GREENCAP
Going Further in Managing Risk

Environmental Condition – Site Contamination Study

Fairland Group Pty Ltd

Cnr Findon & Valetta Roads, Kidman Park

APPENDIX C 2015 ENVIRONMENTAL SITE ASSESSMENT REPORT

12 Greenhill Road
Wayville SA 5034
Australia
P: (08) 8299 9955
F: (08) 8299 9954
www.greencap.com.au

ENVIRONMENTAL SITE ASSESSMENT

HSBC Institutional Trust Services (Singapore) Limited (in its capacity as Trustee of Cache Logistics Trust)
ARA-CWT Trust Management (Cache) Limited (in its capacity as Manager of Cache Logistics Trust)
In For A Pound Pty Ltd

404-450 Findon Road, Kidman Park

November 15
J134221
Report Version: J134221/ESA/01

Environmental Site Assessment

HSBC Institutional Trust Services (Singapore) Limited (in its capacity as Trustee of Cache Logistics Trust)
ARA-CWT Trust Management (Cache) Limited (in its capacity as Manager of Cache Logistics Trust)
In For A Pound Pty Ltd

404-450 Findon Road, Kidman Park

EXECUTIVE SUMMARY

Greencap was commissioned by HSBC Institutional Trust Services (Singapore) Limited (in its capacity as trustee of Cache Logistics Trust), ARA-CWT Trust Management (Cache) Limited (in its capacity as manager of Cache Logistics Trust) and In For A Pound Pty Ltd to undertake an Environmental Site Assessment for the site located at 404-450 Findon Road, Kidman Park, South Australia.

The objective of this assessment was to undertake investigations to determine the significance of the contamination reported at the site to date, and to further assess whether any of the activities that have been carried out on the site have caused site contamination that would require management or remediation as part of future redevelopment of the site.

Soil Investigation

A soil investigation was conducted comprising the drilling of 112 grid based soil bores across the site and 25 targeted soil bores in areas of identified potential contamination. The maximum depth of the soil investigation was 8.0 metres below ground level (mbgl). The identified impacts include:

- *Isolated elevated levels of fuel related compounds above ecological screening levels for residential land use but below the ecological screening levels for commercial/industrial land use.*
- *Elevated results for fuel related compounds above the adopted health screening level around the eastern underground tank area.*
- *An isolated result for benzo(a)pyrene (commonly associated with fill material) was reported above the adopted health investigation level for residential use. Statistically, this elevated result is not considered significant.*
- *Asbestos containing material was identified at one location under the dry goods warehouse at a depth greater than 1.0m.*

Groundwater Investigation

The most recent investigations comprised the sampling of four existing onsite groundwater monitoring wells and the installation and sampling of seven additional groundwater wells. Groundwater was encountered at depths between 5.5 and 6.5 metres below ground level and the groundwater flow direction was inferred to be west to north westerly. The results of interest include:

- *Elevated levels of solvents in the north western and western portions of the site. Only one result exceeded the adopted water quality criteria along the site's western boundary.*
- *Elevated concentrations of pesticides were reported above the adopted water quality criteria at two locations; west of the cold store warehouse and along the site's western boundary.*
- *Fuel related compounds above the adopted water quality criteria were identified at one location adjacent to the underground fuel tanks in the eastern portion of the site. Several other results for fuel related compounds were reported at detectable concentrations around the underground tanks, but these did not exceed the adopted water quality criteria.*
- *An elevated result was reported for the heavy metal selenium in a well that was installed to assess the background quality of groundwater entering the site from the east (up inferred hydraulic gradient).*

Previous groundwater investigations undertaken at the site identified elevated concentrations of similar compounds. Overall, the reported results from this monitoring round (for those wells sampled previously) indicate a decrease in concentrations of the chemicals of concern identified in these sampling events.

Soil Vapour Investigation

A soil vapour investigation was undertaken around underground tanks located in the north western and eastern portions of the site to measure the potential presence of vapours.

Detectable concentrations of fuel related compounds were reported from all soil vapour points, but these were below the adopted assessment criteria for residential land use. A number of soil vapour concentrations exceeding the adopted criteria for residential land use were reported for solvent related chemicals. The highest results were from the southern side of the north western underground tank area. It is noted that a groundwater well in this area did not report elevated concentrations of the chemicals identified in soil vapour. This may indicate that the soil vapours detected are from contamination in soil rather than groundwater.

Concluding Comments

No impacts have been identified that would preclude ongoing commercial / industrial use in the site's current layout. If the site was to be redeveloped for a more sensitive land use (i.e. residential), additional works would be required. These have been detailed under a separate cover.

Statement of Limitations

This report has been prepared in accordance with the agreement between HSBC Institutional Trust Services (Singapore) Limited (in its capacity as trustee of Cache Logistics Trust), ARA-CWT Trust Management (Cache) Limited (in its capacity as manager of Cache Logistics Trust) and In For A Pound Pty Ltd and Greencap.

Within the limitations of the agreed upon scope of services, this work has been undertaken and performed in a professional manner, in accordance with generally accepted practices, using a degree of skill and care ordinarily exercised by members of its profession and consulting practice. No other warranty, expressed or implied, is made.

This report is solely for the use of HSBC Institutional Trust Services (Singapore) Limited (in its capacity as trustee of Cache Logistics Trust), ARA-CWT Trust Management (Cache) Limited (in its capacity as manager of Cache Logistics Trust) and In For A Pound Pty Ltd and any reliance on this report by third parties shall be at such party's sole risk and may not contain sufficient information for purposes of other parties or for other uses. This report shall only be presented in full and may not be used to support any other objective than those set out in the report, except where written approval with comments are provided by Greencap.

Environmental Site Assessment

HSBC Institutional Trust Services (Singapore) Limited (in its capacity as trustee of Cache Logistics Trust)

ARA-CWT Trust Management (Cache) Limited (in its capacity as manager of Cache Logistics Trust)

In For A Pound Pty Ltd

404-450 Findon Road, Kidman Park

Table of Contents

Figures

Environmental Site Assessment

HSBC Institutional Trust Services (Singapore) Limited (in its capacity as trustee of Cache Logistics Trust)

ARA-CWT Trust Management (Cache) Limited (in its capacity as manager of Cache Logistics Trust)

In For A Pound Pty Ltd

404-450 Findon Road, Kidman Park

Greencap Document Control.

Report Title:- Environmental Site Assessment – 404-450 Findon Road, Kidman Park **Greencap Job Ref:-** J134221/ESA/01	**Filename:-** J134221 Environmental Site Assessment - 404-450 Findon Road, Kidman Park
Written:  **Emily Godsiffe** Senior Environmental Scientist	**Approved:**  **Andrew Durand** Contaminated Land Manager (SA)

Rev No	Status	Date	Author	Reviewer
0	Draft	October 2015	EG	AD/NW
1	Final	November 2015	EG	AD/NW

Rev No	Copies	Recipient(s)
0	1 x Digital	HSBC Institutional Trust Services (Singapore) Limited (in its capacity as trustee of Cache Logistics Trust) ARA-CWT Trust Management (Cache) Limited (in its capacity as manager of Cache Logistics Trust) In For A Pound Pty Ltd
1	1 x Digital	HSBC Institutional Trust Services (Singapore) Limited (in its capacity as trustee of Cache Logistics Trust) ARA-CWT Trust Management (Cache) Limited (in its capacity as manager of Cache Logistics Trust) In For A Pound Pty Ltd

1.0 INTRODUCTION

1.1 Background

Greencap was commissioned by HSBC Institutional Trust Services (Singapore) Limited (in its capacity as trustee of Cache Logistics Trust), ARA-CWT Trust Management (Cache) Limited (in its capacity as manager of Cache Logistics Trust) and In For A Pound Pty Ltd to undertake an Environmental Site Assessment for the site located at 404-450 Findon Road, Kidman Park, South Australia.

The objective of this assessment was to undertake a detailed investigation to determine the significance of the contamination reported at the site to date, and to further assess whether any of the activities that have been carried out on the site have caused site contamination that would require management or remediation as part of future redevelopment of the site.

It is understood the medium to long term plan to develop the site for residential purposes, which in South Australia will trigger the need for a Site Contamination Audit Report to be completed by an independent Site Contamination Auditor accredited by SA EPA. The location of the site is presented in Figure 1.

Figure 1 - Site Location

The scope of the work has comprised:

- A review of existing reports in order to identify potentially contaminating activities at the site.
- A soil investigation comprising the drilling of 112 grid soil bores and 25 targeted soil bores.
- A groundwater investigation comprising the sampling of four existing onsite groundwater monitoring wells and the installation and sampling of seven additional groundwater wells.
- A soil vapour investigation around two known areas of former underground fuel storage. A total of four soil vapour points were installed around in these areas and sampled for volatile compounds.

The assessment has been prepared with reference to industry standards and guidelines including the National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) and the Australian Standard "Guide to the investigation and sampling of potentially contaminated soil": AS4482.1-2005.

1.2 Contaminated Land Management in SA

The management of contaminated land in South Australia is achieved through a variety of national and state laws and guidelines. The principal legislation is the Environment Protection Act (1993) which includes amendments related to site contamination which were enacted in 2009, and subordinate legislation the Environment Protection Regulations 2009. The Land and Business (Sale and Conveyancing) Act 1994 was also amended in 2009 as part of new site contamination provisions introduced in the Environment Protection Act. The Development Act 1993 is in the process of being amended to include new site contamination provisions.

Planning Advisory Notice 20 (Site Contamination) issued by Planning SA in December 2001 outlines the responsibilities of planning authorities in relation to addressing site contamination through the Plan Amendment Report (PAR) Process and when assessing development applications.

Planning Advisory Notice 20 also outlines the requirements for confirming the suitability of sites, depending on the sensitivity of the proposed future use. Where a sensitive use is proposed (residential, primary school, preschool or child care centre) on a site where site contamination exists or a potentially contaminating activity has occurred, the use of an independent site contamination auditor, accredited by the Environmental Protection Authority (EPA), is required to confirm the suitability of the site for the intended use. For development or continuation of an existing commercial, industrial or similar use, assessment by an experienced site contamination consultant should generally be acceptable.

Guidance for conducting site assessments is provided in the NEPM, published by the National Environment Protection Council (NEPC). The NEPM has been adopted in all States and Territories of Australia for overall guidance on assessment of contaminated land.

Sites with groundwater contamination issues must be dealt with in accordance with EPA's risk based groundwater management framework, as outlined in the Guidelines for Assessment and Remediation of Groundwater Contamination (EPA, Feb 2009). This includes remediating groundwater impacts to the point of necessity, with the point of necessity as determined by a site specific risk assessment. There are certain circumstances relating to groundwater contamination and remediation work where an accredited site contamination auditor will need to be engaged, if they are not already involved.

The EPA is responsible for administering the site contamination audit system. Further details are provided in the EPA Information Sheet 'Overview of the Site Contamination Audit System' (EPA, Sept 2009). The EPA maintains the integrity of the audit system by accrediting individuals as site contamination auditors and ensuring site contamination audits are carried out in accordance with the legislation and guidance issued or approved by the EPA. Guidance for conducting Audits of contaminated land in South Australia is provided in Guidelines for the Site Contamination Audit System (EPA, Jan 2009).

2.0 SITE DETAILS

2.1 Site Identification and Zoning

The site is described by Certificates of Title Volume 6154, Folio 507 and Volume 6155, Folio 62. The legal description of the site is Allotment 401 of Deposited Plan 19661 and Allotment 301 of Filed Plan 6069 in the area named Kidman Park, Hundred of Yatala.

The site is located within an Industrial Zone within the City of Charles Sturt, and is bordered by residential zoned areas to the north, east and west. A copy of the current Council zoning information is provided in Appendix A.

2.2 Physical Setting

The site is located in Kidman Park, which is approximately 6 kilometres north west of Adelaide and 3.6 kilometres east of the coast (Gulf St Vincent). The site is generally level and the surrounding areas are slightly undulating. A raised area (soil mound) is present running along the north western boundary of the site. The nearest permanent watercourse is the Torrens River, located adjacent to the southern site boundary.

2.3 Site Description and Current Land Use

The site is an irregular shaped parcel of land with a total area of approximately 11.9 hectares. The site is currently operating as a food distribution outlet (dry and frozen goods) and comprises several warehouses, offices and loading areas. The current site operations include warehousing and distribution of goods, washing of trucks and forklift maintenance.

Figure 2 shows the current site layout and photographs of the site (taken 20 July 2015) follow.

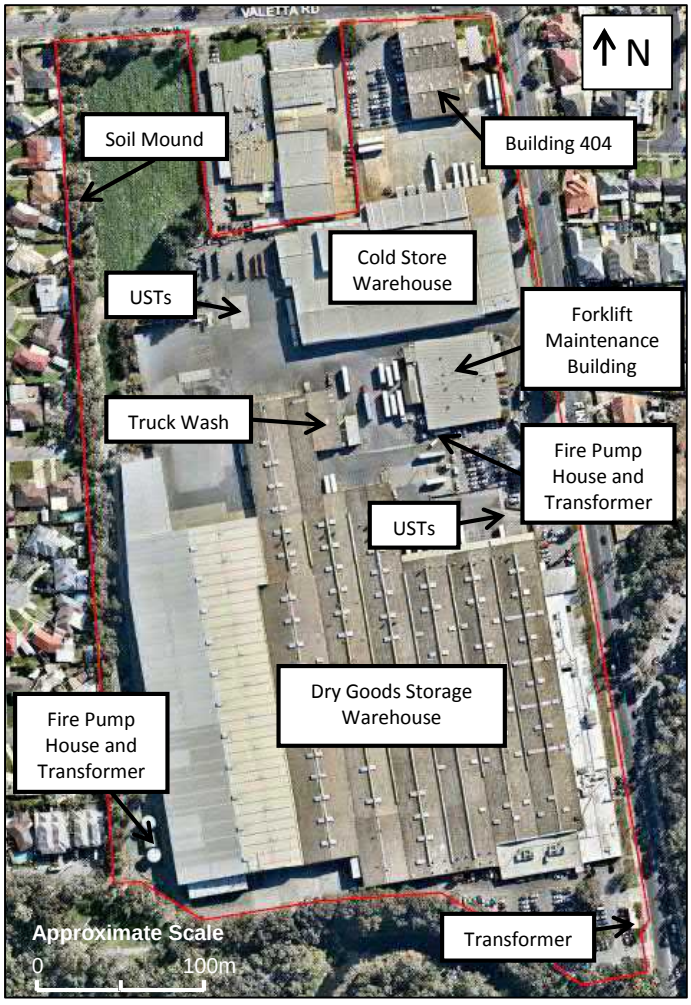


Figure 2 – Current Site Layout

Photograph 1 – View of the car park and office building in the south east of the site

Photograph 2 – View along the southern boundary of the site from west to east

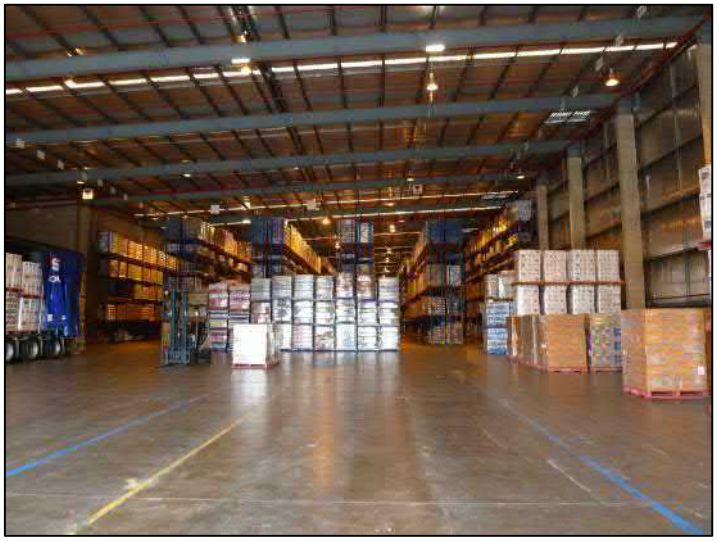
Photograph 3 – View of the south western boundary of the site from north to south

Photograph 4 – View of the paddock in the north western corner of the site from south to north

Photograph 5 – View of the pallet storage and truck loading area in the north of the site from south west to north east

Photograph 6 – View of the dry goods warehouse in the central portion of the site from north to south

Photograph 7 – View of the dry goods warehouse truck loading area in the centre of the site from north to south



Photograph 8 – View inside the dry goods warehouse

Photograph 9 – View of the Maintenance Building in the northern portion of the site from west to east

Photograph 10 – View of the cold store warehouse in the north eastern portion of the site from west to east

Photograph 11 – View of the cold store warehouse loading area in the north east of the site

Photograph 12 – View of the car park in the north east of the site

Photograph 13 – View inside Building 404 in the north eastern portion of the site

2.4 Surrounding Land Use

The surrounding land use comprises a combination of residential, open space and light commercial / industrial. The site is surrounded by the following:

- The site is bound to the north by Valetta Street and residential properties are present beyond. In addition, two commercial / industrial properties are situated on the central northern boundary of the site (fronting Valetta Road).
- The site is bound to the east by Findon Road and residential properties and a dog park are located beyond.
- The River Torrens Linear Park, River Torrens and a cycleway are present to the south of the site.
- Residential properties are present to the west of the site.

2.5 Site Inspection for Contamination Indicators

A site inspection was conducted by a Greencap field engineer on 20 July 2015. The objectives of the inspection were to locate and identify:

- Structures and storage areas including underground tanks, waste pits and lagoons, hazardous materials storage, electrical transformers and hydraulic equipment, asbestos products, septic tanks and drain fields.
- Obvious visual contamination indicators such as disturbed vegetation, discoloured, oily or disturbed soil and / or the presence of any odours.

The following features were noted during the inspection:

Stockpile

A stockpile of waste material (bricks, concrete, soil and wood) was noted to be present adjacent to the fire pump house in the south western portion of the site.

Photograph 14 – View of the stockpile in the south western portion of the site

Soil Mounds

A soil mound is present along the north western boundary of the site.

