REDITUS

Operational Environmental Management Plan (OEMP)

238-258 Captain Cook Drive, Kurnell NSW

Prepared for Dicker Data Limited

5 January 2021

Version 3

reditusconsulting.com

OEMP
238-258 Captain Cook Drive, Kurnell NSW

Prepared for Dicker Data Limited

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1. Introduction

1.1. Background

Reditus Consulting Pty Ltd (Reditus) was engaged by Dicker Data Pty Ltd (Dicker Data) to prepare an operational environmental management plan (OEMP), at the Dicker Data Warehouse and Distribution Facility located at 238 – 258 Captain Cook Drive, Kurnell, NSW (the site). See **Figure 1**, **Appendix A** for property location.

1.2. Objectives & Scope of Work

The primary objectives of this OEMP are to:

- Provide a management framework that aims to manage potential operational impacts on the environment. This includes practical mitigations strategies for managing key environmental impacts including a system of monitoring, reporting and auditing, and a process for implementation of corrective action;
- To establish and define environmental roles and responsibilities;
- Assign responsibility for the implementation, management, and review process of the OEMP; and
- Ensure all operation staff are made aware of the potential impacts on the environment resulting from the operation of the facility, and the associated management strategies to ensure compliance with legal and other relevant environmental requirements.

The OEMP should be treated as a live document and as such may require periodic amendments to ensure the plan remains effective and relevant to current site operations. All amendments should be conducted by a suitably qualified and experience consultant.

1.3. OEMP Audience

This OEMP has been prepared for the site owner, Dicker Data, who are also occupying and responsible for the management of the site.

1.4. Areas Covered by this OEMP

The areas covered by this OEMP are within the sites boundary as shown in **Figure 2**, **Appendix A**.

2. Site Identification

The location of the site and site layout is shown in **Figure 1 and Figure 2, Appendix A.** A summary of the site identification details are provided in Table 2-1 below.

Table 2-1: Site Summary Details

Site Characteristics	Details
Street Address	238-258 Captain Cook Drive, Kurnell NSW
Lot & Deposited Plan	Lot 1 DP225973 and Lot 2 DP1088703
Local Government Area	Sutherland Shire Council
Zoning	'4(a) – General Industrial' as specified in the Sutherland Shire Local Environmental Plan 2015
Site Coordinates to the approximate centre of the site (GDA94-MGA56)	Easting: 333750.73 Northing: 6233822.99
Site Area	Approximately 17.2 hectares

2.1. Site Description

The site is currently occupied by a free standing warehouse building (Stage 1) with ancillary office space hardstand extending from Captain Cook Drive. Bitumen car parking facilities occupy the southern western boundary. An overflow carpark at the eastern portion of the site is also present.

2.2. Surrounding Land Uses

The following surrounding land uses were identified:

- North: Captain Cook Drive and vacant bush land (Towra Point Nature Reserve);
- East: Dicker Data commercial property;
- South: vacant bush land;
- West: access road to Boat Harbour with Britton Maritime Systems commercial property beyond.

The following potentially contaminating surrounding land uses were identified:

- East: Caltex Kurnell Refinery; and
- South East: Sydney Desalination Plant.

3. Environmental Setting

Refer to the WSP (June 2019) RAP for details regarding site topography, hydrology, regional soil and geology, regional hydrogeology and acid sulfate soils. A summary has been provided below:

3.1. Topography and Hydrology

WSP (2019) sates that the site is relatively flat and is approximately 2 to 5m above the Australian Height Datum (mAHD).

The nearest down gradient natural water body is Quibray Bay, which is located approximately 500 metres north-west of the site and is part of Botany Bay. Boat Harbour Beach is located approximately 850 m to the south of the site. Based on the site topography and observations of surface cover, precipitation is expected to consist of overflow land across the developed areas and penetrate unsealed areas of the site.

A pond is located in the southern area of the site within the vegetation zone, and was historically used as a water source for use on site using a pump system.

3.2. Regional Geology and Soils

The Wollongong 1:250,000 Geological sheet S1 56-9, second edition 1966, indicates the site is underlain by the following geological unit:

- Alluvium, gravel, swamp deposits and sand dunes from the quaternary period.

The Wollongong – Port Hacking 1:100,000 Soil Landscapes Series indicates that the landscape of the region of the site comprises of Disturbed Landscapes and Aeolian Landscapes.

3.3. Regional Hydrogeology

Previous investigations by WSP (2008 and 2018) encountered groundwater in sands beneath the site at depths ranging from approximately 1.40 to 3.11m below ground level (mBGL). Groundwater is expected to flow towards Quibray Bay.

A search of the Bureau of Meteorology's Australian Groundwater Explorer indicated there are seven (7) registered groundwater bores within a 500m radius of the site:

- GW104274 – Registered as a functioning monitoring bore.
- GW026617 – Registered an irrigation bore built in 1966. It is unknown if it is still functioning.
- GW104273 – Registered as a functioning monitoring bore.
- GW104267 – Registered as a functioning monitoring bore.
- GW07061 – Registered as a monitoring bore. It is unknown if it is still functioning.

- GW104272 – Registered as a functioning monitoring bore.
- GW07060 – Registered in 2001. Unknown purpose and status.

3.4. Acid Sulfate Soils

A Supplementary Acid Sulfate Soil Investigation was conducted by Douglas Partners (DP) in 2015 and revised in 2018 (DP, 2018). DP concluded that actual acid sulfate soil (AASS) or potential acid sulfate soil (PASS) are not present within 2 m of the current ground surface levels. As such, an ASSMP will not be required for excavation activities within the upper 1 m of the soil profile on the site. However, results from a previous DP investigation suggested that deeper excavations may encounter ASS.

DP prepared an acid sulfate soils management plan (ASSMP) for the proposed industrial development (DP, 2018):

- Outlines the procedures for the identification of acid sulfate soil (ASS);
- Outlines the procedures for the appropriate management/mitigation of potential environmental impacts that may result from the disturbance of ASS;
- Outlines the procedures for the on-site treatment of ASS;
- Outlines the procedures for the off-site disposal of ASS at a licensed facility;
- Provides a monitoring program for validating the effectiveness of the management process; and
- Provides emergency response procedures for potential environmental threats which could occur during ASS management.

Supplementary assessment works completed by Reditus determined that soils from the base of the bio retention basin (swale), including those under the water table, were not considered actual or potential ASS.

Refer to the (DP, 2018) ASSMP attached in **Appendix D**.

4. Legal Enforceability

In order for the OEMP to be effective it must be legally enforceable. Reditus understands that the OEMP will be enforceable as it will need to meet the State Significant Development (SSD) consent conditions, particularly the requirement to meet SSD 8662 consent conditions C5-C7 are presented as follows:

OPERATIONAL ENVIRONMENTAL MANAGEMENT PLAN

C5. The Applicant must prepare an Operational Environmental Management Plan (OEMP) in accordance with the requirements of condition C1 and to the satisfaction of the Planning Secretary.

C6. As part of the OEMP required under Condition C5 of this consent, the Applicant must include the following:

(a) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the development;

(b) describe the procedures that would be implemented to:

(i) keep the local community and relevant agencies informed about the operation and environmental performance of the development;

(ii) receive, handle, respond to, and record complaints;

(iii) resolve any disputes that may arise;

(iv) respond to any non-compliance;

(v) respond to emergencies; and

(c) include the following environmental management plans:

(i) Work Place Travel Plan (see Condition B12); and

(ii) Flood Emergency Response (see Condition B19).

C7. The Applicant must:

(a) not commence operation until the OEMP is approved by the Planning Secretary; and

(b) operate the development in accordance with the OEMP approved by the Planning Secretary (and as revised and approved by the Planning Secretary from time to time).

Stakeholders and potential future purchasers of the site will be notified on the existence of the OEMP and the obligations for implementing the OEMP as noted on the Section 10.7 certificate (Environmental Planning and Assessment Act 1979) for the site which is legally required to be provided as part of the contract of sale.

Consent condition C6 has been addressed as follows:

a) This OEMP is relevant to site operation and is addressed throughout the document;

b) Procedures to be implemented to keep the local community and relevant agencies informed, maintain and handle a complaints register, non-compliances and emergency response; and

c) Refers to existing Work Place Travel Plan and Flood Emergency Response (pursuant to Conditions B12 and B19, respectively).

5. Operational Environmental Management Structure and Responsibility

This section summarises the various parties who have been allocated a responsibility under this OEMP. The responsibilities have been allocated according to which party is best placed to manage the requirements. The responsibilities may be delegated where appropriate.

Dicker Data, as owner of the site will manage these responsibilities by including the OEMP and its requirements in a facilities management tool or similar. Dicker Data are required to ensure its maintenance employees and contractors have read and understood the OEMP, agree to undertake the relevant obligations within the OEMP and confirm that they are readily competent to discharge the same obligations.

Roles and responsibilities are summarised in Table 5-1.

Table 5-1: Responsibilities

Party	Responsibility of party
Dicker Data	The key responsibility of Dicker Data is to ensure the protection of site users and future maintenance workers. Specifically will: 1. Maintain ultimate responsibility for implementation of the OEMP; 2. Review the effectiveness of the OEMP on a five yearly basis and following any incident or other event that suggests the OEMP is ineffective; 3. Implement and communicate improvements and amendments to the OEMP as needed; 4. Provide sufficient resources, where needed, to comply with the requirements of this OEMP; and 5. Brief the facilities/maintenance employees of the existence of this OEMP, and their roles within it.
Facilities / Maintenance Employees	The facilities/maintenance employees are responsible for successful planning, implementation and completion of maintenance activities in a manner that does not compromise the health of workers or site users: 1. Arrange for routine inspections of the site conditions; 2. Maintain records of maintenance and/or reports related to the site. 3. Review subcontractor work method statements for compliance with the OEMP and any other aspects required for the safe completion of works on each site; and 4. Promptly notify any concerns regarding the implementation of this OEMP to the relevant Dicker Data representative.

Party	Responsibility of party
Sub-Contractors	All subcontractors have an obligation to carrying out their own work with due diligence. They must: 1. Comply with statutory requirements applicable to their work; 2. Prepare their Safe Work Method Statements (SWMSs) with reference to this OEMP; 3. Have SWMSs reviewed by the facilities/maintenance employees, and amended if necessary prior to starting works; 4. Abide by their SWMS during all works; 5. Report any incidents that may result in health or environmental risk arising during, or in connection with, their work; 6. Implement practical ways to control health and environmental risks.

5.1. Communications Protocol

In developing this OEMP, consultation has been and will continue to be conducted with the following government authorities and key community stakeholders with respect to the implementation and update of this OEMP and protocols where relevant:

- Department of Planning, Industry and Environment (NSW DPIE).
- Environmental Protection Authority (NSW EPA);
- Sutherland Shire Council;
- The land owner, the site lessee/site operator (if any in the future), and any individual, business, or organisation conducting works at the site, such as consultants, contractors, subcontractors and the like; and
- Workers performing construction and maintenance activities.

5.2. Legislation

This OEMP has been developed in with consideration to the following guidelines and legislation:

- Environmental Planning and Assessment Act 1979;
- Local Government Act 1993;
- Local Government (General) Regulation 2005;
- Roads Act 1993;
- Roads (General) Regulation 2000;
- Environment Protection and Biodiversity Conservation Act 1999 (Cwth);
- Native Vegetation Act 2003;
- Native Vegetation Regulation 2013
- Contaminated Land Management Act 1997;

- Rural Fires Act 1997;
- Water Management Act 2000 Water Management (General) Regulation 2004;
- Coastal Protection Act 1979;
- Water Act 1912;
- Protection of the Environment Operations Act 1997;
- Environment Protection Act, 1970;
- Work Health and Safety Act 2011;
- Work Health and Safety Regulations 2017;
- NEPM (2013) National Environment Protection (Assessment of Site Contamination) Measure, 1999. (Amended 2013);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018);
- ANZECC / NHIVIRC (1992): Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites;
- NEPM (1999): National Environment Protection (Assessment of Site Contamination) Measure (Amended 2013);
- Safe Work Australia (2018) Managing risks of hazardous chemicals in the workplace. Code of Practice;
- NSW EPA (2014) Waste Classification Guidelines. Part 1: Classifying waste.

The site operators should refer to the above documents to understand in further detail responsibilities in managing actual and potential contamination. The following relevant regulatory bodies may also become stakeholders in environmental and human health issues associated with contamination:

- NSW EPA;
- NSW Department of Planning and Environment;
- Worksafe NSW;
- Water NSW;
- NSW Government Department of Planning.

5.2.1. Additional Regulatory Requirements

All monitoring will be undertaken in accordance with Australian Standards and other relevant guidance, by a qualified technician or competent, trained internal personnel.

All samples will be submitted to a National Association of Testing Authorities (NATA) accredited laboratory for analysis.

5.3. Community Consultation

Stakeholders and potential future purchasers must ensure that the local community is kept informed of the information such as:

- Changes in Operating hours;
- Changes in Contact details (telephone number);
- Major changes to the program relating to work required outside the normal operating hours; and
- Any major proposed works which may impact the community.

5.4. Complaints Management

All complaints are to be recorded in a Complaints Register. This register may be made publicly available and may be provided to regulatory bodies and the privacy of the complainant must remain confidential. The receipt of complaints must be acknowledged promptly and assessed and prioritised in accordance with the urgency and/or seriousness of the issues raised. If a matter concerns an immediate risk to safety or security the response will be immediate and will be escalated appropriately.

Where complaints are received in person, via telephone or email, an acknowledgement and initial response should be issued immediately if possible, or the next working day. Where complaints are received by post, acknowledgement and initial response should be within five working days.

Following this, the complaint will be assessed and investigated (if required) and propose resolution provided. Communication of the results of investigations and proposed resolution should be within five working days and include:

- actions taken in response to the complaint;
- outcome(s) of the complaint;
- rationale for any decisions made;
- the proposed resolution offered; and
- request for feedback from the complainant as whether the information provided is satisfactory and has resolved their complaint; and
- information on escalation options available to the complainant if there has been no resolution.

5.5. Incident Reporting

Stakeholders and potential future purchasers must ensure all environmental incidents and non-compliances are required to be recorded and tracked. Incident response and notifications ensure that:

- The environmental impact is minimised and cleaned up/rehabilitated as soon as reasonable and feasible;

- All relevant stakeholders, including regulators, are informed of the incident in a timely manner; and
- Mitigation and management measures are identified and implemented as appropriate to prevent recurrence.

All Incidents are to be recorded and managed in the following sequence:

- Log incident;
- Investigate incident;
- Close incident, unless further action is required, therefore corrective action will be implemented to prevent recurrence.

5.6. Emergency Preparedness & Response

Environmental emergencies and accidents are regarded as environmental nonconformities. Accordingly, in the event of an occurrence, immediate action is taken to mitigate the environmental impact, followed by corrective action to avoid a recurrence.

It has been noted that an emergency response procedure needs to be developed and implemented to be utilised in the event of an environmental emergency for each project. An environmental emergency is an event that causes or has the potential to cause harm to the environment. This procedure needs to include the following items:-

- Names of key personnel and contact telephone numbers;
- Contact details for emergency services;
- The location of onsite information (Safety Data Sheets and Hazardous Substance Register); and
- The procedure for notifying the relevant authorities.

This procedure is to be reviewed prior to its implementation to site-specific projects and furthermore an overall review yearly to assess the procedures effectiveness.

The emergency response procedure is tested on each site each month using the Principal Contractor's Evacuation Checklist. Planned tests should also be recorded in a Register.

Table 5-2: Emergency Response Summary

ENVIRONMENTAL EMERGENCY RESPONSE PROCEDURE	
Project	Dicker Data Limited
Address	280-258 Captain Cook Drive, Kurnell NSW
Emergency Contact:	Project Manager – TBA (contactable 24hrs)
ON SITE INFORMATION	
Item	Location on site
Safety Data Sheets (SDS Register)	In site office – Site Supervisor to show actual location during site induction
Hazardous Substance Register	In site office – Site Supervisor to show actual location during site induction
Mobile Spill Control Kit	In site office - Site Supervisor to show actual location during site induction
NOTIFICATION / REPORTING	
Authority	Procedure
Facilities/ Maintenance Manager	Inform via telephone – immediately TBA (24hour contactable)
Work Cover Authority	Notify within 24 hours of incident
Other relevant authorities	Should be contacted within the relevant time frames, i.e Fire Explosion, fire department to be called immediately etc.

Table 5-3: Emergency Contacts

EMERGENCY CONTACT NUMBERS		
Emergency Situation	**Contact Who**	**Telephone Contact Details**
Environmental Emergency	Fire Brigade / Ambulance	000 – no mobile service 112
Pollution Incident	Fire Brigade / Ambulance	000 – no mobile service 112
Fire	Fire Brigade / Ambulance	000 – no mobile service 112
Medical Emergency	Ambulance	000 – no mobile service 112
Medical Emergency - Poison	Poison Info Line	131 126
Car Accident	Police / Ambulance	000 – no mobile service 112
Bomb Threat	Police / Ambulance	000 – no mobile service 112
Explosion	Fire Brigade / Ambulance	000 – no mobile service 112
Gas Explosion (Bottle)	Fire Brigade / Ambulance	000 – no mobile service 112
Gas Explosion (Line)	Fire Brigade / Ambulance	000 – no mobile service 112
Storms / Winds /Floods	State Emergency Services	132 500
Earthquake	State Emergency Services	132 500
Chemical Spill / Oil Spill	Fire Brigade / Ambulance	000 – no mobile service 112
Electrical Faults	Energy Australia	131 388
	Integral Energy	131 003
	Country Energy	13 23 56
Water Mains - Burst	Sydney Water	13 20 90
Non-English-speaking person - Serious (life threatening) emergencies - Translating / Interpreting Service	Translating / Interpreting Service (TIS National)	131 450

Table 5-4: Emergency Response Procedure

Type of Emergency	Preparation for Emergency	Response to the Emergency
Minor spill of hazardous or toxic substance	▪ Awareness training of appropriate response and procedures to be incorporated into Environmental and Safety Induction; ▪ SDS on site for all materials and kept up to date; ▪ Adequate supply of absorbent materials and spill kits available in the site compound.	▪ Report spill immediately to the Site Supervisor; ▪ Attempts to be made to limit or contain the spill using sandbags to construct a bund wall, use of absorbent material, temporary sealing of cracks or leaks in containers, use of geotextile or silt fencing to contain the spill; ▪ Site Supervisor to coordinate the response, clean up and disposal of the material; ▪ Material to be disposed of in accordance with the manufacturer's recommendations and applicable legislation.
Major spill of hazardous or toxic substance	▪ Awareness training of appropriate response and procedures to be incorporated into Environmental and Safety Induction; ▪ SDS on site for all materials and kept up to date;	▪ Report spill immediately to the Site Supervisor and Project Manager; ▪ Attempts to be made to limit or contain the spill using available resources such as deploying absorbent material, temporary sealing of cracks or leaks in containers, creating bunds, use of geotextile or silt fencing to contain the spill,

Type of Emergency	Preparation for Emergency	Response to the Emergency
	▪ Adequate supply absorbent materials to contain initial spill; ▪ Supplies available at the site compound; ▪ Emergency telephone numbers prominently displayed around office and issued to Site Foremen.	righting overturned containers, transferring remaining material to a secure location; ▪ Implement procedures to notify the relevant authorities; ▪ Site Supervisor/s to coordinate the response, clean up and disposal of the material; ▪ If spill is regarded to be outside the onsite resources, then the fire brigade should be called; ▪ Where appropriate, evacuation procedures are to be implemented to remove non- essential personnel from the affected area; ▪ The Client Principal is informed of the incident; ▪ Access and egress to the area is established to ensure the appropriate vehicles have effective access and congestion is minimised; ▪ If the Hazmat Crew or other authority attends, their senior officer assumes control of the operation with the principal contractor and subcontractor personnel assisting as required; ▪ A full investigation report of the event is to be completed by the Project Manager as soon as practicable after the area has been secured.
Flood	▪ Evacuate all nonessential personnel; ▪ Remove computer, electrical equipment and files from office to higher ground; ▪ Remove plant and equipment from potentially affected areas and away from watercourses; ▪ If plant cannot be removed ensure it is secured and, in a position, where it is unlikely to cause damage; ▪ Awareness training of appropriate response and procedures to be incorporated into Environmental and Safety Induction; ▪ Monitor flood warnings	▪ Stow all minor and small equipment into containers that are to be sealed; ▪ Containers to be removed to above 1 in 100-year flood level; ▪ Ensure all other materials are removed or stowed and secured away from watercourses and other potentially affected areas; ▪ All chemicals to be in secured containers and stored within a sealable shipping container; ▪ Remove plant and equipment to above the 1 in 100-year flood level or as directed.
Severe Storm	▪ Awareness training of appropriate response and procedures to be incorporated into Environmental and Safety Induction; ▪ Monitor cyclone/storm warnings for the area; ▪ Ensure First Aid supplies are well stocked and adequate.	▪ Evacuate all nonessential personnel; ▪ Secure plant and equipment in sheltered location; ▪ Stow all minor and small equipment into containers, which are to be sealed; ▪ Remove computer, electrical equipment and files from office to higher ground; ▪ Remove plant and equipment from the immediate foreshore to above 1 in 100 flood level;

Type of Emergency	Preparation for Emergency	Response to the Emergency
		▪ Ensure all other materials are either removed from foreshore or stowed and secured; ▪ All chemicals to be in secured containers and stored within a sealable shipping container, shipping container to be removed to above 1 in 100 flood level.
Fire	▪ Awareness training of appropriate response and procedures to be incorporated into Environmental and Safety Induction; ▪ Fire extinguishers maintained, clearly labelled and distributed around site compound and vehicles; ▪ Training in the use of fire extinguishers and which one to use for each type of fire; ▪ First Aid supplies are stocked and adequate.	▪ For small fires, attempts to be made to extinguish the fire or limit its spread with available fire extinguishers or water hoses if appropriate; ▪ A supervisor is to be informed immediately; ▪ The Supervisor will contact the Project manager who will arrange for external services (fire, ambulance) to be advised as a precautionary measure; ▪ The Client shall be informed; ▪ Where external services attend, their senior officer assumes control of situation; ▪ All personnel in the vicinity to be assembled in the Evacuation Assembly Area and a head count performed; ▪ Any resulting fuel or chemical spill to be handled as detailed above; ▪ Site Supervisor to coordinate with emergency services and provide assistance as required.

5.7. Workplace Travel Plan

Pursuant to conditions B12, B13, B14 and C6(c)(i) a Workplace Travel Plan (WTP) has been prepared by Ason Group (October 2019, Ref: 0839r02v2).

The WTP has been developed to identify sustainable modes of travel by promoting active transport' modes such as cycling and public transport to reduce the environmental footprint of the development.

The WTP considers accessibility to cycling networks and surrounding public transport services as well as a communication strategy as part of the on-site induction for all new staff. A designated travel plan co-ordinator will be appointed who will be responsible for implementation, monitoring and effectiveness of the WTP.

A copy of the Workplace Travel Plan is appended in **Appendix B**.

5.8. Flood Emergency Response Plan

Pursuant to condition B19 and C6(c)(i) a Food Emergency Response Plan (FERP) has been prepared by Floodmit Pty Ltd (May 2019, Ref: J1902_R2.doc)

The objective of the FERP is to alert owners and provide appropriate response advice with respect to stormwater flood risk within proximity to the site.

A copy of the Flood Emergency Response Plan is appended in **Appendix C**.

5.9. Sediment and Surface Water Management

It is important that sediment laden water is controlled during site operations. The following provides some guidance for management of sediment sourced from unsealed areas of the site:

Runoff:

- Ensure that all overland flow at the site remains contained within the sealed areas of the site.
- All drains in the immediate vicinity of any future soil excavation works must be blocked or barricaded and silt fencing, sandbags and/or hay bales installed to prevent offsite sediment movement to ensure compliance with the Protection of the Environment Operations Act 1997 (POEO Act).
- Runoff water, including that due to rain, which is contained within the onsite stormwater retainment network, is not of concern.
- Any surface water that comes into contact with unsealed areas of the site must be collected and tested prior to disposal or discharge.
- Removal of sediment, leaf litter and other materials regularly from drainage lines and drains.

