

APPENDIX

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PRELIMINARY SITE INSPECTION

Preliminary Site Investigation & Limited Site Assessment

Tripoli Way Extension, Albion Park
NSW

8201612601



Prepared for
Shellharbour City Council

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Executive Summary

Cardno completed a PSI and limited site assessment for the study area of the proposed Tripoli Way Extension, which runs parallel to the north of Tongarra Road/Illawarra Highway and encompasses multiple lots between the intersection of Broughton Avenue and Tongarra Road in the west to Terry Street in the east.

The topography within the site is highly modified and typically situated in areas of low density residential and rural-residential dwellings within the suburb of Albion Park. The site has an elevation ranging from 9m Australian Height Datum (AHD) in the east to 15m AHD in the west and Macquarie Rivulet is located approximately 130m north.

The scope of works carried out during the PSI and Limited Site Assessment included:

- A site inspection/walkover to identify the presence of potential hazardous materials, evidence of current and/or historical contaminating activities, evidence for the storage or handling of chemicals, and waste management practices on or adjacent to the site;
 - A desktop review of available information including soil, geology and acid sulfate soil risk maps, historical aerial photographs, current and historical land title documents;
 - Targeted soil sampling during a geotechnical investigation undertaken at the site by Cardno to preliminarily assess for potential contamination. Eleven (11) primary soil samples were collected and submitted to a NATA accredited laboratory for analysis of targeted contaminants of interest and acid sulfate soil parameters.
- > Extensive filling was not identified within the site with the exception of at test pit TP008 where a fill profile with a thickness of 1.3m was observed. Anthropogenic inclusions within the fill consisted of concrete, brick, tile and plastic offcuts, however, asbestos was not observed. The lateral distribution of fill surrounding test pit TP008 was not delineated during the assessment.
 - > Groundwater was not intersected during the investigation; however, seepage was observed at test pit TP008 at an approximate depth of 0.7m bgl and was inferred to be localised perched water within the fill profile.
 - > Three boreholes, BH003, BH006 and BH007, were drilled by Cardno in 2016 in the low-lying western portion of the site in the vicinity of Hazleton Creek. Each borehole was converted to a permanent groundwater monitoring well and groundwater levels were gauged on up to seven occasions between the 17th of August 2016 and the 3rd of July 2017. The data obtained by Cardno is reported in a Geotechnical Investigation Factual Report (2018) and shows that the depth to groundwater ranged from 0.78 to 1.56 metres below ground level (m bgl), indicative of a shallow groundwater table at that specific location.
 - > Laboratory testing has confirmed that soils beneath the site are slightly to moderately acidic with several exceedances of the ASSMAC (1998) PASS Indicator Values and Action Criteria for TPA and TSA. Whilst soils are acidic, the SPOS and SCR results indicate that sulfides and sulfidic ores do not appear to be present, suggesting that the acidity present within soil may not be attributable to ASS, however, as a precautionary measure the soils must be managed during construction
 - > COPC concentrations in all analysed samples were reported less than the NEPM human health and ecological screening criteria for a commercial / industrial land use.
 - > Information obtained during the PSI and limited site assessment generally indicate a low to moderate potential for contamination, however, further investigation is warranted at the eight potential areas of environmental concern as summarised below:

Potential Areas of Environmental Concern

Potential Area of Environment Concern	Site Activity / Potential Source	Contaminants of Potential Concern
Construction Laydown and Stockpiling Area (AEC01)	<p>A laydown and stockpiling area is located in the far western extremity of the site within Lot 1182 in DP1202087. Large stockpiles of solid waste are present and the land is believed to be under occupation by Lend Lease during the Calderwood residential development.</p> <p>The nature of the stockpiled material was unable to be determined due to limited site access, however, it appeared to comprise of construction materials and waste including concrete, asphalt and coal washery reject. Aerial imagery suggests that the area has been used as a laydown and storage area since at least May 2017.</p>	<ul style="list-style-type: none"> > Heavy metals > PAHs; > TRHs; > BTEXN; and
Farm Laydown Area (AEC02)	A farm laydown area was observed in the southern portion of Lot 1 in DP559819 and contained a variety of agricultural plant and equipment. Whilst no contaminant sources were observed to be stored on the ground surface during the inspection, aerial imagery suggests that the area has been used for storage since at least 1993.	<ul style="list-style-type: none"> > Asbestos.
Former Dairy and Butter Factory (AEC03)	The former "Tulkeroo" Butter Factory is located in Lot 12 / DP 1205733 and operated between 1887 to 1908. Depending on the scale of the operation there may have been potential contaminant sources at the site associated with industrial processes such as storage of petroleum products. Whilst potential contamination associated with the operations may have degraded, such as hydrocarbons, it is possible that more persistent contaminants may still exist. Current and former structures may also have been constructed of hazardous building materials such as asbestos and/or lead based paints.	<ul style="list-style-type: none"> > Heavy metals > PAHs; > TRHs;
Stockpiles (AEC04)	Two stockpiles were observed in Lots 11 and 12 / DP1205733 north of the former "Tulkeroo" Albion Park Dairy. The contents of each stockpile were unable to be assessed as the stockpiles were vegetated with grass during the walkover	<ul style="list-style-type: none"> > BTEXN; > Phenols; > OCP;
Fill Areas (AEC05)	Two areas of obvious filling were observed during the site walkover within vacant Lot 1 / DP 1119325 and Lot 24 / DP1138317. The nature of the fill material was unable to be assessed due to a dense grass cover.	<ul style="list-style-type: none"> > OPP; > PCBs; and > Asbestos
Landscape Supplies Activities (AEC06)	Albion Park Landscaping Supplies occupies Lot 1 / DP714125. The current commercial operations are situated north of the site, however, a portion of vacant land that has historically contained a large stockpile and equipment is within the site. Current and historical commercial operations may have included storage of potentially contaminated materials.	
Potential Coal Tar Asphalt Pavement (AEC07)	There is potential for existing remnant asphalt pavement within the site to contain coal tar. This includes pavement within Terry Street, Tripoli Way, The Expressway, Moles Street, Calderwood Road and the Illawarra Highway.	<ul style="list-style-type: none"> > Phenol; and > PAH
Demolished Building (AEC08)	At least one former building within Lot 3 / DP714125 has been demolished. The building is visible in the 1993 aerial imagery and is partially within the site. It is unknown if the building contained hazardous building materials and whether the waste was removed from site or disposed of on site.	<ul style="list-style-type: none"> > Heavy metals; and > Asbestos
Potential Filling with Keith Grey Oval (AEC09)	A portion of Keith Grey Oval is situated in the south eastern extremity of the site within Lot 1000 / DP813443. During construction of the oval imported fill may have contained contaminated material, solid waste and/or asbestos containing materials.	<ul style="list-style-type: none"> > Heavy metals > PAHs; > TRHs; > BTEXN; > Phenols; > OCP;

Potential Area of Environment Concern	Site Activity / Potential Source	Contaminants of Potential Concern
		<ul style="list-style-type: none"> > OPP; > PCBs; and > Asbestos

- > The following potential SPR linkages were identified in consideration of the AEC listed above:
 - Human Health
 - > Direct contact (including dermal, inhalation and ingestion) of current and future site occupants and workers with impacted site soils.
 - > Soil vapour inhalation by current and future site occupants and workers.
 - > Inhalation of asbestos fibres
 - Ecological
 - > Potential uptake of contaminants via root network
 - > Sediment laden runoff entering waterways
 - > infiltration of mobile contaminants into groundwater and potentially discharge into surface water bodies

Further investigation at each potential AEC is warranted to characterise and delineate possible contamination as per the recommendations below. An intrusive investigation would confirm the suitability of these areas for the proposed development and determine if remedial action is required to manage potential human health and environmental risk.

Potential Contamination

Based upon the findings of this PSI and with reference to the proposed future land use Cardno makes the following recommendations:

- > Intrusive investigations should be undertaken at each AEC to determine if measurable COPCs are present and the suitability of these areas for the proposed land use / redevelopment. Investigations should be undertaken in accordance with relevant regulatory legislation and guidance including the *National Environment Protection (Assessment of Site Contamination) Measure* 1999, as amended 2013.
- > Each AEC should be assessed for the applicable COPCs summarised in this report. If concentrations of COPCs are identified above the Tier I screening values, additional remedial or management actions may be necessary.
- > The proposed intrusive investigation should include a thorough inspection of all drainage channels and overgrown areas as well as private properties that were unable to be accessed during this investigation. Some areas were inaccessible at the time of the inspection due to a thick cover of Lantana and other vegetation, and as such potential contaminant sources were not adequately assessed.
- > A hazardous building material survey should be undertaken prior to the demolition of any buildings and structures within the site. Underground utilities such as water mains and Telstra pits may contain asbestos cement and should be identified and removed in accordance with regulatory guidance prior to and/or during construction of the project.
- > Any future works involving demolition and soil disturbance should incorporate an unexpected finds protocol to facilitate the identification and management of previously undocumented contamination.
- > The intrusive investigations and hazardous building materials surveys should take place prior to issue of a construction certificate (or similar).

Acid Sulfate Soils

Despite the likely absence of oxidisable sulfur in the soils tested, it is recommended that appropriate management measures be implemented during construction to mitigate the potential impact of acidic soils on

concrete and steel structures (i.e. aggressivity), noting that liming rates up to 12kg per tonne of soil were prescribed by the laboratory to neutralise acidity. It is also noted that the acid sulfate soil assessment was preliminary in nature and undertaken without a confirmed design and excavation extents.

Management measures must be designed and implemented prior to and during construction by an appropriately qualified geotechnical engineer as described below:

- > The data collected during this investigation should be reviewed by an appropriately qualified consultant upon confirmation of the project design and excavation extents, and at potential locations for ancillary sites where required. Supplementary testing must be undertaken to confirm the presence / absence and potential risk associated with acid sulfate soils. This applies particularly to areas of deep cut and at the locations of foundations and piling.
- > Whilst the acidity present in soil may not be attributable to oxidisable sulfur, it is recommended that future investigation be utilised to inform the requirement for an acid sulfate soil management plan (ASSMP (or equivalent), which if required must be prepared prior to the commencement of earthworks and construction. The management plan should be prepared in consideration of the ASSMAC Guidelines (ASSMAC 1998) and should be included as a sub-plan of the broader project Construction Environmental Management Plan (CEMP).
- > The management plan, if required, must include the following:
 - Review and interpretation of field testing and analytical results from previous investigations, and in doing so identify areas of the site that may contain ASS / acidic soils
 - Describe the proposed construction works and identify those works that may result in the disturbance of ASS / acidic soils
 - Detail the mitigation measures and actions that would be required to mitigate potential risks associated with disturbance of ASS / acidic soils. This includes but is not limited to excavated soils, excavation surfaces, soil treatment performance criteria, validation testing, stockpiling durations, soil treatment areas, prescribed liming rates, groundwater and surface water management and contingencies (e.g. weather events, over-liming and offsite disposal of soil)
 - Monitoring oversight and reporting requirements including environmental monitoring programs (surface water and stockpile), inspection and oversight and provision of suitable reporting and deliverables.

The ASSMP (or equivalent) must adhere to Part 6.1 of the Shellharbour City Council Local Environment Plan 2013 (LEP) and any other relevant local, state or national government planning and regulatory instrument. Additional testing may be required prior to or during construction to confirm the neutralising capacity of soil.

1 Introduction

1.1 Introduction

Cardno (NSW/ACT) Pty Ltd (Cardno) was engaged by Shellharbour City Council (the client) to prepare a Preliminary Site Investigation (PSI) and Targeted Site Assessment for the study area of the proposed Tripoli Way Extension (the “site”). The site is located at Albion Park NSW and encompasses areas of existing roadway, public open space and private properties.

The site location and regional context is depicted on the **Figure 1, Appendix A** and a site layout plan is shown on **Figure 2, Appendix A**. This PSI has been prepared in accordance with the scope of works presented in Cardno’s proposal *Offer of Professional Services - Tripoli Way Bypass - Rev3*, dated the 9th of February 2016.

1.2 Purpose and Objectives

The purpose of this investigation is to provide the client with a preliminary contamination assessment with the following objectives:

- > Assess the degree to which past and present activities may have caused contamination of land on the site and the potential for impacts to human and ecological receptors;
- > Assess the likelihood of acid sulphate soils (ASS) being present within the site; and
- > Assess the requirement, if any, for further environmental investigation to assess or make the site suitable for the proposed use.

1.3 Scope

Cardno carried out the following scope of works to meet the objectives of the PSI and Limited Site Assessment:

- > A site inspection/walkover that was undertaken by qualified and experienced Senior Environmental Scientist from Cardno to identify the presence of potential hazardous materials, evidence of current and/or historical contaminating activities, evidence for the storage or handling of chemicals, and waste management practices on or adjacent to the site;
- > A review of background information relating to the site including the following:
 - NSW Environment Protection Authority (EPA) registers including the Contaminated Land Public Record and List of NSW Contaminated Sites Reported to the NSW EPA;
 - Local and regional geology, hydrogeology, topography and hydrology;
 - Acid sulphate soil (ASS) and salinity risk maps;
 - Historic aerial photographs for the years 1948, 1963, 1979, 1990, 2006, 2015 and 2019;
 - Current and historical land title information for selected lots within the site. The lots presenting the greatest risk of historical activities that may have resulted in contamination were selected;
- > Targeted soil sampling during a geotechnical investigation undertaken at the site by Cardno to preliminarily assess for potential contamination. Eleven (11) primary soil samples were collected and submitted to a National Associated Testing Authority (NATA) accredited laboratory for analysis of the following:
 - Heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg);
 - Total Recoverable Hydrocarbons (TRH);
 - Benzene, Toluene, Ethyl-benzene, Xylenes and Naphthalene (BTEXN);
 - Polycyclic Aromatic Hydrocarbons (PAH);
 - Polychlorinated Biphenyls (PCBs);
 - Organochlorine and Organophosphate pesticides (OCP/OPP);

- Asbestos (presence / absence).
- > Collection of sixty-four (64) soil samples during the Cardno geotechnical investigation to assess for potential and actual ASS within the site. All samples were tested for pH field screening of which seventeen (17) were tested for Suspension Peroxide Oxidation – Combined Acidity and Sulfate (SPOCAS) and five (5) were tested for Chromium Reducible Sulfur.
- > Preparation of a PSI and Limited Site Assessment report (this report) in general accordance with the Guidelines for Consultants Reporting on Contaminated Sites (OEH, 2011) and the National Environmental Protection Measure (Assessment of Site Contamination), 1999, as amended 2013 (NEPM, 2013).

