

Remediation Action Plan (RAP) Newcastle Grammar School - Park Campus: 127 Union Street, Cooks Hill NSW

754-NTLGE282007-AK

APP Corporation Limited Pty Ltd



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REMEDIATION ACTION PLAN (RAP), NEWCASTLE GRAMMAR SCHOOL - PARK CAMPUS: 127 UNION STREET, COOKS HILL NSW

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EXECUTIVE SUMMARY¹

The Newcastle Grammar School are planning a partial redevelopment and refurbishment of their Park Campus at 127 Union Street, Cooks Hill NSW (Lot 102 DP861562) (the Site). APP Corporation Limited Pty Ltd commissioned Tetra Tech Coffey (Tetra Tech) to prepare a Remedial Action Plan (RAP) for PAH contamination (carcinogenic PAH as benzo(a)pyrene BaP_{TEQ}) identified in soils in the western portion of the Site.

The remediation options were assessed in conjunction with proposed final land uses and conceptual plans for the Site. These include:

- Final development for use as a primary school incorporating buildings, hardstand areas and landscaping.

Factors considered during the assessment included:

- The cost and time associated with excavation and offsite disposal of PAH impacted fill material.
- Understanding the concentration distribution of PAHs both vertically and horizontally at the impacted locations.
- Ability to identify the contaminated material visually in the soil profile and differentiate from uncontaminated soils.
- Identifying an option for the beneficial reuse of the PAH impacted material in mine subsidence grouting activities.

Based on consideration of potential remedial options, the preferred remedial strategy for the PAH impacted soil is Option 4 as presented in Table 5-1 – mixing with grout and placement within mine voids below the site. The material will replace externally purchased fly-ash for use within the grout mix applied within the areas of low-strength grout.

The remediation strategy includes the removal of contaminated fill soils from the investigation area in the western portion of the Site. This will be followed by temporary stockpiling of the impacted soils (segregated from the cleaner overlying soil layer). The material will be assessed for leachability of metals and PAH prior to incorporation into the grout mix.

Following the removal of impacted fill soils, the excavation may require the importation of clean fill materials to bring the investigation area level with the existing ground at the Site. Imported material must be assessed prior to importation to site and must meet at least one of the requirements outlined in Section 5.11.2 of this RAP.

The decision to remove the locations with PAH concentrations exceeding the land use scenario for the site, was based on the following two considerations:

1. Generally, the contaminated PAH layer identified within the soil profile represents a PAH hotspot (2.5 times the BaP_{TEQ} and Total PAH) Residential HIL-A values, hence is identified for removal.
2. The ongoing sensitive use of the Site as an Infant/Primary School facility, required further consideration to ensure the remedial works proposed, address the PAH issue identified.

Soil will be removed from the impacted investigation area by the earthworks/remediation contractor under the guidance of a suitably qualified Environmental Scientist. The excavated soils will be stockpiled within the excavated footprint atop HDPE liner to avoid contaminated soils impacted underlying residual soils. The stockpiled soils will be covered to lower the risk of infiltration of rainwater.

The excavated impacted material will be reused within grouting slurry proposed to infill mine voids underlying the Site. The impacted material used in the grout mix must be volumetrically tracked from source to final

¹ This executive summary must be read in the context of the full report and the attached limitations.

placement location (including depth) and the total volume of material utilised recorded and documented for inclusion in the final validation report.

The RAP as prepared provides sufficient guidance on the remediation and validation activities to be undertaken in order to render the Site suitable for the proposed development of a primary school. The successful implementation of the RAP assumes the procedures within this RAP including the remedial guidance and final validation methodology, will be followed and any departures duly noted.

The implementation of this RAP includes a combination of contaminated material removal followed by the incorporation of the contaminated boiler ash material into cementitious grout mix for use in mine subsidence void remediation beneath the Site. By removing the exposure pathways to sensitive receptors Tetra Tech considers the Site can be made suitable for the proposed uses if this RAP is implemented.

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ACM	Asbestos Containing Material
AEC	Areas of Environmental Concern
AHD	Australian Height Datum
AHIP	Aboriginal Heritage Impact Permit
ASRIS	Australian Soil Resource Information System
ASS	Acid Sulfate Soils
BGS	Below Ground Surface
BTEX	Benzene Toluene Ethylbenzene and Xylene
CLMP	Contaminated Land Management Plan
CN	City of Newcastle
COPC	Chemicals/Contaminants of Potential Concern
CSM	Conceptual Site Model
DECC	Department of Environment and Climate Change
DNAPL	Dense Non-Aqueous Phase Liquid
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
ESL	Ecological Screening Level
HIL	Health Investigation Level
HCCD	Honeysuckle City Campus Development
HDPE	High-Density Polyethylene
HSE	Health, Safety and Environmental
HSSE	Health, Safety, Security and Environmental
HSL	Health Screening Level
LNAPL	Light Near-Aqueous Phase Liquid
LTEMP	Long-Term Environmental Management Plan
NEPC	National Environment Planning Council
NEPM	National Environment Protection (Assessment of Site Contamination) Measure
NSW	New South Wales
NSW EPA	New South Wales Environmental Protection Authority

PAH	Polycyclic Aromatic Hydrocarbon
PSI	Preliminary Site Investigation
QA	Quality Assurance
QC	Quality Control
RAP	Remediation Action Plan
SAC	Site Assessment Criteria
SEPP	State Environmental Protection Policy
SWMS	Safe Work Method Statement
TCLP	Toxicity Characteristic Leaching Procedure
TRH	Total Recoverable Hydrocarbon
UCL	Upper Confidence Limit
UFP	Unexpected Finds Protocol
VENM	Virgin Excavated Natural Material

1. INTRODUCTION

The Newcastle Grammar School are planning a partial redevelopment and refurbishment of their Park Campus at 127 Union Street, Cooks Hill NSW (Lot 102 DP861562) (the Site). APP Corporation Limited Pty Ltd commissioned Tetra Tech Coffey (Tetra Tech) to prepare a Remedial Action Plan (RAP) for PAH contamination (carcinogenic PAH as benzo(a)pyrene BaP_{TEQ}) identified in soils in the western portion of the Site.

The partial redevelopment will require the demolition of existing buildings occupying the northern portion of the Site, which will be replaced with a new 3-storey building along the Union St boundary and a 2-storey building along Corlette Street. The new 3 storey building will consist of an under-croft play area, 2 levels of learning space and rooftop sports court. The new 2 storey building will consist of a semi-basement level car park and 2 storeys of learning spaces, New kiss and drop internal roadway along the northern boundary. Other work will include refurbishment of the existing Block B and refurbishment of the western side of the existing Sandy Warren Centre. The proposed works will require major earthworks and spoil management activities during the construction phase of the redevelopment. A concept plan displaying the proposed site layout is presented in Appendix E:.

Tetra Tech completed a Preliminary Site investigation (PSI) at the Site to support the ongoing use as an Infant/Primary School facility (Residential A land use setting) (*Tetra Tech Ref: 754-NTLGE282007-AE_Rev01, dated 12 May 2021- Tetra Tech 2021a*). The Tetra Tech (2021a) PSI identified concentrations of chemicals of potential concern (COPC) typically below the residential land use criteria contained in the *National Environment Protection Council (NEPC) (1999) National Environment Protection (Assessment of Site Contamination) Measure 1999, amended in 2013 (ASC NEPM)*. Exceedances of the guideline values of the Health Investigation Levels (HIL), for residential land use were measured for Polycyclic Aromatic Hydrocarbons (PAH), specifically Total PAH and BaP_{TEQ} in samples collected from the western portion of the Site.

A delineation assessment of the impacted soils in the western portion of the Site was carried out, using a higher sample density in the area identified to be impacted by PAH. The delineation assessment identified the extent of the areas within the Site requiring remediation with results presented in Section 3.3.2 of this report.

This Remediation Action Plan (RAP) has been developed to guide the remediation activities required to make the proposed development Site suitable for the proposed final use. The RAP has been developed in accordance with the requirements of the *NSW EPA (2020) Consultants Reporting on Contaminated Land, Contaminated Land Guidelines (CRCL)* and *NSW State Environmental Planning Policy No 55 - Remediation of Land (SEPP 55)*.

1.1 OBJECTIVES

The objective of the Remediation Action Plan (RAP) is to provide guidance on the remediation and validation activities to be undertaken in order to render the Site suitable for the proposed Residential A land use (development of a primary school) proposed.

1.2 REGULATORY GUIDELINES

This RAP has been prepared in general accordance with the requirements of the following guidelines:

- National Environment Protection Council (NEPC) (1999) *National Environment Protection (Assessment of Site Contamination) Measure* (ASC NEPM), which was amended in 2013 (ASC NEPM).
- NSW EPA (2020) *Consultants Reporting on Contaminated Land, Contaminated Land Guidelines*.

- NSW EPA (2017) *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*.
- NSW EPA (1995) *Sampling Design Guidelines*; and
- NSW EPA (2014) *Waste Classification Guidelines Part 1: Classifying Waste*.

1.3 RAP REQUIREMENTS

The NSW EPA (2020) *Consultants Reporting on Contaminated Land, Contaminated Land Guidelines* (CRCL) provides requirements that are to be considered in the preparation of RAPs. As such, the RAP addresses the following requirements as per Section 1.5 of the CRCL:

- *summarise the findings of the preliminary and detailed site investigations and risk assessment (where applicable), and present the refined conceptual site model*
- *document the identified contamination risks to human health and/or the environment*
- *set remediation objectives that ensure the remediated site will be suitable for its current and/or proposed use and which will result in no unacceptable risk to human health or to the environment and state remediation criteria*
- *define the extent of remediation required across the site*
- *assess options and remedial technologies to achieve the remediation objectives and select and justify a preferred approach, which must include the consideration of the principles of ecologically sustainable development*
- *document in detail all procedures and plans to reduce risks posed by contamination to acceptable levels for the proposed site use*
- *identify the need for and reporting requirements of remedial technology pilot trials (if applicable)*
- *establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner, including consideration of the potential for off-site impacts (such as air quality, odour and aesthetics)*
- *address contingencies and unexpected finds protocols*
- *identify the necessary approvals and licences required by regulatory authorities including any items contained in development consent conditions*
- *clearly outline waste classification, handling and tracking requirements in accordance with the Guidelines for the NSW Site Auditor Scheme and Waste Classification Guidelines (EPA 2014)*
- *ensure remediation is consistent with relevant laws, policies (including planning instruments and policies) and guidelines and reference these in the remedial action plan*
- *identify how successful implementation of the remedial action plan will be demonstrated, for example the validation requirements by documentation of site works and sampling and analysis etc (when sampling and analysis is required, a validation sampling and analysis quality plan must be included, with clearly defined acceptance validation criteria indicating what statistics will be used and any trend analysis following remediation, i.e. Mann-Kendall test)*
- *identify the need for, and nature of, any long-term management and/or monitoring following the completion of remediation and, if required, provide an outline of an environmental management plan and include this in the remedial action plan."*

2. SITE INFORMATION

2.1 SITE LOCATION AND IDENTIFICATION

The general site location is shown in Figure 1, Appendix E: with the relevant site information provided below in Table 2-1.

Table 2-1: Site identification summary

Site Address	127 Union Street, The Hill NSW
Approximate Site Area	Approximately 0.33 hectares (3,300m ²)
Title Identification Details	The Site comprises mainly the eastern portion Lot 102 DP861562
Site Ownership	Newcastle Grammar School
Local Government	City of Newcastle
Current Land Zoning	R3 – Medium Density Residential
Current Land use	Currently operating as a primary school facility
Proposed Land use	Continuation as a primary school facility once partial redevelopment and refurbishment works are completed.
Adjoining Site Uses	- East – Corlette St and medium density residential - South - Parkway Ave and medium density residential - West – Union St and recreational sporting fields (national park); and - North – High-Medium density residential.
Site Coordinates (latitude, longitude)	The boundary corner of the investigation area of the Site is located approximately at: Latitude: - 32.934922° Longitude: 151.762183°

2.2 SITE TOPOGRAPHY AND DRAINAGE

The Site is near level with an approximate elevation of 4m AHD, including a mixture of open space areas with grass cover, buildings and pavements. Rain falling on the Site is likely to infiltrate into the site soils or drain towards the municipal stormwater system.

Surface water and stormwater is likely to drain in a southerly direction towards Cottage Creek storm water drain located along the Site southern boundary. Cottage Creek eventually flows north and discharges into the Throsby Basin, part of Newcastle Harbour, located approximately 1.1 km to the north north-west of the Site.

2.2.1 Geology and Soils

Based on the 1:100,000 scale Newcastle Coalfield Geology map, the Site is underlain by Quaternary deposits comprising gravel, sand, silt and clay. Underling this unit is the late Permian aged Lambton Subgroup of the Newcastle Coal Measures comprising interbedded and interlaminated siltstone, sandstone and coal.

Site Specific Geology

Based on the investigation observations and previous works undertaken at the Site, a geotechnical model has been formulated. The model is separated into the following geotechnical units summarised below in Table 2-2.

Table 2-2: Summary of geotechnical units

Unit	Material / Origin	Depth to base of unit (m)	Description
1a	Topsoil/Fill	0.35	Gravelly SAND to Sandy GRAVEL: fine to medium grained, brown to pale brown in colour, fine to medium sized subangular gravels trace to some rootlets
1b	Fill (Variable)	4.5	Highly variable unit includes the following ²SAND to Silty SAND and Clayey SAND: fine to coarse grained, pale brown/ grey, brown dark brown and black, trace to with some gravel including coal reject material, fine to coarse grain slag, ash fines, trace rootlets, bricks Sandy CLAY: medium plasticity, orange mottled red and white, with fine to medium sand CLAY: high plasticity yellow and mottled grey SAND: fine to medium grained, pale brown/ pale yellow/ grey, some fine to medium grained subangular gravels
2a	Swamp deposits	8.0	PEAT: dark grey to black, trace of fine to medium sand and rootlets, very soft to soft consistency
2c	Estuarine Soil	15	Clayey SILT: low plasticity, dark grey to black, trace of fine to medium sand and marine/shell fragments, very soft to soft consistency

The complete geotechnical unit summary is presented in *Tetra Tech Geotechnical Assessment (Tetra Tech Ref: 754-NTLGE282007-AD, dated 19 February 2021)*.

2.2.2 Acid Sulfate Soils

Reference to the Department of Land and Water Conservation Newcastle 1:25,000 Acid Sulfate Soil (ASS) Risk Map indicates that the Site is located within a Low Probability Acid Sulfate Soil risk area.

ASS if present, is expected to be buried by alluvium or windblown sediments at a depth range of greater than 3 metres below the ground surface (mbgs).

An Acid Sulfate Soil Management Plan (ASSMP) was completed for the Site (*Tetra Tech Ref: 754-NTLGE282007-AH, dated 2 June 2021 – Tetra Tech 2021b*). The ASSMP provided liming methodology, liming rate calculation and on-site soil management of ASS material proposed for civil earthwork activities including deeper foundation installation and managing pile spoil. It is unlikely that ASS soils will be encountered during remediation works proposed within the fill soil profile <0.6m bgs.

2.2.3 Hydrogeology

Groundwater beneath the Site was reported in Tetra Tech (2021b) as being present in an unconfined aquifer at depths ranging from 1.4 - 1.8m below ground surface (mbgs). Regional groundwater flow was anticipated to follow the general slope of the region to the north west eventually discharging to the lower reaches of Cottage Creek. Cottage Creek eventually enters Newcastle Harbour about 1.1km to the north west.

A search of the Water NSW registered bores located within a 500m radius of the Site was undertaken. The search revealed that there were four (4) registered bores within this radius. The details of the registered bores are summarised below in Table 2-3.

² Impacted PAH soil layer 0.25 – 0.5m bgs

Table 2-3: Summary of registered groundwater bores in the area

Bore ID	Licence Status	Purpose	Standing Water Level (mbgs)	Bore Depth (mbgs)	Approximate Distance from South East Corner of Site
GW200589	Unknown	Irrigation	2.100	7.5	220m South West
GW055210	Current	Domestic	Unknown	4.5	220m North East
GW200588	Unknown	Irrigation	1.185	8.0	390m West
GW201379	Unknown	Domestic	4.100	6.2	310m South

Approximate groundwater levels were recorded during the Geotechnical Investigation (*Tetra Tech Ref: 754NTLGE282007-AD, dated 19th February 2021*). Groundwater was measured during the geotechnical investigation at depths ranging from 1.2m up to 2.0m.

3. SUMMARY OF PREVIOUS ASSESSMENTS

3.1 PRELIMINARY SITE INVESTIGATION (COFFEY, 2021)

A Preliminary Site Investigation was undertaken at the site by Tetra Tech (Tetra Tech Ref: 754-NTLGE282007-AE_Rev01, dated 12 May 2021) to identify evidence of potentially contaminating activities that may be currently occurring or had historically occurred on the site.

The objective of the assessment was to identify Areas of Environmental Concern (AEC's) and Chemicals of Potential Concern (COPCs) to develop a preliminary Conceptual Site Model (CSM) and provide recommendations for further assessment, if required.

The scope of works included a desktop assessment of the site to understand published information held on file by Coffey including soil, geology and hydrogeology. A site history assessment including a review of Section 10.7 Certificates, Historical Aerial Images and Historical Title and a site walkover was undertaken to assist identifying potential AECs and COPCs.

A soil sampling assessment was also undertaken as part of the PSI, including sampling of ten locations with the aid of a drill rig and hand auger, to a maximum depth of 2.0m bgs.

Collection of soil samples occurred at specific intervals within the soil profile including:

- Two in the fill (or shallow soils <0.3 mbgs and 0.3 to 0.5 mbgs); and
- One in the natural material (where achievable).

Laboratory analysis of the soil samples for the identified COPCs included:

- Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc)
- Total Recoverable Hydrocarbons (TRH)
- Benzene, Toluene, Ethylbenzene and Xylene (BTEX)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Asbestos (targeting possible asbestos in fill)
- pH Field Screen (Acid Sulfate Soils); and
- Chromium Reduced Sulfur (Acid Sulfate Soils).

The laboratory results showed concentrations of COPC typically below the adopted criteria for human health with the exception of one location, BH4 at approximately 0.5m depth bgs. The location contained polycyclic aromatic hydrocarbons (PAH) and Benzo a Pyrene (BaP) above the adopted health assessment criteria. The Conceptual Site Model (CSM) identified a complete exposure pathway related to the PAH contamination to construction workers. The PSI concluded that the exceedances observed at borehole location BH4 would require further assessment in order to delineate the PAH impact in the western portion of the Site where the exceedance was identified.

3.2 DELINEATION ASSESSMENT 1 – (21ST JUNE 2021)

A delineation assessment was undertaken by Tetra Tech to investigate the vertical and horizontal extent of fill material impacted by BaP_{TEQ} (carcinogenic PAH) and Total PAHs. The initial delineation fieldwork assessment was undertaken on the 21st June 2021 and the results discussed with APP prior to preparation of the RAP.

The assessment included the following scope of works:

- Field assessment program, including:
 - Soil sampling from ten (10) boreholes (DS1 to DS10).
- Laboratory analysis for COPCs for soil included:

- Polycyclic Aromatic Hydrocarbons (PAH)
- Total Recoverable Hydrocarbons (TRH)
- Benzene, Toluene, Ethylbenzene, Xylenes, Naphthalene (BTEXN)

The scope of delineation works was completed in accordance with the ASC NEPM, *Schedule B2 – Guideline on Site Characterisation* using a design consistent with recommendations in the *NSW EPA (1995) Sampling Design Guidelines* (Sampling Guidelines). Delineation samples were collected in an east, west, south and northern direction from BH4 at an approximate distance of 1.7m between sample locations. The sampling points were set out in a regular square grid across the Site and samples were collected from three vertical intervals in fill material, being 0.0-0.3m, 0.3-0.5m and 0.8-1.0m.

The samples were collected from boreholes using a hand auger that facilitated visual observations of the fill and sampling from the four vertical intervals. The sampling and analytical schedule is included in Table 3-2. The sampling locations are presented in Figure 2, Appendix E. Samples were collected with the assistance of a hand auger and stored in an ice-filled esky for transport to the laboratory.

Results of the delineation investigation is presented below in Section 3.3.2.

3.3 DELINEATION INVESTIGATION 2 – (7/8TH JULY 2021)

During the initial delineation sampling event (21.06.2021), a medium to coarse grained gravelly sand material, black/grey in colour, was observed consistently across the investigation area at an approximate depth range of 0.25 – 0.5m bgs. The layer was confirmed to contain the most elevated concentrations of BaP_{TEQ} and Total PAH.

Due to the visual observation of topsoil covering the suspected contaminated layer, the decision to collect surface samples was undertaken to assess the chemical concentrations of the covering soil layer. A total of ten samples were collected from the 0.0-0.3m bgs surface layer on the 7th July 2021 and submitted for PAH analysis.

Given the distinct visual characteristic of the suspected contaminated soil layer in the sub-surface profile, an additional eight (8) boreholes (DS11 – DS18) were advanced to the north, east, west and south of the delineation area on the 8th July 2021 in order to confirm the presence of the impacted layer in the soil profile across the wider development footprint. Samples were collected from varying depths 0.0-0.2, 0.3-0.5 and 0.8-1.0m bgs surface soil layer with samples submitted and held by the laboratory for additional analysis if required. A total of ten samples submitted to the laboratory for analysis. An additional 14 samples were collected and HELD by the laboratory for additional PAH analysis if required. Analysis of the additional samples was not required for this investigation.

The samples were collected from boreholes using hand auger that facilitated visual observations of the fill and sampling from the four vertical intervals. The sampling and analytical schedule is included in Table 3-2. The sampling locations are presented in Figure 2, Appendix E. Samples were collected with the assistance of a hand auger and stored in an ice-filled esky for transport to the laboratory.

Results of the delineation investigation is presented below in Section 3.3.2. Figure 2, Appendix E: presents the delineation borehole locations (DS11 – DS18). Borehole Logs are presented in Appendix C.

3.3.1 Field Quality Assurance

QA/QC procedures implemented for this project included:

- Sampling performed by qualified Coffey Environmental professionals in accordance with Coffey's SOPs which are based on industry accepted protocols for environmental sampling and are consistent with Schedule B2 of the ASC NEPM.

- The following intra-laboratory (duplicate) and inter-laboratory (triplicate) samples were collected and submitted for laboratory analysis as listed in Table LR4, Appendix B:. The QA/QC samples are summarised in Table 3-1.

Table 3-1: Summary of QAQC samples

Sample Date	Primary Sample	Sample Matrix	Field Duplicate	Field Triplicate
21/06/2021	DS1-0.3-0.5	Soil	QC1	QC2
07/07/2021	DS8-0.0-0.3	Soil	QC1	QC2

As part of the delineation assessments undertaken, a total of 29 Primary soil samples were selected for PAH analysis. Two field duplicate and two split duplicate QC samples were analysed from soil samples. In summary, these duplicate samples were completed in accordance with the 1 in 20 sample rates in accordance with Coffey's SOPs and recommendations detailed within Section 8.2 of Australian Standard (AS 4482.1-2005) *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-volatile and Semi-volatile Compounds*.

Calculated RPD values from collected primary, blind duplicate and split duplicate QC samples for soil, are summarised below and presented in Table LR2 of Appendix B:.

Sample Pair – DS1-0.3-0.5/QC1:

- Fluoranthene – (82%)
- Pyrene – (82%)
- Total PAHs – (131%)

Sample Pair – DS1-0.3-0.5/QC2:

- Benzo(a)anthracene (95%)
- Benzo(a)pyrene (113%)
- Benzo(a)pyrene TEQ (lower bound) (126%)
- Benzo(a)pyrene TEQ (medium bound) (80%)
- Benzo(g,h,i)perylene – (120%)
- Benzo(k)fluoranthene – (95%)
- Benzo[b+j]fluoranthene – (95%)
- Fluoranthene – (120%)
- Indeno(1,2,3-c,d)pyrene – (82%)
- Phenanthrene – (135%)
- Pyrene – (117%)
- Total PAHs – (159%)

Sample Pair DS8-0.0-0.3/QC1

- Benz(k)fluoranthene – (95%)

Sample Pair DS8-0.0-0.3/QC2

- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Benzo[b+j]fluoranthene
- Indeno(1,2,3-c,d)pyrene

A review of Trip Blank (TB), Trip Spike (TS) and Rinsate Blank (RB) samples showed that concentrations were reported to be less than the laboratory LOR. Therefore, the likelihood that cross contamination occurred during transportation of samples from site to the laboratory is unlikely. Trip Blank, Trip Spike and Rinsate Blank results are presented in Table LR3, Appendix B:.

3.3.2 Results

Soil analytical results were compared to the adopted site assessment criteria (SAC), presented in Table LR1, Appendix B: . Copies of the NATA endorsed laboratory reports are presented in Appendix F:.

The total number of primary soil samples collected during both the initial delineation investigation (21/06/21) and second delineation investigation (07/06/21), are summarised below in Table 3-2.

Table 3-2: Schedule of analysis for soil

Chemical of Concern	No. Primary Soil Samples
PAH	29
TRH	10
BTEXN	10

PAH – Polycyclic Aromatic Hydrocarbons, TRH = Total Recoverable Hydrocarbons, BTEX = Benzene, Toluene, Ethylbenzene and Total Xylenes.

The results of delineation assessments undertaken identified exceedances of the ASC NEPM Health Investigation Level HIL-A (Residential Land Use) guideline values for Total PAHs and BaP_{TEQ} within the investigation area. The exceedances reported are summarised below in Table 3-3.

Table 3-3: Delineation investigation results summary

Sample ID	Depth Range	Exceeds HIL-A – Residential Land Use (SAC)	
		Benzo(a)pyrene BaP _{TEQ} 3mg/kg	PAH 300mg/kg
DS3-0.3-0.5	0.3-0.5	BaP _{TEQ} (120mg/kg)	
		Total PAHs (1002.5mg/kg)	
DS4-0.3-0.5	0.3-0.5	BaP _{TEQ} (42mg/kg)	
		Total PAHs (385.4mg/kg)	
DS4-0.8-1.0	0.8-1.0	BaP _{TEQ} (33mg/kg)	
		Total PAHs (305.3mg/kg)	
DS5-0.3-0.5	0.3-0.5	BaP _{TEQ} (100mg/kg)	
		Total PAHs (988.5mg/kg)	
DS5-0.8-1.0	0.8-1.0	BaP _{TEQ} (69mg/kg)	
		Total PAHs (631.4mg/kg)	
DS6-0.0-0.3	0.0-0.3	BaP_{TEQ} (<20mg/kg) ³	
	0.3-0.5	BaP _{TEQ} (57mg/kg)	

³ Sample DS6-0.0-0.3 reported matrix interference during laboratory analysis and the LOR has been raised for this sample.

Sample ID	Depth Range	Exceeds HIL-A – Residential Land Use (SAC)	
		Benzo(a)pyrene BaP _{TEQ} 3mg/kg	PAH 300mg/kg
DS6-0.3-0.5		Total PAHs (491.5mg/kg)	
DS6-0.8-1.0	0.8-1.0	BaP _{TEQ} (98mg/kg)	
		Total PAHs (1093mg/kg)	
DS7-0.3-0.5	0.3-0.5	BaP _{TEQ} (99mg/kg)	
		Total PAHs (876.6mg/kg)	
DS8-0.3-0.5	0.3-0.5	BaP _{TEQ} (84mg/kg)	
		Total PAHs (736.6mg/kg)	
DS8-0.8-1.0	0.8-1.0	BaP _{TEQ} (69mg/kg)	
		Total PAHs (624.4mg/kg)	
DS10-0.3-0.5	0.3-0.5	BaP _{TEQ} (29mg/kg)	
		Total PAHs (317.1mg/kg)	
DS10-0.8-1.0	0.8-1.0	BaP _{TEQ} (15mg/kg)	

Delineation chemical data compared to the SAC is presented in Table LR1, Appendix B: Figure 2, Appendix B: shows the delineation sample locations.

3.3.3 Leachability Assessment

An Australian Standard Leachable Procedure (ASLP) analysis was undertaken on samples reported with significantly higher BaP_{TEQ} and Total PAH concentrations (DS3-0.3-0.5, DS8-0.8-1.0, DS6-0.3-0.5 and DS6-0.8-1.0) to assess the potential for these analytes to leach and migrate into the underlying groundwater table.

A summary of the results is presented below in Table 3-4.

Table 3-4: Summary of ASLP results

Analyte	Sample and BaP _{TEQ} Concentration in soil (mg/kg)	ASLP (mg/L)
BaP _{TEQ}	DS3-0.3-0.5 – (120)	0.002
	DS8-0.8-1.0 – (69)	<0.001
	DS6-0.3-0.5 – (57)	<0.005
	DS6-0.8-1.0 – (98)	<0.005
Total PAHs	DS3-0.3-0.5 – (1002.5)	0.013
	DS8-0.8-1.0 – (624.4)	<0.001
	DS6-0.3-0.5 – (491.5)	<0.01
	DS6-0.8-1.0 – (1093)	<0.05

Based on the reported ASLP results, BaP_{TEQ} and Total PAH have low potential for migration into the groundwater table as a result of surface water infiltration.

3.3.4 Preliminary Waste Classification

A preliminary waste classification has been assessed for the soils in accordance with the NSW (2014) EPA *Waste Classification Guidelines*. A classification is being provided for the impacted PAH material identified in fill soils in the western portion of the site in exceedance of the HIL A (Residential) assessment criteria. The impacted locations identified in Table 3-3 including (DS3, DS4, DS5, DS6, DS7, DS8 and DS10) for the impacted depth range 0.3-1.0m bgs is preliminarily classified as Hazardous Waste.

3.3.5 Discussion

The delineation assessment has been subject to a Tier 1 site assessment screening evaluation to establish whether there is potential for an unacceptable health risk associated with cPAH impacts at the site. The generic screening criteria have been selected based on the Conceptual Site Model discussed in Section 4.

The Tier 1 screening criteria are generally derived based on conservative assumptions relating to land use, receptor use, receptor behaviour, site, building design and soil characteristics. The ASC NEPM health investigation levels (HILs) HIL-A were adopted based on Residential land use setting.

The comparison of site data to the Tier 1 screening criteria (HIL-A) for the three depth intervals assessed for BaP_{TEQ} and Total PAH's are summarised below in Table 3-5.

Table 3-5: Tier 1 screening comparison of impacts at different depths and the NEMP HIL-A criteria

Chemical of concern	Tier 1 health screening criteria [mg/kg]	Depth Range [m]	Number of soil samples	Concentration Range [mg/kg]	95% UCL concentration [mg/kg]
cPAH as BaP _{TEQ}	3	0.0 – 0.3	10	0.6 - <20	1.53
		0.3 - 0.5	10	0.6 – 120	79.7
		0.8 – 1.0	10	0.6 - 97	68.1
PAHs (total)	300	0.0 – 0.3	10	1.2 – 178.7	84.8
		0.3 - 0.5	10	<0.5 – 1002.5	775.8
		0.8 – 1.0	10	<0.5 – 1093	653.5

The 95% UCL_{AVE} concentration for BaP_{TEQ} in depth range 0.0-0.3m bgs (1.53mg/kg) was reported below the HIL-A Tier 1 site assessment criteria for surface samples. The contaminated layer is therefore confirmed to be the ash-impacted layer identified in the depth range 0.25m – 0.5m bgs with a 95% UCL_{AVE} (79.7mg/kg BaP_{TEQ}). Impact in the deeper soil profile was related to cross-contamination by soils from the impacted layer.

4. CONCEPTUAL SITE MODEL

Based on the results of the PSI and delineation assessments, the conceptual site model (CSM) has been updated to reflect identified COPC's. Areas and chemicals of environmental concern, affected media, receptors and transport mechanisms and a summary of key potential exposure pathways are included in Table 4-1 to Table 4-3.

Table 4-1: Areas and Chemicals of Environmental Concern

AEC	Contaminating Activity	Identified COCs	Likelihood of Contamination*	Relevant Samples Targeting AEC
Western Portion of site (Children sports field).	Imported fill of unknown origin	PAHs	High (PAH) as BaP _{TEQ} and Total PAH	- BH4 – 0.5m (PSI) - DS1 – DS10 (Delineation#1) 0.3-0.5, 0.8-1.0 - DS11 – DS18 (Delineation#2) - Samples collected from varying depths (0.0-0.2, 0.3-0.5 and 0.8-1.0m bgs). Samples were submitted and held by laboratory.

Table 4-2: Affected media, receptors and transport mechanisms

Consideration	Information
Source of Contamination	Shallow imported soil – fill material (about 0.25 to 0.5m bgs).
Transport Mechanisms &	Leaching from soil to groundwater Surface Water run-off if exposed Wind erosion (dusts) if exposed
Receptors Exposure Pathways	Construction/maintenance workers Exposure via dermal/direct contact with soil and ingestion of soil. Current and future site users Exposure via dermal contact, and ingestion/inhalation of soil and dust. Contact with onsite groundwater is considered unlikely due to no identified beneficial use of groundwater. Ecological Exposure to transitory wildlife exposed to the site, including surface water and aquatic ecosystems. Leaching of contaminants is not expected into groundwater as the primary contaminants identified are typically relatively non-leachable (BaP_{TEQ} and Total PAHs). Regional groundwater in the Newcastle region has been impacted by industrialisation and widespread placement of industrial fill. Offsite impact from the fill placed on the study site is unlikely to have exacerbated the regional groundwater quality. Surface Water – Throsby Basin/Newcastle Harbour Lateral transport of surface water and discharge of stormwater at the nearest surface water receptor is likely to drain in a southerly direction towards Cottage Creek. Cottage Creek eventually flows north and discharges into the Throsby Basin, part of Newcastle Harbour, located approximately 1.1 km to the north north-west of the Site.

Table 4-3: Summary of identified key potential exposure pathways

Receptor	Exposure Pathway	Comment
Construction/ Maintenance Workers	Complete	There is a potential for workers conducting subsurface and surface disturbance to be exposed to unexpected finds of contamination via dermal contact, ingestion and inhalation pathways during development and maintenance works.
Current and Future site users	Potentially Complete	Unsealed surfaces may present a potentially complete pathway to dermal contact, ingestion and inhalation of soils and/ or dust fibers. Current laboratory data suggest high risk to human health. Pathway is considered potentially complete until the final determination is made for design in that section of the site.
Ecological (surface water soil biota and transitory wildlife)	Complete	Current data indicates a potential risk to ecological receptors from fill soils. This risk should be eliminated following re-development assuming the areas will be covered by building foundations and pavements. Surface water runoff has the potential to transport sediment containing COPCs from any unsealed surfaces during rainfall events. Given the distance to the nearest receptor a complete pathway could exist during periods of high rainfall.
Groundwater	Incomplete	Leaching of COPCs into groundwater. Fill quality beneath the Site would be similar to other nearby sites that have been raised to prevent flooding. Impacts to groundwater would be regional and unlikely site specific. Given the use of reticulated water in the area it is also unlikely that groundwater is re-used for domestic use and direct contact with the groundwater is considered unlikely during or following re-development. Leachability of PAH impacted soil samples were analyzed and reported to have low potential for migration into the groundwater table as a result of surface water infiltration through fill soils. A complete pathway is unlikely to exist.
Surface Water	Potentially Incomplete	Impact to surface water from the impacted soils is incomplete as they are located below surface soils. During construction they are likely to be exposed and controlled under a Soil and water management Plan. Following remediation and development the pathway to surface water would be incomplete.

5. REMEDIATION OPTIONS ASSESSMENT

5.1 REMEDIAL GOALS

The broad remediation goals, with respect to contamination, are to identify management measures that would ensure the Site is suitable for ongoing Residential land use⁴ following the completion of the partial re-development of the Site.

5.2 REMEDIATION HIERARCHY

The ASC NEPM provides a preferred hierarchy of options for site clean-up and/or management which is outlined as follows:

- If practicable, on-site treatment for the contamination so that it is destroyed, and the concentrations are reduced to below the adopted site clean-up criteria; or
- Offsite treatment of excavated soil, so that the contamination is destroyed, or the associated risk is reduced to an acceptable level.

If the above is not practicable:

- Consolidation and isolation of the soil on site by containment within a properly designed barrier; or
- Removal of contaminated material to an approved facility followed, where necessary, by replacement with appropriate material; or
- Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

Given that PAHs are the primary contaminant identified on the site which warrants remediation, the relevant remediation hierarchy reverts to the second part, which includes isolation on Site.

5.3 REMEDIATION OPTION REVIEW

Remediation and/or management of soils on the Site are required under SEPP 55 to address soil contamination issues identified in the DSI and delineation assessments. The remediation will reduce potential risk to human health and the environment and demonstrate the Site is suitable for the proposed use as a primary school.

To achieve the remedial objectives, there are several remedial options available, each with advantages and disadvantages. Remediation may comprise implementation of one or a combination of the remedial management measures described in Table 5-1.

The appropriateness of a particular option would vary depending on a combination of factors including:

- Space available on-site during remediation.
- Air quality, noise, and traffic impact on adjacent site users.
- Nature and extent of contamination.
- Geological and hydrogeological conditions.
- Type(s) of contamination, including the impacted media; and
- Human health and environmental risks (both during and post redevelopment).

The selection of a preferred remedial option would consider:

⁴ Most sensitive land use setting utilized due to primary receptor group being primary school children

- Effectiveness of remediation – will the solution meet the remedial objectives.
- Contractor experience with remedial technology/approach.
- Sustainability – waste generation, stakeholder acceptance of the remedial solution etc.
- Time required to complete remediation.
- Cost effectiveness; and
- Long term liabilities and ongoing management requirements.

Based on the information presented in the contamination assessment reports, and the likely extent of remediation, four (4) remediation options were considered as applicable options for implementation at the site. These are discussed in Table 5-1.

Table 5-1: Remediation options

No.	Option	Assessment
1.	Leave the contamination undisturbed.	This option is not considered to be acceptable as there are education imperatives on redevelopment of the site and space is limited at the school campus. Alternative sites within the school grounds are therefore not available.
2.	Excavation and off-site disposal of material that does not comply with the adopted assessment criteria.	Contaminated material could be removed and disposed at an appropriately licensed facility following classification as waste in accordance with NSW EPA (2014). The advantages of this option include the potential for minimising long-term management of the land, as well as minimising restrictions on future land use following remediation and validation. The disadvantages of this option include significant costs associated with waste transport and disposal, potentially unnecessary use of landfill capacity and importing replacement materials.
3.	On site capping of material that does not comply with the adopted assessment criteria.	Contaminated materials could be capped beneath a suitable barrier. That is, the contaminated material would not be excavated but isolated in situ by a capping layer. The advantage of this option is reduced use of waste disposal resources. The disadvantage of this option is that the Site will require ongoing management of the barrier layers with the implementation of a Long-Term Environmental Management Plan (LTEMP). The works will also potentially require Development Consent from Council for completion as a Category 1 remediation.
4.	Onsite reuse of impacted fill soils as part of the cementitious grout mix used to remediate the mine subsidence voids beneath the Site (Depths greater than 50m bgs).	Contaminated soil layer could be excavated and stockpiled within the investigation area during earthworks. The material could then be reused under a NSW EPA issued Site Specific Resource Recovery Order as part of the cementitious grouting mix used for grouting of mine subsidence voids beneath the Site. The visual identification of the impacted material will enable separation of contaminated soils during earthwork activities. The advantage of this option is that the material will be mixed with grout during the mine subsidence remediation works and reused beneficially during the mine subsidence void remediation to be undertaken at the Site. The grout will act as binder and should further reduce the capacity for leaching. The disadvantage of this option is that the management of impacted soils will remain stored at the Site until grouting works commence. This could be minimised if remedial works are undertaken just prior to the commencement of grouting works

5.4 PREFERRED REMEDIAL STRATEGY

The remediation options outlined in Table 5-1 were assessed in conjunction with proposed final land uses and conceptual plans for the Site. These include:

- Final development for use as a primary school incorporating buildings, hardstand areas and landscaping.

Factors considered during the assessment included:

- The cost and time associated with excavation and offsite disposal of PAH impacted fill material.
- Understanding the concentration distribution of PAHs both vertically and horizontally at the impacted locations.
- Ability to identify the contaminated material visually in the soil profile and differentiate from uncontaminated soils.
- Identifying an option for the beneficial reuse of the PAH impacted material in mine subsidence grouting activities.

Based on consideration of potential remedial options, the preferred remedial strategy for the PAH impacted soil is Option 4 as presented in Table 5-1 – mixing with grout and placement within mine voids below the site. The material will replace externally purchased fly-ash for use within the grout mix applied within the areas of low-strength grout.

The remediation strategy includes the removal of contaminated fill soils, from the investigation area in the western portion of the Site as shown in Figure 2, Appendix B:. This will be followed by temporary stockpiling of the impacted soils (segregated from the cleaner overlying soil layer). The material will be assessed for leachability of metals and PAH prior to incorporation into the grout mix.

Following the removal of impacted fill soils, the excavation may require the importation of clean fill materials to bring the investigation area level with the existing ground at the Site. Imported material must be assessed prior to importation to site and must meet at least one of the requirements outlined in Section 5.11.2.

The decision to remove the locations with PAH concentrations exceeding the land use scenario for the site, was based on the following two considerations:

1. Generally, the contaminated PAH layer identified within the soil profile represents a PAH hotspot (2.5 times the BaP_{TEQ} and Total PAH) Residential HIL-A values, hence is identified for removal.
2. The ongoing sensitive use of the Site as an Infant/Primary School facility, required further consideration to ensure the remedial works proposed, address the PAH issue identified.

Soil will be removed from the impacted investigation area outlined in Figure 2, Appendix A:, by the earthworks/remediation contractor under the guidance of a suitably qualified Environmental Scientist. The excavated soils will be stockpiled within the excavated footprint atop HDPE liner to avoid contaminated soils impacted underlying residual soils. The stockpiled soils will be covered to lower the risk of infiltration of rainwater.

The excavated impacted material will be reused within grouting slurry proposed to infill mine voids underlying the Site. The impacted material used in the grout mix must be volumetrically tracked from source to final placement location (including depth) and the total volume of material utilised recorded and documented for inclusion in the final validation report.

5.5 TIMING

To optimise and achieve efficiencies in the project, remediation works should be undertaken as per the general steps listed in Table 5-2.

Table 5-2: General steps in Remediation and Validation Strategy

Step	Item	Responsible Party
1	Carry out community consultation (as required) and notify City of Newcastle (CN) 30 days before commencement of Category 2 Remedial Works (SEPP 55, Clause 15) and obtain approval to undertake works.	Site Owner (Newcastle Grammar School)
2	Remediation work undertaken by a suitably qualified bulk earthworks/remediation Contractor under the guidance of a suitably qualified environmental consultant.	Environmental Consultant/Remedial Contractor
3	Material to be sampled following excavation works and leachability of the metals and PAH in the stockpiled material confirmed.	Environmental Consultant/Remedial Contractor/Grouting Contractor
4	Reuse material within grout mix and volumetrically track as required for inclusion into the final Validation Report. This includes confirmation of volumes excavated, volumes incorporated into the grout mix, volumes of grout mix injected into the ground and at what depth below ground surface.	Environmental Consultant/Remedial Contractor/Grouting Contractor
5	Validate completion of remediation and prepare a Validation Report reviewed and signed off by a Certified Environmental Professional – Site Contamination Specialist (CEnvP-SC).	Environmental Consultant/Certified Environmental Professional
6	Submit Validation Report to CN for Section 4.55 amendment to existing Development Consent (if required)	Environmental Consultant/CN
7	Confirmation from CN that the Development Consent has been amended to reflect the completion of remedial activities as per the RAP	CN/Site Owner

5.6 REMEDIAL APPROACH

The following steps outline the remediation approach which will be required for successful remediation of the Site:

1. Engagement of an experienced, suitably qualified remediation contractor.
2. The contractor is to take steps to avoid cross contamination excavation (i.e. contaminating clean areas of the site with PAH impacted material). These steps/procedures must be included as part of the Construction Environmental Management Plan for the remedial activities.
3. The remediation contractor will be guided of an experienced, suitably qualified Environmental Scientist.
4. Strip/removal of clean surface soil layer across the development footprint and stockpile separately for potential reuse assessment /waste classification (150mm – 300mm bgs).
5. Fill will be observed by the Environmental Scientist to confirm the impacted soil layer (coarse grained gravelly sand black in colour) consisting of boiler ash, coal wash fines and coal chitter in order to target the contaminated fill soils.
6. Impacted PAH layer will be removed from the soil profile across the extent of the development footprint and stockpiled separately from the surface soils atop black HDPE liner material, to prevent PAH soils from contaminating clean areas of the Site.
7. Confirmation of final stockpile volume by survey.
8. Cover stockpiled material with tarpaulin or construction plastic to prevent wind-blown mobilisation and erosion by rain.
9. Validation of the excavation footprint to confirm remaining soils are compliant with the ASC NEPM Residential HIL A guideline values by undertaking validation sampling of the resulting excavation walls and base. This will be carried out as per the procedures outlined in Section 5.8.2.
10. Importation of clean topsoil or other appropriate VENM or ENM classified media for use as excavation backfill as required. Imported media must be compliant with Section 5.11.2.
11. Assessment of the leachability of PAH and heavy metals in the excavated impacted soil stockpile.

12. Reuse of excavated impacted soils within grouting slurry proposed to infill mine voids underlying the Site.
13. Material used in grout mixed must be volumetrically tracked from source to final placement location (including depth) and the total volume of material utilised recorded and documented for inclusion in the final validation report.

5.7 EXCAVATION AND ON-SITE REUSE OF PAH IMPACTED SOILS

The following works are to be carried out:

- The PAH impacted fill soil locations are identified in Figure 2, Appendix B: with the impact depths and relevant concentrations summarised in Table 3-3.
- The PAH impacted portion of the fill profile has shown a typical occurrence between 0.25 – 0.5mbgs. Excavation will be done progressively from the surface with the soils visually screened by a Suitably experienced Environmental Scientist during excavation works and impacted areas confirmed prior to removal.
- The Impacted soil has typically been associated with the presence of coarse grain gravelly sand, grey/black in colour with the presence of ash and coal fines in the fill profile. This will be assessed as the remediation excavations are progressed with areas containing coarse grained soil and coal fines targeted for removal.
- During excavation, care must be taken to segregate clean fill materials from PAH impacted soils in order to minimise cross contamination of surface material intended to be retained. This will be facilitated by the visual assessment of the fill during stripping activities.
- The excavated PAH impacted soils are to be stockpiled separately from the clean surface soils on an impervious surface (HDPE Liner).
- The volume of the impacted stockpile must be confirmed by survey and its onsite location confirmed for placement into the material tracking documentation to be provided in the Validation report.
- Removal of the impacted material will be first confirmed visually (no visible observation of black material). The PAH concentrations in the walls and base of the excavation will then be sampled following removal of the PAH impacted soil layer.
- Following removal of PAH impacted soils, validation soil sampling will be carried out by the environmental consultant in accordance with Section 5.8.2.
- The stockpiled excavated material will be sampled and assessed for leachability of metals and PAH prior to reuse within the slurry/grout mix proposed to fill mine voids underlying the Site.
- Impacted material must be tracked volumetrically during its incorporation into the grout mix and records kept providing full accounting of the incorporated volume for inclusion in the Validation Report.
- Volume of grout mix utilising the impacted material must be tracked volumetrically and final placement depth confirmed with documentation provided for inclusion in the Validation Report; and
- The results of the validation sampling are to be detailed and presented in a final Validation Report.

5.8 VALIDATION PROGRAMME

Validation soil sampling will be undertaken to confirm that impacted material has been removed, assessed for reuse, incorporated into the grout mix and injected into the grout void. Records of volume of material reuse and a confirmation of grout placement will be required for inclusion into the final site validation report. The validation process is discussed in the sections below.

5.8.1 General

Table 5-3 outlines a validation approach to demonstrate the effectiveness of remedial works.

Table 5-3: Summary of validation areas and proposed validation method

Validation Area	Proposed Validation Method
Proposed development footprint in western section of the Site	Validation is to be undertaken as follows: - Validation of remaining fill soils/shallow residual material through visual (confirmation impacted layer removed) and laboratory analyses of soil samples collected from the base and sides of the excavation following removal of contaminated soils and placement into stockpile (s). - Clean and impacted material stockpiles to be tracked within the Site and their respective volumes surveyed. A figure showing the locations of the stockpiles is to be included in the final validation report. - Assessment of stockpile for ASLP leachability of metals and PAH. Details to be provided with the final Validation Report. - Confirmation of volume of fill material incorporated into the grouting mix. Records of volumes incorporated to be retained and included in the final Validation Report. - Confirmation of grout mix volume (containing impacted material) injected into mine voids. Documentation to be provided confirming that impacted material was appropriately reused within the mix and injected into the mine voids (volumes and final placement depths). - If excavation is backfilled, records of imported material type and conformance with the requirements of the RAP are to be retained and included in the final Validation Report. - Material that is disposed to landfill (if required) will be tracked and dockets provided in the Validation Report

5.8.2 Soil Validation Strategy

Validation soil sampling will be completed in accordance with the following guidelines:

- Australian Standard AS 4482.1 (1997) Guide to the Sampling and Investigation of Potentially Contaminated Sites.
- ASC NEPM (2013).

Following completion of the excavation works, a suitably qualified environmental scientist will collect a minimum of one sample per 25 square meters from the walls and base of the remediated excavation. Validation sampling locations should typically be systematic, however areas identified to contain remnant impacted material must be targeted to provide a conservative approach to validation.

Samples will be analysed for the schedule of parameters included in Section 5.10.2. Where significant number of validation samples or excavations continually fail the Investigation Levels, other validation technique (e.g. by use of statistics, etc.) may be undertaken. Alternatively, other remediation and/or management strategy can be adopted.

The following steps will be undertaken in order to obtain representative validation samples for laboratory analysis:

- Samples will be collected from the remediated areas directly by hand or by using hand tools (stainless steel hand augers or shovels or trowels).
- Samples will be placed into laboratory-supplied glass jars.
- Hand tools used during sample collection will be decontaminated between samples by rinsing with phosphate-free detergent and potable water.
- A clean pair of disposable nitrile gloves will be worn when handling samples.
- Samples will be placed into secure containers after collection; and
- Samples will be submitted to a NATA-accredited laboratory under chain of custody conditions.

Based on the validation sampling results, one of the following actions will be taken:

- If some of the validation samples fail the remediation (acceptance) criteria, the soil identified as failing the remediation criteria will be removed and placed within the stockpile of contaminated material. Further validation of the soils exposed following removal will occur (laboratory analysis).
- If some of the validation samples fail the remediation (acceptance) criteria and further excavation is not considered practicable, alternate remedial strategies and / or risk assessment to assess the significance of the remaining contamination may be considered. A proposal for management will be prepared by Coffey and reviewed by the nominated CEnvP-SC.

If validation samples meet the remediation criteria, no further remedial excavation works will be required, and we can proceed to the next step of the validation as per Table 5-3.

5.8.3 Validation of Surface Soils (0.0 to 0.3m bgs) for Reuse

Surface soils (0.0-0.3m bgs) at the site will be carefully excavated under the guidance of a suitably qualified environmental scientist and stockpiled separately for a reuse assessment against the ASC NEPM (2013) Residential A criteria, to understand if the overlying surface soils are suitable for reuse following remediation works. Where appropriate, soil samples shall be analysed for site COPCs, which include the following

- Heavy Metals (Arsenic, Cadmium, Chromium (total), Copper, Mercury, Nickel, Lead and Zinc)
- Total Recoverable Hydrocarbons (TRH)
- Benzene, Toluene, Ethylbenzene and Xylene
- Polycyclic Aromatic Hydrocarbons (PAH)

Sampling to confirm waste classification/reuse should be undertaken as per the guidance included in *Table 2, ASC NEPM Schedule B2* for stockpile samples as reproduced below in Table 5-4.

Table 5-4: Minimum number of samples for stockpiles 200m³ or less

Soil Volume m ³	No of Samples
< 75	3
75 – <100	4
100 – <125	5
125 – <150	6
150 – <175	7
175 – <200	8

For sample volumes > 200m³ a sampling rate reduction can be applied subject to a comparison of the 95%UCL_{AVERAGE} of the soil as per the *EPA Victoria, Industrial Waste Resource Guidelines 2009* (IWRG702, 2009). The applicable sampling rate is dependent on the heterogeneity of the material being assessed. The sampling rates applicable to generally homogeneous material in excess of 200m³ is included in Table 5-5.

Table 5-5: Minimum number of samples for soil volumes greater than 200m³ (1:25 or 95%UCL_{AVERAGE})

Soil Volume m ³	No of Samples at 1:25m ³	Minimum Number of Samples 95%UCL _{AVERAGE}
300	12	10
400	16	10
500	20	10
600	24	10
700	28	10
800	32	10
900	36	10
1000	40	10
1500	60	10
2000	80	10
2500	100	10
3000	120	12 (1:250)
4000	160	16 (1:250)
4500	180	18 (1:250)
5000	200	20 (1:250)
>5000	1:25	1:250

5.9 WASTE CLASSIFICATION FOR OFF-SITE DISPOSAL OR ON-SITE REUSE

5.9.1 Sampling of stockpiles

- To validate stockpiles for re-use on site, or to provide waste classification to allow disposal to landfill, the sampling rates included in Table 5-4 and Table 5-5 are applicable.
- Where stockpiles are not placed on impervious material, sampling of the stockpile footprints at a rate of 1 sample per 25m².
- Soil samples from large stockpiles will be taken with the aid of excavators to provide representative samples of material from within the stockpiles.
- Samples will be taken from the centre of the excavator bucket in order to minimise the potential for cross-contamination.
- A clean pair of disposable gloves will be worn when collecting each sample.
- Samples will be kept chilled while in the field and in transit to the laboratory.

5.9.2 Laboratory analysis for stockpile disposal to landfill

Where required, the stockpile waste classification samples will be dispatched to a NATA-accredited laboratory for analysis. Each sample will be analysed for the following suite of contaminants:

- Heavy Metals (Arsenic, Cadmium, Chromium (total), Copper, Mercury, Nickel, Lead and Zinc)
- Total Recoverable Hydrocarbons (TRH)
- Benzene, Toluene, Ethylbenzene and Xylene
- Polycyclic Aromatic Hydrocarbons (PAH)

In addition, selected samples may be analysed for leachability using the Toxicity Characteristic Leaching Procedure (TCLP), based on the initial results.

The volume and type of waste material will be tracked using the relevant material tracking form as described in Section 6.1.

Classified waste is to be transported to an appropriately licensed facility. In some cases (i.e. disposal of special (asbestos) waste), disposal approval may be required from the landfill prior to transportation.

5.9.3 Waste Classification

In order to provide a waste classification, the results of the laboratory analysis will be compared to threshold levels for General Solid Waste and Restricted Solid Waste in the NSW EPA (2014) *Waste Classification Guidelines*. If the criteria for Restricted Solid Waste is exceeded, then waste is classified as Hazardous Waste, unless a General Immobilisation Approval is able to be applied. Applicable volumetric sampling rates are as per Table 5-4 and Table 5-5.

5.9.4 Leachability of Metals and PAH in Impacted Stockpile

The impacted material stockpile is to be assessed for leachability of PAH and heavy metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc). The assessment must be undertaken to confirm the leachable risk presented by the material pre-incorporation into grout. This will provide a record should future questions be raised regarding the leachability of the material used and its potential risk to groundwater resources.

5.10 VALIDATION CRITERIA

The current zoning is R3 Residential, and the development as proposed includes the ongoing use of the site for residential zoning (primary school). Assessment criteria was selected for relevance to the sensitive (primary school) future use of the Site.

The criteria presented in Table 5-7 are intended to apply as Tier 1 risk assessment criteria based on certain site-specific characteristics. Where concentrations of a contaminant exceed the generic assessment criteria (after statistical analysis is appropriate), then further consideration of the specific exposure pathway is required which may warrant further investigation, assessment or the development of a strategy to mitigate the potential risks identified.

5.10.1 Soil health-based and ecological investigation levels

The soil investigation levels are adopted from the ASC NEPM.

Schedule B1, Guideline on Investigation Levels for Soil and Groundwater, of the ASC NEPM presents health-based investigation levels for different land uses (e.g. industrial / commercial, residential, recreational etc.) as well as ecological investigation levels.

Table 4 of the *ASC NEPM Schedule B7, Guideline on Derivation of Health-Based Investigation Levels*, shows the exposure pathways considered for these four generic land use categories. The content is re-produced in Table 5-6.

Table 5-6: Exposure pathways for Generic Land Use Categories

Exposure pathways	Land use scenario			
	HIL A	HIL B	HIL C	HIL D
Indoor inhalation of dust	Y	Y	N	Y
Outdoor inhalation of dust	Y	Y	Y	Y
Dermal contact with shallow soil and dust	Y	Y	Y	Y
Incidental ingestion of shallow soil and dust	Y	Y	Y	Y
Ingestion of home-grown vegetables and fruit	Y	N	N	N
Ingestion of home-grown poultry and/or eggs	N	N	N	N
Ingestion of soil adhering to home-grown produce	Y	N	N	N

Y – indicates exposure pathway has been considered in the derivation of the HILs

N – indicates exposure pathway has not been considered in the derivation of the HILs or interim soil vapour HILs

The proposed development will comprise offices and educational facilities with the primary sensitive population being infant and primary children. The “HIL-A” exposure scenario described in Schedule B7 of the ASC NEPM has been selected as most appropriate for the proposed development considered to fall in line with Residential land use. Residential land uses typically includes a variety of building densities, ranging from separate low-density dwellings to high-density unit blocks. The residential land-use scenario considered in the derivation of the HIL A values is low-density residential, including a sizeable garden.

The HIL A values are also applicable to the preliminary assessment of potential risks at sites where children are likely to be the most sensitive human receptors, including day-care centres, kindergartens, pre-schools and primary schools. The scenario is designed to represent a typical residential land use. The HIL A values will also be protective of circumstances where less exposure to soil would be likely (for example, older people, or without fruit and vegetable gardens).

Section 3.3.1 of Schedule B7 of the ASC NEPM (2013) states the following about sensitive populations applicable to the HIL-A criteria values.

“The populations that are usually most sensitive to health risks associated with soil contamination in both low-density and high-density residential settings and in the open space scenario are young children. The characteristics of exposed populations applied in the development of the HILs have been derived in accordance with the recommendations outlined by enHealth (2011). Young child residents and recreational users are therefore considered to be aged between 0 and 6 years of age and to live within the same dwelling or visit the same open-space area for their entire childhood.”

The definition of sensitive groups under the ASC NEPM (2013) falls in line with other jurisdictions that have further clarified “sensitive uses” in their guidelines and legislation. For example, The Department of Sustainability and Environment, Vic EPA, *PPN30: Potentially Contaminated Land*, (2005) defines “Sensitive use” as per the Ministerial Direction No. 1 – Potentially Contaminated Land (Direction No. 1) as follows:

“Ministerial Direction No. 1 – Potentially Contaminated Land (Direction No. 1) requires planning authorities when preparing planning scheme amendments, to satisfy themselves that the environmental conditions of land proposed to be used for a sensitive use (defined as residential, child-

care centre, pre-school centre or primary school), agriculture or public openspace are, or will be, suitable for that use”

The usage scenario of the proposed re-development supports a population of young children (students) and staff (in line with the applicable HIL A sensitive groups as defined in the ASC NEPM (2013)) and includes young children and the infirmed as groups intended to be primary users of the development.

Tetra Tech considers that the exposure pathways for the future site are consistent with those for the derivation of HIL A.

5.10.2 Health Investigation Levels

The relevant HIL value from the ASC NEPM for Residential land use for the Site is listed in Table 5-7.

Table 5-7: Summary of adopted health investigation levels

Contaminant	HIL A (mg/kg)
Applicable land use	Residential
BaP _{TEQ}	3
Total PAHs	300

5.11 DATA QUALITY OBJECTIVES

Data quality objectives (DQO) have been prepared to establish the type, quality, quantity of data, as well as temporal and spatial data required to achieve the specific validation objectives of the project. DQOs have been developed in accordance with the seven-step process documented in AS4482.1-2005 and Appendix B in Schedule B2 of the ASC NEPM.

The specific DQOs for validation are summarised in Table 5-8.

Table 5-8: Data Quality Objectives

Step 1 State the Problem	PAH impacted soil within fill material is widely dispersed within the western section of the Site, with specific areas identified for remediation. These impacts have the potential to pose unacceptable health risk to future site users including construction workers, students and teachers. Remediation and validation is required to render the site be suitable for the intended development (primary school)
Step 2 Identify the Decision	Does residual contamination on the site pose an unacceptable potential health-based and/or ecological risk for use as: • Infant/Primary School facility (Residential land use scenario (HIL-A)), including final design including buildings, hardstand pavement, open space and landscaped areas?
Step 3 Identify Inputs to the Decision	The primary inputs to assessing the above include: • data collected during the previous contamination assessments and delineation activity • relevant legislation and regulatory guidelines • field observations, civil design plans and survey drawings • laboratory analysis of samples collected during site validation

Step 4 Define the Boundaries of the Study	The investigation area is defined by the boundaries of the Site confirmed by detailed survey. The vertical boundary extends to approximately 1.0m bgs.
Step 5 Develop a Decision Rule	Both conditions below must be satisfied: If contaminant impact at the impacted locations identified for remediation is below the acceptance criteria as listed in Table 5-7 (HIL-A BaP/Total PAH) and Section 5.10, then the Site is considered suitable for the proposed Residential final land use. Otherwise, removal of impacted material around the failed validation sample is required.
Step 6 Specify Limits of Decision Error	There are two types of decision errors: - Sampling errors, which occur when the samples collected are not representative of the conditions within the investigation area; and - Measurement errors, which occur during sample collection, handling, preparation, analysis and data reduction. The null hypothesis for this study is: - Contaminant concentrations within the Site soils are more than the adopted investigation levels. These errors may lead the decision maker to make the following errors: - Deciding that the soils are of acceptable quality and, therefore, the final surface is deemed suitable for the proposed land uses when the reverse is true; and - Deciding that the soils are contaminated and, therefore, not suitable for the proposed land uses when the reverse is true. An assessment will be made as to the likelihood of a decision error being made based on the results of a QA/QC assessment and the closeness of the data to assessment criteria.
Step 7 Optimise the Design for Obtaining Data	The validation programme is outlined in Section 5.8 and is designed to assess that the remediation goals have been reached and that the site is suitable for the intended use

5.11.1 Quality Assurance / Quality Control

DQIs for the project will be based on the field and laboratory considerations in the table in Appendix V of NSW DECC (2006) and NEPM Schedule B2 Appendix B, (NEPC, 2013). These comprise:

- Completeness – a measure of the amount of useable data (expressed as %) from a data collection activity.
- Comparability – the confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event.
- Representativeness – the confidence (expressed qualitatively) that data are representative of each media present on the site.
- Precision – a quantitative measure of the variability (or reproducibility) of data; and
- Accuracy – a quantitative measure of the closeness of reported data to the true value.

Laboratory analyses will be undertaken in laboratories which are NATA accredited for the analyses undertaken. The following laboratory QA/QC analyses will be undertaken:

- Laboratory duplicates – at least one per batch
- Matrix spike – at least one per batch or approximately at 5% of analyses
- Laboratory blank – at least one per batch or approximately at 5% of analyses
- Laboratory control samples – at least one per batch or approximately at 5% of analyses

- Surrogates – for relevant analytes
- Surrogate spikes – for relevant analytes

Specific indicators for field and laboratory QC samples are shown below in Table 5-9.

Table 5-9: Data Quality Indicators for Analytical Results

Type of Quality Control Sample	Control Limit
Duplicate Samples	Relative Percentage Difference (RPD) within 50% for soil
Triplicate Samples	RPD within 50% for soil
Spikes	Recoveries within the following ranges • 70% - 130% for inorganics / metals • 60% - 140% for organics • or as specified in laboratory's quality plan
Blanks	Analytes not detected

5.11.2 Imported Fill Materials

Imported material should be assessed prior to importation and **must** meet one of the following material types:

- Virgin Excavated Natural Material (VENM).
- Suitable exempt material (such as ENM). This material will be assessed in accordance with *NSW EPA Excavated Natural Material Order 2014* and *NSW EPA The Excavated Natural Material Exemption 2014*.
- Other materials approved by NSW EPA resource recovery orders or resource recovery exemptions determined to be suitable for importation.
- Some commercial material or quarry product may be used (e.g. road aggregate, re-cycled building materials, topsoil, mulch, etc.) with prior approval from a suitably qualified environmental consultant.
- Imported topsoil, landscaping or soil growth media must be compliant with Australian Standard AS4419:2018 with relevant documentation provided by the supplier confirming compliance.

Material being imported to the site shall also be tracked and the following information shall also be recorded:

- Truck and/or bin registration number
- Origin of material
- Material type
- Approximate volume
- Relevant classification document
- Proposed use onsite
- Proposed location for use
- Observations and photographs of material and confirmation it matches approved material.

5.12 REPORTING

A site validation report will be prepared, following the soil remediation and validation works, summarising the results of the soil remediation and validation of the site. The report will be written in accordance with relevant sections of the NSW EPA (2020) CRCL and Schedule B2 of the ASC NEPM), documenting the works as completed. The validation report will provide a statement as to the suitability of the site for the proposed land use.

The validation report will also include evidence of the disposal of material removed from the site (e.g. waste disposal dockets).

This report will contain information including:

- Information demonstrating compliance with appropriate regulations and guidelines.
- Soil validation analysis results and survey drawings showing the location of the isolated contaminated material.
- Details of the source, classification and suitability of imported materials.
- Validation of the base of the excavation following removal of the impacted fill layer.
- Variations to the strategy undertaken during the implementation of the remedial works.
- Details of environmental incidents and/or unexpected finds of contamination occurring during remedial works and the actions undertaken in response to these incidents.
- Details on waste classification, tracking and off-site disposal.
- Clear statement of the suitability of the site that is the subject of the validation report, for the proposed use.

The report will also serve to document the remediation works for future reference.

5.13 CONTINGENCY STRATEGY

The preferred remedial strategy for the PAH impacted soil is Option 4 as presented in Table 5-1 – mixing with grout and placement within mine voids below the site. The material will replace externally purchased fly-ash for use within the grout mix applied within the areas of low-strength grout.

The point of potential failure is the inability to completely reuse the total volume of PAH impacted material excavated into the grout mix (volumetric requirement exceeded). Should this occur, the final control strategy will be the offsite disposal of excess material to landfill under a NSW EPA General Immobilisation Approval (GIA).

The EPA issues immobilisation approvals in accordance with *Part 10 of the Protection of the Environment Operations (Waste) Regulation 2014*. Immobilisation approvals may either be general or specific. The most applicable general approval that may be used is the *1999/05 – Ash, ash-contaminated natural excavated materials or coal-contaminated natural excavated materials*. This GIA is considered applicable given the benzo(a)pyrene and other PAH compounds within the boiler ash material are immobilised within a vitrified carbonaceous and siliceous matrix.

Should the GIA not be applicable, a Specific Immobilisation Approval (SIA) will be pursued. Specific immobilisation approvals are issued for a particular waste which meets the non-liquid criteria contained in the Waste Classification Guidelines. The approvals issued are subject to conditions which include:

- the period for which the approval is valid.
- the treatment required to immobilise the waste, for waste that is not naturally immobilised.
- testing and record keeping requirements.
- how waste subject to the approval may be classified for disposal – essentially the contaminants of concern can be classified on TCLP (toxicity characteristics leaching procedure) alone, the SCC (specific contaminant concentration) is not taken into account for waste classification purposes.
- disposal requirements; and
- any other conditions, such as waste tracking, which are required

6. SITE MANAGEMENT DURING REMEDIATION

The management strategies for environmental issues that may arise during site works are discussed in the sections below. These strategies are considered a minimum requirement to be followed by the remediation contractor before and during remediation activities. It is envisaged that the remediation contractor will develop site specific environmental work plans for soil removal.

6.1 MATERIAL TRACKING

During construction works, the Site Superintendent / Principal Contractor will be responsible for the tracking of soil and fill materials that are imported to the site, and removed from the site, to provide required information for site validation.

Accurate records must be maintained to ensure that, on-site reuse of excavated soil is consistent with site acceptance criteria. A register of validation samples collected from excavations and stockpiles will be maintained by the environmental consultant. Validation activities should be carried out by a suitably qualified environmental consultant in accordance with the relevant NSW EPA endorsed guidelines (if required).

Material tracking forms will be used during construction works to provide relevant information about:

- **Off-site Reuse / Disposal Form:** provides a record of the soil-like materials removed from the site including the type, volume, origin and approved fate of the material based on advice from the environmental consultant.
- **Material Stockpiling Form:** provides a record of soil-like material temporarily placed in stockpiles within the site including the type, origin, volume and temporary on-site storage location of the material. Where known, the intended fate of the material would also be documented. This form would be used for material excavated from the site awaiting beneficial on-site reuse and/or off-site disposal, and material imported to the site for use as fill.
- **Imported Materials:** Must be tracked as per the requirements outlined in Section 6.1.

In addition to the above forms, copies of weighbridge dockets from off-site disposal and importation of material will be retained by the Site Superintendent / Principal Contractor.

6.2 SOIL MANAGEMENT

6.2.1 Management of Earthworks

Given that the proposed works will be undertaken in proximity to the general public, there is a likelihood for soil and sediments from bulk earthworks to have indirect impact. Prior to the commencement of construction and excavation works, sandbags or similar water diversion measures will be used to divert surface runoff away from construction zones and proposed excavation areas towards any existing site drainage lines or constructed basins. This will be typically established just outside of the works perimeter as the sands are highly permeable, which will in itself limit direct runoff opportunities.

Activities that involve soil disturbance will be avoided during rain periods or when heavy rain is forecast.

Excavation areas will be isolated from the surrounding site through the use of temporary barricades and fencing.

6.2.2 Management of Excavated Material

Excavated soil should be stockpiled on an impervious surface (hardstand, HDPE, tarpaulin, construction plastic) and in areas designated by the Site Superintendent / Principal Contractor for additional waste classification. Any stockpiling of material on bare ground may require re-validation for stockpile footprints following removal of stockpiles, particularly for storage of asbestos impacted fill. Stockpiles potentially impacted by asbestos will be covered and stored separately to other materials.

6.2.3 Haulage of Soils

Trucks transporting soil or imported fill to and from the site must be covered to prevent dust generation. Dust generation from movement of material within the works boundaries should also be minimised either by covering the load or by wetting the load down prior to transport from one section of the site to the next. The following procedures will be followed on-site to limit the potential for transport of soil/dust off-site via vehicular movement:

- Vehicles, plant and equipment on the site at any one time will be kept to a practical minimum.
- Vehicles, plant and equipment entry to and exit from the site will be kept to a practical minimum.
- Movements within site to use defined haul roads.
- Transport of loads within the site boundaries (cut to fill activities) should minimise the generation of dust (covering or wetting down the loads).
- Plant and equipment will be washed down before it leaves the site.

6.2.4 Requirements for Material Transport

Minimum requirements for transport of material from the site are:

- All material transported off-site by a licensed contractor.
- Excess dust or load material will be removed from the outside of the truck (and dog where relevant) prior to leaving the site. This may require on-site a wheel wash or spray wash to dislodge excess material. Where soil is tracked outside the site, it will be promptly cleaned up in a manner that does not adversely affect the surrounding land, surface water bodies or local stormwater system.
- Trucks will be covered prior to leaving the site and throughout travel to the disposal site.
- Trucks will enter and exit the site in predetermined points and will follow strict transport routes to and from the disposal site/s.
- Trucks will not wait in the streets surrounding the site.

6.2.5 Licenced Waste Disposal Facilities

The following facilities are licenced to accept various types of contaminated soils that may be required to be disposed during the works.

Table 6-1: Waste facilities and types of waste accepted (Newcastle)

Waste Facility	Address	Environmental Protection Licence	Waste Accepted
Summerhill Waste Management Centre	141 Minmi Rd, Wallsend NSW 2287	5897	General Solid Waste, Special Waste Asbestos
Cleanaway Technical Services	Raven Street, Kooragang, NSW 2304	6124	Various Hazardous and Restricted materials including contaminated soil and liquids

6.3 DUST

The remediation works will involve excavation of the subsurface, movement of soils, and general vehicular movements across the site. As such, dust generation is considered a potential environmental impact to the surrounding environment and the public.

The following management measures should be implemented to prevent dust impacts.

- A communications and complaints register should be kept on site to ensure that concerns of local residents and workers are recorded and addressed.
- Boundary fences should be maintained around the perimeter of the site to prevent dust from migrating laterally from these areas.
- Excavated soils should be watered as required to minimise the potential for dust generation.
- If dust migration from excavation areas is considered excessive due to high winds, the works should be delayed or limited during these periods.
- Trucks removing material from the site should have loads covered.
- Vehicular movements entering and exiting the site should be kept to a minimum; and
- Works should be limited during times of high winds.

Stockpile Areas

Based on the proposed remedial strategy, stockpiling of soils is considered likely. The following procedures are to be followed:

- Stockpiles must be established on high-density polyethylene (HDPE) or equivalent.
- Stockpiles should be regularly watered to minimise dust generation.
- Stockpiles should be covered with HDPE or equivalent, after being created in order to minimise the potential for dust generation and generation of runoff; and
- Stockpile heights should not exceed the heights of the boundary fences.

6.4 STORMWATER MANAGEMENT

Surface water runoff resulting from rainfall must be managed by the Contractor in accordance with an approved Stormwater Management Plan prepared as part of their Construction Environmental Management Plan. Stormwater must be managed as per industry practice in accordance with *Landcom, Managing Urban Stormwater: Soils and Construction – Volume 1 (2004)*.

6.5 NOISE CONTROLS

Noise will be generated during site works and is considered a potential environmental issue. The noise that will be generated is anticipated to be mainly derived from earthworks activities. It is anticipated that the level of noise generated will not exceed that of a typical construction site.

Noise limitations imposed by Council are to be adhered to. This may include restrictions on working days and hours, and acceptable noise levels.

A noise monitoring programme may be required if noise cannot be easily managed. This may include noise surveys at the source and at surrounding properties.

6.6 TRAFFIC MANAGEMENT

The management and control of traffic (both vehicular and pedestrian as applicable) must be managed by the Contractor in accordance with an approved Traffic Management Plan (TMP). The TMP must be prepared as part of their Construction Environmental Management Plan developed for the remediation works. The TMP must ensure the following:

- The safety of workers, the public, vehicular traffic, sub-contractors, the client and their representatives, pedestrians and cyclists during the execution of the remediation works.

- Disturbances and delays to the smooth flow of traffic are minimised during the remediation works.
- Disruption and disturbances to nearby and surrounding businesses are kept to a minimum.
- Disruptions of residential activities are kept to a minimum.
- Control of the interactions between pedestrians and vehicles.
- Identification and control of accesses into and out of the Site.

6.7 SAFETY AND ENVIRONMENTAL MANAGEMENT

6.7.1 Personal Protective Equipment during Construction

In order to reduce short and long-term health risks associated with the potential exposure to the chemicals of concern, the minimum level of Personal Protective Equipment (PPE) required for people, during site preparation, excavation works, stockpiling and the reuse of impacted PAH soil down into the mine workings beneath the site, is listed below:

- **Respiratory Protection.** Respiratory protection is required to prevent inhalation of airborne dusts. A minimum of a P1 rated respirator fitted with a P1 rated cartridge is to be used whilst working within the impacted areas. The respirator will also be needed to be fit tested.
- **Head Protection.** Personnel working around excavation equipment will be required to wear a hard-hat. The hard hat must be in date, worn properly and not altered in ways that would lessen the degree of protection offered.
- **Eye Protection.** Eye protection is required to prevent eye injuries resulting from contact with dust, contaminated soil or liquid. Safety glasses are required to be worn by site personnel during the works.
- **Foot Protection.** Steel toed boots without laces will be worn by on-site personnel.
- **Skin Protection.** Long sleeves and trousers are to be worn. Skin protection will be required to prevent absorption of contaminated soil into the body. Gloves will be worn by personnel involved in site activities which will come into contact with contaminated soil or liquid. Sunscreen (SPF +30) shall also be worn to protect exposed skin areas not covered by PPE from the sun.
- **Hearing Protection.** Site workers will be required to have hearing protection (ear plugs or earmuffs) on site during works. Personnel who are likely to be exposed to high noise levels on site will be required to wear hearing protection.

Site personnel will be made aware during induction and at toolbox meetings that PPE required to be worn may limit manual dexterity, hearing, visibility and may increase the difficulty of performing tasks. PPE places an additional strain on the user when performing work that requires physical activity.

Eating, drinking, chewing gum or tobacco, smoking or other practices that involves hand to mouth transfer increases the probability of ingestion of foreign matter into the body. Hands must be thoroughly washed before eating, drinking or smoking.

6.8 WORKING HOURS

Working hours would need to be consistent with Council requirements. These are considered to be in the order of 7am to 6pm Monday to Friday and 8am to 1pm on Saturdays. Due to the school being operational Monday to Friday during semester, the works are recommended to be undertaken during school break/holiday periods only.

6.9 SITE ACCESS RESTRICTIONS

During the remediation and validation works it will be necessary to restrict site access solely to authorised staff and contractors who have appropriate levels of personal protective equipment and hazard awareness.

Temporary site fencing and appropriate signage is to be maintained, and unauthorised personnel are to be kept outside.

7. OCCUPATIONAL HEALTH AND SAFETY

7.1 HEALTH AND SAFETY PLANS

Prior to the commencement of site works, Coffey will prepare a Health, Safety, Security and Environmental (HSSE) Plan. The HSSE Plan will include the following information:

- Likely hazards and control measures.
- Emergency assembly areas.
- Emergency contact numbers.
- Site security procedures.
- First aid wardens on the site; and
- Procedures for the safe handling of chemicals and contaminated soil and groundwater.

The HSSE Plan should be reviewed when new tasks are undertaken. The HSSE Plan should be updated as required to cover the tasks undertaken.

In addition, subcontractors engaged by Coffey should prepare Safe Work Method Statements (SWMS) for their activities. The SWMS should contain the following information:

- The steps of the activity to be performed.
- Hazards and perceived risks for each step of the activity.
- Control measures to be adopted to eliminate or minimise the hazards; and
- The persons responsible for implementing control measures.

7.2 EMERGENCY AND INCIDENT MANAGEMENT

An Emergency and Incident Management Plan (EIMP) must be prepared by the Contractor and approved for use by Newcastle Grammar/APP. The EIMP must guide the effective management of emergency and incident response. The EIMP must:

- Provide measures to minimise and control the risk of occurrence of incidents via a risk identification and planned mitigation process.
- Ensure timely communication of incidents with relevant stakeholders and local authorities including the University, EPA, Safework NSW and any affected businesses or residential interests.
- Ensure the plan is implemented correctly and staff are made aware of relevant emergency procedures.
- Identify hazardous storage areas as required.
- Identify nearby waterways and other sensitive receptors.
- Location and names of residential and business contacts in proximity to the Site.
- Provide guidance for coordinated incident management response and contingency actions.

8. LICENSES AND APPROVALS

This section discusses some of the regulatory compliance requirements associated with the remediation. It is important to note that this section is not exhaustive, and the Contractor must ensure they comply with all relevant and applicable legislation and guidelines.

8.1 DEVELOPMENT APPLICATION FOR CATEGORY 2 REMEDIATION

The preferred RAP strategy includes the excavation and reuse of PAH impacted fill soils as grouting mix and classifies as Category 2 remediation works. Under *State Environmental Planning Policy – Remediation of Land* (SEPP 55) Category 2 remediation works may be carried out without development consent. Councils *Contaminated Land Technical Manual 2012* (Technical Manual) have been considered.

The Technical Manual states the following regarding the disposal of contaminated soil:

“The disposal of contaminated soil shall have regard to the provision of both the Protection of the Environment Operations Act 1997 and Regulations and relevant state agency waste guidelines. Any queries associated with the off-site disposal of waste from a contaminated site should be referred to the appropriate NSW state government agency. If contaminated soil or other waste is transported to a site unlawfully, the owner of the waste and the transporter are both guilty of an offence.”

In accordance with clause 16 of SEPP 55, prior notice of category 2 remediation work to Council is required at least 30 days before commencement of works.

In addition to the information that must be submitted to Council in clause 16 of SEPP 55, Council will require the following information to be submitted at least 14 days prior to the commencement of category 2 remediation works:

- copies of any Preliminary Investigation, Detailed Investigation and Remedial Action Plan for the subject site
- contact details for the remediation contractor and party responsible for ensuring compliance of remediation work with all relevant regulatory requirements (if different to remediation contractor).

Although consent is not required for Category 2 remediation work, Council will need to be satisfied that the site is suitable for the proposed use when considering any subsequent development applications for the subject site. Hence it is recommended that comprehensive records are maintained during the remediation and validation works for all sites.

Although consent is not required for Category 2 remediation work, Council will need to be satisfied that the site is suitable for the proposed use when considering any subsequent development applications for the site. Hence it is recommended that comprehensive records are maintained during the remediation and validation works for all sites.

8.2 WASTE CLASSIFICATION

Surplus materials disposed from the site must be classified in accordance with the *NSW EPA (2014) Waste Classification Guidelines*. All impacted soil and water requiring off-site disposal will be transported and disposed of to either a licensed landfill, liquid waste facility or to public sewer (after obtaining approvals for disposal) following on site treatment. Any wastes leaving the site will need to be transported by a NSW EPA licensed contractor in accordance with regulation. All material leaving the site will be tracked and documented.

8.3 OTHER REQUIREMENTS

Other legislative requirements that may be applicable include, but are not limited to:

- Contaminated Land Management Act 1997
- Environmental Planning and Assessment Act 1979
- Protection of the Environment Operations Act 1997
- Waste Avoidance and Resource Recovery Act 2001

9. RESPONSIBILITIES

A summary of the responsibilities in relation to the RAP is tabulated in Table 9-1.

Table 9-1: Summary of responsibilities

Role	Contact Information	Responsibilities
Site Owner/Representative	Brendan Fisher (APP)	- Project management and execution, Newcastle Grammar School authorised representative. - Preparation of Category 2 Remediation notice to City of Newcastle.
Site Superintendent / Principal Contractor		- Arrange for themselves (including contractors/subcontractors) and relevant representatives to be inducted into this RAP, both now and in the future as required, by a competent environmental professional or appropriately trained alternative representative. - Ensure that this RAP is implemented and adhered to. - Provide relevant information regarding site environmental management to contractors and subcontractors working at the Site. - Ensure that contractors and subcontractors undertaking works at the Site are fulfilling the environmental protection/management responsibilities for the work, including holding relevant licences and permits. - Maintain records and documents produced as a result of this RAP, especially for movement of soil materials from and onto the Site.
Contractors / subcontractors		- Liaise with the Site Superintendent / Principal Contractor, other contractors and parties, and relevant authorities. - Ensure overall compliance with the RAP, applicable legislation and regulations for their contribution to site works. - Regular reporting of the RAP performance to the Site Superintendent / Principal Contractor.
Environmental Consultant		- Induct the Civil Contractor into the requirements of the RAP, as required. - Provide advice to the Site Superintendent / Principal Contractor and relevant parties regarding management of environmental issues as detailed in this RAP. - Address unexpected finds, as required. - Required to validate the remediation and make a conclusion on the suitability of the site for the proposed end use (s). - Undertake periodic review of the effectiveness of the RAP, and revise the RAP as required at the request of the Site Superintendent / Principal Contractor.

10. CONCLUSIONS

The remediation options outlined in Table 5-1 were assessed in conjunction with proposed final land uses and conceptual plans for the Site. These include:

- Final development for use as a primary school incorporating buildings, hardstand areas and landscaping.

Factors considered during the assessment included:

- The cost and time associated with excavation and offsite disposal of PAH impacted fill material.
- Understanding the concentration distribution of PAHs both vertically and horizontally at the impacted locations.
- Ability to identify the contaminated material visually in the soil profile and differentiate from uncontaminated soils.
- Identifying an option for the beneficial reuse of the PAH impacted material in mine subsidence grouting activities.

Based on consideration of potential remedial options, the preferred remedial strategy for the PAH impacted soil is Option 4 as presented in Table 5-1 – mixing with grout and placement within mine voids below the site. The material will replace externally purchased fly-ash for use within the grout mix applied within the areas of low-strength grout.

The remediation strategy includes the removal of contaminated fill soils from the investigation area in the western portion of the Site as shown in Figure 2, Appendix B:. This will be followed by temporary stockpiling of the impacted soils (segregated from the cleaner overlying soil layer). The material will be assessed for leachability of metals and PAH prior to incorporation into the grout mix.

Following the removal of impacted fill soils, the excavation may require the importation of clean fill materials to bring the investigation area level with the existing ground at the Site. Imported material must be assessed prior to importation to site and must meet at least one of the requirements outlined in Section 5.11.2.

The decision to remove the locations with PAH concentrations exceeding the land use scenario for the site, was based on the following two considerations:

3. Generally, the contaminated PAH layer identified within the soil profile represents a PAH hotspot (2.5 times the BaP_{TEQ} and Total PAH) Residential HIL-A values, hence is identified for removal.
4. The ongoing sensitive use of the Site as an Infant/Primary School facility, required further consideration to ensure the remedial works proposed, address the PAH issue identified.

Soil will be removed from the impacted investigation area outlined in Figure 2, Appendix A:, by the earthworks/remediation contractor under the guidance of a suitably qualified Environmental Scientist. The excavated soils will be stockpiled within the excavated footprint atop HDPE liner to avoid contaminated soils impacted underlying residual soils. The stockpiled soils will be covered to lower the risk of infiltration of rainwater.

The excavated impacted material will be reused within grouting slurry proposed to infill mine voids underlying the Site. The impacted material used in the grout mix must be volumetrically tracked from source to final placement location (including depth) and the total volume of material utilised recorded and documented for inclusion in the final validation report.

The RAP as prepared provides sufficient guidance on the remediation and validation activities to be undertaken in order to render the Site suitable for the proposed development of a primary school. The successful implementation of the RAP assumes the procedures within this RAP including the remedial guidance and final validation methodology, will be followed and any departures duly noted.

The implementation of this RAP includes a combination of contaminated material removal followed by the incorporation of the contaminated boiler ash material into cementitious grout mix for use in mine subsidence void remediation beneath the Site. By removing the exposure pathways to sensitive receptors Tetra Tech considers the Site can be made suitable for the proposed uses if this RAP is implemented.

11. LIMITATIONS

In preparing this report, current guidelines for assessment and management of contaminated land were followed. This work has been conducted in good faith in accordance with Tetra Tech's understanding of the client's brief and general accepted practice for environmental consulting.

This report was prepared for the Newcastle Grammar School with the objectives to provide guidance on the remediation and validation activities to be undertaken in order to render the site suitable for the proposed future development of a Primary School (Residential A land use setting). No warranty, expressed or implied, is made as to the information and professional advice included in this report. Anyone using this document does so at their own risk and should satisfy themselves concerning its applicability and, where necessary, should seek expert advice in relation to the particular situation.

12. BIBLIOGRAPHY

National Environment Protection Council (NEPC) (1999) National Environment Protection (Assessment of Site Contamination) Measure, amended in 2013

National Environment Protection Council (NEPC) (1999) National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM), which was amended in 2013 (ASC NEPM)

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

NSW EPA (2017), Contaminated Sites: Guidelines for the NSW Site Auditor Scheme

NSW EPA (1995), Contaminated Sites: Sampling Design Guidelines

NSW EPA (2014), Waste Classification Guidelines Part 1: Classifying Waste

Safe Work Australia (2011), Code of Practice: How to Manage and Control Asbestos in the Workplace.

Safe Work Australia (2011,) Code of Practice: How to Safely Remove Asbestos.

SEPP 55 State Environmental Planning Policy 55 – Remediation of Land.

Standards Australia (2005), Australian Standard (AS 4482.1-2005) Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-volatile and Semi-volatile Compounds

Tetra Tech Coffey Pty Ltd. (2021a), Newcastle Grammar School, Preliminary Site investigation (Tetra Tech Ref: 754-NTLGE282007-AE_Rev01)

Tetra Tech Coffey Pty Ltd. (2021b), Newcastle Grammar School, Acid Sulfate Soil Management Plan (Tetra Tech Ref: 754-NTLGE282007-AH)

Tetra tech Coffey Pty Ltd. (2021c), Geotechnical Assessment (Tetra Tech Ref: 754-NTLGE282007-AD)

IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY ENVIRONMENTAL REPORT

Introduction

This report has been prepared by Tetra Tech Coffey for you, as Tetra Tech Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice.

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Tetra Tech Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Tetra Tech Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Tetra Tech Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Tetra Tech Coffey should be kept apprised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statutes and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Tetra Tech Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Tetra Tech Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Tetra Tech Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Tetra Tech Coffey prepared the report and has familiarity with the site, Tetra Tech Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Tetra Tech Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

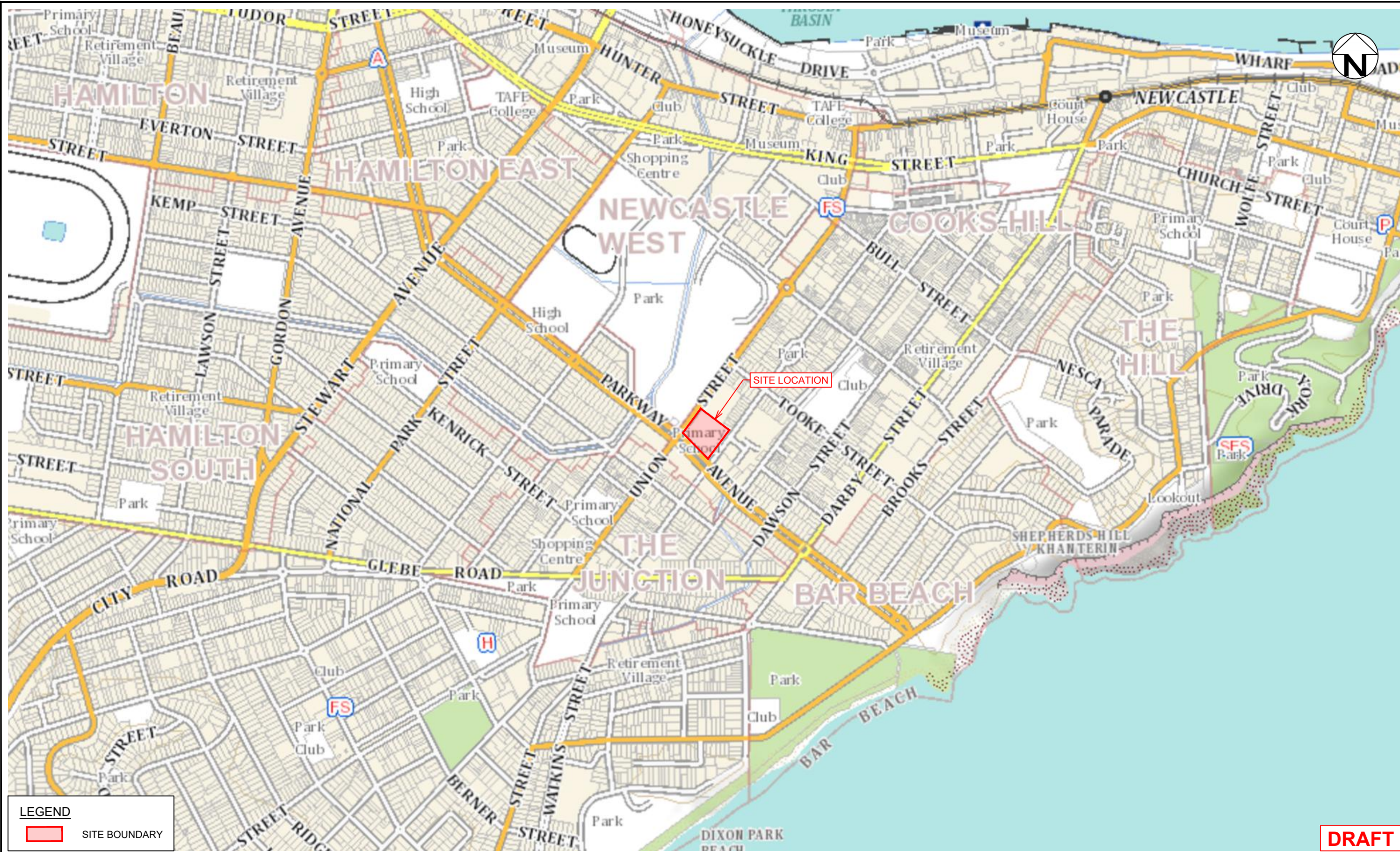
The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

APPENDIX A: FIGURES



LEGEND

SITE BOUNDARY

DRAFT

revision	no.	description			drawn	approved	date
	A	ORIGINAL ISSUE					

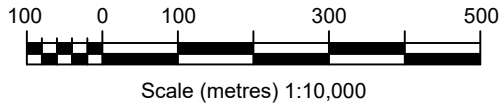


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drawn	SB/AW
approved	-
date	05/03/2021
scale	AS SHOWN
original size	A3



client:	APP CORPORATION LIMITED PTY LTD -NEWCASTLE GRAMMER SCHOOL		
project:	PRELIMINARY SITE INVESTIGATION NEWCASTLE GRAMMAR SCHOOL - PARK CAMPUS 127 UNION STREET, COOKS HILL, NSW		
title:	SITE LOCATION PLAN		
project no:	754-NTLGE282007-AE	drawing no:	FIGURE 1
		rev:	A

PLOT DATE: 5/03/2021 12:21:17 PM DWG FILE: P11 PROJECT: SYD-GEOTECHNICS 2 OTHER OFFICES: 9 ONTLC-GET54-NTLGE282007/CAD/754-NTLGE282007-AE.DWG



LEGEND

SITE BOUNDARY

● APPROXIMATE ENVIRONMENTAL BOREHOLE LOCATION (SHALLOW)

DRAFT

revision	no.	description			drawn	approved	date
	A	ORIGINAL ISSUE					

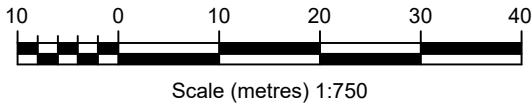


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drawn	SB/AW
approved	-
date	05/03/2021
scale	AS SHOWN
original size	A3



client:	APP CORPORATION LIMITED PTY LTD -NEWCASTLE GRAMMER SCHOOL		
project:	PRELIMINARY SITE INVESTIGATION NEWCASTLE GRAMMAR SCHOOL - PARK CAMPUS 127 UNION STREET, COOKS HILL, NSW		
title:	BOREHOLE LOCATION PLAN		
project no:	754-NTLGE282007-AE	drawing no:	FIGURE 2
		rev:	A

APPENDIX B: LABORATORY RESULTS TABLES

								Field_ID	BH1-0.0-0.2	BH1-3.2-3.4	BH2-0.0-0.2	BH2-2.8-3.0	BH3-0.0-0.2	BH3-0.4-0.6	BH3-1.5-1.7
								LocCode	BH1-0.0-0.2	BH1-3.2-3.4	BH2-0.0-0.2	BH2-2.8-3.0	BH3-0.0-0.2	BH3-0.4-0.6	BH3-1.5-1.7
								Sampled_Date	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21
				NEPM 2013 HILs Residential A Soil	EIL/ESL	HSL-A/B, 0 to <1m, Sand Soils for Vapour Intrusion	HSL-A/B, 1 to <2m, Sand Soils for Vapour Intrusion	HSL-intrusive maintenance worker, 0 to <2m, Sand for Vapour Intrusion							
Method	ChemName	Units	EQL												
Metals	Arsenic	mg/kg	2	100	100				<2	4.4	3.2	4.9	2.4	<2	9.8
	Cadmium	mg/kg	0.4	20					<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
	Chromium	mg/kg	5		480				8.2	7.8	13	9.1	10	7.4	30
	Copper	mg/kg	5	6000	120				7.2	27	16	14	9.8	<5	<5
	Lead	mg/kg	5	300	1100				8.4	37	56	20	24	5.5	6.1
	Mercury	mg/kg	0.1	40					0.3	0.1	0.9	<0.1	<0.1	<0.1	<0.1
	Nickel	mg/kg	5	400	50				<5	<5	5.3	5.5	<5	<5	<5
	Zinc	mg/kg	5	7400	290				22	33	150	35	56	7.7	<5
Inorgan	Moisture Content (dried @ 103°C)	%	1						6.7	20	14	16	9.6	6.4	16
Organic	Naphthalene	mg/kg	0.5		170	3			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	F2-NAPHTHALENE	mg/kg	50				240		<50	<50	<50	<50	<50	<50	<50
	C6 - C9	mg/kg	20						<20	<20	<20	<20	<20	<20	<20
	C10 - C40 (Sum of total)	mg/kg	100						<100	<100	<100	<100	<100	<100	<100
	C6-C10 less BTEX (F1)	mg/kg	20			44	70		<20	<20	<20	<20	<20	<20	<20
	C10-C16	mg/kg	50		120	110			<50	<50	<50	<50	<50	<50	<50
	C16-C34	mg/kg	100		1300				<100	<100	<100	<100	<100	<100	<100
	C34-C40	mg/kg	100		5600				<100	<100	<100	<100	<100	<100	<100
PAH	C6 - C10	mg/kg	20		120				<20	<20	<20	<20	<20	<20	<20
	Acenaphthene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Acenaphthylene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Anthracene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a)anthracene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene	mg/kg	0.5		0.7				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene TEQ (lower bound) *	MG/KG	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene TEQ (medium bound) *	MG/KG	0.5	3					0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Benzo(a)pyrene TEQ (upper bound) *	MG/KG	0.5						1.2	1.2	1.2	1.2	1.2	1.2	1.2
	Benzo(g,h,i)perylene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(k)fluoranthene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Chrysene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo[b+j]fluoranthene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Fluoranthene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Fluorene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Naphthalene	mg/kg	0.5			3			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Phenanthrene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Pyrene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Total PAHs	mg/kg	0.5	300					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TPH	C10 - C14	mg/kg	20						<20	<20	<20	<20	<20	<20	<20
	C15 - C28	mg/kg	50						<50	<50	<50	<50	60	<50	<50
	C29 - C36	mg/kg	50						<50	<50	<50	<50	53	<50	<50
	C10 - C36 (Sum of total)	mg/kg	50						<50	<50	<50	<50	113	<50	<50
	Volatile	Benzene	mg/kg	0.1		65	0.5	0.5	77	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene		mg/kg	0.1		125	57			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene		mg/kg	0.1		105	160	220		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Xylene (m & p)		mg/kg	0.2						<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Xylene (o)		mg/kg	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Xylene Total		mg/kg	0.3		45	40	60		<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

Result NEPM 2013 HILs Residential A Soil

Result Environmental Investigation/Screening Levels - Urban Residential/public open space

Result Health Screening Level Residential A/B Landuse, 0 to <2m, Sand for

Result HSL-intrusive maintenance worker, 0 to <2m, Sand for Vapour Intrusion

Notes:

* Sample Re-analysed by Laboratory

380 Value exceeds HIL-A (UCL 95% Stat used = 143mg/kg)

									Field_ID	BH4-0.0-0.2	BH4-0.3-0.5	*BH4-0.3-0.5	BH4-1.4-1.6	BH5-0.3-0.5	BH5-1.0-1.2	BH6-0.0-0.2	BH6-1.6-1.9	BH7-0.0-0.2	BH7-0.5-0.6
									LocCode	BH4-0.0-0.2	BH4-0.3-0.5	*BH4-0.3-0.5	BH4-1.4-1.6	BH5-0.3-0.5	BH5-1.0-1.2	BH6-0.0-0.2	BH6-1.6-1.9	BH7-0.0-0.2	BH7-0.5-0.6
									Sampled_Date	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21	15-Jan-21
				NEPM 2013 HILs Residential A Soil	EIL/ESL	HSL-A/B, 0 to <1m, Sand Soils for Vapour Intrusion	HSL-A/B, 1 to <2m, Sand Soils for Vapour Intrusion	HSL-intrusive maintenance worker, 0 to <2m, Sand for Vapour Intrusion											
Metho	ChemName	Units	EQL																
Metals	Arsenic	mg/kg	2	100	100					3.9	13	12	<2	3.7	9.4	4.1	7.2	2	3.9
	Cadmium	mg/kg	0.4	20						<0.4	0.6	0.7	<0.4	<0.4	<0.4	<0.4	1.3	<0.4	<0.4
	Chromium	mg/kg	5		480					8.9	13	12	<5	7.2	14	7.8	14	<5	8.6
	Copper	mg/kg	5	6000	120					8.7	50	1000	<5	56	5.3	16	36	5.3	23
	Lead	mg/kg	5	300	1100					16	150	160	<5	12	17	18	180	7.6	380
	Mercury	mg/kg	0.1	40						<0.1	<0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	0.9	<0.1	0.3
	Nickel	mg/kg	5	400	50					9.3	9.7	7.6	<5	<5	<5	<5	28	<5	10
	Zinc	mg/kg	5	7400	290					39	380	270	<5	21	8.7	61	730	28	220
Inorgan	Moisture Content (dried @ 103°C)	%	1							9.8	18	13	16	14	9.7	19	25	9.2	10
Organic	Naphthalene	mg/kg	0.5		170	3				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	F2-NAPHTHALENE	mg/kg	50				240			<50	71	<50	<50	<50	<50	<50	<50	<50	<50
	C6 - C9	mg/kg	20							<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	C10 - C40 (Sum of total)	mg/kg	100							180	1481	1210	<100	<100	<100	<100	220	<100	280
	C6-C10 less BTEX (F1)	mg/kg	20			44	70			<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	C10-C16	mg/kg	50		120	110				<50	71	<50	<50	<50	<50	<50	<50	<50	<50
	C16-C34	mg/kg	100		1300					180	1300	1000	<100	<100	<100	<100	220	<100	280
	C34-C40	mg/kg	100		5600					<100	110	210	<100	<100	<100	<100	<100	<100	<100
C6 - C10	mg/kg	20		120					<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
PAH	Acenaphthene	mg/kg	0.5							1.4	2	2.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Acenaphthylene	mg/kg	0.5							<0.5	1.8	6.1	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5
	Anthracene	mg/kg	0.5							3.7	6.6	13	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	2
	Benzo(a)anthracene	mg/kg	0.5							7.1	25	36	<0.5	<0.5	<0.5	<0.5	3.5	<0.5	7
	Benzo(a)pyrene	mg/kg	0.5		0.7					7.1	32	40	<0.5	<0.5	<0.5	<0.5	3.6	<0.5	7.1
	Benzo(a)pyrene TEQ (lower bound) *	MG/KG	0.5							11	48	59	<0.5	<0.5	<0.5	<0.5	5.4	<0.5	11
	Benzo(a)pyrene TEQ (medium bound) *	MG/KG	0.5	3						11	48	59	0.6	0.6	0.6	0.6	5.4	0.6	11
	Benzo(a)pyrene TEQ (upper bound) *	MG/KG	0.5							11	48	59	1.2	1.2	1.2	1.2	5.4	1.2	11
	Benzo(g,h,i)perylene	mg/kg	0.5							4.3	25	30	<0.5	<0.5	<0.5	<0.5	1.6	<0.5	3.8
	Benzo(k)fluoranthene	mg/kg	0.5							7.9	20	29	<0.5	<0.5	<0.5	<0.5	2.7	<0.5	5.4
	Chrysene	mg/kg	0.5							5	25	33	<0.5	<0.5	<0.5	<0.5	3.2	<0.5	6.9
	Benzo[b+j]fluoranthene	mg/kg	0.5							13	28	31	<0.5	<0.5	<0.5	<0.5	2.8	<0.5	5.7
	Dibenz(a,h)anthracene	mg/kg	0.5							0.7	6.2	6.7	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	1.4
	Fluoranthene	mg/kg	0.5							32	71	99	<0.5	0.6	<0.5	<0.5	6.2	<0.5	12
	Fluorene	mg/kg	0.5							2	3.1	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5							3.4	23	21	<0.5	<0.5	<0.5	<0.5	2	<0.5	4
	Naphthalene	mg/kg	0.5			3				1.5	0.9	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Phenanthrene	mg/kg	0.5							31	49	55	<0.5	<0.5	<0.5	<0.5	2.8	<0.5	4.9
	Pyrene	mg/kg	0.5							28	66	91	<0.5	0.5	<0.5	<0.5	5.7	<0.5	10
	Total PAHs	mg/kg	0.5	300						148.1	384.6	498.6	<0.5	1.1	<0.5	<0.5	36.1	<0.5	70.2
TPH	C10 - C14	mg/kg	20							<20	41	<20	<20	<20	<20	<20	<20	<20	21
	C15 - C28	mg/kg	50							160	1000	790	<50	<50	<50	<50	160	<50	200
	C29 - C36	mg/kg	50							<50	290	350	<50	<50	<50	<50	92	<50	110
	C10 - C36 (Sum of total)	mg/kg	50							160	1331	1140	<50	<50	<50	<50	252	<50	331
Volatile	Benzene	mg/kg	0.1		65	0.5	0.5	77		<0.1	<0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Ethylbenzene	mg/kg	0.1		125	57				<0.1	<0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Toluene	mg/kg	0.1		105	160	220			<0.1	<0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Xylene (m & p)	mg/kg	0.2							<0.2	<0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Xylene (o)	mg/kg	0.1							<0.1	<0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Xylene Total	mg/kg	0.3		45	40	60			<0.3	<0.3	< 0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

Result 'NEPM 2013 HILs Residential A Soil

Result Environmental Investigation/Screening Levels - Urban Residential/public open space

Result Health Screening Level Residential A/B Landuse, 0 to <2m, Sand for

Result HSL-intrusive maintenance worker, 0 to <2m, Sand for Vapour Intrusion

Notes:

* Sample Re-analysed by Laboratory

380 Value exceeds HIL-A (UCL 95% Stat used = 143mg/kg

				Field_ID	BH8-0.0-0.2	BH8-0.5-0.6	BH9-0.4-0.6	BH9-0.7-0.8	BH10-0.0-0.2	BH10-0.5-0.6				
				LocCode	BH8-0.0-0.2	BH8-0.5-0.6	BH9-0.4-0.6	BH9-0.7-0.8	BH10-0.0-0.2	BH10-0.5-0.6				
				Sampled_Date	18-Jan-21	18-Jan-21	18-Jan-21	18-Jan-21	18-Jan-21	18-Jan-21				
				NEPM 2013 HILs Residential A Soil	EIL/ESL	HSL-A/B, 0 to <1m, Sand Soils for Vapour Intrusion	HSL-A/B, 1 to <2m, Sand Soils for Vapour Intrusion	HSL-intrusive maintenance worker, 0 to <2m, Sand for Vapour Intrusion						
Method	ChemName	Units	EQL											
Metals	Arsenic	mg/kg	2	100	100				3.6	6.6	2.3	<2	14	7.7
	Cadmium	mg/kg	0.4	20					<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
	Chromium	mg/kg	5		480				6	9.8	10	6.1	12	7.9
	Copper	mg/kg	5	6000	120				20	34	<5	<5	15	11
	Lead	mg/kg	5	300	1100				50	160	6	<5	49	32
	Mercury	mg/kg	0.1	40					<0.1	0.2	<0.1	<0.1	0.1	<0.1
	Nickel	mg/kg	5	400	50				<5	<5	<5	<5	<5	<5
	Zinc	mg/kg	5	7400	290				140	160	11	6.4	230	85
Inorganic	Moisture Content (dried @ 103°C)	%	1						18	13	7.9	6.9	7.1	6.4
Organic	Naphthalene	mg/kg	0.5		170	3			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	F2-NAPHTHALENE	mg/kg	50				240		<500	<50	<50	<50	63	71
	C6 - C9	mg/kg	20						<20	<20	<20	<20	<20	<20
	C10 - C40 (Sum of total)	mg/kg	100						<1000	120	<100	<100	393	401
	C6-C10 less BTEX (F1)	mg/kg	20			44	70		<20	<20	<20	<20	<20	<20
	C10-C16	mg/kg	50		120	110			<500	<50	<50	<50	63	71
	C16-C34	mg/kg	100		1300				<1000	120	<100	<100	330	330
	C34-C40	mg/kg	100		5600				<1000	<100	<100	<100	<100	<100
C6 - C10	mg/kg	20		120				<20	<20	<20	<20	<20	<20	
PAH	Acenaphthene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Acenaphthylene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Anthracene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a)anthracene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene	mg/kg	0.5		0.7				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene TEQ (lower bound) *	MG/KG	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene TEQ (medium bound) *	MG/KG	0.5	3					0.6	0.6	0.6	0.6	0.6	0.6
	Benzo(a)pyrene TEQ (upper bound) *	MG/KG	0.5						1.2	1.2	1.2	1.2	1.2	1.2
	Benzo(g,h,i)perylene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(k)fluoranthene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Chrysene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo[b+j]fluoranthene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Fluoranthene	mg/kg	0.5						0.8	0.5	<0.5	<0.5	<0.5	<0.5
	Fluorene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Naphthalene	mg/kg	0.5			3			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Phenanthrene	mg/kg	0.5						<0.5	<0.5	<0.5	<0.5	0.5	<0.5
	Pyrene	mg/kg	0.5						0.7	<0.5	<0.5	<0.5	0.5	<0.5
	Total PAHs	mg/kg	0.5	300					1.5	0.5	<0.5	<0.5	1	<0.5
	TPH	C10 - C14	mg/kg	20						<200	<20	<20	<20	31
C15 - C28		mg/kg	50						<500	71	<50	<50	240	260
C29 - C36		mg/kg	50						<500	59	<50	<50	160	120
C10 - C36 (Sum of total)		mg/kg	50						<500	130	<50	<50	431	380
Volatile	Benzene	mg/kg	0.1		65	0.5	0.5	77	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Ethylbenzene	mg/kg	0.1		125	57			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Toluene	mg/kg	0.1		105	160	220		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Xylene (m & p)	mg/kg	0.2						<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Xylene (o)	mg/kg	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Xylene Total	mg/kg	0.3		45	40	60		<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Result	NEPM 2013 HILs Residential A Soil													
Result	Environmental Investigation/Screening Levels - Urban Residential/public open space													
Result	Health Screening Level Residential A/B Landuse, 0 to <2m, Sand for													
Result	HSL-intrusive maintenance worker, 0 to <2m, Sand for Vapour Intrusion													
Notes:														
	* Sample Re-analysed by Laboratory													
	380 Value exceeds HIL-A (UCL 95% Stat used = 143mg/kg)													

			21-01-21	21-01-21	21-01-21	21-01-21	21-01-21	21-01-21
			GBH02 2.5m	GBH02 4.0m	GBH02 8.5m	GHB02 10.0m	GHB02 11.5m	GHB02 14.5m
ASS Field Screening Analysis								
pH (F)	pH Unit	0.1	7	7.3	8.7	8.1	7.8	7.6
pH (Fox)	pH Unit	0.1	2.8	3.3	2	1.3	2.1	2.1
Reaction Rate	-	1	3	3	4	4	3	3

Notes:

pH F(ox) Reaction

- 1 Slight
- 2 Moderate
- 3 Strong
- 4 Extreme

			21-01-21	21-01-21	21-01-21	21-01-21	21-01-21	21-01-21	21-01-21
			GBH02 16.0m	GBH02 17.5m	GBH02 19.0m	GBH03 3.0m	GBH03 4.5m	GBH03 7.5m	GBH03 10.5m
ASS Field Screening Analysis									
pH (F)	pH Unit	0.1	8.7	8.6	8.5	6.3	7	8.8	8.1
pH (Fox)	pH Unit	0.1	1.6	1.5	2	3.6	1.9	2.7	1.3
Reaction Rate	-	1	4	4	4	3	4	3	4

Notes:

pH F(ox) Reaction

- 1 Slight
- 2 Moderate
- 3 Strong
- 4 Extreme

			21-01-21	21-01-21	21-01-21	21-01-21	21-01-21
			GBH03 12.0m	GBH03 15.0m	GBH03 16.5m	GBH03 18.0m	GBH03 19.5m
ASS Field Screening Analysis							
pH (F)	pH Unit	0.1	8	7.7	7	7.1	7.9
pH (Fox)	pH Unit	0.1	5.1	1.8	2.4	2	6.8
Reaction Rate	-	1	4	4	4	3	4

Notes:

pH F(ox) Reaction

- 1 Slight
- 2 Moderate
- 3 Strong
- 4 Extreme



Field Duplicates (SOIL)
Filter: SDG in('20 Jan 2021')

SDG	20-Jan-21	20-Jan-21		20-Jan-21	Interlab_D		20-Jan-21	20-Jan-21		20-Jan-21	Interlab_D	
Field ID	BH1-0.0-0.2	QC1	RPD	BH1-0.0-0.2	QC2	RPD	BH8-0.0-0.2	QC3	RPD	BH8-0.0-0.2	QC4	RPD
Sampled Date	15-01-21	15-01-21		15-01-21	15-01-21		18-01-21	18-01-21		18-01-21	18-01-21	

Method	ChemName	Units	EQL												
Organic	C6-C10 less BTEX (F1)	mg/kg	20 (Primary): 10	<20.0	<20.0	0	<20.0	<10.0	0	<20.0	<20.0	0	<20.0	<10.0	0
Volatile	Benzene	mg/kg	0.1 (Primary): 0	<0.1	<0.1	0	<0.1	<0.2	0	<0.1	<0.1	0	<0.1	<0.2	0
	Ethylbenzene	mg/kg	0.1 (Primary): 0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0
	Toluene	mg/kg	0.1 (Primary): 0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0
	Xylene (m & p)	mg/kg	0.2 (Primary): 0	<0.2	<0.2	0	<0.2	<0.5	0	<0.2	<0.2	0	<0.2	<0.5	0
	Xylene (o)	mg/kg	0.1 (Primary): 0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0
	Xylene Total	mg/kg	0.3 (Primary): 0	<0.3	<0.3	0	<0.3	<0.5	0	<0.3	<0.3	0	<0.3	<0.5	0
Inorganic	Moisture Content (dried @ 103°C)	%	1	6.7	10.0	40	6.7			18.0	15.0	18	18.0		
Heavy Met	Arsenic	mg/kg	2 (Primary): 5	<2.0	2.2	10	<2.0	<5.0	0	3.6	3.0	18	3.6	<5.0	0
	Cadmium	mg/kg	0.4 (Primary): 1	<0.4	<0.4	0	<0.4	<1.0	0	<0.4	<0.4	0	<0.4	<1.0	0
	Chromium	mg/kg	5 (Primary): 2	8.2	13.0	45	8.2	8.0	2	6.0	5.0	18	6.0	4.0	40
	Copper	mg/kg	5	7.2	7.0	3	7.2	5.0	36	20.0	16.0	22	20.0	15.0	29
	Lead	mg/kg	5	8.4	5.4	43	8.4	<5.0	51	50.0	40.0	22	50.0	37.0	30
	Mercury	mg/kg	0.1	0.3	<0.1	100	0.3	<0.1	100	<0.1	<0.1	0	<0.1	<0.1	0
	Nickel	mg/kg	5 (Primary): 2	<5.0	9.7	64	<5.0	9.0	57	<5.0	<5.0	0	<5.0	2.0	0
	Zinc	mg/kg	5	22.0	25.0	13	22.0	19.0	15	140.0	110.0	24	140.0	106.0	28
Organic	Naphthalene	mg/kg	0.5 (Primary): 1	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
PAH	Acenaphthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(a)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	0.6	18
	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	0.6	18
	Benzo(a)pyrene TEQ (lower bound) *	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	0.7	33
	Benzo(a)pyrene TEQ (medium bound) *	mg/kg	0.5	0.6	0.6	0	0.6	0.6	0	0.6	0.6	0	0.6	1.0	50
	Benzo(a)pyrene TEQ (upper bound) *	mg/kg	0.5	1.2	1.2	0	1.2	1.2	0	1.2	1.2	0	1.2	1.4	15
	Benzo(g,h,i)perylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Chrysene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	0.7	33
	Benzo[b+j]fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	0.8	46
	Dibenz(a,h)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	0.8	0.7	13	0.8	1.8	77
	Fluorene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Naphthalene	mg/kg	0.5 (Primary): 1	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Phenanthrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	1.0	67
	Pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	0.7	0.7	0	0.7	1.8	88
	Total PAHs	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	1.5	1.4	7	1.5	7.3	132
Organic	F2-NAPHTHALENE	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0	<500.0	<50.0	0	<500.0	<50.0	0
	C6 - C9	mg/kg	20 (Primary): 10	<20.0	<20.0	0	<20.0	<10.0	0	<20.0	<20.0	0	<20.0	<10.0	0
	C10 - C40 (Sum of total)	mg/kg	100 (Primary): 5	<100.0	<100.0	0	<100.0	<50.0	0	<1000.0	400.0	0	<1000.0	<50.0	0
	C10-C16	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0	<500.0	<50.0	0	<500.0	<50.0	0
	C16-C34	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0	<1000.0	260.0	0	<1000.0	<100.0	0
	C34-C40	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0	<1000.0	140.0	0	<1000.0	<100.0	0
	C6 - C10	mg/kg	20 (Primary): 10	<20.0	<20.0	0	<20.0	<10.0	0	<20.0	<20.0	0	<20.0	<10.0	0
TPH	C10 - C14	mg/kg	20 (Primary): 50	<20.0	<20.0	0	<20.0	<50.0	0	<200.0	<20.0	0	<200.0	<50.0	0
	C15 - C28	mg/kg	50 (Primary): 10	<50.0	<50.0	0	<50.0	<100.0	0	<500.0	160.0	0	<500.0	<100.0	0
	C29 - C36	mg/kg	50 (Primary): 10	<50.0	<50.0	0	<50.0	<100.0	0	<500.0	150.0	0	<500.0	<100.0	0
	C10 - C36 (Sum of total)	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0	<500.0	310.0	0	<500.0	<50.0	0

*RPDs have only been considered where a concentration is greater than 0 times the EQL.

**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 50 (0-10 x EQL); 50 (10-20 x EQL); 30 (> 20 x EQL))

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory



Field Blanks (SOIL)
Filter: SDG in('20 Jan 2021',

SDG	20-Jan-21	20-Jan-21
Field ID	TB	TS
Sampled_Date/Time	18-01-21	18-01-21
Sample Type	Trip_B	Trip_Spike

Me	ChemName	Units	EQL		
Organic	Naphthalene	mg/kg	0.5	<0.5	<0.5
	C6 - C9	mg/kg	20	<20	<20
	C6-C10 less BTEX (F1)	mg/kg	20	<20	<20
	C6 - C10	mg/kg	20	<20	<20
Volatile	Benzene	mg/kg	0.1	<0.1	<0.1
	Ethylbenzene	mg/kg	0.1	<0.1	<0.1
	Toluene	mg/kg	0.1	<0.1	<0.1
	Xylene (m & p)	mg/kg	0.2	<0.2	<0.2
	Xylene (o)	mg/kg	0.1	<0.1	<0.1
	Xylene Total	mg/kg	0.3	<0.3	<0.3

Inputs
Select contaminant from list below
Cu
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
5.7
Enter soil pH (calcium chloride method) (values from 1 to 14)
5.6
Enter organic carbon content (%OC) (values from 0 to 50%)
1.2
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
1.4
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Cu soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	35	55
Urban residential and open public spaces	65	120
Commercial and industrial	90	170

Inputs
Select contaminant from list below
Ni
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
5.7
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
1.4
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Ni soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	10	15
Urban residential and open public spaces	20	50
Commercial and industrial	35	80

Inputs
Select contaminant from list below
Cr III
Below needed to calculate fresh and aged ACLs
Enter % clay (values from 0 to 100%)
17
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
1.4
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Cr III soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	85	160
Urban residential and open public spaces	210	480
Commercial and industrial	340	800

Inputs
Select contaminant from list below
Zn
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
5.7
Enter soil pH (calcium chloride method) (values from 1 to 14)
5.6
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
1.4
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Zn soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	35	120
Urban residential and open public spaces	95	290
Commercial and industrial	140	410

APPENDIX C: BOREHOLE LOGS

Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID. **DS1**

sheet: 1 of 1

project no. **754-NTLGE282007**

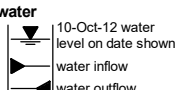
date started: **21 Jun 2021**

date completed: **21 Jun 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						FILL: Fresh Grass Vegetation.	D
								FILL: Sandy GRAVEL : fine to medium grained, sub-rounded to sub-angular, Brown, fine to coarse sand.	
		E			0.5			FILL: Gravelly SAND : fine to coarse grained, Black, fine to medium slag gravels, traces of ash fines.	
								FILL: Sandy CLAY : fine to medium grained, medium plasticity, Mottled Orange.	
		E			1.0			Borehole DS1 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nill water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL loose L very loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS10**

sheet: 1 of 1

project no. **754-NTLGE282007**

date started: **21 Jun 2021**

date completed: **21 Jun 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	D
					0.5			FILL: Sandy GRAVEL: fine to medium grained, sub-rounded to sub-angular, brown, fine to coarse sand.	
		E						FILL: Gravelly SAND: fine medium grained, angular, black, Black soil staining, fine to medium slag gravels, traces of ash fines.	
					1.0			FILL: Sandy CLAY: fine grained, angular, low to medium plasticity, black, fine to medium sand.	
								Borehole DS10 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nil water  10-Oct-12 water level on date shown  water inflow  water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL loose L very loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID. **DS11**

sheet: 1 of 1

project no. **754-NTLGE282007**

date started: **07 Aug 2021**

date completed: **07 Aug 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	TOPSOIL
								FILL: Sandy GRAVEL : fine to medium grained, sub-rounded to sub-angular, brown, fine to coarse sand.	FILL - GENERAL
		E						FILL: Gravelly SAND : fine grained, sub-angular, black, Black soil staining, fine to medium slag gravels, traces of ash fines.	FILL - COAL ASH
					0.5			FILL: CLAYEY SAND : low plasticity, brown, fine to medium sand.	FILL GENERAL
					1.0			Borehole DS11 terminated at 1.00 m	

method	support	samples & field tests	soil group symbol & material description based on AS 1726:2017	consistency / relative density
AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	M mud C casing N nill water 10-Oct-12 water level on date shown water inflow water outflow	B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense

Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS12**

sheet: 1 of 1

project no. **754-NTLGE282007**

date started: **07 Aug 2021**

date completed: **07 Aug 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	TOPSOIL
								FILL: CLAYEY SAND: low plasticity, brown, fine to medium sand.	FILL - GENERAL
		E						FILL: Gravelly SAND: fine to medium grained, sub-angular, black, Black soil staining, fine to medium slag gravels, traces of ash fines.	FILL - COAL ASH
		E			0.5			FILL: Clayey Gravelly SAND: fine grained, sub-angular, low plasticity, brown, fine to medium sand.	FILL - GENERAL
		E			1.0			FILL: Sandy CLAY: low plasticity, brown, fine to medium sand.	
								Borehole DS12 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nil water  10-Oct-12 water level on date shown  water inflow  water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS13**

sheet: 1 of 1

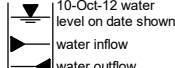
project no. **754-NTLGE282007**

date started: **07 Aug 2021**

date completed: **07 Aug 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E			0.5			TOPSOIL: Fresh Grass Vegetation.	D
								FILL: SAND: fine grained, sub-rounded to sub-angular, brown, fine to medium sand.	
		E						FILL: GRAVEL: fine to coarse grained, grey/dark brown, concrete fragment observed.	
		E						FILL: Sandy CLAY: low plasticity, brown, fine to medium sand.	
					1.0			Borehole DS13 terminated at 0.70 m	
method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit		support M mud C casing N nil water  10-Oct-12 water level on date shown water inflow water outflow		samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal		soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit		consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	

Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS14**

sheet: 1 of 1

project no. **754-NTLGE282007**

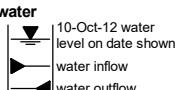
date started: **07 Aug 2021**

date completed: **07 Aug 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description	soil origin, structure and additional observations
HA		E						TOPSOIL: Fresh Grass Vegetation.	D
								TOPSOIL: SAND: brown, fine to medium sand.	
								FILL: CLAYEY SAND: low plasticity, brown/dark brown, fine to medium.	
		E						FILL: Gravelly SAND: fine grained, sub-angular, black, Black soil staining, fine to medium slag gravels, coal wash fines, traces of ash fines.	
					0.5			FILL: Sandy CLAY: low plasticity, black, fine to medium sand.	
					1.0			Borehole DS14 terminated at 0.60 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nill water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS15**

sheet: 1 of 1

project no. **754-NTLGE282007**

date started: **07 Aug 2021**

date completed: **07 Aug 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA					0.5			TOPSOIL: Fresh Grass Vegetation. FILL: SAND: fine to medium grained, angular, brown, fine to medium sand. FILL: Gravelly SAND: fine grained, sub-angular, black, Black soil staining, fine to medium slag gravels, traces of ash fines. FILL: CLAYEY SAND: brown/yellow, fine to medium sand.	TOPSOIL FILL - GENERAL FILL - COAL ASH FILL GENERAL
					1.0			Borehole DS15 terminated at 0.80 m	

method	support	samples & field tests	soil group symbol & material description based on AS 1726:2017	consistency / relative density
AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	M mud C casing N nill water 10-Oct-12 water level on date shown water inflow water outflow	B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	moisture condition D dry M moist W wet Wp plastic limit WI liquid limit	VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense

Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID. **DS16**

sheet: 1 of 1

project no. **754-NTLGE282007**

date started: **07 Aug 2021**

date completed: **07 Aug 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information						material substance			
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description	moisture condition / consistency / relative density
HA		E						TOPSOIL: Sandy GRAVEL : fine grained, angular, brown, exposed soils - No grass vegetation.	D
								FILL: Gravelly SAND : fine to medium grained, sub-angular, dark brown, fine to medium sand.	
		E						FILL: Gravelly SAND : fine grained, sub-angular, black, Black soil staining, fine to medium slag gravels, traces of ash fines.	
					0.5			Borehole DS16 terminated at 0.50 m	
					1.0				

method	support	samples & field tests	soil group symbol & material description	consistency / relative density
AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	M mud C casing N nil water 10-Oct-12 water level on date shown water inflow water outflow	B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit WL liquid limit	VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense

Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS17**

sheet: 1 of 1

project no. **754-NTLGE282007**

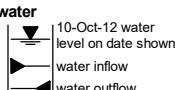
date started: **07 Aug 2021**

date completed: **07 Aug 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	TOPSOIL
								FILL: CLAYEY SAND: fine grained, low plasticity, brown/pale brown, fine to medium sand.	FILL - GENERAL
		E						FILL: Gravelly SAND: black/grey, Black soil staining, fine to medium slag gravels, traces of ash fines.	FILL - COAL ASH
					0.5			CLAY: fine grained, angular, low plasticity, brown/mottled orange.	FILL - GENERAL
					1.0			Borehole DS17 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nill water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL loose L very loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID. **DS18**

sheet: 1 of 1

project no. **754-NTLGE282007**

date started: **07 Aug 2021**

date completed: **07 Aug 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	D
								FILL: Sandy GRAVEL: fine to medium grained, sub-rounded to sub-angular, dark brown, fine to medium sand, fine to coarse cobbles/boulders.	
		E						FILL: Gravelly SAND: fine grained, sub-angular, black, Black soil staining, fine to medium slag gravels, traces of ash fines.	
					0.5				
					1.0			Borehole DS18 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nill water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS2**

sheet: 1 of 1

project no. **754-NTLGE282007**

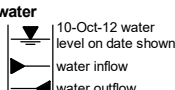
date started: **21 Jun 2021**

date completed: **21 Jun 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	D
								FILL: Gravelly SAND: fine to medium grained, sub-rounded, Brown, fine to coarse sand.	
		E						FILL: Gravelly SAND: fine to medium grained, sub-rounded to sub-angular, Black, Black soil staining, fine to medium slag gravels, traces of ash fines.	
					0.5			FILL: SAND: fine to medium grained, Pale Brown, fine to medium sand.	
		E						FILL: Sandy CLAY: low plasticity, fine to medium sand.	
					1.0			Borehole DS2 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nill water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS3**

sheet: 1 of 1

project no. **754-NTLGE282007**

date started: **21 Jun 2021**

date completed: **21 Jun 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information						material substance			
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	D
								FILL: Gravelly SAND: fine to medium grained, brown, fine to medium sand, fine to coarse cobbles.	
		E						FILL: Gravelly SAND: fine to medium grained, black, Black soil staining, fine to medium slag gravels, traces of ash fines.	
					0.5			FILL: CLAYEY SAND: fine grained, low plasticity, dark brown, fine to medium sand.	
		E						FILL: Sandy CLAY: low plasticity, mottled red, fine sand.	
					1.0			Borehole DS3 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nil water  10-Oct-12 water level on date shown  water inflow  water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL loose L very loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS4**

sheet: 1 of 1

project no. **754-NTLGE282007**

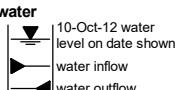
date started: **21 Jun 2021**

date completed: **21 Jun 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	D
								FILL: Gravelly SAND: Brown, fine to medium sand, fine to coarse cobbles.	
		E						FILL: Sandy GRAVEL: fine to medium grained, sub-angular, Black/Grey, Black soil staining, fine to medium slag gravels, traces of ash fines.	
					0.5			FILL: CLAYEY SAND: fine grained, angular, Brown/Grey, fine to medium sand.	
		E						FILL: CLAYEY SAND: fine grained, angular, Yellow/Brown, fine to medium sand.	
					1.0			Borehole DS4 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nil water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS5**

sheet: 1 of 1

project no. **754-NTLGE282007**

date started: **21 Jun 2021**

date completed: **21 Jun 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	D
								FILL: Gravelly SAND: fine to medium grained, sub-rounded to sub-angular, dark brown/black, fine to medium sand.	
		E						FILL: Gravelly SAND: fine to medium grained, angular, black/grey, Black soil staining, fine to medium slag gravels, traces of ash fines.	
								FILL: CLAYEY SAND: fine grained, sub-angular, brown, fine to medium sand.	
		E			0.5			FILL: CLAYEY SAND: fine grained, sub-angular to angular, pale brown, fine to medium sand.	
					1.0			Borehole DS5 terminated at 1.00 m	
method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit					support M mud C casing N nill water 10-Oct-12 water level on date shown water inflow water outflow				
samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal					soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit				
					consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense				

Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS6**

sheet: 1 of 1

project no. **754-NTLGE282007**

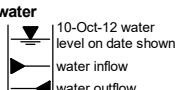
date started: **21 Jun 2021**

date completed: **21 Jun 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description	moisture condition
		E						TOPSOIL: Fresh Grass Vegetation.	D
								FILL: Gravelly SAND: fine to medium grained, sub-angular, Dark Brown, fine to medium sand.	
		E			0.5			FILL: CLAYEY SAND: fine grained, angular, Dark Brown, No visual observation of soil staining/PAH impacted soil layer.	
								FILL: Sandy CLAY: fine grained, angular, Pale Brown, fine to coarse sand.	
		E			1.0			Borehole DS6 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nil water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL loose L very loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS7**

sheet: 1 of 1

project no. **754-NTLGE282007**

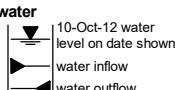
date started: **21 Jun 2021**

date completed: **21 Jun 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoionization detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	D
								FILL: Gravelly SAND: fine to medium grained, sub-rounded to sub-angular, Brown, fine to medium sand.	
		E						FILL: Gravelly SAND: fine to medium grained, angular, Black, Black soil staining, fine to medium slag gravels, traces of ash fines.	
					0.5			Borehole DS7 terminated at 0.50 m	
					1.0				

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nil water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS8**

sheet: 1 of 1

project no. **754-NTLGE282007**

date started: **21 Jun 2021**

date completed: **21 Jun 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information						material substance			
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	D
								FILL: Gravelly SAND: fine grained, angular, black, fine to medium sand.	
								FILL: Gravelly SAND: fine to medium grained, sub-angular, black, Black soil staining, fine to medium slag gravels, traces of ash fines.	
		E						FILL: SAND: fine grained, sub-angular, black, fine to medium sand.	
					0.5			FILL: CLAYEY SAND: fine to medium grained, low plasticity, yellow, fine to medium sand.	
		E						FILL: SAND: yellow, fine to medium sand.	
					1.0			Borehole DS8 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nill water  10-Oct-12 water level on date shown  water inflow  water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Environmental Log - Borehole

client: **Newcastle Grammar School/APP**

principal:

project: **Delineation of PAH impacted Soils**

location: **Newcastle Grammar School - Park Campus, 127 Union St, Cooks Hill NSW**

Hole ID: **DS9**

sheet: 1 of 1

project no. **754-NTLGE282007**

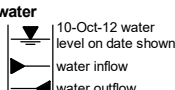
date started: **21 Jun 2021**

date completed: **21 Jun 2021**

logged by: **SB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°
equipment type: Hand Auger drilling fluid: hole diameter : 50 mm

drilling information					material substance				
method & support	water	samples & field tests	photoluminescence detector (ppmv)	RL (m)	depth (m)	graphic log	soil group symbol	material description SOIL NAME: plasticity or particle characteristics, colour, secondary and minor components	moisture condition consistency / relative density
HA		E						TOPSOIL: Fresh Grass Vegetation.	D
								FILL: Sandy GRAVEL : fine to medium grained, sub-angular, dark brown, fine to coarse sand.	
		E						FILL: Sandy CLAY : fine grained, sub-angular, low plasticity, pale brown, fine to medium sand.	
		E						FILL: CLAY : low to medium plasticity, orange.	
					1.0			Borehole DS9 terminated at 1.00 m	

method AD auger drilling* HA hand auger MR mud rotary W washbore PT push tube HS hollow stem SS solid stem SD sonic drilling * bit shown by suffix e.g. AD/T B blank bit T TC bit V V bit	support M mud C casing N nil water 	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter WS water sample HB hammer bouncing N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone R refusal	soil group symbol & material description based on AS 1726:2017 moisture condition D dry M moist W wet Wp plastic limit Wl liquid limit	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL loose L very loose MD medium dense D dense VD very dense
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APPENDIX D: PHOTO LOG

Appendix D – Photo Log



Photo 1: PAH impacted soil layer – DS2



Photo 2: Close-up impacted gravelly sand material



Photo 3: PAH impacted soil layer – DS12



Photo 4: PAH impacted soil layer – DS16

APPENDIX E: CONCEPT PLAN DRAWINGS



04 Stage 01

No.	Drawing	Rev
4.01	Site Plan	F
4.02	Staging Diagram	B
4.11	Stage 01 Ground Floor Plan	H
4.12	Stage 01 First Floor Plan	H
4.20	Union Street Design Diagrams	B
4.21	Ground Floor Plan	H
4.22	First Floor Plan	H
4.23	Second Floor Plan	H
4.24	Rooftop Play	H
4.32	Typical Learning Space	C
4.33	Motif: Garden, Growth & Geometry	C
4.34	Perspective - Streetview	C
4.35	Perspective - Undercroft	C
4.36	Perspective - Playground	C
4.37	Perspective - Campfire	C
4.38	Perspective - Campfire	C
4.39	Perspective - Makerspace	C
4.40	Perspective - Makerspace	C
4.41	Perspective - First Floor Campfire	C
4.42	Interior Palette	A

No.	Drawing	Rev
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Stage 01 Site



Newcastle
Grammar
— SCHOOL —

S H A C

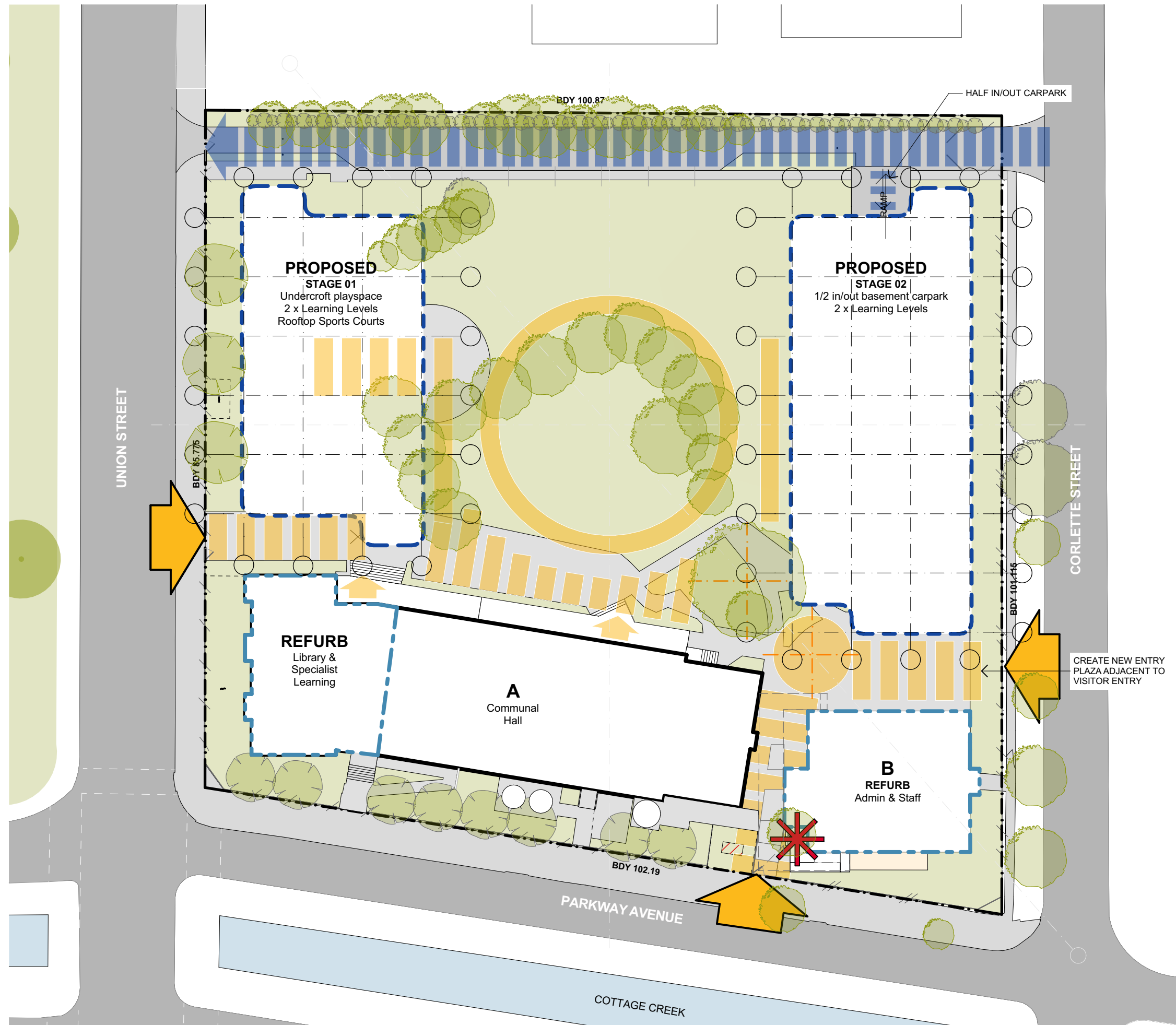


SSD APPLICATION

1. Dimensions are in millimeters unless otherwise shown.
2. Work to given dimensions. Do not scale from drawing.
3. Check all dimensions on site prior to construction and fabrication.
4. Bring any discrepancies to the attention of the proprietor & architect.

LEGEND

	- EXISTING PERMANENT BUILDINGS		- ONSITE PEDESTRIAN CIRCULATION
	- ROAD		- HARDSTAND PLAY
	- BUILDINGS TO BE DEMOLISHED		- SCHOOL ENTRY POINTS
	- PROPOSED BUILDING FOOTPRINT		- EXISTING SITE TREES
	- EXISTING BUILDINGS TO BE REFURBISHED		- PROPOSED SCREEN PLANTING
	- ONSITE VEHICULAR CIRCULATION		- ADMINISTRATION / VISITOR ENTRY POINT



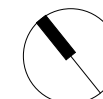
4293
4.04

RevE 28.05.21

Proposed Masterplan

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

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SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846

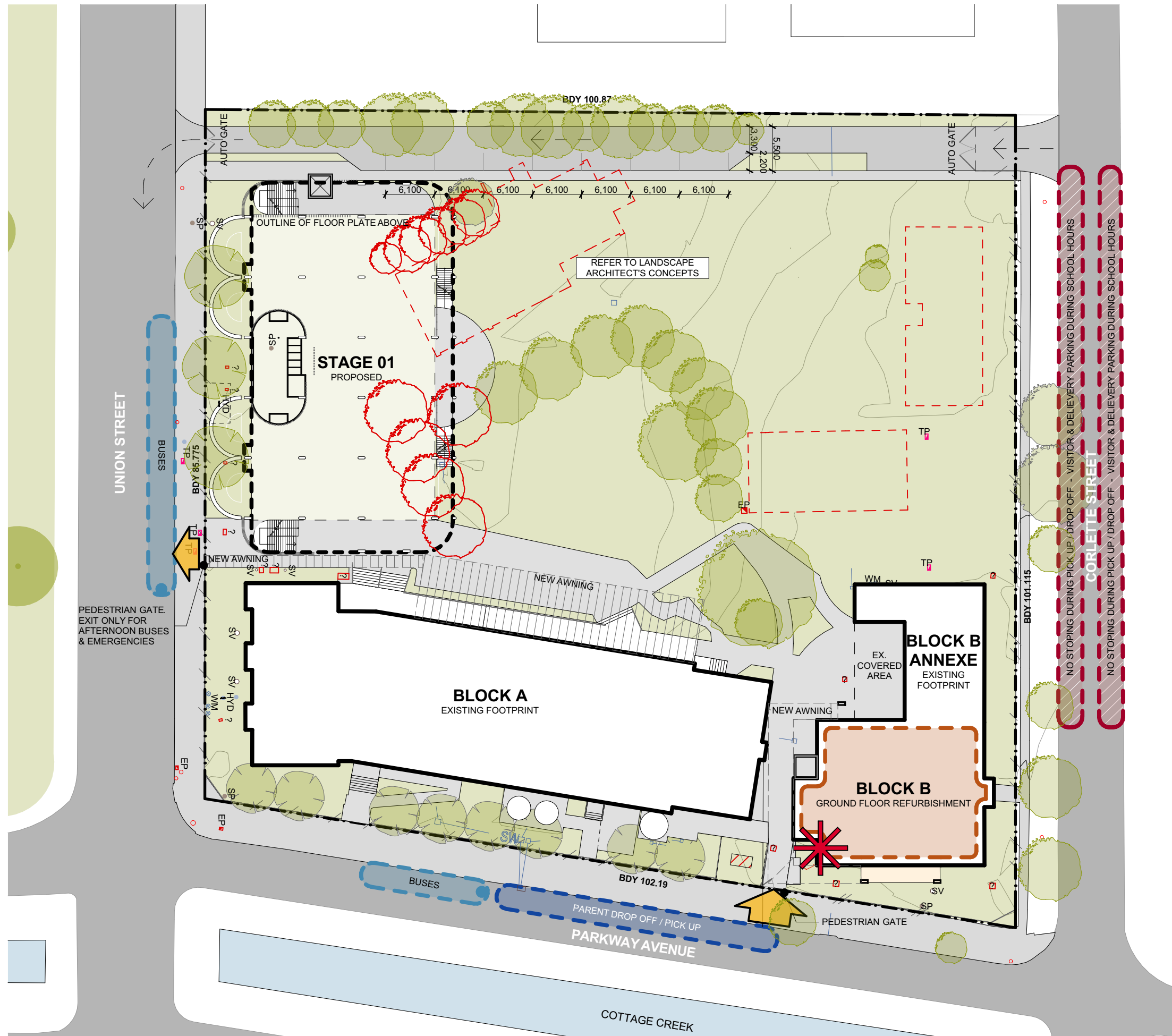


SSD APPLICATION

1. Dimensions are in millimeters unless otherwise shown.
2. Work to given dimensions. Do not scale from drawing.
3. Check all dimensions on site prior to construction and fabrication.
4. Bring any discrepancies to the attention of the proprietor & architect.

LEGEND

- EXISTING PERMANENT BUILDINGS
- EXISTING BUILDINGS TO BE DEMOLISHED
- REFURBISHMENT OF EXISTING BUILDING
- ROAD
- NO STANDING DURING PICK UP/DROP OFF, VISITOR PARKING DURING SCHOOL HOURS
- BUS ZONE
- EXISTING SITE TREES
- EXISTING SITE TREES TO BE REMOVED
- PROPOSED SCREEN PLANTING
- ADMINISTRATION / VISITOR ENTRY POINT
- SCHOOL ENTRY POINTS



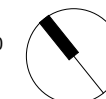
4293
4.01

RevF 07.06.21

Site Plan

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

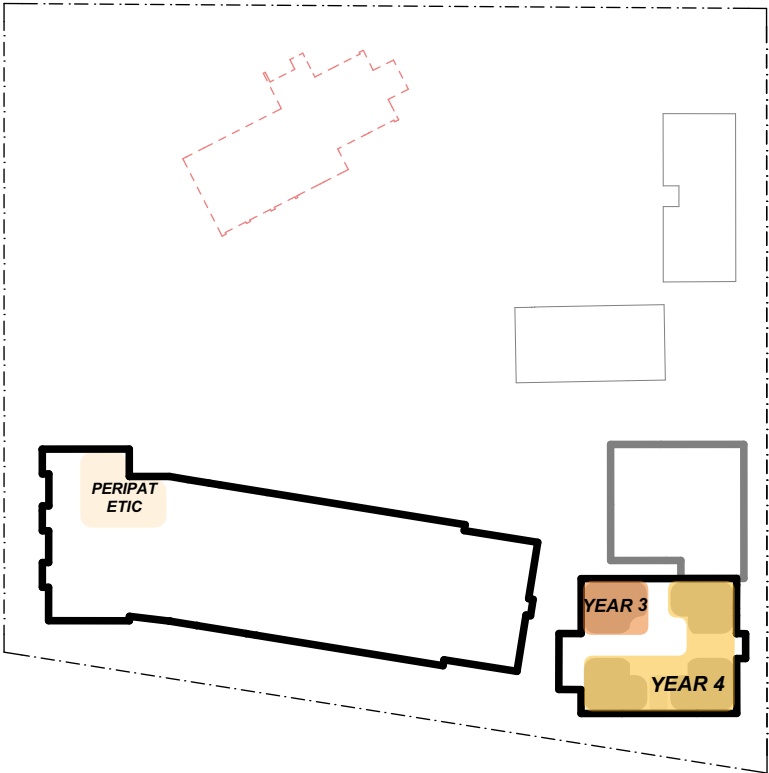
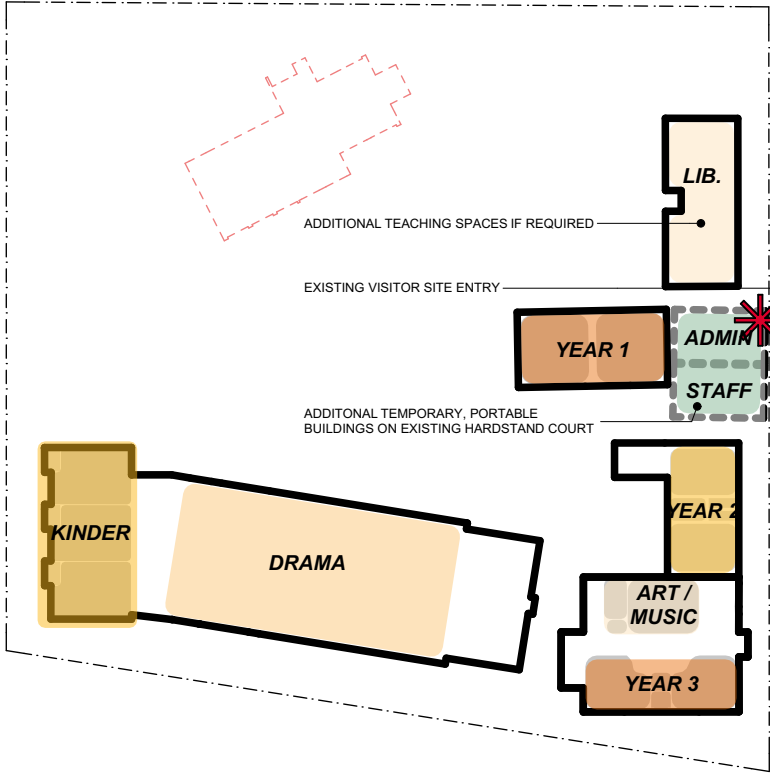
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@A3



SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846

DURING STAGE 1 CONSTRUCTION



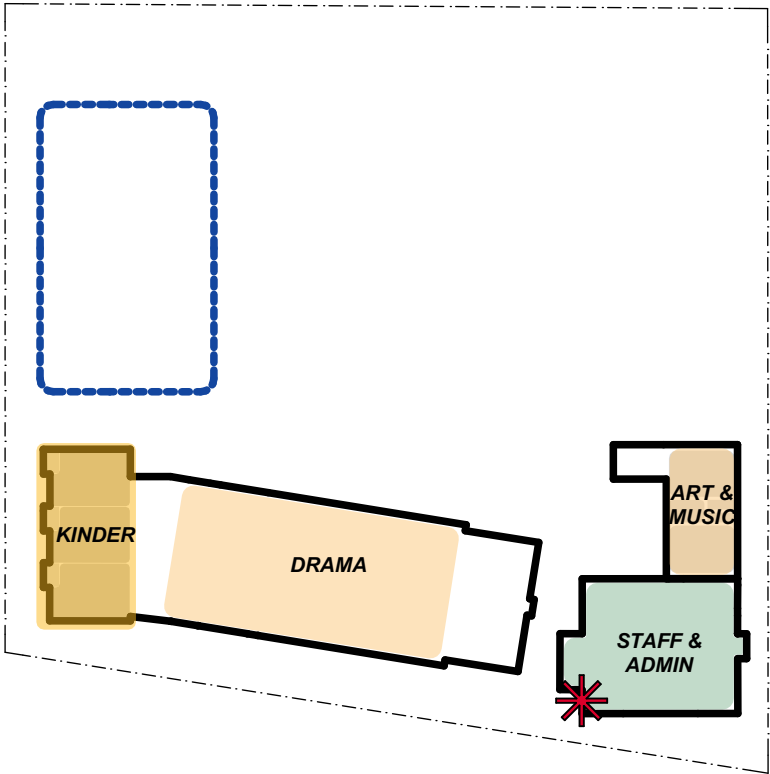
Newcastle
Grammar
SCHOOL

SSD APPLICATION

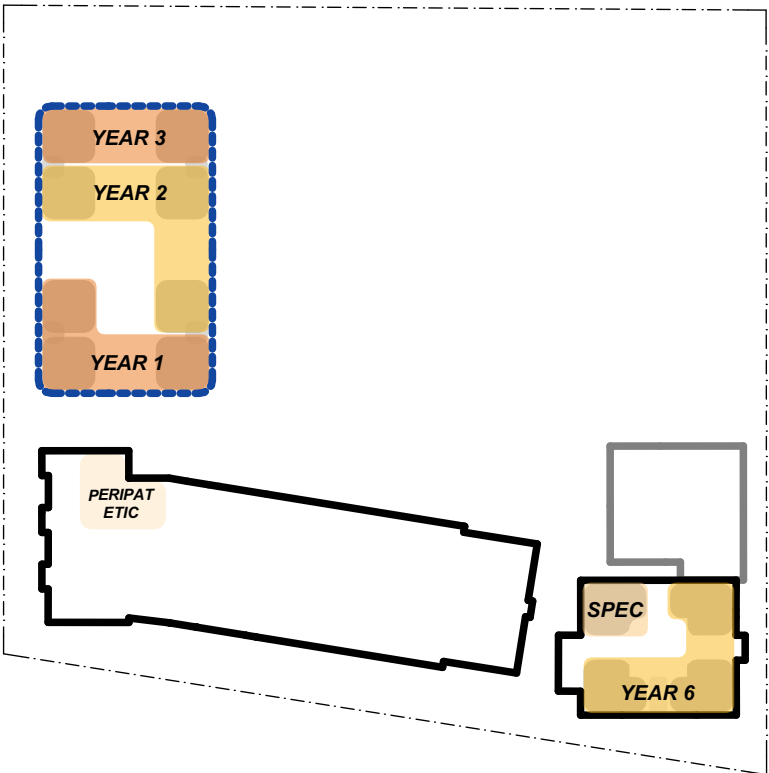
- 1. Dimensions are in millimeters unless otherwise shown.
- 2. Work to given dimensions. Do not scale from drawing.
- 3. Check all dimensions on site prior to construction and fabrication.
- 4. Bring any discrepancies to the attention of the proprietor & architect.

DRAFT FOR CLIENT REVIEW & APPROVAL

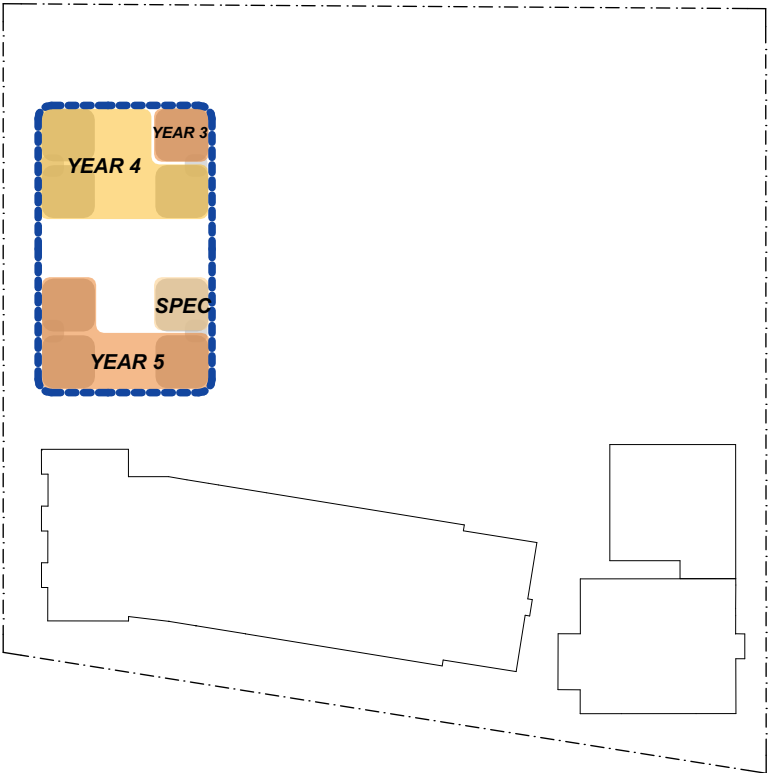
UPON STAGE 1 COMPLETION



GROUND FLOOR



FIRST FLOOR



SECOND FLOOR

4293
4.02

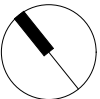
RevB 07.06.21

Staging Diagram

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

0m 10 20 30 40 50

1:1000
@A3



SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846

Drawing and design © SHAC Pty Ltd 2016. The signed control copy of this drawing is held by SHAC Pty Ltd. | Ref: BIMcloud: BIMSERVER24 - BIMcloud Basic for ARCHICAD 24/4293 NGS Park Campus Stage 1 date:10/06/2021 time: 1:04 PM

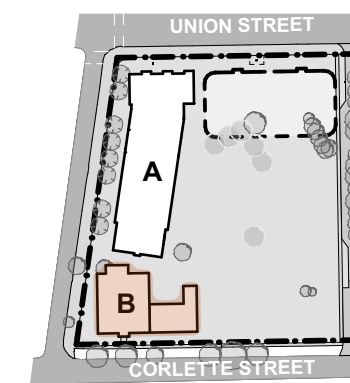
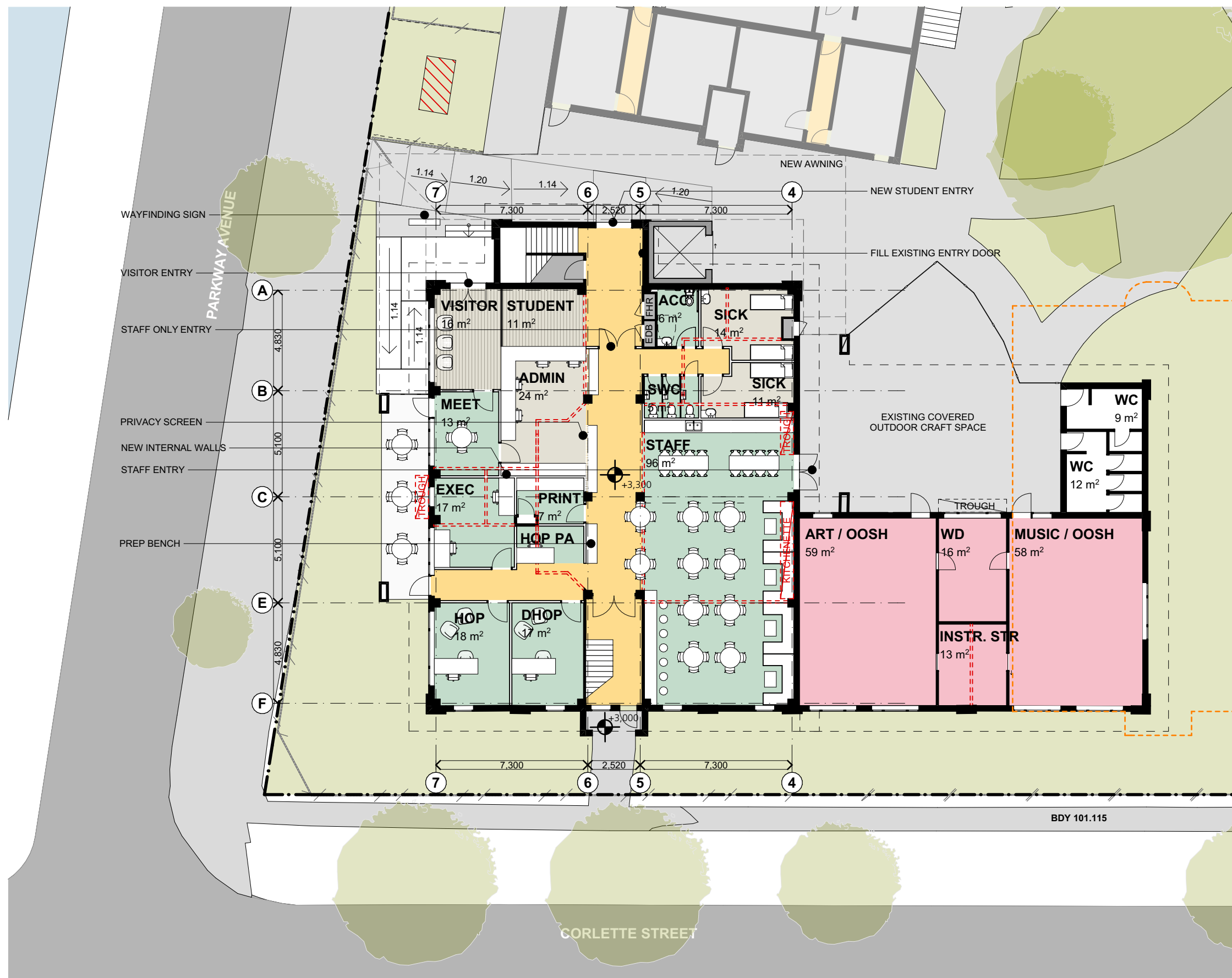


Stage 01
Block B
Refurbishment



SSD APPLICATION

1. Dimensions are in millimeters unless otherwise shown.
2. Work to given dimensions. Do not scale from drawing.
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4. Bring any discrepancies to the attention of the proprietor & architect.



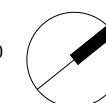
4293
4.11

RevH 07.06.21

Stage 01 Ground Floor Plan

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

0m 2 4 6 8 10 1:200
@A3



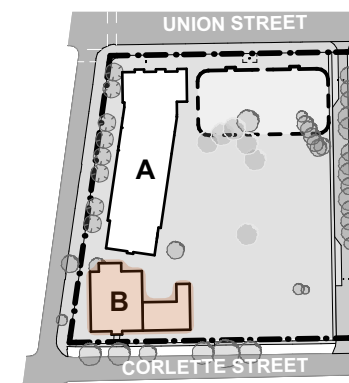
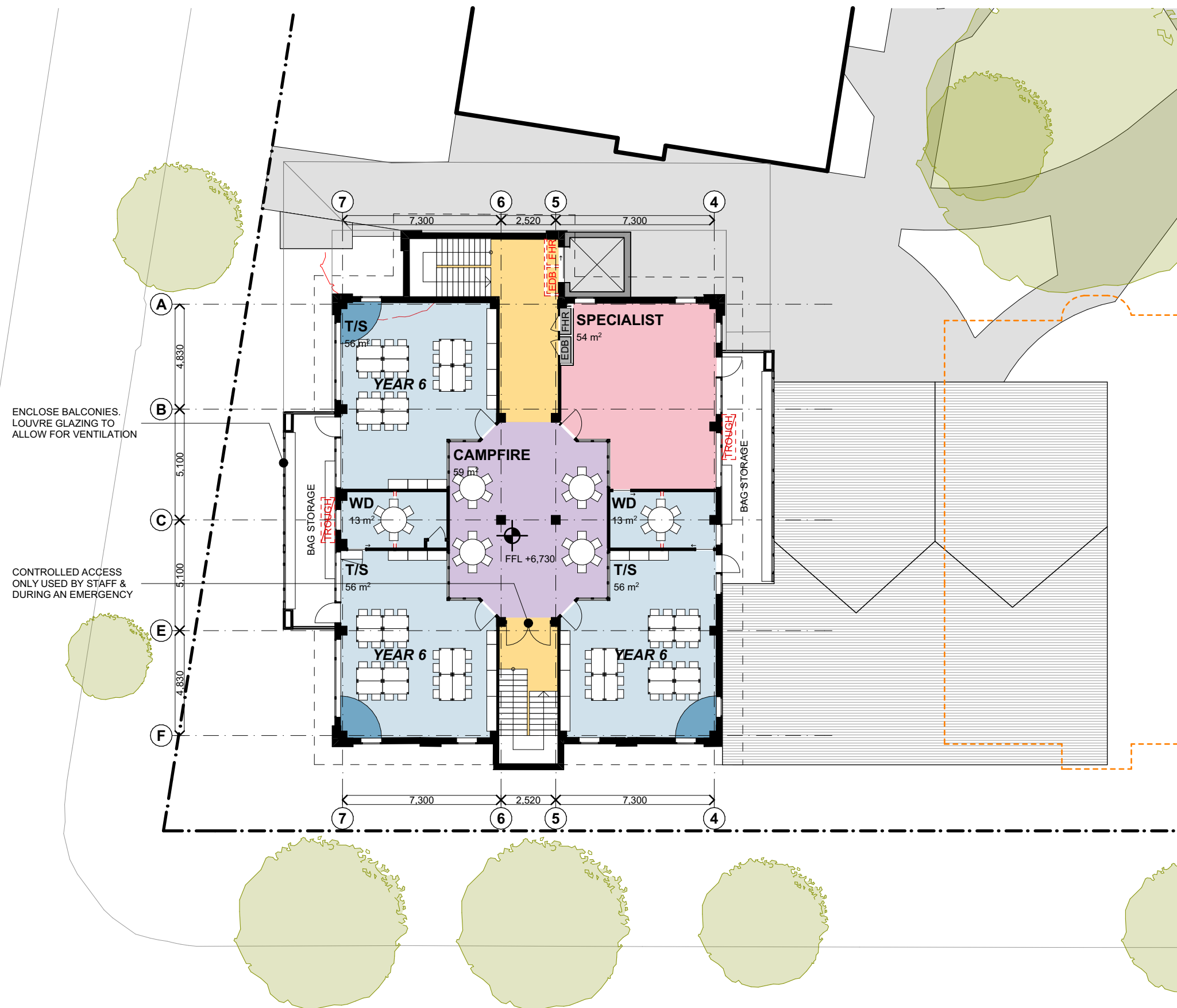
SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846



SSD APPLICATION

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4. Bring any discrepancies to the attention of the proprietor & architect.



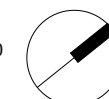
4293
4.12

RevH 07.06.21

Stage 01 First Floor Plan

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

0m 2 4 6 8 10 1:200 @A3



SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846

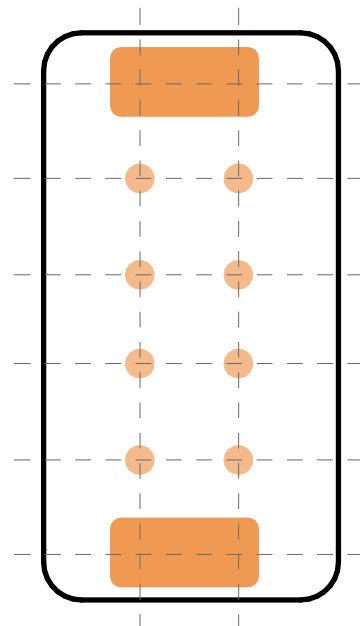


Stage 01
Union Street



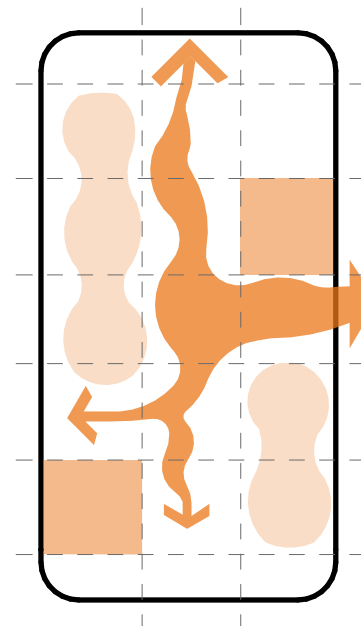
SSD APPLICATION

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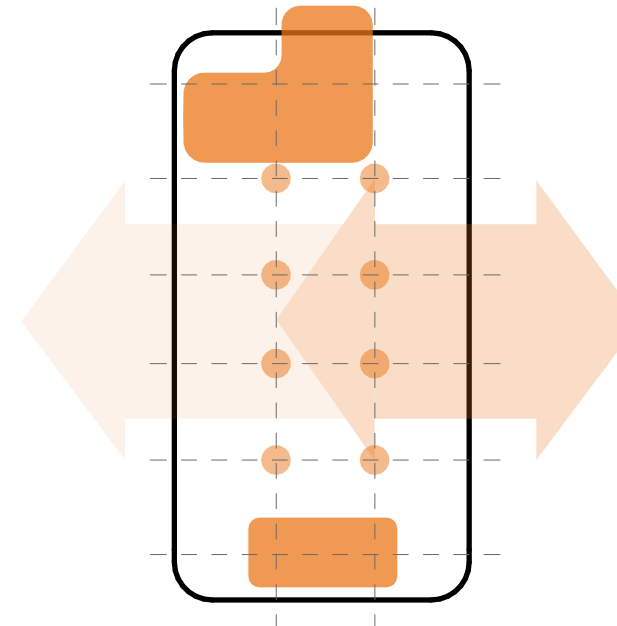
GRID & SYMMETRY

- Structural efficiency
- Rationalised structural spans
- Kit of part of materials



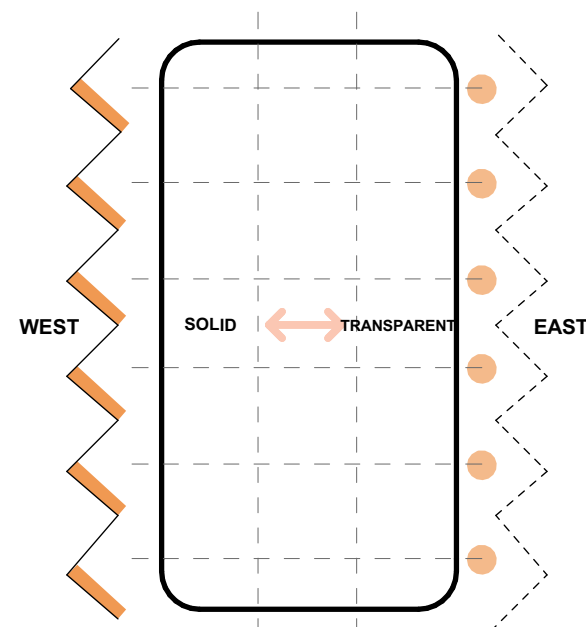
FLEXIBILITY

- The regular grid allows for flexibility & future adaptation of the floor plate



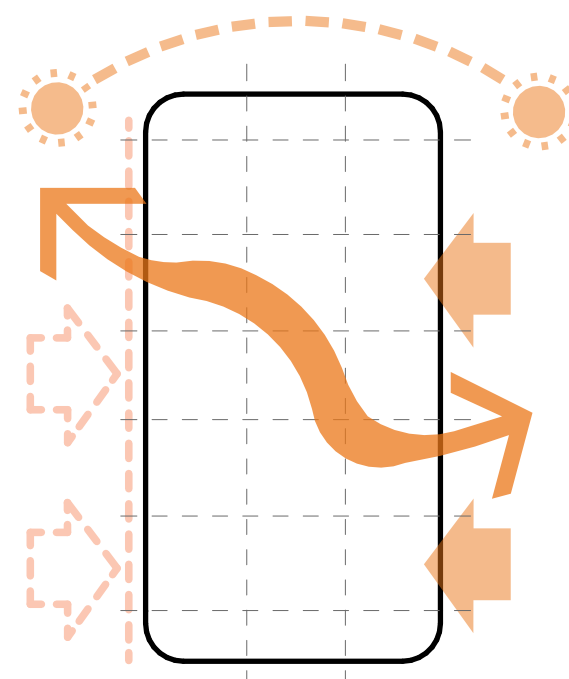
MAXIMISING OPEN SPACE

- The undercroft playspace maximises the onsite play area & maintains its connection with National Park



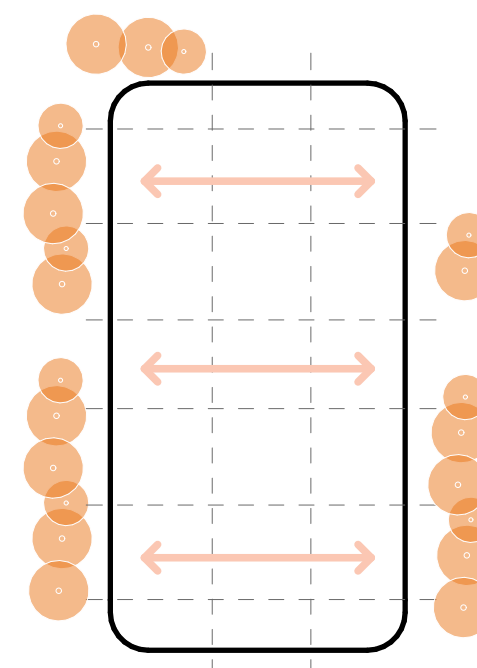
PUBLIC / PRIVATE EDGES

- The building maintains privacy from the busy public street
- The decks on the other side allow the classrooms to open up & have a relationship with the rest of the school



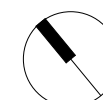
NATURAL LIGHT & VENTILATION

- Form allows good light & air penetration



CONNECTION TO NATURE

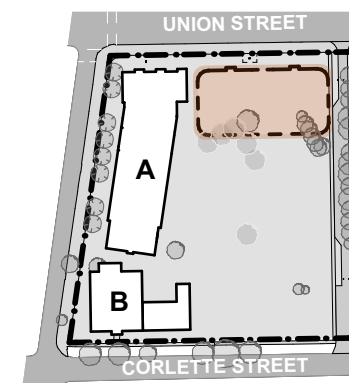
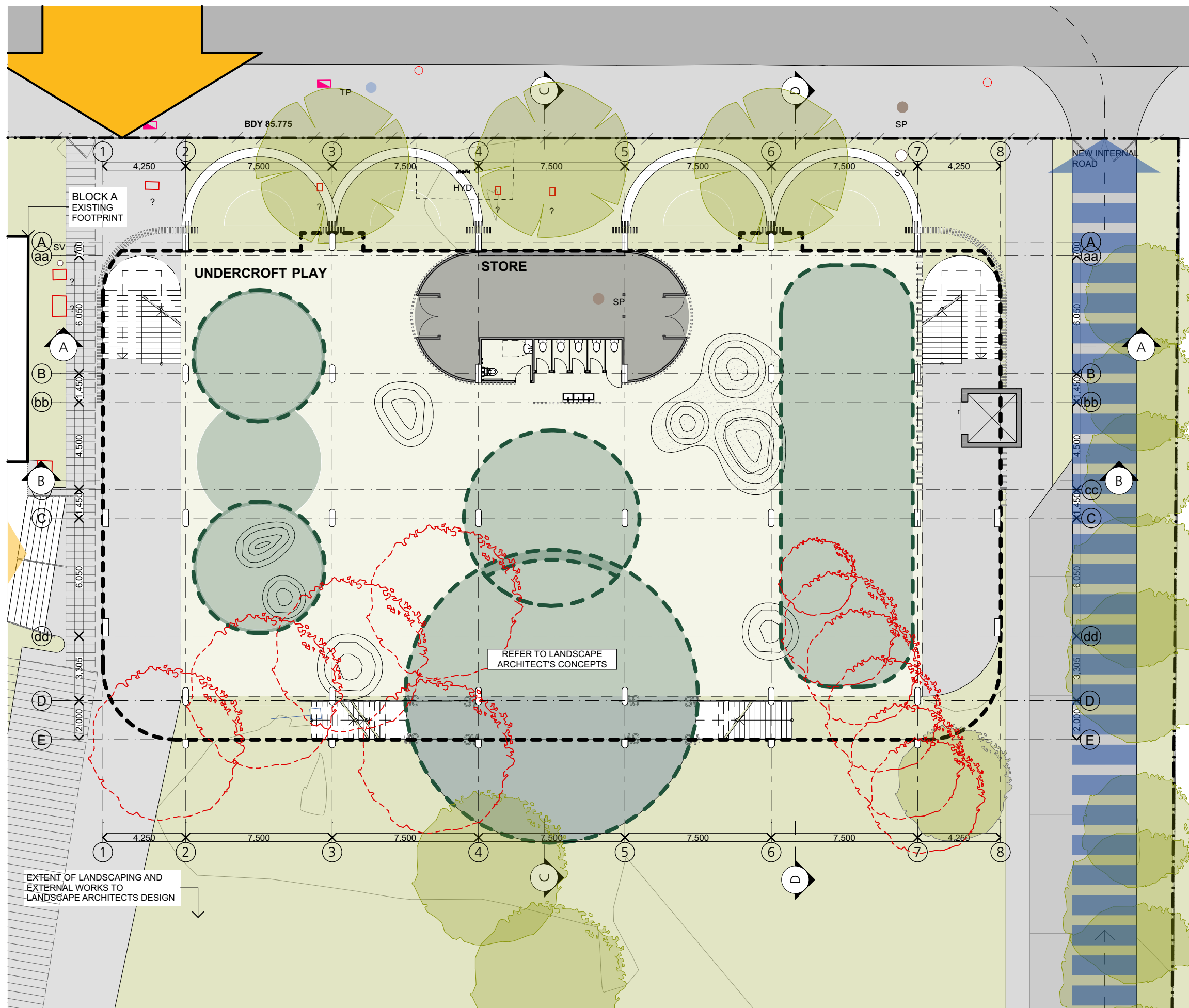
- The building has views to nature on either side





SSD APPLICATION

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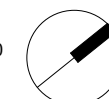
4293
4.21

RevH 07.06.21

Ground Floor Plan

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

0m 2 4 6 8 10 1:200
@A3



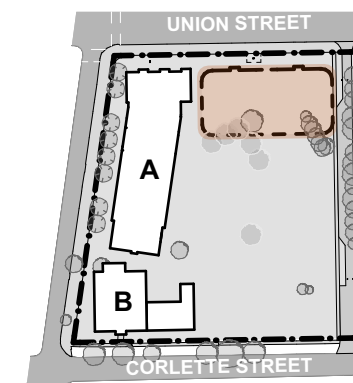
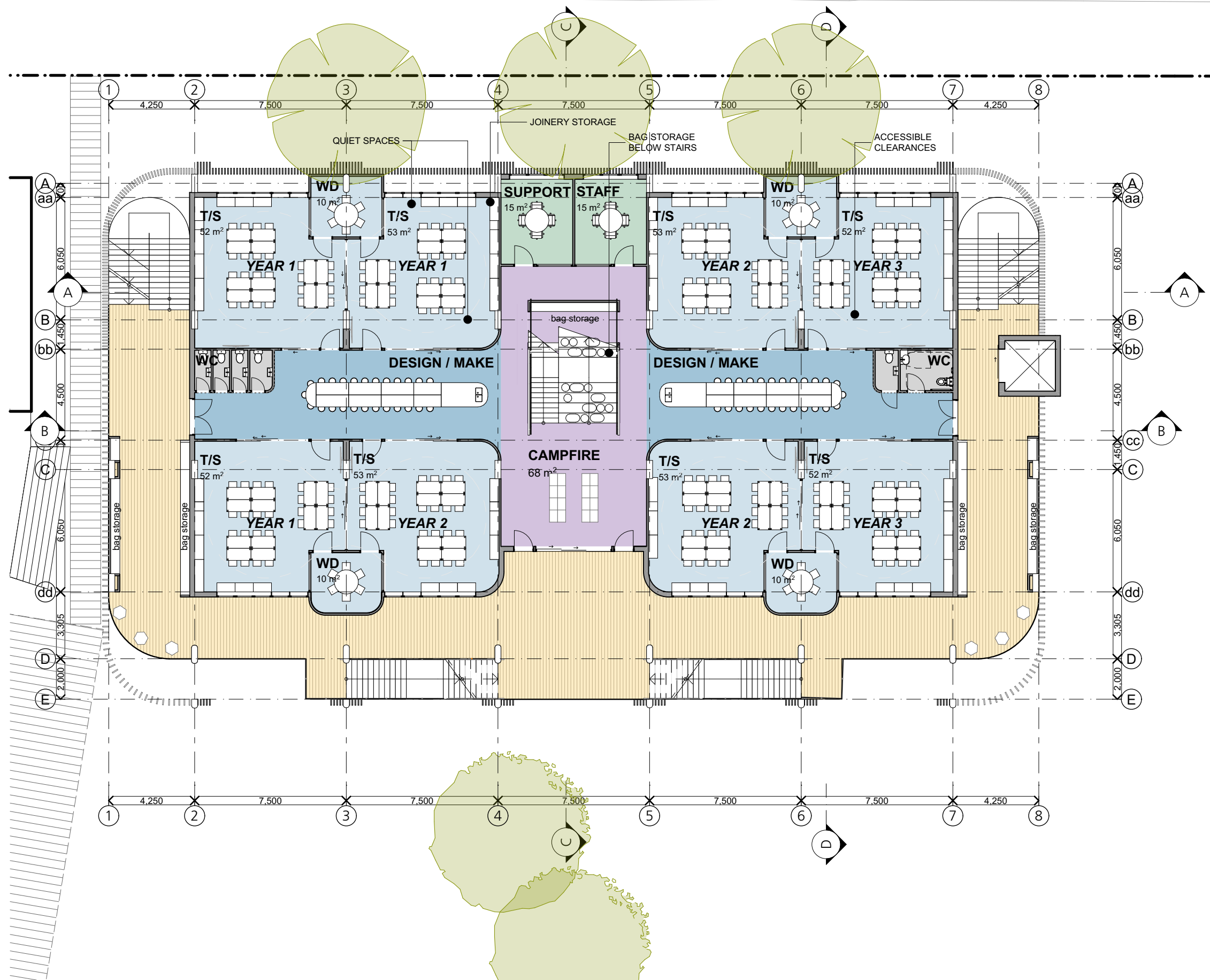
SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846



SSD APPLICATION

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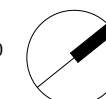
4293
4.22

RevH 07.06.21

First Floor Plan

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

0m 2 4 6 8 10 1:200
@A3



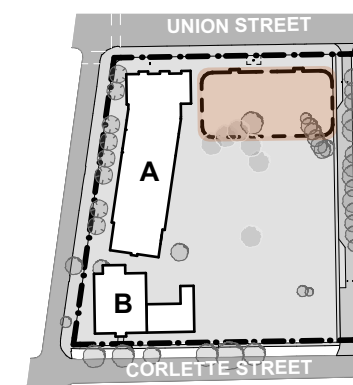
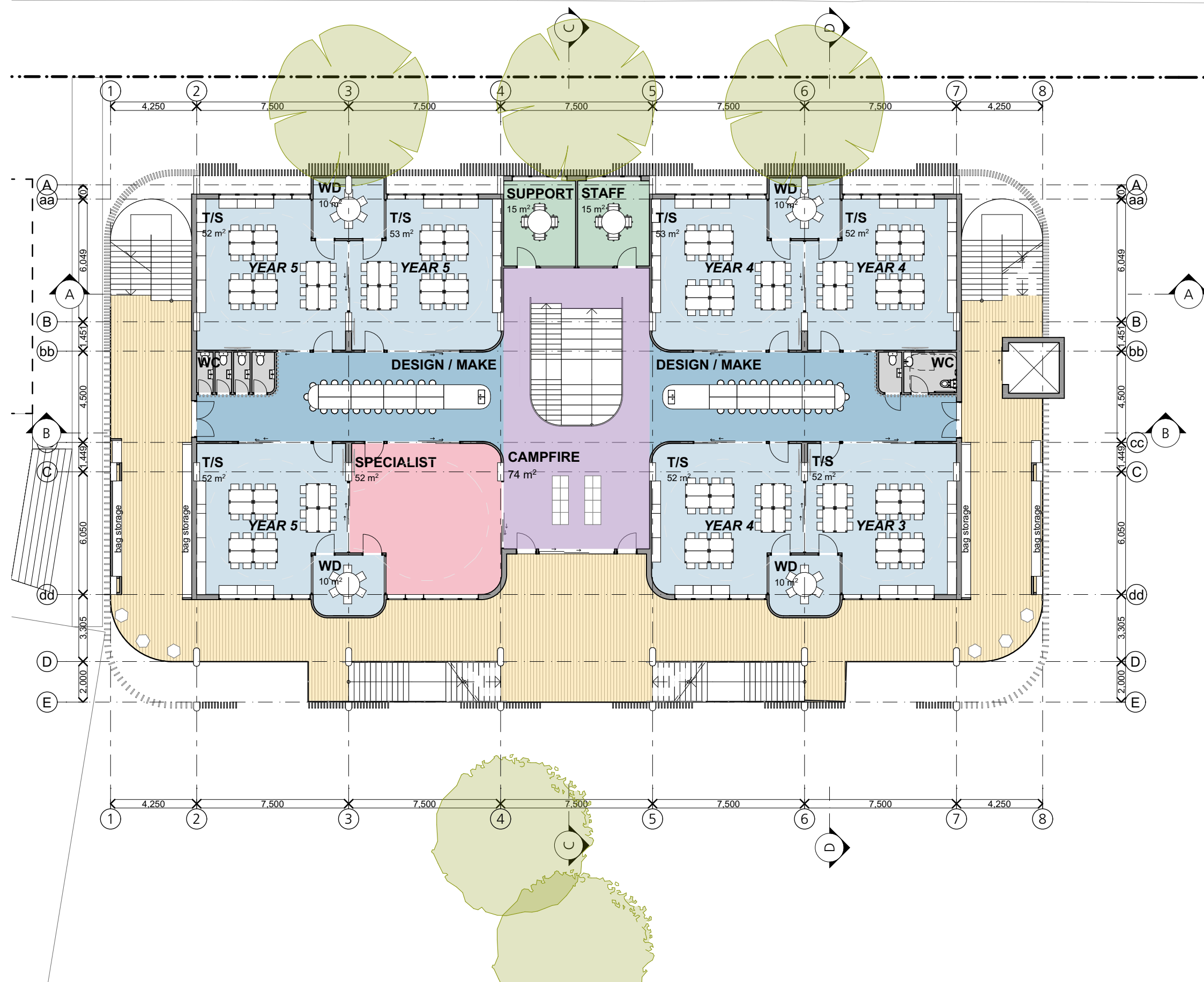
SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846



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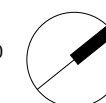
4293
4.23

RevH 07.06.21

Second Floor Plan

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

0m 2 4 6 8 10 1:200 @A3

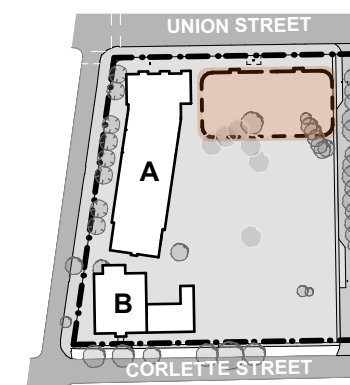
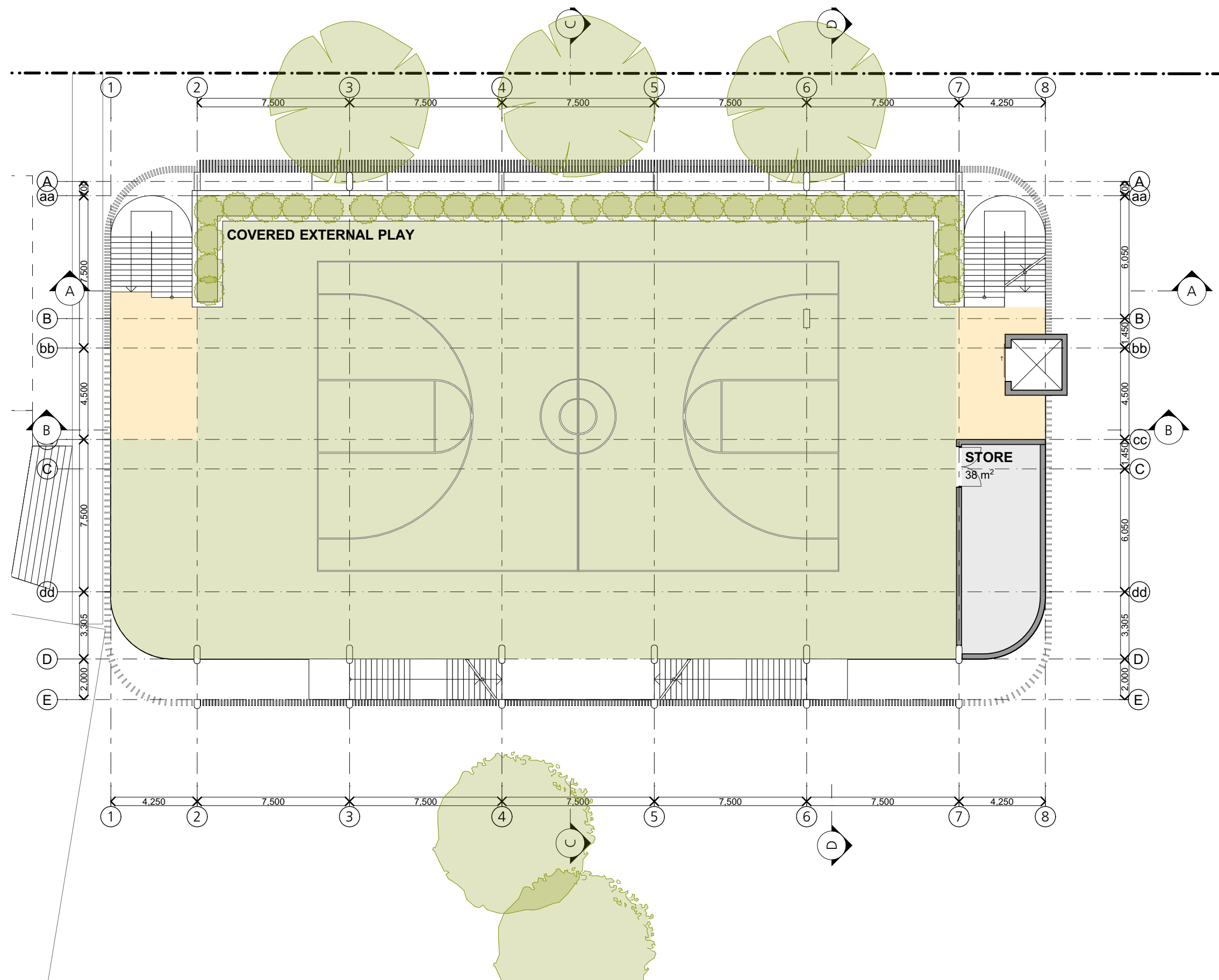


SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846

SSD APPLICATION

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4293
4.24

RevH 07.06.21

Rooftop Play

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

0m 2 4 6 8 10 1:200
@A3



SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846



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4293
4.34

RevC 09.06.21

Perspective - Streetview

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

NTS
@A3

SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846

SSD APPLICATION

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4293
4.35

RevC 09.06.21

Perspective - Undercroft

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

NTS
@A3

SHA-1

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846



SSD APPLICATION

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FULL HEIGHT TENSILE MESH



REFER TO LANDSCAPE ARCHITECT'S CONCEPTS

4293
4.36

RevC 09.06.21

Perspective - Playground

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

NTS
@A3

SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846



SSD APPLICATION

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4293
4.37

RevC 09.06.21

Perspective - Campfire

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

NTS
@A3

SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846



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4293
4.38

RevC 09.06.21

Perspective - Campfire

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

NTS
@A3

SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846



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4293
4.39

RevC 09.06.21

Perspective - Makerspace

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

NTS
@A3

SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846



SSD APPLICATION

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4293
4.40

RevC 09.06.21

Perspective - Makerspace

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

NTS
@A3

SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846



SSD APPLICATION

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4293
4.41

RevC 09.06.21

Perspective - First Floor Campfire

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

NTS
@A3

SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846

Drawing and design © SHAC Pty Ltd 2016. The signed control copy of this drawing is held by SHAC Pty Ltd. | Ref: BIMcloud: BIMSERVER24 - BIMcloud Basic for ARCHICAD 24/4293 NGS Park Campus Stage 1 date:10/06/2021 time: 1:04 PM



Newcastle
Grammar
— SCHOOL —

SSD APPLICATION

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4293
4.42

RevA 09.06.21

Interior Palette

Newcastle Grammar School - Park Campus Stage 1
Parkway Avenue, Cooks Hill NSW

SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846

APPENDIX F: LABORATORY REPORTS

Fw: Eurofins Test Results, Invoice - Report 805315 : Site NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION (754-NTLEN282007)

John Nguyen <JohnNguyen@eurofins.com>

Fri 7/2/2021 9:58 AM

To: #AU04_Enviro_Sample_NSW <EnviroSampleNSW@eurofins.com>

Hi Truong,

Please log additional **PAH soil analysis** on the following samples - **2 day TAT**:

- DS1 - 0.3-0.5;
- DS2 - 0.3-0.5;
- DS3 - 0.3-0.5;
- DS4 - 0.3-0.5;
- DS5 - 0.3-0.5;
- DS6 - 0.3-0.5;
- DS7 - 0.3-0.5;
- DS8-0.3-0.5;
- DS9-0.3-0.5;
- DS10-0.3-0.5;

John Nguyen

Analytical Services Manager

Eurofins | Environment Testing

Unit F3, Parkview Building

16 Mars Road

LANE COVE WEST NSW 2066

AUSTRALIA

Mobile: +61 424 521 210

Email: johnnguyen@eurofins.com

Website: www.eurofins.com.au/environmental-testing

*For sample receipt enquiries (eg. SRAs, changes to analysis) please contact EnviroSampleNSW@eurofins.com or 02 9900 8421 (7am – 12am).
For despatch enquiries (eg. courier bookings, bottle orders) please contact AU04_Despatch_SYD@eurofins.com or 0488 400 929 (8am – 4pm).*

From: Blackford, Sean <Sean.Blackford@coffey.com>

Sent: Friday, July 2, 2021 9:43 AM

To: John Nguyen <JohnNguyen@eurofins.com>; Andrew Black <AndrewBlack@eurofins.com>

Cc: COF.newcastle <newcastle@coffey.com>

Subject: RE: Eurofins Test Results, Invoice - Report 805315 : Site NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION (754-NTLEN282007)

Australia
Melbourne

6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254

Sydney

Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane

1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth

46-48 Banksia Road
Welshpool WA 6106
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Newcastle

4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448
NATA # 1261 Site # 25079

New Zealand
Auckland

35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch

43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Sample Receipt Advice

Company name: Coffey Environments P/L N'castle
Contact name: Sean Blackford
Project name: ADDITIONAL - NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION
Project ID: 754-NTLEN282007
Turnaround time: 2 Day
Date/Time received: Jul 2, 2021 9:43 AM
Eurofins reference: 807481

Sample Information

- ✓ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ✓ Sample Temperature of a random sample selected from the batch as recorded by Eurofins Sample Receipt : 19.6 degrees Celsius.
- ✓ All samples have been received as described on the above COC.
- ✓ COC has been completed correctly.
- ✓ Attempt to chill was evident.
- ✓ Appropriately preserved sample containers have been used.
- ✓ All samples were received in good condition.
- ✓ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ✓ Appropriate sample containers have been used.
- ✓ Sample containers for volatile analysis received with zero headspace.
- ✗ Split sample sent to requested external lab.
- ✗ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Sean Blackford - sean.blackford@coffey.com.

Note: A copy of these results will also be delivered to the general Coffey Environments P/L N'castle email address.

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
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NATA # 1261
Site # 1254

Sydney
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NATA # 1261
Site # 23736

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Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

Company Name: Coffey Environments P/L N'castle
Address: 16 Callistemon Close
Warabrook
NSW 2304

Order No.:
Report #: 807481
Phone: 02 4016 2300
Fax: 02 4016 2380

Received: Jul 2, 2021 9:43 AM
Due: Jul 6, 2021
Priority: 2 Day
Contact Name: Sean Blackford

Project Name: ADDITIONAL - NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION
Project ID: 754-NTLEN282007

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Polyyclic Aromatic Hydrocarbons	Moisture Set
Melbourne Laboratory - NATA Site # 1254							
Sydney Laboratory - NATA Site # 18217						X	X
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
Mayfield Laboratory - NATA Site # 25079							
External Laboratory							
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID		
1	DS1-0.3-0.5	Jun 21, 2021		Soil	S21-JI02476	X	X
2	DS2-0.3-0.5	Jun 21, 2021		Soil	S21-JI02477	X	X
3	DS3-0.3-0.5	Jun 21, 2021		Soil	S21-JI02478	X	X
4	DS4-0.3-0.5	Jun 21, 2021		Soil	S21-JI02479	X	X
5	DS5-0.3-0.5	Jun 21, 2021		Soil	S21-JI02480	X	X
6	DS6-0.3-0.5	Jun 21, 2021		Soil	S21-JI02481	X	X
7	DS7-0.3-0.5	Jun 21, 2021		Soil	S21-JI02482	X	X
8	DS8-0.3-0.5	Jun 21, 2021		Soil	S21-JI02483	X	X
9	DS9-0.3-0.5	Jun 21, 2021		Soil	S21-JI02484	X	X

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Phone : 0800 856 450
IANZ # 1290

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

Company Name: Coffey Environments P/L N'castle
Address: 16 Callistemon Close
Warabrook
NSW 2304

Project Name: ADDITIONAL - NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION
Project ID: 754-NTLEN282007

Order No.:
Report #: 807481
Phone: 02 4016 2300
Fax: 02 4016 2380

Received: Jul 2, 2021 9:43 AM
Due: Jul 6, 2021
Priority: 2 Day
Contact Name: Sean Blackford

Eurofins Analytical Services Manager : Andrew Black

Sample Detail

Polycyclic Aromatic Hydrocarbons

Moisture Set

Melbourne Laboratory - NATA Site # 1254

Sydney Laboratory - NATA Site # 18217

Brisbane Laboratory - NATA Site # 20794

Perth Laboratory - NATA Site # 23736

Mayfield Laboratory - NATA Site # 25079

External Laboratory

10	DS10-0.3-0.5	Jun 21, 2021		Soil	S21-JI02485	X	X
----	--------------	--------------	--	------	-------------	---	---

Test Counts						10	10
-------------	--	--	--	--	--	----	----

Coffey Environments Pty Ltd Newcastle
16 Callistemon Close
Warabrook
NSW 2304



NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition
Arrangement for the mutual recognition of the
equivalence of testing, medical testing, calibration,
inspection, proficiency testing scheme providers and
reference materials producers reports and certificates.

Attention: **Sean Blackford**

Report **807481-S**
Project name **ADDITIONAL - NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION**
Project ID **754-NTLEN282007**
Received Date **Jul 02, 2021**

Client Sample ID			DS1-0.3-0.5	DS2-0.3-0.5	G01 DS3-0.3-0.5	G01 DS4-0.3-0.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-JI02476	S21-JI02477	S21-JI02478	S21-JI02479
Date Sampled			Jun 21, 2021	Jun 21, 2021	Jun 21, 2021	Jun 21, 2021
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	< 0.5	< 100	< 20
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	0.6	< 100	< 20
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	1.2	140	31
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 5	< 1
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	2.8	0.9
Anthracene	0.5	mg/kg	< 0.5	< 0.5	12	4.0
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 50	< 10
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 100	< 20
Benzo(b&j)fluoranthene ^{N07}	0.5	mg/kg	< 0.5	< 0.5	< 50	< 10
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5	< 0.5	< 100	< 20
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 50	< 20
Chrysene	0.5	mg/kg	< 0.5	0.6	< 50	< 20
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 20	< 5
Fluoranthene	0.5	mg/kg	1.0	1.2	< 200	< 50
Fluorene	0.5	mg/kg	< 0.5	< 0.5	2.5	0.6
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 50	< 20
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	1.8	< 0.5
Phenanthrene	0.5	mg/kg	0.6	0.6	< 100	< 20
Pyrene	0.5	mg/kg	1.0	1.2	< 100	< 50
Total PAH*	0.5	mg/kg	2.6	3.6	< 200	< 50
2-Fluorobiphenyl (surr.)	1	%	91	86	69	84
p-Terphenyl-d14 (surr.)	1	%	84	78	74	56
% Moisture	1	%	24	29	12	16

Client Sample ID			G01 DS5-0.3-0.5	G01 DS6-0.3-0.5	G01 DS7-0.3-0.5	G01 DS8-0.3-0.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-JI02480	S21-JI02481	S21-JI02482	S21-JI02483
Date Sampled			Jun 21, 2021	Jun 21, 2021	Jun 21, 2021	Jun 21, 2021
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 100	< 50	< 100	< 50
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	< 100	< 50	< 100	< 50
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	140	81	140	81
Acenaphthene	0.5	mg/kg	< 5	< 2	< 5	< 5
Acenaphthylene	0.5	mg/kg	2.9	1.5	2.6	1.6
Anthracene	0.5	mg/kg	12	6.8	9.7	11
Benz(a)anthracene	0.5	mg/kg	< 50	< 50	< 50	< 50
Benzo(a)pyrene	0.5	mg/kg	< 100	< 50	< 100	< 50
Benzo(b&j)fluoranthene ^{N07}	0.5	mg/kg	< 50	< 50	< 50	< 50
Benzo(g,h,i)perylene	0.5	mg/kg	< 100	< 50	< 50	< 50
Benzo(k)fluoranthene	0.5	mg/kg	< 50	< 50	< 50	< 50
Chrysene	0.5	mg/kg	< 50	< 50	< 50	< 50
Dibenz(a,h)anthracene	0.5	mg/kg	< 20	< 10	< 20	< 10
Fluoranthene	0.5	mg/kg	< 200	< 100	< 200	< 200
Fluorene	0.5	mg/kg	3.4	1.1	2.4	1.5
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	< 50	< 50	< 50	< 50
Naphthalene	0.5	mg/kg	1.6	0.5	1.1	0.7
Phenanthrene	0.5	mg/kg	< 100	< 50	< 100	< 100
Pyrene	0.5	mg/kg	< 200	< 100	< 200	< 100
Total PAH*	0.5	mg/kg	< 200	< 100	< 200	< 200
2-Fluorobiphenyl (surr.)	1	%	86	87	85	91
p-Terphenyl-d14 (surr.)	1	%	79	69	88	85
% Moisture	1	%	18	12	13	15

Client Sample ID			DS9-0.3-0.5	G01 DS10-0.3-0.5
Sample Matrix			Soil	Soil
Eurofins Sample No.			S21-JI02484	S21-JI02485
Date Sampled			Jun 21, 2021	Jun 21, 2021
Test/Reference	LOR	Unit		
Polycyclic Aromatic Hydrocarbons				
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	< 50
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	< 50
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	63
Acenaphthene	0.5	mg/kg	< 0.5	< 5
Acenaphthylene	0.5	mg/kg	< 0.5	1.2
Anthracene	0.5	mg/kg	< 0.5	8.3
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 20
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 50
Benzo(b&j)fluoranthene ^{N07}	0.5	mg/kg	< 0.5	< 20
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5	< 20
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 20
Chrysene	0.5	mg/kg	< 0.5	< 20
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5	< 5
Fluoranthene	0.5	mg/kg	< 0.5	< 100
Fluorene	0.5	mg/kg	< 0.5	2.3
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	< 0.5	< 20
Naphthalene	0.5	mg/kg	< 0.5	3.2

Client Sample ID			DS9-0.3-0.5	^{G01} DS10-0.3-0.5
Sample Matrix			Soil	Soil
Eurofins Sample No.			S21-JI02484	S21-JI02485
Date Sampled			Jun 21, 2021	Jun 21, 2021
Test/Reference	LOR	Unit		
Polycyclic Aromatic Hydrocarbons				
Phenanthrene	0.5	mg/kg	< 0.5	< 50
Pyrene	0.5	mg/kg	< 0.5	< 50
Total PAH*	0.5	mg/kg	< 0.5	< 100
2-Fluorobiphenyl (surr.)	1	%	83	95
p-Terphenyl-d14 (surr.)	1	%	84	79
% Moisture	1	%	8.7	27

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description

Polycyclic Aromatic Hydrocarbons

- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water

% Moisture

- Method: LTM-GEN-7080 Moisture

Testing Site

Sydney

Sydney

Extracted

Jul 02, 2021

Jul 02, 2021

Holding Time

14 Days

14 Days

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
46-48 Banksia Road
Welshpool WA 6106
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Newcastle
4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448
NATA # 1261 Site # 25079

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Coffey Environments P/L N'castle
Address: 16 Callistemon Close
Warabrook
NSW 2304

Order No.:
Report #: 807481
Phone: 02 4016 2300
Fax: 02 4016 2380

Received: Jul 2, 2021 9:43 AM
Due: Jul 6, 2021
Priority: 2 Day
Contact Name: Sean Blackford

Project Name: ADDITIONAL - NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION
Project ID: 754-NTLEN282007

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Polycyclic Aromatic Hydrocarbons	Moisture Set
Melbourne Laboratory - NATA Site # 1254							
Sydney Laboratory - NATA Site # 18217						X	X
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
Mayfield Laboratory - NATA Site # 25079							
External Laboratory							
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID		
1	DS1-0.3-0.5	Jun 21, 2021		Soil	S21-JI02476	X	X
2	DS2-0.3-0.5	Jun 21, 2021		Soil	S21-JI02477	X	X
3	DS3-0.3-0.5	Jun 21, 2021		Soil	S21-JI02478	X	X
4	DS4-0.3-0.5	Jun 21, 2021		Soil	S21-JI02479	X	X
5	DS5-0.3-0.5	Jun 21, 2021		Soil	S21-JI02480	X	X
6	DS6-0.3-0.5	Jun 21, 2021		Soil	S21-JI02481	X	X
7	DS7-0.3-0.5	Jun 21, 2021		Soil	S21-JI02482	X	X
8	DS8-0.3-0.5	Jun 21, 2021		Soil	S21-JI02483	X	X
9	DS9-0.3-0.5	Jun 21, 2021		Soil	S21-JI02484	X	X

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
46-48 Banksia Road
Welshpool WA 6106
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Newcastle
4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448
NATA # 1261 Site # 25079

New Zealand

Auckland
35 O'Rourke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

Company Name: Coffey Environments P/L N'castle
Address: 16 Callistemon Close
Warabrook
NSW 2304

Project Name: ADDITIONAL - NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION
Project ID: 754-NTLEN282007

Order No.:
Report #: 807481
Phone: 02 4016 2300
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Received: Jul 2, 2021 9:43 AM
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Contact Name: Sean Blackford

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Polycyclic Aromatic Hydrocarbons	Moisture Set
Melbourne Laboratory - NATA Site # 1254							
Sydney Laboratory - NATA Site # 18217						X	X
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
Mayfield Laboratory - NATA Site # 25079							
External Laboratory							
10	DS10-0.3-0.5	Jun 21, 2021		Soil	S21-JI02485	X	X
Test Counts						10	10

Internal Quality Control Review and Glossary

General

- Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
- All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
- All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
- Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
- SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- Samples were analysed on an 'as received' basis.
- Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
- This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ug/L: micrograms per litre
ppm: Parts per million	ppb: Parts per billion	%: Percentage
org/100mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

- Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
- Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
- Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
- Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
- Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
- pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
- Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
- Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
- For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
- Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Polycyclic Aromatic Hydrocarbons									
Acenaphthene			mg/kg	< 0.5			0.5	Pass	
Acenaphthylene			mg/kg	< 0.5			0.5	Pass	
Anthracene			mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene			mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene			mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene			mg/kg	< 0.5			0.5	Pass	
Benzo(g,h,i)perylene			mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene			mg/kg	< 0.5			0.5	Pass	
Chrysene			mg/kg	< 0.5			0.5	Pass	
Dibenz(a,h)anthracene			mg/kg	< 0.5			0.5	Pass	
Fluoranthene			mg/kg	< 0.5			0.5	Pass	
Fluorene			mg/kg	< 0.5			0.5	Pass	
Indeno(1,2,3-cd)pyrene			mg/kg	< 0.5			0.5	Pass	
Naphthalene			mg/kg	< 0.5			0.5	Pass	
Phenanthrene			mg/kg	< 0.5			0.5	Pass	
Pyrene			mg/kg	< 0.5			0.5	Pass	
LCS - % Recovery									
Polycyclic Aromatic Hydrocarbons									
Acenaphthene			%	90			70-130	Pass	
Acenaphthylene			%	89			70-130	Pass	
Anthracene			%	88			70-130	Pass	
Benz(a)anthracene			%	88			70-130	Pass	
Benzo(a)pyrene			%	89			70-130	Pass	
Benzo(b&j)fluoranthene			%	70			70-130	Pass	
Benzo(g,h,i)perylene			%	81			70-130	Pass	
Benzo(k)fluoranthene			%	98			70-130	Pass	
Chrysene			%	92			70-130	Pass	
Dibenz(a,h)anthracene			%	86			70-130	Pass	
Fluoranthene			%	91			70-130	Pass	
Fluorene			%	90			70-130	Pass	
Indeno(1,2,3-cd)pyrene			%	75			70-130	Pass	
Naphthalene			%	100			70-130	Pass	
Phenanthrene			%	90			70-130	Pass	
Pyrene			%	92			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	S21-JI02476	CP	%	126			70-130	Pass	
Acenaphthylene	S21-JI02476	CP	%	111			70-130	Pass	
Anthracene	S21-JI02476	CP	%	111			70-130	Pass	
Benz(a)anthracene	S21-JI02476	CP	%	99			70-130	Pass	
Benzo(a)pyrene	S21-Jn54537	NCP	%	120			70-130	Pass	
Benzo(b&j)fluoranthene	S21-JI02476	CP	%	72			70-130	Pass	
Benzo(g,h,i)perylene	S21-JI02476	CP	%	81			70-130	Pass	
Benzo(k)fluoranthene	S21-JI02476	CP	%	107			70-130	Pass	
Chrysene	S21-JI02476	CP	%	118			70-130	Pass	
Dibenz(a,h)anthracene	S21-JI02476	CP	%	86			70-130	Pass	
Fluoranthene	S21-JI02476	CP	%	115			70-130	Pass	
Fluorene	S21-JI02476	CP	%	113			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Indeno(1.2.3-cd)pyrene	S21-Jn54537	NCP	%	113			70-130	Pass	
Naphthalene	S21-Jn54537	NCP	%	128			70-130	Pass	
Phenanthrene	S21-JI02476	CP	%	125			70-130	Pass	
Pyrene	S21-JI02476	CP	%	118			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	S21-Jn61701	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthylene	S21-JI02485	CP	mg/kg	1.2	0.6	70	30%	Fail	Q15
Anthracene	S21-JI02485	CP	mg/kg	8.3	3.5	81	30%	Fail	Q02
Benz(a)anthracene	S21-JI02485	CP	mg/kg	< 20	< 5	<1	30%	Pass	
Benzo(a)pyrene	S21-JI02485	CP	mg/kg	< 50	< 10	<1	30%	Pass	
Benzo(b&j)fluoranthene	S21-JI02485	CP	mg/kg	< 20	< 5	<1	30%	Pass	
Benzo(g,h,i)perylene	S21-JI02485	CP	mg/kg	< 20	< 10	<1	30%	Pass	
Benzo(k)fluoranthene	S21-JI02485	CP	mg/kg	< 20	< 10	<1	30%	Pass	
Chrysene	S21-JI02485	CP	mg/kg	< 20	< 10	<1	30%	Pass	
Dibenz(a,h)anthracene	S21-JI02485	CP	mg/kg	< 5	< 1	<1	30%	Pass	
Fluoranthene	S21-JI02485	CP	mg/kg	< 100	< 50	<1	30%	Pass	
Fluorene	S21-JI02485	CP	mg/kg	2.3	0.8	99	30%	Fail	Q15
Indeno(1.2.3-cd)pyrene	S21-JI02485	CP	mg/kg	< 20	< 5	<1	30%	Pass	
Naphthalene	S21-JI02485	CP	mg/kg	3.2	1.4	77	30%	Fail	Q15
Phenanthrene	S21-JI02485	CP	mg/kg	< 50	< 20	<1	30%	Pass	
Pyrene	S21-JI02485	CP	mg/kg	< 50	< 20	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	S21-JI02485	CP	%	27	32	14	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
G01	The LORs have been raised due to matrix interference
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q02	The duplicate %RPD is outside the recommended acceptance criteria. Further analysis indicates sample heterogeneity as the cause
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Andrew Black	Analytical Services Manager
Andrew Sullivan	Senior Analyst-Organic (NSW)



Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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Grace Tuckwell

From: #AU04_Enviro_Sample_NSW
Subject: FW: 1 DAY TAT ADDITIONAL LEACHATES: FW: Additional Analysis - 808215-S & 808534-S
Importance: High

From: Blackford, Sean <Sean.Blackford@coffey.com>
Sent: Friday, 13 August 2021 1:12 PM
To: Andrew Black <AndrewBlack@eurofins.com>
Subject: Additional Analysis - 808215-S & 808534-S

EXTERNAL EMAIL*

Hey Andrew,

Can I request additional analysis on samples listed below from recent soil reports = 808215-S (DS3-0.3-0.5) and 808534-S (DS6-0.8-1.0)

Can I request ASLP analysis for PAH analytes (Benzo(a)pyrene TEQ and Total PAHs)

- DS3-0.3-0.5;
- DS8-0.8-1.0;
- DS6-0.3-0.5; and
- DS6-0.8-1.0.

Can I request the quickest TAT the laboratory can provide?

Give me a call if there are any issues with this request.

Kind Regards,

Sean Blackford BEnvSc&Mgt | Senior Environmental Scientist
Direct +61 02 4028 9719 | Mobile +61 418 549 796

Tetra Tech | *Leading with Science*® | Newcastle Geoservices Office (Australia)
16 Callistemon Close, Warabrook NSW 2304

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NATA # 1261 Site # 1254

Sydney

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Phone : +64 9 526 45 51
IANZ # 1327

Christchurch

43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Sample Receipt Advice

Company name: Coffey Environments P/L N'castle
Contact name: Sean Blackford
Project name: ADDITIONAL NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION
Project ID: 754-NTLEN282007
Turnaround time: 1 Day
Date/Time received: Aug 13, 2021 1:12 PM
Eurofins reference: 816949

Sample Information

- ✓ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ✓ Sample Temperature of a random sample selected from the batch as recorded by Eurofins Sample Receipt : 19.6 degrees Celsius.
- ✓ All samples have been received as described on the above COC.
- ✓ COC has been completed correctly.
- ✓ Attempt to chill was evident.
- ✓ Appropriately preserved sample containers have been used.
- ✓ All samples were received in good condition.
- ✓ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ✓ Appropriate sample containers have been used.
- ✓ Sample containers for volatile analysis received with zero headspace.
- ✗ Split sample sent to requested external lab.
- ✗ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Sean Blackford - sean.blackford@coffey.com.

Note: A copy of these results will also be delivered to the general Coffey Environments P/L N'castle email address.

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Company Name: Coffey Environments P/L N'castle
Address: 16 Callistemon Close
Warabrook
NSW 2304

Order No.:
Report #: 816949
Phone: 02 4016 2300
Fax: 02 4016 2380

Received: Aug 13, 2021 1:12 PM
Due: Aug 16, 2021
Priority: 1 Day
Contact Name: Sean Blackford

Project Name: ADDITIONAL NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION
Project ID: 754-NTLEN282007

Eurofins Analytical Services Manager : Andrew Black

Sample Detail

Polyyclic Aromatic Hydrocarbons

AUS Leaching Procedure

Melbourne Laboratory - NATA Site # 1254

Sydney Laboratory - NATA Site # 18217

Brisbane Laboratory - NATA Site # 20794

Perth Laboratory - NATA Site # 23736

Mayfield Laboratory - NATA Site # 25079

External Laboratory

No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID		
1	DS3-0.3-0.5	Jun 21, 2021		AUS Leachate - Reagent Water	S21-Au24904	X	X
2	DS6-0.3-0.5	Jun 21, 2021		AUS Leachate - Reagent Water	S21-Au24905	X	X
3	DS6-0.8-1.0	Jun 21, 2021		AUS Leachate - Reagent Water	S21-Au24906	X	X
4	DS8-0.8-1.0	Jun 21, 2021		AUS Leachate - Reagent Water	S21-Au24907	X	X

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Project Name: ADDITIONAL NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION
Project ID: 754-NTLEN282007

Eurofins Analytical Services Manager : Andrew Black

Sample Detail

Polycyclic Aromatic Hydrocarbons

AUS Leaching Procedure

Melbourne Laboratory - NATA Site # 1254

Sydney Laboratory - NATA Site # 18217

Brisbane Laboratory - NATA Site # 20794

Perth Laboratory - NATA Site # 23736

Mayfield Laboratory - NATA Site # 25079

External Laboratory

Test Counts

X

X

4

4

Coffey Environments Pty Ltd Newcastle
16 Callistemon Close
Warabrook
NSW 2304



NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
 NATA is a signatory to the ILAC Mutual Recognition
 Arrangement for the mutual recognition of the
 equivalence of testing, medical testing, calibration,
 inspection, proficiency testing scheme providers and
 reference materials producers reports and certificates.

Attention: **Sean Blackford**

Report **816949-L**
 Project name **ADDITIONAL NEWCASTLE GRAMMAR SCHOOL - PAH DELINEATION**
 Project ID **754-NTLEN282007**
 Received Date **Aug 13, 2021**

Client Sample ID			DS3-0.3-0.5	DS6-0.3-0.5	DS6-0.8-1.0	DS8-0.8-1.0
Sample Matrix			AUS Leachate - Reagent Water	AUS Leachate - Reagent Water	AUS Leachate - Reagent Water	AUS Leachate - Reagent Water
Eurofins Sample No.			S21-Au24904	S21-Au24905	S21-Au24906	S21-Au24907
Date Sampled			Jun 21, 2021	Jun 21, 2021	Jun 21, 2021	Jun 21, 2021
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	0.001	< 0.005	< 0.005	< 0.001
Benzo(a)pyrene	0.001	mg/L	0.002	< 0.005	< 0.005	< 0.001
Benzo(b&j)fluoranthene ^{N07}	0.001	mg/L	0.002	< 0.005	< 0.005	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	0.002	< 0.005	< 0.005	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	0.001	< 0.005	< 0.005	< 0.001
Chrysene	0.001	mg/L	0.002	< 0.005	< 0.005	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	< 0.001	< 0.005	< 0.005	< 0.001
Fluoranthene	0.001	mg/L	< 0.01	< 0.05	< 0.05	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	0.001	< 0.005	< 0.005	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	0.002	0.005	0.005	< 0.001
Pyrene	0.001	mg/L	< 0.01	< 0.05	< 0.05	< 0.001
Total PAH*	0.001	mg/L	0.013	< 0.05	< 0.05	< 0.001
2-Fluorobiphenyl (surr.)	1	%	88	86	92	93
p-Terphenyl-d14 (surr.)	1	%	65	INT	INT	50
AUS Leaching Procedure						
Leachate Fluid ^{C01}		comment	4.0	4.0	4.0	4.0
pH (initial)	0.1	pH Units	6.3	6.2	6.2	6.3
pH (Leachate fluid)	0.1	pH Units	6.1	6.1	6.1	6.1
pH (off)	0.1	pH Units	8.0	7.8	8.2	8.4

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description

Polycyclic Aromatic Hydrocarbons

- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water

AUS Leaching Procedure

- Method: LTM-GEN-7010 Leaching Procedure for Soils & Solid Wastes

Testing Site

Sydney

Sydney

Extracted

Aug 13, 2021

Aug 13, 2021

Holding Time

7 Days

7 Days

Australia

Melbourne
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NSW 2304

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Report #: 816949
Phone: 02 4016 2300
Fax: 02 4016 2380

Received: Aug 13, 2021 1:12 PM
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Project ID: 754-NTLEN282007

Eurofins Analytical Services Manager : Andrew Black

Sample Detail

Polycyclic Aromatic Hydrocarbons

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External Laboratory

Test Counts

X

X

4

4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ug/L: micrograms per litre
ppm: Parts per million	ppb: Parts per billion	%: Percentage
org/100mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	S21-Au16183	NCP	%	96			70-130	Pass	
Acenaphthylene	S21-Au16183	NCP	%	95			70-130	Pass	
Anthracene	S21-Au16183	NCP	%	93			70-130	Pass	
Benz(a)anthracene	S21-Au16183	NCP	%	104			70-130	Pass	
Benzo(a)pyrene	S21-Au16183	NCP	%	93			70-130	Pass	
Benzo(b&j)fluoranthene	S21-Au16183	NCP	%	93			70-130	Pass	
Benzo(g,h,i)perylene	S21-Au16183	NCP	%	96			70-130	Pass	
Benzo(k)fluoranthene	S21-Au16183	NCP	%	89			70-130	Pass	
Chrysene	S21-Au16183	NCP	%	102			70-130	Pass	
Dibenz(a,h)anthracene	S21-Au16183	NCP	%	86			70-130	Pass	
Fluoranthene	S21-Au16183	NCP	%	101			70-130	Pass	
Fluorene	S21-Au16183	NCP	%	106			70-130	Pass	
Indeno(1,2,3-cd)pyrene	S21-Au16183	NCP	%	88			70-130	Pass	
Naphthalene	S21-Au16183	NCP	%	98			70-130	Pass	
Phenanthrene	S21-Au16183	NCP	%	112			70-130	Pass	
Pyrene	S21-Au16183	NCP	%	95			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	S21-Au24255	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	S21-Au24255	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	S21-Au24255	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	S21-Au24255	NCP	mg/L	0.002	< 0.001	130	30%	Fail	Q15
Benzo(a)pyrene	S21-Au24255	NCP	mg/L	0.002	< 0.001	170	30%	Fail	Q15
Benzo(b&j)fluoranthene	S21-Au24255	NCP	mg/L	0.001	< 0.001	160	30%	Fail	Q15
Benzo(g,h,i)perylene	S21-Au24255	NCP	mg/L	0.001	< 0.001	190	30%	Fail	Q15
Benzo(k)fluoranthene	S21-Au24255	NCP	mg/L	0.001	< 0.001	180	30%	Fail	Q15
Chrysene	S21-Au24255	NCP	mg/L	0.002	< 0.001	180	30%	Fail	Q15
Dibenz(a,h)anthracene	S21-Au24255	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	S21-Au24255	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Fluorene	S21-Au24255	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1,2,3-cd)pyrene	S21-Au24255	NCP	mg/L	0.001	< 0.001	190	30%	Fail	Q15
Naphthalene	S21-Au24255	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	S21-Au24255	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Pyrene	S21-Au24255	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
C01	Leachate Fluid Key: 1 - pH 5.0; 2 - pH 2.9; 3 - pH 9.2; 4 - Reagent (DI) water; 5 - Client sample, 6 - other
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Andrew Black Analytical Services Manager
 Andrew Sullivan Senior Analyst-Organic (NSW)



Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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