Sydney Grammar School
c/-Jattca Property Solutions

Acid Sulfate Soil Management Plan

Proposed SGS Weigall Sports Complex
Neild Avenue, Paddington NSW

22 February 2021

58554/135442 (Rev 0)

JBS&G Australia Pty Ltd

www.jbsg.com.au

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Abbreviations

Term	Definition
AASS	Actual Acid Sulfate Soil
AHD	Australian Height Datum
ASS	Acid Sulfate Soil
ASSMP	Acid Sulfate Soil Management Plan
BGS	Below Ground Surface
CC	Construction Certificate
DA	Development Application/Approval
DCP	Development Control Plan
EPA	NSW Environmental Protection Authority
ha	Hectare
JBS&G	JBS&G Australia Pty Ltd
LEP	Local Environment Plan
LOR	Limit of Reporting
NoW	NSW Office of Water
OEH	Office of Environment and Heritage
PASS	Potential Acid Sulfate Soil
pH	Potential of Hydrogen
PCC	Parramatta City Council
RAP	Remedial Action Plan
SAC	Site Action Criteria
SGS	Sydney Grammar School
S_{Cr}%	Chromium Reducible Sulfur (%)
SO4	Sulfate
sPOCAS	Suspended Potential Oxidation Combined Acidity and Sulfur (test method)
S_{pos}%	Potential Oxidisable Sulfur
SWL	Standing Water Level
TAA	Total Actual Acidity
TPA	Total Potential Acidity
TSA	Total Sulfidic Acidity

1. Introduction

1.1 Introduction and Background

JBS&G Australia Pty Ltd (JBS&G) was engaged by Jattca Property Solutions on behalf of Sydney Grammar School (SGS, the client) to provide environmental consultancy services for the proposed SGS Weigall Sports Complex development at Neild Avenue, Paddington NSW (the site). The site is legally identified as Part Lot 2 in Deposited Plan (DP) 547260, Part Lot 1 in DP 311460 and Lot 1 in DP 633259 and encompasses an approximate area of 1.0775 hectare (ha). The site location and layout are provided in **Figures 1** and **2**.

The site is currently utilised by SGS for recreational purposes and comprises multipurpose/tennis courts, pavilion, car park, cricket nets and playing field. It is understood that the proposed redevelopment of the site will comprise demolition of existing structures and buildings and construction of a sporting facility comprising of a multi-purpose hall with basement and associated aboveground car park.

Review of the Woollahra Local Environmental Plan (LEP) 2014 indicates that the northern portion of the site falls within a category classified as Class 3 ASS whilst the southern portion falls within Class 5 ASS. According to the LEP, development consent is required for any works in a Class 3 ASS area that extend beyond 1 metre below the natural ground surface and which are likely to lower the water table more than 1 m below ground surface (bgs). Further, development consent is required for any works in a Class 5 ASS area that is within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 m AHD and by which the water table is likely to be lowered below 1 metre AHD on adjacent Class 1, 2, 3 or 4 land.

Previous site investigation activities (DP 2020 and JBS&G 2020) have identified the occurrence of acid sulfate soils (ASS) underlying the site. The Planning Secretary's Environmental Assessment Requirements (SEARs) issued for the proposed development requires an acid sulfate soil management plan (ASSMP) to be prepared if concentration of acid sulfate soils meet or exceed the "action criteria". As such an ASSMP is required to document procedures to be implemented to manage the potential environmental risk associated with potential disturbance of these materials during construction activities.

This document presents an ASSMP for the site and has been prepared in accordance with the general requirements of the *Acid Sulfate Soil Manual* (ASSMAC 1998[1]) and with consideration to the National Acid Sulfate Soils Guidance (DAWR 2018[2]).

1.2 Aims and Objectives

The aim of this ASSMP is to outline management techniques to mitigate the potential environmental impacts associated with disturbance of acid sulfate soils (ASS) during the proposed site construction works. Specifically, the objectives of this ASSMP are to document:

- the known site sub-surface characteristics anticipated to be encountered during future excavation works for consideration in development of future investigative and management activities;
- a monitoring and sampling strategy to be implemented prior to and during the proposed ground disturbance activities such that ASS may be appropriately identified and managed during the excavation works;

[1] *Acid Sulfate Soil Manual*, NSW Acid Sulfate Soil Management Advisory Committee, August 1998 (ASSMAC 1998)
[2] *National Acid Sulfate Soil Guidance*. Australian Government Department of Agriculture and Water Resources (DAWR), June 2018 (AGDAW, 2018)

- evaluation of potential ASS management opportunities and constraints resulting in the identification of a preferred management strategy; and
- procedures for the management and validation of ASS during the future site excavation works so as to minimise the potential for adverse environmental impacts as a result of the ASS disturbance activities.

1.3 Proposed Development Details

It is understood that the proposed development will comprise the following:

1) Demolition of the following existing structures and buildings at the southern edge of the Weigall Sports Ground:
    (a) Multipurpose/tennis courts and associated fencing;
    (b) Barry Pavilion;
    (c) The existing cricket nets off Alma Street; and
    (d) Paved car park near Neild Avenue.
2) Construction of the SGS Weigall Sports Complex comprising the following:
    (a) Building 1 - Sports Facilities Building accommodating the following facilities:
        (i) Ground floor: Main pool, programme pool, terrace/assembly facing Weigall, entry foyer, offices, change rooms, back of house, services and external car parking (5 spaces) and loading
        (ii) Mezzanine floor: Spectator terrace and services
        (iii) First floor: Multipurpose sports hall 01 – basketball and volleyball, Multipurpose sports hall 02 –cardio, weights, taekwondo, fencing, PDHPE, change rooms, storage and services
        (iv) Level 2: Multipurpose room 04; Multipurpose sports hall 03 –cardio, weights, taekwondo, fencing, PDHPE, storage and services
        (v) Driveway entry from Neild Avenue (comprising relocation of the existing driveway southwards with the existing driveway potentially retained for maintenance access)
    (b) Building 2 – Car Park comprising an ancillary car park of one/two split levels accommodating 93 spaces with an additional 4 spaces on grade, accessed from the existing driveway entry from Alma Street (located on the existing cricket nets site). The lower ground level includes the flexibility to be used as an extension of the existing playing fields
    (c) Parking for a total of 102 cars comprising:
        (i) Building 1: 5 spaces
        (ii) Building 2: 97 spaces (93 within the building and 4 at grade)
    (d) Landscaping of the site including tree removal/retention/replacement, paths, fencing and lighting
    (e) Building identification signage
    (f) New kiosk substation.
3) Use of the completed building as an educational establishment with external/community use of the proposed facilities that coordinates with the programming of SGS.

The proposal does not include any of the following:

- General learning areas (GLA)
- An increase in the existing student population.

It is further understood that the basement level in Building 1 will comprise rainwater tank, floor of main pool and programme pool, pool filtration plant, other plant, services and storage with finished floor level varying between RL 0.60 to RL 3.55. It is anticipated that the building foundation system will include concrete piles extending into rock with a secant piled wall basement retention system. Proposed site development plans at the time of preparing this ASSMP are provided in **Appendix A**.

2. Acid Sulfate Soil General Information

2.1 Acid Sulfate Soil Background

ASSMAC (1998) and DAWR (2018) provide useful information on acid sulfate soils. ASS is a common name given to naturally occurring sediments and soils containing iron sulfides (generally as iron sulfide or iron disulfide). These soil profiles are typically located in coastal, low-lying alluvial or estuarine areas such as mangroves, salt marshes, coastal rivers and creeks, estuaries, tidal lakes and coastal floodplains where historical iron rich sediment deposition in the presence of a sulfate source (commonly salt water), organic matter and microbial action over time has resulted in the formation of particular environmental conditions. ASS are predominantly encountered in areas where the soil profile has an elevation of less than 5m Australian Height Datum (AHD), and may be found close to the ground level or at depth in the soil profile where continued deposition has resulted in raising of the ground levels.

Changes in environmental conditions which result in the exposure of these materials to air, via excavation or drainage of subsurface soils, can lead to the reaction of the iron sulfides with oxygen, causing the generation of sulfuric acid. This may result in significant environmental and infrastructure damage if the produced acid is spread by groundwater or surface water.

ASS consist of two major categories:

- Actual Acid Sulfate Soils (AASS) are soils that have been exposed to oxygen which has caused the oxidation of iron sulfides to form sulfuric acid. Some of this acid is commonly neutralised by other soil particles in a process known as buffering, however the excess acid is spread by water movement through the soil; and
- Potential Acid Sulfate Soils (PASS) are soils which contain iron sulfides, but which have not been oxidised. These soils are generally kept from contact with air by permanent waterlogging or the density of the soil profile and so are relatively stable, or in equilibrium. In this state, the soils are generally non-acidic and are considered harmless to the environment. However, oxidation of such soils through disturbance has the potential to generate acidic conditions.

Commonly, an ASS profile will consist of a combination of both AASS and PASS material as a result of ongoing chemical reactions in response to environmental changes including groundwater fluctuations and seasonal soil moisture changes.

The following types of site activities are likely to result in disturbance of ASS (both ASS and PASS) during urban development activities:

- Bulk excavation works which encounter subsurface soil which may be completed to achieve basement levels, installation of drainage infrastructure, alteration of existing site levels to achieve modified ground levels, dredging or otherwise mobilisation such that the sediment may become oxidised, etc.;
- Dewatering activities associated with construction works proposed at elevations below the standing water table, for example installation of drainage infrastructure, etc. which may result in ASS beyond the excavation extent becoming exposed to oxygen due to a lowering of groundwater levels, thereby generating acidic conditions; and
- Generation of spoil which may return ASS to the ground surface associated with foundation construction works, including piling spoil during continuous flight auger piles (CFA) or bored pile installation activities, directional drilling works for infrastructure services installation, etc.

In NSW, development of land subject to ASS occurrence is managed at a planning level in accordance with the *Acid Sulfate Soil Manual* (1998) prepared by the Acid Sulfate Soil Management Advisory Committee (ASSMAC). Local Environmental Plans (LEP) provide a regulatory regime for the sustainable management of ASS in the coastal zone. The ASS Manual provides guidance on the assessment of ASS conditions and appropriate management strategies for development of ASS identified land.

2.2 Laboratory Assessment Guidelines

The assessment of site soil conditions with respect to ASS occurrence is completed in accordance with the guidance provided in ASSMAC (1998). The requirement to manage soils for ASS is evaluated by comparison of laboratory analysis results with Site Action Criteria (SAC) developed based on three broad soil texture categories. The SAC is based on the percentage of oxidisable sulfur or equivalent acid trail (i.e. titratable actual acidity-TAA or titratable potential acidity-TPA) results. There are two categories based on the scale of the proposed disturbance, with the SAC for small scale (i.e. less than 1000 tonnes) works based upon the texture of the soil material and the SAC for large scale works adopting the most sensitive SAC being the SAC for coarse textured soils in small scale works.

Table 2.1 ASSMAC Site Action Criteria based on General Soil Texture Categories

Type of material		Action Criteria 1-1000 tonnes disturbed		Action Criteria if more than 1000 tonnes disturbed	
Texture Range. McDonald at al. (1990)	Approx. clay content (%<0.002 mm)	Sulfur trail % S oxidisable (oven-dry basis) e.g. S_{Cr} or S_{pos}	Acid trail Mol H^+/tonne (oven-dry basis) e.g., TPA or TSA	Sulfur Trail % S oxidisable (oven-dry basis) e.g. S_{Cr} or S_{pos}	Acid trail Mol H^+/tonne (oven-dry basis) e.g., TPA or TSA
Coarse Texture Sands to loamy sands	≤5	0.03	18	0.03	18
Medium texture Sandy loams to light clay	5-40	0.06	36	0.03	18
Fine texture Medium to Heavy clays and silty clays	≥40	0.1	62	0.03	18

Exceedance of the SAC attributable to ASS material generally triggers the need to prepare a management plan and is based on the percentage of oxidisable sulfur (or equivalent TPA, TAA) for broad categories of soil. However, it is noted that other soil properties and constituents may cause acidic conditions in soils that are not related to ASS conditions. This may include sources of organic acidity where the soils have a pH of less than 5 and positive titratable actual acidity (TAA) or titratable potential acidity (TPA) but have no detectable sulfur source (i.e. no S%). In this case, exceedance of the Acid Trail SAC does not trigger treatment of these soils.

Given the nature of the works to be undertaken at the subject site and with consideration to the variability of the soils types noted in previous investigations, the SAC adopted for assessment and management of ASS at this site are:

- Sulfur Trail Criteria (S_{pos} or S_{Cr} %) > 0.03 %;
- Acid Trail Criteria (TSA, TPA) > 18 mol H^+ / tonne soil.

2.3 Other Regulatory Guidance

Section 105 of the *Contaminated Land Management Act 1997* (CLM Act) allows the Environment Protection Authority (EPA) to "make or approve" guidelines for any purpose related to the objects of

the Act. In addition to ASSMAC (1998), this management plan has been prepared with reference to the following:

- *Waste Classification Guidelines Part 1: Classifying Waste* (EPA 2014a)
- *Waste Classification Guidelines Part 4: Acid Sulfate Soils* (EPA 2014b)
- *Protection of the Environment Operations Act 1997* (POEO Act) and associated regulations.

Note is also made of the National Acid Sulfate Soil Guidance issued in June 2018 by the Australian Government Department of Agriculture and Water Resources (DAWR), including:

- National Acid Sulfate Soil Guidance: A Synthesis (DAWR 2018a);
- National Strategy for the Management of Coastal Acid Sulfate Soils (DAWR 2018b);
- National Acid Sulfate Soils Sampling and Identification Methods Manual (DAWR 2018c);
- National Acid Sulfate Soils Sampling and Laboratory Methods Manual (DAWR 2018c);
- Guidance for the Dewatering of Acid Sulfate Soils in Shallow Groundwater Environments (DAWR 2018d); and
- Guideline for the Dredging of Acid Sulfate Soil Sediments and Associated Dredge Spoil Management (DAWR 2018e).

3. Site Condition & Surrounding Environment

3.1 Identification

The location of the assessment area within the site and surrounds is shown on **Figure 1.** The current site layout is shown in **Figure 2**. Site details are summarised in **Table 3.1** and discussed in detail in the following section.

Table 3.1: Summary Site Details

Address	Neild Avenue, Paddington NSW
Lot/DP	Part Lot 2 in DP 547260, Part Lot 1 in DP 311460 and Lot 1 in DP 633259
Local Government Authority	Woollahra Municipal Council
Approximate MGA Coordinates of Centre (MGA 56)	Easting: 336155.965 Northing: 6249863.042
Site Zoning	RE2 Private Recreation and R3 Medium Density Residential under the *Woollahra Local Environmental Plan (LEP) 2014*
Previous Use	Sports/recreation area
Current Use	Sports/recreation area
Proposed Use	Sporting complex and car park
Site Area	1.0775 ha

3.2 Condition

A detailed site inspection was undertaken by one of JBS&G's trained and experienced environmental consultants on 25 March and 27 May 2020. The site layout is shown in **Figure 2**.

The site comprised an irregular shaped parcel of land located within the broader SGS property, bound to the west by Neild Avenue, east by Alma Street, south by residential properties and north by SGS Weigall playing fields.

Six multipurpose/tennis hard courts and associated fencing were located in the southwestern portion of the site. A bitumen sealed car park was located off Neild Avenue in the northwestern portion of the site. The area to the north of the multipurpose/tennis hard courts was grassed and formed an embankment to the playing field to the north, located approximately 2m below the remainder of the site. Hardstand with cricket nets were located in the eastern extent of the site. A two-storey timber/brick pavilion (Barry pavilion) was located on the embankment with a grandstand on the upper level with toilets and storage room located on the lower level. At the time of the inspection, the storage room was observed to contain sports training equipment and a secured chemical storage area containing paint, insecticides and herbicides. There was no evidence of surface staining associated with chemical spills in this area.

The southern portion of the site comprising the multipurpose/tennis hard courts was generally flat and level with its surrounds. The northern portion including playing filed and cricket nets were at a lower level beyond the embankment. Mature trees were located along the western site boundary, in the south central portion of the site and adjacent to the pavilion. The vegetation was observed to be in good condition.

No evidence of storage of waste or storage tanks were observed at the site. No asbestos containing materials were observed on the ground surfaces. In addition, there were no signs of distressed vegetation or other potential indicators of significant contamination issues at the site.

3.3 Assessment Area Surrounding Land Uses

The surrounding land uses beyond the assessment area footprint was identified as comprising:

- North – the site was bound by SGS Weigall playing fields followed by Rushcutters Creek and New South Head Road further north;
- East – the site was bound by Alma Street followed by Sydney Grammar Preparatory School (southeast) and White City Tennis Club further east;

- South – the site was bound by low/medium density residential buildings followed by Lawson Street; and
- West – the site was bound by Neild Avenue and medium-high density residential buildings beyond.

3.4 Topography

Review of the regional topographic maps available on SIX maps[3] indicated that the site is situated at an elevation of approximately 8-10 m Australian Height Datum (AHD). The southern portion of the site is predominantly flat with an elevation of 10m AHD whilst the playing field and cricket nets at the base of the embankment was located approximately at 8 m AHD. The site appears to have previously been subject to cut and fill activities to facilitate construction of the current built form.

3.5 Geology & Soils

A review of the Sydney 1:100 000 Geological Map[4] indicated that the site is located in an area comprising man made fill including dredged estuarine sand and mud, demolition rubble, industrial and household waste, underlain by silty to peaty quartz sand, silt and clay with ferruginous and humic cementation in places and common shell layers. The surrounding areas were underlain by Hawkesbury Sandstone comprising medium to coarse grained quartz sandstone, very minor shale and laminate lenses.

Review of eSDPADE 2.0 tool hosted by the NSW Office of Environment and Heritage (OEH 2017[5]) indicated the site is predominantly underlain by disturbed terrain. The landscape is described as level plain to hummocky terrain, extensively disturbed by human activity, including complete disturbance by removal or burial of soil. Landfill includes soil, rock, building and waste materials with original vegetation completely cleared, replaced with turf or grassland. The soil is turfed, and fill areas are commonly capped with up to 40 cm of sandy loam or up to 60 cm of compacted clay over fill or waste materials. Soil limitations are dependent on the nature of fill material and includes mass movement hazard, unconsolidated low wet strength materials, impermeable soil, poor drainage and localised very low fertility and toxic materials.

The southeastern extent of the site is underlain by Gymea Erosional Soil. The landscape is characterised by undulating to rolling rises and low hills on Hawkesbury Sandstone with local relief 20-80 m, slopes 10-25%, rock outcrop <25%, broad convex crests, moderately inclined side slopes with wide benches, localised rock outcrop on low broken scarps, extensively cleared open-forest (dry sclerophyll forest) and eucalypt woodland. The soils are characterised as shallow to moderately deep (30-100 cm) Yellow Earths and Earthy Sands on crests and inside of benches; shallow (<20 cm) Siliceous Sands on leading edges of benches; localised Gleyed Podzolic Soils and Yellow Podzolic Soils on shale lenses; shallow to moderately deep (<100 cm) Siliceous Sands and Leached Sands along drainage lines. Soil limitations include localised steep slopes, high soil erosion hazard, rock outcrop, shallow highly permeable soil, very low soil fertility.

Previous intrusive investigations (DP 2020 and JBS&G 2020b) encountered fill material across the site to a maximum depth of approximately 6.0 m below ground surface (bgs). Trends in the depth of fill underlying the site are inconsistent. Depth to fill was generally between 0.6-3.5 m bgs at most locations with deeper fill between 5-6 m bgs encountered at BH01 and BH04. Fill materials are considered to result from a combination of historical site activity and importation of fill materials to establish site levels, backfill services trenches, etc. Fill materials were noted to comprise sand/clay with low proportions of gravels, with anthropogenic inclusions of terra cotta, glass, brick, ash, slag and charcoal.

[3] SIX Maps http://maps.six.nsw.gov.au/ accessed 02 April 2020
[4] Sydney 1:100 000 Geological Series Sheet 9130 Edition 1 (1983)
[5] *ESPADE 2.0*, NSW Office of Environment and Heritage, Accessed 15 May 2019, OEH (2017)

Fill material was underlain by grey/brown homogeneous sand and grey clayey sand. Sandstone bedrock was encountered between 0.6-3.4 m bgs in boreholes BH109-BH114 advanced in the eastern extent of the site.

Borehole logs from previous intrusive investigations (DP 2020 and JBS&G 2020b) are provided in **Appendix B**.

3.6 Hydrology

The site footprint is a combination of flat and sloped grassed surfaces, asphaltic/concrete hardstands and building footprints. As such, surface water generated during periods of rainfall is anticipated to migrate from the site via surface water flow entering local stormwater catchment system with subsurface infiltration and seepage.

The nearest surface water receptor is Rushcutters Creek located approximately 200 m to the north east of the site. Rushcutters Creek has been converted to a concrete lined stormwater channel which flows into Rushcutters Bay approximately 580 m to the north east of the site.

3.7 Hydrogeology

Registered groundwater monitoring well data was obtained from the NSW Department of Primary Industries groundwater mapping tools, NSW DPI (2016[6]). A review of the registered bore information indicated that there were 14 registered bores within an approximate 1.0 km radius of the site. Relevant details of registered bores have been summarised in **Table 3.2** below.

Table 3.2: Registered Groundwater Bore Search

Bore ID	Use	Property	Standing Water Level (m bgs)	Well Depth (m)	Distance from Site
GW106911	Recreation	-	10.5	42.6	on-site
GW103059	Monitoring	-	-	5.5	43 m northwest
GW103063	Monitoring	-	-	5.0	43 m northwest
GW103064	Monitoring	-	-	5.0	43 m northwest
GW103058	Monitoring	-	-	6.2	43 m northwest
GW103066	Monitoring	-	-	4.7	43 m northwest
GW103067	Monitoring	-	-	5.0	43 m northwest
GW103068	Monitoring	-	-	5.0	43 m northwest
GW109375	Irrigation	Local Government	-	13.5	375 m southeast
GW107358	Domestic	Private	41.8	180.5	775 m southeast
GW026439	Irrigation	Local Government	-	7.90	400 m northeast
GW100467	Recreation	Private	2.35	14.5	340 m northeast
GW107418	Domestic	Private	3.5	11.5	460 m northwest
GW105473	Monitoring	-	-	2.4	530 m southwest

Groundwater bore GW106911 listed for recreational use is located in the northeastern extent of the site. The PSI (DP 2020) reported that bore water is used to top up underground irrigation tanks in the Weigall 4 car park. Review of the borehole log identified that GW106911 was installed targeting the underlying sandstone bedrock.

