REPORT TO

HAMMONDCARE

ON

ACID SULFATE SOIL ASSESSMENT

FOR

PROPOSED HOSPITAL REDEVELOPMENT

AT

GREENWICH HOSPITAL, 97-115 RIVER ROAD, GREENWICH, NSW

Date: 5 May 2022
Ref: E32507BRrpt3Rev2

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E32507BRrpt3	Final Report	18 February 2022
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Attachments

Abbreviations

Asphaltic Concrete	**AC**
Actual Acid Sulfate Soil	**AASS**
Australian Height Datum	**AHD**
Additional Site Investigation	**ASI**
Acid Sulfate Soil	**ASS**
Acid Sulfate Soil Management Advisory Committee	**ASSMAC**
ASS Management Plan	**ASSMP**
Below Ground Level	**BGL**
Borehole	**BH**
Calcium Carbonate	**$CaCO_3$**
Chain of Custody	**COC**
Department of Planning and Environment	**DPE**
Environmental Investigation Services	**EIS**
Environmental Protection Agency	**EPA**
Environmental Site Assessment	**ESA**
JK Environments	**JKE**
JK Geotechnics	**JKG**
National Association of Testing Authorities	**NATA**
National Environmental Protection Measure	**NEPM**
Potential ASS	**PASS**
Field pH	**pH_F**
Field Peroxide pH	**pH_{FOX}**
Practical Quantitation Limit	**PQL**
Reduced Inorganic Sulfur	**RIS**
Relative Level	**RL**
Sulfur	**S**
Chromium Reducible Sulfur	**SCr**
Secretary Environmental Assessment Requirements	**SEARs**
Standard Penetration Test	**SPT**
State Significant Development Application	**SSDA**
Standard Sampling Procedure	**SSP**
Standing Water Level	**SWL**
Test Pit	**TP**

Units

Kilograms	**kg**
Metres BGL	**mBGL**
Metres	**m**
Millimetres	**Mm**
Moles Hydrogen per Tonne	**Mol H^+/t**
Percentage by Mass	**%w/w**

1 INTRODUCTION

HammondCare ('the client') commissioned JK Environments (JKE) to undertake an acid sulfate soil (ASS) assessment for the proposed hospital redevelopment at Greenwich Hospital, 97-115 River Road, Greenwich, NSW.

This ASS assessment report is to be submitted to the Department of Planning and Environment (DPE) in support of a State Significant Development Application (SSD-13619238) for the redevelopment of Greenwich Hospital into an integrated hospital and seniors living facility on land identified as 97-115 River Road, Greenwich, NSW (the site). The extent of the site is shown below.

The subject proposal is for the detailed design and construction of the facility following its concept approval under SSD-8699. Specifically, SSD-13619238 seeks approval for the following:

- Demolition of the existing hospital building and associated facilities at the site;
- Construction of a new hospital facility and integrated healthcare campus comprising of hospital, residential aged care, seniors housing, overnight respite, across:
  - A new main hospital building up to RL 80.0;
  - Two new seniors living buildings, Northern building up to RL 56.36, and Southern building up to RL 60.65;
  - A new 2-3 storey respite care building up to RL 56.9;
- Construction of associated site facilities and services, including pedestrian and vehicular access and basement parking;
- Site landscaping and infrastructure works; and
- Preservation of Pallister House which will continue to host dementia care and administrative functions.

JKE note that the development plans issued to JKE on 20 April 2022 indicate the new main hospital building is to be constructed above set-down and mezzanine levels. The buildings will be terraced to account for the slope of the site.

In accordance with section 4.39 of the Environmental Planning & Assessment Act 1979 (EP&A Act), the Secretary's Environmental Assessment Requirements (SEARs) for SSD-13619238 were issued on 24 February, 2021. This report has been prepared to respond to the following SEARs:

SEAR	Relevant section of report
17. Soil and Water. An assessment of salinity and acid sulphate soil impacts, including a Salinity Management Plan (SMP) and/or Acid Sulphate Soils Management Plan (ASSMP), where relevant.	This report relates to the assessment of acid sulphate soils impacts. The results of the assessment are presented in Section 5. The conclusions of the assessment are presented in Section 6. The assessment of salinity impacts is presented in a separate report (E32507Brpt4Rev1, dated 8 April 2022)[1].

1.1 Proposed Development Details

JKE has reviewed the development plans prepared by Bickerton Masters (DD-SW-0200 to 0210, dated 8 April 2022). Based on review of these plans, we understand the proposed development includes:

- The demolition of the existing hospital building and associated facilities (excluding Pallister House);
- Construction of the main hospital building and two serviced seniors living buildings constructed over 1-2 levels of carparking;
- The proposed lowest (basement) car park finished floor reduced level (RL) will be formed at between RL37.95m Australian Height Datum (AHD) and RL38.6mAHD;
- Construction of a new 2-3 storey respite care building to the east of the main building; and
- Reconfiguration of the surrounds including new access roads, external parking areas, walkways and landscaped areas.

The proposed development includes major earthworks (cut/fill) over the majority of the site to achieve the development levels. The maximum cut is anticipated to be approximately 14m below ground level (BGL).

Selected development plans issued to JKE are attached in the appendices.

1.2 Aim and Objectives

The primary aim of the assessment was to assess the potential for ASS occurrence at the site. The objectives were to:

[1] JKE, (2022b). *Report to HammondCare on Salinity Investigation for Proposed Hospital Redevelopment at Greenwich Hospital, 97-115 River Road, Greenwich, NSW.* (Ref: E32507BRrpt4Rev1) (referred to as Salinity Report)

- Review relevant desktop information relating to ASS occurrence;
- Inspect the sub-surface soil conditions via an intrusive investigation;
- Analyse a selection of soil samples for ASS characteristics;
- Review and interpret the results in comparison to relevant action criteria; and
- Assess the need to prepare an ASS management plan (ASSMP).

1.3 Scope of Work

The assessment was undertaken generally in accordance with a JKE proposal (Ref: EP53931BR) of 14 April 2021 and written acceptance in the form of a purchase order (PO No: 28737) issued by the client on 29 September 2021. The scope of work included the following:

- Review of relevant desktop information presented in the Lotsearch report, including regional geology information and ASS risk;
- Soil sampling from a total of eight boreholes drilled for the concurrent ASI;
- Analysis of selected soil samples for ASS characteristics using field tests and acid base accounting methods;
- Review and interpretation of the results against relevant ASS indicators and action criteria; and
- Preparation of a report.

The scope of work was undertaken with reference to the *National Acid Sulfate Soil Guidance: National acid sulfate soils sampling and identification methods manual* (2018)[2], the *National Acid Sulfate Soil Guidance: National acid sulfate identification and laboratory methods manual* (2018)[3] (collectively referred to as the National Acid Sulfate Soil Guidance (2018) documents) and the Acid Sulfate Soil Manual (1998)[4]. A list of reference documents/guidelines is included in the appendices.

1.4 Background Information on Acid Sulfate Soils

ASS materials include potential acid sulfate soils (PASS or sulfidic soil materials) and actual acid sulfate soils (AASS or sulfuric soil materials). These are often found in the same profile, with AASS overlying PASS. AASS and PASS are defined further as follows:

- PASS are soil materials which contain Reduced Inorganic Sulfur (RIS) such as pyrite. The field pH of these soils in their undisturbed state is usually more than pH 4 and is commonly neutral to alkaline (pH 7–9). These soil materials are invariably saturated with water in their natural state. Their texture may be peat, clay, loam, silt or sand and is often dark grey in colour and soft in consistence, but these materials may also exhibit colours that are dark brown, or medium to pale grey to white; and
- AASS are soil materials which contained RIS such as pyrite that have undergone oxidation. This oxidation results in low pH (that is pH less than 4) and often a yellow (jarosite) and/or orange to red mottling (ferric iron oxides) in the soil profile. Actual ASS contains Actual Acidity, and commonly also contains RIS (the source of Potential Sulfuric Acidity) as well as Retained Acidity.

[2] Sullivan. L (et al), (2018). *National Acid Sulfate Soils guidance: National acid sulfate soils sampling and identification methods manual*
[3] Sullivan. L (et al), (2018). *National Acid Sulfate Soils guidance: National acid sulfate soils identification and laboratory methods manual*
[4] Acid Sulfate Soils Management Advisory Committee (ASSMAC), (1998). *Acid Sulfate Soils Manual* (referred to as ASS Manual 1998)

Further background information on ASS and the assessment process is provided in the appendices.

2 SITE INFORMATION

2.1 Summary of Previous Investigations

A Detailed Site Investigation (DSI) was previously undertaken by JKE in 2019[5]. The DSI included:

- A review of site information and site history information, including a Preliminary Site Investigation (PSI) prepared by Douglas Partners (DP) in 2018;
- A walkover site inspection;
- Soil sampling from 30 borehole locations; and
- Groundwater sampling from three monitoring wells installed at the site.

The DSI was reviewed for relevant geological and ASS risk and planning information.

The site information indicated that the site was underlain by Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses. The ASS risk information indicated the site was not in an ASS risk area.

The intrusive investigation identified asphaltic concrete (AC)/concrete pavements in 12 locations, ranging in thickness from 45mm to 170mm. Fill was encountered at the surface or beneath the pavement in all boreholes, and extended to depths of approximately 0.2mBGL to 4.1mBGL. The fill typically comprised silty and/or sandy, clay, gravel and sand, with inclusions of igneous, ironstone, quartz and sandstone gravel, root fibres, ash, slay, clay nodules, building rubble and mulch.

Residual soils, comprised of clayey sand, sandy clay and sand, were encountered beneath the fill in nine locations at depths of approximately 0.3mBGL to 2.2mBGL. Sandstone bedrock was encountered beneath the fill or natural soils at depths of approximately 0.3mBGL to 3.9mBGL.

All boreholes remained dry during and on completion of drilling. The three monitoring wells were reviewed one week after installation, two of which were dry. The standing water level (SWL) in MW7 was measured at 6.35mBGL. The groundwater relative level (RL) calculated on this measurement was RL46.25m.

2.2 Site Identification

Table 2-1: Site Identification

Current Site Owner:	HammondCare
Site Address:	97-115 River Road, Greenwich, NSW
Lot & Deposited Plan:	Lot 3 and Lot 4 in DP584287
Current Land Use:	Hospital
Proposed Land Use:	Hospital and Seniors Living

[5] JKE, (2019). *Report to HammondCare on Detailed Site Investigation (DSI) for Proposed Hospital Redevelopment at Greenwich Hospital, 97-115 River Road, Greenwich, NSW.* (Ref: E32507BTrptRev1) (referred to as JKE DSI)

Local Government Authority (LGA):	Lane Cove Municipal Council
Development Area (m^2) (approx.):	23,700
RL (AHD in m) (approx.):	36-51
Geographical Location (decimal degrees) (approx. centre of site):	Latitude: -33.827404 Longitude: 151.183875
Site Location Plan:	Figure 1
Sample Location Plan:	Figure 2

2.3 Site Description

The site is located in a predominantly residential area of Greenwich. The site is bounded by River Road to the north and St Vincents Road to the east. The site is located approximately 75m to the north-east of the Gore Creek and 275m to the north-east of the Lane Cove River.

At the time of the inspection, the main hospital buildings were located in the central to west portion of the site and include wards, theatres, two gas-fired boiler units, two emergency generators, clinical and general waste facilities, oxygen storage and maintenance equipment. A building to the east of the main hospital building contained non-clinical facilities. The main hospital buildings were a mix of brick, fibre cement, and concrete construction typically on concrete slab and between one and four storeys. Reference should be made to Figures 1 and 2 in the appendices for further details.

2.4 Regional Geology

A review of the regional geological information presented in the Lotsearch report indicated the site is underlain by Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses.

2.5 Acid Sulfate Soil Risk and Planning

The site is not located in an ASS risk area according to the maps prepared by Department of Land and Water Conservation. Information presented in the Lotsearch report indicated that site is classed as having extremely low probability of ASS occurrence.

2.6 Lane Cove Council Local Environmental Plan (LEP) 2009

A review of the Lance Cove Council LEP indicates that the site is not located in an area identified as Risk Class 1, 2, 3, 4 or 5 land. Reference should be made to Appendix C for further information regarding ASS risk classes.

3 INVESTIGATION REQUIREMENTS AND ASSESSMENT CRITERIA

3.1 Investigation Requirements

The National Acid Sulfate Soil Guidance (2018) requires sampling to a depth of 1m beyond the depth of disturbance (including the depth of any groundwater disturbance). A summary of the sampling densities and analysis requirements is provided in the following tables:

Table 3-1: Minimum Soil Sampling Densities for ASS Investigations

Type of disturbance	Extent of site	Sample point frequency
Small volumes (≤ 1000 m^3) – prior to disturbance	Volume of disturbance (m^3) < 250 251–500 501–1000	Number of boreholes 2 3 4
Large volumes (> 1000 m^3) – prior to disturbance	Project area (ha) <1 1-2 2-3 3-4 >4	Number of boreholes 4 6 8 10 10 plus 2 per additional hectare
Linear	Width and volume Minor[1] Major[2]	Intervals (m) 100 50
Existing stockpiles & verification testing	Volume (m^3) <250 251-500 1,000 >1,000	Number of samples 2 3 4 4 plus 1 per additional 500m^3

[1] Minor Linear Disturbance – for example underground services, narrow shallow drains (less than 1 m below ground level).
[2] Major Linear Disturbance – for example roads, railways, canals, deep sewer, wide drains, deep drains and dredging projects[#].
[#] Further guidance is provided in the Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management (Simpson et al. 2017).

Table 3-2: Minimum Number of Soil Samples to be Submitted for Laboratory Analysis (small-scale disturbance)

Volume of disturbed soils	Maximum disturbance depth			
	< 1 m	1–2 m	2-3 m	3-4 m
≤ 250m^3	3	4	5	6
251–500m^3	4	5	6	7
500–1,000m^3	5	6	7	8

Note: Small scale is considered less than or equal to 1,000 m^3 and does not involve dewatering or groundwater pumping (excluding linear disturbances). Number of samples to be analysed per total volume of soil to be disturbed, not per borehole. Depth of disturbance to be measured from ground surface. Borehole depth must be at least 1 m below maximum proposed depth of disturbance.

The investigation component of this assessment was designed to address the minimum sampling point frequency in terms of spatial coverage (i.e. minimum of 8 boreholes based on the site area of approximately 23,700m^2). It is acknowledged that the vertical distribution and frequency of samples analysed did not meet the minimum requirements outlined in the National ASS Guidance (2018) documents. Specifically, samples were not recovered at 0.25m intervals for field tests, and 0.5m intervals for laboratory analysis using acid base accounting methods. The sampling intervals adopted for this investigation are shown on the respective borehole logs attached in the appendices. Based on the extremely low probability of ASS occurrence, JKE are of the opinion that the sampling and analysis intervals adopted are appropriate for the purpose of this investigation.

3.2 Action Criteria

The action criteria presented in the National Acid Sulfate Soil Guidance (2018) documents are summarised in the following table:

Table 3-3: ASS Action Criteria Based on Soil Texture and Volume of Material Being Disturbed

Type of material		**Net Acidity**			
Texture range* (NCST 2009)	Approximate clay content (%)	1–1000 t materials disturbed		> 1000 t materials disturbed	
		% S-equiv. (oven-dried basis)	mol H^+/t (oven-dried basis)	% S-equiv. (oven-dried basis)	mol H^+/t (oven-dried basis)
Fine - light medium to heavy clays	>40	≥0.10	≥62	≥0.03	≥18
Medium - clayey sand to light clays	5–40	≥0.06	≥36	≥0.03	≥18
Coarse and Peats - sands to loamy sands	<5	≥0.03	≥18	≥0.03	≥18

* If bulk density values are not available for the conversion of cubic meters to tonnes of soil, then default bulk densities, based on the soil texture, may be used.

The action criteria for coarse texture soils were used for this assessment to account for the large volume of material to be disturbed.

3.3 Field Tests

The soil field tests commonly used for investigations for ASS materials include field pH (pH_F) and field pH peroxide (pH_{FOX}) tests. The pH_F test can help identify Actual ASS. While a pH_F of less than or equal to pH 4 is indicative of the presence of Actual ASS, it is not conclusive of the presence of ASS on its own, as naturally occurring, non-ASS soils such as many organic soils (for example peats) and heavily leached soils may also have pH_F less than or equal to pH 4. To identify an Actual ASS other evidence must be presented that indicates the low pH_F has been mainly caused by the oxidation of reduced inorganic sulfur. Such information includes the presence of jarosite in the soil layer/horizon, or the location of other Actual ASS or PASS materials within the sampling location or in the nearby vicinity.

The difference between the pH_F and the pH_{FOX} is helpful in the preliminary identification of PASS. Combined, the pH_F and pH_{FOX} results can be a useful aid with soil sample selection for laboratory analysis. Additional Information in relation to interpretation of the pH field tests is provided in the appendices.

4 SAMPLING AND ANALYSIS PLAN

The sampling and analysis for this assessment was conducted generally in accordance with the Sampling, Analysis and Quality Plan (SAQP)[6] prepared for the additional investigations. Reference should be made to the SAQP for detailed information. A summary of the sampling and analysis methods is provided in the following sub-sections.

4.1 Subsurface Investigation and Soil Sampling Methods

Field work was undertaken between 27 September 2021 and 6 October 2021. Soil samples were collected from nine locations (BH101, BH102, BH104 to BH109 and BH119) in conjunction with the ASI, to a maximum borehole depth of approximately 4.1mBGL (approximate maximum depth to rock). The sampling locations are shown on the attached Figure 2.

The borehole locations were drilling using a track-mounted drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) sampler or directly from the auger when conditions did not allow use of the SPT sampler.

Soil samples were obtained at various depths, based on observations made during the field investigation. All samples were placed in plastic bags and sealed with plastic ties with minimal headspace. Each sample was labelled with a unique job number, the sampling location, sampling depth and date. All samples were recorded on the borehole and test pit logs attached in the appendices.

The samples were preserved by immediate storage in an insulated sample container with ice and frozen upon return to the JKE office at the completion of each day of soil sampling. Samples were subsequently delivered in the insulated sample container (on ice or with ice packs) to a NATA registered laboratory for analysis under standard chain of custody (COC) procedures. Additional samples were frozen and stored pending further analysis.

4.2 Laboratory Analysis

Samples for this assessment were analysed for ASS field tests (including pH_F and pH_{FOX}) and using the chromium reducible sulfur (S_{CR}) acid base accounting analytical methods. All tests/analysis were performed at the laboratory and JKE did not carry out the testing in the field due to WHS constraints. Samples were Analysed by Envirolab Services (NATA Accreditation Number – 2901). Reference should be made to the laboratory report (Ref: 279440-B, 279440-C, 280020 and 280020-A) attached in the appendices for further information regarding the laboratory methods used.

[6] JKE, (2021). *Report to TSA Management on Sampling, Analysis and Quality Plan (SAQP) for Additional Site Investigation at 97-115 River Road, Greenwich, NSW*. (Ref: E32507BRrpt2-SAQP) (Referred to as SAQP).

5 RESULTS OF THE INVESTIGATION

5.1 Subsurface Conditions

A summary of the subsurface soil conditions encountered during the investigation is presented in the table below. For completeness, the summary below includes details from all boreholes drilled for the concurrent ASI. Reference should be made to the borehole logs attached in the appendices for further details.

Table 5-1: Summary of subsurface conditions

Profile	Description (depth in m below ground level)
Pavement	Asphaltic concrete (AC) pavements were encountered at the surface in BH101 to BH106, BH109, BH114, BH116 and BH119 and ranged in thickness from 20mm to 100mm. Concrete pavement was encountered at the surface in BH112 and was 220mm thickness.
Fill	Fill was encountered at the surface or beneath the pavement in all boreholes and extended to depths of approximately 0.1mBGL (BH116) to 4.1mBGL (BH104). BH111 and BH117 were terminated in the fill at approximate depths of 0.8mBGL and 1.5mBGL. The fill typically comprised silty gravelly sand, sandy clay and silty clay, with occasional silty sand, clayey sand and sandy gravel, with inclusions of igneous, ironstone, sandstone and siltstone gravel, ash, slag, root fibres and building rubble (asphalt, brick, tile, ceramic, glass, metal and plastic fragments). Organic odours were not encountered in the fill during the assessment.
Natural Soil	Residual sandy clay, silty clay and silty sand was encountered beneath the fill in BH103, BH105, to BH107, BH109, BH110A, BH113 to BH116 and BH118 at depths of approximately 0.2mBGL (BH114) to 1.6mBGL (BH118). Organic odours were not encountered in the natural soils during the assessment.
Bedrock	Sandstone bedrock was encountered beneath the fill in BH101, BH102, BH104, BH108, BH112 and BH119, and beneath the residual soils in BH105 to BH107, BH109 and BH116 at depths of approximately 0.3mBGL (BH119) to 4.1mBGL (BH104). A layer of siltstone approximately 500mm thick was encountered within the sandstone bedrock at a depth of approximately 11mBGL in BH109. The siltstone was assessed to be of low strength.
Groundwater	All boreholes were dry during and on completion of auger drilling. Potable water was introduced during core drilling activities, which inhibits meaningful groundwater seepage measurements during drilling.

5.2 Laboratory Results

The soil laboratory results were assessed against the action criteria adopted for the assessment. The results are presented in the attached report tables and are summarised in the following table.

Table 5-2: Summary of Results

Analysis	N	Comments
pH_F and pH_{FOX}	27	The pH_F results ranged from pH 4.5 to pH 12. The pH_{FOX} results ranged from pH 3.8 to pH 10.7. The maximum difference from pH_F to PH_{FOX} was 2.8 pH units.
pH_{FOX} reaction rates	27	Reaction rates ranged from low to volcanic. Nine samples recorded volcanic/extreme reactions. All other reactions were classed as low or medium. The pH_F results, pH_{FOX} results, and reaction rates indicated that some of the soils may contain PASS. JKE note that the samples with volcanic/extreme reactions resulted in differences from pH_F to PH_{FOX} of up to 2.8 pH units. The lowest pH_{FOX} value for samples with volcanic/extreme reactions was pH 3.8. Six samples were selected for analysis of ASS characteristics using acid base accounting methods. The samples were selected based on a combination of the pH_F results, pH_{FOX} results, and reaction rates, and to provide spatial coverage and vertical distribution of the soil/rock profiles.
Net Acidity % S-equiv.	6	The net acidity results ranged from below the laboratory PQL to 0.1%S. The net acidity (%/S) results were equal to or exceeded the action criterion in two samples collected from BH105 (1.5-1.7m) and BH108 (0.1-0.4m).
Net Acidity mol H^+/t	6	The net acidity results ranged from below the laboratory PQL to 65 mol H^+/t. The net acidity (mol H^+/t) results exceeded the action criterion in two samples collected from BH105 (1.5-1.7m) and BH108 (0.1-0.4m).
S_{CR}%	6	The S_{CR}% results ranged from below the laboratory PQL to 0.005 S_{CR}%. These results indicated that the soils did not contain oxidisable sulfur concentrations.
Liming Rate	6	The liming rate required for neutralisation ranged from <0.75kg$CaCO_3$/tonne to 4.9kg$CaCO_3$/tonne.