Photograph 15 – View of the soil mound in the north west of the site

Truck Wash

A truck wash area and associated sump and interceptor trap were present in the northern area of the site.

Photograph 16 & 17 – View of the truck wash in the north of the site

Fire Pump Houses

A fire pump house (containing a diesel generator and storage drum), electrical transformer and two water storage tanks are present in the south western portion of the site. A fire pump house containing a diesel generator and electrical transformer are present in the north of the site adjacent to the maintenance building. A secondary pump house is present adjacent to the main warehouse in the centre of the site.


Photograph 18 & 19 – View of the fire pump houses in the south west and north of the site

Underground Storage Tanks

Underground storage tanks (USTs) are present in the north western and eastern portions of the site. Previous investigations undertaken in these areas have identified some fuel related impacts in soil and groundwater. Further details on the nature of the impacts along with details relating to the USTs are presented in Section 3.0.


Photograph 20 & 21 – View of the USTs in the north western and eastern portions of the site

Maintenance Building

A workshop used for the maintenance of forklift trucks (and formerly trucks) is present in the northern portion of the site.


Photograph 22 & 23 – View of the forklift maintenance area in the north of the site

Electrical Transformers

Three electrical transformers are present on site in the car park in the south east of the site, adjacent to the fire pump house in the south western portion of the site and adjacent to the fire pump house in the north east of the site. No obvious signs of leaks were evident around any of the transformers.



Photograph 24, 25 & 26– View of the forklift maintenance area in the north of the site

Asbestos

Many of the buildings were noted to contain asbestos containing materials. As asbestos register for the site was not reviewed by Greencap as part of this investigation, but one is understood to exist.

Photograph 27 – View of asbestos containing material Building 404 in the north east of the site

Existing Groundwater Wells

Five existing groundwater monitoring wells (GW1, GW2, GW3, EBT1 and EB2) are located onsite and appeared to be in good condition, with the exception of EB2 which was blocked with soil and organic matter. The groundwater wells were located adjacent to USTs in the northern western portion of the site, adjacent to a truck wash and interceptor in northern portion of the site, adjacent to a former workshop and two disused USTs located in the eastern portion of the site and adjacent to an electrical transformer in the south western portion of the site. Plans showing the locations of these wells are presented in Section 9.3 of this report and attached as Figure 4.

3.0 PREVIOUS INVESTIGATIONS

Several environmental assessments have been previously undertaken for the site as follows:

- Noel Arnold and Associates (October 2011) Phase 1 Environmental Site Assessment – Kidman Park IGA.
- Site Environmental and Remediation Services (December 2011) Due Diligence Environmental Site Assessment (with Limited and Targeted Sampling) – 404-450 Findon Road, Kidman Park.
- Greecap (July 2015) Due Diligence Site Assessment, 404-450 Findon Road, Kidman Park.

The main findings are summarised in the following sections.

3.1 Phase 1 Environmental Site Assessment (October 2011)

A Phase 1 Environmental Site Assessment was undertaken at the site in 2011 and included a review of available current and historical information in relation to the site and a site inspection.

The assessment indicated that the site and surrounding areas were used for market gardening from the early 1900s until the mid-1960s. The site was developed in the 1960s for commercial / industrial purposes. Metcash Trading Limited (under its former name) commenced operations on the site in the mid to late 1960's utilising the site for warehousing of goods prior to distribution to various supermarkets across South Australia. The site operations since the 1960s have included warehousing and distribution of goods, washing of trucks, truck maintenance (including refueling) and forklift maintenance.

The following items of interest were identified at the site during the site inspection:

- Underground storage tanks – Two areas containing decommissioned diesel and petrol underground storage tanks were located on the north western and eastern portions of the site.
- A sump and an interceptor trap were noted within and adjacent to the truck washing area.
- Fill material – An elongated soil mound (approximately 100 metres long and 3 metres high) was located on the north western boundary of the site. In addition, areas of fill material were noted on the ground surface on the northern portion of the site (where exposed soil is evident). It was also noted that the land adjacent to the southern boundary of the site was at least five metres lower than the site. This was thought to likely be a result of fill being brought onto the site for site levelling and build up.
- Workshop – The workshop area located in the central portion of the site was utilised as an area to conduct maintenance on the on-site forklifts. A small chemical / waste oil store was noted on shelves in an unbunded area with a concrete floor.
- Electrical transformers – Three electrical transformers were noted to be located on-site in the south western corner, south eastern corner and central portion of the site adjacent to the service department.
- Fire Pump House – Two fire pump houses containing diesel powered generators were located on the site. Each Fire Pump House contained an estimated 200 litre capacity diesel day storage drum. Both rooms were bunded and had a concrete floor.
- Water tanks and Fire Pump House – A third Fire Pump House and two associated large water tanks were noted in the south western corner of the site. The Fire Pump House contained a diesel powered generator and an estimated 20 litre capacity diesel day storage drum.
- Asbestos – many of the buildings were noted to contain asbestos containing materials.
- Two groundwater monitoring wells on-site – One well was located near the main truck loading area adjacent to the decommissioned underground fuel storage tanks. The other well was located adjacent to the southern boundary of the site next to the River Torrens.

It was concluded that there were several potential contamination issues present at the site including:

- Historical use of the site for market garden purposes.
- Importation of uncontrolled fill for site levelling purposes, including fill used to build up the site from former floodplains in the southern portion of the site and to construct a noise mound along the site's western boundary.
- Five underground fuel storage tanks.

- A sump and interceptor pit associated with a truck wash bay.
- Electrical transformers.
- Some small diesel storage tanks (200L drums) within the fire pump houses.
- Current (and former) vehicle maintenance areas.

It was recommended that prior to future redevelopment works, further environmental site assessment should be undertaken to determine the contamination status of the soils and groundwater underlying the site.

3.2 Due Diligence Environmental Site Assessment (December 2011)

A Due Diligence Environmental Site Assessment was undertaken at the site in 2011. The aim of the investigation was to identify any contamination or environmental issues at the site.

Soil Investigation

The investigation included the sampling of soil at 28 locations across the site. The following contaminants were identified to be elevated above the adopted guidelines (National Environment Protection (Assessment of Site Contamination) Measure 1999):

- Benzo(a)pyrene elevated above health investigation levels (HILs) and ecological investigations levels (EILs) in one soil sample;
- Benzene, toluene, ethyl benzene and xylenes (BTEX) elevated above EILs in three samples;
- Total recoverable hydrocarbons (TRH) elevated above EILs in one sample; and
- Copper and zinc elevated above EILs in four samples.

The following contaminants were also detected above the laboratory's limit of reporting:

- Pesticides (DDT and DDE) detected in two soil samples;
- Polycyclic aromatic hydrocarbons (PAHs) detected in several samples across the site; and
- Volatile organic compounds (VOCs) detected in several samples across the site.

The adopted guidelines have been updated since this assessment work was undertaken (National Environment Protection (Assessment of Site Contamination) Measure 1999 was amended in 2013).

The investigation included the installation and sampling of three groundwater monitoring wells and the sampling of an existing groundwater monitoring well. It was noted that a second pre-existing groundwater was present on site but was damaged and not able to be sampled.

Elevated levels of VOCs, heavy metals (chromium and lead) and fuel related compounds (TRH, PAHs and BTEX) were reported in the groundwater underlying the site, with elevated levels of contaminants being reported in all the groundwater wells sampled. It is understood that the South Australian Environmental Protection Authority (SA EPA) was made aware of these impacts though a Section 83A notification in accordance with the Environment Protection Act (1993).

The investigation recommended that further works were conducted to assess the nature and extents of the identified contamination and determine any management measures to be implemented.

3.3 Due Diligence Site Assessment (July 2015).

A Due Diligence Site Assessment was undertaken at the site in July 2015. The objectives of the assessment were to undertake a detailed review of the available reports relevant to the site and conduct a groundwater sampling event of existing monitoring wells to obtain current data and inform any recommendations for additional work (assessment and / or remediation).

Main Potential Contamination Issues

The following potential contamination issues were identified from the previous assessments undertaken for the site:

- Several potentially contaminating activities (historical and current) were identified including:
  - Former use of the site as market gardens.
  - Imported fill material which has used to build up the site from former floodplains in the southern portion of the site and to construct a noise mound along the site's western boundary.
  - Five underground storage tanks (containing diesel and leaded petrol) and associated infrastructure.
  - A truck washing area including a sump and interceptor trap.
  - Fire Pump house which contains a diesel powered generator and diesel storage tanks.
  - Electrical transformers.
  - Forklift and (former) truck maintenance areas.
- Elevated levels of contaminants (heavy metals and fuel related compounds) were reported in several soil samples across the site.
- Elevated levels of contaminants (fuel related compounds, volatile organic compounds and heavy metals) were identified to be present in the groundwater underlying the site.
- Asbestos was noted to be present in several buildings at the site.

Comparison of Historical Soil Results against Current Guidelines

Commonly adopted guidelines have been updated since the previous assessment work was undertaken (National Environment Protection (Assessment of Site Contamination) Measure 1999 was amended in 2013). The soil results presented in the Due Diligence Environmental Assessment were compared to amended guidelines to provide an up to date indication of the contamination status of soils at the site.

The following contaminants were identified to be elevated above current guidelines:

- An elevated result for benzo(a)pyrene at one location (MG SURFACE) in the northwest of the site. The reported result at this location was 1.8mg/kg which exceeds the ecological screening level (ESL) of 0.7mg/kg. It is noted that the ESL is considered to be overly conservative and it is generally accepted to use the relevant health investigation level for benzo(a)pyrene as ecological screening criteria. The reported result is below this screening criteria for all land uses.
- Elevated results were reported for copper in two locations (BH6 0.5m bgl and BH12 0.3m bgl) in the northwest and south of the site. The reported results were 160mg/kg and 110mg/kg respectively which exceed / meet the ecological investigation level (EIL) of 110mg/kg. It is noted that site specific EILs were not derived as outlined in the NEPM and conservative values were selected for soil properties in order to calculate the aforementioned EIL. Based on recent testing (September 2015, discussed in Section 5.4), EILs were derived using site specific data. The EIL for copper in a residential scenario was calculated to be 230mg/kg and both results are below this concentration.
- Elevated results were reported for zinc in two locations (BH7 0.5m bgl and MG SURFACE) in the northwest of the site. The reported results were 1,590mg/kg and 290mg/kg respectively which exceed the ecological investigation level (EIL) of 290mg/kg. It is noted that site specific EILs were not derived as outlined in the NEPM and conservative values were selected for soil properties in order to calculate the aforementioned EIL. Based on recent testing (September 2015, discussed in Section 5.4), EILs were derived using site specific data. The EIL for zinc in a residential scenario was calculated to be 810mg/kg and only one result (BH7 0.5m) exceeds this concentration.

Data Gaps

The following data gaps were identified in the previous investigations undertaken at the site:

- The density of the soil sampling undertaken in previous site investigations was not in accordance with the relevant Australian Standards (Table 2 in AS4482.1). Fewer soil locations were tested than is recommended and the soil locations appeared to be targeted and not undertaken on a grid. It was noted that several areas were not targeted as part of previous investigations.
- The soil beneath the buildings was not investigated.
- Fill was noted to be present at the site, but the extent of the fill material was not fully investigated.

- The groundwater well in the south of the site was unable to be sampled and information was only provided for the groundwater underlying the north and centre of the site.
- Overall the groundwater investigation was identified to be limited in nature and it was recommended that additional groundwater monitoring wells would be required to provide site coverage and appropriately assess the potential contamination issues. It was recommended that this would need to include an assessment of groundwater flow direction.
- The extent of contamination identified at the site in both the soil and groundwater was not delineated.
- Soil vapour has not been assessed. The amended guidelines present additional focus on soil vapour in terms of site assessment. Due to the presence of volatile compounds in groundwater and soil, it is likely that soil vapour investigations would be required.

Groundwater Investigation

A groundwater investigation was undertaken at the site comprising the sampling and analyses of four existing on site groundwater monitoring wells (GW1, GW2, GW3 and EBT1). It is noted that an additional groundwater well was present onsite (EB2), but was blocked with dirt and organic matter and could not be sampled. Due to the limited timeframe, it was also not possible to install and sample additional groundwater monitoring wells as part of this investigation.

It was noted that groundwater wells were located near both areas of underground fuel storage, but as no survey data was available to assess the groundwater flow direction, it was not known if these monitoring wells were in the most appropriate locations to assess contamination from the various potential sources identified.

Elevated results were reported for fuel related compounds (ethyl benzene and naphthalene) above adopted water quality criteria at one location (GW3) adjacent to the underground fuel tanks in the eastern portion of the site. Trace concentrations of fuel related compounds were also reported from ETB1 which is located in the same part of the site. Trace concentrations of tetrachloroethene were also reported from one monitoring well in the north western portion of the site adjacent to the USTs in this area (GW1).

The previous groundwater investigation undertaken in 2011 identified elevated concentrations of VOCs, heavy metals (chromium and lead) and fuel related compounds (TRH, PAHs and BTEX) in all the groundwater wells well above adopted guidelines. Overall, the reported results from this monitoring round indicated a decrease in concentrations of the chemicals of concern identified in the 2011 sampling event.

Recommendations

It was recommended that further site assessment (soil, groundwater and soil vapour investigations), along with remediation and/or management (i.e. underground fuel tanks would need to be removed along with any soils that are unsuitable for the proposed development) would be required prior to the proposed redevelopment of the site.

4.0 SUMMARY OF POTENTIAL CONTAMINANTS

Several potentially contaminating activities (PCA) were identified from the review of the previous investigations and the site inspection. The details of the PCAs, contaminant persistence / mobility and other comments are presented in Table 1.

Table 1 – Potential Contamination Sources and Contaminants of Concern (On-Site Only)

PCA and Likely Location	Contaminants of Potential Concern	Persistence / Mobility in Soils and Toxicity	Comments
Former use of the site as market gardens.	Heavy metals, OCPs, herbicides and fertilisers	Heavy metals - Mobility = low, persistence = high OCP - Mobility = low to moderate, persistence = high OPP - Mobility = low to moderate, persistence = low Herbicides – Mobility = low to moderate, persistence = low to moderate Fertilisers – Mobility = low to moderate, persistence = high	Previous investigations have indicated that the site and surrounding areas were used for market gardening from the early 1900s until the mid-1960s. No specific mixing areas were identified and any application of pesticides, herbicides or fertiliser is likely to have been on a broader scale. Elevated levels of heavy metals (copper and zinc) and PAHs (benzo(a)pyrene) were reported in several soil samples across the site above adopted assessment criteria for a residential land use in the previous investigation. Pesticides were reported above the laboratory limit of reporting, but below the adopted guidelines in the paddock in the north east of the site and in an area in the south west corner of the site.
Imported fill material (unknown source/s)	Heavy metals, PAH, BTEX, TRH, asbestos and OCP	Heavy metals - Mobility = low, persistence = high PAH - Mobility = low, persistence = high BTEX - Mobility = moderate, persistence = moderate TRH - Mobility = moderate, persistence = moderate OCP - Mobility = low to moderate, persistence = high	Information from previous investigations indicates that imported fill material was used in the southern portion of the site (to build up the site from former floodplains) and to construct a noise mound along the site's western boundary. The soil mound along the north western boundary of the site was noted to be present during the site inspection. The previous soil investigation undertaken at the site in 2011 identified fill material across the site to a maximum depth of 1.0m below ground level (mbgl). Areas of deeper fill were present around the underground storage tanks in the northern and central portion of the site. Analysis of the fill material identified elevated levels of heavy metals (copper and zinc) and PAHs (benzo(a)pyrene) above adopted assessment criteria for a residential land use in several soil samples across the site. Elevated levels of fuel related compounds (TRH and BTEX) were reported in the fill material associated with the underground storage tanks. Pesticides were reported above the laboratory limit of reporting, but below the adopted guidelines in the paddock in the north east of the site and in an area in the south west corner of the site.
Stockpile of waste materials (unknown source/s)	Heavy metals, PAH, BTEX and TRH	Heavy metals - Mobility = low, persistence = high PAH - Mobility = low, persistence = high BTEX - Mobility = moderate, persistence = moderate TRH - Mobility = moderate, persistence = moderate	A stockpile of waste material (bricks, concrete, soil and wood) was noted to be present adjacent to the pump station in the south western portion of the site during the site inspection. The soil mound was not assessed as part of the previous investigation undertaken at the site.
Underground storage tanks (containing diesel and leaded petrol) and associated infrastructure.	BTEX, TRH and lead	Lead - Mobility = low, persistence = high BTEX - Mobility = moderate, persistence = moderate TRH - Mobility = moderate, persistence = moderate	Underground storage tanks (USTs) are present in the north western and eastern portions of the site. The USTs are reported to be disused. Elevated levels of fuel related compounds (TRH and BTEX) were reported in soils adjacent to the USTs above adopted assessment criteria in the previous investigation undertaken in 2011. The investigation also identified elevated levels of heavy metals (chromium and lead) and fuel related compounds (TRH, PAHs, VOCs and BTEX) in the groundwater underlying the site, including around the USTs.

