



Orica Australia Pty Ltd
Remediation Action Plan

28 McPherson Street
Banksmeadow, NSW

15 May 2019

54709/119224 Rev 0

JBS&G

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Abbreviations

Term	Definition
ACM	Asbestos Containing Material (eg fibre cement sheet)
AF/FA	Asbestos fibres/friable asbestos
AHD	Australian Height Datum
APM	Australian Paper Manufacturers Limited
BGCP	Botany Groundwater Cleanup Project
bgl	Below ground level
bgs	Below ground surface
BIP	Botany Industrial Park
BTEX	Benzene, toluene, ethylbenzene and xylenes
B(a)P	Benzo(a)pyrene
CEMP	Construction Environmental Management Plan
CHCs	Chlorinated Hydrocarbons
COCs	Contaminants of concern
COPCs	Contaminants of potential concern
CGS	Characteristic gas situation
CSM	Conceptual site model
DP	Deposited Plan
DQIs	Data quality indicators
DQOs	Data Quality Objectives
EDC	1,2-dichloroethane
EMP	Environmental Management Plan
ENM	Excavated Natural Material
EnRiskS	Environmental Risk Sciences Pty Ltd
EPA	Environment Protection Authority
GDA	Geocentric Datum of Australia
GILs	Groundwater investigation levels
GSV	Gas screening value
GTP	Groundwater Treatment Plant
Ha	Hectare
HCB	Hexachlorobenzene
HCBD	Hexachlorobutadiene
HHRA	Human Health Risk Assessment
HIL	Health-based investigation level
JBS&G	JBS&G Australia Pty Ltd
LOR	Limit of Reporting
MGA	Map grid of Australia
NATA	National Association of Testing Authorities
NSW	New South Wales
OCPs	Organochlorine pesticides
OPPs	Organophosphorus pesticides
PAHs	Polycyclic aromatic hydrocarbons
PARCC	Precision, accuracy, representativeness, comparability and completeness
PCA	Primary Containment Area
PCBs	Polychlorinated biphenyls
PID	Photo-ionisation detector
PPE	Personal protective equipment
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
RPD	Relative Percentage Difference
RSL	Regional Screening Level
SAQP	Sampling, Analysis and Quality Plan
SEAR's	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
SVCH	Semi-volatile chlorinated hydrocarbons
TCE	Trichloroethylene (trichloroethene)

TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbon
UCL	Upper confidence limit
UFP	Unexpected finds protocol
URS	URS Australia Pty Ltd
USEPA	United States Environment Protection Agency
UST	Underground storage tank
VCHs	Volatile chlorinated hydrocarbons
VENM	Virgin Excavated Natural Material
VMP	Voluntary Management Proposal
VOC	Volatile organic compound
WWC	Woodward-Clyde Pty Ltd

1. Introduction and Background

1.1 Introduction

JBS&G Australia Pty Ltd (JBS&G) was engaged by Orica Australia Pty Ltd (Orica, the client) to prepare a Remediation Action Plan (RAP) for part Lot 9 in DP 1205673, located at 28 McPherson Street, Banksmeadow, NSW (the site). The site location and site layout are shown on **Figures 1 and 2**, respectively.

Further this report is also to form part of an Environmental Impact Statement for the development of a warehousing and distribution facility on the subject site. Specifically, the report addresses the Secretary's Environmental Assessment Requirements (SEARs) for State Significant Development (SSD 9691) covering *Contamination, including:*

- *assessment of the extent and nature of any contamination of the soil, groundwater and soil vapour including the potential risks to human health and the environmental receptors near the site*
- *a remediation action plan (RAP) detailing the measures that will be undertaken to remediate and manage any contamination identified at the site*
- *the engagement of a Site Auditor accredited under the Contaminated Land Management Act 1997 NSW Site Auditor Scheme - a Section B Site Audit Statement and Site Audit Report prepared by a NSW Site Auditor, certifying site suitability for the intended use subject to the implementation of an appropriate RAP.*

JBS&G (2015) has previously completed validation of remediation works undertaken for identified soil contamination hotspots on a larger parcel of land (the former Orica Southlands estate), which included the site. Validation was undertaken for non-volatile compounds to validate the site as suitable for commercial/industrial use, and for volatile compounds to validate the site as suitable for commercial/industrial use in an outdoor setting. JBS&G (2015) concluded that the soil contamination hotspots were successfully remediated. JBS&G (2015) reported that future development will require remediation to manage access to asbestos-impacted soil, volatile organic compound (VOC) impacted groundwater and provide measures for gas mitigation in buildings. It was known that asbestos was present on the site, however, no asbestos quantification had been completed to assess the requirements, if any, for managing asbestos in future site development. Similarly, while it was assumed that soil gas would be present at the site, no site-specific data was available.

JBS&G (2018) subsequently completed an asbestos and vapour assessment of the site that identified the presence of bonded and friable asbestos in concentrations exceeding applicable assessment criteria. It was recommended that a Remediation Action Plan (RAP) be prepared to manage potential risks from asbestos containing material (ACM) and friable asbestos/asbestos fines (FA/AF) in soils, and potential risks from soil vapour and ground gas, to render the site suitable for commercial/industrial development of the site. It was also concluded that a long-term Environmental Management Plan (EMP) will be required for on-going management of the identified contaminants in soil, soil vapour/gas and groundwater.

It is noted that the site is impacted by flooding and the proposed development will require building on a suspended slab with a large open void beneath. The presence of a large open void will provide a passive venting system for gas mitigation into buildings. The proposed development plans, including architectural and civil plans, are provided in **Appendix B**.

This RAP has been prepared in accordance with the requirements of NSW Environment Protection Authority (EPA) endorsed guidelines.

1.2 Background

A summary of the historical land use activities and site layout prior to the preparation of URS (2008a) was provided in a report on Further Contaminated Soil/Fill Delineation Investigation prepared by Golder Associates (Golder 2011). Relevant information, with respect to the decision rules provided in **Table 4.1**, and potential for migration of contaminants from the site, provided in Golder (2011), is presented below:

Southlands is an undeveloped parcel of land owned by Orica. Orica purchased the site in 1980 from Australian Paper Manufacturers Limited (APM) (<http://www.oricabotanytransformation.com>). The site is divided by Springvale Drain and Nant Street, into two blocks, Blocks 1 and 2. Springvale Drain is a north to south trending man-made drainage feature and surface water conduit. Nant Street is an unsealed roadway adjacent to Springvale Drain that provides access to Southlands from the McPherson Street site entrance to the Qenos Pty Ltd (Qenos) tank farm, located to the north of Southlands.

Groundwater beneath Southlands and the up-gradient Botany Industrial Park (BIP) is contaminated with chlorinated hydrocarbons (CHCs) as a result of historical BIP manufacturing activities. Orica is now responsible for managing the groundwater contamination and has established the Botany Groundwater Cleanup Project to hydraulically contain the contaminated groundwater to prevent it from entering Botany Bay and to treat the groundwater to usable standard at a Groundwater Treatment Plant (GTP). Various infrastructure, including above ground pipe lines, monitoring wells and groundwater extraction bores, associated with the Botany Groundwater Cleanup Project are located on Southlands. These are principally located along the McPherson Street site Boundary and the western margin of Springvale Drain. Groundwater is extracted and is pumped via pipelines to the GTP located on BIP to the north east of Southlands.

The site is the last remaining portion of what had been known as Southlands, to be developed. Other areas of the former Southlands were redeveloped in the last 5 years for commercial/industrial use.

An EPA Accredited Site Auditor has been engaged by Orica to review the RAP and to provide the Section B Site Audit Statement and Site Audit Report, as required by the SEARs.

1.3 Objectives

The objective of this RAP is to document the procedures and standards to be followed in order to manage the risks posed by contaminated soil and groundwater and associated vapours/gas, to make the site suitable for the proposed commercial/industrial land use, while ensuring the protection of human health and the surrounding environment.

Further the RAP is aimed at addressing the SEARs as required for SSD 9691 for the staged development of the subject site comprising:

- a suspended concrete platform above the flood detention basin to support warehouse buildings and hardstand / parking areas; and
- construction of two warehouse buildings for the storage and distribution of general merchandise including goods arriving from Port Botany.

2. Site Background

2.1 Site identification

The location of the site is shown in **Figure 1**, and site layout is shown in **Figure 2**. The site details are summarised in **Table 2.1** and described in more detail in the following sections.

Table 2.1: Summary Site Details

Lot/DP	Part Lot 9 in DP 1205673
Address	28 McPherson Street, Banksmeadow
Local Government Authority	Bayside Council
MGA Coordinates (GDA 94 - MGA56) of approximate centre of the site	E: 335680 N: 6242175
Site Zoning	IN1 – General Industrial under State Environmental Planning Policy (Three Ports) 2013
Previous Use	The site has been subject to historical sand/peat mining and subsequent filling.
Proposed Use	Commercial/industrial landuse
Site Area	Approximately 41 000 m ²

2.2 Site Description

Current access to the site is via Nant Street, which adjoins the western boundary of the site and is accessed off McPherson Street. Access to Nant Street is via locked, steel security gate. The site is secured with an approximately 1.8 m high chain wire mesh fence. Access onto the site is via a locked gate near the northern extent of the Nant Street boundary. The site is vacant land, which is utilised as compensatory flood storage. The site surface has a maintained vegetation cover.

Underground infrastructure (access road, pipeline, extraction and monitoring wells) associated with the Botany Groundwater Cleanup Project (BGCP) is located in a gravel road at the southern end of the site.

2.3 Surrounding Land Use

The site surroundings are described under the following headings.

North

The site is located to the south west of a Detector Dog Facility (Department of Agriculture, Border Force, Federal Police). Beyond the Detector Dog Facility is Botany Industrial Park (BIP), separated by the Sydenham – Botany Goods Railway Corridor. Several businesses have chemical manufacturing and distribution facilities in the BIP.

A Qenos Pty Ltd (Qenos) owned tank farm facility known as the Nant Street Tank Farm is located immediately to the north of the Border Force facility. A former Tank Farm (now demolished) operated by Mobil is located to the north west of the site. Underground pipelines leading to the tank farms are present in Nant Street.

Located approximately 0.4 km due west of the former Mobil Terminal is another chemical business, Nuplex Industries (Aust) Pty Ltd. Nuplex has frontage on Stephen Road.

West

The western boundary of the site is formed by Nant Street. Beyond Nant Street is Springvale Drain and warehouses recently constructed on land that formed Stage 1 of the Southlands development and now owned by Goodman, comprising warehousing facilities. A chemical manufacturing facility owned by Solvay Interlox Pty Ltd (Solvay) is located to the west of Stage 1/Block 2, separated by Floodvale Drain. Beyond Solvay, is an industrial estate.

South

McPherson Street forms the southern boundary of the site. Beyond McPherson Street, there is a shipping container storage facility operated by Toll. Beyond the Toll holding facility to the south is a commercial/industrial estate.

East

The Detector Dog Facility and a new 8 unit warehousing facility (currently under construction) are present to the east of the site. These facilities were constructed on land that formed Stage 2 of the Southlands development. Beyond these facilities is a narrow strip of land owned by Orica associated with the BGCP. The Sydenham to Botany railway line is located beyond this land with a waste transfer facility located beyond the rail line.

2.4 Topography, Geology and Hydrogeology

Detailed descriptions of site topography, geology and hydrogeology are provided in the Orica Conceptual Site Model (CSM) (Orica 2017). A summary is presented in the following sections.

2.4.1 Topography

The site is located on an area of former sand dunes and coastal swamps within the Botany Basin. The local topography generally slopes down towards the south west and Penrhyn Estuary, from a relative high point of 20 m Australian Height Datum (AHD) at the eastern side of BIP, down to elevations of less than 4 m AHD at and to the south of Southlands (WWC 1996a).

The Southlands property (of which the site is part) formed part of an extensive low lying (<4 m AHD) area to the west of BIP, which was formerly referred to as Veterans Swamp, prior to construction of the Springvale and Floodvale Drains during the 1940s (WWC 1996a). The drains were designed to assist in the drainage of the former swamp and both discharge into Botany Bay via Penrhyn Estuary, which was formed by the reclamation of the Port Botany Container Terminal area.

2.4.2 Local Geology

Botany Basin

The Botany Basin occupies an area of approximately 80 square km and lies to the south of the city of Sydney. It is bounded by Centennial Park to the north, Randwick and Matraville in the east, Alexandria and Rockdale to the west and Kurnell Peninsula to the south (WWC 1996b).

Quaternary sediments in the basin reach thicknesses of up to 80 m. The sediments were deposited on a surface eroded into the Hawkesbury Sandstone and the thickest sediments infill palaeodrainage features incised into that surface. One such feature, the "Lakes Valley Palaeochannel" has been inferred by geophysics and confirmed by drilling (WWC 1996a) to lie to the west of the BIP / Southlands area.

The Quaternary sediments generally comprise predominantly unconsolidated to semi-consolidated permeable sands, interspersed with discrete layers of low permeability peat and peaty sands (WWC 1996a).

2.4.3 Local Hydrogeology

The site is located on the Botany Sands which contains a system of unconfined and semi-confined unconsolidated aquifers with varying yields that are referred to as the Botany Aquifer. They are interconnected vertically via leakage through the confining peaty layers (WWC 1996b).

The site is located within the Botany Basin Groundwater Extraction Exclusion Area, where groundwater is known or suspected to be contaminated by CHCs and groundwater extraction is prohibited.

3. Summary of Previous Remediation Works and Additional Assessments

The validation report (JBS&G 2015a) detailed the remediation works undertaken at the site to remove areas of soil contamination as identified in the Block 2 RAP (JBS&G 2014a) and further delineated by JBS&G (2014b). **Table 3.1**, as extracted from the validation report (JBS&G 2015) summarises the locations areas identified in the Block 2 RAP (JBS&G 2014a) that required remediation. It is noted that the table includes some locations that are not located on the site. All locations described in **Table 3.1** were successfully remediated.

Table 3.1: Summary of Areas Remediated during Site Works

Sampling Location	Contaminant of Concern	Location
GETRS06 (Area 3)	Mercury	On-site
TP31 (Area 4)	Lead	On-site
GETP38 (Area 8)	TRH	Not on-site
TP14 (Area 5)	TRH	Not on-site
TP127 (Area 7)	Lead	Not on-site
TP81, TP82, GEHA54 and GEHA 55 (Area 10)	TRH	On-site
GETP25 (Area 11)	TCE	Not on-site
GETP31 (Area 11)	VCHs	Not on-site
TP105 (Area 11)	VCHs	Not on-site
TP29 (Area 11)	VCHs	Not on-site
TP37 (Area 11)	VCHs	Not on-site
GEHA32 (Area 11)	TRH	Not on-site
HA01 and HA02 (Area 11)	HCB	Not on-site
GETP23 (Area 11B)	TRH	Not on-site

Based on the approach for remedial excavations set out in the RAP (JBS&G 2014a), all remedial areas were suitably validated based on either delineation sampling results (JBS&G 2014b) where the excavation had not intercepted groundwater, or, where the remedial excavation had intercepted groundwater, it was considered to have been advanced to the extent practicable and therefore appropriately remediated.

JBS&G (2015a) concluded that, provided future site development incorporates remediation measures to manage access to asbestos-impacted soil, impacted groundwater and measures for gas mitigation in buildings, and an appropriate plan is implemented to manage exposure to the remaining contamination issues, it is considered that the site can be made suitable for commercial and industrial landuse.

3.1 Asbestos Quantification, Soil Vapour and Ground Gas Assessment

JBS&G (2018) reported results of asbestos quantification at one hundred locations, and soil vapour and ground gas assessment at six locations at the site. The results of the asbestos quantification indicated the presence of ACM and/or FA/AF at twenty locations exceeding the commercial/industrial criteria. Soil vapour sampling indicated the presence of 1,1-dichloroethane at one location and elevated carbon dioxide at three locations exceeding applicable criteria. It was concluded that ACM and FA/AF in soil, and CHCs and carbon dioxide in soil vapour/gas, and impacted groundwater pose a human health risk to potential, future site receptors. It was recommended that a RAP be prepared to manage potential risks from the identified contaminants to render the site suitable for commercial/industrial development of the site.

3.2 Human Health Risk Assessment Revision (EnRiskS 2019)

The site formed part of a larger parcel of land previously referred to as Southlands, which comprised two parcels of land referred to as Block 1, which included the site, located to the east of Springvale Drain and Nant Street and Block 2, located to the west of Springvale Drain and Nant Street. In 2008, URS Australia Pty Ltd (URS) completed a Human Health Risk Assessment (HHRA) (URS 2008b) for the proposed staged development of the Southlands property. A HHRA (EnRiskS 2013) was

subsequently prepared by Environmental Risk Sciences (EnRiskS) to address potential risk issues associated with development of Block 2 Southlands. Following completion of remediation works on Block 1, as reported by JBS&G (2015), development of part of Block 1 for commercial/industrial use was proposed. EnRiskS subsequently completed a HHRA (EnRiskS 2015) to address human health risks specific to development of Block 1 based on development plans that included a large flood detention basin (the site), that was open space, adjacent to Nant Street, with commercial/industrial warehouses on the remainder of Block 1.

The HHRA (EnRiskS 2015) did not include assessment of commercial/industrial development on the site, therefore, EnRiskS (2019) was undertaken to assess human health risks issues specifically relevant to the proposed development of the flood detention basin, based on building construction on a suspended slab with a large open void beneath.

Based on the information available at the time EnRiskS (2015) was conducted, EnRiskS (2019) identified the following risk issues that may warrant further consideration in relation to the proposed site development:

- Direct contact with soil;
- Inhalation of vapours that may be derived from the migration of volatile contaminants in shallow groundwater beneath the site into the proposed buildings (i.e. vapour intrusion);
- Inhalation of vapours that may migrate onto Lot 9 from the presence of volatile chemicals in surface water within Springvale Drain, located on the western side of Nant Street; and
- Exposure to hazards associated with landfill gas in the subsurface beneath the site and other areas of former Block to the east.

EnRiskS (2019) noted that based on the proposed development there will be no potential for any direct contact with groundwater or flood water. In addition, EnRiskS (2019) acknowledged that an appropriate management plan would be implemented to manage risk to construction and other intrusive maintenance workers from exposure to subsurface contamination on the site, and these potential exposures were not considered in EnRiskS (2019).

The HHRA revision (EnRiskS 2019) was based on historical site data and the following additional data that were not available at the time EnRiskS (2015) was completed:

- Proposed development plans prepared by Axis Architectural, dated January 2018;
- Soil vapour data and sample locations relevant to sampling works completed by JBS&G (2018); and
- Groundwater and surface water data available to September 2018, provided by Golder Associates.

Based on review of available data, EnRiskS (2019) concluded that:

On the basis of the review undertaken in relation to the proposed development of Lot 9 of Southlands Block 1, which comprises a commercial/industrial development on a raised concrete slab over the flood detention basin, and the available data in relation to contamination, there are no human health risk issues of concern. On this basis, there are no requirements to design and implement any risk management/mitigation measures for the proposed development. It is noted that should the proposed development change, then the assessment of risks to human health may need to be revised.

4. Remediation Requirement

As summarised in **Section 3**, remediation of contamination soil hotspots has previously been undertaken at the site. Due to the presence of ground gases (primarily carbon dioxide), dissolved phase chlorinated hydrocarbon groundwater plumes, and chlorinated hydrocarbon soil vapour, gas mitigation is required to prevent vapour intrusion for buildings proposed to be constructed on the site. It is noted that gas mitigation will be achieved in the proposed development by construction of a building on a suspended slab with a large open void beneath. The presence of a large open void will provide a passive venting system for gas mitigation into buildings. Remediation will be also required to manage asbestos in soil.

5. Remediation/Management Methodology

5.1 Remediation Requirement/Objective

The remediation requirement/objective for the site is the same as stated in Section 4.2 of URS (2008a). That is, the objective for the proposed remediation works is to remove or manage risk posed to future site occupants by making the site suitable for the proposed commercial/industrial land use. Following the completion of the hotspot remediation and validation works (JBS&G 2015), the results of asbestos quantification and soil vapour/ground gas monitoring works (JBS&G 2018), and on the basis that access to groundwater is managed/excluded, the following require remediation/management:

- asbestos in fill material;
- ground gases (carbon dioxide);
- potential vapour intrusion of volatile chlorinated hydrocarbons.

5.1.1 Guidance Framework

The approach adopted in this RAP is consistent with the preferred hierarchy of options for site clean-up and/or management provided in NEPC (2013), which are listed as follows:

- on-site treatment so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
- off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site; or

if the above are not practicable,

- consolidation and isolation of the soil on-site by containment within a properly designed barrier; and
- removal of contaminated soil to an approved site or facility, followed where necessary, by replacement with appropriate material;

or

- where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

With respect to in-situ management of contamination via an Environment Management Plan (EMP), NSW EPA (2017) states that:

An EMP can be an effective means of ensuring the environment is protected, users of the site are not exposed to contamination remaining on site and the site remains suitable for the proposed use when:

- *complete remediation of contamination affecting an area is not practicable (for example low levels of contamination under a concrete slab)*
- *contaminants are being capped or contained on site*
- *remediation is likely to cause a greater adverse impact than would occur if the site were left undisturbed.*

5.1.2 Asbestos Management Options

Asbestos impacted soils are widespread across the site, and require specific consideration in the development of a remediation strategy for the site.

The 'Code of Practice: How to Manage and Control Asbestos in the Workplace' (Safe Work Australia (SWA) 2011) provides practical guidance for persons conducting a business or undertaking on how to manage risks associated with asbestos and ACM at the workplace and thereby minimise the incidence of asbestos-related disease.

The code of practice (SWA 2011) provides general guidance on ways to minimise or eliminate risk of exposure to asbestos and recommends following a risk management process involving:

- Identifying whether asbestos or ACM is at a workplace;
- Including them in the asbestos register;
- Assessing the risk of exposure; and
- If necessary, implementing appropriate control measures.

The Code (SWA 2011) also provides the following hierarchy of controls that must be considered with respect to managing the risks associated with asbestos:

- Eliminating the risk (i.e. asbestos removal).
- Substituting the risk (isolation of asbestos by applying engineering controls).
- Using administrative controls.
- Using personal protection equipment (PPE).

The 'Management of Asbestos in the Non-Occupational Environment' (EnHealth 2005) provides guidance on the application of controls in residential areas. EnHealth (2005) presents the view that buried asbestos (left undisturbed) does not present a risk to health, rather the risks depend on the potential for disturbance and generation of airborne asbestos which may be inhaled.

EnHealth (2005) notes the following in relation to land contaminated with asbestos:

- It is impractical to propose that a site can be free of asbestos fibres. Risk assessment and management is required before sites can be declared acceptable for unrestricted use;
- No site criteria values were recommended as there was insufficient and unreliable data; and
- Health risks from ACM in soil will depend on the potential for asbestos fibres to be disturbed, become airborne and be inhaled.

Specific management options EnHealth (2005) presents include:

- Isolation of the soil by covering with a properly designed barrier;
- Choosing a less sensitive land use;
- Leaving contaminated material in situ providing there is no immediate danger to the environment or community; and
- Removing contaminated soil to an approved site or facility.

EnHealth (2005) acknowledges the removal of ACM fragments mixed with other fill involves the excavation and disposal of considerable amounts of other material and, in many situations, is not economical.

5.1.3 Discussion of Asbestos Management Options

Brief discussions of the appropriateness of each of the remediation options listed in the preferred hierarchy of options in NEPC (2013), are provided below.

Asbestos at the site has been identified as being present in both a bonded and friable form and is widespread across the site (JBS&G 2018). From review of asbestos management options provided in SWA (2011) and EnHealth (2005) it is considered that the preferred two remediation options provided in the NEPC (2013) are not applicable to asbestos in soil at the site. That is, there are no on-site or off-site treatment technologies available which destroy or reduce the hazards to an acceptable level, other than screening/picking/sorting. Further, since fill material present at the site has been identified to contain asbestos fibres or asbestos fines, it is considered that removal of asbestos fibres from the fill material would not be achievable. These options are not applicable due to the nature of the asbestos present in the fill and therefore the remediation would not be achieved.

Of the secondary preferred remediation options, it is considered that asbestos impact may be addressed by the excavation of all fill materials considered to potentially contain asbestos impact. However, excavation and off-site disposal is considered to be:

- not economically viable due to the large quantity of fill materials at the site; and
- impracticable because impacted fill is located both above and beneath groundwater at the site and excavation beneath the groundwater is impracticable.

Consolidation and isolation of the soil on-site by containment within a properly designed barrier is considered to be the most appropriate remediation option for asbestos-impacted fill at the site. This remediation option will minimise soil disturbance and therefore public risk and, therefore, as noted in Section 4.11 of Schedule B1 (NEPC 2013), is a preferred remediation option for asbestos.

5.2 Gas Mitigation

Taking into consideration the highest concentration of carbon dioxide (13% v/v) recorded in soil vapour (JBS&G 2018) and assuming a flow rate of 1 L/hour, noting that no flow was recorded in the soil vapour points, a gas screening value (GSV) of 0.2 was calculated as set out in NSW EPA (2012). As per the modified Wilson and Card classification provided in Table 6 of EPA (2012), a GSV of <0.7 L/hr provides a low risk characteristic gas situation (CS) of 2. Table 7 of EPA (2012) provides a required gas protection guidance value of 1 for large commercial (warehousing) and industrial buildings where there is a CS of 2. Table 8 in EPA (2012) provides scores for various protection measures for gas mitigation, with a rating of 4 for an undercroft, which is equivalent to the large open void that will be part of the proposed building design for the site. Therefore, a sub-slab void is considered suitable for gas mitigation into the proposed building at the site.

5.3 Factors Potentially Affecting Contaminant Migration

Two variations for preliminary concept piling designs have been provided for the proposed development. A copy of the concept piling designs is provided in **Appendix C**. These piling design variations are based on either:

- Groups of 5 x 300 mm diameter driven timber piles concrete capped at ground level as a base for concrete columns on an approximately 11.5 m spacing to support construction of a suspended, 250 mm thick concrete slab building platform. The distance between the four outer piles in each five pile grouping and the centre pile is approximately 440 mm; or
- Single 300 mm diameter driven timber piles on an approximately 5 m spacing to support construction of a suspended, 300 mm thick concrete slab building platform.

It may be considered that piling has the potential to create preferred pathways for migration of contaminants in the vapour, dissolved and dense non aqueous-phase liquid (DNAPL) phases. The following sections address the potential for the proposed piling to affect migration of contamination present on the site in the vapour phase, dissolved liquid phase and DNAPL.

A report on a geotechnical assessment of the required piling depth for the proposed development was prepared by Pells Sullivan Meynink (PSM, 2019). A copy of the PSM report is provided in

Appendix D. PSM identified the following general subsurface conditions at the site:

- An upper layer of loose fill, peat and loose sands with a thickness of around 0 to 6 m; underlain by
- An intermediate layer comprising predominately dense sands with intercalated peat, sandy peat and peaty sand layers of between 10 and 20 m; underlain by
- A basal zone of clayey sand and sandy clay with discontinuous layers of gravel, peat and peaty clay.

The identified soil layers are underlain by sandstone bedrock.

From review of cone penetrometer tests (CPT), PSM (2019) estimated the depth to dense sand is around 5 to 6 m bgs. PSM expected that that driven timber piles may need to extend 3 to 4 m into the dense sand to achieve desired loads for the proposed development.

5.3.1 Potential for Vapour Migration due to Piling

The potential for vapour migration from piling has been considered in Wilson and Mortimer (2018). The focus of Wilson and Mortimer (2018) is to assess the potential impacts for ground gas migration related to piling through clay layers. It is noted that the site does not directly fit this scenario, however, the fundamental findings regarding the potential for an increase in ground gas migration from piling is applicable to the site soils.

The source of vapour impacts at the site are groundwater derived, with depth to groundwater between 1 to 2 m bgs with the upper layer of material (0-6 m bgs) comprising loose fill (PSM 2019). Therefore, vapour migration at the site is diffusion driven.

Wilson and Mortimer (2018) report that:

If a pile is driven into a gas source that is not confined and gas is freely venting to atmosphere, then it should not form a preferential pathway even if an annulus develops around the pile.

Wilson, S. and S. Mortimer (2018) also note that:

Where the source of ground gas is a low generation material such as Alluvium, Made Ground and older landfill sites, flow through the ground to the underside of a building is usually driven by diffusion (i.e. based on a concentration gradient). In these ground conditions pressure driven flow only occurs when the gas reaches the underside of the floor slab and stack pressures occur. It is not relevant when considering migration up piles (unless the gas source is under pressure).

Previous ground gas monitoring on adjoining land to the east indicated that ground gas is not pressure driven and positive pressure was only recorded in gas monitoring wells following rainfall events with sufficient rainfall to raise groundwater levels, pushing ground gas out of the unsaturated, overlying soils. The unsaturated zone on the site is limited to a metre or less and, therefore, there will be limited soil gas driven out of the unsaturated zone during periods of rising groundwater levels. Taking into consideration that soil vapour migration at the site is diffusion driven and the proposed development will not be slab on ground construction, pressure driven flow

of soil vapour into buildings cannot occur. Therefore, piling required for site development will not affect soil vapour migration.

5.3.2 Potential Effects of Piling on Dissolved Phase Contamination

On the same basis (such as the increase in density of soil/sand around the pile) that piling does not result in significant migration of ground gas/vapour it is also unlikely to result in the redistribution of contaminated groundwater in the subsurface.

In addition to the above, it is noted that a detailed assessment of the interaction of shallow groundwater and Springvale Drain was presented JBS (2013). The assessment presented the following summary:

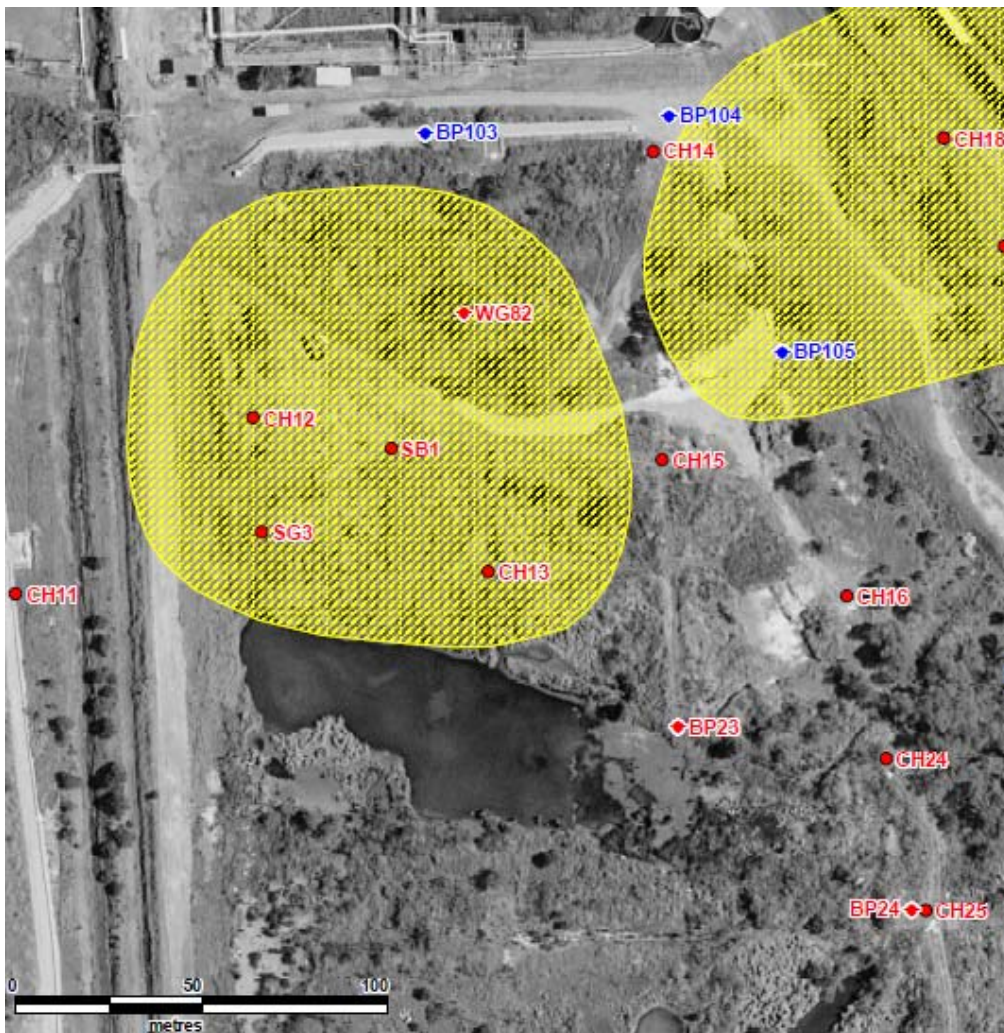
- *“Prior to operation of the Groundwater Treatment Plant (GTP) groundwater that discharged into the drain was characterised by relatively high dissolved CHC concentrations. The elevated CHC concentrations were a result of the upward flow of deep groundwater into the shallow aquifer that subsequently discharged into the drain.*
- *Operation of the GTP has resulted in changes to the pattern of groundwater flow near Springvale Drain. During GTP operation groundwater flow downward from the shallow aquifer into the deep aquifer. In addition, when water levels are below the invert of the drain relatively clean surface water enters the aquifer and creates a freshwater lens (this process also occurs beneath the depressions on Block 1). The combination of these two processes has resulted in significant decreases in CHC concentrations in shallow groundwater adjacent to Springvale Drain.*
- *In contrast to the period prior to GTP operation elevated shallow groundwater levels at Southlands no longer result in the discharge of highly contaminated groundwater into Springvale Drain. Discharged water is now characterised by relatively low CHC concentrations...”*

Recent groundwater data collected as part of the GTP groundwater and surface monitoring program (Golder 2017) confirms that concentrations of chlorinated hydrocarbons in groundwater collected from depths shallower than 12 m below ground level at the site remain low (<10 mg/L). While deeper groundwater at the site is characterised by higher contaminant concentrations the current levels (of the order of 20 to 100 mg/L) are substantially lower than those historically reported (>1000 mg/L)

As vertical hydraulic gradients at the site have been demonstrated to be downwards and concentrations of contaminants in shallow groundwater are lower than those in the deeper system piling (to any depth) will not result in unacceptable changes to the distribution of dissolved phase contamination at the site.

