Epping Road widening between Essex Street and Blaxland Road, Epping

Appendix M
Targeted contamination assessment
Part A

November 2015

Roads and Maritime Services

Proposed Epping Road Widening, Epping, NSW
Targeted Contamination Assessment

November 2015

Executive Summary

GHD was commissioned by RMS to conduct a targeted contamination assessment along Epping Road between Blaxland Road and Essex Street in Epping, NSW. The assessment was undertaken in August and September 2014.

The objective of this investigation was to provide information on the current and historical setting of the site in order to assess the potential for contamination sources within the footprint of the road upgrade area. The data was used to inform whether environmental management is warranted on the site during construction and to enable waste classification of soil which may require disposal offsite.

The scope of works completed by GHD included the following key tasks:

- A detailed site walkover/inspection to identify areas of potential contamination.
- A review of historical, regulatory and environmental information sources.
- Soil sampling from 13 boreholes at regular intervals across the site.
- Installation of one groundwater monitoring well.
- Laboratory analysis of 24 primary soil samples and one primary groundwater sample for contaminants of potential concern.

Ten boreholes (BH13 – BH23) were drilled for the purpose of combined geotechnical and contamination assessment along Epping Road and Essex Street. A further three bores were drilled at Tuffy's Mechanics (BH101 – BH103) on the northern boundary. A groundwater well was installed within BH103 for groundwater monitoring purposes.

The subsurface conditions across the site generally consisted of concrete and/or asphalt layer overlaying gravelly sand, underlain by residual layers of gravelly clay and/or clay to the maximum borehole depth of 6.0 m bgl, with shallow sandstone encountered at one location.

The following results were obtained:

- All soil concentrations were reported below the selected investigation levels appropriate for construction workers and intrusive maintenance workers and on-going land use under a commercial / industrial setting.
- The majority of analytes reported non-detect concentrations in the groundwater sample collected. However, concentrations of the heavy metals copper and zinc exceeded the adopted screening criteria, with values of 0.002 mg/L and 0.015 mg/L respectively. It is likely that these minor exceedances are indicative of background concentrations.
- Based on the preliminary waste classification results, waste soil would be provisionally classified as restricted solid waste.

Based on the findings of the investigation, GHD recommend:

- There is potential for fill material to have been used during levelling/construction of the road ways hence there is a potential risk of encountering unexpected contaminated material during the proposed construction works. A Construction Environmental Management Plan (CEMP) should be developed prior to construction including an unexpected contamination findings protocol. This protocol should contain procedures for the identification and management of contamination including controls to ensure adequate protection of health, safety and the environment.

- Final waste classification is required once the volumes of waste requiring offsite disposal are confirmed. Waste soils should be classified in accordance with the NSW EPA (2014) *Waste Classification Guidelines*.
- It is recommended that RMS liaise with the site owners of the mechanics workshop to ascertain if any further contamination investigations have been completed which may provide additional information pertaining to the presence of contamination associated with current or former use of this land.
- The following procedures should be implemented by RMS as a minimum to asses and manage potential soil contamination at the proposed road widening work compound sites including the mechanical workshop (2 Epping Road) and two residential properties at the corner of Epping Road and Essex Street (36 and 38 Essex Street), Epping, NSW;
  - Prior to acquisition, all available reports pertaining to contamination should be reviewed. Hazardous material surveys and soil contamination assessment (from lead paint and asbestos) should also be completed;
  - Procedures must be prepared and implemented to management lead paint and asbestos during demolition so that soil contamination is minimised;
  - Following demolition a baseline soil contamination assessment should be undertaken prior to site use as a works compound. This should include assessment of contamination from underground fuel storage infrastructure at the Tuffy Mufflers site. Remediation should be undertaken if identified contamination poses a risk to human health or the environment; and
  - When the works compound is no longer required, site assessment should be undertaken to assess the risk posed by contamination (if any) introduced during use of the works compounds. Remediation should be undertaken if contamination poses an unacceptable risk to human health or the environment under the proposed land use scenario.

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1. Introduction

1.1 Authorisation

GHD Pty Ltd (GHD) was commissioned by Roads and Maritime Services (RMS) to conduct a targeted contamination assessment along Epping Road between Blaxland Road and Essex Street in Epping, NSW. The assessment was undertaken in August and September 2014. This investigation will consider the proposed road widening area as defined on the site location plan provided as **Figure 1**, **Appendix A**. This area will hence forth be referred to as 'the site'.

1.2 Background

Based on the information provided by RMS, and desktop searches completed by GHD, the site occupies an area of approximately 9,637 m^2 around approximately 430 m of existing road alignment. The south east corner of the Epping Road / Blaxland Road intersection comprises a mechanical workshop which was formerly occupied by a service station. Other potential sources of contamination in the vicinity of the site were unknown, hence a PSI was required to investigate whether contamination management is required during construction.

In March 2015, the road widening plan was updated to include the demolition properties which will potentially be used as road widening works compound sites. These include the mechanical workshop at the corner of Epping Road and Blaxland Road (2 Epping Road), two residential properties at the corner of Epping Road and Essex Street (36 and 38 Essex Street), and two residential properties along Forest Grove (2 and 4 Forest Grove) in Epping, NSW. RMS has requested this report include procedures for the associated assessment and management of contamination associated with the proposed demolitions.

1.3 Objective

The objective of this investigation was to provide information on the current and historical setting of the site in order to assess the potential for contamination sources within the footprint of the road upgrade area. The assessment included a targeted soil and groundwater investigation at selected locations across the site.

The data was used to inform whether environmental management is warranted on the site during construction and to enable waste classification of soil which may require disposal offsite.

1.4 Scope of work

The scope of works completed by GHD included the following key tasks:

- A detailed site walkover/inspection to identify areas of potential contamination based on observation of surface conditions, evidence of current or former potentially contaminating activities and the surrounding built and natural environment.
- A review of historical, regulatory and environmental information sources including:
  - Historical aerial photographs for the site (where available) to assist in establishing the physical patterns of development over time and the historical land uses.
  - A review of NSW Environment Protection Authority (EPA) notices under the *Contaminated Land Management Act* (1997) and licences held under the provisions of the *Protection of the Environment Operations Act* (POEO).
  - WorkCover NSW Dangerous Goods Records for Lot 1, DP 1192833 to verify if the site was licenced to store chemicals or fuels.

  - A review of published soil, geology, hydrogeology, hydrology and topography records.
- Soil sampling from 13 boreholes at regular intervals across the site, to provide a preliminary assessment of contamination concentrations at the site.
- Extension of one soil borehole to a depth of 6.5 metres and installation of one groundwater monitoring well.
- Laboratory analysis of 24 primary soil samples and one primary groundwater sample for contaminants of potential concern.
- Preparation of this report documenting the findings of the assessment and recommendations regarding the requirements for environmental management during construction.

1.5 Limitations

The work was undertaken as part of a combined geotechnical and contamination investigation, therefore the findings of the assessment are limited and not in full accordance with a detailed site investigation as per NSW EPA (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.*

GHD's limitations to the assessment are provided in **Section 10**.

2. Site setting

2.1 Site identification

A site location plan detailing proposed road works is provided as **Figure 1**, **Appendix A**. A summary of available information pertaining to the site is presented in **Table 1**.

Table 1 – Site identification summary[1]

Information	Details
Site location	Epping Road, Epping, NSW (between Blaxland Road and Essex Street)
Site area	9,637 m² along approximately 430 m of road length
Lot and DP	Road corridor (unidentified). The proposed road widening will extend into the boundary of 17 residential properties and one commercial property, as identified in **Table 2**
Geographic Coordinates	(33.7739 S, 151.0833 E) to (33.7737 S, 151.0872 E) approximately
Local Government Area	The council of the Shire of Hornsby
County	Cumberland
Local Land Use Zoning	SP2 - Infrastructure R4 – High Density Residential
Current Land Use	Road corridor and residential

The road widening will extend into the boundary of 18 properties. **Table 2** outlines the identification details of these properties.

Table 2 – Properties

Lot	DP	Land use
1	1192833	Mechanical work shop
SP 16921		Residential (south side Epping Road)
B	308840	Residential (south side Epping Road)
5	10385	Residential (south side Epping Road)
6	10385	Residential (south side Epping Road)
1	203492	Residential (south side Epping Road)
2	203492	Residential (south side Epping Road)
B	327784	Residential (south side Epping Road)
9	10385	Residential (south side Epping Road)
16	10385	Residential (south side Epping Road)

[1] Information Sources: https://maps.six.nsw.gov.au/

Lot	DP	Land use
17	10385	Residential (south side Epping Road)
18	10385	Residential (south side Epping Road)
19	10385	Residential (west side Essex Street)
20	10385	Residential (west side Essex Street)
B	300119	Residential (west side Essex Street)
1	173652	Residential (west side Essex Street)
5	1033683	Residential (north west corner Essex Street and Epping Road)
1	430745	Residential (north east corner Essex Street and Epping Road)

2.1 Site observations

The existing road alignment is primarily bordered by residential properties to the north and south.

On the far western side of the alignment, on the border of Blaxland Road and Epping Road, one commercial facility (Westpac Corporate Office) is present on the north side. Additionally, a commercial facility (Tuffy's Mechanic), formerly a service station, was located on the southern side.

Observations made during the drilling works in the vicinity of the mechanic noted two to three potential tanks located within the lot. This information was based on the presence of fill/dip points remaining on site, and concrete cuts present on the site surface. In addition, a bowser island was present however no bowers were present. The concrete covering the site was in poor condition. No further information regarding the number, size or decommissioning status of the tanks is known. The borehole locations drilled relevant to the alignment were located up gradient of the assumed tank locations to assess potential contamination that may be encountered during the Epping Road widening works.

2.1.1 Surrounding land use

Land immediately adjacent to the site consists of the following:

- North: Residential apartments north of Epping Road. A foot path and grass separated the road from the residential properties. A large commercial building (Westpac Services) was present to the northwest of the site, on the corner of Epping Road and Langston Place.
- East: Continuation of Epping Road and residential properties. A number of cuts in the road surface were noticed along the alignment.
- South: Residential properties. Most of the properties were observed to have a large front yard, majority of which were grassed. Drive ways connected each property to Epping Road across a foot path. On the corner of Epping Road and Blaxland Road, a car mechanics workshop (Tuffy's) was observed.
- West: North-western train line was observed which cut into the surrounding land bordering the site boundary to the west. Epping Road continued past Blaxland Road over the railway line via a bridge and was surrounded by commercial properties.

2.2 Environmental setting

2.2.1 Topography and drainage

The site is situated at an elevation of approximately 90 mAHD, according to the *NSW Land and Property Information Spatial Information Exchange*. The site appears to be at the top of a gentle spur, with a slight slope downwards towards the east north-east and a low ridgeline south west of the site. Surface water flow is expected to follow local topography until it is intersected by local roads where it would then into stormwater drainage systems.

2.2.2 Soils and landscapes

The *Soil Conservation Service of NSW 1:100,000 Soil Landscape Series Sheet 930, Sydney*, classifies the soil as an erosional landscape of Glenorie and describes the soil and landscape as follows:

- Landscape: undulating to rolling rises and low hills on Wianamatta Group shales. Local relief 50 to 80 m, slopes 5-20%. Narrow ridges, hillcrests, and valleys. Extensively cleared tall open-forest.
- Soils: Shallow to moderately deep (<100 cm) Red Podzolic on crests; moderately deep (70-150cm) Red and Brown Podzolic Soils on upper slopes; deep (>200cm) Yellow Podzolic Soils on lower slopes and Humic Gleys, Yellow Podzolic Soils and Gleyed Podzolic Soils along drainage lines.
- Limitations: high soil erosion hazard, localised impermeable highly plastic subsoil, moderately reactive.

2.2.3 Acid sulfate soils

The Land and Water Conservation Acid Sulfate Soil Risk Map (1997), Prospect and Parramatta, describes the site as having no known occurrence of acid sulfate soils or not expected to occur in these environments. Land management activities not likely to be affect by acid sulfate soil materials.

2.2.4 Hydrology

The closest receiving water body from the site is expected to be Terrys Creek, which has a drainage line approximately 750 m north east of the site and another 370 m south east of the site. This creek flows into Lane Cove River approximately 2,200 m north east of the site. However, due to the high density urban environmental surrounding the site, surface water will likely enter the stormwater drainage system prior to discharge.

2.2.5 Geology

According to the Sydney 1:250,000 *Geological Series Sheet SI 56-5,* the site appears to be underlain by the following geological units outlined in **Table 3**.

Table 3 – Published geology

Period	Group	Description
Triassic.	Wianamatta Group	Ashfield Shale. Described as: black to dark-grey Shale and laminate.
Triassic	Hawkesbury Sandstone	Sandstone. Medium to coarse grained quartz sandstone, very minor shale and laminate lenses.

The geological maps indicate a dyke is located approximately 870 m north east of the site.

2.2.6 Hydrogeology

The *1:2,000,000 Groundwater in New South Wales, Assessment of Pollution Risk Map* indicates that the site is close to the boundary of:

- Shale, siltstone in a sedimentary basin other than the Great Artesian Basin
  - Low potential for groundwater movement.
  - Groundwater salinity greater than 14,000 mg/L, which is unsuitable for stock use.
- Sandstone in a sedimentary basin other than the Great Artesian Basin
  - Low to medium potential for groundwater movement.
  - Groundwater salinity 0 - 1000 mg/L, which is suitable for stock, domestic and some irrigation purposes.

GHD conducted a review of existing groundwater borehole records using the NSW Water Information Database on 17 July 2014. The search was conducted to identify registered groundwater boreholes in close proximity to the site and to record information such as use and standing water level. A total of twelve groundwater boreholes were identified within a one kilometre radius of the site, all of which were registered for monitoring purposes. Nine of these bores are located on an active service station present approximately 400 m north west of the site. The remaining three bores are located on the corner of Bridge and Victoria Street located 300 m to the west of the site. None of these groundwater boreholes are within the site boundary.

Where information was provided, standing water level was relatively shallow in all the registered wells, ranging from 1 to 2.5 metres below ground level. Details of the groundwater borehole are summarised in **Table 4** and the search results are presented in **Appendix B**.

Table 4 – Review of existing groundwater data

Borehole ID	Purpose	Depth (m)	Standing Water Level (m)	Approx. Distance from Site	Location (lat, long)	Drillers Log
GW112773	Monitoring Borehole	4.0	No details	400m north west	(33 46’ 14”, 151 4’ 49”)	No details
GW112772	Monitoring Borehole	4.0	2.5	400 m north west	(33 46’ 14”, 151 4’ 49”)	No details
GW112771	Monitoring Borehole	4.0	2.5	400 m north west	(33 46’ 15”, 151 4’ 49”)	No details
GW112770	Monitoring Borehole	4.0	2.0	400 m north west	(33 46’ 15”, 151 4’ 49”)	No details
GW112769	Monitoring Borehole	4.0	2.0	400 m north west	(33 46’ 16”, 151 4’ 49”)	No details
GW112768	Monitoring Borehole	4.0	2.0	400 m north west	(33 46’ 16”, 151 4’ 50”)	No details

Borehole ID	Purpose	Depth (m)	Standing Water Level (m)	Approx. Distance from Site	Location (lat, long)	Drillers Log
GW112765	Monitoring Borehole	3.0	1.0	400 m north west	(33 46' 14", 151 4' 51")	No details
GW112766	Monitoring Borehole	4.0	2.0	400 m north west	(33 46' 15", 151 4' 51")	No details
GW112767	Monitoring Borehole	4.0	No details	400 m north west	(33 46' 15", 151 4' 51")	No details
GW110661	Monitoring Borehole	10.0	No details	300 m west	(33 46' 29", 151 4' 47")	Fill over a sandstone and a shale layer
GW110662	Monitoring Borehole	10.0	No details	300 m west	(33 46' 29", 151 4' 47")	Fill over a sandstone and a shale layer
GW110663	Monitoring Borehole	10.0	No details	300 m west	(33 46' 29", 151 4' 48")	Fill over a sandstone and a shale layer

2.3 Site history

2.3.1 Historical aerial photographs

A selection of aerial photographs was examined in order to ascertain past activities and land uses at the site. The years examined were 1930, 1951, 1961, 1970, 1982, 1991, 2002 and 2009 (current). These photographs are provided in **Appendix C** and the current aerial photograph is also provided in **Figure 1**, **Appendix A**.

A summary of the information gained from the review of historical aerial photography is provided in **Table 5**.

Table 5 – Review of historical aerial photographs

Year	Observations
1930 (black and white)	Epping Road was identifiable and was observed to be unsealed with no road connection over the railway line at the western end. At the eastern end of the site, Epping Road was found to terminate at the Essex Street intersection. Immediately adjacent to the site on the south side of Epping Road, twelve residential properties were observed. Behind the houses, a bowling green was noted to have been developed next to a large park area. At the south western end of Epping Road, a small building was observed, separated from the row of houses by a vacant block of land. Immediately adjacent to the site on the north side is the east bound lane of Epping road and a series of houses beyond that. Regionally, road and residential density was considered to be low. Small paddock areas were observed dispersed across the region. The gully east of the site remained naturally vegetated and Terry's creek was noted. The land on the south west corner of the intersection remained vacant. The railway line was clearly observed running north-south.

Year	Observations
1951 (black and white)	It was noted that Epping Road had become sealed and connected over the railway line at its western end. The eastern end of the road had also been extended (curving northward) however it was not sealed. The houses immediately adjacent to the south and north side of Epping Road appeared relatively unchanged. The vacant block of land previously identified appeared to have a large dwelling developed on it and the small building adjacent to the western end of the site appeared to have been extended. Regionally, housing density was noted to have increased substantially, however natural vegetation remained around Terry's Creek.
1961 (black and white)	The site was observed to be entirely sealed and closely resembled its current features. Land immediately adjacent to the south and north side of the site appeared relatively unchanged since the previous photograph, with the exception of the most western property (previously identified as containing a small building). This property appeared to be a service station with the main building located on the eastern side of the area and a car parking area on the north western side of the area (concrete surfacing between). No substantial changes were noted on a regional scale.
1970 (black and white)	The site and majority of the surrounding area appeared relatively unchanged from the previous photograph. The service station previously identified was noted to have extended the main building along the eastern side of the property. Housing density had further increased on a regional scale, however no other substantial change was observed in the wider area.
1982 (sepia tone)	The site and majority of the surrounding area appeared relatively unchanged from the previous photograph. A large multistorey building was observed on the north western end of Epping road and a number of houses on the northern side of Epping Road were noted to have been redeveloped into a low-rise apartment 'village'. No substantial changes were observed on a regional scale.
1991 (colour)	The site and land immediately adjacent to the intersection appeared to be relatively unchanged from the previous photograph, except for the service station on the south western end of Epping Road. The ground surface of this area was noted to have changed from cement to a more brown colour. No substantial changes were observed on a regional scale.
2002 (colour)	The site appeared relatively unchanged from the previous photograph, as did the land immediately adjacent to the site, and no substantial changes were observed on a regional scale.
2009 (current, colour)	The site appeared relatively unchanged from the previous photograph. Land immediately adjacent to the site appeared to be relatively unchanged. The ground surface of service station on the south west end of the site remained a speckled brown colour (possibly dirt / fill). It was noted that the bowling greens previously identified were no longer in use as large brown patches (possibly mulch stock piles) and a variety of grass covers were observed on the ground surface. Regionally, only minor changes were observed.

In Summary:

- No major changes were observed on the site since 1930, however the road was observed to have been extended westward over the railway line and northward between 1930 and 1951.
- No major changes were observed to occur to the houses immediately adjacent to Epping Road on the north and south side, with the exception of a development of low-rise apartment ‘village’ (1970-1982) and a multistorey building at the north-western end of the Epping Road.
- The block of land on the south western end of Epping Road was observed to be developed into a service station between 1961 and 1970. The main buildings were observed to remain in this area in the current photograph, however the ground surface was noted to change colour between 1982 and 1991.
- The regional road network was observed to resemble the current road network by 1951. The area immediately surrounding Terry’s creek (east of the site) appeared unchanged in all photographs with natural vegetation.

3. Regulatory information review

3.1 Overview

As part of the desk based review, information was obtained from a number of sources to enable a greater understanding of historical land use at the site, including former site practices which may have the potential to cause contamination. The desk based review included the following sources of information:

- NSW WorkCover documentation.
- Council information including land zoning, and permissible use.
- NSW EPA contaminated sites register (notifications or incidents.
- NSW EPA Protection of the Environment Operations (POEO) licence register.

Relevant results from these sources are provided in **Appendix D**.

3.2 WorkCover – dangerous goods

A dangerous goods search was undertaken with WorkCover NSW on 13 August 2014 for 2 Epping Road, Epping. This is the location of the current mechanic and former service station site. The Stored Chemical Information Database and the microfiche records held by WorkCover NSW did not identify any records pertaining to the search area. A copy of the WorkCover correspondence is provided in **Appendix D**.

3.3 Council information

3.3.1 Local Environment Plan (LEP)

The site is located in the Shire of Hornsby Council. Reference to the Hornsby Local Environmental Plan 2013 indicates that the site is zoned as:

- SP2 – Infrastructure; and
- R4 – High Density Residential.

The LEP does not make any specific reference to contamination issues within the area.

3.3.2 Development Control Plan (DCP)

A review of the Hornsby Development Control Plan, 2013 found that the council requires prescriptive measures for development applications that require a preliminary contamination assessment in accordance with *SEPP 55 Remediation of Land* where land is suspected to be contaminated or where work is proposed that may disturb contaminated land. Additionally, the DCP states that in the instance where land is being developed for community uses, a land contamination report should accompany an application for a community use on or adjacent to land that is potentially contaminated.

3.4 Environment Protection Authority

GHD reviewed datasets maintained by the Environment Protection Authority (EPA) including notices under *Contaminated Land Management Act 1997*, POEO Environment Protection License Register, environmental incidents and State Heritage Register. Results are presented in **Appendix D** where applicable and summarised below.

3.4.1 Contaminated sites register

A site will be on the Contaminated Land: Record of Notices only if the EPA has issued a regulatory notice in relation to the site under the *Contaminated Land Management Act* 1997. GHD undertook a search of the register on 18 July 2014. No contaminated lands records are listed for the site and no results were found within a one kilometre radius of the site.

3.4.2 POEO environment protection license register

GHD undertook a search of the register on 18 July 2014. The search did not show any records for the site. The search showed three premises within a one kilometre radius of the site. **Table 6** provides a summary of the licence.

Table 6 – Summary of POEO license register

Applicant	Site Address	Activity Type	Licence Status	Proximity to the site
Epping Private Hospital Pty, Ltd	66 Norfolk Rd, Epping NSW 2121	Hazardous, industrial or group A waste generation / storage	Surrendered (August 2007)	990 m north
Hornsby Shire Council	Epping aquatic centre 26A Stanley Road, Epping NSW 2121	Miscellaneous licenced discharge to waters (at any time)	Surrendered (September 2011)	470 m east
Lend Lease Engineering Pty Ltd	North west rail link early works project Between Tallawong Rd Maintenance Facility and Epping Station, Epping NSW 2121	Railway systems activities	Surrendered (February 2014)	315 m north west

Given the 'surrendered' status of these licences, it is unlikely that potentially contaminating activities are occurring on these premises. They are therefore unlikely to pose an elevated risk to the site.

3.4.3 List of NSW contaminated sites notified to EPA

The sites appearing on the EPA "List of NSW contaminated sites notified to the EPA" indicate that the notifiers consider that the sites are contaminated and warrant reporting to EPA

However, the contamination may or may not be significant enough to warrant regulation by the EPA. The EPA needs to review information before it can make a determination as to whether the site warrants regulation.

GHD undertook a search of the listing on 18 July 2014. The search showed one premise within a one kilometre radius of the site. The listing is summarised in **Table 7**.