PCA and Likely Location	Contaminants of Potential Concern	Persistence / Mobility in Soils and Toxicity	Comments
A truck washing area including a sump and interceptor trap.	Heavy metals, VOC, BTEX and TRH	Heavy metals - Mobility = low, persistence = high BTEX - Mobility = moderate, persistence = moderate TRH - Mobility = moderate, persistence = moderate	A truck wash area and associated sump and interceptor trap are present in the north of the site. The truck wash is currently in operation. The soils in the vicinity of the truck wash were not investigated during the previous soil assessment. A groundwater well was installed adjacent to the truck wash. Elevated levels of heavy metals and fuel related compounds (TRH and BTEX) were reported in the groundwater from this monitoring well.
Fire pump houses which contain a diesel powered generator and diesel storage tanks.	BTEX and TRH	BTEX - Mobility = moderate, persistence = moderate TRH - Mobility = moderate, persistence = moderate	A fire pump house (containing a diesel generator and storage drum), electrical transformer and two water storage tanks are present in the south western portion of the site. A fire pump house containing a diesel generator) and electrical transformer are present in the north of the site adjacent to the maintenance building. A secondary pump house is present adjacent to the main warehouse in the centre of the site. Elevated levels of copper were reported in soils above adopted assessment criteria adjacent to the fire pump house in the south west of the site in the previous investigation undertaken at the site. Pesticides were also reported in soils above the laboratory limit of reporting, but below the adopted guidelines in this area.
Electrical transformers.	PCBs and TRH	TRH - Mobility = moderate, persistence = moderate PCBs - Mobility = moderate, persistence = high	Three electrical transformers are present on site in the car park in the south east of the site, adjacent to the fire pump house in the south western portion of the site and adjacent to the fire pump house in the north east of the site. Elevated levels of copper were reported in soils above adopted assessment criteria adjacent to the electrical transformer in the south west of the site in the previous investigation undertaken at the site. Pesticides were also reported in soils above the laboratory limit of reporting, but below the adopted guidelines in this area.
Forklift and (former) truck maintenance areas.	Heavy metals, BTEX, TRH and solvents	Heavy metals - Mobility = low, persistence = high TRH - Mobility = moderate, persistence = moderate BTEX – Mobility = moderate, persistence = high Solvents – Mobility = high, persistence = moderate to high	A workshop used for the maintenance of forklifts (and formerly for the maintenance of trucks) is present in the central portion of the site. PAHs and heavy metals were reported in soils above the laboratory limit of reporting, but below the adopted guidelines in this area in the previous investigation undertaken at the site.
Termite control chemicals used underneath buildings	Arsenic and OCPs	Arsenic - Mobility = low, persistence = high OCP - Mobility = low to moderate, persistence = high	Termite control chemicals may have been used under the buildings on the site. Any impacts are likely to be limited to near surface soils. The soil beneath the buildings was not assessed as part of the previous investigation.
Use of asbestos in buildings across the site.	Asbestos	Asbestos - Mobility = low to high (depending on whether friable or non-friable), persistence = high	Asbestos was noted to be present in several buildings at the site. No asbestos was noted in soils during the previous soil investigations.

NOTES:-
BTEX = benzene, toluene, ethylbenzene, xylene TRH = total recoverable hydrocarbons PAH = polycyclic aromatic hydrocarbons OCP = organochlorine pesticides VOCs = volatile organic compounds
PCBs = polychlorinated biphenyls OPP = organophosphate pesticide

5.0 SOIL INVESTIGATION

5.1 Sampling Rationale

A soil investigation was undertaken at the site between 21 and 30 September 2015 comprising the drilling of 112 grid based soil bores across the site and 25 targeted soil bores. The sampling location rationale is detailed below in Table 2.

Table 2 – Soil Sampling Location Rationale

Sample ID	Sample Type	Location	Depth Drilled (mbgl)
SB01 to SB112	Grid based soil bore	Across the site	1.0 to 2.0
TB01	Targeted soil bore	Adjacent to the triple interceptor in the north of the site	2.0
TB03	Targeted soil bore	Adjacent to the fire pump house in the south western portion of the site.	1.0
TB04	Targeted soil bore	Adjacent to the transformer in the south western portion of the site	1.0
TB05	Targeted soil bore	Adjacent to the transformer in the south east of the site	1.0
TB02, TB06, TB07, TB08, TB09 and TB10	Targeted soil bore	Around USTs in the north western portion of the site	5.0 to 7.0
TB11, TB12, TB15, TB16, TB17, TB18 and TB19	Targeted soil bore	Around USTs in the eastern of the site	5.0 to 8.0
TB13	Targeted soil bore	Truck wash in the north of the site	1.0
TB14	Targeted soil bore	Forklift maintenance workshop in the centre of the site	1.0
TB20	Targeted soil bore	Adjacent to the fire pump house and transformer in the north of the site	1.0
HA1 to HA5	Targeted soil bore	Soil mound along the north western boundary of the site	1.0 to 2.0

The soil bore locations are presented in Figures 2 and 3 at the end of this report.

It is noted that the site has an approximate area of 11.9 hectares. The 112 grid based bores increases the total number of test locations (including those not targeting underground fuel infrastructure from the Due Diligence Environmental Assessment undertaken in 2011) to 131. This sampling density is in general accordance with the relevant Australian Standards (Table 2 in AS4482.1), but it is noted that no specific guidance is provided for site's larger than 5.0 hectares. Using the same diameter of hotspot that can be detected with 95% confidence for a site of 5.0 hectares, the number of test locations was determined to be 130 for a site 11.9 hectares in size.

Due to restricted access in the dry goods warehouse, soil bores were not able to be drilled on a strict grid pattern. As such, the soil bores were drilled in areas where access was possible (generally at the end of rows of shelving). Furthermore, no access was possible within the majority of the cold store warehouse to undertake intrusive investigations.

5.2 Sampling Methodology

Soil bores were drilled to a maximum depth of 8 metres below ground level (mbgl). All soil bores were drilled using push tube methods or hand equipment (depending on access).

Soil bores were drilled into natural soils where possible and were logged by an experienced Greencap environmental scientist. Soil samples were collected by the Greencap environmental scientist from the different material types encountered and at regular depth intervals.

Samples were screened in the field for volatile organic compounds (VOCs) using a photoionisation detector (PID) with a 10.6 eV ultraviolet lamp. The PID calibration record is attached in Appendix B.

Decontamination of push tube equipment was conducted between each sampling location by removing all adhered soil and / or other matter by means of scrubbing and flushing with clean water.

Soil samples were placed into acid-rinsed and solvent-washed screw top glass jars supplied by the testing laboratory. All soil samples were stored in an ice filled portable cooler immediately following sampling and delivered under similar conditions to the testing laboratory under chain of custody procedures.

5.3 Soil Analytical Program

Soil samples were analysed for a range of potential contaminants as summarised in Table 3.

The laboratories used for the soil testing were Eurofins-mgt (MGT) and Australian Laboratory Services (ALS). The laboratories are approved by the National Association of Testing Authorities (NATA), and the analyses conducted are within the NATA registration of the laboratories. Duplicate soil samples were submitted to the primary laboratory (MGT) and the secondary laboratory (ALS) for quality assurance / quality control (QA/QC) purposes. Results of QA/QC analyses are discussed in detail in Section 11.

It is noted that one suspect sample of cement sheet identified at one location (SB81) under the northern portion of the dry goods warehouse at a depth of 1.0m was tested at Greencap's in-house NATA accredited laboratory for asbestos.

A summary table of the soil analyses is presented at the end of this report and the results are discussed in Section 6.3.

Table 3 - Soil Analytical Program

Sample	Location	pH	CEC/ Clay Content	Heavy Metals	Lead	TRH	BTEX	PAH	VOC	OPP	OCP	PCB	Vic EPA Screen	Asbestos in soils	Asbestos Identification
SB01 to SB112	Grid based across the site	29	25	190	-	37	34	138	12	14	116	-	15	6	1
TB01	Adjacent to the triple interceptor in the north of the site	-	-	-	1	1	1	-	1	-	-	-	-	-	-
TB03	Adjacent to the fire pump house in the south western portion of the site.	-	-	-	-	1	1	-	-	-	-	-	-	-	-
TB04	Adjacent to the transformer in the south western portion of the site	-	-	-	-	1	1	-	-	-	-	1	-	-	-
TB05	Adjacent to the transformer in the south east of the site	-	-	1	-	1	1	1	-	-	1	1	-	-	-
TB02, TB06, TB07, TB08, TB09 and TB10	Around USTs in the north western portion of the site	-	-	-	17	17	17	-	-	-	-	-	-	-	-
TB11, TB12, TB15, TB16, TB17, TB18 and TB19	Around USTs in the eastern of the site	-	-	-	15	15	15	-	-	-	-	-	-	-	-
TB13	Truck wash in the north of the site	-	-	2	-	2	-	2	2	-	-	-	-	-	-
TB14	Forklift maintenance workshop in the centre of the site	-	-	1	-	1	-	1	1	-	-	-	-	-	-
TB20	Adjacent to the fire pump house and transformer in the north of the site	-	-	1	-	1	1	1	-	-	-	1	-	-	-
HA1 to HA5	Soil mound along the north western boundary of the site	1	1	8	-	5	5	8	-	-	7	-	-	2	-
Total		**30**	**26**	**203**	**33**	**82**	**76**	**151**	**16**	**14**	**124**	**3**	**15**	**8**	**1**

NOTES:-

TRH = total recoverable hydrocarbons
OPP = organophosphate pesticide
PAH = polycyclic aromatic hydrocarbons
OCP = organochlorine pesticides
BTEX = benzene, toluene, ethylbenzene, xylene
PCBs = polychlorinated biphenyls
VOCs = volatile organic compounds
CEC = cation exchange capacity
Heavy metals = arsenic, cadmium, chromium, copper, nickel, lead, mercury, silver, tin, zinc
Vic EPA Screen - includes heavy metals (as above + molybdenum and selenium), OCP, TRH, volatile organic compounds, PCBs, vinyl chloride, PAH, phenols, hexavalent chromium, cyanide and total fluoride

5.4 Assessment Criteria / Investigation Levels

Analytical results have been compared with criteria specified in the National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) (NEPM). It is understood that the site will likely continue to be used for commercial/industrial purposes in the short term and potentially be redeveloped for residential purposes in the medium to long term. As such, the relevant investigation exposure settings are considered to be:

- Ecological Screening Levels (ESLs) for commercial and industrial, urban residential and public open space land use;
- Health Investigation Levels for commercial and industrial land use (HILs D), standard residential (accessible soil) land use (HILs A) and high density residential (no access to soils) land use (HILs B);
- Health Screening Levels for Vapour Intrusion (HSLs 'D') for commercial and industrial land use and (HSLs 'A and B') for Urban Residential and Public Open Space land use – the screening levels were selected based on overlying material type (unconsolidated fill / sand) and depth of sample; and
- 'Management Limits' for petroleum hydrocarbon compounds (Management Limits) for commercial and industrial, residential, parkland and public open space.

In addition, Ecological Investigation Levels (EILs) for commercial and industrial and residential land use were determined for some chemicals as outlined in the 2013 NEPM. In relation to the derivation of the EILs, the following values/rationale was used:

- The application of any chemicals and / or importation of material was likely to have been more than two years ago and are therefore considered to be 'aged'.
- An average pH of 8.7 was adopted for the site based on the average of reported results from near surface samples.
- An average clay content of 14.8% was adopted for the site based on the average of reported results from near surface samples.
- An average cation exchange capacity (CEC) of 23 cmol/kg was adopted for the site based on the average of reported results from near surface samples.

6.0 SOIL INVESTIGATION RESULTS

6.1 Subsurface Conditions

The maximum depth of the soil investigation was 8 metres below ground level (mbgl). The subsurface conditions of the site are described in further detail below.

6.1.1 Area Surrounding the Warehouses

A bitumen surface cover was present at the majority of soil bore locations drilled across the site in the areas surrounding the warehouses and in the car parks in the south west and north east of the site. A concrete cover was present in the loading area surrounding the cold storage warehouse in the north eastern portion of the site and within the truck wash in the northern portion of the site. Grass cover and leaf litter were present within the paddock in the north western of the site and along sections of the eastern and western boundaries of the site.

Fill material was encountered to a maximum depth of 1.1mbgl. Areas of deeper fill were present along the western boundary of the site (SB04 to SB10 and TB04), along the southern boundary of the site (SB33), in the paddock in the north west of the site (SB11 to SB13 and SB30 to SB32), in the car park in the south western portion of the site (SB36) and in the area to the north of the main warehouse (SB41 to SB47 and TB01). The fill material generally comprised crushed rock mixed with silts and sands and dark brown silty clay.

Secondary constituents were noted within the fill material in the paddock including crushed rock, organic matter, ash, bitumen, red brick and glass fragments (SB11 to SB14, SB31 and SB32). Red brick fragments were noted within the fill material along the southern boundary of the site (SB02, SB03 and SB04). Red brick fragments, ash and cinders and glass fragments were noted within the fill material along the western boundary of the site (SB05 to SB10). Bitumen and red brick fragments were noted within the fill material in the northern portion of the site (SB50, SB51 and SB65). No odours, suspected asbestos containing materials or staining were noted during the investigation.

Underlying natural soils were encountered at all soil bore locations comprising brown to dark brown silty clay.

6.1.2 Warehouses

A concrete surface was present at soil bore locations drilled within the warehouses in the centre and northern portion of the site. Fill material was encountered in the soil bores to a maximum depth of 1.4mbgl with areas of deeper fill noted beneath the northern portion of the main warehouse. The fill material generally comprised crushed rock mixed with silts and sands and yellow sand (typical sub-grade material). An underlying layer of fill (yellow sand) was present in areas of deeper fill in the northern portion of the warehouse. A concrete layer was encountered in several of soil bores SB79 (0.3mbgl), SB80 (0.3mbgl), SB81 (1.2mbgl), SB87 (0.3mbgl) and SB99 (0.3mbgl). Soil bores were not able to be extended to the target depth at these locations. Underlying natural soils were encountered at all soil bore locations comprising dark brown silty clay.

Suspected asbestos containing material was encountered in SB81 at 1.1mbgl above the layer of concrete identified at a depth of 1.3mbgl. No odours or staining were noted during the investigation.

6.1.3 Soil Mound

Leaf litter was present at the surface of the soil bores drilled in the soil mound located along the north western portion of the site. Fill material was encountered in the soil bores to a maximum depth of 1.2mbgl. The fill material generally comprised crushed rock mixed with silts and sands. Secondary constituents were noted within the fill material including bitumen, crushed rock, red brick, organic matter and glass fragments. Ash and cinders were noted to be present within HA3 and HA4. Underlying natural soils were encountered at all soil bore locations comprising dark brown silty clay. No odours, staining or suspected asbestos containing materials were noted during the investigation.

6.1.4 Underground Storage Tanks

A bitumen cover was present at soil bore locations drilled around the underground storage tanks (USTs) in the north western and eastern portions of the site, but it is noted that the tanks themselves were covered by concrete. Fill material was encountered in the soil bores to a maximum depth of 1.4mbgl, with deeper fill noted around the USTs in the northern portion of the site. The fill material generally comprised brown silty sand and grey / pale brown sand. Secondary constituents were noted within the fill material including crushed rock, red brick and bitumen fragments.

One location (TB19) refused on a metal pipe at a depth of 0.4m so the bore was not able to be extended to the target depth.

Natural soils were encountered comprising dark brown to red brown silty clay and silty sandy clay. Trace gravels were noted to be present between 2.0 to 2.2mbgl and an increase in sand content was noted from 2.7mbgl. Dark brown mottling was present from 3.0mbgl.

Grey and black staining and hydrocarbon odours were noted between 4.7 to 7.0mbgl in TB02, TB08, TB11, TB12 and TB16. Black staining was also noted in TB06 and TB07 between 2.0 and 2.2mbgl.

Soil bore logs are provided at the end of this report as Appendix B.

6.2 Field Screening of Volatile Organic Compounds

Selected samples were screened for volatile organic compounds (VOCs) in the field using a photoionisation detector (PID) which was calibrated prior to use. Samples were placed in sealable plastic bags, agitated, and then a headspace reading taken using the PID.

The majority of PID readings were recorded below 2 parts per million (ppm). Elevated PID readings (ranging from 15.2 to 222 ppm) were reported in TB02 and TB08 located around the USTS in the northern portion of the site between 4.7 and 6mbgl. Elevated PID readings (ranging from 4.2 to 344 ppm) were reported in TB11, TB12 and TB16 in the north eastern portion of the site between 4.0 and 7.0mbgl. All PID readings are noted on the soil bore logs presented in Appendix B.

6.3 Laboratory Testing Results and Discussion

Exceedences of either the adopted ecological or health based investigation/screening levels were reported for a number of analytes as follows:

- Elevated results for benzo(a)pyrene were reported above or equal to the ESL (0.7mg/kg) for urban residential land use in SB04_0.1-0.2 (0.7mg/kg), SB11_0.01-0.3 (1.3mg.kg), SB11_0.35-0.45 (0.7mg/kg), SB81_0.9-1.0 (1.7mg/kg), SB83_0.1-03 (2.0mg.kg) and SB83_0.5-0.6 (0.8mgkg). It is noted that the SA EPA has recommended the consideration of other guidelines in the assessment of benzo(a)pyrene for ecological protection, including the health investigation level for residential land use (3mg/kg). The elevated levels of benzo(a)pyrene are below this guideline and the exceedances are therefore not considered to be significant.

  One result for benzo(a)pyrene TEQ was reported above the adopted HIL for standard residential use of 3mg/kg from SB83_0.1-0.3 (3.4mg/kg). The reported result is below the adopted HIL for high density residential and commercial/industrial land uses. Statistically, this elevated result is not considered significant and is within acceptable levels. The maximum concentration (3.4mg/kg) is less than 2.5 times the adopted HILs, the standard deviation (0.3) is less than half of the adopted HILs and the 95% upper confidence limit of the average (0.7mg/kg) is below the adopted HILs.
- Elevated results for TRH C16-C34 were reported above the adopted ESL for urban residential land use (300mg/kg) in SB20_0.015-0.3 (440mg/kg), SB30_0.01-0.2 (1,100mg/kg), SB36_0.2-0.3 (350mg/kg), SB50_0.15-0.2 (370mg/kg) and SB51_0.15-0.2 (390mg/kg). The results are all below the ESL for commercial/industrial land use.
- Elevated results for TRH C6-C10 less BTEX were reported above the adopted HSL for urban residential land use for sand at depths greater than 4.0 metres (200mg/kg) in TB11_5.5-5.6 (220mg/kg) and

TB16_5.0-5.1 (340mg/kg) around the eastern UST area. Sand was selected as a conservative material type given the vicinity of the underground tanks and associated backfill material. It is noted that the reported results from the overlying and underlying samples tested at both locations were below the laboratory detection limit.

It is noted that fuel related compounds (TRH and BTEX compounds) were detected at a number of other locations around the underground fuel infrastructure, but none of the reported results were above the adopted assessment criteria.

Slightly elevated results for some individual OCP compounds (DDE, DDT, DDD, chlordane, aldrin and dieldrin) were identified at concentrations above the laboratory limit of reporting. All reported results were below the adopted site assessment criteria.

The one suspect sample of cement sheet (identified at SB81 under the northern portion of the dry goods warehouse) was confirmed to contain asbestos. A soil sample collected at the same location and depth was also analysed for asbestos at Eurofins-mgt. Asbestos was also identified in this sample in weathered cement fragments and in the form of loose fibre bundles.

Results of the soil analyses are summarised in tables at the end of this report. NATA laboratory certificates are presented in Appendix C.

7.0 GROUNDWATER INVESTIGATION

A groundwater investigation was conducted between September and October 2015 comprising the sampling of four existing onsite groundwater monitoring wells and the installation and sampling of seven additional groundwater wells.

7.1 Rationale and Well Installation Methodology

The installation of seven additional groundwater monitoring wells was conducted on 28 and 29 September 2015. The purpose of the additional groundwater wells was to to further assess the contamination status of groundwater beneath the site. The rationale behind the selected locations for the additional wells is as follows:

- MW01 was installed to assess groundwater quality down inferred hydraulic gradient from the operations in the southern portion of the site.
- MW02, MW03, MW04 and MW06 were installed to further delineate the groundwater impacts (VOCs, heavy metals and fuel related compounds) identified around underground storage tanks during the previous site investigations.
- MW05 was installed to assess groundwater quality around the operations within the north eastern portion of the site.
- MW07 was installed to assess the background quality of groundwater entering the site from the east (up inferred hydraulic gradient).

The location of the groundwater monitoring wells is presented in Figure 4.

The seven additional groundwater monitoring wells were installed using solid flight auger drilling techniques to a maximum depth of 9 metres below the ground level (mbgl). All monitoring wells were installed with a 3 metre screened interval at the base and a sand pack to a minimum of 1m above the top of the screened interval. A one metre bentonite plug was installed on the top of the sand pack preventing surface water infiltration into the screened area. Cement grout was used above the bentonite layer to seal the wells to the surface. The wells were completed with a lockable gatic covers. The wells were developed the day after installation.

The well drilling logs, construction details and well permits of the additional seven monitoring wells are included in Appendix G.

7.2 Groundwater Sampling Methodology

Groundwater sampling from the four existing (EBT01, GW01 to GW3) and seven additional (MW01 to MW07) groundwater monitoring wells was undertaken on 1 October 2015. Generally, it is accepted practice to wait one week following well installation and development prior to sampling. However, due to time constraints for this work, the newly installed wells were sampled 24 - 48 hours after installation. It is noted that the SA EPA's groundwater sampling guideline specifies that '*following development, the well sampling should be postponed for at least 24 hours and may need to be delayed for as long as a week until it can be demonstrated that well chemistry has stabilised.*' Furthermore the NEPM states '*after development, bores should be left for a period until bore water chemistry can be demonstrated to have stabilised (generally between 24 hours and seven days) before samples are collected*.' All wells were sampled at least 24 hours after sampling and as demonstrated in field sampling records (discussed in Section 8.2) field parameters were able to be stabilised during sampling.

Initially, standing water levels were measured from the surveyed mark on the top of the well casing. The well gauging was undertaken using a water-product interface meter to check for the potential presence of any separate (non-aqueous) phase hydrocarbons in the groundwater monitoring wells. The wells were gauged prior to sampling to minimise the effects of any fluctuations in water levels that may influence the groundwater flow direction assessment.

Groundwater samples from all wells were collected using the low flow groundwater sampling technique with a peristaltic pump. Water quality parameters (pH, temperature, conductivity, oxidation reduction potential

and dissolved oxygen) were monitored during groundwater purging and prior to the sampling using a YSI Quatro Pro Plus water quality meter. Water levels were also monitored during sampling to ensure that minimal drawdown occurred. Samples were collected when water quality parameters had stabilised. Groundwater sampling records and calibration certificates (for the water quality meters) are presented in Appendix H.

All groundwater samples collected from the wells were placed in containers provided by the analytical laboratories. Groundwater samples collected for heavy metals were filtered through a Stericup pre-sterilised 150mL vacuum driven disposable filter (0.45 micron) prior to placement in sample containers supplied by the testing laboratory. The samples were stored on ice in a portable cooler immediately following sampling and were delivered under similar conditions to the National Association of Testing Authorities (NATA) accredited analytical laboratories with accompanying chain of custody documentation. Quality assurance and quality control (QA/QC) samples were also collected as discussed in Section 11.

7.3 Groundwater Analytical Program

The groundwater analytical program is summarised in Table 5 below.

Table 4 - Groundwater Analytical Program (October 2015)

Well I.D.	pH / TDS	VOC	TRH and PAH	Metals	Vic EPA Screen
GW1	X	X	X	X	
GW2	X	X	X	X	
GW3	X	X	X	X	
EBT1	X	X	X	X	
MW01	X	X			X
MW02	X	X	X	X	
MW03	X	X			X
MW04	X	X			X
MW05	X	X	X	X	
MW06	X	X	X	X	
MW07	X	X			X

NOTES:-

Metals - As, Cd, Cr, Cu, Ni, Pb, Zn, Hg

Vic EPA Screen - TRH/ PAH/ Phenols/ OCP/ PCB/ BTEX/ Metals (As, Cd, Cr, Cu, Pb, Hg, Mo, Ni, Se, Ag, Sn, Zn)/ CN/ Total Fluoride

Testing for Vinyl Chloride was undertaken at ultra-trace level

The laboratories used for the groundwater testing were Eurofins-mgt (MGT) and Australian Laboratory Services (ALS). The laboratories are approved by the National Association of Testing Authorities (NATA), and the analyses conducted are within the NATA registration of the laboratories. An inter laboratory duplicate groundwater sample was also submitted to the secondary laboratory (ALS) for quality assurance / quality control (QA/QC) purposes. Results of QA/QC analyses are discussed in detail in Section 11.

7.4 Beneficial Uses of Groundwater

The South Australian Environment Protection (Water Quality) Policy 2003 (EPP) identifies the following protected environmental values of underground waters in South Australia:

- Marine aquatic ecosystems.
- Freshwater aquatic ecosystems.
- Primary contact recreation.

- Aesthetics.
- Potable.
- Irrigation.
- Livestock.
- Aquaculture.
- Industrial.

The abovementioned environmental values are also protected for surface waters, but for surface waters the EPP also identifies secondary contact recreation as a protected environmental value. This includes activities involving partial body contact with water where swallowing of water is unlikely (e.g. fishing, wading, paddling and boating).

The risk based approach for assessing groundwater contamination outlined in Schedule B(6) of the National Environment Protection (Assessment of Site Contamination) Measure is based on protection of relevant (i.e. current or realistic) uses of groundwater. The SA EPA's groundwater assessment and management framework also involves deciding on appropriate beneficial uses of groundwater to be protected. There are a number of factors considered relevant in terms of the appropriate beneficial uses of groundwater within the site:

- Marine aquatic ecosystem is not considered to be a realistic beneficial use because the nearest marine water body is the Gulf of St Vincent located some 3.5 km to the west of the site and is unlikely to be impacted from the onsite groundwater.
- Future potable water use from the water table aquifer is considered possible as onsite groundwater at some locations has salinity less than 2,000 mg/L, which is the potable water limit as presented in the SA EPA Guideline 'Guidelines for the Assessment and Remediation of Groundwater Contamination' dated February 2009. It should be noted however that the 2009 SA EPA Guideline also states that *'the shallow aquifer through metropolitan Adelaide would not be considered for a potable water supply. Based on the salinity of the water and the fact that a town water supply is available for potable use, the assessor would consider that the use of the water from the shallow aquifer is for irrigation for domestic purposes.'*
- Following from the above, irrigation for domestic purposes groundwater use is considered a beneficial use of the uppermost aquifer.
- The River Torrens is located in the proximity of the eastern and southern boundaries of the site. Therefore the protection of the fresh aquatic ecosystem of the River Torrens has been considered.
- Livestock watering and aquaculture use of groundwater are not compatible with the likely future use of the site.
- Groundwater underlying the site is not currently used for industrial purposes. In the future, if groundwater was to be extracted for this purpose, the shallow aquifers would not have sufficient yield.
- The shallow groundwater may potentially be used for recreational purposes offsite within the residential areas. The recreational use may include filling spas or swimming pools. Accordingly, primary contact recreation may be considered a realistic beneficial groundwater use.

The realistic groundwater beneficial uses/environmental values are therefore considered to be potable, irrigation for domestic (local gardens) purposes, protection of fresh aquatic ecosystem (River Torrens) and primary/secondary contact and recreation.

It should be noted that although this review has discounted particular beneficial uses of groundwater under the site (i.e. current and likely future uses), the ultimate decision on whether the beneficial uses require protection rests with regulatory authorities in South Australia such as the Environment Protection Authority (SA EPA) and the Department of Environment, Water and Natural Resources (DEWNR).

7.5 Groundwater Assessment Criteria

The groundwater assessment criteria for the identified beneficial uses are provided in Table 6.

Table 5 - Protected Environmental Values (EPP, 2003)

Water body	Freshwater Ecosystem	Marine Ecosystem	Primary/ Secondary Contact & Recreation	Potable	Irrigation	Livestock	Aquaculture	Industrial
Groundwater	X		X	X	X			

The South Australian Environment Protection (Water Quality) Policy 2003 provides the assessment criteria for the environmental values outlined in Table 6. Where the abovementioned criteria have not been proposed for particular analytes, the following alternative sources have been used:

- National Environment Protection (Assessment of Site Contamination) Measure (NEPM) – Groundwater Investigation Levels;
- Australian Water Quality Criteria (ANZECC, 2000);
- Australian Drinking Water Guidelines (NHMRC & ARMCANZ, 2011);
- Guidelines for Managing Risks in Recreational Water (NHMRC, 2008); and
- World Health Organisation (WHO) drinking water guidelines (WHO 2011).

8.0 GROUNDWATER INVESTIGATION RESULTS

8.1 Groundwater Flow Direction

Groundwater elevations along with the inferred groundwater flow direction are discussed in detail in Section 9.3, however it is noted that the inferred groundwater flow direction was determined to be west to north westerly. This is consistent with the expected groundwater flow direction in the locality.

8.2 Field Measured Water Quality Parameters

Groundwater quality parameters as well as water turbidity, colour and presence of sheens or odours were monitored during groundwater purging and prior to sampling. Groundwater sampling records are presented in Appendix H. The stabilised values of groundwater quality parameters are summarised in Table 7 below.

Table 6 – Field measured groundwater quality parameters (October 2015)

Well I.D	pH	Temp (Deg C)	Electrical Conductivity (µS/cm)	Calculated TDS (mg/L)	Oxidation-Reduction Potential (mV)	Dissolved Oxygen (mg/L)
GW1	7.36	23.2	4,379	2,630	-331.3	0.27
GW2	7.12	21.9	4,276	2,570	-180.1	0.60
GW3	7.36	22.0	2,317	1,390	-406.2	0.12
EBT1	7.09	22.3	2,840	1,700	-89.2	0.01#
MW01	7.01	20.0	6,480	3,890	-198.0	0.08
MW02	6.98	20.8	5,480	3,290	-42.7	0.11#
MW03	7.28	19.7	3,480	2,090	22.0	0.23#
MW04	7.05	21.2	4,330	2,600	70.2	0.14#
MW05	7.32	23.3	4,557	2,735	-101.1	2.38
MW06	7.23	21.9	4,901	2,940	-100.4	4.59
MW07	7.22	21.4	4,809	2,885	-124.3	3.57

NOTES:-

* Conversion factor of 0.6 used to convert field Electrical Conductivity (uS/cm) to TDS (mg/L). #dissolved oxygen calculated from percent saturation to mg/L based on altitude and water temperature

Table 7 indicates that the groundwater within the uppermost aquifer is brackish and has the near neutral pH. Reducing conditions in groundwater were noted in the majority of wells.

Fuel related odours were noted in groundwater from monitoring wells EBT01 and GW3 and a slight sheen was also evident in monitoring well GW3. No other groundwater contamination indicators were identified during the October 2015 groundwater sampling.

8.3 Groundwater Analytical Results

Summary tables of the groundwater analyses are presented at the end of this report. Laboratory certificates are attached in Appendix J. It is noted that the groundwater results from the July 2015 sampling have also been included in the summary table for comparison purposes.

In the most recent round of groundwater sampling (October 2015), no elevated results above the adopted water quality criteria were reported for:

- Heavy metals (arsenic, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, silver, tin or zinc);
- Cyanide;
- Fluoride;
- TRH/BTEX; and
- PCBs.

Volatile Organic Compounds

Elevated levels of the chlorinated hydrocarbon dichloromethane were reported above potable water assessment criteria in MW01 located in the southern portion of the site. The reported result was 18µg/L compared with the adopted drinking water criteria of 4µg/L. MW01 was installed to assess groundwater quality along down inferred hydraulic gradient from the operations in the southern portion of the site.

It is noted that several results were reported above the laboratory limit of reporting, but below the assessment criteria for chlorinated hydrocarbons (trichloroethene and tetrachloroethene) in MW02, MW03 and MW04 in the north western portion of the site.

Organochlorine Pesticides

An elevated concentration of the organochlorine pesticide dieldrin was reported above the adopted criteria from monitoring well MW04. The reported result was 2µg/L compared with adopted drinking water and freshwater ecosystem protection criteria of 0µg/L. It is also noted that primary duplicate (QW01) reported elevated concentrations for dieldrin and DDE above the adopted criteria of 0µg/L. The primary sample (MW03) and secondary duplicate (QW02) from this location reported all results for pesticides below the laboratory detection limit.

Fuel Related Compounds

An elevated result was reported for total PAHs (likely to be associated with naphthalene and fuel related compounds) above the adopted drinking water criteria and the adopted freshwater ecosystem protection criteria at one location (GW3) adjacent to the underground fuel tanks in the eastern portion of the site. The reported result was 8µg/L compared with the drinking water criteria of 0.01µg/L and the freshwater ecosystem protection criteria of 3µg/L.

It is noted that several results were reported above the laboratory limit of reporting, but below the assessment criteria for fuel related compounds (ethylbenzene, TRH C6-C10, TRH C10-16 or TRH C10-C36) in GW3 and EBT1 around the USTs in the eastern portion of the site.

Heavy Metals

An elevated result was reported for selenium (0.045mg/L) at one location (MW07) on the eastern boundary of the site above the adopted drinking water criteria (0.01mg/L), freshwater ecosystem protection criteria (0.005mg/L) and irrigation criteria (0.02mg/L). MW07 was installed to assess the background quality of groundwater entering the site from the east (up inferred hydraulic gradient).

Total Dissolved Solids

Elevated levels of total dissolved solids were reported in all groundwater monitoring wells above the adopted guidelines for recreational use. The levels of total dissolved solids were reported in groundwater monitoring wells up inferred hydraulic gradient of the site as well as those on site and are considered to be representative of background conditions in the area.

Comparison with Previous Results

The previous groundwater investigations undertaken in 2011 and July 2015 identified elevated concentrations of VOCs, heavy metals (chromium and lead) and fuel related compounds (TRH, PAHs and BTEX) in all the groundwater wells above adopted guidelines. Overall, the reported results from this monitoring round indicate a decrease in concentrations of the chemicals of concern identified in the wells sampled in these sampling events.

Due to the reported results from newly installed wells, the SA EPA has been notified of the groundwater impacts in accordance with Section 83A of the Environment Protection Act.

9.0 GROUNDWATER CONCEPTUAL SITE MODEL

9.1 Regional Geology and Hydrogeology

9.1.1 Geology

The 1:50,000 scale Adelaide geological map produced by the South Australian Department of Mines and Energy shows the surface geology in the area is the Quaternary Pooraka Formation. The Pooraka Formation reportedly comprises alluvial / colluvial clays with varying amounts of sand and silt.

The general geological sequence in the area (as shown on the 1:50,000 scale Adelaide geological map) comprises:

- Quaternary Age sediments of fluvial and marine origin of the order of 100 metres thickness. The dominant formation is Hindmarsh Clay, which is predominantly clay, but has lenses of gravels, silts and sands. The Hindmarsh Clay is covered by clayey material of the Pooraka and other formations;
- Tertiary sediments of mainly marine origin up to 500 metres thickness are represented by limestones, sands and calcareous sandstones of the Port Willunga, Chinaman Gully, Blanche Point and other formations; and
- Precambrian Age basement rock below approximately 500-600 metres depth.

Reference to the former Department of Mines and Energy Report Book 94/9 “Soils stratigraphy and engineering geology of the Adelaide Plains” indicates the site is situated in the Adelaide Plains in a landform area known as the Lower Alluvial Plain (see Figure 5).

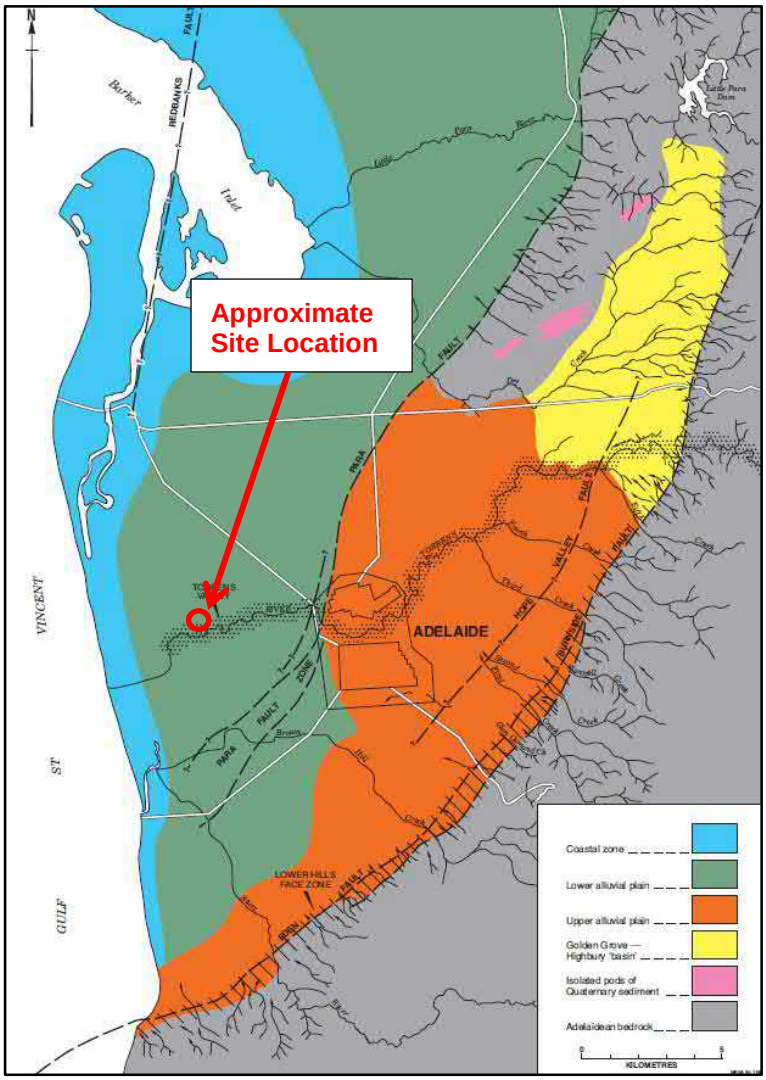


Figure 5 - Geomorphic and geologic zones of the Adelaide region (source: DME Report Book 94/9)

A number of cross-sections were presented in Report Book 94/9 as shown in Figures 6 and 7. Cross sections which run in the vicinity of the site (E-E and L-L) are reproduced in Figure 8 (E-E section) and Figure 9 (L-L section). Cross sections indicate that the site is likely be underlain by the following:-

- The Pooraka Formation – approximately 3 to 6 metres thick:
    - The Pooraka Formation typically consists of sandy clay and clayey to sandy silt, with interbedded clay layers, sand and occasional gravel. Layers rich in carbonate silt and segregations occur within the Pooraka Formation.
- Quaternary Alluvium – approximately 5 to 8 metres thick:
    - Quaternary Alluvium – is found throughout the Hindmarsh Clay and the Pooraka Formation. The deposits follow present and past drainage lines that emerge from the Eden–Burnside and Para Fault Escarpments. The material is predominantly sandy in texture and may also contain abundant silt, clay, gravel and pebbles.
- Hindmarsh Clay – greater than 10 metres thick:
    - Hindmarsh Clay is predominantly clay with some sand and silt content.

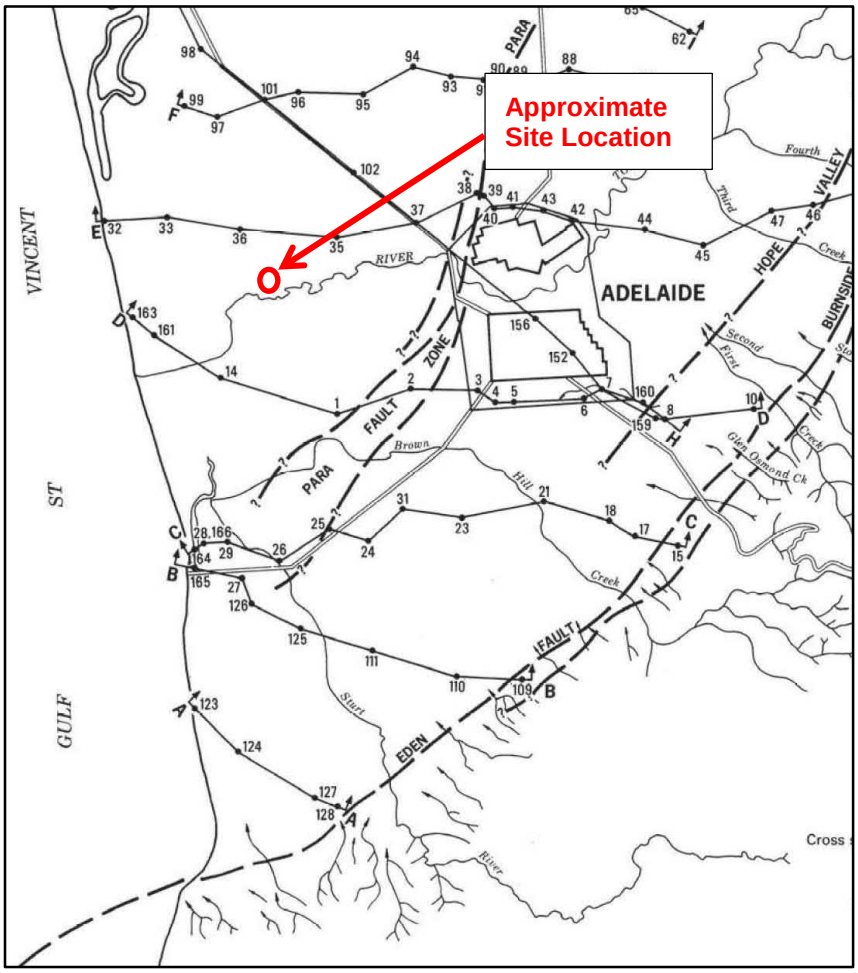


Figure 6 - West-East Cross Section Lines (source: DME Report Book 94/9)

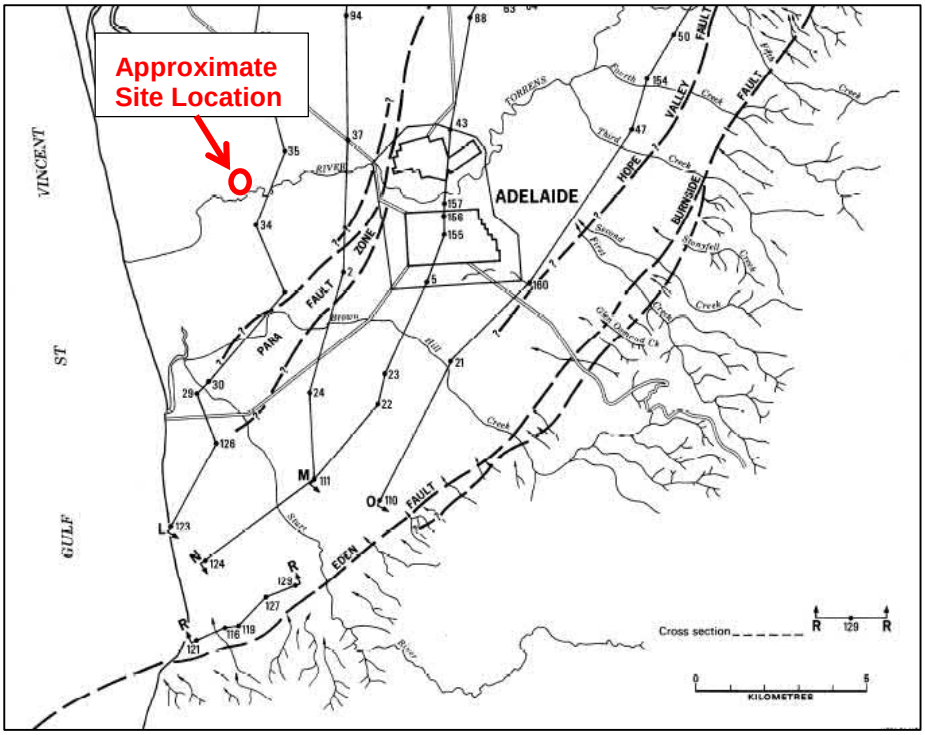


Figure 7 - North-South Cross Section Lines (source: DME Report Book 94/9)

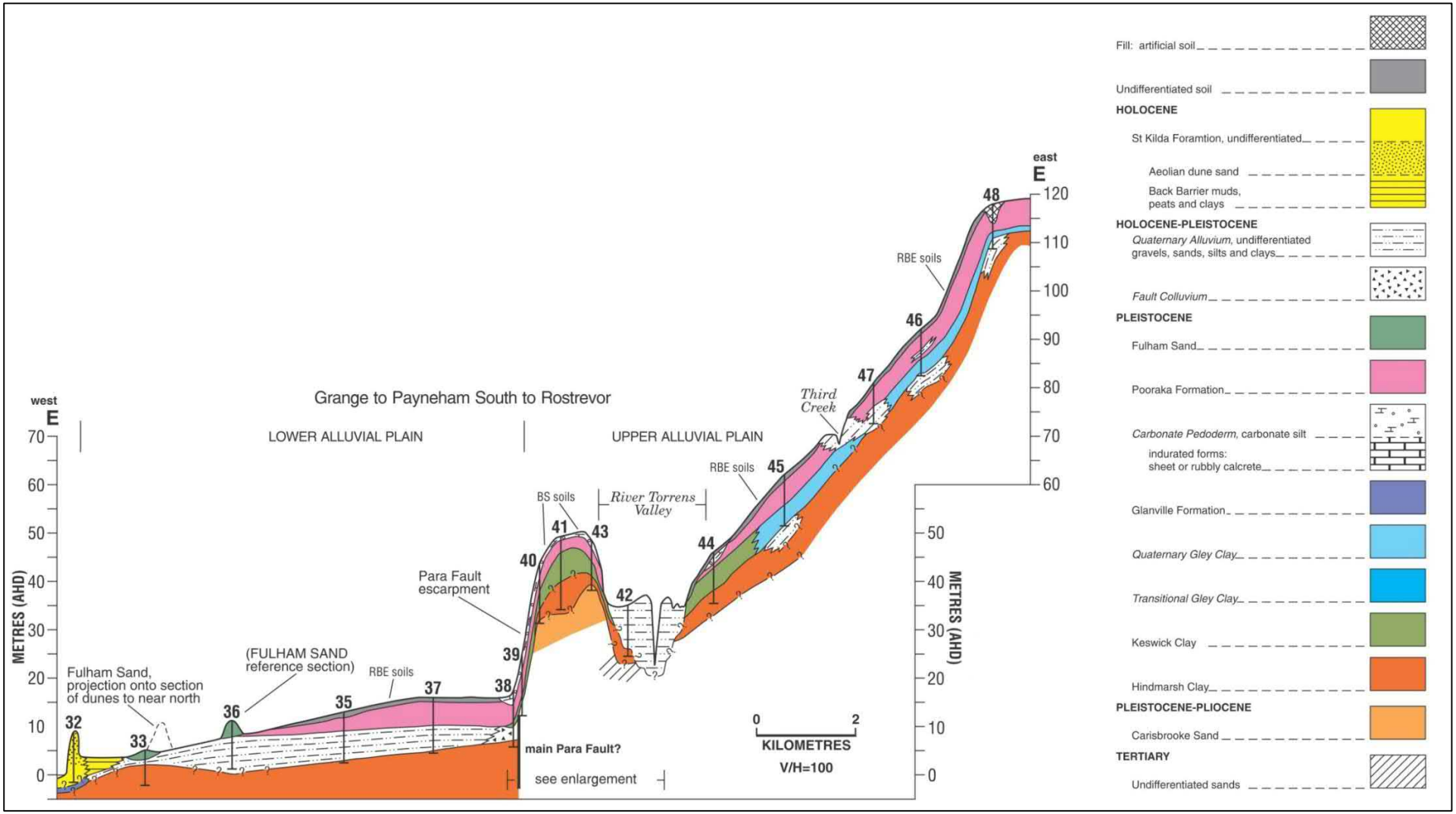


Figure 8 - E-E cross section and geological legend (source: DME Report Book 94/9)

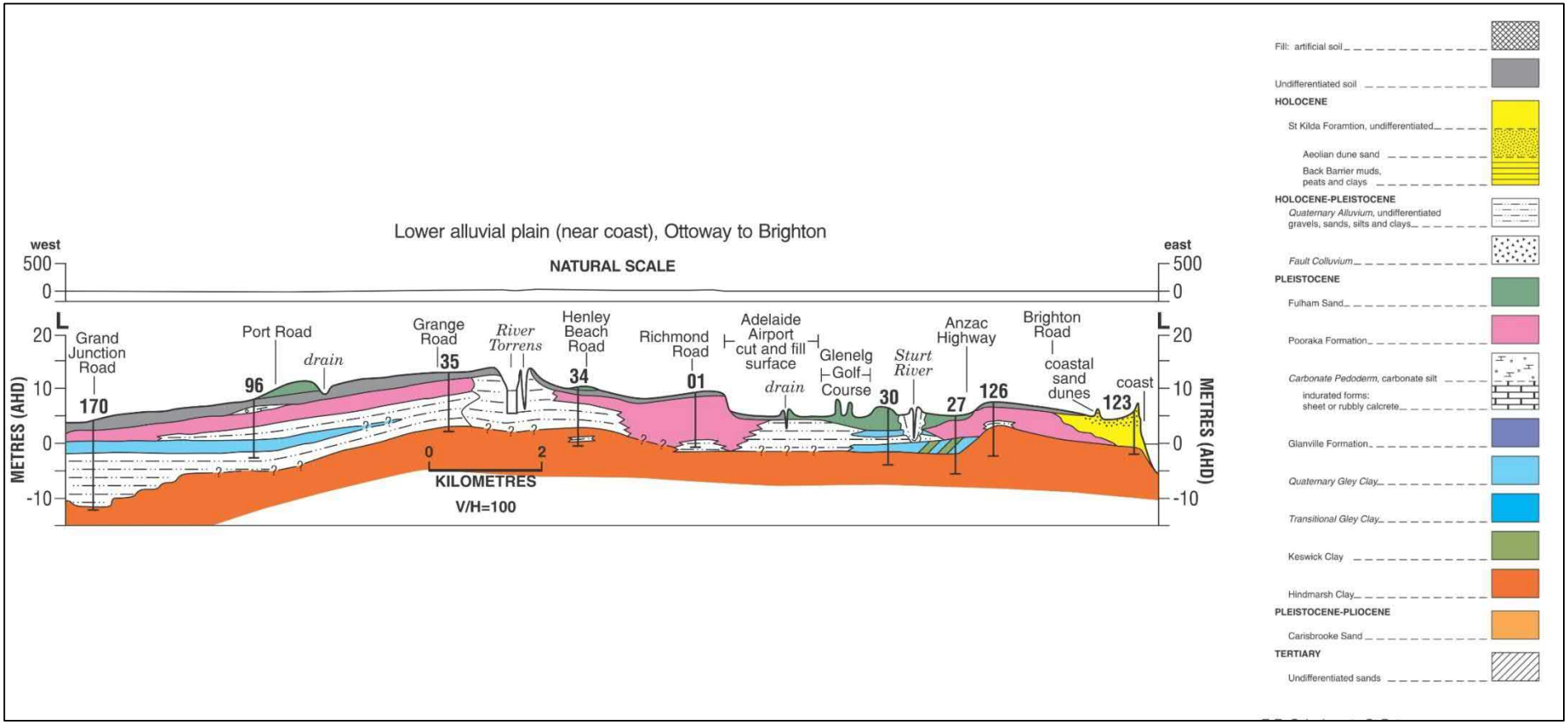
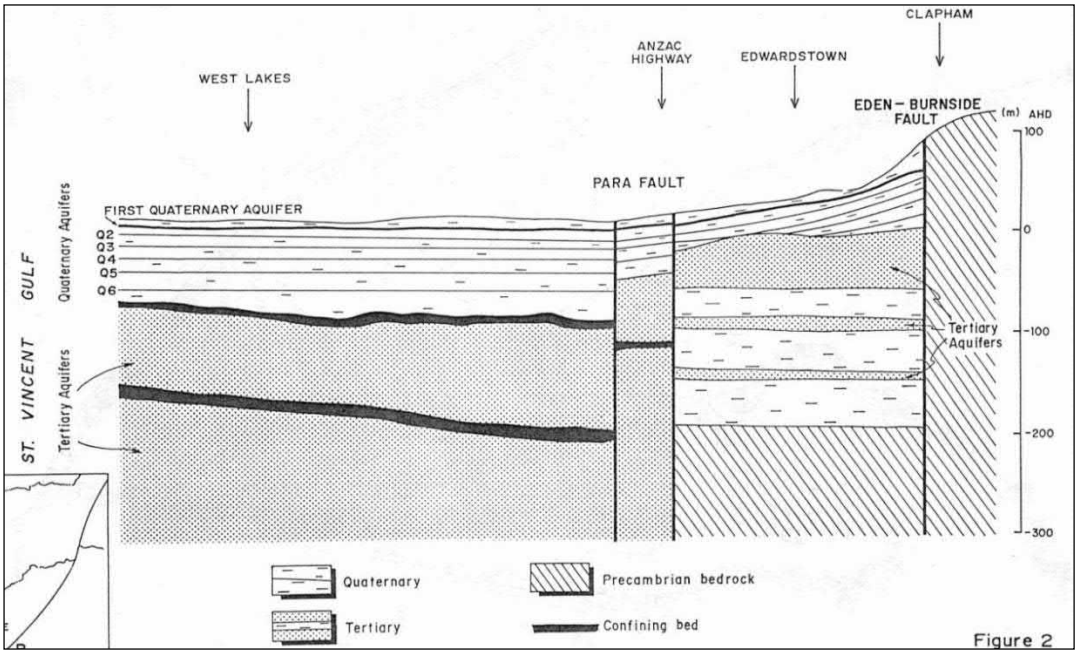


Figure 9 - L-L and N-N cross sections and geological legend (source: DME Report Book 94/9)

9.1.2 Hydrogeology

The Quaternary sediments within the Adelaide Plains include inter-bedded sand and gravel layers within which the water table (uppermost) aquifer generally occurs, and also from other deeper aquifers in the underlying Hindmarsh Clay Formation (reportedly up to six distinct Quaternary aquifers have been identified – designated Q1-Q6 in literature, Gerges 2006). These aquifers are not highly utilised as the yield and water quality are highly variable. The deeper Tertiary aquifers generally have better quality water and yields, and are utilised in some areas within the Adelaide Plains. A generalised cross section through the Adelaide Plains is presented below in Figure 10.