N: Total number (primary samples)

6 CONCLUSION

The results of the field tests and other laboratory results identified acidic conditions greater than the action criteria. However, these results are considered to be indicative of acid soils associated with organic/humic material rather than ASS materials as significant concentrations of oxidisable sulfur, demonstrated by the low S_{CR}% results, were not encountered in the samples.

As such, and considering the information reviewed for this assessment (risk maps, subsurface conditions etc), PASS or AASS conditions that would be expected to pose a risk to the environment, if disturbed, during the proposed development works described in Section 1.1 have not been identified. On this basis, an ASSMP is not considered necessary for the proposed development.

JKE consider that the report objectives outlined in Section 1.2 have been addressed.

7 LIMITATIONS

The report limitations are outlined below:

- JKE accepts no responsibility for any unidentified AASS or PASS issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the JKE proposal; and terms of contract between JKE and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- JKE have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or land use. JKE should be contacted immediately in such circumstances;
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose;
- Copyright in this report is the property of JKE. JKE has used a degree of care, skill and diligence normally exercised by consulting professionals in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report;
- If the client, or any person, provides a copy of this report to any third party, such third party must not rely on this report except with the express written consent of JKE; and
- Any third party who seeks to rely on this report without the express written consent of JKE does so entirely at their own risk and to the fullest extent permitted by law, JKE accepts no liability whatsoever, in respect of any loss or damage suffered by any such third party.

Important Information About This Report

These notes have been prepared by JKE to assist with the assessment and interpretation of this report.

The Report is based on a Unique Set of Project Specific Factors
This report has been prepared in response to specific project requirements as stated in the JKE proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- The proposed land use is altered;
- The defined subject site is increased or sub-divided;
- The proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- The proposed development levels are altered, eg addition of basement levels; or
- Ownership of the site changes.

JKE will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by JKE to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is based on Professional Interpretations of Factual Data
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Assessment Limitations
Although information provided by a site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Site Assessments by Design Professionals

Costly problems can occur when other design professionals develop plans based on misinterpretation of an assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Assessment Report

Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely

Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

Appendix A: Report Figures

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the Environmental report.

Title: **SITE LOCATION PLAN**

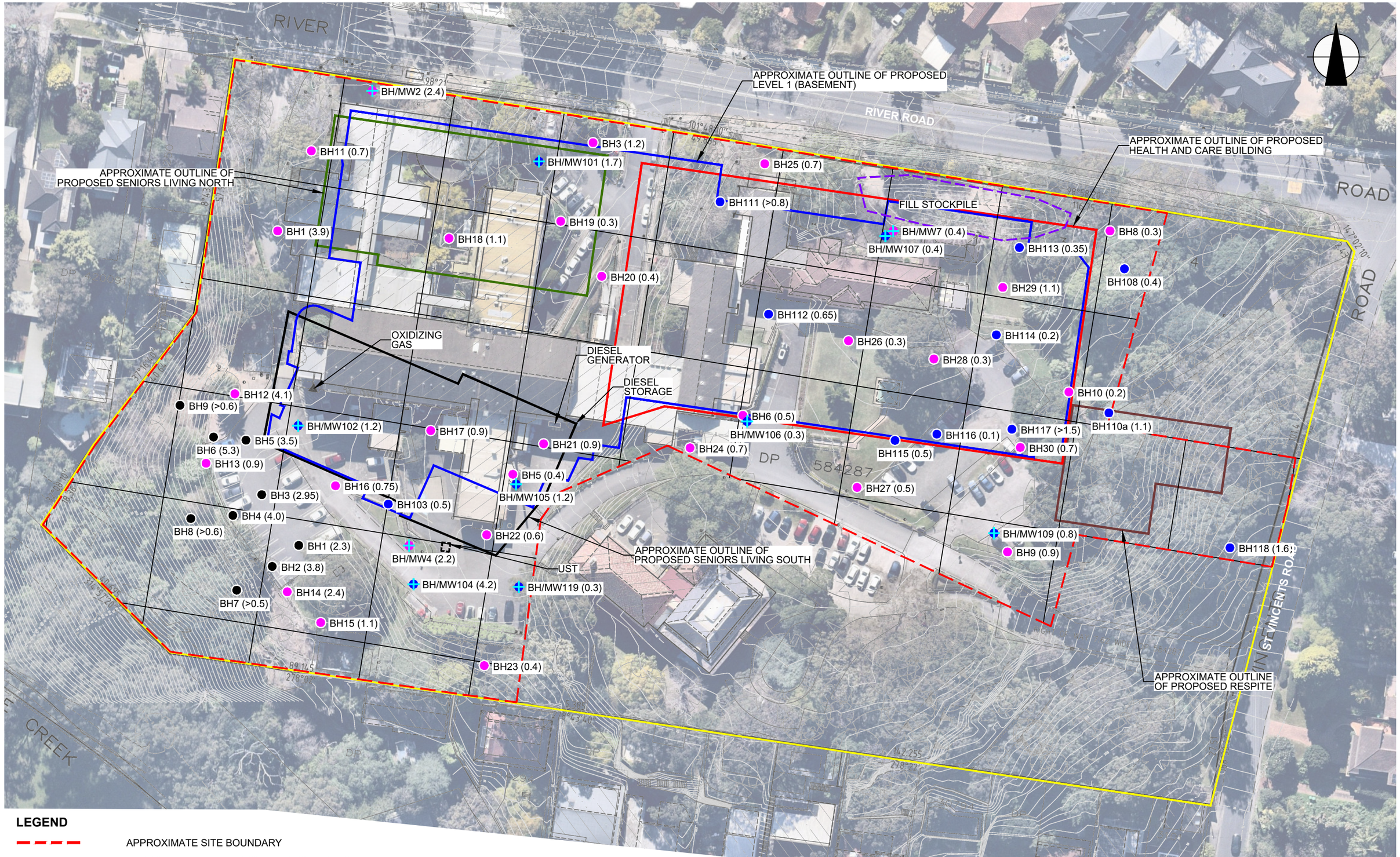
Location: 95-115 RIVER ROAD, GREENWICH, NSW

Project No: E32507BR

Figure No: 1

JKEnvironments

PLOT DATE: 16/09/2021 10:48:31 AM DWG FILE: Z:\S EIS\SC EIS JOBS\32000'S\SE32507BT GREENWICH\CAD\BRIE32507BR.DWG



LEGEND

APPROXIMATE SITE BOUNDARY	
APPROXIMATE WIDER PROPERTY BOUNDARY	
BH(Fill Depth)	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2019)
BH/MW(Fill Depth)	BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2019)
BH/MW(Fill Depth)	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (EIS, 2014)
BH(Fill Depth)	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)
BH(Fill Depth)	BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m)

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 8 16 24 32 40

SCALE 1:800 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **SAMPLE LOCATION PLAN**

Location: 95-115 RIVER ROAD, GREENWICH, NSW

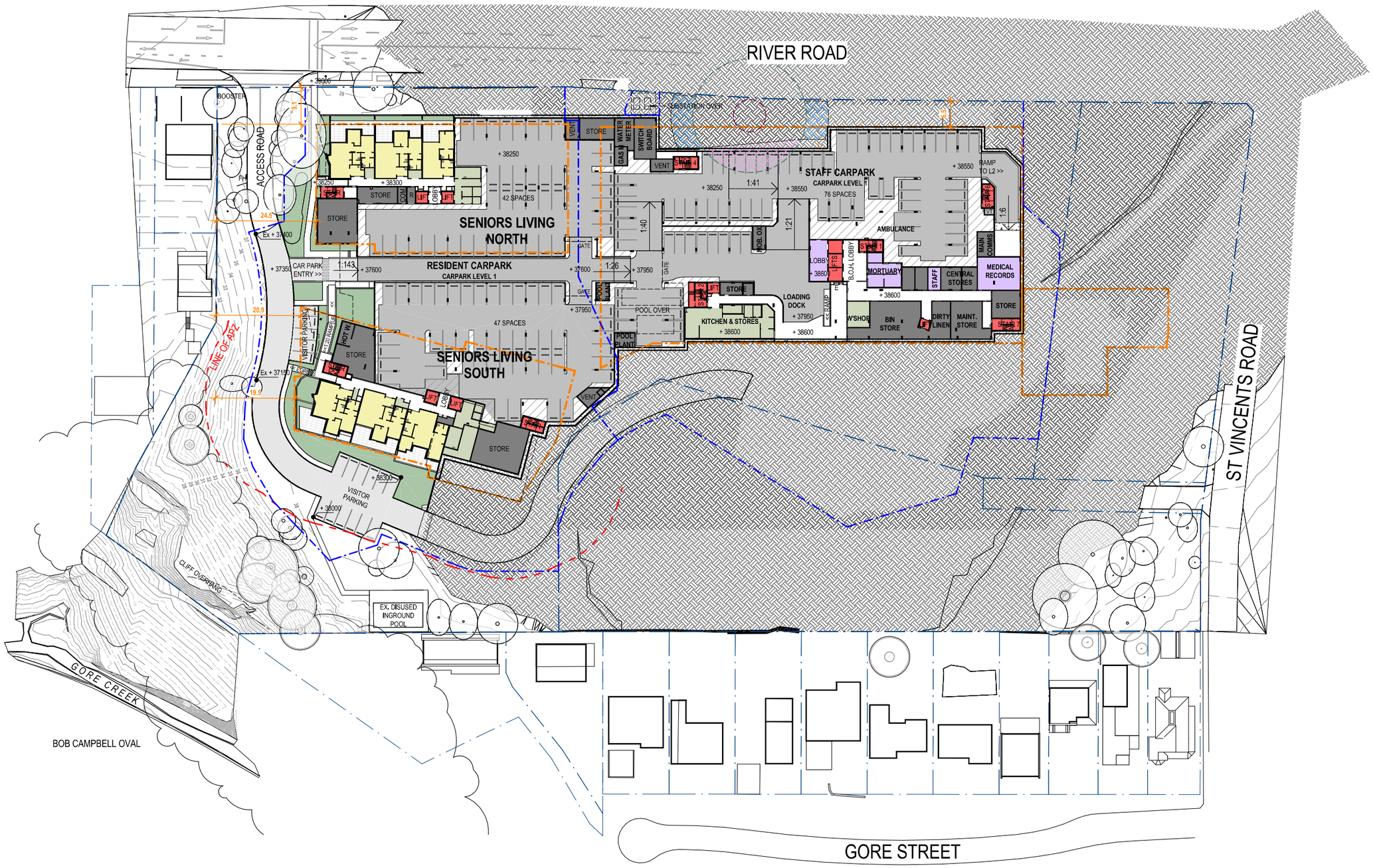
Project No: E32507BR

Figure No: 2

JKEnvironments

PLOT DATE: 9/02/2022 9:40:08 AM DWG FILE: S:\5 EIS\5C EIS JOBS\32000'S\E32507BT GREENWICH\CAD\BRE32507BR.DWG

Appendix B: Selected Development Plans



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P18	2022.03.28	SSD UPDATE	NAH
P17	2022.03.25	ISSUE TO CONSULTANTS	AMac
P16	2022.03.18	ISSUE TO CONSULTANTS	AMac
P15	2022.03.16	SSD UPDATE	NAH

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PROJECT: 01605
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REVISION: P20
DATE: 01/11/21
DRAWING TITLE: SITE LEVEL PLAN - LEVEL 1 (BASEMENT)

DRAWING No: DD-SW-0200

DRAWN: NAH CHECKED: SCALE: 1 : 500 @A1

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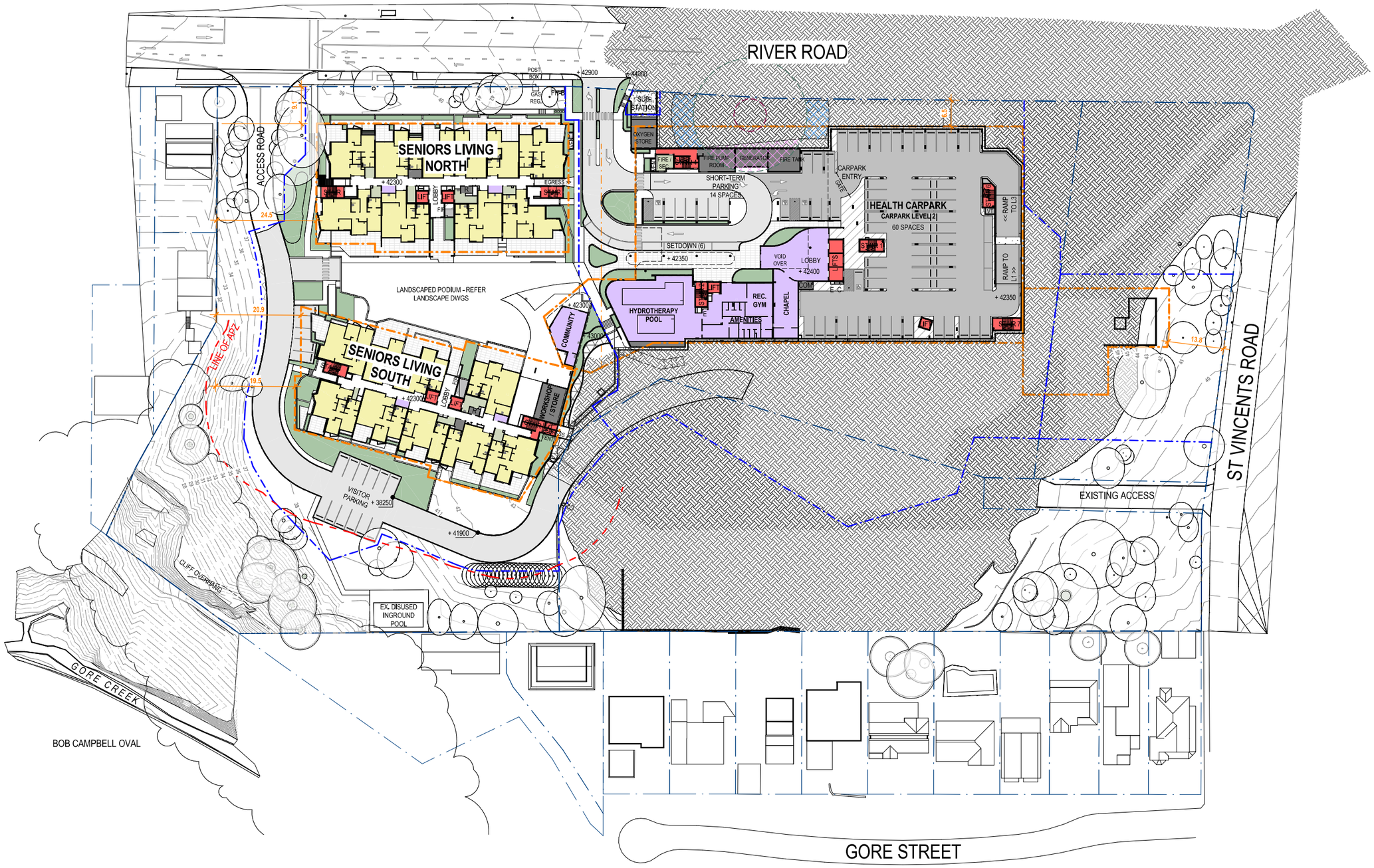

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P15	2022.03.16	SSD UPDATE	NAH

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DRAWING No: DD-SW-0201

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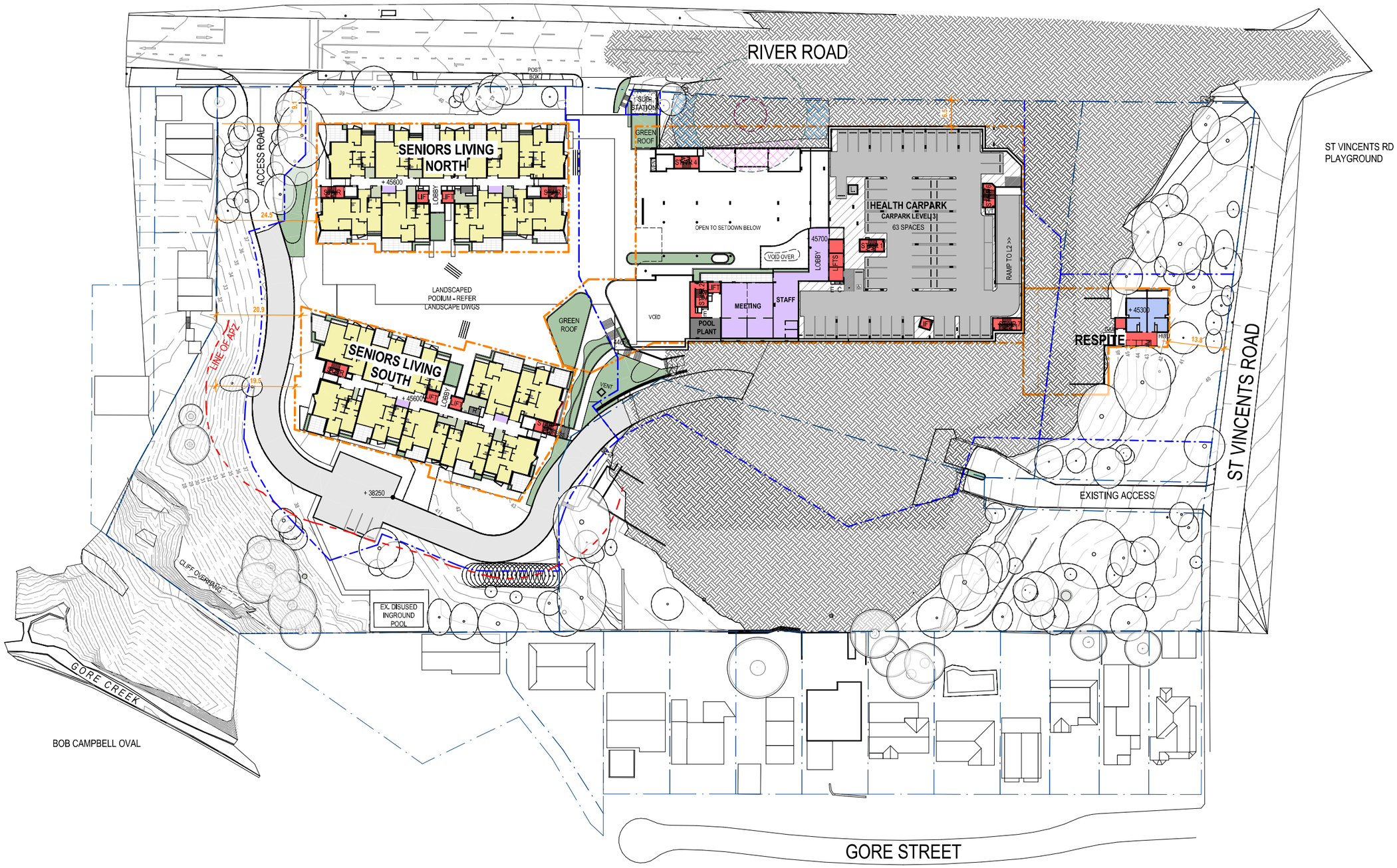

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DATE: 11/04/21

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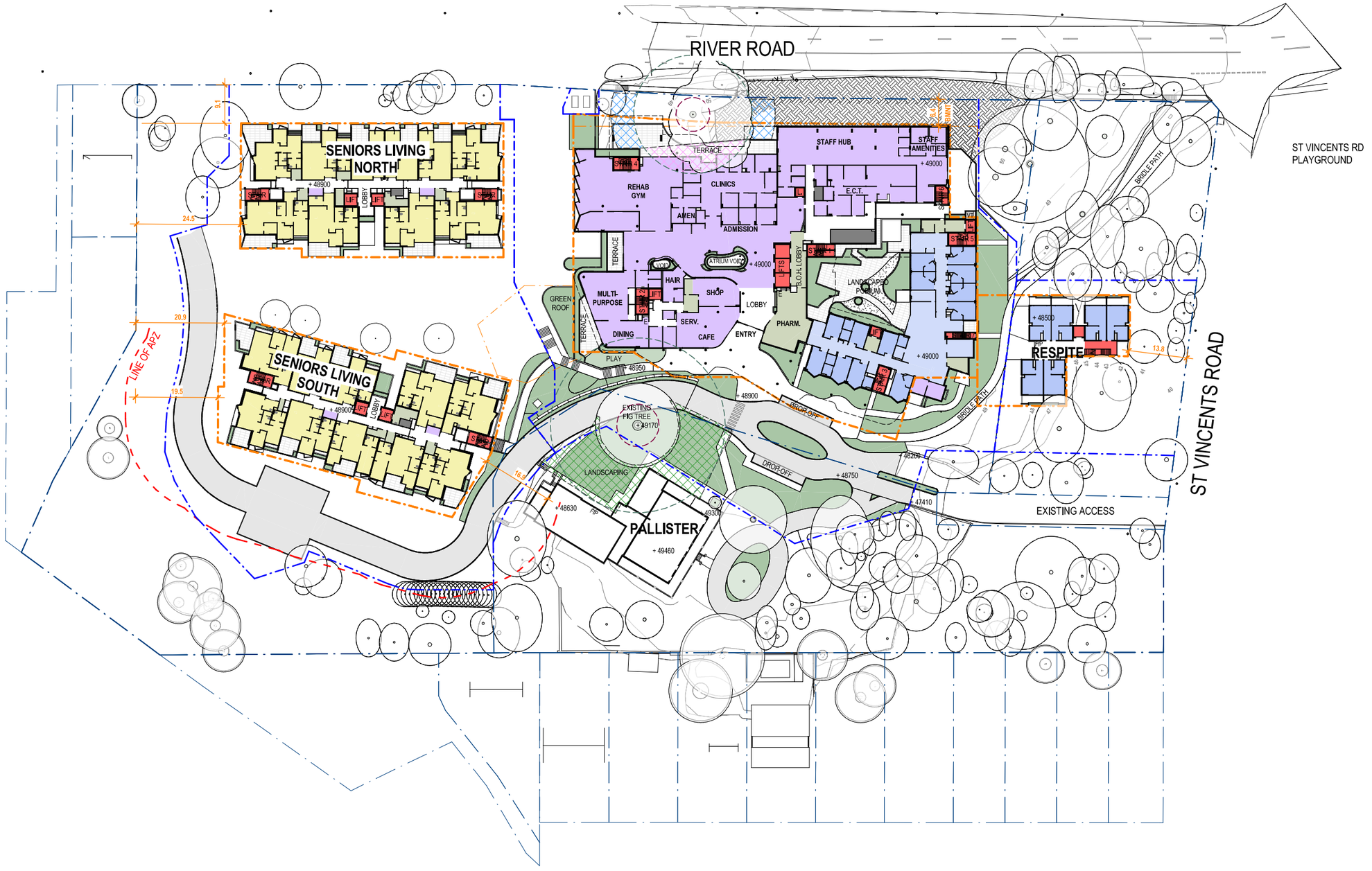