Table 7 – Summary of contaminated sites notified to EPA

Site Description	Site Address	Proximity to the Site	EPA Assessment and Management
Mobil Service Station (currently a 7-Eleven)	246 Beecroft Road, Epping	400 m north west	The contamination of this site is being assessed by the EPA. Sites which have yet to be determined as significant enough to warrant regulation may result in no further regulation under the *Contaminated Land Management* Act 1997.

Due to the substantial separation between the site and these premises, they are considered unlikely to have impacted the site.

3.4.4 State heritage register

GHD undertook a search of the register on 21 July 2014. No search results were returned on the site; however the search showed six premises within a one kilometre radius. These listings are summarised in **Table 8**.

Table 8 – Summary of state heritage register

Item name	Address	Proximity to the site	Comments
Asheldom	47 Essex Street	50 m east	Federation home of fine quality construction
Road side trees	Epping Road (between Terrys Creek and Pembroke Road)	600 m north east	Section of indigenous bushland and cultural planting of Willows and Poplars prominent on main road.
Stanely House	58 Pembroke Street, Epping	250 m north east	Good example of a two storey Victorian period Filigree style building. Distinctive sandstone and brick quoined walling
Terrys Creek Bridge	Epping Road, Epping	710 m north east	Terrys Creek Bridge is historically and aesthetically significant locally. It forms an important component of Epping Road, which is intimately related to the patterns of development of the northern and north western sector of Sydney.
Epping Railway Station Group	Beecroft Road, Epping	150 m north west	Epping Railway Station has heritage significance at a local level. The Epping Railway Station was opened in 1886.
Bushland	Beecroft Road (between Carlingford Road and Kandy Avenue)	800 m north north-west	Remnant native forest in prominent location along Beecroft Road in Epping.

4. Preliminary conceptual site model

Based on the current information, the following preliminary contamination conceptual site model (CSM) has been developed for the potential on-site sources of contamination.

4.1 Sources

4.1.1 Historical

Based on the historical land use of the site, potential contamination sources include:

- The former service station, located on the corner of Epping Road and Blaxland Road, was observed to have been built between 1961 and 1970 (currently Tuffys mechanic).
- Construction of Epping Road and/or the north west railway line.

4.1.2 Current

Majority of the site currently remains in use as Epping Road. Fill under the road surface may therefore be encountered. The perimeter of the site extends onto the surrounding residential properties and the car mechanic workshop.

Potential sources of contamination therefore include:

- The active car mechanics site (Tuffys).
- Fill beneath the road surface.
- Potential rubbish and/or chemical storage on private residential properties.

4.2 Pathways

The primary pathways by which receptors could be exposed to the sources of contamination outlined above are considered to be:

- Direct contact or inhalation with contaminated shallow soil (including asbestos).
- Ingestion of soils and dust.
- Vertical and horizontal migration through the unsaturated zone into the saturated zone and horizontal migration within the groundwater.

4.3 Receptors

When evaluating potential adverse health / environmental effects from exposure to a contaminated site, all potentially exposed populations should be considered. For the site, the key populations or receptors of interest are considered to include:

- Onsite commercial/industrial and construction workers.
- Intrusive maintenance (utility) and workers (onsite and offsite).
- Neighbouring property users (residential with gardens/commercial properties).
- Environmental receptors, including soil and groundwater.

4.4 Potential source-pathway-receptor linkages

Based on the current information, the following preliminary contamination conceptual site model (CSM) has been developed for potential on site sources of contamination in **Table 9**.

Table 9 – Preliminary Conceptual Site Model

Potential Source	Potential Contaminants	Potential Pathway	Potential Receptor	Linkage
Road construction (potential fill/road base)	Various (TRH, BTEX, PAH, Heavy Metals, Asbestos)	Human exposure: ◗ Ingestion of soils, dust, asbestos fibres. ◗ Inhalation of dust, asbestos fibres. ◗ Dermal contact with soil and dust. ◗ Inhalation of vapours. Environmental exposure: ◗ Surface water runoff.	Human receptor: ◗ On-site workers including maintenance and construction workers. ◗ Nearby residential/ commercial occupants. Environmental receptor: ◗ Surface water ecosystems (Terrys Creek/ Land Cove River).	Linkage between possible source-pathway-receptor during road construction from fill materials is likely to be low to moderate. Risk is further reduced when site management practices are employed including dust mitigation and sediment and water control. The risk to maintenance workers is also considered to be moderate; however ongoing widespread subsurface maintenance is not anticipated to occur and this activity may be regulated under an ongoing site maintenance plan.
Potential chemical storage and hazardous building materials on private properties	Hydrocarbons (TRH, BTEX), solvents and pesticides Asbestos within building materials	Human exposure: ◗ Ingestion of soils, asbestos fibres. ◗ Inhalation of dust, asbestos fibres. ◗ Dermal contact with soil and dust. ◗ Inhalation of vapours.	Human receptor: ◗ Off-site occupants and visitors.	Given the likely isolated and limited nature of this potential source, the risk from source-pathway-receptor linkages is considered low.

Potential Source	Potential Contaminants	Potential Pathway	Potential Receptor	Linkage
Former service station on the corner of Blaxland Road and Epping Road / Current car mechanics workshop on the corner of Blaxland Road and Epping Road	Hydrocarbons (TRH, BTEX), PAHs, VOCs, MTBE, Heavy Metals, Asbestos)	Human exposure: ◗ Ingestion of soils and dust. ◗ Inhalation of dust. ◗ Dermal contact with soil and dust. ◗ Inhalation of vapours. Environmental exposure: ◗ Vertical migration through the unsaturated zone into the saturated zone and horizontal migration within the groundwater. ◗ Plant communities.	Human receptor: ◗ On-site workers including maintenance workers. ◗ Nearby residential/ commercial occupants. Environmental receptor: ◗ Groundwater on and off site. ◗ Terrestrial ecosystems (Forest Park).	Pathway potentially complete. Intrusive investigation limited to the footprint of the property which will be affected by the road widening. Characterisation of the broader site is beyond the scope of this investigation.
Current service station located on the corner of Carlingford and Beecroft intersection	Hydrocarbons (TRH, BTEX), PAHs, VOCs, Heavy Metals, MTBE, Asbestos)			Limited information is available for this property. Given the use of the land and nature of the potential source contaminants, the risk of contamination to the immediate vicinity is moderate. Should further information or assessments be undertaken, the risk considerations can be further refined. However as this property is located approximately 400 meters to the inferred groundwater up gradient of the alignment, the risk is reduced to very low as impacts along the alignment are not expected from this source.

TRH – Total Recoverable Hydrocarbons; BTEX – Benzene, Toluene, Ethyl benzene and Xylene; PAH – Polycyclic Aromatic Hydrocarbons.

5. Data quality objectives

5.1 Overview

A process for establishing data quality objectives for an investigation site has been defined in the NSW DEC *Guidelines for the NSW Site Auditor Scheme* (2nd edition, 2006). The Data Quality Objectives (DQO) process was applied to the investigation and data assessment, as described below, to ensure that data collection activities were appropriate and achieved the project objectives. The DQO process involved seven steps defined as follows:

5.1.1 Step 1: State the problem

The alignment of Epping road between Blaxland Road and Essex Street in Epping NSW requires widening. The potential for contamination associated with current and former land use within the footprint of the alignment was identified.

5.1.2 Step 2: Identify the decisions

The key decisions to be made in the assessment are:

- Is soil or groundwater contamination present on-site at concentrations exceeding adopted site investigation levels?
- Are the sources of contamination (primary or secondary) from on and / or off-site sources?
- Is there an unacceptable risk posed by contamination (if present) to human health (site workers) in the context of the proposed construction works and/or end users?
- If soil or groundwater contamination is identified on-site at concentrations exceeding the adopted site investigation levels, is there a need for further assessment, remediation and/or management of the contamination?

5.1.3 Step 3: Identify inputs to the decision

The sampling program was designed to provide sufficient information to allow a sound scientific evaluation of the questions set out in **Section 5.1.2**. This was achieved by:

- Visual inspection of site areas, along with soils at the investigation locations;
- Collection of soil samples to provide data upon which to base subsequent decisions;
- Collection of one groundwater sample within the former service station property to provide data upon which to assess for contamination; and
- Comparing the soil and groundwater analytical data to applicable guidelines (as defined in **Section 6**) to evaluate the potential for contamination to adversely impact upon human health and ecological receptors.

5.1.4 Step 4: Define the study boundaries

With respect to physical boundaries, the lateral boundaries of the investigation area are defined on **Figure 1**, **Appendix A** and discussed in **Section 2**.

The vertical investigation boundary is defined as up to six metres below ground level (m bgl) which is the maximum depth of the intrusive investigation.

5.1.5 Step 5: Develop a decision rule

The degree of impact by contaminants and the decisions associated with accepting data was assessed with reference to the chosen site investigation levels, which were established within the framework of guidelines made or approved by NSW EPA. The decision rule is:

- If the data has been collected in an appropriate manner to establish completeness, comparability, representativeness, precision and accuracy, it will be considered suitable for the purposes of this assessment; and
- If soil or groundwater contamination is identified on-site at concentrations exceeding the adopted site investigation levels (**Section 6**), then further assessment and/or management of the contamination may be required.

5.1.6 Step 6: Specify limits on decision errors

Two primary decision error-types may occur due to uncertainties or limitations in the project data set:

- A sample/area may be deemed to pass the nominated criteria, when in fact it does not. This may occur if contamination is 'missed' due to limitations in the sampling plan, or if the project analytical data set is unreliable.
- A sample/area may be deemed to fail the nominated criteria, when in fact it does not. This may occur if the project analytical data set is unreliable, due to inappropriate sampling, sample handling, or analytical procedures.

An assessment will be made as to the likelihood of a decision error being made based on the results of a QA/QC assessment and the closeness of the data to the assessment criteria. The QA/QC assessment will include reference these data quality indicators.

5.1.7 Step 7: Optimise the design for obtaining data

This was achieved through the development of an appropriate sampling and analytical strategy which was reviewed and refined as necessary during the assessment evaluating field observations and analytical results. This included collection and analysis of soil and groundwater samples.

5.2 Data quality indicators

Data quality indicators (DQIs) have been established for completeness, comparability, representativeness, precision and accuracy.

The DQIs for sampling techniques and laboratory analysis of collected samples identifies the acceptable level of error for this investigation. The data quality objectives were assessed by reference to data quality indicators as follows:

Data Representativeness - expresses the degree which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples in an appropriate pattern across the site, and by using an adequate number of sample locations to characterise the site. Consistent and repeatable sampling techniques and methods are utilised throughout the sampling.

Completeness - defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study. If there is insufficient valid data, then additional data are required to be collected.

Comparability - is a qualitative parameter expressing the confidence with which one data set can be compared with the other set. This is achieved through maintaining a level of consistency in techniques used to collect samples and ensuring analysing laboratories use consistent analysis techniques and reporting methods.

Precision - measures the reproducibility of measurements under a given set of conditions. The precision of the data is assessed by calculating the Relative Percent Difference (RPD) between duplicate sample pairs.

$$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where C_o = Analyte concentration of the original sample

C_d = Analyte concentration of the duplicate sample

GHD adopts a nominal acceptance criterion of 30% RPD for field duplicates and splits for inorganics and a nominal acceptance criterion of 50% RPD for field duplicates and splits for organics. However, it is noted that this will not always be achieved, particularly in heterogeneous soil or fill materials, or at low analyte concentrations.

Accuracy - measures the bias in a measurement system. Accuracy can be undermined by such factors as field contamination of samples, poor preservation of samples, poor sample preparation techniques and poor selection of analytical techniques by the analysing laboratory. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes, laboratory blanks and analyses against reference standards.

Accuracy of field works is assessed by examining the level of contamination detected in trip blanks. Blanks should return concentrations of all organic analytes as being less than the practical quantitation limit of the testing laboratory.

6. Basis for assessment

6.1 Relevant guidelines

The framework for the contamination assessment made herein, was developed in accordance with guidelines "made or approved", by the NSW EPA under Section 105 of the *Contaminated Land Management Act, 1997*. These guidelines include, but are not limited to the following:

- NEPM (2013) *National Environment Protection (Assessment of Site Contamination) Measure*, National Environment Protection Council (NEPC).
- NSW DEC (2006) *Contaminated Sites: Guidelines for NSW Site Auditor Scheme (2nd Edition).*
- NSW DECCW (2009) *Waste Classification Guidelines Part 1: Classifying Waste.*
- NSW DECC (2009) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.*
- NSW EPA (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.*

The investigations were undertaken in accordance with the National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure (NEPM)* (December 2013).

GHD was commissioned to undertake a PSI with targeted soil and groundwater sampling for a contamination assessment. In addition, targeted sampling was conducted at the mechanical workshop site located on the corner of Epping Road and Blaxland Road. This section outlines the investigation levels adopted for the purpose of evaluating the potential risk posed by contamination, if any, during construction and under the land use setting of a road alignment.

6.2 Assessment criteria

6.2.1 Soil assessment criteria

Published NEPM screening criteria include health-based investigation levels (HILs) and health screening levels (HSLs). They provide for a range of different exposure settings, which are based on the nature of the use(s) for which the land is currently used and/or it's approved use(s). The site is currently zoned 'infrastructure' and is located in close proximity to residential properties with gardens. Given that the end land use will be road alignment, this assessment is based on exposure setting D (commercial/industrial) from herein referred as HIL D or HSL D.

There are not direct contact guidelines in NEPM. Therefore, health screening levels for direct contact (intrusive maintenance workers) in CRC Care (2011) have been adopted for the assessment.

A summary of the soil investigation levels which have been used to assess soil contamination levels is presented in **Table 10**.

Table 10 – Adopted soil criteria

Parameter	Soil (mg/kg)			
	HIL D Commercial /Industrial	HSL D, Vapour Intrusion Commercial / Industrial 0 - <1 m (Sand)	CRC Care, Vapour Intrusion, Intrusive Maintenance Workers 0-<1m (Sand)	CRC Care Intrusive Maintenance Workers direct contact
Arsenic	3000	-	-	-
Cadmium	900	-	-	-
Chromium (VI)	-	-	-	-
Copper	240,000	-	-	-
Lead	1,500	-	-	-
Mercury (inorganic)	730	-	-	-
Nickel	6,000	-	-	-
Zinc	400,000	-	-	-
TRH C_6-C_{10} (F1)	-	260	NL	82,000
TRH C_{10}-C_{16} (F2)	-	NL	NL	62,000
Benzene	-	3	77	1,100
Toluene	-	NL	NL	120,000
Ethylbenzene	-	NL	NL	85,000
Xylenes	-	230	NL	130,000
Naphthalene	-	NL	NL	29,000
Total PAH	4000	-	-	-
Carcinogenic PAHs as (BaP TEQ)[1]	40			
Asbestos	Nil	-	-	-

1. BaP TEQ – Benzo(a)pyrene toxicity equivalent quotient

6.2.1 Groundwater assessment criteria

The groundwater investigations were undertaken in accordance with the following guidelines:

- National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure (NEPM)* (December 2013); and
- The ANZECC/ARMCANZ 2000 *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC 2000) are approved as guidelines under Section 105 of the Contaminated Land Management Act 1997 as of 6 December 2001.

ANZECC 2000 outlines the principles, objectives and philosophical basis underpinning the development and application of the guidelines. It also outlines the management framework recommended for applying the water quality guidelines to the natural and semi-natural marine and freshwater resources in Australia and New Zealand. The guidelines provide a risk-based decision framework where possible, to help refine trigger values for application at local and/or regional scales.

The NSW EPA recommends that when assessing contamination of water, consideration needs to be given to the impact of any contaminants to the beneficial uses or resources of the

groundwater. The beneficial uses of groundwater may include providing recharge to rivers, lakes and bays or being a source of water for drinking, irrigation and industrial uses.

For the site, the closest receiving freshwater ecosystem is Terrys Creek. Given that this waterway can be considered moderately disturbed due to it being in an urban environment, a protection of level of 95% freshwater was utilised for the assessment of water contamination.

Table 11 provides a summary of the adopted water investigation levels that were used to compare the recorded ground water chemical concentrations.

Table 11 – Adopted groundwater criteria

Parameter	Groundwater
Arsenic	-
Cadmium	0.0002 mg/L
Chromium (VI)	0.001 mg/L
Copper	0.0014 mg/L
Lead	0.0034 mg/L
Mercury (inorganic)	0.00006 mg/L
Nickel	0.011 mg/L
Zinc	0.008 mg/L
TRH C_6-C_{10} (F1)	-
TRH C_{10}-C_{16} (F2)	-
Benzene	950 ug/L
Toluene	-
Ethylbenzene	-
Xylenes	350 ug/L
Naphthalene	16 ug/L
Total PAH	-
1,1,2-trichloroethane	6500 ug/L
1,2-dichlorobenzene	160 ug/L
1,3-dichlorobenzene	260 ug/L
1,4-dichlorobenzene	60 ug/L

6.2.2 Waste classification

The NSW DECCW (2009), *Waste Classification Guidelines Part 1: Classifying Waste* provides criteria for assessing the appropriate waste classification and subsequent disposal location for solid and liquid wastes.

The classification process for non-liquid wastes focuses on the potential for the waste to release chemical contaminants into the environment through contact with liquids (leachates). The guidelines set different maximum levels of the leachable concentration of each contaminant in order for waste to be classified as general solid or restricted solid waste. If the level exceeds industrial the waste criteria the material is classified as is hazardous.

The second test used to complete the assessment is the Specific Contamination Concentration (SCC) test, which determines the total concentration of each contaminant. In the waste sample the guidelines set different maximum levels for the total concentration of each contaminant in order for waste to be classified as inert, solid, or industrial waste. If the level exceeds the industrial waste criteria the material must be classified as hazardous waste.

7. Sampling and analysis program

7.1 General

The following section provides details of the sampling and analysis program that was developed based on information gathered in **Section 2** to **Section 0**. The aim of the site works was to address the objectives and the scope of works for the project outlined in **Section 1.3**.

7.2 Workplace health and safety

GHD developed a site specific health safety and environment (HSE) Plan for the site investigation works as part of the overall commitment to provide a healthy and safe working environment for staff and contractors. All work employed appropriate personal protection equipment (PPE).

The HSE plan included a job safety and environment analysis detailing the step by step procedures of all aspects of the works and associated hazards and control measures to be implemented. The HSE plan was read by all GHD personnel and subcontractors and feedback and discussion provided prior to the works commencing. A site specific pre-start safety assessment was conducted each morning before commencing works.

GHD also completed a site inspection prior to on-site intrusive works to finalise the proposed borehole locations, which included the following:

- Accessibility of each location was checked by GHD's site representative; and
- Services clearance was undertaken by a professional underground services locator to further reduce the risk of intersecting subsurface services during the intrusive works, and dial before you dig were also referenced.

7.3 Sampling locations and details

7.3.1 Sampling locations

The sampling locations undertaken by GHD are outlined in **Figure 2**, **Appendix A** and were evenly distributed along the alignment of the site.

A total of 10 bore holes (BH13 – BH23) were drilled for geotechnical and contamination assessment purposes along the alignment boundary in regular intervals. Drilling was undertaken using both a track mounted Geoprobe rig which were operated by a licensed driller. A further three bores were drilled within the Tuffy's Mechanics lot boundary (BH101 – BH103) for the contamination assessment.

These borehole locations were selected to target the area between the mechanics and road alignment boundary, located up gradient of the assumed underground tank locations. Groundwater well BH103 was installed in an area closest to the assumed vicinity of the tanks, remaining within the alignment boundary.

7.3.2 Soil sampling

The soil bores were advanced in accordance with GHD procedures, with majority extending to depths of up to approximately 3.5 metres below ground level (mbgl). BH103 extended to 6 mbgl and had a groundwater well installed for groundwater monitoring purposes. Further information is provided in **Section 7.3.3**.

Prior to undertaking intrusive works at the site, the locations were inspected and assessed by a service location contractor engaged by GHD. Using *Dial Before you Dig* (DBYD) utility plans as

an indicator of the below ground utilities entering the site, the service locator used a cable avoidance tool and signal generator to scan the proposed exploratory areas for services.

During drilling of the bore holes, soil samples were collected at intervals from the surface profile until termination including where changes in the lithology or indications of contamination were observed. Samples were recovered directly from the auger and representative samples were transferred to laboratory prepared sample jars for transfer to the nominated laboratory. The geology encountered during these works is discussed in **Section 8.1.1**.

24 parent soil samples and one duplicate were submitted to the nominated laboratory for analysis for the contaminants of potential concern (CoPC). These were:

- Heavy metals.
- Total Recoverable Hydrocarbons (TRH).
- Polycyclic aromatic hydrocarbons (PAH).
- Benzene, toluene, ethyl benzene and xylenes (BTEX).
- Asbestos.

All spoil material generated from the drilling of the boreholes was used to backfill the locations following sampling.

Soil samples were collected at the intervals as detailed on the borehole logs and soils were described in general accordance with the Unified Soil Classification System (USCS), with features such as seepage, discolouration, staining, odours and other indications of contamination being noted. Copies of the borehole logs are included in **Appendix E**.

All samples were screened in the field using a hand held photo-ionisation detector (PID). A PID was used to measure volatile organic concentrations in ambient air and is useful as a preliminary 'check' for the possible presence of volatile contaminants such as BTEX and light fraction TRH species. The results of the PID screen are provided on the logs, with the calibration certificate provided in **Appendix H**.

7.3.3 Groundwater sampling

Groundwater sampling was conducted at BH103 in accordance with GHD Standard Operating Procedures (SOP's).

The well was constructed using Class 18 PVC casing, a bentonite 'plug' to preclude downward percolation of water from the surface and graded sand backfill around the well screen. The ground surfaces at the well locations were reinstated with a gatic cover set in concrete. The well was screened from 1.5 m to 6.0 m blg, through the residual clay material.

After a period of one week (on 17 September 2014), the well was gauged and sampled using a low flow sampling system. Groundwater was present at a depth of 1.38 m bgl. Field measurements were measured continuously to ensure representative samples were collected. These measurements are provided in **Section 8.2.2**.

A duplicate was also collected at this location, and both samples were analysed for:

- Heavy metals.
- TRH.
- PAH.
- BTEX.
- VOC.

7.4 Quality assurance

7.4.1 Field quality controls

All fieldwork was conducted in general accordance with GHD's Standard Field Operating Procedures, aimed at collecting all environmental samples using a set of uniform and systematic methods, as required by GHD's Quality Assurance system. Key requirements of these procedures were as follows:

- Appropriately trained and experienced staff documented site activities using photographs and notes on standard field forms such as daily and sampling logs.
- Decontamination procedures including the use of new disposable gloves for the collection of each sample, decontamination of the sampling equipment between each sampling location and the use of dedicated sampling containers.
- Logging procedures - all samples were described using a recognised system.
- Calibration procedures - all field monitoring equipment was appropriately calibrated.
- Sample identification procedures - collected samples were immediately transferred to sample containers of appropriate composition and preservation for the required laboratory analysis. All sample containers were clearly labelled with a sample number, sample location, sample depth, sample date and sampler's initials. The sample containers were transferred to a chilled cooler for sample preservation prior to and during shipment to the testing laboratory.
- Chain of custody information requirements - a chain-of-custody form was completed and forwarded to the testing laboratory.

As detailed in the GHD field quality control procedures used during the project comprised the collection and analysis of the following:

Blind Duplicates: Comprise a single sample that is divided into two separate sampling containers. Both samples were sent anonymously to the project laboratory. Blind duplicates provide an indication of the analytical precision of the laboratory, but are inherently influenced by other factors such as sampling techniques and sample media heterogeneity.

One soil sample (QA01/BH101_3.0-3.1) and one groundwater sample (QA1/BH103) blind duplicates were taken.

Duplicates were assessed by calculating the Relative Percentage Difference (RPD) between the primary and duplicate samples, and the results are discussed in **Section 7**.

7.4.2 Laboratory program

Laboratory Information

The primary laboratory used was Eurofins MGT (Sydney) who adopted their internal procedures and NATA accredited methods in accordance with their quality assurance system.

Laboratory QA/QC

Laboratory quality control procedures used during the project included:

Laboratory Duplicate Samples: The analytical laboratory collects duplicate sub samples from one sample submitted for analytical testing at a rate equivalent to one in twenty samples per analytical batch, or one sample per batch if less than twenty samples are analysed in a batch. A laboratory duplicate provides data on the analytical precision and reproducibility of the test result.

Spiked Samples: An authentic field sample is 'spiked' by adding an aliquot of known concentration of the target analyte(s) prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques. Spiked samples will be analysed for each batch where samples are analysed for organic chemicals of concern.

Certified Reference Standards: A reference standard of known (certified) concentration is analysed along with a batch of samples. The Certified Reference Standard (CRS) or Laboratory Control Spike provides an indication of the analytical accuracy and the precision of the test method and is used for inorganic analyses.

Surrogate Standard / Spikes: These are organic compounds which are similar to the analyte of interest in terms of chemical composition, extractability, and chromatographic conditions (retention time), but which are not normally found in environmental samples. These surrogate compounds are 'spiked' into blanks, standards and samples submitted for organic analyses by gas-chromatographic techniques prior to sample extraction. Surrogate Standard/Spikes provide a means of checking that no gross errors have occurred during any stage of the test method leading to significant analyte loss.

Method Blank: Usually an organic or aqueous solution that is as free as possible of analytes of interest to which is added all the reagents, in the same volume, as used in the preparation and subsequent analysis of the samples. The reagent blank is carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample.

The individual testing laboratory conducted an assessment of the laboratory QC program, internally; however, the results were also independently reviewed and assessed by GHD.

Laboratory duplicate samples should return RPDs within the NEPM acceptance criteria of ±30%. Percent recovery is used to assess spiked samples and surrogate standards. Percent recovery; although dependent on the type of analyte tested, concentrations of analytes and sample matrix; should normally range from about 70-130%. Method (laboratory) blanks should return analyte concentrations as 'not detected'.

8. Site investigation results

8.1 General

Soil analytical results have been compared to the site investigation levels referenced in **Section 5**, and have been used to assess risks to identified receptors for a commercial/industrial land use setting.

8.1.1 Stratigraphy

The soil profile conditions along Epping Road were relatively consistent at each borehole location.

Fill layers were encountered at the surface and consisted of concrete and/or asphalt layer overlaying gravelly sand/ clayey sand. These layers were approximately 0.1 – 0.35 m and 0.7 – 1.0 m thick respectively. A fill layer was identified at all locations with the exception of BH22 and BH23.

Under the gravelly sand, residual layers of gravelly clay and/or clay were encountered until bore termination (maximum depth of 6 mbgl, BH103). Exceptions to this pattern were:

- BH15 – no clay layer was encountered. Instead, gravelly sand, encountered under the asphalt layer, extended to 2.8 mbgl (end of hole)
- BH18 – sandstone was encountered at 1.6 mbgl and extended to 2.8 mbgl (end of hole)

BH17 was not completed due to refusal on concrete road base at 0.05 mbgl. Therefore no samples were collected for chemical analysis.

No groundwater strike was encountered during the drilling works, including during installation of the monitoring well.

Detailed soil profile information from the investigation is supplied in the borehole logs provided in **Appendix E**.

8.1.2 Visual and olfactory indications of soil contamination

A slight organic odour and black staining was noted in clay fill material at BH13. No other olfactory indications of potential contamination were observed. A PID was used to screen for volatiles for samples collected during the preliminary site investigation, with readings ranging from less than 0.1 to 4.2 ppm at BH13 (0.35-0.8 mbgl). This maximum PID reading corresponds with the depth at which the slight odour and staining was noted.

Visual indicators of potential contamination included fill/road base below an asphalt sealing layer at the surface. These anthropogenic materials have an unknown origin and were identified up to depths of approximately 1.3 mbgl in some locations.

8.2 Analytical results

8.2.1 Soil results

The soil investigation laboratory results are presented in **Table 1**, **Appendix F** and laboratory reports are provided in **Appendix G**.

The majority of analytes reported concentrations below the laboratory practical quantitation limit (PQL) across all sampling locations with minor detections present within heavy metals and heavy fraction TRH. These are detailed as follows:

- TRH C_{16}-C_{34}: Concentrations ranging from 110 mg/kg (BH103_1.0-1.1) to 450 mg/kg (BH20_0.2).
- TRH C_{34}-C_{40}: Concentrations ranging from 160 mg/kg (BH15_0.4) to 700 mg/kg (BH20_0.2).
- Sample location BH13_0.4 was the only location to report BTEX concentrations, with benzene (1.6 mg/kg) less than the most conservative guideline criteria of 3 mg/kg. Additionally, total xylenes reported 2.4 mg/kg, less than the criteria value of 230 mg/kg.

Overall, all concentrations were reported below the selected guideline criteria.

A total of nine surface soil samples were submitted for analysis of asbestos. All soil samples reported no detectable asbestos fragments or fibres in the soil.

8.2.2 Groundwater results

Field measurements collected during groundwater sampling are summarised in **Table 12**.

BH103 reported reducing conditions with only slightly acidic, saline conditions. No visual or olfactory evidence of contamination was noted during groundwater sampling.

Table 12 – Field parameters

Borehole ID	SWL	Temp (ºC)	Conductivity (mS/cm)	pH	Dissolved oxygen (ppm)	Redox (mV)
BH103	1.389	19.1	134.6	6.17	11.2	167.9

The groundwater laboratory results are presented in **Table 2**, **Appendix F** and laboratory reports are provided in **Appendix G**.

The majority of analytes reported non-detect concentrations in the groundwater monitoring well BH103, located on the former service station site.

Concentrations of some heavy metals, including copper and zinc, reported an exceedence of the adopted screening criteria, with values of 0.002 mg/L and 0.015 mg/L, respectively.

8.3 Preliminary waste classification (in-situ soils)

The concentrations of contaminants were compared to the criteria outlined in Section 5 of the NSW DECC (2008) *Waste Classification Guidelines, Park 1: Classifying Waste.* The results are summarised in **Table 3**, **Appendix F**.

Overall, the majority of samples fell below the applicable criteria for general solid waste, with minor exceedances reported for lead and nickel. Two samples of lead exceeding the general solid waste guideline (no leaching) were reported as 110 mg/kg and 360 mg/kg. Additionally, two samples exceeded the general solid waste (no leaching) guidelines for nickel, with concentrations of 81 mg/kg and 92 mg/kg.

Based on these results, the material would exceed the threshold for general solid waste and would be classified as restricted solid waste. It is noted that these are marginal exceedances, and further analysis through Toxicity Characteristic Leaching Potential (TCLP) would likely reduce this classification to general solid waste.

Further detailed waste classification will be required prior to any offsite disposal.

8.4 QA/QC data quality assessment

8.4.1 Field QA/QC

Soil RPDs

As part of the GHD QA/QC program, one blind duplicate sample was analysed from the fieldworks. Concentrations were reported for heavy metals and PAH, however for TRH and BTEX reported concentrations below the limit of laboratory reporting and as a result, it was not possible to calculate a RPD for these analytes. QA/QC analysis is shown in **Table 4a**, **Appendix F**. For analytes with detected concentrations reported, RPDs were generally within the acceptable range with the exception of copper. This analyte had a RPD of 32%, which marginally exceeds GHD's nominal acceptance criteria for inorganic compounds.

The results are not considered to be significant, and the elevated RPD for some samples is likely attributed to the low concentrations and close to the laboratory reporting limits, meaning a relatively small change in concentration gives rise to a large RPD value. In addition, the heterogeneity of fill material may also account for some of the discrepancies in the RPDs.

Groundwater RPDs

One blind duplicate sample was analysed from the fieldworks. Concentrations were reported for some heavy metals however for TRH, BTEX and PAH reported concentrations below the limit of laboratory PQL and as a result, it was not possible to calculate a RPD for these analytes. QA/QC analysis is shown in **Table 4b**, **Appendix F**.

For analytes with detected concentrations, RPDs were reported within the acceptable range of 30% for inorganic compounds.

8.4.2 Laboratory QA/QC

Holding times

All analytes were extracted within the laboratory's technical holding times.

Laboratory program

The NATA certified laboratory utilised for this assessment (Eurofins MGT Sydney) undertook their own quality assurance and quality control procedures for sample analysis. GHD has reviewed the internal laboratory control data provided within the laboratory reports, which are attached as **Appendix G**.

- **Duplicate soil sample TRH C29-C36, Chromium and Zinc**: The RPD for these analytes was found to be greater than 30%, however these RPDs are accepted by Eurofins | mgt as it passes the internal Acceptance Criteria.

All other method blank results were less than the PQL, and surrogate spike and laboratory control sample recoveries were within laboratory acceptance criteria for both water and soil samples.

8.4.3 Discussion

The results of the QA/QC program are considered to provide an acceptable degree of confidence in the analytical program completed. Overall, the analytical data set is considered to be valid and acceptable to base conclusions on the contamination status of the site.

9. Conclusions and recommendations

9.1 Conclusions

GHD was commissioned by RMS to conduct a targeted contamination assessment along Epping Road between Blaxland Road and Essex Street in Epping, NSW.

The PSI comprised a desk study with a targeted soil and groundwater investigation to assess the nature and extent of soil contamination at targeted locations along the proposed alignment upgrade and assess potential risks posed by the identified contaminants of potential concern during construction.

A review of historical information indicted the primary sources of potential contamination within the footprint of the proposed upgrade works comprised:

- A former service station, currently operating as a mechanical workshop;
- The former construction of Epping Road and the north west railway line; and
- Fill material beneath the ground surface.

The subsurface conditions across the site generally consisted of concrete and/or asphalt layer overlaying gravelly sand, underlain by residual layers of gravelly clay and/or clay to the maximum borehole depth of 6.0 m bgl, with shallow sandstone encountered at one location.

Ten boreholes (BH13 – BH23) were drilled for the purpose of combined geotechnical and contamination assessment along Epping Road and Essex Street. A further three bores were drilled at Tuffy's Mechanics (BH101 – BH103) on the northern boundary. A groundwater well was installed within BH103 for groundwater monitoring purposes.

The following results were obtained:

- The majority of analytes reported non-detect concentrations across all soil sampling locations with minor detections present within heavy metals and heavy fraction TRH. Overall, all concentrations were reported below the selected investigation levels appropriate for the protection of construction / intrusive maintenance workers and on-going land use under a commercial / industrial setting.
- A total of nine surface soil samples were submitted for analysis of asbestos. All soil samples resulted in no detectable asbestos fragments or fibres in the soil.
- The majority of analytes reported non-detect concentrations in the groundwater sample collected and analysed. However the heavy metals copper and zinc reported an exceedance of the adopted screening criteria, with values of 0.002 mg/L and 0.015 mg/L respectively. It is likely that these minor exceedances are indicative of background concentrations.
- Based on the preliminary waste classification results, waste soil would be provisionally classified as restricted solid waste owing to concentrations of lead and nickel marginally exceeding the specific contaminant concentration for general solid waste. Further analysis through TCLP extraction and analysis would likely reduce this classification to general solid waste.
- Although the results of the soil and groundwater investigation undertaken in the vicinity of the mechanics workshop (former service station) did not identify any contamination exceeding site investigation guidelines, it is noted the locations targeted the proposed alignment and were up gradient of the underground tanks. There is the potential for

further contamination to be present within the footprint of the site, in areas adjacent and down gradient of the underground tanks and in the direction of groundwater flow.

9.2 Recommendations

With reference to the objectives in **Section 1.3** and the limitation in **Section 10**, the following recommendations are made:

- There is potential for fill material to have been used during levelling/construction of the road ways hence there is a potential risk of encountering unexpected contaminated material during the proposed construction works. A Construction Environmental Management Plan (CEMP) should be developed prior to construction including an unexpected contamination findings protocol. This protocol should contain procedures for the identification and management of contamination including controls to ensure adequate protection of health, safety and the environment.
- Final waste classification is required once the volumes of waste requiring offsite disposal are confirmed. Waste soils should be classified in accordance with the NSW EPA (2014) *Waste Classification Guidelines*.
- It is recommended that RMS liaise with the site owners of the mechanics workshop to ascertain if any further contamination investigations have been completed which may provide additional information pertaining to the presence of contamination associated with current or former use of this land.
- The following procedures should be implemented by RMS as a minimum to asses and manage potential soil contamination at the proposed road widening work compound sites including the mechanical workshop at the corner of Epping Road and Blaxland Road (2 Epping Road), and two residential properties at the corner of Epping Road and Essex Street (36 and 38 Essex Street), and two residential properties along Forest Grove (2 and 4 Forest Grove) in Epping, NSW;
  - Prior to acquisition, all available reports pertaining to contamination should be reviewed. Hazardous material surveys and soil contamination assessment (from lead paint and asbestos) should also be completed;
  - Procedures must be prepared and implemented to management lead paint and asbestos during demolition so that soil contamination is minimised;
  - Following demolition a baseline soil contamination assessment should be undertaken prior to site use as a works compound. This should include assessment of contamination from underground fuel storage infrastructure at the Tuffy Mufflers site. Remediation should be undertaken if identified contamination poses a risk to human health or the environment; and
  - When the works compound is no longer required, site assessment should be undertaken to assess the risk posed by contamination (if any) introduced during use of the works compounds. Remediation should be undertaken if contamination poses an unacceptable risk to human health or the environment under the proposed land use scenario.

10. Limitations

This Targeted Contamination Assessment Report

- has been prepared by GHD for RMS;
- may only be used and relied on by RMS;
- must not be copied to, used by, or relied on by any person other than RMS without the prior written consent of GHD and subject always to the next paragraph; and
- may only be used for the purpose as stated in Section 1.2 of the Report (and must not be used for any other purpose).

GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than RMS arising from or in connection with this Report.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by GHD in connection with preparing this Report:

- were limited to those specifically detailed in Section 1.3 of this Report;
- were undertaken in accordance with current profession practice and by reference to relevant environmental regulatory authority and industry standards, guidelines and assessment criteria in existence as at the date of this Report.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation of this Report and are relevant until such times as the site conditions or relevant legislations changes, at which time, GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations."

GHD has prepared this Report on the basis of information provided by RMS and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work.

GHD expressly disclaims responsibility in connection with the unverified Information, including (but not limited to) errors in, or omissions from, the Report, which were caused or contributed to by errors in, or omissions from, the Unverified Information."

No investigations have been undertaken into any off-site conditions, or whether any adjoining sites may have been impacted by contamination or other conditions originating from this site.

The opinions, conclusions and any recommendations in this Report are based on information obtained from, and testing undertaken at or in connection with, specific sampling points and may not fully represent the conditions that may be encountered across the site at other than these locations. Conditions at other parts of the site may be different from the site conditions found at the specific sampling points.

Investigations undertaken in respect of this Report were constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this Report.

GHD has considered and/or tested for only those chemicals specifically referred to in this Report and makes no statement or representation as to the existence (or otherwise) of any other chemicals.

Site conditions (including any the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD expressly disclaims responsibility:

- arising from, or in connection with, any change to the site conditions; and
- to update this Report if the site conditions change.

Except as otherwise expressly stated in this Report GHD makes no warranty or representation as to the presence or otherwise of asbestos and/or asbestos containing materials ("ACM") on the site. If fill material has been imported on to the site at any time, or if any buildings constructed prior to the prohibition date of asbestos in Australia, 31 December 2003, have been demolished on the site or material from such buildings disposed of on the site, the site may contain asbestos or ACM.

Subsurface conditions can vary across a particular site and cannot be exhaustively defined by the investigation carried out prior to this Report. As a result, it is unlikely that the results and estimations expressed or used to compile this Report will represent conditions at any location other than the specific points of sampling. A site that appears to be unaffected by contamination at the time of the Report may later, due to natural causes or human intervention, become contaminated.

Except as otherwise expressly stated in this Report, GHD makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.

These Limitations should be read in conjunction with the entire Report and no excerpts are taken to be representative of the findings of this Report.

Appendices

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