(Sourced from Centre for Groundwater Studies Report 'Potential for Storage and Reuse of Adelaide's Stormwater Runoff Using the Upper Quaternary Aquifer System' (CGS report No.40, April 1992)

Figure 10 - Generalised Cross Section – Adelaide Plains Geology & Aquifers

The report "*Overview of the hydrogeology of the Adelaide metropolitan area*" prepared by Gerges (reference RB 2006/10 June 2006) provides a general overview of the hydrogeological settings of the Adelaide Metropolitan area. Gerges sub-divided the Adelaide Metropolitan area into several hydrogeological zones as shown on Figure 11.

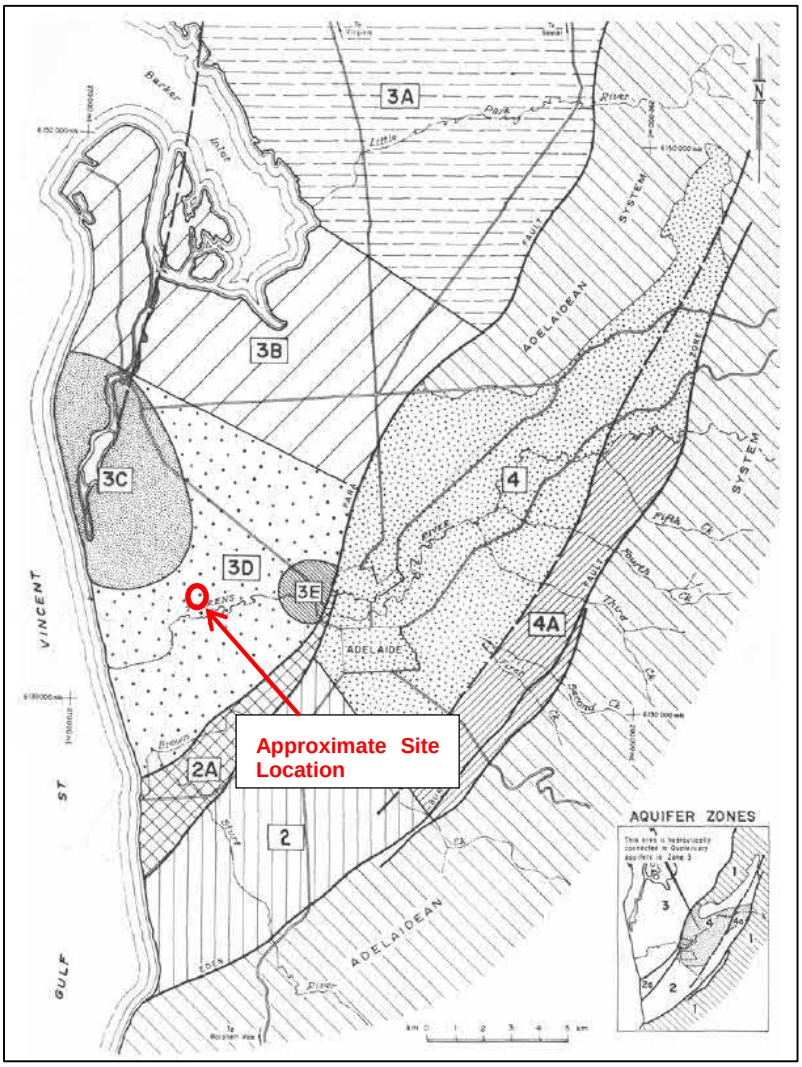


Figure 11 - Hydrogeological Zones (Gerges, 2006) Source "Overview of the hydrogeology of the Adelaide metropolitan area" (reference RB 2006/10, June 2006)

Figure 11 shows that the site is located within zone 3 which is described by Gerges as follows:

'This zone contains five to six Quaternary aquifers and also three to four, almost flat lying, Tertiary aquifers. The first and second Tertiary aquifers are the thickest and the most productive, with relatively low salinity. The greatest proportion of abstracted groundwater for industrial and recreational use comes from the first Tertiary aquifer.'

It should be noted that the sub-division of Zone 3 (e.g. 3A, 3B etc.) is related to the first Tertiary Aquifer (T1) and not to Quaternary aquifers.

Q1 aquifer

The uppermost aquifer (or Q1 aquifer as identified by Gerges) is of most relevance in terms of contamination and assessment for the completion of this DRA. The uppermost aquifer generally receives direct recharge from rainfall percolation through the ground surface and therefore is the most susceptible to contamination.

Report RB 2006/10 presents generalised groundwater contours for the uppermost aquifer within the Adelaide metropolitan area (refer Figure 12).

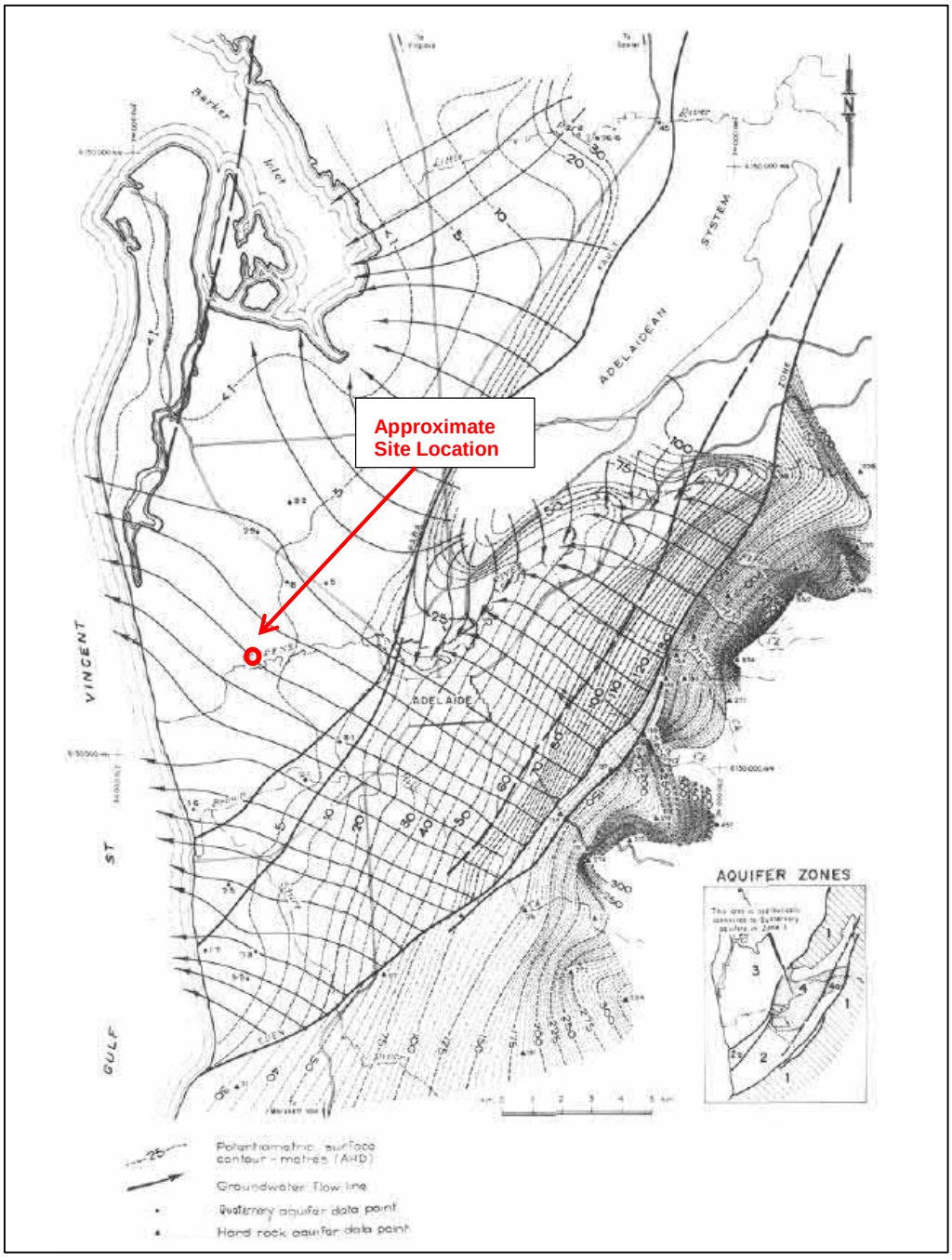


Figure 12 - Groundwater Level Contours, Uppermost aquifer (source Gerges 2006)

Figure 12 indicates that the movement of groundwater in the uppermost aquifer at the site is expected to be in a north westerly direction towards the Gulf St Vincent. The elevation of groundwater levels at the site area is expected to range between 3 and 5 metres Australian Height Datum (mAHD).

The salinity distribution for the uppermost aquifer is also presented in the Gerges, 2006 report and is reproduced in Figure 13.

Figure 13 indicates that the groundwater salinity of the uppermost aquifer in the vicinity of the site is expected to be between 1,000 and 2,500 mg/L.

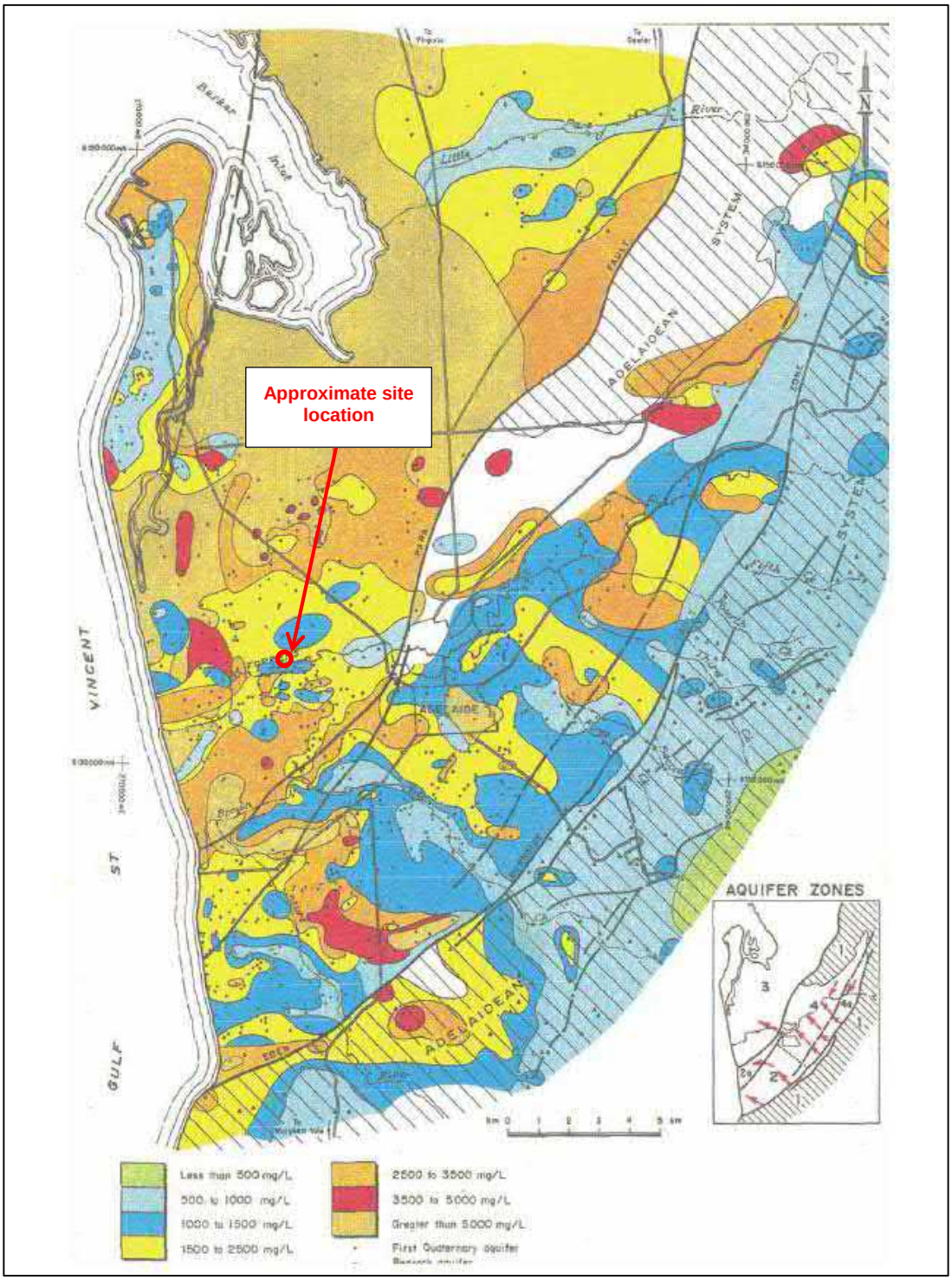


Figure 13 - Groundwater Salinity, Uppermost aquifer (Gerges, 2006)

9.2 Site Specific Groundwater Occurrence

Based on the groundwater well logs presented in Appendix G, the top of the uppermost (Q1) aquifer was encountered at around 7mbgl. The aquifer is located within the natural material represented by silty and sandy clays brown to dark brown in colour. This material was interpreted to represent the Quaternary Alluvial sediments (refer Section 10.1.1). Fuel hydrocarbon odours were noted in in monitoring wells EBT01 and GW3 during the investigation.

Depth to groundwater level in the uppermost aquifer ranged between 5.5 and 6.9 metres below the reference points on the top of well casings (mbTOC) over the October 2015 groundwater monitoring event.

The groundwater level gauging results and inferred groundwater flow direction is discussed in the section below.

9.3 Survey, Gauging & Groundwater Flow Direction

The elevations of the top of casings for on-site and the off-site wells were surveyed by a licenced surveyor (Alexander Symonds Surveying Consultants). The survey results are attached in Appendix I.

Groundwater levels from the most recent groundwater level gauging conducted on 1 October 2015 are presented in Table 8.

Table 7 – Groundwater Level Gauging Results (October 2015)

Well I.D	Date	Reference Point Elevation (mAHD)	Depth to groundwater level (m bTOC)	Groundwater level Elevation (mAHD)
EBT1	Oct - 2015	8.598	5.600	2.998
GW1	Oct - 2015	9.015	6.142	2.873
GW2	Oct - 2015	8.715	5.756	2.959
GW3	Oct - 2015	8.528	5.525	3.003
MW01	Oct - 2015	9.105	6.257	2.848
MW02	Oct - 2015	9.305	6.462	2.843
MW03	Oct - 2015	8.327	5.506	2.821
MW04	Oct - 2015	8.495	5.630	2.865
MW05	Oct - 2015	8.618	5.702	2.916
MW06	Oct - 2015	9.47	6.541	2.929
MW07	Oct - 2015	9.155	6.147	3.008

NOTES:

mAHD – metres Australian Height Datum

mbTOC – metres below top of casing.

Groundwater level elevations ranged from 2.82 to 3.01m AHD. The groundwater level data has been used to construct a groundwater contour plan as shown in Figure 14. The general groundwater flow direction was assessed to be in a west to north westerly direction. The direction is consistent with the expected regional flow direction (refer Section 9.1.2).

Averaged hydraulic gradient for the Q1 aquifer at the site calculated using the October 2015 contours is approximately 0.0008 m/m.

Figure 14 – Groundwater level Contours (October 2015)

9.4 Recharge Sources, Discharge Areas and Other Hydraulic Boundaries

The recharge to the uppermost aquifer (Q1) occurs as a result of two major mechanisms:

- Rainwater infiltration across the unpaved open space areas of the site and surrounding areas; and
- Groundwater through flow from up hydraulic gradient locations including the River Torrens.

Infiltration recharge rates are likely to be low due to the combined effects of urbanisation and the high evaporation potential, which exceeds rainfall for most months of the year. A review of available publications indicates that the infiltration generally comprises less than 10% of the annual rainfall. It is noted that infiltration rates may be greater in the unsealed areas within the site; however, the impact of this infiltration in these areas is relatively low compared to the large scale of the aquifer.

Groundwater through-flow from up hydraulic gradient sources is also expected to be low to moderate as the aquifer material is generally of low permeability (mainly comprising clays and silts).

Regionally, groundwater flow in the uppermost aquifer is in a north westerly direction towards the Gulf St Vincent, which is considered to be the primary discharge area for this aquifer.

There are no on-site watercourses, or water bodies deep enough to intersect the groundwater flow and to act as discharge areas for the shallow aquifer system. The nearest water body (River Torrens) acts as a recharge boundary for the Q1 aquifer.

9.5 Groundwater salinity

The groundwater TDS ranges between 1,400 and 3,900 mg/L which is generally consistent with the expected regional groundwater salinity (refer Section 9.1.2). The groundwater salinity distribution in the Q1 aquifer at the site area is presented on Figure 15. The extent of the fresher groundwater with salinity less than 2,000 mg/L was only observed at the locations of EBT01 and GW3 indicating a localised groundwater recharge at this location.

