Preliminary Site Investigation
Hillsborough Road Upgrade

Rev 5

25 October 2022

Preliminary Site Investigation – Hillsborough Road Upgrade

Project no:	IS400500
Document title:	Preliminary Site Investigation – Hillsborough Road Upgrade, Warners Bay NSW
Document No.:	
Revision:	Rev 5
Date:	25 October 2022
Client name:	Transport for NSW
Client no:	
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File name:	\\Jacobs.com\ANZ\IE\Admin\04_Eastern\EnvironmentalSciences\Ecology&Heritage\Heritage\Projects\NSW\IS400500 Hillsborough Road PACHCI 3\07 updated PSI\Hillsborough Rd PSI 221025_01.docx

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Executive summary

Transport for NSW (Transport) is planning the duplication of about 1.8 kilometres of Hillsborough Road (the proposal), including installing traffic lights at Crockett and Chadwick Streets as well as other road and safety improvements.

The aim of the proposal is to improve network efficiency and road safety for local and regional road users along Hillsborough Road. The road acts as the primary link between the urban centres of Charlestown and Warners Bay.

The proposal involves:

- duplication of about 1.8km of Hillsborough Road from Newcastle Inner City Bypass to west of Crockett Street
- installation of traffic lights at Barker Avenue, Crockett and Chadwick Street
- other road safety improvements.

Phase 1 Site (contamination) investigations (PSI) are required to identify and understand potential contamination risks (if any) that may be associated with the Hillsborough Road upgrade study area.

In support of the proposed upgrade works, Jacobs undertook desktop investigations that included record searches and review of historical aerial imagery. Desktop reporting was supplemented by two site inspections (the first site inspection undertaken across the initial project alignment on 22 October, 2018, with the second inspection undertaken on 8 September 2022, to collect observations relating to some additional ancillary areas), to gather obvious visual indicators of potential contamination risks, and to ground-truth the results of the historical information where necessary.

Jacobs has undertaken the PSI of the study area to assess Areas of Environmental Interest (AEIs) (with respect to contamination) to support the planning provision for the construction of the proposal.

Based on the desktop information review, significant contamination is considered unlikely to be present within the study area which would constrain the development of the road upgrade. A number of activities undertaken on and/or adjacent to the study area were considered to hold a potential contamination risk, as follows:

- Potential contamination from historical coal mining in the area
- Potential contamination from the high number of industrial buildings located within the study area
- Potential contamination associated with degradation of asphalt roads and run off from raised banks from industry
- Potential for areas to contain lead/zinc slag from the former Pasminco smelter
- Potential for areas of demolition waste or imported fill sourced from farmland and/or agricultural related activities.

The results of this PSI study indicate a low risk of significant contamination risks associated with the site areas, given the assumptions listed above, and subject to any actual sample capture and analytical events.

To quantify the potential moderate risk AEIs, it is recommended that intrusive contamination investigations be carried out in the vicinity of the proposal to quantify the risk of contamination being present at the site. Contamination investigations should extend laterally and vertically to the extent of the proposal and include sample capture and analysis of relevant environmental matrices (air/soil/water).

Introduction

1.1 Overview of the proposal

The aim of the proposal is to improve network efficiency and road safety for local and regional road users along Hillsborough Road. The road acts as the primary link between the urban centres of Charlestown and Warners Bay.

Key feature of the proposal include:

- Duplication of about 1.8 kilometres of Hillsborough Road from the NICB roundabout west to a tie in point about 300 metres west of Crockett Street.
- Two lanes each a minimum 3.3 metre wide each way with a solid central median barrier.
- Posted speed of 60 kilometres per hour.
- New traffic lights at the Chadwick Street intersection including pedestrian crossings.
- Modification of Higham Road intersection.
- New traffic lights at the Baker Avenue intersection including pedestrian crossing.
- U-turn bay on Barker Avenue.
- Access gates to be relocated beyond u turn facility.
- New traffic lights at the Crockett Street intersection including pedestrian crossings.
- Provision for on road cyclists within shoulder in both directions.
- Off road concrete shared path on the northern side tying into existing path.
- Upgraded bus stop facilities on Hillsborough Road at Crockett Street intersection, Chadwick Street intersection and on Crockett Street. All bus stops are to have shelters with the exception of the southbound bus lay over on Crockett Street.
- Culvert widening on Winding Creek both up stream and down stream of existing culvert structure.
- Culvert widening and full replacement of existing culvert between Crockett Street and Baker Avenue.
- New separated left in only entry and left out only exit for the CNCC Showgrounds located east (entry) and west (exit) of Chadwick Street intersection.
- Maintained access to the Hillsborough Road fire trail opposite Crockett Street.
- Left in / left out only access from existing business fronting Hillsborough Road, east of the CNCC Showgrounds.
- Left in / left out only access to residences on Hillsborough Road, east of CNCC Showgrounds.
- Relocation of utilities including, telecommunications, water, power, street lighting and minor adjustments to sewer infrastructure.
- New as well as upgraded street lighting on Hillsborough Road.
- Reinforced concrete retaining walls including facing panels.
- Site investigations, including but not limited to geotechnical investigations.
- Installation of fauna connectivity structures, such as rope crossings.
- Minor property acquisition and adjustments including fencing, access and driveway adjustments.
- Site preparation works, including establishing ancillary facilities, vegetation clearing, site fencing, temporary drainage measures, and implementation of environmental management measures.

- Temporary construction facilities, including site compounds and stockpile sites at the former Whalan's Nursery site– Hillsborough Road, and at vacant commercial buildings within the Warners Bay Commercial Centre – Accessed by northern commercial access road of Hillsborough Road.

1.2 Project understanding

The proposal is consistent with a number of state and regional transport plans and priorities. These are listed as follows.

NSW Long Term Transport Master Plan (LTTMP)

The Long Term Transport Master Plan outlines a clear framework to address transport challenges in NSW over the next 20 years. For the first time, it integrates planning for roads, freight and all other modes of transport and sets out initiatives, solutions and actions to meet NSW transport challenges. The proposal aligns with the following goals of the LTTMP:

- Improve liveability by providing services that support jobs growth and facilitating ease of movement
- Support economic growth and productivity – by providing a transport system that responds to customer needs, is more efficient, improves connectivity and accessibility
- Support regional development – by improving accessibility to jobs, services and people
- Improve safety - by providing suitable intersection controls, improved active transport facilities and wider shoulders
- Improve sustainability – by optimising the use of the transport network, easing congestion, growing the proportion of travel by sustainable modes

NSW Road Safety Strategy

The NSW Road Safety Strategy 2012-2021 sets the direction of road safety in NSW for the next 10 years. NSW is committed to reducing fatalities to less than 4.3 per 100,000 population by 2016 together with at least a 30 per cent reduction in fatalities and serious injuries by 2021.

The Road Safety Strategy is underpinned by the Safe System approach to improving road safety. This takes a holistic view of the road transport system and interactions among the key components of that system – the road user, the roads and roadsides, the vehicle and travel speeds. It recognises that all these components have a role to play in helping to keep road users safe. The corridor strategy identifies several major crash clusters along Hillsborough Road and safety risks for vulnerable road users, and proposes actions to improve safety and reduce the crash rate along this section of the corridor.

The proposal objectives include improving safety. The proposal is consistent with the NSW Roads Safety Strategy (2012-2021).

1.3 Purpose and scope

Jacobs Group (Australia) Pty Ltd (Jacobs) was commissioned by Transport to undertake a Preliminary Site Investigation (PSI) of the study area of the proposal.

This PSI report has been prepared in general accordance with the requirements specified for a Preliminary Site Investigation as detailed in the NSW EPA (1997) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* and Transport Roads & Maritime Services *(2003) Guideline for the Management of Contamination.*

The objectives of the PSI were to identify potential areas of environmental interest (AEI) which would assist in identifying construction limitations/constraints and management options within the proposal area with respect to contamination.

To achieve these objectives, Jacobs undertook the following tasks:

Review of publicly available information from the following sources:

  - NSW EPA Contaminated Land Record of Notices
  - NSW EPA List of NSW Contaminated sites notified to the NSW EPA
  - NSW EPA Protection of the Environment Operations Act Public Register
  - Historical aerial photographs
  - Topographic and/or orthophoto maps
  - Geology and soil maps
  - Available hydrogeological information the *Environmental Risk and Planning Report* (Lotsearch, 11 October 2022)
- Review of information provided by Transport
- Site walkover and inspections of the study area (refer to **Appendix A**)
- Preparation of a PSI on the data obtained from the desktop background review and observations from the inspection of the proposal area. The expected ground conditions are presented together with any contamination issues identified and recommendations for further investigations, if required.

1.4 Relevant contamination guidelines

In preparing this report, the following guidelines were considered (where relevant):

- *Acid Sulfate Soils Assessment Guidelines* (Department of Planning, 2008)
- *Managing Land Contamination: Planning Guidelines State Environmental Planning Policy (SEPP) 55 – Remediation of Land*, (Department of Urban Affairs and Planning & Environmental Protection Authority, 1998)
- *Guidelines for Consultants Reporting on Contaminated Sites (Office of Environment and Heritage, 2000).*

Should Transport purchase properties and take responsibility for existing contamination and contamination sources within these properties, the requirements of the *Contaminated Land Management Act 1997* would be applicable for the management of contamination.

Should remediation or other construction activities be undertaken which would involve the offsite disposal of materials (both uncontaminated and contaminated), the requirements of the Protection of the Environment Operations (Waste) Regulations 2014 would need to be considered and implemented where applicable.

Should further investigations, remediation works and validation be undertaken, these activities would need to be undertaken in accordance with the following guidelines or other appropriate/endorsed guidelines available at that time.

- Australian Standard (AS 4482.1-2005) *Guide to the sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds*
- Australian Standard (AS 4482.2-1999) *Guide to the sampling and investigation of potentially contaminated soils – Volatile substances*
- *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as revised 2013)*
- Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand (ANZECC & ARMCANZ), (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*
- NSW EPA (2014) *Waste Classification Guidelines*
- Department of Environment, Climate Change and Water (DECCW (2009) *Guidelines for the Implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008*
- NSW EPA (1995) *Contaminated Sites: Sampling Design Guidelines*
- Department of Environment and Conservation (DEC) (2006) *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd Edition)*

- DEC (2007) *Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination*
- NSW EPA (2015) *Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*
- NSW EPA (2015) *Technical Note: Light Non-Aqueous Phase Liquid Assessment and Remediation*
- NSW EPA (2014) *Technical Note: Investigation of Service Station Sites*
- NSW EPA (2014) *Best Practice Note: Landfarming*
- DEC (2005) *Information for the assessment of former gasworks sites*
- DECCW (2010) *Vapour Intrusion: Technical Practice Note*
- NSW EPA (2012) *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*
- Workcover NSW (2014) *Managing asbestos in or on soil*
- Acid Sulfate Soil Management Advisory Committee (ASSMAC) (1998) *Acid Sulfate Soil Assessment Guidelines*
- NSW EPA (2014) *Waste Classification Guidelines.*

1.5 Report structure

This report is structured with the following sections:

- Section 1: Introduction
- Section 2: Existing environment
- Section 3: Information review
- Section 4: Site information
- Section 5: Discussion
- Section 6: Preliminary conceptual site model
- Section 7: Conclusions and recommendations
- Appendix A: Site photographs.
- Appendix B: Lotsearch (11 October 2022) Environmental Risk and Planning Report