1.4 Guidelines and Legislation

The investigation and this report have been prepared with reference to the following guidelines and regulations.

- > CRC Care (2011) *Technical Report No. 10 Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater Part 1: Technical Development Document*, September 2011;
- > *National Environment Protection (Assessment of Site Contamination) Measure (NEPM)*. National Environment Protection Council (NEPC) 1999;
- > NSW ASSMAC (1998), *Acid Sulfate Soil Manual*, Acid Sulfate Soil Management Advisory Committee (ASSMAC) 1998;
- > NSW Department of Urban Affairs and Planning (1998) *Managing Land Contamination: Planning Guidelines: SEPP 55 Remediation of Land*, 1998;
- > NSW EPA (1995) *Contaminated Sites Sampling Design Guidelines*. New South Wales Environment Protection Authority (EPA), September 1995;
- > NSW OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites*. New South Wales Office of Environment & Heritage (OEH), November 1997, Reprinted September 2000, Reprinted August 2011;
- > Standards Australia (2005) *Australian Standard AS 4482.1-2005 – Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds*. Standards Australia, Homebush, NSW; and
- > Standards Australia (1999) *Australian Standard AS 4482.2-1999 - Guide to the sampling and investigation of potentially contaminated soil. Part 2: Volatile substances*. Standards Australia, Homebush, NSW.
- > WA DOH, 2009. *Guidelines for Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, Western Australia Department of Health (WA DOH).

2 Site Conditions & Surrounding Environment

2.1 Site Definition

The site locality is depicted on **Figure 1** of **Appendix A** and a site details are summarised in **Table 2-1**.

Table 2-1 Site Identification

Item	Details		
Site Address	The site runs parallel to the north of Tongarra Road/Illawarra Highway and encompasses multiple lots between the intersection of Broughton Avenue and Tongarra Road in the western portion to Terry Street in the eastern portion		
Site Area	The lateral extent of the site is indicated by the 'Study Area' boundary as shown on Figure 2 in Appendix A . The site has an approximate area of 276,500 m ² or 27.65 hectares (ha).		
Site Coordinates	Approximate centroid -34.569090, 150.763974		
Title Details (lot / Dp) * denotes part lot	31 / 1237947*	1178 / 1202087*	18 / 225240*
	13 / 286179*	5 / 225240*	1 / 38838*
	25 / 30705*	1179 / 1202087*	34 / 30705*
	1 / 602265*	30 / 253407*	31 / 253407*
	11 / 286179*	30 / 30705*	39 / 30705*
	1000 / 813443*	2 / 714125*	6 / 225240*
	60 / 30476*	6 / 38838*	13 / 225240*
	36 / 30705*	10 / 1151689*	12 / 225240*
	1 / 628732*	101 / 547372*	37 / 30705*
	27 / 30705*	220 / 1138309*	3 / 286179*
	3 / 714125*	1182 / 1202087*	8 / 286179*
	2 / 38838*	24 / 1138317*	1 / 225240*
	35 / 30705*	12 / 286179*	2 / 286179*
	11 / 1205733*	2 / 225240*	170 / 1131978*
	26 / 225240*	21 / 225240*	23 / 1138317*
	3 / 38838*	9 / 286179*	10 / 536561*
	28 / 30705*	15 / 248001*	10 / 286179*
	25 / 1237947*	1 / 714125*	1 / 1251688*
	4 / 714125*	2 / 1251688*	26 / 30705*
	32 / 253407*	1 / 1119325*	2 / 220429*
	4 / 286179*	102 / 547372*	61 / 30476*
	B / 38838*	7 / 225240*	5 / 286179*
	24 / 225240*	19 / 225240*	12 / 1205733*
	7 / 286179*	1 / 1069961*	107 / 748313*
	11 / 225240*	38 / 30705*	3 / 225240*
	14 / 225240*	25 / 225240*	24 / 30705*
	1 / 559819*	6 / 286179*	29 / 30705*
	68 / 253407*	20 / 225240*	4 / 225240*
	33 / 253407*	10 / 225240*	CP/SP88106–Cell 32*
	21 / 1107336*	22 / 225240*	CP/SP94622 – Cell 47*
	CP/SP47846 – Cell 83*		
Local Government Area	Shellharbour City Council		
Zoning	Various zones within the site including: <ul style="list-style-type: none"> ▪ RU1 – Primary Production; ▪ SP2 – Infrastructure; ▪ RE1 – Public Recreation; 		

Item	Details
	<ul style="list-style-type: none"> ▪ R2 – Low Density Residential; ▪ RU6 – Transition; and ▪ E3 – Environmental Management
Current Site Owners	Various property owners within the site.
Current Site Usage	The site encompasses rural land, low density residential, public open space and road corridor.

2.2 Proposed Development

The project would see the upgrade and extension of the existing Tripoli Way alignment to connect arterial roads, Terry Street (Illawarra Highway) and Tongarra Road (Illawarra Highway), without passing through the Albion Park Town Centre. The site encompasses the full length of these existing access roads and extends them east to link into the future Albion Park Rail bypass and west into Tongarra Road (Illawarra Highway) at the roundabout intersection with Broughton Avenue. The extension would primarily pass through undeveloped rural properties and the design aims to have a limited impact on existing residential lots.

The project will include the following general design features:

- > Significant road widening of the existing Tripoli Way to allow four (4) travel lanes (two in each direction) for the section of Tripoli Way east of Calderwood Road
- > The section of Tripoli Way west of Calderwood Road would consist of two (2) travel lanes (one in each direction) and incorporate a bridge and culverts to cross the existing Hazleton Creek at two locations
- > Addition of a second leg on the southern and northern approach on Hamilton Road to the intersection with TWE
- > Addition of a second leg on the southern approach on Calderwood Road to the intersection with site
- > A 2.5 m shared path on the northern side of the alignment, a 1.5 m footpath on the southern side for a section of the alignment, kerb and gutter, a minor and major stormwater drainage network and water treatment devices would also be installed as part of the upgrade
- > A bridge will be constructed for the site to cross the existing Hazleton Creek. The new bridge will have an overall span of approximately 52 m and has been documented as a three span bridge in order to span the channel and maintain hydrological constraints
- > Three signalised intersections from Calderwood Road east to Terry Street, with potential for future signalisation of the Broughton Avenue intersection from existing roundabout.

The primary objective of the project is to alleviate traffic impacts through the Albion Park Town Centre. Population modelling indicates that the Shellharbour LGA is expected to grow 28% between 2020 and 2041. As such an upgrade to the local road network is required to proactively manage the current and future pressures on local roads.

To facilitate the development there will be a requirement to establish at least one ancillary site within the broader site for the storage of construction materials, temporary site offices, lay down areas and amenities areas for site workers. Portions of the site that have been considered as potential locations for ancillary sites are illustrated on **Figure 2** in **Appendix A**.

2.3 Site Description

The Tripoli Way Extension is located within Albion Park; a suburb in the Shellharbour City Council Local Government Area (LGA).

The existing Tripoli Way is a local road that currently runs between Hamilton Road to the east and Calderwood Road to the west. The roadway is split into two segments, separated by residential development. The existing road extends approximately 455 metres east of Hamilton Road and 65 metres west of Calderwood Road, with the two portions separated by a residential lot (see **Figure 2** in **Appendix A**). Photographs of the site as viewed during December 2019 are presented in **Appendix B**.

2.4 Surrounding Land Uses

The site and surrounding land uses are illustrated in **Figure 1** of **Appendix A** and are summarised below in **Table 2-2**.

Table 2-2 Surrounding Land Uses

Direction	Land Use or Activity
North	Rural-residential and agricultural (livestock grazing) land users and the Macquarie Rivulet are located north of the site. The Macquarie Rivulet is a perennial river that is listed as Environmentally Sensitive Land under the Shellharbour Local Environmental Plan (2013).
East	The Illawarra Highway, Frazers Creek and associated wetland are located east of the site. The wetland and its foreshore are classified as "Environmentally Sensitive Land" under the Shellharbour LEP (2013). May Harris Park, including Keith Gray Oval and the Albion Park Showground, are located further east. May Harris Park is listed as a heritage item under the Shellharbour LEP (2013).
South	Low-Medium density residential development of the Albion Park township and Tongarra Road.
West	Hazelton Creek, rural landscape and the current development of Calderwood Valley are located west of the site.

2.5 Topography and Drainage

The topography within the site is highly modified and typically situated in areas of low density residential and rural-residential dwellings within the suburb of Albion Park.

The site has a gradual fall from west to east toward Macquarie Rivulet and has an elevation ranging from 9m Australian Height Datum (AHD) in the east to 15m AHD in the west. Macquarie Rivulet is located approximately 130m north of the study area and runs roughly parallel with the proposed road corridor.

In the developed parts of the site surface water site is expected to drain to existing stormwater drainage infrastructure and discharge into the Macquarie Rivulet.

2.6 Geology and Hydrogeology

2.6.1 Soil Landscape

The NSW Office of Environment and heritage online tool, eSPADE, was accessed on the 13th of January 2020 and situates the western portion of the study area within the Fairy Meadow landscape which is characterised by gently undulating broad alluvial plains with slopes of less than 5% gradient, and floodplains and valley flats with minor terraces and scattered swamps. The remainder, and majority, of the study area is situated within the Albion Park landscape, which is characterised by short steep upper slopes grading into long gently inclined foot slopes.

The limitations of the soil landscape are listed as localised flood hazards, seasonal water logging, permanently high-water tables and run-off. These areas generally have gently undulating and mostly flat topography.

The central portion of the site is located on the Albion Park Erosional Landscape which is characterised by short steep upper slopes grading into gently inclined foot slopes. The landscape is known to encounter waterlogging, seasonally high-water table, shrink-swell; low wet bearing strength, high available water-holding capacity.

The soils encountered during the intrusive investigation are summarised in **Section 8.2** and in the geological logs provided in **Appendix C**.

2.6.2 Geology

The geology of the site was obtained from the Shellharbour-Kiama Area Coastal Quaternary Geology Map (OEH, 2007) and Kiama 1:50,000 Geological Map 9028-I (Geological Survey of NSW, 1974), which are shown on **Figures 3** and **4** of **Appendix A** and described below:

- > Quaternary age alluvium and Permian age Shoalhaven Group geology of the Berry Formation. Alluvium is located at the eastern and western end of the site and at areas within close proximity to Macquarie Rivulet. The alluvium can be described as, gravel, swamp deposits and sand dunes.

- > Permian age Shoalhaven Group geology of the Berry Formation is located in the central portion of the site and is characterised by undifferentiated siltstone, shale and sandstone.
- > Older (Pleistocene) alluvial deposits over the eastern section of the site, with more recent Holocene deposits characterising the floodplain at the western end of the alignment.

The geological conditions encountered during the intrusive investigation are summarised in **Section 8.2** and in the geological logs provided in **Appendix C**.

2.6.3 Groundwater

A search of the NSW Department of Primary Industries (Water) groundwater database of registered groundwater bores were undertaken on the 26th of November 2019. The search identified one registered groundwater bore located within 500 m of the site, which is located approximately 110 m south of the site. Groundwater details from the bore are provided below in **Table 2-3**.

Table 2-3 Registered Bore Summary

Bore ID	Distance from Site	Well Depth (m bgl)	Groundwater Depth (m bgl)	Geology
GW107819	110m south	150m	0.2 m (water strike noted at 14m)	0.0-0.7m – clay 7.0-150m - siltstone

Three boreholes, BH003, BH006 and BH007, were drilled by Cardno in 2016 in the low-lying western portion of the site in the vicinity of Hazleton Creek. Each borehole was converted to a permanent groundwater monitoring well and groundwater levels were gauged on up to seven occasions between the 17th of August 2016 and the 3rd of July 2017.

The data obtained by Cardno is reported in the *Geotechnical Investigation Factual Report* (2018) and shows that the depth to groundwater ranged from 0.78 to 1.56 metres below ground level (m bgl), indicative of a shallow groundwater table. Groundwater samples were not collected or submitted for laboratory testing during the geotechnical investigation.

2.6.4 Acid Sulphate Soils

With reference to Shellharbour City Council's 2013 Local Environmental Plan (LEP) ASS risk maps, the site footprint lies outside the indicative regions mapped as at risk of ASS. A large portion north of the site, north of Macquarie Rivulet, is mapped as a Class 4 ASS area as illustrated below on **Figure 1-1** and shown on **Figure 5** of **Appendix A**.



Figure 1-1 ASS risk mapping included in Shellharbour Local Environmental Plan 2013

Whilst the LEP does not indicate the presence of ASS beneath the site, given the alluvial nature and low relative elevation the presence of ASS cannot be discounted. Acid sulfate soils were assessed as part of this limited site assessment and the analytical results are discussed in **Section 8.3.3**.

