GREENCAP
Going Further in Managing Risk

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REMEDIATION ACTION PLAN

September 2021
J169135

Department of Education (SCHOOL INFRASTRUCTURE NSW)

7-11 Burroway Road, Wentworth Point, NSW

C123934 : MB

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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.

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

Document Control

Document Quality Management Details		
Report Name:	Remediation Action Plan	
Site Details:	7-11 Burroway Road, Wentworth Point, NSW	
Project Number:	J169135	
Client Name:	Department of Education (School Infrastructure NSW)	
Client Number:	C123934	
Signatures:	Prepared and Authorised By:  Matthew Barberson **Team** Manager | CLM East | **CENVP: 1227**	Reviewed By:  Emma Lavas **Senior Environmental Consultant** | CLM East

Issue Status

Version No.	Date	Creator	Reviewer
3	15/09/2021	Matthew Barberson	Emma Lavas

Document Circulation

No of Copies	Type	Customer Name	Position & Company
1	Electronic	Sherwin Rasquinha	Project Director - Department of Education (School Infrastructure NSW)

Remediation Action Plan

Department of Education (School Infrastructure NSW)

7-11 Burroway Road, Wentworth Point, NSW

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1 Introduction

Greencap Pty Ltd (Greencap) was engaged by Department of Education (School Infrastructure NSW) to prepare a Remediation Action Plan (RAP) for the property located at 7-11 Burroway Road, Wentworth Point, NSW (the site). The site is identified as parts of Lot 202, 203, and 204 in Deposited Plan (DP) 1216628 and covers an approximate area of 0.95 ha *(see Figure 1).* It should be noted that to the north of the site there is a Play Space, which will be subject to a joint use agreement.

The site is planned to be developed by Department of Education (Schools Infrastructure of NSW) as a new high school site, which will be known as Sydney Olympic Park High School (SOPHS), (see *Figure 2* for planned development layout and *Appendix A* for site survey).

1.1 Background

The proposed high school development includes 2 high school buildings and a sports field area (Play Space) to the north of the site (see Figure 2). Greencap undertook Preliminary and Detailed Site Investigations (PSI and DSI) for the site and prepared the PSI and DSI Reports (Greencap 2021a and 2021b).

The investigations undertaken by Greencap included a review of provided historical documents, a systematic sampling design to obtain general site coverage, and a targeted ground-gas, soil-vapour, and groundwater contamination risk assessment.

As a result of these investigations, it was concluded that the site requires remediation to be made suitable for the planned high school development. Following contamination risks were identified on-site that require remediation:

- Ground gas risk for methane and carbon dioxide;
- An abandoned Underground Storage Tank (UST) identified at the south east section of the site;
- Fill material impacted with asbestos and petroleum hydrocarbons;

The following data gaps were noted in the scope of the DSI that require further investigation:

- The size and alignment of the identified UST was unknown;
- A second UST may be present at the western section of the concrete slab area (see Figure 2)—*this was indicated in PB 2015 as a potential UST location, which could not be appropriately investigated due to the access restrictions caused by the soil mound and concrete slab;*
- There was limited understanding about the extent of asbestos found in previous investigations—*no comment was provided weather it was below or above the NEPM 2013 criteria in previous PB and GHD reports.*

2 Remediation Objectives

The remediation objectives include the following:

- Remediate the contamination risk on site to a level that is suitable for the proposed use as a high school;
- Mitigate the hazardous ground gas risk on-site at a level that will enable safe occupation of the school buildings and ensure protection of the on-site receptors (e.g. students, workers, and built assets);
- Ensure, through appropriate construction management, the planned construction activities do not pose any unacceptable health or environmental risk; and
- Ensure there is no genuine human health or environmental risk on-site following the completion of construction with minimal long-term management requirements.

3 Scope of Work

The scope of this RAP included the following:

- Evaluation of potential remediation options and selection of the most feasible remediation option for the site;
- Establishing necessary remedial actions to meet the remediation objectives stated in Section 2;
- Establishing the requirements and conceptual design for gas mitigation systems and ground gas management in line with relevant industry standards and guidelines; and
- Establishing the necessary environmental management procedures to ensure protection of human health and the environment during remediation and construction.

This RAP has been prepared with reference to the following legislation and guidelines:

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

4 Site Information

4.1 Site Identification

General site information is provided in *Table 1* below.

Table 1: Site Information		
Site Address:	7-11 Burroway Road, Wentworth Point, NSW	
Property Identification:	Parts of 202, 203 and 204 DP1216628	
Local Government Area:	Parramatta City Council	
Approximate Site Area:	0.95 ha (excluding the Play Space subject Joint Use Agreement) – 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)

4.2 Site Condition and Surrounding Environment

At the time of writing this RAP southern section of the site was largely sealed with concrete. Northern and north-western sections of the site was extensively filled with imported sandstone. A relatively large (potentially > 20,000 m^3) soil mound consisting of sandstone material extends along the western border of the site and stretches towards north, and northeast. The stratigraphy on site is noted as fill material underlain by alluvial soils and sediments, followed by sandstone bedrock.

The site is situated on a Class 2 Acid Sulfate Soil zone and contains Acid Sulfate Soils below the natural ground surface.

4.3 Site History Summary

The site has a history of contamination associated with hazardous ground gases (primarily methane and carbon dioxide), petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAH), heavy metals, and asbestos in fill (bonded and friable). Former potentially contaminating activities identified included: legacy landfilling, industrial operations (inc. waste recycling, and timber production), and legacy demolition activities on-site.

Historical use of underground petroleum storage systems was noted on site and the site contains identified and potential abandoned underground asset locations (see *Figure 2* and Section 4.4). The site is a non-regulated former NSW EPA notified contaminated site. The site was subject to partial remediation in 2019, which consisted capping at the western corridor and north western sections of the site (see *Figure 2*).

4.4 Summary of Previous Reports

4.4.1 Preliminary Site Investigation (GHD 2009)

The PSI (GHD 2009) covered a larger area comprising the site within one of the assessed sub-section areas (referred to as Area 1B).

Two separate legacy Underground Storage Tank (UST) areas were identified in the scope of the GHD investigation based on historical Work Cover Dangerous Goods (DSG) records. A review of the provided DGS records indicated, from the western UST area (see. 3 Burroway Rd, see. *Figure 2* Potential Abandoned UST Area), a 10,000 L Petroleum and 55,000 L Diesel UST may have been removed or abandoned in-situ before 1996 and 1999 respectively—*no validation data was present*. The DGS records for the eastern UST area (5-7 Burroway Road) indicated the area may contain three abandoned USTs potentially 5,000L - 9,000L each. An above ground storage tank (AST) and a bowser were noted by GHD (2009) see *Appendix B* (Former Report Figures) for indicative locations of these historical asset records.

4.4.2 Detailed Site Investigation – Stage 1 Area (GHD 2010)

The GHD (2010) identified, within the site, ecological criteria exceedances for total petroleum hydrocarbons (TPH) C_{10}-C_{36} at three locations and a zinc exceedance in one groundwater sample. Additional findings were noted in other off-site locations that was covered in GHD's investigation. GHD indicated further investigations were required to delineate contamination.

4.4.3 Additional Contamination Investigation – Stage 1 Area (GHD 2012)

This assessment further investigated the detections identified in the GHD 2010 investigation. Total recoverable hydrocarbons (TRH) (C10-C36), Benzo(a)pyrene, polyaromatic hydrocarbon (PAH) exceedances were noted on-site in this assessment. Asbestos (both friable and bonded) was identified in fill material. Groundwater marine ecological criteria exceedances were noted for copper, chromium and zinc.

It is understood at 1B09b and 1BW04 benzo(a)pyrene and at 1BW04b and BH37 total petroleum hydrocarbons (TPH C10-C36) exceeded the ecological screening levels for urban residential and public open space (see. *Appendix B* for the locations of these samples). 50,000 mg/kg TPH C_{10}-C_{36} was detected at 1BW04b. GHD (2012) concluded the benzo(a)pyrene and total PAH in soil may pose an unacceptable risk to future residential site users.

Asbestos was detected in fill material at two locations 1B09b and 1B03. Laboratory report of 1B03 indicated the detection was in the form of asbestos fibres of Chrysotile (friable). Laboratory certificate of 1B09b for asbestos could not be located. Greencap notes that asbestos fines/ friable asbestos (AF/FA) testing was not undertaken in accordance with the requirements of NEPM 2013.

This investigation did not identify (within the proposed SOPHS site area) unacceptable levels of health risk associated with heavy metals.

Elevated methane was detected. GHD 2012 noted there are several possible sources for the detected ground gases including natural sediments, the Woo-La-Ra landfill site (although the area was not adjacent to the landfill site), hydrocarbon contamination and/ or fill materials the site is formed. GHD mentioned: "There is evidence to suggest that that the bulk of the detected ground gases may be derived from either the underlying fill materials and / or the underlying natural sediments rather than the Woo-La-Ra landfill site and / or hydrocarbon related contamination (although it is noted that these sources may be locally important for individual sub-surface bores)".

4.4.4 Homebush Bay West - Ground Gas Monitoring (GHD 2013)

This investigation included ground gas monitoring at 9 nearby site locations during 3 monitoring rounds (see. *Appendix B* for former monitoring locations). It should be noted that none of these locations were within the SOPHS site but at the eastern and western neighbouring sites.

Maximum observed readings as part of this investigation were noted as follows:

- Peak methane: 87.2% v/v (1CW02)
- Peak carbon dioxide: 14.7% v/v (1CW01)
- Hydrogen sulphide: 16 ppm (1CW02)
- Carbon monoxide: 53 ppm (1BW05)
- Flow rate: 7.012 L/hr (1BW06)

Based on above the gas screening values (GSV) in the scope of a "worst possible scenario" (W&C 2009) for methane and carbon dioxide are calculated as follows:

- Methane: 87.2% x 7.012 L / hr = 6.114 L/ hr
- Carbon dioxide: 14.7 % x 7.012 L / hr = 1.030 L/ hr

Above GSV's indicate a risk classification of Moderate to High Ground Gas Risk for methane. GHD (2013) conclude that this classification is applicable to the entire Stage 1B area, which included the site. However, as all the investigation locations were outside of the SOPHS site borders further consideration needs to be given to this classification.

GHD did not identify ground gas impacts in service pits, on-site buildings or above ground surface.

4.4.5 Homebush Bay West – Stage 1 Area – Health Risk Assessment (GHD 2013)

GHD (2013) conducted a human health risk assessment associated with potential exposure of future site users to elevated concentrations of petroleum hydrocarbons in soil at the site. The health risk assessment assumed medium and high-density end use including recreational open space and primary schooling.

The risk assessment has considered potential effects to the following receptors in particular:

- The risks to future residents, recreational users, and school children from exposure to volatiles indoors emitted from soil at the site;
- The risks to intrusive maintenance workers associated with inhalation of volatiles in sub-surface works at the site.

The investigation did not take into account the planned remedial activities on site and establishment of a clean fill layer with sufficient thickness and commented that this would block the exposure pathway. The risk assessment recommended a management plan to manage the dermal contact risk with lead, PAH, and TPH on-site.

The two main findings of the assessment were as follows:

- The estimated non-cancer Hazard Index (HI) for future site users exceeded the nominated acceptable level of 1 for indoor exposure from TPH in soil at location 1BW04b via the indoor vapour pathway;
- The estimated non-cancer HI for onsite intrusive maintenance workers from exposure to vapours from soil was well below acceptable level of 1 for soil source 1BW04b—*this indicated there were no unacceptable risks to future intrusive maintenance workers posed by TPH concentrations via the vapour inhalation pathway.*

The risk assessment assumed final developed ground levels were either remaining the same or increasing (through capping).

4.4.6 Former Remediation Action Plan (PB 2015)

Greencap was provided with a historical Remediation Action Plan (RAP) for the site, issued in 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 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;

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;
- 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 containing exceedances of copper, chromium and zinc was identified (Additional Contamination Assessment – Stage 1 Area, incorporated results from the Detailed Site Investigation GHD, 2012);
- Two Underground Storage Tank (UST) areas were marked on Figure 5 of this RAP, however no discussion was included in the report regarding these tanks (see. *Appendix B*);
- A potential unacceptable ground gas and soil 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 (Additional ground gas monitoring GHD, 2013d); and
- 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).

4.4.7 Interim Validation Report – Early Works Package (Zoic 2020)

This report included a Virgin Excavated Natural Material (VENM) report for the sandstone fill imported to the site in 2019, which corresponds to the sandstone mound on-site and capping material applied to the west and north of the mound (see Figure 2). Results of this report showed the sandstone fill area indicated on Figure 2 included a minimum of 500 mm capping in-line with the requirements of PB RAP (2015). Greencap understands Zoic undertook asbestos air monitoring during the remediation works targeting the school boundary to the north. Figures of this report, showing the extent of partial remediation are provided in *Appendix B*.

4.4.8 Preliminary Site Investigation Report (Greencap 2021a)

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.

Southern section of the site was noted to be largely sealed with concrete. Northern and north-western section of the site was observed to be extensively filled with imported fill. A relatively large (potentially > 20,000 m^3) soil mound was observed to extend along the western border of the site and stretches towards northwest. 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, requiring further investigation.

4.4.9 Detailed Site Investigation Report (Greencap 2021b)

The DSI identified ground gas impact on site at a level that would require physical gas protection measures for the planned development. Methane and carbon dioxide were identified exceeding the trigger levels for further investigation and/or corrective action at multiple locations at the planned building footprints. While the former RAP (PB 2015) classified the site (largely based on legacy near-site data) as “Moderate to High Risk” of ground gas, the semi-quantitative risk assessment conducted in this scope of the DSI, with six rounds of monitoring data extending over two months, indicated the site can be classified as “Low Risk” of ground gas. This corresponds to a Characteristic Gas Situation (CS) 2.

DSI (2021) identified localised elevated concentrations of contaminants in soil samples including some exceedances of the Health-based Investigation Levels (HIL-C exposure setting). These included lead at BH4 (870 mg/kg), Benzo(a)pyrene TEQ at BH4 (3.5 mg/kg), GG8 (6.2 mg/kg) and GG12 (8.6 mg/kg), TRH F2 at GG8 after silica-gel clean up (2400 mg/kg, hotspot). Among them, the TCLP (Toxicity Characteristic Leaching Procedure) test results of Benzo(a)pyrene at BH4, GG8 and GG12 were all lower than the Limit of Reporting (LOR). The 95% UCL average concentrations of Lead across the site (excluding the soil mound area) was below the HIL-C criteria. The level of TRH >C10-C16 less Naphthalene (F2) at GG8 (0.4-0.5mBGL) exceeded the selected soil vapor intrusion criteria HSL A after silica-gel clean-up.

Asphalt was observed at borehole GG12 where Bzeno(a)yprene TEQ exceedance was noted.

Three pieces of Asbestos fines were detected in one borehole sample collected at north-eastern section of the site where the ground surface was covered by concrete slab. The detection was noted as 0.21% w/w which exceeded the adopt HSL-C criteria. Bonded asbestos on the ground surface was observed at two locations. Refer to Figure 2.

Acid sulphate soil was identified on site at depths ranging between 2.0-4.6 m and an ASS management plan is required for site redevelopment works.

Groundwater assessment identified ammonia and copper concentrations, at the single location sampled (GG5, see Figure 2), that exceeded the groundwater investigation criteria levels. Groundwater monitoring results did not indicate the presence of any other contamination in the assessed unconfined aquifer beneath the site at the single location sampled.

One legacy underground storage tank – UST, (potentially an oil sump) was identified in the south-east section of the site. Another potential legacy UST location, not yet investigated, was marked up on a figure attached to the former RAP (PB 2015)—"*this area was inaccessible for investigation due to the soil mound and concrete slab”* (see Figure 2).

5 Characterisation of Site Contamination

5.1 Soil

5.1.1 Imported sandstone (2019)

Sandstone material imported in 2019, which makes up the Soil Mound (see Figure 4) as well as the former capping layer applied to the western corridor and north and northwest sections of the site (see Figure 2), was previously verified as VENM and suitable to be re-used on-site.
Based on the Interim Validation Report (Zoic 2020) and field stratigraphic observations, it is understood this material is separated from the fill material discussed on Section 5.1.2 with a geofabric marker layer. The VENM reports associated with this material can be found in the Interim Validation Report (Zoic 2020).

5.1.2 Fill material

Fill material on-site, although had some exceedances for lead and PAH, however satisfied the HIL-C site criteria for chemical contaminants with 95% confidence. The exceedances were generally in depths ranging between 0.9 – 2.5 mBGL.
An exceedance of vapour intrusion screening criteria (HSL A and B) was noted in this material at GG8, which had 2,400 mg/kg TRH. This exceedance was noted at 0.4-0.5 mBGL.
Concrete slab and soil accessibility was noted as a limitation for asbestos investigation in the fill material. However former investigation reports (GHD 2012) indicated the presence of asbestos within fill material (noted as bonded and friable). Therefore, the fill material on-site (indicated as Fill Layer in Figure 4) is considered to be impacted by bonded and friable asbestos.

5.1.3 Dredged Natural Sediment

Below the fill material is dredged natural sediment soils, which contain seashells, clay inclusions, and acid sulfate soils. This material extends down to ~ 6 mBGL and requires treatment for acid sulfate soils (refer to Acid Sulfate Soils Management Plan (Greencap 2021)). Below this layer is a natural clay aquitard, which is underlain by bedrock (see Figure 4).

5.2 Ground gas

5.2.1 Ground gas concentrations and flowrates

The following peak gas measurements were recorded in the scope of the 6 monitoring rounds undertaken in the scope of the DSI (2021):

- Peak methane: 14.8% v/v at GG1—recorded on 6th of March 2021;
- Peak flowrate: 4.1 L / hr at GG1—recorded on 7th of May 2021; and
- Peak carbon dioxide: 7.7% v/v at GG3—recorded on 9th of June 2021.

In addition to above, GHD (2013) recorded the following peak readings in their former ground gas monitoring events:

- Peak methane: 87.2% v/v (1CW02)—*neighbouring site to the west*; and
- Flow rate: 7.012 L/hr (1BW06)—*neighbouring site to the east*.

5.2.2 Ground gas risk classification of the site

DSI (2021) identified hazardous ground gas risk on-site associated with methane and carbon dioxide, both exceeding the NSW EPA (2020) criteria for further investigation and corrective action. Semi-quantitative ground gas risk assessment undertaken in the scope of the DSI (2021) indicated, which was based on the ground gas data collected in 6 monitoring rounds over two months, the site can be classified as “Low Risk”

in accordance with the Wilson and Card (2009) method. This classification corresponds to Characteristic Gas situation (CS) 2 as per NSW EPA (2020) ground gas guidelines in the scope of a worst credible scenario.
Based on above, this RAP aims to provide sufficient coverage for a "Low Risk" scenario and therefore, a characteristic gas situation (CS) of CS2 will be adopted. This corresponds to a minimum required gas protection guidance value of 3 (NSW EPA 2020). It should be noted that the proposed gas mitigation system design must include adequate redundancies to allow for contingencies in future worst-case scenarios due to the changing site conditions in line with NSW EPA 2020 and Wilson and Card 2009.

5.3 Groundwater

Groundwater assessment (DSI 2021) identified ammonia and copper concentrations, at the single location sampled, that exceeded the groundwater investigation criteria levels. Groundwater monitoring results did not indicate the presence of any other contamination in the assessed perched aquifer beneath the site at the single location sampled.

5.4 Identified and Potential Underground Assets

A UST was identified in the scope of the DSI (2021), which may be an abandoned oil-sump. The UST was filled with water. Furthermore, review of former contamination reports indicated the site may contain additional abandoned UST's, one potential location was indicated as the southwest section of the site (see. Figure 2 and Figure 4) in the previous reports (PB 2015, GHD 2013).

5.5 Data Gaps

- Greencap noted the asbestos concentrations was not quantified in the former investigations; therefore, NEPM 2013 criteria comparisons could not be made. This data gap will require further investigation during the construction phase via test pitting (as per NEPM 2013), after the concrete slab has been removed;
- Further investigations (test pitting and tank chasing) are required to investigate the following:
    - Extent of the identified UST;
    - Potential UST area indicated on Figure 2—*it should be noted that the investigation area shall not limited to the indicated area on this figure and will need to be established following the removal of the concrete slab with the guidance of a suitably qualified and experienced Environmental Consultant based on a combination of the following factors but not limited to: Visual and olfactory evidence, photo ionization detector (PID) readings, extending underground assets (e.g. potential fuel lines), test pits and trenches to be excavated during tank chasing); and*
    - In-situ validation data was not available for the identified UST and potentially abandoned UST.

6 Conceptual Site Model Summary

Conceptual Site Model (CSM) of the site has been formed by considering the geophysical characteristics of the site, contamination sources, potential receptors and the pathways to the receptors. The CSM, as required by the NEPC (2013), is an iterative process constantly being updated during the investigation process as more information becomes available. The following CSM is presented based on the results of the DSI (2021) and review of previous contamination reports (see Section 4.4). A graphical illustration of the CSM is displayed on **Figure 4** as a cross-section drawing. The cross-section line is displayed on **Figure 2**, indicated as A-A'.

6.1.1 Sources

The following sources of contamination were identified on-site:

- Legacy landfilling;
- Underground Storage Tanks;

- Potential former underground petroleum storage;
- Asbestos impacted fill (GHD 2013) with localised lead, TRH, and PAH exceedances of site criteria (DSI 2021);
- Asbestos impacted aggregate (see. **Figure 2**, ACM noted near GG7 and the site gate); and
- Acid Sulphate Soils.

6.1.1.1 Chemicals of Concern

Chemicals of concern were determined in accordance with the identified sources and results of this investigation. A breakdown of these chemicals is provided in Table 2.

Table 2: Chemicals of Concern

Ground Gas/ Soil Vapour	Groundwater	Soil
CH_4 and CO_2	Ammonia and Copper	TRH (F2)
		Lead
		PAH
		Asbestos in soils (bonded/friable)
		Acid Sulphate Soils

Note:

1. TRH = Total Recoverable Hydrocarbons; F2 = TRH C_{10}-C_{16} less Naphthalene.
2. PAH = Poly-cyclic Aromatic Hydrocarbons

6.1.2 Receptors

Human receptors on site include the workers involved in the future development, students, staff and other temporary visitors to the site such as maintenance workers. Off-site human receptors include residents and visitors of the neighbouring residential areas, as well as workers and customers of the surrounding commercial area facilities.

Parramatta River noted as the closest ecological receptor to the site.

6.1.3 Pathways

Potential pathways that link the human receptors on site to the identified contamination sources are as follows:

- Legacy Landfilling (on and off-site):
  - Sub-surface migration of ground gas through unsaturated soil media,
  - Sub-surface migration of ground gas through potential preferential pathways created by on-site service lines,
  - Direct emissions of ground gases from ground surface, and
  - Inhalation, ingestion, and dermal contact with contaminants in fill.
- Asbestos in soils:
  - Disturbance of asbestos fibres and generation of dust, and
  - Inhalation of airborne fibres.
- Underground Storage Tank (UST) & potential former underground petroleum storage:
  - Leaching of contaminants into groundwater and offsite migration, and

- Inhalation, ingestion, and dermal contact with residual petroleum hydrocarbons.

Pathways that link the ecological receptors to identified contamination on site are envisaged to be as follows:

- Landfill, and USTs:
  - Leaching of contaminants or and leakage of potential residue UST content into groundwater and offsite migration, and
  - Surface water run-off carrying dissolved or particulate contaminants.
- Acid Sulphate Soils:
  - Oxygenation of acid sulfate soils in potential future excavations or groundwater drawdown; and
  - Migration of acidified run-off water into the drains and into the nearby surface water bodies.

6.2 Source, Pathway and Receptor Analysis

Identified actual or potential contaminant source, pathway and receptor linkages are tabulated in Table 3. A pictorial CSM is provided in **Figure 4**. The cross-section line of this drawing is indicated in **Figure 2** as A-A'.

Table 3: CSM (Source, Pathway and Receptor Analysis)

Potential Source	Phases of Contaminants	Potential Transport Pathways	Potential Exposure Pathways	Potential Receptors	Further Investigation Required (Yes/ No)	Remedial Action and Validation Required (Yes/ No)	Long Term Environmental Management Required (Yes/ No)	Comments
Legacy Landfill	Gaseous/ vapour phase	• Unsaturated soils • Preferential pathways created by utility service lines • Direct emissions from ground surfaced soils	Gas/vapour intrusion into enclosed spaces and inhalation	On-site: Future students, staff, and visitors of the school Off-site: Students, staff and visitors of the Wentworth Point Public School. Residents of the high density residential/commercial properties neighbouring the site.	**No**	**Yes**	**Yes**	The site is impacted by hazardous ground gases that requires gas mitigation and management measures for the proposed development. Further investigation is not required as same level of design protection applies between Low (current risk classification) and Moderate Risk (potential, although not very likely, elevated risk classification) sites for Public School Buildings. Validation monitoring will be required as part of remediation. Gas mitigation system will require long-term environmental management.
	Liquid phase (leachate)	Leaching into groundwater and offsite migration		Off-site: Parramatta River north and east to the site	**No**	**No**	**No**	**No**
UST and Potential Abandoned UPSS	Vapour phase	• Unsaturated soils • Preferential pathways created by utility service lines • Direct emissions from ground surface	Gas/vapour intrusion into enclosed spaces and inhalation	On-site: Future students, staff, and visitors of the school	**Yes**	**Yes**	**Potentially**	The extent and content of the identified UST (Figure 2) at the eastern section of the site requires further investigation. Potential UST area indicated in PB 2015, also shown indicatively on Figure 2 requires further investigation in the form of tank chasing.
	Liquid phase (leachate)	Leaching into groundwater and offsite migration with advection and dispersion.	Vapour intrusion into buildings.	Off-site: Parramatta River north and east to the site	**Yes**	**Yes**	**Potentially**	
Asbestos impacted aggregate and fill	Bonded asbestos in aggregate and bonded and friable asbestos in fill (potentially above site criteria)	Disturbance of asbestos fibres and generation of dust	Inhalation of airborne fibres	On-site: Future students, staff, visitors of the school, temporary visitors, and workers on site Off-site: Students, staff and visitors of the Wentworth Point Public School. Residents of the high density residential/commercial properties neighbouring the site.	**Yes**	**Yes**	**Yes**	An Asbestos Management Plan (AMP) is required to manage the identified asbestos risk during construction activities.

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7 Further Investigation Plan

Following site preparation and further investigation scope is required to be undertaken prior to the commencement of construction:

- Remove all the sandstone fill that was placed on concrete slab and stockpile it at a location outside of the concrete slab area;
- Demolish the concrete slab by applying the resource recovery & recycling procedure described in Section 17.4;
  - As a work health and safety measure, an Environmental Consultant will supervise these works and use a photo ionizing detector (PID) and a landfill gas meter (GA5000) to monitor the ambient air quality (potential surface gas emissions would pose only a low risk for workers and no genuine risk for off-site receptors)—*monitoring will be undertaken on a targeted basis based on the field observations and professional judgment of the consultant*;
- When the soils beneath the concrete slab are exposed a visual inspection of the soil surface will be undertaken on a minimum 20 m x 20 m grid basis by a suitably qualified and experienced Environmental Consultant to note visual and olfactory contaminants of concern;
  - The Environmental Consultant will advise if field observations indicate the presence of any unidentified contamination hotspots (e.g. buried putrescible material, liquid drums, petroleum hydrocarbons or buried asbestos pockets);
  - Targeted PID and surface gas readings (GA5000 and Inspectra Laser Unit (ILU)) will be taken during the inspection; and
  - Based on the findings of above inspection, the Environmental Consultant will advise if any of the inspection findings require intrusive investigation and potential delineation.
- Regardless of the findings of the above-mentioned investigation the following systematic test pitting exercise will be undertaken to assess the asbestos in soils risk on site in comparison with the site criteria established by NEPM 2013 0.001 % w/w for asbestos fines/ friable asbestos (AF/FA) and 0.02% w/w for bonded asbestos that is applicable to Secondary Schools (High School):
  - Test pitting down to 1 mBGL at 20 investigation locations at the area where slab was removed;
  - During test pitting the excavator operator must segregate the excavated material in 300 mm depths minimum;
  - Gravimetric analysis will be undertaken at each investigation location. A minimum of 1 x 10 L bulk asbestos sample will be collected from encountered fill material will be sieved by using a 7 x 7 mm sieve;
  - A minimum of 1 AF/FA sample will be collected at each location in a 500 ml plastic bag;
  - The excavated test pits will be back filled in the order to match the initial stratigraphic condition (material excavated from the bottom will go to the bottom and material excavated from top layers will end up in top of the back filled test pit);
  - Samples will be submitted to a NATA Accredited laboratory for analysis.
- The extent of the identified UST will be chased and documented by an excavator under the supervision of a suitably qualified Environmental Consultant;
- The potential UST area will be further investigated by targeted trench and test pit excavations;
  - The trench and test pit locations will be selected by professional judgment by the Environmental Consultant by using multiple lines of evidence approach (field observations, legacy dangerous goods documentation, former consultant reports, PID readings, visual and olfactory evidence etc.);
  - A minimum of 1 day on-site with an excavator must be allowed to investigate the potential UST area—*additional intrusive investigations may be needed based on the data obtained during the first day of the event*;

- It is crucial to undertake this exercise with neat segregation of layers (particularly layers of clean fill vs. contaminated fill) under the supervision of a suitably qualified Environmental Consultant;
- A minimum of 300 mm segregation is required for trenches;
- The excavator must be supervised by a suitably qualified Environmental Consultant, who will be conducting field screening with a calibrated PID.

- The excavated trenches and test pits will be back filled in the order to match the initial stratigraphic condition (material excavated from the bottom will go to the bottom and material excavated from top layers must end up in top of the back filled test pit).

8 Remediation Options Assessment

In-line with s.6(16) Assessment of Site Contamination Policy Framework of NEPM 2013, The NSW EPA's adopted remedial hierarchy of most preferable option to least preferable option is:

1. **On-site treatment –** On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. **Off-site treatment –** Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site;

Or if above is not practicable:

3. **On-site containment –** Consolidation and isolation of the soil on-site by containment within a properly designed barrier; and
4. **Off-site disposal –** Removal of contaminated material to an approved site or facility, followed where necessary by replacement with clean fill;

Or,

5. **Leave as is –** Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

When deciding which option to choose, the sustainability (environmental, economic and social) of each option should be considered, in terms of achieving an appropriate balance between the benefits and effects of undertaking the option.

By taking above principles as a basis, an options appraisal has been undertaken and presented in **Table 4**. As a result of this options appraisal, "On-site Containment" is selected as the primary remediation strategy. This strategy is in line with the regional remediation strategy established by the PB RAP (2015), which is applicable to a larger site area comprising the site.

Going Further in Managing Risk

Table 4: Remediation Strategy Discussion		
Remediation Strategy	**Suitability**	**Discussion**
1. On-site treatment	Not suitable	**Ground-gas:** On-site treatment is not applicable to mitigate ground gas risk on-site. **Petroleum hydrocarbons:** On-site treatment may be suitable to treat the identified TRH hotspot, however, this would not add tangible value to the project as this is unlikely to mitigate the identified ground gas risk. **PAH and lead:** No treatment is required for lead as 95% UCL average concentration were below the site criteria. B(a)p is found in non-leachable form; therefore, no on-site treatment is applicable. **Asbestos in Soils:** On-site treatment for asbestos contaminated soils may be applicable for bonded asbestos treatment only (with considerable limitations). There is no technology available to treat AF/FA in soils. As the previous contamination reports indicated the presence of friable asbestos in-soil, this option is unlikely to be suitable for the site.
2. Off-site treatment	Not suitable	**Ground-gas:** Off-site treatment is not applicable to mitigate ground gas risk on-site. **Petroleum hydrocarbons:** Off-site treatment of soils would not be possible due to the presence of heavy metals, PAH, and asbestos in fill-mater, which makes the material non-recyclable. **PAH and lead:** No treatment is required for lead as 95% UCL average concentration were below the site criteria. B(a)p is found in non-leachable form; therefore, no on-site treatment is applicable. **Asbestos in Soils:** Off-site treatment for bonded asbestos contaminated soils is not applicable due to legislative restrictions in NSW, as these materials being non-recyclable. There is no treatment technology available for AF/FA contamination in soils.
3. On-site containment	Suitable	**Ground-gas:** Due to i) the ground gas risk profile on-site, ii) ground gas contamination history of the site and the adjacent sites, and iii) extent of the fill material and dredged sediment encountered on-site, installation of appropriate barriers beneath the planned buildings blocking the gas migration pathways is deemed to be the most suitable strategy for the site. Details about the gas mitigation measures are provided in Section 9. **Petroleum hydrocarbons:** A suitably designed and installed ground gas mitigation system would also mitigate the vapour intrusion risk that is posed by the TRH hotspot identified on-site. This is in line with the conclusion of Health Risk Assessment Report of GHD (2013). **PAH and lead:** A suitably designed and constructed capping layer would block the exposure pathways between the fill material and the human and ecological receptors on-site. This is in line with RAP prepared by PB (2015). **Asbestos in Soils:** Capping and on-site containment of asbestos contaminated soils on-site is a preferred methodology as it minimises the disturbance of asbestos in soils and is cost beneficial as the material will remain on-site. This is in line with RAP prepared by PB (2015). **General considerations:** The project site is planned to be raised as part of the architectural designs, which makes capping and on-site containment a favorable option.
4. Removal and disposal	Not suitable	**Ground gas:** There are multiple ground gas sources identified on-site this include the fill material contaminated with petroleum hydrocarbons, dredged sediment with pockets of organic material, adjacent ground gas impacted sites, legacy landfilling in the region. Therefore, removal of the ground gas source is not a viable option.

Table 4: Remediation Strategy Discussion		
Remediation Strategy	**Suitability**	**Discussion**
		Contaminated soils: Due to the extent of fill material and dredged sand on-site, it is deemed impractical and not feasible to dispose the contaminated soils off-site. **General considerations:** Off-site disposal is to be avoided as much as practical to ensure sustainability of the project. However items such as ex-situ decommissioning of UST's may require off-site disposal to avoid potential blockages to planned piling activities and mitigate the geotechnical hazards that may be caused by potential voids forming in legacy underground assets.
5. Leave as is	Not suitable	**Ground gas:** Construction of the buildings without appropriately designed and installed ground gas barriers may result in unacceptable health and structural asset risks associated with gas migration into and accumulation in the occupied building spaces. **Contaminated soils:** Contaminated soils, when exposed on-surface, would cause unacceptable health and environmental risk. Furthermore, the TRH hotspot identified in DSI (2021) would pose an unacceptable vapour intrusion health risk to the future occupants of the site's buildings. Based on above, the strategy of no remediation is not suitable for this site.

9 Selection of The Ground Gas Mitigation Approach for The Site

The ground gas risk assessment results (see. DSI, Greencap 2021) indicated the ground gas poses an unacceptable risk on-site; therefore, gas protection measures are required to interrupt the pathway between the on-site buildings and the source.

Types of measures are defined in NSW EPA (2020) as follows:

- Passive measures to prevent or restrict gas from migrating into and accumulating in enclosed spaces;
  - Passive measures do not require human intervention (other than period inspection and maintenance) once installed. Examples include barriers, gas-proof membranes and natural ventilation.
- Active control measures;
  - Active measures require continuous operation to control gas concentrations. They include forced ventilation systems, fans and blowers.
- Management and/ or monitoring.
  - Management controls include monitoring systems, alarms, and restrictions on building use.

NSW EPA (2020) states "where site conditions permit, passive gas protection measures should be preferred over active measures or management controls, because they are less likely to fail in the future due to mechanical breakdown or human error and are more energy-efficient."

9.1 Design Guidance Value

The EPA recommends determining the level of protection required for a site based on the Characteristic Situation (CS) and corresponding guidance value (see. Table 5 below) together with professional judgment.

As discussed in Section 5.2.2, this RAP aims to provide sufficient coverage for a "Low Risk" scenario and therefore, a characteristic gas situation (CS) of CS2 will be adopted. This corresponds to a minimum required gas protection guidance value of 3 (NSW EPA 2020), see Table 5 below. It should be noted that the proposed gas mitigation system design must include adequate redundancies to allow for contingencies in future worst-case scenarios due to the changing site conditions (in line with NSW EPA 2020 and Wilson and Card 2009).

Table 5: Guidance Values for Gas Protection NSW EPA (2020) Table 8

CS	Required gas protection guidance value				
	Low-density residential	Medium-to-high density residential (strata title)	Public buildings, schools, hospitals, and shopping centres	Standard commercial buildings (offices, etc.)	Large commercial (warehousing) and industrial buildings
1	0	0	0	0	0
2	3	3	3	2	1 (a)
3	4	3	3	2	2
4	6 (b)	5 (b)	5	4	3
5	- (b)	6 (b)	6 (c)	5	4
6	- (d)	- (d)	6 (c)	6	6

	Required gas protection guidance value applicable for the site

(a) If maximum methane concentration exceeds 20% v/v, increase to CS3

(b) Residential development is not recommended at CS4 and above without pathway intervention (for example, source depressurisation or control of lateral migration) external to the buildings and a high level of management. These requirements necessarily preclude low-density residential (NEPM HIL A residential) development.
(c) Evacuation issues and social risks must be considered.
(d) Level 3 risk assessment is required.

9.2 Evaluation of the Protection Measures

Passive protection measures will be preferred to minimise long-term management requirements. Passive protection measures will target building protection as source removal and pathway intervention are not applicable to the site.

9.3 Defining the Scope of Gas Protection and Conceptual Design

By using the guidance provided in NSW EPA (2020) and with professional judgment, combination of the following two engineering controls are deemed suitable for the site (see **Table 6** for a breakdown of protection measures):

- Passive sub-floor ventilation with very good performance (min 150 mm sub-floor void) – the steady-state concentration of methane over 100% of the ventilation layer remains below 1% v/v at a wind speed of 0.3 m/s[1]—***2.5 design score****; and*
- Reinforced concrete cast in situ or post-tensioned suspended slab with minimal service penetrations and water bars around all penetrations and at joints—***1.5 design score****.*

Above measures provide **two levels of protection with a design score of 4** and deemed appropriate to ensure protection of the buildings from ground gas risk on-site with sufficient redundancies and safety margin. Conceptual design of the proposed gas mitigation system is provided on Figure 5.

[1] Verified by post-construction monitoring

Table 6: Scores for Protection Measures		
Measure or System Element	**Score**	**Comments**
Venting and dilution measures		
Passive sub-floor ventilation with very good performance – the steady-state concentration of methane over 100% of the ventilation layer remains below 1% v/v at a wind speed of 0.3 metres per second (m/s) (a)	2.5	The design of the venting layer (i.e. granular medium with inlet/outlet pipes versus open-void or modular drainage system)(b) must be considered when modelling steady-state concentrations
Passive sub-floor ventilation with good performance – the steady-state concentration of methane over 100% of the ventilation layer remains below 1% v/v at a wind speed of 1 m/s and below 2.5% v/v at a wind speed of 0.3 m/s)(a)	1.5	If post-installation testing of passive ventilation indicates that it cannot meet this requirement, inlets and outlets must be upgraded. If this is unsuccessful, it will be necessary to retrofit an active system
Sub-floor ventilation with active abstraction or pressurisation	2.5	Not appropriate for NEPM HIL A residential settings because robust management systems, including alarms, must be in place to ensure long-term operation and maintenance. Achieving the full score requires a design with adequate redundancy and full coverage of the building footprint.
Ventilated car park (basement or undercroft)	4.0	Assumes that the car park is vented to deal with exhaust fumes in accordance with BCA(c) requirements. The design of a car-park and the specifications of its ventilation system need to be considered in assigning an appropriate score of up to four.
Horizontal soil barriers beneath building footprint		
Horizontal clay or amended soil barriers designed to achieve defined permeability and diffusivity of the gases of concern placed, compacted and tested under appropriate engineering supervision	(d)	Requires appropriate engineering input and integration with the building design from the earliest possible stage. This must consider the effects of any proposed piling on the gas regime
Floor slabs		
Reinforced concrete ground-bearing floor slab or waffle pod slab	0.5	At a minimum, it is good practice to install ventilation in all foundation systems to relieve pressure. Breaches in floor slabs, such as joints, have to be effectively sealed against gas ingress to maintain performance
Reinforced concrete ground-bearing foundation raft slab with limited service penetrations cast into slab	1.0	
Reinforced concrete cast in situ or post-tensioned suspended slab with minimal service penetrations and water bars around all penetrations and at joints	1.5	
Fully tanked basement	2.0 (d)	
Membranes		
Proprietary gas-resistant membrane with a gas transmission rate for the gases of concern on the site that is certified and appropriate to the overall design of the gas protection system. It should be installed by a specialist to an appropriate level of workmanship with documented internal CQC, including integrity testing (e.g. tracer gas or smoke testing), under independent CQA carried out by a certified specialist(e) or appropriately qualified and experienced professional with independent verification of the entire process(f)	2.0	Membrane performance depends on the membrane material and thickness specified, design and quality of the installation, protection from and resistance to damage after installation, and the integrity of joints in membranes that require joints. Materials that offer some degree of self-sealing and repair are preferred. Long-term performance depends on the durability of the material, including its resistance to chemical degradation in the environment in which it is installed

Table 6: Scores for Protection Measures		
Measure or System Element	**Score**	**Comments**
Monitoring and detection (alarms)		
Intermittent monitoring using hand-held equipment	0.5	Monitoring and alarm systems are only valid as part of a combined gas protection system. Where fitted, permanent systems should be installed in the underfloor venting system but can also be provided in the occupied space as a back-up
Permanent monitoring system installed in the occupied space of the building	1.5	
Permanent monitoring system installed in the underfloor venting or dilution system	2.0	
Pathway intervention external to building footprint		
Vertical barriers	(g)	Required for residential and public buildings at CS 4 and above
Vertical venting systems (source depressurisation)	(g)	

(a) Verified by post-construction monitoring
(b) See Appendix 6 of NSW EPA (2020) Guidelines on Hazardous Ground Gases
(c) Building Code of Australia
(d) Score depends on site-specific conditions and design
(e) For example, Geosynthetic Certification Institute – Inspectors Certification Program
(f) See Appendix 7 of NSW EPA (2020) Guidelines on Hazardous Ground Gases
(g) Score depends on site-specific conditions and design, but scores of 4.0+ should be achievable

9.4 General Design and Installation Considerations

Detailed design of the gas mitigation system must be prepared and approved by a suitably qualified and experienced gas mitigation and ventilation system designer. This design must be incorporated into the structural design of the buildings and finalised prior to site establishment and the commencement of construction.