Existing environment

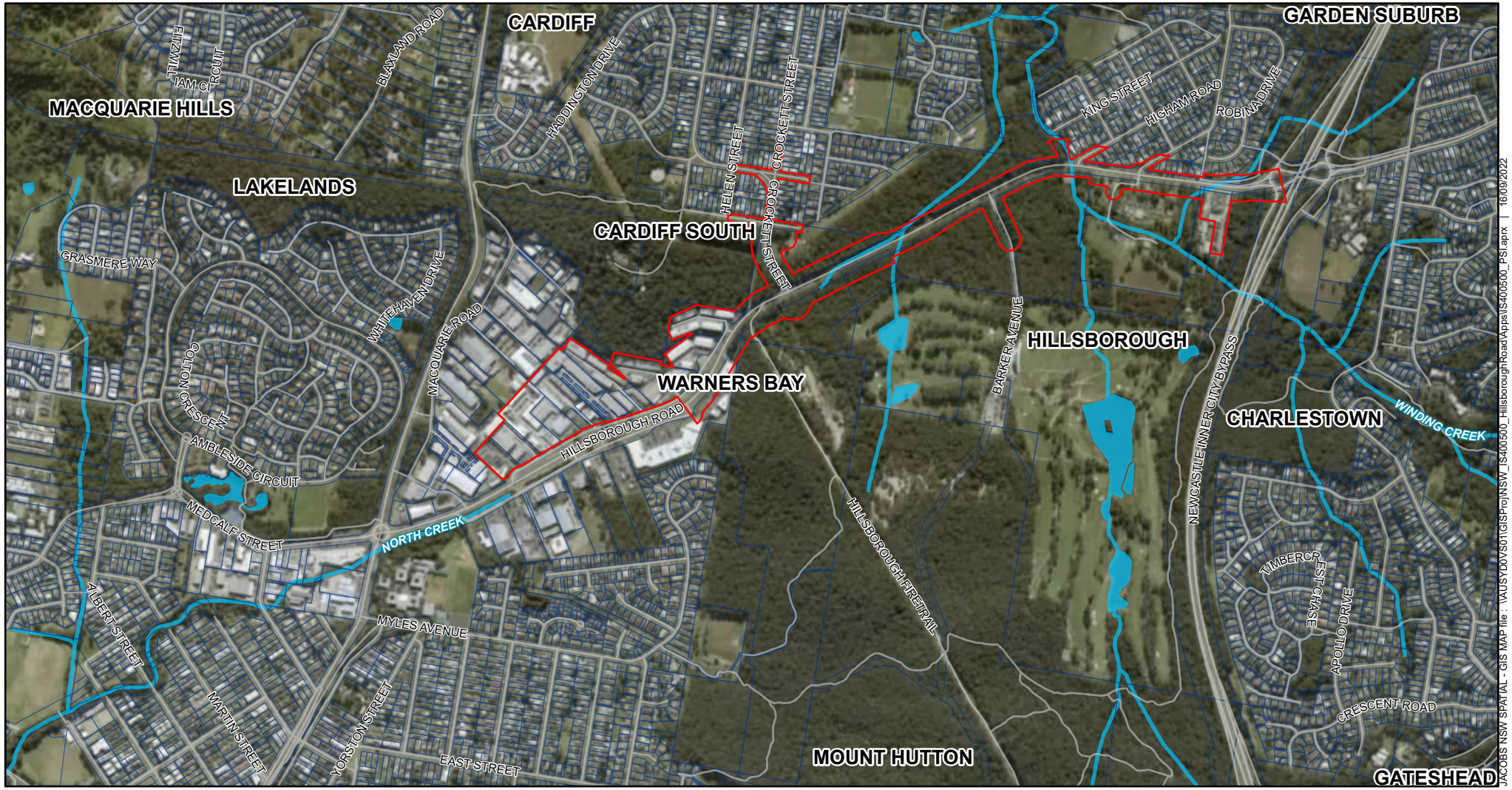
The study area information presented below is based on a review of readily available government information sources and information provided in the *Environmental Risk and Planning Report* (Lotsearch, October 2022) reports for the Hillsborough Road Upgrade, refer to **Appendix B**.

The site area history, historical aerial photographs and zoning and NSW EPA records have been used to guide site inspections undertaken initially on 22 October, 2018, and then on 8 September 2022 for additional areas. The 150m buffer zone that has been applied to the Site Boundary (Lotsearch study area) is considered adequate to capture the current alignment for the study area.

2.1 Site identification

The study area includes a proposed upgrade to the Hillsborough Road. The study area is defined spatially as starting at the traffic lights at Warners Bay Homemaker Centre (The Good Guys), and continuing onto Hillsborough Road, from the traffic lights, finishing just after the Newcastle Inner City Bypass. The study area is located at Hillsborough, within the Lake Macquarie City Council Local Government Area (LGA).

The proposal predominantly occupies the road reserve with asphalt road and unsealed road side verges covered by grass and trees. The study area as shown in Figure 1 is based on spatial data provided to Jacobs by GHD on 18 March 2022.



KEY

- Addendum Study Area
- Cadastral boundary
- Road
- Waterway
- Waterbody

0 250 500m

1:15,000 @ A4
GDA 1994 MGA Zone 56

N

Data sources

Jacobs 2022
GHD 2022
Department of Customer Service 2021
Department of Planning and Environment 2021
Aerometrex 2021

Note that the scale of the map applies to A4 paper only. Scale may be distorted if printed on different paper size or otherwise resized.

Figure 1 | Study Area

2.2 Site zoning and land use

At the time of undertaking the PSI, the proposal area was occupied by a combination of land uses, the zonings of the study area under the Lake Macquarie Local Environment Plan 2014 (Lake Macquarie LEP) are:

Hillsborough Road duplication to Newcastle Inner City Bypass roundabout.

- B7 Business Park
- C2 Environmental Conservation
- C4 Environmental Living
- R2 Low Density Residential
- RE1 Public Recreation
- RU4 Primary Production
- SP2 Classified Road

2.3 Topography and drainage

The topography of the proposal area can be characterised as flat landform which is surrounded by slightly elevated topography causing the study area to act as a watershed. The study area is covered by both unsealed (grassed areas, open space) and sealed areas (roadways). Water falling onto the unsealed areas of the study area is likely to infiltrate directly into soils. Rainfall falling onto sealed areas within the study area are likely to be discharged directly into formal drainage structures (e.g. concrete kerb and guttering, formalised storm water pits) and discharge to the local storm water system. There are several creeks located within close proximity of the study area with the most prominent being north creek located north west continuing into Lake Macquarie located 1km north west.

2.4 Hydrogeology

Shallow groundwater beneath the proposal is expected to be perched above the residual weathered bedrock and to be recharged predominantly by the infiltration of surface water falling onto the unsealed surfaces including north creek and into Lake Macquarie.

Based on information from the *Environmental Risk and Planning Report* (Lotsearch, October 2022), the aquifer beneath the proposal is described as fractured or fissured, extensive aquifers of low to moderate productivity.

The *Environmental Risk and Planning Report* (Lotsearch, October 2022) search of the NSW Department of Primary Industries – Office of Water registered groundwater bore database identified one groundwater well located within one kilometre of the proposal area. This is provided in **Table 2.1**.

Table 2.1: Registered Groundwater Wells

Well ID	Location	Registered Use	Depth
GW047633	238m North East	Drainage	27.7

2.5 Geology

Reference to the *Environmental Risk and Planning Report* (Lotsearch, October 2022) Geology maps indicate that most of the proposal area is underlain by undifferentiated alluvial deposits; sand, silt, clay and gravel; including residual and colluvial deposits. Two other units from the group Newcastle Coal Measures include sandstone, conglomerate, siltstone, coal and tuff.

2.6 Soils

The Newcastle 1:100,000 soil landscape map indicates the following landscape characters for the proposal area:

- Wyong landscape; process: alluvial soils
- Warners Bay landscape; process: residual soils
- Cockle Creek landscape; process: alluvial
- Gateshead landscape; process: erosional

2.7 Acid sulfate soils

Acid sulfate soils (ASS) are the common name given to naturally occurring sediments and soils containing iron sulfides (principally iron sulfide or iron disulfide or their precursors). The exposure of the sulfide in these soils to oxygen by drainage or excavation leads to the generation of sulfuric acid. Areas of ASS can typically be found in low lying and flat locations which are often swampy or prone to flooding.

A review of the ASS risk maps from the *Environmental Risk and Planning Report* (Lotsearch, October 2022) and risk maps from the Australian Soil Resource Information System (ASRIS) database indicated that the majority of the proposal area is located within an extremely low probability of occurrence, 1-5% chance of occurrence.

Historical information

The site history has been sourced from publicly available information and the *Environmental Risk and Planning Report* (Lotsearch, October 2022) commissioned by Jacobs which is provided in **Appendix B**.

The information reviewed and summary of the results in the context of contamination risk is provided in **Table 3.1**. Contamination risks have been assessed as high (if present on site), moderate (if present within 500 metres of the site), low risk (if greater than 500 metres and less than one kilometres from the site) and no risk where there were no relevant records or information was not relevant with respect to contamination.

Businesses with potential contaminating activities are based on those industries detailed in the Australian Standard *Guide to the sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds* (AS 4482.1-2005).

- Agricultural / horticultural activities
- Airports
- Asbestos production and disposal
- Battery manufacture and recycling
- Breweries / distilleries
- Chemicals manufacture and use
- Defence works
- Drum reconditioning
- Dry cleaning
- Electrical
- Engine works
- Foundries
- Gas works
- Iron and steel works
- Landfill sites
- Marinas
- Metal treatments
- Mining and extractive industries
- Power stations
- Printing shops
- Railway yards
- Scrap yards
- Service stations and fuel storage facilities
- Sheep and cattle dips
- Smelting and refining
- Tanning and associated trades
- Water and sewerage treatment plant
- Wood preservation.

Table 3.1: Summary of Potential Contamination Risks

Database	Information	Potential for site contamination	Comment
NSW EPA	List of NSW contaminated sites notified to EPA	Low	7-Eleven Service Station (393 Hillsborough Road) – Regulation under CLM Act not required
NSW EPA	NSW contaminated sites notified to EPA under *Contaminated Lands Management Act 1997* (CLM Act).	No	No records in buffer
NSW EPA	Contaminated Land: Records of Notice	No	No records in buffer
NSW EPA	Known former gasworks sites.	No	No records in buffer
Geoscience Australia	National waste management site database which lists known landfills, waste transfer stations and waste reprocessing facilities	No	No records in buffer
NSW EPA	NSW EPA PFAS investigation program	No	No known PFAS investigation sites within 1km of the site
NSW EPA	Licensed activities under the *Protection of the Environment Operations Act 1997* (POEO Act)	Low	Lake Macquarie City Council – Other activities (onsite)
NSW EPA	Former POEO Act licensed activities now revoked or surrendered	Low	• Luhrmann Environment Management Pty Ltd (Waterways throughout NSW) - Other Activities / Non Scheduled Activity - Application of Herbicides (onsite) • Robert Orchard (Various Waterways throughout NSW) - Other Activities / Non Scheduled Activity - Application of Herbicides (onsite) • Sydney Weed & Pest Management Pty Ltd (Waterways throughout NSW) - Other Activities / Non Scheduled Activity - Application of Herbicides (onsite) • Roads & Traffic Authority of New South Wales (Pacific Highway, Charlestown, NSW 2290) – Road Construction (onsite)

Database	Information	Potential for site contamination	Comment
NSW Department of Environment, Climate Change and Water	Environmentally sensitive zones for the regulation of Underground Petroleum Storage Systems (UPSS)	Low	Part of site located on a UPSS sensitive zone and within close proximity.
EPA PFAS Investigation Program	Sites that are part of the EPA Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) investigation program	Low	No records in buffer
Defence PFAS Investigation Program	Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer	Low	No records in buffer

4.1 Aerial photography

Aerial imagery was reviewed for the years 1954, 1965, 1976, 1983, 1993, 2007, 2016 and 2018 to assess land use and changes in general conditions within and adjacent to the study area. The findings of the aerial imagery review are summarised in **Table 3.2** (Hillsborough Road Duplication) and **Table 3.3** (Warners Bay/Hillsborough Road Commercial/Industrial Precinct). Historical aerial imagery is presented in the *Environmental Risk and Planning Report* (Lotsearch, October 2022) report provided in **Appendix B**.

