives

The objective of this SAQP is establish a plan to undertake the DSI in accordance with the following legislation and guidelines:

- National Environment Protection (Assessment of Site Contamination) Measures (NEPC 2013);
- NSW EPA Guidelines on Assessment and Management of Hazardous Ground Gases (NSW EPA 2020);
- Consultants Reporting on Contaminated Land (NSW EPA 2020); and
- State Environment Planning Policy (SEPP) 55.

Data to be collected following the implementation of this SAQP will be used to update the CSM of the site and inform a RAP.

4 Preliminary Risk Screening for Hazardous Ground Gasses

4.1 Preliminary Risk Screening

As established in NSW EPA (2020), the preliminary screening process should provide answers to three questions:

1. Is the model based on sufficient, reliable site information to allow its use for screening purposes?—*Yes (for screening purposes only), available information include PSI (Greencap 2021) and RAP (PB 2015);*
2. Is there a potential source of bulk ground gas?—*Yes, potential for legacy landfilling identified in PSI (Greencap 2021) and the site was defined as moderate to high risk for hazardous ground gases by PB (2015); and*
3. Is there a credible pathway between the source and the receptors?— *Yes, potential gas migration pathways in unsaturated soil, through cracks, and utility lines and accumulation in enclosed paces (potential future buildings on-site).*

Based on the existing data (see Section 5 for the CSM), answers to above questions are Yes to undertake a Level 1 Risk Assessment. Therefore, a Level 1 risk assessment has been prepared (see Section 4.2 below).

4.2 Level 1 Risk Assessment

Level 1 risk assessment is a qualitative approach focusing on identification of the hazards and probability. In line with NSW EPA (2020) a classification of consequences (**Table 2**) and classification of likelihood (**Table 3**) are evaluated on a qualitative risk assessment matrix (**Table 4**).

Table 2: Classification of consequences

Classification	Definition - NSW EPA (2020)	Examples - NSW EPA (2020)
Severe	Fatalities, including multiple fatalities Very serious injuries Catastrophic damage to buildings	Explosion causing building collapse
Medium	Long-term damage to human health Serious injuries Major damage to structures	Permanent injuries Structural damage requiring major repair or demolition and rebuild

Classification	Definition - NSW EPA (2020)	Examples - NSW EPA (2020)
Mild	More significant non-permanent injuries Significant damage to buildings, structures or services	Fractures, burns, gas inhalation or other injuries requiring medical treatment Severe cracking requiring closure of buildings and urgent repair
Minor	Minor non-permanent health effects Harm that may result in financial loss, business disruption or reputational damage Minor property damage	Minor cuts or bruises requiring first-aid treatment Cosmetic damage to buildings or pavement Damage to landscaping Minor damage to vehicles

Table 3: Classification of likelihood

Classification	Definition - NSW EPA (2020)
High likelihood	A credible linkage exists, and a trigger hazardous event is very likely to occur in the short term and is almost inevitable over the full timeframe of concern (typically the effective life of a building or development). The likelihood of the stated consequence is also high.
Likely	A credible linkage exists, and all necessary elements required for a trigger hazardous event to occur are present. Occurrence is not inevitable, but it is possible in the short term, and probable over the full timeframe of concern. The stated consequence is likely.
Low likelihood	A credible linkage exists and circumstances under which a trigger hazardous event could occur are possible. However, it is by no means certain that the event will occur within the timeframe of concern, and it is less likely in the short term. Therefore, there is a low likelihood that the stated consequence will occur.
Unlikely	A credible linkage exists but circumstances are such that it is improbable that a trigger hazardous event would occur within the timeframe of concern. Therefore, it is unlikely that the stated consequence will occur.

Table 4: Qualitative risk assessment matrix

		Consequence			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high risk	High Risk	Moderate risk	Moderate / low risk
	Likely	High Risk	Moderate risk	Moderate / low risk	Low risk
	Low likelihood	Moderate risk	Moderate / low risk	Low risk	Very low risk
	Unlikely	Moderate / low risk	Low risk	Very low risk	Very low risk

Taking the CSM (see. Section 5) and PB (2015) into consideration, Severe/ Medium consequences appear possible at the site. Probability of occurrence is uncertain, however, at this stage it is qualitatively assessed as Likely. Therefore, the investigation area is initially considered as High to Moderate Risk of hazardous ground gas impact. It must be noted that this classification is not conclusive and will be updated with a semi-quantitative approach (by using Wilson and Card method as per NSW EPA 2020) following further investigation works (see Section 6 for the proposed sampling plan) and collection of additional site data.

5 Conceptual Site Model Summary

Potential contaminant source, pathway, and receptor linkages that require investigation according to the current CSM are presented in **Table 5**. A pictorial CSM will need to be prepared following the completion of the DSI to comply with NSW EPA (2020).

Table 5: CSM Items That Require Further Investigation (ref: PSI, Greencap 2021)

Potential Source	Contaminants of Concern	Phases of Contaminants	Potential Transport Pathways	Potential Exposure Pathways	Potential Receptors	Comments
Unverified fill (potentially containing dredged sediments and putrescible material)	Hazardous ground gases; Methane (CH_4), hydrogen sulphide (H_2S), carbon monoxide (CO), and carbon dioxide (CO_2).	Ground gas	Preferential pathways created by future utility service lines and deep pile foundations below school buildings Gas/ vapour migration through unsaturated soils Surface emissions	Gas accumulation in enclosed spaces and inhalation	Future students, staff, visitors of the school, temporary visitors, and workers on site Neighbouring properties (lateral gas & groundwater migration)	**On-site:** potential source, pathway, receptor linkages require to be investigated through ground gas, soil vapour, groundwater monitoring and soil assessment **Off-site:** this shall be determined based on the results of intrusive investigations to be undertaken
	TRH, BTEXN, PAH, VOCs, organochlorine pesticides (OCP), polychlorinated biphenyls (PCB)	Soil vapour (TRH (F1 and F2) and BTEXN), VOCs				
		Dissolved phase, light non-aqueous phase liquid (LNAPL), and dense non-aqueous phase liquid (DNAPL).	Off-site migration with advection and dispersion	Migration into regional aquifer	Parramatta River Neighbouring sites	
	Heavy Metals (As, Cd, Cr, Cu, Pb, Zn, Ni, Hg) Nutrients (NH_3, NO_2, and NO_3)	Dissolved phase				
	ACM	Solid phase (friable and bonded)	Future excavation works and generation of dust	Inhalation	Future students, staff, visitors of the school, temporary visitors, and workers on site	**On-site** potential source, pathway, receptor linkages require investigation through soil assessment.

Potential Source	Contaminants of Concern	Phases of Contaminants	Potential Transport Pathways	Potential Exposure Pathways	Potential Receptors	Comments
Potential abandoned UPSS	TRH, BTEXN, PAH, Pb	Soil vapour (TRH (F1 and F2) and BTEXN)	Preferential pathways created by future utility service lines and deep pile foundations below school buildings Vapour migration through unsaturated soils Surface emissions	Vapour intrusion into the buildings	Future students, staff, visitors of the school, temporary visitors, and workers on site	**On-site** potential source, pathway, receptor linkages requires to be investigated through soil and groundwater assessment **Off-site:** this shall be determined based on the results of intrusive investigations to be undertaken
		Dissolved phase, light non-aqueous phase liquid (LNAPL), and dense non-aqueous phase liquid (DNAPL).	Off-site migration with advection and dispersion		Parramatta River Neighbouring sites	

5.1 Chemicals of Potential Concern

Contaminants of concern (CoC) were determined in accordance with results from previous reports. A breakdown of CoC is provided in Table 6.

Table 6: Chemicals of concern

Ground Gas	Soil Vapour	Groundwater	Soil
CO	TRH	TRH	TRH
CO_2	BTEXN	BTEXN	BTEXN
CH_4	VOC	PAH	PAH
H_2S	-	Heavy Metals (As, Cd, Cr, Cu, Pb, Zn, Ni, Hg)	Heavy Metals (As, Cd, Cr, Cu, Pb, Zn, Ni, Hg)
-	-	Nutrients (NH_3, NO_2, and NO_3)	ACM
-	-	VOC and SVOC scan	OCP, PCB

Note:

1. CO = Carbon Monoxide; CO_2 = Carbon Dioxide; CH_4 = Methane; H_2S = Hydrogen Sulfide.
2. TRH = Total Recoverable Hydrocarbons;
3. BTEXN = Benzene, Toluene, Ethylbenzene, Xylenes, and Naphthalene; F1 = TRH C_6-C_{10} less BTEX; F2 = TRH C_{10}-C_{16} less Naphthalene.
4. Arsenic (As), Cadmium Cd, Chromium (Cr), Copper (Cu), Lead (Pb), Zinc (Zn), Nickel (Ni), Mercury (Hg)
5. NH_3 = Ammonia, Nitrite = NO_2, and Nitrate = NO_3
6. VOC = Volatile Organic Carbons, SVOC = Semi Volatile Organic Carbons
7. ACM = Asbestos containing material
8. OCP = Organochlorine pesticides
9. PCB = Polychlorinated biphenyls

5.2 Identified Data Gaps

Data gaps identified for the investigation area include the following:

- A Safe Work Dangerous Goods Search is required to be undertaken for both lots 202, 203, and 204 DP 1216628;
- Soil, soil vapour and groundwater chemical data was absent for the site;
- Sites ground gas risk profile requires investigation targeting the planned building footprints;

➢ Ground gas/ soil vapour composition, pressure and flowrate in soil was unknown—*PB (2015) indicated previous assessments did not target the proposed high school building footprints;*

➢ Total organic carbon (TOC) content of the fill material and alluvial soils were unknown—*this is required in order to investigate the methane generation potential of fill and anticipated alluvial soils on-site*;

➢ Gas composition in utility pits (if any) on site and around site's perimeter was unknown;

➢ Potential for surface gas emissions was unknown;

- Vertical extent of fill beneath the site requires delineation;
- Depth of aquifer on site and groundwater chemical characteristics requires confirmation; and
- Asbestos containing materials may be present within the unverified fill material on-site.

