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DIRT+ **DOCTORS**

GEOTECHNICAL TESTING SERVICES



Prepared For: Western Sydney Parklands Trust

Address: Wallgrove Rd, Eastern Creek NSW

Job No: DD648_1rev01

Date: 29-03-19

Project: Light Horse Interchange Business Hub- SSD 9667

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Western Sydney Parklands Trust

DD-648_1

Geotechnical Investigation

Proposed Light Horse Interchange Business Hub- SSD 9667

Wallgrove Road, Eastern Creek NSW

Report No. DD-648_1
Date 29-03-2019
Revision 1

The following is Dirt Doctors geotechnical investigation for the above address from information obtained through field observations and laboratory analysis. This Document is provided for sole use by the Client and is confidential to it and its professional advisers. No responsibility whatsoever for the contents of this Document will be accepted to any person other than the Client.

For and on behalf of
Dirt Doctors Pty Ltd



M. Tofler
Principal

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1.0 INTRODUCTION

1.1 Overview

Dirt Doctors (DD) has been contracted to prepare a geotechnical investigation as requested by Western Sydney Parklands Trust for the proposed industrial development at Wallgrove Rd, Eastern Creek NSW (the site), Part of Lot 10 in Deposited Plan 1061237 and Lot 5 in Deposited Plan 804051 (SEARs Ref. SSD 9667).

The objectives of DD assessment are to:

- Identify the subsurface conditions of the site;
- Conduct laboratory testing on subsurface materials;
- Determine soil reactivity and aggressiveness to steel and concrete (refer salinity assessment);
- Recommend site preparation and fill methodologies for bulk earthworks operations;
- Determine footing types and soil bearing capacity;
- Assess the suitability of the site for potential development based on its current condition and the findings of this investigation.

2.0 SCOPE OF WORK

The following scope of work was carried out by DD:

- A total of thirty-two boreholes were excavated to a maximum depth of 3.6m below existing surface level or to prior refusal on bedrock;
- Boreholes were spaced and proportioned over the entire site to determine subsurface conditions during bulk earthworks operations;
- Determination of groundwater depths, if encountered ;
- DCP testing was undertaken adjacent to boreholes to a maximum depth of 1.8m below existing surface level;
- CBR samples were collected to determine material properties of current underlying natural material;
- Aggressivity samples were submitted to NATA accredited laboratories;
- Preparation of a geotechnical report documenting findings of the investigation.

3.0 SITE DESCRIPTION AND SURROUNDING ENVIRONMENT

The subject site is legally defined as Part of Lot 10 in Deposited Plan 1061237 and Lot 5 in Deposited Plan 804051. The site has been proposed to be developed, with a total area of approximately 29.5ha. The site is bounded by the M4 motorway to the north, the M7 motorway to the west, vacant land followed by a recreational development to the east and vacant land to the south. The site is currently predominantly vacant, with vegetation and grass covering the majority of the exposed surface, with former defence structures remaining on the site.

3.1 Topography

The site has an approximate average height of 48m above Australian Height Datum (AHD) and grades east towards Eastern Creek.

3.2 Geology

The 1:100,000 Sydney Geological information indicates that the site underlain by:

- Triassic aged Bringelly Shale of the Wianamatta Group, comprising Shale, carbonaceous claystone, claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff and;
- Quaternary aged Alluvium, comprising Fine-grained sand, silt and clay.

4.0 SAMPLING PLAN AND SAMPLING METHODOLOGY

4.1 Sampling Plan

Proposed works drawings, such as cut to fill diagrams were not provided to DD at the time of assessment, and therefore could not be referenced to determine borehole and sampling locations. As a result, a judgmental based sampling pattern was adopted to determine the current subsurface conditions.

4.2 Sampling Methodology

Boreholes were excavated using a 4WD mounted drill rig. Sampling locations were selected based on their position within the proposed development.

5.0 SUBSURFACE PROFILE

5.1 Existing Fill/Topsoil

Existing silt/ clayey silt/ silty sand (topsoil) material was encountered in borehole locations to an average depth of 0.3m and a maximum depth of 0.6m below existing surface level. Fill material encountered predominantly consisted of silty sand, dark brown, moist, medium dense.

5.2 Underlying Natural Clay

Underlying natural clay material predominantly consisted of silty clay, medium to high plasticity, brown becoming red/ mottled grey, moist, firm becoming hard with depth.

5.3 Underlying Bedrock

Bedrock was intersected at approximate depths:

- 1.8m from existing surface level. Shale, extremely to completely weathered;
- 3.6m from existing surface level. Shale, distinctly weathered;

5.4 Ground water

No groundwater was encountered at the time of our visit; however, minor seepage from surface water infiltration is likely from the soil/rock interface following periods of heavy rainfall. Some allowance should be made for minor seepage water inflow behind proposed excavation retention systems. It should be noted that no long-term monitoring program of groundwater was carried out during this investigation.

Groundwater assessment at the time of investigation was consistent in borehole locations across the site, however; comment cannot be made for areas not accessible during the investigation.

5.5 DCP Results

DCP results indicate the overlying, moist silty clay, averaging an approximate depth of 1.8m from existing surface level, has an approximate allowable bearing capacity of 100kPa.

Footings should be founded through any silt, topsoil, deleterious soils or uncontrolled fill and into stiff engineered fill, natural clay or bedrock. All footings for the same structure should be founded on strata of similar stiffness and reactivity to minimise the risk of differential movements.

6.0 LABORATORY TEST RESULTS

6.1 California Bearing Ratio

Twenty-seven (27) California Bearing Ratio samples were collected during field investigations. Samples were collected during borehole excavations from the auger of the drill rig. Samples were collected from the natural underlying clay, approximately 0.7m to 1.2m below existing surface level. The samples were submitted for 4 day soaked CBR value analysis and are summarised in the table below.

Table 1 – Summary of CBR results

Sample No	Depth	Test Results		
		OMC	MDD	CBR
L1,BH1	0.6m-1.0m	17.5	1.77	4.0
L2,BH2	0.6m-1.0m	17.0	1.64	12.0
L3,BH3	0.7m-1.2m	19.0	1.64	7.0
L4,BH4	0.6m-1.0m	17.0	1.73	4.0
L5,BH5	0.6m-1.0m	15.0	1.73	12.0
L6,BH6	0.6m-1.0m	20.5	1.68	4.0
L7,BH7	0.7m-1.2m	18.0	1.72	4.0
L8,BH8	0.7m-1.2m	19.5	1.74	8.0
L9,BH9	0.7m-1.1m	15.5	1.80	12.0
L10,BH10	0.6m-1.0m	19.0	1.64	8.0
L11,BH11	0.7m-1.1m	19.0	1.67	4.0
L12,BH12	0.7m-1.1m	18.0	1.68	4.0
L13,BH14	0.6m-1.0m	16.5	1.78	4.0
L14,BH17	0.7m-1.1m	17.0	1.75	6.0
L15,BH19	0.7m-1.2m	13.5	1.82	5.0
L16,BH21	0.6m-1.0m	19.5	1.62	4.0
L17,BH22	0.7m-1.1m	18.0	1.66	4.0
L18,BH23	0.6m-1.0m	17.5	1.74	5.0
L19,BH24	0.6m-1.0m	14.5	1.82	11.0
L20,BH25	0.7m-1.2m	18.0	1.73	3.0
L21,BH26	0.6m-1.0m	18.0	1.64	7.0
L22,BH27	0.7m-1.2m	18.5	1.70	5.0
L23,BH28	0.6m-1.0m	19.0	1.68	4.0
L24,BH29	0.6m-1.0m	15.0	1.80	13.0
L25,BH30	0.7m-1.2m	18.0	1.71	5.0
L26,BH31	0.6m-1.0m	20.0	1.65	4.0
L27,BH32	0.6m-1.0m	20.5	1.64	4.5

6.2 Discussion of Laboratory Results

Assessment of CBR test results indicates that the soils at future subgrade level have achieved a minimum CBR of 3.0%, which can be used as a guide for future pavement construction.

6.3 Recommendations for Pavement Construction

Any proposed pavement should be constructed in accordance with good engineering principles and the following recommendations.

- Strip any topsoil or deleterious materials encountered and stockpile for re-use or removal from site.
- Excavate to design pavement subgrade levels.
- Compact exposed (subgrade) natural surfaces with a minimum of 7 passes of a 12 tonne pad foot roller or other approved device acceptable to Council and/or the independent certifier. Proof rolling should then be carried out using a 12 tonne smooth drum roller or as directed by Council and/or the independent certifier.
- Excavate areas of localised heaving to a depth of 300mm and replace with suitable granular fill, such as non-reactive well graded materials (eg. crushed sandstone), with maximum particle size not exceeding 75mm, compacted to a Minimum Dry Density Ratio (MDDR) of 100% Standard, with moisture variation maintained within 1% wet to 2% dry of Standard Optimum Moisture Content (SOMC).
- The proof rolling should be supervised by a suitably qualified Geotechnical Consultant.
- On certification of proof rolling, placement of the pavement materials may proceed. The following minimum dry density ratios (AS1289 5.4.1) must be achieved during pavement construction. Testing should be carried out by a NATA registered laboratory.
 - Base Course 98% Modified
 - Subbase 98% Modified
 - Subgrade 100% Standard
- CBR testing should be undertaken at finished subgrade level to ensure test values are consistent with design parameters outlined within table 1 of this report.
- Subgrade conditions exposing weathered bedrock material should be scarified to a depth of 300mm and re-compacted to 100% standard dry density (AS1289 5.4.1) with moisture variation maintained within 1% wet to 2% dry of Standard Optimum Moisture Content (SOMC).
- Carry out all earthworks in accordance with Civil Works Specification prepared by an approved qualified engineer.

6.4 Soil Aggressivity

The aggressiveness or erosion potential of an environment in building materials, particularly concrete and steel is dependent on the levels of pH and types of salts present. In order to determine the degree of aggressiveness, the test values obtained are compared to tables 6.4.2 (C) and 6.5.2 (C) in AS2159 Piling. Design and installation and tables 5.1 to 5.4 in AS2870-2011 "residential slabs and footings". The following testing suite was undertaken with results summarised within table 1 below;

- pH
- Electrical Conductivity (EC dS/m)
- Chloride (Cl)
- Resistivity (ohm.cm)
- Sulphates

Table 2 – Soil Salinity and Aggressivity

Borehole Number	pH	EC dS/m	ECe*	Resistivity	Cl	Sulphate	Salinity Classification	Concrete Aggressiveness	Steel Aggressiveness
E1,BH1	4.7	1.20	8.4	860	700	200	Very	Mild	Non-aggressive
E2,BH2	4.9	1.00	7.0	970	630	100	Moderately	Mild	Non-aggressive
E3,BH3	5.5	0.89	6.2	1100	530	98	Moderately	Mild	Non-aggressive
E4,BH4	4.6	1.60	11.2	640	990	170	Very	Mild	Non-aggressive
E5,BH5	4.6	1.10	7.7	880	690	120	Moderately	Mild	Non-aggressive
E6,BH6	5.0	0.64	4.5	1600	300	85	Moderately	Mild	Non-aggressive
E7,BH7	4.9	0.58	4.1	1700	270	74	Moderately	Mild	Non-aggressive
E8,BH8	4.5	1.20	8.4	830	780	150	Very	Moderate	Non-aggressive
E9,BH9	4.4	1.20	8.4	830	770	140	Very	Moderate	Non-aggressive
E10,BH10	4.6	0.80	5.6	1200	420	68	Moderately	Mild	Non-aggressive
E11,BH11	4.4	0.96	6.7	1000	580	74	Moderately	Moderate	Non-aggressive
E12,BH12	4.5	0.99	6.9	1000	570	130	Moderately	Moderate	Non-aggressive
E13,BH14	4.5	0.97	6.8	1000	610	150	Moderately	Moderate	Non-aggressive
E14,BH17	4.6	1.10	7.7	880	780	150	Moderately	Mild	Non-aggressive
E15,BH19	4.9	0.93	6.5	1100	610	68	Moderately	Mild	Non-aggressive
E16,BH21	4.9	1.10	7.7	880	790	91	Moderately	Mild	Non-aggressive
E17,BH22	5.8	0.89	6.2	1100	560	95	Moderately	Non-aggressive	Non-aggressive
E18,BH23	6.2	0.83	5.8	1200	500	79	Moderately	Non-aggressive	Non-aggressive
E19,BH24	5.0	1.80	12.6	540	1300	180	Very	Mild	Non-aggressive
E20,BH25	5.4	0.51	3.6	2000	270	110	Slightly	Mild	Non-aggressive
E21,BH26	5.6	0.57	4.0	1700	320	110	Moderately	Non-aggressive	Non-aggressive
E22,BH27	5.0	0.61	4.3	1600	320	110	Moderately	Mild	Non-aggressive
E23,BH28	4.5	0.90	6.3	1100	560	180	Moderately	Moderate	Non-aggressive
E24,BH29	4.5	0.86	6.0	1200	520	170	Moderately	Moderate	Non-aggressive
E25,BH30	4.5	0.76	5.3	1300	420	120	Moderately	Moderate	Non-aggressive
E26,BH31	4.5	0.83	5.8	1200	490	130	Moderately	Moderate	Non-aggressive

Soil Salinity Classes (from Urban Salinity DLWC 2002)

Salinity Classification	ECe (ds/m)	Comments
Non-saline	<2	Salinity effects mostly negligible
Slightly saline	2-4	Yields of very sensitive crops may be affected
Moderately saline	4-8	Yields of crops may be affected
Very saline	8-16	Only tolerant crops yield satisfactorily
Highly saline	>16	Only a few very tolerant crops yield satisfactorily

Aggressiveness to Concrete (from AS2159-2009)

Exposure Conditions		Exposure Classification	
Sulfates expressed as SO ₄ (ppm in soil)	pH	High permeability soils in groundwater	Low permeability soils above groundwater
<5000	>5.5	Mild	Non-aggressive
5000-10,000	4.5-5.5	Moderate	Mild
10,000-20,000	4-4.5	Severe	Moderate
>20,000	<4	Very Severe	Severe

Aggressiveness to Steel (from AS2159-2009)

Exposure Conditions		Exposure Classification	
Chlorides (Cl) (ppm in soil)	pH	High permeability soils in groundwater	Low permeability soils above groundwater
<5000	>5	Non-aggressive	Non-aggressive
5000-20,000	4-5	Mild	Non-aggressive
20,000-50,000	3-4	Moderate	Mild
>50,000	<3	Severe	Moderate

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Site Preparation

Prior to placement of engineered fill (see below), the foundation material is to be cleared of all trees, stumps and other materials unsuitable for incorporation in the proposed works.

The roots of all trees and debris, such as old foundations, buried pipelines (and the like, if discovered) should be removed to sufficient depth to prevent inconveniences during subsequent excavation or foundation works. Resulting excavations should be backfilled and compacted to the same standard as that required for subsequent filling operations.

7.2 Subgrade Preparation

The area on which the fill is to be placed and the area from which the cut is to be removed should be stripped of all vegetation and of such soils as may be unsuitable to support the proposed loadings or for incorporation in fills subject to density, moisture or other specified controls.

Topsoil and severely root-affected soils may need to be stripped as unsuitable material or as required for subsequent revegetation. Special care is needed to ensure that materials that will inhibit or prevent the satisfactory placement of subsequent fill layers are not allowed to remain in the foundations of fills.

Wherever practicable, the ground surface exposed after stripping should be shaped to assist drainage and be compacted to the same requirements as for the overlying layers of fill.

Prior to fill placement, the exposed foundation material is to be treated the same requirements as for the overlying layers of fill. Such treatment may include loosening the exposed excavation surface by scarifying to a depth of at least 150 mm, and to then moisture-condition and compact this loosened material. The depth to which scarifying carried out should not exceed that which can be compacted.

Alternatively, existing fill or weak or variable subgrade materials may respond to ground improvement using an impact roller or impact compaction and, if considered appropriate, a trial or specification should be applied.

Foundation material is to be inspected by a qualified geotechnical consultant before fill placement and is to be approved by qualified geotechnical consultant before fill placement. Following stripping, foundation material is to be proof rolled with at least six passes of a 12 tonne static smooth drum roller under the supervision of qualified geotechnical consultant. A report from qualified geotechnical consultant, deeming the area suitable to receive fill is required before fill placement.

If soft, heaving or foundation showing signs of deformation is identified during the foundation inspection, over-excavation below the depth of non-conforming material is required. The excavated base is to be re-inspected and approved by qualified geotechnical consultant with the excavated material to be replaced with engineered fill as described below.

7.3 Engineered Fill

To raise site level, Engineered Fill, as described below, must be used. Fill material is to be placed in 300mm loose horizontal layers, of a homogeneous type, such as material type, quality and moisture. Each fill layer thickness should be such that the bottom of each layer is compacted to the specified relative compaction and can be tested by the specified test methods.

Before any loose layer of fill is compacted, the material and its moisture condition should be as uniform as practicable throughout its depth.

The maximum particle size of any rocks or other lumps within the layer, after compaction, generally, should not exceed two-thirds of the compacted layer thickness.

All fill material is to be inspected by qualified geotechnical consultant as suitable for use as engineered fill.

All fill is to contain <0.1% by weight of deleterious material such as Rubber, plastic, bitumen, paper, cloth, paint and wood and other vegetable matter.

7.3.1 Compaction Specification

Engineered fill is to comprise of:

- Engineered fill as described in section 7.3;
- Achieving a compaction ratio of 98% and 102% of Standard Maximum Dry Density (SMDD).
- Virgin Excavated Natural Material
- Excavated Natural Material

Virgin Excavated Natural Material

VENM- for future use; since it is in accordance with the definition of VENM given under the *Protection of the Environments Operations Act 1997* as outlined below:

‘Natural material (such as clay, gravel, sand, soil or rock fines):

- That has been excavated or quarried from areas that are not contaminated with manufactured chemicals or process residues, as a result of industrial, commercial, mining or agricultural activities, and
- That does not contain any sulfidic ores or soils or any other waste.’

Excavated Natural Material

Excavated natural material means naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

- Been excavated from the ground, and
- Contains at least 98% (by weight) natural material, and
- Does not meet the definition of Virgin Excavated Natural Material in the Act.

Excavated natural material does not include material located in a hotspot; that has been processed; or that contains asbestos, Acid Sulfate Soils (ASS), Potential Acid Sulfate soils (PASS) or sulfidic ores.

Blended Topsoil

Topsoil material is to comprise stripped topsoil, generated during onsite preparation and stripping works, and is to meet the definition of VENM or ENM as noted above. Proposed material is to be inspected and approved by a qualified geotechnical consultant prior to use as engineered fill.

Proposed topsoil material is to be blended at a ratio of no greater than one-part topsoil to four-parts VENM or ENM, and must not contain grass roots or other deleterious material. The engineered fill is to be thoroughly blended, achieving a homogeneous layer, prior to compaction. After placement of two layers of engineered fill ($\leq 0.6\text{m}$), the exposed layer is to be inspected and proof rolled by a qualified geotechnical consultant before continued fill placement. Blended topsoil should not be placed within 1.5m of bulk earthworks level.

7.3.2 Moisture Control

Engineered fill placed is to have moisture contents at a maximum of $\pm 2\%$ of Standard Optimum Moisture Content (SOMC).

7.4 Earthworks Inspection and Testing

To assess whether the quality of materials and workmanship provided on a project are consistent with the design requirements, the earthworks for a project should be inspected and tested at regular and appropriate intervals, having regard to the nature of the work, its required function and the specification.

The Geotechnical Inspection and Testing Authority (GITA) is required to have competent personnel on site at all times while earthwork operations are undertaken. Such operations include the following:

- Completion of removal of topsoil.
- Placing of imported or cut material.
- Compaction and adding/removal of moisture.

- Trenching and backfilling, where applicable.
- Test rolling.
- Testing.

The GITA should have the necessary independence, equipment and competence to be able to undertake all inspections and testing called for. Inspections and testing should be carried out by competent personnel experienced and knowledgeable in earthworks, materials and have a sound understanding of the implication of the specification requirements, e.g., an inspection authority accredited in accordance with NATA (National Association of Testing Authorities, Australia).

7.5 Batter Slopes

Any exposed batters are susceptible to weakening from storm water scour. Fill batter profiles should be limited to a maximum grade of 1 to 2.5 (vertical to horizontal). Surficial soils are also susceptible to localised erosion which could cause instability if placement of fill material and construction of footings are not carried out with care and if areas of the land disturbed by building activities are not subsequently suitably landscaped (such as the subject site).

Surface storm water runoff should always be diverted around fill batters, along with vegetating the batter, in order to improve the batters long term ability to resist landslip and or surface scour. Where these recommendations are unachievable, benching, shoring or retaining measures should be implemented.

7.6 Edge Compaction

To achieve the required the specified site compaction DD recommends that, where fill platforms are proposed, the outer edge of the platform is to extend 1m beyond the design geometry. The edge of the fill platform is to achieve the same compaction specification as defined above.

7.7 Service Trenches

Service trenches are to be backfilled in accordance with Engineered Fill specification above, with the exception that fill material may comprise of material meeting NSW EPA resource recovery exemptions and Orders for recovered fines and 'AS NZS 3725-2007 Design for installation of buried concrete pipes' material specification. Material used for trench backfill is to comply to RMS R11 specifications.

7.8 Additional Earthworks Requirements

Additional requirements, not stated above, may be required during earthworks operations within the vicinity of onsite services (Sydney Water, RMS, Jemena etc.). Additional information relating but not limited to compaction requirements and safe operating procedures, should be sought prior to earthworks operations being undertaken.

8.0 LIMITATIONS

This type of investigation (as per our commission) is not designed or capable of locating all ground conditions, (which can vary even over short distances). The advice given in this report is based on the assumption that the test results are representative of the overall ground conditions. However, it should be noted that actual conditions in some parts of the site might differ from those found. If excavations reveal ground conditions significantly different from those shown in our findings, Dirt Doctors must be consulted. No geotechnical investigation can provide a full understanding of all possible subsurface details and anomalies at a site.

The scope and the period of Dirt Doctors services are described in the report and are subject to restrictions and limitations. Dirt Doctors did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Dirt Doctors in regards to it.

Where data has been supplied by the client or a third party, it is assumed that the information is correct unless otherwise stated. No responsibility is accepted by Dirt Doctors for incomplete or inaccurate data supplied by others.

Any drawings or figures presented in this report should be considered only as pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions should not be used for accurate calculations or dimensioning.

Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that DD be notified of any variations and be provided with an opportunity to review the recommendations of this report

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Should you have any queries, please do not hesitate to contact the undersigned.

For and on behalf of
Dirt Doctors Pty Ltd



M. Tofler
Principal

References

Geological Series Map of the Sydney Region, scale 1:250,000

Pells, P.J., Douglas, D.J., Rodway, B, Thorne, C. And McMahon, B.K "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region". Australian Geomechanics Journal, Vol.3 1978.

Pells, P.J., Mostyn, G and Walker, B.F. "Foundations on Sandstone and Shale in the Sydney Region". Australian Geomechanics Journal, Vol. No. 33, Part 3, Dec 1998.

AS1726:1993, Geotechnical Site Investigations, Standards Australia.

AS2159:2009, Piling – Design and Installation, Standards Australia.

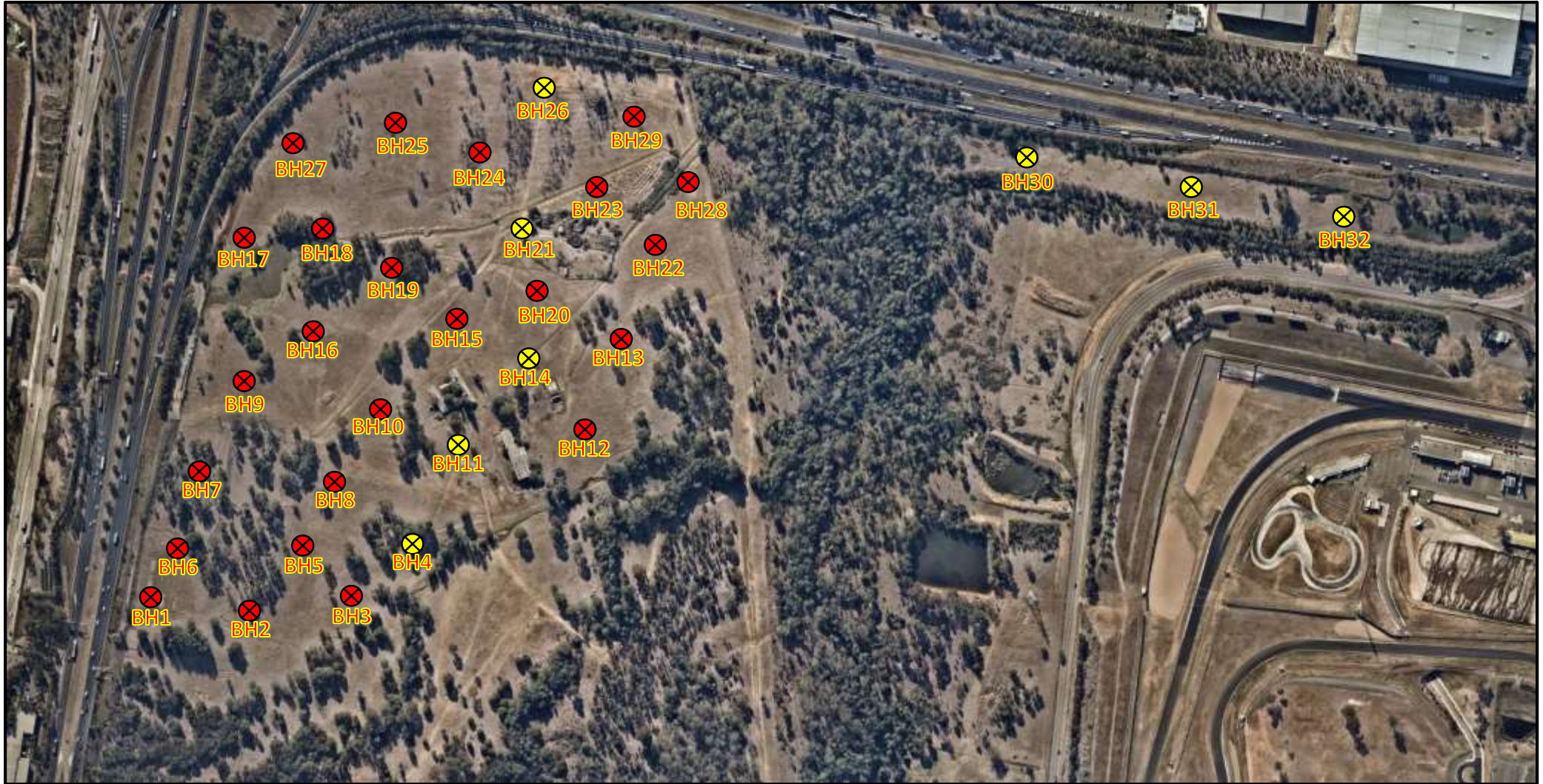
AS2870:2011, Residential Slabs and Footings, Standards Australia.

AS3798:2007, Guidelines on Earthworks for Commercial and Residential Developments, Standards Australia

APPENDIX A

FIGURES

Bore Hole Location Plan and Logs



	Borehole Locations Proposed Rd, Borehole Locations	Western Sydney Parklands Trust		Job No.	DD – 648
		Lighthorse Interchange Business Hub, NSW		Drawing No.	
		Drawn By	DB	Ref No.	DD – 648_1
		Approved By	MT	Scale	N.T.S.

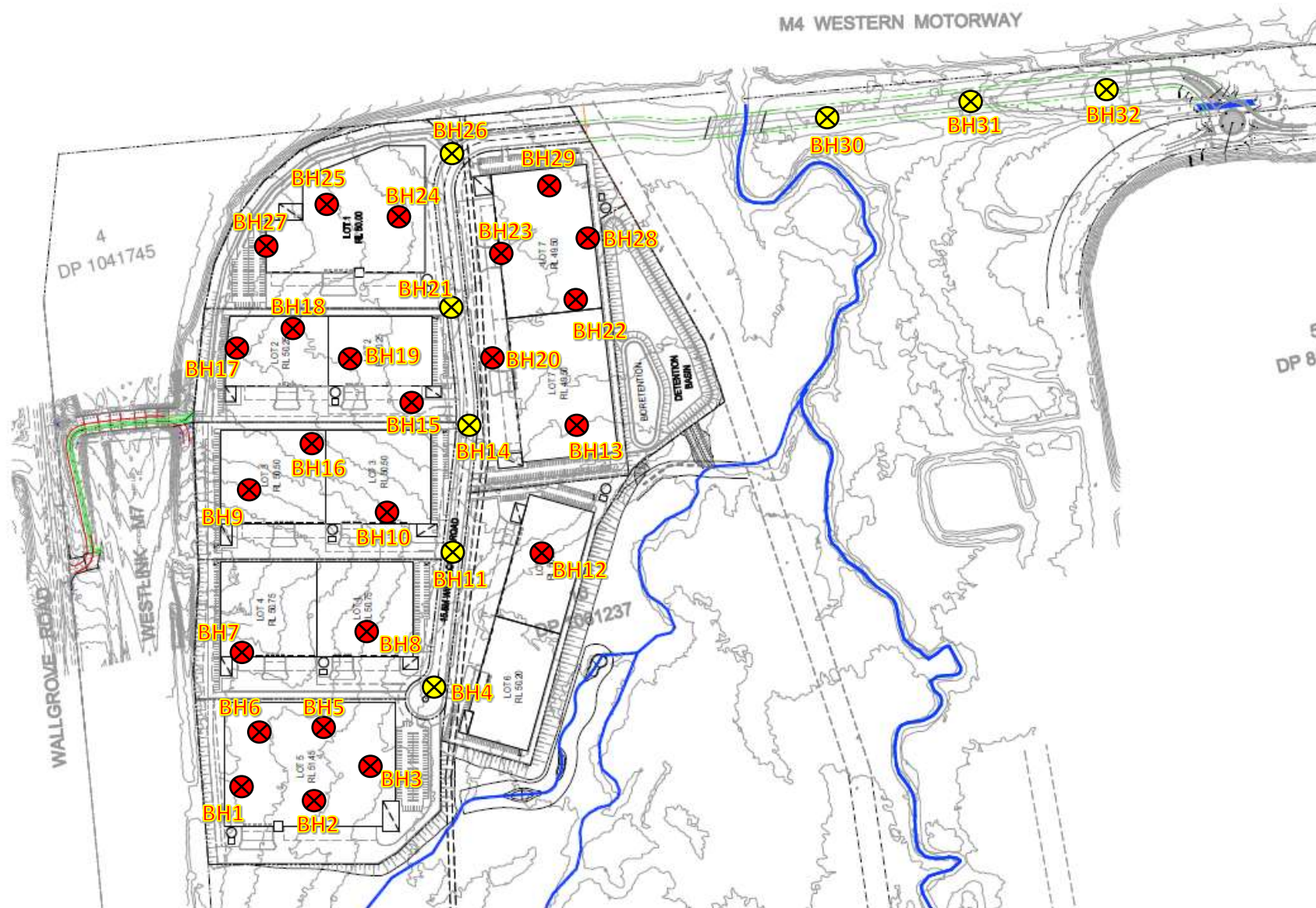




Figure 1: Standard Symbols for Stormwater Management Plans. The figure displays various symbols used in stormwater management plans, organized into two columns. Each symbol is accompanied by a descriptive label and a corresponding line style or icon.

Left Column:

- PROPOSED LIMIT OF WORK: A solid black line.
- SITE/LOT BOUNDARY: A dashed line.
- PROPOSED RIDGE LINE: A line with 'R' markers.
- PROPOSED VAULTED LINE: A line with 'V' markers.
- PROPOSED SILTOUT LINE: A line with 'SS' markers.
- PROPOSED JUNCTION PITS: A square with an 'X' inside.
- PROPOSED SURFACE INLET PITS: A square with a circle inside.
- PROPOSED LINTEL, ONGRADE & SAG PITS: A square with a circle inside.
- PROPOSED PIT TAG: A circle with 'A-1' and 'PIT NUMBER'.
- EXISTING STORMWATER PIPE: A line with 'X' markers.
- PROPOSED STORMWATER PIPE: A line with 'X' markers.
- PROPOSED BATTER LINE: A line with '5/4' markers.
- EXISTING CONTOURS: A line with '49.50' markers.
- PROPOSED COLLECTION LINE: A line with 'RW' markers.
- PROPOSED RETAINING WALL: A line with 'X' markers.
- PROPOSED DESIGN SPOT LEVEL: A line with 'FP' markers.
- PROPOSED FLUSHING POINT (FP): A line with 'IR' markers.
- PROPOSED INTERMEDIATE RISER (IR): A line with 'IR' markers.

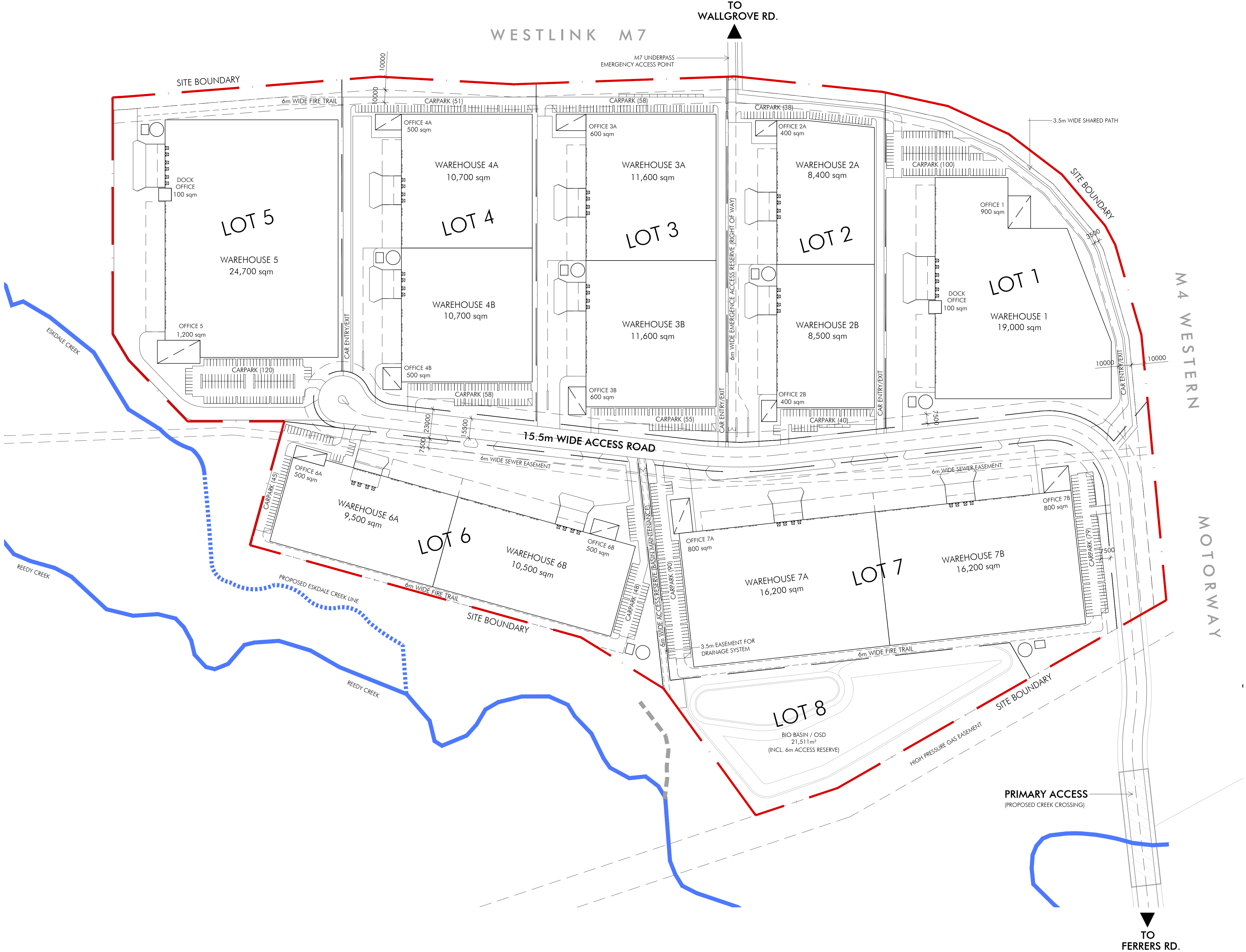
Right Column:

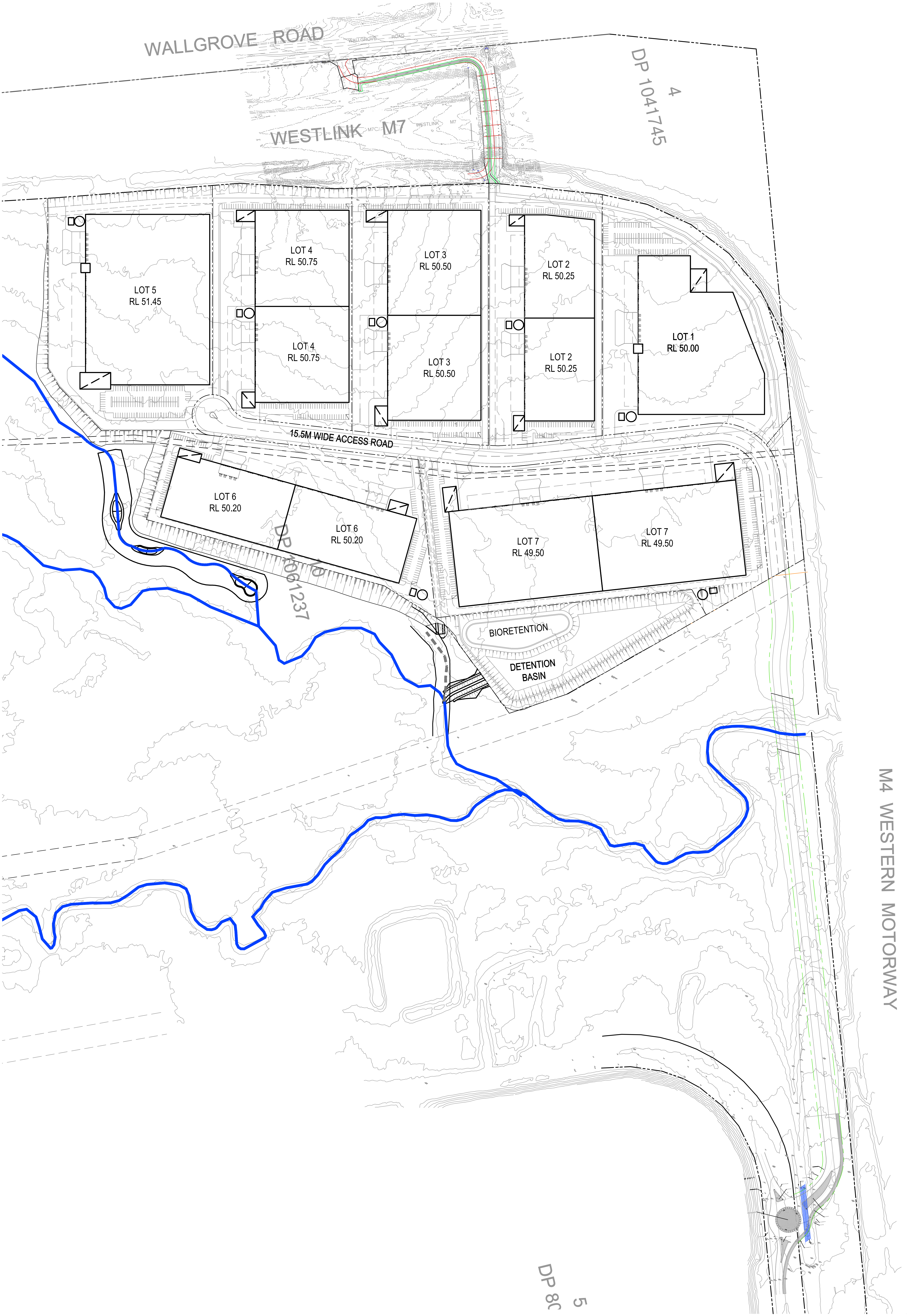
- PROPOSED LIMIT OF WORK: A solid black line.
- SITE/LOT BOUNDARY: A dashed line.
- PROPOSED RIDGE LINE: A line with 'R' markers.
- PROPOSED VAULTED LINE: A line with 'V' markers.
- PROPOSED SILTOUT LINE: A line with 'SS' markers.
- PROPOSED JUNCTION PITS: A square with an 'X' inside.
- PROPOSED SURFACE INLET PITS: A square with a circle inside.
- PROPOSED LINTEL, ONGRADE & SAG PITS: A square with a circle inside.
- PROPOSED PIT TAG: A circle with 'A-1' and 'PIT NUMBER'.
- EXISTING STORMWATER PIPE: A line with 'X' markers.
- PROPOSED STORMWATER PIPE: A line with 'X' markers.
- PROPOSED BATTER LINE: A line with '5/4' markers.
- EXISTING CONTOURS: A line with '49.50' markers.
- PROPOSED COLLECTION LINE: A line with 'RW' markers.
- PROPOSED RETAINING WALL: A line with 'X' markers.
- PROPOSED DESIGN SPOT LEVEL: A line with 'FP' markers.
- PROPOSED FLUSHING POINT (FP): A line with 'IR' markers.
- PROPOSED INTERMEDIATE RISER (IR): A line with 'IR' markers.

[illegible]

GENERAL ARRANGEMENT PLAN

DEVELOPMENT DATA			
OVERALL SITE AREA	336,287m ²		
LOT 8 (RESIDUAL) - ESTATE BIO-BASIN/OSD	21,511m ²		
ACCESS ROAD RESERVE	21,137m ²		
TOTAL DEVELOPABLE AREA (LOT 1 TO 7)	293,639m ²		
TOTAL BUILDING AREA	165,500m ²		
FLOOR SPACE RATIO	56.4%		
DEVELOPABLE LOT	W/H AREA	OFFICE AREA	TOTAL
LOT 1 SITE AREA (41,270m ²)	19,000	1,000	20,000
LOT 2 SITE AREA (34,141m ²)	16,900	800	17,700
LOT 3 SITE AREA (41,112m ²)	23,200	1,200	24,400
LOT 4 SITE AREA (38,686m ²)	21,400	1,000	22,400
LOT 5 SITE AREA (44,193m ²)	24,700	1,300	26,000
LOT 6 SITE AREA (38,406m ²)	20,000	1,000	21,000
LOT 7 SITE AREA (55,831m ²)	32,400	1,600	34,000
TOTAL	157,600	7,900	165,500
CARPARK PROVISIONS			
TOTAL CARPARK REQUIRED		723 spaces	
RMS - Warehouse: 1 space/300sqm Office: 1 space/40sqm			
TOTAL CARPARK PROVIDED		782 spaces	





SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.1						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, Light Grey			
			End 2.0m			
	2.5					
	3					
	3.5					
Method: Ute Mounted Drill Rig						
Date: 22-06-18						
Logged and Drilled by: DB						

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.2						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL	0.5 					



SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.3						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL	<div>0.5</div> <div>1</div> <div>1.5</div> <div>2</div> <div>2.5</div> <div>3</div> <div>3.5</div>	Fill	Silty sand, dark brown, non plastic, moist			
		Nat	Silty Clay, light brown, brown, medium - high Plasticity, slighty moist, firm			
			Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
		XW	Class V Shale, Light Grey			
			End 1.9m			

Method:

Ute Mounted Drill Rig

Date:

22-06-18

Logged and Drilled by:

DB



SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.4						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay traces of ironstone, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, Light Grey			
	2.5					
	3					
	3.5		End 3.5m			
Method: Ute Mounted Drill Rig						
Date: 22-06-18						
Logged and Drilled by: DB						

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SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.5						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, moist			
	0.5	Nat	Silty Gravelly Clay, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5					
	2		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
		XW	Class V Shale, Light Grey			
	2.5		End 1.9m			
	3					
	3.5					

Method: Ute Mounted Drill Rig
Date: 22-06-18
Logged and Drilled by: DB

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SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.6						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, light grey, grey			
			End 2.0m			
	2.5					
	3					
	3.5					

Method:

Ute Mounted Drill Rig

Date:

22-06-18

Logged and Drilled by:

DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.7						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay, brown, medium - high Plasticity, slightly moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, light grey			
			End 2.0m			
	2.5					
	3					
	3.5					

Method: Ute Mounted Drill Rig
Date: 22-06-18
Logged and Drilled by: DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.8						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, light grey			
			End 2.0m			
	2.5					
	3					
	3.5					
Method: Ute Mounted Drill Rig						
Date: 22-06-18						
Logged and Drilled by: DB						

SITE LOCATION: Lighthouse Interchange Business Hub						
BORE HOLE No.9						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay traces of ironstone, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, light grey			
	2.5		End 2.3m			
	3					
	3.5					

Method: Ute Mounted Drill Rig
Date: 22-06-18
Logged and Drilled by: DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.10						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, light grey			
			End 2.0m			
	2.5					
	3					
	3.5					

Method: Ute Mounted Drill Rig
Date: 22-06-18
Logged and Drilled by: DB



SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.11						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay traces of ironstone, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, Light Grey, brown			
	2.5					
	3					
	3.5		End 3.4m			

Method:

Ute Mounted Drill Rig

Date:

22-06-18

Logged and Drilled by:

DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.12						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay traces of ironstone gravel, light brown, brown, medium - high Plasticity, slightly moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, Light Grey, brown			
			End 2.0m			
	2.5					
	3					
	3.5					
Method: Ute Mounted Drill Rig						
Date: 22-06-18						
Logged and Drilled by: DB						

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.13						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay traces of ironstone gravel, light brown, brown, medium - high Plasticity, slightly moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, Light Grey, brown			
			End 2.0m			
	2.5					
	3					
	3.5					

Method: Ute Mounted Drill Rig
Date: 22-06-18
Logged and Drilled by: DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.14						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay traces of ironstone, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, light grey			
	2.5					
	3					
	3.5		End 3.5m			
Method: Ute Mounted Drill Rig						
Date: 22-06-18						
Logged and Drilled by: DB						

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.15						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL	<div> <div>0.5</div> <div>1</div> <div>1.5</div> <div>2</div> </div>	Fill	Silty sand, dark brown, non plastic, moist			
		Nat	Silty Clay traces of ironstone gravel, light brown, brown, medium - high Plasticity, slightly moist, firm			
			Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
		XW	Class V Shale, Light Grey			
	<div>2.5</div> <div>3</div> <div>3.5</div>		End 2.3m			

Method: Ute Mounted Drill Rig

Date: 22-06-18

Logged and Drilled by: DB

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SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.16						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay with 10% fine gravel, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
		XW	Class V Shale, Light Grey, brown			
	2		End 1.9			
	2.5					
	3					
	3.5					

Method: Ute Mounted Drill Rig
Date: 22-06-18
Logged and Drilled by: DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.17						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay traces of gravel, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, brown, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
		XW	Class V Shale, Light Grey, brown			
	2		End 1.9			
	2.5					
	3					
	3.5					

Method: Ute Mounted Drill Rig
 Date: 22-06-18
 Logged and Drilled by: DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.18						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
		XW	Class V Shale, Light Grey, brown			
	2		End 1.9			
	2.5					
	3					
	3.5					

Method: Ute Mounted Drill Rig
Date: 22-06-18
Logged and Drilled by: DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.19						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
		XW	Class V Shale, Light Grey, brown			
	2		End 1.9			
	2.5					
	3					
	3.5					

Method: Ute Mounted Drill Rig
Date: 22-06-18
Logged and Drilled by: DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.20						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, light grey			
			End 2.0m			
	2.5					
	3					
	3.5					
Method: Ute Mounted Drill Rig						
Date: 22-06-18						
Logged and Drilled by: DB						

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.21						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay, brown, high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, mottled, grey, red, brown, med Plasticity to high plastic, slightly moist, stiff to hard			
	2	XW	Class V Shale, light grey			
	2.5					
	3					
	3.5					
			End 3.6m			
Method: Ute Mounted Drill Rig						
Date: 22-06-18						
Logged and Drilled by: DB						

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.22						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay traces of ironstone, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
	2	XW	Class V Shale, light grey			
			End 2.0m			
	2.5					
	3					
	3.5					

Method:

Ute Mounted Drill Rig

Date:

22-06-18

Logged and Drilled by:

DB



SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.23						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay traces of ironstone, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5					
	2	XW	Class V Shale, Light Grey			
	2.5		End 2.4m			
	3					
	3.5					

Method: Ute Mounted Drill Rig

Date: 22-06-18

Logged and Drilled by: DB

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SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.25						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5					
	2	XW	Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
			Class V Shale, Light Grey			
	2.5		End 2.4m			
	3					
	3.5					
Method: Ute Mounted Drill Rig						
Date: 22-06-18						
Logged and Drilled by: DB						

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SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.26						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, non plastic, dry			
	0.5	Nat	Silty Clay, brown, high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity to high plastic, slightly moist, stiff to hard			
	2	XW	Class V Shale, light grey			
	2.5					
	3					
	3.5					

Method: Ute Mounted Drill Rig
 Date: 22-06-18
 Logged and Drilled by: DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.27						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand, dark brown, non plastic, moist			
	0.5	Nat	Silty Clay with 10% fine gravel, light brown, brown, medium - high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity, slightly moist, hard			
		XW	Class V Shale, Light Grey, brown			
	2		End 1.9			
	2.5					
	3					
	3.5					

Method: Ute Mounted Drill Rig
 Date: 22-06-18
 Logged and Drilled by: DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.28						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, dark grey, non plastic, dry			
	0.5	Nat	Silty Clay traces of ironstone gravels, brown, high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity to high plastic, slightly moist, stiff to hard			
	2	XW	Class V Shale, light grey, brown			
	2.5					
	3					
	3.5	DW	Class IV Shale TC-Bit Refusal End 3.4m			

Method:

Ute Mounted Drill Rig

Date:

22-06-18

Logged and Drilled by:

DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.29						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, dark grey, non plastic, dry			
	0.5	Nat	Silty Clay traces of ironstone gravels, brown, high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity to high plastic, slightly moist, stiff to hard			
	2	XW	Class V Shale, light grey			
	2.5					
	3					
3.5						
		DW	Class IV Shale TC-Bit Refusal End 3.6m			

Method:

Ute Mounted Drill Rig

Date:

22-06-18

Logged and Drilled by:

DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.31						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, dark grey, non plastic, dry			
	0.5	Nat	Silty Clay traces of gravel, ironstone gravels, brown, high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity to high plastic, slightly moist, stiff to hard			
	2	XW	Class V Shale, light grey			
	2.5					
	3					
	3.5					
		DW	Class IV Shale TC-Bit Refusal End 3.6m			

Method:

Ute Mounted Drill Rig

Date:

22-06-18

Logged and Drilled by:

DB

SITE LOCATION: Lighthorse Interchange Business Hub						
BORE HOLE No.32						
WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION <small>(SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)</small>	Pocket Penetrometer kPa	DCP	REMARKS
NIL		Fill	Silty sand traces of gravel, dark brown, dark grey, non plastic, dry			
	0.5	Nat	Silty Clay traces of gravel, brown, high Plasticity, slighty moist, firm			
	1					
	1.5		Silty Clay, light brown, grey, red, mottled med Plasticity to high plastic, slightly moist, stiff to hard			
	2	XW	Class V Shale, light grey			
	2.5					
	3					
	3.5					
		DW	Class IV Shale TC-Bit Refusal End 3.6m			

Method: Ute Mounted Drill Rig
Date: 22-06-18
Logged and Drilled by: DB

APPENDIX B

Laboratory Analysis

California Bearing Ratio

CLIENT: Western Sydney Parklands Trust
PROJECT: Light Horse Interchange Business Hub
LOCATION: Wallgrove Road, Eastern Creek

JOB NO: DD-648
REPORT NO: DDR-1
REPORT DATE: 24/07/18

Test Methods: AS1289.6.1.1, AS1289.1.1, AS1298.2.1.1, AS1289.5.1.1 T117, T118

Results

Laboratory Sample Number	L1	L2	L3	L4	L5	L6
Date Sampled	22/06/18	22/06/18	22/06/18	22/06/18	22/06/18	22/06/18
Material Description	Silty Clay, Light Brown mottled brown	Silty Clay, Light Brown mottled brown	Silty Clay, Light Brown mottled brown	Silty Clay, Light Brown mottled brown	Silty Clay, Light Brown mottled brown	Silty Clay, Light Brown mottled brown
Maximum Dry Density t/m^3	1.77	1.64	1.64	1.73	1.73	1.68
Optimum Moisture Content %	17.5	17.0	19.0	17.0	15.0	20.5
Field Moisture Content %	14.7	10.2	14.4	11.6	10.3	13.3
Oversize Material On 19mm Sieve %	0.0	0.0	0.0	0.0	0.0	0.0
Oversize Included Y/N	N	N	N	N	N	N
Dry Density before soak t/m^3	1.78	1.64	1.66	1.74	1.72	1.70
Dry Density after soak t/m^3	1.74	1.63	1.64	1.74	1.70	1.69
Moisture Content before soak %	17.3	16.8	19.1	16.6	14.8	20.2
Moisture Content after soak %	23.3	18.4	20.7	19.4	18.0	21.6
Moisture Content After Test-Top 30mm %	25.8	19.0	21.9	20.1	20.8	23.0
Moisture Content After Test- Whole Sample %	23.0	18.2	20.6	19.3	17.8	21.5
Density ratio before soaking %	100.5	100.0	101.2	100.7	99.4	101.2
Moisture ratio before soaking %	98.9	98.8	100.5	97.6	98.7	98.5
Period of soaking days	4	4	4	4	4	4
Compactive effort	Standard	Standard	Standard	Standard	Standard	Standard
Mass of Surcharge kg	4.5	4.5	4.5	4.5	4.5	4.5
Swell After Soaking %	2.8	0.6	1.3	0.4	1.1	0.4
Penetration mm	5.0	2.5	2.5	5.0	2.5	5.0
CBR Value %	4.0	12.0	7.0	4.0	12.0	4.0

Approved Signatory


Mitchell Toller
Principal

Date 24-07-18

California Bearing Ratio

CLIENT: Western Sydney Parklands Trust
PROJECT: Light Horse Interchange Business Hub
LOCATION: Wallgrove Road, Eastern Creek

JOB NO: DD-648
REPORT NO: DDR-2
REPORT DATE: 24/07/18

Test Methods: AS1289.6.1.1, AS1289.1.1, AS1298.2.1.1, AS1289.5.1.1 T117, T118

Results

Laboratory Sample Number	L7	L8	L9	L10	L11	L12
Date Sampled	22/06/18	22/06/18	22/06/18	22/06/18	22/06/18	22/06/18
Material Description	Silty Clay, Brown	Silty Clay, Brown	Silty Clay, Brown, traces of gravel	Silty Clay, Brown	Silty Clay, Brown, traces of gravel	Silty Clay, Brown, traces of gravel
Maximum Dry Density t/m^3	1.72	1.74	1.80	1.64	1.67	1.68
Optimum Moisture Content %	18.0	19.5	15.5	19.0	19.0	18.0
Field Moisture Content %	14.9	16.8	13.8	15.5	15.9	16.6
Oversize Material On 19mm Sieve %	0.0	0.0	0.0	0.0	0.0	0.0
Oversize Included Y/N	N	N	N	N	N	N
Dry Density before soak t/m^3	1.72	1.74	1.77	1.67	1.67	1.67
Dry Density after soak t/m^3	1.71	1.72	1.75	1.65	1.64	1.62
Moisture Content before soak %	18.1	19.4	15.3	18.8	18.6	18.1
Moisture Content after soak %	22.7	21.3	18.8	19.6	22.2	24.2
Moisture Content After Test-Top 30mm %	23.8	24.7	22.2	23.6	23.6	26.4
Moisture Content After Test- Whole Sample %	22.5	21.2	18.7	19.3	22.1	23.9
Density ratio before soaking %	100.0	99.8	98.5	101.6	100.2	99.5
Moisture ratio before soaking %	100.5	99.5	98.7	98.9	97.9	100.6
Period of soaking days	4	4	4	4	4	4
Compactive effort	Standard	Standard	Standard	Standard	Standard	Standard
Mass of Surcharge kg	4.5	4.5	4.5	4.5	4.5	4.5
Swell After Soaking %	1.1	1.0	1.3	0.9	2.1	3.2
Penetration mm	2.5	2.5	2.5	2.5	2.5	2.5
CBR Value %	4.0	8.0	12.0	8.0	4.0	4.0

Approved Signatory


Mitchell Toffler
Principal

Date 24-07-18

California Bearing Ratio

CLIENT: Western Sydney Parklands Trust
PROJECT: Light Horse Interchange Business Hub
LOCATION: Wallgrove Road, Eastern Creek

JOB NO: DD-648
REPORT NO: DDR-3
REPORT DATE: 24/07/18

Test Methods: AS1289.6.1.1, AS1289.1.1, AS1298.2.1.1, AS1289.5.1.1 T117, T118

Results

Laboratory Sample Number	L13	L14	L15	L16	L17	L18
Date Sampled	22/06/18	22/06/18	22/06/18	22/06/18	22/06/18	22/06/18
Material Description	Silty Clay, Brown	Silty Clay, Brown, traces of Gravel	Silty Clay, Light Brown mottled brown	Silty Clay, Brown, traces of Gravel	Silty Clay, Brown, traces of Gravel	Silty Clay, Light Brown mottled brown
Maximum Dry Density t/m^3	1.78	1.75	1.82	1.62	1.66	1.74
Optimum Moisture Content %	16.5	17.0	13.5	19.5	18.0	17.5
Field Moisture Content %	14.1	13.9	11.7	15.9	14.3	13.4
Oversize Material On 19mm Sieve %	0.0	0.0	0.0	0.0	0.0	0.0
Oversize Included Y/N	N	N	N	N	N	N
Dry Density before soak t/m^3	1.78	1.74	1.83	1.60	1.67	1.75
Dry Density after soak t/m^3	1.76	1.72	1.81	1.57	1.64	1.74
Moisture Content before soak %	16.6	16.9	13.5	19.6	18.2	17.5
Moisture Content after soak %	17.8	18.1	18.6	23.4	22.8	20.6
Moisture Content After Test-Top 30mm %	19.1	19.6	20.7	25.8	24.0	21.8
Moisture Content After Test- Whole Sample %	17.7	18.0	18.4	23.1	22.6	20.5
Density ratio before soaking %	100.0	99.6	100.8	99.0	100.4	100.5
Moisture ratio before soaking %	100.6	99.4	100.0	100.5	101.1	100.0
Period of soaking days	4	4	4	4	4	4
Compactive effort	Standard	Standard	Standard	Standard	Standard	Standard
Mass of Surcharge kg	4.5	4.5	4.5	4.5	4.5	4.5
Swell After Soaking %	1.3	0.7	1.2	1.9	2.2	1.0
Penetration mm	2.5	2.5	5.0	2.5	2.5	2.5
CBR Value %	4.0	6.0	5.0	4.0	4.0	5.0

Approved Signatory


Mitchell Toffler
Principal

Date 24-07-18

California Bearing Ratio

CLIENT: Western Sydney Parklands Trust
PROJECT: Light Horse Interchange Business Hub
LOCATION: Wallgrove Road, Eastern Creek

JOB NO: DD-648
REPORT NO: DDR-4
REPORT DATE: 24/07/18

Test Methods: AS1289.6.1.1, AS1289.1.1, AS1298.2.1.1, AS1289.5.1.1 T117, T118

Results

Laboratory Sample Number	L19	L20	L21	L22	L23	L24
Date Sampled	22/06/18	22/06/18	22/06/18	22/06/18	22/06/18	22/06/18
Material Description	Silty Clay, Light Brown	Silty Clay, Brown	Silty Clay, Brown	Silty Clay, Brown, traces of Gravel	Silty Clay, Brown, traces of Gravel	Silty Clay, Brown, traces of Gravel
Maximum Dry Density t/m^3	1.82	1.73	1.64	1.70	1.68	1.80
Optimum Moisture Content %	14.5	18.0	18.0	18.5	19.0	15.0
Field Moisture Content %	11.9	14.9	12.1	14.4	15.2	11.5
Oversize Material On 19mm Sieve %	0.0	0.0	0.0	0.0	0.0	0.0
Oversize Included Y/N	N	N	N	N	N	N
Dry Density before soak t/m^3	1.83	1.72	1.66	1.71	1.68	1.78
Dry Density after soak t/m^3	1.83	1.70	1.64	1.70	1.65	1.77
Moisture Content before soak %	14.6	17.8	18.2	18.3	19.2	15.0
Moisture Content after soak %	16.3	20.3	21.9	20.5	21.5	19.1
Moisture Content After Test-Top 30mm %	17.8	22.4	24.2	22.6	24.1	19.7
Moisture Content After Test- Whole Sample %	16.2	20.1	21.5	20.3	21.3	18.8
Density ratio before soaking %	100.4	99.6	101.0	100.5	100.1	99.1
Moisture ratio before soaking %	100.7	98.9	101.1	98.9	101.1	100.0
Period of soaking days	4	4	4	4	4	4
Compactive effort	Standard	Standard	Standard	Standard	Standard	Standard
Mass of Surcharge kg	4.5	4.5	4.5	4.5	4.5	4.5
Swell After Soaking %	0.4	2.1	0.9	1.6	1.9	0.9
Penetration mm	2.5	2.5	2.5	2.5	2.5	2.5
CBR Value %	11.0	3.0	7.0	5.0	4.0	13.0

Approved Signatory


Mitchell Toller
Principal

Date 24-07-18

California Bearing Ratio

CLIENT: Western Sydney Parklands Trust
PROJECT: Light Horse Interchange Business Hub
LOCATION: Wallgrove Road, Eastern Creek

JOB NO: DD-648
REPORT NO: DDR-6
REPORT DATE: 24/07/18

Test Methods: AS1289.6.1.1, AS1289.1.1, AS1298.2.1.1, AS1289.5.1.1 T117, T118

Results

Laboratory Sample Number	L25	L26	L27			
Date Sampled	22/06/18	22/06/18	22/06/18			
Material Description	Silty Clay, Brown	Silty Clay, Brown	Silty Clay, Brown, traces of Gravel			
Maximum Dry Density t/m^3	1.71	1.65	1.64			
Optimum Moisture Content %	18.0	20.0	20.5			
Field Moisture Content %	14.6	16.2	16.3			
Oversize Material On 19mm Sieve %	0.0	0.0	0.0			
Oversize Included Y/N	N	N	N			
Dry Density before soak t/m^3	1.72	1.63	1.64			
Dry Density after soak t/m^3	1.70	1.60	1.61			
Moisture Content before soak %	17.8	20.1	20.4			
Moisture Content after soak %	19.9	21.8	22.3			
Moisture Content After Test-Top 30mm %	21.7	23.0	24.7			
Moisture Content After Test- Whole Sample %	19.8	21.6	22.1			
Density ratio before soaking %	100.6	99.1	100.0			
Moisture ratio before soaking %	98.9	100.5	99.5			
Period of soaking days	4	4	4			
Compactive effort	Standard	Standard	Standard			
Mass of Surcharge kg	4.5	4.5	4.5			
Swell After Soaking %	1.4	2.2	2.0			
Penetration mm	2.5	2.5	2.5			
CBR Value %	5.0	4.0	4.5			

Approved Signatory


Mitchell Toffler
Principal

Date 24-07-18

CLIENT DETAILS

Contact Mitchell Tofler
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Project DD-648
Order Number (Not specified)
Samples 26

LABORATORY DETAILS

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SGS Reference SE181011 R0
Date Received 3/7/2018
Date Reported 6/7/2018

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES



Dong Liang
Metals/Inorganics Team Leader



Kamrul Ahsan
Senior Chemist

pH in soil (1:2) [AN101] Tested: 4/7/2018

			E1	E2	E3	E4	E5
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.001	SE181011.002	SE181011.003	SE181011.004	SE181011.005
pH (1:2)	pH Units	-	4.7	4.9	5.5	4.6	4.6

			E6	E7	E8	E9	E10
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.006	SE181011.007	SE181011.008	SE181011.009	SE181011.010
pH (1:2)	pH Units	-	5.0	4.9	4.5	4.4	4.6

			E11	E12	E13	E14	E15
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.011	SE181011.012	SE181011.013	SE181011.014	SE181011.015
pH (1:2)	pH Units	-	4.4	4.5	4.5	4.6	4.9

			E16	E17	E18	E19	E20
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.016	SE181011.017	SE181011.018	SE181011.019	SE181011.020
pH (1:2)	pH Units	-	4.9	5.8	6.2	5.0	5.4

			E21	E22	E23	E24	E25
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.021	SE181011.022	SE181011.023	SE181011.024	SE181011.025
pH (1:2)	pH Units	-	5.6	5.0	4.5	4.5	4.5

			E26
			SOIL
			-
			19/6/2018
PARAMETER	UOM	LOR	SE181011.026
pH (1:2)	pH Units	-	4.5

Conductivity (1:2) in soil [AN106] Tested: 4/7/2018

PARAMETER	UOM	LOR	E1	E2	E3	E4	E5
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018 SE181011.001	19/6/2018 SE181011.002	19/6/2018 SE181011.003	19/6/2018 SE181011.004	19/6/2018 SE181011.005
Conductivity (1:2) @25 C*	µS/cm	1	1200	1000	890	1600	1100
Resistivity (1:2)*	ohm cm	-	860	970	1100	640	880

PARAMETER	UOM	LOR	E6	E7	E8	E9	E10
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018 SE181011.006	19/6/2018 SE181011.007	19/6/2018 SE181011.008	19/6/2018 SE181011.009	19/6/2018 SE181011.010
Conductivity (1:2) @25 C*	µS/cm	1	640	580	1200	1200	800
Resistivity (1:2)*	ohm cm	-	1600	1700	830	830	1200

PARAMETER	UOM	LOR	E11	E12	E13	E14	E15
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018 SE181011.011	19/6/2018 SE181011.012	19/6/2018 SE181011.013	19/6/2018 SE181011.014	19/6/2018 SE181011.015
Conductivity (1:2) @25 C*	µS/cm	1	960	990	970	1100	930
Resistivity (1:2)*	ohm cm	-	1000	1000	1000	880	1100

PARAMETER	UOM	LOR	E16	E17	E18	E19	E20
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018 SE181011.016	19/6/2018 SE181011.017	19/6/2018 SE181011.018	19/6/2018 SE181011.019	19/6/2018 SE181011.020
Conductivity (1:2) @25 C*	µS/cm	1	1100	890	830	1800	510
Resistivity (1:2)*	ohm cm	-	880	1100	1200	540	2000

PARAMETER	UOM	LOR	E21	E22	E23	E24	E25
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018 SE181011.021	19/6/2018 SE181011.022	19/6/2018 SE181011.023	19/6/2018 SE181011.024	19/6/2018 SE181011.025
Conductivity (1:2) @25 C*	µS/cm	1	570	610	900	860	760
Resistivity (1:2)*	ohm cm	-	1700	1600	1100	1200	1300

PARAMETER	UOM	LOR	E26
			SOIL
			-
			19/6/2018 SE181011.026
Conductivity (1:2) @25 C*	µS/cm	1	830
Resistivity (1:2)*	ohm cm	-	1200

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography [AN245] Tested: 4/7/2018

PARAMETER	UOM	LOR	E1	E2	E3	E4	E5
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018 SE181011.001	19/6/2018 SE181011.002	19/6/2018 SE181011.003	19/6/2018 SE181011.004	19/6/2018 SE181011.005
Chloride	mg/kg	0.25	700	630	530	990	690
Sulfate	mg/kg	0.5	200	100	98	170	120

PARAMETER	UOM	LOR	E6	E7	E8	E9	E10
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018 SE181011.006	19/6/2018 SE181011.007	19/6/2018 SE181011.008	19/6/2018 SE181011.009	19/6/2018 SE181011.010
Chloride	mg/kg	0.25	300	270	780	770	420
Sulfate	mg/kg	0.5	85	74	150	140	68

PARAMETER	UOM	LOR	E11	E12	E13	E14	E15
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018 SE181011.011	19/6/2018 SE181011.012	19/6/2018 SE181011.013	19/6/2018 SE181011.014	19/6/2018 SE181011.015
Chloride	mg/kg	0.25	580	570	610	780	610
Sulfate	mg/kg	0.5	74	130	150	150	68

PARAMETER	UOM	LOR	E16	E17	E18	E19	E20
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018 SE181011.016	19/6/2018 SE181011.017	19/6/2018 SE181011.018	19/6/2018 SE181011.019	19/6/2018 SE181011.020
Chloride	mg/kg	0.25	790	560	500	1300	270
Sulfate	mg/kg	0.5	91	95	79	180	110

PARAMETER	UOM	LOR	E21	E22	E23	E24	E25
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018 SE181011.021	19/6/2018 SE181011.022	19/6/2018 SE181011.023	19/6/2018 SE181011.024	19/6/2018 SE181011.025
Chloride	mg/kg	0.25	320	320	560	520	420
Sulfate	mg/kg	0.5	110	110	180	170	120

PARAMETER	UOM	LOR	E26
			SOIL
			-
			19/6/2018 SE181011.026
Chloride	mg/kg	0.25	490
Sulfate	mg/kg	0.5	130

pH in soil (1:5) [AN101] Tested: 4/7/2018

			E1	E2	E3	E4	E5
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.001	SE181011.002	SE181011.003	SE181011.004	SE181011.005
pH	pH Units	0.1	5.4	5.7	6.3	5.1	5.3

			E6	E7	E8	E9	E10
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.006	SE181011.007	SE181011.008	SE181011.009	SE181011.010
pH	pH Units	0.1	5.9	6.0	5.4	5.2	5.4

			E11	E12	E13	E14	E15
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.011	SE181011.012	SE181011.013	SE181011.014	SE181011.015
pH	pH Units	0.1	5.6	5.4	5.4	5.4	5.8

			E16	E17	E18	E19	E20
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.016	SE181011.017	SE181011.018	SE181011.019	SE181011.020
pH	pH Units	0.1	5.9	6.7	7.1	5.7	6.2

			E21	E22	E23	E24	E25
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.021	SE181011.022	SE181011.023	SE181011.024	SE181011.025
pH	pH Units	0.1	6.2	5.5	5.4	5.3	5.3

			E26
			SOIL
			-
			19/6/2018
PARAMETER	UOM	LOR	SE181011.026
pH	pH Units	0.1	5.4

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122] Tested: 4/7/2018

PARAMETER	UOM	LOR	E1	E2	E3	E4	E5
			SOIL	SOIL	SOIL	SOIL	SOIL
			19/6/2018 SE181011.001	19/6/2018 SE181011.002	19/6/2018 SE181011.003	19/6/2018 SE181011.004	19/6/2018 SE181011.005
Exchangeable Sodium, Na	mg/kg	2	580	1100	580	950	580
Exchangeable Sodium, Na	meq/100g	0.01	2.5	4.7	2.5	4.1	2.5
Exchangeable Sodium Percentage*	%	0.1	14.0	20.9	24.4	22.0	15.8
Exchangeable Potassium, K	mg/kg	2	170	220	70	160	120
Exchangeable Potassium, K	meq/100g	0.01	0.43	0.57	0.18	0.40	0.31
Exchangeable Potassium Percentage*	%	0.1	2.4	2.5	1.7	2.1	1.9
Exchangeable Calcium, Ca	mg/kg	2	470	26	92	65	120
Exchangeable Calcium, Ca	meq/100g	0.01	2.3	0.13	0.46	0.32	0.61
Exchangeable Calcium Percentage*	%	0.1	13.0	0.6	4.4	1.7	3.8
Exchangeable Magnesium, Mg	mg/kg	2	1500	2100	880	1700	1500
Exchangeable Magnesium, Mg	meq/100g	0.02	13	17	7.2	14	13
Exchangeable Magnesium Percentage*	%	0.1	70.5	76.0	69.4	74.1	78.5
Cation Exchange Capacity	meq/100g	0.02	18	22	10	19	16

PARAMETER	UOM	LOR	E6	E7	E8	E9	E10
			SOIL	SOIL	SOIL	SOIL	SOIL
			19/6/2018 SE181011.006	19/6/2018 SE181011.007	19/6/2018 SE181011.008	19/6/2018 SE181011.009	19/6/2018 SE181011.010
Exchangeable Sodium, Na	mg/kg	2	800	650	960	1000	710
Exchangeable Sodium, Na	meq/100g	0.01	3.5	2.8	4.2	4.4	3.1
Exchangeable Sodium Percentage*	%	0.1	26.8	26.4	20.5	18.9	19.8
Exchangeable Potassium, K	mg/kg	2	98	85	200	230	130
Exchangeable Potassium, K	meq/100g	0.01	0.25	0.22	0.52	0.58	0.34
Exchangeable Potassium Percentage*	%	0.1	1.9	2.0	2.5	2.5	2.2
Exchangeable Calcium, Ca	mg/kg	2	25	13	18	37	34
Exchangeable Calcium, Ca	meq/100g	0.01	0.13	0.07	0.09	0.19	0.17
Exchangeable Calcium Percentage*	%	0.1	1.0	0.6	0.4	0.8	1.1
Exchangeable Magnesium, Mg	mg/kg	2	1100	930	1900	2200	1500
Exchangeable Magnesium, Mg	meq/100g	0.02	9.1	7.6	16	18	12
Exchangeable Magnesium Percentage*	%	0.1	70.3	71.0	76.6	77.9	76.9
Cation Exchange Capacity	meq/100g	0.02	13	11	20	23	16

PARAMETER	UOM	LOR	E11	E12	E13	E14	E15
			SOIL	SOIL	SOIL	SOIL	SOIL
			19/6/2018 SE181011.011	19/6/2018 SE181011.012	19/6/2018 SE181011.013	19/6/2018 SE181011.014	19/6/2018 SE181011.015
Exchangeable Sodium, Na	mg/kg	2	890	910	960	870	860
Exchangeable Sodium, Na	meq/100g	0.01	3.9	4.0	4.2	3.8	3.7
Exchangeable Sodium Percentage*	%	0.1	21.8	20.6	20.0	18.4	18.3
Exchangeable Potassium, K	mg/kg	2	150	180	180	200	150
Exchangeable Potassium, K	meq/100g	0.01	0.37	0.46	0.46	0.50	0.39
Exchangeable Potassium Percentage*	%	0.1	2.1	2.4	2.2	2.4	1.9
Exchangeable Calcium, Ca	mg/kg	2	18	37	99	66	18
Exchangeable Calcium, Ca	meq/100g	0.01	0.09	0.19	0.49	0.33	0.09
Exchangeable Calcium Percentage*	%	0.1	0.5	1.0	2.4	1.6	0.4
Exchangeable Magnesium, Mg	mg/kg	2	1600	1800	1900	1900	2000
Exchangeable Magnesium, Mg	meq/100g	0.02	13	15	16	16	16
Exchangeable Magnesium Percentage*	%	0.1	75.6	76.0	75.4	77.6	79.3
Cation Exchange Capacity	meq/100g	0.02	18	19	21	21	20

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122] Tested: 4/7/2018 (continued)

PARAMETER	UOM	LOR	E16	E17	E18	E19	E20
			SOIL	SOIL	SOIL	SOIL	SOIL
			19/6/2018 SE181011.016	19/6/2018 SE181011.017	19/6/2018 SE181011.018	19/6/2018 SE181011.019	19/6/2018 SE181011.020
Exchangeable Sodium, Na	mg/kg	2	940	630	700	790	910
Exchangeable Sodium, Na	meq/100g	0.01	4.1	2.8	3.0	3.4	3.9
Exchangeable Sodium Percentage*	%	0.1	20.7	28.7	32.2	24.2	22.4
Exchangeable Potassium, K	mg/kg	2	160	55	58	100	120
Exchangeable Potassium, K	meq/100g	0.01	0.40	0.14	0.15	0.26	0.30
Exchangeable Potassium Percentage*	%	0.1	2.1	1.5	1.6	1.8	1.7
Exchangeable Calcium, Ca	mg/kg	2	8	13	5	15	12
Exchangeable Calcium, Ca	meq/100g	0.01	0.04	0.06	0.02	0.08	0.06
Exchangeable Calcium Percentage*	%	0.1	0.2	0.7	0.2	0.5	0.3
Exchangeable Magnesium, Mg	mg/kg	2	1800	810	760	1300	1600
Exchangeable Magnesium, Mg	meq/100g	0.02	15	6.6	6.2	10	13
Exchangeable Magnesium Percentage*	%	0.1	77.0	69.1	66.0	73.5	75.5
Cation Exchange Capacity	meq/100g	0.02	20	9.6	9.4	14	18

PARAMETER	UOM	LOR	E21	E22	E23	E24	E25
			SOIL	SOIL	SOIL	SOIL	SOIL
			19/6/2018 SE181011.021	19/6/2018 SE181011.022	19/6/2018 SE181011.023	19/6/2018 SE181011.024	19/6/2018 SE181011.025
Exchangeable Sodium, Na	mg/kg	2	960	830	910	870	840
Exchangeable Sodium, Na	meq/100g	0.01	4.2	3.6	4.0	3.8	3.7
Exchangeable Sodium Percentage*	%	0.1	23.4	18.7	19.2	19.4	21.0
Exchangeable Potassium, K	mg/kg	2	120	110	210	180	160
Exchangeable Potassium, K	meq/100g	0.01	0.31	0.27	0.54	0.47	0.41
Exchangeable Potassium Percentage*	%	0.1	1.7	1.4	2.6	2.4	2.4
Exchangeable Calcium, Ca	mg/kg	2	13	6	21	16	47
Exchangeable Calcium, Ca	meq/100g	0.01	0.06	0.03	0.11	0.08	0.23
Exchangeable Calcium Percentage*	%	0.1	0.4	0.1	0.5	0.4	1.3
Exchangeable Magnesium, Mg	mg/kg	2	1600	1900	2000	1900	1600
Exchangeable Magnesium, Mg	meq/100g	0.02	13	15	16	15	13
Exchangeable Magnesium Percentage*	%	0.1	74.5	79.8	77.7	77.8	75.3
Cation Exchange Capacity	meq/100g	0.02	18	19	21	20	17

PARAMETER	UOM	LOR	E26
			SOIL
			19/6/2018 SE181011.026
Exchangeable Sodium, Na	mg/kg	2	1200
Exchangeable Sodium, Na	meq/100g	0.01	5.0
Exchangeable Sodium Percentage*	%	0.1	31.1
Exchangeable Potassium, K	mg/kg	2	140
Exchangeable Potassium, K	meq/100g	0.01	0.37
Exchangeable Potassium Percentage*	%	0.1	2.3
Exchangeable Calcium, Ca	mg/kg	2	14
Exchangeable Calcium, Ca	meq/100g	0.01	0.07
Exchangeable Calcium Percentage*	%	0.1	0.4
Exchangeable Magnesium, Mg	mg/kg	2	1300
Exchangeable Magnesium, Mg	meq/100g	0.02	11
Exchangeable Magnesium Percentage*	%	0.1	66.3
Cation Exchange Capacity	meq/100g	0.02	16

Moisture Content [AN002] Tested: 3/7/2018

			E1	E2	E3	E4	E5
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.001	SE181011.002	SE181011.003	SE181011.004	SE181011.005
% Moisture	%w/w	0.5	15.1	16.7	10.1	15.1	13.2

			E6	E7	E8	E9	E10
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.006	SE181011.007	SE181011.008	SE181011.009	SE181011.010
% Moisture	%w/w	0.5	11.8	9.7	12.6	14.3	11.4

			E11	E12	E13	E14	E15
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.011	SE181011.012	SE181011.013	SE181011.014	SE181011.015
% Moisture	%w/w	0.5	12.8	12.5	13.6	13.8	14.3

			E16	E17	E18	E19	E20
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.016	SE181011.017	SE181011.018	SE181011.019	SE181011.020
% Moisture	%w/w	0.5	14.0	12.5	13.7	13.2	15.3

			E21	E22	E23	E24	E25
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			19/6/2018	19/6/2018	19/6/2018	19/6/2018	19/6/2018
PARAMETER	UOM	LOR	SE181011.021	SE181011.022	SE181011.023	SE181011.024	SE181011.025
% Moisture	%w/w	0.5	16.1	15.6	15.6	14.8	14.0

			E26
			SOIL
			-
			19/6/2018
PARAMETER	UOM	LOR	SE181011.026
% Moisture	%w/w	0.5	11.2

METHOD

METHODOLOGY SUMMARY

AN002

The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.

AN101

pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl₂) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H⁺.

AN106

Conductivity : Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:2 and the EC determined and reported on the extract basis after the 1 hour extraction (EC(1:2)) or after the 1 hour extraction and overnight aging (EC(1:2) aged). Reference APHA 2510 B.

AN106

Resistivity of the extract is reported on the extract basis and is the reciprocal of conductivity. Salinity and TDS can be calculated from the extract conductivity and is reported back to the soil basis.

AN122

Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pre-treated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.

AN122

The Exchangeable Sodium Percentage (ESP) is calculated as the exchangeable sodium divided by the CEC (all in meq/100g) times 100.

ESP can be used to categorise the sodicity of the soil as below :

ESP < 6%	non-sodic
ESP 6-15%	sodic
ESP >15%	strongly sodic

Method is referenced to Rayment and Lyons, 2011, sections 15D3 and 15N1.-

AN245

Anions by Ion Chromatography: A water sample or extract is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO₂, NO₃ and SO₄ are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
		IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- 1 Bq is equivalent to 27 pCi
- 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf>

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