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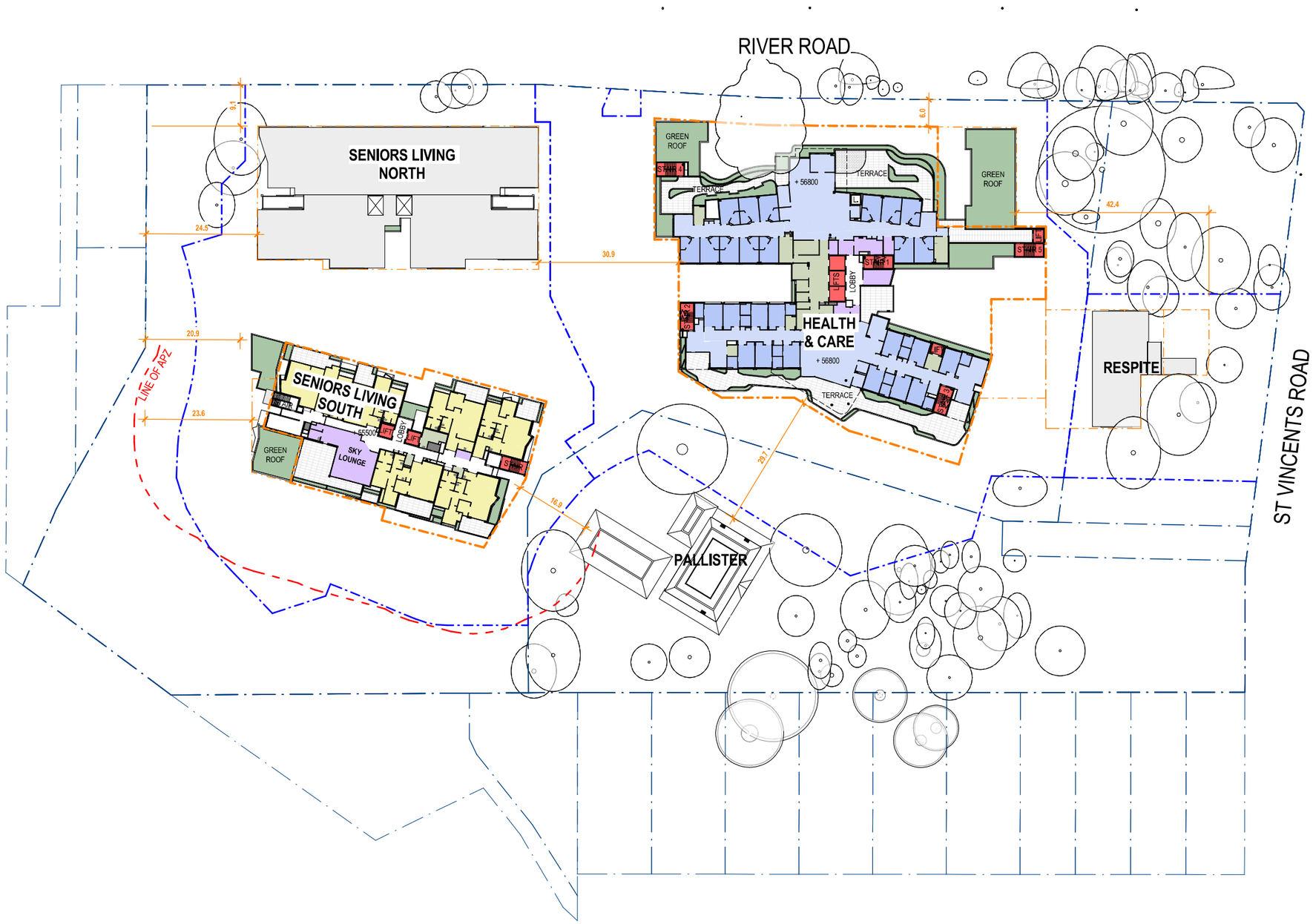

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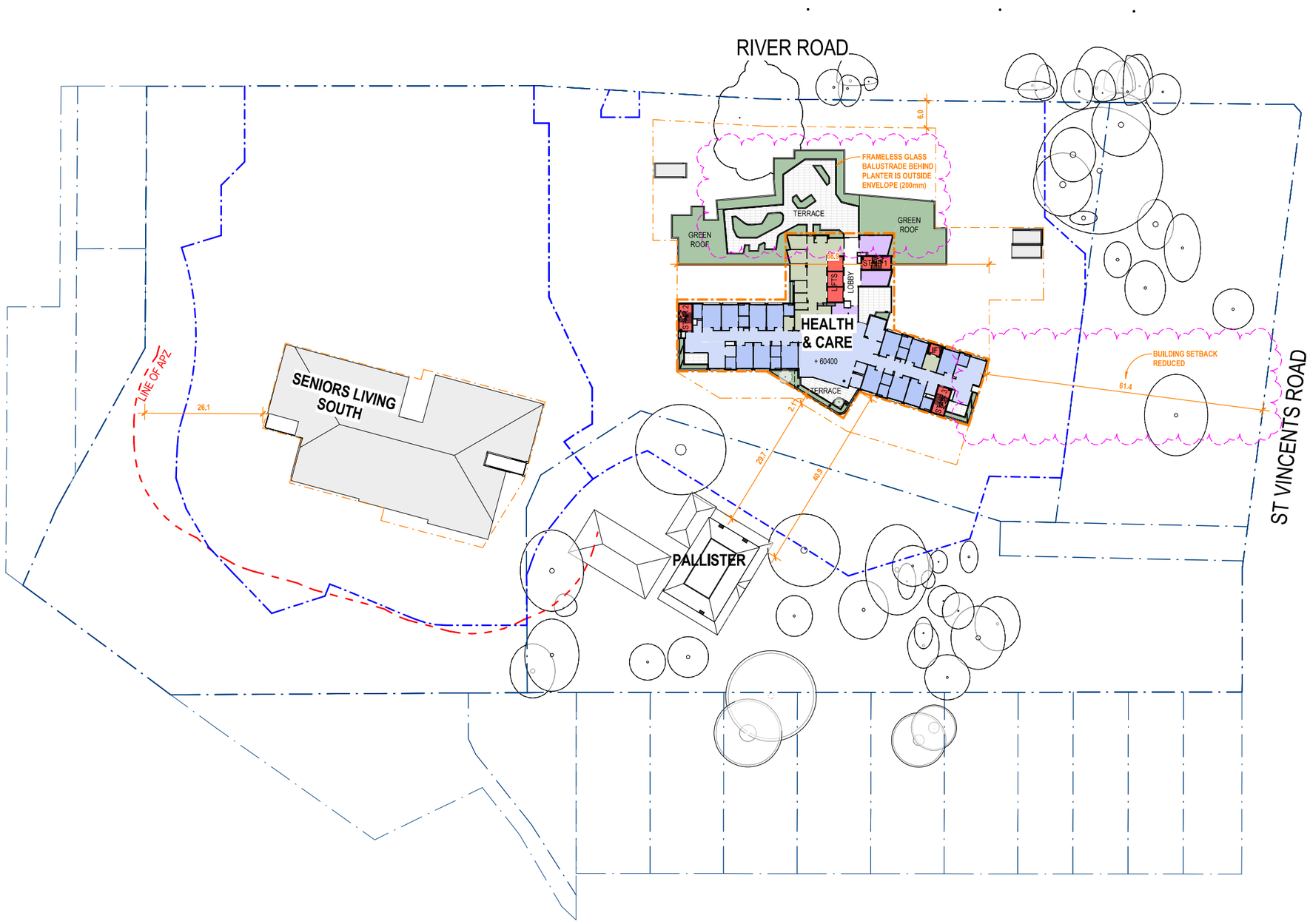

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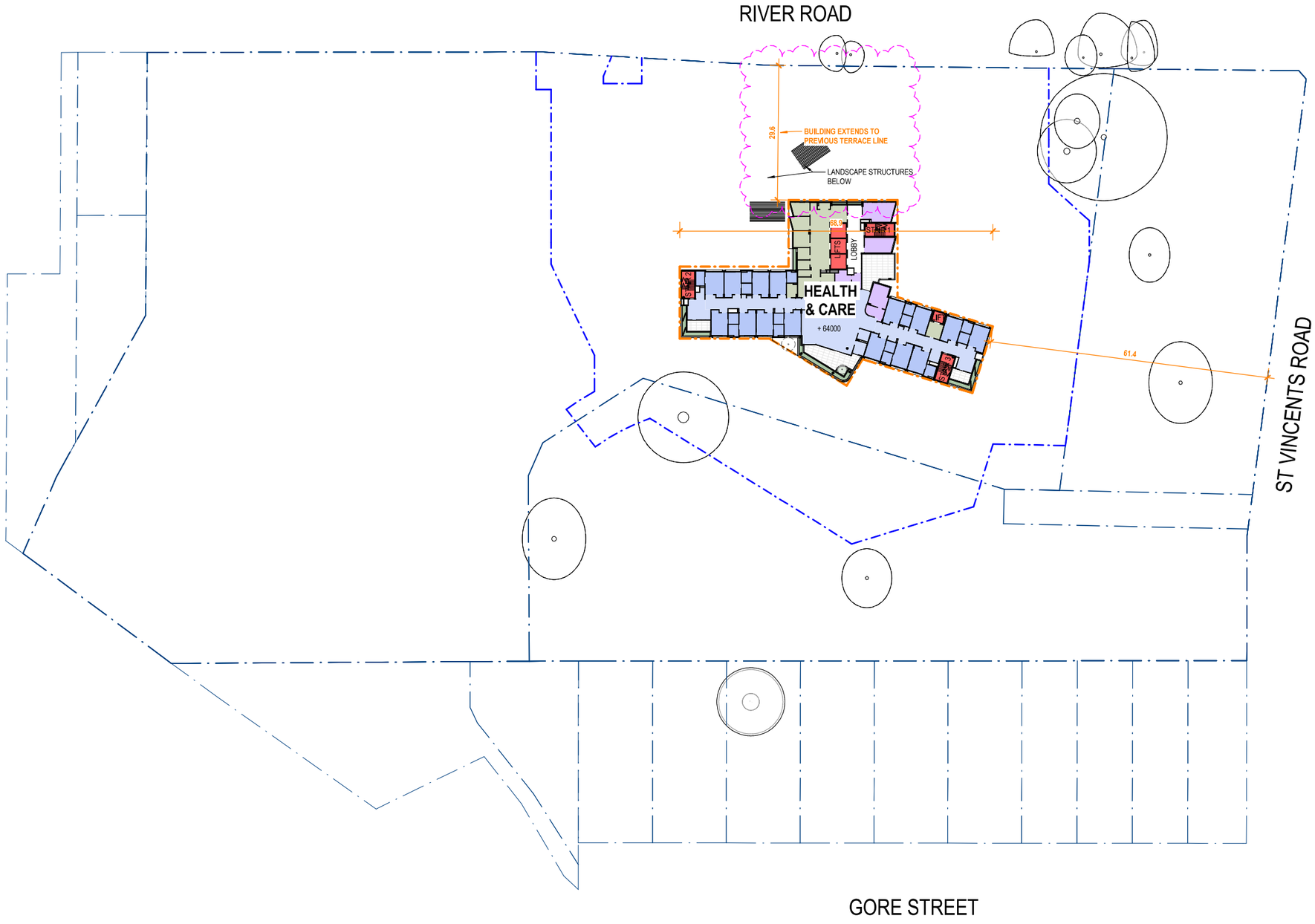

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DATE: 01/11/21

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DRAWING TITLE:
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DRAWN: NAH CHECKED: SCALE: 1 : 500 @A1

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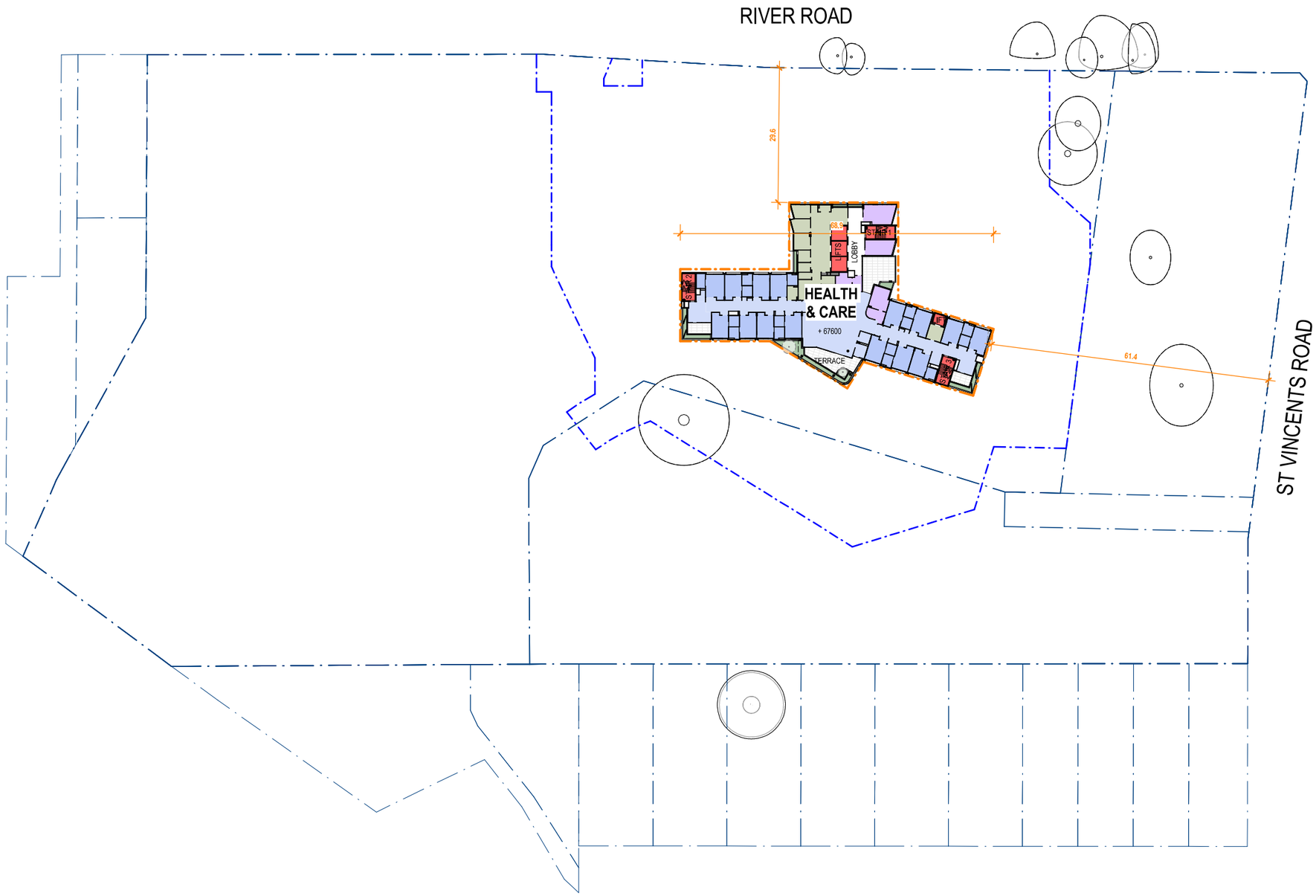

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P14	2022.03.16	SSD UPDATE	NAH

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REVISION: P19
DATE: 01/11/21
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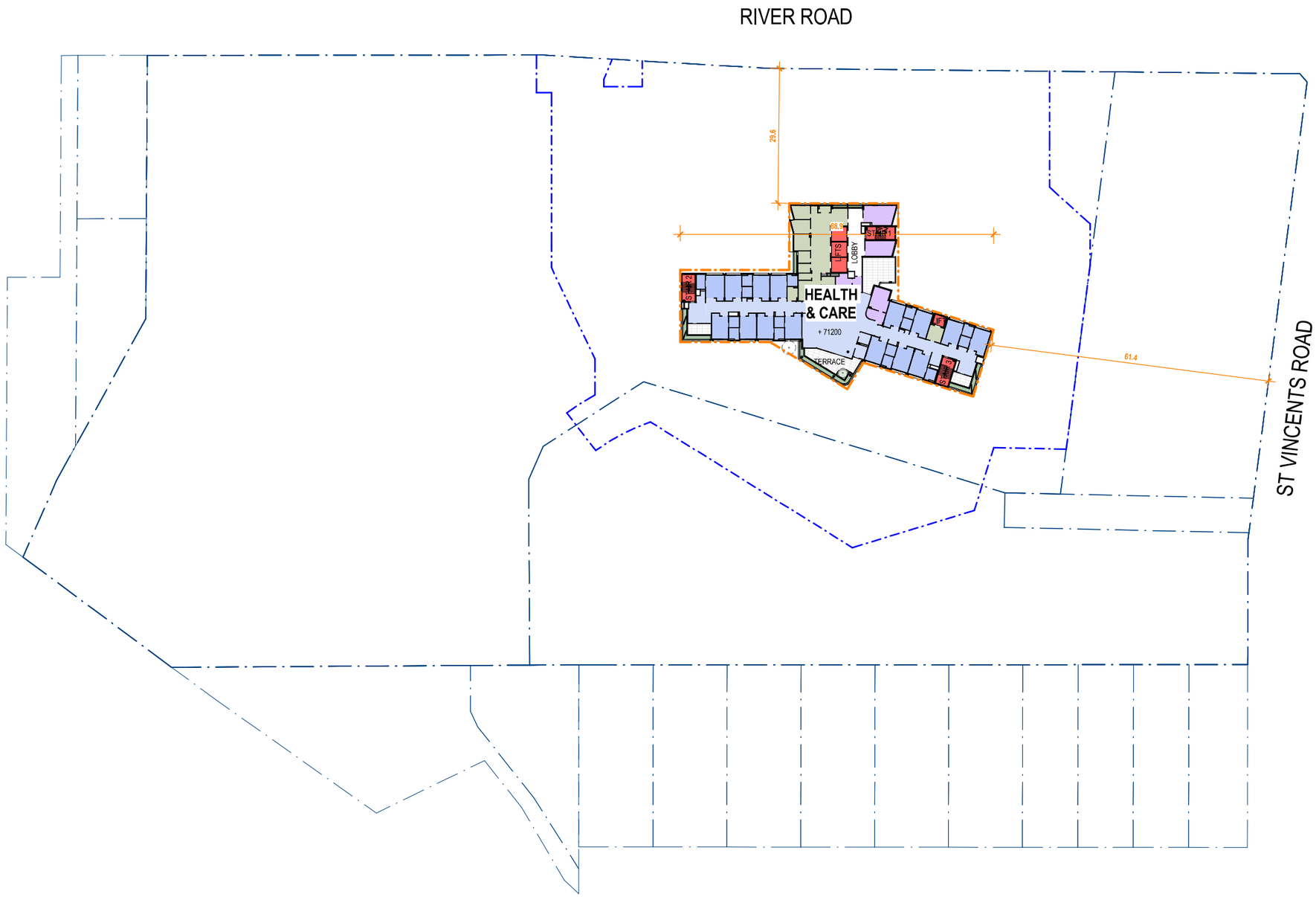

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P13	2022.03.18	ISSUE TO CONSULTANTS	AMac
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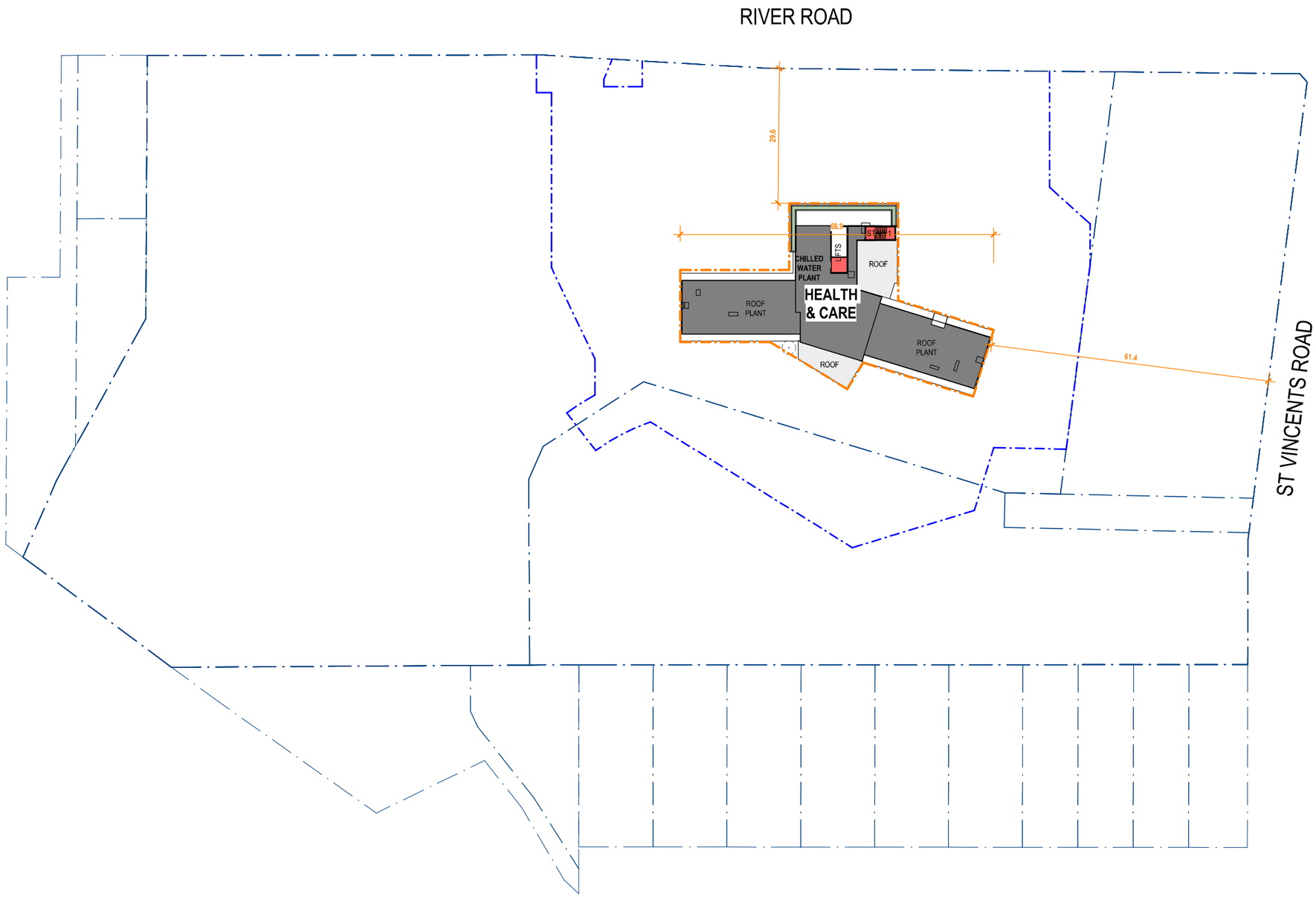

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P12	2022.03.16	SSD UPDATE	NAH

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DATE: 04/09/21

DRAWING No: **DD-SW-0210**

DRAWING TITLE:
SITE LEVEL PLAN - LEVEL 11

DRAWN: NAH CHECKED: SCALE: 1 : 500 @A1

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Appendix C: Laboratory Results Summary Tables

ABBREVIATIONS AND EXPLANATIONS FOR ACID SULFATE SOIL TABLE

Abbreviations used in the Tables:

ANC_{BT}	Acid Neutralising Capacity - Back Titration
ANCE	Excess Acid Neutralising Capacity
$CaCO_3$	Calcium Carbonate
kg	kilogram
mol H^+/t	moles hydrogen per tonne
pHF	Field pH
pHFOX	Field peroxide pH
pH_{KCl}	Pottasium chloride pH
S	Sulfur
SCr	The symbol given to the result from the Chromium Reducible Sulfur method
S_{NAS}	Net Acid Soluble Sulfur
% w/w	Percentage by mass

Results have been assessed against the criteria specified in Table 1.1 of National Acid sulfate Soil Guidance - National acid sulfate soil identification and laboratory method manual. Water Quality Australia. June 2018

JKEnvironments

TABLE I
SUMMARY OF LABORATORY RESULTS - ACID SULFATE SOIL ANALYSIS

Soil Texture: Coarse		Analysis	pH_F and pH_{FOX}				pH_{KCL}	Actual Acidity (Titratable Actual Acidity - TAA)	Potential Sulfidic Acidity		Retained Acidity	Acid Neutralising Capacity (ANC_{BT})	a-Net Acidity without ANCE	s-Net Acidity without ANCE	Liming Rate - without ANCE
			pH_F	pH_{FOX}	Reaction	pH_F - pH_{FOX}		(mol H^+/t)	(% SCr)	(mol H^+/t)	(%S_{NAS})	(% $CaCO_3$)	(mol H^+/t)	(%w/w S)	(kg $CaCO_3$/tonne)
National Acid Sulfate Soils Guidance (2018)			-	-	-	-	-	-	-	-	-	-	18	0.03	-
Sample Reference	**Sample (m)**	**Sample Description**													
BH101	0.02-0.4	Fill: Silty Gravelly Sand	**9**	**6.8**	Medium reaction	**2.2**	**8.5**	<5	**0.005**	**3**	[NT]	**0.6**	<5	**0.005**	<0.75
BH101	0.02-0.4	Laboratory Duplicate	**9.1**	**6.8**	Medium reaction	**2.3**	**8.5**	<5	**0.005**	**3**	[NT]	**0.6**	<5	**0.005**	<0.75
BH101	1.0-1.2	Fill: Silty Sand	**9.9**	**9**	Volcanic reaction	**0.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH101	1.7-1.95	XW Sandstone	**9**	**6.5**	Medium reaction	**2.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH102	0.05-0.1	Fill: Silty Gravelly Sand	**8.8**	**9.5**	Volcanic reaction	**-0.7**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH102	1.0-1.2	Fill: Silty Clay	**7.4**	**5.3**	Low reaction	**2.1**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH102	1.4-1.6	Sandstone	**7.5**	**5**	Low reaction	**2.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH104	0.04-0.3	Fill: Sandy Gravel	**8.3**	**8.3**	Volcanic reaction	**0**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH104	0.5-0.95	Fill: Silty Gravelly Sand	**7.9**	**6.4**	Low reaction	**1.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH104	2.4-2.5	Fill: Silty Gravelly Sand	**12**	**10.7**	Volcanic reaction	**1.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH104	3.2-3.45	Fill: Silty Sand	**5.7**	**4.9**	Low reaction	**0.8**	**5.5**	<5	<0.005	<3	[NT]	<0.05	<5	<0.005	<75
BH104	3.8-4.1	Fill: Silty Sand	**7.6**	**6.1**	Medium reaction	**1.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH105	0.25-0.4	Fill: Silty Gravelly Sand	**8.2**	**8.3**	Low reaction	**-0.1**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH105	0.5-0.95	Fill: Clayey Silty Sand	**7.7**	**5.4**	Medium reaction	**2.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH105	1.2-1.4	Sandy Clay	**7.4**	**4.8**	Volcanic reaction	**2.6**	**7**	<5	<0.005	<3	[NT]	<0.05	<5	<0.005	<0.75
BH105	1.5-1.7	XW Sandstone	**5.1**	**3.8**	Medium reaction	**1.3**	**4.4**	**19**	<0.005	<3	<0.005	[NT]	**19**	**0.03**	**1.4**
BH106	0.03-0.3	Fill: Clayey Gravelly Sand	**9.4**	**10**	Extreme reaction	**-0.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH106	0.6-0.8	Silty Clay	**6.8**	**5.8**	Medium reaction	**1**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH107	0-0.2	Fill: Silty Clay	**6.6**	**3.8**	Volcanic reaction	**2.8**	**6**	<5	<0.005	<3	[NT]	[NT]	<5	<0.05	<0.75
BH107	0.2-0.4	Fill: Sandy Clay	**7**	**4.9**	Medium reaction	**2.1**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH107	0.5-0.95	Silty Sand	**7.1**	**5.1**	Low reaction	**2**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH107	1.0-1.3	Silty Clay	**6.6**	**5.2**	Low reaction	**1.4**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH107	1.0-1.3	Laboratory Duplicate	**6.7**	**5.2**	Low reaction	**1.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH108	0.1-0.4	Fill: Sandy Silty Clay	**4.8**	**4.2**	Medium reaction	**0.6**	**4**	**61**	<0.005	<3	<0.005	[NT]	**65**	**0.1**	**4.9**
BH108	0.8-1.0	Sandstone	**4.5**	**4.2**	Low reaction	**0.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH109	0.01-0.4	Fill: Clayey Gravelly Sand	**8.5**	**8.8**	Volcanic reaction	**-0.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH109	0.5-0.8	Fill: Sandy Clay	**6.6**	**5.1**	Low reaction	**1.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH109	0.8-0.95	Sandy Clay	**6.4**	**5.6**	Low reaction	**0.8**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH109	0.8-0.95	Laboratory Duplicate	**6.3**	**5.7**	Low reaction	**0.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH119	0.05-0.3	Fill: Silty Sand	**8.7**	**8.3**	Volcanic reaction	**0.4**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Number of Samples			30	30	30	30	7	7	7	7	2	4	7	7	7
Minimum Value			4.5	3.8	Low	-0.7	4.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.005	<PQL
Maximum Value			12	10.7	Volcanic	2.8	8.5	61	0.005	3	<PQL	0.6	65	0.1	4.9

Values Exceeding Action Criteria

Appendix D: Information on Acid Sulfate Soils

A. Background

Acid Sulfate Soil (ASS) is formed from iron rich alluvial sediments and sulfate (found in seawater) in the presence of sulfate reducing bacteria and plentiful organic matter. These conditions are generally found in mangroves, salt marsh vegetation or tidal areas and at the bottom of coastal rivers and lakes. ASS materials are distinguished from other soil or sediment materials (referred to as 'soil materials' throughout the National Acid Sulfate Soils Guidance) by having properties and behaviour that have either:

1) Been affected considerably by the oxidation of Reduced Inorganic Sulfur (RIS), or
2) The capacity to be affected considerably by the oxidation of their RIS constituents.

Acid sulfate soil materials include potential acid sulfate soils (PASS or sulfidic soil materials) and actual acid sulfate soils (AASS or sulfuric soil materials). These are often found in the same profile, with AASS overlying PASS. PASS and AASS are defined further below:

- PASS are soil materials which contain RIS such as pyrite. The field pH of these soils in their undisturbed state is usually more than pH 4 and is commonly neutral to alkaline (pH 7–9). These soil materials are invariably saturated with water in their natural state. Their texture may be peat, clay, loam, silt or sand and is often dark grey in colour and soft in consistence, but these materials may also exhibit colours that are dark brown, or medium to pale grey to white; and
- AASS are soil materials which contained RIS such as pyrite that have undergone oxidation. This oxidation results in low pH (that is pH less than 4) and often a yellow (jarosite) and/or orange to red mottling (ferric iron oxides) in the soil profile. Actual ASS contains Actual Acidity, and commonly also contains RIS (the source of Potential Sulfuric Acidity) as well as Retained Acidity.

B. The ASS Planning Maps

The ASS planning maps provide an indication of the relative potential for disturbance of ASS to occur at locations within the council area. These maps do not provide an indication of the actual occurrence of ASS at a site or the likely severity of the conditions.

The maps are divided into five classes dependent upon the type of activities/works that if undertaken, may represent an environmental risk through the development of acidic conditions associated with ASS:

Table B1: Risk Classes

Risk Class	Description
Class 1	All works.
Class 2	All works below existing ground level and works by which the water table is likely to be lowered.
Class 3	Works at depths beyond 1m below existing ground level or works by which the water table is likely to be lowered beyond 1m below existing ground level.
Class 4	Works at depths beyond 2m below existing ground level or works by which the water table is likely to be lowered beyond 2m below existing ground level.
Class 5	Works within 500m of adjacent Class 1, 2, 3, 4 land which are likely to lower the water table below 1m AHD on the adjacent land.

C. The ASS Risk Maps

The ASS risk maps provide an indication of the probability of occurrence of ASS materials at a particular location based on interpretation from geological and soil landscape maps. The maps provide classes based on high probability, low probability, no known occurrence and areas of disturbed terrain (site specific assessment necessary) and the likely depth at which ASS materials are likely to be encountered.

D. Interpretation of ASS Field Tests

Tables A1 and A2 below provide some guidance on the interpretation of pH_F and pH_{FOX} test results, as detailed in the *National Acid Sulfate Soil Guidance: National acid sulfate soils sampling and identification methods manual* (2018):

Table D1: Interpretation of some pH_F test ranges

pH value	Result	Comments
$pH_F \leq 4$, jarosite not observed in the soil layer/horizon	May indicate an AASS indicating previous oxidation of RIS or may indicate naturally occurring, non ASS soils.	Generally not conclusive as naturally occurring, non ASS soils, such as many organic soils (for example peats) and heavily leached soils, often also return $pH_F \leq 4$.
$pH_F \leq 4$, jarosite observed in the soil layer/horizon	The soil material is an AASS.	Jarosite and other iron precipitate minerals in ASS such as schwertmannite require a pH < 4 to form and indicate prior oxidation of RIS.
$pH_F > 7$	Expected in waterlogged, unoxidised, or poorly drained soils.	Marine muds commonly have a pH > 7 which reflects a seawater (pH 8.2) influence. Oxidation of samples with H_2O_2 can help indicate if the soil materials contain RIS.

Source: Adapted from DER (2015a).

Table D2: Interpretation of pH_{FOX} test results

pH value and reaction	Result	Comments
Strong reaction of soil with H_2O_2 (that is X or V)	Useful indicator of the presence of RIS but cannot be used alone	Organic rich substrates such as peat and coffee rock, and soil constituents like manganese oxides, can also cause a reaction. Care must be exercised in interpreting these results. Laboratory analyses are required to confirm if appreciable RIS is present.
pH_{FOX} value at least one unit below field pH_F and strong reaction with H_2O_2 (that is X or V)	May indicate PASS	The difference between pH_F and pH_{FOX} is termed the ΔpH. Generally, the larger the ΔpH the more indicative of PASS. The lower the final pH_{FOX} the better the likelihood of an appreciable RIS content. For example, a change from pH_F of 8 to pH_{FOX} of 7 (that is a ΔpH of 1) would not indicate PASS, however, a unit change from pH_F of 3.5 to pH_{FOX} of 2.5 would be indicative of PASS. Laboratory analyses are required to confirm if appreciable RIS is present.
$pH_{FOX} < 3$, large pH and a strong reaction with H_2O_2 (that is X or V)	Strongly indicates PASS	The lower the pH_{FOX} below 3, the greater the likelihood that appreciable RIS is present. A combination of all three parameters – pH_{FOX}, ΔpH and reaction strength – gives the best indication of PASS. Laboratory analyses are required to confirm that appreciable RIS is present.

A pH_{FOX} 3–4 and Low, Medium or Strong reaction with H_2O_2	Inconclusive	RIS may be present; however, organic matter may also be responsible for the decrease in pH. Laboratory analyses are required to confirm the presence of RIS.
pH_{FOX} 4–5	Inconclusive	RIS may be present in small quantities, or poorly reactive under rapid oxidation, or the sample may contain shell/ carbonate which neutralises some or all acid produced on oxidation. Equally, the pH_{FOX} value may be due to the production of organic acids with no RIS present. Laboratory analyses are required to confirm if appreciable RIS is present.
pH_{FOX} > 5, small or no pH, but Low, Medium or Strong reaction with H_2O_2	Inconclusive	For neutral to alkaline pHF with shell or white concretions, the fizz test with 1 M HCl can be used to identify the presence of carbonates. Laboratory analyses are required to confirm if appreciable RIS is present and further testing is required to confirm that effective self-neutralising materials are present.

Source: Adapted from DER (2015a).

Appendix E: Borehole Logs

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BOREHOLE LOG

Borehole No. 101 1 / 2

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Method:** SPIRAL AUGER **R.L. Surface:** ~42.1 m

Date: 6/10/21 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** J.L./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING						42			-	ASPHALTIC CONCRETE: 20mm.t	M			APPEARS MODERATELY COMPACTED
					N > 9 9,9/ 100mm REFUSAL					FILL: Silty gravelly sand, fine to medium grained, grey, fine to medium grained, igneous gravel, trace of brick fragments.				SCREEN: 5.2kg 0.02-0.4m NO FCF
						41	1			FILL: Silty sand, fine to medium grained, brown, trace of sandstone gravel, clay nodules, glass, plastic and earthenware fragments.				SCREEN: 6.7kg 0.4-1.4m NO FCF
					N = 11 3,5,6									SCREEN: 1.4-1.7m NO FCF
						40	2		-	Extremely Weathered sandstone: silty clayey SAND, fine to medium grained, yellow brown.	XW	(D - VD)		HAWKESBURY SANDSTONE
ON 20/10/21										SANDSTONE: fine to medium grained, yellow brown and orange brown.	DW	L - M		LOW TO MODERATE 'TC' BIT RESISTANCE
						39	3							
						38	4							
						37	5			REFER TO CORED BOREHOLE LOG				GROUNDWATER MONITORING WELL INSTALLED TO 7.5m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 1.2m TO 7.5m. CASING 0m TO 1.2m. 2mm SAND FILTER PACK 1.0m TO 7.5m. BENTONITE SEAL 0.25m TO 1.0m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						36	6							

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CORED BOREHOLE LOG

Borehole No. 101

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~42.1 m

Date: 6/10/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK205 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		38			START CORING AT 4.37m					ROCK STRENGTH BASED ON TACTILE ASSESSMENT	
100% RETURN		37	5		SANDSTONE: medium grained, yellow brown and orange brown, bedded at 0-25°.	HW - MW	(L - M)			(4.95m) Be, 0°, P, R, Fe Ct	Hawkesbury Sandstone
		36	6		SANDSTONE: fine to medium grained, light grey.	FR	(M - H)			(5.77m) CS, 0°, 5 mm.t	
		35	7								
		34	8		END OF BOREHOLE AT 7.50 m						
		33	9								
		32	10								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 102 1 / 2

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Method:** SPIRAL AUGER **R.L. Surface:** ~37.7 m

Date: 6/10/21 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** J.L./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING									-	ASPHALTIC CONCRETE: 50mm.t FILL: Silty gravely sand, fine to medium grained, brown, fine to medium grained igneous gravel, trace of concrete fragments and slag.	M			APPEARS POORLY TO MODERATELY COMPACTED
					N = 7 2,4,3	37	1			FILL: Silty clay, low to medium plasticity, grey and brown, trace of igneous, ironstone and siltstone gravel, and slag.	w<PL			SCREEN: 7.60kg 0.05-0.5m NO FCF
														SCREEN: 9.5kg 0.5-1.2m NO FCF
						36	2		-	SANDSTONE: fine to medium grained, orange brown.	DW	(L - M)		HAWKESBURY SANDSTONE LOW TO MODERATE 'TC' BIT RESISTANCE
						35	3			REFER TO CORED BOREHOLE LOG				GROUNDWATER MONITORING WELL INSTALLED TO 6.1m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 1.2m TO 6.1m. CASING 0m TO 1.2m. 2mm SAND FILTER PACK 1.0m TO 6.1m. BENTONITE SEAL 0.25m TO 1.0m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						34	4							
						33	5							
						32	6							
						31								

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CORED BOREHOLE LOG

Borehole No. 102 **2 / 2**

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~37.7 m

Date: 6/10/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK205 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		36	2		START CORING AT 2.05m					ROCK STRENGTH BASED ON TACTILE ASSESSMENT	
100% RETURN ON 20/10/21		35 34 33 32	3 4 5 6		SANDSTONE: medium grained, light grey and yellow brown, bedded at 0-20°.	MW	(L - M)				Hawkesbury Sandstone
					SANDSTONE: fine to medium grained, light grey, trace of dark grey laminae, bedded at 0-30°.	FR	(M)			(4.58m) Be, 10°, P, R, Cn (5.27m) CS, 0 - 10°, 75 mm.t	
		31 30	7		END OF BOREHOLE AT 6.12 m						

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. 103 **1/1**

PFASDUP5: 0.03-0.4m

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: E32507BR **Method:** SPIRAL AUGER **R.L. Surface:** ≈ 38.8m

Date: 6/10/2021 **Datum:** AHD

Plant Type: JK205 **Logged/Checked by:** M.M.E./V.B.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE -TION	■		■	■	■		0		-	ASPHALTIC CONCRETE: 30mm.t	M			SCREEN: 7.4kg 0.03-0.05m NO FCF
	■			■		N = 16 3,3,13			CL-CI	FILL: Silty gravelly sand, fine to medium grained, brown, fine to medium grained, sub-angular, igneous gravel, trace of ironstone gravel, ceramic fragments and concrete.	w<PL			
	■			■			1		CI-CH	Sandy CLAY: low to medium plasticity, orange brown, fine to medium grained, trace of ironstone gravel.				
	■			■					CL-CI	Silty CLAY: medium to high plasticity, grey and brown, trace of ironstone gravel.				HYDROCARBON ODOUR
										Sandy CLAY: low to medium plasticity, grey and brown, fine to medium grained, trace of ironstone gravel.				REFUSAL ON INFERRED BEDROCK
							2			END OF BOREHOLE AT 1.5m				
							3							
							4							
							5							
							6							
							7							

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BOREHOLE LOG

Borehole No. 104 1 / 2

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Method:** SPIRAL AUGER **R.L. Surface:** ~41.6 m

Date: 1/10/21 **Datum:** AHD

Plant Type: JK305 **Logged/Checked By:** J.L./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING									-	ASPHALTIC CONCRETE: 40mm.t	M			APPEARS POORLY TO MODERATELY COMPACTED
										FILL: Sandy gravel, fine to medium grained, dark grey, fine to medium grained, sub-angular, igneous gravel, trace of ironstone and sandstone gravel, and slag.				SCREEN: 4.45kg 0.04-0.3m NO FCF
					N = 9 2,5,4	41	1			FILL: Silty gravelly sand, fine to medium grained, yellow brown, fine to medium grained sandstone gravel, trace of metal and glass fragments, slag and ash.				SCREEN: 4.7kg 0.3-1.3m NO FCF
					N = 10 3,3,7	40	2							SCREEN: 4.8kg 1.3-2.3m NO FCF
					N > 10 4,6,4/ 100mm REFUSAL	39	3							SCREEN: 5.45kg 2.3-3.2m NO FCF
										FILL: Silty sand, fine to medium grained, brown, trace of igneous, sandstone and siltstone gravel, glass fragments and ash.				GROUNDWATER MONITORING WELL INSTALLED TO 5.97m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 1.2m TO 5.97m. CASING 0m TO 1.2m. 2mm SAND FILTER PACK 1.0m TO 5.97m. BENTONITE SEAL 0.25m TO 1.0m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						38	4			REFER TO CORED BOREHOLE LOG				
						37	5							
						36	6							
						35								

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CORED BOREHOLE LOG

Borehole No. 104 **2 / 2**

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~41.6 m

Date: 1/10/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	DEFECT DETAILS SPACING (mm) (600, 200, 60, 20) DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
					START CORING AT 3.40m				ROCK STRENGTH BASED ON TACTILE ASSESSMENT	
100% RETURN		38	4		NO CORE 0.74m					
		37	5		Extremely weathered sandstone: sandy silty CLAY, low to medium plasticity, light grey mottled orange brown.	XW	(Hd)			Hawkesbury Sandstone
					SANDSTONE: medium grained, light grey and orange brown, bedded at 0-20°.	MW	(L - M)		(4.45m) J, 40 - 90°, C, R, Fe Sn (4.58m) Be, 20°, P, R, Fe Sn (4.95m) CS, 5°, 50 mm.t (5.77m) Cr, 0 - 5°, 10 mm.t (5.82m) Be, 5°, C, R, Fe Ct	
		36	6		END OF BOREHOLE AT 5.97 m					
		35	7							
		34	8							
		33	9							
		32								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 105 1 / 2

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Method:** SPIRAL AUGER **R.L. Surface:** ~44.8 m

Date: 27/9/21 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** J.L./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING					N = 8 4,4,4	44	1		-	ASPHALTIC CONCRETE: 25mm.t.	M			SCREEN: 5.25kg 0.25-0.4m NO FCF
										FILL: Silty gravelly sand, fine to medium grained, grey, fine to coarse grained igneous gravel.				
										FILL: Clayey silty sand, fine to medium grained, dark grey, with fine to coarse grained ironstone and igneous gravel, trace of slag.				APPEARS POORLY COMPACTED
									CL	Sandy CLAY: low plasticity, grey and brown, trace of fine to coarse grained ironstone gravel.	w>PL	(St)		RESIDUAL
					N > 14 18,14/ 100mm REFUSAL	43	2			Extremely Weathered sandstone: Sandy CLAY, low plasticity, orange brown and red brown, with occasional low strength sandstone bands and clay bands.	XW	(Hd)		HAWKESBURY SANDSTONE VERY LOW 'TC' BIT RESISTANCE WITH LOW RESISTANCE BANDS
						42	3			SANDSTONE: fine to medium grained, red brown.	MW	L		
										REFER TO CORED BOREHOLE LOG				Groundwater monitoring well installed to 7.86m. Class 18 machine slotted 50mm dia. PVC standpipe 0.86m to 7.86m. Casing 0.1m to 0.86m. 2mm sand filter pack 1.6m to 7.86m. Bentonite seal 0.8m to 1.6m. Backfilled with sand to the surface. Completed with a concreted gatic cover. JKE SAMPLES WERE COLLECTED FROM THE CORED SAMPLES AT THE FOLLOWING DEPTHS: 3.9-4.0m 4.9-5.0m 5.9-6.0m 6.9-7.0m 7.7-7.83m
						41	4							
						40	5							
						39	6							
						38								

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 105 **2 / 2**

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~44.8 m

Date: 27/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK205 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
					START CORING AT 3.13m						
80% RETURN		41	4		SANDSTONE: medium grained, red brown, orange brown and light grey, bedded at 0-30°.	MW	M	0.60, 0.50, 0.90, 0.70, 0.60, 0.90		(3.21m) Be, 25°, P, R, Fe Sn	Hawkesbury Sandstone
		40	5							(4.38m) Be, 30°, P, R, Fe Sn; (4.57m) Be, 10°, P, R, Fe Sn; (4.62m) Be, 0°, C, R, Fe Sn; (4.65m) Be, 0°, P, R, Clay Ct; (4.95m) Be, 0°, P, R, Fe Sn; (5.15m) Be, 0°, P, R, Fe Sn; (5.25m) J, 25°, P, R, Cn; (5.53m) Be, 20°, C, R, Fe Sn; (5.58m) Be, 20°, P, R, Fe Sn; (5.70m) Be, 20°, P, R, Fe Sn; (5.86m) Be, 0°, P, R, Fe Sn; (5.91m) Be, 0°, P, R, Fe Sn	
ON 20/10/21		39	6								
ON 22/10/21							M - H	1.1, 1.4, 0.70, 0.70, 1.6		(6.35m) Bex2, 0°, P, R, Fe Ct; (6.70m) Be, 0°, P, R, Fe Ct; (7.46m) Be, 0°, P, R, Clay Ct; (7.60m) CS, 0°, 12 mm.t; (7.65m) XWS, 0°, 25 mm.t	
60% RETURN		38	7								
		37			END OF BOREHOLE AT 7.83 m						
		36	8								
		35	9								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 106 1 / 3

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Method:** SPIRAL AUGER **R.L. Surface:** ~49.1 m

Date: 28/9/21 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** J.L./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■					49			-	ASPHALTIC CONCRETE: 30mm.t	M			SCREEN: 3.8kg 0.03-0.3m NO FCF
									CL	FILL: Clayey gravelly sand, fine to medium grained, grey, medium to coarse grained igneous gravel.	w~PL	VSt - Hd		RESIDUAL
				■	N > 10 10,10/ 50mm REFUSAL					Silty CLAY: low plasticity, light grey with fine to medium grained sand and medium to coarse grained ironstone gravel.	XW	(Hd)	440 470 300	HAWKESBURY SANDSTONE
	■					48	1			Extremely Weathered sandstone: sandy CLAY, low to medium plasticity, fine to medium grained sand, light grey and red brown.	MW	H		LOW 'TC' BIT RESISTANCE WITH VERY LOW BANDS
				■						SANDSTONE: fine to medium grained, light grey and orange brown with occasional clay nodules.				Groundwater monitoring well installed to 12.52m. Class 18 machine slotted 50mm dia. PVC standpipe 1.52m to 12.52m. Casing 0.11m to 1.52m. 2mm sand filter pack 1.2m to 12.52m. Bentonite seal 0.4m to 1.2m. Backfilled with sand to the surface. Completed with a concreted gatic cover.
						47	2			REFER TO CORED BOREHOLE LOG				JKE SAMPLES WERE COLLECTED FROM THE CORED SAMPLES AT THE FOLLOWING DEPTHS: 1.4-1.5m 1.9-2.0m 2.4-2.5m 2.9-3.0m 3.9-4.0m 4.9-5.0m 5.9-6.0m 6.9-7.0m 7.9-8.0m 8.9-9.0m 9.9-10.0m 10.9-11.0m 11.9-12.0m 12.45-12.55m
						46	3							
						45	4							
						44	5							
						43	6							

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CORED BOREHOLE LOG

Borehole No. 106 **2 / 3**

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~49.1 m

Date: 28/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK205 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm)	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		48			START CORING AT 1.24m						
100% RETURN		47	2		SANDSTONE: medium grained, light grey with grey laminations, and orange brown bands, bedded at 0-25°.	MW	H	1.4 1.6 1.6 1.7 1.8 1.9 1.6 1.5		(1.43m) Be, 10°, P, R, Cn (2.04m) Be, 25°, P, R, Fe Sn (3.03m) Bex2, P, R, Fe Sn (3.38m) Be, 15°, C, R, Fe Sn (4.37m) Be, 0°, P, R, Fe Sn	Hawkesbury Sandstone
		46	3								
		45	4								
		44	5		SANDSTONE: medium grained, light grey with orange brown bands, bedded at 0-25°.	SW	M - H	1.0 1.0 1.0		(4.87m) Be, 20°, P, R, Clay Ct (5.18m) Be, 25°, P, R, Fe Sn (5.43m) CS, 0°, 20 mm.t	
		43	6		SANDSTONE: medium grained, light grey with grey and dark grey laminations, and red brown bands, bedded at 0-25°.	FR	M	0.90		(6.28m) Be, 25°, P, R, Clay Ct (6.40m) CS, 20°, 20 mm.t	
		42	7		SANDSTONE: medium grained, light grey with grey and dark grey laminations, and occasional red brown bands, bedded at 0-25°.			0.70 0.90		(7.11m) Be, 25°, P, R, Fe Sn (7.20m) Be, 25°, P, R, Fe Sn (7.30m) XWS, 0°, 40 mm.t (7.35m) CS, 0°, 5 mm.t	

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 106 3 / 3

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~49.1 m

Date: 28/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK205 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
ON 20/10/21		41			SANDSTONE: medium grained, light grey with grey and dark grey laminations, and occasional red brown bands, bedded at 0-25°. *(continued)*	FR	M	0.60		(8.05m) Be, 0°, P, R, Cn	Hawkesbury Sandstone
		40	9					0.70		(8.52m) Be, 0°, P, R, Fe Sn	
								0.90		(8.63m) CS, 0°, 35 mm.t	
										(8.82m) CS, 10°, 5 mm.t	
										(9.47m) Be, 20°, P, R, Fe Sn	
								0.80		(9.90m) Be, 10°, P, R, Cb Ct	
100% RETURN		39	10		as above, but brown and red brown banded.	MW	H	1.3		(10.12m) Cr, 0°, 50 mm.t	
										(10.19m) Be, 20°, P, R, Fe Ct	
								1.4			
		38	11		as above, but light grey, with grey and dark grey laminations.	FR		1.5		(11.54m) CS, 15°, 3 mm.t	
										(11.60m) Be, 20°, P, R, Clay Ct	
								1.1			
		37	12					1.8			
								1.4			
					END OF BOREHOLE AT 12.55 m						
		36	13								
		35	14								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 107

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Method:** SPIRAL AUGER **R.L. Surface:** ~51.6 m

Date: 27/9/21 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** J.L./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING										FILL: Silty clay, low plasticity, dark brown, trace of fine to coarse grained igneous, ironstone and sandstone gravel, fine grained sand, roots and root fibres.	w~PL			TOP 100mm ROOT AFFECTED
						51			SM	FILL: Sandy clay, low plasticity, grey and brown, fine grained sand, medium to coarse grained ironstone gravel.	M			SCREEN: 11.05kg 0-0.2m NO FCF
					N = 3 2,1,2		1							SCREEN: 4.55kg 0.2-0.4m NO FCF
									CI	Silty SAND: fine to medium grained, light grey brown mottled orange brown, with clay fines and clay nodules.	w>PL			RESIDUAL
						50			-	Silty CLAY: medium plasticity, orange brown, red brown and grey, with fine to medium grained sand.	MW	M		HAWKESBURY SANDSTONE
										SANDSTONE: fine to medium grained, light grey and orange brown, with occasional clay seams.				LOW 'TC' BIT RESISTANCE
							2			REFER TO CORED BOREHOLE LOG				Groundwater monitoring well installed to 14.93m. Class 18 machine slotted 50mm dia. PVC standpipe 1.93m to 14.93m. Casing 0.05m to 1.93m. 2mm sand filter pack 1.5m to 14.93m. Bentonite seal 0.3m to 1.5m. Backfilled with sand to the surface. Completed with a concreted gatic cover.
						49	3							JKE SAMPLES WERE COLLECTED FROM THE CORED SAMPLES AT THE FOLLOWING DEPTHS: 1.9-2.0m 2.4-2.5m 2.75-2.85m 3.9-4.0m 4.9-5.0m 5.9-6.0m 6.9-7.0m 7.9-8.0m 8.9-9.0m 9.9-10.0m 10.9-11.0m 11.9-12.0m 12.9-13.0m 13.9-14.0m 14.9-15.0m
						48	4							
						47	5							
						46	6							
						45								

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CORED BOREHOLE LOG

Borehole No. 107 **2 / 3**

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~51.6 m

Date: 27/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK205 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness) Specific / General	Formation
		50			START CORING AT 1.80m						
30% RETURN		49	2		SANDSTONE: fine to medium grained, light grey, red brown and orange brown, bedded at 0-20°.	MW	M	0.40, 0.60		(2.21m) Be, 10°, P, R, Clay Ct; (2.43m) XWS, 5°, 30 mm.t; (2.56m) CS, 0 - 5°, 145 mm.t	Hawkesbury Sandstone
							H	1.1		(2.85m) CS, 5°, 30 mm.t	
					NO CORE 0.13m						
90% RETURN		48	3		SANDSTONE: medium to coarse grained, light grey and orange brown, bedded at 0-25°.	MW	H	2.0, 1.5		(3.16m) Be, 5°, P, R, Fe Sn	Hawkesbury Sandstone
		47	4					1.8, 2.0		(4.05m) Be, 25°, P, R, Fe Sn; (4.30m) Be, 15°, P, R, Fe Sn	
		46	5					1.9		(4.94m) Bex2, 20°, P, R, Cn; (5.06m) Be, 20°, P, R, Fe Sn; (5.27m) Be, 0°, P, R, Fe Sn	
			6			SW		1.9		(5.78m) Be, 15°, P, R, Clay Vn	
		45			SANDSTONE: medium grained, light grey with grey laminations, bedded at 0-25°.	FR		1.3		(6.18m) Be, 20°, P, R, Cn; (6.28m) Be, 20°, P, R, Cn	
			7		SANDSTONE: medium grained, light grey with grey laminations, bedded at 0-25°.			1.7, 1.8		(6.72m) Be, 20°, P, R, Fe Sn; (7.22m) Be, 20°, P, R, Fe Sn	
		44						1.2		(7.75m) CS, 0 - 20°, 60 mm.t	

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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CORED BOREHOLE LOG

Borehole No. 107 3 / 3

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~51.6 m

Date: 27/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK205 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
ON 22/10/21		43	9		SANDSTONE: medium grained, light grey with grey laminations, bedded at 0-25°. *(continued)*	FR	H	1.5			Hawkesbury Sandstone
								1.2		(8.71m) CS, 10°, 25 mm.t	
					SANDSTONE: medium grained, light grey, with grey laminations and trace of carbonaceous lenses, bedded at 0-25°.			0.30			
								1.7		(9.00m) Be, 0°, P, R, Cb Vn	
		42	10					1.2			
								1.7		(10.31m) Be, 25°, C, R, Cb Sn	
										(10.40m) Be, 0°, P, R, Cb Sn	
		41						1.1		(10.72m) Be, 10°, P, R, Cn	
					Extremely Weathered siltstone band:	XW					
			11		NO CORE 0.22m						
					Extremely Weathered siltstone band.	XW	H				
90% RETURN		40			SANDSTONE: medium grained, light grey and orange brown, bedded at 0-25°.	FR MW		1.3	200 60 20	(11.27m) Be, 10°, P, R, Cb Vn (11.31m) Be, 0°, P, R, Fe FILLED (11.33m) Be, 0°, P, R, Fe Ct	
										(11.65m) Be, 0°, C, R, Fe Sn	
			12					1.7			
								1.5		(12.15m) CS, 10°, 10 mm.t	
		39						1.8			
			13			FR		1.9			
					SANDSTONE: medium grained, light grey, with grey lamination, bedded at 0-25°.					(13.47m) Be, 25°, P, R, Cn	
		38						1.4		(13.71m) Be, 15°, P, R, Clay FILLED	
			14								
								1.5		(14.28m) Be, 0°, P, R, Clay Ct	
		37						1.7	200 60 20	(14.78m) Be, 10°, C, R, Cb Vn	

END OF BOREHOLE AT 15.00 m

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 108 **1 / 3**

SDUP7: 0-0.1m

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Method:** SPIRAL AUGER **R.L. Surface:** ~50.5 m

Date: 30/9/21 **Datum:** AHD

Plant Type: JK305 **Logged/Checked By:** J.L./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING										FILL: Sandy silty clay, low plasticity, orange brown, fine grained sand, trace of fine to medium grained ironstone gravel.	w<PL			GRASS COVER TOP 100mm ROOT AFFECTED
					N=SPT 10/ 50mm REFUSAL	50			-	SANDSTONE: fine to medium grained, light grey and red brown, with high strength iron indurated bands.	DW	L		HAWKESBURY SANDSTONE LOW 'TC' BIT RESISTANCE
						49	1					L - M		
										REFER TO CORED BOREHOLE LOG				JKE SAMPLES WERE COLLECTED FROM THE CORED SAMPLES AT THE FOLLOWING DEPTHS: 1.9-2.0m 2.4-2.5m 2.9-3.0m 3.9-4.0m 4.9-5.0m 5.9-6.0m 6.9-7.0m 7.9-8.0m 8.9-9.0m 9.9-10.0m 10.9-11.0m 11.9-12.0m 12.9-13.0m 13.85-13.95m
						48	2							
						47	3							
						46	4							
						45	5							
						44	6							

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CORED BOREHOLE LOG

Borehole No. 108 **2 / 3**

SDUP7: 0-0.1m

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~50.5 m

Date: 30/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
					START CORING AT 1.49m						
100% RETURN		49	1		SANDSTONE: fine to medium grained, red brown orange brown and light grey, bedded at 0-25°.	MW	H	1.8		(1.58m) Be, 5°, P, R, Fe Sn	Hawkesbury Sandstone
										(1.81m) Be, 25°, P, R, Fe Sn	
		48	2					1.1			
								1.0		(2.35m) Be, 0°, P, R, Fe Sn	
		47	3					1.1		(3.05m) Bex2, P, R, Fe Sn	
								1.7			
		46	4					1.6			
					SANDSTONE: medium to coarse grained, light grey, with grey laminations, bedded at 0-25°.	SW	M - H	0.70		(4.77m) Be, 20°, P, R, Fe Sn	
		45	5					1.5			
								1.1			
		44	6			FR		0.90		(6.07m) Be, 10°, P, R, Fe Sn	
										(6.56m) Be, 0°, P, R, Cn	
		43	7				H	1.0		(7.07m) CS, 0°, 5 mm.t	
										(7.25m) Be, 20°, P, R, Clay Ct	
								1.4			
								1.3			

JK 9.02.4 LIB GLB Log JK CORED BOREHOLE - MASTER 32507R2 GREENWICH.GPJ <<DrawingFiles>> 21/01/2022 12:47 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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CORED BOREHOLE LOG

Borehole No. 108 **3 / 3**

SDUP7: 0-0.1m

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~50.5 m

Date: 30/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
100% RETURN		42	9		SANDSTONE: medium to coarse grained, light grey, with grey laminations, bedded at 0-25°. *(continued)*	FR	H	2.0			Hawkesbury Sandstone
		41	10					1.3		(8.67m) Bex2, P, R, Clay Ct	
		40	11					1.1			
		39	12					1.3			
		38	13					1.4		(10.21m) CS, 10°, 10 mm.t	
		37	14					1.5			
								2.4	600 200 60 20	(11.50m) Be, 20°, P, Cb Vn	
								1.9			
								1.5			
								1.7			
								1.4			
								1.7			
		36			END OF BOREHOLE AT 13.95 m				600 200 60 20		

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 109 1 / 3

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Method:** SPIRAL AUGER **R.L. Surface:** ~49.1 m

Date: 30/9/21 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** J.L./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING						49				ASPHALTIC CONCRETE: 100mm.t				
									-	FILL: Clayey gravelly sand, fine to medium grained, dark grey and brown, fine to coarse grained igneous gravel, with clay nodules.	M			SCREEN: 4.7kg 0.1-0.4m NO FCF
					N = 28 14,16,12						w<PL		280 140 180	APPEARS MODERATELY COMPACTED
									CL	FILL: Sandy clay, low plasticity, grey brown and orange brown, with medium to coarse grained ironstone sandstone and igneous gravel, trace of slag.	w~PL	VSt - Hd	560 500	SCREEN: 7.4kg 0.4-0.8m NO FCF
						48	1		-	Sandy CLAY: low plasticity, orange brown, fine to medium grained sand, trace of fine to medium grained sandstone.	MW	M - H	340	RESIDUAL
										SANDSTONE: fine to medium grained, light grey and orange brown.				HAWKESBURY SANDSTONE
										REFER TO CORED BOREHOLE LOG				LOW TO MODERATE 'TC' BIT RESISTANCE
						47	2							Groundwater monitoring well installed to 12.54m. Class 18 machine slotted 50mm dia. PVC standpipe 1.54m to 12.54m. Casing 0.1m to 1.54m. 2mm sand filter pack 1.4m to 12.54m. Bentonite seal 0.3m to 1.4m. Backfilled with sand to the surface. Completed with a concreted gatic cover.
						46	3							JKE SAMPLES WERE COLLECTED FROM THE CORED SAMPLES AT THE FOLLOWING DEPTHS: 1.42-1.5m 1.9-2.0m 2.4-2.5m 2.9-3.0m 3.9-4.0m 4.9-5.0m 5.9-6.0m 6.9-7.0m 7.9-8.0m 8.9-9.0m 9.9-10.0m 10.96-11.0m 11.35-11.45m 11.9-12.0m 12.45-12.56m
						45	4							
						44	5							
						43	6							

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 109 **2 / 3**

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~49.1 m

Date: 30/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK205 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
		48			START CORING AT 1.42m						
100% RETURN		47	2		SANDSTONE: fine to medium grained, light grey with red brown bands, bedded at 0-25°. JKE sample 1.42-1.5m	MW	M - H	1.2 1.7 0.80		(2.15m) Cr, 20 mm.t (2.25m) Be, P, R, Fe Sn	Hawkesbury Sandstone
		46	3		SANDSTONE: medium grained, light grey with grey lamination, and orange brown bands, bedded at 0-25°.	SW		0.90 0.80		(3.04m) Be, P, R, Fe Sn (3.24m) XWS, 15 mm.t (3.53m) J, P, R, Clay FILLED	
		45	4					0.80 0.70		(4.66m) CS, 35 mm.t (4.80m) CS, 150 mm.t	
		44	5					1.1 0.80		(5.31m) Be, P, R, Cb Ct (5.40m) Be, P, R, Clay Ct	
		43	6					1.5		(6.14m) CS, 15 mm.t (6.29m) CS, 5 mm.t (6.46m) Cr, 20 mm.t	
ON 22/10/21		42	7					1.1 0.70 0.80		(6.86m) CS, 5 mm.t (7.83m) Be, P, R, Cb Ct (7.91m) CS, 3 mm.t	

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 109 3 / 3

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~49.1 m

Date: 30/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK205 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness) Specific / General	Formation
ON 20/10/21		41			SANDSTONE: medium grained, light grey with grey lamination, and orange brown bands, bedded at 0-25°.	SW	M - H	1.0		(8.27m) Be, 15°, P, R, Cb Ct	Hawkesbury Sandstone
		40	9					1.3		(8.88m) Be, 25°, P, R, Fe Sn	
								1.2		(9.37m) Be, 25°, P, R, Cb Ct	
										(9.57m) XWS, 15°, 15 mm.t	
								0.60		(9.85m) CS, 10°, 20 mm.t	
100% RETURN		39	10					1.5			
								1.1		(10.76m) Be, 0°, P, R, Clay Ct	
		38	11		SILTSTONE: dark grey, bedded sub horizontally.	MW	L			(10.96m) Be, 0 - 20°, C, R, Cn	
								0.30		(11.45m) CS, 0°, 30 mm.t	
					SANDSTONE: medium grained, light gey with grey lamination, trace of siltstone, bedded at 0-20°.	FR	H			(11.48m) Cr, 0°, 25 mm.t	
		37	12					1.0			
								1.3			
								1.4		(12.50m) CS, 0°, 15 mm.t	
					END OF BOREHOLE AT 12.56 m						
		36	13								
		35	14								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 110

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Method:** SPIRAL AUGER **R.L. Surface:** ~48.5 m

Date: 30/9/21 **Datum:** AHD

Plant Type: JK305 **Logged/Checked By:** J.L./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING										FILL: Clayey silt, low plasticity, dark brown, trace of fine grained igneous and ironstone gravel.	w<PL			MULCH COVER
											D			APPEARS MODERATELY COMPACTED
					N = 9 4,5,4	48				FILL: Clayey sand, fine to medium grained, orange brown, trace of fine to medium grained sandstone and ironstone gravel, and clay nodules.	w<PL			
							1		CI	FILL: Silty clay, low plasticity, brown, grey and orange brown, with fine to medium grained sand, trace of medium to coarse grained ironstone and sandstone gravel.	w~PL	(St - VSt)		RESIDUAL
						47				Silty CLAY: medium plasticity, orange brown, trace of fine to medium grained sand.				
							2			REFER TO CORED BOREHOLE LOG				
						46	3							
						45	4							
						44	5							
						43	6							
						42								

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CORED BOREHOLE LOG

Borehole No. 110

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~48.5 m

Date: 30/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
					START CORING AT 1.36m						
100% RETURN		47	1		SANDSTONE: medium to coarse grained, brown orange, bedded at 0-25°.	MW	M - H	0.80		(1.58m) J, 80°, P, Fe Sn	Hawkesbury Sandstone
								0.90			
		46	2					0.40			
					SANDSTONE: medium to coarse grained, light grey with red brown bands.	SW		1.1		(3.03m) Bex2, 25°, P, R, Fe Sn	
		45	3			MW	L - M	0.30			
								0.40		(3.64m) CS, 15°, 40 mm.t	
80% RETURN		44	4			SW	M - H	0.60		(4.28m) CS, 10°, 30 mm.t	
								1.1			
		43	5					0.90			
								0.90			
		42	6		as above, but bedded at 30°.			1.0		(6.04m) CS, 5°, 10 mm.t (6.26m) CS, 5°, 15 mm.t (6.34m) Be, 0°, P, R, Fe Sn	
								1.6			
		41	7					1.0			
								1.1			

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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CORED BOREHOLE LOG

Borehole No. 110

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** ~48.5 m

Date: 30/9/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
80% RETURN		40	9		SANDSTONE: medium to coarse grained, light grey with red brown bands, bedded at 30°.	FR	M - H	1.0, 1.4			Hawkesbury Sandstone
		39			SILTSTONE: dark grey, bedded at 20-30°.	MW	L	0.30, 0.30		(8.97m) CS, 10°	
100% RETURN		38	10		SANDSTONE: medium grained, light grey with grey lamination, trace of siltstone clasts, bedded at 0-20°.	FR	M - H	0.90, 1.1, 1.4		(10.63m) Be, 5°, P, R, Fe Sn	
		37	11								
		36	12					1.4, 1.3, 1.7		(11.91m) CS, 0°, 10 mm.t	
		35	13		END OF BOREHOLE AT 12.85 m						
		34	14								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. 110A 1/1

SDUP6: 0.0-0.1m

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: E32507BR **Method:** PUSH TUBE **R.L. Surface:** ≈ 48.5m

Date: 29/9/2021 **Datum:** AHD

Plant Type: EZIPROBE **Logged/Checked by:** M.M.E./V.B.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION							0			FILL: Silty gravelly sand, fine to medium grained, dark brown, fine to medium grained igneous gravel, trace of ash, slag and root fibres.	M			GRASS COVER
											w<PL			SCREEN: 10.0kg 0.0-0.1m NO FCF
										FILL: Sandy gravel, fine to medium grained igneous gravel, grey, fine to medium grained, trace of ash, asphaltic concrete fragments and root fibres.				SCREEN: 4.2kg 0.1-0.2m NO FCF
							1		CL-CI		w<PL			SCREEN: 5.8kg 0.2-1.1m NO FCF
										FILL: Sandy clay, low to medium plasticity, yellow brown mottled red brown, trace of sandstone cobble and ironstone gravel, terracotta and root fibres.				RESIDUAL
										Sandy CLAY: low to medium plasticity, yellow brown, trace of ironstone gravel, ash and root fibres.				REFUSAL ON INFERRED BEDROCK
							2			END OF BOREHOLE AT 1.3m				
							3							
							4							
							5							
							6							
							7							

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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. 111 **1/1**

SDUP3: 0.0-0.1m

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: E32507BR **Method:** HAND AUGER **R.L. Surface:** ≈ 48.6m

Date: 28/9/2021 **Datum:** AHD

Plant Type: - **Logged/Checked by:** M.M.E./V.B.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■		■		0			FILL: Silty sand, fine to medium grained, dark brown, trace of ironstone, siltstone and sandstone gravel, tile fragments and root fibres.	D			GRASS COVER
	■		■		■						w<PL			SCREEN: 10.8kg 0.0-0.1m NO FCF
	■		■		■					FILL: Silty clay, medium to high plasticity, brown, trace of sand, ironstone and igneous gravel and ash.	D			SCREEN: 4.8kg 0.1-0.3m NO FCF
							1			FILL: Silty clayey sand, fine to medium grained, brown, trace of ironstone and igneous gravel and ash.				SCREEN: 5.2kg 0.3-0.6m NO FCF
										END OF BOREHOLE AT 0.8m				SCREEN: 4.9kg 0.6-0.8m NO FCF
							2							HAND AUGER REFUSAL ON INFERRED BEDROCK
							3							
							4							
							5							
							6							
							7							

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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. 112 **1/1**

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: E32507BR **Method:** PUSH TUBE **R.L. Surface:** ≈ 48.6m

Date: 29/9/2021 **Datum:** AHD

Plant Type: EZIPROBE **Logged/Checked by:** H.W./V.B.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION			■		■		0			CONCRETE: 220mm.t				STEEL REINFORCEMENT AT 150mm
	■								-	FILL: Silty gravelly sand, fine to medium grained, brown, fine to medium grained sandstone gravel, trace of clay nodules, igneous and ironstone gravel and asphaltic concrete fragments.	M			SCREEN: 6.90kg 0.22-0.65m
									-		XW			NO FCF
							1			Extremely Weathered sandstone: silty SAND, fine to medium grained, yellow brown.				HAWKESBURY SANDSTONE
										END OF BOREHOLE AT 0.8m				REFUSAL
							2							
							3							
							4							
							5							
							6							
							7							

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ENVIRONMENTAL LOG

Log No. 113 1/1

Environmental logs are not to be used for geotechnical purposes

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: E32507BR **Method:** PUSH TUBE **R.L. Surface:** ≈ 52.0m

Date: 29/9/2021 **Datum:** AHD

Plant Type: EZIPROBE **Logged/Checked by:** M.M.E./V.B.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■		■		0			FILL: Silty sand, fine to medium grained, brown, trace of igneous gravel, glass and root fibres.	D M			GRASS COVER
	■		■						CL-CI	FILL: Silty clayey sand, fine to medium grained, light brown, trace of ironstone and igneous gravel, ash and root fibres.	w<PL			SCREEN: 10.1kg 0.0-0.1m NO FCF
							1			Sandy CLAY: low to medium plasticity, dark brown mottled yellow, trace of ironstone gravel, ash and root fibres.				SCREEN: 9.6kg 0.1-0.35m NO FCF
										Sandy CLAY: low to medium plasticity, yellow brown, trace of ironstone gravel and root fibres.				RESIDUAL
							2			END OF BOREHOLE AT 0.65m				REFUSAL ON INFERRED BEDROCK
							3							
							4							
							5							
							6							
							7							

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ENVIRONMENTAL LOG

Log No. 114 1/1

Environmental logs are not to be used for geotechnical purposes

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: E32507BR **Method:** PUSH TUBE **R.L. Surface:** ≈ 50.7m

Date: 29/9/2021 **Datum:** AHD

Plant Type: EZIPROBE **Logged/Checked by:** M.M.E./V.B.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■		■		0		-	ASPHALTIC CONCRETE: 50mm.t	D			SCREEN: 9.61kg
	■		■						SC	FILL: Silty sandy gravel, fine to medium grained, igneous gravel, sub angular, light grey, fine to medium grained sand, trace of ironstone gravel and asphaltic concrete fragments.	M			0.05-0.2m NO FCF
	■		■						CL-CI	Silty clayey SAND: fine to medium grained, light brown, trace of ironstone and sandstone gravel and root fibres.	w<PL			RESIDUAL
							1			Sandy CLAY: low to medium plasticity, yellow brown with ironstone gravel.				REFUSAL ON INFERRED BEDROCK
										END OF BOREHOLE AT 0.5m				
							2							
							3							
							4							
							5							
							6							
							7							

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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. 115 **1/1**

SDUP4: 0.0-0.1m

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: E32507BR **Method:** PUSH TUBE **R.L. Surface:** ≈ 50.1m

Date: 29/9/2021 **Datum:** AHD

Plant Type: EZIPROBE **Logged/Checked by:** M.M.E./V.B.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■		■		0			FILL: Silty clayey sand, fine to medium grained, brown, trace of ironstone and sandstone gravel, and root fibres.	D			GRASS COVER SCREEN: 11.8kg 0.0-0.1m NO FCF
	■		■						CL-CI	Silty CLAY: low to medium plasticity, light grey, with ironstone banding, trace of root fibres.	w<PL			RESIDUAL
	■						1							
										END OF BORHEOLE AT 1.1m				REFUSAL ON INFERRED BEDROCK
							2							
							3							
							4							
							5							
							6							
							7							

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ENVIRONMENTAL LOG

Log No. 116 1/1

Environmental logs are not to be used for geotechnical purposes

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: E32507BR **Method:** PUSH TUBE **R.L. Surface:** ≈ 50.1m

Date: 29/9/2021 **Datum:** AHD

Plant Type: EZIPROBE **Logged/Checked by:** M.M.E./V.B.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■		■		0		-	ASPHALTIC CONCRETE: 20mm.t	D			SCREEN: 11.9kg
	■								SC	FILL: Silty sandy gravel, fine to medium grained, igneous gravel, sub angular, light grey, fine to medium grained sand, trace of ironstone gravel and asphaltic concrete fragments.	M			0.02-0.1m
	■								CL-CI		w<PL			NO FCF
									-		XW			RESIDUAL
							1			Silty clayey SAND: light brown mottled yellow brown, trace of ironstone gravel, ash and root fibres.				HAWKESBURY SANDSTONE
										Sandy CLAY: low to medium plasticity, yellow brown, with ironstone banding.				REFUSAL
							2			Extremely Weathered sandstone: silty SAND, fine to medium grained, yellow brown.				
										END OF BOREHOLE AT 0.6m				
							3							
							4							
							5							
							6							
							7							

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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. 117 **1/1**

SDUP10: 0.0-0.1m

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: E32507BR **Method:** SPIRAL AUGER **R.L. Surface:** ≈ 49.3m

Date: 6/10/2021 **Datum:** AHD

Plant Type: JK205 **Logged/Checked by:** A.D./V.B.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■		■		0			FILL: Silty sand, fine to medium grained, brown, trace of tile fragments and root fibres.	M			GRASS COVER SCREEN: 10.0kg 0-0.1m NO FCF
	■		■			N = 25 8,13,12				FILL: Silty sand, fine to medium grained, grey and brown, trace of igneous gravel and sandstone gravel.	D			
							1							
										END OF BOREHOLE AT 1.5m				
							2							
							3							
							4							
							5							
							6							
							7							

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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. 118 **1/1**

SDUP5: 0.0-0.1m

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: E32507BR **Method:** PUSH TUBE **R.L. Surface:** ≈ 40.0m

Date: 29/9/2021 **Datum:** AHD

Plant Type: EZIPROBE **Logged/Checked by:** M.M.E./V.B.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION							0			FILL: Silty sandy clay, low to medium plasticity, light brown mottled red and yellow, trace of siltstone, ironstone and sandstone gravel, ash, tile fragments and root fibres.	D			GRASS COVER SCREEN: 10.6kg 0.0-0.1m NO FCF SCREEN: 9.85kg 0.1-1.1m NO FCF SCREEN: 8.1kg 1.1-1.6m NO FCF
							1							
							2		CL-CI	Sandy CLAY: low to medium plasticity, yellow brown mottled red, trace of ironstone gravel.	w<PL			RESIDUAL
									CI-CH	Sandy CLAY: medium to high plasticity, light brown mottled yellow and red, with ironstone banding.				
										END OF BOREHOLE AT 2.5m				REFUSAL
							3							
							4							
							5							
							6							
							7							

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BOREHOLE LOG

Borehole No. 119

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Method:** SPIRAL AUGER **R.L. Surface:** 42.5 m

Date: 1/10/21 **Datum:** AHD

Plant Type: JK305 **Logged/Checked By:** J.L./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING						42	0		-	ASPHALTIC CONCRETE: 50mm.t	D			SCREEN: 3.2kg 0.05-0.3m NO FCF
									-	FILL: Silty sand, fine to medium grained, yellow brown, trace of igneous and sandstone gravel, and ceramic tile fragments.	DW	MD / M		HAWKESBURY SANDSTONE
										SANDSTONE: fine to medium grained, yellow brown.				MODERATE 'TC' BIT RESISTANCE
						41	1							
												L - M		LOW TO MODERATE RESISTANCE
						40	2					H		HIGH RESISTANCE
						39	3			REFER TO CORED BOREHOLE LOG				GROUNDWATER MONITORING WELL INSTALLED TO 5.75m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 1.2m TO 5.75m. CASING 0m TO 1.2m. 2mm SAND FILTER PACK 1.0m TO 5.75m. BENTONITE SEAL 0.25m TO 1.0m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
							4							
						38	5							
						37	6							
						36								

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CORED BOREHOLE LOG

Borehole No. 119

Client: HAMMOND CARE

Project: PROPOSED HOSPITAL REDEVELOPMENT

Location: 97-115 RIVER ROAD, GREENWICH, NSW

Job No.: 32507R2 **Core Size:** NMLC **R.L. Surface:** 42.5 m

Date: 1/10/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** J.L./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		40			START CORING AT 2.94m					ROCK STRENGTH BASED ON TACTILE ASSESSMENT	
100% RETURN		39	3		SANDSTONE: medium grained, light grey, orange brown and red brown, bedded at 0-25°.	MW	(L - M)				Hawkesbury Sandstone
		38	4							(4.10m) CS, 5°, 10 mm.t (4.61m) J, 45°, P, R, Fe Ct	
		37	5		SANDSTONE: fine to medium grained, light grey, bedded at 0-20°.	FR	(M)			(5.15m) Be, 20°, C, R, Fe Sn (5.16m) CS, 5°, 10 mm.t (5.32m) Be x 2, 0°, C, R, Fe Ct (5.49m) Cr, 0°, 15 mm.t	
		36	6		END OF BOREHOLE AT 5.75 m						
		35	7								
		34	8								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

ENVIRONMENTAL LOGS EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the environmental report in regard to classification methods, field procedures and certain matters relating to the logging of soil and rock. Not all notes are necessarily relevant to all reports.

Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies include gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726:2017 *'Geotechnical Site Investigations'*. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geoenvironmental practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached soil classification table qualified by the grading of other particles present (eg. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	< 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2.36mm
Gravel	2.36 to 63mm
Cobbles	63 to 200mm
Boulders	> 200mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose (VL)	< 4
Loose (L)	4 to 10
Medium dense (MD)	10 to 30
Dense (D)	30 to 50
Very Dense (VD)	> 50

Cohesive soils are classified on the basis of strength (consistency) either by use of a hand penetrometer, vane shear, laboratory testing and/or tactile engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength (kPa)	Indicative Undrained Shear Strength (kPa)
Very Soft (VS)	≤ 25	≤ 12
Soft (S)	> 25 and ≤ 50	> 12 and ≤ 25
Firm (F)	> 50 and ≤ 100	> 25 and ≤ 50
Stiff (St)	> 100 and ≤ 200	> 50 and ≤ 100
Very Stiff (VSt)	> 200 and ≤ 400	> 100 and ≤ 200
Hard (Hd)	> 400	> 200
Friable (Fr)	Strength not attainable – soil crumbles	

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'shale' is used to describe fissile mudstone, with a weakness parallel to bedding. Rocks with alternating inter-laminations of different grain size (eg. siltstone/claystone and siltstone/fine grained sandstone) are referred to as 'laminite'.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All methods except test pits, hand auger drilling and portable Dynamic Cone Penetrometers require the use of a mechanical rig which is commonly mounted on a truck chassis or track base.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the

structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the hand auger can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of limited reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock cuttings. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be assessed from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, NMLC or HQ triple tube core barrels, which give a core of about 50mm and 61mm diameter, respectively, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as NO CORE. The location of NO CORE recovery is determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the bottom of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289.6.3.1–2004 (R2016) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – Standard Penetration Test (SPT)'*.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63.5kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of, say, 4, 6 and 7 blows, as

  N = 13
  4, 6, 7

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as

  N > 30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

A modification to the SPT is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as 'N_c' on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

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

The terms and symbols used in preparation of the logs are defined in the following pages.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than 'straight line' variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

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

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if reliable water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably assess the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse environmental characteristics or behaviour. If the volume and nature of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classification and rock strengths indicated on the environmental logs unless noted in the report.

SYMBOL LEGENDS

SOIL


FILL


TOPSOIL


CLAY (CL, CI, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CI, CH)


SILTY CLAY (CL, CI, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CI, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML, MH)


PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK


CONGLOMERATE


SANDSTONE


SHALE/MUDSTONE


SILTSTONE


CLAYSTONE


COAL


LAMINITE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

OTHER MATERIALS


BRICKS OR PAVERS


CONCRETE


ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

Major Divisions		Group Symbol	Typical Names	Field Classification of Sand and Gravel	Laboratory Classification	
Coarse grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm	GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 4$ $1 < C_c < 3$
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Fines behave as silt
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Fines behave as clay
	SAND (more than half of coarse fraction is smaller than 2.36mm)	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 6$ $1 < C_c < 3$
		SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	N/A
		SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	

Major Divisions		Group Symbol	Typical Names	Field Classification of Silt and Clay			Laboratory Classification
				Dry Strength	Dilatancy	Toughness	% < 0.075mm
ine grained soils (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silt	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clay of high plasticity	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	–	–	–	–

Laboratory Classification Criteria

A well graded coarse grained soil is one for which the coefficient of uniformity $Cu > 4$ and the coefficient of curvature $1 < C_c < 3$. Otherwise, the soil is poorly graded. These coefficients are given by:

$$C_U = \frac{D_{60}}{D_{10}} \qquad and \qquad C_C = \frac{(D_{30})^2}{D_{10}\, D_{60}}$$

Where D_{10}, D_{30} and D_{60} are those grain sizes for which 10%, 30% and 60% of the soil grains, respectively, are smaller.

NOTES:

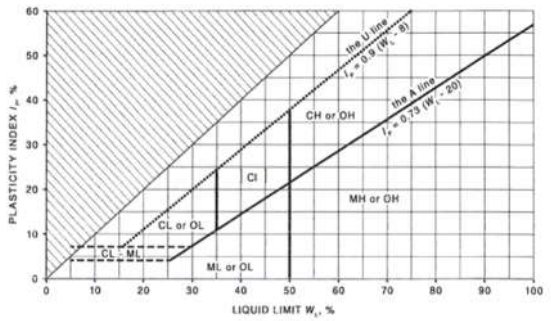
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

2 Where the grading is determined from laboratory tests, it is defined by coefficients of curvature (C_c) and uniformity (C_u) derived from the particle size distribution curve.

3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

4 The U line on the Modified Casagrande Chart is an approximate upper bound for most natural soils.

Modified Casagrande Chart for Classifying Silts and Clays according to their Behaviour



LOG SYMBOLS

Log Column	Symbol	Definition
Groundwater Record		Standing water level. Time delay following completion of drilling/excavation may be shown.
		Extent of borehole/test pit collapse shortly after drilling/excavation.
		Groundwater seepage into borehole or test pit noted during drilling or excavation.
Samples	ES	Sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos analysis.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
	PFAS	Soil sample taken over depth indicated, for analysis of Per- and Polyfluoroalkyl Substances.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25 PID = 100	Vane shear reading in kPa of undrained shear strength. Photoionisation detector reading in ppm (soil sample headspace test).
Moisture Condition (Fine Grained Soils)	w > PL $w \approx$ PL w < PL $w \approx$ LL w > LL	Moisture content estimated to be greater than plastic limit. Moisture content estimated to be approximately equal to plastic limit. Moisture content estimated to be less than plastic limit. Moisture content estimated to be near liquid limit. Moisture content estimated to be wet of liquid limit.
(Coarse Grained Soils)	D M W	DRY – runs freely through fingers. MOIST – does not run freely but no free water visible on soil surface. WET – free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS S F St VSt Hd Fr ( )	VERY SOFT – unconfined compressive strength ≤ 25kPa. SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa. FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa. STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa. VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa. HARD – unconfined compressive strength > 400kPa. FRIABLE – strength not attainable, soil crumbles. Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.
Density Index/ Relative Density (Cohesionless Soils)	VL L MD D VD ( )	**Density Index (I_D) Range (%)** / **SPT 'N' Value Range (Blows/300mm)** VERY LOOSE ≤ 15 / 0 – 4 LOOSE > 15 and ≤ 35 / 4 – 10 MEDIUM DENSE > 35 and ≤ 65 / 10 – 30 DENSE > 65 and ≤ 85 / 30 – 50 VERY DENSE > 85 / > 50 Bracketed symbol indicates estimated density based on ease of drilling or other assessment.

Log Column	Symbol	Definition
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

Term		Abbreviation		Definition
Residual Soil		RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered		XW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered (Note 1)	HW	DW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered		MW		The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

NOTE 1: The term 'Distinctly Weathered' is used where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock. 'Distinctly Weathered' is defined as follows: *'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores'*. There is some change in rock strength.

Rock Material Strength Classification

Term	Abbreviation	Uniaxial Compressive Strength (MPa)	Guide to Strength	
			Point Load Strength Index $Is_{(50)}$ (MPa)	Field Assessment
Very Low Strength	VL	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Appendix F: Laboratory Reports & COC Documents

Envirolab Services Pty Ltd
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CERTIFICATE OF ANALYSIS 279440-B

Client Details

Client	JK Environments
Attention	C Ridley
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32507BR, Greenwich**
Number of Samples	131 Soil
Date samples received	30/09/2021
Date completed instructions received	01/10/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

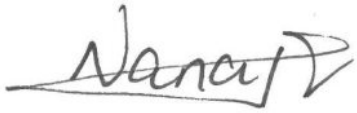
Date results requested by	06/10/2021
Date of Issue	06/10/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Inorganics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

sPOCAS field test						
Our Reference		279440-B-119	279440-B-120	279440-B-121	279440-B-122	279440-B-123
Your Reference	UNITS	BH107	BH105	BH105	BH105	BH106
Depth		1.0-1.3	0.25-0.4	0.5-0.95	1.2-1.4	1.5-1.7
Type of sample		Soil	Soil	Soil	Soil	Soil
Date Sampled		27/09/2021	27/09/2021	27/09/2021	27/09/2021	28/09/2021
Date prepared	-	06/10/2021	06/10/2021	06/10/2021	06/10/2021	06/10/2021
Date analysed	-	06/10/2021	06/10/2021	06/10/2021	06/10/2021	06/10/2021
pH_F (field pH test)*	pH Units	6.6	8.2	7.7	7.4	5.1
pH_{FOX} (field peroxide test)*	pH Units	5.2	8.3	5.4	4.8	3.8
Reaction Rate*	-	Low reaction	Low reaction	Medium reaction	Volcanic reaction	Medium reaction

sPOCAS field test						
Our Reference		279440-B-124	279440-B-125	279440-B-126	279440-B-127	279440-B-128
Your Reference	UNITS	BH106	BH106	BH107	BH107	BH107
Depth		0.03-0.3	0.6-0.8	0-0.1	0.1-0.4	0.5-0.95
Type of sample		Soil	Soil	Soil	Soil	Soil
Date Sampled		28/09/2021	27/09/2021	27/09/2021	27/09/2021	27/09/2021
Date prepared	-	06/10/2021	06/10/2021	06/10/2021	06/10/2021	06/10/2021
Date analysed	-	06/10/2021	06/10/2021	06/10/2021	06/10/2021	06/10/2021
pH_F (field pH test)*	pH Units	9.4	6.8	6.6	7.0	7.1
pH_{FOX} (field peroxide test)*	pH Units	10.0	5.8	3.8	4.9	5.1
Reaction Rate*	-	Extreme reaction	Medium reaction	Volcanic reaction	Medium reaction	Low reaction

sPOCAS field test				
Our Reference		279440-B-129	279440-B-130	279440-B-131
Your Reference	UNITS	BH109	BH109	BH109
Depth		0.01-0.4	0.5-0.8	0.8-0.95
Type of sample		Soil	Soil	Soil
Date Sampled		28/09/2021	28/09/2021	28/09/2021
Date prepared	-	06/10/2021	06/10/2021	06/10/2021
Date analysed	-	06/10/2021	06/10/2021	06/10/2021
pH_F (field pH test)*	pH Units	8.5	6.6	6.4
pH_{FOX} (field peroxide test)*	pH Units	8.8	5.1	5.6
Reaction Rate*	-	Volcanic reaction	Low reaction	Low reaction

Method ID	Methodology Summary
Inorg-063	pH- measured using pH meter and electrode. Soil is oxidised with Hydrogen Peroxide or extracted with water. Based on section H, Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions.