5.3 Data Quality Objectives

The Data Quality Objectives (DQO) process is a series of seven steps to guide the planning and collection of data to ensure its suitable (quality and quantity) for the intended use in the site assessment and CSM development. To develop an accurate CSM, the field sampling and laboratory sample analysis data has to be accurate, representative and complete. The NSW EPA requires this process to be followed for site contamination investigation and assessment (NSW EPA 2017 Guidelines for the NSW Site Auditor Scheme, Section 4.1.1). The DQO process is based on the United States Environmental Protection Agency (U.S. EPA) Guidance of the Data Quality Objectives Process – EPA QA/G-4 (USEPA, February 2006).

DQOs are statements that define the confidence required in conclusions drawn from data produced by a project, and which must be set to realistically define and measure the quality of data needed. The DQO process involves assessing uncertainty in data obtained to characterise subsurface media, the sampling protocols, and the uncertainty that is governed by the analytical laboratory procedures used in analysis of samples. The process is a series of planning steps designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate when used to assess compliance of a site with environmental assessment criteria.

Table 7: Data Quality Objectives

Step	Issue	Comments
1	State the Problem	There are unaddressed human health and environmental risks associated with the identified potential contamination sources at the site (inc. legacy landfill on-site). For the assessment of the above-mentioned risks, data gaps identified in the Section 5.2 are required to be eliminated and a complete CSM for the site is required to be developed.
2	Identify the Decision	Results of the DSI are sufficient to complete the identified data gaps identified in this SAQP and develop a complete CSM that can inform a RAP.
3	Identify the Inputs to the Decision	Inputs to the decision will include the scientific data collected during the further investigations. This will include but not be limited to: • Borehole/ test pit logs, • Data obtained from boreholes and visual observation of the profile, • Well installation details, • Field observations made by the Environmental Consultant, • Gas monitoring wells measurement results, • Service pit and confined spaces gas monitoring results, • Soil analytical results, • Soil vapour analytical results, • Groundwater analytical results, and • Groundwater monitoring data (inc. standing water level and survey data)
4	Define the Study Boundaries	Site boundaries are indicated on **Figure 1**. Vertical study boundary will be established by the bedrock, which is anticipated to be encountered at depths ~10 -12 m BGL (Geotechnical Investigation Report - Douglas Partners, 2018). Specific horizontal and vertical study boundaries are established as follows: <u>Ground gas and soil vapour monitoring:</u> • Lateral study boundaries: Investigation area is shown on **Figure 2** • Vertical study boundaries: Extent down to bedrock <u>Service pit monitoring (if any):</u> • Lateral study boundaries: Site borders and service pits in the immediate vicinity of the site. <u>Groundwater monitoring:</u> • Lateral study boundaries: Investigation area is shown on **Figure 2** • Vertical study boundaries: Water bearing zone or depth of bedrock.

Step	Issue	Comments
		The temporal boundary of the project is restricted to the timing of the investigations which need to include climate and seasonal variations which can influence gas emissions. Delineation of Depth of Fill: • Lateral study boundaries: Site borders. • Vertical study boundaries: Depth of natural soil.
5	Develop a Decision Rule	Following decision rules are identified for the proposed DSI: Soil contamination assessment: **IF** Chemicals of potential concern do not exist in samples at concentrations in excess of adopted site criteria (NEPM 2013); **THEN** no further soil assessment/ remediation is required. Ground gas: **IF** ground gas measurements indicate the presence of unacceptable level of hazardous ground gas risk on-site (anything classification above "Very Low Risk" would require certain level of physical protection measures) ; **THEN** Installation of gas protection systems would be required at a level satisfying the requirements corresponding to the characteristic gas situation (CS) level identified as per NSW EPA (2020). Soil vapour: **IF** Chemicals of potential concern do not exist in samples at concentrations in excess of adopted site criteria (NEPM 2013); **THEN** no further soil vapour assessment/ remediation is required. Service pit monitoring: **IF** service pits at or in the immediate vicinity of the site do not contain hazardous gases at or above acute toxicity levels (e.g. 15 ppm for H_2S) and/ or within explosive ranges (e.g 5-15% for CH_4) and/ or greater than NSW EPA/ WorkCover notification criteria (e.g. 1% for CH_4), **THEN** no further assessment/ remediation is required targeting these pits. Groundwater monitoring: **IF** contaminant concentrations do not exceed NEPM 2013 Groundwater Investigation Levels (GIL), **THEN** no further assessment/ remediation is required.
6	Specify Limits on Decision Errors	Potential for decision errors will be minimised through an analysis of a site-specific worst-case scenario (including ground gas measurements under low and dropping barometric pressures). In this context maximum values and peak concentrations of contaminants will be used for comparison against the acceptance criteria threshold concentrations. Determining peak concentrations will include data obtained for climate and seasonal variations. Long term gas risk monitoring should continue after decisions are made.
7	Optimise the Design for Obtaining Data	The design has been optimised to provide the most resource-effective sampling and analysis as follows: • By adopting a systematic sampling density based on NSW EPA Sampling Design Guidelines (1995)—*a minimum of 32 investigation locations are needed to provide coverage at the 2.2 ha site; and* • Boreholes advanced during monitoring well development will be used for soil sampling to ensure sufficient site coverage with optimum number if sampling points; • By adopting a discretional sampling approach (risk / target-based) to the assessment of soil, ground gas, soil vapour and groundwater. Data will be continuously evaluated in the context of the evolving conceptual model, and modifications to the sampling plan will be made to optimise the design as required.