Table 3.2: Historical Aerial Imagery Review - Hillsborough Road Duplication

Date	Study Area	Surrounding Areas
1954	The western extent of the study area is covered by existing tracks which run from north to south and east to west (Hillsborough Road). Scattered trees also appear along the edges of the study area. Possibility of agricultural land along northern part of the study area. Eastern extent of study area appears as existing road alignment up to future Inner City Bypass Roundabout location, with some small dwellings.	The areas surrounding the study area appear to be predominantly grassland and agricultural fields. Densely populated trees north, east and west of the study area with industrial and residential buildings north and south of the site. Further tracks are visible connecting developments. Possible excavations evident along the northern boundary at the western extent of the study area.
1965	The track running from north (Macquarie Road) to south (King Street) has been replaced by an asphalt road. The Hillsborough Road alignment has additional housing along the northern side, mainly along the area where Moody Street is now located.	Additional industrial development north and south of the study area. Cleared area along the northern boundary of the western extent of the study area appears to show vehicles and possibly stockpiles of unknown origin. Area to the south of the southern study area boundary (near what is now Crockett Street) has been cleared and levelled.
1976	Hillsborough Road running from east to west has been replaced by an asphalt road with further industrial development adjacent to the road.	Additional industrial development within the Warners Bay Industrial area south of the between Macquarie Road and Hillsborough Road, industrial buildings include vehicle repair, tyre shops, engineering units, battery facilities, car wash, supermarkets and several other types. Extensive ground disturbance along the southern boundary of the study area at the western extent, across from what is now Crockett Street. An appearance of a golf course south of the study area. More established housing along the northern boundary of the study area within Higham Road and Chadwick Street, near the eastern extremity of the study area.
1983	The study area appears largely unchanged from the 1976 imagery.	Additional industrial development within the Warners Bay Industrial/Commercial area in the north of the study area. Multiple stockpiles within the disturbed area south of Crockett Street to the south of the western extent of the study area. Golf course appears well established. Large garden supply/nursery and/or landscaping and/or soil/landscaping materials site appears south of study area, across from Chadwick Street residential area on the northern boundary.

Date	Study Area	Surrounding Areas
1993	Greater widening of the Hillsborough Road western extremity, within the study boundary.	The north west of the study area has undergone large residential development where connection to Hillsborough Road seems vital for access. Further residential and industrial development to the north of the study area, at the eastern alignment extent.
2001	The construction of multiple roundabouts connecting Hillsborough road to the north and south. The construction of the Newcastle Inner City Bypass over Hillsborough Road roundabouts allowing connection from the north of Charlestown Road to the south.	Further residential development north of the study area and industrial development in the north east.
2010	The study area appears largely unchanged from the 2001 imagery.	The areas surrounding the study area appear largely the same as per the 2001 imagery.
2017	The study area appears largely unchanged from the 2010 imagery	The areas surrounding the study area appear largely the same as per the 2010 imagery
2022	The study area appears largely unchanged from the 2010 imagery	The areas surrounding the study area appear largely the same as per the 2010 imagery

Table 3.3: Historical Aerial Imagery Review - Warners Bay/Hillsborough Road Commercia/Industrial Precinct Area

Date	Study Area	Surrounding Areas
1954	The study area along Hillsborough Road appears to follow the general alignment as today. The future Commercial/Industrial Precinct appears to be grazing and bush land, while there are disturbed ground areas associated with areas to the west of Crockett Street and to the south of Knight Street. Areas to the east and west along Crockett Street appear to be covered with sparse bush and some minor residential development.	There are indications of increasing residential development along First and Fifth Street to the north of Crockett Street.
1965	The Precinct are north of Hillsborough remains largely covered with grazing/bush land, while there are appears to be increased disturbed ground areas associated with areas to the west of Crockett Street and to the south of Knight Street, possibly a farm dam and some quarrying activities. The area south of the Hillsborough Road and Crockett Street intersection appears to be disturbed with ground clearing activities. There is increased residential development along Crockett Street, and Knight and Gertrude Street.	There appears to be construction of bulk water storage tanks to the west of the study area near Crockett and Gertrude Streets.. Increasing residential development in this area.

Date	Study Area	Surrounding Areas
1976	Intensive development of the eastern portion of the Precinct, with large warehouses/sheds and considerable car parking. The remainder of the western portion of the Precinct remains as previous 1965. There is significant ground disturbance to the area south of the Hillsborough Road and Crockett Street intersection. Land clearing south and west of Crockett and Knight Streets.	Construction of the Charlestown Golf course and club can be seen to the south.
1983	Several new, large warehouses can be seen in the western portion, and most of the western portion of the Precinct area now cleared and built upon. The eastern portion of the Precinct remains largely vegetated with scrub.	Charlestown Golf Course appears established.
1993	Increased development across the western portion of the Precinct, while the eastern portion appears to have been cleared of vegetation with ground preparation works.	As per 1983.
2001	The western portion of the Precinct is further developed and consolidated, while the eastern area of the Precinct has a number of warehouses and sealed areas. Barker Avenue is well established.	Further residential and commercial development surrounding the study area.
2010	The study area appears largely unchanged from the 2001 imagery, with some additional commercial development to the south of Hillsborough Road, and improvements to road quality.	The areas surrounding the study area appear largely the same as per the 2001 imagery.
2017	The study area appears largely unchanged from the 2010 imagery.	The nearby areas appear largely unchanged from the 2010 imagery.
2022	The study area appears largely unchanged from the 2017 imagery	The nearby areas appear largely unchanged from the 2017 imagery

4.2 Previous investigations

The results and conclusions of the previous investigations have been assessed in the context of the contamination risk to the study area. The following information from two reports was reviewed for contamination on site:

- Peak Land Management (March 2011) Minor Works Review of Environmental Factors. Road Widening - MR674- Hillsborough Road Warners Bay

  The Peak Land Management (March 2011) assessment was undertaken to describe the proposal, to document the likely impacts of the proposal on the environment, to detail mitigation measures to be implemented and to determine whether the project can proceed.