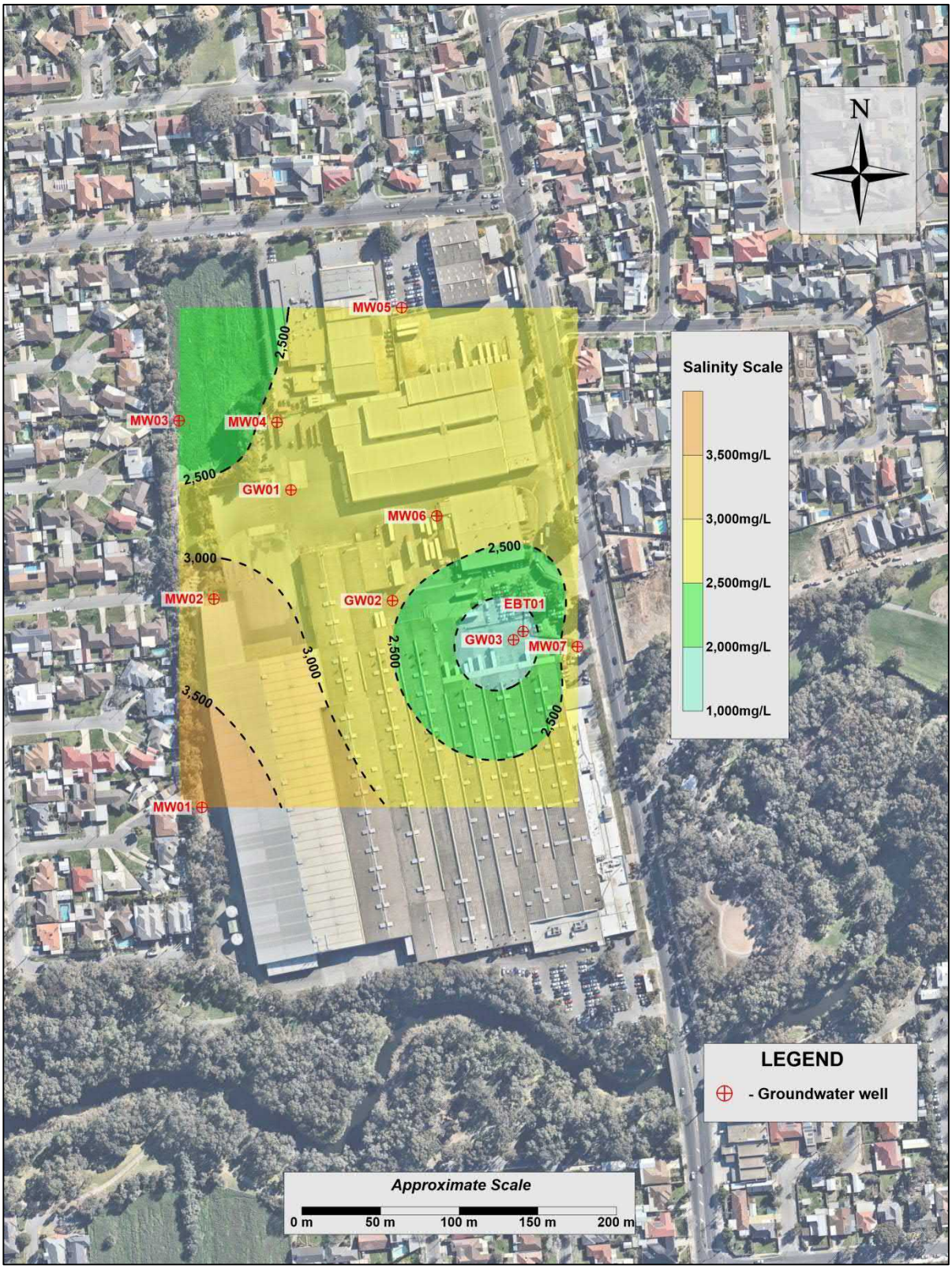


Figure 15 - Groundwater Salinity Contours (field data October 2015)

10.0 SOIL VAPOUR INVESTIGATION

Soil vapour investigations were undertaken around the underground storage tanks (USTs) located in the northern and north eastern portions of the site to assess the presence of soil vapour.

10.1 Installation of Soil Vapour Points

A total of four soil vapour monitoring points (two around each underground storage tank area) were drilled and installed on 29 September 2015 under the supervision of an experienced Greencap environmental scientist. The soil vapour points VP01 to VP04 (inclusive) were installed to 1.5 metres below ground level (mbgl). All soil vapour points were drilled using percussive push tube drilling equipment to reach the target depth. A summary plan showing the soil vapour point locations is presented in Figure 3 at the end of this report.

The soil vapour points comprised a stainless steel implant (with woven wire screen) connected to Teflon tubing extending to the ground surface. The vapour points were surrounded by a discrete lightly compacted sand pack (grain size of 2-3mm) finishing approximately 150mm above the implant. A bentonite seal/plug was installed above the sand pack finishing approximately 50mm from the ground surface. Following vapour sampling, the vapour points were removed and backfilled with bentonite and the ground surface reinstated with bitumen. Further construction details are shown on the soil vapour installation logs attached in Appendix D.

10.2 Sampling of Soil Vapour Point Network

A soil vapour monitoring event was undertaken on 30 September 2015 by an experienced environmental scientist using summa canister sampling methodology.

10.2.1 Vapour Point Sampling Methodology

Soil vapour samples were collected from all soil vapour points into summa canisters supplied by the primary and secondary analytical laboratories, EnviroLab and Australian Laboratory Services (ALS) respectively. The summa canisters were supplied with flow regulators to limit the flow of air from the soil vapour point into the canisters (which were under vacuum). These flow regulators were set to allow a sampling time of approximately 1 hour.

Prior to sampling (and during the helium leak test described in Section 11) all soil vapour points were purged to remove at least one well volume before basic gases (Oxygen, Carbon Dioxide, Methane, Hydrogen Sulphide and Carbon Monoxide) were measured and stabilised using a GA2000 landfill gas meter. A PID concentration was also collected during the purging process. The measured stabilised gases prior to sampling are discussed in Section 9.3.1.

Leak testing was undertaken prior to and during sampling using both helium and isopropanol testing techniques to ensure representative soil vapour was being sampled from each location. These tests are discussed in further detail within Section 11 and as well as the collection and analysis of duplicates and blanks.

Soil vapour sampling sheets and equipment calibration certificates (for the helium meter, landfill gas meter and PID) are attached to Appendix E.

10.2.2 Soil Vapour Analytical Program

Summa canister were submitted to the NATA accredited primary and secondary analytical laboratories (EnviroLab and ALS respectively) and analysed for a suite of volatile compounds (known as a TO-15 suite). The analytical suite includes BTEX compounds (benzene, toluene, ethylbenze and Xylene) and chlorinated hydrocarbons. Samples were also analysed for petroleum related compounds (TRH).

Results of the soil vapour analyses are discussed in Section 9.3. There is also a summary table of analytical results presented as an attachment to this report and NATA laboratory certificates presented in Appendix F. Samples of soil vapour submitted to the secondary laboratory (ALS) for QA/QC purposes are discussed in detail in Section 11.

10.3 Soil Vapour Investigation Results

10.3.1 Measured Basic Gas Levels

The measured basic gas levels during the September 2015 sampling event are summarised in Table 4.

Table 8 - Ambient Air and Stabilised Gases (September 2015)

Soil Vapour Point	Measured Parameters					
	Oxygen (O_2) (%)	Carbon Dioxide (CO_2) (%)	Methane (CH_4) (%)	Hydrogen Sulphide (H_2S) (ppm)	Carbon Monoxide (CO) (ppm)	PID reading (ppm)
VP01	12.1	5.4	0	13	99	5.2
VP02	18.6	0	0	3	3	4.4
VP03	15.9	4.7	0	5	1	1.5
VP04	11.7	6	0	5	1	0.2

As shown in Table 4, oxygen levels in vapour points around the USTs in the northern portion of the site (VP01 and VP02) ranged between 12.1% and 18.6%. Vapour points VP03 and VP04 around the USTs in the north eastern portion of the site measured oxygen levels of 11.7% and 15.9%. The oxygen levels are similar in both locations. The slightly lower levels of oxygen recorded in VP01, VP03 and VP04 correspond to the higher carbon dioxide levels measured at these locations.

All of measured methane levels were at the ambient level of 0%. Hydrogen sulphide levels were measured between 3ppm and 13ppm above the ambient background level of 2ppm. Carbon monoxide levels were also measured above the ambient background level of 0ppm in all vapour points with levels ranging from 1ppm to 99ppm. Hydrogen sulphide and carbon monoxide levels were most elevated in VP01 located around the USTs in the northern portion of the site.

The elevated levels of carbon dioxide, hydrogen sulphide and carbon monoxide are an indication of oxygen reducing conditions and are may be the related to the elevated levels of hydrocarbons reported in the soils around the USTs.

The PID readings measured for the USTs in the north eastern portion of the site were below 2ppm. The PID readings measured for the vapour points around the USTs in the northern portion of the site were slightly elevated ranging from 4.4 to 5.2ppm.

The majority of ambient air levels were measured to be consistent across the soil vapour point network, with hydrogen sulphide levels measuring at 2ppm, carbon monoxide levels measuring 0ppm, carbon dioxide levels at 0.1% and oxygen levels measuring 20.3%.

10.3.2 Soil Vapour Assessment Criteria

Soil vapour results were compared with Interim Soil Vapour Health Investigation Levels (HILs) for volatile organic chlorinated compounds as outlined in Table 1A(2) 'Interim soil vapour health investigation levels for volatile organic chlorinated compounds' presented in the NEPM. Commercial/industrial and residential levels have been adopted for the investigation. It is noted that for some volatile compounds there was no criteria adopted. Alternative sources were not sourced as part of this investigation.

Soil vapour results were also compared to Health Screening Levels (HSLs) presented in the NEPM for fuel related compounds. The appropriate NEPM HSLs used were selected based on the depth of soil vapour point installation (either 0 to <1m or 1m to <2m), the material type in which the vapour points were installed (sand was selected as a conservative measure given the vicinity of the underground tank pits) and the land use (commercial/industrial or residential).

10.3.3 Laboratory Testing Results

A table summarising the soil vapour sampling results is attached to this report. NATA laboratory certificates are attached to Appendix F.

A number of soil vapour concentrations exceeding the adopted criteria were reported as follows:

- **cis -1,2-Dichloroethene (DCE)** – Elevated concentrations were reported to exceed the Interim Soil Vapour HIL for residential use of 80µg/m^3 from one of the sample locations (250µg/m^3 at VP01) in the vicinity of the USTs in the north western portion of the site. The duplicate sample collected from this location (QV02) reported a result of 339µg/m^3 which also exceeded the Interim Soil Vapour HIL for commercial/industrial use (300µg/m^3). Detectable concentrations of DCE were also reported from VP02, but these concentrations were below the Interim Soil Vapour HILs.
- **Trichloroethene (TCE)** – Elevated concentrations were reported to exceed the Interim Soil Vapour HIL for residential use of 20µg/m^3 and the Interim Soil Vapour HIL for commercial/industrial use of 80µg/m^3 from two of the sample locations (ranging from 110µg/m^3 at VP02 to 2,400µg/m^3 at VP01). It is noted that the duplicate result (collected from location VP01) reported a result of 3,120 µg/m^3. Both VP01 and VP02 are in the vicinity of the USTs in the north western portion of the site. Detectable concentrations of TCE were also reported from VP03 adjacent the USTs in the eastern portion of the site, but these concentrations were below the Interim Soil Vapour HIL for residential land use.
- **Vinyl chloride (VC)** – Elevated concentrations were reported equal to the Interim Soil Vapour HIL for residential use of 30µg/m^3 from VP01 in the vicinity of the USTs in the north western portion of the site. The duplicate sample collected from this location (QV02) reported a result of 39.6µg/m^3 which exceeds the Interim Soil Vapour HIL for residential use (30µg/m^3). These results are below the Interim Soil Vapour HIL for commercial/industrial use (100µg/m^3). All other reported results for vinyl chloride were below the laboratory detection limits.

Furthermore, the following observations have been made in relation to the soil vapour data:

- Elevated concentrations of tetrachloroethene (PCE) were reported from VP01 and VP02 adjacent the USTs in the north western portion of the site. Although none of the results exceeded the Interim Soil Vapour HILs, these results were still well above the laboratory detection limits.
- Detectable concentrations of fuel related compounds (TRH and BTEX) were reported from all soil vapour points. The most significant results were reported from VP01 and VP02 in the vicinity of the north western UST area, but these were still be below the adopted assessment criteria.
- Detectable concentrations were also reported from one or more locations for Dichlorodifluoromethane (VP02 only), Bromomethane (VP01 only), ethanol (all four vapour points), Trichlorofluoromethane (VP02 only), Isopropyl Alcohol (all four vapour points), 1,1-Dichloroethene (VP01 only), Carbon Disulfide (all four vapour points), trans-1,2-dichloroethene (VP01 only), MEK (VP01 and VP02), Hexane (all four vapour points), Benzene (VP01, VP02 and VP03), Cyclohexane (VP01, VP02 and VP04), Heptane (VP01 and VP02), MIBK (VP01 and VP02), Toluene (all four vapour points), Methyl Butyl Ketone (VP02 only), Ethylbenzene (all four vapour points), xylenes (all four vapour points), 4-ethyl toluene (VP02 only), 1,3,5-Trimethylbenzene (VP02 only), 1,2,4-Trimethylbenzene (all four vapour points), Naphthalene (VP01, VP02 and VP03). For all of these compounds, either there is no adopted assessment criteria, or the results did not exceed the adopted assessment criteria.

A number of solvents have been identified in soil vapour at the locations tested. The most significant results are from VP01 along the southern side of the north western area of underground storage tanks. It is noted that a groundwater well installed in this same area did not report any elevated concentration of solvents during this sampling event. As such, the identified soil vapour impacts may be related to contamination in the underlying soil and not groundwater.

Given the impacts have been identified in a portion of the site that does not contain any buildings, the risk to site users in the current site layout is unlikely to be unacceptable. Further site specific risk assessment would be required to confirm this.

11.0 QUALITY ASSURANCE AND QUALITY CONTROL

QA/QC measures for this investigation were based on AS4482.1–2005 and included:-

- Appropriate sample labelling, preservation, storage and transport under chain of custody procedures.
- Laboratory analyses conducted within appropriate holding times.
- Analysis of laboratory QA/QC samples including duplicates, blanks, matrix spikes, matrix spike duplicates, and surrogates.
- The use of laboratories that hold NATA accreditation for the analyses undertaken.
- Collection and analysis of field QA/QC samples including duplicates and blanks.

11.1 Internal Laboratory QA

The results of the internal quality assurance programs of the laboratory are presented with the NATA test certificates at the end of this report as Appendices C, F and J. According to the NEPM, the quality of data supplied by the analytical laboratory must meet the objectives of the testing laboratory's quality plan for at least 95% of test results for duplicates. The primary laboratory reported all internal duplicates passed internal laboratory testing.

11.2 Field Duplicates

11.2.1 Soil Analyses

Field duplicate soil samples were collected and submitted to the primary and secondary laboratories for testing respectively as summarised in Table 9.

Table 9 – Soil Duplicate Analyses

Sample ID	Primary laboratory (Eurofins-mgt)	Secondary laboratory (ALS)
SB05_0.0-0.1	QC01 – Vic EPA Screen	QC02 – Vic EPA Screen
SB08_0.2-0.4	QC03 – heavy metals, TRH, BTEX, OCP, OPP and PAH	QC04 – heavy metals, TRH, BTEX, OCP, OPP and PAH
SB10_0.3-0.5	QC07 – heavy metals and PAH	QC08 – heavy metals and PAH
SB31_0.01-0.3	QC11 – heavy metals, OCP and PAH	QC12 – heavy metals, OCP and PAH
SB34_0.9-1.0	QC13 – heavy metals, BTEX, TRH, OCP and PAH	QC14 – heavy metals, BTEX, TRH, OCP and PAH
SB39_0.25-0.4	QC15 – heavy metals and OCP	QC16 – heavy metals and OCP
SB41_0.6-0.8	QC17 – heavy metals, TRH, BTEX, PAH and OCP	QC18 – heavy metals, TRH, BTEX, PAH and OCP
SB44_0.8-0.9	QC19 – heavy metals and PAH	QC20 – heavy metals and PAH
SB46_0.6-0.8	QC21 – heavy metals and PAH	QC22 – heavy metals and PAH
TB11_0.4-0.5	QC25 – heavy metals and OCP	QC26 – heavy metals and OCP
TB13_0.15-0.25	QC27 – TRH, VOC, heavy metals, PAH	QC28 – TRH, VOC, heavy metals, PAH

NOTES:-
TRH = total recoverable hydrocarbons
PAH = polycyclic aromatic hydrocarbons
OCP = organochlorine pesticides
BTEX = benzene, toluene, ethylbenzene, xylene
VOCs = volatile organic compounds
Heavy metals = arsenic, cadmium, chromium, copper, nickel, lead, mercury, silver, tin, zinc
Vic EPA Screen - includes heavy metals (as above + molybdenum and selenium), OCP, TRH, volatile organic compounds, PCBs, vinyl chloride, PAH, phenols, hexavalent chromium, cyanide and total fluoride

The frequency of field duplicate analyses for the main contaminants of concern is considered to be acceptable when compared to the 1 per 20 analyses recommended in AS4482.1.

The majority of comparable results reported relative percentage differences (RPDs) below the accepted criteria of 50%. RPD exceedences were reported from the following samples:

- SB05_0.0-0.1 and secondary duplicate QC02 for nickel (63%).
- SB08_0.2-0.4 and primary duplicate QC03 for chlordane (67%).
- SB08_0.2-0.4 and secondary duplicate QC04 for chlordane (120%) and arsenic (52%).
- SB20_0.3-0.5 and scondary duplicate QC08 for nickel (52%).
- SB31_0.01-0.3 and primary duplicate QC11 for mercury (67%).
- SB31_0.01-0.3 and secondary duplicate QC12 for copper (62%), mercury (67%), nickel (57%) and total PAH (126%).
- TB13_0.15-0.25 and primary duplicate QC27 for lead (100%), arsenic (86%), chromium (75%), copper (108%) and zinc (102%).

All of the reported results (from both primary and duplicate samples listed above) are below the adopted guidelines. As such, in terms of this investigation, the variations are not considered significant. A table summarising the field duplicate results is attached to this report. Given the relatively low number of RPD exceedences compared to the total number of comparable duplicate samples, the data set is considered to be of acceptable quality for the purposes of this report.

11.2.2 Groundwater Analyses

Field duplicate samples were collected during the October 2015 sampling event and analysed at the primary and secondary laboratories (Eurofins-mgt and ALS respectively). Field duplicate samples QW01 and QW02 were collected from groundwater well MW03 and tested as outlined in Table 10.

Table 10 – Groundwater Duplicate Analyses

Sample ID	Primary laboratory (Eurofins-mgt)	Secondary laboratory (ALS)
MW03	QW01 – pH, TDS, VOC, vinyl chloride and Vic EPA Short Screen	QW02 – pH, TDS, VOC, vinyl chloride and Vic EPA Short Screen

NOTES:-

TDS = total dissolved solids

VOCs = volatile organic compounds

Vic EPA Short Screen - includes heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, mercury, silver, tin, zinc, molybdenum and selenium), OCP, TRH, PAH, phenols, cyanide and total fluoride

The majority of comparable inter and intra laboratory duplicate groundwater analyses had relative percentage difference (RPD) values below the recommended comparison criteria of 50%. However, the following variations were reported:

- Dieldrin – a variation of 100% was calculated between the primary sample (MW03) and the intra laboratory duplicate (QW01). It is noted the duplicate sample also reported detectable concentrations of DDE where the primary sample did not.
- Lead – a variation of 67% was calculated between the primary sample (MW03) and the inter laboratory duplicate (QW02).
- Nickel – a variation of 100% was calculated between the primary sample (MW03) and the inter laboratory duplicate (QW02).