[6] Office of Water's Groundwater Monitoring Overview Map http://allwaterdata.water.nsw.gov.au/water.stm (accessed 02 April 2020)

4. ASS Assessment Data

4.1 Desktop Assessment of Published Data

Review of the *Acid Sulfate Soil Risk Map for Botany Bay*[7] indicates that the southern portion of the site is located within an area of 'no known occurrence of Acid Sulfate Soils'. Acid sulfate soils (ASS) are not known or expected to occur in areas having this classification. However, the northern portion of the site is identified to be located in an area identified as disturbed terrain which may include filled areas which often occur during reclamation of low lying swamps for urban development. Other disturbed terrain includes areas which have been mined or dredged or have undergone heavy ground disturbance through general urban development or construction of dams and levees. Areas of disturbed terrain are required to be the subject of individual assessments to characterise the potential presence of ASS/PASS prior to proposed works that may result in disturbance of such materials, should they be present. The nearest occurrence of mapped ASS comprises the sediments of the Rushcutters Bay, located approximately approximately 580 m to the north east of the site. Based on this outcome, site specific investigation of PASS conditions was required to further assess the potential presence at the site and evaluate the risk that such conditions may be disturbed during the proposed development works.

4.2 Intrusive Investigation Data

The suspension peroxide oxidation combined acidity and sulfur (sPOCAS) analysis results from DP (2020) and JBS&G (2020) are summarised in **Table 4.1**.

Table 4.1: Results of sPOCAS Analysis (DP 2020 and JBS&G 2020)

Sample	Sample description	Texture	Action Criteria (1-1000 tonnes disturbed)		Action Criteria (>1000 tonnes disturbed)	
			Sulfur Trail (S_{pos}%) - S %	Acid Trail (TPA/TSA) mol H^+/tonne	Sulfur Trail (S_{pos}%) - S %	Acid Trail (TPA/TSA) mol H^+/tonne
		Coarse	0.03	18	0.03	18
		Medium	0.06	36	0.03	18
		Fine	0.1	62	0.03	18
BH1 4-4.45	Dark grey clayey sand, wet (possible fill)	Coarse	0.02	**20**	0.02	**20**
BH1 5.5-5.95	Dark grey clayey sand, wet (possible fill)	Coarse	0.02	11	0.02	11
BH1 7-7.45	Grey sand	Coarse	**0.03**	17	**0.03**	17
BH1 11.5-11.95	Brown clay with sand	Medium	<0.005	**26**	<0.005	**26**
BH2 2.5-2.95	Dark grey clayey sand, wet (possible fill)	Coarse	**0.21**	**130**	**0.21**	**130**
BH2 4-4.45	Pale grey to grey sand	Coarse	**0.03**	17	**0.03**	17
BH6 2.4-2.5	Fill, grey to brown silty sand with clay	Coarse	<0.005	<5	<0.005	<5
BH7 5-5.1	Dark brown to brown silty sand, wet	Coarse	<0.005	<5	<0.005	<5
MW1_3.5-3.6	Clayey sand, grey	Coarse	**0.07**	9	**0.07**	9
MW1_4.5-4.6	Clayey sand, grey	Coarse	**0.09**	5	**0.09**	5
MW1_5.3-5.4	Clayey sand, grey	Coarse	**0.05**	**36**	**0.05**	**36**
MW2_0.9-1.0	Fill, sandy clay, black	Medium	<0.02	7	<0.02	7
MW2_2.0-2.1	Fill, sandy clay, brown/yellow	Medium	**0.07**	<2	**0.07**	<2
MW2_4.0-4.1	Sand, beige, wet	Coarse	**0.03**	**45**	**0.03**	**45**
MW3_3.0-3.1	Sand, grey	Coarse	**0.09**	**57**	**0.09**	**57**
MW3_4.0-4.1	Sand, grey/brown	Coarse	**0.06**	8	**0.06**	8

[7] *Acid Sulfate Soil Risk Map – Botany Bay, Edition 2, 1997*. 1:25 000 Ref: 91 30S3. NSW DLWC

The peroxide oxidisable sulfur for samples submitted to the laboratory ranged from <0.005 $\%S_{pos}$ to 0.21 $\%S_{pos}$. The total potential acidity (TPA) results for the samples ranged between <5 mol H+/tonne and 130 mol H+/tonne. Review of analytical results against adopted criteria indicates 10 of 16 soil samples exceeded the action criterion for both 1-1000 tonnes of disturbed soils and the action criteria for >1000 tonnes of disturbed soils.

DP (2020) indicated that the northern portion of the investigation area is potentially underlain by ASS, in particular the wet, dark grey clayey sand fill containing organic matter encountered in the vicinity of BH01, BH02 and BH03 (**Figure 3**) from depths of 2.5 m bgs. Given the limited testing, DP (2020) reported that soils beneath this layer should be considered to present an elevated risk of ASS. DP (2020) further stated that, based on the preliminary field-testing results there is the potential for ASS to be present in the southern portion of the site and also noted that given the site lies in an area of disturbed terrain there exists the additional possibility for ASS to have been used as backfill at the site. Additional sampling undertaken during the DSI (JBS&G 2020) identified the presence of PASS/ASS in grey clayey sand and grey sand encountered at borehole locations MW1, MW2 and MW3.

Based on these results, an Acid Sulfate Soil Management plan (ASSMP) is required to be prepared to manage the environmental risks associated with site activities that may result in disturbance of the PASS/ASS underlying the site.

5. Management Procedures

The aim of the following management procedures is to identify PASS material disturbed during the proposed site works activities and to implement appropriate mitigation measures such that the potential environmental impacts associated with disturbance of PASS during the proposed site remediation and construction works may be appropriately managed. Specifically, the objectives are to provide:

- A methodology for the identification of materials requiring management;
- Protocols for the on-site treatment and management of PASS materials and associated leachate water (as required) during the proposed works;
- Excavation inspection and validation assessment protocols to be implemented during the proposed works such that the extent of excavated PASS material may be delineated from non-PASS material to provide for off-site disposal of the balance of excavated material without the need for lime stabilisation);
- Water and soil quality targets for the excavation, treatment and removal of material encountered during the proposed works;
- Management of site excavation and dewatering activities to ensure in-situ PASS material is not disturbed to the extent that acidification of this material occurs, thereby resulting in release of acid to the groundwater system; and
- A contingency framework in the event that additional ASS conditions are encountered during the site works; monitoring indicates disturbance of underlying PASS or off-site PASS materials; or the proposed treatment strategy fails.

5.1 Scope of Soil Disturbance Activities

As identified in **Section 1.3**, the proposed development works will include excavation works across majority of the site to facilitate the construction of design plans including (but not limited to) building foundations (piling), service installations, and Building 1 basement envelope.

On this basis, it is anticipated that the following works will have the potential to result in disturbance of acid sulfate soils, where present:

- Installation of piled retention structures where methods that result in the generation of spoil at ground surface are employed (excluding driven or similar piling methods that do not result in spoil return to the surface).
- Dewatering of saturated alluvial soil within the excavation envelope that may occur prior to, or during proposed excavation works.
- Excavation of alluvial soil, where required to facilitate the construction of features that would require the excavation of PASS material , and/or that may result in a reduction in standing groundwater levels within the PASS profile. (e.g. basement, lift pits, on-site stormwater detention (OSD) tanks, etc.).

Given the proposed depth of excavation required at the site, it is anticipated that the basement retention portion to be completed below the groundwater table will be completed as a 'tanked' structure. On this basis, it is anticipated that standing water levels below the basement void will be isolated by the installed retention structure such that basement envelope dewatering activities as required to be completed will not result in a significant change to standing water levels in surrounding alluvial soils with the potential to comprise PASS material.

5.2 Investigation of Occurrence of ASS and/or PASS Material

Based on the field and laboratory assessment of PASS conditions summarised in **Section 4.2**, grey clayey sand and grey sand material encountered from approx. 2.5 m bgs should be considered to contain PASS unless further testing shows otherwise.

Further investigation of the location and extent of PASS material within areas of the site should be undertaken either prior to the commencement of excavation works and/or sequentially as excavation materials extend vertically such that material requiring management may be identified and treatment requirements established as separate to non-ASS material.

To evaluate the potential presence and extent of PASS material, the following assessment activities should be undertaken by an appropriately qualified environmental/geotechnical consultant in accordance with the general philosophies outlined in ASSMP (1998) with regard to the identification of PASS material:

- Sampling locations should be completed within the zone of likely alluvial soil occurrence at the site on an even grid spacing of no less than 20m. In transitional zones between the alluvial and residual profiles, additional sampling locations may be completed to better define the extent of alluvial soil underlying the site. Each sampling location should be extended to confirm the presence of bedrock, or a maximum of 1.5 m below the proposed bulk excavation level (whichever is less);
- Visual inspection and sampling of representative soil profiles of damp to saturated alluvial soil at a frequency of no less than 1m per metre depth interval at each sampling location. Each sample should be the subject of field pH_f and pH_{fox} tests;
- Based on the inspection and field testing results, at least one sample per material type per sampling location should subsequently be selected for sPOCAS or chromium reducible sulfur (S_{Cr}) laboratory analysis to confirm the presence/absence of ASS/PASS material requiring management;
- Based upon the results of the field and laboratory analysis program the extent of alluvial soils requiring management will be determined. In addition, the laboratory data will be used to identify anticipated liming requirements for ASS/PASS material types at the site; and
- The results of the assessment will provide a line of evidence for the validation of material beyond the PASS zone (if identified) for characterisation of the balance of the natural soils as VENM.

5.3 Evaluation of Management Strategies

Where the presence of ASS/PASS has been identified, evaluation of options to minimise the level of disturbance and to mitigate the potential impact of disturbance (if necessary) of the materials is required. As per ASSMP (1998), potential mitigation approaches have been identified:

- Avoid PASS materials being encountered during works by not undertaking the proposed development works or by altering the proposed development plans, i.e. removing excavation and/or dewatering requirements;
- Where encountering ASS/PASS during works cannot be avoided, manage the potential for acid generation by neutralising disturbed materials, preventing movement of acid impacted water, and the use of suitable construction materials;
- If ASS/PASS materials have previously been disturbed, undertake works to mitigate the existing conditions, minimise the production of further acid during the proposed works and rehabilitate impacted areas;

- Treat soil by allowing full oxidation of the sulfide component under controlled conditions followed by flushing the acid from the soil with water and neutralisation of the subsequent leachate;
- Avoid using untreated ASS/PASS materials as fill material in non-ASS areas by either leaving material on-site, or managing the potential for acid generation prior to material being transported from the site of origin; and/or
- Reburial of ASS/PASS materials beneath the permanent water table or beneath a dense soil profile which excludes oxygen exposure such as an engineered clay cap. This may be undertaken on-site if there are low lying areas where reburial and consequential flooding of the soil profile or construction of a suitable capping layer can be undertaken as part of development works, or at an alternative off-site location provided that sufficient stabilisation of material is undertaken to minimise acid generation during transportation and handling.

The potential suitability of the various options is further discussed in the following sections.

5.3.1 Avoidance Strategies

Avoidance of ASS disturbance is generally considered to be the preferred means of ASS risk management where such actions can be achieved. Implementation of appropriate basement retention methods to minimise impacts to groundwater levels and associated saturated PASS material beyond the basement extent will result in avoidance of disturbance of PASS material beyond the lateral extent of any proposed basement envelopes.

In general, for works extending beneath the water table and/or to approximate depths of 2-3 m bgs which may generate excess materials, the alternative management strategies detailed below will need to be considered.

5.3.2 Management by Neutralisation

Neutralisation techniques can be used to treat ASS by the addition of chemicals that react with the produced acid to ensure that acid is not released from the treated material. The neutralisation activities should result in the pH of the disturbed materials (water and/or soil) being between 5.5 to 7.5 and requires that PASS material disturbed during site activities be treated with the preferred neutralising agent.

Laboratory analysis is used to assess the levels of existing and/or actual acidity and indicates the level of neutralising capacity required to react with all potential acidity that may be generated during/following disturbance of the ASS material.

The potential uncertainty associated with the quantity of neutralising capacity to be added is commonly managed by the use of a factor of safety of 1.2 or 2 depending upon the level of uncertainty.

Sufficient capacity in terms of a suitable treatment area, machinery, budget to purchase the neutralising agent and time is necessary to successfully implement ASS neutralisation. Implementation of environmental controls is also necessary to ensure that all potentially acidic leachate produced during the treatment process is captured and adequately treated and that heavy metals which may be released during oxidation of ASS material are also appropriately managed.

An evaluation of potential neutralisation chemicals should be undertaken during the planning process and appropriate quantities of the preferred chemicals sourced for the duration of the site activities.

For the purposes of this plan, the neutralising chemical is assumed to be high quality agricultural lime (aglime). The aglime should be fine ground (<1mm) calcium carbonate ($CaCO_3$) or calcite

(limestone or marble powder). In the event that neutralising products other than high quality aglime are selected for use in this project, there are several issues that should be considered:

- Is there any potential environmental risk associated with use of the compounds (i.e. other components that may contaminate water, result in a much higher pH value (i.e. hydrated lime), stain treatment areas, etc); and
- Will the neutralising agent be of comparable effectiveness or will properties including: neutralising value, effective neutralising capacity, solubility, pH, chemical components, moisture content, impurities and particle size; require the quantity of agent addition to be varied by a consistent factor.

It is recommended that small scale treatment trials be implemented prior to broad scale implementation of alternative neutralising compounds. The small scale trials should document the effectiveness of the revised approach in terms of the time, cost, availability, suitability, etc.

During works, a sufficient supply of agricultural lime (aglime) will be required to be kept on site at all times. The quantity is based on requirements for the treatment of ASS to be neutralised within the treatment area; for application on exposed excavation faces where ASS is expected or suspected; and for wet weather events where existing applications will require replacement and/or treatment of acidic water is necessary. Receipts, dockets and other field records showing the storage locations of all chemicals and location of all applications of neutralising agents must be kept.

ASS management by neutralisation is considered a suitable option for the proposed works as:

- The PASS material, if generated during works will generally occur as a result of excavation works (piling spoil, lift shaft, foundation installation, etc) and as such treatment of the resulting material by neutralisation may be completed at this point;
- Via staging of the excavation/piling/foundation works, a contractor will be able to ensure sufficient space can be made available within the site to set aside a treatment area(s) close to the identified ASS disturbance which can be hydraulically isolated from the remainder of the site;
- The proposed works are able to be staged in a manner which will allow treatment of ASS material in a timely manner;
- Appropriate machinery to mix the soil and neutralisation chemicals can be supplied by the civil works/earthworks contractors completing works on site; and
- Following successful completion of the neutralisation process, the treated soils are no longer considered to be ASS materials and so may either be reused on site beyond the basement footprint as engineered fill material, or alternatively, may be removed off-site as waste.

5.3.3 Full Oxidation and Leachate Collection

In the event that the acid production potential is relatively low, or there is a relatively low quantity of material to be treated, consideration may be given to the excavation and exposure of the soils to promote full oxidation. This option requires the implementation of environmental controls to ensure that all acid produced is flushed from the soil as leachate. Similar to management by neutralisation, a suitable treatment area is necessary where material can be spread and reworked to allow oxygen to react with the sulfides in the soil and where all leachate produced can be captured and treated by neutralisation.

This method is considered not to be a viable option for the proposed works as the process of soil oxidation may take extended periods (weeks to months) to reach completion. There is also a significant level of uncertainty in the volumes of leachate that would require neutralisation and

disposal due to climatic variation, including rainfall events. Given the currently unknown anticipated volume of material requiring treatment, the requirement to maintain environmental controls for this period and the potential for such works to extent the basement excavation program, this option is considered undesirable when compared to the relatively low cost of neutralisation chemicals as discussed in **Section 5.3.2** above.

5.3.4 Reburial of ASS Material

Strategic reburial or interment techniques can be used to manage PASS material by prevention of oxidation through permanent storage in an anoxic environment. These techniques are often adopted where areas are available for reburial and cost savings can be achieved by avoiding soil handling labour and neutralisation chemical costs. An alternative method of achieving reburial is over excavation of non-acid sulfate soil materials followed by reinstatement of the excavation with PASS material. Potential reburial sites must have a permanent groundwater table level above the proposed top of the reburial cell or alternatively measures to minimise oxygen exposure to ensure that the material is returned to an anoxic environment. Such works may include compaction and in-situ isolation below future building pavements at depth.

Reburial may occur within the assessment area or alternatively, where appropriate licences are obtained, at a site lawfully able to accept this material in accordance with the requirements of EPA (2014).

Excavation of ASS and creation of re-interment voids must be staged to ensure that adequate space is available for all ASS materials to be adequately reburied below a permanent water table and that the ASS will not be buried in conditions that may cause the formation of acidic conditions. A maximum period of time between the commencement of disturbance and completion of interment works of approximately 48 hours should be adopted in all instances. If the material is to remain exposed for longer the 24 hours the pH levels should be monitored every 12 hours to ensure acid conditions are not developing.

On this site, given the required depth of excavation to expose the PASS material, the proposed basement excavation requirements and the standing water table, strategic reburial of PASS without neutralisation is considered unlikely to be a practicable management option.

5.3.5 Separation Techniques

Separation techniques are increasingly being implemented to reduce the quantity of PASS material requiring treatment in areas where works include the disturbance of large quantities of PASS. These activities include the removal of fine ASS particles including pyrite and monosulfides from coarser grained soil particles. This results in two material streams, concentrated ‘ASS fines’ and non-ASS material which can be removed from the management process. Management of ASS fines would then involve implementation of other ASS management techniques such as reburial, neutralisation, etc.

Separation is typically implemented by creating a soil slurry where fine particles can be suspended in solution away from heavier soil particles using methods such as sluicing or cycloning. Typically, such methods require suitably grained soils such as sand or non-consolidated sediments and a significant water source to implement the separation.

Environmental controls are required during the separation processes to ensure that the PASS fines do not undergo oxidation prior to the implementation of other management measures and validation of the non-ASS stream would then be necessary to confirm that the ASS fines have been adequately removed.

On this site, separation techniques are considered not to be a viable management option as these techniques cannot be used as a standalone management option and as such the ASS fines once separated would still require further treatment. The use of separation techniques would require the

construction of sluicing channels or installation of cyclone treatment equipment to manage the quantities of slurry produced during the treatment process and provide sufficient areas for drying of the separated non-ASS portions following separation of the ASS fines.

5.3.6 Selection of Preferred Management Strategies

Evaluation of potential management strategies has identified the use of neutralisation techniques where disturbance cannot be avoided as the most appropriate technique for this site.

Management measures for identified PASS material will include the application of neutralisation chemicals to excavated PASS material, neutralisation of exposed base excavation faces during staged treatment works and neutralisation (as appropriate) of groundwater seepage and drainage leachate produced during the excavation and treatment works. Following validation to confirm the acid generation potential of the material has been appropriately neutralised, the material will either be set aside for use as engineered fill material within the development site, or alternatively, will require off-site disposal in accordance with the requirements of EPA (2014).

5.4 Site Management Strategy

The site management strategy to be implemented during works which may disturb PASS materials will ensure the following:

- Adequate treatment of PASS material disturbed during site activities, either in-situ or following excavation such that there is sufficient acid neutralizing capacity and no net acidity following stabilization (as measured through appropriate field testing and laboratory validation);
- Water discharged from the excavation and treatment areas (including run-off, water from dewatering and leachate) is neutral and discharged to stormwater once it has been shown to meet with the criteria specified in this plan or shall be reused on site, or alternatively reused on site for dust suppression;
- Groundwater quality indicators and levels are not significantly changed beyond the basement footprint from the existing levels/quality during excavation activities and are re-established after the completion of construction works; and
- Implementation of additional assessment procedures during earthworks operations for the effective treatment and management of any drained, disturbed or excavated acid sulfate soils.

5.4.1 Pre-disturbance Works

Subsequent to the additional investigation activities as identified in **Section 4.2**, and prior to the commencement of excavation/disturbance works which may disturb PASS materials at the site, including piling activities with the potential to generate spoil, the following preparations should be implemented:

- The sequencing of proposed piling, excavation, services installation and other activities should be planned in detail taking into account the time and space necessary to complete the PASS management activities outlined in this document. The planning should provide a contingency for treatment of additional quantities of materials in the event that further PASS material is identified following the commencement of site works, or heavy rainfall events result in significant additional quantities of collected impacted water.
- The actual areas of PASS occurrence where disturbance/excavation will occur during each stage of works (piling, remediation, bulk excavation, services installation, etc) as part of the site activities should be identified and suitable location(s) for treatment areas close to the areas of disturbance identified. Based on the proposed works, the available space for

treatment and the approximate volume anticipated to be disturbed, staging of the disturbance activities should then be planned such that sufficient drying and mixing time can be achieved for all disturbed materials. The staging should also allow for adequate time to obtain the results of verification testing before the material is placed at the final location or removed from the site.

5.4.2 Neutralisation Chemicals

An evaluation of potential neutralisation chemicals should be undertaken during the planning process and appropriate quantities of the preferred chemicals sourced for the duration of the site activities. For the purposes of this plan, the neutralising chemical is assumed to be high quality agricultural lime (aglime). The aglime should be fine ground (<1 mm) calcium carbonate ($CaCO_3$) or calcite (limestone or marble powder). In the event that neutralising products other than high quality aglime are selected for use in this project, there are several issues that should be considered:

- Is there any potential environmental risk associated with use of the compounds (i.e. other components that may contaminate water, result in a much higher pH value (i.e. hydrated lime), stain treatment areas, etc); and
- Will the neutralising agent be of comparable effectiveness or will properties including: neutralising value, effective neutralising capacity, solubility, pH, chemical components, moisture content, impurities and particle size; require the quantity of agent addition to be varied by a consistent factor.

It is recommended that a small scale treatment trial be implemented at the commencement of site works prior to broad scale implementation of alternative neutralising compounds. The small scale trials should document the effectiveness of the revised approach in terms of the time, cost, availability, suitability, etc.

5.4.3 Excavated Material Treatment Area Design

As noted above, the treatment area should be situated in an appropriate location(s) with respect to site disturbance activities. In addition, consideration should also be given to the ease with which environmental controls can be implemented and potential requirement for off-site disposal of the material once stabilised and validated.