5.3.3 Potential Effects of Piling on DNAPL Distribution

Detailed assessments of the distribution of dense non-aqueous phase liquid (DNAPL) have been undertaken at the site. The figure below has been taken from URS (2006) and shows a summary of investigation locations WG82, CH12, CH13, SB1, SG3 and SG4) where DNAPL has been positively identified.



At locations on the site, DNAPL was observed (as liquid or as positive dye tests) at the following depths;

- WG82 – from 13 to 14 m (positive dye test) and at 21.5 m (liquid in drilling mud);
- CH12 – from 23.9 to 24.0 m (positive dye test);
- CH13 – from 21.85 to 21.9 m (positive dye test);
- SB1 (SG1) – from 21 to 23 m (liquid in pore water). An elevated soil concentration was also identified in a thin band at 10 m at this location although DNAPL was not directly observed;
- SG3 – from 21 to 24 m (based on soil concentrations); and
- SG4 - - at a thin band at 21 m and from 25.6 to 25.8 m (liquid in pore water).

As the positive identification of DNAPL is limited to significant depth (>13 m but typically at 21 m) and the pile design indicates that pile depths will be of the order of 10 m it is considered that the piling will have no significant effect on the distribution of DNAPL at the site.

5.4 Preferred Remediation Approach

With consideration to established hierarchies for soil remediation options, and to the site-specific contaminants and proposed environmental setting, the preferred remediation strategy for the site comprises:

- On-site containment of fill materials impacted by bonded (i.e. ACM) and friable (asbestos fines) asbestos using marker and barrier layers across the site, with the exception of an

existing vegetation buffer along the eastern portion of the site that will be retained in its current state and secured with a fence to minimise access; and

- Management of potential soil vapour intrusion into buildings by construction of any buildings on a suspended slab with a large open void beneath, which will provide a passive venting system for gas mitigation into buildings.

5.5 Underground Services

All existing services on the site will be located and surveyed, by suitably qualified contractors, in order to avoid intercepting services during remediation works and to enable incorporation of service and easement locations into the long-term EMP. Any new services to be installed on the site will be installed on the underside of the suspended slab or in the void to minimise disturbance of the barrier layer

5.6 Barrier System

Although the site has been subject to previous site investigations and identified hotspots have been remediated, a barrier system is required to manage the asbestos in soils. An approach that is common to commercial industrial sites, the barrier will comprise at minimum a marker layer separating potentially impacted soils from a physical barrier layer. With the exceptions of an existing vegetated batter along the northern, eastern and southern sides of the site, a barrier layer will be located in all areas of the site. The barrier requirements are discussed in the following sections.

5.6.1 Marker Layer

A marker layer comprising a bright orange geotextile, such as bidim or similar geotextile approved by the Site Auditor, is to be installed prior to placement of the barrier layer.

5.6.2 Physical Barrier

To minimise any potential off-site disposal of soils and to retain the required flood capacity of the site, the physical barrier requirements across the site will be based upon future accessibility of site areas. The following four areas, as shown on **Figure 3**, have been identified based on barrier layer requirements:

- A 0.1 m barrier layer will be required beneath the suspended slab across the undercroft. The barrier layer in this area will comprise a porous material, to allow infiltration of detained floodwater, that will be required to be stable for capping purposes and to provide vehicular access. Alternatively, a layer of stabilised roadbase or similar material may be placed over most areas, with placement of porous materials over selected areas evenly distributed across the site to allow infiltration of detained floodwater. This area will be secured with fencing to prevent casual access.
- A 3 m wide emergency vehicle access road adjacent the northern and eastern sides of the proposed building platform. A minimum 0.1 m barrier layer is required in this area. It will comprise a compacted roadbase material or similar that will provide a stable vehicular accessway. Because this area will be for emergency access, including a potential emergency exit path for site workers, it cannot be locked to prevent casual access. Therefore, the capping material in this accessway will require stabilisation with a bituminous spray seal to prevent access to the underlying material.
- An approximately 5 m wide Orica easement along the western boundary of the site that will be landscaped. It is intended that this area is left in its current state without marker or barrier layers, and access will be restricted by secured fencing. The 10 m wide strip of land along the southern McPherson Street frontage will be subdivided and maintained in Orica ownership.

- An approximately 7 m wide strip of vegetated batter is present along the northern and eastern boundaries of the site, and approximately 10 m wide Orica easement along the southern boundary of the site. It is intended that those areas be left in their current state without marker or barrier layers. Access to these areas will be restricted by secured fencing. The 10 m wide strip of land along the southern, McPherson Street frontage will be subdivided and maintained in Orica ownership as it contains infrastructure associated with Orica's hydraulic containment system.

It is noted there are two surface stormwater entry points on the eastern boundary of the site as shown on **Figure 3**. The ground surface in these areas will be treated with appropriate erosion control measures.

5.6.3 Erosion Control

Two surface water drainage points from adjoining land to the east, enter along the eastern boundary of the site. Detailed drawings for erosion control at these discharge points will need to be prepared by the developer for review and approval by the Auditor.

5.7 Vapour/Gas Mitigation System

The site provides flood storage capacity, which must be retained for any proposed site development. Therefore, any buildings constructed on-site necessitates construction on a suspended slab with an undercroft, which will provide a passive venting system for gas mitigation into buildings. The design for the proposed development provides an undercroft with a clearance of between 1.5 and 2.5 m across the construction area. Orica have required, generally a 2.5m clearance across most of the undercroft.

It is understood that building construction on a suspended slab will require pile foundations installed on approximately 10 m spacings and that material will be imported to site to form a platform for the piling rig, also forming the physical barrier.

5.8 Waste Classification and Off-Site Disposal of Soils

During remediation works, confirmation of waste classification will be completed as necessary to ensure material is removed and disposed of from the site appropriately. Soils to be disposed off-site shall require a waste classification in accordance with NSW EPA (2014). **Table 6.2** summarises the sampling density for offsite disposal of soil.

All fill materials at the site are considered to contain asbestos. Therefore, any fill material to be disposed off-site is to be classified as Special Waste (asbestos waste). Additional analysis will be required for other Contaminants of Potential Concern (COPCs) to provide adequate waste classification.

Surplus soils from the site will be disposed off-site to a facility licensed to accept the waste.

5.9 Backfilling of Excavations and Barrier Layer

Materials used to level the site prior to placement of the marker layer can be sourced from on-site materials above the groundwater level. Any materials used to form the barrier layer shall be imported from off-site. It is anticipated that reinstated soils will need to meet compaction standards suitable for the proposed redevelopment of the site as specified by the project geotechnical consultants or structural engineer. Where vegetation is required to be grown in the area of fill placement, the soils will also need to be suitable for use as growing medium. Material to be imported onto the site is required to be either virgin excavated natural material (VENM) or considered suitable for beneficial reuse, such as material compliant with an appropriate EPA waste exemption approval (e.g., excavated natural material (ENM)). ENM shall not be used as a component of topsoils unless expressly approved by the site auditor.

The site history of the proposed VENM source will be reviewed and the source area will be inspected. The site history review and inspection will assess whether any activities (historic or current) undertaken at the site may potentially have caused contamination of the source material.

Appropriate documentation of the VENM or ENM classification of any imported material will be required prior to receipt on site, and will require inclusion in the Validation Report.

5.10 Validation

Validation sampling and analyses will be conducted to verify any unexpected finds have been appropriately remediated and to verify materials imported to form the barrier layer are suitable for use at the site.

The requirements for validation sampling are detailed in **Section 6**.

5.11 Unexpected Finds

The possibility exists for residual hazards to be present at the site. Environmental sampling is based on chemical analytes identified as a potential concern during a documented process of reviewing historical site activities. However, ground conditions between sampling points may vary, and further hazards may arise from unexpected sources and/or in unexpected locations. Typical examples of unexpected finds may include underground storage tanks (USTs), buried drums, industrial residues etc.

As a precautionary measure to ensure the protection of the workforce and surrounding community, should any of the abovementioned items be identified (or any other unexpected potentially hazardous substance), the procedure summarised in the Flow Chart provided in **Appendix A**, shall be followed.

An enlarged version of the unexpected finds protocol (UFP), suitable for use on site, should be posted in the Site Office and referred to during the Site-Specific Induction by the Principal Contractor.

The sampling strategy for each “unexpected find” shall be designed by a suitably qualified environmental consultant. The strategy will, however, be aimed at determining the nature of the substance – that is, is it hazardous and, if so, at what concentrations might it pose an unacceptable risk to human health or the environment.

The sampling frequency of the identified substance / materials shall meet the minimum requirements of NSW EPA (1995). Reference shall be made to EPA (1995) as required to derive statistically valid sampling strategies for validation on the unexpected find area, including use of Section 4.2 of that document to determine the required number of validation samples for each unexpected find area.

6. Validation Plan

6.1 Data Quality Objectives

Data quality objectives (DQOs) have been developed for the validation assessment, as discussed in the following sections.

6.1.1 State the Problem

Validation of remediation works undertaken at the site indicate that, with the exception of asbestos in soil, the areas of contaminated soil have been successfully remediated in accordance with the RAP (JBS&G 2014a). The asbestos-impacted fill and potential vapour intrusion risk, from soil and groundwater, into buildings to be constructed on the site require remediation/management in order to make the site suitable for the proposed commercial/industrial landuse.

The potential impacts from these contaminants will be the basis for an Environmental Management Plan to be prepared for the site.

6.1.2 Identify the Issue

Based on the decision-making process for assessing urban redevelopment sites detailed in EPA (2017), the following decisions must be made:

- Are there any unacceptable risks to likely future onsite receptors from soil?
- Are there any impacts of chemical mixtures?
- Are there any aesthetic issues?
- Is there any evidence of, or potential for, migration of contaminants from the site?
- Is a site management strategy required?
- Is the site suitable for the proposed commercial/industrial landuse?

While not strictly tied to the validation program, the following decision is also required to assess the adequacy of the remediation works as a whole:

- Have the surplus materials, if any, removed from site been disposed to a landfill lawfully licensed to receive such material?

6.1.3 Identify Inputs to the Decision

The inputs to the decisions are:

- Physical observations, including visual and olfactory results during site activities;
- The results of previous investigations (**Section 3**);
- Soil analytical data from any imported fill;
- Soil analytical data for waste classification purposes for materials requiring off-site disposal; and
- Waste disposal documentation for surplus materials disposed off-site.

6.1.4 Define the Study Boundaries

The site is shown **Figure 2**. With the exception of the existing vegetated batters in the northern and eastern extents of the site, the lateral extent of the remediation works for the barrier and marker layers will cover the site. Gas mitigation measures will comprise building construction on a raised platform to incorporate an undercroft, which will be open on all sides. The vertical extent of remediation works will be limited to the thickness of the barrier layer.

6.1.5 Develop a Decision Rule

Imported Fill

Importation of soils will be required to form the barrier layer. Imported fill will either be accompanied by a letter classifying the material as VENM or ENM, or specially exempted imported soils/materials will be sampled as per the requirements set out in **Table 6.2** and compared against selected validation criteria provided in **Table 6.4**.

Gas Mitigation Controls

Construction on a suspended slab with an undercroft is proposed for the site. The construction method will provide a suitable passive venting system for gas mitigation into site buildings as reported in **Section 5.2**.

6.2 Decision Rules

The decision rules adopted to answer the decisions identified in **Section 6.1.5** are summarised in **Table 6.1**.

Table 6.1 Summary of Decision Rules

Decision Required to be Made	Decision Rule
1. Are there any unacceptable risks to future on-site receptors from any residual soil contamination?	At the completion of remediation works, asbestos in fill will remain across the site. Furthermore, impacted soil and groundwater underlying the site has the potential to generate vapours/ground gases that could potentially impact occupants of future site buildings. Control measures will be required to manage these risks. If the required control measures have been installed, the decision is No. If the required control measures have not been installed, the decision is Yes.
2. Are there any chemical mixtures?	Is there more than one group of contaminants present which increase the risk of harm? If there is, the decision is Yes. Otherwise, the decision is No.
3. Are there any aesthetic issues?	If there are any unacceptable odours or soil discolouration, the decision is Yes. Otherwise, the decision is No.
4. Is there any evidence of, or potential for, migration of contaminants from the Site?	As noted in Section 1 , impacted groundwater located beneath the site is associated with upgradient contamination that is the responsibility of Orica. What is known as the Primary Containment Area (PCA), a line of groundwater extraction wells, is located along the southern boundary of the site and is used for groundwater remediation works being undertaken as part of Orica's Botany Groundwater Cleanup Project. Therefore, off-site migration is an issue that does not require assessment at the site as this issue is being managed by Orica under an agreed Voluntary Management Proposal (VMP).
5. Is a site management strategy required?	Was the answer to any of the above decisions Yes? If Yes, a site management strategy is required. If No, a site management strategy is not required. The requirement for site management can typically be precluded by remediation of the areas of environmental impact that causes a site decision to be yes. However, it is noted that potential asbestos-impacted materials remain on site and impacted soil and groundwater on-site has the potential to generate vapour/ground gases that could potentially impact occupants of future site buildings. Therefore, the site will require a management strategy.
6. Were imported materials validated as being suitable for use on the site?	Fill/soil analytical data will be collected at the frequency specified in Table 6.2 and compared against validation criteria provided in Table 6.4 . Statistical analysis of the data in accordance with relevant guidance documents will be undertaken, where appropriate, to facilitate the decisions. If the material fails the criteria, the decision is No. If the material meets the criteria, the decision is Yes.
7. Were the excavated surplus fill and soils appropriately classified and disposed off-site to a facility licensed to accept the classified waste or lawfully allowed to receive such material?	Fill/soil analytical data will be compared against EPA (2014) criteria. Statistical analysis of the data in accordance with relevant guidance documents will be undertaken, where appropriate, to facilitate the decisions (as detailed above). Documentation from the operation receiving the material including the dates, tonnage and classification of the accepted material will be required to facilitate the decision. If the statistical criteria stated above are satisfied, the decision is Yes, and if receipts are provided recording the disposal of material to an off-site licensed facility, the decision is Yes. If the material fail the criteria, and no disposal receipts are provided, the answer is No.
8. Is the Site suitable for commercial/industrial land use?	The data obtained for the Site will be used to make an assessment of site suitability as per the decision making process set out in Appendix A of NSW EPA Guidelines for the NSW Site Auditor Scheme (3rd Edition)(EPA, 2017).

6.2.1 Specify Limits of Decision Error

This step is to establish the decision maker's tolerable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data. Data generated during this project must be appropriate to allow decisions to be made with confidence.

Specific limits for this project have been adopted in accordance with the appropriate guidance from the NSW EPA, NEPC 2013, appropriate data quality indicators (DQIs used to assess quality assurance / quality control) and standard procedures for field sampling and handling provided in other Australian state and federal guidance documents.

6.2.2 Optimise the Design for Obtaining Data

The purpose of this step is to identify a resource-effective field investigation sampling design that generates data that are expected to satisfy the performance criteria, as specified in the preceding steps of the DQO Process. The output of this step is the sampling design that will guide development of the field sampling and analysis plan. This step provides a general description of the activities necessary to generate and select data collection designs that satisfy decision performance criteria.

Validation data are required to be collected to verify:

- The effectiveness of the remediation works;
- Any contaminated soils retained on-site have been appropriately contained and managed;
- Any materials imported to backfill excavations, if required, or form the barrier layer are suitable for the proposed site use; and
- The condition of the site is suitable for the proposed future use.

The proposed soil sampling program is outlined in **Table 6.2**.

6.3 Summary of Proposed Validation Sampling and Analyses

The proposed validation sampling and analytical program is outlined in **Table 6.2**.

Table 6.2 Soil Validation Sampling Program

Item	Sampling Frequency			Analytes
	Excavation floors	Excavation Walls	Materials	
Waste Classification for Materials Requiring Off-Site Disposal	Not applicable (N/A)	N/A	1 / 100m ³	Heavy metals (arsenic, cadmium, chromium, nickel, lead, mercury - total and leachable) TRH PAHs (total and leachable) VCH SVCH Presence of asbestos containing materials
Unexpected finds	1 / 25 m ²	1 / 5 m (from each distinct horizon / material type)	N/A	As appropriate, depending on the location and characteristics of the unexpected find
Imported Soils (VENM)	N/A	N/A	1 / 250 m ³ Minimum 7 samples per distinct material per source site to enable calculation of 95%UCL _{avg} concentrations	Heavy metals – (arsenic, cadmium, chromium, copper, nickel, lead, zinc, mercury) TRH/BTEX PAHs OCPs/OPPs/PCBs Asbestos
Imported Soils (ENM)	N/A	N/A	As per the NSW EPA current Excavated Natural Material Order and Exemption	As per the NSW EPA current Excavated Natural Material Order and Exemption

95%UCL_{avg} – 95% upper confidence limit of the average concentration

Sampling Rationale

The sampling and analytical regime presented in **Table 6.2** is based on the following rationale:

- Soil sampling frequencies indicated are the minimum required. The soil data as generated by all data sets will be assessed, where appropriate, in accordance with Procedure B in Contaminated Sites Sampling Design Guidelines, NSW EPA, September 1995 (EPA 1995) to

ensure that an appropriate number of samples are obtained in order to show that the average concentration of each of the contaminants is below the adopted limits. Hence, the final adopted sampling regime will meet the requirements outlined in EPA 1995; and

- Imported material sampling frequencies exceed the minimum 1 composite sample requirement outlined in EPA 1995, and are based on having sufficient data to generate reliable 95%UCLavg concentrations. Procedure B (EPA 1995) will also be used to confirm that an appropriate number of samples have been obtained from each source type / material type to enable comparison against the appropriate criteria.

Sampling Methodology

Samples shall be collected by appropriately trained and experienced personnel from:

- Near surface depths of excavation walls and bases;
- Materials representative of stockpiled materials for waste classification purposes; and
- Materials representative of any VENM or ENM identified as potentially suitable for importation as fill.

Samples shall generally be collected using a hand trowel or equivalent, which will be thoroughly decontaminated using phosphate-free detergent and distilled water between each sampling location. Where deeper samples are required within large excavations, embankments or stockpiles, samples shall be collected using an excavator or equivalent. Samples shall be collected from the centre of the excavator bucket ensuring that no part of the sample has contacted the sides of the excavator bucket.

During the collection of soil samples, features such as seepage, discolouration, staining, odours and other indications of contamination will be noted on the field documentation. Soil samples will be screened on site during works using a photo-ionisation detector (PID) to assess the presence of volatile organic compounds (VOCs).

Collected soil samples will be immediately transferred to appropriate sample containers, that is, glass jars or plastic bags as required for asbestos analysis. Sample labels will record: job number; sample identification number; and date of sampling.

Sample containers will be transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody (COC) form will be completed and forwarded with the samples to the testing laboratory.

Soil validation samples shall be analysed by a primary laboratory which shall be NATA accredited for the required analyses. The secondary (check) laboratory responsible for analysing a certain proportion and type of QA/QC samples shall also be NATA accredited for the required analyses. Both laboratories will also be required to meet the environmental consultant's own internal quality assurance requirements.

6.4 Validation of Soil Management (Marker and Barrier Layer) Areas

With the exception of existing vegetated batters along the northern and eastern boundaries, an Orica easement along the western boundary and the Orica retained 10 m wide strip on the southern boundary, the site will be subject to placement of a barrier layer to prevent unforeseen access to impacted soils. Furthermore, a marker layer is to be installed between impacted fill materials and all areas where a barrier layer is to be placed. Therefore, the areas of marker and barrier layer installations will require the following validation information as prepared by a Registered Surveyor, for survey requirements:

- A location plan with co-ordinates relative to the lot boundaries;
- The levels in m AHD of the upper surface of the impacted fill materials;

- Daily inspections and photographic record by the environmental consultant to record when and where the marker layer has been installed; and
- The levels in m AHD of the finished barrier layer surface.

The survey information shall be used to document the thickness of the barrier layer across the site as specified in **Section 5.5.2**.

An Environmental Management Plan (EMP) will be prepared documenting the presence of the impacted material and the management measures required to ensure the long-term protection of human health. Appropriate notation on planning certificate and/or title will be made, documenting the presence of the EMP and impacted materials.

6.5 Quality Assurance / Quality Control

The pre-determined DQIs established for the validation program are discussed below in relation to precision, accuracy, representativeness, comparability and completeness (PARCC parameters), and are shown in **Table 6.3**.

- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD)¹ of duplicate samples.
- **Accuracy** - measures the bias in a measurement system. The accuracy of the laboratory data generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** –expresses the degree to which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal requires there are sufficient valid data generated during the study.

$$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

1

Where C₀ is the analyte concentration of the original sample
C_d is the analyte concentration of the duplicate sample

Table 6.3: Summary of Data Quality Indicators for Validation Program

Data Quality Objective	Frequency	Data Quality Indicator
Precision		
Blind duplicates (intra-laboratory)	1 / 20 samples	<50% RPD ¹
Split duplicates (inter-laboratory)	1 / 20 samples	<50% RPD ¹
Trip blank (when sampling for volatiles)	1 / day	<Limit of reporting (LOR)
Rinsate blank (if sampling equipment used)	1 / day	<LOR
Trip spike (when sampling for volatiles)	1 / day	>70%
Accuracy		
Surrogate spikes	All organic analytes	70-130%
Matrix spikes	1 / 20 samples	70-130%
Representativeness		
Sampling appropriate for media and analytes	All media / analytes	-
Laboratory blanks	1 per lab batch	<LOR
Samples extracted and analysed within holding times.	All samples	14 days for organics, 28 days for mercury, metals 6 months
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All samples
Standard analytical methods used for all analyses	All Samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples
Limits of reporting appropriate and consistent	All Samples	All samples
Completeness		
Sample description and COCs completed and appropriate	All Samples	All samples
Appropriate documentation	All Samples	All samples
Satisfactory frequency and result for QC samples	All QA/QC samples	95%
Data from critical samples is considered valid	All samples	Critical samples valid

(1) If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgement will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.

6.6 Soil Validation Criteria

Based on the proposed commercial/industrial use, and in accordance with the decision process for assessment of urban redevelopment sites (EPA 2017), concentrations of contaminants in the soil will be compared against health investigation levels for commercial/industrial land use (HIL D) and other criteria adopted for the site (**Table 6.4**). The HILs (NEPC 2013) were adopted for use in screening site soil data in EnRiskS (2015) and have subsequently been adopted as soil validation criteria. Note that the criteria provided for volatile compounds are for outdoor areas only, as adopted in the hotspot validation report (JBS&G 2015). Noting that soil remediation works have been completed at the site (JBS&G 2015), and that the proposed development will require building on a suspended slab with a large open void beneath, soil criteria for volatile compounds for potential vapour intrusion into buildings are not relevant and have not been provided in **Table 6.4**.

Any material imported to site will require to be assessed as suitable for the proposed commercial/industrial use.

Table 6.4: Soil Validation Criteria

Constituent	Validation Criteria ¹	
	Commercial/ Industrial Landuse HIL-D (NEPC 2013)	Industrial Criteria Relevant to VOCs – Outdoor Areas Only (mg/kg)
Metals and Metalloids		
Arsenic	3000 ^N	-
Cadmium	900 ^N	-
Chromium (VI)	3600 ^N	-
Copper	240000 ^N	-
Nickel	6000 ^N	-
Lead	1500 ^N	-
Zinc	400000 ^N	-
Mercury (inorganic)	730 ^N	-
TRH and BTEX		
TRH C ₆ – C ₁₀	700 [*]	-
TRH >C ₁₀ -C ₁₆	1000 [*]	-
TRH >C ₁₆ -C ₃₄	3500 [*]	-
TRH >C ₃₄ -C ₄₀	10000 [*]	-
benzene	-	54 ^U
ethylbenzene	-	21000 ^{UT}
xylene	-	2700 ^U
Polycyclic Aromatic Hydrocarbons		
Benzo(a)pyrene (TEQ)	40 ^N	-
Total PAHs	4000 ^N	-
Chlorinated Hydrocarbons		
vinyl chloride	-	17 ^U
cis-1,2-dichloroethane	-	2000 ^U
1,2-dichloroethane	-	22 ^U
trichloroethane	-	20 ^U
1,1,2-trichloroethane	-	6.8 ^U
tetrachloroethane	-	410 ^U
1,1,2,2-tetrachloroethane	-	28 ^U
Chloroform	-	1100 ^{UT}
Hexachlorobutadiene	620 ^{UT}	-
Hexachlorobenzene	80	-

N = NEPC HIL D (1999 amended 2013)

* = NEPC 2013 Management limits – commercial and industrial

U = USEPA RSL for industrial soil, based on a carcinogenic risk level of 1x10⁻⁵ (consistent with NEPM guidance)

T = Criteria adopted based on threshold dose-response relationship as relevant to the nature of the COPC evaluated

TEQ = Toxicity equivalence quotient

6.7 Validation Reporting

6.7.1 Validation Report

At the completion of the remedial works, a validation report will be prepared in general accordance with OEHL (2011) and Schedule B(2) of NEPC (2013), documenting the works as completed.

This report will contain information including:

- Details of the remediation works conducted;
- Information demonstrating that the objectives of the RAP have been achieved, in particular the validation sample results for imported materials and assessment of the data against both the pre-defined DQOs and the remediation acceptance (validation) criteria;
- Information demonstrating compliance with appropriate regulations and guidelines;
- Full details of the source and classification of all imported materials;

- Any variations to the strategy undertaken during the implementation of the remedial works;
- Details of any environmental incidents occurring during the course of the remedial works and the actions undertaken in response to these incidents;
- Details on waste classification, tracking and off-site disposal;
- Clear statement of the suitability of the site that is the subject of the validation report, for the proposed use; and
- Other information as appropriate, including a draft or outline of the EMP that will apply to the site to address residual contamination issues.

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

6.7.2 Ongoing Monitoring / Management

The proposed remediation strategy for the site requires ongoing monitoring and management of all areas of the site to ensure the continued protection of human health and the environment. An EMP will be prepared to detail the ongoing management and monitoring requirements for the site. The EMP will need to be prepared and submitted to the Site Auditor and Appropriate Consent Authority for approval prior to any Site Audit Statement being issued for the site.

The EMP shall contain the following elements:

- A statement of the objectives of the EMP – i.e., to ensure continued suitability of the site after it has been remediated;
- Methodology for piling works and any in ground works;
- Description of the residual contamination issue(s) required to be managed, including the type of contamination and location on the site (including a plan prepared by a registered surveyor showing the location of the marker layer);
- Description of the environmental controls to manage the residual contamination issue(s), including as-built drawings of gas mitigation measures installed at the site, noting that the undercroft area is to remain open on all sides;
- Description of responsibilities for implementing various elements of the provisions contained in the EMP;
- Timeframe for implementing various elements of the provisions contained in the EMP;
- Health and safety requirements for potential future sub-surface activities;
- A program of review and audits;
- The provisions in the EMP are feasible (i.e., able to be implemented) and able to be legally enforceable (i.e., a mechanism exists, such as development consent conditions, to give the plan a basis in law); and
- The relevant consent authority is satisfied that the inclusion of a development consent condition relating to the implementation of the EMP is acceptable.

7. Site Management Plan – Remediation Works

7.1 Contact Persons

The remediation works shall be managed by the remediation contractor (to be advised).

Contact: To be advised

Phone: To be advised

Mobile: To be advised

Email: To be advised

7.2 Remediation Schedule and Duration

At this stage, the duration of the remediation works is unknown and will be subject to the remediation approach adopted by the remediation contractor.

7.3 Environmental Management

A site-specific Construction Environmental Management Plan (CEMP) shall be prepared for the construction phase for the proposed development and will need to consider how the required remediation works will be completed. The CEMP will require approval by the appointed Site Auditor and will need to consider the following:

- Removal of existing tree and shrubs by hand and placement of trees into a woodchipper feeding directly into a truck to ensure green waste is not impacted by site soils;
- Grubbing of tree roots, stumps and other vegetation not removed by hand, and separation of any material geotechnically unsuitable to remain on-site for off-site disposal, noting the material will potentially be mixed with asbestos-impacted soils;
- As noted in **Section 5.8**, imported materials will be required to form a base for a piling rig. The remediation contractor will need to consider the potential for cross contamination of any imported materials with the underlying asbestos-impacted soils and the need to minimise materials imported to site, noting that the barrier layer thicknesses specified in **Section 5.2.2** are based on minimum requirements to maintain required flood detention capacity of the site. Therefore, any materials imported to site and impacted by site soils are likely to require off-site disposal to install the required barrier layer and maintain flood capacity.

It is noted that potentially, piling could be completed under asbestos work conditions, which could potentially minimise materials imported to site to form a stable base for a piling rig.

In addition to the above, the CEMP should set out the requirements for environmental management during the works including:

- Management structure and responsibilities;
- Approval and licensing requirements;
- Environmental induction and training;
- Emergency contacts;
- Environmental incident response
- Implementation of the plan;
- Community consultation process; and
- Monitoring required during the works and the process for review of the CEMP, if required.

7.4 Work, Health and Safety Plan

All work is to be undertaken in accordance with the Site Health and Environmental Management Plan (Orica 2012) prepared for the Project.

8. Regulatory Approvals/Licensing

8.1 Development Approval

Remediation works will be development-specific, with passive vapour mitigation measures inherent to the proposed development of a suspended slab with an undercroft, which will require approval by the Site Auditor, and building development approval by the relevant planning consent authority prior to commencement of remediation works.

8.2 Protection of the Environment Operations Act 1997

The proposed remediation/validation activities are not required to be licensed under the Protection of the Environment Operation Act 1997 since the works do not involve:

- treatment otherwise than by incineration and storage of more than 30 000 cubic metres of contaminated soil originating exclusively from the site, or
- disturbance of more than an aggregate area of 3 hectares of contaminated soil originating exclusively from the site.

8.3 Protection of the Environment Operations (Waste) Regulation 2005

The regulations make requirements relating to non-licensed waste activities and waste transporting. The proposed works on the site will not be required to be licensed.

Section 42 of the Regulation stipulates special transportation, re-use or recycling requirements relating to asbestos waste and must be complied with regardless of whether the activity is licensed.

The requirements for the transportation of asbestos waste include:

- bonded asbestos material must be securely packaged at all times,
- friable asbestos material must be kept in a sealed container,
- asbestos-contaminated soils must be wetted down,
- all asbestos waste must be transported in a covered, leak-proof vehicle.

The requirements relating to the off-site disposal of asbestos waste are as follows:

- asbestos waste in any form must be disposed of only at a landfill site that may lawfully receive the waste,
- when asbestos waste is delivered to a landfill site, the occupier of the landfill site must be informed by the person delivering the waste that the waste contains asbestos,
- when unloading and disposing of asbestos waste at a landfill site, the waste must be unloaded and disposed of in such a manner as to prevent the generation of dust or the stirring up of dust,
- asbestos waste disposed of at a landfill site must be covered with VENM or other material as approved in the facility's Environment Protection Licence.

Section 48 of the Regulation requires that wastes are stored in an environmentally safe manner. It also stipulates that vehicles used to transport waste must be covered when loaded.

8.4 Waste Classification Guidelines (EPA 2014)

All wastes generated shall be assessed, classified and managed in accordance with this guideline.

8.5 Bayside Council Requirements

Site remediation works will need to consider Botany Bay Development Control Plan 2013 (Amendment 8), enforced 5/9/2017, Part 3K Contamination, where applicable.

8.6 Asbestos Removal Regulations and Code of Practice

The removal and disposal of asbestos will be managed in accordance with the Work Health and Safety Act (2011) and Work Health and Safety Regulation (2017), "How to Safely Remove Asbestos: Code of Practice (SafeWork NSW 2016), the, NSW WorkCover Guidelines and the NSW EPA Waste Classification Guidelines (EPA 2014).

Excavation and removal of asbestos fibre-contaminated soils are required to be conducted by a Class A licensed contractor.

Before starting the affected works, the appointed contractor is required to obtain a site-specific permit approving the asbestos works from NSW WorkCover. A permit will not be granted without a current licence and the permit application must be made at least seven days before the work is due to commence.

9. Conclusion

Subject to the successful implementation of the measures detailed in this RAP and subject to the limitations in **Section 11**, it is considered that the site can be made suitable for the proposed commercial/industrial land-use.

10. References

- enHealth (2005) Management of Asbestos in the Non-Occupational Environment. Department of Health and Ageing
- EnRiskS 2013 Revised Human Health Risk Assessment, Southlands Development Project, Environmental Risk Sciences, Report Reference O/13/SDR001, 21 November 2013
- EnRiskS 2015 Revised Human Health Risk Assessment, Southlands Block 1 Development, Environmental Risk Sciences, Report Reference O/15/SDB1R001, B – Final, 28 July 2015
- EnRiskS 2019 Southlands Block 1 HHRA Revision: Development of Flood Detention Basin, Environmental Risk Sciences Pty Ltd, 9 January 2019
- EPA, NSW, 1995 Contaminated Sites Sampling Design Guidelines, EPA 95/59, September 1995
- EPA, NSW 2012 Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases, EPA 2012/0932, November 2012
- EPA, NSW, 2014 Waste Classification Guidelines. Part 1: Classifying Waste, NSW EPA, November 2014
- EPA, NSW, 2017 Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition)
- Golder 2011 Further Contaminated Soil/Fill Delineation Investigation – Orica Southlands, Golder Associates Pty Ltd, 6 September 2011
- Golder 2017 Groundwater Treatment plant – September 2017 Biennial Groundwater and Surface water Monitoring Report, Golder Associates Australia Pty Ltd, ref 1786313_001_R_RevA, dated 30 November 2017
- JBS 2013 Review of Groundwater-Surface Water Interaction at Springvale Drain, Southlands Development Site, Banksmeadow, NSW, JBS Environmental ref 42049-54480 dated 23 May 2013
- JBS&G 2014a Revised Remediation Action Plan, Block 2, Stage 1 Southlands Development, Banksmeadow, NSW, 42049-53373 (Rev 0), JBS&G Australia Pty Ltd, 30 January 2014
- JBS&G 2014b Delineation of Remediation Areas, Southlands, McPherson Street, Banksmeadow, NSW. 43499-57915, JBS&G Australia Pty Ltd, 24 July 2014
- JBS&G 2015 Soil Hotspot Validation Report, Block 1, Southlands, 28 McPherson Street, Banksmeadow, NSW. 43499-100797 (Rev A), JBS&G Australia Pty Ltd, 9 June 2015
- JBS&G 2018 Asbestos and Vapour Assessment, Lot 9 in DP 1205673, 28 McPherson Street, Banksmeadow, NSW. 54709-114803 (Rev A), JBS&G Australia Pty Ltd, 14 August 2018
- NEPC, 2013 National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), National Environmental Protection Council
- NSW EPA 1995. Contaminated Sites Sampling Design Guidelines, EPA 95/59, New South Wales Environment Protection Authority (NSW EPA), September 1995
- NSW EPA 2012. Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases, EPA 2012/0932, NSW EPA, November 2012
- NSW EPA 2014. Waste Classification Guidelines. Part 1: Classifying Waste, NSW EPA, November 2014
- NSW EPA 2017. Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition), NSW EPA, October 2017

OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites, OEH 2011/0650, Office of Environment and Heritage, August 2011

Orica 2012 Orica Southlands Remediation and Development Site Health and Environmental Management Plan Document No. EN1591 Southlands Revision 0, Orica Australia Pty Ltd

Orica 2017 Conceptual Site Model Orica Botany, Version: Rev2, Orica Australia Pty Ltd, 20 September 2017

PSM 2019 Development Plan at Lot 9, McPherson Street, Banksmeadow – Geotechnical Assessment

SafeWork NSW 2016 Code of Practice How to Safely Remove Asbestos, September 2016

SWA 2011 Code of Practice: How to Manage and Control Asbestos in the Workplace' Safe Work Australia, 2011

URS 2006 WCIE4302 – Southern Plumes Source Area Delineation Investigation – February 2006, URS Australia Pty Limited, Project No. 43346038.07901 dated 26 June 2006

URS 2008a Remediation Action Plan, Southlands Remediation and Development Project, URS Australia Pty Ltd, October 2008

URS 2008b Human Health Risk Assessment Southlands Remediation and Development Project, URS Australia Pty Ltd

WA DOH 2009 Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia Western Australian Department of Health May 2009

Wilson, S. and S. Mortimer 2018, Piled foundations and pathways for ground gas migration in the UK, Environmental Geotechnics, Published Online: November 2017

WWC 1996a ICI Botany, Groundwater Stage 2 Survey. Contract S2/C1, Springvale Drain Woodward Clyde August 1996

WWC 1996b ICI Botany, Groundwater Stage 2 Survey. Contract S2/C3, Water/Soil Phase 2 Woodward-Clyde August 1996

11. Limitations

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

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

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

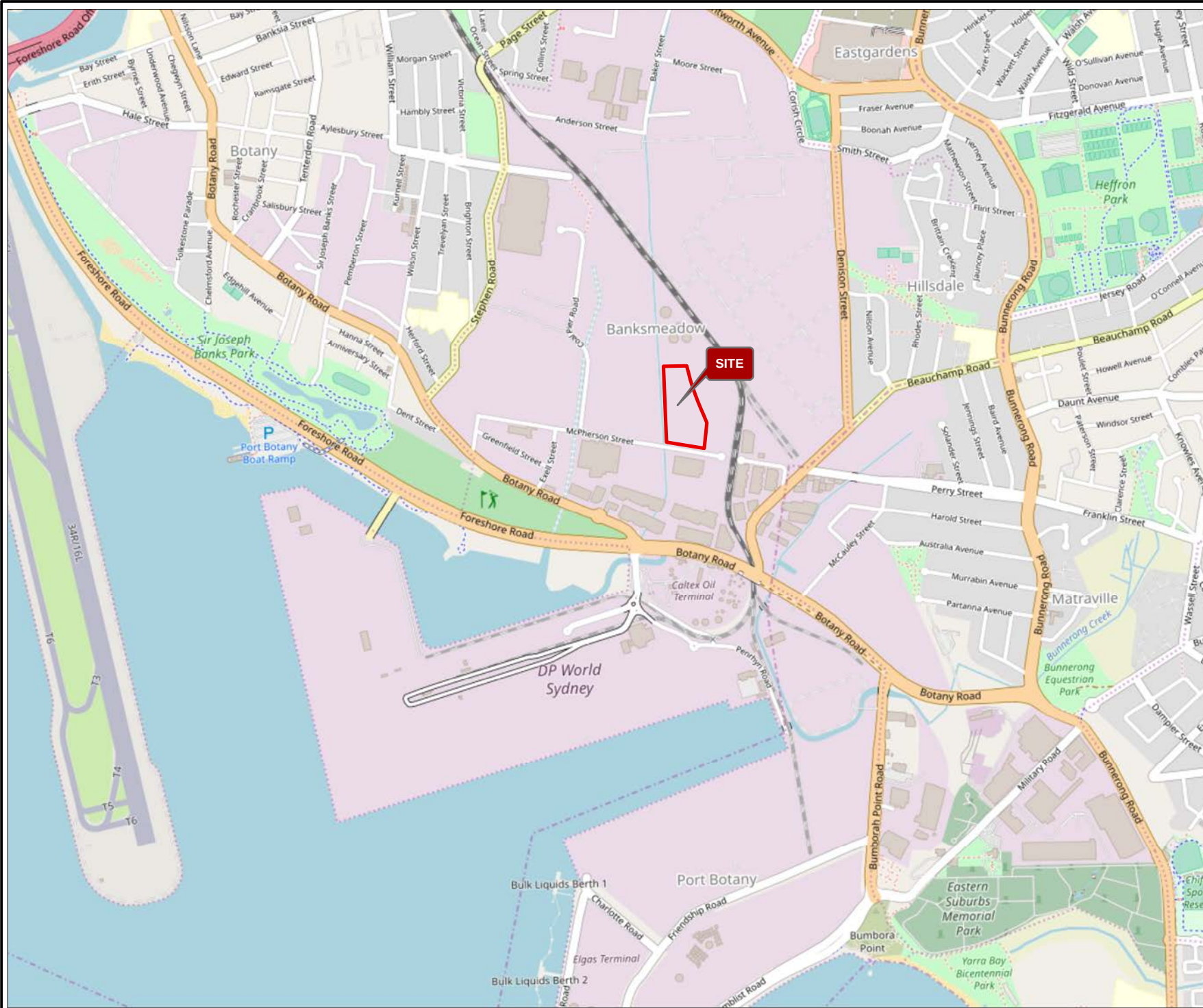
Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the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

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

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

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

Figures

**Legend:** Approximate Site Boundary

Job No:54709

Client: Orica

Version: R02 Rev A

Date: 18-Feb-2019

Drawn By: AV

Checked By: JDM

Scale 1:20,000



0 240 480
metres

Coor. Sys. GDA 1994 MGA Zone 56

**Lot 9 DP 1205673
Banksmeadow, NSW****SITE LOCATION****FIGURE 1**



Legend:

Approximate Site Boundary



Job No:54709

Client: Orica

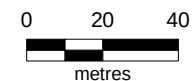
Version: R02 Rev A

Date: 18-Feb-2019

Drawn By: AV

Checked By: JDM

Scale 1:2,000



Coor. Sys. GDA 1994 MGA Zone 56

**Lot 9 DP 1205673
Banksmeadow, NSW**

SITE LAYOUT

FIGURE 2



Legend:

- Approximate Site Boundary
- 0.1m Hardstand Barrier Layer
- 0.1m Sealed Hardstand Barrier Layer
- No Marker / Barrier Layer
- Surface Water Entry Points



Job No:54709

Client: Orica

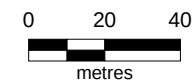
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Date: 18-Feb-2019

Drawn By: AV

Checked By: JDM

Scale 1:2,000



Coor. Sys. GDA 1994 MGA Zone 56

Lot 9 DP 1205673
Banksmeadow, NSW

PROPOSED DEVELOPMENT AND
BARRIER LAYER REQUIREMENTS

FIGURE 3

Appendix A Unexpected Finds Protocol

**BE AWARE
UNEXPECTED HAZARDS MAY BE PRESENT**



drums



asbestos



chemical bottles



odour



ash / slag



demolition waste

if you SEE or SMELL anything unusual

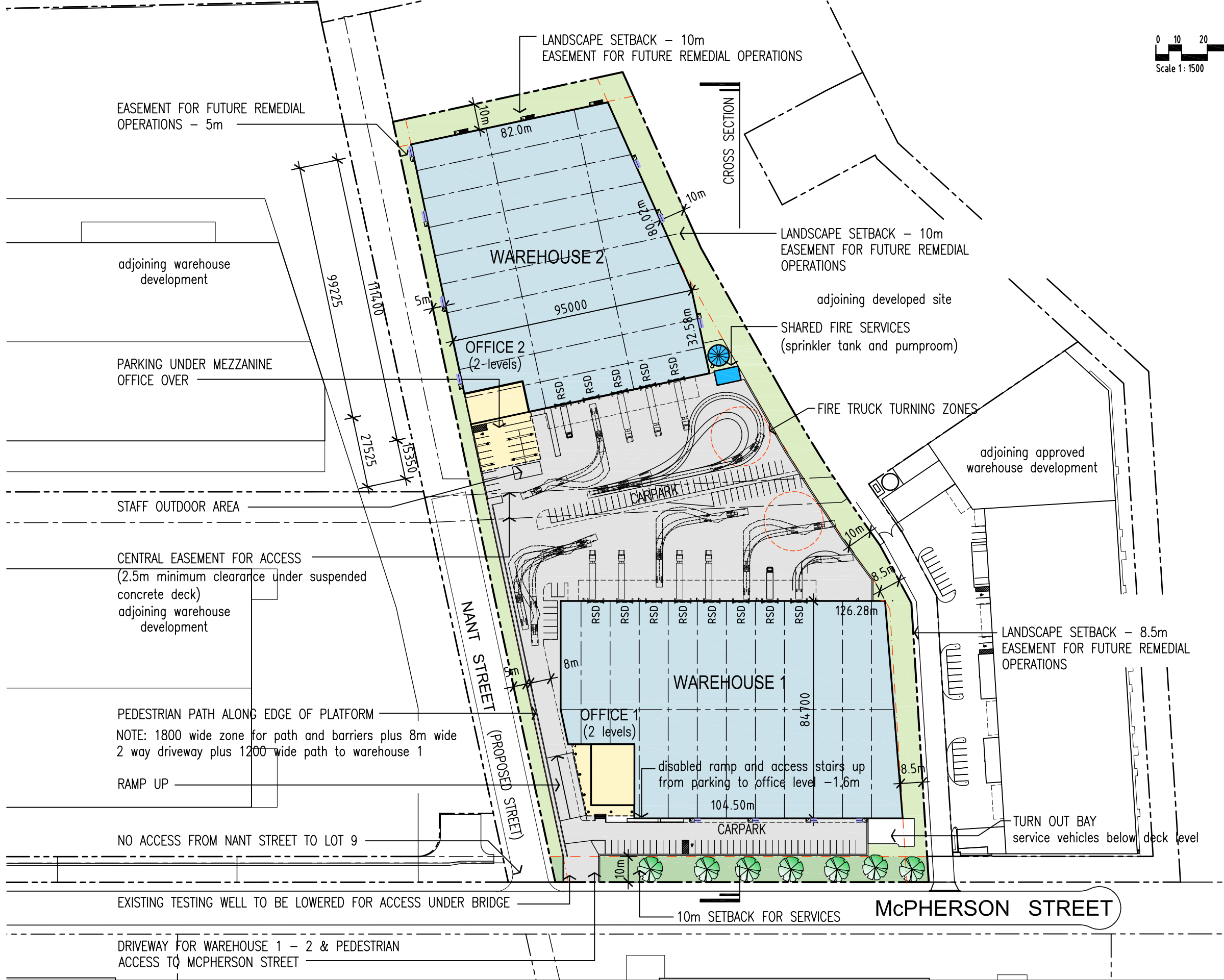


STOP WORK & contact the Site Foreman



do not restart working before the area has been
investigated and cleared by an Environmental
Consultant

Appendix B Proposed Development, Architectural and Civil Plans

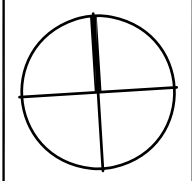


SCHEDULE OF AREAS	
SITE AREA	41 290 sqm
SITE AREA - less 1 459 sqm for 10m front setback services zone to McPherson St.	39 831 sqm
CONCRETE PLATFORM	34 130 sqm
suspended concrete platform to support buildings & hardstand / parking areas above basin including crossover over easement to McPherson Street	
BUILDING 1	
for services)	
WAREHOUSE 1	10 135 sqm
OFFICE 1 - 2 storey	1 000 sqm
405 gnd floor + 595 first floor	
TOTAL BUILDING AREA	11 135 sqm
AWNING 1 - 8m wide	740 sqm
59 carspaces including 1 disabled space provided on site for building 1	
BUILDING 2	
WAREHOUSE 2	9 645 sqm
OFFICE 2 - 2 storey	1 000 sqm
280 gnd floor + 720 first floor	
TOTAL BUILDING AREA	10 645 sqm
AWNING 1 - 8m wide	496 sqm
58 carspaces including 1 disabled space provided on site for building 2	
COUNCIL CARPARK REQUIREMENTS	
WAREHOUSE DISTRIBUTION AREA	1 CAR / 300m2
OFFICE AREA	1 CAR / 40m2



PROPOSED WAREHOUSE DISTRIBUTION
AND OFFICE DEVELOPMENT
ORICA AUSTRALIA
lot 9 McPherson Street, Banksmedow. NSW

AXIS ARCHITECTURAL
4 / 112 Cronulla Street, Cronulla NSW 2230
p + 02 9523 7858 / m + 0414 954 405
e + david@axisarchitects.com.au
AXIS ARCHITECTURAL Pty Ltd - ABN 18 086 853 376
Nominated Architect - David McDonald NSW ARB No. 7997



Drawing :
SITE PLAN - OPTION 6
NO ACCESS VIA NANT STREET
Scale : 1: 1500 @A3 Project No : Drawing No : Issue :
Drawn : AA 180101 SK - A 106 P4
Date : Jan 2018

DEVELOPMENT APPLICATION DRAWINGS
PROPOSED WAREHOUSE DEVELOPMENT
WAREHOUSE/STORAGE/DISTRIBUTION

FOR: ORICA AUSTRALIA

ADDRESS: LOT 9 D.P.1205673
28 McPHERSON STREET
BANKSMEADOW, NEW SOUTH WALES

DATE: DECEMBER 2018

DEVELOPMENT APPLICATION DRAWING REGISTER	
DRAWING No.	DRAWING NAME
DA - A 000	COVER SHEET
STAGE 1	
DA - A 100	PODIUM SLAB PLAN
STAGE 2	
DA - A 101	SITE & GROUND FLOOR PLAN
DA - A 102	SITE ANALYSIS
DA - A 103	SHADOW DIAGRAMS
DA - A 201	OFFICE FLOOR PLANS
DA - A 202	ROOF PLAN
DA - A 301	ELEVATIONS - WAREHOUSE 1
DA - A 302	ELEVATIONS - WAREHOUSE 2
DA - A 303	PHOTOMONTAGES
DA - A 401	SECTIONS

SCHEDULE OF AREAS			
SITE AREA		41 290 sqm	
CONCRETE PLATFORM		<u>34 130 sqm</u>	
suspended concrete platform to support buildings& hardstand / parking areas above basin including crossover over easement to McPherson Street			
BUILDING 1		BUILDING 2	
WAREHOUSE 1	10 135 sqm	WAREHOUSE 2	9 645 sqm
OFFICE 1 - 2 storey	1 000 sqm	OFFICE 2 - 2 storey	1 000 sqm
405 gnd floor + 595 first floor		280 gnd floor + 720 first floor	
TOTAL BUILDING AREA	<u>11 135 sqm</u>	TOTAL BUILDING AREA	<u>10 645 sqm</u>
AWNING 1 - 8m wide	740 sqm	AWNING 1 - 8m wide	496 sqm
59 carspaces including 1 disabled space provided on site for building 1		58 carspaces including 1 disabled space provided on site for building 2	
COUNCIL CARPARK REQUIREMENTS:			
WAREHOUSE DISTRIBUTION AREA		1 CAR / 300m2	
OFFICE AREA		1 CAR / 40m2	



SITE LOCATION AND CONTEXT PLAN
(NTS)



Notes

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Issue : Date: Amendment:
A 12/12/18 ISSUED FOR DEVELOPMENT APPLICATION

Project Manager :

Project :

PROPOSED WAREHOUSE DEVELOPMENT
WAREHOUSE/STORAGE/DISTRIBUTION
28 McPherson Street, Banksmeadow, NSW

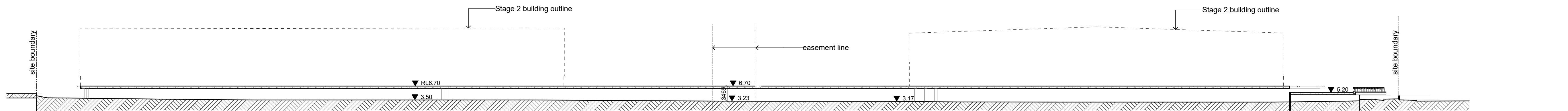
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Nominated Architect - David McDonald NSW ARB No. 7997



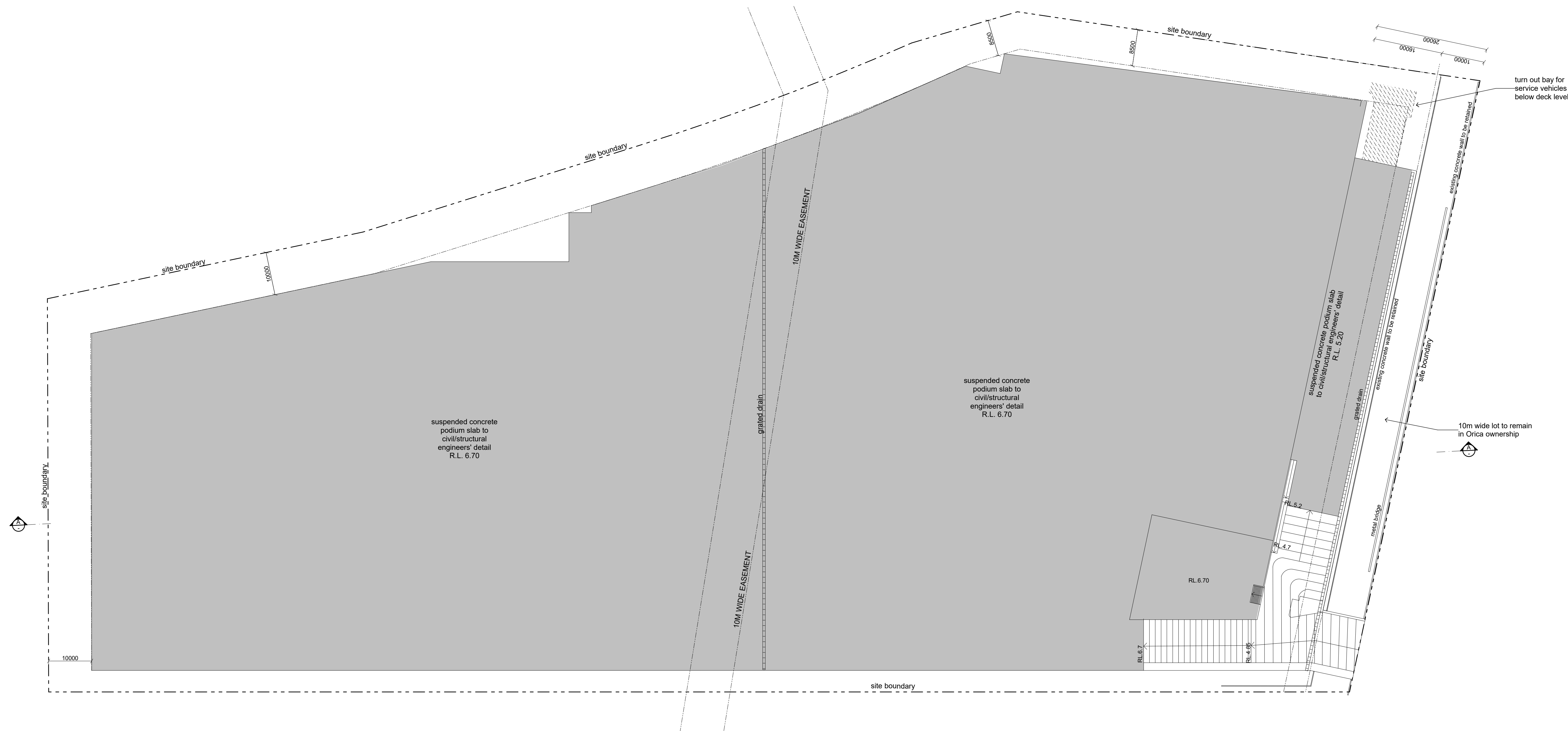
Drawing :

COVER PAGE + LOCATION

Drawn : RG	Project No : 180101	Drawing No : DA / A 000	Issue : A
Date : DEC 2018			
Scale : NTS			



SECTION AA
Scale 1:500



PODIUM SLAB PLAN
Scale 1:500

Notes

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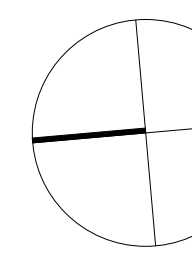
Project Manager :

Project :

PROPOSED WAREHOUSE DEVELOPMENT
WAREHOUSE/STORAGE/DISTRIBUTION
28 McPherson Street, Banksmeadow, NSW



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AXIS ARCHITECTURAL Pty Ltd - ABN 18 086 853 376
Nominated Architect - David McDonald NSW ARB No. 7997



Drawing :

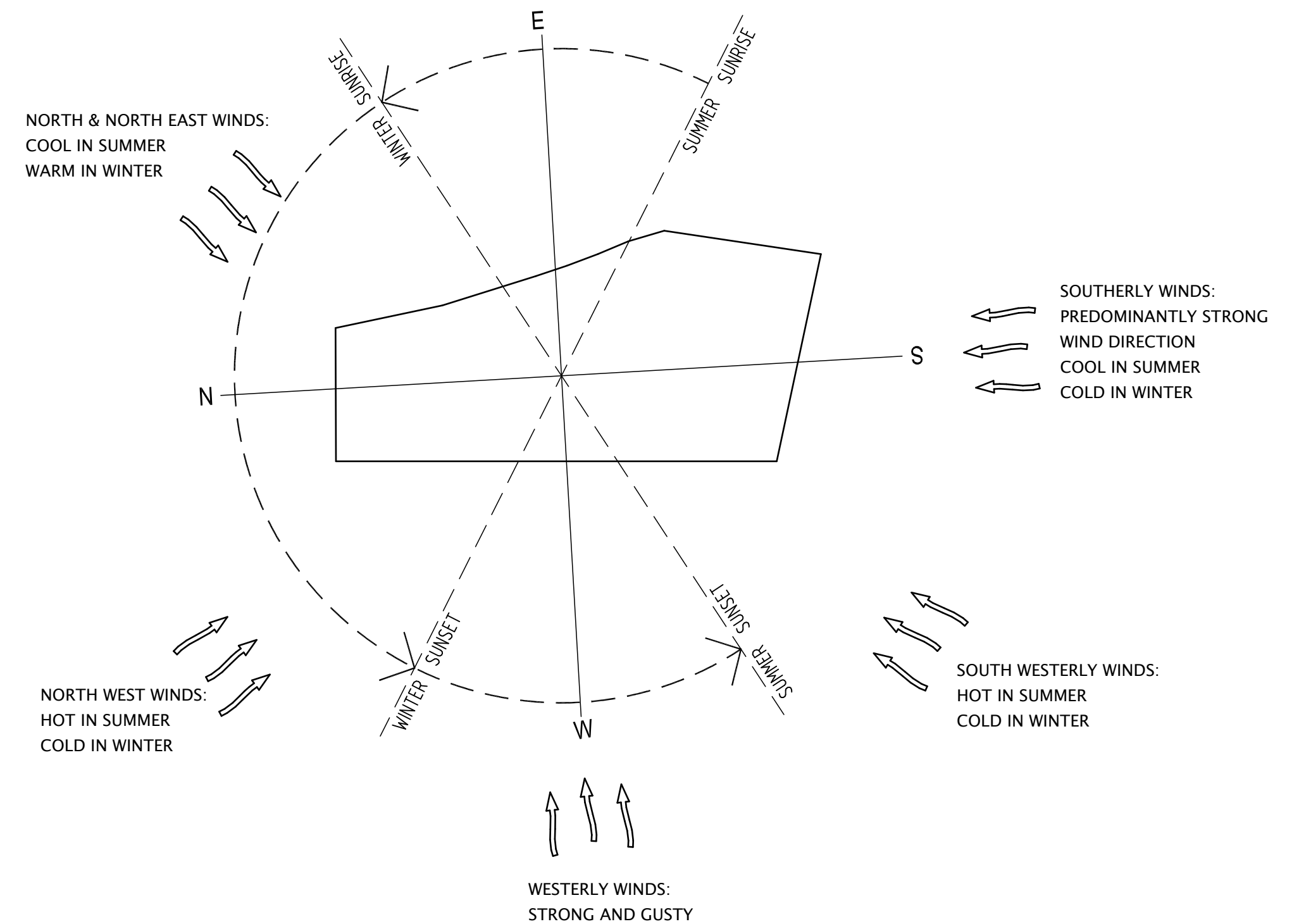
PODIUM SLAB PLAN - STAGE 1

Drawn : RG
Date : DEC 2018
Scale : 1:500 @ A1

Project No :
180101

Drawing No :
DA / A 100

Issue :
A



SITE ANALYSIS PLAN
Scale 1:1000

Notes

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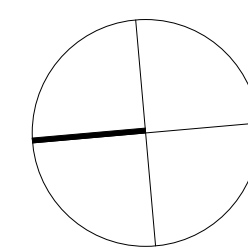
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A 12/12/18 ISSUED FOR DEVELOPMENT APPLICATION

Project Manager :

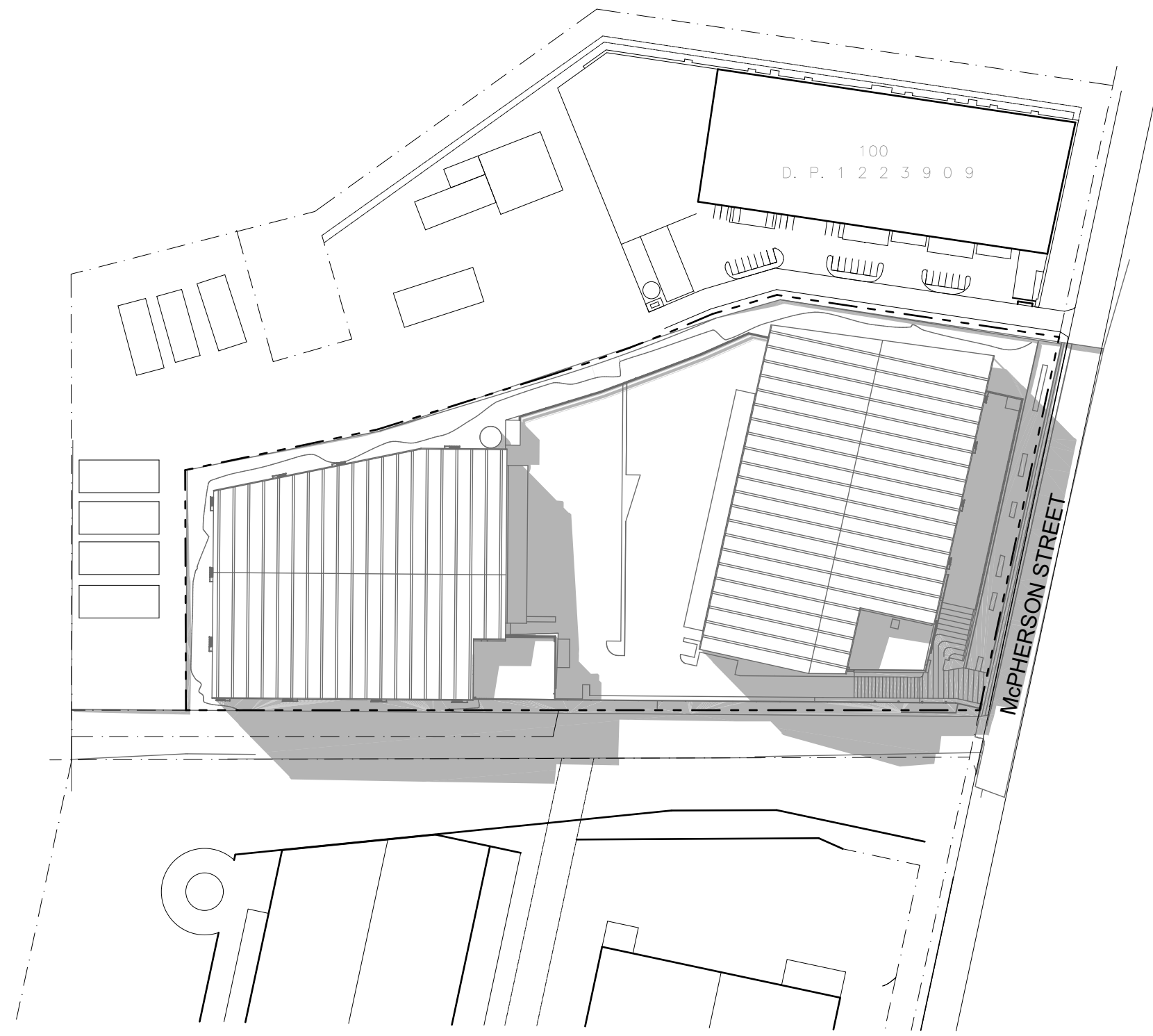
Project :

PROPOSED WAREHOUSE DEVELOPMENT
WAREHOUSE/STORAGE/DISTRIBUTION
28 McPherson Street, Banksmeadow, NSW

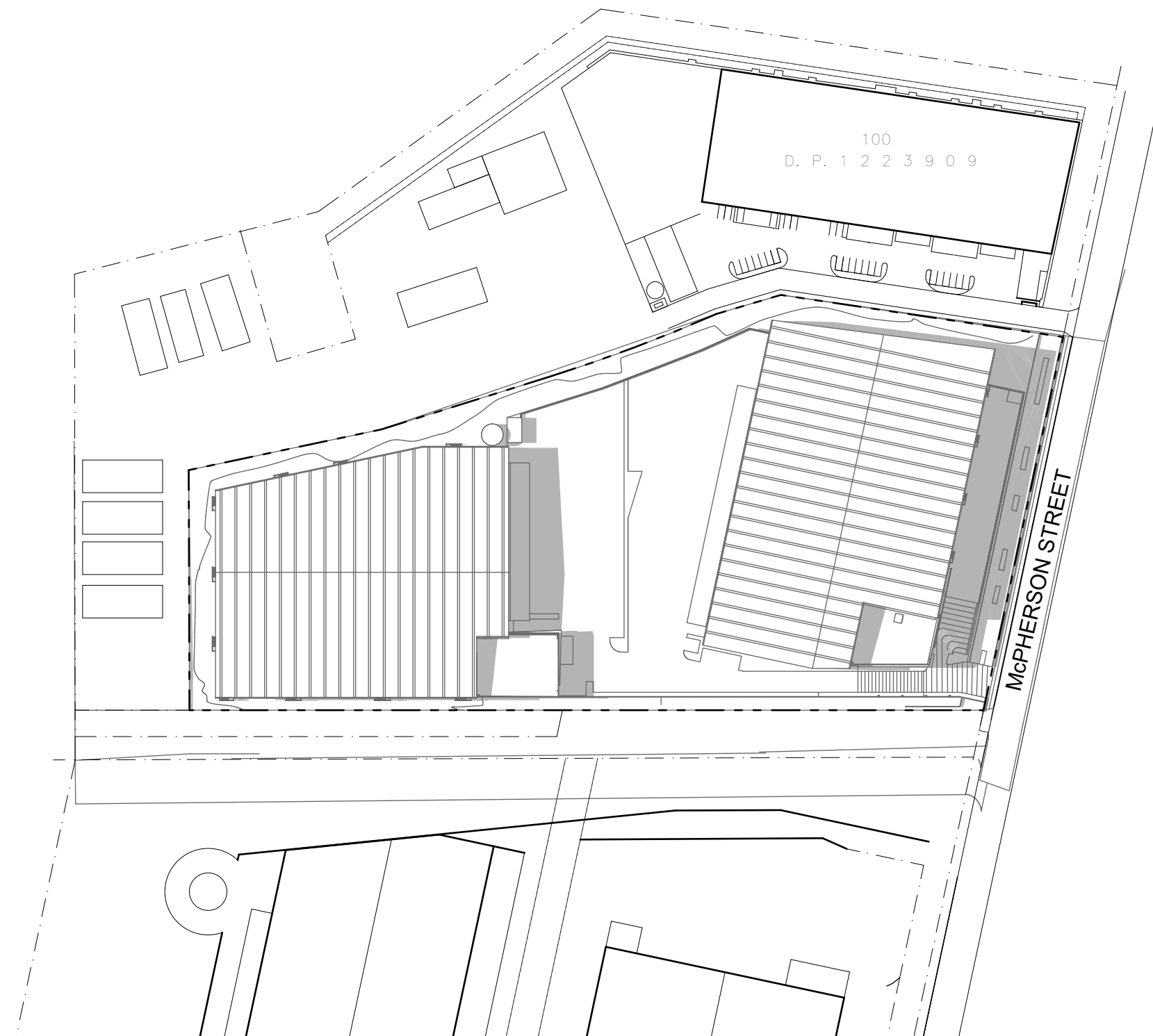
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p + 02 9523 7858 / m + 0414 954 405
e + david@axisarchitects.com.au
AXIS ARCHITECTURAL Pty Ltd - ABN 18 086 853 376
Nominated Architect - David McDonald NSW ARB No. 7997



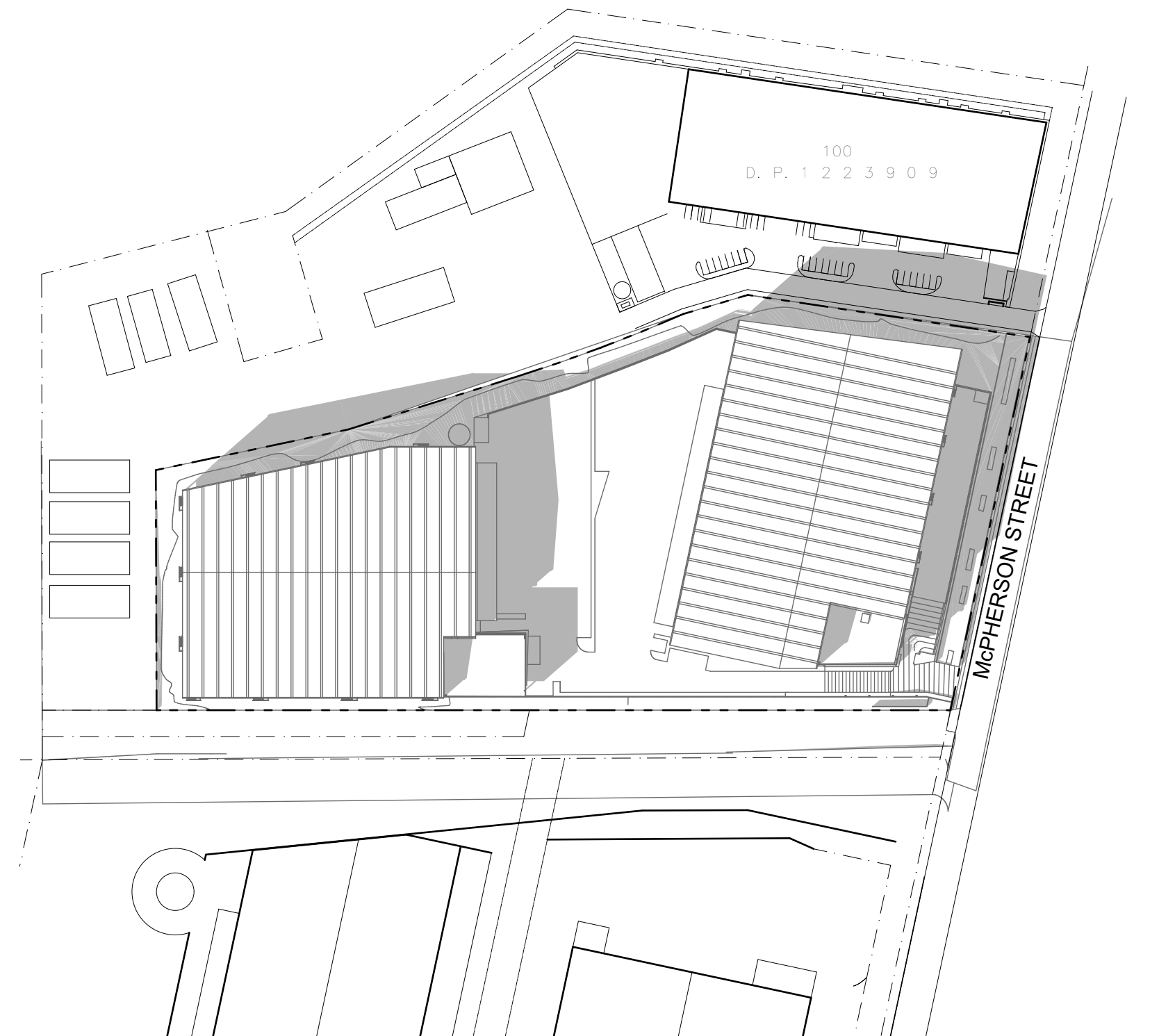
Drawing : SITE ANALYSIS			
Drawn : RG Date : DEC 2018 Scale : 1:1000 @ A1	Project No : 180101	Drawing No : DA / A 102	Issue : A



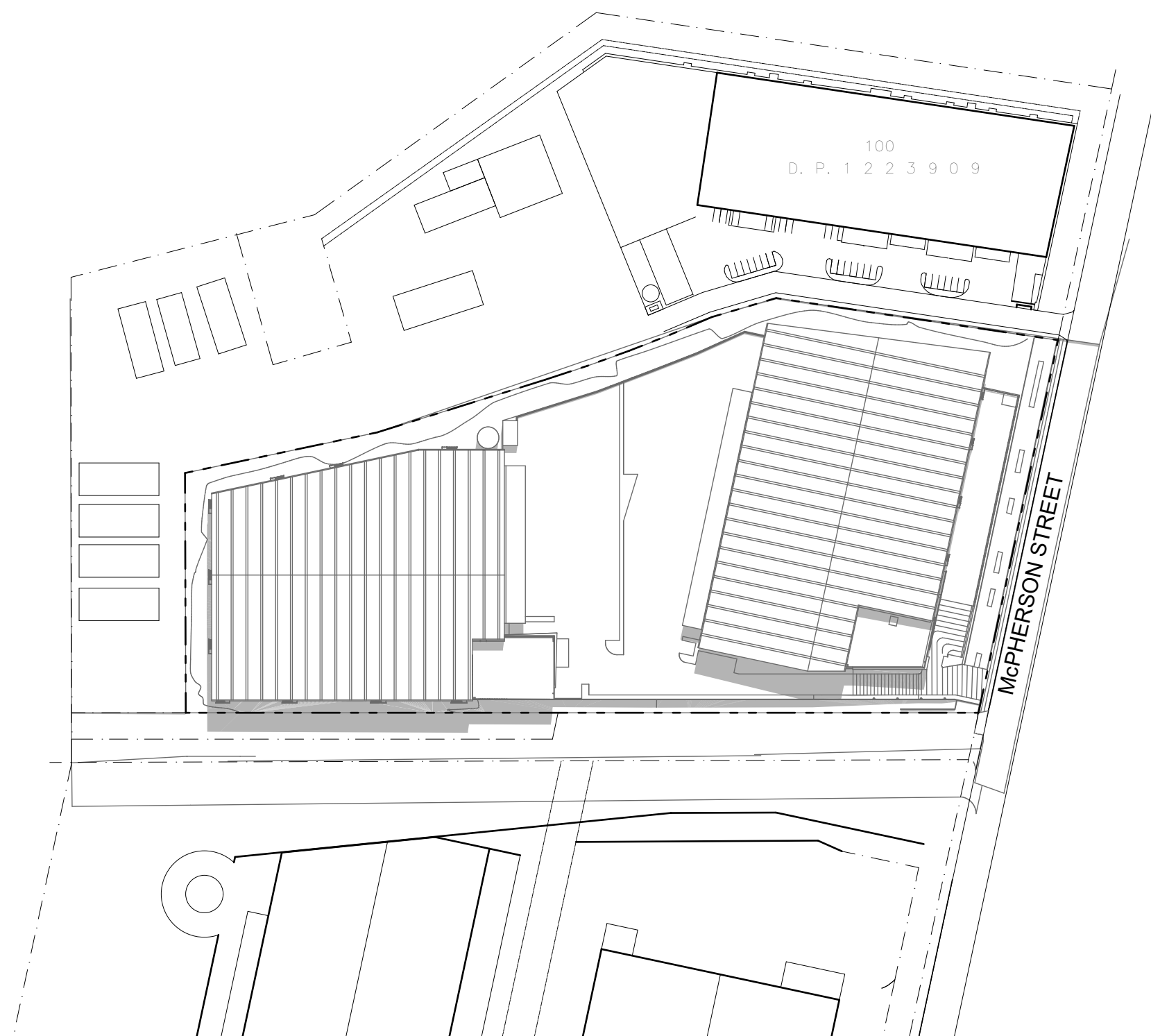
○ JUNE 21 - 9am
1:2000



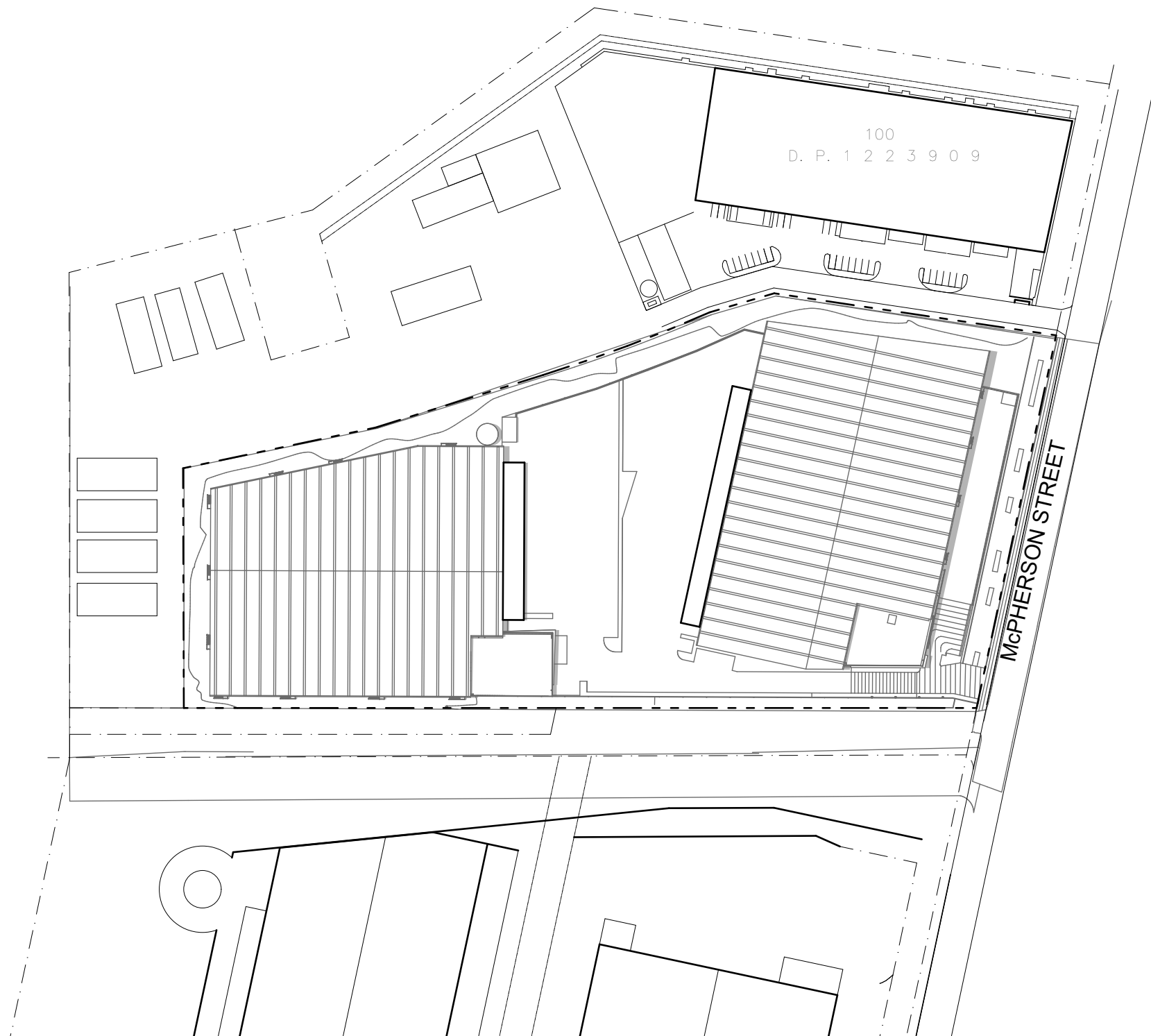
○ JUNE 21 - 12pm
1:2000



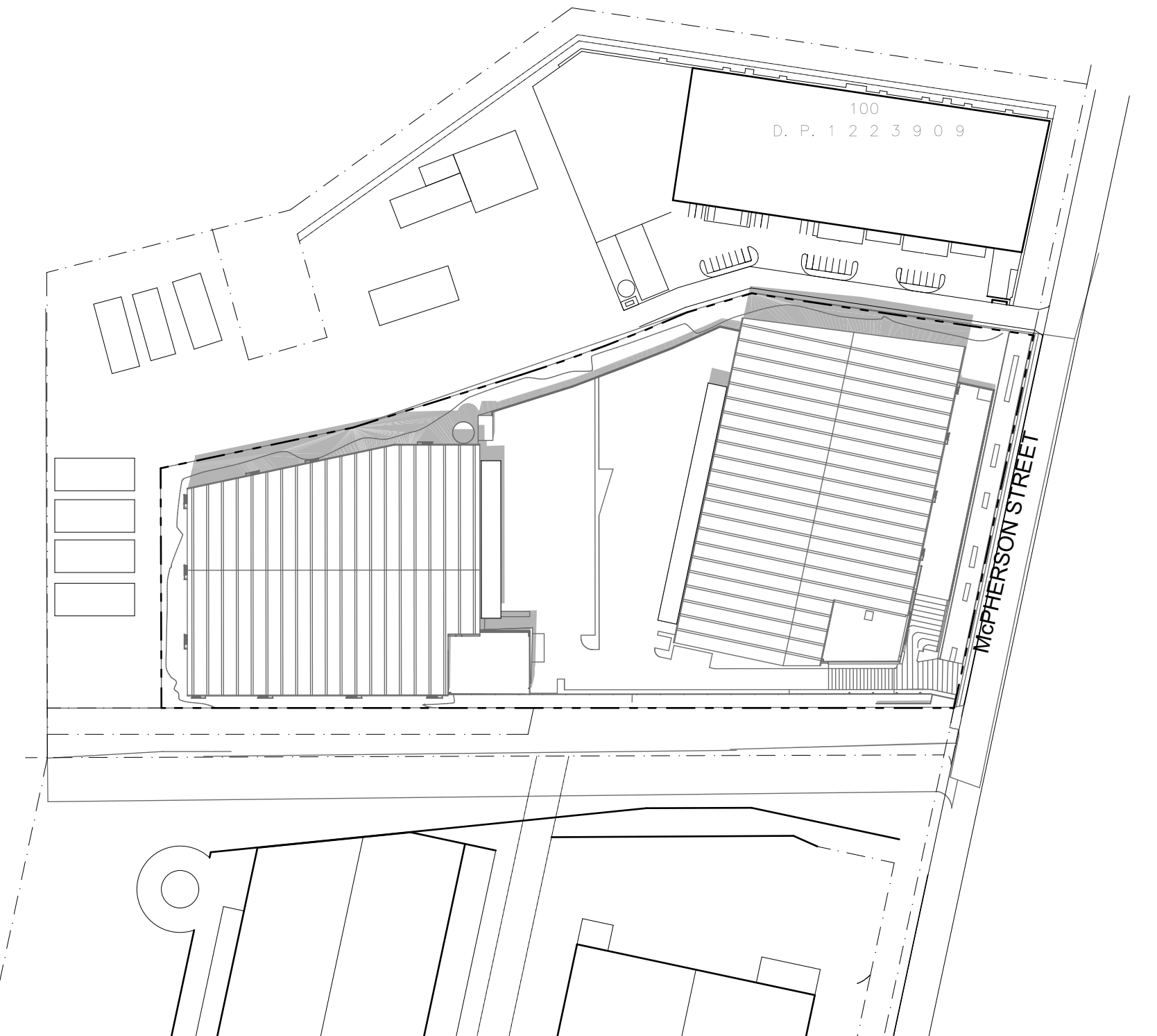
○ JUNE 21 - 3pm
1:2000



○ DECEMBER 21 - 9am
1:2000



○ DECEMBER 21 - 12pm
1:2000



○ DECEMBER 21 - 3pm
1:2000

Notes

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Issue : Date : Amendment :

A 12/12/18 ISSUED FOR DEVELOPMENT APPLICATION

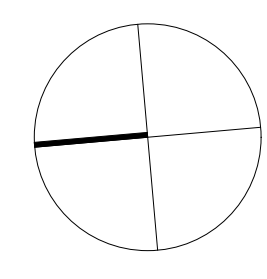
Project Manager :

Project :

PROPOSED WAREHOUSE DEVELOPMENT
WAREHOUSE/STORAGE/DISTRIBUTION
28 McPherson Street, Banksmeadow, NSW



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e + david@axisarchitects.com.au
AXIS ARCHITECTURAL Pty Ltd - ABN 18 086 853 376
Nominated Architect - David McDonald NSW ARB No. 7997



Drawing :

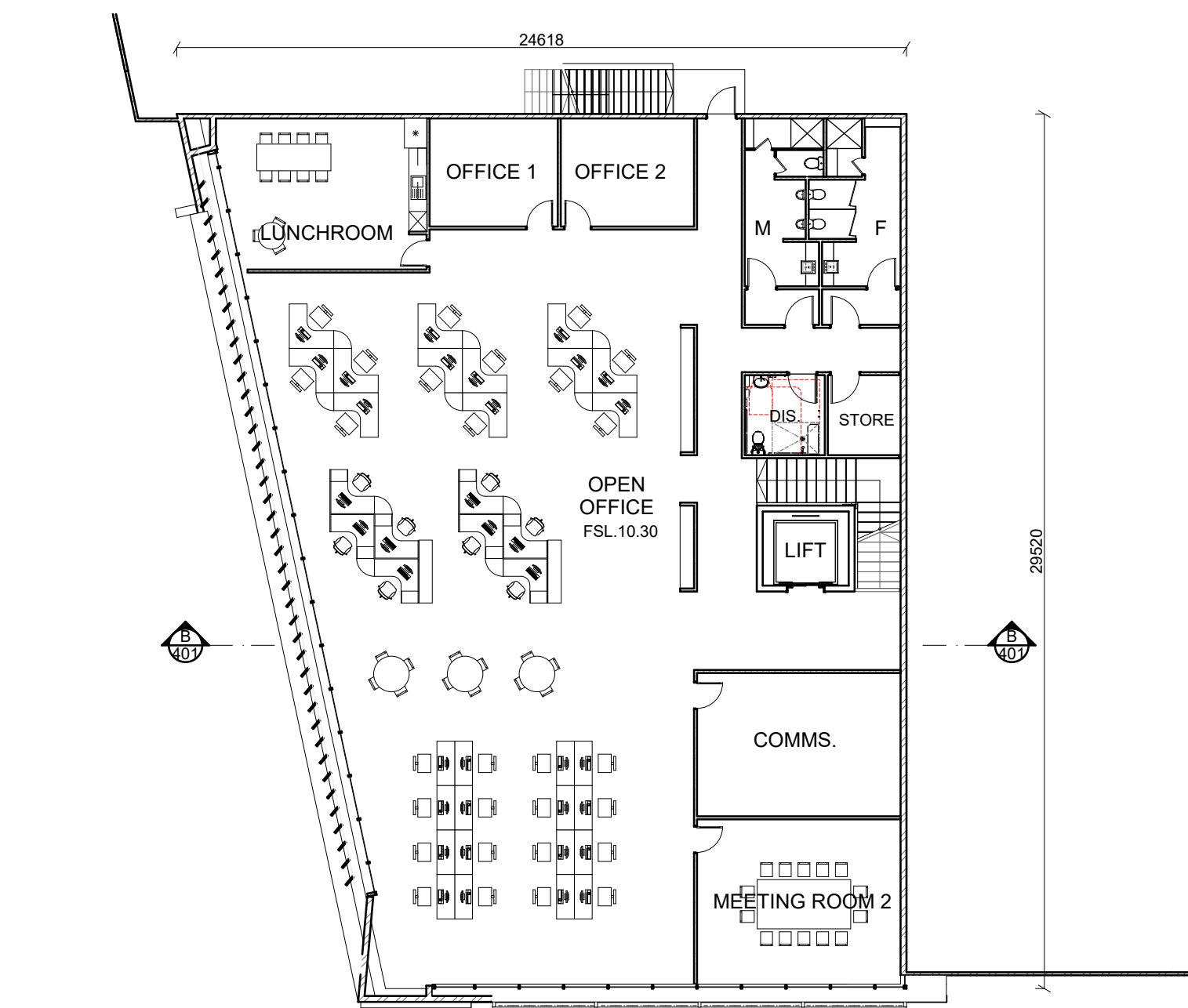
SHADOW DIAGRAMS

Drawn : RG
Date : DEC 2018
Scale : 1:2000 @ A1

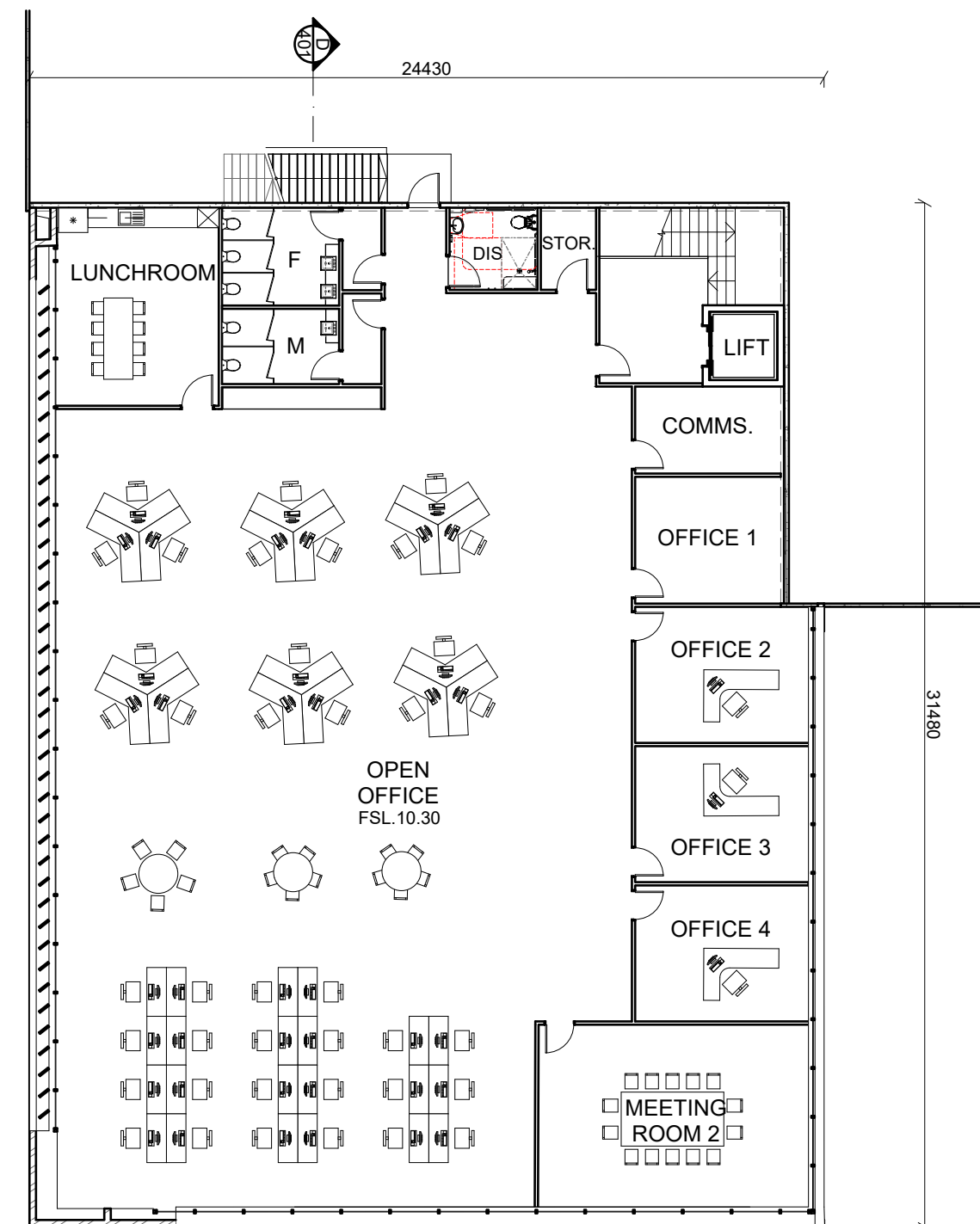
Project No :
180101

Drawing No :
DA / A 103

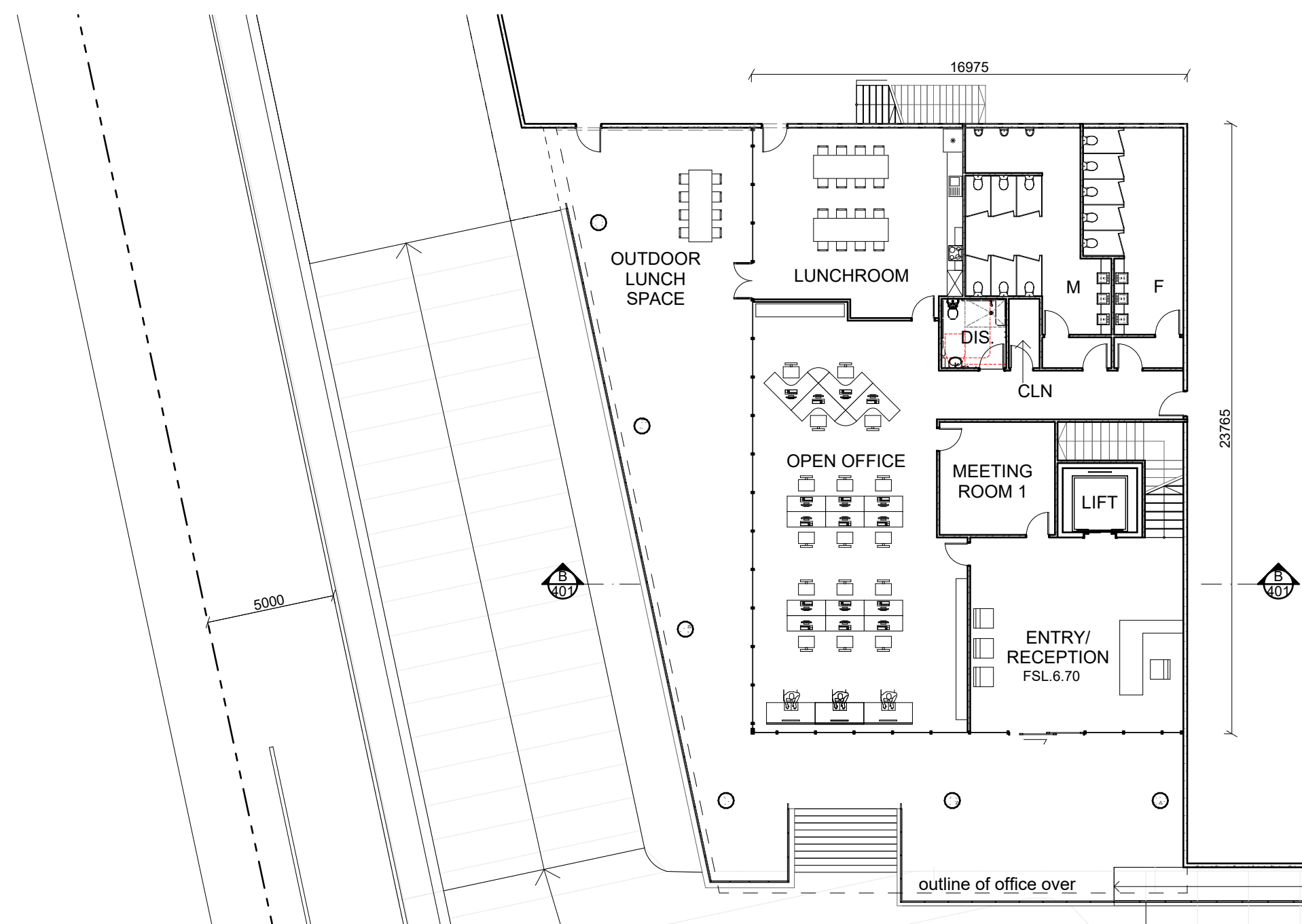
Issue :
A



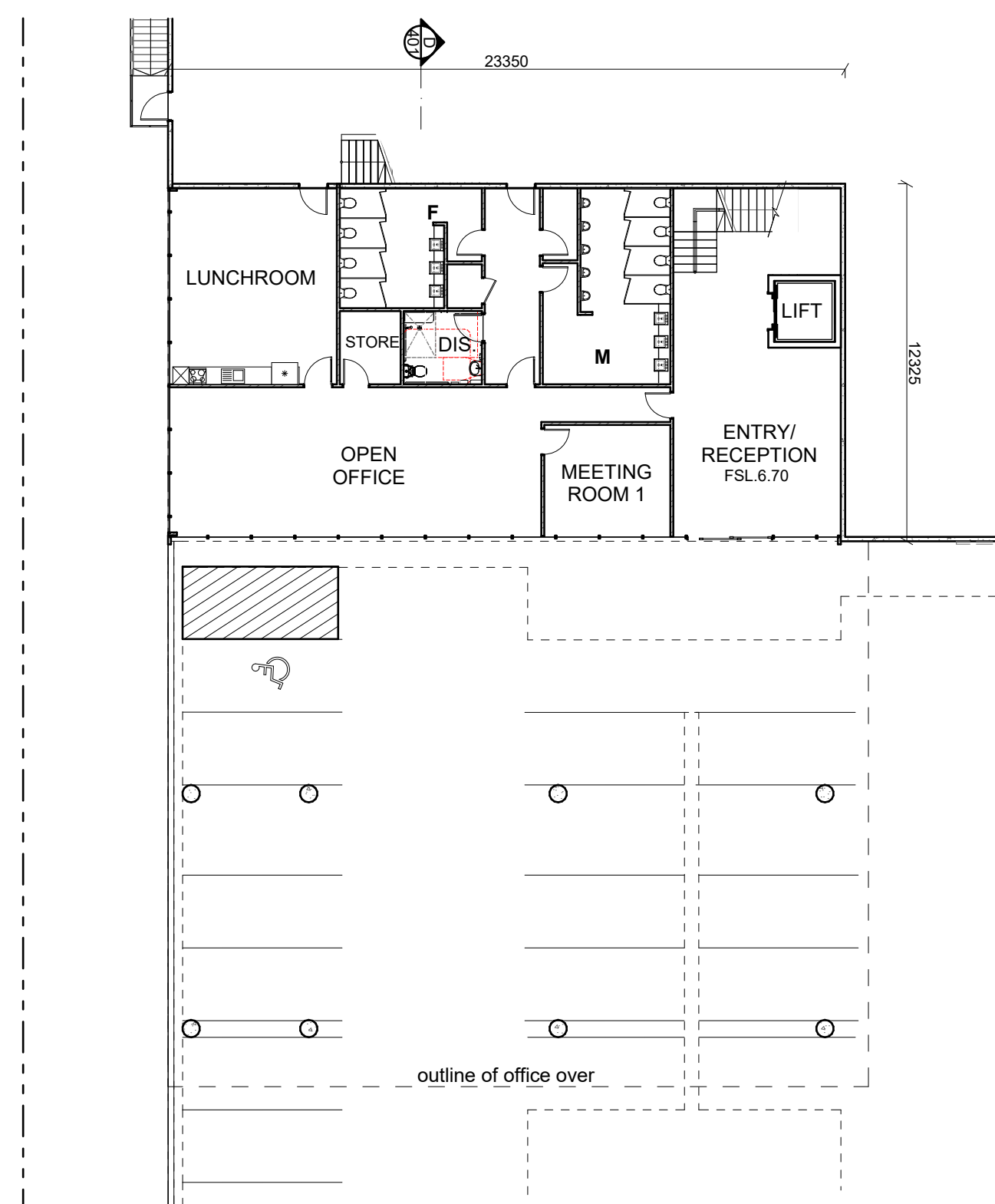
OFFICE 1 - FIRST FLOOR LAYOUT
Scale 1:200



OFFICE 2 - FIRST FLOOR LAYOUT
Scale 1:200



OFFICE 1 - GROUND FLOOR LAYOUT
Scale 1:200



OFFICE 2 - GROUND FLOOR LAYOUT
Scale 1:200

Notes

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Issue : Date : Amendment :

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Project Manager :

Project :

PROPOSED WAREHOUSE DEVELOPMENT
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28 McPherson Street, Banksmeadow, NSW

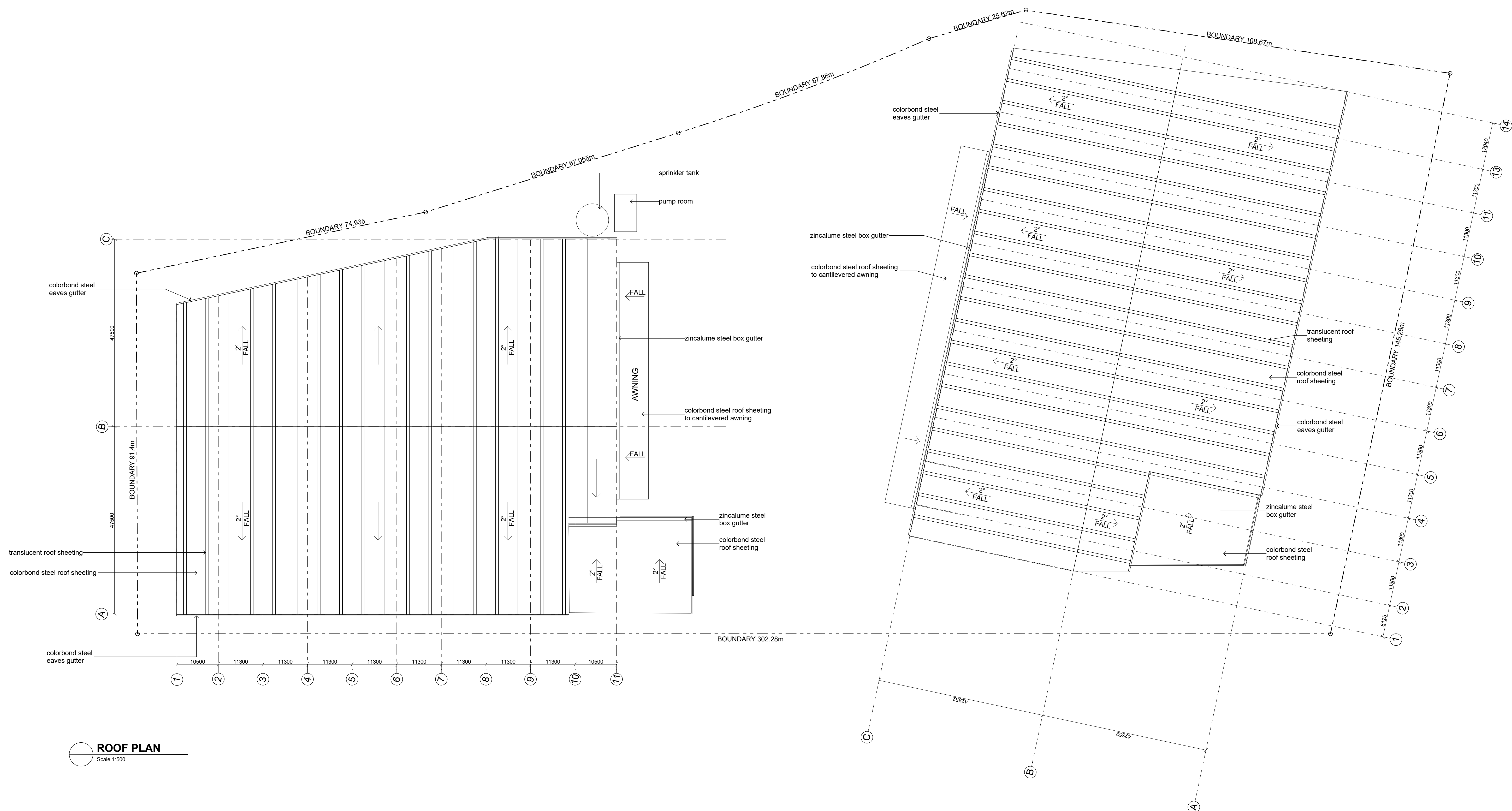
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Drawing :

OFFICE FLOOR PLANS

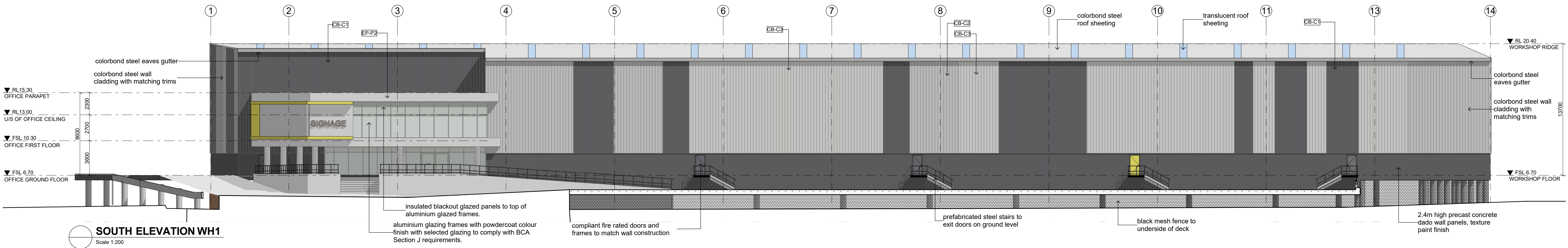
Drawn : RG	Project No : 180101	Drawing No : DA / A 201	Issue : A
Date : DEC 2018			
Scale : 1:200 @ A1			



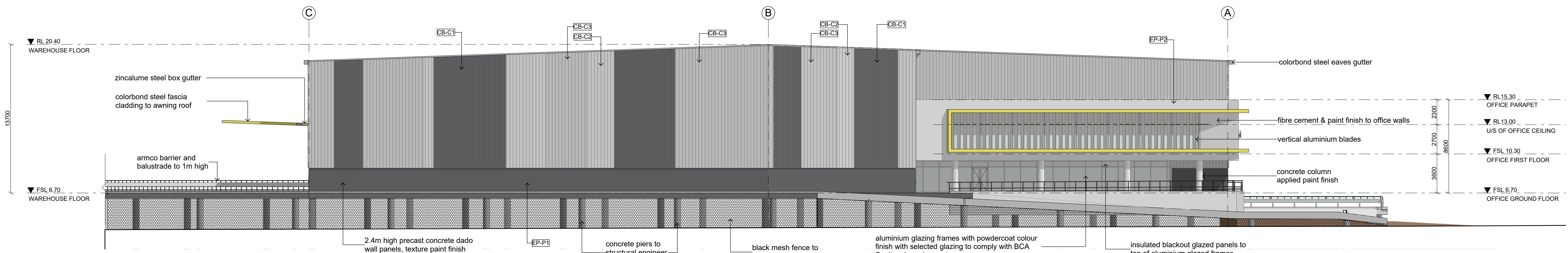
Notes

Issue : Date: Amendment:

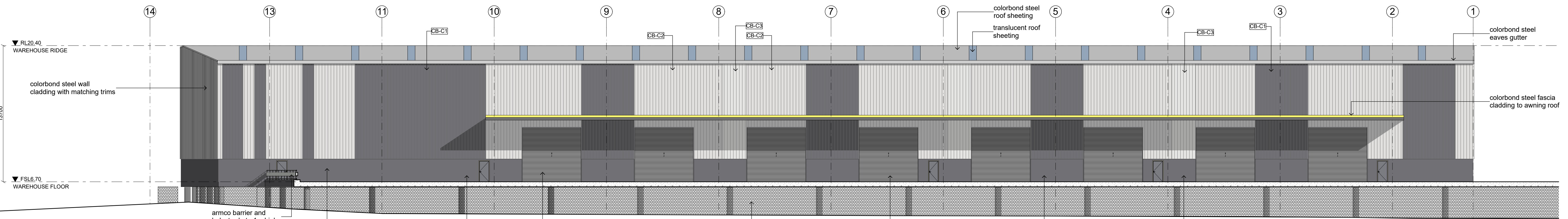
A 12/12/18 ISSUED FOR DEVELOPMENT APPLICATION



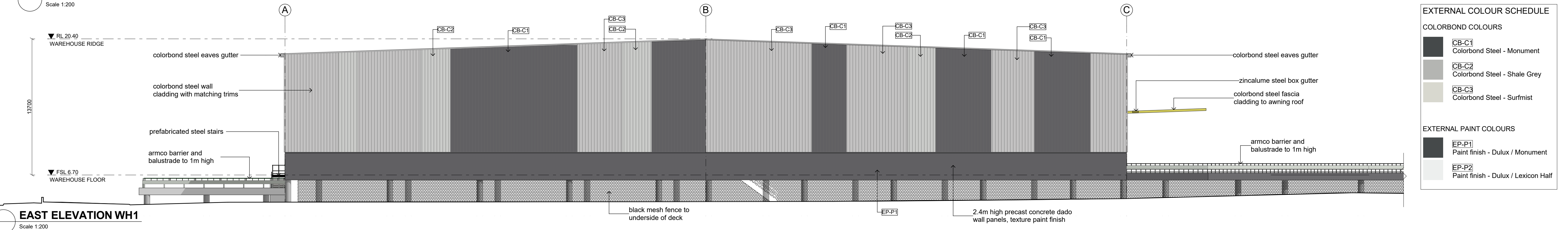
SOUTH ELEVATION WH1
Scale 1:200



WEST ELEVATION WH1
Scale 1:200



NORTH ELEVATION WH1
Scale 1:200



EAST ELEVATION WH1
Scale 1:200

EXTERNAL COLOUR SCHEDULE	
COLORBOND COLOURS	
	CB-C1 Colorbond Steel - Monument
	CB-C2 Colorbond Steel - Shale Grey
	CB-C3 Colorbond Steel - Surfist
EXTERNAL PAINT COLOURS	
	EP-P1 Paint finish - Dulux / Monument
	EP-P2 Paint finish - Dulux / Lexicon Half

Notes

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Project Manager :

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PROPOSED WAREHOUSE DEVELOPMENT
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28 McPherson Street, Banksmeadow, NSW

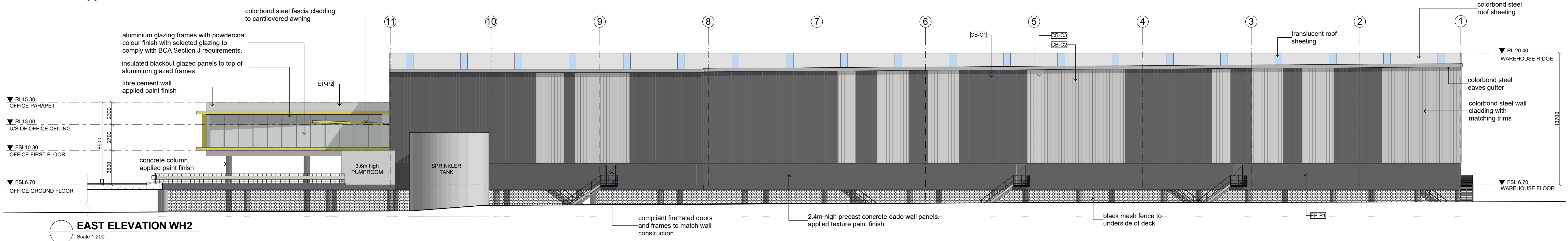
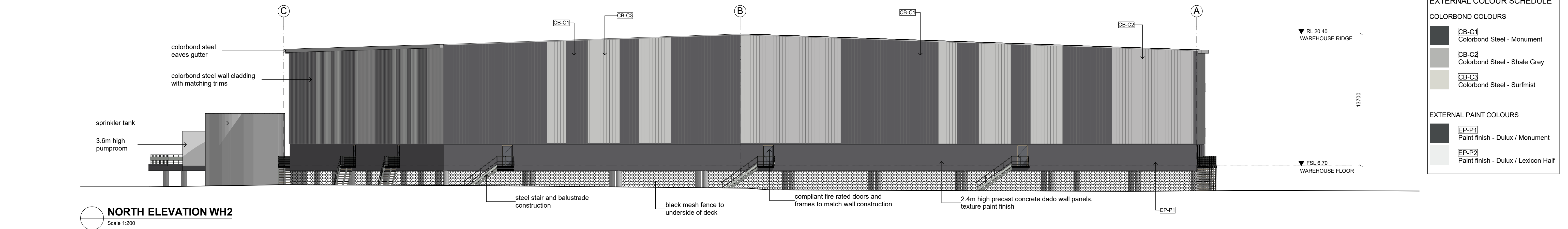
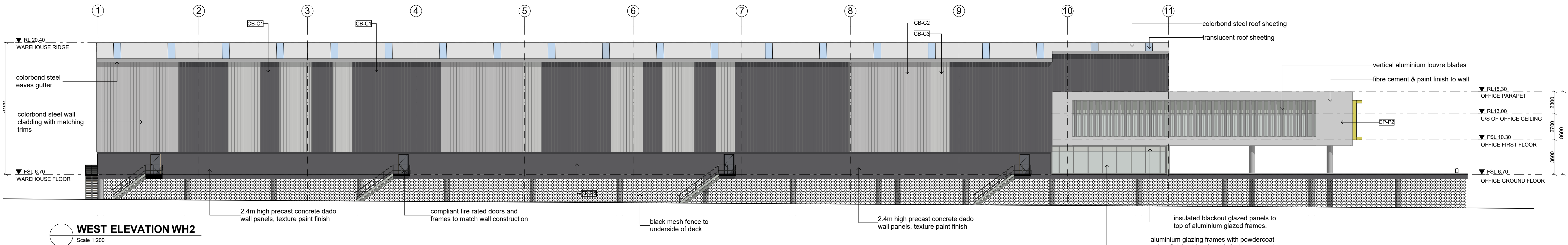
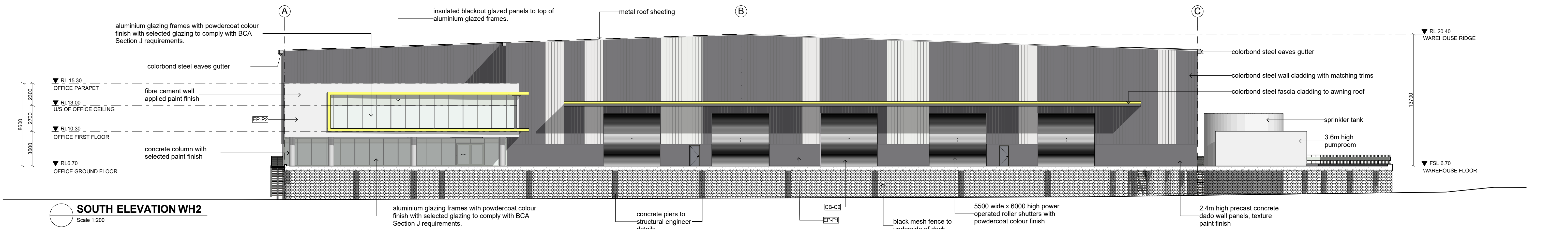
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Nominated Architect - David McDonald NSW ARB No. 7997



Drawing :

WAREHOUSE 1 ELEVATIONS

Drawn : RG	Project No : 180101	Drawing No : DA / A 301	Issue : A
Date : DEC 2018			
Scale : 1:200 @ A1			



EXTERNAL COLOUR SCHEDULE	
COLORBOND COLOURS	
	CB-C1 Colorbond Steel - Monument
	CB-C2 Colorbond Steel - Shale Grey
	CB-C3 Colorbond Steel - Surfist
EXTERNAL PAINT COLOURS	
	EP-P1 Paint finish - Dulux / Monument
	EP-P2 Paint finish - Dulux / Lexicon Half



PERSPECTIVE OF PROPOSED DEVELOPMENT



WESTERN VIEW OF PROPOSED DEVELOPMENT

Notes

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Drawing :

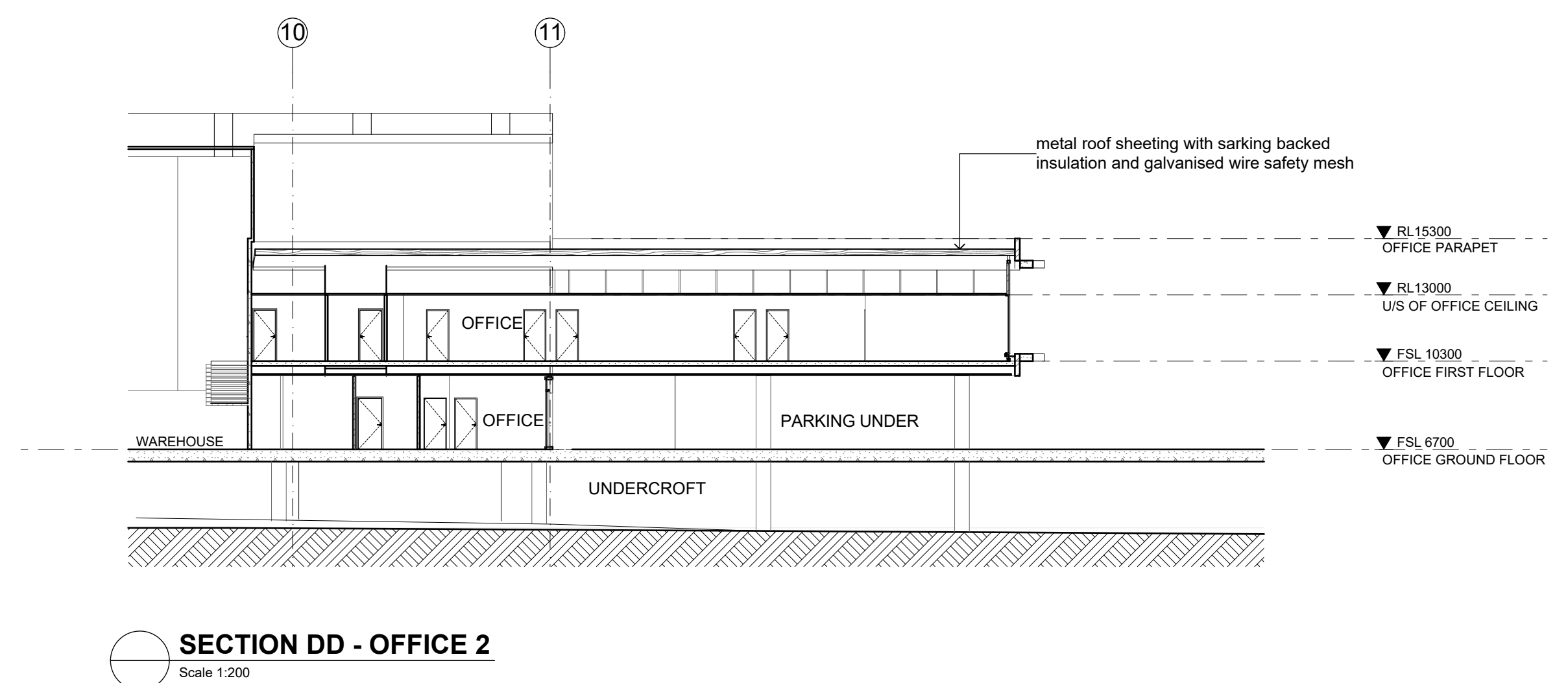
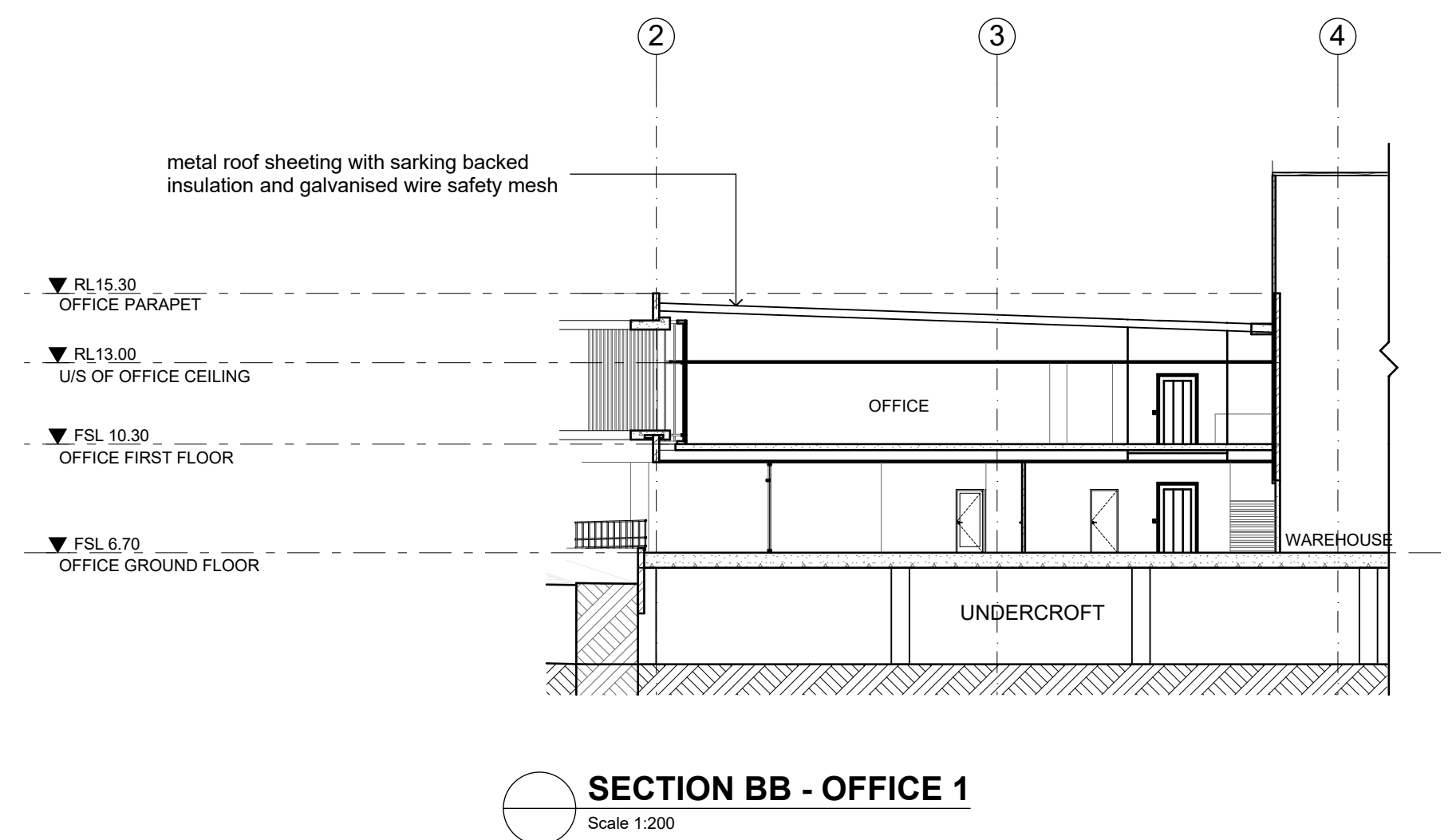
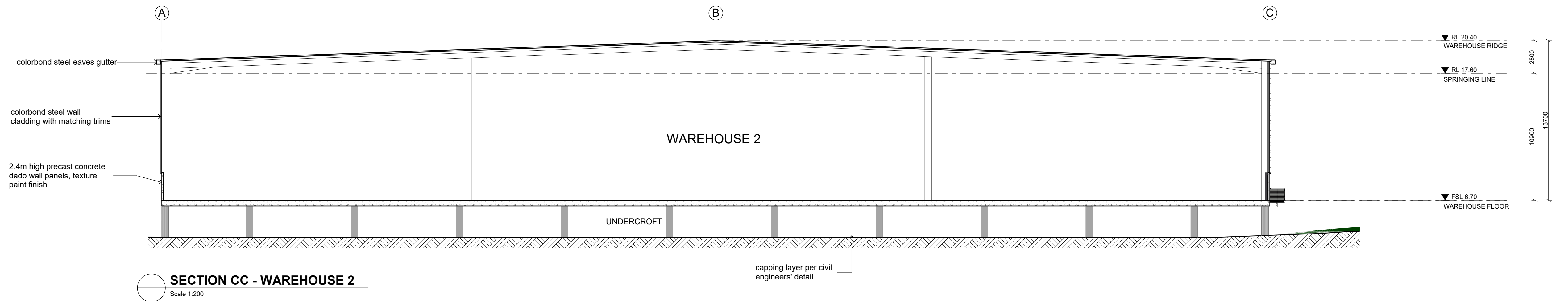
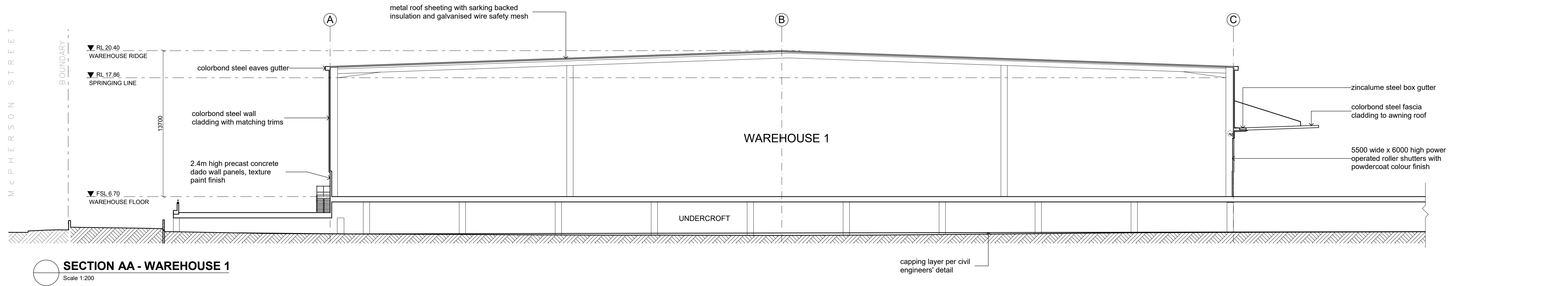
PHOTOMONTAGES

Drawn : RG
Date : DEC 2018
Scale : @A1

Project No :
180101

Drawing No :
DA / A 303

Issue :
A



Notes

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Project Manager :

Project :

PROPOSED WAREHOUSE DEVELOPMENT
WAREHOUSE/STORAGE/DISTRIBUTION
28 McPherson Street, Banksmeadow, NSW

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Nominated Architect - David McDonald NSW ARB No. 7997



Drawing :

SECTIONS

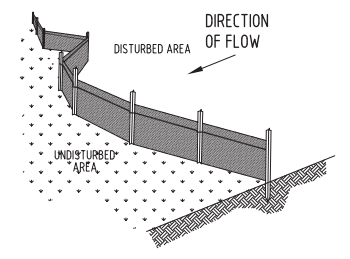
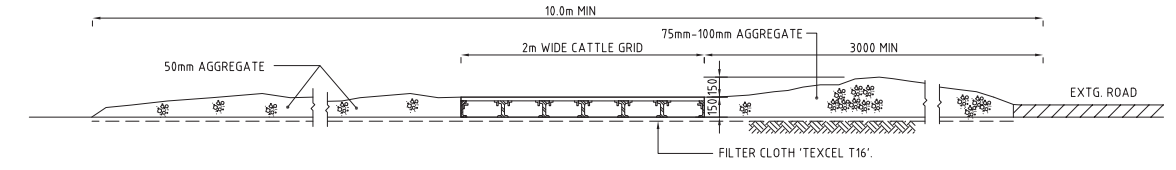
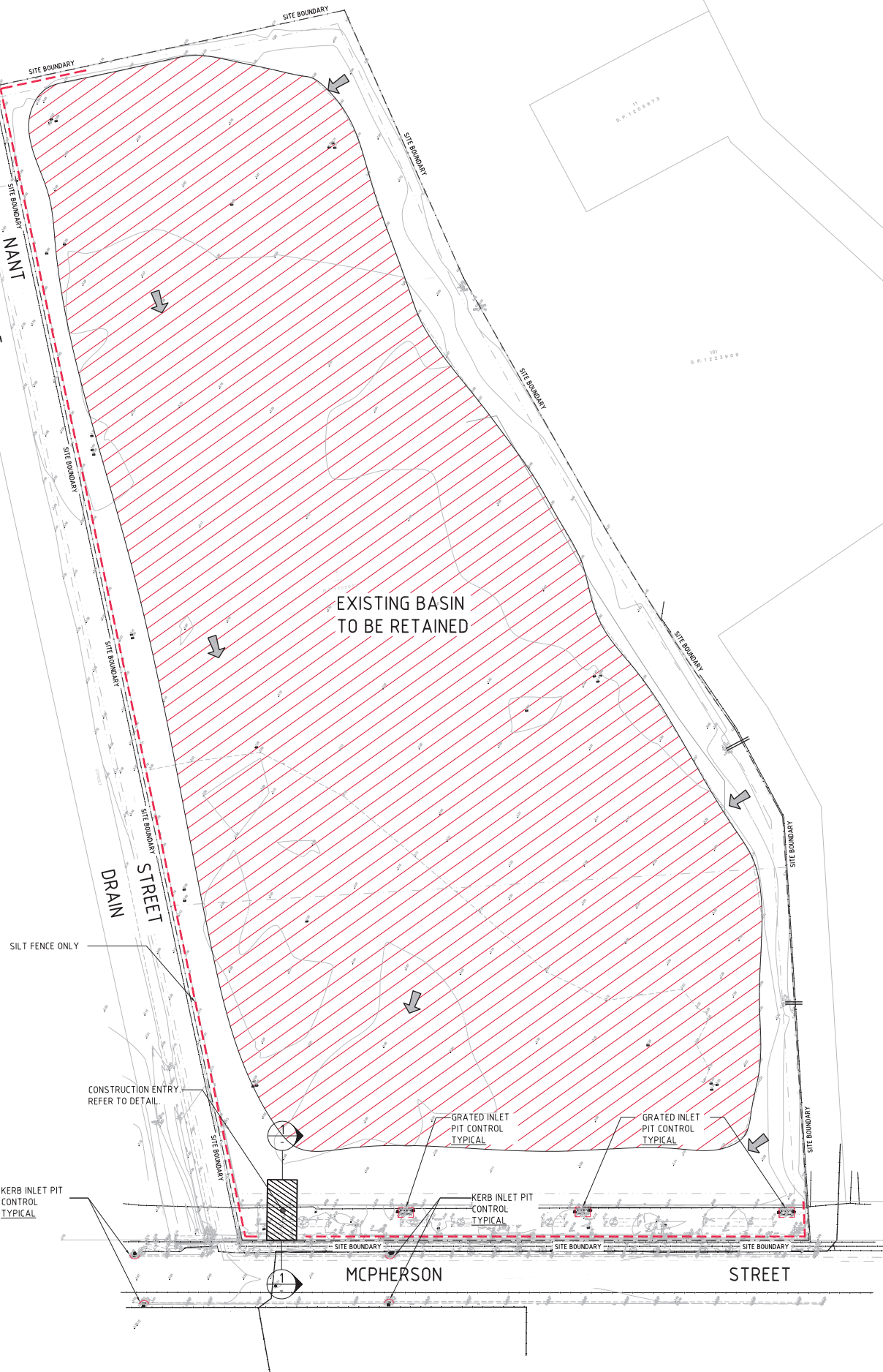
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Date : DEC 2018
Scale : 1:200 @ A1

Project No :
180101

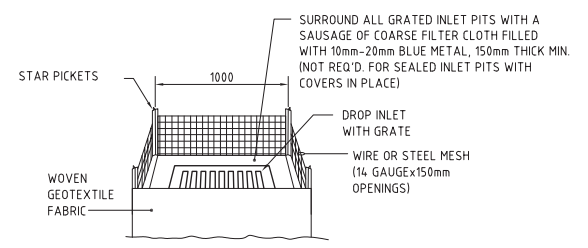
Drawing No :
DA / A 401

Issue :
A

SPRINGVALE



TYPICAL SILT FENCE DETAIL
N.T.S.
PROVIDE 1m RETURNS AT 30m INTERVALS.
TYPICAL



GRADED INLET PIT FILTER DETAIL
N.T.S.

LEGEND:
PROVIDE 1m RETURNS TO SILT FENCE AT 30m MAX. INTERVALS.
TYPICAL (N.S.O.P.)

- DENOTES DIRECTION OF OVERLAND FLOW
- DENOTES SILT FENCE WITH CATCH DRAIN
- DENOTES GRADED INLET PIT FILTER

NOTE:
NO SEDIMENTATION BASIN IS REQUIRED AS THE TOTAL DISTURBED AREA IS LESS THAN 2,500m². ALTERNATE METHODS HAVE BEEN EMPLOYED TO PROTECT THE RECEIVING WATERS.

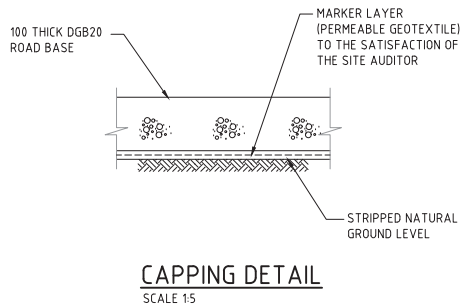
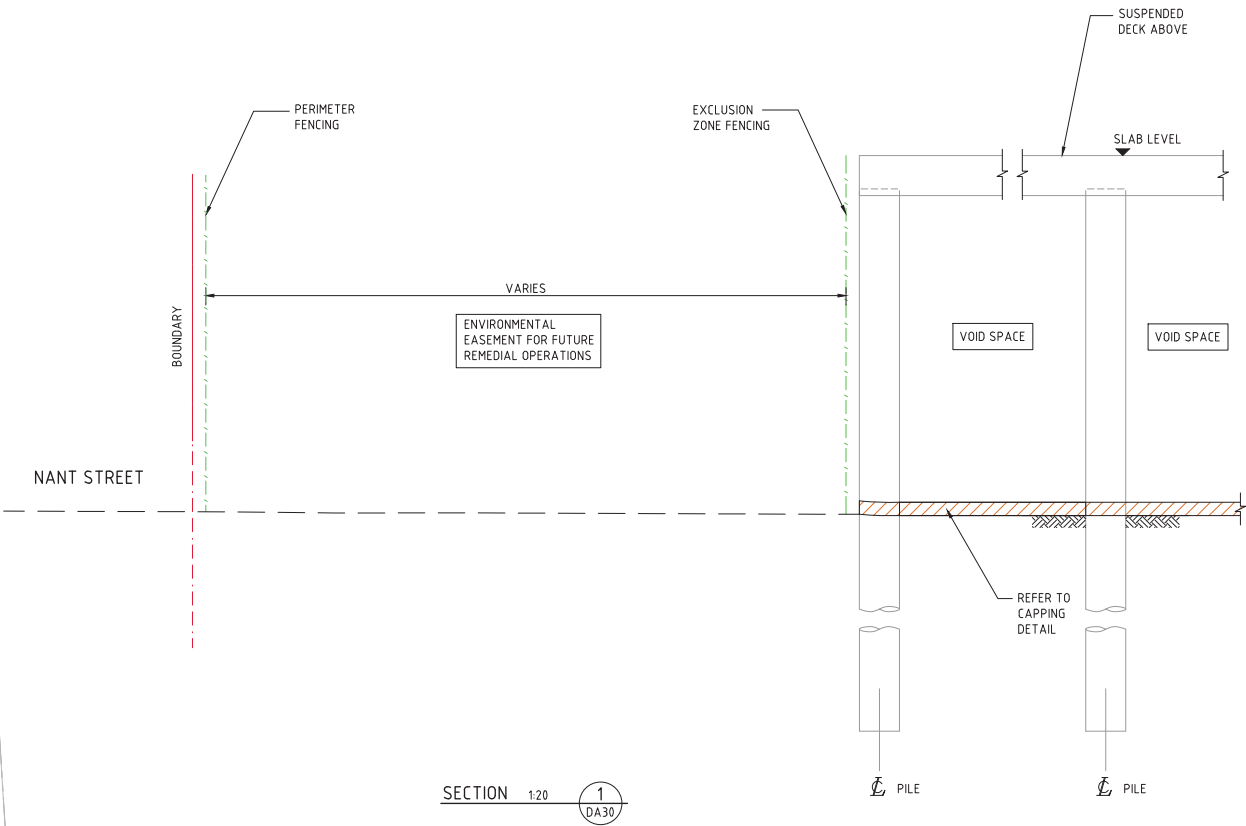
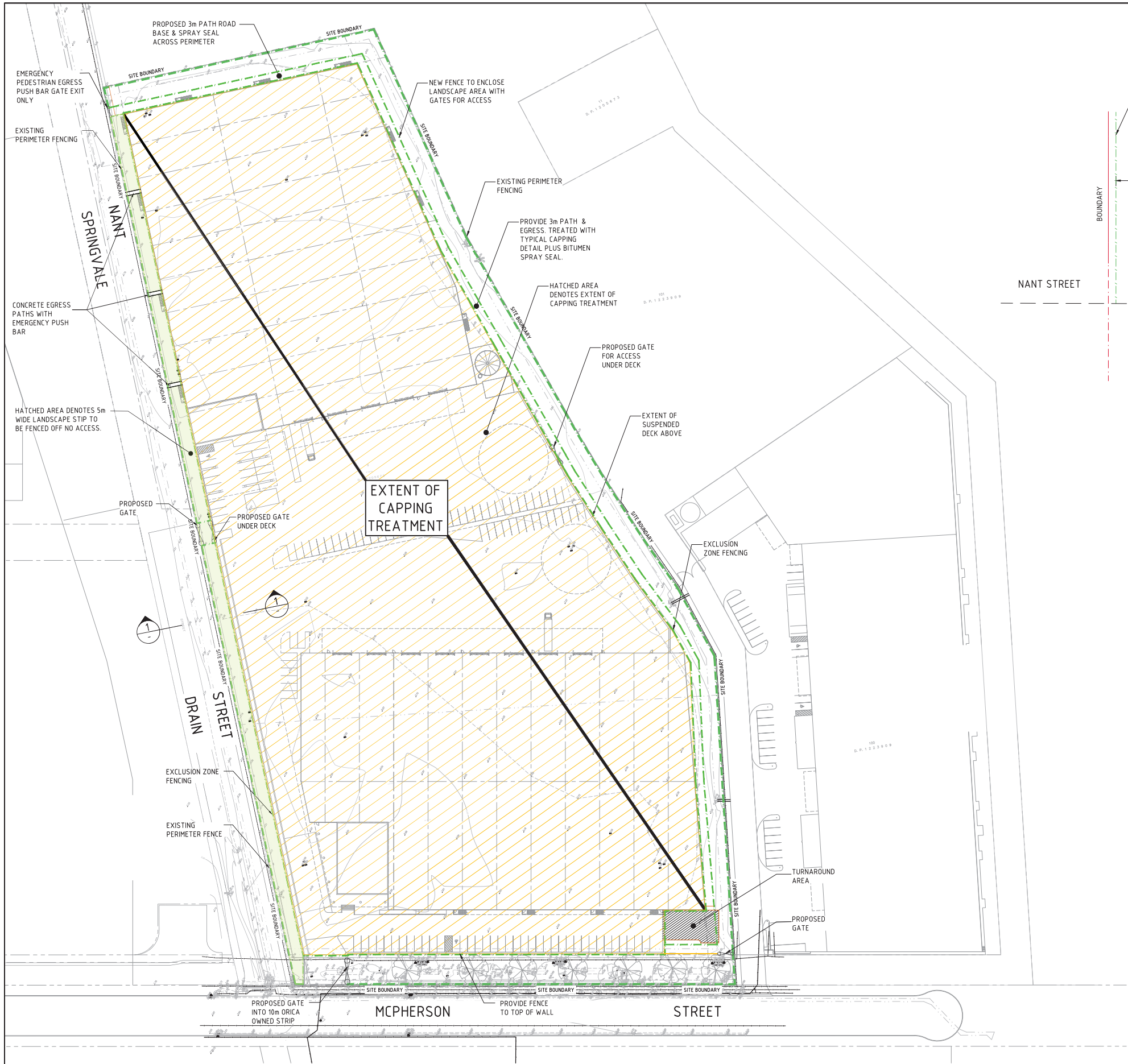
NOTE:
REFER TO DRAWING C09349.12-DA10 FOR EROSION CONTROL NOTES.

 EROSION AND SEDIMENT CONTROL PLAN & DETAILS
1500

FOR INFORMATION ONLY



ISSUED FOR INFORMATION ONLY				30.01.19				B			
ISSUED FOR INFORMATION ONLY				30.11.18				A			
AMENDMENTS				DATE	ISSUE	AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE
ARCHITECT				AXIS				CLIENT			
PROJECT				PROPOSED WAREHOUSE DISTRIBUTION AND OFFICE DEVELOPMENT				COSTIN ROE CONSULTING PTY LTD.			
DESIGNED				DATE	CHECKED	SIZE	SCALE	CADD REF: 9349.12-DA20			
DRAWN				SM	XC	A0	AS SHOWN	Level 1, 8 Windmill Street, Wahah Bay, Sydney NSW 2000			
DATE				NOV 18				Tel: (02) 8551-7899 Fax: (02) 8541-3721			
AMENDMENTS								email: mail@costinroe.com.au			
DRAWING TITLE				EROSION AND SEDIMENT CONTROL PLAN & DETAILS				DRAWING No 9349.12-DA 20			
PRECISION				COMMUNICATION				ACCOUNTABILITY			
ISSUE				B							



SITE PREPARATION NOTES:

1. STRIP ANY TOPSOIL OR DELETERIOUS MATERIAL AND DISPOSE OFF FROM SITE OR STORE AS DIRECTED.
2. EXISTING SUBGRADE TO BE PROOF ROLLED TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER.
3. INSTALL MARKER LAYER TO THE SATISFACTION OF THE SITE AUDITOR.
4. PLACE ROAD BASE AS NOTED ON CAPPING DETAIL.
5. FOLLOWING COMPLETION OF PILING WORKS, ROAD BASE TO BE BROKEN UP TO ALLOW FOR INFILTRATION TO BASE OF OPEN BASIN.

LEGEND:

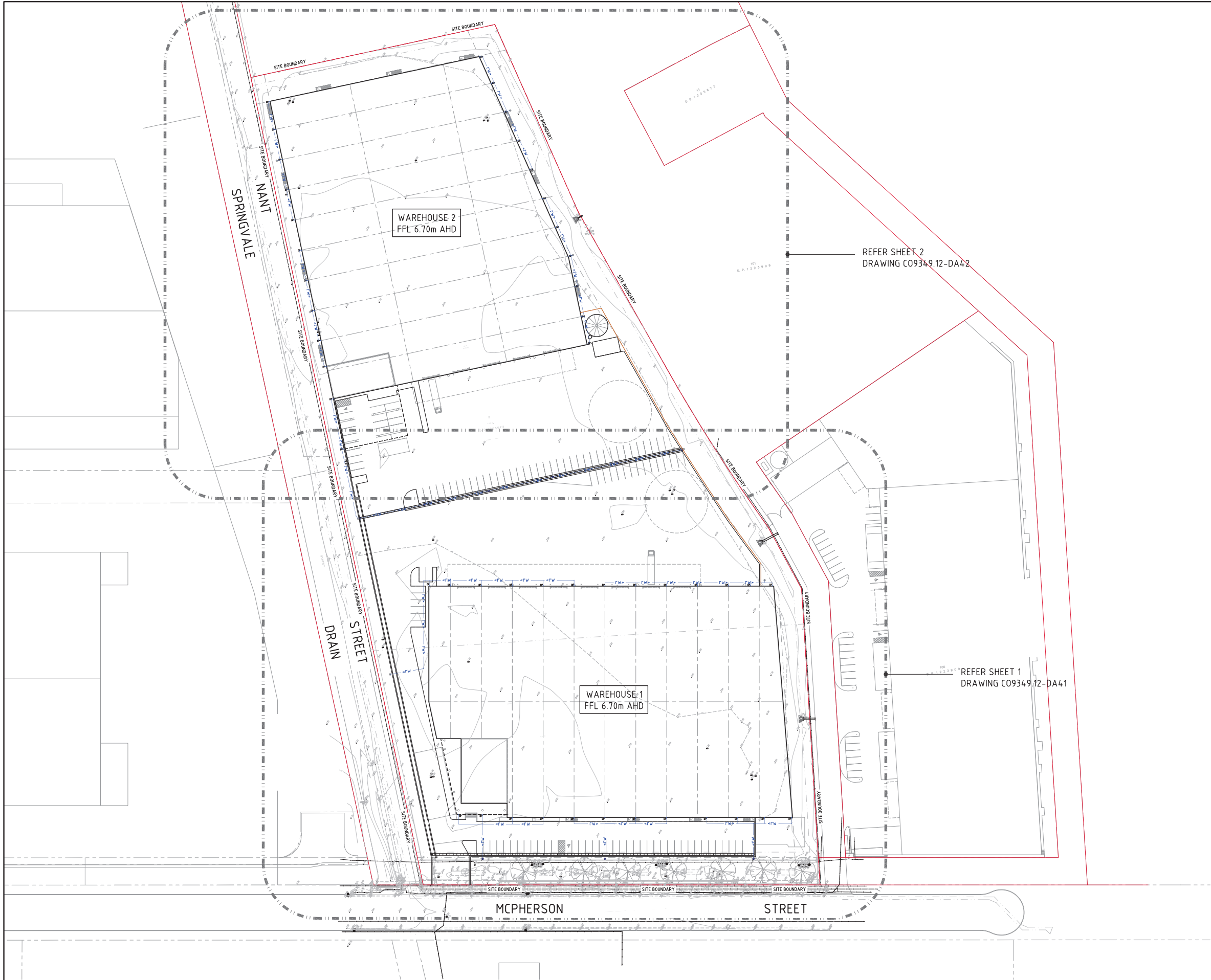
- DENOTES EXTENT OF CAPPING TREATMENT
- DENOTES EXTENT OF FENCED LANDSCAPED AREA (NO ACCESS)
- DENOTES PERIMETER FENCING
- DENOTES EXCLUSION ZONE FENCING
- DENOTES GATES



SITE PREPARATION PLAN
1:500

FOR INFORMATION ONLY

										ARCHITECT										CLIENT										PROJECT										CONSULTING ENGINEERS										DRAWING TITLE																			
										axis										DBL Property Pty Limited Development Managers and Property Advisors Suite 5, Upper Ground Floor 410 Kent Street Sydney NSW 2000 P: 02 9379 7882 M: 041 5016 986-401 E: info@dblproperty.com.au W: www.dblproperty.com.au										PROPOSED WAREHOUSE DISTRIBUTION AND OFFICE DEVELOPMENT 28 MCPHERSON ST, BANKS MEADOW NSW										Costin Roe Consulting Pty Ltd. Consulting Engineers Level 1, 8 Windmill Street Wahbi Bay, Sydney NSW 2000 Tel: (02) 8551-7699 Fax: (02) 8541-3721 email: mail@costinroe.com.au ©										SITE PREPARATION PLAN																			
ISSUED FOR INFORMATION ONLY 30.01.19 C 11.01.19 B 21.12.18 A										DATE ISSUE AMENDMENTS										DATE ISSUE AMENDMENTS										DATE ISSUE AMENDMENTS										DATE ISSUE AMENDMENTS										PRECISION COMMUNICATION ACCOUNTABILITY										DRAWING No 934.9.12-DA 30									



 **STORMWATER KEY PLAN**
1:500

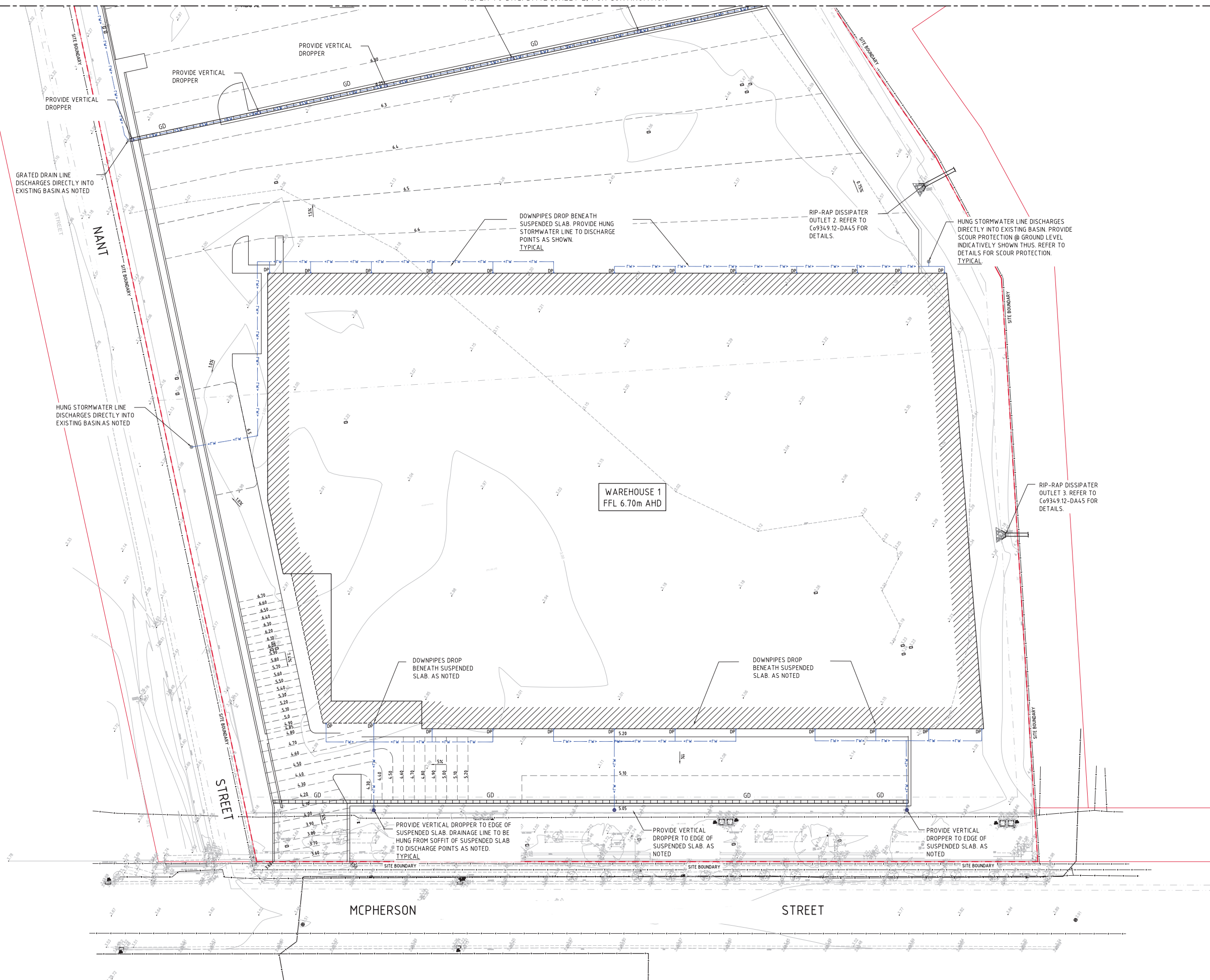
NOTE:
REFER TO DRAWING C09349.12-DA10 FOR STORMWATER NOTES.



FOR INFORMATION ONLY

ISSUED FOR INFORMATION ONLY ISSUED FOR INFORMATION ONLY AMENDMENTS				30.01.19 30.11.18 DATE				B A ISSUE				AMENDMENTS DATE ISSUE AMENDMENTS				ARCHITECT  CLIENT 				PROJECT PROPOSED WAREHOUSE DISTRIBUTION AND OFFICE DEVELOPMENT 28 MCPHERSON ST, BANKS MEADOW NSW DESIGNED: HW DRAWN: SM DATE: NOV 18 CHECKED: XC SIZE: A0 SCALE: AS SHOWN CAD REF: 9349.12-DA40				 Costin Roe Consulting Pty Ltd. Consulting Engineers Level 1, 8 Windmill Street Wahbi Bay, Sydney NSW 2000 Tel: (02) 8551-7899 Fax: (02) 8541-3721 email: mail@costinroe.com.au				 PRECISION COMMUNICATION ACCOUNTABILITY				DRAWING TITLE STORMWATER KEY PLAN PLAN & DETAILS DRAWING No 9349.12-DA 40 ISSUE B			
---	--	--	--	---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	--	--	--	--	--	--	--

REFER TO DRG. DA42 (SHEET 2) FOR CONTINUATION



LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION TITLED PLANS SHOWING DETAIL AND PLAN LEVELS LOT 9 D.P. 1205673 NO.28 MCPHERSON STREET BY RYGATE SURVEYORS DATED 30.10.18

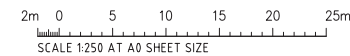
- DP - ROOFWATER DOWNPIPE (INDICATIVE)
- +60.00 - SPOT LEVEL
- 1% - PAVEMENT FALL DIRECTION AND GRADE
- FW - PROPOSED ROOFWATER LINE
- SW - PROPOSED STORMWATER LINE
- GRATED DRAIN
- DP - VERTICAL DROPPER
- DP - DRAIN TO EXISTING BASIN
- 50.00 - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 - FINISHED PAVEMENT CONTOUR (MINOR)

NOTE:

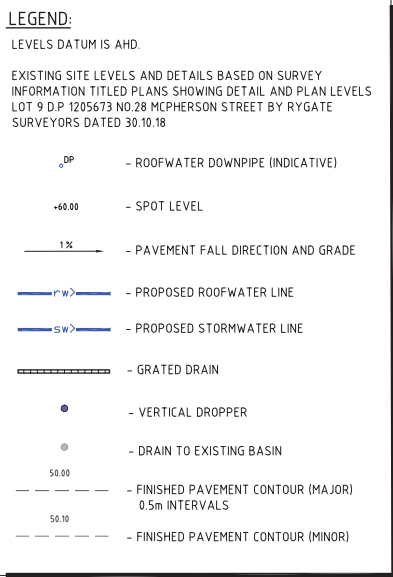
REFER TO DRAWING C09349.12-DA10 FOR STORMWATER NOTES.

STORMWATER DRAINAGE PLAN SHEET 1
1:250

FOR INFORMATION ONLY

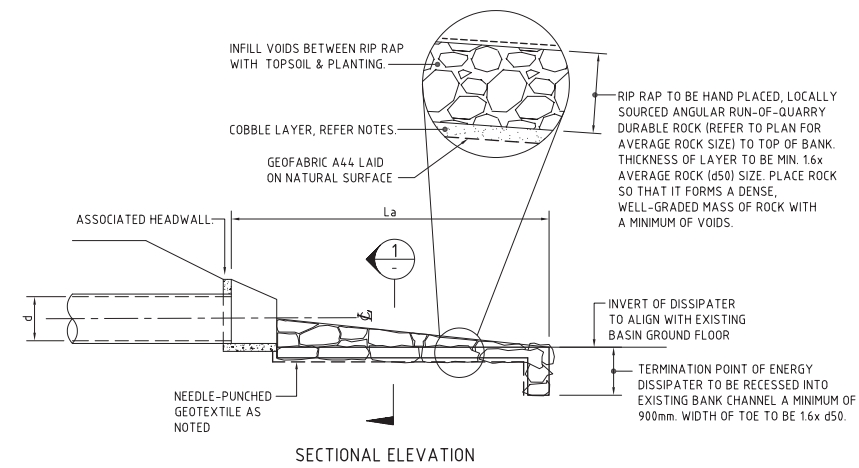
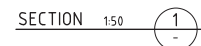


ISSUED FOR INFORMATION ONLY 30.01.19 B			ARCHITECT			CLIENT			PROJECT			Costin Roe Consulting Pty Ltd. Consulting Engineers Level 1, 8 Windmill Street Wahah Bay, Sydney NSW 2000 Tel: (02) 8551-7889 Fax: (02) 8541-3721 email: mail@costinroe.com.au			DRAWING TITLE STORMWATER DRAINAGE PLAN SHEET 1		
AMENDMENTS			DATE			DATE			DESIGNED (DATE)			PRECISION COMMUNICATION ACCOUNTABILITY			DRAWING No 9349.12-DA 41		
AMENDMENTS			DATE			DATE			CHECKED (DATE)			SCALE 1:250 AT A0 SHEET SIZE			ISSUE B		
AMENDMENTS			DATE			DATE			SIZE A0			CNO REF: 9349.12-DA41					
AMENDMENTS			DATE			DATE			NOV 18			AS SHOWN					
AMENDMENTS			DATE			DATE			SM			XC					

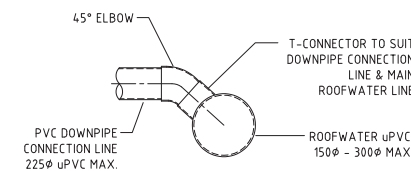




DISSIPATER	SCHEDULE			
DISCHARGE POINT	d	La	W	RIP-RAP (d50)
OUTLET 1	225	2000	2300	150
OUTLET 2	600	5500	6100	200
OUTLET 3	600	5100	6100	200
OUTLET 4	300	3200	3500	150



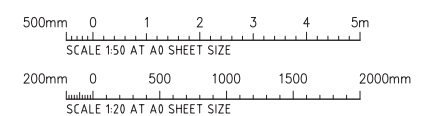
STORMWATER OUTLET DISSIPATER WITH HEADWALL
SCALE 1:50



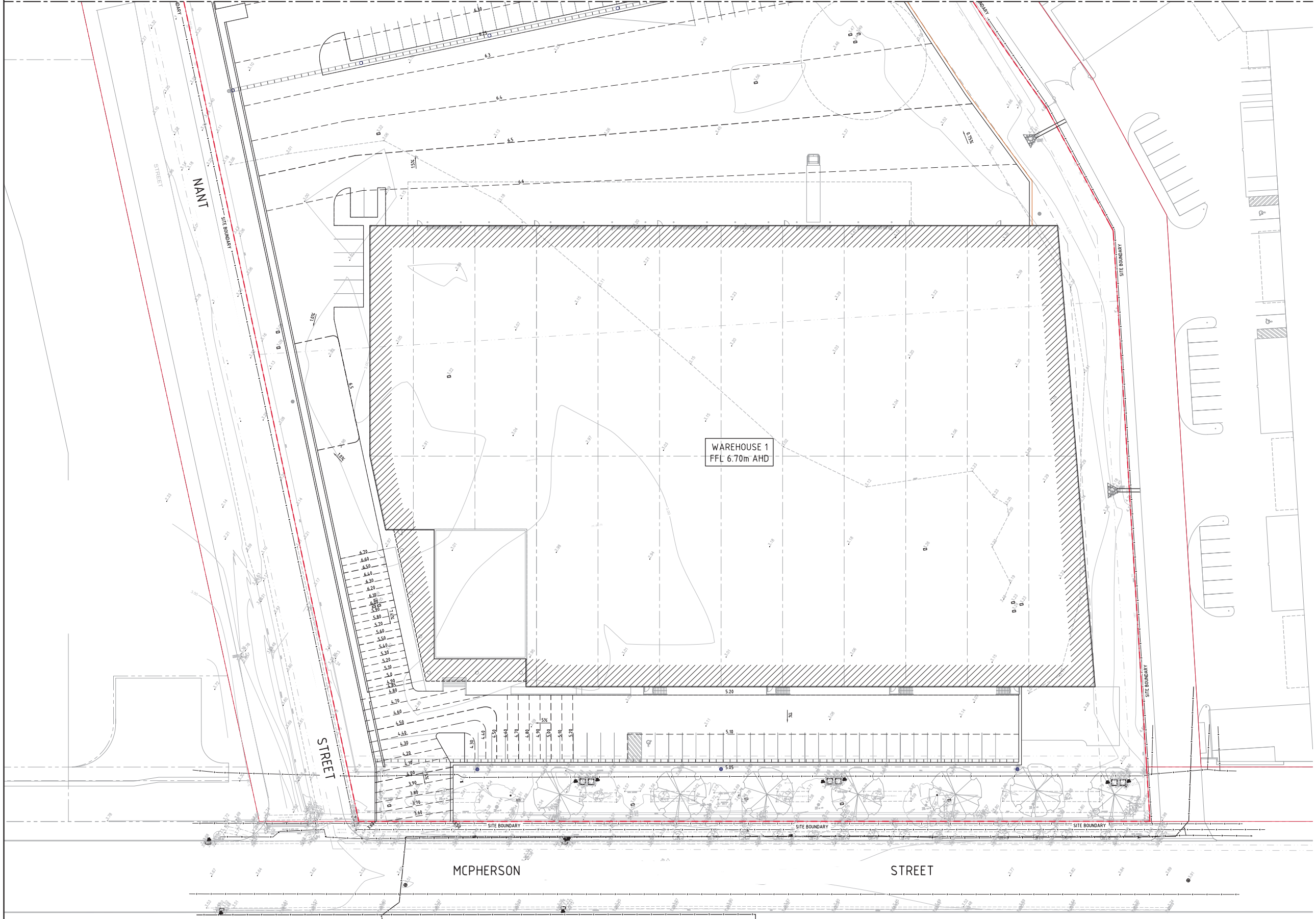
DOWN PIPE CONNECTION TO uPVC PIPE

1. PROPRIETARY T-PIECE CONNECTORS SHALL BE USED TO WHERE DIRECT CONNECTIONS ARE REQUIRED TO uPVC PIPES.
2. ALL JOINTS TO BE SEALED WITH SOLVENT WELDED JOINTS.
3. THE PVC PIPE SHALL NOT PROTRUDE BEYOND THE INNER SURFACE OF THE STORMWATER PIPE.

SCALE 1:20



REFER TO DRG. DA52 (SHEET 2) FOR CONTINUATION

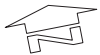


LEGEND:
LEVELS DATUM IS AHD.

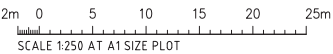
EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION TITLED PLANS SHOWING DETAIL AND PLAN LEVELS LOT 9 D.P. 1205673 NO.28 MCPHERSON STREET BY RYGALE SURVEYORS DATED 30.10.18

- DP - ROOF WATER DROPPED (INDICATIVE)
- +6.00 - FINISHED LEVEL SPOT LEVEL
- +6.70 - EXISTING SPOT HEIGHT
- 1% - PAVEMENT FALL DIRECTION AND GRADE
- - GRATED DRAIN
- o - VERTICAL DROPPER
- o - DRAIN TO EXISTING BASIN
- 50.00 --- - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 --- - FINISHED PAVEMENT CONTOUR (MINOR)

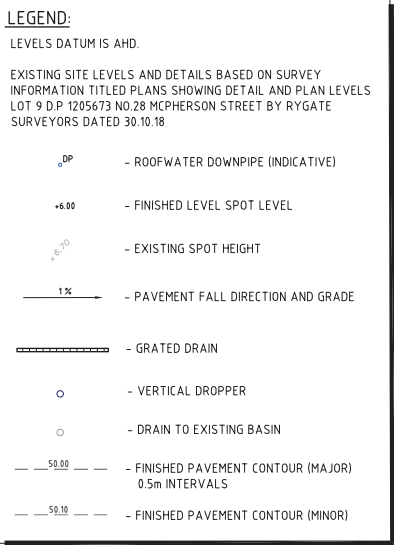
NOTE:
REFER TO DRAWING C0934.9.12-DA10 FOR FINISHED LEVELS NOTES.

 **FINISHED LEVELS PLAN SHEET 1**
1:250

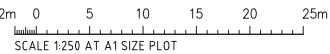
FOR INFORMATION ONLY



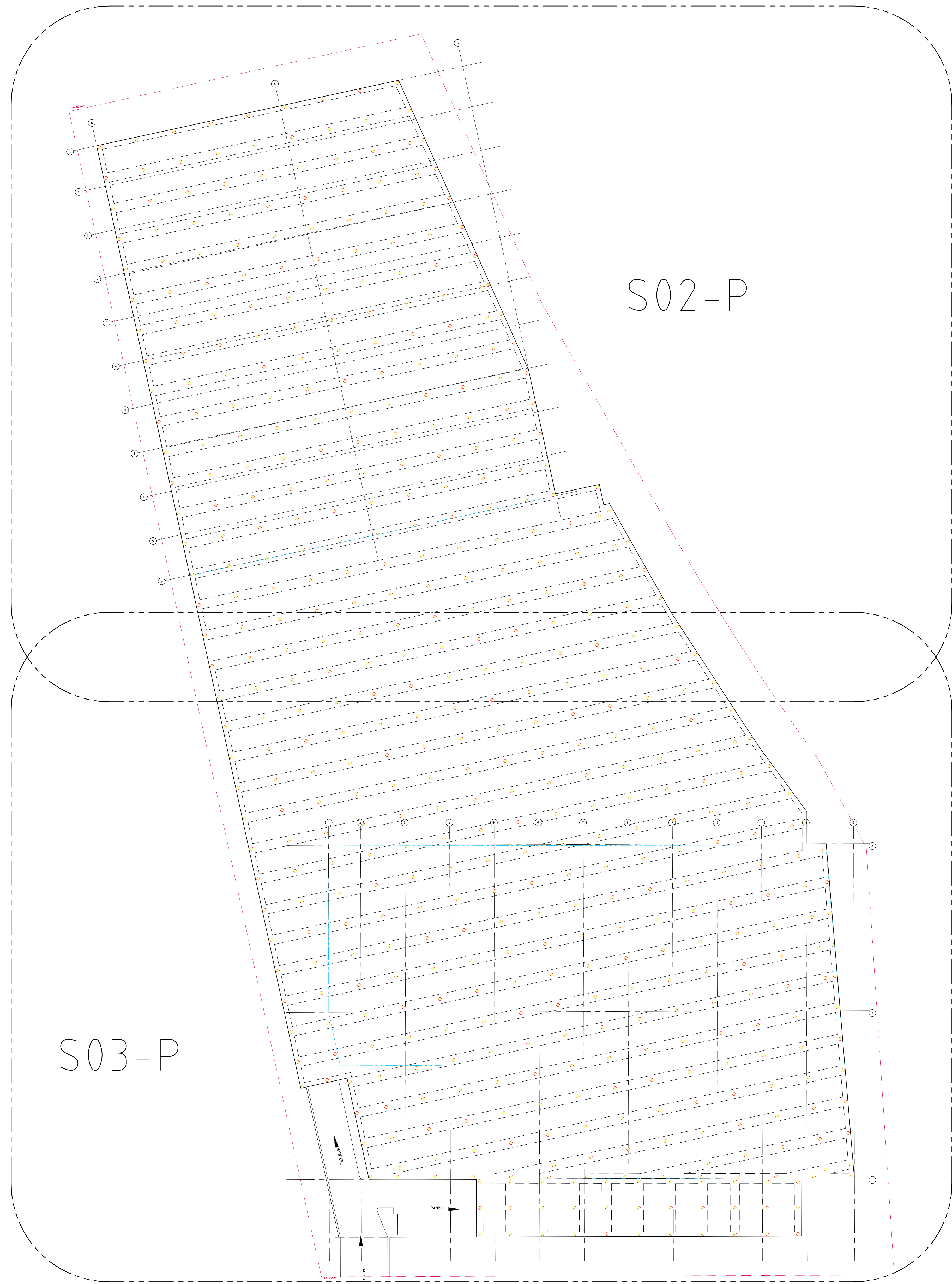
ISSUED FOR INFORMATION ONLY		30.01.19	B			ARCHITECT		CLIENT		PROJECT		COSTIN ROE CONSULTING PTY LTD.		DRAWING TITLE	
ISSUED FOR INFORMATION ONLY		30.11.18	A			AXIS				PROPOSED WAREHOUSE DISTRIBUTION AND OFFICE DEVELOPMENT		Level 1, 8 Windmill Street, Wahah Bay, Sydney NSW 2000		FINISHED LEVELS PLAN SHEET 1	
AMENDMENTS		DATE	ISSUE	AMENDMENTS		DATE		DATE		DESIGNED (DRAWN) DATE		CHECKED (XC) DATE		SCALE (A0) AS SHOWN	
										MW SM NOV 18		XC NOV 18		1:250	
										CAD REF: 9349.12-DA51				PRECISION COMMUNICATION ACCOUNTABILITY	
														DRAWING No 9349.12-DA 51	
														ISSUE B	



FOR INFORMATION ONLY

[illegible]

Appendix C Concept Piling Designs



250 MIN. THICK SUSPENDED PT BANDED SLAB
ON CONCRETE COLUMNS OVERALL PLAN
SCALE 1500

PRELIMINARY DRAWING; NOT ALL DETAILS SHOWN
ALLOW FOR ADDITIONAL STRUCTURAL COMPONENTS
SUBJECT TO ARCHITECTURAL RESOLUTION

- GENERAL NOTES :**
- SUSPENDED SLAB TO BE A POST-TENSIONED SLAB OF 250 MINIMUM THICKNESS U.N.O. SUPPORTED ON EDGE AND BAND BEAMS
 - EDGE BEAMS TO BE 600 DEEP x 1200 WIDE U.N.O. ON DRGS S02 & S03
 - BAND BEAMS TO BE 600 DEEP x 2400 WIDE U.N.O. PLACED AT 8000 MAX. CTRS. U.N.O. ON DRGS S02 & S03
 - EDGE BEAMS & BAND BEAMS ARE SUPPORTED CENTRALLY ON 800 DIA. REINFORCED CONCRETE COLUMNS, PLACED AT 10000 MAX. CTRS. U.N.O. ON DRGS S02 & S03. A REINFORCED CONCRETE PILE CAPS (ON DRIVEN TIMBER PILES) AS DETAILED ON DRG S04 SUPPORTS EACH CONCRETE COLUMNS.
 - SLAB PENETRATION LOCATIONS TO BE CONFIRMED & COORDINATED WITH ARCHITECT & OTHER CONSULTANTS. ANY VARIATIONS TO THOSE SHOWN ON THESE DRAWINGS TO BE ADVISED TO STRUCTURAL ENGINEER.
 - SLAB DEFLECTIONS :
SPAN/500 INCREMENTAL
SPAN/250 TOTAL
 - LANDSPAN RAMP TO BE A 300 THICK CONVENTIONALLY REINFORCED TRAFFICABLE SLAB SUPPORTED ON A 600 WIDE CORBEL OFF MAIN SLAB EDGE BEAM & SPANNING TO NATURAL GROUND AT NANT STREET.

- POST TENSIONED SLAB NOTES**
1. POST TENSIONED SLAB TO BE COMPLETED BY A SPECIALIST PT DESIGN AND CONSTRUCT CONTRACTOR.
 2. LOADS INDICATED ARE PRESENT FOR DESIGN PURPOSE PT DESIGN TO ALLOW FOR ALL LOADS AS REQUIRED BY AS1170
 3. MAXIMUM SHORT TERM DEFLECTION OF SLABS & BEAMS SHALL BE SPAN/500
MAXIMUM LONG TERM DEFLECTION OF SLABS & BEAMS SHALL BE SPAN/250
 4. PT CONTRACTOR TO PROVIDE ALL PT REINFORCEMENT AND ANY REQUIRED SECONDARY NON PT INCLUDING BEAM SHEAR REINFORCEMENT AND PUNCHING SHEAR REQUIREMENTS.
 5. MINIMUM RESIDUAL COMPRESSION OF PT SLABS TO BE 14 MPa GENERALLY AND 20 MPa EXTERNALLY. THE CONTRIBUTION OF THE COLUMN STIFFNESS IN THE FLOOR SLAB DESIGN SHALL NOT BE PERMITTED
 6. THE PT DESIGN SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL 14 DAYS PRIOR TO CONSTRUCTION
 7. THE DESIGN OF THE PT FLOOR SHALL BE THE RESPONSIBILITY OF THE PT CONTRACTOR. A STRUCTURAL ENGINEER WITH NPER SHALL CERTIFY THE SLAB DESIGN & INSTALLATION.
 8. FLOOR TO BE CONSTRUCTED TO A TOLERANCE OF +/- 3mm OVER 3M LENGTH IN ANY DIRECTION. THE FINISHED LEVEL OF ANY POINT ON THE FLOOR SHALL BE WITHIN +/- 10mm OF THE NOMINATED FLOOR LEVEL.
- LOADS:** **HARDSTAND** **WAREHOUSE**
TRUCKS - 25kPa 5 TONNE POST LOAD - 35kPa

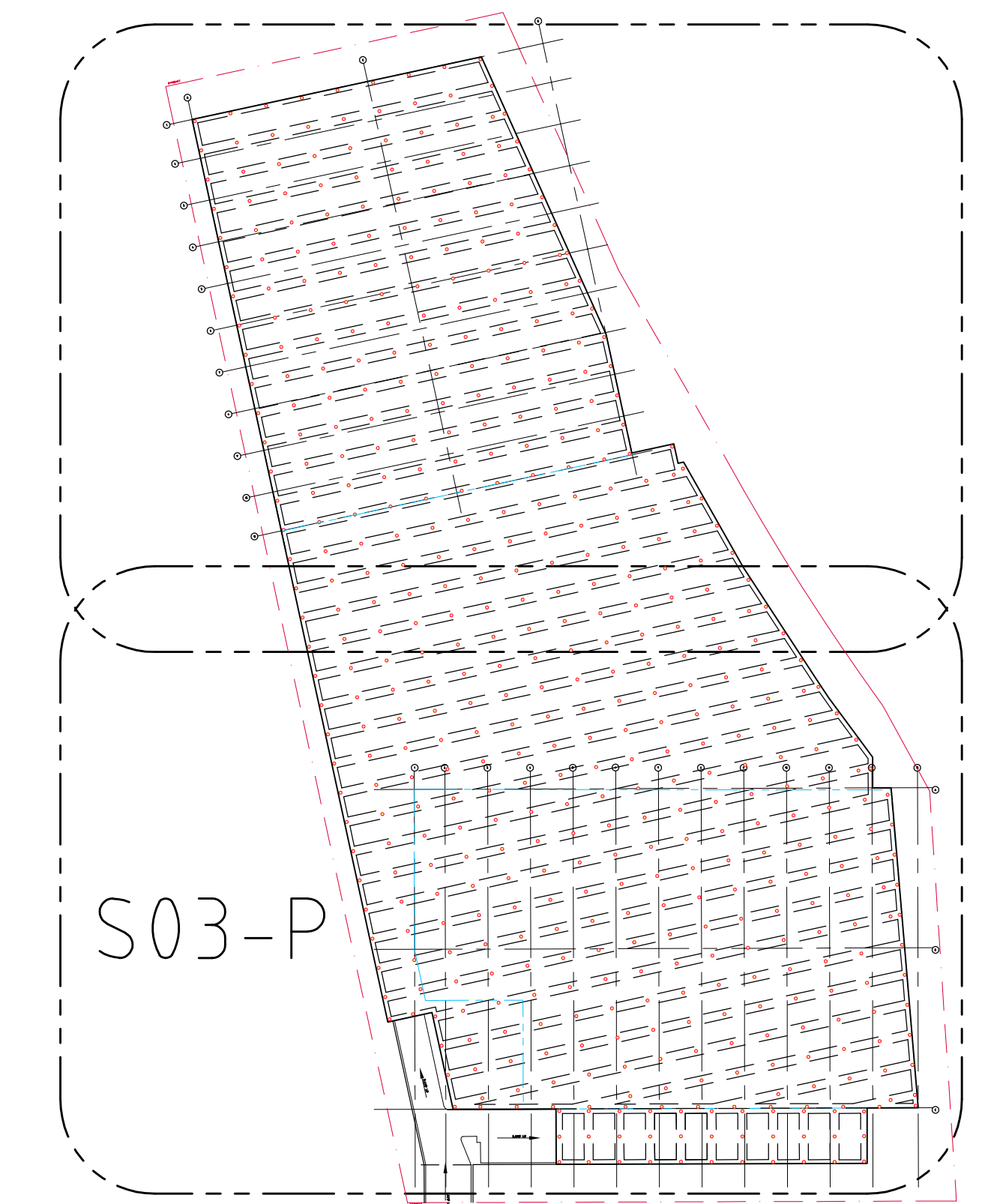
NOTE:
ATTENTION IS DRAWN TO THE FACT THAT DUE TO THE NATURE OF CONCRETE, CRACKING OF A NON-STRUCTURAL NATURE MAY OCCUR. REINFORCEMENT HAS BEEN ADDED TO THE SLABS TO MITIGATE THE EXTENT OF CRACKING, HOWEVER IT IS NOT POSSIBLE TO GUARANTEE COMPLETE ELIMINATION OF SLAB CRACKING.

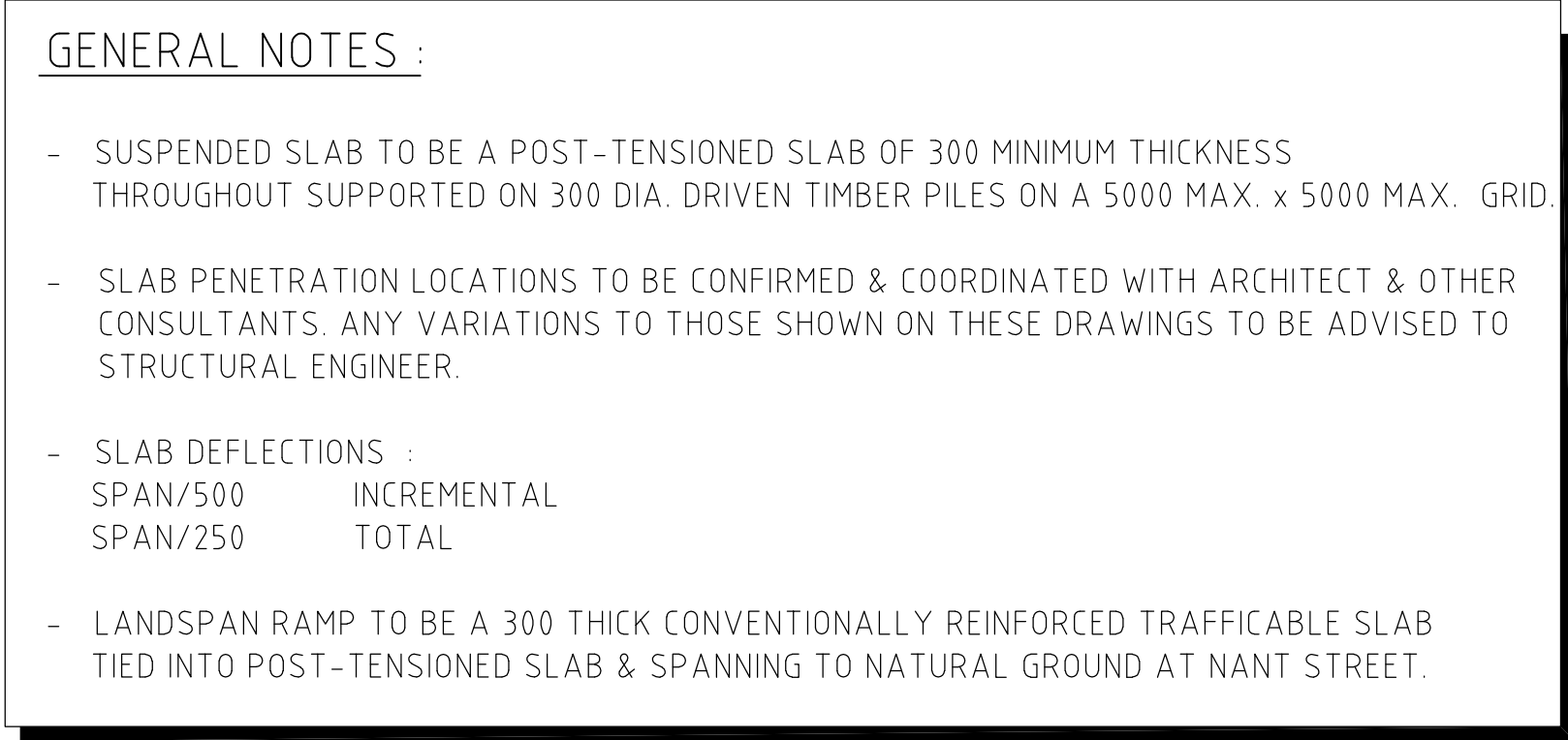
CONCRETE QUALITY					
ELEMENT	SLUMP	AGGREGATE (MAX. SIZE)	CEMENT TYPE	ADDMIXTURE	F _{ck} (MPa)
POST TENSIONED SLAB	80	20	SL	NL	40
COLUMNS	80	20	GP	NL	40
COLUMN FOOTINGS	80	20	SL	NL	32
LANDSPAN RAMP	80	20	GP	NL	32
MAXIMUM 56 DAY SHRINKAGE 650 MICROSTRAIN					

- REINFORCEMENT RATES :**
- POST TENSIONED SLAB**
POST TENSION REINFORCEMENT - 18 kg/m²
CONVENTIONAL REINFORCEMENT - 80 kg/m²
- CONCRETE COLUMNS**
CONVENTIONAL REINFORCEMENT - 120 kg/m³
- LANDSPAN RAMP**
CONVENTIONAL REINFORCEMENT - 160 kg/m³
- COLUMN FOOTINGS**
CONVENTIONAL REINFORCEMENT - 120 kg/m³

PRELIMINARY ONLY
CONCEPT DESIGN ONLY
FOR DISCUSSION



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NOTE:
ATTENTION IS DRAWN TO THE FACT THAT DUE TO THE NATURE OF CONCRETE, CRACKING OF A NON-STRUCTURAL NATURE MAY OCCUR. REINFORCEMENT HAS BEEN ADDED TO THE SLABS TO MITIGATE THE EXTENT OF CRACKING, HOWEVER IT IS NOT POSSIBLE TO GUARANTEE COMPLETE ELIMINATION OF SLAB CRACKING.

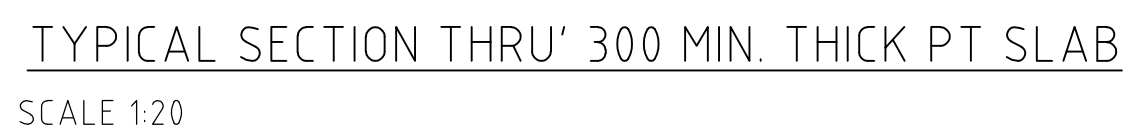
TIMBER PILE SAFE WORKING LOAD :

TIMBER PILE SAFE WORKING LOAD (S.W.L.) = 1000 kN

REINFORCEMENT RATES :

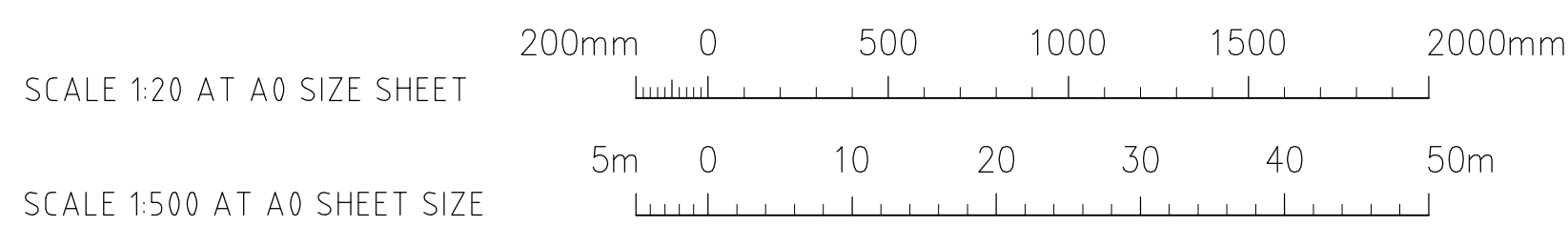
POST TENSIONED SLAB
POST TENSION REINFORCEMENT - 18 kg/m^2
CONVENTIONAL REINFORCEMENT - 80 kg/m^3

LANDSPAN RAMP
CONVENTIONAL REINFORCEMENT - 160 kg/m^3



300 MIN. THICK PT SLAB ON TIMBER
PILES OVERALL PLAN
SCALE 1:500

**PRELIMINARY ONLY
CONCEPT DESIGN ONLY
FOR DISCUSSION**



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Consulting Engineers

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email: mail@costinroe.com.au

web: www.costinroe.com.au

PROJECT:

CO9349.12

ORICA AUSTRALIA

LOT 9 MCPHERSON STREET
BANKSMEADOW NSW 2019

DELIVER TO:

DBL PROPERTY PTY. LTD.

SUITE 2, UPPER GROUND FLOOR, 437 KENT STREET
SYDNEY NSW 2000

ATTENTION:

JEFFREY LORD

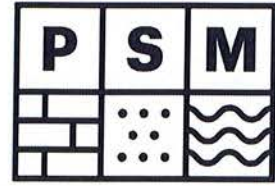
jlord@dblpproperty.com

DOCUMENT TRANSMITTAL

DAY	11									CURRENT
MONTH	4									
YEAR	19									

[illegible]

Appendix D PSM Geotechnical Assessment



Our Ref: PSM1329.1-002L

10 January 2019

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Sydney NSW 2000

G3 56 Delhi Road
North Ryde NSW 2113

P +61-2 9812 5000
F +61-2 9812 5001
E mailbox@psm.com.au
www.psm.com.au

Attention: Jeffrey Lord

Dear Jeffrey

RE: DEVELOPEMENT PLAN AT LOT 9, MCPHERSON STREET, BANKSMEADOW – GEOTECHNICAL ASSESSMENT

1. Introduction

This letter has been prepared at the request of Orica Australia Pty Ltd for geotechnical assessment for the proposed development at Lot 9, McPherson Street, Banksmeadow referred herein as the Site as shown in Figure 1. The letter contains our assessment of the depth to dense sand at the Site and some comment on the proposed erosion cover system.

The work was undertaken in accordance with our proposal dated 30 November 2018 (Ref. PSM1329.1-001L), which was accepted by email dated 5 December 2018.



Figure 1 Lot 9 locality plan.

2. Background

The Site is located along McPherson Street and Nant Street in Banksmeadow. PSM understands that DBL is preparing a Development Application for a suspended 34,025 m² concrete slab on the Site to be supported by timber group piles supporting two warehouses with office buildings, carparks and loading zones.

PSM have provided a previous assessment of the Site in terms of the potential impacts of different proposed groundwater extraction rates at the Site. This assessment was provided in our report PSM1329.R1 dated 26 November 2009. This study included the analysis of 119 CPT across the Botany Industrial Park (BIP) which incorporates the Site.

Our assessment found the subsurface conditions of the Site and the BIP generally to be comprised of three soil layers, these being:

- An upper layer comprising loose fills, peat and loose sands with a thickness of around 0 to 6 m, underlain by
- An intermediate layer comprising predominantly dense sands with intercalated peat, sandy peat and peaty sand layers with a thickness of between 10 and 20 m, underlain by
- A basal zone of clayey sand and sandy clay with discontinuous layers of gravel, peat and peaty clay of varying thickness.

These soil layers are underlain by sandstone bedrock.

The proposed foundation solution is a network of 300 mm diameter driven timber piles at 10 m centres. The foundation is to support a concrete slab as part of a proposed warehouse development and associated car park.

It is understood that these piles are to be founded in dense sand.

It is proposed to cover the ground surface with a cover to prevent or limit the loss of soil through erosion processes. Currently it is understood this cover system comprises:

- Bidim unwoven geotextile equivalent to Geofabrics A39 or similar
- Overlain by up to 100 mm of suitable aggregate such as gravel or road base.

3. Information Provided

We received the following documents to assist with this assessment:

- Lot 9 Locality plan
- Axis Architectural drawing SK-A105 'Proposed Warehouse Distribution and Office Development' dated Jan 2018
- Axis Architectural drawing CO9349.11-S01-P 'Preliminary Slab and Timber Piles Concept Design' dated Feb 2018
- DP Report on geotechnical conditions of the site dated 9 Aug 2005
- Golder Associates drawing indicating the location of all the CPTs undertaken in the vicinity of Lot 9 dated 11 Oct 2011
- Golder Associates 2011 CPT data.

The following documents were also available from our previous work in the vicinity of the Site:

- DP Factual Report on field sampling and testing dated 20 Dec 1993.

We have also relied upon our assessment of potential settlement impacts due to groundwater extraction; report PSM1329.R1 dated 26 Nov 2009.

4. Assessment of CPT Data

A suite of CPT testing has been conducted by Douglas Partners at the Site as part of a previous multi-stage assessment of geological, geotechnical and environmental conditions whose details are summarised in their report dated 20 December 1993. An additional complain was conducted in 2011 and these results have also been made available to PSM. Among these CPTs, 11 tests are performed on Lot 9. The locations of these CPTs are shown in Figure 2.

PSM have analysed the CPT data for the site to assess material and strength profiles. The results of this analysis are provided in the Appendix. From this analysis PSM have estimated the depth to dense sand at all 11 CPT test sites. For the purposes of this report dense sand has been defined as where the CPT tip resistance exceeds 20 MPa. The depth to dense sand has only been adopted where this resistance continues or increases for at least another 2 m below this depth.

The interpreted depths to dense sand at the Site are provided in Table 2. Based on this assessment the depth to dense sand at the Site is around 5 to 6 m.

Table 1 – Interpreted depths to Dense Sand at the Site

CPT Test Site	Approximate Easting (m)	Approximate Northing (m)	Depth to Dense Sand (m)
CPT51	335301	6241058	4.8
CPT58	335240.6	6241304	5.2
CPT59	335181	6241291	5.5
CPT63	335243	6241252	5.0
CPT65	335183.5	6241254	4.8
CPT68	335297.7	6241157	4.0
CPT69	335238.2	6241154	3.8
CPT71	335250.2	6241105	3.6
CPT72	335201.8	6241152	4.0
CPT74	335254.4	6241041	5.2
CPT75	335192	6241051	5.6

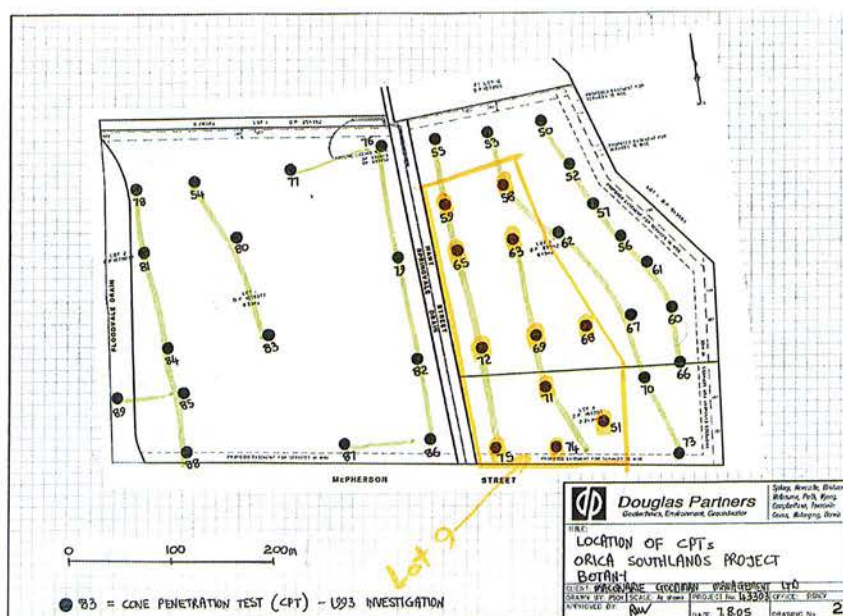


Figure 2 1993 Douglas Partners CPTs undertaken at Lot 9 (Taken from DP report dated 9 Aug 2005).

5. Likely Piling Depth

We understand the proposed foundation system includes driven timber piles. The likely depth of piling will depend on pile diameter, pile material and applied loading. A definitive assessment of pile depth is beyond the scope of this assessment; however, we would expect that piles may need to extend 3 to 4 m into the dense sand to achieve desired loads.

6. Piling Rig Access

Access for piling may require the use of a permanent or temporary raft to reduce loads to acceptable levels. The required dimensions of such a raft are plant specific and beyond the scope of this assessment. Irrespective of plant specifics we envisage that provision of a temporary support system could readily employed over the Site by the constructing of a temporary access pad. The pad requirements are rig specific and this should be confirmed with the contractor.

Access roads could be built on top of the proposed ground cover by increasing the thickness of the granular material.

Material used to provide suitable bearing capacity for plant access could be readily removed after construction to maintain required flood capacity.

For and on behalf of
PELLS SULLIVAN MEYNINK

GARETH SWARBRICK
PRINCIPAL

Encl Attachment A CPT Result

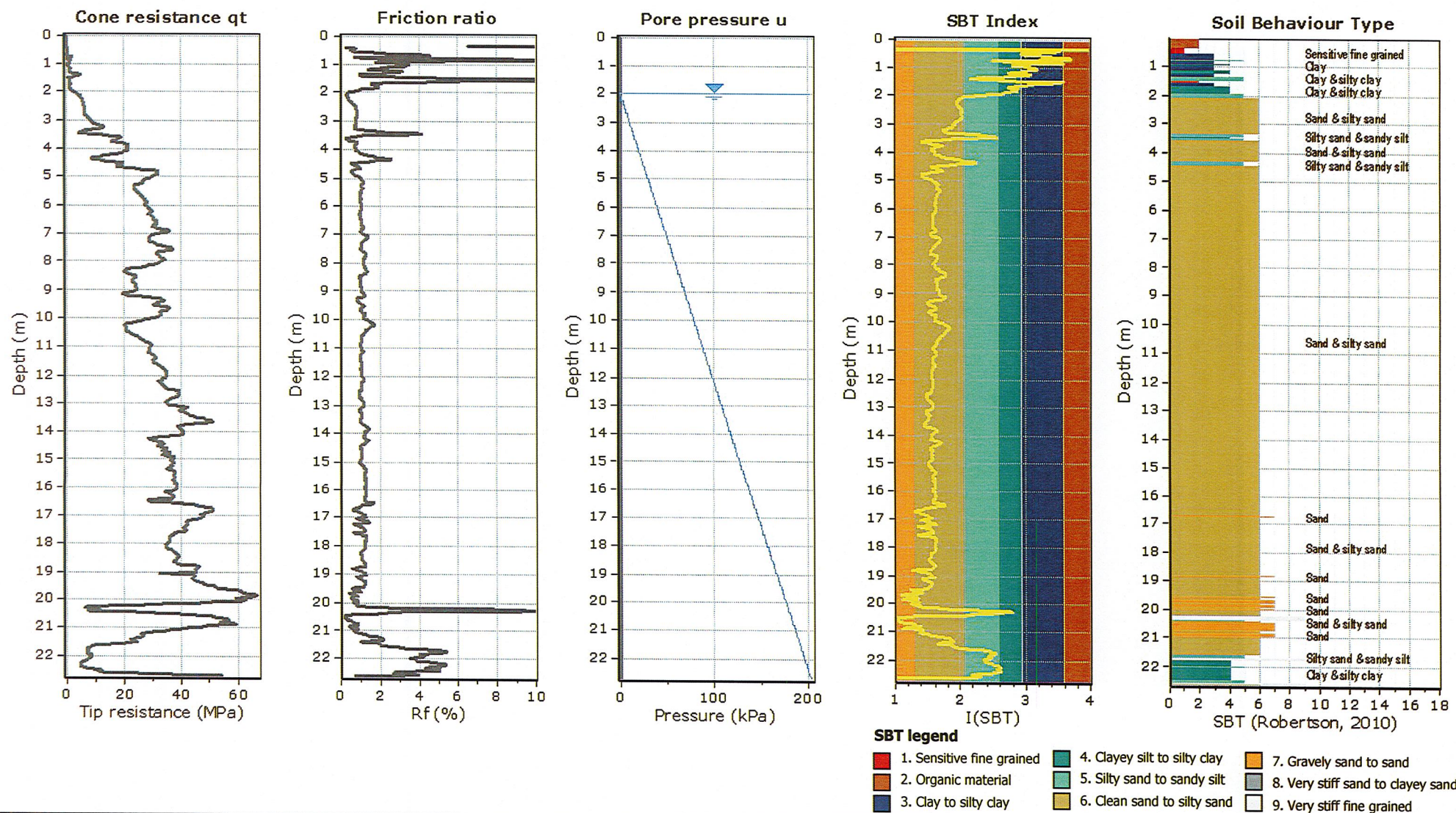
Attachment A

CPT Result

Project:
Location:

CPT: CPT51

Total depth: 22.70 m, Date: 17/12/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Unknown
Cone Operator: Unknown



Project:

Location:

CPT: CPT58

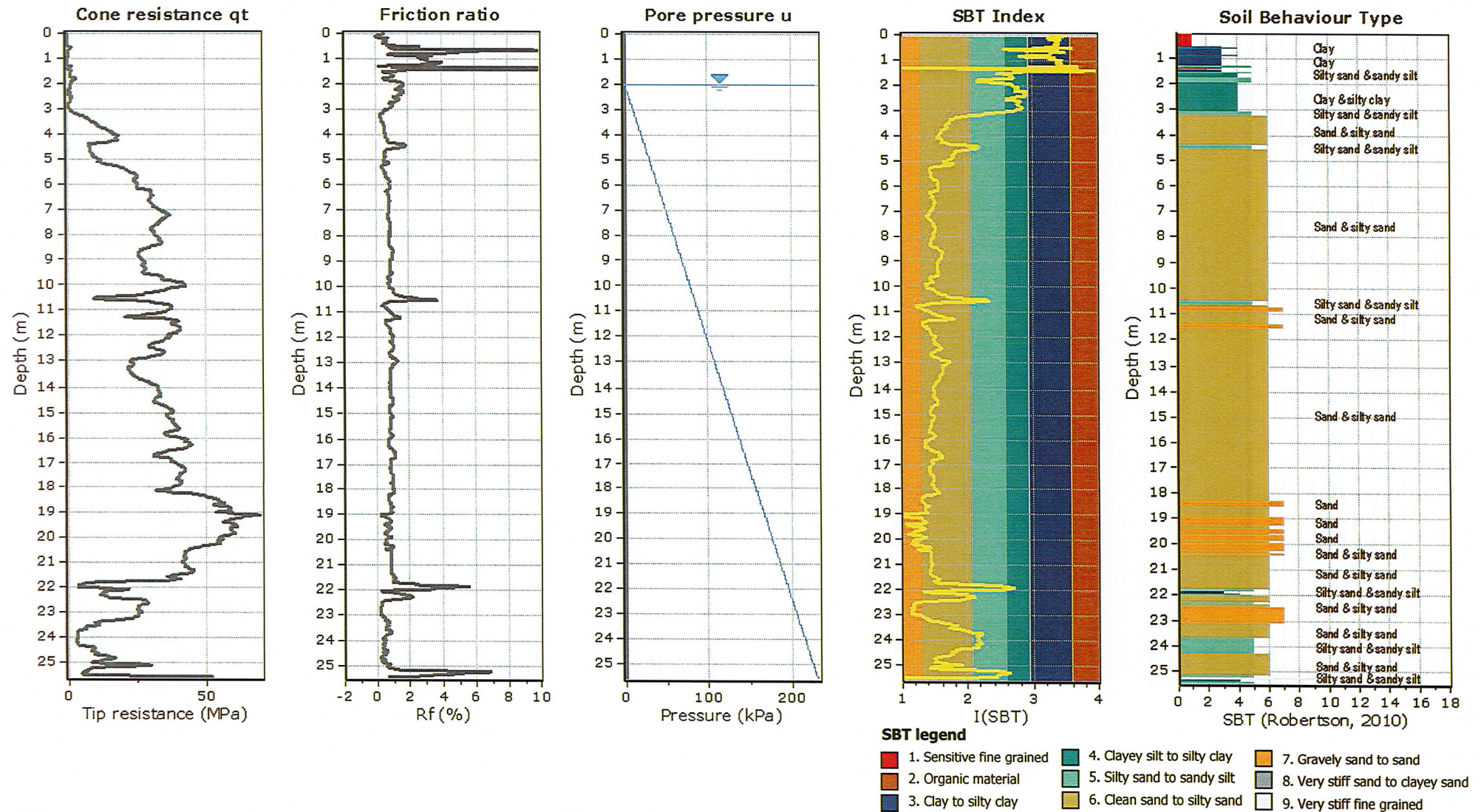
Total depth: 25.54 m, Date: 17/12/2018

Surface Elevation: 0.00 m

Coords: X:0.00, Y:0.00

Cone Type: Unknown

Cone Operator: Unknown



Project:

Location:

CPT: CPT59

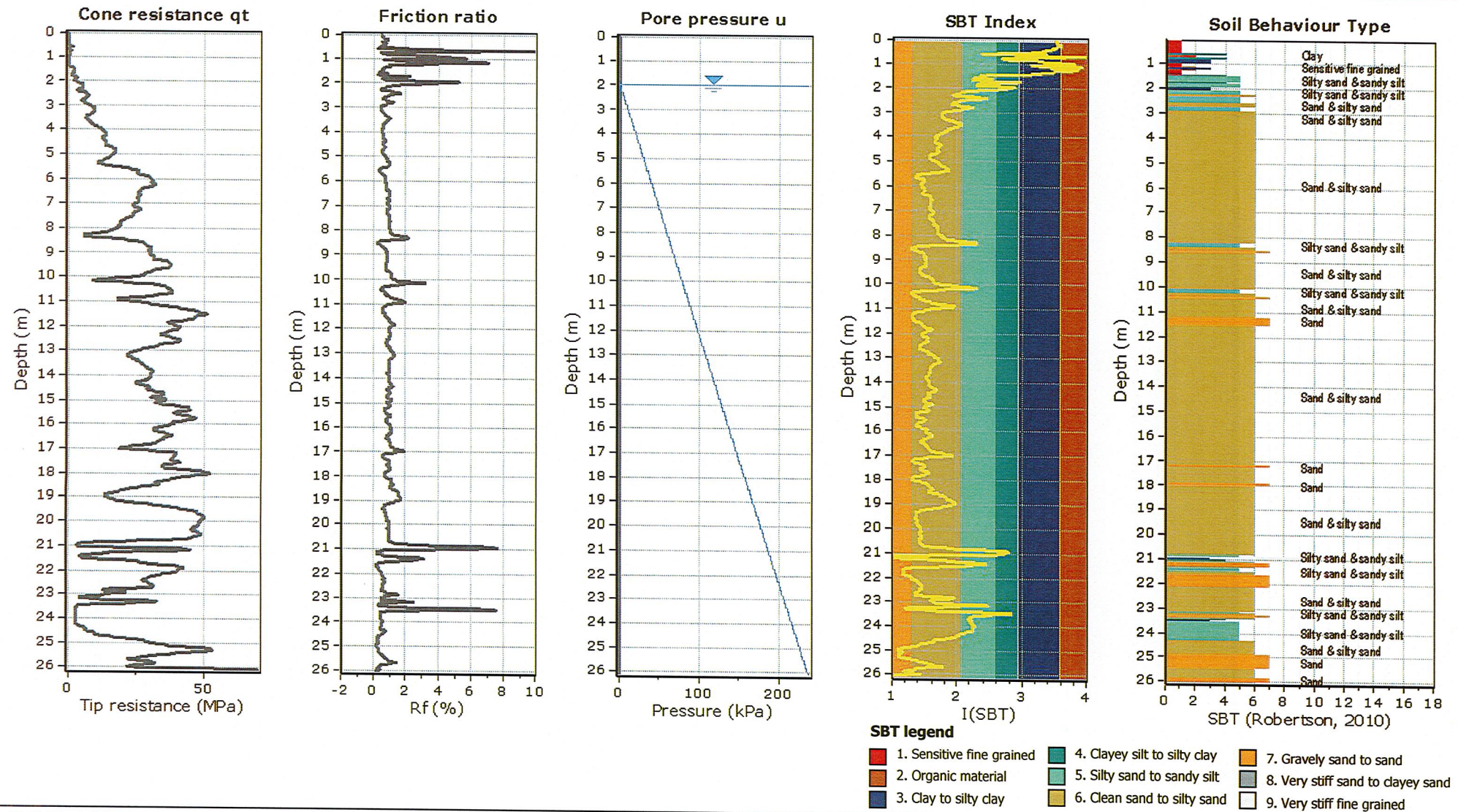
Total depth: 26.10 m, Date: 17/12/2018

Surface Elevation: 0.00 m

Coords: X:0.00, Y:0.00

Cone Type: Unknown

Cone Operator: Unknown



Project:

Location:

CPT: CPT63

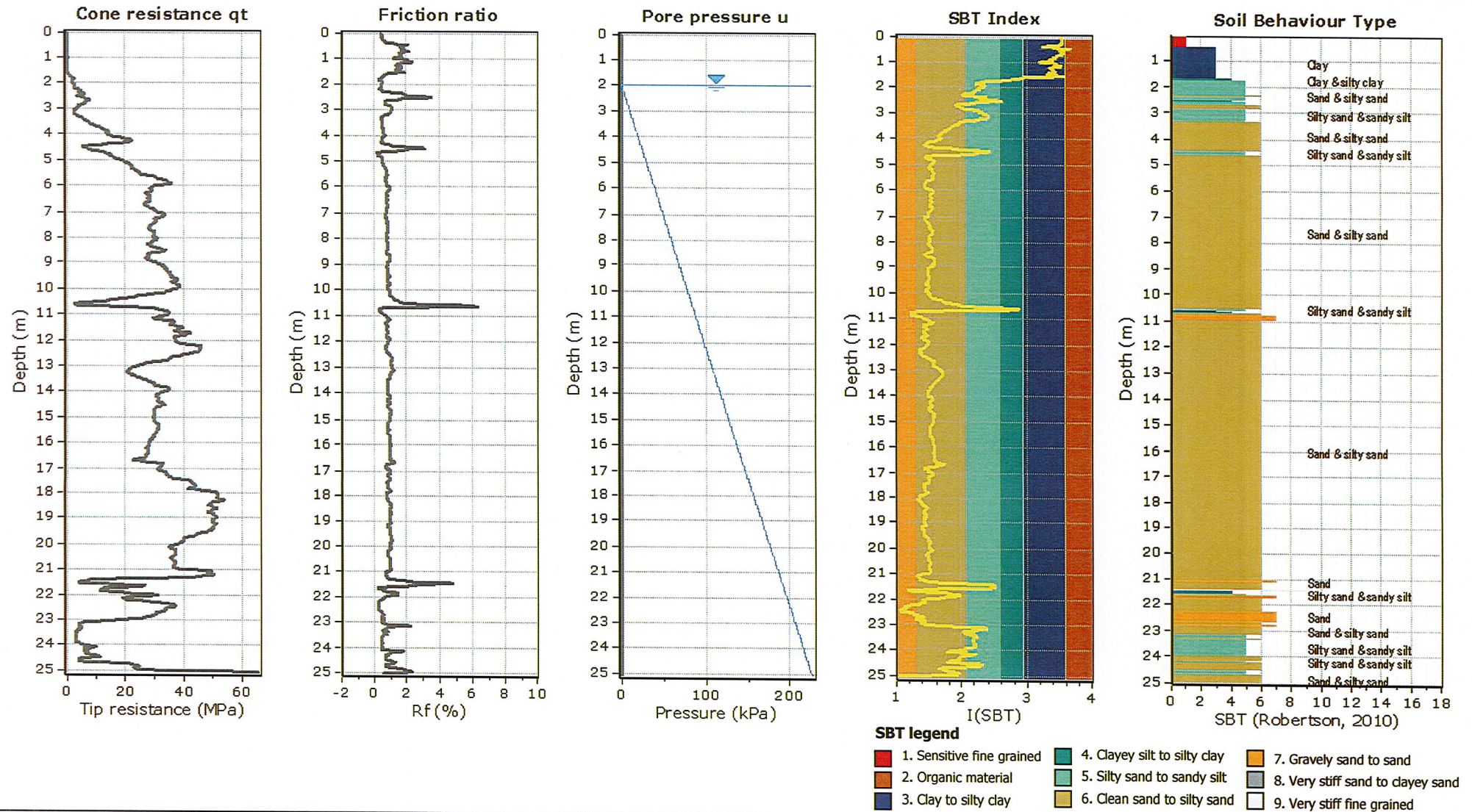
Total depth: 25.06 m, Date: 17/12/2018

Surface Elevation: 0.00 m

Coords: X:0.00, Y:0.00

Cone Type: Unknown

Cone Operator: Unknown



Project:

Location:

CPT: CPT65

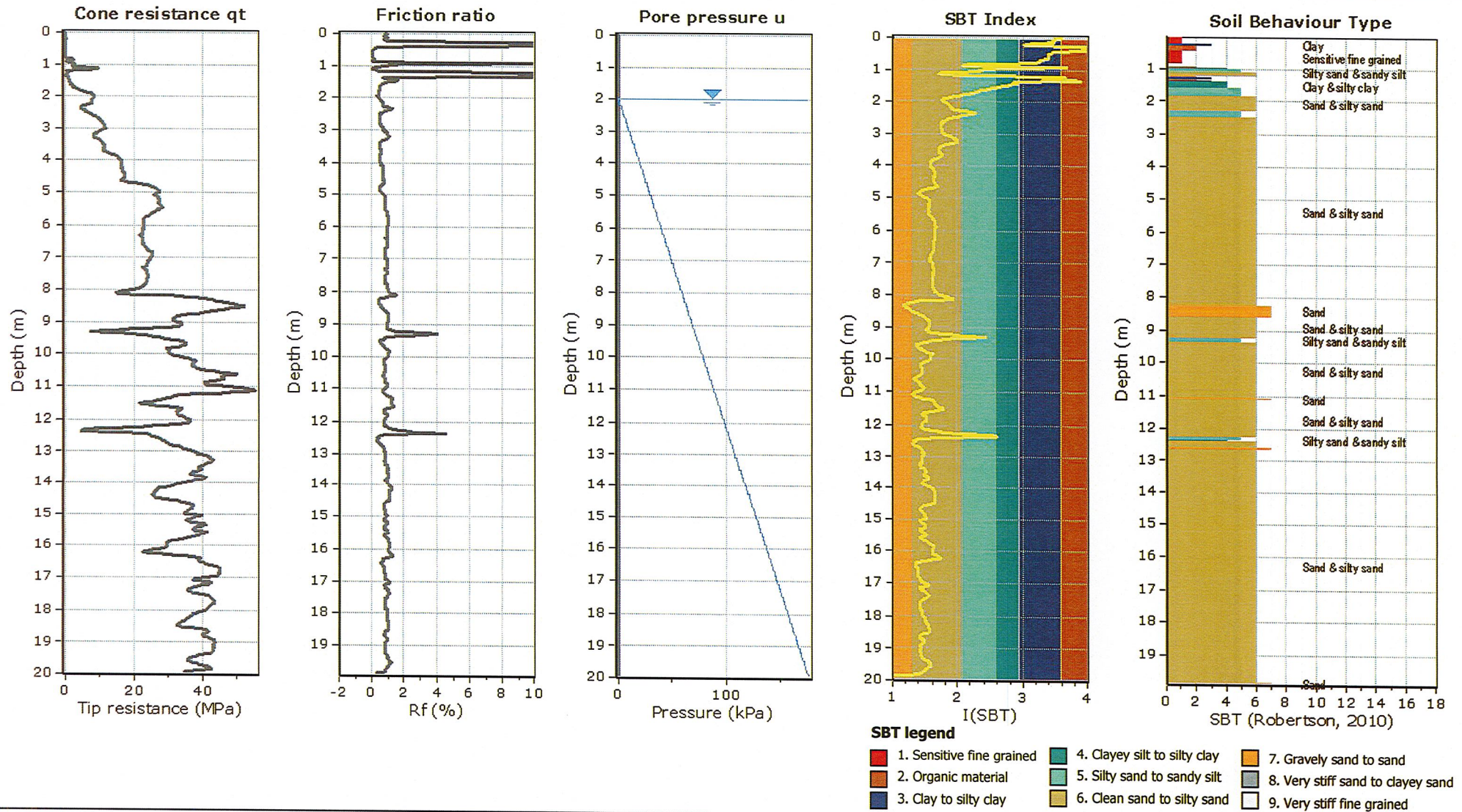
Total depth: 19.92 m, Date: 17/12/2018

Surface Elevation: 0.00 m

Coords: X:0.00, Y:0.00

Cone Type: Unknown

Cone Operator: Unknown



Project:

Location:

CPT: CPT68

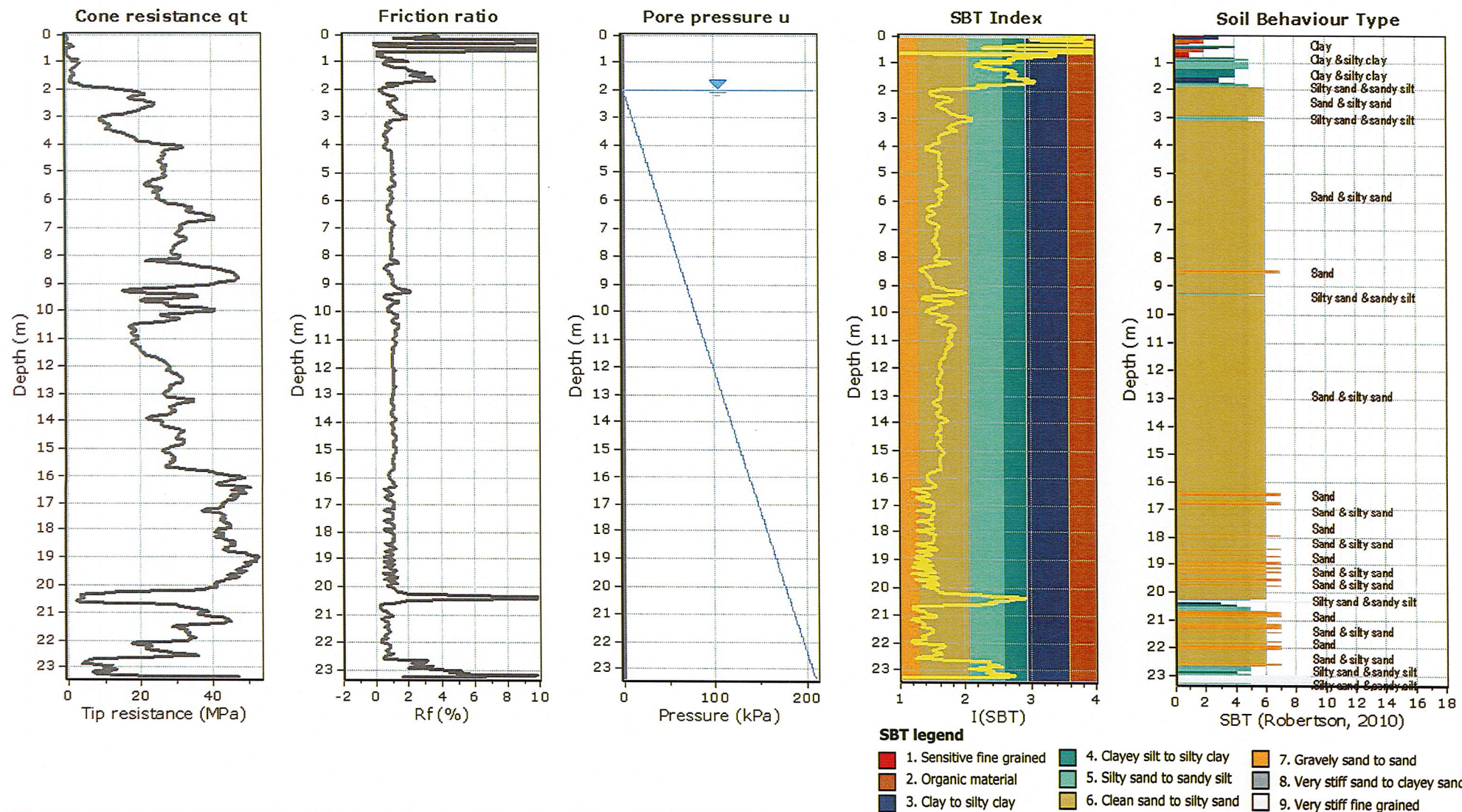
Total depth: 23.34 m, Date: 17/12/2018

Surface Elevation: 0.00 m

Coords: X:0.00, Y:0.00

Cone Type: Unknown

Cone Operator: Unknown



Project:

Location:

CPT: CPT69

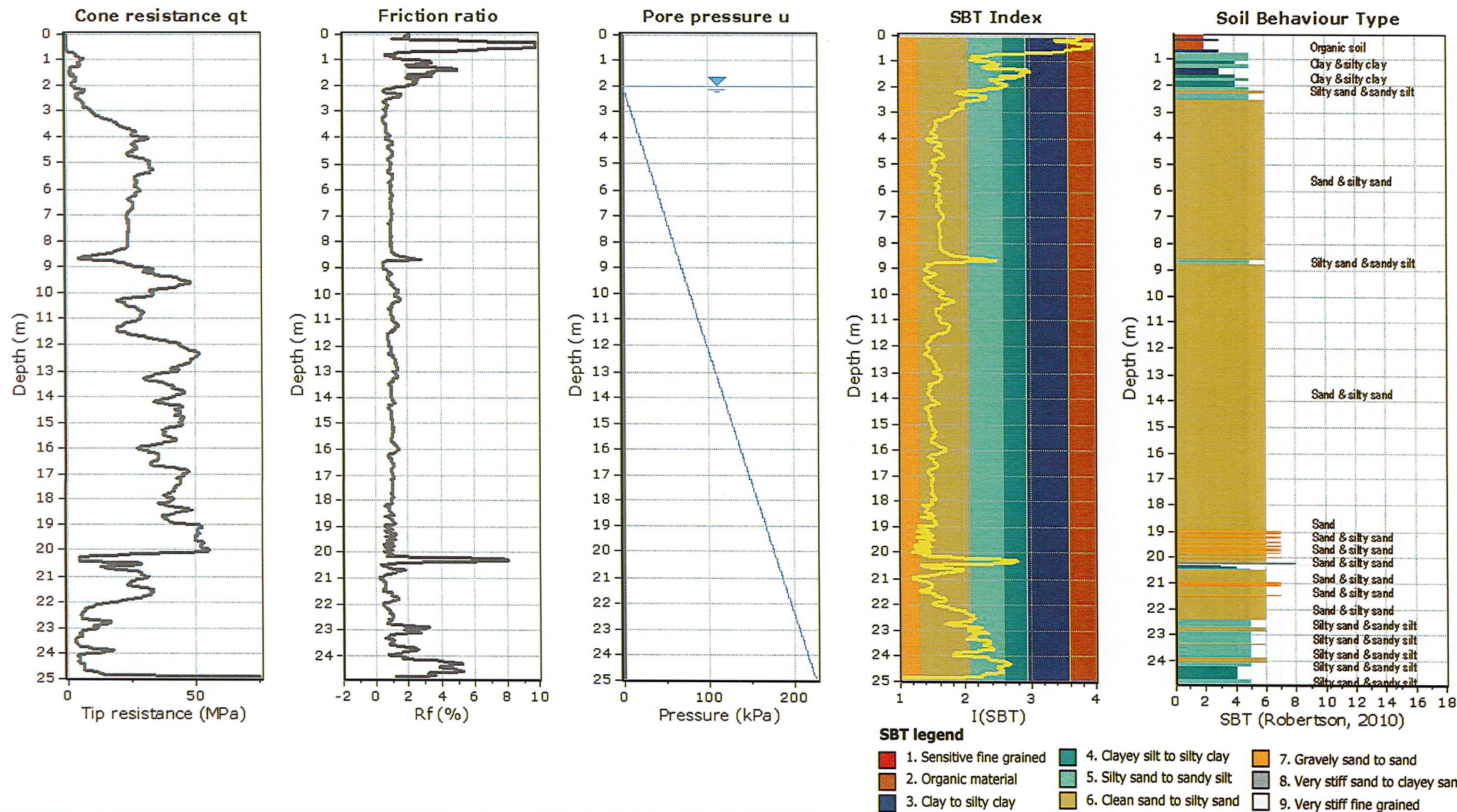
Total depth: 24.90 m, Date: 17/12/2018

Surface Elevation: 0.00 m

Coords: X:0.00, Y:0.00

Cone Type: Unknown

Cone Operator: Unknown



Project:

Location:

CPT: CPT71

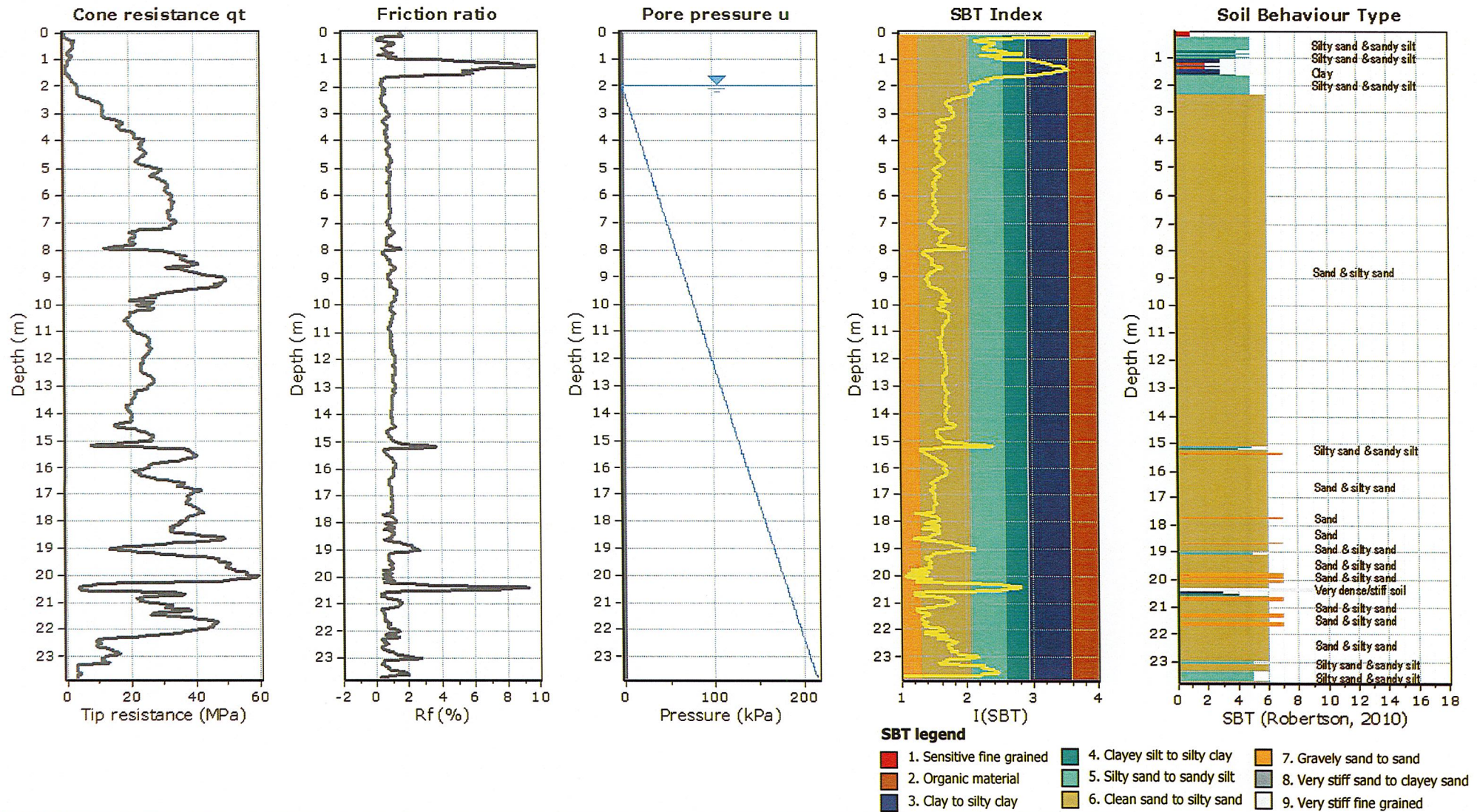
Total depth: 23.78 m, Date: 17/12/2018

Surface Elevation: 0.00 m

Coords: X:0.00, Y:0.00

Cone Type: Unknown

Cone Operator: Unknown



Project:

Location:

CPT: CPT72

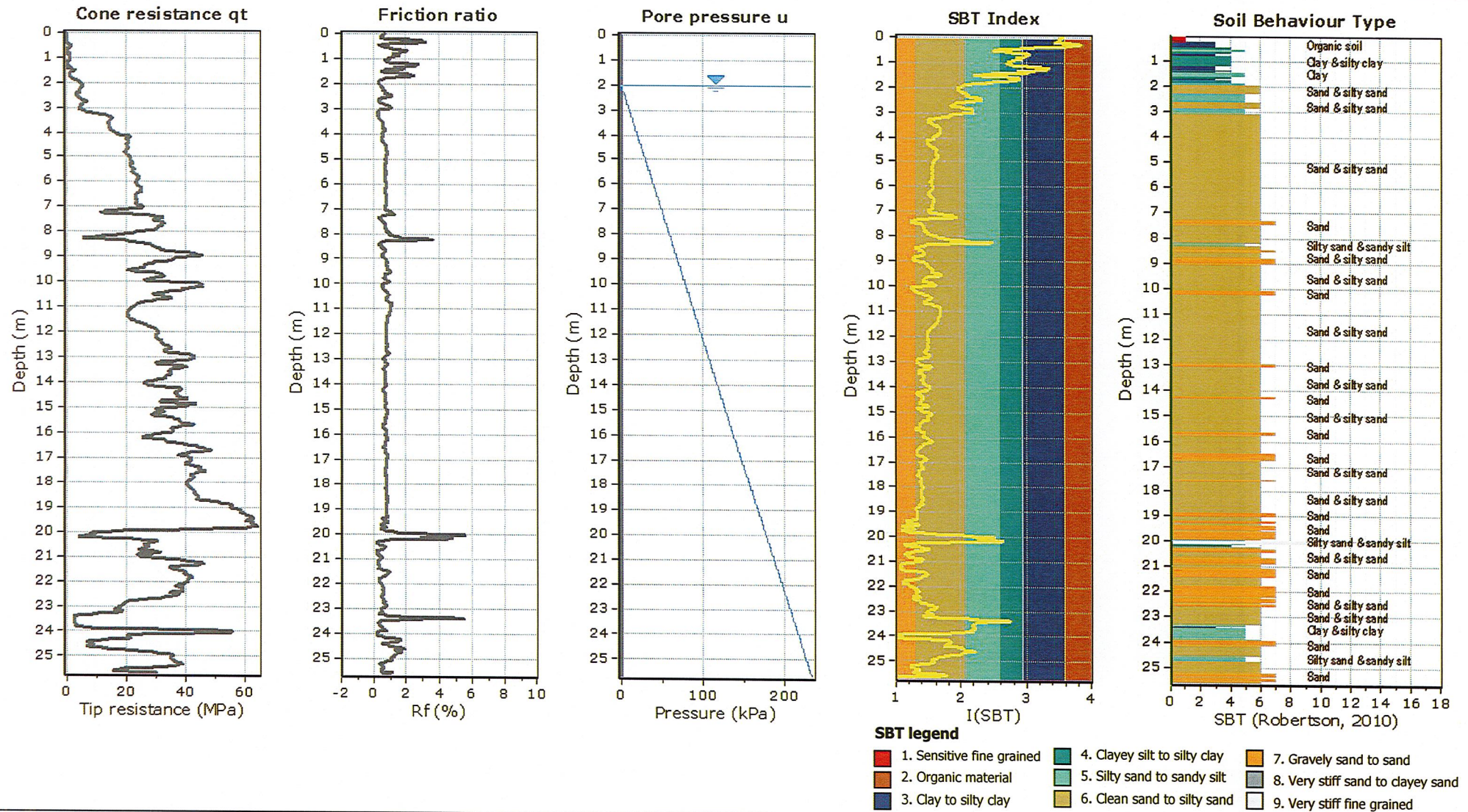
Total depth: 25.68 m, Date: 17/12/2018

Surface Elevation: 0.00 m

Coords: X:0.00, Y:0.00

Cone Type: Unknown

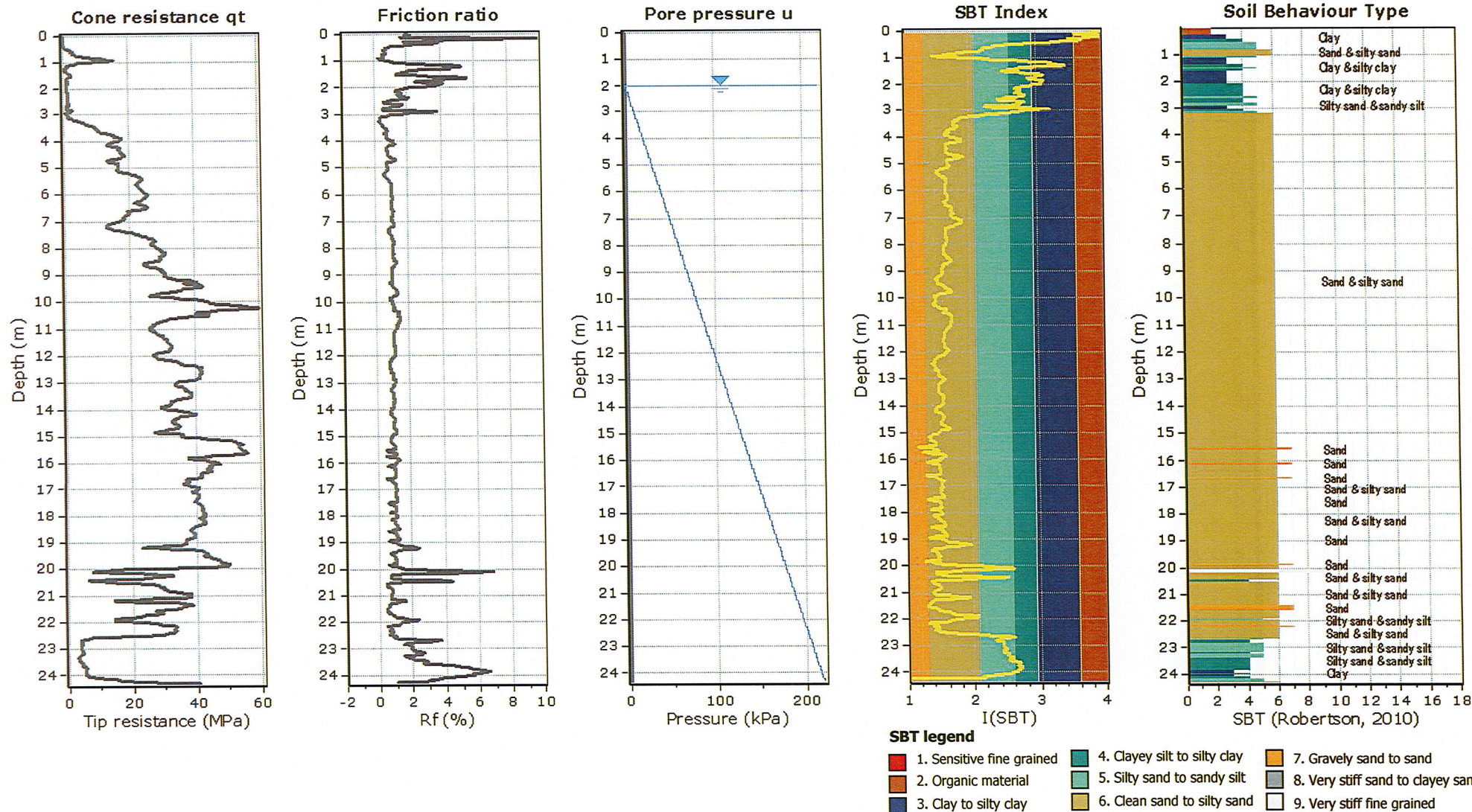
Cone Operator: Unknown



Project:
Location:

CPT: CPT74

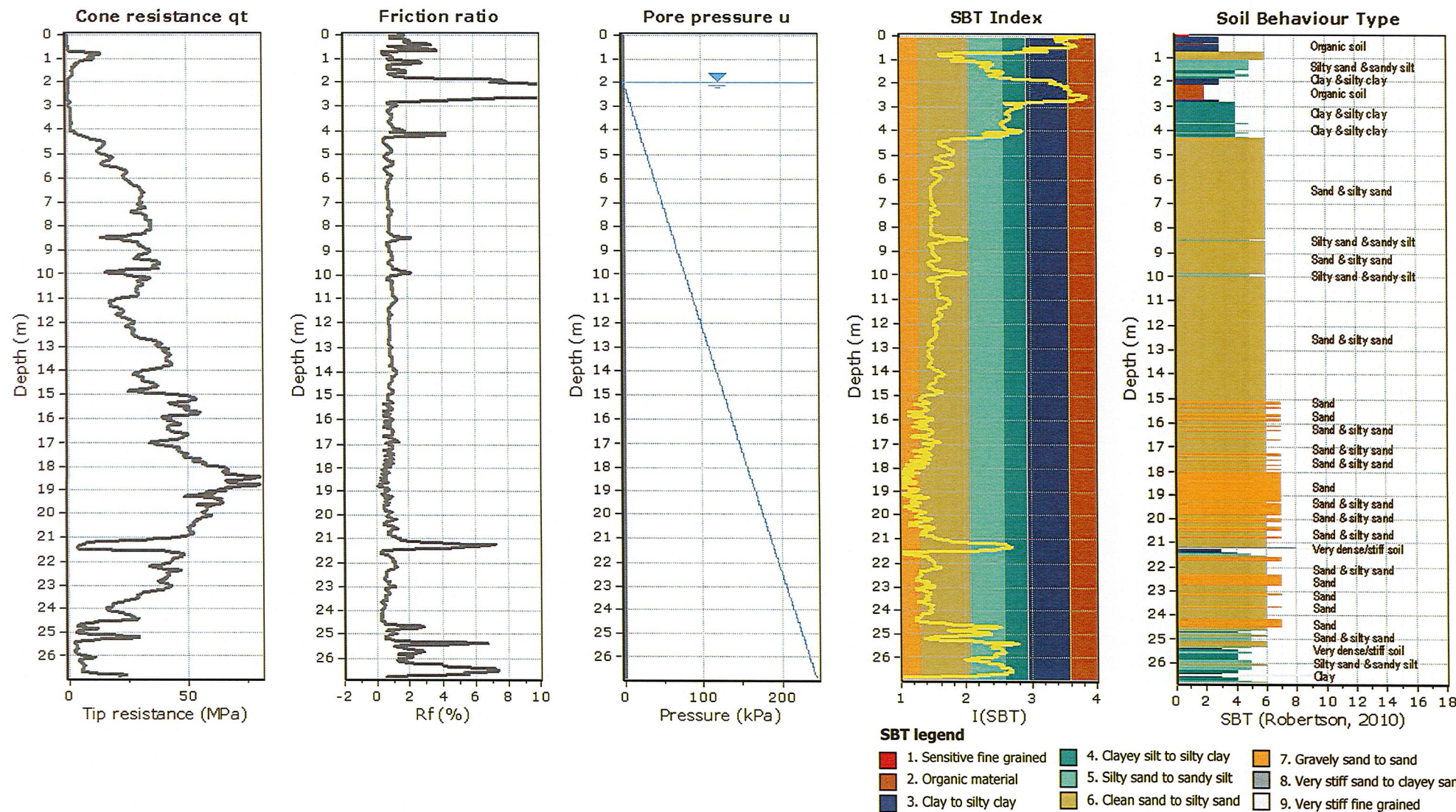
Total depth: 24.34 m, Date: 17/12/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Unknown
Cone Operator: Unknown



Project:
Location:

CPT: CPT75

Total depth: 26.86 m, Date: 17/12/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Unknown
Cone Operator: Unknown



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