- Roads and Maritime Services (June 2014) MR674- Hillsborough Road Upgrade – Geotechnical investigations for the proposed duplication between HW23 and west of Crockett Street

The aim of the report was to seek general advice on environmental assessment requirements for the proposed geotechnical works. The information provided by the geotechnical works is critical for the design of the culvert floor extension and the foundation detail for the retaining wall design.

The report summarised that the presence of known or potential contaminated sites requires further consideration pending selection and refinement of a preferred option. It was proposed to carry out 7 boreholes to establish geotechnical conditions. The logs of the boreholes were not available for this PSI scope and therefore environmental conditions cannot be determined from this report.

Based on the two reports discussed above there is not enough factual information to determine the environmental conditions in relation to contamination.

4.3 Integrity assessment

Historical and site information was sourced from NSW Government departments and reports provided by the client. Jacobs has relied on the accuracy of the documentation provided and our experience in historical document interpretation. Whilst there is a margin for error in interpretation, Jacobs consider the information presented in this assessment to be of acceptable reliability for the purposes of this investigation.

Site Information

4.1 Site inspection

An initial site inspection was carried out by a Jacobs contamination specialist on 22 October 2018, focussing on areas within the project alignment and an applied buffer area (nominally a 150m area surrounding the alignment). These areas would be part of the upgrade works proposed within the existing alignment.

The study area was amended in 2022 to remove the Warners Bay Roundabout locations.

An additional site inspection was undertaken on 8 September 2022 by Jacobs within the newly expanded Addendum Study Area locations (see **Figure 2**), focusing on areas within the Warners Bay/Hillsborough Road Commercial/Industrial precincts between Hillsborough Road and Macquarie Road, additional extensions on Crockett Street, Barkers Avenue and the Nursery site near the Newcastle Inner City Bypass Interchange at the eastern extent of the Study Area. It is understood that the newly expanded areas (as above) could be used as potential lay down areas or storage or a new U-Turn facility at the Nursery site, while the Warners Bay commercial/industrial precinct could offer office space or similar within existing buildings/warehouses.

The site inspections were undertaken from publicly accessible areas as well as access to the route alignment from some privately owned land. Photographs taken during the inspection are provided in **Appendix A**.

At the time of the initial site inspection, the majority of the original study area was covered by existing asphalt roads including starting at Medcalf Street on the east continuing onto Hillsborough Road to the west and being intersected by Macquarie Road and King Street at Warners Bay roundabout. The site is approximately 1.8 kilometres in length and starts at Metcalf Street with four lanes, two lanes each direction, then becoming two lanes, one lane in each direction up till the Newcastle Inner City Bypass.

The study area is surrounded by several industrial buildings including vehicle repair, tyre shops, engineering units, battery facilities, car wash, supermarkets and several other light industrial and commercial operators. There are three residential blocks within 100 metres of the study area including Lakelands and Cardiff South to the north and Warners Bay to the south. There are several community buildings within 500 metres of the study area including a public schools, a nursery, community centre, sports pitches, hospitals and places of worship. Scattered trees and vegetation appear along the verges of Hillsborough Road with the Lake Macquarie located within 1 kilometres east of the study area.

Many existing buildings (e.g. industrial buildings, churches and residential houses) located across the study area are likely to have been constructed pre-1980. The age of these buildings could indicate that they contain hazardous building materials including, but not limited to asbestos and heavy metals. It is assumed that most of these building materials may remain in a good, non-degraded condition within buildings, and hence pose a limited contamination risk to the project area. These materials (if present) could represent a potential contamination source if they are not adequately managed through ongoing occupation and/or demolition.

The recently amended study area includes the addition of the Warners Bay/Hillsborough Road Commercial/Industrial Precinct, with site inspection observations recorded on 8 September 2022 indicating box-type galvanised warehouses, retail outlets and low-level offices and retail outlets. The moderate gradients in this area have been serviced with extensive surface water channels and stormwater drainage, with most surface areas covered by buildings and hard stand roads and parking areas.

4.2 Surrounding land use

At the time of the site inspections, the following land uses were observed surrounding the study area:

- North: Lakelands and Cardiff South high density residential blocks, industrial buildings and the commercial/industrial precinct
- East: Residential areas and the Newcastle Inner City Bypass
- South: Warners Bay residential blocks and industrial buildings
- West: Residential area and Lake Macquarie.

Discussion

The results of the site history review and the site inspection have indicated that there are a number of potential contamination risk areas on and/or adjacent to the site associated with current and historical activities. These potential contamination risk areas include:

- Service station site (located 200 metres west of the study area)
- Previous road construction activities (licensed under the POEO Act)
- Four currently licensed activities under the POEO Act, these include railway system activities, waste storage and agricultural processing.
- There is one delicensed POEO Act activity still regulated by the NSW EPA for Warners Bay Private Hospital
- Other commercial land-use including vehicle repair, tyre shops, engineering units, battery facilities, car wash, supermarkets and several other types.
- Herbicide application (former POEO Act licensed activities now revoked or surrendered) within and adjacent to waterways located on site. These areas are likely to be located in the areas immediately surrounding on-site water courses. There is a potential risk of residual herbicide contamination being present within on-site water courses.
- General agricultural use of land on and adjacent to the site (current and historical) including application of pesticides and herbicides, miscellaneous waste disposal, burial areas, chemical and fuel storage.
- Hazardous buildings materials may be present within buildings/structures present across the site. Whist these materials remain in a good, non-degraded condition within buildings, they do not represent a contamination issue. These materials (if present) could represent a potential contamination source if they are not adequately managed through ongoing occupation and/or demolition of these buildings/structures.
- Known historical reuse of Pasminco Smelter lead and zinc slag across many areas of the Lake Macquarie local government area, particularly used as road base and subgrades at as backfill in sporting fields. Pasminco slag can contain elevated concentrations of heavy metals and has been proven to leach metals under acidic conditions.
- Historical coal mining is known to have been undertaken across many areas within Cardiff and Warners Bay, and while no specific information has been reviewed as to the extent and significance (if any) of historical mining in the area, potential contaminants of concern associated with mining and subsidence are possible.

Although not identified from the information reviewed, it is possible that the site or surrounding areas may have been subject to the illegal disposal of quantities of waste through fly tipping and stockpiles of fill materials. Road side verges along Barker Avenue and Crockett Street appear to have had minor amounts of rubbish and carboard, tyres etc that have been dumped in these areas.

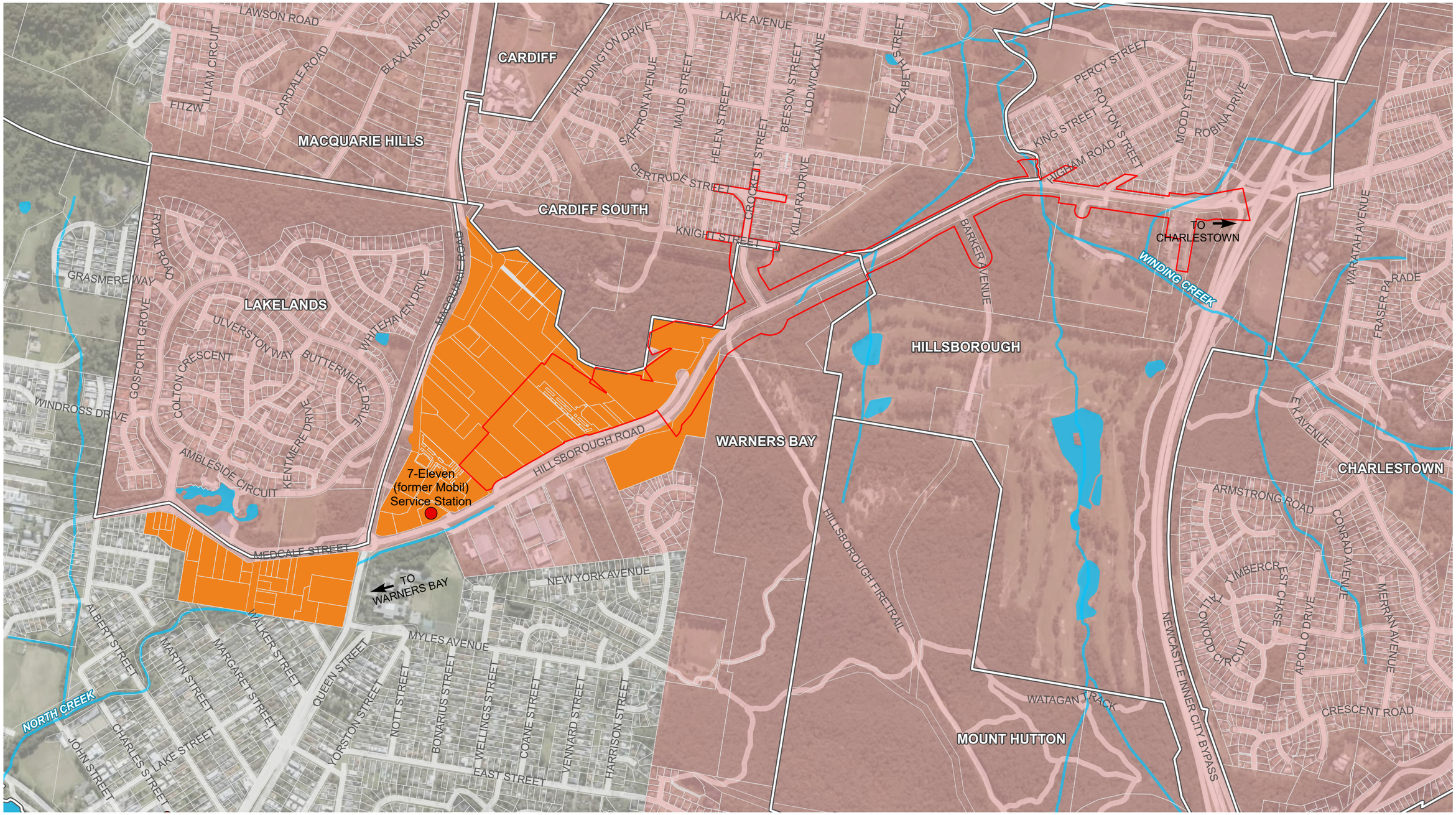
Preliminary conceptual site model

A number of potential Areas of Environmental Interest (AEI)s were identified during the information review. Based on the information contained within the preceding sections of this report, **Table 6.1** outlines the potential AEIs located within and in close proximity to the study area and their associated risks to environmental receptors, construction limitations, and site users in consideration of the potential for contamination and construction activities associated with the proposal. These risks are also mapped in **Figure 2**.

Table 6.1: Preliminary Conceptual Site Model

Source	Contaminants of Concern	Contamination Mechanism	Contamination Depth	Receptor	Risk Assessment
Petrol filling station located approximately 200 metres West of the study area	Heavy metals, total recoverable hydrocarbons (TRH), volatile organic compounds (VOC), polycyclic aromatic hydrocarbons (PAH)	Leaking of underground storages and associated infrastructure	Depth	Site users, environmental receptors, beneficial groundwater users	Low – Site is located outside and down-hydraulic gradient of the study area
Various industrial buildings located within 1km of the site ranging from vehicle repair, tyre shops, engineering units, battery facilities, car wash, supermarkets and several other types	Heavy metals, VOC, TRH, PAH	Spills and leaks from storage, handling of waste	Surface	Site users	Unknown – large number of industrial buildings and difficult to measure any possible pollution
Waste management facilities and railway systems activities.	Potential for a range of organic and inorganic contaminants including, but not limited, to heavy metals, hydrocarbons, pesticides and asbestos	Contamination of surface soils underlying and immediately surrounding wastes	Surface	Site users, environmental receptors	Low
Agricultural related activities including but not limited to livestock dips and stockyards, chemical use and storage	Potential for a range of organic and inorganic contaminants including but not limited to heavy metals, hydrocarbons, pesticides, nutrients and pathogens.	Spills onto surface soils, and infiltration into groundwater	Surface (soils) and depth (soils and groundwater)	Site users, environmental receptors.	Low – Contaminated soils (if present) likely to be localised around field areas.
Road run-off	Heavy metals, hydrocarbon compounds (TRH, VOC, PAH)	Road run-off into surface water	Surface	Environmental receptors	Low – Road unlikely to be significantly contaminated (oil and fuel spills and vehicle particulate deposition) as not heavily trafficked. Contamination (if present) likely to be heavily diluted during rainfall events.

Source	Contaminants of Concern	Contamination Mechanism	Contamination Depth	Receptor	Risk Assessment
Imported fill (Pasminco slag)	Heavy metals	Leaching of lead and zinc from reuse of slag in road corridor	Surface and shallow depths	Site users, environmental receptors, beneficial groundwater users	Medium – Original construction of roadway would have been undertaken during the periods when slag was popularly reused in the area. The presence of slag could pose a risk to construction works due to exposure and an increase in waste disposal costs.
Fly-tipped waste and demolition waste	Potential for a range of organic and inorganic contaminants including, but not limited, to heavy metals, hydrocarbons, pesticides and asbestos	Contamination of surface soils underlying and immediately surrounding wastes	Surface and shallow depths	Site users, environmental receptors, beneficial groundwater users	Medium – possibility of demolition wastes including asbestos associated with demolition of buildings during original construction of roadway may have resulted in wastes being incorporated into embankments or beneath existing roads. The presence of asbestos or other wastes could pose a risk to construction works due to exposure and an increase in waste disposal costs.



KEY

- REF boundary
- Site notified to EPA (EPA)
- Area with elevated potential for contamination risk (derived from DPE)
- Lake Macquarie Mine Subsidence District (Spatial Services)
- Suburb boundary
- Water way
- Cadastral boundary

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Note that the scale of the map applies to A3 paper only. Scale may be distorted if printed on different paper size or otherwise resized.

Figure 2 | Potentially contaminated sites and Mine Subsidence Districts

Conclusions and recommendations

Jacobs has undertaken the PSI of the study area to assess AEIs (with respect to contamination) to support the planning provision for the construction of the proposal.

Based on the desktop information review, significant contamination is considered unlikely to be present within the study area which would constrain the development of the road upgrade.

A number of activities undertaken on and/or adjacent to the study area were considered to hold a potential contamination risk, as follows:

- Potential contamination from the high number of industrial buildings located within the study area
- Potential contamination associated with degradation of asphalt roads and run off from raised banks from industry
- Potential for areas to contain lead/zinc slag from the former Pasminco smelter
- Farmland and agricultural related activities.

Other AEIs were considered to represent a low risk in consideration of potential construction activities and the likely localised nature of the associated contamination (if present).

To quantify the potential moderate risk AEIs, it is recommended that intrusive contamination investigations be considered to quantify the risk of contamination within the project footprint. The contamination investigations should extend laterally and vertically to the extent of the proposal and include sample capture and analysis of relevant environmental matrices (air/soil/water).

There is the potential for other contamination sources to be present within the study area which were not identified during the preparation of the PSI or were assessed as low risk. Any potential contamination which is identified during construction activities should be managed in accordance with an appropriate unexpected finds protocol detailed in a construction environmental management plan (CEMP).

References

ASRIS (2016). *Australian Soil Resource Information System*, Accessed 6 November 2018, Available at http://www.asris.csiro.au/

Lotsearch Enviro Professional *(2022) Environmental Risk and Planning Report* (Lotsearch, 2022)

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

NSW EPA (2000) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2000).

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 (AS 4482.1-2005).

Appendix A – Site photographs (22 October 2018 and 08 September 2022)

Photograph 1: View from Medcalf St overlooking Main Road westwards (Oct 2018)	**Photograph 2:** Raised embankment on Medcalf St adjacent to tennis courts (Oct 2018)
	
Photograph 3: Examples of industry along Medcalf St including auto repair, battery shop and factories (Oct 2018)	**Photograph 4:** View looking eastwards of Hillsborough Road from Warners Bay Roundabout (Oct 2018)
	
Photograph 5: Slip road from Hillsborough Road giving access to various industrial buildings showing example of steep road layout (Oct 2018)	**Photograph 6:** Hillsborough Road leading onto Newcastle Inner City Bypass showing absence of road side guttering increasing run off of Asphalt from road surfaces (Oct 2018)
	

Photograph 7: View from Crockett Street looking onto Hillsborough Road (Oct 2018)	**Photograph 8:** View from Chadwick Street looking onto Hillsborough Road (Oct 2018)
	
Photograph 9: View from Hillsborough Road (North end of alignment near Interchange) looking South at Nursery (Sept 2022)	**Photograph 10:** View from Hillsborough Road (North end of project alignment near Interchange) looking South at Nursery (Sept 2022)
	
Photograph 11: View Barker Avenue looking North towards Hillsborough Road (Sept 2022)	**Photograph 12:** View from Top of Warner's Bay Commercial/Industrial Precinct looking West (Sept 2022)
	

Photograph 13: View from Hillsborough Road looking North East into Warner's Bay Commercial/Industrial Precinct (Sept 2022)	**Photograph 14:** View from Top of Crockett Street looking South towards Hillsborough Road (Sept 2022)
	
Photograph 15: View of intersection at Knight Street and Crockett Street, looking East on Knight Street (Sept 2022)	**Photograph 16:** View of intersection of from Gertrude Street and Crockett Street looking East on Gertrude Street (Sept 2022)
	

Appendix B – Lotsearch (11 October 2022) Environmental Risk and Planning Report