6 Proposed Sampling and Analysis Program

Following sampling program will be undertaken in the scope of Further Investigations:

- Drilling/ test pitting and soil sampling: 23 boreholes/ test pits will be drilled/ excavated across the site, soil samples will be collected at each test pit and from 9 boreholes that will be drilled during monitoring well development (see Figure 2). This adds up to 32 investigation locations complying with NSW EPA (1995)[1]. See Section 6.1 for details.

  Note: As a portion of the site has been previously remediated (explained in the scope of Zoic (2020) Interim Validation Report)), and remaining portion is largely sealed with concrete, drilling and push tubing will be preferred compared to using test pits to minimise disturbance and avoid potential cross contamination.

- Ground Gas & Soil Vapour Monitoring:

  This stage will cover installation and monitoring of nine (9) gas monitoring wells (5 x max depth 1.5 mBGL, 3 x max depth 6 mBGL, and 1 x max depth 12 mBGL), see **Figure 2** and Section 6.2.

- Service Pit and Confined Space Monitoring:

  Service pit and confined space monitoring for gas composition will be undertaken at on-site service pits and drainage gutters located at or near the site. See Section 6.4 for details.

- Surface Gas Monitoring: Surface gas monitoring on a 25 x 25 m grid by using a GA5000 and In spectra Laser Unit (ILU). See Section 6.5 for details.

- Groundwater Monitoring: Groundwater monitoring will be undertaken at three of the ground gas wells where groundwater is encountered. See Section 6.6 for details.

6.1 Soil Sampling

Drilling / test pitting and soil sampling will be undertaken as follows:

- Preparation of relevant safety information (JSEA and SWMS);
- Conducting dial before you dig (DBYD) and engagement of a Telstra Accredited service locator for underground clearance;
- Engagement of a drill rig/ excavator and operator for drilling/ excavation;
- Supervision of drilling/ test pitting, soil logging and soil sampling by a suitably qualified and experienced Environmental Consultant;
- Boreholes/ test pits are planned to advance at the following depths:
  - 23 x boreholes/ test pits to maximum 1.5 - 4 metres below ground level (mBGL) or 0.5 mBGL into natural soil.
- Asbestos sieve testing of 10 L bulk samples will be undertaken at each sample location by using a 7 x 7 mm sieve or spreading soil over a surface for visual inspection;
- Soil sampling of 9 boreholes that will be advanced for monitoring well construction;
- Field screening of fill material with a photoionizing detector will be undertaken;
- At each sampling location a minimum of 1 x 250 ml glass jar and 1 x 500 ml plastic bag sample will be collected targeting fill layers. Layers with visual or olfactory indicators of potential contamination will be targeted;

[1] The site area was reduced from 2.2 ha to 0.95 ha with the written notice of SINSW on 3 June 2021 (refer to Figure 1). As per NSW EPA Sampling Design Guidelines (1995), the minimum systematic sampling locations required for a 0.95ha site is estimated as 21 investigation locations. For the initial DSI minimum number of investigations required were estimated as 32 locations, targeting the initial 2.2 ha site area.