Small Quantities

For small scale disturbance activities, it is anticipated that a large lined skip bin or suitable structure could be used as a 'treatment cell' for management excavated material to minimise the potential for release of acidic leachate or partially treated soil.

Bulk Excavation Works

Should quantities of material disturbed in a stage exceed that able to be managed in a large skip bin, a treatment area should be established with consideration of the following:

- The treatment area should be established separate to the area of disturbance but able to be accessed from the area of disturbance by plant/vehicles transporting the material to be treated and material to be removed from the treatment area at the completion of stabilisation activities;
- The treatment areas should be sufficiently large to facilitate a pre-treatment stockpile area, a treatment pad, water/ sediment collection and treatment measures, post treatment stockpile storage area and lime storage area.
- The treatment area should be isolated from major external surface water catchments, including overland surface water flow and potential flood water, basement excavation flooding by rainfall events, by ground surface contouring, installation of perimeter drains

or bunds covered with an impervious layer (concrete, geomembrane, compacted non-ASS clay, etc).

- Infiltration of surface water (rain or drainage) through the ASS to groundwater within the treatment area should also be prevented to the extent possible. Alternatively, a layer of lime stabilised soil should be prepared on the ground surface within the treatment area that will act to neutralise any acidic water that my infiltrate the ground surface during treatment activities. The minimum application should be no less than 5 kg lime/m^2 of treatment area. This application should not be taken into account when material to be treated is placed within the treatment area as the neutralisation capacity of these added chemicals will decrease with time as a result of insoluble iron coating generation and it is difficult to ensure that there has been adequate mixing of the neutralising agent within the soil added to the site.
- Pre-treatment and post-treatment stockpile areas should be separately bunded or drained to minimise the potential for re-acidification of treated material.
- The treatment pad should be of a size that would allow treatment of material by a single machine over a reasonable timeframe to minimise the oxidation of material during spreading and treatment. Assuming the material the subject of treatment is spread to a depth of approximately 0.3 m, a single treatment area 10 m by 20 m could treat 60 m^3 of material per treatment cycle. Should capacity to treat more material be required, two or three treatment pads could be established, separated by a suitable width to allow for excavator movement between the bunds of each pad.
- The bund surrounding each treatment pad may be constructed of concrete, compacted non-ASS clay, sand and lime filled sandbags or other suitable materials that are relatively impervious and can be coated with a guard layer of lime to neutralise acidic leachate that may contact the bund.
- The base of the treatment pad should be surfaced with concrete, asphaltic concrete, or soil mixed with lime as discussed above. This base should be graded where possible at a minimum fall of 1° to facilitate drainage of leachate such that it can be collected and/or pumped to a treatment/holding tank.
- Once well mixed with a suitable quantity of neutralisation agent, the material should be transferred to the post treatment stockpile area. Here the validation testing will be completed and the material will remain until receipt of the validation results. The material will then be cleared for beneficial reuse within the site, or alternatively for off-site disposal to landfill.
- Surface water flows will be diverted around the treatment area where possible. Water falling within the various portions of the treatment area will be collected at appropriate locations and transferred either to a holding tank or artificial detention basin. The water quality will be monitored to ensure only water of suitable quality is discharged from the treatment area of the site. Dilution of water collected within the treatment area is not an acceptable method of treatment at this site. Contaminants resulting from oxidation of ASS should be collected, treated and/or managed on-site. Water discharges from the site must not have a significant impact on pH, buffering capacity, colour or ionic composition of the receiving water body (stormwater, groundwater, sewer, etc).
- A sufficient supply of aglime should be kept on site at all times for the treatment of PASS to be neutralised within the treatment area, for application on exposed excavation faces where ASS is expected or suspected; and for wet weather events where existing applications will require replacement and/or treatment of acidic water is necessary.

Receipts, dockets and other field records showing the storage locations of all chemicals and location of all applications of neutralising agents must be kept.

- The supply shall be stored in a covered and bunded area to prevent accidental exposure to water and deterioration of the inherent neutralizing capacity. ASS treatment materials should be stored in a manner that minimise the exposure of the materials to wet or humid conditions. Such conditions may result in the clumping or surface crusting of particulate lime which can reduce the level of effectiveness in neutralising water or soil.

5.4.4 General Site Management

All natural soils within the PASS identified zones must be treated as PASS material until such a time as the soil is demonstrated to be non-PASS material or treatment effectively reduces the risk associated with the material and validation results meet the relevant specifications.

PASS materials that have been excavated should be immediately transferred to the treatment area or treated in-situ as soon as practicable to minimise the quantity of soil, sediment and/or groundwater requiring treatment and the risk of environmental harm to the site and/or down-gradient receptors.

Bunding, diversion drains, contaminated water treatment/containment, etc may be used to contain surface water run-off from PASS storage and treatment areas. However, PASS materials must not be used in the construction of bunds and other diversion devices.

Equipment used in the treatment of PASS shall be washed with an alkaline solution at the completion of each work period to minimize corrosion of equipment.

5.4.5 Excavation Works

Excavation works to be undertaken in the identified PASS areas of the site should be undertaken in the following manner:

- Fill material required to be removed from within the PASS zone footprint should be excavated and removed from the PASS zone and treatment area as per the requirements of the site RAP. Assessment and treatment of this material for PASS conditions is not considered necessary based upon past investigation results;
- Natural soils within the PASS zone should be assumed to be PASS unless demonstrated otherwise. All excavated natural soil material should be transferred immediately to the treatment area;
- Field testing upon initial exposure/generation of the excavated clay material will be required to establish treatment requirements for the material. Field testing will include pH_f and post peroxide pH_{fox}, with both required to meet the validation criteria of pH 6 to be considered non-PASS soil. Alternatively, dependent upon the scheduling of the excavation works, laboratory pre-testing of soils within each zone may be undertaken using laboratory sPOCAS or S_{Cr} methods. If either the field criteria or laboratory analysis results indicate the material is considered to be PASS, then the material will require treatment as discussed in the following section;
- Excavation works should be staged to limit the period of any required dewatering (and the consequential extent of groundwater drawdown in surrounding PASS areas). This may involve the excavation of smaller cells (than allowable within the treatment area);
- At the completion of the day's activities, where excavation works result in the exposure of known or suspected PASS, a guard layer of fine aglime will be applied to the base of the excavation at a rate of 5 kg lime/m^2 of exposed soil. If the base of the excavation is to remain exposed for an extended period (i.e. more than three days) the lime coating

should be checked and re-limed as necessary. Alternatively, the lime may be covered with a layer of compacted non-ASS material at least 0.3 m in thickness;

- All cut foundation pads, lift shafts, batters/exposed faces potentially including ASS, (i.e. faces at the edge of excavation extents, etc), shall be coated with fine aglime at a rate of 5 kg/m^2 and the lime coating should be checked and re-limed as necessary on a daily basis during periods of dewatering, whilst the faces are temporarily exposed and/or following wet weather events;

5.4.6 Treatment of Excavated PASS Material

Treatment of PASS soils will comprise the addition of sufficient quantities of finely ground neutralising agent to treat all oxidisable S% and actual acidity and provide a factor of safety to compensate for potential impurities in the neutralising agent, non-homogenous mixing and limitations to the solubility of the neutralising agent. This will need to be determined on the basis of analysis data collected as per **Section 5.2**.

The excavated PASS material will be immediately transferred to the treatment area and placed either in a stockpile within the pre-treatment stockpile area or immediately on the treatment pad. Treatment of excavated material should occur within one day of excavation of the material.

If stockpiled, the material should be formed into a conical stockpile to minimise the exposure of the material to air. In the event of significant wet weather periods, the stockpiles should be covered with builder's plastic or similar to limit the infiltration of rainfall into the stockpiles.

If site conditions require the stockpiling of material for longer than 24 hours, the stockpiles should be treated with a guard layer of aglime of 5 kg lime/ m^2 per vertical metre of soil in the stockpile. This would result in a two metre high stockpile requiring an application of 10 kg lime/m^2 surface area. The stockpile should then be covered with an impervious surface (i.e. builder's plastic) that covers the top and sides of the stockpile to minimise drying by wind and sun and to prevent rainfall entering the stockpile.

Following placement within the treatment pad the material should be spread to a depth that will allow the material to be properly treated by thoroughly mixing neutralising agent through the soil. The actual depth of spreading will be somewhat dependent upon the soil type, the machinery used to mix the material and the form of the neutralising agent. However, the nominal spread depth should initially be no more than 0.3 m. Mixing of the lime and soil mixture may be undertaken by harrowing, rotary hoeing, using an excavator shaker bucket to blend the material, the use of a pug mill or similar equipment.

Care shall be taken to ensure that mixing occurs throughout the depth of the layer. The soil must be managed to achieve a consistency that will allow for thorough mixing of the soil and neutralising agent to ensure that the effective neutralisation occurs. This may require drying of the disturbed material (with associated management of any acidic leachate and other resulting contaminants), mechanical turning and breaking up of soil. Drying should not be undertaken during foreseeable wet weather events due to the increased risk of runoff flushing acid from the material and into uncontrolled areas.

Following mixing, aglime shall be spread at a rate of approximately 5 kg lime/m^2 around the toe of the treated soil, around a 1 m perimeter between the toe of the material and across the exposed face of the bund to neutralise any leachate released from the soil. Once the soil has sufficiently dried that no more leachate is being released, the material should be turned to ensure that all leachate is released from the treatment area.

If there is a likelihood that neutralisation treatment of particular soils encountered during works (i.e. heavy clays) will not be effective for the soil type/s, a small scale trial to demonstrate that the proposal is practical should be performed before larger scale disturbance of this soil type.

5.4.7 Water Management During Treatment

Surface drainage and groundwater that come into contact with PASS materials has the potential to become acidic and contaminated with heavy metals leached from the acidified soil. Sources of water may include ground surface drainage associated with rainfall, dewatering product produced during the excavation works, leachate produced during treatment of excavated soils, and groundwater inflow into open excavations.

In general, soil and water at the site is required to be managed under an earthworks Soil and Water Management Plan to be prepared by the Principal Contractor prior to the commencement of site works. However, in addition to these requirements, water from within the treatment area will be required to be collected, assessed and if necessary treated prior to discharge from the site. Once pH and contaminant concentrations are considered suitable for discharge from the site, the water may be used for dust suppression at the site and/or released to the site stormwater system.

Additional water holding tanks may be necessary in the vicinity of the treatment works zones to store collected water prior to treatment. The water holding capacity directly related to the acid sulfate soil excavation and treatment areas should be maintained at a minimum quantity associated with a 1 in 10 year rainfall event to ensure that sufficient capacity is available to store all potentially acidic water that may be generated during site works.

Water will be neutralised, where required by the addition of lime within a dedicated treatment tank or lined detention basin. Lime shall be added incrementally and thoroughly mixed within the treatment vessel. Approximate lime application rates based on initial pH are provided in **Table 7.1** below.

Table 5.1 Treatment of Acidic Dewater

Water pH	Agricultural Lime / 1000L Water
0.5	11.7kg
1.0	3.7kg
1.5	1.2kg
2.0	0.37kg
2.5	0.12kg
3.0	37g
3.5	12g
4.0	4g
4.5	1.2g
5.0	0.37g
5.5	0.12g

Lime addition and mixing shall continue until the pH of the water is within the range of 6.5 – 8.5.

In the event water volumes greater than the capacity of the water treatment holding capacity are produced during site activities, consideration should be given to off-site disposal of water via a licensed contractor or treatment of water using neutralisation chemical dosing within holding tanks prior to re-irrigation of open excavations once the pH of the water has been demonstrated to be suitable.

5.4.8 Validation of Treated PASS Material

Following the application and mixing of lime to the PASS at the treatment pad the material should be allowed to stand for a minimum of 48 hours prior to validation assessment. The spread soil should then be assessed to establish whether the following performance criteria have been achieved:

- The neutralising capacity of the treated soil must exceed the sum of the TAA and TPA of the soil, i.e. there is no net acidity in the soil as measured by sPOCAS / SCr < 0.03%S;

- Post neutralisation, the soil pH is greater than pH 5.5 (and preferably less than 9); and
- Excess neutralising potential should remain in the soil as all acid generation reactions may not be complete and so the soil may still have further capacity to generate acidity.

Validation testing using field tests to measure the soil/water pH shall be undertaken at a rate of ten samples per treatment batch (to a maximum quantity of 100 m^3, or a rate of 1 sample per 20 m^3). Field testing will include pH_f and post treatment peroxide pH_{fox}, with both required to meet the post neutralisation criteria noted above for all samples per treatment batch.

Confirmatory laboratory analysis (pH and sPOCAS / SCr) will be undertaken at a rate of two samples per treatment batch (to a maximum quantity of 100 m^3, or a rate of 1 sample per 100 m^3 for larger quantities). The samples obtained for laboratory analysis may be obtained by compositing three subsamples obtained from the treatment material to provide a broader indication of net acidity levels.

Samples should be obtained immediately following movement of the material from the treatment pad area to the post-treatment stockpile area of the treatment zone. Each stockpile should be identified with a unique designation and its location logged with the laboratory validation sample identification so that laboratory results can then be matched to each stockpile within the post-treatment area. Following additional applications of neutralisation chemicals, a greater density of validation sampling is necessary to confirm the successful neutralisation.

In the presence of positive field validation tests, laboratory analysis of validation samples may be employed to determine the level of net acidity and confirm that the treatment has been successful, or provide an indication of the quantity of further aglime application necessary to neutralise the soil.

If negative field tests occur but the confirmatory laboratory analysis results indicate that there is still net acidity, a further application of aglime will be mixed with material to ensure additional neutralisation capacity, prior to further confirmatory analysis.

Following receipt and logging of the successful laboratory validation results, the stockpile may then be released for beneficial reuse of material at the site, or alternatively, for off-site disposal. If the laboratory results indicate that the stockpile requires further treatment, the material should be returned to the treatment pad as a unique treatment batch and treated as required prior to re-sampling.

5.4.9 Site Condition Monitoring

It is anticipated that monitoring of conditions will be undertaken by both the site contractors and an independent appropriately qualified consultant to ensure that the appropriate environmental controls are in place and the treatment strategy is minimising the environmental risk associated with the ASS materials.

The following inspection/monitoring regime will be implemented during the site works period and documented as appropriate to demonstrate compliance with this ASSMP:

- Stockpiles of material within the treatment area and of treated material will be inspected daily by the site contractors with pH measurements of any retained leachate taken and recorded. If the leachate is significantly acidic (pH < 5.0), the stockpiled material will be returned to the pre-treatment area until the laboratory results are available and the quantity of required additional lime application is known;
- If the on-site sump/detention basin is used to manage water ingress, surface water monitoring points will be sampled and field tested and the pH recorded every day by site contractors during active site activities and weekly during periods where no active ground works are being undertaken within the PASS area; and

- All treated excavation faces to be retained for more than three days will be inspected on the third morning and lime reapplied as necessary each following morning.

Regular inspection of all excavation and treatment areas will be undertaken to identify potential indications of PASS oxidation. These inspections should note:

- Unexplained scalding, corrosion or degradation of onsite steel equipment and concrete paved surfaces;
- Formation of the mineral jarosite or other acidic salts in exposed or excavated soils;
- Areas of surface water blue-green, blue-white in colour or extremely clarified indicating high concentrations of aluminium;
- Rust coloured deposits on excavation faces, in drainage paths, on bunds, channels, etc indicating iron precipitates; and
- Such inspections should also identify the presence of unusual odours, including strong organic or sulfurous smells (i.e. rotten egg gas).

5.4.10 Removal of Neutralised PASS from the Site

Only material confirmed to be below the criteria listed in **Section 5.4.8** will be considered as stabilised ASS material for potential reuse within the site, or off-site removal. A final round of field pH testing should be undertaken prior to loading of the trucks to ensure that pH levels remain above 6. Material to be removed from the site will be classified in accordance with current EPA (2014) requirements and disposed of to a licensed facility permitted to accept the material.

6. Responsibilities

The selection of samples for environmental analysis as per **Section 7.2** shall be undertaken by a suitably qualified and experienced environmental or geotechnical consultant. Results of analysis shall be assessed and evaluated by a suitably qualified and experienced consultant.

Implementation of the physical treatment, material management and environmental controls detailed in this ASSMP will be the responsibility of the site contractor engaged to complete remediation and/or construction earthworks within the site. The monitoring of conditions, unless otherwise specified in the monitoring sections will be the responsibility of a suitably qualified environmental consultant who will regularly inspect the site, the treatment area and treatment activities and implement the validation assessments to document compliance with this ASSMP.

The contractor should appoint a foreman or other responsible employee to undertake the appropriate monitoring activities as designated in the ASSMP. This person should be appropriately trained by the environmental consultant in all actions to be completed by the contractor. Where doubt arises concerning the results of the inspections or of field test validity, the environmental consultant should be contacted for verification of appropriate actions.

The contractor is not authorised to make any changes to the ASSMP or implement unapproved variations to the treatment and/or monitoring protocols outlined in this document unless explicit written approval is obtained from the environmental consultant prior to implementation of the changes.

Where ambiguity or conflicts in procedures arise, it is the contractor's responsibility to seek clarification on appropriate actions from the environmental consultant.

ASS mitigation measures should be documented as they apply to all individual works activities to be undertaken at the site. All persons responsible for the works activities should be made aware of their responsibilities in writing and suitable ASS management training should be provided to those persons to ensure that the responsibilities can be achieved.

Where contingency actions are necessary, or in the event that non-compliance with the ASSMP is identified by the contractor, the environmental consultant should be immediately informed in writing. The environmental consultant will then be obliged to provide a timely response documenting the necessary corrective actions.

7. Contingencies

In the event of unexpected events, including the identification of additional PASS zones at the site, or the failure of management measures as described in the ASSMP, the associated environmental risk will be managed by the evaluation and implementation of the contingency procedures and mitigation strategies.

7.1.1 Additional Acid Sulfate Soil Identification

In the event that site excavation works encounter the potential for additional acid sulfate soil areas at the site as may be identified by visual cues, field testing or laboratory analysis, the additional areas will be treated as per the primary PASS zone material treatment protocols. If the material is to be excavated as part of the development works, the excavation will be undertaken in stages with suitable volumes to allow the completion of the neutralisation treatment process prior to excavation of the next stage.

If the proposed works do not require excavation of the identified material, exposed surfaces will be treated with a guard layer of lime upon exposure. Groundwater seepage will be monitored and neutralising agents added as necessary to manage the potentially acidic leachate produced.

7.1.2 Failure of Initial Acid Neutralisation Treatment

As described in **Section 5.4.8** following the treatment of excavated materials within the treatment pad area, validation sampling will be completed to assess the success of the neutralisation process prior to removal of the material from the holding area. If the validation testing indicates that neutralisation of the material is incomplete (i.e. pH<6 or S_{pos}>0.03 %), a further application of lime and repeat of the treatment procedure will be undertaken prior to further validation assessment. If the proposed techniques fail, further consideration may be given to alternative management strategies as outlined in **Section 5.3**.

7.1.3 Significant Acidification of Groundwater

Monitoring of groundwater conditions via in-situ monitoring wells conditions within the site will be undertaken prior to the commencement of site disturbance activities and during the period of disturbance as PASS conditions. Monitoring will also be completed of extracted water prior to off-site discharge and any surface water collected during treatment of extracted material. Should the works identify the acidification of groundwater not directly related to the treatment area, all works associated with the potential disturbance of PASS at the site (including temporary construction dewatering extraction) shall cease.

Active exposure areas will require to be limed with a guard layer of at least 5 kg lime/m^2 exposed soil and all treatment areas will be checked to ensure that leachate and water migration is not occurring onto exposed soils or into surface water drainage channels at the site. If these activities identify a source of the increased acidity, remedial actions will be implemented to prevent the further occurrence of acidification at the site.

If these activities do not identify the source of the added acidity, or alternatively, if conditions are not corrected by the addition of lime, consideration may be required to the construction of a subsurface limestone treatment trench along the site boundary to neutralise groundwater prior to movement off-site. The design of such a barrier will be highly dependent upon the stage of the disturbance works at the site and extent of the acidic plume identified in this section of the site. Disturbance works within the PASS area should not recommence until the barrier has been installed to limit the generation of additional acidic groundwater.

8. Conclusions

Site characterisation assessment data available for subsurface conditions across the site has identified the occurrence of PASS material in fill and underlying alluvial soils at the site.

This ASSMP provides a detailed framework to manage the risks associated with the proposed activities which when successfully implemented will minimise environmental risks associated with disturbance of the ASS materials.

9. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

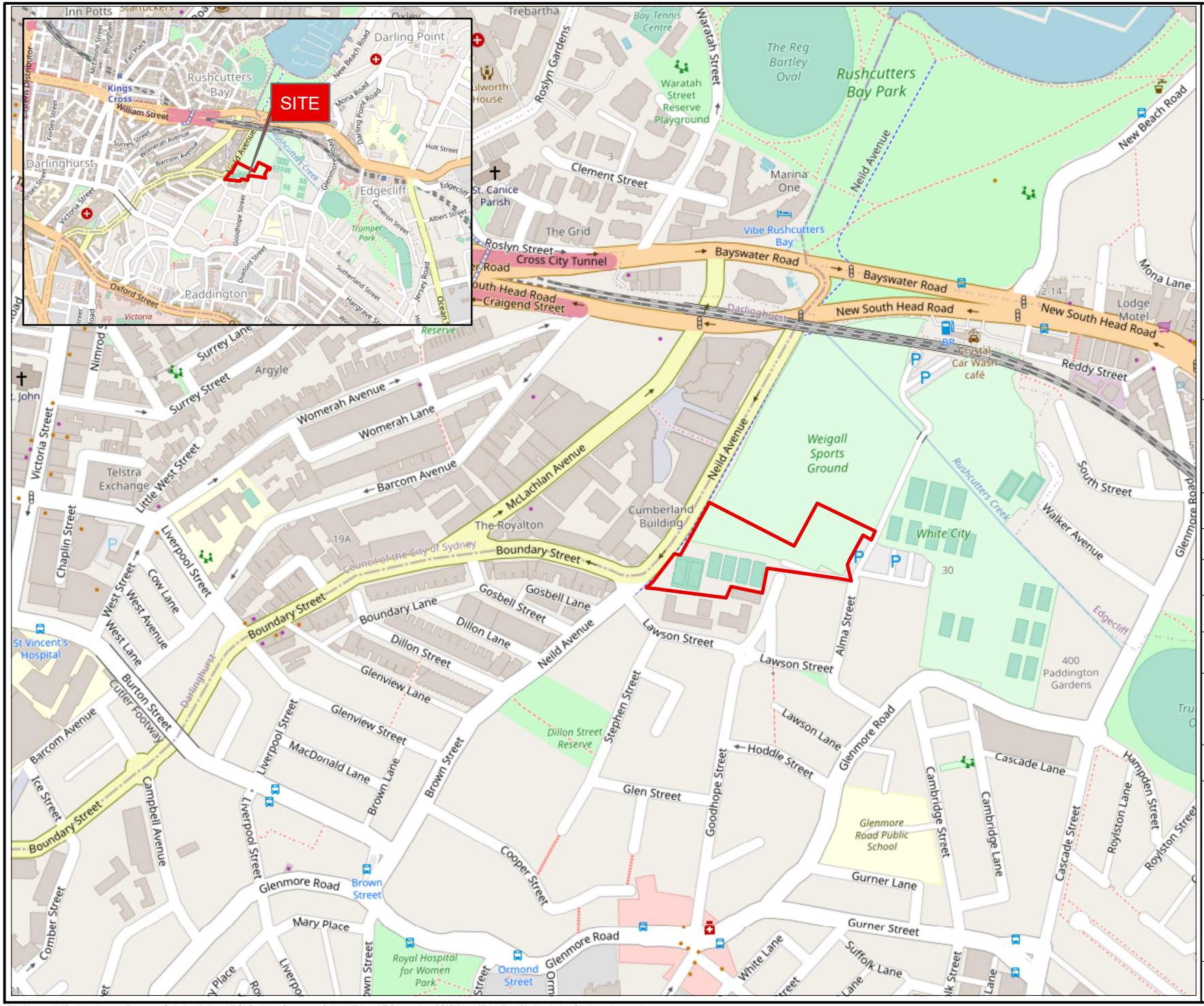
Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

Figures



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Legend:

Approximate Site Boundary

JBS&G

Job No: 58554	
Client: Jattca Property Solutions	
Version: R05 Rev A	Date 12/06/2020
Drawn By: RH	Checked By: SG
Scale 1:1,100	

0 10 20

metres

Coord. Sys. GDA 1994 MGA Zone 56

Neild Avenue, Paddington NSW

SITE LAYOUT

FIGURE 2

File Name: N:\Projects\Jattca Property Solutions\58554 DSI Sydney Grammar School Edgecliff Sports Area\GIS\Maps\R01 Rev B\58554_02_Site_Layout.mxd
Reference:

Legend:

- Approximate Site Boundary

Previous Sample Locations

- Borehole Location (DP 2020)

Sample Locations

- Monitoring Well
- Borehole Location

JBS&G

Job No: 58554	
Client: Jattca Property Solutions	
Version:R05 Rev A	Date 12/06/2020
Drawn By: RH	Checked By: SG
Scale 1:1,100	

0 10 20
metres

Coord. Sys. GDA 1994 MGA Zone 56

Neild Avenue, Paddington NSW

SITE LAYOUT AND SAMPLE LOCATIONS

FIGURE 3

File Name: N:\Projects\Jattca Property Solutions\58554 DSI Sydney Grammar School Edgecliff Sports Area\GIS\Maps\R01 Rev B\58554_03_SampleLocations.mxd
Reference:

Appendix A Design Plans

Revisions				
No.	Date	Description	Checked	Approved
A	02/09/2020	ISSUED FOR SSDA	ADC	LC

Key

N

Client
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Project
SGS Weigall Sports Complex
Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
WEIGALL SPORTS COMPLEX
BUILDING 01 AND BUILDING 02
LOCALITY PLAN

Sheet Status
NOT FOR CONSTRUCTION

Scale	Drawing No.	Issue
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ELEMENTS TO BE DEMOLISHED

Revisions

No.	Date	Description	Checked	Approved
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Key

N

Client
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Proj. No. 19086

Drawing Title
WEIGALL SPORTS COMPLEX
BUILDING 01 AND BUILDING 02
DEMOLITION PLAN

Sheet Status
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Issue: A

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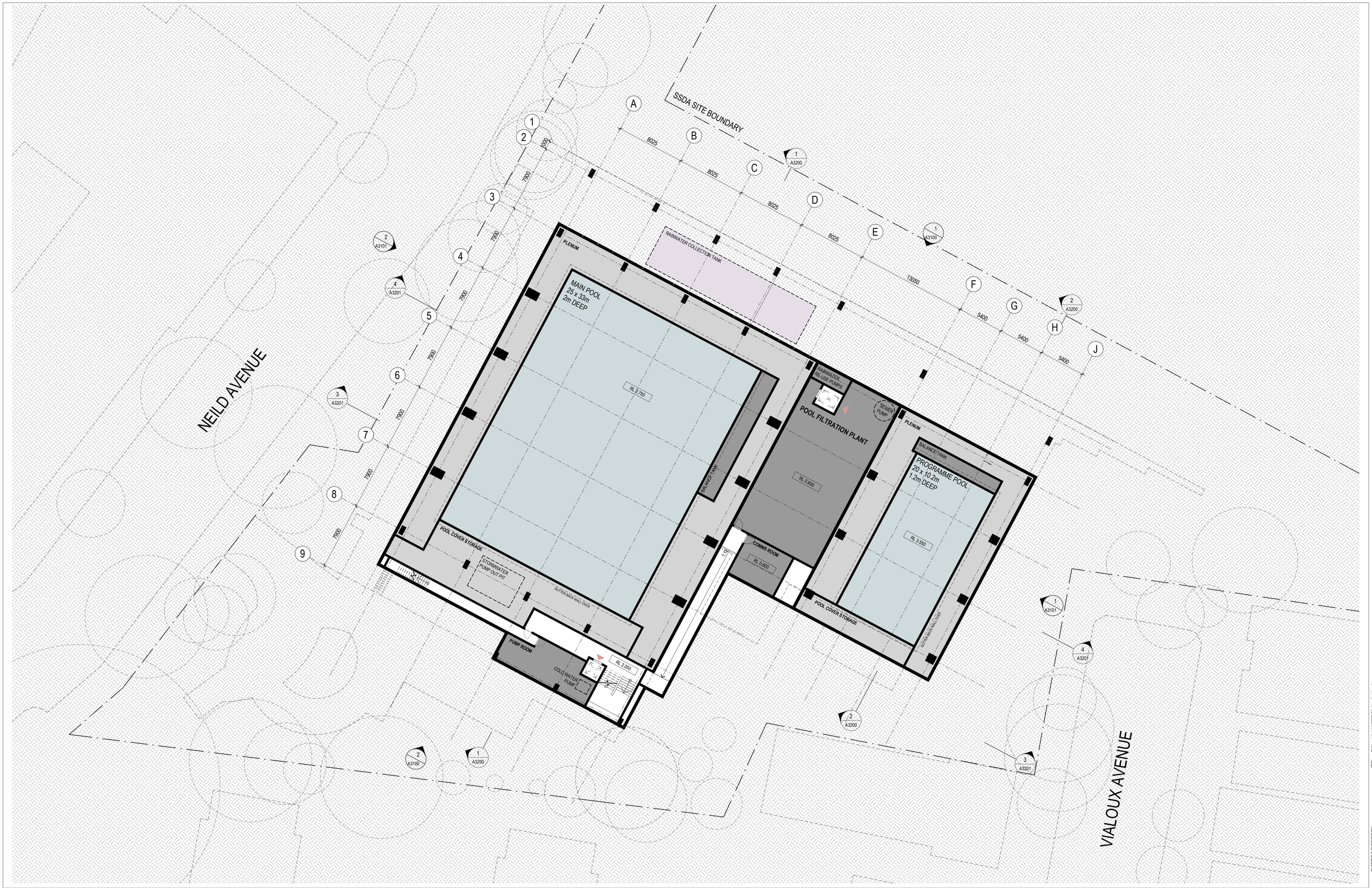

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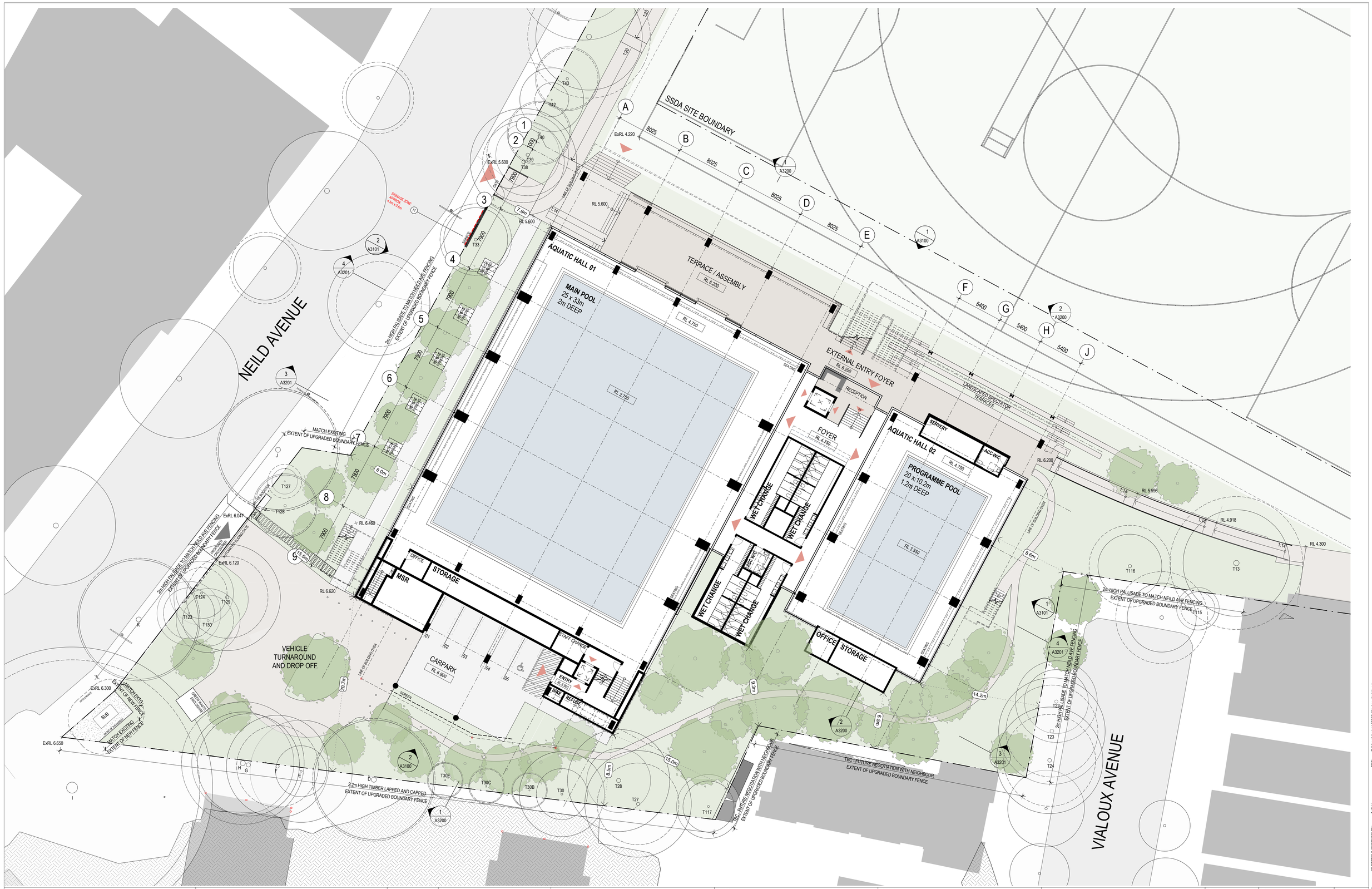

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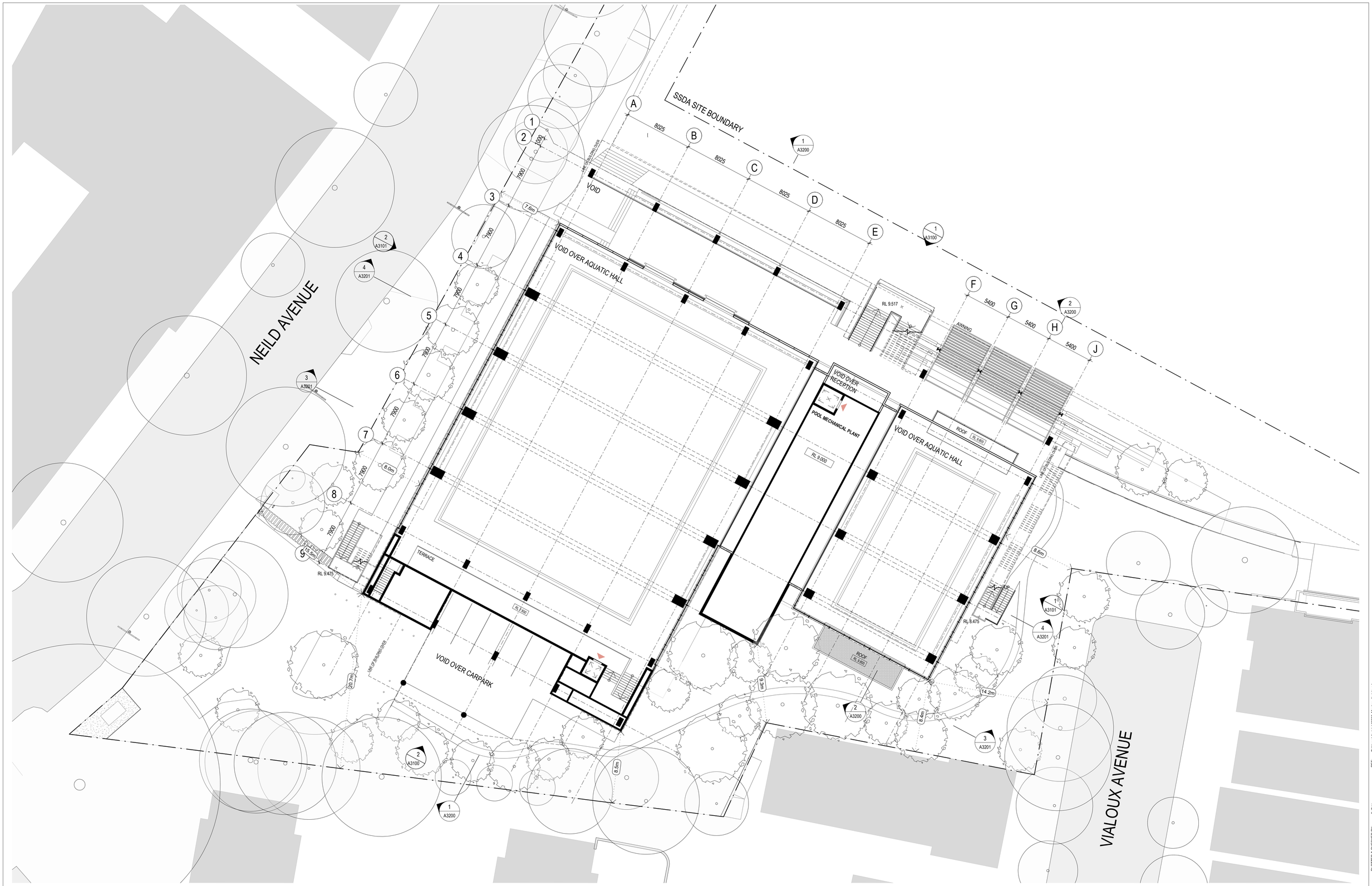

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NEILD AVENUE

SSDA SITE BOUNDARY

VIALOUX AVENUE

MAIN MULTIPURPOSE SPORTS HALL 01

MULTIPURPOSE SPORTS HALL 02

BALCONY

EXTERNAL FOYER
RL 12.650

CIRCULATION

STORAGE
17 m²

OPERABLE WALL

DRY CHANGE

DRY CHANGE

DRY CHANGE

DRY CHANGE

WC

STORAGE
25 m²

STORAGE
5 m²

STORAGE
22 m²

STORAGE

SPECTATOR SEATING

LINE OF ROOF OVER

RL 9.517

RL 12.650

RL 10.525

RL 8.475

8025 8025 8025 8025 13050 5400 5400 5400

7900 7900 7900 7900 7900 7900 7900

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LINE OF ROOF OVER

N

Revisions				
No.	Date	Description	Checked	Approved
A	02/09/2020	ISSUED FOR SSDA	ADC	LC

Key

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Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
BUILDING 01
SPORTS FACILITIES BUILDING
GENERAL ARRANGEMENT PLAN
FIRST

Sheet Status
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Drawing No.
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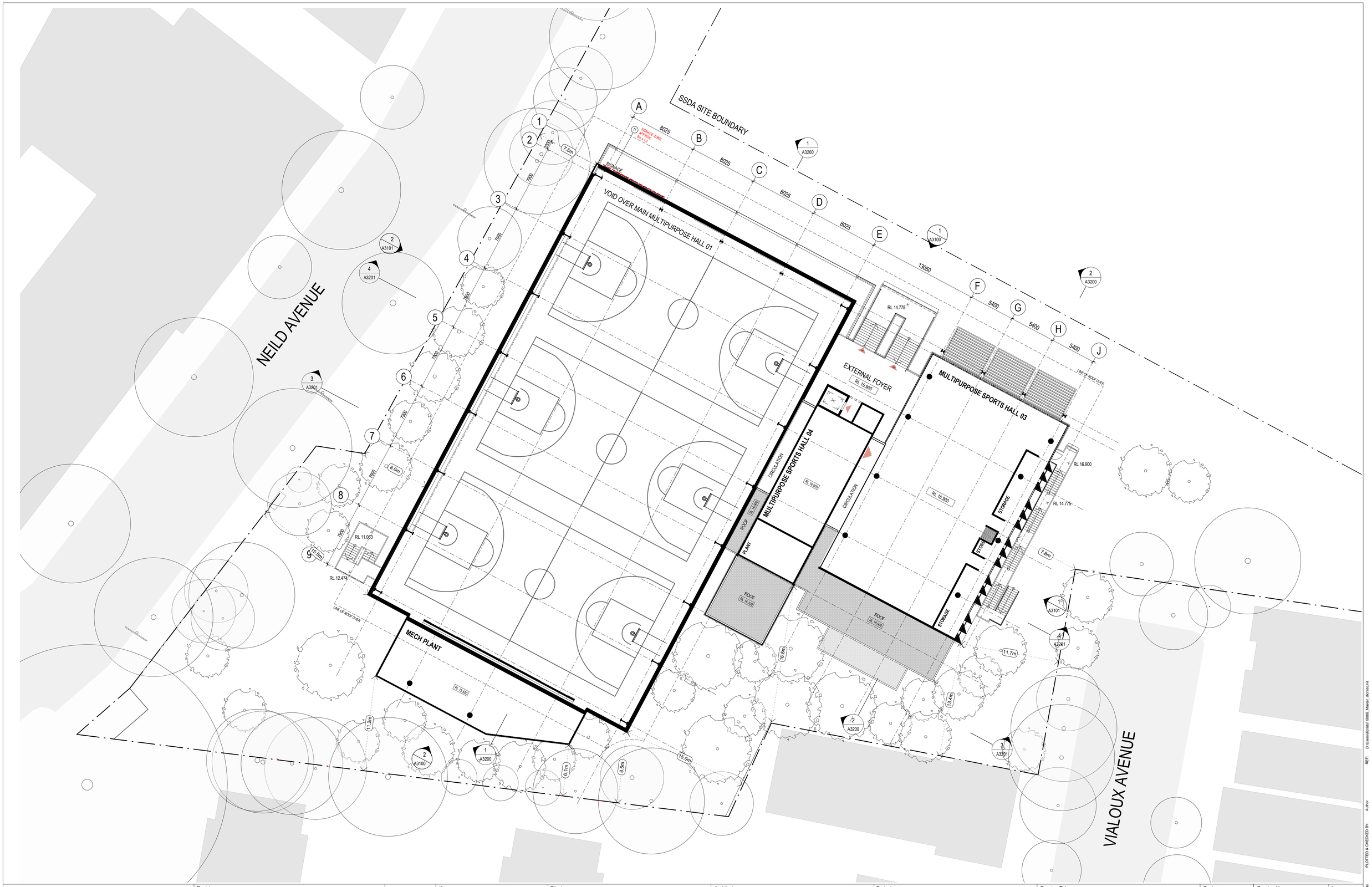

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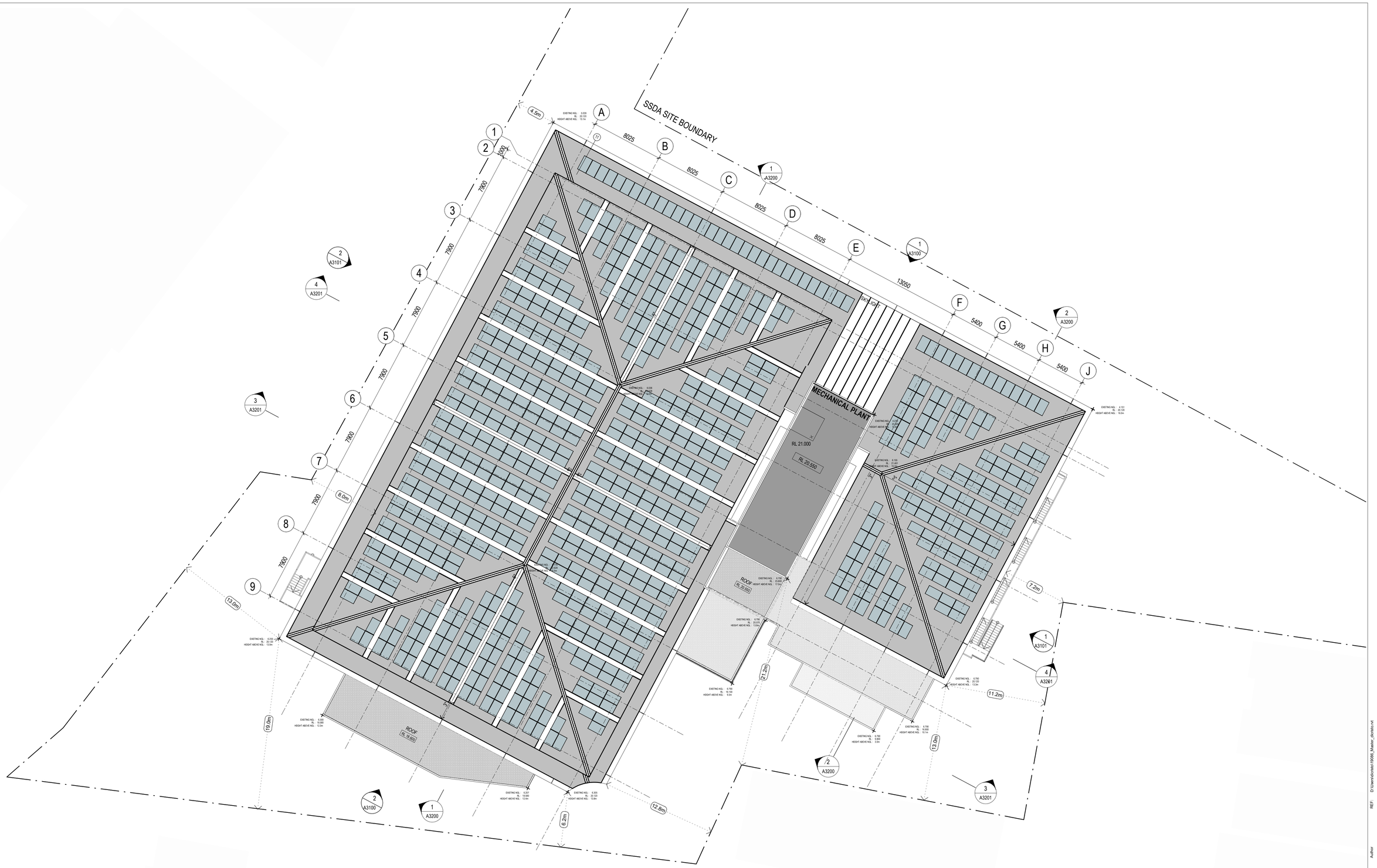

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Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
BUILDING 02
CAR PARK
GENERAL ARRANGEMENT PLAN
LOWER/UPPER FIRST

Sheet Status
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Drawing No.
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Issue
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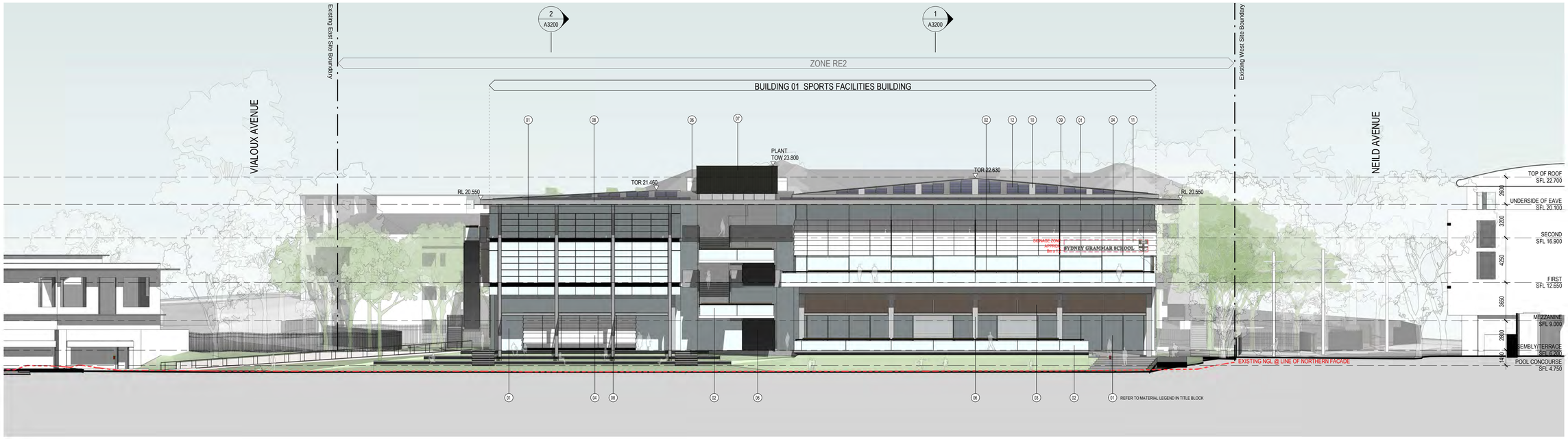

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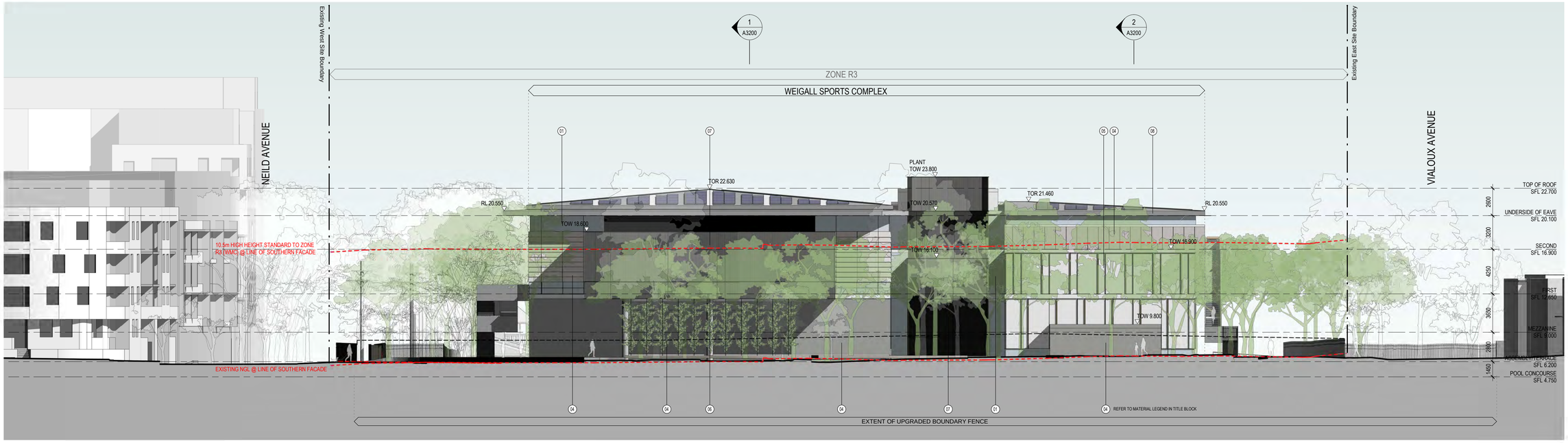

2 SOUTH ELEVATION

MATERIAL LEGEND:

01 GLAZING	06 CONCRETE / MASONRY	11 SIGNAGE
02 BALUSTRADE	07 LOUVRES	12 PHOTOVOLTAIC ARRAY
03 OPERABLE SCREENS	08 STEELWORK	
04 SOLID WALL CLADDING	09 SOLID ROOF CLADDING	
05 SEMI-OPAQUE WALL CLADDING	10 SEMI-OPAQUE ROOF CLADDING	

Revisions

No.	Date	Description	Checked	Approved
A	02/09/2020	ISSUED FOR SSDA	ADC	LC

Key

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ABN 53 003 782 250

Project
SGS Weigall Sports Complex
Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
BUILDING 01
SPORTS FACILITIES BUILDING
ELEVATIONS
NORTH AND SOUTH

Sheet Status
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Scale
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Drawing No.
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Issue
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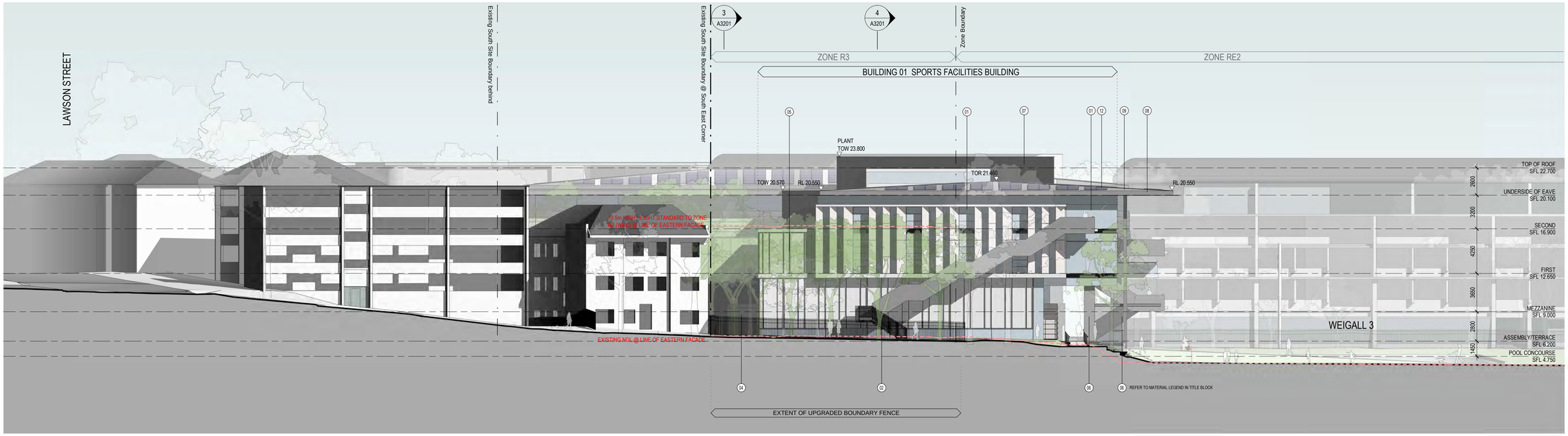

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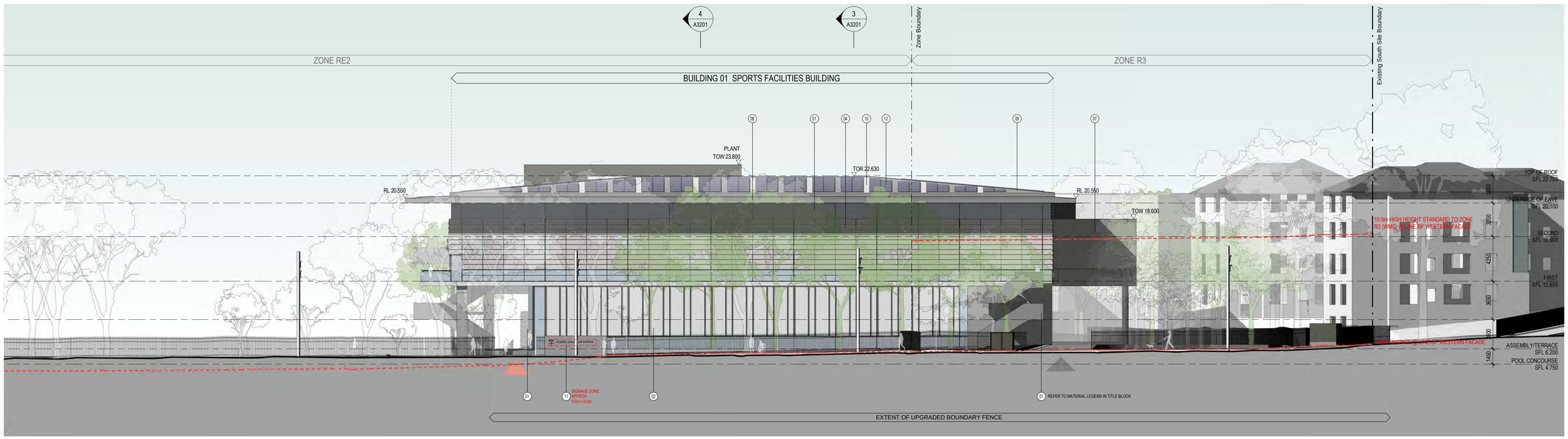

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03 OPERABLE SCREENS	08 STEELWORK	
04 SOLID WALL CLADDING	09 SOLID ROOF CLADDING	
05 SEMI-OPAQUE WALL CLADDING	10 SEMI-OPAQUE ROOF CLADDING	

Revisions

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Project
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Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
BUILDING 01
SPORTS FACILITIES BUILDING
ELEVATIONS
EAST AND WEST

Sheet Status
NOT FOR CONSTRUCTION

Scale
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Drawing No.
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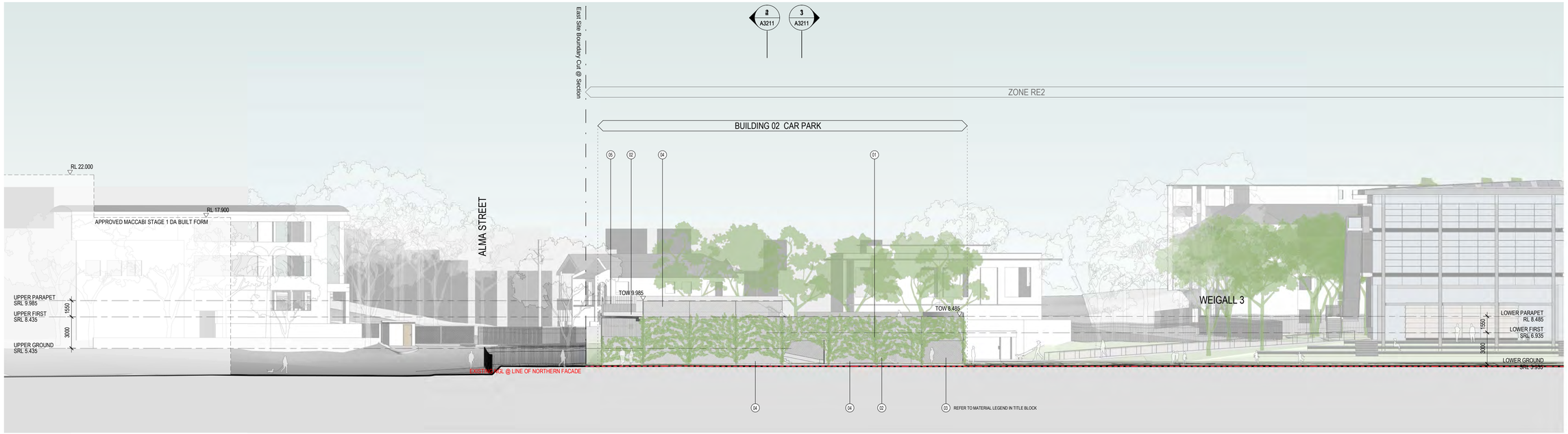

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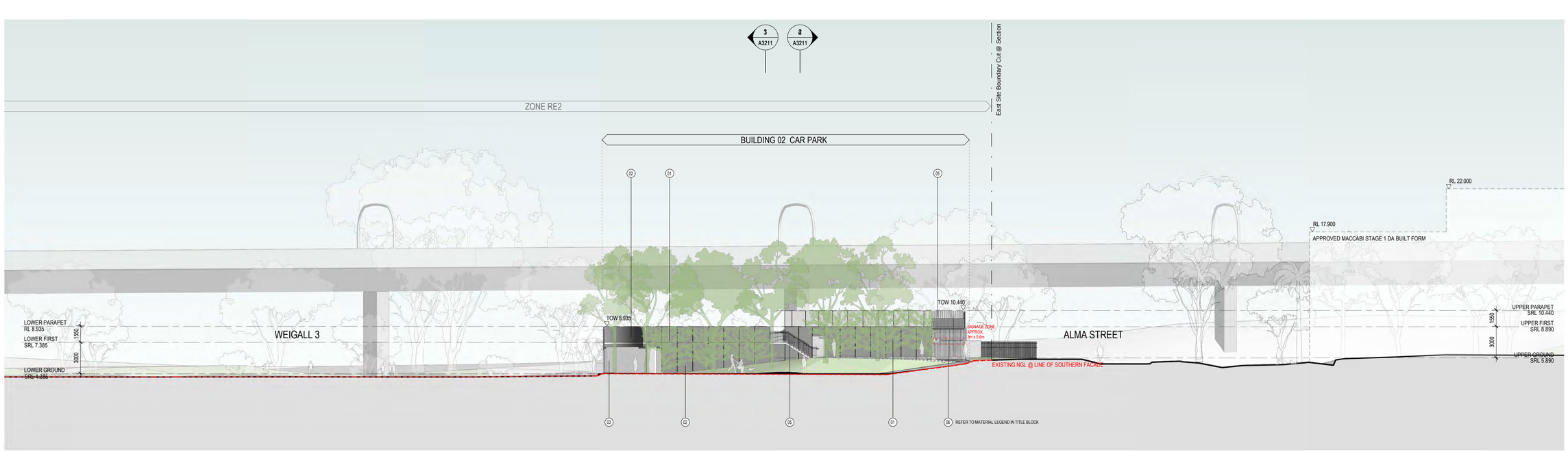

2 SOUTH ELEVATION

MATERIAL LEGEND:

- 01 LANDSCAPED FACADE
- 02 CONCRETE / MASONRY
- 03 OPERABLE NETTING
- 04 FIXED NETTING
- 05 STEELWORK
- 06 SIGNAGE

Revisions

No.	Date	Description	Checked	Approved
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Project
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Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
BUILDING 02
CAR PARK
ELEVATIONS
NORTH AND SOUTH

Sheet Status
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Drawing No.
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Issue
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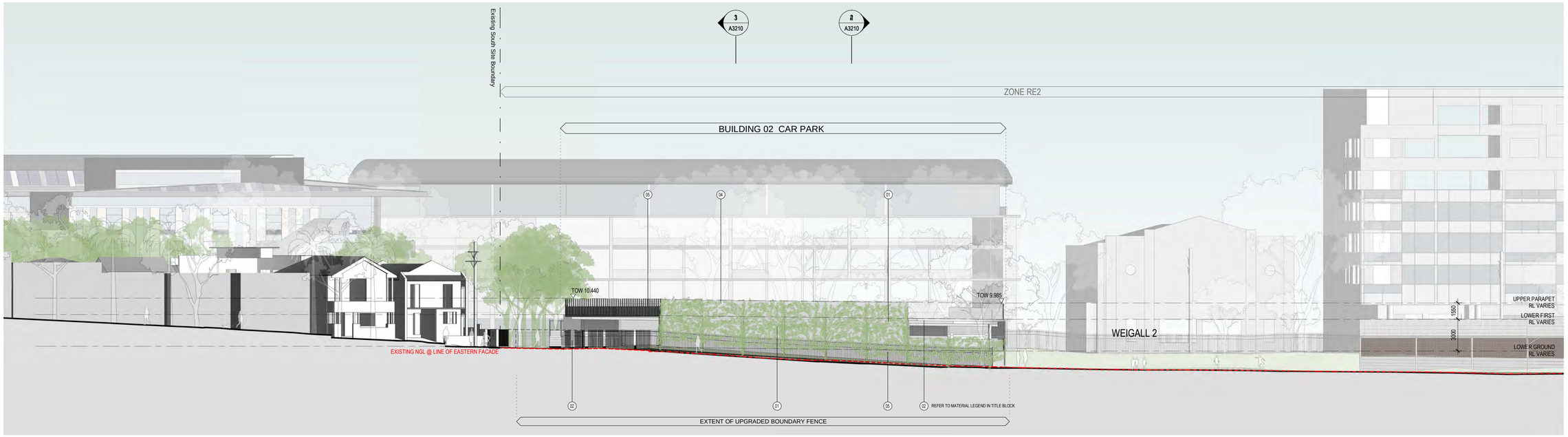
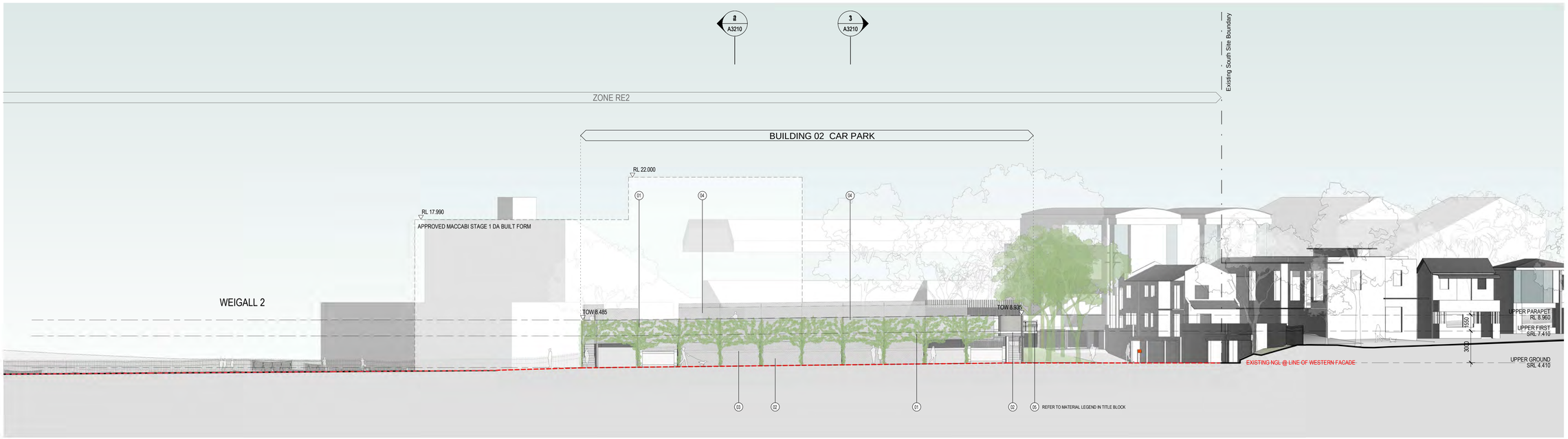


1 EAST ELEVATION



2 WEST ELEVATION

MATERIAL LEGEND:

- 01 LANDSCAPED FACADE
- 02 CONCRETE / MASONRY
- 03 OPERABLE NETTING
- 04 FIXED NETTING
- 05 STEELWORK
- 06 SIGNAGE

Revisions

No.	Date	Description	Checked	Approved
A	02/09/2020	ISSUED FOR SSDA	ADC	LC

Key

Client
Sydney Grammar School

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Project
SGS Weigall Sports Complex
Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
BUILDING 02
CAR PARK
ELEVATIONS
EAST AND WEST

Sheet Status
NOT FOR CONSTRUCTION

Scale
1 : 200 @A1

Drawing No.
A3111

Issue
A

DRAFT

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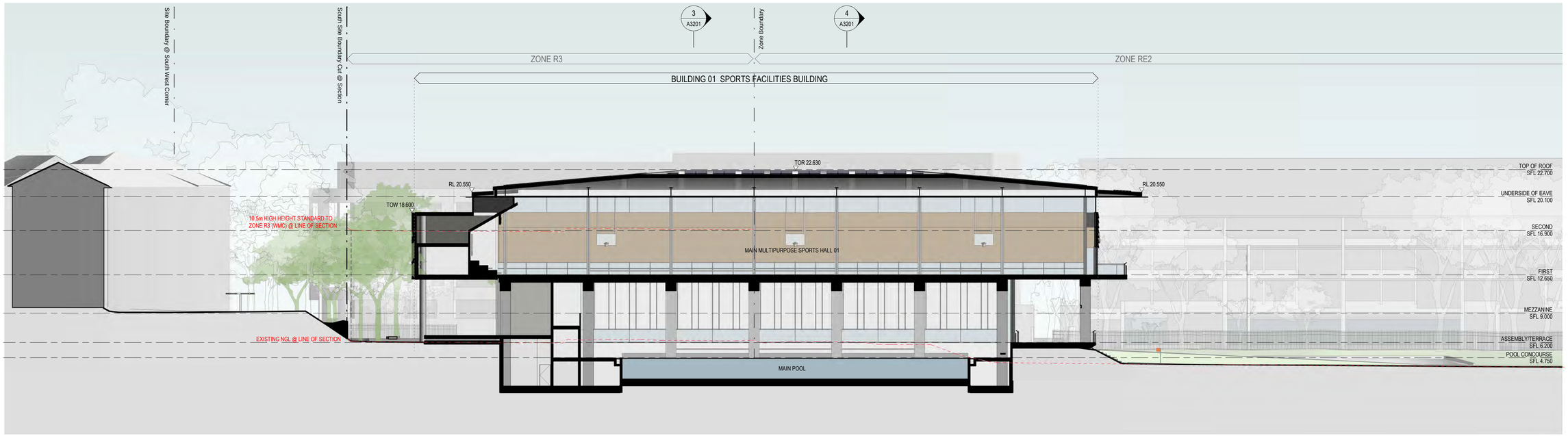
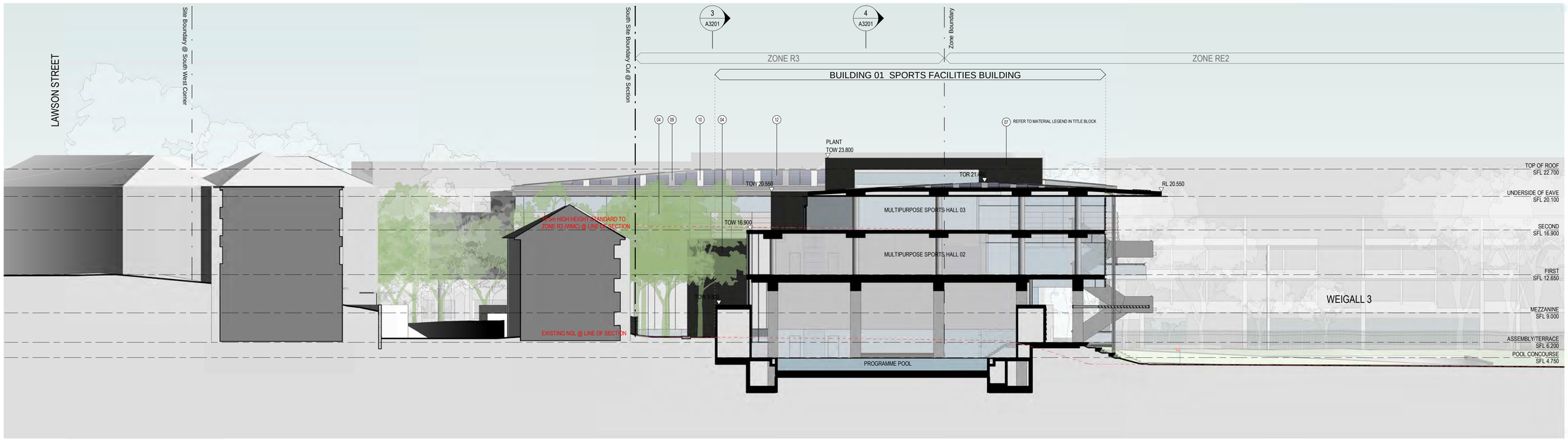


1 SECTION 01



2 SECTION 02

MATERIAL LEGEND:

01 GLAZING	06 CONCRETE / MASONRY	11 SIGNAGE
02 BALUSTRADE	07 LOUVRES	12 PHOTOVOLTAIC ARRAY
03 OPERABLE SCREENS	08 STEELWORK	
04 SOLID WALL CLADDING	09 SOLID ROOF CLADDING	
05 SEMI-OPAQUE WALL CLADDING	10 SEMI-OPAQUE ROOF CLADDING	

Revisions

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A	02/09/2020	ISSUED FOR SSDA	ADC	LC

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Project
SGS Weigall Sports Complex
Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
BUILDING 01
SPORTS FACILITIES BUILDING
SECTIONS
01 AND 02

Sheet Status
NOT FOR CONSTRUCTION

Scale
1 : 200 @A1

Drawing No.
A3200

Issue
A

DRAFT

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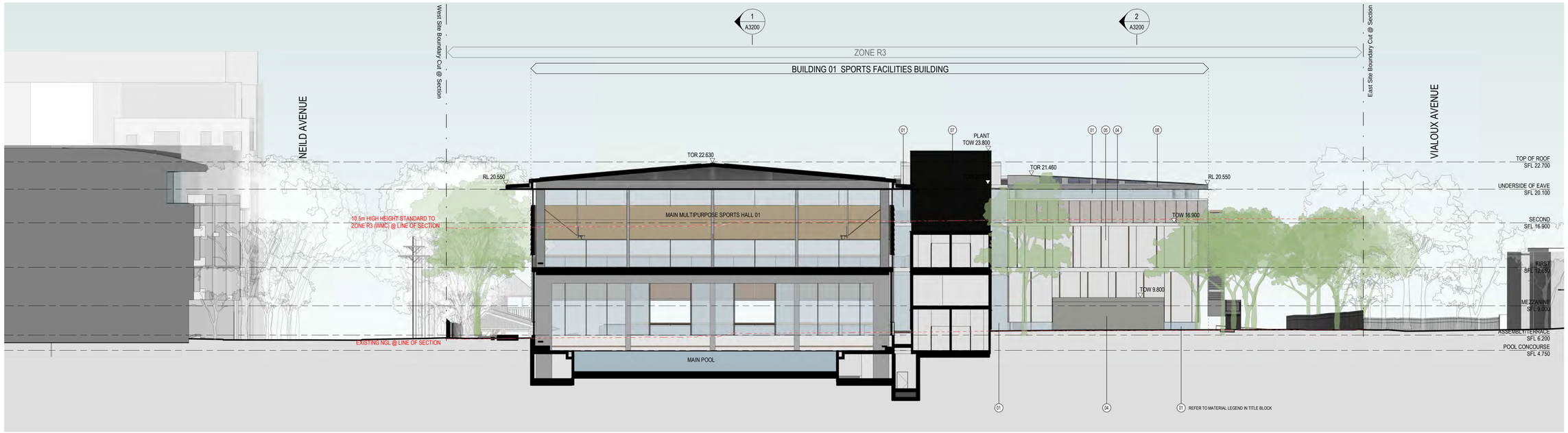
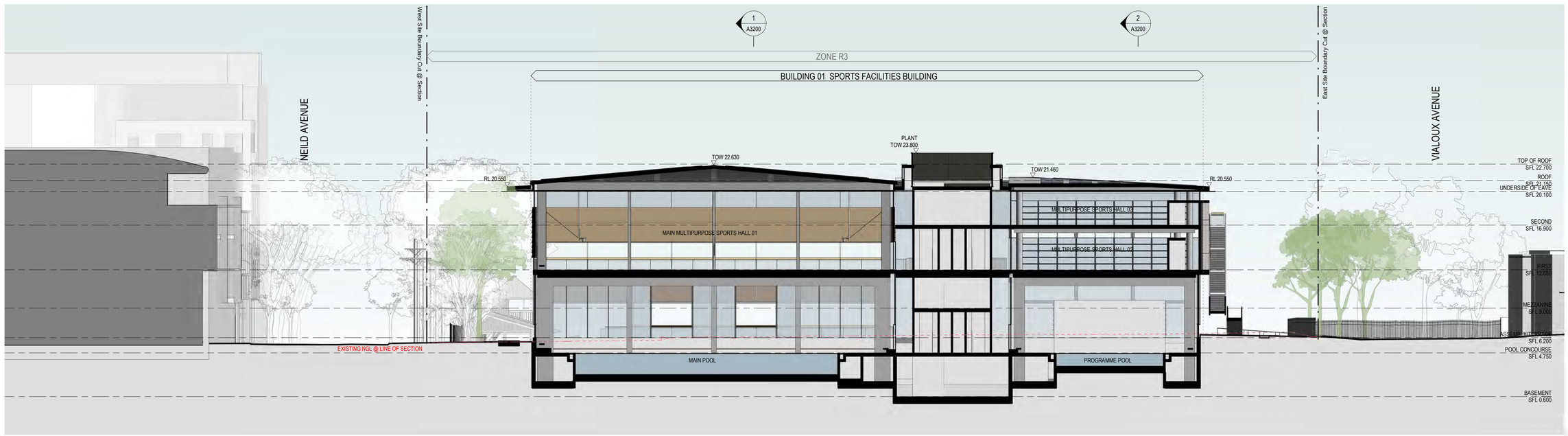


3 SECTION 03



4 SECTION 04

MATERIAL LEGEND:

01 GLAZING	06 CONCRETE / MASONRY	11 SIGNAGE
02 BALUSTRADE	07 LOUVRES	12 PHOTOVOLTAIC ARRAY
03 OPERABLE SCREENS	08 STEELWORK	
04 SOLID WALL CLADDING	09 SOLID ROOF CLADDING	
05 SEMI-OPAQUE WALL CLADDING	10 SEMI-OPAQUE ROOF CLADDING	

Revisions

No.	Date	Description	Checked	Approved
A	02/09/2020	ISSUED FOR SSDA	ADC	LC

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Project
SGS Weigall Sports Complex
Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
BUILDING 01
SPORTS FACILITIES BUILDING
SECTIONS
03 AND 04

Sheet Status
NOT FOR CONSTRUCTION

Scale
1 : 200 @A1

Drawing No.
A3201

Issue
A

DRAFT

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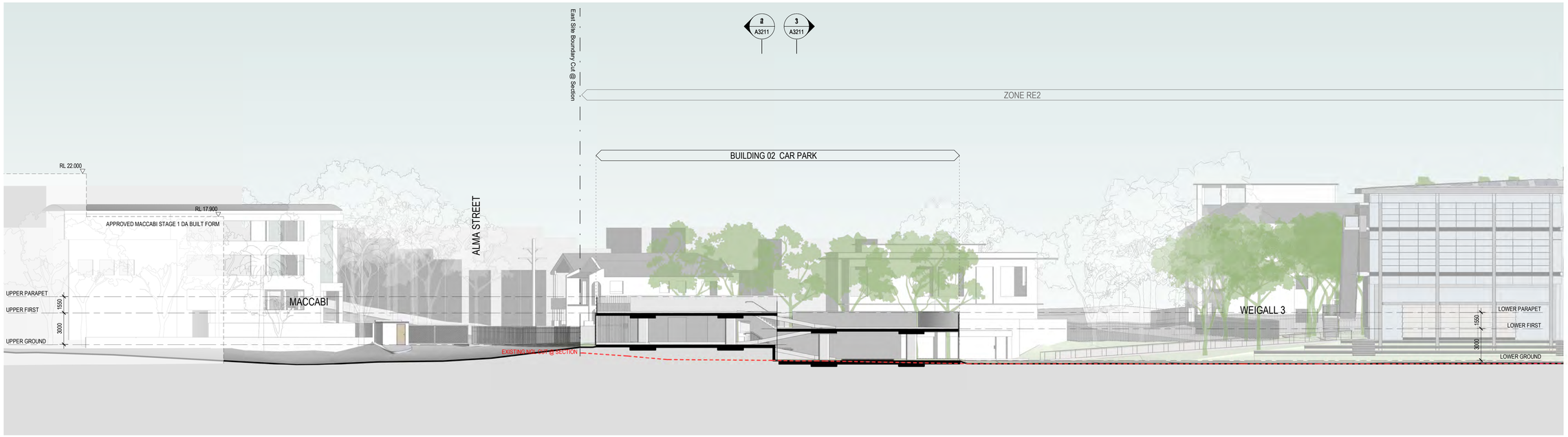
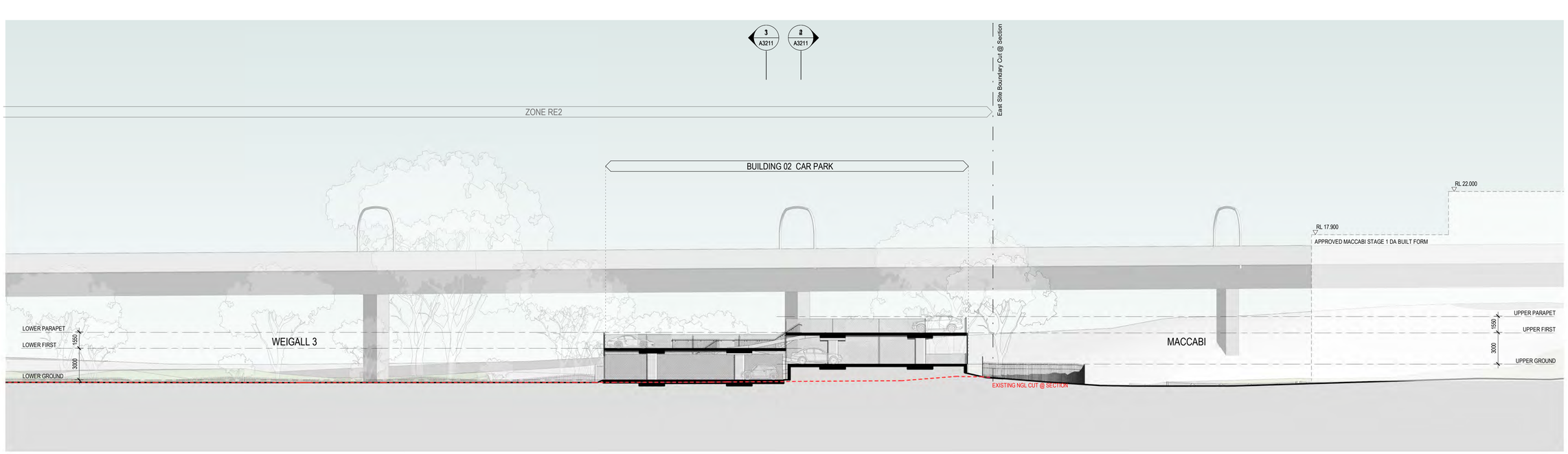


1 SECTION 01



2 SECTION 02

Revisions				
No.	Date	Description	Checked	Approved
A	02/09/2020	ISSUED FOR SSDA	ADC	LC

Key

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Project
SGS Weigall Sports Complex
Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
BUILDING 02
CAR PARK
SECTIONS
01 AND 02

Sheet Status
NOT FOR CONSTRUCTION

Scale
1 : 200 @A1

Drawing No.
A3210

Issue
A

DRAFT

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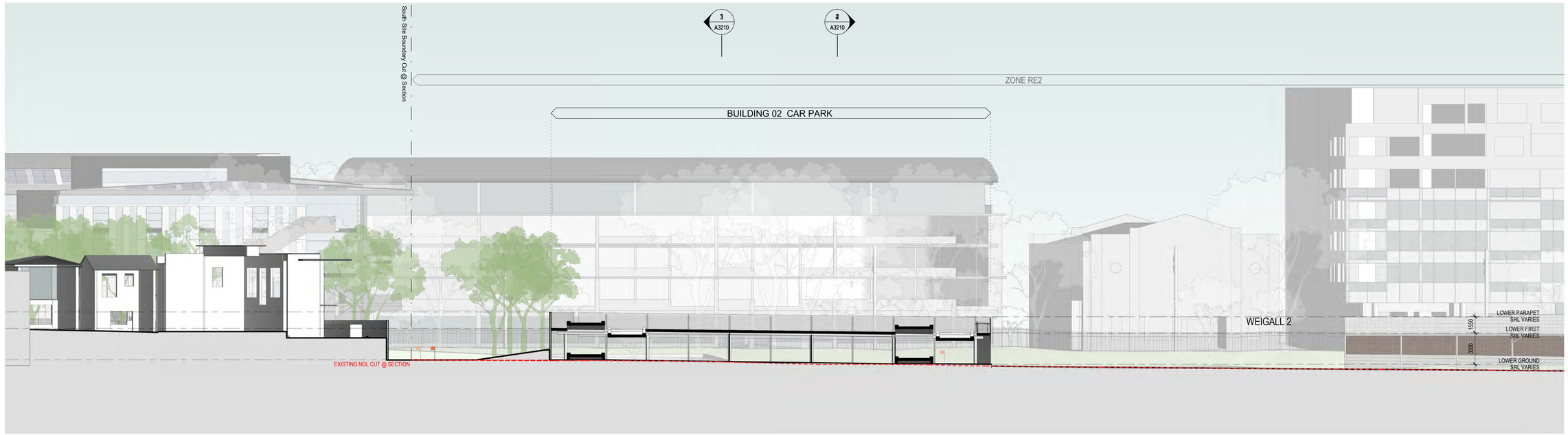

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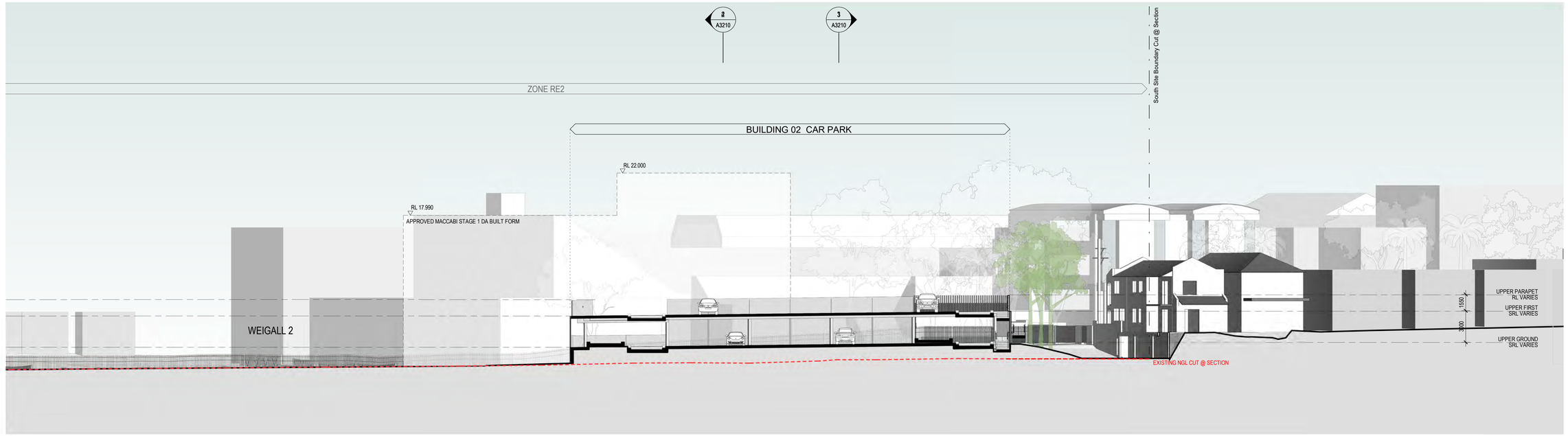

2 SECTION 04

Revisions

No.	Date	Description	Checked	Approved
A	02/09/2020	ISSUED FOR SSDA	ADC	LC

Key

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Project
SGS Weigall Sports Complex
Neild Ave, Rushcutters Bay
Proj. No. 19086

Drawing Title
BUILDING 02
CAR PARK
SECTIONS
03 AND 04

Sheet Status
NOT FOR CONSTRUCTION

Scale
1 : 200 @A1

Drawing No.
A3211

Issue
A

DRAFT

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Appendix B Borehole Logs (DP 2020 and JBS&G 2020)

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 5.9 AHD
EASTING: 336157
NORTHING: 6249865
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 99538.00
DATE: 19/12/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE		A/E	0.0				Gatic flush with ground level Top Cap
	0.2	FILL/ROADBASE: grey, medium to coarse sand, angular to subangular igneous gravels, apparently well compacted, moist		A/E	0.2				Backfill Material (0.2-1.0m)
				A/E	0.5				
	1.2	FILL/SAND and GRAVEL: fine to medium, pale grey-brown, trace of brick fragments, charcoal, ash, clinker and organic matter, apparently poorly compacted, moist		S	1.0		6,3,2 N = 5		
		FILL/SAND : fine to medium grained, light brown, trace of concrete, ripped sandstone gravel, ash and charcoal, apparently poorly compacted, moist			1.45				Blank PVC Casing (0.2-3.0m) Bentonite Plug (1.0-2.5m)
				A/E	1.9 2.0				
					2.5				
	2.8			S			1,2,1 N = 3		
		FILL/SAND: fine to medium, brown, trace of indurated coffee sand, sandstone gravel, clinker and charcoal, loose, moist			2.95				
				A/E	3.0 3.1				
				A/E	3.9 4.0				
				S	4.45		1,0,1 N = 1		
	4.5	FILL/Clayey SAND: fine grained, low plasticity, grey, dark grey organic clay, trace sandstone gravel, clinker and charcoal, very loose to loose, wet							
	6.0	SAND SP: fine grained, grey, medium dense, alluvial, wet							Gravel (2.5-11.7m) Slotted PVC Casing (3.0-11.7m)
				S	7.5		2,3,5 N = 8		
					7.95				
		8.5m: becoming pale grey and dense, possibly aeolian							
	10.0								

RIG: Bobcat **DRILLER:** JE **LOGGED:** SI **CASING:** HQ to 8.0m

TYPE OF BORING: Solid flight auger (TC-bit) to 3.5m; Rotary (mud) to 12.0m

WATER OBSERVATIONS: Free groundwater observed at 3.0m whilst augering

REMARKS: Stand pipe installed to 11.7m (screen 11.7 to 3.0m, solid PVC 3.0 to 1.0m, gravel 11.7 to 2.5m, bentonite 1.0 to 2.5m, backfill to surface)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 5.9 AHD
EASTING: 336157
NORTHING: 6249865
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 99538.00
DATE: 19/12/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-5	11	SAND SP; fine grained pale grey, medium dense, possibly aeolian, wet							11
	11.1				11.0				
		CLAY CI: medium plasticity, brown, with fine sand, w~PL, stiff, residual		S			2,4,6 N = 10		
-6	12				11.45				End Cap
	12.0	Bore discontinued at 12.0m							12
-7	13								13
-8	14								14
-9	15								15
-10	16								16
-11	17								17
-12	18								18
-13	19								19
-14									

RIG: Bobcat **DRILLER:** JE **LOGGED:** SI **CASING:** HQ to 8.0m

TYPE OF BORING: Solid flight auger (TC-bit) to 3.5m; Rotary (mud) to 12.0m

WATER OBSERVATIONS: Free groundwater observed at 3.0m whilst augering

REMARKS: Stand pipe installed to 11.7m (screen 11.7 to 3.0m, solid PVC 3.0 to 1.0m, gravel 11.7 to 2.5m, bentonite 1.0 to 2.5m, backfill to surface)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 4.1 AHD
EASTING: 336199
NORTHING: 6249875
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 99538.00
DATE: 19/12/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	FIILL/TOPSOIL: grey-brown, silty sand, with rootlets		A/E	0.1–0.2				
	0.5	FILL/SAND: fine to medium, pale brown to brown, trace brick and concrete fragments, ash, slag and rootlets, apparently loose, dry		A/E	0.4–0.5				
		FILL/Sandy GRAVEL: fine grained, with clay, crushed sandstone gravel and cobbles, trace shale gravel, slag and rootlets, apparently poorly to moderately compacted, moist		A/E	0.9–1.0				
				S	1.0–1.45		5,2,4 N = 6		
				*A/E	1.9–2.0				
		2.4m: becoming wet							
	2.5	FIll/Clayey SAND: fine to medium grained, dark grey, with organic matter, trace ash, wet, very loose to loose, alluvial		S	2.5–2.95		0,0,1 N = 1		
	3.5	SAND: fine to medium, pale grey to grey, trace organic matter, loose, wet, alluvial		S	4.0–4.45		3,2,3 N = 5		
				S	5.5–5.95		1,2,1 N = 3		
	7.0	SAND: fine, pale grey brown, medium dense, wet , alluvial (possibly aeolian)		S	7.0–7.45		5,4,5 N = 9		
				S	8.5–8.95		6,7,7 N = 14		

RIG: Bobcat **DRILLER:** JE **LOGGED:** SI **CASING:** HQ to 8.0m

TYPE OF BORING: Solid flight auger to 3.5m; Rotary (mud) to 12.0m

WATER OBSERVATIONS: Free groundwater observed at 2.4m whilst augering

REMARKS: *BD219122019

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 4.1 AHD
EASTING: 336199
NORTHING: 6249875
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 99538.00
DATE: 19/12/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-6	11	SAND: fine, pale grey brown, medium dense, wet , alluvial (possibly aeolian) *(continued)*		S	10.0 10.45		8,12,11 N = 23		11
-7	11.7	Clay CI: medium plasticity, pale brown to brown, trace silt and fine sand, apparently stiff to very stiff, residual							
-8	12 12.0	Bore discontinued at 12.0m							12
-9	13								13
-10	14								14
-11	15								15
-12	16								16
-13	17								17
-14	18								18
-15	19								19

RIG: Bobcat **DRILLER:** JE **LOGGED:** SI **CASING:** HQ to 8.0m

TYPE OF BORING: Solid flight auger to 3.5m; Rotary (mud) to 12.0m

WATER OBSERVATIONS: Free groundwater observed at 2.4m whilst augering

REMARKS: *BD219122019

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 4.1 AHD
EASTING: 336235
NORTHING: 6249860
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 99538.00
DATE: 20/12/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
4	0.1	FiLL/TOPSOIL : grey, silty sand, with rootlets		A/E	0.1				
		FILL/SAND: fine to medium grained, pale grey, with ripped sandstone gravel, dry, trace ash, apparently poorly compacted			0.2				
				*A/E	0.4				
	0.7				0.5				
		FILL/Silty CLAY: low plasticity, grey, with ripped shale gravel, w<PL, moderately compacted		A/E	0.9				
3	1				1.0				1
				S			4,5,2 N = 7		
	1.4				1.45				
		FILL/Clayey SAND: low plasticity, dark grey, with sandstone gravels and cobbles, apparently well compacted, w<PL, dry		A/E	1.5				
					1.6				
				A/E	1.9				
2	2				2.0				2
	2.1	Clayey SAND SC: fine to medium grained, dark grey, with oraganic matter, trace sandstone gravel, wet, loose, alluvial (possibly fill)			2.5				
				S			3,2,3 N = 5		
1	3				2.95				3
	3.62	SANDSTONE: medium grained, brown to dark brown, medium strength to high strength, moderately weathered, slightly fractured and unbroken, Hawkesbury Sandstone			3.62				
					3.75		PL(A) = 0.9		
0	4								4
				C	4.6		PL(A) = 0.8		
-1	5								5
					5.4		PL(A) = 1.3		
					5.8				
	6								6
-2	6.1	SANDSTONE: medium to coarse grained, pale grey, high strength, fresh, slightly fractured and unbroken, Hawkesbury Sandstone			6.1		PL(A) = 1.5		
	7								7
-3				C	7.2		PL(A) = 1.8		
	8								8
-4					8.3		PL(A) = 1.7		
					8.75				
	9								9
-5				C	9.2		PL(A) = 2.1		
	10.0								

RIG: Bobcat **DRILLER:** JE **LOGGED:** SI **CASING:** HQ to 3.8m

TYPE OF BORING: Solid flight auger (TC-bit) to 3.62m; NMLC Coring to 10.3m

WATER OBSERVATIONS: Free groundwater observed at 2.5m whilst augering

REMARKS: *BD320122019

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 4.1 AHD
EASTING: 336235
NORTHING: 6249860
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 99538.00
DATE: 20/12/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-6		SANDSTONE: as above		C	10.1		PL(A) = 1.5		
	10.3	Bore discontinued at 10.3m			10.3				
-7	11								
-8	12								
-9	13								
-10	14								
-11	15								
-12	16								
-13	17								
-14	18								
-15	19								

RIG: Bobcat **DRILLER:** JE **LOGGED:** SI **CASING:** HQ to 3.8m

TYPE OF BORING: Solid flight auger (TC-bit) to 3.62m; NMLC Coring to 10.3m

WATER OBSERVATIONS: Free groundwater observed at 2.5m whilst augering

REMARKS: *BD320122019

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 6.2 AHD
EASTING: 336115
NORTHING: 6249834
DIP/AZIMUTH: 90°/--

BORE No: BH4
PROJECT No: 99538.00
DATE: 18/12/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
6		FILL/SAND: fine to medium, pale grey to grey-brown, with ripped sandstone and brick gravel and cobbles, trace of decomposed organic matter and ash, dry, apparently moderately compacted to well compacted		A/E	0.1–0.2				
				A/E	0.4–0.5				
5	1			A/E	0.9–1.0				
				S	1.0–1.45		6,6,10 N = 16		
4	2			A/E	1.9–2.0				
		2.5m: becoming wet		S	2.5–2.95		5,5,13 N = 18		
3	3			A/E	2.95–3.1				
2	3.5	FILL/SAND: fine to medium, grey, trace of clay, sandstone gravel, clinker and organic matter, wet, very loose to loose, alluvial		A/E	3.9–4.0				
	4			S	4.0–4.45		0,0,1 N = 1		
1	5	5.0 SAND: fine to medium, grey, trace of clay, wet, very loose to loose, alluvial		A/E	5.5–5.6				
0	6								
-1	7	SAND: fine to medium, pale brown to pale grey, wet, dense, alluvial		S	7.0–7.45		12,16,25 N = 41		
-2	8								
-3	9								

RIG: Rig 16 **DRILLER:** BG **LOGGED:** SI **CASING:** HQ to 5.0m

TYPE OF BORING: Solid flight auger to 3.0m, Rotary to 12.0m

WATER OBSERVATIONS: Free groundwater observed at 3.5m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 6.2 AHD
EASTING: 336115
NORTHING: 6249834
DIP/AZIMUTH: 90°/--

BORE No: BH4
PROJECT No: 99538.00
DATE: 18/12/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-4	11	SAND: fine to medium, pale brown to pale grey, wet, dense, alluvial *(continued)*		S	11.0 11.45		14,16,23 N = 39		11
-5	12 12.0	Bore discontinued at 12.0m							12
-6	13								13
-7	14								14
-8	15								15
-9	16								16
-10	17								17
-11	18								18
-12	19								19
-13									

RIG: Rig 16 **DRILLER:** BG **LOGGED:** SI **CASING:** HQ to 5.0m

TYPE OF BORING: Solid flight auger to 3.0m, Rotary to 12.0m

WATER OBSERVATIONS: Free groundwater observed at 3.5m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 7.0 AHD
EASTING: 336220
NORTHING: 6249815
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 99538.00
DATE: 18/12/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
7	0.06	ASPHALTIC CONCRETE							
	0.2	ROADBASE GRAVEL: medium to coarse, angular to subangular gravel, apparently well compacted, dry		A/E	0.2				
				A/E	0.3 0.4				
		FILL/SAND: fine to medium, grey-brown to pale grey, with ripped sandstone gravel and cobbles, brick and aspahltic fagments, trace of ash, dry to moist, variably compacted			0.5				
6	1	0.6m: hydrocarbon odour		A/E	0.9 1.0				1
				S			0,0,1 N = 1		
					1.45				
				A/E	1.5 1.6				
5	2			A/E	1.9 2.0				2
				A/E	2.4 2.5				
	2.7	SAND: fine grained, pale grey brown, moist, very loose to loose, alluvial (possibly colluvial)		S			1,1,1 N = 2		
4	3				2.95				3
	3.5								
	3.57	SANDSTONE: medium grained, pale grey brown, low to medium strength, Hawkesbury Sandstone			3.57 3.7		PL(A) = 0.7		
3	4								4
	4.0	SANDSTONE: medium grained, brown, medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone							
		SANDSTONE: medium grained, pale grey, brown then pale grey, high strength, moderately weathered then fresh, slightly fractured and unbroken Hawkesbury Sandstone			4.65		PL(A) = 1.7		
2	5			C					5
					5.5		PL(A) = 1.1		
1	6								6
					6.3		PL(A) = 2		
					6.52				
0	7								7
					7.25		PL(A) = 2.1		
-1	8			C					8
					8.3		PL(A) = 2.1		
-2	9								9
					9.3		PL(A) = 2.2		
					9.58				
	10.0			C					

RIG: Bobcat **DRILLER:** JE **LOGGED:** SI **CASING:** HQ to 3.57m

TYPE OF BORING: Solid flight auger to 0.4m, diacore to 0.6m; NMLC Coring to 10.25m

WATER OBSERVATIONS: Free groundwater observed at 3.1m whilst augering

REMARKS: HC odour at 0.8m to 1.0m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 7.0 AHD
EASTING: 336220
NORTHING: 6249815
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 99538.00
DATE: 18/12/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-3		SANDSTONE: as above		C	10.15		PL(A) = 2.3		
		Bore discontinued at 10.25m			10.25				
-4	11								
-5	12								
-6	13								
-7	14								
-8	15								
-9	16								
-10	17								
-11	18								
-12	19								

RIG: Bobcat **DRILLER:** JE **LOGGED:** SI **CASING:** HQ to 3.57m

TYPE OF BORING: Solid flight auger to 0.4m, diacore to 0.6m; NMLC Coring to 10.25m

WATER OBSERVATIONS: Free groundwater observed at 3.1m whilst augering

REMARKS: HC odour at 0.8m to 1.0m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 6.3 AHD
EASTING: 336165
NORTHING: 6249825
DIP/AZIMUTH: 90°/--

BORE No: BH6
PROJECT No: 99538.00
DATE: 15/1/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	FILL/Silty SAND: fine to medium, dark brown with fine sandstone gravel, brick fragments, moist		*A/E	0.0 0.01				
	0.5	FILL/Clayey SAND: fine to medium, yellow-brown, with clay, moist, variably compacted		A/E	0.3 0.4				
	1	FILL/Silty SAND: fine to medium, brown, with fine sandstone gravel and cobble, moderately to well compacted, moist		A/E	0.9 1.0				
	1.3	FILL/Silty SAND: fine to medium, grey to brown, with clay, fine sandstone gravel, trace brick fragments, ash, clinker and decomposing organic matter, moist, apparently moderately to well compacted, burnt odour		S			6,5,5 N = 10		
				A/E	1.4 1.45				
				A/E	1.5 1.9				
	2			A/E	2.0 2.4				
				A/E	2.5				
				S			3,3,9 N = 12		
	3				2.95				
	3.5	SAND: fine to medium, dark grey and pale grey, trace silt, medium dense, moist, alluvial		A/E	3.9 4.0				
	4	4.0 m: becoming wet		S			4,5,6 N = 11		
					4.45				
	5								
	6								
	7			S	7.0 7.45		5,8,12 N = 20		
	8								
	8.53	SANDSTONE: orange-brown, medium to coarse grained, moderately weathered, slightly fractured, medium strength with very to low strength bands, Hawkesbury Sandstone		C	8.53				
	9								

RIG: BG 17 **DRILLER:** BG **LOGGED:** KR **CASING:** HQ to 8.53 m

TYPE OF BORING: Solid flight auger to 4.0m, Rotary to 8.53 m; NMLC to 14.56 m

WATER OBSERVATIONS: Free groundwater observed at 4.0m whilst augering

REMARKS: *BD220200116

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 6.3 AHD
EASTING: 336165
NORTHING: 6249825
DIP/AZIMUTH: 90°/--

BORE No: BH6
PROJECT No: 99538.00
DATE: 15/1/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-4		SANDSTONE: orange-brown, medium to coarse grained, moderately weathered, slightly fractured, medium strength with very to low strength bands, Hawkesbury Sandstone *(continued)*		C					
-5	10.97	SANDSTONE: medium to coarse grained, pale grey, fresh, unbroken, medium to high strength, Hawkesbury Sandstone			11.58				
-6									
-7				C					
-8									
-9	14.56	Bore discontinued at 14.56m			14.56				
-10									
-11									
-12									
-13									

RIG: BG 17 **DRILLER:** BG **LOGGED:** KR **CASING:** HQ to 8.53 m

TYPE OF BORING: Solid flight auger to 4.0m, Rotary to 8.53 m; NMLC to 14.56 m

WATER OBSERVATIONS: Free groundwater observed at 4.0m whilst augering

REMARKS: *BD220200116

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 6.3 AHD
EASTING: 336179
NORTHING: 6249822
DIP/AZIMUTH: 90°/--

BORE No: BH7
PROJECT No: 99538.00
DATE: 15/1/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILL/Silty SAND: fine to medium, brown, trace clay, fine sandstone gravel and brick fragments, moist, variably compacted		B	0.0				
				A/E	0.04				
					0.1				
				A/E	0.4				
	0.7				0.5				
		FILL/SAND: fine to medium, pale grey, with sandstone gravel and cobbles, trace silt and clay, moist, apparently moderately to well compacted		A/E	0.9				
					1.0				
				S			8,10,7 N = 17		
				A/E	1.4				
					1.45				
	1.7				1.5				
		FILL/SAND: fine to mediumm, brown, fine sandstone gravel, with, sandstone gravels and clay, trace glass fragment, ash and clinker, moist, apparently poorly to moderately compacted		A/E	1.9				
					2.0				
					2.5				
	2.7			S			2,2,2 N = 4		
		SAND SW: fine to medium, brown to pale grey, trace silt, clay and decomposing organic matter, moist, medium dense, alluvial (possibly fill)		A/E	2.9				
					2.95				
					3.0				
				A/E	3.9				
					4.0				
				S			3,5,5 N = 10		
	4.5				4.45				
		Silty SAND SM: fine to medium , dark brown to brown, wet, medium dense, alluvial		A	5.0				
					5.1				
				A	5.4				
	5.5				5.5				
		SAND SW: fine to medium, grey and brown, trace silt, wet, very loose to loose, alluvial		S			1,0,0 N = 0		
					5.95				
	6.61				6.61				
		SANDSTONE: medium to coarse grained, orange and brown, , medium to high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone		C					
					7.9				
				C					
	9.1								
		SANDSTONE: medium to coarse grained, pale grey, high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone							

RIG: BG 17 **DRILLER:** BG **LOGGED:** KR **CASING:** HQ to 6.61 m

TYPE OF BORING: Solid flight auger to 6.61 m; NMLC to 13.49 m

WATER OBSERVATIONS: Free groundwater observed at 3.9m whilst augering

REMARKS: *BD120200115

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Grammar School
PROJECT: Grammar Edgecliff Sports Area
LOCATION: 11 Alma Street, Paddington

SURFACE LEVEL: 6.3 AHD
EASTING: 336179
NORTHING: 6249822
DIP/AZIMUTH: 90°/--

BORE No: BH7
PROJECT No: 99538.00
DATE: 15/1/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-4	11	SANDSTONE: medium to coarse grained, pale grey, high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*		C	10.51				
-5	12			C					
-6	13								
-7	13.49	Bore discontinued at 13.49m			13.49				
-8	14								
-9	15								
-10	16								
-11	17								
-12	18								
-13	19								

RIG: BG 17 **DRILLER:** BG **LOGGED:** KR **CASING:** HQ to 6.61 m

TYPE OF BORING: Solid flight auger to 6.61 m; NMLC to 13.49 m

WATER OBSERVATIONS: Free groundwater observed at 3.9m whilst augering

REMARKS: *BD120200115

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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SOIL BOREHOLE BH101

PROJECT NUMBER 58554	**DRILLING COMPANY**	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Hand Auger:Hand Auger	**TOTAL DEPTH** 0.8 m bgl
DRILLING DATE 30-Mar-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA		0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8		Silty sand, dark brown, heterogeneous, damp, poorly graded, medium dense, with inclusion of gravel and rootlets.	SM	BH101 0.0-0.1 BH101 0.2-0.3 BH101 0.5-0.6	0.2 0.6 0.8	No ACM, odours or staining observed. Refusal on roots.
		0.85 0.9 0.95 1 1.05		Termination Depth at:0.800 m.				

SOIL BOREHOLE BH102

PROJECT NUMBER 58554	**DRILLING COMPANY**	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Hand Auger:Hand Auger	**TOTAL DEPTH** 0.8 m bgl
DRILLING DATE 30-Mar-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA		0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5		Sandy clay, dark brown, heterogeneous, damp, soft, medium plasticity, with inclusion of gravel and rootlets.	SM	BH102 0.0-0.1 BH102 0.2-0.3	2.8 2.9	No ACM, odours or staining observed.
		0.55 0.6 0.65 0.7 0.75 0.8		Sandy gravel, brown, heterogeneous, damp, poorly graded, medium dense, with inclusion of roots and terracotta.	SM	BH102 0.5-0.6 BH102 0.7-0.8	4.1 4.2	No ACM, odours or staining observed. Refusal on anthropogenic fill and roots.
		0.85 0.9 0.95 1 1.05		Termination Depth at:0.800 m.				

SOIL BOREHOLE BH103

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube:Push Tube	**TOTAL DEPTH** 1 m bgl
DRILLING DATE 27-Mar-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
Push Tube		0.05		Roadbase, grey, heterogeneous, dry, coarse, loose.	D	BH103 0.0-0.1	1.5	No ACM, odours or staining observed.
		0.1						
		0.15						
		0.2						
		0.25						
		0.3		Sandy clay, brown/black/grey, heterogeneous, dry, medium plasticity, with inclusion of gravel and sandstone.	D			No ACM, odours or staining observed.
		0.35						
		0.4						
		0.45						
		0.5						
		0.55						
		0.6						
		0.65						
		0.7						
		0.75						
		0.8		Clay, brown/red, heterogeneous, dry, stiff, high plasticity.	D			No ACM, odours or staining observed.
		0.85						
		0.9				BH103 0.9-1.0	2.5	
		0.95						
		1		Termination Depth at:1.000 m.				
		1.05						

SOIL BOREHOLE BH104

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube:Push Tube	**TOTAL DEPTH** 1 m bgl
DRILLING DATE 27-Mar-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
Push Tube		0.05 0.1 0.15 0.2 0.25 0.3		Roadbase, grey, heterogeneous, dry, coarse, loose.	D	BH104 0.0-0.1	1.2	No ACM, odours or staining observed.
		0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8		Sandy clay, brown/black/grey, heterogeneous, dry, medium plasticity, with inclusion of gravel and sandstone.	D	BH104 0.3-0.4	5.1	No ACM, odours or staining observed.
		0.85 0.9 0.95 1		Sandy clay, brown/red, heterogeneous, dry, stiff, high plasticity, with inclusion of sandstone and slag.	D			No ACM, odours or staining observed.
		1.05		Termination Depth at:1.000 m.				

GROUNDWATER WELL BH105/MW2

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube / Hollow Flight Au	**ELEVATION** N/A
DRILLING DATE 30-Mar-20	**TOTAL DEPTH** 4.5 m bgl	**LOGGED BY** MN
PERMIT NO. N/A	**DIAMETER** 200 mm	**CHECKED BY** -
COMPLETION Roadbox	**CASING** Class 18 PVC - 50mm	**SCREEN INTERVAL** 1.5 - 4.5 m bgl

COMMENTS

Drilling Method	Water (m bgl)	Well Details	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA			0.2		Silty sand, dark brown, heterogeneous, damp, loose, coarse sand, with inclusion of rootlets.	SM	BH105/MW2 0.0-0.1	2.3	No ACM, odours or staining observed.
			0.4		Clayey silty sand, dark brown, heterogeneous, damp, medium dense.	SM	BH105/MW2 0.2-0.3	1.8	No ACM, odours or staining observed.
			0.6				BH105/MW2 0.5-0.6	1.3	
			0.8		Sandy clay, red/brown, heterogeneous, damp, stiff, high plasticity, with inclusion of charcoal.	SM	BH105/MW2		Charcoal odour. No ACM or staining observed.
Push Tube			1		Charcoal, black, heterogeneous, damp, with inclusion of gravel.	SM	0.9-1.0	4.2	Charcoal odour. No ACM or staining observed.
			1.2						
			1.4						
			1.6		Sandy clay, brown/yellow, heterogeneous, damp, firm, medium plasticity, with inclusion of sandstone.	SM			Charcoal odour. No ACM or staining observed.
			1.8						
			2				BH105/MW2 2.0-2.1	2.1	
	▽		2.2		Clayey sand, dark grey, heterogeneous, wet, dense, with inclusion of gravel.	W			Organic odour. No ACM or staining observed.
			2.4						
			2.6				BH105/MW2 2.5-2.6	1.8	
			2.8		Sand, brown/grey, heterogeneous, wet, dense, with inclusion of gravel.	W			No ACM, odours or staining observed.
			3				BH105/MW2 3.0-3.1	1.3	
			3.2						
			3.4						
			3.6		Sand, beige, homogeneous, wet, dense, poorly graded.	W			No ACM, odours or staining observed.
			3.8						
HFA			4				BH105/MW2 4.0-4.1	1.6	
			4.2						
			4.4						
			4.6		Termination Depth at:4.500 m.				
			4.8						
			5						
			5.2						
			5.4						

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GROUNDWATER WELL BH106/MW3

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube / Solid Flight Aug	**ELEVATION** N/A
DRILLING DATE 27-Mar-20	**TOTAL DEPTH** 5 m bgl	**LOGGED BY** MN
PERMIT NO. N/A	**DIAMETER** 125 mm	**CHECKED BY** -
COMPLETION Roadbox	**CASING** Class 18 PVC - 50mm	**SCREEN INTERVAL** 2 - 5 m bgl

COMMENTS

Drilling Method	Water (m bgl)	Well Details	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA			0.2		Sand, brown, heterogeneous, damp, medium sand, medium dense, with inclusion of rootlets and some gravel.	SM	BH106/MW3 0.0-0.1	1.5	No ACM, odours or staining observed.
			0.4		Clayey sand, dark brown, heterogeneous, damp, medium dense, with inclusion of rootlets.	SM	BH106/MW3 0.2-0.3	1.3	No ACM, odours or staining observed.
Push Tube			0.6		Sandy clay, light brown/orange turning black on the outside from 0.5 to 0.6 m bgs then changes to brown/grey, heterogeneous, dry, firm, medium plasticity.	D	BH106/MW3 0.4-0.5	1.8	No ACM, odours or staining observed.
			0.8						
			1				BH106/MW3 1.0-1.1	2.3	
			1.2		Sandy clay, grey, heterogeneous, damp, firm, medium plasticity.	SM			No ACM, odours or staining observed.
			1.4				BH106/MW3 1.4-1.5	2.4	
			1.6		Sand, brown, homogeneous, damp, medium sand, medium dense.	SM			No ACM, odours or staining observed.
			1.8		Sandstone, white, homogeneous, damp, coarse.	SM			No ACM, odours or staining observed.
			2				BH106/MW3 1.9-2.0	1.6	
			2.2		Sand, brown, homogeneous, damp, medium sand, medium dense.	SM			No ACM, odours or staining observed.
			2.4		Sandy clay, grey, heterogeneous, damp, firm, medium/high plasticity.	SM	BH106/MW3 2.4-2.5	3.7	No ACM, odours or staining observed.
			2.6		Sand, grey, moist, becomes wet at 3.0 m bgs dense.	M			No ACM, odours or staining observed.
	▽		2.8						
			3				BH106/MW3 3.0-3.1	3.5	
			3.2		Sand, grey/brown, wet, dense.	W			No ACM, odours or staining observed.
			3.4						
			3.6						
			3.8						
SFA			4				BH106/MW3 4.0-4.1	2.8	
			4.2						
			4.4						
			4.6						
			4.8				BH106/MW3 4.9-5.0	3.1	
			5		Termination Depth at:5.000 m.				
			5.2						
			5.4						

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SOIL BOREHOLE BH107

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Solid Flight Auger:Solid Fligh	**TOTAL DEPTH** 1 m bgl
DRILLING DATE 27-Mar-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
SFA		0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8 0.85 0.9 0.95 1		Silty sand, dark brown, heterogeneous, damp, loose, medium sand, with inclusion of gravel.	SM	BH107 0.0-0.1 BH107 0.2-0.3 BH107 0.5-0.6 BH107 0.9-1.0	0.5 1.3 1.8 2	No ACM, odours or staining observed.
		1.05		Termination Depth at:1.000 m.				

GROUNDWATER WELL BH108/MW1

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube / Solid Flight Aug	**ELEVATION** N/A
DRILLING DATE 27-Mar-20	**TOTAL DEPTH** 5.4 m bgl	**LOGGED BY** MN
PERMIT NO. N/A	**DIAMETER** 125 mm	**CHECKED BY** -
COMPLETION Roadbox	**CASING** Class 18 PVC - 50mm	**SCREEN INTERVAL** 2.4 - 5.4 m bgl

COMMENTS

Drilling Method	Water (m bgl)	Well Details	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
Push Tube			0		Asphalt.	D	BH108/MW1 0.05-0.1	0.1	No ACM, odours or staining observed.
			0.2		Roadbase: Gravelly silty sand, grey, heterogeneous, dry, loose.	D			
			0.4		Sandy clay, grey, heterogeneous, dry, stiff, low plasticity, with inclusion of gravel and glass fragments.	D	BH108/MW1 0.30-0.4	0.1	No ACM, odours or staining observed.
			0.6			D	BH108/MW1 0.50-0.6	1	No ACM, odours or staining observed.
			0.8		Sandy clay, brown/grey turning red/light grey at 0.8 m bgs, heterogeneous, dry, stiff, low plasticity, with inclusion of ash and charcoal.				Slightly odourous. No ACM or staining observed.
			1				BH108/MW1 1.00-1.1	1.7	
			1.2						
			1.4						
			1.6						
			1.8						
			2				BH108/MW1 2.00-2.1	1.5	
			2.2		Sandy clay, grey turning light brown at 2.7 m bgs, heterogeneous, dry, firm, low/medium plasticity, with inclusion of sandstone and charcoal.	D			Slightly odourous. No ACM or staining observed.
			2.4						
			2.6						
			2.8				BH108/MW1 2.90-3.0	2.4	
			3		Clayey sand, grey, moist, dense, medium sand.	M			Slightly odourous. No ACM or staining observed.
			3.2						
	▽		3.4				BH108/MW1 3.50-3.6	1.2	
			3.6		Clayey sand, grey, wet, dense, medium sand.	W			Slightly odourous. No ACM or staining observed.
			3.8						
SFA			4						
			4.2						
			4.4				BH108/MW1 4.50-4.6	1.4	
			4.6						
			4.8						
			5						
			5.2				BH108/MW1 5.30-5.4	1.1	
			5.4		Termination Depth at:5.400 m.				

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SOIL BOREHOLE BH109

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube	**COORD SOURCE**
DRILLING DATE 27-May-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA		0.2		Sandy silty clay (topsoil), dark brown/black, heterogeneous, damp, with inclusions of rootlets.	SM	BH109 0-0.1	1.6	No odours, staining or ACM observed.
		0.4		Sand, brown/grey, heterogeneous, damp, medium sand, with traces of sandstone gravles and ash.	SM	BH109 0.3-0.4	2.4	No odours, staining or ACM observed.
PT		0.6						
		0.8						
		1				BH109 0.9-1	1.9	No odours, staining or ACM observed.
		1.2						
		1.4		Sandy silty clay, light grey turning red at 1.5 m bgs then changes to light grey at 1.7 m bgs, damp, firm, medium to high plasticity.	SM			
		1.6				BH109 1.5-1.6	2.1	No odours, staining or ACM observed.
		1.8						
		2		Clayey sand, light grey turning black at 2.6 m bgs then changes to beige at 2.8 m bgs, homogeneous, damp turning moist at 2.5 m bgs, with traces of sandstone gravel.	SM			
		2.2						
		2.4						
		2.6				BH109 2.6-2.7	1.4	No odours, staining or ACM observed.
		2.8						
SFA		3		Sandstone, light grey, homogeneous, wet, very hard.	W			
		3.2				BH109 3.2-3.3	1.3	No odours, staining or ACM observed.
		3.4						End of hole at 3.4 m bgs. Refusal on very hard sandstone.
		3.6		Termination Depth at:3.400 m.				
		3.8						
		4						
		4.2						
		4.4						
		4.6						

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SOIL BOREHOLE BH110

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube	**COORD SOURCE**
DRILLING DATE 28-May-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
SFA		0		Concrete slab	D			No odours, staining or ACM observed.
PT		0.2		Sand, brown turning lighter at 0.8 m bgs and 1.5 m bgs, homogeneous, damp, medium sand, compacted, with traces of sandstone gravels and ash.	SM	BH110 0.1-0.2	0.3	
		0.4						No odours, staining or ACM observed.
		0.6				BH110 0.5-0.6	0.7	
		0.8						No odours, staining or ACM observed.
		1				BH110 1-1.1	0.5	
		1.2						Slight swampy odour, no staining or ACM observed.
		1.4						
		1.6						
SFA		1.8		Sandstone, light grey, damp turning moist at 2.0 m bgs, hard.	SM	BH110 1.7-1.8	0.8	
		2						
		2.2						
		2.4						
		2.6						
		2.8						End of hole at 3.0 m bgs. Refusal on very hard sandstone.
		3		Termination Depth at:3.000 m.				
		3.2						
		3.4						
		3.6						
		3.8						
		4						
		4.2						
		4.4						
		4.6						

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SOIL BOREHOLE BH111

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube	**COORD SOURCE**
DRILLING DATE 28-May-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
SFA		0		Concrete slab	D			No odours, staining or ACM observed.
PT		0.2		Sand, grey turning light brown at 0.2 m bgs, heterogeneous, damp, with inlcusions of gravels.	SM	BH111 0.1-0.2	0.6	
		0.4		Sandy clay, light brown, heterogeneous, damp, firm, low plasticity.	SM			
		0.6		Sandstone, light brown/red turning yellow at 1.0 m bgs, homogeneous, damp.	SM	BH111 0.6-0.7	0.2	No odours, staining or ACM observed.
		0.8						
		1						
		1.2						
		1.4						No odours, staining or ACM observed.
		1.6				BH111 1.5-1.6	0.5	
		1.8						End of hole at 2.0 m bgs. Refusal on hard sandstone.
		2		Termination Depth at:2.000 m.				
		2.2						
		2.4						
		2.6						
		2.8						
		3						
		3.2						
		3.4						
		3.6						
		3.8						
		4						
		4.2						
		4.4						
		4.6						

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SOIL BOREHOLE BH112

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube	**COORD SOURCE**
DRILLING DATE 27-May-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA		0.2		Sand, brown, homogeneous, damp, medium sand, loose.	SM	BH112 0-0.1	1.8	No odours, staining or ACM observed.
		0.4		Clayey sand, dark brown turning grey at 0.4 m bgs, heterogeneous, damp, medium sand, with traces of glass fragments, sandstone and ash.	SM	BH112 0.3-0.4	1.2	No odours, staining or ACM observed.
PT		0.6		Silty clay, brown turning grey at 1.1 m bgs, firm, medium plasticity, with inclusions of sandstone from 1.6 to 2.0 m bgs.	SM			
		0.8						
		1						
		1.2						
		1.4						
		1.6				BH112 1.5-1.6	1	No odours, staining or ACM observed.
		1.8						
		2						No odours, staining or ACM observed.
		2.2		Clayey sand, grey turning dark brown/black: wet, with inclusions of sandstone.	W	BH112 2-2.1	1.2	No odours, staining or ACM observed.
		2.4		Clayey sand, black, wet.	W	BH112 2.2-2.3	1.4	No odours, staining or ACM observed.
SFA		2.6		Sandstone, light grey, homogeneous, wet.	W			
		2.8						
		3						End of hole at 3.6 m bgs. Refusal on hard sandstone.
		3.2						
		3.4				BH112 3.4-3.5	0.9	No odours, staining or ACM observed.
		3.6						
		3.8		Termination Depth at:3.600 m.				
		4						
		4.2						
		4.4						
		4.6						

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SOIL BOREHOLE BH113

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube	**COORD SOURCE**
DRILLING DATE 27-May-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA		0.2		Sand, light brown/beige turning dark at 0.2 m bgs and then changes to light grey at 0.3 m bgs, heterogeneous, damp, coarse, with inclusions of rootlets, ash, glass fragments and sandstone.	SM	BH113 0.1-0.2	1.6	No odours, staining or ACM observed.
		0.4		Sandy silty clay, light grey turning grey /brown, heterogeneous, firm, medium plasticity, with inclusions of ash, sandstone cobbles in clusters and traces of small brick fragments.	SM	BH113 0.4-0.5	1.5	No odours, staining or ACM observed.
PT		0.6						
		0.8		Sandstone, red/orange, heterogeneous, dry, with inclusions of sand.	D			
		1		Sand, brown turning grey at 2.1 m bgs them changes to brown at 2.2 m bgs, moist, with inclusions of sandstone gravels and traces of ash.	M	BH113 1-1.1	1.1	No odours, staining or ACM observed.
		1.2						
		1.4						
		1.6						
		1.8						
		2						No odours, staining or ACM observed.
		2.2		Sand, grey, homogeneous, wet, medium dense.	W	BH113 2-2.1	0.8	
		2.4						
		2.6		Sandstone, light grey turning red then changes to light brown, homogeneous, wet.	W	BH113 2.6-2.7	1.2	No odours, staining or ACM observed.
SFA		2.8						
		3						
		3.2						
		3.4						
		3.6				BH113 3.5-3.6	1.1	No odours, staining or ACM observed.
		3.8						End of hole at 4.0 m bgs. Refusal on hard sandstone.
		4		Termination Depth at:4.000 m.				
		4.2						
		4.4						
		4.6						

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SOIL BOREHOLE BH114

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube	**COORD SOURCE**
DRILLING DATE 27-May-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA		0		Sand, beige, homogeneous, damp, medium sand, medium dense, with inclusions of rootlets.	SM	BH114 0-0.1	1.6	No odours, staining or ACM observed.
		0.2		Sandy silty clay, dark brown, heterogeneous, damp, firm, medium plasticity, with traces of ash.	SM	BH114 0.2-0.3	1.5	No odours, staining or ACM observed.
		0.4		Clayey sand, brown, heterogeneous, damp, medium desne, with inclusions of ash and traces of sandstone.	SM	BH114 0.4-0.5	1.3	No odours, staining or ACM observed.
PT		0.6		Silty clay, red/brown/light grey, heterogeneous, damp, firm, medium plasticity, with inclusions of ash, sandstone and slag.	SM			
		0.8						
		1				BH114 1-1.1	0.8	No odours, staining or ACM observed.
		1.2						
		1.4						
		1.6		Crushed sandstone, grey/light brown/beige, heterogeneous, moist.	M			
		1.8						
		2				BH114 1.9-2	1.1	No odours, staining or ACM observed.
		2.2		Silty clay turning sandy at 2.1 m bgs, beige turning black at 2.1 m bgs, heterogeneous, moist.	M			
		2.4		Sand turning clayey at 2.8 m bgs then changes to sand at 3.0 m bgs, grey/beige turning black, heterogeneous, moist, coarse sand.	M			
		2.6				BH114 2.5-2.6	1.3	No odours, staining or ACM observed.
		2.8						
		3						
		3.2		Sand, beige turning grey at 3.2 m bgs, homogeneous, wet,	W	BH114 3-3.1	0.3	No odours, staining or ACM observed.
		3.4		Sandstone, light brown, homogeneous, wet, very hard.	W			
		3.6						
		3.8						
		4						
		4.2						
		4.4				BH114 4.4-4.5	0.8	No odours, staining or ACM observed.
		4.6		Termination Depth at:4.500 m.				End of hole at 4.5 m bgs. Refusal on hard sandstone.

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SOIL BOREHOLE BH115

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube	**COORD SOURCE**
DRILLING DATE 27-May-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA		0.2		Sand, beige, homogeneous, damp, medium sand, medium dense, with inclusions of rootlets.	SM			
				Sandy silty clay, dark brown, heterogeneous, damp, firm, medium plasticity, with traces of ash.	SM	BH115 0.2-0.3	1.1	No odours, staining or ACM observed.
PT		0.4						
		0.6		Sandy silty clay, brown, heterogeneous, damp, firm, medium plasticity, with inclusions of ash, slag and sandstone.	SM			
		0.8						No odours, staining or ACM observed.
		1				BH115 0.9-1	1.4	
		1.2		Crushed sandstone, light brown/yellow, homogeneous, damp.	SM			
		1.4						No odours, staining or ACM observed.
		1.6		Sand, grey turning brown then changes to dark brown, moist.	M	BH115 1.5-1.6	0.7	
		1.8						
		2						
		2.2		Sandy clay, dark grey/black, homogeneous, moist, firm, medium plasticity.	M			
		2.4						No odours, staining or ACM observed.
		2.6				BH115 2.5-2.6	0.3	
		2.8		Sandstone, light brown, homogeneous, wet, very hard.	W			
		3						
		3.2						
		3.4						
		3.6						
		3.8						
		4						
		4.2						
		4.4						End of hole at 4.6 m bgs. Refusal on hard sandstone.
		4.6		Termination Depth at:4.600 m.				

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SOIL BOREHOLE BH116

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube	**COORD SOURCE**
DRILLING DATE 27-May-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA		0.2		Sand, brown, homogeneous, damp, medium sand, loose.	SM	BH116 0-0.1	1.3	No odours, staining or ACM observed.
				Clayey sand, dark brown, heterogeneous, damp, medium sand, medium dense, with inclusions of ash.	SM			No odours, staining or ACM observed.
		0.4				BH116 0.3-0.4	1.7	
PT		0.6		Sandstone gravels, brown turning light grey/white at 1.2 m bgs then changes to grey, heterogeneous, damp, with inclusions of ash.	SM	BH116 0.5-0.6	0.9	No odours, staining or ACM observed.
		0.8						
		1						
		1.2						
		1.4		Clayey sand, light brown/orange turning grey at 2.0 m bgs, damp turning wet at 2.0 m bgs, with inclusions of ash at 2.0 to 2.1 m bgs.	SM	BH116 1.5-1.6	1.1	No odours, staining or ACM observed.
		1.6						
		1.8						
		2						
		2.2						
		2.4		Sand, grey, homogeneous, wet, medium dense.	W			
		2.6						
		2.8						Organic/swampy odour, no staining or ACM observed.
		3				BH116 2.9-3	0.8	
		3.2						
		3.4						
		3.6						
		3.8						End of hole at 3.9 m bgs. Refusal on hard sandstone.
		4		Termination Depth at:3.900 m.				
		4.2						
		4.4						
		4.6						

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SOIL BOREHOLE BH117

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube	**COORD SOURCE**
DRILLING DATE 27-May-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA		0.2		Sand, brown/beige, homogeneous, damp, medium sand, with inclusions of rootlets.	SM	BH117 0-0.1	0.5	No odours, staining or ACM observed.
		0.4		Clayey sand, dark brown, heterogeneous, damp, medium sand, medium dense.	SM	BH117 0.3-0.4	1.1	No odours, staining or ACM observed.
PT		0.6		Sandy silty clay, brown turning red/pink at 1.0 m bgs then changes to brown at 1.5 m bgs, heterogeneous, damp, low plasticity, with inclusions of sandstone and black coloured ash/slag at 0.7 to 0.8 m bgs.	SM	BH117 0.7-0.8	0.2	No odours, staining or ACM observed.
		0.8						
		1						
		1.2						
		1.4						
		1.6				BH117 1.5-1.6	0.9	No odours, staining or ACM observed.
		1.8						
		2						
		2.2						
		2.4		Sand, grey, homogeneous, wet, medium dense.	W			Swampy odour, no staining or ACM observed.
		2.6				BH117 2.5-2.6	1.6	
		2.8						
		3						
		3.2						End of hole at 3.3 m bgs. Refusal on hard sandstone.
		3.4		Termination Depth at:3.300 m.				
		3.6						
		3.8						
		4						
		4.2						
		4.4						
		4.6						

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SOIL BOREHOLE BH118

PROJECT NUMBER 58554	**DRILLING COMPANY** Terratest	**EASTING** N/A
PROJECT NAME DSI and HMS SGS Edgecliff Sp	**DRILLER**	**NORTHING** N/A
CLIENT Jattca Property Solutions	**DRILL RIG**	**COORD SYS** GDA94_MGA_zone_54
ADDRESS 11 Alma Street, Paddington, NSW	**DRILLING METHOD** Push Tube	**COORD SOURCE**
DRILLING DATE 27-May-20	**DIAMETER** 50 mm	**LOGGED BY** MN

COMMENTS

Drilling Method	Water (m bgl)	Depth (m bgl)	Graphic Log	Lithological Description	Moisture	Samples	PID	Additional Observations
HA		0.2		Sand, brown, homogeneous, damp, medium sand, loose.	SM	BH118 0-0.1	2.1	No odours, staining or ACM observed.
		0.4		Clayey sand, dark brown, heterogeneous, damp, medium dense, with inclusions of sandstone and traces of ash.	SM	BH118 0.3-0.4	2.3	No odours, staining or ACM observed.
PT		0.6						
		0.8		Sandy clay turning silty clay at 1.3 m bgs, brown/grey turning brown/red/grey at 1.3 m bgs, heterogeneous, damp, firm, with inclusions of sandstone.	SM			
		1				BH118 1-1.1	1.8	No odours, staining or ACM observed.
		1.2						
		1.4						
		1.6				BH118 1.5-1.6	2	No odours, staining or ACM observed.
		1.8						
		2						
		2.2		Clayey sand, dark grey, homogeneous, moist, medium dense sand.	M	BH118 2.2-2.3	1.3	No odours, staining or ACM observed.
		2.4		Sand, dark grey, homogeneous, wet, medium sand.	W			Swampy odour, no staining or ACM observed.
		2.6				BH118 2.5-2.6	1.1	
		2.8						End of hole at 2.8 m bgs. Refusal on hard sandstone.
		3		Termination Depth at:2.800 m.				
		3.2						
		3.4						
		3.6						
		3.8						
		4						
		4.2						
		4.4						
		4.6						

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