To ensure design effectiveness the following need to be taken into consideration by the designer:

Foundation Slabs

- Foundation slabs will need to be suspended due to potential settlement and columns will need be supported on piles founded on bedrock;
- High-quality reinforced concrete slabs, such as post-tensioned slabs (which generally have high resistance to cracking), can be effective barriers against gas migration if all joints and penetrations are adequately sealed;
- All slabs should be inspected after curing, and any cracks should be sealed with an appropriate flexible sealant;

Passive Ventilation

- Construction of an open void beneath the suspended slab is recommended as this would provide much better ventilation compared to modular gas drainage systems;
- Void formers would need to be used to allow in-situ casting of the reinforced concrete slab;
    - The void former product to be used must be selected carefully to allow airflow between voids (a fit for purpose product must be used, e.g. Ventform 150);
- Use of gravel as a void former is not preferred due to limitations associated with ventilation flowrate and; therefore should be avoided--geocomposite vent layers, products similar to Ventform, should be considered instead;
- Airflow through sub-slab gas drainage systems should be maintained through inlet vents (generally placed at or close to ground level) and outlet vents (generally placed at roof level);
- Cross-flow arrangements should be used whenever possible. It is essential to place inlet vents to avoid damage and inadvertent blockage, and outlet vents to ensure adequate dispersion of vented gas;

- The system needs to be designed as a fully passive system, which will be vented using entirely natural airflow or natural convection, making use of the stack effect;
- Rotating wind driven cowls can be used to enhance ventilation;
- The design objective of the passive sub-floor ventilation will be to "achieve sub-floor ventilation with very-good performance"
- The design requirements are:
    - Steady state concentration of methane over 100% of the ventilation layer remains below 1% v/v at a wind speed of 0.3 metres/ second.
- The designer must follow the following steps to finalise the design (Wilson and Card 2009)
    - Step 1 - Modelling gas flux from the ground into the venting layer;
        - Design flowrate and methane concentrations should be selected with reasonable conservatism and by taking into consideration the peak methane and flowrate values obtained on-site.
    - Step 2 - Calculating the airflow required through the venting layer (ventilation rate) to maintain the gas concentration at the design level < 1 % v/v for methane;
    - Step 3 - Designing a ventilation system to provide this flowrate under the design weather conditions with adequate redundancy; and
    - Step 4 - Designing a monitoring system.
- The designer must follow the relevant industry standards and guidelines associated with the ventilation system design which includes: Appendix A6 of NSW EPA (2020) Guideline on Hazardous Ground Gases, CIRIA C735 (CIRIA 2014a) and Annex B of BS8485:2015+A1:2019, and BS 5925:1991,

General

Gas mitigation and management measures must be:

- Designed on a site- and building-specific basis to suit the conditions present;
- Designed and installed by competent people, in a manner that involves collaboration between designers, suppliers, specialist installers and building contractors; and
- Approached as holistic systems in which the individual components function together to provide both the required primary system performance and adequate redundancy should one component fail.

10 Capping Design

Following capping layer design is deemed suitable for the site and the proposed development (see. Figure 6):

- Marker layer (geo-fabric or mesh) placed over existing contaminated surface, overlain by;
- Minimum 600mm thick approved VENM (validated/certified 'virgin excavated natural material') or ENM ('excavated natural material) cap (VENM is recommended). Cap thickness may be tapered at the perimeter of the site to meet the surrounding soil horizon.

As far as practical, no off-site disposal of soils or demolition materials is required. As there is the potential for disturbance of asbestos contaminated fill, works are to be conducted in accordance with the AMP (see. Section 18) meeting SafeWork NSW requirements for bonded asbestos and AF/FA.

The VENM cap layer is to be laid down in maximum 150mm lifts.

The marker layer should consist of a bright coloured non-woven polyester continuous filament or PET (such as nonwoven geotextiles) or similar with a minimum density of approximately 150 grams per square metre (or equivalent). In general, a marker layer should:

- Be easily recognisable within soils (e.g., bright orange in colour);
- Be durable as a long-term marker layer (i.e., > 150 grams per square metre); and
- Maintain integrity during remedial/civil works such as capping layer insulation.

All trenches should be installed in validated soil VENM or ENM. Deeper trench excavations may require excavation within contaminated fill. In these cases, the contaminated fill should not be back-filled into the trenches and preferably be capped elsewhere onsite. Concept design for deeper trenches is provided in Figure 7 and 8.

At areas where concrete or asphalt hardstand will seal the surface, a minimum of 125 mm hardstand seal on top of 50 mm road base is deemed to be appropriate (see. Figure 8)—*specification does not apply to the buildings, which require special sub-floor ventilation and gas mitigation measures (see Section 9).*

11 Remediation Work Program

This section presents the remediation procedures associated with the selected remediation methodology for the site. These steps require complete implementation to meet the stated remediation objectives and ensure that the remedial goal (Section 3) is met.

11.1 Remediation Design and RAP Approval

Following design and approval procedures will be undertaken prior to site establishment and the commencement of remediation:

- Detailed gas mitigation system design will be completed by a suitably qualified and experienced ground gas mitigation and ventilation system designer in accordance with the requirements established under Section 9;
- The detailed gas mitigation system design will be submitted for the review and approval of the Validating Consultant, Site Auditor, and the Specialist Contractors who will be involved in the construction and installation of the gas mitigation and ventilation systems;
- Design review process will continue until all parties have approved the design;
- The approved design will be incorporated into the final structural design of the buildings and appended to this RAP;
- The RAP and the final design will be reviewed and approved by the Department of Planning, Industry, and Environment (DPIE), City of Parramatta Council (CoPC), Site Auditor, School Infrastructure NSW (SINSW), Site Auditor, and Principal Contractor;

11.2 Notifications

The planned remediation activities are categorised as Category 2 remediation; therefore, the following must be satisfied:

- A written notification must be provided to the City of Parramatta Council (CoPC) more than 30-days prior to the anticipated remediation start date;

11.3 Site Establishment

- All site staff, contractors and sub-contractors to provide relevant documentation, insurances and Safe Work Method Statements (SWMS) to the Principal Contractor as required;
- All site staff, contractors and sub-contractors are to be inducted to the site by the principal contractor and made aware of the contaminated fill materials;
- Mobilisation of plant, equipment and amenities; and

- The Principal Contractor is to establish secure site boundaries, install necessary environmental controls (including water runoff controls) and delineate holding areas to store materials generated during the remediation works.

11.4 Site Preparation

- Engage a Class A removalist contractor (Department of Education Asbestos Management Plan requires Class A controls for any type of asbestos) to emu pick the asbestos fragments on the sites surface and within the aggregate material;
- Validating Consultant will visually inspect the site surface and undertake validating testing on the aggregate piles found on-site;
- Any asbestos containing materials identified by the Validating Consultant will be either emu-picked by the asbestos removalist contractor or stockpiled at a designated location on-site to be capped later in the remediation project;
- Once the site's surface is visually cleared from asbestos, undertake earthworks to uncover the entire concrete seal surfaces on-site—*part of the soil mound is placed on top of the concrete blocking access (see Figure 2);*
- Undertake demolition of the legacy concrete slab under Class A asbestos controls (inc. air monitoring, and minimum P2 dust masks) by following the procedure described in Section 17.4;

11.5 Further Investigation

- Undertake further investigations as per the Further Investigation Plan provided in Section 7;
- Ensure Class A asbestos controls (see. Section 18) during trench excavations.

11.6 Remediation and Validation

- Undertake UST decommissioning and validation as per the UST decommissioning plan in Section 12;
- If feasible, undertake piling prior to the application of clean capping layer (to avoid potential cross contamination of clean fill applied as caping);
- Ensure asbestos controls (see. Section 18) in any activities that may cause disturbance of fill material on-site (inc. any piling that generates spoil);
- Ensure acid sulfate soil management controls (see. ASSMP Greencap 2021) in any activities that may cause disturbance of dredged or natural material on site;
- Cover the entire fill material with geofabric marker layer;
- Get the site surveyed by a qualified surveyor;
- Apply minimum 600 mm of capping on entire site as per the capping design provided in Section 10 (take into account previously remediated areas on-site under Zoic Interim Validation Report 2020, see Figure 2, and also the areas that will be sealed with concrete hardstand or asphalt);
- Undertake another site survey to confirm sufficient capping thicknesses among the site;
- Undertake installation of the ground gas mitigation systems as per the approved final design, under full-time supervision of the Validating Consultant;
    - Strictly follow the Construction Quality Assurance (CQA) and Construction Quality Control (CQC) procedures as per the gas mitigation system design;
    - Obtain written approval from the Validating Consultant and Site Auditor regarding the appropriateness of void formers, and penetration management prior to pouring slab;
- Undertake validation monitoring of the void spaces and buildings;
- Undertake landscaping with validated landscaping materials; and

- Issue Validation Report and Long Term Environmental Management Plan (LTEMP) for the site prior to occupation.

12 UST Decommissioning Plan

The extent of UST will be investigated as per the procedure detailed in Section 7. Following the delineation works the following decommissioning activities will be undertaken under the supervision of a suitably qualified Environmental Consultant:

- Removal and off-site disposal of the liquid in the UST at a licenced liquid waste facility;
- Demolition of concrete as per the procedure explained in Section 17.4;
- Removal of tanks and associated of UPSS elements (e.g. legacy fuel lines);
- Collection of validation samples from the bottom of the excavation pits for documentation purposes;
- Any criteria exceedances should be evaluated by the Validating Consultant in the context of the remediation activities to be undertaken in the scope of this RAP;
    - The buildings will be protected from vapour intrusion with the gas mitigation and ventilation systems to be installed; therefore, TRH detections in soil are unlikely to trigger additional remediation;
- In the event of an unexpected find, such as encountering light non-aqueous phase liquid (LNAPL) in groundwater:
    - The works will stop;
    - Notifications will be made to necessary stakeholders, including SINSW, Site Auditor, NSW EPA (if notifiable as per NSW EPA Guideline on Duty to Notify Contaminated Land), and CoPC;
    - A RAP Addendum will be prepared; and
    - The unexpected find will be remediated as per the RAP Addendum; and
- The legacy UST pits will be backfilled through cut and fill.

13 Validation Plan

13.1 Validation of Site Gained Soils

13.1.1 Imported sandstone *(2019)

The only material on-site that is eligible to be used in capping is the sandstone material imported in 2019. This is the material that makes up the Soil Mound (see Figure 4) and the former capping layer applied to the western corridor and north and northwest sections of the site (see Figure 2). This material has been previously verified as VENM and suitable to be re-used on-site. The VENM report of this material can be found in the Interim Validation Report (Zoic 2020).
Prior to the use of this material as a capping layer on site the following validation procedure will be undertaken:

- Stockpiling of this material prior to its transfer to the capping area;
    - Alternatively already stockpiled material can be marked up for inspection;
- Validating Consultant inspects the material by supervising an excavator and collects confirmatory samples in a sampling density of 1 sample per 250 m^3 (minimum 3 samples);
- The collected samples will be tested for the following analytical suite:
    - TRH,
    - Benzene, toluene, ethylene, xylene, and naphthalene (BTEXN),
    - PAH,
    - Heavy Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn)
    - Organochlorine pesticides (OCP),
    - Organophosphorus Pesticides (OPP), and
    - Poly-chlorinated biphenyls (PCB).
    - Asbestos (AF/FA)
- Validation criteria for material that will be used in capping will be as follows:
    - Visual and olfactory evidence indicate the material is consistent with VENM materials reported in Interim Validation Report (Zoic 2020);
    - Chemical results satisfy the site criteria for HIL-C and HSL-A;
    - Chemical results indicate natural soil background conditions (e.g. BTEXN, OCP, OPP, PCB < laboratory limit of reporting); and
    - Asbestos (non-detect).

13.2 Validation of Imported Materials

13.2.1 VENM

Prior to the importation of any VENM to the site:

- VENM certification must be supplied to the Validating Consultant for review and approval;
- The history of the VENM source site and potential for ground contamination will be assessed for certification of VENM imported to the site;
- Validating consultant to undertake an inspection at the VENM source site and collect a minimum of three confirmatory VENM samples (in addition to the samples analysed in the scope of the original VENM report);

- Concentrations of organic compounds screened in samples of the VENM should be below the respective laboratory limits of reporting (LORs) including TRH, BTEX, PAH, COP, OPP and PCB. Concentrations of metals/metalloids (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) should be indicative of natural background concentrations for the VENM source site soils and rock.
- VENM material must be demonstrated to be free from contamination and be aesthetically suitable for the purpose of use at the site;
- The material must be free from rubble, fibre cement, plastic, glass and other inclusions which may make it unsuitable; and
- VENM must be imported under full-time supervision of the Validating Consultant, who will verify the material brough to the site matches the material inspected at the source site.

13.2.2 ENM

If ENM is to be imported, then it is imperative that the material complies with the Excavated Natural Material Order 2014 (NSW EPA). Prior to any ENM importation the following procedure will be undertaken:

- Proposed ENM reports must be supplied to the Validating Consultant for review and approval;
- Validating consultant to inspect the ENM source site and undertake confirmatory sampling of the proposed ENM (a minimum three confirmatory samples, in addition to the samples analysed for the original ENM Report);
- Results must indicate satisfaction of the ENM criteria as per ENM Order 2014; and
- ENM must be imported under full-time supervision of the Validating Consultant, who will verify the material brough to the site matches the material inspected at the source site.

13.2.3 Recycled Construction Materials

Following procedure applies to the validation of recycled aggregate prior to its importation:

- Following documentation will be provided to the Validating Consultant prior to importation of any recycled aggregate:
    - Product sheets of the aggregate that is intended to be imported;
    - Licencing details of the re-cycling facility;
    - Incoming loads procedure of the re-cycling facility (acceptable and unacceptable loads procedure);
    - Laboratory results of monthly asbestos testing of re-cycled materials at the facility; and
    - Laboratory results of testing as per the relevant aggregate order.
- Validating consultant will collect a minimum of three aggregate validation samples per source site (source site means the recycling facility) and test these samples for the following analytical suite:
    - Analytical suite required as per the relevant aggregate order; and
    - Asbestos (presence/ absence).
- Results must satisfy the criteria specified in the relevant aggregate order with asbestos being non detect.

13.2.4 Landscaping Materials

Validation of landscaping materials will be made by the provision of the product sheet, visual observation of the material, and by testing 3 confirmatory samples at a NATA Accredited laboratory for the following suite of contaminants:

- Total recoverable hydrocarbons (TRH);
- Benzene, toluene, ethylbenzene, xylene, and naphthalene (BTEXN);

- Polycyclic aromatic hydrocarbons (PAH);
- Heavy metals (As, Cd, Cr, Cu, Ni, Zn, Pb, Hg).
- Organochlorine and organophosphorus pesticides (OCP and OPP),
- Polychlorinated biphenyls (PCB), and
- Asbestos.

Naturally occurring TRH is a common find in landscaping materials; therefore, is generally acceptable. However, asbestos, BTEXN, PAH, OCP, OPP, and PCB concentrations must be below laboratory limit of reporting. Heavy metal concentrations must indicate natural background soil levels.

13.3 SAQP for Validation

13.3.1 Data Quality Objectives and QA/QC Data Quality Assessment Procedures

Appropriate QA/QC samples should be obtained during validation sampling and analysed for the contaminants of concern. As a minimum, QA/QC sampling should include 5% inter-laboratory and 5% intra-laboratory duplicates per sample batch. Duplicate samples are not required for asbestos analysis.

DQOs and Data Quality Indicators (DQIs) should be clearly outlined and assessed as part of the validation process. A framework for the DQO and DQI process is outlined below (based on NEPM 2013) and should be reflected in the validation report. The seven DQO steps include the following:

- State the problem;
- Identify the decisions/goal of the study;
- Identify information inputs;
- Define the study boundary;
- Develop the analytical approach/decision rule;
- Specify the performance/acceptance criteria; and
- Optimise the design for obtaining the data.

DQIs are to be assessed based on field and laboratory considerations for precision, accuracy, representativeness, completeness and comparability.

13.4 Documentation of Site Activities By The Contractor

Following documentation will be kept by the Contractor and supplied to the Validating Consultant:

- Site survey data prior to capping;
- Site survey data following capping;
- All VENM, ENM, and Aggregate source site reports as per the requirements specified in Section 13.2;
- Importation tonnage and dates for all materials to imported to site;
    - Contractor shall provide a spreadsheet breakdown showing all material importations, tonnage and importation date details clearly broken down for each material type
- Waste disposal dockets for all material disposed off-site;
- CQA and CQC documentation for the ground gas mitigation system installation; and
- As built design drawings of the installed ground gas mitigation and ventilation system;

13.5 Site Monitoring

A site camera will be established prior to the commencement of the works at an angle that captures the activities happening on the entire site;

- Site camera to record all activities during entire remediation and construction; and

- Validating Consultant will be given real time access to this data to monitor the activities on-site.

14 Contingency Plan

Following risks were identified that may affect the success of remediation:

- Failure of the gas mitigation system; and
- Unexpected finds.

14.1 Gas Mitigation System Contingencies

In the event of unsuccessful validation of the gas mitigation system design (e.g., measurement of methane >1 % v/v in the void) then active ventilation fans can be installed to improve venting. Should there is a CQA/CQC failure in one of the installations, additional controls such as continuous gas monitoring devices can be installed to meet the design guidance value. Under worst case scenario of gas leakage into the building's installation of additional engineering controls such as active gas extraction wells at buildings perimeter or ventilation trenches will be considered.

14.2 Unexpected Finds Protocol

In the event of an Unexpected Find the following procedure will be followed:

- Stop work;
- Call Validating Consultant to inspect the area;
- Temporary barricades will be erected to isolate the area from access to workers;
- In the event suspected friable asbestos material is encountered, an LAA will inspect the area and provide advice regarding specific asbestos management actions and controls required;
- Validating Consultant will provide advice regarding further investigation and remediation (if required) with reference to the RAP, relevant legislation and guidelines;
- In the event remediation is required outside the purview of the RAP, a RAP Addendum will be issued by the Validating Consultant (if necessary) and be submitted to the review and approval of the Site Auditor, Contractor, and SINSW;
- Appropriate remediation and validation sampling should be undertaken, and the results should be included in the validation report.

15 Legislative Requirements

This RAP has been prepared in general accordance with guidance documents endorsed by NSW EPA under Section 105 of the *Contaminated Land Management Act 1997*. Works will be carried out with regard to the development consent conditions and relevant guidelines and regulations.

The primary references under the Act include:

- *NEPC NEPM 1999 National Environment Protection (Assessment of Site Contamination) Amendment Measure (2013 amendment);*
- *NSW DEC (2017), Guidelines for NSW Site Auditor Scheme (3rd Edition), NSW Department of Environment and Conservation;*
- *NSW EPA (2020), Contaminated Land Guidelines – Consultants Reporting on Contaminated Sites;*
- *NSW DECCW (2010) Technical Note: Site Validation Reporting;*

Other guidance references include:

- *NSW EPA (2020) Contaminated Land Guidelines – Assessment and Management of Hazardous Ground Gases*

- *WA Department of Health (2009) Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*;
- *NSW WorkCover (2014), Managing Asbestos in or on Soil;*
- Code of practice - *How to manage and control asbestos in the workplace* (Safework NSW 2020);
- How to Safely Remove Asbestos (Safework NSW 2020);
- *Protection of the Environment Operations Act 1997;*
- *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55)*;*
- *NSW EPA Fact Sheet on Virgin Excavated Natural Material;*
- NSW EPA (2014) *Resource Recovery Orders under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 The Recovered Aggregates Order, Excavated Natural material Order 2014*.
- *NSW EPA 2014, Waste Classification Guidelines Part 1 Classifying Waste;*
- *Work Health and Safety Regulation 2011; and*
- *Storage and Handling of Dangerous Goods Code of Practice.*

It is noted that this list is not exhaustive and may be added to as the project progresses.

Any remediation at the site must comply with Councils most current Contaminated Land Policy, *Contaminated Land DCP 2004.* Remediation should also be undertaken with reference to SEPP 55.

16 Site Management During Construction

16.1 Site Access and Security

The Principal Contractor shall be responsible for ensuring that site access is limited to required personnel and residents, that security of the work area is maintained and that all equipment and plant is maintained through the project. As a minimum the following is required:

- A visual barrier / signage and warning labels are to be erected around the boundaries of the work area; and
- A site induction and sign in/out register to familiarise personnel with site conditions and remediation requirements.

16.2 Traffic Control

The Principal Contractor shall be responsible for adequate levels of traffic control for the roadway entrances to the site. As a minimum the following needs to be implemented:

- Traffic Management for vehicles entering and leaving the site;
- A log in/out vehicle checklist for heavy vehicle movements on/off the site;
- Traffic management shall also be controlled internally on the site. Designated haul roads and exclusion areas shall be marked to ensure trucks do not enter restricted areas of the site. Where haul roads are bare earth appropriate dust suppression shall take place; and
- At no time are trucks to drive over exposed areas of the fill material.

16.3 Hours of Operation

The Principal Contractor shall be responsible for ensuring all works are conducted during the hours of 07:00 through 18:00 Monday to Friday, and 08:00 to 13:00 on Saturdays or otherwise as directed on Development Consent. No work will be carried out on Sundays and Public Holidays.

16.4 Contact Details

The Principal Contractor shall be responsible for the posting of contact details for key personnel associated with the remediation. As a minimum the following contact details should be posted in a visible portion of the site:

Table 7: Contact Details			
Project Involvement	**Company**	**Contact number**	**Contact Name/Title**
Principal Contractor	TBA	TBA	TBA
Project Manager	TBA	TBA	TBA
Site Supervisor	TBA	TBA	TBA
Validating Consultant	TBA	TBA	TBA
Out of hours contact	TBA	TBA	TBA
Note: Contact details shall be added to this list as contractor appointments are finalised.			

17 Environmental Control Measures

This section outlines the necessary steps which need to be implemented to ensure the protection of the site and surrounding environment during remediation projects. The key issues which, as a minimum, must be addressed by the Principal Contractor, associated with any remediation project, are listed in the following sections. The control measures discussed in this section are general and need to be considered on a site-specific basis.

17.1 Sediment and Contaminant Run-off

The management of all storm and surface water runoff is critical in remediation projects to limit the potential for contamination spread and impact to waterways during exposure of soils. As a minimum the following is to be implemented:

- Storm and surface water diversion and detention system if required;
- Silt control fencing should be erected around the entire boundary of the works area;
- Silt control fencing should be placed around all stockpiles; and
- Regular inspections of fences should be conducted to ensure their ongoing effectiveness.

All works should be undertaken with reference to the NSW DECC (2008) *Managing Urban Stormwater, Soils and Construction Guidelines, Volume 2A Installation of services.*

17.2 Soil and Stockpile Management Plan

- Contractors must take all practical measures to avoid cross contamination of soils on-site;
- Excavator operators must be inducted and briefed in detail about this RAP and appropriate soil management requirements;
- Avoid piling, excavation through, or stockpiling of spoil/ fill material on clean soils as much as practical;
- Where above cannot be avoided segregate clean soils from fill material during piling or excavations and stockpile these materials separately;
- Spoil generated during piling and excavations must be placed on builders plastic (not directly on clean soils);
- Where spoil/ fill material needs to be stockpiled on clean soils, cover the surface of clean soils with builders plastic to avoid cross contamination; and

- Due to various layers of clean and contaminated fill on-site careful segregation and separate handling of clean and contaminated materials is crucial.

17.3 Waste Classification and Disposal

Waste soil materials disposed from site (transported offsite) are to be classified in accordance with the NSW EPA (2014) *Waste Classification Guidelines - Part 1: Classifying Waste*, prior to disposal.

Material sampling for waste classification should be carried out as per the methodology prescribed in the Victorian EPA *Industrial Waste Resource Guidelines (IWRG702)* - June 2009.

All wastes to be transported off-site are to be taken to a facility appropriately licenced under the *Protection of the Environment Operations Act 1997* to accept that waste. Receipts and waste tracking dockets are to be retained to assist in materials tracking and preparation of the final validation report.

17.4 Resource Recovery & Re-Cycling Plan

Following resource recovery considerations and actions are applicable to the planned remediation and construction:

- The site is not suitable for Virgin Excavated Natural Material (VENM) exportation due to its history of contamination;
- Previous investigation results indicated the sandstone mound (extending from the south western section of the site towards north and north east, see Figure 2), which was imported in 2019 (Zoic 2020), may be suitable for Excavated Natural Material (ENM) classification as per the ENM order (NSW EPA 2014). Prior to any exportation, an ENM assessment must be undertaken in accordance with the ENM order (NSW EPA 2014) to the portion that is planned to be taken off-site and an ENM report must be prepared by a suitably qualified Environmental Consultant;
    - ENM assessment is not required for on-site re-use of this material (refer to Section 13.1 for validation sampling procedures applicable for this material)
- The legacy aggregate material found at the southern section of the site is non-recyclable as bonded asbestos fragments were identified in this material;
- The concrete slab at the southern section of the site (to be demolished) may be eligible for re-cycling if multiple lines of evidence are provided indicating the material is likely to be free of asbestos. This is to be ensured with the following procedure at a minimum:
    - Prior to the commencement of demolition surface of the concrete slab must be cleared of from all aggregate and asbestos containing material fragments and a clearance report must be issued by an LAA;
    - A suitably qualified Environmental Consultant with official asbestos awareness training or an LAA must be present on-site fulltime supervising demolition activities;
    - Demolished concrete to be spread over a designated area in for visual inspection by the Environmental Consultant or LAA;
    - The concrete spread must be done in a thin layer allowing the consultant to inspect each piece of concrete;
    - Following inspection, if no asbestos containing materials are identified, the material to be stockpiled at a designated area;
    - After the completion of demolition and clearance of the material, if no ACM was identified during above exercise a clearance report will be provided by the supervising consultant reporting the following for each batch:
        - Photographs taken during demolition and inspections;
        - Asbestos air monitoring results during demolition;

- Field observations made by the supervising consultant; and
- A clear statement indicating no ACM was identified during above exercise.

➢ Following the provision of above report the material can be taken to a licenced concrete recycling facility; and

➢ If any asbestos containing material fragment is identified in concrete materials, the material will be deemed as non-recyclable and must be disposed off-site as special waste at a facility that is licenced to accept this type of waste.

17.5 Dust Control

Site personnel, the public, neighbours and the environment need to be protected from dust generated during remediation works. All works must be conducted with dust suppression in place such that no significant visible dust is generated. As a minimum the following needs to be implemented:

- Regular dampening of areas where heavy machinery will be utilised, where excavations are occurring and where spreading/compaction is being undertaken;
- Protecting stockpiled material with tarps, consolidation, erection of wind breaks and if these measures cannot be reached, then wetting down of the material;
- Ceasing work in heavy wind events;
- Loading of materials into trucks as close to stockpile or in situ locations as possible;
- Trucks should have their loads covered when not being loaded, including movement on the site; and
- Special consideration should be given to soils which may contain asbestos.

17.6 Materials Handling and Transportation

The appropriate management of materials during remediation and transport is critical in remediation projects. As a minimum the following needs to be implemented if contaminated material is to be removed from the site:

- The trucks or bins used to transport waste from the site are to be lined with one layer of 200micron polythene sheeting or equivalent or are to be thoroughly cleaned at the completion of the project to facilitate decontamination after tipping of the waste;
- Trucks should have their loads tarped prior to leaving site and vehicles should stay to designate haul roads at all times to prevent the potential spreading of impacted material;
- Equipment, trucks, etc. are to be decontaminated prior to leaving the site to prevent the inadvertent transport of contaminated material off-site (e.g., materials tracked off-site on truck tyres etc.). If required a shaker grid should be installed at the exit point; and
- Trucks and other machinery transporting material around site or working in contaminated areas should remain on contaminated material until wheels/tracks and vehicle undercarriage can be cleaned.

Note: Any contaminated soils requiring offsite disposal will need to be classified for waste disposal prior to leaving site. Contaminated soils will need to be disposed of at a landfill facility licensed to accept that waste and all disposal dockets will need to be retained. Validation sampling across the footprint from where the contaminated soils were removed will be required.

17.7 Noise Control

Due to the use of heavy machinery required during remediation, excess noise will be generated. To help minimise excess noise the following needs to be implemented:

- Strict adherence to hours of operation as prescribed for the site; and
- Australian Standard (AS) 2436-1981 *Guide to noise control on construction, maintenance and demolition sites outlines guidelines for the minimisation of noise on construction sites* and should be implemented to minimise noise generation.

17.8 Maintenance of Environmental Controls

Regular inspections of the environmental controls to confirm their presence and validity should be routinely conducted by the Principal Contractor. This should be undertaken on a daily basis, and more frequently if conditions require, such as rain or high winds.

18 Asbestos Management Plan

18.1 Pre remediation

Prior to remediation works occurring, the following preparatory items are to be undertaken:

- Preparation of ARCP, Safe Work Method Statements (SWMS), Job Safety Assessments (JSA) and any other applicable procedures by the LARC;
- Enclosure of area to restrict access to students and visitors;
- Ensure that a permit is received from DoE to commence works;
- Sufficient and appropriate warning signs (e.g., "Caution: Asbestos Removal") are to be erected at regular intervals around the boundaries and at entry points to the work area exclusion zone during the works (the exclusion zone is required in areas where there is known ACM contamination);
- Notification to NSW WorkSafe NSW is required at least 5 days in advance of licensed asbestos removal works. The Asbestos Removal license and notification must be displayed on site at all times;
- Provide copies of current license and insurances, including a Class A Asbestos Removal License and Public Liability and Worker's Compensation Insurances;
- All persons undertaking the asbestos remediation must be competent and appropriately trained, with training records available on-site;
- In accordance with current legislation, any neighbouring properties and persons within and surrounding an area that may be affected by the asbestos processes, must be informed of the works prior to their commencement;
- A dedicated decontamination area is to be established at the boundary of the exclusion zone, i.e., exit point. The decontamination area shall contain all necessary Personal Protective Equipment (PPE) and decontamination equipment, i.e. P2 respirators, disposable coveralls (Type 5, Category 6), gloves, and 200µm polythene labelled asbestos waste bags for disposal of waste PPE;
    - Disposable coveralls and booties would only be required if friable asbestos above site criteria is encountered during further investigations;
- Fencing or barricading covered with shade cloth must be in place around the boundaries of the exclusion zone and its integrity maintained for the duration of the works;
- An inspection by the supervising qualified consultant is to be undertaken prior to the commencement of any works to confirm that the asbestos work area has been adequately set up; and

A site induction must inform workers of the presence of ACM in fill soils, the related risks and controls in place to manage the risks and any other general information relating to asbestos as seen appropriate. A more detailed induction / training process must be implemented for all workers expected to come in direct contact with and/or disturbance of asbestos.

18.2 Decontamination Procedures / Exclusion Zone

Dry decontamination procedures are considered adequate for the site's non-friable asbestos remediation works. Following departure of the exclusion zone personal decontamination procedures will involve the following:

- On exit from the exclusion zone, disposable PPE is to be removed and discarded in asbestos waste bags. Respiratory protection to be removed last. Re-useable RPE is to be thoroughly wiped with alcohol-based antiseptic swabs and the swabs are to be discarded in asbestos waste bags;
- Dirty boots shall be washed before leaving the work area. Alternatively, dedicated steel capped gum boots should be provided to the workers and left within the work area during breaks;
- Washing of hands and face will finalise the dry decontamination process. Washing through a mobile decontamination unit is only undertaken for friable asbestos removal/remediation works;
- Contaminated equipment, clothes and PPE are to be double bagged, well-sealed and consolidated pending disposal to an appropriately licenced landfill facility;
- In the event of an emergency evacuation situation which does not allow time to decontaminate, the decontamination procedures can be waived;
- Excavators, trucks and other plant leaving the work area will need to be cleaned to the satisfaction of the Environmental consultant; and
- The exclusion zone barriers and decontamination area are to remain in place until the conclusion of the asbestos works. Barriers and asbestos control measures are not to be removed until approved by the Asbestos Consultant (see **Section 18.7** for Clearance Inspection).

18.3 PPE

For bonded asbestos the minimum PPE requirement will be P2 dust mask and disposable nitrile gloves. For friable P2 half face respirators, disposable coveralls, nitrile gloves and booties will be required.

18.4 Asbestos Consultant

The LARC will be required to meet the hygiene requirements of the project as specified in this AMP or as identified by the Asbestos Consultant appointed by the client. The following provides a summary of the work to be carried out by the Asbestos Consultant as part of the remediation works:

- Inspect the asbestos remediation work site prior to commencement of the remediation works;
- Undertake control asbestos fibre air monitoring during remediation works within and surrounding the remediation area and within public areas;
- Undertake clearance air monitoring and a visual inspection in the areas where ACM affected soils have been removed; and
- Complete a validation report detailing the results of the remediation works and monitoring data.

The Asbestos Consultant has the authority to stop the job if work is not being carried out in accordance with the contract, the WHS Regulation, SafeWork NSW Codes of Practice and other applicable guidelines or if elevated air monitoring results are obtained.

The Asbestos Consultant may request that a LARC worker be removed from site following a serious safety breach. The Asbestos Consultant may also assist in conducting inductions, preparation of procedures and risk advice relating to the management of asbestos materials on the site.

18.5 Asbestos Fibre Air Monitoring

Asbestos fibre air monitoring will be required during any activity that disturbs the contaminated fill material on-site as per the DoE AMP (regardless of asbestos being bonded or friable). The air monitoring program will involve air sampling around the site for airborne asbestos fibres for the duration of remediation works. This will assist in assessing the potential exposure to asbestos during the works and measure the effectiveness of implemented control measures. Asbestos air monitoring is to be undertaken by a Licenced asbestos assessor (LAA) or a suitably competent person under the supervision of an LAA. Clearance air monitoring is to be undertaken by an LAA. A brief overview of the air monitoring program is provided below:

- Air monitoring should be undertaken around the boundary of the asbestos exclusion area and also along the site perimeter for the duration of the works to assess whether airborne asbestos fibre concentrations are below the relevant control level and analytical detection limit of 0.01 fibres/mL (refer to Table 8 below);
- Air monitors will be placed around the work area, decontamination area and lunch room. Monitoring may also be conducted within the excavator cabin; and
- All air monitoring filters will be examined by a NATA-accredited laboratory in accordance with the Guidance Note on the Membrane Filter Method for the Estimation of Airborne Asbestos Fibres 2nd Edition [NOHSC:3003 (2005)].

18.6 Asbestos Air Monitoring Action Limits

If requested, the Asbestos Consultant shall carry out air monitoring of the exclusion zone and surrounding areas (see **Section 18.5**).

The LARC shall maintain air-monitoring results below the control limit in areas which are being worked, and areas checked by the Asbestos Consultant.

The control limits shall be as follows:

Table 8: Control (Static) Monitoring During Removal/Remediation Works

Control Level (fibres/mL)	Who	Control / Action
< 0.01	-	No Action. Continue with existing control measures.
≥ 0.01	Consultant Hygienist/ Asbestos Assessor	Asbestos Consultant to notify LARC and advice of results as soon as is practicable.
	Consultant Hygienist/ Asbestos Assessor	Asbestos Consultant and LARC to review current control measures and improve, where applicable. This may include improved work practices, use of further control measures (e.g. plastic screening or dust suppression techniques) or changing the work methodology.
> 0.02	Consultant Hygienist/ Asbestos Assessor & Project Manager/ Principal Contractor/ Facilities Manager	Asbestos Consultant to notify LARC to **stop works immediately**. LARC to notify WorkSafe NSW or relevant regulator (using NAF01 form) by phone, followed by written statement within 24 hours, that work has ceased and the results of the air monitoring.
	Consultant Hygienist/ Asbestos Assessor / Principal Contractor/ Facilities Manager	Asbestos Consultant to conduct investigations to establish cause of problem. Following advice from the Asbestos Assessor, LARC to undertake any necessary improvement works to rectify problem. Additional air monitoring to be conducted by Asbestos Assessor. LARC will be allowed to recommence removal works after results are <0.01 fibres/mL. Asbestos Consultant to advise of the results once levels have returned to normal.

18.7 Clearance

- The Asbestos Consultant is to conduct final visual clearance inspection following completion of works.
- Subsequent to successful visual inspection and air monitoring results confirmed as <0.01 fibres/mL, the Asbestos Consultant will give notice to contractor to remove containment to adjacent areas.

  The area should be thoroughly cleared with all equipment and trace of works removed from area

following the works and prior to normal occupancy.

18.8 Post Remediation Works

- The results of the monitoring and validation program for the capping layer should be provided in a validation report to confirm activities as detailed within the RAP/AMP have been implemented and providing comment that the land has been remediated / encapsulated to allow for intended use. This should also include survey details of the encapsulated area, to allow for accurate determination of location and depth at a later date.
- All asbestos materials remaining in situ must be suitably managed in accordance with the Code of Practice: How to Manage Asbestos in The Workplace (SafeWork NSW, 2020) and an up to date management plan must be kept in place.
- Notification by DoE is to be made to the respective council to allow inclusion on the site s149 certificate (under the NSW EP&A Act, 1997).
- A site-management plan should be prepared to manage any future sub-surface activities that may be required for the site (e.g. excavation of a trench to install new electricity cables or stormwater).

19 Waste Management

The following section provides a generic a Waste Management Plan (WMP) for the site. It is recommended that the Principal Contractor develop a specific WMP once the contract for the project is awarded. This should be submitted to Council if required as part of the Development Conditions for the site.

19.1 Waste Objectives

The Principal Contractor at all times should aim to avoid waste in the design and implementation of the project through adopting strategies of separating, reusing and recycling during demolition and minimisation waste by reducing packaging at the source by subcontractor and supplier.

Procedures on and off-site for the management of waste materials should be developed. The Principal Contractor should monitor and record waste from all phases of the project including demolition, excavation and construction.

20 Workplace Health and Safety

This section outlines the general Workplace Health and Safety (WHS) issues pertaining to the remediation project. The steps outlined in the following sections will need to be followed during all remedial works. The WHS steps discussed in this section are general and need to be considered on a site specific basis based on the nature of the contamination, remediation works and associated risks.

20.1 Site Inductions

The Principal Contractor must ensure all personnel working on the remediation project attend a Site Induction undertaken prior to entering the site for the first time. The Site Induction should include a brief outline of the remediation project, details on general site hazards (e.g., vehicle movements, heavy machinery, contamination etc.) and details on the specific hazards associated with the remediation works including but not limited to:

- Nature of the materials being handled (i.e., asbestos contaminated soil);
- Personal protective equipment to be utilised on site; and
- Necessary decontamination procedures to be undertaken whilst on site.

20.2 Personal Protective Equipment

Safety boots, high visibility vests and hard hats shall be worn by all personnel on the site. Hearing protection devices will be worn by personnel exposed to noise levels exceeding LAeq,8hr 85 dB(A) or L_{peak} 140 dB(C) (e.g., those working around heavy machinery).

When personnel are working in the designated contaminated area and are required to handle or to come into direct contact with contaminated soil then disposable gloves, long sleeves and long trousers shall be worn as a minimum requirement. There is no requirement for personnel to wear respiratory protective equipment, however care should be taken in avoiding walking over the contaminated material and monitoring of volatile compounds should be undertaken using a PID. If the alarm limits of the PID are exceeded, then personnel should leave the work area until the odour has dissipated. Contaminated equipment, clothes and PPE are to be disposed of with contaminated waste materials at the completion of the project.

These requirements are specified as a minimum standard and may be modified at the discretion of the Project Manager or Principal Contractor during the remediation works.

20.3 Licensing and Permits

As per the *State Environmental Planning Policy No. 55 – Remediation of Land* the City of Parramatta Council and DoE SINSW must be informed of the remediation no less than 30 days prior to the remediation taking place. The Principal Contractor is required to be appropriately licensed.

20.4 Decontamination

At the end of each work shift (i.e., before morning tea, lunch and afternoon tea), personnel will remove their contaminated gloves and any other contaminated clothing (if required) in the remediation area. Washing of hands and face will finalise the decontamination process. Separate controls may be required when friable asbestos is encountered.

20.5 Hazard Assessment

A hazard assessment will be conducted on site prior to commencement of works. It will address, as a minimum, the following:

- On site contamination hazard: The contaminant of concern is hydrocarbons. However, if any other odours, vapour or potential asbestos containing materials are identified, work is to stop and the source is to be located;
- Additional hazards: Other hazards associated with remediation projects include heat stress, manual handling, underground utilities, electrical hazards and plant; and
- Hazard assessments should include information on the controls to be implemented by the contractor to minimise hazards associated with the works.

20.6 Community Health and Safety

As the site is a remediation project, only inducted personnel are allowed on site. To ensure the protection of the community, the following needs to be implemented:

- A visual barrier is to be erected around the entire perimeter of the remediation area; and
- Dust suppression is to be undertaken to minimise exposure to the site workers or the surrounding community.

It is understood that the surrounding neighbours will be advised of the remediation works.

20.7 Site Facilities and Personal Hygiene Requirements

As the site is a remediation project the following facilities need to be provided and available to the personnel on the site:

- Fresh protective coveralls will be available at all times during the remediation project to staff who require them;
- Lunchroom and associated facilities; and
- Bathroom and associated facilities.

The following hygiene requirements are to be followed by all personnel working at the site:

- No eating, smoking or drinking to be conducted in the remediation area; and
- Staff to wash hands and face prior to eating, smoking or drinking.

21 Emergency Procedures and Response

The responsibility for emergency procedures lies with the Principal Contractor however the following is an example of the type of information which can be included in the general emergency procedure document.

In the event that an emergency arises, a potentially dangerous situation is encountered or suspect/unknown material is identified, site work is to cease immediately and the matter reported to the Principal Contractor for immediate assessment and action.

The following procedures should be conducted if site personnel are injured, suffer exposure or a condition is uncovered that has not been covered by this RAP is identified:

- Visual contact to be maintained by personnel on site;
- In the event that any site personnel experiences any adverse symptoms of exposure whilst onsite, work will be halted and instruction or assistance sought from the Principal Contractor;
- In the event of an accident, the Site Supervisor and the injured person will compile an incident report, which will be submitted to the Principal Contractor within 24 hours of the incident. Follow-up actions will be carried out to correct the situation;
- In the event that an emergency situation arises, the Site Supervisor must address the problem and notify the ambulance, fire brigade and police if necessary. In addition, the Project Manager must be notified immediately;
- To minimise the impact of an emergency situation, at least one of the Principal Contractor's site personnel working full time on site will be trained in basic first aid procedures and all field personnel will have immediate access to a first aid kit; and
- Emergency phone numbers will be made available at the commencement of the project including ambulance, fire brigade, police and the nearest hospital. Emergency services can be called on 000 in a life-threatening emergency (or 112 via mobile phone). In addition, the mobile phone numbers of the Principal Contractor, Site Supervisor and the Project Manager will be made available.

22 Validation Reporting

Following the completion of remediation, a validation report will be written by the Validating Consultant with a clear site suitability statement. Validation Report will be written in accordance with NSW EPA (2020) Guideline on Consultants Reporting on Contaminated Land and include but not limited to the following information:

- As built design drawings of the gas mitigation and ventilation systems;
- CQA and CQC documentation of the gas mitigation and ventilation system installations;
- As built design drawing of the constructed capping layer;
- Survey data verifying capping thickness;
- Photographic evidence of remediation;

- Waste tracking information (disposal dockets and volumetric calculations of materials assessed for waste classification and disposed off-site);
- Material validation and importation data;
- Validation data of the soils used in capping;
- Ground gas validation monitoring data;
- Validation data of landscaping materials;
- Site suitability statement; and
- Recommendations for any further remediation work (if applicable).

23 Ongoing Site Management

Following the completion of the Validation Report, a Long Term Environmental Management Plan (LTEMP) will be prepared for the site to manage the residual contamination risk on-site. This is anticipated to include routine inspections of the gas mitigation system and measures to ensure integrity of the gas mitigation system and capping on-site.

24 Limitations

- Ground gas risk profile on-site were established based on short term monitoring data, with the receipt of additional data, ground gas risk profile on-site and requirements for level of gas protection may change;
- In the scope of the DSI (2021) a large portion of the site-soils were not accessible due to concrete slab and soil mound and our investigation and RAP has been prepared based on limited data obtained from borehole logs;
- Our investigation contains inherent uncertainties, more and other types of contamination may be present outside of our sampling points;
- Further investigation recommended as part of this RAP may result in the discovery of more extensive contamination and potentially increase the scope of remediation required;
- Success of remediation largely depends on contractor's capability and the level of collaboration between key stakeholders such as Principal Contractor, Remediation Contractor, Specialist Contractors, Validating Consultant, Site Auditor, SINSW (and their assigned Project Managers), DPIE, and CoPC;
- It is Principal Contractor's responsibility to fully read, understand and implement the RAP, *all questions must be directed to Greencap in writing;*
- It is the Principal Contractor's responsibility to ensure the RAP is read, understood, and implemented by their sub-contractors (inc. but not limited to the Remediation Contractor, Earthworks Contractor, LARC, Specialist Contractors for gas mitigation system installations); and
- Any decisions regarding remediation methodologies, RAP clarifications, departures, or addendums must be made in writing with the inclusion Principal Contractor, Validating Consultant, Site Auditor, and SINSW. Where applicable DPIE and CoPC are to be notified.

September 2021

GREENCAP
Going Further in Managing Risk

Remediation Action Plan
Department of Education (School Infrastructure NSW)
7-11 Burroway Road, Wentworth Point, NSW

Figures

GREENCAP
Going Further in Managing Risk

G, N - Building, 22 Giffnock Ave
Macquarie Park, NSW 2113
Ph: 02-9889-1800
Fx: 02-9889-1811

Client Name:	Department of Education (School Infrastructure NSW)				
Client Number:	C123934	Project Number:	J169135-01		
Project Description:	Remediation Action Plan - SOPHS				
Address:	Proposed Sydney Olympic Park High School, 7-11 Burroway Road, Wentworth Point, NSW 2127				
Prepared:	SW	Reviewed:	MB	Version Date:	15/09/2021
Figure 1	Site Location and Regional Context				

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Note: B(a)p TEQ* - Benzo(a)pyrene TEQ (upper bound)

BH9

BH7

A

GG2

GG1

BH10
Asbestos Fines: 0.21 %w/w
at 0.3-0.4 mBGL

BH6

GG10

GG11

Legacy Well

GG3

BH5

GG4

BH1

BH2

GG5

BH4
Lead: 870 mg/kg at 1.0-1.2 mBGL
B(a)p TEQ*: 3.5 mg/kg at 1.0-1.2 mBGL

BH3

GG9

GG6

SP3

A’

GG12
B(a)p TEQ*: 8.6mg/kg at 1.4-1.5 mBGL

UST

SP2

GG8
B(a)p TEQ*: 6.7 mg/kg
at 0.9-1.0 mBGL
TRH>C10-C16 (F2):2400 mg/kg
at 0.4-0.5 mBGL

PACM1

GG7

SP1

PACM2

Lead HIL-C Criterion: 600 mg/kg;
TRH>C10-C16(F2) HSL-A&B (0 to <1m): 110 mg/kg;

Benzo(a)pyrene TEQ HILC Criterion: 3mg/kg;
AF/FA HIL-C Creiterion: 0.001%w/w;

Metres
0 10 20 30 40

Site Boundary (03/06/2021)
- *largely covered with concrete slab*

Proposed Building Footprint
- 16/08/2021

Boreholes

Test Pits

PACM

Service Pit

Gas Monitoring Wells

Legacy Well found on-site

Underground Storage Tank (UST)

Potential Abandoned UST Area
(red circle does not limit the extent of thefurther investigation area)

Indicative extent of sandstone fill imported in 2019
(areas capped under supervision of Zoic in 2019)

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Prepared:	SW	Reviewed:	MB	Version Date:	15/09/2021
Figure 2	Sample Locations - Site Criteria Exceedances				

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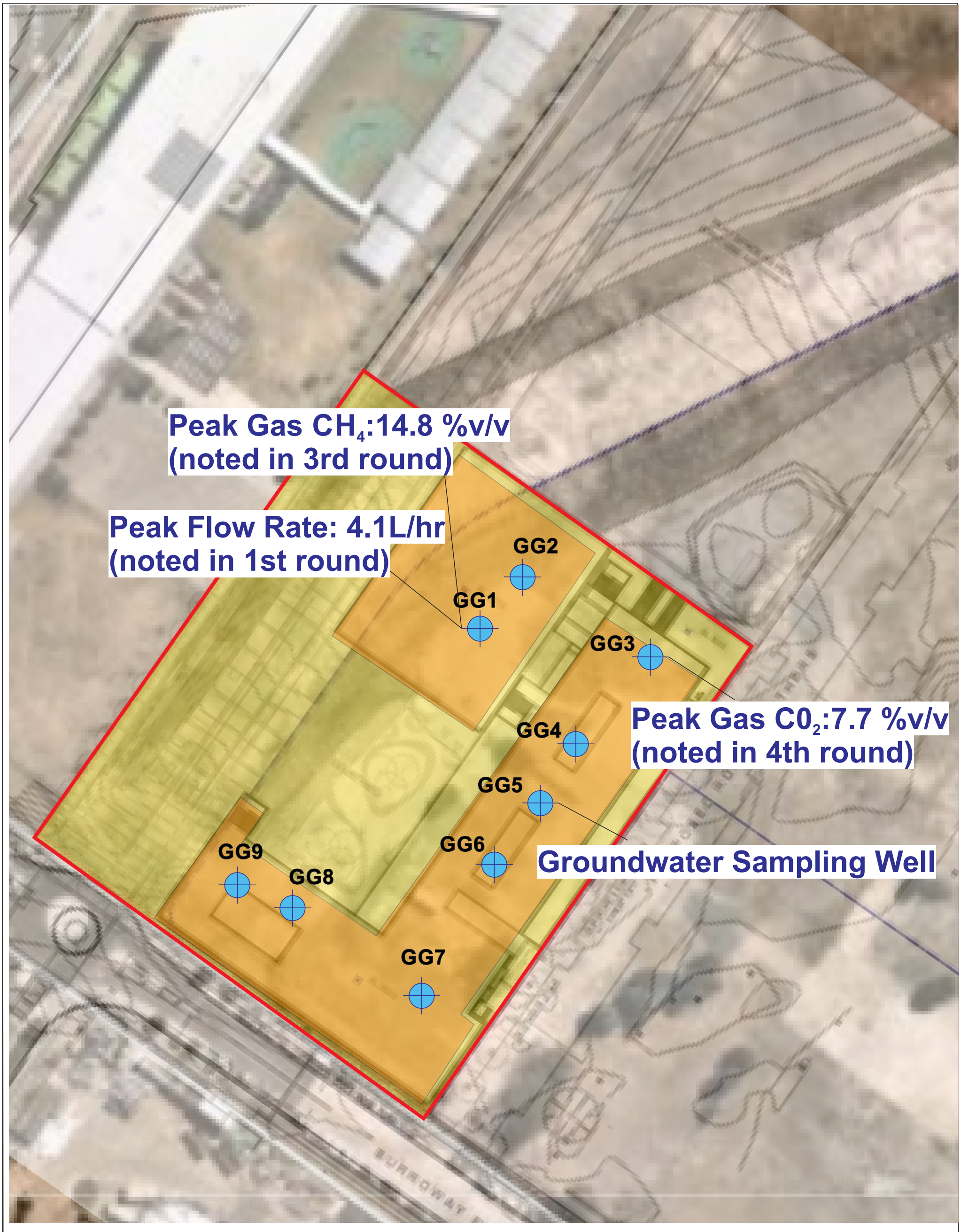

Metres
0 10 20 30 40

Site Boundary (03/06/2021)

Proposed Building Footprint - 16/08/2021

Gas Monitoring Wells

GREENCAP
Going Further in Managing Risk

G, N - Building, 22 Giffnock Ave
Macquarie Park, NSW 2113

Ph: 02-9889-1800

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Client Name:	Department of Education (School Infrastructure NSW)				
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Prepared:	SW	Reviewed:	MB	Version Date:	15/09/2021
Figure 3	Peak Gas Concentration & Peak Flow Rate (1st & 2nd rounds)				

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A

A’

Soil Mound
(Sandstone)

Bh6

GG9
(Projected)

BH5

GG8
(Projected)

BH4

Concrete Slab

GG5

Service Pit (SP3)

mBGL

0
1
2
3
4
5
6
7
8
9
10
11
12

Potential UST
Indicative location
& Boundary

Fill Layer

Depth to Groundwater at GG5 is 1.8 mBGL

Legacy UST
Indicative Boundary

Fill?/Natural? - clay and sand mixture
with inclusion of seashells, ASS & PASS

Legacy Well
(Projected, Indicative depth)

Natural Dark Grey to Black Clay, High Plasticity

Bedrock

Legend:

- Proposed School Buildings
- Soil Mound
- Underground Storage Tank (UST)
- Potential UST
- Fill Layer
- Bedrock
- Service Pit
- Fill Material And/ Or Dredged Natural Material Form Sea Or River
- Potential Gas / Soil Vapor Migration
- Potential Gas Generation / Accumulation

GREENCAP
Going Further in Managing Risk

Level 2, 11-17 Khartoum Road
North Ryde, NSW 2113
Ph: 02-9889-1800
Fx: 02-9889-1811

Client Name:	Department of Education (School Infrastructure NSW)				
Client Number:	C123934	Project Number:	J169135-01		
Project Description:	Remediation Action Plan - SOPHS				
Address:	Proposed Sydney Olympic Park High School 7-11 Burroway Road, Wentworth Point, NSW 2127				
Prepared:	SW	Reviewed:	MB	Date:	15/09/2021
Figure 4	Conceptual Site Model- Prior To Remediation				

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A

A’

Passive Ventilation With Rotating Cowls

Planned Building (Projected)

Planned Building

Void formers (used for in-situ casting) must allow airflow

Reinforced Concrete Slab

Service penetrations are managed through application of water bars

Air inlets or air bricks to allow air influx to the void

Reinforced Concrete Slab

Hi-viz geofabric marker layer

Ventilated Sub-slab Void (min 150 mm)

Ventilated Sub-slab Void (min 150 mm)

Capping layer (min 600 mm)

mBGL

0
1
2
3
4
5
6
7
8
9
10
11
12

Fill Layer

No trenches/ conduits/ drainage lines to be installed beneath the capping layer

Groundwater Depth ~ 1.8 mBGL

Foundation Piles

Fill?/Natural? - clay and sand mixture with inclusion of seashells, ASS & PASS

Natural Dark Grey to Black Clay, High Plasticity

Bedrock

Legend:

- Proposed School Buildings
- Validated Capping Layer
- Fill Layer (contaminated)
- Fill Material And/ Or Dredged Natural Material
- Bedrock
- Foundation Piles
- Potential Gas / Soil Vapor Migration
- Ambient Air/ Diluted Gas Ventilation
- Gas Generation / Accumulation
- Geofabric marker layer
- Service and drainage lines (all utilities to be installed)
- Air inlets/ air bricks
- Vent Piping
- Rotating cowls

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Going Further in Managing Risk

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Macquarie Park, NSW 2113
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Address:	Proposed Sydney Olympic Park High School 7-11 Burroway Road, Wentworth Point, NSW 2127				
Prepared:	SW	Reviewed:	MB	Date:	15/09/2021
Figure 5	Conceptual Site Model - Post Remediation				

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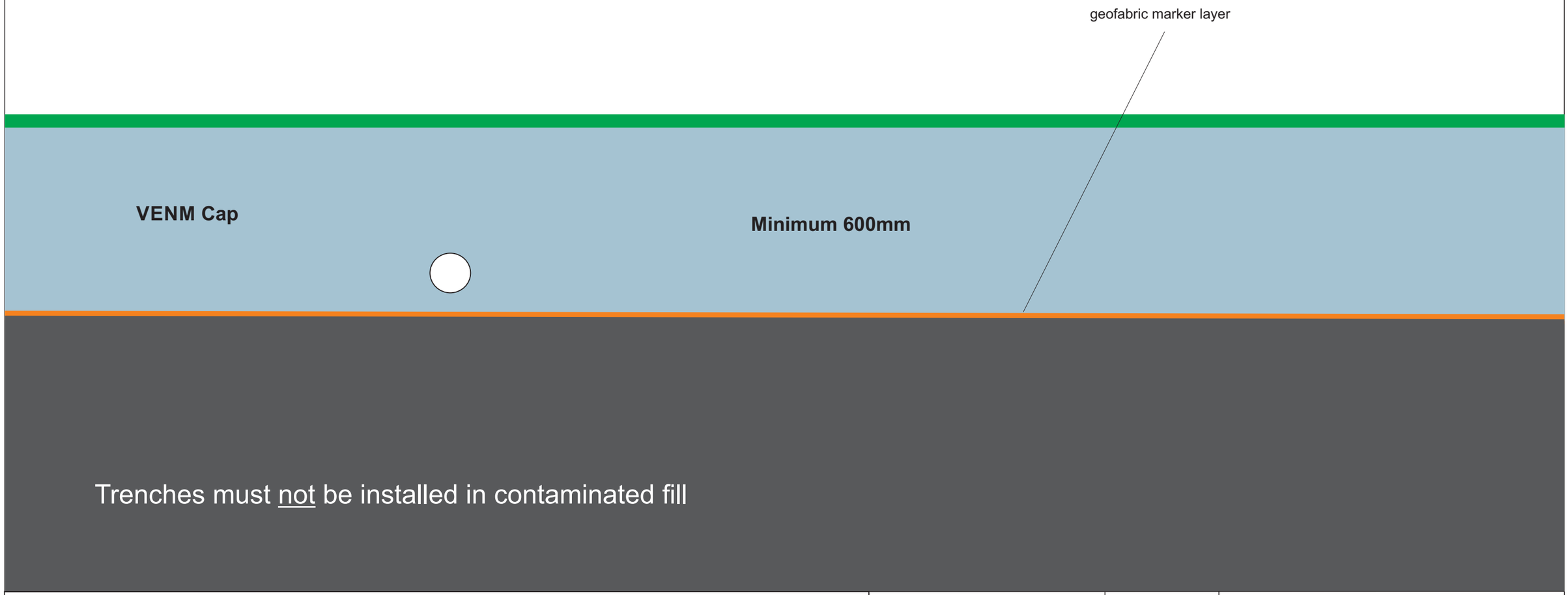

Legend:

- Turf Layer
- Certified VENM or ENM
- Contaminated Fill
- Drainage Pipe
- Non-Woven Geofabric Marker Layer

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Going Further in Managing Risk

GF, North Building,22 Giffnock Av
Mcquarie Park, NSW 2113
Ph: 02-9889-1800
Fx: 02-9889-1811

Client Name:	Department of Education (School Infrastructure NSW)				
Client Number:	C123934	Project Number:	J169135		
Project Description:	Remediation Action Plan - SOPHS				
Address:	7-11 Burroway Road, Wentworth Point, NSW				
Prepared:	MB	Reviewed:	SW	Date:	21/06/2021
Figure 6	Cap Construction Details				

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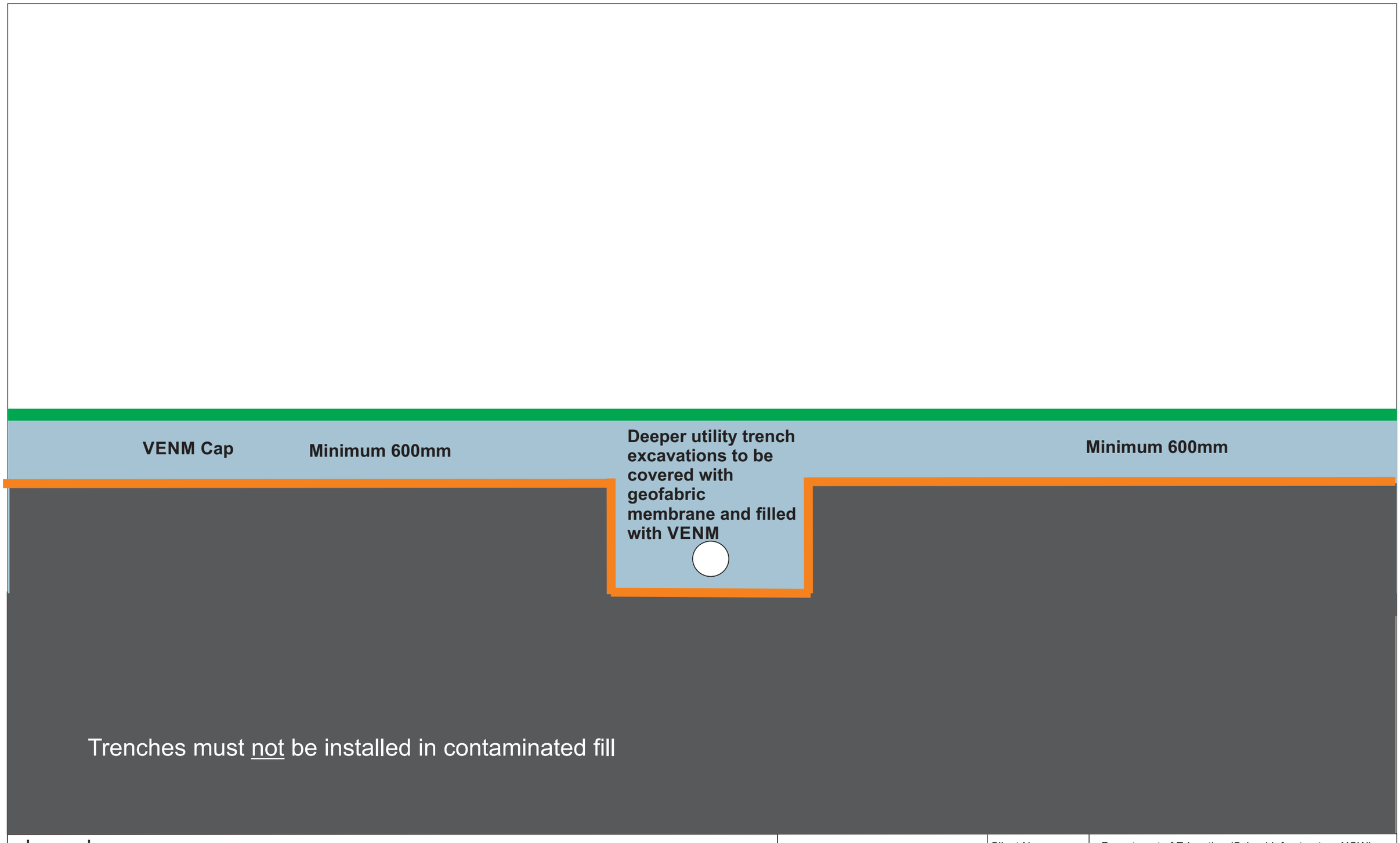

Legend:

- Turf Layer
- Certified VENM or ENM
- Contaminated Fill
- Drainage Pipe
- Non-Woven Geofabric Marker Layer

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Project Description:	Remediation Action Plan - SOPHS				
Address:	7-11 Burroway Road, Wentworth Point, NSW				
Prepared:	MB	Reviewed:	SW	Date:	21/06/2021
Figure 7	Remediation Area - Possible Diversion of storm water pipe/trenches				

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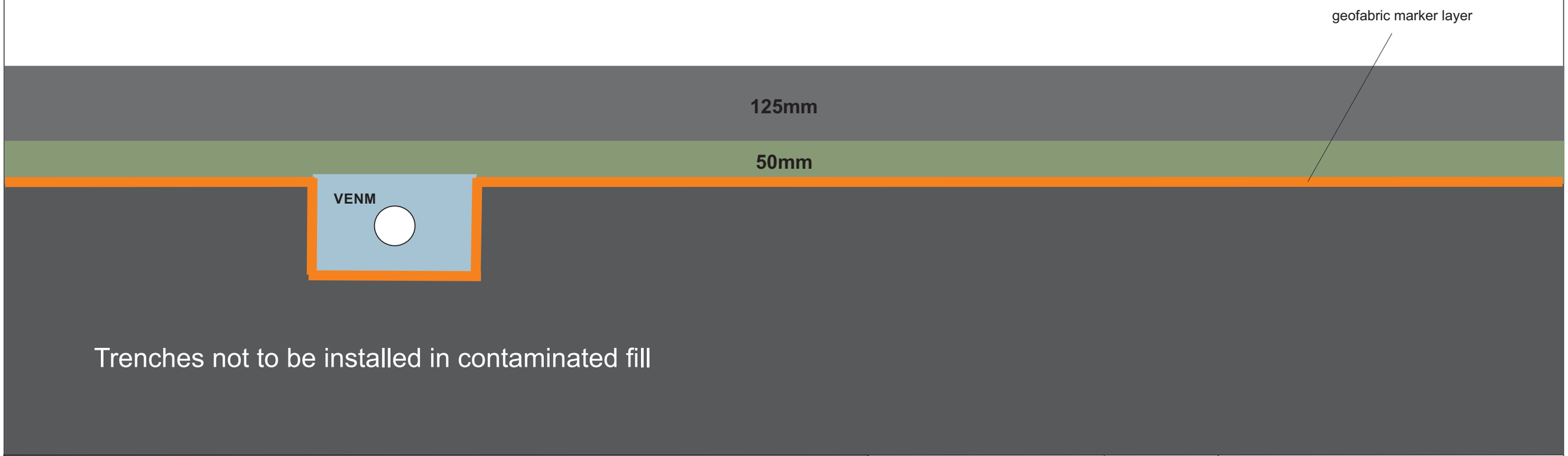

Legend:

- Asphalt/ Concrete Pavement
- Depth Compacted Base Course
- Certified VENM or ENM
- Contaminated Fill
- Drainage Pipe
- Non-Woven Geofabric Marker Layer

GREENCAP
Going Further in Managing Risk

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Mcquarie Park, NSW 2113
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Client Number:	C123934	Project Number:	J169135		
Project Description:	Remediation Action Plan - SOPHS				
Address:	7-11 Burroway Road, Wentworth Point, NSW				
Prepared:	MB	Reviewed:	SW	Date:	21/06/2021
Figure 8	Remediation Area - Trafficable Pavement around the field				

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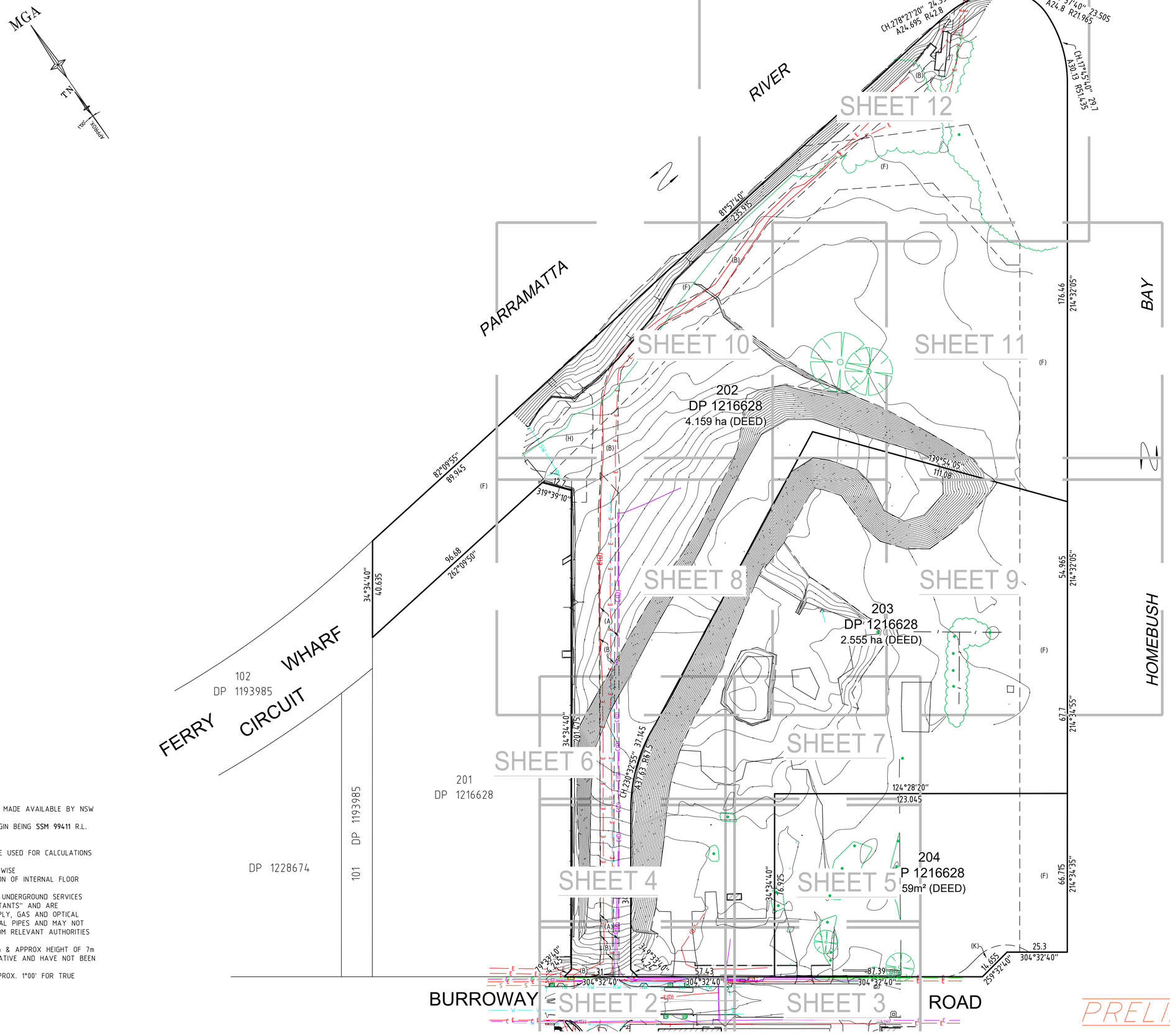
September 2021

GREENCAP
Going Further in Managing Risk

Remediation Action Plan
Department of Education (School Infrastructure NSW)
Appendix A – Site Survey



LEGEND

TELSTRA PILLAR	⊠ TP
TELSTRA PIT	TEL
ELECTRIC LIGHT POLE	◐ ELP
ELECTRICITY BOX	EL
POWER POLE	● PP
PIT WITH CONCRETE LID	□ CLID
PIT WITH METAL LID	□ MLID
STREET SIGN	⊠ SS
GRATED INLET PIT	▤ GIP
KERB INLET PIT	KIP
SEWER MANHOLE	◯ SMH
STOP VALVE	⊠ SV
HYDRANT	◧ HYD
VEHICLE CROSSING	(VC)
PRAM CROSSING	(PC)
GAS (DBYD)	G
COMMUNICATIONS (DBYD)	C
WATER (DBYD)	W
SEWER (DBYD)	S
ELECTRICITY (U'GROUND) (DBYD)	E
STORMWATER	SW
GAS (DETECTED)	G(D)
COMMUNICATIONS (DETECTED)	C(D)
OPTUS (DETECTED)	CO(D)
WATER (DETECTED)	W(D)
ELECTRICITY (DETECTED)	E(D)
SERVICE DEPTH	ie. D:0.6

NOTES

1. THE BOUNDARIES HAVE NOT BEEN MARKED ON GROUND
2. ALL AREAS AND DIMENSIONS HAVE BEEN COMPILED FROM PLANS MADE AVAILABLE BY NSW LAND REGISTRY SERVICES AND ARE SUBJECT TO FINAL SURVEY
3. ORIGIN OF LEVELS ON A.H.D. IS DERIVED BY GPS WITH THE ORIGIN BEING **SSM 99411** R.L. **2.094** (A.H.D.) IN HILL ROAD
4. CONTOUR INTERVAL **0.2m**
5. CONTOURS ARE INDICATIVE ONLY. ONLY SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION
6. KERB LEVELS ARE TO THE TOP OF KERB UNLESS SHOWN OTHERWISE
7. FLOOR LEVELS SHOWN ARE THRESHOLD LEVELS. NO INVESTIGATION OF INTERNAL FLOOR LEVELS HAS BEEN UNDERTAKEN
8. AN INVESTIGATION OF UNDERGROUND SERVICES HAS BEEN MADE. UNDERGROUND SERVICES HAVE BEEN DETECTED BY "QASAR SUBSURFACE UTILITY CONSULTANTS" AND ARE APPROXIMATE ONLY. SOME SERVICES SUCH AS FIRE&WATER SUPPLY, GAS AND OPTICAL FIBRE CABLING DO NOT HAVE METALLIC TRACING WIRES OR METAL PIPES AND MAY NOT HAVE BEEN DETECTED. SERVICES HAVE ALSO BEEN PLOTTED FROM RELEVANT AUTHORITIES RECORDS AS SUPPLIED BY DIAL BEFORE YOU DIG
9. 8/.4/7 DENOTES TREE SPREAD OF 8m, TRUNK DIAMETER OF 0.4m & APPROX HEIGHT OF 7m
10. TREES DENOTED WITH TREE NUMBERS (EG. T21) ONLY ARE INDICATIVE AND HAVE NOT BEEN SURVEYED
11. BEARINGS SHOWN ARE MGA (MAP GRID OF AUSTRALIA) ADD APPROX. 1°00' FOR TRUE NORTH

EASEMENTS

SEE SHEET 13

DIAL BEFORE YOU DIG www.1100.com.au

GDA2020

0 16 32 48 64 80

SCALE 1:800 @ A1

Revision	Date	Description	Reference
H	00/00/00	–	00
G	00/00/00	–	00
F	00/00/00	–	00
E	00/00/00	–	00

Revision	Date	Description	Reference
D	00/00/00	–	00
C	21/04/21	ARBORIST TREES (INDICATIVE) AND TREE NUMBERS ADDED	002
B	08/04/21	UNDERGROUND DETECTED SERVICES AND DETAIL & LEVELS ADDED	002
A	09/03/21	UNDERGROUND DETECTED SERVICES ADDED	002

LTS CONFIDENCE TOGETHER
www.ltsl.com.au | P 1300 587 000

THIS IS THE PLAN REFERRED TO IN MY LETTER DATED:

.....
Registered Surveyor NSW

PRELIMINARY

Client NSW DEPARTMENT OF EDUCATION

Drawing title
PLAN OF DETAIL AND LEVELS OVER LOT 204 AND PART OF LOTS 202 & 203 IN DP 1216628, KNOWN AS SYDNEY OLYMPIC HIGH SCHOOL, WENTWORTH POINT

datum	AHD	reference number	51086 001DT
site Area	SEE SHEET 8	scale	1:800 @A1
		date of survey	FEB 2021
LGA	CITY OF PARRAMATTA	SHEET	1 OF 13

DIAL BEFORE YOU DIG
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GDA2020

SCALE 1:100 @ A1

Revision	Date	Description	Reference
H	00/00/00	–	00
G	00/00/00	–	00
F	00/00/00	–	00
E	00/00/00	–	00

Revision	Date	Description	Reference
D	00/00/00	–	00
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Drawing title
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datum AHD
reference number 51086 001DT
site Area SEE SHEET 8
scale 1:100 @A1
date of survey FEB 2021
LGA CITY OF PARRAMATTA
SHEET 2 OF 13

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ADJOINS SHEET 7

ADJOINS SHEET 3

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SHEET 5 OF 13

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LGA	CITY OF PARRAMATTA
SHEET	7 OF 13

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LGA CITY OF PARRAMATTA

SHEET 8 OF 13

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LGA CITY OF PARRAMATTA
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MAGNETIC NORTH

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LGA CITY OF PARRAMATTA	SHEET OF 13		10

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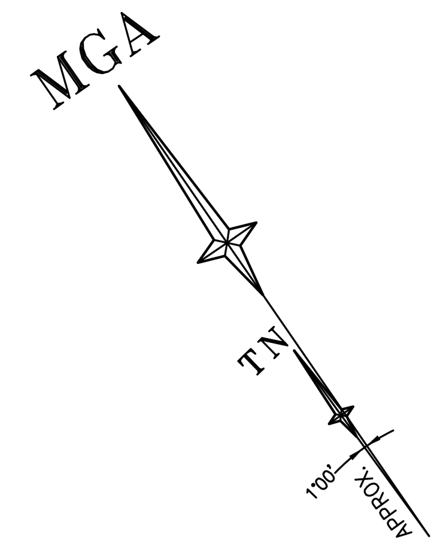
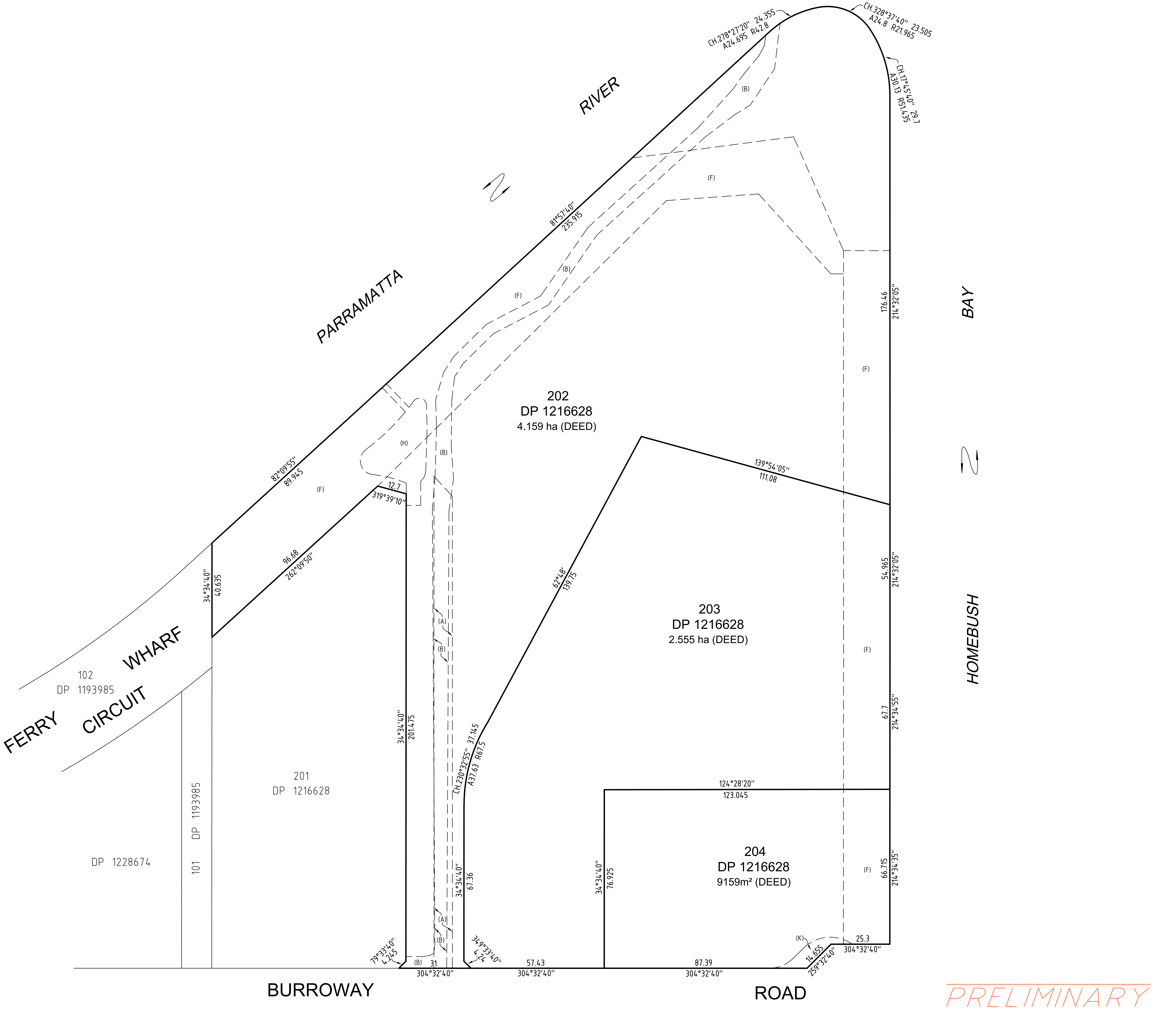
SHEET 12 OF 13





EASEMENTS

(A) EASEMENT FOR ELECTRICITY PURPOSES 7.925 WIDE (M287401)
(B) EASEMENT FOR ELECTRICITY PURPOSES 5 WIDE, 5.53 WIDE & VARIABLE WIDTH (AA298780)
(F) EASEMENT FOR ACCESS 20 WIDE AND VARIABLE WIDTH (DP 1216628)
(H) EASEMENT FOR DRAINAGE VARIABLE WIDTH (DP 1216628)
(K) PUBLIC POSITIVE COVENANT VARIABLE WIDTH (DP 1216628)

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GDA2020

0 16 32 48 64 80
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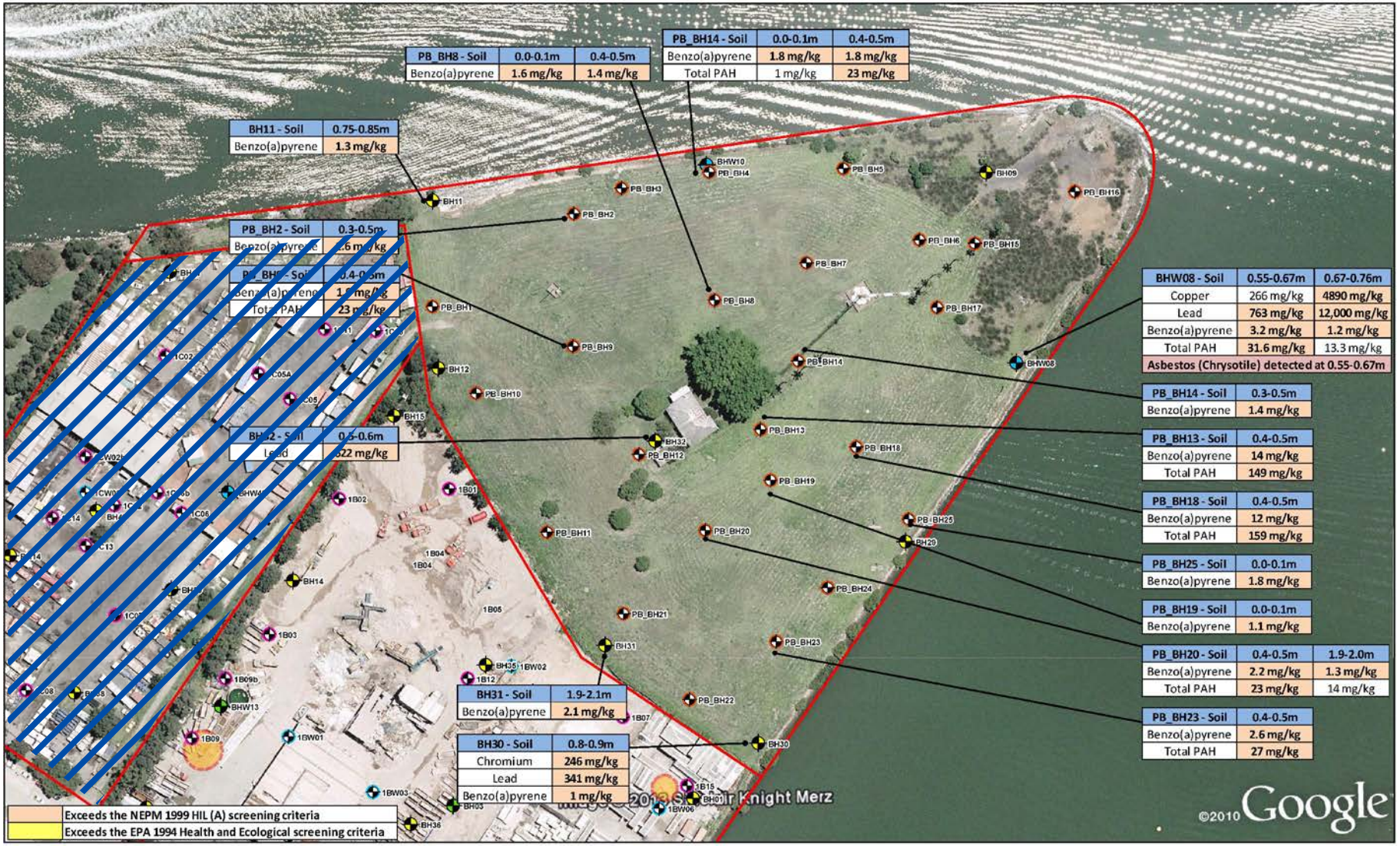
LGA CITY OF PARRAMATTA
SHEET 13 OF 13

September 2021

GREENCAP
Going Further in Managing Risk

Remediation Action Plan
Department of Education (School Infrastructure NSW)
Appendix B – Former Report Figures



Data Source: GHD, 2013g

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Map No: 2207004B_GIS_005_A

Author: MB

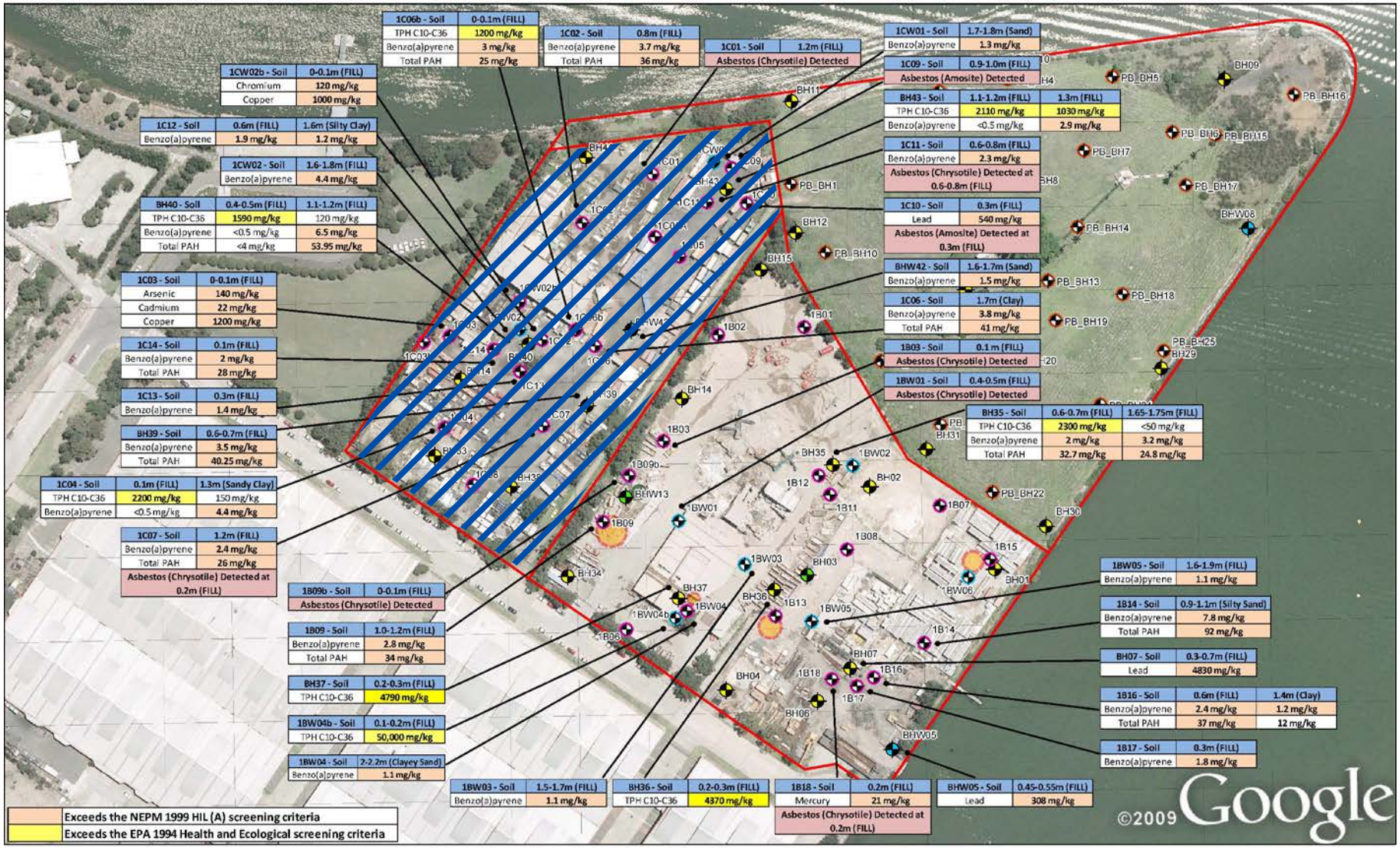
Approved by: OH

Date: 1/12/2014

NOTE: Area excluded from detailed RAP

LEGEND
- Site Boundary (Approximate)
- Removed/Abandoned/Suspected UST Areas
- Soil Boreholls Locations (PB, 2009)
- Soil Sampling Location (GHD, 2011)
- Groundwater Well (GHD, 2011)
- Groundwater Well (GHD, 2009)
- Soil Sampling Location (GHD, 2009)
- Lost/Destroyed Groundwater Wells