Maintenance of surrounding hardstand areas and roads:

- Hardstand and internal roads to enter and exit the site are to be maintained in a clean manner at all times.
- If necessary vehicles should be loaded on sealed or clean surfaces where possible and covered before leaving site.
- Contractors shall monitor the exit points from site and any evidence of soil being transported offsite on truck tyres must be investigated immediately and corrective actions implemented.

5.10. Long Term Environmental Management Plan

This OEMP should be read in conjunction with the Long Term Environmental Management Plan (LTEMP) (Reditus, October 2020) which applies to soils beneath the site in the two designated encapsulation areas are disturbed or exposed.

The LTEMP was prepared to ensure that the capping material covering previously identified asbestos containing materials (ACM) impacted soil at the site. This LTEMP was developed for the site with reference to guidance on LTEMPs provided in the NSW EPA, 2017 Contaminated Sites: Guidelines for the NSW Site Auditor Scheme, 3rd Edition (Section 3.4.6 and 4.3.3).

LTEMP applies only if the soil beneath the site in two designated areas is disturbed or exposed. These two areas were as follows:

- ACM stuck to existing concrete underneath the former main pharmaceutical building slab (average RL 3.15m AHD) has remained in-situ and capped under clean fill; and

- During removal of the building slabs (i.e former engineering building, fermentation building and chemical building) fragments of ACM were observed to be adhered to the underside of the slabs. The fragments appeared to have been placed between the plastic/liner and the concrete during construction and generally appeared to be in good condition. The pieces of demolished concrete slab and the administration building slab along with ACM emu picked from the site has been encapsulated within a purpose-built cell located at the south eastern portion of the site and capped under clean fill.

The primary objectives of this LTEMP are to:

- Summarise the presence of known contamination within the two encapsulation areas on site (i.e. ACM in soils beneath capping and hardstand);
- Document the site containment infrastructure (capping layer);
- Outline a program for ongoing monitoring of the capping layer; and
- Provide a framework for ongoing environmental management of the site during future disturbance of the designated ACM encapsulation areas.

The facilities/maintenance employees should maintain records of subcontractor works including compliance with the OEMP and evidence of appropriate reinstatement of the capping layer (e.g. a photographic record).

Requirements regarding the monitoring program are outlined in the LTEMP (Reditus, October 2020).

5.11. Ecological Management

The following measures are recommended to minimise the potential for direct and indirect impacts of the site operations on flora and fauna and their habitat should works within the vegetation zones be required:

- A suitably qualified ecologist to be on-site during vegetation clearance and to inspect hollows where practicable prior to necessary felling of trees;
- familiarise contractors with their obligations for protecting flora and fauna and with relevant flora and fauna management protocols and methods;
- high visibility signs erected to clearly demarcate operational areas from surrounding native vegetation and habitats ('no-go zones'); and
- Installation of signs at property access points to restrict off-road activities and fauna warning signs and speed signs at appropriate locations.

5.12. Aboriginal Heritage Management Plan

Coast History & Heritage (June 2019) prepared an Aboriginal Cultural Heritage Management Plan (ACHMP) pursuant to conditions B47, B46, B47 and B48. The ACHMP was prepared in consultation with Registered Aboriginal Parties (RAPs) (the LA Perouse Local Aboriginal Land Council, Darug Land Observations and

Tocomwall). The ACHMP addressed historically identified Aboriginal Cultural Heritage items.

Areas of Aboriginal Archaeological Sensitivity and an Aboriginal site (midden) have been mapped as being located within the vegetation along the south-western boundary. An Aboriginal Cultural Heritage Assessment (Mary Dallas Consulting Archaeologists, 2018) stated that an area in the north of the site has moderate archaeological potential.

A site plan prepared by Axis Architectural (2016) has further identified an aboriginal archaeological zone and vegetation corridor at the site. The aboriginal archaeological zone is located on the northern boundary.

The ACHMP (Coast, June 2019) must be consulted prior to any works identified in those areas identified as:

- Conservation Area – not investigated;
- Low Potential; and
- Moderate potential.

5.13. Bushfire Management

The site is situated within a bushfire prone area as identified in the Sutherland Shire Bush Fire Prone Land Map.

As such Stakeholders and potential future purchasers must ensure appropriate bushfire protection measures including:

- Asset Protection Zones (fuel reduced areas).
- Building construction standards and design (using Australian Standard AS3959).
- Access for fire fighters, emergency service workers and those involved in evacuation.
- Water supply and utilities.
- Emergency management arrangements.
- Suitable landscaping to limit fire spreading to a building.

Awareness training of appropriate response and procedures must be incorporated into environmental and safety inductions

5.14. Unexpected Finds Protocol

For any excavation works to be completed outside of the two ACM encapsulation areas as identified in the LTEMP (Reditus, October 2020) a UFP should be developed, which includes the identification of potential contaminants and a process to manage each find. This should include such aspects as:

- stop work in the immediate area;

- notification of supervisors/site managers immediately;
- establishing the required controls (these may include barricading, fencing, warning signs, covering odorous/volatile materials and asbestos, etc., avoiding leaving materials exposed on the surface, and including erosion and sediment controls as appropriate);
- document the material's characteristics, e.g. location, extent, odours, appearance, etc., and details of the actions undertaken;
- report the finding to the site owner, council, WorkCover, environment regulator (EPA) as required;
- contact appropriately qualified environmental staff/consultant with a description of the material; and
- UFP materials should not be removed or spread across the site without confirmation from an environmental consultant or emergency services as required.

UFPs should be integrated with any contractor emergency response plan. If the unexpected findings present an imminent or immediate hazard, then the emergency response plan is to take precedence over the UFP.

6. Environmental Training and Induction

The environmental awareness induction is to be completed by the site Manager and/or the delegated person responsible for implementation of this OEMP. The awareness induction will cover:

- Outlining the objective and purpose of the works;
- Contents of the OEMP and their responsibilities.
- Environmental objectives and targets;
- Site environmental rules and consequences of departure from rules;
- •Emergency procedure and response (for example, spill clean-up);
- •Basic understanding of their legal obligations.

Environmental requirements must be explained to employees during site inductions and ongoing training via daily toolbox meetings and daily pre-start meetings.

7. Monitoring and Review

7.1. Outline of the Monitoring Program

7.1.1. Routine Site Inspections

Routine site inspections should be conducted or arranged to be conducted by the facilities/maintenance employees on a quarterly basis every year or immediately following inclement weather.

7.1.2. Environmental Records

Environmental records, which will be collated by facilities/maintenance staff shall include the following:

- OEMP distribution records;
- Training and induction records;
- Environmental incident reports;
- Environmental complaint records;
- Non-conformances and corrective and preventative action reports; and
- Inspection checklists/reports (if conducted).

7.2. OEMP Review and Updates

The OEMP is a dynamic document which will be reviewed regularly so that it remains consistent with legislation and best practice and site changes over time. A review may be called for by Dicker Data at any time to assess the performance of the OEMP and to suggest changes. We recommend a review take place at a minimum of every five years to ensure the references to legislation, codes of practice and environmental guidelines and standards remains up to date.

The EMP must be updated in the following circumstances:

1. Change of site owner/site operator; or
2. Changes in OEMP procedures; or
3. Changes in site use, approved land use or development

8. Limitations

This report has been prepared in accordance with the scope of services described in the Section 1.2. The report has been prepared for the sole use of the client and has been prepared in accordance with a scope of work agreed by the client.

The report or document does not purport to provide legal advice and any conclusions or recommendations made should not be relied upon as a substitute for such advice.

The report does not constitute a recommendation by Reditus for the client or any other party to engage in any commercial or financial transaction and any decision by the client or other party to engage in such activities is strictly a matter for the client.

The report relies upon data, surveys, measurements and results taken at or under the site at particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the client. Furthermore, the report has been prepared solely for use by the client and Reditus accepts no responsibility for its use by other parties. The client agrees that Reditus' report or associated correspondence will not be used or reproduced in full or in part for promotional purposes and cannot be used or relied upon by any other individual, party, group or company in any prospectus or offering. Any individual, party, group or company seeking to rely this report cannot do so and should seek their own independent advice.

No warranties, express or implied, are made. Subject to the scope of work undertaken, Reditus assessment is limited strictly to identifying typical environmental conditions associated with the subject property based on the scope of work and testing undertaken and does not include and evaluation of the structural conditions of any buildings on the subject property or any other issues that relate to the operation of the site and operational compliance of the site with state or federal laws, guidelines, standards or other industry recommendations or best practice. Scope of work undertaken for assessments are agreed in advance with the client and may not necessarily comply with state or federal laws or industry guidelines for the type of assessment conducted.

The results of this assessment are based upon (if undertaken as part of the scope work) a site inspection conducted by Reditus personnel and/or information from interviews with people who have knowledge of site conditions and/or information provided by regulatory agencies. All conclusions and recommendations regarding the property are the professional opinions of the Reditus personnel involved with the project, subject to the qualifications made above.

While normal assessments of data reliability have been made, Reditus assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of Reditus, or developments resulting from situations outside the scope of this project/assessment.

Reditus is not engaged in environmental auditing and/or reporting of any kind for the purpose of advertising sales promoting, or endorsement of any client's interests, including raising investment capital, recommending investment decisions, or other publicity purposes. Reditus assumes no responsibility or liability for errors in any data

obtained from regulatory agencies, statements from sources outside of Reditus, or developments resulting from situations outside the scope of this project.

In relation the conduct of Asbestos inspections or the preparation of hazardous materials reports Reditus has conducted inspections and the identification of hazardous material within the constraints presented by the property. Whist efforts are made to access areas not normally accessed during normal use of the site to identify the presence of asbestos or other hazardous material, unless explicitly tested no guarantee can be provided that such material is or is not present.

Reditus' professional opinions are based upon its professional judgment, experience, and training. These opinions are also based upon data derived from the limited testing and analysis described in this report or reports reviewed. It is possible that additional testing and analysis might produce different results and/or different opinions or other opinions. Reditus has limited its investigation(s) to the scope agreed upon with its client. Reditus believes that its opinions are reasonably supported by the testing and analysis that has been undertaken (if any), and that those opinions have been developed according to the professional standard of care for the environmental consulting profession in this area at this time. Other opinions and interpretations may be possible. That standard of care may change and new methods and practices of exploration, testing and analysis may develop in the future, which might produce different results.

9. References

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Reditus (October 20) Long Term Environmental Management Plan Captain Cook Drive, Kurnell.

SafeWork Australia (2016) Code of Practice - How to Manage and Control Asbestos in the Workplace. SafeWork Australia (2016) Code of Practice - How to Safely Remove Asbestos.

SafeWork Australia (2014) Code of Practice - Construction Work. SafeWork Australia (2015) Code of Practice - Excavation Work.

State Environmental Planning Policy No 55 – Remediation of Land.

Appendix A - Figures

REDITUS

FIGURE 1
Site Location
238-258 Captain Cook Drive, Kurnell NSW
Dicker Data Pty Ltd

REDITUS

FIGURE 2
Site Layout
238-258 Captain Cook Drive, Kurnell NSW
Dicker Data Pty Ltd

Appendix B – Workplace Travel Plan (Ason 2019)

Workplace Travel Plan

Warehouse Development
238-258 Captain Cook Drive, Kurnell

Ref: 0839r02v2

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Document Control

Project No: 0839r02v2

Project: 238-258 Captain Cook Drive, Kurnell

Client: Dicker Data

File Reference: 0839r02v2 WTP_238-258 Captain Cook Dr, Kurnell, Issue II

Revision History

Revision	Date	Details	Author	Approved by
-	1/8/2019	Draft	A. Tan	J. Mulhaire
1	26/9/2019	Issue I	A. Tan	J. Mulhaire
2	09/10/2019	Issue II	A. Tan	A. Tan

Table of Contents

Appendices

1 Introduction

1.1 Background

This Workplace Travel Plan (WTP) has been developed to address Development Consent Conditions B12, B13 and B14 for a warehouse development (the Development) at 238-258 Captain Cook Drive, Kurnell (the Site). The Development was approved under the State Significant Development Application (SSD) process by the Department of Planning, Industry and Environment (DPIE) on 12 April 2017 (Reference: SSD 8662).

The Development consists of 39,680m^2 of warehouse gross floor area (GFA), 5,950m^2 of ancillary office GFA and 925m^2 of amenities GFA. The Site is located within the Sutherland Shire Council (LGA) and is therefore subject to that Council's controls, inline with the SSD consent.

This WTP has specifically been prepared in response to the Development Consent dated 12 April 2019 and Conditions B12, B13 and B14 which stipulates:

"B12. Prior to the commencement of operation of any part of the development, the Applicant must prepare a Work Place Travel Plan to the satisfaction of the Planning Secretary. The Work Place Travel Plan must form part of the OEMP required by condition C5 and must:

(a) be prepared in consultation with TfNSW;

(b) outline facilities and measures to promote public transport usage, such as car share schemes and employee incentives; and

(c) describe pedestrian and bicycle linkages and end of trip facilities available on-site.

B13. The Applicant must not commence operation until the Work Place Travel Plan is approved by the Planning Secretary.

B14. The Applicant must implement the most recent version of the Work Place Travel Plan approved by the Planning Secretary for the duration of the development.

This WTP is intended to develop a package of site specific measures to promote and maximise the use of sustainable travel modes, including walking, cycling, public transport and car sharing.

1.2 WTP Compliance with Development Consent

A summary of the Development Consent Conditions B12 – B14 and this WTP's compliance with each individual requirement is provided in **Table 1** below.

Table 1: Development Consent Compliance Table

Reference	Requirement	Response
B12	Prior to the commencement of operation of any part of the development, the Applicant must prepare a Work Place Travel Plan to the satisfaction of the Planning Secretary. The Work Place Travel Plan must form part of the OEMP required by condition C5 and must:	n/a
a)	be prepared in consultation with TfNSW;	Consultation with TfNSW has been undertaken in the preparation of this WTP; refer to Appendix C for the correspondence.
b)	outline facilities and measures to promote public transport usage, such as car share schemes and employee incentives; and	Section 3.1 discusses the measures which are to be implemented to promote public transport usage.
c)	describe pedestrian and bicycle linkages and end of trip facilities available on-site.	The pedestrian and bicycle linkages and end of trip facilities are described in Section 2.3 and Section 2.1, respectively.
B13	The Applicant must not commence operation until the Work Place Travel Plan is approved by the Planning Secretary.	Noted; operations will not commence until this WTP is approved by the Planning Secretary.
B14	The Applicant must implement the most recent version of the Work Place Travel Plan approved by the Planning Secretary for the duration of the development.	Noted; the most recent version of the WTP (as approved by the Planning Secretary) will be implemented for the duration of the development.

With regard to Condition B12a, Ason Group have consulted with Transport for NSW (TfNSW) for comment. The TfNSW comments are detailed in Table 1 which includes a summary response to each recommendation and a reference to the relevant section of this report.

Table 2: TfNSW Comments

TfNSW Comment	Summary Response	Section
Bicycle parking should be increased to a minimum 33 spaces (30 proposed) to support targeted bicycle mode share of 6% - 33 bicycle trips	The bicycle parking provision will be increased to 33 spaces to support the target of 6% bicycle mode share.	2.1
As per Development Consent, Part B Specific Environmental Conditions, B9. Bus Stops – the applicant must update proposed road upgrade of Captain Cook Drive to include "two bus stops adjacent to the site, comprising a bus stop on the northern and southern sides of Captain Cook Drive and associated pedestrian refuges"	Noted; Dicker Data will provide two bus stops adjacent to the site and associated pedestrian refuges prior to commencement of operation. This will be delivered under the civil engineering discipline, separate to this WTP. The design will be required to be at the satisfaction of Council and TfNSW.	n/a
The Applicant should also design and construct an accessible footpath or shared path between the bus stop on the southern side of Captain Cook Drive and the site to improve pedestrian amenity and safety when accessing bus stops	Noted; Dicker Data will design and construct an accessible footpath or shared path between the bus stop on the southern side of Captain Cook Drive and the site to improve pedestrian amenity and safety when accessing bus stops. This will be delivered under the civil engineering discipline as per Condition B9.	3.1
The pedestrian refuge on Captain Cook Drive should be designed with sufficient space for dismounted bicycle riders and pedestrians to safely cross Captain Cook Drive from the bus stop and bicycle lane on the northern side of Captain Cook Drive	Noted; Dicker Data will design the pedestrian refuge with sufficient space for dismounted bicycle riders and pedestrians to safely cross Captain Cook Drive from the bus stop and bicycle lane on the northern side of Captain Cook Drive. This will be delivered under the civil engineering discipline as per Condition B9.	3.1
Proposed shuttle service between the site and Cronulla Station does not satisfy this condition	Noted, the proposed shuttle service does not satisfy Condition B9.	n/a
Walked only mode share target (2%) to be removed as there is no pedestrian accessibility to the site	The 2% walking mode share has been reduced to 0% to reflect the existing site conditions. The balance has been dispersed to the other mode shares.	2.4
WTP to be updated to include details of end of trip facilities available on-site in addition to parking e.g. shower and locker provision	This report has been updated to include the number of available end-of-trip facilities (such as lockers and showers).	2.1
Preferred pedestrian and bicycle access to be added to the TAG	The TAG has been updated to reflect the preferred pedestrian and bicycle access.	Appendix A
Car parking spaces to be corrected to 390 spaces with 4 accessible spaces as per the Traffic Impact Assessment (currently states 496 spaces including 6 accessible spaces)	The TAG has been updated to reflect the proposed car parking provision, 390 spaces with 4 accessible spaces.	Appendix A
Applicant could consider incentivising car sharing and active travel to the site by providing employee incentives for the on-site café and gym	Dicker Data will incentivise car sharing and active travel to the site by providing employee schemes such as discounts for the on-site café and free locker usage for cyclists for the gym. This is also highlighted in Point 1.6 of Table 6	3.1
Addition of E-bike charging station(s) on-site to be considered to support bicycle mode share target	Dicker Data will provide one E-bike charging station on-site to support bicycle mode share target, as discussed in Point 2.3 of Table 6.	3.1

1.3 Objective

This management strategy comprises a package of measures designed to address the specific travel needs and impacts of the Development. The overall intention of this WTP is to encourage and facilitate the use of alternatives to single-occupancy car travel for journeys associated with the Site.

The primary objectives of the WTP will be to:

- Reduce the environmental footprint of the Development.
- Promote the use of 'active transport' modes, particularly for short-medium distance journeys.
- Reduce reliance on the use of private vehicles for all journeys.
- Encourage a healthier, happier and more active social culture.

Having regard for the above, this WTP would seek to adopt the movement hierarchy shown in **Figure 1** with priority given to 'active transport'.

Figure 1: Movement Hierarchy

2 Site Audit and Targets

An audit of the Site was conducted to determine facilities in the area and projected modal splits. The audit considered the following:

- Public transport services in the area, including proximity to the Site, frequency of services and accessibility;
- Location of nearby car share pods;
- Bicycle and pedestrian facilities, including accessibility, connectivity and safety;
- Mode-split data for the Site and local area;

This section reviews the existing transport choices and sets targets so that the effective implementation of the WTP can be assessed. These targets are to be realistic but ambitious enough to initiate substantive behavioural change to achieve the desired outcomes. The WTP shall be reviewed regularly as part of an ongoing review to ensure it remains relevant and reflective of current conditions.

2.1 Development Site Facilities and Staff

The Development provides the following parking quantities for the anticipated 548 staff numbers, as per **Table 3** below:

Table 3: Development Details

Facilities	Total
Staff Parking Spaces	376
Accessible Parking Spaces	4
Visitor Parking Spaces	10
Motorcycle Parking Spaces	18
Bicycle Parking Spaces	33
Lockers	20
Showers	10

Furthermore, the bicycle parking facilities are supplemented by end-of-trip facilities such as showers and lockers which would further encourage active transport usage.

2.2 Travel Mode Share Analysis

The existing travel patterns of employees within the surrounding locality was surveyed within the 2011 Census and presented in the Journey to Work data provided by the Bureau of Transport Statistics. The data has been presented in **Figure 2** for Travel Zones 2913. Travel Zones (TZs) are the geographic units of the Bureau of Transport Statistics' (BTS) data collection, transport modelling and analysis. TZs allow for detailed spatial analysis as they are smaller than Statistical Local Areas (SLA), but generally larger than an ABS Collection District (CD) or Mesh Block (MB). In order to provide for a similar level of trip generation across zones, TZs are configured so that they tend to be small in areas with high land use densities and larger in areas of lower density. The key land uses of interest in defining TZs are employment, housing and transport infrastructure.

The modal share data shows that a majority of the commuter trips are undertaken as a vehicle driver (86%) with approximately 6% of commuter trips undertaken by as a vehicle passenger.

Figure 2: Journey to Work Mode Share - 2011

The mode share for the top 5 origin locations for persons employed within the selected TZ are summarised in **Table 4** below.

Table 4: Mode of Travel by Origin for Employees within Travel Zone - 2011

Origin	% Total Trips	Walking	Train	Bus	Car Passenger	Car Driver
Cronulla	43%	3%	1%	1%	4%	84%
Sutherland	18%	0%	0%	0%	4%	93%
Wollongong	4%	0%	0%	0%	13%	83%
Hurstville	4%	0%	0%	0%	8%	85%
Kogarah	4%	0%	5%	0%	15%	75%

It is evident that there are a low proportion of public transport users within the TZ, however the lack of public transport facilities is offset by commuters utilising the opportunity to car pool, most notably Wollongong (13%), Hurstville (8%), and Kogarah (15%). The origin for persons employed with the locality is generally incoming from the east of the subject Site.

Further analysis has been undertaken for the 2016 Census data, which now provides statistical data for a larger area consisting the suburbs of Cronulla, Kurnell and Bundeena. This area is referred to as a Statistical Area Level 2 (SA2), which is purposed to represent a community that interacts together socially and economically. The SA2 code for Cronulla, Kurnell and Bundeena is 128011604 and the data analysis results are presented as a pie chart in **Figure 3** below.

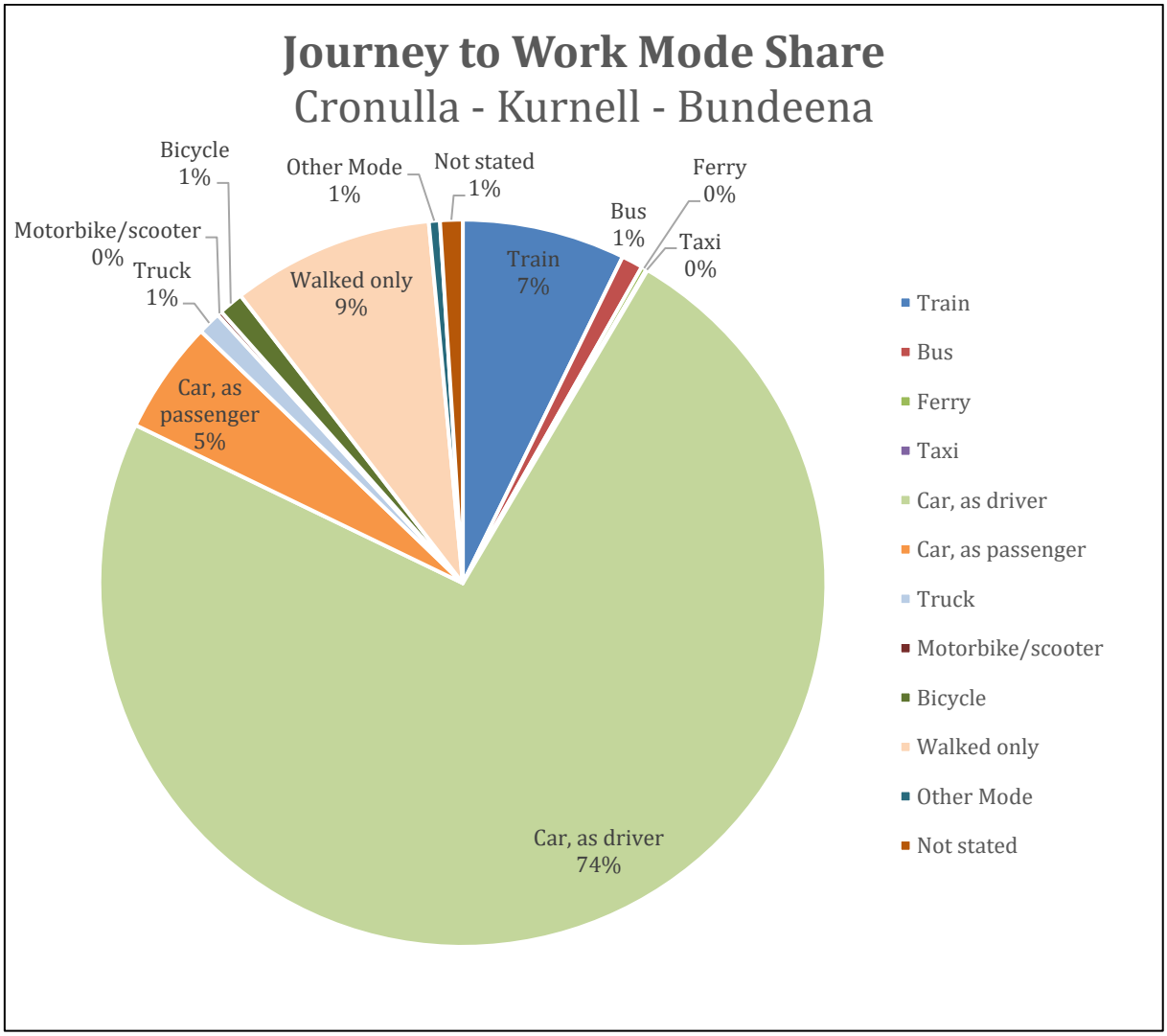


Figure 3: Journey to Work Mode Share - 2016

It is apparent that private car usage is still relied upon as a primary mode of transport. Comparatively, private car usage is lower in the 2016 data. This is likely attributed to the larger statistical area which

now incorporates the suburbs of Bundeena and Cronulla, the latter of which provides better sustainable transport means than Kurnell.

A breakdown of the top 5 origin locations and their respective mode shares for the SA are provided in **Table 5** below.

Table 5: Mode of Travel by Origin for Employees within Travel Zone - 2016

Origin	% Total Trips	Walking	Train	Bus	Car Passenger	Car Driver
Cronulla	28%	5%	19%	1%	3%	68%
Caringbah South	5%	1%	14%	1%	4%	76%
Caringbah	4%	5%	18%	1%	4%	68%
Kurnell	4%	1%	5%	0%	3%	84%
Bundeena	4%	5%	16%	0%	4%	69%

The data indicates that workers residing in Kurnell have the highest private car dependency, likely due to the remoteness of the suburb. Kurnell notwithstanding, rail usage is evidently the preferred method of sustainable transport, followed by walking and bus. Carpooling is not common, with a maximum of 4% of workers who carpool across all origin suburbs.

2.3 Surrounding Public Transport Services

2.3.1 Rail Services

The Integrated Public Transport Service Planning Guidelines, Sydney Metropolitan Area (TfNSW, December 2013), states that train services influence the travel mode choices of areas within 800 metres walking distance (approximately 10 minutes) of a train station. It is therefore noteworthy that the Site is not located within 800m of any rail stations.

Cronulla train station is located approximately 6 kilometres to the south-west of the site. Whilst not located within the nominal walking catchment outlined above, commuters can rely on the busway service from Cronulla Train Station to Kurnell. A breakdown of the train service frequencies is provided in **Table 6** below.

Table 6: Train Frequencies

Station – Line	Travelling to City	Arriving from City	Total
Cronulla – via T4 Eastern Suburbs & Illawarra Line			
Morning Peak Hour (8 AM – 9 AM)	6	5	11
Off Peak Hour (9 AM – 5 PM)	32	32	64
Afternoon Peak Hour (5 PM – 6 PM)	4	5	9

The above table indicates that Cronulla railway station is well serviced in peak periods with trains arriving approximately every 10 minutes to and from the City. **Figure 4** showcases Cronulla Station, located at end of the T4 Eastern Suburbs and Illawarra Line, in relation with the rest of the Sydney Trains Network.

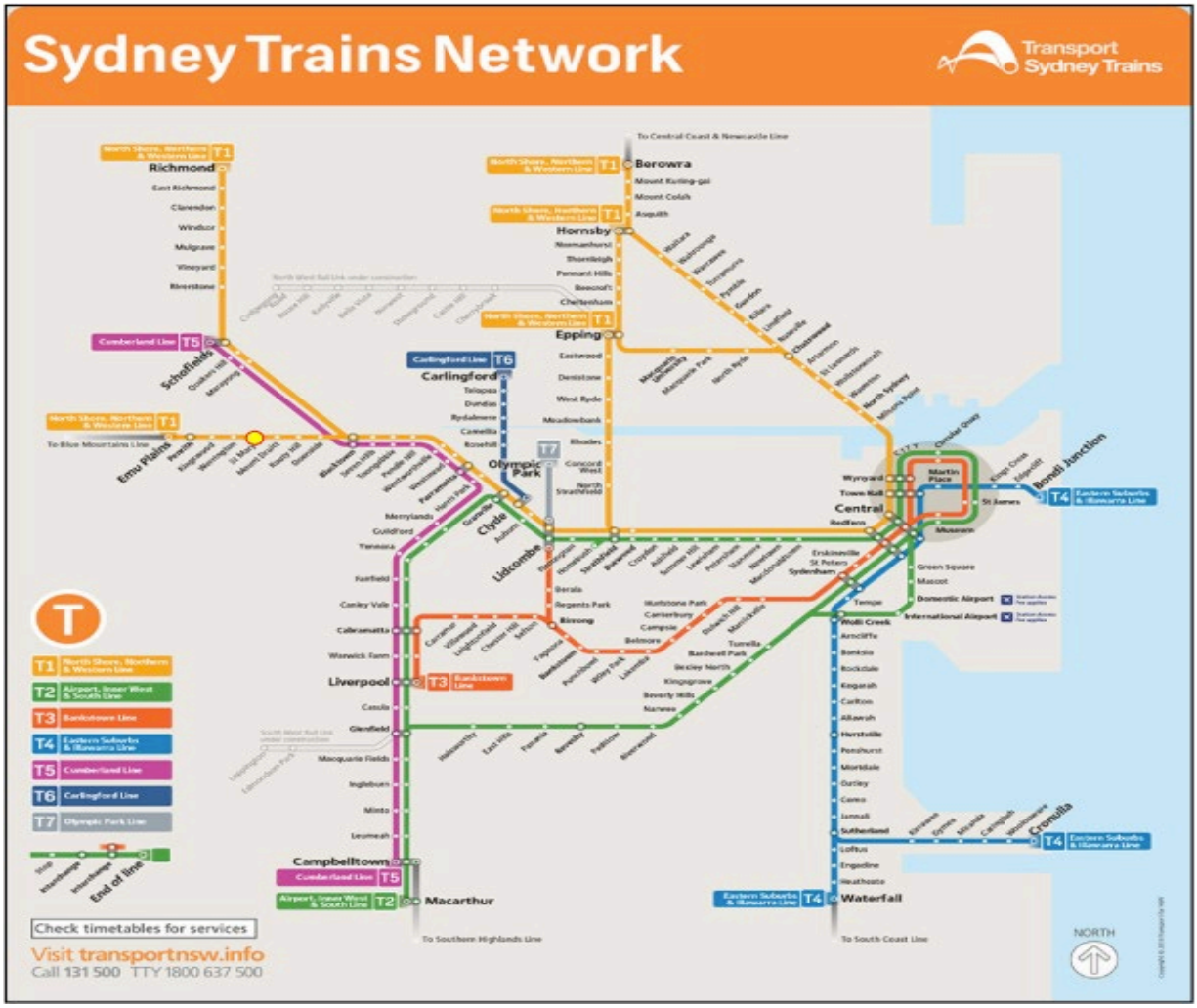


Figure 4: Suburban Rail Network

2.3.2 Bus

With regard to bus travel, the same TfNSW guidelines state that bus services influence the travel mode choices of sites within 400 metres walk (approximately 5 minutes) of a bus stop.

In this regard, the Site lies within the 400 metres radius of the nearest existing bus stops. Bus services available nearby are depicted in **Figure 5**. It can be seen that the bus stops within the vicinity of the Site has connections to Cronulla Station. A summary of the single bus route in close proximity to the Site is summarised in below:

- Bus service 987 which provides connections between Kurnell and Cronulla Station with approximately 30 minutes interval during the peak hours and hourly frequencies throughout the day.

Bus stops for this route are available directly on the Site's street frontage of Captain Cook Drive.

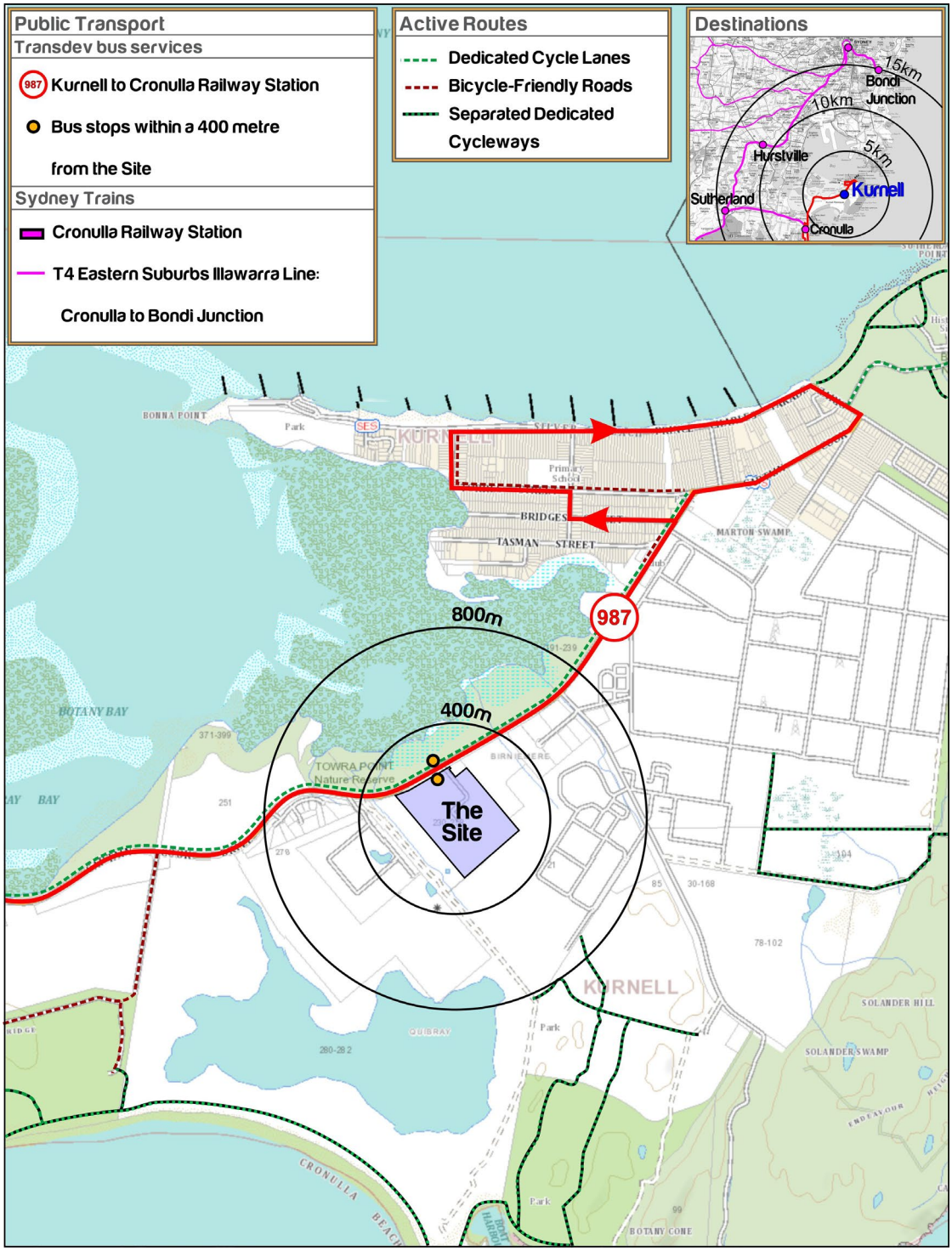


Figure 5: Public Transport Network

2.3.3 Pedestrian and Cycling Network

Although the Site does not have any pedestrian accessibility via pedestrian footpaths in its vicinity, Captain Cook Drive has dedicated bicycle lanes in both directions on either side of the road. This bicycle route connects with the rest of Sutherland Shire's extensive bicycle path network. Additional bicycle paths have been planned by Council to extend the bicycle network's accessibility for the Sutherland Shire area. Reference to **Figure 6** demonstrates the Site's accessibility to the bicycle network.

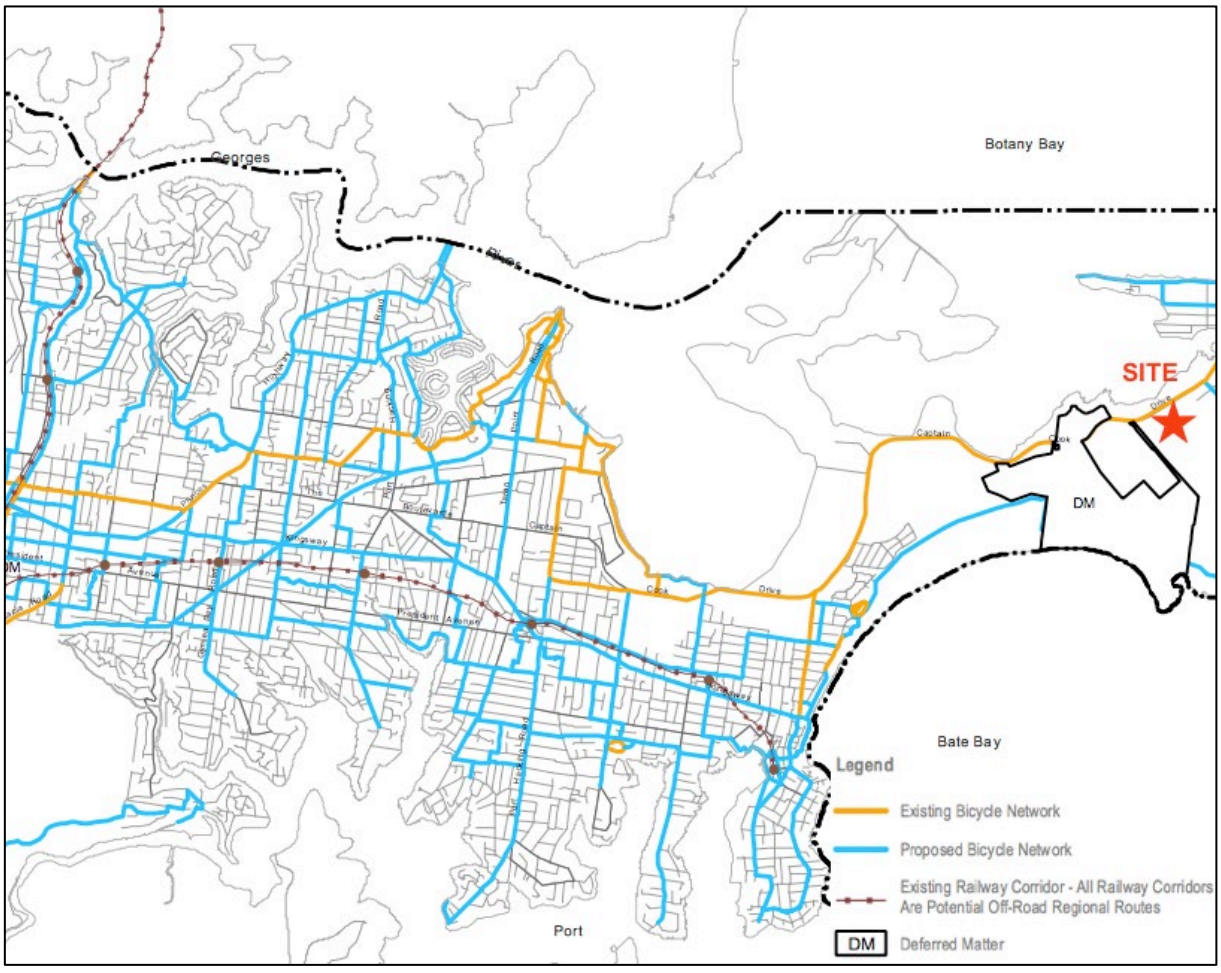


Figure 6: Existing Public Transport Map

2.3.4 Car Share

There are no existing Car Share operators providing vehicles in close proximity to the site.

With consideration to the remote location, it is unlikely for a car share operator to be located solely within or near the Development. As such, an alternative strategy is proposed by Dicker Data which would provide for carpooling schemes which would represent a more viable 'car share' approach for this Development.

2.4 Mode Share Targets

With the above public and active transport accessibility in mind, the mode share targets outlined in **Table 7** are set as the target modal splits for sustainable transport.

Table 7: Mode Share Targets

Travel Mode	Existing	Target	Relative Change
Walking	9%	0%	-9%
Cycling	1%	6%	+4%
Train	7%	10%	+3%
Bus	1%	5%	+4%
Car Passenger	5%	10%	+5%
Car Driver	74%	69%	-5%
Other/Mode Not Stated	2%	0%	-4%

The target mode share has been developed by considering the likelihood of change of each travel mode, with a specific push to encourage cycling and ride sharing between staff members. Taking into account the lack of footpaths and the remote location, the Development is not accessible by walking. As such, the target 'Walking' mode share has been set to 0% to accurately reflect the existing conditions.

It is noteworthy that industrial workers often have an average vehicle occupancy of 1.26 persons per car as described in the Roads and Maritime Services, Guide to Traffic Generating Developments (RMS Guide). Therefore, it is noted that the target mode increase in the number of car passengers effectively equates to an average vehicle occupancy of 1.13 persons per car which is considered achievable.

Furthermore, Ason Group has liaised with Adrian Dessanti, Director Bus & Ferry Planning at TfNSW to increase the frequency of Bus Route 987. TfNSW note that this route is currently being considered for increase of frequency as part of the NSW Government's commitment to introduce 14,000 additional weekly services over the next four years. Notably, TfNSW is consulting with the bus operator, Transdev, to discuss additional services.

Measures and strategies to achieve these targets are discussed in **Section 3**.

3 Action Strategies

3.1 Measures and Strategies

The specific actions which have been identified to aid achievement of the targets for the WTP are provided in **Table 8,** which also identifies the body responsible for each action.

Table 8: Recommended Action Plan Measures

Item No.		Action / Description	Responsibility
1. General			
	1.1	Establish a Site specific transport committee which is to include (but not limited to) the Travel Plan Coordinator (TPC) and any warehouse staff members designated to manage transport demands for individual tenancies	TPC
	1.2	Preparation and maintenance of a Sustainable Travel Plan	TPC
	1.3	Provide 'Travel Welcome Pack' for new staff	Business Management
	1.4	Allow staff the flexibility to commute outside peak periods to reduce overall congestion and travel time.	Business Management
	1.5	Implement a reward scheme for to encourage car share and active transport by providing discounts for the café and free locker usage for cyclists.	TPC / Business Management
2. Cycling			
	2.1	Promote participation in the National Ride2Work Day activity	TPC / Business Management
	2.2	Provide clearly signposted cycle parking within the Site	TPC / Business Management
	2.3	Provide one (1) of E-bike charging station in the bicycling parking area	TPC
3. Public Transport			
	3.1	Update the WTP to reflect changes to any bus routes and service times	TPC
	3.2	Liaise with TfNSW to request an increase in the frequency of Bus Service 987 during the peak hours	TPC
	3.3	Construct two bus stops on either side of Captain Cook Drive and associated pedestrian refuges	Business Management
4. Car Share			
	4.1	Facilitate engagement between staff with a view to encourage ride sharing for those staff that do require the use of private vehicles	TPC / Business Management

Notes: 1) TPC = Travel Plan Coordinator

A Workplace Travel Plan Pamphlet has been prepared and is included in **Appendix A**. The Pamphlet is intended to be distributed to all employees to inform them of the available sustainable travel modes.

To encourage ride sharing between staff (to assist with Item 4.1 identified in Table 6), Dicker Data management will consider the allocation and signposting of parking spaces for use by vehicles with multiple occupants. With 43% of employees originating from Cronulla, it is likely that these cycling and car share strategies will result in the reduction of private vehicle trips.

Regarding the new bus stops (as per Development Condition B9), Dicker Data will also design and construct an accessible footpath or shared path between the bus stop on the southern side of Captain Cook Drive and the site to improve pedestrian amenity and safety when accessing bus stops.

The pedestrian refuge on Captain Cook Drive will be designed with sufficient space for dismounted bicycle riders and pedestrians to safely cross Captain Cook Drive from the bus stop and bicycle lane on the northern side of Captain Cook Drive.

It should be noted that the footpath and pedestrian refuge design falls under the civil engineering discipline. As such, reference should be made to the civil engineering report for further detail regarding this matter.

It should be noted that correspondence with TfNSW to increase Bus Route 987, as per item 3.2, is currently underway. Discussions with TfNSW indicate that the authorities have flagged Bus Route 987 as a service for increased frequency as part of the NSW Government's initiative to introduce 14,000 additional services over the next four years.

3.2 Communications Strategy

3.2.1 Welcome Packs

New staff shall be provided with a 'welcome pack' as part of the on-site induction process which includes the WTP Pamphlet and other information in relation to sustainable transport choices. This pack shall include a copy of the WTP as well as general information regarding the health and social benefits of active transport and advice on where to seek further information such as links to Sydney Cycleways website.

3.2.2 Accurate Transport Information

In addition to these 'welcome packs', a copy of the WTP shall be clearly displayed in communal areas of the site including (but not limited to):

- Staff lunch room for each tenancy
- Lift lobby area and entrances to buildings
- Any marketing material associated with the site, such as websites and newsletters

The WTP shall be presented in a form that is reflective of the commitment to achieving positive transport objectives. This may involve provision of a laminated cover or another protective frame. The WTP is not to be presented on loose paper.

3.3 Travel Plan Coordinator

A representative from the office shall be designated as the overall Travel Plan Coordinator. This person(s) shall be responsible for:

- Implementation and promotion of the WTP actions.
- Monitoring the effectiveness and ongoing maintenance of the WTP.
- Provide advice in relation to transport-related subjects to staff, tenancy management and visitors, as required.
- Liaise with external parties (i.e. Council, public transport and car share operators) in relation to Travel Plan matters.

This role does not necessarily require full-time position; however, it shall be clearly designated among the key responsibilities of the Site management.

3.4 Plan Maintenance

This Plan shall be subject to ongoing reviews and will be updated accordingly. Regular reviews will be undertaken by the Travel Plan Coordinator. As a minimum, a review of the WTP would occur annually.

The key considerations when reviewing or monitoring the WTP are as follows:

- Update baseline conditions to reflect any changes to the transport environment in the vicinity of the site such as changes to bus services, new cycle routes etc. In this regard, review of the WTP may be undertaken on a more frequent basis.
- Track progress against target travel mode targets.
- Identify any shortfalls and develop an updated action plan to address issues.
- Ensure travel modes targets are updated (if necessary) to ensure they are realistic and remain ambitious.

3.5 Travel Mode Audit Requirements

Travel mode surveys may be undertaken to determine the proportion of persons travelling to/from the Site by each transport mode. This will be in the form of annual travel mode questionnaire surveys to be completed by all persons attending the site, as far as practicable. A sample of a typical travel mode questionnaire form is included in **Appendix B**.

A physical survey recording the mode of travel for all persons entering and exiting the Site shall be undertaken following a year of operation to establish a reliable baseline data set from to inform future iterations of this WTP. Subsequent surveys will primarily rely on the questionnaire survey methodology to reduce the costs associated with this data collection.

Appendix A

Workplace Travel Plan Pamphlet

Getting to and from Dicker Data 238 - 258 Captain Cook Drive

Parking

The Site has 390 standard parking spaces including 4 accessible spaces.

The at-grade carpark can be accessed from Captain Cook Drive.

There are a limited number of alternative travel options available which are detailed below:

Bus Service

Transdev runs a loop bus service (No. 987) between Cronulla Railway Station and Kurnell. Bus stops are located toward the eastern end of the site.

Monday to Friday services operate between 6:30 am and 8:40pm every 30 minutes during peak hours and hourly throughout the day.

Hourly services between 8:30am and 6:00pm operate on Saturdays.

The service also operates on Sundays.

Bus fares are based on the distance you travel with convenient payment options available through the use of the Opal card. The Opal card allows you to pay electronically on all public transport services, including buses. You can get an Opal card online at opal.com.au or by calling 13 67 25 (13 OPAL).

Further information regarding buses can be found by visiting the NSW Government's Plan Your Trip website at http://www.transportnsw.info/. or download the real-time app to your phone at http://www.transportnsw.info/en/travel-with-us/keep-updated/apps/real-time-transport.page?

Train Services

The 987 bus service connects to the T4 Sydney Trains line,

Services generally run every 10 minutes during peak hours and 20 minutes during off-peak periods between 5:00am and 12:30 am. on weekdays.

Weekend services operate every 20 minutes.

Further information regarding trains can be found by visiting the NSW Government's Plan Your Trip website at:- http://www.transportnsw.info/.

Cycling

Dedicated cycle lanes run along the length of Captain Cook Drive meeting lanes along Elouera Road to the Railway Station.
Other Cycle Lanes, Shared Cycle Paths and Bicycle - friendly road are shown on the map overleaf.

A more comprehensive map including areas beyond this immediate vicinity can be found at http://www.sydneycycleways.net/

Access to the Site's bicycle parking and end of trip facilities, such as lockers and showers, is via Captain Cook Drive (denoted through the red arrow).

asongroup

info@asongroup.com.au | +61 2 9083 6601 | Suite 502 Level 5, 1 Castlereagh Street, Sydney NSW 2000

Dicker Data
238 - 258 Captain Cook Drive

Kurnell 2231

Workplace Travel Plan

August 2019

Public Transport

Transdev bus services

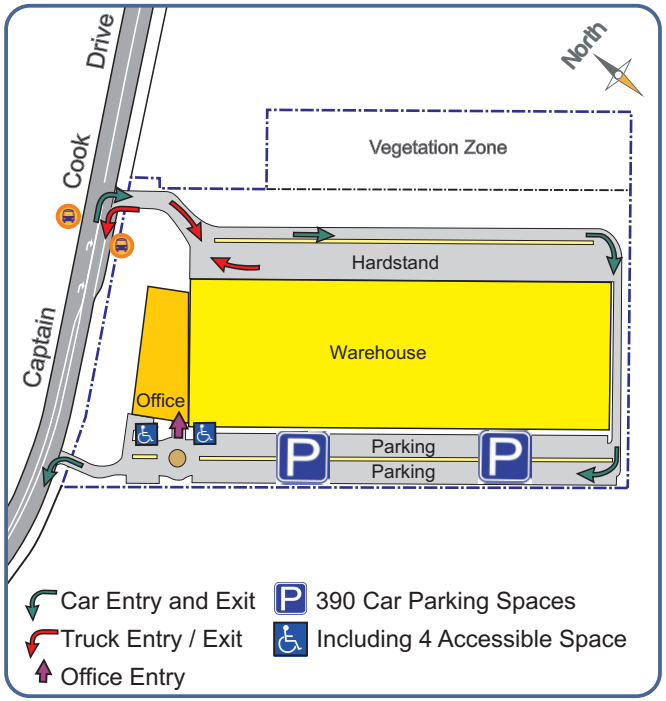
- 987 — Kurnell to Cronulla Railway Station
- Bus stops

Sydney Trains

- Cronulla Railway Station
- T4 Illawarra Eastern Suburbs Line: Cronulla to Bondi Junction via City Change at Sutherland for South Coast

Active Transport

- Dedicated Cycle Lanes
- Bicycle-Friendly Roads
- Separated Dedicated Cycleways



Appendix B

Sample Questionnaire Survey

Instructions for Surveyor(s)

1. The Survey Form (over page) should be completed by EVERY PERSON attending the site on a particular day.

2. This survey should be completed SEPARATELY for EACH TRIP undertaken

Travel Mode Questionnaire Survey Form

Date: **Approximate Time:**

Q1. Are you one of the following?

☐ Full Time employee

☐ Warehouse staff

☐ Office staff

☐ Courier / office delivery

☐ Casual contractor

☐ Company driver / sub-contractor

☐ Other (Please specify) ……..

Q2. How did you travel to / from the site today?

☐ Walked only

☐ Bicycle only

☐ Train

☐ Bus

☐ Taxi

☐ Car share vehicle

☐ Motorcycle / scooter

☐ Car (as passenger)

☐ Car (as driver)

☐ Other (Please specify) ……...

Q3. If you drove to the site, where did you park?

☐ Not applicable – did not drive

☐ On-site car park

☐ On-site within truck hardstand

☐ Other (Please specify) ……...

Appendix C

Consultation with TfNSW

Alan Tan

From: Katrina Loader <Katrina.Loader@transport.nsw.gov.au>
Sent: Thursday, 8 August 2019 10:59 AM
To: Alan Tan
Cc: Joel Azzopardi; Adam Tanner
Subject: RE: Dicker Data Warehouse Captain Cook Drive, Kurnell - Workplace Travel Plan

Hi Alan,

Thank you for referring the Workplace Travel Plan for Dicker Data Captain Cook Drive, Kurnell to TfNSW.

We have received and make the following recommendations:

- Bicycle parking should be increased to a minimum 33 spaces (30 proposed) to support targeted bicycle mode share of 6% - 33 bicycle trips;
- As per Development Consent, Part B Specific Environmental Conditions, B9. Bus Stops – the applicant must update proposed road upgrade of Captain Cook Drive to include "two bus stops adjacent to the site, comprising a bus stop on the northern and southern sides of Captain Cook Drive and associated pedestrian refuges".
    - The Applicant should also design and construct an accessible footpath or shared path between the bus stop on the southern side of Captain Cook Drive and the site to improve pedestrian amenity and safety when accessing bus stops.
    - The pedestrian refuge on Captain Cook Drive should be designed with sufficient space for dismounted bicycle riders and pedestrians to safely cross Captain Cook Drive from the bus stop and bicycle lane on the northern side of Captain Cook Drive
    - Proposed shuttle service between the site and Cronulla Station does not satisfy this condition.
- Workplace Travel Plan (WTP)
    - Walked only mode share target (2%) to be removed as there is no pedestrian accessibility to the site.
    - WTP to be updated to include details of end of trip facilities available on-site in addition to parking e.g. shower and locker provision.
    - Appendix E (Travel Access Guide (TAG)):
        - Preferred pedestrian and bicycle access to be added to the TAG
        - Car parking spaces to be corrected to 390 spaces with 4 accessible spaces as per the Traffic Impact Assessment (currently states 496 spaces including 6 accessible spaces)
    - Applicant could consider incentivising car sharing and active travel to the site by providing employee incentives for the on-site café and gym.
    - Addition of E-bike charging station(s) on-site to be considered to support bicycle mode share target.

Please don't hesitate to contact me should you wish to discuss any of the above.

Many thanks,
Katrina

Katrina Loader
A/Associate Director Travel Demand Management Implementation
Sydney Coordination Office

Transport Coordination, Greater Sydney
Transport for NSW

M 0468 565 700 **E** katrina.loader@transport.nsw.gov.au
Level 44 680 George Street Street, Sydney NSW 2000

(non-working day: Wednesday's)

From: Joel Azzopardi
Sent: Tuesday, 30 July 2019 2:09 PM
To: Katrina Loader
Subject: FW: Dicker Data Warehouse Captain Cook Drive, Kurnell - Workplace Travel Plan

Hi Katrina,

As discussed, this development requires a Work Place Travel Plan in consultation with TfNSW. Can I leave this in your capable hands?

Joel

From: Alan Tan [mailto:alan.tan@asongroup.com.au]
Sent: Tuesday, 30 July 2019 1:57 PM
To: Joel Azzopardi
Cc: John Mulhaire; Rebecca Butler-Madden; Vincent Cheng
Subject: Dicker Data Warehouse Captain Cook Drive, Kurnell - Workplace Travel Plan

Hi Joel,

I trust you are well. As per your phone discussion with John, we have been working with Dicker Data on developing a Workplace Travel Plan (WTP) for a warehouse development. The project is an SSDA and is located at 238-258 Captain Cook Drive, Kurnell. In the first instance, can you please advise the correct TfNSW contact person for this component of work?

As with the WTP, we are aiming to address Condition B12 which requires which relates to consultation with TfNSW as per the Condition below:

***Condition B12**: Prior to the commencement of operation of any part of the development, the Applicant must prepare a Work Place Travel Plan to the satisfaction of the Planning Secretary. The Work Place Travel Plan must form part of the OEMP required by condition C5 and must:*

(a) ***be prepared in consultation with TfNSW***

For reference, I have attached the TIA (prepared by Ason Group) which accompanied the SSDA submission. Of particular importance is Section 8 – Sustainable Travel Plan which will form the basis of the WTP. Please see below for a brief summary of the key components of the development:

- The proposed development consists of 39,485m2 of Warehouse Gross Floor Area (GFA) and 6,875 m2 of ancillary Office and Amenities GFA.

- Application of Sutherland Shire Council's DCP yields a requirement of 285 car spaces. Notwithstanding, a first principle analysis (incorporating data from the existing Data Dicker warehouse) indicates a peak parking demand of 376 spaces.
- In response, the proposed development provides a total of 390 spaces are proposed to meet the projected private vehicle demands of the development.
- It is anticipated that the development would generate 149 and 152 trips in the AM and PM peak hours, respectively.
- The access, loading and car parking design is compliant with the relevant Australian Standards.
- Our WTP intends to shift mode shares as per the following table:

Table 11: Mode Share Targets

Travel Mode.	Existing	Proposed	Relative Change
Walking	2%	2%	-
Cycling	-	6%	+6%
Train	1%	6%	+5%
Bus	1%	5%	+4%
Car Passenger	6%	12%	+6%
Car Driver	86%	69%	-17%
Other/Mode Not Stated	4%	0%	-4%

With regard to the above, are there any initial comments or queries that TfNSW would like highlight in relation to the WTP?

We would also be happy to have a meeting with TfNSW if required.

Please feel free to contact me should you wish to discuss further. Hope to hear from you soon.

Regards,

Alan Tan
BE. Civil MAITPM
Traffic Engineer | Ason Group

T: +61 2 9083 6601 | M: +61 430 919 929 | E: alan.tan@asongroup.com.au
A: Suite 5.02, Level 5, 1 Castlereagh Street, Sydney NSW 2000

Appendix C – Flood Management Plan

2 May 2019
Ref: J1902_R2.doc

FloodMit Pty Ltd
ABN 46 148 958 696

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www.floodmit.com.au

The General Manager
Dicker Data Limited
238-258 Captain Cook Drive,
Kurnell, NSW, 2231

FLOOD EMERGENCY RESPONSE PLAN

Purpose of this Plan

This Flood Emergency Response Plan aims to alert the owner and occupants of the risk of stormwater flooding in the immediate vicinity of the above property, and the most appropriate response measures to take if flooding is experienced.

The Plan is a requirement of Development Consent Conditions provided by the Minister for Planning for the construction and operation of a warehouse and distribution centre at 238-258 Captain Cook Drive, Kurnell. It is to form part of the Construction Environment Plan (CEMP) and the Operational Environment Plan (OEMP) for the development. It is also recommended that it is included in the Work Heath and Safety Manual to be provided for this workplace.

Source of Information

This property is located within a small, unnamed local catchment that drains towards culverts under Captain Cook Drive, and into Quibray Bay, and ultimately Botany Bay.

Information on flooding in the vicinity of the property has been drawn from a number of sources, including:

i) Lower Georges River Floodplain Risk Management Study & Plan (Bewsher, 2011)

ii) Kurnell Township Flood Study (WMA Water, 2009);

iii) Woolooware Bay Catchment Flood Study (WMA Water, 2014);

iv) Gwawley Bay Catchment Floodplain Risk Management Study & Plan (FloodMit, 2015);

v) Dicker Data Warehouse & Dist. Centre: Flood Study (Taylor Thomson Whitting, 2018).

The first report provides information on design flood levels and flood extents in the Georges River and Botany Bay as a result of tidal inundation and storm tide events. The Kurnell, Woolooware Bay and Gwawley Bay reports provide detailed information on stormwater flooding in nearby catchment areas. The final report provides specific information on local flood conditions within the subject property.

Floodplain Risk Management Guidelines (OEH 2007)

This Plan relies on the results of a number of previous flood studies, as noted above. The methodology adopted in these studies is generally consistent with recommendations provided in Floodplain Risk Management Guidelines issued by the Office of Environment and Heritage (OEH) for the preparation of such studies.

The Flood Risk

The local catchment contributing to flooding is largely confined to the site itself, and part of the property to the rear. This area is drained by a channel within the existing bushland along the western boundary of the property, which leads to twin 1.25m diameter stormwater pipes under Captain Cook Drive, and eventually into Quibray Bay. Other parts of the development drain to water quality ponds along the eastern boundary of the site. These drain to a second (0.45m x 0.3m) culvert under Captain Cook Drive.

The site is not directly affected by tidal flooding or storm tide conditions in Botany Bay.

Onsite flooding occurs when the intensity of rainfall exceeds the capacity of the stormwater drainage network. This will typically occur during intense, short duration, thunderstorm conditions. Flooding will mostly be shallow (less than 0.3m in depth) across the site, except in the water quality ponds and stormwater channel where deeper inundation depths will be experienced. Captain Cook Drive may be overtopped near the main (eastern) entrance to the site. There is no risk of flooding to the office and factory.

Predicted Flood Levels

Flood levels and depths at key locations are provided below:

Location	Level [1]	100 Year Storm		Extreme (PMF)[3]		Comment
		Level [2]	Depth	Level[2]	Depth	
Main (east) Entrance at Capt Cook Dr	2.8	2.9	0.1m	3.0	0.2m	Road is likely to be inundated in a 100 year Storm event.
Eastern Carpark	3.0 avg	2.9	-	3.0	0.0m	The Carpark is not inundated in an extreme storm
Western Carpark	3.2 min	3.2	0.0m	3.4	0.2m	Shallow inundation of the Carpark could occur in an extreme storm
Office	3.7	3.2	-	3.4	-	There is no risk of flooding to the office floor level
Warehouse	3.7	3.3	-	3.4	-	There is no risk of flooding to the warehouse floor level
Secondary (west) exit at Capt Cook Dr	3.0	2.7	-	3.3	0.3m	Road not inundated in 100 year storm, but could be inundated in more extreme events

1. Ground and Floor Levels (m AHD) from Site Survey (Masters Surveying, 2018) & Architectural Plans (WMK, 2018) with advised amendments
2. Flood Levels extracted from Dicker Data Flood Study (Taylor Thomson Whitting, 2018)
3. The Extreme Storm is based on the Probable Maximum Flood (PMF) Event, which is the largest event that could conceivably occur

Flood Warning Time and Flood Notification

Flooding is from short duration storm events, in which there will be little or no warning of impending flooding. Flooding will typically occur over a period of less than 2 hours.

No formal flood warning is provided for this area due to its small size and the fact that flooding may occur immediately following heavy rainfall.

More generalised advice may be provided through the Bureau of Meteorology for *"severe weather alerts"* or *"severe thunderstorm warnings"*. Approaching heavy rainfall can be monitored through weather radars on the Bureau's web site at www.bom.gov.au

Other advice and assistance may be available from the State Emergency Service www.ses.nsw.gov.au or telephone 132-500.

Access and Evacuation Protocols

The main point of access to the site is via Captain Cook Drive.

Captain Cook Drive is not affected by storm tide events that lead to elevated levels within Botany Bay, except in the vicinity of Cronulla Golf Club, where road access could be cut for several hours.

Captain Cook Drive is more likely to be impacted from thunderstorm activities occurring over local catchment areas that drain towards Captain Cook Drive and into Botany Bay. Potential problem sites include areas adjacent to Woolooware Golf Club, Shark Park, and Cronulla Golf Club.

There is no need to evacuate this site in response to flooding that may be experienced. The factory and warehouse floor level is not predicted to be inundated, even in extreme flood events. It is safer to shelter within the office and warehouse until the flood threat abates than to try and evacuate the site.

For cases where staff are currently in transit, or evacuation is unavoidable, the preferred evacuation route which avoids know flood threats is shown on Figure 1.

Site Emergency Response Measures

The recommended strategy for major storm events, or where flooding is experienced, includes:

i) The operational manager, or delegated staff member, should assume responsibility for monitoring flood conditions and communicating with staff whenever there is a severe weather alert issued for the area, or when heavy rain is experienced.

ii) Staff should shelter in the office or warehouse until the flood threat abates. There is no risk of flooding above floor level, and it is safer to remain here than attempt to leave the site. It is likely that flooding will occur over a period of less than 2 hours.

iii) Avoid all travel by car during storms that result in roads being flooded. If this is unavoidable, or you are currently driving, the most flood accessible route, that avoids known problem areas, is shown on Figure 1. When travelling away from the site, you should turn off Captain Cook Drive at Elouera Road and head towards the Kingsway.

iv) Never drive through roads that are flooded.

v) Where it is safe to leave the site, the preferred vehicular exit is from the western exit gate, which avoids potential road inundation problems in the vicinity of the main (eastern) entry location.

vi) This Strategy should be reviewed following any significant storm event or as further experience of local flood behaviour becomes available.

vii) This strategy should be included in the Work, Health & Safety Manual prepared for this workplace. The strategy should be communicated to all new staff members as part of their induction process.

Awareness & Training

The Operational Manager, or delegated staff member, shall assume responsibility for maintaining awareness of the content of this Plan; monitoring flood conditions when there is a threat of flooding; and communicating the appropriate measures to be taken to other staff members should flooding be experienced in the vicinity of the site.

The Plan should be included in the Work, Health & Safety Manual prepared for this workplace, and communicated to new staff members as part of their normal induction process. Additionally, the Plan should be displayed in a prominent location within the workplace.

Prepared by:

John Maddocks
Director

Attachments
Figure 1 – Preferred Access/Evacuation Route

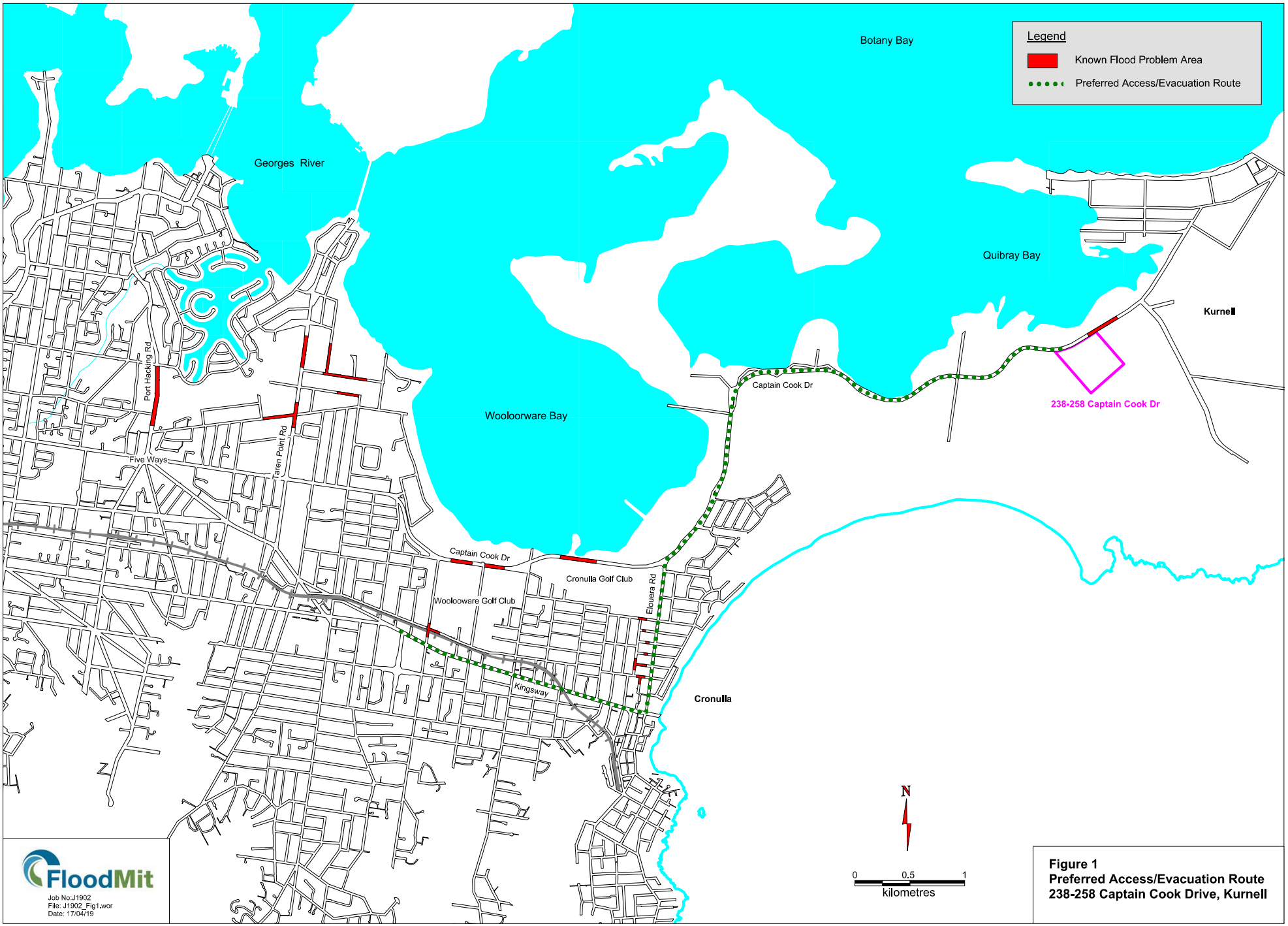

Figure 1
Preferred Access/Evacuation Route
238-258 Captain Cook Drive, Kurnell

Appendix D – Acid Sulfate Soils Management Plan

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Contingency Acid Sulphate Soil Management Plan

Proposed Industrial Development
238-258 Captain Cook Drive, Kurnell

Prepared for
Dicker Data Limited

Project 84677.02
August 2018

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	84677.02	Document No.	R.001.Rev1
Document title	Contingency Acid Sulphate Soil Management Plan Proposed Industrial Development		
Site address	238-258 Captain Cook Drive, Kurnell		
Report prepared for	Dicker Data Limited		
File name	84677.02.R.001.Rev1		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 1	Andrew McIntyre	Mike Nash	24 August 2018

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 1	1	-	Geoffrey Hill, Devkon Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		24/8/18
Reviewer		24-08-18

bsi. ISO 9001 Quality Management
FS 604853

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Glossary of Terms

AASS	Actual Acid Sulphate Soil
ANC	Acid Neutralising Capacity
ASS	Acid Sulphate Soil (including AASS and PASS) (also known as acid sulfate soil)
ASSMAC	Acid Sulphate Soil Management Advisory Committee
ASSMP	Acid Sulphate Soil Management Plan
bgl	below ground level
DECC	Department of Environment and Climate Change
DWE	Department of Water and Energy
DP	Douglas Partners Pty Ltd
ENV	Effective neutralising value
EPA	Environmental Protection Authority
FF	Fineness factor
GW	Groundwater
m	Metres
mg/kg	Milligrams per kilogram (or parts per million)
NATA	National Association of Testing Authorities
PASS	Potential Acid Sulphate Soil
pH	Unit measure of acidity/ alkalinity
pH_{KCL}	Potassium chloride pH
SPOCAS	Suspension peroxide oxidation combined acidity and sulphate
OSD	On-site Detention
PQL	Practical quantitation limit
RL	Reduced level (m AHD)
SKCl	KCl extractable sulphur
SP	Peroxide oxidation sulphur
SPOS	Peroxide Oxidisable Sulphur
SRAS	Residual Acid Soluble Sulphur
SWL	Standing water level
TAA	Total Actual Acidity
TPA	Total Potential Acidity
TSA	Total Sulphidic Acidity
TSS	Total Suspended Solids

Table of Contents

Page

Contingency Acid Sulphate Soil Management Plan
Proposed Industrial Development
238-258 Captain Cook Drive, Kurnell

1. Introduction

1.1 Purpose and Overview

This Contingency Acid Sulphate Soil Management Plan (ASSMP) has been prepared by Douglas Partners Pty Ltd (DP) for a proposed industrial development at 238 - 258 Captain Cook Drive, Kurnell. DP previously prepared an ASSMP for this site in September 2015 for Kurnell Developments Pty Ltd (*Supplementary Acid Sulphate Management Plan,* DP Project 84677.01.R.001.Rev0, dated 8 September 2015).

This ASSMP has been updated at the request of Mr Geoffrey Hill of Devkon Pty Ltd to reflect the current proposed development and supersedes our previous plan dated 8 September 2015.

The purpose of this ASSMP is to:

- Provide general site coverage to supplement previous targeted assessment by DP;
- Outline the procedures for the identification of acid sulphate soil (ASS);
- Outline the procedures for the appropriate management/mitigation of potential environmental impacts that may result from the disturbance of ASS;
- Outline the procedures for the on-site treatment of ASS;
- Outline the procedures for the off-site disposal of ASS at a licensed facility;
- Provide a monitoring program for validating the effectiveness of the management process; and
- Provide emergency response procedures for potential environmental threats which could occur during ASS management.

This ASSMP has been developed as a contingency plan to provide the method of management in the event that ASS is disturbed by the development.

1.2 Site Identification

The site comprises 238 - 258 Captain Cook Drive, Kurnell. The site covers an approximately rectangular area of 17 hectares. It is bordered by a large warehouse to the north east, Captain Cook Drive to the north-west, bushland to the south east and an unnamed gravel road to the south west. The site is relatively flat, with surface levels in the vicinity of 4 m AHD.

1.3 Proposed Development

It is understood that development of the site comprises the staged construction of a warehouse and office building with associated at grade car parks, hardstands and access driveways. The stage 1 warehouse is approximately 120 m by 190 m in plan dimension. Proposed excavations within these areas may be in the order of 1 m.

2. Acid Sulphate Soils Background and Guidelines

2.1 Background

ASS are naturally occurring sediments containing iron sulphides, primarily pyrite, commonly deposited in alluvial and estuarine environments. The occurrence of ASS is associated with areas or regions that have previously been or are currently estuarine environments. Due to changes in sea level or geomorphologic changes to the coastal systems, these sediments are often overlain by terrestrial sediments.

When ASS are exposed to air (e.g. due to excavation or dewatering), the oxygen reacts with iron sulphides in the sediment, producing sulphuric acid. This acid can be produced in large quantities and is highly mobile in water. The process can also release iron and other metals present in the soils. The sulphuric acid (and metals) can drain into waterways causing severe short and long term socio-economic and environmental impacts, including damage to man-made structures and natural ecosystems.

ASS can either be classified as actual acid sulphate soils (AASS) that have already reacted with oxygen to produce acid, or potential acid sulphate soils (PASS). PASS are soils containing iron sulphide that have not been exposed to oxygen (e.g. soils below the water table). PASS therefore have not produced sulphuric acid, but have the potential to do so if exposure to oxygen occurs.

2.2 Guidelines

This ASSMP has been devised broadly in accordance with the following publications:

- NSW Acid Sulfate Soil Management Advisory Committee (ASSMAC), 1998. *Acid Sulfate Soil Manual* (ASSMAC, 1998);
- NSW Environmental Protection Authority (EPA), 2014. *Waste Classification Guidelines* (EPA, 2014); and
- Ahern CR, McElnea AE, Sullivan LA (2004). *Acid Sulfate Soils Laboratory Methods Guidelines*. Queensland Department of Natural Resources, Mines and Energy, Indooroopilly, Queensland, Australia (Ahern et al, 2004).

Reference has also been made to the following document:

- Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M., 2014. *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines*.

Brisbane: Department of Science, Information Technology, Innovation and the Arts, Queensland Government. (Dear et al, 2014).

The thresholds for determining the need to manage ASS are provided in Table 1. The Action Criteria are not the appropriate thresholds for determining if treated ASS has been successfully neutralised.

Table 1: Thresholds for ASS Assessment (ASSMAC 1998)

Material Type	Potential + Actual Acidity / Net Acidity	
	Equivalent Acidity (mol H+/tonne) (oven-dry basis)	Equivalent Sulphur (%S) (oven-dry basis)
ASSMAC Action Criteria for disturbance of 1 – 1000 tonnes		
coarse textured material i.e. sands to loamy sands	18	0.03
medium textured material i.e. sandy loams to light clay	36	0.06
fine textured material i.e. medium to heavy clays and silty clay	64	0.1
ASSMAC Action Criteria for disturbance of more than 1000 tonnes		
all textures	18	0.03

3. Regional Mapping and Previous Assessments

3.1 Regional Geological Mapping

Reference to the Wollongong - Port Hacking 1:100,000 Geology Sheet indicates that the site is underlain by Pleistocene transgressive dunes, typically comprising fine to very fine quartzose sand. The south eastern boundary of the site is located close to the boundary with swamp land, typically comprising peat, sandy peat and mud.

Reference to the corresponding 1:100,000 Soils Landscape Sheet indicates that the site is underlain by disturbed terrain, typically comprising level plain to hummocky terrain extensively disturbed by human activity. The south eastern boundary of the site is located close to the boundary with aeolian soils of the Kurnell association, typically comprising gently undulating to rolling coastal sand dunes.

Reference to the New South Wales 1:25,000 Acid Sulphate Soil Risk Mapping 1994 – 1998 indicates that the main development area in the north-west and central portions of the site is mapped as disturbed terrain, with soil investigations required to assess the area for ASS. The undeveloped parts of the site in the north east, south east and south west are mapped as having a high probability of

occurrence of ASS at depths of 1 m to 3 m below the ground surface. There will be a risk to the surrounding environment if ASS materials are disturbed by excavation activities.

3.2 Previous Assessments

DP has previously carried out a geotechnical investigation for assessment of hydraulic conductivity and acid sulphate soils in proposed infiltration areas of the site:

- DP *Report on Geotechnical Investigation Proposed Industrial Development, 238 - 258 Captain Cook Drive, Kurnell* (Project 84677, Document 1, February 2015) [DP 2015a].

The investigations included the drilling of six boreholes (BH1 to BH6), with four of these terminated in sandy soils at 3 m depth and the other two encountering auger refusal on sandstone at depths of 0.8 m and 2.5 m. The previous borehole locations are shown on Drawing 1 in Appendix B.

The boreholes generally encountered brown silty sand and clayey sand filling to depths of between 0.1 m and 0.3 m, overlying grey and brown sand, silty sand and clayey sand to depths of between 0.5 m and 3.0 m, overlying grey and grey-orange sandstone which was encountered in BH2 and BH4 only at depths of 0.5 m and 1.2 m respectively. Groundwater was observed whilst drilling at depths of approximately 1.5 m to 2.5 m, except in BH2 where groundwater was observed at 0.5 m depth and BH4 where no groundwater was observed down to the final depth of 2.5 m. The borehole logs from the previous investigations are presented in Appendix C.

Thirty-six soil samples (detailed in Appendix D) collected from BH1 to BH6 were screened by a NATA accredited laboratory to assess the potential for ASS on the site. Based on the results of the screening tests, six samples were then subjected to Suspension Peroxide Oxidation and Combined Acidity and Sulphate (SPOCAS) testing at a NATA accredited laboratory. The results of these tests were assessed against the action criteria triggering the need for an ASSMP, outlined in Table 4.4 of the New South Wales Acid Sulphate Soils Management Advisory Committee (ASSMAC) *Acid Sulphate Soil Manual* (1998).

Assessment of the SPOCAS laboratory test results against the ASSMAC action criteria indicated that an ASSMP was required for excavation and/or dewatering activities within some of the soils encountered on site. The action criteria were exceeded in tests conducted on brown and grey-brown silty sand present in BH3 below 2.2 m depth and in BH6 below 2.3 m depth.

DP produced an ASSMP in the following report:

- DP *Report on Acid Sulphate Soil Management Plan, Proposed Industrial Development, 238 - 258 Captain Cook Drive, Kurnell* (Project 84677, Document 2, February 2015) [DP 2015b].

3.3 Current Assessment

This supplementary assessment was requested by council as the previous assessment targeted areas of proposed excavation only and did not provide assessment of the entire site. The current assessment had a vertical investigation limit of 2 m bgl as opposed to 3 m bgl in DP 2015a, as the general excavation depth across the site is expected to be approximately 1m bgl outside the excavation areas targeted in DP 2015a.

The investigations included the drilling of 22 boreholes (BH101 to BH122), with all bores terminated in sandy soils at 2 m depth with the exception of BH105 which encountered auger refusal on sandstone at 1.6 m. The borehole locations are shown on Drawing 1 in Appendix B.

The boreholes generally encountered brown silty sand and clayey sand filling to depths of between 0.15 m and 2.0 m, overlying grey and brown sand and silty sand to from surface level to a depth of 2.0 m. Sandstone was only encountered in BH105 at a depth of 1.6 m. Free groundwater was not observed whilst drilling to depths of approximately 2.0m, however soils were often moist to wet from 1.5m. The borehole logs are presented in Appendix C.

106 soil samples (detailed in Appendix D) were collected from BH101 to BH122 and screened by a NATA accredited laboratory to assess the potential for ASS on the site. Based on the results of the screening tests, ten samples were then subjected to Suspension Peroxide Oxidation and Combined Acidity and Sulphate (SPOCAS) testing at a NATA accredited laboratory.

Assessment of the SPOCAS laboratory test results against the ASSMAC action criteria indicated that no ASS were present at the borehole locations to a maximum depth of 2.0m.

4. Results

The results of Acid Sulphate Screening and SPOCAS testing are presented in Appendix D.

5. ASS Occurrence at the Site

The current investigation which included the drilling of 22 boreholes to a depth of 2m or prior refusal did not detect any ASS with the top 2m soil profile of the site.

In the previous investigation (DP, 2015a) ASS was positively identified in the two samples tested from a depth of 3 m (BH3 and BH6), with none of the four samples tested from 2.0 m or 2.5 m depth recording ASS above the Action Criteria. Based on interpretation of the borehole logs, SPOCAS and field screening results, materials possibly containing ASS are considered to have been encountered from depths of approximately 2.2 m in some locations, or below the water table.

Based on expected depth of ASS, and the proposed excavation depth of 1.0 m, ASS is not expected to be encountered during the main excavation works at the site. ASS may, however, be encountered/ disturbed in the following scenarios:

- ASS being present higher in the profile than identified in the current assessment or DP (2015a). This could occur between sample locations due to heterogeneous subsurface conditions;
- Local deeper excavation (e.g. piling work or excavation for pits and tanks); or
- Dewatering below the depth to ASS.

The below interpretation of ASS occurrence is based on results from DP (2015a) and the current assessment, with the borehole locations shown on Drawing 1, Appendix B. Based on the results it is

considered that the following materials have an elevated risk of containing ASS and should be assumed to be ASS unless further investigation confirms otherwise:

- Brown and grey silty sand below the water table. ASS at the site may or may not have organic odours.
- Similar material immediately above the water table may also contain ASS.

6. Management Strategy

Based on the proposed excavation depth being above the depth at which ASS/ suspected ASS has been encountered in the sample locations, the management strategy for ASS at the site comprises:

- Identify where suspected ASS material may be or have been encountered during excavation works;
- Identify where suspected ASS material may be or have been impacted by dewatering; and
- If suspected ASS will be or has been disturbed, undertake further assessment to confirm the presence/ absence in the area/ depth of concern; and
- If the further assessment confirms that ASS will be or has been disturbed, implement one or more of the contingency plans detailed in the below sub-sections.

This will be done as follows:

Prior to Commencement of Excavation/ Dewatering:

- Review results of DP (2015) with respect to final plans for any proposed excavation and dewatering. Obtain advice from a geotechnical/ environmental consultant if required;
- If the review indicates that ASS may potentially be disturbed, undertake further assessment to confirm the presence/ absence of ASS in the area of concern, or assume that the material is ASS for planning purposes. It is considered that further assessment should be undertaken prior to commencement of works to allow appropriate planning;
- Further assessment would comprise test pitting in the area of concern and testing of the materials considered to possibly contain ASS; and
- If ASS is identified or assumed to be present in a location which will be disturbed by excavation or dewatering, determine the appropriate contingency plan(s) from those detailed in the below subsections.

During Excavation/ Dewatering:

Any materials confirmed or assumed to be ASS are to be managed in accordance with the applicable below contingency plan(s). The applicable contingency plans are likely to including at least one soil contingency plan and the surface and groundwater contingency plan. Materials confirmed or assumed to be ASS will include:

- Materials confirmed to be ASS based on testing prior to or during excavation/ dewatering works;
- Materials assumed to be ASS based on the review of previous results prior to excavation/ dewatering works in the absence of any further testing results; and

- Materials considered to possibly be ASS based on observations during excavation/ dewatering works in the absence of any further testing results. Materials should be inspected during excavation and if any materials are assumed to possibly contain ASS, obtain advice from a geotechnical/ environmental consultant if required.

6.1 Soil Contingency Plan 1 – Direct Disposal of Untreated PASS

This strategy involves excavation of PASS and direct trucking of the untreated PASS to a facility licenced to receive it. This option is only applicable to PASS in natural soils (i.e. not to AASS or to any filling material), that are not contaminated and only if the PASS is managed in accordance with Part 4 (Acid Sulphate Soils) of EPA (2014). This option will only be able to be implemented if the status and properties of the ASS have been determined prior to excavation. Based on the results to date, ASS identified in at the site is likely to be suitable for management using this option based on the ASS results; however, this is subject to assessment for potential contamination.

At the time of preparation of this ASSMP one facility in Sydney was licenced to receive untreated PASS. This facility is located in Kurnell and operated by Besmaw Pty Ltd. The EPA can be contacted on 131 555 to provide updated information on appropriately licenced landfills.

In addition to this ASSMP, specific requirements of EPA (2014) and the receiving facility must also be complied with.

Prior to this option being adopted an agreement must be made with the receiving facility to accept the materials. The agreement should detail the requirements for the management of the material to allow it to be accepted and the protocol and responsibility for the treatment and handling of any material rejected by the facility (i.e. due to it arriving at the facility in a condition which the facility cannot accept).

6.1.1 On Site Management, Monitoring and Transport

The following works are required:

- For soils loaded directly into a truck: Sampling and testing of field pH of at least one sample per truck load of untreated material to confirm the pH is greater than the receiving site acceptance requirements (i.e. pH ≥ 5.5 at the time of arrival);
- For soils stockpiled prior to loading into a truck: Given the higher risk of oxidation for stockpiles soils, sampling and testing of field pH of at least three samples per truck load of untreated material to confirm the pH is greater than the receiving site acceptance requirements (i.e. pH ≥ 5.5 at the time of arrival);
- Any materials with a field pH of less than 5.5 are not suitable for disposal as untreated PASS and must be managed in accordance with Section 6 or 7. Note some lowering of the field pH is likely to occur during transport, and as such the contractor may wish to consider an alternative management option for PASS with a field pH close to this limit (e.g. a field pH of 5.5 - 6 depending on soil type and pH screening results) in accordance with Section 6.2 or 6.3;
- Management of leachate/ runoff water potentially impacted by ASS in accordance with Section 6.4;

- All PASS must be kept wet during excavation and transport. Materials should be sprayed with water as required to keep them wet. Transport must be conducted in a sealed/lined truck to prevent water leaking from the truck during transport. Given the material will be wet, it will be heavy (estimated to be approximately 2 t/m^3), and this should be taken into account in loading of trucks to ensure they are not overweight;
- PASS must be transported to the receiving facility with minimal delay. All PASS must arrive at the receiving facility no more than 16 hours after excavation, but should be preferably excavated directly into trucks and taken to the receiving facility without delay to reduce the potential for the material to dry out and oxidise, thus reducing the pH (and potentially resulting in the rejection of the material by the receiving facility);
- Full time inspection of excavation and truck loading procedures by either a dedicated site engineer or an environmental consultant to confirm the works are carried out according to general good works practice and with the intention to minimise the aeration (i.e. oxidation) of the PASS, and to undertake the field pH testing and prepare documentation to be sent to the receiving facility with the truck;
- Documentation is to be sent with each truck load detailing the soil's excavation, transport and handling procedures and timing as well as the field pH recorded on site and the time the truck left the site. A copy of this documentation will also be kept on site. The documentation is to show that the PASS management has been conducted in general accordance with this ASSMP and EPA (2014) and have appropriately mitigated oxidation of the PASS. This documentation is to be provided to the receiving facility in accordance with the requirements of EPA (2014). It is expected that the receiving facility will have a standard pro-forma for the documentation required;
- Direct transport routes should be used to minimise transport times; and
- Once the PASS has been accepted by the receiving facility they are required to manage it in accordance with their licence conditions. It is not the role of this document to discuss management of material once it has been accepted by the receiving facility.

6.1.2 The Receiving Facility Acceptance Criteria

EPA (2014) only allows untreated PASS to be accepted if it has not dried out and if it has a pH equal to or greater than 5.5.

6.2 Soil Contingency Plan 2 – On-Site Treatment

This strategy comprises on-site treatment and can be applied to all materials containing ASS. On-site neutralisation, management, monitoring and validation of ASS should be undertaken as required using the methodology given below. Following on-site treatment, the material could be re-used on site or be disposed off-site.

6.2.1 Prior to Excavation

On-site treatment will require preparation of a Treatment Area(s), Stockpiling Area(s) and Leachate Collection Area(s).

Allowances should be made during construction planning to resume sufficient land to allow for these items. Leachate collection location, lining and construction should be similarly pre-planned.

Figure 1, below, shows a cross section of a typical treatment pad.

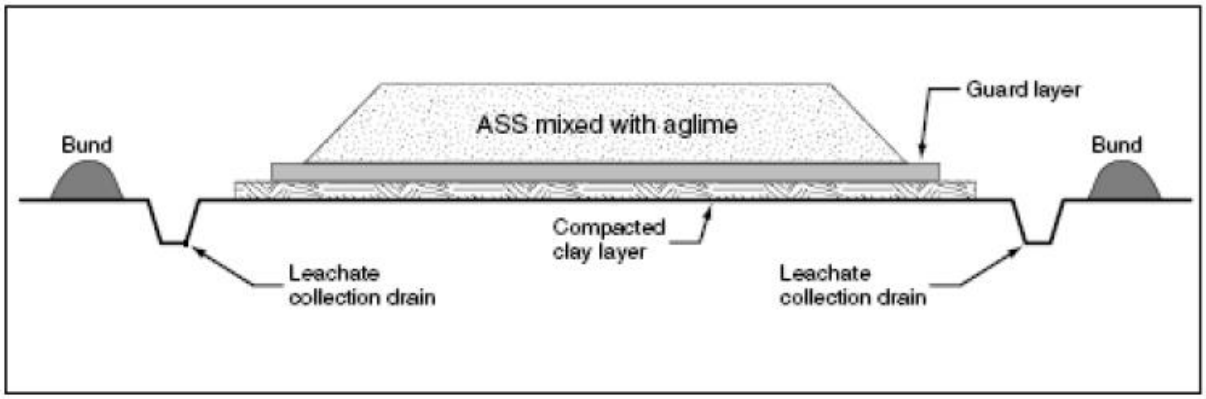


Figure 1: Schematic cross-section of a treatment pad, including clay layer, guard layer, leachate collection system and containment with bunding[1]

These areas should be prepared as follows:

- Prepare a treatment pad and (if required) stockpile pad of appropriate area for the volume of soil to be treated/stored. The pad should be prepared on relatively level or gently sloping ground to minimise the risk of any potential instability issues, with a natural (or shaped) fall to the local drainage sump;
- Lining of the surface of the pad with selected compacted clay (at least two layers to a combined compacted thickness of 0.5 m) or a geosynthetic liner as approved by the environmental consultant. A concrete pad may also be suitable subject to the construction details and location and subject to the approval of the environmental consultant;
- Apply a guard layer of fine agricultural lime ('ag lime') over the compacted clay or geosynthetic liner, to neutralise downward seepage. This guard layer of lime should be applied at a rate of 5 kg[2] ag lime/m^2 of surface area of the pad/metre height of stockpile, i.e. if a treatment stockpile height of 3 m is proposed, the guard layer would need to comprise 15 kg of ag lime per m^2 of surface area. The guard layer should be re-applied following removal of treated soils prior to addition of untreated ASS; and
- Liming pads should be bunded and a circumference drain excavated to collect and contain leachate. The drain and inner bund slopes should be lined with impermeable material and covered with a layer of fine lime applied to neutralise any possible leachate migrating from the stockpiled material. The drain should direct water into an appropriately sized detention basin, the base of which has been prepared in the same manner as the liming pad. Alternatively water from the drain can be pumped into on-site tanks for storage, testing and treatment.

[1] Figure reproduced from Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M., 2014. *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines*. Brisbane: Department of Science, Information Technology, Innovation and the Arts, Queensland Government. (Dear et al, 2014).
[2] Based on the recommendations of Dear et al (2014)

6.2.2 Treatment Process

- Prepare a treatment/ stockpiling pad in accordance with Section 6.2.1;
- Remove non-ASS overburden from the area containing ASS if material types can be separated during works;
- Transport ASS material requiring treatment to the treatment area in sealed trucks;
- Manage ASS during stockpiling and treatment to minimise dust and leachate generation (e.g. by covering, or lightly conditioning with water). If wet weather prevails, stop works and cover the stockpiled material with a plastic sheet to reduce the formation of leachate;
- Spread the ASS onto the guard layer in a layer of 0.2 to 0.3 m thickness, leaving a 1 m flat area between the toe of the spread soil and the containment bund or drain. When spreading the first soil layer, care should be taken not to churn up the lime guard layer;
- Let the ASS dry to facilitate lime mixing (if too wet, then adequate mixing of lime cannot be undertaken);
- Apply ag lime (refer to Section 6.2.3) to the stockpiled soil, at the indicative liming rate in Section 6.2.4 and harrow/ mix thoroughly prior to spreading the next layer;
- Continue the spreading/liming/mixing cycle. This can be done one layer at a time, or with multiple ASS layers placed on top of each other;
- Assess the success of the treatment using verification testing in accordance with Section 6.2.5. Samples will need to be collected from all layers, which is likely to require use of plant for sampling. The verification testing has two components: field screening and laboratory analysis. Laboratory analysis will only be undertaken after the field screening results have passed;
- If verification sampling indicates that additional neutralisation is required, add additional lime and mix;
- When verification testing indicates that lime neutralisation is complete, then the stockpiled soil may be removed from the treatment pad;
- Re-use the treated ASS on-site or undertake waste classification assessment and dispose off-site in accordance with Sections 6.2.7 and 6.2.8; and
- Management of leachate water in accordance with Section 6.4.

6.2.3 Neutralising Materials for Soils

Agricultural lime commonly known as ag lime is the preferred neutralisation material for the management of ASS, as this material is usually the cheapest and most readily available product for acid neutralisation. Furthermore, ag lime is slightly alkaline (pH of 8.5 to 9), non-corrosive, of low solubility and does not present handling problems. Ag lime comprises calcium carbonate ($CaCO_3$), typically made from limestone that has been finely ground and sieved to a fine powder.

It is generally preferable if an ag lime with a purity of 95% or better is used (i.e. NV >95, where NV is the neutralising value, a term used to rate the neutralising power of different forms of materials relative to pure, fine calcium carbonate which is designated NV = 100). The ag lime should be fine and dry, as texture and moisture can also decrease the effective neutralising value. Ag lime with a NV of 95% to 98% is usually used. There could be economic justification for using a less pure grade of ag lime,

however, this would require a higher application rate, requiring the lime dosing rates given in Section 6.2.4 to be adjusted by a factor of 100/NV. Potential cost savings from using less pure material may be offset by the corresponding increase in the transport and disposal costs.

Coarse grained calcite is not recommended, as one of the products of the neutralisation reaction is gypsum ($CaSO_4.2H_2O$) which has a relatively low solubility and tends to coat the reacting calcite grain, forming a partial barrier against further reaction.

Gypsum may also give off hydrogen sulphide if in reaction with acidic conditions and can itself result in the generation of sulphuric acid.

Dolomitic ag lime, or magnesium blend ag lime, should not be used as these materials impose environmental risks from overdosing with the potential to damage estuarine ecosystems.

An alternative neutralising material can be used subject to prior approval by a suitably qualified scientist or engineer.

6.2.4 Lime Application Rate

Based on the "worst case" results of the SPOCAS analysis to date, and assuming the use of 95% NV ag lime, the recommended initial treatment rate of 130 kg of lime per tonne of ASS as calculated by the laboratory as part of the SPOCAS analysis.

If specific laboratory results are available for a "batch" of ASS, a liming rate based on these results may be used.

It is noted that the acid production will vary both horizontally and vertically through the ASS profile due to the variability of natural systems. The liming rate to be calculated from the analytical results should therefore be considered as a "starting point", and pH monitoring should be conducted during treatment to assess the progress of the neutralisation, and need for additional mixing and/ or addition of ag lime. Material will only be considered to have been successfully treated when all soil has been validated in accordance with Section 6.2.5.

If an alternate neutralising product is used, a specific dosing rate will need to be calculated. The required dosing rate should be calculated from one of the following formulas.[3]

Equation 1:

Neutralising Material Required (kg CaCO3/tonne soil) = Net acidity (S% x 30.59) x 1.02 x FOS x 100/ENV

Equation 2:

Neutralising Material Required (kg CaCO3/m3 soil) = D (tonne/m3) x Net acidity (S% x 30.59) x 1.02 x FOS x 100/ENV10

[3] Sourced from WA Department of Environment and Conservation *Treatment and management of soils and water in acid sulfate soil landscapes* (July 2011)

Where:

%S = net acidity (% S units). This value is obtained from the SPOCAS/ chromium suite analytical results and should be the "worst case" result of the acid or sulphur trails of all samples;

30.59 converts to kg H2SO4/tonne

1.02 is used to stoichiometrically convert units of sulfuric acid (H2SO4) to units of calcium carbonate (CaCO3).

FOS (factor of safety) = a minimum value of 1.5 needs to be adopted, although values of up to 2 can be suitable;

ENV = Effective Neutralising Value (e.g. Approx. 95% for fine ag lime).

Notes:

- The ENV is calculated based on the molecular weight, particle size and purity of the neutralising agent and should be assessed for proposed materials in accordance with ASSMAC (1998);
- The "worst case" of the acid or sulphur trail results should be used. Where the acid trail is used the mol H+/t should be converted to %S as per the formula given above.

Whilst the above formulas are provided, the environmental consultant will provide the liming rate based on the soil analysis results. The WA Department of Environment Regulation also provides a calculator for liming rates at http://www.der.wa.gov.au/your-environment/acid-sulfate-soils/.

6.2.5 Validation Testing

Validation of works should be conducted as follows:

- During and following neutralisation, the soils will require pH screening to confirm that the appropriate quantities of lime have been added and the soils have been suitably mixed/blended. The pH testing should be undertaken on the treated material at the following frequency:
  - One sample per 25 m^3 of treated soil or a minimum of six samples per treatment batch (for field and oxidised pH screening tests);
- Once the pH screening results all meet the criteria given in Section 6.2.6, laboratory validation testing will be required at the following rate:
  - At least one sample per 1,000 m^3 or at least one per batch of treated material, whichever is greater (the sample(s) with the "worst case" pH screening results should be selected for laboratory analysis). The laboratory testing can comprise the SPOCAS or the full Chromium Suite analytical method. It is noted that the fastest turnaround of analytical results is three days from receipt of the sample at the laboratory (with the timing generally commencing from the morning after the samples are received by the laboratory), and this timing may not always be available from the laboratory. This should be taken into account to ensure adequate on-site storage is available for treated and untreated ASS; and
- Compare the validation results with the acceptance criteria given in Section 6.2.6. If all results meet the acceptance criteria, the ASS will be considered to have been successfully treated.

6.2.6 Acceptance Criteria for Treated ASS

The acceptance criteria are based on the results of "field" and peroxide pH testing and laboratory testing. ASS will be considered to have been successfully treated when all of the following are met:

- field pH (i.e. field pH in water) is ≥ 5.5 (and preferably ≤8.5 for any materials to be re-used on-site);
- peroxide pH (i.e. pH after forced oxidation) is ≥ 6.5;
- pH_{KCL} is ≥ 6.5;
- TAA = 0;
- TPA = 0 (preferably, although TPA<ANC may be considered suitable subject to specific assessment); and
- Net acidity is < 0.

The net acidity is calculated from SPOCAS/ chromium suite analytical results as follows:

Net Acidity ($\%_{Sulphur}$) = (S_{pos} or S_{Cr}) + TAA + S_{RAS} – ANC / FF

Further treatment of the soil will be required if any of the above conditions are not met.

6.2.7 On-Site Re-Use of Treated ASS

The treated material will be suitable for re-use on site subject to the final pH not presenting a risk to the environment or building materials for its proposed placement location.

The treatment process can result in elevated pH of soil (e.g. greater than pH 8.5), which may potentially impact plant growth.

If on-site re-use is proposed, individual batches of treated soil should be assessed for their suitability to remain on site.

6.2.8 Disposal of Treated ASS

Waste classification of treated ASS material to be disposed of off-site is to be conducted in accordance with EPA (2014) and the *Protection of the Environment Operations (POEO) Act* 1997 (the POEO Act 1997).

With regard to ASS, Part 4 (Acid Sulphate Soils) of EPA (2014) states that ASS must be treated (neutralised) prior to acceptance by a landfill (unless it is to be disposed of as “PASS” to an appropriately licensed landfill). After treatment the soil should be chemically assessed in accordance with Part 1 of EPA (2014). This will determine whether any other contaminants are present in the material. When the classification has been established, the soil should be disposed of to a landfill that can lawfully accept that classification of waste. The treated ASS would (at a minimum) be classifiable as General Solid Waste, however, chemical testing needs to be conducted to confirm the classification prior to disposal and a higher classification could apply.

Prior arrangements should be made with the landfill to ensure that it is licensed to accept the waste. The landfill should be informed that the ASS has been treated in accordance with the neutralising techniques outlined in an ASSMP produced in accordance with ASSMAC (1998) and that the waste has also been classified in accordance with EPA (2014).

6.3 Soil Contingency Plan 3 - Off-Site Treatment

This strategy comprises off-site treatment and can be applied to all materials containing ASS. This is likely to be the most expensive management option for the ASS.

6.3.1 Prior to Excavation

Prior to disturbance of potential ASS, the following will be undertaken:

- Identification of a suitable, appropriately licenced treatment facility. It is advised that the waste generator is responsible for ensuring that waste is disposed to a facility/ site which is legally able to accept it, as required by the POEO Act 1997;
- Provision of test results to the facility;
- Determining and addressing any specific requirements of the treatment facility, and amending this ASSMP as required to check that all requirements are met; and
- Confirming that the treatment facility will accept ASS from the site on the dates required.

6.3.2 Management and Transport

- Excavation and disposal of non-ASS overburden from the area containing ASS if material types can be separated during works;
- Any ASS material requiring transport to the treatment facility should be loaded directly into sealed trucks (sufficient to contain any water draining from the soils) and covered. Given that the soil is likely to be wet, and as such heavier than dry soils, it is critical that an accurate estimate of the weight of the material is made so that trucks are not overloaded. If the material is to be stockpiled overnight on-site prior to transport, it will need to be stockpiles in an area prepared in the same manner as the liming pad described in Section 6.2.1;
- Transport of the ASS to the waste facility by a direct route to minimise transport time; and
- Management of leachate water and groundwater in accordance with Section 6.4.

6.3.3 Treatment

The treatment facility must manage, treat and dispose of the ASS in accordance with their licence conditions.

6.4 Contingency Plan for Surface Water and Groundwater Management

Water is the main mechanism by which acid and metals from oxidised ASS are mobilised and transported. Careful management of water is therefore paramount to effective management of potential adverse impacts from ASS.

The below sections provide strategies for management, assessment and disposal of water which has been in contact with the ASS. This could comprise water leaching from the ASS or surface water. The proposed works are not expected to require significant groundwater dewatering.

Management of water is of particular concern at the subject site given the shallow water table and the sandy soils, allowing surface water to readily infiltrate into the groundwater.

6.4.1 Leachate and Surface Water Collection

All water that has been in contact with ASS/ assumed ASS must be managed, assessed, treated and appropriately disposed of.

Water from the ASS treatment/ storage area should be collected in the lined drains/ detention basin constructed in accordance with Section 6.2.1, or in a tank. The stored water should not be in direct contact with groundwater or surface water, and should be stored away from overland flow paths. Any other water which may have come into contact with ASS should be collected in an on-site detention basin/ tank.

All water which has potentially come into contact with ASS requires management in accordance with the below sections.

6.4.2 Dewatering Management

No significant dewatering is expected to be required for the proposed development.

If any localised dewatering is required, the methods used should be chosen to minimise lowering of the water table beyond the excavation footprint both spatially and temporally.

Any water extracted as part of dewatering would need to be collected, assessed and treated in accordance with this section as having potentially been impacted by ASS.

6.4.3 Water Assessment

All water which has potentially come into contact with ASS requires assessment (and if necessary treatment) for the parameters listed in Table 2, below, as a minimum. This table also details the recommended monitoring frequencies and target thresholds.

Table 2: Suggested Water Monitoring Frequencies and Target Levels for Disposal to Stormwater

Test	Frequency	Target Level for Disposal to Stormwater
pH	Field measurement: • During storage as required to allow timely treatment; • Immediately prior to disposal; and • Daily checks during discharge period.	• pH 6.5 – 8.5
Total Suspended Solids (TSS)	Field measurement: • Immediately prior to disposal; and • As required based on visual observations; and	• water observed to be clear; • Turbidity <50 NTU

Test	Frequency	Target Level for Disposal to Stormwater
	Visual assessment: • Daily during discharge period.	
Oil and Grease	Visual assessment: • Immediately prior to disposal; and • Daily checks during discharge period; and Laboratory analysis: • As required based on visual observations.	• None observable • <10 mg/L
Iron (total and soluble)	Laboratory analysis: • Immediately prior to disposal; and • Weekly checks during discharge period; and • As required based on visual observations; and Visual assessment: • Daily during discharge	• ≤ 0.3 mg/L filterable iron • No obvious sign of iron staining/ settlement
Metals (aluminium, arsenic, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc)	Laboratory analysis: • One round of testing before first disposal; • If first round of testing exceeds target levels then further testing prior to disposal is required	• ANZECC (2000) Trigger Levels for 95% Level of Protection for freshwater ecosystems
Contaminants of Concern	Laboratory analysis: • One round of testing before disposal for any water which has come into contact with contaminated/ potentially contaminated soil or water	• As required, based on what contaminants of concern (e.g. in soil or groundwater) the water has potentially been impacted by. This may include, inter alia, TRH, BTEX, metals or VOC

6.4.4 Treatment

Treatment of water from construction sites is commonly required for pH and total suspended solids (TSS). Aeration and removal of TSS also generally decreases metal concentrations in the water. Standard industry treatment methods and commercial treatment products are suitable for the site and are likely to provide the most efficient treatment.

If a suitable treatment method for man-made contaminants in the water (e.g. oil and grease or metals) cannot be implemented, an alternate disposal method may be required (e.g. to trucking off-site to a liquid waste disposal facility or disposal to sewer in accordance with a specific Trade Waste Agreement which would need to be obtained from Sydney Water).

6.4.5 Water Disposal

Water requiring off-site discharge should be disposed of in accordance with the POEO Act 1997, relevant guidelines, consents and licences. Consent for discharge should be obtained from the relevant authorities, where appropriate. The approval body for discharge into the stormwater system is the local Council.

6.4.6 Groundwater Monitoring

If ASS below the water table is disturbed by excavation or dewatering, the groundwater could be impacted by leaching of pH or metals from oxidised ASS. As such monitoring of groundwater for potential impacts would be required in these circumstances.

The groundwater monitoring should include wells in the vicinity of/ down gradient of ASS treatment area(s), and excavations were ASS is being excavated.
During excavation or treatment of ASS, weekly monitoring of groundwater should be conducted from three locations (across the site). Monitoring of pH will be used as an initial screen.

If a drop in pH of more than 0.5 pH units below the measured background pH is observed at any time during the monitoring programme, the measures detailed in Section 7 must be implemented.

7. Emergency Response Procedures

Construction activities which may cause potential environmental threats are summarised in Table 3 below, together with recommended “Emergency Response Procedures”.

Table 3: Contingency and Emergency Response Procedures

Construction Activity	Potential Environmental Threat	Emergency Response
Bulk excavation into ASS	Flooding of open excavation causing adjacent groundwater levels to rise, leading to potential acid leachate once the excavation is drained	• Inform site foreman and project manager/environmental representative; • Determine pH of groundwater / floodwater in excavation; • Correct groundwater / floodwater pH to bring pH in range of 6.5 to 8.5; • Drain pit to tanks/ basins for water quality assessment prior to discharge.

Construction Activity	Potential Environmental Threat	Emergency Response
Stockpiling / neutralisation of ASS	Stockpile washes or slips outside of bunded lime pad	• Inform site foreman and project manager/environmental representative; • Estimate volume of material breeching bund; • Conduct pH analysis of adjacent surface water (if potentially impacted); • Correct pH in any adjacent surface water (if impacted); • Move breeched soil into a bunded limed pad; • Over-excavate contaminated area to 0.2m depth, apply and mix lime at rate as for guard layers (5kg ag lime per m^2 of surface).
	Breach in stockpile containment bund	• Inform site foreman and project manager/environmental representative; • Close breach in bund; • Conduct pH analysis of adjacent surface water (if potentially impacted); • Correct pH in any adjacent surface water (if impacted);
Dewatering/ ASS excavation/ ASS treatment	Groundwater pH decrease by 0.5-1 pH unit below background	• Increase pH monitoring to every second day; • Undertake groundwater assessment of metals (aluminium, arsenic, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc and iron); • Assess possible cause(s) of pH drop; • Implement measures to prevent further decrease in pH.
	Groundwater pH decrease by more than 1 pH unit below background	• As per pH drop of 0.5-1; and • Assess the need for corrective measures to increase pH to background level.

For all construction incidents which pose an environmental threat, an incident report must be completed in order that:

- The cause of the incident may be determined; additional control measures may be implemented; and
- Work procedures may be modified to reduce the likelihood of the incident re-occurring.

8. Protection of Engineered Materials in Contact with ASS

If engineered materials which are sensitive to acid are to be installed in excavations near where ASS has been exposed a “guard layer” should be placed to protect these materials. Following completion of the excavation, the newly exposed ASS should be covered with a guard layer (which can also serve

as a working platform) to counteract the generation of acidic leachate due to the soils being exposed to air. This layer could be constructed of crushed recycled concrete mixed with limestone to form a 300 mm thick layer.

9. Responsibilities

The responsible party for the main issues relating to ASS management are presented in Table 4. This section does not cover responsibilities related to general construction site activities.

Table 4: Responsibilities

Issue	Responsibility	Verified by / Subject to the Approval of:-
Implementation of this ASSMP	Contractor	Principal Contractor
Monitoring	Contractor / Environmental Consultant	Environmental Consultant
Liaison with landfill operator	Contractor	Principal Contractor
Record keeping	Contractor	Principal Contractor/ Environmental Consultant
Corrective action for non-compliance	Contractor	Principal Contractor/ Environmental Consultant
Changes to ASSMP	Environmental Consultant	Principal Contractor

10. Reporting

ASSMAC does not require formal reporting of ASS management; however, it is important to keep records of implementation of this ASSMP, including any management and validation process to show compliance with the guidelines. The records should be provided to the Project Principal, and to the consent authority upon request. The records should include documentation of review/ inspection for possible/suspected ASS material in any areas of excavation/ dewatering, and details of any treatment/ management and off-site disposal of ASS materials. This would include records showing that any treated materials were successfully validated.

11. Conclusion

Whilst ASS has been recorded at the site, it has been identified below the expected level of excavation, and as such is not expected to be disturbed by the proposed development works.

However, there may be some potential for disturbance, as discussed in Section 5 of this ASSMP.

This ASSMP has therefore been developed as a contingency plan to provide the method of management in the event that ASS is disturbed by the development.

It is considered that implementation of this ASSMP if required (i.e. triggered by the eventualities outlined in Section 5) will enable appropriate management of the associated potential risk related to the potential disturbance of ASS during the proposed development.

12. Limitations

Douglas Partners (DP) has prepared this plan for this project at 238-258 Captain Cook Drive, Kurnell, in accordance with DP's email proposal dated 21 August 2018 and acceptance received from Mr Geoffrey Hill of Devkon Pty Ltd (acting on behalf of Dicker Data Limited) dated 21 August 2018. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Dicker Data Limited for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This plan must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role

respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the (geotechnical / environmental / groundwater) components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Introduction

Copyright

Borehole and Test Pit Logs

Groundwater

Reports

About this Report

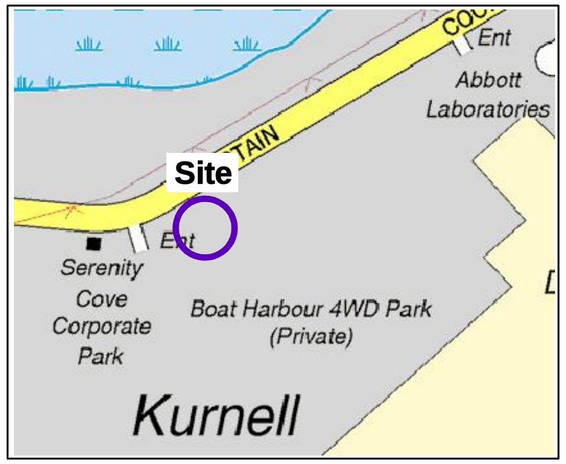
Site Anomalies

Information for Contractual Purposes

Site Inspection

Appendix B

Drawings

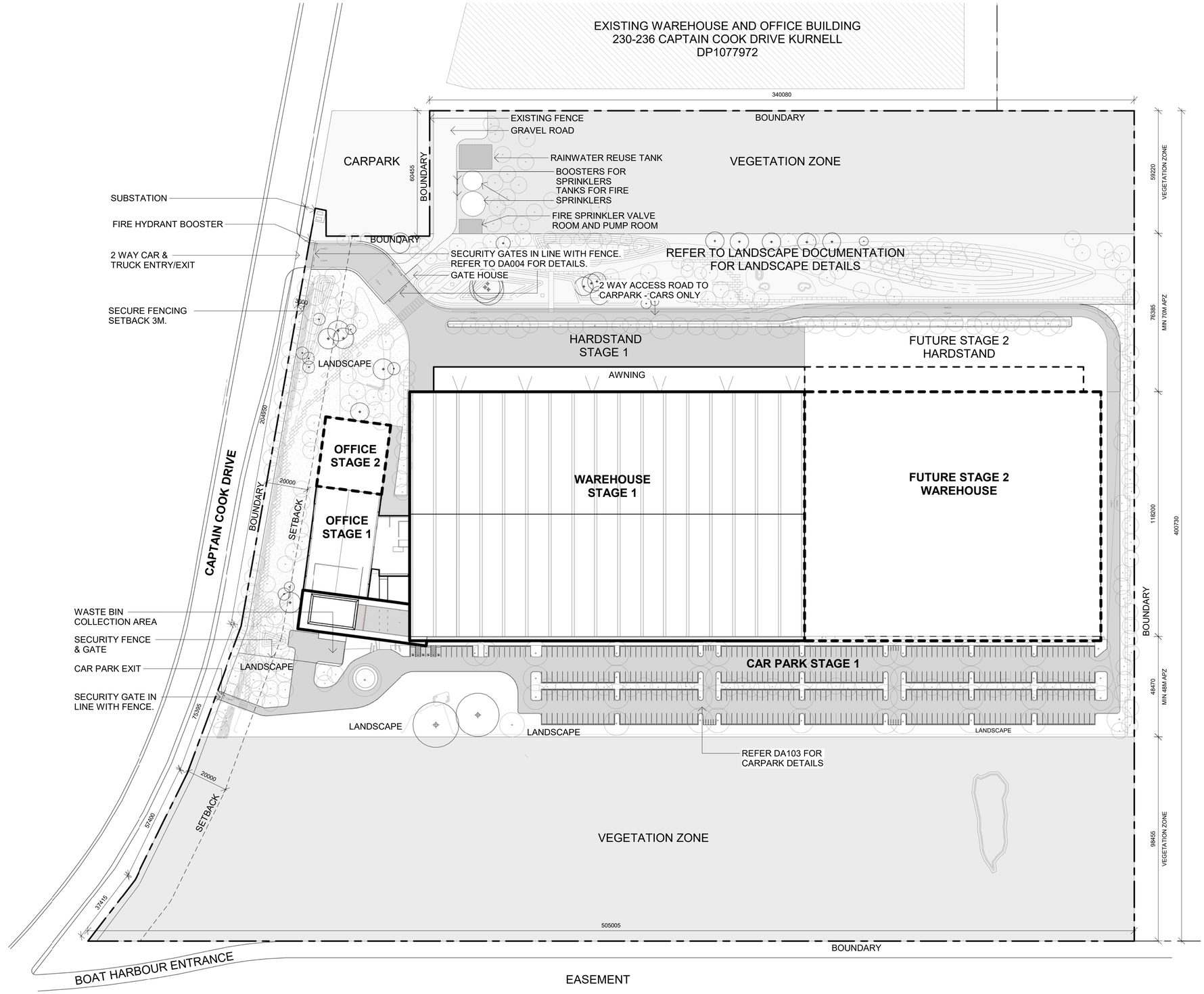


Locality Plan

LEGEND

Douglas Partners
Geotechnics | Environment | Groundwater

Borehole Location Plan
Proposed Industrial Development
238-258 Captain Cook Drive, KURNELL



EXISTING BUILDINGS
260 SIR CAPTAIN COOK DRIVE
SP72545

KEY

PROPOSED TREES
(DETAILED & DESIGNED BY LANDSCAPE ARCHITECT). REFER TO LANDSCAPE DOCUMENTATION FOR DETAILS

EXISTING TREES
REFER TO LANDSCAPE AND ARBORIST DOCUMENTATION FOR DETAILS

1 **SITE PLAN - STAGE 1**

SCALE 1 : 1000

PRELIMINARY

WMK Architecture
L1 346-348 Kent St
Sydney NSW 2000
Telephone 02 9299 0401
Facsimile 02 9299 0402
wmkarchitecture.com
ABN 25 082 956 929

0 1 2 3 4m
1:100

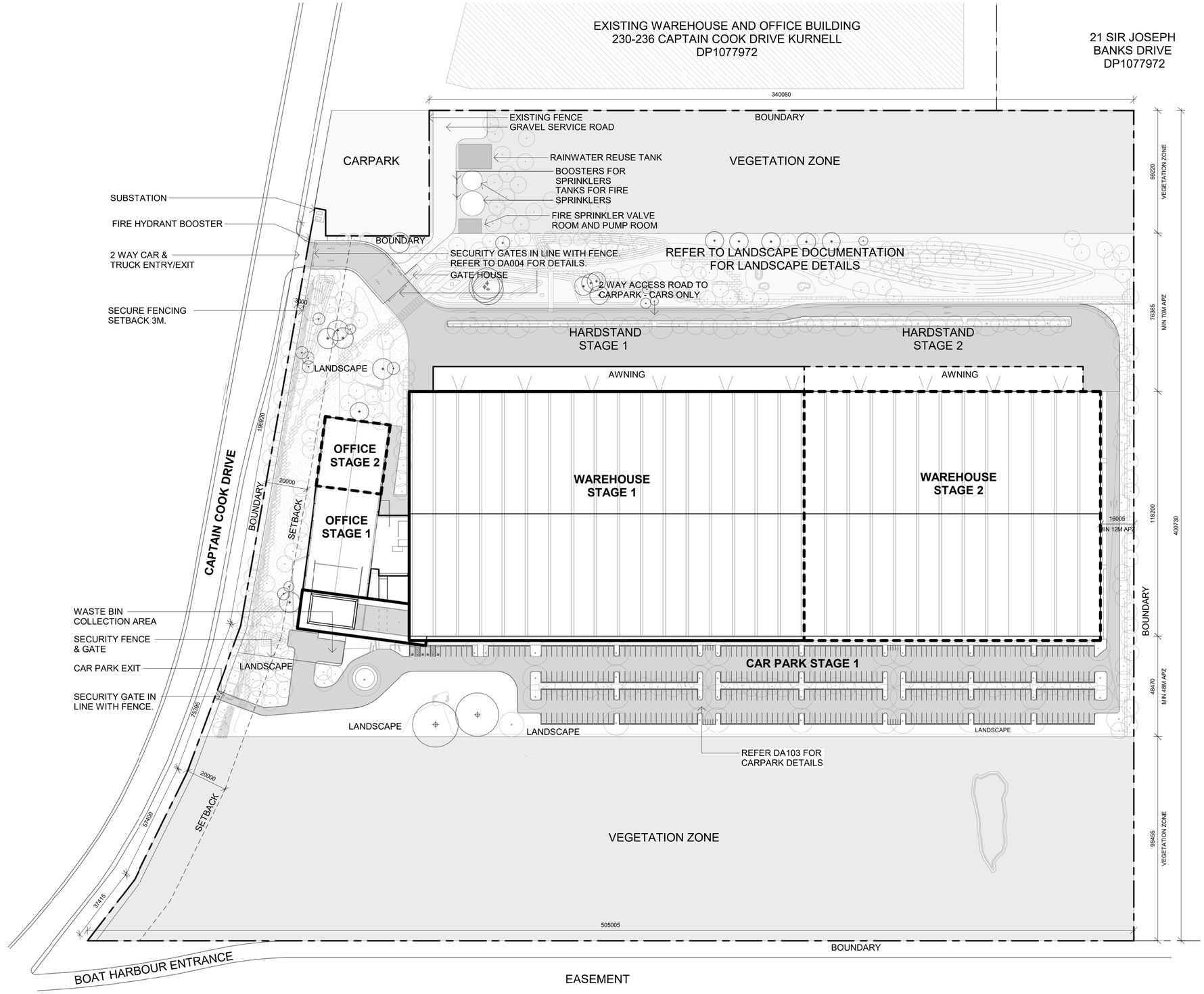
Issue	Description	Date

Client
DICKER DATA PTY LTD

Project
238-258 CAPTAIN COOK DRIVE, KURNELL, NSW 2231

Title
SITE PLAN STAGE 1

Drawing No.	Issue
DA001A	
Scale	**Drawing Size**
1 : 1000@A1	A1
Project No.	**Drawn By**
16202	PK
CAD Reference	
*DWG-REVIT	



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- PROPOSED TREES (DETAILED & DESIGNED BY LANDSCAPE ARCHITECT). REFER TO LANDSCAPE DOCUMENTATION FOR DETAILS
- EXISTING TREES REFER TO LANDSCAPE AND ARBORIST DOCUMENTATION FOR DETAILS

1 **SITE PLAN - STAGE 2**

SCALE 1 : 1000

PRELIMINARY

WMK Architecture
L1 346-348 Kent St
Sydney NSW 2000
Telephone 02 9299 0401
Facsimile 02 9299 0402
wmkarchitecture.com
ABN 25 082 956 929

0 1 2 3 4m 1:100

Issue	Description	Date

Client DICKER DATA PTY LTD

Project 238-258 CAPTAIN COOK DRIVE, KURNELL, NSW 2231

Title SITE PLAN STAGE 2

Drawing No. DA001B	**Issue**
Scale 1 : 1000@A1	**Drawing Size** A1
Project No. 16202	**Drawn By** Author
CAD Reference *DWG/REVIT	

Appendix C

Results of Field Work

Sampling

Test Pits

Large Diameter Augers

Continuous Spiral Flight Augers

Non-core Rotary Drilling

Continuous Core Drilling

Standard Penetration Tests

Sampling Methods

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

-
-

Description and Classification Methods

[illegible]

Soil Types

[illegible]

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Cohesive Soils

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Cohesionless Soils

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Soil Descriptions

Soil Origin

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Rock Strength

[illegible]

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Degree of Weathering

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Rock Descriptions

Rock Quality Designation

$$\text{RQD} = \frac{\text{sum of lengths of core pieces} \geq 1 \text{ unit long}}{\text{total length of core run}}$$

Stratification Spacing

Introduction

Drilling or Excavation Methods

Water

Sampling and Testing

Description of Defects in Rock

Defect Type

Orientation

Coating or Infilling Term

Coating Descriptor

Shape

Roughness

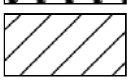
Other

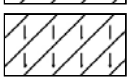
Symbols & Abbreviations

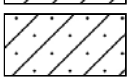
Graphic Symbols for Soil and Rock

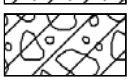
General

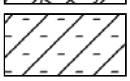
Soils

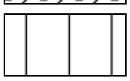


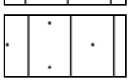


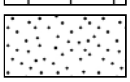


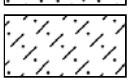


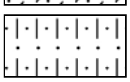


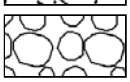




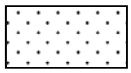


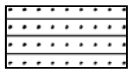


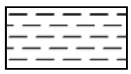


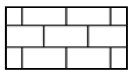


Sedimentary Rocks

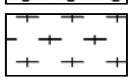


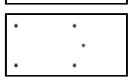




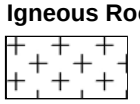


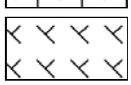
Metamorphic Rocks

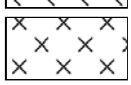


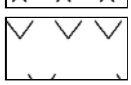


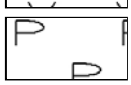
Igneous Rocks











BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 2.5 AHD
EASTING: 333786
NORTHING: 6234043
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.04	ASPHALTIC CONCRETE							
	0.15	ROADBASE							
		FILLING - brown, clayey, fine sand filling, damp		A	0.5				
				A	1.0				
	1.4	SAND - loose, grey, fine to medium sand, moist		A	1.5				
		- brown and wet from 1.6m							
	2.0	Bore discontinued at 2.0m		A	2.0				
		- target depth reached							

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.5 AHD
EASTING: 333848
NORTHING: 6233940
DIP/AZIMUTH: 90°/--

BORE No: 102
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - brown, silty, fine sand, damp 0.0-0.05m: with some rootlets		A	0.1				
				A	0.5				
	0.8	FILLING - brown, fine to medium sand filling, damp		A	1.0				
	1.4	FILLING - grey, fine to medium sand filling with some ash and gravel, damp		A	1.5				
	2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.4 AHD
EASTING: 333865
NORTHING: 6233905
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	SAND - loose, light brown, fine to medium sand, damp		A	0.1				
				A	0.5				
	1			A	1.0				1
		- grey and moist from 1.4m		A	1.5				
	2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				2
	3								3
	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 2.5 AHD
EASTING: 333885
NORTHING: 6233860
DIP/AZIMUTH: 90°/--

BORE No: 104
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.2	SILTY SAND - loose, brown, silty fine sand, damp 0.0-0.05m: with some rootlets		A	0.1				
		SAND - loose, light brown, fine sand, damp		A	0.5				
	1			A	1.0				
		- grey from 1.3m		A	1.5				
		- moist from 1.7m							
	2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.3 AHD
EASTING: 333926
NORTHING: 6233770
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTY SAND - loose, brown, silty, fine sand, damp		A	0.1				
	0.2	SAND - loose, dark grey, fine to medium sand, damp		A	0.5				
	1			A	1.0				1
		- brown and wet from 1.4m		A	1.5				
	1.6	Bore discontinued at 1.6m - refusal on possible sandstone bedrock							
	2								2
	3								3
	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.1 AHD
EASTING: 333771
NORTHING: 6233991
DIP/AZIMUTH: 90°/--

BORE No: 106
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
3	0.04	ASPHALTIC CONCRETE							
	0.15	ROADBASE							
		SAND - loose, light brown, fine sand, damp		A	0.5				
2	1			A	1.0				1
				A	1.5				
		- dark grey, moist, with strong organic odour from 1.85m							
	2 2.0	Bore discontinued at 2.0m		A	2.0				2
1		- target depth reached							
	3								3
0									
	4								4
-1									

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 2.9 AHD
EASTING: 333783
NORTHING: 6233917
DIP/AZIMUTH: 90°/--

BORE No: 107
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.2	FILLING - brown, silty, fine sand topsoil filling, damp 0.0-0.05m: with some rootlets		A	0.1				
		FILLING - brown, fine sand filling with some silt, damp		A	0.5				
2	1			A	1.0				1
	1.2	SILTY SAND - dark grey, silty, fine sand with clay and organic matter, moist		A	1.5				
1		- wet with strong organic odour from 1.7m							
	2 2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				2
0	3								3
-1	4								4
-2									

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.1 AHD
EASTING: 333836
NORTHING: 6233852
DIP/AZIMUTH: 90°/--

BORE No: 108
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - brown, silty, fine sand filling, damp 0.0-0.05m: with some rootlets		A	0.0				
	0.3	SAND - loose, light brown, fine to medium sand, damp		A	0.5				
	1			A	1.0				
		- light grey and moist from 1.1m							
				A	1.5				
		- brown and wet from 1.7m							
	2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.2 AHD
EASTING: 333874
NORTHING: 6233783
DIP/AZIMUTH: 90°/--

BORE No: 109
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	SAND - loose, light grey, fine to medium sand, damp		A	0.1				
		- light brown from 0.4m		A	0.5				
	1			A	1.0				1
				A	1.5				
		- brown from 1.8m							
	2 2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				2
	3								3
	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.0 AHD
EASTING: 333688
NORTHING: 6233934
DIP/AZIMUTH: 90°/--

BORE No: 110
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
3		FILLING - brown, silty, fine sand filling, damp		A	0.1				
		0.0-0.05m: with some rootlets							
	0.2	SAND - loose, brown, fine to medium sand, damp		A	0.5				
2	1			A	1.0				1
		- moist from 1.4m		A	1.5				
		- dark grey with organic odour from 1.6m							
1	2	2.0		A	2.0				2
		Bore discontinued at 2.0m							
		- target depth reached							
0	3								3
-1	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.0 AHD
EASTING: 333716
NORTHING: 6233883
DIP/AZIMUTH: 90°/--

BORE No: 111
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
3		FILLING - brown, silty sand filling, humid 0.0-0.05m: with some rootlets		A	0.1				
	0.2	SAND - loose, brown, fine to medium sand, humid		A	0.5				
2	1			A	1.0				1
		- moist from 1.4m		A	1.5				
		- wet and dark grey with sulphurous odour from 1.7m							
1	2 2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				2
0	3								3
-1	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.3 AHD
EASTING: 333777
NORTHING: 6233838
DIP/AZIMUTH: 90°/--

BORE No: 112
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - brown, silty, fine sand filling, humid 0.0-0.05m: with some rootlets		A	0.1				
	0.2	SAND - loose, grey, fine to medium sand, humid		A	0.5				
	1			A	1.0				1
		- light brown from 1.2m		A	1.5				
		- wet from 1.7m							
	2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				2

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 2.8 AHD
EASTING: 333816
NORTHING: 6233745
DIP/AZIMUTH: 90°/--

BORE No: 113
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - light brown, fine to medium gravelly sand filling, humid		A	0.1				
	0.2	SAND - loose, light brown, fine to medium sand, humid		A	0.5				
	1			A	1.0				1
		- moist from 1.5m		A	1.5				
		- wet from 1.7m							
	2 2.0	Bore discontinued at 2.0m		A	2.0				2
		- target depth reached							
	3								3
	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.0 AHD
EASTING: 333874
NORTHING: 6233726
DIP/AZIMUTH: 90°/--

BORE No: 114
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
3		SAND - loose, brown, fine sand, damp		A	0.1				
				A	0.5				
2	1			A	1.0				1
		- grey from 1.2m							
		- wet from 1.5m		A	1.5				
		- light brown from 1.6m							
1	2	2.0		A	2.0				2
		Bore discontinued at 2.0m - target depth reached							
0	3								3
-1	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 2.9 AHD
EASTING: 333632
NORTHING: 6233881
DIP/AZIMUTH: 90°/--

BORE No: 115
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	FILLING - brown, silty, fine sand filling, humid 0.0-0.05m: with some rootlets		A	0.1				
		SAND - loose, light brown, fine to medium sand, humid		A	0.5				
2	1			A	1.0				1
		- grey and wet with organic odour from 1.5m		A	1.5				
1	2 2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				2
0	3								3
-1	4								4
-2									

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.0 AHD
EASTING: 333647
NORTHING: 6233804
DIP/AZIMUTH: 90°/--

BORE No: 116
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
3		FILLING - brown, fine to medium sand filling, humid							
	0.3	SAND - loose, brown, fine to medium sand, humid		A	0.5				
2	1			A	1.0				1
				A	1.5				
		- dark grey and wet from 1.7m							
1	2.0	Bore discontinued at 2.0m		A	2.0				2
		- target depth reached							
0	3								3
-1	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.0 AHD
EASTING: 333745
NORTHING: 6233744
DIP/AZIMUTH: 90°/--

BORE No: 117
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
3		FILLING - light brown, silty, fine sand filling, damp 0.0-0.05m: with some rootlets		A	0.1				
	0.5	SAND - loose, light brown, fine to medium grained sand, damp		A	0.5				
2	1			A	1.0				1
		- light grey and moist from 1.3m							
				A	1.5				
		- wet from 1.6m							
1	2 2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				2
0	3								3
-1	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.1 AHD
EASTING: 333795
NORTHING: 6233672
DIP/AZIMUTH: 90°/--

BORE No: 118
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
3		SILTY SAND - loose, light brown, silty, fine sand, damp		A	0.0				
		0.0-0.05m: with some rootlets							
				A	0.5				
	0.8								
2	1	SAND - loose, brown, fine to medium sand, damp		A	1.0				1
		- dark grey from 1.5m		A	1.5				
		- wet from 1.6m							
1	2	2.0		A	2.0				2
		Bore discontinued at 2.0m							
		- target depth reached							
0	3								3
-1	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.2 AHD
EASTING: 333867
NORTHING: 6233654
DIP/AZIMUTH: 90°/--

BORE No: 119
PROJECT No: 84677.01
DATE: 12/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTY SAND - loose, brown, silty, fine sand, humid		A	0.1				
				A	0.5				
	0.6	SAND - loose, light brown, fine to medium sand, humid							
	1			A	1.0				1
		- dark grey and moist from 1.5m		A	1.5				
		- wet from 1.7m							
	2.0	Bore discontinued at 2.0m		A	2.0				2
		- target depth reached							
	3								3
	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.0 AHD
EASTING: 333585
NORTHING: 6233892
DIP/AZIMUTH: 90°/--

BORE No: 120
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
3		FILLING - brown, silty, fine sand filling, damp		A	0.1				
	0.2	SAND - loose, brown, fine to medium sand, damp		A	0.5				
2	1			A	1.0				1
				A	1.5				
		- grey and wet from 1.7m							
1	2 2.0	Bore discontinued at 2.0m - target depth reached		A	2.0				2
0	3								3
-1	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.0 AHD
EASTING: 333666
NORTHING: 6233731
DIP/AZIMUTH: 90°/--

BORE No: 121
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
3		SAND - loose, light brown, fine to medium sand, damp		A	0.1				
		0.0-0.05m: with some rootlets		A	0.5				
2	1			A	1.0				1
		- moist from 1.4m		A	1.5				
		- dark grey and wet with organic odour from 1.8m							
1	2 2.0			A	2.0				2
		Bore discontinued at 2.0m - target depth reached							
0	3								3
-1	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Kurnell Developments Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 238-258 Captain Cook Drive, Kurnell

SURFACE LEVEL: 3.1 AHD
EASTING: 333785
NORTHING: 6233603
DIP/AZIMUTH: 90°/--

BORE No: 122
PROJECT No: 84677.01
DATE: 13/8/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
3		SILTY SAND - loose, brown, silty, fine sand, humid		A	0.1				
				A	0.5				
	0.6	SAND - loose, grey, fine sand, humid							
2	1			A	1.0				1
				A	1.5				
		- wet from 1.8m							
1	2	2.0 Bore discontinued at 2.0m - target depth reached		A	2.0				2
0	3								3
-1	4								4

RIG: 3.5T Excavator **DRILLER:** A & A Hire **LOGGED:** MW **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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Appendix D

Results of Laboratory Testing

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Acid Sulphate Soil Screening and Laboratory Results (February 2015)

Sample	Depth	Date Sampled	Description	ASS Screening				SPOCAS										
				pH_F (field pH test)	pH_{ox}	pH change	Reaction Rate	pH_{kcl}	pH_{ox}	s-TAA pH 6.5	s-TPA pH 6.5	s-TSA pH 6.5	S_{KCl}	S_P	S_{POS}	s-ANC_E	a-Net Acidity	Liming rate
				pH Units	pH units	pH units	-	pH units	pH units	%w/w S	%w/w S	%w/w S	%w/w S	%w/w	%w/w	%w/w S	moles H^+/t	kg $CaCO_3$/t
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Sample	Depth	Date Sampled	Description	ASS Screening				SPOCAS										
				pH_F (field pH test)	pH_{Ox}	pH change	Reaction Rate	pH_{kcl}	pH_{Ox}	s-TAA pH 6.5	s-TPA pH 6.5	s-TSA pH 6.5	S_{KCl}	S_P	S_{POS}	s-ANC_E	a-Net Acidity	Liming rate
				pH Units	pH units	pH units	-	pH units	pH units	%w/w S	%w/w S	%w/w S	%w/w S	%w/w	%w/w	%w/w S	moles H^+/t	kg $CaCO_3$/t
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Action Criteria																		
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Notes

Bold Result above action criteria

Acid Sulphate Soil Screening and Laboratory Results (September 2015)

Sample	Depth	Date Sampled	Description	ASS Screening				SPOCAS										
				pH_F (field pH test)	pH_{Ox}	pH change	Reaction Rate	pH_{kcl}	pH_{Ox}	s-TAA pH 6.5	s-TPA pH 6.5	s-TSA pH 6.5	S_{KCl}	S_P	S_{POS}	$s\text{-}ANC_E$	a-Net Acidity	Liming rate
				pH Units	pH units	pH units	-	pH units	pH units	%w/w S	%w/w S	%w/w S	%w/w S	%w/w	%w/w	%w/w S	moles H^+/t	kg $CaCO_3$/t
BH103	0.5					-1.9												
BH103	1					-1.6												
BH103	1.5					-2.5												
BH103	2					-2.2												
BH104	0.1					-1.9												
BH104	0.5					-2												
BH104	1					-2.1												
BH104	1.5					-2.3												
BH104	2					-2.5												
BH105	0.1					-2.3												
BH105	0.5					-2.6												
BH105	1					-2.2												
BH105	1.5					-1.6												
BH106	0.5					-1.5												
BH106	1					-2.1												
BH106	1.5					-3.5												
BH106	2					-2.9												
BH107	0.1					-1.2												
BH107	0.5					-1.4												
BH107	1					-1.6												
BH107	1.5					-2.4												

Sample	Depth	Date Sampled	Description	ASS Screening				SPOCAS										
				pH_F (field pH test)	pH_{Ox}	pH change	Reaction Rate	pH_{KCl}	pH_{Ox}	s-TAA pH 6.5	s-TPA pH 6.5	s-TSA pH 6.5	S_{KCl}	S_P	S_{POS}	s-ANC_E	a-Net Acidity	Liming rate
				pH Units	pH units	pH units	-	pH units	pH units	%w/w S	%w/w S	%w/w S	%w/w S	%w/w	%w/w	%w/w S	moles H^+/t	kg $CaCO_3$/t
BH107	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH108	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH108	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH108	1	[illegible]	[illegible]	[illegible]	[illegible]	-2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH108	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH108	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH109	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH109	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH109	1	[illegible]	[illegible]	[illegible]	[illegible]	-2.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH109	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH109	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH110	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH110	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH110	1	[illegible]	[illegible]	[illegible]	[illegible]	-2.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH110	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH110	2	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH111	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-2.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH111	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH111	1	[illegible]	[illegible]	[illegible]	[illegible]	-2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH111	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH111	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH112	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH112	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH112	1	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH112	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH112	2	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH113	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH113	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH113	1	[illegible]	[illegible]	[illegible]	[illegible]	-2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH113	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH113	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH114	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH114	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH114	1	[illegible]	[illegible]	[illegible]	[illegible]	-2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH114	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Sample	Depth	Date Sampled	Description	ASS Screening				SPOCAS										
				pH_F (field pH test)	pH_{ox}	pH change	Reaction Rate	pH_{kcl}	pH_{ox}	s-TAA pH 6.5	s-TPA pH 6.5	s-TSA pH 6.5	S_{KCl}	S_P	S_{POS}	$s\text{-}ANC_E$	a-Net Acidity	Liming rate
				pH Units	pH units	pH units	-	pH units	pH units	%w/w S	%w/w S	%w/w S	%w/w S	%w/w	%w/w	%w/w S	moles H^+/t	kg $CaCO_3$/t
BH114	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH115	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH115	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH115	1	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH115	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH115	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH116	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH116	1	[illegible]	[illegible]	[illegible]	[illegible]	-2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH116	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH116	2	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH117	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH117	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH117	1	[illegible]	[illegible]	[illegible]	[illegible]	-2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH117	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-1.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH117	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH118	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-1.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH118	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH118	1	[illegible]	[illegible]	[illegible]	[illegible]	-2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH118	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH118	2	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH119	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH119	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH119	1	[illegible]	[illegible]	[illegible]	[illegible]	-2.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH119	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH119	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH120	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH120	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-1.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH120	1	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH120	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH120	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH121	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH121	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH121	1	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH121	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH121	2	[illegible]	[illegible]	[illegible]	[illegible]	-1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH122	0.1	[illegible]	[illegible]	[illegible]	[illegible]	-1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH122	0.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH122	1	[illegible]	[illegible]	[illegible]	[illegible]	-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Sample	Depth	Date Sampled	Description	ASS Screening				SPOCAS										
				pH_F (field pH test)	pH_{Ox}	pH change	Reaction Rate	pH_{KCl}	pH_{Ox}	s-TAA pH 6.5	s-TPA pH 6.5	s-TSA pH 6.5	S_{KCl}	S_P	S_{POS}	s-ANC_E	a-Net Acidity	Liming rate
				pH Units	pH units	pH units	-	pH units	pH units	%w/w S	%w/w S	%w/w S	%w/w S	%w/w	%w/w	%w/w S	moles H^+/t	kg $CaCO_3$/t
BH122	1.5	[illegible]	[illegible]	[illegible]	[illegible]	-2.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BH122	2	[illegible]	[illegible]	[illegible]	[illegible]	-2.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Action Criteria																		
[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Appendix E

Laboratory Certificates and Chain of Custody

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

CERTIFICATE OF ANALYSIS 132766

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Matt West, Ray Blinman

Sample log in details:

Your Reference:	**84677.01, Kurnell**
No. of samples:	106 soils
Date samples received:	14/08/15
Date completed instructions received:	14/08/15

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by:	21/08/15
Date of Preliminary Report:	Not Issued
Issue Date:	21/08/15

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025.
Tests not covered by NATA are denoted with *.

Results Approved By:

Jacinta Hurst
Laboratory Manager

sPOCAS field test						
Our Reference:	UNITS	132766-1	132766-2	132766-3	132766-4	132766-5
Your Reference	----------	BH101	BH101	BH101	BH101	BH101
Depth	----------	0.5	1	1.5	2	0.1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	8.1	8.7	9.2	7.9	8.0
pH_{FOX} (field peroxide test)*	pH Units	7.8	6.3	6.8	5.8	6.0
Reaction Rate*	-	Moderate	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-6	132766-7	132766-8	132766-9	132766-10
Your Reference	----------	BH102	BH102	BH102	BH102	BH103
Depth	----------	0.5	1	1.5	2	0.1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	8.0	8.2	8.1	8.2	8.2
pH_{FOX} (field peroxide test)*	pH Units	5.8	6.1	6.2	6.1	6.2
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-11	132766-12	132766-13	132766-14	132766-15
Your Reference	----------	BH103	BH103	BH103	BH103	BH104
Depth	----------	0.5	1	1.5	2	0.1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	8.4	8.3	8.6	8.5	8.1
pH_{FOX} (field peroxide test)*	pH Units	6.5	6.7	6.1	6.3	6.2
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-16	132766-17	132766-18	132766-19	132766-20
Your Reference	----------	BH104	BH104	BH104	BH104	BH105
Depth	----------	0.5	1	1.5	2	0.1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	8.2	8.2	8.6	8.1	8.1
pH_{FOX} (field peroxide test)*	pH Units	6.2	6.1	6.3	5.6	5.8
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-21	132766-22	132766-23	132766-24	132766-25
Your Reference	----------	BH105	BH105	BH105	BH106	BH106
Depth	----------	0.5	1	1.5	0.5	1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	8.2	8.0	7.5	8.7	8.5
pH_{FOX} (field peroxide test)*	pH Units	5.6	5.8	5.9	7.2	6.4
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-26	132766-27	132766-28	132766-29	132766-30
Your Reference	----------	BH106	BH106	BH107	BH107	BH107
Depth	----------	1.5	2	0.1	0.5	1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	8.4	8.1	7.3	7.4	7.5
pH_{FOX} (field peroxide test)*	pH Units	6.4	5.7	5.2	5.5	5.6
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-31	132766-32	132766-33	132766-34	132766-35
Your Reference	----------	BH107	BH107	BH108	BH108	BH108
Depth	----------	1.5	2	0.1	0.5	1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	7.6	7.4	7.8	8.0	8.0
pH_{FOX} (field peroxide test)*	pH Units	4.9	5.2	6.1	6.0	5.9
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-36	132766-37	132766-38	132766-39	132766-40
Your Reference	----------	BH108	BH108	BH109	BH109	BH109
Depth	----------	1.5	2	0.1	0.5	1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	7.9	7.8	8.3	8.3	8.2
pH_{FOX} (field peroxide test)*	pH Units	6.0	6.1	6.3	6.3	5.9
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-41	132766-42	132766-43	132766-44	132766-45
Your Reference	----------	BH109	BH109	BH110	BH110	BH110
Depth	----------	1.5	2	0.1	0.5	1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	8.2	8.0	8.6	8.8	9.0
pH_{FOX} (field peroxide test)*	pH Units	6.0	6.1	6.6	6.7	6.7
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-46	132766-47	132766-48	132766-49	132766-50
Your Reference	----------	BH110	BH110	BH111	BH111	BH111
Depth	----------	1.5	2	0.1	0.5	1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pHF (field pH test)*	pH Units	9.2	8.1	7.7	7.7	7.7
pHFOX (field peroxide test)*	pH Units	6.8	6.1	5.4	5.6	5.6
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-51	132766-52	132766-53	132766-54	132766-55
Your Reference	----------	BH111	BH111	BH112	BH112	BH112
Depth	----------	1.5	2	0.1	0.5	1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pHF (field pH test)*	pH Units	7.6	7.2	7.6	7.9	8.0
pHFOX (field peroxide test)*	pH Units	5.6	5.5	5.8	6.0	6.0
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-56	132766-57	132766-58	132766-59	132766-60
Your Reference	----------	BH112	BH112	BH113	BH113	BH113
Depth	----------	1.5	2	0.1	0.5	1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pHF (field pH test)*	pH Units	8.0	8.0	8.1	8.3	8.1
pHFOX (field peroxide test)*	pH Units	5.9	6.0	6.3	6.3	6.0
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-61	132766-62	132766-63	132766-64	132766-65
Your Reference	----------	BH113	BH113	BH114	BH114	BH114
Depth	----------	1.5	2	0.1	0.5	1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pHF (field pH test)*	pH Units	8.3	8.0	8.4	8.1	8.2
pHFOX (field peroxide test)*	pH Units	6.1	6.3	6.4	6.1	6.1
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-66	132766-67	132766-68	132766-69	132766-70
Your Reference	----------	BH114	BH114	BH115	BH115	BH115
Depth	----------	1.5	2	0.1	0.5	1
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pHF (field pH test)*	pH Units	8.0	7.9	8.0	8.6	8.8
pHFOX (field peroxide test)*	pH Units	6.2	6.6	6.4	6.6	6.8
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-71	132766-72	132766-73	132766-74	132766-75
Your Reference	----------	BH115	BH115	BH116	BH116	BH116
Depth	----------	1.5	2	0.5	1	1.5
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	9.1	8.4	8.6	8.6	8.4
pH_{FOX} (field peroxide test)*	pH Units	6.8	6.6	6.4	6.4	6.1
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-76	132766-77	132766-78	132766-79	132766-80
Your Reference	----------	BH116	BH117	BH117	BH117	BH117
Depth	----------	2	0.1	0.5	1	1.5
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	7.8	8.3	8.6	8.3	8.3
pH_{FOX} (field peroxide test)*	pH Units	5.8	6.5	6.7	6.2	6.9
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-81	132766-82	132766-83	132766-84	132766-85
Your Reference	----------	BH117	BH118	BH118	BH118	BH118
Depth	----------	2	0.1	0.5	1	1.5
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	8.4	7.8	8.2	8.4	8.6
pH_{FOX} (field peroxide test)*	pH Units	6.6	6.4	6.6	6.2	6.3
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-86	132766-87	132766-88	132766-89	132766-90
Your Reference	----------	BH118	BH119	BH119	BH119	BH119
Depth	----------	2	0.1	0.5	1	1.5
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	8.2	8.0	8.3	8.1	8.1
pH_{FOX} (field peroxide test)*	pH Units	6.2	6.4	6.3	6.1	5.5
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-91	132766-92	132766-93	132766-94	132766-95
Your Reference	----------	BH119	BH120	BH120	BH120	BH120
Depth	----------	2.	0.1	0.5	1	1.5
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	7.7	8.4	8.5	8.6	8.5
pH_{FOX} (field peroxide test)*	pH Units	5.9	6.6	7.0	6.6	6.3
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-96	132766-97	132766-98	132766-99	132766-100
Your Reference	----------	BH120	BH121	BH121	BH121	BH121
Depth	----------	2	0.1	0.5	1	1.5
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	8.0	8.3	8.2	8.1	8.1
pH_{FOX} (field peroxide test)*	pH Units	6.3	6.5	6.3	6.1	6.2
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test						
Our Reference:	UNITS	132766-101	132766-102	132766-103	132766-104	132766-105
Your Reference	----------	BH121	BH122	BH122	BH122	BH122
Depth	----------	2	0.1	0.5	1	1.5
Date Sampled		12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
pH_F (field pH test)*	pH Units	7.7	8.0	8.0	8.5	8.5
pH_{FOX} (field peroxide test)*	pH Units	6.0	6.3	5.9	6.5	6.3
Reaction Rate*	-	Slight	Slight	Slight	Slight	Slight

sPOCAS field test		
Our Reference:	UNITS	132766-106
Your Reference	----------	BH122
Depth	----------	2
Date Sampled		12/08/2015
Type of sample		Soil
pH_F (field pH test)*	pH Units	8.2
pH_{FOX} (field peroxide test)*	pH Units	6.1
Reaction Rate*	-	Slight

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

Report Comments:

Asbestos was analysed by Approved Identifier: Not applicable for this job
Asbestos was authorised by Approved Signatory: Not applicable for this job

INS: Insufficient sample for this test
NA: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

CHAIN OF CUSTODY

Douglas Partners
Geotechnics | Environment | Groundwater

Client: Douglas Partners	**Project Number** 84677.01	**To:**	Envirolab Services
Contact Person: Matt West	**Project Name:** Kurnell	**Contact Person:**	Aileen Hie
Project Mgr: Ray Blinman	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. :		Chatswood NSW 2068
Address: 96 Hermitage Road	**Date results required:** Standard	**Phone:**	02 9910 6200
West Ryde NSW 2114	**Or choose:** standard	**Fax:**	02 9910 6201
	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	**Email:**	ahie@envirolab.com.au
Phone: 9809 0666 **Mob:** 0412 985 938	**Report format:** esdat / PDF / Excel	**Laboratory Report No:**	
Email: Matt.West@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required										Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	ASS Screening									Combo	Provide as much information about the sample as you can
1	BH101	0.5	12-13/08/2015	plastic	SOIL	x										
2	BH101	1	12-13/08/2015	plastic	SOIL	x										
3	BH101	1.5	12-13/08/2015	plastic	SOIL	x										
4	BH101	2	12-13/08/2015	plastic	SOIL	x										
5	BH102	0.1	12-13/08/2015	plastic	SOIL	x										
6	BH102	0.5	12-13/08/2015	plastic	SOIL	x										
7	BH102	1	12-13/08/2015	plastic	SOIL	x										
8	BH102	1.5	12-13/08/2015	plastic	SOIL	x										
9	BH102	2	12-13/08/2015	plastic	SOIL	x										
10	BH103	0.1	12-13/08/2015	plastic	SOIL	x										
11	BH103	0.5	12-13/08/2015	plastic	SOIL	x										
12	BH103	1	12-13/08/2015	plastic	SOIL	x										
13	BH103	1.5	12-13/08/2015	plastic	SOIL	x										
14	BH103	2	12-13/08/2015	plastic	SOIL	x										
15	BH104	0.1	12-13/08/2015	plastic	SOIL	x										
16	BH104	0.5	12-13/08/2015	plastic	SOIL	x										
17	BH104	1	12-13/08/2015	plastic	SOIL	x										
18	BH104	1.5	12-13/08/2015	plastic	SOIL	x										
19	BH104	2	12-13/08/2015	plastic	SOIL	x										
20	BH105	0.1	12-13/08/2015	plastic	SOIL	x										
21	BH105	0.5	12-13/08/2015	plastic	SOIL	x										
22	BH105	1	12-13/08/2015	plastic	SOIL	x										
23	BH105	1.5	12-13/08/2015	plastic	SOIL	x										
24	BH106	0.5	12-13/08/2015	plastic	SOIL	x										
25	BH106	1	12-13/08/2015	plastic	SOIL	x										
26	BH106	1.5	12-13/08/2015	plastic	SOIL	x										
27	BH106	2	12-13/08/2015	plastic	SOIL	x										
28	BH107	0.1	12-13/08/2015	plastic	SOIL	x										
29	BH107	0.5	12-13/08/2015	plastic	SOIL	x										
30	BH107	1	12-13/08/2015	plastic	SOIL	x										
31	BH107	1.5	12-13/08/2015	plastic	SOIL	x										
32	BH107	2	12-13/08/2015	plastic	SOIL	x										
33	BH108	0.1	12-13/08/2015	plastic	SOIL	x										
34	BH108	0.5	12-13/08/2015	plastic	SOIL	x										
35	BH108	1	12-13/08/2015	plastic	SOIL	x										
36	BH108	1.5	12-13/08/2015	plastic	SOIL	x										
37	BH108	2	12-13/08/2015	plastic	SOIL	x										
38	BH109	0.1	12-13/08/2015	plastic	SOIL	x										
39	BH109	0.5	12-13/08/2015	plastic	SOIL	x										
40	BH109	1	12-13/08/2015	plastic	SOIL	x										
41	BH109	1.5	12-13/08/2015	plastic	SOIL	x										
42	BH109	2	12-13/08/2015	plastic	SOIL	x										
43	BH110	0.1	12-13/08/2015	plastic	SOIL	x										
44	BH110	0.5	12-13/08/2015	plastic	SOIL	x										
45	BH110	1	12-13/08/2015	plastic	SOIL	x										
46	BH110	1.5	12-13/08/2015	plastic	SOIL	x										
47	BH110	2	12-13/08/2015	plastic	SOIL	x										
48	BH111	0.1	12-13/08/2015	plastic	SOIL	x										
49	BH111	0.5	12-13/08/2015	plastic	SOIL	x										
50	BH111	1	12-13/08/2015	plastic	SOIL	x										

ENVIROLAB GROUP

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 132766

Date Received: 14/8/15
Time Received: 16:30
Received by: JYH
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

132766

51	BH111	1.5	12-13/08/2015	plastic	SOIL	x												
52	BH111	2	12-13/08/2015	plastic	SOIL	x												
53	BH112	0.1	12-13/08/2015	plastic	SOIL	x												
54	BH112	0.5	12-13/08/2015	plastic	SOIL	x												
55	BH112	1	12-13/08/2015	plastic	SOIL	x												
56	BH112	1.5	12-13/08/2015	plastic	SOIL	x												
57	BH112	2	12-13/08/2015	plastic	SOIL	x												
58	BH113	0.1	12-13/08/2015	plastic	SOIL	x												
59	BH113	0.5	12-13/08/2015	plastic	SOIL	x												
60	BH113	1	12-13/08/2015	plastic	SOIL	x												
61	BH113	1.5	12-13/08/2015	plastic	SOIL	x												
62	BH113	2	12-13/08/2015	plastic	SOIL	x												
63	BH114	0.1	12-13/08/2015	plastic	SOIL	x												
64	BH114	0.5	12-13/08/2015	plastic	SOIL	x												
65	BH114	1	12-13/08/2015	plastic	SOIL	x												
66	BH114	1.5	12-13/08/2015	plastic	SOIL	x												
67	BH114	2	12-13/08/2015	plastic	SOIL	x												
68	BH115	0.1	12-13/08/2015	plastic	SOIL	x												
69	BH115	0.5	12-13/08/2015	plastic	SOIL	x												
70	BH115	1	12-13/08/2015	plastic	SOIL	x												
71	BH115	1.5	12-13/08/2015	plastic	SOIL	x												
72	BH115	2	12-13/08/2015	plastic	SOIL	x												
73	BH116	0.5	12-13/08/2015	plastic	SOIL	x												
74	BH116	1	12-13/08/2015	plastic	SOIL	x												
75	BH116	1.5	12-13/08/2015	plastic	SOIL	x												
76	BH116	2	12-13/08/2015	plastic	SOIL	x												
77	BH117	0.1	12-13/08/2015	plastic	SOIL	x												
78	BH117	0.5	12-13/08/2015	plastic	SOIL	x												
79	BH117	1	12-13/08/2015	plastic	SOIL	x												
80	BH117	1.5	12-13/08/2015	plastic	SOIL	x												
81	BH117	2	12-13/08/2015	plastic	SOIL	x												
82	BH118	0.1	12-13/08/2015	plastic	SOIL	x												
83	BH118	0.5	12-13/08/2015	plastic	SOIL	x												
84	BH118	1	12-13/08/2015	plastic	SOIL	x												
85	BH118	1.5	12-13/08/2015	plastic	SOIL	x												
86	BH118	2	12-13/08/2015	plastic	SOIL	x												
87	BH119	0.1	12-13/08/2015	plastic	SOIL	x												
88	BH119	0.5	12-13/08/2015	plastic	SOIL	x												
89	BH119	1	12-13/08/2015	plastic	SOIL	x												
90	BH119	1.5	12-13/08/2015	plastic	SOIL	x												
91	BH119	2	12-13/08/2015	plastic	SOIL	x												
92	BH120	0.1	12-13/08/2015	plastic	SOIL	x												
93	BH120	0.5	12-13/08/2015	plastic	SOIL	x												
94	BH120	1	12-13/08/2015	plastic	SOIL	x												
95	BH120	1.5	12-13/08/2015	plastic	SOIL	x												
96	BH120	2	12-13/08/2015	plastic	SOIL	x												
97	BH121	0.1	12-13/08/2015	plastic	SOIL	x												
98	BH121	0.5	12-13/08/2015	plastic	SOIL	x												
99	BH121	1	12-13/08/2015	plastic	SOIL	x												
100	BH121	1.5	12-13/08/2015	plastic	SOIL	x												
101	BH121	2	12-13/08/2015	plastic	SOIL	x												
102	BH122	0.1	12-13/08/2015	plastic	SOIL	x												
103	BH122	0.5	12-13/08/2015	plastic	SOIL	x												
104	BH122	1	12-13/08/2015	plastic	SOIL	x												
105	BH122	1.5	12-13/08/2015	plastic	SOIL	x												
106	BH122	2	12-13/08/2015	plastic	SOIL	x												

Relinquished by: Douglas Partners	**Sample Receipt**	***Lab use only:***
Courier (by whom) HUNTER EXPRESS	**Received by (Company):** JLB	**Samples Received: Cool or Ambient (circle one)**
Condition of Sample at dispatch Cool or Ambient (circle)	**Print Name:** Kevin Wong	**Temperature Received at:** (if applicable)
Temperature (if Applicable):	**Date & Time:** 14/8/15 16:50	**Transported by: Hand delivered / courier**
Print Name: MATTHEW WEST	**Signature:**	
Date & Time: #########		
Signature:		

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

SAMPLE RECEIPT ADVICE

Client:

Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde NSW 2114

ph: 02 9809 0666
Fax: 02 9809 4095

Attention: Matt West, Ray Blinman

Sample log in details:

Your reference:	**84677.01, Kurnell**
Envirolab Reference:	**132766**
Date received:	14/08/15
Date results expected to be reported:	**21/08/15**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	106 soils
Turnaround time requested:	Standard
Temperature on receipt (°C)	5.9
Cooling Method:	None
Sampling Date Provided:	YES

Comments:

If there is sufficient sample after testing, samples will be held for the following time frames from date of receipt of samples:
Water samples - 1 month
Soil and other solid samples - 2 months
Samples collected in canisters - 1 week. Canisters will then be cleaned.
All other samples are not retained after analysis
If you require samples to be retained for longer periods then retention fees will apply as per our pricelist.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

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

CERTIFICATE OF ANALYSIS 132766-A

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Matt West, Ray Blinman

Sample log in details:

Your Reference:	**84677.01, Kurnell**		
No. of samples:	106 soils		
Date samples received / completed instructions received	14/08/15	/	26/08/15

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	1/09/15	/	1/09/15
Date of Preliminary Report:	Not Issued		

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

sPOCAS Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	132766-A-4 BH101 2 12/08/2015 Soil	132766-A-18 BH104 1.5 12/08/2015 Soil	132766-A-22 BH105 1 12/08/2015 Soil	132766-A-30 BH107 1 12/08/2015 Soil	132766-A-35 BH108 1 12/08/2015 Soil
Date prepared	-	31/08/2015	31/08/2015	31/08/2015	31/08/2015	31/08/2015
Date analysed	-	31/08/2015	31/08/2015	31/08/2015	31/08/2015	31/08/2015
pH $_{kcl}$	pH units	7.6	9.4	6.0	6.6	6.6
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
pH $_{Ox}$	pH units	4.6	7.2	4.9	5.3	5.6
TPA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
ANC_E	% $CaCO_3$	<0.05	0.47	<0.05	<0.05	<0.05
a-ANC_E	moles H^+/t	<5	95	<5	<5	<5
s-ANC_E	%w/w S	<0.05	0.15	<0.05	<0.05	<0.05
S_{KCl}	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
S_P	%w/w	0.02	<0.005	<0.005	<0.005	<0.005
S_{POS}	%w/w	0.01	<0.005	<0.005	<0.005	<0.005
a-S_{POS}	moles H^+/t	9	<5	<5	<5	<5
Ca_{KCl}	%w/w	0.11	0.07	0.01	0.03	0.02
Ca_P	%w/w	0.14	0.17	0.02	0.04	0.02
Ca_A	%w/w	0.024	0.10	<0.005	0.006	<0.005
Mg_{KCl}	%w/w	0.005	<0.005	<0.005	<0.005	<0.005
Mg_P	%w/w	<0.005	0.006	<0.005	<0.005	<0.005
Mg_A	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+/t	<10	<10	<10	<10	<10
Liming rate	kg $CaCO_3$/t	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+/t	NA	<10	NA	NA	NA
Liming rate without ANCE	kg $CaCO_3$/t	NA	<0.75	NA	NA	NA

sPOCAS Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	132766-A-56 BH112 1.5 12/08/2015 Soil	132766-A-60 BH113 1 12/08/2015 Soil	132766-A-65 BH114 1 12/08/2015 Soil	132766-A-75 BH116 1.5 12/08/2015 Soil	132766-A-99 BH121 1 12/08/2015 Soil
Date prepared	-	31/08/2015	31/08/2015	31/08/2015	31/08/2015	31/08/2015
Date analysed	-	31/08/2015	31/08/2015	31/08/2015	31/08/2015	31/08/2015
pH $_{kcl}$	pH units	6.6	6.5	7.5	7.2	7.3
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
pH $_{Ox}$	pH units	5.7	5.6	6.0	5.7	5.7
TPA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
ANC_E	% $CaCO_3$	<0.05	<0.05	<0.05	<0.05	<0.05
a-ANC_E	moles H^+/t	<5	<5	<5	<5	<5
s-ANC_E	%w/w S	<0.05	<0.05	<0.05	<0.05	<0.05
S_{KCl}	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
S_P	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
S_{POS}	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
a-S_{POS}	moles H^+/t	<5	<5	<5	<5	<5
Ca_{KCl}	%w/w	0.008	0.008	0.05	0.03	0.04
Ca_P	%w/w	0.008	0.009	0.06	0.05	0.05
Ca_A	%w/w	<0.005	<0.005	0.014	0.014	0.010
Mg_{KCl}	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
Mg_P	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
Mg_A	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+/t	<10	<10	<10	<10	<10
Liming rate	kg $CaCO_3$/t	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+/t	NA	NA	NA	NA	NA
Liming rate without ANCE	kg $CaCO_3$/t	NA	NA	NA	NA	NA

Method ID	Methodology Summary
Inorg-064	sPOCAS determined using titrimetric and ICP-AES techniques. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

Client Reference: 84677.01, Kurnell

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			31/08/2015	132766-A-4	31/08/2015 || 31/08/2015	LCS-1	31/08/2015
Date analysed	-			31/08/2015	132766-A-4	31/08/2015 || 31/08/2015	LCS-1	31/08/2015
pH kcl	pH units		Inorg-064	[NT]	132766-A-4	7.6 || 7.7 || RPD: 1	LCS-1	93%
TAA pH 6.5	moles H^+/t	5	Inorg-064	<5	132766-A-4	<5 || <5	LCS-1	97%
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	132766-A-4	<0.01 || <0.01	[NR]	[NR]
pH ox	pH units		Inorg-064	[NT]	132766-A-4	4.6 || 4.7 || RPD: 2	LCS-1	104%
TPA pH 6.5	moles H^+/t	5	Inorg-064	<5	132766-A-4	<5 || <5	LCS-1	90%
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	132766-A-4	<0.01 || <0.01	[NR]	[NR]
TSA pH 6.5	moles H^+/t	5	Inorg-064	<5	132766-A-4	<5 || <5	LCS-1	89%
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	132766-A-4	<0.01 || <0.01	[NR]	[NR]
ANC_E	% $CaCO_3$	0.05	Inorg-064	<0.05	132766-A-4	<0.05 || <0.05	[NR]	[NR]
a-ANC_E	moles H^+/t	5	Inorg-064	<5	132766-A-4	<5 || <5	[NR]	[NR]
s-ANC_E	%w/w S	0.05	Inorg-064	<0.05	132766-A-4	<0.05 || <0.05	[NR]	[NR]
S_{KCl}	%w/w S	0.005	Inorg-064	<0.005	132766-A-4	<0.005 || <0.005	LCS-1	111%
S_P	%w/w	0.005	Inorg-064	<0.005	132766-A-4	0.02 || 0.02 || RPD: 0	LCS-1	91%
S_{POS}	%w/w	0.005	Inorg-064	<0.005	132766-A-4	0.01 || 0.01 || RPD: 0	LCS-1	86%
a-S_{POS}	moles H^+/t	5	Inorg-064	<5	132766-A-4	9 || 9 || RPD: 0	LCS-1	86%
Ca_{KCl}	%w/w	0.005	Inorg-064	<0.005	132766-A-4	0.11 || 0.09 || RPD: 20	LCS-1	99%
Ca_P	%w/w	0.005	Inorg-064	<0.005	132766-A-4	0.14 || 0.13 || RPD: 7	[NR]	[NR]
Ca_A	%w/w	0.005	Inorg-064	<0.005	132766-A-4	0.024 || 0.038 || RPD: 45	[NR]	[NR]
Mg_{KCl}	%w/w	0.005	Inorg-064	<0.005	132766-A-4	0.005 || <0.005	LCS-1	103%
Mg_P	%w/w	0.005	Inorg-064	<0.005	132766-A-4	<0.005 || <0.005	[NR]	[NR]
Mg_A	%w/w	0.005	Inorg-064	<0.005	132766-A-4	<0.005 || <0.005	[NR]	[NR]
S_{HCl}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
S_{NAS}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
a-S_{NAS}	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NR]	[NR]
s-S_{NAS}	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
Fineness Factor	-	1.5	Inorg-064	<1.5	132766-A-4	1.5 || 1.5 || RPD: 0	[NR]	[NR]
a-Net Acidity	moles H^+/t	10	Inorg-064	<10	132766-A-4	<10 || <10	LCS-1	86%
Liming rate	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	132766-A-4	<0.75 || <0.75	LCS-1	86%

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
a-Net Acidity without ANCE	moles H^+/t	10	Inorg-064	<10	132766-A-4	NA || NA	[NR]	[NR]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	132766-A-4	NA || NA	[NR]	[NR]

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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