- At testpits and soil bores samples will be collected at intervals of minimum 1 sample per 1 m;
- Additional acid sulfate soil samples will be collected in plastic bags at the planned deep groundwater monitoring bore at 1 m depth intervals;
- Up to 3 x 250 ml glass jar natural soil samples will be collected at each site to establish natural soil baseline data;
- All boreholes/ test pits advanced during the intrusive works will be reinstated after sampling;
- Quality Assurance and Quality Control (QA/QC) samples will be collected at a rate of 1 duplicate sample per 10 primary samples. It is proposed that Eurofins Australia be used as the primary laboratory (approx. 1 in 20 intra-laboratory duplicates), while ALS will be used as the secondary laboratory (1 in 20 interlaboratory duplicates);
- Chemical analysis of the samples by a NATA accredited laboratory for relevant combinations of the following Chemicals of Potential Concern (also listed in **Table 6**)—*final chemical suite will be determined by using professional judgment based on the field observations*:
  - Asbestos in soils (AF/FA);
  - Total recoverable hydrocarbons (TRH);
  - Benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN);
  - Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc);
  - Polycyclic aromatic hydrocarbons (PAH);
  - Polychlorinated biphenyls (PCBs);
  - Organochlorine pesticides (OCPs);
  - VOCs;
  - QA/QC samples (heavy metals suite); and
  - Acid sulfate soils SPOCAS testing.

6.2 Ground Gas Monitoring

The scope of the proposed ground gas monitoring has been established with professional judgment under the guidance of NSW EPA (2020).

The number and density of boreholes are selected by taking into consideration the nature of the gas source (unverified fill) and the robustness of the CSM (largely incomplete as discussed in Section 5.2). Taking these factors (which are also referred in Section 3.4.2 of NSW EPA 2020) into consideration, installation and monitoring of 9 ground gas monitoring has been planned (see **Figure 2** and **Table 8** below).

Table 8: Planned Ground Gas Monitoring Wells

Location ID	Target Area	Target Depth Range [1]
GG1	School building - North	0.5-1.5 mBGL [2]
GG2	School building - North	1.5-5 m BGL (This or below values are not the proposed screening intervals, see notes beneath the table [2])
GG3	School building - Northeast	0.5-1.5 mBGL [2]
GG4	School building - East	0.5-1.5 mBGL [2]
GG5	School building - East	< 12 mBGL [2] **Note:** This well is planned to be screened from the bottom all the way to ~ 1 mBGL for a general screening purpose and to investigate the standing water level.
GG6	School building - East	1.5-5 mBGL [2]

Location ID	Target Area	Target Depth Range (1)
GG7	School building – Southeast	0.5-1.5 mBGL (2)
GG8	School building – South	1.5-5 mBGL (2)
GG9	School building – South	0.5-1.5 mBGL (2)

Notes:

1. Screens of monitoring wells will be installed to target a layer of concern.
2. Screened intervals of each monitoring well will be selected based on professional judgment by taking into consideration the visual and olfactory observations of the borehole log cuttings and standing water levels to target layers with higher gas generation potential. In this scope, layers with putrescible waste, timber, ash, hydrocarbon odours, or similar will be targeted.

6.2.1 Ground Gas Monitoring Well Construction

Gas monitoring wells will be installed in general accordance with Guidelines for the Assessment and Management of Sites Impacted by Hazardous Gases (NSW EPA 2020). Well construction detail will be as follows:

- Gas monitoring wells will be established by experienced environmental drillers (Epoca Environmental, Numac, Matrix drilling or similar);
- The gas monitoring wells will target various depths along the waste media (see **Table 8** above, actual depths will be selected on the field through professional judgment based on the layers encountered and standing water levels in initial wells);
- The deep well to be installed will be screened from the bottom of the unconfined acquifer all the way to ~ 1m BGL aiming to investigate the overall gas situation of the entire profile;
- Screened intervals of each monitoring well will be selected based on professional judgment by taking into consideration the visual and olfactory observations of the borehole log cuttings to target layers with higher gas generation potential. In this scope, layers with putrescible waste, timber, ash, hydrocarbon odours, or similar will be targeted as much as practical;
- Construction of the wells will be as follows:
  - Drill down to target depth with push tube/ auger/ hollow flight auger (where required);
  - An Environmental Consultant will supervise drilling and log the soil profile encountered;
  - In addition to the soil sampling regime defined in Section 6.1, Total Organic Carbon (TOC) soil samples will be collected at a minimum rate of 1 sample per 1 m depth interval throughout each borehole profile in 250 ml glass jars;
  - Field screening will be undertaken by using a photo-ionizing detector (PID);
  - The screened section of the PVC pressure pipe will be adjusted to cover the thickness of the selected target layer;
  - PVC casings with the screened lower sections will be placed into the borehole;
  - The gap remaining outside of the PVC casing and the borehole wall will be filled up as follows (starting from bottom to the top):
    - Gravel / coarse sand to cover the screened interval and 100 mm above the screen;
    - Bentonite plug interval above the coarse sand (min 300 mm for shallow wells and 500 mm

for deeper wells, small amount of water will be applied to finalise sealing of the plug if required);

- Back fill on-top of bentonite plug using a granular soil;
- Concrete collar around pipe at ground surface (above ground pipe base support);
- Monument or gathic cover (preference will be decided based on discussions with the site manager); and
- Top of the PVC casing will be sealed with a self-sealing vapour sampling cap (valve fitting).

- Minimum depth of ground-gas wells is established as 0.5 mBGL to avoid air intrusion into the gas well from the ground surface.

6.2.2 Ground Gas Monitoring Details

A minimum of six monitoring events will be undertaken for initial assessment of the ground gas risk at the investigation area. These events will be extended to a period of minimum two months.

The barometric pressure trends will be checked weekly, aiming to capture a low and falling barometric pressure trend. In case such an event cannot be captured within two months, continuous ground gas monitoring by using an Ion Science GasClam 2 Ground Gas Monitor at a number of selected wells may be required to develop further confidence.

6.2.3 Ground Gas Sampling Methodology

Flow rates at each monitoring well will be measured prior to any sampling being undertaken. Readings of flow rate, relative and atmospheric pressure, and gas concentrations will be taken by a calibrated GA5000 landfill gas analyser.

Typical procedure for taking measurements at gas monitoring wells can be summarised into the following consecutive steps:

Step 1. On the day of sampling prior to travelling to the site, the instrument and the calibration certificate is checked. The unit is then zeroed for the main gases of concern.

Step 2. Prior to commencing sampling, note and record weather, approximate temperature and ground condition at the site, turn on the instrument allowing it to purge and initialise.

Step 3. Attach the required gas monitoring tubing and flow meter tubing and calibrate both the relative pressure and flow readings to zero. At the monitoring well, ensure the flow is at zero prior to attaching the inlet tube of the flow pod tubing to the nozzle of the gas well cap (J-plug). Observe the flow readings and record the initial and stable flow.

Step 4. Remove the flow pod tube and attach the gas monitoring tubing to the nozzle of the well cap. Observe the readings of relative pressure and again record the initial and stable readings.

Step 5. Switch on the pump and observe the readings for gases of concern (CH_4, CO_2, CO, H_2S and O_2), wait (at least 45 seconds) until the readings stabilise and save the readings into the instrument. If the gas readings have not reached a stable value after 3 minutes, save the concentration and record the direction and rate of change in concentration;

Step 6. Remove tubing from well cap nozzle, purge and prepare the instrument for next monitoring site.

Step 7. Remove well cap and record water level using a dip meter, replace well cap ensuring a tight and secure seal.

Collected data will be used in risk classification of the site according to NSW EPA (2019). This information will be presented in a Further Investigation Report.

6.3 Soil Vapour Sampling

Soil vapour will be sampled during one monitoring round at 9 monitoring locations (GG1, GG2, GG3, GG4, GG5, GG6, GG7, GG8, and GG9). The monitoring will be aimed to be undertaken during low or falling barometric pressure.

Following procedure will be undertaken for soil vapour sampling:

Purging and Screening:

- Prior to sampling, PID reading will be collected at each of the soil vapour points.
- Wells will then be purged using the GA 5000 landfill gas meter with oxygen, carbon dioxide, carbon monoxide, hydrogen sulphide and methane concentrations measured for a period of up to 3 minutes until the gas concentrations were shown to stabilise.
- PID readings will also be taken at the end of purging.

Leak Tests

- A helium leak test will be undertaken on each soil vapour point to ensure that ambient air was not being drawn into the vapour point(s).
- The helium leak test methodology adopted comprise the filling of a shroud with helium (which overlies the soil vapour point) and measuring the concentration using a GasCheck handheld helium detector.
- Soil vapour will be drawn from the vapour point and a real-time helium concentration measured.
- A comparison will be made between the helium concentrations within the shroud and the vapour point to assess whether the measured vapour point concentration is less than 10% of the concentration within the shroud.
- A shut-in test will be performed on each sample train, which will included the external components used to sample soil vapour such as tubing / pipes, joints, summa canisters and regulator.
- The shut-in test will involve capping the intake from the soil vapour sampling point and opening the canister regulator to allow the sample train to be under the vacuum from the summa canister.

Sampling and Sampling Flow Rate

- Following a check of the canister pressure (using a calibrated pressure gauge) a clean calibrated mass flow controller will be connected to the top of each canister, allowing the desired volume (~800mL) to enter the 1 Litre canister over a period of 1 to 2 hours.
- Following the completion of sampling, the canisters will be transported to a NATA accredited laboratory for the vapour analysis accompanied by appropriate chain of custody documentation.
- The samples will be tested for the chemicals of concern listed for soil vapour on **Table 6**.

6.4 Service Pit and Confined Space Monitoring

On and near site service pits and drainage gutters will be targeted for gas monitoring during each ground-gas monitoring round:

- Service pit monitoring will be undertaken by a calibrated landfill gas analyser (GA5000);
- The tubing of the GA5000 will be inserted into each pit and at least 45 seconds of pumping time will be allowed before taking readings for CH_4, CO_2, CO, H_2S and O_2;
- Readings will be recorded on the GA5000 and on a field sheet for back up; and
- Location of each identified service pit and drainage gutter will be marked by a GPS.

As required by NSW EPA (2020), NSW EPA will be notified within 24hrs if CH_4 concentration is identified 1% v/v or greater in a service pit or an enclosed surface.

6.5 Surface Gas Monitoring

A surface gas walkover will be undertaken by using an Inspectra Laser Unit (ILU) and a GA5000 on a 25 m x 25 m grid basis among the site. Readings will be taken 5 cm above ground level (as per NSW EPA 2020

6.6 Groundwater Monitoring

Groundwater monitoring will be undertaken at the deep monitoring well (Figure 2), other wells where groundwater is encountered will be visually assess and sampled if deemed necessary:

- Installed groundwater monitoring wells will be surveyed by a qualified surveyor;
- Development of the wells will be done by purging water equivalent to 10 times the volume of the standing water column of each well;
- Wells will be inspected for well integrity and the Standing Water Levels in each will be gauged prior to the groundwater sampling (within one day) to establish more accurate direction of groundwater flow beneath the site;
- Purging and sampling of monitoring wells will be done by using a submerged electric pump (as the groundwater is anticipated in relatively deeper layers) or dedicated foot valves and waterra tubing;
- Water quality parameters (pH, temperature, conductivity, oxidation reduction potential and dissolved oxygen) will be monitored during purging, using a calibrated water quality meter and a flow cell;
- Samples will be collected after water quality parameters are stabilised or water equivalent to three times the volume of measured standing water is purged;
- If a well is purged dry, samples will be collected from the recharged water;
- Field logs for each sampling location will be recorded showing the volume of purged water, field readings of the physical parameters, and details of the colour and turbidity and potential contamination indicators (odours and sheens);
- The sampler will wear a clean pair of latex disposable gloves during sampling and replace the gloves with a new pair between each sampling location;
- All groundwater samples collected will be placed in containers provided by the analytical laboratory;
- Samples will be placed and kept in iced containers until they are delivered to the laboratory;

- QA/QC sampling and analysis will comprise collecting and analysing both intra and inter-laboratory duplicate groundwater samples at the recommended testing rate of 1 sample per 20 primary samples analysed. Trip blank samples are proposed to be collected at a rate of 1 per day and will be tested for a similar suite of analytes as per the primary samples tested. In addition, laboratory trip spikes samples will be included at a rate of one per batch of samples sent to the laboratory and analysed for Volatile Organic Compounds (VOCs);
- When a non-dedicated pump is used for purging and sampling (e.g. peristaltic pump) rinsate blank samples will be collected at a rate of 1 per day and will be tested for a similar suite of analytes as per the primary samples tested;
- Rinsate blanks will not be required if dedicated foot valves and waterra tubing will be used in sampling;
- Groundwater samples will be analysed for the suite detailed in **Table 6** using a NATA accredited laboratory; and
- The results of groundwater sampling will be compared to the GIL presented in NEPM (2013).

7 Reporting

The DSI Report will be prepared in accordance with the NSW EPA (2020) Consultants Reporting on Contaminated Land Guidelines and will include:

- Drilling/ test pitting details and soil logs;
- Gas and groundwater monitoring well installation details and borehole logs;
- Results of field measurements;
- Laboratory analysis results and relevant discussions;
- Evaluation of the updated CSM in accordance with National Environment Protection (Assessment of Site Contamination) Measures (NEPC 2013);
- Assessment in accordance with NSW EPA 2020, including a Level 2 Ground Gas Risk assessment; and
- Recommendations for further assessment, management, or remediation.

8 References

BSI 2013, *Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)*

Parsons Brinckerhoff (2015), *Detailed Remediation Actin Plan – Infrastructure Delivery – Wentworth Point Development*

Douglas Partners (2018), *Geotechnical Report – Burroway Road, Wentworth Point (2018)*

Douglas Partners (2021), *Geotechnical Desktop Study – Proposed Sydney Olympic Park High School – Burroway Road, Wentworth Point (March 2021)*

Greencap (2021), *Preliminary Site Investigation – 7-11 Burroway Road, Wentworth Point, NSW (April, 2021)*

NEPC 2013, *National Environment Protection (Assessment of Site Contamination) Measures (2013)*

NSW EPA 2020, *Contaminated Land Guidelines – Assessment and Management of Hazardous Ground Gasses*.