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			06/10/2021	119	06/10/2021	06/10/2021		06/10/2021	[NT]
Date analysed	-			06/10/2021	119	06/10/2021	06/10/2021		06/10/2021	[NT]
pH_F (field pH test)*	pH Units		Inorg-063	[NT]	119	6.6	6.7	2	100	[NT]
pH_{FOX} (field peroxide test)*	pH Units		Inorg-063	[NT]	119	5.2	5.2	0	100	[NT]

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	131	06/10/2021	06/10/2021		[NT]	[NT]
Date analysed	-			[NT]	131	06/10/2021	06/10/2021		[NT]	[NT]
pH_F (field pH test)*	pH Units		Inorg-063	[NT]	131	6.4	6.3	2	[NT]	[NT]
pH_{FOX} (field peroxide test)*	pH Units		Inorg-063	[NT]	131	5.6	5.7	2	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	JK Environments
Attention	C Ridley

Sample Login Details

Your reference	E32507BR, Greenwich
Envirolab Reference	279440-B
Date Sample Received	30/09/2021
Date Instructions Received	01/10/2021
Date Results Expected to be Reported	06/10/2021

Sample Condition

Samples received in appropriate condition for analysis	Holding time exceedance
No. of Samples Provided	131 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	14
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Please contact the laboratory within 24 hours if you wish to cancel the aformentioned testing. Otherwise testing will proceed as per the COC and hence invoice accordingly.

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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www.envirolab.com.au

Sample ID	sPOCAS field test	On Hold
BH105-0.25-0.4		✓
BH105-0.5-0.95		✓
BH105-1.2-1.4		✓
BH105-1.5-1.7		✓
BH106-0.03-0.3		✓
BH106-0.6-0.8		✓
BH107-0-0.2		✓
BH107-0.2-0.4		✓
BH107-0.5-0.95		✓
BH109-0.01-0.4		✓
BH109-0.5-0.8		✓
BH109-0.8-0.95		✓
BH109-1.0-1.2		✓
BH110A-0-0.1		✓
BH110A-0.1-0.2		✓
BH110A-0.5-0.8		✓
BH110A-1.1-1.3		✓
BH111-0-0.1		✓
BH111-0.2-0.3		✓
BH111-0.3-0.6		✓
BH111-0.6-0.8		✓
BH112-0.22-0.65		✓
BH112-0.65-0.8		✓
BH113-0-0.1		✓
BH113-0.1-0.2		✓
BH113-0.35-0.45		✓
BH113-0.45-0.6		✓
BH113-0.6-0.65		✓
BH114-0.05-0.2		✓
BH114-0.2-0.4		✓
BH114-0.4-0.5		✓
BH115-0-0.1		✓

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Sample ID	sPOCAS field test	On Hold
BH115-0.3-0.5		✓
BH115-0.6-0.8		✓
BH115-0.9-1.1		✓
BH116-0-0.1		✓
BH116-0.1-0.3		✓
BH116-0.3-0.55		✓
BH118-0-0.1		✓
BH118-0.5-0.6		✓
BH118-1.4-1.5		✓
BH118-1.6-1.8		✓
BH118-2.3-2.5		✓
SDUP1		✓
SDUP2		✓
SDUP3		✓
SDUP4		✓
SDUP5		✓
SDUP6		✓
PFAS DUP1		✓
TS-S1		✓
TB-S1		✓
BH105-0.25-0.4		✓
BH105-0.5-0.95		✓
BH105-1.2-1.4		✓
BH105-2.4-2.5		✓
BH105-2.9-3.0		✓
BH105-3.9-4.0		✓
BH105-4.9-5.0		✓
BH105-5.9-6.0		✓
BH105-6.9-7.0		✓
BH105-7.7-7.83		✓
BH106-0.03-0.3		✓
BH106-0.6-0.8		✓

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Sample ID	sPOCAS field test	On Hold
BH106-0.9-1.1		✓
BH106-1.4-1.5		✓
BH106-1.9-2.0		✓
BH106-2.4-2.5		✓
BH106-2.9-3.0		✓
BH106-3.9-4.0		✓
BH106-4.9-5.0		✓
BH106-5.9-6.0		✓
BH106-6.9-7.0		✓
BH106-7.9-8.0		✓
BH106-8.9-9.0		✓
BH106-9.9-10.0		✓
BH106-10.9-11.0		✓
BH106-11.9-12.0		✓
BH106-12.45-12.55		✓
BH107-0-0.2		✓
BH107-0.2-0.4		✓
BH107-0.5-0.95		✓
BH107-1.3-1.5		✓
BH107-1.9-2.0		✓
BH107-2.4-2.5		✓
BH107-2.75-2.85		✓
BH107-3.9-4.0		✓
BH107-4.9-5.0		✓
BH107-5.9-6.0		✓
BH107-6.9-7.0		✓
BH107-7.9-8.0		✓
BH107-8.9-9.0		✓
BH107-9.9-10.0		✓
BH107-10.9-11.0		✓
BH107-11.9-12.0		✓
BH107-12.9-13.0		✓

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Sample ID	sPOCAS field test	On Hold
BH107-13.9-14.0		✓
BH107-14.9-15.0		✓
BH109-0.01-0.4		✓
BH109-0.5-0.8		✓
BH109-0.8-0.95		✓
BH109-1.0-1.2		✓
BH109-1.42-1.50		✓
BH109-1.9-2.0		✓
BH109-2.4-2.5		✓
BH109-2.9-3.0		✓
BH109-3.9-4.0		✓
BH109-4.9-5.0		✓
BH109-5.9-6.0		✓
BH109-6.9-7.0		✓
BH109-7.9-8.0		✓
BH109-8.9-9.0		✓
BH109-9.9-10.0		✓
BH109-10.96-11.0		✓
BH109-11.9-12.0		✓
BH109-12.45-12.56		✓
BH109-11.35-11.45		✓
PFAS Trip Blank -.		✓
BH107-1.0-1.3	✓	
BH105-0.25-0.4	✓	
BH105-0.5-0.95	✓	
BH105-1.2-1.4	✓	
BH106-1.5-1.7	✓	
BH106-0.03-0.3	✓	
BH106-0.6-0.8	✓	
BH107-0-0.1	✓	
BH107-0.1-0.4	✓	
BH107-0.5-0.95	✓	

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Sample ID	sPOCAS field test	On Hold
BH109-0.01-0.4	✓	
BH109-0.5-0.8	✓	
BH109-0.8-0.95	✓	

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	JKE Job Number: E32507BR Date Results Required: STANDARD Page: 1 of 2	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: Craig Ridley cridley@jkenvironments.com.au

Location: Greenwich

Sampler: HW

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	Combo 2	Combo 3	Combo 6	Combo 6a	8 Metals	PAHs	TRH/BTEX	BTEX	Asbestos (NEPM)	PFAS	Asbestos (ID)
27/09/2021	1	BH105	0.25-0.4	G, A, PFAS	0	Fill: Silty Gravelly Sand			X						X	X	
27/09/2021	2	BH105	0.5-0.95	G, A, PFAS	0	Fill: Clayey silty sand		X								X	
27/09/2021	3	BH105	1.2-1.4	G, A, PFAS	0	Sandy Clay		X									
27/09/2021	4	BH105	1.5-1.7	G, A, PFAS	0	XW Sandstone											
28/09/2021	5	BH106	0.03-0.3	G, A	0	Fill: Clayey gravelly sand			X						X		
28/09/2021	6	BH106	0.6-0.8	G, A	0	Silty Clay		X									
27/09/2021	7	BH107	0-0.2	G, A	0	Fill: Silty clay			X						X		
27/09/2021	8	BH107	0.2-0.4	G, A	0	Fill: Sandy clay		X									
27/09/2021	9	BH107	0.5-0.95	G, A	0	Silty Sand											
28/09/2021	10	BH109	0.01-0.4	G, A	0	Fill: Clayey gravelly sand			X						X		
28/09/2021	11	BH109	0.5-0.8	G, A	5	Fill: Sandy clay		X									
28/09/2021	12	BH109	0.8-0.95	G, A	1.5	Sandy Clay		X									
28/09/2021	13	BH109	1.0-1.2	G, A	0	Sandstone											
29/09/2021	14	BH110A	0-0.1	G, A	0.3	Fill: Silty gravelly sand			X						X		
29/09/2021	15	BH110A	0.1-0.2	G, A	0	Fill: Sandy gravel		X									
29/09/2021	16	BH110A	0.5-0.8	G, A	0	Fill: Sandy clay		X							X		
29/09/2021	17	BH110A	1.1-1.3	G, A	0	Sandy clay											
28/09/2021	18	BH111	0-0.1	G, A	0	Fill: Silty sand			X						X		
28/09/2021	19	BH111	0.2-0.3	G, A	0	Fill: Silty sand											
28/09/2021	20	BH111	0.3-0.6	G, A	0	Fill: Silty clay		X									
28/09/2021	21	BH111	0.6-0.8	G, A	0	Fill: Silty clayey Sand		X									
29/09/2021	22	BH112	0.22-0.65	G, A	0	F: Silty gravelly sand			X						X		
29/09/2021	23	BH112	0.65-0.8	G, A	0	XW Sandstone		X									
29/09/2021	24	BH113	0-0.1	G, A	0	Fill: Silty sand			X						X		
29/09/2021	25	BH113	0.1-0.2	G, A	0	Fill: Silty clayey sand		X									
29/09/2021	26	BH113	0.35-0.45	G, A	0	Sandy Clay		X									

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag
PFAS - Pfas Jar

Relinquished By:	Date:	Time:	Received By:	Date:
				30/09/2021 COC 01/10/2021

279440
updated
COC

SAMPLE AND CHAIN OF CUSTODY FORM

TO:
ENVIROLAB SERVICES PTY LTD
12 ASHLEY STREET
CHATSWOOD NSW 2067
P: (02) 99106200
F: (02) 99106201

Attention: Aileen

JKE Job Number: E32507BR

Date Results Required: STANDARD

Page: 2 of 2

FROM:
JKEnvironments
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 F: 02-9888 5001
Attention: Craig Ridley
cridley@jkenvironments.com.au

Location: Greenwich
Sampler: HW

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	Combo 2	Combo 3	Combo 6	Combo 6a	8 Metals	PAHs	TRH/BTEX	BTEX	Asbestos (NEPM)	PFAS	Asbestos (ID)	
29/09/2021	27	BH113	0.45-0.6	G	0	Sandy clay												
29/09/2021	28	BH113	0.6-0.65	G	0	Sandstone												
29/09/2021	29	BH114	0.05-0.2	G, A	0	Fill: Silty sandy gravel			X						X			
29/09/2021	30	BH114	0.2-0.4	G, A	0	Silty clayey sand												
29/09/2021	31	BH114	0.4-0.5	G, A	0	Sandy clay												
29/09/2021	32	BH115	0-0.1	G, A	0	Fill: Silty clayey sand			X						X			
29/09/2021	33	BH115	0.3-0.5	G, A	0	Fill: silty clayey sand												
29/09/2021	34	BH115	0.6-0.8	G, A	0	Sandy clay		X										
29/09/2021	35	BH115	0.9-1.1	G, A	0	Sandy clay												
29/09/2021	36	BH116	0-0.1	G, A	0	Fill: Silty sandy gravel			X						X			
29/09/2021	37	BH116	0.1-0.3	G, A	0	Silty clayey sand		X										
29/09/2021	38	BH116	0.3-0.55	G	0	Sandy clay												
29/09/2021	39	BH118	0-0.1	G, A	0	Fill: Silty sandy clay			X						X			
29/09/2021	40	BH118	0.5-0.6	G, A	0	Fill: Silty sandy clay												
29/09/2021	41	BH118	1.4-1.5	G, A	0	Fill: Silty sandy clay		X										
29/09/2021	42	BH118	1.6-1.8	G, A	0	Sandy clay		X										
29/09/2021	43	BH118	2.3-2.5	G, A	0	Sandy clay												
28/09/2021	44	SDUP1	-	G, A	-	Duplicate												
28/09/2021	45	SDUP2	-	G	-	Duplicate												
28/09/2021	46	SDUP3	-	G, A	-	Duplicate		X							X			
29/09/2021	47	SDUP4	-	G, A	-	Duplicate			X						X			
29/09/2021	48	SDUP5	-	G, A	-	Duplicate												
29/09/2021	49	SDUP6	-	G, A	-	Duplicate			X						X			
27/09/2021	50	PFAS DUP1	-	PFAS	-	Duplicate								X				
27/09/2021	51	TS-S1	-	V	-	Spike							X					
27/09/2021	52	TB-S1	-	G, PFAS	-	Blank								X				

Remarks (comments/detection limits required):
PLEASE SEND SDUP6 TO VIC

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag PFAS - PFAS Jar
P - Plastic Bag

Relinquished By:	Date:	Time:	Received By:	Date:

279440

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	JKE Job Number: E32507BR Date Results Required: STANDARD Page: 1 of 3	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: Craig Ridley cridley@jkenvironments.com.au

Location:	Greenwich					Sample Preserved in Esky on Ice											
Sampler:	HW					Tests Required											
Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	Sample Description	pH	EC	ECe (texture)	Sulphate	Chloride	Resistivity	CEC					
27/09/2021	53	BH105	0.25-0.4	G	Fill: Silty Gravelly Sand	X	X	X	X	X	X	X					
27/09/2021	54	BH105	0.5-0.95	G	Fill: Clayey silty sand	X	X	X	X	X	X	X					
27/09/2021	55	BH105	1.2-1.4	G	Sandy Clay	X	X	X	X	X	X	X					
27/09/2021	56	BH105	2.4-2.5	G	XW Sandstone												
27/09/2021	57	BH105	2.9-3.0	G	XW Sandstone	X	X	X	X	X	X	X					
27/09/2021	58	BH105	3.9-4.0	G	Sandstone												
27/09/2021	59	BH105	4.9-5.0	G	Sandstone												
27/09/2021	60	BH105	5.9-6.0	G	Sandstone												
27/09/2021	61	BH105	6.9-7.0	G	Sandstone												
27/09/2021	62	BH105	7.7-7.83	G	Sandstone												
28/09/2021	63	BH106	0.03-0.3	G	Fill: Clayey gravelly sand												
28/09/2021	64	BH106	0.6-0.8	G	Silty Clay												
28/09/2021	65	BH106	0.9-1.1	G	Sandstone												
28/09/2021	66	BH106	1.4-1.5	G	Sandstone												
28/09/2021	67	BH106	1.9-2.0	G	Sandstone												
28/09/2021	68	BH106	2.4-2.5	G	Sandstone												
28/09/2021	69	BH106	2.9-3.0	G	Sandstone												
28/09/2021	70	BH106	3.9-4.0	G	Sandstone												
28/09/2021	71	BH106	4.9-5.0	G	Sandstone												
28/09/2021	72	BH106	5.9-6.0	G	Sandstone												
28/09/2021	73	BH106	6.9-7.0	G	Sandstone												
28/09/2021	74	BH106	7.9-8.0	G	Sandstone	X	X	X	X	X	X	X					
28/09/2021	75	BH106	8.9-9.0	G	Sandstone												
28/09/2021	76	BH106	9.9-10.0	G	Sandstone												
28/09/2021	77	BH106	10.9-11.0	G	Sandstone	X		X	X	X	X						

Remarks (comments/detection limits required):	Sample Containers: G - 250mg Glass Jar A - Ziplock Asbestos Bag P - Plastic Bag

Relinquished By:	Date:	Time:	Received By:	Date:

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SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	JKE Job Number: E32507BR Date Results Required: STANDARD Page: 2 of 3	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: Craig Ridley cridley@jkenvironments.com.au

Location:	Greenwich					Sample Preserved in Esky on Ice											
Sampler:	HW					Tests Required											
Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	Sample Description	pH	EC	ECe (texture)	Sulphate	Chloride	Resistivity	CEC					
28/09/2021	78	BH106	11.9-12.0	G	Sandstone												
28/09/2021	79	BH106	12.45-12.55	G	Sandstone	X	X		X	X	X						
27/09/2021	80	BH107	0-0.2	G	Fill: Silty clay	X	X	X	X	X	X	X					
27/09/2021	81	BH107	0.2-0.4	G	Fill: Sandy clay												
27/09/2021	82	BH107	0.5-0.95	G	Silty Sand												
27/09/2021	119	BH107	1.0-1.3	G	Silty Clay												
27/09/2021	83	BH107	1.3-1.5	G	Sandstone	X	X		X	X	X						
27/09/2021	84	BH107	1.9-2.0	G	Sandstone												
27/09/2021	85	BH107	2.4-2.5	G	Sandstone												
27/09/2021	86	BH107	2.75-2.85	G	Sandstone												
27/09/2021	87	BH107	3.9-4.0	G	Sandstone	X	X		X	X	X						
27/09/2021	88	BH107	4.9-5.0	G	Sandstone												
27/09/2021	89	BH107	5.9-6.0	G	Sandstone	X	X		X	X	X						
27/09/2021	90	BH107	6.9-7.0	G	Sandstone												
27/09/2021	91	BH107	7.9-8.0	G	Sandstone												
27/09/2021	92	BH107	8.9-9.0	G	Sandstone												
27/09/2021	93	BH107	9.9-10.0	G	Sandstone												
27/09/2021	94	BH107	10.9-11.0	G	Sandstone												
27/09/2021	95	BH107	11.9-12.0	G	Sandstone												
27/09/2021	96	BH107	12.9-13.0	G	Sandstone												
27/09/2021	97	BH107	13.9-14.0	G	Sandstone	X	X		X	X	X						
27/09/2021	98	BH107	14.9-15.0	G	Sandstone	X	X		X	X	X						
28/09/2021	99	BH109	0.01-0.4	G	Fill: Clayey gravelly sand	X	X	X	X	X	X	X					
28/09/2021	100	BH109	0.5-0.8	G	Fill: Sandy clay	X	X	X	X	X	X	X					
28/09/2021	101	BH109	0.8-0.95	G	Sandy Clay												

Remarks (comments/detection limits required):	Sample Containers: G - 250mg Glass Jar A - Ziplock Asbestos Bag P - Plastic Bag

Relinquished By:	Date:	Time:	Received By:	Date:

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SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	JKE Job Number: E32507BR Date Results Required: STANDARD Page: 3 of 3	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: Craig Ridley cridley@jkenvironments.com.au

Location:	Greenwich	Sample Preserved in Esky on Ice
Sampler:	HW	Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	Sample Description	pH	EC	ECe (texture)	Sulphate	Chloride	Resistivity	CEC					
28/09/2021	102	BH109	1.0-1.2	G	Sandstone												
28/09/2021	103	BH109	1.42-1.50	G	Sandstone												
28/09/2021	104	BH109	1.9-2.0	G	Sandstone												
28/09/2021	105	BH109	2.4-2.5	G	Sandstone												
28/09/2021	106	BH109	2.9-3.0	G	Sandstone												
28/09/2021	107	BH109	3.9-4.0	G	Sandstone												
28/09/2021	108	BH109	4.9-5.0	G	Sandstone												
28/09/2021	109	BH109	5.9-6.0	G	Sandstone												
28/09/2021	110	BH109	6.9-7.0	G	Sandstone												
28/09/2021	111	BH109	7.9-8.0	G	Sandstone												
28/09/2021	112	BH109	8.9-9.0	G	Sandstone												
28/09/2021	113	BH109	9.9-10.0	G	Sandstone												
28/09/2021	114	BH109	10.96-11.0	G	Sandstone												
28/09/2021	115	BH109	11.9-12.0	G	Sandstone												
28/09/2021	116	BH109	12.45-12.56	G	Sandstone												
28/09/2021	117	BH109	11.35-11.45	G	Sandstone												
27/09/21	118	AEAS Trip Blank	—														

Remarks (comments/detection limits required):	Sample Containers: G - 250mg Glass Jar A - Ziplock Asbestos Bag P - Plastic Bag

Relinquished By:	Date:	Time:	Received By:	Date:

279440

S

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	JKE Job Number: E32507BR Date Results Required: STANDARD Page: 1 of 1	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: Craig Ridley cridley@jkenvironments.com.au

Location:	Greenwich					Sample Preserved in Esky on Ice											
Sampler:	HW					Tests Required											
Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	Sample Description	SCr extended	pH field test (pHF apHFOX)										
27/09/2021	120	BH105	0.25-0.4	P	Fill: Sandy Gravelly Sand		X										
27/09/2021	121	BH105	0.5-0.95	P	Fill: Clayey silty sand		X										
27/09/2021	122	BH105	1.2-1.4	P	Sandy Clay		X										
28/09/2021	123	BH106	1.5-1.7	P	Fill: Clayey gravelly sand		X										
28/09/2021	124	BH106	0.03-0.3	P	Silty Clay		X										
27/09/2021	125	BH106	0.6-0.8	P	Silty Clay		X										
27/09/2021	126	BH107	0-0.1	P	Fill: Silty clay		X										
27/09/2021	127	BH107	0.1-0.4	P	Fill: Sandy clay		X										
27/09/2021	128	BH107	0.5-0.95	P	Silty Sand		X										
28/09/2021	129	BH109	0.01-0.4	P	Fill: Clayey gravelly sand		X										
28/09/2021	130	BH109	0.5-0.8	P	Fill: Clayey gravelly sand		X										
28/09/2021	131	BH109	0.8-0.95	P	Sandy Clay		X										
27/09/2021	119	BH107	1-1.3	P	Silty Clay		X										

Remarks (comments/detection limits required):	Sample Containers: G - 250mg Glass Jar A - Ziplock Asbestos Bag P - Plastic Bag

Relinquished By:	Date:	Time:	Received By:	Date:
			Tony	

279440

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CERTIFICATE OF ANALYSIS 279440-C

Client Details

Client	JK Environments
Attention	C Ridley
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32507BR, Greenwich**
Number of Samples	additional analysis
Date samples received	30/09/2021
Date completed instructions received	08/10/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	15/10/2021
Date of Issue	15/10/2021

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Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Chromium Suite				
Our Reference		279440-C-122	279440-C-123	279440-C-126
Your Reference	UNITS	BH105	BH106	BH107
Depth		1.2-1.4	1.5-1.7	0-0.1
Type of sample		Soil	Soil	Soil
Date Sampled		27/09/2021	28/09/2021	27/09/2021
Date prepared	-	11/10/2021	11/10/2021	11/10/2021
Date analysed	-	11/10/2021	11/10/2021	11/10/2021
pH $_{kcl}$	pH units	7.0	4.4	6.0
s-TAA pH 6.5	%w/w S	<0.01	0.03	<0.01
TAA pH 6.5	moles H^+ /t	<5	19	<5
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H^+ /t	<3	<3	<3
S_{HCl}	%w/w S	[NT]	0.013	[NT]
S_{KCl}	%w/w S	[NT]	0.014	[NT]
S_{NAS}	%w/w S	[NT]	<0.005	[NT]
ANC_{BT}	% $CaCO_3$	<0.05	[NT]	[NT]
s-ANC_{BT}	%w/w S	<0.05	[NT]	[NT]
s-Net Acidity	%w/w S	<0.005	0.031	<0.005
a-Net Acidity	moles H^+ /t	<5	19	<5
Liming rate	kg $CaCO_3$ /t	<0.75	1	<0.75
a-Net Acidity without ANCE	moles H^+ /t	<5	19	<5
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75	1.4	<0.75
s-Net Acidity without ANCE	%w/w S	<0.005	0.031	<0.005

Method ID	Methodology Summary
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity.

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			11/10/2021	[NT]	[NT]	[NT]	[NT]	11/10/2021	[NT]
Date analysed	-			11/10/2021	[NT]	[NT]	[NT]	[NT]	11/10/2021	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	[NT]	[NT]	[NT]	[NT]	97	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	[NT]	[NT]	[NT]	[NT]	109	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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SAMPLE RECEIPT ADVICE

Client Details

Client	JK Environments
Attention	C Ridley

Sample Login Details

Your reference	E32507BR, Greenwich
Envirolab Reference	279440-C
Date Sample Received	30/09/2021
Date Instructions Received	08/10/2021
Date Results Expected to be Reported	15/10/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	additional analysis
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	14
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
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Sample ID	Chromium Suite	On Hold
BH105-0.25-0.4		✓
BH105-0.5-0.95		✓
BH105-1.2-1.4		✓
BH105-1.5-1.7		✓
BH106-0.03-0.3		✓
BH106-0.6-0.8		✓
BH107-0-0.2		✓
BH107-0.2-0.4		✓
BH107-0.5-0.95		✓
BH109-0.01-0.4		✓
BH109-0.5-0.8		✓
BH109-0.8-0.95		✓
BH109-1.0-1.2		✓
BH110A-0-0.1		✓
BH110A-0.1-0.2		✓
BH110A-0.5-0.8		✓
BH110A-1.1-1.3		✓
BH111-0-0.1		✓
BH111-0.2-0.3		✓
BH111-0.3-0.6		✓
BH111-0.6-0.8		✓
BH112-0.22-0.65		✓
BH112-0.65-0.8		✓
BH113-0-0.1		✓
BH113-0.1-0.2		✓
BH113-0.35-0.45		✓
BH113-0.45-0.6		✓
BH113-0.6-0.65		✓
BH114-0.05-0.2		✓
BH114-0.2-0.4		✓
BH114-0.4-0.5		✓
BH115-0-0.1		✓

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Sample ID	Chromium Suite	On Hold
BH115-0.3-0.5		✓
BH115-0.6-0.8		✓
BH115-0.9-1.1		✓
BH116-0-0.1		✓
BH116-0.1-0.3		✓
BH116-0.3-0.55		✓
BH118-0-0.1		✓
BH118-0.5-0.6		✓
BH118-1.4-1.5		✓
BH118-1.6-1.8		✓
BH118-2.3-2.5		✓
SDUP1		✓
SDUP2		✓
SDUP3		✓
SDUP4		✓
SDUP5		✓
SDUP6		✓
PFAS DUP1		✓
TS-S1		✓
TB-S1		✓
BH105-0.25-0.4		✓
BH105-0.5-0.95		✓
BH105-1.2-1.4		✓
BH105-2.4-2.5		✓
BH105-2.9-3.0		✓
BH105-3.9-4.0		✓
BH105-4.9-5.0		✓
BH105-5.9-6.0		✓
BH105-6.9-7.0		✓
BH105-7.7-7.83		✓
BH106-0.03-0.3		✓
BH106-0.6-0.8		✓

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www.envirolab.com.au

Sample ID	Chromium Suite	On Hold
BH106-0.9-1.1		✓
BH106-1.4-1.5		✓
BH106-1.9-2.0		✓
BH106-2.4-2.5		✓
BH106-2.9-3.0		✓
BH106-3.9-4.0		✓
BH106-4.9-5.0		✓
BH106-5.9-6.0		✓
BH106-6.9-7.0		✓
BH106-7.9-8.0		✓
BH106-8.9-9.0		✓
BH106-9.9-10.0		✓
BH106-10.9-11.0		✓
BH106-11.9-12.0		✓
BH106-12.45-12.55		✓
BH107-0-0.2		✓
BH107-0.2-0.4		✓
BH107-0.5-0.95		✓
BH107-1.3-1.5		✓
BH107-1.9-2.0		✓
BH107-2.4-2.5		✓
BH107-2.75-2.85		✓
BH107-3.9-4.0		✓
BH107-4.9-5.0		✓
BH107-5.9-6.0		✓
BH107-6.9-7.0		✓
BH107-7.9-8.0		✓
BH107-8.9-9.0		✓
BH107-9.9-10.0		✓
BH107-10.9-11.0		✓
BH107-11.9-12.0		✓
BH107-12.9-13.0		✓

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Sample ID	Chromium Suite	On Hold
BH107-13.9-14.0		✓
BH107-14.9-15.0		✓
BH109-0.01-0.4		✓
BH109-0.5-0.8		✓
BH109-0.8-0.95		✓
BH109-1.0-1.2		✓
BH109-1.42-1.50		✓
BH109-1.9-2.0		✓
BH109-2.4-2.5		✓
BH109-2.9-3.0		✓
BH109-3.9-4.0		✓
BH109-4.9-5.0		✓
BH109-5.9-6.0		✓
BH109-6.9-7.0		✓
BH109-7.9-8.0		✓
BH109-8.9-9.0		✓
BH109-9.9-10.0		✓
BH109-10.96-11.0		✓
BH109-11.9-12.0		✓
BH109-12.45-12.56		✓
BH109-11.35-11.45		✓
PFAS Trip Blank -.		✓
BH107-1.0-1.3		✓
BH105-0.25-0.4		✓
BH105-0.5-0.95		✓
BH105-1.2-1.4	✓	
BH106-1.5-1.7	✓	
BH106-0.03-0.3		✓
BH106-0.6-0.8		✓
BH107-0-0.1	✓	
BH107-0.1-0.4		✓
BH107-0.5-0.95		✓

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customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Chromium Suite	On Hold
BH109-0.01-0.4		✓
BH109-0.5-0.8		✓
BH109-0.8-0.95		✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Ming To

Subject: FW: Results for Registration 279440-B E32507BR, Greenwich

Ref: 279440-C.
TAT: Standard
Due: 15/10/2021.
MT

279440-C

From: Craig Ridley <CRidley@jkenvironments.com.au>
Sent: Friday, 8 October 2021 12:03 PM
To: Greta Petzold <GPetzold@envirolab.com.au>
Cc: Samplereceipt <Samplereceipt@envirolabservices.com.au>
Subject: RE: Results for Registration 279440-B E32507BR, Greenwich

Good afternoon Greta,

Can we please arrange the following additional testing for this batch on standard turnaround:

Sample number and Depth	Lab Reference	Tests Required
BH105 (1.2-1.4m)	122	SCR Suite
BH106 (1.5-1.7m)	123	SCR Suite
BH107 (0-0.1m)	126	SCR Suite

Any issues, please call.

Regards
Craig Ridley
Senior Environmental Scientist

In accordance with the current NSW Government health orders, we are mostly working from home. When phoning, please contact staff on their mobile first.

T: +612 9888 5000
D: 0421 856 992
E: cridley@jkenvironments.com.au
www.jkenvironments.com.au

PO Box 976
NORTH RYDE BC NSW 1670
115 Wicks Road
MACQUARIE PARK NSW 2113

JKEnvironments

From: Greta Petzold <GPetzold@envirolab.com.au>
Sent: Wednesday, 6 October 2021 4:19 PM
To: Craig Ridley <CRidley@jkenvironments.com.au>
Subject: Results for Registration 279440-B E32507BR, Greenwich

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customerservice@envirolab.com.au
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CERTIFICATE OF ANALYSIS 280020

Client Details

Client	JK Environments
Attention	C Ridley
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32507BR, Greenwich**
Number of Samples	21 Soil
Date samples received	08/10/2021
Date completed instructions received	08/10/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

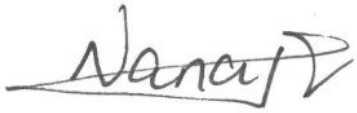
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	15/10/2021
Date of Issue	15/10/2021

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

sPOCAS field test						
Our Reference		280020-1	280020-3	280020-5	280020-7	280020-9
Your Reference	UNITS	BH101	BH101	BH101	BH102	BH102
Depth		0.02-0.4	1.0-1.2	1.7-1.95	0.05-0.1	1.0-1.2
Type of sample		Soil	Soil	Soil	Soil	Soil
Date Sampled		6/10/2021	6/10/2021	6/10/2021	6/10/2021	6/10/2021
Date prepared	-	11/10/2021	11/10/2021	11/10/2021	11/10/2021	11/10/2021
Date analysed	-	11/10/2021	11/10/2021	11/10/2021	11/10/2021	11/10/2021
pH_F (field pH test)*	pH Units	9.0	9.9	9.0	8.8	7.4
pH_{FOX} (field peroxide test)*	pH Units	6.8	9.0	6.5	9.5	5.3
Reaction Rate*	-	Medium reaction	Volcanic reaction	Medium reaction	Volcanic reaction	Low reaction

sPOCAS field test						
Our Reference		280020-10	280020-11	280020-12	280020-14	280020-15
Your Reference	UNITS	BH102	BH104	BH104	BH104	BH104
Depth		1.4-1.6	0.04-0.3	0.5-0.95	2.4-2.5	3.2-3.45
Type of sample		Soil	Soil	Soil	Soil	Soil
Date Sampled		6/10/2021	1/10/2021	1/10/2021	1/10/2021	1/10/2021
Date prepared	-	11/10/2021	11/10/2021	11/10/2021	11/10/2021	11/10/2021
Date analysed	-	11/10/2021	11/10/2021	11/10/2021	11/10/2021	11/10/2021
pH_F (field pH test)*	pH Units	7.5	8.3	7.9	12.0	5.7
pH_{FOX} (field peroxide test)*	pH Units	5.0	8.3	6.4	10.7	4.9
Reaction Rate*	-	Low reaction	Volcanic reaction	Low reaction	Volcanic reaction	Low reaction

sPOCAS field test					
Our Reference		280020-16	280020-17	280020-20	280020-21
Your Reference	UNITS	BH104	BH119	BH108	BH108
Depth		3.8-4.1	0.05-0.3	0.1-0.4	0.8-1.0
Type of sample		Soil	Soil	Soil	Soil
Date Sampled		1/10/2021	1/10/2021	30/09/2021	30/09/2021
Date prepared	-	11/10/2021	11/10/2021	11/10/2021	11/10/2021
Date analysed	-	11/10/2021	11/10/2021	11/10/2021	11/10/2021
pH_F (field pH test)*	pH Units	7.6	8.7	4.8	4.5
pH_{FOX} (field peroxide test)*	pH Units	6.1	8.3	4.2	4.2
Reaction Rate*	-	Medium reaction	Volcanic reaction	Medium reaction	Low reaction

Method ID	Methodology Summary
Inorg-063	pH- measured using pH meter and electrode. Soil is oxidised with Hydrogen Peroxide or extracted with water. Based on section H, Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions.

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			11/10/2021	1	11/10/2021	11/10/2021		11/10/2021	[NT]
Date analysed	-			11/10/2021	1	11/10/2021	11/10/2021		11/10/2021	[NT]
pH_F (field pH test)*	pH Units		Inorg-063	[NT]	1	9.0	9.1	1	101	[NT]
pH_{FOX} (field peroxide test)*	pH Units		Inorg-063	[NT]	1	6.8	6.8	0	101	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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SAMPLE RECEIPT ADVICE

Client Details

Client	JK Environments
Attention	C Ridley

Sample Login Details

Your reference	E32507BR, Greenwich
Envirolab Reference	280020
Date Sample Received	08/10/2021
Date Instructions Received	08/10/2021
Date Results Expected to be Reported	15/10/2021

Sample Condition

Samples received in appropriate condition for analysis	Holding time exceedance
No. of Samples Provided	21 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	9
Cooling Method	None
Sampling Date Provided	YES

Comments

Please contact the laboratory within 24 hours if you wish to cancel the aformentioned testing. Otherwise testing will proceed as per the COC and hence invoice accordingly.

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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12 Ashley St Chatswood NSW 2067
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Sample ID	sPOCAS field test	On Hold
BH101-0.02-0.4	✓	
BH101-0.5-0.85		✓
BH101-1.0-1.2	✓	
BH101-1.5-1.7		✓
BH101-1.7-1.95	✓	
BH101-2.4-2.5		✓
BH102-0.05-0.1	✓	
BH102-0.5-0.95		✓
BH102-1.0-1.2	✓	
BH102-1.4-1.6	✓	
BH104-0.04-0.3	✓	
BH104-0.5-0.95	✓	
BH104-1.5-1.95		✓
BH104-2.4-2.5	✓	
BH104-3.2-3.45	✓	
BH104-3.8-4.1	✓	
BH119-0.05-0.3	✓	
BH119-0.5-0.8		✓
BH108-0-0.1		✓
BH108-0.1-0.4	✓	
BH108-0.8-1.0	✓	

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

SAMPLE AND CHAIN OF CUSTODY FORM

TO:
ENVIROLAB SERVICES PTY LTD
12 ASHLEY STREET
CHATSWOOD NSW 2067
P: (02) 99106200
F: (02) 99106201

Attention: Aileen

JKE Job Number: E32507BR

Date Results Required: STANDARD

Page: 1 of 1

FROM:
JKEnvironments
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 F: 02-9888 5001
Attention: Craig Ridley
cridley@jkenvironments.com.au

Location: Greenwich
Sampler: HW

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	Sample Description	SCr extended	pH field test (pHF apHFOX)
06/10/2021	1	BH101	0.02-0.4	P	F: Silty gravelly sand		X
06/10/2021	2	BH101	0.5-0.85	P	F: silty sand		
06/10/2021	3	BH101	1.0-1.2	P	F: silty sand		X
06/10/2021	4	BH101	1.5-1.7	P	F: silty sand		
06/10/2021	5	BH101	1.7-1.95	P	XW Sandstone		X
06/10/2021	6	BH101	2.4-2.5	P	Sandstone		
06/10/2021	7	BH102	0.05-0.1	P	F: Silty gravelly sand		X
06/10/2021	8	BH102	0.5-0.95	P	F: silty clay		
06/10/2021	9	BH102	1.0-1.2	P	F: silty clay		X
06/10/2021	10	BH102	1.4-1.6	P	Sandstone		X
01/10/2021	11	BH104	0.04-0.3	P	F: sandy gravel		X
01/10/2021	12	BH104	0.5-0.95	P	F: gravelly sand		X
01/10/2021	13	BH104	1.5-1.95	P	F: gravelly sand		
01/10/2021	14	BH104	2.4-2.5	P	F: gravelly sand		X
01/10/2021	15	BH104	3.2-3.45	P	F: silty sand		X
01/10/2021	16	BH104	3.8-4.1	P	F: silty sand		X
30/09/2021	19	BH108	0-0.1	P	F: gravelly sand		
30/09/2021	20	BH108	0.1-0.4	P	F: silty sand		X
30/09/2021	21R	BH108	0.8-1.0	P	Sandy clay		X
01/10/2021	17	BH119	0.05-0.3	P	F: silty sand		X
01/10/2021	18	BH119	0.5-0.8	P	Sandstone		

ENVIROLAB GROUP
Envi...
Chatswood NSW
Ph: (02) 9910...
Job No: 280020
Date Received: 8/10/21
Time Received: 1530
Received By: W
Temp: Cool/Ambient
Cooler/Icepack 9°C
Sa... Broke...

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By:	Date:	Time:	Received By:	Date:
C. Ridley	08/10/2021	1530	V. VEGA	8/10/21

FROZEN

COC 8/10/2021 1600

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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 280020-A

Client Details

Client	JK Environments
Attention	C Ridley
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32507BR, Greenwich**
Number of Samples	additional analysis
Date samples received	08/10/2021
Date completed instructions received	20/10/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	27/10/2021
Date of Issue	27/10/2021

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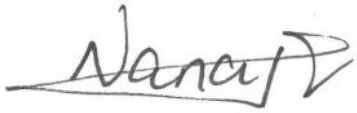
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Nick Sarlamis, Assistant Operation Manager

Authorised By



Nancy Zhang, Laboratory Manager

Chromium Suite				
Our Reference		280020-A-1	280020-A-15	280020-A-20
Your Reference	UNITS	BH101	BH104	BH108
Depth		0.02-0.4	3.2-3.45	0.1-0.4
Type of sample		Soil	Soil	Soil
Date Sampled		6/10/2021	1/10/2021	30/09/2021
Date prepared	-	21/10/2021	21/10/2021	21/10/2021
Date analysed	-	21/10/2021	21/10/2021	21/10/2021
pH $_{kcl}$	pH units	8.5	5.5	4.0
s-TAA pH 6.5	%w/w S	<0.01	<0.01	0.1
TAA pH 6.5	moles H^+ /t	<5	<5	61
Chromium Reducible Sulfur	%w/w	0.005	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H^+ /t	3	<3	<3
S_{HCl}	%w/w S	[NT]	[NT]	0.009
S_{KCl}	%w/w S	[NT]	[NT]	0.005
S_{NAS}	%w/w S	[NT]	[NT]	<0.005
ANC_{BT}	% $CaCO_3$	0.60	<0.05	[NT]
s-ANC_{BT}	%w/w S	0.19	<0.05	[NT]
s-Net Acidity	%w/w S	<0.005	<0.005	0.10
a-Net Acidity	moles H^+ /t	<5	<5	65
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	5
a-Net Acidity without ANCE	moles H^+ /t	<5	<5	65
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75	<0.75	4.9
s-Net Acidity without ANCE	%w/w S	0.0050	<0.005	0.10

Method ID	Methodology Summary
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity.

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			21/10/2021	1	21/10/2021	21/10/2021		21/10/2021	[NT]
Date analysed	-			21/10/2021	1	21/10/2021	21/10/2021		21/10/2021	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	1	8.5	8.5	0	98	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	1	<0.01	<0.01	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	1	<5	<5	0	98	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	1	0.005	0.005	0	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	1	3	3	0	110	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	1	[NT]	[NT]		[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	1	[NT]	[NT]		[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	1	[NT]	[NT]		[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	1	0.60	0.60	0	[NT]	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	1	0.19	0.19	0	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	1	<5	<5	0	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	<0.75	<0.75	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	1	<5	<5	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	<0.75	<0.75	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	1	0.0050	0.0050	0	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	JK Environments
Attention	C Ridley

Sample Login Details

Your reference	E32507BR, Greenwich
Envirolab Reference	280020-A
Date Sample Received	08/10/2021
Date Instructions Received	20/10/2021
Date Results Expected to be Reported	27/10/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	additional analysis
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	9
Cooling Method	None
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Chromium Suite	On Hold
BH101-0.02-0.4	✓	
BH101-0.5-0.85		✓
BH101-1.0-1.2		✓
BH101-1.5-1.7		✓
BH101-1.7-1.95		✓
BH101-2.4-2.5		✓
BH102-0.05-0.1		✓
BH102-0.5-0.95		✓
BH102-1.0-1.2		✓
BH102-1.4-1.6		✓
BH104-0.04-0.3		✓
BH104-0.5-0.95		✓
BH104-1.5-1.95		✓
BH104-2.4-2.5		✓
BH104-3.2-3.45	✓	
BH104-3.8-4.1		✓
BH119-0.05-0.3		✓
BH119-0.5-0.8		✓
BH108-0-0.1		✓
BH108-0.1-0.4	✓	
BH108-0.8-1.0		✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Ming To

Subject: FW: Results for Registration 280020 E32507BR, Greenwich

Ref: 280020-A.
TAT: Standard.
Due: 20/10/2021
MT

280020-A

From: Craig Ridley <CRidley@jkenvironments.com.au>
Sent: Wednesday, 20 October 2021 5:28 PM
To: Greta Petzold <GPetzold@envirolab.com.au>
Subject: Re: Results for Registration 280020 E32507BR, Greenwich

Hi Greta,

Can we please arrange for the following additional analysis for this sample batch (standard turnaround):

Sample ID and Depth		Lab Reference	Test Required
BH101 (0.02-0.4m)	1.	1	SCR Suite
BH104 (3.2-3.45m)	15.	15	SCR Suite
BH108 (0.1-0.4m)	20.	20	SCR Suite

Any issues, please call.

Thanks,

Craig

Regards
Craig Ridley
Senior Environmental Scientist

In accordance with the current NSW Government health orders, we are mostly working from home. When phoning, please contact staff on their mobile first.

Appendix G: Guidelines and Reference Documents

Acid Sulfate Soils Management Advisory Committee (ASSMAC), (1998). Acid Sulfate Soils Manual

Department of Land and Water Conservation, (1997). 1:25,000 Acid Sulfate Soil Risk Map Series

Sullivan. L, Ward. N, Toppler. N, and Lancaster.G, (2018) *National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual*

Sullivan. L, Ward. N, Toppler. N, and Lancaster.G, (2018) National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual