REPORT TO

HEALTH INFRASTRUCTURE NSW

ON

ENVIRONMENTAL SITE ASSESSMENT

FOR

PROPOSED OPERATING THEATRE UPGRADE

AT

SUTHERLAND HOSPITAL
CORNER OF KINGSWAY & KAREENA ROAD
CARINGBAH, NSW

Date: 2 February 2021
Ref: E33141PArptRev1

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Executive Summary

Health Infrastructure NSW ('the client') commissioned JK Environments (JKE) to undertake an Environmental Site Assessment (ESA) for the proposed operating theatre upgrade at Sutherland Hospital on the corner of Kingsway & Kareena Road, Caringbah, NSW. The site location is shown on Figure 1 and the assessment was confined to the site boundaries as shown on Figure 2.

This report has been prepared to support and to inform the design and construction of upgrades for The Sutherland Hospital Operating Theatre Upgrade project. Based on the Request for Tender (RFT) documentation provided, we understand the operating theatre upgrade includes a three-storey western extension to the main existing hospital building and minimal refurbishment works.

A geotechnical investigation was undertaken in conjunction with this ESA by JK Geotechnics (JKG). The results of the geotechnical investigation are presented in a separate report.

The primary aims of the investigation were to identify any past or present potentially contaminating activities at the site, identify the potential for site contamination, and make a preliminary assessment of the soil contamination conditions. The objectives were to:

- Provide an appraisal of the past site use(s) based on a review of historical records;
- Assess the current site conditions and use(s) via a site walkover inspection;
- Identify potential contamination sources/areas of environmental concern (AEC) and contaminants of potential concern (CoPC);
- Assess the soil contamination conditions via implementation of a preliminary sampling and analysis program;
- Prepare a conceptual site model (CSM);
- Assess the potential risks posed by contamination to the receptors identified in the CSM (Tier 1 assessment);
- Provide a preliminary waste classification for off-site disposal of in-situ soil;
- Assess whether the site is suitable or can be made suitable for the proposed development (from a contamination viewpoint);
- Assess whether further intrusive investigation and/or remediation is required; and
- Provide an appraisal of hazardous materials present at the site based on the desktop review of available information and the site walkover.

The scope of work included the following:

- Review of site information, including background and site history information from a Lotsearch Pty Ltd Environmental Risk and Planning Report and other sources;
- Preparation of a CSM;
- Design and implementation of a sampling, analysis and quality plan (SAQP);
- Interpretation of the analytical results against the adopted Site Assessment Criteria (SAC);
- Data Quality Assessment; and
- Preparation of a report including a Tier 1 risk assessment.

The investigation included a review of historical information and soil sampling from a total of four boreholes. The site area was part of a wider Sutherland Hospital premises since at least 1956 and was used predominantly as a carpark/accessway since at least 2005. A Woolworths service station was noted to be located 150m to the north/north-west (up-gradient) of the site which is considered to be a potential source of contamination. This property is notified to the EPA and is currently regulated under the CLM Act.

The investigation identified elevations of Total PAHs, carcinogenic PAHs, Benzo(a)pyrene and nickel contamination in soils on site and within the areas of proposed development works. The source of contamination was identified as the fill material historically imported onto the site. The contaminants requiring remediation include: Total PAHs and carcinogenic PAHs within the northern part of the site area, and TRH F3, Benzo(a)pyrene and nickel identified also within

northern as well as southern parts of the site which poses a risk to ecological receptors. These TRH exceedances where co-located with carcinogenic PAHs requiring remediation due to the potential risk to human health.

Although the contaminants in the soil were assessed to pose a potential risk, currently the site is largely paved and there are no complete source-pathway-receptor (SPR) linkages to the contamination. On this basis, we are of the opinion that interim management of contamination risks (e.g. via an interim Environmental Management Plan) is not considered to be required prior to commencement of the proposed development. If the proposed development does not commence within two years of the date of this report, JKE should be contacted to provide further advice in this regard.

Asbestos Containing Materials (ACM) and/or potential ACM has been identified within areas of proposed upgrades and refurbishments (i.e. western part of the Main Building A) which are likely to be disturbed as part of the proposed works. Further characterization and controlled management of these materials is required as part of the proposed works.

Based on the findings of the assessment, JKE are of the opinion that the site can be made suitable for the proposed development described in Section 1.1, subject to the implementation of the following recommendations:

- Prepare a RAP to address the data gaps and contamination issues identified at the site. This will include the requirements to complete the data gap assessment including groundwater assessment utilising the existing groundwater wells on site and the preparation of an unexpected find protocol (UFP);
- Undertake a validation assessment documenting the remediation works;
- Prior to any refurbishment and/or demolition/dismantling works proposed as part of the upgrades a detailed/destructive hazardous materials survey should be undertaken on all parts of the building which will be affected by the proposed works by a qualified and competent person to confirm the presence and extent of any existing and additional hazardous materials including those identified by JKE's inspection; and
- Any ACMs/PACMs identified within areas likely to be disturbed by the proposed upgrades should be removed by a licensed contractor prior to these works being undertaken. All removal works should be undertaken in accordance with Safe Work NSW (2016) – Code of Practice – How to Safely Remove Asbestos. A clearance inspection and certificate should be produced by a licenced Asbestos Assessor upon completion of all required removal works and prior to any refurbishment or demolition works taking place.

The conclusions and recommendations should be read in conjunction with the limitations presented in the body of this report.

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Attachments

Abbreviations

Asbestos Fines/Fibrous Asbestos	**AF/FA**
Ambient Background Concentrations	**ABC**
Added Contaminant Limits	**ACL**
Asbestos Containing Material	**ACM**
Australian Drinking Water Guidelines	**ADWG**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Above-Ground Storage Tank	**AST**
Below Ground Level	**BGL**
Benzo(a)pyrene Toxicity Equivalent Factor	**BaP TEQ**
Bureau of Meteorology	**BOM**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Cation Exchange Capacity	**CEC**
Contaminated Land Management	**CLM**
Contaminant(s) of Potential Concern	**CoPC**
Chain of Custody	**COC**
Conceptual Site Model	**CSM**
Development Application	**DA**
Dial Before You Dig	**DBYD**
Data Quality Indicator	**DQI**
Data Quality Objective	**DQO**
Detailed Site Investigation	**DSI**
Ecological Investigation Level	**EIL**
Ecological Screening Level	**ESL**
Environmental Management Plan	**EMP**
Excavated Natural Material	**ENM**
Environment Protection Authority	**EPA**
Environmental Site Assessment	**ESA**
Ecological Screening Level	**ESL**
Fibre Cement Fragment(s)	**FCF**
General Approval of Immobilisation	**GAI**
Health Investigation Level	**HILs**
Hardness Modified Trigger Values	**HMTV**
Health Screening Level	**HSL**
Health Screening Level-Site Specific Assessment	**HSL-SSA**
International Organisation of Standardisation	**ISO**
JK Environments	**JKE**
Lab Control Spike	**LCS**
Light Non-Aqueous Phase Liquid	**LNAPL**
Map Grid of Australia	**MGA**
National Association of Testing Authorities	**NATA**
National Environmental Protection Measure	**NEPM**
Organochlorine Pesticides	**OCP**
Organophosphate Pesticides	**OPP**
Polycyclic Aromatic Hydrocarbons	**PAH**
Potential ASS	**PASS**
Polychlorinated Biphenyls	**PCBs**
Per-and Polyfluoroalkyl Substances	**PFAS**
Photo-ionisation Detector	**PID**
Protection of the Environment Operations	**POEO**
Practical Quantitation Limit	**PQL**
Quality Assurance	**QA**

Quality Control	**QC**
Remediation Action Plan	**RAP**
Relative Percentage Difference	**RPD**
Site Assessment Criteria	**SAC**
Sampling, Analysis and Quality Plan	**SAQP**
Site Audit Statement	**SAS**
Site Audit Report	**SAR**
Site Specific Assessment	**SSA**
Source, Pathway, Receptor	**SPR**
Specific Contamination Concentration	**SCC**
Standard Penetration Test	**SPT**
Standard Sampling Procedure	**SSP**
Standing Water Level	**SWL**
Trip Blank	**TB**
Toxicity Characteristic Leaching Procedure	**TCLP**
Total Recoverable Hydrocarbons	**TRH**
Trip Spike	**TS**
Upper Confidence Limit	**UCL**
United States Environmental Protection Agency	**USEPA**
Underground Storage Tank	**UST**
Virgin Excavated Natural Material	**VENM**
Volatile Organic Compounds	**VOC**
World Health Organisation	**WHO**
Work Health and Safety	**WHS**

Units

Litres	**L**
Metres BGL	**mBGL**
Metres	**m**
Millivolts	**mV**
Millilitres	**ml or mL**
Milliequivalents	**meq**
micro Siemens per Centimetre	**µS/cm**
Micrograms per Litre	**µg/L**
Milligrams per Kilogram	**mg/kg**
Milligrams per Litre	**mg/L**
Parts Per Million	**ppm**
Percentage	**%**

1 INTRODUCTION

Health Infrastructure NSW ('the client') commissioned JK Environments (JKE) to undertake an Environmental Site Assessment (ESA) for the proposed operating theatre upgrade at Sutherland Hospital on the corner of Kingsway & Kareena Road, Caringbah, NSW. The site location is shown on Figure 1 and the assessment was confined to the site boundaries as shown on Figure 2 attached in the appendices.

The assessment was limited to the proposed development area only which occupies the north-western section of the property, as shown on Figure 2. For the purpose of this report, the assessment area has been referred to as 'the site', whilst the whole property has been referred to as 'the wider hospital site'.

This report has been prepared to support and to inform the design and construction of upgrades for The Sutherland Hospital Operating Theatre Upgrade project.

A geotechnical investigation was undertaken in conjunction with this assessment by JK Geotechnics (JKG). The results of the investigation are presented in a separate report (Ref: 33141LXrpt, dated 9 June 2020)[1]. This report should be read in conjunction with the JKG report.

1.1 Proposed Development Details

Based on the information provided, we understand the operating theatre upgrade includes a three-storey western extension to the main existing hospital building and minimal refurbishment works. No new basement levels are being proposed as part of the upgrades and the ground floor level at, or close to the ground floor levels of the existing hospital. It is likely reconstruction of sections of the existing 'Carpark 3' would be required as part of the works.

1.2 Aims and Objectives

The primary aims of the assessment were to identify any past or present potentially contaminating activities at the site, identify the potential for site contamination, and make a preliminary assessment of the soil contamination conditions. The assessment objectives were to:

- Provide an appraisal of the past site use(s) based on a review of historical records;
- Assess the current site conditions and use(s) via a site walkover inspection;
- Identify potential contamination sources/areas of environmental concern (AEC) and contaminants of potential concern (CoPC);
- Assess the soil contamination conditions via implementation of a preliminary sampling and analysis program;
- Prepare a conceptual site model (CSM);
- Assess the potential risks posed by contamination to the receptors identified in the CSM (Tier 1 assessment);
- Provide a preliminary waste classification for off-site disposal of soil;
- Assess whether the site is suitable or can be made suitable for the proposed development (from a contamination viewpoint);

[1] Referred to as JKG report

- Assess whether further intrusive investigation and/or remediation is required; and
- Provide an appraisal of hazardous materials present at the site based on the desktop review of available information and the site walkover.

1.3 Scope of Work

The assessment was undertaken generally in accordance with a JKE proposal (Ref: EP51464P-Rev3) of 6 April 2020 and was commissioned by the client via Letter of Award (Contract No. HI20115) of 14 April 2020. The scope of work included the following:

- Review of site information, including background and site history information from a Lotsearch Pty Ltd *Environmental Risk and Planning Report* and other sources;
- Preparation of a CSM;
- Design and implementation of a sampling, analysis and quality plan (SAQP);
- Interpretation of the analytical results against the adopted Site Assessment Criteria (SAC);
- Data Quality Assessment; and
- Preparation of a report including a Tier 1 risk assessment.

The scope of work was undertaken with reference to the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)[2], other guidelines made under or with regards to the Contaminated Land Management Act (1997)[3] and State Environmental Planning Policy No.55 – Remediation of Land (1998)[4]. A list of reference documents/guidelines is included in the appendices.

[2] National Environment Protection Council (NEPC), (2013). *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).* (referred to as NEPM 2013)

[3] Contaminated Land Management Act 1997 (NSW) (referred to as CLM Act 1997)

[4] *State Environmental Planning Policy No. 55 – Remediation of Land 1998* (NSW) (referred to as SEPP55)

2 SITE INFORMATION

2.1 Background

2.1.1 Hazardous Materials Register by Greencap

Asbestos containing materials (ACMs) and potential asbestos containing materials (PACMs) have previously been identified on site associated with the Sutherland Hospital – Main Building (A) and were listed in the Hazardous Materials Register prepared by Greencap in August 2015. This building was estimated to have been constructed circa 1960s.

Friable and non-friable ACMs and PACMs were confirmed by sampling or presumed to be present in the following locations:

- Level 1 Exterior – east courtyard – awning, flat cement sheeting;
- Level 1 Interior – walkway between corridor (west) – insulation within fire doors;
- Level 1 Interior – throughout – electrical distribution board, bituminous material and electric panels;
- Level 1 Interior – south western part of the building – suspended ceiling panels, compressed cement sheeting;
- Level 1 Interior – south west part – suspended ceiling, non-hazardous material;
- Level 1 Interior – air handling room – air conditioning ductwork, mastic sealant;
- Level 1 Interior – some of the internal kitchen areas –ceiling panels, compressed cement sheeting;
- Level 1 Interior – kitchen areas – insulation within fire doors;
- Level 1 Interior – emergency escape fire stairs areas – insulation within fire doors;
- Level 2 Interior – central corridor – insulation within fire doors;
- Level 2 Interior – throughout kiosk area – suspended ceiling panels, compressed cement sheeting;
- Level 2 Interior – various parts of the building – insulation within fire doors;
- Level 3 Exterior – building perimeter (west) – window louvers, compressed cement sheeting;
- Level 3 Exterior – plant room (south) – roof-bituminous membrane;
- Level 3 Exterior – platform (Level 2 roof) (north-west) – roof-bituminous membrane;
- Level 3 Exterior – southern part of the building – eaves, fibre cement sheeting;
- Level 3 Interior – central and north-west fire stairs – air conditioning ductwork, mastic sealant;
- Level 3 Interior – north-west fire stairs – insulation within fire doors;
- Level 3 Interior – plant room (north-east) – air conditioning ductwork, mastic sealant;
- Level 3 Interior – plant room (south-east) – electrical distribution board, bituminous material;
- Level 4 Exterior – throughout courtyard– awnings and eaves, fibre cement sheeting;
- Level 4 Exterior – building perimeter (west) – window louvers, compressed cement sheeting;
- Level 4 Exterior – throughout exterior platform and south perimeter – waterproof membrane, bituminous material;
- Level 4 Exterior – roof (north-east) and surrounding the building – eaves, fibre cement sheeting;
- Level 4 Interior – walkway between corridors – double insulation within fire door;
- Level 4 Interior – fire stairs –insulation within fire doors;
- Level 4 Interior – records active room – suspended ceiling panels, compressed cement sheeting;
- Level 5 Interior – fire stairs, north-east, south-east, south-west and north-west risers – insulation within fire doors;

- Level 5 Interior – south-west boiler plant room, fan rooms within north-east, south-east and north-west risers – air conditioning ductwork, mastic sealant; and
- Roof Level Exterior – roof, throughout – roof covering and lining, bituminous membrane.

Synthetic Mineral Fibre (SMF) was listed to be present throughout the site as insulation beneath the roof (roof lining), within boilers and hot water units, around pipe / ductwork insulation and as ceiling tiles.

Polychlorinated Biphenyls (PCBs) containing equipment was listed to be present associated with the fluorescent light fittings observed in some of the plantrooms within the building.

2.1.2 Previous Investigations by Douglas Partners (DP)

Douglas Partners Pty Ltd (DP) have previously prepared the following reports to support the most recent development and upgrade works for the wider Sutherland Hospital Planning Project:

- Report on Preliminary Site Investigation (Contamination) Rev 0 dated 17 July 2014; and
- Report on Detailed Site Investigation (Contamination) Rev 0 dated 24 November 2014.

Both of these reports were prepared for the wider redevelopment area which did not specifically include the site area subject of this investigation. The area investigated by DP was situated north-west of the site. Soil testing results were therefore not considered as part of the investigation and no reliance has been made on any of the aforementioned reports prepared by DP.

2.2 Site Identification

Table 2-1: Site Identification

Current Site Owner:	The Minister of Health
Site Address:	Corner of Kingsway & Kareena Road, Caringbah, NSW
Lot & Deposited Plan:	Part of Lot 1 in DP432283 Part of Lot 1 in DP398975 Part of Lot 1 in DP119519
Current Land Use:	Sutherland Hospital
Proposed Land Use:	Sutherland Hospital
Local Government Authority:	Sutherland Shire Council
Current Zoning:	SP1 – Special Activities – Health Services Facilities
Site Area (m^2) (approx.):	1,900
RL (AHD in m) (approx.):	40-42
Geographical Location (decimal degrees) (approx.):	Latitude: -34.036829 Longitude: 151.114518

Site Location Plan:	Figure 1
Sample Location Plan:	Figure 2
Site Contamination Plan:	Figure 3

2.3 Site Location and Regional Setting

The wider hospital site is located in a predominantly residential and commercial area of Caringbah and is bound by Kareena Road to the west, Kingsway to the north, railway corridor (Eastern Suburbs and Illawarra Line) to the south and residential properties to the east. Predominantly residential type properties were also located further to the north and to the west across bounding streets with some commercial land uses (including private hospital) identified to the north-west. The site is located approximately 650m to the north of Yowie Bay.

2.4 Topography

The characteristics of the regional topography suggests the site is located midway on a local hillside which falls to the south at approximately 3˚ towards Yowie Bay. Parts of the site appear to have been levelled to account for the slope and accommodate the existing development.

2.5 Site Inspection

A walkover inspection of the site was undertaken by JKE on 7 May 2020. The inspection was limited to accessible areas of the site and immediate surrounds. An internal inspection of buildings was not undertaken. Selected site photographs obtained during the inspection are attached in the appendices.

A summary of the inspection findings is outlined in the following subsections:

2.5.1 Current Site Use and/or Indicators of Former Site Use

At the time of the inspection, the site comprised a relatively flat area at the western end of wider Sutherland Hospital site as depicted on Figures 1 and 2.

2.5.2 Buildings, Structures and Roads

The site included eastern part of Carpark 3 and surrounds, western parts of the main hospital building, access roads and a foot path. The carpark was retained by a concrete block masonry wall which was approximately 0.5m to 0.9m high.

2.5.3 Boundary Conditions, Soil Stability and Erosion

Boundaries have not been exactly defined for the site, however visual inspection of the site extents revealed no obvious signs of erosion.

2.5.4 Visible or Olfactory Indicators of Contamination

Buildings identified to be present at the wider site appeared to have been constructed in different time periods. Based on the age of some of these buildings, it is considered likely that hazardous building materials including asbestos could potentially be present at the site.

No obvious visible or olfactory signs of contamination were observed during drilling works on site.

2.5.5 Presence of Drums/Chemicals, Waste and Fill Material

A review of the chemicals used and stored within the wider site was not undertaken. JKE presumed that various hospital grade chemicals were used at the wider site.

Fill soils were encountered within all boreholes drilled during fieldworks. More than one fill material layer was identified in some of the boreholes which is indicative of cut/fill activities across parts of the site for levelling purposes. Fill embankment approximately 0.5-1.0m high was noted for the vegetated area south of Carpark 3. No information regarding potential source of identified fill material was provided.

2.5.6 Drainage and Services

A stormwater drainage appeared to be provided along the access roads through the site, with stormwater collection pit and underground overflow detection tank/s noted to have been situated beneath the access road in the central part of the site. Numerous services were also noted to be present beneath the access roads through the site.

2.5.7 Sensitive Environments

Sensitive environments such as wetlands, ponds, creeks or extensive areas of natural vegetation were not identified at the site.

2.5.8 Landscaped Areas and Visible Signs of Plant Stress

Vegetated area was located immediately south of Carpark 3 and was overgrown with grasses containing a number of scattered medium to large trees area and fill embankment as described above. No obvious signs of vegetation stress or grass dieback were observed anywhere on site.

2.5.9 Hazardous Building Materials

Hazardous building material inspection was limited to accessible external areas associated with the western façade of Main Building A were refurbishment and additions are proposed as part of the upgrades.

JKE's inspection confirmed the ACMs/PACMs listed in the Hazardous Materials Register associated with this part of the Main Building. All inspected ACMs/PACMs were non-friable and identified to be in good or fair condition.

Confirmed ACMs/PACMs for the western façade of Main Building included:

- Levels 2 and 3 Exterior – building perimeter (west) – window louvers, compressed cement sheeting;
- All observed levels Exterior – throughout the western façade of the building – eaves and awnings, fibre cement sheeting;
- Level 1 Interior – south western part of the building (flu/covid clinic) – suspended ceiling panels, compressed cement sheeting;
- Roof Level Exterior – roof, throughout – roof covering and lining, bituminous membrane; and
- Level 3 Exterior – plant room (south) – roof-bituminous membrane.

Our inspection also identified a number of additional PACMs present associated with the western façade of Main Building which were not listed within the register. These PACMs consisted of:

- Levels 1 (ground level) – entrance to flu/covid clinic – structural joint mastic material within the awning structure;
- Levels 1 (ground level) – entrance to flu/covid clinic – fibre cement sheeting panels to various parts of the awning structure;
- Building Exterior (south-west) –brick veneer façade – movement joint mastic; and
- Telstra pits exterior to the building within western/south-western parts of the site.

No samples of PACMs could be collected for analysis due to the nature of identified PACMs and OHS risks associated with access.

The remaining hazardous materials (i.e. SMF and PCBs) were not confirmed during our inspection which was limited to accessible external areas of the site.

2.6 Surrounding Land Use

During the site inspection, JKE observed the following land uses in the immediate surrounds:

- North – Carpark 2, NSW Pathology Health and Administration building, accessing roads and footpath;
- North-west – Ambulance Bay and Emergency Department of Sutherland hospital;
- South / south-east – Accessing Road and Ambulance Station;
- East – Carpark 3 beyond which was Kareena Road; and
- West / south-west – Main Hospital Building.

JKE did not observe any land uses in the immediate surrounds that were identified as potential contamination sources for the site.

2.7 Underground Services

The 'Dial Before You Dig' (DBYD) plans were reviewed for the assessment in order to establish whether any major underground services exist at the site or in the immediate vicinity that could act as a preferential pathway for contamination migration. The DBYD plans indicated that a number of services ran beneath the access road through the middle of the site (i.e. Telstra, NBN, Optus fibre optic). The backfill around these services could act as potential migratory pathways. Selected plans are attached in the appendices.

3 GEOLOGY AND HYDROGEOLOGY

3.1 Regional Geology

Regional geological information presented in the Lotsearch report (attached in the appendices) indicated that the site is underlain by Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses.

3.2 Acid Sulfate Soil (ASS) Risk and Planning

The site is not located in an acid sulfate soil (ASS) risk area according to the risk maps prepared by the Department of Land and Water Conservation.

3.3 Hydrogeology

Hydrogeological information presented in the Lotsearch report indicated that the regional aquifer on-site and, in the areas, immediately surrounding the site includes porous, extensive aquifers of low to moderate productivity. There were a total of 22 registered bores within the report buffer of 1,000m. In summary:

- The nearest registered bore was located approximately 177m north from the site. This was utilised for monitoring purposes;
- The majority of the bores were registered for monitoring purposes;
- There was one nearby bore (i.e. 539m to the East and cross gradient of the site) registered for recreation (groundwater) uses; and
- The drillers log information from the closest registered bores typically identified fill and/or clay soil to depths of 1.2-2.5m, underlain by shale and sandstone bedrock. Standing water levels (SWLs) in the bores ranged from 6.0mBGL to 11.0mBGL.

The information reviewed for this assessment indicated that the subsurface conditions at the site are likely to consist of relatively low permeability (residual) soils overlying shallow bedrock. The potential for viable groundwater abstraction and use of groundwater under these conditions is considered to be low. There is a reticulated water supply in the area and consumption of groundwater is not expected to occur. Use of groundwater is not proposed as part of the development.

Considering the local topography and surrounding land features, JKE would generally expect groundwater to flow south towards Yowie Bay.

3.4 Receiving Water Bodies

The site location and topography indicates that most of the excess surface water flows through the site are expected to eventuate in the stormwater drainage provided beneath access roads through the site which are expected to connect to municipal stormwater drainage along the main streets and eventually discharge into Yowie Bay located approximately 650m south of the site. This water body is considered to be the closest potential ecological receptor.

4 SITE HISTORY INFORMATION

4.1 Review of Historical Aerial Photographs

Historical aerial photographs were included in the Lotsearch report. JKE has reviewed the photographs and summarised relevant information in the following table:

Table 4-1: Summary of Historical Aerial Photographs

Year	Details
1943	**On-site:** The site appeared to be mostly vacant land part of the larger rural type properties. Majority of the site was grassed and possibly used for grazing purposes. Some trees were visible along the eastern site boundary. Small structures were visible in the middle part across the site which were most likely associated with animal upkeep and farming. **Off-site:** The surrounds appeared similar to the site and were most likely used for grazing and/or market garden purposes. Some residential buildings and ancillary structures were visible on the nearby land to the south and further west and north-west across the bounding streets of the wider site.
1956	**On-site:** The site appeared to have been part of a wider hospital site and was occupied by a T shaped ancillary building. **Off-site:** Main hospital building appeared to have been developed immediately to the east with some additional ancillary buildings present immediately north-east and south-east of the site. The land due south and further south east appeared to remain vacant overgrown with trees and vegetation. Residential properties appeared to have been established to the west and further north across bounding streets of the wider hospital site.
1961	**On-site:** The site appeared mostly unchanged with more paved areas provided throughout the site area. **Off-site:** A number of ancillary buildings appeared to have been added to the wider site situated to the south and north-west of the site area. On-grade carparking are was established north of the site. Some of the properties further to the north-west fronting the intersection appeared to have been redeveloped for commercial uses.
1965	The site and surrounding features appeared generally similar to the previous photograph. More residential properties appeared to have been established further to the west and north /north-west across the bounding streets
1970	**On-site:** The site appeared generally similar to the previous photograph. **Off-site:** Additional on grade car parking area appeared to have been established south-east of the site. No other major changes were noted.
1978	**On-site:** The site appeared generally similar to the previous photograph. **Off-site:** The areas further south and south-east of the site (part of the wider hospital site) appeared to have been developed with various commercial type buildings with a number of on grade car parking areas established.
1984	**On-site:** The site appeared generally similar to the previous photograph with a number of small ancillary buildings/structures constructed.

Year	Details
	Off-site: Major structural addition to the main hospital building was noted to have been built directly to the east/south-east of the site area. Various other structural additions and upgrades were noted for the wider hospital site area.
1994	**On-site:** The site appeared generally similar to the previous photograph. **Off-site:** Structural addition was noted for a building to the north-east of the site area. Some of the previously existing commercial properties further to the north-west appeared to have been redeveloped for higher density residential uses. Some commercial properties were also noted to have been established further to the north across Kingsway.
2005	**On-site:** Former buildings on site appeared to have been demolished and the site cleared with access ways present across the northern and eastern parts. **Off-site:** The old main hospital building appeared to have been demolished and removed from the wider site area. Further structural additions were noted to the newer main hospital structure further to the east. Further commercial development was noted for the properties to the north across Kingsway.
2007	**On-site:** The majority of the site area appeared to have been used as a car park. **Off-site:** More on-grade carparking was provided further north-east.
2014	The site and surrounding features appeared generally similar to the previous photograph.
2019	**On-site:** Upgrades to the access ways were noted across northern and eastern parts of the site. **Off-site:** A structural addition to the main hospital building was noted to have been established directly to the east of the site. New ambulance station building appeared to have been developed south of the site. Some other structural additions and upgrades were noted for the wider site. Further commercial development was noted on the properties to the north across Kingsway.

4.2 SafeWork NSW Records

SafeWork NSW records were reviewed for the assessment. Copies of relevant documents are attached in the appendices. A summary of the relevant information is provided in the following table:

Table 4-2: Summary of SafeWork NSW Records

Date	Record Number	License Details
1957, 1985, 1996 and 2004	35-013581	The search identified an original application and a number of renewal applications for Licence to Keep Dangerous Goods submitted by the Department of Health and Ambulance Service of NSW for the same dangerous good identified as 12,000 Litre underground fuel storage tanks (USTs) storing unleaded petrol / diesel. This tank was shown to have been associated with the former ambulance station building which was present south of the site area until at least 2014.

4.3 NSW EPA Records

The Lotsearch report included information from the NSW EPA databases for the following:

- Records maintained in relation to contaminated land under Section 58 of the CLM Act 1997;
- Records of sites notified in accordance with the Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997 (2015)[5]; and
- Licensed activities under the Protection of the Environment Operations Act (1997)[6].

The search included the site area and surrounding areas in the report buffer of 1,000m. The search indicated the following:

- There were no records for the site under Section 58 of the CLM Act 1997. However, there were three records for properties in the report buffer with mostly former notices, with an exception of Woolworths service station located approximately 123m north-west of the site which had 2 current notices;
- The site has not been notified with regards to the Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997. There were a total of four notified properties in the report buffer. One of these properties was noted as being a service station (Woolworths) approximately 123m north-west of the site. This property is recorded as "Contamination currently regulated under the CLM Act" and is located up-gradient of the site area, JKE considered this property may pose an off-site source of contamination risk to the site. The remaining three properties within the buffer were located 650-950m east and south-east of the site and were considered unlikely to pose an off-site source of contamination risk to the site; and
- There were no records for licenced activities at the site under the POEO Act 1997. Current licenses were identified for the train corridor due south (151m) of the site, which includes the railway system activities within the corridor, however these activities are considered unlikely to pose a contamination risk to the site. The wider Sutherland Hospital was noted as a delicensed activity which was still regulated by the EPA. The activity included the generation and storage of hazardous, industrial or Group A waste.

4.4 Historical Business Directory and Additional Lotsearch Information

Historical business records for the site and surrounding areas in the report buffer were included in the Lotsearch report. The records indicated the following:

- There were five potential motor mechanics/service stations businesses registered within the report buffer from 1950s through to 1990s. These were matched to the nearby road and road intersection 100m north and up-gradient of the site; and
- There was one dry cleaner business registered within the report buffer during the 1980s. This business was located approximately 500m up-gradient of the site.

JKE are of the opinion that the historical businesses in the report buffer may represent potential off-site sources of site contamination given the fact that some of these registered businesses are still in operation and are notified to the EPA (i.e. Woolworths service station 123m to the north-west).

[5] NSW EPA, (2015). *Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997.* (referred to as Duty to Report Contamination)

[6] Protection of the Environment Operations Act 1997 (NSW) (referred to as POEO Act 1997)

In addition to the above, JKE have reviewed additional information contained within the Lotsearch report and note the following:

- There were no local or state heritage items at the site or in the immediate surrounds; and
- There were no significant ecological constraints at the site or in the immediate surrounds, with an exception of one unassessed exotic/native species north-west of the site, this however is not considered to pose an issue of concern for the proposed development.

4.5 Summary of Site History Information

A time line summary of the historical land uses and activities is presented in the table below. The information presented in the table is based on a weight of evidence assessment of the site history documentation and observations made by JKE.

Table 4-3: Summary of Historical Land Uses / Activities

Year(s)	On-site - Potential Land Use / Activities	Off-site - Potential Land Use / Activities
1943-1956	Rural / Agricultural – possibly grazing with small structures present most likely associated with animal upkeep.	Rural / Agricultural
1956-2005	Site area is part of a wider hospital site and was occupied by an ancillary building of unconfirmed use.	Wider hospital site, Residential and Commercial across the bounding Kareena Road and Kingsway.
2005-current	Site area is part of a wider hospital site used mostly as a carpark and access ways.	Wider hospital site, Residential and Commercial across the bounding Kareena Road and Kingsway.

4.6 Integrity of Site History Information

The majority of the site history information was obtained from government organisations as outlined in the relevant sections of this report. The veracity of the information from these sources is considered to be relatively high. A certain degree of information loss can be expected given the lack of specific land use details over time. JKE have relied upon the Lotsearch report and have not independently verified any information contained within. However, it is noted that the Lotsearch report is generated based on databases maintained by various government agencies and is expected to be reliable.

5 CONCEPTUAL SITE MODEL

NEPM (2013) defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site is presented in the following sub-sections and is based on the site information (including the site inspection information) and the review of site history information. Reference should also be made to the figures attached in the appendices.

A review of the CSM in relation to source, pathway and receptor (SPR) linkages has been undertaken as part of the Tier 1 risk assessment process, as outlined in Section 10.

5.1 Potential Contamination Sources/AEC and CoPC

The potential contamination sources/AEC and CoPC are presented in the following table:

Table 5-1: Potential (and/or known) Contamination Sources/AEC and Contaminants of Potential Concern

Source / AEC	CoPC
Fill material – The site appears to have been historically filled to achieve the existing levels. The fill may have been imported from various sources and could be contaminated. The boreholes drilled foe this investigation encountered fill ranging in depth from approximately 0.8m to 1.4mBGL	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), petroleum hydrocarbons (referred to as total recoverable hydrocarbons – TRHs), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs) and asbestos.
Parked Vehicles –Vehicles parking across the site may have resulted in spills and/or leaks of fuels/oils and other products over a period of time in various parts of the site.	Heavy metals, TRHs, BTEX and PAHs.
Hazardous Building Material – Hazardous building materials may be present as a result of former building and demolition activities. These materials may also be present in the existing buildings/ structures on site.	Asbestos, lead and PCBs
Off-site service station – A Woolworths service station is located 150m to the north/north-west (up-gradient) of the site and is considered to be a potential source of contamination. This property is notified to the EPA and is currently regulated under the CLM Act.	Heavy metals, TRH, naphthalene, phenols and BTEX
Off-site historical fuel storage – At least one 12,000L UST was identified to have previously been in place on the neighbouring site of the Ambulance Station directly south of the site (see Figure 2). Records indicated that the UST was previously used to store diesel and petrol. No records exist pertaining the decommissioning of this UST.	Lead, TRH, BTEX, naphthalene, phenols and PAHs
Off-site historical mechanics workshops – a number of motor mechanics/service stations businesses were identified in the vicinity of the site between 1950s through to at least 1990s. These were matched to the	Heavy Metals, TRH and BTEX

Source / AEC	CoPC
nearby road and road intersection. Fuels, oils and solvents may have been used during this site use.	

5.2 Mechanism for Contamination, Affected Media, Receptors and Exposure Pathways

The mechanisms for contamination, affected media, receptors and exposure pathways relevant to the potential contamination sources/AEC are outlined in the following CSM table:

Table 5-2: CSM

Potential mechanism for contamination	Potential mechanisms for contamination include: • Fill material – importation of impacted material, 'top-down' impacts (e.g. placement of fill, leaching from surficial material etc), or sub-surface release (e.g. impacts from buried material); • Parked Vehicles – 'top-down' and spills (e.g. leaks through cracks in the pavement); • Hazardous building materials – 'top-down' (e.g. demolition resulting in surficial impacts in unpaved areas); • Fuel storage – 'top-down', spills (e.g. during filling of the tanks and/or dispensing activities), or sub-surface release (e.g. from leaking tank or pipework); • Mechanics workshop - 'top-down', spills (e.g. leaks through cracks in the pavement), or sub-surface release (e.g. from leaking separator/grease pits or sewer pipework); and • Off-site land uses – 'top-down', spill or sub-surface release. Impacts to the site could occur via migration of contaminated groundwater.
Affected media	Soil and groundwater have been identified as potentially affected media. The impacts on groundwater beneath the site were not assessed and were outside the scope for this assessment. The potential for soil vapour impacts is considered to be relatively low. However, soil vapour would need to be considered in the event significant contamination is identified in soil and/or groundwater (at a later stage).
Receptor identification	Human receptors include site occupants/users (including adults and children), construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users, and recreational water users within Yowie Bay. Ecological receptors include terrestrial organisms and plants within unpaved areas (including the proposed landscaped areas), and marine ecology in Yowie Bay.
Potential exposure pathways	Potential exposure pathways relevant to the human receptors include ingestion, dermal absorption and inhalation of dust (all contaminants) and vapours (volatile TRH, naphthalene and BTEX). The potential for exposure would typically be associated with the construction and excavation works, and future use of the site. Potential exposure pathways for ecological receptors include primary contact and ingestion. Exposure during future site use could occur via direct contact with soil in unpaved areas such as gardens, inhalation of airborne asbestos fibres during soil disturbance, or inhalation of vapours within enclosed spaces such as buildings and basements.

	Exposure to groundwater may potentially occur through direct migration and potential exposure to groundwater seepage within buildings and basements. Exposure to groundwater could also occur in Yowie Bay through direct migration, however, connectivity between the aquifer and the creek has not been confirmed at this time. Groundwater has the potential to enter the Bay via the stormwater system (which is expected to discharge into the Bay) in a drained basement scenario and/or a situation where groundwater seepage is captured and discharged to stormwater.
Potential exposure mechanisms	The following have been identified as potential exposure mechanisms for site contamination: • Vapour intrusion into the proposed structures (either from soil contamination or volatilisation of contaminants from groundwater); • Contact (dermal, ingestion or inhalation) with exposed soils in landscaped areas and/or unpaved areas or during construction; and • Migration of groundwater off-site and into nearby water body (Yowie Bay), including aquatic ecosystems and those being used for recreation.
Presence of preferential pathways for contaminant movement	Local underground services such stormwater and services cable trenches/pipes have the potential to act as preferential pathways for contaminant migration at the site. However, the potential for migration would depend on the fate and transport properties of the CoPC.

6 SAMPLING, ANALYSIS AND QUALITY PLAN

6.1 Data Quality Objectives (DQO)

Data Quality Objectives (DQOs) were developed to define the type and quality of data required to achieve the project objectives outlined in Section 1.2. The DQOs were prepared with reference to the process outlined in Schedule B2 of NEPM (2013) and the Guidelines for the NSW Site Auditor Scheme, 3rd Edition (2017)[7]. The seven-step DQO approach for this project is outlined in the following sub-sections.

The DQO process is validated in part by the Data Quality Assurance/Quality Control (QA/QC) Evaluation. The Data (QA/QC) Evaluation is summarised in Section 8.1 and the detailed evaluation is provided in the appendices.

6.1.1 Step 1 - State the Problem

The CSM identified potential sources of contamination/AEC at the site that may pose a risk to human health and the environment. Investigation data is required to assess the contamination status of the site, assess the risks posed by the contaminants in the context of the proposed development/intended land use, and assess whether remediation is required. This information will be considered by the project team in the design and delivery of the project as well as by the consent authority in exercising its planning functions in relation to the approval of the development consent and issue of construction certificate.

A waste classification is required prior to off-site disposal of excavated soil/bedrock.

6.1.2 Step 2 - Identify the Decisions of the Study

The objectives of the assessment are outlined in Section 1.2. The decisions to be made reflect these objectives and are as follows:

- Did the site inspection, or does the historical information identify potential contamination sources/AEC at the site?
- Are any results above the SAC?
- Do potential risks associated with contamination exist, and if so, what are they?
- Is remediation required?
- Is the site characterisation sufficient to provide adequate confidence in the above decisions?
- Is the site suitable for the proposed development, or can the site be made suitable subject to further characterisation and/or remediation?
- Is there a risk posed by hazardous building materials considered to potentially be disturbed in areas were refurbishment and additions are proposed as part of the upgrades?

6.1.3 Step 3 - Identify Information Inputs

The primary information inputs required to address the decisions outlined in Step 2 include the following:

- Existing relevant environmental data from previous reports;
- Site information, including site observations and site history documentation;

[7] NSW EPA (2017). *Guidelines for the NSW Site Auditor Scheme, 3rd ed.* (referred to as Site Auditor Guidelines 2017)

- Sampling of potentially affected media, soil only;
- Observations of sub-surface variables such as soil type, photo-ionisation detector (PID) concentrations, odours and staining;
- Laboratory analysis of soils using NATA accredited methods for the CoPC identified in the CSM;
- Field and laboratory QA/QC data; and
- Assessment of laboratory results against SAC with reference to relevant guidelines.

6.1.4 Step 4 - Define the Study Boundary

The sampling was confined to the site boundaries as shown in Figure 2 and was limited vertically to a depth of 8.86mBGL (spatial boundary). The sampling was completed on 7 and 8 May 2020 (temporal boundary). The assessment of potential risk to adjacent land users has been made based on data collected within the site boundary. The scope of the investigation is limited to that described in Section 1.3.

6.1.5 Step 5 - Develop an Analytical Approach (or Decision Rule)

6.1.5.1 Tier 1 Screening Criteria

The laboratory data will be assessed against relevant Tier 1 screening criteria (referred to as SAC), as outlined in Section 7. Exceedances of the SAC do not necessarily indicate a requirement for remediation or a risk to human health and/or the environment. Exceedances are considered in the context of the CSM and valid SPR-linkages.

For this assessment, the individual results have been assessed as either above or below the SAC. Statistical evaluation of the dataset via calculation of mean values and/or 95% upper confidence limit (UCL) values has not been undertaken due to the preliminary nature of the intrusive investigation.

6.1.5.2 Field and Laboratory QA/QC

Field QA/QC included analysis of intra-laboratory duplicates and trip blank samples. Further details regarding the sampling and analysis undertaken, and the acceptable limits adopted, is provided in the Data Quality (QA/QC) Evaluation in the appendices.

The suitability of the laboratory data is assessed against the laboratory QA/QC criteria which is outlined in the attached laboratory reports. These criteria were developed and implemented in accordance with the laboratory's National Association of Testing Authorities, Australia (NATA) accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

In the event that acceptable limits are not met by the laboratory analysis, other lines of evidence are reviewed (e.g. field observations of samples, preservation, handling etc) and, where required, consultation with the laboratory is undertaken in an effort to establish the cause of the non-conformance. Where uncertainty exists, JKE typically adopt the most conservative concentration reported (or in some cases, consider the data from the affected sample as an estimate).

6.1.5.3 Appropriateness of Practical Quantitation Limits (PQLs)

The PQLs of the analytical methods are considered in relation to the SAC to confirm that the PQLs are less than the SAC. In cases where the PQLs are greater than the SAC, a discussion of this is provided.

6.1.6 Step 6 – Specify Limits on Decision Errors

To limit the potential for decision errors, a range of quality assurance processes are adopted. A quantitative assessment of the potential for false positives and false negatives in the analytical results is undertaken with reference to Schedule B(3) of NEPM (2013) using the data quality assurance information collected.

Decision errors can be controlled through the use of hypothesis testing. The test can be used to show either that the baseline condition is false or that there is insufficient evidence to indicate that the baseline condition is false. The null hypothesis is an assumption that is assumed to be true in the absence of contrary evidence. For this assessment, the null hypothesis has been adopted which is that, there is considered to be a complete SPR linkage for the CoPC identified in the CSM unless this linkage can be proven not to (or unlikely to) exist. The null hypothesis has been adopted for this assessment.

6.1.7 Step 7 - Optimise the Design for Obtaining Data

The most resource-effective design will be used in an optimum manner to achieve the assessment objectives. Adjustment of the assessment design can occur following consultation or feedback from project stakeholders. For this investigation, the design was optimised via consideration of the various lines of evidence used to select the sample locations, the media being sampled, and also by the way in which the data were collected.

The sampling plan and methodology are outlined in the following sub-sections.

6.2 Soil Sampling Plan and Methodology

The soil sampling plan and methodology adopted for this assessment is outlined in the table below:

Table 6-1: Soil Sampling Plan and Methodology

Aspect	Input
Sampling Density	Samples were collected from four borehole locations (BH1 to BH4) as shown on the attached Figure 2. Based on the site area (1,900m^2), this number of locations corresponded to a sampling density of approximately one sample per 475m^2. The sampling plan was not designed to meet the minimum sampling density for hotspot identification, as outlined in the NSW EPA Contaminated Sites Sampling Design Guidelines (1995)[8].
Sampling Plan	The sampling locations were placed on a judgemental sampling plan and were broadly positioned for site coverage, taking into consideration areas that were not easily accessible. This sampling plan was considered suitable to make a preliminary assessment of potential risks associated with the AEC and CoPC identified in the CSM, and assess whether further investigation is warranted.

[8] NSW EPA, (1995), *Contaminated Sites Sampling Design Guidelines.* (referred to as EPA Sampling Design Guidelines 1995)

Aspect	Input
Intrusive field works to be undertaken in accordance with the Asbestos Management Plan (AMP)	All field works are required to be undertaken in consideration of the AMP as a precautionary measure based on the anecdotal evidence provided by the client. Drilling works and sampling procedures were designed in accordance with the AMP which has been developed specifically to outline the necessary requirements for the management of potential asbestos-impacted soil, if encountered, during the proposed intrusive field works. This includes management requirements for handling, temporary storage, removal, transportation and disposal procedures and clearance inspections.
Set-out and Sampling Equipment	Sampling locations were set out using a tape measure. In-situ sampling locations were checked for underground services by an external contractor prior to sampling. Samples were collected using a drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) split-spoon sampler, or directly from the auger when conditions did not allow use of the SPT sampler.
Sample Collection and Field QA/QC	Soil samples were obtained on 7 and 8 May 2020 in accordance with the standard sampling procedure (SSP) attached in the appendices. Soil samples were collected from the fill and natural profiles based on field observations. The sample depths are shown on the logs attached in the appendices. Samples were placed in glass jars with plastic caps and Teflon seals with minimal headspace. Samples for asbestos analysis were placed in zip-lock plastic bags. During sampling, soil at selected depths was split into primary and duplicate samples for field QA/QC analysis. 500mL soil samples were collected for asbestos analysis for the purposes of risk assessment in regards to our in-house geotechnical lab testing only. However, these were considered as part of the dataset for completeness.
Field Screening	A portable Photoionisation Detector (PID) fitted with a 10.6mV lamp was used to screen the samples for the presence of volatile organic compounds (VOCs). PID screening for VOCs was undertaken on soil samples using the soil sample headspace method. VOC data was obtained from partly filled zip-lock plastic bags following equilibration of the headspace gases. PID calibration records are maintained on file by JKE. Fill/spoil at the sampling locations was visually inspected during the works for the presence of fibre cement fragments.
Decontami-nation and Sample Preservation	Sampling personnel used disposable nitrile gloves during sampling activities. Re-usable sampling equipment was decontaminated as outlined in the SSP. Soil samples were preserved by immediate storage in an insulated sample container with ice in accordance with the SSP. On completion of the fieldwork, the samples were stored temporarily in fridges in the JKE warehouse before being delivered in the insulated sample container to a NATA registered laboratory for analysis under standard chain of custody (COC) procedures.

6.3 Analytical Schedule

The analytical schedule (for primary samples) is outlined in the following table:

Table 6-2: Analytical Schedule (Primary Samples)

Analyte/CoPC	Fill Samples	Natural Soil Samples	Fibre Cement Material Samples
Heavy Metals	8	-	-
TRH/BTEX	8	-	-
PAHs	8	-	-
OCPs/OPPs	4	-	-
PCBs	4	-	-
Total Phenolics	4	-	-
Asbestos ID including 500mL samples	8	-	-
Toxicity characteristic leachate procedure (TCLP) Metals and/or PAHs for waste classification purposes	2	-	-

6.3.1 Laboratory Analysis

Samples were analysed by an appropriate, NATA Accredited laboratory using the analytical methods detailed in Schedule B(3) of NEPM 2013. Reference should be made to the laboratory reports attached in the appendices for further details.

Table 6-3: Laboratory Details

Samples	Laboratory	Report Reference
All primary samples and field QA/QC samples including (intra-laboratory duplicates and trip blanks)	Envirolab Services Pty Ltd NSW, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)	242632 and 242632-A

6.4 Compliance with AMP

The AMP which has been specifically developed for the investigation applied from the commencement of ground disturbance works on site until completion of all fieldwork activities and reinstatement of boreholes where required. JKE's Licensed Asbestos Assessor was present during the initial part of the field works to check the appropriateness of the setup and compliance with the AMP.

Given that asbestos may have been encountered during field works all excess spoil from boreholes was considered to potentially contain asbestos and the following actions were implemented as per the AMP:

- The work areas were dedicated as asbestos works areas;
- The work areas were isolated and secured during drilling and remained inaccessible to general public; and

- To minimise the release of fibres into the air the soil was kept damp at all times and, where safe the surface area around boreholes was covered with plastic sheeting.

During the intrusive field works air monitoring was undertaken by a separately engaged subcontractor (Clear Safe) using calibrated portable air sampling pumps. Monitoring locations were determined and included at three locations surrounding the proposed asbestos works areas. At the end of intrusive works, on each of the two days, the pump and attached filter were collected and analysed at a NATA-accredited laboratory. The results of air monitoring are provided in the appendices. All results were below the adopted action levels as stipulated by the regulations.

7 SITE ASSESSMENT CRITERIA (SAC)

The SAC were derived from the NEPM 2013 and other guidelines as discussed in the following sub-sections. The guideline values for individual contaminants are presented in the attached report tables and further explanation of the various criteria adopted is provided in the appendices.

7.1 Soil

Soil data were compared to relevant Tier 1 screening criteria in accordance with NEPM (2013) as outlined below.

7.1.1 Human Health

- Health Investigation Levels (HILs) for a 'residential with minimal opportunities for soil access' exposure scenario (HIL-A);
- Health Screening Levels (HSLs) for a 'low-high density residential' exposure scenario (HSL-A & HSL-B). HSLs were calculated based on conservative assumptions including 'sand' and 'clay' type where appropriate and a depth interval of 0m to 1m;
- Where exceedances of the HSLs were reported for hydrocarbons (TRH/BTEX and naphthalene), the soil health screening levels for direct contact presented in the CRC Care Technical Report No. 10 – Health screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document (2011)[9] were considered; and
- Asbestos was assessed on the basis of presence/absence. Asbestos HSLs were not adopted as detailed asbestos quantification was not undertaken.

7.1.2 Environment (Ecological – terrestrial ecosystems)

- Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) for an 'urban residential and public open space' (URPOS) exposure scenario. These have only been applied to the top 2m of soil as outlined in NEPM (2013). The criterion for benzo(a)pyrene has been increased from the value presented in NEPM (2013) based on the Canadian Soil Quality Guidelines[10];
- ESLs were adopted based on the soil type; and
- EILs for selected metals were calculated based on the most conservative added contaminant limit (ACL) values presented in Schedule B(1) of NEPM (2013) and published ambient background concentration (ABC) values presented in the document titled Trace Element Concentrations in Soils from Rural and Urban Areas of Australia (1995)[11] This method is considered to be adequate for the Tier 1 screening.

7.1.3 Management Limits for Petroleum Hydrocarbons

Management limits for petroleum hydrocarbons (as presented in Schedule B1 of NEPM 2013) were considered (if required) following evaluation of human health and ecological risks, and risks to groundwater.

[9] Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC Care), (2011). Technical Report No. 10 - *Health screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document*

[10] Canadian Council of Ministers of the Environment, (1999). *Canadian soil quality guidelines for the protection of environmental and human health: Benzo(a)Pyrene (1997)* (referred to as the Canadian Soil Quality Guidelines)

[11] Olszowy, H., Torr, P., and Imray, P., (1995), *Trace Element Concentrations in Soils from Rural and Urban Areas of Australia. Contaminated Sites Monograph Series No. 4*. Department of Human Services and Health, Environment Protection Agency, and South Australian Health Commission

7.1.4 Waste Classification

Data for the waste classification assessment were assessed in accordance with the Waste Classification Guidelines, Part 1: Classifying Waste (2014)[12] as outlined in the following table:

Table 7-1: Waste Categories

Category	Description
General Solid Waste (non-putrescible)	• If Specific Contaminant Concentration (SCC) ≤ Contaminant Threshold (CT1) then Toxicity Characteristics Leaching Procedure (TCLP) not needed to classify the soil as general solid waste; and • If TCLP ≤ TCLP1 and SCC ≤ SCC1 then treat as general solid waste.
Restricted Solid Waste (non-putrescible)	• If SCC ≤ CT2 then TCLP not needed to classify the soil as restricted solid waste; and • If TCLP ≤ TCLP2 and SCC ≤ SCC2 then treat as restricted solid waste.
Hazardous Waste	• If SCC > CT2 then TCLP not needed to classify the soil as hazardous waste; and • If TCLP > TCLP2 and/or SCC > SCC2 then treat as hazardous waste.
Virgin Excavated Natural Material (VENM)	Natural material (such as clay, gravel, sand, soil or rock fines) that meet the following: • That has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial mining or agricultural activities; • That does not contain sulfidic ores or other waste; and • Includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved from time to time by a notice published in the NSW Government Gazette.

[12] NSW EPA, (2014). *Waste Classification Guidelines, Part 1: Classifying Waste.* (referred to as Waste Classification Guidelines 2014)

8 RESULTS

8.1 Summary of Data (QA/QC) Evaluation

The data evaluation is presented in the appendices. In summary, JKE are of the opinion that the data are adequately precise, accurate, representative, comparable and complete to serve as a basis for interpretation to achieve the investigation objectives.

8.2 Subsurface Conditions

A summary of the subsurface conditions encountered during the investigation is presented in the following table. Reference should be made to the borehole logs attached in the appendices for further details.

Table 8-1: Summary of Subsurface Conditions

Profile	Description
Pavement	Asphaltic Concrete (AC)/Concrete pavements were encountered at the surface in BH1, BH2 and BH3. A Concrete pavement of 150mm thickness was encountered at the surface in BH1 underlain by a 200mm thickness of sand gravel (roadbase). AC pavement of 60mm thickness was encountered at surface in BH2 and BH3 and was underlain by a 50mm and 440mm thick of sandy gravel (roadbase) respectively.
Fill	Fill was encountered at the surface or beneath the pavement in all boreholes and extended to depths of approximately 0.8 to 1.4mBGL. The fill typically comprised Sandy Gravel and Silty Clay, with inclusions of igneous and ironstone gravel, fine to medium grained sand and brick fragments.
Natural Soil	Residual silty clay was encountered beneath the fill in each borehole and extended to depths ranging between 2.1 (BH1) and 3.05mBGL (BH3).
Bedrock	Bedrock underlying the soil profile comprised siltstone overlying sandstone. The siltstone extended to depths ranging from approximately 5.8 (BH3) to 7.3mBGL (BH2).
Groundwater	Groundwater seepage was not encountered in the boreholes during drilling. All boreholes remained dry on completion of auguring. On 1 June 2020 (about 1 month later), groundwater levels were measured at depths of approximately 4.15m, 3.15m and 3.9m below surface levels within the monitoring wells installed within BH2, BH3 and BH4, respectively.

8.3 Field Screening

PID soil sample headspace readings are presented in attached report tables and the COC documents attached in the appendices. All results were 0ppm isobutylene equivalents which indicates a lack of PID detectable VOCs.

8.4 Soil Laboratory Results

The soil laboratory results are compared to the relevant SAC in the attached report tables. A summary of the results assessed against the SAC is presented below:

8.4.1 Human Health and Environmental (Ecological) Assessment

Table 8-2: Summary of Soil Laboratory Results – Human Health and Environmental (Ecological)

Analyte	Results Compared to SAC
Heavy Metals	All heavy metals results were below the human health based SAC. However, the following exceedances of ecological criteria values were identified: The concentrations of nickel were above the adopted ESL of 35 mg/kg for urban residential and public open space land use (coarse soil texture) within the following samples: • BH2 (0.06-0.1m) – 77 mg/kg; and • SDUP1 (field duplicate of BH2 (0.06-0.1)) – 80 mg/kg.
TRH	All TRH results were below the human health-based SAC as well as direct contact (including for workers in trenches) criteria values. However, the following exceedances of ecological criteria values were identified: The concentrations of TRH F3 fraction were above the adopted ESL of 300 mg/kg for urban residential and public open space land use (coarse soil texture) within the following sample: • BH3 (0.06-0.2m) – 1100 mg/kg.
BTEX	All BTEX results were below the SAC. All BTEX concentrations were below the laboratory PQLs.
PAHs	The concentrations of Carcinogenic PAHs (i.e. Benzo(a)pyrene TEQ) were above the adopted HIL-B screening criteria of 4 mg/kg for this assessment in the following sample: • BH3 (0.06-0.2m) – 57 mg/kg. The concentrations of Total PAHs were also detected above the adopted HIL-B screening criteria of 400 mg/kg for this assessment in the following sample: • BH3 (0.06-0.2m) – 580 mg/kg. The concentrations of Benzo(a)pyrene were above the adopted ESLs of 20 mg/kg for urban residential and public open space land use (coarse soil texture) in the following sample: • BH3 (0.06-0.2m) – 39 mg/kg.
OCPs and OPPs	All OCP and OPP results were below the SAC. All pesticide concentrations were below the laboratory PQLs.
PCBs	All PCB results were below the SAC. All PCB concentrations were below the laboratory PQLs.
Total Phenolics	All total phenolic concentrations were below the SAC and were also below the laboratory PQLs.
Asbestos	All asbestos results were below the SAC (i.e. asbestos was absent in the samples analysed for the investigation).

8.4.2 Waste Classification Assessment

The laboratory results were assessed against the criteria presented in Part 1 of the Waste Classification Guidelines, as summarised previously in this report. The results are presented in the report tables attached in the appendices. A summary of the results is presented in the following table:

Table 8-3: Summary of Soil Laboratory Results Compared to CT and SCC Criteria

Analyte	No. of Samples Analysed^	No. of Results > CT Criteria	No. of Results > SCC Criteria	Comments
Heavy Metals	8	1	0	Nickel concentrations exceeded the CT1 criterion in one fill sample collected from BH2 (0.06-0.1m). Detected nickel concentration was 77mg/kg in the primary sample and 80 mg/kg in the field duplicate.
TRH	8	0	0	-
BTEX	8	0	0	-
Total PAHs	8	1	1	Concentration exceeded the CT1/SCC1 criterion in one fill sample collected from BH3 (0.06-0.2m). The Total PAHs concentration was reported at 580mg/kg for this sample.
Benzo(a)pyrene	8	1	1	Concentration exceeded the SCC2 criterion in one fill sample collected from BH3 (0.06-0.2m). Benzo(a)pyrene concentration was reported at 39mg/kg for this sample.
OCPs & OPPs	4	0	0	-
PCBs	4	0	0	-
Asbestos	4	-	-	Asbestos was not detected in the samples analysed.

^ Primary samples

Table 8-4: Summary of Soil Laboratory Results Compared to TCLP Criteria

Analyte	No. of Samples Analysed	No. of Results > TCLP Criteria	Comments
Nickel	1	0	DUP1 sample which is a filed duplicate sample of BH2 (0-0.3m) with nickel concentration above the CT1 criterion was analysed for TCLP nickel. The result was below the TCLP 1 criterion.
Benzo(a)pyrene	1	0	The fill sample BH3 (0.06-0.2m) with Benzo(a)pyrene concentrations above the SCC2 criterion were analysed for TCLP PAHs including Benzo(a)pyrene. The results were below the TCLP 1 criteria.

9 PRELIMINARY WASTE CLASSIFICATION ASSESSMENT

9.1 Preliminary Classification of Fill

Based on the results of the assessment, and at the time of reporting, the preliminary classification of fill material from the majority of tested locations is **General Solid Waste (non-putrescible).**

Further TCLP testing for Heavy Metals including Nickel, confirmed the tested surface fill material to be below the SCC1 / TCLP1 threshold criteria for "General Solid Waste" in location BH2. One fill material sample collected from BH3 (0.06-0.2m) had the Total PAHs concentration detected at 580mg/kg and the Benzo(a)pyrene concentration detected at 39mg/kg and falls within the **Hazardous Waste (non-putrescible) (HW)** category**.**

JKE recommend undertaken additional testing to confirm the extent of HW waste stream during the next stage or works and during development works.

Classification of any fill material to be disposed off-site is to be confirmed via additional sampling and analysis following its segregation and stockpiling from the material remaining on-site.

Material classed as HW will require special handling and disposal in accordance to the NSW EPA POEO Act. HW can only be taken to NSW EPA approved facilities which are licensed to accept HW.

9.2 Preliminary Classification of Natural Soil and Bedrock

Based on the scope of work undertaken for this preliminary screening, and at the time of reporting, JKE are of the opinion that the natural soil and sandstone bedrock at the site meets the definition of **VENM** for off-site disposal or re-use purposes. This should be confirmed by additional testing when the overly fill has been removed from the site.

VENM is considered suitable for re-use purposes. Further assessment of the bedrock is required following removal of the fill in order to confirm the VENM classification prior to any off-site disposal of VENM.

Management protocols for safe handling and waste classification for off-site disposal of excavated material on site would be covered within the Remediation Action Plan (RAP) to be prepared for proposed construction works. (Refer Section 11 of this report).

10 DISCUSSION

10.1 Tier 1 Risk Assessment and Review of CSM

For a contaminant to represent a risk to a receptor, the following three conditions must be present:

1. Source – The presence of a contaminant;
2. Pathway – A mechanism or action by which a receptor can become exposed to the contaminant; and
3. Receptor – The human or ecological entity which may be adversely impacted following exposure to contamination.

If one of the above components is missing, the potential for adverse risks is relatively low.

10.1.1 Soil

10.1.1.1 Heavy Metals

All heavy metals results were below the adopted human health-based SAC.

Nickel concentration in fill exceeded the adopted ecological screening criteria for heavy metals in sample BH2 (0.06-0.1m) as well as in its field split duplicate sample. While not a health risk, this would have additional management implications for construction works if this area is to remain unsealed and there is exposure to ecological receptors.

Nickel in soil do not appear to pose a risk to groundwater based on the low concentration of this heavy metal reported in the immediately underlying fill soil sample.

10.1.1.2 Hydrocarbons

All hydrocarbon concentrations (i.e. TRHs, PAHs and BTEX) in soil were below the adopted human health based SAC as well as direct contact (including for workers in trenches) criteria values (i.e. for TRHs and BTEX only), with the exception of Carcinogenic PAHs (i.e. Benzo(a)pyrene TEQ) as well as Total PAHs which were identified above the adopted HILs in sample BH3 (0.06-0.2m). This contamination is considered to pose a risk to human receptors, particularly as the exceeding concentrations occurred in surficial fill samples and there is a potential for complete SPR linkage during proposed construction works.

In addition, the concentrations of TRH F3 fractions and Benzo(a)pyrene in fill exceeded the adopted ecological screening criteria for petroleum hydrocarbons in the same sample BH3 (0.06-0.2m). While not a health risk, this would have additional management implications for construction works if this area is to remain unsealed and there is exposure to ecological receptors.

The TRHs and PAHs in soil do not appear to pose a risk to groundwater based on the absent/low concentrations of these contaminants reported in the underlying fill soil sample, and the overall expected depth to groundwater and confining layers beneath the site (i.e. expected at between, 3.15 and 4.15 metres below the surface). In addition, TCLP testing confirmed the lack of leaching PAHs including Benzo(a)pyrene from the fill material across the site. Leaching characteristics of TRHs have not been assessed at this stage.

10.1.1.3 Pesticides, PCBs and Total Phenolics

All pesticide and PCB concentrations were below the laboratory limits of reporting.

10.1.1.4 Asbestos

Asbestos was not identified in any of the samples tested.

10.2 Hazardous Building Materials

ACMs/PACMs have previously been identified for the exterior western façade of the Main Building A as compressed cement sheet window louvers, fibre cement sheet eaves and awnings throughout the exterior parts of the structure, suspended ceiling panels within the flu/covid clinic and bituminous membrane roof covering and lining. Additional PACMs were also identified by our inspection for this exterior part of the building and included structural joint mastic and fibre cement sheeting associated with the awning structure near the entrance to flu/covid clinic, movement joint mastic for the brick veneer façade (south-western exterior part of the building) and Telstra pits exterior to the building. These ACMs/PACMs are considered to be present within areas of proposed operating theatre upgrades and refurbishments and are likely to be disturbed as part of the proposed works.

Due to the age of the Main Building A (i.e. constructed circa 1960s), there remains the potential that unidentified ACMs remain present in areas of the building not inspected, covered up, or which were inaccessible.

Other hazardous materials (i.e. SMF and PCBs) were also present within the Main Building A as listed within the Hazardous Materials Register (Greencap, 2015). These were not confirmed during our inspection which was limited to accessible external areas of the site. SMF and PCBs may also be disturbed as part of the proposed works.

10.3 Decision Statements

The decision statements are addressed below:

> *Did the site inspection, or does the historical information identify potential contamination sources/AEC at the site?*

The historical information identified potential sources of contamination, being: the historical levelling and filling of the site; the presence of potentially hazardous building materials within the existing structures and in the ground as a result of weathering and/or previous demolition activities; the use of the site areas by parked vehicles; a Woolworths service station located 150m to the north/north-west (up-gradient) of the site which is notified to the EPA and is currently regulated under the CLM Act; historical UST previously present on the neighbouring site of the Ambulance Station directly south of the site; and a number of historic motor mechanics/service stations businesses in the vicinity of the site area. The site inspection confirmed that site levelling activities had historically taken place, and based on the apparent age of some of the buildings present across the wider site, hazardous building materials may potentially be present on site.

Are any results above the SAC?

Carcinogenic PAHs (i.e. Benzo(a)pyrene TEQ) and Total PAHs were identified in soil at concentrations that exceeded the adopted human health-based HILs in fill sample BH3 (0.06-0.2m). The concentrations were greater than 250% of the SAC. In addition, the concentrations of TRH F3 fractions and Benzo(a)pyrene in the same sample exceeded the adopted ecological screening criteria.

Nickel was also detected above the ecological SAC in BH2 (0.06-0.1m).

Do potential risks associated with contamination exist, and if so, what are they?

Carcinogenic PAHs (i.e. Benzo(a)pyrene TEQ) and Total PAHs are considered to pose a risk to human receptors, particularly as the exceeding concentrations occurred in surficial fill samples and there is a potential for complete SPR linkage during the course of the proposed development works.

The concentrations of TRH F3 fractions, Benzo(a)pyrene and nickel in fill exceeded the adopted ecological screening criteria in BH2 and BH3. While not a health risk, this would have additional management implications for construction works if these areas are to remain unsealed and there is exposure to ecological receptors.

Hydrocarbons in fill are considered to be associated with potentially uncontrolled historically imported fill material to achieve its existing levels as part of upgrades that have historically taken place around the site. The fill may have been imported from various sources and could have been contaminated.

The potential risk of complete SPR linkage at the site associated with potential off-site sources of contamination, as was identified by the CSM (i.e. a Woolworths service station located 150m to the north/north-west of the site) is considered to be an issue of concern given the close proximity of this property to the site and its upgradient position in relation to the site as well as the fact that this property is notified to the EPA (2 current notices) and is currently regulated under the CLM Act. In addition, the depth to groundwater beneath the site is expected to be shallow (i.e. between, 3.15 and 4.15 metres below the surface) which presents a greater risk of exposure to groundwater during the proposed development

Decommissioning and validation of the UST from the neighbouring site of the Ambulance Station directly south should be confirmed.

Although the contaminants in the soil were assessed to pose a potential risk, currently the site is largely paved and there are no complete source-pathway-receptor (SPR) linkages to the contamination. On this basis, we are of the opinion that interim management of contamination risks (e.g. via an interim Environmental Management Plan) is not considered to be required prior to commencement of the proposed development. If the proposed development does not commence within two years of the date of this report, JKE should be contacted to provide further advice in this regard.

Is remediation required?

Remediation is required to address the Total PAHs and carcinogenic PAHs within the fill soils in relation to human health risk. Remediation is also required to address the TRH F3 and nickel impact within fill soils in relation to ecological receptors. JKE note that some impacts are co-located with a potential human health risk posed by Total PAHs and carcinogenic PAHs.

Is the site characterisation sufficient to provide adequate confidence in the above decisions?

Yes. Though the sampling pattern was not probabilistic, the approach provided adequate spatial coverage of the site, and representative samples were analysed based on the results of field screening and observations.

Is the site suitable for the proposed development, or can the site be made suitable subject to further characterisation and/or remediation?

The site can be made suitable for the proposed development subject to appropriate remediation.

Is there a risk posed by hazardous building materials considered to potentially be disturbed in areas were refurbishment and additions are proposed as part of the upgrades?

Hazardous Building Materials have been identified which are likely to be disturbed as part of the proposed upgrades and refurbishment works. Further characterization and controlled management of these materials is required as part of the proposed works.

10.4 Data Gaps

An assessment of data gaps is provided in the following table:

Table 10-1: Data Gap Assessment

Data Gap	Assessment
Groundwater quality and characteristics not confirmed / groundwater was not assessed as part of the agreed scope for this investigation	This data gap relates to the lack of groundwater data beneath the site. Groundwater quality between up-gradient and down-gradient locations at the site was not completed and actual depth to groundwater table and flow direction beneath the site was not ascertained. There is a potential that proposed construction works would affect the groundwater beneath the site to an extent which would pose a risk of concern from a contamination viewpoint. Given that there are three monitoring wells which have been installed as part of the geotechnical assessment it is considered that all potential contamination concerns for groundwater can be further addressed as part of RAP protocols. Further groundwater monitoring is considered necessary for the proposed construction works. Groundwater conditions and quality could be further confirmed during the remediation/validation process.
Delineation of identified contamination hotspot.	This data gap relates to the lack of information associated with the lateral extent of the identified hotspot of Carcinogen PAHs as well as Total PAHs and TRH F3 ecological impacts associated with fill material in the vicinity of BH3. The detected nickel exceedance above the ecological criteria in BH2 has not been adequately delineated. Given the limited scope of anticipated excavations as part of the construction works this data gap can be addressed as part of RAP protocols including during waste classification for off-site disposal of excavated material as part of the development.
Characterisation of soils for waste classification purposes	Based on the results of the intrusive investigation, the characteristics of fill and natural soils across the site vary considerably. The waste classifications provided within this report are preliminary in nature due to the limited samples and variation encountered, and will require confirmation prior to off-site disposal of soils and bedrock.

11 CONCLUSIONS AND RECOMMENDATIONS

The assessment included a review of historical information and soil sampling from four borehole locations. The site area was part of a wider Sutherland Hospital premises since at least 1956 and was used predominantly as a carpark/accessway since at least 2005. A Woolworths service station was noted to be located 150m to the north/north-west (up-gradient) of the site which is considered to be a potential source of contamination. This property is notified to the EPA and is currently regulated under the CLM Act.

The investigation identified Total PAHs, carcinogenic PAHs, Benzo(a)pyrene and nickel contamination in soils on site and within the areas of proposed development works. The source of contamination was identified as the fill material historically imported onto the site. The contaminants requiring remediation include: Total PAHs and carcinogenic PAHs within the northern part of the site area, and TRH F3, Benzo(a)pyrene and nickel identified also within northern as well as southern parts of the site which poses a risk to ecological receptors. These TRH exceedances where co-located with carcinogenic PAHs requiring remediation due to the potential risk to human health.

Although the contaminants in the soil were assessed to pose a potential risk, currently the site is largely paved and there are no complete source-pathway-receptor (SPR) linkages to the contamination. On this basis, we are of the opinion that interim management of contamination risks (e.g. via an interim Environmental Management Plan) is not considered to be required prior to commencement of the proposed development. If the proposed development does not commence within two years of the date of this report, JKE should be contacted to provide further advice in this regard.

ACMs/PACMs have been identified within areas of proposed upgrades and refurbishments (i.e. western part of the Main Building A) which are likely to be disturbed as part of the proposed works. Further characterization and controlled management of these materials is required as part of the proposed works.

Based on the findings of the assessment, JKE are of the opinion that the site can be made suitable for the proposed development described in Section 1.1, subject to the implementation of the following recommendations:

- Prepare a RAP to address the data gaps and contamination issues identified at the site. This will include the requirements to complete the data gap assessment including groundwater assessment utilising the existing groundwater wells on site and the preparation of an unexpected find protocol (UFP); and
- Undertake a validation assessment documenting the remediation works;
- Prior to any refurbishment and/or demolition/dismantling works proposed as part of the upgrades a detailed/destructive hazardous materials survey should be undertaken on all parts of the building which will be affected by the proposed works by a qualified and competent person to confirm the presence and extent of any existing and additional hazardous materials including those identified by JKE's inspection; and
- Any ACMs/PACMs identified within areas likely to be disturbed by the proposed upgrades should be removed by a licensed contractor prior to these works being undertaken. All removal works should be undertaken in accordance with Safe Work NSW (2016) – Code of Practice – How to Safely Remove Asbestos. A clearance inspection and certificate should be produced by a licenced Asbestos Assessor upon completion of all required removal works and prior to any refurbishment or demolition works taking place.

At this stage, JKE consider that there is no requirement to notify the NSW EPA under the NSW EPA Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997 (2015)[13], provided the recommendations provided above are implemented.

JKE consider that the report objectives outlined in Section 1.2 have been addressed.

[13] NSW EPA, (2015). *Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997* (referred to as Duty to Report Contamination)

12 LIMITATIONS

The report limitations are outlined below:

- JKE accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the JKE proposal; and terms of contract between JKE and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- JKE accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- JKE have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. JKE should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

Important Information About This Report

These notes have been prepared by JKE to assist with the assessment and interpretation of this report.

The Report is based on a Unique Set of Project Specific Factors
This report has been prepared in response to specific project requirements as stated in the JKE proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- The proposed land use is altered;
- The defined subject site is increased or sub-divided;
- The proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- The proposed development levels are altered, eg addition of basement levels; or
- Ownership of the site changes.

JKE will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by JKE to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is based on Professional Interpretations of Factual Data
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Assessment Limitations
Although information provided by a site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Site Assessments by Design Professionals

Costly problems can occur when other design professionals develop plans based on misinterpretation of an assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Assessment Report

Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely

Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

Appendix A: Report Figures

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the Environmental report.

Title: **SITE LOCATION PLAN**

Location: CNR KINGSWAY AND KAREENA ROAD, CARINGBAH, NSW

Project No: E33141PA

Figure No: 1

JKEnvironments

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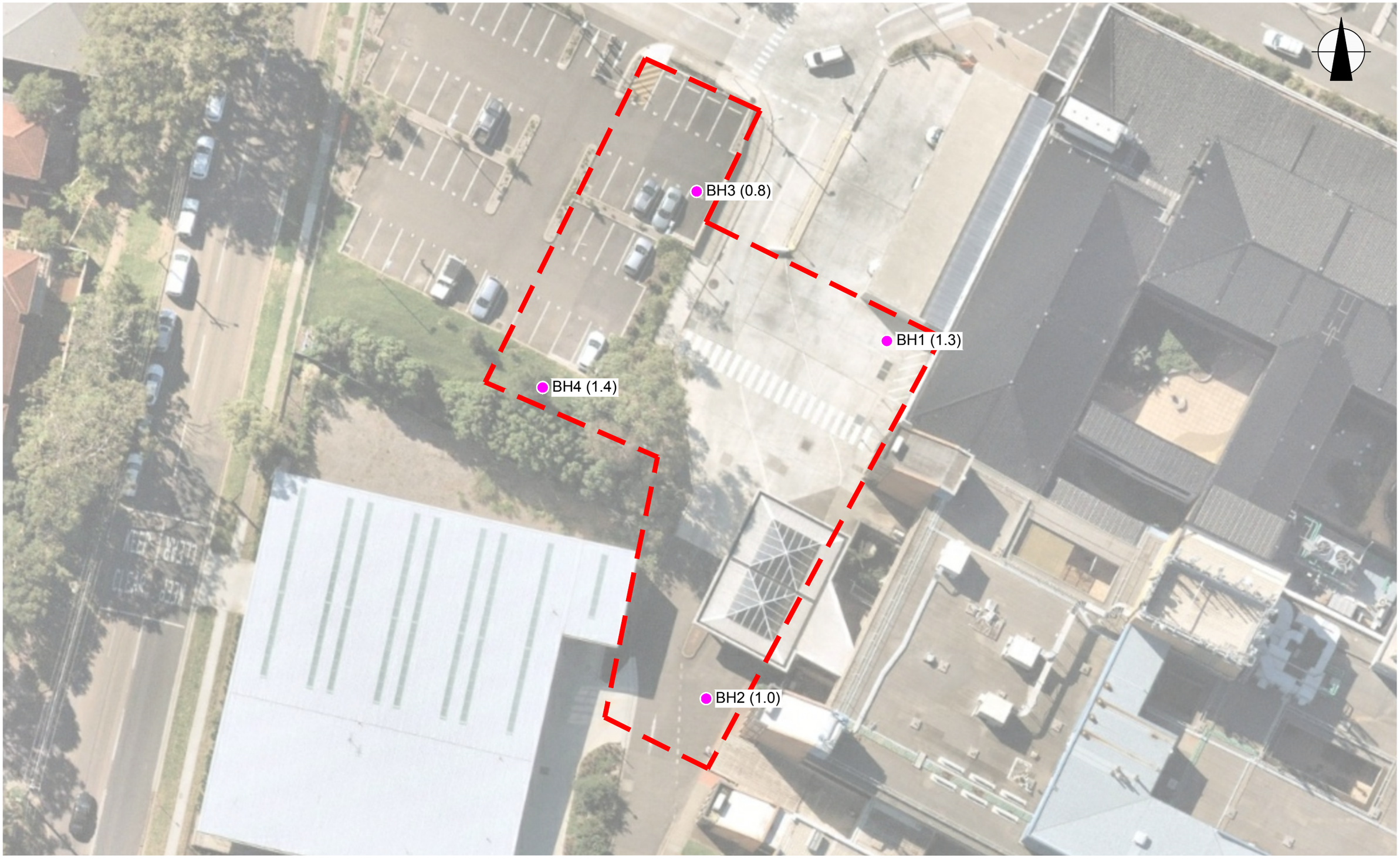

LEGEND

- APPROXIMATE SITE BOUNDARY
- BH(Fill Depth) BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

0 4 8 12 16 20

SCALE 1:400 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **SAMPLE LOCATION PLAN**

Location: CNR KINGSWAY AND KAREENA ROAD, CARINGBAH, NSW

Project No: E33141PA

Figure No: 2

JKEnvironments

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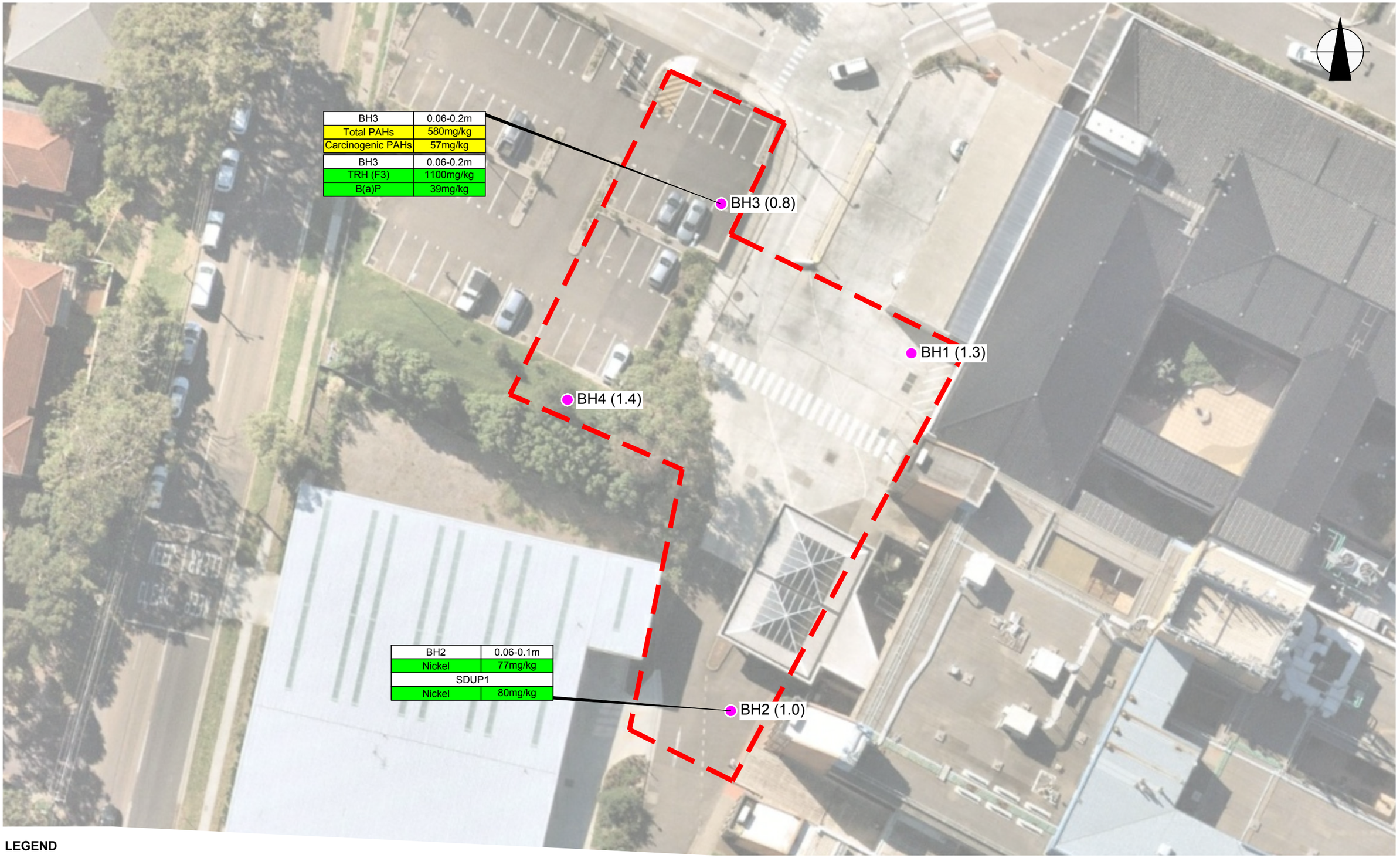

LEGEND

- APPROXIMATE SITE BOUNDARY
- BH(Fill Depth) — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

SAMPLE ID	DEPTH (metres)
CHEMICAL	CONCENTRATION

SOIL/SURFACE SAMPLE EXCEEDANCE

- SOIL/SURFACE CONTAMINATION ABOVE SAC FOR HUMAN HEALTH RISK
- SOIL CONTAMINATION ABOVE SAC FOR ECOLOGICAL RISK

0 4 8 12 16 20

SCALE 1:400 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **CONTAMINATION LOCATION PLAN**

Location: CNR KINGSWAY AND KAREENA ROAD, CARINGBAH, NSW

Project No: E33141PA

Figure No: 3

JKEnvironments

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Appendix B: Laboratory Results Summary Tables

ABBREVIATIONS AND EXPLANATIONS

Abbreviations used in the Tables:

ABC: Ambient Background Concentration
ACM: Asbestos Containing Material
ADWG: AustralianDrinking Water Guidelines
AF: Asbestos Fines
ANZG Australian and New Zealand Guidelines
B(a)P: Benzo(a)pyrene
CEC: Cation Exchange Capacity
CRC: Cooperative Research Centre
CT: Contaminant Threshold
EILs: Ecological Investigation Levels
ESLs: Ecological Screening Levels
FA: Fibrous Asbestos
GIL: Groundwater Investigation Levels
GSW: General Solid Waste
HILs: Health Investigation Levels
HSLs: Health Screening Levels
HSL-SSA: Health Screening Level-SiteSpecific Assessment
kg/L kilograms per litre
NA: Not Analysed
NC: Not Calculated
NEPM: National Environmental Protection Measure
NHMRC: National Health and Medical Research Council
NL: Not Limiting
NSL: No Set Limit
OCP: Organochlorine Pesticides
OPP: Organophosphorus Pesticides
PAHs: Polycyclic Aromatic Hydrocarbons
%w/w: weight per weight
ppm: Parts per million
PCBs: Polychlorinated Biphenyls
PCE: Perchloroethylene (Tetrachloroethylene or Teterachloroethene)
pH_{KCL} : pH of filtered 1:20, 1M KCL extract, shaken overnight
pH_{ox} : pH of filtered 1:20 1M KCl after peroxide digestion
PQL: Practical Quantitation Limit
RS: Rinsate Sample
RSL: Regional Screening Levels
RSW: Restricted Solid Waste
SAC: Site Assessment Criteria
SCC: Specific Contaminant Concentration
S_{Cr}: Chromium reducible sulfur
S_{POS}: Peroxide oxidisable Sulfur
SSA: Site Specific Assessment
SSHSLs: Site Specific Health Screening Levels
TAA: Total Actual Acidity in 1M KCL extract titrated to pH6.5
TB: Trip Blank
TCA: 1,1,1 Trichloroethane (methyl chloroform)
TCE: Trichloroethylene (Trichloroethene)
TCLP: Toxicity Characteristics Leaching Procedure
TPA: Total Potential Acidity, 1M KCL peroxide digest
TS: Trip Spike
TRH: Total Recoverable Hydrocarbons
TSA: Total Sulfide Acidity (TPA-TAA)
UCL: Upper Level Confidence Limit on Mean Value
USEPA United States Environmental Protection Agency
VOCC: Volatile Organic Chlorinated Compounds
WHO: World Health Organisation

Table Specific Explanations:

HIL Tables:

- The chromium results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.
- Carcinogenic PAHs is a toxicity weighted sum of analyte concentrations for a specific list of PAH compounds relative to B(a)P. It is also refered to as the B(a)P Toxic Equivalence Quotient (TEQ).
- Statistical calculations are undertaken using ProUCL (USEPA). Statistical calculation is usually undertaken using data from fill samples.

EIL/ESL Table:

- ABC Values for selected metals have been adopted from the published background concentrations presented in Olszowy et. al., (1995), Trace Element Concentrations in Soils from Rural and Urban New South Wales (the 25th percentile values for old suburbs with high traffic have been quoted).

Waste Classification and TCLP Table:

- Data assessed using the NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (2014).
- The assessment of Total Moderately Harmful pesticides includes: Dichlorovos, Dimethoate, Fenitrothion, Ethion, Malathion and Parathion.
- Assessment of Total Scheduled pesticides include: HBC, alpha-BHC, gamma-BHC, beta-BHC, Heptachlor, Aldrin, Heptachlor Epoxide, gamma-Chlordane, alpha-chlordane, pp-DDE, Dieldrin, Endrin, pp-DDD, pp-DDT, Endrin Aldehyde.

QA/QC Table:

- Field blank, Inter and Intra laboratory duplicate results are reported in mg/kg.
- Trip spike results are reported as percentage recovery.
- Field rinsate results are reported in µg/L.

TABLE S1
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013.
HIL-B: 'Residential with minimal opportunities for soil access; including dwellings with fully/permanently paved yards like high-rise buildings'

All data in mg/kg unless stated otherwise			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)	TOTAL PHENOLICS (as Phenol)	TOTAL PCBs	ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	Carcinogenic PAHs	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos			
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	5	0.1	100
Site Assessment Criteria (SAC)			500	150	500	30000	1200	120	1200	60000	400	4	15	400	500	10	90	600	10	340	50000	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																					
BH1	0.15-0.25	Fill: Sandy Gravel	<4	<0.4	**22**	**19**	**20**	<0.1	**9**	**46**	**3.8**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<5	<0.1	Not Detected
BH1 - [LAB_DUP]	0.15-0.25	Fill: Sandy Gravel	<4	<0.4	**12**	**17**	**22**	<0.1	**9**	**110**	**0.5**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	NA
BH1 - [TRIPLICATE]	0.15-0.25	Fill: Sandy Gravel	<4	<0.4	**10**	**15**	**18**	<0.1	**10**	**48**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH1	0.5-0.6	Fill: Silty Clay	**5**	<0.4	**15**	**21**	**31**	<0.1	**24**	**49**	**1.6**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	0.06-0.1	Fill: Sandy Gravel	<4	<0.4	**22**	**39**	**7**	<0.1	**77**	**33**	**0.1**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	0.1-0.2	Fill: Silty Clay	**7**	<0.4	**15**	**12**	**30**	<0.1	**6**	**24**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<5	<0.1	Not Detected
BH3	0.06-0.2	Fill: Sandy Gravel	<4	<0.4	**25**	**36**	**14**	<0.1	**5**	**32**	**580**	**57**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<5	<0.1	Not Detected
BH3	0.5-0.6	Fill: Sandy Gravel	**4**	<0.4	**28**	**31**	**16**	<0.1	**11**	**34**	**0.3**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH4	0.1-0.2	Fill: Silty Clay	**7**	<0.4	**11**	**21**	**49**	<0.1	**6**	**78**	**1.6**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<5	<0.1	Not Detected
BH4	0.5-0.6	Fill: Silty Clay	**10**	<0.4	**19**	**28**	**25**	<0.1	**6**	**36**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP-1	-		<4	<0.4	**22**	**41**	**4**	<0.1	**80**	**35**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Number of Samples			11	11	11	11	11	11	11	11	10	10	5	5	5	5	5	5	5	5	4	5	4
Maximum Value			10	<PQL	28	41	49	<PQL	80	110	580	57	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	Not Detected

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

TABLE S2
SOIL LABORATORY RESULTS COMPARED TO HSLs
All data in mg/kg unless stated otherwise

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	Field PID Measurement
PQL - Envirolab Services					25	50	0.2	0.5	1	1	1	ppm
NEPM 2013 HSL Land Use Category					**HSL-A/B:LOW/HIGH DENSITY RESIDENTIAL**							
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**								
BH1	0.15-0.25	Fill: Sandy Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH1 - [LAB_DUP]	0.15-0.25	Fill: Sandy Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH1 - [TRIPLICATE]	0.15-0.25	Fill: Sandy Gravel	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA	0
BH1	0.5-0.6	Fill: Silty Clay	0m to <1m	Clay	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH2	0.06-0.1	Fill: Sandy Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH2	0.1-0.2	Fill: Silty Clay	0m to <1m	Clay	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH3	0.06-0.2	Fill: Sandy Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH3	0.5-0.6	Fill: Sandy Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH4	0.1-0.2	Fill: Silty Clay	0m to <1m	Clay	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH4	0.5-0.6	Fill: Silty Clay	0m to <1m	Clay	<25	<50	<0.2	<0.5	<1	<3	<1	0
SDUP-1	-		0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	NA
Total Number of Samples					10	10	10	10	10	10	10	10
Maximum Value					<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the concentration above the SAC is highlighted in grey in the Site Assessment Criteria Table below

HSL SOIL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
BH1	0.15-0.25	Fill: Sandy Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH1 - [LAB_DUP]	0.15-0.25	Fill: Sandy Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH1 - [TRIPLICATE]	0.15-0.25	Fill: Sandy Gravel	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA
BH1	0.5-0.6	Fill: Silty Clay	0m to <1m	Clay	50	280	0.7	480	NL	110	5
BH2	0.06-0.1	Fill: Sandy Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	0.1-0.2	Fill: Silty Clay	0m to <1m	Clay	50	280	0.7	480	NL	110	5
BH3	0.06-0.2	Fill: Sandy Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH3	0.5-0.6	Fill: Sandy Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH4	0.1-0.2	Fill: Silty Clay	0m to <1m	Clay	50	280	0.7	480	NL	110	5
BH4	0.5-0.6	Fill: Silty Clay	0m to <1m	Clay	50	280	0.7	480	NL	110	5
SDUP-1	-		0m to <1m	Sand	45	110	0.5	160	55	40	3

TABLE S3
SOIL LABORATORY RESULTS COMPARED TO MANAGEMENT LIMITS
All data in mg/kg unless stated otherwise

			C_6-C_{10} (F1) plus BTEX	$>C_{10}$-C_{16} (F2) plus napthalene	$>C_{16}$-C_{34} (F3)	$>C_{34}$-C_{40} (F4)
PQL - Envirolab Services			25	50	100	100
NEPM 2013 Land Use Category			**RESIDENTIAL, PARKLAND & PUBLIC OPEN SPACE**			
Sample Reference	**Sample Depth**	**Soil Texture**				
BH1	0.15-0.25	Coarse	<25	<50	<100	<100
BH1 - [LAB_DUP]	0.15-0.25	Coarse	<25	<50	<100	<100
BH1 - [TRIPLICATE]	0.15-0.25	Coarse	NA	NA	NA	NA
BH1	0.5-0.6	Fine	<25	<50	<100	<100
BH2	0.06-0.1	Coarse	<25	<50	<100	**200**
BH2	0.1-0.2	Fine	<25	<50	<100	<100
BH3	0.06-0.2	Coarse	<25	<50	**1100**	**420**
BH3	0.5-0.6	Coarse	<25	<50	**140**	**210**
BH4	0.1-0.2	Fine	<25	<50	**120**	**120**
BH4	0.5-0.6	Fine	<25	<50	**130**	**180**
SDUP-1	-	Coarse	<25	<50	<100	**190**
Total Number of Samples			10	10	10	10
Maximum Value			<PQL	<PQL	1100	420

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

MANAGEMENT LIMIT ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Soil Texture**	C_6-C_{10} (F1) plus BTEX	$>C_{10}$-C_{16} (F2) plus napthalene	$>C_{16}$-C_{34} (F3)	$>C_{34}$-C_{40} (F4)
BH1	0.15-0.25	Coarse	700	1000	2500	10000
BH1 - [LAB_DUP]	0.15-0.25	Coarse	700	1000	2500	10000
BH1 - [TRIPLICATE]	0.15-0.25	Coarse	--	--	--	--
BH1	0.5-0.6	Fine	800	1000	3500	10000
BH2	0.06-0.1	Coarse	700	1000	2500	10000
BH2	0.1-0.2	Fine	800	1000	3500	10000
BH3	0.06-0.2	Coarse	700	1000	2500	10000
BH3	0.5-0.6	Coarse	700	1000	2500	10000
BH4	0.1-0.2	Fine	800	1000	3500	10000
BH4	0.5-0.6	Fine	800	1000	3500	10000
SDUP-1	-	Coarse	700	1000	2500	10000

TABLE S4
SOIL LABORATORY RESULTS COMPARED T0 DIRECT CONTACT CRITERIA
All data in mg/kg unless stated otherwise

Analyte		C_6-C_{10}	>C_{10}-C_{16}	>C_{16}-C_{34}	>C_{34}-C_{40}	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID
PQL - Envirolab Services		25	50	100	100	0.2	0.5	1	1	1	
CRC 2011 -Direct contact Criteria		5,600	4,200	5,800	8,100	140	21,000	5,900	17,000	2,200	
Site Use		**HIGH DENSITY RESIDENTIAL - DIRECT SOIL CONTACT**									
Sample Reference	**Sample Depth**										
BH1	0.15-0.25	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH1 - [LAB_DUP]	0.15-0.25	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH1 - [TRIPLICATE]	0.15-0.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
BH1	0.5-0.6	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH2	0.06-0.1	<25	<50	<100	**200**	<0.2	<0.5	<1	<3	<1	0
BH2	0.1-0.2	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH3	0.06-0.2	<25	<50	**1100**	**420**	<0.2	<0.5	<1	<3	<1	0
BH3	0.5-0.6	<25	<50	**140**	**210**	<0.2	<0.5	<1	<3	<1	0
BH4	0.1-0.2	<25	<50	**120**	**120**	<0.2	<0.5	<1	<3	<1	0
BH4	0.5-0.6	<25	<50	**130**	**180**	<0.2	<0.5	<1	<3	<1	0
SDUP-1	-	<25	<50	<100	**190**	<0.2	<0.5	<1	<3	<1	NA
Total Number of Samples		10	10	10	10	10	10	10	10	10	10
Maximum Value		<PQL	<PQL	1100	420	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

TABLE S5
ASBESTOS TESTING - LABORATORY RESULTS
HSL-B: Residential with minimal opportunities for soil access

FIELD DATA															LABORATORY DATA											
Date Sampled	Sample reference	Sample Depth	Visible ACM in top 100mm	Approx. Volume of Soil (L)	Soil Mass (g)	Mass ACM (g)	Mass Asbestos in ACM (g)	[Asbestos from ACM in soil] (%w/w)	Mass ACM <7mm (g)	Mass Asbestos in ACM <7mm (g)	[Asbestos from ACM <7mm in soil] (%w/w)	Mass FA (g)	Mass Asbestos in FA (g)	[Asbestos from FA in soil] (%w/w)	Lab Report Number	Sample refeference	Sample Depth	Sample Mass (g)	Asbestos ID in soil (AS4964) >0.1g/kg	Trace Analysis	Total Asbestos (g/kg)	Asbestos ID in soil <0.1g/kg	ACM >7mm Estimation (g)	FA and AF Estimation (g)	ACM >7mm Estimation %(w/w)	FA and AF Estimation %(w/w)
SAC			**No**					**0.04**			**0.001**			**0.001**											**0.04**	**0.001**
															242632	BH1	0.15-0.25	65	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected						
															242632	BH2	0.1-0.2	70	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected						
	No Field Screening														242632	BH3	0.06-0.2	60	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected						
															242632	BH4	0.1-0.2	45	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected						
															242632	B1	-	798.5	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
															242632	B2	-	815.45	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
															242632	B3	-	942.85	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
															242632	B4	-	748.57	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001

Concentration above the SAC **VALUE**

JKEnvironments

TABLE S6
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013 EILs AND ESLs
All data in mg/kg unless stated otherwise

Land Use Category				URBAN RESIDENTIAL AND PUBLIC OPEN SPACE																		
							AGED HEAVY METALS-EILs						EILs		ESLs							
				pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services				-	1	-	4	1	1	1	1	1	1	0.1	25	50	100	100	0.2	0.5	1	1	0.05
Ambient Background Concentration (ABC)				-	-	-	NSL	13	28	163	5	122	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**																			
BH1	0.15-0.25	Fill: Sandy Gravel	Coarse	NA	NA	NA	<4	**22**	**19**	**20**	**9**	**46**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH1 - [LAB_DUP]	0.15-0.25	Fill: Sandy Gravel	Coarse	NA	NA	NA	<4	**12**	**17**	**22**	**9**	**110**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH1 - [TRIPLICATE]	0.15-0.25	Fill: Sandy Gravel	Coarse	NA	NA	NA	<4	**10**	**15**	**18**	**10**	**48**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH1	0.5-0.6	Fill: Silty Clay	Fine	NA	NA	NA	**5**	**15**	**21**	**31**	**24**	**49**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH2	0.06-0.1	Fill: Sandy Gravel	Coarse	NA	NA	NA	<4	**22**	**39**	**7**	**77**	**33**	<1	NA	<25	<50	<100	**200**	<0.2	<0.5	<1	<3	<0.05
BH2	0.1-0.2	Fill: Silty Clay	Fine	NA	NA	NA	**7**	**15**	**12**	**30**	**6**	**24**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH3	0.06-0.2	Fill: Sandy Gravel	Coarse	NA	NA	NA	<4	**25**	**36**	**14**	**5**	**32**	<1	<0.1	<25	<50	**1100**	**420**	<0.2	<0.5	<1	<3	**39**
BH3	0.5-0.6	Fill: Sandy Gravel	Coarse	NA	NA	NA	**4**	**28**	**31**	**16**	**11**	**34**	<1	NA	<25	<50	**140**	**210**	<0.2	<0.5	<1	<3	<0.05
BH4	0.1-0.2	Fill: Silty Clay	Fine	NA	NA	NA	**7**	**11**	**21**	**49**	**6**	**78**	<1	<0.1	<25	<50	**120**	**120**	<0.2	<0.5	<1	<3	**0.2**
BH4	0.5-0.6	Fill: Silty Clay	Fine	NA	NA	NA	**10**	**19**	**28**	**25**	**6**	**36**	<1	NA	<25	<50	**130**	**180**	<0.2	<0.5	<1	<3	<0.05
SDUP-1	-		Coarse	NA	NA	NA	<4	**22**	**41**	**4**	**80**	**35**	<1	NA	<25	<50	<100	**190**	<0.2	<0.5	<1	<3	<0.05
Total Number of Samples				0	0	0	11	11	11	11	11	11	10	5	10	10	10	10	10	10	10	10	10
Maximum Value				NA	NA	NA	10	28	41	49	80	110	<PQL	<PQL	<PQL	<PQL	1100	420	<PQL	<PQL	<PQL	<PQL	39

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the elevated value is highlighted in grey in the EIL and ESL Assessment Criteria Table below

EIL AND ESL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**	pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
BH1	0.15-0.25	Fill: Sandy Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH1 - [LAB_DUP]	0.15-0.25	Fill: Sandy Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH1 - [TRIPLICATE]	0.15-0.25	Fill: Sandy Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	--	--	--	--	--	--	--	--	--	--	--
BH1	0.5-0.6	Fill: Silty Clay	Fine	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	1300	5600	65	105	125	45	20
BH2	0.06-0.1	Fill: Sandy Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH2	0.1-0.2	Fill: Silty Clay	Fine	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	1300	5600	65	105	125	45	20
BH3	0.06-0.2	Fill: Sandy Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH3	0.5-0.6	Fill: Sandy Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH4	0.1-0.2	Fill: Silty Clay	Fine	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	1300	5600	65	105	125	45	20
BH4	0.5-0.6	Fill: Silty Clay	Fine	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	1300	5600	65	105	125	45	20
SDUP-1	-		Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20

TABLE S7
SOIL LABORATORY RESULTS COMPARED TO WASTE CLASSIFICATION GUIDELINES
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		OC/OP PESTICIDES				Total PCBs	TRH					BTEX COMPOUNDS				ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P	Total Endosulfans	Chloropyrifos	Total Moderately Harmful	Total Scheduled		C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Total C_{10}-C_{36}	Benzene	Toluene	Ethyl benzene	Total Xylenes	
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.05	0.1	0.1	0.1	0.1	0.1	25	50	100	100	50	0.2	0.5	1	1	100
General Solid Waste CT1			100	20	100	NSL	100	4	40	NSL	200	0.8	60	4	250	50	50	650		NSL		10,000	10	288	600	1,000	-
General Solid Waste SCC1			500	100	1900	NSL	1500	50	1050	NSL	200	10	108	7.5	250	50	50	650		NSL		10,000	18	518	1,080	1,800	-
Restricted Solid Waste CT2			400	80	400	NSL	400	16	160	NSL	800	3.2	240	16	1000	50	50	2600		NSL		40,000	40	1,152	2,400	4,000	-
Restricted Solid Waste SCC2			2000	400	7600	NSL	6000	200	4200	NSL	800	23	432	30	1000	50	50	2600		NSL		40,000	72	2,073	4,320	7,200	-
Sample Reference	**Sample Depth**	**Sample Description**																									
BH1	0.15-0.25	Fill: Sandy Gravel	<4	<0.4	**22**	**19**	**20**	<0.1	**9**	**46**	**3.8**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH1 - [LAB_DUP]	0.15-0.25	Fill: Sandy Gravel	<4	<0.4	**12**	**17**	**22**	<0.1	**9**	**110**	**0.5**	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH1 - [TRIPLICATE]	0.15-0.25	Fill: Sandy Gravel	<4	<0.4	**10**	**15**	**18**	<0.1	**10**	**48**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH1	0.5-0.6	Fill: Silty Clay	**5**	<0.4	**15**	**21**	**31**	<0.1	**24**	**49**	**1.6**	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH2	0.06-0.1	Fill: Sandy Gravel	<4	<0.4	**22**	**39**	**7**	<0.1	**77**	**33**	**0.1**	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	**120**	**120**	<0.2	<0.5	<1	<3	NA
BH2	0.1-0.2	Fill: Silty Clay	**7**	<0.4	**15**	**12**	**30**	<0.1	**6**	**24**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH3	0.06-0.2	Fill: Sandy Gravel	<4	<0.4	**25**	**36**	**14**	<0.1	**5**	**32**	**580**	**39**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	**740**	**570**	**1310**	<0.2	<0.5	<1	<3	Not Detected
BH3	0.5-0.6	Fill: Sandy Gravel	**4**	<0.4	**28**	**31**	**16**	<0.1	**11**	**34**	**0.3**	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	**150**	**150**	<0.2	<0.5	<1	<3	NA
BH4	0.1-0.2	Fill: Silty Clay	**7**	<0.4	**11**	**21**	**49**	<0.1	**6**	**78**	**1.6**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	**160**	**160**	<0.2	<0.5	<1	<3	Not Detected
BH4	0.5-0.6	Fill: Silty Clay	**10**	<0.4	**19**	**28**	**25**	<0.1	**6**	**36**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	**150**	**150**	<0.2	<0.5	<1	<3	NA
SDUP-1	-		<4	<0.4	**22**	**41**	**4**	<0.1	**80**	**35**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	**110**	**110**	<0.2	<0.5	<1	<3	NA
Total Number of Samples			11	11	11	11	11	11	11	11	10	10	5	5	5	5	5	10	10	10	10	10	10	10	10	10	4
Maximum Value			10	<PQL	28	41	49	<PQL	80	110	580	39	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	740	570	1310	<PQL	<PQL	<PQL	<PQL	Not Detected

Concentration above the CT1 — **VALUE**
Concentration above SCC1 — **VALUE**
Concentration above the SCC2 — **VALUE**
Concentration above PQL — **Bold**

TABLE S8
SOIL LABORATORY TCLP RESULTS
All data in mg/L unless stated otherwise

			Arsenic	Cadmium	Chromium	Lead	Mercury	Nickel	B(a)P
PQL - Envirolab Services			0.05	0.01	0.01	0.03	0.0005	0.02	0.001
TCLP1 - General Solid Waste			5	1	5	5	0.2	2	0.04
TCLP2 - Restricted Solid Waste			20	4	20	20	0.8	8	0.16
TCLP3 - Hazardous Waste			>20	>4	>20	>20	>0.8	>8	>0.16
Sample Reference	**Sample Depth**	**Sample Description**							
BH3	0.06-0.2		NA	NA	NA	NA	NA	NA	<0.001
BH3 - [LAB_DUP]	0.06-0.2		NA	NA	NA	NA	NA	NA	<0.001
SDUP-1	-	Duplicate of BH2 (0.06-0.1)	<0.05	<0.01	<0.01	<0.03	<0.0005	**0.08**	NA
Total Number of samples			1	1	1	1	1	1	2
Maximum Value			<PQL	<PQL	<PQL	<PQL	<PQL	0.08	<PQL

General Solid Waste	**VALUE**
Restricted Solid Waste	**VALUE**
Hazardous Waste	**VALUE**
Concentration above PQL	**Bold**

TABLE S9
SOIL QA/QC SUMMARY

			TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene
	PQL Envirolab SYD		*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1*	*2*	*1*
	PQL Envirolab VIC		*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1.0*	*2.0*	*1.0*
Intra	BH2	0.06-0.1	<25	<50	<100	200	<0.2	<0.5	<1	<2	<1
laboratory	SDUP-1	-	<25	<50	<100	190	<0.2	<0.5	<1	<2	<1
duplicate	MEAN		nc	nc	nc	195	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	5%	nc	nc	nc	nc	nc
Field	TB-S1	-	NA	NA	NA	NA	<0.2	<0.5	<1	<2	<1
Blank	11/05/20										

			Naphthalene	Acenaphthylene	Acenaph-thene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthra-cene	Benzo(g,h,i)perylene
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.05*	*0.1*	*0.1*	*0.1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*
Intra	BH2	0.06-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
laboratory	SDUP-1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	0.075	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	67%	nc	nc	nc	nc	nc	nc	nc
Field	TB-S1	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	11/05/20																

			HCB	alpha- BHC	gamma- BHC	beta- BHC	Heptachlor	delta- BHC	Aldrin	Heptachlor Epoxide	Gamma- Chlordane	alpha- chlordane	Endosulfan I	pp- DDE	Dieldrin	Endrin	pp- DDD	Endosulfan II	pp- DDT	Endrin Aldehyde	Endosulfan Sulphate	Methoxychlor
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Intra	BH2	0.06-0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
laboratory	SDUP-1	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Field	TB-S1	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	11/05/20																					

			Azinphos-methyl (Guthion)	Bromophos-ethyl	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Parathion	Ronnel	Total PCBS	Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Nickel	Zinc
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4*	*0.4*	*1*	*1*	*1*	*0.1*	*1*	*1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4.0*	*0.4*	*1.0*	*1.0*	*1.0*	*0.1*	*1.0*	*1.0*
Intra	BH2	0.06-0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4	<0.4	22	39	7	<0.1	77	33
laboratory	SDUP-1	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4	<0.4	22	41	4	<0.1	80	35
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	22	40	5.5	nc	78.5	34
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0%	5%	55%	nc	4%	6%
Field	TB-S1	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	11/05/20																						

Result outside of QA/QC acceptance criteria 🟨

Appendix C: Site Information and Site History

Selected Site Photographs

Project Ref: E33141PArptRev1 Caringbah
Site Address: Sutherland Hospital, corner of Kingsway & Kareena Road, Caringbah, NSW
Selected Site Photos Dated: 7 May 2020

Photograph 1: Looking south-east at the site area including Main Hospital Building.

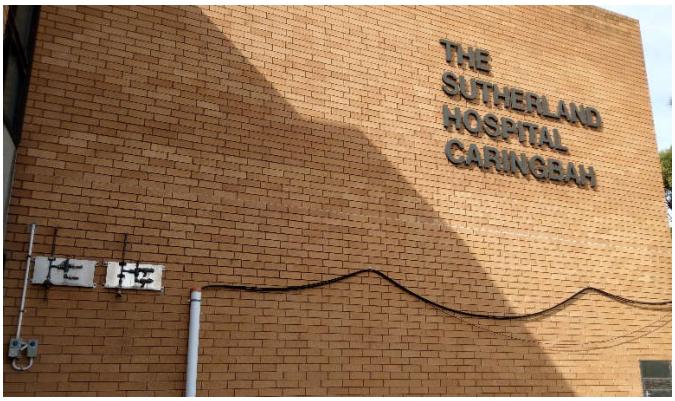
Photograph 2: Looking south-west at the Carpark 3 area**.**

Photographs 3: Neighboring Ambulance Station building**.**

Photograph 4: Looking north-east at the site area including Main Hospital Building.

Project Ref: E33141PArptRev1 Caringbah
Site Address: Sutherland Hospital, corner of Kingsway & Kareena Road, Caringbah, NSW
Selected Site Photos Dated: 7 May 2020

Photograph 5: View of the entrance to flu/covid clinic.



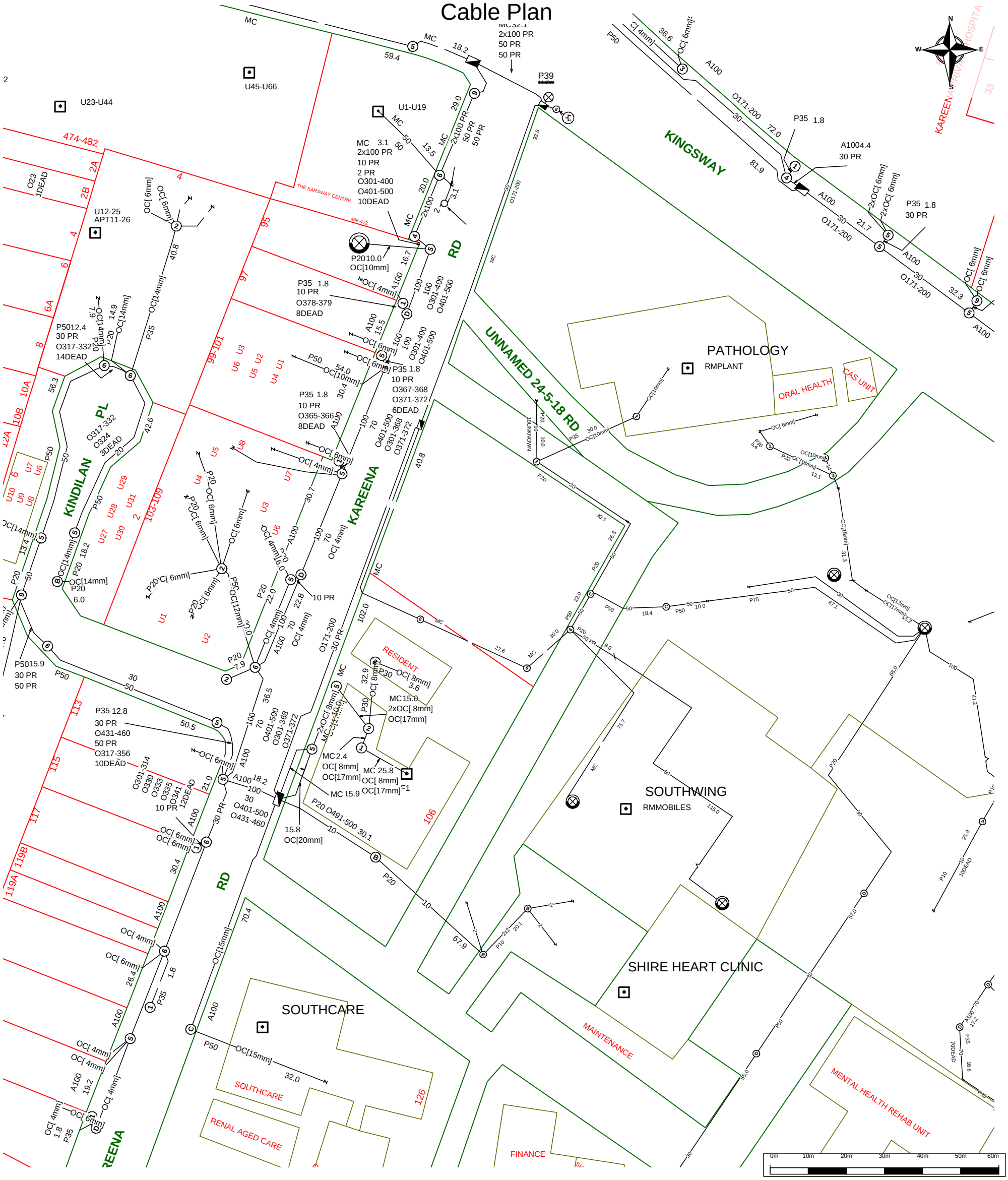
Photograph 6: View of the south-west corner of the building and the brick veneer façade**.**

Photographs 7: View of the window louvers across the western façade of the building.

Photograph 8: Awnings throughout the western façade of the building.

Selected DBYD Plans

Cable Plan



Telstra

For all Telstra DBYD plan enquiries -
email - Telstra.Plans@team.telstra.com
For urgent onsite contact only - ph 1800 653 935 (bus hrs)

TELSTRA CORPORATION LIMITED A.C.N. 051 775 556

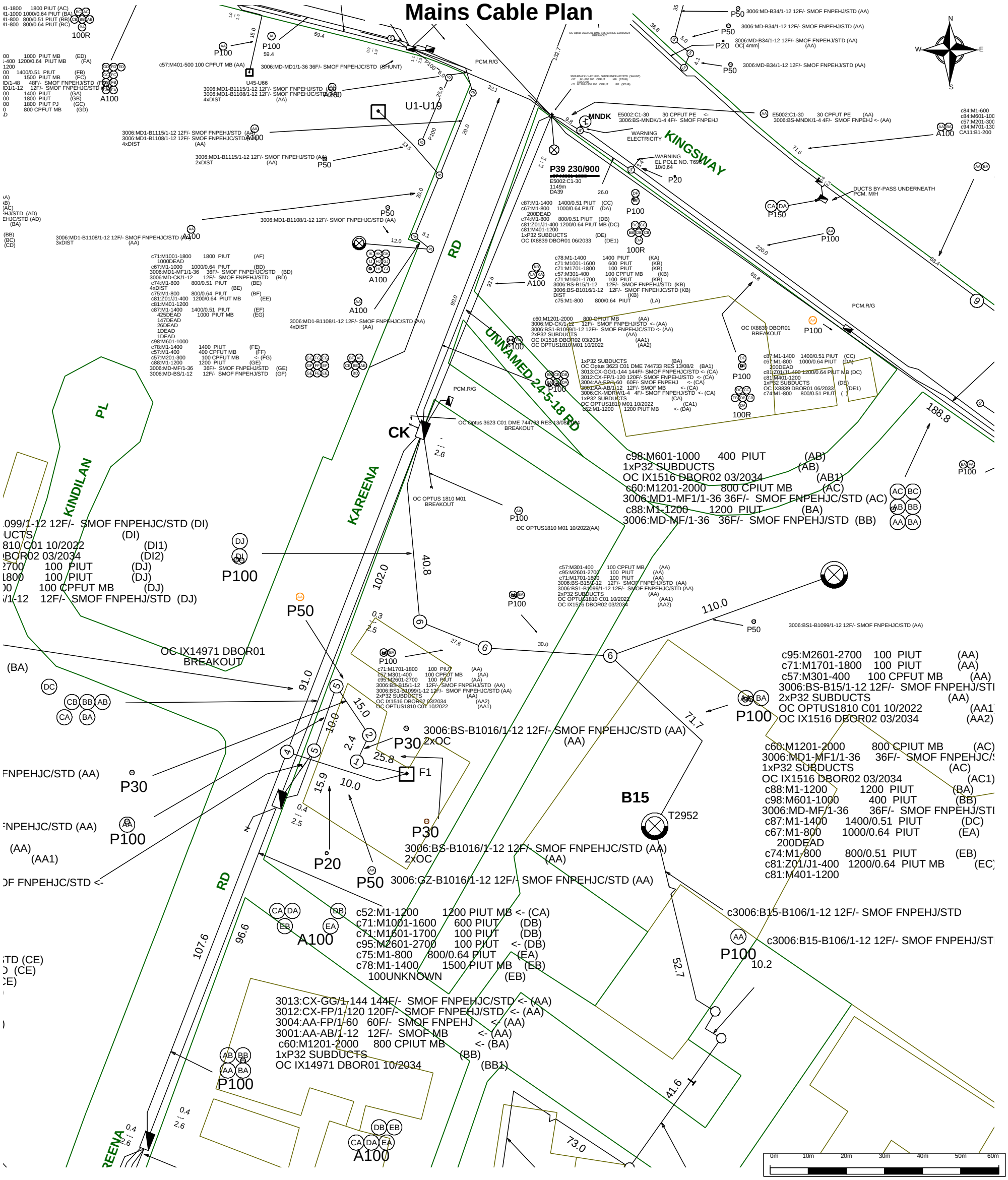
Generated On 16/04/2020 10:46:08

Sequence Number: 96730684

CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.

The above plan must be viewed in conjunction with the Mains Cable Plan on the following page

Mains Cable Plan



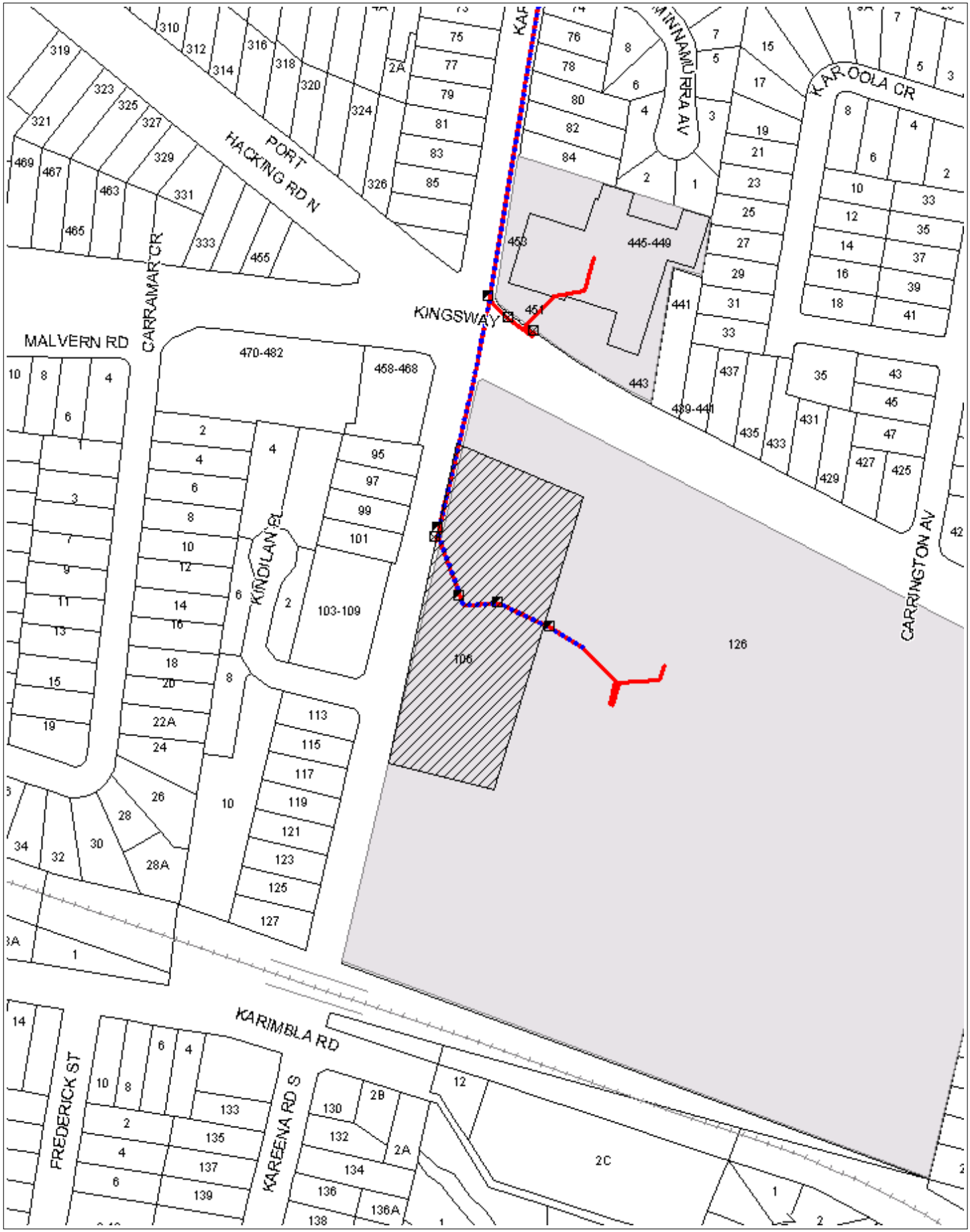
For all Telstra DBYD plan enquiries -
email - Telstra.Plans@team.telstra.com
For urgent onsite contact only - ph 1800 653 935 (bus hrs)

TELSTRA CORPORATION LIMITED A.C.N. 051 775 556

Generated On 16/04/2020 10:46:12

Sequence Number: 96730684

CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.



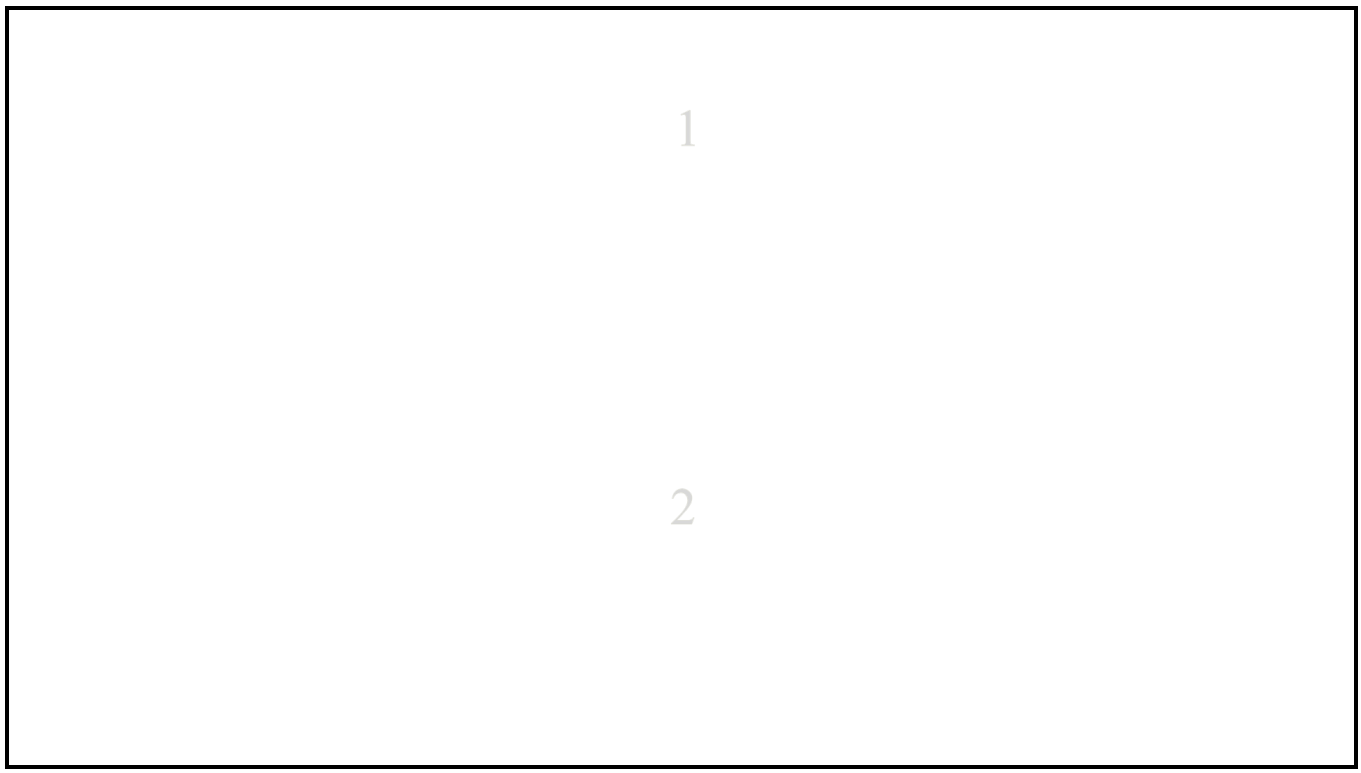
Sequence Number: 96730685

Date Generated: 16/04/2020

For all Optus DBYD plan enquiries –
Email: Fibre.Locations@optus.net.au
For urgent onsite assistance contact 1800 505 777
Optus Limited ACN 052 833 208

Indicative Plans

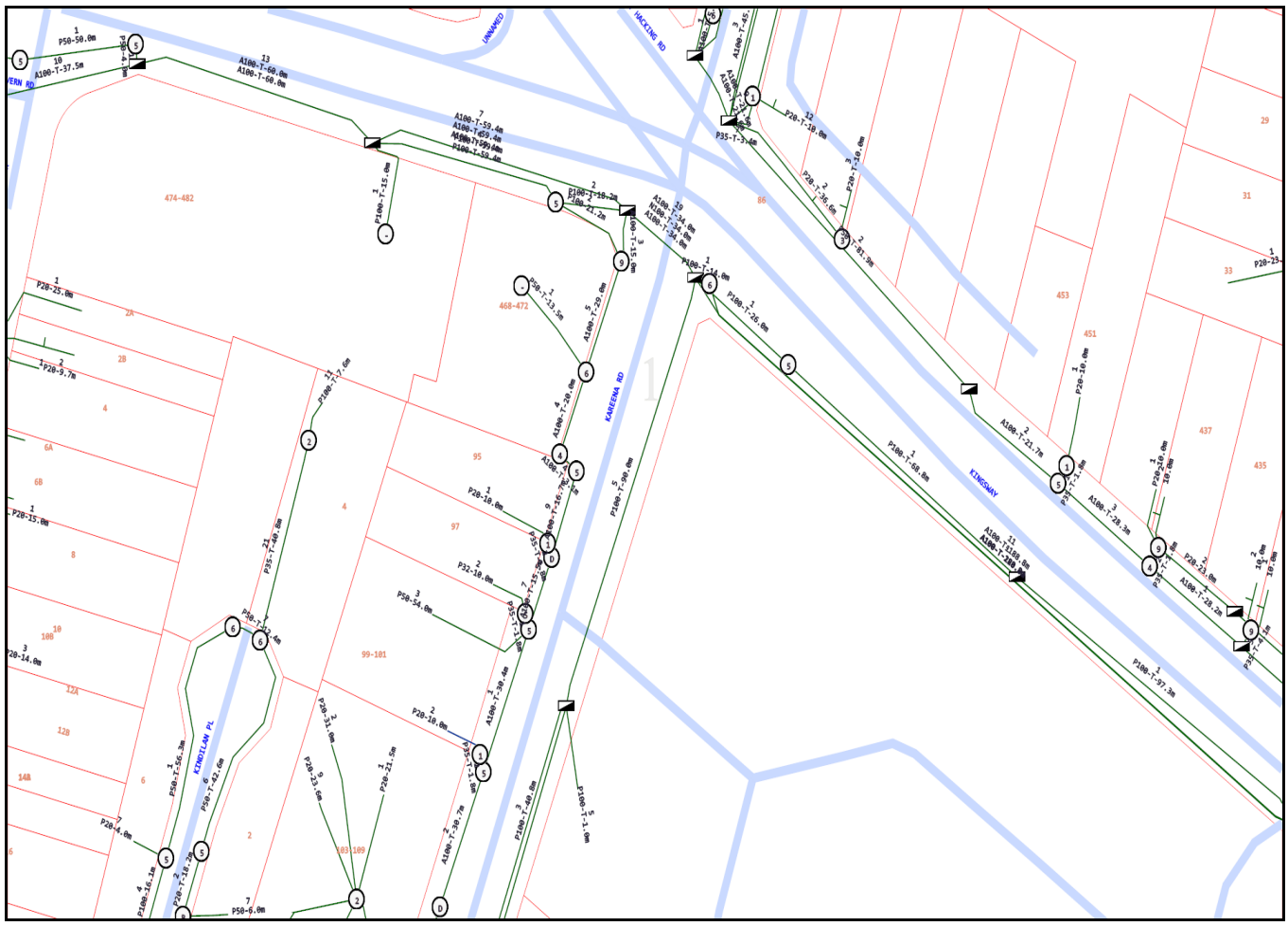
Issue Date:	16/04/2020
Location:	Kareena Road , Miranda , NSW , 2228



LEGEND

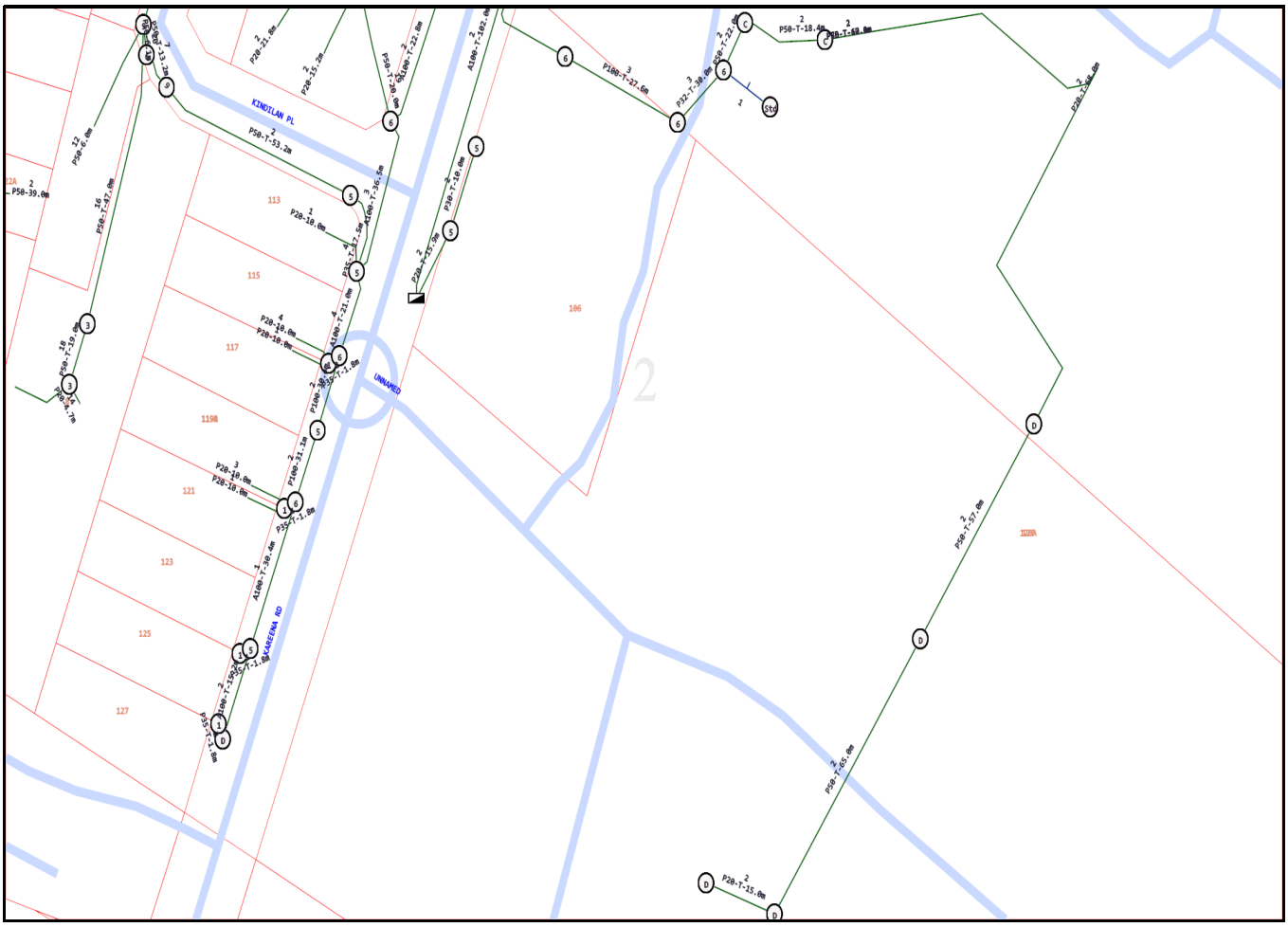
34	Parcel and the location
5	Pit with size "5"
2E	Power Pit with size "2E". Valid PIT Size: e.g. 2E, 5E, 6E, 8E, 9E, E, null.
	Manhole
	Pillar
2 PO – T- 25.0m P40 – 20.0m 5 9	Cable count of trench is 2. One "Other size" PVC conduit (PO) owned by Telstra (-T-), between pits of sizes, "5" and "9" are 25.0m apart. One 40mm PVC conduit (P40) owned by NBN, between pits of sizes, "5" and "9" are 20.0m apart.
2 10.0m 5 9	2 Direct buried cables between pits of sizes ,"5" and "9" are 10.0m apart.
5 9	Trench containing any INSERVICE/CONSTRUCTED (Copper/RF/Fibre) cables.
5 9	Trench containing only DESIGNED/PLANNED (Copper/RF/Fibre/Power) cables.
5 9	Trench containing any INSERVICE/CONSTRUCTED (Power) cables.
BROADWAY ST	Road and the street name "Broadway ST"
Scale	0 20 40 60 Meters 1:2000 1 cm equals 20 m

Email info@nbn.com.au Web nbn.com.au



Level 11, 100 Arthur Street, North Sydney NSW 2060

Email info@nbn.com.au Web nbn.com.au



Emergency Contacts

You must immediately report any damage to **nbn™** network that you are/become aware of. Notification may be by telephone - 1800 626 329.

Lotsearch Environmental Risk and Planning Report

LOTSEARCH

LOTSEARCH ENVIRO PROFESSIONAL

Date: 07 May 2020 10:59:16

Reference: LS012218 EP

Address: Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Cadastre Boundaries	NSW Department of Finance, Services & Innovation	05/03/2020	05/03/2020	Quarterly	-	-	-	-
Topographic Data	NSW Department of Finance, Services & Innovation	25/06/2019	25/06/2019	As required	-	-	-	-
List of NSW contaminated sites notified to EPA	Environment Protection Authority	15/04/2020	15/04/2020	Monthly	1000	0	0	4
Contaminated Land Records of Notice	Environment Protection Authority	21/04/2020	21/04/2020	Monthly	1000	0	0	3
Former Gasworks	Environment Protection Authority	21/04/2020	11/10/2017	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	12/02/2020	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	05/02/2020	13/07/2012	Quarterly	1000	0	0	2
EPA PFAS Investigation Program	Environment Protection Authority	22/04/2020	22/04/2020	Monthly	2000	0	0	1
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	12/02/2020	12/02/2020	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	12/02/2020	12/02/2020	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	22/04/2020	22/04/2020	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	04/05/2020	04/05/2020	Monthly	2000	0	0	0
EPA Other Sites with Contamination Issues	Environment Protection Authority	04/02/2020	13/12/2018	Annually	1000	0	0	0
Licensed Activities under the POEO Act 1997	Environment Protection Authority	09/04/2020	09/04/2020	Monthly	1000	0	0	1
Delicensed POEO Activities still regulated by the EPA	Environment Protection Authority	09/04/2020	09/04/2020	Monthly	1000	1	2	2
Former POEO Licensed Activities now revoked or surrendered	Environment Protection Authority	09/04/2020	09/04/2020	Monthly	1000	0	0	5
UBD Business Directories (Premise & Intersection Matches)	Hardie Grant			Not required	150	2	28	31
UBD Business Directories (Road & Area Matches)	Hardie Grant			Not required	150	-	137	158
UBD Business Directory Dry Cleaners & Motor Garages/Service Stations (Premise & Intersection Matches)	Hardie Grant			Not required	500	0	27	27
UBD Business Directory Dry Cleaners & Motor Garages/Service Stations (Road & Area Matches)	Hardie Grant			Not required	500	-	41	57
Points of Interest	NSW Department of Finance, Services & Innovation	19/02/2020	19/02/2020	Quarterly	1000	0	14	57
Tanks (Areas)	NSW Department of Customer Service - Spatial Services	19/02/2020	19/02/2020	Quarterly	1000	0	0	0
Tanks (Points)	NSW Department of Customer Service - Spatial Services	19/02/2020	19/02/2020	Quarterly	1000	0	0	0
Major Easements	NSW Department of Finance, Services & Innovation	19/02/2020	19/02/2020	Quarterly	1000	0	0	24
State Forest	Forestry Corporation of NSW	18/01/2018	18/01/2018	As required	1000	0	0	0
NSW National Parks and Wildlife Service Reserves	NSW Office of Environment & Heritage	21/01/2020	30/09/2019	Annually	1000	0	0	0
Hydrogeology Map of Australia	Commonwealth of Australia (Geoscience Australia)	08/10/2014	17/03/2000	As required	1000	1	1	1
Botany Groundwater Management Zones	NSW Department of Planning, Industry and Environment	15/03/2018	01/10/2005	As required	1000	0	0	0

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Groundwater Boreholes	NSW Dept. of Primary Industries - Water NSW; Commonwealth of Australia (Bureau of Meteorology)	24/07/2018	23/07/2018	Annually	2000	0	0	49
Geological Units 1:100,000	NSW Department of Planning, Industry and Environment	20/08/2014		None planned	1000	2	-	4
Geological Structures 1:100,000	NSW Department of Planning, Industry and Environment	20/08/2014		None planned	1000	0	-	0
Naturally Occurring Asbestos Potential	NSW Dept. of Industry, Resources & Energy	04/12/2015	24/09/2015	Unknown	1000	0	0	0
Atlas of Australian Soils	Australian Bureau of Agriculture and Resource Economics and Sciences (ABARES)	19/05/2017	17/02/2011	As required	1000	1	1	1
Soil Landscapes	NSW Department of Planning, Industry and Environment	12/08/2014		None planned	1000	1	-	4
Environmental Planning Instrument Acid Sulfate Soils	NSW Department of Planning, Industry and Environment	24/04/2020	28/02/2020	Monthly	500	0	-	-
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	1	2
Dryland Salinity - National Assessment	National Land and Water Resources Audit	18/07/2014	12/05/2013	None planned	1000	0	0	0
Dryland Salinity Potential of Western Sydney	NSW Department of Planning, Industry and Environment	12/05/2017	01/01/2002	None planned	1000	-	-	-
Mining Subsidence Districts	NSW Department of Customer Service - Subsidence Advisory NSW	19/02/2020	19/02/2020	Quarterly	1000	0	0	0
Environmental Planning Instrument SEPP State Significant Precincts	NSW Department of Planning, Industry and Environment	24/04/2020	07/12/2018	Monthly	1000	0	0	0
Environmental Planning Instrument Land Zoning	NSW Department of Planning, Industry and Environment	26/03/2020	26/03/2020	Monthly	1000	1	7	79
Commonwealth Heritage List	Australian Government Department of the Agriculture, Water and the Environment	04/02/2020	31/07/2018	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of the Agriculture, Water and the Environment	04/02/2020	20/11/2019	Quarterly	1000	0	0	0
State Heritage Register - Curtilages	NSW Department of Planning, Industry and Environment	12/02/2020	09/11/2018	Quarterly	1000	0	0	0
Environmental Planning Instrument Heritage	NSW Department of Planning, Industry and Environment	24/04/2020	17/04/2020	Monthly	1000	0	0	13
Bush Fire Prone Land	NSW Rural Fire Service	04/02/2020	14/12/2019	Quarterly	1000	0	0	2
Native Vegetation of the Sydney Metropolitan Area	NSW Office of Environment & Heritage	01/03/2017	16/12/2016	As required	1000	0	1	10
Ramsar Wetlands of Australia	Department of the Agriculture, Water and the Environment	08/10/2014	24/06/2011	As required	1000	0	0	0
Groundwater Dependent Ecosystems	Bureau of Meteorology	14/08/2017	15/05/2017	Unknown	1000	0	0	3
Inflow Dependent Ecosystems Likelihood	Bureau of Meteorology	14/08/2017	15/05/2017	Unknown	1000	0	0	4
NSW BioNet Species Sightings	NSW Office of Environment & Heritage	06/05/2020	06/05/2020	Weekly	10000	-	-	-

Site Diagram

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Legend

- Site Boundary
- Internal Parcel Boundaries

Total Area: 4333m^2

Total Perimeter: 322m

Scale: 0 15 30 Meters

Data Sources: Aerial Imagery: © Aerometrex Pty Ltd

Disclaimers:

Measurements are approximate only and may have been simplified or smaller lengths removed for readability.

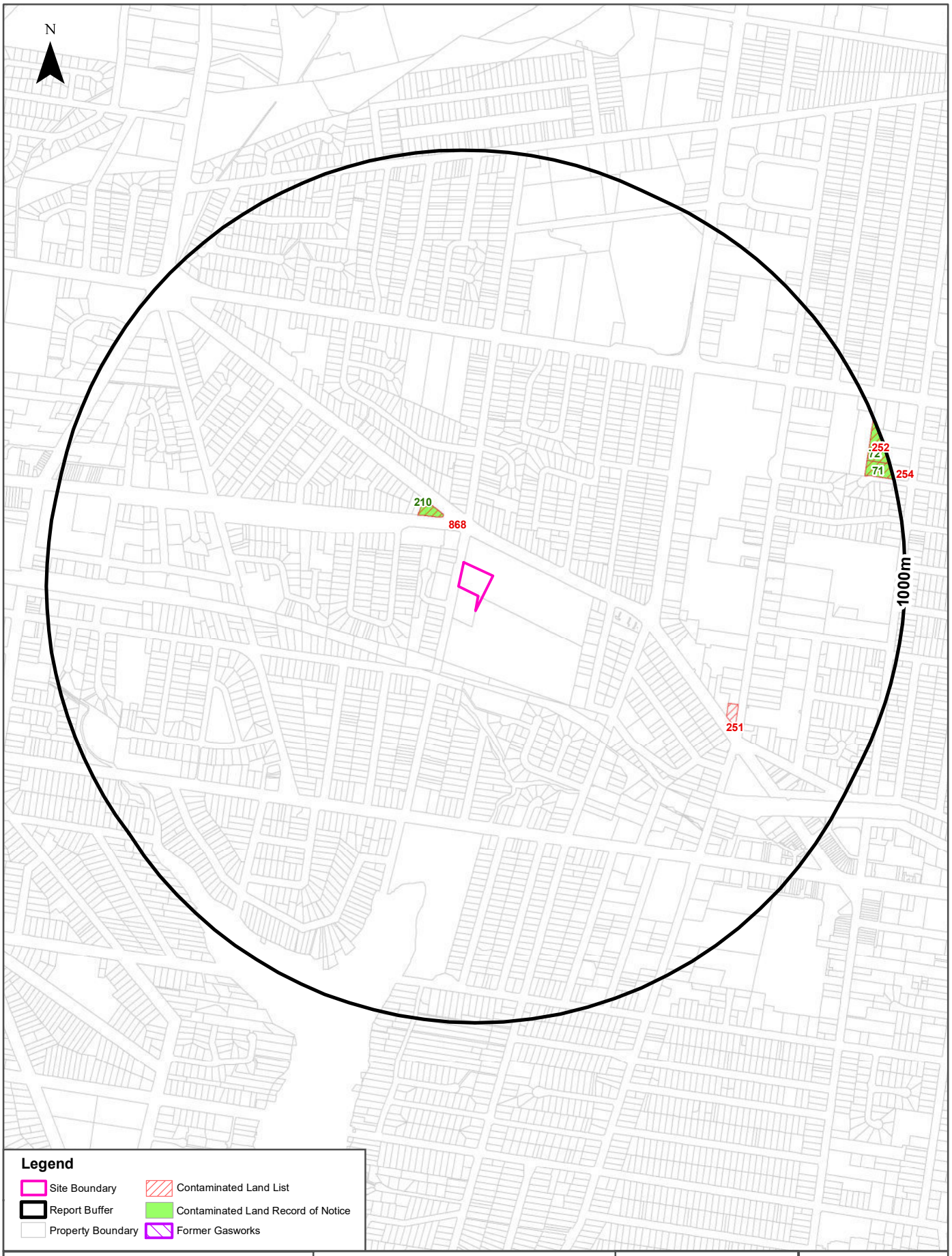
Parcels that make up a small percentage of the total site area have not been labelled for increased legibility.

Coordinate System: GDA 1994 MGA Zone 56

Date: 07 May 2020

Contaminated Land

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Contaminated Land

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

List of NSW contaminated sites notified to EPA

Records from the NSW EPA Contaminated Land list within the dataset buffer:

Map Id	Site	Address	Suburb	Activity	Management Class	Status	Location Confidence	Dist (m)	Direction
868	Woolworth's Service Station	455 Kingsway	Miranda	Service Station	Contamination currently regulated under CLM Act	Current EPA List	Premise Match	123m	North West
251	7-Eleven Service Station	367 The Kingsway	Caringbah	Service Station	Regulation under CLM Act not required	Current EPA List	Premise Match	648m	South East
254	Spirent Australia	105 Cawarra Road	Caringbah	Other Industry	Contamination formerly regulated under the CLM Act	Current EPA List	Premise Match	932m	East
252	Adjacent to Spirent Australia	101-103 Cawarra Road	Caringbah	Other Industry	Contamination formerly regulated under the CLM Act	Current EPA List	Premise Match	949m	East

The values within the EPA site management class in the table above, are given more detailed explanations in the table below:

EPA site management class	Explanation
Contamination being managed via the planning process (EP&A Act)	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. The contamination of this site is managed by the consent authority under the Environmental Planning and Assessment Act 1979 (EP&A Act) planning approval process, with EPA involvement as necessary to ensure significant contamination is adequately addressed. The consent authority is typically a local council or the Department of Planning and Environment.
Contamination currently regulated under CLM Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). Management of the contamination is regulated by the EPA under the CLM Act. Regulatory notices are available on the EPA's Contaminated Land Public Record of Notices.
Contamination currently regulated under POEO Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. Management of the contamination is regulated under the Protection of the Environment Operations Act 1997 (POEO Act). The EPA's regulatory actions under the POEO Act are available on the POEO public register.
Contamination formerly regulated under the CLM Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). The contamination was addressed under the CLM Act.
Contamination formerly regulated under the POEO Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed under the Protection of the Environment Operations Act 1997 (POEO Act).
Contamination was addressed via the planning process (EP&A Act)	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed by the appropriate consent authority via the planning process under the Environmental Planning and Assessment Act 1979 (EP&A Act).
Ongoing maintenance required to manage residual contamination (CLM Act)	The EPA has determined that ongoing maintenance, under the Contaminated Land Management Act 1997 (CLM Act), is required to manage the residual contamination. Regulatory notices under the CLM Act are available on the EPA's Contaminated Land Public Record of Notices.
Regulation being finalised	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997. A regulatory approach is being finalised.
Regulation under the CLM Act not required	The EPA has completed an assessment of the contamination and decided that regulation under the Contaminated Land Management Act 1997 is not required.

EPA site management class	Explanation
Under assessment	The contamination is being assessed by the EPA to determine whether regulation is required. The EPA may require further information to complete the assessment. For example, the completion of management actions regulated under the planning process or Protection of the Environment Operations Act 1997. Alternatively, the EPA may require information via a notice issued under s77 of the Contaminated Land Management Act 1997 or issue a Preliminary Investigation Order.

NSW EPA Contaminated Land List Data Source: Environment Protection Authority

Contaminated Land

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Contaminated Land: Records of Notice

Record of Notices within the dataset buffer:

Map Id	Name	Address	Suburb	Notices	Area No	Location Confidence	Distance	Direction
210	Woolworth's Service Station	455 Kingsway OTHER	Miranda	2 current and 5 former	3245	Premise Match	123m	North West
71	Spirent Australia	105 Cawarra Road	Caringbah	4 former	3162	Premise Match	932m	East
72	Adjacent to Spirent Australia	101-103 Cawarra Road	Caringbah	3 former	3161	Premise Match	949m	East

Contaminated Land Records of Notice Data Source: Environment Protection Authority

Terms of use and disclaimer for Contaminated Land: Record of Notices, please visit http://www.epa.nsw.gov.au/clm/clmdisclaimer.htm

Former Gasworks

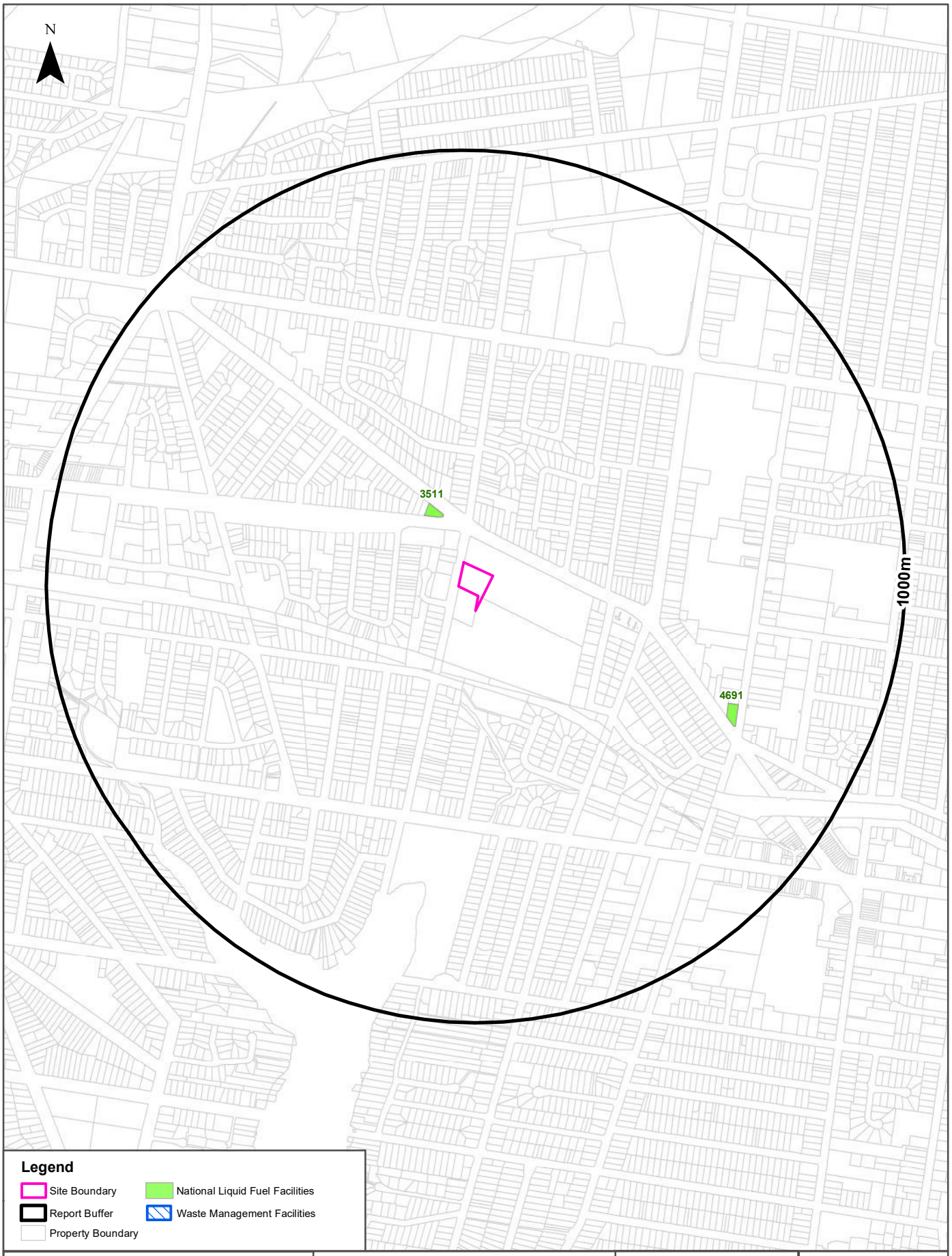
Former Gasworks within the dataset buffer:

Map Id	Location	Council	Further Info	Location Confidence	Distance	Direction
N/A	No records in buffer					

Former Gasworks Data Source: Environment Protection Authority

Waste Management & Liquid Fuel Facilities

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Waste Management & Liquid Fuel Facilities

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site Id	Owner	Name	Address	Suburb	Class	Landfill	Reprocess	Transfer	Comments	Loc Conf	Dist (m)	Direction
N/A	No records in buffer											

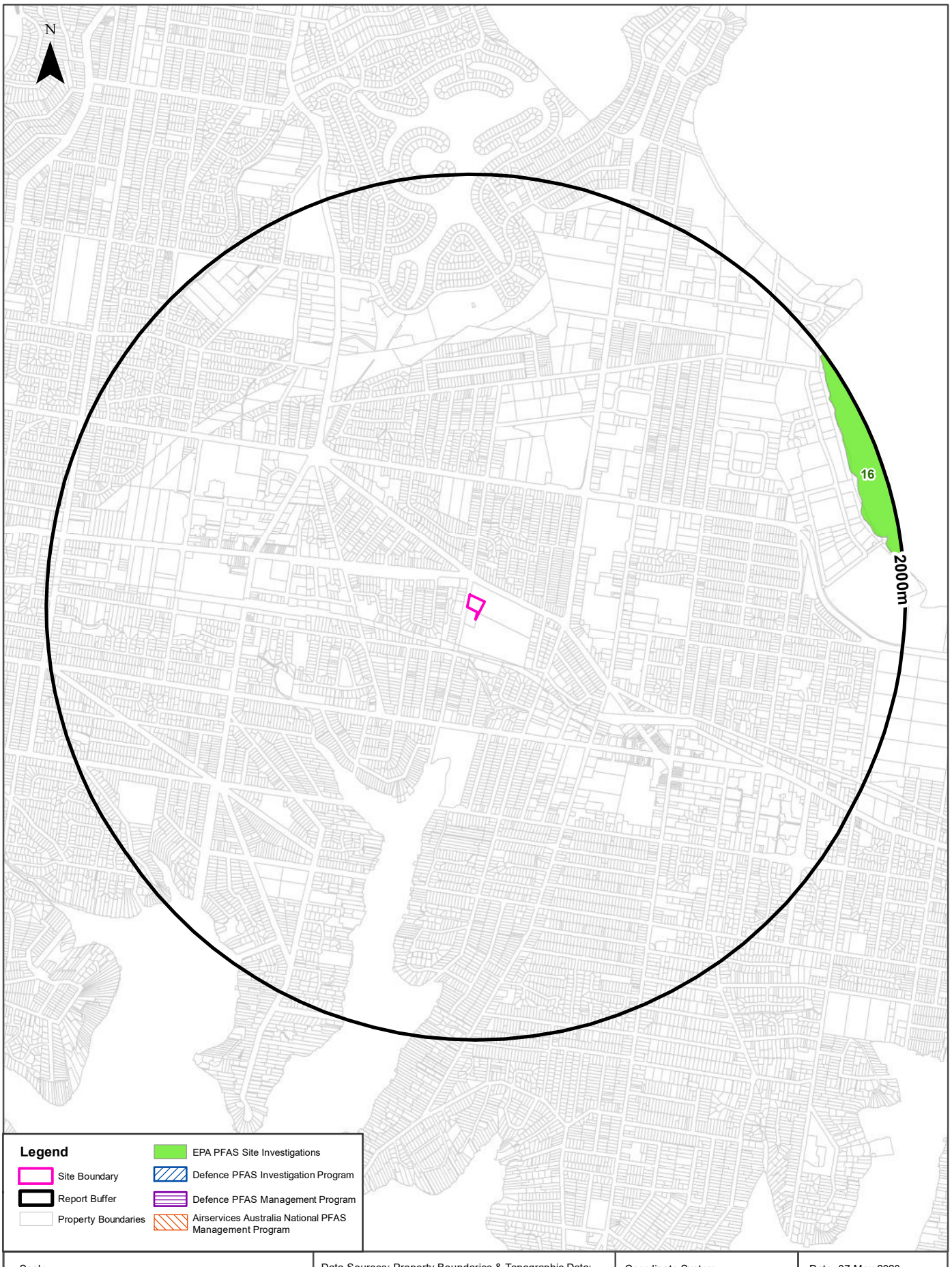
National Liquid Fuel Facilities

National Liquid Fuel Facilties within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Direction
3511	Caltex	Woolworths Caltex Miranda	455 Kingsway	Miranda	Petrol Station	Operational		25/07/2011	Premise Match	123m	North West
4691	7-Eleven Pty Ltd	Caringbah	367 The Kings Way	Caringbah	Petrol Station	Operational		13/07/2012	Premise Match	648m	South East

PFAS Investigation & Management Programs

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Data Sources: Property Boundaries & Topographic Data: © Department Finance, Services & Innovation 2020

Coordinate System: GDA 1994 MGA Zone 56

Date: 07 May 2020

PFAS Investigation & Management Programs

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

EPA PFAS Investigation Program

Sites that are part of the EPA PFAS investigation program, within the dataset buffer:

Id	Site	Address	Loc Conf	Dist	Dir
16	Botany Bay area & Georges River		General Area/ Suburb Match	1839m	North East

EPA PFAS Investigation Program: Environment Protection Authority

Defence PFAS Investigation Program

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Management Program

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Dist	Dir
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

EPA Other Sites with Contamination Issues

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

EPA Other Sites with Contamination Issues

This dataset contains other sites identified on the EPA website as having contamination issues. This dataset currently includes:

- James Hardie asbestos manufacturing and waste disposal sites
- Radiological investigation sites in Hunter's Hill
- Pasminco Lead Abatement Strategy Area

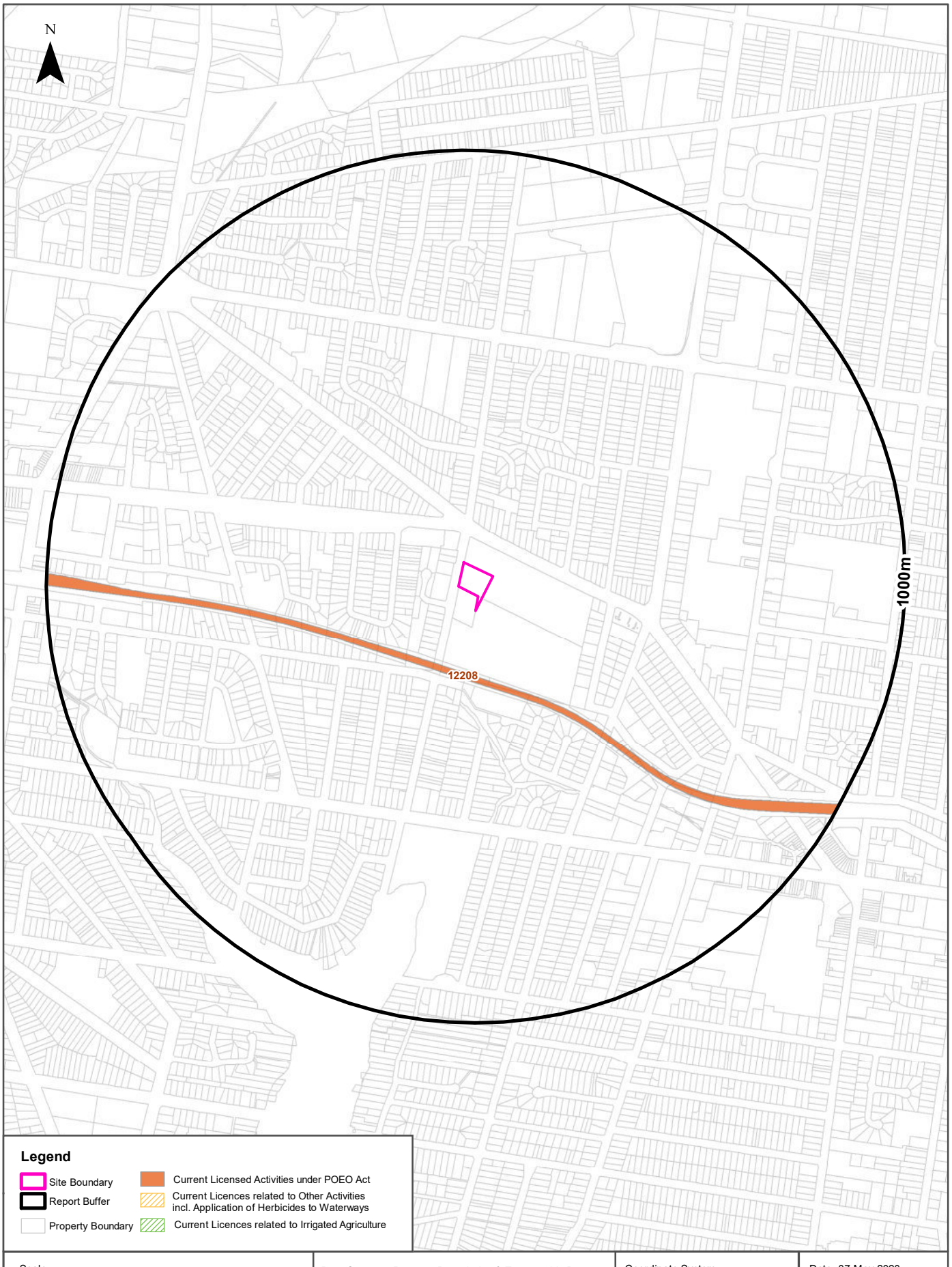
Sites within the dataset buffer:

Site Id	Site Name	Site Address	Dataset	Comments	Location Confidence	Distance	Direction
N/A	No records in buffer						

EPA Other Sites with Contamination Issues: Environment Protection Authority

Current EPA Licensed Activities

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Data Sources: Property Boundaries & Topographic Data: © Department Finance, Services & Innovation 2020

Coordinate System: GDA 1994 MGA Zone 56

Date: 07 May 2020

EPA Activities

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Licensed Activities under the POEO Act 1997

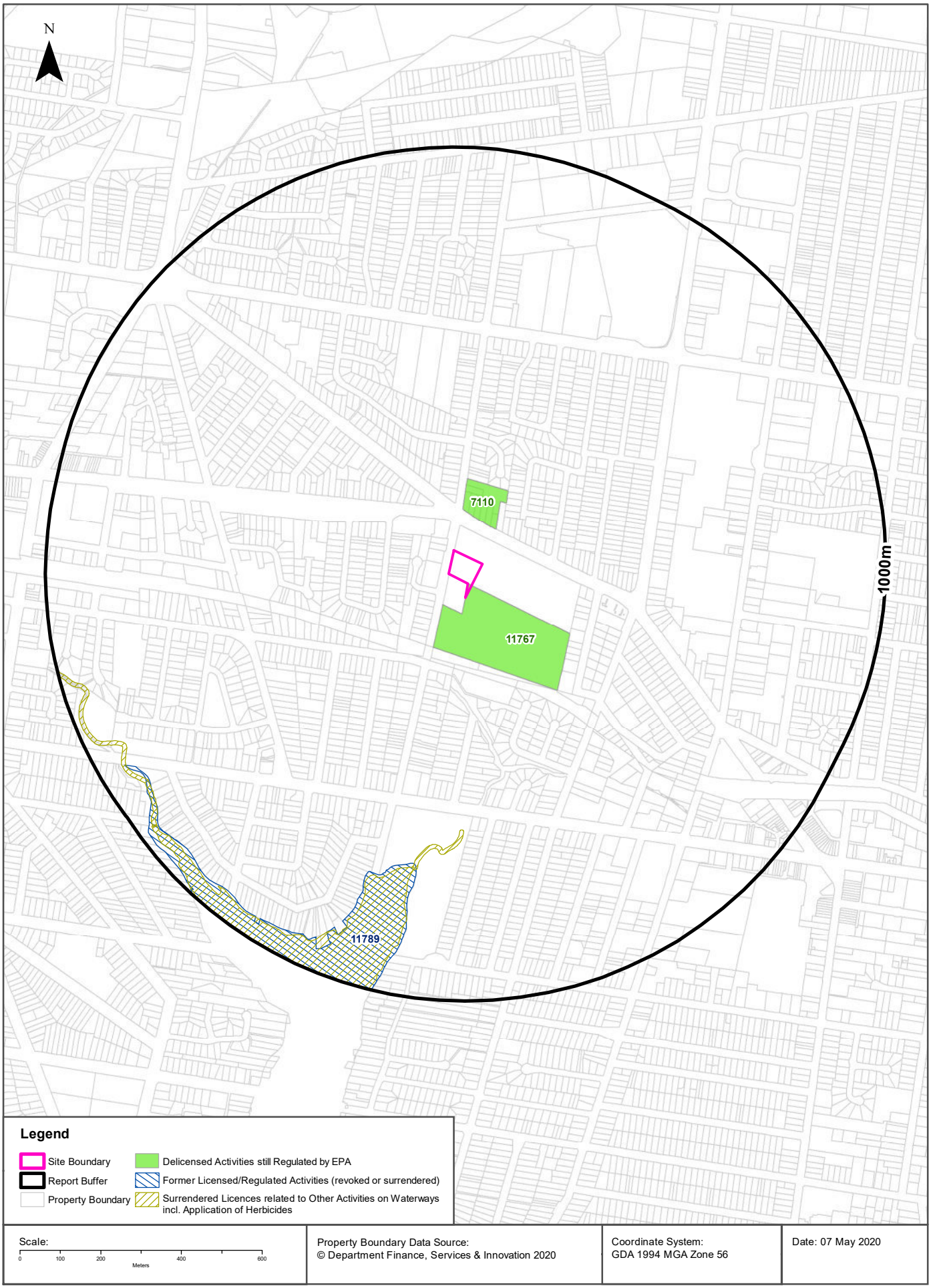
Licensed activities under the Protection of the Environment Operations Act 1997, within the dataset buffer:

EPL	Organisation	Name	Address	Suburb	Activity	Loc Conf	Distance	Direction
12208	SYDNEY TRAINS		PO BOX K349, HAYMARKET, NSW 1238		Railway systems activities	Network of Features	151m	South

POEO Licence Data Source: Environment Protection Authority

Delicensed & Former Licensed EPA Activities

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



EPA Activities

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Delicensed Activities still regulated by the EPA

Delicensed activities still regulated by the EPA, within the dataset buffer:

Licence No	Organisation	Name	Address	Suburb	Activity	Loc Conf	Distance	Direction
11767	SOUTH EASTERN SYDNEY AND ILLAWARRA AREA HEALTH SERVICE	SUTHERLAND HOSPITAL	CNR KINGSWAY AND KAREENA ROAD	CARINGBAH	Hazardous, Industrial or Group A Waste Generation or Storage	Premise Match	0m	Onsite
7110	HCOA OPERATIONS (AUSTRALIA) PTY LIMITED	KAREENA PRIVATE HOSPITAL	86 KAREENA ROAD	CARINGBAH	Hazardous, Industrial or Group A Waste Generation or Storage	Premise Match	91m	North

Delicensed Activities Data Source: Environment Protection Authority

Former Licensed Activities under the POEO Act 1997, now revoked or surrendered

Former Licensed activities under the Protection of the Environment Operations Act 1997, now revoked or surrendered, within the dataset buffer:

Licence No	Organisation	Location	Status	Issued Date	Activity	Loc Conf	Distance	Direction
4653	LUHRMANN ENVIRONMENT MANAGEMENT PTY LTD	WATERWAYS THROUGHOUT NSW	Surrendered	06/09/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	575m	-
4838	Robert Orchard	Various Waterways throughout New South Wales - SYDNEY NSW 2000	Surrendered	07/09/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	575m	-
6375	SUTHERLAND SHIRE COUNCIL	WATERWAYS OF SUTHERLAND SHIRE COUNCIL AREA	Surrendered	26/06/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	575m	-
6630	SYDNEY WEED & PEST MANAGEMENT PTY LTD	WATERWAYS THROUGHOUT NSW - PROSPECT, NSW, 2148	Surrendered	09/11/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	575m	-
11789	MCQUADE MARINE NO 2 PTY LTD	PORT HACKING, PORT HACKING, NSW 2229	Surrendered	17/12/2002	Water-based extractive activity	General Area/ Suburb Match	671m	South West

Former Licensed Activities Data Source: Environment Protection Authority

Historical Business Directories

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Legend

- Site Boundary
- Buffer 150m
- Property Boundary
- Business directory records mapped to a specific premise
- Business directory records mapped to a road intersection
- Business directory records mapped to a road corridor
- Business directory records mapped to a general area

Scale: 0 30 60 90 120 Meters

Coordinate System: GDA 1994 MGA Zone 56

Date: 07 May 2020

Historical Business Directories

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Business Directory Records 1950-1991
Premise or Road Intersection Matches

Universal Business Directory records from years 1991, 1986, 1982, 1978, 1975, 1970, 1965, 1961 & 1950, mapped to a premise or road intersection within the dataset buffer:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
1	Hospitals - Public	Sutherland Public Hospital, Kingsway (Corner Kareena Co.), Miranda	101142	1965	Premise Match	0m	On-site
	HOSPITALS-PUBLIC	Sutherland Public Hospital, Kingsway (Corner Kareena Rd.), Miranda	324900	1961	Premise Match	0m	On-site
2	Fruiterers & Greengrocers	Kingsway Fruiterers., 458 The Kingsway, Miranda	91527	1965	Premise Match	34m	North West
	FRUITERERS/GREENGROCERS	Gullice, R., 458 Kingsway, Miranda	315491	1961	Premise Match	34m	North West
	BUTCHERS-RETAIL	Kingsway Miranda Butchery, 458 Kingsway, Miranda	280607	1961	Premise Match	34m	North West
3	MEDICAL PRACTITIONERS. (M2020)	Segal, H., 447 Kingsway, Caringbah. 2229.	50192	1982	Premise Match	93m	North
	MEDICAL PRACTITIONERS.	Segal. H., 447 Kingsway, Caringbah. 2229	44195	1978	Premise Match	93m	North
	MEDICAL PRACTITIONERS.	Segal, H., 447 Kingsway., Caringbah. 2229.	51500	1975	Premise Match	93m	North
	MEDICAL PRACTITIONERS (M216)	Segal, Harry., 447 The Kingsway, Caringbah	328175	1970	Premise Match	93m	North
4	VETERINARY SURGEONS (V150)	Capell, J.W., 451 The Kingsway, Caringbah	372707	1970	Premise Match	96m	North
5	MOTOR GARAGES & ENGINEERS(M6S6)	Civic Garage & Service Station., Kingsway & Port Hacking Rd., MIRANDA	337578	1970	Road Intersection	100m	North
	Motor Towing Services	Civic Garage & Service Station, Cnr. The Kingsway & Port Hacking Rd., Miranda	127021	1965	Road Intersection	100m	North
	Motor Garages & Engineers	Civic Garage & Service Station, Kingsway & Port Hacking Rd. Miranda	123040	1965	Road Intersection	100m	North
	Motor Car/Truck Dealers - New/Used	Civic Garage & Service Station, Kingsway & Port Hacking. Rd., Miranda	120571	1965	Road Intersection	100m	North
	Motor Garages & Engineers	Port Hacking (Ampol) Service Station, Cnr. The Kingsway & Port Hacking Rd. Caringbah	122382	1965	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS	Civic Garage & Service Station, Kingsway & Port Hacking Rd. MIRANDA	346885	1961	Road Intersection	100m	North
	MOTOR CAR/TRUCK DEALERS—NEW/USED	Civic Garage & Service Station, Kingsway & Port Hacking Rd., Miranda	344949	1961	Road Intersection	100m	North
	MOTOR CAR/TRUCK DEALERS—NEW/USED	Falson, A., Cnr. Port Hacking & Kareena Rds., Miranda	345017	1961	Road Intersection	100m	North
	MOTOR PANEL BEATERS	Falson, A., Cnr. Port Hacking & Kareena Rds., Miranda	349562	1961	Road Intersection	100m	North
	MOTOR SERVICE STATIONS—PETROL, OIL, Etc.	Port Hacking (Ampol) Service Station, Cnr. Kingsway & Port Hacking Rds. CARINGBAH	350973	1961	Road Intersection	100m	North
	MOTOR PAINTERS	Civic Garage and Service Station, Cnr. Port Hacking Rd. & Kingsway, Miranda	84755	1950	Road Intersection	100m	North

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
5	MOTOR PANEL BEATERS	Civic Garage and Service Station, Cnr. Port Hacking Rd. and Kingsway, Miranda	85219	1950	Road Intersection	100m	North
	MOTOR TRIMMERS	Civic Garage and Service Station, Cnr. Port Hacking Rd. and Kingsway, Miranda	87016	1950	Road Intersection	100m	North
	MOTOR ACCESSORIES-DEALER	Civic Garage and Service Station, Kingsway and Port Hacking Rd., Miranda	81541	1950	Road Intersection	100m	North
	MOTOR CAR & TRUCK DEALERS-USED	Civic Garage and Service Station, Kingsway and Port Hacking Rd., Miranda	82326	1950	Road Intersection	100m	North
	MOTOR ELECTRICIANS	Civic Garage and Service Station, Kingsway and Port Hacking Rd., Miranda	83092	1950	Road Intersection	100m	North
	MOTOR GARAGES &/OR ENGINEERS	Civic Garage and Service Station, Kingsway and Port Hacking Rd., Miranda	83588	1950	Road Intersection	100m	North
	MOTOR SERVICE STATIONS-PETROL, Etc.	Civic Garage and Service Station, Kingsway and Port Hacking Rd., Miranda	85871	1950	Road Intersection	100m	North
6	MEDICAL PRACTITIONERS	Roston, S., 429 Kingsway, Caringbah	336218	1961	Premise Match	127m	East
7	MEDICAL PRACTITIONERS (M216)	Larum, N., 427 The Kingsway., Caringbah	327398	1970	Premise Match	138m	East
8	Auto Electricians	Dino Auto Electrical Service, 455 Kingsway, Miranda 2228	34928	1991	Premise Match	150m	North West

Business Directory Records 1950-1991
Road or Area Matches

Universal Business Directory records from years 1991, 1986, 1982, 1978, 1975, 1970, 1965, 1961 & 1950, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
9	Conveyor &/or Conveying Equip Mfrs &/or Imps &/or Dists	Reflex Pty. Ltd., Kareena Rd., Caringbah 2229	40818	1991	Road Match	0m
	Castor &/or Wheel Mfrs &/or Dists	Richmond Engineering Co. Pty. Ltd., Kareena Rd, Caringbah 2229	38567	1991	Road Match	0m
	PLASTIC COATING SPECIALISTS MATERIAL.	Laminex Industries Div. of A. V. Wehl, Kareena Rd., Miranda. 2028	57428	1978	Road Match	0m
	PLASTIC FABRICATORS &/OR VACUUM FORMERS.	Laminex Industries Div. of A. V. Wehl, Kareena Rd., Miranda. 2028	57594	1978	Road Match	0m
	PLASTIC LAMINATED PRODUCTS MFRS. &/OR DISTS.,	Laminex Industries Div. of A. V. Wehl, Kareena Rd., Miranda. 2028	57733	1978	Road Match	0m
	LAMINATED MATERIALS &/OR PRODUCTS MFRS.	Laminex Industries Div. of A.V. Wehl, Kareena Rd., Miranda., 2028	39570	1978	Road Match	0m
	PLASTIC FABRICATORS &/OR VACUUM FORMERS.	Laminex Industries Div. of A.V Wehl., Kareena Rd., Miranda. 2028	67813	1975	Road Match	0m
	PLASTIC LAMINATED PRODUCTS MFRS. &/OR DISTS.	Laminex Industries Div. of A.V. Wehl, Kareena Rd., Miranda2028	67983	1975	Road Match	0m
	PLASTIC COATING SPECIALISTS MATERIAL	Laminex Industries Div. of A.V. Wehl., Kareena Rd., Miranda. 2028	67616	1975	Road Match	0m
	LAMINATED MATERIALS &/OR PRODUCTS MFRS.	Laminex Industries Div. of A.V.Wehl., Kareena Rd., Miranda. 2028	46682	1975	Road Match	0m
	DELICATESSENS (D080)	Australian & Continental Delicatessen., Shop 3, Kareena Rd., Miranda	287122	1970	Road Match	0m
	BUTCHERS-RETAIL (B860)	Kingsway Butchery., Shop 2., Kareena Rd., Miranda	273891	1970	Road Match	0m
	CHEMISTS-PHARMACEUTICAL	Peoples, C.J., Shop 5, Kareena Rd., Miranda	280958	1970	Road Match	0m
	MOTOR GARAGES & ENGINEERS(M6S6)	Total Miranda Service Station., Kareena Rd., MIRANDA	338747	1970	Road Match	0m
	LAMINATED MATERIALS/PRODUCTS MANUFACTURERS (L070)	Wehl, A. V. Industries (N.S.W.) Pty. Ltd., Kareena Rd., Miranda	322385	1970	Road Match	0m
	PLASTIC COATING SPECIALISTS MATERIAL, ETC.	Wehl, A. V. Industries (N.S.W.) Pty. Ltd., Kareena Rd., Miranda	349364	1970	Road Match	0m
	PLASTIC FABRICATORS & VACUUM FORMERS	Wehl, A. V. Industries (N.S.W.) Pty. Ltd., Kareena Rd., Miranda	349572	1970	Road Match	0m
	PLASTIC LAMINATED PRODUCTS MANUFACTURERS (P576)	Wehl, A. V. Industries (N.S.W.) Pty. Ltd., Kareena Rd., Miranda	349795	1970	Road Match	0m
	BAKER'S CART MANUFACTURERS	Matson Bros., Kareena Rd., Miranda	5070	1950	Road Match	0m
	BOAT, LAUNCH & YACHT BUILDERS & REPAIRERS	Matson, O. and F., Kareena Rd., Miranda	8796	1950	Road Match	0m
10	MOTOR GARAGES & SERVICE STATIONS.	Port Hacking Service Station, Kingsway, Caringbah. 2229	65276	1986	Road Match	61m
	RESTAURANTS.	Spartacus Restaurant, Shop 6 Caringbah Centre Court, Kingsway, Caringbah. 2229	82896	1986	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS. (M6860)	Port Hacking Service Station, Kingsway, Caringbah. 2229.	57396	1982	Road Match	61m
	BUILDERS &/OR BUILDING CONTRACTORS.	Crusade Construction Co. Pty. Ltd., Kingsway, Caringbah. 2229	7662	1978	Road Match	61m
	REAL ESTATE AGENTS &/OR VALUERS.	Crusade Estates Pty. Ltd., Kingsway, Caringbah. 2229	61541	1978	Road Match	61m

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
10	MILK, FRUIT JUICE BARS &/OR CONFECTIONERS.	Parry's Pty. Ltd., Kingsway, Caringbah. 2229	46110	1978	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Port Hacking Service Station, Kingsway, Caringbah. 2229	50676	1978	Road Match	61m
	TRAVEL GOODS., RETAILERS.	Caringbah Bag Store, Kingsway, Caringbah. 2229	85204	1975	Road Match	61m
	FISH MERCHANTS-RETAIL	Caringbah Fish Shop, 1 Newton Shopping Centre, Caringbah. 2229.	32313	1975	Road Match	61m
	BUILDERS &/OR BUILDING CONTRACTORS.	Crusade Construction Co. Pty. Ltd. The Kingsway Caringbah 2229	8426	1975	Road Match	61m
	HOLDING COMPANIES.	Crusade Enterprises Pty. Ltd., The Kingsway., Caringbah. 2229	42217	1975	Road Match	61m
	REAL ESTATE AGENTS &/OR VALUERS.	Crusade Estates Pty. Ltd., The Kingsway., Caringbah. 2229	72200	1975	Road Match	61m
	BUILDERS &/OR BUILDING CONTRACTORS.	Crusade Homes, Kingsway, Caringbah 2229	8427	1975	Road Match	61m
	MILK, FRUIT JUICE BARS &/OR CONFECTIONERS.	Parry's Pty. Ltd., Kingsway., Caringbah. 2229	53721	1975	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS.	Port Hacking Service Station., Kingsway Rd., Caringbah. 2229	59405	1975	Road Match	61m
	REAL ESTATE AGENTS &/OR VALUERS.	Reliable Real Estate, The Kingsway., Caringbah. 2229	72869	1975	Road Match	61m
	BUTCHERS-RETAIL	Western Downs Meat Co. Pty. Ltd., Kingsway, Caringbah. 2229	11381	1975	Road Match	61m
	CHEMISTS-PHARMACEUTICAL	Wilson's Pharmacy, Kingsway, Caringbah. 2229	16088	1975	Road Match	61m
	PHOTOGRAPHIC SUPPLIES (P300)	Alderson Camera Stores., 6 Newton Shopping Centre, Kingsway., Caringbah	348308	1970	Road Match	61m
	SURVEYORS-LAND	Brown, J. N., The Kingsway, Caringbah, 2229	366393	1970	Road Match	61m
	TRAVEL GOODS RETAILERS (T655)	Caringbah Bag Store, Newton Shopping Centre, Kingsway, Caringbah	371245	1970	Road Match	61m
	HANDBAG/GLOVE SPECIALISTS (H160)	Caringbah Bag Store., The Kingsway., Caringbah	314745	1970	Road Match	61m
	FISH MERCHANTS-RETAIL (F245)	Caringbah Fish Shop., 1 Newton Shopping Centre., Caringbah	303351	1970	Road Match	61m
	BUILDERS & CONTRACTORS (B800)	Crusade Homes., Kingsway Rd., Caringbah	270056	1970	Road Match	61m
	MERCERS-MEN'S & BOYS' OUTFITTERS(M232)	Day's Shoe Store Pty. Ltd., Newton Shopping Centre., Kingsway, Caringbah	328831	1970	Road Match	61m
	CAKE SHOPS & PASTRYCOOKS (C045)	Hall's Cake Shop, Newton Shopping Centre., The Kingsway., Caringbah	276559	1970	Road Match	61m
	JEWELLERS/WATCHMAKERS-RETAIL(J060)	Harvey & Kennedy., 9 Newton Shopping Centre, The Kinsgway., Caringbah	321097	1970	Road Match	61m
	REAL ESTATE AGENTS/VALUERS(R205)	Harvey Real Estate (Caringbah) Pty. Ltd., The Kingsway., CARINGBAH	355452	1970	Road Match	61m
	MERCERS-MEN'S & BOYS' OUTFITTERS(M232)	Kevin's Men's Wear., 14 Newton Shopping Centre, The Kingsway, Caringbah	328977	1970	Road Match	61m
	DEPARTMENTAL STORES (D170)	McDowells., The Kingsway., Caringbah	289205	1970	Road Match	61m
	MILK, FRUIT JUICE BARS/CONFECTIONERS	Parry's Pty. Ltd., 3 Newton Shopping Centre, The Kingsway., Caringbah	331035	1970	Road Match	61m
	DRESS SHOPS (D595)	Pastels., 2 Newton Centre., Caringbah	291619	1970	Road Match	61m
	BABY & CHILDREN'S WEAR-RETAIL(B005)	Tiny Tots (Prim & Pretty)., 8 Newton Shopping Centre., The Kingsway., Caringbah	264300	1970	Road Match	61m
	BUTCHERS-RETAIL (B860)	Western Downs Meat Co. Pty. Ltd., 2 Newton Shopping Centre, Kingsway., Caringbah	274792	1970	Road Match	61m
	CHEMISTS-PHARMACEUTICAL	Wilson's Pharmacy., Newton Shopping Centre, Kingsway., Caringbah	281287	1970	Road Match	61m
	Insurance Agents	Reliable Real Estate Pty. Ltd., Crusade Bldg., The Kingsway, Caringbah	104499	1965	Road Match	61m
	MOTOR ELECTRICIANS	Caringbah Garage, Kingsway, Caringbah	346012	1961	Road Match	61m
	BANKS	Commercial Bank Of Australia Ltd The Kingsway, Caringbah	271209	1961	Road Match	61m

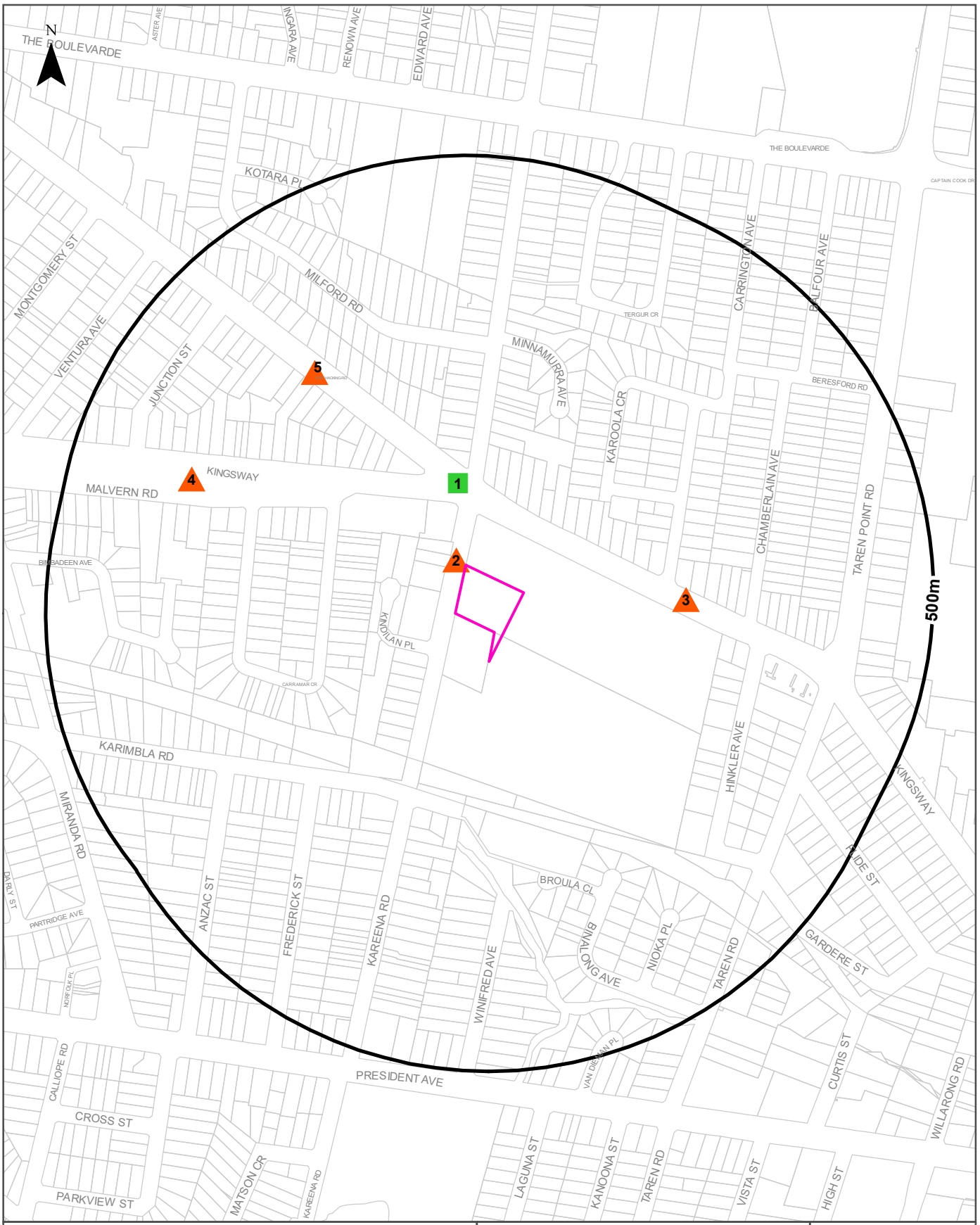
Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
10	BUILDERS & CONTRACTORS-(M.M.B.A.)	Crusade Construction Co. Pty. Ltd Rear Crusade House, The Kingsway CARINGBAH	277007	1961	Road Match	61m
	BUILDERS & CONTRACTORS	Crusade Construction Co. Pty. Ltd., Crusade Hse., The Kingsway, Caringbah	276294	1961	Road Match	61m
	REAL ESTATE AGENTS/VALUERS	Hooker, L. J. Ltd., Kingsway CARINGBAH	365227	1961	Road Match	61m
	INSURANCE AGENTS	Reliable Real Estate Pty. Ltd. (Crusade Building), The Kingsway, Caringbah	327982	1961	Road Match	61m
	CAKE SHOPS & PASTRYCOOKS	Barton, D., Kingsway, Caringbah	16403	1950	Road Match	61m
	DENTISTS	Booth, R. E. T., Kingsway, Caringbah	31708	1950	Road Match	61m
	FIBRE & FIBRE GOODS MFRS. &/OR DISTRIBUTORS	Burns, W. M., Kingsway, Caringbah	43837	1950	Road Match	61m
	PAINT, VARNISH, OILS & COLOUR MERCHANTS	Burns, W. M., Kingsway, Caringbah	90728	1950	Road Match	61m
	TIMBER MERCHANTS	Burns, W. M., Kingsway, Caringbah	78021	1950	Road Match	61m
	DRAPERS-RETAIL	Bush, Frank W., Kingsway, Caringbah	33548	1950	Road Match	61m
	GROCERS-RETAIL	Bush, Frank W., Kingsway, Caringbah	56629	1950	Road Match	61m
	FROCK & COAT SALONS	Caringbah Fashion Store, Kingsway, Caringbah	48339	1950	Road Match	61m
	MOTOR ELECTRICIANS	Caringbah Garage, Kingsway, Caringbah	83088	1950	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS	Caringbah Garage, Kingsway. Caringbah	83547	1950	Road Match	61m
	TAXIS	Caringbah Taxis, Kingsway, Caringbah	107301	1950	Road Match	61m
	HAIRDRESSERS (GENT.'S) &/OR TOBACCONISTS	Clarke, A. J., Kingsway, Caringbah	59299	1950	Road Match	61m
	DELICATESSENS & SMALLGOODS DEALERS	FInley, E., Kingsway, Caringbah	30485	1950	Road Match	61m
	REAL ESTATE AGENTS	Gilbey and Son, Kingsway, Caringbah	98274	1950	Road Match	61m
	FROCK & COAT SALONS	Henry, R., Kingsway, Caringbah	48558	1950	Road Match	61m
	BUTCHERS-RETAIL	Hooley, F. and Sons, Kingsway, Caringbah	13715	1950	Road Match	61m
	BUTCHERS-RETAIL	Hooley, F., Kingsway, Caringbah	42704	1950	Road Match	61m
	CAKE SHOPS & PASTRYCOOKS	Lilllcris Cake Shop, Kingsway, Caringbah	16890	1950	Road Match	61m
	REAL ESTATE AGENTS	Robertson, T. J. and Co., Kingsway, Caringbah	98746	1950	Road Match	61m
	DELICATESSENS & SMALLGOODS DEALERS	Rumsey, A., Kingsway, Caringbah	31124	1950	Road Match	61m
	LIBRARIES-LENDING	Wayside Library (Miss D. Cridland), Kingsway, Caringbah	68991	1950	Road Match	61m
11	FIRST AID SUPPLIES.	Amalgamated Pharmaceutical Supplies Pty. Ltd., Suite 3 Forum Centre, Kingsway, Miranda. 2228	33031	1986	Road Match	76m
	MOTOR GARAGES & SERVICE STATIONS.	Civic Garage & Service Station, Kingsway, Miranda. 2228	64474	1986	Road Match	76m
	REAL ESTATE AGENTS.	Stewart Upton, Kingsway, Miranda. 2228	80216	1986	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS. (M6860)	Civic Garage & Service Station, Kingsway, Miranda. 2228.	56534	1982	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Civic Garage & Service Station, Kingsway, Miranda. 2228	49810	1978	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS.	Civic Garage & Service Station., Kingsway, Miranda. 2228	58669	1975	Road Match	76m
	FRUITERERS/GREENGROCERS (F640)	Johnny's Fruit Market., The Kingsway., Miranda	307297	1970	Road Match	76m
	CAFES, COFFEE LOUNGES, Etc. (C030)	Studio Coffee Lounge, Miranda Fair Garden Court., The Kingsway., Miranda	276119	1970	Road Match	76m
	Motor Accessories - Dealers	Civic Garage & Service Station, Kingsway, Miranda	119386	1965	Road Match	76m

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
11	STOCK FOODS MANUFACTURERS &/OR DISTRIBUTORS	Miranda Trading Co-Operative Society Ltd., Kingsway, Miranda	148999	1965	Road Match	76m
	MOTOR ACCESSORIES/DEALERS	Civic Garage & Service Station, Kingsway, Miranda	343479	1961	Road Match	76m
	CLUBS & SPORTS BODIES	Miranda R.S.L. Sub-Branch Club, Kingsway, Miranda	291644	1961	Road Match	76m
	STOCK FOODS MANUFACTURERS &/OR DISTRIBUTORS	Miranda Trading Co-operative Society Ltd., Kingsway, Mrnda	254044	1961	Road Match	76m
	CAKE SHOPS & PASTRYCOOKS	Bowen, R., Kingsway Miranda	16469	1950	Road Match	76m
	GROCERS-RETAIL	Bowen, R., Kingsway, Miranda	56495	1950	Road Match	76m
	MILK BARS & CONFECTIONERS	Bowen, R., Kingsway, Miranda	76387	1950	Road Match	76m
	QUARRY PROPRIETORS	Caringbah Clay and Shale Pits, Kingsway, Miranda	96473	1950	Road Match	76m
	WELDERS-ELECTRIC &/OR OXY	Fletcher, M. F., Kingsway, Miranda	112789	1950	Road Match	76m
	MOTOR ELECTRICIANS	Fletcher, N. F., Kingsway, Miranda	83114	1950	Road Match	76m
	HAIRDRESSERS (GENT.'S) &/OR TOBACCONISTS	Hamilton, Gus, Kingsway, Miranda	59528	1950	Road Match	76m
	DELICATESSENS & SMALLGOODS DEALERS	Jones, F. T., Kingsway, Miranda	30708	1950	Road Match	76m
	FRUITERERS & GREENGROCERS	Jones, F. T., Kingsway, Miranda	50402	1950	Road Match	76m
	MILK BARS & CONFECTIONERS	Jones, F. T., Kingsway, Miranda	76853	1950	Road Match	76m
	POULTRY FARMERS	Lappin, M., Kingsway, Miranda	94126	1950	Road Match	76m
	BUTCHERS-RETAIL	Mac's, Billy, Kingsway, Miranda	13879	1950	Road Match	76m
	BEAUTY SALONS &/OR LADIES' HAIRDRESSERS	Mapstone, Miss I. (Cameo Beauty Salon), Kingsway, Miranda	7492	1950	Road Match	76m
	BUTCHERS-RETAIL	McDonald, W., Kingsway, Miranda	13934	1950	Road Match	76m
	STEEL-STRUCTURAL-MERCHANTS	McGourlay, Frank, Kingsway, Miranda	105359	1950	Road Match	76m
	BAKERS-BREAD	Miranda Bakery, The Kingsway, Miranda	5378	1950	Road Match	76m
	HALLS	Miranda R.S.L. Sub-Branch Hall, Kingsway, Miranda	60385	1950	Road Match	76m
	PICTURE THEATRES-SUBURBAN	Miranda Theatre, Kingsway, Miranda	92845	1950	Road Match	76m
	FUEL MERCHANTS-COAL, COKE & WOOD	Miranda Trading Co-operative Society Ltd. (The), Kingsway, Miranda	51817	1950	Road Match	76m
	MOTOR OIL & SPIRIT MERCHANTS	Miranda Trading Co-operative Society Ltd. (The), Kingsway, Miranda	84649	1950	Road Match	76m
	PRODUCE MERCHANTS-GRAIN & SEED-RETAIL	Miranda Trading Co-operative Society Ltd. (The), Kingsway, Miranda	95608	1950	Road Match	76m
	POULTRY FARMERS' SUPPLIERS	Miranda Trading Co-operative Society Ltd., Kingsway, Miranda	94411	1950	Road Match	76m
	STOCK FOODS MFRS. &/OR DISTRIBUTORS	Miranda Trading Co-operative Society Ltd., Kingsway, Miranda	105685	1950	Road Match	76m
	HATCHERIES	Phillips, E. H. and Sons, Kingsway, Miranda	61794	1950	Road Match	76m
	BOOKSELLERS &/OR STATIONERS	Reynolds, F. H., Kingsway, Miranda	9728	1950	Road Match	76m
	MILK BARS & CONFECTIONERS	Reynolds, F. H., Kingsway, Miranda	77263	1950	Road Match	76m
	NEWSAGENTS	Reynolds, F. H., Kingsway, Miranda	88303	1950	Road Match	76m
	TOBACCONISTS-RETAIL	Reynolds, F. H., Kingsway, Miranda	108822	1950	Road Match	76m
	TOY DEALERS-RETAIL	Reynolds, F. H., Kingsway, Miranda	109570	1950	Road Match	76m

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
11	AUCTIONEERS-GENERAL	Shaw, F. R., Kingsway, Miranda	4159	1950	Road Match	76m
	REAL ESTATE AGENTS	Shaw, F. R., Kingsway, Miranda	98786	1950	Road Match	76m
	CHEMISTS-PHARMACEUTICAL	Thacker, L. H., Kingsway, Miranda	22110	1950	Road Match	76m
	DRAPERS-RETAIL	Thacker, L. H., Kingsway, Miranda	34021	1950	Road Match	76m
	FANCY GOODS RETAILERS	Thacker, L. H., Kingsway, Miranda	43429	1950	Road Match	76m
	FOOTWEAR-RETAILERS	Thacker, L. H., Kingsway, Miranda	47505	1950	Road Match	76m
	MERCERS & GENT'S OUTFITTERS	Thacker, L. H., Kingsway, Miranda	74655	1950	Road Match	76m
	TOBACCONISTS-RETAIL	Thacker, L. H., Kingsway, Miranda	108868	1950	Road Match	76m
	GROCERS-RETAIL	Walkers Newsagency and General Store, Kingsway, Miranda	55996	1950	Road Match	76m
	REAL ESTATE AGENTS	White, E. B., Kingsway, Miranda,	98961	1950	Road Match	76m
	REAL ESTATE AGENTS	Willcock and O'Niell, Kingsway, Miranda	98972	1950	Road Match	76m
	FRUITERERS & GREENGROCERS	Wybrow, R. D., Kingsway, Miranda	51602	1950	Road Match	76m
12	MOTOR GARAGES & SERVICE STATIONS.	Total Miranda Service Station, Port Hacking Rd., Miranda. 2228	65616	1986	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS. (M6860)	Total Miranda Service Station, Port Hacking Rd., Miranda. 2228.	57738	1982	Road Match	118m
	CHEMISTS SUPPLIES &/OR SUNDRYMEN	Dalen Pharmaceuticals. Port Hacking Rd., Miranda. 2228	14038	1978	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Total Miranda Service Station, Port Hacking Rd., Miranda. 2228	50969	1978	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	West, Alan Service Station, Port Hacking Rd., Miranda. 2228	51082	1978	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS.	Total Miranda Service Station., Port Hacking Rd., Miranda. 2228	59662	1975	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS.	West, Alan Service Station., Port Hacking Rd., Miranda. 2228	59766	1975	Road Match	118m
	REAL ESTATE AGENTS/VALUERS	Cacclola, V., 173 Port Hacking Rd., MIRANDA	244791	1961	Road Match	118m
	MOTOR SPARE PARTS DEALERS—RETAIL	Civic Garage & Service Station, Port Hacking Rd., Miranda	351451	1961	Road Match	118m
	MOTOR GARAGES & ENGINEERS	Faison, A., Cnr. Port Hacking & Kareena Rds. MIRANDA	347126	1961	Road Match	118m
	CARRIERS & CARTAGE CONTRACTORS	McKenna, P., Port Hacking Rd., Miranda	285074	1961	Road Match	118m
	MOTOR SERVICE STATIONS—PETROL, OIL, Etc.	Williams, Duff, Cnr. Port Hacking & Parramatta Rds. Miranda	351295	1961	Road Match	118m
	MOTOR BUS SERVICES	Hume, J. N., Port Hacking Rd., Miranda	87246	1950	Road Match	118m
	CARRIERS & CARTAGE CONTRACTORS	Loveday, W. H., "Kathwill," Port Hacking Rd., Miranda	19262	1950	Road Match	118m
	CARRIERS & CARTAGE CONTRACTORS	McKenna, P., Port Hacking Rd., Miranda	19360	1950	Road Match	118m
	POULTRY FARMERS	Noad, W., Port Hacking Rd., Miranda	94201	1950	Road Match	118m
	POULTRY FARMERS	Rhodes, L. A., Port Hacking Rd., Miranda	94245	1950	Road Match	118m
	POULTRY FARMERS	Robson, P. J., Port Hacking Rd., Miranda	94253	1950	Road Match	118m
	POULTRY FARMERS	Shepherd, E. E., Port Hacking Rd., Miranda	94275	1950	Road Match	118m
	HATCHERIES	Ventura Poultry Farm, Port Hacking Rd., Miranda	61805	1950	Road Match	118m
	POULTRY FARMERS	Ventura Poultry Farm, Port Hacking Rd., Miranda	94339	1950	Road Match	118m

Dry Cleaners, Motor Garages & Service Stations

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Legend

- Site Boundary
- Buffer 500m
- Property Boundary
- Business directory records mapped to a specific premise
- Business directory records mapped to a road intersection
- Business directory records mapped to a road corridor
- Business directory records mapped to a general area

Scale: 0 90 180 270 360 Meters

Coordinate System: GDA 1994 MGA Zone 56

Date: 07 May 2020

Historical Business Directories

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Dry Cleaners, Motor Garages & Service Stations 1948-1993 Premise or Road Intersection Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, mapped to a premise or road intersection, within the dataset buffer.

Note: The Universal Business Directories were published between 1948 and 1993. Dry Cleaners, Motor Garages & Service Stations have been extracted from all of these directories except the following years 1951, 1955, 1957, 1960, 1963, 1973, 1974, 1977, 1987.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
1	MOTOR GARAGES &/OR ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd., Miranda	12632	1972	Road Intersection	100m	North
	MOTOR GARAGES &/OR ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	62318	1971	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS(M6S6)	Civic Garage & Service Station., Kingsway & Port Hacking Rd., MIRANDA	337578	1970	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd., Miranda	42680	1969	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	26154	1968	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	10654	1967	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	60395	1966	Road Intersection	100m	North
	Motor Garages & Engineers	Civic Garage & Service Station, Kingsway & Port Hacking Rd. Miranda	123040	1965	Road Intersection	100m	North
	Motor Garages & Engineers	Port Hacking (Ampol) Service Station, Cnr. The Kingsway & Port Hacking Rd. Caringbah	122382	1965	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	48317	1964	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	33003	1962	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS.	Faison A., Cnr Port Hacking & Kareena Rds Miranda	33004	1962	Road Intersection	100m	North
	MOTOR SERVICE STATIONS-PETROL, OIL, ETC.	Port Hacking (Ampol) Service Station., Cnr Kingsway & Port Hacking Rds Caringbah	38010	1962	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS	Civic Garage & Service Station, Kingsway & Port Hacking Rd. MIRANDA	346885	1961	Road Intersection	100m	North
	MOTOR SERVICE STATIONS—PETROL, OIL, Etc.	Port Hacking (Ampol) Service Station, Cnr. Kingsway & Port Hacking Rds. CARINGBAH	350973	1961	Road Intersection	100m	North
	MOTOR GARAGES & ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	19599	1959	Road Intersection	100m	North
	MOTOR SERVICE STATIONS-PETROL,. OIL, ETC.	Port Hacking (Ampol) Service Station., Cnr Kingsway & Port Hacking Rds Caringbah	24059	1959	Road Intersection	100m	North
	MOTOR GARAGE/ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	835	1958	Road Intersection	100m	North
	MOTOR GARAGES &/OR ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	57432	1956	Road Intersection	100m	North
	MOTOR GARAGES &/OR ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	49057	1954	Road Intersection	100m	North
	MOTOR GARAGES &/OR ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	39813	1953	Road Intersection	100m	North
	MOTOR GARAGES &/OR ENGINEERS.	Civic Garage & Service Station., Kingsway & Port Hacking Rd Miranda	31478	1952	Road Intersection	100m	North

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
1	MOTOR GARAGES &/OR ENGINEERS	Civic Garage and Service Station, Kingsway and Port Hacking Rd., Miranda	83588	1950	Road Intersection	100m	North
	MOTOR SERVICE STATIONS-PETROL, Etc.	Civic Garage and Service Station, Kingsway and Port Hacking Rd., Miranda	85871	1950	Road Intersection	100m	North
	MOTOR GARAGES &/OR ENGINEERS.	Civic Garage & Service Station., Cnr Kingsway & Port Hacking Rd Miranda	17620	1948-49	Road Intersection	100m	North
	MOTOR SERVICE STATIONS-PETROL, ETC.	Civic Garage and Service Station., Kingsway And Port Hacking Rd Miranda	23183	1948-49	Road Intersection	100m	North
	MOTOR GARAGES &/OR ENGINEERS.	Civic Garage and Service Station., Kingsway and Port Hacking Rd, Miranda	17900	1948-49	Road Intersection	100m	North

Dry Cleaners, Motor Garages & Service Stations 1948-1993 Road or Area Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published.

Note: The Universal Business Directories were published between 1948 and 1993. Dry Cleaners, Motor Garages & Service Stations have been extracted from all of these directories except the following years 1951, 1955, 1957, 1960, 1963, 1973, 1974, 1977, 1987.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
2	MOTOR GARAGES &/OR ENGINEERS.	Total Miranda Service Station., Kareena Rd Miranda	12640	1972	Road Match	0m
	MOTOR GARAGES &/OR ENGINEERS.	Total Miranda Service Station., Kareena Rd Miranda	62325	1971	Road Match	0m
	MOTOR GARAGES & ENGINEERS(M6S6)	Total Miranda Service Station., Kareena Rd., MIRANDA	338747	1970	Road Match	0m
	MOTOR GARAGES & ENGINEERS.	Total Miranda Service Station., Kareena Rd Miranda	42690	1969	Road Match	0m
3	MOTOR GARAGES & SERVICE STATIONS.	Port Hacking Service Station, Kingsway, Caringbah. 2229	11996	1990	Road Match	61m
	MOTOR GARAGE & SERVICE STATIONS.	Port Hacking Service Station, Kingsway, Caringbah. 2229	5415	1989	Road Match	61m
	MOTOR GARAGES & SERVICE STATIONS.	Port Hacking Service Station, Kingsway, Caringbah. 2229	59795	1988	Road Match	61m
	MOTOR GARAGES & SERVICE STATIONS.	Port Hacking Service Station, Kingsway, Caringbah. 2229	65276	1986	Road Match	61m
	MOTOR GARAGES & SERVICE STATIONS.	Port Hacking Service Station, Kingsway, Caringbah. 2229	45386	1985	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Port Hacking Service Station, Kingsway., Caringbah. 2229	33958	1984	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Port Hacking Service Station., Kingsway Caringbah 2229	21407	1983	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS. (M6860)	Port Hacking Service Station, Kingsway, Caringbah. 2229.	57396	1982	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Port Hacking Service Station., Kingsway., Caringbah 2229	3936	1981	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Port Hacking Service Station., Kingsway., Caringbah. 2229	58677	1980	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Port Hacking Service Station., Kingsway., Caringbah. 2229.	46173	1979	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Port Hacking Service Station, Kingsway, Caringbah. 2229	50676	1978	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Port Hacking Service Station., Kingsway., Caringbah 2229	34743	1976	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS.	Port Hacking Service Station., Kingsway Rd., Caringbah. 2229	59405	1975	Road Match	61m
	MOTOR GARAGES & ENGINEERS	Caringbah Garage., Kingsway Caringbah	13800	1959	Road Match	61m
	MOTOR GARAGE/ENGINEERS.	Caringbah Garage., Kingsway Caringbah	783	1958	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS.	Caringbah Garage., Kingsway Caringbah	57384	1956	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS.	Caringbah Garage., Kingsway Caringbah	49010	1954	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS.	Caringbah Garage Kingsway., Caringbah	36721	1953	Road Match	61m

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
3	MOTOR GARAGES &/OR ENGINEERS.	Caringbah Garage Kingsway., Caringbah	31437	1952	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS	Caringbah Garage, Kingsway. Caringbah	83547	1950	Road Match	61m
	MOTOR GARAGES &/OR ENGINEERS.	Caringbah Garage., Kingsway Caringbah	17858	1948-49	Road Match	61m
4	MOTOR GARAGES & SERVICE STATIONS.	Civic Garage & Service Station, Kingsway, Miranda. 2228	64474	1986	Road Match	76m
	MOTOR GARAGES & SERVICE STATIONS.	Civic Garage & Service Station, Kingsway, Miranda. 2228	39472	1985	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Civic Garage & Service Station, Kingsway Miranda. 2228	28058	1984	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Civic Garage & Service Station., Kingsway, Miranda 2228	14478	1983	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS. (M6860)	Civic Garage & Service Station, Kingsway, Miranda. 2228.	56534	1982	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Civic Garage & Service Station., Kingsway., Miranda. 2228	3087	1981	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Civic Garage & Service Station., Kingsway., Miranda. 2228	52728	1980	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Civic Garage & Service Station., Kingsway., Miranda. 2228.	41278	1979	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Civic Garage & Service Station, Kingsway, Miranda. 2228	49810	1978	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Civic Garage & Service Station., Kingsway Miranda 2228	29737	1976	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS.	Civic Garage & Service Station., Kingsway, Miranda. 2228	58669	1975	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS.	Fletcher N. F. Kingsway., Miranda	17636	1948-49	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS.	Fletcher N. F., Kingsway Miranda	18032	1948-49	Road Match	76m
	MOTOR SERVICE STATIONS-PETROL, ETC.	Fletcher N. F., Kingsway Miranda	23254	1948-49	Road Match	76m
	MOTOR GARAGES &/OR ENGINEERS.	Miranda Motor And Engineering Works., Kingsway Miranda	22635	1948-49	Road Match	76m
5	MOTOR GARAGES & SERVICE STATIONS.	Total Miranda Service Station, Port Hacking Rd., Miranda. 2228	65616	1986	Road Match	118m
	MOTOR GARAGES & SERVICE STATIONS.	Total Miranda Service Station, Port Hacking Rd., Miranda. 2228	45737	1985	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Total Miranda Service Station, Port Hacking Rd., Miranda. 2228	34297	1984	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Total Miranda Service Station., Port Hacking Rd., Miranda 2228	21739	1983	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS. (M6860)	Total Miranda Service Station, Port Hacking Rd., Miranda. 2228.	57738	1982	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Total Miranda Service Station., Port Hacking Rd., Miranda 2228	8324	1981	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Total Miranda Service Station., Port Hacking Rd., Miranda. 2228	59010	1980	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Total Miranda Service Station., Port Hacking Rd., Miranda. 2228.	46491	1979	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Total Miranda Service Station, Port Hacking Rd., Miranda. 2228	50969	1978	Road Match	118m

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
5	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	West, Alan Service Station, Port Hacking Rd., Miranda. 2228	51082	1978	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Total Miranda Service Station., Port Hacking Rd., Miranda 2228	35052	1976	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	West Alan Service Station., Port Hacking Rd., Miranda 2228	35192	1976	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS.	Total Miranda Service Station., Port Hacking Rd., Miranda. 2228	59662	1975	Road Match	118m
	MOTOR GARAGES &/OR ENGINEERS.	West, Alan Service Station., Port Hacking Rd., Miranda. 2228	59766	1975	Road Match	118m
	MOTOR GARAGES & ENGINEERS	Faison, A., Cnr. Port Hacking & Kareena Rds. MIRANDA	347126	1961	Road Match	118m
	MOTOR SERVICE STATIONS—PETROL, OIL, Etc.	Williams, Duff, Cnr. Port Hacking & Parramatta Rds. Miranda	351295	1961	Road Match	118m

Aerial Imagery 2019

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Scale:	Data Sources: Aerial Imagery © Aerometrex Pty Ltd	Coordinate System: GDA 1994 MGA Zone 56	Date: 07 May 2020

0 25 50 75 100 Meters

Aerial Imagery 2014

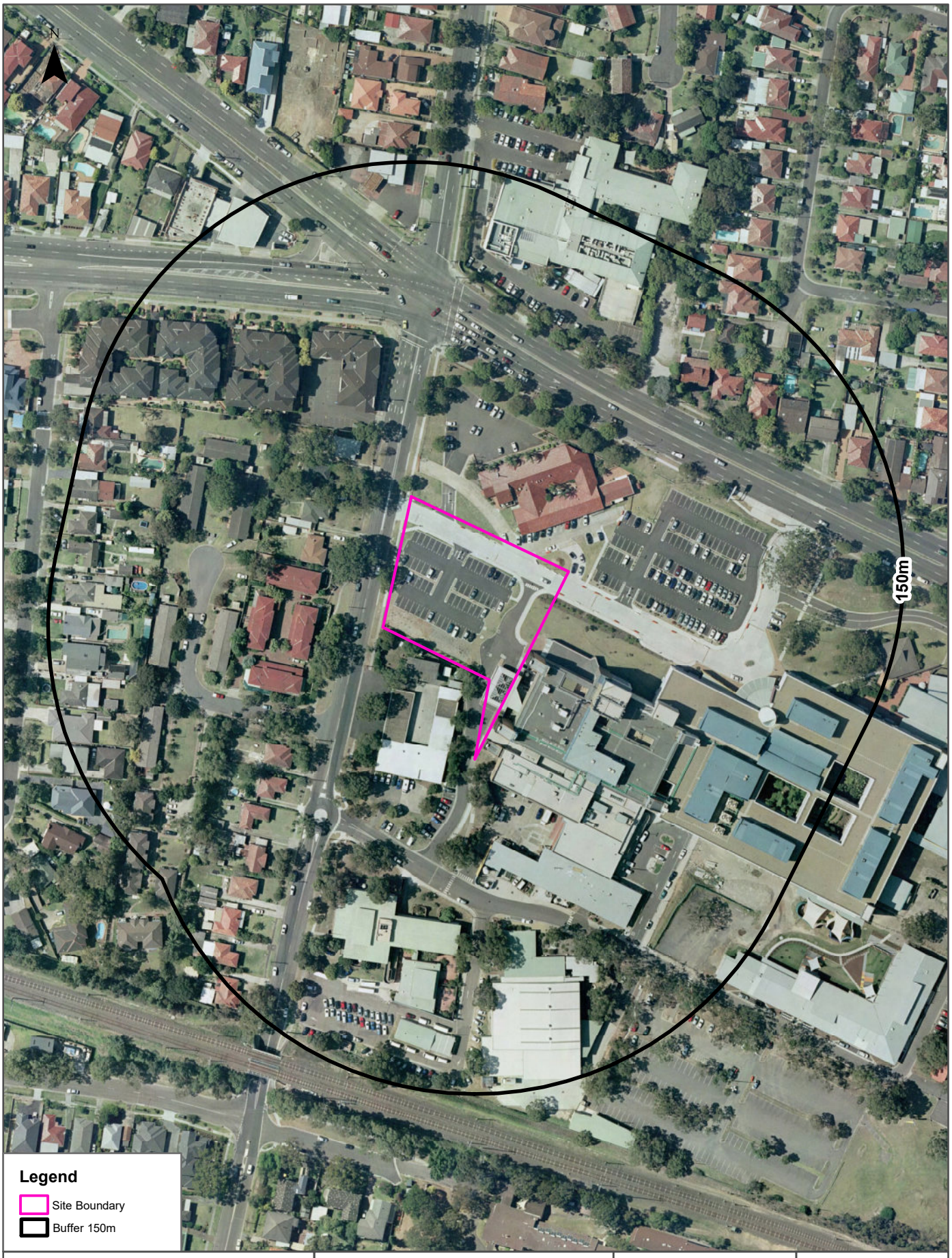
Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Scale:	Data Sources: Aerial Imagery © Aerometrex Pty Ltd	Coordinate System: GDA 1994 MGA Zone 56	Date: 07 May 2020

0 25 50 75 100 Meters

Aerial Imagery 2007

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Scale:	Data Sources: Aerial Imagery © Aerometrex Pty Ltd	Coordinate System: GDA 1994 MGA Zone 56	Date: 07 May 2020

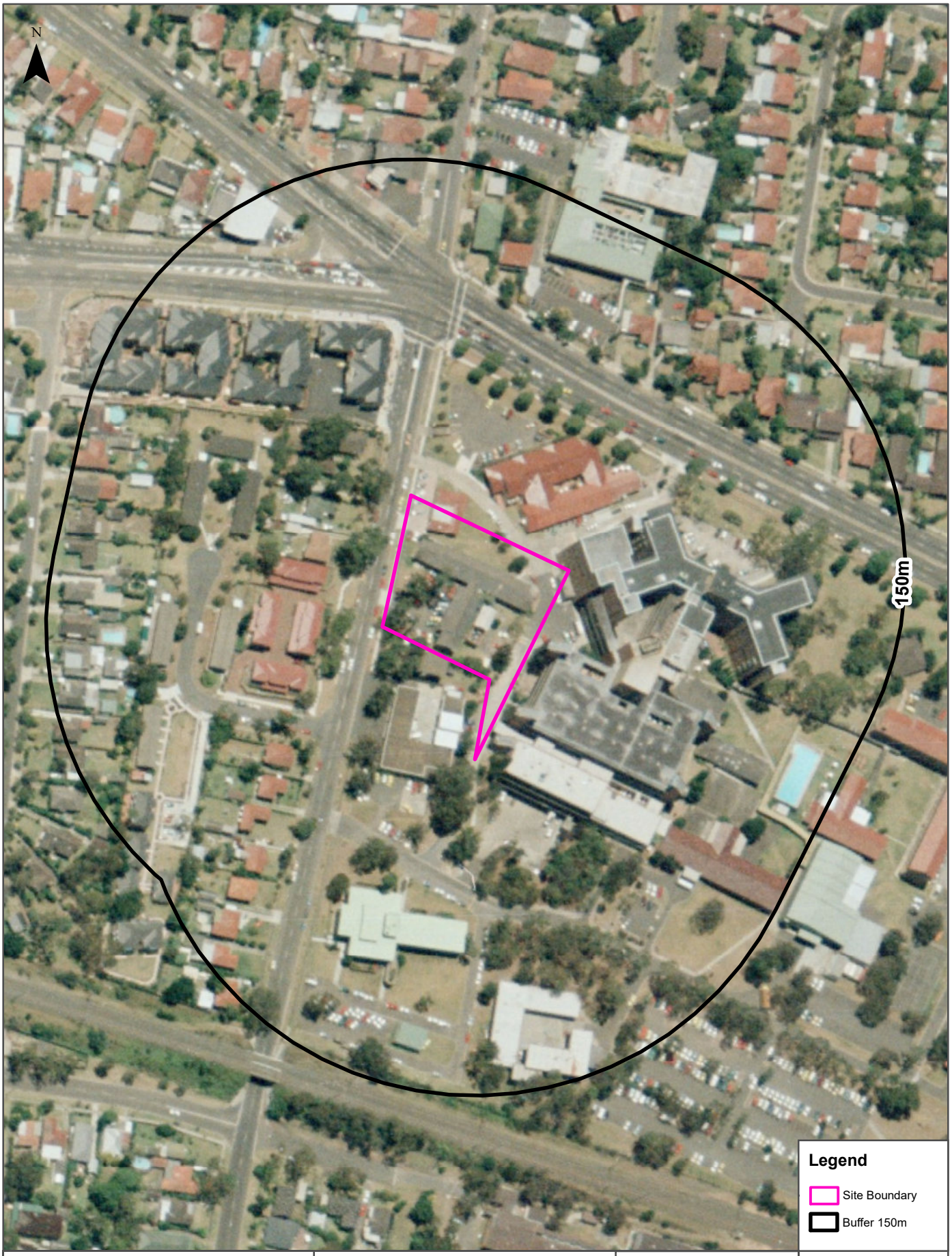
0 25 50 75 100 Meters

Aerial Imagery 2005

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

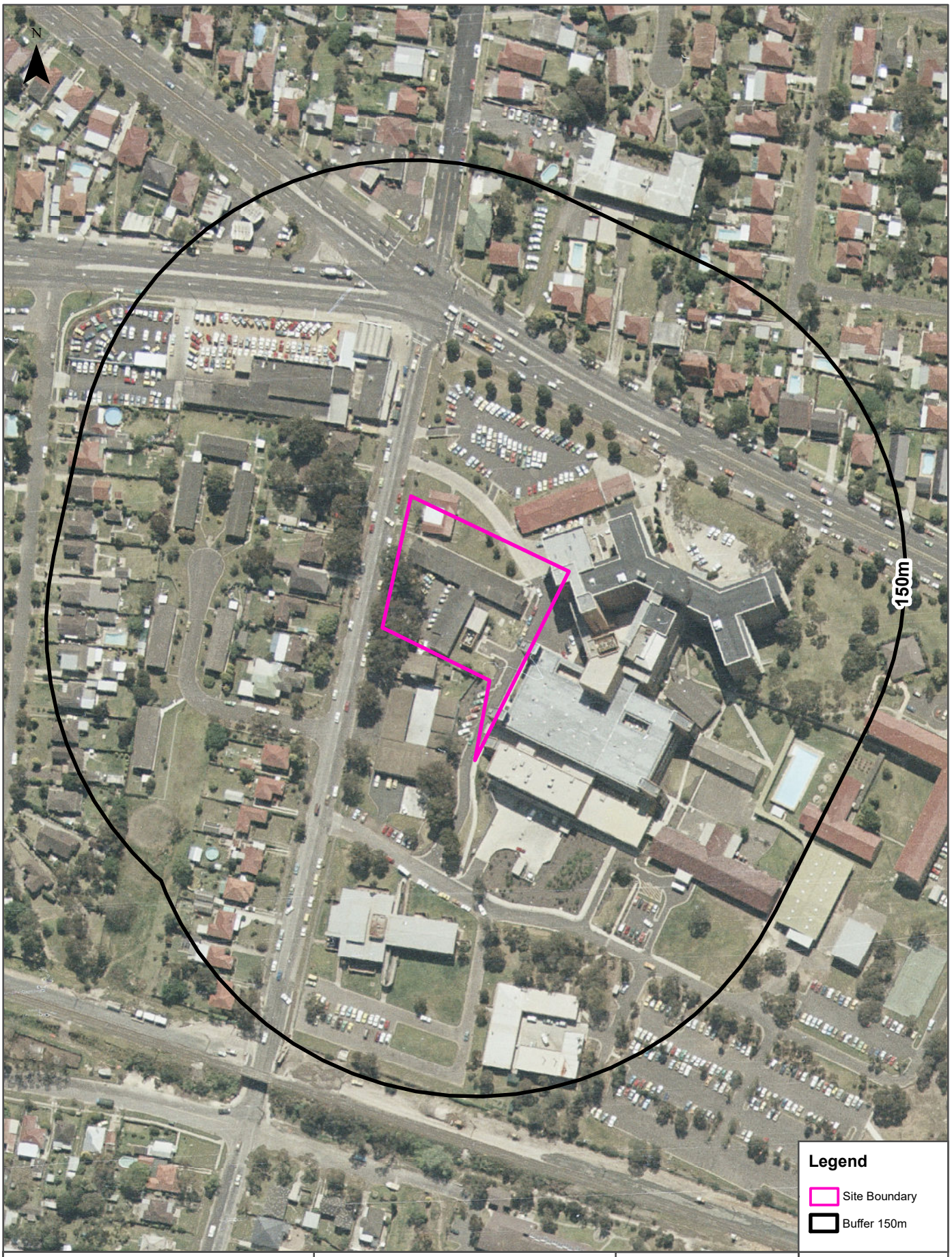
Aerial Imagery 1994

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



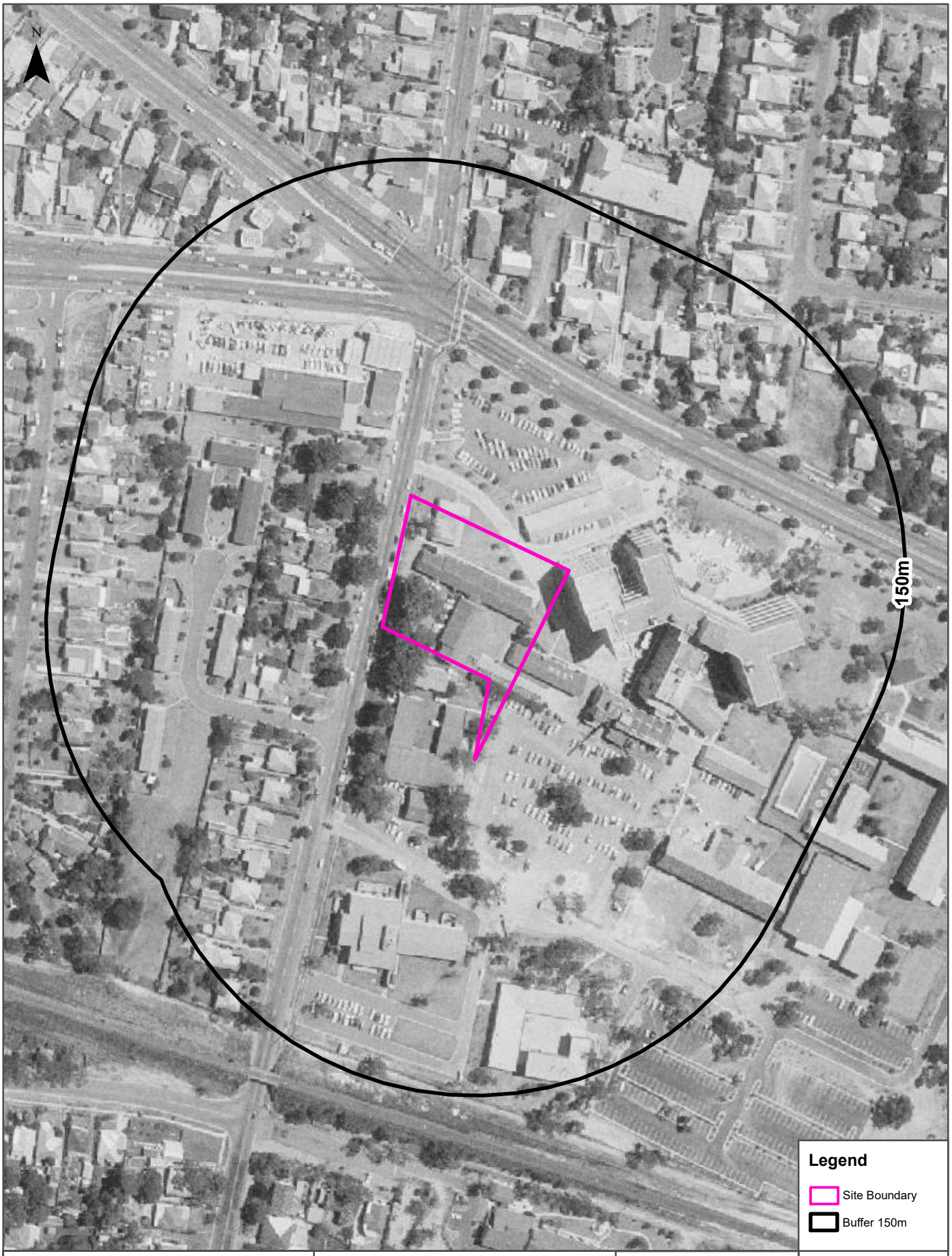
Aerial Imagery 1984

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Aerial Imagery 1978

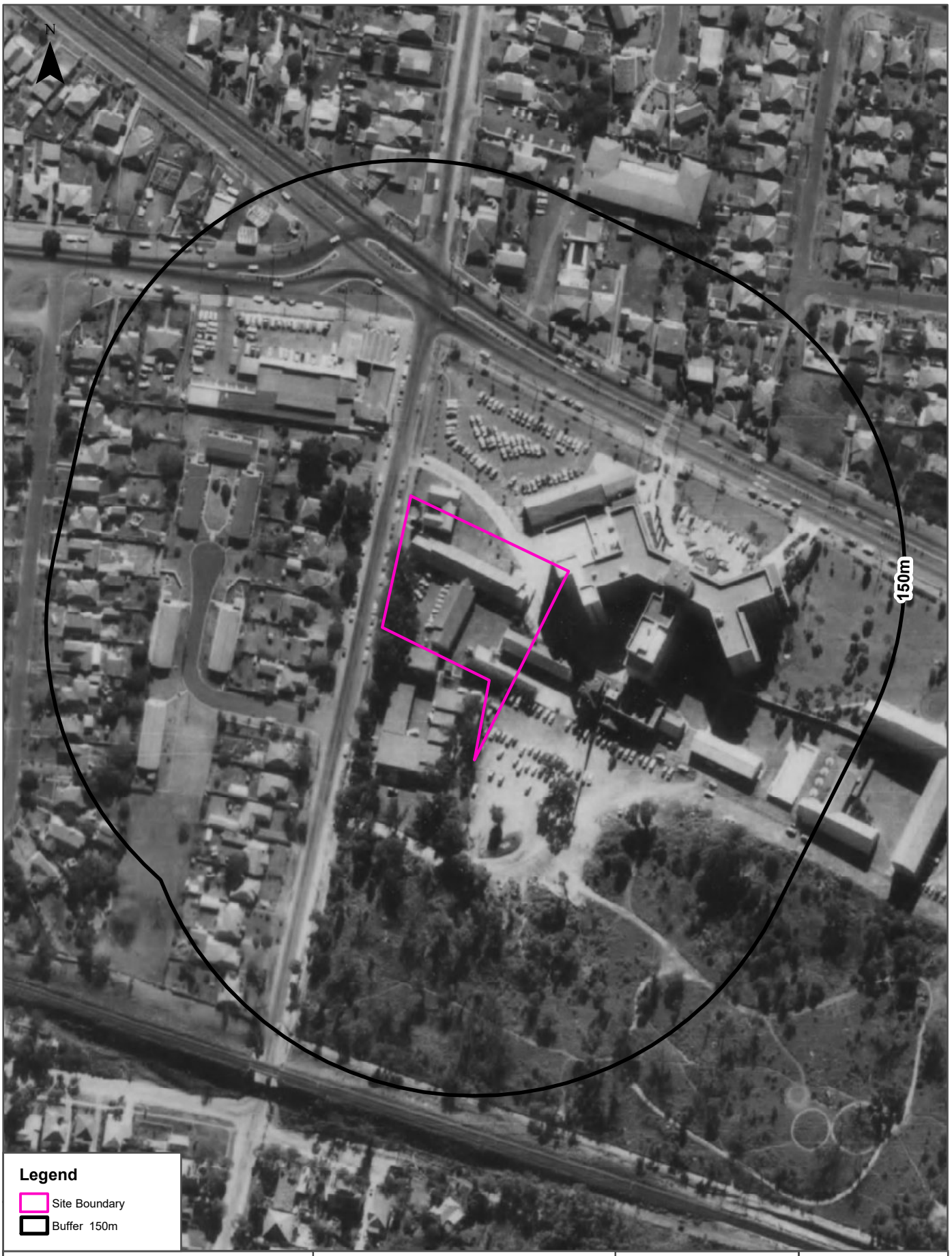
Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Scale:	Data Source Aerial Imagery:	Coordinate System:	Date: 05 May 2020
0 25 50 75 100 Meters	© NSW Department of Finance, Services & Innovation	GDA 1994 MGA Zone 56	

Aerial Imagery 1970

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



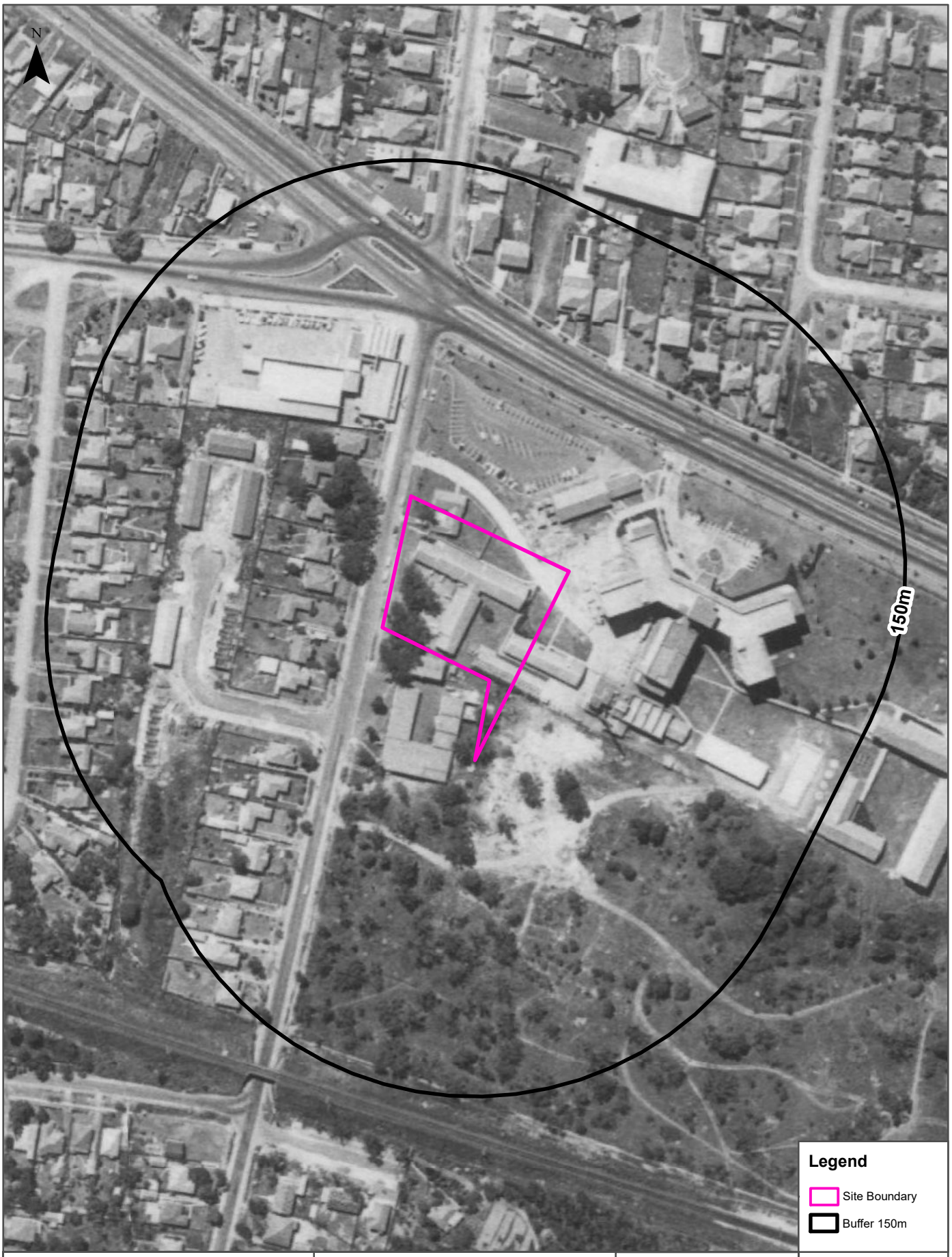
Data Sources: Aerial Imagery © Department of Finance, Services & Innovation

Coordinate System: GDA 1994 MGA Zone 56

Date: 07 May 2020

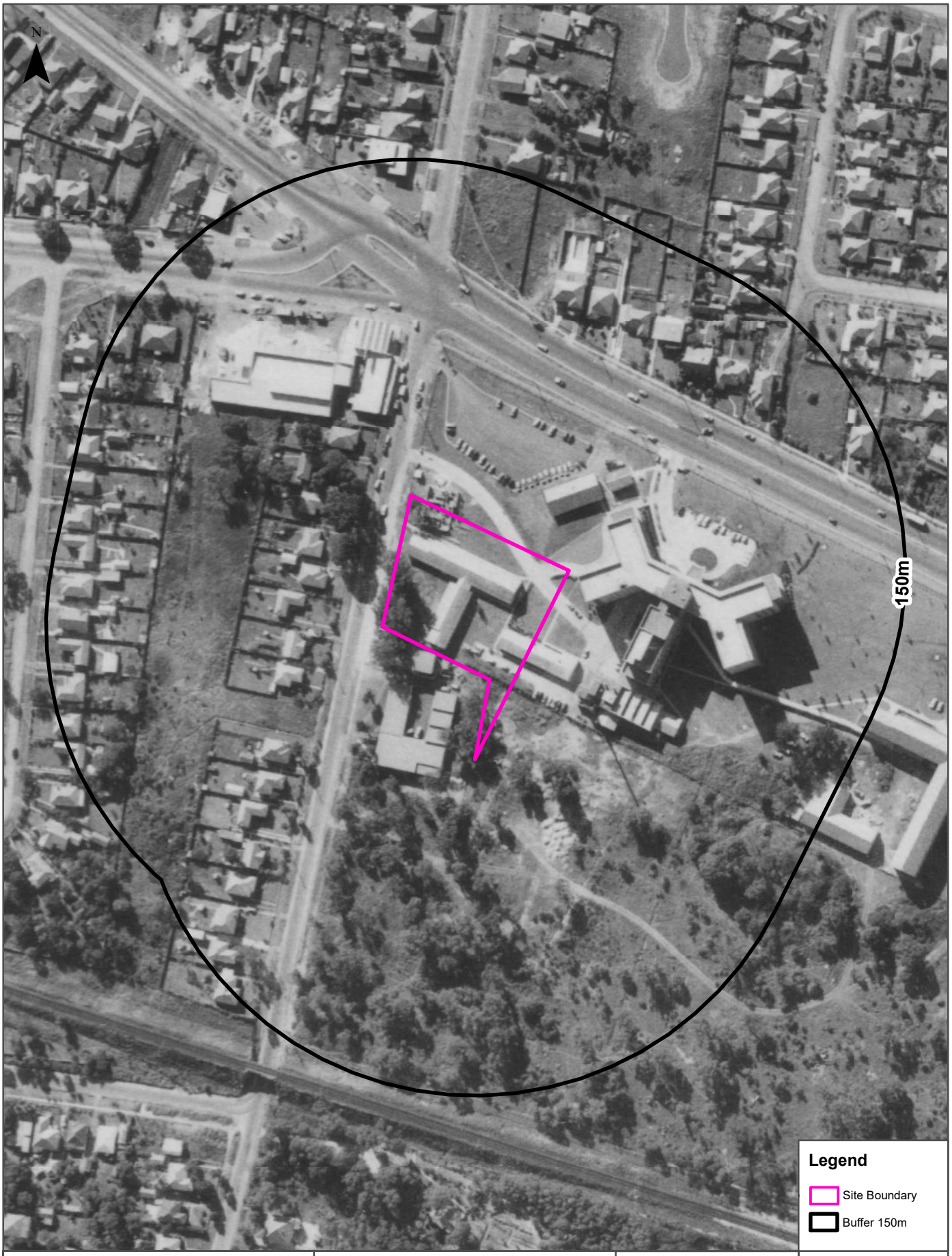
Aerial Imagery 1965

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



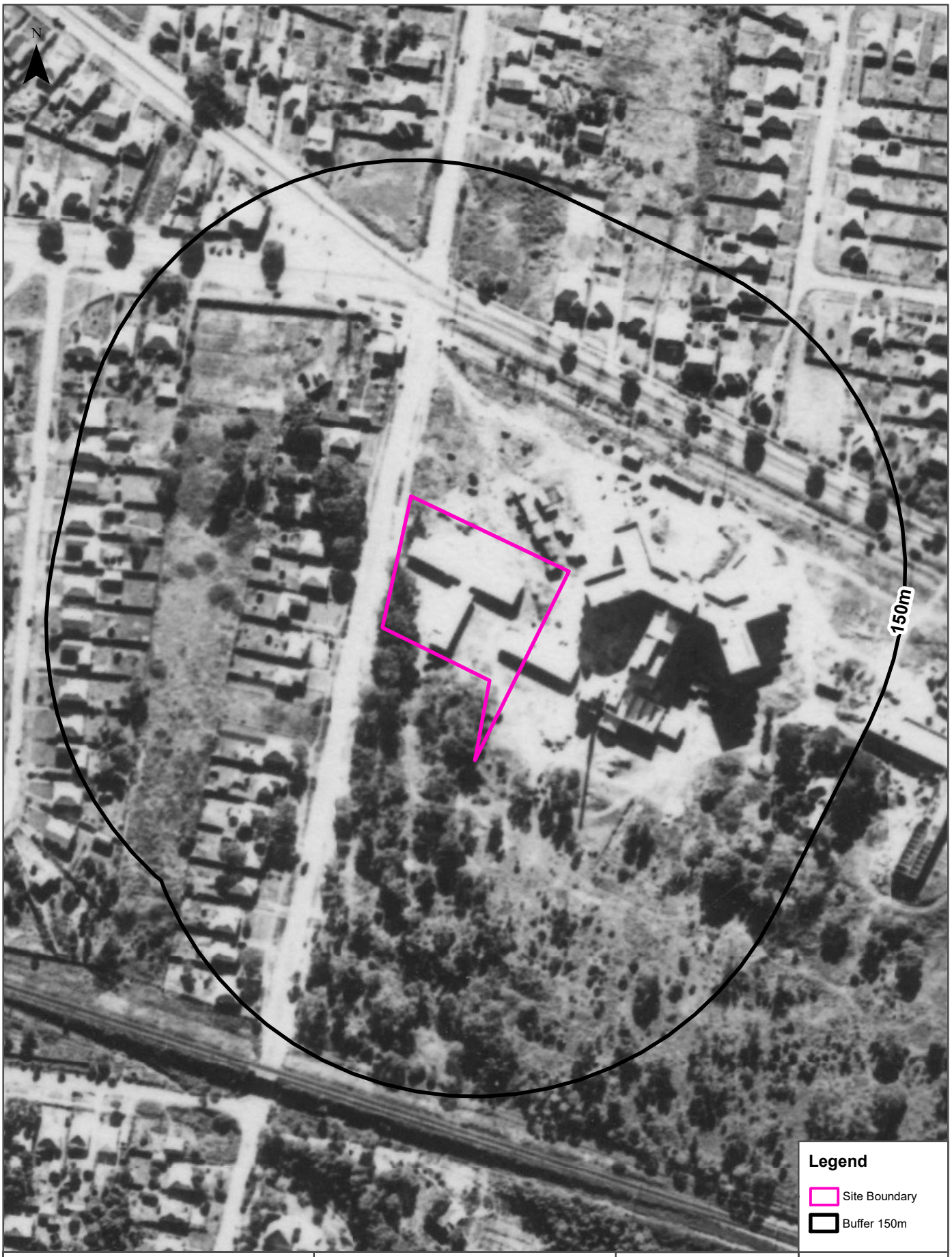
Aerial Imagery 1961

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



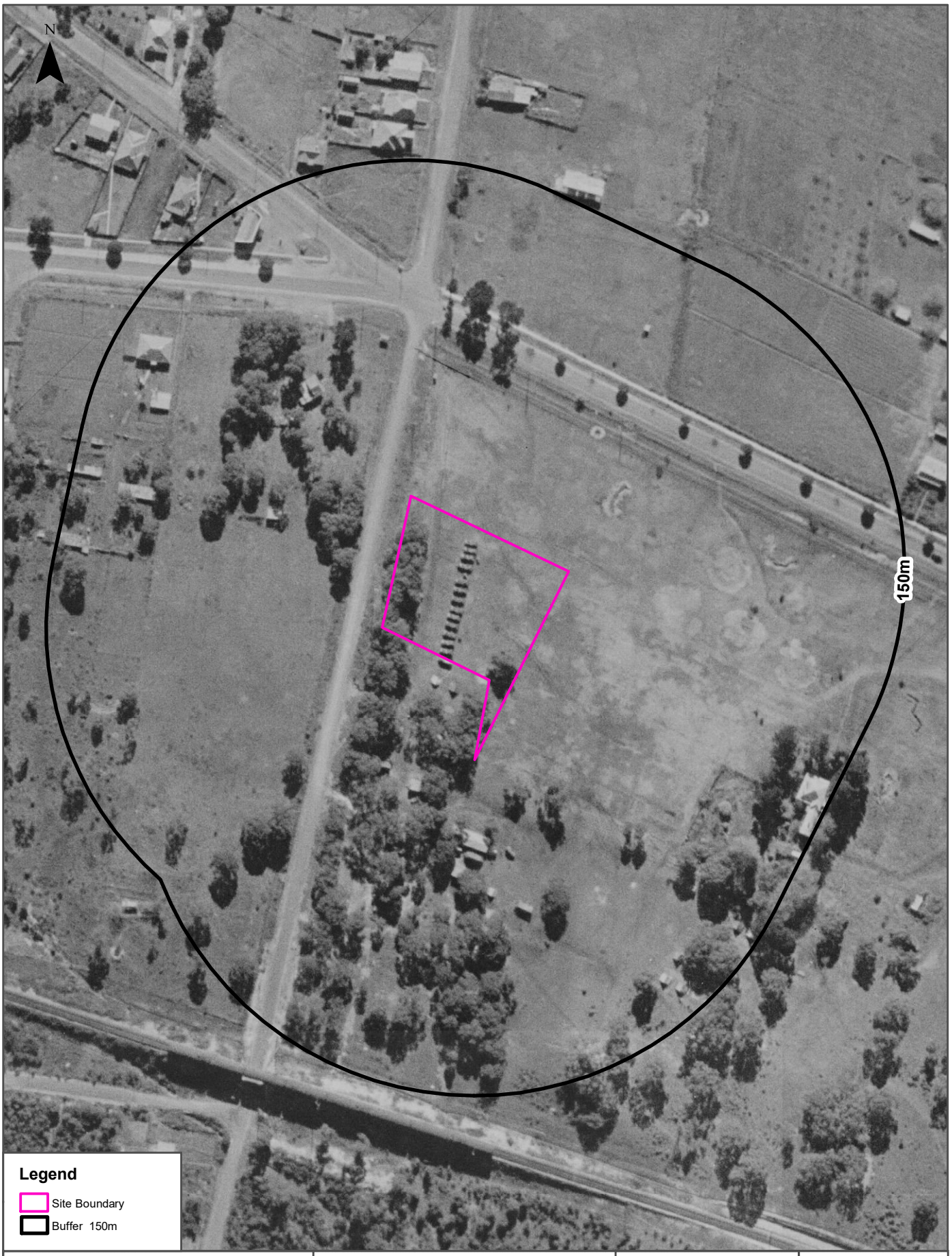
Aerial Imagery 1956

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



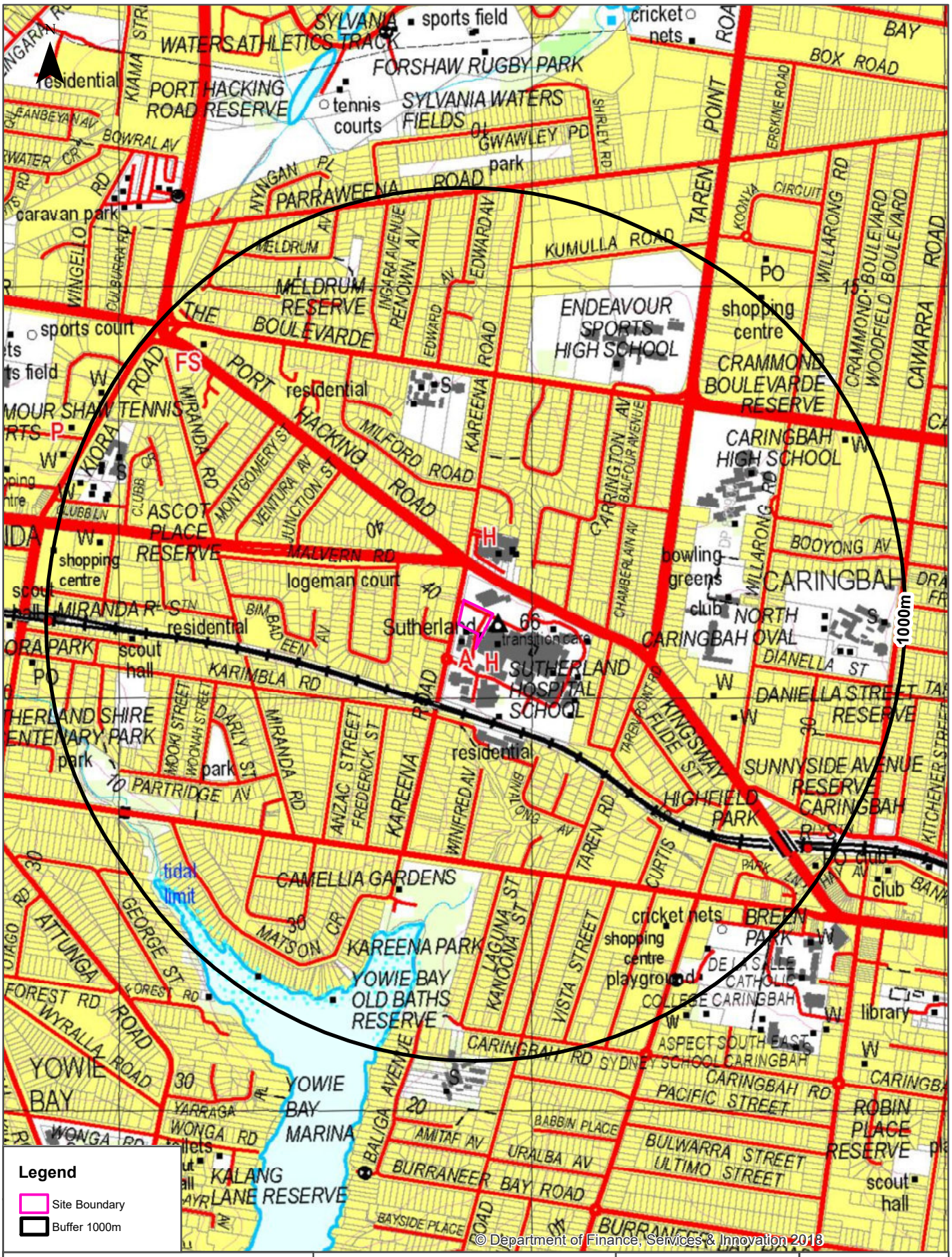
Aerial Imagery 1943

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



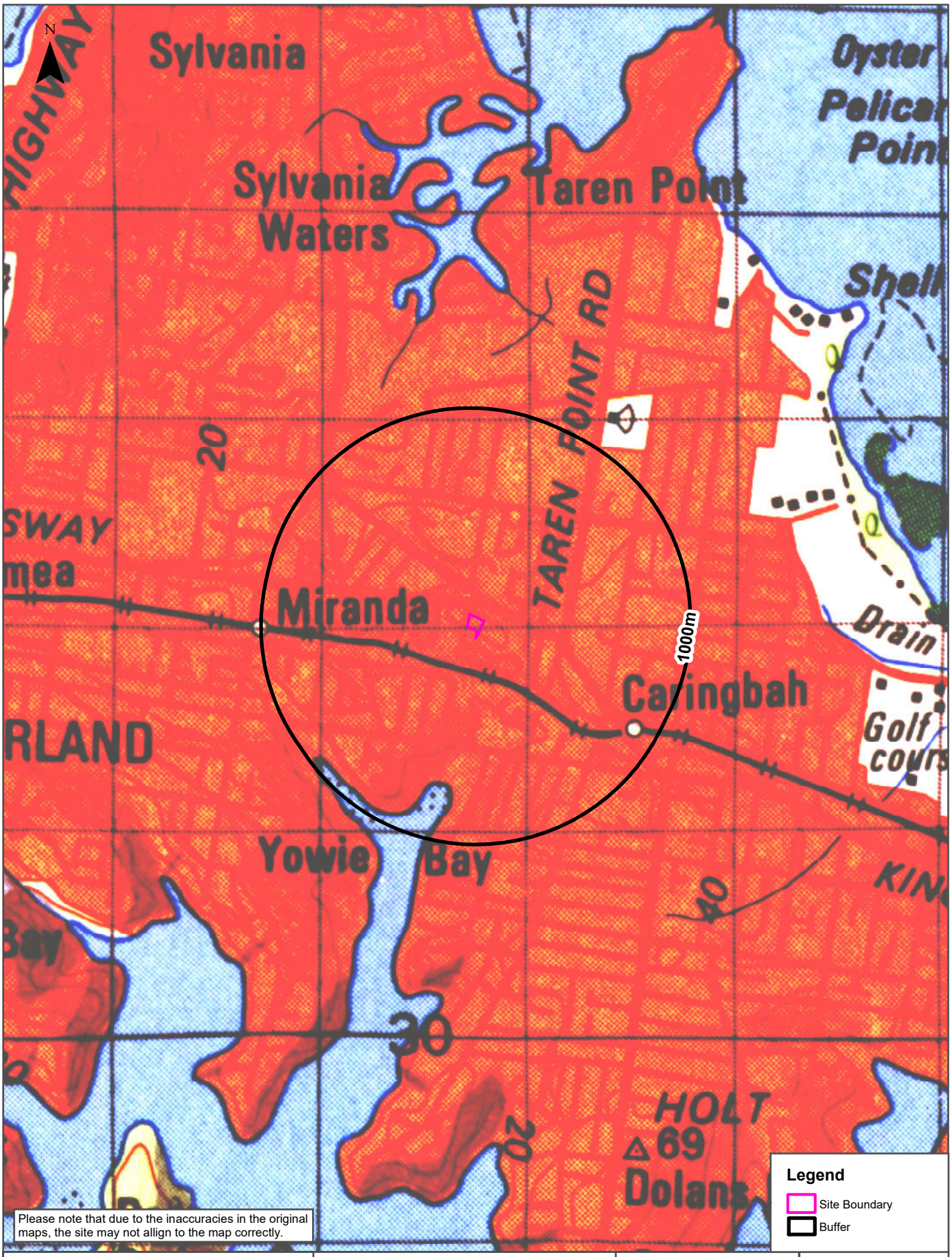
Topographic Map 2015

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



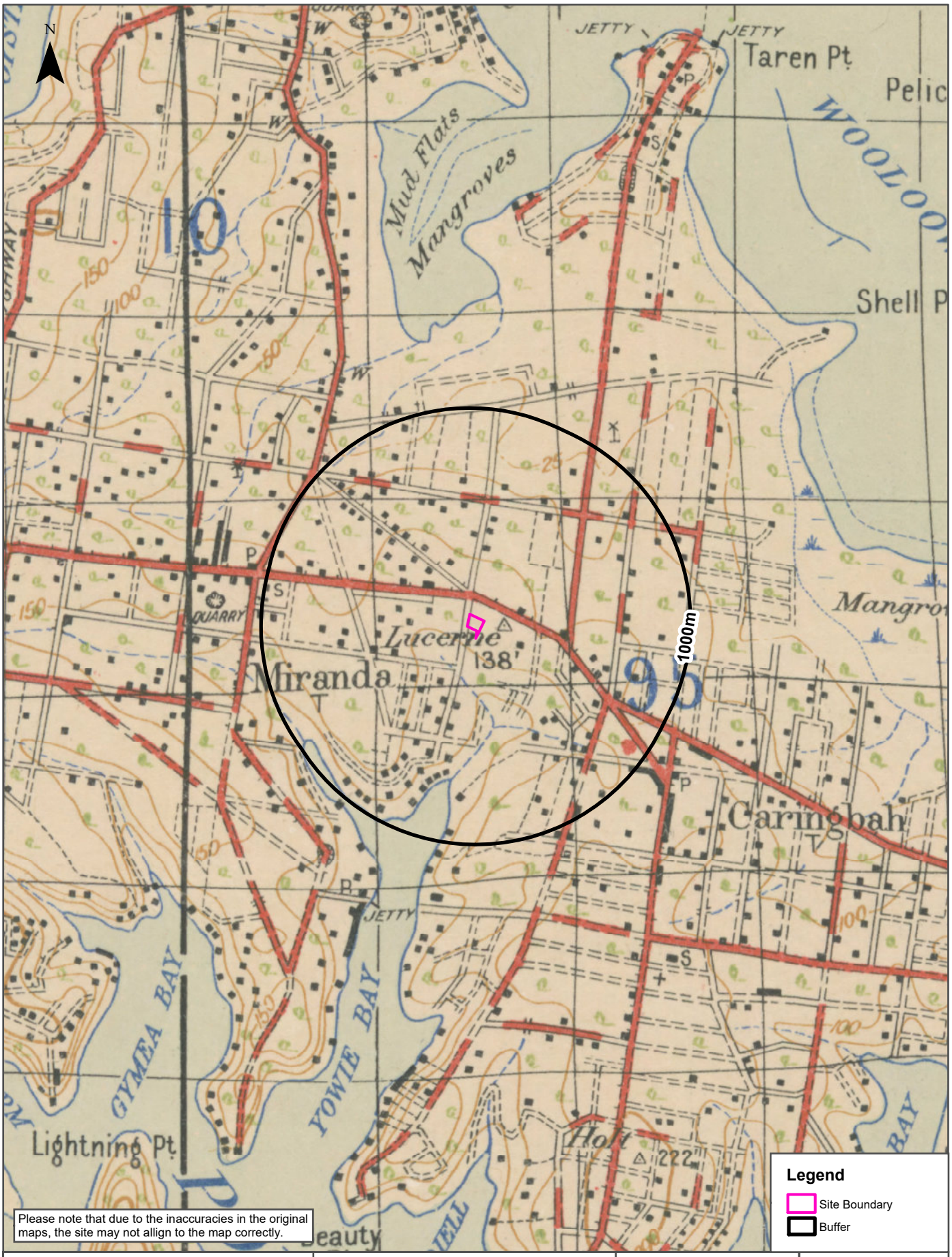
Historical Map 1976

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Historical Map c.1935

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Scale:	Data Sources: Australia 1:63360, Produced by Australian Section Imperial General Staff	Coordinate System: GDA 1994 MGA Zone 56	Date: 07 May 2020

0 125 250 500 750 1,000 1,250 Meters

Topographic Features

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Topographic Features

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Points of Interest

What Points of Interest exist within the dataset buffer?

Map Id	Feature Type	Label	Distance	Direction
1599086	General Hospital	SUTHERLAND HOSPITAL	43m	South East
1599097	Community Home	SUTHERLAND TRANSITIONAL AGED CARE SERVICE	43m	South East
1599432	Community Medical Centre	SUTHERLAND CHILD AND FAMILY SCHOOL HEALTH CENTRE	43m	South East
1599433	Community Medical Centre	SUTHERLAND COMMUNITY MENTAL HEALTH SERVICE	43m	South East
1599434	Community Medical Centre	SUTHERLAND DENTAL CLINIC	43m	South East
1599426	Community Medical Centre	CARINGBAH CHILD AND FAMILY SPEECH PATHOLOGY	80m	South East
1599427	Community Medical Centre	CARINGBAH YOUTH FAMILY COUNSELLING	80m	South East
1599428	Community Medical Centre	CARINGBAH PAEDIATRIC OCCUPATIONAL THERAPY	80m	South East
1599429	Community Medical Centre	CHILD AND FAMILY PAEDIATRIC HEARING CLINIC	80m	South East
1599430	Community Medical Centre	CHILD FAMILY PRIOR TO SCHOOL HEALTH CHECK CLINIC	80m	South East
1599431	Community Medical Centre	POSSUM COTTAGE CHILD AND FAMILY CENTRE	80m	South East
1599419	Community Medical Centre	CARINGBAH COMMUNITY HEALTH CENTRE	80m	South East
1599420	Community Medical Centre	SOUTHCARE BUILDING	89m	South
1599070	Special School	SUTHERLAND HOSPITAL SCHOOL	91m	South East
1599035	Swimming Pool	Swimming Pool	128m	South East
1599019	General Hospital	KAREENA PRIVATE HOSPITAL	139m	North
1599415	Community Medical Centre	SUTHERLAND HEART CLINIC	163m	South East
1599444	Nursing Home	IBIS CARE MIRANDA	232m	South
1599378	Retirement Village	LOGEMAN COURT	354m	West
1599100	Retirement Village	JULIANA VILLAGE	474m	West
1599099	Community Home	JULIANA VILLAGE	494m	West
1599204	Primary School	MIRANDA NORTH PUBLIC SCHOOL	528m	North
1599025	Place Of Worship	BAPTIST CHURCH	571m	East
1599017	Club	CARINGBAH BOWLING AND RECREATION CLUB	572m	East
1599054	Sports Field	BOWLING GREENS	573m	East
1599145	Park	CAMELLIA GARDENS	594m	South
1599026	Place Of Worship	BRETHREN CHURCH	637m	East
1599225	Community Home	MIRANDA AGED CARE FACILITY	667m	North West
1599046	Park	Park	669m	South West
1599066	High School	ENDEAVOUR SPORTS HIGH SCHOOL	678m	North East
1599121	Park	ASCOT PLACE RESERVE	714m	North West

Map Id	Feature Type	Label	Distance	Direction
1599067	High School	CARINGBAH HIGH SCHOOL	715m	North East
1599132	Sports Field	NORTH CARINGBAH OVAL	752m	East
1599042	Park	KAREENA PARK	759m	South
1599051	Park	HIGHFIELD PARK	790m	South East
1599144	Park	SUTHERLAND SHIRE CENTENARY PARK	813m	West
1599031	Shopping Centre	CARINGBAH SHOPPING VILLAGE	817m	South East
1599049	Park	YOWIE BAY OLD BATHS RESERVE	837m	South
1599138	Park	MELDRUM RESERVE	847m	North
1599122	Park	SUNNYSIDE AVENUE RESERVE	853m	East
1599152	Fire Station	MIRANDA FIRE STATION	884m	North West
1599109	Place Of Worship	ST LUKES CHURCH	890m	West
1599208	Primary School	OUR LADY STAR OF THE SEA CATHOLIC SCHOOL	903m	North West
1599117	Sports Court	CRICKET NETS	907m	South East
1599118	Park	PLAYGROUND	919m	South East
1599103	Railway Station	CARINGBAH RAILWAY STATION	941m	South East
1599045	Park	Park	941m	West
1599061	Primary School	CARINGBAH NORTH PUBLIC SCHOOL	949m	East
1599078	Transport Interchange	CARINGBAH BUS INTERCHANGE	950m	South East
1599112	Place Of Worship	CARRINGBAH BAPTIST CHURCH	953m	North East
1599043	Park	BREEN PARK	954m	South East
1599124	Park	DANIELLA STREET RESERVE	955m	East
1599153	Place Of Worship	CATHOLIC CHURCH	971m	West
1599028	Post Office	CARINGBAH POST OFFICE	978m	South East
1599105	Railway Station	MIRANDA RAILWAY STATION	993m	West
1599123	Park	CRAMMOND BOULEVARDE RESERVE	996m	North East
1599033	Shopping Centre	MIRANDA FAIR	997m	West

Topographic Features

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Tanks (Areas)

What are the Tank Areas located within the dataset buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Feature Currency	Distance	Direction
	No records in buffer					

Tanks (Points)

What are the Tank Points located within the dataset buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Feature Currency	Distance	Direction
	No records in buffer					

Major Easements

What Major Easements exist within the dataset buffer?
Note. Easements provided by LPI are not at the detail of local governments. They are limited to major easements such as Right of Carriageway, Electrical Lines (66kVa etc.), Easement to drain water & Significant subterranean pipelines (gas, water etc.).

Map Id	Easement Class	Easement Type	Easement Width	Distance	Direction
120118187	Primary	Undefined		189m	South West
120114404	Primary	Right of way		249m	South
120116553	Primary	Undefined		275m	South
120113533	Primary	Undefined		284m	South
120121081	Primary	Undefined		295m	North West
120121597	Primary	Undefined		319m	North
120108858	Primary	Undefined		374m	North West
120108638	Primary	Undefined		410m	South West
120108334	Primary	Undefined		417m	East
120114411	Primary	Undefined		427m	South
120122200	Primary	Undefined		448m	North West
120110355	Primary	Undefined		462m	East
162531041	Primary	Right of way	4m and Variable	480m	South West

Map Id	Easement Class	Easement Type	Easement Width	Distance	Direction
149978364	Primary	Right of way	var	584m	South
120120255	Primary	Undefined		612m	West
120112573	Primary	Undefined		615m	West
120115823	Primary	Undefined		661m	North West
120113855	Primary	Undefined		661m	South
120117267	Primary	Undefined		721m	North West
120109857	Primary	Undefined		877m	South West
120121711	Primary	Undefined		919m	North
120120130	Primary	Undefined		976m	South West
120117139	Primary	Undefined		976m	South
120113587	Primary	Undefined		985m	South

Topographic Features

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

State Forest

What State Forest exist within the dataset buffer?

State Forest Number	State Forest Name	Distance	Direction
N/A	No records in buffer		

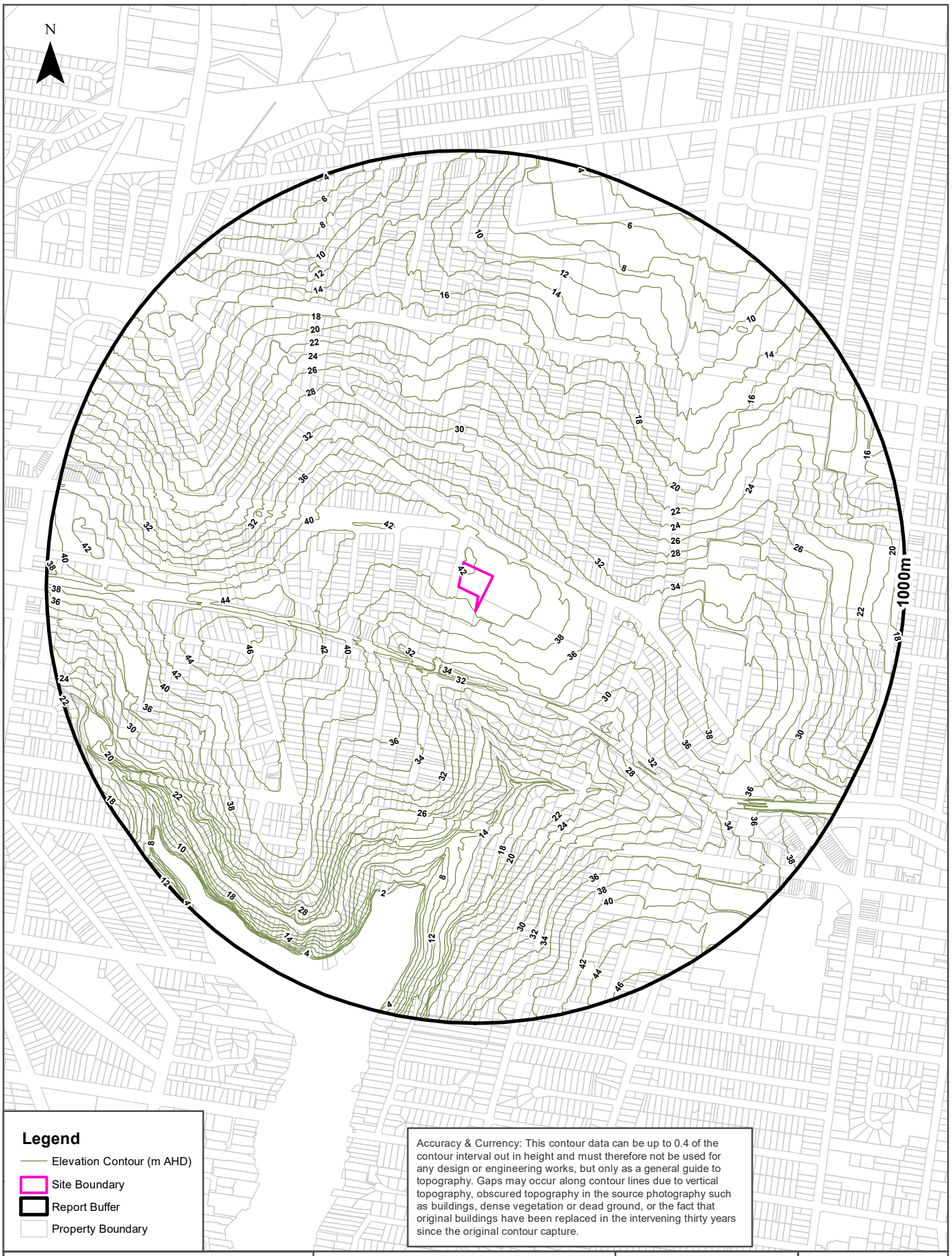
National Parks and Wildlife Service Reserves

What NPWS Reserves exist within the dataset buffer?

Reserve Number	Reserve Type	Reserve Name	Gazetted Date	Distance	Direction
N/A	No records in buffer				

Elevation Contours (m AHD)

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Hydrogeology & Groundwater

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Hydrogeology

Description of aquifers on-site:

Description
Porous, extensive aquifers of low to moderate productivity

Description of aquifers within the dataset buffer:

Description
Porous, extensive aquifers of low to moderate productivity

Hydrogeology Map of Australia : Commonwealth of Australia (Geoscience Australia)

Botany Groundwater Management Zones

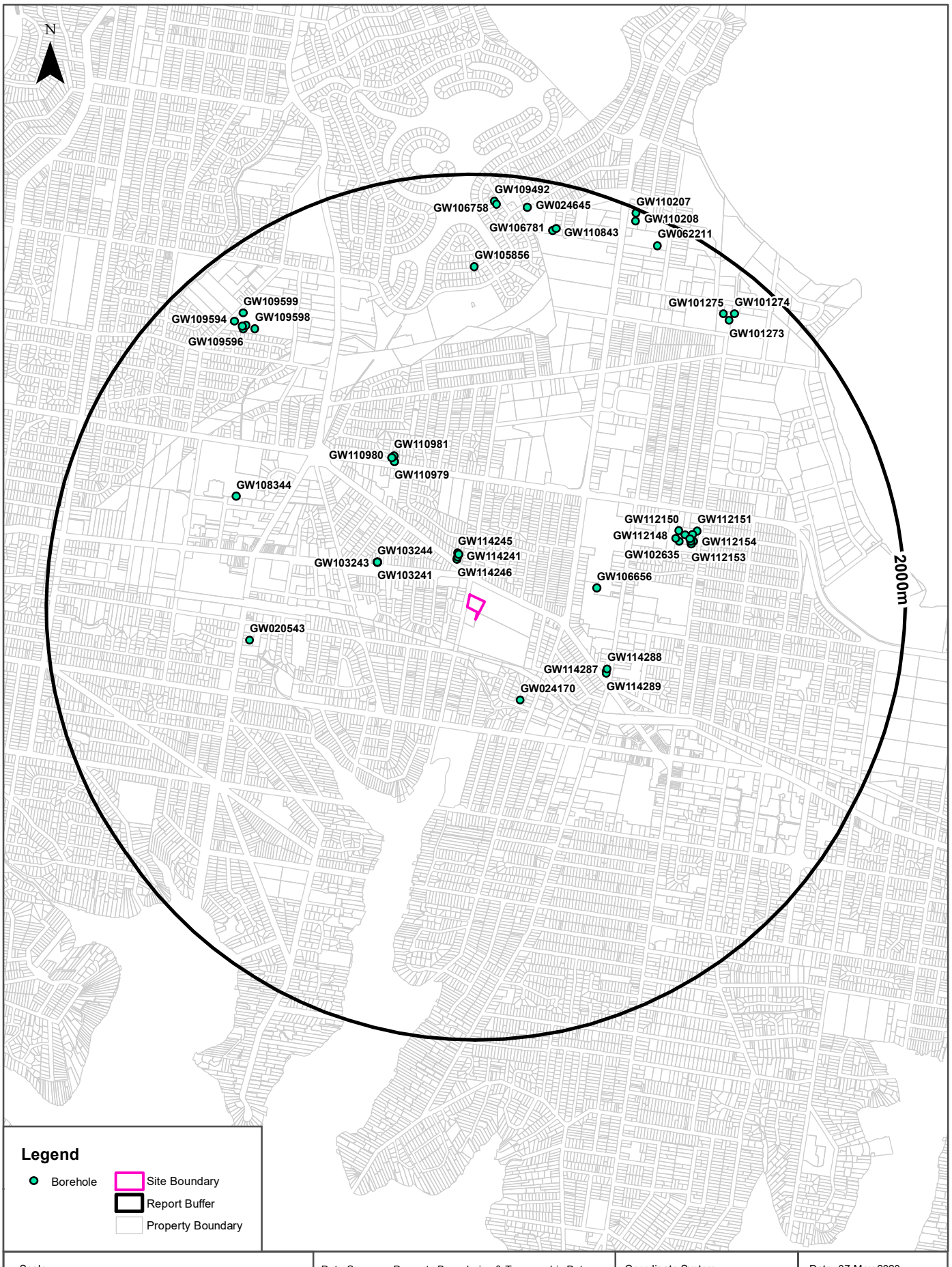
Groundwater management zones relating to the Botany Sand Beds aquifer within the dataset buffer:

Management Zone No.	Restriction	Distance	Direction
N/A	No records in buffer		

Botany Groundwater Management Zones Data Source : NSW Department of Primary Industries

Groundwater Boreholes

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Hydrogeology & Groundwater

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Groundwater Boreholes

Boreholes within the dataset buffer:

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m bgl)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW114246	10BL605312	Bore	Private	Monitoring Bore	Monitoring Bore		22/06/2009	7.00	7.00					177m	North
GW114244	10BL605312	Bore	Private	Monitoring Bore	Monitoring Bore		22/06/2009	7.00	7.00					178m	North
GW114243	10BL605312	Bore	Private	Monitoring Bore	Monitoring Bore		22/06/2009	7.00	7.00					188m	North
GW114241	10BL605312	Bore	Private	Monitoring Bore	Monitoring Bore		22/06/2009	6.00	6.00					193m	North
GW114242	10BL605312	Bore	Private	Monitoring Bore	Monitoring Bore		22/06/2009	6.00	6.00					199m	North
GW114245	10BL605312	Bore	Private	Monitoring Bore	Monitoring Bore		22/06/2009	7.00	7.00					205m	North
GW024170	10BL018656, 10WA108138	Spear	Private	Domestic	Domestic		01/09/1966	4.50	4.60					440m	South East
GW103241	10BL157411	Bore		Monitoring Bore	Monitoring Bore		06/11/1995	8.70	8.70		7.80			464m	North West
GW103244	10BL157411	Bore		Monitoring Bore	Monitoring Bore		06/11/1995	8.50	8.50		6.00			464m	North West
GW103243	10BL157411	Bore		Monitoring Bore	Monitoring Bore		06/11/1995	8.50	8.50		6.00			464m	North West
GW103245	10BL157411	Bore		Monitoring Bore	Monitoring Bore		06/11/1995	9.80	9.80		9.00			465m	North West
GW103242	10BL157411	Bore		Monitoring Bore	Monitoring Bore		06/11/1995	8.80	8.80		7.50			465m	North West
GW106656	10BL164318, 10WA109431	Bore		Recreation (groundwater)	Recreation (groundwater)		24/09/2004	103.00	103.00	Fresh	11.00	0.300		539m	East
GW114288	10BL603771	Bore	Private	Monitoring Bore	Monitoring Bore		07/05/2012	7.00	7.00					666m	South East
GW114287	10BL603771	Bore	Private	Monitoring Bore	Monitoring Bore		07/05/2012	7.00	7.00					667m	South East
GW114289	10BL603771	Bore	Private	Monitoring Bore	Monitoring Bore		07/05/2012	7.20	7.20					673m	South East
GW110979	10BL603738	Bore	Private	Monitoring Bore	Monitoring Bore		02/02/2010	5.00	5.00					727m	North West
GW110980	10BL603738	Bore	Private	Monitoring Bore	Monitoring Bore		02/02/2010	5.00	5.00		2.20			749m	North West
GW110981	10BL603738	Bore	Private	Monitoring Bore	Monitoring Bore		02/02/2010	5.00	5.00		2.20			751m	North West
GW112148	10BL158918	Bore	Private	Monitoring Bore	Monitoring Bore		15/11/1998	1.30	1.30					959m	East
GW102635	10BL158789	Bore		Monitoring Bore	Monitoring Bore		14/09/1998	4.50	4.50					970m	East
GW112150	10BL158918	Bore	Private	Monitoring Bore	Monitoring Bore		15/11/1998	1.20	1.20					986m	East
GW112152	10BL158918	Bore	Private	Monitoring Bore	Monitoring Bore		15/11/1998	1.40	1.40					1006m	East
GW112153	10BL158918	Bore	Private	Monitoring Bore	Monitoring Bore		15/11/1998	1.00	1.00					1021m	East
GW112147	10BL158918	Bore	Private	Monitoring Bore	Monitoring Bore		15/11/1998	2.20	2.20					1021m	East
GW112146	10BL158918	Bore	Private	Monitoring Bore	Monitoring Bore		15/11/1998	2.10	2.10					1023m	East

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m bgl)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW112154	10BL158918	Bore	Private	Monitoring Bore	Monitoring Bore		15/11/1998	1.70	1.70					1034m	East
GW112149	10BL158918	Bore	Private	Monitoring Bore	Monitoring Bore		15/11/1998	2.40	2.40					1041m	East
GW020543	10BL011378, 10WA108104	Bore open thru rock	Private	Waste Disposal	Waste Disposal		01/06/1960	40.80	40.80	Good				1045m	West
GW112151	10BL158918	Bore	Private	Monitoring Bore	Monitoring Bore		15/11/1998	3.60	3.60					1068m	East
GW108344	10BL163856	Bore		Test Bore	Test Bore		16/09/2004	120.00	120.00	2047		0.050		1204m	North West
GW105856	10BL163250, 10WA108710	Bore		Domestic			04/05/2005							1559m	North
GW109598	10BL160159	Well	Other Govt	Monitoring Bore	Monitoring Bore		10/05/2001	6.00	6.00					1625m	North West
GW109596	10BL160159	Well	Other Govt	Monitoring Bore	Monitoring Bore		10/05/2001	5.40	5.40					1661m	North West
GW109597	10BL160159	Well	Other Govt	Monitoring Bore	Monitoring Bore		10/05/2001	6.00	6.00					1662m	North West
GW109595	10BL160159	Well	Other Govt	Monitoring Bore	Monitoring Bore		10/05/2001	5.60	5.60					1673m	North West
GW109594	10BL160159	Well	Other Govt	Monitoring Bore	Monitoring Bore		10/05/2001	4.40	4.40					1713m	North West
GW109599	10BL160159	Well	Other Govt	Monitoring Bore	Monitoring Bore		11/05/2001	4.00	4.00					1717m	North West
GW101273	10BL158253	Bore	Private	Monitoring Bore	Monitoring Bore		25/11/1997	4.20	4.20					1773m	North East
GW106781	10BL164185, 10WA114721	Bore	Private	Recreation (groundwater)	Recreation (groundwater)		01/06/2004	11.00	11.00		1.70			1776m	North
GW101275	10BL158253	Bore	Private	Monitoring Bore	Monitoring Bore		26/11/1997	4.00	4.00					1779m	North East
GW110843	10BL165299, 10WA113951	Spear	Private	Domestic	Domestic		26/06/2008	5.00	5.00					1788m	North
GW101274	10BL158253	Bore	Private	Monitoring Bore	Monitoring Bore		25/11/1997	4.00	4.00					1813m	North East
GW106758	10BL164305, 10WA108863	Spear	Private	Domestic	Domestic		28/12/2004	4.50	4.50					1860m	North
GW024645	10BL018681	Battery Spears	Private	Recreation (groundwater)	Irrigation		01/02/1966	5.40	5.50	Fair				1861m	North
GW109492	10BL164856, 10WA108935	Spear	Private	Domestic	Domestic		01/03/2005	6.00						1875m	North
GW062211	10BL136181	Bore open thru rock	Private	Industrial	Industrial		01/03/1988	130.00	130.00	S.Salty				1883m	North East
GW110208	10BL603059	Bore	Private	Monitoring Bore	Monitoring Bore		07/05/2009	4.00	4.00		1.60			1944m	North East
GW110207	10BL603059	Bore	Private	Monitoring Bore	Monitoring Bore		06/05/2009	4.00	4.00		1.50			1980m	North

Hydrogeology & Groundwater

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

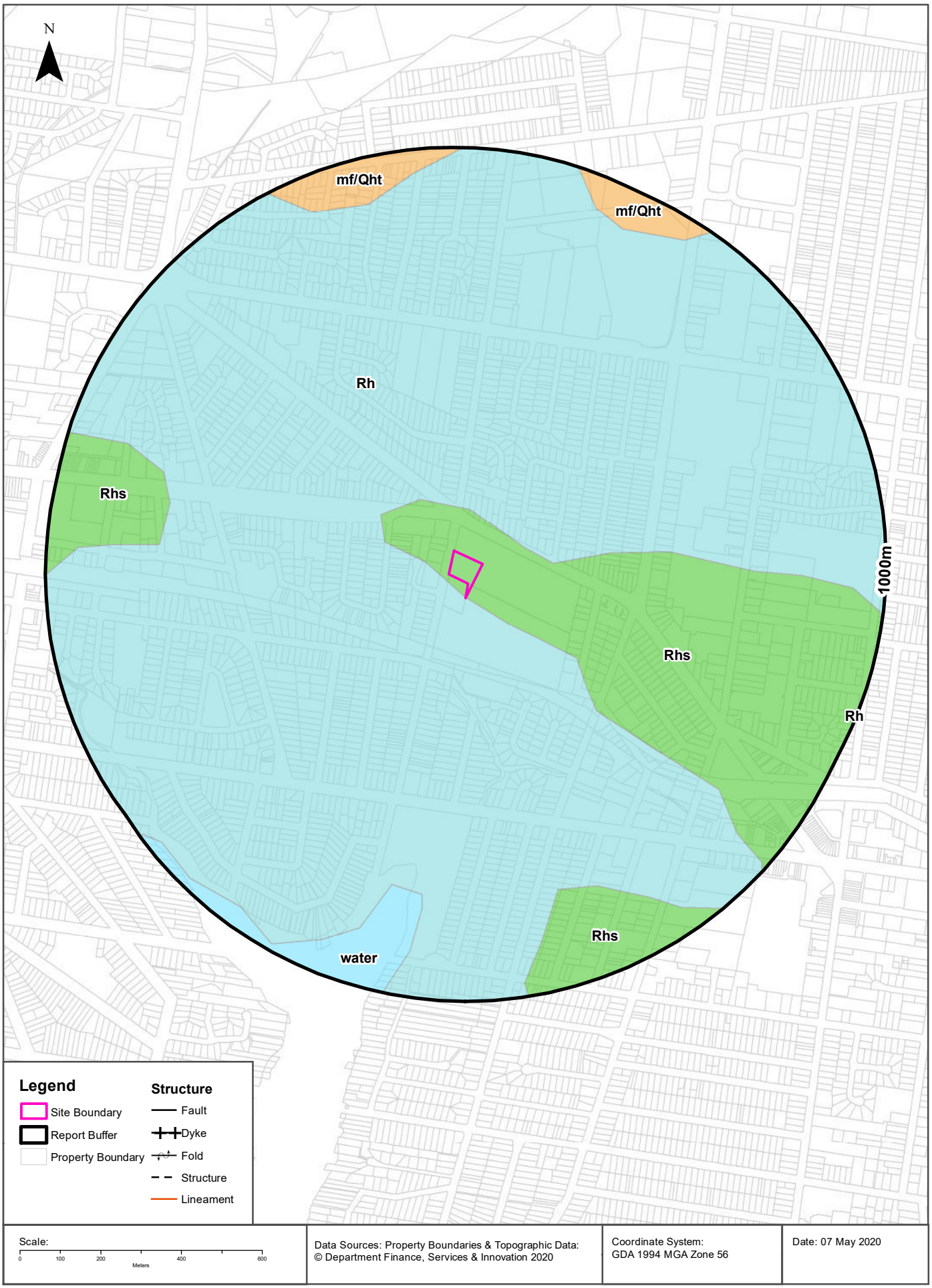
Groundwater No	Drillers Log	Distance	Direction
GW024170	0.00m-4.57m Loam Sandy Water Supply	440m	South East
GW103241	0.00m-0.20m CONCRETE 0.20m-0.50m CLAY 0.50m-1.20m CLAY ORANGE 1.20m-6.00m SHALE WEATHERED BROWN 6.00m-8.50m CLAY GREY BROWN 8.50m-8.70m CLAY BROWN STIFF	464m	North West
GW103243	0.00m-0.20m TOPSOIL 0.20m-1.20m CLAY 1.20m-5.00m WEATHERED SHALE 5.00m-7.50m CLAY BROWN MOIST 7.50m-8.50m CLAY GREY BROWN	464m	North West
GW103244	0.00m-0.20m TOPSOIL 0.20m-2.00m CLAY 2.00m-5.10m WEATHERED SHALE 5.10m-7.50m CLAY BROWN GREY 7.50m-8.50m CLAY GREY BROWN	464m	North West
GW103242	0.00m-0.20m TOPSOIL 0.20m-1.20m CLAY 1.20m-2.50m CLAY/ LIGHT GREY 2.50m-6.50m SHALE WEATHERED 6.50m-8.80m CLAY GREY BROWN, SOFT	465m	North West
GW103245	0.00m-0.10m GRAVEL SURFACE 0.10m-2.10m CLAY 2.10m-5.50m WEATHERED SHALE 5.50m-9.50m CLAY MOIST 9.50m-9.80m CLAY DRY LOW PLASTICITY	465m	North West
GW106656	0.00m-1.00m TOPSOIL/CLAY 1.00m-4.00m COLOURED CLAY 4.00m-5.50m WEATHERED SANDSTONE 5.50m-103.00m SANDSTONE WITH SMALL SHALE BANDS	539m	East
GW110979	0.00m-1.00m FILL 1.00m-5.00m SANDSTONE	727m	North West
GW110980	0.00m-2.60m FILL 2.60m-3.00m SANDY CLAY 3.00m-5.00m SANDSTONE	749m	North West
GW110981	0.00m-1.50m FILL 1.50m-5.00m SANDSTONE	751m	North West
GW102635	0.00m-3.80m SILTY CLAY 3.80m-4.50m SANDSTONE	970m	East
GW020543	0.00m-6.09m Clay 6.09m-40.84m Sandstone Grey Water Supply	1045m	West
GW108344	0.00m-6.80m CLAY BROWN 6.80m-11.10m SANDSTONE CG YELLOW DARK 11.10m-33.40m SANDSTONE MG GREY LT 33.40m-80.50m SANDTONE CG GREY LT 80.50m-85.90m SANDSTONE MG GREY DARK 85.90m-92.10m SANDSTONE MG GREY LT 92.10m-93.00m SANDSTONE MG GREY LT WB 93.00m-98.90m SANDSTONE FG GREY DARK 98.90m-120.00m SANDSTONE MG GREY LT	1204m	North West

Groundwater No	Drillers Log	Distance	Direction
GW109598	0.00m-0.20m FILL,SILTY,LOOSE,DAMP,DARK BROWN 0.20m-0.50m CLAYEY SILT DAMP,YELLOW,BLACK 0.50m-1.50m CLAY YELLOW,RED,ORANGE MOTTLES,LOW PLASTICITY,STIFF,DAMP 1.50m-5.00m WEATHERED SANDSTONE,WHITE,DAMP,FINE GRAINED,SOFT 5.00m-6.00m SANDSTONE MEDIUM,FINE GRAINED,FIRM DAMP	1625m	North West
GW109596	0.00m-0.20m ASPHALT,GRAVELLY,SILTY FILL 0.20m-1.00m CLAY,RED,YELLOW,ORANGE,DAMP 1.00m-1.40m CLAY SANDY,MOTTLED,STIFF L/PLASTICITY 1.40m-2.00m WEATHERED SANDSTONE 2.00m-3.00m WEATHERED SANDSTONE RED,FINE GRAINED 3.00m-4.00m WEATHERED SANDSTONE,DRY FIRM 4.00m-5.00m WEATHERED SANDSTONE,SOME MOISTURE,RED 5.00m-5.40m WEATHERED SANDSTONE,AS ABOVE.	1661m	North West
GW109597	0.00m-0.10m FILL,SILTY,GRAVELLY,LOOSE,BLACK,DRY 0.10m-0.80m CLAY,RED/ORANGE,YELLOW MOTTLES,NO ODOUR 0.80m-1.50m CLAY.SANDY.HIGH PLASTICITY,FINE GRAINED 1.50m-5.50m WEATHERED SANDSTONE,MOIST RED/ORANGE 5.50m-6.00m SHALE,WITH MINOR SAND,GREY/RED,NO ODOIUR	1662m	North West
GW109595	0.00m-0.20m ASPHALT 0.20m-0.70m CLAY,RED,ORANGE,MINOR GRAVEL 0.70m-1.70m SANDY CLAY 1.70m-3.00m WEATHERED SANDSTONE 3.00m-4.00m WEATHERED SANDSTONE,YELLOW,RED MOTTLES 4.00m-5.00m WEATHERED SANDSTONE,SOME MOISTURE 5.00m-5.30m WEATHERED SANDSTONE FINE GRAINED 5.30m-5.55m SANDSTONE,RED,MOIST,FINE GRAINED	1673m	North West
GW109594	0.00m-0.30m TOPSOIL,SOFT BLACK 0.30m-0.70m SILTY CLAY,LOOSE,BROWN 0.70m-1.50m CLAY,SANDY,DRY,YELLOW 1.50m-2.70m WEATHERED SANDSTONE 2.70m-3.70m SANDSTONE FINE GRAINED,WHITE 3.70m-4.35m SANDSTONE,FRESH,RED/ORANGE	1713m	North West
GW109599	0.00m-0.20m CLAY,SANDY,MINOR GRAVELS,RED,YELLOW 0.20m-1.00m SANDSTONE WEATHERED,YELLOW,M/GRAINED 1.00m-1.50m SANDSTONE RED, FINE GRAINED,DRY,MINOIR CLAY 1.50m-4.00m SANDSTONE RED, FINE GRAINED,DRY,MINOIR CLAY	1717m	North West
GW101273	0.00m-0.15m clayey gravel 0.15m-0.85m gravelly clay 0.85m-1.80m sandy clay 1.80m-2.40m sandy silt/organics 2.40m-2.90m clayey sand 2.90m-3.80m sandy clay 3.80m-4.20m sandstone	1773m	North East
GW106781	0.00m-0.60m SOIL, LOAM 0.60m-6.50m SAND 6.50m-9.00m CLAYEY SAND 9.00m-11.00m SILTY SAND AND CLAY	1776m	North
GW101275	0.00m-1.40m gravelly clay 1.40m-2.30m sandy clay 2.30m-4.00m clayey sand	1779m	North East
GW110843	0.00m-5.00m SAND	1788m	North
GW101274	0.00m-0.40m Asphalt/crushed rock 0.40m-1.20m sandy clay 1.20m-3.00m silty sand 3.00m-4.00m clayey sand	1813m	North East
GW106758	0.00m-2.50m fill 2.50m-4.50m sand	1860m	North
GW024645	0.00m-0.60m Sand Black 0.60m-1.21m Clay Grey Water Supply 1.21m-5.48m Sand White White Clay Water Supply 1.21m-5.48m Sandstone	1861m	North
GW062211	0.00m-110.00m Driller 110.00m-120.00m Shale Grey Water Supply 110.00m-120.00m Clay Soft Lens Or Lenses 120.00m-130.00m Sandstone White Medium Water Supply	1883m	North East
GW110208	0.00m-0.10m SURGACE CONCRETE 0.10m-0.50m FILL,ROADBASE 0.50m-2.00m SAND BROWNM,FINE GRAINED,STRONG ODOUR 2.00m-2.50m BECOMING MOIST 2.50m-4.00m SATURATED,SLIGHT HYDROCARBON ODOUR	1944m	North East

Groundwater No	Drillers Log	Distance	Direction
GW110207	0.00m-0.10m SURFACE CONCRETE 0.10m-0.50m FILL ROADBASE 0.50m-1.80m SAND,FINE GRAINED,BROWN.NO ODOUR 1.80m-2.60m SAND,FINE GRAINED LIGHT BROWN 2.60m-3.40m BECOMING DARK BROWN,NO ODOUR 3.40m-4.00m SAND,FINE GRAINED,DARK BROWN,GRAVELS	1980m	North

Geology 1:100,000

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Geology

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Geological Units

What are the Geological Units onsite?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
Rh	medium to coarse-grained quartz sandstone, very minor shale and laminite lenses	Hawkesbury Sandstone					Wollongong & Port Hacking	1:100,000
Rhs	shale, laminite	Unnamed					Wollongong & Port Hacking	1:100,000

What are the Geological Units within the dataset buffer?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
mf/Qht	manmade fill over Qht	Unnamed					Wollongong & Port Hacking	1:100,000
Rh	medium to coarse-grained quartz sandstone, very minor shale and laminite lenses	Hawkesbury Sandstone					Wollongong & Port Hacking	1:100,000
Rhs	shale, laminite	Unnamed					Wollongong & Port Hacking	1:100,000
water							Wollongong & Port Hacking	1:100,000

Geological Structures

What are the Geological Structures onsite?

Feature	Name	Description	Map Sheet	Dataset
No features				1:100,000

What are the Geological Structures within the dataset buffer?

Feature	Name	Description	Map Sheet	Dataset
No features				1:100,000

Geological Data Source : NSW Department of Industry, Resources & Energy

Naturally Occurring Asbestos Potential

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

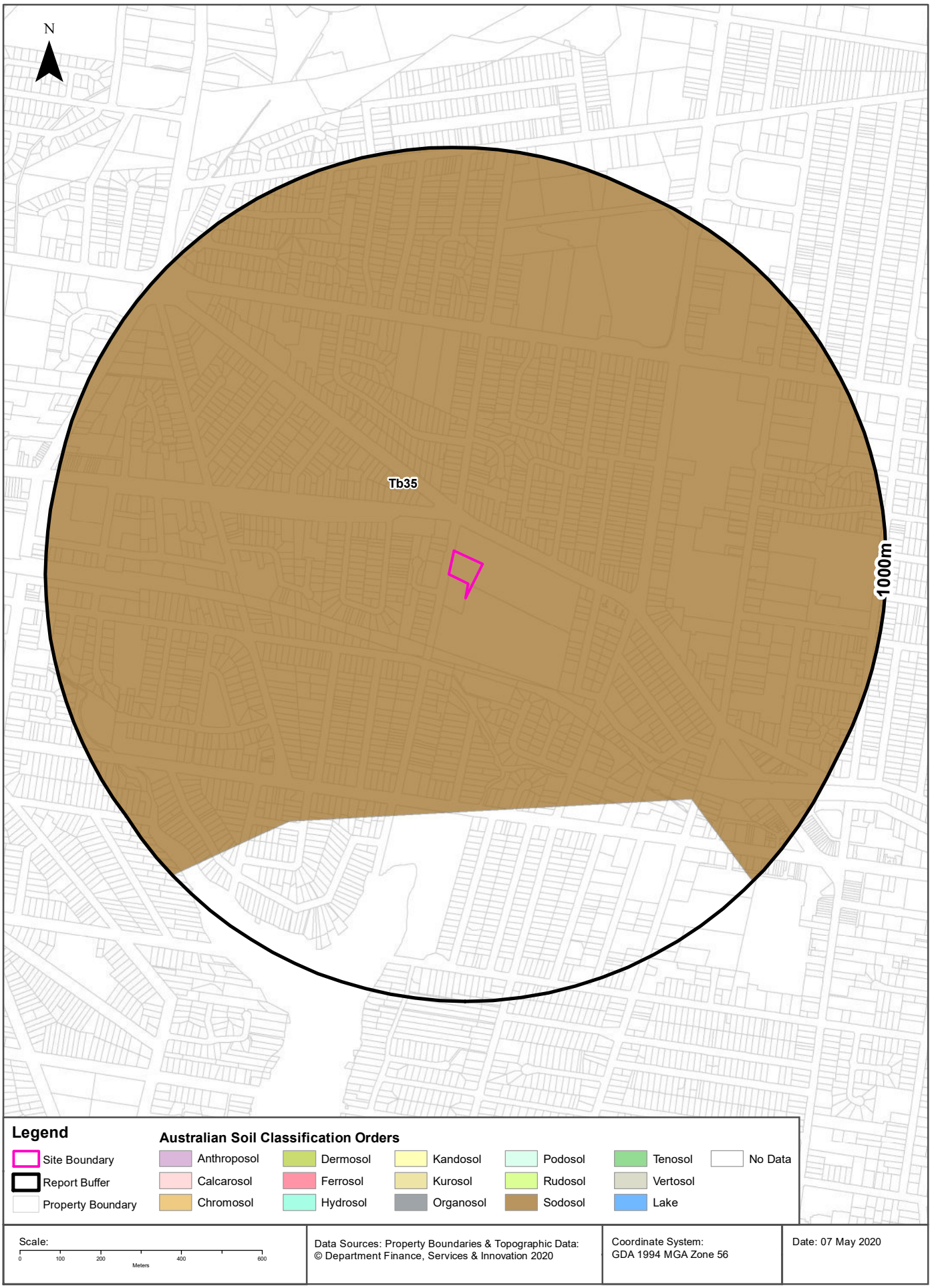
Naturally Occurring Asbestos Potential

Naturally Occurring Asbestos Potential within the dataset buffer:

Potential	Sym	Strat Name	Group	Formation	Scale	Min Age	Max Age	Rock Type	Dom Lith	Description	Dist	Dir
No records in buffer												

Atlas of Australian Soils

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Soils

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

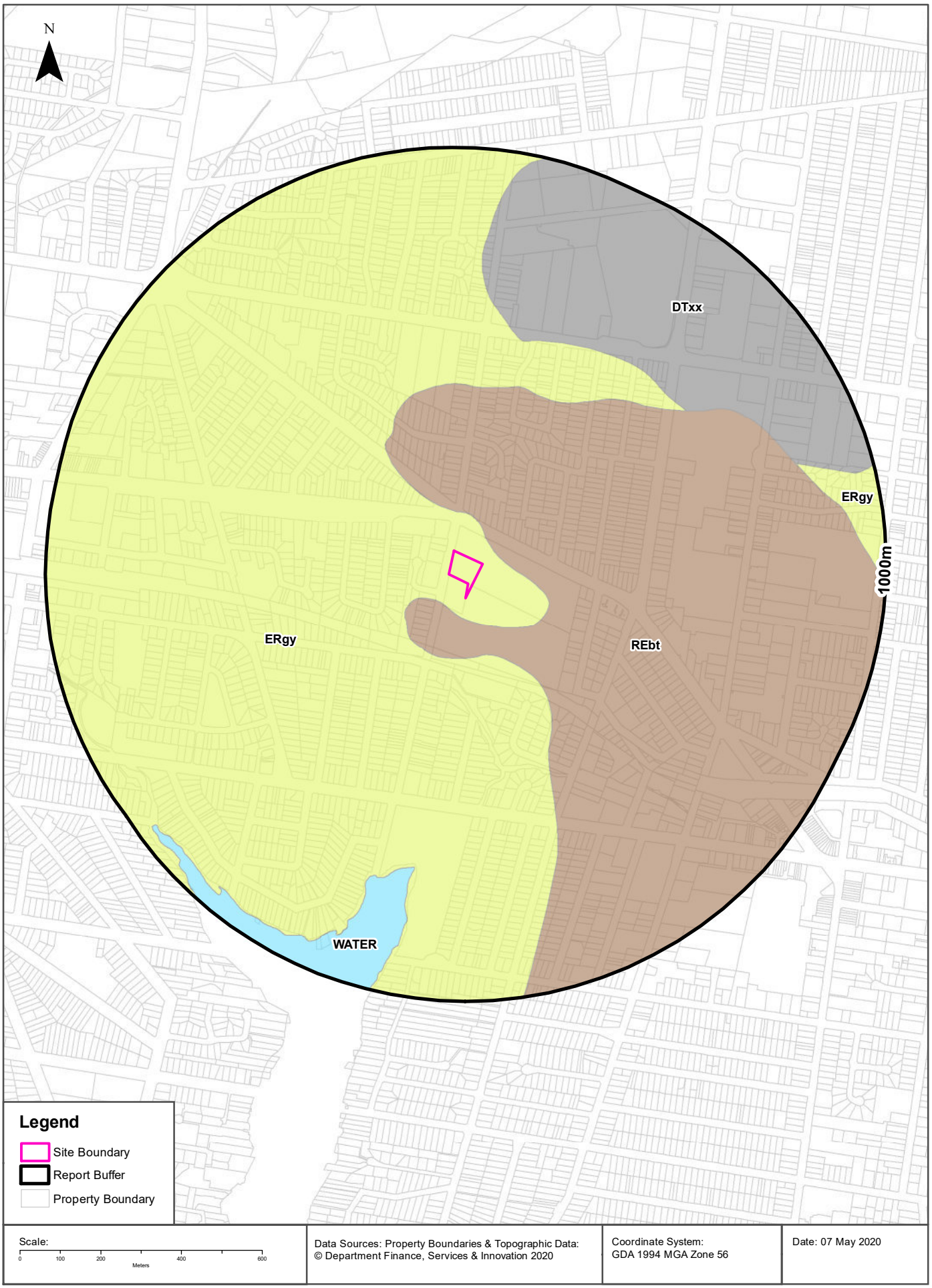
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Tb35	Sodosol	Dissected plateau remnants--flat to undulating ridge tops with moderate to steep side slopes: chief soils are hard acidic yellow and yellow mottled soils (Dy3.41), (Dy2.21), and (Dy2.41) and hard acidic red soils (Dr2.21); many shallow profiles occur and profile thickness varies considerably over short distances. Associated are: (Gn3.54), (Gn3.14), and possibly other (Gn3) soils; (Db1.2) soils on some ridges; (Dy5.81) soils in areas transitional to unit Mb2; soils common to unit Mb2; and eroded lateritic remnants. Small areas of other soils are likely. Flat ferruginous shale or sandstone fragments are common on and/or in and/or below the soils of this unit.	0m

Soil Landscapes

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Soils

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Soil Landscapes

What are the onsite Soil Landscapes?

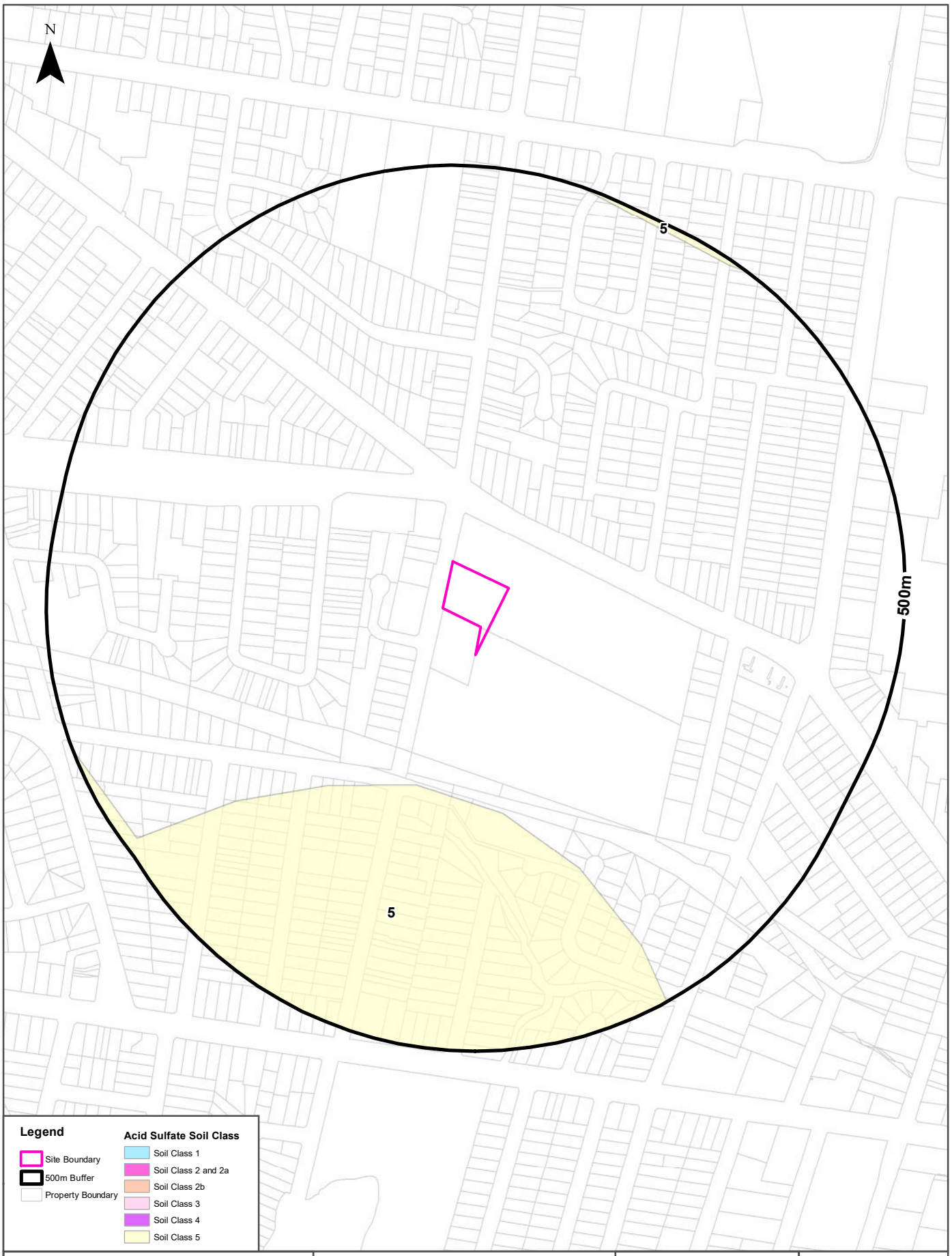
Soil Code	Name	Group	Process	Map Sheet	Scale
ERgy	GYMEA		EROSIONAL	Wollongong & Port Hacking	1:100,000

What are the Soil Landscapes within the dataset buffer?

Soil Code	Name	Group	Process	Map Sheet	Scale
DTxx	DISTURBED TERRAIN		DISTURBED TERRAIN	Wollongong & Port Hacking	1:100,000
ERgy	GYMEA		EROSIONAL	Wollongong & Port Hacking	1:100,000
REbt	BLACKTOWN		RESIDUAL	Wollongong & Port Hacking	1:100,000
WATER	WATER		WATER	Wollongong & Port Hacking	1:100,000

Acid Sulfate Soils

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Scale: 0 100 200 Meters	Data Sources: Property Boundaries & Topographic Data: © Department Finance, Services & Innovation 2020	Coordinate System: GDA 1994 MGA Zone 56	Date: 07 May 2020

Acid Sulfate Soils

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Environmental Planning Instrument - Acid Sulfate Soils

What is the on-site Acid Sulfate Soil Plan Class that presents the largest environmental risk?

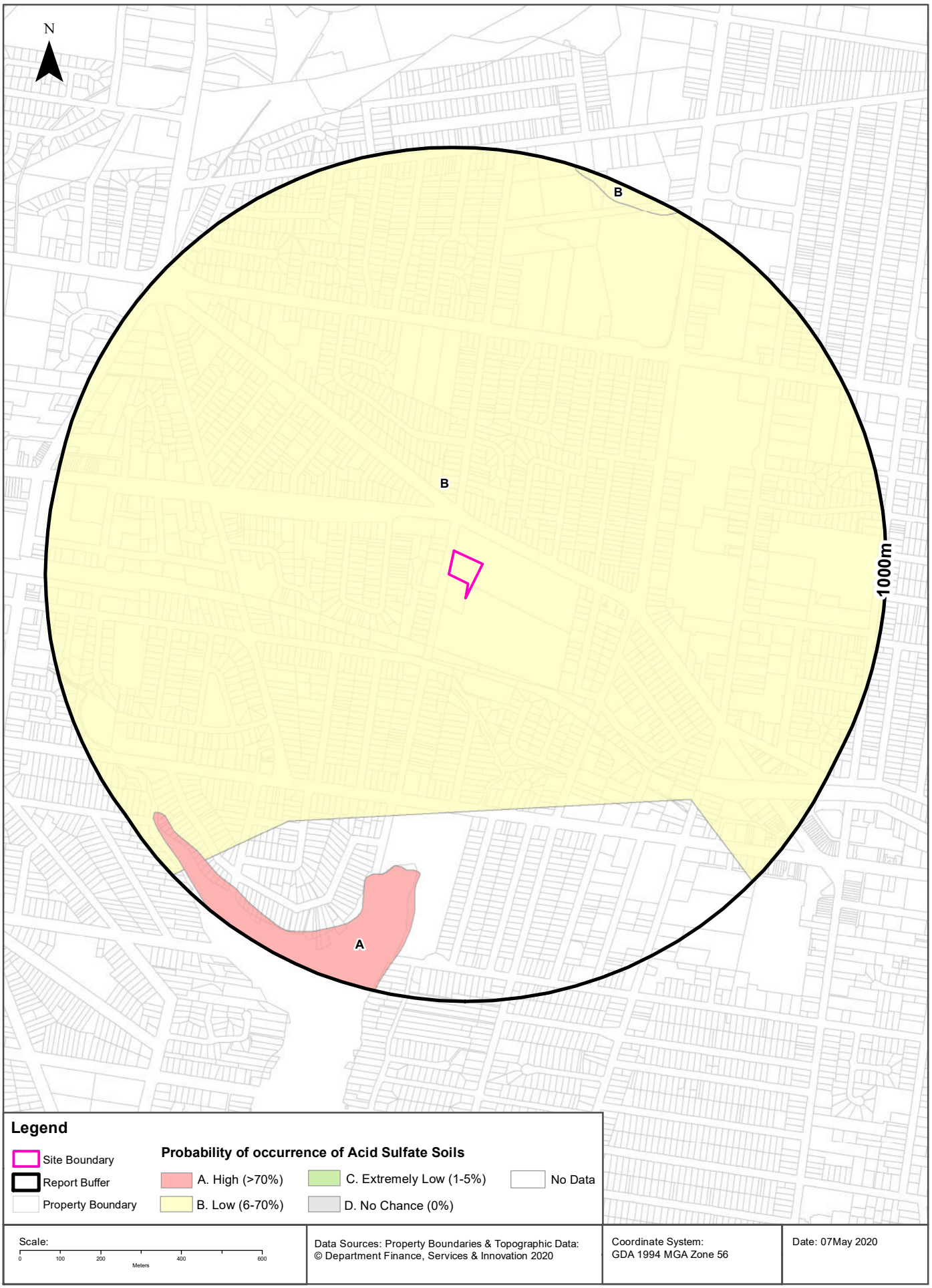
Soil Class	Description	EPI Name
N/A		

If the on-site Soil Class is 5, what other soil classes exist within 500m?

Soil Class	Description	EPI Name	Distance	Direction
N/A				

Atlas of Australian Acid Sulfate Soils

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Acid Sulfate Soils

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
B	Low Probability of occurrence. 6-70% chance of occurrence.	0m
A	High Probability of occurrence. >70% chance of occurrence.	685m

Dryland Salinity

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Dryland Salinity - National Assessment

Is there Dryland Salinity - National Assessment data onsite?

No

Is there Dryland Salinity - National Assessment data within the dataset buffer?

No

What Dryland Salinity assessments are given?

Assessment 2000	Assessment 2020	Assessment 2050	Distance	Direction
N/A	N/A	N/A	N/A	N/A

Dryland Salinity Data Source : National Land and Water Resources Audit
The Commonwealth and all suppliers of source data used to derive the maps of "Australia, Forecast Areas Containing Land of High Hazard or Risk of Dryland Salinity from 2000 to 2050" do not warrant the accuracy or completeness of information in this product. Any person using or relying upon such information does so on the basis that the Commonwealth and data suppliers shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information. Any persons using this information do so at their own risk.
In many cases where a high risk is indicated, less than 100% of the area will have a high hazard or risk.

Dryland Salinity Potential of Western Sydney

Dryland Salinity Potential of Western Sydney within the dataset buffer?

Feature Id	Classification	Description	Distance	Direction
N/A	Outside Data Coverage			

Dryland Salinity Potential of Western Sydney Data Source : NSW Office of Environment and Heritage

Mining Subsidence Districts

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Mining Subsidence Districts

Mining Subsidence Districts within the dataset buffer:

District	Distance	Direction
There are no Mining Subsidence Districts within the report buffer		

State Environmental Planning Policy

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

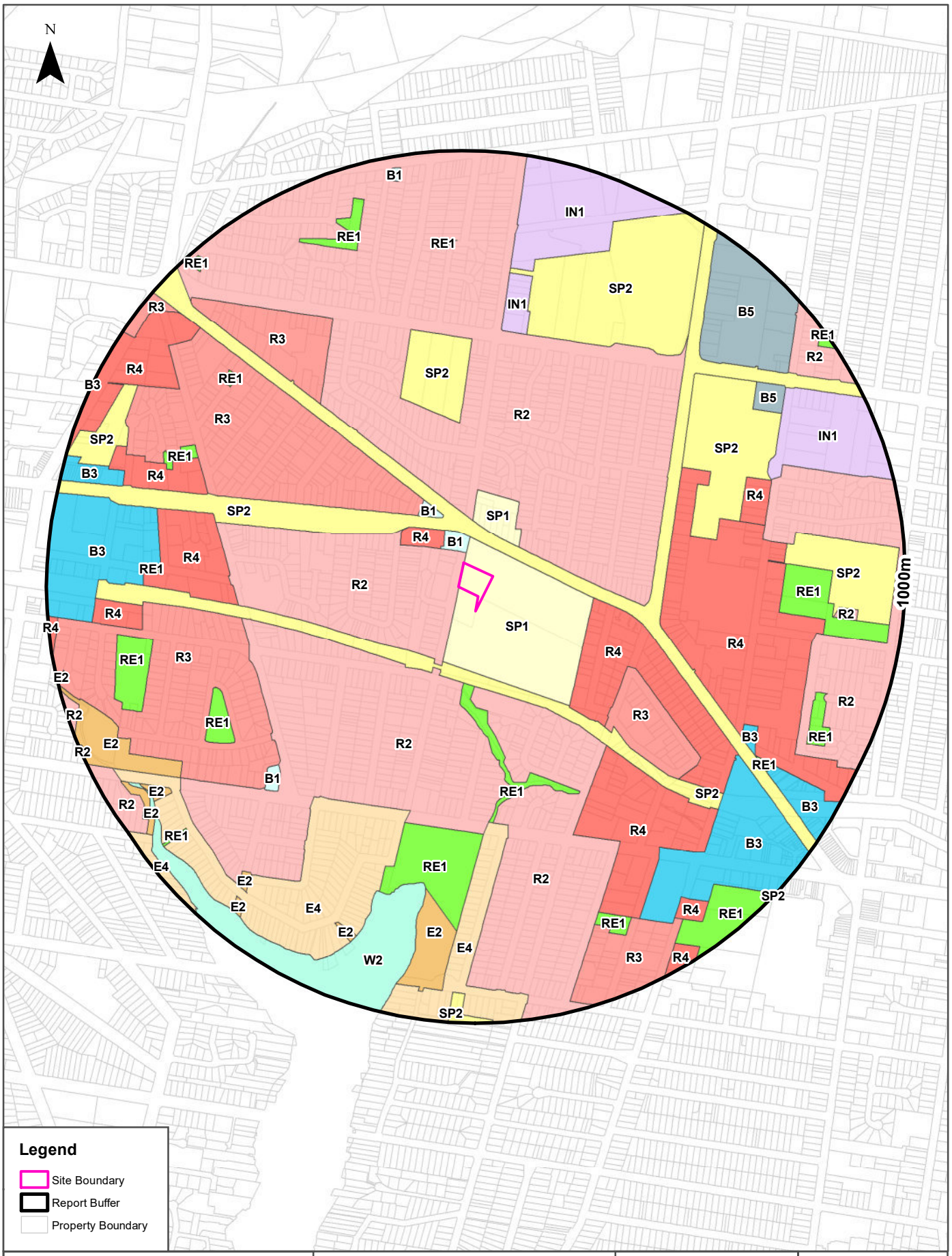
State Significant Precincts

What SEPP State Significant Precincts exist within the dataset buffer?

Map Id	Precinct	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
N/A	No Records in Buffer							

EPI Planning Zones

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Data Sources: Property Boundaries & Topographic Data: © Department Finance, Services & Innovation 2020
Planning: NSW Crown Copyright - Planning & Environment

Coordinate System: GDA 1994 MGA Zone 56

Date: 07 May 2020

Environmental Planning Instrument

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Land Zoning

What EPI Land Zones exist within the dataset buffer?

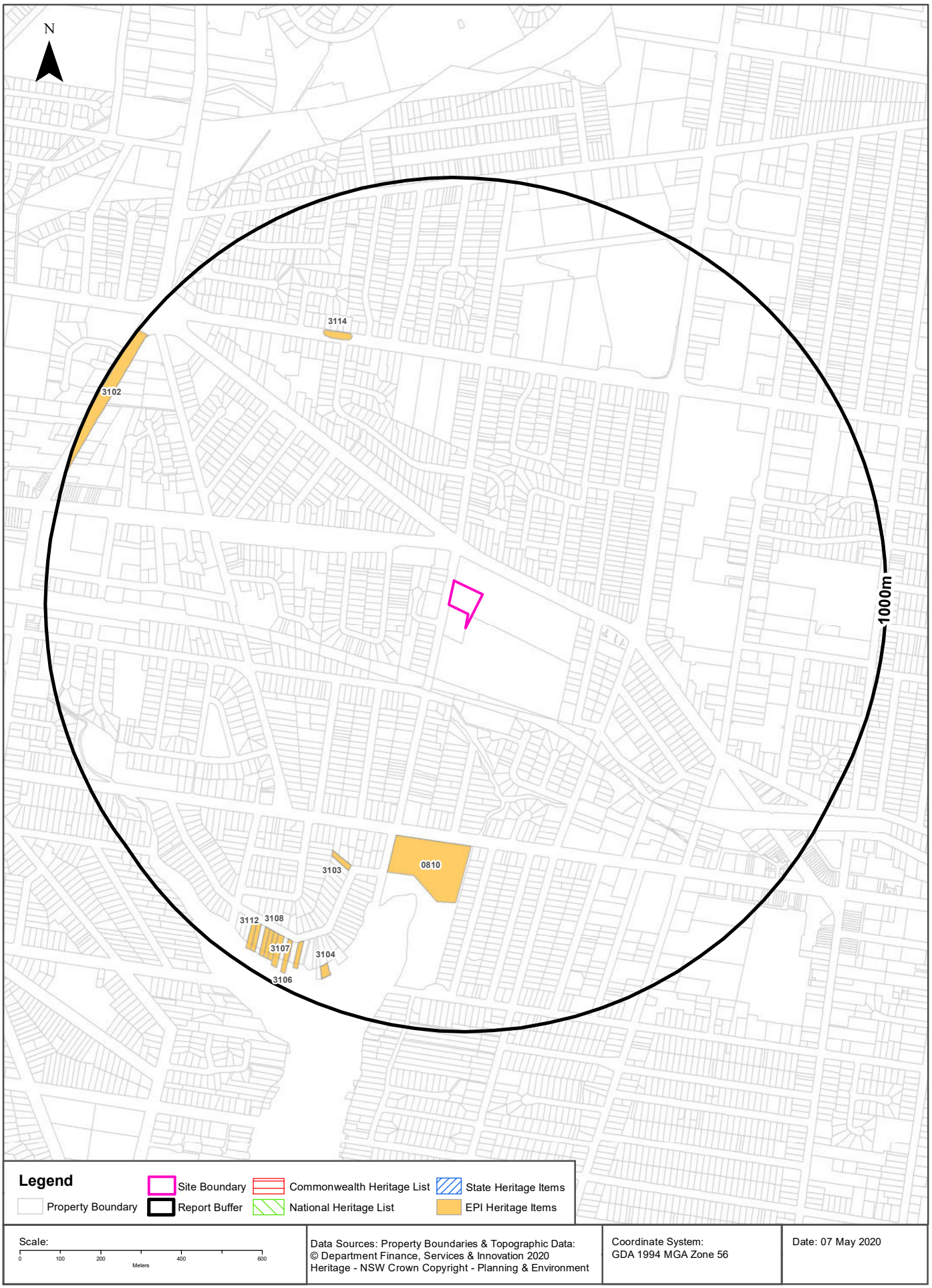
Zone	Description	Purpose	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
SP1	Special Activities	Health Services Facilities	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		0m	Onsite
R2	Low Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		0m	West
B1	Neighbourhood Centre		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		24m	North West
SP2	Infrastructure	Classified Road	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		61m	West
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		64m	North West
SP1	Special Activities	Health Services Facilities	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		91m	North
R2	Low Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		94m	North
B1	Neighbourhood Centre		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		123m	North West
SP2	Infrastructure	Railway	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		142m	South West
R3	Medium Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		161m	North West
R2	Low Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		166m	South West
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		176m	South
R2	Low Density Residential		Sutherland Shire Local Environmental Plan 2015	06/03/2020	06/03/2020	06/03/2020	Amendment No 17	182m	South East
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		248m	South East
SP2	Infrastructure	Educational Establishment	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		340m	North
R3	Medium Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		389m	South East
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		414m	East
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		454m	South East
SP2	Infrastructure	Educational Establishment	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		487m	North East
E4	Environmental Living		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		510m	South West
E4	Environmental Living		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		513m	South
R3	Medium Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		520m	North West
R3	Medium Density Residential		Sutherland Shire Local Environmental Plan 2015	28/07/2017	28/07/2017	06/03/2020	Amendment No 4	528m	West
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		532m	South
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		537m	West
IN1	General Industrial		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		570m	North
SP2	Infrastructure	Educational Establishment	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		574m	North East

Zone	Description	Purpose	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
B1	Neighbourhood Centre		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		606m	South West
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	17/03/2017	17/03/2017	06/03/2020	Amendment No 7	612m	East
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		629m	South West
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		644m	West
R2	Low Density Residential		Sutherland Shire Local Environmental Plan 2015	04/08/2017	04/08/2017	06/03/2020	Amendment No 9	659m	East
SP2	Infrastructure	Educational Establishment	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		668m	East
W2	Recreational Waterways		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		671m	South
E2	Environmental Conservation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		682m	South
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		694m	North West
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		698m	East
B3	Commercial Core		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		703m	South East
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		710m	North West
IN1	General Industrial		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		711m	East
B3	Commercial Core		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		721m	South East
IN1	General Industrial		Sutherland Shire Local Environmental Plan 2015	04/08/2017	04/08/2017	06/03/2020	Amendment No 9	724m	North
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		724m	West
B3	Commercial Core		Sutherland Shire Local Environmental Plan 2015	28/07/2017	28/07/2017	06/03/2020	Amendment No 4	726m	West
B5	Business Development		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		731m	North East
B5	Business Development		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		749m	North East
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	28/07/2017	28/07/2017	06/03/2020	Amendment No 4	752m	West
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		761m	South East
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		765m	North
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		768m	West
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		788m	South
E2	Environmental Conservation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		793m	South West
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		800m	North
B3	Commercial Core		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		805m	South East
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		808m	North West
R3	Medium Density Residential		Sutherland Shire Local Environmental Plan 2015	04/08/2017	04/08/2017	06/03/2020	Amendment No 9	812m	South East
E2	Environmental Conservation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		825m	South
R2	Low Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		830m	East
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		831m	East
E2	Environmental Conservation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		838m	South West
B3	Commercial Core		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		848m	West

Zone	Description	Purpose	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		853m	South East
E2	Environmental Conservation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		855m	South West
SP2	Infrastructure	Educational Establishment & Place of Worship	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		865m	West
R2	Low Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		870m	North East
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		878m	South East
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		879m	South West
E2	Environmental Conservation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		902m	South West
E2	Environmental Conservation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		906m	South West
R3	Medium Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		915m	North West
R2	Low Density Residential		Sutherland Shire Local Environmental Plan 2015	04/08/2017	04/08/2017	06/03/2020	Amendment No 9	925m	West
SP2	Infrastructure	Educational Establishment	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		926m	South
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		938m	South East
B1	Neighbourhood Centre		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		939m	North
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		953m	North West
E4	Environmental Living		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		954m	South West
RE1	Public Recreation		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		965m	North East
R4	High Density Residential		Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		976m	West
SP2	Infrastructure	Educational Establishment	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	06/03/2020		996m	South East

Heritage Items

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Heritage

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

National Heritage List

What are the National Heritage List Items located within the dataset buffer?
Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

State Heritage Register - Curtilages

What are the State Heritage Register Items located within the dataset buffer?

Map Id	Name	Address	LGA	Listing Date	Listing No	Plan No	Distance	Direction
N/A	No records in buffer							

Environmental Planning Instrument - Heritage

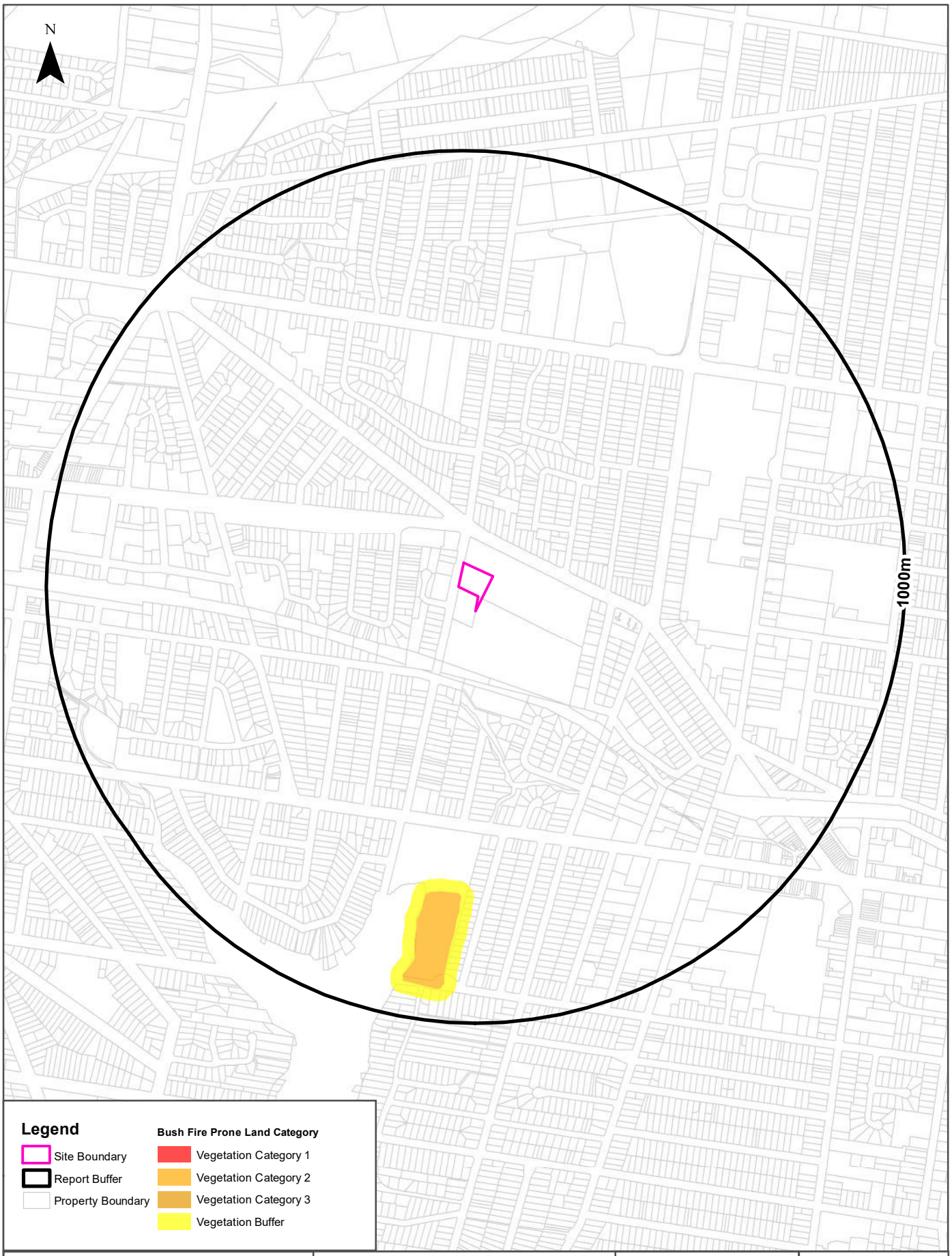
What are the EPI Heritage Items located within the dataset buffer?

Map Id	Name	Classification	Significance	EPI Name	Published Date	Commenced Date	Currency Date	Distance	Direction
0810	EG Waterhouse National Camellia Garden	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	28/07/2017	28/07/2017	03/04/2020	532m	South
3103	House	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	641m	South West

Map Id	Name	Classification	Significance	EPI Name	Published Date	Commenced Date	Currency Date	Distance	Direction
3114	Remnant stand, consisting of Eucalyptus racemosa (Snappy Gum or Small-leaf Scribbly Gum)	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	651m	North West
3105	Boatsheds and boatshed/dwellings (including the simple form, the gabled roof.)	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	873m	South West
3106	Boat shed (part of a group), sea wall and boat ramp	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	886m	South West
3107	Boat shed (part of a group), slipways and jetty	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	887m	South West
3108	Boat shed (part of a group), slipways and jetty	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	887m	South West
3109	Boathouse	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	888m	South West
3110	Mount View Boathouse	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	889m	South West
3111	Boathouse (including the estuarine, the fine boathouse, the overall, the fenestration pattern)	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	891m	South West
3112	Boatshed	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	892m	South West
3104	Waterfront house (including the roof form and finishes, the seawall.)	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	898m	South
3102	Street trees, alternate planting of Lophostemon confertus (Brush Box) and Cinnamomum camphora (Camphor Laurel)	Item - General	Local	Sutherland Shire Local Environmental Plan 2015	23/06/2015	23/06/2015	03/04/2020	966m	North West

Natural Hazards - Bush Fire Prone Land

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Data Sources: Bush Fire Prone Land: © NSW Rural Fire Service 2020. Property Boundaries: © Department Finance, Services & Innovation 2020

Coordinate System: GDA 1994 MGA Zone 56

Date: 07 May 2020

Natural Hazards

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Bush Fire Prone Land

What are the nearest Bush Fire Prone Land Categories that exist within the dataset buffer?

Bush Fire Prone Land Category	Distance	Direction
Vegetation Buffer	653m	South
Vegetation Category 2	683m	South

Ecological Constraints - Native Vegetation & RAMSAR Wetlands

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Ecological Constraints

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Native Vegetation

What native vegetation exists within the dataset buffer?

Map ID	Map Unit Name	Threatened Ecological Community NSW	Threatened Ecological Community EPBC Act	Understorey	Disturbance	Disturbance Index	Dominant Species	Dist	Direction
Urban_E/N	Urban_E/N: Urban Exotic/Native			00: Not assessed	00: Not assessed	0: Not assessed	Urban Exotic/Native	9m	North West
S_DSF04	S_DSF04: Coastal Enriched Sandstone Dry Forest			24: Urban and hard surface	24: Urban mixed use	4: Very high	A.costata/E.racemosa/C.gummifera/E.piperita/A.littoralis	186m	East
S_WSF09	S_WSF09: Sydney Turpentine-Ironbark Forest	Sydney Turpentine Ironbark Forest	Turpentine Ironbark Forest (possible)	15: Grassy natives and exotics	31: Parkland open understorey	4: Very high	S.glomulifera/E.paniculata/E.resinifera	482m	North East
Weed_Ex	Weed_Ex: Weeds and Exotics			00: Not assessed	00: Not assessed	0: Not assessed	Exotic Species >90%cover	524m	South
S_FoW02	S_FoW02: Coastal Flats Swamp Mahogany Forest	Swamp Sclerophyll Forest on Coastal Floodplains		20: Weeds and exotics	13: Weeds	3: High	E.robusta	644m	South
S_FoW08	S_FoW08: Estuarine Swamp Oak Forest	Swamp Oak Floodplain Forest		31: Saltmarsh	14: Canopy gaps	2: Moderate	C.glauca	666m	South
S_SW01	S_SW01: Estuarine Mangrove Forest			00: Not assessed	00: Not assessed	0: Not assessed	Mangroves	687m	South
S_SW03	S_SW03: Seagrass Meadows			00: Not assessed	00: Not assessed	0: Not assessed	Seagrass (DPI)	716m	South
S_WSF02	S_WSF02: Coastal Enriched Sandstone Moist Forest			10: Mesic/rainforest	13: Weeds	3: High	E.pilularis/E.punctata/A.costataE.racemosa	786m	South West
S_SW02	S_SW02: Estuarine Saltmarsh	Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh (possible)	00: Not assessed	00: Not assessed	0: Not assessed	S.repens/S.quinqueflora/S.virginicusJ.krausii	937m	South West

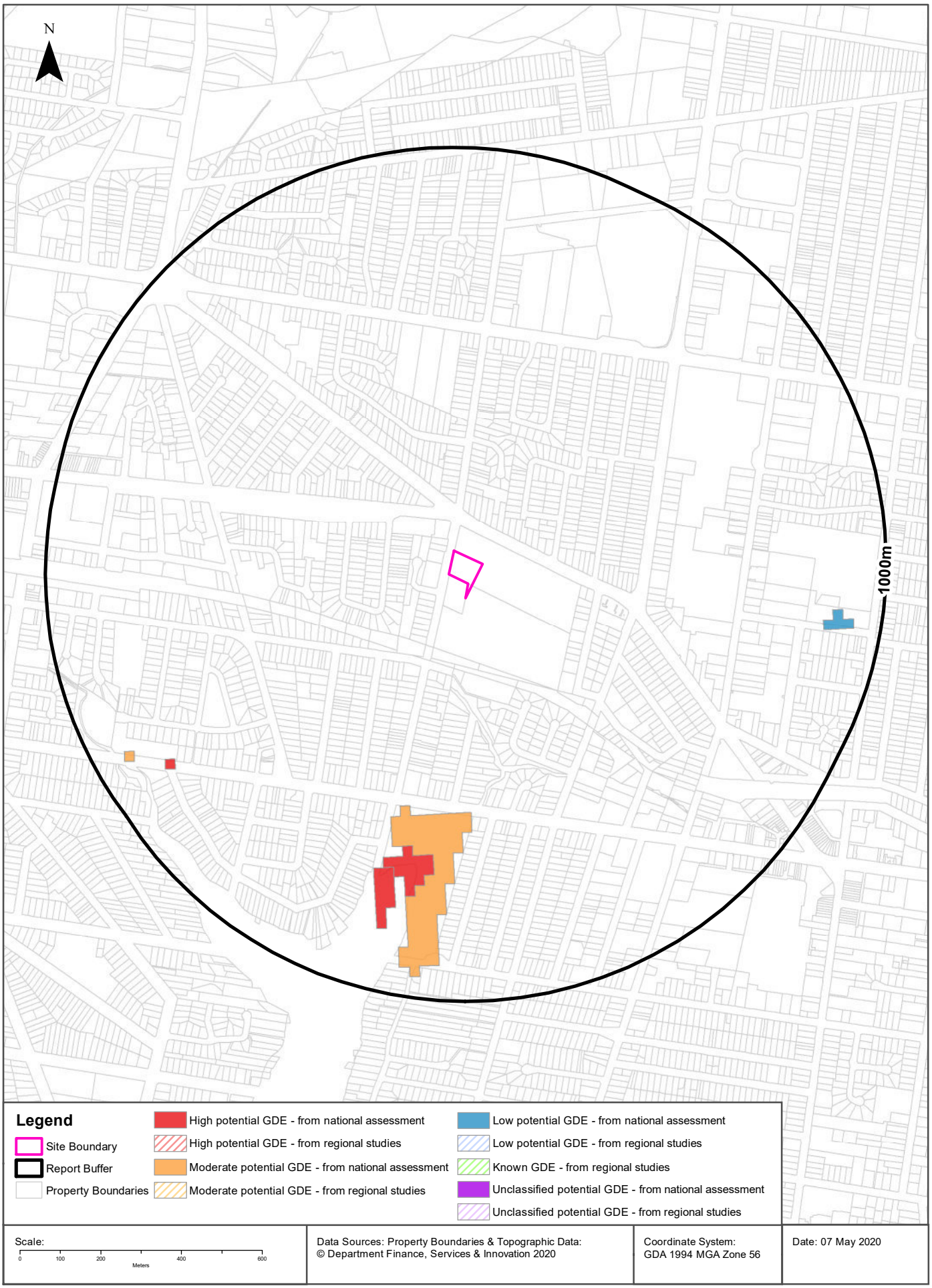
Ramsar Wetlands

What Ramsar Wetland areas exist within the dataset buffer?

Map Id	Ramsar Name	Wetland Name	Designation Date	Source	Distance	Direction
N/A	No records in buffer					

Ecological Constraints - Groundwater Dependent Ecosystems Atlas

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Ecological Constraints

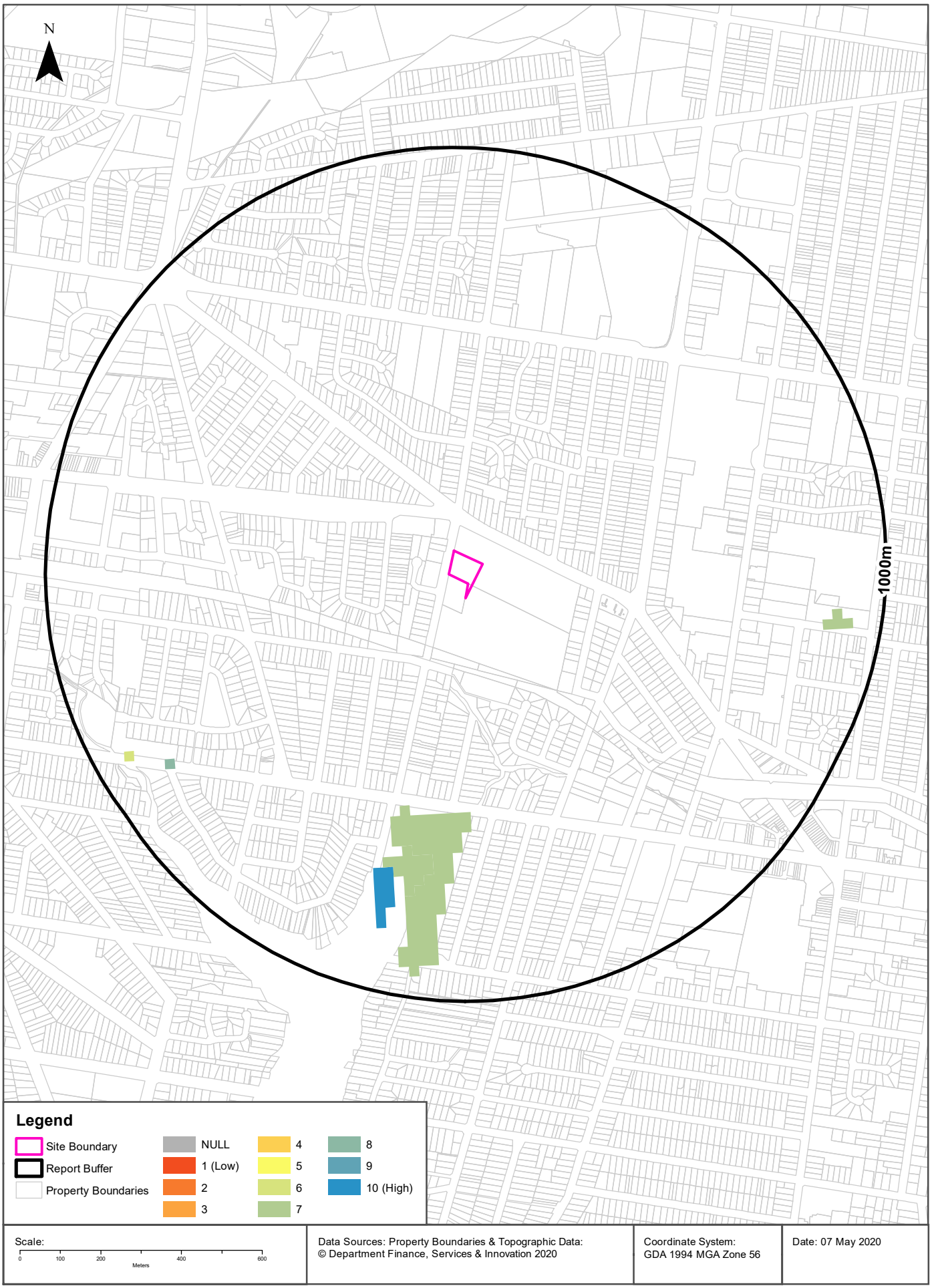
Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Groundwater Dependent Ecosystems Atlas

Type	GDE Potential	Geomorphology	Ecosystem Type	Aquifer Geology	Distance
Terrestrial	Moderate potential GDE - from national assessment	Deeply dissected sandstone plateaus.	Vegetation	Consolidated sedimentary	529m
Terrestrial	High potential GDE - from national assessment	Deeply dissected sandstone plateaus.	Vegetation	Consolidated sedimentary	627m
Terrestrial	Low potential GDE - from national assessment	Deeply dissected sandstone plateaus.	Vegetation	Consolidated sedimentary	853m

Ecological Constraints - Inflow Dependent Ecosystems Likelihood

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229



Ecological Constraints

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

Inflow Dependent Ecosystems Likelihood

Type	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Distance
Terrestrial	7	Deeply dissected sandstone plateaus.	Vegetation	Consolidated sedimentary	529m
Terrestrial	10	Deeply dissected sandstone plateaus.	Vegetation		689m
Terrestrial	8	Deeply dissected sandstone plateaus.	Vegetation	Consolidated sedimentary	818m
Terrestrial	6	Deeply dissected sandstone plateaus.	Vegetation	Consolidated sedimentary	894m

Inflow Dependent Ecosystems Likelihood Data Source: The Bureau of Meteorology

Ecological Constraints

Corner of Kingsway & Kareena Road, Caringbah, NSW 2229

NSW BioNet Atlas

Species on the NSW BioNet Atlas that have a NSW or federal conservation status, a NSW sensitivity status, or are listed under a migratory species agreement, and are within 10km of the site?

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Amphibia	Crinia tinnula	Wallum Froglet	Vulnerable	Not Sensitive	Not Listed	
Animalia	Amphibia	Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Amphibia	Litoria aurea	Green and Golden Bell Frog	Endangered	Not Sensitive	Vulnerable	
Animalia	Amphibia	Pseudophryne australis	Red-crowned Toadlet	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Actitis hypoleucos	Common Sandpiper	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Amaurornis moluccana	Pale-vented Bush-hen	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Anous stolidus	Common Noddy	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Anseranas semipalmata	Magpie Goose	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Not Sensitive	Critically Endangered	
Animalia	Aves	Apus pacificus	Fork-tailed Swift	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Ardea ibis	Cattle Egret	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Ardenna carneipes	Flesh-footed Shearwater	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Ardenna grisea	Sooty Shearwater	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Ardenna pacificus	Wedge-tailed Shearwater	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Ardenna tenuirostris	Short-tailed Shearwater	Not Listed	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Arenaria interpres	Ruddy Turnstone	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Botaurus poiciloptilus	Australasian Bittern	Endangered	Not Sensitive	Endangered	
Animalia	Aves	Burhinus grallarius	Bush Stone-curlew	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Calamanthus fuliginosus	Striated Fieldwren	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Calidris acuminata	Sharp-tailed Sandpiper	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calidris alba	Sanderling	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calidris canutus	Red Knot	Not Listed	Not Sensitive	Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calidris ferruginea	Curlew Sandpiper	Endangered	Not Sensitive	Critically Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calidris melanotos	Pectoral Sandpiper	Not Listed	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Calidris ruficollis	Red-necked Stint	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calidris subminuta	Long-toed Stint	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Aves	Calidris tenuirostris	Great Knot	Vulnerable	Not Sensitive	Critically Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Callocephalon fimbriatum	Gang-gang Cockatoo	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Calyptorhynchus banksii banksii	Red-tailed Black-Cockatoo (coastal subspecies)	Critically Endangered	Category 2	Not Listed	
Animalia	Aves	Calyptorhynchus banksii samueli	Red-tailed Black-Cockatoo (inland subspecies)	Vulnerable	Category 2	Not Listed	
Animalia	Aves	Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable	Category 2	Not Listed	
Animalia	Aves	Charadrius leschenaultii	Greater Sand-plover	Vulnerable	Not Sensitive	Vulnerable	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Charadrius mongolus	Lesser Sand-plover	Vulnerable	Not Sensitive	Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Charadrius veredus	Oriental Plover	Not Listed	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Chlidonias leucopterus	White-winged Black Tern	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Chlidonias niger	Black Tern	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Chthonicola sagittata	Speckled Warbler	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Circus assimilis	Spotted Harrier	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Daphoenositta chrysoptera	Varied Sittella	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Diomedea exulans	Wandering Albatross	Endangered	Not Sensitive	Endangered	JAMBA
Animalia	Aves	Egretta sacra	Eastern Reef Egret	Not Listed	Not Sensitive	Not Listed	CAMBA
Animalia	Aves	Ephippiorhynchus asiaticus	Black-necked Stork	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Epthianura albifrons	White-fronted Chat	Endangered Population, Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Esacus magnirostris	Beach Stone-curlew	Critically Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Falco subniger	Black Falcon	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Gallinago hardwickii	Latham's Snipe	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Gelochelidon nilotica	Gull-billed Tern	Not Listed	Not Sensitive	Not Listed	CAMBA
Animalia	Aves	Glossopsitta porphyrocephala	Purple-crowned Lorikeet	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Glossopsitta pusilla	Little Lorikeet	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Gygis alba	White Tern	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Haematopus fuliginosus	Sooty Oystercatcher	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Haematopus longirostris	Pied Oystercatcher	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable	Not Sensitive	Not Listed	CAMBA
Animalia	Aves	Halobaena caerulea	Blue Petrel	Not Listed	Not Sensitive	Vulnerable	
Animalia	Aves	Hieraaetus morphnoides	Little Eagle	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Hirundapus caudacutus	White-throated Needletail	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Hydroprogne caspia	Caspian Tern	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Ixobrychus flavicollis	Black Bittern	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Lathamus discolor	Swift Parrot	Endangered	Category 3	Critically Endangered	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Aves	Limicola falcinellus	Broad-billed Sandpiper	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Limosa lapponica	Bar-tailed Godwit	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Limosa limosa	Black-tailed Godwit	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Lophochroa leadbeateri	Major Mitchell's Cockatoo	Vulnerable	Category 2	Not Listed	
Animalia	Aves	Lophoictinia isura	Square-tailed Kite	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Motacilla citreola	Citrine Wagtail	Not Listed	Not Sensitive	Not Listed	CAMBA
Animalia	Aves	Neochmia ruficauda	Star Finch	Presumed Extinct	Not Sensitive	Endangered	
Animalia	Aves	Ninox connivens	Barking Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Ninox strenua	Powerful Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Numenius madagascariensis	Eastern Curlew	Not Listed	Not Sensitive	Critically Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Numenius minutus	Little Curlew	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Numenius phaeopus	Whimbrel	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Oceanites oceanicus	Wilson's Storm-Petrel	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Onychoprion fuscata	Sooty Tern	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Oxyura australis	Blue-billed Duck	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Pandion cristatus	Eastern Osprey	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Petroica boodang	Scarlet Robin	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Petroica phoenicea	Flame Robin	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Petroica rodinogaster	Pink Robin	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Phaethon lepturus	White-tailed Tropicbird	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Philomachus pugnax	Ruff	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Plegadis falcinellus	Glossy Ibis	Not Listed	Not Sensitive	Not Listed	CAMBA
Animalia	Aves	Pluvialis fulva	Pacific Golden Plover	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Pluvialis squatarola	Grey Plover	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	Endangered	Category 3	Vulnerable	
Animalia	Aves	Polytelis swainsonii	Superb Parrot	Vulnerable	Category 3	Vulnerable	
Animalia	Aves	Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Pterodroma leucoptera leucoptera	Gould's Petrel	Vulnerable	Not Sensitive	Endangered	
Animalia	Aves	Pterodroma nigripennis	Black-winged Petrel	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Pterodroma solandri	Providence Petrel	Vulnerable	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Ptilinopus superbus	Superb Fruit-Dove	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Puffinus assimilis	Little Shearwater	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Rostratula australis	Australian Painted Snipe	Endangered	Not Sensitive	Endangered	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Aves	Stercorarius pomarinus	Pomarine Jaeger	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Sterna hirundo	Common Tern	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Sternula albifrons	Little Tern	Endangered	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Sternula nereis nereis	Fairy Tern	Not Listed	Not Sensitive	Vulnerable	
Animalia	Aves	Sula leucogaster	Brown Booby	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Thalassarche cauta	Shy Albatross	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Thalassarche melanophris	Black-browed Albatross	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Thinornis rubricollis	Hooded Plover	Critically Endangered	Not Sensitive	Vulnerable	
Animalia	Aves	Tringa brevipes	Grey-tailed Tattler	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Tringa glareola	Wood Sandpiper	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Tringa incana	Wandering Tattler	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Tringa nebularia	Common Greenshank	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Tyto longimembris	Eastern Grass Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Tyto novaehollandiae	Masked Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Tyto tenebricosa	Sooty Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Xenus cinereus	Terek Sandpiper	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Insecta	Menippus darcyi		Endangered Population	Not Sensitive	Not Listed	
Animalia	Insecta	Petalura gigantea	Giant Dragonfly	Endangered	Not Sensitive	Not Listed	
Animalia	Mammalia	Arctocephalus forsteri	New Zealand Fur-seal	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Arctocephalus pusillus doriferus	Australian Fur-seal	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Cercartetus nanus	Eastern Pygmy-possum	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Not Sensitive	Endangered	
Animalia	Mammalia	Dugong dugon	Dugong	Endangered	Not Sensitive	Not Listed	
Animalia	Mammalia	Eubalaena australis	Southern Right Whale	Endangered	Not Sensitive	Endangered	
Animalia	Mammalia	Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Macrotis lagotis	Bilby	Presumed Extinct	Not Sensitive	Vulnerable	
Animalia	Mammalia	Megaptera novaeangliae	Humpback Whale	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Miniopterus australis	Little Bent-winged Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Miniopterus orianae oceanensis	Large Bent-winged Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Myotis macropus	Southern Myotis	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Notomys cervinus	Fawn Hopping-mouse	Presumed Extinct	Not Sensitive	Not Listed	
Animalia	Mammalia	Petrogale xanthopus	Yellow-footed Rock-wallaby	Endangered	Not Sensitive	Vulnerable	
Animalia	Mammalia	Phascolarctos cinereus	Koala	Vulnerable	Not Sensitive	Vulnerable	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Mammalia	Pseudomys novaehollandiae	New Holland Mouse	Not Listed	Not Sensitive	Vulnerable	
Animalia	Mammalia	Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Antaresia stimsoni	Stimson's Python	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Caretta caretta	Loggerhead Turtle	Endangered	Not Sensitive	Endangered	
Animalia	Reptilia	Chelonia mydas	Green Turtle	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Reptilia	Eretmochelys imbricata	Hawksbill Turtle	Not Listed	Not Sensitive	Vulnerable	
Animalia	Reptilia	Hoplocephalus bungaroides	Broad-headed Snake	Endangered	Category 2	Vulnerable	
Animalia	Reptilia	Hoplocephalus stephensii	Stephens' Banded Snake	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Suta flagellum	Little Whip Snake	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Tiliqua occipitalis	Western Blue-tongued Lizard	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Uvidicolus sphyrurus	Border Thick-tailed Gecko	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Reptilia	Varanus rosenbergi	Rosenberg's Goanna	Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Acacia baueri subsp. aspera		Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Acacia bynoeana	Bynoe's Wattle	Endangered	Not Sensitive	Vulnerable	
Plantae	Flora	Acacia prominens	Gosford Wattle	Endangered Population	Not Sensitive	Not Listed	
Plantae	Flora	Acacia pubescens	Downy Wattle	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Acacia terminalis subsp. terminalis	Sunshine Wattle	Endangered	Not Sensitive	Endangered	
Plantae	Flora	Allocasuarina diminuta subsp. mimica		Endangered Population	Not Sensitive	Not Listed	
Plantae	Flora	Caladenia tessellata	Thick Lip Spider Orchid	Endangered	Category 2	Vulnerable	
Plantae	Flora	Callistemon linearifolius	Netted Bottle Brush	Vulnerable	Category 3	Not Listed	
Plantae	Flora	Chamaesyce psammogeton	Sand Spurge	Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Cryptostylis hunteriana	Leafless Tongue Orchid	Vulnerable	Category 2	Vulnerable	
Plantae	Flora	Epacris purpurascens var. purpurascens		Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Eucalyptus camfieldii	Camfield's Stringybark	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Eucalyptus nicholii	Narrow-leaved Black Peppermint	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Eucalyptus scoparia	Wallangarra White Gum	Endangered	Not Sensitive	Vulnerable	
Plantae	Flora	Genoplesium baueri	Bauer's Midge Orchid	Endangered	Category 2	Endangered	
Plantae	Flora	Hibbertia puberula		Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Hibbertia stricta subsp. furcatula		Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Leucopogon exolasius	Woronora Beard-heath	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Macadamia tetraphylla	Rough-shelled Bush Nut	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Maundia triglochinoides		Vulnerable	Not Sensitive	Not Listed	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Plantae	Flora	Melaleuca deanei	Deane's Paperbark	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Persoonia hirsuta	Hairy Geebung	Endangered	Category 3	Endangered	
Plantae	Flora	Prostanthera densa	Villous Mint-bush	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Prostanthera saxicola		Endangered Population	Not Sensitive	Not Listed	
Plantae	Flora	Pterostylis gibbosa	Illawarra Greenhood	Endangered	Category 2	Endangered	
Plantae	Flora	Pultenaea aristata	Prickly Bush-pea	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Rhodamnia rubescens	Scrub Turpentine	Critically Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Senecio spathulatus	Coast Groundsel	Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Syzygium paniculatum	Magenta Lilly Pilly	Endangered	Not Sensitive	Vulnerable	
Plantae	Flora	Tetratheca juncea	Black-eyed Susan	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Thesium australe	Austral Toadflax	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Tinospora tinosporoides	Arrow-head Vine	Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Wilsonia rotundifolia	Round-leafed Wilsonia	Endangered	Not Sensitive	Not Listed	

Data does not include NSW category 1 sensitive species.

Location Confidences

Where Lotsearch has had to georeference features from supplied addresses, a location confidence has been assigned to the data record. This indicates a confidence to the positional accuracy of the feature. Where applicable, a code is given under the field heading “LC” or “LocConf”. These codes lookup to the following location confidences:

LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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SafeWork NSW Records

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Customer Experience 13 10 50
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Our Ref: D20/116064

15 May 2020

Mr Anthony Barkway
JK Environments
PO Box 976
NORTH RYDE BC NSW 1670

Dear Mr Barkway

RE SITE: Lot 1 DP432283, Lot 1 DP398975, Lot 1 DP119519 Cnr Kingsway & Kareena Rd, Caringbah NSW

I refer to your site search request received by SafeWork NSW on 08 May 2020 requesting information on Storage of Hazardous Chemicals for the above site.

Enclosed are copies of the documents that SafeWork NSW holds on record number 35/013581 relating to the storage of Hazardous Chemicals at the above-mentioned premises.

For further information or if you have any questions, please call us on 13 10 50 or email licensing@safework.nsw.gov.au

Yours sincerely

Customer Service Officer
Customer Experience - Operations
SafeWork NSW

Licence No. 35/013581 ATF

443 c 1 box

APPLICATION FOR RENEWAL

OF LICENCE TO KEEP DANGEROUS GOODS

ISSUED UNDER AND SUBJECT TO THE PROVISIONS OF THE DANGEROUS GOODS ACT, 1975 AND REGULATION THEREUNDER

DECLARATION: Please renew licence number 35/013581 to 24/06/2005 . I confirm that all the licence details shown below are correct (amend if necessary).

..... (Signature) for: AMBULANCE SERVICE OF NSW

P WILSON (Please print name)

17/5/04 (Date signed)

*THIS **SIGNED** DECLARATION SHOULD BE **RETURNED TO:***

WorkCover New South Wales
Dangerous Goods Licensing Section
LOCKED BAG 2906
LISAROW NSW 2252

Enquiries:ph (02) 43215500
fax (02) 92875500

Details of licence on 7 May 2004

Licence Number 35/013581 **Expiry Date** 24/06/2004

Licensee AMBULANCE SERVICE OF NSW

Postal Address: ~~UNIT 1 / 143 BARKER ST RANDWICK NSW 2031~~ 59 BUTLER RD, HURSTVILLE 2220

Licensee Contact PHIL WILSON Ph. ~~9314 5603~~ 9580-3106 Fax. ~~9326 7470~~ 9580-3090

Premises Licensed to Keep Dangerous Goods
AMBULANCE SERVICE OF NSW
104-106 KAREENA RD CARINGBAH 2229

Nature of Site AMBULANCE SERVICES

Major Supplier of Dangerous Goods SHELL

Emergency Contact for this Site SENIOR SUPERVISOR Ph. 8396 5150

Site staffing 24HRS 7DAYS

Details of Depots

Depot No.	Depot Type	Goods Stored in Depot	Qty
1	**EXEMPT - U/G TANK**	**Class C1**	**11900 L**
	UN 00C1 DIESEL		11900 L

WorkCover New South Wales, 400 Kent Street, Sydney 2000. Telephone (02) 370 5000 ALL MAIL TO LOCKED BAG 10, CLARENCE STREET SYDNEY 2000

Reference

WORKCOVER NEW SOUTH WALES

APPLICATION FOR RENEWAL

OF LICENCE TO KEEP DANGEROUS GOODS

ISSUED UNDER AND SUBJECT TO THE PROVISIONS OF THE DANGEROUS GOODS ACT, 1975 AND REGULATION THEREUNDER

DECLARATION: *Please renew licence number 35/013581 to 1997. I confirm that all the licence details shown below are correct (amend if necessary).*

Scott Colly ..... S COLLINGS ..... 30.5.96 .....

(Signature) *(Please print name)* *(Date signed)*

for: AMBULANCE SERVICE OF NSW STATION OFFICER

*THIS **SIGNED** DECLARATION SHOULD BE **RETURNED TO:***

WorkCover New South Wales
Dangerous Goods Licensing Section (Level 3)
Locked Bag 10
P O CLARENCE STREET 2000

RECEIVED
-4 JUN 1996
SCIENTIFIC SERVICES BRANCH

Details of licence on 20 May 1996

Licence Number 35/013581 **Expiry Date** 26/06/96

Licensee AMBULANCE SERVICE OF NSW

Postal Address BOX 491 P O, KOGARAH 2217
Licensee Contact DISTRICT INSPECTOR Ph. 580 3106 Fax. 580 3090
Premises Licensed to Keep Dangerous Goods
104 KAREENA RD
CARINGBAH 2229

Nature of Site AMBULANCE SERVICES **Major Supplier of Dangerous Goods** NOT APPLICABLE

Emergency Contact for this Site Duty Officer ph. 524 2106

Site staffing 24 HRS 7 DAYS

Details of Depots

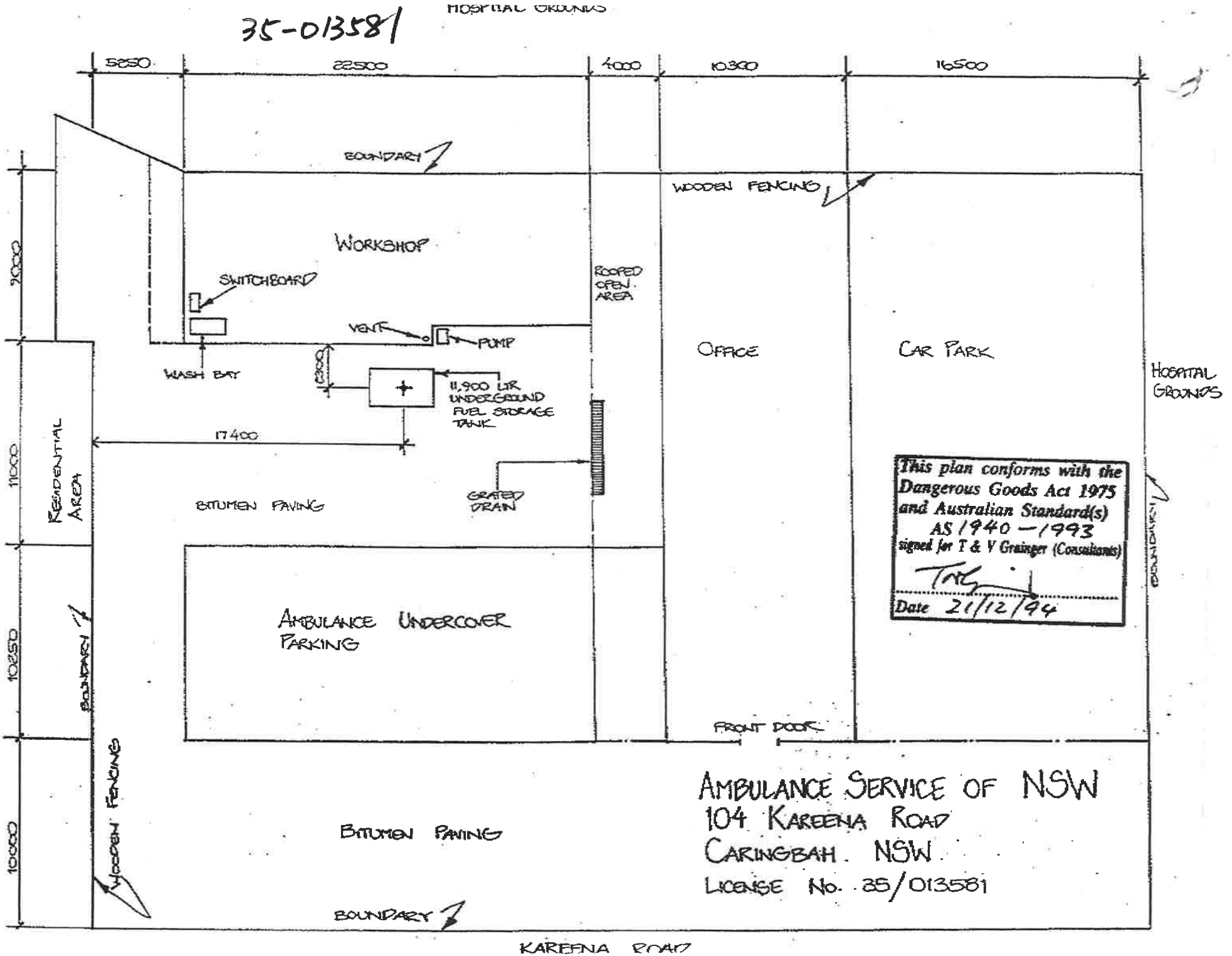
Depot No.	Depot Type	Goods Stored in Depot	Qty
1	UNDERGROUND TANK	Class 3 UN 1203 PETROL	11900 L 11900 L

DATA
-5 JUN 1996
ENTERED

Licence returned undelivered resent to Hurstville with application form RW 17/6/96.

RECEIVED
MAIL ROOM
- 4 JUN 1996
WORKCOVER NEW SOUTH WALES

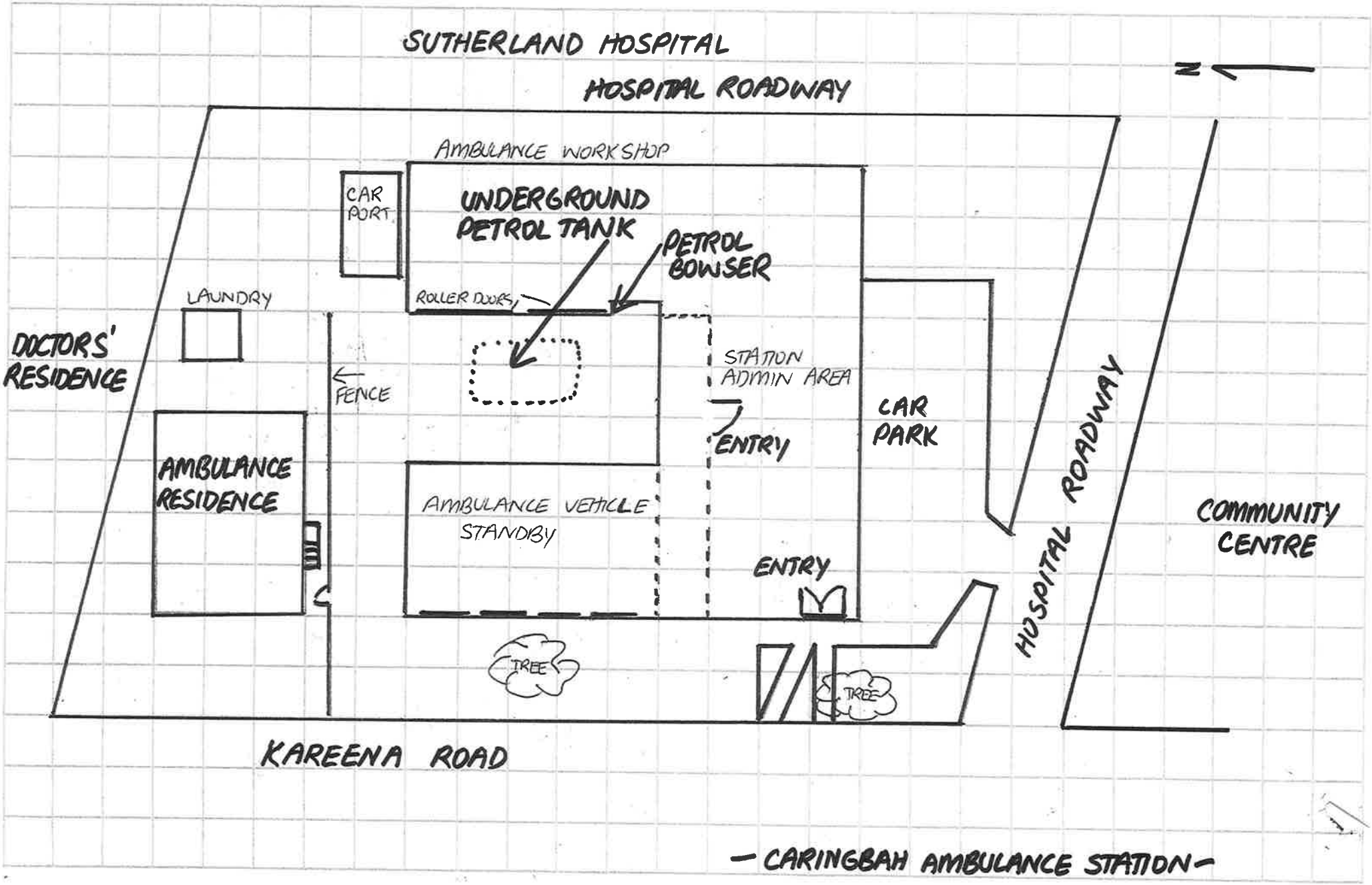
35-013581



AMBULANCE SERVICE OF NSW
104 KAREENA ROAD
CARINGBAH. NSW.
LICENSE No. 35/013581

Site Sketch 35-01358/

Please carefully read the instructions in Part B of the guide before sketching the site.



PART B

Complete 1 section per depot

I[illegible]u have more depots than the space provided, photocopy sufficient sheets first.

Depot number	Type of depot	Class	Licensed maximum storage capacity
ne	underground tank	three	~~X~~ 12,000 litres

UN number	Shipping name	Class	Pkg. Group	EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³
1203	~~[illegible]~~	3	II		~~Petrol~~	12,000	L
	PETROL				UNLEADED ~~PETROL~~		

Depot number	Type of depot	Class	Licensed maximum storage capacity

UN number	Shipping name	Class	Pkg. Group	EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³

Depot number	Type of depot	Class	Licensed maximum storage capacity

UN number	Shipping name	Class	Pkg. Group	EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³

Depot number	Type of depot	Class	Licensed maximum storage capacity

UN number	Shipping name	Class	Pkg. Group	EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³

Form DG1

Department of Industrial Relations

DANGEROUS GOODS ACT, 1975

LICENCE No. 35—013581/6

APPLICATION FOR LICENCE (or AMENDMENT or TRANSFER of LICENCE)* FOR THE KEEPING OF DANGEROUS GOODS

(* delete whichever is not required)

FEE: $15.00 per Depot for new licence.
$15.00 for amendment or transfer.

NO FEE

Name of Applicant in full (see Item 1—Explanatory notes—page 4)	~~DEPT OF~~ HEALTH DEPT CENTRAL DISTRICT AMBULANCE
Trading name or occupier's name (if any)	93-105 QUAY ST SYDNEY.
Postal Address	" " " " Postcode 2000
Address of the premises to be licensed. (Including Street No.)	106 KARLENA ROAD MIRANDA Postcode 2228
Nature of premises (See Item 2—Explanatory notes—page 4)	AMBULANCE STATION
Telephone number of applicant	STD Code 02 Number 20920

Particulars of type of depots and maximum quantities of dangerous goods to be kept at any one time.

Depot number	Type of depot (See item 3—Explanatory notes—page 4)	Storage capacity	Dangerous goods: Product being stored	C & C Office use only
1	UNDERGROUND TANK	10,000 LTS	3.1 PETROL	
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Has site plan been approved by the Dangerous Goods Branch? Yes ~~No~~ If yes, no plans required. If no, please attach site plan, or provide sketch plan overleaf.

Have premises previously been licensed? Yes ~~No~~ If, yes, state name of previous occupier, and licence No. (if known).

Name of oil company supplying flammable liquid (if applicable).

Signature of applicant ..... Date 12/11/85

For external explosives magazine(s), please fill in page 3.

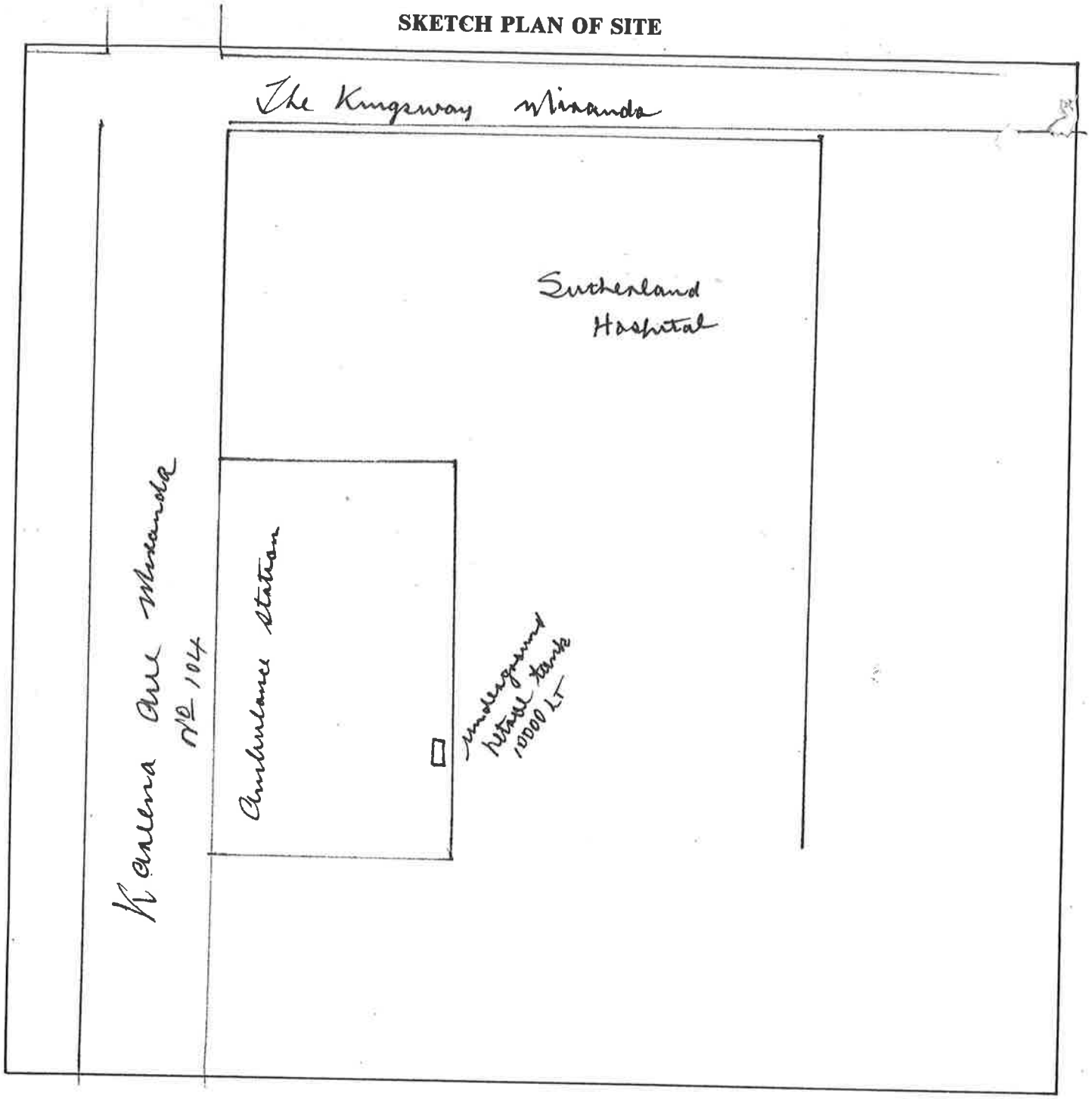
FOR OFFICE USE ONLY

CERTIFICATE OF INSPECTION

I, ERNEST WILBE being an Inspector under the Dangerous Goods Act, 1975, do hereby certify that the premises described above do comply with the requirements of the Dangerous Goods Act, 1975, and the Dangerous Goods Regulation with regard to their situation and construction for the keeping of dangerous goods of the nature and in the quantity specified.

Signature of Inspector ..... Date 20-12-85

SKETCH PLAN OF SITE

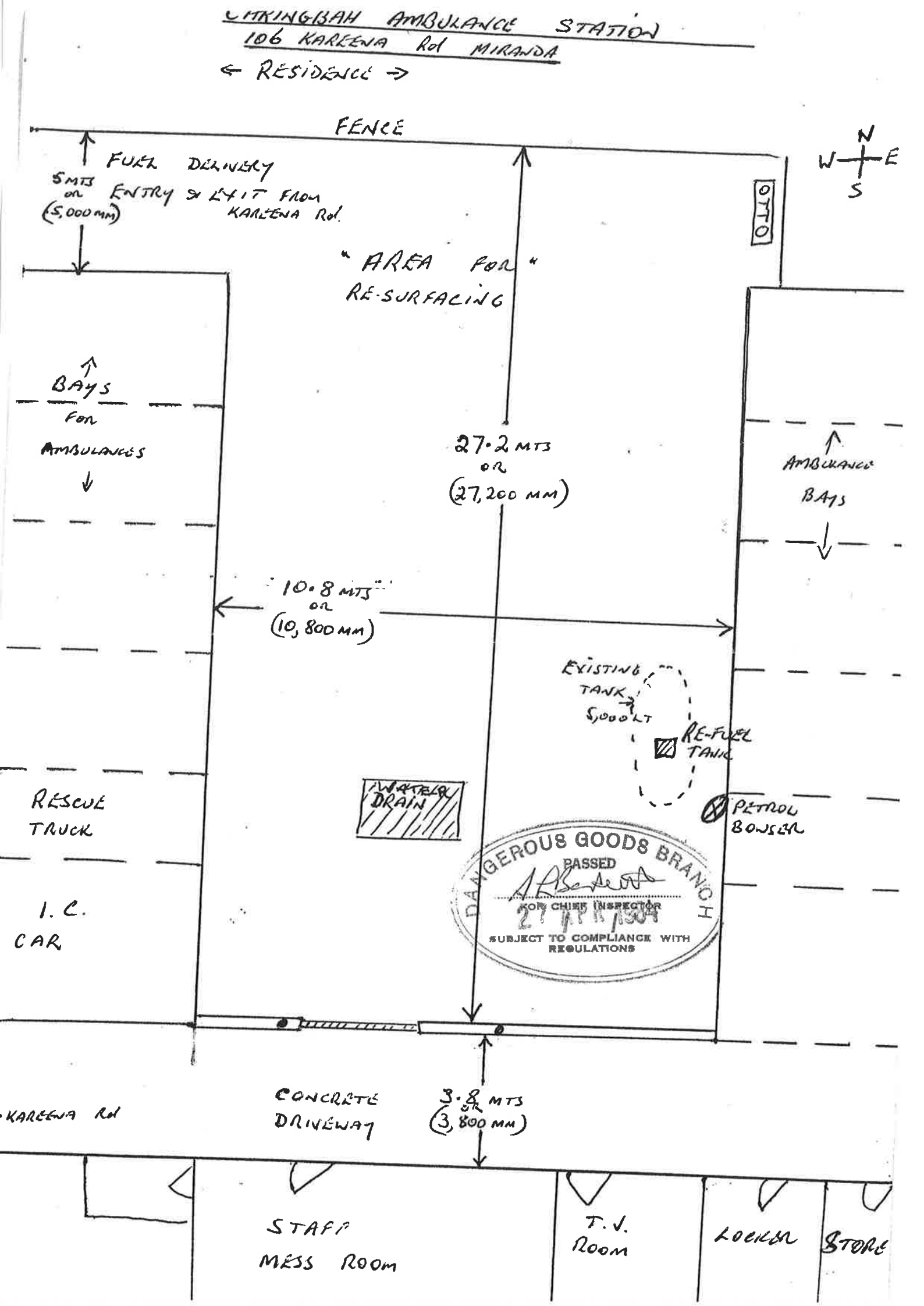


Show positions of Depot(s) with:—

(1) distances from public places and protected works;

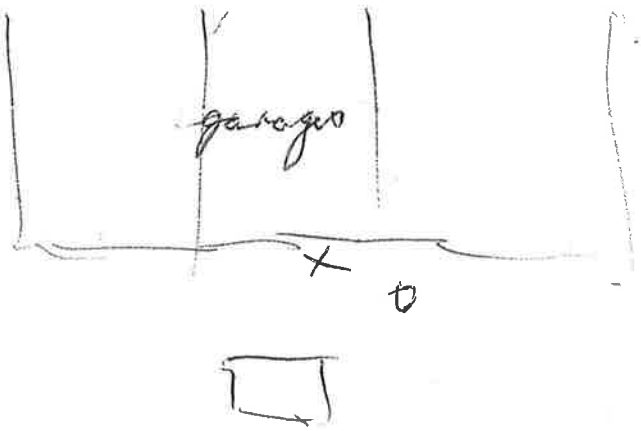
(2) street names;

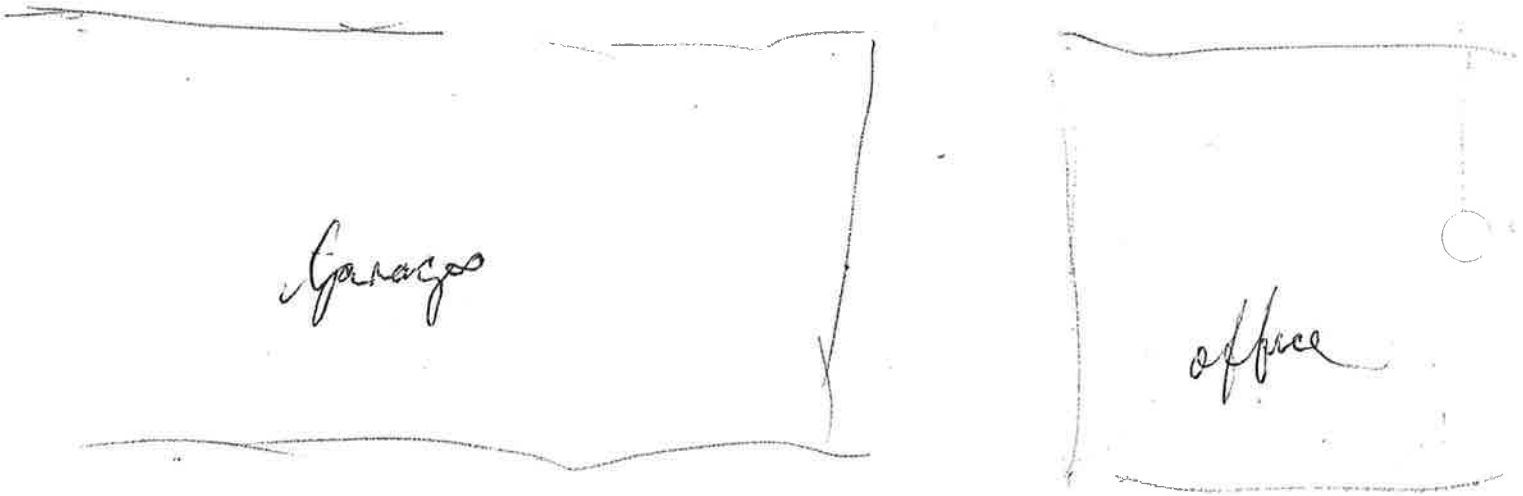
(3) nature and details of adjacent properties.


ITKINGBAH AMBULANCE STATION
106 KARLENA Rd MIRANDA
← RESIDENCE →
FENCE
FUEL DELIVERY
5 MTS or (5,000 MM)
ENTRY & EXIT FROM KARLENA Rd.
OTTO
N
W
E
S
"AREA FOR" RE-SURFACING
BAYS FOR AMBULANCES
27.2 MTS or (27,200 MM)
AMBULANCE BAYS
10.8 MTS or (10,800 MM)
EXISTING TANK 5,000 LT
RE-FUEL TANK
WATER DRAIN
RESCUE TRUCK
PETROL BOWSER
DANGEROUS GOODS BRANCH
PASSED
FOR CHIEF INSPECTOR
27 APR 1994
SUBJECT TO COMPLIANCE WITH REGULATIONS
I. C. CAR
KARLENA Rd
CONCRETE DRIVEWAY
3.8 MTS or (3,800 MM)
STAFF MESS ROOM
T.V. ROOM
LOCKER
STORE

St. George Sutherland Ambulance.
Kareena Rd,
Caringbah

Ampol tank list - 1,000 installed 18/4/60.
12/8/60





I herewith enclose Cheque
(Cheque, Money Order, etc.)

for the sum of £3/5/-, being the fee for renewal of Store License numbered as under. Rosso.

29.2.56.

NEW SOUTH WALES. (Inflammable Liquid Act, 1915-1953)

STORE LICENSE

Amendment, Transfer or Alteration of Store License.

Store License No. A 8294.

Rosso & Co.,
Collins Street,
CARINDA. 4W.

Balance of fee paid on

Receipt No.

SUBJECT to the imprint of the CASH REGISTER APPEARING ABOVE, the store occupied situated and described as specified hereunder is hereby licensed for the keeping therein of inflammable liquic and/or dangerous goods in nature and quantity as hereunder prescribed, subject to the provisions of th "Inflammable Liquid Act, 1915-1953," and of any Proclamations, Rules, Regulations and By-laws mad thereunder and for the time being in force:—

Occupier's Name T.E. Conomos, J. Rosso & P. Rosso - trading as - ROSSO & CO.,
Calling Storekeepers.
Situation of the Store Collins Street, CARINDA.
Description of Store Store.

Particulars of Construction of Depots and Maximum Quantities of Inflammable Liquid and/or Dangerous Goods to be kept at any one time:—

Depot No.	Construction of Depots			Maximum Quantities to be kept at any one time:—					
	Walls	Roof	Floor	Mineral Spirit Gallons	Mineral Oil Gallons	Dangerous Goods Class 1, Gallons	Class 2, Gallons	Class 3, lb.	Class 4, Cubic Feet
1-2	u/ground tanks ea. 500 gls.			1,000					

St 6950—2

THIS LICENSE WILL EXPIRE ON 29.2.57.

FEE PAYABLE, £3/5/-.

Appendix D: Borehole Logs

JKGeotechnics

BOREHOLE LOG

Borehole No. 1

Client: HEALTH INFRASTRUCTURE NSW

Project: PROPOSED OPERATING THEATRE UPGRADE

Location: CNR KINGSWAY & KAREENA ROAD, CARINGBAH, NSW

Job No.: 33141LX **Method:** SPIRAL AUGER **R.L. Surface:** 41.12 m

Date: 7/5/20 **Datum:** AHD

Plant Type: JK305 **Logged/Checked By:** K.K.S./A.F.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
						41				CONCRETE: 150mm.t				18mm DIA. REINFORCEMENT 75mm TOP COVER
									-	FILL: Sandy gravel, fine to coarse grained, brown, sub-angular igneous gravel.	M			
										FILL: Silty clay, medium plasticity, brown, trace of fine to medium grained sub-angular igneous gravel, fine to medium grained sand.	w<PL			
						40	1							
					N = 19 3,3,16				CH	Silty CLAY: high plasticity, orange brown and grey, trace of fine to medium grained ironstone gravel.	w<PL	Hd	>600 >600 >600	RESIDUAL
						39	2		-	SILTSTONE: grey and brown, with iron indurated bands.	DW	VL - L		HAWKESBURY SANDSTONE LOW 'TC' BIT RESISTANCE WITH VERY LOW BANDS
ON COMPLETION						38	3							
						37	4							
										REFER TO CORED BOREHOLE LOG				
						36	5							
						35	6							

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 1 **2 / 2**

Client: HEALTH INFRASTRUCTURE NSW

Project: PROPOSED OPERATING THEATRE UPGRADE

Location: CNR KINGSWAY & KAREENA ROAD, CARINGBAH, NSW

Job No.: 33141LX **Core Size:** NMLC **R.L. Surface:** 41.12 m

Date: 7/5/20 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** K.K.S./A.F.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
		37			START CORING AT 4.22m						
90% RETURN					NO CORE 0.16m						
					Extremely Weathered siltstone: silty CLAY, high plasticity, grey and orange brown.	XW	Hd				Hawkesbury Sandstone
			5		SILTSTONE: dark grey, with iron indurated bands, bedded at 0-10°.	MW	L	0.20			
		36			Extremely Weathered siltstone: silty CLAY, high plasticity, dark grey and orange brown, with iron indurated bands and clay bands.	XW	Hd				
					SILTSTONE: dark grey, bedded at 0-10°.	MW	VL	0.20		(5.70m) XWS, 0°, 100 mm.t (5.80m) CS, 0°, 60 mm.t (5.89m) Be, 0°, Un, R, Cn (5.94m) XWS, 0°, 100 mm.t (6.09m) CS, 0°, 50 mm.t (6.18m) J, 80 - 90°, R, Cn (6.25m) XWS, 0°, 110 mm.t	
		35	6		SANDSTONE: fine to medium grained, bedded at 0-20°.	MW	M	0.40 0.80		(6.89m) J, 35°, Un, R, Cn	
		34	7		SANDSTONE: fine to medium grained, light grey, with dark grey laminae, bedded at 0-10°.	FR	H	0.70			
					END OF BOREHOLE AT 7.22 m						
		33	8								
		32	9								
		31	10								

POINT LOAD STRENGTH INDEX $I_s(50)$: VL -0.1, L -0.3, M -1, H -3, VH -10, EH

DEFECT DETAILS SPACING (mm): 600, 200, 60, 20

JK 9.02.4 LIB:GLB Log JK CORED BOREHOLE - MASTER 33141LX CARINGBAH.GPJ <<DrawingFile>> 02/06/2020 13:52 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 2

1 / 2

Client: HEALTH INFRASTRUCTURE NSW

Project: PROPOSED OPERATING THEATRE UPGRADE

Location: CNR KINGSWAY & KAREENA ROAD, CARINGBAH, NSW

Job No.: 33141LX **Method:** SPIRAL AUGER **R.L. Surface:** 40.85 m

Date: 7/5/20 **Datum:** AHD

Plant Type: JK305 **Logged/Checked By:** K.K.S./A.F.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
										ASPHALTIC CONCRETE: 60mm.t				
									-	FILL: Sandy gravel, fine to medium grained, grey, fine to medium grained sub-angular igneous gravel.	M w<PL			APPEARS MODERATELY COMPACTED
					N = 8 2,4,4	40	1			FILL: Silty clay, medium plasticity, grey and brown, trace of fine to medium grained sub-angular igneous and ironstone gravel, trace of fine to medium grained sand.			110 180 120	
									CH	Silty CLAY: high plasticity, orange brown and grey, trace of fine to medium grained ironstone gravel.	w<PL	Hd		RESIDUAL
					N = 19 7,7,12	39	2						>600 >600 >600	
						38	3		-	Extremely Weathered siltstone: silty CLAY, high plasticity, grey and orange brown, with iron indurated bands.	XW	Hd		HAWKESBURY SANDSTONE
ON COMPLETION						37	4			SILTSTONE: dark grey and brown, with iron indurated bands.	DW	VL - L		LOW RESISTANCE WITH VERY LOW BANDS
1 MONTH LATER										REFER TO CORED BOREHOLE LOG				GROUNDWATER MONITORING WELL INSTALLED TO 8.38m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 5.38m TO 8.38m. CASING 0m TO 5.38m. 2mm SAND FILTER PACK 5.05m TO 8.38m. BENTONITE SEAL 4.0m TO 5.05m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						36	5							
						35	6							
						34								

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 2 **2 / 2**

Client: HEALTH INFRASTRUCTURE NSW

Project: PROPOSED OPERATING THEATRE UPGRADE

Location: CNR KINGSWAY & KAREENA ROAD, CARINGBAH, NSW

Job No.: 33141LX **Core Size:** NMLC **R.L. Surface:** 40.85 m

Date: 7/5/20 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** K.K.S./A.F.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	DEFECT DETAILS: SPACING (mm) (600, 200, 60, 20)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
					START CORING AT 4.24m						
90% RETURN					NO CORE 0.18m						
		36	5		Extremely Weathered siltstone: silty CLAY, high plasticity, grey and brown, with iron indurated bands.	XW	Hd				Hawkesbury Sandstone
		35	6		SILTSTONE: dark grey, with iron indurated bands, bedded at 0-10°.	SW	VL	0.10 0.10		(5.20m) XWS, 0°, 50 mm.t (5.46m) XWS, 0°, 140 mm.t (5.64m) J, 80 - 90°, Un, R, Cn (5.78m) XWS, 0°, 20 mm.t (5.90m) J, 55°, St, R, Fe Sn	
					Extremely Weathered siltstone: silty CLAY, high plasticity, dark grey and brown, with iron indurated bands.	XW	Hd				
		34	7		SILTSTONE: dark grey, bedded at 0-10°.	SW	L	0.30 0.040		(6.76m) XWS, 0°, 120 mm.t (6.96m) Be, 0°, Un, R, Cn (7.02m) Be, 0°, Un, R, Cn (7.08m) J, 50°, P, R, Fe Sn	
		33	8		SANDSTONE: fine to medium grained, orange brown and grey, bedded at 0-10°.	HW	L M	0.30 0.20 0.80		(7.28m) Be, 0°, Un, R, Fe Sn (7.38m) Be, 0°, Un, S, Clay (7.80m) Be, 0°, Un, R, Fe Sn (7.89m) Ji, 90°, Un, Cn (7.97m) Be, 0°, Un, R, Cn (8.05m) J, 75°, Un, Cn	
		32	9		END OF BOREHOLE AT 8.38 m						
		31	10								
		30									

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 3

Client: HEALTH INFRASTRUCTURE NSW

Project: PROPOSED OPERATING THEATRE UPGRADE

Location: CNR KINGSWAY & KAREENA ROAD, CARINGBAH, NSW

Job No.: 33141LX **Method:** SPIRAL AUGER **R.L. Surface:** 41.89 m

Date: 8/5/20 **Datum:** AHD

Plant Type: JK305 **Logged/Checked By:** K.K.S./A.F.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
									-	ASPHALTIC CONCRETE: 60mm.t FILL: Sandy gravel, fine to coarse grained, grey, sub-angular igneous gravel.	M			APPEARS WELL COMPACTED
					N = 19 16,12,7					FILL: Silty clay, medium plasticity, brown, with fine to medium grained sub-angular igneous gravel.	w<PL			
						41	1		CH	Silty CLAY: high plasticity, orange brown and grey, trace of fine to coarse grained ironstone gravel.		VSt	230 260 250	RESIDUAL
					N = 29 12,13,16							Hd	>600 >600 >600	
ON COMPLETION						40	2							
					N=SPT 12/ 50mm REFUSAL	39	3		-	Extremely Weathered siltstone: silty clay, high plasticity, grey and orange brown, with iron indurated and clay bands.	XW	Hd		HAWKESBURY SANDSTONE SOIL RESISTANCE WITH BANDS OF VERY LOW 'TC' BIT RESISTANCE
1 MONTH LATER						38	4			SILTSTONE: dark grey, with iron indurated bands.	DW	VL - L		LOW RESISTANCE WITH VERY LOW BANDS
						37	5							
						36	6			REFER TO CORED BOREHOLE LOG				GROUNDWATER MONITORING WELL INSTALLED TO 8.84m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 5.84m TO 8.84m. CASING 0m TO 5.84. 2mm SAND FILTER PACK 5.3m TO 8.84m. BENTONITE SEAL 4.3m TO 5.3m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						35								

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 3 **2 / 2**

Client: HEALTH INFRASTRUCTURE NSW

Project: PROPOSED OPERATING THEATRE UPGRADE

Location: CNR KINGSWAY & KAREENA ROAD, CARINGBAH, NSW

Job No.: 33141LX **Core Size:** NMLC **R.L. Surface:** 41.89 m

Date: 8/5/20 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** K.K.S./A.F.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm)	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
					START CORING AT 5.78m						
90% RETURN		36	6		SANDSTONE: fine to medium grained, grey and orange brown, bedded at 0-10°.	HW SW	L M - H	1.5			Hawkesbury Sandstone
					as above, but bedded at 0-15°.			1.1			
		35	7		as above, but bedded t 0-10°.			1.3		(6.73m) CS, 0°, 40 mm.t (6.79m) Be, 10°, Un, R, Fe Sn	
								1.8			
		34	8					1.3		(7.84m) Be, 0°, Un, R, Fe Sn (7.88m) Be, 0°, Un, R, Fe Sn (8.05m) CS, 0°, 20 mm.t	
								0.80	200 60 20		
					Extremely Weathered siltstone: silty CLAY, high plasticity, grey.	XW	Hd			(8.51m) Be, 5°, Un, R, Fe Sn (8.56m) Be, 0°, Un, S, Cn	
		33	9		END OF BOREHOLE AT 8.84 m						
		32	10								
		31	11								
		30							600 200 60 20		

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 4

Client: HEALTH INFRASTRUCTURE NSW

Project: PROPOSED OPERATING THEATRE UPGRADE

Location: CNR KINGSWAY & KAREENA ROAD, CARINGBAH, NSW

Job No.: 33141LX **Method:** SPIRAL AUGER **R.L. Surface:** 42.09 m

Date: 8/5/20 **Datum:** AHD

Plant Type: JK305 **Logged/Checked By:** K.K.S./A.F.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
						42				FILL: Silty clay, medium plasticity, brown, trace of fine to medium grained sub-angular igneous gravel, fine to medium grained sand, brick fragments.	w<PL			GRASS COVER APPEARS POORLY COMPACTED
						41	1							
									CH	Silty CLAY: high plasticity, orange brown and grey, trace of fine to medium grained ironstone gravel.	w<PL	Hd	>600 >600 >600	RESIDUAL
ON COMPLETION						40	2							
									-	SILTSTONE: grey and brown, with iron indurated bands.	DW	VL		HAWKESBURY SANDSTONE VERY LOW 'TC' BIT RESISTANCE
						39	3							
1 MONTH LATER							4			as above, but dark grey.		VL - L		LOW RESISTANCE WITH VERY LOW BANDS
						38								
							5							
						37								
							6			REFER TO CORED BOREHOLE LOG				GROUNDWATER MONITORING WELL INSTALLED TO 8.86m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 4.36m TO 8.86m. CASING 0m TO 4.36. 2mm SAND FILTER PACK 3.95m TO 8.86m. BENTONITE SEAL 2.5m TO 3.95m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						36								

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. 4 **2 / 2**

Client: HEALTH INFRASTRUCTURE NSW

Project: PROPOSED OPERATING THEATRE UPGRADE

Location: CNR KINGSWAY & KAREENA ROAD, CARINGBAH, NSW

Job No.: 33141LX **Core Size:** NMLC **R.L. Surface:** 42.09 m

Date: 8/5/20 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK305 **Bearing:** N/A **Logged/Checked By:** K.K.S./A.F.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
		37			START CORING AT 5.83m						
90% RETURN		36	6		Extremely Weathered siltstone: silty CLAY, high plasticity, dark grey, with iron indurated and clay bands.	XW	Hd				Hawkesbury Sandstone
		35	7		SANDSTONE: fine to medium grained, orange brown and grey, bedded at 0-10°.	MW	M - H	1.0, 1.1, 0.90, 1.2		(6.84m) CS, 0°, 15 mm.t; (6.91m) Be, 0°, Un, R, Fe Sn; (7.14m) Be, 0°, Un, R, Fe Sn; (7.64m) Be, 0°, Un, R, Fe Sn	
		34	8		as above, but bedded at 0-15°.			0.90, 1.4	200	(8.33m) XWS, 0°, 10 mm.t; (8.65m) Be, 0°, P, S, Fe Sn	
		33	9		END OF BOREHOLE AT 8.86 m						
		32	10								
		31	11								

JK 9.02.4 LIB:GLB Log JK CORED BOREHOLE - MASTER 33141LX CARINGBAH.GPJ <<DrawingFile>> 02/06/2020 13:52 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

ENVIRONMENTAL LOGS EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the environmental report in regard to classification methods, field procedures and certain matters relating to the logging of soil and rock. Not all notes are necessarily relevant to all reports.

Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies include gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726:2017 *'Geotechnical Site Investigations'*. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geoenvironmental practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached soil classification table qualified by the grading of other particles present (eg. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	< 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2.36mm
Gravel	2.36 to 63mm
Cobbles	63 to 200mm
Boulders	> 200mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose (VL)	< 4
Loose (L)	4 to 10
Medium dense (MD)	10 to 30
Dense (D)	30 to 50
Very Dense (VD)	> 50

Cohesive soils are classified on the basis of strength (consistency) either by use of a hand penetrometer, vane shear, laboratory testing and/or tactile engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength (kPa)	Indicative Undrained Shear Strength (kPa)
Very Soft (VS)	≤ 25	≤ 12
Soft (S)	> 25 and ≤ 50	> 12 and ≤ 25
Firm (F)	> 50 and ≤ 100	> 25 and ≤ 50
Stiff (St)	> 100 and ≤ 200	> 50 and ≤ 100
Very Stiff (VSt)	> 200 and ≤ 400	> 100 and ≤ 200
Hard (Hd)	> 400	> 200
Friable (Fr)	Strength not attainable – soil crumbles	

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'shale' is used to describe fissile mudstone, with a weakness parallel to bedding. Rocks with alternating inter-laminations of different grain size (eg. siltstone/claystone and siltstone/fine grained sandstone) are referred to as 'laminite'.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All methods except test pits, hand auger drilling and portable Dynamic Cone Penetrometers require the use of a mechanical rig which is commonly mounted on a truck chassis or track base.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the

structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the hand auger can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of limited reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock cuttings. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be assessed from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, NMLC or HQ triple tube core barrels, which give a core of about 50mm and 61mm diameter, respectively, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as NO CORE. The location of NO CORE recovery is determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the bottom of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289.6.3.1–2004 (R2016) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – Standard Penetration Test (SPT)'*.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63.5kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of, say, 4, 6 and 7 blows, as

  N = 13
  4, 6, 7

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as

  N > 30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

A modification to the SPT is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as 'N_c' on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

The borehole or test pit logs presented herein are an interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment, but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The terms and symbols used in preparation of the logs are defined in the following pages.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than 'straight line' variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if reliable water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably assess the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse environmental characteristics or behaviour. If the volume and nature of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classification and rock strengths indicated on the environmental logs unless noted in the report.

SYMBOL LEGENDS

SOIL


FILL


TOPSOIL


CLAY (CL, CI, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CI, CH)


SILTY CLAY (CL, CI, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CI, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML, MH)


PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK


CONGLOMERATE


SANDSTONE


SHALE/MUDSTONE


SILTSTONE


CLAYSTONE


COAL


LAMINITE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

OTHER MATERIALS


BRICKS OR PAVERS


CONCRETE


ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

Major Divisions		Group Symbol	Typical Names	Field Classification of Sand and Gravel	Laboratory Classification	
Coarse grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm	GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 4$ $1 < C_c < 3$
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Fines behave as silt
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Fines behave as clay
	SAND (more than half of coarse fraction is smaller than 2.36mm)	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 6$ $1 < C_c < 3$
		SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	N/A
		SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	

Major Divisions		Group Symbol	Typical Names	Field Classification of Silt and Clay			Laboratory Classification
				Dry Strength	Dilatancy	Toughness	% < 0.075mm
Fine grained soils (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silt	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clay of high plasticity	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	–	–	–	–

Laboratory Classification Criteria

A well graded coarse grained soil is one for which the coefficient of uniformity $Cu > 4$ and the coefficient of curvature $1 < C_c < 3$. Otherwise, the soil is poorly graded. These coefficients are given by:

$$C_U = \frac{D_{60}}{D_{10}} \qquad and \qquad C_C = \frac{(D_{30})^2}{D_{10}\, D_{60}}$$

Where D_{10}, D_{30} and D_{60} are those grain sizes for which 10%, 30% and 60% of the soil grains, respectively, are smaller.

NOTES:

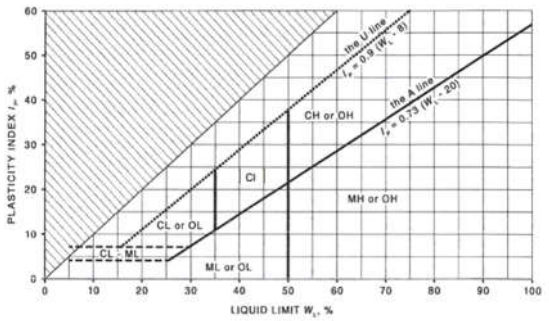
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

2 Where the grading is determined from laboratory tests, it is defined by coefficients of curvature (C_c) and uniformity (C_u) derived from the particle size distribution curve.

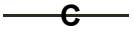
3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

4 The U line on the Modified Casagrande Chart is an approximate upper bound for most natural soils.

Modified Casagrande Chart for Classifying Silts and Clays according to their Behaviour



LOG SYMBOLS

Log Column	Symbol	Definition
Groundwater Record		Standing water level. Time delay following completion of drilling/excavation may be shown.
		Extent of borehole/test pit collapse shortly after drilling/excavation.
		Groundwater seepage into borehole or test pit noted during drilling or excavation.
Samples	ES	Sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos analysis.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25 PID = 100	Vane shear reading in kPa of undrained shear strength. Photoionisation detector reading in ppm (soil sample headspace test).
Moisture Condition (Fine Grained Soils)	w > PL $w \approx$ PL w < PL $w \approx$ LL w > LL	Moisture content estimated to be greater than plastic limit. Moisture content estimated to be approximately equal to plastic limit. Moisture content estimated to be less than plastic limit. Moisture content estimated to be near liquid limit. Moisture content estimated to be wet of liquid limit.
(Coarse Grained Soils)	D M W	DRY – runs freely through fingers. MOIST – does not run freely but no free water visible on soil surface. WET – free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS S F St VSt Hd Fr ( )	VERY SOFT – unconfined compressive strength ≤ 25kPa. SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa. FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa. STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa. VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa. HARD – unconfined compressive strength > 400kPa. FRIABLE – strength not attainable, soil crumbles. Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.
Density Index/ Relative Density (Cohesionless Soils)	VL L MD D VD ( )	**Density Index (I_D) Range (%)** / **SPT 'N' Value Range (Blows/300mm)** VERY LOOSE ≤ 15 / 0 – 4 LOOSE > 15 and ≤ 35 / 4 – 10 MEDIUM DENSE > 35 and ≤ 65 / 10 – 30 DENSE > 65 and ≤ 85 / 30 – 50 VERY DENSE > 85 / > 50 Bracketed symbol indicates estimated density based on ease of drilling or other assessment.
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.

Log Column	Symbol	Definition
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

Term		Abbreviation		Definition
Residual Soil		RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered		XW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered (Note 1)	HW	DW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered		MW		The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

NOTE 1: The term 'Distinctly Weathered' is used where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock. 'Distinctly Weathered' is defined as follows: *'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores'*. There is some change in rock strength.

Rock Material Strength Classification

Term	Abbreviation	Uniaxial Compressive Strength (MPa)	Guide to Strength	
			Point Load Strength Index $Is_{(50)}$ (MPa)	Field Assessment
Very Low Strength	VL	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Appendix E: Laboratory Report & COC Documents

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CERTIFICATE OF ANALYSIS 242632

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E33141PA, Caringbah**
Number of Samples	21 Soil
Date samples received	11/05/2020
Date completed instructions received	11/05/2020

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	18/05/2020
Date of Issue	18/05/2020

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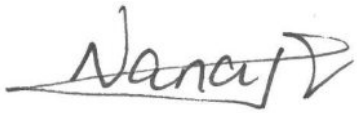
Analysed by Asbestos Approved Identifier: Lucy Zhu
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Dragana Tomas, Senior Chemist
Josh Williams, Senior Chemist
Ken Nguyen, Reporting Supervisor
Lucy Zhu, Asbestos Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		242632-1	242632-2	242632-5	242632-6	242632-9
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		0.15-0.25	0.5-0.6	0.06-0.1	0.1-0.2	0.06-0.2
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	13/05/2020	13/05/2020	13/05/2020	13/05/2020	13/05/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	97	98	102	99	98

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		242632-10	242632-12	242632-13	242632-16	242632-17
Your Reference	UNITS	BH3	BH4	BH4	SDUP-1	TB-S1
Depth		0.5-0.6	0.1-0.2	0.5-0.6	-	-
Date Sampled		08/05/2020	08/05/2020	08/05/2020	07/05/2020	11/05/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	13/05/2020	13/05/2020	13/05/2020	13/05/2020	13/05/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	[NA]
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	[NA]
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	[NA]
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	95	100	95	101	98

svTRH (C10-C40) in Soil						
Our Reference		242632-1	242632-2	242632-5	242632-6	242632-9
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		0.15-0.25	0.5-0.6	0.06-0.1	0.1-0.2	0.06-0.2
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	13/05/2020	13/05/2020	13/05/2020	13/05/2020	13/05/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	740
TRH C_{29} - C_{36}	mg/kg	<100	<100	120	<100	570
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	1,100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	200	<100	420
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	200	<50	1,600
Surrogate o-Terphenyl	%	86	86	89	87	102

svTRH (C10-C40) in Soil					
Our Reference		242632-10	242632-12	242632-13	242632-16
Your Reference	UNITS	BH3	BH4	BH4	SDUP-1
Depth		0.5-0.6	0.1-0.2	0.5-0.6	-
Date Sampled		08/05/2020	08/05/2020	08/05/2020	07/05/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	13/05/2020	13/05/2020	13/05/2020	13/05/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	150	160	150	110
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	140	120	130	<100
TRH >C_{34} -C_{40}	mg/kg	210	120	180	190
Total +ve TRH (>C10-C40)	mg/kg	350	230	310	190
Surrogate o-Terphenyl	%	86	88	93	86

PAHs in Soil						
Our Reference		242632-1	242632-2	242632-5	242632-6	242632-9
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		0.15-0.25	0.5-0.6	0.06-0.1	0.1-0.2	0.06-0.2
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	3.5
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	3.6
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	2.9
Phenanthrene	mg/kg	0.6	0.2	<0.1	<0.1	95
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
Fluoranthene	mg/kg	0.8	0.3	<0.1	<0.1	130
Pyrene	mg/kg	0.6	0.3	0.1	<0.1	110
Benzo(a)anthracene	mg/kg	0.4	0.2	<0.1	<0.1	57
Chrysene	mg/kg	0.3	0.2	<0.1	<0.1	52
Benzo(b,j+k)fluoranthene	mg/kg	0.6	0.3	<0.2	<0.2	64
Benzo(a)pyrene	mg/kg	0.2	<0.05	<0.05	<0.05	39
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	10
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	4.2
Benzo(g,h,i)perylene	mg/kg	0.2	<0.1	<0.1	<0.1	12
Total +ve PAH's	mg/kg	3.8	1.6	0.1	<0.05	580
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	57
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	57
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	57
Surrogate p-Terphenyl-d14	%	70	74	84	89	84

PAHs in Soil					
Our Reference		242632-10	242632-12	242632-13	242632-16
Your Reference	UNITS	BH3	BH4	BH4	SDUP-1
Depth		0.5-0.6	0.1-0.2	0.5-0.6	-
Date Sampled		08/05/2020	08/05/2020	08/05/2020	07/05/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	0.2	<0.1	<0.1
Pyrene	mg/kg	0.1	0.3	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	0.2	<0.1	<0.1
Chrysene	mg/kg	<0.1	0.2	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	0.3	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	0.2	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	0.3	1.6	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	80	88	71	81

Organochlorine Pesticides in soil					
Our Reference		242632-1	242632-6	242632-9	242632-12
Your Reference	UNITS	BH1	BH2	BH3	BH4
Depth		0.15-0.25	0.1-0.2	0.06-0.2	0.1-0.2
Date Sampled		07/05/2020	07/05/2020	08/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	93	116	94	107

Organophosphorus Pesticides in Soil					
Our Reference		242632-1	242632-6	242632-9	242632-12
Your Reference	UNITS	BH1	BH2	BH3	BH4
Depth		0.15-0.25	0.1-0.2	0.06-0.2	0.1-0.2
Date Sampled		07/05/2020	07/05/2020	08/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	93	116	94	107

PCBs in Soil					
Our Reference		242632-1	242632-6	242632-9	242632-12
Your Reference	UNITS	BH1	BH2	BH3	BH4
Depth		0.15-0.25	0.1-0.2	0.06-0.2	0.1-0.2
Date Sampled		07/05/2020	07/05/2020	08/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	93	116	94	107

Acid Extractable metals in soil						
Our Reference		242632-1	242632-2	242632-5	242632-6	242632-9
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		0.15-0.25	0.5-0.6	0.06-0.1	0.1-0.2	0.06-0.2
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Arsenic	mg/kg	<4	5	<4	7	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	22	15	22	15	25
Copper	mg/kg	19	21	39	12	36
Lead	mg/kg	20	31	7	30	14
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	9	24	77	6	5
Zinc	mg/kg	46	49	33	24	32

Acid Extractable metals in soil						
Our Reference		242632-10	242632-12	242632-13	242632-16	242632-22
Your Reference	UNITS	BH3	BH4	BH4	SDUP-1	BH1 - [TRIPLICATE]
Depth		0.5-0.6	0.1-0.2	0.5-0.6	-	0.15-0.25
Date Sampled		08/05/2020	08/05/2020	08/05/2020	07/05/2020	07/05/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Arsenic	mg/kg	4	7	10	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	28	11	19	22	10
Copper	mg/kg	31	21	28	41	15
Lead	mg/kg	16	49	25	4	18
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	11	6	6	80	10
Zinc	mg/kg	34	78	36	35	48

Moisture						
Our Reference		242632-1	242632-2	242632-5	242632-6	242632-9
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		0.15-0.25	0.5-0.6	0.06-0.1	0.1-0.2	0.06-0.2
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	13/05/2020	13/05/2020	13/05/2020	13/05/2020	13/05/2020
Moisture	%	24	15	6.4	21	16

Moisture					
Our Reference		242632-10	242632-12	242632-13	242632-16
Your Reference	UNITS	BH3	BH4	BH4	SDUP-1
Depth		0.5-0.6	0.1-0.2	0.5-0.6	-
Date Sampled		08/05/2020	08/05/2020	08/05/2020	07/05/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	13/05/2020	13/05/2020	13/05/2020	13/05/2020
Moisture	%	13	8.2	13	7.5

Misc Soil - Inorg					
Our Reference		242632-1	242632-6	242632-9	242632-12
Your Reference	UNITS	BH1	BH2	BH3	BH4
Depth		0.15-0.25	0.1-0.2	0.06-0.2	0.1-0.2
Date Sampled		07/05/2020	07/05/2020	08/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Date analysed	-	12/05/2020	12/05/2020	12/05/2020	12/05/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5

Asbestos ID - soils					
Our Reference		242632-1	242632-6	242632-9	242632-12
Your Reference	UNITS	BH1	BH2	BH3	BH4
Depth		0.15-0.25	0.1-0.2	0.06-0.2	0.1-0.2
Date Sampled		07/05/2020	07/05/2020	08/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil
Date analysed	-	15/05/2020	15/05/2020	15/05/2020	15/05/2020
Sample mass tested	g	Approx. 65g	Approx. 70g	Approx. 60g	Approx. 45g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown fine-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils NEPM - ASB-001					
Our Reference		242632-18	242632-19	242632-20	242632-21
Your Reference	UNITS	B1	B2	B3	B4
Depth		-	-	-	-
Date Sampled		07/05/2020	07/05/2020	08/05/2020	08/05/2020
Type of sample		Soil	Soil	Soil	Soil
Date analysed	-	14/05/2020	14/05/2020	14/05/2020	14/05/2020
Sample mass tested	g	798.5	815.45	942.85	748.57
Sample Description	-	Brown fine-grained soil & rocks	Beige clayey soil & rocks	Brown fine-grained soil & rocks	Brown fine-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–	–	–
FA and AF Estimation*	g	–	–	–	–
ACM >7mm Estimation*	%(w/w)	<0.01	<0.01	<0.01	<0.01
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.

Method ID	Methodology Summary
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-022	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date extracted	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Date analysed	-			13/05/2020	1	13/05/2020	13/05/2020		13/05/2020	[NT]
TRH C_6 - C_9	mg/kg	25	Org-023	<25	1	<25	<25	0	97	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	1	<25	<25	0	97	[NT]
Benzene	mg/kg	0.2	Org-023	<0.2	1	<0.2	<0.2	0	99	[NT]
Toluene	mg/kg	0.5	Org-023	<0.5	1	<0.5	<0.5	0	86	[NT]
Ethylbenzene	mg/kg	1	Org-023	<1	1	<1	<1	0	96	[NT]
m+p-xylene	mg/kg	2	Org-023	<2	1	<2	<2	0	102	[NT]
o-Xylene	mg/kg	1	Org-023	<1	1	<1	<1	0	100	[NT]
naphthalene	mg/kg	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	100	1	97	96	1	100	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date extracted	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Date analysed	-			12/05/2020	1	13/05/2020	13/05/2020		12/05/2020	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	1	<50	<50	0	105	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	1	<100	<100	0	108	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	1	<100	<100	0	77	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	1	<50	<50	0	105	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	1	<100	<100	0	108	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	1	<100	<100	0	77	[NT]
Surrogate o-Terphenyl	%		Org-020	91	1	86	89	3	110	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date extracted	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Date analysed	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	86	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	103	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	1	0.6	<0.1	143	110	[NT]
Anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	1	0.8	0.1	156	84	[NT]
Pyrene	mg/kg	0.1	Org-022/025	<0.1	1	0.6	0.2	100	88	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	0.4	0.1	120	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	1	0.3	0.1	100	86	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	1	0.6	<0.2	100	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	1	0.2	<0.05	120	98	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	1	0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	1	0.2	<0.1	67	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	78	1	70	72	3	84	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date extracted	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Date analysed	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	102	[NT]
HCB	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	108	[NT]
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	112	[NT]
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	104	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	128	[NT]
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	124	[NT]
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	126	[NT]
Endrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	130	[NT]
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	108	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	106	[NT]
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	93	1	93	97	4	87	[NT]

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date extracted	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Date analysed	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Dichlorvos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	86	[NT]
Dimethoate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	121	[NT]
Fenitrothion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	130	[NT]
Malathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	130	[NT]
Chlorpyriphos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	122	[NT]
Parathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	84	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-022	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	96	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	93	1	93	97	4	87	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date extracted	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Date analysed	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Aroclor 1016	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	89	[NT]
Aroclor 1260	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	93	1	93	97	4	87	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date prepared	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Date analysed	-			12/05/2020	1	12/05/2020	12/05/2020		12/05/2020	[NT]
Arsenic	mg/kg	4	Metals-020	<4	1	<4	<4	0	103	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	103	[NT]
Chromium	mg/kg	1	Metals-020	<1	1	22	12	59	99	[NT]
Copper	mg/kg	1	Metals-020	<1	1	19	17	11	100	[NT]
Lead	mg/kg	1	Metals-020	<1	1	20	22	10	99	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	101	[NT]
Nickel	mg/kg	1	Metals-020	<1	1	9	9	0	101	[NT]
Zinc	mg/kg	1	Metals-020	<1	1	46	110	82	106	[NT]

QUALITY CONTROL: Misc Soil - Inorg					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			12/05/2020	[NT]	[NT]	[NT]	[NT]	12/05/2020	[NT]
Date analysed	-			12/05/2020	[NT]	[NT]	[NT]	[NT]	12/05/2020	[NT]
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	[NT]	[NT]	[NT]	[NT]	101	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

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.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-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.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 242632-1 for Cr & Zn. Therefore a triplicate result has been issued as laboratory sample number 242632-22.

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Asbestos: Excessive sample volume was provided for asbestos analysis. A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Samples 242632-1, 6, 9, 12 were sub-sampled from bags provided by the client.

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E33141PA, Caringbah
Envirolab Reference	242632
Date Sample Received	11/05/2020
Date Instructions Received	11/05/2020
Date Results Expected to be Reported	18/05/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	21 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	10.6
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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

Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	Organophosphorus Pesticides in Soil	PCBsin Soil	Acid Extractable metalsin soil	Misc Soil - Inorg	Asbestos ID - soils	Asbestos ID - soils NEPM - ASB-001	On Hold
BH1-0.15-0.25	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH1-0.5-0.6	✓	✓	✓				✓				
BH1-1.0-1.1											✓
BH1-1.5-1.6											✓
BH2-0.06-0.1	✓	✓	✓				✓				
BH2-0.1-0.2	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH2-0.5-0.6											✓
BH2-1.0-1.2											✓
BH3-0.06-0.2	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH3-0.5-0.6	✓	✓	✓				✓				
BH3-0.8-0.95											✓
BH4-0.1-0.2	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH4-0.5-0.6	✓	✓	✓				✓				
BH4-1.2-1.3											✓
BH4-1.5-1.6											✓
SDUP-1	✓	✓	✓				✓				
TB-S1	✓										
B1										✓	
B2										✓	
B3										✓	
B4										✓	

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

SAMPLE AND CHAIN OF CUSTODY FORM

TO:
ENVIROLAB SERVICES PTY LTD
12 ASHLEY STREET
CHATSWOOD NSW 2067
P: (02) 99106200
F: (02) 99106201

Attention: Aileen

JKE Job Number: E33141PA

Date Results Required: STANDARD

Page: 1 of 1

FROM:
JKEnvironments
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 F: 02-9888 5001
Attention: abarkway@jkenvironments.com.au

Location: Caringbah

Sampler: AVB

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	Combo 6a	Combo 3	Phenols	HOLD				BTEX	Asbestos - WA			
7.05.20	1	BH1	0.15-0.25	G, A	0	F: Sandy Gravel	X		X									
7.05.20	2	BH1	0.5-0.6	G	0	F: Silty Clay		X										
7.05.20	3	BH1	1.0-1.1	G	0	F: Silty Clay				X								
7.05.20	4	BH1	1.5-1.6	G	0	Silty Clay				X								
7.05.20	5	BH2	0.06-0.1	G, A	0	F: Sandy Gravel		X										
7.05.20	6	BH2	0.1-0.2	G, A	0	F: Silty Clay	X		X									
7.05.20	7	BH2	0.5-0.6	G, A	0	F: Silty Clay				X								
7.05.20	8	BH2	1.0-1.2	G	0	Silty Clay				X								
8.05.20	9	BH3	0.06-0.2	G, A	0	F: Sandy Gravel	X		X									
8.05.20	10	BH3	0.5-0.6	G, A	0	F: Sandy Gravel		X										
8.05.20	11	BH3	0.8-0.95	G	0	Silty Clay				X								
8.05.20	12	BH4	0.1-0.2	G, A	0	F: Silty Clay	X		X									
8.05.20	13	BH4	0.5-0.6	G, A	0	F: Silty Clay		X										
8.05.20	14	BH4	1.2-1.3	G, A	0	F: Silty Clay				X								
8.05.20	15	BH4	1.5-1.6	G	0	Silty Clay				X								
7.05.20	16	SDUP-1		G				X										
11.05.20	17	TB-S1		G										X				
7.05.20	18	B1		A		500ml									X			
7.05.20	19	B2		A		500ml									X			
8.05.20	20	B3		A		500ml									X			
8.05.20	21	B4		A		500ml									X			

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 244282
Date Received: 11/05/20
Time Received: 1510
Received By: SB
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By: Anthony Barkway	Date: 11.05.2020	Time: 1510	Received By: [signature]	Date: 11/05/20

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CERTIFICATE OF ANALYSIS 242632-A

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E33141PA, Caringbah**
Number of Samples	21 Soil
Date samples received	11/05/2020
Date completed instructions received	22/05/2020

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.

Report Details

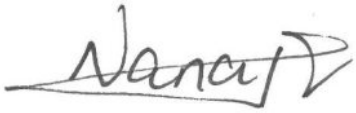
Date results requested by	29/05/2020
Date of Issue	29/05/2020

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Josh Williams, Senior Chemist
Loren Bardwell, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Metals in TCLP USEPA1311			
Our Reference		242632-A-9	242632-A-16
Your Reference	UNITS	BH3	SDUP-1
Depth		0.06-0.2	-
Date Sampled		08/05/2020	07/05/2020
Type of sample		Soil	Soil
Date extracted	-	26/05/2020	26/05/2020
Date analysed	-	28/05/2020	28/05/2020
pH of soil for fluid# determ.	pH units	10.9	9.8
pH of soil TCLP (after HCl)	pH units	6.1	1.8
Extraction fluid used	-	2	1
pH of final Leachate	pH units	5.0	5.1
Arsenic in TCLP	mg/L	[NA]	<0.05
Cadmium in TCLP	mg/L	[NA]	<0.01
Chromium in TCLP	mg/L	[NA]	<0.01
Copper in TCLP	mg/L	[NA]	0.03
Lead in TCLP	mg/L	[NA]	<0.03
Mercury in TCLP	mg/L	[NA]	<0.0005
Nickel in TCLP	mg/L	[NA]	0.08
Zinc in TCLP	mg/L	[NA]	<0.02

PAHs in TCLP (USEPA 1311)		
Our Reference		242632-A-9
Your Reference	UNITS	BH3
Depth		0.06-0.2
Date Sampled		08/05/2020
Type of sample		Soil
Date extracted	-	26/05/2020
Date analysed	-	26/05/2020
Naphthalene in TCLP	mg/L	<0.001
Acenaphthylene in TCLP	mg/L	<0.001
Acenaphthene in TCLP	mg/L	<0.001
Fluorene in TCLP	mg/L	<0.001
Phenanthrene in TCLP	mg/L	<0.001
Anthracene in TCLP	mg/L	<0.001
Fluoranthene in TCLP	mg/L	<0.001
Pyrene in TCLP	mg/L	<0.001
Benzo(a)anthracene in TCLP	mg/L	<0.001
Chrysene in TCLP	mg/L	<0.001
Benzo(bjk)fluoranthene in TCLP	mg/L	<0.002
Benzo(a)pyrene in TCLP	mg/L	<0.001
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	<0.001
Dibenzo(a,h)anthracene in TCLP	mg/L	<0.001
Benzo(g,h,i)perylene in TCLP	mg/L	<0.001
Total +ve PAH's	mg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	76

Method ID	Methodology Summary
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using in house method INORG-004. Please note that the mass used may be scaled down from the default based on sample mass available.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Org-022/025	Leachates are extracted with Dichloromethane and analysed by GC-MS/GC-MSMS.

QUALITY CONTROL: Metals in TCLP USEPA1311					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			26/05/2020	[NT]	[NT]	[NT]	[NT]	26/05/2020	[NT]
Date analysed	-			28/05/2020	[NT]	[NT]	[NT]	[NT]	28/05/2020	[NT]
Arsenic in TCLP	mg/L	0.05	Metals-020 ICP-AES	<0.05	[NT]	[NT]	[NT]	[NT]	103	[NT]
Cadmium in TCLP	mg/L	0.01	Metals-020 ICP-AES	<0.01	[NT]	[NT]	[NT]	[NT]	88	[NT]
Chromium in TCLP	mg/L	0.01	Metals-020 ICP-AES	<0.01	[NT]	[NT]	[NT]	[NT]	91	[NT]
Copper in TCLP	mg/L	0.01	Metals-020 ICP-AES	<0.01	[NT]	[NT]	[NT]	[NT]	108	[NT]
Lead in TCLP	mg/L	0.03	Metals-020 ICP-AES	<0.03	[NT]	[NT]	[NT]	[NT]	91	[NT]
Mercury in TCLP	mg/L	0.0005	Metals-021 CV-AAS	<0.0005	[NT]	[NT]	[NT]	[NT]	103	[NT]
Nickel in TCLP	mg/L	0.02	Metals-020 ICP-AES	<0.02	[NT]	[NT]	[NT]	[NT]	93	[NT]
Zinc in TCLP	mg/L	0.02	Metals-020 ICP-AES	<0.02	[NT]	[NT]	[NT]	[NT]	91	[NT]

QUALITY CONTROL: PAHs in TCLP (USEPA 1311)					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			26/05/2020	9	26/05/2020	26/05/2020		26/05/2020	[NT]
Date analysed	-			26/05/2020	9	26/05/2020	26/05/2020		26/05/2020	[NT]
Naphthalene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	118	[NT]
Acenaphthylene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	[NT]	[NT]
Acenaphthene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	[NT]	[NT]
Fluorene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	118	[NT]
Phenanthrene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	122	[NT]
Anthracene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	[NT]	[NT]
Fluoranthene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	92	[NT]
Pyrene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	92	[NT]
Benzo(a)anthracene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	[NT]	[NT]
Chrysene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	126	[NT]
Benzo(bjk)fluoranthene in TCLP	mg/L	0.002	Org-022/025	<0.002	9	<0.002	<0.002	0	[NT]	[NT]
Benzo(a)pyrene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	120	[NT]
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	[NT]	[NT]
Dibenzo(a,h)anthracene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	[NT]	[NT]
Benzo(g,h,i)perylene in TCLP	mg/L	0.001	Org-022/025	<0.001	9	<0.001	<0.001	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	91	9	76	77	1	83	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

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.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-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.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E33141PA, Caringbah
Envirolab Reference	242632-A
Date Sample Received	11/05/2020
Date Instructions Received	22/05/2020
Date Results Expected to be Reported	29/05/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	21 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	10.6
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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12 Ashley St Chatswood NSW 2067
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Sample ID	pH of soil for fluid#determ.	pH of soil TCLP (after HCl)	Extraction fluid used	pH of final Leachate	Arsenic in TCLP	Cadmium in TCLP	Chromium in TCLP	Copper in TCLP	Lead in TCLP	Mercury in TCLP	Nickel in TCLP	Zinc in TCLP	Naphthalene in TCLP	Acenaphthylene in TCLP	Acenaphthene in TCLP	Fluorene in TCLP	Phenanthrene in TCLP	Anthracene in TCLP	Fluoranthene in TCLP	Pyrene in TCLP	Benzo(a)anthracene in TCLP	Chrysene in TCLP	Benzo(bjk)fluoranthene in TCLP	Benzo(a)pyrene in TCLP	Indeno(1,2,3-c,d)pyrene - TCLP	Dibenzo(a,h)anthracene in TCLP	Benzo(g,h,i)perylene in TCLP	Total +vePAH's	Surrogate p-Terphenyl-d14	On Hold
BH1-0.15-0.25																														✓
BH1-0.5-0.6																														✓
BH1-1.0-1.1																														✓
BH1-1.5-1.6																														✓
BH2-0.06-0.1																														✓
BH2-0.1-0.2																														✓
BH2-0.5-0.6																														✓
BH2-1.0-1.2																														✓
BH3-0.06-0.2	✓	✓	✓	✓									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
BH3-0.5-0.6																														✓
BH3-0.8-0.95																														✓
BH4-0.1-0.2																														✓
BH4-0.5-0.6																														✓
BH4-1.2-1.3																														✓
BH4-1.5-1.6																														✓
SDUP-1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																		
TB-S1																														✓
B1																														✓
B2																														✓
B3																														✓

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customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	pH of soil for fluid#determ.	pH of soil TCLP (after HCl)	Extraction fluid used	pH of final Leachate	Arsenic in TCLP	Cadmium in TCLP	Chromium in TCLP	Copper in TCLP	Lead in TCLP	Mercury in TCLP	Nickel in TCLP	Zinc in TCLP	Naphthalene in TCLP	Acenaphthylene in TCLP	Acenaphthene in TCLP	Fluorene in TCLP	Phenanthrene in TCLP	Anthracene in TCLP	Fluoranthene in TCLP	Pyrene in TCLP	Benzo(a)anthracene in TCLP	Chrysene in TCLP	Benzo(bjk)fluoranthene in TCLP	Benzo(a)pyrene in TCLP	Indeno(1,2,3-c,d)pyrene - TCLP	Dibenzo(a,h)anthracene in TCLP	Benzo(g,h,i)perylene in TCLP	Total +vePAH's	Surrogate p-Terphenyl-d14	On Hold
B4																														✓
BH1 - [TRIPLICATE]-0.15-0.25																														✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Jessica Hie

From: Anthony Barkway <ABarkway@jkenvironments.com.au>
Sent: Friday, 22 May 2020 3:12 PM
To: Nick Sarlamis
Cc: Nancy Zhang; Customer Service; Joshua Williams
Subject: RE: Results for Registration 242632 E33141PA, Caringbah

Standard TA please.

242632-A
Due: 29/5/20
Std TAT

Need those by next Friday or preferably before if can.

Thank you!

Kind Regards

Regards
Anthony Barkway
Senior Environmental Engineer
CEnvP (General Certified Environmental Practitioner) | NSW Licensed Asbestos Assessor

JK Group is open for business. Should you wish to speak to us, then please contact us by mobile phone rather than the landline as most staff are working from home.

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D: 0423 611 339
E: abarkway@jkenvironments.com.au
www.jkenvironments.com.au

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NORTH RYDE BC NSW 1670
115 Wicks Road
MACQUARIE PARK NSW 2113

JKEnvironments

From: Nick Sarlamis <NSarlamis@envirolab.com.au>
Sent: Friday, 22 May 2020 3:09 PM
To: Anthony Barkway <ABarkway@jkenvironments.com.au>
Cc: Nancy Zhang <NZhang@envirolab.com.au>; Customer Service <customerservice@envirolab.com.au>; Joshua Williams <JWilliams@envirolab.com.au>
Subject: RE: Results for Registration 242632 E33141PA, Caringbah

Hi Anthony
We will get that organized, are these on high priority?

Kind Regards,

Nick Sarlamis | Inorganics Supervisor | Envirolab Services Pty Ltd

***Celebrating 15 years of* Great Science. Great Service.**

12 Ashley Street Chatswood NSW 2067
T 612 9910 6200 **F** 612 9910 6201
E nsarlamis@envirolab.com.au | **W** www.envirolab.com.au

View reduced sampling bottle provision for PFAS in water | COVID-19 Update

Please note that all samples submitted to the Envirolab Group laboratories will be analysed under the Envirolab Group Terms and Conditions. The Terms and Conditions are accessible by clicking this link

From: Anthony Barkway <ABarkway@jkenvironments.com.au>
Sent: Friday, 22 May 2020 3:06 PM
To: Nick Sarlamis <NSarlamis@envirolab.com.au>
Cc: Nancy Zhang <NZhang@envirolab.com.au>
Subject: RE: Results for Registration 242632 E33141PA, Caringbah

Hi Nick,

Could I please ask you to schedule some additional testing for the above batch, as follows? -

Sample Number + Depth	Sample Number Lab Ref:	Tests Required
BH3 (0.06-0.2)	9	TCLP PAHs
SDUP-1	16	TCLP Heavy Metals

Thank you!

Kind Regards

Regards
Anthony Barkway
Senior Environmental Engineer
CEnvP (General Certified Environmental Practitioner) | NSW Licensed Asbestos Assessor

JK Group is open for business. Should you wish to speak to us, then please contact us by mobile phone rather than the landline as most staff are working from home.

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JKEnvironments

From: Nick Sarlamis <NSarlamis@envirolab.com.au>
Sent: Monday, 18 May 2020 4:49 PM
To: Anthony Barkway <ABarkway@jkenvironments.com.au>
Subject: Results for Registration 242632 E33141PA, Caringbah

Appendix F: Report Explanatory Notes

Standard Sampling Procedure

These protocols specify the basic procedures to be used when sampling soils or groundwater for environmental site assessments undertaken by JKE. The purpose of these protocols is to provide standard methods for: sampling, decontamination procedures for sampling equipment, sample preservation, sample storage and sample handling. Deviations from these procedures must be recorded.

A. Soil Sampling

- Prepare a borehole/test pit log or made a note of the sample description for stockpiles.
- Layout sampling equipment on clean plastic sheeting to prevent direct contact with ground surface. The work area should be at a distance from the drill rig/excavator such that the machine can operate in a safe manner.
- Ensure all sampling equipment has been decontaminated prior to use.
- Remove any surface debris from the immediate area of the sampling location.
- Collect samples and place in glass jar with a Teflon seal. This should be undertaken as quickly as possible to prevent the loss of any volatiles. If possible, fill the glass jars completely.
- Collect samples for asbestos analysis and place in a zip-lock plastic bag.
- Label the sampling containers with the JKE job number, sample location (eg. BH1), sampling depth interval and date. If more than one sample container is used, this should also be indicated (eg. 2 = Sample jar 1 of 2 jars).
- Photoionisation detector (PID) screening of volatile organic compounds (VOCs) should be undertaken on samples using the soil sample headspace method. Headspace measurements are taken following equilibration of the headspace gasses in partly filled zip-lock plastic bags. PID headspace data is recorded on the borehole/test pit log and the chain of custody forms.
- Record the lithology of the sample and sample depth on the borehole/test pit log generally in accordance with AS1726-2017[14].
- Store the sample in a sample container cooled with ice or chill packs. On completion of the sampling the sample container should be delivered to the lab immediately or stored in the refrigerator prior to delivery to the lab. All samples are preserved in accordance with the standards outlined in the report.
- Check for the presence of groundwater after completion of each borehole using an electronic dip metre or water whistle. Boreholes should be left open until the end of fieldwork where it is safe to do so. All groundwater levels in the boreholes should be rechecked on the completion of the fieldwork.
- Backfill the boreholes/test pits with the excavation cuttings or clean sand prior to leaving the site.

B. Decontamination Procedures for Soil Sampling Equipment

- All sampling equipment should be decontaminated between every sampling location. This excludes single use PVC tubing used for push tubes etc. Equipment and materials required for the decontamination include:
  - Phosphate free detergent (Decon 90);
  - Potable water;
  - Stiff brushes; and
  - Plastic sheets.
- Ensure the decontamination materials are clean prior to proceeding with the decontamination.
- Fill both buckets with clean potable water and add phosphate free detergent to one bucket.
- In the bucket containing the detergent, scrub the sampling equipment until all the material attached to the equipment has been removed.
- Rinse sampling equipment in the bucket containing potable water.
- Place cleaned equipment on clean plastic sheets.

[14] Standards Australia, (2017), *Geotechnical Site Investigations.* (AS1726-2017)

If all materials are not removed by this procedure, high-pressure water cleaning is recommended. If any equipment is not completely decontaminated by both these processes, then the equipment should not be used until it has been thoroughly cleaned.

C. Groundwater Sampling

Groundwater samples are more sensitive to contamination than soil samples and therefore adhesion to this protocol is particularly important to obtain reliable, reproducible results. The recommendations detailed in AS/NZS 5667.1:1998 are considered to form a minimum standard.

The basis of this protocol is to maintain the security of the borehole and obtain accurate and representative groundwater samples. The following procedure should be used for collection of groundwater samples from previously installed groundwater monitoring wells.

- After monitoring well installation, at least three bore volumes should be pumped from the monitoring wells (well development) to remove any water introduced during the drilling process and/or the water that is disturbed during installation of the monitoring well. This should be completed prior to purging and sampling.
- Groundwater monitoring wells should then be left to recharge for at least three days before purging and sampling. Prior to purging or sampling, the condition of each well should observed and any anomalies recorded on the field data sheets. The following information should be noted: the condition of the well, noting any signs of damage, tampering or complete destruction; the condition and operation of the well lock; the condition of the protective casing and the cement footing (raised or cracked); and, the presence of water between protective casing and well.
- Measure the groundwater level from the collar of the piezometer/monitoring well using an electronic dip meter. The collar level should be taken (if required) during the site visit using a dumpy level and staff.
- Purging and sampling of piezometers/monitoring wells is done on the same site visit when using micro-purge (or other low flow) techniques.
- Layout and organize all equipment associated with groundwater sampling in a location where they will not interfere with the sampling procedure and will not pose a risk of contaminating samples. Equipment generally required includes:
  - Stericup single-use filters (for heavy metals samples);
  - Bucket with volume increments;
  - Sample containers: teflon bottles with 1 ml nitric acid, 75mL glass vials with 1 mL hydrochloric acid, 1 L amber glass bottles;
  - Bucket with volume increments;
  - Flow cell;
  - pH/EC/Eh/Temperature meters;
  - Plastic drums used for transportation of purged water;
  - Esky and ice;
  - Nitrile gloves;
  - Distilled water (for cleaning);
  - Electronic dip meter;
  - Low flow peristaltic pump and associated tubing; and
  - Groundwater sampling forms.
- Ensure all non-disposable sampling equipment is decontaminated or that new disposable equipment is available prior to any work commencing at a new location. The procedure for decontamination of groundwater equipment is outlined at the end of this section.
- Disposable gloves should be used whenever samples are taken to protect the sampler and to assist in avoidance of contamination.
- Groundwater samples are obtained from the monitoring wells using low flow sampling equipment to reduce the disturbance of the water column and loss of volatiles.

- During pumping to purge the well, the pH, temperature, conductivity, dissolved oxygen, redox potential and groundwater levels are monitored (where possible) using calibrated field instruments to assess the development of steady state conditions. Steady state conditions are generally considered to have been achieved when the difference in the pH measurements is less than 0.2 units, the difference in conductivity is less than 10% and whilst the well is no longer in draw-down.
- All measurements are recorded on specific data sheets.
- Once steady state conditions are considered to have been achieved, groundwater samples are obtained directly from the pump tubing and placed in appropriate glass bottles, BTEX vials or plastic bottles.
- All samples are preserved in accordance with water sampling requirements specified by the laboratory and placed in an insulated container with ice. Groundwater samples are preserved by immediate storage in an insulated sample container with ice.
- At the end of each water sampling complete a chain of custody form for samples being sent to the laboratory.

D. <u>Decontamination Procedures for Groundwater Sampling Equipment</u>

- All equipment associated with the groundwater sampling procedure (other than single-use items) are decontaminated between every sampling location.
- The following equipment and materials are required for the decontamination procedure:
  - Phosphate free detergent;
  - Potable water;
  - Distilled water; and
  - Plastic Sheets or bulk bags (plastic bags).
- Fill one bucket with clean potable water and phosphate free detergent, and one bucket with distilled water.
- Flush potable water and detergent through pump head. Wash sampling equipment and pump head using brushes in the bucket containing detergent until all materials attached to the equipment are removed.
- Flush pump head with distilled water.
- Change water and detergent solution after each sampling location.
- Rinse sampling equipment in the bucket containing distilled water.
- Place cleaned equipment on clean plastic sheets.
- If all materials are not removed by this procedure that equipment should not be used until it has been thoroughly cleaned

QA/QC Definitions

The QA/QC terms used in this report are defined below. The definitions are in accordance with US EPA publication SW-846, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (1994)[15] methods and those described in *Environmental Sampling and Analysis, A Practical Guide,* (1991)[16]. The NEPM (2013) is consistent with these documents.

A. Practical Quantitation Limit (PQL), Limit of Reporting (LOR) & Estimated Quantitation Limit (EQL)

These terms all refer to the concentration above which results can be expressed with a minimum 95% confidence level. The laboratory reporting limits are generally set at ten times the standard deviation for the Method Detection Limit for each specific analyte. For the purposes of this report the LOR, PQL, and EQL are considered to be equivalent.

When assessing laboratory data it should be borne in mind that values at or near the PQL have two important limitations: *"The uncertainty of the measurement value can approach, and even equal, the reported value. Secondly, confirmation of the analytes reported is virtually impossible unless identification uses highly selective methods. These issues diminish when reliably measurable amounts of analytes are present. Accordingly, legal and regulatory actions should be limited to data at or above the reliable detection limit*" (Keith, 1991).

B. Precision

The degree to which data generated from repeated measurements differ from one another due to random errors. Precision is measured using the standard deviation or Relative Percent Difference (RPD).

C. Accuracy

Accuracy is a measure of the agreement between an experimental result and the true value of the parameter being measured (i.e. the proximity of an averaged result to the true value, where all random errors have been statistically removed). The assessment of accuracy for an analysis can be achieved through the analysis of known reference materials or assessed by the analysis of surrogates, field blanks, trip spikes and matrix spikes. Accuracy is typically reported as percent recovery.

D. Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is primarily dependent upon the design and implementation of the sampling program. Representativeness of the data is partially ensured by the avoidance of contamination, adherence to sample handing and analysis protocols and use of proper chain-of-custody and documentation procedures.

E. Completeness

Completeness is a measure of the number of valid measurements in a data set compared to the total number of measurements made and overall performance against DQIs. The following information is assessed for completeness:

- Chain-of-custody forms;
- Sample receipt form;
- All sample results reported;
- All blank data reported;

[15] US EPA, (1994). *SW-846: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* (US EPA SW-846)

[16] Keith., H, (1991). *Environmental Sampling and Analysis, A Practical Guide*

- All laboratory duplicate and RPDs calculated;
- All surrogate spike data reported;
- All matrix spike and lab control spike (LCS) data reported and RPDs calculated;
- Spike recovery acceptable limits reported; and
- NATA stamp on reports.

F. Comparability

Comparability is the evaluation of the similarity of conditions (e.g. sample depth, sample homogeneity) under which separate sets of data are produced. Data comparability checks include a bias assessment that may arise from the following sources:

- Collection and analysis of samples by different personnel; Use of different techniques;
- Collection and analysis by the same personnel using the same methods but at different times; and
- Spatial and temporal changes (due to environmental dynamics).

G. Blanks

The purpose of laboratory and field blanks is to check for artefacts and interferences that may arise during sampling, transport and analysis.

H. Matrix Spikes

Samples are spiked with laboratory grade standards to detect interactive effects between the sample matrix and the analytes being measured. Matrix Spikes are reported as a percent recovery and are prepared for 1 in every 20 samples. Sample batches that contain less than 20 samples may be reported with a Matrix Spike from another batch. The percent recovery is calculated using the formula below. Acceptable recovery limits are 70% to 130%.

$$\frac{\text{(Spike Sample Result – Sample Result) x 100}}{\text{Concentration of Spike Added}}$$

I. Surrogate Spikes

Samples are spiked with a known concentration of compounds that are chemically related to the analyte being investigated but unlikely to be detected in the environment. The purpose of the Surrogate Spikes is to check the accuracy of the analytical technique. Surrogate Spikes are reported as percent recovery.

J. Duplicates

Laboratory duplicates measure precision, expressed as Relative Percent Difference. Duplicates are prepared from a single field sample and analysed as two separate extraction procedures in the laboratory. The RPD is calculated using the formula where D1 is the sample concentration and D2 is the duplicate sample concentration:

$$\frac{(D1 - D2) \times 100}{\{(D1 + D2)/2\}}$$

Appendix G: Data (QA/QC) Evaluation

Data (QA/QC) Evaluation

A. INTRODUCTION

This Data (QA/QC) Evaluation forms part of the validation process for the DQOs documented in Section 6.1 of this report. Checks were made to assess the data in terms of precision, accuracy, representativeness, comparability and completeness. These 'PARCC' parameters are referred to collectively as DQIs and are defined in the Report Explanatory Notes attached in the report appendices.

1. Field and Laboratory Considerations

The quality of the analytical data produced for this project has been considered in relation to the following:

- Sample collection, storage, transport and analysis;
- Laboratory PQLs;
- Field QA/QC results; and
- Laboratory QA/QC results.

2. Field QA/QC Samples and Analysis

A summary of the field QA/QC samples collected and analysed for this assessment is provided in the following table:

Sample Type	Sample Identification	Frequency (of Sample Type)	Analysis Performed
Intra-laboratory duplicate (soil)	SDUP-1 (primary sample BH2 0.06-0.1m)	Approximately 12.5% of primary samples	Heavy metals, TRH/BTEX and PAHs
Trip blank (soil)	TB-S1 (11/05/2020)	One for the assessment to demonstrate adequacy of storage and transport methods	BTEX

The results for the field QA/QC samples are detailed in the laboratory summary tables (Table S9 inclusive) attached to the assessment report and are discussed in the subsequent sections of this Data (QA/QC) Evaluation report.

3. Data Assessment Criteria

JKE adopted the following criteria for assessing the field and laboratory QA/QC analytical results:

Field Duplicates

Acceptable targets for precision of field duplicates in this report will be 30% or less, consistent with NEPM (2013). RPD failures will be considered qualitatively on a case-by-case basis taking into account factors such as the concentrations used to calculate the RPD (i.e. RPD exceedance where concentrations are close to the PQL are typically not as significant as those where concentrations are reported at least five or 10 times the PQL), sample type, collection methods and the specific analyte where the RPD exceedance was reported.

Field Blanks

Acceptable targets for field blank samples in this report will be less than the PQL for organic analytes.

Laboratory QA/QC

The suitability of the laboratory data is assessed against the laboratory QA/QC criteria which is outlined in the laboratory reports. These criteria were developed and implemented in accordance with the laboratory's NATA accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

A summary of the acceptable limits adopted by the primary laboratory (Envirolab) is provided below:

RPDs

- Results that are <5 times the PQL, any RPD is acceptable; and
- Results >5 times the PQL, RPDs between 0-50% are acceptable.

Laboratory Control Samples (LCS) and Matrix Spikes

- 70-130% recovery acceptable for metals and inorganics;
- 60-140% recovery acceptable for organics; and
- 10-140% recovery acceptable for VOCs.

Surrogate Spikes

- 60-140% recovery acceptable for general organics; and
- 10-140% recovery acceptable for VOCs.

Method Blanks

- All results less than PQL.

B. DATA EVALUATION

1. Sample Collection, Storage, Transport and Analysis

Samples were collected by trained field staff in accordance with the JKE SSP. The SSP was developed to be consistent with relevant guidelines, including NEPM (2013) and other guidelines made under the CLM Act 1997.

Appropriate sample preservation, handling and storage procedures were adopted. Laboratory analysis was undertaken within general holding times in accordance with Schedule B(3) of NEPM (2013) and the laboratory NATA accredited methodologies.

JKE note that the temperature on receipt of soil samples was reported to be up to 10.6°C. JKE understand that the temperature is measured at the laboratory using an infrared temperature probe by scanning the outside of the sample container (i.e. one sample jar/container at the time of registering the samples). This procedure is not considered to be robust as there is a potential for the outside of the jar to warm to ambient temperature, or at least to increase from that of the internal contents, relatively quickly. On this basis, JKE are of the opinion that the temperatures reported on the Sample Receipts are unlikely to be reliable or representative of the overall batch.

Envirolab noted that the asbestos results were reported to be consistent with the recommendations in NEPM (2013), however this level of reporting is outside the scope of their NATA accreditation. In the absence of other available analytical methods for asbestos, this was found to be acceptable for the purpose of this assessment.

Review of the project data also indicated that:

- COC documentation was adequately maintained;
- Sample receipt advice documentation was provided for all sample batches;
- All analytical results were reported; and
- Consistent units were used to report the analysis results.

2. Laboratory PQLs

Appropriate PQLs were adopted for the analysis and all PQLs were below the SAC.

3. Field QA/QC Sample Results

Field Duplicates

The results indicated that field precision was acceptable. RPD non-conformances were reported for some analytes as discussed below:

- Elevated RPDs were reported for one PAH compound in soil SDUP-1/BH2 (0.06-0.1m); and
- Elevated RPDs were also reported for heavy metal lead in soil SDUP-1/BH2 (0.06-0.1m).

Values outside the acceptable limits have been attributed to the heterogeneous nature of fill material strata from which these samples were collected and the difficulties associated with obtaining homogenous duplicate samples of heterogeneous matrices. In addition, detectable concentrations of these analytes were relatively low and close to the laboratory PQLs which would yield higher RPD values for detected variations. Both the primary and duplicate results were screened against the SAC, therefore the RPD exceedances are not significant.

Field Blanks

During the investigation, one soil trip blank was placed in the esky during sampling and transported back to the laboratory. The results were all less than the PQLs, therefore cross contamination between samples that may have significance for data validity did not occur.

4. Laboratory QA/QC

The analytical methods implemented by the laboratory were performed in accordance with their NATA accreditation and were consistent with Schedule B(3) of NEPM (2013). The frequency of data reported for the laboratory QA/QC (i.e. duplicates, spikes, blanks, LCS) was considered to be acceptable for the purpose of this assessment.

One laboratory RPD exceeded for chromium and zinc. These exceedances were minor and a triplicate was analysed (See lab report 242632). The result is attributed to minor heterogeneity in the fill and is not significant as chromium and zinc concentrations were well below the SAC.

C. DATA QUALITY SUMMARY

JKE are of the opinion that the data are adequately precise, accurate, representative, comparable and complete to serve as a basis for interpretation to achieve the investigation objectives.

Non-conformances were reported for some field QA/QC samples and laboratory QA/QC analysis. These non-conformances were considered to be sporadic and minor, and were not considered to be indicative of systematic sampling or analytical errors. On this basis, these non-conformances are not considered to materially impact the report findings.

Appendix H: Air Monitoring Certificates

Air Monitoring Certificate

Clearsafe Environmental Solutions Pty Ltd
9 Industrial Road, Unanderra NSW 2526
info@clearsafe.com.au
1300 042 962

Report Number: 40-11763-01-AM
Monitoring Date: 7/5/2020
Received Date: 7/5/2020
Analysis Date: 11/5/2020
Report Date: 11/5/2020
Site Address: Sutherland Hospital, Kingsway & Kareena Rd
Caringbah NSW 2229
Client Name: Jeffery & Katauskas Services Pty Ltd ATF The Trustee for Jeffery Katauskas Walker Unit Trust
Client Address: PO Box 976
North Ryde BC NSW 1670

Client Contact: Anthony Barkway
Sampled By: Gonzalo Serna Diaz
Approved Counter: Nathan Crouch
Approved Signatory: Luke Heckenberg

Test Method: Airborne fibre monitoring in accordance with the Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC:3003(2005)] and Clearsafe method SOP.AM.01.

Notes: The results contained within this report relate only to the samples tested. This report should not be copied, presented or reviewed except in full.

Sample Number	Location	Code*	Time On	Time Off	Airflow On	Airflow Off	Fibres	Fields	Conc.**
40-11763/1	Western building, north-western emergency exit, crossing sign	5	07:30	15:30	1.09	1.09	0	100	<0.01
40-11763/2	Western building, western carport, south-eastern column	5	07:31	15:31	1.09	1.09	1	100	<0.01
40-11763/3	Western building, emergency ambulance sign	5	07:32	15:32	1.09	1.09	1	100	<0.01
40-11763/4	Field Blank	6					0	100	N/A

**** Concentration in Fibres/mL of air**

*** Sample Codes:**

1 - Asbestos removal
2 - Bag-out
3 - Enclosure dismantling
4 - Clearance
5 - Background
6 - Blank Sample
7 - Fibre Count Only
8 - Personal monitoring

NATA Accredited Laboratory No. 18542

Accredited for compliance with ISO/IEC 17025 - Testing. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian / national standards.

Air Monitoring Certificate

Clearsafe Environmental Solutions Pty Ltd
9 Industrial Road, Unanderra NSW 2526
info@clearsafe.com.au
1300 042 962

Report Number: 40-11763-02-AM
Monitoring Date: 8/5/2020
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Notes: The results contained within this report relate only to the samples tested. This report should not be copied, presented or reviewed except in full.

Sample Number	Location	Code*	Time On	Time Off	Airflow On	Airflow Off	Fibres	Fields	Conc.**
40-11763/5	Carpark, south-eastern corner, on crossing sign	5	07:30	14:57	0.97	0.97	0	100	<0.01
40-11763/6	Carpark, north-eastern corner, on crossing sign	5	07:31	14:58	0.97	0.97	1	100	<0.01
40-11763/7	Carpark, ticket machine	5	07:32	14:59	0.97	0.97	1	100	<0.01
40-11763/8	Field Blank	6					0	100	N/A

**** Concentration in Fibres/mL of air**

*** Sample Codes:**

1 - Asbestos removal
2 - Bag-out
3 - Enclosure dismantling
4 - Clearance
5 - Background
6 - Blank Sample
7 - Fibre Count Only
8 - Personal monitoring

NATA Accredited Laboratory No. 18542

Accredited for compliance with ISO/IEC 17025 - Testing. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian / national standards.

Appendix I: Guidelines and Reference Documents

Acid Sulfate Soils Management Advisory Committee (ASSMAC), (1998). Acid Sulfate Soils Manual

Australian and New Zealand Environment Conservation Council (ANZECC), (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality

Canadian Council of Ministers of the Environment, (1999). Canadian soil quality guidelines for the protection of environmental and human health: Benzo(a)Pyrene (1997)

CRC Care, (2011). Technical Report No. 10 – Health screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document

Contaminated Land Management Act 1997 (NSW)

Department of Land and Water Conservation, (1997). 1:25,000 Acid Sulfate Soil Risk Map Series

Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land (1998)

National Health and Medical Research Council (NHMRC), (2018). National Water Quality Management Strategy, Australian Drinking Water Guidelines 2011

NSW Department of Environment and Conservation, (2007). Guidelines for the Assessment and Management of Groundwater Contamination

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

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

NSW EPA, (2015). Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997

NSW EPA, (2017). Guidelines for the NSW Site Auditor Scheme, 3rd Edition

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

NSW Office of Environment and Heritage (OEH), (2011). Guidelines for Consultants Reporting on Contaminated Sites

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

Olszowy, H., Torr, P., and Imray, P., (1995). Trace Element Concentrations in Soils from Rural and Urban Areas of Australia. Contaminated Sites Monograph Series No. 4. Department of Human Services and Health, Environment Protection Agency, and South Australian Health Commission

Protection of the Environment Operations Act 1997 (NSW)

State Environmental Planning Policy No.55 – Remediation of Land 1998 (NSW)

World Health Organisation (WHO), (2008). Petroleum Products in Drinking-water, Background document for the development of WHO Guidelines for Drinking Water Quality

Western Australia Department of Health, (2009). Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia