ENVIRONMENTAL EARTH SCIENCES
THE KNOW AND THE HOW

REPORT NO. 117107

PRELIMINARY REMEDIATION ACTION PLAN

EDUCATION AND LANDS BUILDINGS PROJECT, 22-33 & 35-39 BRIDGE STREET, SYDNEY NSW

ENVIRONMENTAL EARTH SCIENCES NSW
REPORT TO PONTIAC LAND (AUSTRALIA) PTY LTD
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EXECUTIVE SUMMARY

Environmental Earth Sciences NSW were commissioned by Built Pty Limited (Built) on behalf of Pontiac Land (Australia) Pty Ltd (Pontiac) to prepare a preliminary remediation action plan (RAP) to be implemented during proposed construction works at the former Education and Lands Department buildings, 22-33 and 35-39 Bridge Street, Sydney NSW (the "site").

The preferred remedial option for management of fill material identified to contain elevated contaminants of concern is:

- *In situ* characterisation of chemical status to derive a waste classification in accordance with the NSW Environment Protection Authority (EPA) (2014) - *Waste Classification Guidelines*;
- Direct offsite disposal to an appropriately licensed waste facility;
- Validation of underlying bedrock surface / walls of excavations(s) to demonstrate that removal of soil impacted with contamination of concern has been successful.

The remediation management component will also provide direction for appropriate risk posed by known and unexpected contamination in soil during earthworks. Subject to the implementation of the actions in this preliminary RAP, the site can be made suitable for its intended land use.

Sampling and testing procedures for the different offsite soil management options are detailed in this preliminary RAP. This report also sets a framework for ensuring the effectiveness of environmental controls, reporting of environmental incidents and response procedure, responsible persons and emergency contact information. It is a living document and as such should undergo review, corrective action and continual improvement as needed.

On behalf of
Environmental Earth Sciences NSW

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1 INTRODUCTION & BACKGROUND

Environmental Earth Sciences NSW were commissioned by Built Pty Limited (Built) on behalf of Pontiac Land (Australia) Pty Ltd (Pontiac) to prepare a preliminary remediation action plan (RAP) to be implemented during proposed construction works at the former Education and Lands Department buildings, 22-33 and 35-39 Bridge Street, Sydney NSW (the "site"). Refer to Figure 1 for site location.

Preparation of this plan has been undertaken in accordance with fee proposal issued to Built (ref: PO117169_V1; dated 20 October 2017). The plan should be read in conjunction with the limitations situated at the rear of the report.

Both buildings are heritage listed sandstone structures that are proposed to be redeveloped by Pontiac. The building footprints occupy two blocks respectively:

- 23-33 Bridge Street (Lands building) comprising of a four-storey sandstone structure approximately 3,300 square metres (m^2) in area bounded by Bridge Street, Loftus Street, Bent Street and Gresham Street. Building has a basement level.
- 35-39 Bridge Street (Education building) comprising of a six-storey sandstone structure approximately 2,900 m^2 in area bounded by Bridge Street, Loftus Street, Bent Street and Young Street. Building has a basement level.

It is understood that the proposed redevelopment also consists of constructing an underground tunnel beneath Loftus Street connecting newly excavated basements in each building.

2 LEGISLATIVE REQUIREMENTS

2.1 General

Built are managing the contract to redevelop the site in line with the requirements of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act). This preliminary RAP is being prepared prior to issue of development consent.

2.2 Remediation planning requirements

A number of statutes and guidelines will apply to the management of remediation, validation and environmental management at the site during activities associated with the proposed development. These include but not limit:

- NSW EPA Contaminated Land Management Act 1997 (CLM Act).
- NSW EPA Protection of the Environment Operations Act 1997 (POEO Act).
- NSW Department of Urban Affairs and Planning (DUAP) (1998) - State Environmental Planning Policy (SEPP) No.55 – *Managing Land Contamination: Planning Guidelines – Remediation of Land* (SEPP55).
- City of Sydney Council Development Control Plan 2014 (DCP) and City of Sydney Council Contaminated Land Development Control Plan 2004 (CLDCP).

- NSW EPA endorsed guidelines (refer to Section 2.3).
- SafeWork NSW and WorkSafe Australia acts, regulations and factsheets.
- Applicable Australian Standards.

Proposed remediation at the site will be classified as a Category 2 remediation (without consent) in accordance with SEPP55 (Clause 14(a)).
As a general principle in SEPP55 a site audit is only necessary if the local authority believes the information supplied thus far is incorrect or incomplete, or the land is subject to a rezoning. Remediation needs development consent (i.e. Category 1) when at least one on the following points apply:

- If it is considered designated development under Schedule 3 of the NSW Environmental Planning and Assessment (EP&A) Regulation or under a planning instrument.
- If remediation is proposed on land identified as critical habitat under the *Threatened Species Conservation Act 1995*.
- Where consideration of s.5A of the EP&A Act indicates the remediation work is likely to have a significant effect on threatened species, populations, ecological communities or their habitats.
- If remediation is proposed in an area or zone identified in a planning instrument as being an area of environmental significance such as scenic areas, wetlands. These are listed in the SEPP.
- If the remediation will require consent under another SEPP or a regional environmental plan.

As none of the abovementioned points applies to the proposed remediation, development without consent can proceed as long as the following points are satisfied:

- Local authority notified more than 30-days prior to the anticipated 'Category 2' remediation start date.
- Proposal documentation prepared, including RAP if proponent considers it necessary.
- RAP carried-out in accordance with submitted information.
- Validation obtained from qualified expert at completion of remediation work.
- Local authority is notified of validation within a month of completion of work.

2.3 Guidelines and standards

Development and remediation within the Council jurisdiction must be undertaken in accordance with the Council DCP. To ensure compliance with the law earthworks remediation activities for the proposed project are recommended to be undertaken with reference to the following guidance and advice documents:

- Australian & New Zealand Environment & Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) — *Australian and New Zealand guidelines for fresh and marine water quality*, National Water Quality Management Strategy (ANZECC / ARMCANZ, 2000).
- Australian Standard AS4482.1:2005 - *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-volatile and Semi-volatile Compounds*.

- Australian Standard AS4482.2:1998 - *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 2: Volatile Compounds*.
- Department of Infrastructure, Planning and Natural Resources (2004) – *Guideline for the Preparation of Environmental Management Plans*.
- Landcom (2004) - *Managing Urban Stormwater: Soils and Construction - Volume 1*, 4th Edition (New South Wales Government).
- National Environment Protection Council (NEPC) – *National Environment Protection (Assessment of Site Contamination) Amendment Measure No.1 2013* (NEPAM, 2013).
- National Water Quality Management Strategy (NWQMS) (2000) – *Australian Guidelines for Urban Stormwater Management*.
- NSW EPA (1995) – *Sample Design Guidelines*.
- NSW Agriculture (1998) - *Acid Sulfate Soils Management Advisory Committee, Acid Sulfate Soils Manual* (ASSMAC, 1998).
- NSW EPA (2014) – *Waste Classification Guidelines*.
- NSW Office of Environment and Heritage (OEH) (2011) - *Guidelines for Consultants Reporting on Contaminated Sites*.

3 OBJECTIVE

To prepare a preliminary RAP for the site in satisfaction of the Council of the City of Sydney (Council) planning requirements. The preliminary RAP will be developed to outline the remediation methodology, sampling regime and requisite validation to be undertaken that will ensure compliance with all relevant state and local government guidelines and legislation regards the management of potential contamination.

This preliminary RAP will evaluate and select the most appropriate option to manage known and unexpected soil contamination and potential acid sulfate soils (PASS) (if encountered), such that there will be no unacceptable risk to construction workers, future users of the site and the environment.

4 BACKGROUND INFORMATION

The following known assessments have been undertaken to provide an indication of likely contamination at the site and conclude on associated risk to future users in a commercial / industrial land use scenario.

4.1 Cetec (2016) Preliminary Site Investigation

A preliminary site investigation (PSI) was undertaken for the site in 2016 which generated Cetec (2016) – *Preliminary Site Contamination Investigation, Sandstones Redevelopment, Farrer Place Public Reserve* (ref: CN160710; date 4 November 2016). This PSI covered the subject site along with the public reserve adjacent to the Lands building on Farrah Place. Key findings included:

- Existing decommissioned electrical substation located in public reserve acting as a potential source of contamination. Note that this is not on the footprint of the buildings or proposed Loftus Street tunnel.
- The only other contamination source reported was potential diffuse particulate impact from motor vehicles.
- General onsite of contamination to soil was potentially considered to be petroleum hydrocarbons, asbestos and heavy metals, however no inspection of any subsurface soils was made during that assessment.

4.2 PSM (2017) geotechnical investigation

A geotechnical investigation was undertaken for the site by Pells Sullivan Meynink Consult Pty Limited (PSM), generating PSM (2017) – *Education and Lands Department Buildings Geotechnical Investigation* (ref: PSM2426-016L; date: 31 January 2017). Key findings from this report included:

- Six boreholes advanced:
  - Three in Education building to depths ranging 11.85 – 19.38 metres below ground level (mBGL).
  - Two upon Loftus Street to depths ranging 15.93 – 16.30 mBGL.
  - One in Lands building to 14.94 mBGL.
- General subsurface conditions encountered included:
  - Hardstanding – asphalt / brick / concrete.
  - Fill material – Compact sand / clayey sand, thickness ranging from 0.10 – 0.30 metres underneath the buildings, and 0.75 – 0.85 metres of fill underlying the hardstanding of Loftus Street.
  - Soil – sandy clay (weathered Hawkesbury Sandstone bedrock), thickness ranging from 0.00 – 0.80 metres
  - Bedrock - Hawkesbury Sandstone.
- Assessment for contamination not undertaken.

5 SITE SETTING

5.1 Site identification

Site identification details are provided in Table 1. Site location is illustrated on Figure 1.

TABLE 1 SITE IDENTIFICATION

Item	Details
Address	Lands building: 23-33 Bridge Street, Sydney Education building: 35-39 Bridge Street, Sydney
Property Identifiers for Site	Lands building: Lot 1 in Deposited Plan (DP) 877000 Education building: Lot 56 in DP729620
Site Areas	Lands building: 3,300 m^2 Education building: 2,900 m^2
Local Government Authority	Council of the City of Sydney
Land Use Zoning	City centre (Sydney LEP 2005)
Site / investigation Area Map	Refer to Figure 1 for site location; Refer to Figure 2 for site details of proposed development footprints.

5.2 Site setting and surrounding environment

The land use of adjacent properties or properties immediately across adjacent roads includes the following land uses:

- North – Vehicular thoroughfare of Bridge Street immediately adjacent. Macquarie Place Park across Bridge Street. Commercial premises and high-rise residential beyond.
- East – Vehicular thoroughfare of Young Street immediately adjacent. Commercial premises and high-rise residential beyond. Sydney Botanic Gardens situated approximately 200 metres east.
- South - Vehicular thoroughfare of Bent Street immediately adjacent. Commercial premises and high-rise residential beyond. Residential area beyond this.
- West – Vehicular thoroughfare of Gresham Street immediately adjacent. Commercial premises and high-rise residential beyond. The covered Tank Stream stormwater drainage channel is generally situated under Pitt Street, approximately 60 metres west of the site.

The nearest ecological receptor to the site is Sydney Harbour, with Sydney Cove situated approximately 290 metres north of site, Farm Cove situated approximately 580 metres east of site and Darling Harbour situated approximately 800 metres west of site. Sydney Harbour is a tidal marine environment.

5.3 Topography, drainage and hydrology

The site is situated at between elevations ranging from approximately 66 - 69 metres above Australian Height Datum (mAHD). Local topography at the site grades downward to the north toward Sydney Cove.

The site is fully covered by the hardstanding of either car park areas or building footprints. As such precipitation would flow over this hardstanding and be directed into the engineered stormwater system along Loftus Street, Gresham Street, Bridge Street and Young Street.

The covered stormwater drain known as the Tank Stream flows under the present street level in the vicinity of Pitt Street, approximately 60 metres west of site.

5.4 Geology

5.4.1 Regional

The geology underlying the site is described in the Geological Survey NSW (1983) - *Sydney 1:100,000 Geological Sheet 9130* shows that the site is underlain by Triassic-aged Hawkesbury Sandstone, consisting of medium to coarse grained quartz sandstone with very minor shale and laminite lenses.

5.4.2 Site specific

Key findings from the PSM (2017) geotechnical investigation reported the following general subsurface conditions at the site:

- Hardstanding – asphalt / brick / concrete.
- Fill material – Compact sand / clayey sand, thickness ranging from 0.10 – 0.30 metres underneath the buildings, and 0.75 – 0.85 metres of fill underlying the hardstanding of Loftus Street.
- Soil – sandy clay (weathered Hawkesbury Sandstone bedrock), thickness ranging from 0.00 – 0.80 metres depth.
- Bedrock - Hawkesbury Sandstone.

Borelogs from the PSM (2007) geotechnical assessment and their associated investigation location figure is included in Appendix A.

5.5 Hydrogeology

A search of the NSW Groundwater Works Database indicated that there no registered groundwater bored within a 500 metres radius of the site.

Due to the proximity of the site to Sydney Cove it is likely that any infiltration of water through hardstanding or nearby parks would migrate down to the interface of the Hawkesbury sandstone bedrock, where it would either flow laterally along this surface of infiltrate into possible fracture zones. Regional groundwater is expected to be commensurate with sea level, with groundwater expected to discharge into Sydney Harbour.

5.6 Acid sulfate soils

The Cetec (2016) report provided a review of the Sydney Local Environmental Plan 2012 (LEP) acid sulfate soil risk map. This search reported that the site lies within a 'Class 5' zone. This class by definition requires consideration of acid sulfate soils for development works that are:

- Situated < 500 m from a Class 1 - 4 zone that is below 5 mAHD; and
- Where development is likely to lower the water table more than one metre on an adjacent Class 1-4 zone.

As the site is situated directly on top of Hawkesbury Sandstone bedrock the potential for sulfidic sediments to exist underlying the development is negligible.

The nearest Class 1 – 4 zone to the site is a 'Class 2' area situated adjacent to the northern boundary of both the Lands Department and Education building footprints along Bridge Street (refer to the LEP map in Appendix B). As the site is greater than 60 mAHD, development is unlikely to proceed deeper than 10 metres and intersect groundwater. Hence dewatering is not likely to be required that could potentially lower the groundwater table.

Based upon this preliminary assessment no further consideration of acid sulfate soils is required for management during the development.

6 REMEDIATION CRITERIA

The remediation acceptance criteria (RAC) for the appropriate validation of soils during any remediation reflect the interim criteria for commercial / industrial land use (new hotel) prescribed by ASC NEPM (2013). The following subsections detail the criteria that will evaluate remediation success.

6.1 Social performance criteria

To maintain transparency throughout the remedial process, effectiveness of efforts undertaken will be measured by the following main criteria:

- Proactive communication with relevant stakeholders on the progress of works against scope, schedule and remediation activities planned for the immediate future;
- Ability to meet statutory reporting deadlines as per the contracted agreement for the project.
- Success in satisfactorily managing expectations regarding planned works at the site. This could be measured by completing a checklist with information such as:
    - notification of planned fieldworks in advance;
    - adhering to agreed access arrangements;
    - briefing on scope of works and work health & safety (WH&S) requirements; and
    - general housekeeping during and completing of works.

6.2 Technical criteria

The following remediation objectives for management of contamination associated with the site are established as follows:

- Clean-up / manage soil quality to a standard appropriate for commercial land use; and
- Clean-up / manage soil to be protective of relevant environmental values.

6.3 Remediation criteria for soil

As the site will undergo excavation of all soils and bedrock to a prescribed depth over the footprint of site it is likely that there will be no soil media in which to apply these interim criteria for onsite reuse. However, a range of threshold guidelines will be provisionally adopted from ASC NEPM (2013) as remediation criteria for the assessment of acceptable concentrations of contaminants in soils. These investigation levels are derived from toxicity of substances and estimated exposure of humans under various land use scenarios.

6.3.1 Health investigation levels

Appropriate health based investigation levels (HILs) will be applied to the developed areas of site used for current and future commercial purposes. These HILs are taken from the ASC NEPM (2013), and are presented for reference in Table 2.

TABLE 2 HEALTH INVESTIGATION LEVELS FOR SOIL CONTAMINANTS

Chemical	Health-based investigation levels (mg/kg) [1]			
	Residential [2] A	Residential [3] B	Recreational [4] C	Commercial/ Industrial [5] D
Metals and Inorganics				
Arsenic [6]	100	500	300	3,000
Cadmium	20	150	90	900
Chromium (VI)	100	500	300	3,600
Copper	6,000	30,000	17,000	240,000
Lead [7]	300	1,200	600	1,500
Mercury (inorganic)	40	120	80	730
Nickel	400	1200	1,200	6,000
Zinc	7,400	60,000	30,000	400,000
Organochlorine pesticides				
DDD+DDE+DDT	240	600	400	3,600
Chlordane	50	90	70	530
Aldrin and dieldrin	6	10	10	45
Endosulfan	270	400	340	2000
Endrin	10	20	20	100
Heptachlor	6	10	10	50
HCB	10	15	10	80
Methoxychlor	300	500	400	2500
Mirex	10	20	20	100
Toxaphene	20	30	30	160
Polycyclic Aromatic Hydrocarbons (PAHs)				
Carcinogenic PAHs (as BaP TEQ) [8]	3	4	3	40
Total PAHs [9]	300	400	300	4000

Notes:

1. Generic land uses are described in detail in Schedule B7 Section 3 of the NEPAM 2013
2. HIL A - Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), also includes childcare centres, preschools and primary schools.
3. HIL B - Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.
4. HIL C - Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. This does not include undeveloped public open space where the potential for exposure is lower and where a site-specific assessment may be more appropriate.
5. HIL D - Commercial/industrial, includes premises such as shops, offices, factories and industrial sites.
6. Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability may be important and should be considered where appropriate (refer Schedule B7).
7. Lead: HIL is based on blood lead models (IEUBK for HILs A, B and C and adult lead model for HIL D where 50% oral bioavailability has been considered. Site-specific bioavailability may be important and should be considered where appropriate.
8. Carcinogenic PAHs: HIL is based on the 8 carcinogenic PAHs and their TEFs (potency relative to B(a)P) adopted by CCME 2008 (refer Schedule B7). The B(a)P TEQ is calculated by multiplying the concentration of each carcinogenic PAH in the sample by its B(a)P TEF, given below, and summing these products.

PAH species	TEF	PAH species	TEF
Benzo(a)anthracene	0.1	Benzo(g,h,i)perylene	0.01
Benzo(a)pyrene	1	Chrysene	0.01
Benzo(b+j)fluoranthene	0.1	Dibenz(a,h)anthracene	1
Benzo(k)fluoranthene	0.1	Indeno(1,2,3-c,d)pyrene	0.1

9. Total PAHs: HIL is based on the sum of the 16 PAHs most commonly reported for contaminated sites (WHO 1998). The application of the total PAH HIL should consider the presence of carcinogenic PAHs and naphthalene (the most volatile PAH). Carcinogenic PAHs reported in the total PAHs should meet the B(a)P TEQ HIL. Naphthalene reported in the total PAHs should meet the relevant HSL.
10. PCBs: HIL relates to non-dioxin-like PCBs only. Where a PCB source is known, or suspected, to be present at a site, a site-specific assessment of exposure to all PCBs (including dioxin-like PCBs) should be undertaken.

6.3.2 Health screening levels and management limits

For petroleum hydrocarbons, health screening levels (HSLs) have been derived in NEPM (2013) based upon fraction ranges of hydrocarbons together with soil texture classes. The actual soil texture class applied will be determined during description of soil excavated during remediation.

The HSLs adopted will be for the protection of receptors in a commercial land use scenario (HSL-D). These will apply to petroleum hydrocarbons (including BTEX and naphthalene) and take into consideration the potential for vapour generation and migration through the soil profile into indoor air spaces. The HSLs factor-in vapour migration through various soil consistencies and over different depth ranges.

Management limits (MLs) are applied for hydrocarbon fractions (in particular the non-volatile heavy-end ranges F3 ($>C_{16}$-C_{34}) and F4 ($>C_{34}$-C_{40})) to protect human receptors from the potential dermal contact with phase separated hydrocarbon (PSH free-product). Refer to Table 3 for a summary of applicable HSLs and management MLs to be used as remediation criteria.

TABLE 3 MANAGEMENT LIMITS, ESLs AND HSLs (mg/kg dry soil)

Analyte	Soil Texture	Management Limits	ESLs	HSLs
F1 (C_6- C_{10})	Coarse	700	180	950
	Fine	800		
F2 (>C_{10}-C_{16})	Coarse	1,000	120	570
	Fine	1,000		
F3 (>C_{16}-C_{34})	Coarse	2,500	300	----
	Fine	3,500	1,300	
F4 (>C_{34}-C_{40})	Coarse	10,000	2,800	----
	Fine	10,000	5,600	
Benzene	Coarse	----	50	440
	Fine	----	65	
Toluene	Coarse	----	85	640
	Fine	----	105	
Ethyl-benzene	Coarse	----	70	69
	Fine	----	125	
Xylenes	Coarse	----	105	330
	Fine	----	45	
Naphthalene	Coarse	----	170	10
	Fine	----		
Benzo(a)pyrene	Coarse	----	0.7	----
	Fine	----	0.7	

6.3.3 Ecological screening levels

Given that the site will undergo excavation of all soils and bedrock, it unlikely that a soil ecosystem will exist following development. Ecological Screening Levels (ESLs) will provisionally be adopted for petroleum hydrocarbons to protect soil fauna, organisms and processes in a commercial land use scenario.

For petroleum hydrocarbons, ESLs have been derived in NEPAM (2013) based upon fraction ranges of hydrocarbons, BTEX component and benzo(a)pyrene (BaP) together with soil texture classes. These ESLs are of low reliability except for the volatile and semi-volatile hydrocarbon fractions which are of moderate reliability. These ESLs are summarised in Table 3.

6.3.4 Ecological investigation levels

The NEPM (2013) introduces a comprehensive way of considering ecological protection at a site. Ecological investigation levels (EILs) are numerical limits that are designed to protect soil and terrestrial flora and fauna (including pets and wildlife) and soil microbial processes from experiencing substantial deleterious effects caused by contaminants.

The NEPAM (2013) outlines the standard percentage of species and soil processes to be protected for agricultural use. The level of protection to be applied at this site has been adopted for soil processes and terrestrial fauna (80% and 85% if the contaminant meets the criteria for biomagnification).

Relevant EILs from NEPAM (2013) *Schedule B5c – Guideline on Ecological Levels for Arsenic, Chromium (III), Copper, DDT, Lead, Naphthalene, Nickel & Zinc* (NEPAM, 2013) for comparison of soil quality data should be considered. The EIL levels are calculated to determine suitability of site soils for current and future site settings (incorporating agricultural use, public open space through to standard residential land use). Site specific EIL guideline concentrations are calculated using the following parameters:

- Site soil pH, iron content and cation exchange capacity (CEC) data.
- Generic aged levels as the potential contaminants are greater than 2 years old.
- Calculation for commercial / industrial land use scenario.

6.4 Offsite management requirements

Excavated natural material that is considered surplus to requirements can be managed offsite in the following ways:

- Beneficial reuse as virgin excavated natural material (VENM) in accordance with the definition set in the POEO Act Section 6.4.1); or
- Beneficial reuse of excavated natural material (ENM) with a resource recovery exemption (RRE) under *Part 9, Clauses 91 and 92* of the Protection of the Environment Operations (Waste) Regulation 2014 - *the excavated natural material exemption 2014* (ENM General Exemption) (refer to Section 6.4.2); or
- Disposal offsite as either waste material to a suitably licensed landfill of disposal site in accordance with the NSW EPA (2014) *Waste Classification Guidelines: Part 1 – Classifying Waste* (EPA, 2014) (Waste Guidelines) (refer to Section 6.4.3).

6.4.1 Beneficial reuse offsite as VENM

The Protection of the Environment Operations Act 1997 (POEO Act) defines virgin excavated natural material (VENM) as:

- Natural material (such as clay, gravel, sand, soil or rock fines):
    - that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities; and
    - that does not contain any sulfidic ores or soils or any other waste; and
- Includes excavated natural material that meets such criteria for VENM as may be approved for the time being pursuant to a NSW EPA Gazettal notice.

Assessment and characterisation of subject material as VENM must be undertaken by a suitable qualified person. A NSW EPA VENM certificate must be filled-out to accompany subject material to detail the determination as VENM (refer to Appendix C for a template VENM certification form).

For VENM Classification of excavated material as VENM requires certainty that all aspects of the definition are met. Chemical testing may be required to ascertain whether an excavated material is contaminated with manufactured chemicals or process residues, or whether it contains sulfidic ores or soils. VENM is also considered a waste that has been pre-classified as GSW (non-putrescible) for the option of straight disposal.

6.4.2 Beneficial reuse offsite as ENM

Where it can be demonstrated that a specific type of waste can safely be used for another purpose, rather than being disposed of in accordance with the waste regulations, the NSW EPA may grant permission for that waste to be used for the specified purpose, subject to strict conditions.

It is envisaged that an amount of natural shale and/or sandstone material surplus to requirements might be able to be exported as ENM under a RRE exemption (such as the ENM General Exemption). This exemption contains the conditions which the site must meet to apply subject material lawfully to another site which has a requirement.

The Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 - *the excavated natural material order* 2014 (ENM Order) applies to ENM only. In this order, ENM means naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

- been excavated from the ground; and
- contains at least 98% (by weight) natural material.

Stockpile sampling for ENM requirements must be undertaken in accordance with Australian Standard 1141.3.1–2012 *Methods for sampling and testing aggregates* (or equivalent), with collection of the number of samples listed in Table 4.

TABLE 4 ENM SAMPLING FOR STOCKPILED MATERIAL

Quantity (*ex-situ* tonnes)	Number of Samples
< 500	3
500 – 1,000	4
1,000 – 2,000	5
2,000 – 3,000	7
3,000 – 4,000	10

Systematic *in-situ* sampling at the surface can be undertaken using a minimum sampling frequency based upon the diameter of the hot spot that can be detected with 95% confidence (m) in accordance with the NSW EPA (1995). The minimum sampling points required for characterisation of an area is detailed in Table 5.

TABLE 5 ENM SAMPLING FOR IN-SITU MATERIAL

Size of Area (m^2)	Number of Sample Points	Distance between two sampling points (m)	Diameter of the hot spot that can be detected with 95% confidence (m)
500	5	10.0	11.8
1,000	6	12.9	15.2
2,000	7	16.9	19.9
3,000	9	18.2	21.5
4,000	11	19.1	22.5
5,000	13	19.6	23.1

For *in-situ* sampling at depth to one sample must be collected at 1.00 mBGL, followed by one sample point every 0.5 m interval thereafter, and followed by one sample point at the base of the excavation.

The chemical concentration or other attribute of any sample collected and tested as part of the characterisation for ENM must not exceed the absolute maximum concentration or other value listed in Table 6.

TABLE 6 ENM CHEMICAL AND MAERIAL REQUIREMENTS

Chemical	Maximum average concentration for characterisation	Absolute maximum concentration
	mg/kg 'dry weight' unless otherwise specified	mg/kg 'dry weight' unless otherwise specified
Mercury	0.5	1
Cadmium	0.5	1
Lead	50	100
Arsenic	20	40
Chromium (total)	75	150
Copper	100	200
Nickel	30	60
Zinc	150	300
Electrical conductivity	1.5 dS/m	3 dS/m
pH	5 – 9	4.5 – 10
Total PAH	20	40
Benzo(a)pyrene	0.5	1
Benzene	N/A	0.5
Toluene	N/A	65
Ethylbenzene	N/A	25
Xylenes (total)	N/A	15
Total Petroleum Hydrocarbons C_{10} – C_{36}	250	500
Rubber, plastic, bitumen, paper, cloth, paint and wood	0.05 %	0.1 %

Notes:
Totals expressed as mg/kg on a dry weight basis
N/A - not applicable as classification based on total concentration (TC)
dS/m – Decisemens per metre

In accordance with NSW EPA (2014) soils requiring offsite disposal from a site have to be classified as either general solid waste (GSW), restricted solid waste (RSW), hazardous waste (HAZ) or special waste (for instances where asbestos is present).

The process of classification requires that should any one analyte exceed the GSW criteria (but remain beneath the RSW criteria) then the waste would be classified as RSW. Conversely, if all analytes are below the GSW criteria then the waste can be classified as GSW. Statistical analysis including but not limited to 95% upper confidence limits (UCL) must also be considered when undertaking waste classification.

A special classification for specific natural immobilisation may apply to material that contains black carbon which is a source of sparingly leachable PAHs. Application to the NSW EPA must be sought for a specific immobilisation approval.

6.4.3 Disposal to landfill

In accordance with the NSW EPA (2014) *Waste Classification Guidelines* soils requiring offsite disposal from a site have to be classified as either:

- General solid waste (GSW); or
- Restricted solid waste (RSW); or
- Hazardous waste (HAZ); or
- Special waste (for instances where asbestos is present).

The process of classification requires that should any one analyte exceed the GSW criteria (but remain beneath the RSW criteria) then the waste would be classified as RSW. Conversely, if all analytes are below the general solid waste criteria then the waste can be classified as GSW.

The minimum number of samples recommended by NEPM (2013) for characterisation of stockpiles up to 200 cubic metres (m^3) comprising similar materials. A greater number of samples may be required if there is a large range in contaminant concentrations or soil types.

If soil is characterised using the 95% upper confidence limit (UCL) of the arithmetic mean, NEPAM (2013) allows collection of fewer samples and defers to the Victorian EPA (2009) - *Environment Protection (Industrial Waste Resource) Regulations 2009* (Publication IWRG702). Recommended minimum sampling frequencies for waste classification are summarised in Table 12.

If only the minimum number of samples is collected and there is a large range in contaminant concentration, then either the maximum concentration should be assumed for disposal purposes or additional samples collected and analysed and the situation re-evaluated.

The waste criteria for the chemicals of potential concern recommended to be sampled to derive a waste classification are presented below:

- total concentration / contaminant threshold (CT) only (Table 7); or
- total concentration / specific contaminant concentration (SCC) with toxicity characteristic leaching procedure (TCLP) testing (Table 8).

TABLE 7 WASTE DISPOSAL CRITERIA WITHOUT TCLP

Chemical	Maximum values of total concentration for classification without TCLP	
	General Solid waste (CT1)	Restricted Solid Waste (CT2)
	Total Concentration	Total Concentration
Arsenic	100	400
Benzene	10	40
Benzo(a)pyrene	0.8	3.2
Cadmium	20	80
Chromium (VI)	100	400
Ethyl-benzene	600	2,400
Lead	100	400
Mercury	4	16
Nickel	40	160
PAHs (total)	200	800
TPH fraction (C_6 – C_9)	650	2,600
TPH fraction (C_{10} – C_{36})	10,000	40,000
Toluene	288	1,152
Xylenes (total)	1,000	4,000

Notes:
Totals expressed as mg/kg on a dry weight basis;
N/A - not applicable as classification based on total concentration (TC);
Where waste classifications exceed the restricted solid waste criteria, the waste is classified as hazardous.

TABLE 8 WASTE DISPOSAL CRITERIA WITH TCLP

Chemical	Maximum values for leachable concentration and total concentration when used together			
	General Solid waste		Restricted Solid Waste	
	Total	TCLP	Total	TCLP
Arsenic	500	5	2,000	20
Benzene	18	0.5	72	2
Benzo(a)pyrene	10	0.04	23	0.16
Cadmium	100	1	400	4
Chromium (VI)	1,900	5	7,600	20
Ethyl-benzene	1,080	30	4,320	120
Lead	1,500	5	6,000	20
Mercury	50	0.2	200	0.8
Nickel	1,050	2	4,200	8
PAHs (total)	200	N/A	800	N/A
TPH fraction (C_6 – C_9)	650	N/A	2,600	N/A
TPH fraction (C_{10} – C_{36})	10,000	N/A	40,000	N/A
Toluene	510	14.4	2,073	57.6
Xylenes (total)	1,800	50	7,200	200

Notes:
Totals expressed as mg/kg, TCLP as mg/L;
N/A not applicable as classification based on total concentration (TC); and
Where waste classifications exceed the restricted solid waste criteria, the waste is classified as hazardous.

Once a waste classification is derived advice must be prepared to detail:

- general material description;
- material volume;
- laboratory results with comparison to GSW, RSW and HAZ criteria; and
- concluding statement of waste class for subject material.

An application must then be submitted to the selected landfill / disposal site based upon the waste classification advice. On receipt of approval from the landfill / disposal site that subject material is suitable, it can then be transported offsite in haulage vehicles appropriately designed and licensed to transport specific classes of waste soil.

NO SUBJECT WASTE MATERIAL IS TO BE REMOVED FROM SITE PRIOR TO OBTAINING APPROPRIATE CLASSIFICATION ADVICE.

NO SUBJECT MATERIAL IS TO BE TRANSPORTED FROM SITE PRIOR TO ACCEPTANCE BY THE RECEIVING FACILITY.

6.5 Importation of fill

If this is required, any such material proposed to be imported to site must be suitably characterised by an Environmental Consultant or Geotechnical Engineer prior to receiving approval to import. The evaluation of the material should ensure that the fill material:

- Provides no unacceptable risks to human health and the environment.
- Is free of contaminants (or contaminant concentrations are below acceptable levels).
- Is suitable for its intended purpose and land use.
- Has been lawfully obtained.

All development must incorporate soil conservation measures to minimise soil erosion and siltation during construction and following completion of development. All sediment and erosion controls are to be installed prior to the commencement of any construction works and maintained throughout the course of construction until disturbed areas have been revegetated/ established.

7 CONCEPTUAL SITE MODEL

7.1 Known contamination and sources

Based upon the findings of the Cetec (2016) preliminary contamination assessment, there was no evidence of any primary sources of contamination onsite (e.g. fuel storage tanks), nor was there any evidence of historically contaminating industrial uses.

At the commencement of construction of the Lands Department building circa 1876, introduction of poor quality fill material may have occurred to engineer the surface and foundations below the current seal. The same would have occurred for the construction of the Education building circa 1901.

It is expected that if contamination did exist in fill material at site it would most likely derive from these imported fill materials.

7.2 Potential contaminants of concern

Typical constituents of poor quality fill may contain elevated concentrations of the following chemicals:

- Heavy metals (As, Cd, Cr_{TOTAL}, Cu, Hg, Ni, Pb and Zn).
- Polycyclic Aromatic Hydrocarbons (PAH).
- Total Recoverable Hydrocarbons (TRH, Fractions C_6 - C_{40}).
- Benzene, Toluene, Ethylbenzene and Total xylenes (BTEX).
- Asbestos Containing Materials (ACM).

7.3 Exposure pathways and sensitive receptors

A pathway is a means by which the source (contaminants in soil) can contact the identified receptors. Where no pathway exists, there is no risk to the receptor, because exposure cannot occur. Receptors identified include both human and ecological. For humans, there must be a mechanism for contact with interface water or to be exposed to contaminants from the interface water. Identified completed pathways for exposure to contamination inferred from the CSM reported in the Cetec (2016) have been reviewed by Environmental Earth Sciences, with the following linkages considered plausible:

- Human:
  - Dermal contact with organic / inorganic contaminants in soil by onsite construction workers and future maintenance workers.
  - Ingestion of organic / inorganic contaminants in soil by onsite construction workers and future maintenance workers.
  - Inhalation of dust generated by onsite construction workers contaminated with organic / inorganic contaminants.
- Ecological:
  - Onsite interface water and groundwater.
  - Offsite surface water of Blackwattle Bay.

Refer to Figure 3 for graphical representation of CSM.

8 REMEDIAL OPTIONS EVALUATION

8.1 Regulatory framework

The NEPC has authorised the release of the NEPM (2013) and has acknowledged that the assessment of site contamination needs to be placed within the context of the broader site assessment and management process. When assessing site contamination, the following preferred hierarchy of options for site clean-up and/or management exists:

- Onsite management of contamination so that it is destroyed or the associated risk is reduced to an acceptable level; and
- Offsite management of excavated soil, so that the contamination is displaced, destroyed or the associated risk is reduced to an acceptable level.

If the above is not practicable:

- Onsite containment by consolidation and isolation of the contaminated material utilising an appropriately designed barrier;
- Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material; and finally; and
- 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.

In cases where no readily available or economically feasible method is available for remediation, it may be possible to adopt appropriate regulatory controls or develop other forms of remediation.

In summary, options that involve onsite solutions with destruction of contamination are preferred such that the net environmental benefit is greatest, and safety issues are minimised, and issues are not simply transferred from one location to another.

A further consideration for selection of management solutions that follows the above intent is the concept of “Sustainable Remediation” where the chosen solution involves consideration of natural resource use, energy efficiency, negative impacts on the environment, and reduction of waste to the extent possible.

8.2 Options evaluation and selection

As the development will require excavation and offsite management of soil and bedrock over the footprint of the site, any residual soil will most practically be removed from site. This concept has driven the remediation option selection.

8.2.1 Pertinent remediation options

As fill material and natural soil / bedrock at the site is proposed to be completely excavated as part of proposed development, there will be no place for reuse of material deemed suitable for reuse or encapsulation of contaminated material. Process of selection
To screen the above long list and narrow-down the most appropriate technology for this site, the following criteria have been used:

- regulatory acceptance - compliance to meet regulatory and other stakeholder expectations;
- technical suitability - whether the method chosen is capable of meeting the stated objectives;
- practicality - refers to the practicality of applying the option given site- specific constraints such as access availability, geology etc;
- cost – refers to the initial financial outlay of the remedial technique and associated level of risk reduction;
- timeframe – refers to the duration required to deliver remedial goals; and
- sustainability - including greenhouse gases, energy consumption, collateral environmental damage and the overall (net) benefit considering the entire project (e.g., safety of workers, affect on neighbours, transportation, movement of wastes, etc).

8.2.2 Evaluation and selection process

In accordance with common industry practise, potential remedial options have been evaluated for project suitability on the basis of regulatory framework presented in Section 8.1 and on their ability to address the above criteria. The options are then ranked relative to the other options to indicate which ones are most appropriate for the site. This qualitative scoring/ranking system uses a score of ‘0’ to ‘2’ for each criterion being assessed; with ‘0’ corresponding to the lowest score and ‘2’ as the highest.

The remedial options evaluation and screening matrix and the scoring system that has been applied for suitability considerations at this site are presented in Table 9. Options for remediation fell generally into two categories:

- those with low scores of between '2' and '6'; and
- those with high scores of between '7' and '11'.

Those with the low scores are considered inappropriate for application at the site due to issues related to practicality, cost, and technical suitability. Conversely, ones with scores of between '7' and '11' are considered to be potentially applicable (in certain cases).

TABLE 9 REMEDIAL OPTIONS EVALUATION AND SCREENING MATRIX

	Selection Criteria						
Potential Option	Regulatory Acceptance	Technical Suitability	Practicality	Cost	Timeframe	Sustainability	**Total score**
In situ assessment with: • Waste classification and disposal of fill; and • Beneficial reuse offsite as ENM / VENM.	2	2	2	2	2	0	**10**
Ex situ assessment with: • Waste classification and disposal of fill; and • Beneficial reuse offsite as ENM / VENM.	2	2	0	1	1	0	6
Encapsulation of contaminated fill onsite and preparation of a management plan.	2	1	0	0	0	2	5

8.3 Review of preferred option

In view of the nature of the development, restricted space and unlikelihood in obtaining an area to encapsulate identified contamination for onsite management, the only pertinent option for remediation is as follows:

- Conduct *in situ* assessment of fill material to determine volumes of fill material and derive waste classification for disposal off-site to an appropriately licensed waste facility.
- Conduct in situ ENM / VENM assessment of natural material to determine offsite beneficial reuse options.
- Following removal of material conduct appropriate validation of excavation to demonstrate that all potential contamination has been removed.

By following the preliminary RAP and demonstrating compliance with the requirements of SEPP55, a Validation Report is recommended to be prepared by a qualified environmental consultant in general accordance with NSW OEH (2011) and other appropriate guidance documentation. The Validation Report shall confirm whether the site has been remediated to commercial / industrial land use such that there would be no unacceptable risks to human health and the environment. Subject to proper implementation of the preliminary RAP it is considered that the site can be rendered suitable for the proposed commercial / industrial land-use.

9 REMEDIAL ACTION PLAN

9.1 Remediation stages

This preliminary RAP was commissioned to document the remediation and validation strategy for contamination identified at the site. Environmental Earth Sciences have envisaged that seven specific stages of remediation are required to be undertaken. These stages/events are summarised in Table 10.

TABLE 10 REMEDIATION STAGES

Stage	Details
Stage 1	Preparation of a sampling analyses & quality plan (SAQP) and adoption of data quality objectives (DQOs) for contaminated soil management.
Stage 2	Planning / demolition phase of the work.
Stage 3	Preparation of a SEPP55 letter to Council to inform regulator of proposed remediation works (Category 2 remediation works without consent). Standby period of 30 days for Council to provide response prior to commencement allowed.
Stage 4	Conduct *in situ* investigation and testing of soils with laboratory analyses to derive a waste classification. Conduct *in situ* investigation and testing natural material / bedrock with laboratory analyses to ascertain beneficial reuse options as ENM and/or VENM.
Stage 5	Remediation through excavation of fill material, chemical testing and waste classification. Once a waste classification is derived material can be immediately loaded out for disposal to an appropriately licensed waste facility. Once natural material / bedrock has been certified as ENM and/or VENM material can be immediately loaded out for beneficial reuse offsite.
Stage 5	Validation by visual / olfactory field assessment and corresponding sampling / laboratory testing by an appropriately qualified consultant at the top of the bedrock once fill material has been loaded-out. Validation sampling of surfaces in the excavation should consist of an appropriate coverage by area and linear distance for walls with reference to the NSW EPA (1995) – *Sample Design Guidelines*. If there are failures of validation wall / base samples, additional tracking-out of excavation should be undertaken with corresponding sampling done until results indicate that contaminated material has been appropriately removed.
Stage 7	Preparation of a Validation Report to document the remediation works undertaken, results of any validation testing, asbestos disposal, waste soil classification, landfill receipt / weighbridge dockets, laboratory analyses and comparison with applicable site land use / remediation / waste criteria.

9.2 Site remediation goals

The objective of this strategy is to meet the primary conditions relating to contamination that are addressed in the CLM Act and associated NSW EPA regulations and guidelines, and to satisfy those conditions included in SEPP55. Effective site remediation will be demonstrated once:

- Contaminated soil material has obtained a waste classification and has been appropriately disposed to a suitably licensed landfill facility. Waste classification should be undertaken by a suitably qualified consultant.
- Natural soil / bedrock material has been suitable certified an ENM and/or VENM for beneficial reuse offsite.
- Validation of underlying bedrock surface has been undertaken to ensure that no potential residual contamination remains following contaminated soil removal. Visual / olfactory assessment, sampling and laboratory analyses of walls / base of remediation excavations has been undertaken to ensure that all subject material has been removed to the extent practicable. This should be undertaken by a suitably qualified consultant.
- Validation Report documenting management of the abovementioned issues has been completed and issued to Council within 60 days of completion of remediation works. This should be undertaken by a suitably qualified consultant.

9.2 Anticipated volumes and types of material

For the purposes of remediation planning some general assumptions have been made to estimate likely volumes of *in situ* material that will require management. General subsurface conditions encountered in the PSM (2017) geotechnical assessment included:

- Fill material – Compact sand / clayey sand, thickness ranging from 0.10 – 0.30 metres underneath the buildings.
- Residual natural soil – sandy clay (weathered Hawkesbury Sandstone bedrock), thickness ranging from 0.00 – 1.20 metres.
- Hawkesbury sandstone underlies the abovementioned layers (if encountered), to the anticipated depth of the base level of the development.

Estimated volumes for excavation at each of the buildings and the tunnel are summarised on Table 11. Dimensions are based on information supplied in concept schematics (Ridley, 2017; ref: 150021-PAT [Appendix D]).

Environmental Earth Sciences will assume the following average dimensions and thicknesses and assumptions to inform remediation planning:

- Fill material ~ 0.20 metres thickness; and
- Residual natural soil ~ 0.40 metres thickness.
- Likely depth of each subgrade basement level will be ~ 3.00 metres height.
- Bulking factor of 1.3x has been applied to derive *ex situ* volumes.
- Specific gravity to derive tonnage from *ex situ* volumes:
    - Fill material & natural soil = 1.6.
    - Sandstone bedrock = 2.32.

TABLE 11 ESTIMATED VOLUMES OF FOR EXCAVATION

Level	Material	Lands Department Building				Education Building			
		m^2	*In situ* m^3	*Ex situ* m^3	Tonnes	m^2	*In situ* m^3	*Ex situ* m^3	Tonnes
Lower Ground Floor	Fill	3,200	640 *	832 *	1,331	2,816	564 *	733 *	1,173
	Natural soil	3,200	1,280 *	1,664 *	2,622	2,816	1,127 *	1,465 *	2,344
	Sandstone	3,200	3,840 *	4,992 *	11,581	2,816	3,380 *	4,394 *	10.194
Basement 1	Sandstone	----	----	----	----	930	2,790	3,627	8,415
Stairwell ** / Basement 2	Sandstone	260	780	1,014	2,353	930	2,790	3,627	8,415
Basement 3	Sandstone	180	540	702	1,629	600	1,800	2,340	5,429
Tunnel ***	Sandstone	126	378	491	1,140	95	285	371	860
TOTALS			6,818	8,863	20,563		11,889	15,456	35,857

Notes:

Dimensions taken from concept plans developed by Ridley (2017) (ref: 150021-PAT)

* Lower ground floor fin both building does not require excavation to 3.00 metres and the landform slopes down to the west. Hence 50% of footprint used to estimate volumes in sandstone.

** Lands Department building has a stairwell at commensurate level of Basement 1 in Education building

*** Tunnel footprints are located a commensurate level of Basement 3.

Currently it is not known where the excavated soil will be stockpiled, staged, loaded / unloaded during the development. Nonetheless the controls for the appropriate management of soil and sedimentation during the development are detailed in the following subsections.

9.3 Soil stockpiling and material segregation

If material does require stockpiling the following should be considered:

- Stockpiles to be segregated by material type:
  - Unconsolidated fill material.
  - Unconsolidated natural material.
  - Bedrock.
- Ideally, stockpiles should be placed on a lined surface (e.g. geofabric, concrete hard stand) in an area protected from run-on water.
- Where sufficient area available stockpiles should be < 2 metres in height.
- Stockpiles should be stabilised if they are to be in place for > 10 days.
- Stockpiles constructed with water diversion features upslope, and/or construction of earth banks to divert water around stockpiles.
- Sediment fences are recommended to be constructed around stockpiles / stockpile area, at least the down-slope side.
- Stockpiles constructed with sediment fences / filters placed immediately down-slope and cross-slope to protect other lands and waterways from pollution.
- Stockpiles should be clearly labelled in order to expedite their management for potential testing and/or onsite use.

Refer to SSROC Fact Sheet No.8 – *Protected Stockpiles* for further information and example diagrams for engineering controls to be implemented (Appendix E).

9.4 Material assessment and testing

9.4.1 Minimum sampling frequencies

Minimum sampling frequencies to be adopted per material type should be in accordance with NEPM (2013) and are summarised in Table 12. As soil fill material currently resides *in situ*, a bulking factor should be applied to derive an *ex situ* volume (e.g. x1.3 – x1.5).

For example if there is approximately 1,200 m^3 of *in situ* fill material, this will bulk up to approximately 1,560 – 1,800 m^3 when excavated and stockpiled *ex situ*.

TABLE 12 SAMPLE FREQUENCY FOR CHEMICAL CHARACTERISATION

Stockpile Quantity (m^3)	Number of Samples
< 75	3 *
75 – <100	4 *
100 – < 125	5 *
125 – < 150	6 *
150 – < 175	7 *
175 – < 200	8 *
300 – 2,500	10 **
3,000	12 **
4,000	16 **
4,500	18 **
5,000	20 **
> 5,000	20 ** (then 1: 250 m^3)

Notes:

* Minimum number of samples for stockpiles 200 m^3 or less (based upon 1:25 m^3) (NEPAM, 2013)

** Minimum number of samples to provide a sufficient amount of data to calculate the 95%UCLaverage (Vic EPA IRWG 702).

9.4.2 Sampling

Sampling should be undertaken by an appropriately qualified person in accordance with:

- Australian Standard AS4482.1:2005 - Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-volatile and Semi-volatile Compounds; and
- Australian Standard AS4482.2:1999 - Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 2: Volatile Compounds.

Samples should be placed directly into clean glass jars and placed immediately into an ice-filled chest for swift dispatch to a laboratory that is accredited by NATA to perform the tests listed in Section 9.4.3.

9.4.3 Laboratory analyses

Fill material samples should be tested for the following chemicals of concern for waste classification purposes:

- TRH (Fractions C_6 – C_{40});
- BTEX;
- PAH; and
- Heavy metals (arsenic, cadmium, total chromium, copper, nickel, lead, zinc and mercury).

Additional testing using the Toxicity Characteristic Leaching Procedure (TCLP) should be undertaken to determine the potential leachability of heavy metals and PAH as this may lead to a revised waste classification.

9.5 Offsite management of soil

9.5.1 Transportation requirements

All vehicles carting material off-site must be licensed to transport any waste materials as required by the POEO Act. Containers or truck bodies used in the transport of non-liquid waste materials should be equipped with close-fitting and secured covers and with seals around doors such that no soil or dust can escape during transport. All vehicle movements within the site should follow established haulage routes and comply with the prevailing traffic regulations, including speed limits.

9.5.2 Material tracking records

As a minimum, supporting documentation of estimated quantities of material excavated, its origin, stockpile location and fate should be recorded. All truck movements involving soil material should also be documented in records and record as a minimum the date, time, truck registration number, quantity of fill, origin of fill and type of fill.

Records and documentation should be maintained in accordance with regulatory requirements and should be suitable for the purposes of tracking any imported / exported soil materials. These records should be provided by the Construction Project Manager (CPM) (or their contracting representative) and be available upon request by Council, NSW EPA or soil receiving facility.

9.5.3 Disposal register

A register of all material disposed from site should be maintained by the CPM. All waste materials removed from site must be disposed to a licensed landfill facility that can lawfully accept the waste. Disposal receipts / dockets must be obtained by the CPM (or their contracting representative) within 24-hours or the timeframe stipulated by the disposal permit.

10 UNEXPECTED FINDINGS PROTOCOL

An unexpected findings protocol (UFP) has been developed for implementation during earthworks activities associated with the project. It has been prepared to ensure appropriate management of soil or fill contaminated with hazardous materials should they be encountered during site works that were not expected.

Any material that is uncovered deemed to be foreign, be that imported fill material or building waste, should be scrutinised further to determine if asbestos or other contaminants are present. The main features to look for are:

- soil or fill material that differs from the previously identified materials onsite;
- material containing anthropogenic artefacts such as rubble, plastics, metal etc;
- asbestos or suspected asbestos containing material;
- material with fibres visible;
- material with an obvious unnatural odour i.e. fuel, solvent, burnt odour;
- material that is noticeably stained in colour;
- archaeological artefacts; and
- any material that has evidently been dumped on site.

These materials may require additional assessment or management. Prior to the commencement of works onsite a WH&S induction should be undertaken. The aim and importance of the UFP and how it is to be implemented should be discussed at this time.

Monitoring of environmental issues will be undertaken on a daily basis. If an unexpected finding is revealed during works, the following protocol is to be followed:

- cease disturbance of the affected area and assess the risk of the unexpected find;
- contact the Environmental Consultant (if required);
- further investigation and management may be required; and
- following clearance of the unexpected findings, areas can be reopened for work.

If potential hazardous material or contamination is suspected the “Unexpected Findings Protocol Proforma” should be completed, a brief description of the material reported and the location of the material identified on a site map. An example of this proforma has been included in Appendix F.

11 ENVIRONMENTAL PROTECTION PRACTICES

11.1 Construction management

In NSW pollution from building and construction sites is regulated under the POEO Act. Under the POEO Act it is an offence for anyone to let substances other than rainwater enter a waterway or a stormwater system. Council and the NSW EPA can issue notices and penalties on building and construction sites to protect the environment. There are three kinds of notices:

- **clean-up notices** can be issued to require clean up of sites;
- **prevention notices** can be issued if an activity is being carried out or is suspected to be carried out in an environmentally unsatisfactory manner. The prevention notice requires certain action to be taken and can be appealed in the Land and Environment Court; and
- **prohibition notice**s can be issued to require work to cease for a given time.

The environmental management associated with the site, adjoining properties and the surrounding area shall at all times be protected from impacts derived from activities during remediation works. Potential environmental impacts associated with the site will be controlled.

The approach for protection of the environmental during remedial works should be detailed in a construction environmental management plan (CEMP) (or similar document) that details methods to install and operate all environmental control measures according to current and relevant Australian Standards, federal and state guidance and approved industry codes of practice. Detailed specification of items for consideration in a CEMP for remedial works should consider those as summarised in the following subsections.

11.2 Dust management

Methods for dust mitigation and management should be covered in detail in a CEMP document. A summary of the key features are included below:

- hessian will be located along any section of the site fence located in the vicinity of remediation areas;
- hessian covered screens may be used in open areas to minimise dust;
- regular dampening or cleaning of roads and pavements;
- protecting stockpiled materials by sealing (compacting) with an excavator bucket, tarpaulins, consolidation, erection of hessian wind brakes, and/or dampening down the surface of stockpiled soil;
- ceasing work in strong winds;
- undertaking the loading or unloading of dry soil as close as possible to the stockpiles or skip bins to prevent the spread of loose material around the site; and
- reducing the expanse of cleared land to the minimum required to achieve a safe and economical working environment.

Dust is may also be produced during the transfer of materials to and from the site. The Contractor will be responsible for minimising dust generation for vehicles leaving the site and during transportation.

11.3 Material safety data sheets (MSDS)

Material Safety Data Sheets (MSDS) for all chemicals used as part of odour or dust suppression in the treatment process or for any other purpose on site held must be held in the site office.

The MSDS should include information about the chemical including identification, health hazard information, safe handling information, precautions for use and any other relevant information such as ecotoxicity, biodegradability and persistence in soil and water.

11.4 Sediment and erosion control

Methods for sedimentation and erosion control should be covered in detail in a CEMP document. Sediment and erosion control is important as it is a serious offence under the POEO Act to place or expose any soil or waste in an area where it can be washed into any stormwater drain or waterway.

Therefore, drains should be blocked or barricaded and silt fencing, sandbags and/or hay bales be used to prevent offsite sediment movement.

11.5 Stormwater runoff

Methods for stormwater control should be covered in detail in a CEMP document. Runoff water, including that due to rain that has not been in contact with any contaminated material is not of concern however should be managed in such a manner to prevent it coming in contact with contaminated soil or exposed soil surfaces on site that may generate sediment.

Contaminated material may be exposed at the surface and any surface water that comes into contact with this material must be collected. Where possible, excavated material will be placed on the upgradient side of the excavation and will be covered with tarpaulins. In this way, minimal rainwater will come into contact with contaminated material, and if it does, run-off waters will be contained within the excavation.

Samples of any water suspected to be contaminated will be analysed to determine its manner of disposal in accordance with current NSW EPA guidelines and Sydney Water regulations. Note: excavations into contaminated material are best commenced if fine, dry weather is forecast for the next 48 hour working period.

12 WORK HEALTH & SAFETY

12.1 General

This section specifies the contractor's duties and responsibilities in regard to ensuring the WH&S of employees and the public throughout the duration of earthworks. These safety procedures are in addition to any other responsibilities that the principal contractor or subcontractors may have as an employer or self-employed person or other person having responsibility under the Work Health & Safety Act (2011) and Regulations 2011. A list of the key WH&S features to be considered is included below:

- Contractor responsibilities.
- Induction.
- Competency and training.
- Requirement for WH&S plan for contractor and subcontractor(s):
  - Job safety analysis (JSA) and/or
  - Safe method work statements (SWMS).
- Site control.
- Traffic management.
- Site hazards (physical, chemical hazards, unknown or unexpected hazards).
- Personal protective equipment (PPE).
- Decontamination of personnel, plant and equipment.
- Site specific safety rules.
- First aid.
- Accidents / incidents / near miss reporting protocol.
- Emergency response planning – for example all emergencies, spills or leaks, fires / explosions, plant / truck accident, damage to utilities, or rupture of fuel tanks.

In addition to observation of site WH&S rules, the following is a list of relevant WH&S documents that should be consulted in preparation for the work to be undertaken.

12.2 Legislation & regulations

- Work Health & and Safety Act 2011.
- Work Health & and Safety Regulation 2017.

12.3 Codes of Practice

Applicable model codes of practice may include but not limit:

- Safe Work Australia (2016) - *How to Manage and Control Asbestos in the Workplac*e;
- Safe Work Australia (2016) - *How to Safely Remove Asbestos*;

- Safe Work Australia (2016) – *Preparation of Safety Data Sheets for Hazardous Chemicals*;
- Safe Work Australia (2015) – *Labelling of Workplace Hazardous Chemicals*;
- Safe Work Australia (2015) – *Excavation Work*;
- Safe Work Australia (2011) – *Managing the Work Environment and Facilities*; and
- Occupational Health and Safety Induction Training for Construction.

12.4 Standards

Australian Standards may include but not limit:

- AS4482.1 – *Guide to the sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds*;
- AS4482.2 – *Guide to the sampling and investigation of potentially contaminated soil. Part 2: Volatile substances*;
- AS4801 – *Occupational health and safety management systems – Specification with guidance for use*; and
- National Occupational Health and Safety Commission (2015) - *Standard for the Storage and Handling of Workplace Dangerous Goods* [NOHSC: 1015 (2001)].

12.5 Inventory of PPE

The following is an inventory of personal protective equipment (PPE) required for the project, with certain items only requiring implementation in higher risk work:

- Steel capped safety boots / steel capped gum boots;
- High visibility long sleeves / long pants;
- Disposable gloves;
- Disposable boot covers (if required);
- Safety hard hat;
- Disposable coveralls (type 5, category 3 (EN ISO 13982–1) or equivalent would meet this standard) (if required);

  Coveralls worn should be made from either 100 % synthetic material or a mixed natural / synthetic fabric capable of providing adequate protection against fibre penetration. All fabrics must be capable of preventing the penetration of asbestos fibres down to a diameter of 0.5 µm and to a maximum 1 % penetration of all airborne asbestos fibres. Once worn, disposable overalls are not to be reused or laundered; and
- Disposable half-face particulate respirator (P2 rated). The respirator must conform to the requirements of AS/NZS 1716:2009 - *Selection, Use and Maintenance of Respiratory Protective Devices* or its equivalent. These disposable respirators must be replaced at each decontamination event.

NOTE - all disposable PPE will be disposed of as asbestos waste at the completion the removal works.

12.6 PPE measures and determination

The following risk-based scenarios will determine the minimum PPE required, with the respective PPE requirements summarised in Table 13:

- Stage 1 measures – low-level ACM risk work outside, outside of any exclusion zone;
- Stage 2 measures – mid-level risk work handling fill material soils, potentially involving non-friable asbestos;
- Stage 3 measures – high-level risk work involving friable asbestos (not expected).

TABLE 13 PPE MINIMUM REQUIREMENTS

PPE Item	Stage 1 PPE	Stage 2 PPE	Stage 3 PPE
Steel capped safety boots / steel capped gum boots	**YES**	**YES**	**YES**
Safety hard hat	**YES**	**YES**	**YES**
High-visibility long sleeves / long pants	**YES**	**YES**	**YES**
Disposable coveralls	no	**YES**	**YES**
Disposable gloves	no	**YES**	**YES**
Disposable half-face particulate respirator (P2 minimum rated)	no	**to be readily available**	no
Half face respirator (P3 rated)	no	no	**YES**
Disposable boot covers	no	no	**YES**
Wet decontamination measures	no	no	**YES**

13 CONCLUSION

Environmental Earth Sciences NSW were commissioned by Built, on behalf of Pontiac, to prepare a preliminary RAP to be implemented during proposed construction works at the site in satisfaction of requirements of SEPP55.

Considering space constraints of the proposed development and fill assessment undertaken by PSM (2017), the preferred remedial option for management of fill material identified to contain elevated contaminants of concern is:

- *In situ* characterisation of chemical status to derive a waste classification in accordance with the NSW Environment Protection Authority (EPA) (2014) - *Waste Classification Guidelines*;
- Direct offsite disposal to an appropriately licensed waste facility;
- Validation of underlying bedrock surface / walls of excavations(s) to demonstrate that removal of soil impacted with contamination of concern has been successful.

Following removal of fill, natural soil / bedrock material subject to certification as ENM and/or VENM can then be beneficially reused offsite.

The remediation management component will also provide direction for appropriate risk posed by known and unexpected contamination in soil during earthworks. Subject to the implementation of the actions in this preliminary RAP the site can be made suitable for its intended land use.

Sampling and testing procedures for the different offsite soil management options are detailed in this preliminary RAP. This report also sets a framework for ensuring the effectiveness of environmental controls, reporting of environmental incidents and response procedure, responsible persons and emergency contact information. It is a living document and as such should undergo review, corrective action and continual improvement as needed.

14 LIMITATIONS

This report has been prepared by Environmental Earth Sciences NSW ACN 109 404 006 in response to and subject to the following limitations:

1. The specific instructions received from Built Pty Limited on behalf of Pontiac Land (Australia) Pty Ltd;
2. The specific scope of works set out in PO117169_V1 issued by Environmental Earth Sciences NSW to Built Pty Limited on behalf of Built Pty Limited;
3. May not be relied upon by any third party not named in this report (except for Council) for any purpose except with the prior written consent of Environmental Earth Sciences NSW (which consent may or may not be given at the discretion of Environmental Earth Sciences NSW);
4. This report comprises the formal report, documentation sections, tables, figures and appendices as referred to in the index to this report and must not be released to any third party or copied in part without all the material included in this report for any reason;
5. The report only relates to the site referred to in the scope of works being located at:
    a. Lands building: 23-33 Bridge Street, Sydney.
    b. Education building: 35-39 Bridge Street, Sydney.
    c. Subterranean tunnel linking both buildings under Loftus Street.
6. The report relates to the site as at the date of the report as conditions may change thereafter due to natural processes and/or site activities;
7. No warranty or guarantee is made in regard to any other use than as specified in the scope of works and only applies to the depth tested and reported in this report;
8. Fill, soil, groundwater and rock to the depth tested on the site may be fit for the use specified in this report. Unless it is expressly stated in this report, the fill, soil and/or rock may not be suitable for classification as clean fill if deposited off site;
9. This report is not a geotechnical or planning report suitable for planning or zoning purposes; and
10. Our General Limitations set out at the back of the body of this report.

15 REFERENCES

AS/NZS 1716:2009 - *Selection, Use and Maintenance of Respiratory Protective Devices*

Australian Standard AS4801 – *Occupational health and safety management systems – Specification with guidance for use*.

Australian Standard AS4482.1:2005 - Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-volatile and Semi-volatile Compounds; and

Australian Standard AS4482.2:1999 - Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 2: Volatile Compounds.

Australian Standard 1141.3.1–2012 *Methods for sampling and testing aggregates*

Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia (ARMCANZ) (2000). *Australian and New Zealand guidelines for fresh and marine water quality.*

Cetec (2016) – *Preliminary Site Contamination Investigation, Sandstones Redevelopment, Farrer Place Public Reserve* (ref: CN160710; date 4 November 2016)

Geological Survey of NSW 1:100 000 Sheet. (1991). *Sydney geological series sheet (9030)*, Edition 1, NSW Department of Minerals and Energy.

National Environment Protection Council (NEPC) (2013). *National Environment Protection (Assessment of Site Contamination) Amendment Measure*, Adelaide, SA.

National Health and Medical Research Council (NHMRC)/ Natural Resource Management Ministerial Council (NRMMC) (2011). *Australian drinking water guidelines,* National Water Quality Management Strategy.

National Occupational Health and Safety Commission (2015) - *Standard for the Storage and Handling of Workplace Dangerous Goods* [NOHSC: 1015 (2001)]

NHMRC & NRMMC (2008). *Guidelines for managing risks in recreational water.* Australian Government, February 2008.

NSW Department of Primary Industries Office of Water (2015). http://waterinfo.nsw.gov.au/gw/.

NSW Department of Urban Affairs and Planning (DUAP) (1998) - State Environmental Planning Policy (SEPP) No.55 – *Managing Land Contamination: Planning Guidelines – Remediation of Land* (SEPP55)NSW Office of Environment & Heritage (OEH) (2011) - *Contaminated sites: Guidelines for consultants reporting on contaminated sites*

NSW Environment Protection Authority (EPA) (1995) - *Contaminated Sites: Sampling design guidelines.*

Pells Sullivan Meynink Consult Pty Limited (PSM) (2017) – *Education and Lands Department Buildings Geotechnical Investigation* (ref: PSM2426-016L; date: 31 January 2017)

Safe Work Australia (2016) - *How to Manage and Control Asbestos in the Workplace*

Safe Work Australia (2016) - *How to Safely Remove Asbestos*

Safe Work Australia (2016) – *Preparation of Safety Data Sheets for Hazardous Chemicals*

Safe Work Australia (2015) – *Labelling of Workplace Hazardous Chemicals*

Safe Work Australia (2015) – *Excavation Work*

Safe Work Australia (2011) – *Managing the Work Environment and Facilities*

Victorian EPA (2009) - *Environment Protection (Industrial Waste Resource) Regulations 2009* (Publication IWRG702)

ENVIRONMENTAL EARTH SCIENCES GENERAL LIMITATIONS

Scope of services

The work presented in this report is Environmental Earth Sciences response to the specific scope of works requested by, planned with and approved by the client. It cannot be relied on by any other third party for any purpose except with our prior written consent. Client may distribute this report to other parties and in doing so warrants that the report is suitable for the purpose it was intended for. However, any party wishing to rely on this report should contact us to determine the suitability of this report for their specific purpose.

Data should not be separated from the report

A report is provided inclusive of all documentation sections, limitations, tables, figures and appendices and should not be provided or copied in part without all supporting documentation for any reason, because misinterpretation may occur.

Subsurface conditions change

Understanding an environmental study will reduce exposure to the risk of the presence of contaminated soil and or groundwater. However, contaminants may be present in areas that were not investigated, or may migrate to other areas. Analysis cannot cover every type of contaminant that could possibly be present. When combined with field observations, field measurements and professional judgement, this approach increases the probability of identifying contaminated soil and or groundwater. Under no circumstances can it be considered that these findings represent the actual condition of the site at all points.

Environmental studies identify actual sub-surface conditions only at those points where samples are taken, when they are taken. Actual conditions between sampling locations differ from those inferred because no professional, no matter how qualified, and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden below the ground surface. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from that predicted. Nothing can be done to prevent the unanticipated. However, steps can be taken to help minimize the impact. For this reason, site owners should retain our services.

Problems with interpretation by others

Advice and interpretation is provided on the basis that subsequent work will be undertaken by Environmental Earth Sciences NSW. This will identify variances, maintain consistency in how data is interpreted, conduct additional tests that may be necessary and recommend solutions to problems encountered on site. Other parties may misinterpret our work and we cannot be responsible for how the information in this report is used. If further data is collected or comes to light we reserve the right to alter their conclusions.

Obtain regulatory approval

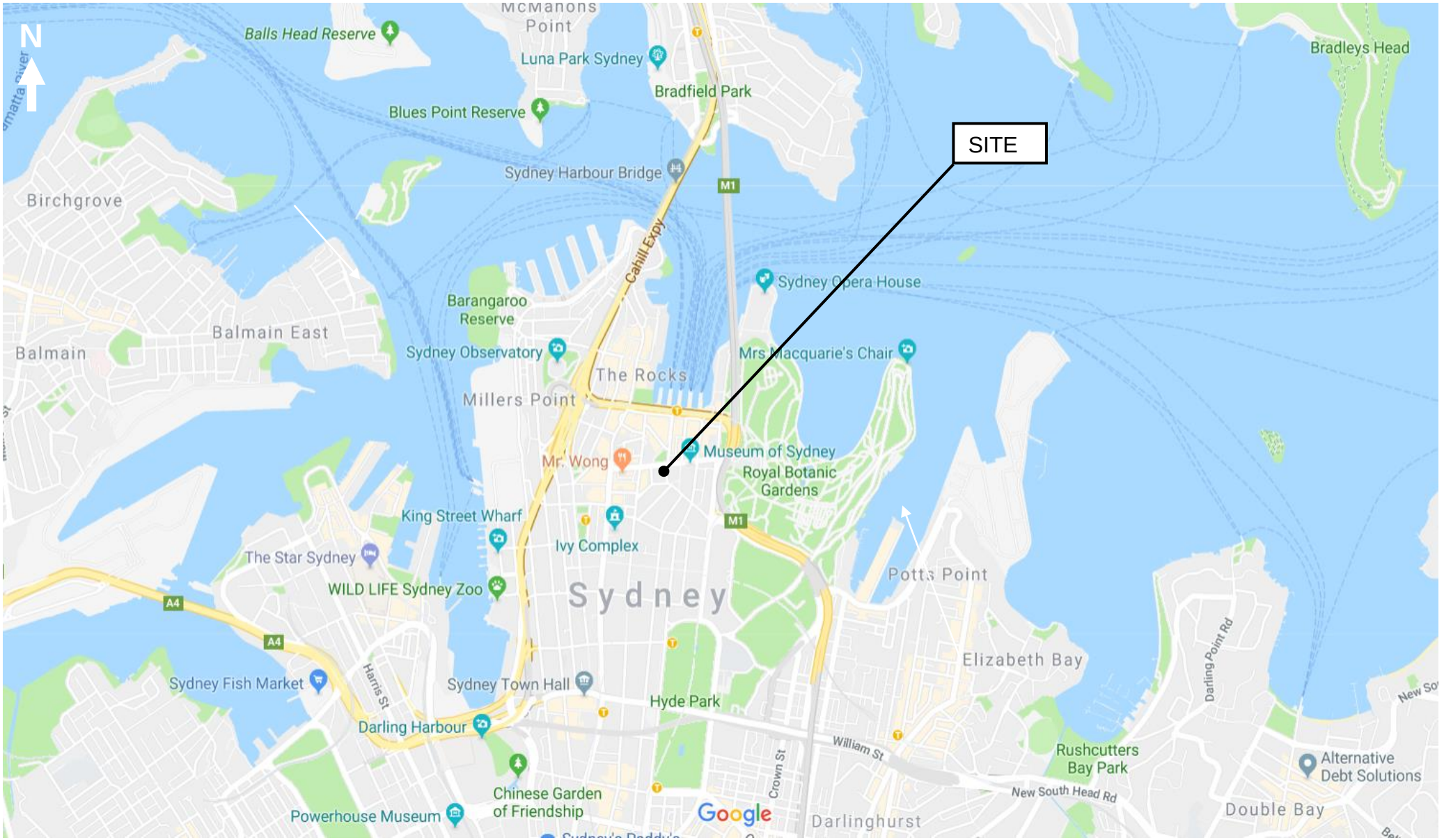
The investigation and remediation of contaminated sites is a field in which legislation and interpretation of legislation is changing rapidly. Our interpretation of the investigation findings should not be taken to be that of any other party. When approval from a statutory authority is required for a project, that approval should be directly sought by the client.

Limit of liability

This study has been carried out to a particular scope of works at a specified site and should not be used for any other purpose. This report is provided on the condition that Environmental Earth Sciences NSW disclaims all liability to any person or entity other than the client in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by any such person in reliance, whether in whole or in part, on the contents of this report. Furthermore, Environmental Earth Sciences NSW disclaims all liability in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by the client, or any such person in reliance, whether in whole or any part of the contents of this report of all matters not stated in the brief outlined in Environmental Earth Sciences NSW's proposal number and according to Environmental Earth Sciences general terms and conditions and special terms and conditions for contaminated sites.

To the maximum extent permitted by law, we exclude all liability of whatever nature, whether in contract, tort or otherwise, for the acts, omissions or default, whether negligent or otherwise for any loss or damage whatsoever that may arise in any way in connection with the supply of services. Under circumstances where liability cannot be excluded, such liability is limited to the value of the purchased service.

FIGURES



LEGEND

ENVIRONMENTAL EARTH SCIENCES	Title: **Site Location**	
	Location: **Sandstone Buildings Project, Sydney NSW**	
Client: **Built Pty Limited**		Job No: **117107**
Drawn By: **CN**	Scale: **NTS**	Source: **SIX Maps**
Proj Man: **CN**	Date: **Dec 2017**	**Figure 1**

LEGEND

- Footprint of Sandstone Buildings development
- Footprint of Loftus Street underground tunnel

ENVIRONMENTAL EARTH SCIENCES

Title: **Site Locality**		
Location: **Sandstone Buildings Project, Sydney NSW**		
Client: **Built Pty Limited**		Job No: **117107**
Drawn By: **CN**	Scale: **NTS**	Source: **SIX Maps**
Proj Man: **CN**	Date: **Dec 2017**	**Figure 2**

APPENDIX A BORELOGS (PSM, 2017)

LEGEND:

- BH03 Borehole locations
- Projected extent of G.P.O Fault Zone (refer Pells et al, 2004)
- Approximate tunnel location

NOTES:

1. Aerial photo obtained from Google Maps.
2. Existing lower ground floor plans provided by Ridley.

0 5 10 15 20

Scale (m)
1:400 @ A3

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Tristar Sandstone Pty Ltd
Education and Lands Department
Geotechnical Site Investigation

BOREHOLE INVESTIGATION LOCATION

PSM2426-016L | Figure 1

ATTACHMENT A
BOREHOLE LOGS, EXPLANATION SHEET AND CORE PHOTOGRAPHS

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Rock-Soil-Water

Borehole Log

Borehole No: **BH01**

Sheet: 1 of 1

Job No: PSM2426

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	27/11/2016
Principal:		**Date completed:**	27/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	YB
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	66 Geopro	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
		Northing:	Refer to Figure 1	**Inclination / azimuth:**	-60° / 090°

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Diatube							CONCRETE			Pavement
Auger		NONE OBSERVED				SP	SAND: fine to medium grained, poorly graded, dark brown with some gravels and sandstone cobbles up to 100 mm Becoming fine grained and brown with highly weathered and iron-stained sandstone gravels up to 15 mm	D	Co	Inferred fill Inferred bedrock
			12.0	1.0						
							Commence coring, refer to cored borehole log			
			11.0	2.0						
			10.0	3.0						
			9.0	4.0						

File Name: PSM2426 BH01 NON CORED.GPJ Print Date: 24/1/17

Refer to Explanation Sheets Attached for Classification Systems

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Borehole No: **BH01**

Sheet: 1 of 3

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	27/11/2016
Principal:		**Date completed:**	27/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	YB
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	66 Geopro	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 090°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
			0.5								
			1.0		Continued from non-cored borehole log						
		12			No core 100 mm						
					SANDSTONE: fine to medium grained, dark red, massive				37		BG, 18°, PL, Ro3, FE, ST
			1.5		110 mm zone of fine-grained sandstone, pale grey			D1.1 A0.8			BG, 20°, PL, Ro3, FE, ST CZ, 18°, PL, Ro3, S, 30 mm BG, 27°, PL, Ro3, KL
			2.0		50 mm zone of variably sized mineral particles, 2-10 mm Healed subvertical joint				83		
		11			Healed joints dipping 40-60°	HW					
			2.5		Multiple healed bedding partings dipping 25-35°						BG, 22°, PL, Ro3, FE, ST BG, 25°, CU, Ro3, KL
								D0.7 A0.9			BG, 24°, PL, Ro3, KL BG, 33°, PL, Ro3, FE, ST
			3.0		Becoming brown, heavily iron-stained						CZ, IR, Ro3, RF, 50 mm BG, 17°, IR, Ro3, FE, ST
	SIGNIFICANT WATER LOSS				Significant water loss				61		BG, 32°, PL, Ro3, FE, ST
		10			No core 70 mm						CZ, IR, Ro3, RF, 150 mm
			3.5		SANDSTONE: fine to medium grained, dark red, massive Two healed joints dipping 60-80°	EW-HW					
			4.0		Becoming grey and dark red, indistinct cross beds dipping 30-40°						BG, 30°, PL, Ro3, KL BG, 10°, UN, Ro3, FE, ST
						HW					BG, 25°, CU, Ro3, FE, ST BG, 20°, IR, Ro5, FE, ST CL, PL, Ro2, CL, with sand, 20 mm
			4.5						19		JN, 60°, PL, Ro5, FE, ST BG, 11°, PL, Ro3, KL FL, 70°, PL, Ro2, RF, with clay
		9			Becoming dark red			D0.5 A0.3			BG, 15°, PL, Ro3, KL BG, 8°, PL, Ro3, RF JN, 90°, UN, Ro3, S

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Rock-Soil-Water

Borehole No: **BH01**

Sheet: 2 of 3

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	27/11/2016
Principal:		**Date completed:**	27/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	YB
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	66 Geopro	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 090°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description (ROCK TYPE; particle characteristics, colour, structure, secondary and minor components)	Weathering	Estimated Strength (S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5)	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) (10 30 100 300 1000)	Defect Description / Comments (Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number)
					SANDSTONE: fine to medium grained, dark red, massive	HW					CZ, IR, Ro5, RF, 20 mm
											BG, 3°, PL, Ro3, KL
					carbonaceous laminations, subhorizontal						JN, 64°, PL, Ro3, CA, VN
									19		JN, 70°, PL, Ro3, KL
											JN, 90°, UN, Ro3, KL
					No core 270 mm						
			5.5								
					SANDSTONE: fine to medium grained, dark red, massive						BG, 10°, CU, Ro3, FE, ST
		8									CZ, IR, Ro3, RF, 60 mm
					Becoming massive						
			6.0					D0.9 A0.8			
											JN, 63°, CU, Ro3, KL
									86		BG, 33°, PL, Ro3, KL
			6.5		Becoming grey						
					Distinct cross beds dipping approximately 40°	MW					
		7	7.0								
											JN, 50°, PL, Ro3, KL
					Becoming massive						BG, 10°, PL, Ro3, FE, ST
											JN, 70°, PL, Ro3, FE, ST
			7.5		Becoming dark red and brown						JN, 70°, PL, Ro3, FE, ST
											JN, 57°, PL, Ro3, FE, ST
											JN, 65°, PL, Ro3, FE, ST
									67		JN, 62°, PL, Ro3, FE, ST
								D1.3 A1			
			8.0								
		6			Healed joint dipping 70°						FL, 9°, PL, Ro3, FE, ST
											JN, 75°, ST, Ro3, FE, ST
											BG, 9°, PL, Ro3, FE, ST
			8.5								JN, 60°, PL, Ro3, FE, ST
											JN, 81°, PL, Ro3, FE, VN
											BG, 2°, PL, Ro3, FE, ST
											BG, 0°, PL, Ro3, FE, ST
											BG, 3°, PL, Ro3, KL
					Becoming fine grained, grey						JN, 77°, PL, Ro3, KL
			9.0			HW					
		5							49		JN, 75°, PL, Ro3, KL
											DB, 270 mm
			9.5								
								D0.2 A0.3			

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Rock-Soil-Water

Borehole No: **BH01**

Sheet: 3 of 3

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	27/11/2016
Principal:		**Date completed:**	27/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	YB
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	66 Geopro	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 090°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		4	10.5		SANDSTONE: fine to medium grained, dark red, massive	HW		D1.4 A0.6	37		JN, 80°, PL, Ro3, RF
					Becoming medium grained, dark red						BG, 23°, PL, Ro3, FE, ST JN, 71°, PL, Ro3, FE, ST
			11.0								BG, 20°, PL, Ro3, KL JN, 58°, PL, Ro3, CB, VN
											JN, 58°, PL, Ro3, CB, VN BG, 31°, PL, Ro3, KL
		3	11.5		No core 720 mm						
			12.0		End of Hole at 11.85m.						
			12.5								
		2	13.0								
			13.5								
		1	14.0								
			14.5								

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Rock-Soil-Water

Borehole Log

Borehole No: **BH02**

Sheet: 1 of 1

Job No: PSM2426

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	26/11/2016
Principal:		**Date completed:**	26/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus St, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geoprobe 6600	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
		Northing:	Refer to Figure 1	**Inclination / azimuth:**	-60° / 270°

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Diatube							ASPHALT			Pavement
							CONCRETE			
Auger		NONE OBSERVED				SW	SAND; fine to coarse grained, brown		Co	Inferred fill
							SANDSTONE; extremely weathered to highly weathered, dark red	M		Inferred bedrock
			12.0	1.0			Increase in drilling resistance			
							Commence coring, refer to cored borehole log			
			11.0	2.0						
			10.0	3.0						
			9.0	4.0						

File Name: PSM2426 BH02 NON CORED.GPJ Print Date: 24/1/17

Refer to Explanation Sheets Attached for Classification Systems

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Rock-Soil-Water

Borehole No: **BH02**

Sheet: 1 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	26/11/2016
Principal:		**Date completed:**	26/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geoprobe 6600	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 270°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
			0.5								
			1.0		Continued from non-cored borehole log						
		12									
					No core 50 mm						BG, 0°, CU, Ro3, KL
			1.5		SANDSTONE; medium to coarse grained, orange and dark red, distinctly to indistinctly cross bedded, cross beds dipping 30° to 35° and are planar	HW		D1.1 A3			BG, 0°, CU, Ro3, KL
					Becoming pale yellow and orange				92		
			2.0			MW		D0.7 A0.3			
		11									
			2.5								
					No core 70 mm						BG, 30°, PL, Ro3, FE, ST
					SANDSTONE; medium to coarse grained, pale yellow and orange, distinctly to indistinctly cross bedded, cross beds dipping 20° to 30° and are planar						BG, 0°, IR, Ro3, KL
			3.0					D0.4 A0.9			FZ, Rock fragments 50mm
											JN, 55°, Healed
		10	3.5		Becoming orange and purple	HW			94		
			4.0					D0.7 A1.1			BG, 20°, IR, Ro3, KL
					Becoming dark red and pale grey						
			4.5								BG, 20°, PL, Ro2, CL, VN
		9									BG, 20°, PL, Ro2, CL, VN
								D0.7			

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Borehole No: **BH02**

Sheet: 2 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	26/11/2016
Principal:		**Date completed:**	26/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geoprobe 6600	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 270°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
					SANDSTONE; medium to coarse grained, dark red and pale grey, distinctly to indistinctly cross bedded, cross beds dipping 20° to 30° and are planar			A1.2	94		JN, 50°, Healed JN, 45°, Healed JN, 60°, Healed CL, 25°, PL, CL S, 30mm
			5.5								
		8				HW					JN, 50°, IR, Ro3, KL FZ, 30°, Rock fragments, 40mm BG, 30°, PL, Ro3, KL
			6.0					D0.6 A0.7			
			6.5		Becoming medium grained, pale grey with discontinuous carbonaceous cross beds						BG, 30°, CU, Ro3, KL BG, 30°, IR, Ro3, KL FZ, 30°, Rock fragments, 10mm
		7				FR		D0.6 A0.8	78		
			7.0								
			7.5		Becoming medium to coarse grained, dark red and orange, indistinctly cross bedded, cross beds dipping 20° and are planar						CL, 10°, PL, CL S, 10mm JN, 60°, UN, Ro3, KL
			8.0								JN, 50°, IR, Ro3, FE, ST JN, 40°, IR, Ro3, S, 2mm
		6						D0.3 A0.5			BG, 25°, IR, Ro4, KL BG, 25°, IR, Ro3, KL
			8.5			HW					BG, 30°, IR, Ro3, FE, ST JN, 45°, Healed BG, 20°, IR, Ro3, KL BG, 20°, IR, Ro3, FE, ST BG, 20°, IR, Ro3, KL BG, 30°, IR, Ro3, KL BG, 20°, IR, Ro3, FE, ST JN, 60°, PL, Ro3, KL
			9.0					D0.5 A0.7			BG, 20°, PL, Ro3, KL JN, 55°, UN, Ro3, KL
		5			Carbonaceous clast 10mm				66		
			9.5								JN, 50°, PL, Ro3, KL JN, 60°, KL, Ro3, KL JN, 50°, IR, Ro4, KL JN, 60°, IR, Ro4, KL BG, 30°, CU, Ro4, KL BG, 30°, IR, Ro4, KL
								D0.5			

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Rock-Soil-Water

Borehole No: **BH02**

Sheet: 3 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	26/11/2016
Principal:		**Date completed:**	26/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geoprobe 6600	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 270°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
					SANDSTONE; medium to coarse grained, dark red and orange, indistinctly cross bedded, cross beds dipping 20° and are planar	HW		A0.7	66		BG, 30°, IR, Ro4, KL BG, 10°, IR, Ro3, S, 15mm BG, 20°, IR, Ro3, KL BG, 30°, IR, Ro3, FE, VN BG, 0°, IR, Ro3, S, 5mm JN, 40°, PL, Ro3, FE, ST BG, 30°, CU, Ro3, KL JN, 40°, IR, Ro3, KL JN, 50°, IR, Ro3, FE, ST JN, 60°, IR, Ro3, FE, ST JN, 50°, IR, Ro3, FE, ST JN, 60°, UN, Ro3, FE, ST
		4	10.5		No core 160 mm						
					SANDSTONE; medium to coarse grained, dark red and pale grey, indistinctly cross bedded, cross beds dipping 20° and are planar	HW					FZ, Rock fragment surfaces are clean and iron stained, 150mm
			11.0					D2.2 A1.7			
		3	11.5						91		JN, 60°, UN, Ro3, FE, ST
											JN, 50°, UN, Ro3, KL
			12.0		Becoming orange and pale grey			D2.5 A2.4			
											BG, 25°, CU, Ro2, CL, VN
			12.5		Becoming orange and brown						JN, 50°, CU, Ro3, KL
		2				MW					
			13.0					D2 A2.1			
			13.5								JN, 80°, IR, Ro4, KL
		1							87		
			14.0					D1.4 A2			BG, 10°, PL, Ro3, KL
											BG, 10°, PL, Ro3, KL
			14.5								
											BG, 10°, CU, Ro3, FE, ST BG, 20°, IR, Ro3, KL BG, 10°, Healed CL, 10°, UN, 10mm
					Becoming medium grained, pale grey, distinctly cross bedded, cross beds	FR					CL, 30°, UN, 10mm

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Rock-Soil-Water

Cored Borehole Log

Borehole No: **BH02**

Sheet: 4 of 4

Job No: PSM2426

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	26/11/2016
Principal:		**Date completed:**	26/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geoprobe 6600	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 270°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
					dipping 15° and are planar			D0.9 A1.3			BG, 20°, CU, Ro3, KL
					SANDSTONE; medium grained, pale grey, distinctly cross bedded, cross beds dipping 15° and are planar				87		JN, 40°, IR, Ro3, KL
			15.5								JN, 60°, IR, Ro2, CL, 1mm
											CL, 20°, CU, CL, 5mm
											JN, 45°, IR, Ro3, KL
											JN, 45°, IR, Ro2, CL, VN
			16.0		Siltstone clast 30mm in size			D2.3 A0.9			BG, 30°, CU, Ro3, KL
		-1									JN, 45°, UN, Ro3, KL
											CL, 30°, PL, CL S, 15mm
			16.5								
			17.0			FR		D1 A1			JN, 60°, UN, Ro3, KL
		-2							97		
			17.5								JN, 60°, IR, Ro3, KL
			18.0					D1.3 A1.3			
		-3	18.5								JN, 50°, IR, Ro3, KL FL, 65°, Healed, 3mm offset on cross beds JN, 40°, Healed JN, 50°, IR, Ro3, KL
			19.0		End of Hole at 18.95m.						
			19.5								
		-4									

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Borehole Log

Borehole No: **BH03**

Sheet: 1 of 1

Job No: PSM2426

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	12/11/2016
Principal:		**Date completed:**	12/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus St, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geoprobe 7822dT	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
		Northing:	Refer to Figure 1	**Inclination / azimuth:**	-60° / 075°

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Auger		NONE OBSERVED					ASPHALT			Pavement
							CONCRETE			
						SW	SAND; fine to coarse grained, well graded, orange		Co	Inferred fill
							SANDSTONE; extremely weathered to highly weathered, dark red and orange	M		Inferred bedrock
			12.0	1.0			Commence coring, refer to cored borehole log			
			11.0	2.0						
			10.0	3.0						
			9.0	4.0						

File Name: PSM2426 BH03 NON CORED.GPJ Print Date: 24/1/17

Refer to Explanation Sheets Attached for Classification Systems

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Rock-Soil-Water

Borehole No: **BH03**

Sheet: 1 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	12/11/2016
Principal:		**Date completed:**	12/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geoprobe 7822DT	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 075°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
			0.5		Continued from non-cored borehole log						
			1.0		CONCRETE						
		12			SANDSTONE; medium grained, grey orange and brown, indistinctly to distinctly cross bedded, cross beds dipping between 0° to 35°and are planar to curved	SW		A0.5 D0.5			
			1.5			HW			92		BG, 20°, CU, Ro2, CL, 3mm BG, 0°, PL, Ro2, CL, 2mm JN, 40°, IR, Ro4, KL
			2.0					A0.6 D0.8			
		11				MW					BG, 35°, PL, Ro2, CL, VN
			2.5		No core 200 mm						
	SIGNIFICANT WATER LOSS				SANDSTONE; medium grained, grey orange and brown, indistinctly to distinctly cross bedded, cross beds dipping between 0° to 35°and are planar to curved	MW					FZ, Rock fragments, 50mm
			3.0					A0.8 D0.8			BG, 35°, PL, Ro3, KL
						HW					
		10	3.5						91		BG, 30°, PL, Ro3, KL BG, 30°, PL, Ro3, KL
			4.0					A0.8 D0.4			BG, Healed
						MW					JN, 45°, IR, Ro3, FE, ST
			4.5								
		9						A0.4			

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Rock-Soil-Water

Borehole No: **BH03**

Sheet: 2 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	12/11/2016
Principal:		**Date completed:**	12/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geoprobe 7822DT	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 075°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
					SANDSTONE; medium grained, grey orange and brown, indistinctly to distinctly cross bedded, cross beds dipping between 0° to 35°and are planar to curved			D0.9	91		BG, 10°, PL, Ro2, CL, VN JN, 65°, UN, Ro3, KL JN, 50°, PL, Ro3, FE, ST JN, 55°, PL, Ro4, KL
		8	5.5			MW					
			6.0					A0.7 D1			
			6.5		Becoming pale grey with discontinuous carbonaceous cross beds						CL, 25°, PL, S, 40mm
		7				FR			94		
			7.0					A0.4 D0.4			CL, 20°, PL, CL S, 25mm BG, 20°, IR, Ro4, FE, ST
			7.5		Becoming medium to coarse grained, orange and dark red, no carbonaceous cross beds						
			8.0			HW		A1.9 D1.7			
		6									JN, 70°, IR, Ro3, FE, ST JN, 70°, Healed
			8.5								
			9.0					A1.6 D2.5	100		JN, 70°, UN, Ro4, FE, ST
		5									
			9.5			HW/MW					BG, 20°, IR, Ro4, KL

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Rock-Soil-Water

Borehole No: **BH03**

Sheet: 3 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	12/11/2016
Principal:		**Date completed:**	12/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geoprobe 7822DT	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 075°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		4	10.5		SANDSTONE; medium to coarse grained, orange and purple, indistinctly cross bedded, cross beds dipping between 0° to 35°and are planar to curved			A2.3 D3.1	100		
			11.0					A2.3 D2.4			
		3	11.5			HW/MW					BG, 30°, PL, Ro3, KL
			12.0					A1.6 D2.6			
			12.5								
		2									BG, 25°, Healed
			13.0					A2.3 D2.3	100		
			13.5								
		1				HW					
			14.0					A1.8 D2.6			
			14.5						99		

File Name: PSM2426 BH03 CORED.GPJ Print date: 23/1/17

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Rock-Soil-Water

Borehole No: **BH03**

Sheet: 4 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	12/11/2016
Principal:		**Date completed:**	12/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geoprobe 7822DT	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 075°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
			15.5		SANDSTONE; medium to coarse grained, orange and purple, indistinctly cross bedded, cross beds dipping between 0° to 35°and are planar to curved	HW		A2.2 D2.7			BG, 20°, IR, Ro4, FE, ST
											CL, 20°, PL, CL S, 20mm
			16.0		Becoming medium grained, pale grey, distinctly cross bedded, cross beds dip between 20° and 30° and are planar			A1.1 D0.6			
		-1							99		
			16.5								
											CL, 20°, PL, CL S, 10mm
			17.0					A1.4 D1.3			
		-2				FR					
			17.5								
			18.0					A0.6 D1.1			
									100		
		-3	18.5								
			19.0					A1.7 D1.1			
											FL, 70°, Healed, 3mm offset on crossbeds
			19.5		End of Hole at 19.38m.						
		-4									

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Borehole Log

Borehole No: **BH04**

Sheet: 1 of 1

Job No: PSM2426

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	24/09/2016
Principal:		**Date completed:**	24/09/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus St, Sydney	**Checked by:**	MLT

Drilling contractor:	Soil Check	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Geo 205	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
		Northing:	Refer to Figure 1	**Inclination / azimuth:**	-70° / 280°

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Diatube		NONE OBSERVED					ASPHALT			Pavement
							CONCRETE			
Auger							SAND; fine to coarse grained, well graded, orange, with a trace of clay	M		Inferred fill
			12.0	1.0		SW				
						SC	Clayey silty SAND; fine to coarse grained, pale grey			Inferred residual soil
							SANDSTONE; Highly weathered, medium to coarse grained, grey and brown			Inferred bedrock
							Commence coring, refer to cored borehole log			
			11.0	2.0						
			10.0	3.0						
			9.0	4.0						

File Name: PSM2426 BH04 NON CORED.GPJ Print Date: 24/1/17

Refer to Explanation Sheets Attached for Classification Systems

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Rock-Soil-Water

Borehole No: **BH04**

Sheet: 1 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	24/09/2016
Principal:		**Date completed:**	24/09/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	J&K Geotechnics	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Comacchio Geo 205	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-70° / 280°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
			0.5								
		12	1.0		Continued from non-cored borehole log						
			1.5								
					SANDSTONE; medium to coarse grained, orange and dark red, minor carbonaceous cross beds dipping 0° to 10°						BG, 10°, CU, Ro4, KL BG, 0°, PL, Ro4, KL BG, 0°, CU, Ro4, KL BG, 0°, CU, Ro4, KL BG, 0°, PL, Ro4, KL BG, 0°, PL, Ro4, KL BG, 0°, PL, Ro4, KL BG, 10°, PL, Ro4, KL BG, 0°, PL, Ro4, KL BG, 0°, PL, Ro4, KL
			2.0			HW		A0.8 D1			
		11	2.5								BG, 0°, PL, Ro3, S, 1mm BG, 0°, PL, Ro4, KL CL, 30°, CL, 40mm, PP=25 kPa
			3.0			MW		A0.3 D0.5	57		
		10	3.5								BG, 0°, IR, Ro4, KL
					No core 550 mm						
			4.0								
		9	4.5		SANDSTONE; medium grained, orange and dark red, minor carbonaceous cross beds dipping 0° to 10°	HW		A1 D0.8	99		

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Rock-Soil-Water

Borehole No: **BH04**

Sheet: 2 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	24/09/2016
Principal:		**Date completed:**	24/09/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	J&K Geotechnics	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Comacchio Geo 205	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-70° / 280°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		8	5.5		SANDSTONE; medium grained, orange and dark red, minor carbonaceous cross beds dipping 0° to 10°	HW		A0.6 D0.8			BG, 15°, PL, Ro2, CL, 3mm
					Becoming pale grey, discontinuous wispy carbonaceous laminations less than 1mm thick						
			6.0					A0.5 D0.8	99		
		7	6.5								
			7.0					A0.5 D0.9			
		6	7.5			FR					
			8.0					A1.1 D1			
		5	8.5						100		
			9.0					A0.5 D1.1			JN, Healed
		4	9.5								

File Name: PSM2426 BH04 CORED.GPJ Print date: 23/1/17

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Rock-Soil-Water

Borehole No: **BH04**

Sheet: 3 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	24/09/2016
Principal:		**Date completed:**	24/09/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	J&K Geotechnics	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Comacchio Geo 205	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-70° / 280°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
					SANDSTONE; medium grained, orange and dark red, minor carbonaceous cross beds dipping 0° to 10°	FR		A0.8 D0.8	100		BG, 20°, PL, Ro2, CL, 3mm
			10.5		Becoming orange and dark red, indistinctly cross bedded	HW					
		3									BG, 10°, IR, Ro4, KL
			11.0					A1.6 D1.1			
											JN, 70°, IR, Ro3, FE, ST
			11.5								
		2							98		
											BG, 0°, PL, Ro4, KL
			12.0					A1.7 D1.5			
						MW					
			12.5								
		1									
			13.0					A2.3 D1.9			BG, 10°, UN, Ro4, KL
											JN, 70°, UN, Ro3, FE, ST
											BG, 10°, IR, Ro4, KL
			13.5		Becoming fine to medium grained, grey, distinctly cross bedded, cross beds dipping between 0° and 20°						BG, 10°, IR, Ro4, KL CL, 10°, CL, 5mm FZ, RF, 20mm
		0									BG, 10°, PL, Ro3, KL
			14.0					A1.2 D0.9			FZ, RF, 40mm
						FR			84		
			14.5								
		-1									

File Name: PSM2426 BH04 CORED.GPJ Print date: 23/1/17

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Rock-Soil-Water

Borehole No: **BH04**

Sheet: 4 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	24/09/2016
Principal:		**Date completed:**	24/09/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	J&K Geotechnics	**R.L. surface:**	13 m	**Vertical datum:**	AHD
Equipment type:	Comacchio Geo 205	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-70° / 280°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
			15.5		SANDSTONE; fine to medium grained, grey, distinctly cross bedded, cross beds dipping between 0° and 20°	FR		A0.9 D1.3	84		
					No core 70 mm						
		-2	16.0		End of Hole at 15.93m.						
			16.5								
		-3	17.0								
			17.5								
		-4	18.0								
			18.5								
		-5	19.0								
			19.5								

File Name: PSM2426 BH04 CORED.GPJ Print date: 23/1/17

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Rock-Soil-Water

Borehole Log

Borehole No: **BH05**

Sheet: 1 of 1

Job No: PSM2426

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	25/09/2016
Principal:		**Date completed:**	25/09/2016
Project:	Education and Lands Dept Building	**Logged by:**	YB
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	J&K Geotechnics	**R.L. surface:**	13.5 m	**Vertical datum:**	AHD
Equipment type:	Comacchio Geo 205	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
		Northing:	Refer to Figure 1	**Inclination / azimuth:**	-70° / 135°

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Auger		NONE OBSERVED	13.5	0.0			ASPHALT			Pavement
			13.4	0.1			CLAYEY SAND: medium grained, poorly graded, brown, medium to high plasticity, with gravels of size 1-5 mm			Inferred fill
			13.0	0.5						
				1.0		SC	Becoming orange and red	M	Co	Inferred residual soil
			12.0	1.5			Becoming more clayey, high plasticity			
				2.0			Becoming pale grey			
			11.5	2.0			Commence coring, refer to cored borehole log			
			11.0	2.5						
				3.0						
			10.5	3.5						
			10.0	4.0						
			9.5	4.5						
			9.0	5.0						

File Name: PSM2426 BH05.GPJ Print Date: 24/1/17

Refer to Explanation Sheets Attached for Classification Systems

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Borehole No: **BH05**

Sheet: 1 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	25/09/2016
Principal:		**Date completed:**	25/09/2016
Project:	Education and Lands Dept Building	**Logged by:**	YB
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	J&K Geotechnics	**R.L. surface:**	13.5 m	**Vertical datum:**	AHD
Equipment type:	Comacchio Geo 205	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-70° / 135°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		13	0.5								
			1.0								
		12	1.5								
			2.0		Continued from non-cored borehole log						
					No core 50 mm						
					SANDSTONE: coarse to medium grained, dark red, massive	HW					BG, 5°, PL, Ro3, KL BG, 3°, PL, Ro3, KL BG, 1°, CU, Ro3, KL
			2.5		Becoming developed, distinct cross beds dipping 10-20°						
		11									BG, 20°, PL, Ro2, CL, VN
			3.0			MW		D0.2 A0.2	84		
											BG, 20°, PL, Ro3, FE, ST
			3.5								BG, 19°, PL, Ro3, CB, VN
		10			Becoming pale grey						CZ, IR, Ro3, RF, 30 mm
			4.0					A0.6			JN, 78°, PL, Ro3, FE, ST BG, 33°, PL, Ro3, KL
						SW					
			4.5						100		
		9						D0.7			

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Rock-Soil-Water

Borehole No: **BH05**

Sheet: 2 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	25/09/2016
Principal:		**Date completed:**	25/09/2016
Project:	Education and Lands Dept Building	**Logged by:**	YB
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	J&K Geotechnics	**R.L. surface:**	13.5 m	**Vertical datum:**	AHD
Equipment type:	Comacchio Geo 205	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-70° / 135°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
					SANDSTONE: coarse to medium grained, red brown and orange, indistinct cross beds			A0.7			JN, 80°, UN, Ro3, FE, ST BG, 30°, PL, Ro3, FE, ST
			5.5			HW/MW					
		8			Becoming medium grained						
			6.0					D0.8 A0.7			BG, 28°, PL, Ro2, CL, VN
									100		
					Becoming pale grey, distinct cross beds dipping approximately 30°						BG, 29°, PL, Ro3, KL BG, 31°, PL, Ro2, CL, 1 - 5mm
			6.5								
					Becoming massive, discontinuous wispy carbonaceous laminations less than 1mm thick						BG, 25°, PL, Ro2, CL, VN BG, 21°, PL, Ro3, KL
		7									
			7.0					D0.9 A0.7			
			7.5								
		6	8.0			FR		D1.4 A1.3			
			8.5						100		
			9.0					D1.2 A1.0			
		5									
			9.5								

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Borehole No: **BH05**

Sheet: 3 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	25/09/2016
Principal:		**Date completed:**	25/09/2016
Project:	Education and Lands Dept Building	**Logged by:**	YB
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	J&K Geotechnics	**R.L. surface:**	13.5 m	**Vertical datum:**	AHD
Equipment type:	Comacchio Geo 205	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-70° / 135°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		4			SANDSTONE: medium grained, dark brown and pale grey, indistinct cross beds				100		
					Becoming massive			D1.6 A1.5			BG, 21°, CU, Ro3, FE, ST
			10.5								
			11.0								
		3									
											BG, 14°, PL, Ro4, KL
			11.5								
						HW/MW			100		
			12.0					D2.3 A2.0			
		2									
			12.5								
								D2.5 A1.6			
					Becoming pale brown						BG, 30°, PL, Ro3, KL
			13.0								BG, 33°, PL, Ro3, KL
											JN, 70°, PL, Ro3, RF
					90 mm zone with healed joint parallel to sub-vertical joint						BG, 32°, PL, Ro3, KL
		1									
			13.5								
					Becoming medium to fine grained, grey, distinct laminations and cross beds, dipping 10-20°						BG, 20°, PL, Ro3, KL
								D1.2 A1.6			
			14.0						100		BG, 15°, PL, Ro3, CB, VN
		0				FR					
			14.5		carbonaceous laminations						BG, 7°, CU, Ro3, KL
								D1.3 A0.9			

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Rock-Soil-Water

Borehole No: **BH05**

Sheet: 4 of 4

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	25/09/2016
Principal:		**Date completed:**	25/09/2016
Project:	Education and Lands Dept Building	**Logged by:**	YB
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	J&K Geotechnics	**R.L. surface:**	13.5 m	**Vertical datum:**	AHD
Equipment type:	Comacchio Geo 205	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-70° / 135°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		-1	15.5		SANDSTONE; fine to medium grained, grey, distinct laminations and cross beds, dipping 10°-20°	FR			100		BG, 16°, PL, Ro3, KL
					200 mm zone of siltstone band						
			16.0					D1.3 A1.0			
		-2	16.5		End of Hole at 16.3m.						
			17.0								
		-3	17.5								
			18.0								
		-4	18.5								
			19.0								
		-5	19.5								

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Rock-Soil-Water

Borehole Log

Borehole No: **BH06**

Sheet: 1 of 1

Job No: PSM2426

Client:	Tristar Sandstone (NSW) Pty Ltd	**Date commenced:**	28/11/2016
Principal:		**Date completed:**	28/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus St, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	8.5 m	**Vertical datum:**	AHD
Equipment type:	DTS700	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
		Northing:	Refer to Figure 1	**Inclination / azimuth:**	-60° / 270°

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Diatube		NONE OBSERVED					BRICK			Pavement
						SW	SAND; medium grained, uniformly graded, brown	M	Co	Inferred fill
							CONCRETE			
Auger			8.0			SC	Clayey SAND; fine to coarse grained, pale grey	M	Co	
							BRICK			
							Commence coring, refer to cored borehole log			
				1.0						
			7.0							
				2.0						
			6.0							
				3.0						
			5.0							
				4.0						
			4.0							

File Name: PSM2426 BH06 NON CORED.GPJ Print Date: 24/1/17

Refer to Explanation Sheets Attached for Classification Systems

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Rock-Soil-Water

Borehole No: **BH06**

Sheet: 1 of 3

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	28/11/2016
Principal:		**Date completed:**	28/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	8.5 m	**Vertical datum:**	AHD
Equipment type:	DTS700	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 270°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		8	0.5		Continued from non-cored borehole log						
			1.0		BRICK, orange and black						
			1.5		SANDSTONE; medium grained, dark red and orange, discontinuous carbonaceous cross beds	MW		D0.5 A0.3	100		
		7	2.0		Becoming orange and pale grey			D0.4 A0.4			
			2.5			SW					
		6	3.0					D0.5 A0.4			
			3.5		Becoming pale grey				100		>>
		5	4.0			FR		D0.5 A0.4			
			4.5					D0.7			

File Name: PSM2426 BH06 CORED.GPJ Print date: 23/1/17

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Rock-Soil-Water

Borehole No: **BH06**

Sheet: 2 of 3

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	28/11/2016
Principal:		**Date completed:**	28/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	8.5 m	**Vertical datum:**	AHD
Equipment type:	DTS700	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 270°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		4	5.5		SANDSTONE; medium to coarse grained with some fine grained gravel up to 3mm, pale grey, discontinuous carbonaceous laminations	FR		A0.6			
					Becoming dark red and orange, no gravel, indistinctly cross bedded						CL, 35°, CL, 30mm
			6.0					D1.9 A1.3			BG, 5°, IR, Ro3, KL
		3	6.5						99		JN, 60°, IR, Ro2, CL, 2mm
			7.0			HW		D1.1 A1			
		2	7.5								
			8.0					D2.4 A2.2			
			8.5								
		1	9.0		Becoming medium grained, pale grey, distinctly cross bedded, cross beds dipping between 0° and 30° and are planar to curved, approximately 90% to 95 % sandstone, 5% to 10% siltstone			D0.7 A0.6	100		JN, 55°, IR, Ro2, CL, VN
			9.5			SW					BG, 30°, PL, Ro3, KL
		0						D1.1			

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Rock-Soil-Water

Borehole No: **BH06**

Sheet: 3 of 3

Job No: PSM2426

Cored Borehole Log

Client:	Tristar Sandstone Pty Ltd	**Date commenced:**	28/11/2016
Principal:		**Date completed:**	28/11/2016
Project:	Education and Lands Dept Building	**Logged by:**	JR
Site location:	Loftus Street, Sydney	**Checked by:**	MLT

Drilling contractor:	Terratest	**R.L. surface:**	8.5 m	**Vertical datum:**	AHD
Equipment type:	DTS700	**Easting:**	Refer to Figure 1	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	Refer to Figure 1	**Inclination / azimuth:**	-60° / 270°

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
			10.5		SANDSTONE; medium grained, pale grey, distinctly cross bedded, cross beds dipping between 0° and 30° and are planar to curved, approximately 90% to 95 % sandstone, 5% to 10% siltstone	SW		A0.9	100		
		-1	11.0					D1.3 A1.3			
			11.5								
		-2	12.0					D0.9 A1			
			12.5						100		JN, 55°, IR, Ro3, KL
			13.0			FR		D0.8 A0.8			
		-3	13.5								JN, 50°, IR, Ro3, KL
			14.0					D1.1 A1.4			JN, 70°, IR, Ro3, KL
		-4	14.5						100		
								D1.1 A1.2			

End of Hole at 14.94m.

File Name: PSM2426 BH06 CORED.GPJ Print date: 23/1/17

□□PL□□□□l□□ S□□□□
□□R□□□L□ L□□

GENERAL

Me□□□d

□□n□□□red □□re□□le
Auger
Hand Auger
Diamond Rotary
Percussion
Other

□es□in□

Sy□ □□l	Des□ri□□i□n
UCS	Uniaxial Compressive Strength
TXL	Triaxial Test
BT	Brazilian Test
DT	Direct Tensile
SD	Slake Durability
Packer	Rock Mass Permeability

Sa□ □les

Sy□ □□l	Des□ri□□i□n
U50	50 mm undisturbed tube sample
D	Disturbed sample
Bs	Bulk sample

□□rin□ Si□e

□□red □□re□□le	□□□inal □□re Dia□ e□er □□ □ □
NMLC	51.9
BQ	36.5
BQ3	33.5
NQ	47.6
NQ3	45.1
HQ	63.5
HQ3	61.1
PQ	85
PQ3	83.1
Diatube	Variable
Other	-

□ a□er

Sy□ □□l	Des□ri□□i□n
	Water level
	Water inflow
	Complete water loss
	Partial water loss

SOIL DESCRIPTIONS

□ni□ied S□il □lassi□a□i□n Sys□e□ □□S□S□

Ma□□r Divisi□ns			Sy□ □□l	□y□i□al □a□es
Coarse-Grained Soils More than 50% coarser than 0.075mm	Gravels (more than 50% coarser than 2mm)	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.
		Gravels With Fines	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels. gravel-sand-clay mixtures.
	Sands (more than 50% of coarse fraction finer than 2mm)	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines.
			SP	Poorly graded sands and gravelly sands, little or no fines.
		Sand With Fines	SM	Silty sands, sand-silt mixture.
			SC	Clayey sands, sand-clay mixtures.
Fine-Grained Soils 50% or more finer than 0.075mm	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour silty or clayey fine sands.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and silty clays of low plasticity.
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity.
Highly Organic Soils			PT	Peat etc.

M□is□ure □□ndi□i□n

□er□	Sy□ □□l
Dry	D
Moist	M
Wet	W
Wet at Plastic Limit	WP
Wet at Liquid Limit	WL

S□ren□□□

□□□□**SIV□ S□ILS** are described in terms of undrained shear strength, colour and structure with comments on minor constituents or apparent special features. Undrained shear strength is measured by hand penetrometer or determined by laboratory testing or estimated from experience. Classification in terms of undrained shear strength is as follows:

□er□	Sy□ □□l	Des□ri□□i□n □□r □ield □s□i□ a□i□n	S□ear S□ren□□□ □kPa□	□□S □kPa□
Very Soft	VS	Easily penetrated several centimetres by fist.	<12	<25
Soft	S	Easily penetrated several centimetres by thumb. Can be moulded by light finger pressure.	12-25	25-50
Firm	F	Can be penetrated by thumb with moderate effort. Can be moulded by strong finger pressure.	25-50	50-100
Stiff	ST	Readily indented by thumb.	50-100	100-200
Very Stiff	VST	Readily indented by thumbnail.	100-200	200-400
Hard	H	Indented with difficulty by thumbnail	>200	>400

□□□□□□□□**SIV□ S□ILS** are described in terms of density, colour, with comments on minor constituents or special features. Density (density index) is generally based on standard penetration testing (AS1289 Method 6.3.1), or other forms of penetration testing. Terms used in describing density are set out below:

□er□	Sy□ □□l	Densi□y Inde□	SP□ □ Values
Very Loose	VL	<15%	<5
Loose	L	15-35 %	5-10
Medium Dense	MD	35-65 %	10-30
Dense	D	65-85 %	30-50
Very Dense	VD	>85 %	>50

ROCK DESCRIPTIONS

□ ea□□erin□

□er□	Sy□ □□l	Des□ri□□i□n
Fresh	FR	Rock substance unaffected by weathering.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
Moderately Weathered	MW	Rock substance affected by weathering to the extent staining extends throughout whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and signs of chemical or physical decomposition of individual minerals are usually evident. Porosity and strength may be increased or decreased when compared to the fresh rock substance, usually as a result of the leaching or deposition of iron. The colour and strength of the original fresh rock substance is no longer recognisable.
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties, i.e. it can be remoulded and can be classified according to the Unified Soil Classification System, but the texture of the original rock is still evident.

S□ren□□□

□er□	Sy□ □□l	Des□ri□□i□n □□r □ield □s□i□ a□i□n	□□S □MPa□
Extremely Low	R0	Thumbnail easily scratches; gentle blow with geological pick leaves deep impression.	0.7-1.5
Very Low	R1	Can be peeled by a pocket knife. Crumbles under firm blows with geological pick.	1.5-3.0
Low	R2	Can be peeled by a pocket knife with difficulty; shallow indentation made by firm blow of geological pick.	3.0-10
Medium	R3	Cannot be scraped or peeled with a pocket knife; specimen can be fractured with single firm blow of hammer end of geological pick.	10-25
High	R4	Specimen requires more than one blow with hammer end of geological pick to fracture.	25-80
Very High	R5	Specimen requires many blows of hammer end of geological pick to fracture.	>80

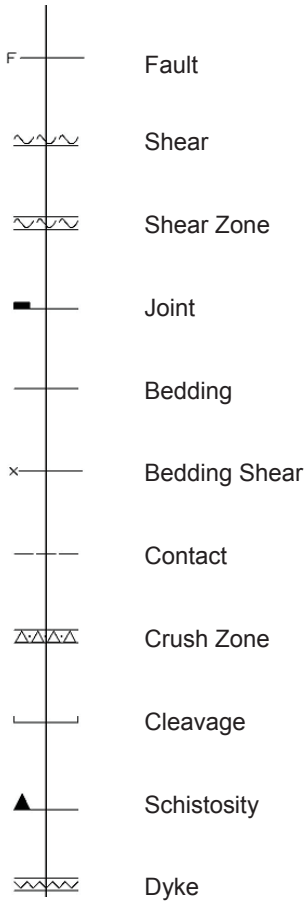
Defect Description

Order of description: type, inclination, shape, roughness, infill type, infill thickness, number

Defect Type

Symbol	Description
CL	Clay Seam
FL	Fault - fracture along which displacement is recognisable.
SR	Shear - a fracture along which movement has taken place but no displacement is recognisable. Evidence for movement may be slickensides, polishing and/or clay gouge.
SH	Sheared Zone - zone of multiple closely spaced fracture planes with roughly parallel planar boundaries usually forming blocks of lenticular or wedge shaped intact material. Fractures are typically smooth, polished or slickensided; and curved.
BG	Bedding parting - arrangement in layers of mineral grains or crystals parallel to surface of deposition along which a continuous observable parting occurs.
BSH	Bedding plane shear - a shear formed along a bedding plane
JN	Joint - a single fracture across which rock has little or no tensile strength and is not obviously related to rock fabric.
CN	Contact - surface between two lithologies.
SC	Schistosity - plane formed by the preferred orientation of the constituent minerals in a parallel arrangement in a coarse grained rock which has undergone regional metamorphism (schist).
CV	Cleavage - plane of mechanical fracture in a rock normally sufficiently closely spaced to form parallel-sided slices.
FO	Foliation
CZ	Crushed Zone - zone with roughly parallel, planar boundaries (commonly slickensided) containing disoriented usually angular rock fragments of variable size often in a soil matrix.
VN	Vein - fracture in which a tabular or sheet-like body of minerals have been intruded.
DK	Dyke - Igneous intrusion - often weathered and altered to a clay like substance.
DZ	Decomposed Zone - zone of any shape but commonly with parallel planar boundaries containing moderately to gradational boundaries into fresher rock.
FZ	Fractured Zone - a zone of closely spaced defects (mainly joints, bedding, cleavage and/or schistosity) comprised of core lengths in the order of 50 mm or less.

Standard Defect Symbols



Roughness Colour Code (for summary log)

Ro1
Ro2
Ro3
Ro4
Ro4

S□a□e

□er□	Sy□ □□l	Des□ri□i□n
Planar	PL	Forms a continuous plane without variation in orientation.
Curved	CU	Has a gradual change in orientation.
Undulating	UN	Has a wavy surface shape.
Stepped	ST	Has one or more well defined steps
Irregular	IR	Many changes of orientation.

R□u□□ness

□er□	Sy□ □□l	Des□ri□i□n
Slickensided or polished	Ro1	Very smooth, reflects light.
Smooth	Ro2	Roughness not detected with finger.
Defined ridges	Ro3	Sandpaper feel (fine to medium sandpaper).
Small steps	Ro4	Sandpaper feel (medium to coarse sandpaper).
Very rough	Ro5	Very well defined ridges and/or steps.

In□ill □y□e

Sy□ □□l	Des□ri□i□n
KL	Clean
CA	Calcite
CB	Carbonaceous
CHL	Chlorite
FE	Iron oxide
QZ	Quartz
MG	Manganese
SU	Sulphides
SE	Sericite
RF	Rock fragments
G	Gravel
S	Sand
Z	Silt
CL	Clay

In□ill □□i□kness

Where infilling is present, the thickness of infill is recorded using the following convention:

ST Iron oxide staining of less than 1 mm
VN Veneer coating of less than 1 mm

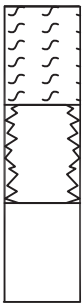
If the infilling is greater than 1 mm, the actual thickness of infill is recorded in millimeters.

If infill is not present, a dash (-) is recorded

□u□ □er

Number of defects with similar characteristics.

Miscellaneous

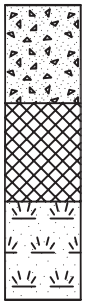


CATACLASTIC – FAULT GOUGE: soft puggy, possibly foliated fault infill

CAVITY: cavity – as indicated by driller

NO_CORE: No Core

Man-Made

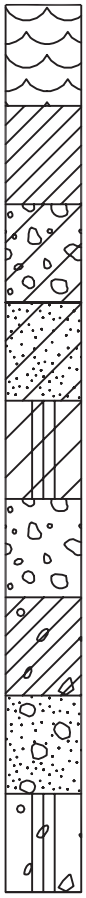


MAN–MADE – CONCRETE/ASPHALT: man–made surface paving

MAN–MADE – FILL: Fill (made ground)

MAN–MADE TOPSOIL: Topsoil

Soil



SOIL – ALLUVIUM: reworked material deposited by water in the past

SOIL – CLAY: Clay

SOIL – CLAYEY GRAVEL: Clayey Gravel

SOIL – CLAYEY SAND: Clayey Sand

SOIL – CLAYEY SILT: Clayey Silt

SOIL – GRAVEL: Gravel

SOIL – GRAVELLY CLAY: Gravelly Clay

SOIL – GRAVELLY SAND: Gravelly Sand

SOIL – GRAVELLY SILT: Gravelly Silt

SOIL – SAND: Sand

SOIL – SANDY CLAY: Sandy Clay

SOIL – SANDY GRAVEL: Sandy Gravel

SOIL – SANDY SILT: Sandy Silt

SOIL – SHELLS: unconsolidated marine material

SOIL – SILT: Silt

SOIL – SILTY CLAY: Silty Clay

SOIL – SILTY SAND: Silty Sand

SOIL – SILTY GRAVEL: Silty Gravel

PSM

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Geotechnical Logging

LITHOLOGY GRAPHIC SYMBOLS
SOIL, MAN-MADE & MISCELLANEOUS

Igneous

IGNEOUS – ANDESITE: mid range mafic to felsic igneous fine grained rock (moderate in quartz and in colour)

IGNEOUS – BASALT (MAFIC): mafic igneous fine grained rock (dark in colour)

IGNEOUS – DIORITE: mid range felsic to mafic igneous coarse grained rock (moderate quartz)

IGNEOUS – DOLERITE: dolerite

IGNEOUS – GABBRO (MAFIC): mafic igneous coarse grained rock (low quartz, dark in colour)

IGNEOUS – GRANITE (FELSIC): felsic igneous coarse grained rock (light in colour)

IGNEOUS – RHYOLITE (FELSIC): felsic igneous fine grained rock (light in colour)

IGNEOUS – TUFF/IGNIMBRITE: extremely fine grained air fall volcanic

Metamorphic

METAMORPHIC – AMPHIBOLITE: non-foliated metamorphic rock formed by regional metamorphism of mafic igneous rocks

METAMORPHIC – GNEISS: a foliated high grade metamorphic rock

METAMORPHIC – HORNFELS: contact metamorphic rock

METAMORPHIC – MARBLE: metamorphosed limestone

METAMORPHIC – SCHIST: a foliated high grade metamorphic rock

METAMORPHIC – SKARN: contact metamorphosed carbonate body

METAMORPHIC – SLATE/PHYLLITE: low grade regionally metamorphosed rock

Sedimentary

SEDIMENTARY – BRECCIA: consolidated clastic rock made up of angular clasts

SEDIMENTARY – CALCRETE/SILCRETE: Calcrete or silcrete

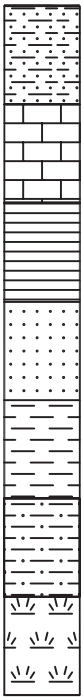
SEDIMENTARY – CHERT: chert/quartz

SEDIMENTARY – COAL: Coal

SEDIMENTARY – CONGLOMERATE: consolidated rounded clastic material

SEDIMENTARY – DOLOMITE: Dolomite

SEDIMENTARY – IRONSTONE: hard iron enriched layer



SEDIMENTARY – LAMINITE: interbedded sandstone and siltstone

SEDIMENTARY – LIMESTONE: Limestone

SEDIMENTARY – MUDSTONE: Mudstone

SEDIMENTARY – SANDSTONE: Sandstone

SEDIMENTARY – SHALE: Shale

SEDIMENTARY – SILTSTONE: Siltstone

SEDIMENTARY – SWAMP/PEAT: Peat (Swamp Symbol)

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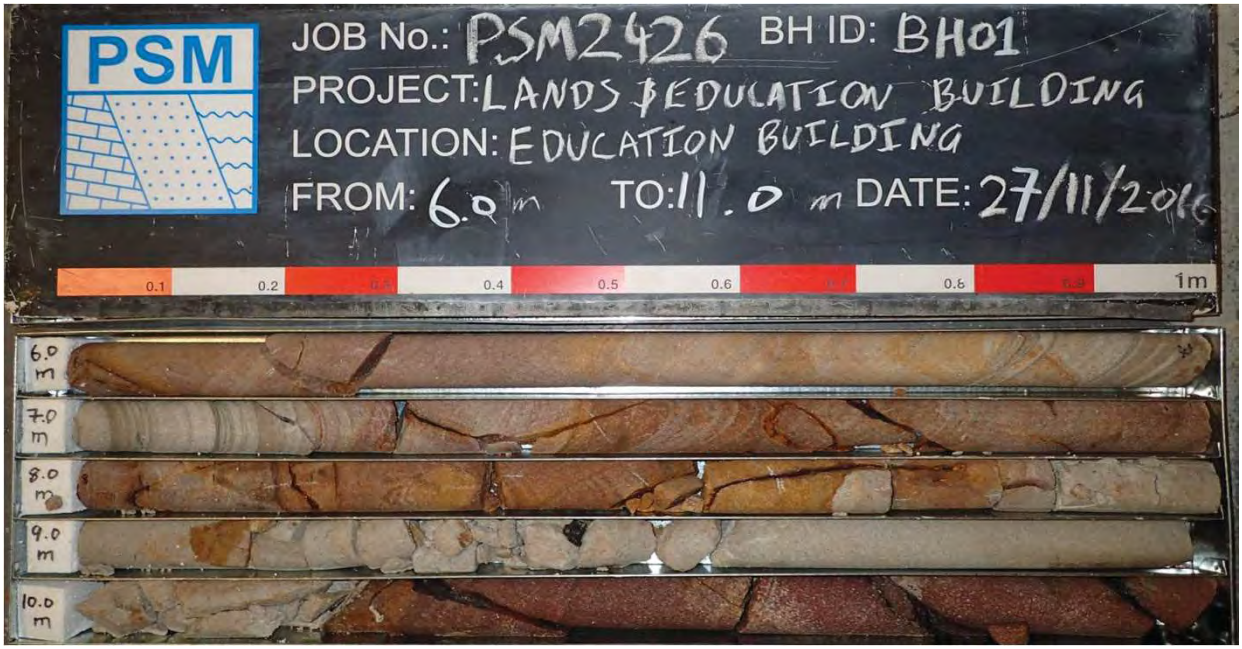
Geotechnical Logging

LITHOLOGY GRAPHIC SYMBOLS
IGNEOUS, METMORPHIC & SEDIMENTARY



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PSM2426	**Figure A-1**

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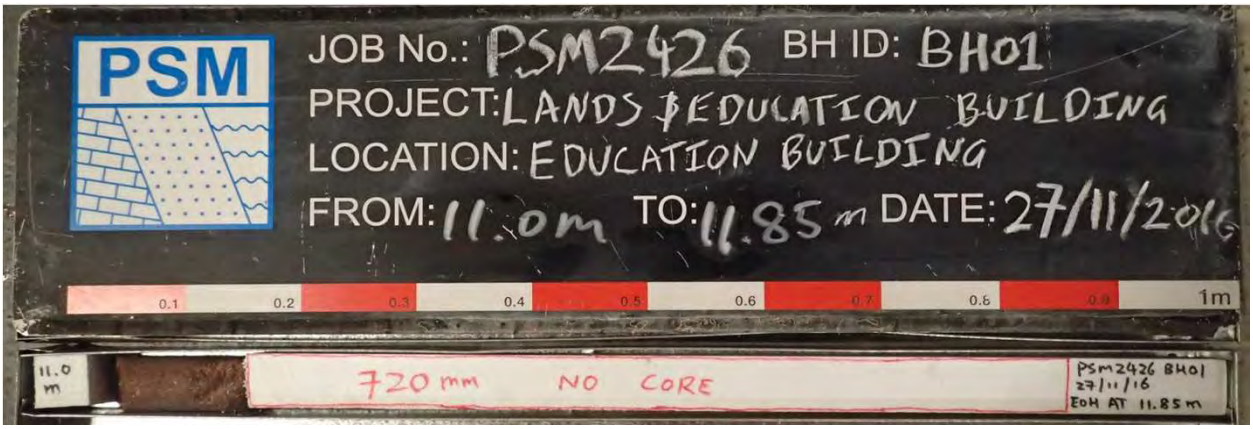

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PSM2426	**Figure A-2**

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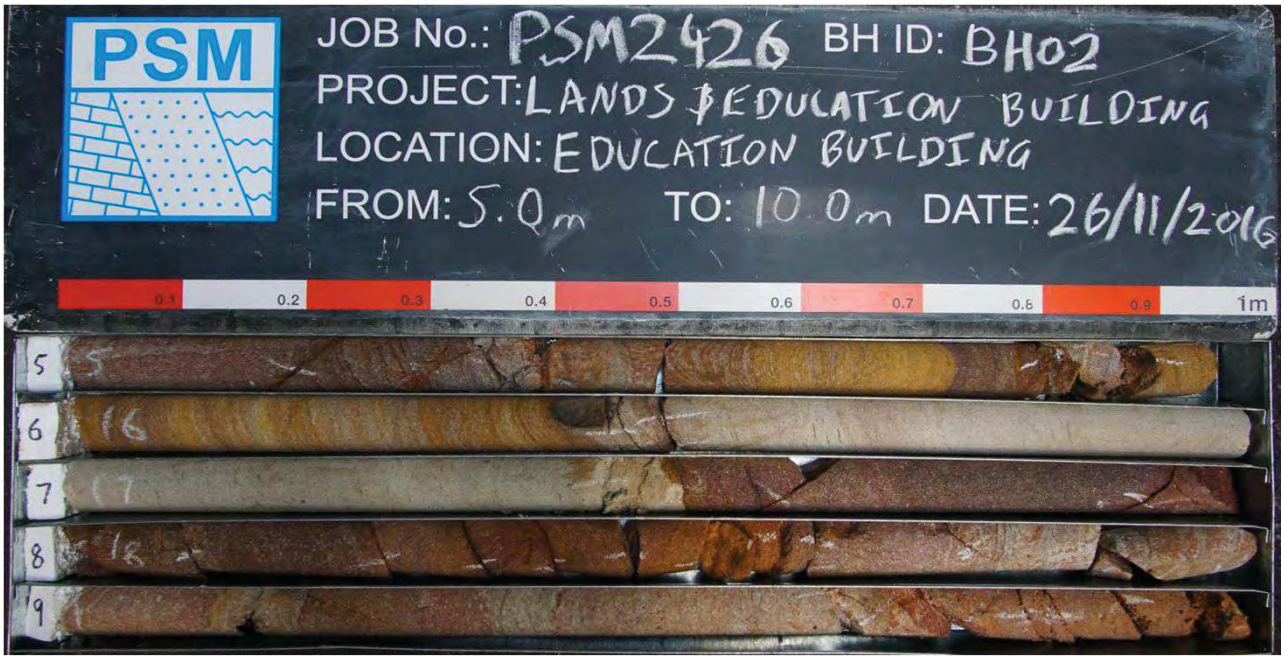

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PSM2426	**Figure A-3**

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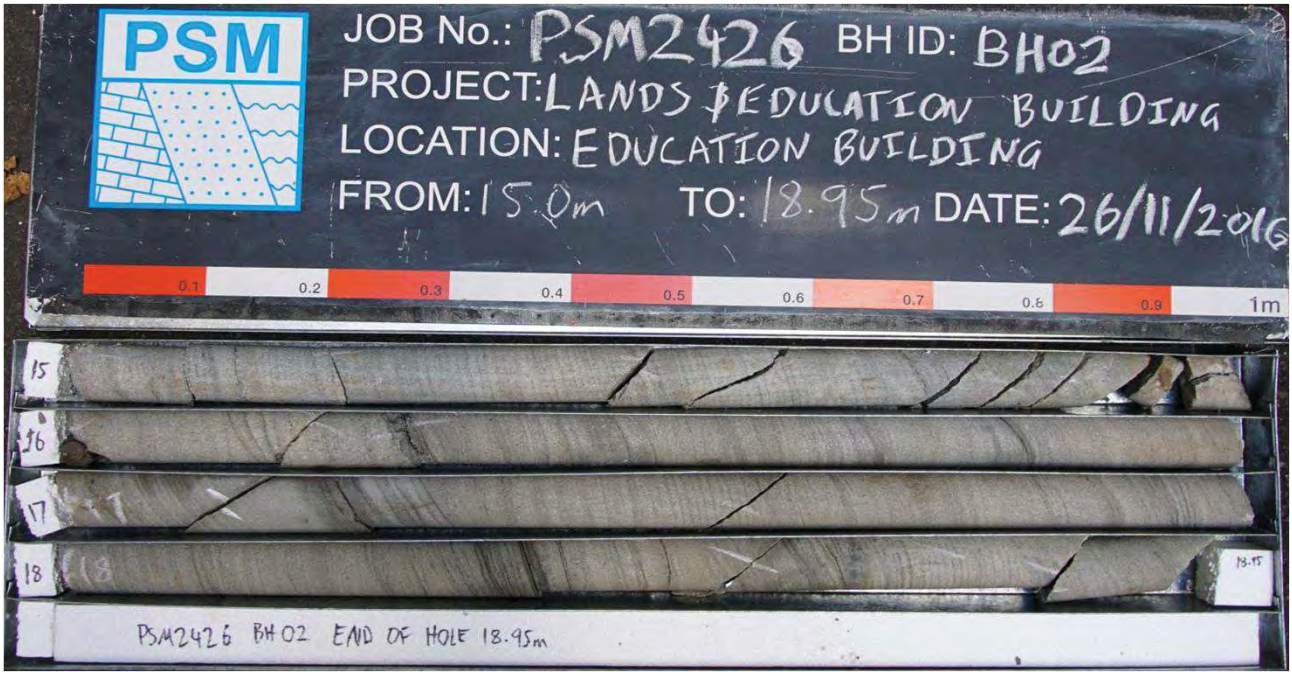

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PSM2426	**Figure A-4**

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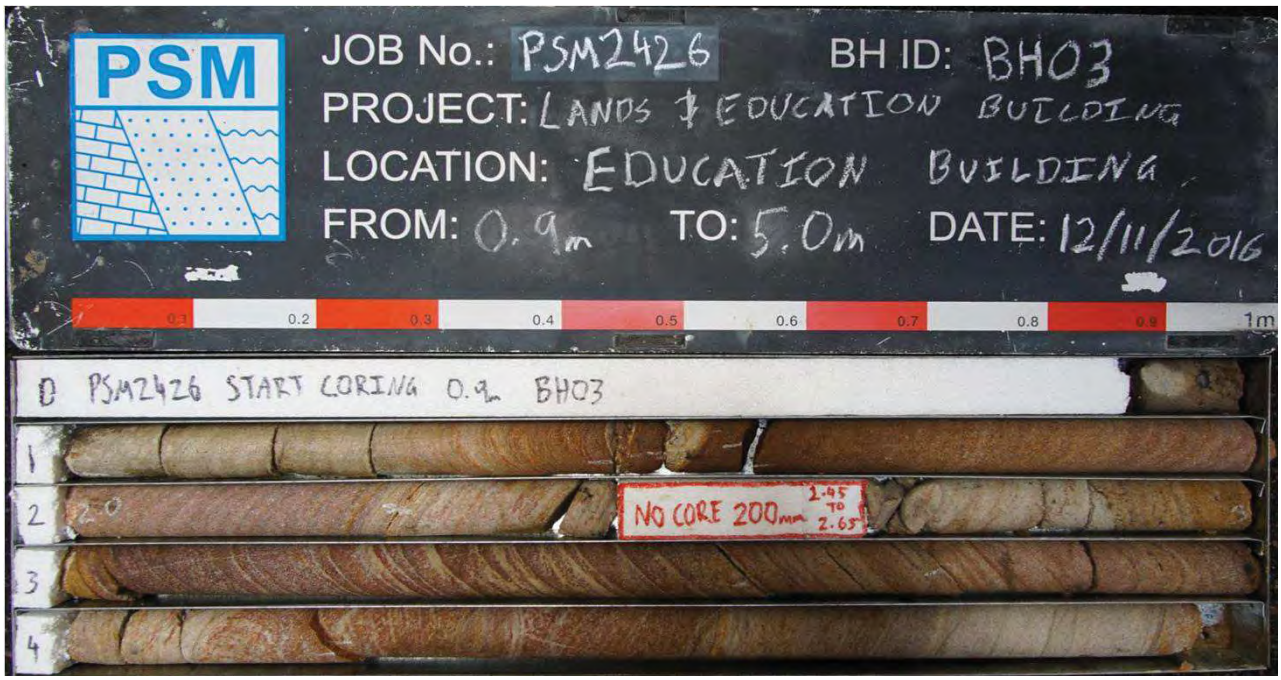

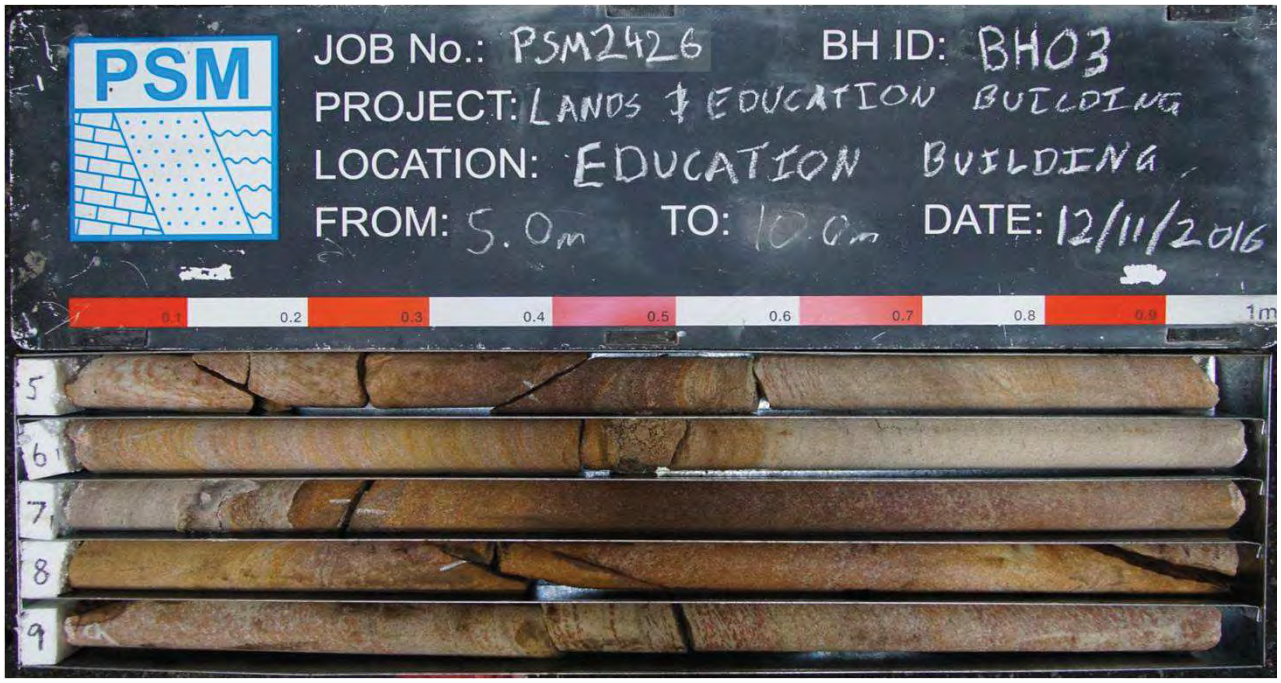

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PSM2426	**Figure A-5**

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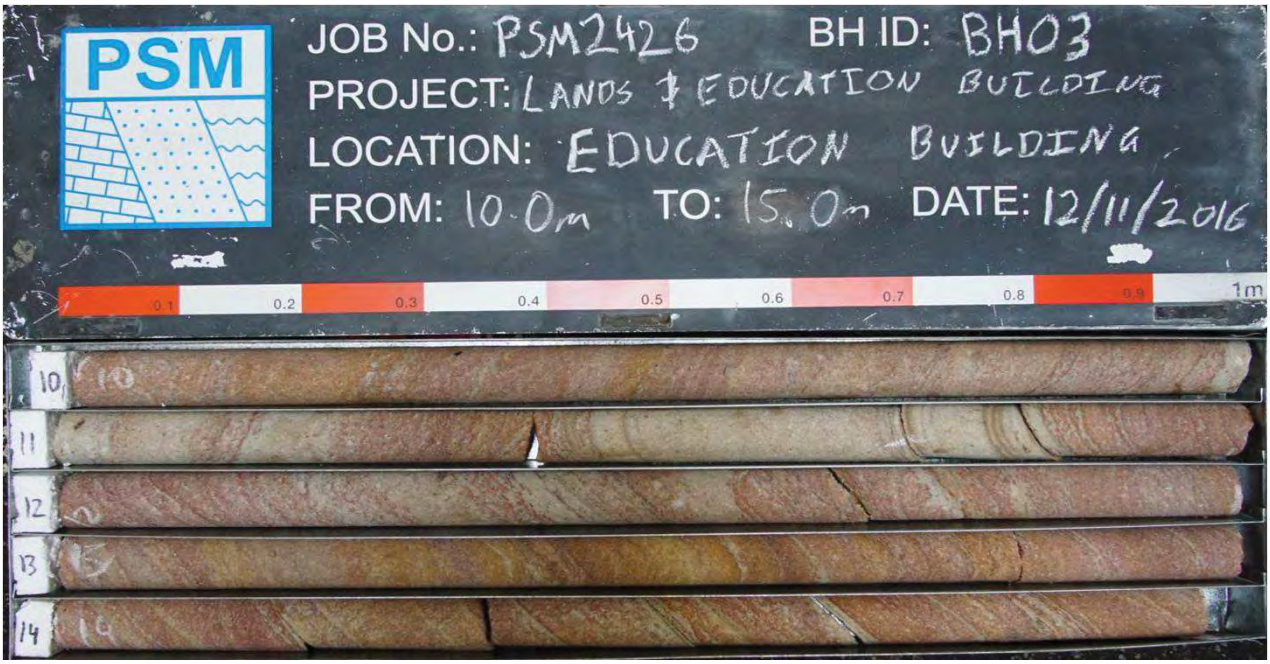

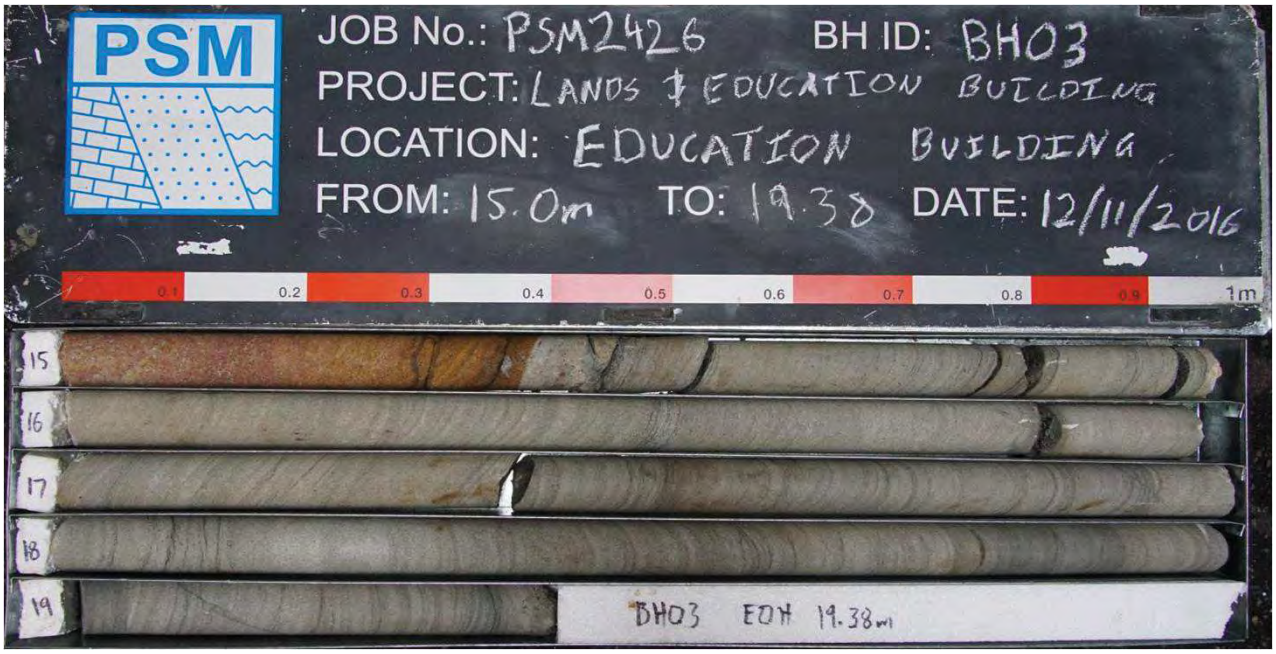

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PSM2426	**Figure A-6**

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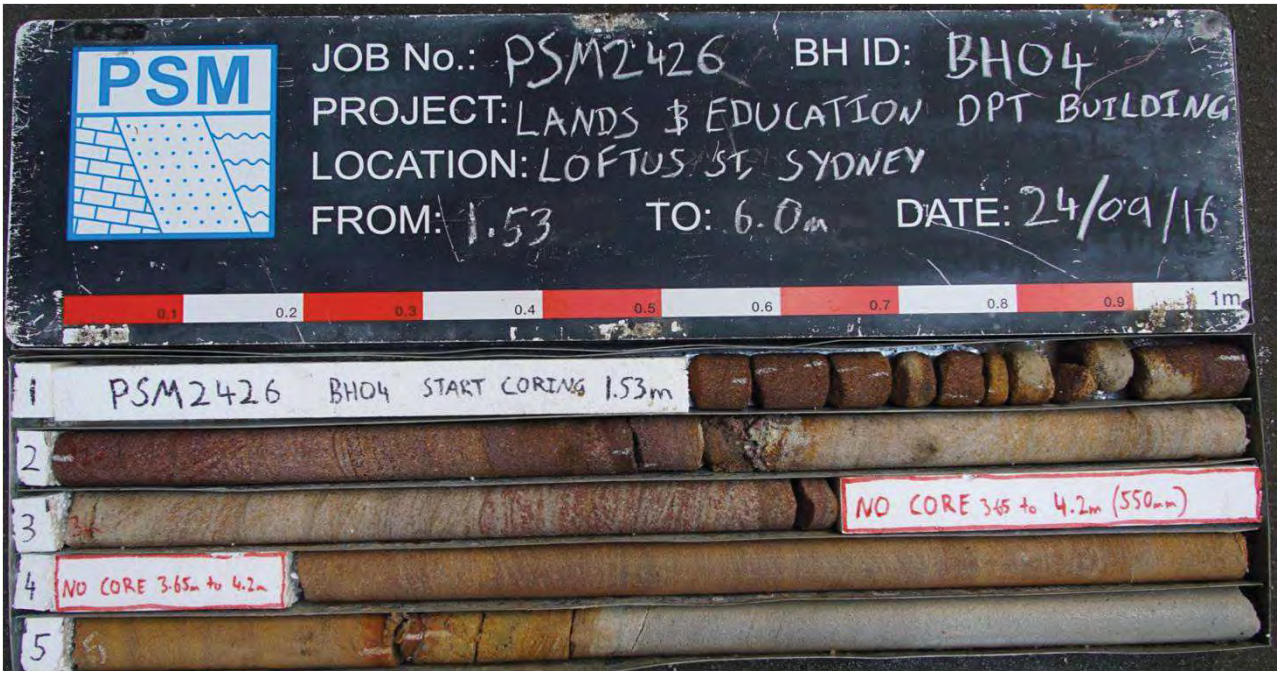

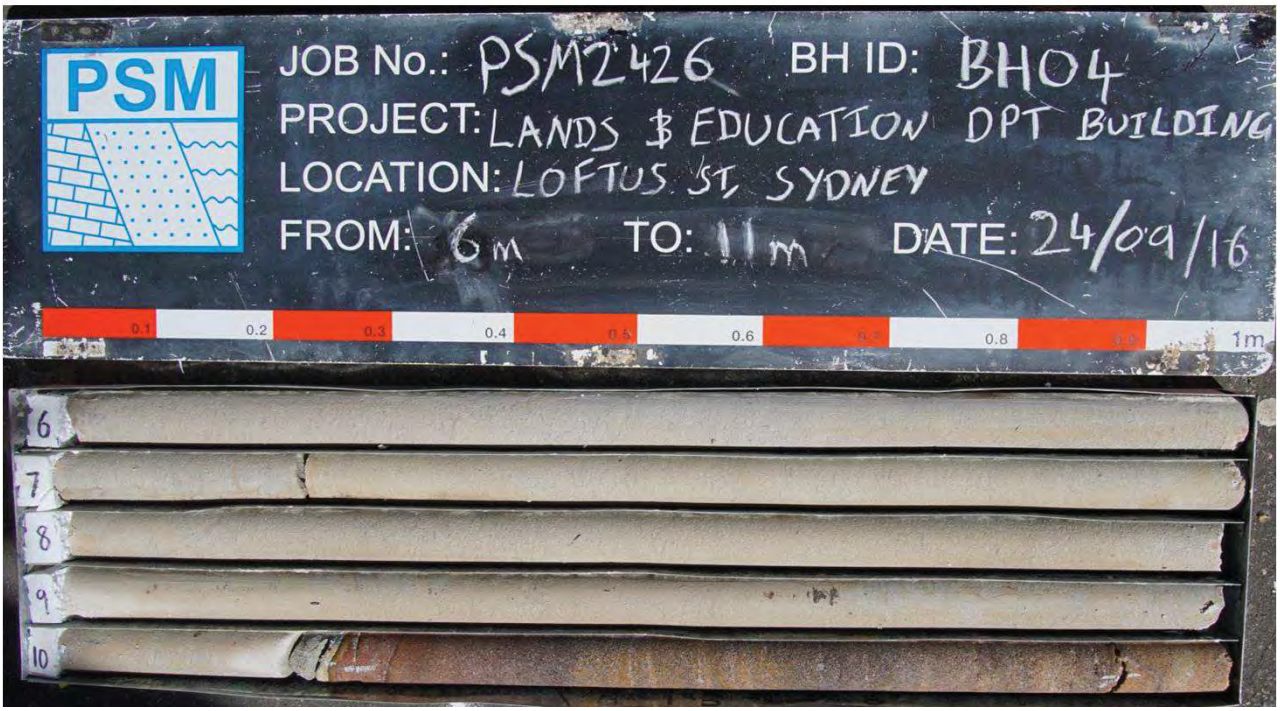

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PSM2426	**Figure A-7**

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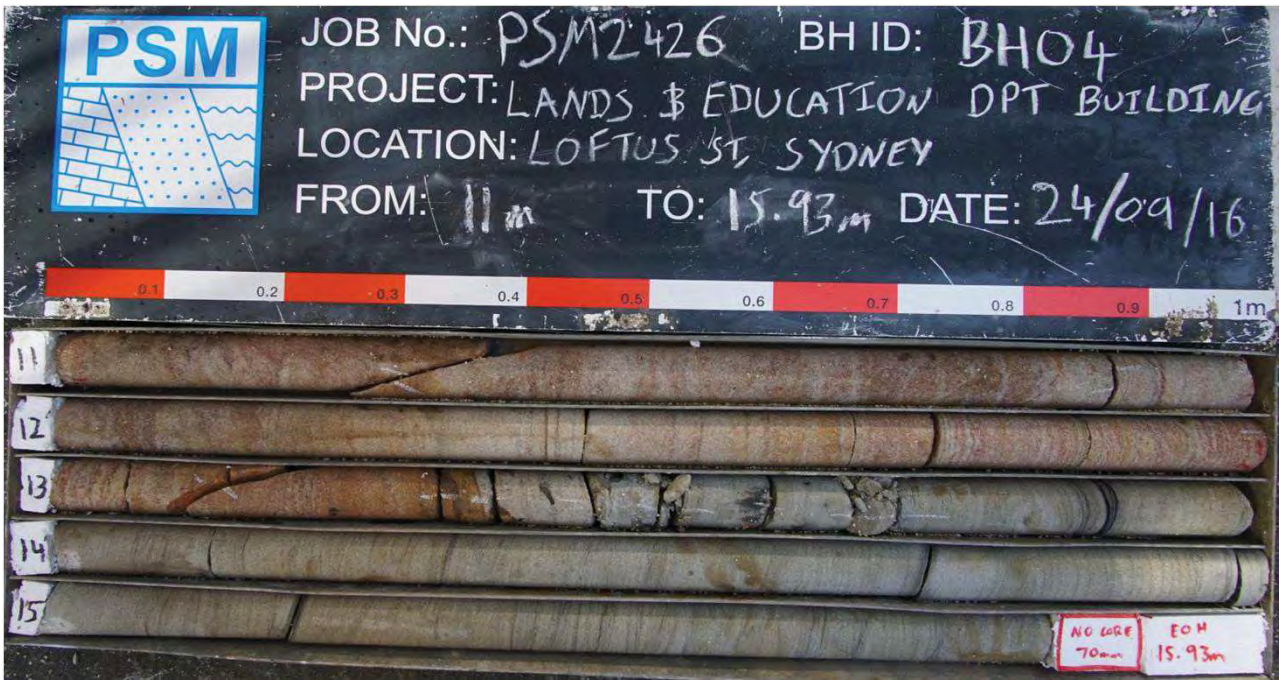

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PSM2426	**Figure A-8**

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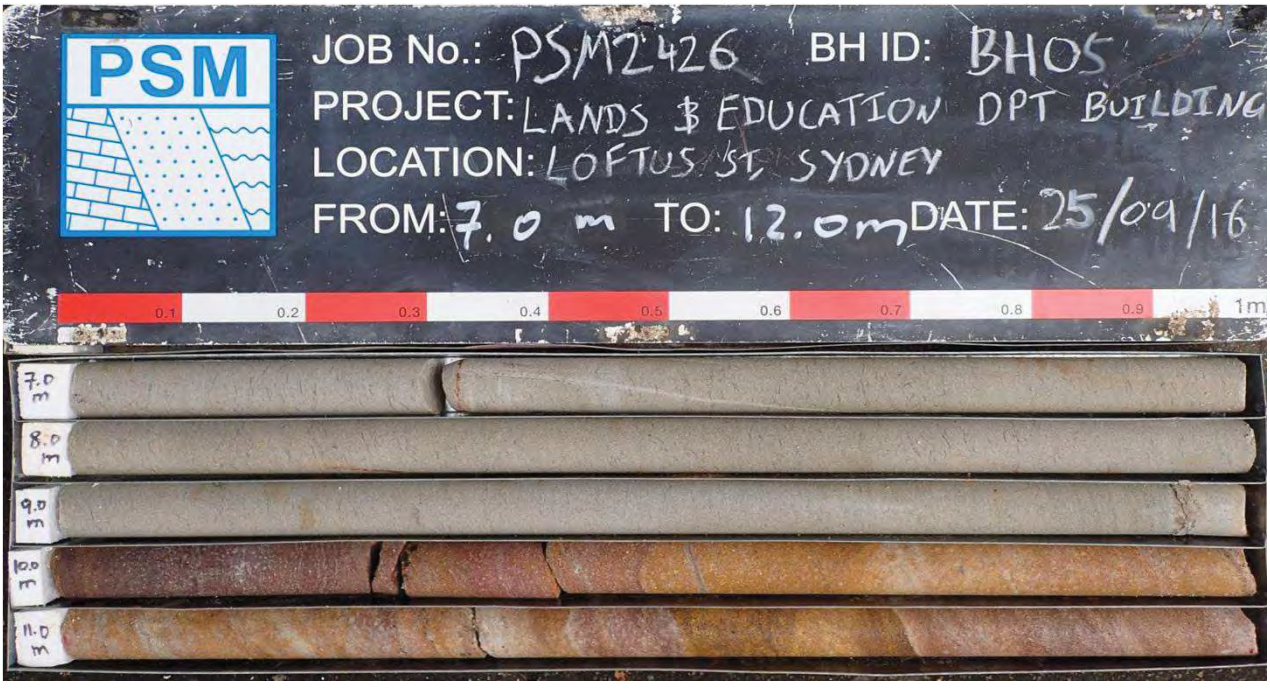

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PSM2426	**Figure A-9**

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PSM2426	**Figure A-10**

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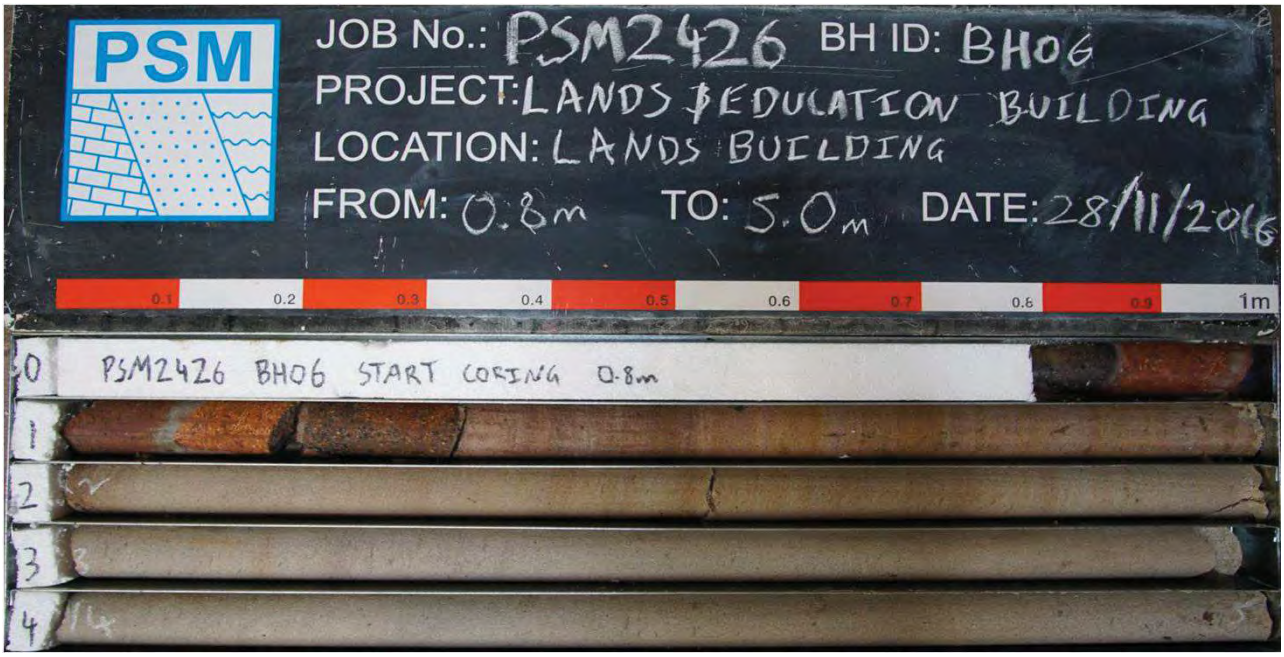

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PSM2426	**Figure A-11**

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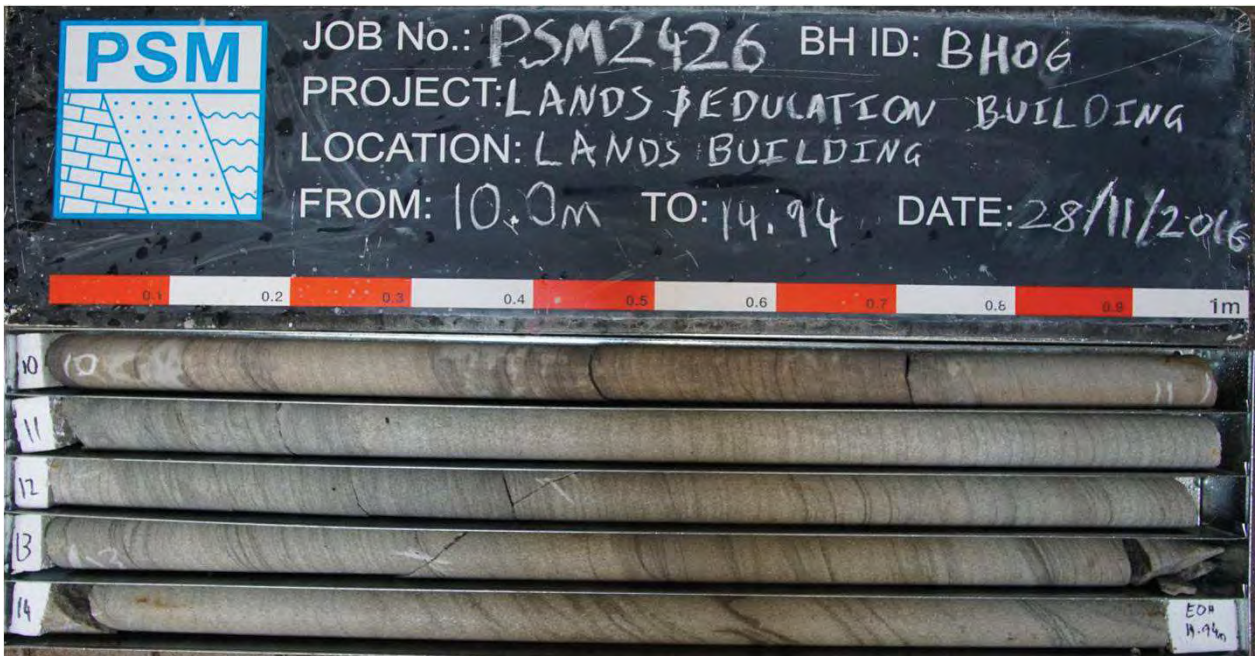

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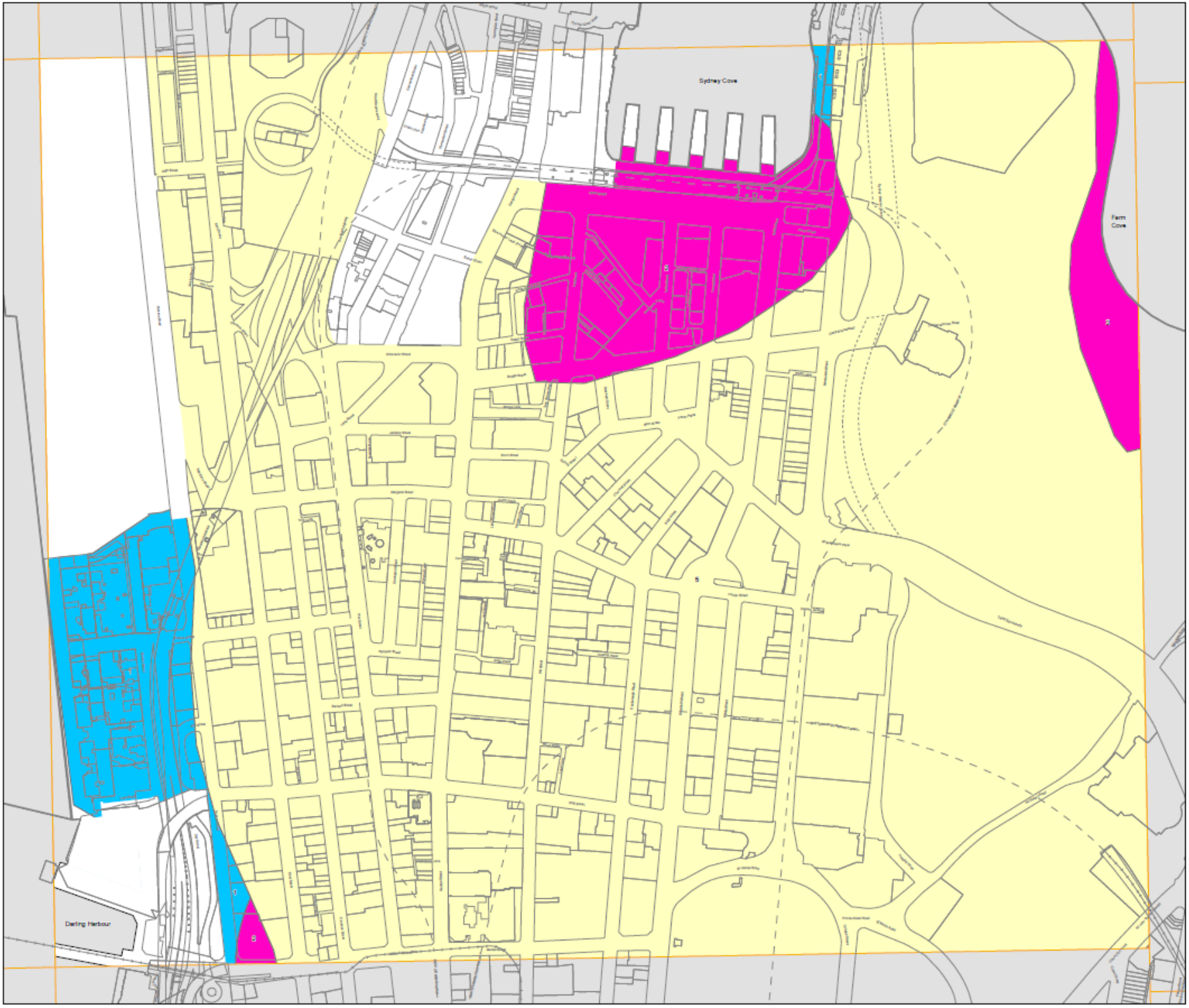
PSM2426	Figure A-12

APPENDIX B ACID SULFATE SOILS RISK MAP

Sydney Local Environmental Plan 2012

Acid Sulfate Soils Map - Sheet ASS_014

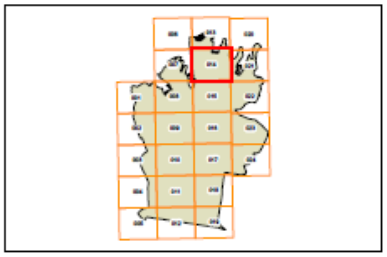


Acid Sulfate Soils

- Class 1
- Class 2
- Class 3
- Class 4
- Class 5

Cadastre

Cadastre 26/09/2012 © City of Sydney



N

0 200 m

Scale: 1:5,000 @ A3

Projection: GDA 1994 Zone 56

Map identification number: 7200_COM_ASS_014_005_20120926

APPENDIX C VENM PROFORMA

Certification:
Virgin excavated natural material

1. I *[full name]*

   of *[organisation and address]*

   certify that the waste as set out in section 2 of this notice is Virgin Excavated Natural Material (VENM) as defined in Schedule 1 of the *Protection of the Environment Operations Act 1997.*

   This certification is made on behalf of the waste generator *[fill out if applicable]*

   being *[full name]*

   of *[organisation and address]*

2. The waste was generated at:

   Street address:

   Title reference (Lot/DP, etc.):

   The amount of waste (by volume or weight) is:

3. I have made the determination that the waste is VENM because:

   - ☐ I have assessed the historical and current land use of the site at which the waste was generated.
   - ☐ The waste is not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities.
   - ☐ The waste does not contain any sulfidic ores or soils.
   - ☐ The waste does not contain any other waste.
   - ☐ The waste does not contain asbestos in any form.

Note: that all sections of this form must be completed including all boxes checked in Section 3 above and signed below for any material to be certified as VENM.

Signature(s) . . . . . .

Name(s) (printed)

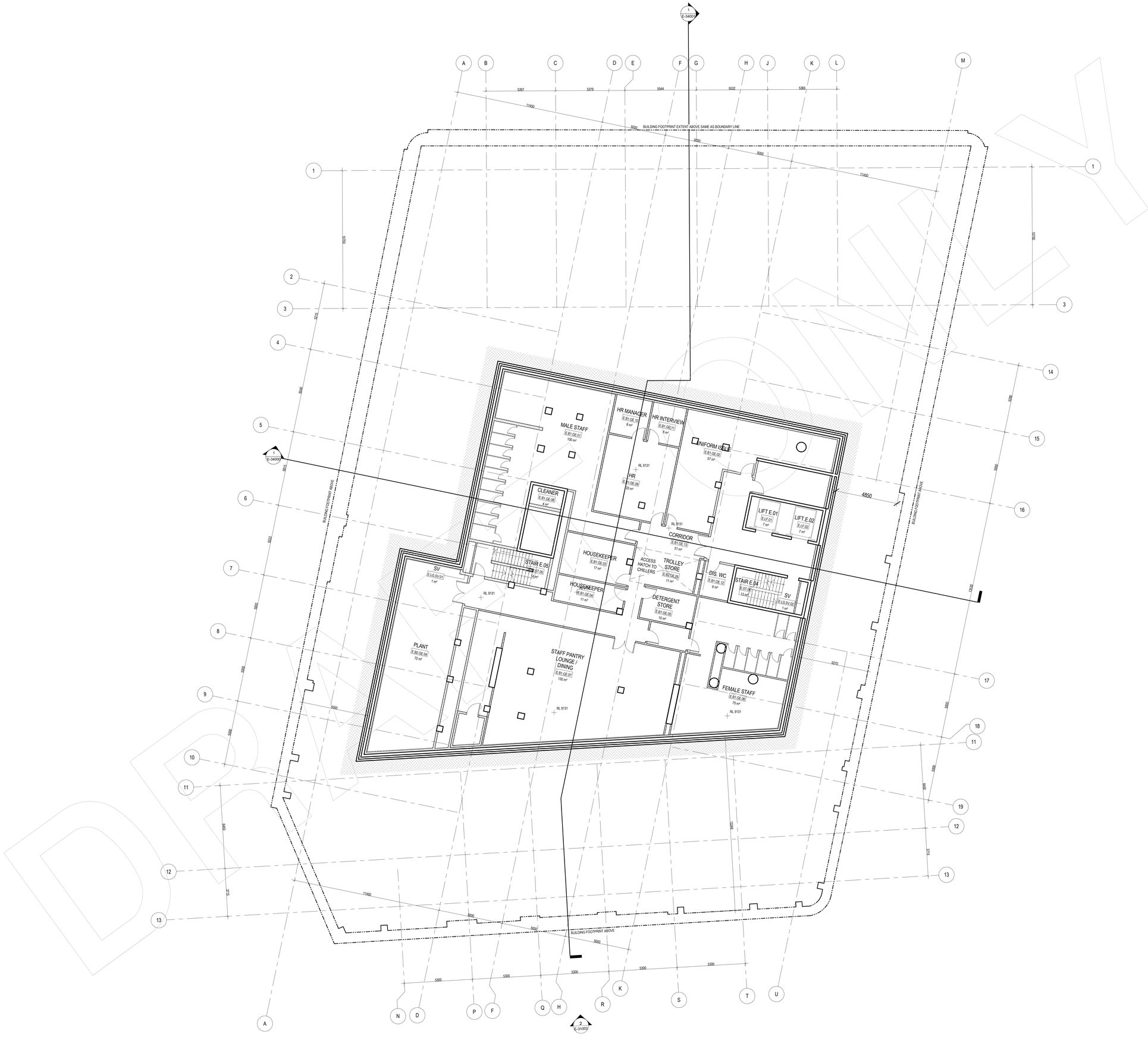
Date

Warning: There are significant penalties under s.144AA of the *Protection of the Environment Operations Act 1997* for a person who supplies (whether knowingly or not) information that is false or misleading in a material respect about waste.

This certificate is intended to assist waste generators, contractors and/or receivers of VENM to have confidence that a range of relevant factors have been considered in the classification of a waste material as VENM.

Published by:
Environment Protection Authority, 59–61 Goulburn Street, Sydney South 1232
Ph: 131 555. TTY users: phone 133 677, then ask for 131 555
Speak and listen users: phone 1300 555 727, then ask for 131 555
Email: info@environment.nsw.gov.au; Web: www.epa.nsw.gov.au
Report pollution and environmental incidents: Environment Line: 131 555 (NSW only)
EPA 2013/0693; September 2013

APPENDIX D DEVELOPMENT CONCEPT PLANS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BUILDING FOOTPRINT EXTENT ABOVE SAME AS BOUNDARY LINE
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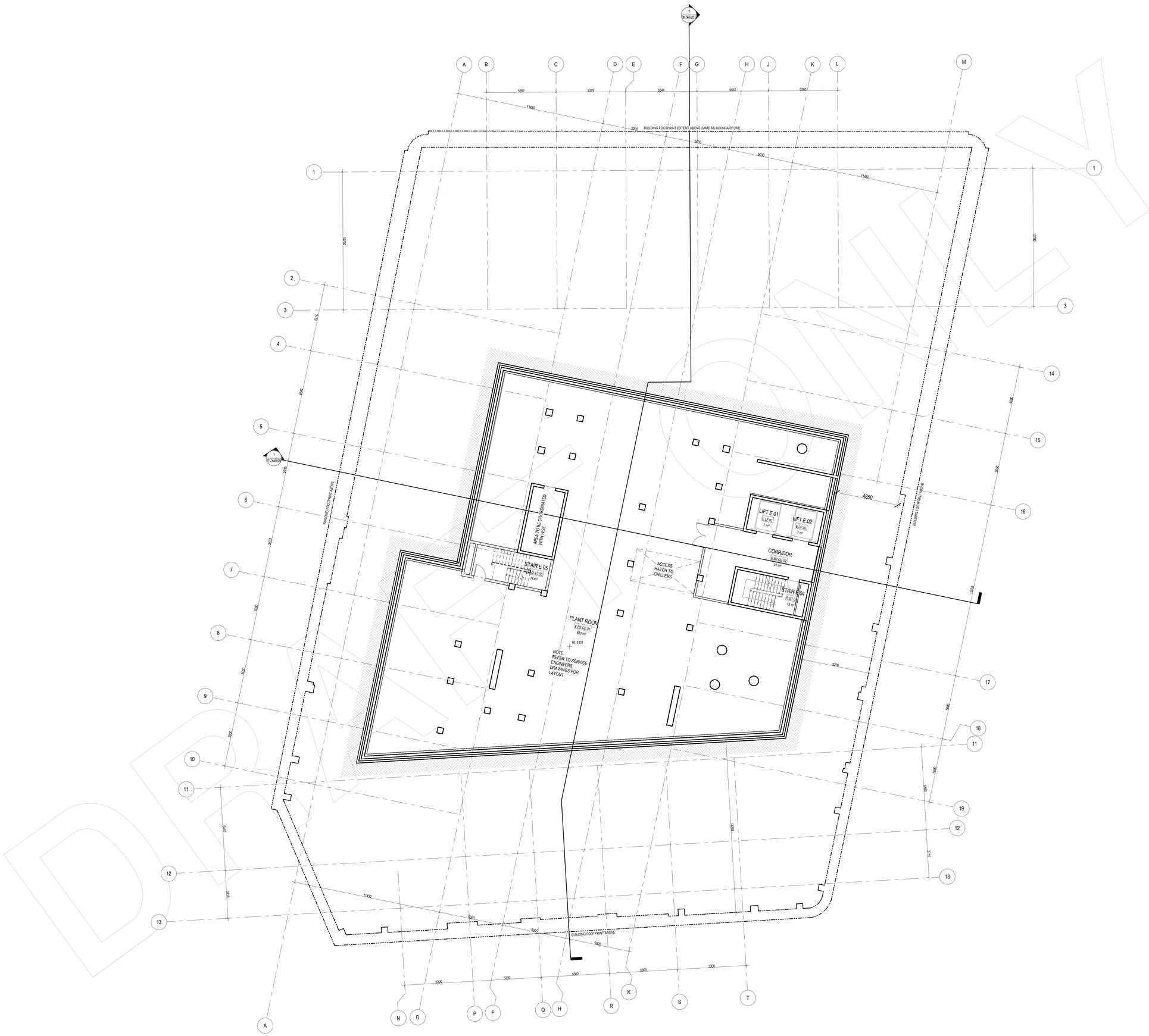

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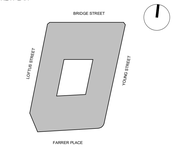

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LEGEND:

- EXISTING WALLS AND COLUMNS
- NEW WALLS
- NEW STRUCTURAL ELEMENTS

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B	FOR INFORMATION	18/04/17
A	DRAFT ECI ISSUE	06/03/17

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EXECUTIVE ARCHITECT
Ridley

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PONTIAC LAND (AUSTRALIA) PTY. LTD.

PROJECT
SANDSTONE PRECINCT
23-39 Bridge Street, Sydney 2000, Australia

RIDLEY PROJECT NUMBER	MAKE PROJECT NUMBER
150021-PAT	1166

SCALE	DRAWN	CHECKED	APPROVED
1 : 100@A0	MO		

STAGE
DESIGN DEVELOPMENT

STATUS
FOR INFORMATION

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E - BASEMENT 2 GA PLAN

DRAWING NUMBER	ISSUE
SP-AR-E-220B2	F

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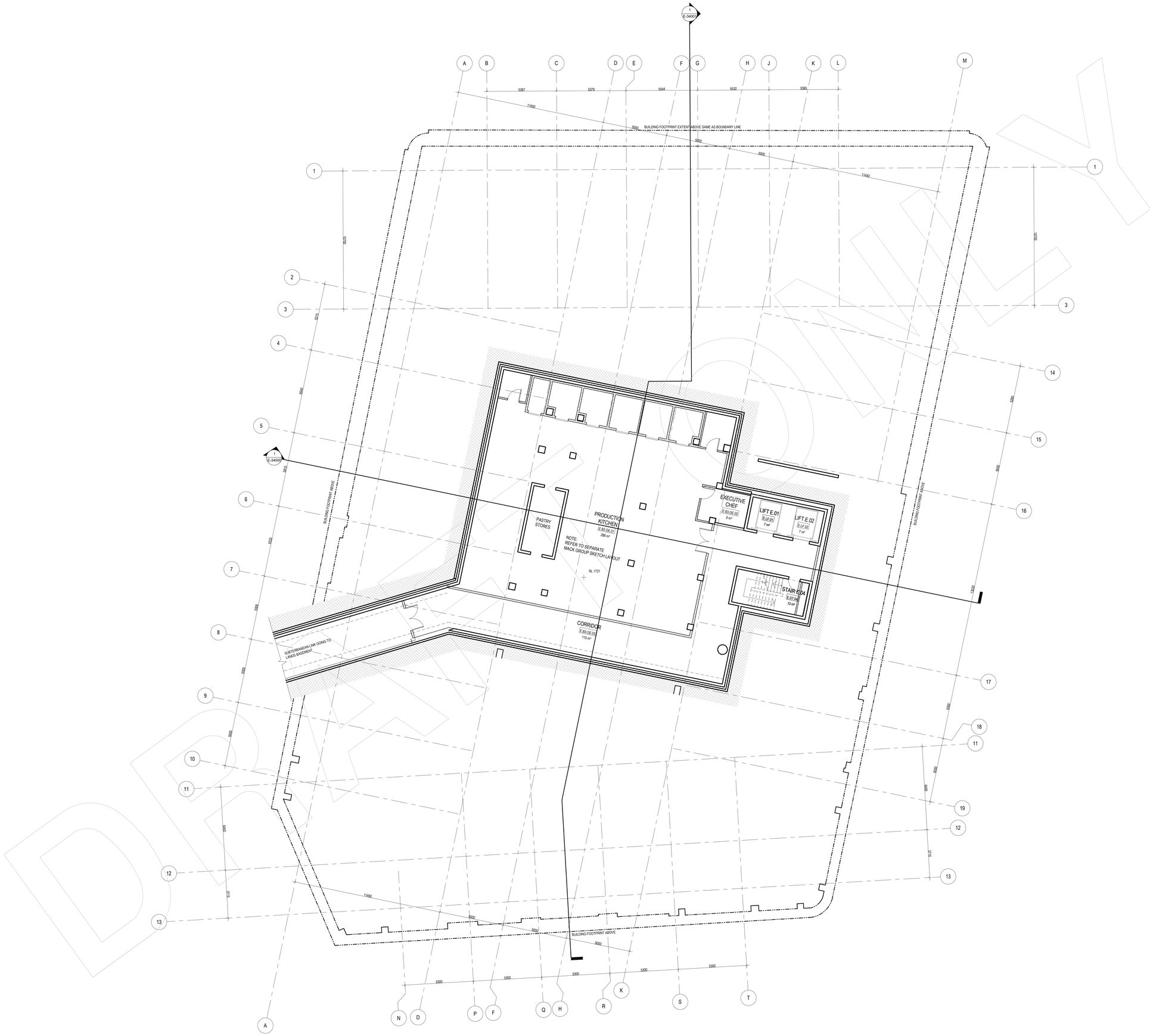
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BUILDING FOOTPRINT EXTENT ABOVE SAME AS BOUNDARY LINE
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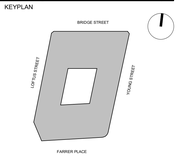

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LEGEND:

- EXISTING WALLS AND COLUMNS
- NEW WALLS
- NEW STRUCTURAL ELEMENTS

BESPOKE SCALLOPED STONE CLADDING

MARBLE TO FLOOR AND WALLS TO COMPLETE LOFTUS STREET VESTIBULE

LARGE FORMAT GRANITE PAVINGS SLABS - E.G. ASISTRAL VERDE

PATINATED BRASS CLAD FULL HEIGHT LOADING BAY DOORS WITH LASER ENGRAVED TEXTURE

STONE CLAD, FEATURE WALL

SLIM PROFILED STEEL AND GLASS DOOR WITH EXISTING GRILLE

POWDER COATED STEEL FRAMED SLIDING POCKET DOORS WITH CAST GLASS INFILL

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PONTIAC LAND (AUSTRALIA) PTY. LTD.

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SANDSTONE PRECINCT
23-39 Bridge Street, Sydney 2000, Australia

RIDLEY PROJECT NUMBER: **150021-PAT** | MAKE PROJECT NUMBER: **1166**

SCALE: 1 : 100@A0 | DRAWN: MO | CHECKED | APPROVED

STAGE
DESIGN DEVELOPMENT

STATUS
FOR TENDER

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E - LOWER GROUND FLOOR GA PLAN

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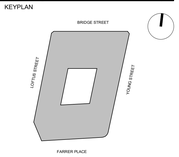

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LEGEND:

- EXISTING WALLS AND COLUMNS
- NEW WALLS
- NEW STRUCTURAL ELEMENTS

ISSUE	DESCRIPTION	DATE
F	FOR INFORMATION	04/09/17
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RIDLEY PROJECT NUMBER	MAKE PROJECT NUMBER
150021-PAT	1166

SCALE	DRAWN	CHECKED	APPROVED
1 : 100@A0	MO		

STAGE
DESIGN DEVELOPMENT

STATUS
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DRAWING
E - GROUND FLOOR GA PLAN

DRAWING NUMBER	ISSUE
SP-AR-E-22000	F

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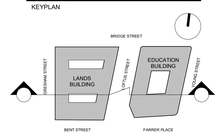

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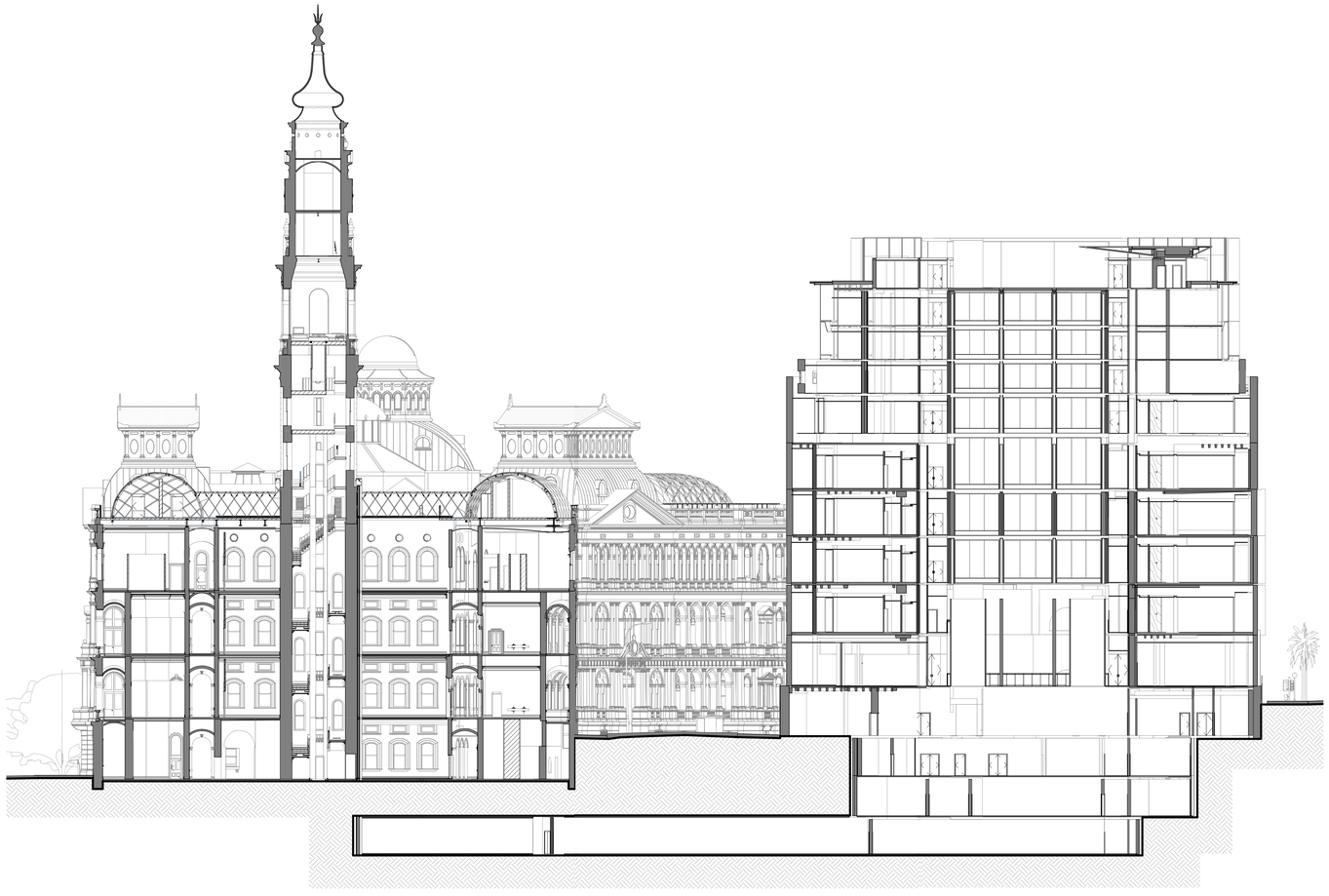

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RIDLEY PROJECT NUMBER	MAKE PROJECT NUMBER
150021-PAT	1166

SCALE	DRAWN	CHECKED	APPROVED
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STAGE
DESIGN DEVELOPMENT

STATUS
FOR TENDER

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PROPOSED SITE SECTION 01

DRAWING NUMBER	ISSUE
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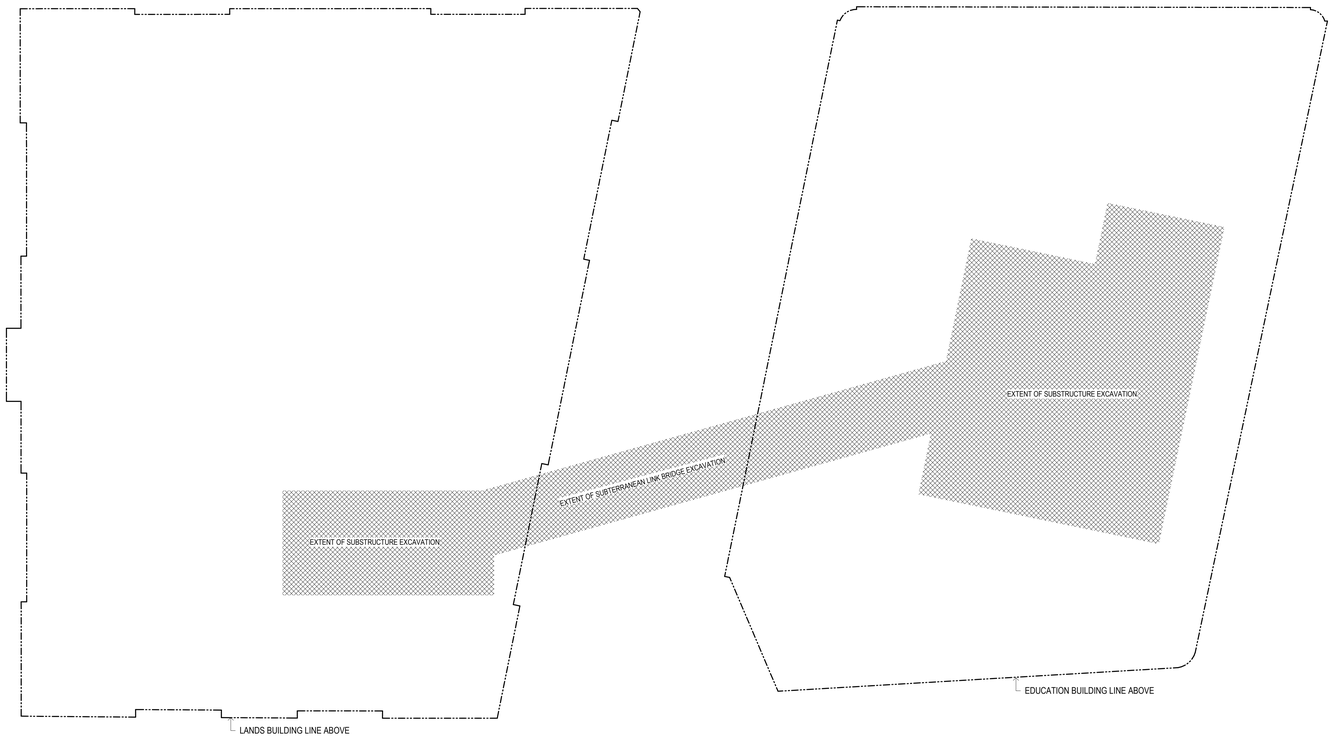

1 PROPOSED SUBTERRANEAN LINK PLAN - DEMOLITION
1 : 200

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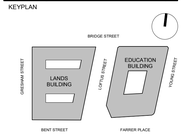

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CLIENT
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PROJECT
SANDSTONE PRECINCT
23-39 Bridge Street, Sydney 2000, Australia

RIDLEY PROJECT NUMBER	MAKE PROJECT NUMBER
150021-PAT	1166

SCALE	DRAWN	CHECKED	APPROVED
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STAGE
DESIGN DEVELOPMENT

STATUS
FOR TENDER

DRAWING
SUBTERRANEAN LINK - EXCAVATION PLAN

DRAWING NUMBER	ISSUE
SP-AR-G-20500	A

Original Sheet Size A0- 1189 x 841

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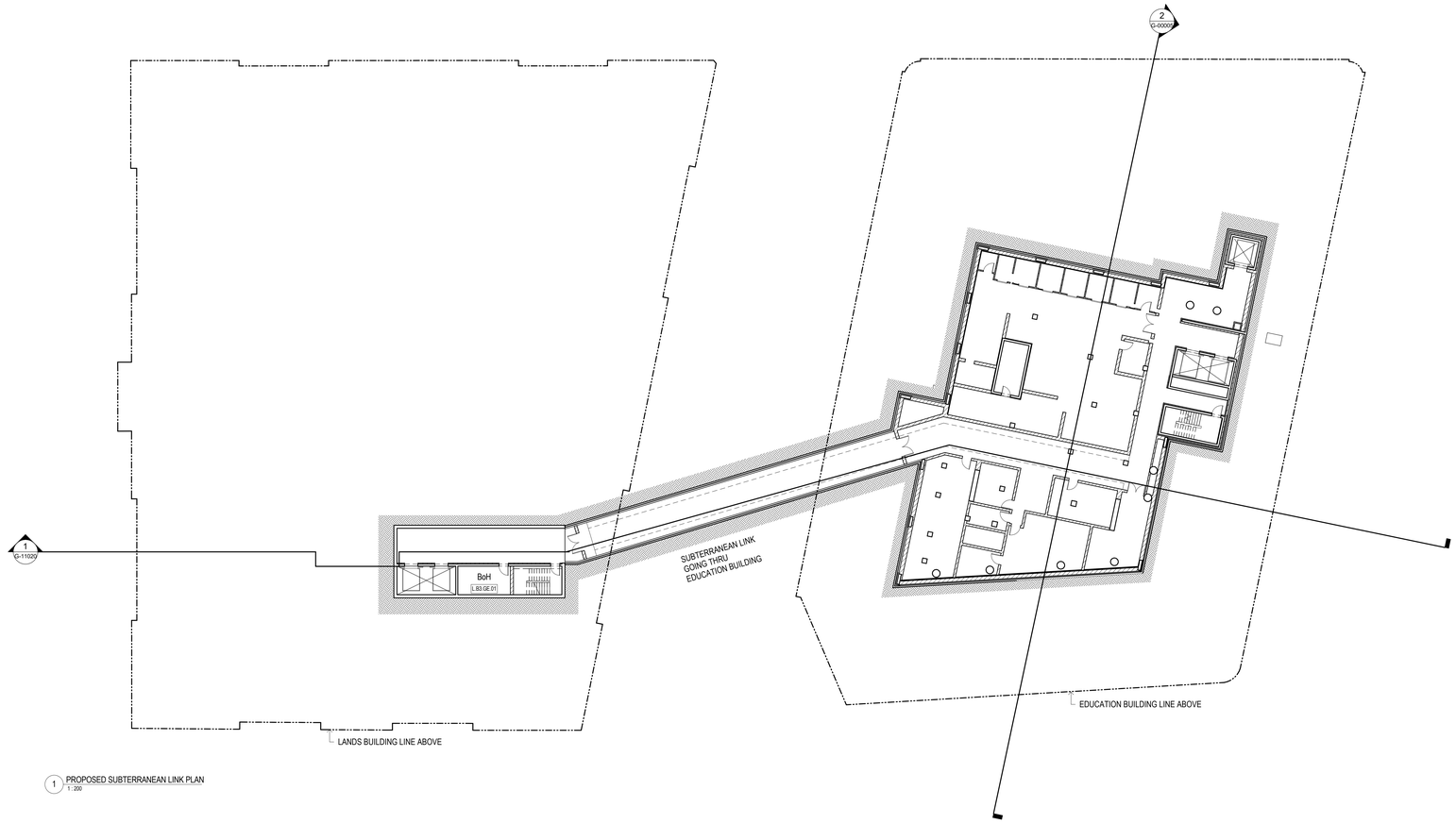

1 PROPOSED SUBTERRANEAN LINK PLAN
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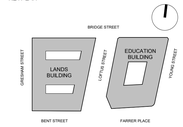

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A	DRAFT ECI ISSUE	06/03/17

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Ridley

INTERIOR DESIGNER
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CLIENT
PONTIAC LAND
(AUSTRALIA) PTY. LTD.

PROJECT
SANDSTONE PRECINCT
23-39 Bridge Street, Sydney 2000, Australia

RIDLEY PROJECT NUMBER	MAKE PROJECT NUMBER
150021-PAT	1166

SCALE	DRAWN	CHECKED	APPROVED
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STAGE
DESIGN DEVELOPMENT

STATUS
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SUBTERRANEAN LINK - GA PLAN

DRAWING NUMBER	ISSUE
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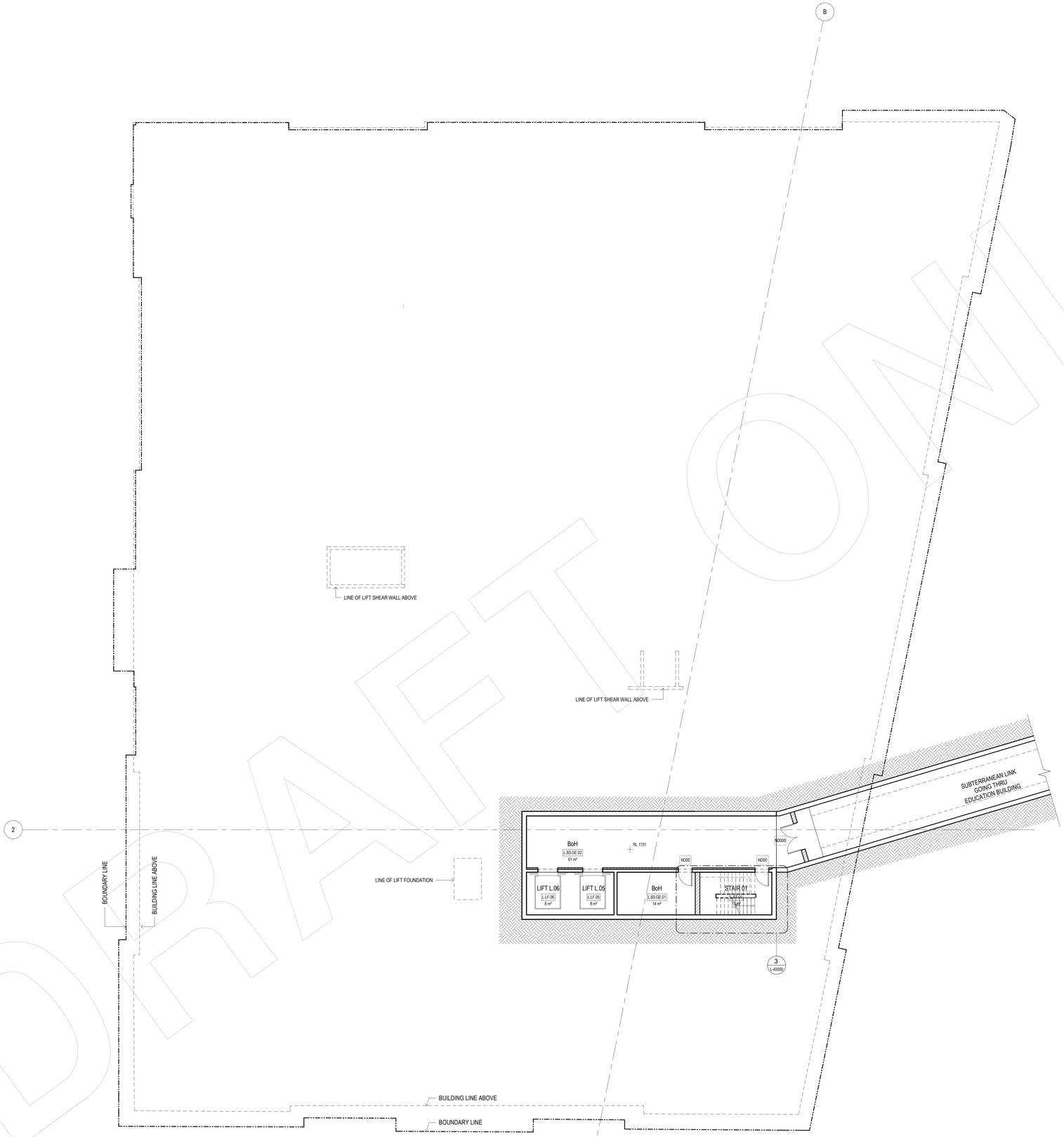

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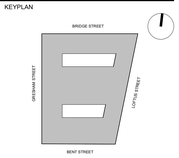

LANDS BUILDING

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LEGEND:

- SITE BOUNDARY
- EXISTING WALLS AND COLUMNS
- NEW WALLS
- NEW STRUCTURAL ELEMENTS

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ISSUE	DESCRIPTION	DATE
E	FOR INFORMATION	04/09/17
D	ECI ISSUE	19/05/17
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INTERIOR DESIGNER
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CLIENT
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PROJECT
SANDSTONE PRECINCT
23-39 Bridge Street, Sydney 2000, Australia

RIDLEY PROJECT NUMBER: **150021-PAT**
MAKE PROJECT NUMBER: **1166**

SCALE: 1 : 100@A0
DRAWN: BV
CHECKED
APPROVED

STAGE: **DESIGN DEVELOPMENT**

STATUS: **FOR INFORMATION**

DRAWING: **L - BASEMENT GA PLAN**

DRAWING NUMBER: **SP-AR-L-220B3**
ISSUE: **E**

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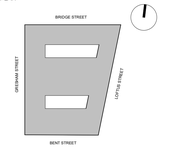
KEYPLAN



LANDS BUILDING

GENERAL NOTES
1. DIMENSIONS ARE IN MILLIMETERS UNO.
2. DO NOT SCALE OFF DRAWING.
3. ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE PROCEEDING.
4. ALL DISCREPANCIES TO BE NOTIFIED IN WRITING TO RIDLEY CONSOLIDATED GROUP PTY LIMITED ("RIDLEY")
5. ALL EXISTING INFORMATION PRODUCED BY 'LANDSURVEYS' FROM NON INTRUSIVE, SUPERFICIAL SURVEY INFORMATION.
6. EXISTING SURVEY INFORMATION REPRESENTED HERE IS FOR INFORMATION ONLY. MAKE AND RIDLEY ARE NOT RESPONSIBLE FOR THIS INFORMATION.
7. ALL DATA AND RELEVANT DIMENSIONS SHOULD BE CHECKED ON SITE.
8. ALL "HL" NOTES, REFER TO HERITAGE CONSULTANT REPORTS.

LEGEND:

- SITE BOUNDARY
- EXISTING WALLS AND COLUMNS
- NEW WALLS
- NEW STRUCTURAL ELEMENTS

NOTE:
ALL CEILINGS (EXCLUDING CORRIDORS, ENTRANCES AND LOGGIAS) REQUIRE A DROPPED CEILING WHICH WILL HOUSE MECHANICAL SERVICES . THE DROPPED CEILING PLASTER FRIEZE DETAILS WILL REINSTATE THE EXISTING DETAIL BASED ON MOULDING OF EXISTING CORNICES

1 PROPOSED GROUND FLOOR PLAN
1 : 100

2 GROUND FLOOR MEZZANINE VAULT PLAN
1 : 100

ISSUE	DESCRIPTION	DATE
E	FOR INFORMATION	04/09/17
D	ECI ISSUE	19/05/17
C	FOR INFORMATION	12/05/17
B	FOR INFORMATION	05/05/17
A	DRAFT ECI ISSUE	06/03/17

DESIGN ARCHITECT
make

EXECUTIVE ARCHITECT
Ridley

INTERIOR DESIGNER
B A R

CLIENT
PONTIAC LAND (AUSTRALIA) PTY. LTD.

PROJECT
SANDSTONE PRECINCT
23-39 Bridge Street, Sydney 2000, Australia

RIDLEY PROJECT NUMBER	MAKE PROJECT NUMBER
150021-PAT	1166

SCALE	DRAWN	CHECKED	APPROVED
1 : 100@A0	BV		

STAGE
DESIGN DEVELOPMENT

STATUS
FOR INFORMATION

DRAWING
L - GROUND FLOOR GA PLAN

DRAWING NUMBER	ISSUE
SP-AR-L-22000	E

Original Sheet Size A0- 1189 x 841

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APPENDIX E ENVIRONMENTAL CONTROLS

Diversion of Upslope Water

'Do it right on site' is a project to help the construction industry protect the environment and achieve the many benefits that come from doing so.

Diversion of Upslope Water What is it?

This refers to placing controls around the disturbed work area and on the road gutters above your site to divert rainwater from travelling through the work site

Why is it important?

Preventing water from above the site reaching the development area will ensure that it doesn't get contaminated and reduces the amount of water you need to deal with. This means less mud problems on site and less sediment being washed into the stormwater system. The environmental impact of sediment such as mud and dirt is significant. They smother animals and plants that live on the bottom of creek beds. They settle and make the creeks shallower. This results in the sun's rays heating the water. Many native plants and animals can not survive in this hotter water and die. Even though mud and dirt are natural they are still serious pollutants that must be prevented from entering our waterways.

Fact Sheet 1

What do I need to do?

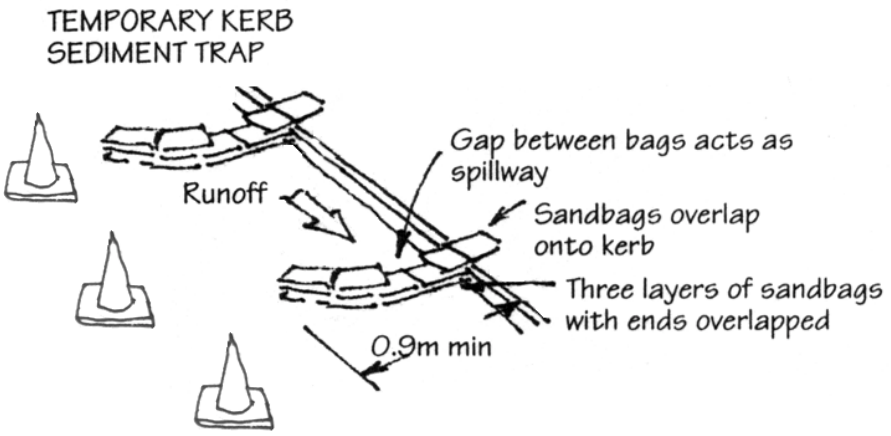
Before building commences:

Look at the construction plans to identify areas on site where water can be diverted around the disturbed or active work area. Identify the relevant street gutters and drains up slope of the site. Decide on diversion methods and install them. Document these on your Soil and Water Management Plan and ensure that staff are aware of their importance.

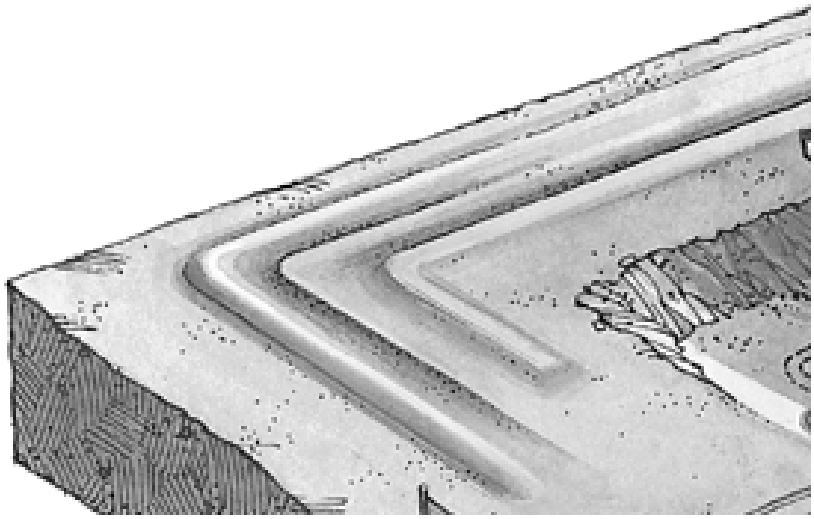
Installing the controls:

Street Gutters: Install a gravel sausage or sand bag barrier downslope of the roadside gully pit that is immediately upslope of the worksite. Make the barrier big enough and sufficiently well attached to divert low and medium flows into the gully pit. Fashion a low point on the barrier, near the kerb, so that high flows spill to the gutter rather than flood the roadway.

Two or three of these traps in a row may be required to allow sediment to drop out. Place safety cones around the area so that cars do not damage them.



On Site: Construct a bund, graded to one end so that clean water flows around your work site without making contact with your construction activities. It can then flow safely to council stormwater drains without any need for pollution control. This bund can be made from soil stabilised with grass, sand bags or 'continuous berm'. Avoid directing stormwater towards the site's entry/exit point as this makes controlling tracking of mud on vehicle wheels more difficult. Also ensure water is not diverted into adjoining properties as this may cause damage and result in a civil lawsuit.



Maintenance of the controls:

Check that controls are in place at the end of the day's operations and when ever rain is forecast. Check diversion channels and bunds for erosion. Ideally they should be lined with geotextile material to ensure that they do not erode.

Remember:

Everyone has a responsibility to protect the environment. The site supervisor is required to make sure that all workers, including sub-contractors are doing the right thing and all workers are required to notify their supervisors and Council if they see pollution occurring.

It is illegal for any substance other than rainwater to enter the stormwater system. If you do have an accident and pollution occurs you are required by law to notify the Council so that they can work with you to minimise any harm to the environment.

Penalties for polluting the stormwater system range from $750 on the spot fines to $1 million and seven years in gaol. Both companies and individuals can be fined.

Council Officers and the EPA enforce the environmental legislation and do routine inspections of building sites. They can issue notices to make companies clean up sites, change the way they are managing the sites and if necessary, cease work. They will attempt to work with you but penalties will be issued if a satisfactory environmental outcome is not achieved.

List of fact sheets available from Council:

1. **Diversion of Upslope Water**
2. Dust Control
3. Early installation of Roof Drainage
4. Excavation Pump Out
5. Protected Concrete, Brick and Tile Cutting
6. Protected Concrete Delivery
7. Protected Service Trenches
8. Protected Stockpiles
9. Protected Wash Areas
10. Protected Waste Management and Chemical Storage
11. Protecting Vegetation
12. Protection of Gutter and Street Stormwater Drains
13. Protection of Site Stormwater Pits
14. Sediment Controls
15. Soil and Water Management Plans
16. Stabilised Site Access

For further information on preventing pollution from building and construction sites contact your local council:

'Do it right on site' is funded by the Natural Heritage Trust and the Southern Sydney Regional Organisation of Councils – Bankstown, Botany Bay, Canterbury, Hurstville, Kogarah, Marrickville, Randwick, Rockdale, South Sydney, Sutherland Shire, Waverley and Woollahra.

THE DRAIN IS JUST FOR RAIN

Southern Sydney Regional Organisation of Councils

Dust Control

'Do it right on site' is a project to help the construction industry protect the environment and achieve the many benefits that come from doing so.

Dust Control

What is it?

Dust control refers to minimising the amount of dust that enters the air and stormwater system from your site.

Why is it important?

Dust blowing from your site has a four way impact. Firstly, it is a nuisance to neighbours which can result in poor relations or complaints about your company.

Secondly, it can result in adverse health effects like asthma in workers and others. Thirdly, blown away materials are blown away dollars, and finally, it is dangerous to the environment.

The environmental impact of dust and sediment is significant. They smother animals and plants that live on the bottom of creek beds and make the creeks shallower. They carry nutrients which can lead to algal blooms and fish kills, as well as weeds which can take over from native plants.

Even though mud and dirt are natural they are still serious pollutants that must be prevented from entering our waterways.

What do I need to do?

Before building commences:

Assess the dust potential of your site and decide on dust controls. If there is high risk of dust generation then barriers to divert the wind up and over the site can be constructed. These include shade cloth walls of height one-fifth the site length. Document controls on your Soil and Water Management Plan and ensure staff are aware of its importance.

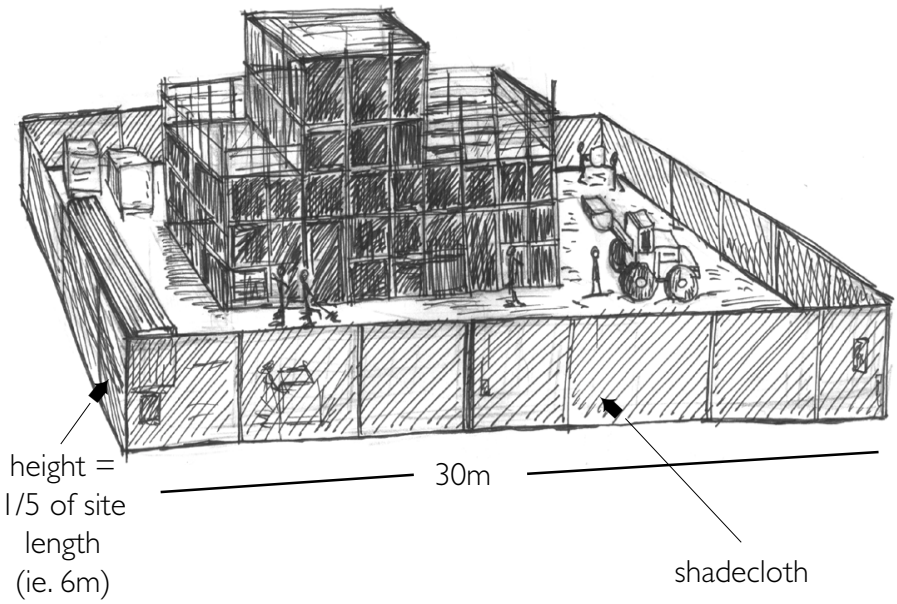
Installing the controls:

Good sediment management can alleviate most of the dust problem. Some of the steps that can be taken to minimise dust include:

- Maintain as much vegetation as possible
- Cover materials and stockpiles
- Ensure that all equipment has dust suppressors fitted
- Dampen the site slightly during excavation or when dust is being raised. Be careful not to wet it to the point of creating polluted runoff.
- Ensure that vehicles only leave via the stabilised site access
- Minimise the amount of the site that is disturbed at any one time

All of these actions will help to minimise the amount of sediment loose on the site and therefore the dust that can be generated.

If dust becomes too serious on windy days the best option is to cease work until wind conditions are suitable.



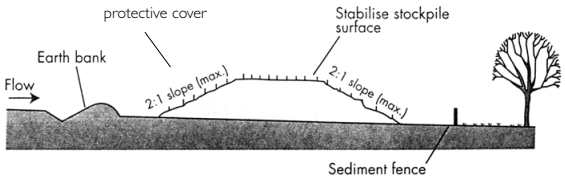
Fact Sheet 2

Maintenance of the sediment controls:

Dust collected around sediment controls will need to be removed regularly to maintain effectiveness. Built up material can be restockpiled, used on site or collected by an Earth Moving Company.

Inspect and sweep roads at the end of each day and when rain is likely.

On larger sites dust monitoring should be undertaken. The National Health and Medical Research Centre (NHMRC) guidelines require an annual mean of 90ug/m^3 for total suspended particulate.



Remember:

Everyone has a responsibility to protect the environment. The site supervisor is required to make sure that all workers, including sub-contractors are doing the right thing and all workers are required to notify their supervisors and Council if they see pollution occurring.

It is illegal for any substance other than rainwater to enter the stormwater system. If you do have an accident and pollution occurs you are required by law to notify the Council so that they can work with you to minimise any harm to the environment.

Penalties for polluting the stormwater system range from $750 on the spot fines to $1 million and seven years in gaol. Both companies and individuals can be fined.

Council Officers and the EPA enforce the environmental legislation and do routine inspections of building sites. They can issue notices to make companies clean up sites, change the way they are managing the sites and if necessary, cease work. They will attempt to work with you but penalties will be issued if a satisfactory environmental outcome is not achieved.

List of fact sheets available from Council:

1. Diversion of Upslope Water
2. **Dust Control**
3. Early installation of Roof Drainage
4. Excavation Pump Out
5. Protected Concrete, Brick and Tile Cutting
6. Protected Concrete Delivery
7. Protected Service Trenches
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12. Protection of Gutter and Street Stormwater Drains
13. Protection of Site Stormwater Pits
14. Sediment Controls
15. Soil and Water Management Plans
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THE DRAIN IS JUST FOR RAIN

Southern Sydney Regional Organisation of Councils

Excavation Pump Out

'Do it right on site' is a project to help the construction industry protect the environment and achieve the many benefits that come from doing so.

Excavation Pumpout

What is it?

Excavation pump out refers to the pumping of water collected in the bottom of excavated sites to the stormwater system. This water may be ground water or collected rain water.

Why is it important?

Rain Water

Rain water pooled on building sites picks up mud, dirt and any other contaminants present.

All of these pollutants can cause serious harm to our waterways. Even if the water is just muddy it can cause significant damage through smothering plants and bottom dwelling animals.

Ground Water

Ground water seeping up from aquifers may contain a range of contaminants such as heavy metals, petrochemicals and toxins depending on prior land uses in the area.

Approval is needed from the Department of Land and Water Conservation and Council to install ground water bores or spear points for pumpout of ground water.

Fact Sheet 4

What do I need to do?

Before building commences:

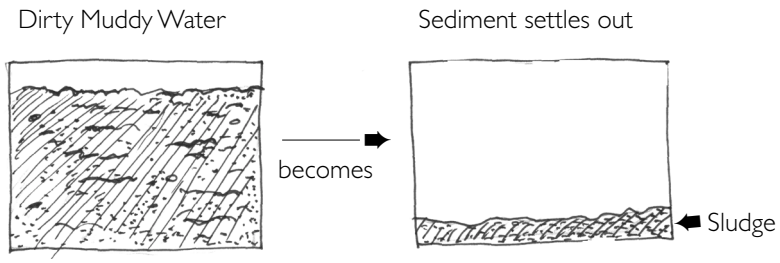
Review the site requirements and consider the best option for dealing with the collected water. Depending on the level of contamination it may be possible to:

1) pump it after treatment to the stormwater system
2) pump it to the sewer with approval from Sydney Water or
3) have it collected by a liquid waste company for disposal at a licensed treatment facility.

The second and third options are the most preferable as they reduce the risk to the stormwater system and ensure you are not breaking the law. Document the methods to be used on your Soil and Water Management Plan and ensure that staff are aware of its importance. If the groundwater is contaminated EPA advice should be sought and may require waste disposal tracking.

Installing the controls:

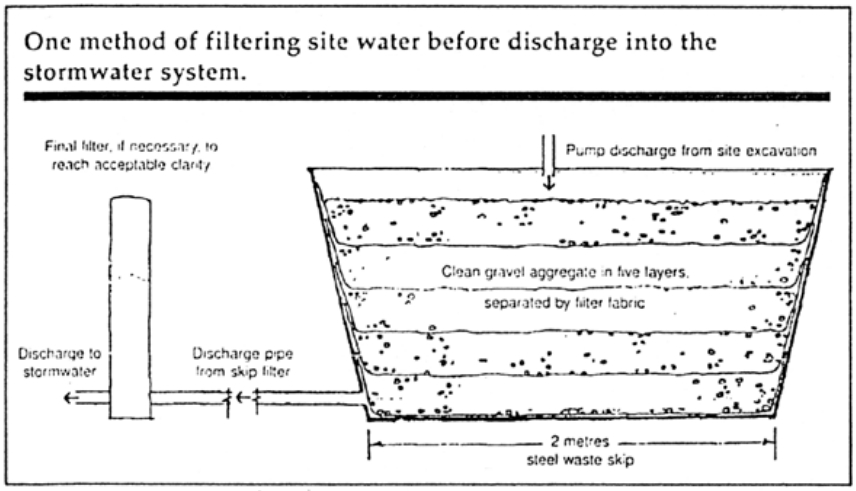
If the water contains only sediment it can be pumped to the stormwater system after filtering. It must have less than 50 mg/L Total Suspended Solids. This is water with no visible cloudiness. If you do not have time or room on-site to let the sediment settle naturally, flocculants such as gypsum can be used. Flocculants speed up the settling process. Unfortunately they raise the pH of the water and pH correction is needed prior to pumping to the stormwater system. Some flocculating agents can be toxic to fish above certain critical concentrations. Council advice should be sought prior to their use. Once settled, pump the clean water from the top to an area of the site where it can soak in or to the stormwaer system. The settled sediments, "the sludge", can be reused on site or disposed of in a bin.



Sediment settles over time but can be sped up with floculant.
Reuse sediment or place in bin

Pump clear water to "soak in" site or to stormwater system

One method of filtering site water before discharge into the stormwater system.



Source: Environetwork News, EPA, 5/99

Maintenance of the sediment controls:

If you install a filtering system such as the one pictured it will need to be cleaned regularly to remove the sediment that it filters out.

Remember:

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The Law in detail:

Pollution from building and construction sites is regulated under the Protection of the Environment Operations Act 1997 (POEO Act). Under this Act it is an offence for anyone to let any substance other than rainwater enter a waterway including the stormwater system.

The Council and the Environment Protection Authority (EPA) can issue notices and penalties on building and construction sites to protect the environment. There are three kinds of notices:

- *Clean up notices* can be issued to require clean up of sites.
- *Prevention notices* can be issued if an activity is being carried out or is suspected to be carried out in an environmentally unsatisfactory manner. The prevention notice requires certain action to be taken and can be appealed in the Land and Environment Court.
- *Prohibition notice* can be issued to require work to cease for a given time.

When a company receives a Clean Up or Prevention Notice they may be liable for a $320 administration fee. They can also be charged all costs incurred by the EPA or Council to ensure compliance with the notice.

As well as notices there are three levels of offences that apply to building and construction sites if they pollute the environment:

- *Tier 1 Offences* are the most serious and involve wilful or negligent behaviour resulting in harm to the environment. The penalty is up to $1 million and 7 years imprisonment. In defending against a Tier 1 offence the company or individual will need to show that they had no control over the pollution event and that they took reasonable precautions and exercised due diligence to prevent the offence.
- *Tier 2 Offences* have a maximum penalty of $250,000 for a corporation and $120,000 for an individual. Further daily penalties apply to continuing offences.
- *Tier 3 offences* are dealt with by penalty infringement notices, similar to speeding fines. These notices impose a fine that can be paid or defended in court. The maximum penalty is $1500 for a corporation or $750 for an individual.

Public Register of Notices: Councils and the EPA are required to keep a public register of all companies and individuals who are issued notices. So in addition to the fines and lost time in cleaning up, companies who pollute also risk damaging their reputation. This is a foolish thing to do when the public are becoming more and more concerned about the environment and are starting to look at a company's environmental record when deciding which company to use.
If you do have a pollution incident which harms the environment, under the POEO Act, you have a *duty to notify* the Council or EPA. They can then work with you to minimise the harm to the environment. The maximum penalty for failing to notify them are $250 000 for corporations or $120 000 for individuals. Further daily penalties apply to continuing offences.

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Southern Sydney Regional Organisation of Councils

'Do It Right On-Site'

Soil and Water Management for the Construction Industry

'Do it right on-site' is a project to help the construction industry protect the environment and achieve the many benefits that come from doing so.

Impact of Building and Construction Industry on the Environment:

The Building and Construction Industry has a large impact on the environment, in particular our waterways. Sand, soil, cement slurry, paint and other building materials that enter our waterways kill fish and aquatic plants, silt up streams, and block stormwater pipes which leads to increased flooding.

Due to the high number of construction sites even small amounts of pollution from each site is enough to cause significant damage to our waterways. This project aims to work cooperatively with the construction industry to find ways to prevent pollution. Together we can make a difference.

Who is responsible for ensuring there is no pollution from the site?

Everyone! Under legislation anyone who places material into the stormwater system or even in a position where it may enter the stormwater system is guilty of an offence. Depending on the extent of the pollution, penalties range from on-the-spot fines of $750 to a maximum of $1 million or 7 years in gaol. It is the Builder/Site Supervisor's responsibility to ensure that all workers on site, including sub-contractors, do not breach environmental laws. Workers have a responsibility under the law to notify their supervisors if they see a pollution incident which harms the environment. If the supervisor cannot be contacted, workers should notify the Council.

What are the benefits of preventing pollution?

Benefits to the Builder

- ✔ a better looking more saleable site
- ✔ reduced clean up costs
- ✔ less mud and dust problems
- ✔ improved occupational health and safety on site
- ✔ money saved due to reduced stockpile losses
- ✔ improved drainage and reduced site wetness which will result in less down time, earlier completion and earlier sales!
- ✔ fewer public complaints
- ✔ no fines, no problems with Council
- ✔ better image within the community
- ✔ marketing advantage to win work from environmentally conscious clients
- ✔ better fishing due to improved water quality!!

Benefits to the Owner

- ✔ Reduced site rehabilitation/landscaping costs because the soil and vegetation is still on the site!
- ✔ Peace of mind knowing that their home hasn't caused damage to the environment
- ✔ Less chance of flooding as the stormwater drains are not clogged up with sediment

Benefits to the Community

- ✔ less risk of flooding
- ✔ healthier waterways with more plants and animals
- ✔ increased recreational opportunities in and around our waterways
- ✔ increased sales as surrounding environment is more attractive

DO IT RIGHT ON SITE – ENVIRONMENTAL INFORMATION FOR BUILDERS

How can you prevent pollution from the site?

Step 1: Planning

Prepare a soil and water management plan, also known as a sediment and erosion control plan. This will be required prior to Council issuing you a Construction Certificate (either at DA stage or as a condition of consent). The Soil and Water Management Plan should outline the methods you will use to prevent pollution of the stormwater system throughout the life of the construction period. There may be different controls needed as the site develops due to changes in drainage patterns and location of building materials. These stages and their controls must be shown on your Soil and Water Management Plan. Sample Soil and Water Management Plans are available from Council, however you must develop a plan specific to your site.

Step 2: Installation of soil and water controls

Before work commences install the sign provided by the Council and ensure that all workers know their responsibilities. Set up the soil and water controls. A recommended sequence for doing this is:

1) establish a single stabilised entry/exit point.
2) install sediment fence(s) along the low side of the site.
3) divert up slope water around the work site and stabilise channels.
4) clear only the areas necessary - fence off no go areas where vegetation is to be kept - and plan the staging of work to minimise the amount of soil exposed at any time. Revegetate any areas that will be left exposed for more than 14 days.
5) store stockpiles on site and place sediment controls around them. If storage room is not available on site, seek Council approval for an offsite storage area with pedestrian access and appropriate soil and water controls.
6) stabilise exposed earth banks (use vegetation or erosion control mats, put sediment fence down slope).
7) install onsite waste receptacles (mini-skips, bins, wind proof litter receptors).
8) commence building activities.
9) install roof downpipes prior to frame inspection.

Step 3: Maintenance of soil and water controls

Soil and water controls should be checked daily to ensure that they are operating effectively. Maintenance that will be required includes:

- Removing sediment collected by sediment fences and catch drains
- Topping up the gravel on the stabilised entrance way
- Repairing erosion in drainage channels
- Inspecting roadways and gutters and sweeping up any sediment

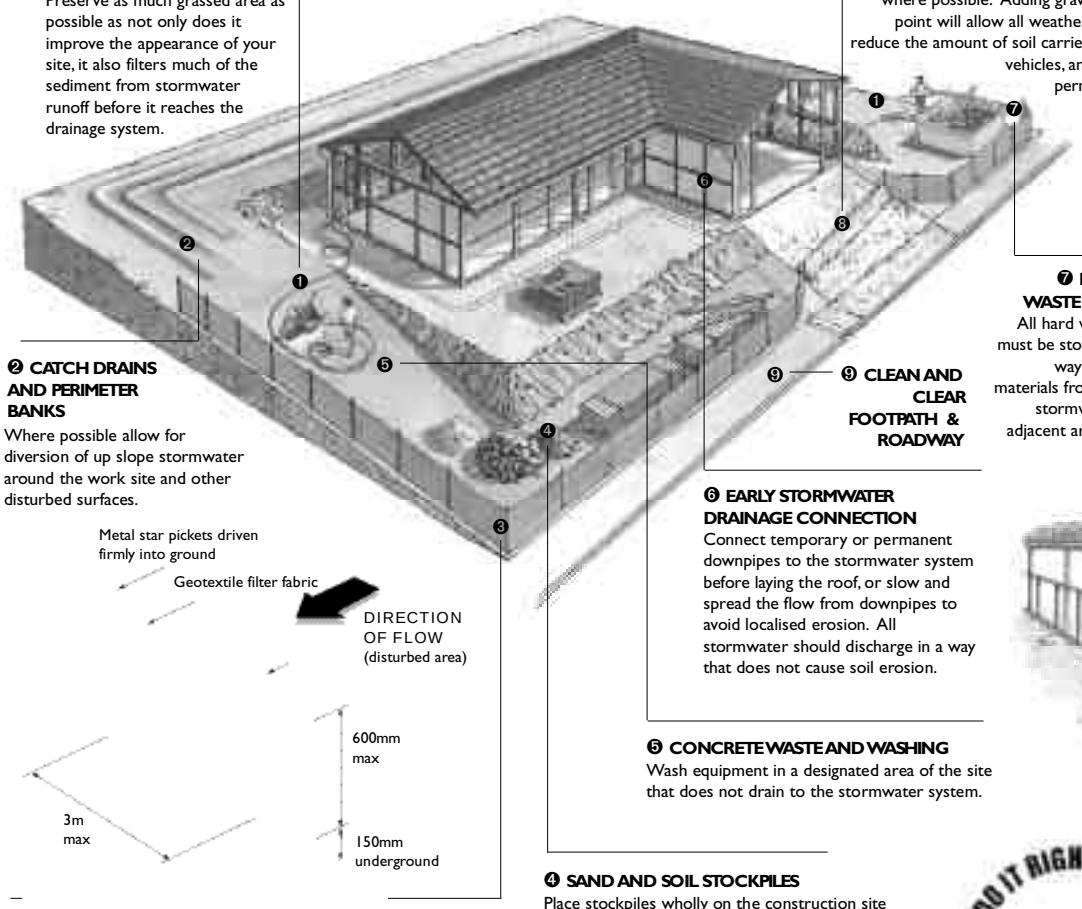
Remember that the soil and water controls may need to be modified if the slope and drainage paths are changed as the site develops. Best practice includes anticipation of risks as well as being prepared for abnormal circumstances and emergencies eg: storage of clean up materials and extra sediment fence on site just in case.

Step 4: Finalisation of site

Ensure the site is stabilised -no exposed soil remains- before removing the soil and water controls. If landscaping is not completed prior to handover ensure that the new owners are aware of their responsibility to prevent pollution from entering the stormwater system.

Ways you can reduce erosion & control sediment on a building or construction site

Follow these site management practices and you will help reduce impact on our waterways . . .



❶ LIMIT DISTURBANCE WHEN EXCAVATING
Preserve as much grassed area as possible as not only does it improve the appearance of your site, it also filters much of the sediment from stormwater runoff before it reaches the drainage system.

❷ CATCH DRAINS AND PERIMETER BANKS
Where possible allow for diversion of up slope stormwater around the work site and other disturbed surfaces.

❸ INSTALL A SEDIMENT BARRIER
Sediment barriers down slope of the building site filter coarse sediment before it can wash into gutters, drains and waterways.
You can . . .
- attach geotextile sediment fabric to posts with the fabric buried in an up slope trench; or
- place straw bales, staked in a 10mm (minimum) deep trench; or
- place turf of a 60mm (minimum) width along the kerb line.

❹ SAND AND SOIL STOCKPILES
Place stockpiles wholly on the construction site and behind a sediment barrier. Soil or cement should be covered at the end of each day if excessive wind or rain is likely.

❺ CONCRETE WASTE AND WASHING
Wash equipment in a designated area of the site that does not drain to the stormwater system.

❻ EARLY STORMWATER DRAINAGE CONNECTION
Connect temporary or permanent downpipes to the stormwater system before laying the roof, or slow and spread the flow from downpipes to avoid localised erosion. All stormwater should discharge in a way that does not cause soil erosion.

❼ LITTER AND WASTE CONTROL
All hard waste and litter must be stored on site in a way to prevent any materials from entering the stormwater system & adjacent areas by wind or water action.

❽ SINGLE GRAVELLED ENTRY/EXIT
Restrict vehicle access to one entry/exit point where possible. Adding gravel to the access point will allow all weather entry/exit, will reduce the amount of soil carried off the site by vehicles, and will provide a permanent base for the driveway.

❾ CLEAN AND CLEAR FOOTPATH & ROADWAY

Illustration reproduced courtesy of Brisbane City Council

Protected Stockpiles

'Do it right on site' is a project to help the construction industry protect the environment and achieve the many benefits that come from doing so.

Protected Stockpiles

What are they?

They are materials such as sand, gravel, topsoil, mulch and woodchip stored in a way that will not enter the stormwater system.

Why are they important?

Stockpiles are at risk of being washed or blown away and polluting stormwater. Loose materials in heaps with steep sides and impervious foundations are most at risk. Not only does this affect the environment but it is expensive to the builder, increasing the amount of materials needing to be purchased for the development.

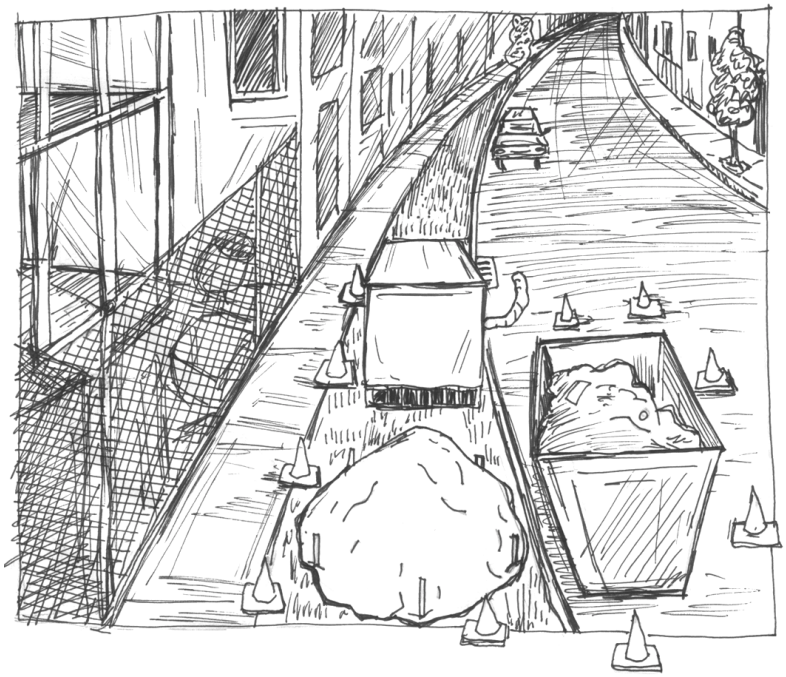
The environmental impact of these materials is significant. Mulch and woodchip decompose absorbing all the oxygen in the water resulting in suffocation of animals. Sediment settles making creeks shallower and smothering animals and plants that live on the creek beds. This shallower water depth also results in the suns rays heating the water. Many native plants and animals can not survive in this hotter water and die.

Fact Sheet 8

What do I need to do?

Before building commences:

Identify a protected storage area for stockpiles. This should be inside the site under cover, away from stormwater flow paths, with erosion control measures such as sediment fence, gravel sausage or straw bales placed around them. If there is no room on site Council approval will be needed to store materials on the kerb or footpath. Materials should be stored in sand bags or bale/pallet containers with sediment controls around them. Document your storage area on the soil and water management plan and ensure staff are aware of its importance.

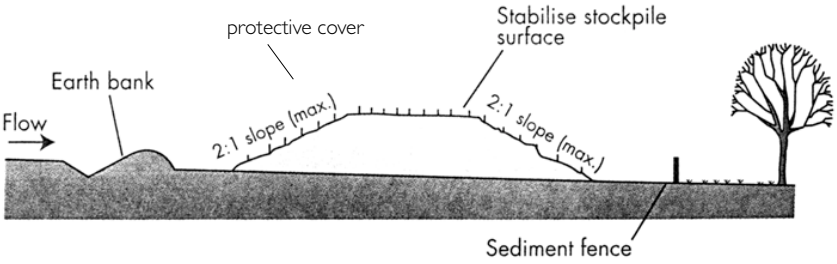


Installing the controls:

1. Locate stockpile away from stormwater flow paths, roads and hazard areas (ideally at least 5m away).
2. Place on a level area as a low, flat, elongated mound.
3. Where there is sufficient area topsoil stockpiles shall be less than 2m in height.
4. Construct an earth bank on the upslope side to divert run off around the stockpile and a sediment fence 1 to 2 m downslope of the stockpile (or sand bag, gravel sausage).
5. Stockpiles should be covered during windy conditions, rain or unattended site periods.
6. Once the roof has been installed on the frame, move stockpiles inside.

Maintenance of the controls:

Stockpiles should be checked and covered at the end of each day. Materials trapped by the down slope controls should be removed regularly to maintain their effectiveness. Built up material can be re-stockpiled, used on site or collected by an Earth Moving Company. Incorrect storage of stockpiles is a major source of stormwater pollution. All site workers, subcontractors, and delivery drivers should be advised of their responsibilities. Delivery drivers should be given a designated location to deliver materials on site.



Remember:

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It is illegal for any substance other than rainwater to enter the stormwater system. If you do have an accident and pollution occurs you are required by law to notify the Council so that they can work with you to minimise any harm to the environment.

Penalties for polluting the stormwater system range from $750 on the spot fines to $1 million and seven years in gaol. Both companies and individuals can be fined.

Council Officers and the EPA enforce the environmental legislation and do routine inspections of building sites. They can issue notices to make companies clean up sites, change the way they are managing the sites and if necessary, cease work. They will attempt to work with you but penalties will be issued if a satisfactory environmental outcome is not achieved.

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15. Soil and Water Management Plans
16. Stabilised Site Access

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THE DRAIN IS JUST FOR RAIN

Southern Sydney Regional Organisation of Councils

Protected Wash Areas

'Do it right on site' is a project to help the construction industry protect the environment and achieve the many benefits that come from doing so.

Protected Wash Areas
What are they?

Protected Wash Areas refers to having a designated spot on site that does not drain to the stormwater system for washing of all painting, plastering, concreting and other dirty equipment.

Why are they important?

Even at low concentrations water soluble paints (acrylics) raise the turbidity in creeks which reduces oxygen and light, resulting in plants, fish and frog deaths. Oil or turps based paints form a thin film over the surface of water, starving insects, frogs, and fish species of oxygen. They can also contain heavy metal components that are highly toxic and irritating to all animal species including humans. Concrete alters the pH of the water making it too alkaline for many plants and animals to survive. Protected Wash Areas are required to trap silt and pollutants and prevent them entering the stormwater system.

What do I need to do?

Before building commences:

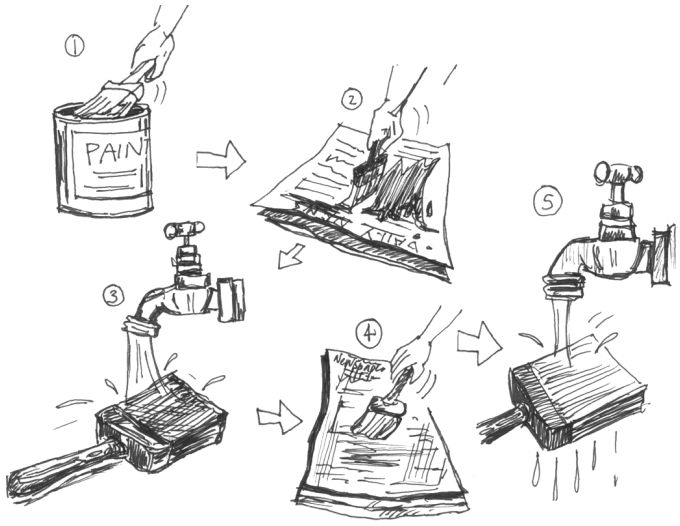
Choose a site for the wash down area that is away from drainage lines and stormwater pits. Show its location on the Soil and Water Management Plan and ensure all staff are aware of it.

Installing the controls:

The wash down area should have sediment controls around it and be large enough to hold all waste water generated. It sould be clearly signposted to alert subcontractors and staff of their responsibilities.

Minimise the amount of waste water generated by:

- Sweeping excess dirt and mud off equipment prior to washing.
- With Paint wastes- Spin the rollers and brushes to remove excess paint and return as much as possible to the original container for reuse. For water based paints- wash brushes in small amounts of water over newspaper. This will let the water soak through into the ground and keep the paint residue on the paper. The paper can then be placed in a solid waste bin or taken to a licensed solid waste transfer station. It is illegal to let paint and other liquid wastes contaminate the soil.
- For oil based paints- wash equipment in a series of solvent baths until clean. The solvent can be reused until it becomes saturated with paint. Solvent should be stored in air tight tins to prevent evaporation and disposed of to a licenced solid waste transfer station. It can not be placed in the bin or on the ground.



- Plastering wastes and wash waters should be allowed to dry within the protected wash area and then disposed of either to a bin or taken to a licensed waste depot. Solid wastes from plastering such as calcium sulphate can be used as a modifier in gardens.

Fact Sheet 9

Remember to clean up all site debris- don't sweep or hose it into the gutter.

Maintenance of the controls:

The protected wash area and its sediment controls will need to be emptied of solid residues regularly in order for it to have the capacity to catch and detain waste waters. The larger the area the less often this will need to be done. Solids from this process should be disposed of in a bin or taken to a licensed waste depot.

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THE DRAIN IS JUST FOR RAIN

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Protection of Gutter and Street Stormwater Drains

'Do it right on site' is a project to help the construction industry protect the environment and achieve the many benefits that come from doing so.

Protection of Gutter and Street Stormwater Drains

What is it?

This refers to placing sediment collection devices around or in the drains down slope of your site to prevent pollutants entering. ***This should not be your only measure.***

Street drain protection is a backup measure to support your on-site controls.

Why is it important?

The environmental impact of sediment such as mud and dirt is significant. They smother animals and plants that live on the bottom of creek beds and make the creeks shallower. This results in the sun's rays heating the water. Many native plants and animals can not survive in this hotter water. Even though mud and dirt are natural they are still serious pollutants that must be prevented from entering our waterways.

What do I need to do?

Before building commences:

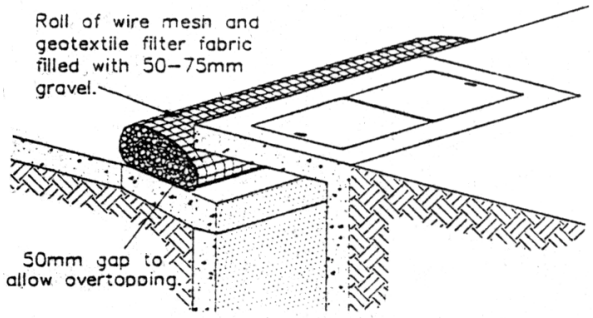
Find the street drains below your work site. Choose the most appropriate method for protection and install prior to commencement of building works. Document these on your Soil and Water Management Plan and ensure staff are aware of its importance.

Installing the controls:

Choose the best down slope control method for your site. Those that collect sediment above the pit are easier to clean but have low storage capacity compared to controls that 'sit' in the pits. Place cones around controls in the gutters or on roads to prevent drivers damaging them.

Portable gravel kerb inlet sediment trap:

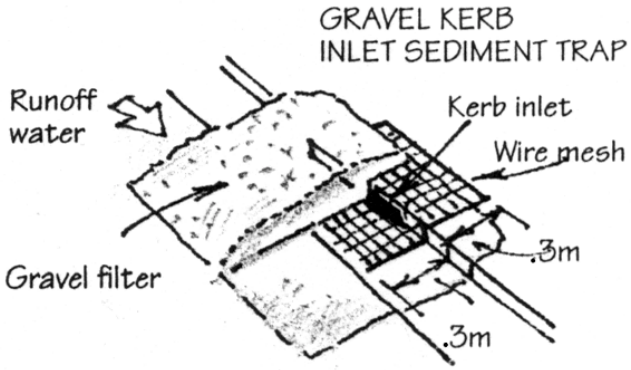
This trap involves a roll of wire mesh and geotextile filter fabric filled with gravel in front of the kerb inlet. It has the benefit of being portable and easily removed for cleaning. Ensure there is a gap at the top to allow overtopping and prevent flooding.



Portable Gravel Kerb Inlet Sediment Trap

Gravel surface barrier strategy

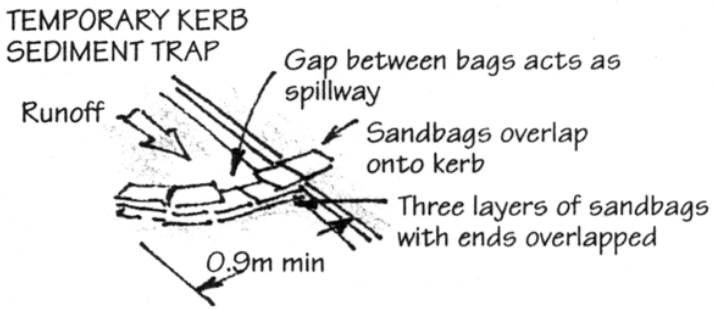
This method involves placing wire mesh over the drain and placing large gravel upslope of it. The sediment will be filtered out into the gravel with only the clean water entering the stormwater system.



Fact Sheet 12

Sandbag kerb sediment trap

Place sandbags in front of flow of water. This will slow down the water enabling sediment to settle out. Two or three of these traps in a row may be required to ensure sediment settles out.



Pit Baskets

There are a range of products that can be placed inside side entry pits that act as baskets or sacks to trap any pollutants that enter. Council permission must be sought before placing any items inside the side entry / gully pit.

Maintenance of the sediment controls:

All sediment collection devices will need to be cleaned regularly to maintain effectiveness. The built up material can be re-stockpiled, used on site or collected by an Earth Moving Company.

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Protection of Site Stormwater Pits

'Do it right on site' is a project to help the construction industry protect the environment and achieve the many benefits that come from doing so.

Protection of Site Stormwater Pits

What is it?

This refers to placement of sediment collection devices around any existing stormwater drains on the site.

Why is it important?

Stormwater drains on the construction site are at high risk of having pollutants such as dirt, stockpiled soil, mulch and barkchips washed straight into them. The environmental impact of these materials is significant. Mulch and woodchip decompose absorbing all the oxygen in the water resulting in suffocation of animals. Sediment settles making creeks shallower, smothering animals and plants that live on the creek beds. Many native plants and animals can not survive this and die.

Fact Sheet 13

What do I need to do?

Before building commences:

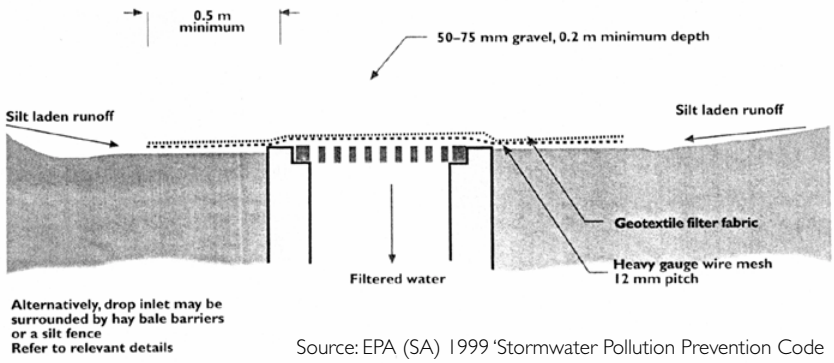
Identify any stormwater drains on the site. Plan the layout of the work site so that any wash down areas, tile or brick cutting areas are not near these drains. Clearly mark the stormwater drains on the site and choose a method of protection for them. Install the protective controls prior to building work commencing. Document all of this on your Soil and Water Management Plan and ensure staff are aware of its importance.

Installing the controls:

There are a range of sediment traps to choose from.

Drop inlet sediment Trap:

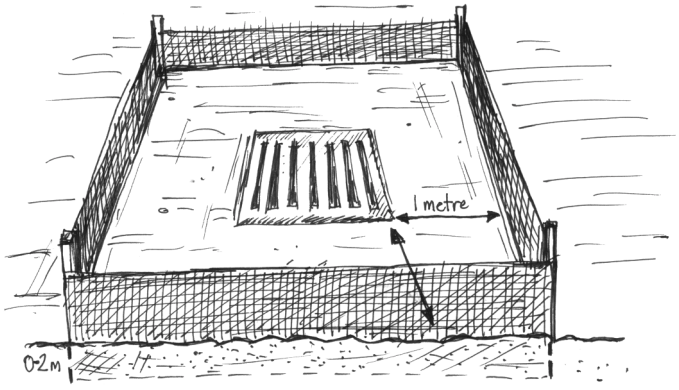
Three layers on top of the drain to trap the sediment. 1) heavy gauge wire netting or mesh 2) geotextile filter fabric with 3) a layer of prewashed 50-75mm gravel on top.



Source: EPA (SA) 1999 'Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry.

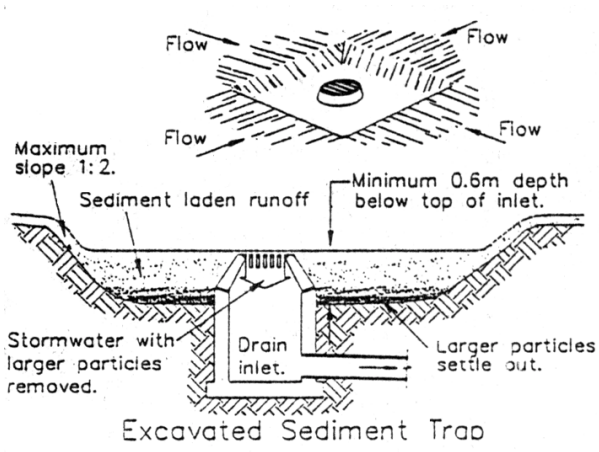
Sediment Fence drop inlet sediment trap:

Sediment fence staked around the drain to trap sediment. Note: It is important to partially bury the fabric so that water and sediment can not just flow underneath. The more space between the fence and the drain, the more chance of sediment settling and the greater the capacity of the trap.



Geotextile Filter Fabric Drop Inlet Sediment Trap

Excavated sediment trap: This is a detention basin technique for on-site drains. The basin depth needs to be at least 0.6m to ensure that water is held in place and sediment can settle out.



Excavated Sediment Trap

Source: Department of Conservation and Land Management (1995) 'Preparing an Erosion and Sediment Control Plan'.

Maintenance of the controls:

All sediment collection devices need regular maintenance to stay effective. Remove the built up sediment and check for holes or other breaks in the controls. Repair and replace them. Built up material can be re-stockpiled, used on site or collected by an Earth Moving Company.

Remember:

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THE DRAIN IS JUST FOR RAIN

Southern Sydney Regional Organisation of Councils

Sediment Controls

'Do it right on site' is a project to help the construction industry protect the environment and achieve the many benefits that come from doing so.

Sediment Control

What is it?

These are a range of products installed across drainage flows to filter sediment out of water and enable its deposition by slowing down water flow. They include sediment fences, straw bales, grass/ vegetation strips and sediment traps/basins. Other controls may be available and advice should be sought from suppliers of Sediment Control Equipment.

Why is it important?

Sediment on building sites causes problems not only for the environment but also for builders. A dirty site causes difficulties in wet weather, increases costs from having to replace stockpiles that are washed away, increases clean up costs, penalties and potential damage to your company's reputation if fined for polluting.

The environmental impact of sediment such as mud and dirt is significant. They smother animals and plants that live on the bottom of creek beds. They settle and make the creeks shallower. Many native plants and animals can not survive this and die. Even though mud and dirt are natural they are still serious pollutants that must be prevented from entering our waterways.

Fact Sheet 14

What do I need to do?

Before building commences:

Prepare a soil and water management plan, also known as a sediment control plan. This will be required by Council prior to issuing a construction certificate (either at DA stage or as a condition of consent) and should outline the methods you will use to prevent pollution of the stormwater system throughout the life of the development. There may be different controls needed as the site develops due to changes in drainage patterns and vegetation. This should be thought through and shown on your plans. Council can provide you with sample plans, however it is important that you develop a plan specifically for your site.

Remember the more erosion you can prevent the less sediment will need to be captured! The easiest way to prevent erosion is to leave shrubs and grass in place. This has the dual effect of holding the soil and dirt together as well as filtering and slowing down water flows enabling sediment to settle out.

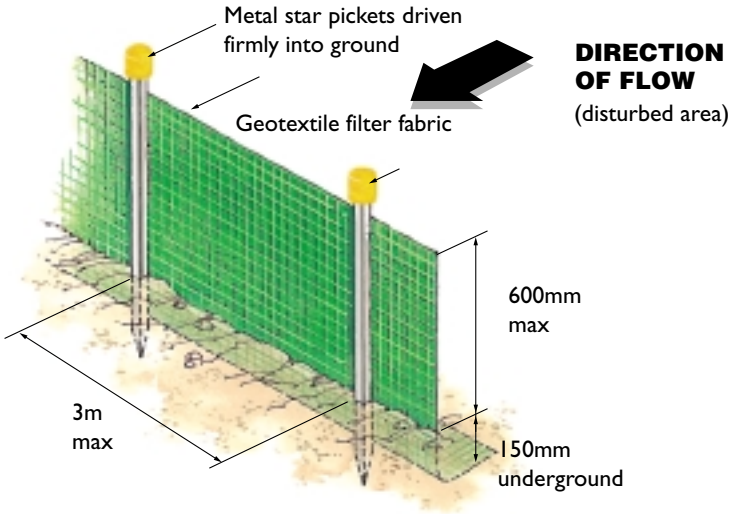
If vegetation needs to be removed try not to do it until immediately before works commence or stage the works to limit the amount of the site that is disturbed at any given time. As you move into a new area, revegetate the finished area. Another way to minimise erosion is to ensure that you only have small amounts of sand, soil and other stockpiles on site at any time. Ensure stockpiles are stored in ways to reduce erosion - *see* Fact Sheet 8 on *Protected Stockpiles*.

Installing the controls:

The sediment controls need to be in place prior to the commencement of building works. Remember that the sediment controls will need to be altered as construction occurs and the sites drainage patterns change.

Sediment Fence

A sediment or silt fence is the most widely used strategy. It is constructed from heavy duty geofabric. Although a sediment fence looks like shade cloth it is very different and is not interchangeable. A sediment fence is specifically designed to allow the free passage of water and trap sediment



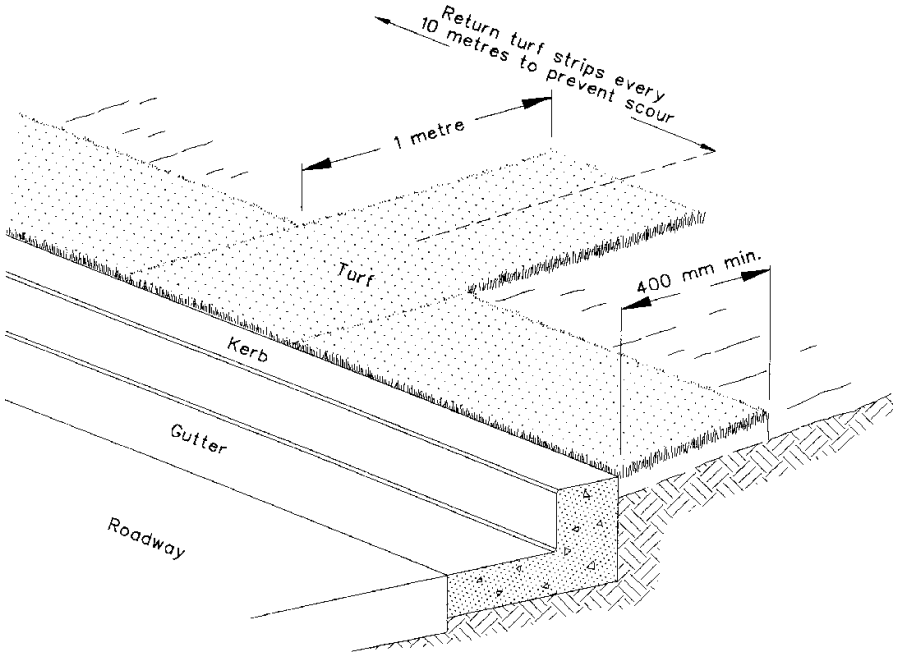
Sediment Fence (continued)

Construction Notes:

1. construct the sediment fence as close as possible to parallel to the contours of the site
2. drive 1.5m long star picket into ground, 3m apart
3. dig a 150mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched
4. backfill trench over the base of fabric (where the sediment barrier has to be located on hard pavement that cannot be trenched, a gravity system held firm by its weight eg: gravel sausage can be used.)
5. fix self supporting geotextile to upslope side of posts with wire ties or as recommended by geotextile manufacturer
6. join sections of fabric at a support post with a 150mm overlap

Grass Strip Filters

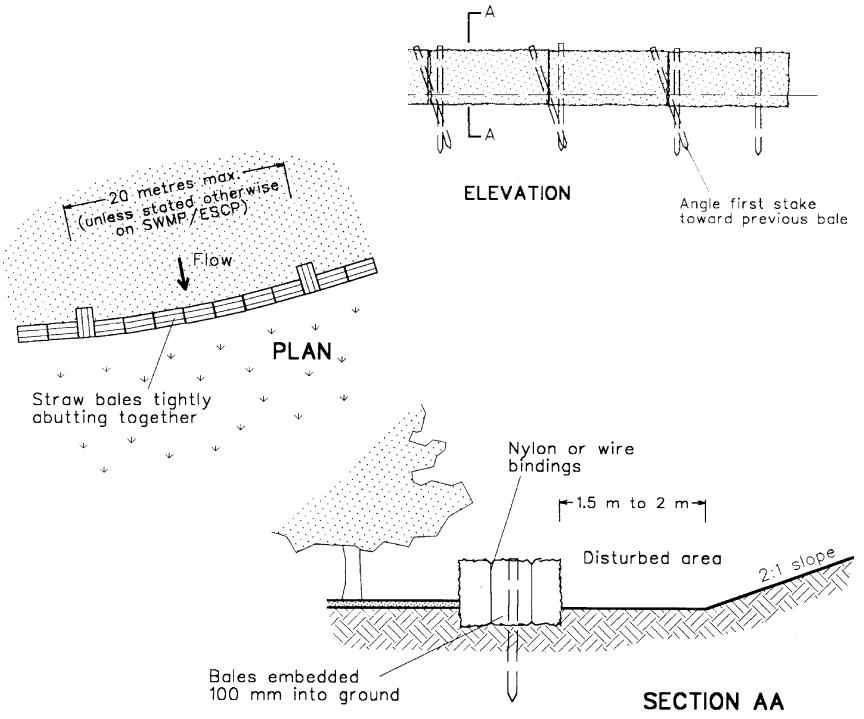
These are strips of undisturbed vegetation or grass planted down slope from earthworks. They provide a simple method of trapping coarse sediment. The flatter and wider the strips are, the more effective they become. They are only suitable on low grades. A 400mm wide grass strip between the kerb and the footpath can be a good last resort sediment control, filtering the water before it enters the stormwater system.



Straw Bale Filters

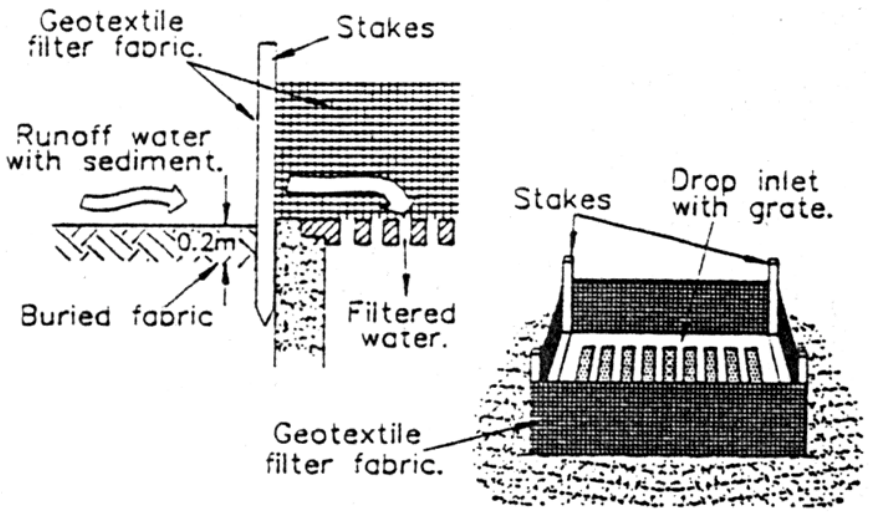
These are straw bales tightly abutted together and partially buried into the ground. They are only suitable for low flows. Filter fabric can be placed in front of them adding to the sediment stoppage. It is recommended that at least 4 bales are used as during a storm any less result in the water simply hitting the bales and flowing around them. This defeats the purpose of using them, which is to slow the water and have it filter through the bales with the sediment settling out.

Straw bales are usually used incorrectly. Seek Council guidance if unsure.

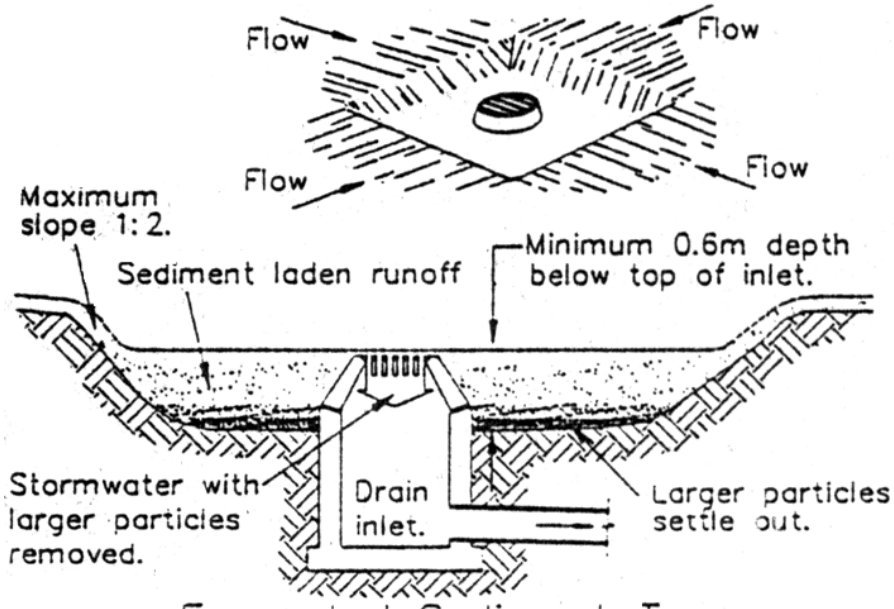


Sediment Traps / Ponds

These are basins designed to capture a concentrated sediment laden flow and store it under still conditions enabling the silt to deposit at the bottom of the trap. The effectiveness of the traps to remove fine particles may be improved by the placement of filter fabric along the uphill face of the embankment.



Geotextile Filter Fabric Drop Inlet Sediment Trap.



Excavated Sediment Trap

Maintenance of the sediment controls:

Sediment controls will naturally fill up with sediment and need to be maintained to stay effective. This involves removing the built up sediment as well as ensuring that they are still in good working condition.

Often sediment controls will be moved during works and they should be checked daily to ensure they have been put back in place properly.

Straw bales deteriorate and can end up polluting waterways. Their average life is 3 months and should be inspected regularly. Enclosing bales in sediment fence reduces this risk. At the end of their life they can be used as mulch on gardens. Sediment fences should also be checked regularly for holes.

Some Councils do not allow straw bales to be used, so check with them when planning your controls.

Soil and water controls should be kept in place until works are completed. If landscaping is not completed prior to handover ensure that the new owners are aware of their responsibility to prevent pollution from entering the stormwater system.

DO IT RIGHT ON SITE
ENVIRONMENTAL INFORMATION FOR BUILDERS

Suppliers of Sediment Control Equipment

There are a large number of companies that supply sediment control equipment listed in Outdoor Design Source and the Yellow Pages. While we do not necessarily endorse any particular company or product we thought it useful to list some company details as a starting point for you:

Total Erosion and Pollution ph: 02 9524 0155

GSE Lining Technology ph: 02 9821 2977

Hardware House

Maccaferri Pty Ltd ph: 02 9648 3800

Mulch Mat Products ph: 02 9905 5344

Naturelink Environmental ph: 02 4578 4588

Polyfabrics Australia Pty Ltd ph: 02 9829 5599

Spraygrass Landscapes ph: 02 9627 4352

Remember:

Everyone has a responsibility to protect the environment. The site supervisor is required to make sure that all workers, including sub-contractors are doing the right thing and all workers are required to notify their supervisors and Council if they see pollution occurring.

It is illegal for any substance other than rainwater to enter the stormwater system. If you do have an accident and pollution occurs you are required by law to notify the Council so that they can work with you to minimise any harm to the environment.

Penalties for polluting the stormwater system range from $750 on the spot fines to $1 million and seven years in gaol. Both companies and individuals can be fined.

Council Officers and the EPA enforce the environmental legislation and do routine inspections of building sites. They can issue notices to make companies clean up sites, change the way they are managing the sites and if necessary, cease work. They will attempt to work with you but penalties will be issued if a satisfactory environmental outcome is not achieved.

List of fact sheets available from Council:

1. Diversion of Upslope Water
2. Dust Control
3. Early installation of Roof Drainage
4. Excavation Pump Out
5. Protected Concrete, Brick and Tile Cutting
6. Protected Concrete Delivery
7. Protected Service Trenches
8. Protected Stockpiles
9. Protected Wash Areas
10. Protected Waste Management and Chemical Storage
11. Protecting Vegetation
12. Protection of Gutter and Street Stormwater Drains
13. Protection of Site Stormwater Pits
14. **Sediment Controls**
15. Soil and Water Management Plans
16. Stabilised Site Access

For further information on preventing pollution from building and construction sites contact your local council:

'Do it right on site' is funded by the Natural Heritage Trust and the Southern Sydney Regional Organisation of Councils – Bankstown, Botany Bay, Canterbury, Hurstville, Kogarah, Marrickville, Randwick, Rockdale, South Sydney, Sutherland Shire, Waverley and Woollahra.

THE DRAIN IS JUST FOR RAIN

Southern Sydney Regional Organisation of Councils

APPENDIX F UFP PROFORMA

UNEXPECTED FINDINGS PROTOCOL REPORT

Date:

Reporters Name:

1. Suspect material encountered during daily activities? (circle): **YES / NO**
   (if yes compete 2 - 8).

2. Environmental Consultant contacted? (circle): **YES / NO**

3. Location of foreign material (label occurrences sequentially 1, 2, 3, etc and mark on a site plan)

Description of material encountered:

4. Odour present: _____

5. Visible staining: _____

6. Asbestos or suspected asbestos containing material present? (circle): **YES / NO**

7. Brief written description and/or sketch:

8. Material quarantined? (circle): **YES / NO**

9. Photograph taken? (circle): **YES / NO**

Reported Name: **Signature:**