NSW EPA (2020), *Consultants Reporting on Contaminated Land Guidelines*

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Sampling and Analysis Quality Plan

Department of Education (School Infrastructure NSW)

Figures

Metres
0 15 30 45 60

Site Boundary (03/06/2021)

Play Space Subject to Joint Use Agreement

Site Location

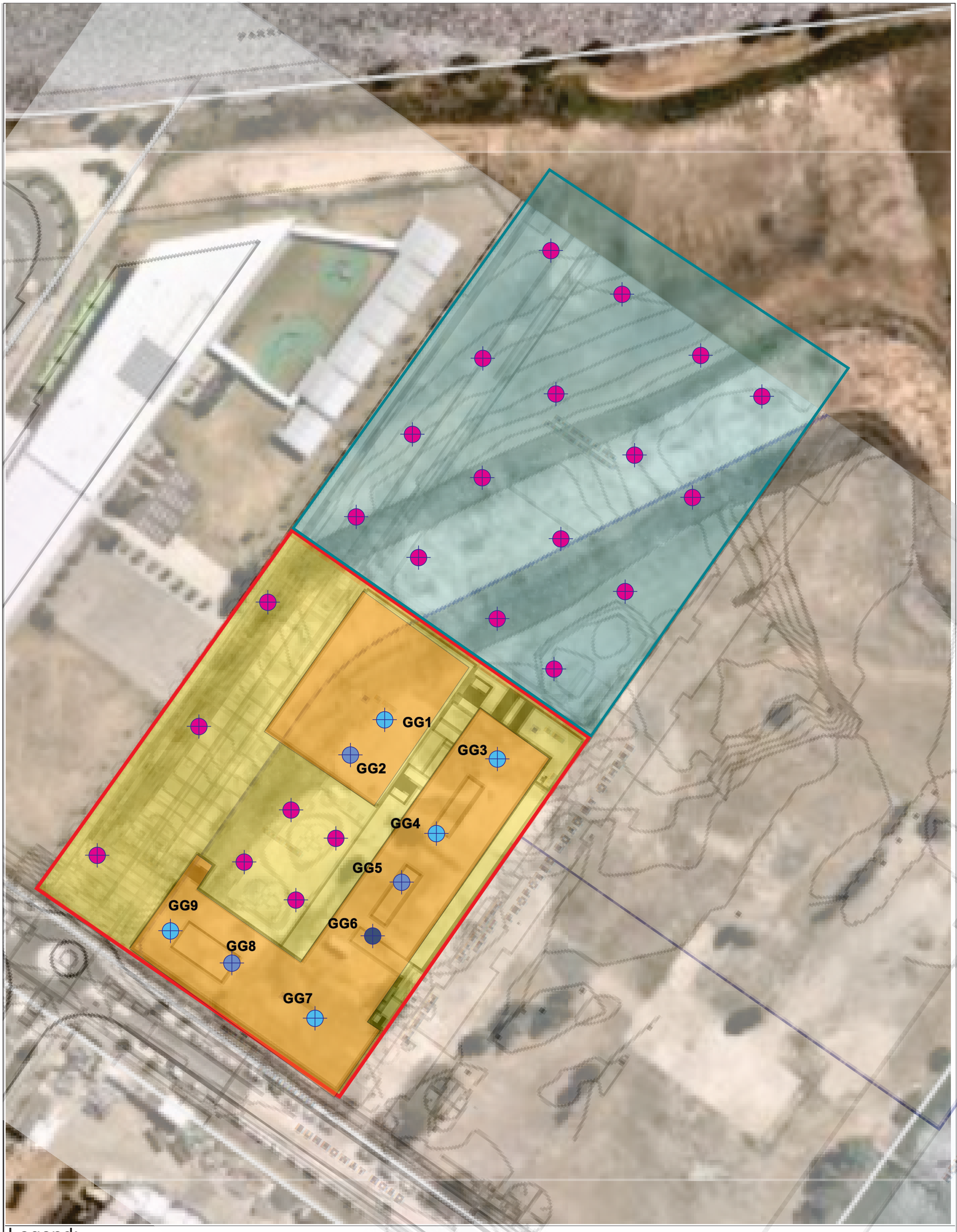
GREENCAP
Going Further in Managing Risk

G, N - Building, 22 Giffnock Ave

Ph: 02-9889-1800

Fx: 02-9889-1811

Client Name:	Department of Education (School Infrastructure NSW)				
Client Number:	C107471		Project Number:	J169135	
Project Description:	Sampling and Analysis Quality Plan - SOPHS				
Address:	Proposed Olympic Park High School, 7-11 Burroway Road, Wentworth Point, NSW 2127				
Prepared:	SW	Reviewed:	MB	Version Date:	18/08/20201
Figure 1	Site Location and Regional Context				



Legend:

Site Boundary

Gas Monitoring Wells 0.5 - 1.5 mBGL

Gas Monitoring Wells 1.5 - 5.0 mBGL

Gas Monitoring Wells 5.0 - 15.0mBGL

Building Footprint

Boreholes/ testpits 0.5-4m mBGL

Metres 0 10 20 30 40

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