Wentworth Point SAQP
Figure 4a
Soil impact plan
2GB area Stage 1 area



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Map No: 2207004B_GIS_006_A

Author: MB

Approved by: OH

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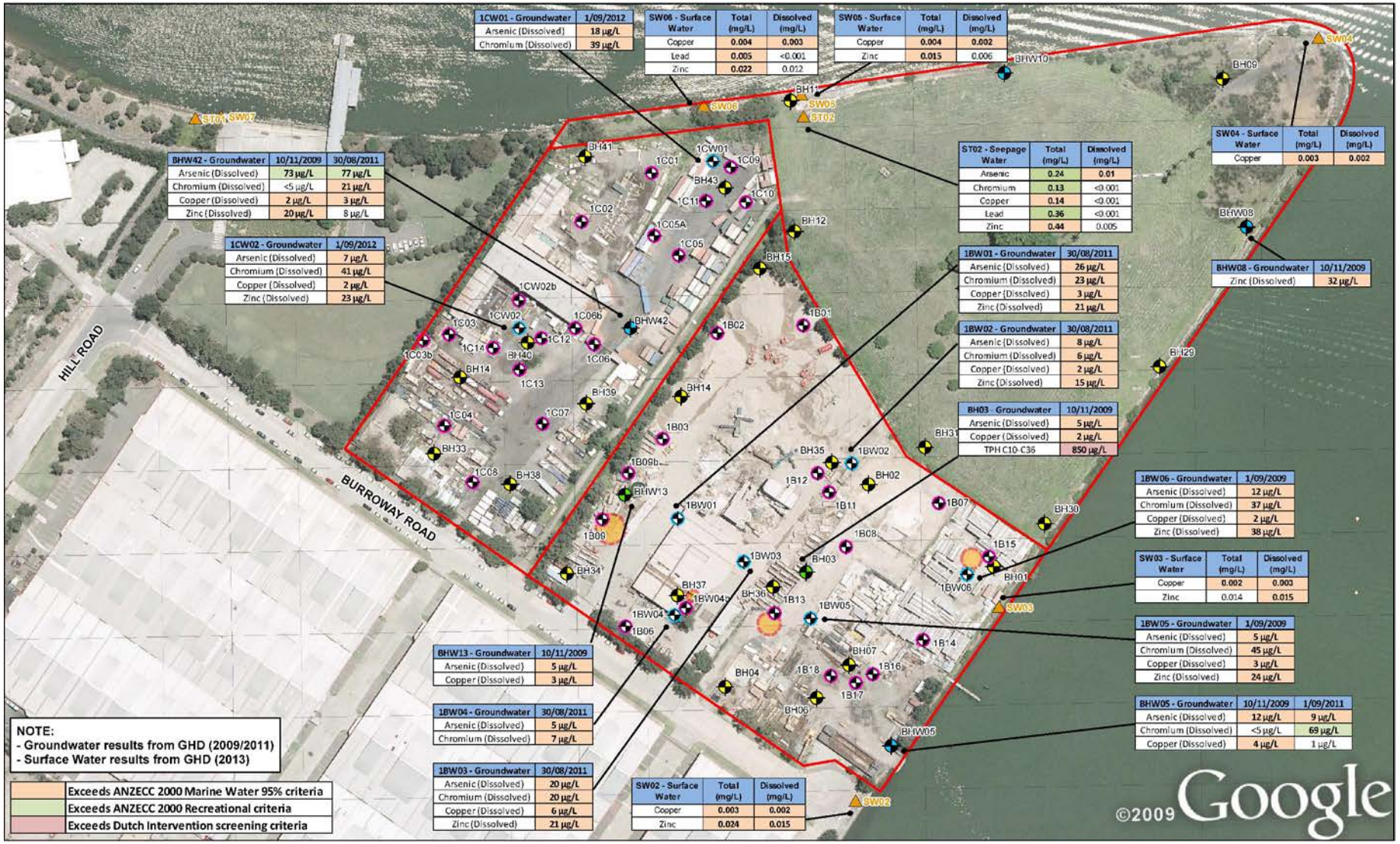
Wentworth Point SAQP
Figure 4b
Soil impact plan
Stage 1 area


1CW01 - Groundwater | 1/09/2012
Arsenic (Dissolved) | 18 µg/L
Chromium (Dissolved) | 39 µg/L
SW06 - Surface Water | Total (mg/L) | Dissolved (mg/L)
Copper | 0.004 | 0.003
Lead | 0.005 | <0.001
Zinc | 0.022 | 0.012
SW05 - Surface Water | Total (mg/L) | Dissolved (mg/L)
Copper | 0.004 | 0.002
Zinc | 0.015 | 0.006
SW04 - Surface Water | Total (mg/L) | Dissolved (mg/L)
Copper | 0.003 | 0.002
BHW42 - Groundwater | 10/11/2009 | 30/08/2011
Arsenic (Dissolved) | 73 µg/L | 77 µg/L
Chromium (Dissolved) | <5 µg/L | 21 µg/L
Copper (Dissolved) | 2 µg/L | 3 µg/L
Zinc (Dissolved) | 20 µg/L | 8 µg/L
ST02 - Seepage Water | Total (mg/L) | Dissolved (mg/L)
Arsenic | 0.24 | 0.01
Chromium | 0.13 | <0.001
Copper | 0.14 | <0.001
Lead | 0.36 | <0.001
Zinc | 0.44 | 0.005
1CW02 - Groundwater | 1/09/2012
Arsenic (Dissolved) | 7 µg/L
Chromium (Dissolved) | 41 µg/L
Copper (Dissolved) | 2 µg/L
Zinc (Dissolved) | 23 µg/L
1BW01 - Groundwater | 30/08/2011
Arsenic (Dissolved) | 26 µg/L
Chromium (Dissolved) | 23 µg/L
Copper (Dissolved) | 3 µg/L
Zinc (Dissolved) | 21 µg/L
BHW08 - Groundwater | 10/11/2009
Zinc (Dissolved) | 32 µg/L
1BW02 - Groundwater | 30/08/2011
Arsenic (Dissolved) | 8 µg/L
Chromium (Dissolved) | 6 µg/L
Copper (Dissolved) | 2 µg/L
Zinc (Dissolved) | 15 µg/L
BH03 - Groundwater | 10/11/2009
Arsenic (Dissolved) | 5 µg/L
Copper (Dissolved) | 2 µg/L
TPH C10-C36 | 850 µg/L
1BW06 - Groundwater | 1/09/2009
Arsenic (Dissolved) | 12 µg/L
Chromium (Dissolved) | 37 µg/L
Copper (Dissolved) | 2 µg/L
Zinc (Dissolved) | 38 µg/L
SW03 - Surface Water | Total (mg/L) | Dissolved (mg/L)
Copper | 0.002 | 0.003
Zinc | 0.014 | 0.015
1BW05 - Groundwater | 1/09/2009
Arsenic (Dissolved) | 5 µg/L
Chromium (Dissolved) | 45 µg/L
Copper (Dissolved) | 3 µg/L
Zinc (Dissolved) | 24 µg/L
BHW05 - Groundwater | 10/11/2009 | 1/09/2011
Arsenic (Dissolved) | 12 µg/L | 9 µg/L
Chromium (Dissolved) | <5 µg/L | 69 µg/L
Copper (Dissolved) | 4 µg/L | 1 µg/L
BHW13 - Groundwater | 10/11/2009
Arsenic (Dissolved) | 5 µg/L
Copper (Dissolved) | 3 µg/L
1BW04 - Groundwater | 30/08/2011
Arsenic (Dissolved) | 5 µg/L
Chromium (Dissolved) | 7 µg/L
1BW03 - Groundwater | 30/08/2011
Arsenic (Dissolved) | 20 µg/L
Chromium (Dissolved) | 20 µg/L
Copper (Dissolved) | 6 µg/L
Zinc (Dissolved) | 21 µg/L
SW02 - Surface Water | Total (mg/L) | Dissolved (mg/L)
Copper | 0.003 | 0.002
Zinc | 0.024 | 0.015
NOTE:
- Groundwater results from GHD (2009/2011)
- Surface Water results from GHD (2013)
Exceeds ANZECC 2000 Marine Water 95% criteria
Exceeds ANZECC 2000 Recreational criteria
Exceeds Dutch Intervention screening criteria
HILL ROAD
BURROWAY ROAD
BH41
1CW01
1C01
1C09
BH43
1C11
1C10
1C02
1C05A
1C05
BH12
BH15
1CW02b
1CW02
1C03
1C06b
BHW42
1B01
1B02
1C03b
1C14
1C12
BH40
1C06
BH14
1C13
BH39
BH14
1C04
1C07
1B03
BH33
1C08
BH38
1B09b
BHW13
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1B12
BH35
1BW02
BH02
1B11
1B07
BH31
BH30
1B09
1B08
1B15
BH34
1BW03
BH03
BH01
BH37
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1B06
1B14
BH07
1B18
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BH04
1B17
BH06
BHW05
SW01
SW02
SW03
SW04
SW05
SW06
ST01
ST02
BHW10
BH09
BHW08
BH29
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Data Source: GHD, 2013g
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Map No: 2207004B_GIS_007_A
Author: MB
Approved by: OH
Date: 1/12/2014
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Groundwater Well (GHD, 2011)
Groundwater Well (GHD, 2009)
Soil Sampling Location (GHD, 2009)
Lost/Destroyed Groundwater Wells
Surface Water Sampling Locations (GHD, 2013)
N
Wentworth Point SAQP
Figure 5
Stage 1 - Groundwater and surface water impact plan
Transport Roads & Maritime Services
NSW GOVERNMENT
esri Partner Network Silver
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Transport Roads & Maritime Services

Data Source: Google Earth 2009, GHD, 2013g

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esri Partner Network Silver

Map No:	2207004B_GIS_013_A
Author:	MB
Approved by:	OH
Date:	1/12/2014

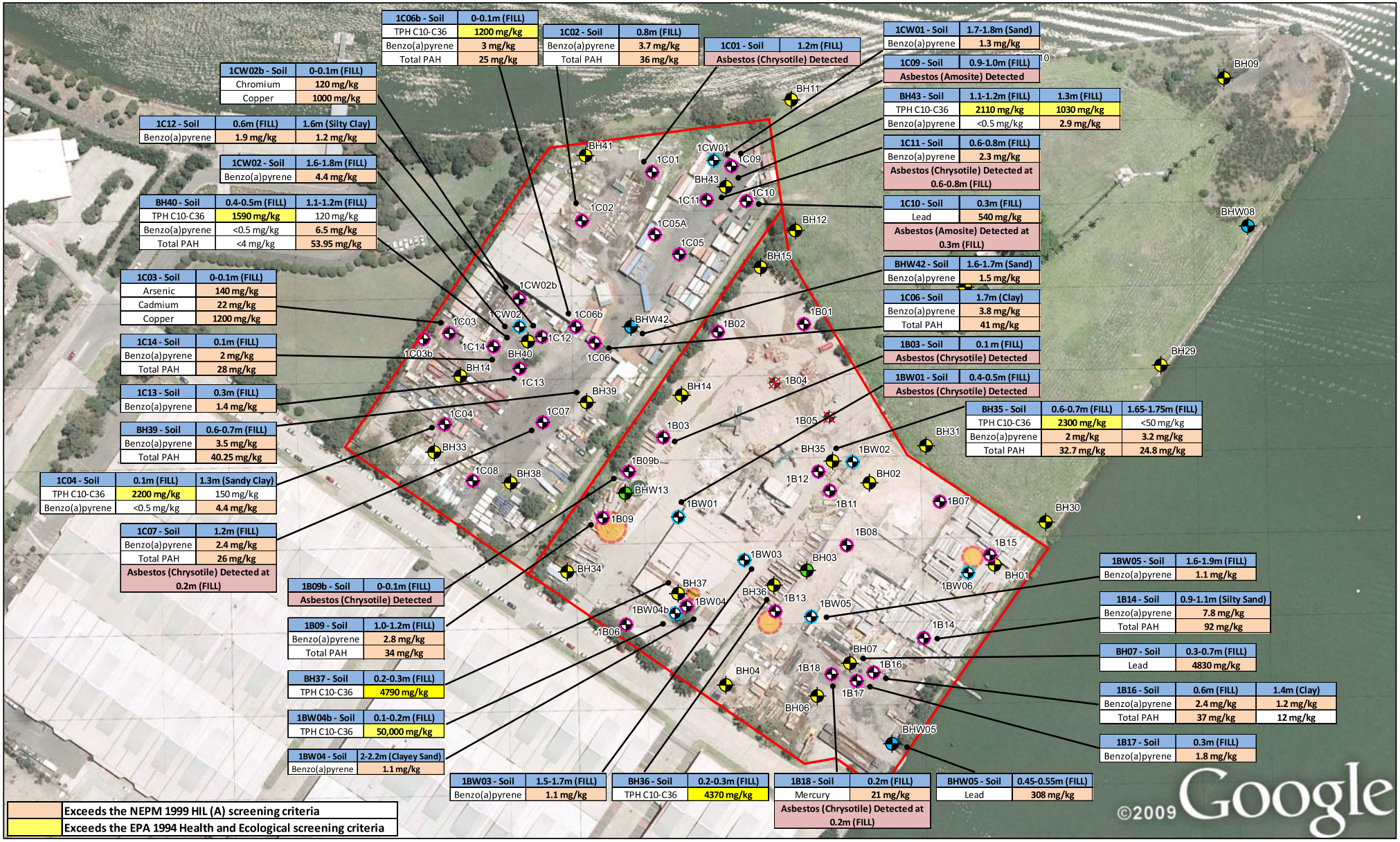
0 25 50 m

1:2,500

N

Scale ratio correct when printed at A4 Landscape
Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56

Wentworth Point SAQP
Figure 10a
Stage 1 - Ground gas impact plan



0 20 40 60 80
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND
- Site Boundary (Approximate)
- Removed/Abandoned/Suspected UST Areas
- Soil Sampling Location (GHD, 2011)
- Groundwater Well (GHD, 2011)
- Groundwater Well (GHD, 2009)
- Soil Sampling Location (GHD, 2009)
- Lost/Destroyed Groundwater Wells
- Sampling Location Abandoned/Refusal (GHD, 2011)

GHD
CLIENTS | PEOPLE | PERFORMANCE

Roads and Maritime Services
Homebush Bay West Stage1 Area
Additional Contamination Assessment

Job Number 21-21835
Revision A
Date 14 Nov 2012

Soil Investigation Exceedences

Figure 4

G:\21\21835\GIS\Maps\MXD\21_21835_Z001_SoilExceedences_Stage_1.mxd

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Data Source: Google Earth Pro Imagery May 2011; GHD Sampling Locations - Sept 2011. Created by: tnham

Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Source:Base plan provided by NSW Maritime

CLIENTS | PEOPLE | PERFORMANCE

NSW Maritime
Homebush Bay West Contamination Assessment

Stage 1 - Site Details

Date | November 2009 Scale | As shown

job no | 21-18600
file ref | 21-18600PSIFig2.cdr

Figure 2

10 Bond Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7194 **E** sydmail@ghd.com.au **W** www.ghd.com.au

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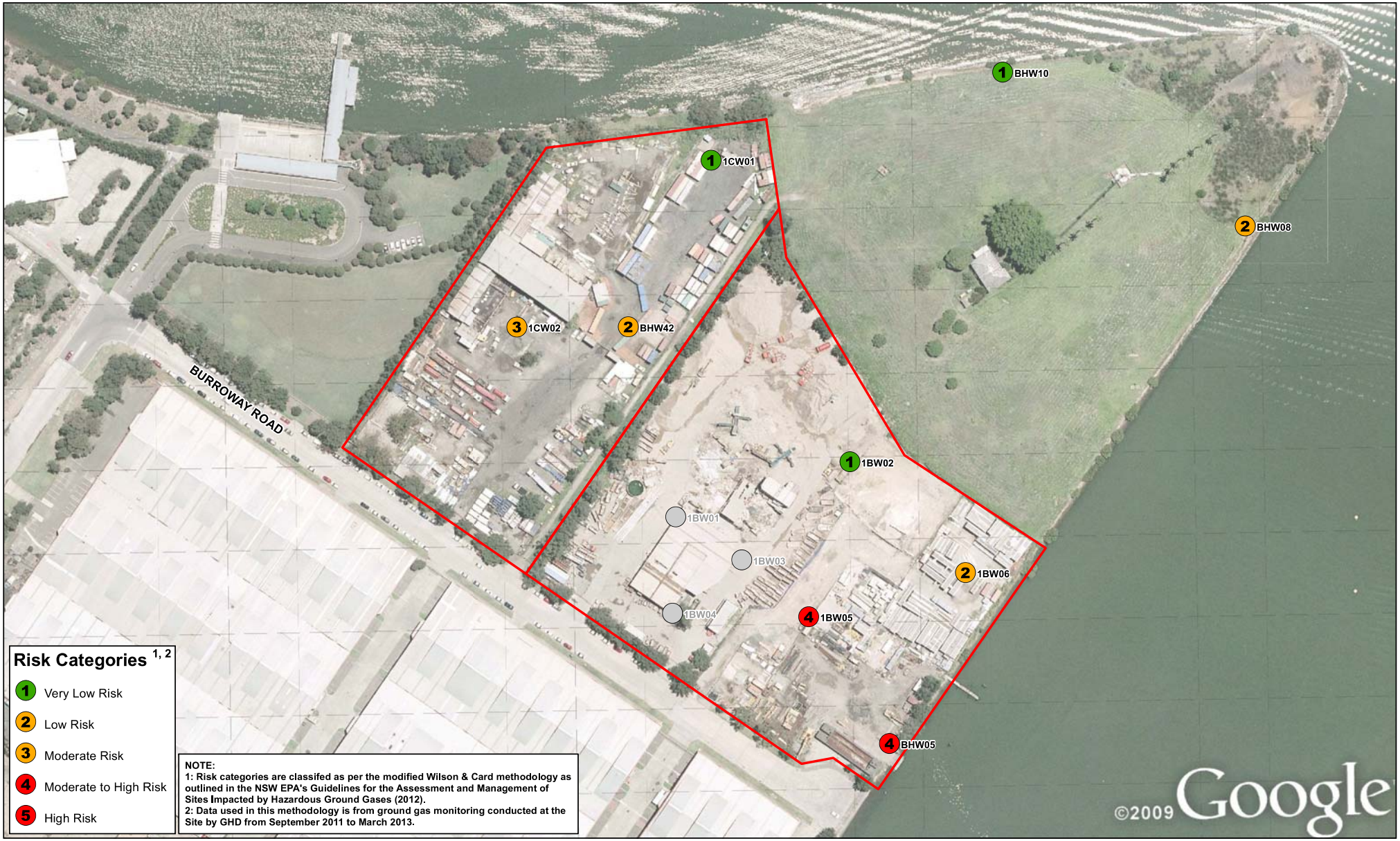

Risk Categories [1, 2]

1. Very Low Risk
2. Low Risk
3. Moderate Risk
4. Moderate to High Risk
5. High Risk

NOTE:
1: Risk categories are classifed as per the modified Wilson & Card methodology as outlined in the NSW EPA's Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases (2012).
2: Data used in this methodology is from ground gas monitoring conducted at the Site by GHD from September 2011 to March 2013.

0 20 40 60 80
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND
Site Boundary (Approximate)

Roads and Maritime Services
Homebush Bay Gas Investigation
Ground Gas Monitoring - Preliminary Characteristic Situations - Stage 1 Area

Job Number	21-21353
Revision	A
Date	23 May 2013

Figure 23

G:\21\21353\GIS\Maps\MXD\21_21353_Z021_HB_Stage1_GasScreeningValues.mxd
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Data Source: Google Earth Pro Imagery May 2011; GHD Sampling Locations - Sept 2011. Created by: tnham

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

LEGEND

Approximate site boundary and placement of the orange marker layer

Placement of the second marker layer above aggregate material

This product has been created to support the main report and is not suitable for other purposes. Image courtesy of Nearmaps.

Not To Scale

Figure 2: Remediation Area

Site Address:Wentworth Point Development, 7, 9 and 11 Burroway Road, Wentworth Point, NSW 2127

Client: Landcom Pty Ltd

Job Number: 18170

Date: 4 December 2019

ZOIC

LEGEND

Approximate site boundary

Asbestos Air Monitoring Points

This product has been created to support the main report and is not suitable for other purposes. Image courtesy of Nearmaps.

Not To Scale

Figure 3: Asbestos Air Monitoring Points

Site Address:Wentworth Point Development, 7, 9 and 11 Burroway Road, Wentworth Point, NSW 2127

Client: Landcom Pty Ltd

Job Number: 18170

Date: 4 December 2019

50	322446.61	6255871.922	1.73		172	322396.526	6255791.715	2.152
51	322446.61	6255871.922	1.73		173	322401.519	6255798.856	2.353
52	322455.488	6255875.658	1.723		174	322407.448	6255806.861	2.495
53	322464.329	6255878.819	1.655		175	322412.852	6255814.613	2.203
54	322473.394	6255881.847	1.698		176	322418.804	6255822.914	1.989
55	322482.345	6255884.878	1.71		177	322425.246	6255831.745	2.041
56	322491.934	6255887.835	1.633		178	322432.272	6255828.154	2.138
57	322500.588	6255890.473	1.752		179	322425.856	6255819.141	2.787
58	322503.515	6255881.722	1.919		180	322419.7	6255810.177	3.076
59	322505.661	6255872.167	1.824		181	322414.09	6255801.902	3.109
60	322512.453	6255852.865	1.914		182	322437.017	6255869.036	1.757
61	322492.849	6255880.381	1.988		183	322426.481	6255865.701	1.957
62	322484.113	6255877.329	1.86		184	322416.827	6255862.496	2.386
63	322474.815	6255874.195	1.899		185	322414.257	6255868.787	2.367
64	322465.768	6255871.252	1.883		186	322426.587	6255871.662	1.933
65	322456.899	6255867.881	1.875		187	322445.712	6255818.519	2.462
66	322447.966	6255864.733	1.723		188	322444.714	6255827.398	2.24
67	322450.386	6255855.322	1.879		189	322444.923	6255836.859	1.976
68	322468.78	6255861.142	1.42		190	322446.544	6255846.029	1.861
69	322477.789	6255863.002	1.357		191	322436.095	6255845.559	2.084
70	322487.449	6255864.546	0.83		192	322437.68	6255821.019	2.696
71	322496.598	6255866.935	0.661		193	322431.995	6255812.556	3.141
72	322490.308	6255853.729	0.824		194	322487.301	6255877.657	2.255
73	322480.922	6255850.421	0.803		195	322516.921	6255833.257	2.05
74	322472.027	6255847.122	0.829		196	322508.099	6255829.713	2.174
75	322463.459	6255844.574	0.793		197	322499.366	6255825.6	2.453
76	322454.376	6255841.881	0.661		198	322489.972	6255821.547	2.363
77	322461.179	6255855.061	2.082		199	322480.975	6255818.295	2.354
78	322405.213	6255859.096	2.264		200	322470.849	6255815.532	2.513
79	322404.376	6255867.968	2.346		201	322462.897	6255813.135	2.566
80	322394.917	6255868.707	2.297		202	322472.523	6255806.826	2.684
81	322385.442	6255867.802	2.346		203	322482.898	6255810.361	2.669
82	322376.314	6255866.918	2.321		204	322492.809	6255814.423	2.587
83	322377.177	6255860.004	1.427		205	322501.809	6255818.455	2.428
84	322387.042	6255861.665	1.471		206	322520.459	6255824.969	2.083
85	322395.791	6255863.156	1.358		207	322510.769	6255822.042	2.359
86	322396.026	6255859.606	1.761		208	322514.46	6255811.912	2.155
87	322387.022	6255858.259	1.778		209	322504.063	6255809.66	2.32
88	322377.402	6255856.983	1.758		210	322494.155	6255805.98	2.422
89	322367.753	6255855.489	1.886		211	322485.553	6255801.528	2.597
90	322367.243	6255858.911	1.37		212	322475.883	6255796.945	2.728
91	322366.465	6255865.658	2.305		213	322465.96	6255792.045	2.812
92	322366.469	6255865.644	2.316		214	322463.728	6255802.82	2.735
93	322357.762	6255864.742	2.327		215	322454.282	6255799.353	2.915
94	322358.077	6255857.606	1.352		216	322455.823	6255788.499	3.058
95	322358.191	6255854.502	1.696		217	322446.692	6255783.069	3.228
96	322349.915	6255853.247	1.784		218	322437.129	6255777.953	3.376
97	322349.757	6255856.286	1.369		219	322427.394	6255772.883	3.121
98	322347.728	6255862.76	2.199		220	322417.984	6255767.709	2.986
99	322339.3	6255862.061	2.149		221	322408.5	6255762.995	3.112
100	322341.197	6255852.976	2.072		222	322398.989	6255757.303	2.934
101	322332.094	6255851.718	2.11		223	322389.833	6255753.313	2.579
102	322323.353	6255851.187	2.108		224	322384.059	6255767.532	2.755
103	322325.137	6255858.904	2.095		225	322375.287	6255754.749	2.631
104	322333.474	6255861.092	2.127		226	322369.478	6255746.454	2.486
105	322412.723	6255852.653	2.398		227	322362.709	6255739.125	2.35
106	322413.387	6255848.321	2.338		228	322356.417	6255731.143	2.374
107	322408.55	6255840.408	2.317		229	322350.399	6255722.906	2.237
108	322402.704	6255832.531	2.333		230	322395.759	6255771.43	2.989
109	322397.303	6255824.939	2.338		231	322405.312	6255775.869	3.053
110	322397.306	6255824.922	2.332		232	322416.322	6255780.385	3.126
111	322392.452	6255817.465	2.391		233	322433.79	6255789.059	3.508
112	322387.025	6255810.111	2.346		234	322444.008	6255794.073	3.313
113	322381.7	6255801.739	2.4		235	322451.761	6255810.288	2.565
114	322376.039	6255793.641	2.359		236	322442.08	6255805.283	3.166
115	322370.21	6255785.493	2.336		237	322428.649	6255798.74	3.496
116	322364.334	6255776.995	2.191		238	322419.746	6255793.802	3.225
117	322358.104	6255768.135	2.24		239	322412.187	6255788.502	3.178
118	322351.981	6255759.774	2.211		240	322401.272	6255784.491	3.048
119	322346.073	6255751.236	2.248		241	322390.767	6255779.783	2.326
120	322340.47	6255742.782	2.322		242	322556.188	6255759.823	1.601
121	322334.631	6255734.65	2.287		243	322552.486	6255769.118	1.668
122	322328.755	6255726.699	2.338		244	322548.377	6255777.539	1.681
123	322323.658	6255718.377	2.371		245	322544.142	6255785.831	1.671
124	322317.717	6255710.071	2.4		246	322540.263	6255794.154	1.747
125	322313.069	6255701.791	2.532		247	322536.321	6255802.649	1.633
126	322307.35	6255693.794	2.417		248	322532.254	6255810.831	1.729
127	322301.512	6255686.637	2.372		249	322527.051	6255818.926	1.877
128	322315.419	6255689.276	2.447		250	322521.732	6255826.215	1.959
129	322321.338	6255697.173	2.512		251	322523.281	6255805.93	1.8
130	322326.99	6255704.844	2.492		252	322526.936	6255797.634	1.611
131	322332.42	6255712.501	2.364		253	322531.274	6255789.208	1.733
132	322338.175	6255720.79	2.261		254	322535.596	6255780.385	1.698
133	322343.753	6255729.398	2.228		255	322539.429	6255771.919	1.682
134	322349.245	6255737.742	2.235		256	322543.074	6255762.642	1.71
135	322366.455	6255761.7	2.189		257	322546.752	6255753.701	1.631
136	322411.814	6255827.92	2.213		258	322548.355	6255748.812	1.693
137	322417.679	6255835.968	2.098		259	322536.583	6255750.559	1.795
138	322423.619	6255844.421	2.182		260	322538.057	6255746.176	1.736
139	322326.703	6255862.161	2.067		261	322528.31	6255745.132	1.909
140	322339.657	6255864.806	2.148		262	322522.213	6255744.374	1.981
141	322347.908	6255865.595	2.235		263	322527.306	6255748.289	1.825
142	322366.445	6255868.292	2.359		264	322533.396	6255759.365	1.665
143	322375.938	6255869.547	2.323		265	322529.99	6255767.436	1.747
144	322385.12	6255870.857	2.403		266	322526.074	6255775.808	1.76
145	322394.906	6255872.341	2.427		267	322521.949	6255783.995	1.788
146	322458.451	6255832.285	2.162		268	322517.712	6255792.412	1.862
147	322468.298	6255835.331	2.139		269	322513.701	6255800.968	1.986
148	322476.882	6255839.521	2.209		270	322509.376	6255808.718	2.066
149	322484.746	6255841.916	1.986		271	322501.153	6255804.585	2.231
150	322493.029	6255845.36	2.039		272	322492.852	6255800.167	2.326
151	322501.953	6255848.249	2.046		273	322485.171	6255795.689	2.325
152	322513.34	6255842.365	1.995		274	322477.301	6255791.515	2.368
153	322505.431	6255838.178	2.066		275	322469.984	6255787.555	2.258
154	322496.046	6255833.975	2.109		276	322461.863	6255783.721	2.251
155	322487.397	6255830.768	2.168		277	322455.174	6255780.684	2.304
156	322479.587	6255827.885	2.151		278	322459.494	6255773.573	2.541
157	322470.885	6255825.447	2.21		279	322467.356	6255777.184	2.281
158	322461.887	6255822.564	2.34		280	322474.757	6255780.854	2.196
159	322405.742	6255819.624	2.234		281	322482.221	6255784.838	2.211
160	322400.64	6255812.074	2.307		282	322489.975	6255788.923	2.253
161	322395.468	6255804.773	2.326		283	322497.05	6255793.022	2.258
162	322390.19	6255796.797	2.357		284	322504.542	6255797.275	2.227
163	322384.551	6255789.412	2.343		285	322508.639	6255788.444	1.763
164	322379.399	6255781.503	2.298		286	322513.108	6255780.409	1.896
165	322373.999	6255774.11	2.233		287	322517.232	6255771.252	1.822
166	322358.899	6255752.913	2.203		288	322521.154	6255762.578	1.85
167	322353.046	6255744.498	2.185		289	322525.053	6255754.555	1.767
168	322404.046	6255873.513	2.719		290	322515.721	6255751.679	1.904
169	322440.023	6255854.696	1.74		291	322510.242	6255759.052	2.009
170	322430.448	6255856.136	1.73		292	322507.041	6255767.843	1.964
171	322421.958	6255855.356	2.422		293	322506.185	6255776.441	1.971

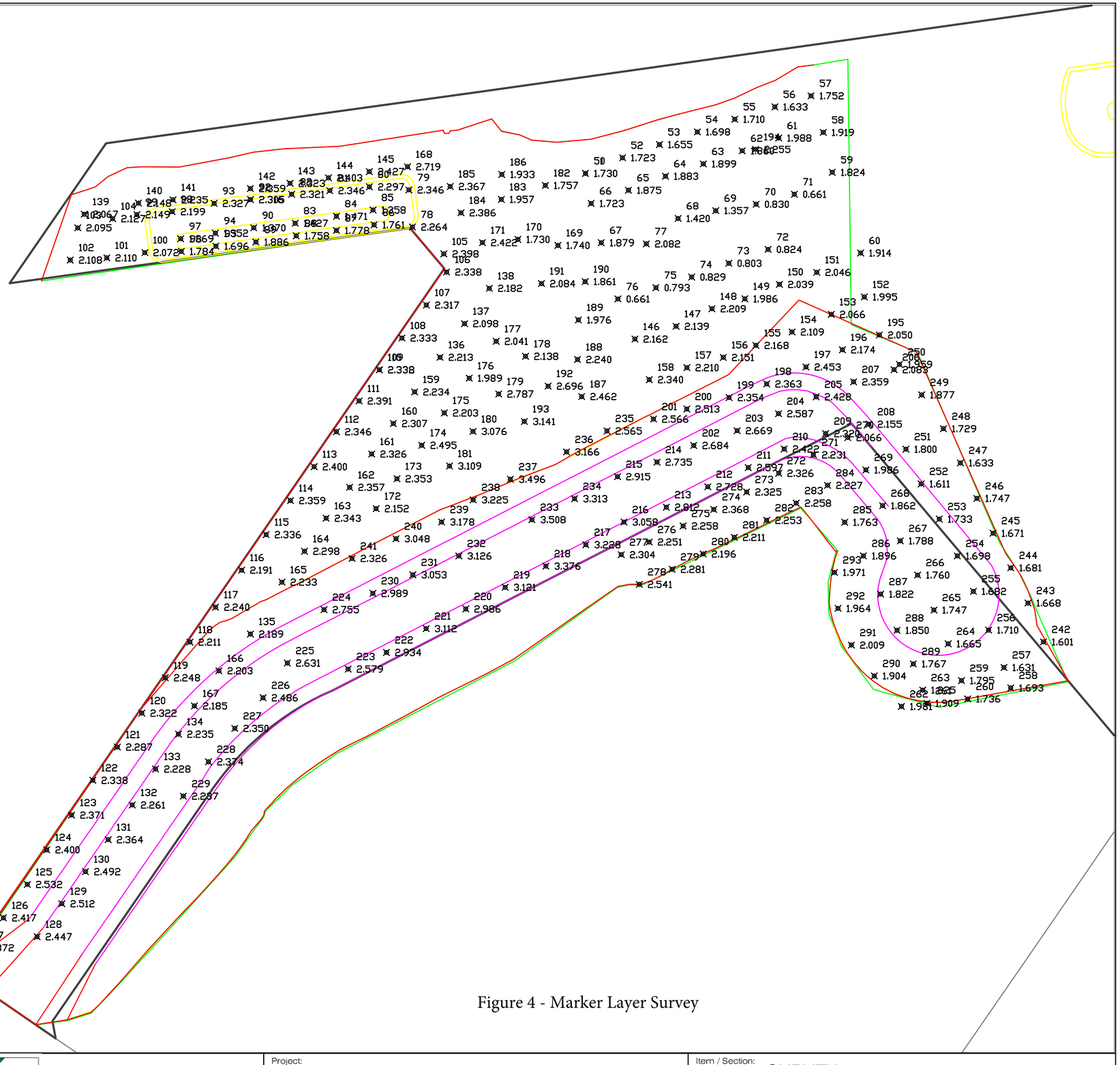

Figure 4 - Marker Layer Survey

Rev.	Issues & Amendments	By	Check'd	App'd	Date
A	SURVEY	RD	TL/TW	TL	4.3.19

FORD CIVIL

Project: WENTWORTH POINT

Client: FORD CIVIL

Drawn: RD | Design: MGA/AHD | Checked: TL | Approved: TL

9 Hattersley street , Arncliffe
NSW, Australia, 2205
P.O. Box 26
Ph. (02) 9597 4122 Fax. (02) 9596 4966

Item / Section: SURVEY

Drawing Title: MARKER LAYER SURVEY

Scale: 1000 A3 | Date: 5.3.2019 | Cad File: 190305 WENT

WCG Project Number: WENT PT | Drawing No: 190305B | Issue: A

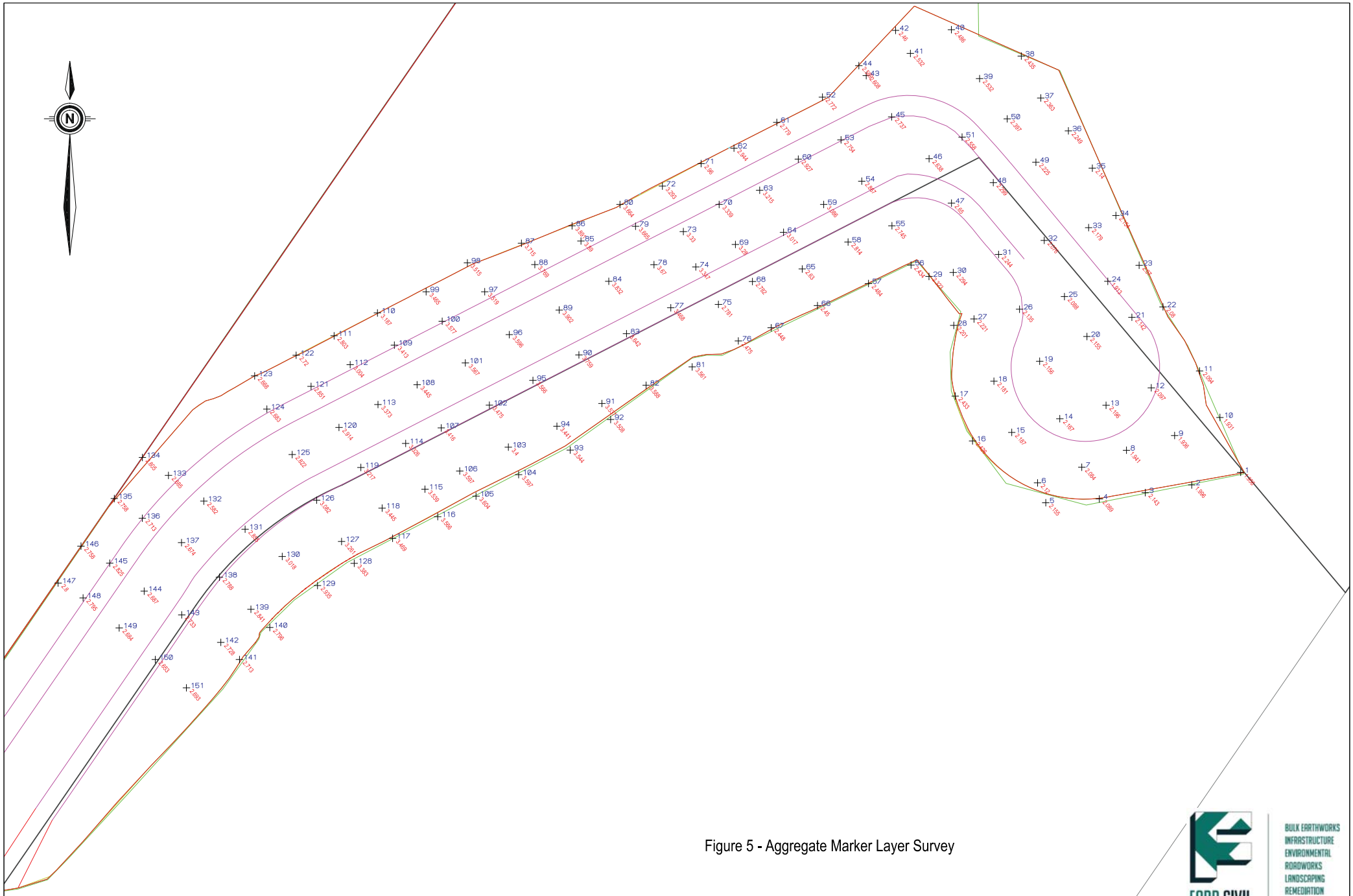

Figure 5 - Aggregate Marker Layer Survey

FORD CIVIL

BULK EARTHWORKS
INFRASTRUCTURE
ENVIRONMENTRL
ROADWORKS
LANDSCAPING
REMEDIATION

Wentworth Point
Aggregate Marker Layer WAE

12d Model
Scale 1:450
Thu May 23 14:51:45 2019

12D PROJECT : Wentworth Point

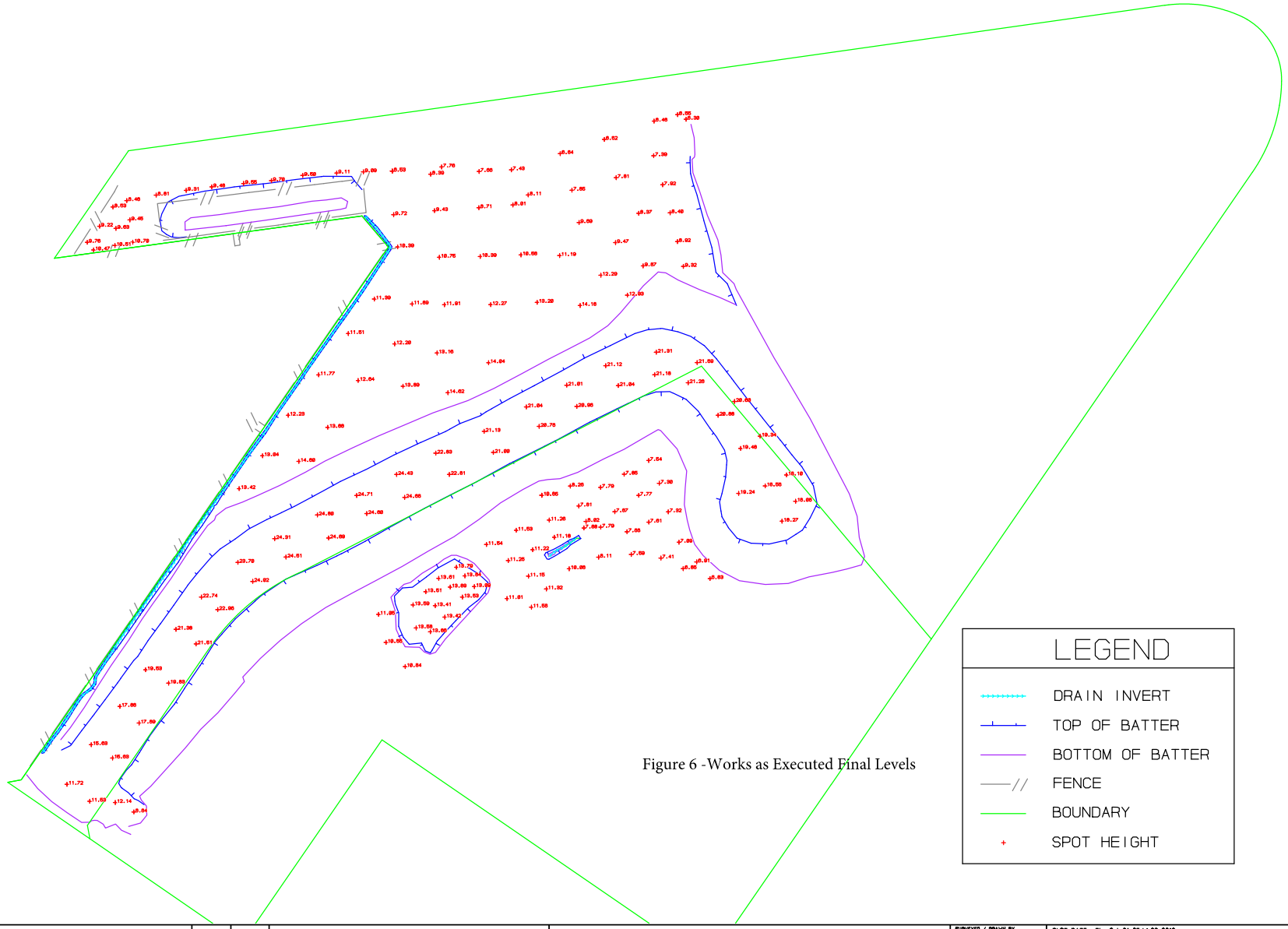

Figure 6 -Works as Executed Final Levels

REV	Notes	APP'D	DATE

GENERAL NOTES / REFERENCES
V DATUM: AHD, H DATUM: MGA ZONE 56

realsurv ENGINEERING SURVEYORS
Ph. 0409207440
www.realsurv.com.au
hamzah@realsurv.com.au

SURVEYED / DRAWN BY: HD
CHECKED:
SCALES AT A3: Horiz 1:4000 Vert 1:4000

PLOT DATE: Thu Oct 31 05:46:23 2019

WENTWORTH POINT WAE

Ford Civil - Wentworth Point

DRAWING STATUS: 24/10/2019
DRAWING No. 1: 001
REV.: A

Scale at 1:1000 0 10 20 30 40 50 60 70 80 90 100