The heavy metals variations are not considered overly significant due to the low concentrations reported and all results being reported below the adopted groundwater quality criteria. Higher variations can be expected for samples with low analyte concentrations, such as in the case with those analytes mentioned above.

The OCP variations may warrant further consideration as part of any later stages of work. The secondary duplicate (QW02) from this location did not report detectable concentration of dieldrin or DDE, but it is noted the detection limit at this laboratory was higher.

A table summarising the field duplicate results for the investigation is presented with the groundwater result summary tables attached to this report.

11.2.3 Soil Vapour Analyses

Field duplicate samples were collected and analysed at the primary and secondary laboratories (using the summa sampling methods). A summary of the field duplicate samples collected are summarised in Table 11.

Table 11 – Soil Vapour Duplicate Analyses

Soil Vapour Point	Duplicate Sample Collected	Laboratory Analyses
VP01	QV02 – inter-laboratory duplicate (ALS)	TO-15 Suite* & TRH
VP02	QV01 – intra-laboratory duplicate (EnviroLab)	TO-15 Suite* & TRH

NOTES:-

* - comprises a suite of 62 volatile compounds

The majority of comparable inter and intra laboratory duplicate soil vapour analyses had relative percentage difference (RPD) values below the adopted comparison criteria of 50%. However, a number of volatile compound (isopropyl alcohol, trichloroethene and naphthalene) variations were calculated ranging between 52% and 186% between the primary and duplicate samples.

A variation in isopropyl alcohol results was reported between the primary sample and the inter laboratory duplicate samples. This compound is commonly used as a leak detection compound and the higher detection may be a result of cross contamination at the secondary laboratory.

A variation in the trichloroethene results was reported between the primary sample and the intra laboratory duplicate. The primary result (which was the higher reported result) has been adopted for the assessment in the first instance, so this variation is not considered overly significant.

A variation in naphthalene results was reported between the primary sample and the intra laboratory duplicate. This is not considered overly significant in terms of the investigation as none of reported concentrations from the primary or duplicate samples tested exceed the adopted criteria for this compound.

A table summarising the field duplicate results for the investigation is presented as an attachment to this report (with soil vapour result summary tables).

11.3 Soil Vapour Leak Testing

As discussed in Section 7.0, prior to the soil vapour sampling taking place, leak testing was undertaken on each sampling point to ensure that vapour samples were representative of the targeted soil depth being sampled and that ambient air was not being drawn into the vapour well. The leak testing procedure is discussed further below.

11.3.1 Helium Leak Test

The helium leak test methodology adopted comprised adding helium to a shroud (which overlies the soil vapour point) and the concentration was measured using a GasCheck 5000 handheld helium detector. Soil vapour was then drawn from the vapour point and a real-time helium concentration was measured. A comparison was then made between the shroud concentrations and measured vapour point concentration to ensure the difference in concentration was less than the recommended difference of 10%.

The measured helium concentrations detected within all soil vapour points sampled were less than 10% of the measured shroud concentration indicating the integrity of all soil vapour points are generally sound using the helium leak test method (refer Appendix E for sampling records).

11.4 Blank Samples

11.4.1 Soil and Groundwater

Rinsate blank samples (RB) and trip blank samples (TB) were collected during soil and groundwater sampling events and analysed at the primary laboratory. Rinsate samples were collected from clean sampling equipment and the trip blank samples were laboratory supplied samples (placed in the esky prior to sampling). The blank sample analysis is summarised in Table 12 below.

Table 12 - Blank sample Analyses

Date	Work Conducted	Samples Blanks	Analyses
21/9/15	Soil Sampling	Rinsate – RB01 Trip – TB01	Metals BTEX
22/9/15	Soil Sampling	Rinsate – RB02 Trip – TB02	Metals BTEX
23/9/15	Soil Sampling	Rinsate – RB03 Trip – TB03	Metals BTEX
24/9/15	Soil Sampling	Rinsate – RB04 Trip – TB04	Metals BTEX
25/9/15	Soil Sampling	Rinsate – RB05 Trip – TB05	Metals BTEX
29/9/15	Soil Sampling	Rinsate – RB06 Trip – TB06	Metals BTEX
30/9/15	Soil Sampling	Rinsate – RB07 Trip – TB07	Metals BTEX
1/10/15	Groundwater Sampling	Rinsate – RB08 Trip – TB08	Metals, VOC and vinyl chloride

All reported concentrations were below laboratory limits of reporting indicating that decontamination and sample handling procedures were acceptable.

11.5 Data Quality Conclusions

Overall, the internal QC procedures reported by the laboratories and the field duplicate analyses indicate the analytical data is of acceptable quality for the purposes of this investigation.

12.0 CONCLUSIONS

Soil Investigation

The soil investigation comprised the drilling of 112 grid soil bores across the site and 25 targeted soil bores in areas of identified potential contamination.

The maximum depth of the soil investigation was 8.0 metres below ground level (mbgl). All soil bores encountered fill material to depths ranging between 0.2 metres to 1.4mbgl comprising crushed rock mixed with silts and sands, grey / pale brown sand and dark brown silty clay. Secondary constituents were noted within the fill material including crushed rock, organic matter, ash, cinders, bitumen, red brick and glass fragments.

Hydrocarbon odours and staining were noted in several soil bores around the underground storage tanks (USTs) in the north western and eastern portions of the site between 4.0m to 7.0mbgl.

Selected samples were analysed for a range of potential contaminants of concern and the results were compared with ecological and health based investigation levels for commercial / industrial and residential land use. Exceedences of either the adopted ecological or health based investigation/screening levels were reported for a number of analytes as follows:

- Elevated results for benzo(a)pyrene were reported above or equal to the ecological screening level (for urban residential land use in shallow soils (<1.0m) at SB04_0.1-0.2, SB11_0.01-0.3, SB11_0.35-0.45, SB81_0.9-1.0, SB83_0.1-0.3 and SB83_0.5-0.6. It is noted that the SA EPA has recommended the consideration of other guidelines in the assessment of benzo(a)pyrene for ecological protection, including the health investigation level for residential land use (3mg/kg). The elevated levels of benzo(a)pyrene are below this guideline and the exceedances are therefore not considered to be significant.

  One result for benzo(a)pyrene TEQ was reported above the adopted health investigation level for standard residential use from SB83_0.1-0.3. The reported result is still below the adopted HIL for high density residential and commercial/industrial land uses. Statistically, this elevated result is not considered significant and is within acceptable levels.
- Elevated results for TRH C16-C34 were reported above the adopted ecological screening level for urban residential land use in SB20_0.015-0.3, SB30_0.01-0.2, SB36_0.2-0.3, SB50_0.15-0.2 and SB51_0.15-0.2. The results are all below the ESL for commercial/industrial land use.
- Elevated results for TRH C6-C10 less BTEX were reported above the adopted health screening level for urban residential land use at depths greater than 4.0 metres in TB11_5.5-5.6 and TB16_5.0-5.1 around the eastern tank area. The reported results from the overlying and underlying samples tested at both locations were below the laboratory detection limit.

  It is noted that fuel related compounds were detected at a number of other locations around the underground fuel infrastructure (both areas of underground tanks), but none of the reported results were above the adopted assessment criteria.
- Asbestos containing material was identified at one location under the dry goods warehouse at a depth greater than 1.0m.

Groundwater Investigation

The previous groundwater investigations undertaken in 2011 and July 2015 identified elevated concentrations of VOCs, heavy metals (chromium and lead) and fuel related compounds (TRH, PAHs and BTEX) in all groundwater above adopted water quality criteria.

The most recent investigations comprised the sampling of four existing onsite groundwater monitoring wells and the installation and sampling of seven additional groundwater wells. The purpose of the additional groundwater wells was to further assess the contamination status of groundwater beneath the site. Groundwater was encountered at depths between 5.5 and 6.5 metres below ground level and the groundwater flow direction was inferred to be west to north westerly.

Elevated levels of the chlorinated hydrocarbon; dichloromethane were reported above potable water assessment criteria in MW01 located in the southern portion of the site. MW01 was installed to assess

groundwater quality along down inferred hydraulic gradient from the operations in the southern portion of the site.

An elevated concentration of the organochlorine pesticide; dieldrin was reported above the adopted drinking water and freshwater ecosystem protection criteria in monitoring well MW04 (west of the cold store warehouse). It is also noted that a duplicate sample reported elevated concentrations for dieldrin and DDE above the adopted criteria. The primary sample (MW03, located along the site's western boundary) and secondary duplicate from this location reported all results for pesticides below the laboratory detection limit.

An elevated result was reported for total PAHs (likely to be associated with naphthalene and fuel related compounds) above the adopted drinking water criteria and the adopted freshwater ecosystem protection criteria at one location (GW3) adjacent to the underground fuel tanks in the eastern portion of the site.

An elevated result was reported for the heavy metal selenium at one location (MW07) on the eastern boundary of the site above the adopted drinking water criteria, freshwater ecosystem protection criteria and irrigation criteria. MW07 was installed to assess the background quality of groundwater entering the site from the east (up inferred hydraulic gradient).

Elevated levels of total dissolved solids were reported in all groundwater monitoring wells above the adopted guidelines for recreational use. The levels of total dissolved solids are considered to be representative of background conditions in the area.

It is noted that several results were reported above the laboratory limit of reporting, but below the assessment criteria for fuel related compounds in GW3 and EBT1 around the USTs in the eastern portion of the site and chlorinated hydrocarbons (trichloroethene and tetrachloroethene) in MW02, MW03 and MW04 in the north western portion of the site.

The previous groundwater investigations undertaken in 2011 and July 2015 identified elevated concentrations of VOCs, heavy metals (chromium and lead) and fuel related compounds (TRH, PAHs and BTEX) in all the groundwater wells above adopted guidelines. Overall, the reported results from this monitoring round indicate a decrease in concentrations of the chemicals of concern identified in these sampling events.

Soil Vapour Investigation

A soil vapour investigation was undertaken around USTs located in the northern and north eastern portions of the site to measure the potential presence of vapours.

A number of soil vapour concentrations exceeding the adopted criteria were reported as follows:

- cis -1,2-Dichloroethene – Elevated concentrations were reported to exceed the Interim Soil Vapour HIL for residential and commercial/industrial use at VP01 in the vicinity of the USTs in the north western portion of the site. Detectable concentrations of DCE were also reported from the other vapour point in this area, but these concentrations were below the Interim Soil Vapour HILs.
- Trichloroethene – Elevated concentrations were reported to exceed the Interim Soil Vapour HIL for residential and commercial/industrial use from both vapour points are in the vicinity of the USTs in the north western portion of the site. Detectable concentrations of TCE were also reported from VP03 (adjacent the USTs in the eastern portion of the site), but these concentrations were below the Interim Soil Vapour HIL for residential land use.
- Vinyl chloride (VC) – Elevated concentrations were reported above the Interim Soil Vapour HIL for residential use from one location in the vicinity of the USTs in the north western portion of the site. All other reported results for vinyl chloride were below the laboratory detection limits.

Furthermore, the following observations have been made in relation to the soil vapour data:

- Elevated concentrations of tetrachloroethene (PCE) were reported from the vicinity of the USTs in the north western portion of the site. Although these results are above the laboratory detection limits, none of the results exceeded the Interim Soil Vapour HILs.
- Detectable concentrations of fuel related compounds (TRH and BTEX) were reported from all soil vapour points. The most significant results were reported from VP01 and VP02 in the vicinity of the north western UST area, but these were still be below the adopted assessment criteria.

- Detectable concentrations were also reported from one or more locations for a number of other volatile compounds, for which either there are no adopted assessment criteria, or the results did not exceed the adopted assessment criteria.

A number of solvents have been identified in soil vapour at the locations tested. The most significant results are from VP01 along the southern side of the north western underground storage tank area. It is noted that a groundwater well installed in this same area did not report any elevated concentration of solvents during this sampling event. As such, the identified soil vapour impacts may be related to contamination in the underlying soil and not groundwater.

Given the impacts have been identified in a portion of the site that does not contain any buildings, the risk to site users in the current site layout is unlikely to be unacceptable.

Concluding Comments

No impacts have been identified that would preclude ongoing commercial / industrial use in the site's current layout. If the site was to be redeveloped for a more sensitive land use (i.e. residential), additional works would be required. These have been detailed under a separate cover.

13.0 LIMITATIONS OF THIS REPORT

This environmental site assessment report has been prepared in accordance with industry recognised standards and procedures at the time of the work. The report presents the results of the assessment based on the quoted scope of works (unless otherwise agreed in writing) for the specific purposes of the commission. No warranties expressed or implied are offered to any third parties and no liability will be accepted for use of this report by any third parties.

Information provided by third parties has been assumed to be correct and complete. Greencap does not assume any liability for misrepresentation of information by third parties or for matters not visible, accessible or present on the subject property during any site inspections conducted during the time of the work.

The first stage in the site assessment process generally involves site history research and/or a site inspection. This stage is intended to establish whether there is a likelihood of site contamination. Depending on the location of the site and surrounding land use, there could be contamination present which could not have been identified by preliminary investigation of this nature - for example, if there had been dumping of waste liquids which has left no visual evidence and past owners were not aware of. If recommendations have been made on whether or not to conduct further investigation, these have been based on the likelihood of site contamination, and are generally based on the sensitivity of the proposed future use of the site. A more conservative approach is generally adopted for a sensitive future use such as residential or a child care centre. Subsequent stages of soil or groundwater investigation may follow. The site assessment process is often ongoing, with additional stages of investigation being required to resolve issues raised in previous stages of the investigation. In cases where sampling and analysis of soil and/or groundwater has been conducted, then the following standard limitations apply:-

- The results presented in the report apply only to the specific locations and the time the sampling was conducted. The nature and extent of contaminants present on a site can change due to physical disturbance or removal, chemical or biological transformation, or due to the migration of the contaminants to different areas.
- The borehole or test pit logs indicate the approximate subsurface conditions only at the specified test locations. Soil and rock formations are variable, and conditions in areas not sampled may differ from those at the actual sampling locations due to natural subsurface variation.
- The precision with which subsurface conditions are indicated depends largely on the frequency and method of sampling and investigation, and the degree of subsurface variation. There can be no complete guarantee that contaminants are not present at significant concentrations in some areas, even with the most thorough site assessment.
- Any conclusions or recommendations are based solely on the land use assumptions stated in the report. These conclusions or recommendations do not apply to any other land use for the site.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. Opinions and judgements expressed herein are based on Greencap's understanding of current regulatory standards and should not be construed as legal opinions.

Environmental Site Assessment

HSBC Institutional Trust Services (Singapore) Limited (in its capacity as trustee of Cache Logistics Trust)

ARA-CWT Trust Management (Cache) Limited (in its capacity as manager of Cache Logistics Trust)

In For A Pound Pty Ltd

404-450 Findon Road, Kidman Park

Figures

Project: Due Diligence Site Assessment			
Location: 404-450 Findon Road, Kidman Park			
Job Ref: J134221	Drawn: MM	Checked: MS	Date: September 2015

Note: All data is approx only & subject to survey

SCALE (at A3) 1:2,000

N W E S

0 10 20 30 40 Meters

Coordinate System: GDA 1994 MGA Zone 54

Aerial image sourced from Nearmap

Figure 1 - Site Layout

GREENCAP

12 Greenhill Road Wayville SA 5034
PO Box 582 Unley SA 5061
(08) 8299 9955
www.greencap.com.au

Project: Due Diligence Site Assessment

Location: 404-450 Findon Road, Kidman Park

Job Ref: J134221	Drawn: MM	Checked: MS	Date: October 2015

Note: All data is approx only & subject to survey

SCALE (at A3) 1:2,000

N W E S

0 10 20 30 40 Meters

Coordinate System: GDA 1994 MGA Zone 54

Aerial image sourced from Nearmap

Figure 2 - Soil Bore Locations

GREENCAP

12 Greenhill Road Wayville SA 5034
PO Box 582 Unley SA 5061
(08) 8299 9955
www.greencap.com.au

Enlargement 1

EBT1
TB18
SB53
TB12
TB19
VP03
TB11
GW3
TB15
TB17
TB16
VP04

Enlargement 2

TB10
VP02
SB49
TB07
TB09
SB46
TB06
TB02
GW1
VP01
TB08

Legend

- Site Boundary
- SB01 - Grid Soil Bore Location
- TB01 & HA1 - Targeted Soil Bore Location
- VP01 - Soil Vapour Monitoring Point
- Groundwater Well Location

Project: Due Diligence Site Assessment

Location: 404-450 Findon Road, Kidman Park

Job Ref: J134221	Drawn: MM	Checked: MS	Date: October 2015

Note: All data is approx only & subject to survey

SCALE (at A3) 1:250

N W E S

0 2 4 6 8 Meters

Coordinate System: GDA 1994 MGA Zone 54

Aerial image sourced from Nearmap

Figure 3 - Soil Bore and Groundwater Well Locations (Enlargement)

GREENCAP

12 Greenhill Road Wayville SA 5034
PO Box 582 Unley SA 5061
(08) 8299 9955
www.greencap.com.au

Project: Due Diligence Site Assessment

Location: 404-450 Findon Road, Kidman Park

Job Ref: J134221	Drawn: MM	Checked: MS	Date: October 2015

Note: All data is approx only & subject to survey

SCALE (at A3) 1:2,000

N W E S

0 10 20 30 40 Meters

Coordinate System: GDA 1994 MGA Zone 54

Aerial image sourced from Nearmap

Figure 4 - Groundwater Monitoring Wells

GREENCAP

12 Greenhill Road Wayville SA 5034
PO Box 582 Unley SA 5061
(08) 8299 9955
www.greencap.com.au