2.6.5 Salinity

The NSW Office of Environment and Heritage eSPADE landscape maps were reviewed as a preliminary indicator of potential site salinity. The report for the Fairy Meadow Landscape indicates that salinity may be present in olive brown heavy clay subsoil, however, the report does not specify the depth at which this material may be encountered. The Albion Park Landscape report does not identify the soils as being prone to salinity.

3 Site Walkover

An experienced Environmental Scientist from Cardno inspected the site on the 18th of December 2019 and a summary of observations made during the inspection is provided in **Table 3-1**. Photographs taken during the inspection are provided in **Appendix B** and are referenced below where relevant.

Table 3-1 Site Observations

Item	Observations
Site use	<p>Western Portion: the western portion of the site is shown on Figure 2 of Appendix A and contained mostly agricultural land utilised for cattle grazing, however, an area of stockpiling was visible in the far western extremity of the site and appears to be associated with construction of the nearby Calderwood residential subdivision. The western portion of the site also contains Hazleton Creek which enters the site from the south west and exits the site to the north east of the western portion.</p> <p>Central Portion: the central portion of the site is shown on Figure 2 of Appendix A and is predominantly occupied by rural-residential land users, low density residential dwellings and public roads including The Expressway, Tripoli Way and Calderwood Road.</p> <p>Eastern Portion: the eastern portion of the site is shown on Figure 2 of Appendix A and is predominantly occupied by rural residential land users, public open space, the north western portion of Keith Grey Oval and an environmentally sensitive wetland at the far eastern extremity.</p>
Weather condition	The weather during the site inspection was hot (approx. 28°C), humid, with a dense smoke haze and no recent rainfall.
Topography and drainage features	The topography of undisturbed areas had a general grade toward local surface water bodies such as Hazleton Creek and Macquarie Rivulet. Disturbed areas had a general topography toward stormwater infrastructure.
Nearby water bodies	Hazleton Creek is located in the south western portion of the site and is a tributary of Macquarie Rivulet (see Photographs 1, 2, 4 and 11 of Appendix B). The Macquarie Rivulet is located between 75 to 200m from the northern perimeter of the site, flowing in an easterly direction and discharging into Lake Illawarra which is approximately 3.7 kilometres north east.
Site surface coverings	The surface covering across the site is a mixture of building footprints, concrete footpaths, road pavement, grassed areas and mature trees as show on Figure 2 in Appendix A and the photographs in Appendix B .
Surface soils	Observations of surface soils were limited to small patches of bare ground in the vicinity of residential buildings and in paddocks. Surface soils appeared to comprise of brown silt and clay with some gravels.
Site cut and fill	<p>Locations where filling was observed during the inspection are described below:</p> <ul style="list-style-type: none"> Filling was largely absent from the western portion of the site with the exception of imported material used to construct an internal bridge over Hazleton Creek and an associated bituminous road in Lot 1182 in DP1202087 (see Photograph 2 of Appendix B). Localised areas of filling were observed in the central portion of the site around the existing Tripoli Way and within the properties to the north. The nature of the fill was unable to be properly assessed due to a dense grass cover (see Photograph 11 of Appendix B). The eastern portion of the site contained filling in a vacant portion of land north of Mountainview Mews, formally identified as Lot 1 in DP1119325 (see Photographs 20 and 21 of Appendix B). The nature of the fill was unable to be properly assessed due to a dense grass cover.
Buildings / Structures	<p>Buildings within the site are limited to the following:</p> <ul style="list-style-type: none"> The dilapidated and heritage listed former Tulkeroo and Albion Park Butter Factory, which is situated within Lot 12 in DP1205733 between The Expressway and Tripoli Way (see Photographs 15 to 17 of Appendix B). At the time of the inspection the building was unable to be accessed due to safety risk. A shed located within the Albion Park Landscaping Supplies at Lot 1 in DP714125. Access to this lot was not permitted so an assessment of the shed was unable to be completed.

Item	Observations
	<ul style="list-style-type: none"> Several buildings were visible in Lot 4 in DP714125, however, access to this lot was not permitted so an assessment of the buildings was unable to be completed. <p>Structures within the site were limited to fences and road infrastructure including pavement, street lights, reflector posts and signage. Two creek crossings across Hazleton Creek were also observed in the western portion of the site, one within Lot 1182 in DP1202087 and the other in Lot 1 in DP559819 (see Photographs 2 and 4 of Appendix B).</p>
Existing Services	<p>Services within the site were unable to be identified in their entirety due to the large site area, however, it is assumed that at a minimum the site would contain water, power, communications and sewer at varying locations, particularly within road easements and surrounding residential lots.</p> <p>A number of Telstra pits were observed within the site during the inspection that potentially contained asbestos cement (see Photograph 18 of Appendix B).</p>
Potential asbestos in building materials	<p>Buildings within the site include Tulkeroo and Albion Park Butter Factory toward the middle of the site in Lot 12 in DP1205733, a shed in Lot 1 in DP714125 and several buildings in Lot 4 in DP714125.</p> <p>The Butter Factory was fenced at the time of the inspection and as such the potential presence of asbestos was unable to be properly assessed. Remaining buildings were unable to be accessed and therefore the potential presence of hazardous building materials is unknown.</p> <p>No other structures within the site are expected to contain asbestos with the exception of underground utilities such as water mains and Telstra pits.</p>
Other hazardous building materials	<p>No other potential hazardous building materials were observed during the site inspection.</p>
Manufacturing, industrial or chemical processes and infrastructure	<p>The former Albion Park Butter Factory is the only location within the site (Lot 12 in DP1205733) that was historically used for manufacturing / industrial processes. The building historically served as a cooperative for local dairy farmers to produce dairy products including butter. The former butter factory has approximate dimensions of 23 x 17m and the potential for bulk storage of chemicals is limited. Infrastructure associated with chemical storage were not observed during the inspection nor was there evidence of chemical residue or staining. Though the building and surrounds were unable to be properly inspected due to limited access.</p> <p>Evidence of industrial or chemical processes and infrastructure were not observed at any other portions of the site during the inspection.</p>
Fuel storage tanks (USTs/ASTs)	<p>Evidence of Underground Storage Tanks (USTs) or aboveground storage tanks (ASTs) for fuel storage were not observed during the site visit. An AST with an approximate volume of 500L was observed within the southern portion of Lot 1 in DP559819 (see Photograph 9 of Appendix B), however, it was situated approximately 10m north of the site. Significant staining was not observed on the ground surface beneath the AST.</p>
Dangerous goods	<p>Storage of dangerous goods was not observed during the site inspection.</p>
Solid waste deposition	<p>Solid waste was observed at the following locations within the site:</p> <ul style="list-style-type: none"> At the far western extremity of the site within Lot 1182 in DP1202087 where a laydown area and large stockpiles were observed (see Photograph 3, 26 and 27 of Appendix B). The land is believed to be under occupation by Lend Lease during the Calderwood residential development and was inaccessible at the time of the inspection. The nature of the stockpiled material was unable to be confirmed due to the distance from which observations were made, however, it appeared to be construction materials and waste including concrete, asphalt and coal washery reject. Aerial imagery accessed using Nearmap suggests that the area has been used as a laydown and storage area since at least May 2017. Minor filling within Hazleton Creek in the western portion of the site within Lot 1182 in DP1202087 and Lot 1 in DP559819. Filling was mostly evident around creek crossings that appear to have been constructed using concrete culverts and backfill including soil and demolition rubble (see Photographs 2 and 11 of Appendix B). Trace quantities of litter were observed within Hazleton Creek but is inferred to be runoff from the upgradient Illawarra Highway. A significant quantity of farming equipment and other miscellaneous materials were observed during the inspection of the southern portion of Lot 1 in DP559819 which is a rural-residential property located west of The Expressway. The materials observed included discarded refrigerators, steel drums, metal farming equipment including

Item	Observations
	irrigation pipe, rusted metal parts and a disused truck (see Photographs 8 to 10 of Appendix B).
Stockpiles	<p>Several stockpiles were observed in Lot 1182 in DP1202087 at the western extremity of the site, however, the nature of the stockpiled material was unable to be determined as access to the area was limited (see Photograph 3, 26 and 27 of Appendix B).</p> <p>Two stockpiles were observed in Lots 11 and 12 of DP1205733 within close proximity to the former Albion Park Dairy (see Photograph 12 and 13 of Appendix B). The contents of each stockpile were unable to be assessed as the stockpiles were vegetated with grass.</p>
Liquid waste disposal features	None observed, however, the township of Albion Park is connected to the local sewer network so wastewater is inferred to be managed by Sydney Water.
Evidence of previous site contamination investigations	None observed.
Evidence of land contamination (staining or odours)	None observed.
Evidence of groundwater contamination	None observed.
Groundwater use	It is possible that groundwater is extracted within the site, particularly for agricultural purposes such as stock watering and irrigation, however, no groundwater bores or windmills were observed during the inspection.
Vegetation	Vegetation within the site is mostly limited to grass cover with only sporadic trees observed, mostly around waterways and within road corridors. One stand of mature trees was observed toward the centre of the site within Lot 1 of DP1119325 with most trees appearing in reasonable condition (see Photograph 21 of Appendix B).
Site fencing	The site comprises of both private property, road corridor and public open space. Private properties were fenced with conventional and typical materials such as timber and wire.

4 Site History

4.1 EPA Records Search

4.1.1 Contaminated Land Record of Notices

The Contaminated Land Record of Notices is maintained by the Environment Protection Authority (EPA) in accordance with Part 5 of the Contaminated Land Management (CLM) Act 1997 and contains regulatory notices issued by the Environment Protection Authority (EPA) in relation to contaminated sites. The Record of Notices was searched on the 26th of November 2019 for notices within the suburb of Albion Park. The search did not identify any contaminated sites.

4.1.2 PoEO Public Register

The PoEO Public Register under Section 308 of the Protection of the Environment Operations (PoEO) Act 1997 contains Environment Protection Licences (EPLs), applications and notices issued by the EPA. The Public Register was searched on 26th of November 2019 within the suburb of Albion Park to identify any issues of relevance to the site. There were no records for EPLs or contaminated lands for the suburb of Albion Park.

4.1.3 List of NSW Contaminated Sites Notified to the EPA

A search of the List of NSW Contaminated Sites Notified to the EPA was undertaken on 26th of November 2019 and did not identify any sites within the suburb of Albion Park.

4.2 Historical Aerial Photograph Review

Cardno reviewed seven (7) historical aerial photographs taken in the years 1948, 1961, 1973, 1980, 1993, 2008 and 2016. The intent of the review was to identify potential historical land uses that may present potential contaminant sources. The aerial photograph summary is provided below in **Table 4-1** below while the photos are included in **Appendix D**.

Table 4-1 Aerial Photograph Analysis

Year	Onsite	Offsite
1948 (B&W)	<p>Western portion: no buildings or structures are visible within the western portion of the site. Hazleton Creek and the Illawarra Highway are visible and their location is consistent with current day. Agricultural activities are evident across the entire western portion of the site with fence lines and paddocks visible.</p> <p>Central portion: Calderwood is visible intersecting the site from north to south and a number of buildings are located approximately 30m west, which are inferred to be the Tulkeroo Butter Factory. A number of small structures are also visible to the east of Calderwood Road and appear to be agricultural sheds.</p> <p>Eastern portion: no buildings or structures are visible within the eastern portion of the site. The dominant land use appears limited to agricultural.</p>	<p>Western portion: areas to the north, south and west of the site are dominated by an agricultural land use. A number of buildings and structures are visible approximately 100 m east of the site along Tongarra Road</p> <p>Central portion: the dominant surrounding land use in all directions is agricultural with only a scatter of buildings visible, mostly to the south and east along Taylor and Calderwood Road. Macquarie Rivulet is visible to the north of the site.</p> <p>Eastern portion: the dominant surrounding land use in all directions is agricultural with only a scatter of buildings and structures visible, mostly to the north along Hamilton Road. Macquarie Rivulet is visible to the north of the site and a wetland is visible to the east of Terry Street.</p>
1961 (B&W)	<p>Western portion: no buildings or structures are visible within the western portion of the site. Agricultural activities remain the dominant land use.</p> <p>Central portion: the central portion of the site remains relatively unchanged since 1948 with the exception of construction of The Expressway and Tripoli Way.</p> <p>Eastern portion: the eastern portion of the site remains relatively unchanged since 1948 with the exception of construction of Tripoli Way.</p>	<p>Western portion: the surrounding land use of the western portion remains relatively unchanged since 1948.</p> <p>Central portion: a significant amount of urban development is visible to the south of the site when compared with 1948 with residential houses and public roads evident.</p> <p>Eastern portion: urban development is visible to the south of the site but otherwise the surrounding area is relatively unchanged.</p>

Year	Onsite	Offsite
1973 (B&W)	<p>Western portion: the western portion of the site remains relatively unchanged since 1961.</p> <p>Central portion: the central portion of the site remains relatively unchanged since 1961 with the exception of rural residential buildings that have been constructed along the northern boundary.</p> <p>Eastern portion: the eastern portion of the site remains relatively unchanged since 1961 with the exception of the construction of Keith Grey Oval in the far south eastern extremity of the site.</p>	<p>Western portion: the surrounding area is relatively unchanged since 1961.</p> <p>Central portion: urban development has continued in the general area, particularly to the south of the central portion of the site.</p> <p>Eastern portion: the surrounding area is relatively unchanged since 1961, however, an area of suspected filling north of Tripoli Way in Lot 3 / DP 605111.</p>
1980 (B&W)	<p>Western portion: aerial imagery is not available for the majority of the western portion of the site. Pollock Park and a bridge over Hazleton Creek appear to have been built adjacent to Pollock Crescent.</p> <p>Central portion: the central portion of the site appears generally unchanged since 1973.</p> <p>Eastern portion: the central portion of the site appears generally unchanged since 1973.</p>	<p>Western portion: aerial imagery is not available for the majority of the western portion of the site.</p> <p>Central portion: urban development has continued in the general area, particularly to the south.</p> <p>Eastern portion: urban development has continued in the general area, particularly to the south.</p>
1993 (Colour)	<p>Western portion: the western portion of the site appears largely unchanged with the exception of a laydown area that has been established in Lot 1 / DP 559819. The nature of the equipment / materials stored at this location are not evident from the imagery.</p> <p>Central portion: The central portion appears largely unchanged since 1980.</p> <p>Eastern portion: ground disturbance and potential filling is visible within Lot 1 / DP 1119325. Two roads now pass within the site from Terry Street that lead to two dwellings located north of the site.</p>	<p>Western portion: the surrounding area is relatively unchanged since 1980.</p> <p>Central portion: the surrounding area is relatively unchanged since 1980 but further urban development is evident.</p> <p>Eastern portion: continued urban development is evident north and south of the eastern portion. A laydown area appears to have been established immediately south of the site within Lot 4 / DP 714125. The nature of the equipment / materials stored at this location are not evident from the imagery.</p>
2008 (Colour)	<p>Western portion: the western portion of the site appears largely unchanged since 1993. A gravel road appears to have been constructed north of the Illawarra Highway and connects to the Calderwood Valley development further west.</p> <p>Central portion: the central portion appears largely unchanged since 1993.</p> <p>Eastern portion: the eastern portion appears largely unchanged since 1993 with the exception of additional filling, disturbance and stockpiling within Lot 1 / DP 1119325. A large stockpile is also visible in Lot 1 / DP 714125 and appears to be covered with grass.</p>	<p>Western portion: the surrounding area is relatively unchanged with the exception of a large residential subdivision located south of the Illawarra Highway.</p> <p>Central portion: the surrounding area is relatively unchanged, however, potential filling and ground disturbance is visible in Lot 24 / DP 1138317, approximately 80 m north of the site boundary.</p> <p>Eastern portion: a commercial operation is evident at the location of Albion Park Landscaping Supplies (Lot 1 / DP 714125) with storage of materials and equipment visible.</p>
2016 (Colour)	<p>Western portion: ground disturbance and an excavation are visible in the far western extremity of the site. The excavation appears to be partially filled with water and may be associated with the nearby subdivision to the west. A new crossing over Hazleton Creek is also visible in the western portion with an associated internal road that appears to be constructed of gravel.</p> <p>Central portion: the laydown area established in Lot 1 / DP 559819, first visible in the 1993 image has extended further east.</p> <p>Eastern portion: a building located within Lot 3 / DP 714125 appears to have been demolished since 2008. Remnants of the building and potential waste are not visible at this location.</p>	<p>Western portion: residential subdivisions are under construction to the south and west of the site.</p> <p>Central portion: the surrounding area is generally unchanged since 2016.</p> <p>Eastern portion: the surrounding area is generally unchanged since 2016.</p>

4.3 Historical land titles

Historical and current land titles were obtained for select lots to assess for historical and current land uses that may present a potential contaminant risk. Lots selected for land title assessment were based upon the review of historical aerial imagery along with the observations from the detailed site inspection and included the following:

- > Lot 1182 / DP1202087
- > Lot1 / DP559819
- > Lot12 / DP1205733
- > Lot1 / DP1119325
- > Lot1 / DP714125
- > Lot4 / DP714125
- > Lot 11 / DP1205733
- > Lot 24 / DP1138317
- > Lot 1000 / DP813443

Copies of current and historical land titles are provided in their entirety in **Appendix E** and a summary of landuses is provided in the table below:

- > Lot 12 in DP 1205733 was owned and operated by The Albion Park Dairy Company Limited between 1887 to 1908. Depending on the scale of the operation there may have been potential contaminant sources at the site associated with industrial processes such as storage of petroleum products.
- > Lot 24 / DP 1138317 was owned by individuals with listed occupations of builder and carpenter from 1960 to 1983. There is potential for building materials and demolition wastes to have been stored / deposited at the site including asbestos containing materials.
- > Lot 1000 / DP 813443 (excluding Lot 33 D.P. 1237947) was acquired by the Municipality of Shellharbour in the early 1960s for the purpose of public recreation i.e. construction of sporting facilities including Keith Grey Oval and the Albion Park Showground. Fill imported to site during construction of the oval and showground may have contained contaminated material and/or asbestos containing materials.

4.4 Previous Environmental Reports

No previous environmental reports relevant to potential existence of contamination at the site were provided to Cardno for review.

4.5 Site History Data Gaps

The following data gaps have been identified as part of the site desktop investigation:

- > Several privately-owned lots within the site were unable to be inspected due to refusal of access or no response from the landowner. Such lots included:
 - Lot 25 in DP 1237947
 - Lot 1 in DP 714125
 - Lot B in DP 38838
 - Lot 4 in DP 714125
 - Lot 2 in DP 220429
 - Lot 3 in DP 714125
 - Lot 24 in DP 1138317
- > The historical aerial photograph from 1980 does not cover the far-western portion of the site.

5 Preliminary Conceptual Site Model

Generally, a conceptual site model (CSM) provides an assessment of the fate and transport of contaminants of potential concern (COPC) relative to site-specific subsurface conditions with regard to their potential risk to human health and the environment. Potential risk to human health and the environment is identified through complete or potentially complete Source – Pathway – Receptor (SPR) linkages. In order to identify SPR linkages the CSM considers site-specific factors including:

- > Source(s) of contamination;
- > Identification of COPCs associated with past (and present) source(s);
- > Vertical, lateral and temporal distribution of COPC;
- > Site specific information including soil type(s), depth to groundwater, effective porosity, and groundwater flow velocity; and
- > Actual or potential receptors considering both current and future land use both for the site and adjacent properties, and any sensitive ecological receptors.

Based on the information available at the time of the PSI the preliminary CSM in **Table 5-1**, including potentially complete SPR linkages was developed.

Table 5-1 Preliminary Conceptual Site Model

Source	Potentially Impacted media	COPC	Pathway	Receptor
Filling and tipping within vacant Lot 1 / DP 1119325	Soil	Metals, PAHs, TRHs, BTEXN, asbestos, phenols, OCP, OPP, PCBs	Human: direct contact with impacted media including dermal contact and ingestion; inhalation of asbestos fibres Ecological: potential uptake of contaminants via root network; infiltration of mobile contaminants into groundwater and potentially discharge into surface water bodies	Human: current site users and future site workers Ecological: a stand of mature trees within and nearby; waterbodies such as Macquarie Rivulet
Laydown areas at the western extremity of Lot 1182 in DP1202087; and southern portion of Lot 1 in DP559819	Soil and water	Metals, PAHs, TRHs, BTEXN, asbestos, phenols	Human: direct contact with impacted media including dermal contact and ingestion; inhalation of asbestos fibres Ecological: sediment laden run-off entering waterways such as Hazleton Creek and Macquarie Rivulet; infiltration of mobile contaminants into groundwater and potentially discharge into surface water bodies	Human: current site occupants, future site workers Ecological: flora and fauna within nearby waterbodies Hazleton Creek and Macquarie Rivulet
Stockpiling within Lot 1182 in DP1202087 at the western extremity of the site	Soil and water	Metals, PAHs, TRHs, BTEXN, asbestos, phenols, OCP, OPP, PCBs	Human: direct contact with impacted media including dermal contact and ingestion; inhalation of asbestos fibres Ecological: sediment laden run-off entering waterways such as Hazleton Creek and Macquarie Rivulet; infiltration of mobile contaminants into groundwater and potentially discharge into surface water bodies	Human: current site users, future site workers Ecological: flora and fauna within nearby waterbodies Hazleton Creek and Macquarie Rivulet

Source	Potentially Impacted media	COPC	Pathway	Receptor
Activities undertaken at the landscaping supplies operation at Lot 1 in DP 714125	Soil and water	Metals, PAHs, TRHs, BTEXN, asbestos, phenols, OCP, OPP, PCBs	<p>Human: direct contact with impacted media including dermal contact and ingestion; inhalation of asbestos fibres</p> <p>Ecological: sediment laden run-off entering waterways such as Macquarie Rivulet; potential uptake of contaminants via root network; infiltration of mobile contaminants into groundwater and potentially discharge into surface water bodies</p>	<p>Human: current site occupants, future site workers</p> <p>Ecological: flora and fauna within and surrounding area; waterbodies such as Macquarie Rivulet and Boles Meadow</p>
Activities undertaken at the former Albion Park Butter Factory at Lot 12 in DP1205733	Soil and water	Metals, PAHs, TRHs, BTEXN, asbestos, phenols, OCP, OPP, PCBs	<p>Human: direct contact with impacted media including dermal contact and ingestion; inhalation of asbestos fibres</p> <p>Ecological: infiltration of mobile contaminants into groundwater and potentially discharge into surface water bodies including Macquarie Rivulet and Boles Meadow</p>	<p>Human: current site occupants, future site workers</p> <p>Ecological: flora and fauna within and surrounding water bodies</p>
Surrounding a demolished building at Lot 3 / DP 714125	Soil and water	Heavy metals, asbestos	<p>Human: direct contact with impacted media including dermal contact and ingestion; inhalation of asbestos fibres</p> <p>Ecological: sediment laden run-off entering wetland east of Terry Street (Boles Meadow)</p>	<p>Human: current site occupants, future site workers</p> <p>Ecological: flora and fauna within and surrounding the wetland (Boles Meadow)</p>
Potential ACM within buried services and Telstra pits across the broader site	Soils	Asbestos	Human: inhalation of asbestos fibres	Human: future site workers
Potential filling and waste deposition within Keith Grey Oval	Soil	Metals, PAHs, TRHs, BTEXN, asbestos, phenols, OCP, OPP, PCBs	<p>Human: direct contact with impacted media including dermal contact and ingestion; inhalation of asbestos fibres</p> <p>Ecological: infiltration of mobile contaminants into groundwater and potentially discharge into surface water bodies within Boles Meadow / Frazers Creek</p>	<p>Human: future site workers</p> <p>Ecological: flora and fauna within and surrounding the wetland</p>

Notes: heavy metals (arsenic, cadmium, chromium (total), copper, lead, mercury, nickel and zinc); Polycyclic Aromatic Hydrocarbons (PAHs); Total Recoverable Hydrocarbons (TRHs); Benzene, Toluene, Ethylbenzene, Xylenes (total), Naphthalene (BTEXN); Organochlorine Pesticides (OCPs); Organophosphate Pesticides (OPPs); Polychlorinated Biphenyl (PCB).

6 Assessment Criteria

6.1 Soil assessment criteria

Soil assessment criteria have been adopted from *National Environmental Protection Measure (Assessment of Site Contamination)*, 1999. Adopted criteria and their application are summarised below.

6.1.1 Human Health Criteria

NEPM 2013, Health investigation levels – Commercial / Industrial D

Health investigations levels (HIL) D have been adopted to assess risk to site users given the current and proposed future land use of a public road.

NEPM 2013, Health screening level – Commercial / Industrial D

Health screening level (HSL) D has been adopted to assess the potential for a vapour intrusion risk to be present from site soils. These criteria consider current site users and allow for potential redevelopment of the site. Based on the material descriptions collected during filed work, samples were screened against criteria for silt based soils.

6.1.2 Other Soil Criteria

NEPM 2013, Ecological Investigation Levels and Ecological Screening levels – Commercial / Industrial

Ecological Investigation Levels (EIL) and Ecological Screening Levels (ESL) for a commercial / industrial land use have been adopted as ecological screening criteria. The highly disturbed nature of the site limits the potential for sensitive ecological receptors to exist, however, it is noted that Hazleton Creek passes through the western portion of the site and two water bodies are located within close proximity to the site, including Macquarie Rivulet and an unnamed wetland to the east.

The application of the commercial / industrial EIL and ESL are considered appropriate to capture risk to potential ecological receptors. Due to the preliminary nature of the intrusive works no soil samples were analysed for the parameters specified in the NEPM for deriving site specific EIL values including % clay, Conductivity, pH, Total Organic Carbon and % iron. Instead EILs were derived in accordance with the methodology described in *Schedule B5c – Guidelines on soil quality guidelines for arsenic, chromium (III), copper, DDT, Lead, Naphthalene, Nickel & Zinc* (NEPC 2013), which is to calculate the sum of the ambient background concentration (ABC) and added contaminant limit (ACL). In the process of deriving criteria it has been assumed that the Suburb Type is “Old suburb, low traffic”, the cation exchange capacity is 10 cmolc/kg, clay content of 2.5% and pH of 6.

Tabulated soil analytical results are compared to the above noted guidelines, which are provided in **Appendix F**.

7 Site investigation methodology

7.1 Sample Strategy and Methodology

Fieldwork was undertaken by an experienced Cardno environmental engineer in accordance with the agreed scope of work. The records and observations made during the fieldwork are presented in the geological logs are presented in **Appendix C**. Tabulated summaries of laboratory results are presented in **Appendix F**. The Quality Assurance/Quality Control program is discussed and summarised in **Section 7.2**. Copies of the NATA stamped laboratory reports and chain of custody documentation are included in **Appendix G**.

Table 7-1 Investigation Activity Summary

Activity	Details
Dates of Field Activity	Soil sampling associated with the limited site assessment was completed on the 10 th of August 2016 and the 11 th , 14 th and 15 th of September 2017.
Service Location	A Telstra accredited service locator was engaged to locate and mark services in the vicinity of each intrusive location to avoid damage to subsurface utilities.
Sampling Locations	<p>Soil samples were collected and submitted for laboratory testing from the investigation locations described below and shown on Figure 6 of Appendix A:</p> <ul style="list-style-type: none"> ▪ Boreholes BH001, BH002, BH003, BH007, BH008, BH101 and BH102 – excavated utilising a Hanjin D&B 8D drill rig; ▪ Test pits TP101, TP102, TP103, TP104 and TP105 – excavated utilising a 5 tonne tracked; ▪ Test pits TP002, TP006, TP008, TP010 and TP011 – excavated utilising a 12 tonne tracked excavator; ▪ Pavement test bores TB101, TB102, TB103 and TB104 – excavated using a 5 tonne tracked excavator fitted with a solid flight auger.
Rationale	<p>Opportunistic soil sampling to assess for potential contamination was undertaken at the following locations:</p> <ul style="list-style-type: none"> ▪ BH101 and TP105: to assess soil at the eastern end of the site within close proximity to Terry Street (Lot 2 / DP714125); ▪ TB103: to assess for potential filling beneath Terry Street; ▪ TP101 and TP103: to assess soil within a portion of land located south of the Landscape Supplies business (Lot 1 / DP714125); ▪ TP006: to assess for potential filling within Tripoli Way, south of the fill area within rural residential property (Lot 24 / DP1138317); ▪ TP008: to assess for potential filling within vacant land (Lot 1 / DP1119325); ▪ TP011: to assess soil in the vicinity of the former Albion Park Butter Factory (Lot 12 / DP1205733). <p>Soil samples were collected from the following intrusive locations to assess for acid sulfate soils:</p> <ul style="list-style-type: none"> ▪ Test pits TP002, TP006, TP008, TP010, TP012, TP101, TP102, TP103, TP104 and TP105; ▪ Boreholes BH001, BH002, BH003, BH007, BH008, BH101 and BH102; ▪ Pavement test bores TB101, TB102, TB103 and TB104.
Soil Logging	Soils encountered during the investigation were described and logged by a qualified and experienced individual. The geological logs are presented in Appendix C .
Sample Collection	<p>Soil samples were collected from excavated spoil or immediate ground surfaces utilizing a fresh pair of nitrile gloves between each sample location to limit potential for cross-contamination.</p> <p>All primary and duplicate samples were submitted to Envirolab, which is a NATA accredited laboratory.</p>
Sample Preservation and Transport	Following collection, soil samples were placed directly in laboratory-supplied containers (glass jars and zip-lock bags) and stored on ice in an esky while on site and in transit to the laboratory under standard Chain of Custody documentation.

Soil bore reinstatement Soil borings and test pits were backfilled with the soil removed and reinstated level to the ground surface.

7.2 Quality Assurance / Quality Control

The details of overall project QA/QC program including, collection of replicates, internal laboratory QA/QC and an assessment for completeness comparability and representativeness is summarised below.

7.2.1 Field QA/QC Evaluation

Field replicate samples

Two replicate samples were collected during the field sampling program, satisfying the minimum required sampling frequency of 1 replicate sample for every 20 primary samples analysed. Relative percentage difference (RPD), a measure of variation between samples, was calculated for each analyte within the sample pairs identified in **Appendix F**. All RPD calculations were within the acceptable ranges.

Instrument Calibration

The photoionisation detector used during soil sampling was calibrated by the provider Airmet Scientific prior to receipt by Cardno. A copy of the PID is presented in **Appendix C**.

Trip blanks

A single trip blank was provided by the laboratory and carried during the sampling program with the results shown in **Appendix F**. Contaminant concentrations within the blank were all less than the laboratories limited of reporting (LOR) with the exception of arsenic, chromium, nickel and zinc, which were detected at concentrations marginally above the laboratory LOR. The detections indicate that the trip blank provided by the laboratory was likely contaminated with trace concentrations of heavy metals. Despite this the validity of the analytical data is not compromised due to the marginal detections.

Rinsate

A single rinsate sample was collected from a hand trowel used during collection of soil samples at test pit TP012, with the trowel was washed and decontaminated in accordance with Cardno's standard operating procedure. Results are shown in the data tables in **Appendix F** and show that contaminant concentrations were all recorded as less than the laboratories limited of reporting for identified COPC, indicating that decontamination procedures implemented during the investigation were satisfactory.

7.2.2 Laboratory QA/QC

The chosen analytical laboratory undertook internal QA/QC procedures which include the analysis of method blanks, internal duplicate samples, laboratory control samples, matrix spikes and surrogate recovery. Additionally, laboratory QA/QC procedures include sample receipt, logging, storage, preservation and analysis within the method specified holding time and are recorded in the laboratory certificates in **Appendix G**.

A review of the laboratory QA/QC procedures indicated that, with the exception of the items summarised below in **Table 7-2** laboratory QA/QC samples percent recoveries were within specified ranges for all samples. Additionally, samples were received and stored appropriately and all samples were analysed within the specified holding time.

Table 7-2 Laboratory QA/QC outliers summary

Report ID	Analyte	QA/QC Outlier	Notes
151838-20	Chromium	Laboratory duplicate RPD outside acceptance range	The laboratory RPD acceptance criteria was exceeded for sample 151838-20 for Cr where an RPD of 87% was calculated, above the acceptable criteria of 50%. The high RPD is most likely the result of poor sample heterogeneity during sample collection.
151838-23	Asbestos	Sample 151838-23 was sub-sampled from jar provided by the client	A sample bag was not provided for analysis of asbestos. Instead the laboratory subsampled from a glass jar provided for chemical analysis. At the time of sampling the regulatory guidance for asbestos testing required a minimum sample

Report ID	Analyte	QA/QC Outlier	Notes
			volume of 40 to 50 grams for analysis of asbestos presence/absence. This volume was able to be retrieved from the jar provided so the results are considered reliable.

7.2.3 Data Useability

The data validation procedure employed in the assessment of the field and laboratory QA/QC data and shown above and in **Appendix F** has indicated that the reported analytical results are representative of the conditions at the sample locations and that the analytical data can be relied upon for the purpose of these additional assessment works. It is concluded that overall the quality of the analytical data produced is reliable for the purposes of validating this site for the intended land use.

8 Results

8.1 Field Observations

Fill materials were observed at two locations, TP006 and TP008, at depths of 0.5m and 1.3m bgl, respectively. The fill material at TP006 appeared to be reworked natural soil with no anthropogenic materials noted. The fill at TP008 contained concrete fragments, bricks, tiles, timber, and plastic from ground surface to 0.7m bgl, no asbestos containing materials were observed. Photographs of the typical geologic profile encountered during drilling are provided in **Appendix A**.

No asbestos containing materials were observed in soil cuttings during the intrusive investigation nor on the ground surface during the site walkover.

Groundwater was not encountered during the intrusive investigation; however, seepage was observed at approximately 0.7m bgl within test pit TP008 and was inferred to be localised perch water within the fill profile. The seepage was situated in the fill profile comprising of clayey sandy silt.

8.2 Soil and Geology

The subsurface conditions encountered on site were generally consistent with data published in geological maps and referenced sources. Note that the geological descriptions below have been utilised from a *Geotechnical Interpretive Report* prepared by Cardno in July 2019 that included a more detailed intrusive program than that described in this report. Four discrete units were identified along the alignment during the geotechnical investigation (Cardno 2019), which are summarised below in **Table 8-1**.

Table 8-1 Summary of sub-surface conditions

Geological Unit		Approximate depths (m bgs)
Unit 1	TOPSOIL – ROAD SURFACE –FILL	Varying thickness from 0.1m to 1.1m
Unit 2	Unit 2A.1 ALLUVIAL CLAY/SILT (VS-S)	Varying thickness from 2.0m to 13.5m
	Unit 2A.2 ALLUVIAL CLAY/SILT (F-ST)	
	Unit 2A.3 ALLUVIAL CLAY/SILT (VST-H)	
	Unit 2B.1 ALLUVIAL SAND/GRAVEL (VL-L)	
	Unit 2B.2 ALLUVIAL SAND/GRAVEL (MD-VD)	
Unit 3	RESIDUAL	Varying thickness from 0.5m to 4.00m
Unit 4	BEDROCK	Tuffaceous Sandstone / Siltstone

Topsoil varied in thickness from 0.00 m to 0.8 m and consisted of silts and sands. Topsoil was observed under a fill layer at sampling locations TP004 and TP009. Varying fill and pavement compositions were encountered throughout the site.

Alluvium was the predominant element observed within the soil profile with thick sediment deposits varying in depth from 0.0 m to 14.0 m bgs. The alluvial deposits had varying amounts of sand, silts and clays throughout, with boreholes showing the subsurface mostly consisted of clays/silts along the alignment.

Up to 8.0m (3.5m to 8.0m thick) of soft to stiff alluvial clay / silt layer (Unit 2A and Unit 2B) with up to 1.6m thick sand layer inclusions was encountered at BH007 to BH009; BH003 - BH004 - BH006 and BH005. The clay/silt layer is present in TP002, TP101 to TP104, BH102, TP105, and TB101 to TB 104 in much thinner layers.

Unit 2A.2 consists of low to high plasticity clays whereas Unit 2A.3 and Unit 3 present high plasticity.

Gravel layers were detected on several boreholes and test pits along the alignment including BH001, BH002, BH004, BH006, BH007, BH010, BH101 and TB102, TB102, TB104 and TP016. Particle Size Distribution test results indicated that cobbles were present in the gravel layer.

Bedrock encountered was sandstone / siltstone that varied significantly in strength, weathering and joint spacing.

8.3 Analytical Results

Tabulated analytical result tables are provided in **Appendix F** and copies of the laboratory certificates in their entirety in **Appendix G**. The subsections below provide a summary of the analytical results in comparison with the adopted screening criteria.

8.3.1 Human Health Criteria

Exceedances of the NEPM human health criteria for a commercial / industrial land use were not reported in any sample submitted for analysis.

8.3.2 Ecological Criteria

Exceedances of the NEPM ecological health criteria for a commercial / industrial land use were not reported in any sample submitted for analysis.

8.3.3 Acid Sulfate Soils

8.3.3.1 pH Field Screening

The pH field screening results were screened against the action criteria provided in the *ASSMAC Acid Sulfate Soil Manual* (1998) and a summary of the results is provided below:

- > No samples screened exhibited a pH_F reading of $pH < 4$, which indicates Actual Acid Sulfate Soils are unlikely to present in soils beneath the site.
- > 51 of the 64 samples (80%) submitted for pH field screening reported a pH_F between 4 to 5.5, indicating the potential presence of PASS.
- > Ten of the 64 samples (16%) submitted for pH field screening reported a pH_{FOX} of < 3.5 , indicating the presence of PASS.
- > 46 of the 64 samples (72%) submitted for pH field screening reported a pH difference ($pH_F - pH_{FOX}$) of > 1 following oxidation, indicating the potential presence of PASS.

A high proportion of samples tested for pH field screening exceeded the ASSMAC action criteria for PASS. Selected samples showing the strongest indications of PASS were scheduled for sPOCAS and Scr suites to confirm the acid potential of each sample.

8.3.3.2 sPOCAS

sPOCAS suite results were screened against the action criteria provided in the *ASSMAC Acid Sulfate Soil Manual* (1998) and a summary of the results is provided below:

- > Titratable Peroxide Acidity (TPA) was reported above the ASSMAC action criteria of 18 mol H^+/t in 10 of the 17 tested samples (59%), with the highest reported concentration of TPA located at TP002 (along Tripoli Way) at a depth of 0.5 m bgs, with a result of 170 mol H^+/t .
- > Titratable sulfidic acidity (TSA) was reported above the ASSMAC action criteria of 18 mol H^+/t in seven of the 17 samples tested (41%). The highest reported concentration of TSA was located at BH008 (toward the easternmost bridge) at a depth of 3.0 m bgs, with a result of 560 mol H^+/t .
- > No samples reported a peroxide oxidisable sulphur (S_{POS}) concentration above the ASSMAC action criteria of 0.03%, however, the sample collected from 0.5m bgs at TP015 had an S_{POS} concentration equal to the action criteria.
- > The maximum reported liming rate (excluding acid neutralising capacity) prescribed by the laboratory was 10 kilograms of calcium carbonate (ag lime) per tonne of soil disturbed for the sample collected from 0.5m bgs at TP002 and 1.0m bgs at TP006.

8.3.3.3 Chromium Suite

Chromium suite results were screened against the action criteria provided in the *ASSMAC Acid Sulfate Soil Manual* (1998) and a summary of the results is provided below:

- > S_{Cr} did not exceed the action criteria of 0.03% in any of the five samples tested, with the highest reported concentration of 0.01% in a soil sample collected from a depth of 2.5 m bgs at test pit TP103. Four of the five samples had concentrations below the LOR of 0.005%.

- > The maximum reported liming rate (excluding acid neutralising capacity) prescribed by the laboratory was 12 kilograms of calcium carbonate (ag lime) per tonne of soil disturbed for the sample collected from 0.5m bgs at TP101.

9 Discussion

9.1 Summary of Potential Areas of Environmental Concern

The potential areas of environmental concern (AEC) identified at the site are summarised below in **Table 9-1** and the approximate lateral extent of each AEC is depicted on **Figure 7** of **Appendix A**.

Table 9-1 Potential Areas of Environmental Concern

Potential Area of Environment Concern	Site Activity / Potential Source	Contaminants of Potential Concern
Construction Laydown and Stockpiling Area (AEC01)	<p>A laydown and stockpiling area is located in the far western extremity of the site within Lot 1182 in DP1202087. Large stockpiles of solid waste are present and the land is believed to be under occupation by Lend Lease during the Calderwood residential development.</p> <p>The nature of the stockpiled material was unable to be determined due to limited site access, however, it appeared to be construction materials and waste including concrete, asphalt and coal washery reject. Aerial imagery suggests that the area has been used as a laydown and storage area since at least May 2017.</p>	<ul style="list-style-type: none"> > Heavy metals > PAHs; > TRHs; > BTEXN; and
Farm Laydown Area (AEC02)	A farm laydown area was observed in the southern portion of Lot 1 in DP559819 and contained a variety of agricultural plant and equipment. Whilst no contaminant sources were observed to be stored on the ground surface during the inspection, aerial imagery suggests that the area has been used for storage since at least 1993.	<ul style="list-style-type: none"> > Asbestos.
Former Dairy and Butter Factory (AEC03)	The former "Tulkeroo" Butter Factory is located in Lot 12 / DP 1205733 and operated between 1887 to 1908. Depending on the scale of the operation there may have been potential contaminant sources at the site associated with industrial processes such as storage of petroleum products. Whilst potential contamination associated with the operations may have degraded, such as hydrocarbons, it is possible that more persistent contaminants may still exist. Current and former structures may also have been constructed of hazardous building materials such as asbestos and/or lead based paints.	<ul style="list-style-type: none"> > Heavy metals > PAHs; > TRHs;
Stockpiles (AEC04)	Two stockpiles were observed in Lots 11 and 12 / DP1205733 north of the former "Tulkeroo" Albion Park Dairy. The contents of each stockpile were unable to be assessed as the stockpiles were vegetated with grass during the walkover	<ul style="list-style-type: none"> > BTEXN; > Phenols; > OCP;
Fill Areas (AEC05)	Two areas of obvious filling were observed during the site walkover within vacant Lot 1 / DP 1119325 and Lot 24 / DP1138317. The nature of the fill material was unable to be assessed due to a dense grass cover.	<ul style="list-style-type: none"> > OPP; > PCBs; and > Asbestos
Landscape Supplies Activities (AEC06)	Albion Park Landscaping Supplies occupies Lot 1 / DP714125. The current commercial operations are situated north of the site, however, a portion of vacant land that has historically contained a large stockpile and equipment is within the site. Current and historical commercial operations may have included storage of potentially contaminated materials.	
Potential Coal Tar Asphalt Pavement (AEC07)	There is potential for existing remnant asphalt pavement within the site to contain coal tar. This includes pavement within Terry Street, Tripoli Way, The Expressway, Moles Street, Calderwood Road and the Illawarra Highway.	<ul style="list-style-type: none"> > Phenol; and > PAH
Demolished Building (AEC08)	At least one former building within Lot 3 / DP714125 has been demolished. The building is visible in the 1993 aerial imagery and is partially within the site. It is unknown if the building contained hazardous building materials and whether the waste was removed from site or disposed of on site.	<ul style="list-style-type: none"> > Heavy metals; and > Asbestos

Potential Area of Environment Concern	Site Activity / Potential Source	Contaminants of Potential Concern
Potential Filling with Keith Grey Oval (AEC09)	A portion of Keith Grey Oval is situated in the south eastern extremity of the site within Lot 1000 / DP813443. During construction of the oval imported fill may have contained contaminated material, solid waste and/or asbestos containing materials.	<ul style="list-style-type: none"> > Heavy metals > PAHs; > TRHs; > BTEXN; > Phenols; > OCP; > OPP; > PCBs; and > Asbestos

9.2 Preliminary Human Health Risk

No exceedances of the adopted human health screening criteria were reported during the limited site assessment. No asbestos containing materials were observed during intrusive works or the site walkover.

Based on the findings of the limited assessment the potential human health risk is considered low under the proposed land use, however, it must be noted that the investigation is preliminary in nature and a statement of the suitability of the site for the intended future land cannot be made without further supplementary investigative works.

9.3 Preliminary Ecological Health Risk

Marginal exceedances of the generic NEPM ecological screening criteria were reported for select heavy metals during the limited assessment. The generic ecological screening levels are conservative and the concentrations reported are potentially representative of background concentrations and unlikely to represent a risk to ecological receptors such as Hazleton Creek, Macquarie Rivulet and the wetland east of Terry Street.

The assessment of potential risk to ecological receptors is preliminary in nature and must be supplemented by a more detailed assessment to adequately make a statement regarding the suitability of the site for the intended future land use.

9.4 Acid Sulfate Soils

Laboratory testing has confirmed that soils beneath the site are slightly to moderately acidic with several exceedances of the ASSMAC (1998) PASS Indicator Values and Action Criteria for TPA and TSA. Whilst soils are acidic, the S_{POS} and S_{CR} results indicate that sulfides and sulfidic ores do not appear to be present, suggesting that the acidity present within soil may not be attributable to ASS, however, as a precautionary measure the soils must be managed during construction (see **Section 10.2.2**).

The acid sulfate soil assessment was preliminary in nature and undertaken without a confirmed design and excavation extents. The data collected during this investigation should be reviewed by an appropriately qualified consultant upon confirmation of the project design and excavation extents, and where required, supplementary testing must be undertaken to the risk of acid sulfate soils has been adequately assessed. This applies particularly to areas of deep cut and at the locations of foundations and piling.

9.5 Data Gaps and Uncertainties

The following data gaps and uncertainties apply to this PSI and limited site assessment:

- > Several privately-owned lots within the site were unable to be inspected due to refusal of access or no response from the landowner. The lots that were unable to be accessed are listed below:
 - Lot 25 in DP 1237947;
 - Lot 1 in DP 714125;

- Lot B in DP 38838;
 - Lot 4 in DP 714125;
 - Lot 2 in DP 220429;
 - Lot 3 in DP 714125; and
 - Lot 24 in DP 1138317.
- > The historical aerial photograph from 1980 does not cover the far-western portion of the site. This is not considered a significant data gap as the area that was not visible in the 1980 image did not change significantly between 1973 and 1993.
- > The soil assessment program implemented during this limited site assessment was preliminary in nature and opportunistic off the back of an intrusive geotechnical investigation undertaken by Cardno. As such not all AEC identified in this report were able to be assessed and a more detailed assessment prior to construction is required (refer to **Section 10.2.1**).
- > Drainage channels and heavily vegetated areas were unable to be adequately visually assessed due to dense ground cover. These areas must be re-inspected during subsequent investigations.

10 Conclusions and Recommendations

10.1 Conclusions

The following conclusions were drawn following the during the investigation:

- > Cardno completed a PSI and limited site assessment for the study area of the proposed Tripoli Way Extension, which runs parallel to the north of Tongarra Road/Illawarra Highway and encompasses multiple lots between the intersection of Broughton Avenue and Tongarra Road in the west to Terry Street in the east.
- > The topography within the site is highly modified and typically situated in areas of low density residential and rural-residential dwellings within the suburb of Albion Park. The site has an elevation ranging from 9m Australian Height Datum (AHD) in the east to 15m AHD in the west and Macquarie Rivulet is located approximately 130m north.
- > The scope of works carried out during the PSI and Limited Site Assessment included:
 - A site inspection/walkover to identify the presence of potential hazardous materials, evidence of current and/or historical contaminating activities, evidence for the storage or handling of chemicals, and waste management practices on or adjacent to the site;
 - A desktop review of available information including soil, geology and acid sulfate soil risk maps, historical aerial photographs, current and historical land title documents;
 - Targeted soil sampling during a geotechnical investigation undertaken at the site by Cardno to preliminarily assess for potential contamination. Eleven (11) primary soil samples were collected and submitted to a NATA accredited laboratory for analysis of targeted contaminants of interest and acid sulfate soil parameters.
- > A number of potential SPR linkages exist on the site associated with the above potential sources and COPC, these include:
 - Human Health
 - > Direct contact (including dermal, inhalation and ingestion) of current and future site occupants and workers with impacted site soils.
 - > Soil vapour inhalation by current and future site occupants and workers.
 - > Inhalation of asbestos fibres
 - Ecological
 - > Potential uptake of contaminants via root network
 - > Sediment laden runoff entering waterways
 - > infiltration of mobile contaminants into groundwater and potentially discharge into surface water bodies
- > Extensive filling was not identified within the site with the exception of at test pit TP008 where a fill profile with a thickness of 1.3m was observed. Anthropogenic inclusions within the fill consisted of concrete, brick, tile and plastic offcuts, however, asbestos was not observed. The lateral distribution of fill surrounding test pit TP008 was not delineated during the assessment.
- > Groundwater was not intersected during the investigation; however, seepage was observed at test pit TP008 at an approximate depth of 0.7m bgl and was inferred to be localised perched water within the fill profile.
- > Three boreholes, BH003, BH006 and BH007, were drilled by Cardno in 2016 in the low-lying western portion of the site in the vicinity of Hazleton Creek. Each borehole was converted to a permanent groundwater monitoring well and groundwater levels were gauged on up to seven occasions between the 17th of August 2016 and the 3rd of July 2017. The data obtained by Cardno is reported in a Geotechnical

Investigation Factual Report (2018) and shows that the depth to groundwater ranged from 0.78 to 1.56 metres below ground level (m bgl), indicative of a shallow groundwater table at that specific location.

- > Laboratory testing has confirmed that soils beneath the site are slightly to moderately acidic with several exceedances of the ASSMAC (1998) PASS Indicator Values and Action Criteria for TPA and TSA. Whilst soils are acidic, the SPOS and SCR results indicate that sulfides and sulfidic ores do not appear to be present, suggesting that the acidity present within soil may not be attributable to ASS, however, as a precautionary measure the soils must be managed during construction
- > COPC concentrations in all analysed samples were reported less than the NEPM human health and ecological screening criteria for a commercial / industrial land use.
- > Whilst the information obtained during this PSI and limited site assessment generally indicate a low to moderate potential for contamination to exist at the site, further investigation is warranted at the eight potential areas of environmental concern as summarised below:

Table 10-1 Potential Areas of Environmental Concern

Potential Area of Environment Concern	Site Activity / Potential Source	Contaminants of Potential Concern
Construction Laydown and Stockpiling Area (AEC01)	A laydown and stockpiling area is located in the far western extremity of the site within Lot 1182 in DP1202087. Large stockpiles of solid waste are present and the land is believed to be under occupation by Lend Lease during the Calderwood residential development. The nature of the stockpiled material was unable to be determined due to limited site access, however, it appeared to comprise of construction materials and waste including concrete, asphalt and coal washery reject. Aerial imagery suggests that the area has been used as a laydown and storage area since at least May 2017.	<ul style="list-style-type: none"> > Heavy metals > PAHs; > TRHs; > BTEXN; and
Farm Laydown Area (AEC02)	A farm laydown area was observed in the southern portion of Lot 1 in DP559819 and contained a variety of agricultural plant and equipment. Whilst no contaminant sources were observed to be stored on the ground surface during the inspection, aerial imagery suggests that the area has been used for storage since at least 1993.	<ul style="list-style-type: none"> > Asbestos.
Former Dairy and Butter Factory (AEC03)	The former "Tulkeroo" Butter Factory is located in Lot 12 / DP 1205733 and operated between 1887 to 1908. Depending on the scale of the operation there may have been potential contaminant sources at the site associated with industrial processes such as storage of petroleum products. Whilst potential contamination associated with the operations may have degraded, such as hydrocarbons, it is possible that more persistent contaminants may still exist. Current and former structures may also have been constructed of hazardous building materials such as asbestos and/or lead based paints.	<ul style="list-style-type: none"> > Heavy metals > PAHs; > TRHs;
Stockpiles (AEC04)	Two stockpiles were observed in Lots 11 and 12 / DP1205733 north of the former "Tulkeroo" Albion Park Dairy. The contents of each stockpile were unable to be assessed as the stockpiles were vegetated with grass during the walkover	<ul style="list-style-type: none"> > BTEXN; > Phenols; > OCP;
Fill Areas (AEC05)	Two areas of obvious filling were observed during the site walkover within vacant Lot 1 / DP 1119325 and Lot 24 / DP1138317. The nature of the fill material was unable to be assessed due to a dense grass cover.	<ul style="list-style-type: none"> > OPP; > PCBs; and > Asbestos
Landscape Supplies Activities (AEC06)	Albion Park Landscaping Supplies occupies Lot 1 / DP714125. The current commercial operations are situated north of the site, however, a portion of vacant land that has historically contained a large stockpile and equipment is within the site. Current and historical commercial operations may have included storage of potentially contaminated materials.	

Potential Area of Environment Concern	Site Activity / Potential Source	Contaminants of Potential Concern
Potential Coal Tar Asphalt Pavement (AEC07)	There is potential for existing remnant asphalt pavement within the site to contain coal tar. This includes pavement within Terry Street, Tripoli Way, The Expressway, Moles Street, Calderwood Road and the Illawarra Highway.	<ul style="list-style-type: none"> > Phenol; and > PAH
Demolished Building (AEC08)	At least one former building within Lot 3 / DP714125 has been demolished. The building is visible in the 1993 aerial imagery and is partially within the site. It is unknown if the building contained hazardous building materials and whether the waste was removed from site or disposed of on site.	<ul style="list-style-type: none"> > Heavy metals; and > Asbestos
Potential Filling with Keith Grey Oval (AEC09)	A portion of Keith Grey Oval is situated in the south eastern extremity of the site. During construction of the oval imported fill may have contained contaminated material, solid waste and/or asbestos containing materials.	<ul style="list-style-type: none"> > Heavy metals > PAHs; > TRHs; > BTEXN; > Phenols; > OCP; > OPP; > PCBs; and > Asbestos

Further investigation at each AEC is warranted to characterise and delineate possible contamination as per the recommendations of **Section 10.2**. An intrusive investigation would confirm the suitability of these areas for the proposed development and determine if remedial action is required to manage potential human health and environmental risk.

10.2 Recommendations

10.2.1 Potential Contamination

Based upon the findings of this PSI and with reference to the proposed future land use Cardno makes the following recommendations:

- > Intrusive investigations should be undertaken at each AEC to determine if measurable COPCs are present and the suitability of these areas for the proposed land use / redevelopment. Investigations should be undertaken in accordance with relevant regulatory legislation and guidance including the *National Environment Protection (Assessment of Site Contamination) Measure* 1999, as amended 2013.
- > Each AEC should be assessed for the applicable COPCs summarised in this report. If concentrations of COPCs are identified above the Tier I screening values, additional remedial or management actions may be necessary.
- > The proposed intrusive investigation should include a thorough inspection of all drainage channels and overgrown areas as well as private properties that were unable to be accessed during this investigation. Some areas were inaccessible at the time of the inspection due to a thick cover of Lantana and other vegetation, and as such potential contaminant sources were not adequately assessed.
- > A hazardous building material survey should be undertaken prior to the demolition of any buildings and structures within the site. Underground utilities such as water mains and Telstra pits may contain asbestos cement and should be identified and removed in accordance with regulatory guidance prior to and/or during construction of the project.
- > Any future works involving demolition and soil disturbance should incorporate an unexpected finds protocol to facilitate the identification and management of previously undocumented contamination.
- > The intrusive investigations and hazardous building materials surveys should take place prior to issue of a construction certificate (or similar).

10.2.2 Acid Sulfate Soils

Despite the likely absence of oxidisable sulfur in the soils tested, it is recommended that appropriate management measures be implemented during construction to mitigate the potential impact of acidic soils on concrete and steel structures (i.e. aggressivity), noting that liming rates up to 12kg per tonne of soil were prescribed by the laboratory to neutralise acidity. It is also noted that the acid sulfate soil assessment was preliminary in nature and undertaken without a confirmed design and excavation extents.

Management measures must be designed and implemented prior to and during construction by an appropriately qualified geotechnical engineer as described below:

- > The data collected during this investigation should be reviewed by an appropriately qualified consultant upon confirmation of the project design and excavation extents, and at potential locations for ancillary sites where required. Supplementary testing must be undertaken to confirm the presence / absence and potential risk associated with acid sulfate soils. This applies particularly to areas of deep cut and at the locations of foundations and piling.
- > Whilst the acidity present in soil may not be attributable to oxidisable sulfur, it is recommended that future investigation be utilised to inform the requirement for an acid sulfate soil management plan (ASSMP (or equivalent), which if required must be prepared prior to the commencement of earthworks and construction. The management plan should be prepared in consideration of the ASSMAC Guidelines (ASSMAC 1998) and should be included as a sub-plan of the broader project Construction Environmental Management Plan (CEMP).
- > The management plan, if required, must include the following:
 - Review and interpretation of field testing and analytical results from previous investigations, and in doing so identify areas of the site that may contain ASS / acidic soils
 - Describe the proposed construction works and identify those works that may result in the disturbance of ASS / acidic soils
 - Detail the mitigation measures and actions that would be required to mitigate potential risks associated with disturbance of ASS / acidic soils. This includes but is not limited to excavated soils, excavation surfaces, soil treatment performance criteria, validation testing, stockpiling durations, soil treatment areas, prescribed liming rates, groundwater and surface water management and contingencies (e.g. weather events, over-liming and offsite disposal of soil)
 - Monitoring oversight and reporting requirements including environmental monitoring programs (surface water and stockpile), inspection and oversight and provision of suitable reporting and deliverables.

The ASSMP (or equivalent) must adhere to Part 6.1 of the Shellharbour City Council Local Environment Plan 2013 (LEP) and any other relevant local, state or national government planning and regulatory instrument. Additional testing may be required prior to or during construction to confirm the neutralising capacity of soil.

11 Limitations

This assessment report is not any of the following:

- > A Site Audit Report or Site Audit Statement as defined under the *Contaminated Land Management Act 1997* (CLM Act).
- > A Detailed or Environmental Site Investigation sufficient for an Environmental Auditor to be able to conclude a Site Audit Report and Site Audit Statement.
- > A geotechnical report.
- > A detailed hydrogeological assessment in conformance with NSW DEC (2007) *Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination*.
- > An assessment of groundwater contaminants potentially arising from other sites or sources nearby.
- > A total assessment of the site to determine suitability of the entire parcel of land at the site for one or more beneficial uses of land.
- > A hazardous building material survey that will identify any specific building materials on site, which may pose a risk to human health or the environment.
- > The agreed scope of this assessment has been limited for the current purposes of the Client. The assessment may not identify contamination occurring in all areas of the site.

This Document has been provided by Cardno subject to the following limitations:

- > This Document has been prepared for the particular purpose outlined in Cardno's proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.
- > The scope and the period of Cardno's services are as described in Cardno's proposal, and are subject to restrictions and limitations. The observations described in this report were current at the time of inspection and do not account for potential contamination that may occur following the inspection.
- > Cardno did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Cardno in regards to it.
- > Conditions may exist which were undetectable given the limited nature of the enquiry Cardno was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.
- > In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Cardno's opinions are based upon information that existed at the time of the production of the Document. It is understood that the services provided allowed Cardno to form no more than an opinion of the actual conditions of the site at the time this Document was prepared and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.
- > Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.
- > Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Cardno for incomplete or inaccurate data supplied by others.

- > A SafeWork NSW (formerly WorkCover) Schedule 11 hazardous chemicals (dangerous goods) search was not considered necessary as part of the PSI given the large scale of the study area and the unlikely storage of bulk hazardous chemicals. If evidence of bulk storage is observed or suspected during future works the requirement for a Schedule 11 search should be reconsidered.

12 References

- Cardno (2018), Geotechnical Investigation Factual Report – Tripoli Way Upgrade and Extension, Albion Park, January 2018
- Cardno (2019), Geotechnical Interpretive Report – Tripoli Way Upgrade and Extension, Albion Park, July 2019
- CRC Care (2011) *Technical Report No. 10 Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater Part 1: Technical Development Document*, September 2011;
- EPA (1997), Guidelines for Consultants Reporting on Contaminated Sites. Environment Protection Authority of New South Wales, Contaminated Sites Section, EPA 97/104, November 1997
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- NSW Department of Urban Affairs and Planning (1998) *Managing Land Contamination: Planning Guidelines: SEPP 55 Remediation of Land*, 1998;
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- NSW EPA (1997), Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997. Department of Environment and Climate Change NSW, Sydney. 2015.
- NSW DEC (2007), Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination. Department of Environment and Conservation NSW, 2007
- NSW OEH (2007), Shellharbour-Kiama Area Coastal Quaternary Geology Map, 2007
- NSW OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites. New South Wales Office of Environment and Heritage, OEH 2011/0650, August 2011.
- Standards Australia (1999) *Australian Standard AS 4482.2-1999 - Guide to the sampling and investigation of potentially contaminated soil. Part 2: Volatile substances*. Standards Australia, Homebush, NSW.
- Standards Australia (2005) *Australian Standard AS 4482.1-2005 – Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds*. Standards Australia, Homebush, NSW; and
- WA DOH, 2009. *Guidelines for Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, Western Australia Department of Health (WA DOH).

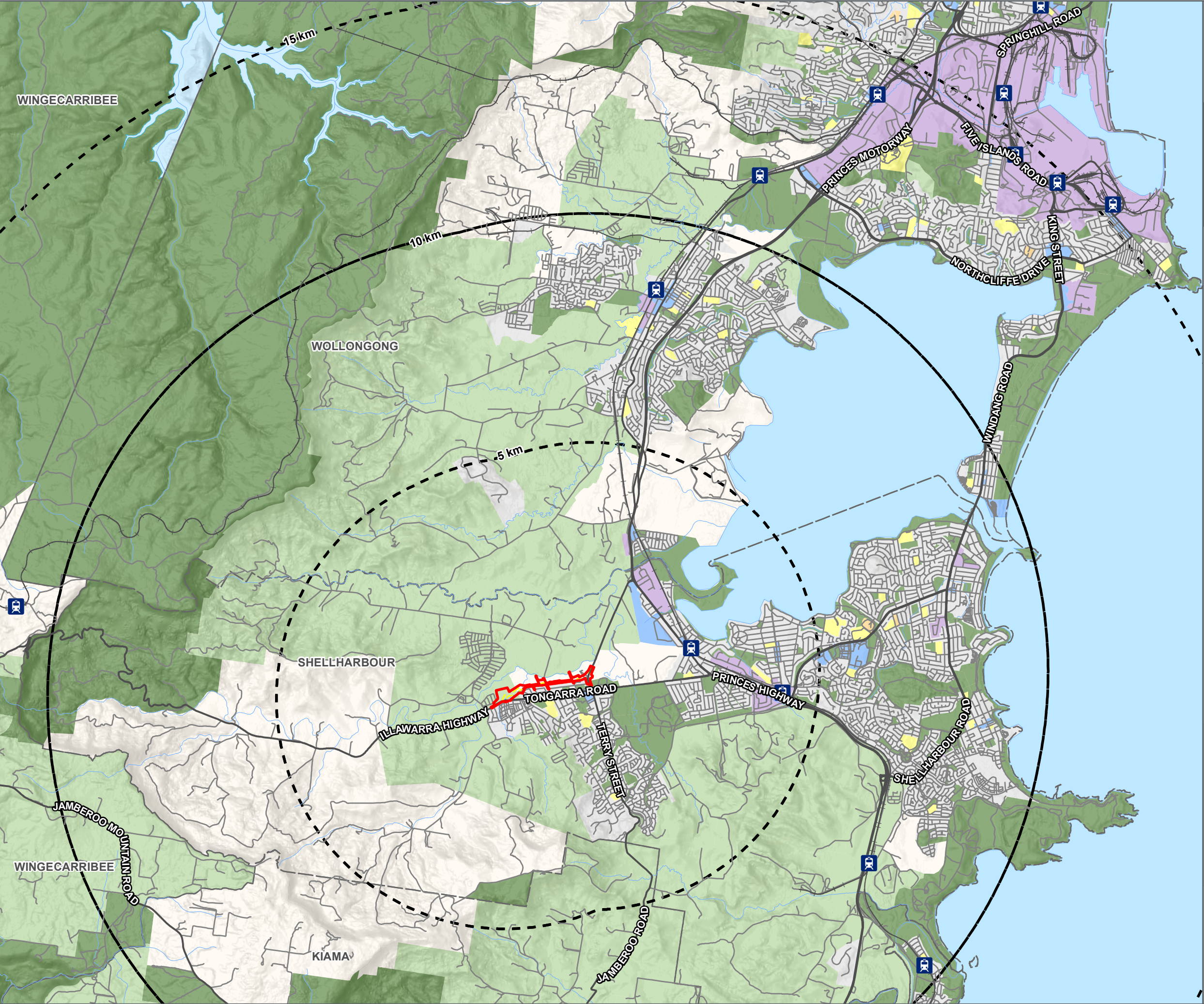
Websites

- > NSW EPA POEO Public Registers
Contaminated Land Record Search <https://apps.epa.nsw.gov.au/prclmapp/searchregister.aspx>
Search for Environment Protection licences, applications, notices, audits or pollution studies and reduction programs <https://apps.epa.nsw.gov.au/prpoeoapp/>
- > Shellharbour City Council, IntraMaps online mapping tool
<https://enterprise.mapimage.net/IntraMaps97/default.htm?configId=3399ba48-3b8f-4cd7-a655-3b84b701202c&project=Shellharbour%20Public>
- > NSW Environment and Heritage, eSPADE NSW Soil and Land Information Online Mapping Tool
<http://www.environment.nsw.gov.au/eSpadeWebapp/>

APPENDIX

A

FIGURES



Location Plan

TRIPOLI WAY EXTENSION

Legend

- Study Area
- Railway Station (NSW SS)
- Railway (NSW SS)
- Major Road (NSW SS)
- Local Road (NSW SS)
- Major Watercourse (NSW SS)
- Design Construction Footprint
- 5km Buffer
- LGA Boundary
- Land Use (ABS 2016)**
 - Other
 - Commercial
 - Education
 - Hospital/Medical
 - Industrial
 - Parkland
 - Primary Production
 - Residential
 - Water

FIGURE 1

1:80,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2022-02-01 | Project: 8201612601
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-002-LocationPlan.mxd 04

Study Area

TRIPOLI WAY EXTENSION PROJECT

Legend



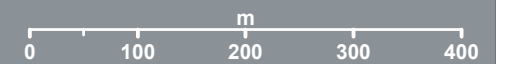
-  Study Area
-  Watercourse (NSW SS)
-  5m Contours (LPI LiDAR, 2011)
-  100% Design Construction Footprint
-  Ancillary Sites
-  Cadastre (NSW SS, 2019)



FIGURE 2

1:7,000 Scale at A3










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Date: 2022-02-01 | Project: 8201612601
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-023-StudyArea.mxd 03
Aerial imagery supplied by MetroMap (November, 2021)

Seamless Geology Plan

TRIPOLI WAY EXTENSION PROJECT

Legend

-  Study Area (20.20 ha)
-  Proposed Road Alignment
-  Proposed Stormwater Network
-  Watercourse (NSW SS)
-  Construction Footprint (14.47 ha)
-  Potential Ancillary Facility
-  Cadastre (NSW SS, 2019)

Seamless Geology - Rock Units (GSNSW, 2021)












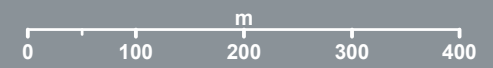
-  QH_af - Alluvial floodplain deposits
-  QP_at - Alluvial terrace deposits
-  Q_ab - Alluvial backswamp deposits
-  Q_acb - Alluvial channel deposits - in-channel bar
-  Q_al - Alluvial levee/overbank deposits
-  Q_ap - Alluvial palaeochannel deposits
-  Q_av - Alluvial valley deposits
-  Q_avf - Alluvial fan deposits
-  P_gu - Bombo Latite Member
-  Pshb - Berry Siltstone
-  Pshr - Broughton Formation

FIGURE 3

1:7,000 Scale at A3














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Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-010-SeamlessGeology.mxd 07
Aerial imagery supplied by MetroMap (July, 2020)



Bedrock Geology Plan

TRIPOLI WAY EXTENSION PROJECT

Legend

-  Study Area (20.20 ha)
-  Proposed Road
-  Proposed Stormwater Network
-  Watercourse (NSW SS)
-  Construction Footprint (14.47 ha)
-  Potential Ancillary Facility
-  Cadastre (NSW SS, 2019)
- Kiama 1:50 000 Geological Map 9028-I (Geological Survey of NSW, 1974)**
 -  Psb: Siltstone to fine-grained Sandstone (Berry Siltstone)
 -  Psg: Volcanic Sandstone (Budgong Sandstone)
 -  Psgb: Aphanitic to Porphyritic Latite (Bumbo Latite)
 -  Qa: Quaternary

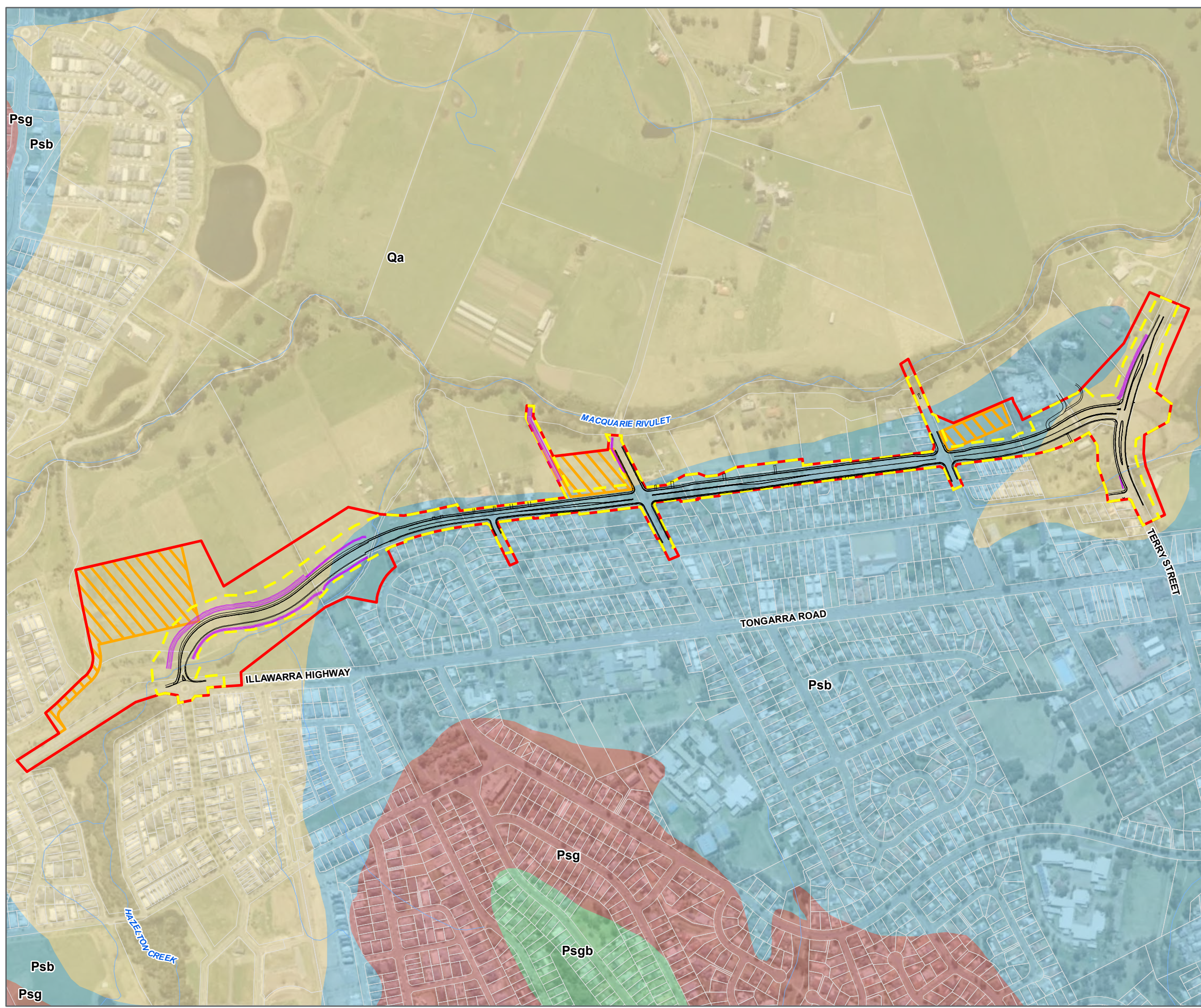
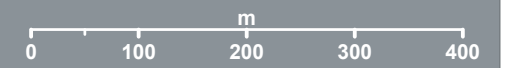


FIGURE 4

1:7,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2022-02-01 | Project: 82016126-01
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-008-Geology.mxd 07
Aerial Imagery supplied by MetroMap (July, 2020)

Acid Sulfate Soils Plan

TRIPOLI WAY EXTENSION PROJECT

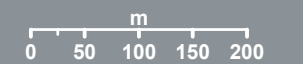
Legend

- Study Area (20.20 ha)
 - Proposed Road
 - Proposed Stormwater Network
 - Watercourse (NSW SS)
 - Construction Footprint (14.47 ha)
 - Potential Ancillary Facility
 - Cadastre (NSW SS, 2019)
- Acid Sulfate Soils (DPE, Feb 2019)**
- Low Risk at >4m



FIGURE 5

1:7,000 Scale at A3



Test Location Plan

TRIPOLI WAY EXTENSION PROJECT

Legend












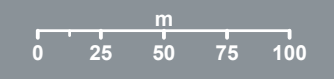
-  Study Area (20.20 ha)
- Test Location**
 -  Borehole
 -  Cone Penetration
 -  Test Bore
 -  Test Pit
 -  Proposed Road
 -  Proposed Stormwater Network
 -  Watercourse (NSW)
 -  Construction Footprint (14.47 ha)
 -  Potential Ancillary Facility
 -  Cadastre (NSW SS,



FIGURE 6

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2022-02-01 | Project: 8201612601
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-037-TestLocationPlan_combined DDP.mxd 04
Aerial imagery supplied by MetroMap (November, 2020)

Test Location Plan

TRIPOLI WAY EXTENSION PROJECT

Legend

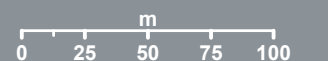
- Study Area (20.20 ha)
- Test Location**
 - + Borehole
 - + Cone Penetration
 - + Test Bore
 - + Test Pit
 - Proposed Road
 - Proposed Stormwater Network
 - Watercourse (NSW)
 - Construction Footprint (14.47 ha)
 - Potential Ancillary Facility
 - Cadastre (NSW SS,



FIGURE 6

Page 2

1:3,000 Scale at A3



Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2022-02-01 | Project: 8201612601
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-037-TestLocationPlan_combined DDP.mxd 04
Aerial imagery supplied by MetroMap (November, 2020)



Test Location Plan

TRIPOLI WAY EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Test Location**
- ⊕ Borehole
- ⚡ Cone Penetration
- ⊕ Test Bore
- ⊕ Test Pit
- Proposed Road
- Proposed Stormwater Network
- Watercourse (NSW)
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility
- Cadastre (NSW SS,



FIGURE 6

Page 3

1:3,000 Scale at A3

0 25 50 75 100
m



Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2022-02-01 | Project: 8201612601
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-037-TestLocationPlan_combined DDP.mxd 04
Aerial imagery supplied by MetroMap (November, 2020)





Potential Areas of Environmental Concern

TRIPOLI WAY EXTENSION PROJECT

Legend

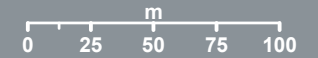
- Study Area (20.20 ha)
- Proposed Road Alignment
- Road Labels
- Proposed Stormwater Network
- Watercourse (NSW SS)
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility
- Cadastre (NSW SS, 2019)

Potential Area of Environmental Concern

- AEC1 - Construction Laydown and Stockpiling Area
- AEC2 - Farm Laydown Area
- AEC7 - Potential Coal Tar Asphalt Pavement

FIGURE 7

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2022-02-01 | Project: 8201612601
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-028-PAECPlan DDP.mxd 07
Aerial imagery supplied by MetroMap (November, 2021)



Potential Areas of Environmental Concern

TRIPOLI WAY EXTENSION PROJECT

Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Road Labels
- Proposed Stormwater Network
- Watercourse (NSW SS)
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility
- Cadastre (NSW SS, 2019)

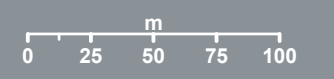
Potential Area of Environmental Concern

- AEC2 - Farm Laydown
- AEC3 - Former Dairy and Butter Factory
- AEC4 - Stockpiles
- AEC5 - Fill
- AEC7 - Potential Coal Tar Asphalt Pavement

FIGURE 7

Page 2

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2022-02-01 | Project: 8201612601
Coordinate System: GDA 1994 MGA Zone 56
Map: 82016126-GS-028-PAECPlan DDP.mxd 07
Aerial imagery supplied by MetroMap (November, 2021)



Potential Areas of Environmental Concern

TRIPOLI WAY EXTENSION PROJECT

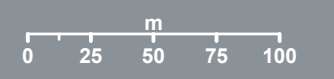
Legend

- Study Area (20.20 ha)
- Proposed Road Alignment
- Road Labels
- Proposed Stormwater Network
- Watercourse (NSW SS)
- Construction Footprint (14.47 ha)
- Potential Ancillary Facility
- Cadastre (NSW SS, 2019)
- Potential Area of Environmental Concern**
- AEC5 - Fill Area
- AEC6 - Landscape Supplies Activities
- AEC9 - Keith Grey Oval
- AEC7 - Potential Coal Tar Asphalt Pavement

FIGURE 7

Page 3

1:3,000 Scale at A3



Tripoli Way
Extension, Albion
Park NSW

APPENDIX

B

SITE
PHOTOGRAPHS



Photograph 1: the far western portion of the site looking east with Hazleton Creek visible



Photograph 2: a creek crossing over Hazleton Creek in the western portion of the site



Photograph 3: the western portion of the site with AEC01 visible in middle ground



Photograph 4: a creek crossing over Hazleton Creek from Polock Park



Photograph 5: a drain passing through the site from the Illawarra Highway to Hazleton Creek



Photograph 6: Sydney Water infrastructure located in the western portion of the site



Photograph 7: a view of Pollock Park looking north west



Photograph 8: a laydown area of mostly agricultural equipment within Lot 1 in DP559819 (AEC02)



Photograph 9: drums and an aboveground storage tank located immediately north of AEC02



Photograph 10: a laydown area of mostly agricultural equipment within Lot 1 in DP559819 (AEC02)



Photograph 11: a creek crossing over Hazleton Creek observed within Lot 1 in DP559819, constructed of rock, concrete with several concrete culverts observed



Photograph 12: a stockpile observed within Lot 11 of DP1205733 (AEC04)



Photograph 13: a stockpile observed within Lot 11 of DP1205733 (AEC04)



Photograph 14: the former “Tulkeroo” Butter Factory located in Lot 12 / DP 1205733 (AEC03)



Photograph 15: the western portion of the “Tulkeroo” Butter Factory located in Lot 12 / DP 1205733 (AEC03)



Photograph 16: the former “Tulkeroo” Butter Factory located in Lot 12 / DP 1205733 (AEC03), with drums and other discarded waste surrounding the structure



Photograph 17: waste observed immediately north of the "Tulkeroo" Butter Factory located in Lot 12 / DP 1205733 (AEC03)



Photograph 18: a Telstra telecommunications pit potentially containing asbestos cement observed within public space within the alignment



Photograph 19: an agricultural shed constructed atop a fill platform within Lot 24 / DP1138317 (AEC05)



Photograph 20: a vacant parcel of land east of Hamilton Road in Lot 1 / DP1119325, with evidence of filling visible throughout (AEC05), looking east



Photograph 21: a vacant parcel of land east of Hamilton Road in Lot 1 / DP1119325, with evidence of filling visible throughout (AEC05), looking west



Photograph 22: a view of Terry Street and the eastern portion of the site, looking northeast



Photograph 23: a wetland in the far eastern extremity of the site, looking east



Photograph 24: cricket nets and a toilet block located within Keith Grey Oval at the south eastern extremity of the site



Photograph 25: an unnamed creek flowing into the wetland in the farm eastern extremity of the site, looking east from a creek crossing on Terry Street



Photograph 26: the construction laydown and stockpiling area in the far western extremity of the site within Lot 1182 in DP1202087



Photograph 27: the construction laydown and stockpiling area in the far western extremity of the site within Lot 1182 in DP1202087